

HSNO: 638607

REPORT NUMBER: 221-MGA-05-003

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

**Les Entreprises Michel Corbell Inc.
2004 Corbell 30 Passenger School Bus
NHTSA No.: C40902**

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



Final Report Date: August 22, 2006

FINAL REPORT

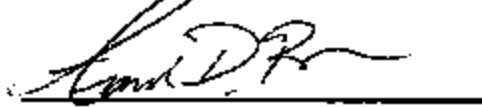
**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW, ROOM 6116 (NVS-224)
WASHINGTON, D.C. 20590**

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Prepared by:  Date: August 22, 2005
James Hansen, Project Engineer

Reviewed by:  Date: August 22, 2005
David Winkelbauer, Program Manager

FINAL REPORT ACCEPTED BY:



08/25/2005
Date of Acceptance

Technical Report Documentation Page

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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY2004 Corbeil 30 Passenger School Bus, NHTSA No. C40902, 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 MY2004 Corbell 30 Passenger School Bus, NHTSA No. C40902, was subjected to FMVSS 221 testing on July 5-8, 2005.

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 mid-roof interior (2), and the mid-roof Exterior (2).

	Maximum Load (N)	60% of Material Strength (N)	PASS/FAIL
Mid-Roof Interior	7002.6	16278.3	FAIL
Mid-Roof Interior	6495.2	16278.3	FAIL
Mid-Roof Exterior	14518.3	24721.9	FAIL
Mid-Roof Exterior	17760.2	23844.7	FAIL

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.

SECTION 4
COMPLIANCE TEST DATA

The following data sheets document the results of FMVSS 221 testing on the MY2004 Corbell 30 Passenger School Bus, NHTSA No. C40902.

**DATA SHEET 1
ADMINISTRATIVE DATA SHEET**

Test Vehicle: **2004 Corbell 30 Passenger School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C40902**
 Test Date: **07/05/05**

INCOMPLETE VEHICLE (IF APPLICABLE)

Manufacturer:	Ford
Model:	30 Passenger
VIN:	1FDXE45P14HA89880
Build Date:	03/04
Certification Date:	N/A

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	Les Enterprises Michel Corbell Inc.
Make/Model:	Ford / 30 Passenger
VIN:	1FDXE45P14HA89880
NHTSA No.:	C40902
Color:	Yellow
GVWR:	8372 kg / 14050 lbs
Build Date:	06/04
Certification Date:	N/A

DATES

Vehicle Receipt:	08/17/04
Start of Compliance Test:	7/5/05
Completion of Compliance Test:	7/8/05

COMPLIANCE TEST:

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

Recorded By: 

Approved By: 

Date: 07/05/05

DATA SHEET 2
SUMMARY OF DATA

Test Vehicle: 2004 Corbell 30 Passenger School Bus
Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C40902
Test Date: 07/05/05

Joint Specimen I.D.	Joint Location	Joint Load Reqmt (60%) (N)	Max. Load at Joint Separation (N)	Calculated Material Strength (N)	PASS/FAIL
C2SRLMI182BBH	Mid-Roof Interior	16278.3	7002.6	27130.6	FAIL
C2SRRMI282BBH	Mid-Roof Interior	16278.3	6485.2	27130.6	FAIL
C2SRLRE382BAV	Mid-Roof Exterior	24721.9	14518.3	41201.0	FAIL
C2SRRFE483BAH	Mid-Roof Exterior	23844.7	17760.2	39741.3	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: 07/05/05

DATA SHEET 3
JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: **2004 Corbell 30 Passenger School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C40902**
 Test Date: **07/05/05**

Specimen Description:	Mid-Roof Interior		
Joint Number:	C2SRLMI182BBH	Test Number:	1

	Weaker Member	Stronger Member
Material	AL EP 3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.9	N/A
Gage/Thickness (mm)	- / 1.016	N/A
Fastener Holes (No./Diameter - mm.)	2 / 4.78	N/A
Net Area (Sq. mm.)	196.8	N/A
Material Strength (N)	27130.6	N/A
60% of Material Strength (N)	16278.3	N/A
Maximum Load From Tensile Test of Joint (N)	7002.6	N/A
PASS/FAIL	FAIL	N/A

Comments: NONE

Recorded By: *J. P. Roberts*

Approved By: *[Signature]*

Date: 07/05/05

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: 2004 Corbell 30 Passenger School Bus
 Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C40902
 Test Date: 07/05/05

Specimen Description:	Mid-Roof Interior		
Joint Number:	C2SRRM1282BBH	Test Number:	2

	Weaker Member	Stronger Member
Material	AL EP 3003 H-14 Aluminum	N/A
Tensile Strength (MPa)	137.8	N/A
Gage/Thickness (mm)	- / 1.016	N/A
Fastener Holes (No./Diameter - mm.)	2 / 4.78	N/A
Net Area (Sq. mm.)	196.8	N/A
Material Strength (N)	27130.6	N/A
80% of Material Strength (N)	18278.3	N/A
Maximum Load From Tensile Test of Joint (N)	6495.2	N/A
PASS/FAIL	FAIL	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 07/05/05

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: 2004 Corbell 30 Passenger School Bus
 Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C40902
 Test Date: 07/06/05

Specimen Description:	Mid-Roof Exterior		
Joint Number:	C2SRLRE362BAV	Test Number:	3

	Weaker Member	Stronger Member
Material	3003 H-22 Aluminum	N/A
Tensile Strength (MPa)	213.7	N/A
Gage/Thickness (mm)	- / 1.016	N/A
Fastener Holes (No./Diameter - mm.)	2 / 6.73	N/A
Net Area (Sq. mm.)	192.8	N/A
Material Strength (N)	41201.0	N/A
60% of Material Strength (N)	24721.9	N/A
Maximum Load From Tensile Test of Joint (N)	14516.3	N/A
PASS/FAIL	FAIL	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 07/06/05

DATA SHEET 3... (Continued)

JOINT STRENGTH WHEN ASTM MATERIAL PROPERTIES ARE KNOWN

Test Vehicle: **2004 Corbell 30 Passenger School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**


NHTSA No.: **C40902**
 Test Date: **07/06/05**

Specimen Description:	Mid-Roof Exterior		
Joint Number:	C2SRFE483BAH	Test Number:	4

	Weaker Member	Stronger Member
Material	3003 H-22 Aluminum	N/A
Tensile Strength (MPa)	213.7	N/A
Gage/Thickness (mm)	- / 1.016	N/A
Fastener Holes (No./Diameter - mm.)	3 / 6.73	N/A
Net Area (Sq. mm.)	185.94	N/A
Material Strength (N)	39741.3	N/A
60% of Material Strength (N)	23844.7	N/A
Maximum Load From Tensile Test of Joint (N)	17750.2	N/A
PASS/FAIL	FAIL	N/A

Comments: NONE

Recorded By: 

Approved By: 

Date: 07/06/05

**SECTION 5
INSTRUMENTATION AND EQUIPMENT LIST**

Test Vehicle: 2004 Corbell 30 Passenger School Bus
Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C40902
Test Date: 07/06/05

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Load Cell	Interface	1220AF / 137778	03/31/05	09/30/05
Linear Potentiometer	Patriot	P40A / 21783	07/01/05	01/01/06
Steel Tape	Stanley	Powerlock / 101	05/31/05	11/31/05
Digital Callipers	Mitutoyo	CD-8" cal/ 0441268	04/01/05	10/01/05
Temp. Stickers	McMaster Carr	60° C / 6852K21	One Time Use	—

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Total Vehicle 2004 Corolla 30 Passenger
Procedure FMS99 221

