

REPORT NUMBER: 221-MGA-03-001

**SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 221
SCHOOL BUS BODY JOINT STRENGTH**

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

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53106**



Final Report Date: October 2, 2003

FINAL REPORT

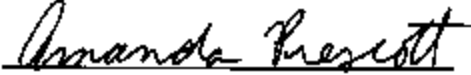
**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW, ROOM 6115 (NVS-220)
WASHINGTON, D.C. 20590**

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Prepared by:  Date: October 2, 2003
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Reviewed by:  Date: October 2, 2003
Michael Janovicz, Program Manager

FINAL REPORT ACCEPTED BY:



10/14/03
Date of Acceptance

Technical Report Documentation Page

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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-221-02 for the determination of FMVSS 221 compliance. TEST FAILURES: NONE					
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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 Procedures TP-221-02 to determine compliance to the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 221, "School Bus Body Joint Strength".

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-02-D-01057.

SECTION 2 TEST PROCEDURE

The MY2003 Blue Bird All American School Bus, NHTSA No. C30900, was subjected to FMVSS 221 testing on August 12, 2003.

The joint samples were selected in conjunction with the Contract Officer's Technical Representative (COTR). Six 12 x 48 inch samples were selected. They were removed from the bus using a metal shear and/or SawzAll type of cutter.

After each sample area had been removed from the bus, the sample was cut to the specific dimensions. Each specimen was carefully shaped to the final size using supports as specified in FMVSS 221. Additionally, temperature monitoring stickers were placed at the specified locations of each sample to ensure the sample temperature did not exceed 140°F during the shaping operation.

The samples were tested using the MGA 50,000 pound tensile tester. The force applied was measured directly at the upper clamp. The upper clamp was attached to the load cell and the lower clamp was attached to the load frame.

The gripping devices were fabricated from 3" x 3" angle iron. Slots were milled on the face that mounted to the machine, in order to allow for fore and aft movement of the clamps. This allowed the specimens to be fixtured so that the axis of the test specimen coincided with the centerline axis of the tensile tester heads.

The test specimen was inserted in between the grips, and the grips were then bolted together using 7 size 1/2" bolts. The bolts were inserted through one grip, through the test specimen, and then through the other grip. This prevented any slipping of the test sample in the grips, while fully distributing the clamping force across the entire end width of the test sample. Post test examination of the specimens indicated that no load was applied to the clamp mounting holes.

The rate of load application was 1/4 inch per minute. The force and displacement were recorded and displacement vs. time was plotted to monitor the displacement rate.

SECTION 3
TEST DATA SUMMARY

A total of six samples were tested for this vehicle. The samples were selected from the Right Rear Interior Side, Right Exterior Side, Left Mid Exterior Side, Left Mid Interior Side, Left Mid Interior Roof and Right Mid External Roof.

	Maximum Load (N)	60% of Material Strength (N)	PASS/FAIL
Right Rear Interior Side (1)	26,040.9	19,438.6	PASS
Right Exterior Side (2)	42,956.3	29,322.9	PASS
Left Mid Exterior Side (3)	35,132.9	29,322.9	PASS
Left Mid Interior Side (4)	31,611.4	18,783.9	PASS
Left Mid Interior Roof (5)	45,831.2	29,919.5	PASS
Right Mid External Roof (6)	40,997.0	27,567.7	PASS

The maximum forces measured, and the displacement rate used, are provided in Section 7. The photographs taken from the samples are provided in Sections 6 and 8.

SECTION 4
COMPLIANCE TEST DATA

The following data sheets document the results of FMVSS 221 testing on the MY2003 Blue Bird All American School Bus, NHTSA No. C30900.

**DATA SHEET 1
ADMINISTRATIVE DATA SHEET**

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

NHTSA No.: **C30900**
 Test Date: **8/12/03**

INCOMPLETE VEHICLE (IF APPLICABLE)

Manufacturer:	
Model:	
VIN:	
Build Date:	
Certification Date:	

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	Blue Bird Corporation
Make/Model:	All American
VIN:	1BABNBPA33F210494
NHTSA No.:	C30900
Color:	Yellow
GVWR:	16,420 kg
Build Date:	8/02
Certification Date:	

DATES

Vehicle Receipt:	November 14, 2003
Start of Compliance Test:	August 12, 2003
Completion of Compliance Test:	August 13, 2003

COMPLIANCE TEST:

All tests were performed in accordance with the references outlined in TP-221-02.

Recorded By: _____

John Walsh

Approved By: _____

Michael J. [Signature]

Date: October 2, 2003

DATA SHEET 2
SUMMARY OF DATA

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

NHTSA No.: **C30900**
Test Date: **8/12/03**

Joint Specimen Identification	Joint Location Description and Number	Joint Load Reqmt (N) (60%)	Max. Load at Joint Separation (N)	Calculated Material Strength (N)	PASS/FAIL
BLSRRI187BRV	Right Rear Interior Side (1)	19,438.6	26,040.9	32,397.5	PASS
BLSRRE286BRV	Right Rear Exterior Side (2)	29,322.9	42,956.3	48,871.5	PASS
BLSLME386BRV	Left Mid Exterior Side (3)	29,322.9	35,132.9	48,871.5	PASS
BLSLMI488BRV	Left Mid Interior Side (4)	18,783.9	31,611.4	31,306.4	PASS
BLRCMI584BRH	Left Mid Interior Roof (5)	29,919.5	45,831.2	49,866.1	PASS
BLRCME688BAH	Right Mid External Roof (6)	27,567.7	40,997.0	45,946.8	PASS

Comments: NONE

Recorded By: 

Approved By: 

Date: October 2, 2003

DATA SHEET 3

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

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

NHTSA No.: **C30900**
 Test Date: **8/12/03**

Specimen Description:	Right Rear Interior Side (1)
Joint Number:	BLSRRI187BRV

	Weaker Member	Stronger Member
Material	Textured Galvalume AZ50 to ASTM A792	—
Tensile Strength (MPa)	310.2	—
Gage/Thickness (mm)	- / 0.64	—
Fastener Holes (No./Diameter - mm)	7 / 5.53	—
Net Area (Sq. mm)	104.5	—
Material Strength (N)	32,397.6	—
60% of Material Strength (N)	19,438.6	—
Maximum Load From Tensile Test of Joint (N)	26,040.9	—
PASS/FAIL	PASS	—

1. Rivet Spacing 25 mm

Comments: Joint Number Should Read BLSRRI187BRV

Recorded By:

Approved By:

Date: October 2, 2003

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

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

NHTSA No.: **C30900**
 Test Date: **8/12/03**

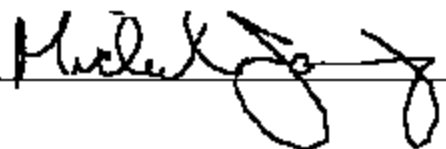
Specimen Description:	Right Rear Exterior Side (2)
Joint Number:	BLSRRE286BRV

	Weaker Member	Stronger Member
Material	CRSZC ASTM A446 Grade A	--
Tensile Strength (MPa)	310.2	--
Gage/Thickness (mm)	-- / 0.91	--
Fastener Holes (No./Diameter -mm)	6 / 5.16	--
Net Area (Sq.mm)	157.4	--
Material Strength (N)	48,871.5	--
60% of Material Strength (N)	29,322.9	--
Maximum Load From Tensile Test of Joint (N)	42,956.3	--
PASS/FAIL	PASS	--

1. Rivet Spacing 30 mm

Comments: NONE

Recorded By: 

Approved By: 

Date: October 2, 2003

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

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


NHTSA No.: C30900
 Test Date: 8/12/03

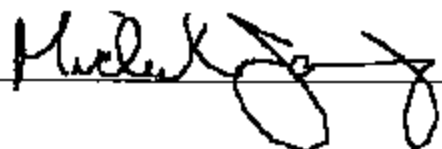
Specimen Description:	Left Mid Exterior Side (3)
Joint Number:	BLSLME386BRV

	Weaker Member	Stronger Member
Material	CRSZC ASTM A448 Grade A	—
Tensile Strength (MPa)	310.2	--
Gage/Thickness (mm)	-- / 0.91	---
Fastener Holes (No./Diameter - mm)	6 / 5.16	—
Net Area (Sq. mm)	157.4	—
Material Strength (N)	48,871.5	—
60% of Material Strength (N)	29,322.9	--
Maximum Load From Tensile Test of Joint (N)	35,132.9	--
PASS/FAIL	PASS	--

1. Rivet Spacing 30 mm

Comments: Joint Number on Photo Should Read BLSLME386BRV.

Recorded By: 

Approved By: 

Date: October 2, 2003

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

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

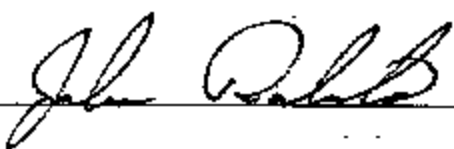
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 Test Date: **8/12/03**

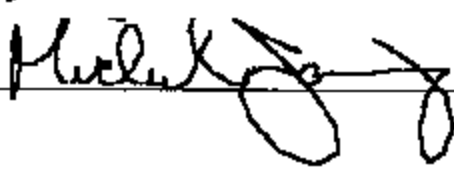
Specimen Description:	Left Mid Interior Side (4)
Joint Number:	BLSLMI488BRV

	Weaker Member	Stronger Member
Material	Textured Galvalume AZ50 to ASTM A792	---
Tensile Strength (MPa)	310.2	---
Gage/Thickness (mm)	- / 0.64	---
Fastener Holes (No./Diameter - mm)	8 / 5.53	---
Net Area (Sq. mm)	100.6	---
Material Strength (N)	31,306.4	---
60% of Material Strength (N)	18,783.9	---
Maximum Load From Tensile Test of Joint (N)	31,611.4	---
PASS/FAIL	PASS	---

1. Rivet Spacing 25 mm

Comments: NONE

Recorded By: 

Approved By: 

Date: October 2, 2003

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN


Test Vehicle:	2003 Blue Bird All American School Bus	NHTSA No.:	C30900
Test Lab:	MGA Research-Wisconsin Operations	Test Date:	8/12/03

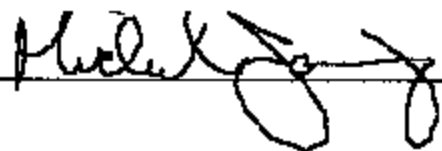
Specimen Description:	Left Mid Interior Roof (5)
Joint Number:	BLRCMI584BRH

	Weaker Member	Stronger Member
Material	CRSZC ASTM A446 Grade A	--
Tensile Strength (MPa)	310.2	--
Gage/Thickness (mm)	- / 0.91	--
Fastener Holes (No./Diameter - mm)	4 / 6.86	--
Net Area (Sq. mm)	160.6	--
Material Strength (N)	49,866.1	--
60% of Material Strength (N)	29,919.5	--
Maximum Load From Tensile Test of Joint (N)	45,831.2	--
PASS/FAIL	PASS	--

1. Rivet Spacing 50 mm

Comments: NONE

Recorded By: 

Approved By: 

Date: October 2, 2003

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN


Test Vehicle:	2003 Blue Bird All American School Bus	NHTSA No.:	C30900
Test Lab:	MGA Research-Wisconsin Operations	Test Date:	8/12/03

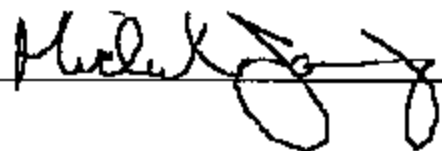
Specimen Description:	Right Mid Exterior Roof (6)
Joint Number:	BLRCME688BAH

	Weaker Member	Stronger Member
Material	CRSZC ASTM A448 Grade A	--
Tensile Strength (MPa)	310.2	--
Gage/Thickness (mm)	-- / 0.91	--
Fastener Holes (No./Diameter - mm)	8 / 5.16	--
Net Area (Sq. mm)	148.4	--
Material Strength (N)	45,946.8	--
60% of Material Strength (N)	27,567.7	--
Maximum Load From Tensile Test of Joint (N)	40,997.0	--
PASS/FAIL	PASS	--

1. Double Rows of Rivets Staggered Spacing 55 mm Each Row

Comments: NONE

Recorded By: 

Approved By: 

Date: October 2, 2003

**SECTION 5
INSTRUMENTATION AND EQUIPMENT LIST**

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

NHTSA No.: C30900
Test Date: 8/12/03

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Computer	HP	Vectra / US03263612	--	--
A/D Interface	Metrabyte	DAS-1802	--	--
Load Cell	Interface	138773	6/19/03	12/19/03
Linear Potentiometer	Amelek	17167	8/9/03	2/9/04
Digital Caliper	Mitutoyo	CD-6"GS/ 0004174	10/18/02	10/18/03
Steel Tape	Stanley	Powerlock / 149	5/30/03	11/30/03
Temp. Recorder	Dickson	TR320 / 03039010	2/1/03	2/1/04
Temp. Stickers	McMaster- Carr	60°C 5952K21	One Time Usage	--

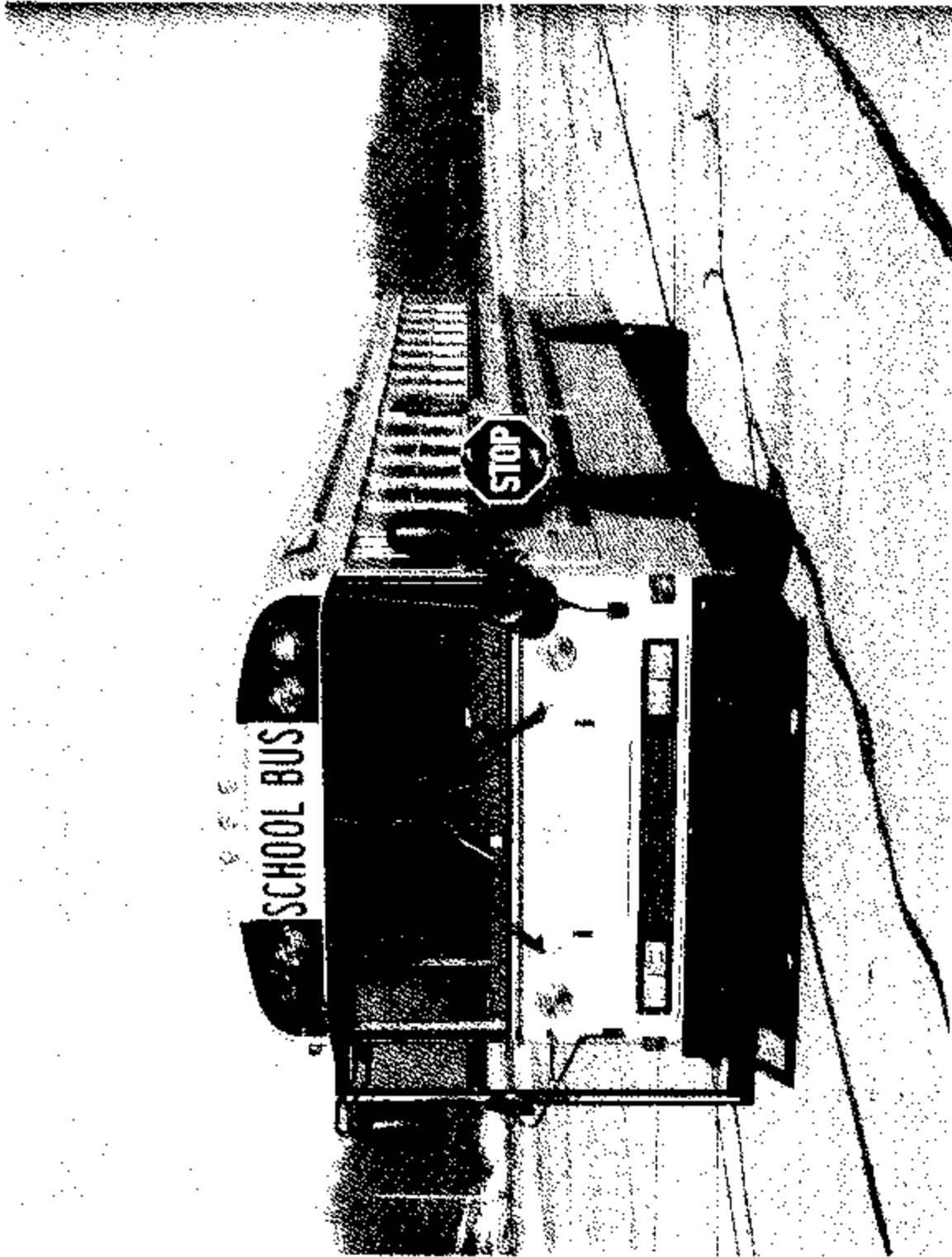
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Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

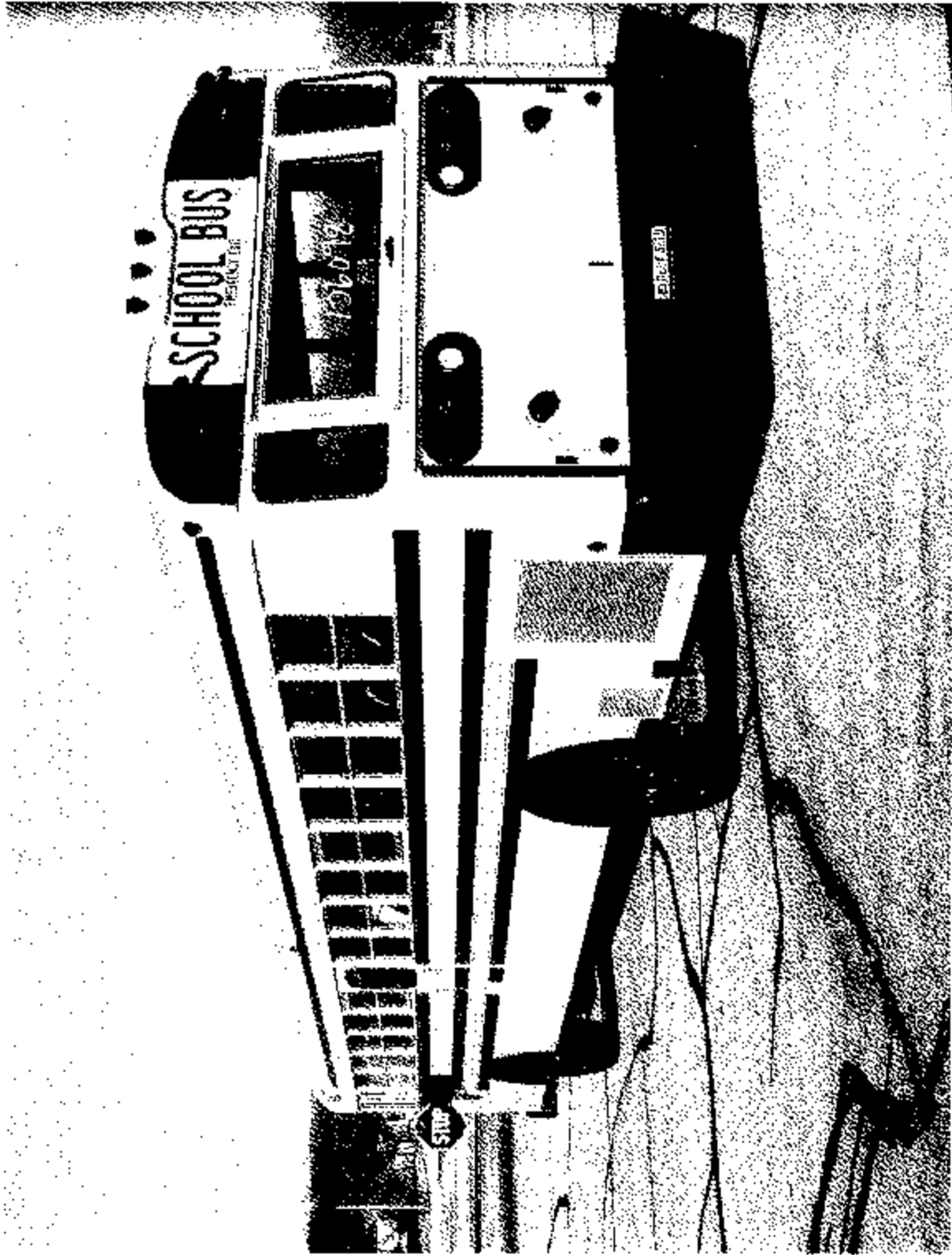
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Left Front 3/4 View of School Bus

