REPORT NUMBER: TR-P34135-05-NC

SAFETY COMPLIANCE TESTING FOR FMVSS 301R

FUEL SYSTEM INTEGRITY – REAR IMPACT

79.3 KM/H 70% OVERLAP REAR IMPACT

VOLKSWAGEN DE MEXICO S.A. DE C.V.

2014 VOLKSWAGEN BEETLE 3-DOOR HATCHBACK

NHTSA NUMBER: C20145801

PREPARED BY:

KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CA 92301

TEST DATE:

SEPTEMBER 5, 2014

REPORT DATE:

SEPTEMBER 19, 2014

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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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, D.C. 20590	Final Test Report, Sept. 5 - 19, 2014 **14. Sponsoring Agency Code**

15. Supplementary Notes

16. Abstract

A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2014 Volkswagen Beetle 3-door hatchback 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 September 5, 2014.

The impact velocity was 79.59 km/h and the outside ambient temperature was 35.0 deg. C. There was no Stoddard solvent leakage immediately after the test or during any portion of the static rollover

17. Key Words	18. Distribution Statement
FMVSS 301R Overlap Rear Impact MDB 2014 Volkswagen Beetle	

19. Security Classification of this report	20. Security Classification of this page	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	38	

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SECTION 1
SUMMARY OF TEST

SUMMARY

The purpose of this rear impact test series is to measure the performance of the subject vehicle, a 2014 Volkswagen Beetle 3-door hatchback, 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 DTNH22-11-D-00245. 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 September 5, 2014. Pre- and post-test photographs of the vehicle and ATD's can be found in Appendix A of this report.

Two (2) 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. FMVSS 301 data is summarized in Data Sheets 6 and 7.

SECTION 2

DATA SHEETS

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

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	^oF	^oC	=(Tf -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: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	C20145801
Model Year	2014
Make	Volkswagen
Model	Beetle
Body Style	3-Door Hatchback
VIN	3VWHX7AT6EM606324
Body Color	Red
Odometer Reading (km / mi)	1003 / 623
Engine Displacement (L)	2.5
Type / No. of Cylinders	Inline 5
Engine Placement	Transverse
Transmission Type	Manual
Transmission Speeds	5
Overdrive	Yes
Final Drive	Front
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
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	No
Driver Head/Torso Airbag	Yes
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	No
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	No
Front Pass. Head/Torso Airbag	Yes
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	No
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
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?

DATA FROM CERTIFICATION LABEL

Manufactured By	Volkswagen de Mexico S.A. de C.V.
Date of Manufacture	Aug-13

GVWR (lbs)	3858
GAWR Front (lbs)	2161
GAWR Rear (lbs)	1808

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

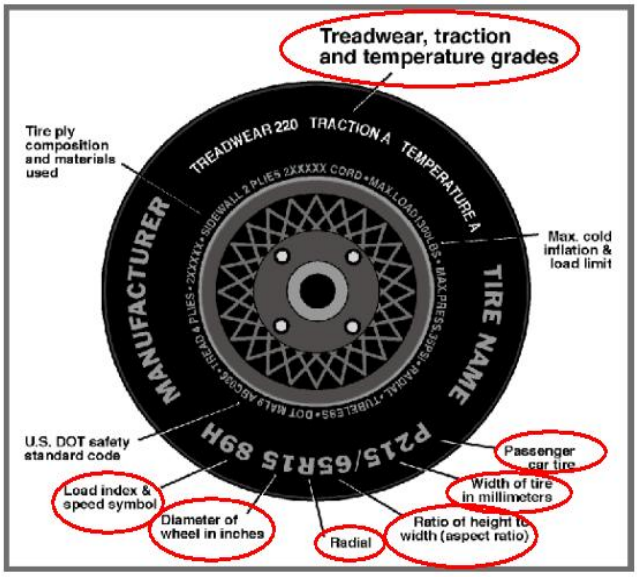
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Bench			
Designated Seating Capacity	2	2		4	
Capacity Weight (VCW) (kg)				383.0	*A*
DSC x 68 (kg)				272.0	*B*
Cargo Weight (RCLW) (kg)				111.0	*A-B*

DATA SHEET NO. 1 … (CONTINUED)

TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max Tire Pressure (kPa)	350	350
Cold Tire Pressure (kPa)	200	200
Max Load Tire Pressure (kPa)		
Recommended Tire Size	P215/55R17	P215/55R17
Tire Size on Vehicle	P215/55R17	P215/55R17
Tire Manufacturer	Hankook	Hankook
Tire Model	Optimo H426	Optimo H426
Load Range	570	570
Treadwear Rating	440	440
Traction Rating	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Nylon	1 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	94H	94H
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	5MT1 DLH 1713	5MT1 DLH 1713
DOT Safety Code Right	5MT1 DLH 1713	5MT1 DLH 1713
Type of Spare Tire	Compact Size Spare Tire T125/90R16	
Location of Tire Placard on Vehicle	Driver Side 'A' Pillar Panel	

