

REPORT NUMBER: 221-MGA-2007-004

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

**US BUS CORPORATION
2006 US BUS STURDIBUS SCHOOL BUS
NHTSA NO.: C60900**

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



FINAL REPORT DATE: November 14, 2007

FINAL REPORT

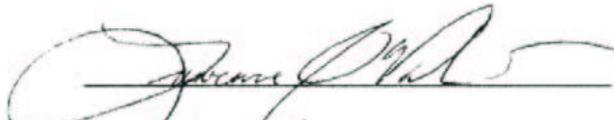
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ENFORCEMENT
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Prepared by: 
James Hansen, Project Engineer Date: November 14, 2007

Reviewed by: 
Michael Janovicz, Program Manager Date: November 14, 2007

FINAL REPORT ACCEPTED BY:


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Technical Report Documentation Page

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16. Abstract Compliance tests were conducted on the subject 2006 US Bus Sturdibus School Bus, NHTSA No. C60900, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-221-02 for the determination of Compliance with FMVSS 221 requirements. Test Failures: None			
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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY 2006 US Bus Sturdibus School Bus, NHTSA No. C60900, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedures TP-221-02 to determine compliance with 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 MY 2006 US Bus Sturdibus School Bus, NHTSA No. C60900 was subjected to FMVSS 221 testing.

The joint samples were selected in conjunction with the Contract Officer's Technical Representative (COTR). Four 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 selected 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 ½" 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 loads were applied to the clamp mounting holes.

The rate of load application was ¼ 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 four samples were tested for this vehicle. The samples were selected from the side rear exterior, 2 samples from the roof mid interior and one from the roof mid exterior.

	Maximum Load (N)	60% of Material Strength (N)	PASS/FAIL
Side Rear Exterior	35448.7	19205.6	PASS
Roof Mid Interior 1	27620.3	15364.5	PASS
Roof Mid Exterior	26275.9	19205.6	PASS
Roof Mid Interior 2	25843.8	14935.3	PASS

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

SECTION 4
COMPLIANCE TEST DATA

The following data sheets document the results of FMVSS 221 testing on the MY 2006 US Bus Sturdibus School Bus, NHTSA No. C60900.

DATA SHEET 1
ADMINISTRATIVE DATA SHEET

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**

INCOMPLETE VEHICLE (IF APPLICABLE)

Manufacturer:	General Motors Corporation
Model:	DW4+91396293
VIN:	1GBHG31V561226021
Build Date:	03/06
Certification Date:	

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	US BUS CORPORATION
Make/Model:	GM / US BUS
VIN:	1GBHG31V561226021
NHTSA No.:	C60900
Color:	Yellow
GVWR:	4,536 kg / 10,000 lbs
Build Date:	08/06
Certification Date:	08/06

DATES

Vehicle Receipt:	09/21/2006
Start of Compliance Test:	10/09/2007
Completion of Compliance Test:	10/09/2007

COMPLIANCE TEST:

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

Recorded By: 

Approved By: 

Date: 10/09/07

DATA SHEET 2
SUMMARY OF DATA

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**

Joint Specimen I.D.	Joint Location	Joint Load Reqmt (60%) (N)	Max. Load at Joint Separation (N)	Calculated Material Strength (N)	PASS/ FAIL
USSLRE184BAV	Side Rear Exterior	19205.6	35448.7	32009.4	PASS
USRRMI284BAH	Roof Mid Interior 1	15364.5	27620.3	25607.5	PASS
USRRME384BAH	Roof Mid Exterior	19205.6	26275.9	32009.4	PASS
USRLMI485BAH	Roof Mid Interior 2	14935.3	25843.8	24892.2	PASS

Comments: NONE

Recorded By: 

Approved By: 

Date: 10/09/07

DATA SHEET 3

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
 Test Date: **10/09/07**

Specimen Description:	Side Rear Exterior		
Joint Number:	USSLRE184BAV	Test Number:	1

	Weaker Member	Stronger Member
Material	3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.9	N/A
Thickness (mm)	1.270	N/A
Fastener Holes (No./Diameter – mm.)	4 / 5.11	N/A
Net Area (Sq. mm.)	232.1	N/A
Material Strength (N)	32009.4	N/A
60% of Material Strength (N)	19205.6	N/A
Maximum Load From Tensile Test of Joint (N)	35448.7	N/A
PASS/FAIL	PASS	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 10/09/07

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
 Test Date: **10/09/07**

Specimen Description:	Roof Mid Interior 1		
Joint Number:	USRRMI284BAH	Test Number:	2

	Weaker Member	Stronger Member
Material	3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.9	N/A
Thickness (mm)	1.016	N/A
Fastener Holes (No./Diameter – mm.)	4 / 5.11	N/A
Net Area (Sq. mm.)	185.7	N/A
Material Strength (N)	25607.5	N/A
60% of Material Strength (N)	15364.5	N/A
Maximum Load From Tensile Test of Joint (N)	27620.3	N/A
PASS/FAIL	PASS	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 10/09/07

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

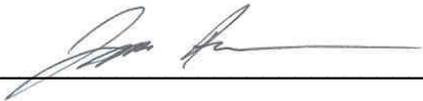
Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
 Test Date: **10/09/07**

Specimen Description:	Roof Mid Exterior		
Joint Number:	USRRME384BAH	Test Number:	3

	Weaker Member	Stronger Member
Material	3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.9	N/A
Thickness (mm)	1.270	N/A
Fastener Holes (No./Diameter – mm.)	4 / 5.11	N/A
Net Area (Sq. mm.)	232.1	N/A
Material Strength (N)	32009.4	N/A
60% of Material Strength (N)	19205.6	N/A
Maximum Load From Tensile Test of Joint (N)	26275.9	N/A
PASS/FAIL	PASS	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 10/09/07

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

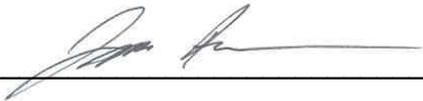
Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
 Test Date: **10/09/07**

Specimen Description:	Roof Mid Interior 2		
Joint Number:	USRLMI485BAH	Test Number:	4

	Weaker Member	Stronger Member
Material	3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.9	N/A
Thickness (mm)	1.016	N/A
Fastener Holes (No./Diameter – mm.)	5 / 5.11	N/A
Net Area (Sq. mm.)	180.5	N/A
Material Strength (N)	24892.2	N/A
60% of Material Strength (N)	14935.3	N/A
Maximum Load From Tensile Test of Joint (N)	25843.8	N/A
PASS/FAIL	PASS	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 10/09/07

**SECTION 5
INSTRUMENTATION AND EQUIPMENT LIST**

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
 Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
 Test Date: **10/09/07**

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Load Cell	Interface	1220AF / 137778A	09/28/07	03/28/08
Linear Potentiometer	Patriot	P40A / 21783	05/08/07	11/08/07
Steel Tape	Stanley	Powerlock / 281	06/29/07	12/29/07
Temp. Stickers	McMaster Carr	60° C / 5952K21	One Time Use	---

