

REPORT NUMBER: 301-MGA-2011-007

**SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT**

**KIA MOTORS MANUFACTURING
2011 KIA SORENTO
NHTSA NUMBER: CB0507**

**PREPARED BY:
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Test Date: August 17, 2011

Final Report Date: September 8, 2011

FINAL REPORT

**PREPARED FOR:
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
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WASHINGTON, D.C. 20590**

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16. Abstract A rear impact was conducted on a 2011 KIA Sorento at MGA Research Corporation on August 17, 2011. This test was conducted to obtain data indicant of FMVSS 301R. The impact velocity was 79.3 km/h. The ambient temperature at the time of impact was 27 degrees Celsius.			
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This rear impact test is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-C-00030. The purpose of this test is to reduce deaths and injuries occurring from fires that result from fuel spillage during and after motor vehicle crashes and resulting from ingestion of fuels during siphoning.

SUMMARY

A 2011 KIA Sorento was impacted by a Moving Deformable Barrier (MDB) at a velocity of 79.3 km/h. The test was performed at MGA Research Corporation on August 17, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and five high-speed cameras were used to document the impact event.

- Left Rear Half 1000 fps
- Right Rear Half 1000 fps
- Overhead Overall 1000 fps
- Left Overall 1000 fps
- Right Overall 1000 fps
- Real Time Pan 30 fps

Two ballast Part 572E, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 2
DATA SHEETS

DATA SHEET NO. 1
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2011 KIA Sorento NHTSA No.: CB0507
Test Program: FMVSS 301 Fuel System Integrity Test Date: 8/17/2011

TEST VEHICLE INFORMATION

Manufacturer	KIA Motors Manufacturing Georgia, Inc.
Model	Sorento
Body Style	SUV
Major Options	None
NHTSA No.	CB0507
VIN	5XYKT3A12BG147653
Color	Bright Silver
Delivery Date	7/26/2011
Odometer Reading (mile)	182
Dealer	Dorsch Kia
Transmission	Manual
Final Drive	Front Wheel Drive
Number of Cylinders	4
Engine Displacement (L)	2.4
Engine Placement	Lateral

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	KIA Motor Manufacturing Georgia, Inc.
Date of Manufacture	1/24/11

GVWR (kg)	2190
GAWR Front (kg)	1350
GAWR Rear (kg)	1450

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				420
Number of Occupants x 68 kg.				340
Cargo Wt. (RCLW) (kg)				80

DATA SHEET NO. 1 (continued)
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2011 KIA Sorento NHTSA No.: CB0507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 8/17/2011

DATA FROM VEHICLE'S TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	P235/65R17	P235/65R17
Recommended Load Range	103T	103T
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	Kumho	Kumho
Location of Placard of Vehicle	Lower B-Post	
Type of Spare Tire (full size/space saver)	Space Saver	

DATA SHEET NO. 2**PRE-TEST DATA**Test Vehicle: 2011 KIA SorentoNHTSA No.: CB0507Test Program: FMVSS 301 Fuel System IntegrityTest Date: 8/17/2011**WEIGHT OF TEST VEHICLE**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	469.0	359.7		520.3	429.1	
Right	kg	470.8	344.3		510.8	406.9	
Ratio	%	57.2	42.8		55.2	44.8	
Totals	kg	939.8	704.0	1643.8	1031.1	836.0	1867.1

CALCULATION OF TARGET TEST WEIGHT (TTW)

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1643.8
Rated Cargo/Luggage Weight (RCLW)	kg	80
Weight of 2 P572E ATDs	kg	148
Calculated Vehicle Target Weight (TVTWT)	kg	1871.8

Vehicle Wheelbase	2704 mm
Vehicle Width	1880 mm
Weight of Ballast Secured in Rear Seat	78.9 kg
Method of Securing Ballast	Ratchet Straps
Vehicle Components Removed for Weight Reduction	None

VEHICLE ATTITUDES

	Units	LF	RF	LR	RR
As Delivered	mm	805	801	800	803
As Tested	mm	793	791	780	784

DATA SHEET NO. 2 (continued)**PRE-TEST DATA**Test Vehicle: 2011 KIA SorentoNHTSA No.: CB0507Test Program: FMVSS 301 Fuel System IntegrityTest Date: 8/17/2011**FUEL SYSTEM DATA**

	Units: Liters
Usable Capacity of "Standard Tank" (Owner's Manual)	68.0
Usable Capacity Figure Furnished by COTR	68.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	62.5 to 63.9
Actual Test Volume (entire fuel system filled)	63.2

Test Fluid Type	Stoddard Solvent
Test Fluid Kinematic Viscosity (centistokes)	2.1 cSt @ 20° C
Test Fluid Color	Purple
Type of Vehicle Fuel Pump	Electrical
Activate Electric Fuel Pump Operation with Ignition Switch ON, but Engine OFF	Yes

Comments (noticeable attributes of fuel system components, capacity, etc.)	None
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DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2011 KIA Sorento NHTSA No.: CB0507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 8/17/2011

