

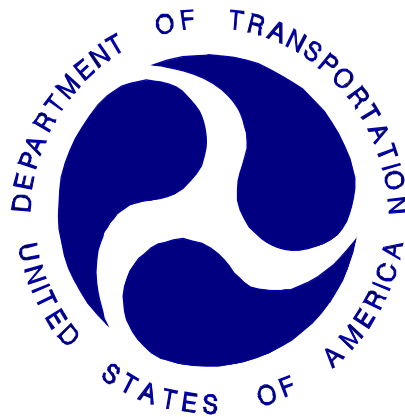
REPORT NUMBER: 301R-CAL-13-003

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

**GM Korea Company
2013 Chevrolet Spark
Four Door Hatchback**

NHTSA NUMBER: C20130101

**PREPARED BY:
CALSPAN CORPORATION
TRANSPORTATION TEST OPERATIONS
P.O. BOX 400
BUFFALO, NEW YORK 14225**



May 21, 2013

FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Avenue, SE
Washington, DC 20590**

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-11-D-00243.

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Prepared By: 
Vanessa Walsh, Project Engineer

Approved By: 
Edward J. Dutton, Test Engineer Director
Transportation Test Operations

Approval Date: May 21, 2013

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Accepted By: Edward E. Chan  Digitally signed by Edward E. Chan
DN: cn=Edward E. Chan, o=Office of Vehicle Safety
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| 15. Supplementary Notes | | | |
| 16. Abstract A compliance test was conducted on a 2013 Chevrolet Spark Four Door Hatchback in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301R-02 for the determination of FMVSS 301R compliance. Test failures identified were as follows: None - The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity – Rear Impact." | | | |
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SECTION 1

PURPOSE AND TEST PROCEDURE

This rear impact test is part of the FMVSS 301R Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-11-D-00243. The purpose of this test was to determine if the subject vehicle, a 2013 Chevrolet Spark Four Door Hatchback, meets the performance requirements of FMVSS No. 301R "Fuel System Integrity – Rear Impact." The test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-301R-02, dated January 17, 2007).

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1202 kg 2013 Chevrolet Spark Four Door Hatchback was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.27 kph (49.26 mph). The test was performed by Calspan Corporation on 5/9/2013.

The test vehicle was equipped with a 35.0 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (13.6kg) was secured in the vehicle cargo area. Two ballast Part 572E 50th percentile male Anthropomorphic Test Devices (ATD) were placed in the front occupant seating positions.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information can be found on page 3-7 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact and including all portions of the static rollover test. The maximum vehicle longitudinal crush was 502 millimeters of which the average was 263 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3

SUMMARY OF TEST RESULTS

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – Test Vehicle Specifications

Data Sheet No. 2 – Pre-Test Data

Data Sheet No. 3 – Moving Deformable Barrier (MDB) Data

Data Sheet No. 4 – High Speed Camera Locations and Data Summary

Data Sheet No. 5 – Post-Test Data

Data Sheet No. 6 – FMVSS No. 301 Static Rollover Test Data

**DATA SHEET NO. 1
TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013

TEST VEHICLE INFORMATION AND OPTIONS

| | |
|--------------------------|---------------------|
| NHTSA No. | C20130101 |
| Model Year | 2013 |
| Make | Chevrolet |
| Model | Spark |
| Body Style | Four Door Hatchback |
| Body Color | Light gray/silver |
| Odometer Reading (km/mi) | 212 / 132 |
| Engine Displacement (L) | 1.2 |
| Type/No. Cylinders | I4 |
| Engine Placement | Transverse |
| Transmission Type | Manual |
| Transmission Speeds | 5-Speed |
| Final Drive | Front Wheel Drive |

| | |
|-----------------------------------|-----|
| Overdrive | Yes |
| Air Conditioning (AC) | Yes |
| All-Wheel Drive (AWD) | No |
| Anti-Lock Brakes (ABS) | Yes |
| Automatic Door Locks (ADL) | Yes |
| Power Brakes | Yes |
| Power Seats | No |
| Power Steering | Yes |
| Power Windows | Yes |
| Stability Control (Auto-Leveling) | No |
| Sunroof/T-Top | No |
| Tilt Steering Wheel | Yes |
| Traction Control System (TCS) | Yes |

DEALER AND DELIVERY INFORMATION FROM CERTIFICATION LABEL

| | |
|---------------------|-------------------|
| Manufactured By | GM Korea Company |
| Date of Manufacture | 7/12 |
| VIN | KL8CA6S93DC509005 |

| | |
|-----------------|------|
| GVWR (kg) | 1390 |
| GAWR Front (kg) | 790 |
| GAWR Rear (kg) | 710 |

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Location: Driver's Door Sill

Spare Tire Type: Driver's Door Sill

| Measured Parameter | Front | Rear |
|--|------------|------------|
| Tire Manufacturer | Goodyear | Goodyear |
| Tire Name | Integrity | Integrity |
| Tire Type | All-Season | All-Season |
| Max. Tire Pressure (kPa) | 350 | 350 |
| Recommended Tire Size | P185/55R15 | P185/55R15 |
| Load Index/Speed Symbol | 82T | 82T |
| Recommended Cold Tire Pressure (kPa) | 275 | 275 |
| Tire Size on Vehicle | P185/55R15 | P185/55R15 |
| Treadwear/ Traction Grade/ Temperature Grade | 460/A/B | 460/A/B |

VEHICLE CAPACITY DATA

| Measured Parameter | Front | Rear | Third | Total |
|---|--------|-------|-------|--------|
| Designated Seating Capacity (DSC) | 2 | 2 | 0 | 4 |
| Seat Type (Bench, Bucket, or Split Bench) | Bucket | Bench | -- | |
| Capacity Weight (VCW) (kg) | | | | 300.00 |
| DSC X 68.04 (kg) | | | | 272.16 |
| Cargo Weight (RCLW) (kg) | | | | 27.84 |

