REPORT NUMBER: 220-MGA-2007-001

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

LES ENTERPRISES MICHEL CORBEIL INC.
2006 CORBEIL SCHOOL BUS
NHTSA NO.: C60902

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

FINAL REPORT DATE: AUGUST 16, 2007

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Prepared by: _____ Date: August 16, 2007
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Reviewed by: _____ Date: August 16, 2007
Michael Janovicz, Program manager

FINAL REPORT ACCEPTED BY:

_____
August 16, 2007
Date of Acceptance

Technical Report Documentation Page

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7. Author(s) James Hansen, Project Engineer Michael Janovicz, Program Manager		*8. Performing Organization Report No.* 220-MGA-2007-001	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-02-D-01057	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance Mail Code: NVS-220 1200 New Jersey Avenue, S.E. Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report 7/18/07 – 8/16/07 *14. Sponsoring Agency Code* NVS-220	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 2006 Corbeil School Bus, NHTSA No. C60902, 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. Test Failures were as Follows: None			
17. Key Words Compliance Testing Safety Engineering FMVSS 220		*18. Distribution Statement* Copies of this report are available from: NHTSA Technical Information Services (NPO-411) 1200 New Jersey Ave., S.E. Washington, DC 20590 Email: tis@nhtsa.dot.gov FAX: 202-493-2833	
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Form DOT F1700.7 (8-72)

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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY 2006 Corbeil School Bus, NHTSA No. C60902, 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. DTNH22-02-D-01057.

SECTION 2
TEST DATA SUMMARY

Based on the tests performed, the MY 2006 Corbeil School Bus, NHTSA No. C60902, appears to meet the requirements of FMVSS 220. The ambient temperature during testing was 23.7° 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	***See Comment**

COMMENTS:

***** The force required to open the rear emergency exit door with the FMVSS 220 roof load applied was in excess of that allowed by FMVSS 217, but the exit was able to be manually released and extended by a single person without the use of tools. This event is not considered a test failure because previous testing had deformed the structure surrounding the exit door.

The vehicle had been subjected to multiple destructive tests, including FMVSS 301 and FMVSS 217, which deformed the rear emergency exit door and the lower door frame area which reduced door clearance prior to the FMVSS 220 test. The sheet metal below the lower door frame was also bent rearward and was torn from the supporting corner structure during the FMVSS 301 test. Due to the previous testing, the FMVSS 220 rear emergency door opening test results are to be treated as indicant.

DATA SHEET 1

VEHICLE INFORMATION

Contract No.:	DTNH22-02-D-01057
Laboratory Name:	MGA Research Corporation

INCOMPLETE VEHICLE (if applicable)	
Manufacturer:	Ford Motor Company
Model:	754-NY-20-00WC-EMC
VIN:	1FDSE35L66DA60778
Build Date:	04/06
Certification Date:	

COMPLETED VEHICLE (SCHOOL BUS)	
Manufacturer:	Les Enterprises Michel Corbeil Inc.
Make/Model:	Ford / Corbeil
VIN:	1FDSE35L66DA60778
NHTSA No.:	C60902
Color:	Yellow
GVWR (kg/lb):	4,355 kg / 9,600 lbs
Build Date:	06/29/2006
Certification Date:	06/29/2006

DATES	
Vehicle Receipt:	September 27, 2006
Start of Compliance Test:	July 18, 2007
Completion of Compliance Test:	July 18, 2007

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

COMMENTS: NONE

Recorded By:_____

Approved By:_____ Date: July 18, 2007

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

SCHOOL BUS UNLOADED VEHICLE WEIGHT (UVW)

Units	LF	RF	LR	RR	TOTAL
kg	640	642	914	910	3106

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	4572	4697	5486
Width (mm):	1829	1954	2692

Notes:

The vehicle was centered laterally and longitudinally under the roof load application plate.