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Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Front View of School Bus

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Rear View of School Bus

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Left Side View of School Bus

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

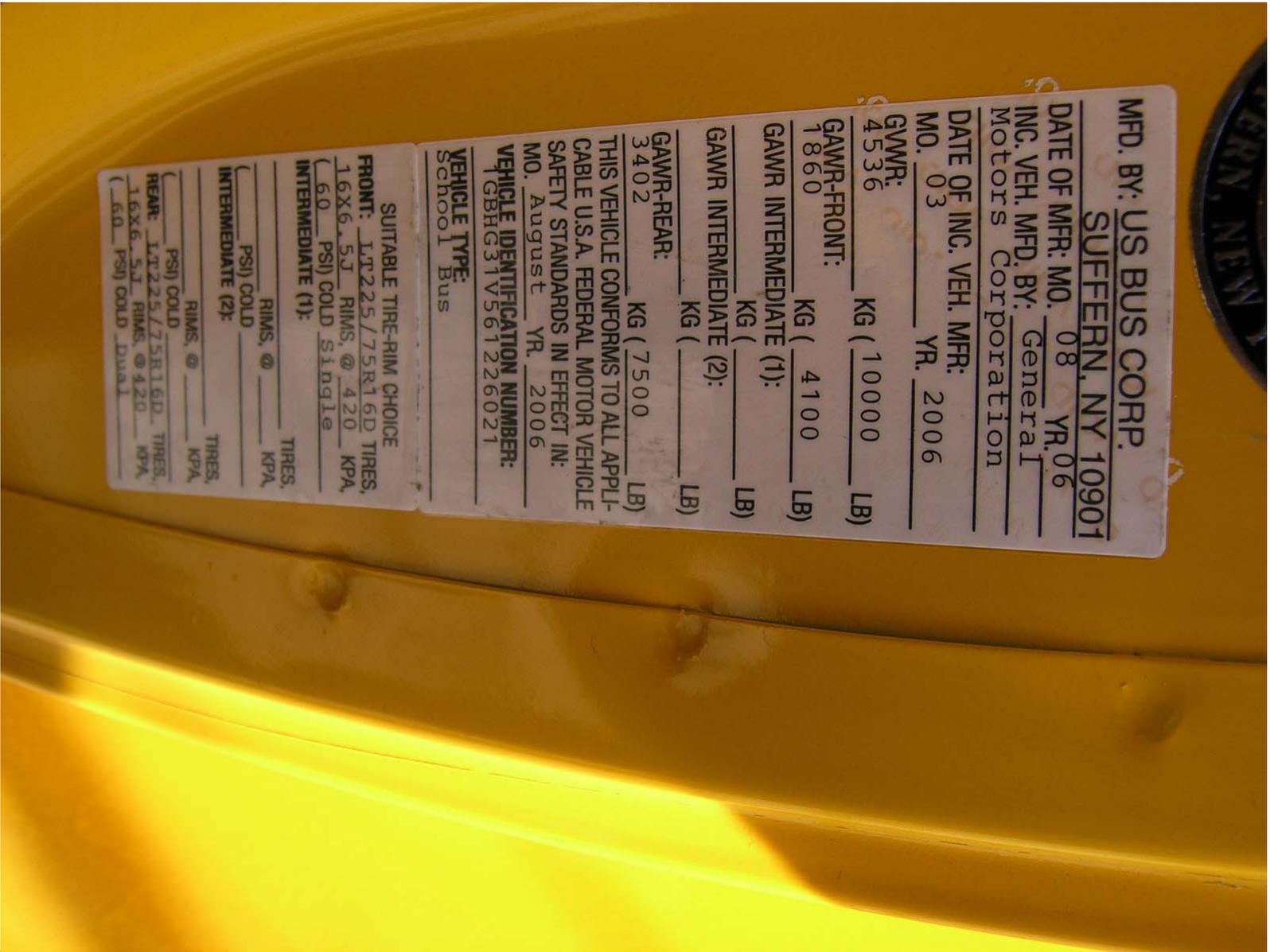
NHTSA No.: **C60900**
Test Date: **10/09/07**



Right Side View of School Bus

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Close up View of Certification and Tire Information Label

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Vehicle Interior View Front to Rear

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Vehicle Interior View Rear to Front

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Location of Joint #1

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Location of Joint #2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

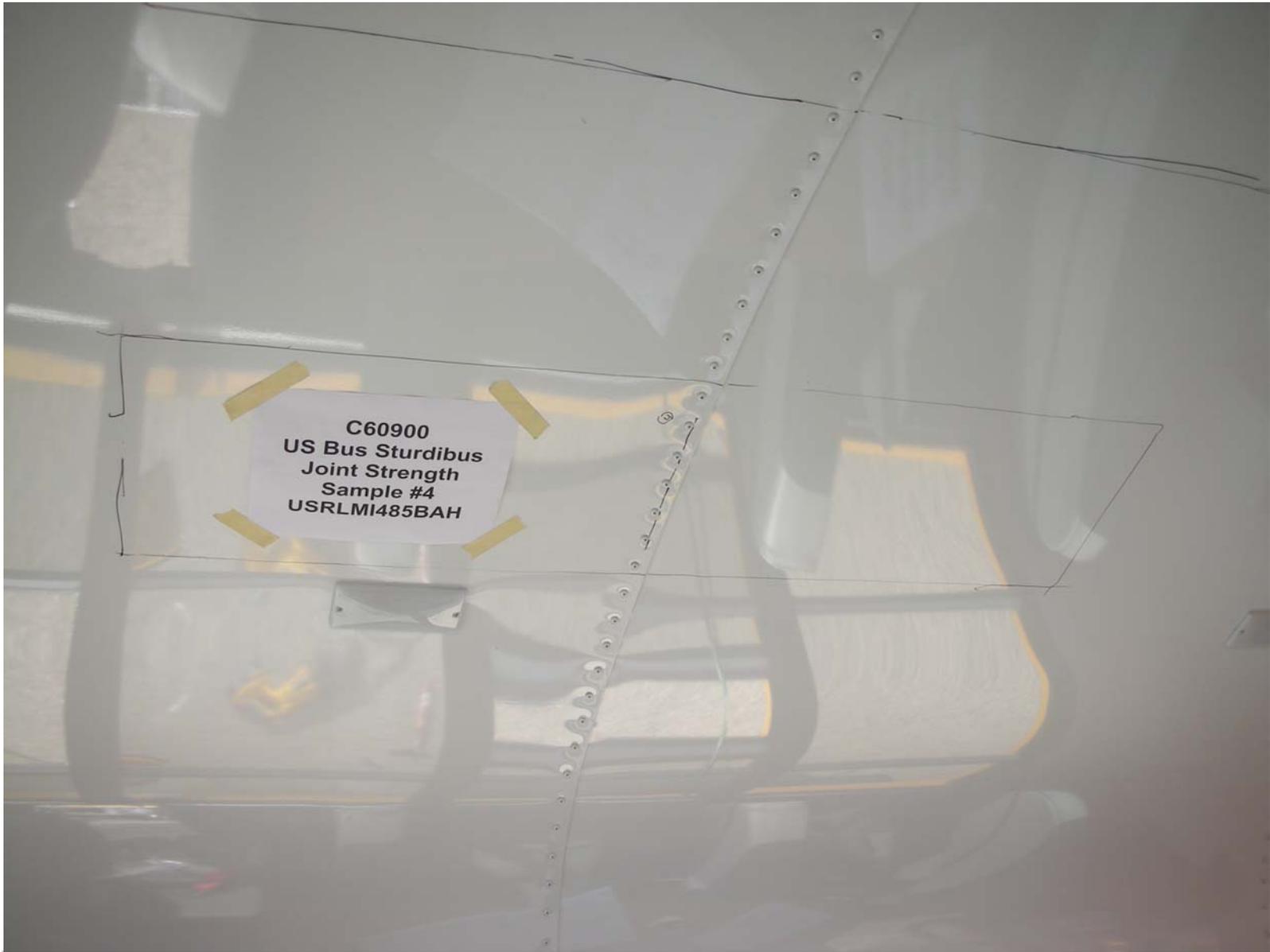
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Test Date: **10/09/07**