**DATA SHEET NO. 2
PRE-TEST DATA**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013

TEST VEHICLE WEIGHTS

| | Units | As Delivered (UVW) | | | As Tested (ATW) | | |
|--------|-------|--------------------|-------|---------|-----------------|-------|---------|
| | | Front | Rear | Total | Front | Rear | Total |
| Left | kg | 312.0 | 207.5 | | 362.0 | 246.5 | |
| Right | kg | 328.5 | 179.0 | | 363.0 | 230.0 | |
| Ratio | % | 62.4 | 37.6 | | 60.3 | 39.7 | |
| Totals | kg | 640.5 | 386.5 | 1,027.0 | 725.0 | 476.5 | 1,201.5 |

TARGET TEST WEIGHT CALCULATION (TTW)

| Measured Parameter | Units | Value | |
|--------------------------------------|-------|---------|---------|
| Total Unloaded Vehicle Weight (UVW) | kg | 1,027.0 | (A) |
| Rated Cargo/Luggage Weight (RCLW) | kg | 27.8 | (B) |
| Weight of two P572E ATDS @ 78kg each | kg | 156.0 | (C) |
| Target Vehicle Test Weight (TVTW) | kg | 1,210.8 | (A+B+C) |

*As tested Weight = (TTW -10kg) <=ATW < (TTW -5kg); TTW = Weight of Test Vehicle with 2 dummies and 27.8kg of Cargo Weight

GENERAL TEST VEHICLE DATA

| Measured Parameter | Units | Value |
|--|-------|--------------------------|
| Vehicle Wheelbase | mm | 2375 |
| Vehicle Length (at Centerline) | mm | 2626 |
| Vehicle Width | mm | 1599 |
| Weight of Ballast Secured in Cargo Area ¹ | kg | 13.6 |
| Type of Ballast | | Lead Shot |
| Method of Securing Ballast | | Rear passenger foot well |
| Components Removed for Weight Reduction | | 0 |
| Vehicle Width at Widest Point | mm | 1599 |
| Vehicle Width at Widest Point Location | | Rear wheel well |
| Centerline offset for impact line | mm | 320 |
| Filler neck side (left/right) | | Right |

¹ Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

TEST VEHICLE ATTITUDE AND CG

| | Units | Left | | Right | | CG (aft of front axle) |
|--------------------|-------|-------|------|-------|------|---------------------------|
| | | Front | Rear | Front | Rear | |
| As Delivered (UVW) | mm | 630 | 630 | 633 | 630 | 894 |
| As Tested (ATW) | mm | 611 | 609 | 612 | 614 | 942 |

**DATA SHEET NO. 2 (Continued)
PRE-TEST DATA**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

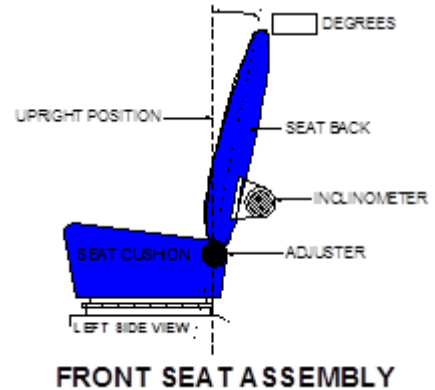
NHTSA No.: C20130101
 Test Date: 5/9/2013

SEATING

Nominal Design Riding Position (for adjustable driver and passenger seat backs). *Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.*

Driver Seat Instructions: The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1.

Passenger Seat Instructions: The passenger seat back was positioned to the Nominal Design Riding position listed in FORM 1.



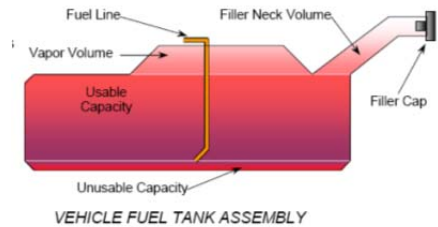
| Measured Parameter | Deg. |
|---------------------------|------|
| Driver Seat Back Angle | 13.1 |
| Passenger Seat Back Angle | 12.1 |

SEAT FORE/AFT POSITIONING

Driver Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.

Passenger Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.

| | Total # of Positions | Placed in Position # |
|----------------|----------------------|----------------------|
| Driver Seat | 15 | 8 |
| Passenger Seat | 15 | 8 |



FUEL TANK CAPACITY DATA

| Measured Parameter | Reference | Liters |
|--------------------------------------|---------------------------|-------------|
| Fuel System Capacity (Standard Tank) | Owner's Manual | 35.0 |
| COTR Usable Capacity (Standard Tank) | Form No. 1 | 35.0 |
| Test Volume Range | 91-94% of Usable Capacity | 31.9 - 32.9 |
| Actual Test Volume (Solvent Used) | 93% of Usable Capacity | 32.6 |

FUEL SYSTEM DATA

| Measured Parameter | Value |
|---|------------------|
| Test Fluid Type | Stoddard Solvent |
| Test Fluid Specific Gravity | 0.764 |
| Test Fluid Kinematic Viscosity (centistokes) | 0.96 |
| Test Fluid Color | Red |
| Electric Fuel Pump? | Yes |
| Can Activate Electric Fuel Pump with Ignition Switch On but Engine Off? | No |

Fuel Pump Comments : None

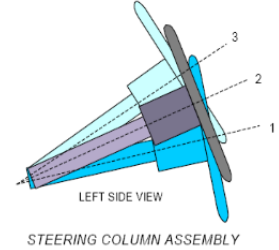
DATA SHEET NO. 2 (Continued)
PRE-TEST DATA

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
Test Date: 5/9/2013

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.



