

**REPORT NUMBER: TR-P32096-09-NC**

**RESEARCH AND DEVELOPMENT  
80 KM/H 70% OVERLAP REAR IMPACT**

**FORD MOTOR CO.  
1999 FORD F-150 2-DOOR TRUCK**

**NHTSA NUMBER: QX0200**

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




**TEST DATE:  
NOVEMBER 29, 2012**

**REPORT DATE:  
DECEMBER 13, 2012**

**FINAL REPORT**

**U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
NATIONAL CENTER FOR STATISTICS AND ANALYSIS  
OFFICE OF REGULATORY ANALYSIS AND EVALUATION  
1200 NEW JERSEY AVE, SE  
ROOM W53-469  
WASHINGTON, DC 20590**

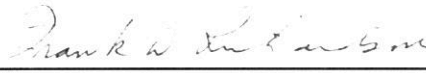
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Prepared By: 

Mr. Kelsey A. Chiu, Engineering Department Supervisor  
KARCO Engineering, LLC.

Reviewed By: 

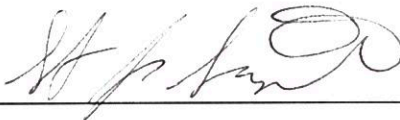
Mr. Michael L. Dunlap, Director of Operations  
KARCO Engineering, LLC.

Approved By: 

Mr. Frank D. Richardson, Program Manager  
KARCO Engineering, LLC.

Approval Date: December 13, 2012

FINAL REPORT ACCEPTANCE BY <sup>COTR</sup>~~NCSA~~



Date: 12/17/12

**TECHNICAL REPORT DOCUMENTATION PAGE**

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			<b>6. Performing Organization Code</b> KAR		
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			<b>14. Sponsoring Agency Code</b>		
<b>15. Supplementary Notes</b>					
<b>16. Abstract</b>  An 80 km/h 70% overlap rear impact test was conducted on the subject 1999 Ford F-150 2-door truck in accordance with the specifications of the Office of Vehicle Compliance Laboratory Test Procedure for FMVSS 301R. The test was conducted at the KARCO Engineering, LLC. facility in Adelanto, California on November 29, 2012.  The impact velocity was 78.75 km/h and the outside ambient temperature was 25.0 deg. C. The vehicle's doors remained closed throughout the event.  There was no Stoddard solvent leakage immediately after impact. The vehicle leaked during the static rollover. The vehicle was observed leaking from the fuel filler door during the 0 to 90 degree and 90 to 180 degree rotation. The fuel filler door leak also occurred at the static 90 and 180 degree position. The vehicle also leaked from the top of the gas tank at the static 270 degree position. The amount of Stoddard solvent collected did not exceed the allowable limits.					
FMVSS 301R Overlap Rear Impact MDB 1999 Ford F-150			<b>18. Distribution Statement</b>		
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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 1999 Ford F-150 2-door truck, for FMVSS 301R *'Fuel System Integrity – Rear Impact'*.

This 80 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 Compliance Laboratory Test Procedure for FMVSS 301R *'Fuel System Integrity – Rear Impact'*, dated January, 2007.

A 1999 Ford F-150 2-door truck was impacted by a moving deformable barrier at a velocity of 78.75 km/h. The test was performed at KARCO Engineering, LLC. on November 29, 2012. Pre- and post-test photographs of the vehicle and dummies 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 50<sup>th</sup> percentile male anthropomorphic test devices (ATD) were placed in the driver and right front passenger seating positions. Both ATD's were un-instrumented for this test.

Both the driver and passenger side doors remained closed during the impact event and after the collision.

There was no Stoddard solvent leakage immediately after impact. The vehicle leaked during the static rollover. The vehicle was observed leaking from the fuel filler door during the 0 to 90 degree and 90 to 180 degree rotation. The fuel filler door leak also occurred at the static 90 and 180 degree position. The vehicle also leaked from the top of the gas tank at the static 270 degree position. The amount of Stoddard solvent collected did not exceed the allowable limits. FMVSS 301 data is summarized in Data Sheets 6 and 7. Photographs are presented in Appendix A.

