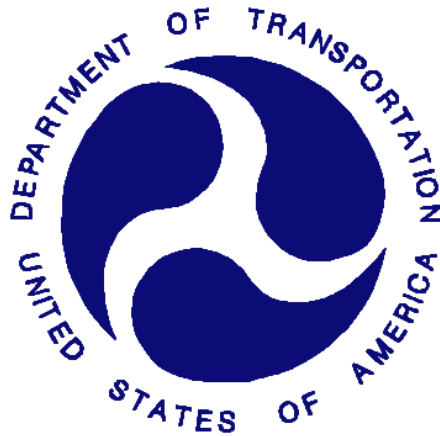


**Vehicle Research and Test Center
1997 Plymouth Neon into
Rear of a 2004 Jeep Liberty
TRC Inc. Test Number: 130925**



**Prepared By:
Transportation Research Center Inc.
10820 State Route 347
East Liberty, OH 43319**

**Final Report
September – October 2013**

**Prepared For:
Vehicle Research and Test Center
P. O. Box 37
East Liberty, OH 43319**

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Test Performed By: John Shultz, Supervisor

Report Approved October 23, 2013 by:

A handwritten signature in black ink, reading "Jeffery W. Sankey". The signature is written in a cursive style with a horizontal line underneath it.

Jeffery W. Sankey
Manager, Project Operations

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Section 1.0

Purpose and Test Procedure

Purpose

This vehicle-to-vehicle rear impact test was conducted for the National Highway Traffic Safety Administration (NHTSA) and Vehicle Research and Test Center (VRTC) by Transportation Research Center Inc. (TRC Inc.).

The test mode was defined as the bullet vehicle moving at 64.51 km/h to impact the target vehicle moving at 0 km/h at an impact angle of 180 degrees. The purpose of this test was to evaluate the aggressiveness of the bullet vehicle, a 1997 Plymouth Neon, and the vehicle response of the target vehicle, a 2004 Jeep Liberty, in this vehicle-to-vehicle rear impact mode.

Test Procedure

This test was conducted in accordance with VRTC instructions for a vehicle-to-vehicle rear impact test. Data was obtained relative to FMVSS 301, "Fuel System Integrity," performance.

The target vehicle, a 2004 Jeep Liberty, was instrumented with six (6) accelerometers to measure longitudinal, lateral and vertical axis accelerations.

The bullet vehicle, a 1997 Plymouth Neon, was instrumented with six (6) accelerometers to measure longitudinal, lateral and vertical axis accelerations. The vehicle's specified impact velocity range was 63.6 to 65.2 km/h.

The bullet vehicle impacted the rear of the target vehicle at an impact angle of 180 degrees. The intended impact point was the bullet vehicle's centerline aligned with the target vehicle's centerline.

One (1) Hybrid III 50th Male Ballast dummy was placed in the bullet vehicle's driver's seat. One (1) Hybrid III 5th Female Ballast dummy was placed in the target vehicle's driver's seat; one (1) weighted 6yo Child dummy was placed in the target vehicle's right front passenger seat, one (1) 6yo Child dummy was placed in the target vehicle's left rear passenger seat in a booster seat. All dummies were restrained with seatbelts.

The twelve (12) data channels were digitally sampled and recorded at 12,500 samples per second and processed per SAE J211 March 1995.

The crash event was recorded by three (3) real-time panning motion picture cameras and eight (8) high-speed motion picture cameras.

The test summary data is presented in Section 2.0. The FMVSS 301 data is presented in Section 3.0. The camera and vehicle measurements are presented in Section 4.0. Appendix A contains the still photographic prints. Appendix B contains the vehicle data plots.

Section 2.0

Test Summary

Test Results Summary

This 64.4 km/h 180° vehicle-to-vehicle rear impact test was conducted by TRC Inc. on September 25, 2013.

The target test vehicle, a 2004 Jeep Liberty, was equipped with a 3.7-liter 6 cylinder engine, 3 speed transmission, power steering, power brakes, and dual stage front airbags. The target vehicle's test weight was 1943.0 kg.

The bullet test vehicle, a 1997 Plymouth Neon, was equipped with a 2.0-liter 4 cylinder transverse engine, 3 speed transmission, power steering, power brakes, and dual stage front airbags. The bullet vehicle's test weight was 1274.6 kg. The bullet vehicle's impact speed was 64.51 km/h.

Data Acquisition Explanations

The real-time onboard target vehicle camera did not record as a result of the impact dislodging the battery from the camera.

Table 1 Crash Test Summary

Test mode:	Vehicle to Vehicle Rear Impact
Test date:	September 25, 2013
Test time:	12:29 PM
Ambient temperature:	17.8° C
Target vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
Target vehicle test weight:	1943.0 kg
Bullet vehicle year/make/ model/body style:	1997/Plymouth/Neon/Passenger sedan
Bullet vehicle test weight:	1274.6 kg
Impact angle ¹ :	180°
Impact velocity ² :	Bullet vehicle = 64.51 km/h
Total number of data channels:	12
Number of cameras:	
High-speed:	8
Real-time:	3

¹ With respect to tow track centerline.

² Speed trap measurement ($\pm .08$ km/h accuracy)

Table 2 Target Vehicle General Test and Vehicle Parameter Data

Vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
VIN:	1J4GL48K44W100778
Model year:	2004
Body style:	SUV
Color:	Silver
Engine data:	
Cylinders:	6
Displacement	3.7 liters
Type:	V
Placement:	Longitudinal
Transmission data:	<u>3</u> speed, <u> </u> manual, <u>X</u> automatic, <u>X</u> overdrive
Final drive:	<u> </u> FWD, <u> </u> RWD, <u>X</u> 4WD
Date vehicle received:	9/23/2013
Odometer reading:	304,274
Dealer's name	Customer Supplied

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	Yes	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	Yes
Clock	Yes	Rear window defroster	Yes
Other	None	Power door locks	Yes

Certification data from vehicle's label:

Vehicle manufactured by:	Daimler Chrysler Corporation
Date of manufacture:	7/03
VIN:	1J4GL48K44W100778
GVWR:	5600 lbs. (2451 kg)
GAWR: Front:	2750 lbs. (1248 kg)
Rear:	3150 lbs. (1429 kg)

Table 2 Target Vehicle General Test and Vehicle Parameter Data, Continued

Tires on vehicle (mfr., line, size): Goodyear, Wrangler ST, P215/75R16
Tire pressure with maximum capacity vehicle load:
Front: 44 psi (300 kPa)
Rear: 44 psi (300 kPa)
Spare tire (mfr., line, size): Goodyear, Wrangler ST, P215/75R16
Type of seats:
Front Bucket
Rear Split Bench
Maximum width: 1815 mm
Wheelbase: 2640 mm

Location of "Recommended Tire Pressure" label:

Glove Box

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: P215/75R16
Recommended cold tire pressure: Front: 33 psi (227 kPa)
Rear: 33 psi (227 kPa)
Seating capacity: Front: 2
Mid: 0
Rear: 3
Total: 5
Vehicle capacity weight: 1150 lbs. (521.6 kg)
Rated cargo/luggage weight: N/A lbs. (N/A kg)

Test vehicle attitude:

Delivered attitude:	LF 800 mm;	RF 802 mm;	LR 815 mm;	RR 828 mm
Pre-test attitude:	LF 785 mm;	RF 797 mm;	LR 806 mm;	RR 812 mm
Post-test attitude:	LF 762 mm;	RF 817 mm;	LR 789 mm;	RR 837 mm

Table 2 Target Vehicle General Test and Vehicle Parameter Data Continued

Weight of test vehicle as received (with maximum fluids)=UDW:

Right front	473.4 kg	Right rear	385.2 kg
Left front	502.8 kg	Left rear	406.4 kg
Total front weight	976.2 kg	(55.2 % of total vehicle weight)	
Total rear weight	791.6 kg	(44.8 % of total vehicle weight)	
Total delivered weight	1767.8 kg		

Weight of test vehicle with required dummies and cargo weight:

Right front	436.4 kg	Right rear	505.6 kg
Left front	460.0 kg	Left rear	541.0 kg
Total front weight	896.4 kg	(46.1% of total vehicle weight)	
Total rear weight	1046.6 kg	(53.9% of total vehicle weight)	
Total test weight	1943.0 kg		

Weight of ballast secured in vehicle: 0 kg

Components removed to meet target test weight: None

Location of Vehicle's CG: 1422 mm rearward of front wheel centerline

Fuel System Data:

Usable fuel system capacity	N/A liters (from owner's manual)
Actual test volume:	68.5 liters

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data

Vehicle year/make/ model/body style:	1997/Plymouth/Neon/Passenger Sedan
VIN:	3P3ES47C5VT530949
Model year:	1997
Body style:	Passenger Sedan
Color:	Blue
Engine data:	
Cylinders:	4
Displacement	2.0 liters
Type:	Straight
Placement:	Transverse
Transmission data:	<u>3</u> speed, <u> </u> manual, <u>X</u> automatic, <u> </u> overdrive
Final drive:	<u>X</u> FWD, <u> </u> RWD, <u> </u> 4WD
Date vehicle received:	9/23/2013
Odometer reading:	134430
Dealer's name	Customer Supplied

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	No
Clock	Yes	Rear window defroster	Yes
Other	None	Power door locks	No

Certification data from vehicle's label:

Vehicle manufactured by:	Chrysler Corporation
Date of manufacture:	10/96
VIN:	3P3ES47C5VT530949
GVWR:	3514 lbs. (1594 kg)
GAWR: Front:	1943 lbs. (882 kg)
Rear:	1621 lbs. (736 kg)

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data, Continued

Tires on vehicle (mfr., line, size):

Left Front:	Republic, Enterprise, P185/65R14
Right Front:	Republic, Enterprise, P185/65R14
Left Rear:	Kelly, Explorer, P185/65R14
Right Rear:	Douglas, Xtra-Track, P185/65R14

Tire pressure with maximum capacity vehicle load:

Front:	35 psi (240 kPa)
Rear:	35 psi (240 kPa)

Spare tire (mfr., line, size): Goodyear, Temp

Type of seats:

Front	Bucket
Rear	Bench

Maximum width: 1700 mm

Wheelbase: 2640 mm

Location of "Recommended Tire Pressure" label:

Driver Door

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: P185/65R14

Recommended cold tire pressure: Front: 32 psi (221 kPa)
Rear: 32 psi (221 kPa)

Seating capacity: Front: 2
Mid: 0
Rear: 3
Total: 5

Vehicle capacity weight: 865 lbs. (392 kg)

Rated cargo/luggage weight: 115 lbs. (52 kg)

Test vehicle attitude:

Delivered attitude:	LF 636 mm;	RF 649 mm;	LR 656 mm;	RR 666 mm
Pre-test attitude:	LF 627 mm;	RF 647 mm;	LR 638 mm;	RR 655 mm
Post-test attitude:	LF 643 mm;	RF 663 mm;	LR 642 mm;	RR 657 mm

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data, Continued

Weight of test vehicle as received (with maximum fluids)=UDW:

Right front	363.4 kg	Right rear	196.4 kg
Left front	380.2 kg	Left rear	199.2 kg
Total front weight	743.6 kg	(65.3 % of total vehicle weight)	
Total rear weight	395.6 kg	(34.7 % of total vehicle weight)	
Total delivered weight	1139.2 kg		

Weight of test vehicle with required dummies and cargo weight:

Right front	366.0 kg	Right rear	241.4 kg
Left front	409.8 kg	Left rear	257.4 kg
Total front weight	775.8 kg	(60.9% of total vehicle weight)	
Total rear weight	498.8 kg	(39.1% of total vehicle weight)	
Total test weight	1274.6 kg		

Weight of ballast secured in vehicle: 0 kg

Components removed to meet target test weight: None

Location of Vehicle's CG: 1033 mm rearward of front wheel centerline

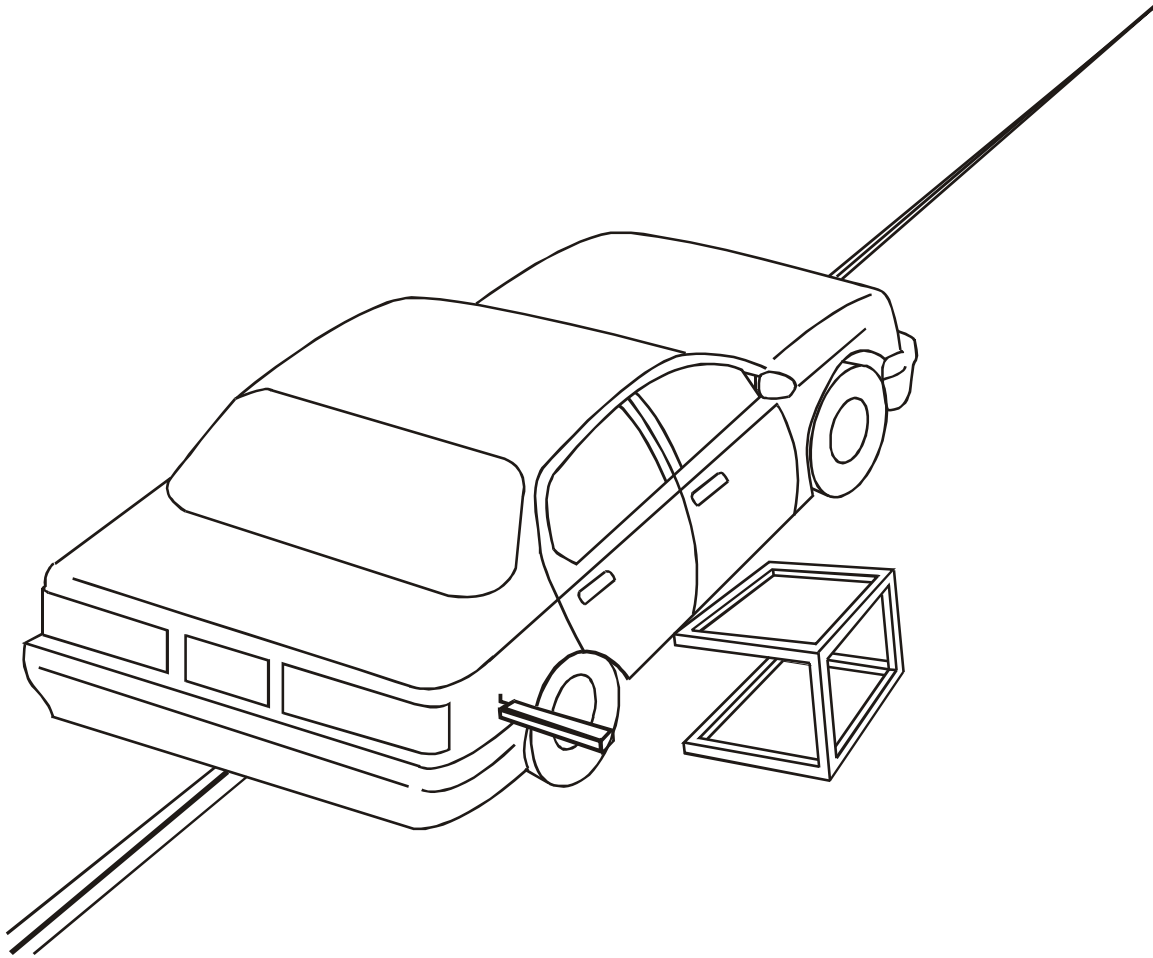
Fuel System Data:

Usable fuel system capacity	N/A liters (from owner's manual)
Actual test volume:	43.9 liters

Table 4 Post-Impact Data

Test number:	130925
Test date:	9/25/2013
Test time:	12:29
Test type:	Vehicle to Vehicle Rear Impact
Impact angle:	180°
Ambient temperature at impact area:	17.8° C
Impact velocity:	
Target vehicle:	0 km/h
Bullet vehicle:	64.51 km/h
Required impact velocity range:	
Bullet vehicle:	63.6 to 65.2 km/h
Distance from each vehicle to intended impact point:	
Entering velocity trap:	660 mm
Exiting velocity trap:	50 mm, approximately

Figure 1 Impact Velocity Measurement System



The vane clears the final emitter/receiver pair approximately 50 millimeters before impact.