Operational Instructions: Tilt wheel was positioned to mid-range at 21.75 degrees

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

Operational Instructions: Anchorage were set to the most upright position

COMMENTS: None

**DATA SHEET NO. 3
MOVING DEFORMABLE BARRIER (MDB) DATA**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013

MDB Face Manufacturer: Plascore MDB Face Serial No. A1012028

MDB SPECIFICATIONS

| Measurement Description | Length (mm) |
|---|-------------|
| Overall Width of Framework Carriage | 1250 |
| Overall Length of MDB (incl. honeycomb impactor face) | 4120 |
| Wheelbase of Framework Carriage | 2591 |
| Tread of Framework Carriage (Front & Rear) | 1880 |
| CG Location of Front Axle | 1136 |

MDB WEIGHTS

| | Units | Front | Rear | Total |
|--------|-------|-------|-------|--------|
| Left | kg | 358.0 | 322.0 | 680.0 |
| Right | kg | 404.0 | 273.0 | 677.0 |
| Ratio | % | 56.2% | 43.8% | 100.0% |
| Totals | kg | 762.0 | 595.0 | 1357.0 |

MDB TIRE SIZE & PRESSURES

| | Units | Requirement | Left Front | Right Front | Left Rear | Right Rear |
|---------------|-------|-------------|------------|-------------|------------|------------|
| Tire Size | | P205/75R15 | P205/75R15 | P205/75R15 | P205/75R15 | P205/75R15 |
| Tire Pressure | kPa | 200 ± 21 | 207 | 207 | 207 | 207 |

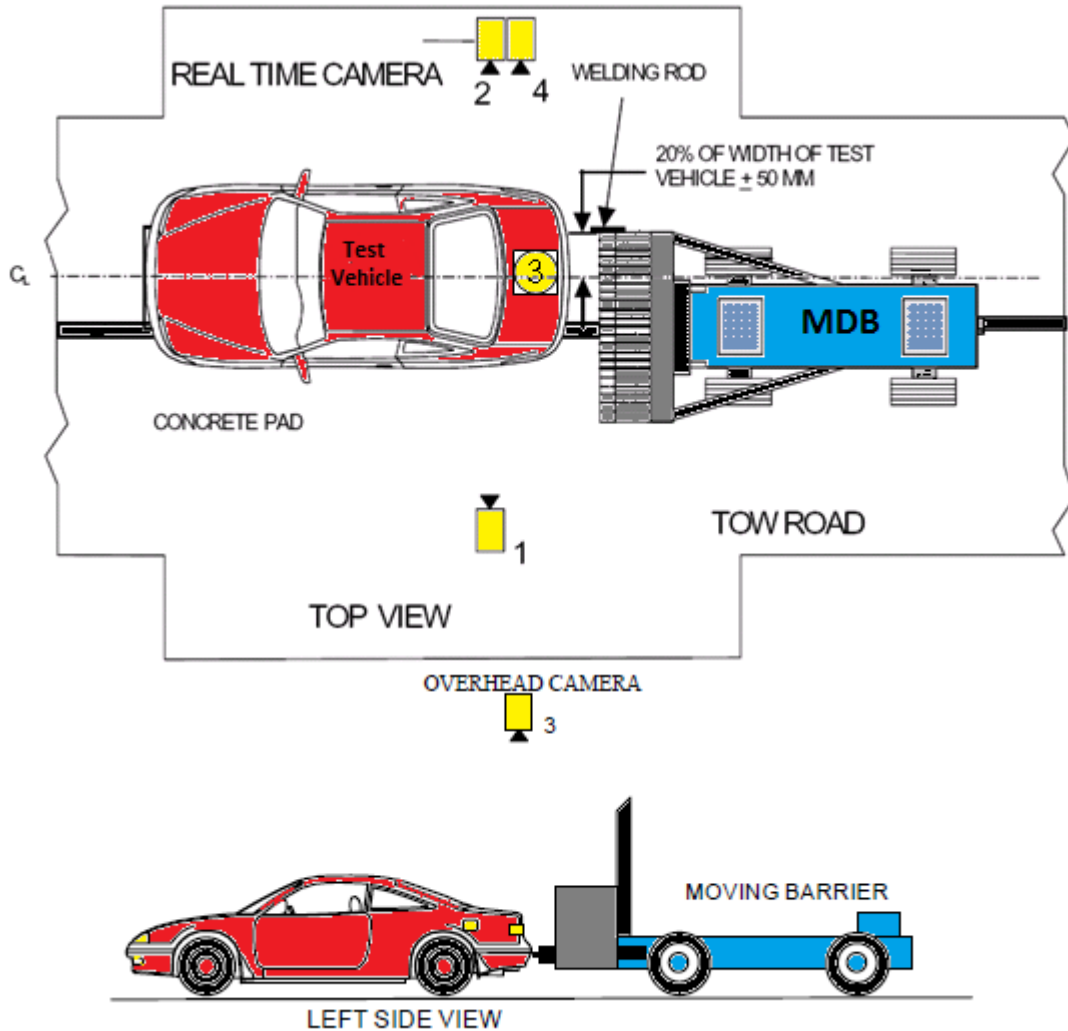
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15th, 2010

**DATA SHEET NO. 4
HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013



| No. | Camera View | Coordinates (mm) | | | Angle (Deg) | Lens (mm) | Film Speed (fps) |
|-----|------------------|------------------|-------|------|-------------|-----------|------------------|
| | | X* | Y* | Z* | | | |
| 1 | Left Side View | 1721 | -9576 | 1291 | 2.2 | 24 | 1000 |
| 2 | Real-Time Camera | | | | | | 30 |
| 3 | Overhead View | 408 | 0 | 5331 | 90.0 | 20 | 1000 |
| 4 | Right Side View | 1667 | 8940 | 1016 | 3.1 | 24 | 1000 |

* Reference (from point of impact); all measurements accurate to within ±6 mm.