**SECTION 2**  
**DATA SHEETS**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
 Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**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 <sup>2</sup>	kPa	6.895
Temperature	General Use	°F	°C	=(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: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
 Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA Number	QX0200
Model Year	1999
Make	Ford
Model	F-150
Body Style	2-door truck
VIN	1FTZF1723XNB
Date Received	11/26/2012
Body Color	White
Odometer Reading (km / mi)	312,337 / 194,077
Engine Displacement (L)	4.2
Engine Placement	Longitudinal
Transmission Type	Manual
Transmission Speeds	5
Overdrive	No
Final Drive	Rear
Roof Rack	No
Sunroof / T-Top	No
Tinted Glass	No
Traction Control	No
Power Brakes	Yes
Front Disc Brakes	Yes
Rear Disc Brakes	Yes
Anti-Lock Brakes (ABS)	No

All Wheel Drive	No
Power Steering	Yes
Driver Front Airbag	Yes
Driver Side Airbag	No
Driver Head Airbag	No
Driver Curtain Airbag	No
Driver Combo Airbag	No
Driver Knee Airbag	No
Passenger Front Airbag	Yes
Passenger Side Airbag	No
Passenger Head Airbag	No
Passenger Curtain Airbag	No
Passenger Combo Airbag	No
Passenger Knee Airbag	No
Seat Belt Pre-Tensioners	Yes
Load Limiters	Yes
Bucket Seats	No
Air Conditioning	Yes
AM/FM CD	Yes
Tilt Steering	Yes
Automatic Door Locks	No
Power Windows	Yes
Power Seats	No

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

**DATA FROM CERTIFICATION LABEL**

Manufactured By	Ford Motor Co.
Date of Manufacture	May-99

GVWR (kg)	2540
GAWR Front (kg)	1202
GAWR Rear (kg)	1451

**VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION**

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Split Bench			
Designated Seating Capacity	3			3
Capacity Weight (VCW) (kg)				Unknown
DSC x 68.04 (kg)				204.0
Cargo Weight (RCLW) (kg)				136.0

A  
B  
A-B



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

Test Vehicle: 1999 Ford F-150 2-Door Truck

NHTSA No.: QX0200

Test Program: 70% Overlap Rear Impact

Test Date: 11/29/12

Feature	Yes	No	Comments
Is the vehicle totally complete?	X		None
Does the vehicle run and drive?	X		None
Is there any sign that the vehicle has ever been in a crash?		X	None
Are the bumpers damaged?		X	None
Do the doors open and close properly?	X		None
Are the doors properly aligned so that there are no gaps when closed?	X		None
Does the battery hold a charge so that electrical accessories in the vehicle may be operated without starting the engine?	X		None
Does the vehicle sag or have a raised or lowered suspension?		X	None
Are any of the control arms or other suspension components damaged or distorted?		X	None
Do the tires have some usable tread remaining and hold pressure?	X		None
Are the radiator and/or its supporting cross members damaged?		X	None
Is the cooling system able to retain its coolant and are the proper fluid levels maintained?	X		None
Does the fuel tank leak?		X	None
Does the fuel tank have any damages or dents that would reduce its internal capacity?		X	None
Is the fuel tank located behind the rear axle?		X	None
Is the fuel tank located between the front and rear axle?	X		None
Is the vehicle attitude "as tested" between "as delivered" and "fully loaded" before running the test?	X		None

Equipment	Present		Proper Place		Operate Properly	
	Yes	No	Yes	No	Yes	No
Engine	X		X		X	
Transmission	X		X		X	
Drive Axles	X		X		X	
Battery	X		X		X	
Alternator	X		X		X	
Radiator	X		X		X	

