

REPORT NUMBER: 220-MGA-03-001

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

2003 Blue Bird
All American School Bus
NHTSA No.: C30900

PREPARED BY:
MGA RESEARCH CORPORATION
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BURLINGTON, WI 53105




Final Report Date: October 7, 2003

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Dec 10 10/9/03

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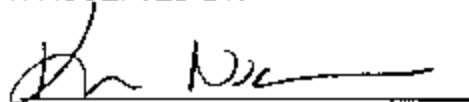
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Date: October 7, 2003

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Michael Janovicz, Program Manager

Date: October 7, 2003

FINAL REPORT ACCEPTED BY:



10/9/2003
Date of Acceptance

Technical Report Documentation Page

1. Report No. 220-MGA-03-001	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS 220 Compliance Testing of 2003 Blue Bird All American School Bus NHTSA No.:C30900		5. Report Date October 7, 2003	
7. Author(s) James Hansen, Project Technician Michael Janovicz, Project Manager		6. Performing Organization Code MGA	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		8. Performing Organization Report No. 220-MGA-03-001	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance (NVS-220) 400 Seventh St., S.W. Room 6115 Washington, D.C. 20590		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-02-D-01057	
		13. Type of Report and Period Covered Final Report 8/7/03 to 10/07/03	
		14. Sponsoring Agency Code NVS-220	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 2003 Blue Bird All American School Bus, NHTSA No. C30900 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. FAILURES: NONE			
17. Key Words Compliance Testing Safety Engineering FMVSS 220		18. Distribution Statement Copies of this report are available from: NHTSA Technical Information Services (TIS) Room 5108, (NPO-230) 400 Seventh Street, S.W. Washington, D.C. 20590 (202) 366-4946	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 47	22. Price

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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY2003 Blue Bird All American School Bus, NHTSA No. C30900, 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 MY2003 Blue Bird All American School Bus, NHTSA No. C30900 appears to meet the requirements of FMVSS 220. The ambient temperature during testing was 24.7° 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	PASS

**DATA SHEET 1
VEHICLE INFORMATION**

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

INCOMPLETE VEHICLE (if applicable)	
Manufacturer:	
Model:	
VIN:	
Build Date:	
Certification Date:	

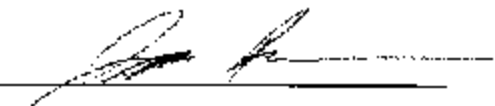
COMPLETED VEHICLE (SCHOOL BUS)	
Manufacturer:	Blue Bird
Make/Model:	School Bus/All American
VIN:	1BABNBPA33F210494
NHTSA No.:	C30900
Color:	Yellow
GVWR (kg/lb):	16,420 kg/36,200 lbs
Build Date:	8/02
Certification Date:	8/02

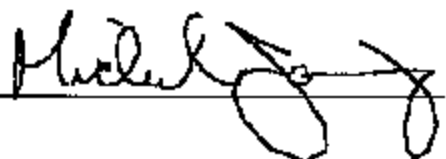
DATES	
Vehicle Receipt:	November 14, 2002
Start of Compliance Test:	August 7, 2003
Completion of Compliance Test:	August 8, 2003

COMPLIANCE TEST:

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

COMMENTS: NONE

Recorded By: 

Approved By: 

Date: October 7, 2003

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

SCHOOL BUS UNLOADED VEHICLE WEIGHT (UVW)

Units	LF	RF	LR	RR	TOTAL
Kg	1,648	1,560	3,006	2,824	9,038

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	11,887	11,582	11,582
Width (mm):	2,380	914	914

Notes:

- ⁽¹⁾ The vehicle was centered laterally and longitudinally under the roof load application plate.

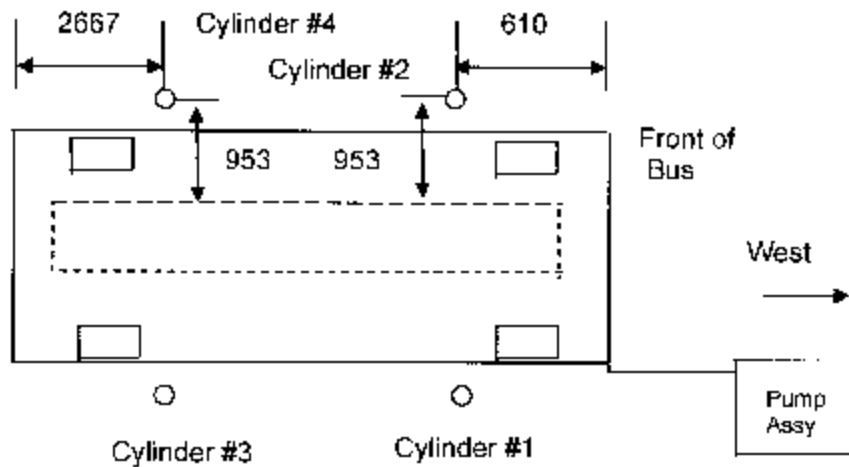
School Bus Has: Rigid Frame; Unibody

Components Removed From Vehicle Before Testing: Rear emergency roof hatch.

DATA SHEET 1 (CONTINUED)
VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION (inches)

Description	LF	RF	LR	RR
From closest corner of load application plate (mm)	610	610	2667	2667
From closest outside edge of load application plate (mm)	953	953	953	953



COMMENTS: NONE

Recorded By: *[Signature]*

Approved By: *[Signature]*

Date: October 7, 2003

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2003 Blue Bird All American School Bus, NHTSA No. C30900.

DATA SHEET 2
FORCE APPLICATION AND DEFLECTION INFORMATION

Test Vehicle: **2003 Blue Bird All American School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

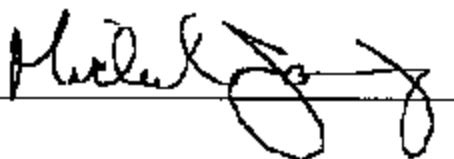
NHTSA No.: **C30900**
 Test Date: **8/07/03**

Unloaded Delivered Weight (UDW): (kg)	9,038 kg
Calculated Test Load = 1.5 * UDW	13,557 kg
Range of Test Load (-1% to -3%)	13,150 kg to 13,421 kg
Maximum Deflection at Full Load:	90.7 mm

		Pre-Load (227 kg) Deflection (mm)	Max. Load		PASS/FAIL
			Deflection (mm)	Load (kg)	
Cylinder	1	0	76.3	3201	PASS
	2	0	70.6	3394	PASS
	3	0	90.7	3393	PASS
	4	0	72.7	3406	PASS
Total Load				13,394	
Average Deflection			77.6		
Backup Measurement	1	0	21.0		
	2	0	13.0		
	3	0	51.0		
	4	0	43.0		

COMMENTS: 1) Backup measurements taken at four most outboard and longitudinal locations on the bus. 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: October 7, 2003

**DATA SHEET 3
FORCE AND OPENING AREA TEST OF EMERGENCY EXITS**

Test Vehicle: **2003 Blue Bird All American School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30900**
 Test Date: **8/07/03**

	PASS/FAIL
Can all exits be manually released and extended by a single person without tools, remove 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.

	PASS/FAIL
BEFORE LOAD:	X Yes No PASS
DURING LOAD:	X Yes No PASS
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 PASS
AFTER LOAD:	X Yes No PASS

DATA SHEET 4

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: 2003 Blue Bird All American School Bus
 Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C30900
 Test Date: 8/07/03

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
Left Front Exit Window	89 N	1. 81.5	PASS	1. 74.5	PASS	1. 83.0	PASS	Rotary
		2. 75.5		2. 80.0		2. 86.5		
		3. 86.5		3. 80.5		3. 80.0		
		Average: 81.2		Average: 78.3		Average: 83.2		
Right Front Exit Window	89 N	1. 87.0	PASS	1. 52.5	PASS	1. 60.5	PASS	Rotary
		2. 86.5		2. 52.0		2. 69.0		
		3. 81.0		3. 55.0		3. 60.0		
		Average: 84.5		Average: 53.2		Average: 63.2		
Left Rear Exit Window	89 N	1. 80.5	PASS	1. 66.5	PASS	1. 85.0	PASS	Rotary
		2. 69.5		2. 68.0		2. 80.0		
		3. 68.5		3. 68.5		3. 75.5		
		Average: 72.8		Average: 67.7		Average: 80.2		
Right Rear Exit Window	89 N	1. 67.0	PASS	1. 60.0	PASS	1. 89.0	PASS	Rotary
		2. 70.5		2. 60.0		2. 86.0		
		3. 74.0		3. 53.5		3. 83.0		
		Average: 70.5		Average: 57.8		Average: 86.0		
Rear Exit Window	178 N	1. 37.5	PASS	1. 42.0	PASS	1. 40.0	PASS	Straight
		2. 31.0		2. 42.5		2. 39.5		
		3. 32.5		3. 49.0		3. 39.0		
		Average: 33.7		Average: 44.5		Average: 39.5		
Left Side Exit Door	178 N	1. 98.0	PASS	1. 89.0	PASS	1. 40.5	PASS	Straight
		2. 89.0		2. 69.5		2. 47.0		
		3. 87.0		3. 61.0		3. 47.0		
		Average: 91.3		Average: 73.2		Average: 44.8		

Note: The "Actual Before" test results were obtained from the FMSSS 217 performed on this vehicle.
 The "Actual During" and "Actual After" test results were obtained during the FMVSS 220 testing.