School Bus Has: X Rigid Frame; __ Unibody

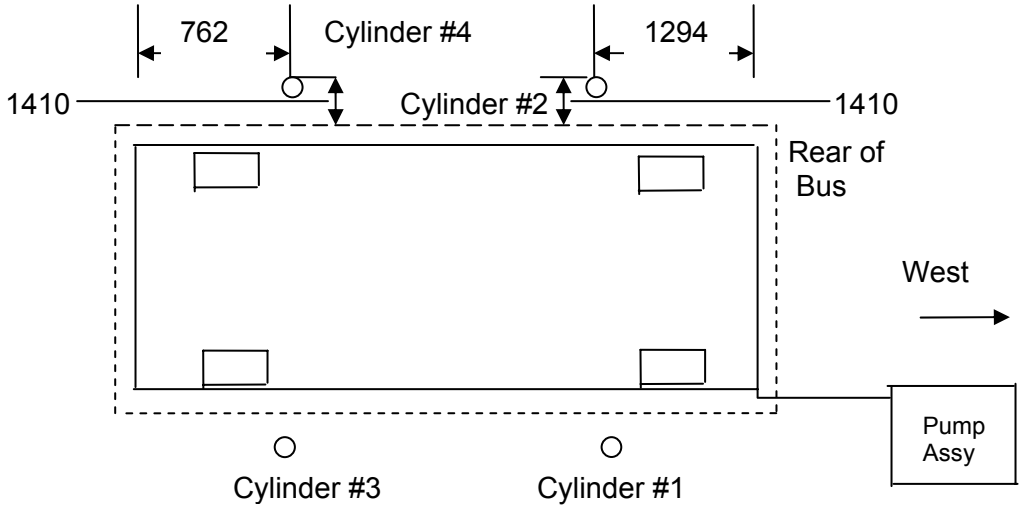
Components Removed From Vehicle Before Testing : Front Roof Vent, Front and Rear Roof Running Lights.

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION (inches)

Description	LF	RF	LR	RR
From closest corner of load application plate (mm)	762	762	1294	1294
From closest outside edge of load application plate (mm)	1410	1410	1410	1410



COMMENTS: NONE

Recorded By:_____

Approved By:_____ Date: July 18, 2007

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2006 Corbeil School Bus, NHTSA No. C60902.

DATA SHEET 2

FORCE APPLICATION AND DEFLECTION INFORMATION

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

Unloaded Delivered Weight (UDW): (kg)	3106 kg
Calculated Test Load = 1.5 * UDW	4659 kg
Range of Test Load (-1% to -3%)	4519 kg – 4612 kg
Maximum Deflection at Full Load:	39.5 mm

		Pre-Load (227 kg)	Maximum		PASSFAIL
		Deflection (mm)	Deflection (mm)	Load (kg)	
Cylinder	1	0	7	1161	PASS
	2	0	77	1152	PASS
	3	0	6	1150	PASS
	4	0	82	1154	PASS
Total Load				4603	
Average Deflection			40		
Backup Measurement	1	0	15		
	2	0	25		
	3	0	17		
	4	0	32		

COMMENTS:

Backup measurements were taken at four most outboard and longitudinal locations on the roof.

Primary cylinder deflections were measured at the locations identified in the diagram on page 5.

Maximum deflection allowed = 130 mm

Recorded By:_____

Approved By:_____ Date: July 18, 2007

DATA SHEET 3

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

	PASS/FAIL
Can all exits be manually released and extended by a single person without tools, remote controls, and without the engine running?	**PASS***

NOTE: BEFORE, DURING & AFTER, refer to the point in time in relation to the load applied to the load application plate on the school bus roof.

Is emergency exit door releasable from inside the school bus?					PASS/FAIL
BEFORE LOAD:	X	Yes		No	**PASS**
DURING LOAD:	X	Yes		No	***See Comment**
AFTER LOAD:	X	Yes		No	**PASS**

Is emergency exit door releasable from outside the school bus?					PASS/FAIL
BEFORE LOAD:	X	Yes		No	**PASS**
DURING LOAD:	X	Yes		No	***See Comment**
AFTER LOAD:	X	Yes		No	**PASS**

COMMENTS:

***** The force required to open the rear emergency exit door with the FMVSS 220 roof load applied was in excess of that allowed by FMVSS 217, but the exit was able to be manually released and extended by a single person without the use of tools. This event is not considered a test failure because previous testing had deformed the structure surrounding the exit door.

The vehicle had been subjected to multiple destructive tests, including FMVSS 301 and FMVSS 217, which deformed the rear emergency exit door and the lower door frame area which reduced door clearance prior to the FMVSS 220 test. The sheet metal below the lower door frame was also bent rearward and was torn from the supporting corner structure during the FMVSS 301 test. Due to the previous testing, the FMVSS 220 rear emergency door opening test results are to be treated as indicant.

DATA SHEET 4

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

FORCE TEST TO UNLATCH THE EMERGENCY EXITS

Exit Location	Maximum Force	Actual Before (N)	PASS/FAIL	Actual During (N)	PASS/FAIL	Actual After (N)	PASS/FAIL	Type of Motion
Rear Exit Door	178 N	1. 36.8 2. 32.4 3. 32.2 Average: 33.8	**PASS**	1. 41.1 2. 33.7 3. 33.1 Average: 36.0	**PASS**	1. 36.6 2. 37.4 3. 31.2 Average: 35.1	**PASS**	Straight

COMMENTS: NONE

FORCE TESTS TO OPEN THE EMERGENCY EXITS

Exit Location	Maximum Force	Actual Before (N)	PASS/FAIL	Actual During (N)	PASS/FAIL	Actual After (N)	PASS/FAIL	Type of Motion
Rear Exit Door	178 N	1. 46.2 2. 28.6 3. 34.3 Average: 36.4	**PASS**	1. 237.2 2. 222.4 3. 196.2 Average: 218.6	***See Comment**	1. 64.6 2. 48.9 3. 52.0 Average: 55.2	**PASS**	Straight

COMMENTS:

***** The force required to open the rear emergency exit door with the FMVSS 220 roof load applied was in excess of that allowed by FMVSS 217, but the exit was able to be manually released and extended by a single person without the use of tools. This event is not considered a test failure because previous testing had deformed the structure surrounding the exit door.

