

REPORT NUMBER: 220-MGA-2009-003

**SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 220
SCHOOL BUS ROLLOVER PROTECTION**

**THOMAS BUILT BUSES
2009 THOMAS MINOTOUR SCHOOL BUS
NHTSA NO.: C90901**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



TEST DATE: JUNE 19, 2009

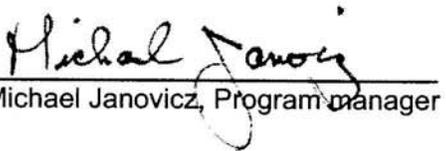
FINAL REPORT DATE: OCTOBER 7, 2010

FINAL REPORT

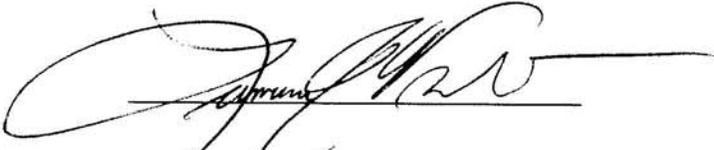
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OFFICE OF VEHICLE SAFETY COMPLIANCE
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FINAL REPORT ACCEPTED BY:


October 7, 2010
Date of Acceptance

Technical Report Documentation Page

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<p>15. <i>Supplementary Notes</i></p>			
<p>16. <i>Abstract</i> Compliance tests were conducted on the subject 2009 Thomas Minotour School Bus, NHTSA No.: C90901, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-220-02 for the determination of FMVSS 220 compliance.</p> <p>Test failures were as follows: None</p>			
<p>17. <i>Key Words</i> Compliance Testing Safety Engineering FMVSS 220</p>		<p>18. <i>Distribution Statement</i> Copies of this report are available from: NHTSA Technical Information Services (TIS) Mail Code: NPO-411 1200 New Jersey Avenue, S.E. Washington, D.C. 20590 Fax No.: (202) 493-2833 E-mail: tis@dot.gov</p>	
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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY 2009 Thomas Minotour School Bus, NHTSA No.: C90901, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedure, TP-220-02, to determine compliance to the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 220, "School Bus Rollover Protection".

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No.: DTNH22-08-D-00075.

SECTION 2
TEST DATA SUMMARY

Based on the tests performed, the MY 2009 Thomas Minotour School Bus, NHTSA No.: C90901 appears to meet the requirements of FMVSS 220. The ambient temperature during testing was 23° C.

TEST RESULTS

S4.a	The downward vertical movement of any point on the application plate shall not exceed 130 mm.	Pass
S4.b	Each emergency exit shall be capable of:	
	Unlatching per FMVSS 217	Pass
	Opening per FMVSS 217	Pass

COMMENTS: None

DATA SHEET 1
VEHICLE INFORMATION

Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
Test Date: **6/19/2009**

Contract No.:	DTNH22-08-D-00075
Laboratory Name:	MGA Research Corporation

INCOMPLETE VEHICLE (if applicable)	
Manufacturer:	General Motors Corporation
Model:	Express TG33503
VIN:	1GBHG31C181210142
Build Date:	06/2008

COMPLETED VEHICLE (SCHOOL BUS)	
Manufacturer:	Thomas Built Buses
Make/Model:	Minotour
VIN:	1GBHG31C181210142
NHTSA No.:	C90901
Color:	Yellow
GVWR (kg/lb):	4356 kg / 9600 lbs
Build Date:	07/2008
Certification Date:	07/2008

DATES	
Vehicle Receipt:	08/19/08
Start of Compliance Test:	06/19/09
Completion of Compliance Test:	06/19/09

COMMENTS:

All tests were performed in accordance with the references outlined in: TP-220-02.

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

SCHOOL BUS UNLOADED VEHICLE WEIGHT (UVW)

	Units	As Delivered (UVW) (Axle)		
		Front	Rear	Total
Left	kg	752	816	
Right	kg	722	782	
Ratio	%	48	52	
Totals	kg	1,474	1,598	3,072

SCHOOL BUS ROOF AND FORCE APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	4,600	4,725	5,410
Width (mm):	2,040	2,165	2,438

Notes: The vehicle was centered laterally and longitudinally under the force application plate.

School Bus Has: Rigid Frame; Unibody

Components Removed From Vehicle Before Testing : Front – Center roof air vent

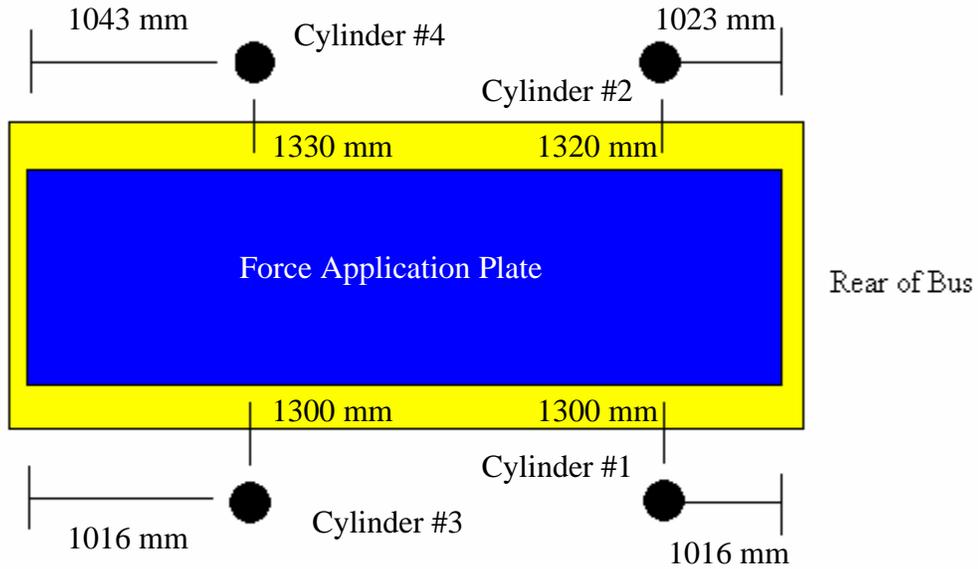
DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION

Description	LF	RF	LR	RR
Perpendicular Distance from closest corner of force application plate (mm)	1,016	1,043	1,016	1,023
From closest outside edge of force application plate (mm)	1,300	1,330	1,300	1,320

NOTE: LF = Left Front, RF = Right Front, LR = Left Rear, and RR = Right Rear.



COMMENTS: None

Recorded By: *[Signature]*

Approved By: *[Signature]*

Date: June 26, 2009

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2009 Thomas Minotour School Bus, NHTSA No. C90901.

DATA SHEET 2

FORCE APPLICATION AND DEFLECTION DATA

Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
 Test Date: **6/19/2009**

FORCE APPLICATION PLATE LOAD CALCULATION

Unloaded Delivered Weight (UDW):	3,072 kg
Calculated Test Load = 1.5 * UDW:	4,608 kg
Range of Test Load (-1% to -3%):	4,562 kg – 4,470 kg

FORCE APPLICATION PLATE LOAD

		Pre-load		Maximum Load	
		Displacement (mm)	Load (kg)	Displacement (mm) **	Load (kg)
Cylinder	1 (LR)	1	57	-77	1,168
	2 (RR)	11	57	137	1,157
	3 (LF)	6	57	-62	1,179
	4 (RF)	12	57	158	1,188
Total Load			228		4,692

NOTE: LR = Left Rear, RR = Right Rear, LF = Left Front, and RF = Right Front

FORCE APPLICATION PLATE DEFLECTION

		Pre-load	Maximum Load	Deflection (B-A) (mm)	Deflection ≤ 130 mm?	
		Displacement (A) (mm)	Displacement (B) (mm) **		Yes - Pass	No - Fail
Corner of Force Application Plate*	1 (LR)	2	-15	-17	X	
	2 (RR)	5	37	32	X	
	3 (LF)	7	-7	-14	X	
	4 (RF)	8	73	65	X	
Average Deflection				17		

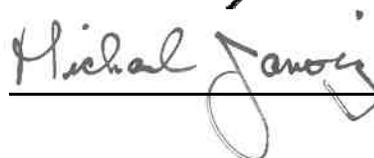
NOTE: LR = Left Rear, RR = Right Rear, LF = Left Front, and RF = Right Front

COMMENTS:

* Deflection at each corner of the required force application plate area was measured with the use of laser indicators positioned near the four most outboard corners of the vehicle's roof.

** At maximum load, previous testing deformation caused the bus to rotate about its centerline relative to the force application plate. To maintain a uniform load on all cylinders, the left side extended in the negative direction, while the right side retracted in the positive direction.

Recorded By: 

Approved By: 

Date: June 26, 2009

DATA SHEET 3
EMERGENCY EXIT OPERATION

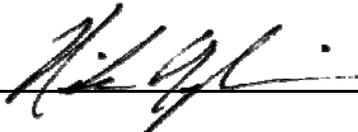
Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
Test Date: **6/19/2009**

		Yes - Pass	No - Fail
Can all exits be manually released and extended by a single person without tools, remote controls, and without the engine running?		X	
Is emergency exit door releasable from inside the school bus?	BEFORE LOAD:	X	
	MAXIMUM LOAD:	X	
	AFTER LOAD:	X	
Is emergency exit door releasable from outside the school bus?	BEFORE LOAD:	X	
	MAXIMUM LOAD:	X	
	AFTER LOAD:	X	

NOTE: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

COMMENTS: None

Recorded By: 

Approved By: 

Date: June 26, 2009

DATA SHEET 4

EMERGENCY EXIT OPERATING FORCES - INTERIOR

Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
 Test Date: **6/19/2009**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

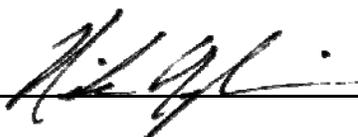
Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Emergency Exit Door	15.3	X		24.5	X		17.1	X		Rotary
	15.8			19.2			14.1			
	13.7			18.9			15.6			
	Average: 14.9			Average: 20.9			Average: 15.6			

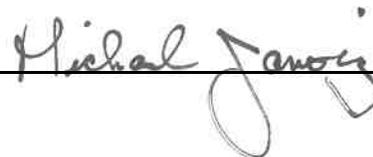
FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Emergency Exit Door	5.4	X		4.0	X		18.4	X		Push To Open
	6.8			6.8			16.2			
	8.6			7.1			18.1			
	Average: 6.9			Average: 6.0			Average: 17.6			

NOTE: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

COMMENTS: None

Recorded By: 

Approved By: 

Date: June 26, 2009

DATA SHEET 5

EMERGENCY EXIT OPERATING FORCES - EXTERIOR

Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
 Test Date: **6/19/2009**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