The emitter/receiver pairs have 610-millimeter spacing.

Table 5 Target Vehicle Accelerometer Data Summary

Accel. No.	Location		Positive Direction		Negative Direction	
			Max. (g)	Time (ms)	Max. (g)	Time (ms)
1	Vehicle Center of Gravity	X	15.1	44.9	-2.8	131.1
		Y	5.5	82.7	-4.2	117.4
		Z	8.3	72.6	-19.0	52.7
		R	19.1	52.7	---	---
2	Vehicle Center of Gravity Redundant	X	15.4	44.9	-2.6	131.4
		Y	5.6	82.6	-3.9	117.4
		Z	9.1	72.8	-19.4	52.6
		R	19.4	52.6	---	---

Reference: X: + Forward From Rear Bumper
 Y: + Rightward From Vehicle Centerline
 Z: + Downward From Ground Level

Table 6 Bullet Vehicle Accelerometer Data Summary

Accel. No.	Location		Positive Direction		Negative Direction	
			Max. (g)	Time (ms)	Max. (g)	Time (ms)
1	Vehicle Center of Gravity	X	0.6	203.1	-22.2	44.2
		Y	4.4	48.2	-3.8	67.4
		Z	12.4	56.0	-12.5	104.7
		R	22.2	44.2	---	---
2	Vehicle Center of Gravity Redundant	X	0.6	203.0	-22.3	44.2
		Y	4.6	48.1	-3.6	67.4
		Z	12.8	56.0	-11.9	104.6
		R	22.3	44.2	---	---

Reference: X: + Forward From Rear Bumper
 Y: + Rightward From Vehicle Centerline
 Z: + Downward From Ground Level

Table 7 Target Vehicle Measurements

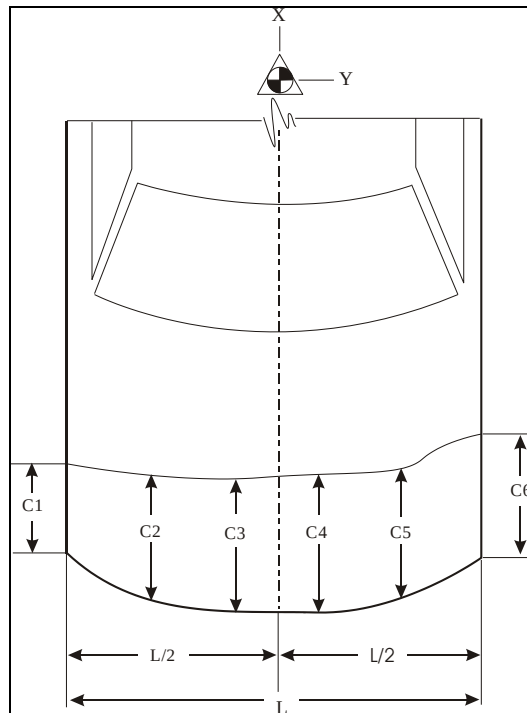
2004 Jeep Liberty

Test Number: 130925

No.	Type of measurement	Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	4210	4154	56
X2	Rear Surface of Vehicle to Front of Engine Block	660	664	-4
X3	Rear Surface of Vehicle to Firewall	1112	1116	-4
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	1400	1401	-1
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	1388	1387	1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	1431	1433	-2
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	1415	1419	-4
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	2389	2389	0
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	2385	2388	-3
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	2385	2389	-4
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	2364	2364	0
X12	Rear Surface of Vehicle to Bottom of " A " Post on Right Side	1465	1460	5
X13	Rear Surface of Vehicle to Bottom of " A " Post on Left Side	1445	1447	-2
X14	Rear Surface of Vehicle to Firewall-Right Side	1070	1072	-2
X15	Rear Surface of Vehicle to Firewall-Left Side	1070	1070	0
X16	Rear Surface of Vehicle to Steering Wheel Center	1795	1798	-3
X17	Center of Steering Column to " A " Post	278	276	2
X18	Center of Steering Column to Headliner	455	455	0
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4142	4095	47
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4140	4070	70
X21	Length of Engine Block	640	640	0

All measurements are in millimeters.

Figure 2 Target Vehicle Crush



Notes: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is vehicle centerline.

Vehicle: 2004 Jeep Liberty

	Pre-test	Post-test	Crush
L	1524 mm		
C1	4140 mm	4070 mm	70 mm
C2	4160 mm	4140 mm	20 mm
C3	4208 mm	4176 mm	32 mm
C4	4222 mm	4145 mm	77 mm
C5	4202 mm	4088 mm	114 mm
C6	4142 mm	4095 mm	47 mm
CL	4210 mm	4154 mm	56 mm

Table 8 Bullet Vehicle Measurements

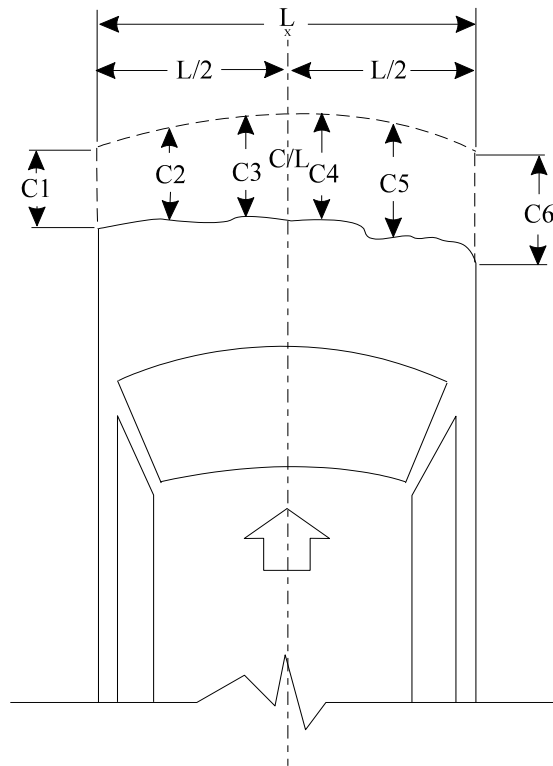
1997 Plymouth Neon

Test Number: 130925

No.	Type of measurement	Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	4380	4317	63
X2	Rear Surface of Vehicle to Front of Engine Block	3946	N/A	N/A
X3	Rear Surface of Vehicle to Firewall	3388	N/A	N/A
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	2958	2962	-4
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	2962	2963	-1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	3016	3016	0
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	3018	3018	0
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	1992	1988	4
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	1996	1996	0
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	1988	1986	2
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	1992	1992	0
X12	Rear Surface of Vehicle to Bottom of " A " Post on Right Side	3015	3015	0
X13	Rear Surface of Vehicle to Bottom of " A " Post on Left Side	3000	N/A	N/A
X14	Rear Surface of Vehicle to Firewall-Right Side	3293	N/A	N/A
X15	Rear Surface of Vehicle to Firewall-Left Side	3289	N/A	N/A
X16	Rear Surface of Vehicle to Steering Wheel Center	2555	2585	-30
X17	Center of Steering Column to " A " Post	300	300	0
X18	Center of Steering Column to Headliner	390	300	90
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4154	4109	45
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4150	4187	-37
X21	Length of Engine Block	610	610	0
	Left Front Overhang	880	830	50
	Right Front Overhang	880	805	75
X26	Firewall to Engine or Transaxle	110	85	25
X27	Vertical Distance from Door Sill to Centerline of Steering Column	556	556	0
X28	Left Wheelbase	2640	2640	0
X28	Right Wheelbase	2640	2640	0
X29	Maximum Width	1700	1708	-8
X30	Rear Surface of Vehicle to Engine Bottom Target	3782	3764	18
X31	Rear Surface of Vehicle to Occupant Compartment Bottom Targets	2420	2420	0
X32	Rear Surface of Vehicle to Front Bumper Bottom Target	4305	4172	133
X33	Rear Surface of Vehicle to Frame Crossmember Bottom Target	3360	3380	-20
RD	Rear Surface of Vehicle to Right Side of Dash Panel	2770	2721	49
CD	Rear Surface of Vehicle to Center of Dash Panel	2725	2661	64
LD	Rear Surface of Vehicle to Left Side of Dash Panel	2760	2734	26

All measurements are in millimeters.

Figure 3 Bullet Vehicle Crush



Notes: L is pre-test length of contact surface.
 $C1$ through $C6$ are spaced equally apart.
 CL is vehicle centerline.

Vehicle: 1997 Plymouth Neon

	Pre-test	Post-test	Crush
L	1524 mm		
$C1$	4150 mm	4187 mm	-37 mm
$C2$	4312 mm	4265 mm	47 mm
$C3$	4380 mm	4321 mm	59 mm
$C4$	4382 mm	4318 mm	64 mm
$C5$	4317 mm	4259 mm	58 mm
$C6$	4154 mm	4109 mm	45 mm
CL	4380 mm	4317 mm	63 mm

Section 3.0

FMVSS 301 Data

Table 9 Target Vehicle Fuel System Data

Vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
Actual test volume:	68.5 liters
Test fluid type:	Stoddard
Specific gravity:	0.764
Kinematic viscosity:	0.99 centistoke
Test fluid color:	Purple
Type of fuel pump:	Electric
Did electric fuel pump operate with ignition switch "on" and the engine not operating.	Yes
Details of fuel system:	The fuel tank is located behind the rear axle. The fuel filler neck enters the top left side of the tank. The fuel filler cap is located on the left rear quarter panel. The fuel lines run along the inside of the left frame rail.

Table 10 Target Vehicle FMVSS 301 Post-Impact Test Data

Test date: 9/25/2013
Vehicle year/make/
model/body style: 2004/Jeep/Liberty/SUV

Test requirements:

Test vehicle fuel tank filled to 92 to 94% of manufacturer's usable capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

Test vehicle impact type:

- ☐ Frontal (30 mph)
- ☐ Oblique (30 mph) with ☐ barrier face first contacting (driver's/passenger's) side
- ☒ Rear vehicle to vehicle impact
- ☐ Lateral moving barrier (20 mph)

Fuel system fluid spillage measurements:

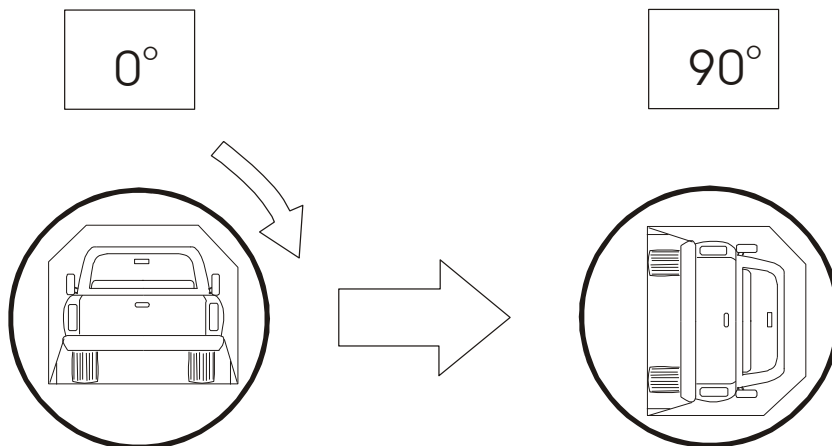
	<u>Test Results</u>	<u>Maximum Allowable</u>
1. From impact until vehicle motion ceases	See Note	28 g
2. 5-minute period after vehicle motion ceases	See Note	142 g
3. Next 25 minutes after 5-minute period	See Note	28 g/minute

Fuel system fluid spillage location(s): Fuel tank

Note: The fuel tank was breached during the impact event, causing most of the 68.5 liters of Stoddard in the tank to spill by the end of 30 minutes.

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90° = 2 minutes, 0 seconds
 FMVSS 301 position hold time = 5 minutes, 0 seconds
 Total = 7 minutes, 0 seconds
 Next whole minute interval = 7 minutes

Fuel system fluid spillage measurements:

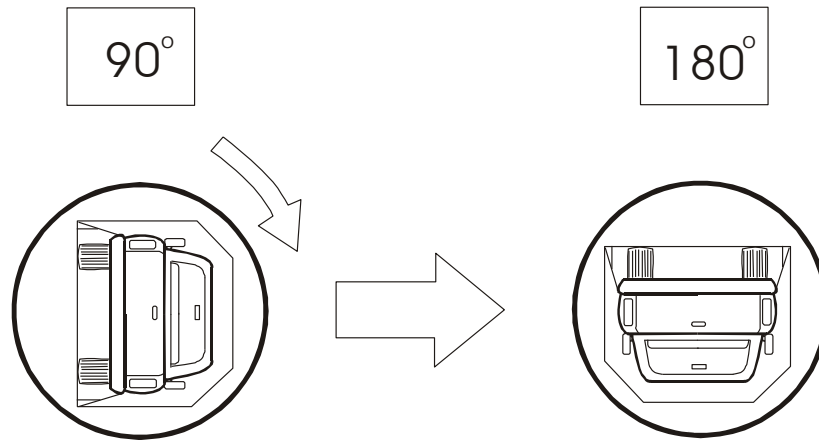
0° to 90° rotation (fuel filler cap down)		Test Results	Maximum Allowable
1.	First five minutes from onset of rotation	See Note	142 g
2.	Sixth minute from onset of rotation	See Note	28 g
3.	Seventh minute from onset of rotation	See Note	28 g

Fuel system fluid spillage location(s): Fuel tank

Note: Stoddard dripped from multiple locations; the amount could not be collected and measured.

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90° = 2 minutes, 0 seconds
FMVSS 301 position hold time = 5 minutes, 0 seconds
Total = 7 minutes, 0 seconds
Next whole minute interval = 14 minutes

Fuel system fluid spillage measurements:

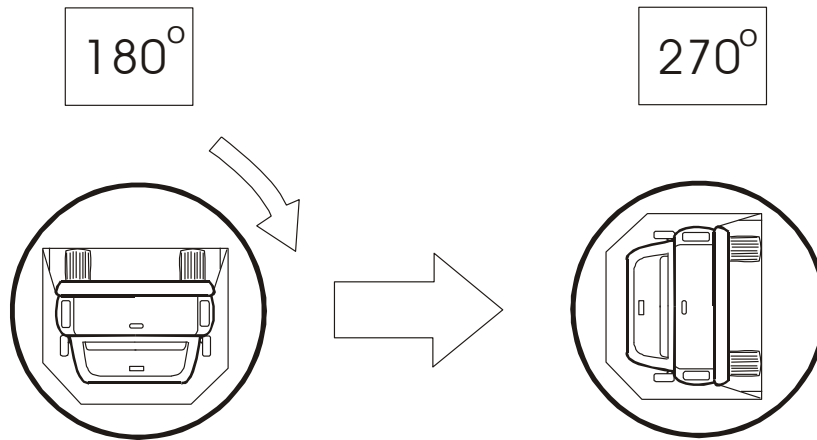
90° to 180° rotation		Test Results	Maximum Allowable
1.	First five minutes from onset of rotation	See Note	142 g
2.	Sixth minute from onset of rotation	See Note	28 g
3.	Seventh minute from onset of rotation	See Note	28 g

Fuel system fluid spillage location(s): Fuel tank

Note: Stoddard dripped from multiple locations; the amount could not be collected and measured.