The vehicle had been subjected to multiple destructive tests, including FMVSS 301 and FMVSS 217, which deformed the rear emergency exit door and the lower door frame area which reduced door clearance prior to the FMVSS 220 test. The sheet metal below the lower door frame was also bent rearward and was torn from the supporting corner structure during the FMVSS 301 test. Due to the previous testing, the FMVSS 220 rear emergency door opening test results are to be treated as indicant.

DATA SHEET 5

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

FORCE TEST TO UNLATCH THE EMERGENCY EXITS

Exit Location	Maximum Force	Actual Before (N)	PASS/FAIL	Actual During (N)	PASS/FAIL	Actual After (N)	PASS/FAIL	Type of Motion
Rear Exit Door	178 N	1. 89.6 2. 87.4 3. 81.7 Average: 86.2	**PASS**	1. 84.2 2. 78.6 3. 74.4 Average: 79.1	**PASS**	1. 78.2 2. 81.7 3. 84.2 Average: 81.4	**PASS**	Rotary

COMMENTS: NONE

FORCE TESTS TO OPEN THE EMERGENCY EXITS

Exit Location	Maximum Force	Actual Before (N)	PASS/FAIL	Actual During (N)	PASS/FAIL	Actual After (N)	PASS/FAIL	Type of Motion
Rear Exit Door	178 N	1. 27.4 2. 19.2 3. 21.7 Average: 22.8	**PASS**	1. 262.2 2. 241.7 3. 192.4 Average: 232.1	***See Comment**	1. 47.6 2. 54.2 3. 41.7 Average: 47.8	**PASS**	Straight

COMMENTS:

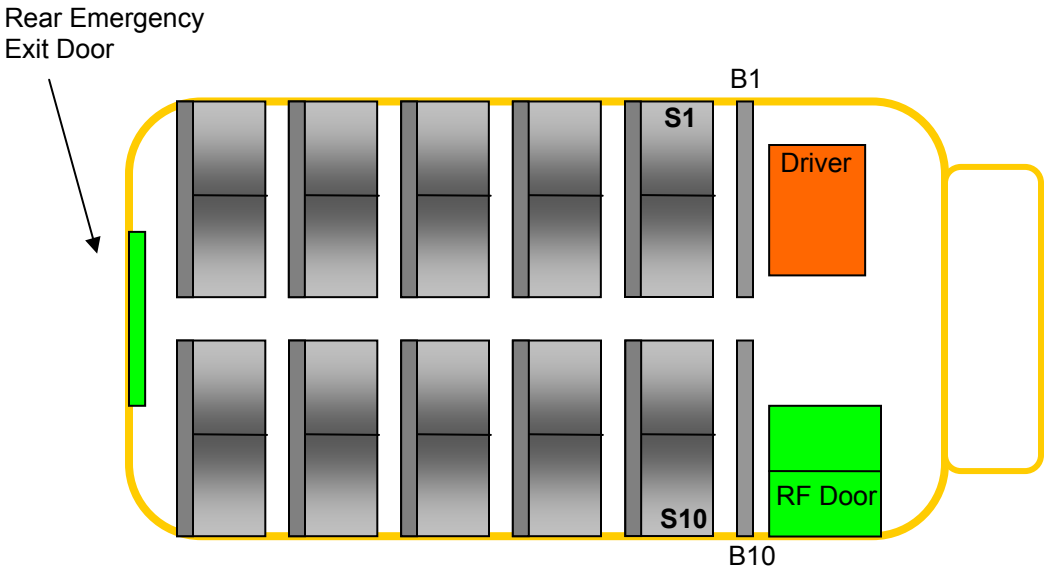
***** The force required to open the rear emergency exit door with the FMVSS 220 roof load applied was in excess of that allowed by FMVSS 217, but the exit was able to be manually released and extended by a single person without the use of tools. This event is not considered a test failure because previous testing had deformed the structure surrounding the exit door.

The vehicle had been subjected to multiple destructive tests, including FMVSS 301 and FMVSS 217, which deformed the rear emergency exit door and the lower door frame area which reduced door clearance prior to the FMVSS 220 test. The sheet metal below the lower door frame was also bent rearward and was torn from the supporting corner structure during the FMVSS 301 test. Due to the previous testing, the FMVSS 220 rear emergency door opening test results are to be treated as indicant.

