

**REPORT NUMBER: TR-P37029-01-NC
SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT
79.3 KM/H 70% OVERLAP REAR IMPACT**

**GENERAL MOTORS LLC
2017 BUICK LACROSSE 4-DOOR SEDAN**

NHTSA NUMBER: C20170101

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



**TEST DATE:
FEBRUARY 20, 2017**

**REPORT DATE:
MARCH 6, 2017
FINAL REPORT**

**U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
ROOM 6111, NVS-220
400 SEVENTH STREET, SW
WASHINGTON, DC 20590**

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Prepared By: Amjad A. Jadallah
Mr. Amjad A. Jadallah, Project Engineer
KARCO Engineering, LLC.

Reviewed By: MLD
Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC.

Approved By: Frank D. Richardson
Mr. Frank D. Richardson, Program Manager
KARCO Engineering, LLC.

Approval Date: March 6, 2017

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7. Authors Mr. Amjad A. Jadallah, Project Engineer, KARCO Mr. Frank Richardson, Program Manager, KARCO		8. Performing Organization Report No. TR-P37029-01-NC	
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16. Abstract A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2017 Buick Lacrosse 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Laboratory Test Procedure for FMVSS 301R. The test was conducted at the KARCO Engineering, LLC. facility in Adelanto, California on February 20, 2017. The impact velocity was 79.70 km/h and the outside ambient temperature was 16.0°C. There was no Stoddard solvent leakage immediately after the test or during any portion of the static rollover. The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity - Rear Impact".			
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SECTION 1

SUMMARY OF TEST

SUMMARY

The purpose of this rear impact test is to measure the performance of the subject vehicle, a 2017 Buick Lacrosse 4-door sedan, for FMVSS 301R "Fuel System Integrity – Rear Impact".

This 79.3 km/h 70% Overlap Rear Impact is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-16-D-00029. It was conducted in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure TP-301R-02 for FMVSS 301R "Fuel System Integrity – Rear Impact", dated January, 2007.

The test was performed at KARCO Engineering, LLC. on February 20, 2017. Pre- and post-test photographs of the vehicle and ATD's can be found in Appendix A of this report.

Three (3) real-time cameras and three (3) high-speed cameras were used to document the rear impact event.

Two Part 572E 50th percentile male anthropomorphic test devices (ATD) were placed in the driver and right front passenger seating positions. Both ATD's were not instrumented for this test.

There was no Stoddard solvent leakage after the impact or during any portion of the static rollover. The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity – Rear Impact". FMVSS 301 data is summarized in Data Sheets 6 and 7.

SECTION 2
DATA SHEETS

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	C20170101
Model Year	2017
Make	Buick
Model	Lacrosse
Body Style	4-Door Sedan
VIN	1G4ZN5SS5HU131560
Body Color	Crimson Red Tintcoat
Odometer Reading (km / mi)	539 / 335
Engine Displacement (L)	3.6
Type / No. of Cylinders	V-6
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

Traction Control System	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	Yes
Driver Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Seat Belt Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other	No

Does Owner's Manual provide instructions to turn off automatic door locks? Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors LLC
Date of Manufacture	Aug-16

GVWR (kg)	2057
GAWR Front (kg)	1067
GAWR Rear (kg)	990

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				416.0	A
DSC x 68 (kg)				340.0	B
Cargo Weight (RCLW) (kg)				76.0	A-B

DATA SHEET NO. 2

PRE-TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	478.5	344.0	822.5	534.5	392.0	926.5	514.0	423.5	937.5
Right	kg	481.0	319.5	800.5	528.0	384.0	912.0	512.5	398.5	911.0
Ratio	%	59.1%	40.9%	100.0%	57.8%	42.2%	100.0%	55.5%	44.5%	100.0%
Total	kg	959.5	663.5	1623.0	1062.5	776.0	1838.5	1026.5	822.0	1848.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1623.0	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	76.0	C
Calculated Vehicle Target Wt (TVTW)	kg	1847.0	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	742	743	740	742	1049
As Tested	mm	720	727	719	722	1083
Fully Loaded	mm	750	755	731	736	1141
Post-Test	mm	726	718	728	724	

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Total Vehicle Wheel Base	mm	2900
Total Vehicle Length	mm	4990
Total Vehicle Width	mm	1855
Amount of Stoddard Solvent in Fuel Tank	L	55.60