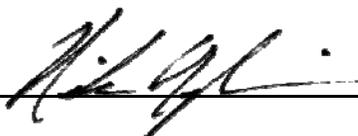
Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Emergency Exit Door	36.0	X		52.3	X		42.3	X		Rotary
	36.8			60.4			53.7			
	34.7			48.1			53.7			
	Average: 35.8			Average: 53.6			Average: 49.9			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Emergency Exit Door	5.4	X		3.2	X		11.2	X		Pull To Open
	6.8			8.3			12.5			
	8.6			6.8			17.4			
	Average: 6.9			Average: 6.1			Average: 13.7			

NOTE: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

COMMENTS: None

Recorded By: 

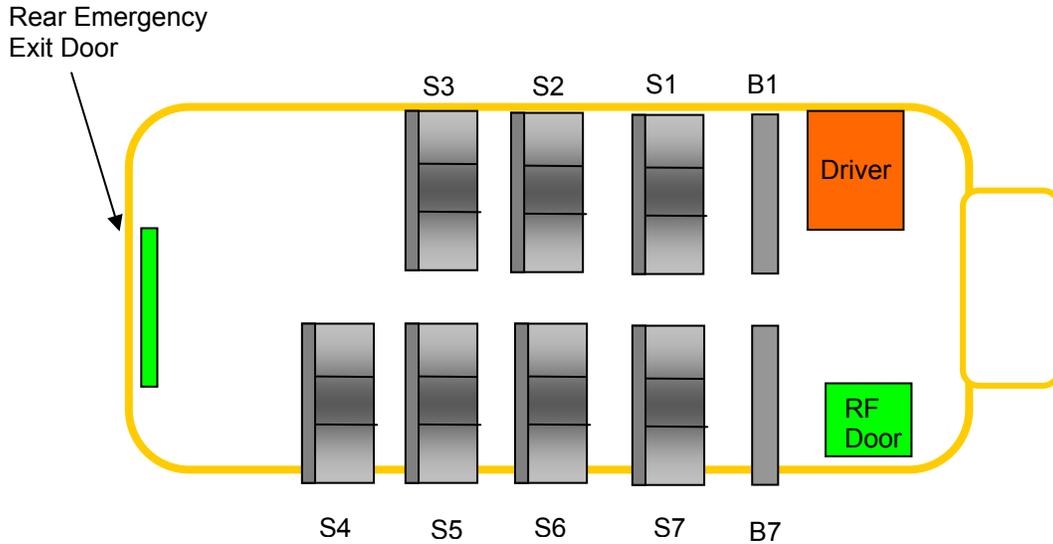
Approved By: 

Date: June 26, 2009

DATA SHEET 6
EMERGENCY EXIT OPENING AREA MEASUREMENTS

Test Vehicle: **2009 THOMAS MINOTOUR SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C90901**
 Test Date: **6/19/2009**



		Height (mm)	Width (mm)	Required Test Form (Ellipsoid or Parallelepiped)	Opening allowed unobstructed passage of the test form?	
					Yes – Pass	No – Fail
1	Rear Emergency Exit Door	1,416	879	Parallelepiped	X	

COMMENTS: NONE

Recorded By: *[Signature]*

Approved By: *Michael Janovic*

Date: June 26, 2009

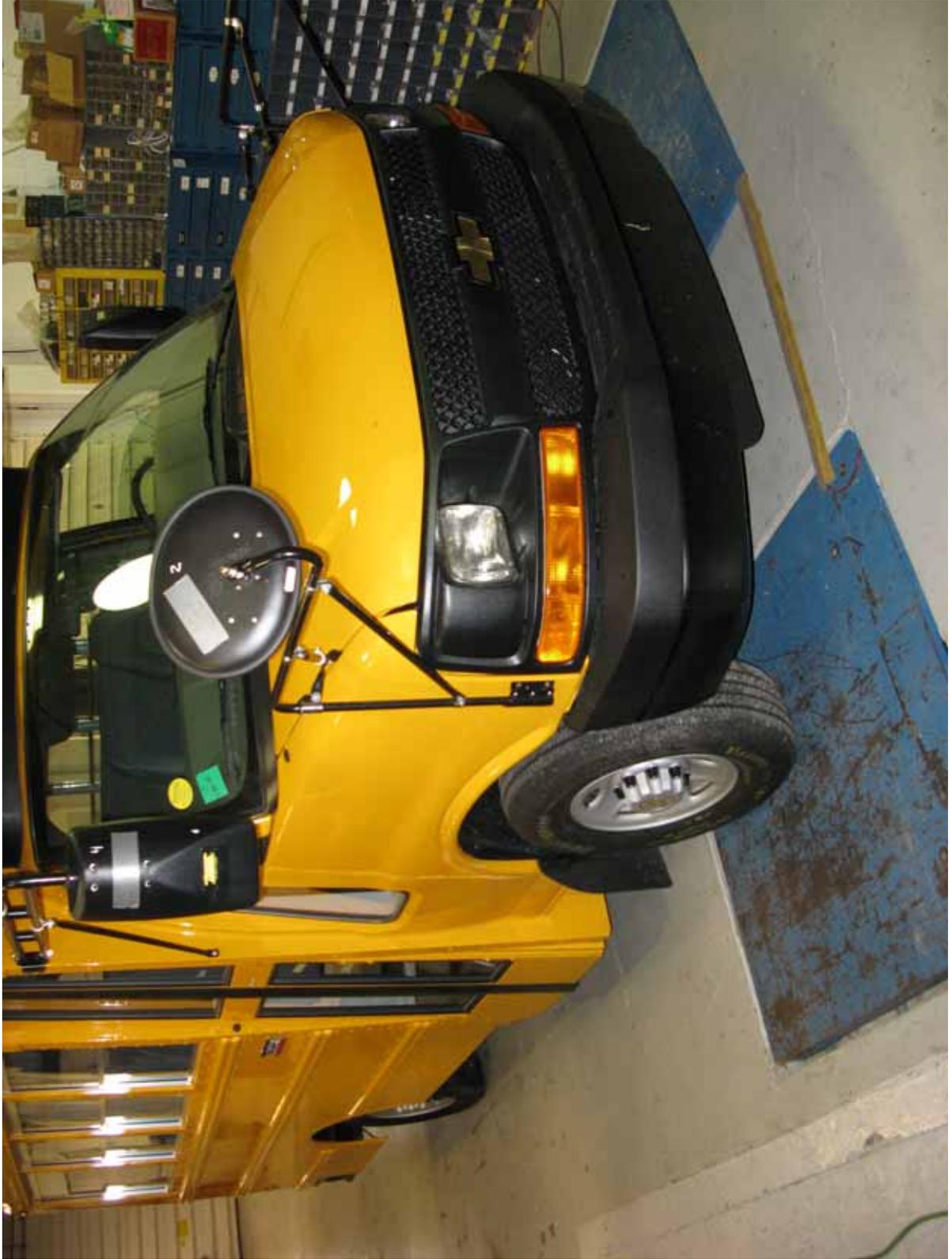
SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