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	21	minutes		

Fuel system fluid spillage measurements:

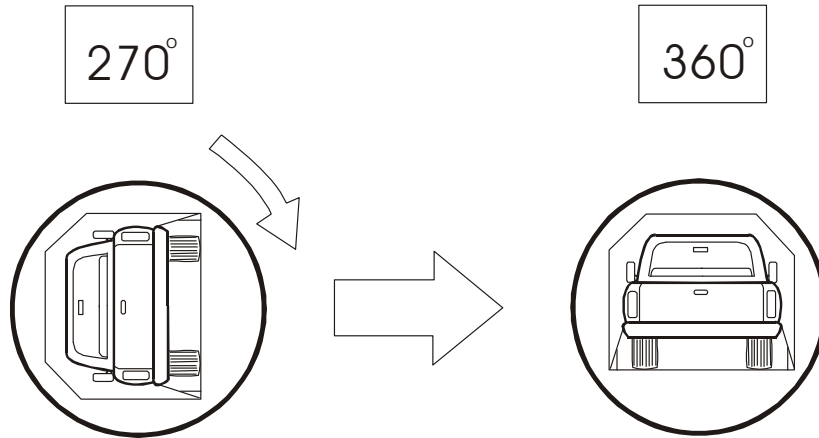
<u>180 to 270° rotation</u>		Test Results	Maximum Allowable
1.	First five minutes from onset of rotation	See Note	142 g
2.	Sixth minute from onset of rotation	See Note	28 g
3.	Seventh minute from onset of rotation	See Note	28 g

Fuel system fluid spillage location(s): Fuel tank

Note: Stoddard dripped from multiple locations; the amount could not be collected and measured.

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90° = 2 minutes, 0 seconds
FMVSS 301 position hold time = 5 minutes, 0 seconds
Total = 7 minutes, 0 seconds
Next whole minute interval = 28 minutes

Fuel system fluid spillage measurements:

270° to 360° rotation		Test Results	Maximum Allowable
1.	First five minutes from onset of rotation	See Note	142 g
2.	Sixth minute from onset of rotation	See Note	28 g
3.	Seventh minute from onset of rotation	See Note	28 g

Fuel system fluid spillage location(s): Fuel tank

Note: Stoddard dripped from multiple locations; the amount could not be collected and measured.

Section 4.0

Camera Information

Figure 5 Camera Positions

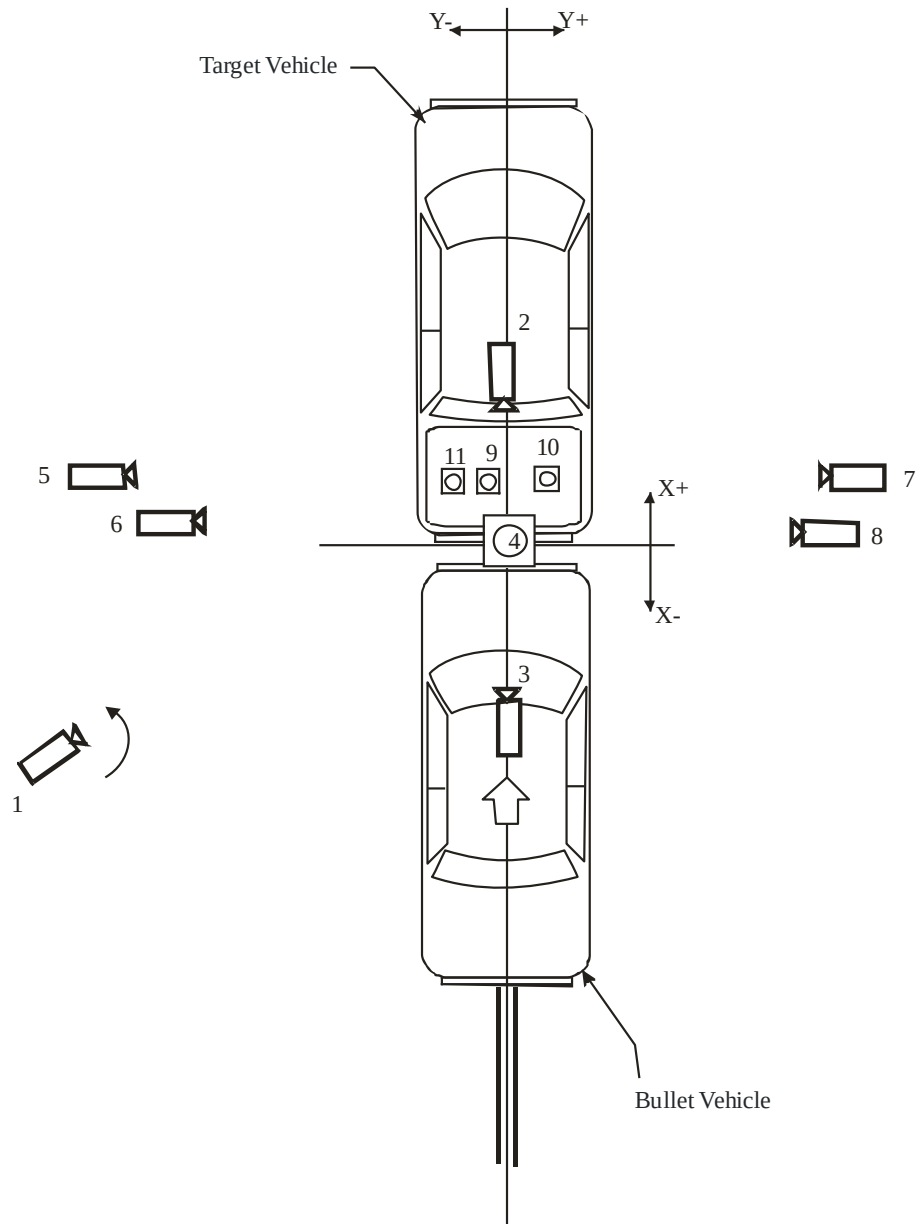


Table 11 Camera Information

Camera Number	Location	Location, mm			Angle (deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Realtime Panning	N/A	N/A	N/A	N/A	Zoom	30
2	Realtime onboard target vehicle	N/A	N/A	N/A	N/A	Zoom	30
3	Realtime onboard bullet vehicle	N/A	N/A	N/A	N/A	Zoom	30
4	Overhead	0	254	6736	-90°	8.5	1000
5	Left target vehicle	-1850	-11460	1089	0.8°	Zoom	1000
6	Left side impact	0	-8016	952	-0.9°	Zoom	1000
7	Right target vehicle	-692	8778	1185	-2°	Zoom	1000
8	Right side impact	-457	8626	1188	-1°	Zoom	1000
9	Pit wide	-1610	-83	-3185	89.1°	12.5	1000
10	Pit medium	-995	40	-2929	88.6°	16	1000
11	Pit tight	-640	-1040	-1915	70.5°	25	1000

+X: Forward (referenced to Target) from impact point
+Y: Rightward (referenced to Target) from impact point
+Z: Downward from ground level