**DATA SHEET NO. 3**

**PRE-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
 Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**TEST VEHICLE AXLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	536.0	419.5		593.0	503.0		580.5	522.0	
Right	kg	507.0	421.0		560.0	502.5		545.0	518.5	
Ratio	%	55.4%	44.6%	100.0%	53.4%	46.6%	100.0%	52.0%	48.0%	100.0%
Total	kg	1043.0	840.5	1883.5	1153.0	1005.5	2158.5	1125.5	1040.5	2166.0

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1883.5	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	136.0	C
Calculated Vehicle Target Wt (TVTWT)	kg	2167.5	A+B+C

**TEST VEHICLE ATTITUDES**

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	840	843	897	896	1264
As Tested	mm	824	825	874	876	1320
Fully Loaded	mm	830	833	866	867	1361
Post-Test	mm	807	888	847	905	

**GENERAL TEST VEHICLE DATA**

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	3055
Total Vehicle Length	mm	5260
Amount of Stoddard Solvent in Fuel Tank	L	88.00

**DATA SHEET NO. 3 ... (CONTINUED)**

**PRE-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
 Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**BALLAST DATA**

Description	Value
Type of Ballast	Steel Plate
Method of Securing Ballast	Bolted
Weight of Ballast in Cargo Area	136.5
Weight of Vehicle Components Removed	24 kg

**VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:**

Tow Hitch (24 kg)

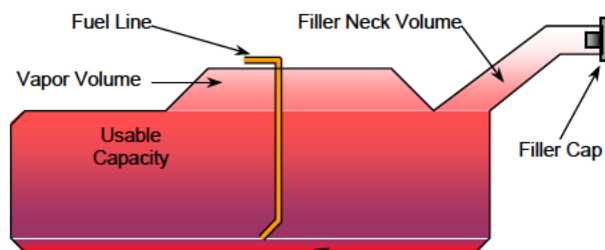
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**FUEL TANK CAPACITY**

Description	Liters
Fuel System Capacity Listed in Owners Manual	94.63
Usable Capacity of "Standard Tank"	94.63
91 - 94% of Usable Capacity	86.11 - 88.95
Actual Amount of Stoddard Solvent Used	88.00

**FUEL PUMP**

The vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned on.



VEHICLE FUEL TANK ASSEMBLY

**TEST FLUID**

Description	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.97
Test Fluid Kinematic Viscosity	
Test Fluid Color	Purple

**DATA SHEET NO. 3 ... (CONTINUED)**

**PRE-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck

NHTSA No.: QX0200

Test Program: 70% Overlap Rear Impact

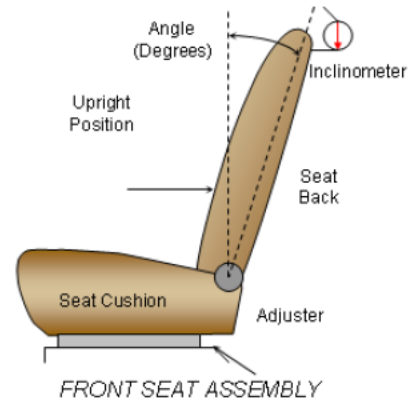
Test Date: 11/29/12

**NOMINAL DESIGN RIDING POSITION**

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

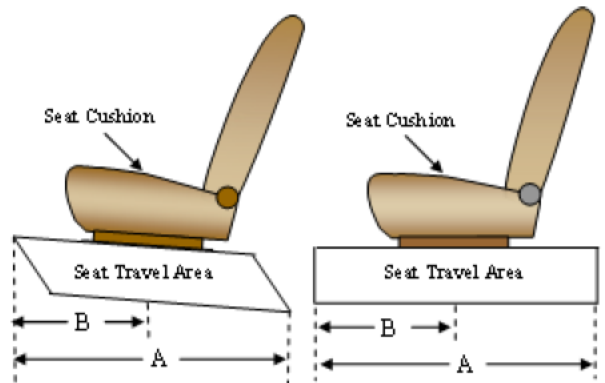
**SEAT BACK ANGLE**

Seating Position	Degrees
Driver Seat Back Angle	2.8
Passenger Seat Back Angle	2.8