DATA SHEET NO. 2

PRE-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	425.0	263.0		478.0	340.0		460.0	359.0	
Right	kg	414.0	266.0		460.0	340.0		443.0	366.5	
Ratio	%	61.3%	38.7%	100.0%	58.0%	42.0%	100.0%	55.4%	44.6%	100.0%
Total	kg	839.0	529.0	1368.0	938.0	680.0	1618.0	903.0	725.5	1628.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1368.0	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	111.0	C
Calculated Vehicle Target Wt (TVTW)	kg	1627.0	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	711	707	737	724	982
As Tested	mm	690	686	694	697	1067
Fully Loaded	mm	701	694	690	687	1132
Post-Test	mm	701	679	666	695	

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Total Vehicle Wheel Base	mm	2540
Total Vehicle Length	mm	4280
Total Vehicle Width	mm	1763
Amount of Stoddard Solvent in Fuel Tank	L	51.15

DATA SHEET NO. 2… (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

BALLAST DATA

Description	Value
Type of Ballast	Ballast Dummies
Method of Securing Ballast	Seat Belt
Weight of Ballast in Cargo Area	0 kg
Weight of Vehicle Components Removed	0 kg

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

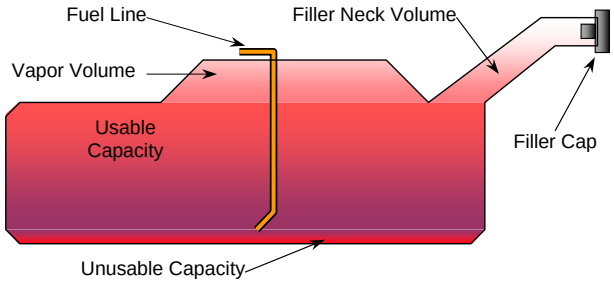
No vehicle components were removed

FUEL TANK CAPACITY

Description	Liters
Fuel System Capacity Listed in Owners Manual	55.00
Usable Capacity of "Standard Tank"	55.00
91 - 94% of Usable Capacity	50.05 - 51.70
Actual Amount of Stoddard Solvent Used	51.15

FUEL PUMP

The vehicle is equipped with an electric fuel pump. The fuel pump runs for 2 seconds after the ignition is switched to the “ON” position.



VEHICLE FUEL TANK ASSEMBLY

TEST FLUID

Description	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.76
Test Fluid Kinematic Viscosity	
Test Fluid Color	Purple

DATA SHEET NO. 2… (CONTINUED)

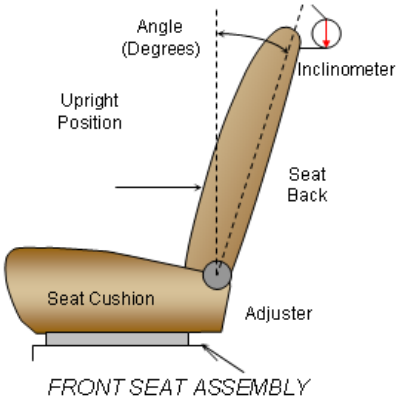
PRE-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

NOMINAL DESIGN RIDING POSITION

Seat back angle is measured at the headrest post using a digital inclinometer.

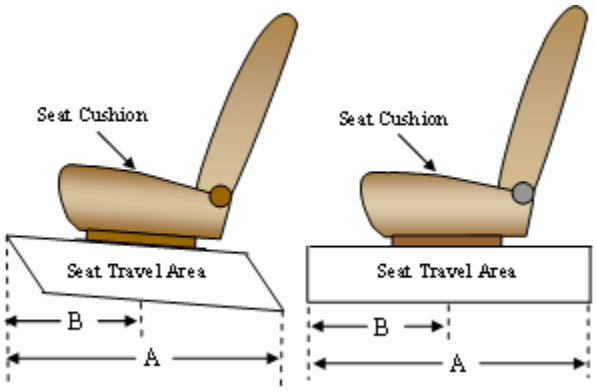


SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	19.0
Passenger Seat Back Angle	19.0

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	37 detents	15th detent
Passenger Seat	37 detents	15th detent

DATA SHEET NO. 2… (CONTINUED)