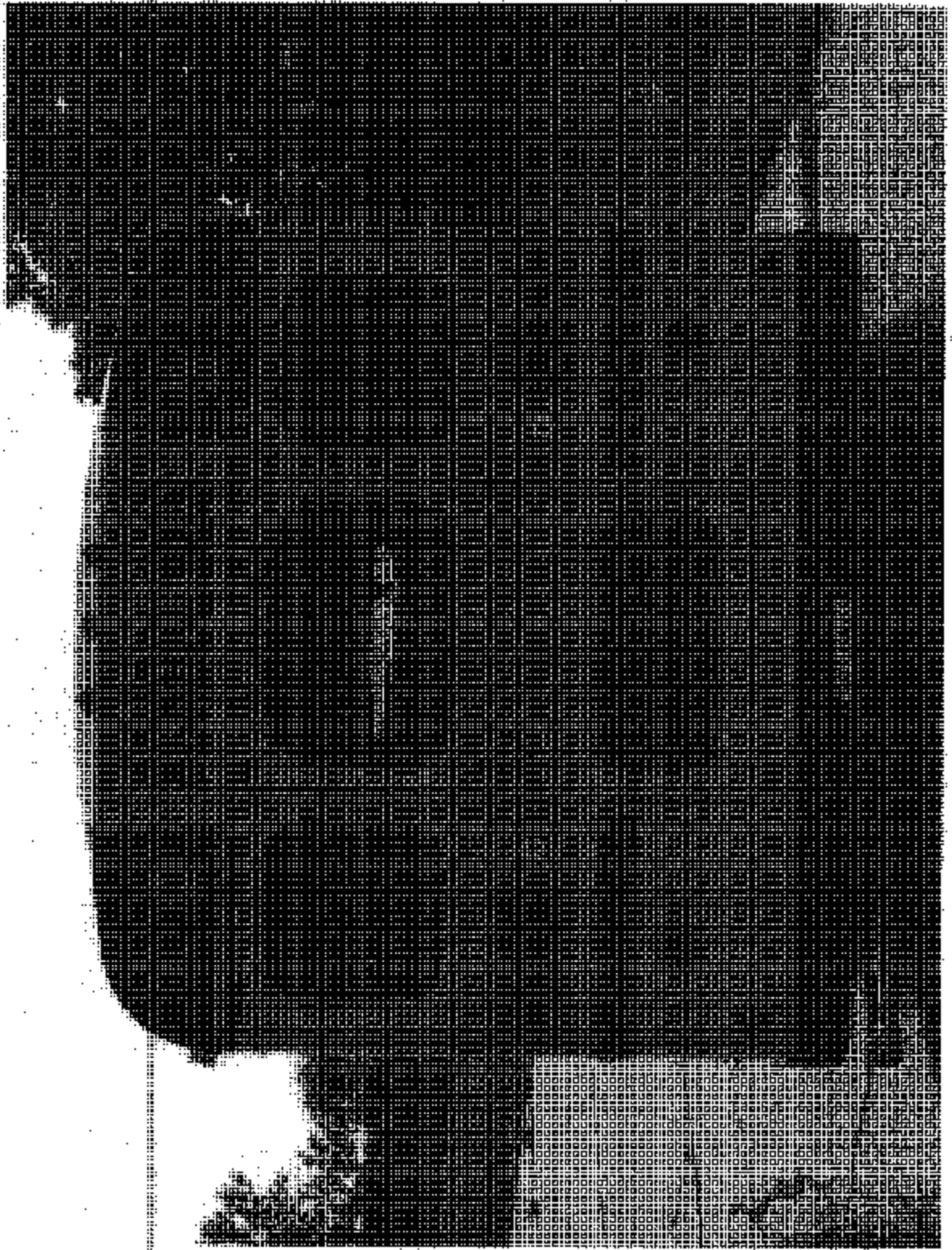
NTISA No. C45002



Top View of Seated Bus

Test Vehicle: 2004 Corolla 30 Passenger
Program: FMVSS 224

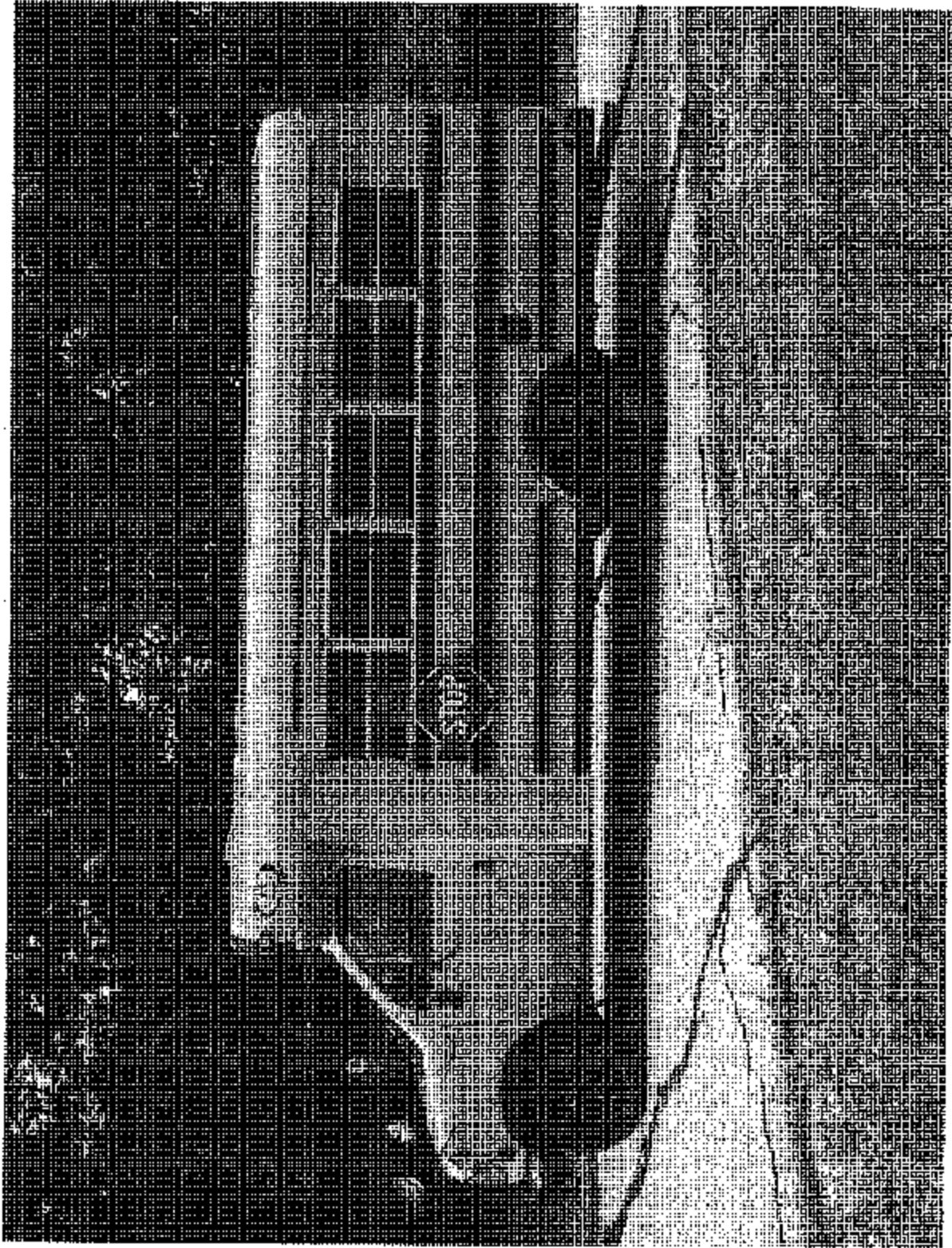
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Rear View of School Bus

Test Vehicle. 2004 Corbaal 10 Passenger
Procedure. FMVSS 221

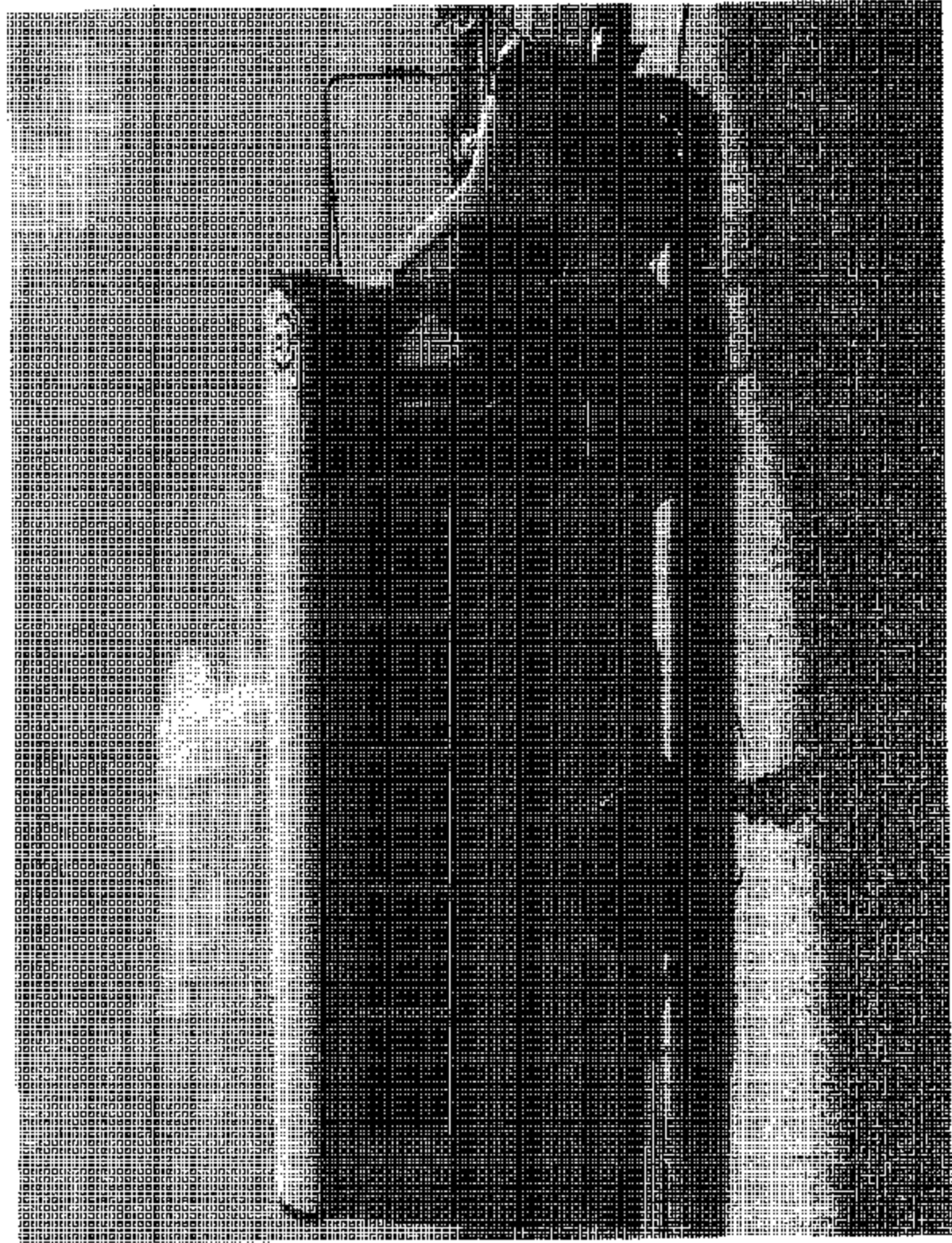
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Left Side View of School Bus

Test Vehicle: 2004 Corbel 30 Passenger
Procedure: FMVSS 226

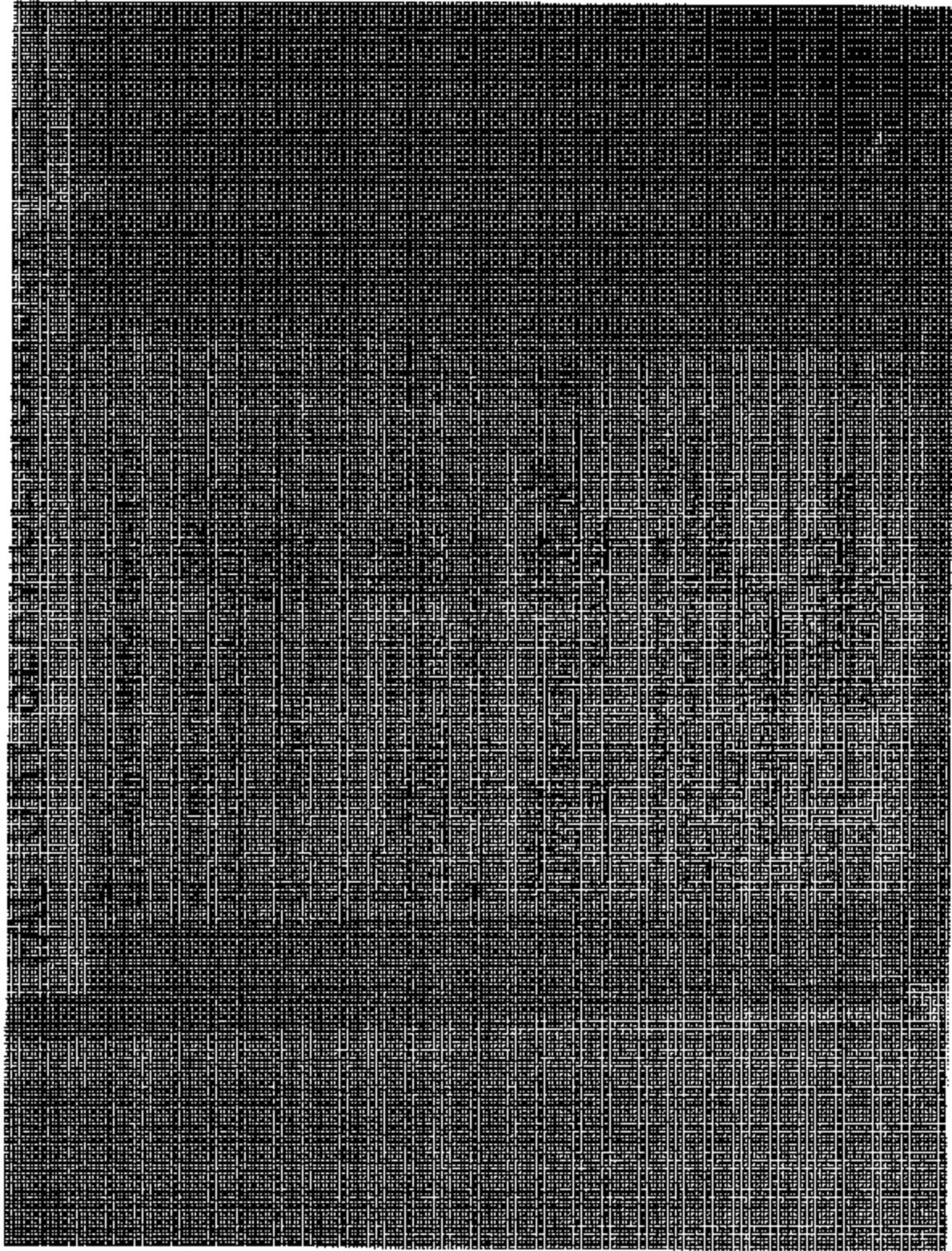
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Right Side View of School Bus

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

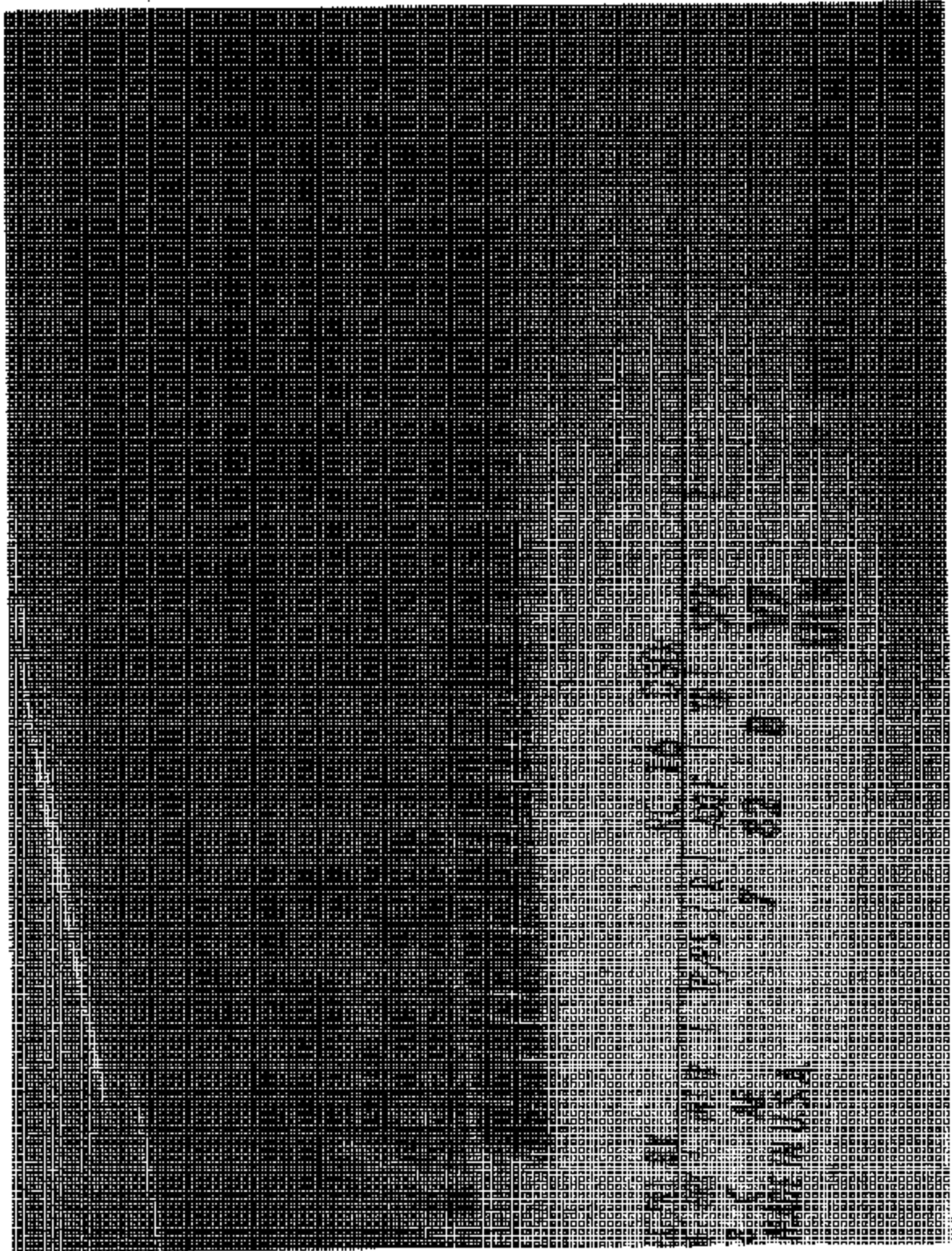
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Close up View of Certification Label