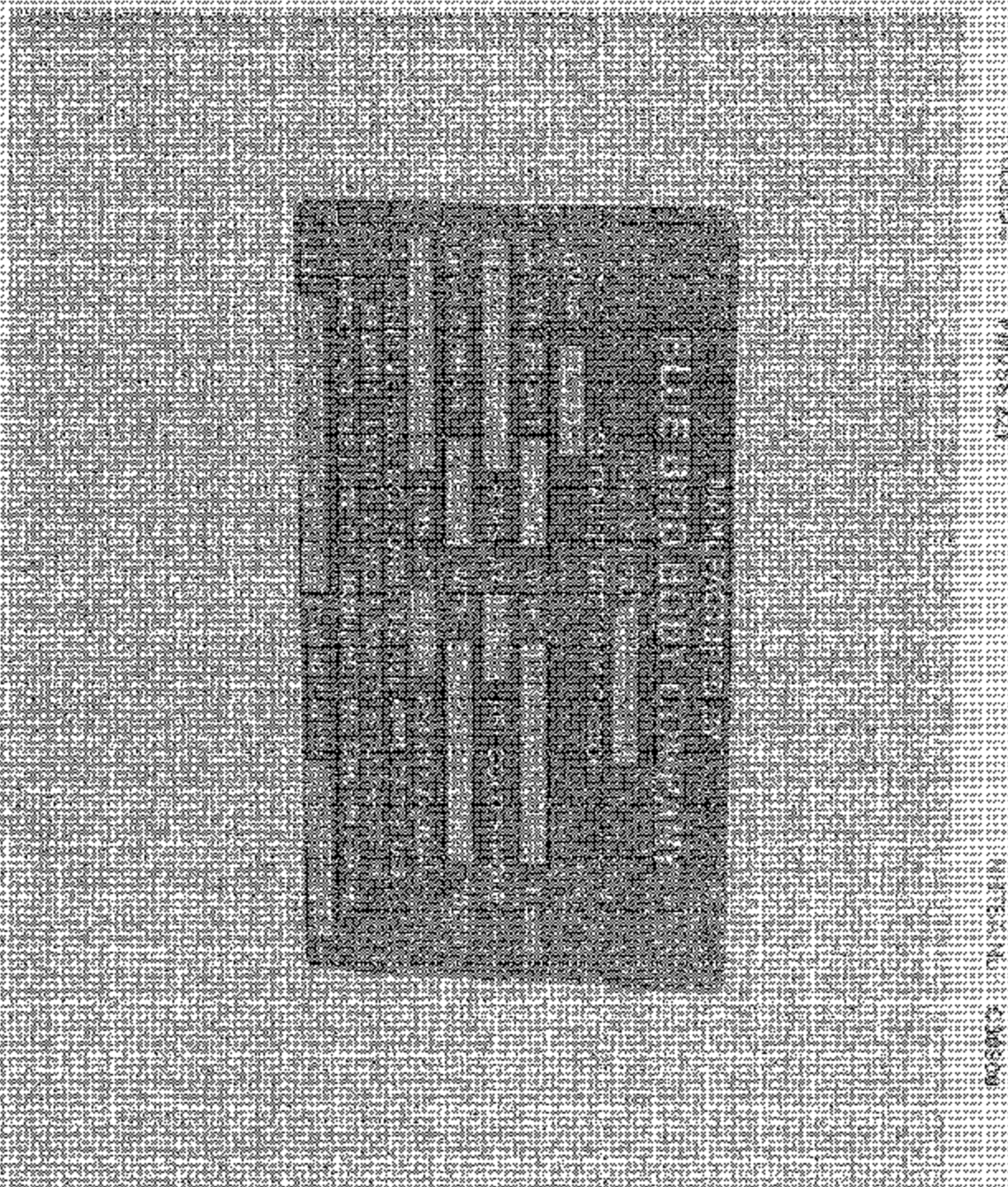
Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Left Rear 3/4 View of School Bus

ASIA

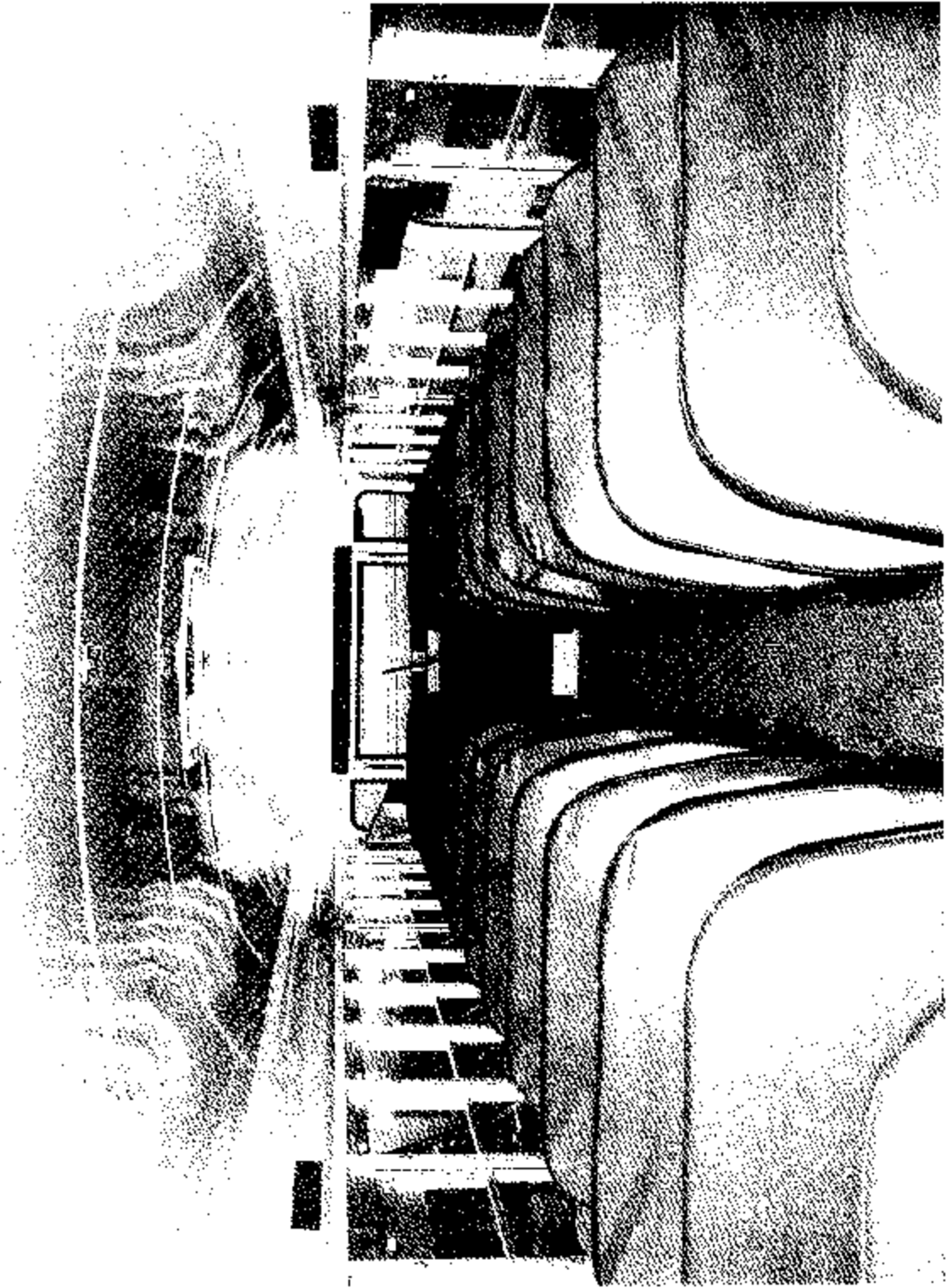


THE NEW YORK TIMES PHOTOGRAPH BY MICHAEL O'NEILL

PHOTO BY MICHAEL O'NEILL

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Front to Rear Interior View

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

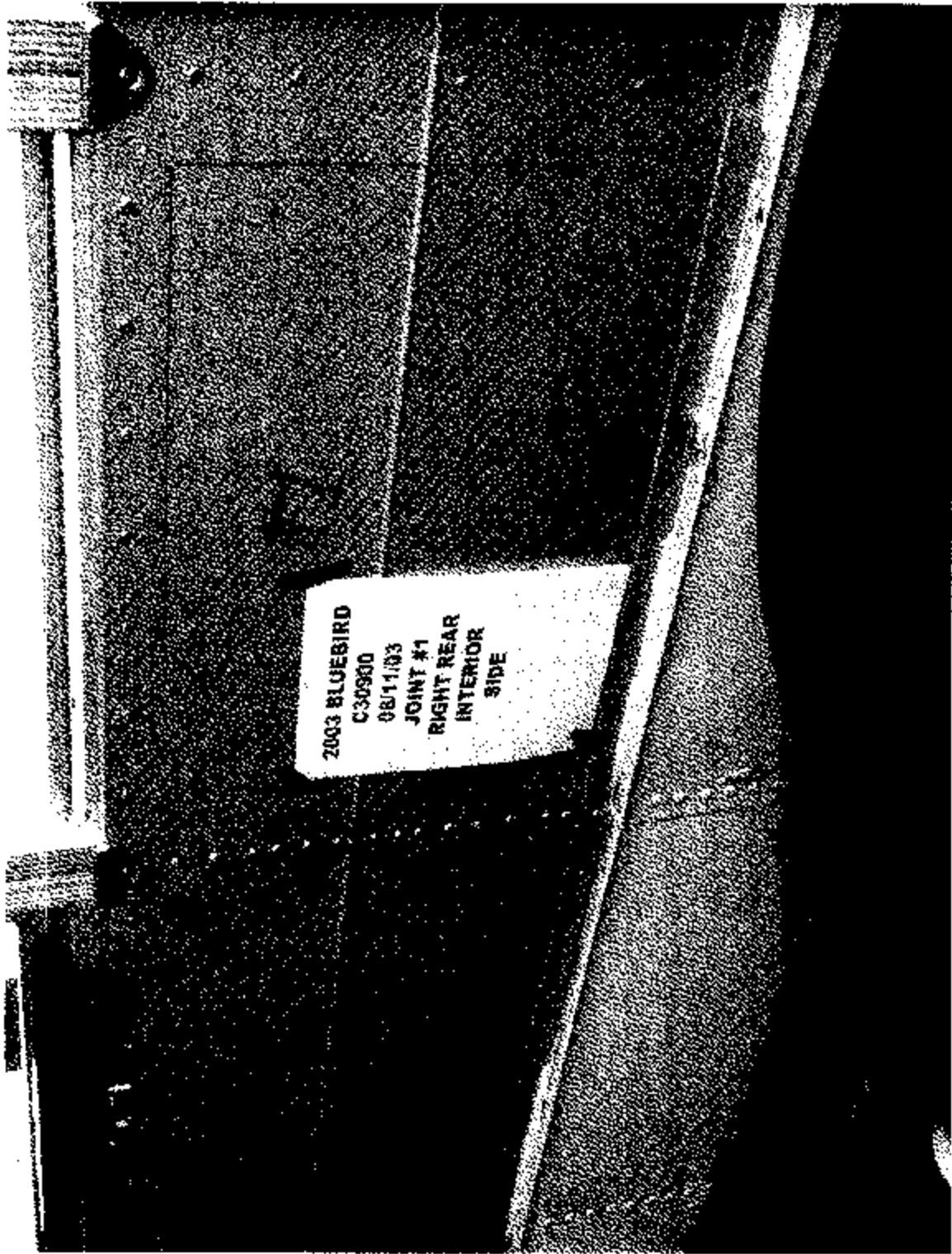
NHTSA No.: C30900



Rear to Front Interior View

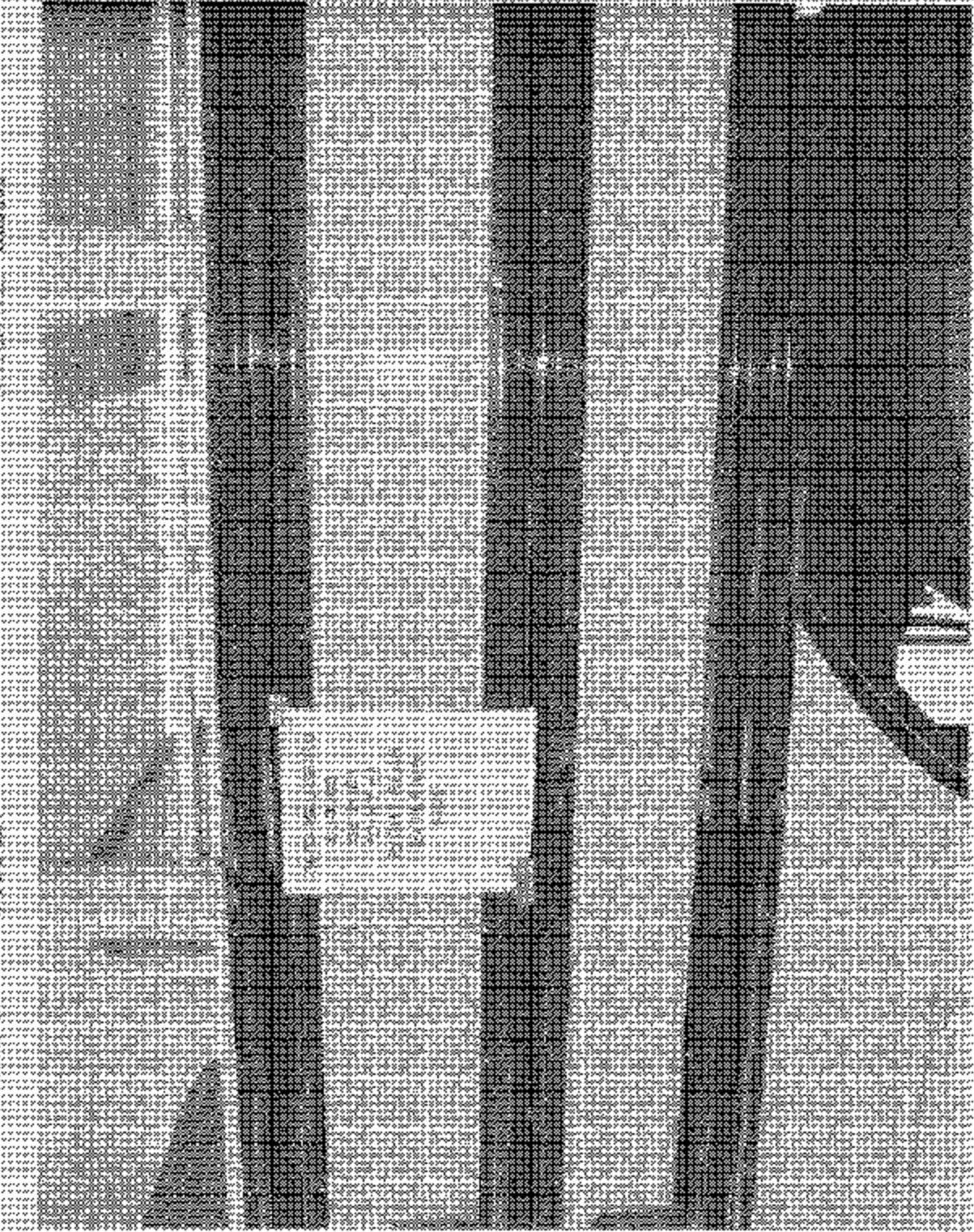
Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Sample #1 Marked on Bus Before Cutout