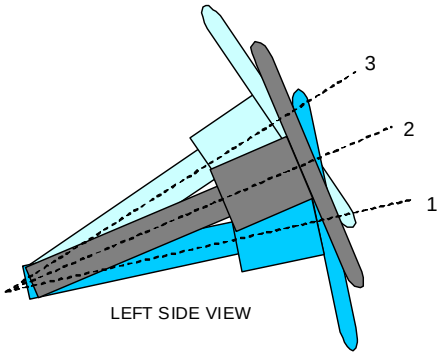
PRE-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

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 ASSEMBLY

STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	20.8	132
Geometric Center Position, No. 2	23.2	105
Uppermost Position, No. 3	25.7	78
Telescoping Steering Wheel Travel	4.9	54
Test Position	23.2	105

DATA SHEET NO. 3

MOVING BARRIER DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

MOVING BARRIER TEST WEIGHT

	Units	As Delivered Weights (UVW)		
		Front Axle	Rear Axle	Total
Left	kg	402.0	298.0	700.0
Right	kg	377.0	292.0	669.0
Ratio	%	56.9%	43.1%	100.0%
Total	kg	779.0	590.0	1369.0

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	382
Overall Depth	483
Bottom Honeycomb to Bottom Bumper	50
Bumper Height	201
Ground to Top of MDB	788
Ground to Bottom of MDB	229
Ground to Bottom of Bumper	279
Ground to Top of Bumper	483

DATA SHEET NO. 4

POST-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

Temperature at Time of Impact: 35.0°C Test Time: 11:32 AM

VIN: 3VWHX7AT6EM606324

IMPACT VELOCITY DATA

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	79.59
Trap No. 2 Velocity (Redundant)	km/h	79.62

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1763
Vertical Impact Reference Line (Left of Vehicle Center Line)	mm		353
Actual Impact Point (Left of Vehicle Center Line)	mm		351
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	2
Vertical Offset (+ down / - up)	mm	± 40 of Intended Impact Point	0

TARGET VEHICLE PRE- AND POST- TEST STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	4280	4172	108
2	Total Length	4280	4172	108
3	Total Width	1763	1978	215
4	Left Side Wheelbase	2540	2533	7
5	Right Side Wheelbase	2541	2458	83

MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Vertical Location			From Centerline		Max. Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	387
B	Top of Bumper	533	800	Left	345
C	Mid Level	686	700	Left	257
D	Top of Stack	813	800	Left	214

DATA SHEET NO. 4… (CONTINUED)

POST-TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14

DOOR OPENING AND SEAT TRACK INFORMATION

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

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Stoddard Solvent Spillage Measurements

A. From impact until vehicle motion ceases: 0 g
(Maximum allowable = 28 g)

B. For the 5 minute period after motion ceases: 0 g
(Maximum allowable = 28 g)

C. For the following 25 minutes: 0 g
(Maximum allowable = 28 g/minute)

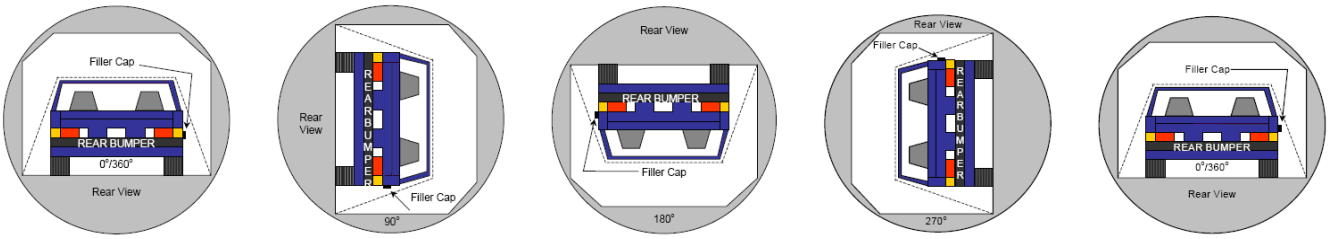
D. Spillage: No Stoddard Solvent leakage

DATA SHEET NO. 5

STATIC ROLLOVER TEST DATA

Test Vehicle: 2014 Volkswagen Beetle 3-Door Hatchback NHTSA No.: C20145801

Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/05/14



0° TO 90° 90° TO 180° 180° TO 270° 270° TO 360°

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: No Stoddard solvent spillage

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	84	300	384
90° To 180°	83	300	383
180° To 270°	76	300	376
270° To 360°	81	300	381