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

BALLAST DATA

Description	Value
Type of Ballast	Ballast Dummies
Method of Securing Ballast	Seat Belt
Weight of Ballast in Cargo Area	51.0 kg
Weight of Vehicle Components Removed	0.0 kg

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

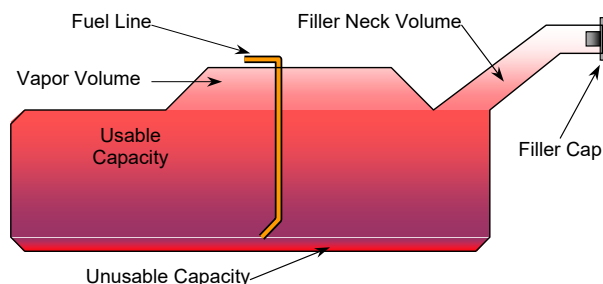
No vehicle components were removed

FUEL TANK CAPACITY

Description	Liters
Fuel System Capacity Listed in Owners Manual	59.80
Usable Capacity of "Standard Tank"	59.80
91 - 94% of Usable Capacity	54.42 - 56.21
Actual Amount of Stoddard Solvent Used	55.60

FUEL PUMP

The vehicle is equipped with an electric fuel pump. The fuel pump will run for 3 seconds when the ignition is turned to the "on" position and then will not run unless the engine is cranking or running.



VEHICLE FUEL TANK ASSEMBLY

TEST FLUID

Description	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.758
Test Fluid Kinematic Viscosity	
Test Fluid Color	Purple

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan

NHTSA No.: C20170101

Test Program: 79.3 km/h 70% Overlap Rear Impact

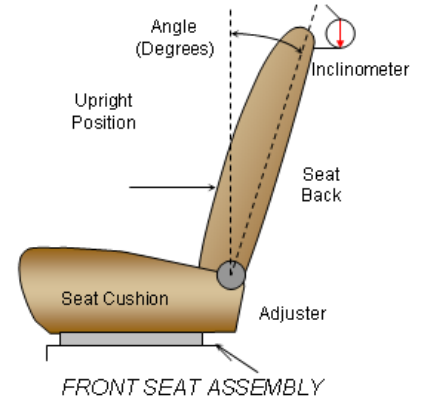
Test Date: 02/20/17

NOMINAL DESIGN RIDING POSITION

Seat back angle is measured using a digital inclinometer placed on the headrest.

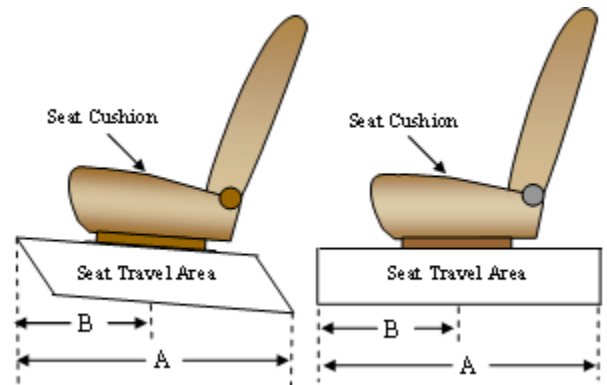
SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	12.8
Passenger Seat Back Angle	12.8



SEAT FORE / AFT POSITIONING

The total seat travel is measured from the forward most possible position to the rear most possible position. The driver's seat is set to the middle of the fore-aft travel. The passenger's seat is set to the middle of the fore-aft travel.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore-Aft Travel	Placed in Position
Driver Seat	330 mm	165 mm
Passenger Seat	328 mm	164 mm

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan

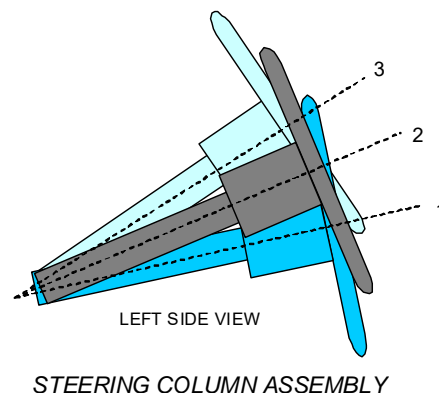
NHTSA No.: C20170101

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 02/20/17

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. A digital inclinometer is used to measure a plate which is placed across the rim of the steering wheel for angular measurements. A tape measure is used to measure telescoping steering wheel travel.



STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	20.4	98
Geometric Center Position, No. 2	22.9	121.5
Uppermost Position, No. 3	25.4	145
Telescoping Steering Wheel Travel		47
Test Position	22.9	121.5

DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

MOVING BARRIER TEST WEIGHT

	Units	As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total
Left	kg	377.0	292.5	669.5
Right	kg	389.5	301.5	691.0
Ratio	%	56.3%	43.7%	100.0%
Total	kg	766.5	594.0	1360.5

MOVING BARRIER TIRE INFORMATION

Measured Parameter	Front	Rear
Recommended Tire Size	205/75R15	205/75R15
Tire Size on Vehicle	205/75R15	205/75R15
Tire Manufacturer	Pacemark	Pacemark
Tire Model	All Weather	All Weather
Treadwear	420	420
Traction	A	A
Temperature Grades	B	B
Tire Pressure - Front	220	220
Tire Pressure - Rear	220	220

MOVING BARRIER DIMENSIONS

Measurement Description	Length (mm)
Overall Width	1676
Overall Height	559
Honeycomb Depth	380
Overall Depth	483
Bottom Honeycomb to Bottom Bumper	51
Bumper Height	204
Ground to Top of MDB	788
Ground to Bottom of MDB	228
Ground to Bottom of Bumper	280
Ground to Top of Bumper	482

DATA SHEET NO. 4**POST-TEST DATA**Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17Temperature at Time of Impact: 16.0°C Test Time: 3:34 PMVIN: 1G4ZN5SS5HU131560**IMPACT VELOCITY DATA**

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	79.70
Trap No. 2 Velocity (Redundant)	km/h	79.68

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1855
Vertical Impact Reference Line (Left of Vehicle Center Line)	mm		371
Actual Impact Point (Left of Vehicle Center Line)	mm		392
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	-21
Vertical Offset (+ down / - up)	mm	± 40 of Intended Impact Point	9

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	4990	4490	500
2	Total Length	4990	4580	410
3	Total Width	1855	2467	612
4	Left Side Wheelbase	2900	2915	15
5	Right Side Wheelbase	2902	2880	22

MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Row	Vertical Location		From Centerline		Max. Crush (mm)
	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	382	800	Left	284
B	Top of Bumper	483	100	Right	264
C	Mid Level	636	300	Left	161
D	Top of Stack	763	200	Right	102

DATA SHEET NO. 4... (CONTINUED)

POST-TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan NHTSA No.: C20170101
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 02/20/17

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door Opening	Remained closed and latched	Remained closed and latched
Rear Door Opening	Remained closed and latched	Remained closed and latched
Hatch and other doors	Rear Hatch Jammed Shut	

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Stoddard Solvent Spillage Measurements

From impact until vehicle motion ceases: 0 g

(Maximum allowable = 28 g)

For the 5 minute period after motion ceases: 0 g

(Maximum allowable = 142 g)

For the following 25 minutes: 0 g

(Maximum allowable = 28 g/minute)

Spillage: None

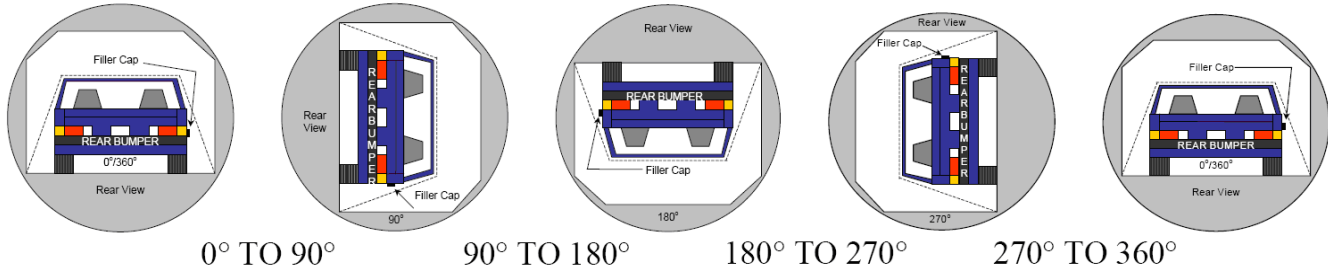
DATA SHEET NO. 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2017 Buick Lacrosse 4-Door Sedan

NHTSA No.: C20170101

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 02/20/17



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).