Location of Joint #3

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Location of Joint #4

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Pre-Test of Joint #1

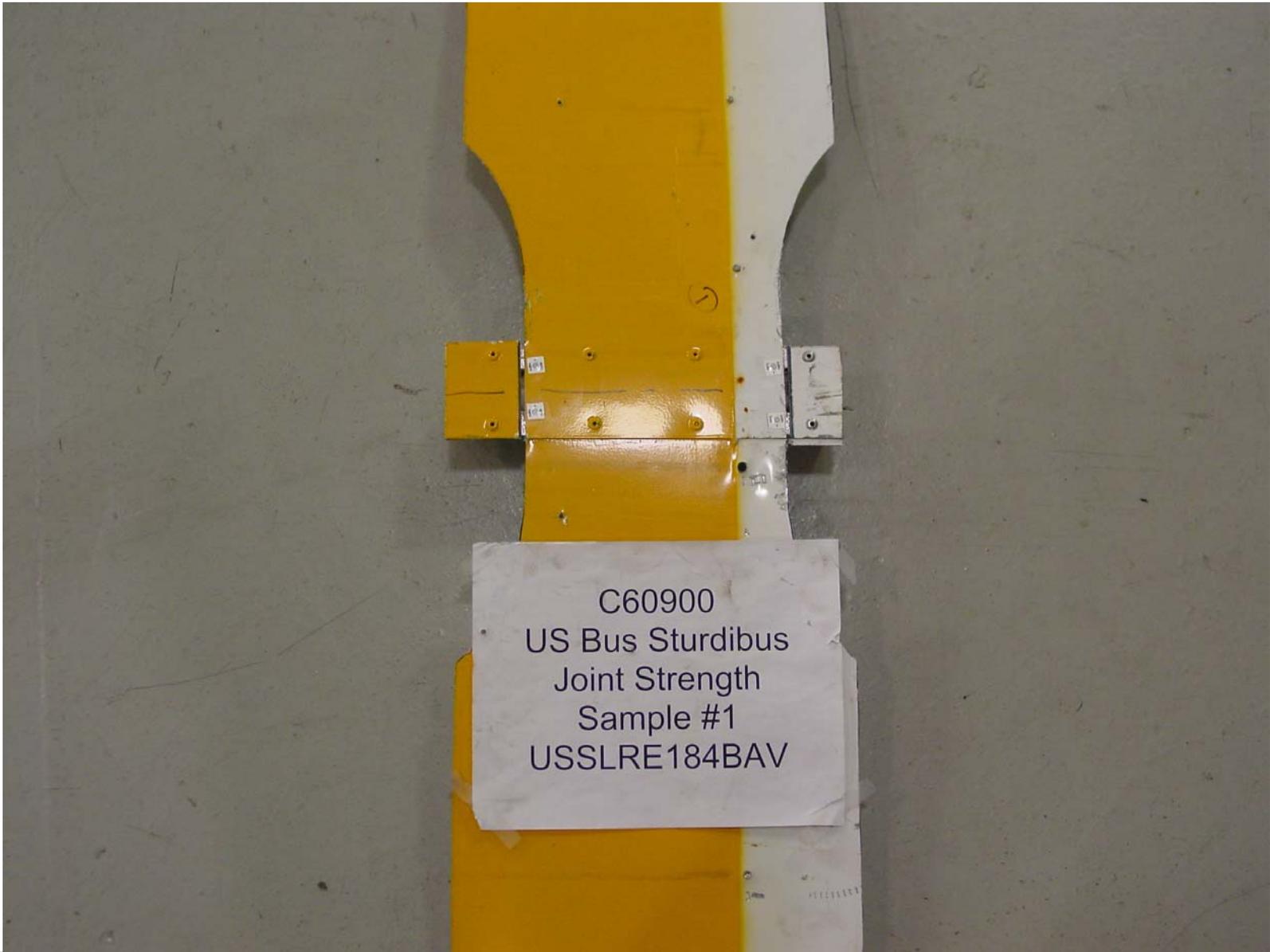
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Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