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMV335 22F

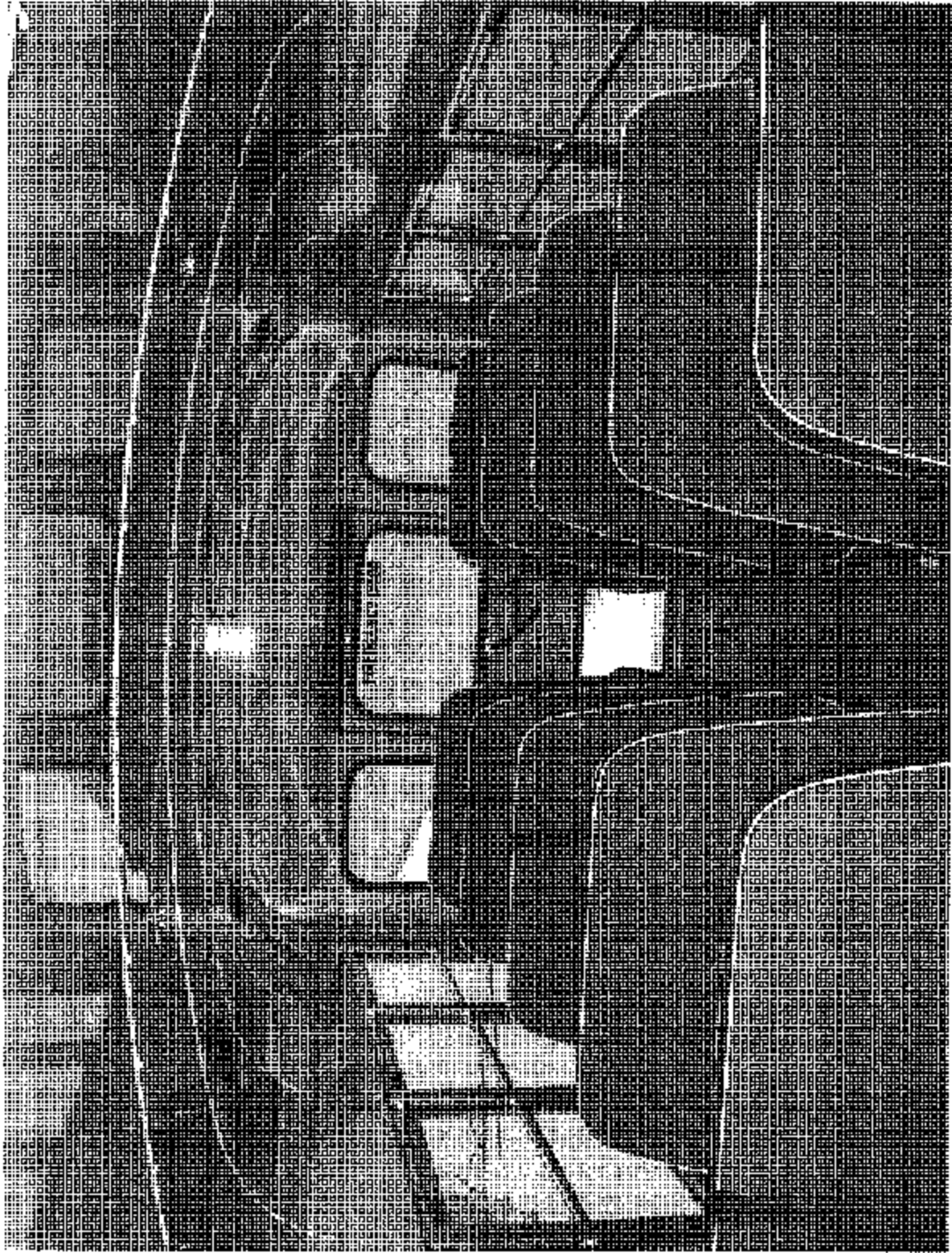
NHTSA No: C-40902



Tire Information Label

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

NHTSA No.: C40902



Vehicle Interior View Front to Rear

Test Vehicle: 2004 Corbett 30 Passenger
Procedure: FMVSS 221

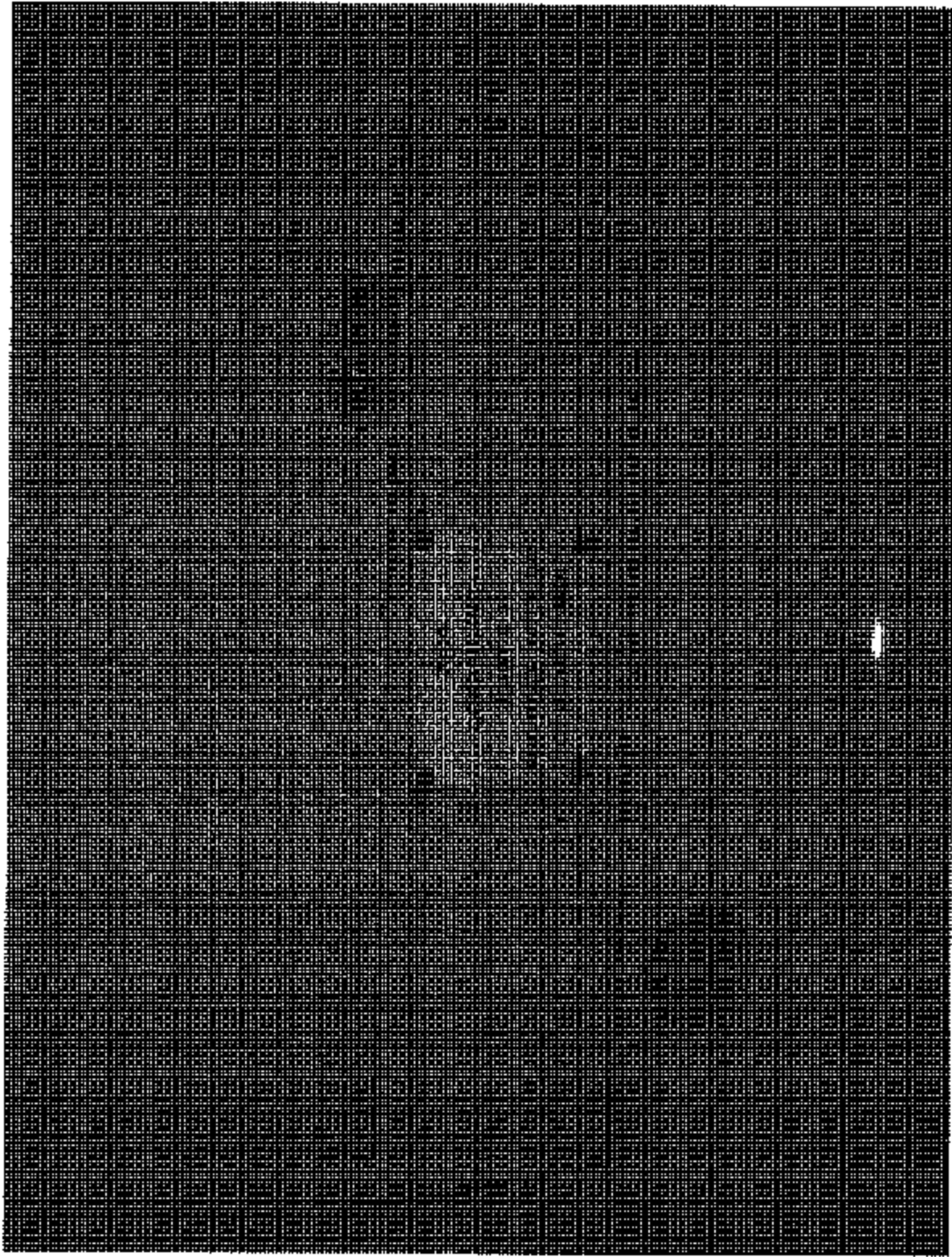
NTSA No. C40802



Vehicle Interior View Rear to Front

Test Vehicle: 2004 Corolla 30 Passenger
Procedure: FMVSS 121

NHTSA No.: C40902

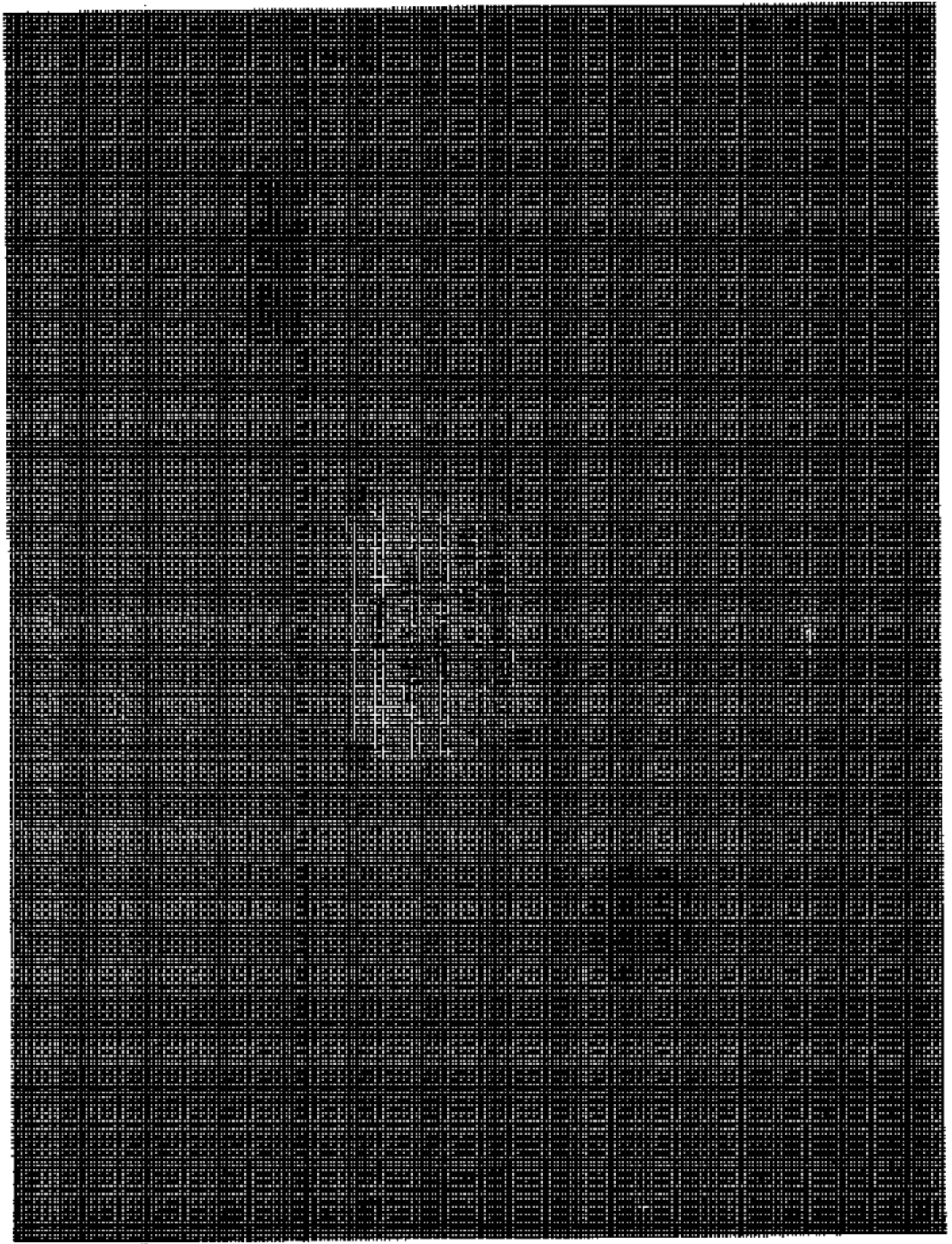


Location of Joint #1

Test Vehicle
Procedure