Details of Stoddard solvent spillage: None

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	83	300	383
90° To 180°	87	300	387
180° To 270°	84	300	384
270° To 360°	79	300	379

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° To 90°	0 g			
90° To 180°	0 g			
180° To 270°	0 g			
270° To 360°	0 g			

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° To 90°	No Spillage
90° To 180°	No Spillage
180° To 270°	No Spillage
270° To 360°	No Spillage

**APPENDIX A
PHOTOGRAPHS**

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FIGURE 1. As Received Right Front ¾ View of Test Vehicle



FIGURE 2. As Received Left Rear ¾ View of Test Vehicle



FIGURE 3. Test Vehicle Manufacturer's Label



FIGURE 4. Test Vehicle Tire Information Placard



FIGURE 5. Pre-Test Front View of Test Vehicle



FIGURE 6. Post-Test Front View of Test Vehicle



FIGURE 7. Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 8. Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 9. Pre-Test Left Side View of Test Vehicle



FIGURE 10. Post-Test Left Side View of Test Vehicle



FIGURE 11. Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 12. Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 13. Pre-Test Rear View of Test Vehicle



FIGURE 14. Post-Test Rear View of Test Vehicle



FIGURE 15. Pre-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 16. Post-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 17. Pre-Test Right Side View of Test Vehicle



FIGURE 18. Post-Test Right Side View of Test Vehicle



FIGURE 19. Pre-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 20. Post-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 21. Pre-Test Close-Up View of Impact Point Target