DATA SHEET 4 (CONTINUED)
FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: 2003 Blue Bird All American School Bus
 Test Lab: MGA Research-Wisconsin Operations
 NHTSA No.: C30900
 Test Date: 8/07/03

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	Motion Required to Open Exit
Left Front Exit Window	178 N	1. 32.0	PASS	1. 20.5	PASS	1. 29.5	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 36.0		2. 18.0		2. 27.0		
		3. 31.5		3. 16.0		3. 27.5		
		Average: 33.2		Average: 18.2		Average: 28.0		
Right Front Exit Window	178 N	1. 32.5	PASS	1. 15.0	PASS	1. 28.0	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 32.0		2. 17.0		2. 26.0		
		3. 29.5		3. 14.0		3. 26.0		
		Average: 31.3		Average: 15.3		Average: 26.7		
Left Rear Exit Window	178 N	1. 33.0	PASS	1. 26.0	PASS	1. 27.5	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 31.5		2. 31.0		2. 26.0		
		3. 30.5		3. 35.0		3. 27.0		
		Average: 31.7		Average: 30.7		Average: 26.8		
Right Rear Exit Window	178 N	1. 32.5	PASS	1. 18.5	PASS	1. 30.5	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 29.5		2. 15.0		2. 28.0		
		3. 32.0		3. 20.0		3. 26.5		
		Average: 31.3		Average: 17.8		Average: 28.3		
Rear Exit Window	178 N	1. 52.0	PASS	1. 59.0	PASS	1. 66.0	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 53.0		2. 66.0		2. 59.5		
		3. 55.0		3. 58.0		3. 58.0		
		Average: 53.3		Average: 61.0		Average: 61.2		
Left Side Exit Door	178 N	1. 40.0	PASS	1. 45.0	PASS	1. 29.5	PASS	Straight and perpendicular to the undisturbed exit surface
		2. 36.0		2. 46.5		2. 29.0		
		3. 37.5		3. 45.5		3. 29.0		
		Average: 37.9		Average: 45.7		Average: 29.2		

Note: The "Actual Before" test results were obtained from the FMVSS 217 performed on this vehicle.
 The "Actual During" and "Actual After" test results were obtained during the FMVSS 220 testing.

DATA SHEET 5
FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

Test Vehicle: **2003 Blue Bird All American School Bus** NHTSA No.: **C30900**
 Test Lab: **MGA Research-Wisconsin Operations** Test Date: **8/07/03**

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
Left Front Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Right Front Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Left Rear Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Right Rear Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Rear Exit Window	178 N	1. 148.5	PASS	1. 140.0	PASS	1. 105.5	PASS	Rotary
		2. 161.0		2. 105.0		2. 110.0		
		3. 142.0		3. 94.0		3. 112.0		
		Average: 150.5		Average: 113.0		Average: 109.2		
Left Side Exit Door	178 N	1. 131.0	PASS	1. 100.0	PASS	1. 128.5	PASS	Straight
		2. 138.0		2. 121.0		2. 122.0		
		3. 130.0		3. 153.0		3. 126.0		
		Average: 133.0		Average: 124.7		Average: 125.5		

Note: The "Actual Before" test results were obtained from the FMSSS 217 performed on this vehicle.
 The "Actual During" and "Actual After" test results were obtained during the FMVSS 220 testing.

DATA SHEET 5 (CONTINUED)
FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

Test Vehicle: 2003 Blue Bird All American School Bus
 Test Lab: MGA Research-Wisconsin Operations
 NHTSA No.: C30900
 Test Date: 8/07/03

FORCE TESTS TO OPEN THE EMERGENCY EXITS

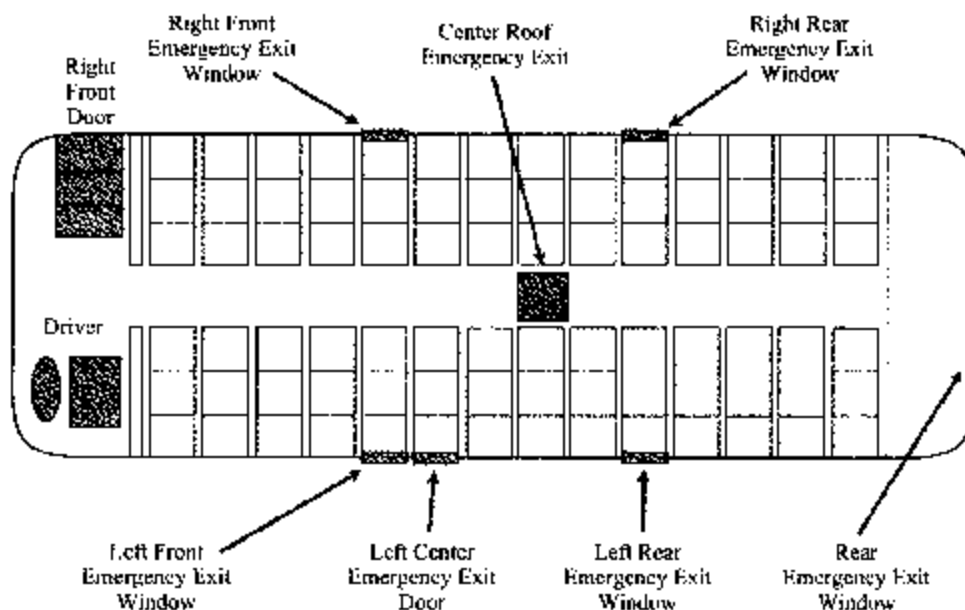
Exit Location	Maximum Force	Actual Before (N)	PASS/FAIL	Actual During (N)	PASS/FAIL	Actual After (N)	PASS/FAIL	Motion Required to Open Exit
Left Front Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Right Front Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Left Rear Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Right Rear Exit Window	N/A	1. --	N/A	1. --	N/A	1. --	N/A	N/A
		2. --		2. --		2. --		
		3. --		3. --		3. --		
		Average: --		Average: --		Average: --		
Rear Exit Window	178 N	1. 64.5	PASS	1. 78.5	PASS	1. 72.0	PASS	Straight outward pull
		2. 56.5		2. 76.5		2. 68.0		
		3. 64.0		3. 78.5		3. 61.0		
		Average: 61.7		Average: 77.8		Average: 67.0		
Left Side Exit Door	178 N	1. 53.0	PASS	1. 41.5	PASS	1. 36.0	PASS	Straight outward pull
		2. 55.0		2. 48.0		2. 39.0		
		3. 52.0		3. 48.5		3. 36.5		
		Average: 53.3		Average: 46.0		Average: 37.2		

Note: The "Actual Before" test results were obtained from the FMSSS 217 performed on this vehicle.
 The "Actual During" and "Actual After" test results were obtained during the FMVSS 220 testing.

**DATA SHEET 6
EMERGENCY EXIT MEASUREMENTS**

Test Vehicle: **2003 Blue Bird All American School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30900**
 Test Date: **8/07/03**



		Height (mm)	Width (mm)	Passage of Ellipsoid or Parallelepiped	PASS/FAIL
1	Left Front Exit Window	505	612	Ellipsoid	PASS
2	Left Rear Exit Window	505	612	Ellipsoid	PASS
3	Right Front Exit Window	505	612	Ellipsoid	PASS
4	Right Rear Exit Window	505	612	Ellipsoid	PASS
5	Rear Exit Window	578	1,359	135 cm x 57 cm Area	PASS
6	Left Side Exit Door	1,295	610	129 cm x 61 cm Area	PASS
7	Roof Exit – Rear	580	585	Ellipsoid	N/A

COMMENTS: Parallelepiped dimensions are 114 cm x 61 cm x 30 cm.

Recorded By: *[Signature]*

Approved By: *[Signature]*

Date: October 7, 2003

**SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST**

Test Vehicle: **2003 Blue Bird All American School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30900**
 Test Date: **8/07/03**

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Computer	HP	Vectra / US03263612	---	---
Steel Tape	Stanley	Powerlock / 148	5/30/03	11/30/03
Scale	GSE	PRO-WEIGH 84 212091/212092	6/9/03	12/9/03
Cylinder #1 Load Cell	Interface	137782	5/1/03	11/1/03
Cylinder #1 Displacement Pot.	Patriot	20650	7/21/03	1/21/04
Cylinder #2 Load Cell	Interface	137781	5/1/03	11/1/03
Cylinder #2 Displacement Pot.	Interface	1202-19368	7/21/03	1/21/04
Cylinder #3 Load Cell	Interface	137778	5/1/03	11/1/03
Cylinder #3 Displacement Pot.	Interface	1102 19181	7/21/03	1/21/04
Cylinder #4 Load Cell	Interface	137783	5/1/03	11/1/03
Cylinder #4 Displacement Pot.	Interface	1202-19364	7/21/03	1/21/04
Ellipsoid	MGA	ELLIP - 1A	12/4/02	12/4/03
Parallelepiped	MGA	PARA - 1A	12/4/02	12/4/03
Force Gauge	CHATILLON	DFGS-R-ND/ F31754	6/17/03	12/17/03
Temperature Recorder	DICKSON	TR320 S/N: 03039010	2/2003	2/2004

