

REPORT NUMBER: 301-MGA-2010-004

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

**FUJI HEAVY INDUSTRIES LTD.
2010 SUBARU OUTBACK
NHTSA NUMBER: CA5502**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: July 9, 2010

Final Report Date: July 23, 2010

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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WASHINGTON, D.C. 20590**

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Technical Report Documentation Page

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16. Abstract A rear impact was conducted on a 2010 Subaru Outback at MGA Research Corporation on July 9, 2010. This test was conducted to obtain data indicant of FMVSS 301R. The impact velocity was 79.5 km/h. The ambient temperature at the time of impact was 28 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 2010 Subaru Outback was impacted by a Moving Deformable Barrier (MDB) at a velocity of 79.5 km/h. The test was performed at MGA Research Corporation on July 9, 2010. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

- Left Rear Half 1000 fps
- Right Rear Half 1000 fps
- Overhead 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: 2010 Subaru Outback NHTSA No.: CA5502
Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/9/2010

TEST VEHICLE INFORMATION

Manufacturer	Fuji Heavy Industries LTD.
Model	Subaru Outback
Body Style	Passenger Car
Major Options	None
NHTSA No.	CA5502
VIN	4S4BRCACXA1324198
Color	Cypress Green Pearl
Delivery Date	6/17/2010
Odometer Reading (mile)	239
Dealer	North Park Subaru
Transmission	Manual
Final Drive	Four Wheel Drive
Number of Cylinders	4
Engine Displacement (L)	2.5
Engine Placement	Lateral

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	Fuji Heavy Industries LTD.
Date of Manufacture	08/09

GVWR (kg)	2080
GAWR Front (kg)	1070
GAWR Rear (kg)	1060

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				408
Number of Occupants x 68 kg.				340
Cargo Wt. (RCLW) (kg)				68

DATA SHEET NO. 1 (continued)
TEST VEHICLE SPECIFICATIONS

Test Vehicle:	<u>2010 Subaru Outback</u>	NHTSA No.:	<u>CA5502</u>
Test Program:	<u>FMVSS 301 Fuel System Integrity</u>	Test Date:	<u>7/9/2010</u>

DATA FROM VEHICLE'S TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	210
Recommended Tire Size	P215/70R16	P215/70R16
Recommended Load Range	99S	99S
Tire Size on Vehicle	P215/70R16	P215/70R16
Tire Manufacturer	Continental	Continental
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: 2010 Subaru OutbackNHTSA No.: CA5502Test Program: FMVSS 301 Fuel System IntegrityTest Date: 7/9/2010**WEIGHT OF TEST VEHICLE**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	434.1	352.0		483.5	409.1	
Right	kg	417.3	337.9		464.5	393.3	
Ratio	%	55.2	44.8		54.2	45.8	
Totals	kg	851.4	689.9	1541.3	948.0	802.4	1750.4

CALCULATION OF TARGET TEST WEIGHT (TTW)

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1541.3
Rated Cargo/Luggage Weight (RCLW)	kg	68
Weight of 2 P572E ATDs	kg	148
Calculated Vehicle Target Weight (TVTWT)	kg	1757.3

Vehicle Wheelbase	2745 mm
Vehicle Width	1822 mm
Weight of Ballast Secured in Rear Seat	61.2 kg
Method of Securing Ballast	Ratchet Straps
Vehicle Components Removed for Weight Reduction	None

VEHICLE ATTITUDES

	Units	LF	RF	LR	RR
As Delivered	mm	790	797	804	818
As Tested	mm	773	784	788	792

DATA SHEET NO. 2 (continued)**PRE-TEST DATA**Test Vehicle: 2010 Subaru OutbackNHTSA No.: CA5502Test Program: FMVSS 301 Fuel System IntegrityTest Date: 7/9/2010**FUEL SYSTEM DATA**

	Units: Liters
Usable Capacity of "Standard Tank" (Owner's Manual)	70.0
Usable Capacity Figure Furnished by COTR	70.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	64.4 to 65.8
Actual Test Volume (entire fuel system filled)	65.1

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: 2010 Subaru Outback NHTSA No.: CA5502
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/9/2010

MOVING BARRIER'S TEST WEIGHT

	Units	Front	Rear	Total
Left	kg	374.2	308.8	
Right	kg	389.5	291.2	
Ratio	%	56.0	44.0	
Totals	kg	763.7	600.0	1363.7