Equipment	Manufacturer	Serial No.	Cal. Date	Next Cal. Date
Steel Tape	Stanley	33 – 428	11/11/08	05/11/09
Cylinder #1 Load Cell	Interface	315453	04/30/09	10/30/09
Cylinder #1 Displacement Pot.	Ametek	27166	02/06/09	08/06/09
Cylinder #2 Load Cell	Interface	321811	04/30/09	10/30/09
Cylinder #2 Displacement Pot.	Ametek	27165	02/06/09	08/06/09
Cylinder #3 Load Cell	Interface	326701	04/30/09	10/30/09
Cylinder #3 Displacement Pot.	Ametek	21782	02/06/09	08/06/09
Cylinder #4 Load Cell	Interface	321788	04/30/09	10/30/09
Cylinder #4 Displacement Pot.	Ametek	27167	02/06/09	08/06/09
Parallelepiped	MGA	PARA – 1A	When Used	When Used
Force Gauge	Wagner	2668	01/08/09	07/08/09

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Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



School Bus Front Axle Being Weighed (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



School Bus Rear Axle Being Weighed (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Frontal View of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Frontal View of School Bus After Testing

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Rear View of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Rear View of School Bus After Testing

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Left Front ¾ View of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Left Rear $\frac{3}{4}$ View of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



Right Front 3/4 View of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Right Front 3/4 View of School Bus After Testing

Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



Right Rear of School Bus Before Testing ¾ View (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



Full View of Left Side of School Bus Before Testing (as received by MGA)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Full View of Right Side of School Bus Before Testing (as received by MGA)

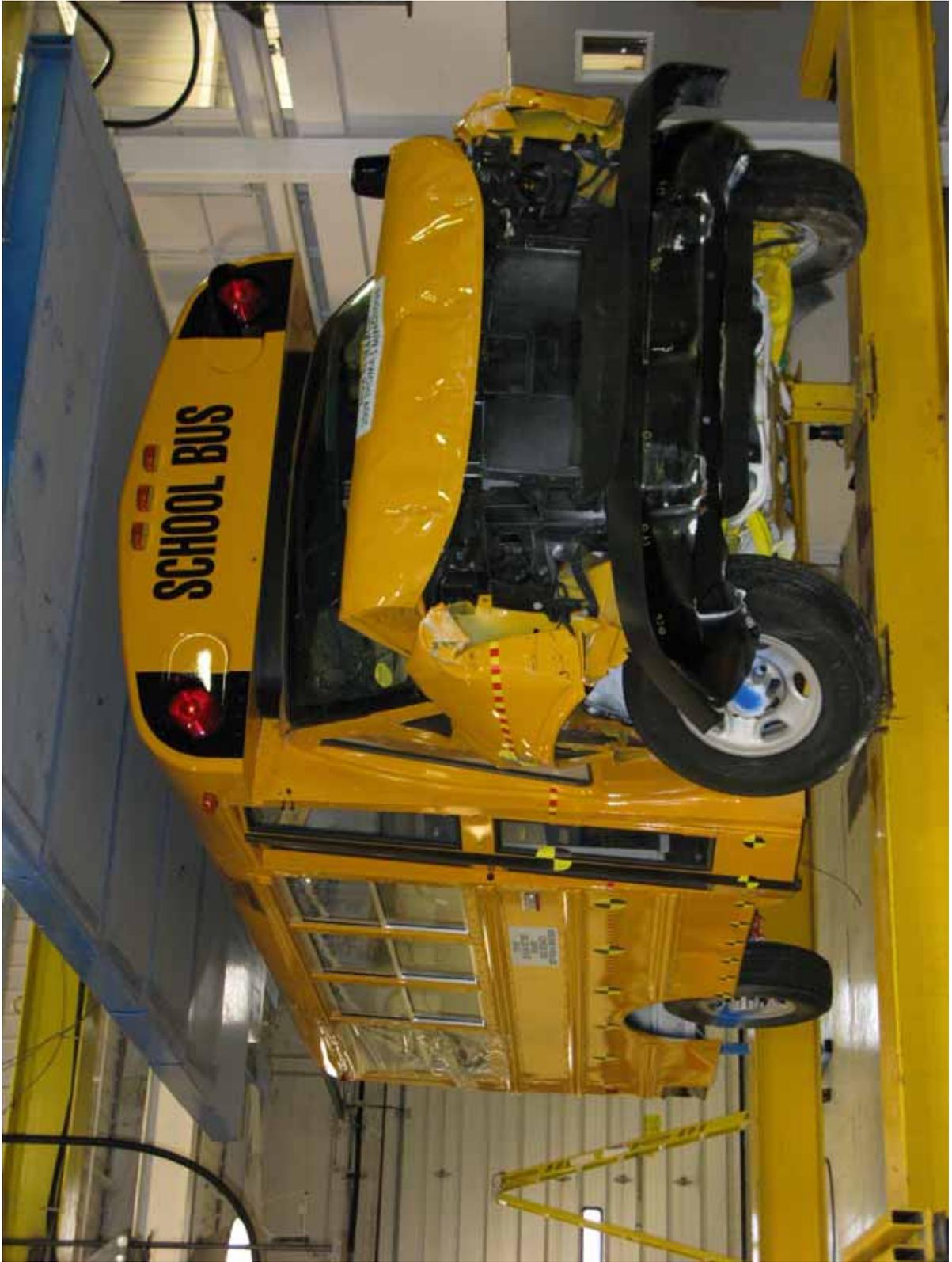
Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Full View of Right Side of School Bus After Testing

Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



Loading Device Placed Against Bus's Roof at Beginning of Test (Right Front)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Loading Device Placed Against Bus's Roof at Beginning of Test (Right Rear)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



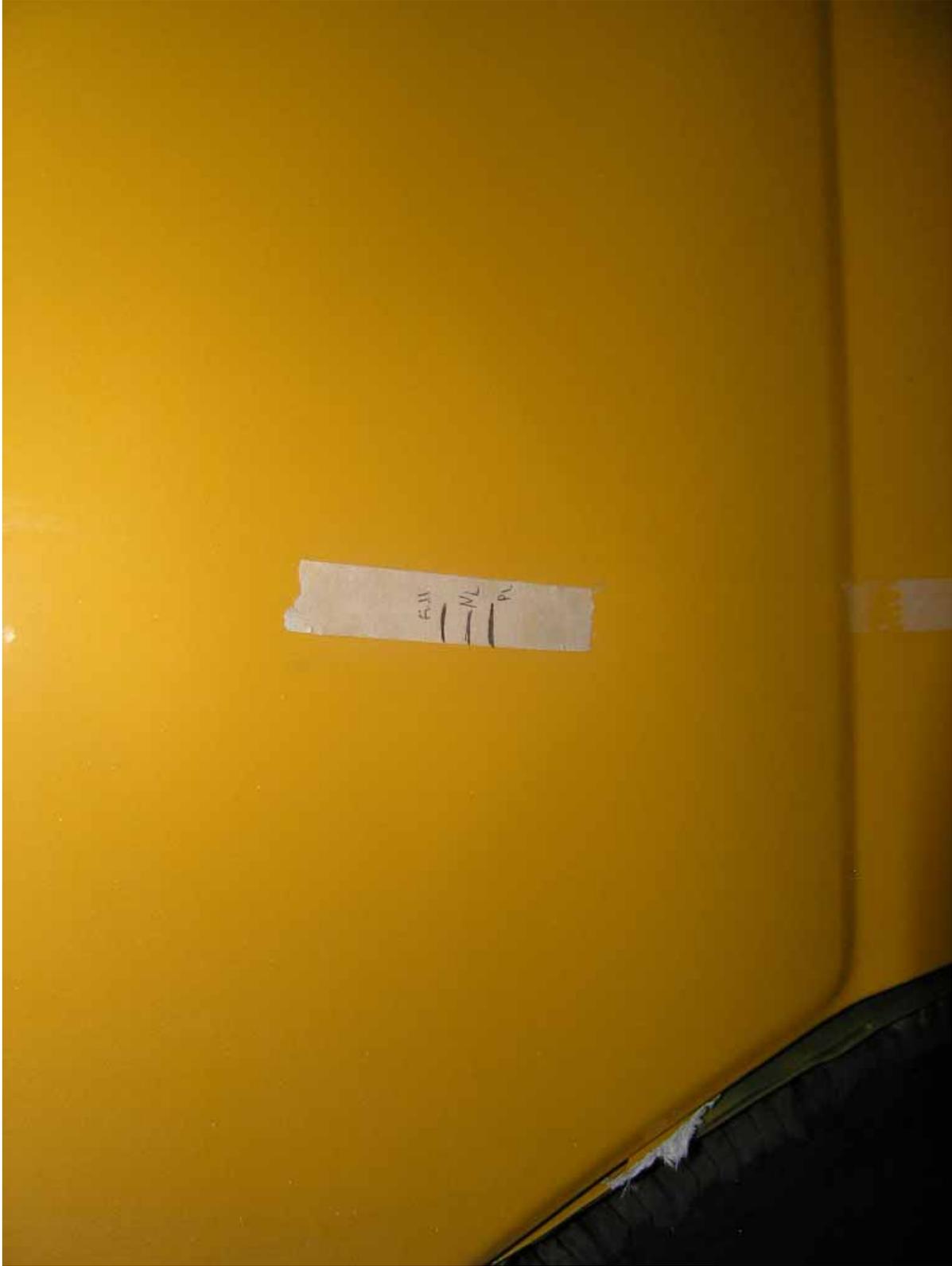
Loading Device Placed Against Bus's Roof at Maximum Load Condition (Right Front)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Loading Device Placed Against Bus's Roof at Maximum Load Condition (Right Rear)

