

REPORT NUMBER: TR-P35090-03-NC
SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT
79.3 KM/H 70% OVERLAP REAR IMPACT

MAZDA MOTOR CORPORATION
2015 MAZDA CX-5 SPORT 5-DOOR MPV

NHTSA NUMBER: C20155400

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



TEST DATE:
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REPORT DATE:
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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: 
Mr. Steven D. Matsusaka, Engineering Dept. Supervisor
KARCO Engineering, LLC.

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

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

Approval Date: February 1, 2016

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16. Abstract A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2015 Mazda CX-5 Sport 5-door MPV 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 January 18, 2016. The impact velocity was 79.98 km/h and the outside ambient temperature was 16.7 deg. C. There was no Stoddard solvent leakage immediately after the impact test. During the first 5 minutes of the static rollover test, as the vehicle rolled from the 0° to 90° and while holding at the 90° position, 7,474 g of solvent spillage was collected. The spillage exceeded the maximum 142 g allowed during the first 5 minutes of the static roll. The spillage appeared to come from the area around the fuel filler neck. After the test, a tear down and inspection was conducted to determine the source of the solvent leak. A hole was discovered on the fuel filler neck, where a weld attaching a bracket to the filler neck broke. The vehicle failed to meet the fuel spillage requirements S5.6 of FMVSS No. 301. Photographs of the damage to the filler neck are included in Appendix A of this report.					
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SECTION 1

SUMMARY OF TEST

The purpose of this rear impact test is to measure the performance of the subject vehicle, a 2015 Mazda CX-5 Sport 5-Door MPV, 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 January 18, 2016. 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 immediately after the impact event. During the first 5 minutes of the static rollover test, as the vehicle rolled from the 0° to 90° position, 7,474 g of solvent spillage was collected. The spillage exceeded the maximum 142 g allowed during the first 5 minutes of the static roll. The spillage appeared to come from the area around the fuel filler neck. FMVSS 301 data is summarized in Data Sheets 4 and 5.

After the test, a tear down and inspection was conducted to determine the source of the solvent leak. A hole was discovered on the fuel filler neck, where a weld attached a bracket to the filler neck broke. The vehicle failed to meet the fuel spillage requirements S5.6 of FMVSS No. 301. Appendix A includes photographs of the fuel filler neck damage.

SECTION 2
DATA SHEETS

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV

NHTSA No.: C20155400

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

Test Date: 01/18/16

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: 2015 Mazda CX-5 Sport 5-Door MPV NHTSA No.: C20155400
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 01/18/16

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	C20155400
Model Year	2015
Make	Mazda
Model	CX-5 Sport
Body Style	5-Door MPV
VIN	JM3KE2BE3F0511927
Body Color	Jet Black Mica
Odometer Reading (km / mi)	3140 / 1951
Engine Displacement (L)	2.0
Type / No. of Cylinders	Inline 4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6
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	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
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	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?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Mazda Motor Corporation
Date of Manufacture	Jul-14

GVWR (kg)	1940
GAWR Front (kg)	972
GAWR Rear (kg)	971

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)				385.0	A
DSC x 68 (kg)				340.0	B
Cargo Weight (RCLW) (kg)				45.0	A-B

*For trucks and MPV's maximum RCLW is 136.0 kg

DATA SHEET NO. 1 ... (CONTINUED)

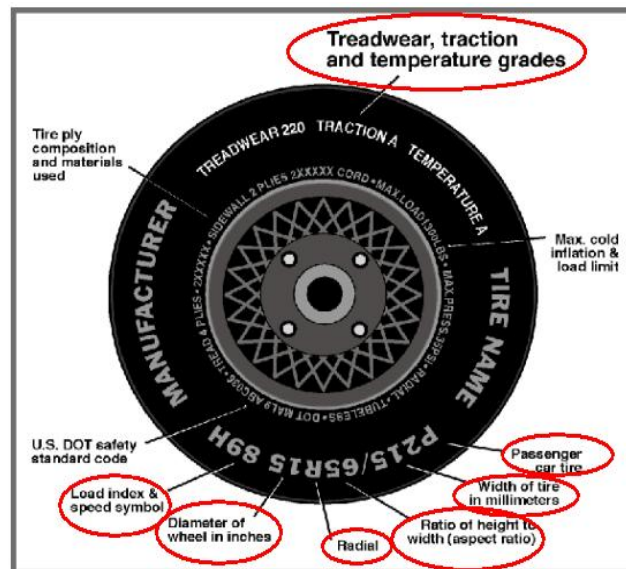
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV

NHTSA No.: C20155400

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

Test Date: 01/18/16



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max Tire Pressure (kPa)	300	300
Cold Tire Pressure (kPa)	230	230
Max Load Tire Pressure (kPa)		
Recommended Tire Size	P225/65R17	P225/65R17
Tire Size on Vehicle	P225/65R17	P225/65R17
Tire Manufacturer	Yokohama	Yokohama
Tire Model	Geolander	Geolander
Load Range	800	800
Treadwear Rating	280	280
Traction Rating	B	B
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	100H	100H
Tire Material	Polyester, Steel, Nylon	Polyester, Steel Nylon
DOT Safety Code Left	FDF5 PC 52914	FDF5 PC 52914
DOT Safety Code Right	FDF5 PC 52914	FDF5 PC 52914
Type of Spare Tire	T145/90D16	
Location of Tire Placard on Vehicle	Driver Side B Pillar	

DATA SHEET NO. 2**PRE-TEST DATA**Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPVNHTSA No.: C20155400Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 01/18/16**TEST VEHICLE AXLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	409.0	309.0	718.0	472.0	360.5	832.5	443.0	373.0	816.0
Right	kg	412.5	304.0	716.5	455.0	333.0	788.0	446.5	367.0	813.5
Ratio	%	57.3%	42.7%	100.0%	57.2%	42.8%	100.0%	54.6%	45.4%	100.0%
Total	kg	821.5	613.0	1434.5	927.0	693.5	1620.5	889.5	740.0	1629.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1434.5	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	45.0	C
Calculated Vehicle Target Wt (TVTW)	kg	1627.5	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	864	872	883	896	1157
As Tested	mm	845	849	870	881	1158
Fully Loaded	mm	851	858	860	869	1229
Post-Test	mm	784	759	729	706	

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Total Vehicle Wheel Base	mm	2707
Total Vehicle Length	mm	4534
Total Vehicle Width	mm	1830
Amount of Stoddard Solvent in Fuel Tank	L	52.10

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

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV NHTSA No.: C20155400
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 01/18/16

BALLAST DATA

Description	Value
Type of Ballast	Test Equipment
Method of Securing Ballast	Bolted to Vehicle Hood
Weight of Ballast	38.0 kg
Weight of Vehicle Components Removed	0.0 kg

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

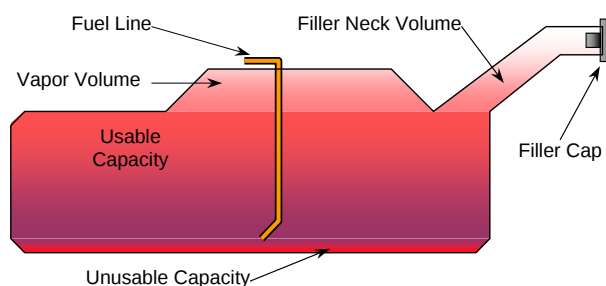
No vehicle components were removed

FUEL TANK CAPACITY

Description	Liters
Fuel System Capacity Listed in Owners Manual	56.02
Usable Capacity of "Standard Tank"	56.02
91 - 94% of Usable Capacity	50.98 - 52.66
Actual Amount of Stoddard Solvent Used	52.10

FUEL PUMP

The vehicle is equipped with an electric fuel pump.
The fuel pump operates when the starter or engine is activated.