Tires (Mfr, line, size)	Yokohama
Tire Pressure (kPa)	207
Brake Abort System (Yes/No)?	Yes
Date of Last Calibration	8/6/2008

DATA SHEET NO. 4**POST-TEST DATA**Test Vehicle: 2010 Subaru OutbackNHTSA No.: CA5502Test Program: FMVSS 301 Fuel System IntegrityTest Date: 7/9/2010**IMPACT VELOCITY**

	Units: km/h
Required Impact Velocity	80.0
Actual Impact Velocity (Trap No. 1)	79.5
Actual Impact Velocity (Trap No. 2)	79.5
Average Impact Speed	79.5

Temperature at Time of Impact (°C)	28
Test Time	12:15 pm

WELDING ROD IMPACT POINT

	Units: mm
Vertical distance from target center (+ above target / - below target)	3 down
Horizontal distance from target center (+ to the right / - to the left)	6 left

DATA SHEET NO. 5

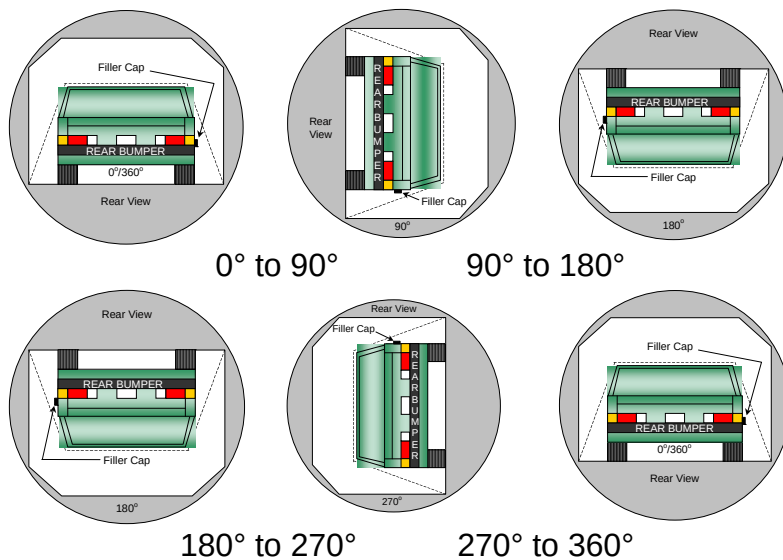
STATIC ROLLOVER TEST DATA

Test Vehicle: 2010 Subaru Outback NHTSA No.: CA5502
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/9/2010

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: 2010 Subaru OutbackNHTSA No.: CA5502Test Program: FMVSS 301 Fuel System IntegrityTest Date: 7/9/2010**STODDARD SOLVENT SPILLAGE MEASUREMENT****Hold Time = 5 minutes at all intervals****0° TO 90° Rotation Time (sec) = 120 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) = 112 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) = 108 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) = 112 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	

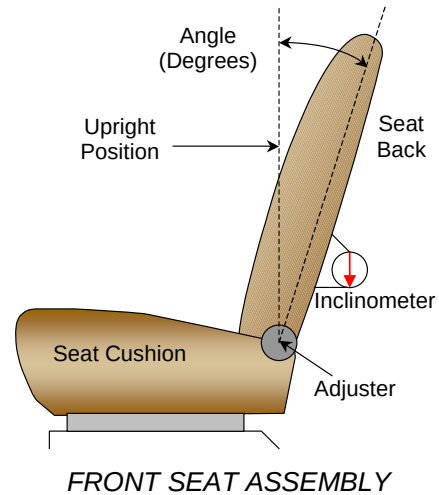
FORM 1
TEST VEHICLE INFORMATION

Test Vehicle: 2010 Subaru Outback
Test Program: FMVSS 301 Fuel System Integrity

NHTSA No.: CA5502
Test Date: 7/9/2010

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 6 degrees on the headrest post.



Driver Seat Back Angle	6.4° at headrest post
Passenger Seat Back Angle	6.8° at headrest post

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	296 mm	148 mm
Passenger Seat	250 mm	125 mm

D-RING ADJUSTMENT

The driver and passenger D-rings were placed in the 1st position of 5, top as 0.

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position.