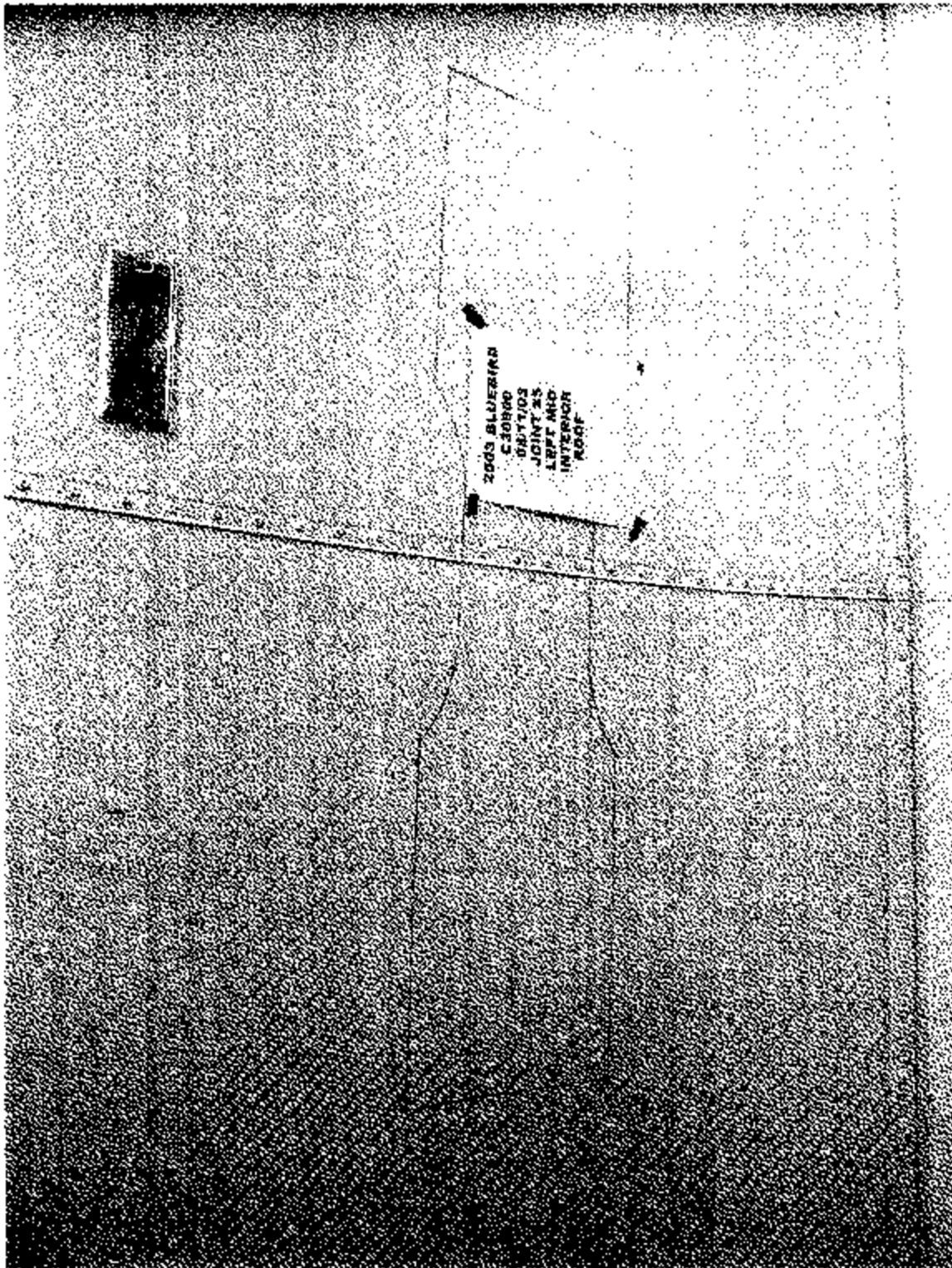
RECOVERING THE HISTORY OF THE 2003 BUS BURN AND THE 2003 BURN





Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

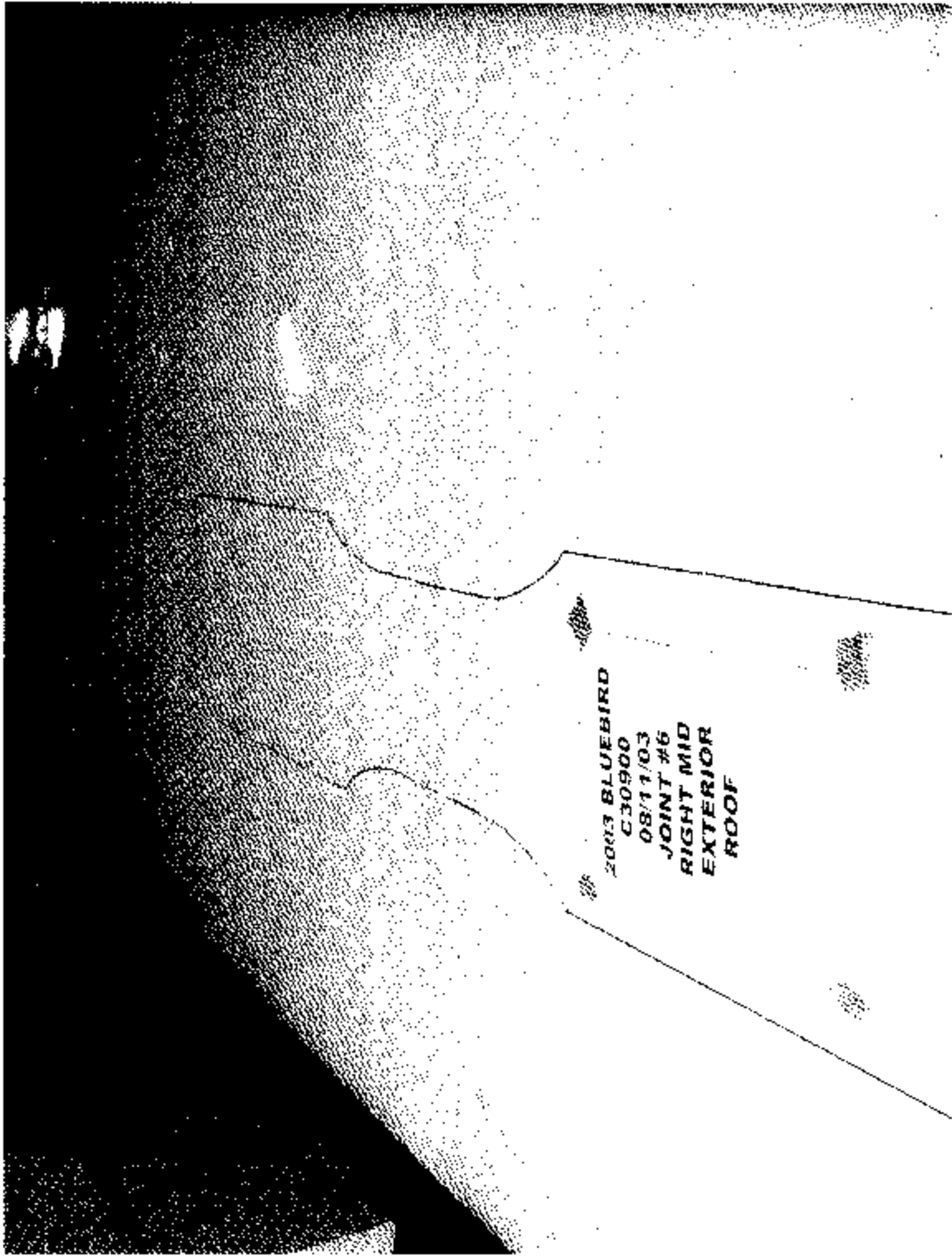
NHTSA No.: C30900



Sample #5 Marked on Bus Before Cutout

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

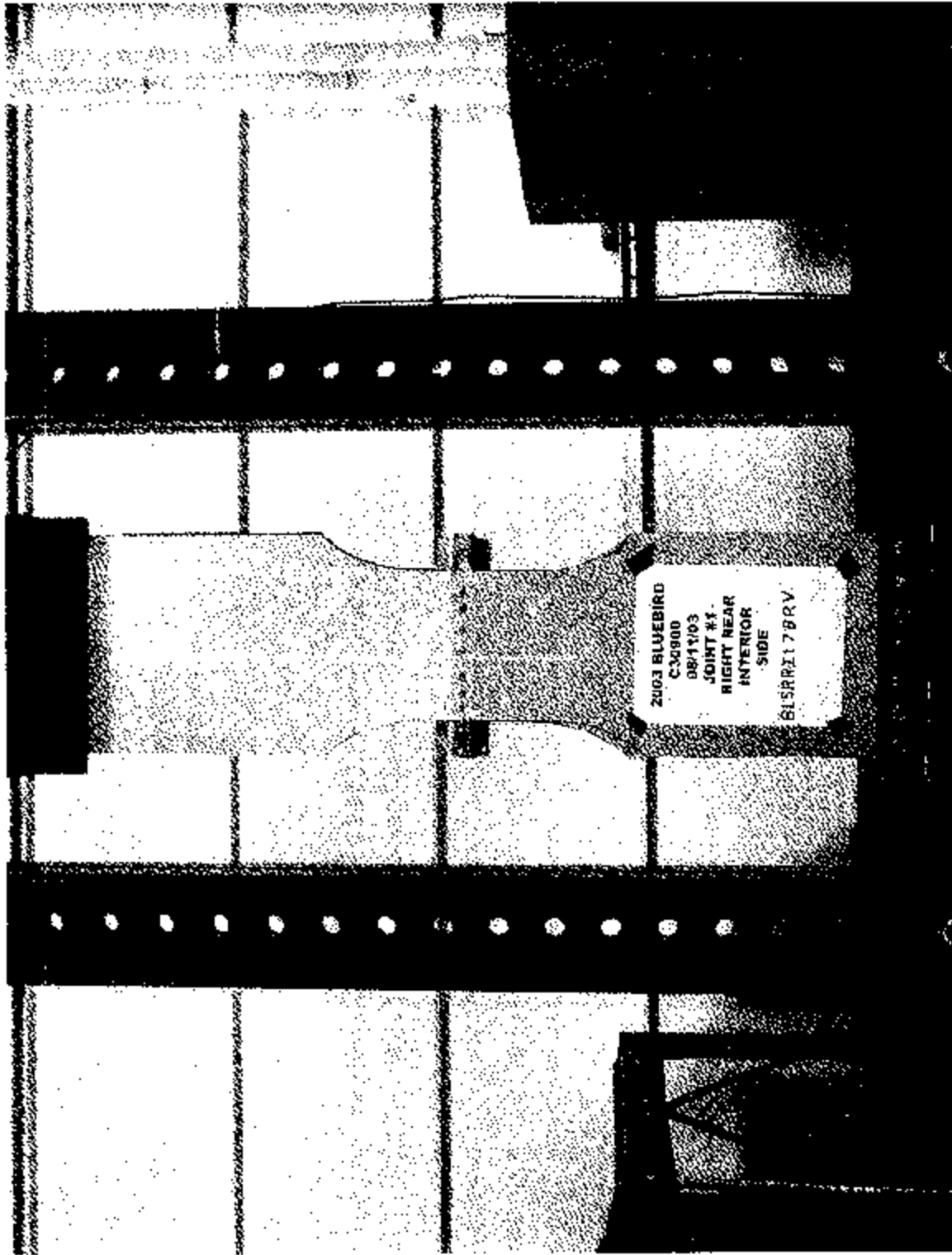
NHTSA No. C30900



Sample #6 Marked on Bus Before Cutout

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

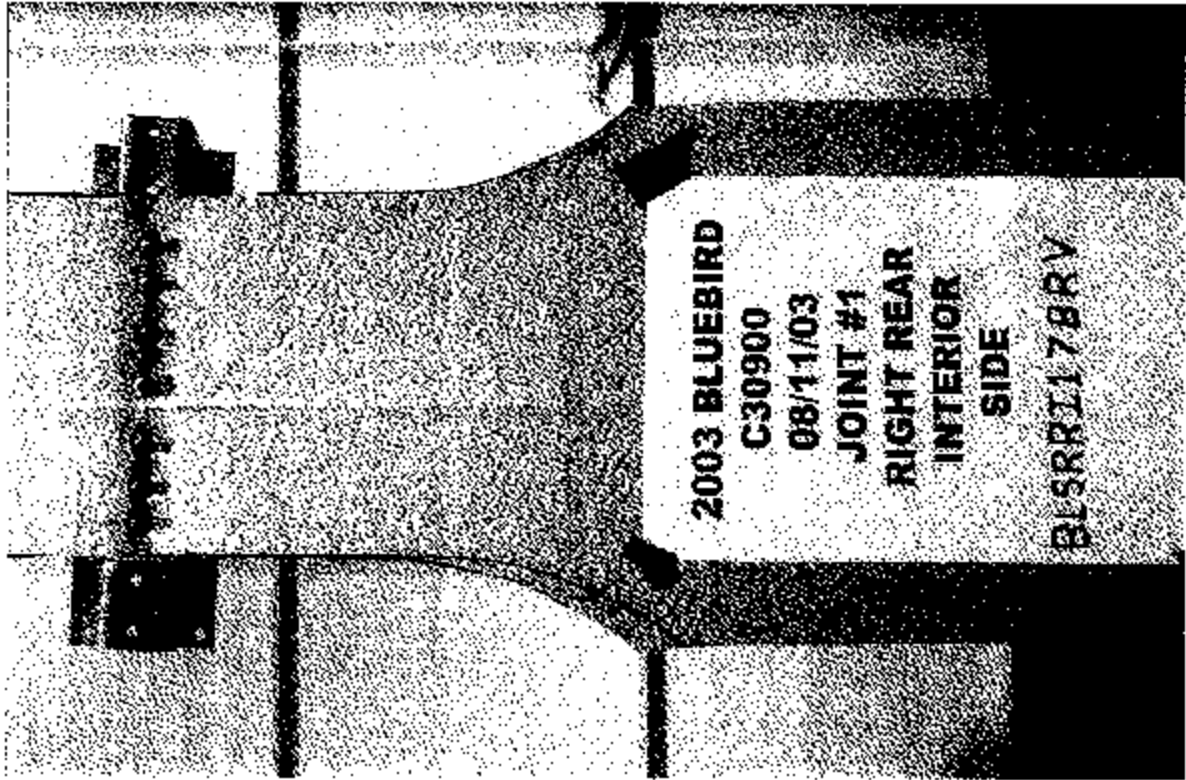
NHTSA No.: C30900



Sample #1 Installed in Test Machine (Pre-Test)

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

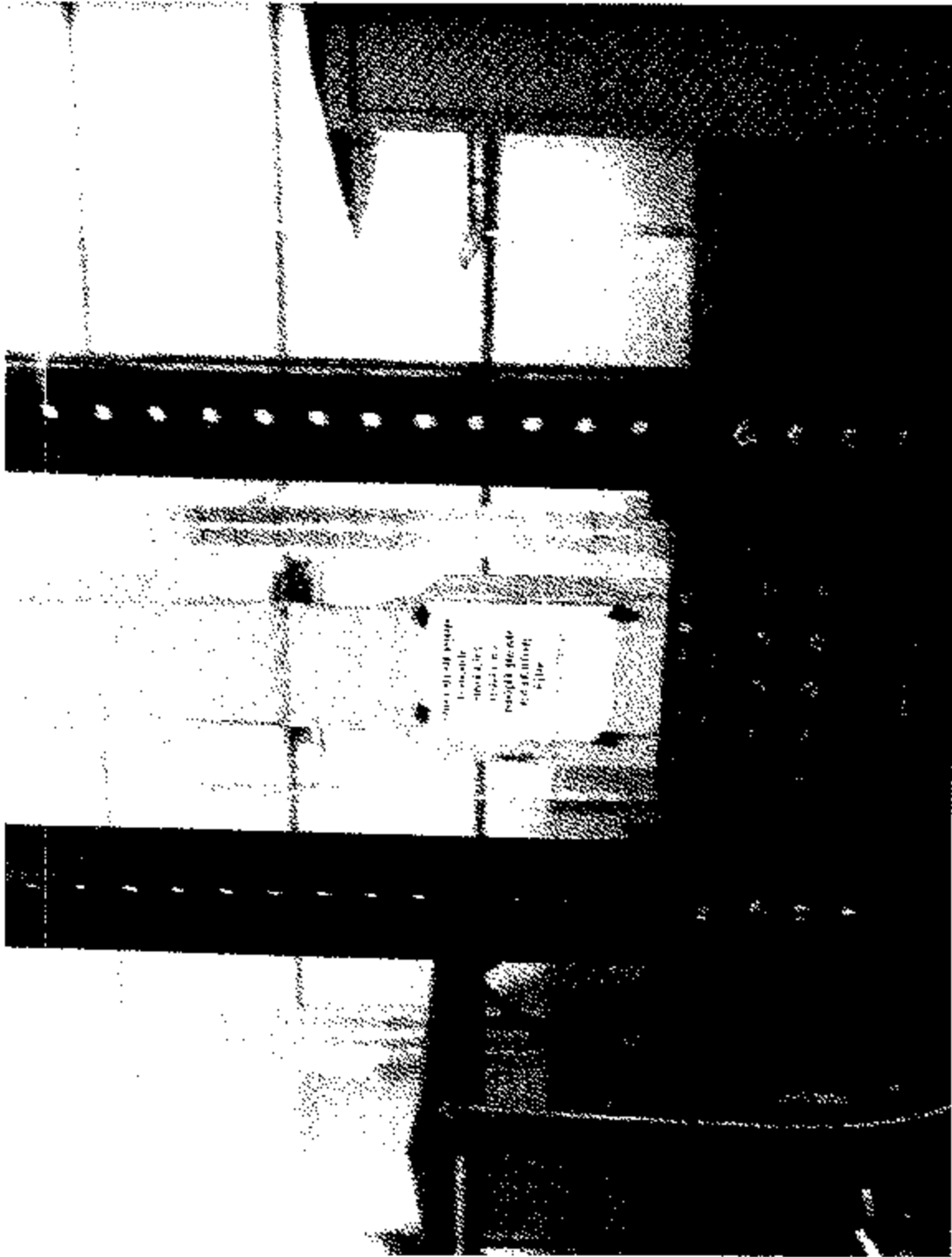
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Sample #1 Post-Test Separation

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

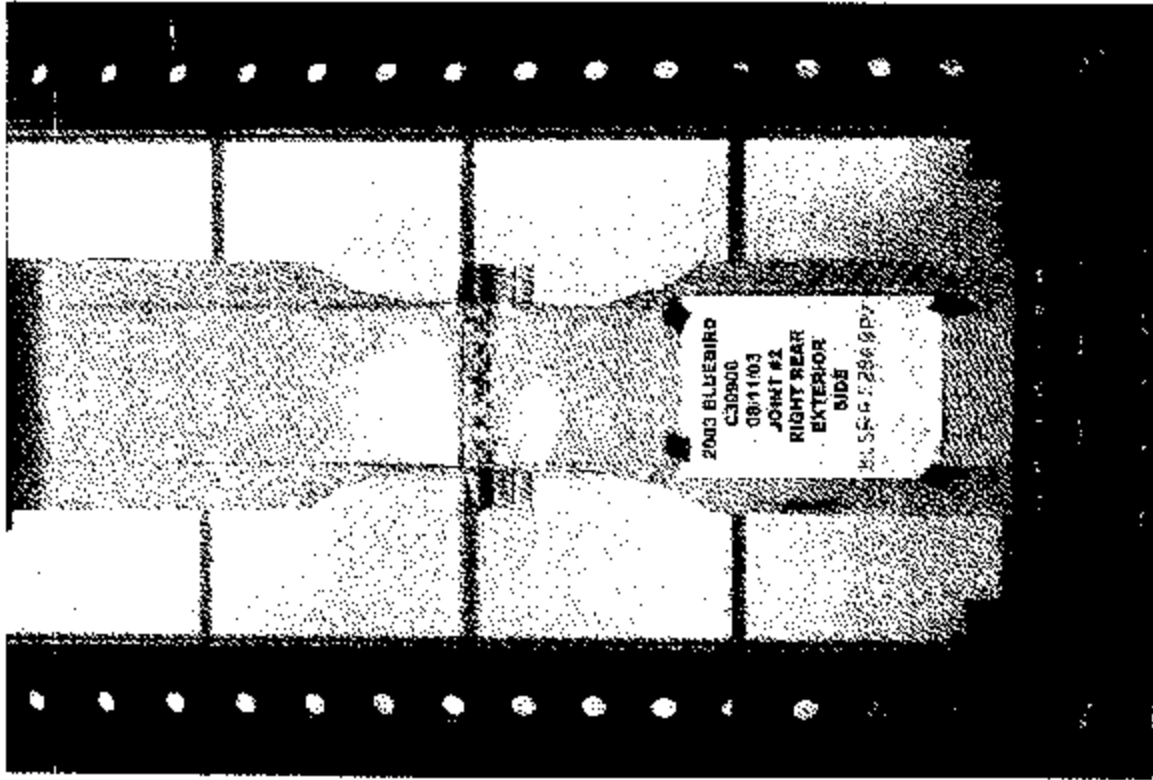
NHTSA No.: C30900



Sample #2 Installed in Test Machine (Pre-Test)