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

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

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

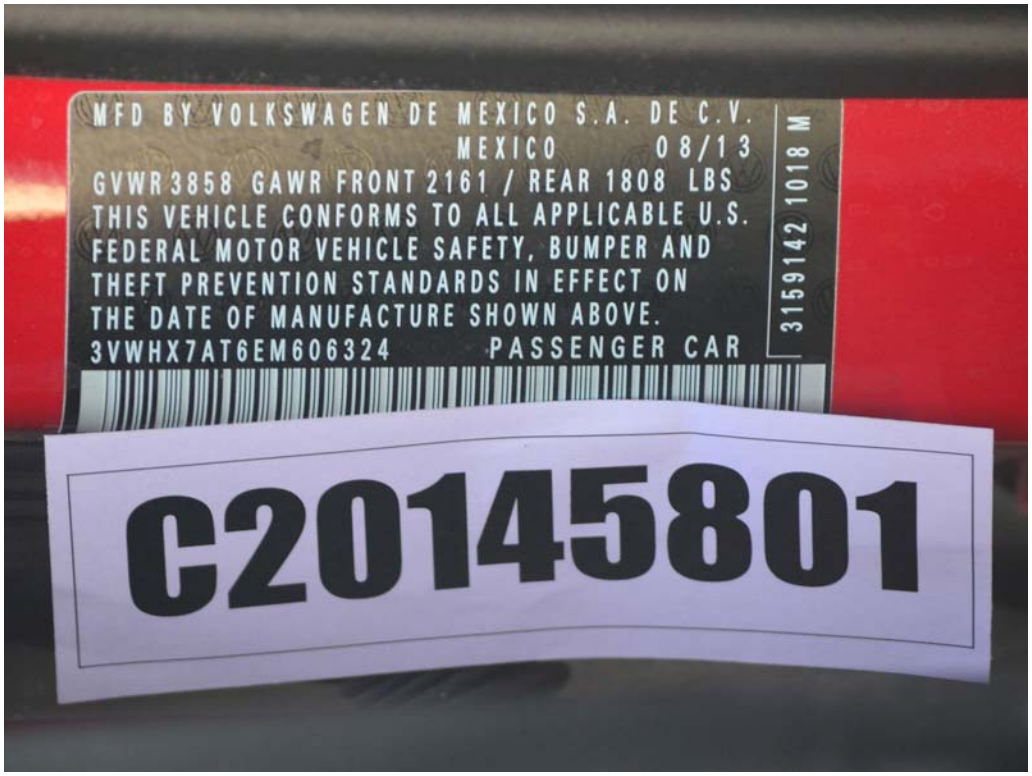


FIGURE 3. Test Vehicle Manufacturer's Label

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 ¾ View of Test Vehicle

FIGURE 8. Post-Test Left Front ¾ 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 ¾ View of Test Vehicle

FIGURE 12. Post-Test Left Rear ¾ 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 ¾ View of Test Vehicle

FIGURE 16. Post-Test Right Rear ¾ 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 ¾ View of Test Vehicle

FIGURE 20. Post-Test Right Front ¾ 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