**SECTION 5
PHOTOGRAPHS**

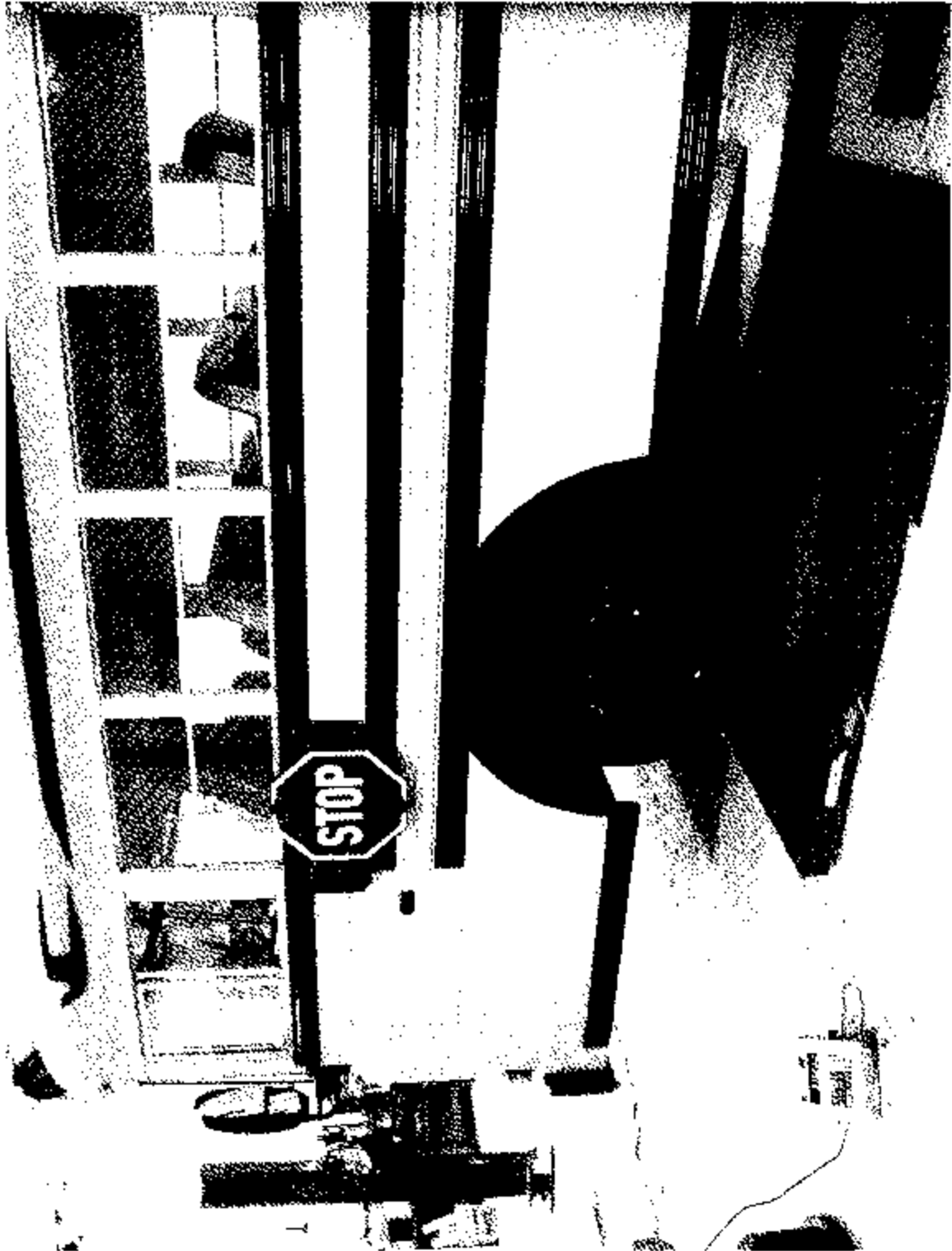
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Test Vehicle: 2003 Blue Bird All American School Bus