**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	210 mm	113 mm
Passenger Seat	182 mm	91 mm

**DATA SHEET NO. 3 ... (CONTINUED)**

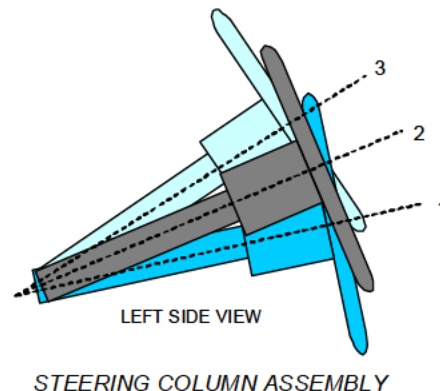
**PRE-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck  
 Test Program: 70% Overlap Rear Impact

NHTSA No.: QX0200  
 Test Date: 11/29/12

**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	13.9	
Geometric Center Position, No. 2	22.2	
Uppermost Position, No. 3	30.1	
Telescoping Steering Wheel Travel		
Test Position		

<sup>1</sup> – Steering wheel was not adjustable

**DATA SHEET NO. 4**  
**MOVING BARRIER DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
 Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**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	1677
Overall Height	560
Honeycomb Depth	384
Overall Depth	486
Bottom Honeycomb to Bottom Bumper	52
Bumper Height	200
Ground to Top of MDB	785
Ground to Bottom of MDB	226
Ground to Bottom of Bumper	278
Ground to Top of Bumper	480

**DATA SHEET NO. 5**

**POST-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200

Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

Temperature at Time of Impact: 25.0°C Test Time: 12:58 PM

VIN: 1FTZF1723XNB

**IMPACT VELOCITY DATA**

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	78.75
Trap No. 2 Velocity (Redundant)	km/h	

**IMPACT POINT LOCATION DATA**

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1995
Vertical Impact Reference Line (Right of Vehicle Center Line)	mm		399
Actual Impact Point (Right of Vehicle Center Line)	mm		407
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	8
Vertical Offset (+ down / - up)	mm	± 50 of Intended Impact Point	-16

**TARGET VEHICLE PRE- AND POST- TEST STRUCTURAL MEASUREMENTS**

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	5260	4917	-343
2	Total Length	5260	5035	-225
3	Total Width	1995	2159	164
4	Left Side Wheelbase	3055	2943	-112
5	Right Side Wheelbase	3055	3073	18

**MAXIMUM STATIC CRUSH OF HONEYCOMB FACE**

Row	Vertical Location		From Centerline		Max. Crush (mm)
	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	500	Right	53
B	Top of Bumper	533	800	Right	169
C	Mid Level	686	800	Right	304
D	Top of Stack	813	800	Right	335

<sup>2</sup> – Redundant Speed Trap failed

**DATA SHEET NO. 5 ... (CONTINUED)**

**POST-TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200  
Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**DOOR OPENING AND SEAT TRACK INFORMATION**