MOVING BARRIER'S TEST WEIGHT

	Units	Front	Rear	Total
Left	kg	401.4	279.6	
Right	kg	368.9	312.5	
Ratio	%	56.5	43.5	
Totals	kg	770.3	592.1	1362.4

Tires (Mfr, line, size)	Kumho
Tire Pressure (kPa)	220
Brake Abort System (Yes/No)?	Yes
Date of Last Calibration	6/24/11

DATA SHEET NO. 4**POST-TEST DATA**

Test Vehicle: 2011 KIA Sorento NHTSA No.: CB0507
Test Program: FMVSS 301 Fuel System Integrity Test Date: 8/17/2011

IMPACT VELOCITY

	Units: km/h
Required Impact Velocity	80.0
Actual Impact Velocity (Trap No. 1)	79.3
Actual Impact Velocity (Trap No. 2)	79.3
Average Impact Speed	79.3

Temperature at Time of Impact (°C)	27
Test Time	11:42 am

WELDING ROD IMPACT POINT

	Units: mm
Vertical distance from target center (+ above target / - below target)	13 up
Horizontal distance from target center (+ to the right / - to the left)	3 left

DATA SHEET NO. 5

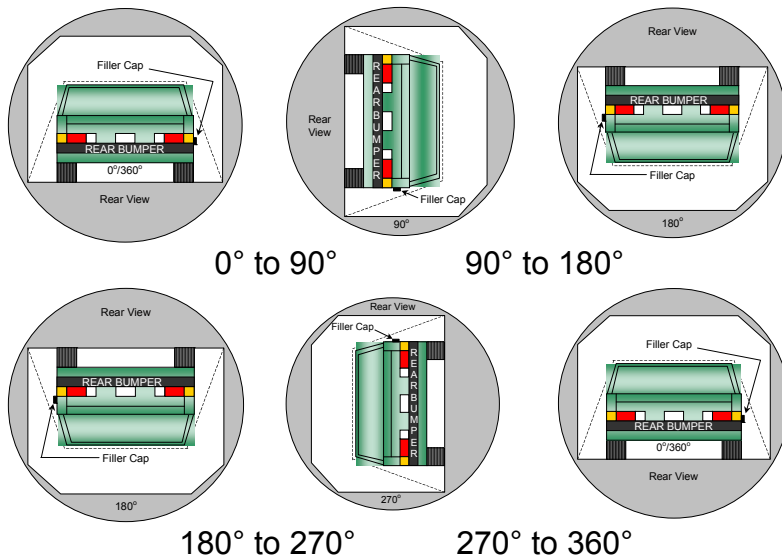
STATIC ROLLOVER TEST DATA

Test Vehicle: 2011 KIA Sorento NHTSA No.: CB0507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 8/17/2011

STODDARD SOLVENT SPILLAGE MEASUREMENT

- A. From impact until vehicle motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- B. For the 5 minute period after motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- C. For the following 25 minutes: 0 g
 (Maximum Allowable = 28 grams/minute)
- D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations: **Not Applicable**

DATA SHEET NO. 5 (continued)

STATIC ROLLOVER TEST DATA

Test Vehicle: 2011 KIA Sorento

NHTSA No.: CB0507

Test Program: FMVSS 301 Fuel System Integrity

Test Date: 8/17/2011

STODDARD SOLVENT SPILLAGE MEASUREMENT

Hold Time = 5 minutes at all intervals

0° TO 90° Rotation Time (sec) = 116 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

90° TO 180° Rotation Time (sec) = 114 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

180° TO 270° Rotation Time (sec) = 109 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

270° TO 360° Rotation Time (sec) = 113 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

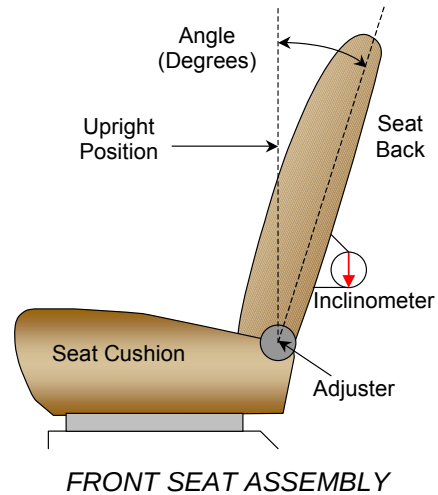
FORM 1
TEST VEHICLE INFORMATION

Test Vehicle: 2011 KIA Sorento
Test Program: FMVSS 301 Fuel System Integrity

NHTSA No.: CB0507
Test Date: 8/17/2011

NORMAL DESIGN RIDING POSITION

With the seat in the mid fore-aft seat track position the angle of the driver's seat back when it is in the nominal riding position is set at a headrest post angle of -0.7 degrees. Front outboard passenger seat is set at 0.2 degrees, reference to front door sill.



Driver Seat Back Angle	-0.2°
Passenger Seat Back Angle	-1.0°

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	24 detents	11 th detent forward most, 1 st as 0
Passenger Seat	22 detents	11 th detent forward most, 1 st as 0

D-RING ADJUSTMENT

The driver and passenger D-rings were full up.