Procedure: FMVSS 220

NHTSA No.: C30900



School Bus Front Axle Being Weighed

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

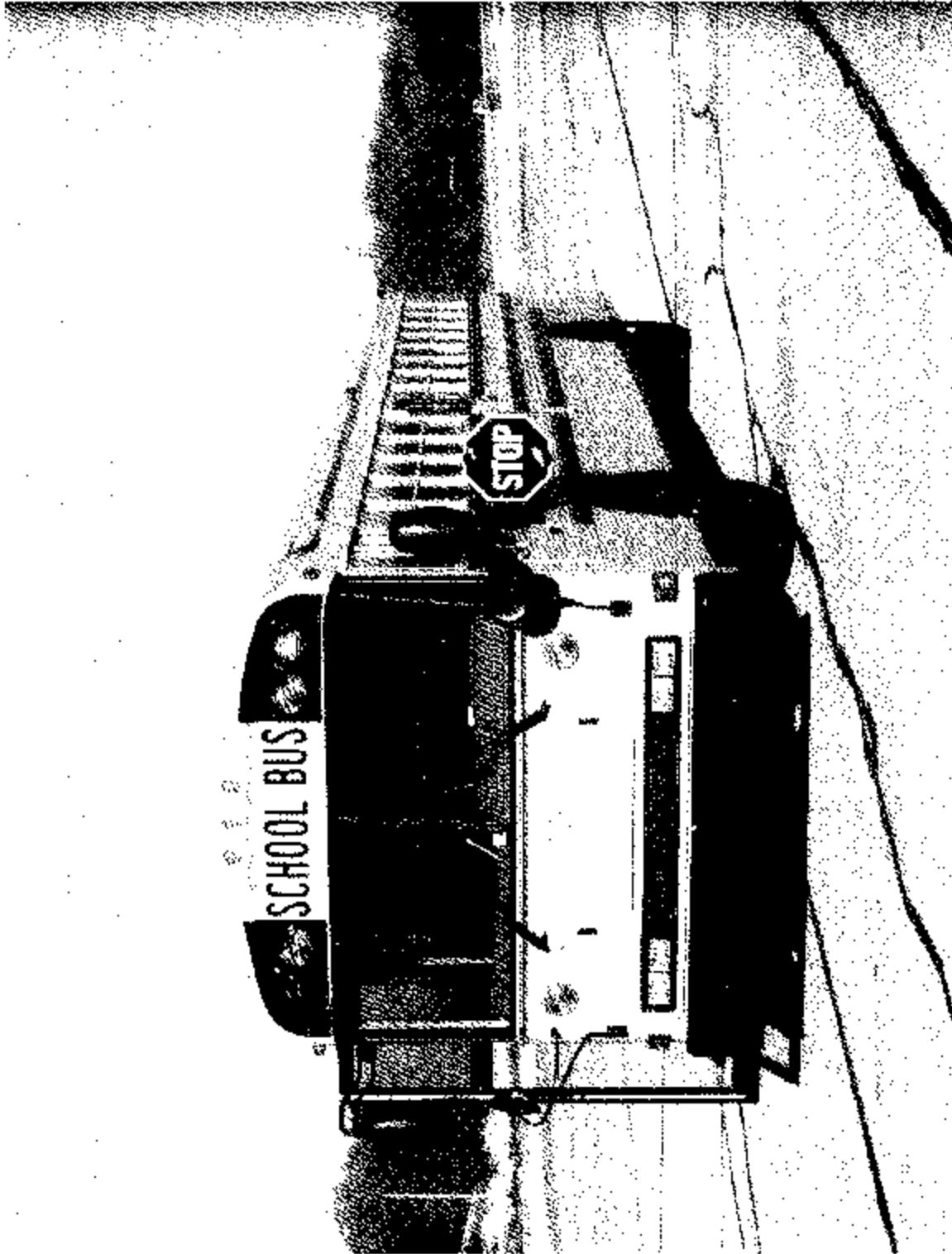
NHTSA No.: C30900



School Bus Rear Axle Being Weighed

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



3/4 Left Front of School Bus Before Testing

Tes: Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

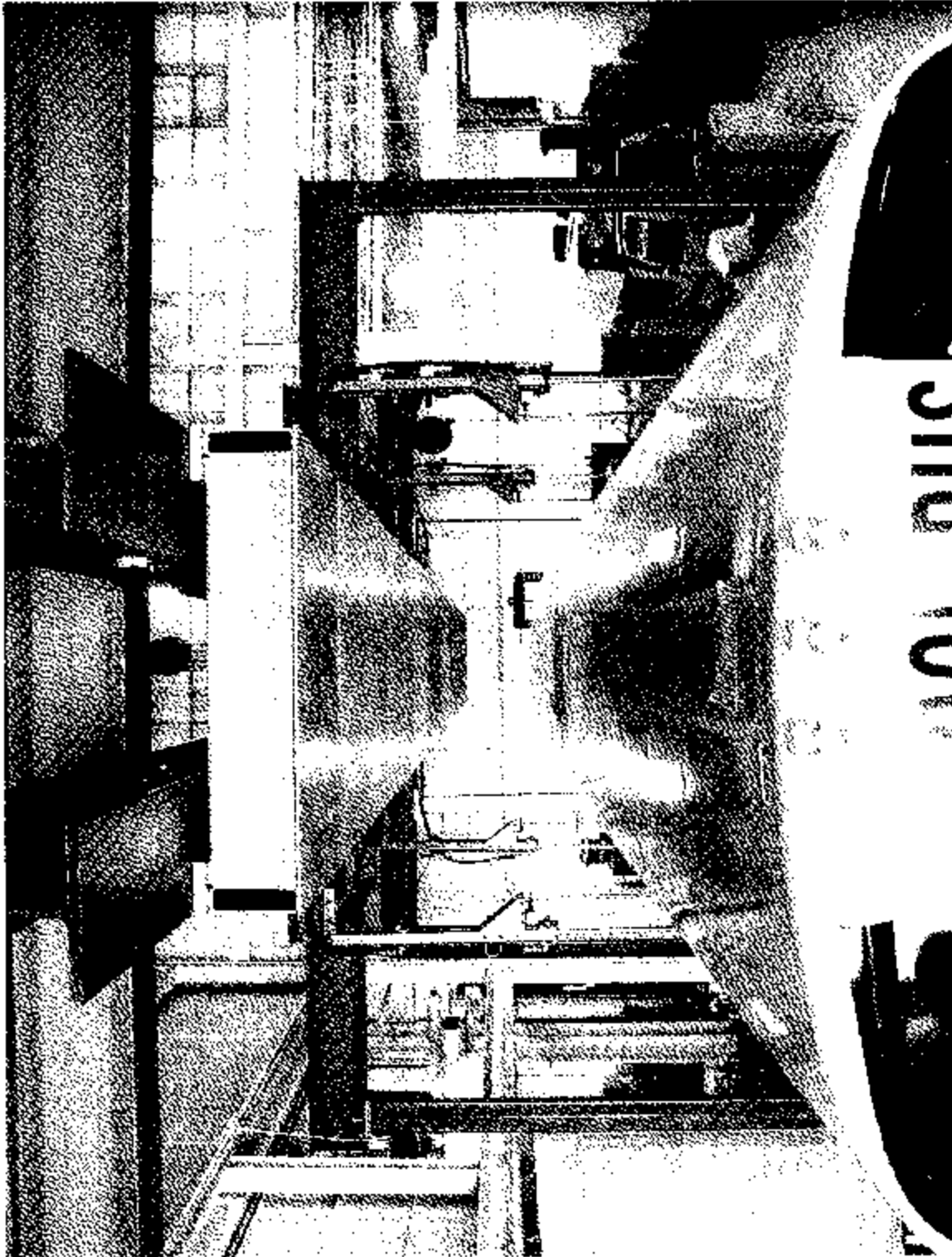
NHTSA No.: C30900



¾ Left Rear of School Bus Before Testing

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

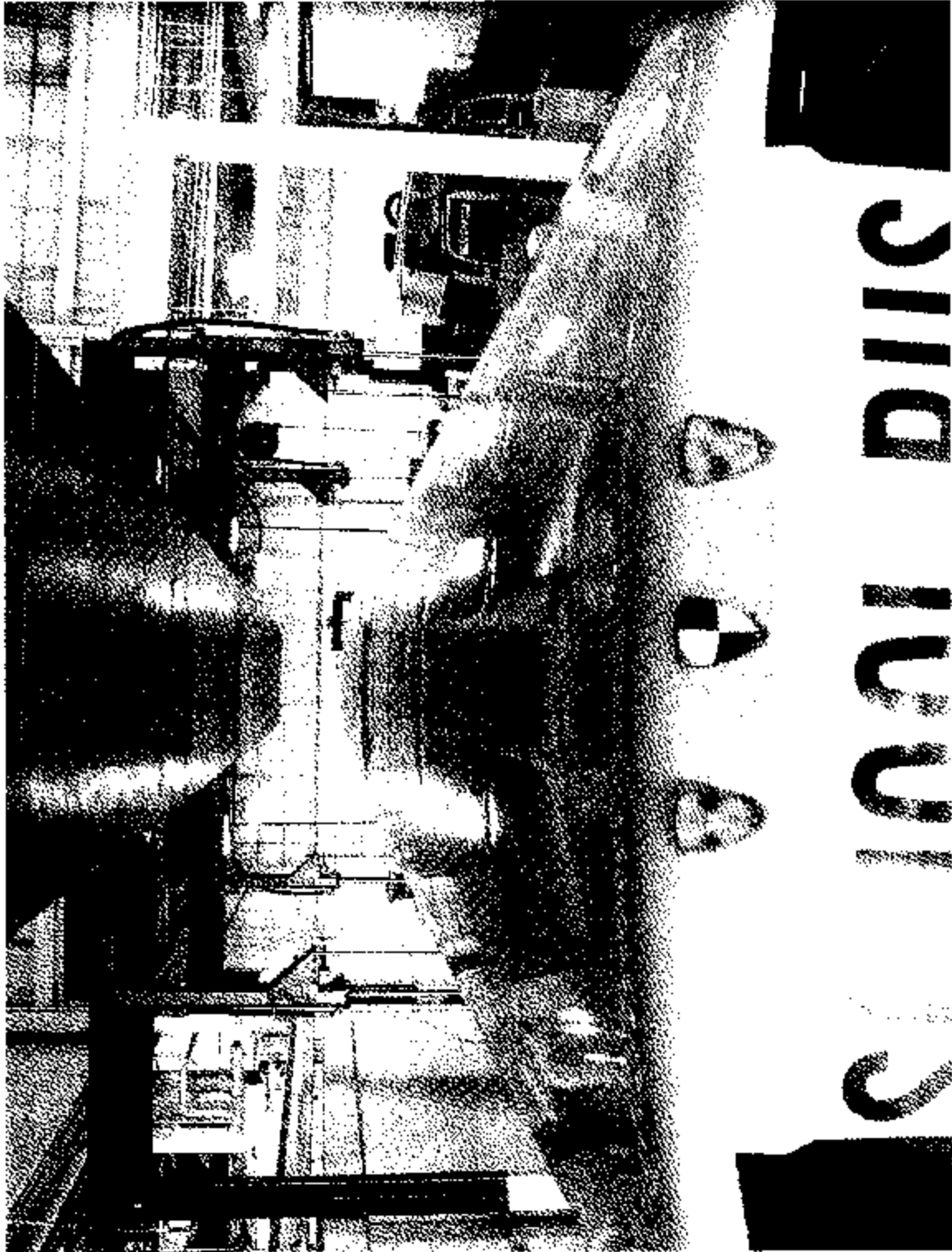
NHTSA No.: C30900



View of Bus Roof From Front Before Testing

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



View of Bus Roof From Front After Testing