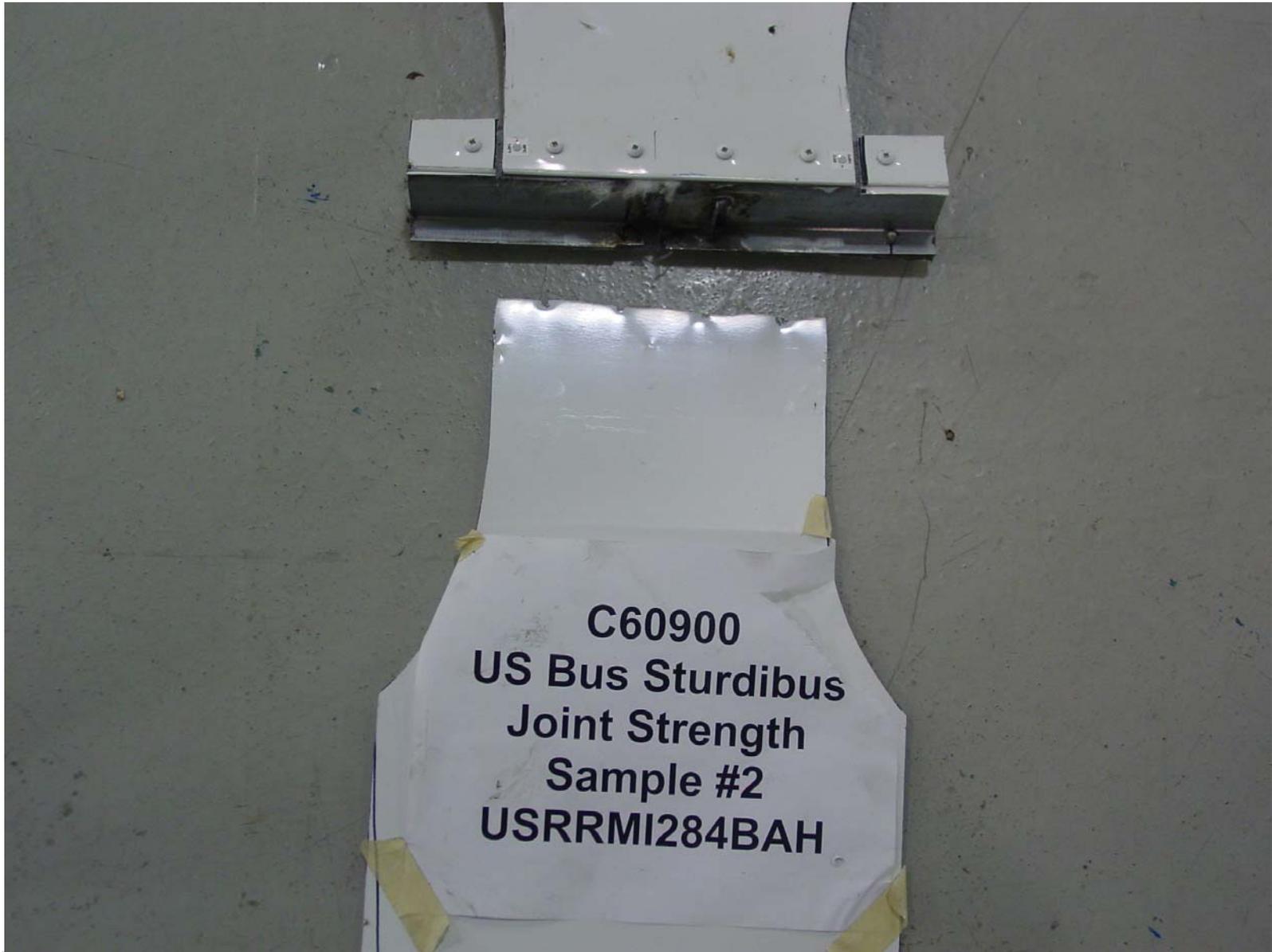
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Test Date: **10/09/07**



Pre-Test of Joint #2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Post-Test of Joint #2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Post-Test of Joint #2 view 2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



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Pre-Test of Joint #3

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Post-Test of Joint #3

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



Post-Test of Joint #3 view 2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

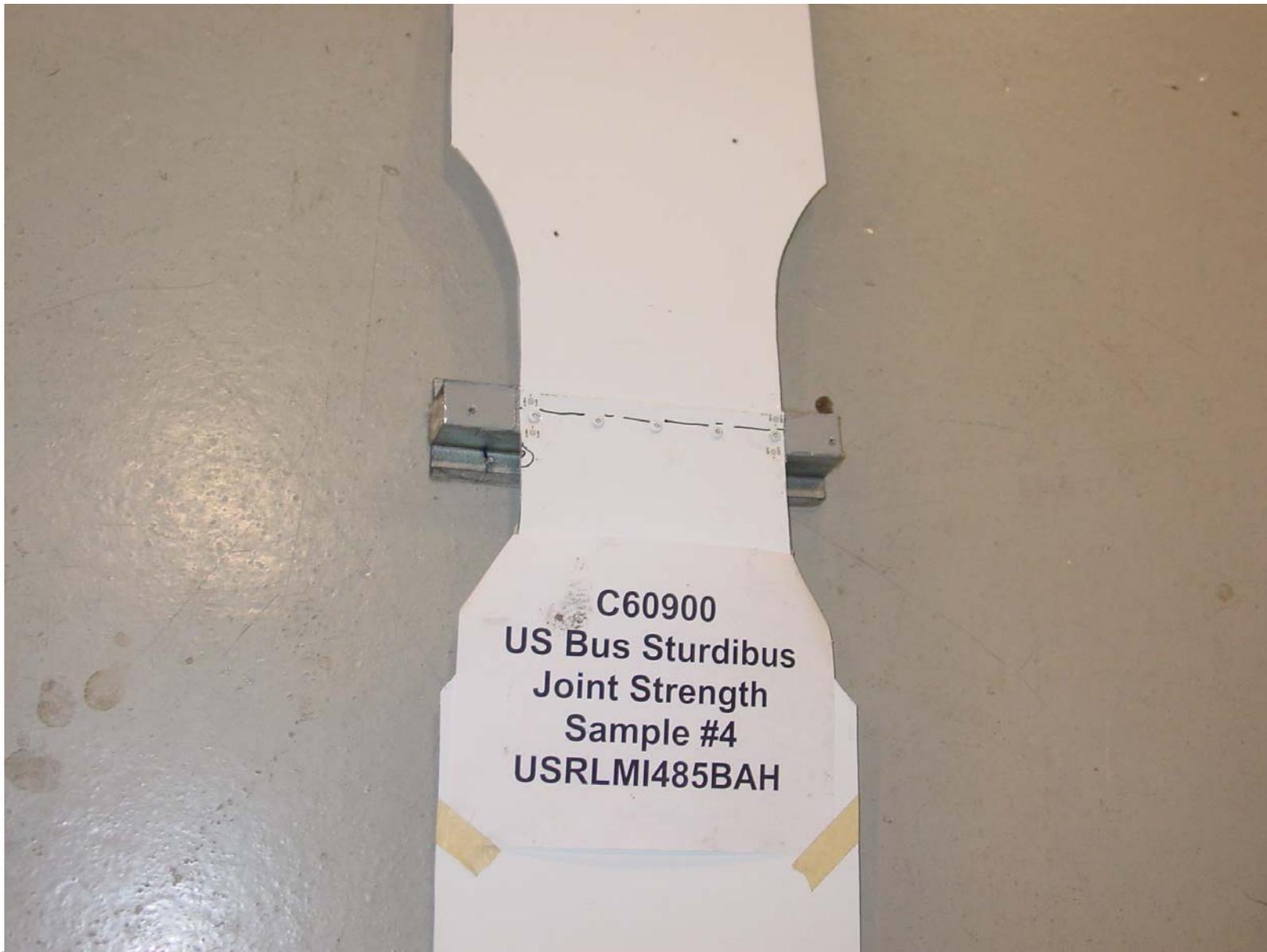
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Pre-Test of Joint #4

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Test Lab: **MGA RESEARCH CORPORATION**