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MFD BY FUJI HEAVY INDUSTRIES LTD.

DATE: 08/09

GVWR: 4585 LB (2080 KG)

GAWR:F 2360 LB (1070 KG) WITH P215/70R16 TIRES.

16X6 1/2JJ RIMS. AT 220 KPA (32 PSI) COLD

GAWR:R 2340 LB (1060 KG) WITH P215/70R16 TIRES.

16X6 1/2JJ RIMS. AT 210 KPA (30 PSI) COLD

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

VIN: 4S4BRCACXA1324198

MPV



ASSEMBLED BY SIA INC. MADE IN U.S.A.

A-1.

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

The combined weight of occupants and cargo should never exceed 408kg or 900 lbs.
Le poids total des occupants et du chargement ne doit jamais dépasser 408kg ou 900lb.

TIRE PNEU	SIZE DIMENSIONS	COLD TIRE PRESSURE PRESSION DES PNEUS À FROID
FRONT AVANT	P215/70R16	220 KPA, 32 PSI
REAR ARRIÈRE	P215/70R16	210 KPA, 30 PSI
SPARE DE SECOURS	T145/80R17	420 KPA, 60 PSI

**SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION**

**VOIR LE MANUEL
DE L'USAGER
POUR PLUS DE
RENSEIGNEMENTS**

4D



Pre-Test Front View of Vehicle



Post-Test Front View of Vehicle

A-5.



Pre-Test Left Side View of Vehicle



Post-Test Left Side View of Vehicle



Pre-Test Left Rear Close-up View of Vehicle

A-8.



Post-Test Left Rear Close-up View of Vehicle



Pre-Test Right Side View of Vehicle



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 ¾ 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