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



View of Bus Roof From Rear Before Testing

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

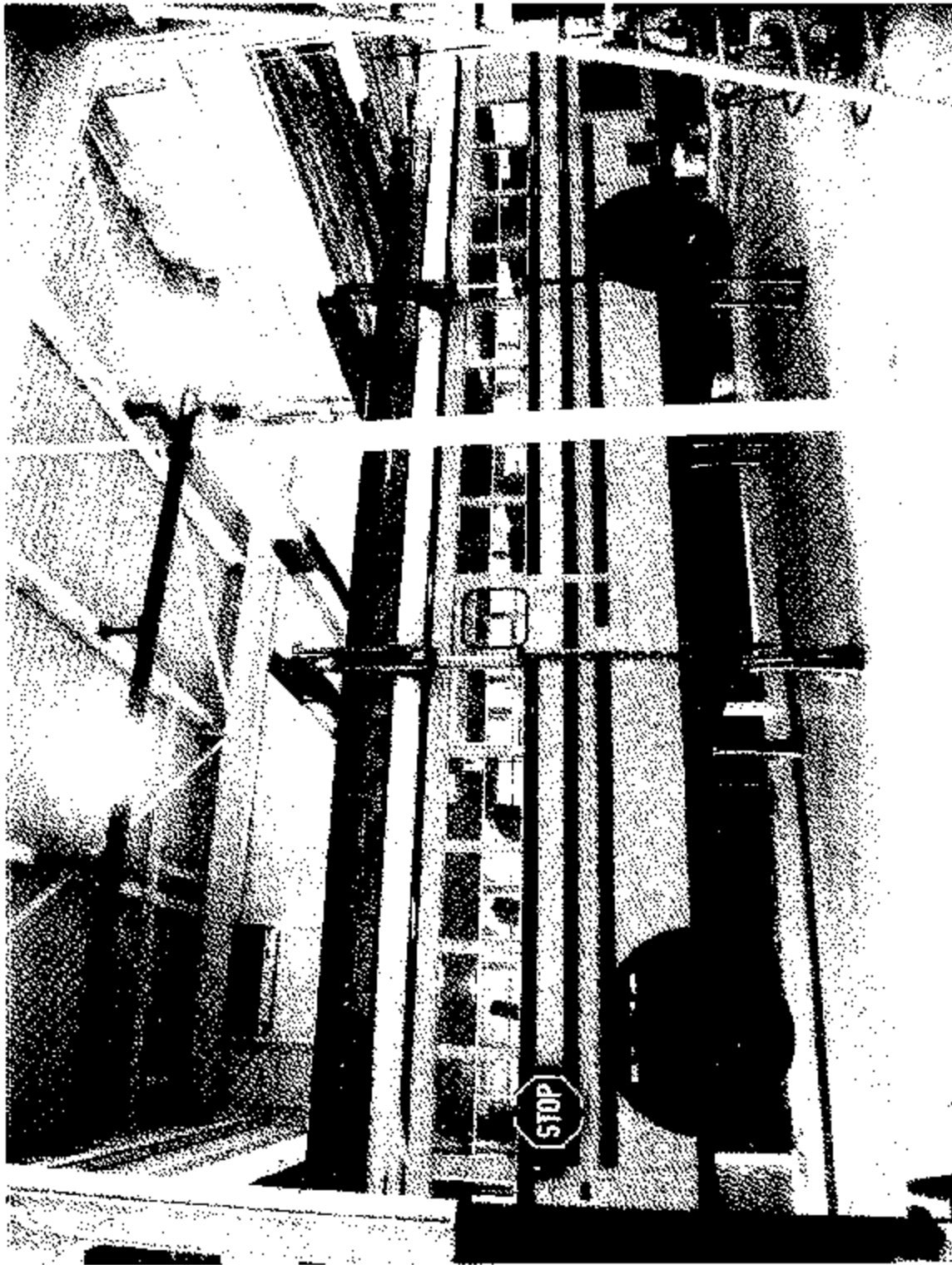
NHTSA No.: C30900



View of Bus Roof From Rear After Testing

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

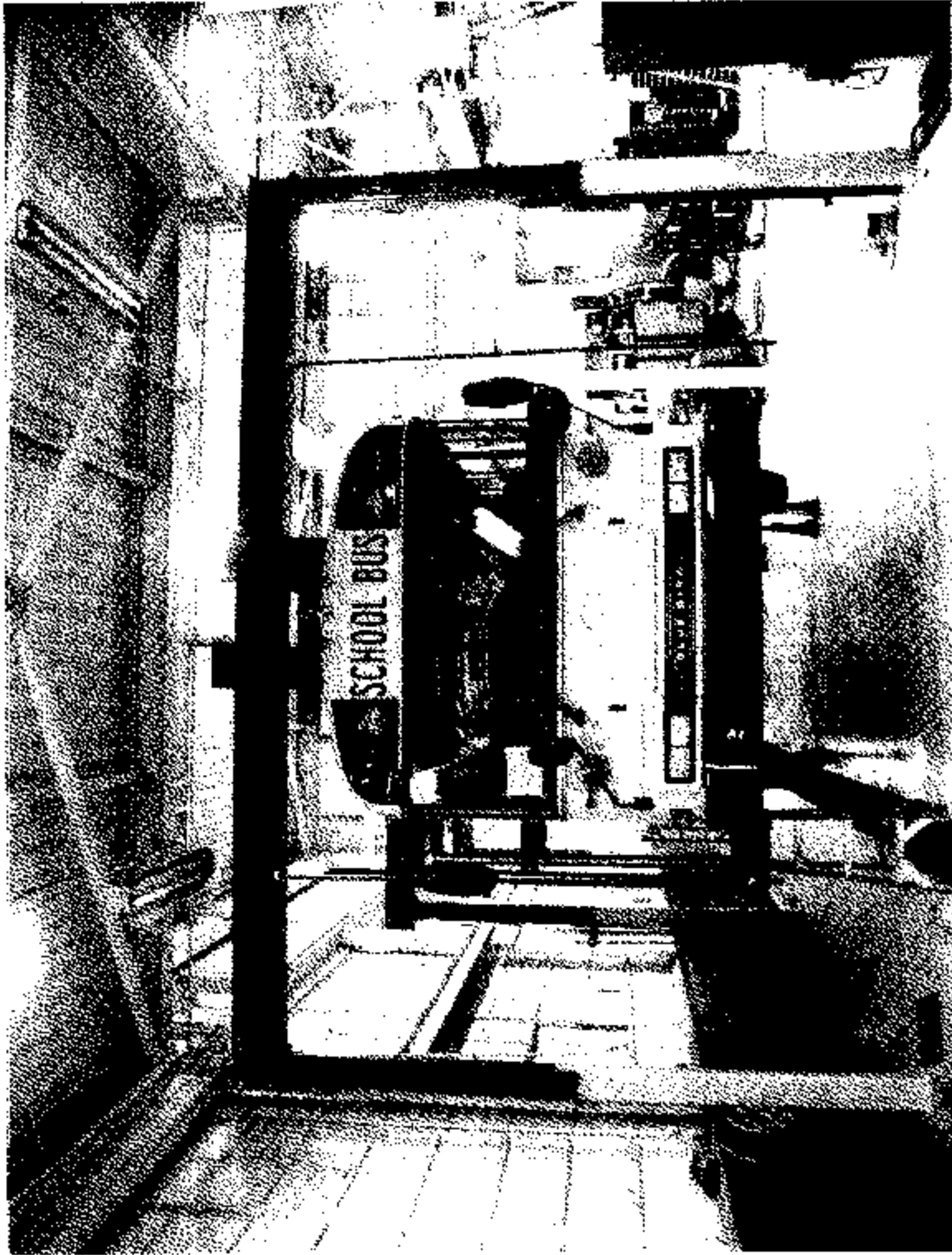
NHTSA No: C30900



Loading Device Placed Against Bus Roof At Start of Test

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

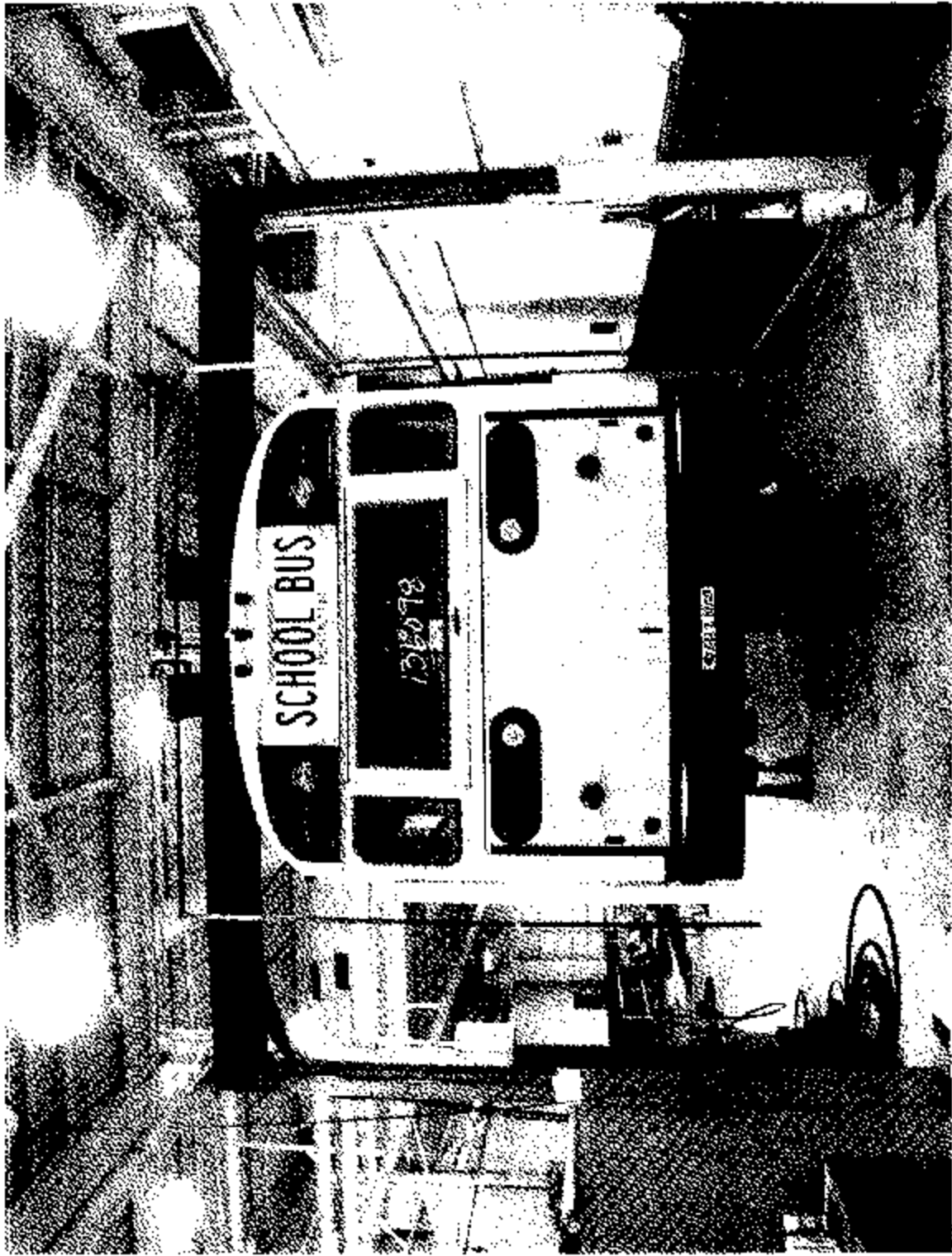
NHTSA No: C30900



Loading Device Placed Against Bus Roof at Maximum Load (Front View)

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No: C30900



Loading Device Placed Against Bus Roof at Maximum Load (Rear View)