DATA SHEET 6

EMERGENCY EXIT MEASUREMENTS

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**



		Height (mm)	Width (mm)	Passage of Ellipsoid or Parallelepiped	PASS/FAIL
1	Rear Exit Door	1364	865	114x55x15 Parallelepiped	**PASS**

COMMENTS: NONE

Recorded By:_____

Approved By:_____ Date: July 18, 2007

SECTION 4

INSTRUMENTATION AND EQUIPMENT LIST

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Steel Tape	Stanley	Powerlock / 281	2-27-07	8-27-07
Cylinder #1 Load Cell	Interface	1220AF/137781	4-26-07	10-26-07
Cylinder #1 Displacement Pot.	Patriot	20650	7-9-07	1-9-08
Cylinder #2 Load Cell	Interface	1220AF/152045	2-22-07	8-22-07
Cylinder #2 Displacement Pot.	Patriot	1202-19368	7-9-07	1-9-08
Cylinder #3 Load Cell	Interface	1220AF/143280	4-26-07	10-26-07
Cylinder #3 Displacement Pot.	Patriot	1102-19181	7-9-07	1-9-08
Cylinder #4 Load Cell	Interface	1220AF/137783	4-26-07	10-26-07
Cylinder #4 Displacement Pot.	Patriot	1202-19364	7-9-07	1-9-08
Ellipsoid	MGA	ELLIP – 1A	When used	When used
Parallelpiped	MGA	PARA – 1A	When used	When used
Force Gauge	Dillon	DFGS-R-ND / F31754	4-19-07	10-19-07

SECTION 5

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

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

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

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

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

Frontal View of School Bus After Testing (front structure damage from FMVSS 301)

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

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

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

Rear View of School Bus After Testing

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

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

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

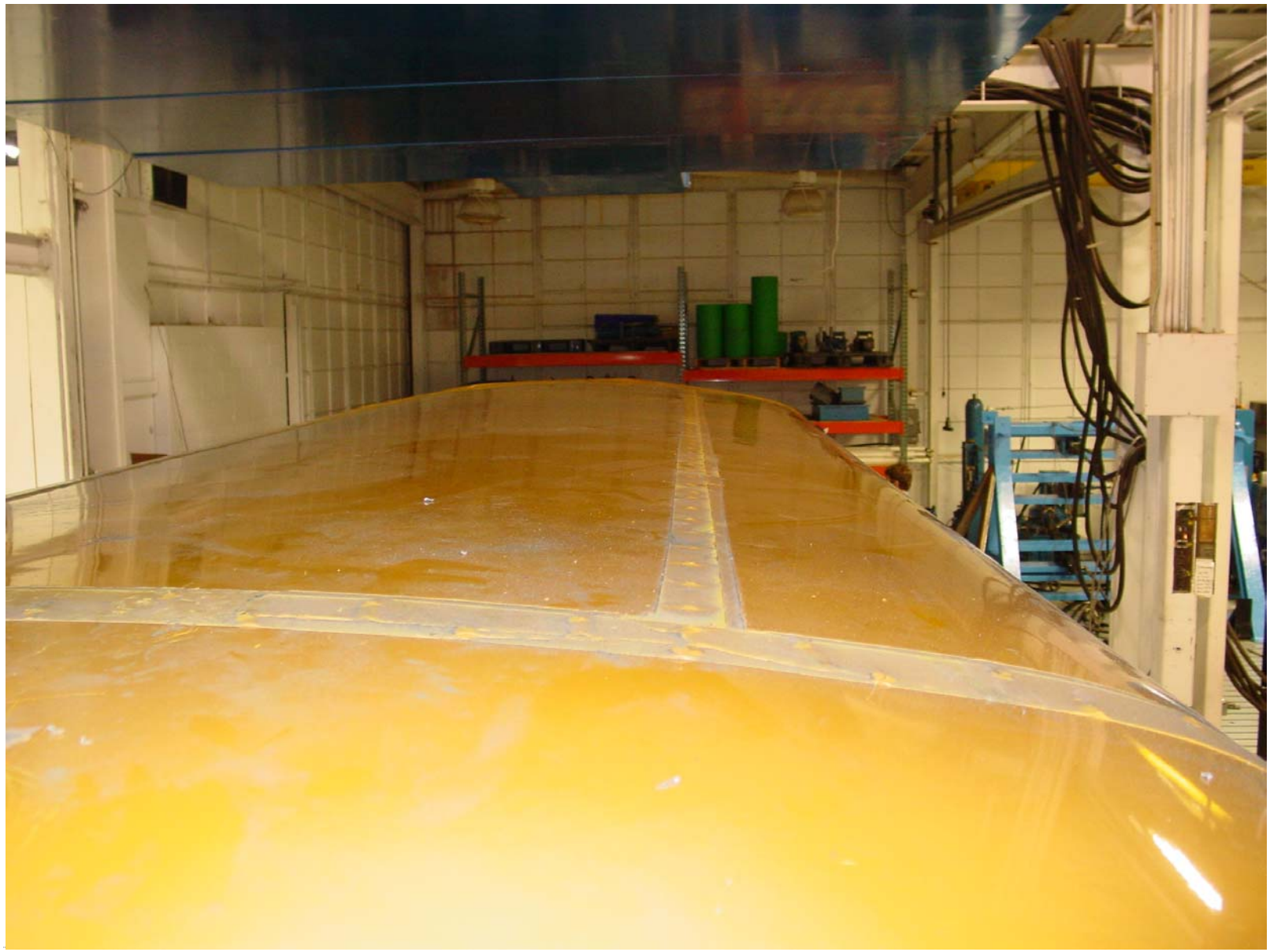
Left Rear of School Bus Before Testing ¾ View (as received by MGA)