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position.

APPENDIX A
PHOTOGRAPHS

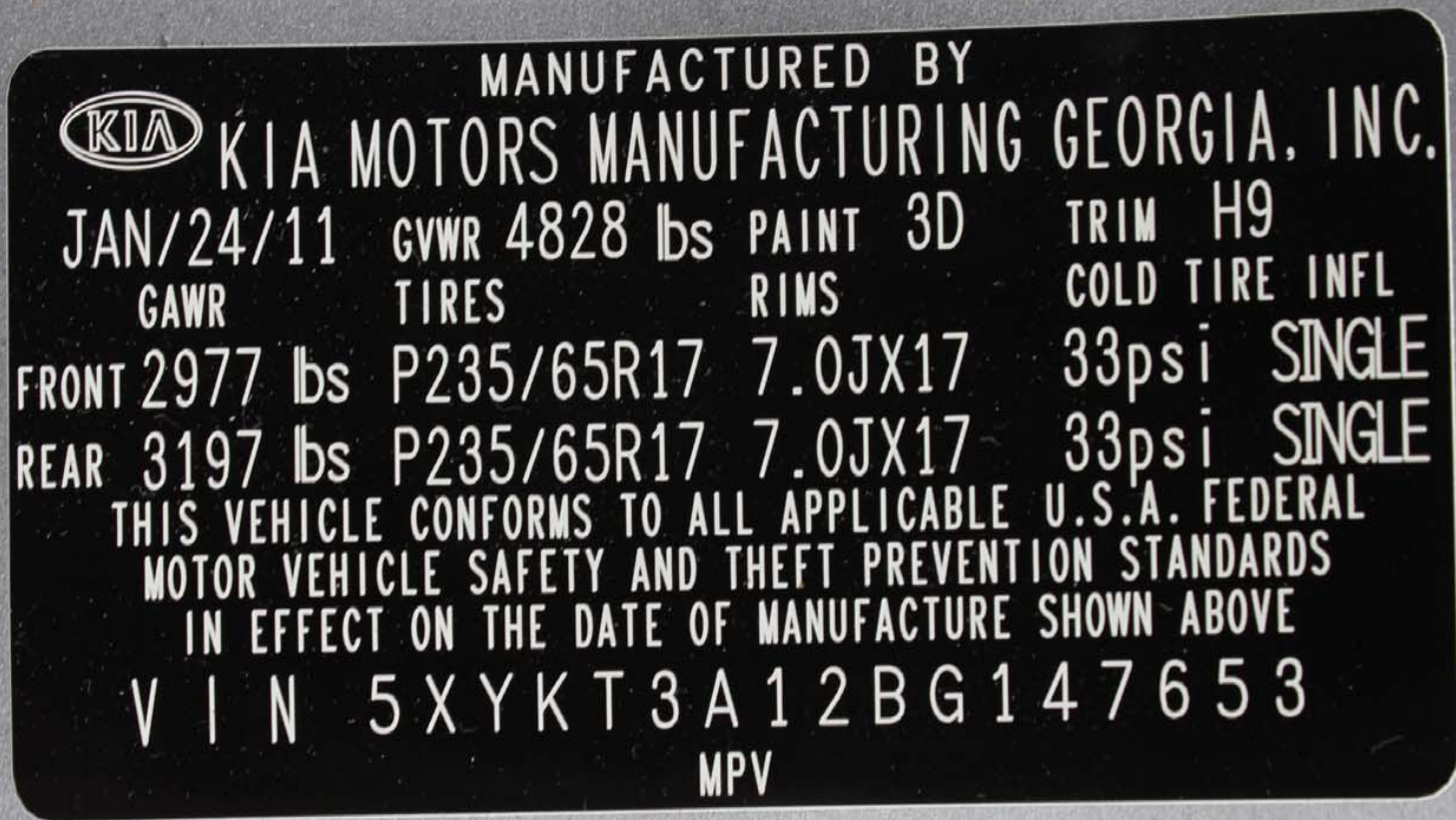
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Vehicle's Certification Label



TIRE AND LOADING INFORMATION RENSEIGNEMENTS SUR LES PNEUS ET LE CHARGEMENT

SEATING CAPACITY NOMBRE DE PLACES	TOTAL 5	FRONT AVANT 2	REAR ARRIÈRE 3
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The combined weight of occupants and cargo should never exceed 420 kg or 930 lbs.
Le poids total des occupants et du chargement ne doit jamais dépasser 420 kg ou 930 lb.

TIRE PNEU	SIZE DIMENSIONS	COLD TIRE PRESSURE PRESSION DES PNEUS À FROID	SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION VOIR LE MANUEL DE L'USAGER POUR PLUS DE RENSEIGNEMENTS
FRONT AVANT	P235/65R17	230kPa, 33psi	
REAR ARRIÈRE	P235/65R17	230kPa, 33psi	
SPARE DE SECOURS	T165/90R17	420kPa, 60psi	

002

Vehicle's Tire Placard



Pre-Test Front View of Vehicle



Post-Test Front View of Vehicle



Pre-Test Left Side View of Vehicle



Post-Test Left Side View of Vehicle



Pre-Test Left Rear Close-up View of Vehicle



Post-Test Left Rear Close-up View of Vehicle



Pre-Test Right Side View of Vehicle

A-10.