Appendix A

Photographs



Figure A-1 Pre-Test Target Vehicle Frontal View



Figure A-2 Post-Test Target Vehicle Frontal View



Figure A-3 Pre-Test Target Vehicle Left Front 3/4 View



Figure A-4 Post-Test Target Vehicle Left Front 3/4 View



Figure A-5 Pre-Test Target Vehicle Left Side View



Figure A-6 Post-Test Target Vehicle Left Side View



Figure A-7 Pre-Test Target Vehicle Rear View



Figure A-8 Post-Test Target Vehicle Rear View



Figure A-9 Pre-Test Target Vehicle Right Rear 3/4 View



Figure A-10 Post-Test Target Vehicle Right Rear 3/4 View



Figure A-11 Pre-Test Target Vehicle Right Side View



Figure A-12 Post-Test Target Vehicle Right Side View



Figure A-13 Pre-Test Target Vehicle Front Underbody View



Figure A-14 Post-Test Target Vehicle Front Underbody View

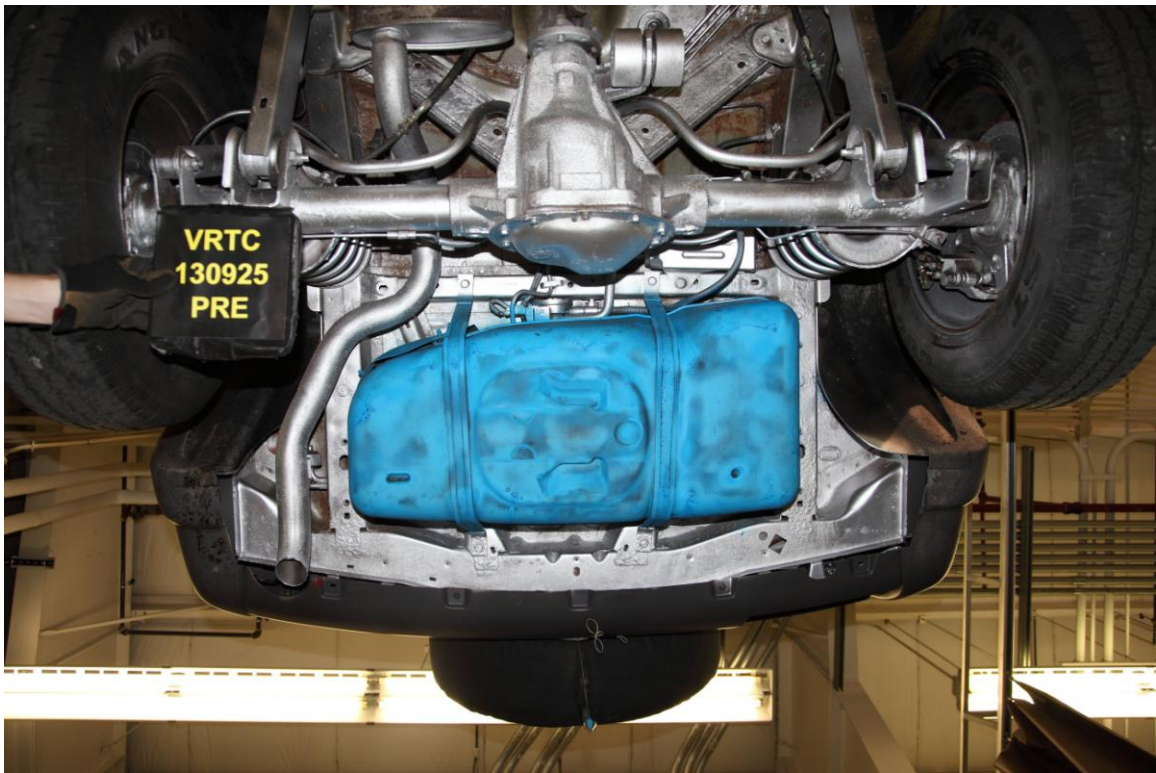


Figure A-15 Pre-Test Target Vehicle Rear Underbody View



Figure A-16 Post-Test Target Vehicle Rear Underbody View



Figure A-17 Pre-Test Target Vehicle Overhead View



Figure A-18 Post-Test Target Vehicle Overhead View



Figure A-19 Pre-Test Target Vehicle Overhead Tight View



Figure A-20 Post-Test Target Vehicle Overhead Tight View



Figure A-21 Pre-Test Target Vehicle Fuel Tank Close-up View

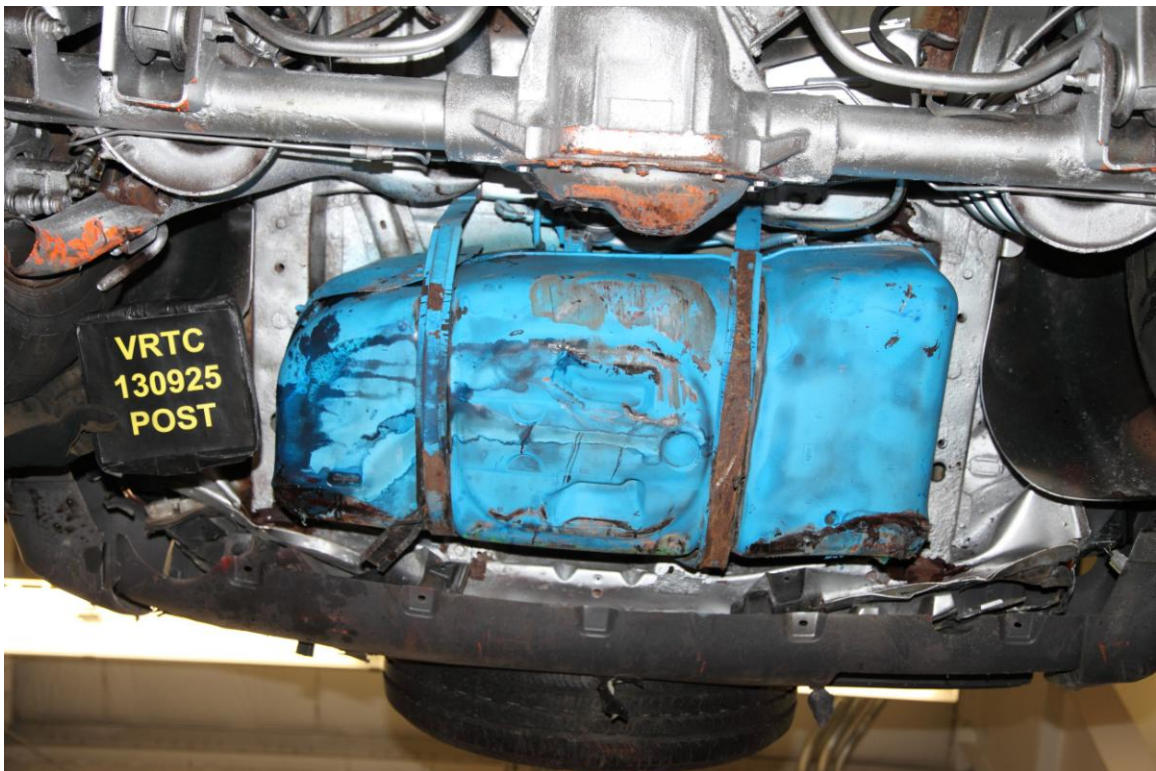


Figure A-22 Post-Test Target Vehicle Fuel Tank Close-up View



Figure A-23 Pre-Test Target Vehicle Fuel Filter Close-up View



Figure A-24 Post-Test Target Vehicle Fuel Filter Close-up View



Figure A-25 Pre-Test Target Vehicle Fuel Filler Close-up View



Figure A-26 Post-Test Target Vehicle Fuel Filler Close-up View

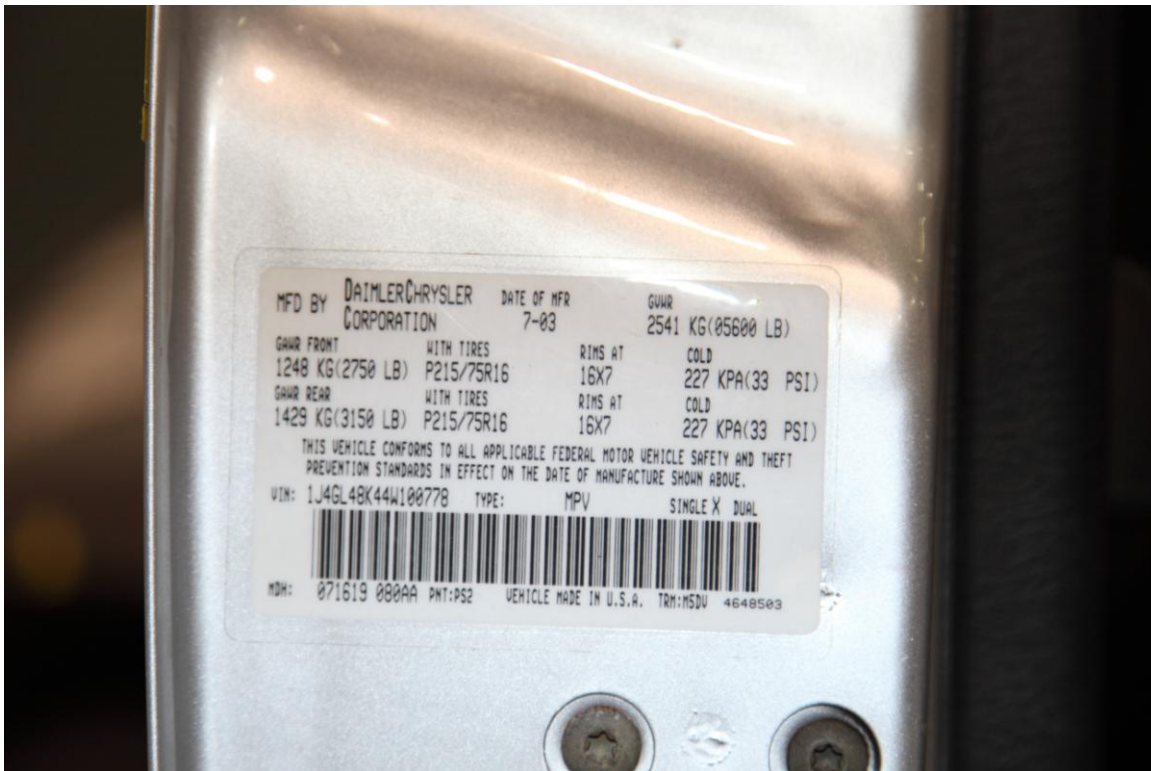


Figure A-27 Close-Up View of Target Vehicle Certification Label

Intentionally Left Blank



Figure A-28 Pre-Test Bullet Vehicle Frontal View



Figure A-29 Post-Test Bullet Vehicle Frontal View



Figure A-30 Pre-Test Bullet Vehicle Left Front 3/4 View



Figure A-31 Post-Test Bullet Vehicle Left Front 3/4 View



Figure A-32 Pre-Test Bullet Vehicle Left Side View



Figure A-33 Post-Test Bullet Vehicle Left Side View



Figure A-34 Pre-Test Bullet Vehicle Rear View



Figure A-35 Post-Test Bullet Vehicle Rear View



Figure A-36 Pre-Test Bullet Vehicle Right Rear 3/4 View



Figure A-37 Post-Test Bullet Vehicle Right Rear 3/4 View



Figure A-38 Pre-Test Bullet Vehicle Right Side View



Figure A-39 Post-Test Bullet Vehicle Right Side View

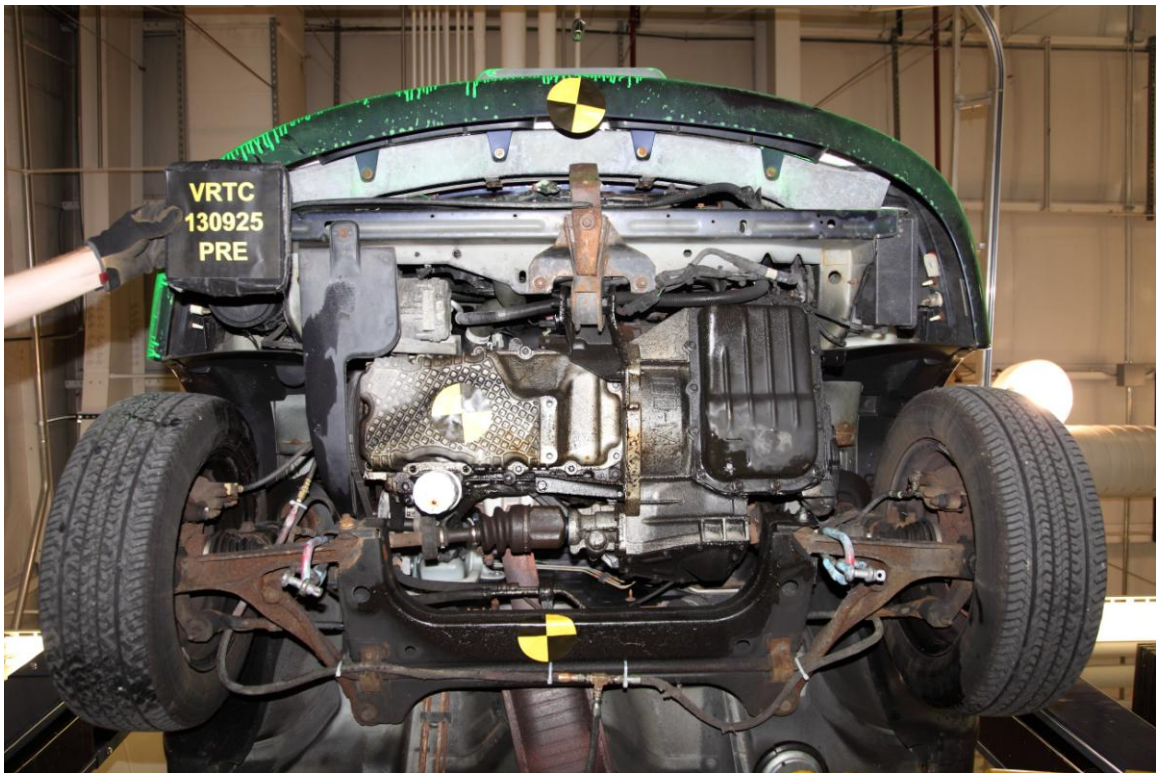