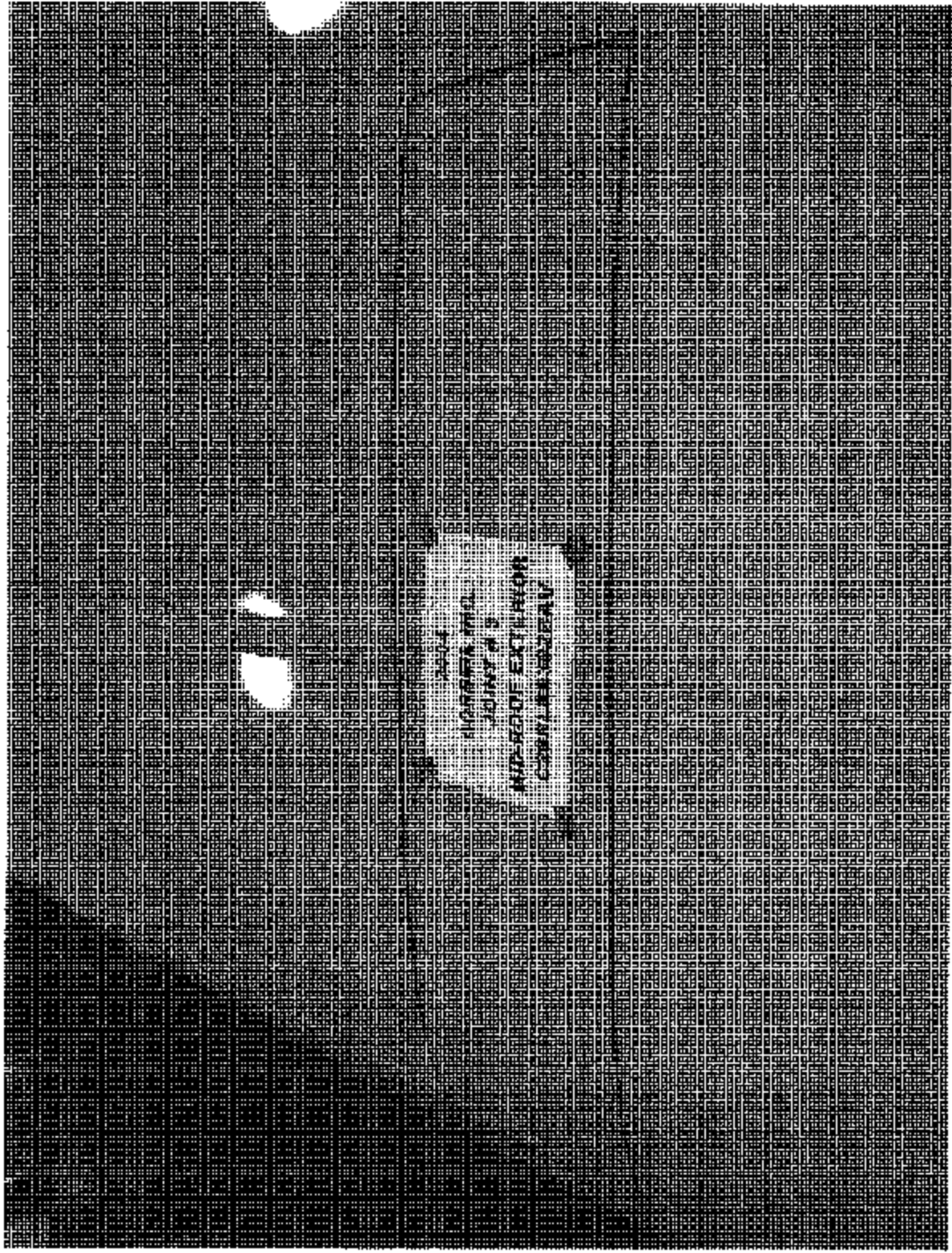
2004 Corbett 30 Passenger
FMYSS 221

NHTSA No: C10502



Test Vehicle: 2004 Corbett 30 Passenger
Procedure: FMVSS 221

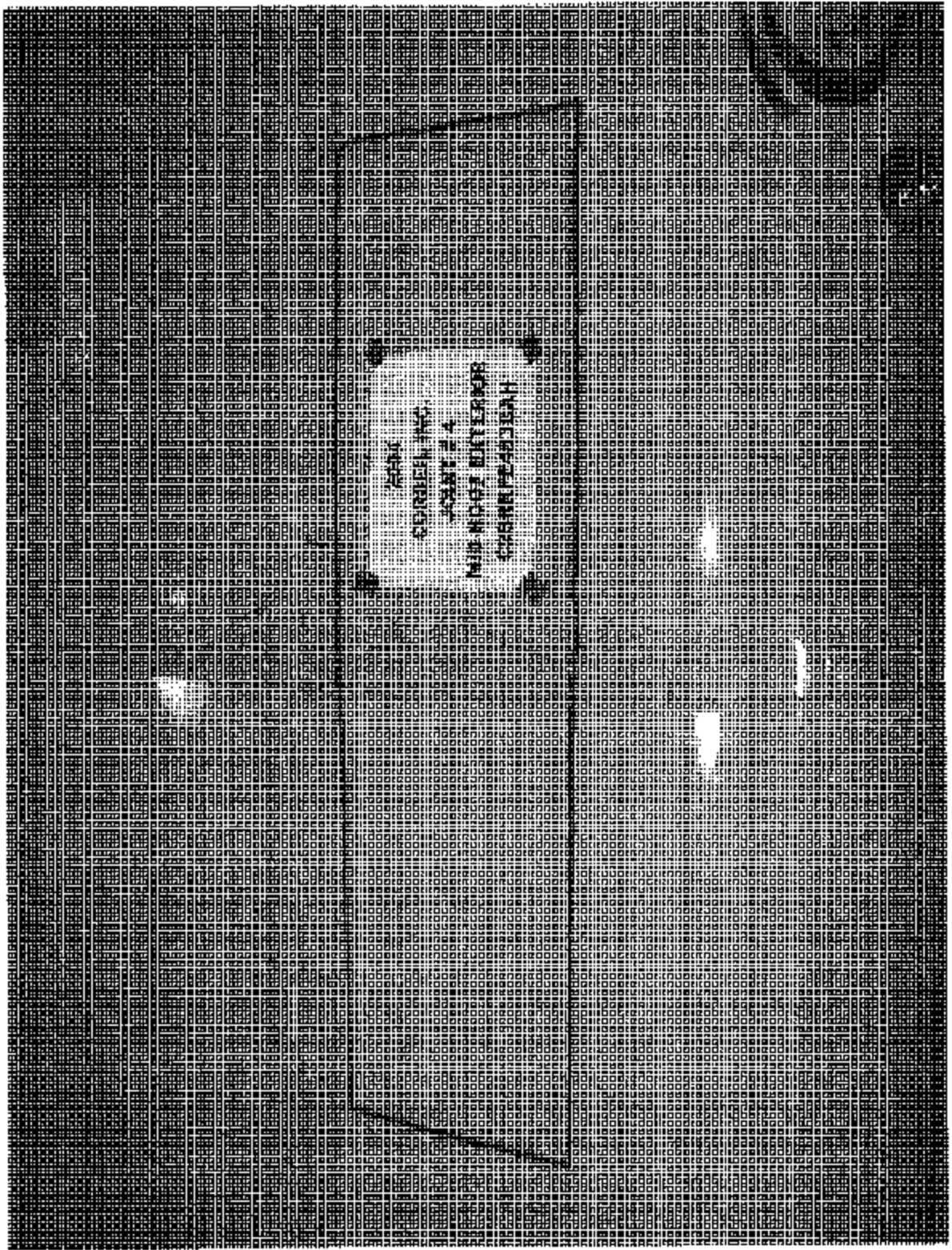
NHTSA No.: C40902



Location of Joint #3

Test Vehicle: 2004 Corolla 3D Passenger
Procedure: FMVSS 227

FHISA No.: 040502



Location of Joint #4

Test Vehicle: 2024 Corolla 30 Passenger
Procedure: FMVSS 221

NHTSA No.: C40902



Pre-Test of Joint #1

Test Vehicle
Procedure.

2004 Corolla 16 Passenger
FMVSS 221

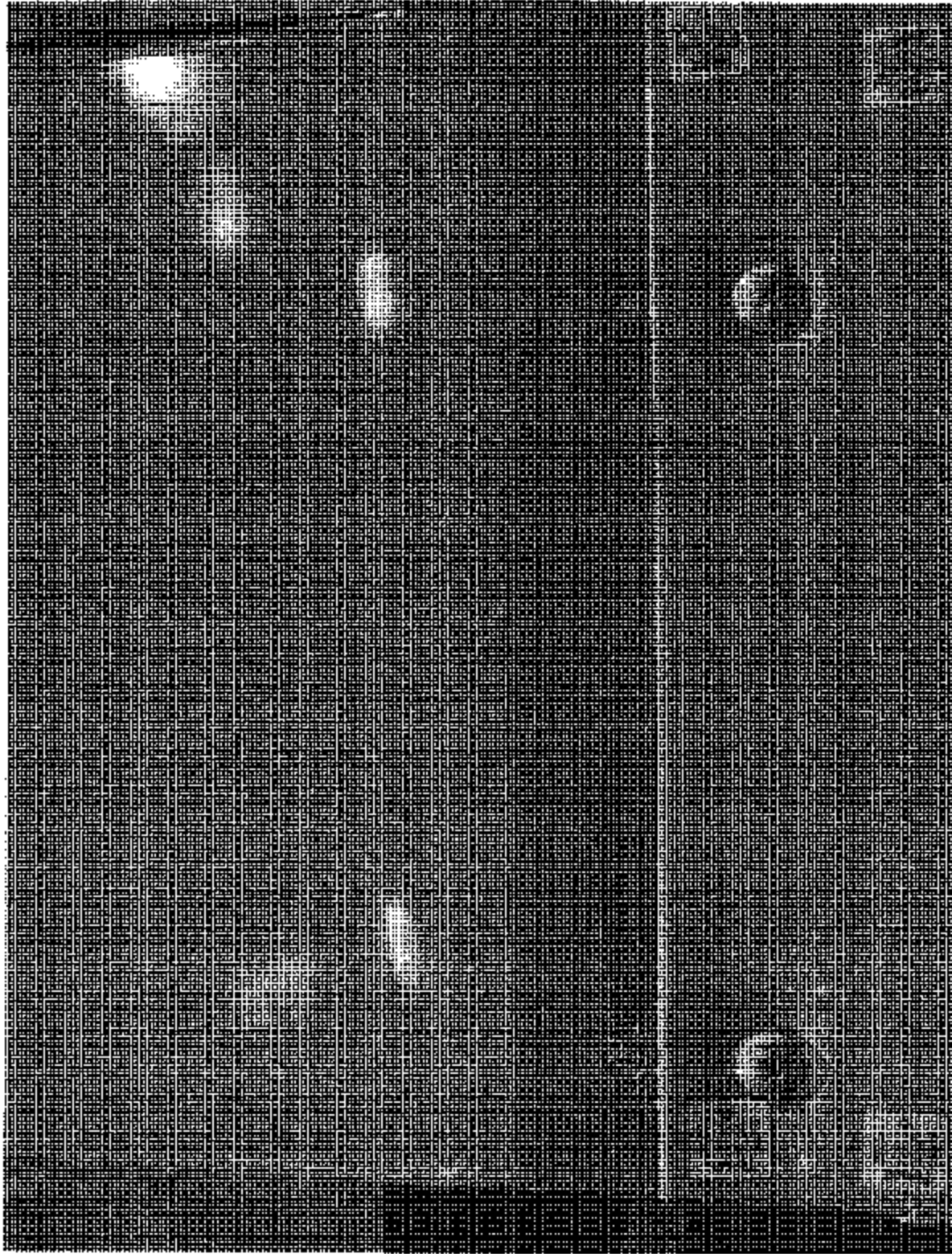
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Post-Test of Vehicle