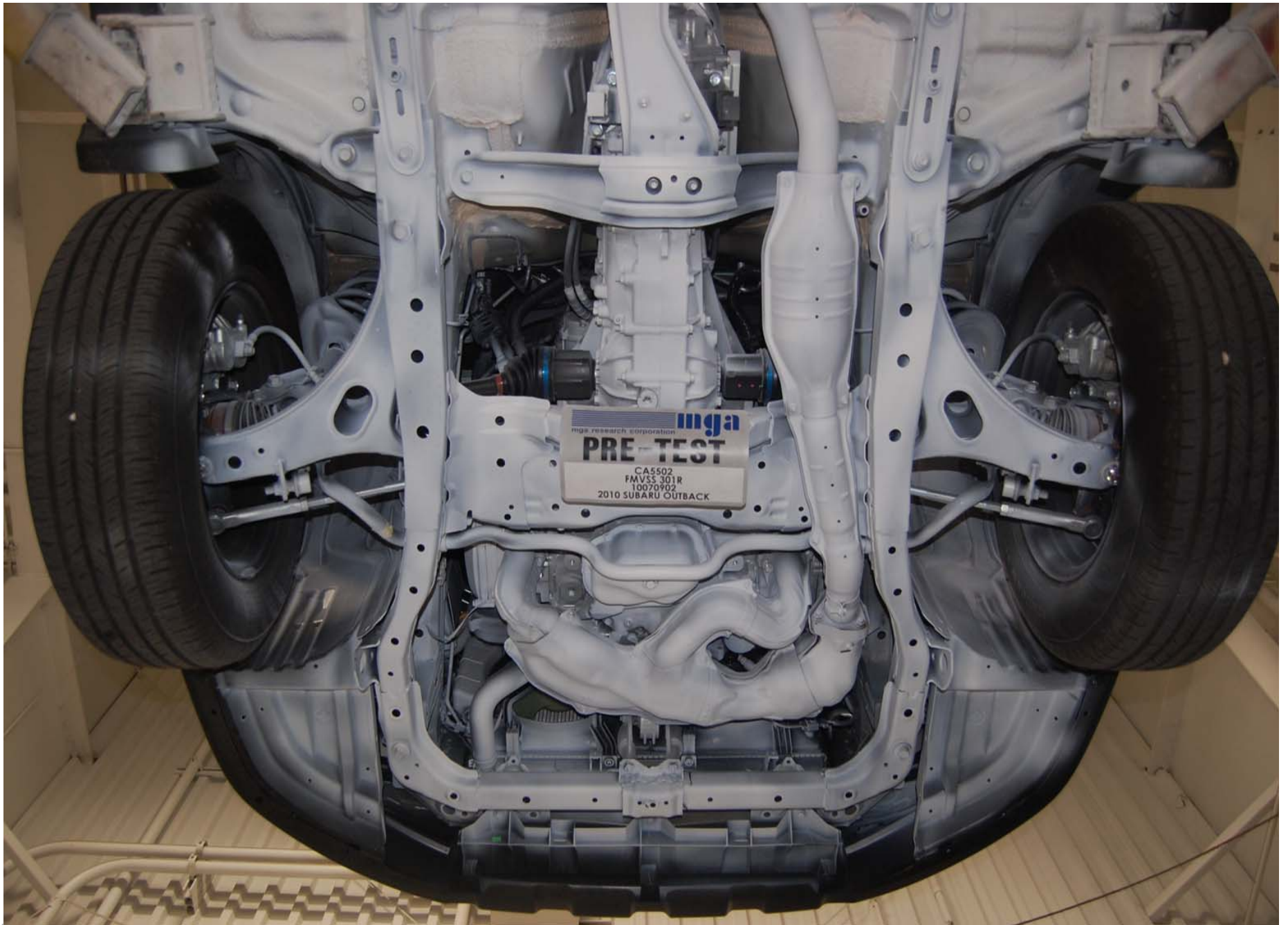


Pre-Test Impact Point

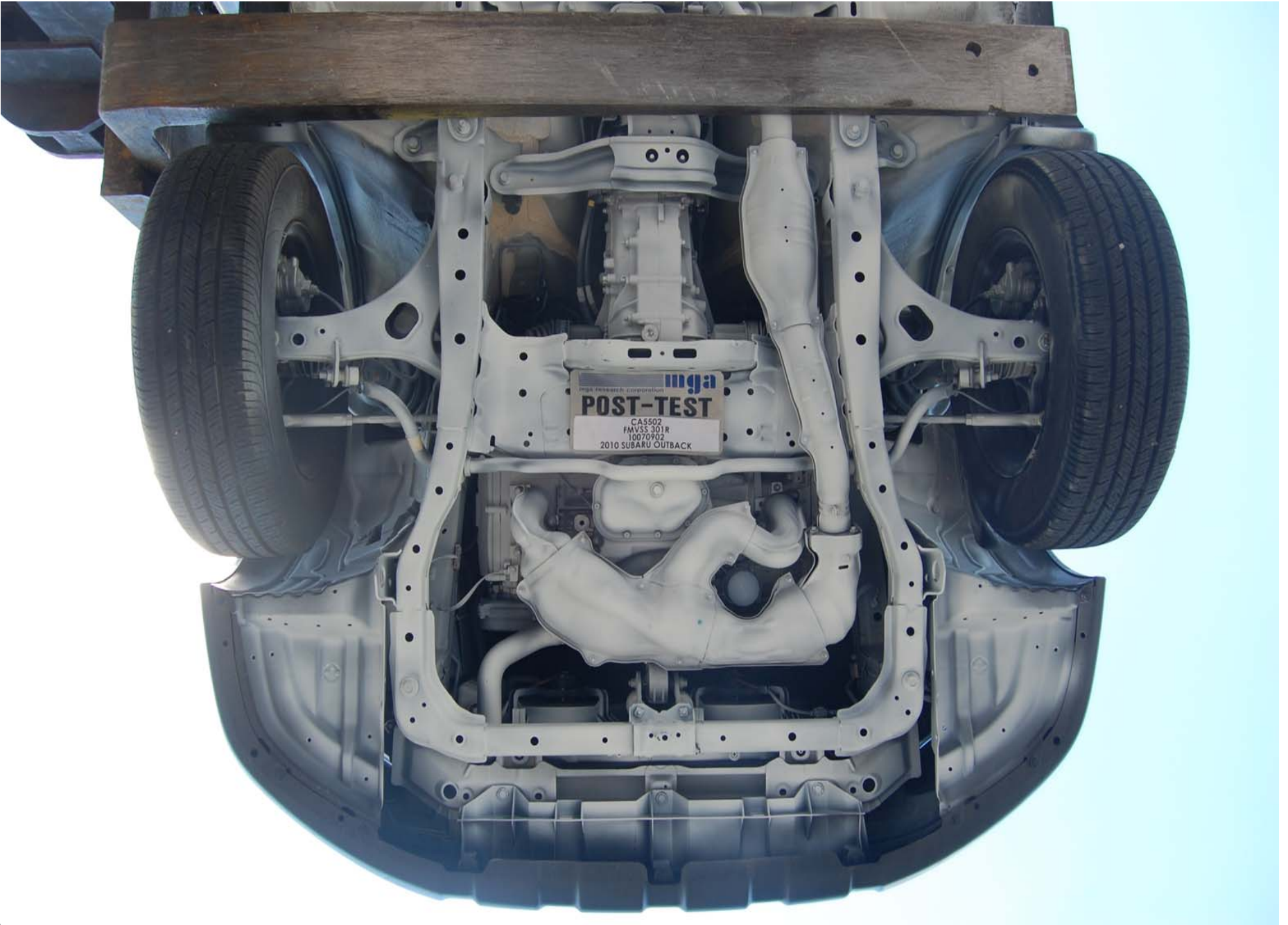