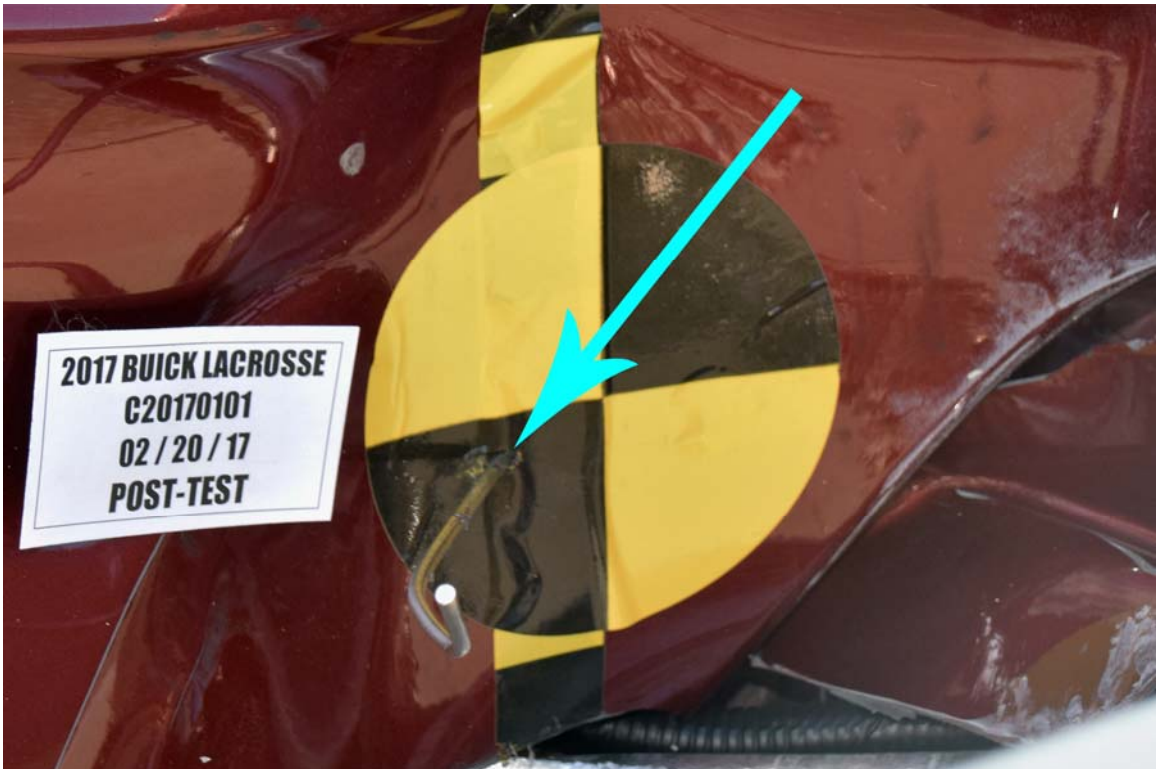


FIGURE 22. Post-Test Close-Up View of Impact Point Target



FIGURE 23. Pre-Test View of Fuel Filler Cap



FIGURE 24. Post-Test View of Fuel Filler Cap



FIGURE 25. Pre-Test Rear Underbody View of Test Vehicle

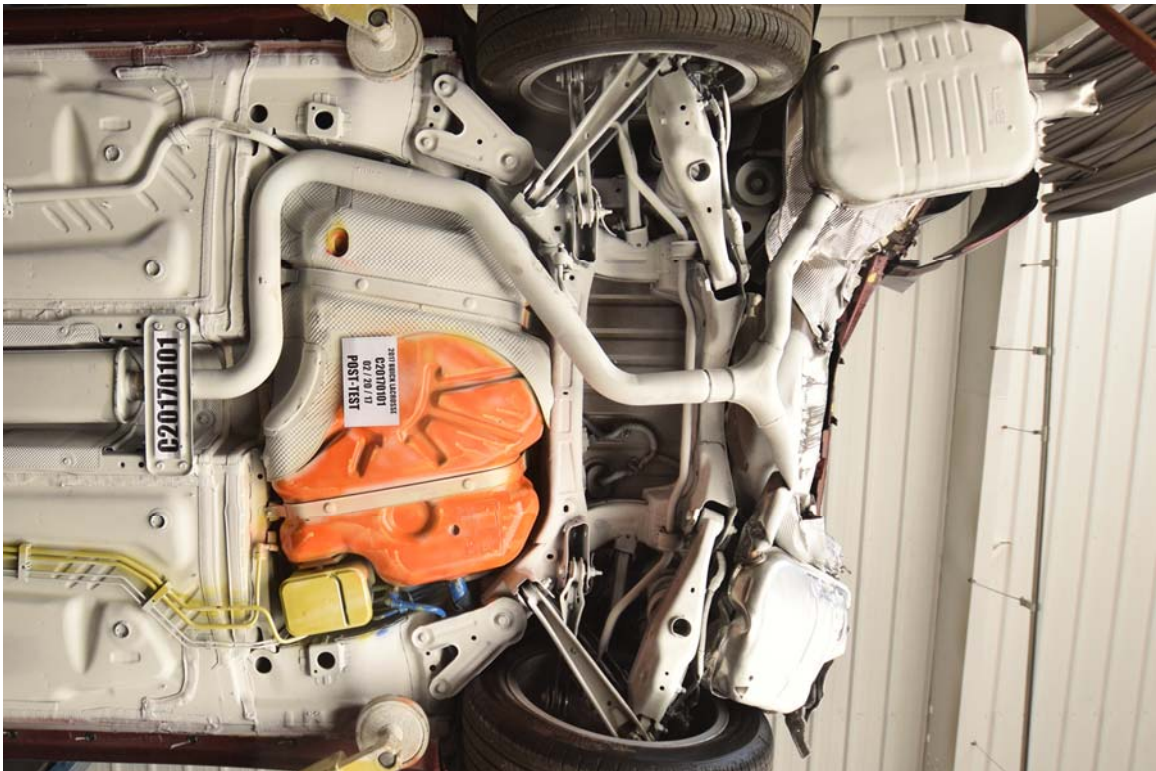


FIGURE 26. Post-Test Rear Underbody View of Test Vehicle