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: 2015 Mazda CX-5 Sport 5-Door MPV

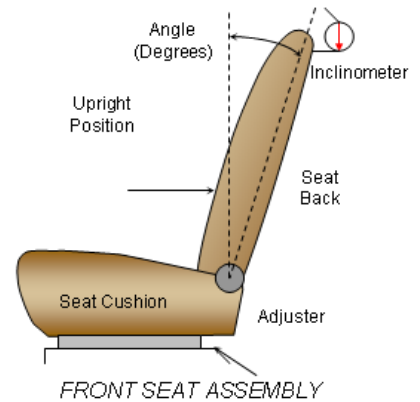
NHTSA No.: C20155400

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

Test Date: 01/18/16

NOMINAL DESIGN RIDING POSITION

Both the driver and front passenger seat backs are set to the manufacturer's designated angle. Seat back angle is measured at the headrest post.

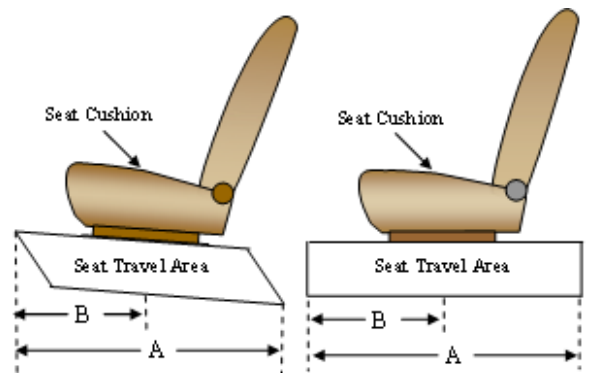


SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	6.7
Passenger Seat Back Angle	6.7

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	314 mm	157 mm
Passenger Seat	258 mm	129 mm

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV

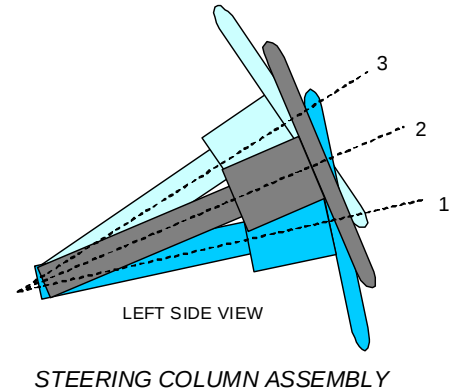
NHTSA No.: C20155400

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

Test Date: 01/18/16

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	23.1	90
Geometric Center Position, No. 2	25.5	114
Uppermost Position, No. 3	28.0	138
Telescoping Steering Wheel Travel	4.9	48
Test Position	25.5	114

DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV NHTSA No.: C20155400
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 01/18/16

MOVING BARRIER TEST WEIGHT

	Units	As Delivered Weights (UVW)		
		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	560
Honeycomb Depth	380
Overall Depth	482
Bottom Honeycomb to Bottom Bumper	51
Bumper Height	203
Ground to Top of MDB	787
Ground to Bottom of MDB	228
Ground to Bottom of Bumper	278
Ground to Top of Bumper	481

DATA SHEET NO. 4**POST-TEST DATA**Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPVNHTSA No.: C20155400Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 01/18/16Temperature at Time of Impact: 16.7°CTest Time: 11:50 AMVIN: JM3KE2BE3F0511927**IMPACT VELOCITY DATA**

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	79.98
Trap No. 2 Velocity (Redundant)	km/h	79.97

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1830
Vertical Impact Reference Line (Right of Vehicle Center Line)	mm		366
Actual Impact Point (Right of Vehicle Center Line)	mm		356
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	-10
Vertical Offset (+ down / - up)	mm	± 40 of Intended Impact Point	-5

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	4534	4345	189
2	Total Length	4534	4550	16
3	Total Width	1830	1945	115
4	Left Side Wheelbase	2707	2600	107
5	Right Side Wheelbase	2706	2705	1

MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Vertical Location			From Centerline		Max. Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	382	800	Right	209
B	Top of Bumper	483	800	Right	244
C	Mid Level	636	100	Right	361
D	Top of Stack	763	800	Right	330