X = (Impact Point) + Forward

Y = (Impact Point) + To Right

Z = (Ground Level) + Down

**DATA SHEET NO. 5
POST-TEST DATA**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013

VIN: KL8CA6S93DC509005

REQUIRED IMPACT VELOCITY RANGE: 78.5 to 80.1 km/h

ACTUAL IMPACT VELOCITY (WITHIN 1.5 M OF IMPACT PLANE)

| Measurement Description | Units | Speed |
|-------------------------|-------|-------|
| Trap No. 1 | km/h | 79.27 |
| Trap No. 2 | km/h | 79.31 |
| Average Impact Speed | km/h | 79.29 |

WELDING ROD IMPACT POINT

| Measurement Description | Tolerance | Units | Value |
|--|-----------|-------|-------|
| Vertical distance from target center (+ is above) | ±40 mm | mm | -7 |
| Horizontal distance from target center (+ is right) | ±50 mm | mm | -8 |

STODDARD SOLVENT SPILLAGE MEASUREMENT:

- A. From impact until vehicle motion ceases:
 (Maximum allowable is 28 grams) 0 grams
- B. For the 5-minute period after motion ceases:
 (Maximum allowable is 28 grams) 0 grams
- C. For the next 25 minutes:
 (Maximum allowable is 28 grams/minute) 0 grams
- D. Spillage Details: No Spillage Occurred

**DATA SHEET NO. 5
POST-TEST DATA (Continued)**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013

DOOR OPENING AND SEAT TRACK INFORMATION

| Description | Driver | Passenger |
|-----------------------|----------------------|-----------------|
| Locked/Unlocked Doors | Unlocked | Unlocked |
| Front Door Opening | Closed & Operational | Closed & Jammed |
| Rear Door Opening | Closed & Jammed | Closed & Jammed |
| Seat Track Shift (mm) | 0 | 0 |
| Seat Back Failure | Yes | Yes |
| Glazing Damage | None | None |

POST TEST STRUCTURAL OBSERVATIONS

| Critical Areas of Performance | Observations and Conclusions |
|-------------------------------|---|
| Windshield Damage | None |
| Window Damage | None |
| Other Notable Effects | Rear Windshield shattered during impact event |

VEHICLE CRUSH MEASUREMENTS: LENGTH

| Measurement | Left Side | Centerline | Right Side |
|-------------|-----------|------------|------------|
| Pre-Test | 3522 | 3626 | 3529 |
| Post-Test | 3452 | 3124 | 3312 |
| Crush | -70 | -502 | -217 |

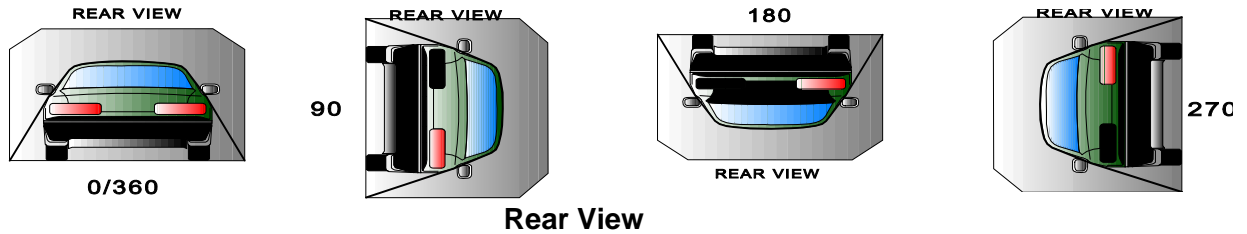
VEHICLE CRUSH MEASUREMENTS: WHEELBASE

| Measurement | Left Side | Centerline | Right Side |
|-------------|-----------|------------|------------|
| Pre-Test | 2375 | | 2377 |
| Post-Test | 2385 | | 2277 |
| Crush | 10 | | -100 |

**DATA SHEET NO. 6
FMVSS NO. 301 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2013 Chevrolet Spark Four Door Hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20130101
 Test Date: 5/9/2013



ROLLOVER SOLVENT COLLECTION TIME TABLE

| Test Phase | Rotation Time (spec. 1 -3 min) | | Hold Time | Total Time | | Next Whole Minute Interval |
|--------------|-----------------------------------|---------|-----------|------------|---------|----------------------------------|
| | Minutes | Seconds | | Minutes | Seconds | |
| 0° to 90° | 1 | 13 | 5 | 6 | 13 | 7 |
| 90° to 180° | 1 | 2 | 5 | 6 | 2 | 7 |
| 180° to 270° | 1 | 1 | 5 | 6 | 1 | 7 |
| 270° to 360° | 1 | 5 | 5 | 6 | 5 | 7 |

FMVSS 301 REQUIREMENTS TABLE (Maximum allowable solvent spillage)

| First 5 Minutes (grams) | 6th Minute (grams) | 7th Minute (grams) | 8th Minute (grams) |
|----------------------------|-----------------------|-----------------------|-----------------------|
| 142 | 28 | 28 | 28 |

ACTUAL TEST VEHICLE STODDARD SOLVENT SPILLAGE TABLE

| Test Phase | First 5 Minutes (grams) | 6th Minute (grams) | 7th Minute (grams) | 8th Minute (grams) |
|--------------|----------------------------|-----------------------|-----------------------|-----------------------|
| 0° to 90° | 0 | 0 | 0 | |
| 90° to 180° | 0 | 0 | 0 | |
| 180° to 270° | 0 | 0 | 0 | |
| 270° to 360° | 0 | 0 | 0 | |