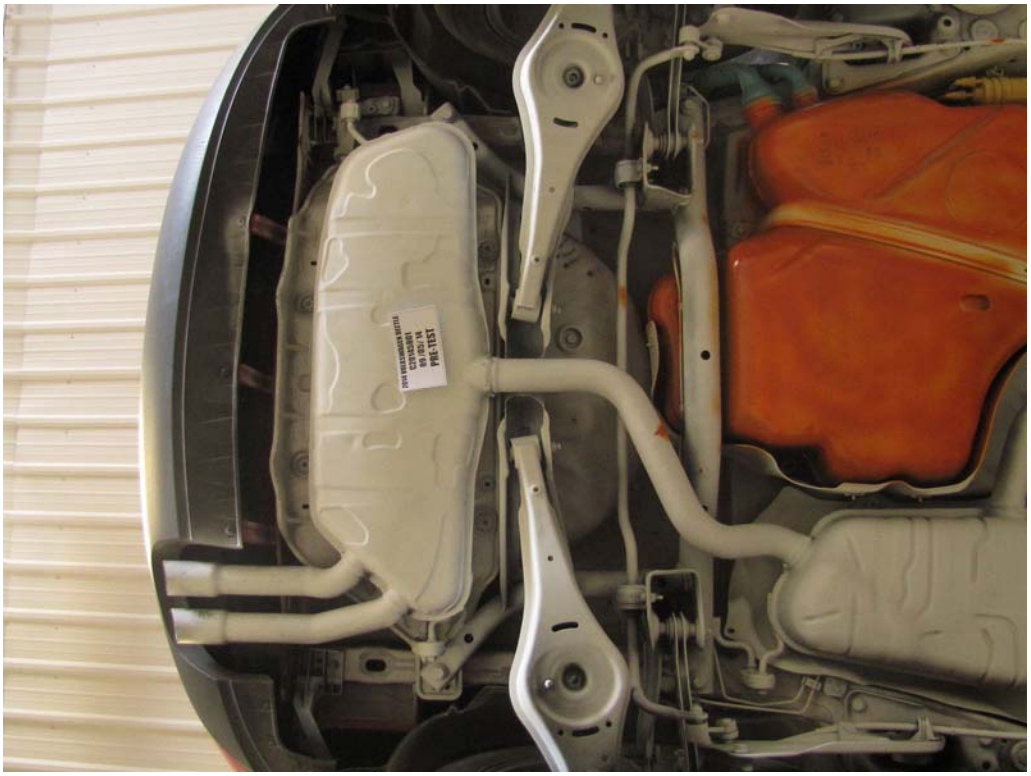


FIGURE 25. Pre-Test Rear Underbody View of Test Vehicle

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

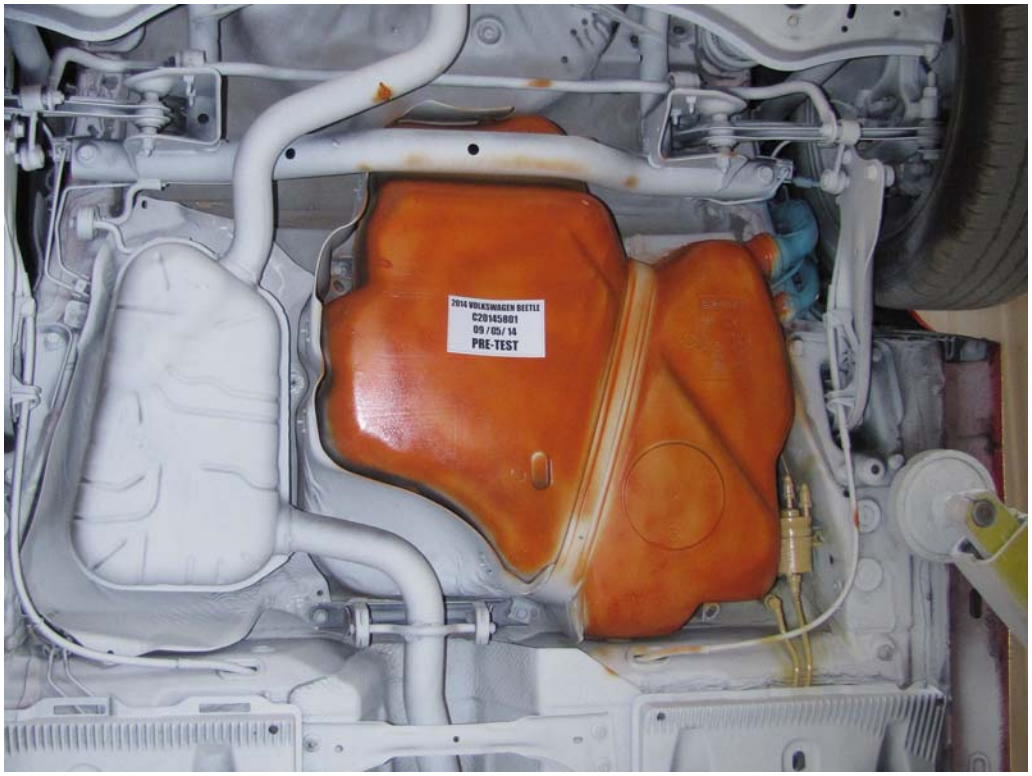


FIGURE 27. Pre-Test Underbody View of Fuel Tank

FIGURE 28. Post-Test Underbody View of Fuel Tank

FIGURE 29. Pre-Test Underbody View of Fuel Filler Neck

FIGURE 30. Post-Test Underbody View of Fuel Filler Neck

FIGURE 31. Pre-Test Underbody View of Fuel Lines

FIGURE 32. Post-Test Underbody View of Fuel Lines

FIGURE 33. Test Vehicle at 0° on FMVSS 301 Static Rollover Device

FIGURE 34. Test Vehicle at 90° on FMVSS 301 Static Rollover Device

FIGURE 35. Test Vehicle at 180° on FMVSS 301 Static Rollover Device

FIGURE 36. Test Vehicle at 270° on FMVSS 301 Static Rollover Device

FIGURE 37. Test Vehicle at 360° on FMVSS 301 Static Rollover Device

FIGURE 38. Impact Event