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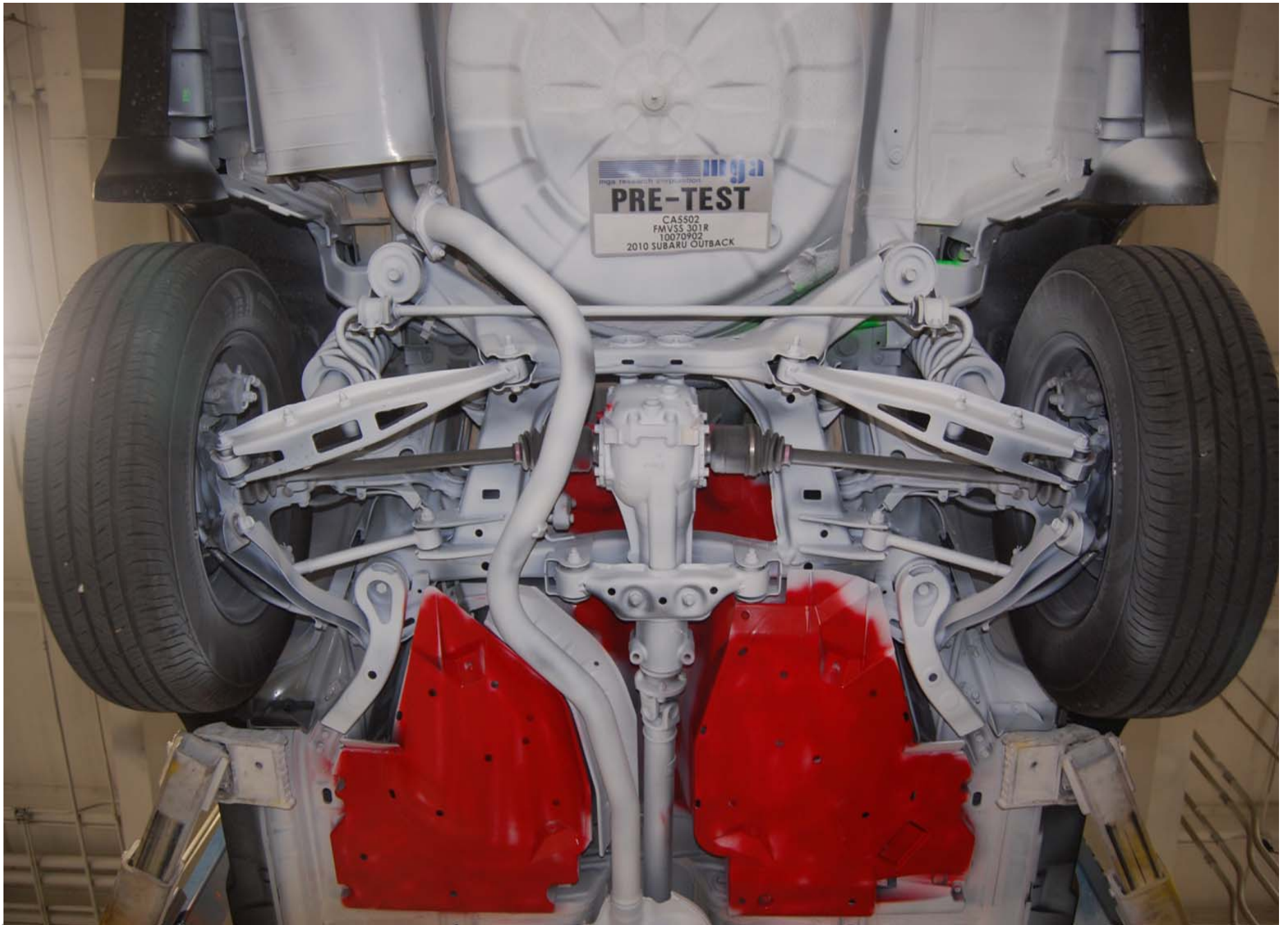
Post-Test Impact Point