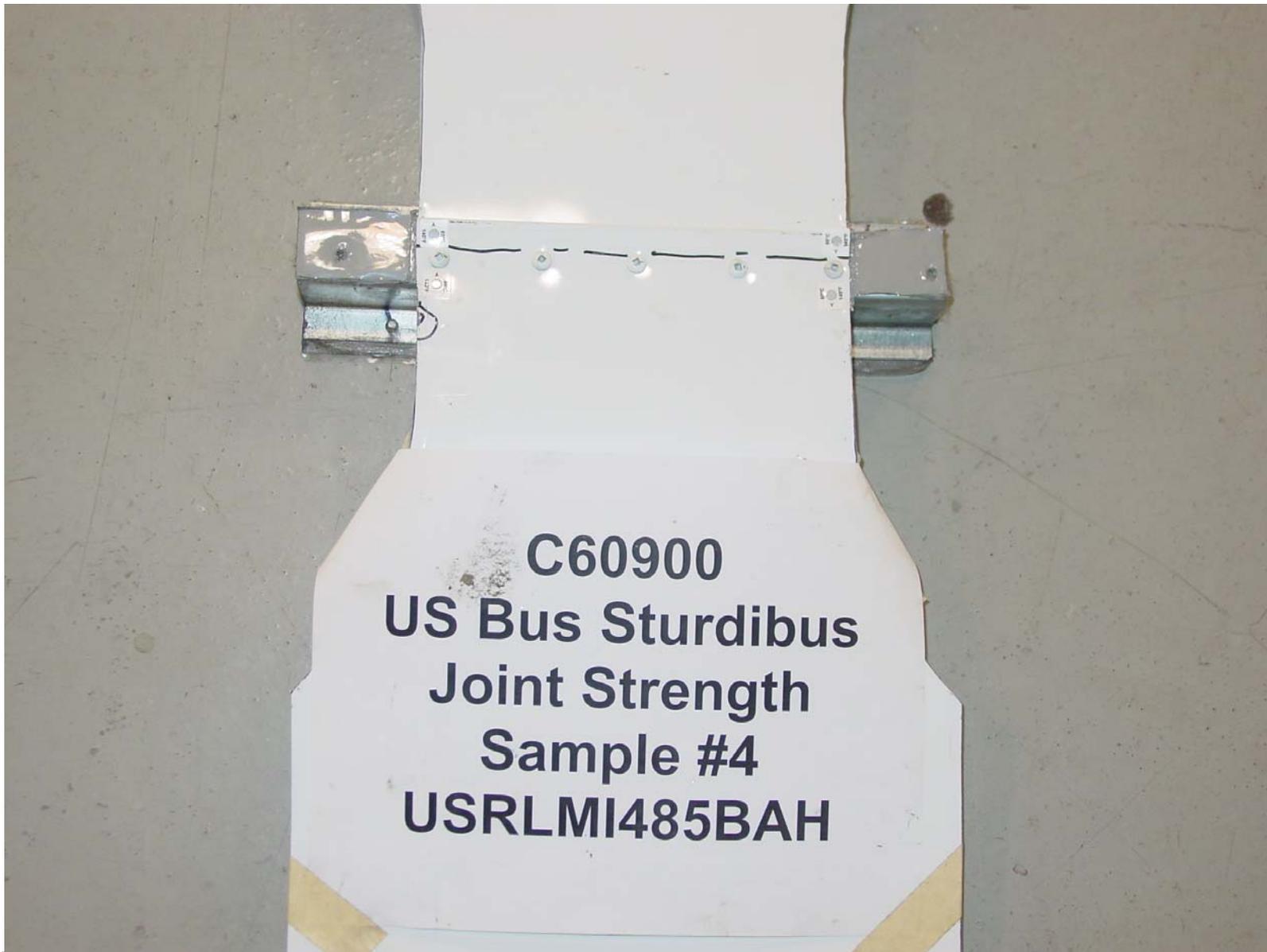
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Test Date: **10/09/07**



Post-Test of Joint #4

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



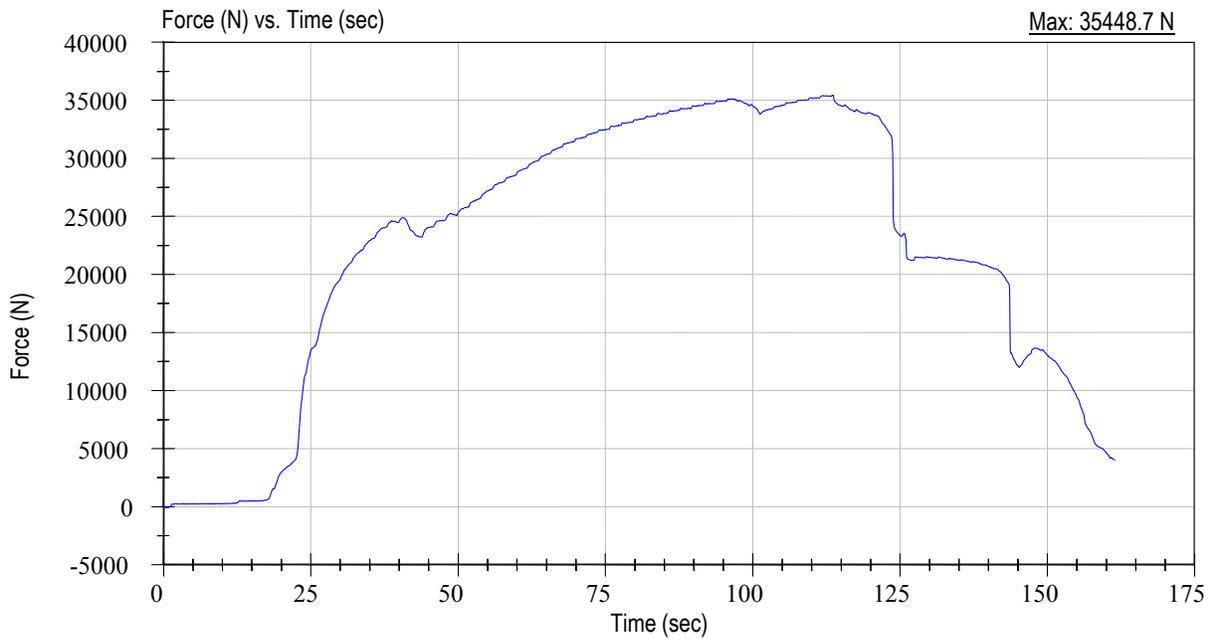
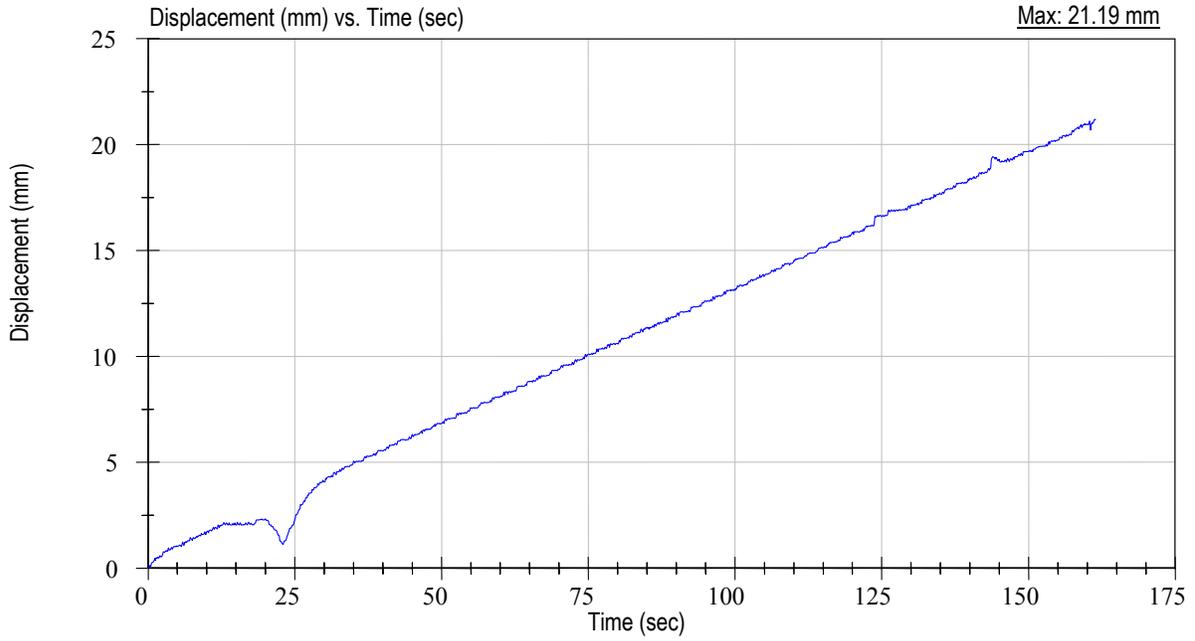
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TEST PLOTS
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Test Desc: FMVSS 221 (Required Load: 19205.6 N)
Sample: 1 (Side Rear Exterior Location)