Test Vehicle: 2014 Corbett 30 Passenger
Procedure: FMVSS 221

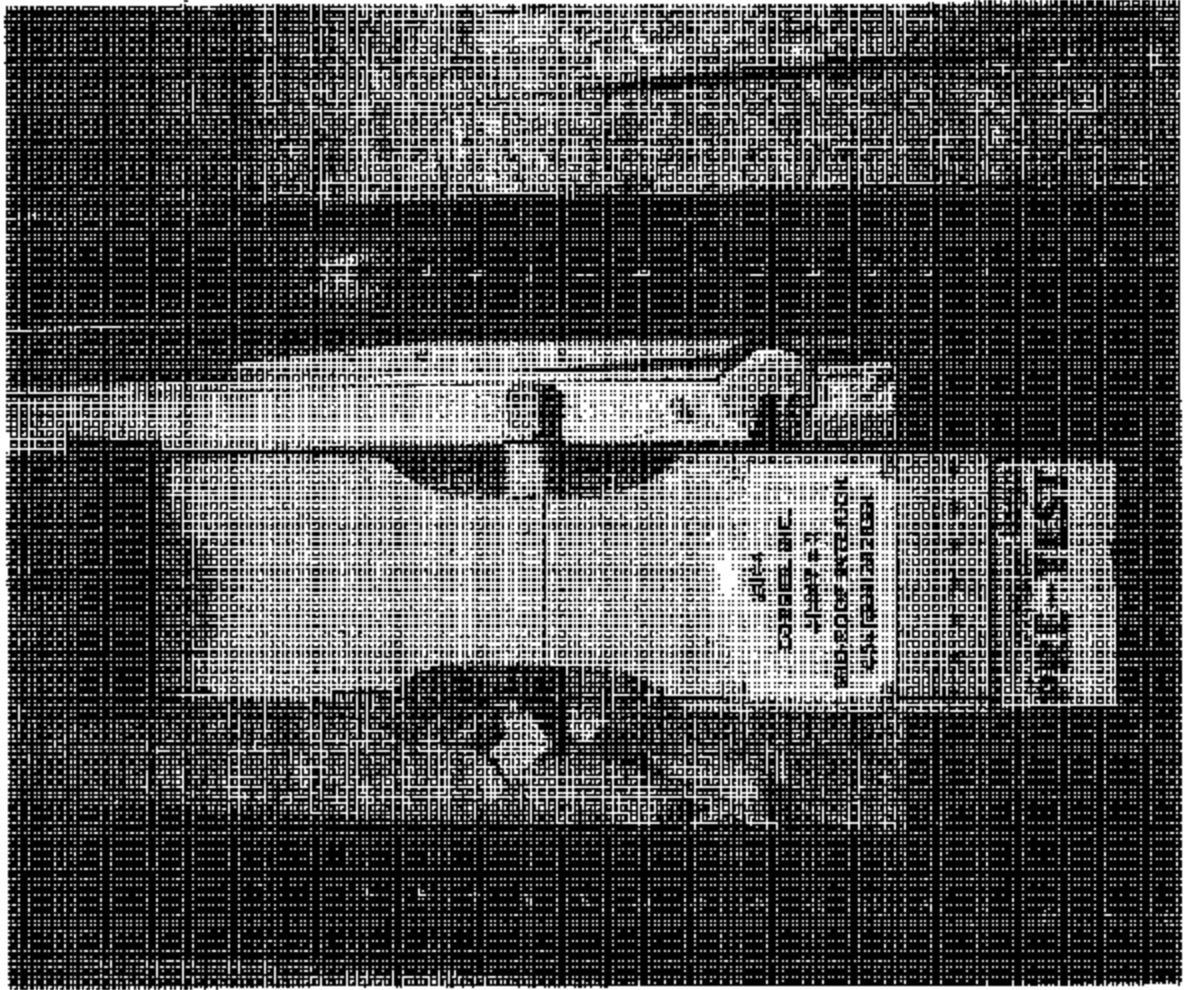
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Post-Test of Joint #3 view 2

Test Vehicle: 2004 Corolla 30 Passenger
Procedure: FMVSS 221

NHTSA No. C49502



Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

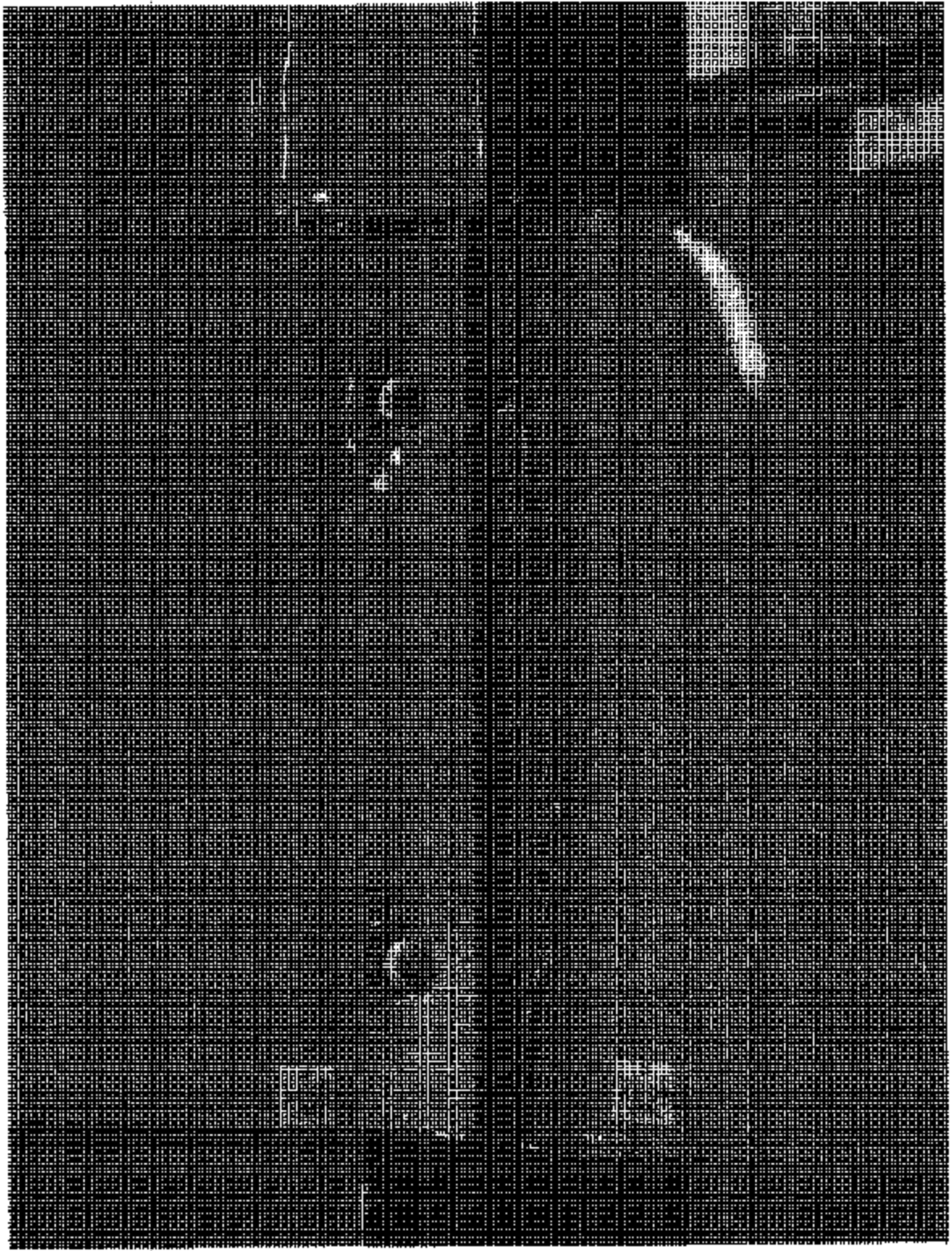
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Post-Test of Joint #2