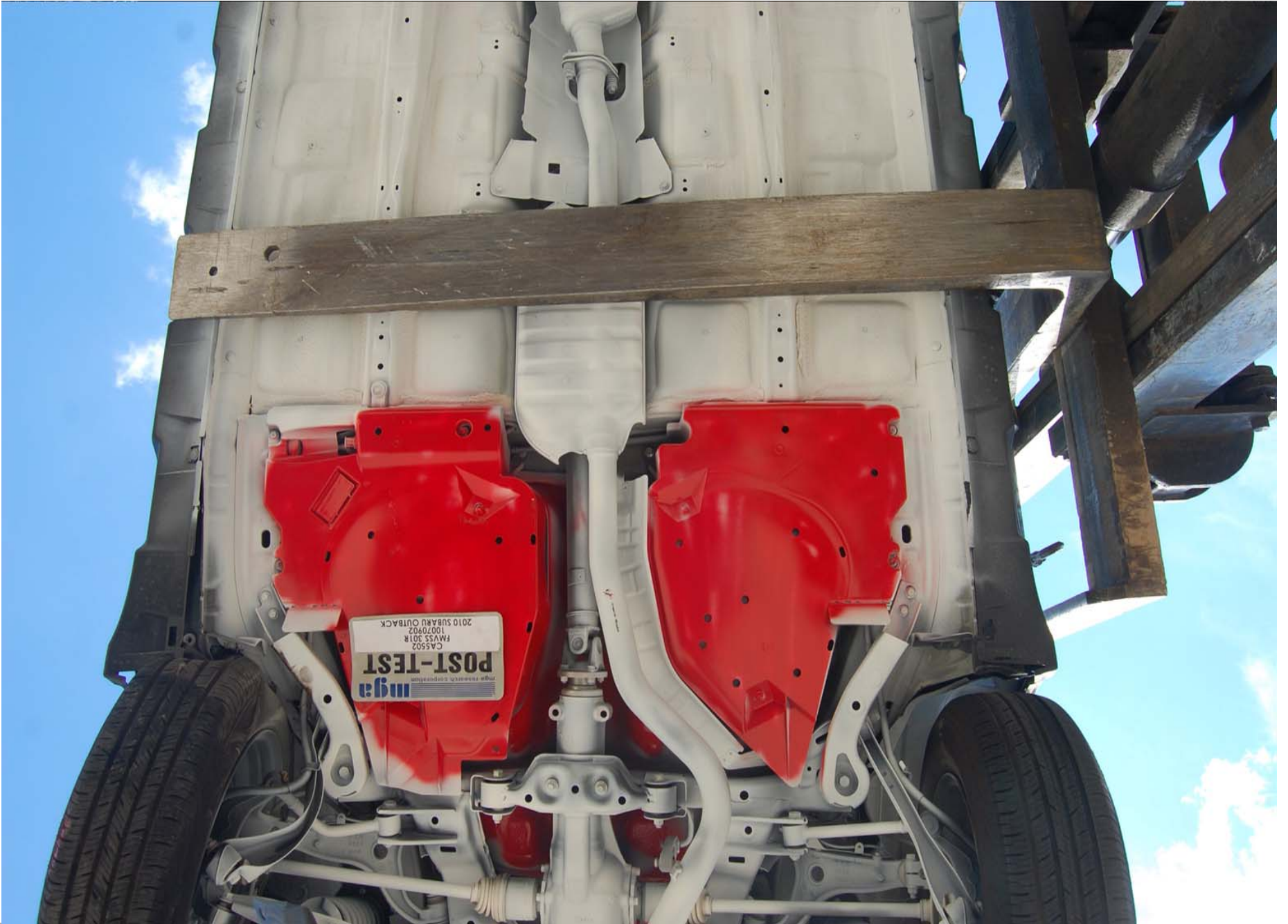
Pre-Test Underbody View 1



Post-Test Underbody View 1



Pre-Test Underbody View 2



Post-Test Underbody View 2