Post-Test Right Side View of Vehicle



Pre-Test Right Rear Close-up View of Vehicle



Post-Test Right Rear Close-up View of Vehicle



Pre-Test Rear View of Vehicle



Post-Test Rear View of Vehicle



Pre-Test ¾ Frontal View From Right Side of Vehicle



Post-Test $\frac{3}{4}$ Frontal View From Right Side of Vehicle



Pre-Test $\frac{3}{4}$ Rear View From Right Side of Vehicle



Post-Test $\frac{3}{4}$ Rear View From Right Side of Vehicle



Pre-Test $\frac{3}{4}$ Rear View From Left Side of Vehicle



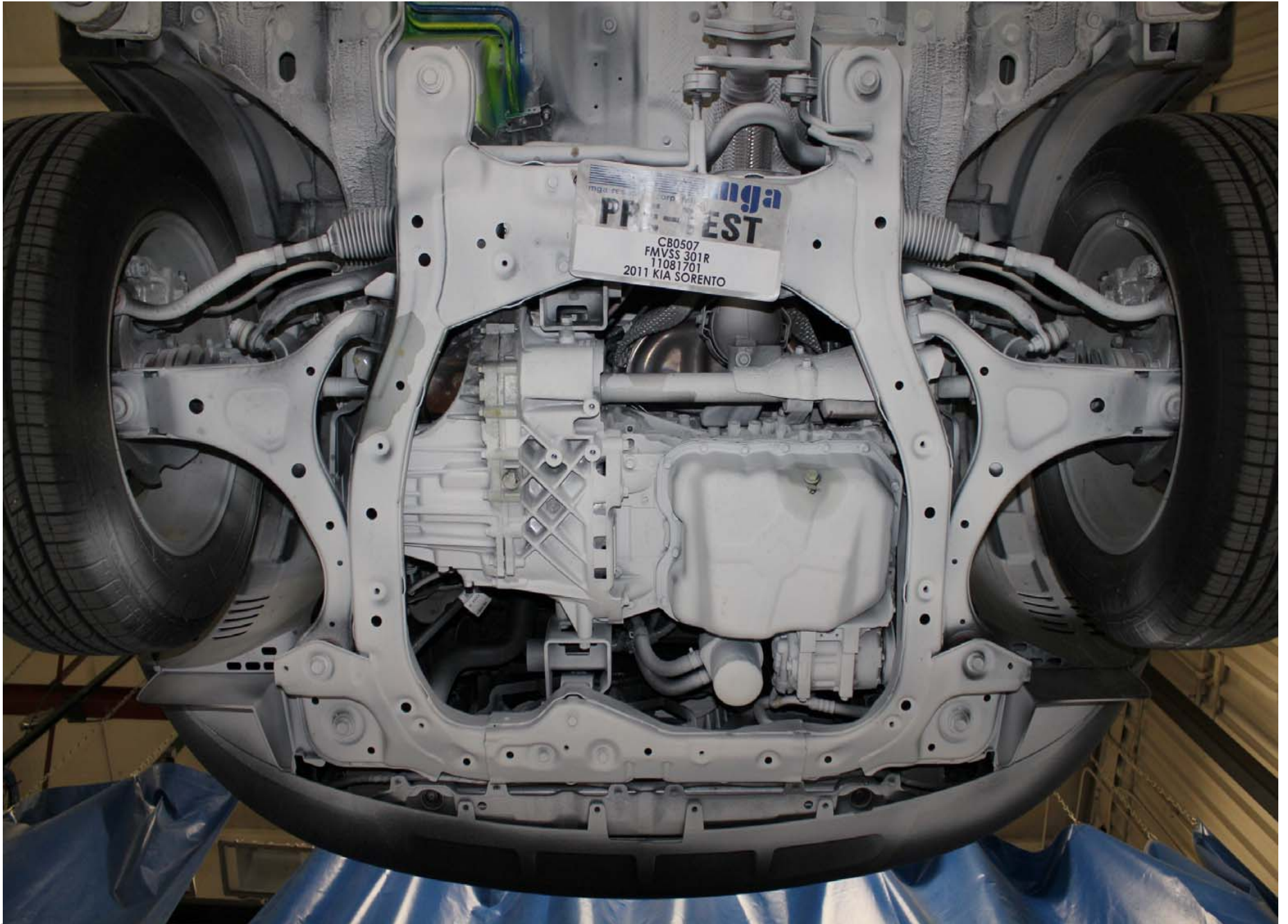
Post-Test $\frac{3}{4}$ Rear View From Left Side of Vehicle