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

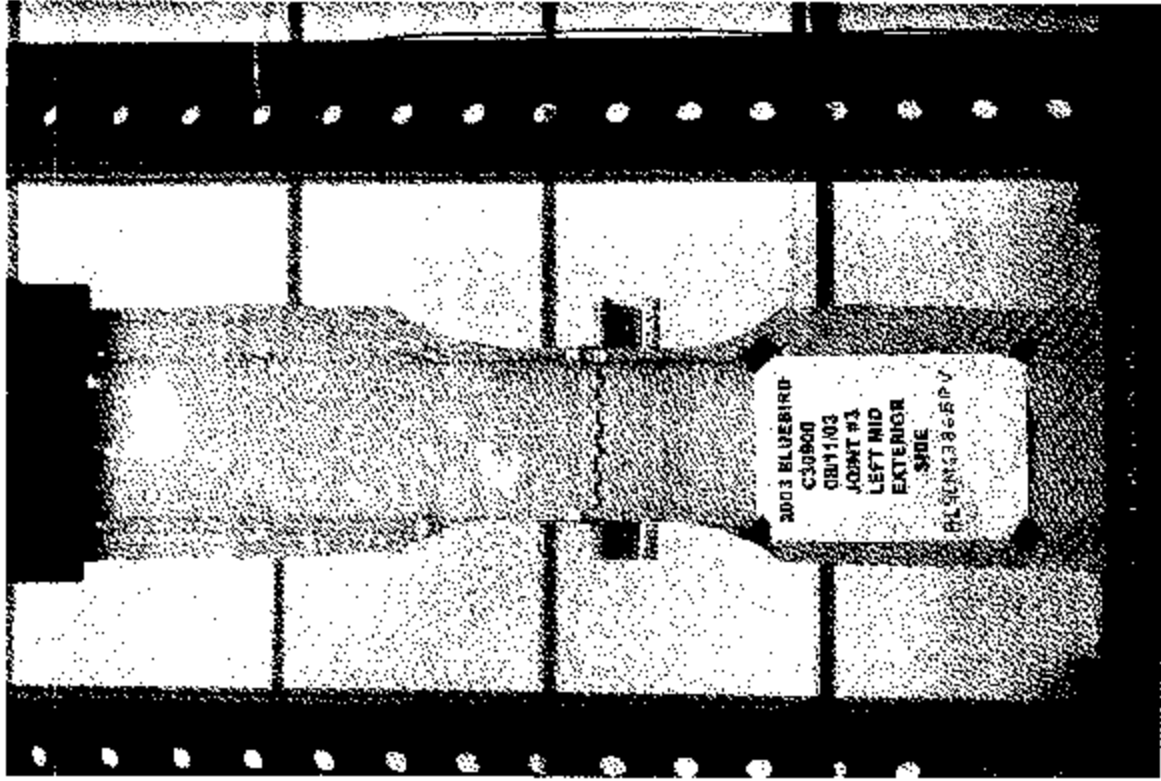
NHTSA No.: C30900



Sample #2 Post-Test Separation

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Sample #3 Installed in Test Machine (Pre-Test)

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

NHTSA No.: C30900

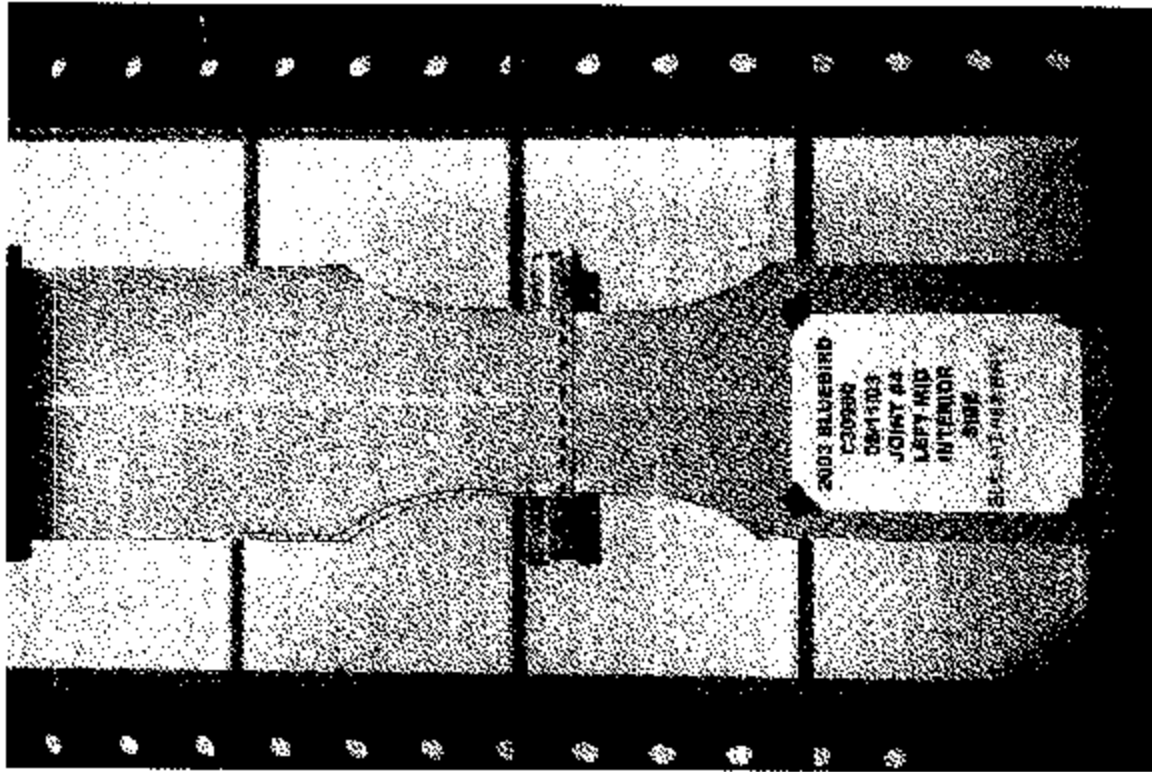


Sample #3 Post-Test Separation

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

NHTSA No.: C30900

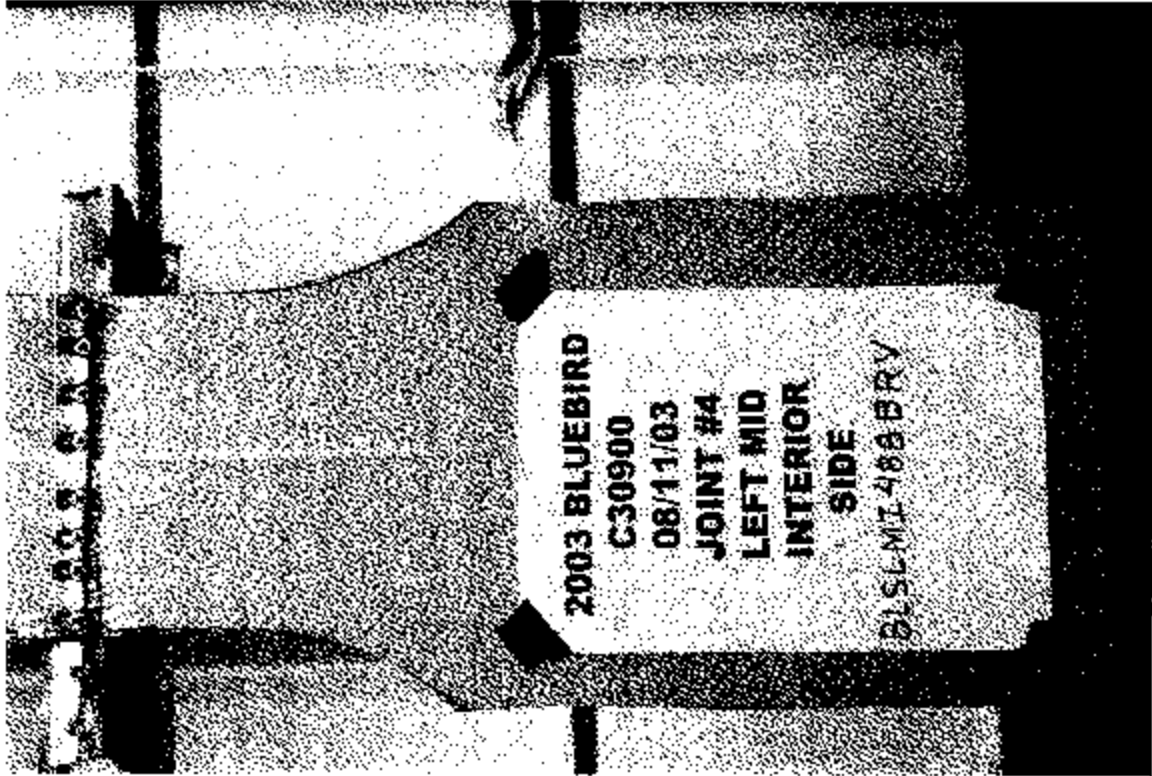


Sample #4 Installed in Test Machine (Pre-Test)

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

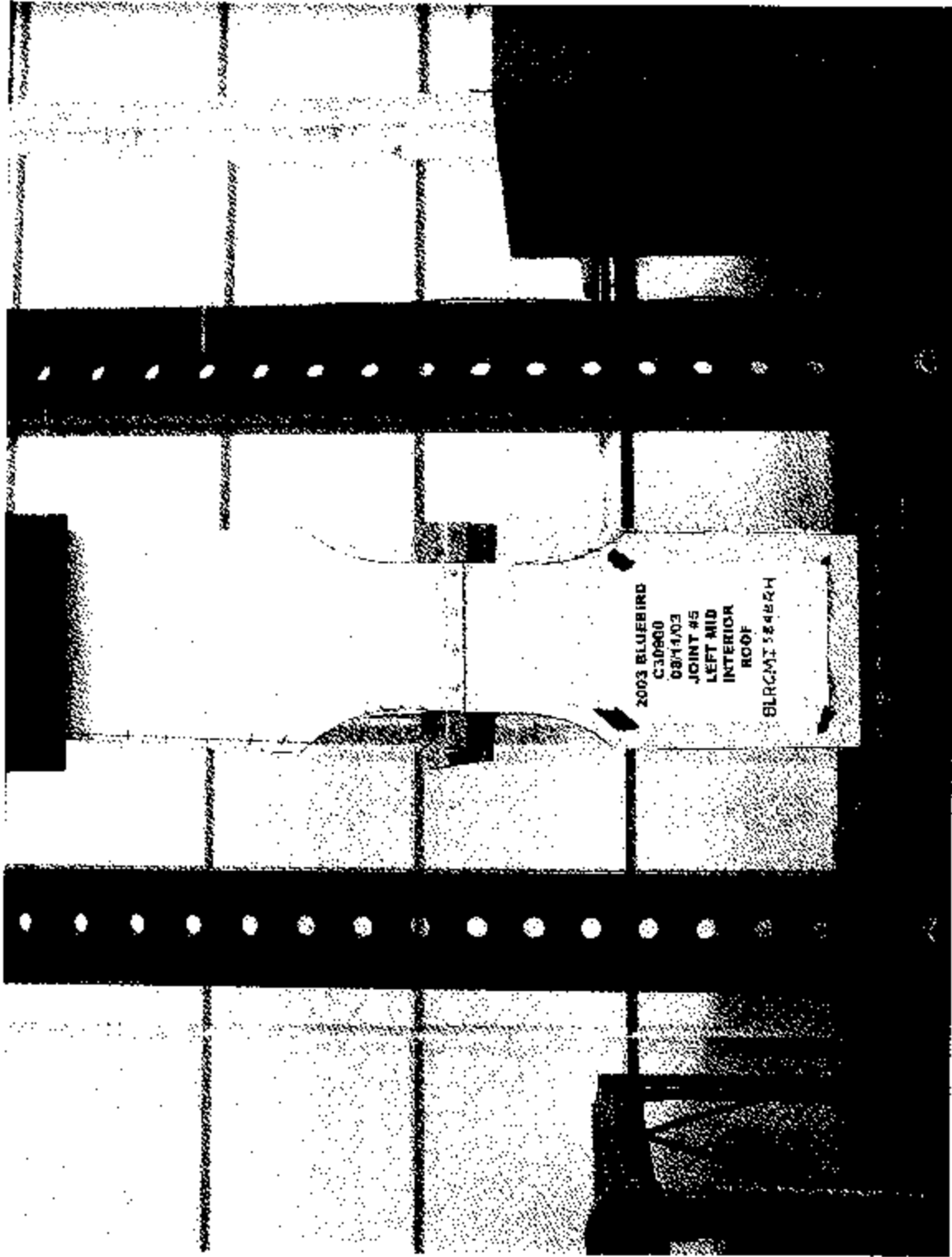
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Sample #4 Post Test Separation

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

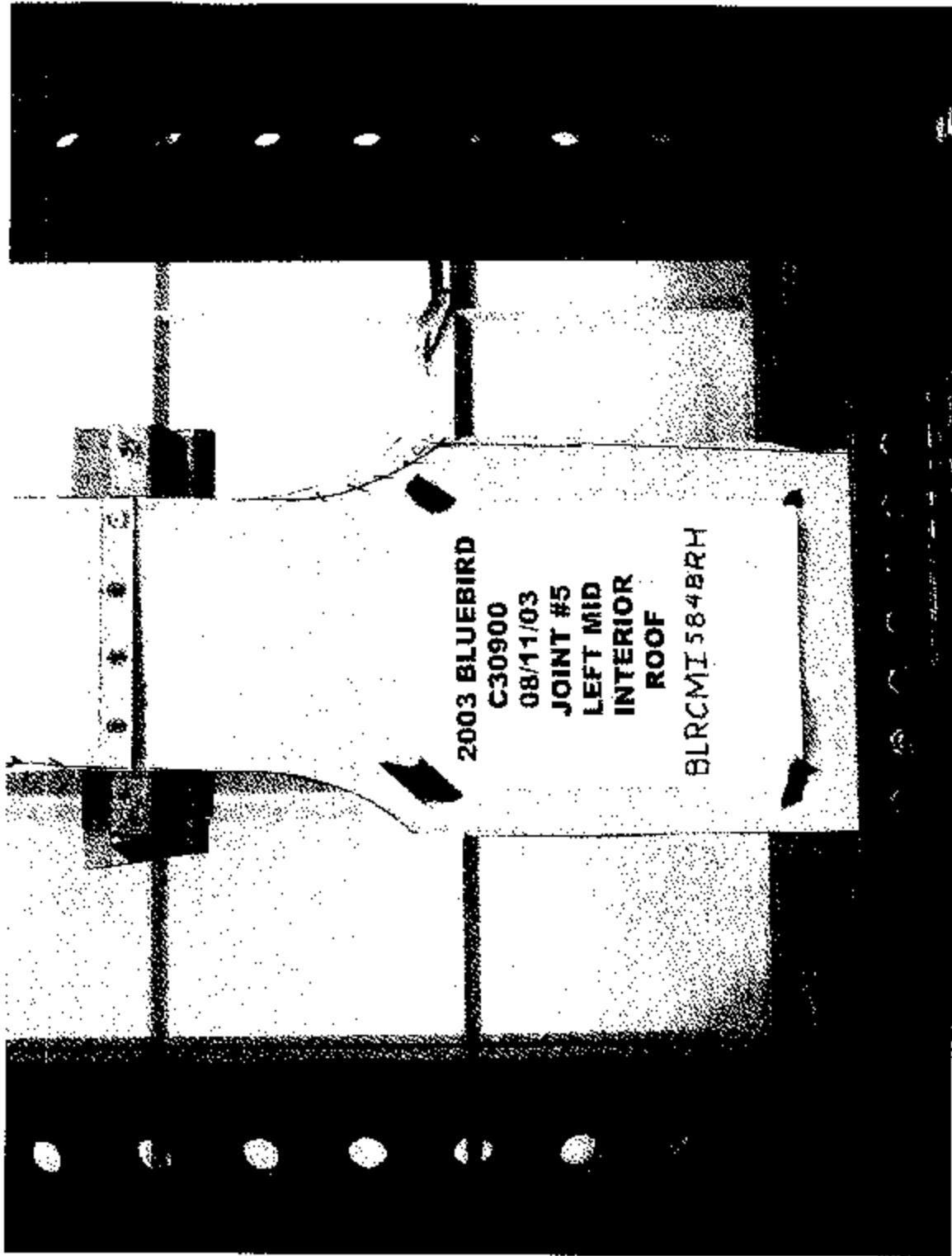
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Sample #5 Installed in Test Machine (Pre-Test)