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

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

Test Vehicle: **2006 CORBEIL SCHOOL BUS** NHTSA No.: **C60902**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **7/18/07**

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



View of Bus Roof From Front Before Testing

View of Bus Roof From Front After Testing

View of Bus Roof From Rear Before Testing

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

View of Bus Roof From Rear After Testing

Loading Device Placed Against Bus Roof At Start of Test

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

Loading Device Placed Against Bus Roof at Maximum Load

Back-up Roof Deflection Measuring Device at LF Corner of Bus at Full Load

Back-up Roof Deflection Measuring Device at LR Corner of Bus at Full Load

Back-up Roof Deflection Measuring Device at RF Corner of Bus at Full Load

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

Back-up Roof Deflection Measuring Device at RR Corner of Bus at Full Load

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

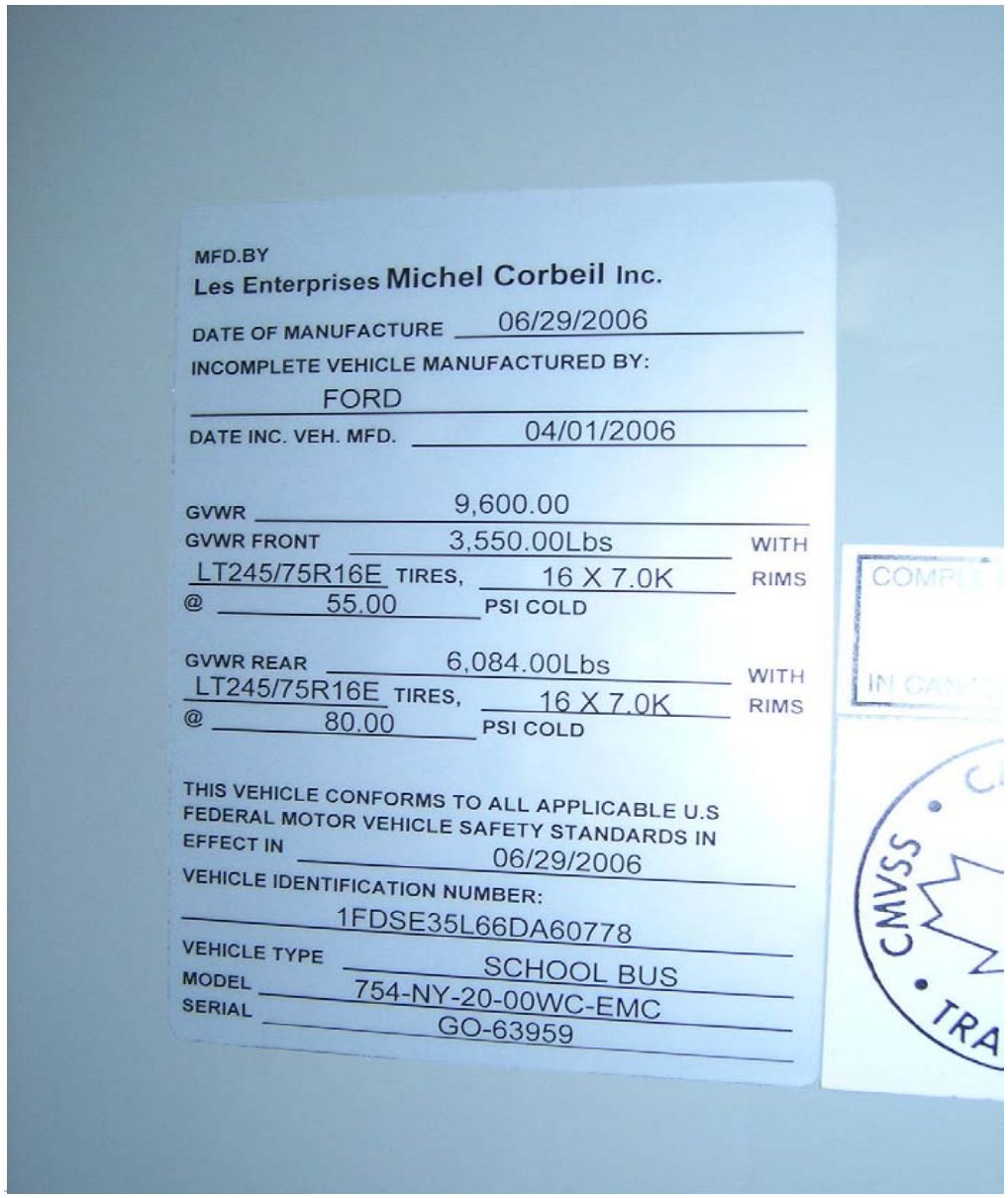
Roof, Before Application of Loading Device, Viewed From Bus Interior