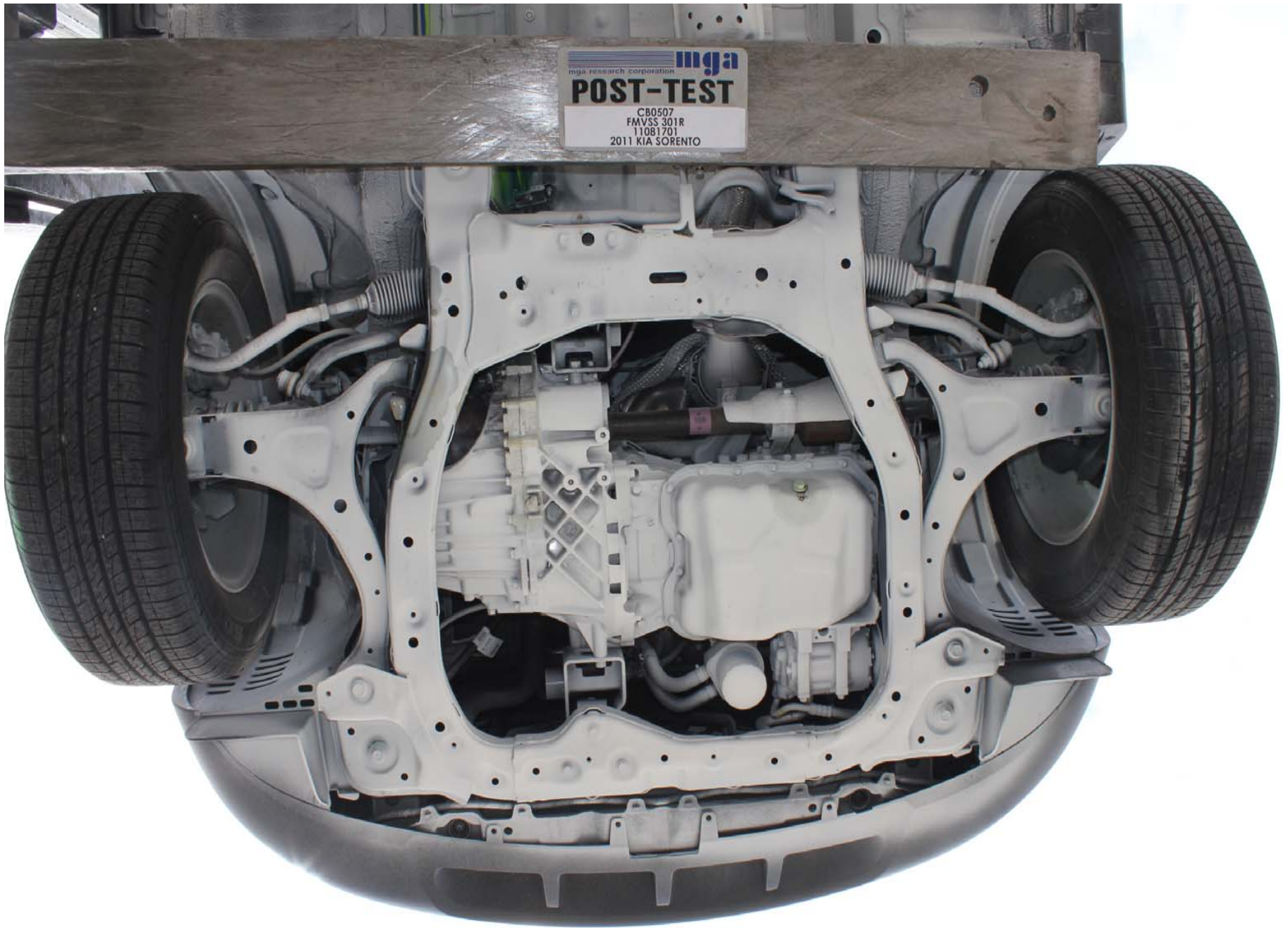
Pre-Test Impact Point



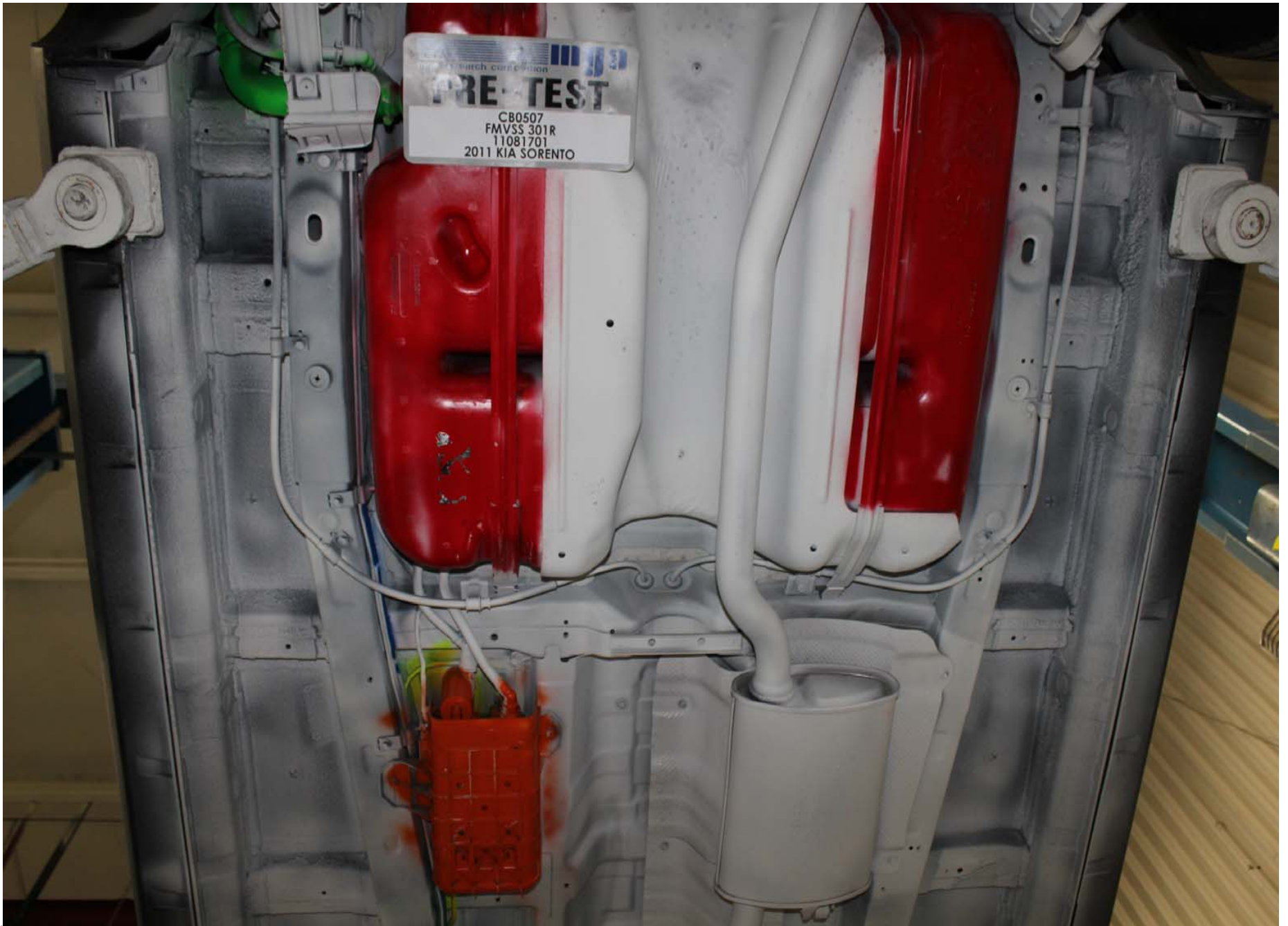
Post-Test Impact Point