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

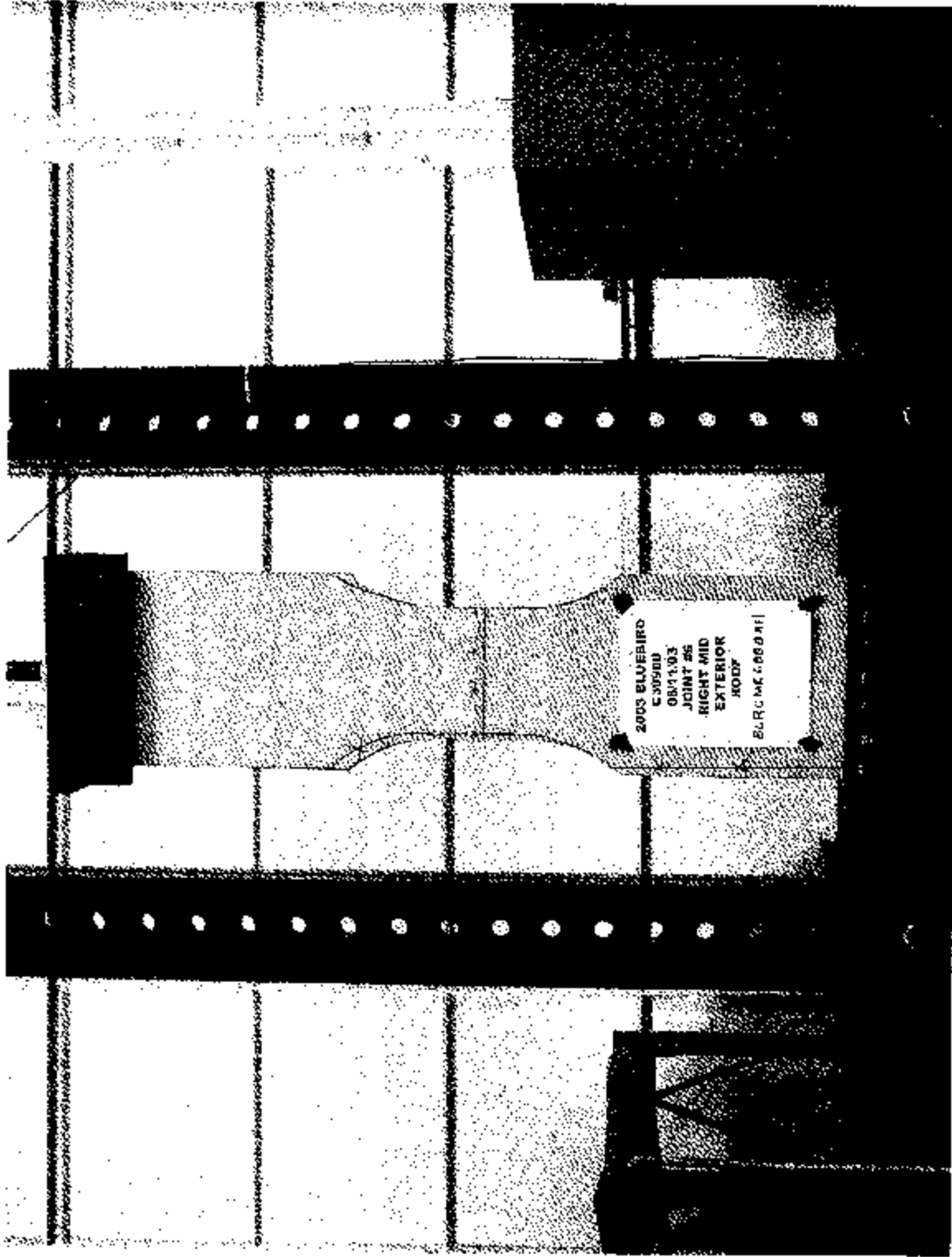
NHTSA No.: C30900



Sample #5 Post-Test Separation

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Sample #6 Installed in Test Machine (Pre-Test)

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

NHTSA No.: C30900



Sample #6 Post-Test Separation

**SECTION 7
TEST PLOTS**

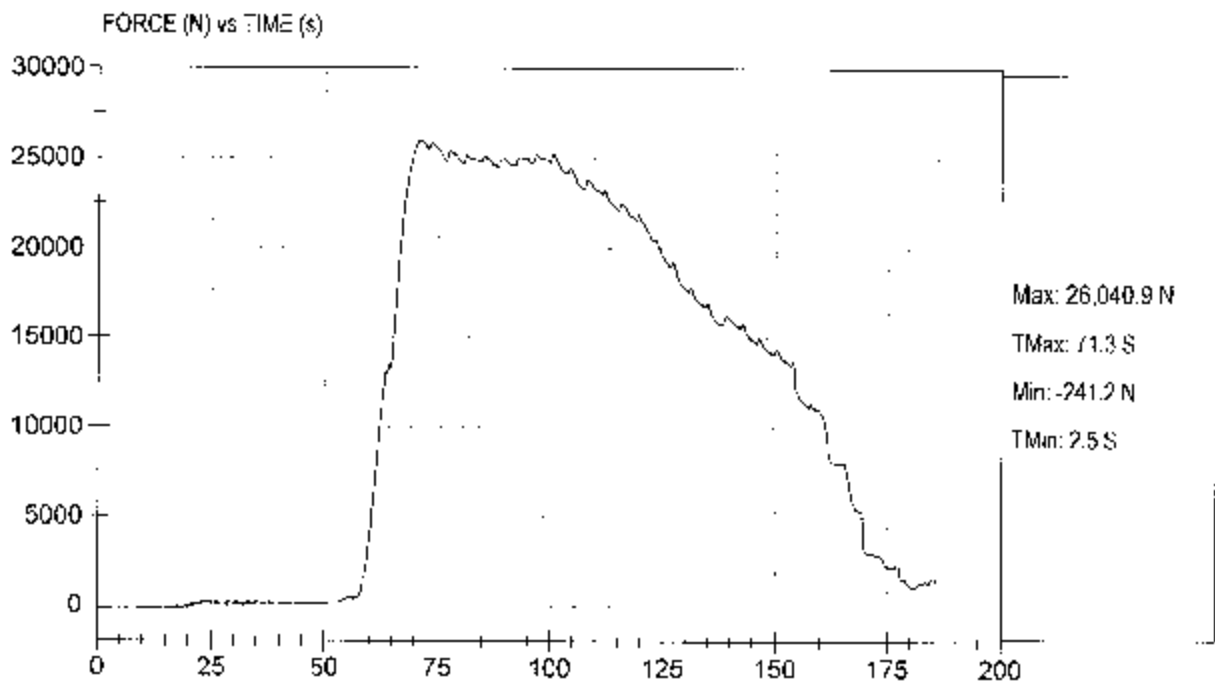
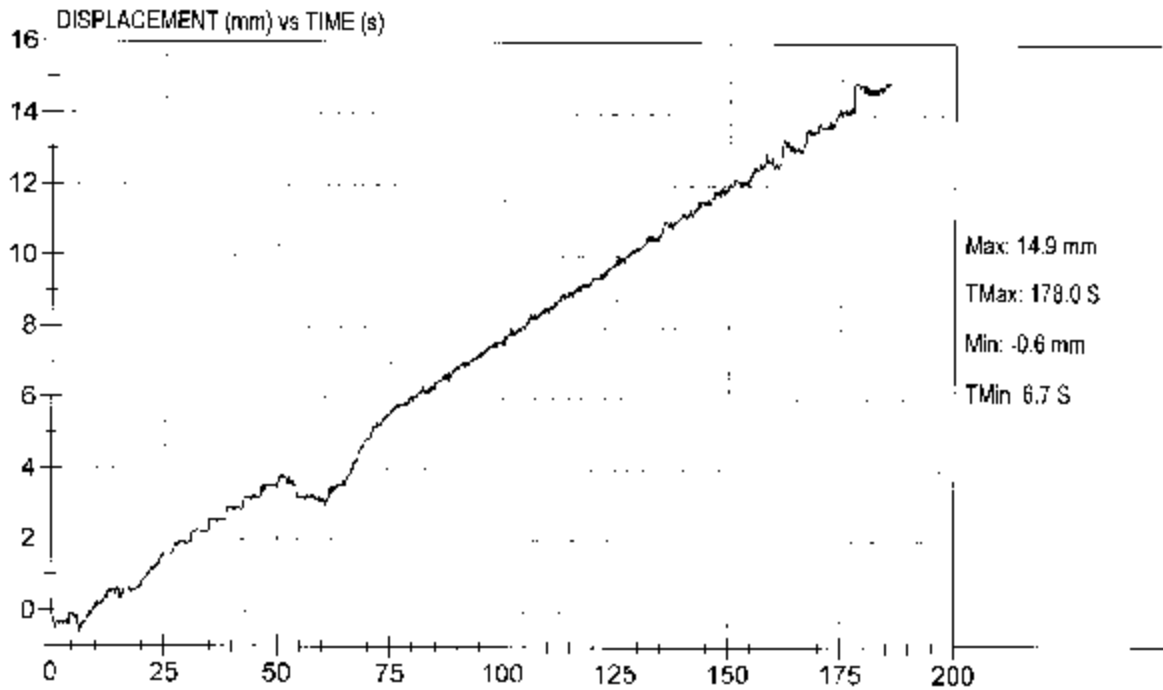
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Test Desc: BLSRR187BRV (Right Rear Int. Side) (1)
Component ID: Blue Bird

Test Date: 8/12/03
NHTSA #: C30900

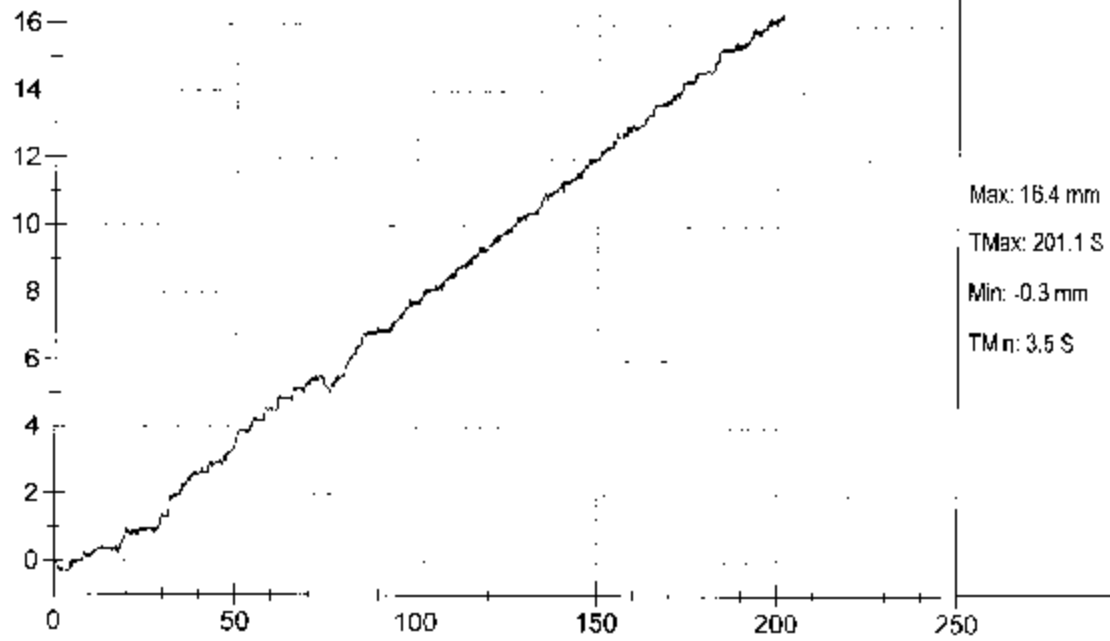




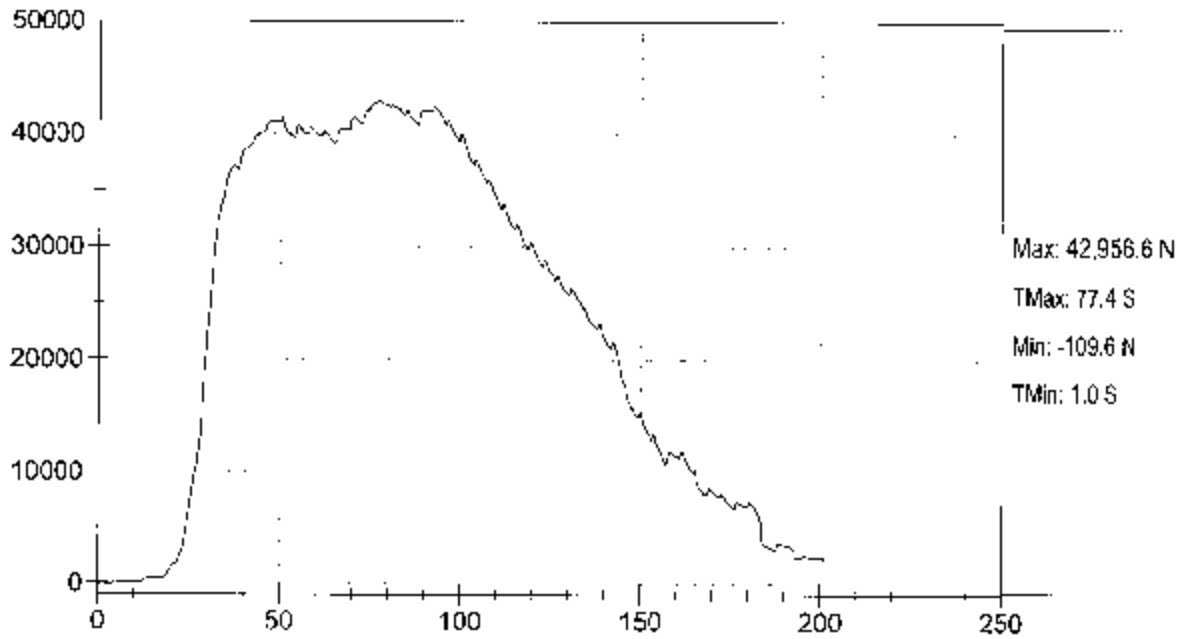
Test Desc: BLSRRE286BRV (Right Rear Ext.side) (2)
Component ID: Blue Bird

Test Date: 8/12/03
NHTSA #: C30900

DISPLACEMENT (mm) vs TIME (s)



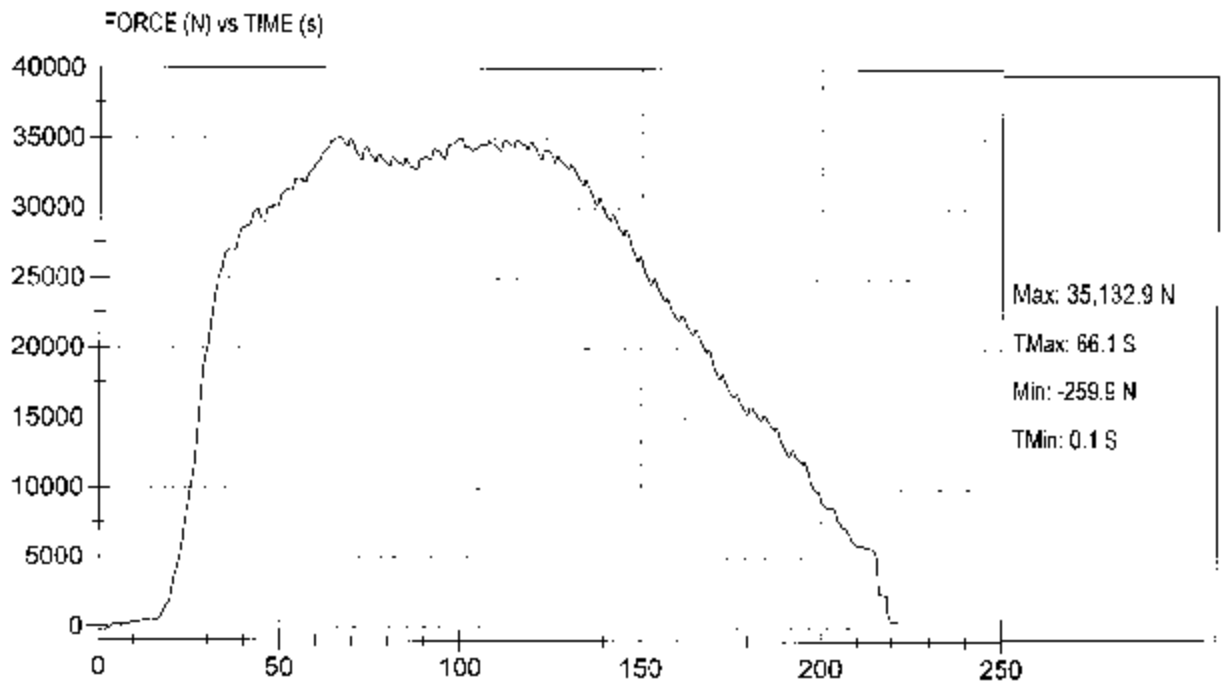
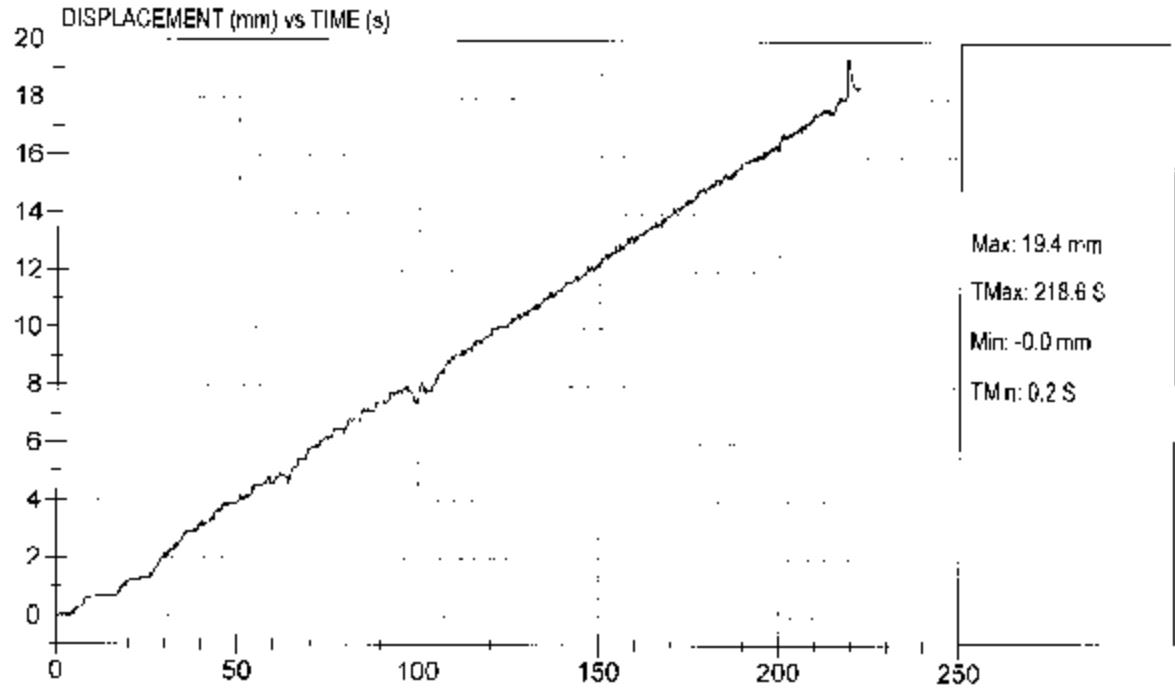
FORCE (N) vs TIME (s)