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

NHTSA No. C40902



Post-Test of Joint #2 view 2

Test Vehicle: 2004 Corbel 30 Passenger
Procedure: EMYSS 221

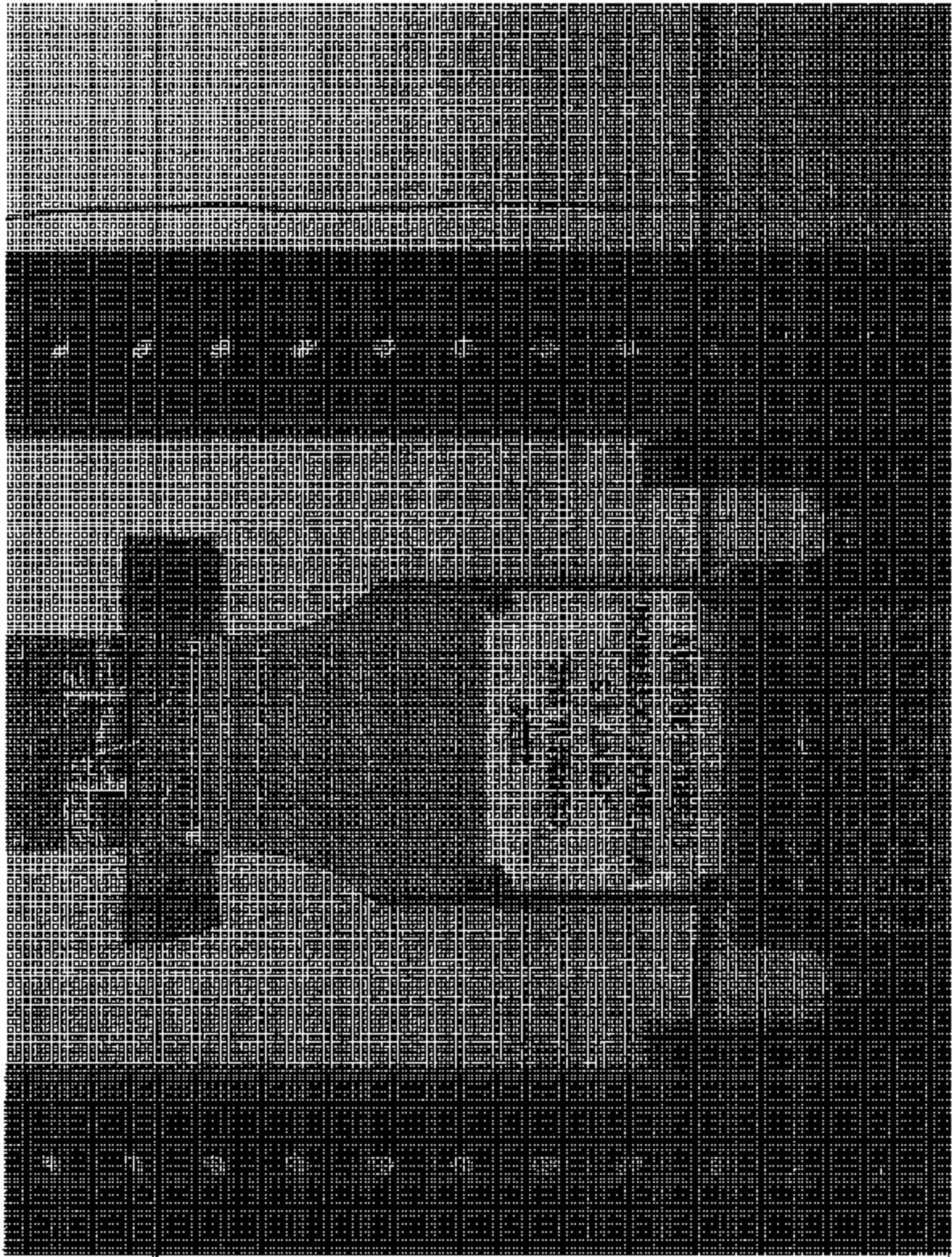
NHTSA No: CA0902



Fig-Test of Joint #3

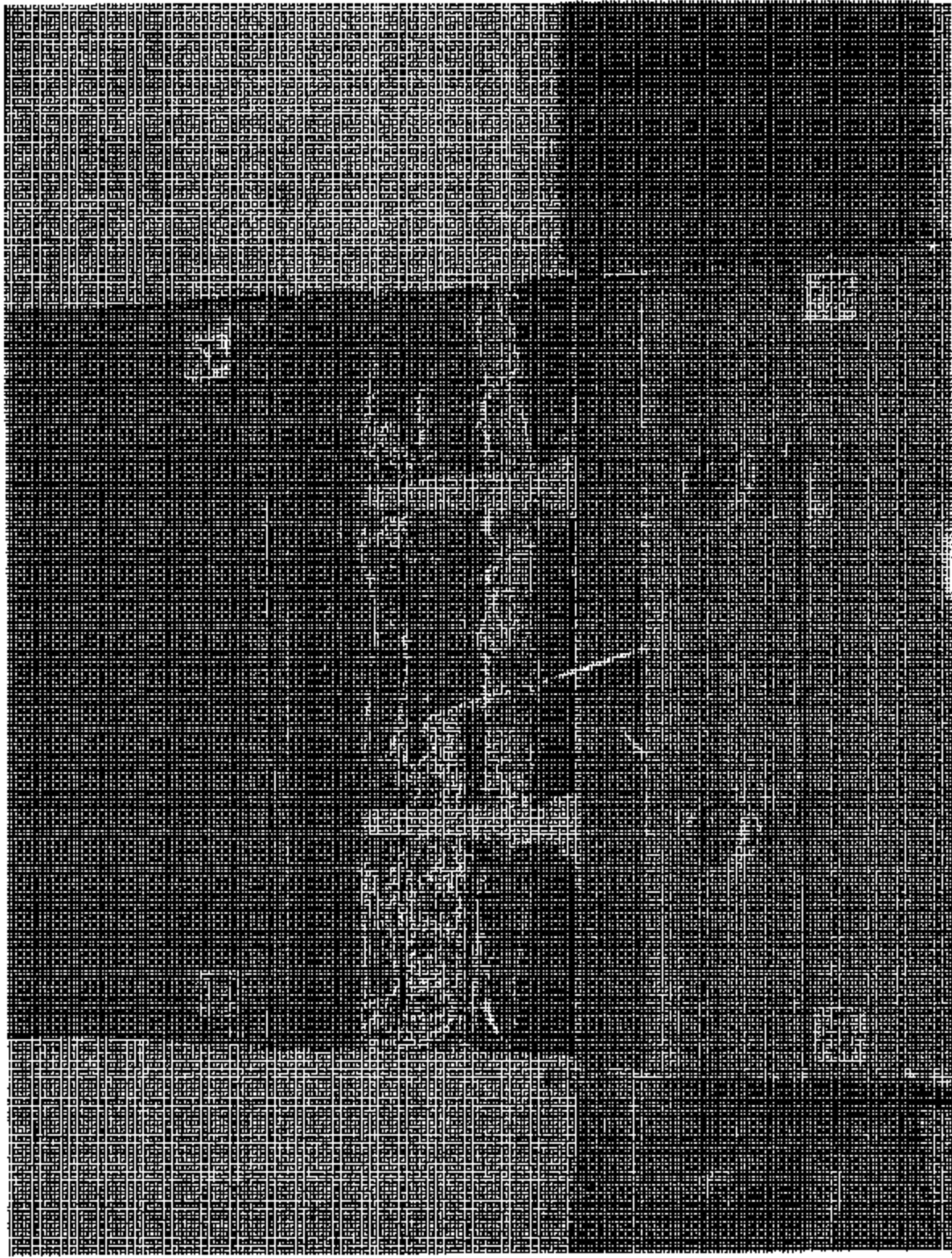
Test Vehicle: 2004 Corolla 80 Passenger
Procedure: FMVSS 221

NHTSA No. C49502



Test Vehicle: 2004 Corbell 50 Passenger
Procedure: FMVSS 221

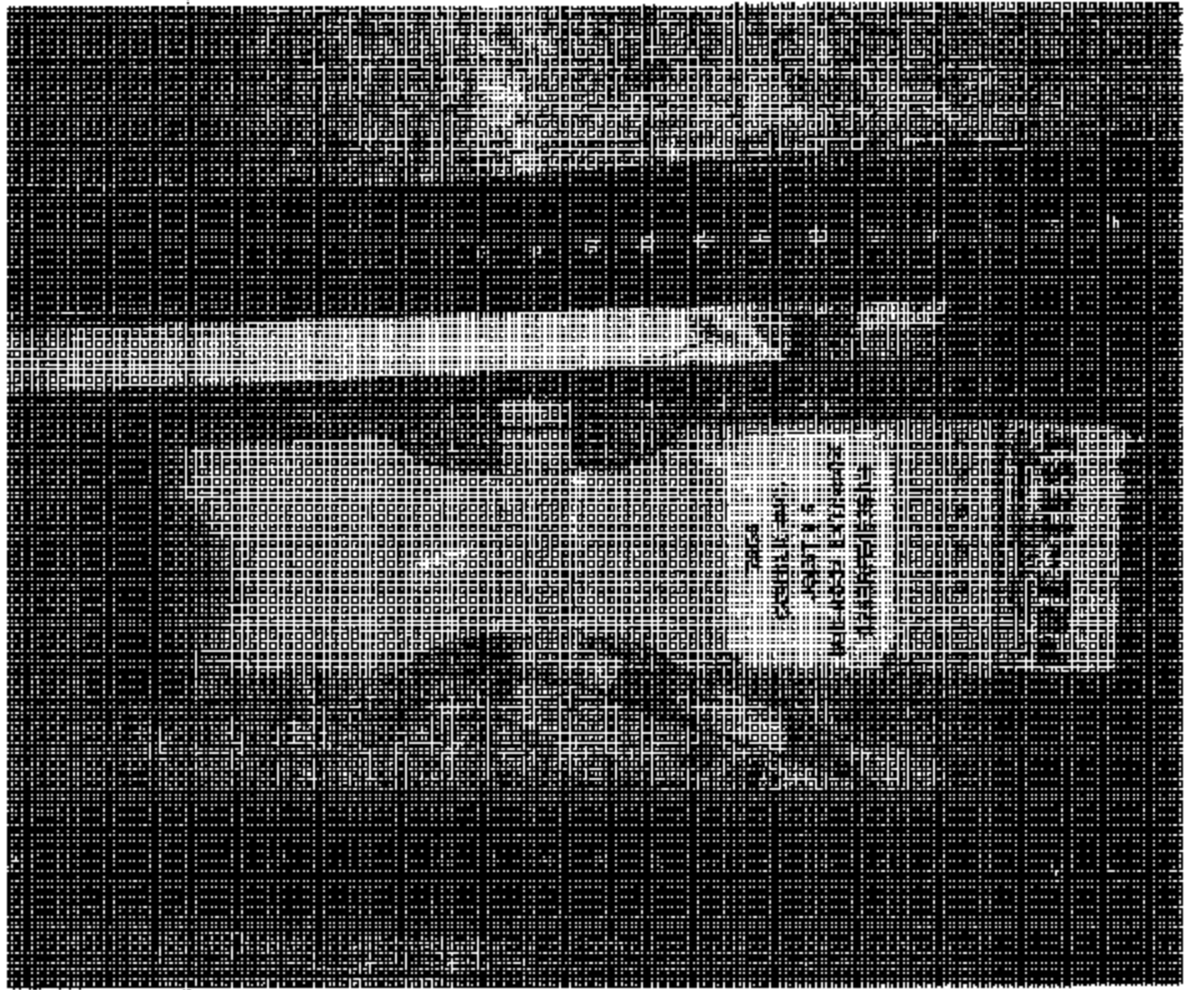
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Front View of Joint #3 view 2

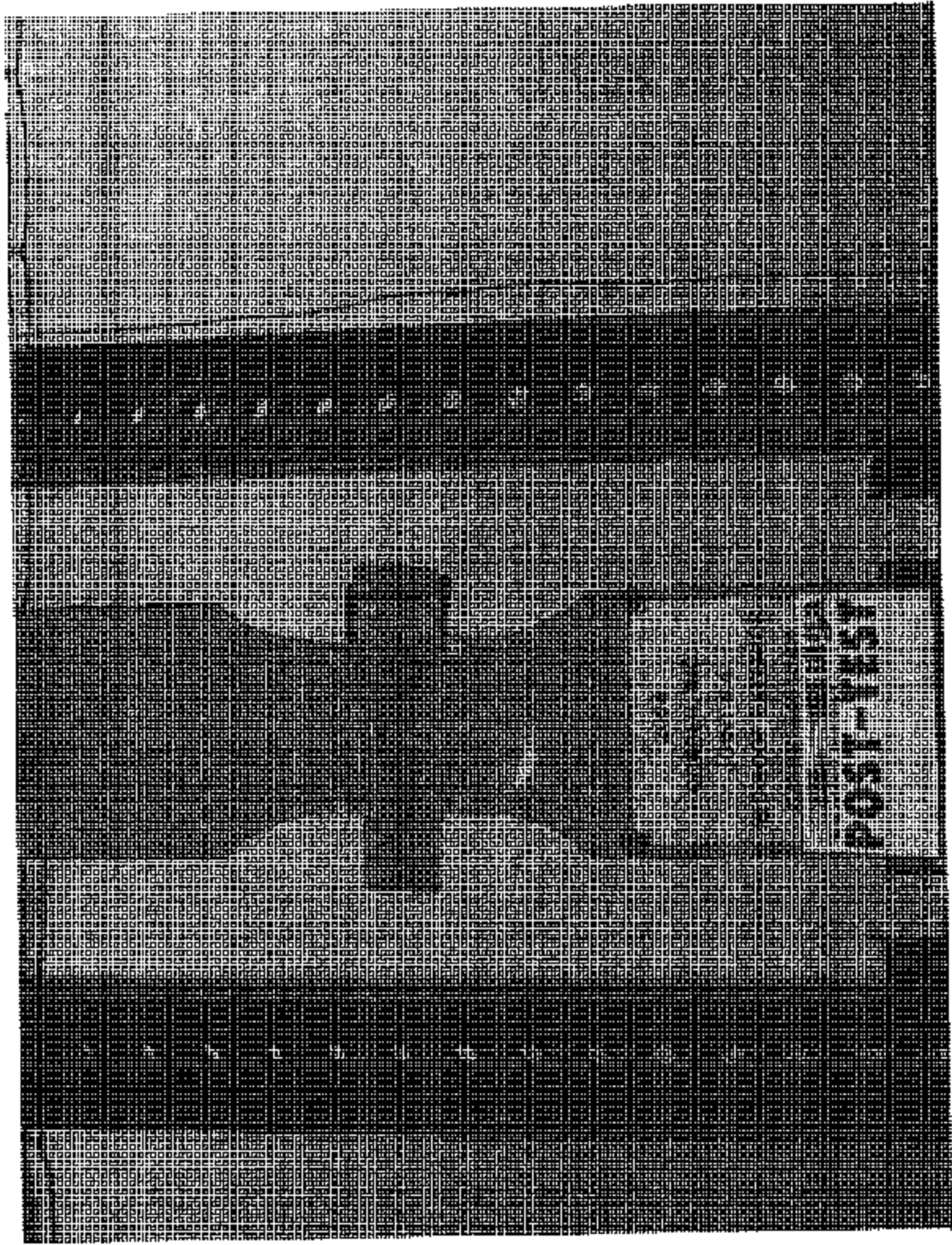
Test Vehicle: 2004 Corolla 30 Passenger
Procedure: FMVSS 224