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

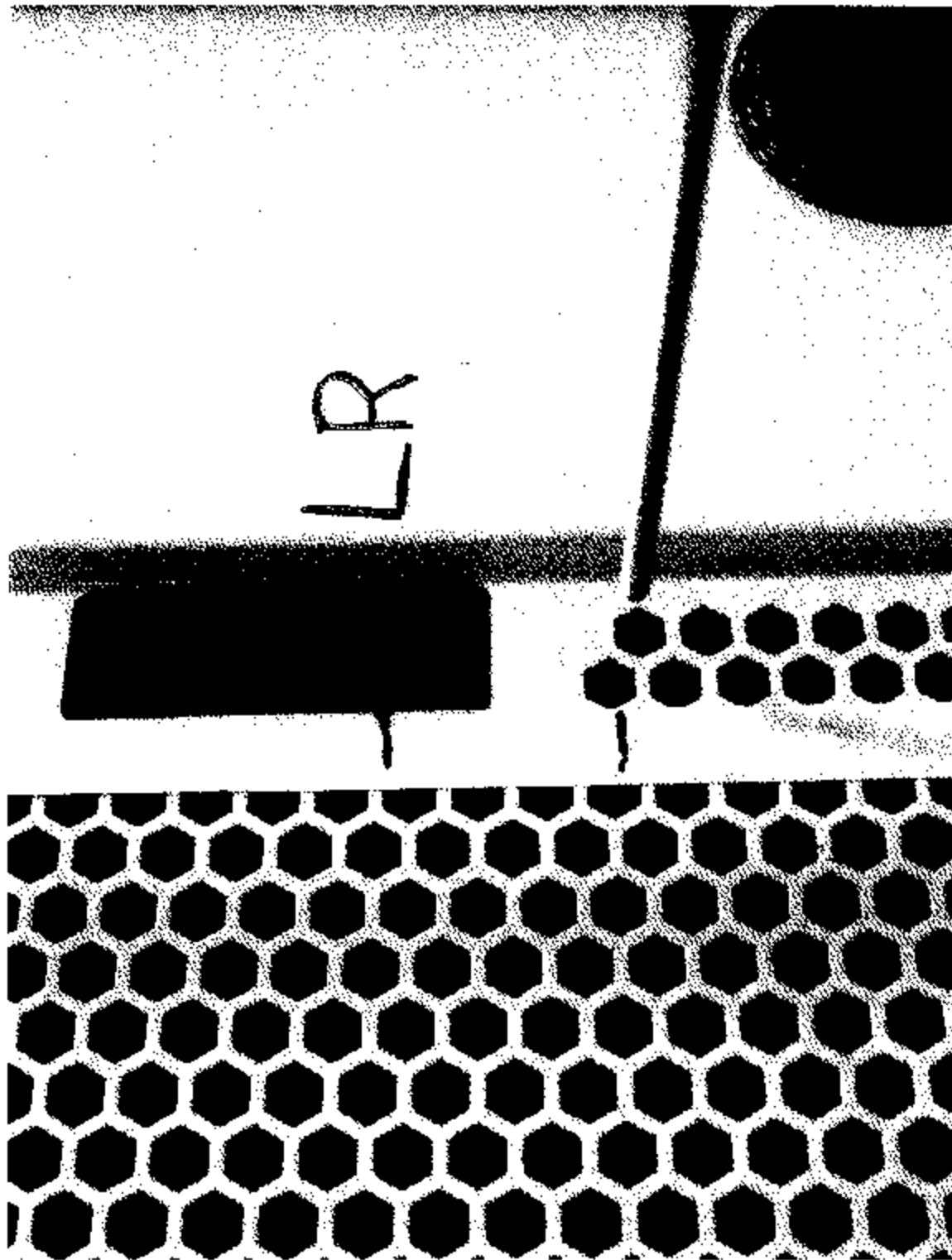
NHTSA No.: C30900



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

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

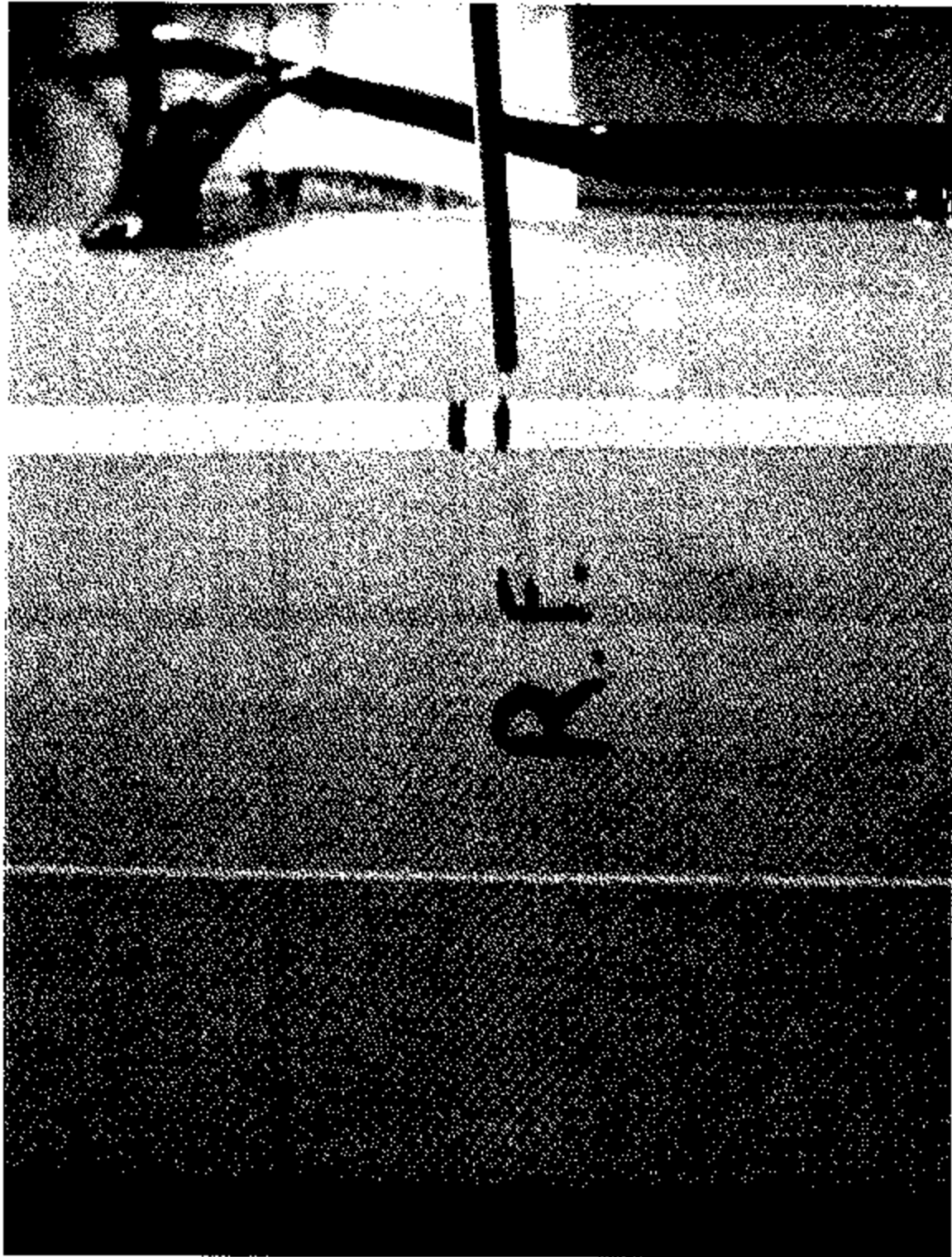
NHTSA No.: C30900



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

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



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

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



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

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



Photo of Actual Instrumentation Setup

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