Pre-Test Underbody View 3



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



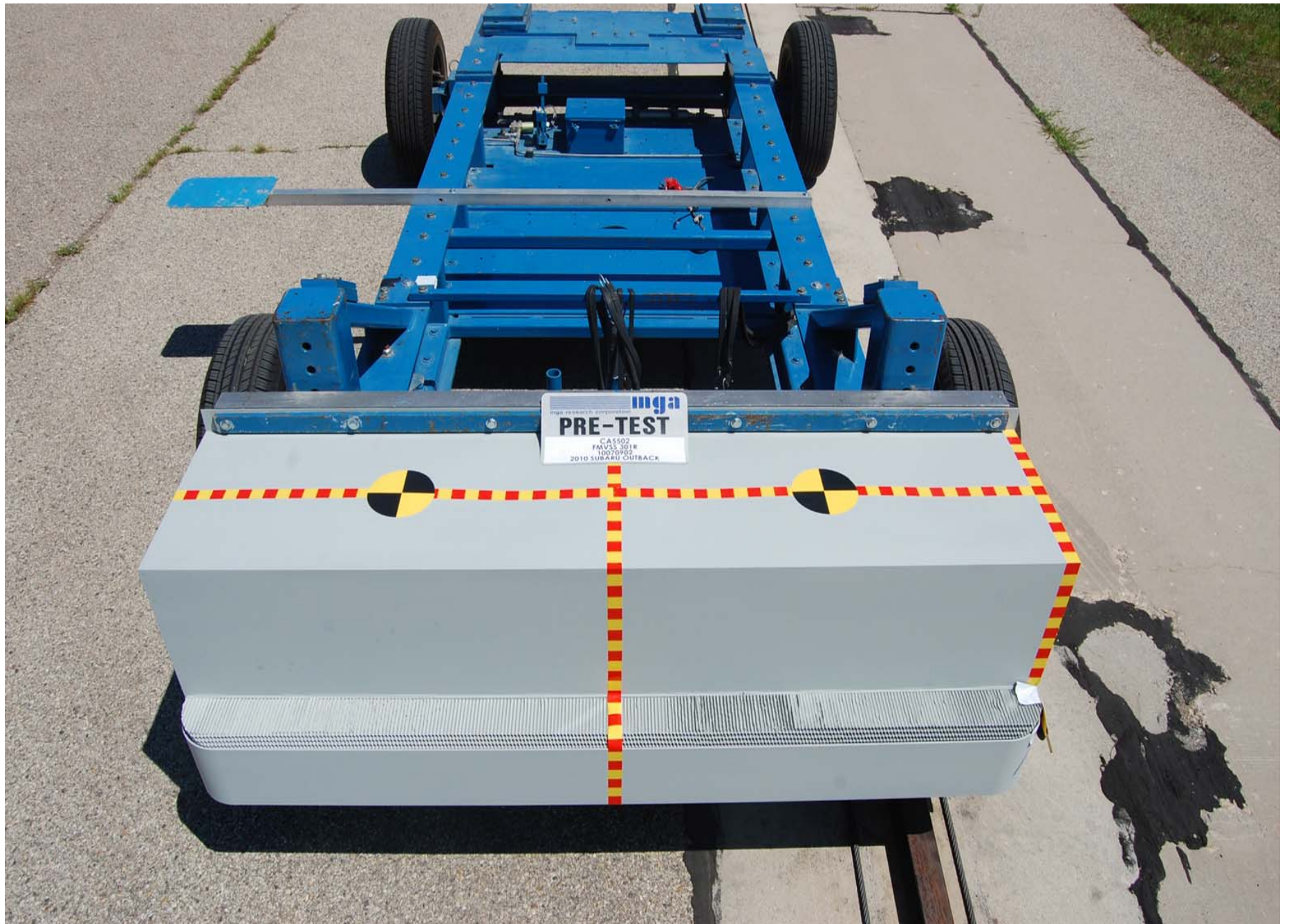
Post-Test $\frac{3}{4}$ Right Side View of MDB