ROLLOVER STODDARD SOLVENT SPILLAGE LOCATION TABLE

| Test Phase | Spillage Location |
|--------------|-------------------|
| 0° to 90° | None |
| 90° to 180° | None |
| 180° to 270° | None |
| 270° to 360° | None |

APPENDIX A
PHOTOGRAPHS

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Figure A-1: Vehicle Certification Placard



Figure A-2: Vehicle Tire Placard



Figure A-3: Pre-Test Front View



Figure A-4: Post-Test Front View



Figure A-5: Pre-Test Left Side View



Figure A-6: Post-Test Left Side View



Figure A-7: Pre-Test Right Side View

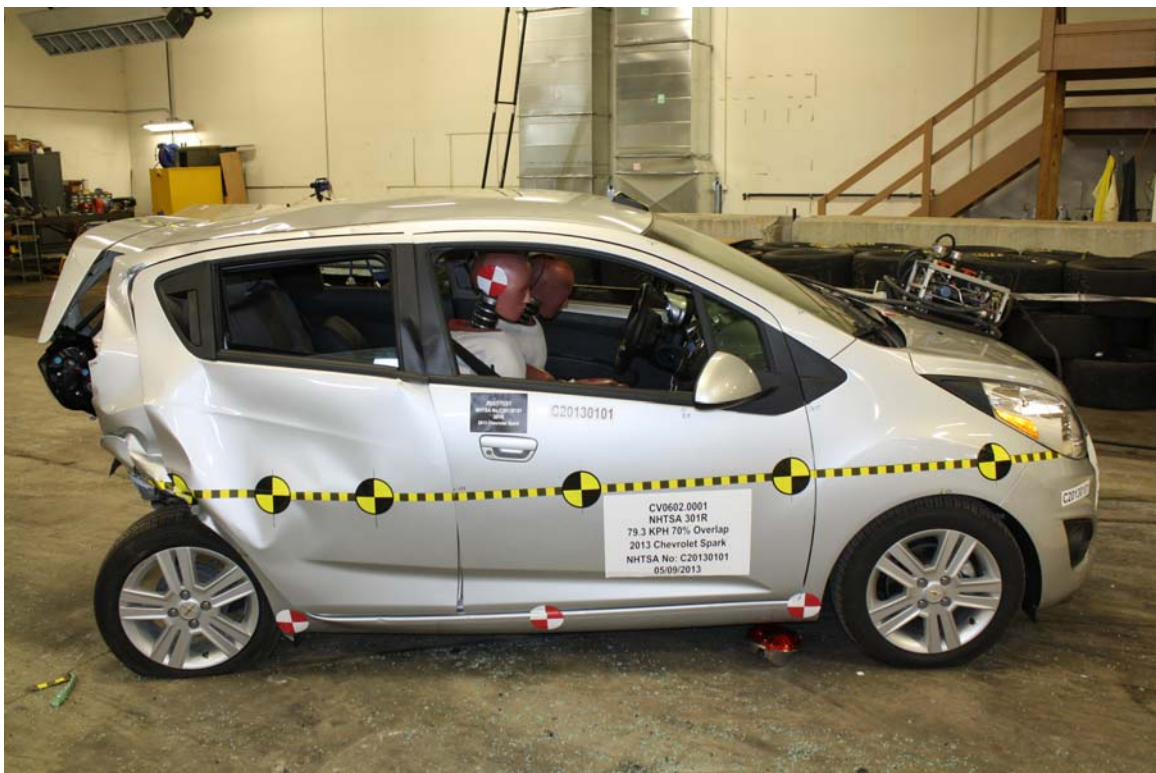


Figure A-8: Post-Test Right Side View



Figure A-9: Pre-Test Left Front 3/4 View



Figure A-10: Post-Test Left Front 3/4 View



Figure A-11: Pre-Test Right Front 3/4 View



Figure A-12: Post-Test Right Front 3/4 View



Figure A-13: Pre-Test Left Rear 3/4 View

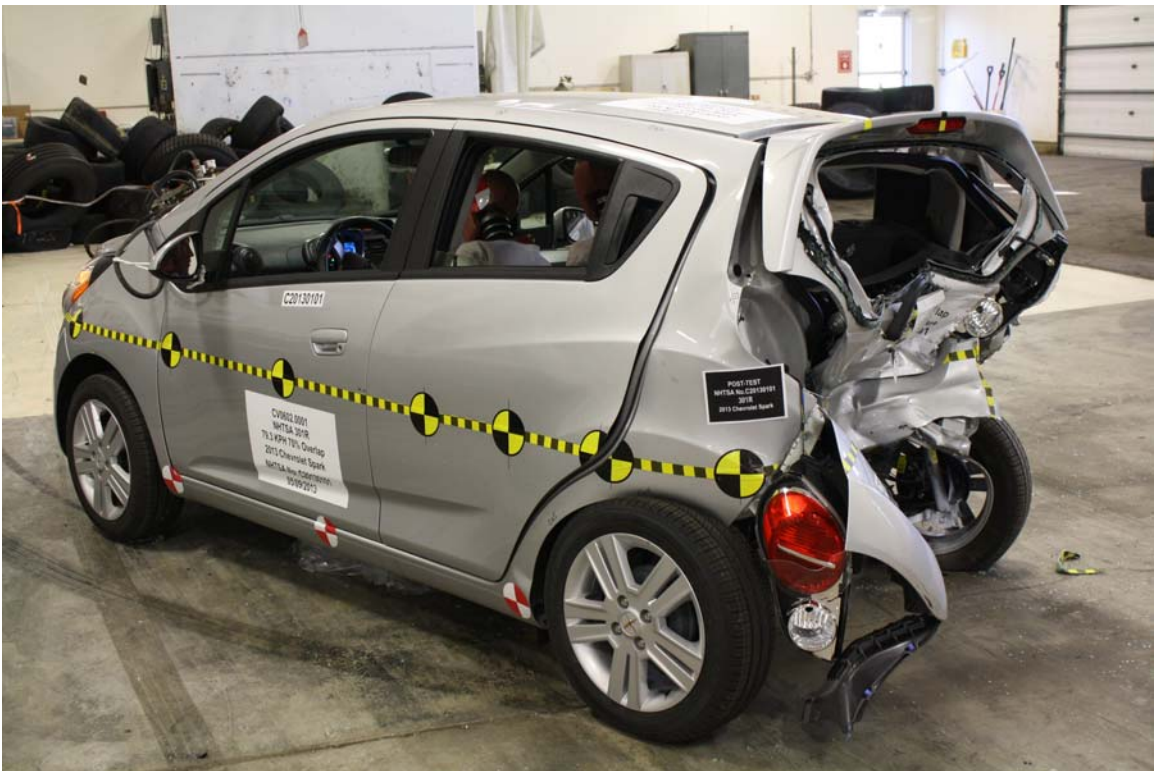


Figure A-14: Post-Test Left Rear 3/4 View



Figure A-15: Pre-Test Right Rear 3/4 View



Figure A-16: Post-Test Right Rear 3/4 View



Figure A-17: Pre-Test Rear View



Figure A-18: Post-Test Rear View



Figure A-19: Pre-Test MDB Front View