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

**DATA SHEET NO. 6**

**FMVSS 301 DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck NHTSA No.: QX0200

Test Program: 70% Overlap Rear Impact Test Date: 11/29/12

**FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA**

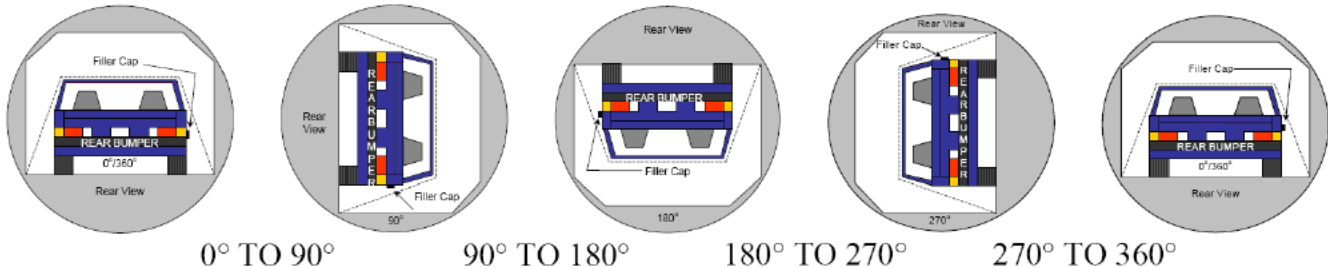
**Stoddard Solvent Spillage Measurements**

- 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. 7**  
**STATIC ROLLOVER TEST DATA**

Test Vehicle: 1999 Ford F-150 2-Door Truck  
 Test Program: 70% Overlap Rear Impact

NHTSA No.: QX0200  
 Test Date: 11/29/12



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: Stoddard solvent leaked from the fuel filler door between the 0° to 90° and 90° to 180° intervals. The vehicle also leaked from the area above the gas tank at the static 270°.

**SOLVENT COLLECTION TIME TABLE IN SECONDS**

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	80	300	380
90° To 180°	80	300	380
180° To 270°	77	300	377
270° To 360°	79	300	379

**FMVSS 301 SPILLAGE TABLE**

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° To 90°	31 g			
90° To 180°	28 g			
180° To 270°	0 g*			
270° To 360°	0 g			

**SOLVENT SPILLAGE LOCATION TABLE**

Test Phase	Spillage Location
0° To 90°	Area Around Fuel Filler Door
90° To 180°	Area Around Fuel Filler Door
180° To 270°	Area Above Gas Tank
270° To 360°	No Spillage

\*Spillage amount was immeasurable.

**APPENDIX A  
PHOTOGRAPHS**

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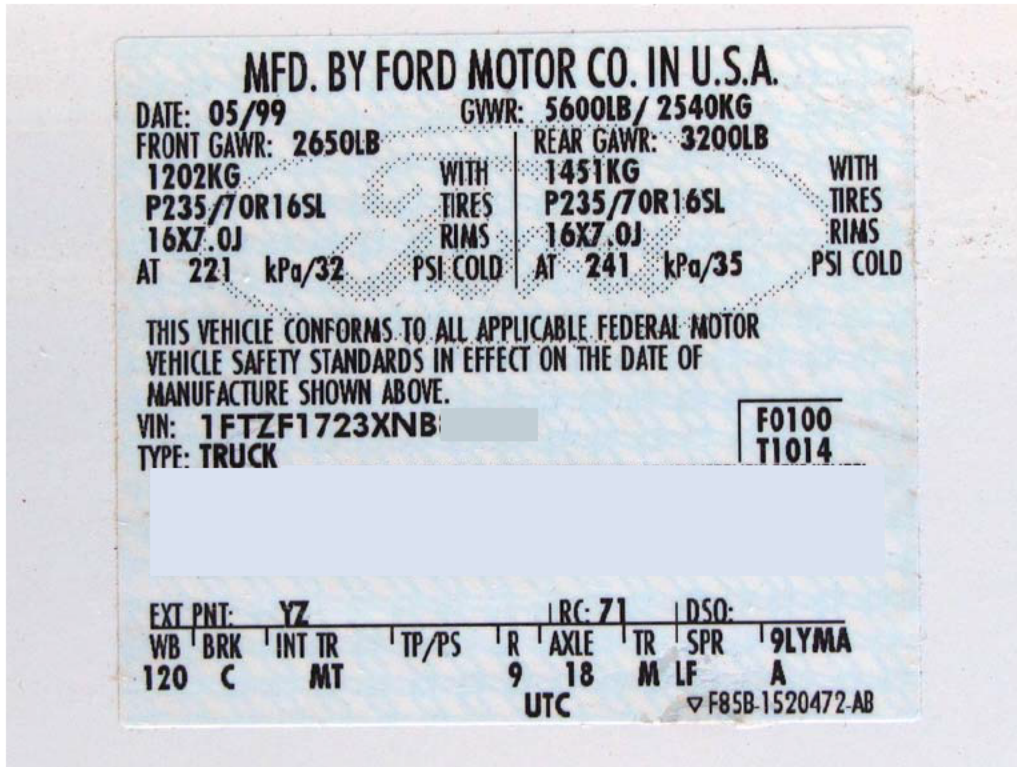