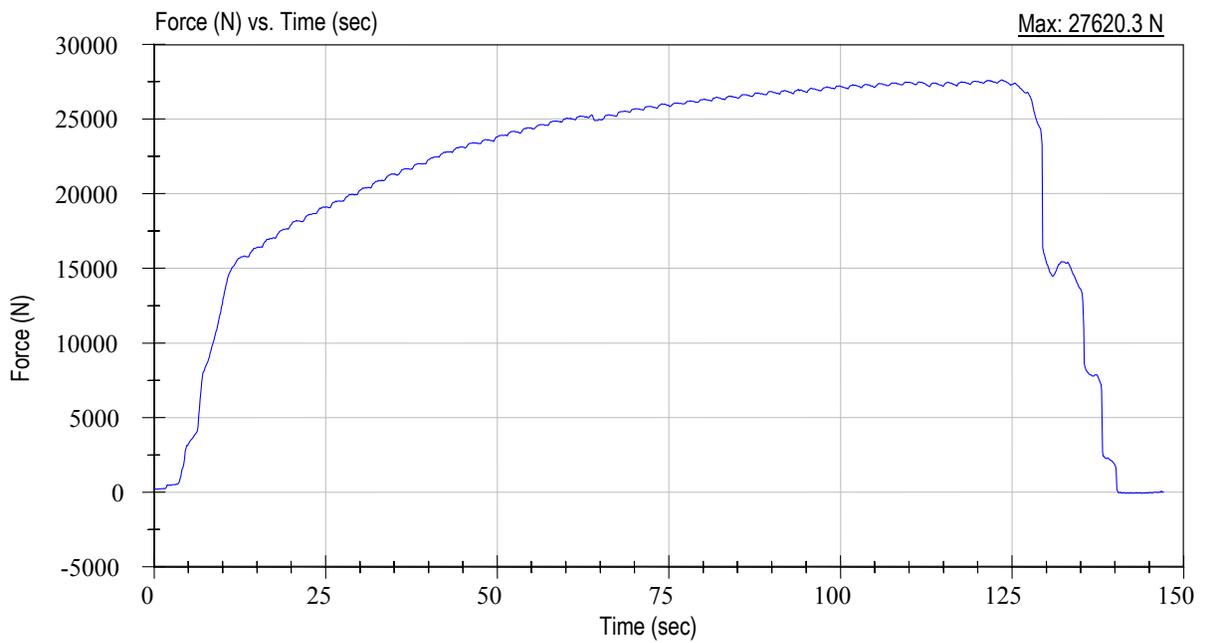
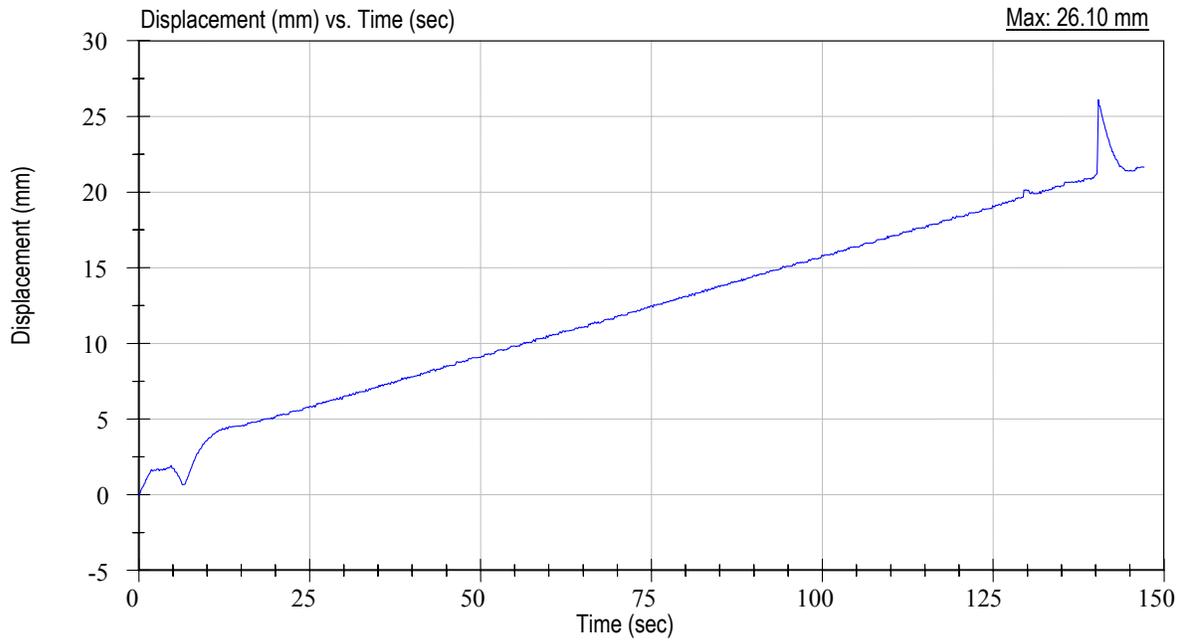
Test Date: 10-9-07
NHTSA No: C60900





Test Desc: FMVSS 221 (Required Load: 15364.5 N)
Sample: 2 (Roof Mid Interior Location)