Figure A-20: Post-Test MDB Front View



Figure A-21: Pre-Test MDB Left Side View



Figure A-22: Post-Test MDB Left Side View



Figure A-23: Pre-Test MDB Right Side View



Figure A-24: Post-Test MDB Right Side View

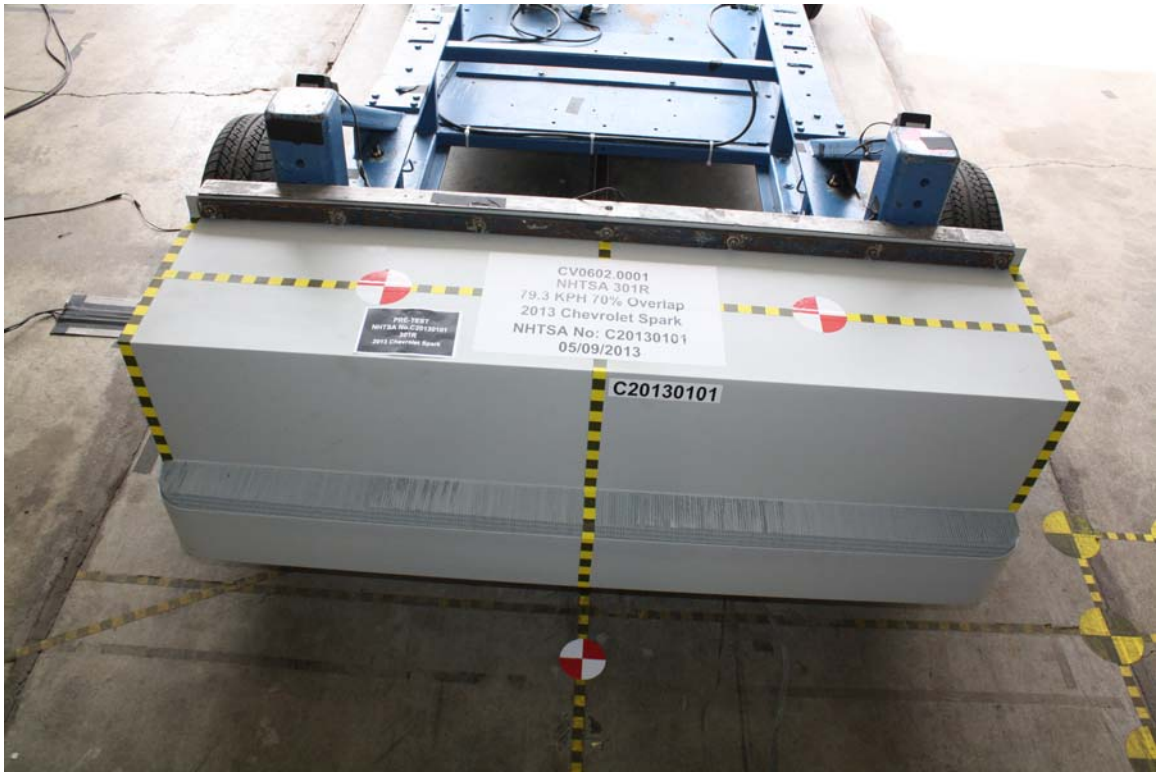


Figure A-25: Pre-Test MDB Top View



Figure A-26: Post-Test MDB Top View



Figure A-27: Pre-Test Overhead Vehicle and MDB View



Figure A-28: Post-Test Impact Target View

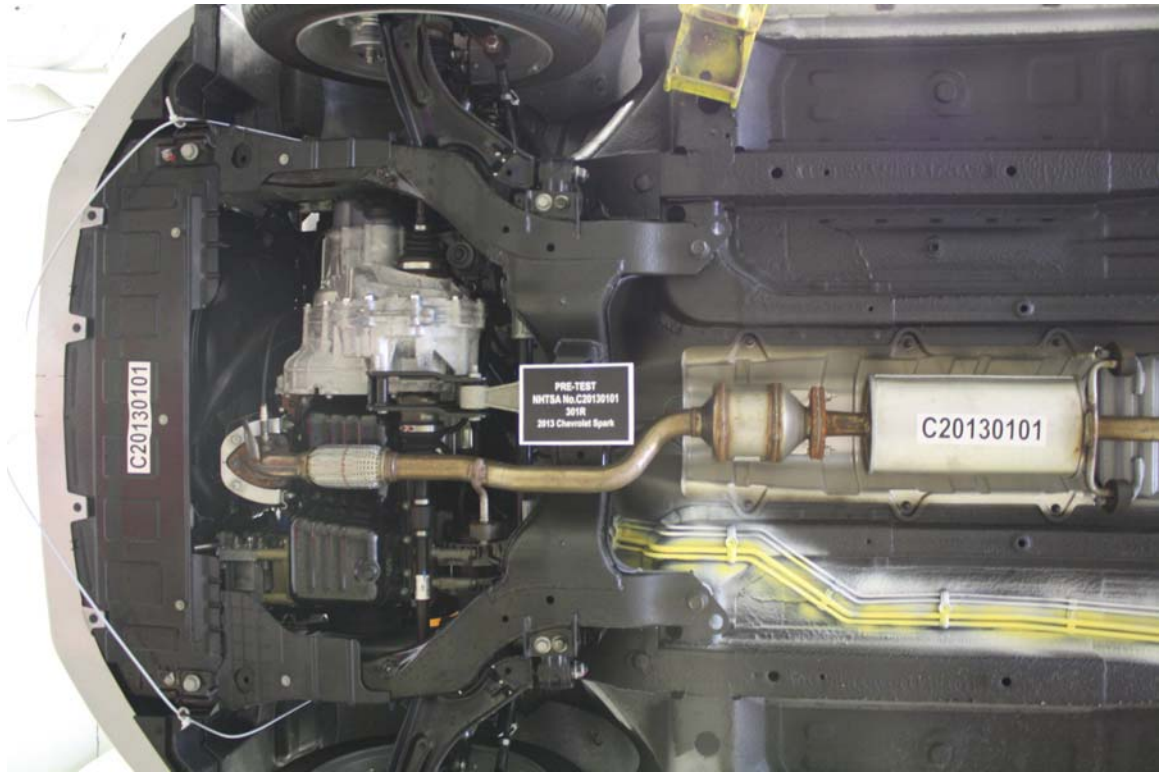


Figure A-29: Pre-Test Front Underbody View



Figure A-30: Post-Test Front Underbody View