DATA SHEET NO. 4... (CONTINUED)**POST-TEST DATA**

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV NHTSA No.: C20155400
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 01/18/16

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door Opening	Remained closed and latched	Remained closed and latched
Rear Door Opening	Jammed Shut	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 = 28 g)

For the following 25 minutes: 0 g

(Maximum allowable = 28 g/minute)

Spillage: None

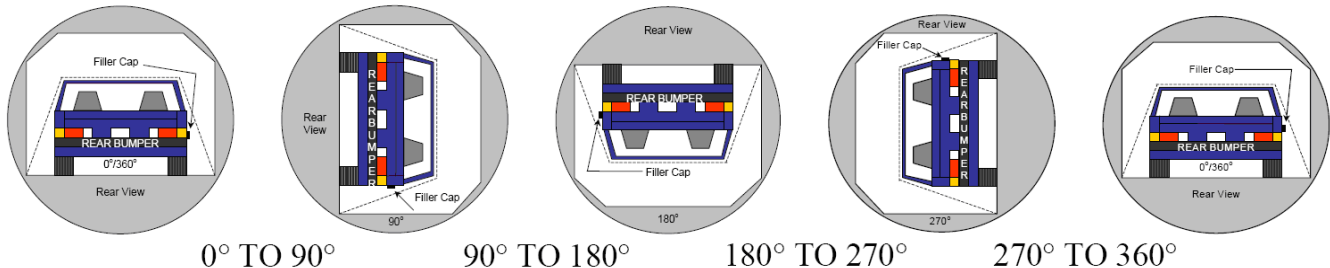
DATA SHEET NO. 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2015 Mazda CX-5 Sport 5-Door MPV

NHTSA No.: C20155400

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

Test Date: 01/18/16



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°	83	300	383
90° To 180°			
180° To 270°			
270° To 360°			

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° To 90°	7,474 g	2,698 g		
90° To 180°				
180° To 270°				
270° To 360°				

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° To 90°	Fuel Filler Neck
90° To 180°	
180° To 270°	
270° To 360°	

APPENDIX A
PHOTOGRAPHS

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FIGURE 1. As Received Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 2. As Received Left Rear $\frac{3}{4}$ View of Test Vehicle