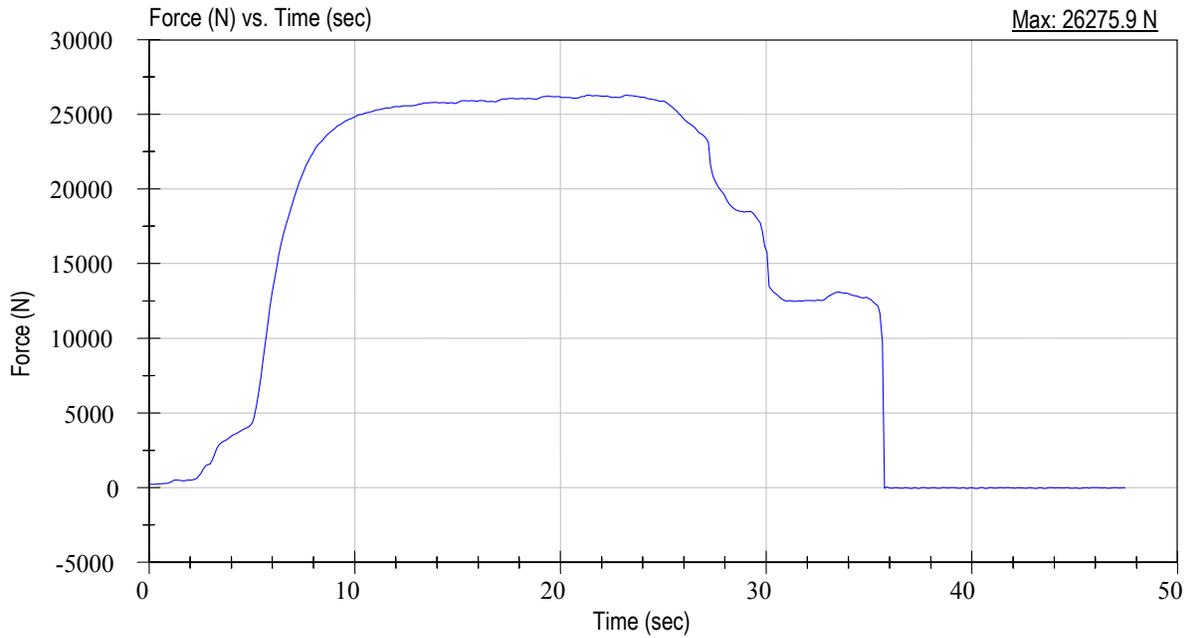
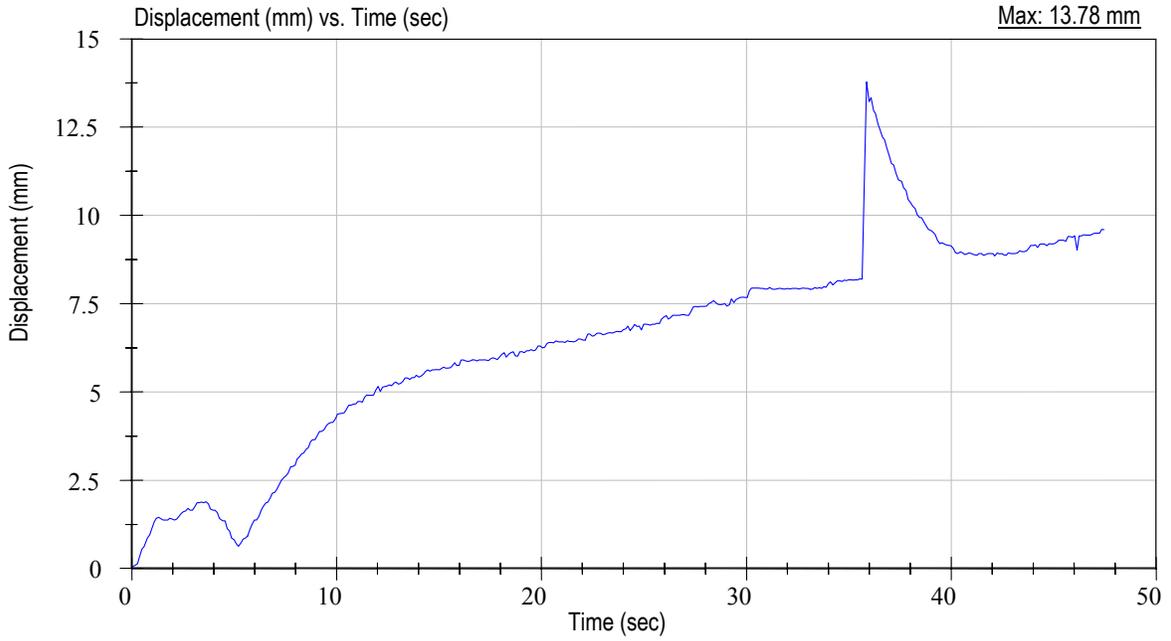
Test Date: 10-9-07
NHTSA No: C60900





Test Desc: FMVSS 221 (Required Load: 19205.6 N)
Sample: 3 (Roof Mid Exterior Location)