FIGURE 1. Vehicle Certification Label

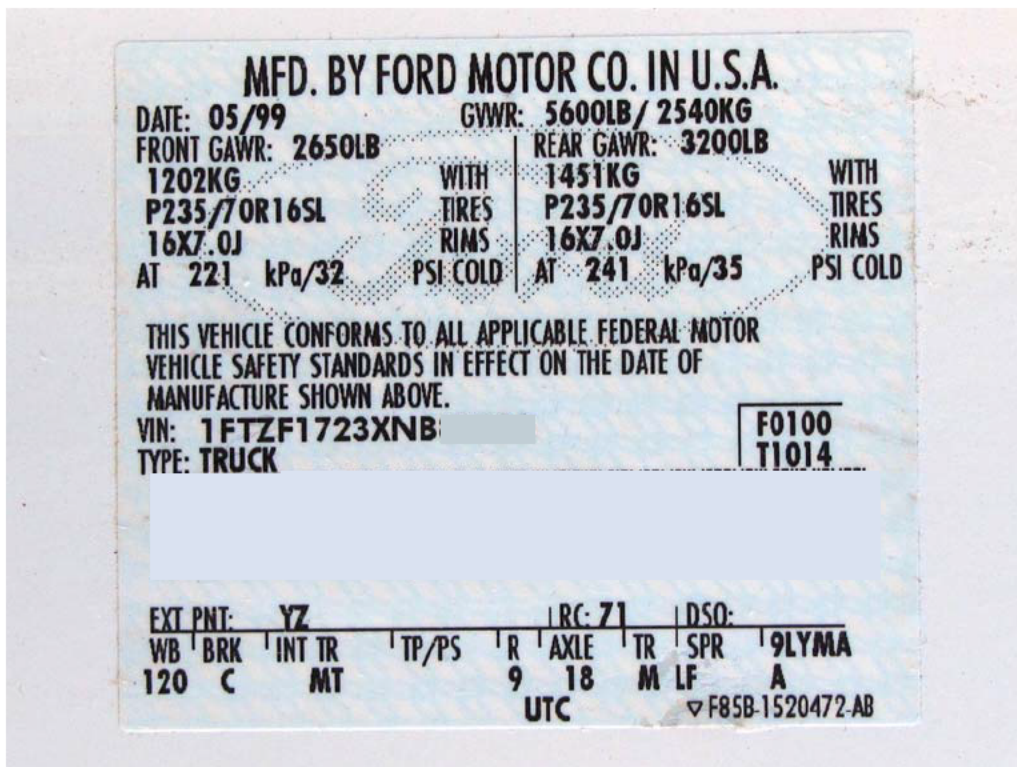


FIGURE 2. Vehicle Tire Placard



FIGURE 3. Pre-Test Front of Test Vehicle



FIGURE 4. Post-Test Front of Test Vehicle



FIGURE 5. Pre-Test Left Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 6. Post-Test Left Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 7. Pre-Test Left View of Test Vehicle



FIGURE 8. Post-Test Left View of Test Vehicle



FIGURE 9. Pre-Test Left Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 10. Post-Test Left Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 11. Pre-Test Rear View of Test Vehicle