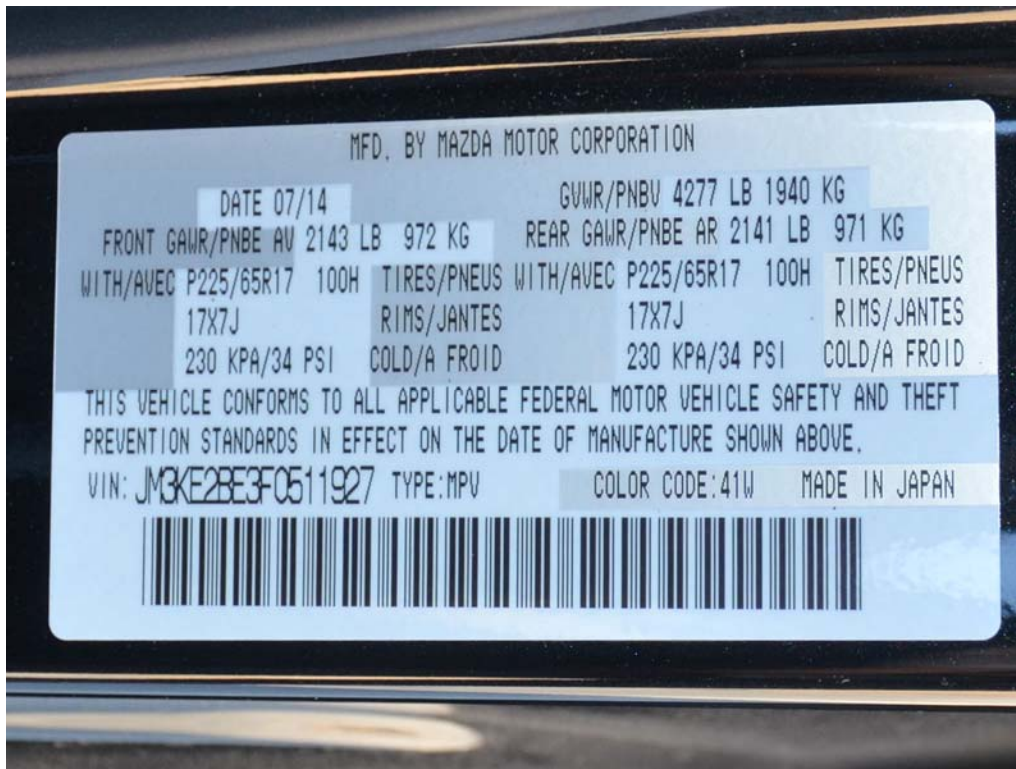


FIGURE 3. Test Vehicle Manufacturer's Label

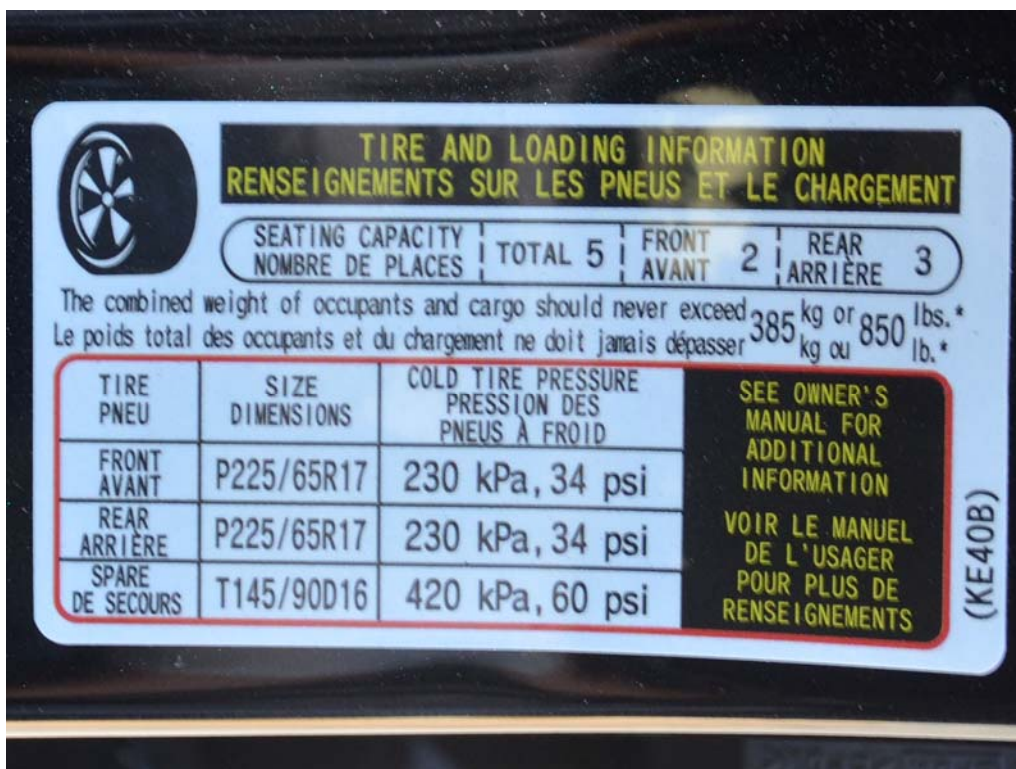


FIGURE 4. Test Vehicle Tire Information Placard



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

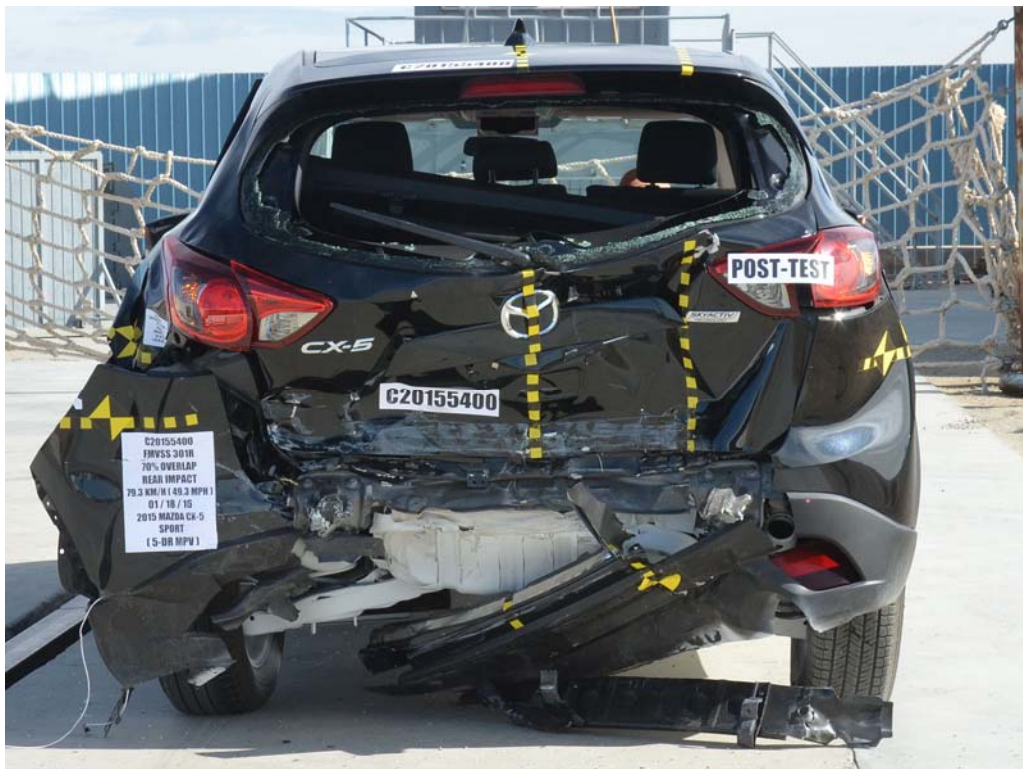


FIGURE 14. Post-Test Rear View of Test Vehicle