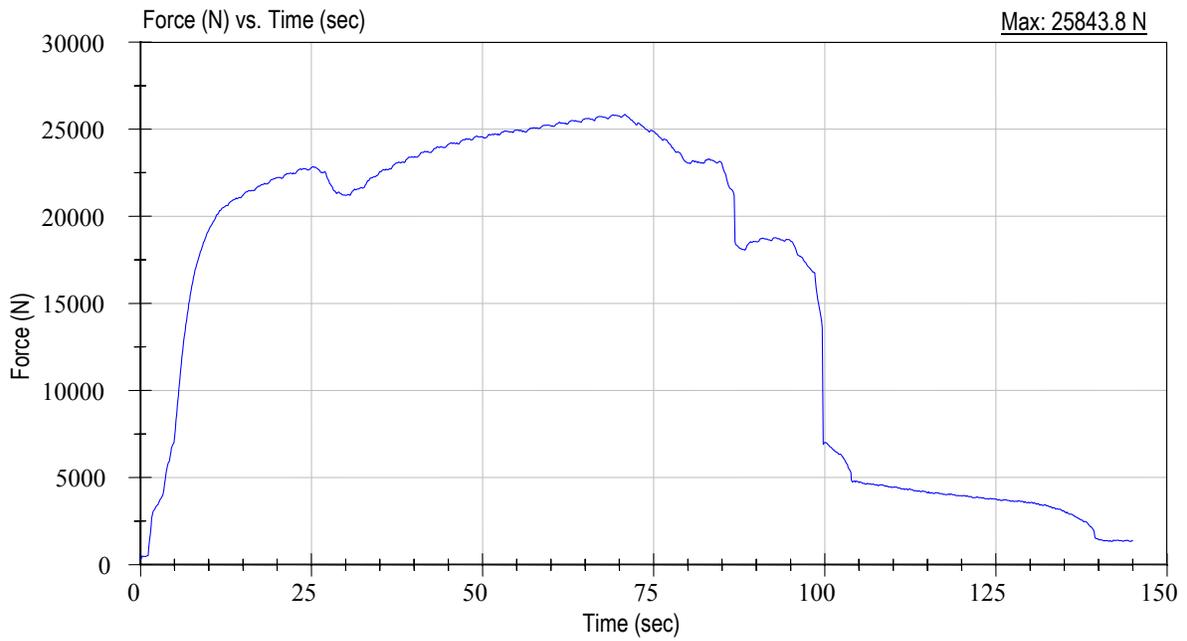
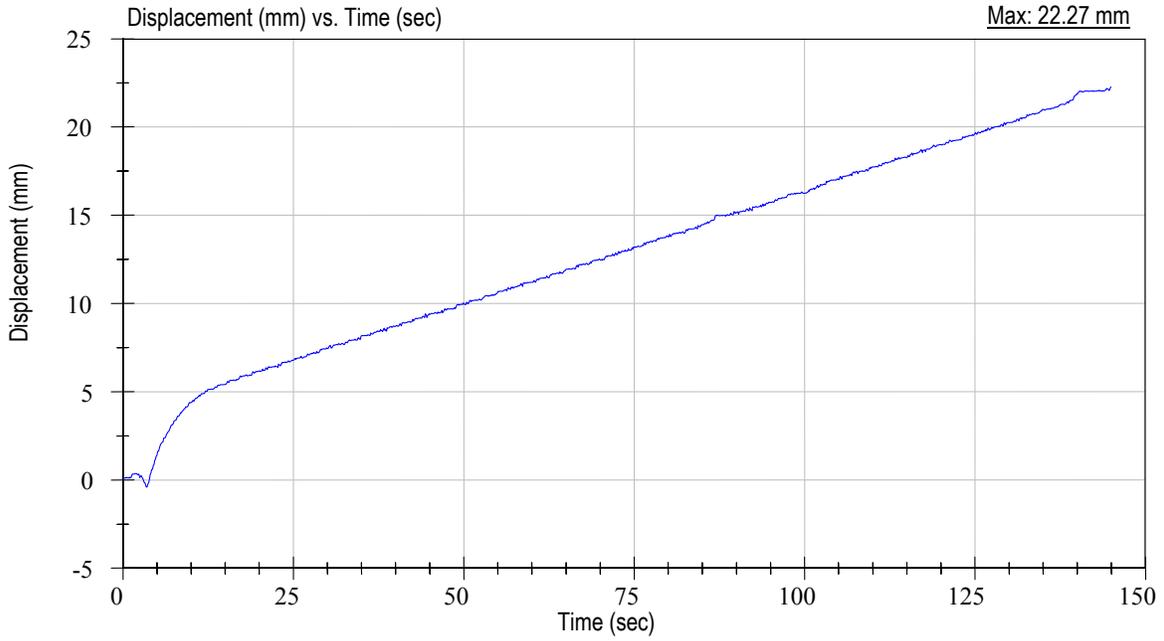
Test Date: 10-9-07
NHTSA No: C60900





Test Desc: FMVSS 221 (Required Load: 14935.3 N)
Sample: 4 (Roof Mid Interior Location)

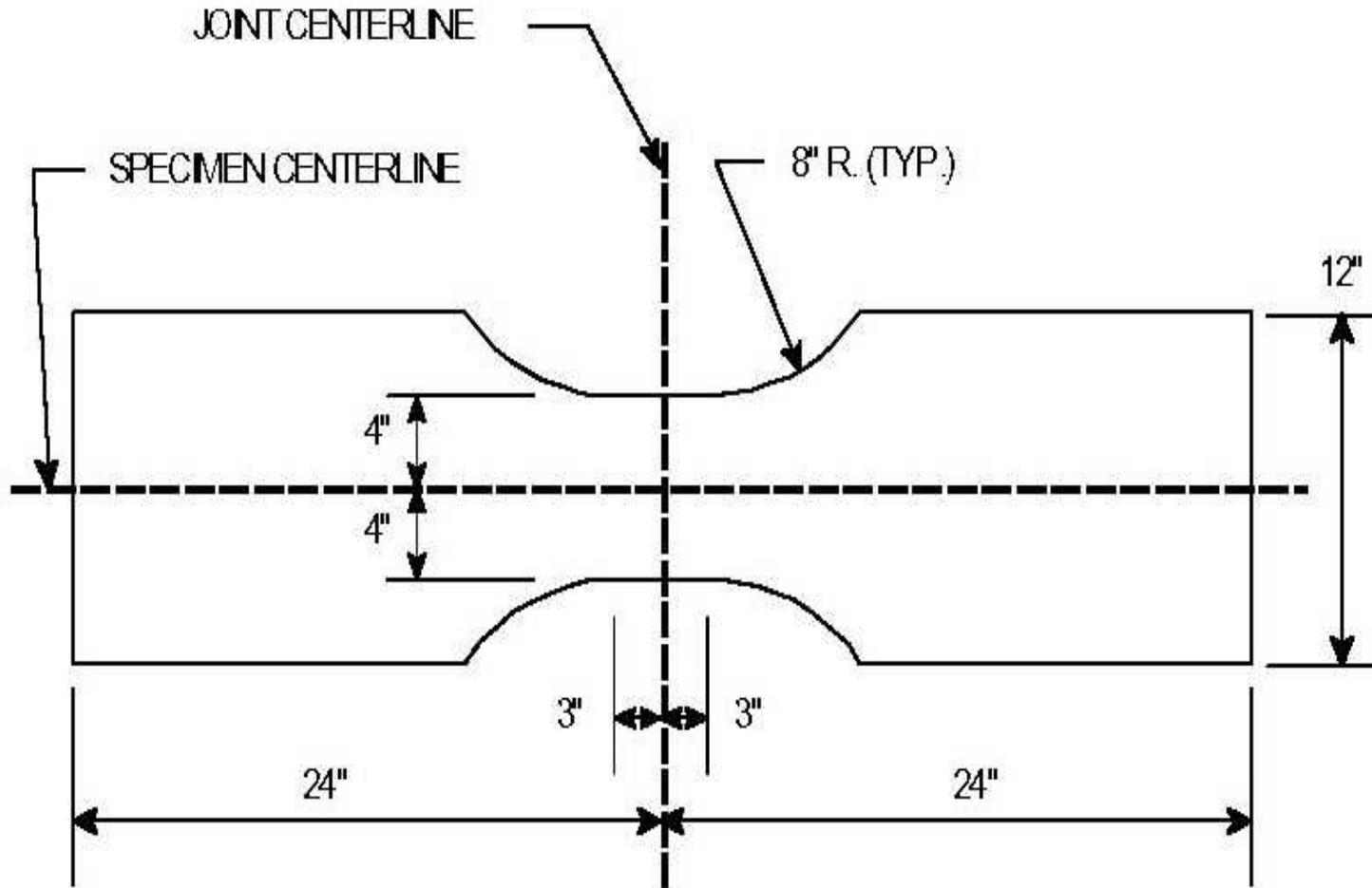
Test Date: 10-9-07
NHTSA No: C60900



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



Typical Test Sample Configuration

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



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View of Joint #1

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



View of Joint #2

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**

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View of Joint #3

Test Vehicle: **2006 US BUS STURDIBUS SCHOOL BUS**
Test Lab: **MGA RESEARCH CORPORATION**

NHTSA No.: **C60900**
Test Date: **10/09/07**



View of Joint #4