Test Desc: BLSLME386BRV (Left Mid Ext Side) (3)
Component ID: Blue Bird

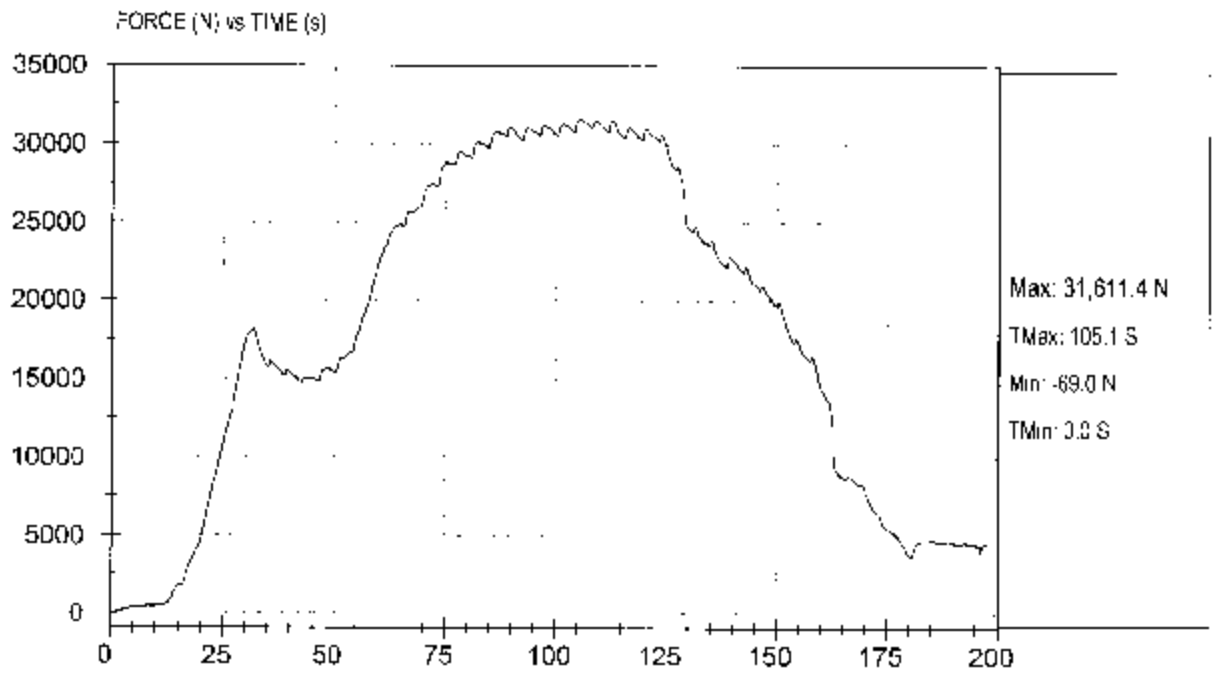
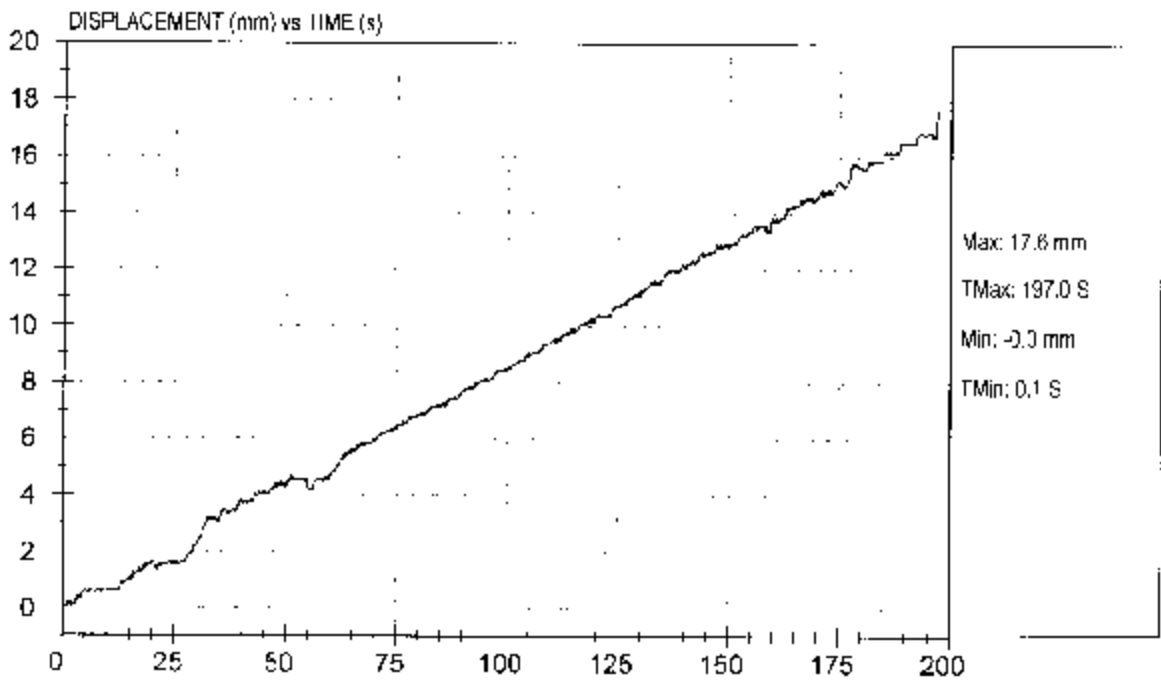
Test Date: 8/12/03
NHTSA #: C30900





Test Desc: BLSLME386BRV (Left Mic Ext. Side) (4)
Component ID: Blue Bird

Test Date: 8/12/03
NF-TSA #: C30900

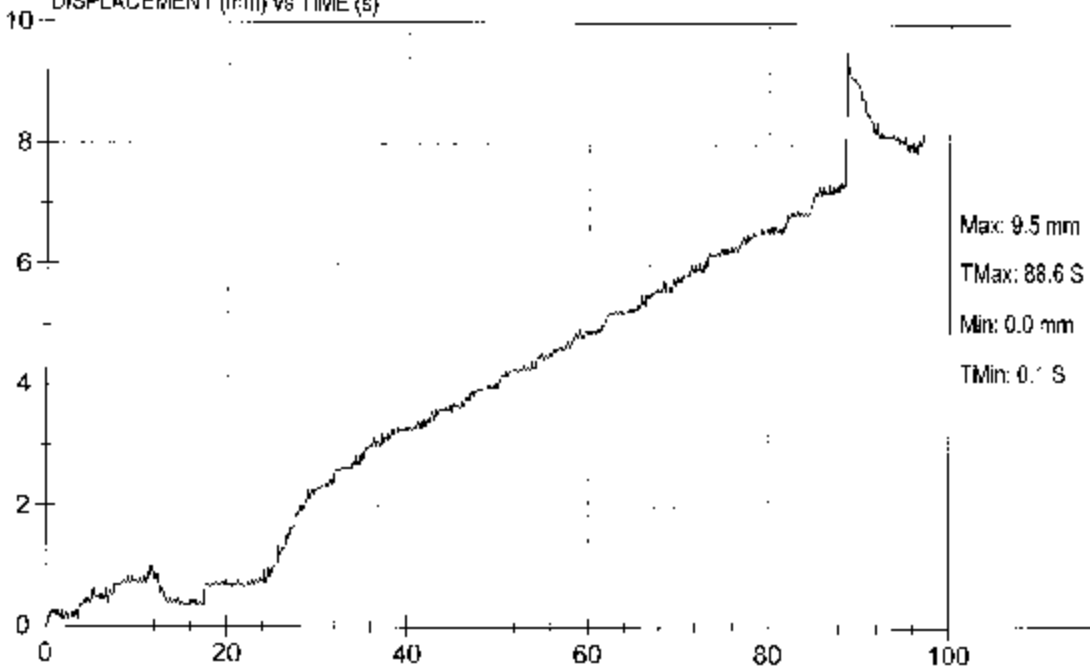




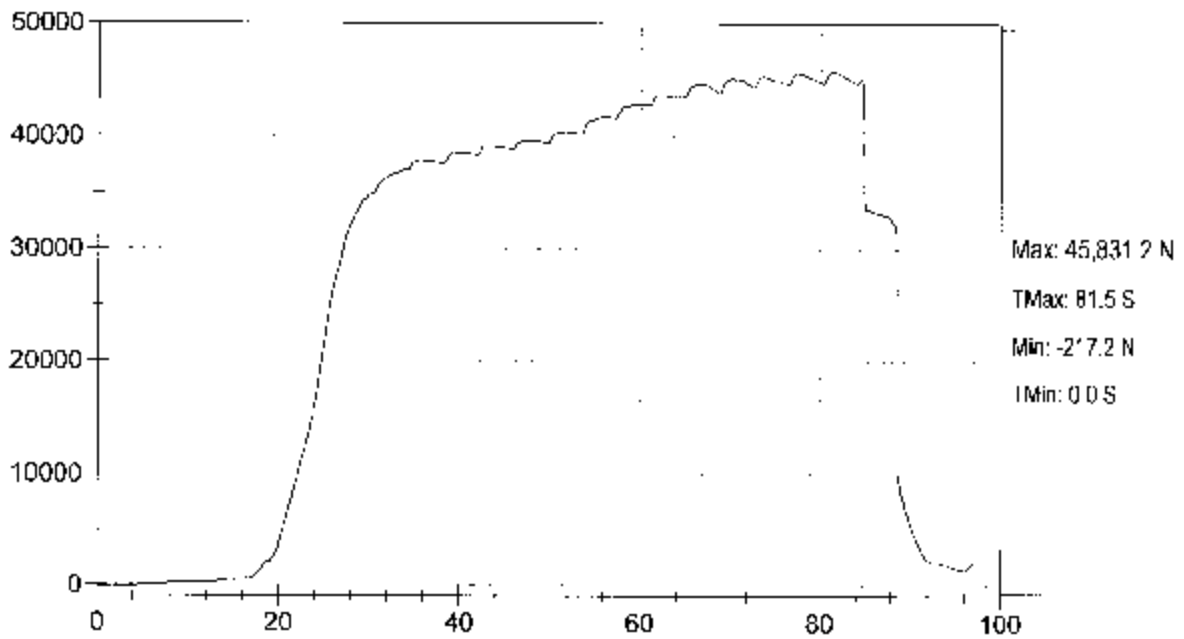
Test Desc: BLRCM1584BRH (Left Mid Int. Roof) (5)
Component ID: Blue Bird

Test Date: 8/12/03
NHTSA #: C30900

DISPLACEMENT (mm) vs TIME (s)



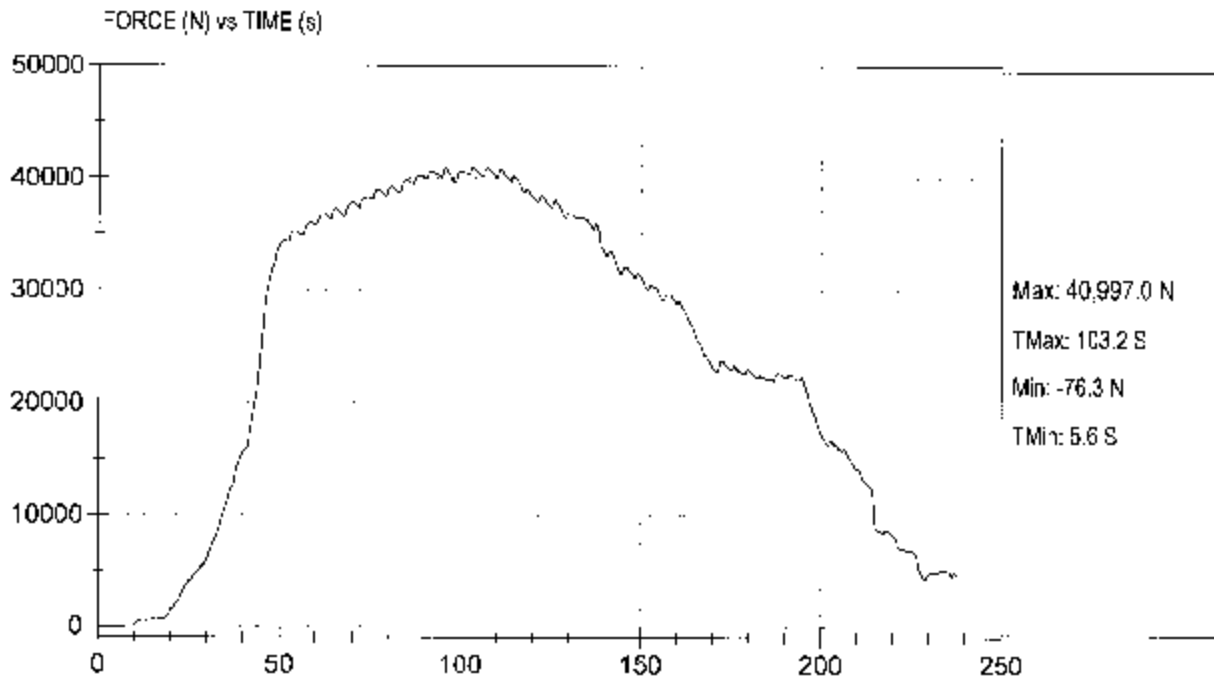
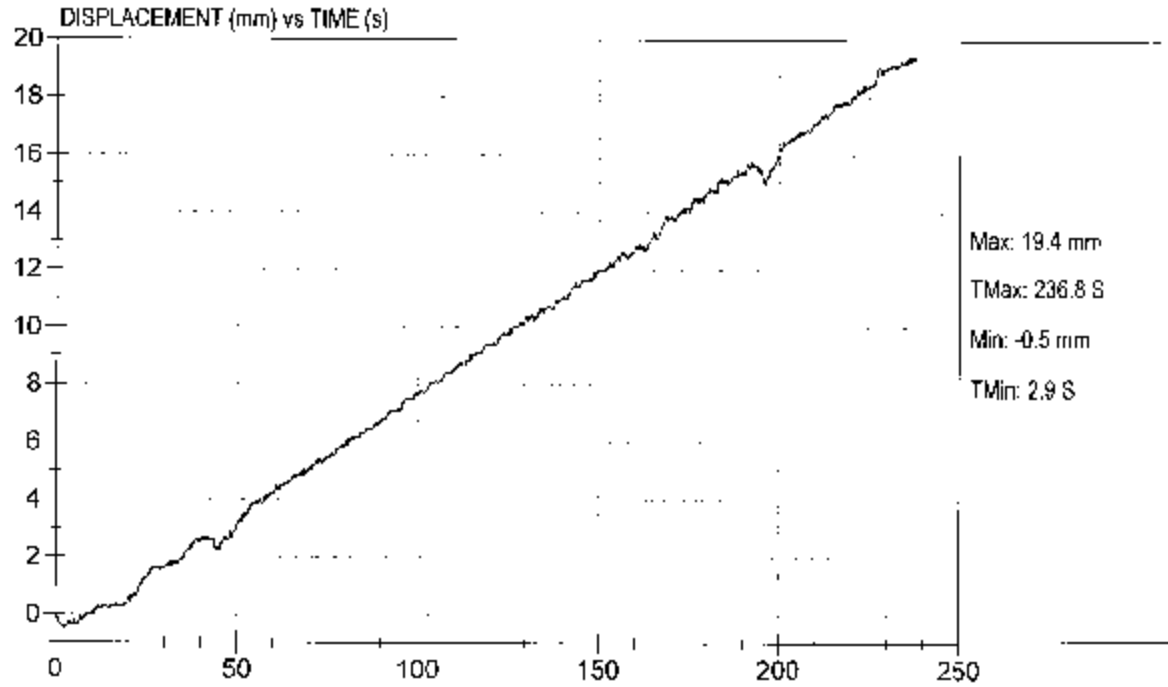
FORCE (N) vs TIME (s)