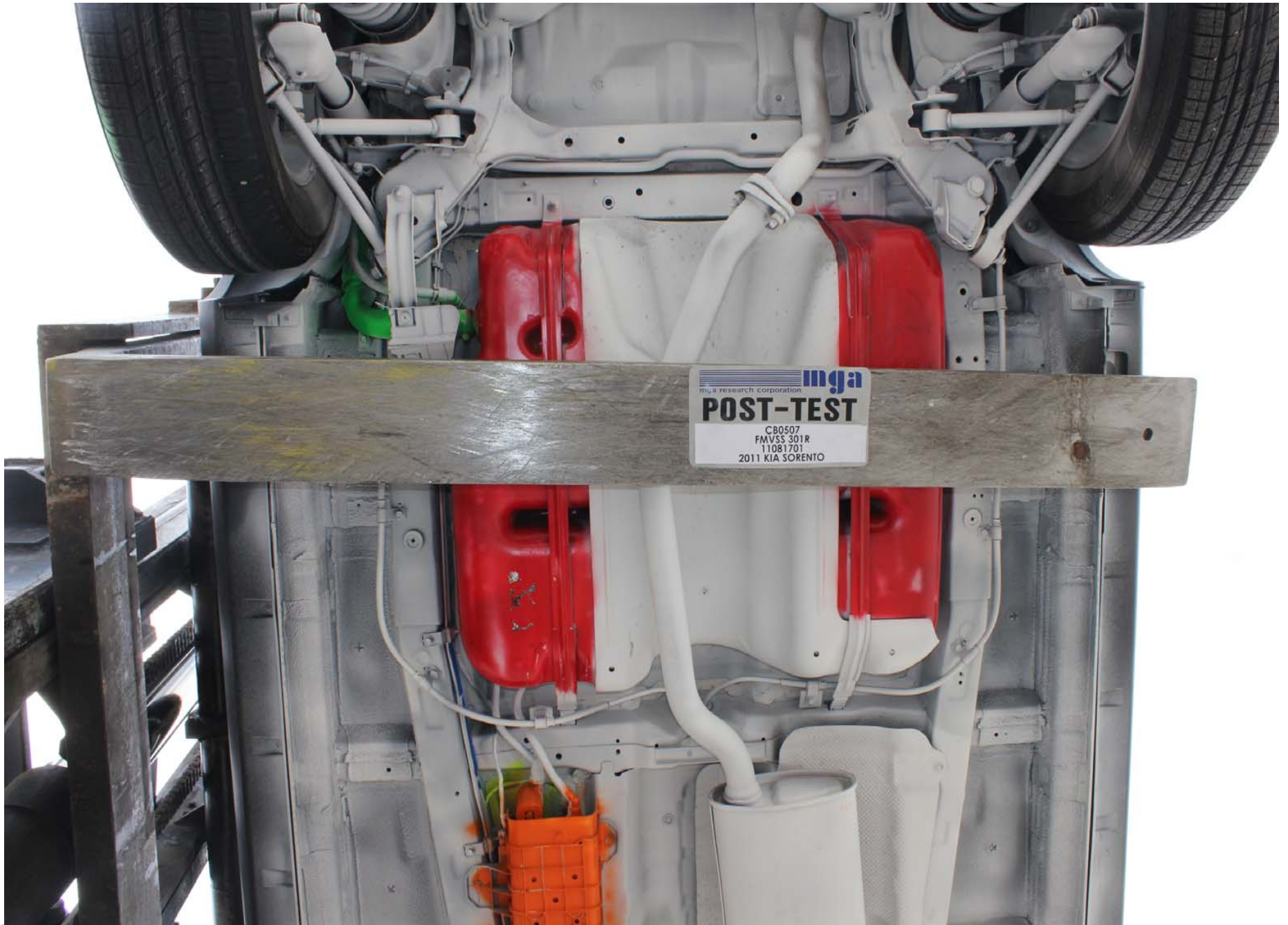
Pre-Test Underbody View 1



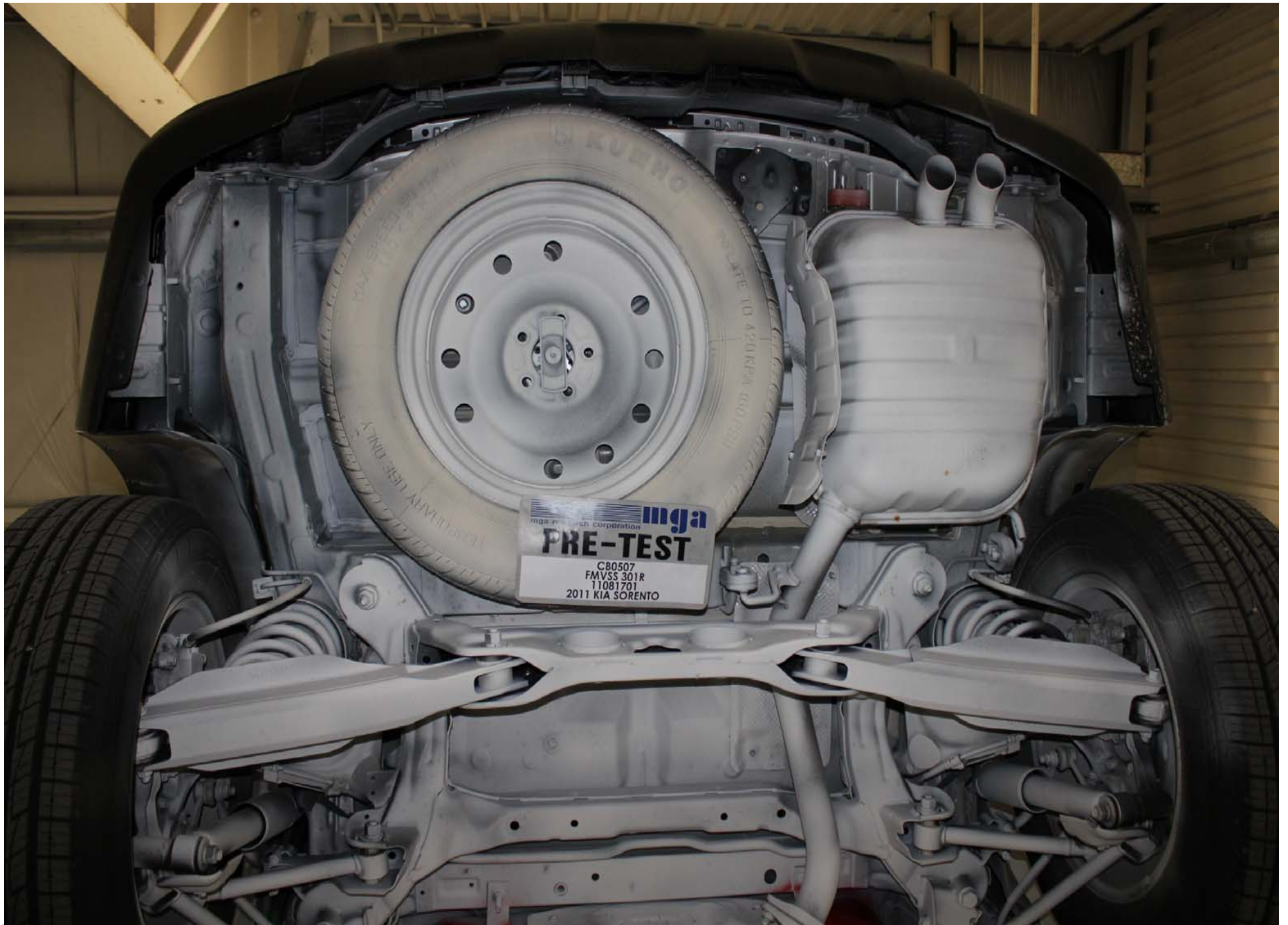
Post-Test Underbody View 1



Pre-Test Underbody View 2



Post-Test Underbody View 2



Pre-Test Underbody View 3

A-28.