Figure A-31: Pre-Test Mid Underbody View



Figure A-32: Post-Test Mid Underbody View

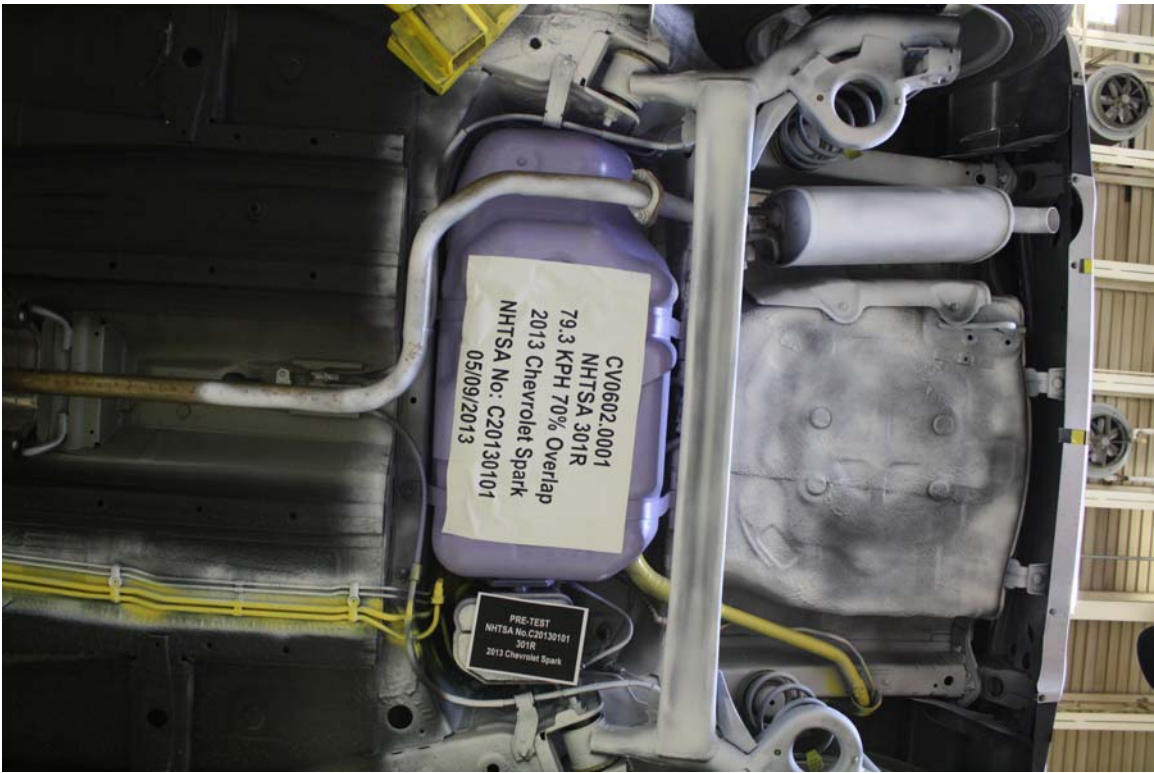


Figure A-33: Pre-Test Rear Underbody View

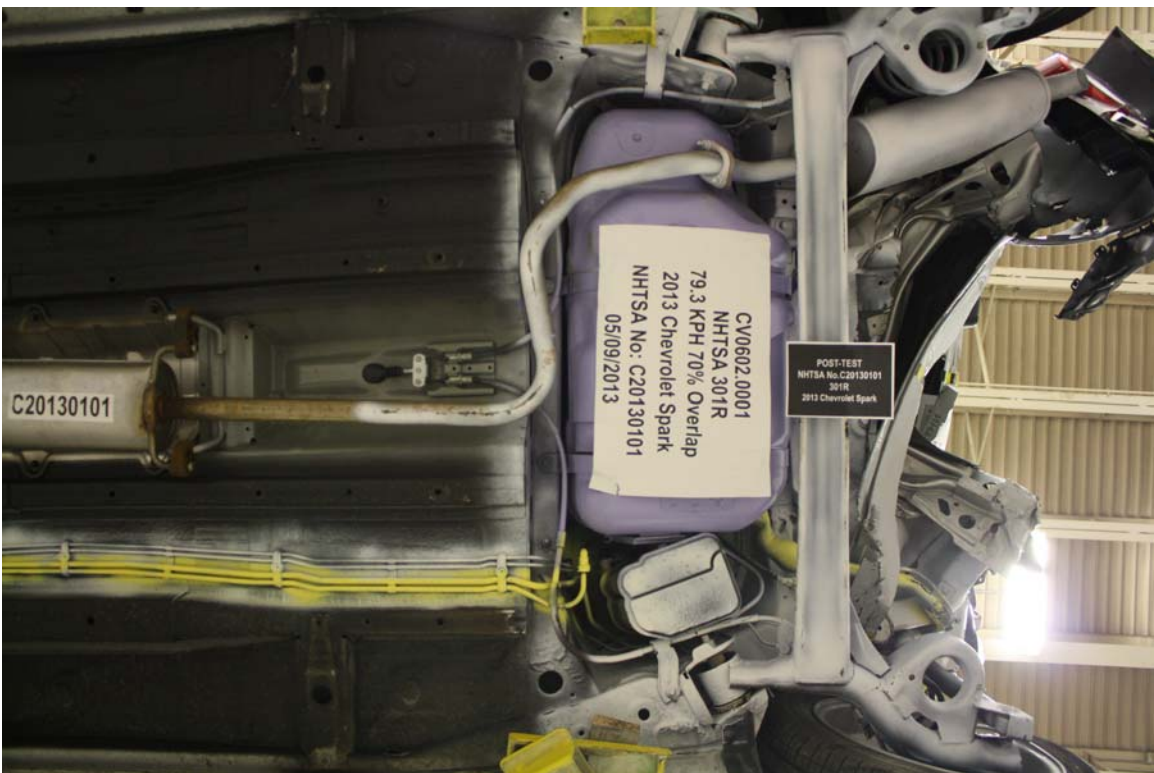


Figure A-34: Post-Test Rear Underbody View



Figure A-35: Pre-Test Fuel Filler Cap View



Figure A-36: Post-Test Fuel Filler Cap View



Figure A-37: Impact View



Figure A-38: Speed Trap View

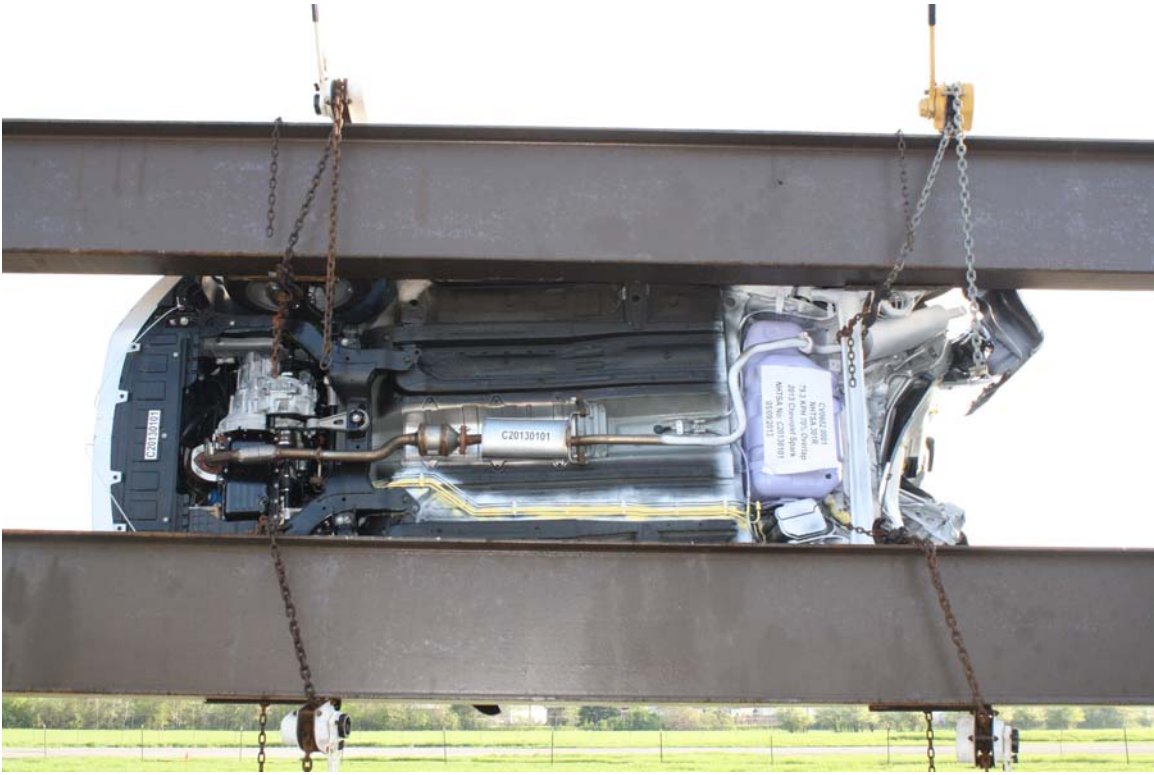


Figure A-39: Rollover 90° View



Figure A-40: Rollover 180° View



Figure A-41: Rollover 270° View



Figure A-42: Rollover 360° View