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

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

Test Vehicle:	**2006 CORBEIL SCHOOL BUS**	NHTSA No.:	**C60902**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Date:	**7/18/07**

Exit Opened After Roof Loading is Attained with Parallelepiped in Place

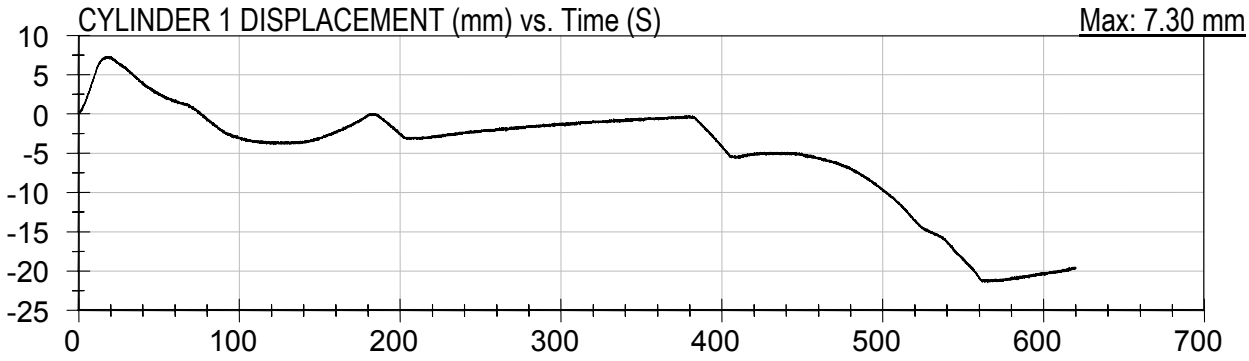


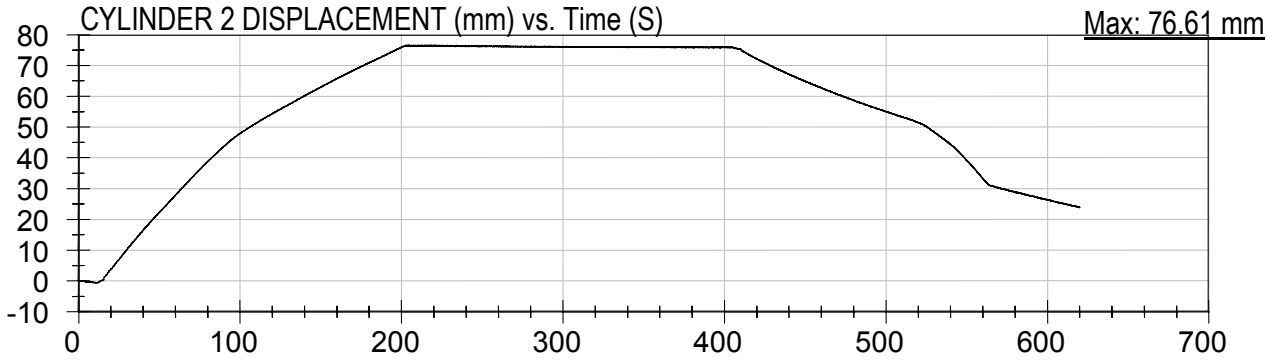
Close-up View of School Bus Certification Label