FIGURE 27. Pre-Test Underbody View of Fuel Tank



FIGURE 28. Post-Test Underbody View of Fuel Tank

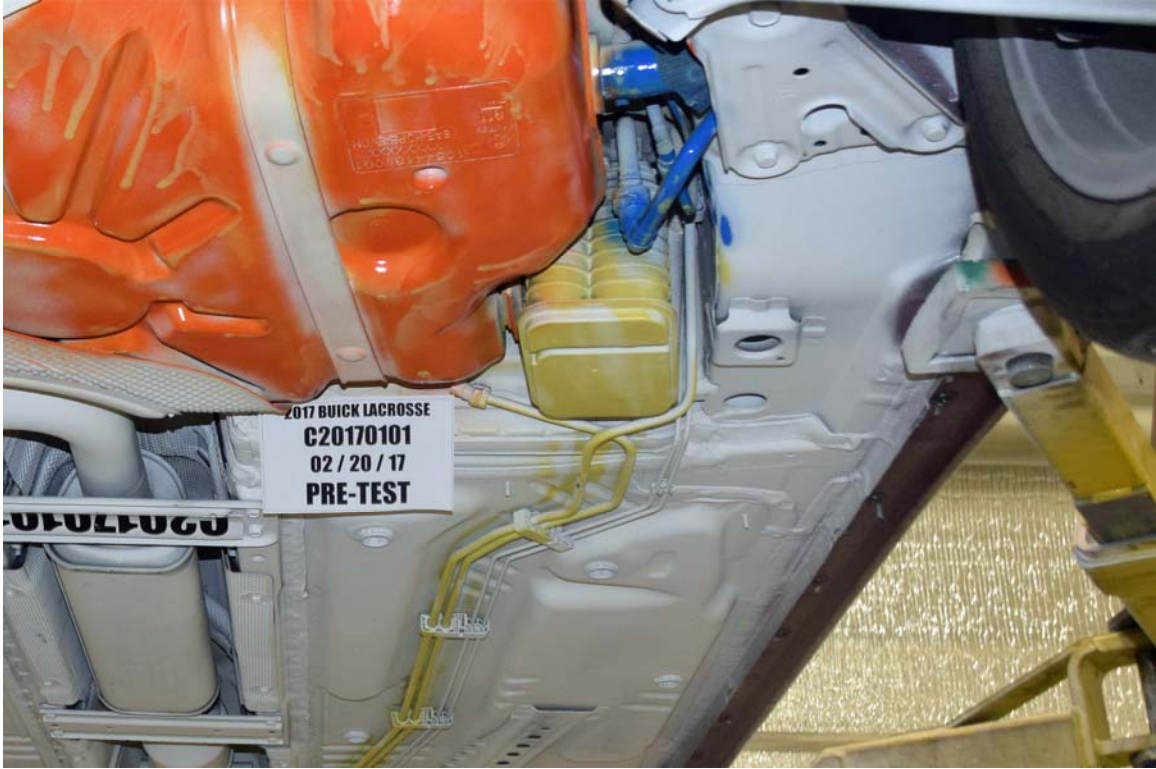


FIGURE 29. Pre-Test Underbody View of Fuel Lines

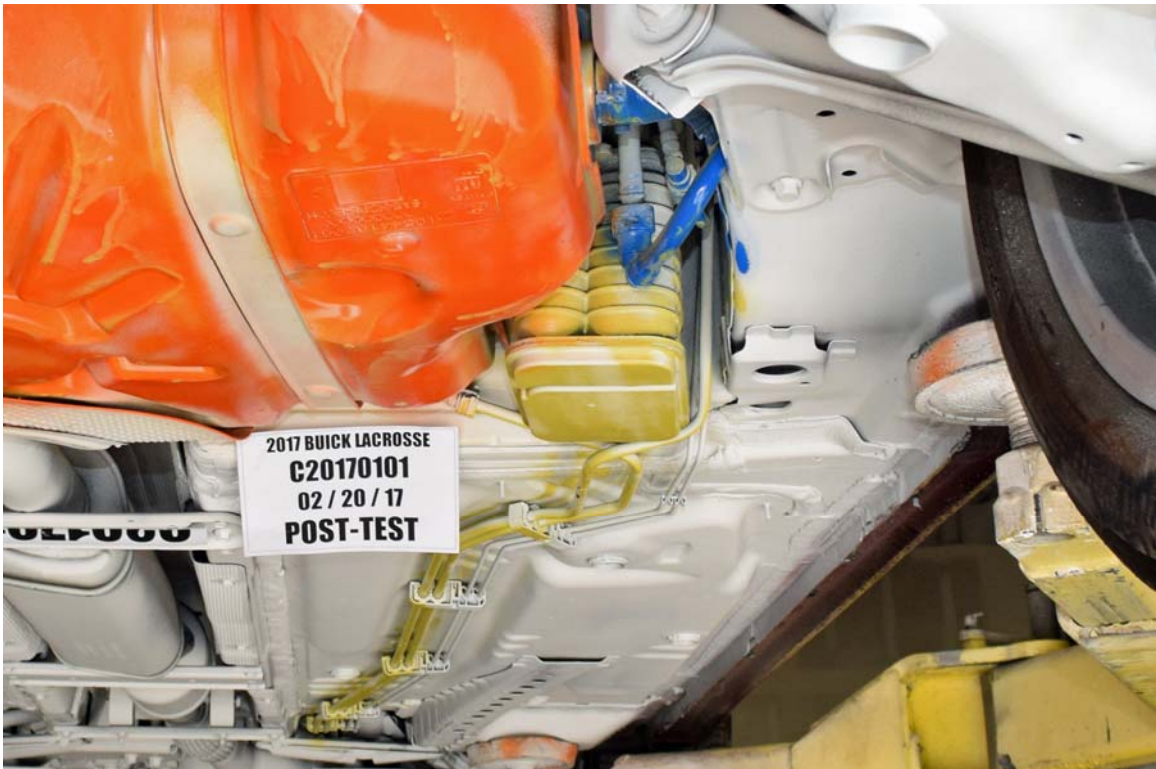


FIGURE 30. Post-Test Underbody View of Fuel Lines



FIGURE 31. Test Vehicle at 0° on FMVSS 301 Static Rollover Device