Post-Test Underbody View 3



Pre-Test Front View of MDB



Post-Test Front View of MDB



Pre-Test $\frac{3}{4}$ Right Side View of MDB



Post-Test 3/4 Right Side View of MDB



Pre-Test ¾ Left Side View of MDB



Post-Test $\frac{3}{4}$ Left Side View of MDB

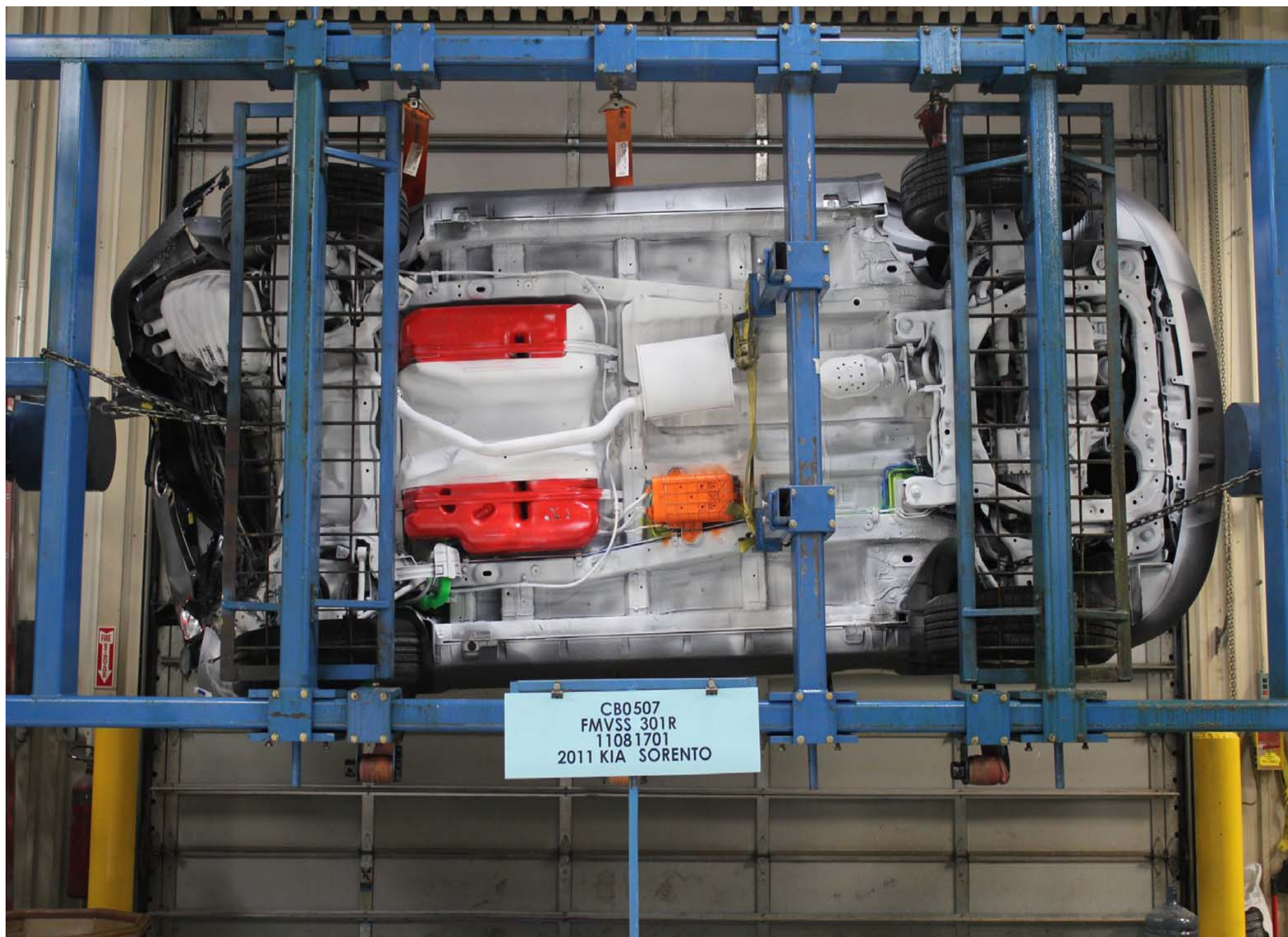


Pre-Test Top View of MDB



Post-Test Top View of MDB

A-37.



Static Rollover at 90 Degrees



Static Rollover at 180 Degrees



Static Rollover at 270 Degrees

A-40.



Static Rollover at 360 Degrees