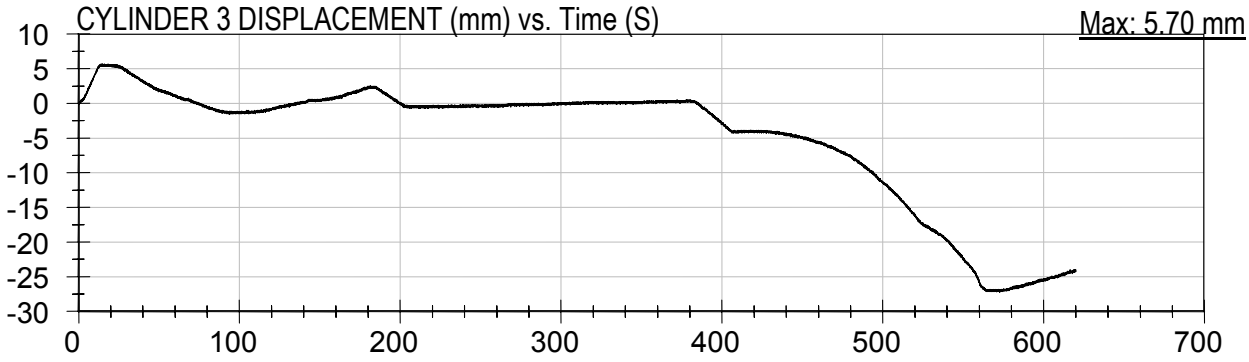
SECTION 6
TEST PLOTS

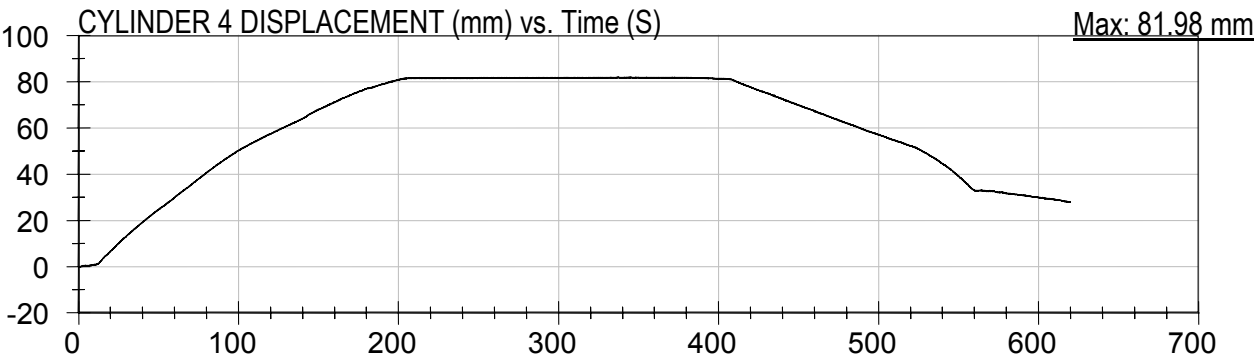
Test Desc: FMVSS 220
Component ID: 2006 Corbeil School Bus