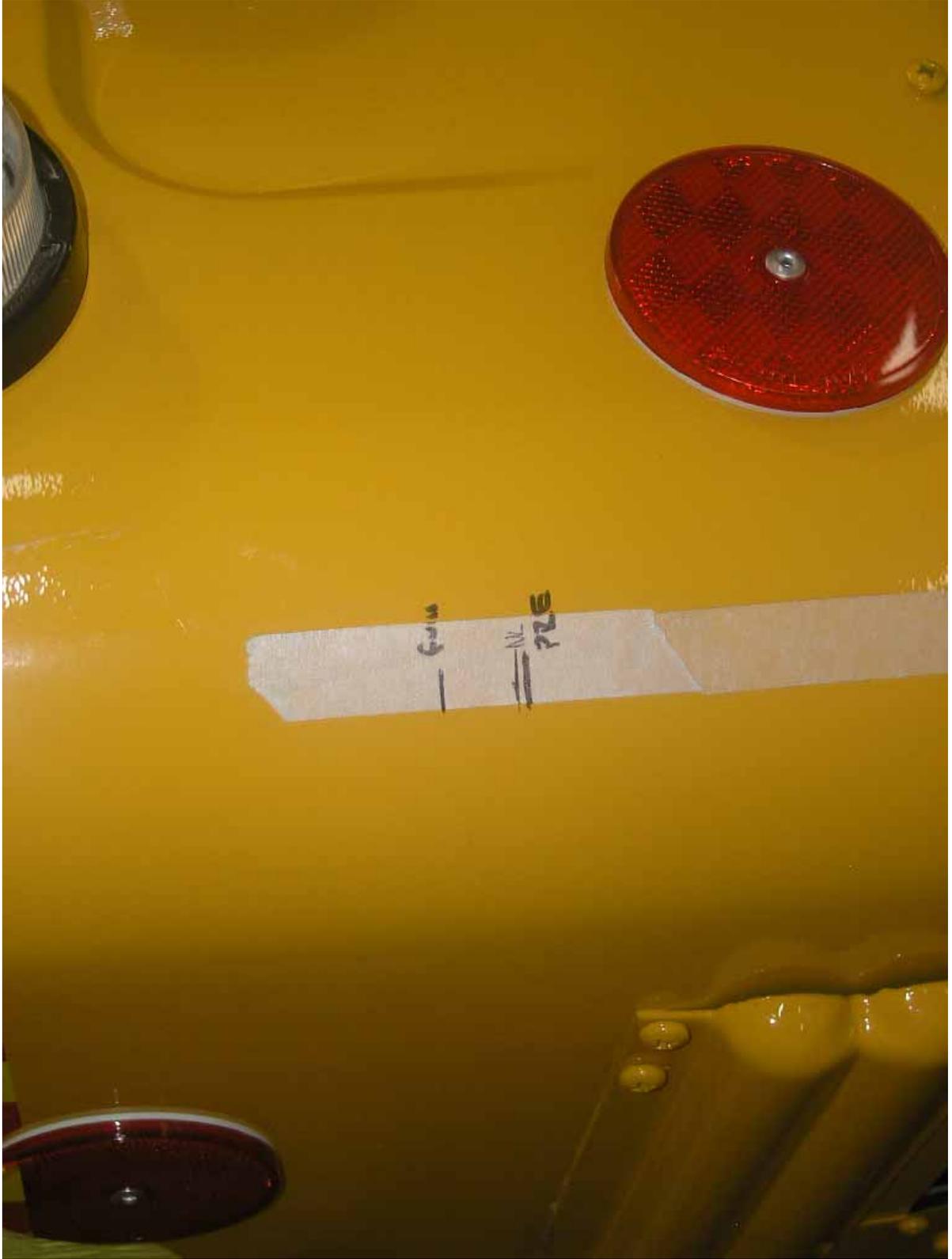
Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Backup Roof Deflection Measuring Device at Maximum Load Condition (Left Front)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