Figure A-40 Pre-Test Bullet Vehicle Front Underbody View



Figure A-41 Post-Test Bullet Vehicle Front Underbody View



Figure A-42 Pre-Test Bullet Vehicle Rear Underbody View



Figure A-43 Post-Test Bullet Vehicle Rear Underbody View



Figure A-44 Pre-Test Bullet Vehicle Fuel Filter Close-up View



Figure A-45 Post-Test Bullet Vehicle Fuel Filter Close-up View



Figure A-46 Pre-Test Bullet Vehicle Fuel Filler Close-up View



Figure A-47 Post-Test Bullet Vehicle Fuel Filler Close-up View



Figure A-48 Close-Up View of Bullet Vehicle Certification Label



Figure A-49 Close-Up View of Bullet Vehicle Tire Information Placard or Label



Figure A-50 Pre-Test Bullet and Target Vehicles Overall Left Side View



Figure A-51 Post-Test Bullet and Target Vehicles Overall Left Side View



Figure A-52 Pre-Test Bullet and Target Vehicles Overall Right Side View



Figure A-53 Post-Test Bullet and Target Vehicles Overall Right Side View

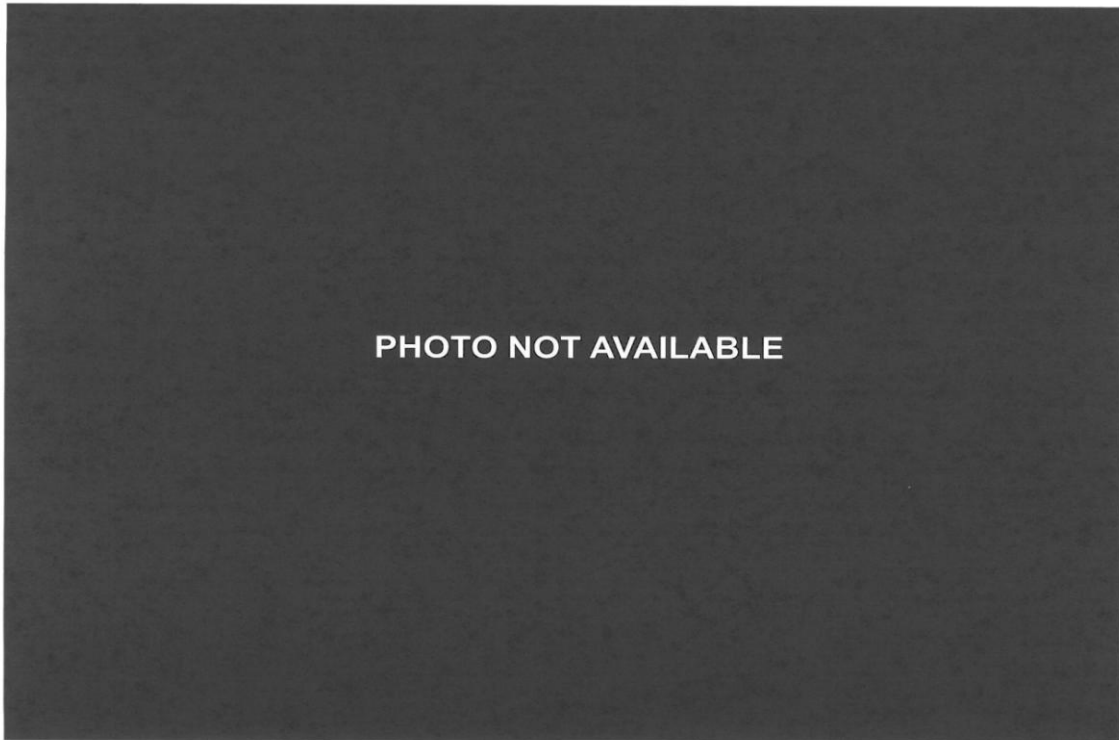


Figure A-54 Pre-Test Bullet and Target Vehicles Overhead View



Figure A-55 Post-Test Bullet and Target Vehicles Overhead View

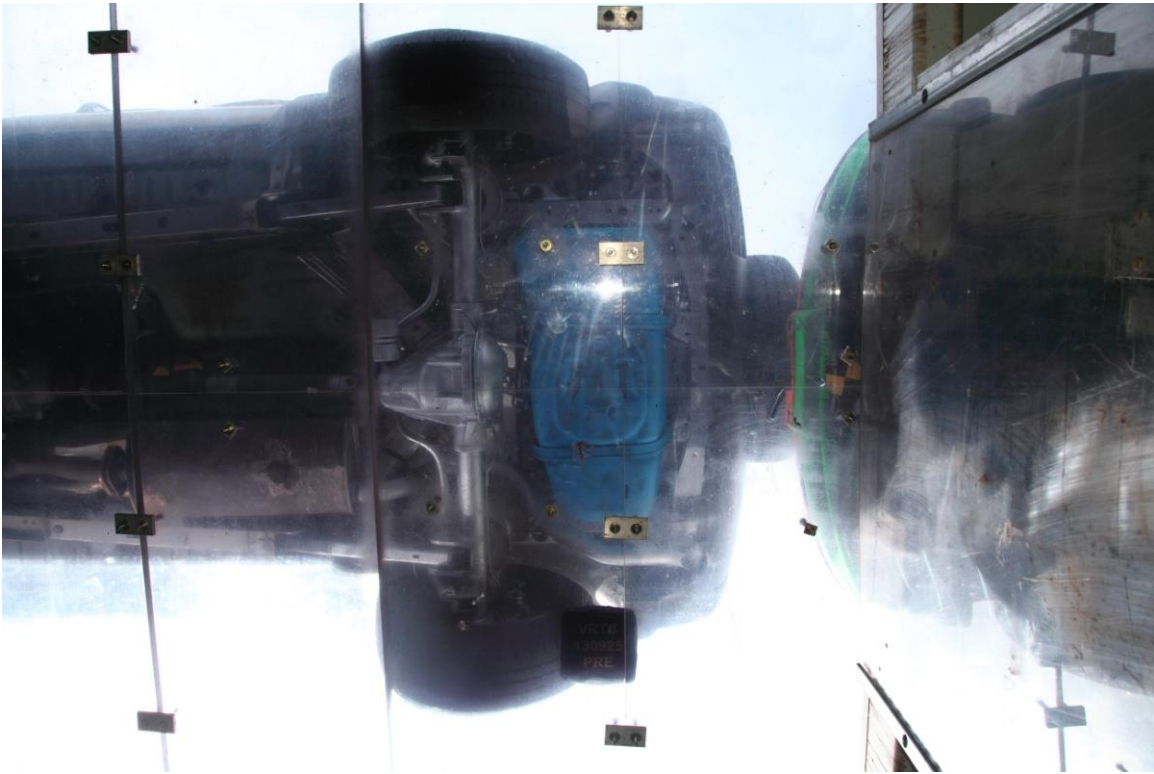


Figure A-56 Pre-Test Impact Alignment – Bullet and Target Vehicles Pit View



Figure A-57 Post-Test Fuel System Fluid Spillage – View 1



Figure A-58 Post-Test Fuel System Fluid Spillage – View 2



Figure A-59 Post-Test Target Vehicle Damaged Area Close-up View

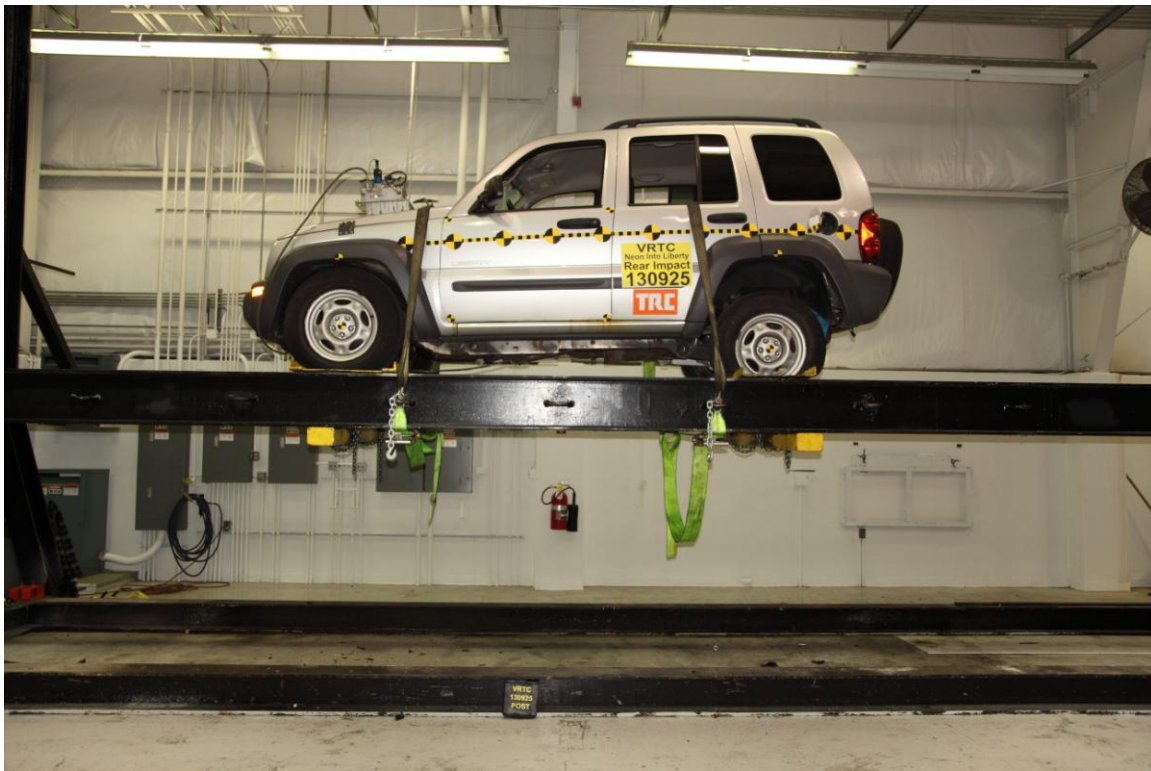


Figure A-60 Target Vehicle at 0° on Static Rollover Device

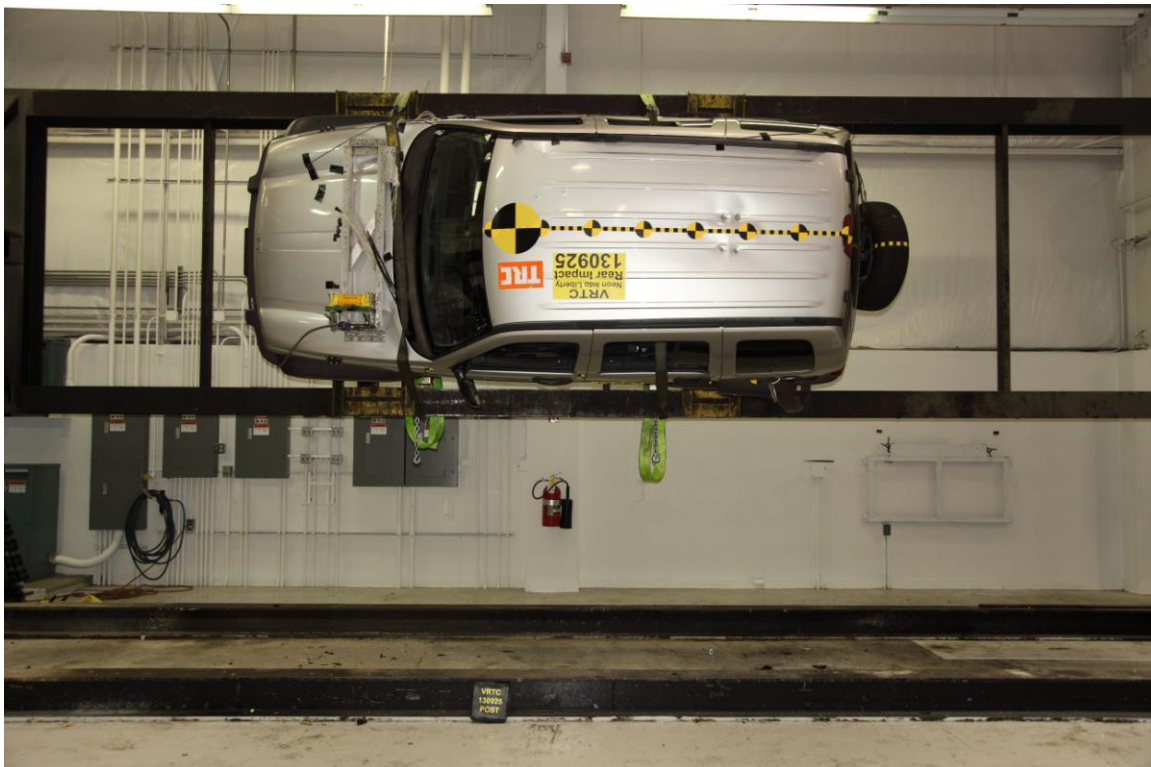


Figure A-61 Target Vehicle at 90° on Static Rollover Device

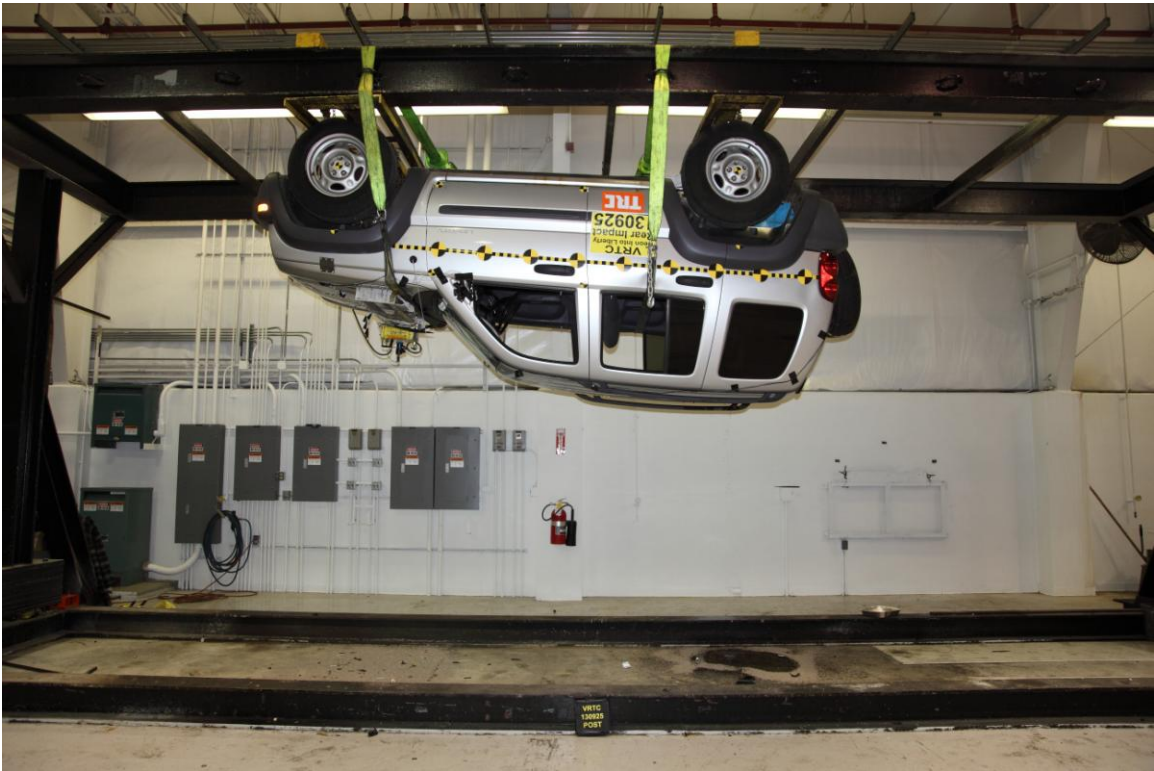


Figure A-62 Target Vehicle at 180° on Static Rollover Device



Figure A-63 Target Vehicle at 270° on Static Rollover Device



Figure A-64 Target Vehicle at 360° on Static Rollover Device

Appendix B

Data Plots



1997 Neon into Rear of 2004 Jeep Liberty

Bullet Vehicle CG X-axis Acceleration

Date: 09/25/2013

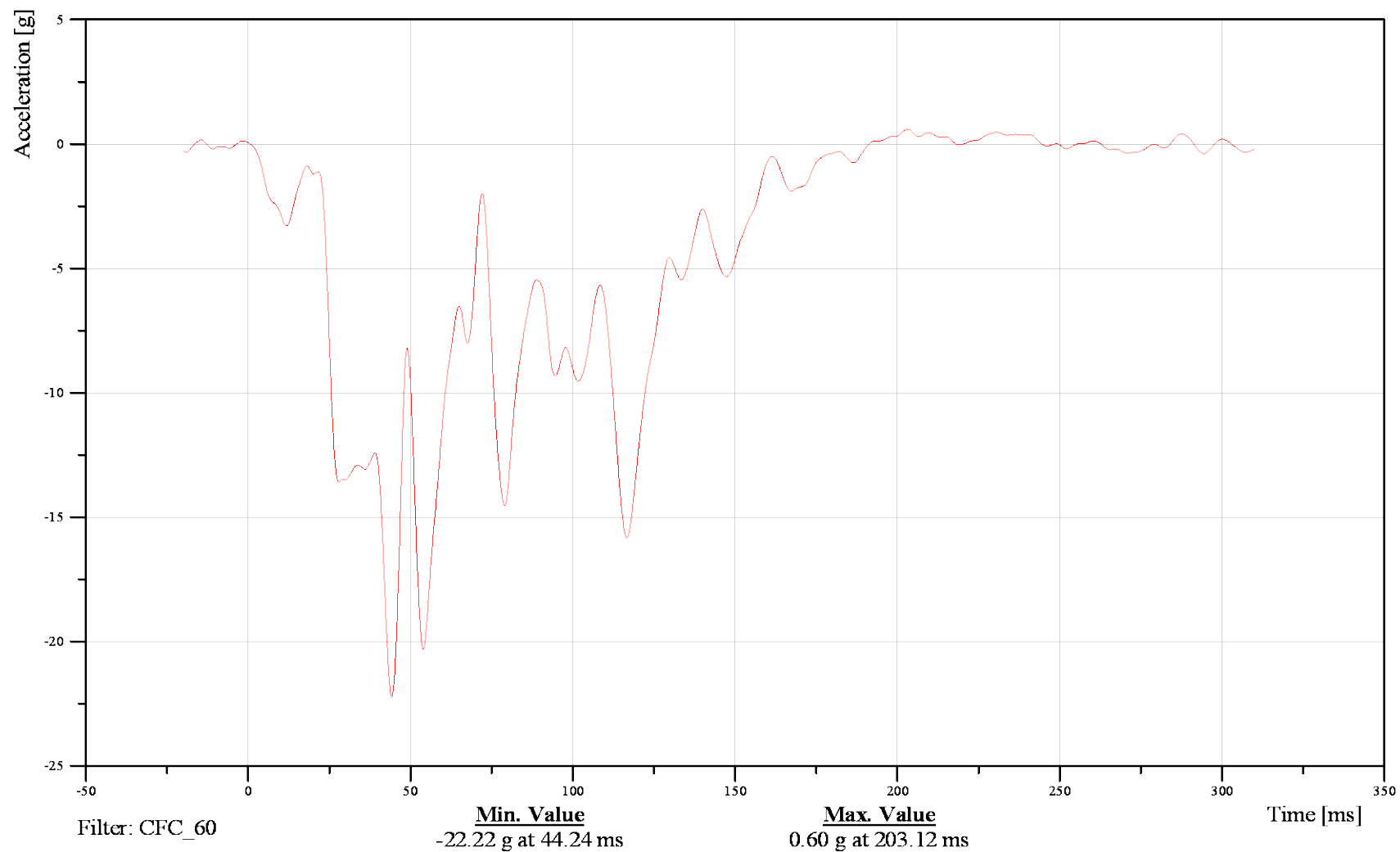
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Bullet Vehicle CG Y-axis Acceleration

Date: 09/25/2013

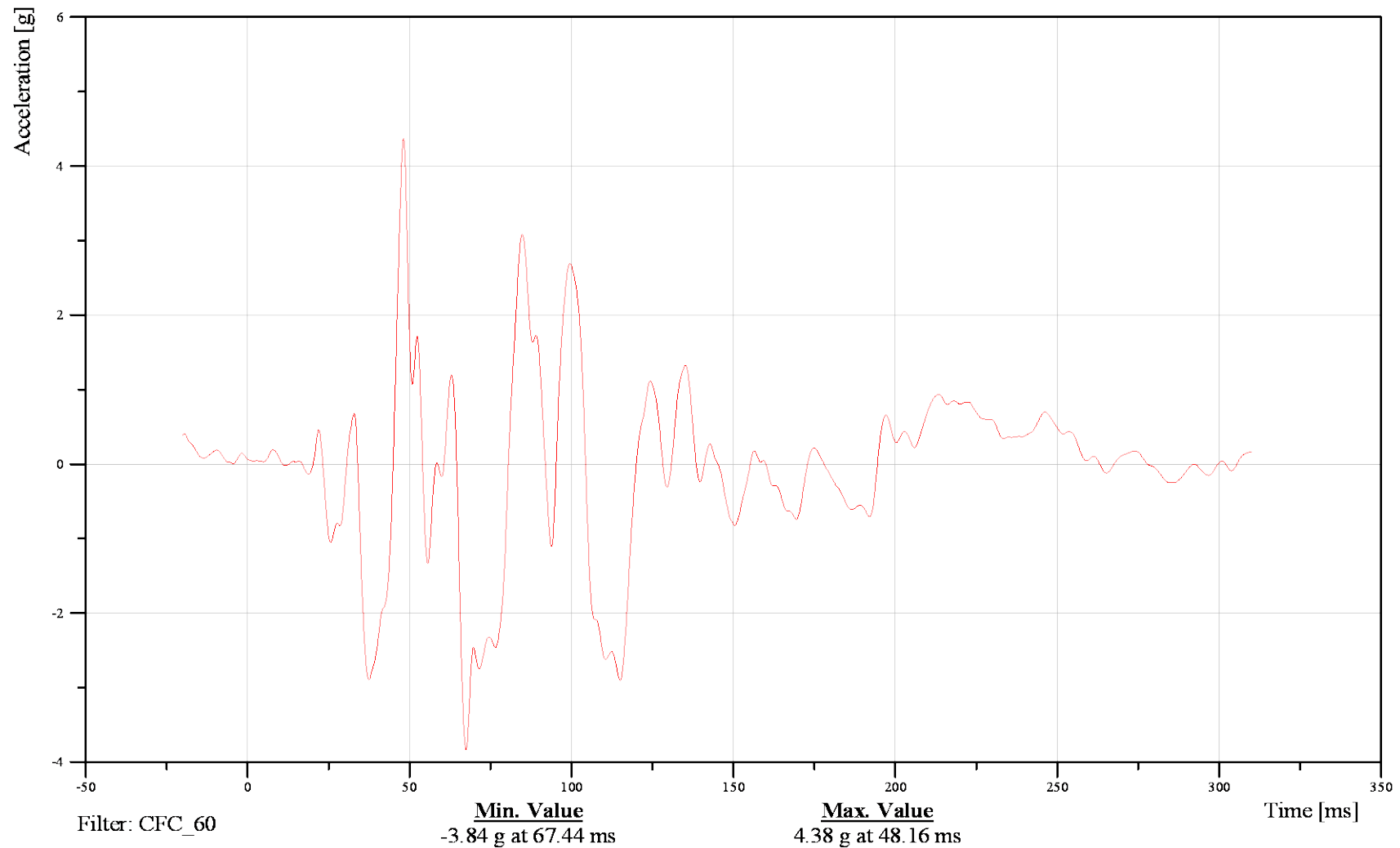
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Bullet Vehicle CG Z-axis Acceleration

Date: 09/25/2013

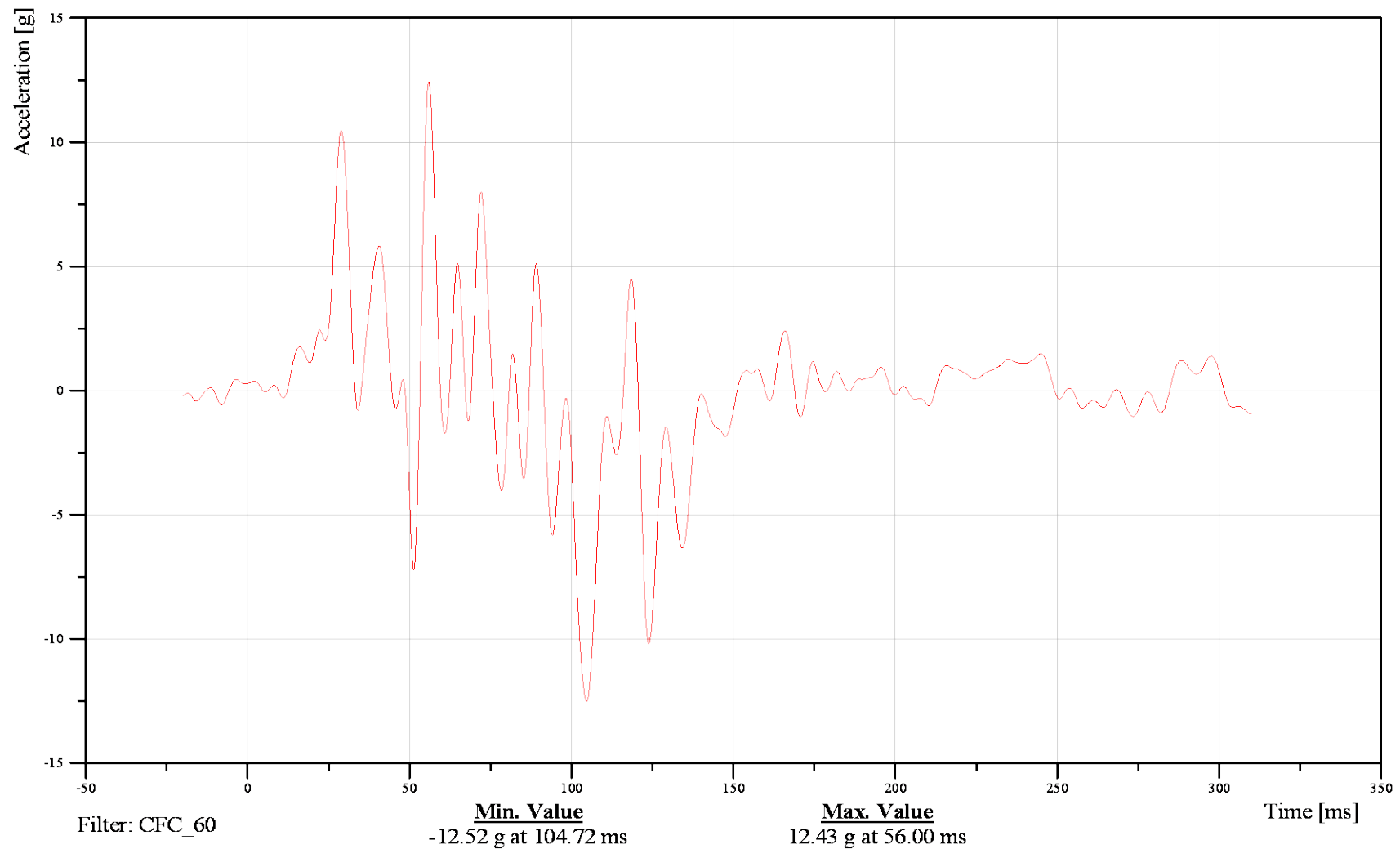
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Bullet Vehicle CG Acceleration Resultant