NHTSA No.: C48902



Test Vehicle: 2004 Corolla 3R Passenger
Procedure: FMVSS 221

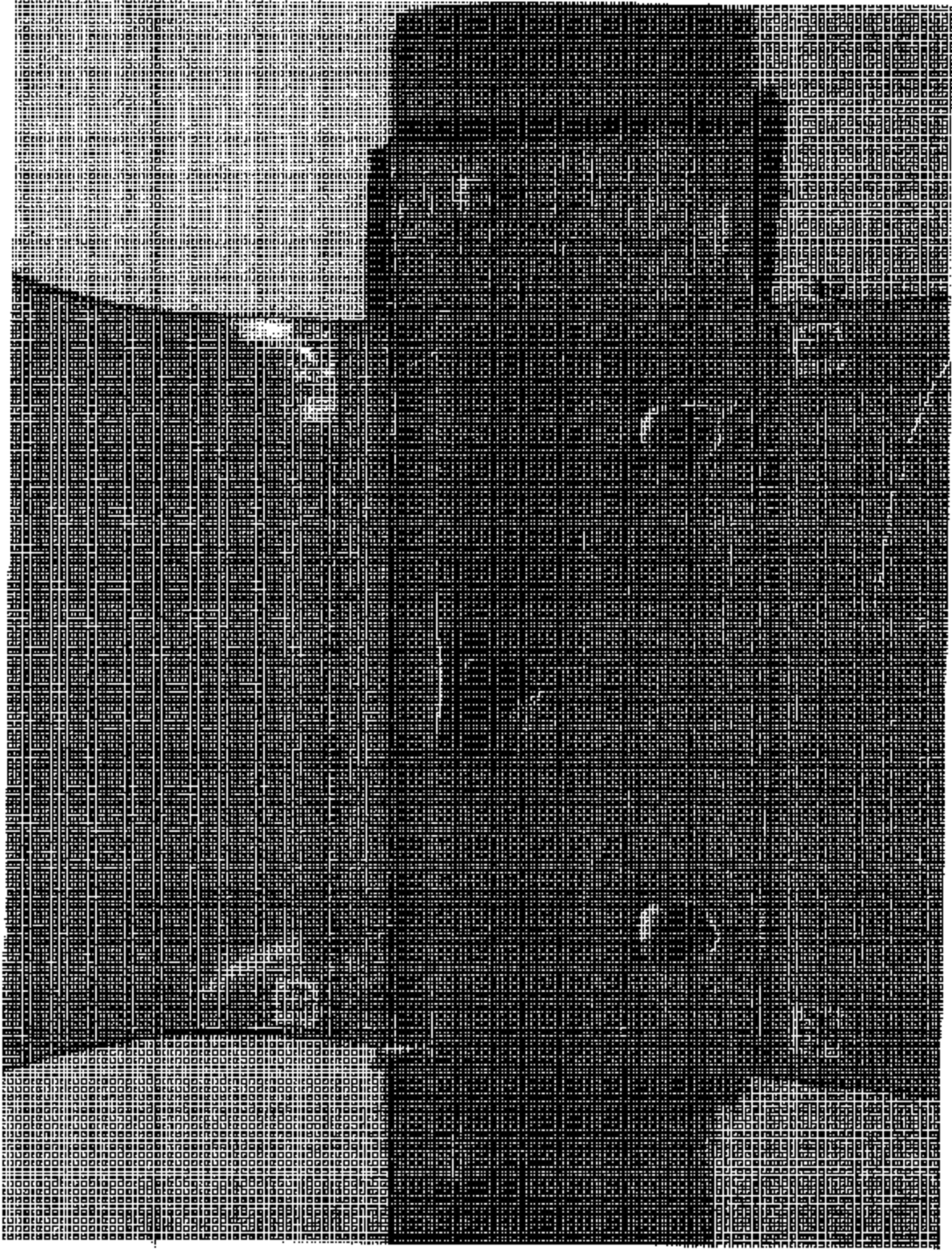
NHTSA No. CA0902



Post-Test of Joint #4

Case Vehicle: 2004 Chevrolet 30 Passenger
Procedure: PMVSS 224

APITSA No.: C40502



**SECTION 7
TEST PLOTS**

TABLE OF TEST PLOTS

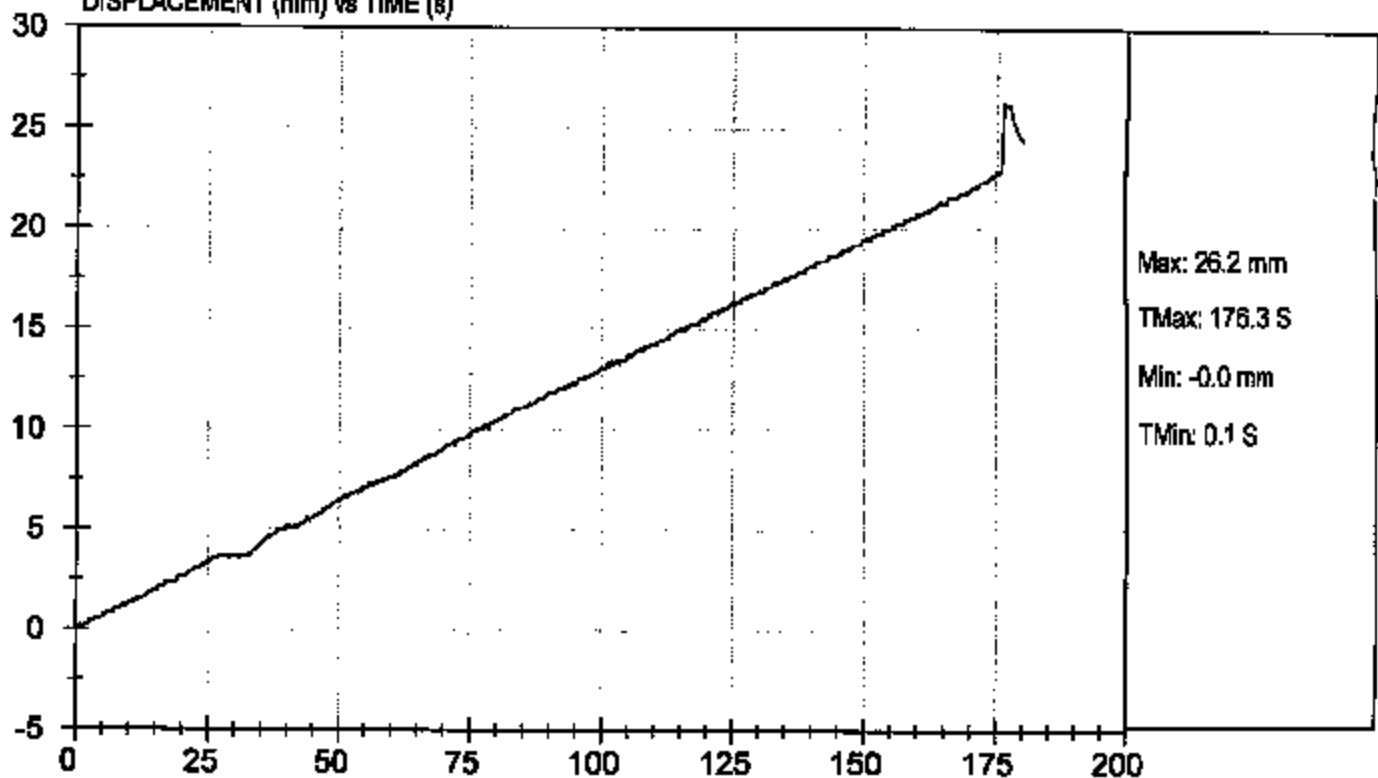
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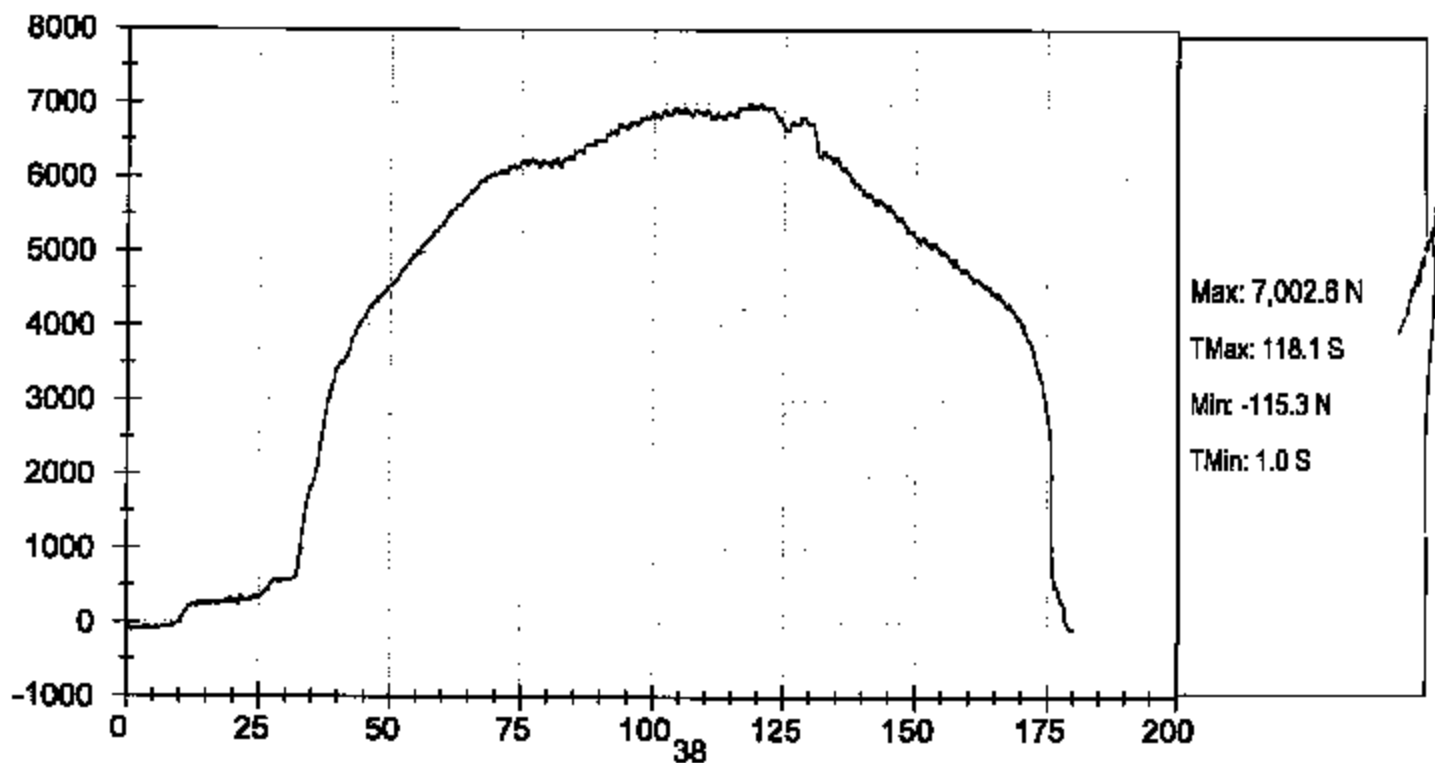
Test Desc: FMVSS 221 (Required Load 16278N)
Sample: Corbel Sample 1

Test Date: 7-5-05
NHTSA#: C40902

DISPLACEMENT (mm) vs TIME (s)



FORCE (N) vs TIME (s)