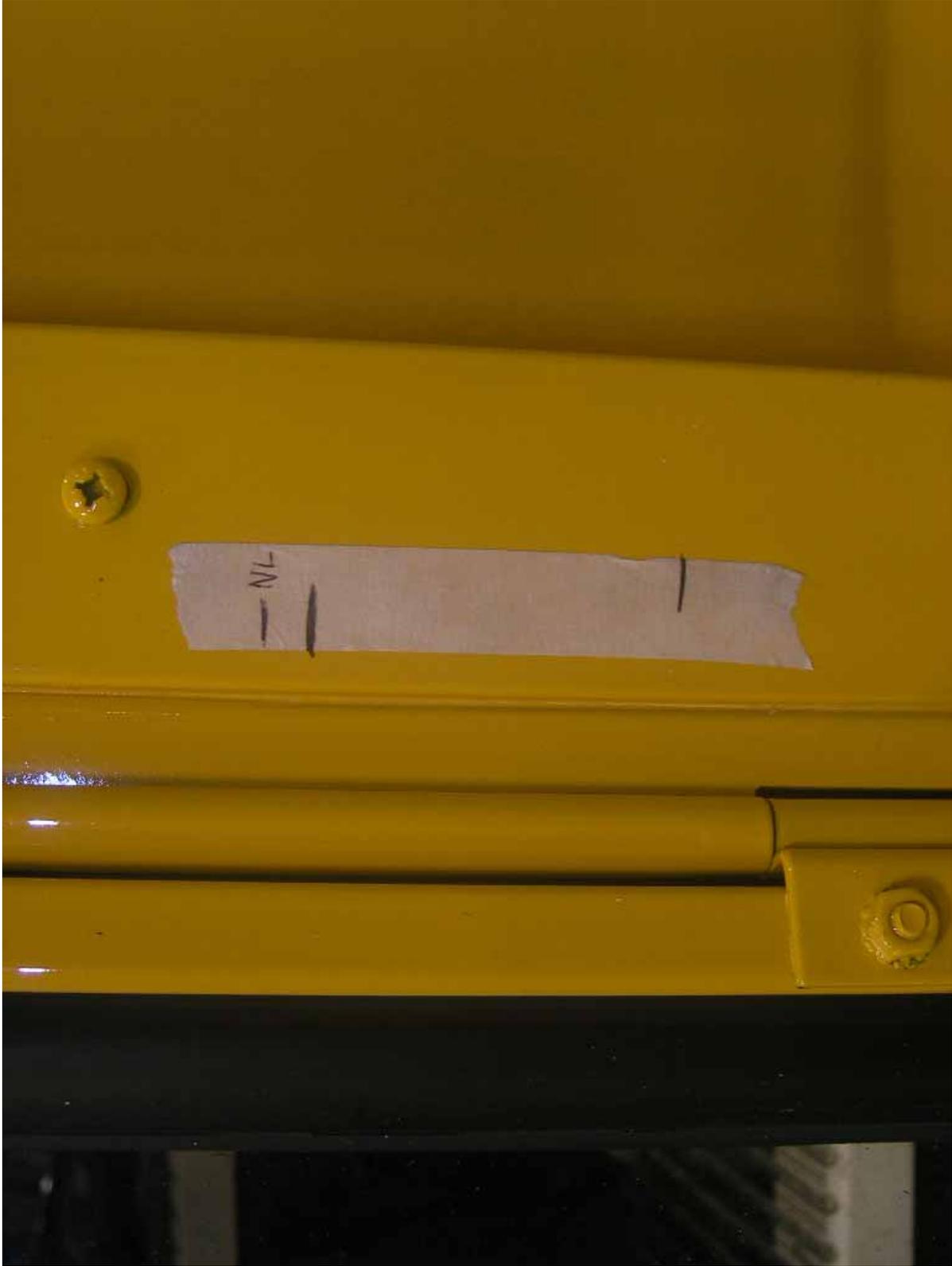
NHTSA No.: C90901
Test Date: 6/19/09



Backup Roof Deflection Measuring Device at Maximum Load Condition (Left Rear)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



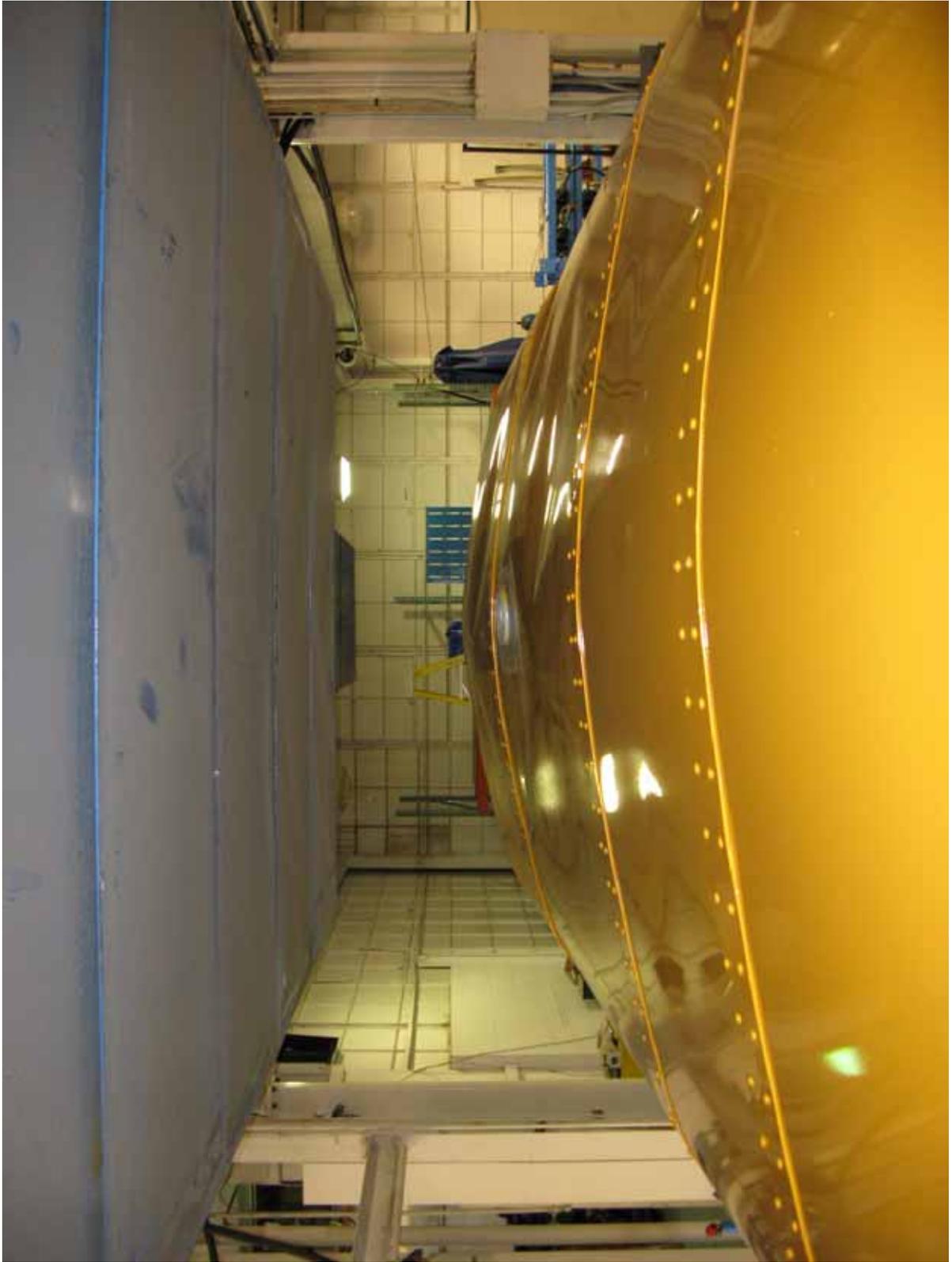
Backup Roof Deflection Measuring Device at Maximum Load Condition (Right Front)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Backup Roof Deflection Measuring Device at Maximum Load Condition (Right Rear)