Date: 09/25/2013

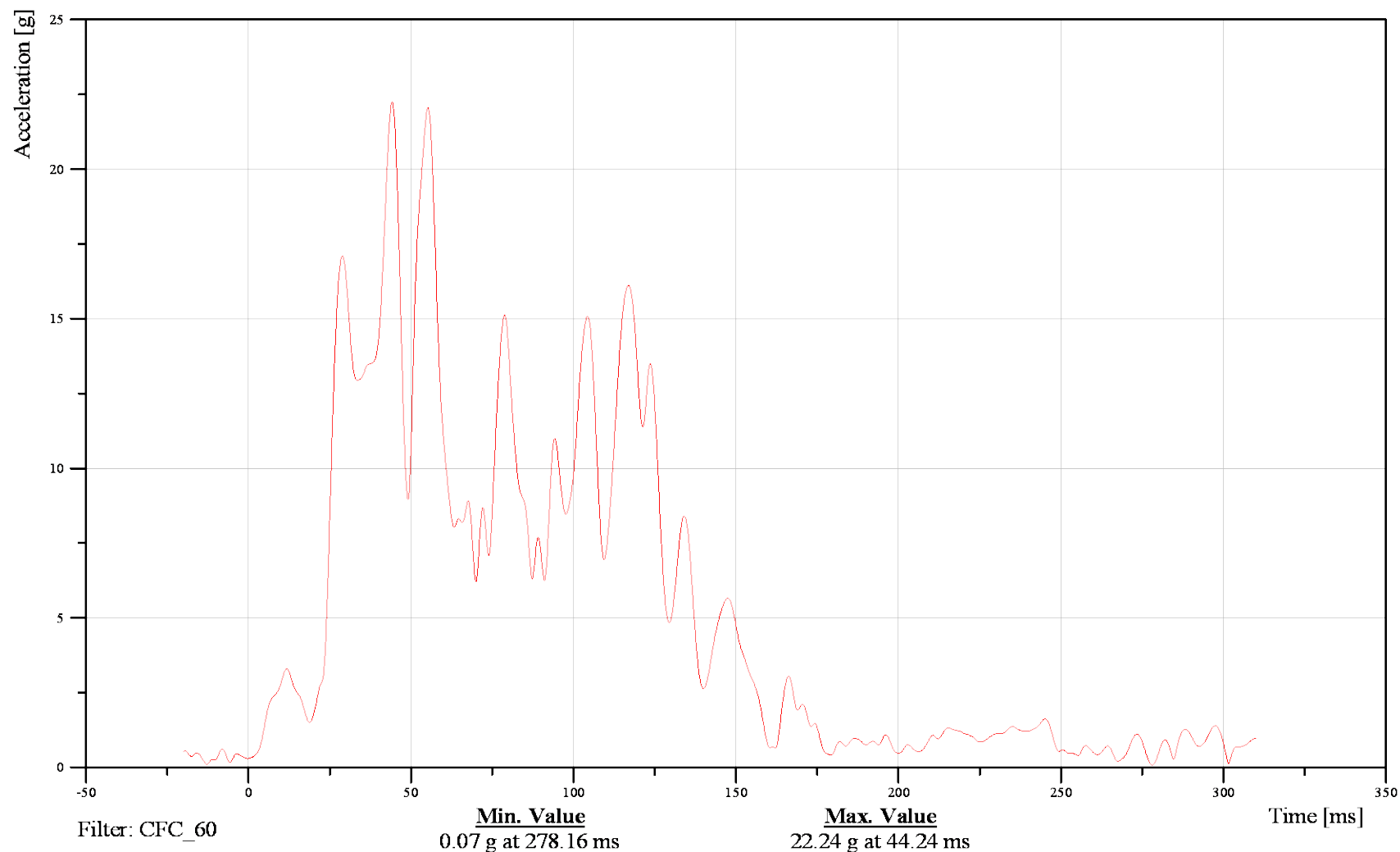
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





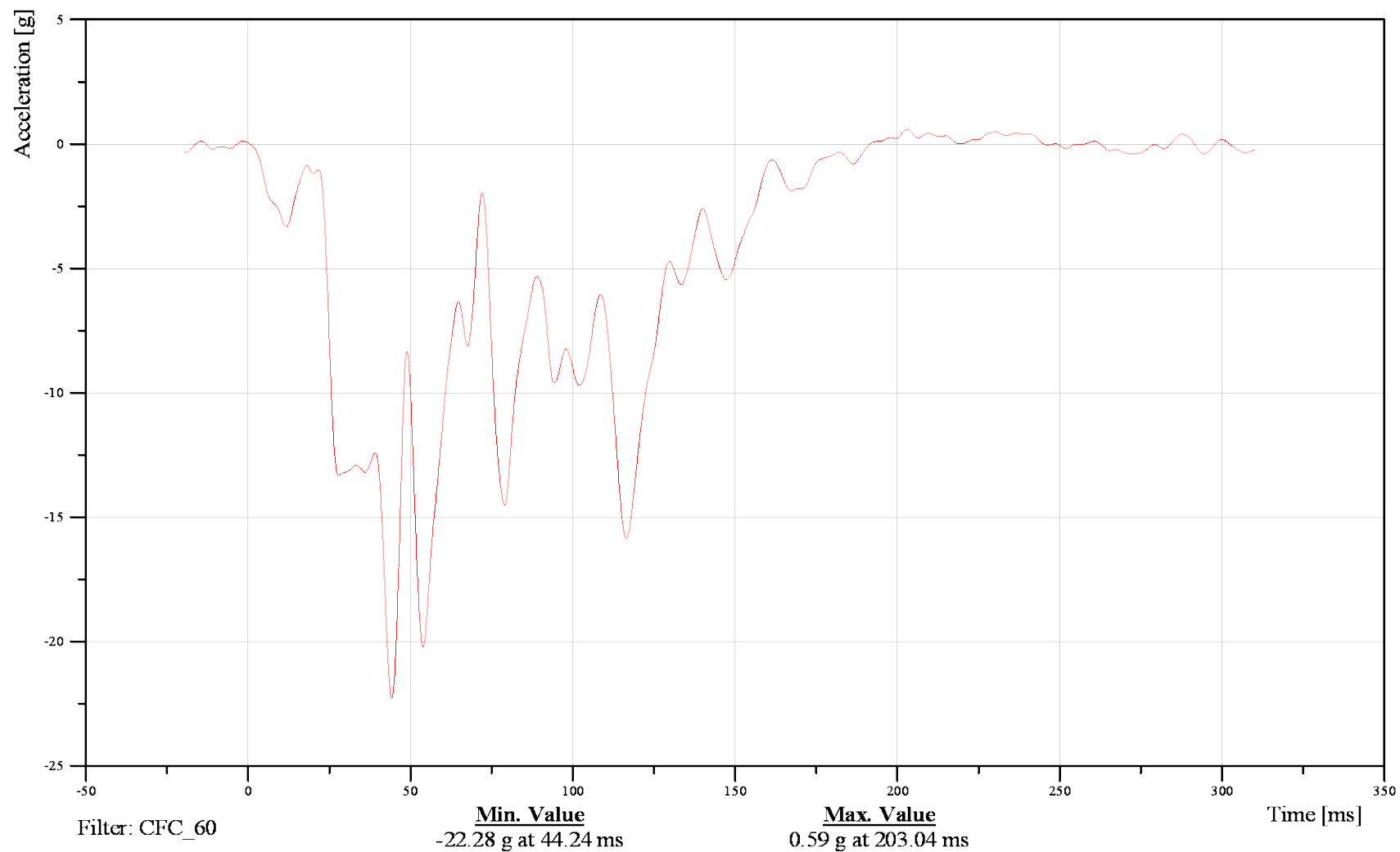
1997 Neon into Rear of 2004 Jeep Liberty
Bullet Vehicle CG Redundant X-axis Acceleration

Date: 09/25/2013
Time: 12:32

Customer: VRTC

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TRC Inc. Test Lab: CTF
Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty
Bullet Vehicle CG Redundant Y-axis Acceleration

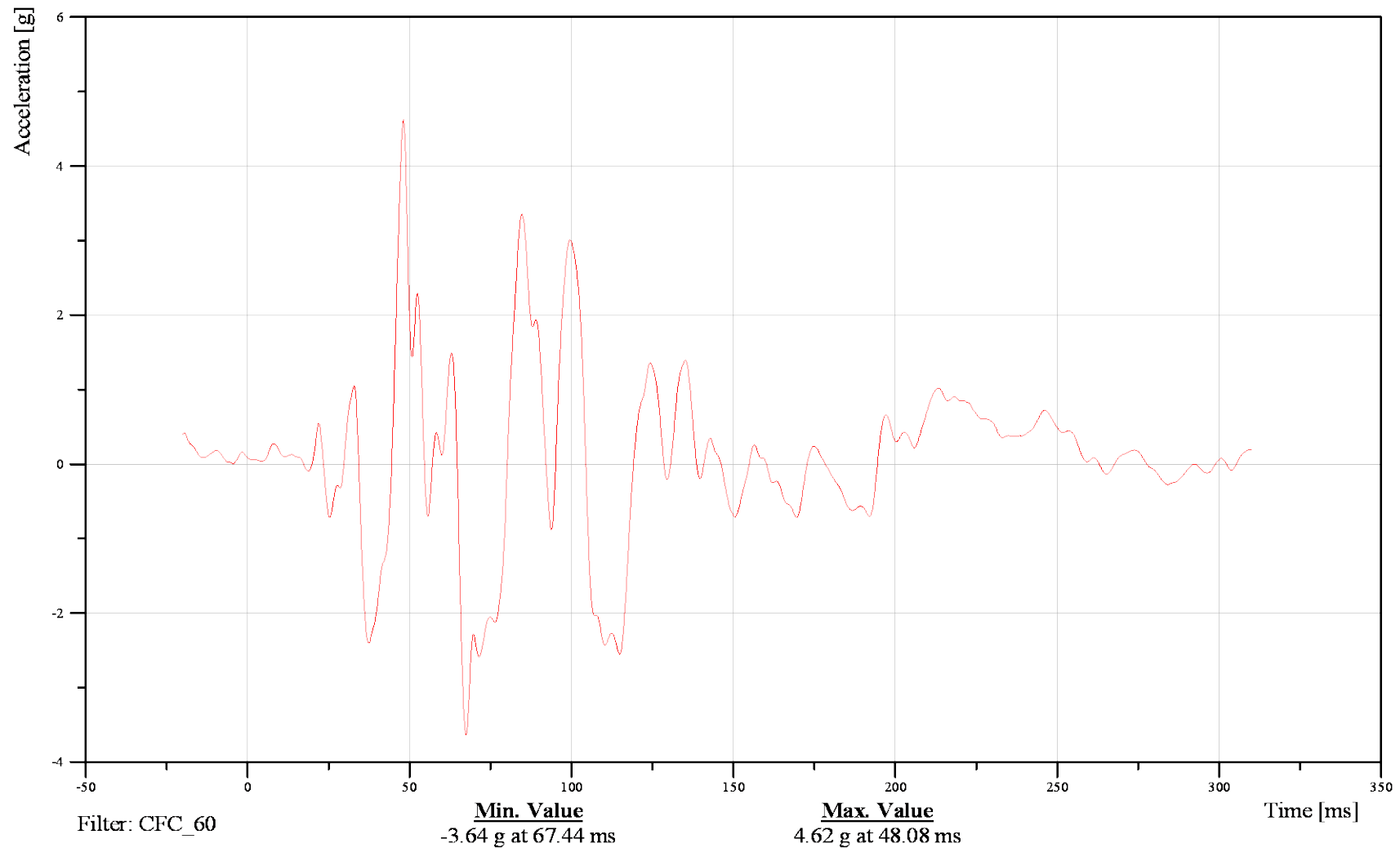
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Time: 12:32

Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty
Bullet Vehicle CG Redundant Z-axis Acceleration

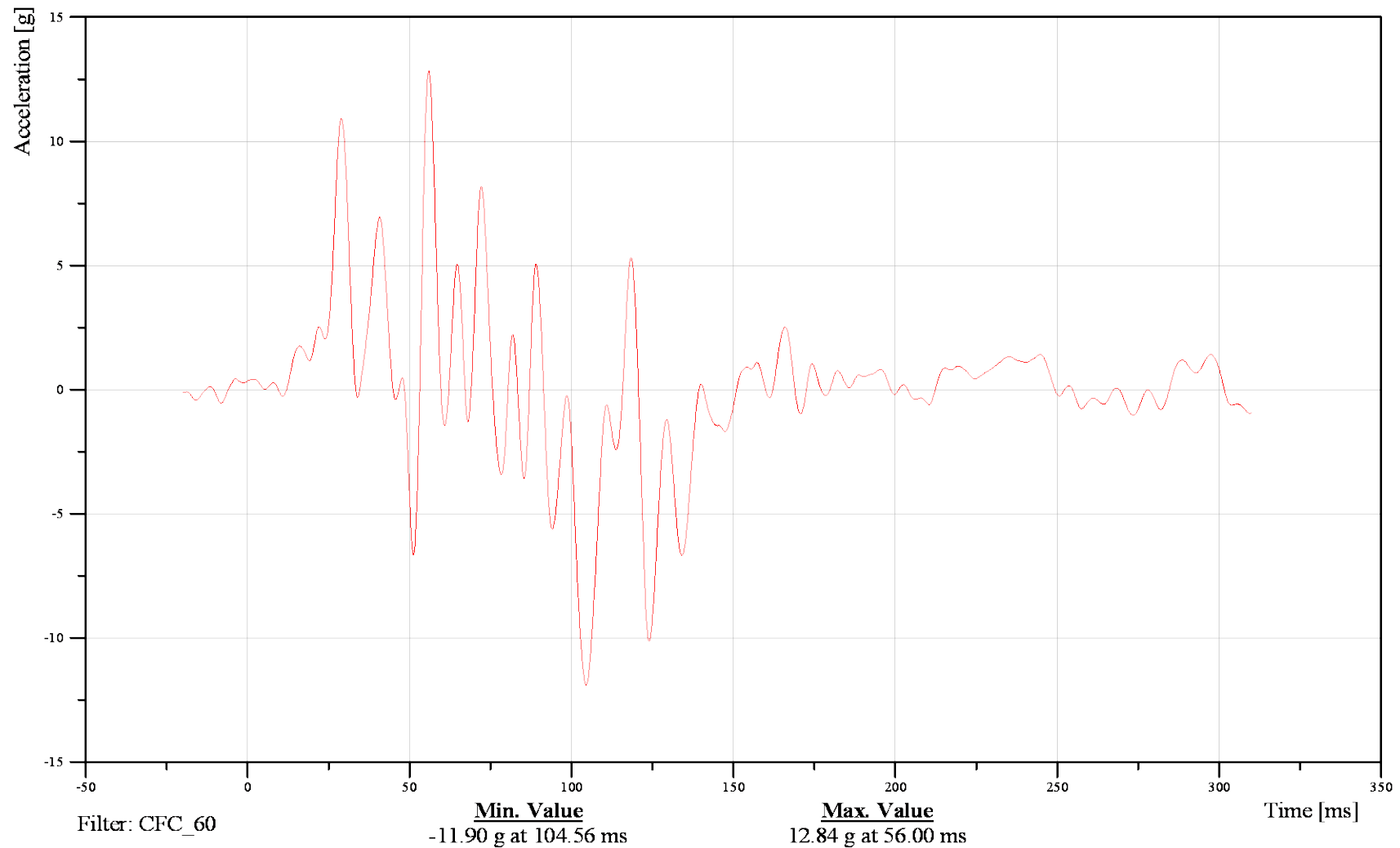
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Time: 12:32

Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





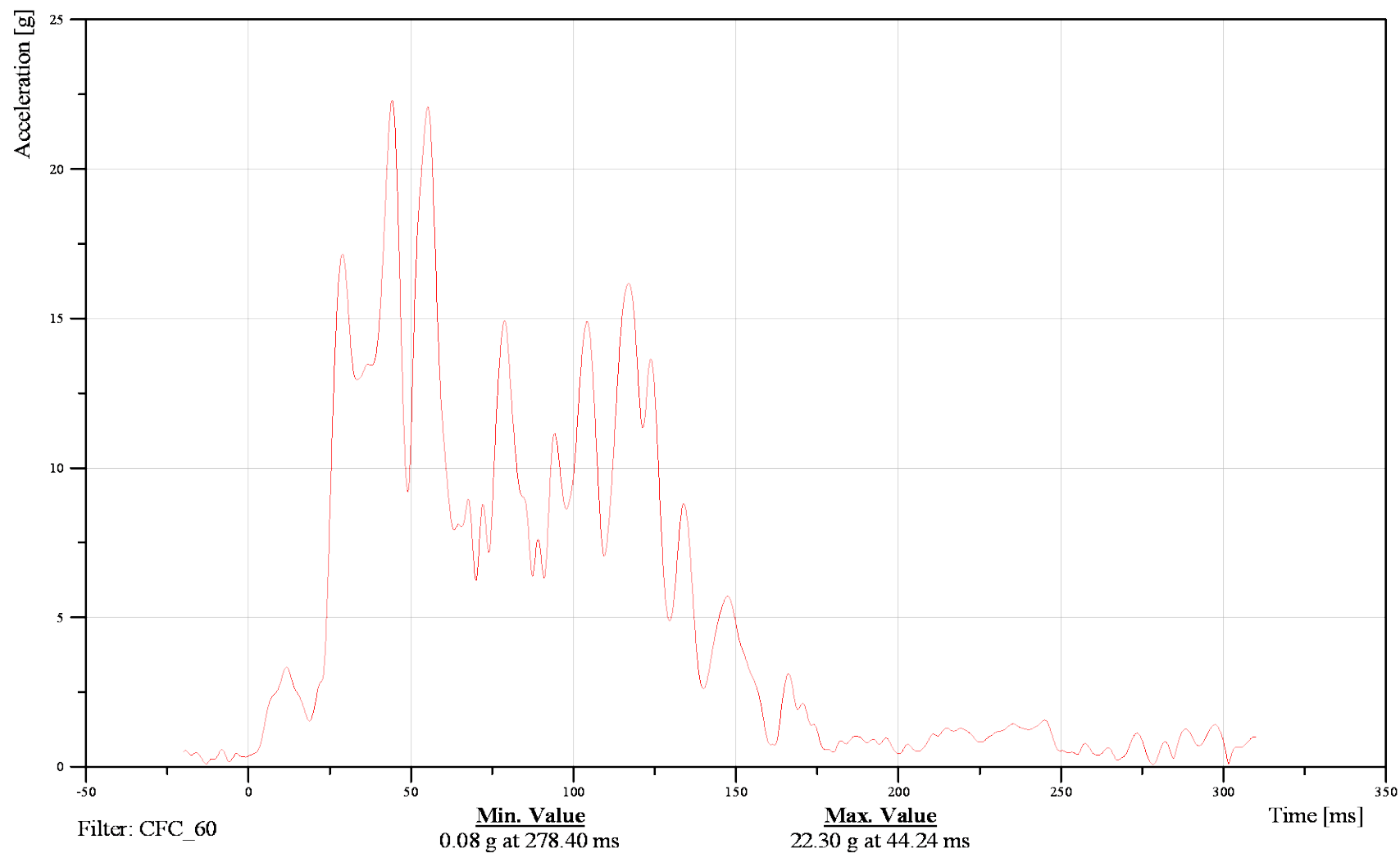
1997 Neon into Rear of 2004 Jeep Liberty
Bullet Vehicle CG Redundant Acceleration Resultant

Date: 09/25/2013
Time: 12:32

Customer: VRTC

10VEHCCGRD00ACRD

TRC Inc. Test Lab: CTF
Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG X-axis Acceleration

Date: 09/25/2013

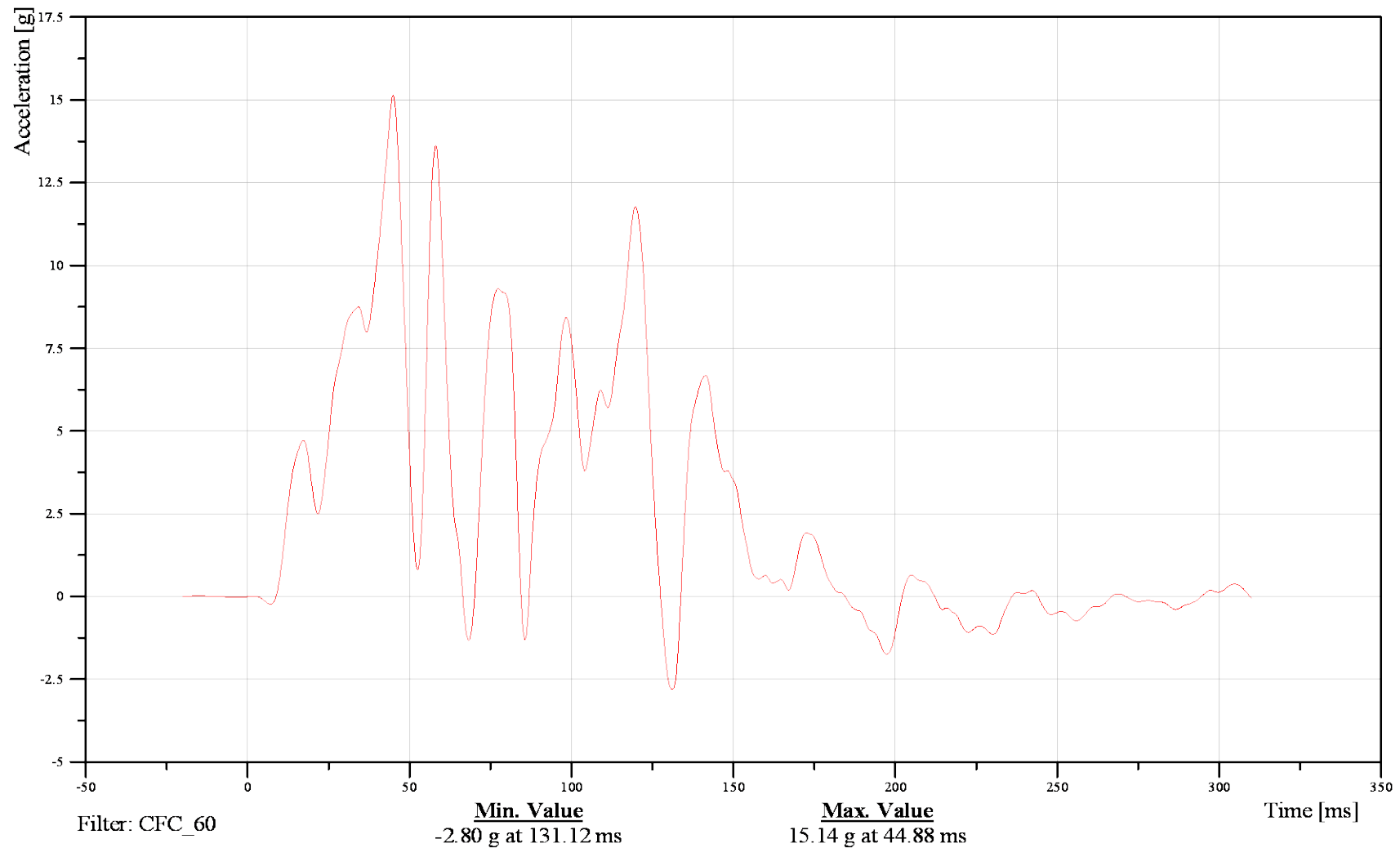
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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Y-axis Acceleration

Date: 09/25/2013

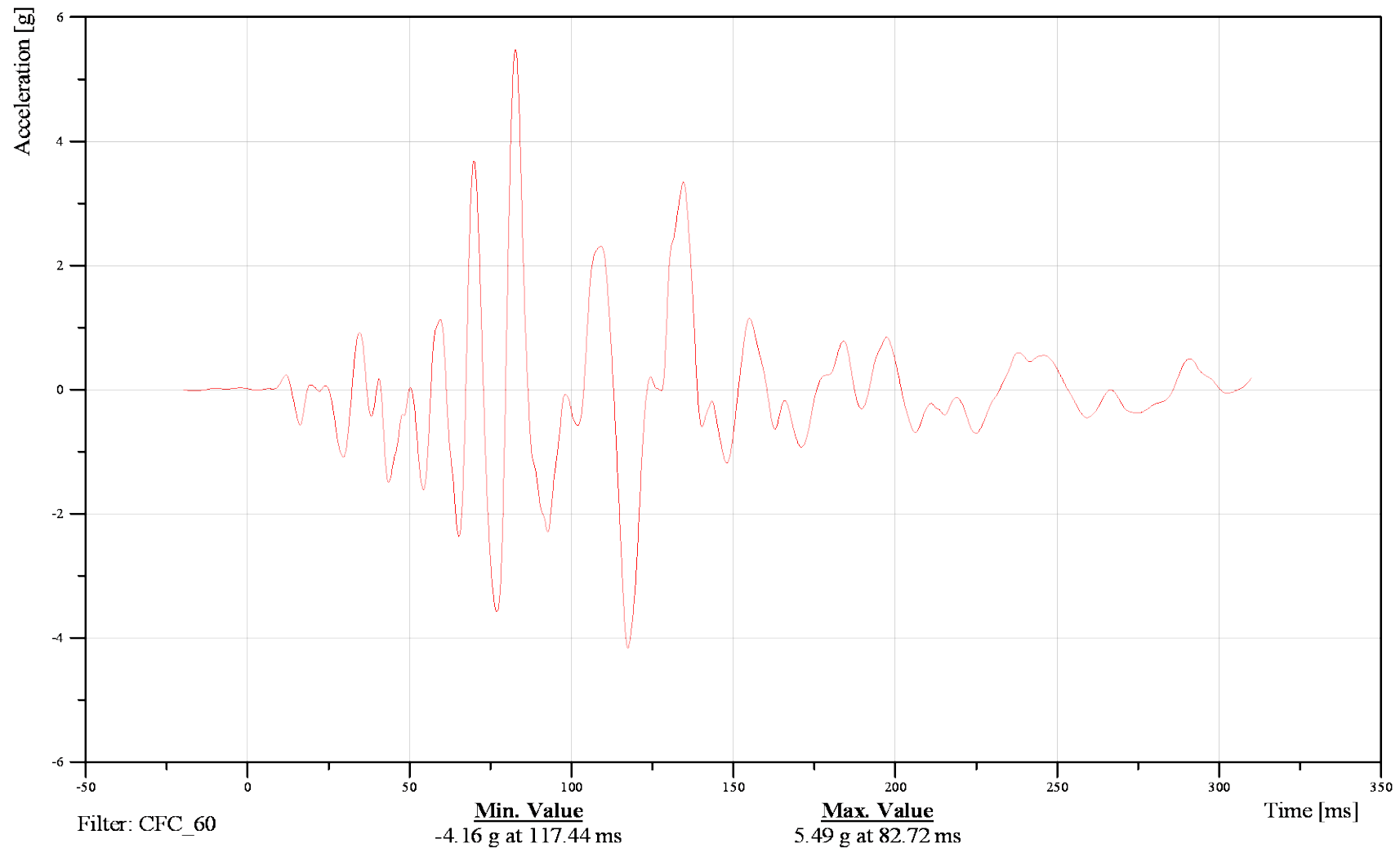
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Z-axis Acceleration

Date: 09/25/2013

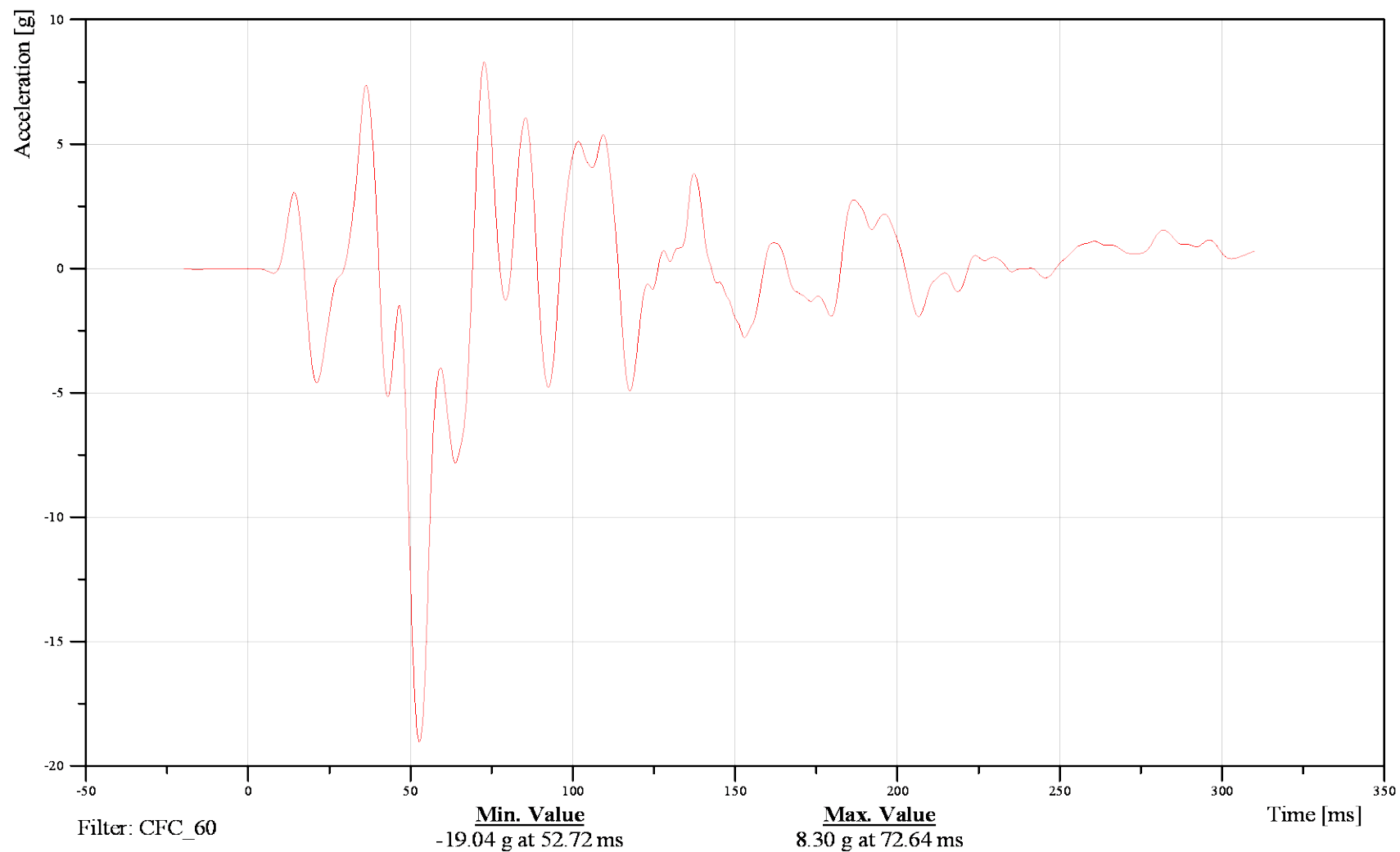
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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Acceleration Resultant