FIGURE 12. Post-Test Rear View of Test Vehicle



FIGURE 13. Pre-Test Right Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 14. Post-Test Right Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 15. Pre-Test Right View of Test Vehicle



FIGURE 16. Post-Test Right View of Test Vehicle



FIGURE 17. Pre-Test Right Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 18. Post-Test Right Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 19. Pre-Test Underbody, Fuel Tank Location



FIGURE 20. Post-Test Underbody, Fuel Tank Location

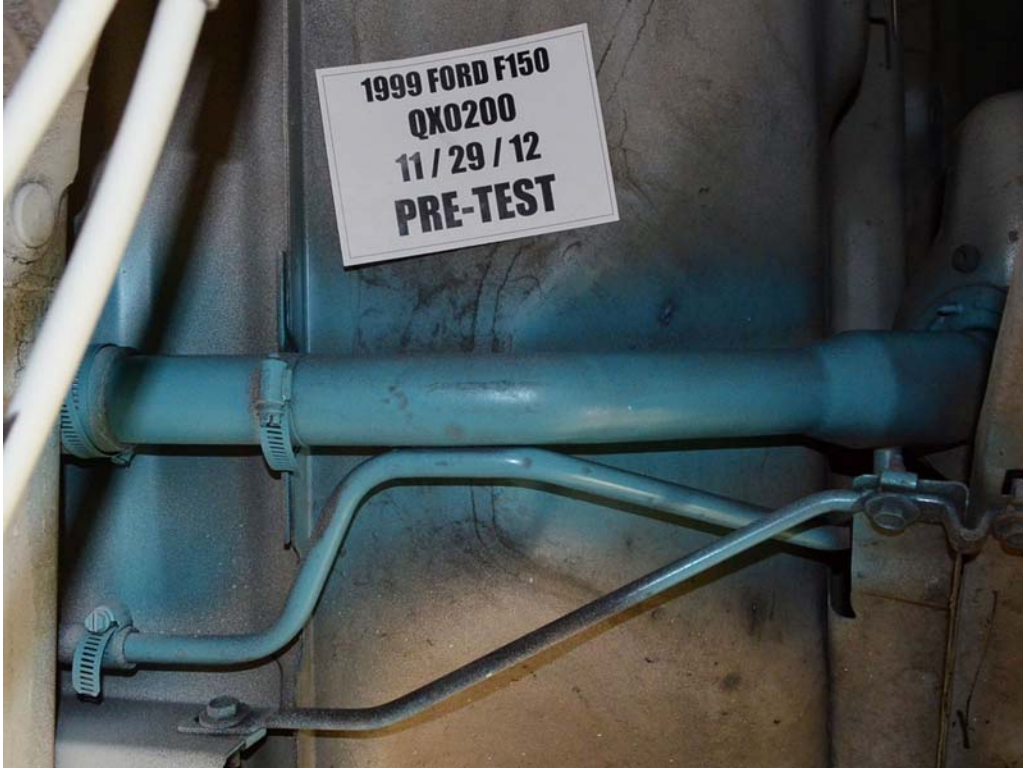


FIGURE 21. Pre-Test Underbody, Fuel Filler Neck Location



FIGURE 22. Post-Test Underbody, Fuel Filler Neck Location



FIGURE 23. Pre-Test Underbody, Fuel Line Location



FIGURE 24. Post-Test Underbody, Fuel Line Location



FIGURE 25. Vehicle at 0° on Static Rollover Device



FIGURE 26. Vehicle at 90° on Static Rollover Device



FIGURE 27. Vehicle at 180° on Static Rollover Device



FIGURE 28. Vehicle at 270° on Static Rollover Device



FIGURE 29. Vehicle at 360° on Static Rollover Device



FIGURE 30. Post-Test Stoddard Solvent Spillage Location View



FIGURE 31. Post-Test Stoddard Solvent Spillage Location View