NHTSA No.: C30900



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

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

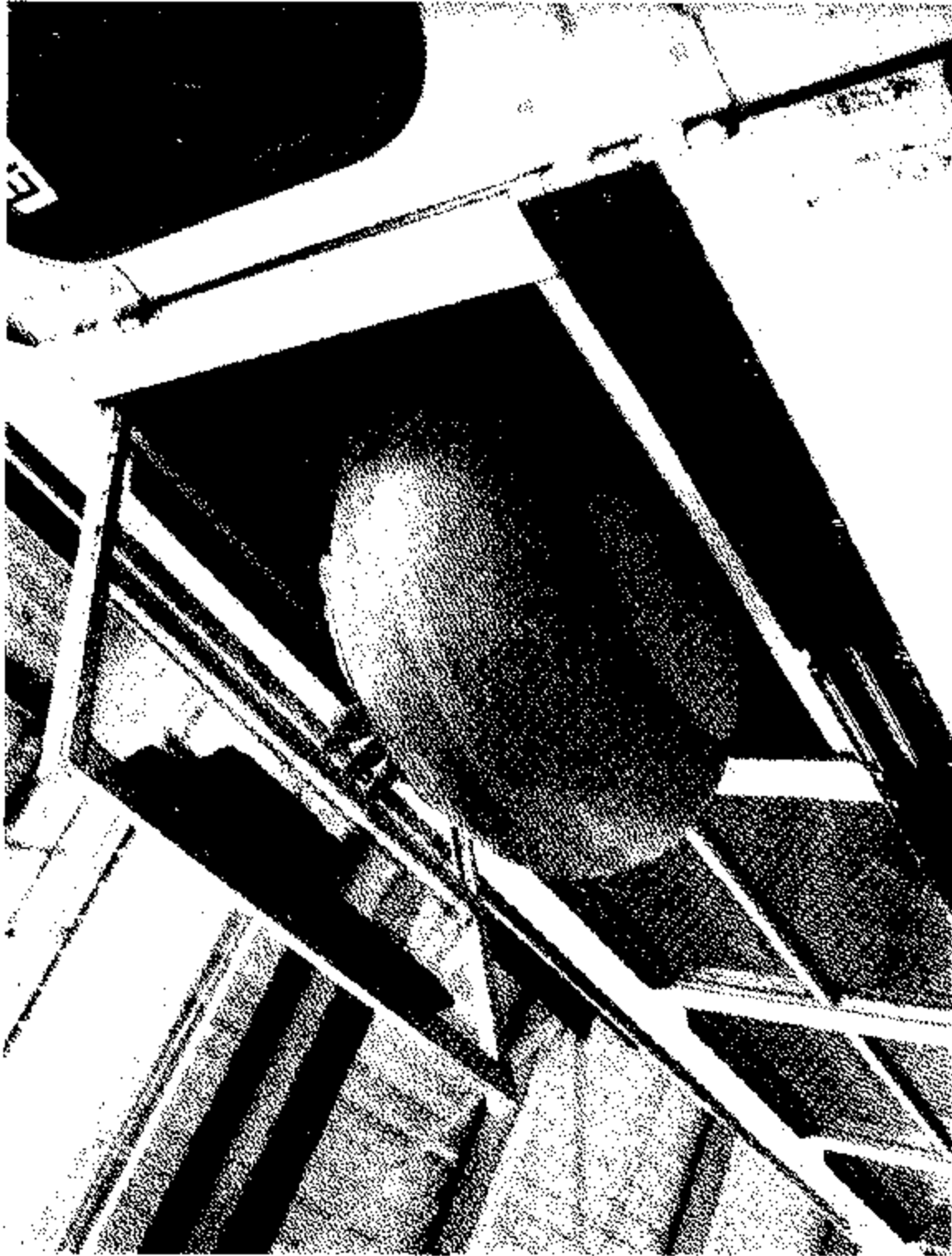
NHTSA No.: C30900



Exit Opened After Roof Loading is Attached with Parallelepiped in Place

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

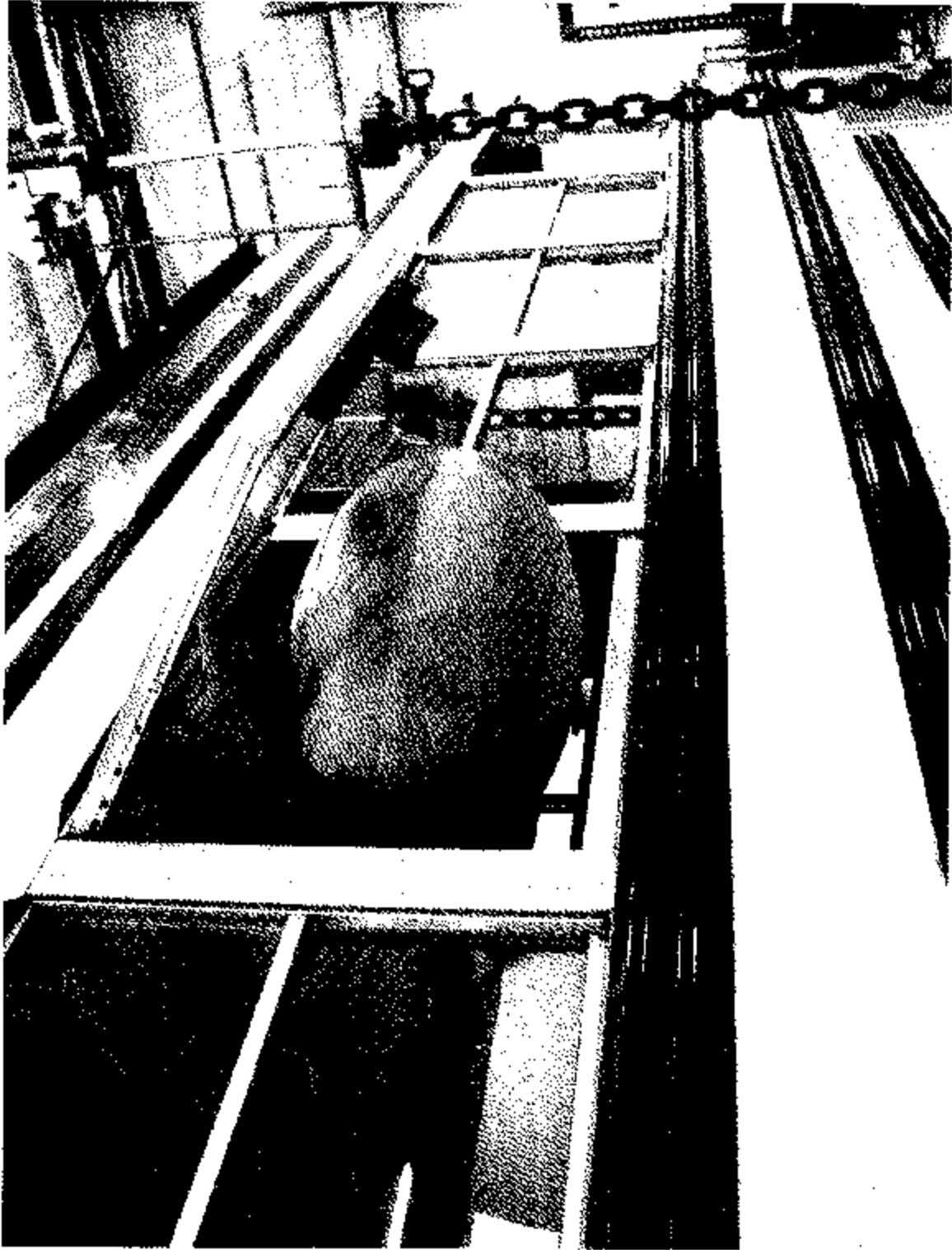
NHTSA No.: C30900



LF Exit Opened After Roof Loading is Attained with Measuring Device in Place

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

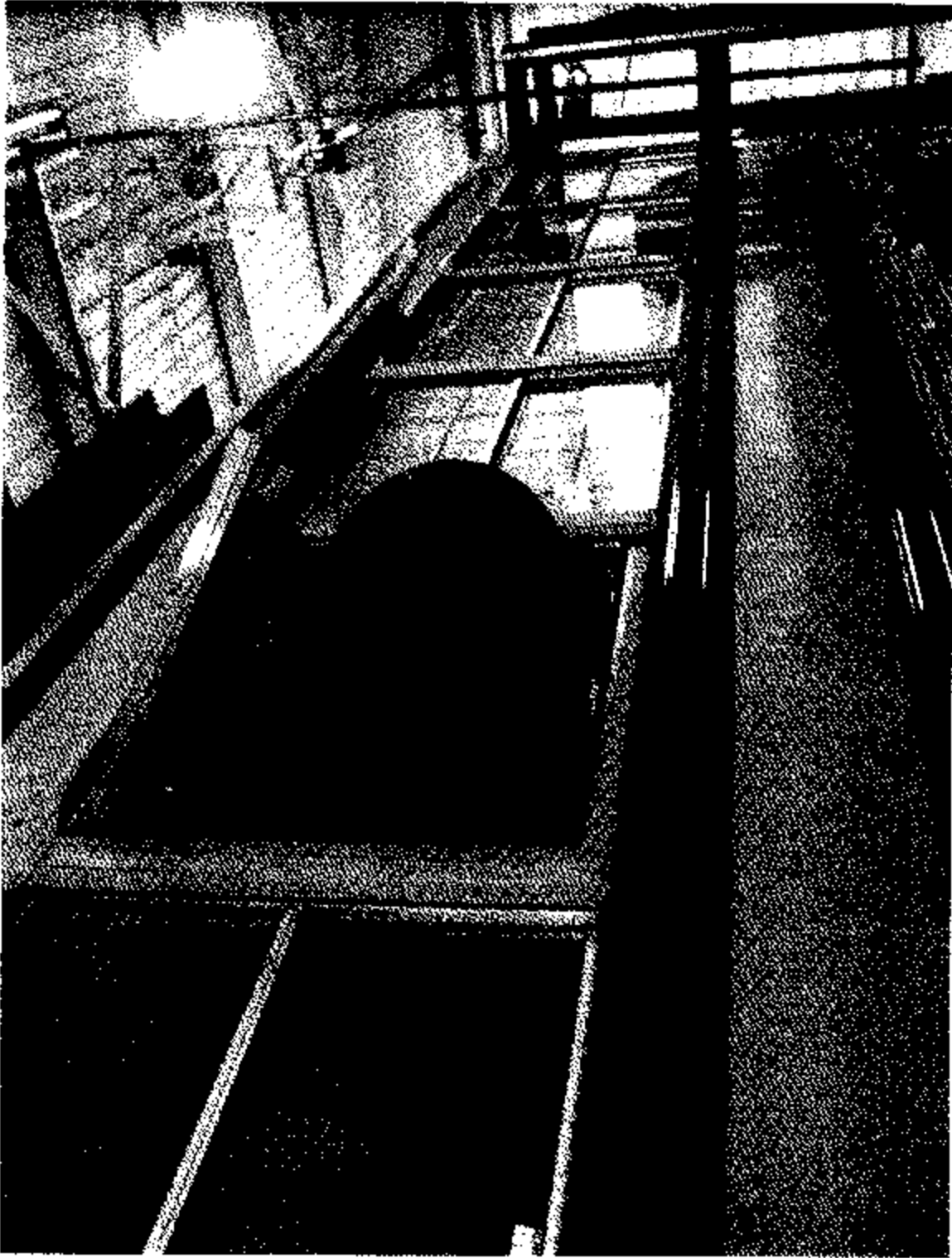
NHTSA No.: C30900



LR Exit Opened After Roof Loading is Attained with Measuring Device in Place

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