Test Date: 7/18/07
NHTSA #: C60902



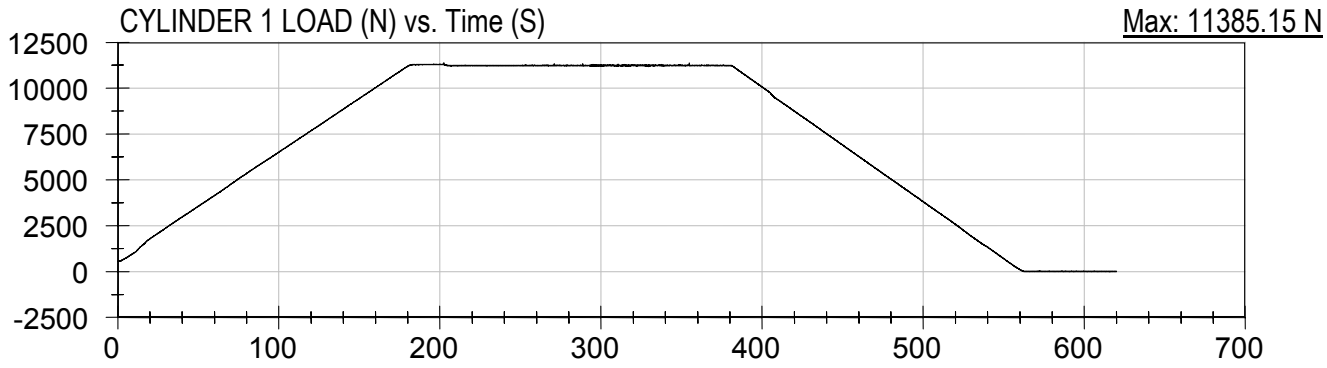


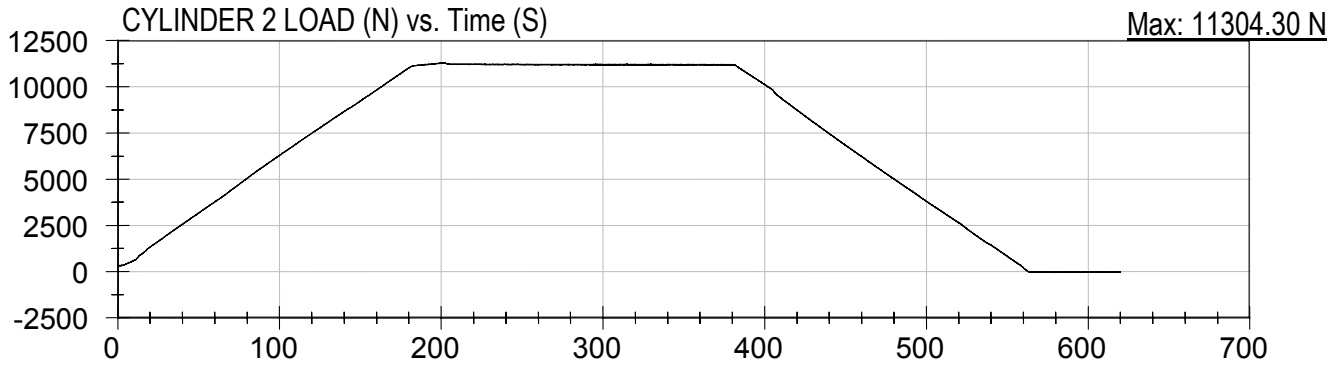


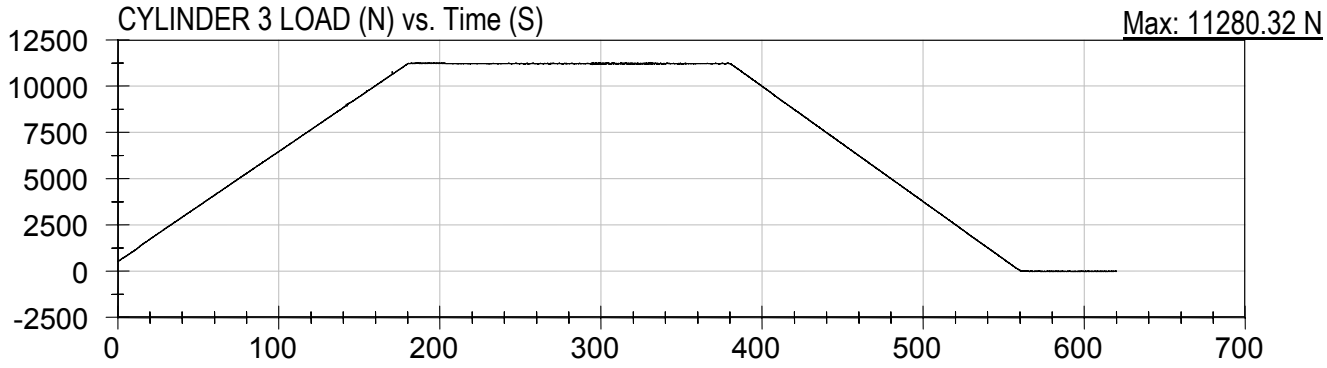


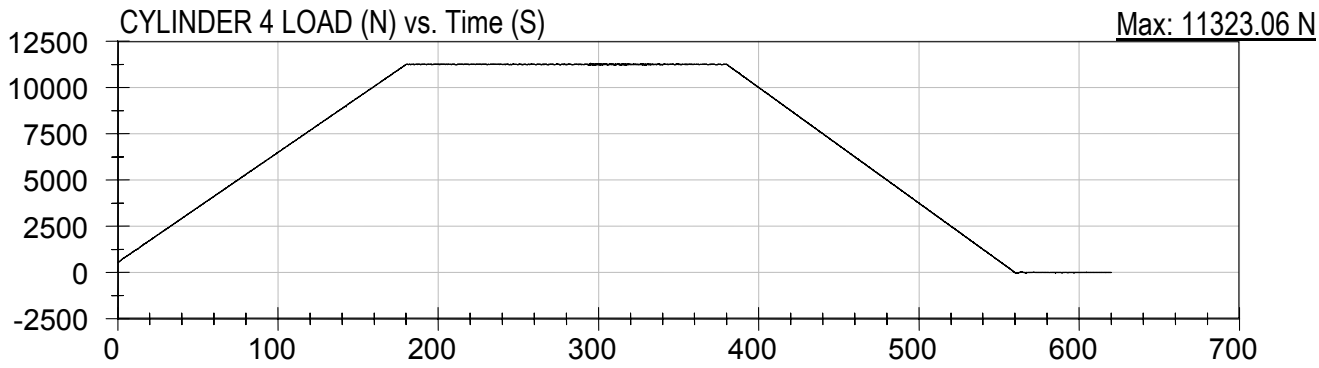
Test Desc: FMVSS 220
Component ID: 2006 Corbeil School Bus

Test Date: 7/18/07
NHTSA #: C60902









Test Desc: FMVSS 220
Component ID: 2006 Corbeil School Bus

Test Date: 7/18/07
NHTSA #: C60902