Test Desc: BLRCME688BAH (Right Mid Ext. Roof) (6)
Component ID: Blue Bird

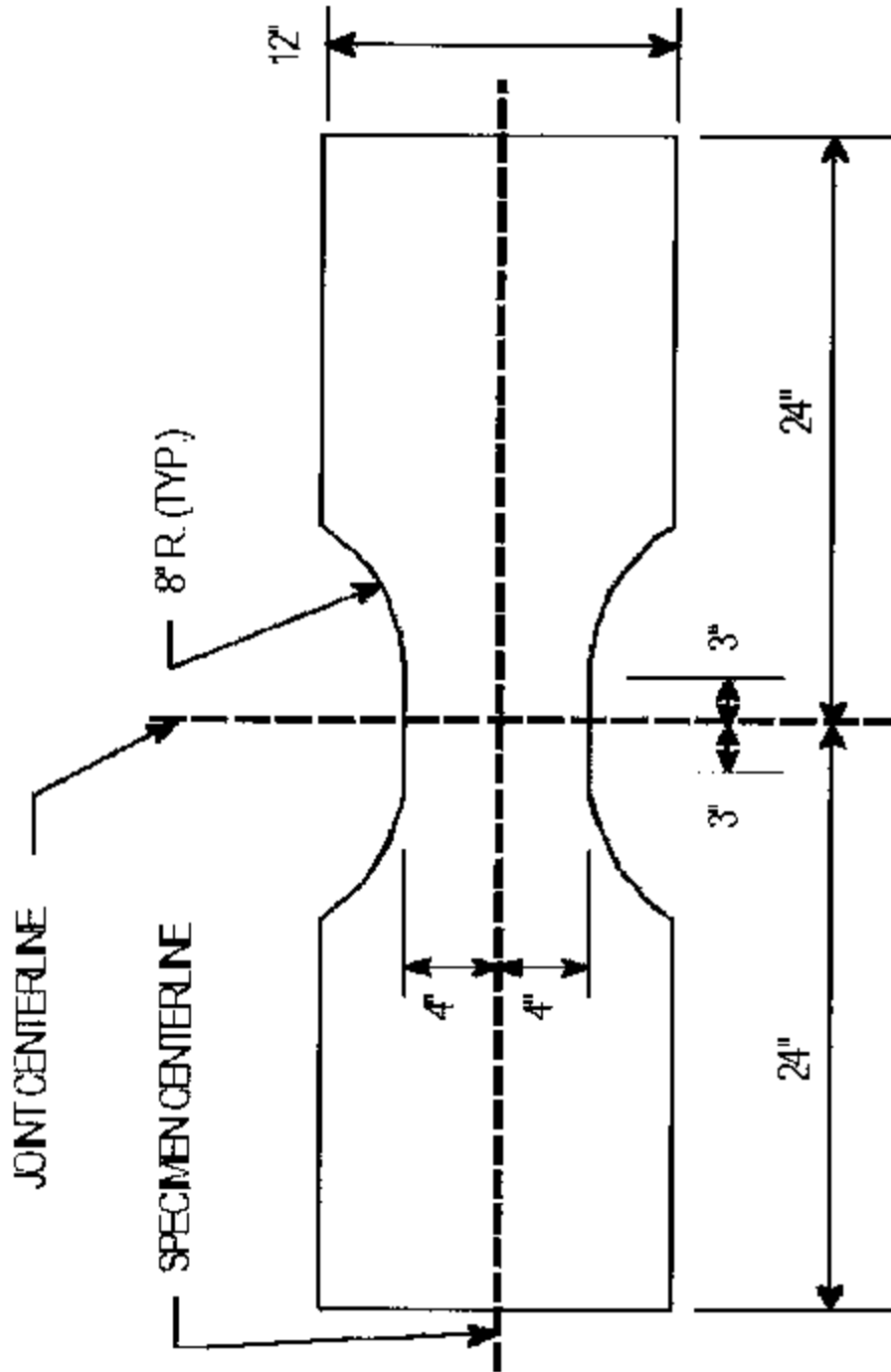
Test Date: 8/12/03
NHTSA #: C30900



SECTION 8
JOINT CONFIGURATIONS

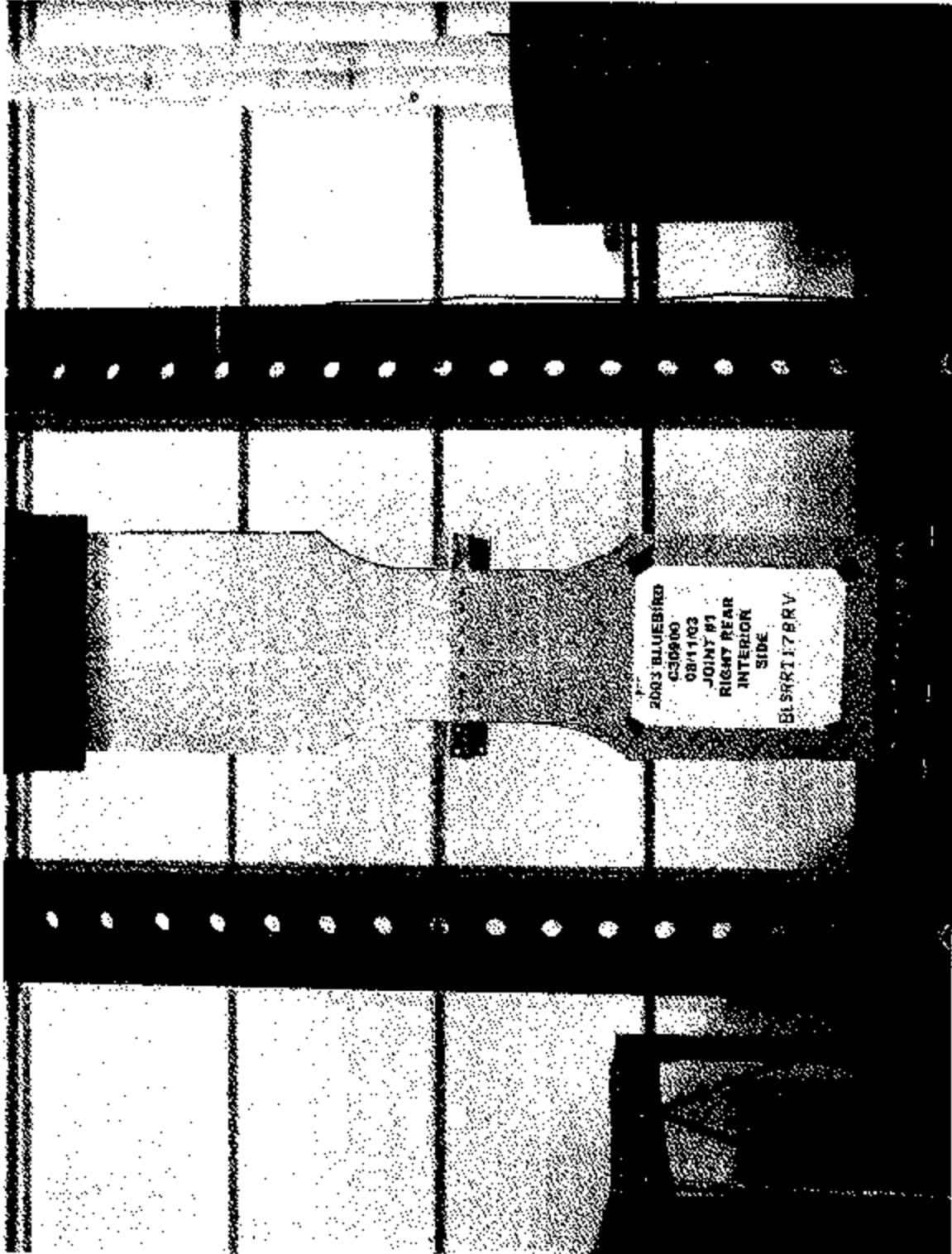
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**DIMENSION REQUIREMENTS OF BODY PANEL SPECIMEN
WHOSE JOINT SEGMENT IS 8 INCHES LONG**



Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Front View of Joint #1

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

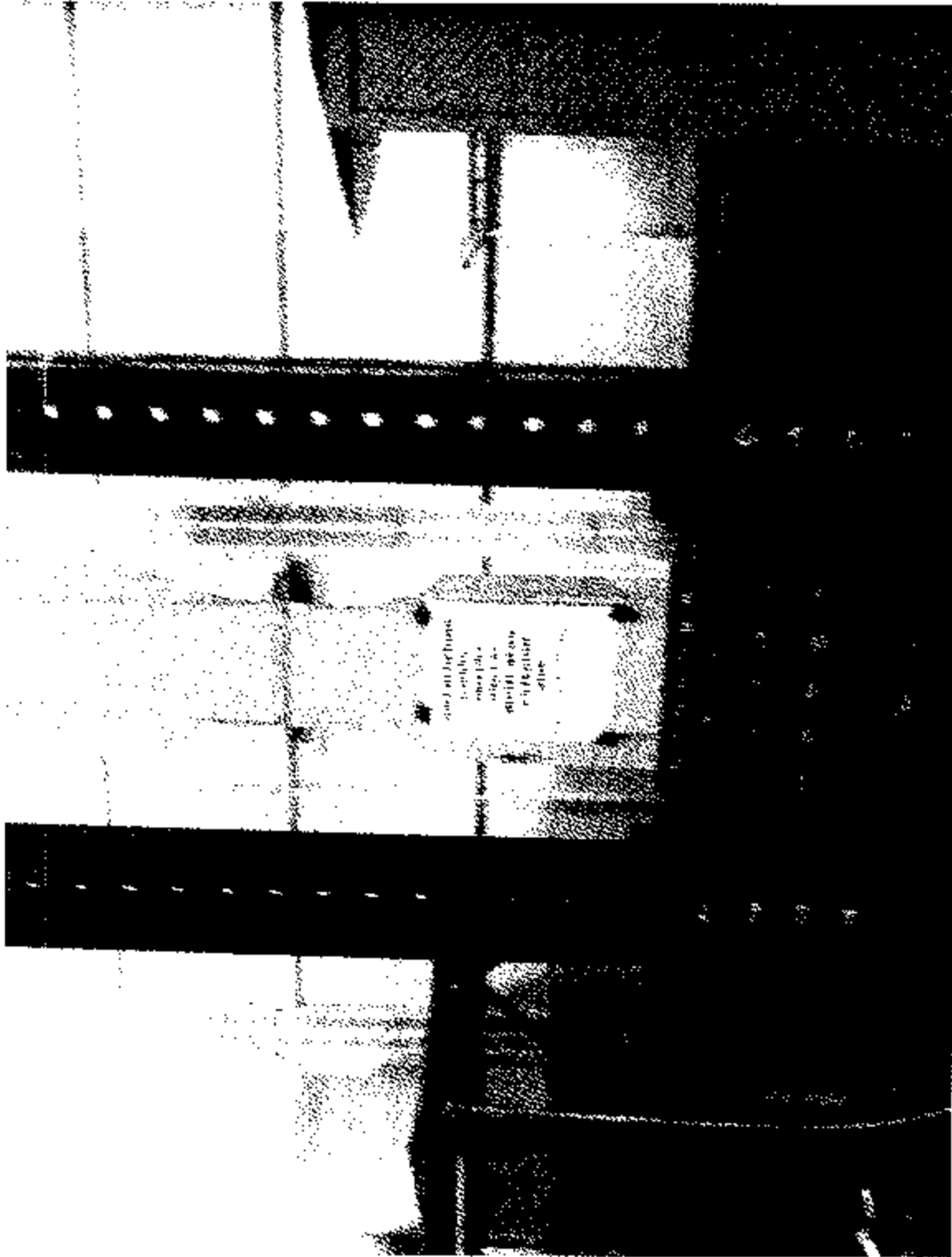
NHTSA No.: C30900



End View of Joint #1

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

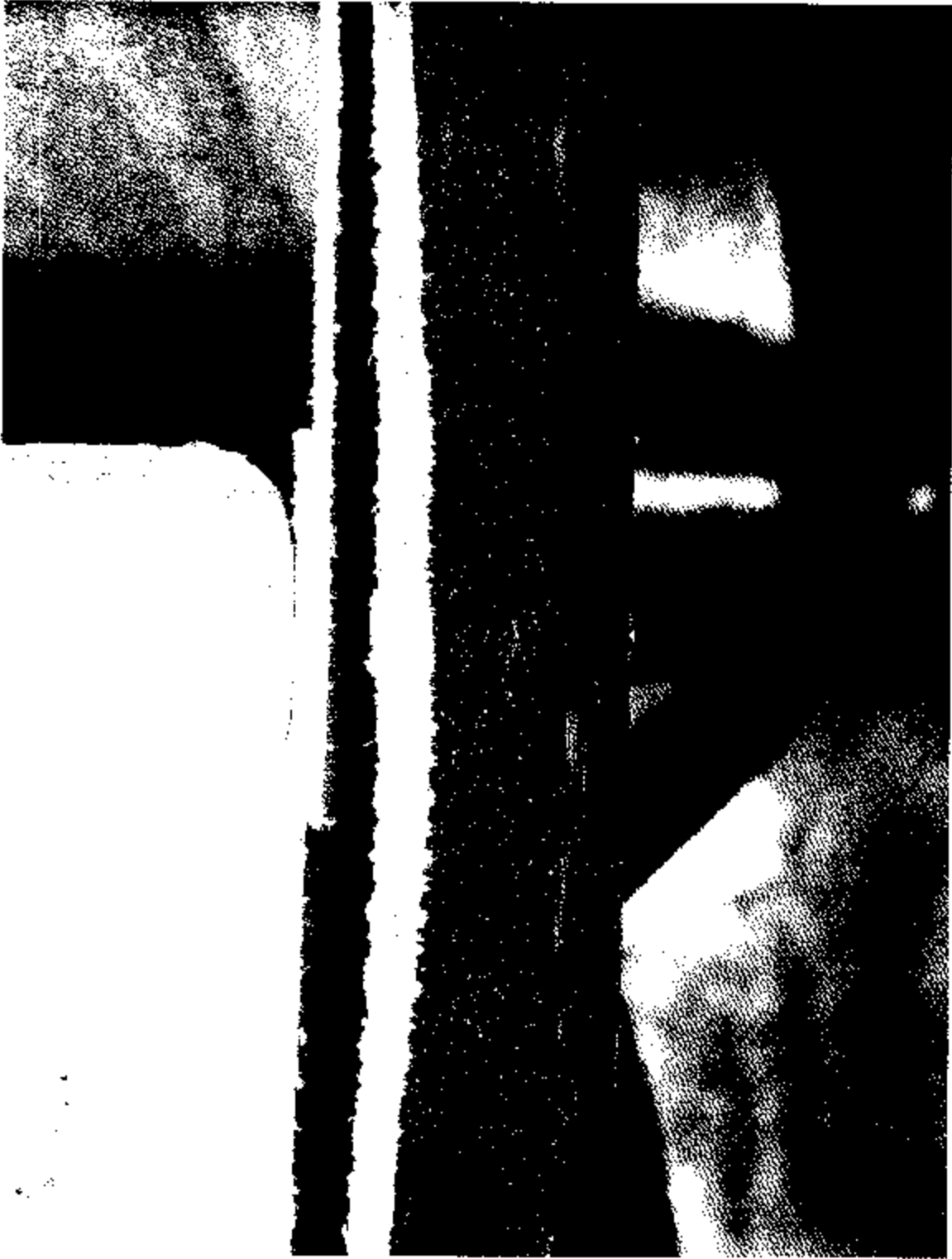
NHTSA No.: C30900



Front View of Joint #2

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900

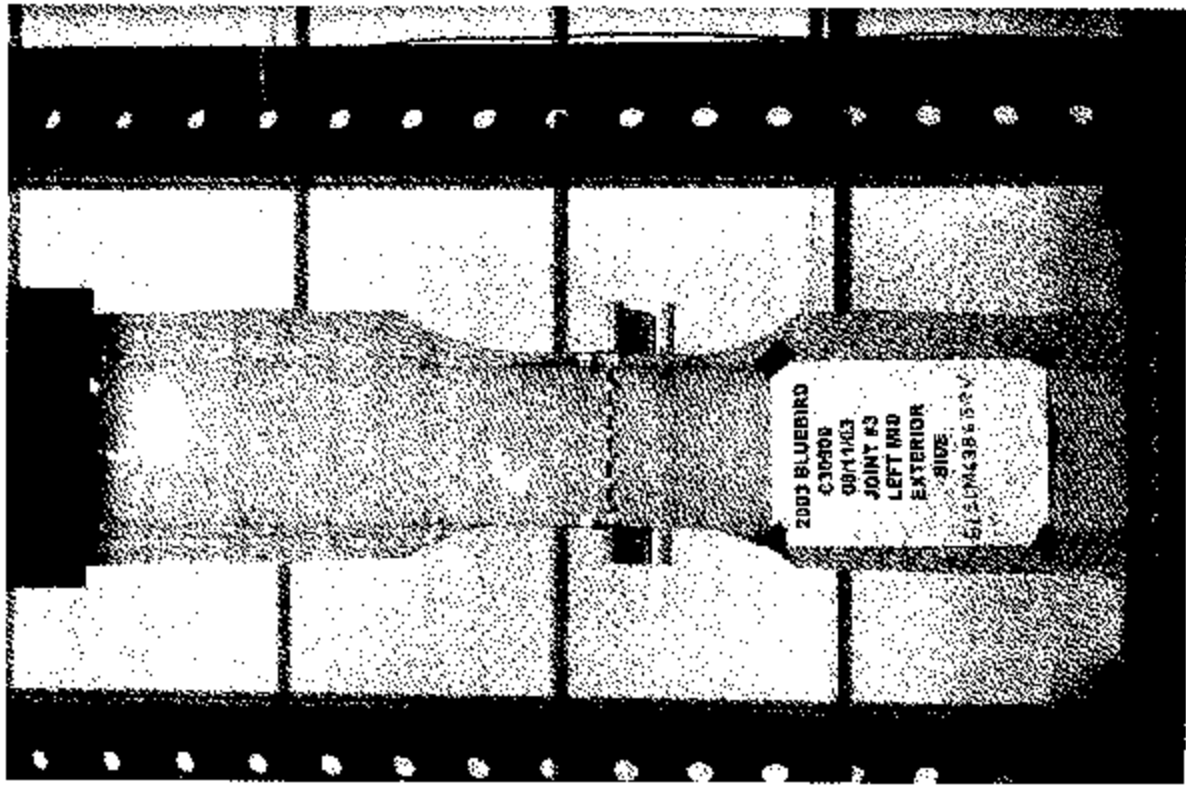


End View of Joint #2

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

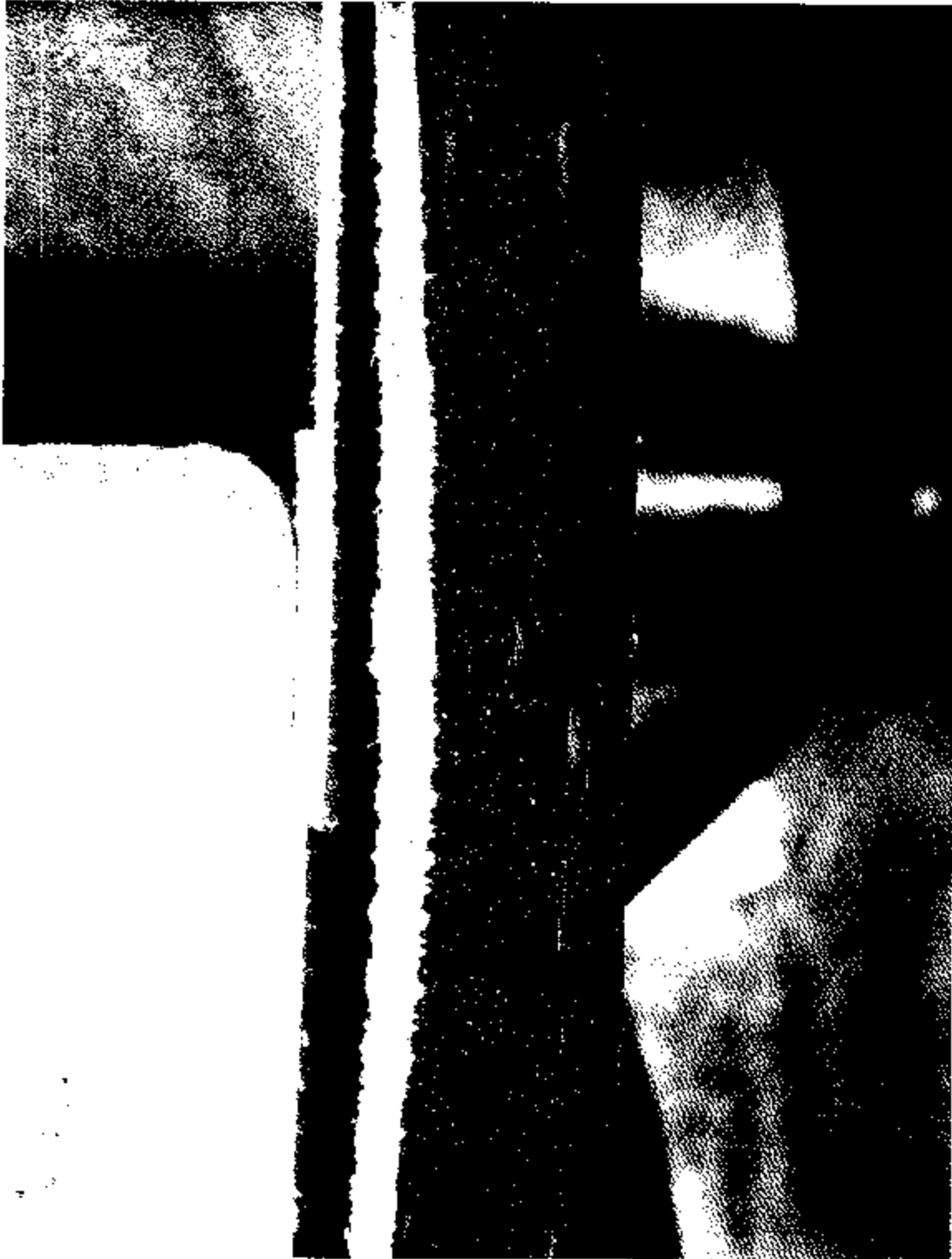
NHTSA No.: C30900



Front View of Joint #3

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900

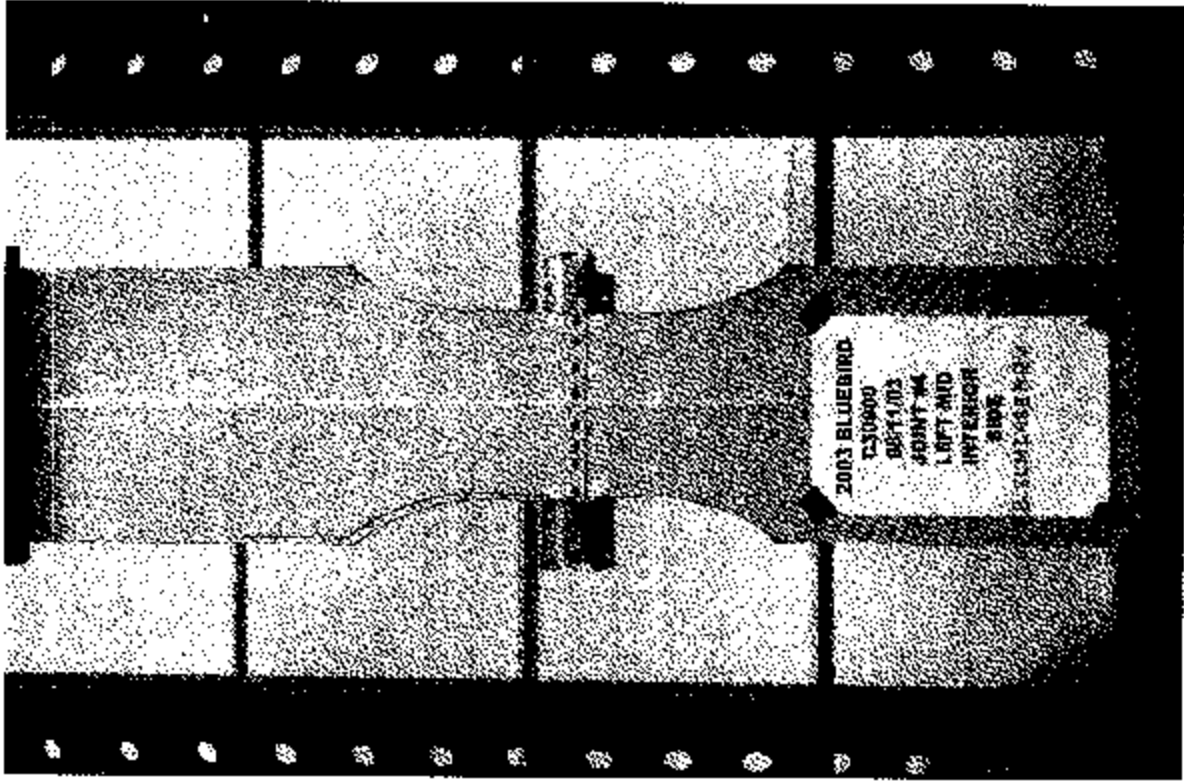


End View of Joint #3

Test Vehicle:
Procedure:

2003 Blue Bird All American School Bus
FMVSS 221

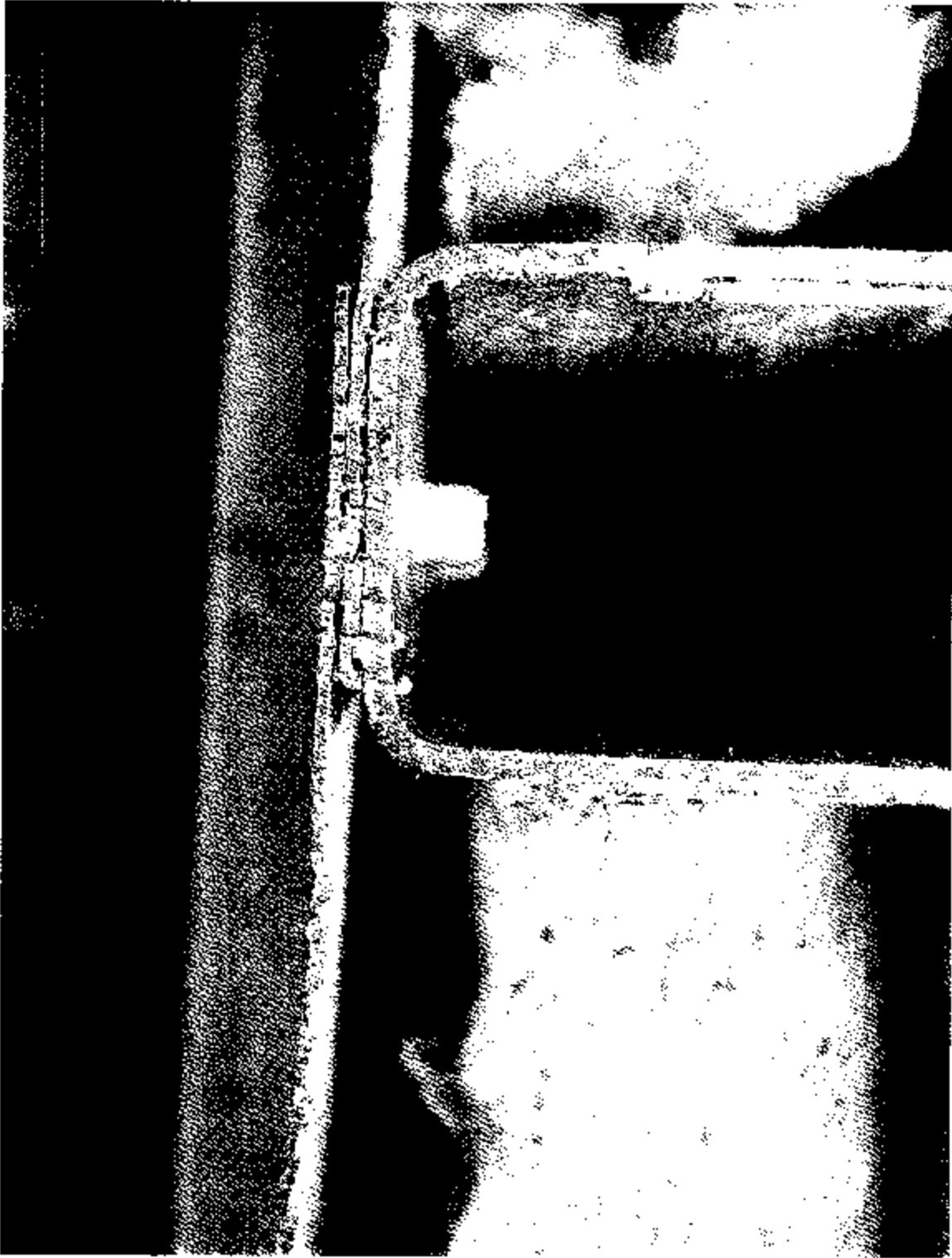
NHTSA No.: C30900



Front View of Joint #4

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

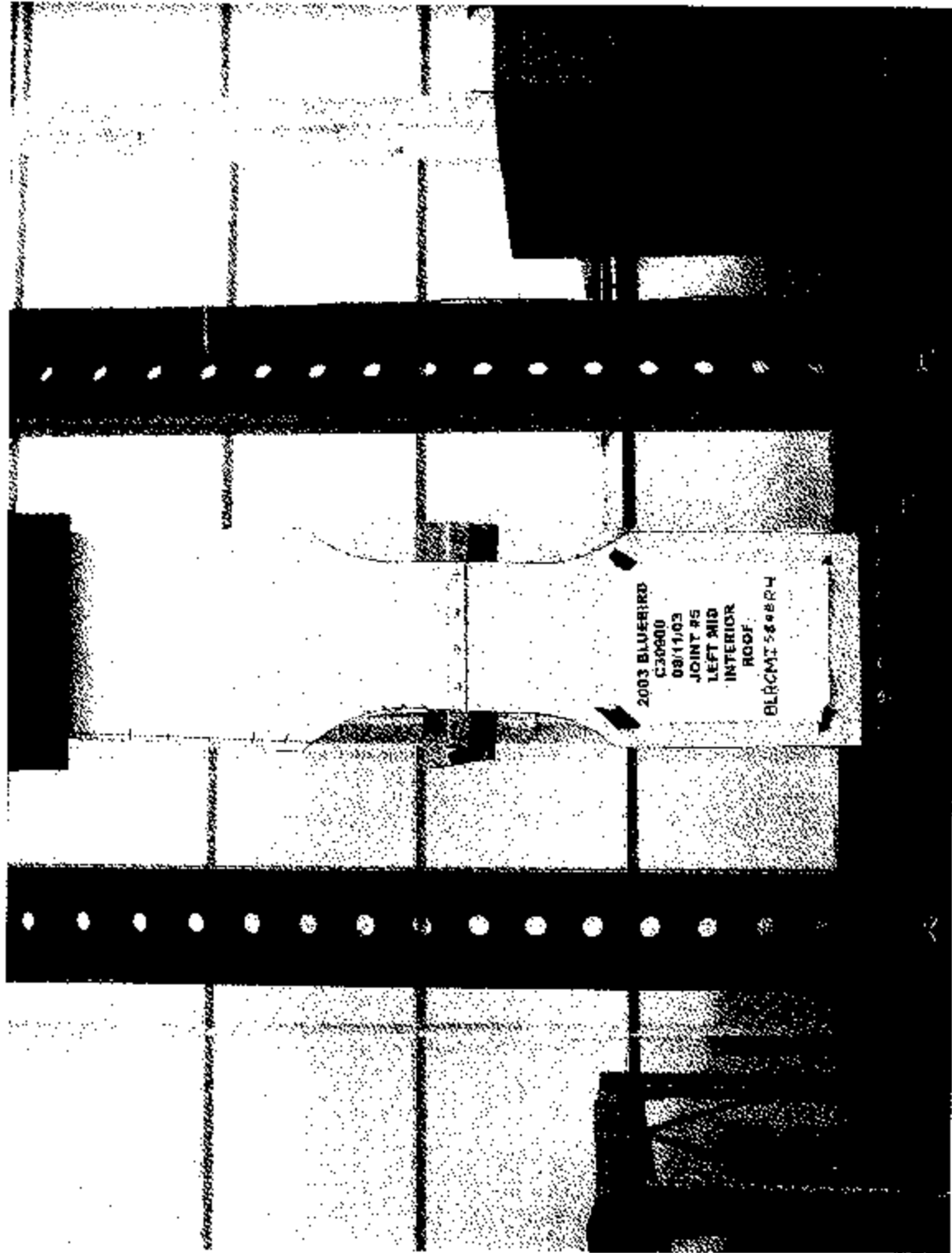
NHTSA No.: C30900



End View of Joint #4

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

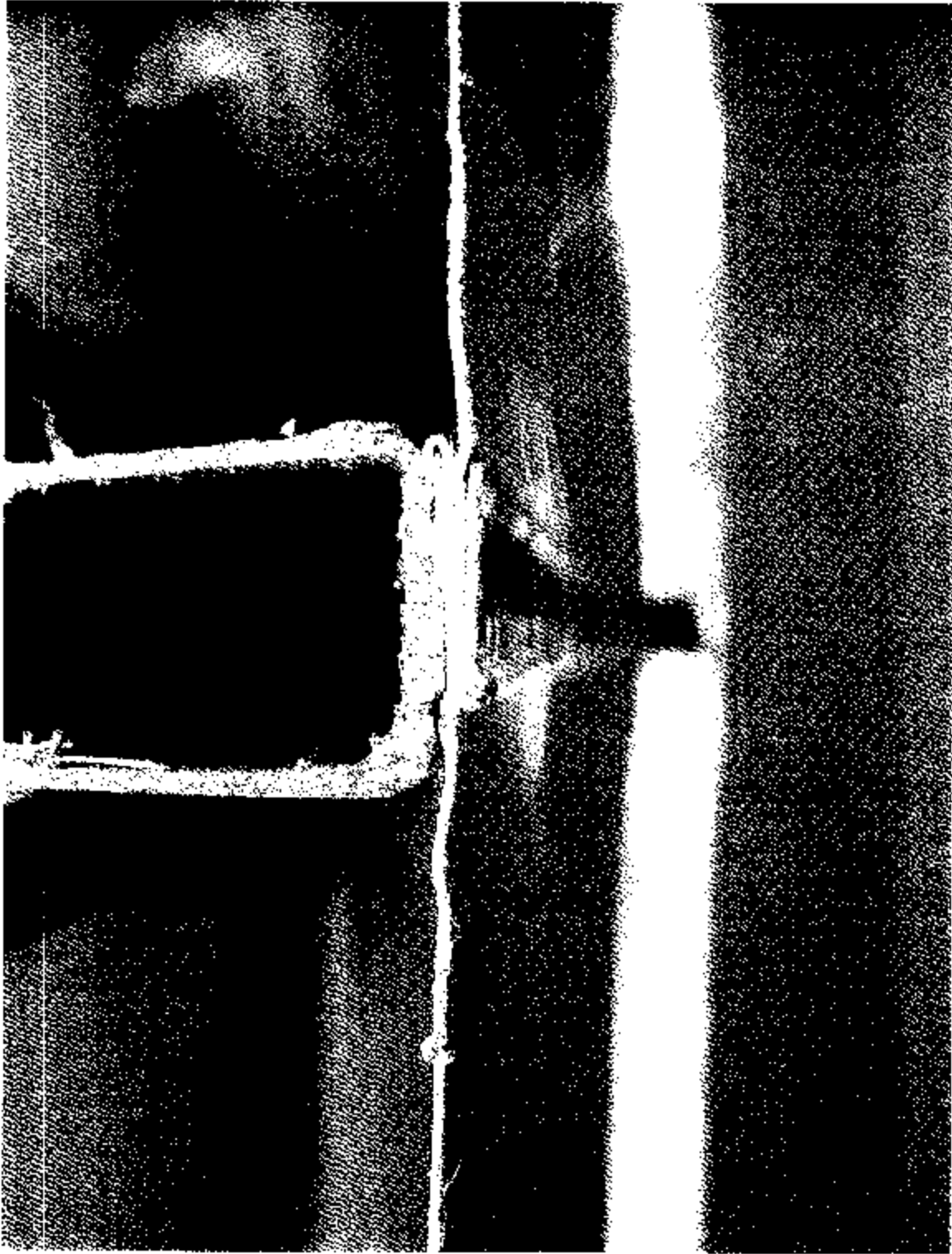
NHTSA No.: C30900



Front View of Joint #5

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

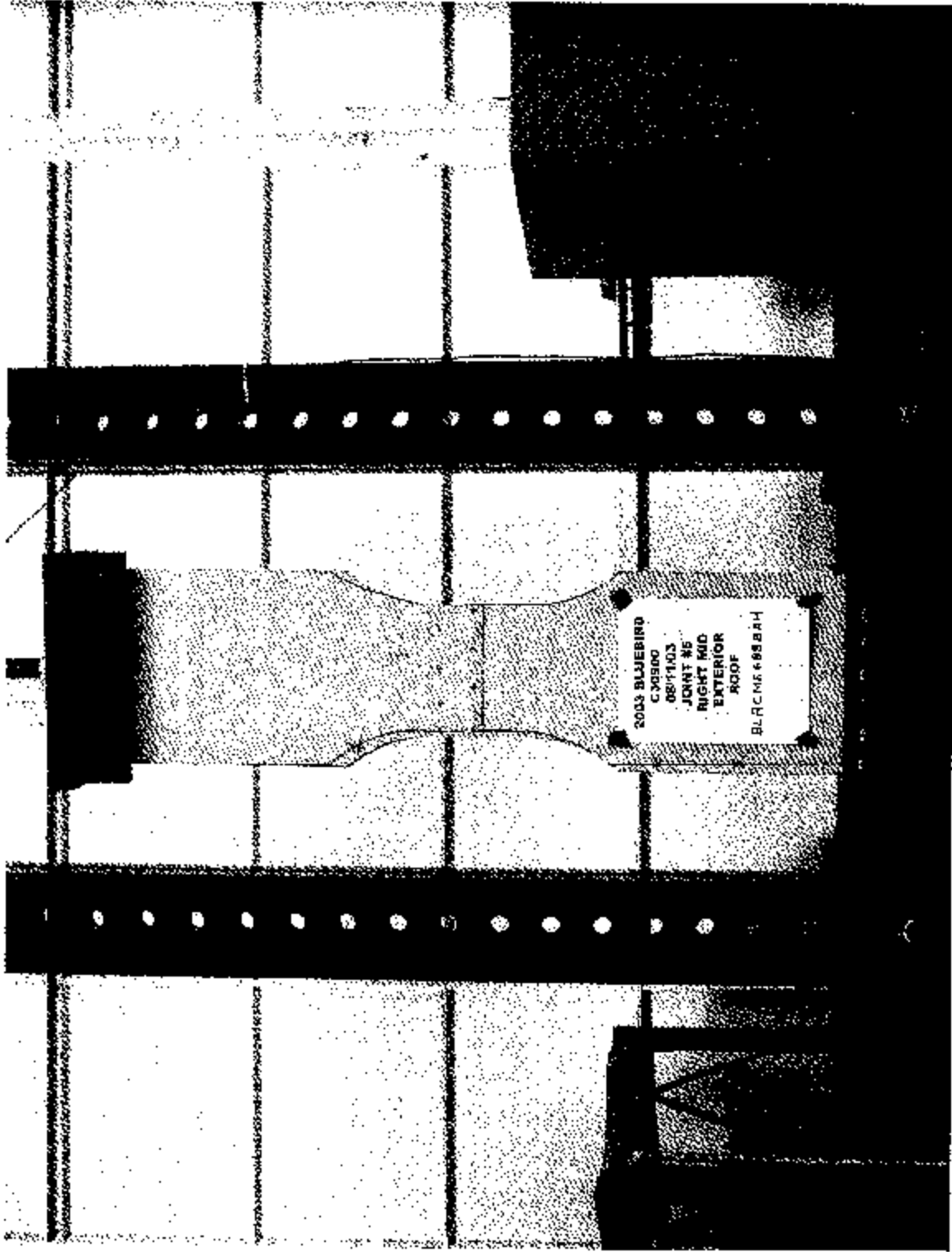
NHTSA No.: C30900



End View of Joint #5

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



Front View of Joint #6

Test Vehicle: 2003 Blue Bird All American School Bus
Procedure: FMVSS 221

NHTSA No.: C30900



End View of Joint #6