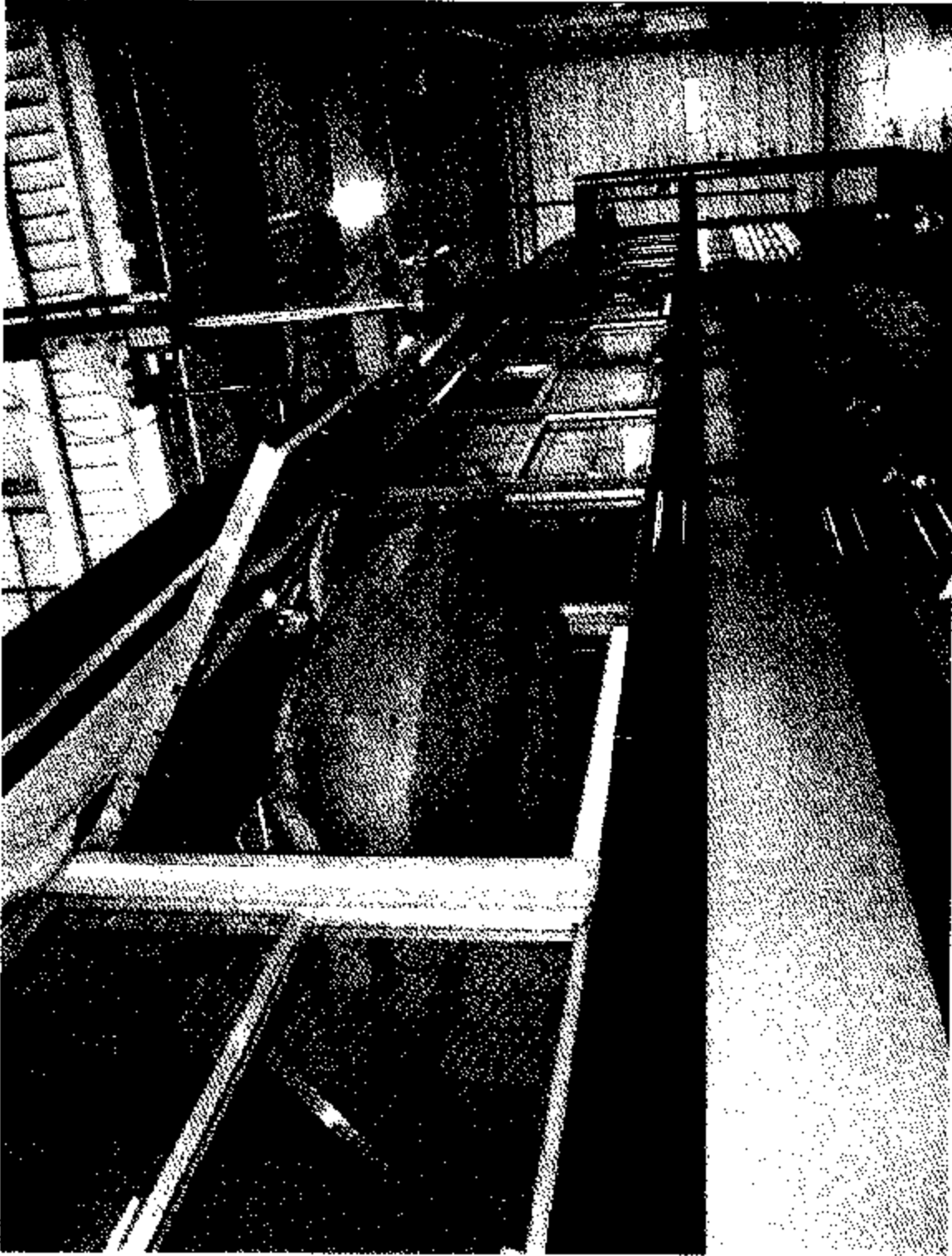
NHTSA No.: C30900



RF Exit Opened After Roof Loading is Attained with Measuring Device in Place

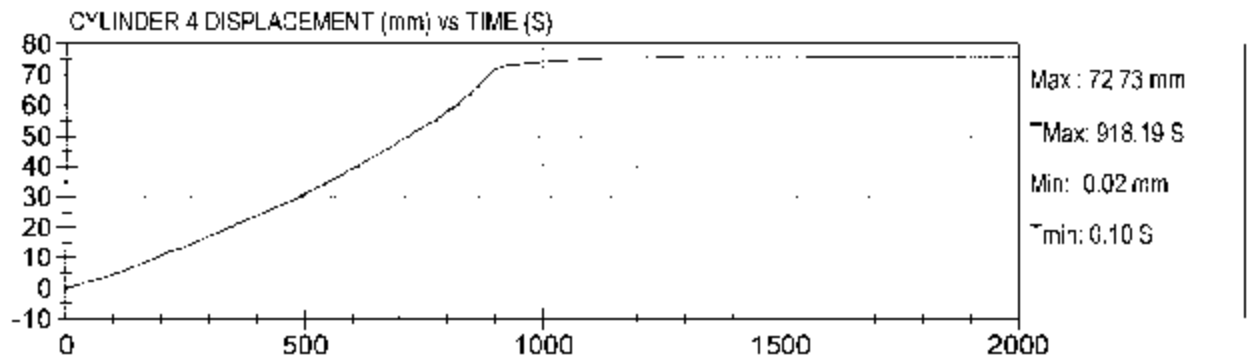
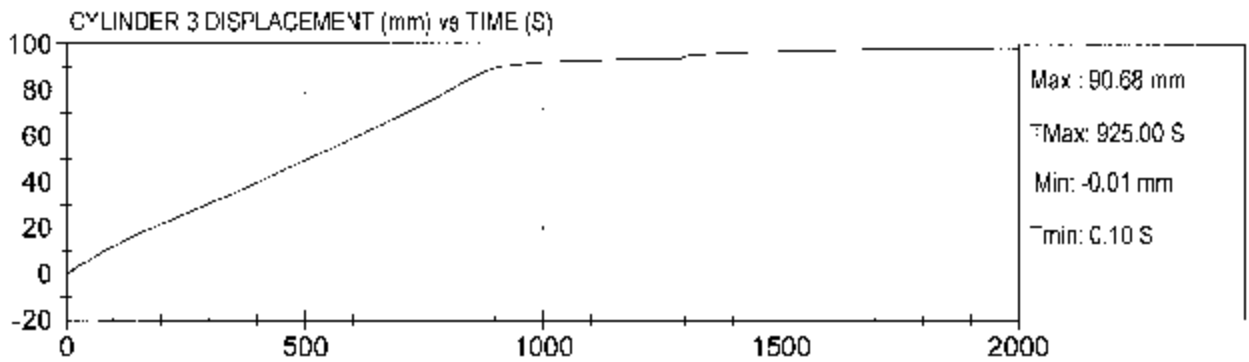
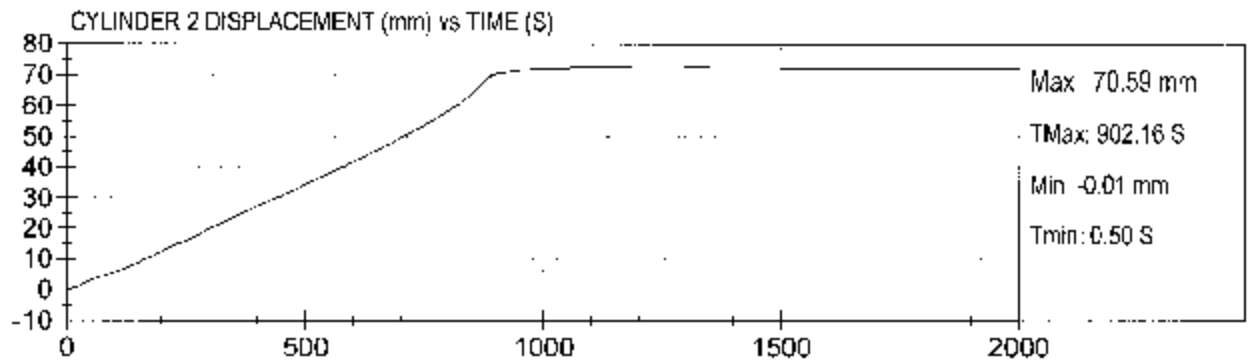
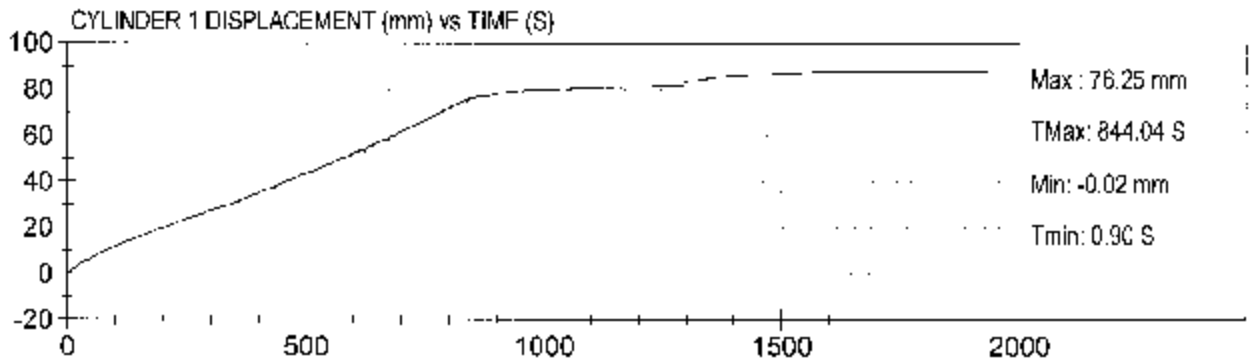
Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 220

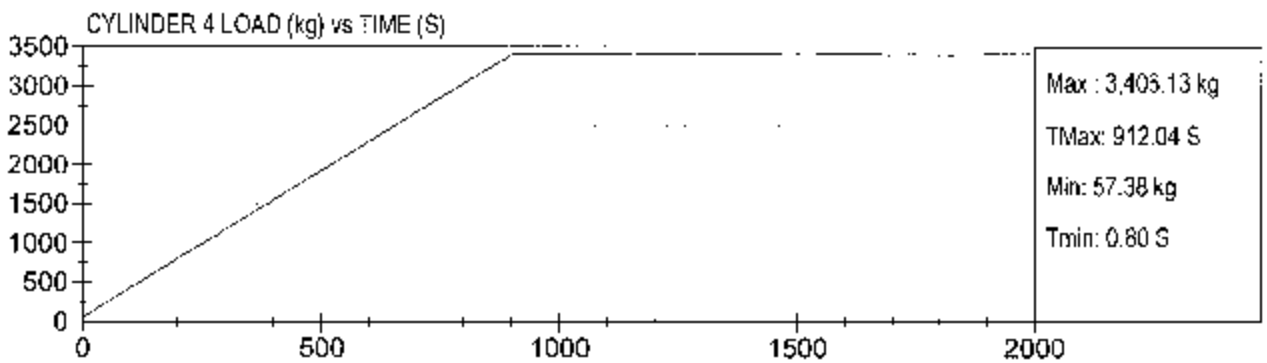
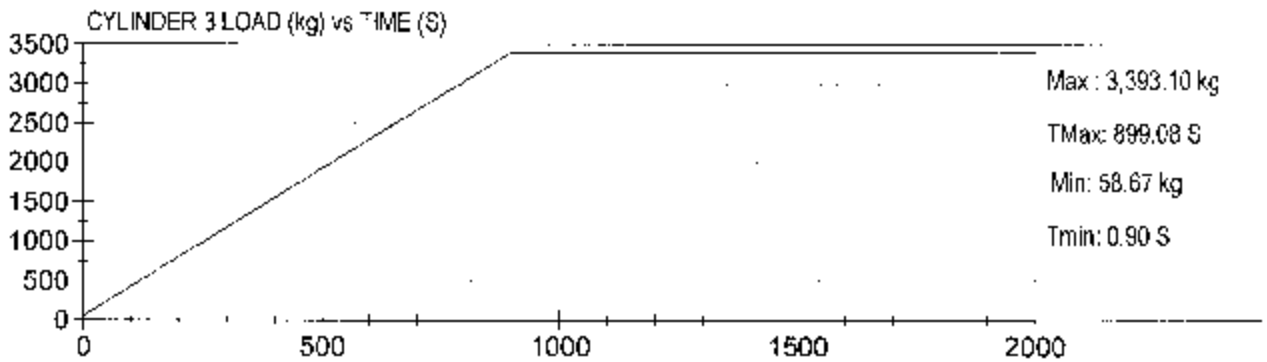
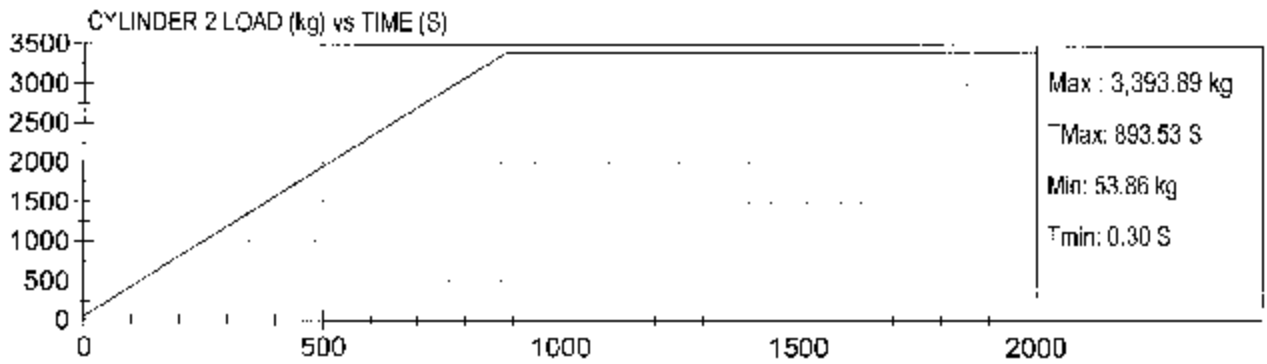
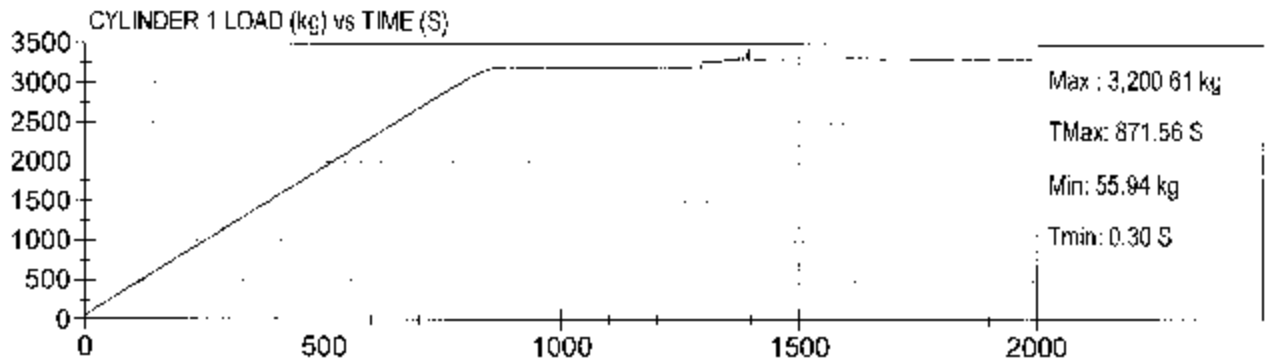
NHTSA No.: C30900



RR Exit Opened After Roof Loading is Attained with Measuring Device in Place

**SECTION 6
TEST PLOTS**







Test Desc: FMVSS 220
NHTSA NO: C30900

Test Date: 8-7-03
Vehicle ID: Blue Bird