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220
NHTSA No.: C90901
Test Date: 6/19/09



Roof, After Removal of Loading Device, Viewed From the Bus Exterior

Test Vehicle: 2009 Thomas Minotour School Bus
Procedure: FMVSS 220

NHTSA No.: C90901
Test Date: 6/19/09



Roof, After Removal of Loading Device, Viewed From the Bus Interior

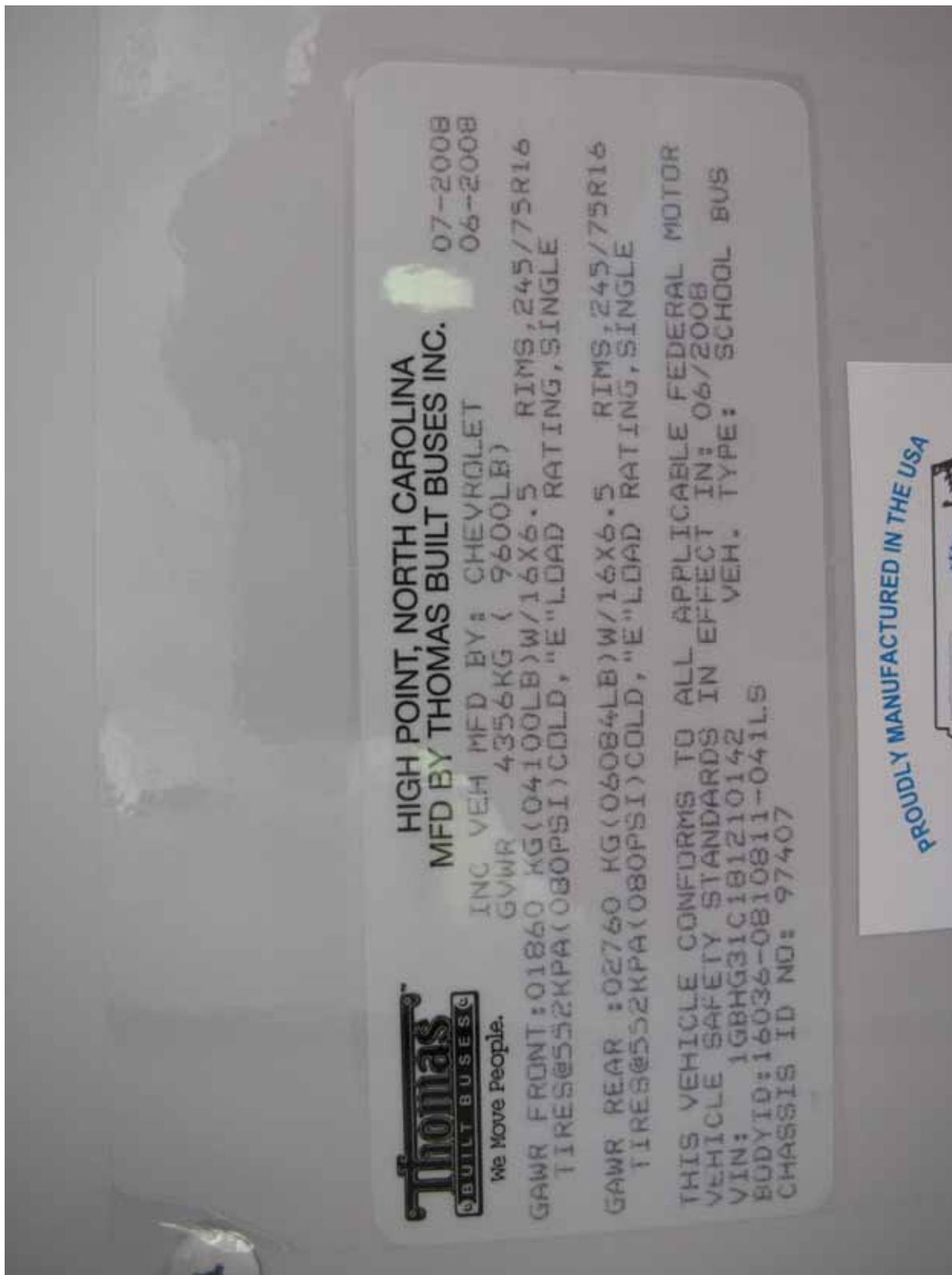
Test Vehicle: C90901
Procedure: FMVSS 220

2009 Thomas Minotour School Bus
NHTSA No.: 6119/09
Test Date:



Rear Exit Window Open With Parallelepiped In Place

Test Vehicle: 2009 Thomas Minotour School Bus NHTSA No.: C90901
Procedure: FMVSS 220 Test Date: 6/19/09



Close-up View of School Bus Certification Label

SECTION 6 TEST PLOTS