Pre-Test ¾ Left Side View of MDB



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



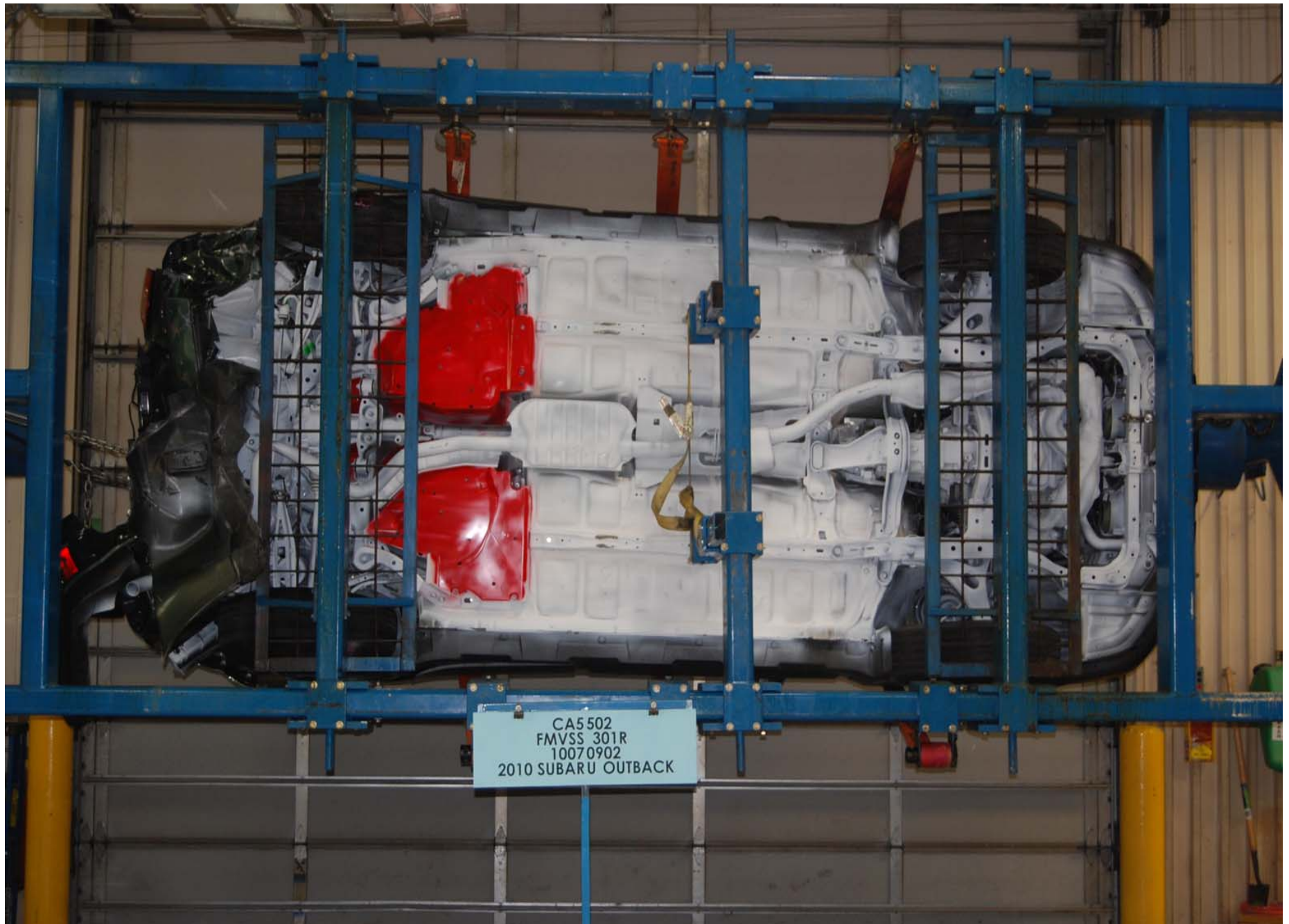
Pre-Test Top View of MDB



Post-Test Top View of MDB



Static Rollover at 90 Degrees



Static Rollover at 270 Degrees

A-40.



Static Rollover at 360 Degrees