Date: 09/25/2013

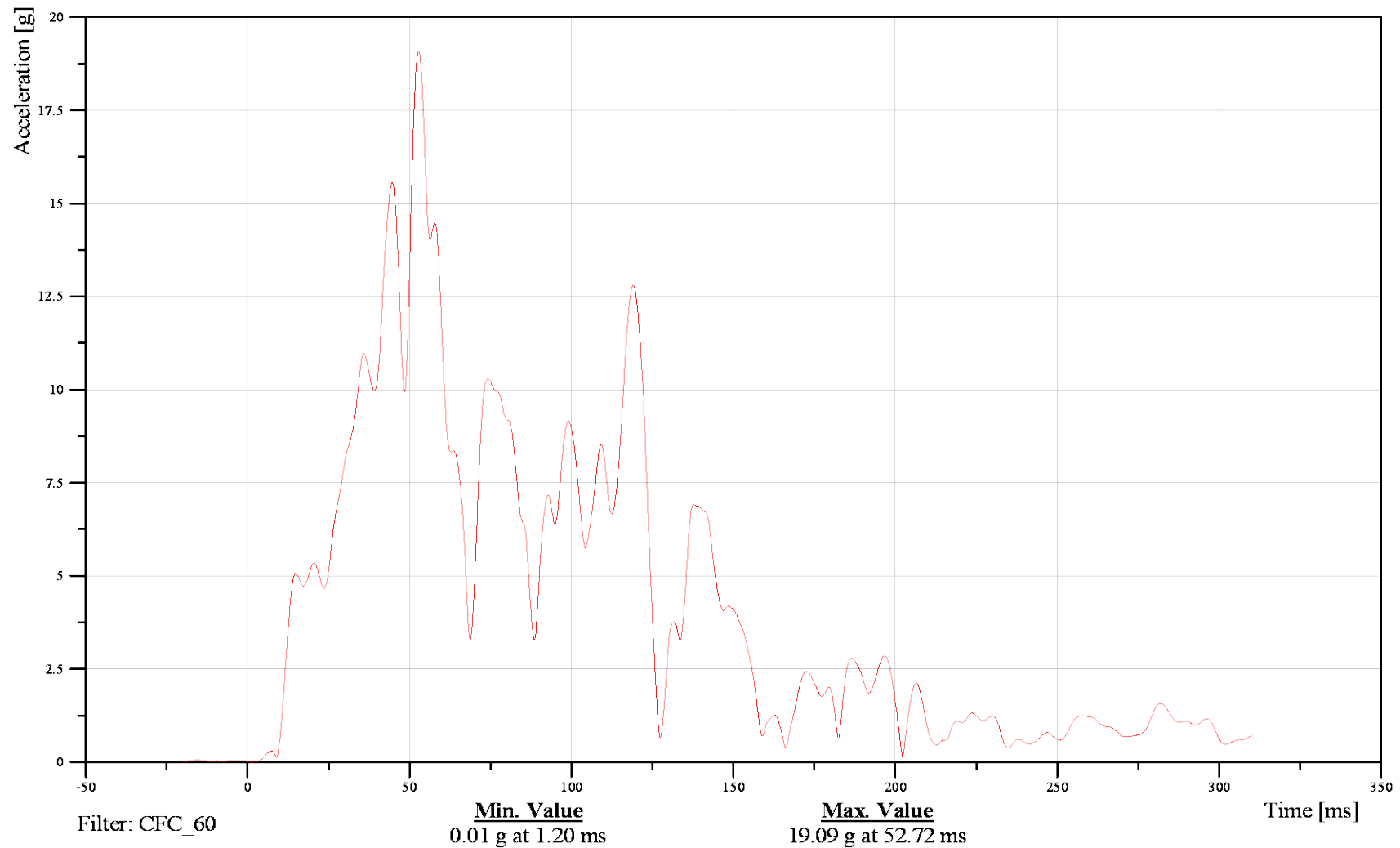
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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Redundant X-axis Acceleration

Date: 09/25/2013

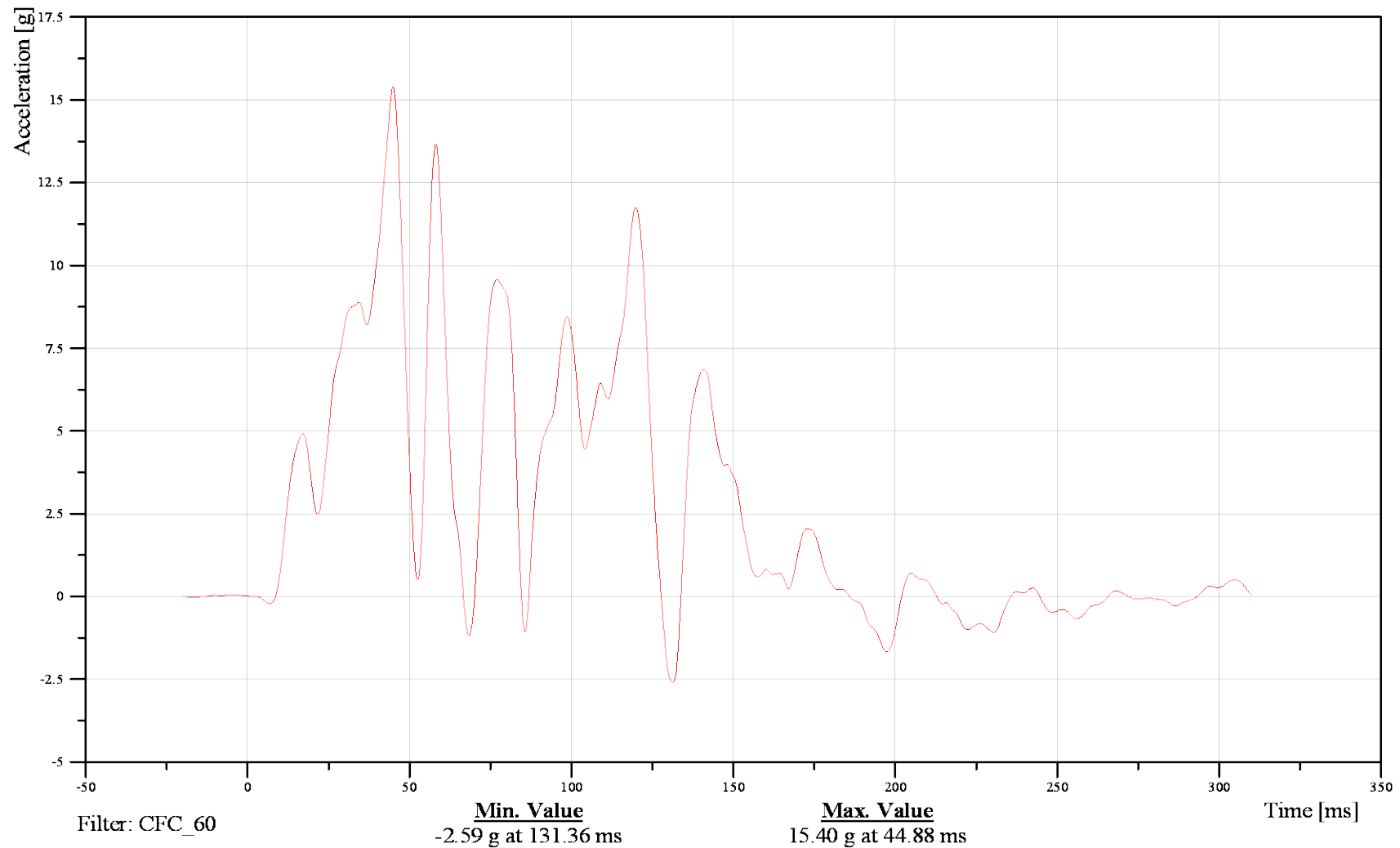
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Redundant Y-axis Acceleration

Date: 09/25/2013

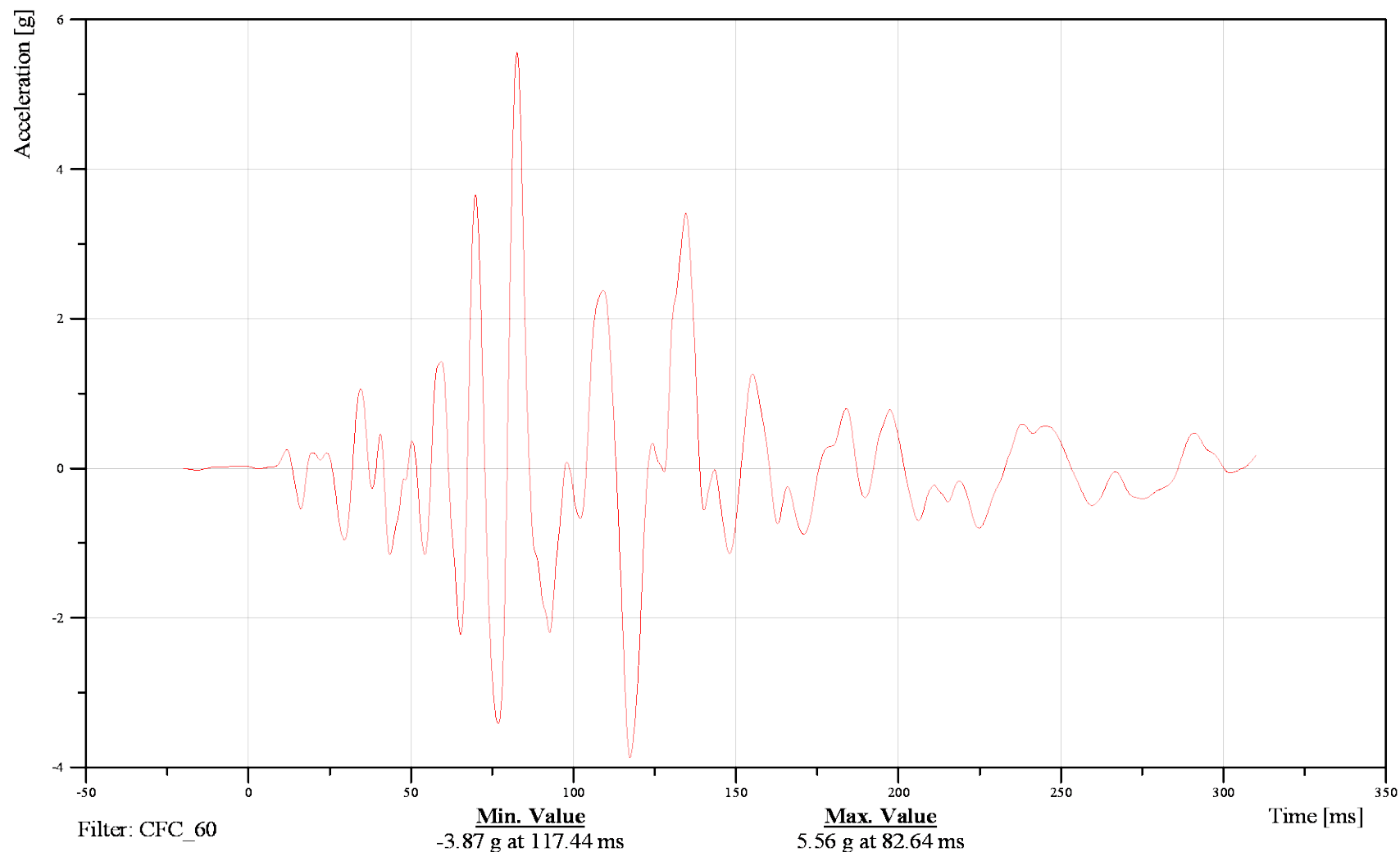
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Customer: VRTC

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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty

Target Vehicle CG Redundant Z-axis Acceleration

Date: 09/25/2013

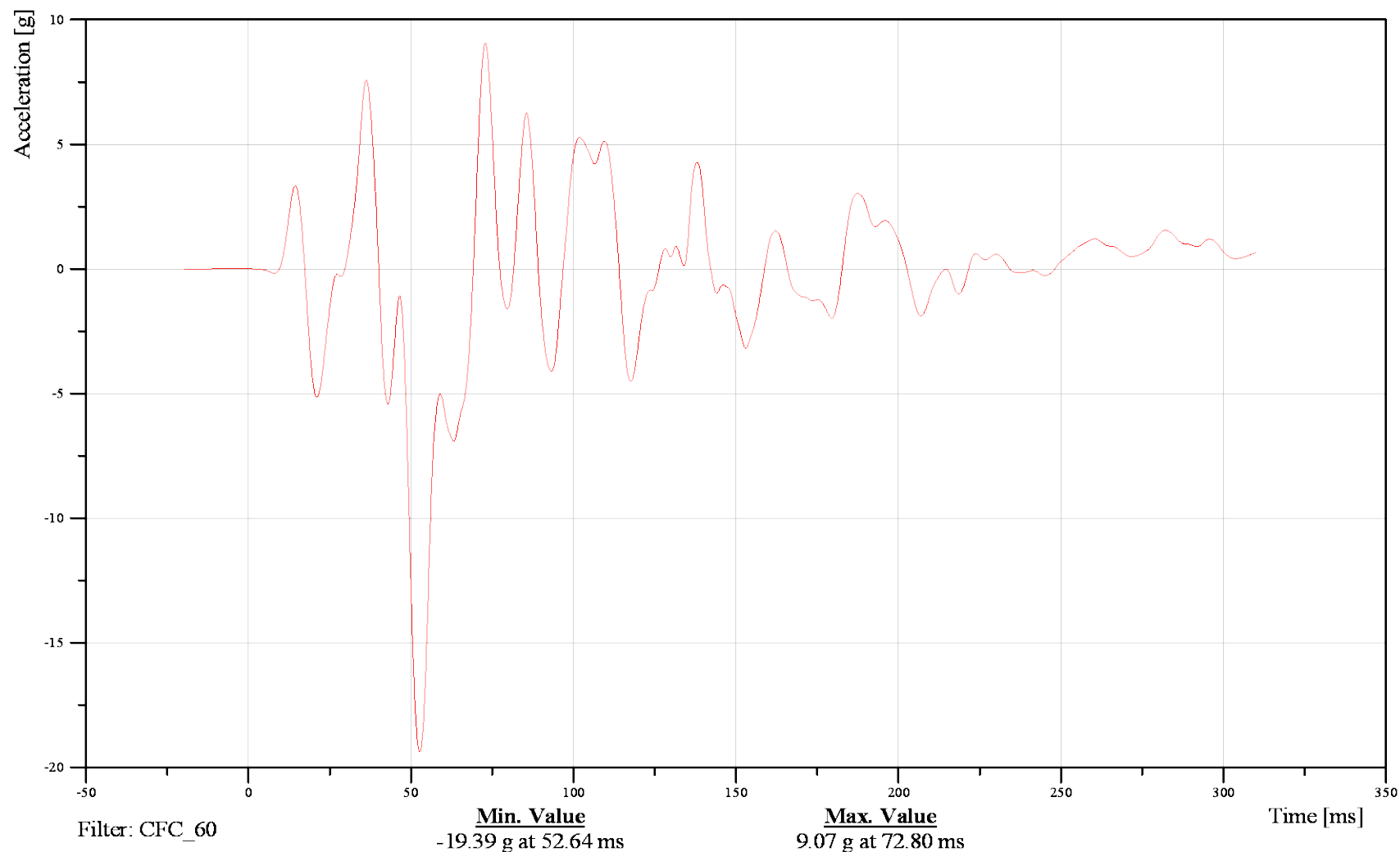
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TRC Inc. Test Lab: CTF

Test Number: 130925





1997 Neon into Rear of 2004 Jeep Liberty
Target Vehicle CG Redundant Acceleration Resultant

Date: 09/25/2013
Time: 12:32

Customer: VRTC

20VEHCCGRD00ACRD

TRC Inc. Test Lab: CTF

Test Number: 130925