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

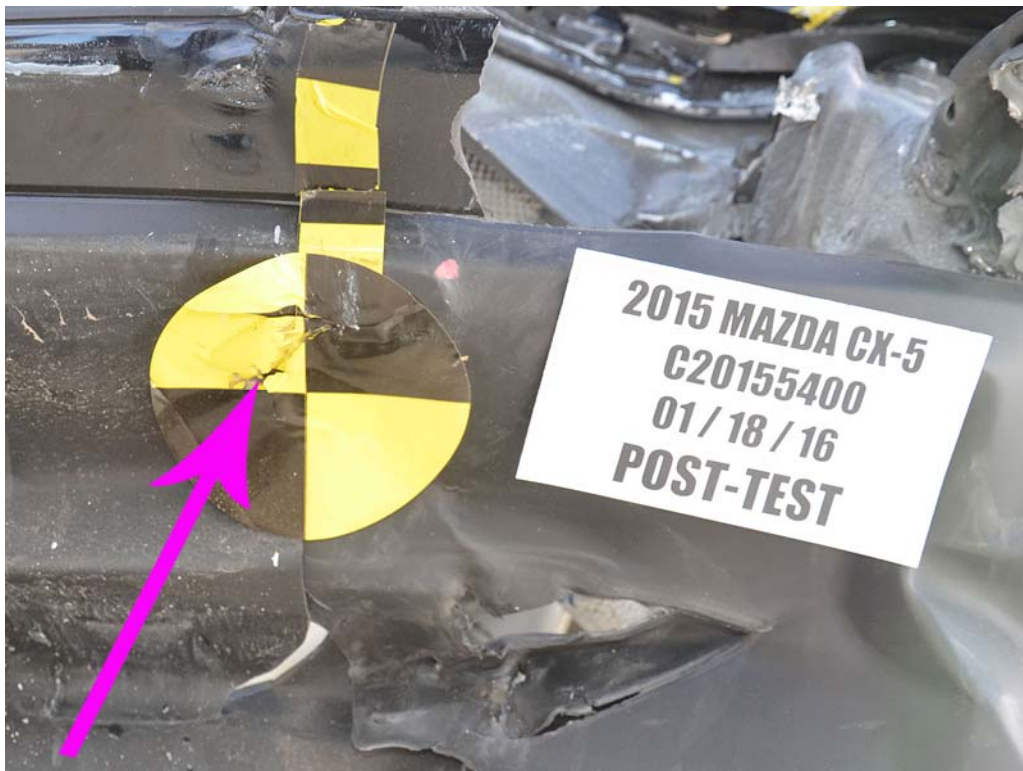


FIGURE 22. Post-Test Close-Up View of Impact Point Target



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

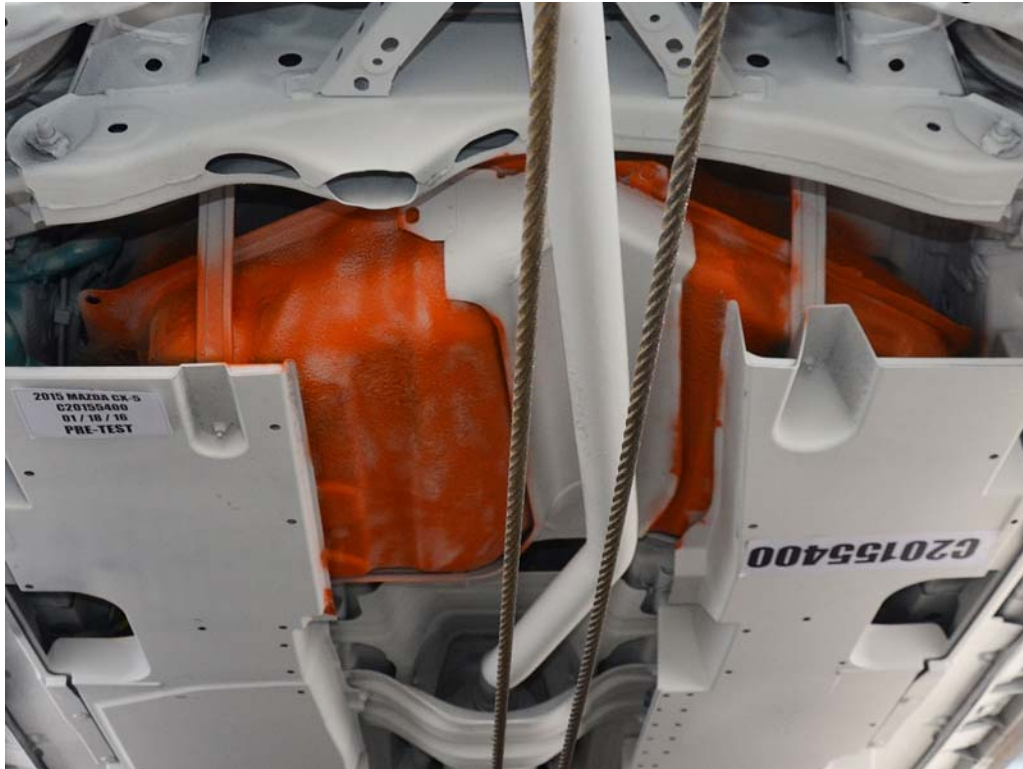


FIGURE 27. Pre-Test Underbody View of Fuel Tank



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. 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. Solvent Spillage at 90° on FMVSS 301 Static Rollover Device



FIGURE 35. Impact Event



FIGURE 36. Post-Test View of Fuel Filler Neck Damage



FIGURE 37. Post-Test View of Fuel Filler Neck Damage