FIGURE 32. Test Vehicle at 90° on FMVSS 301 Static Rollover Device



FIGURE 33. Test Vehicle at 180° on FMVSS 301 Static Rollover Device

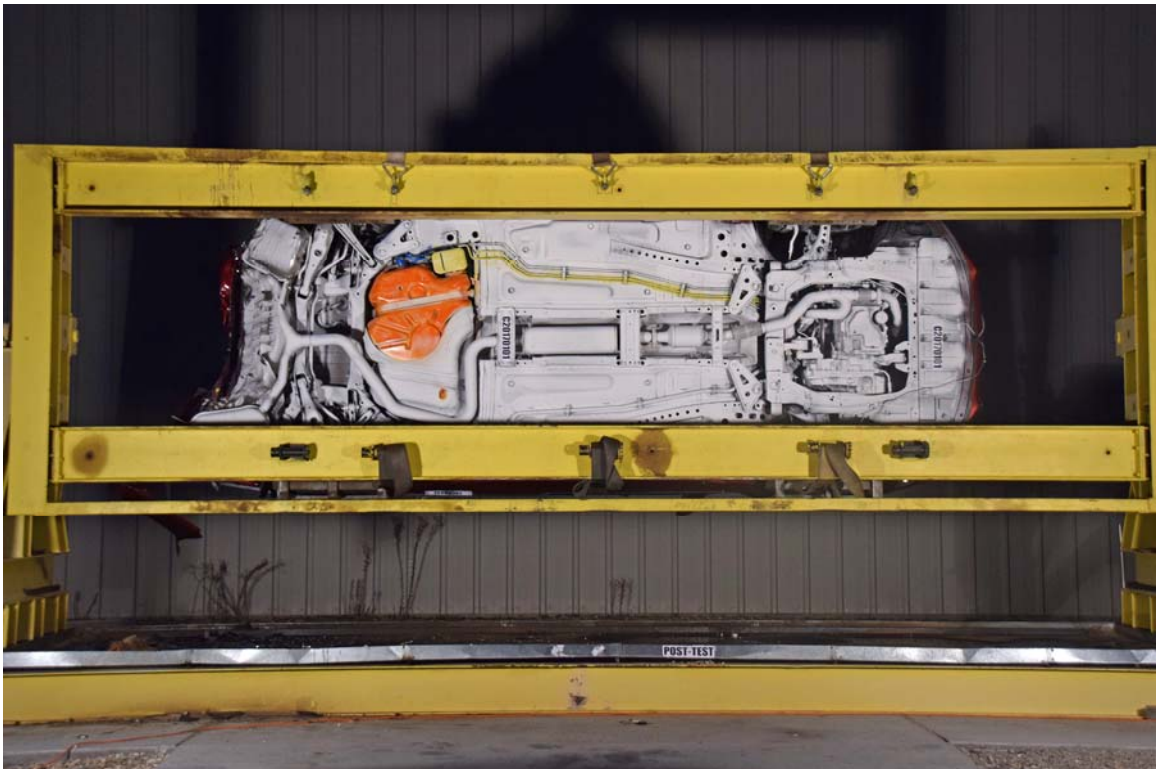


FIGURE 34. Test Vehicle at 270° on FMVSS 301 Static Rollover Device



FIGURE 35. Test Vehicle at 360° on FMVSS 301 Static Rollover Device



FIGURE 36. Impact Event