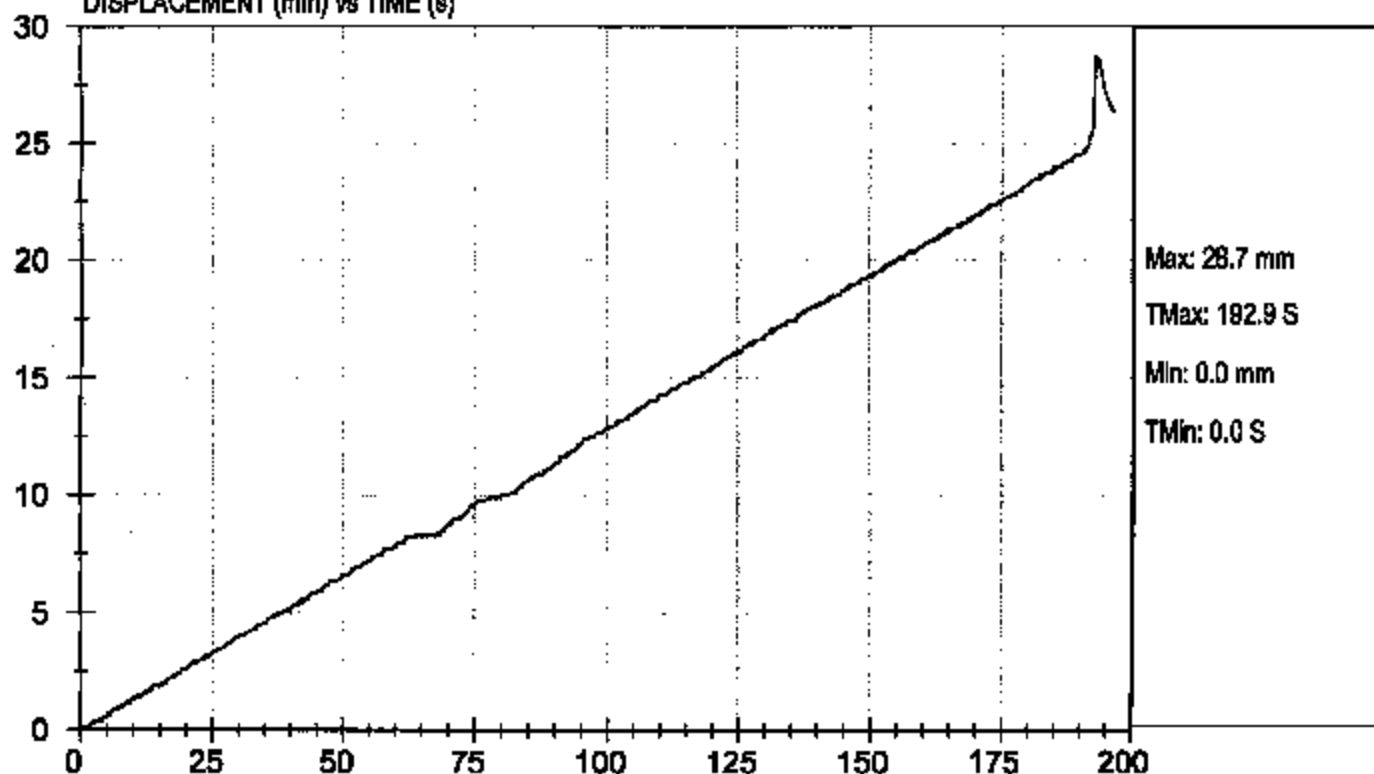




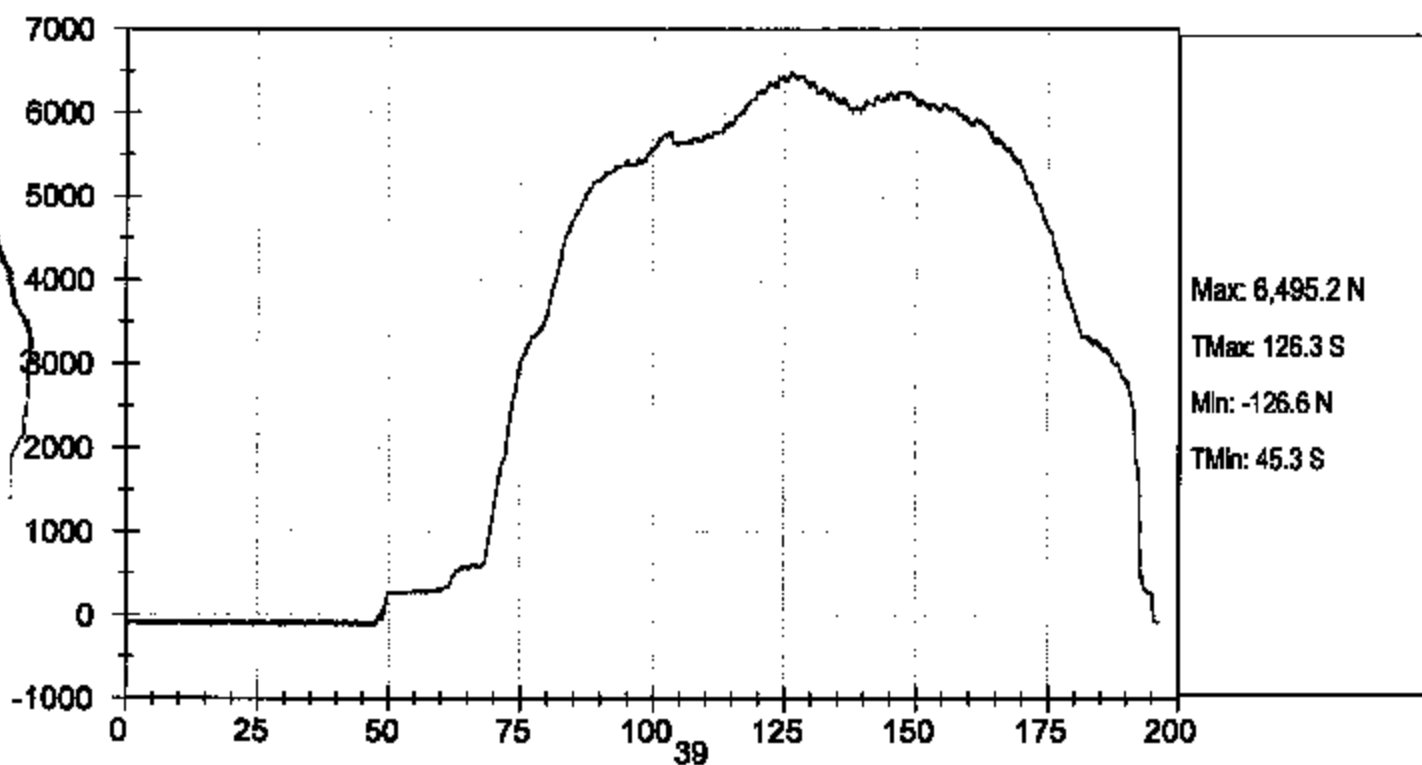
Test Desc: FMVSS 221 (Required Load 16278N)
Sample: Corbeil Sample 2

Test Date: 7-5-05
NHTSA#: C40902

DISPLACEMENT (mm) vs TIME (s)



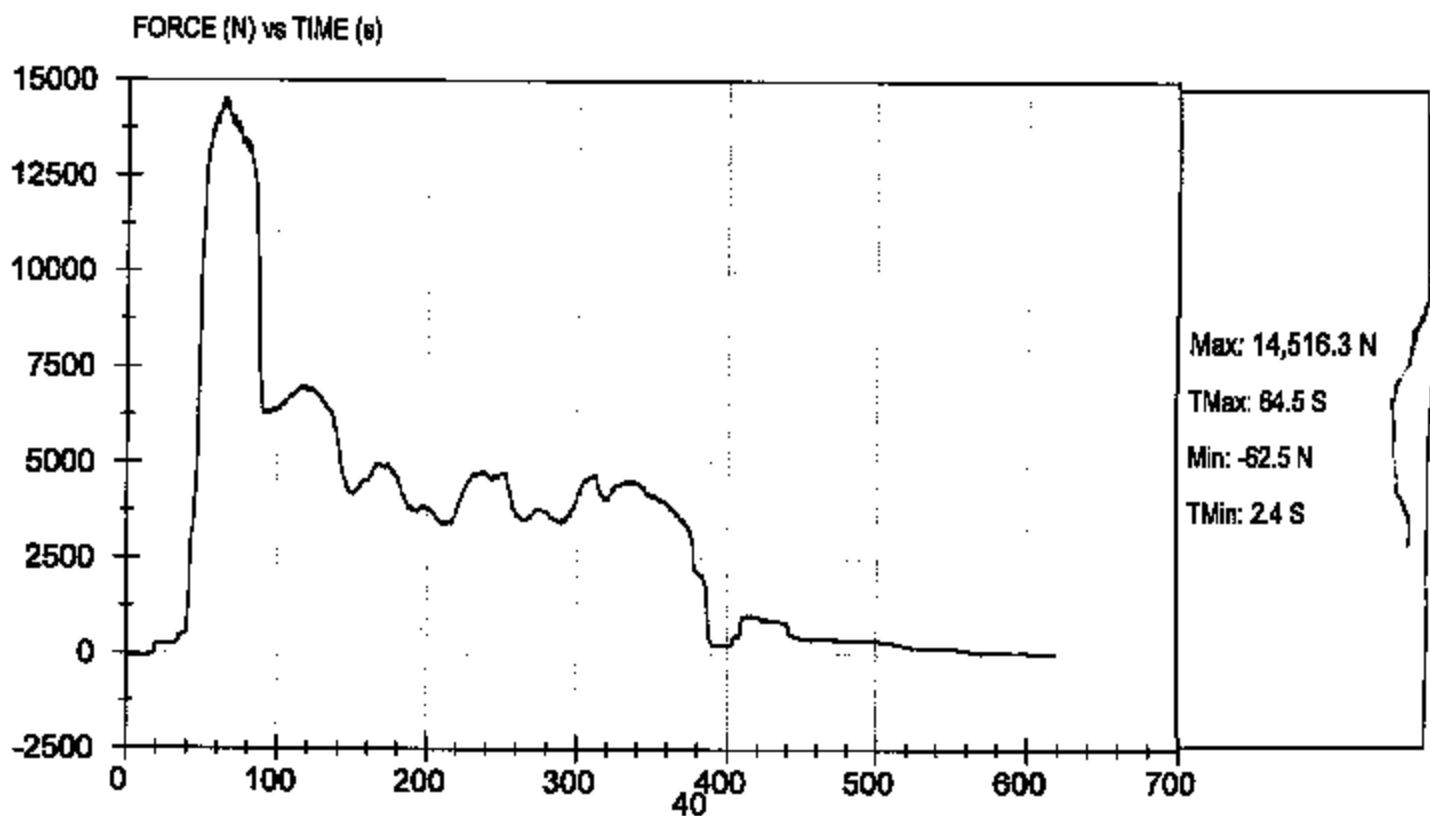
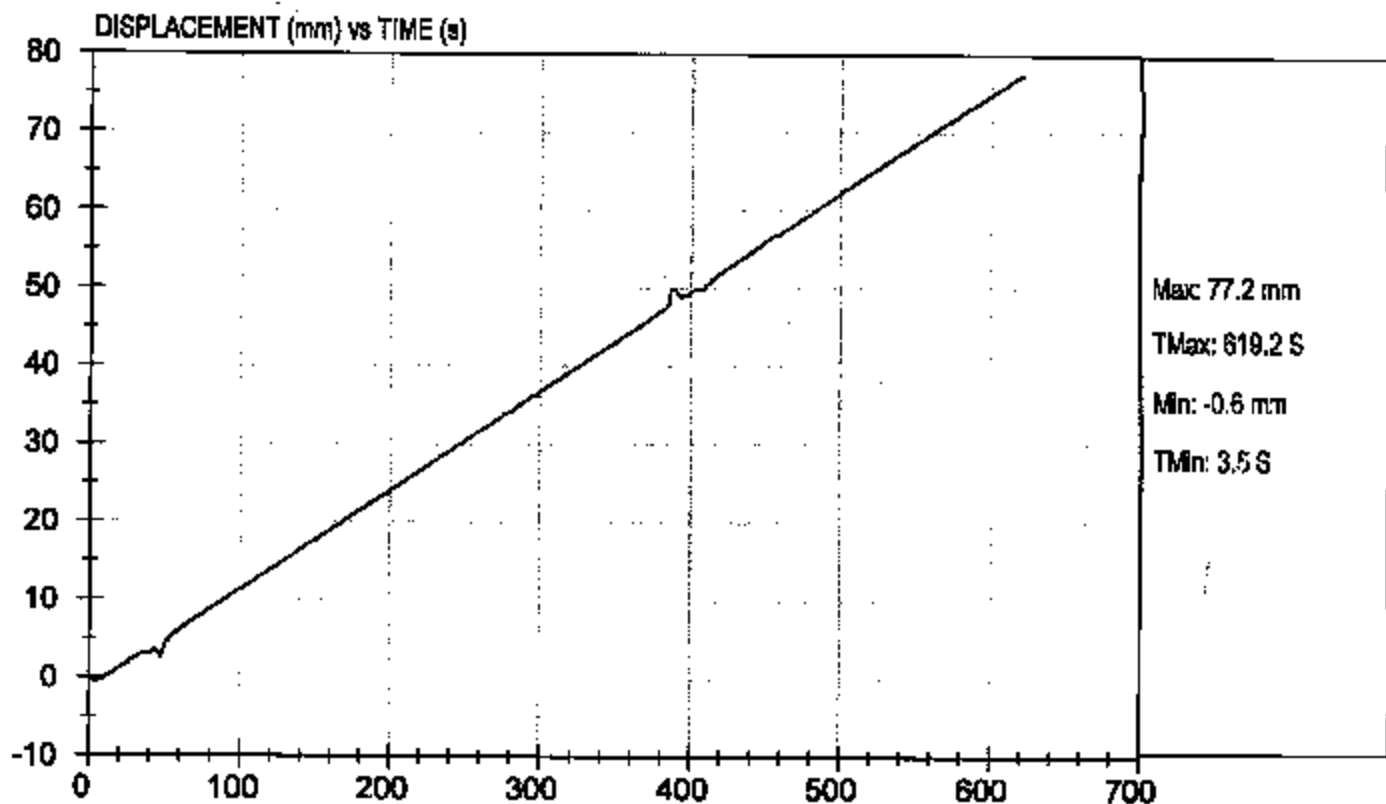
FORCE (N) vs TIME (s)





Test Desc: FMVSS 221 (Required Load 24721N)
Sample: Corbell Sample 3

Test Date: 7-8-05
NHTSA#: C40902

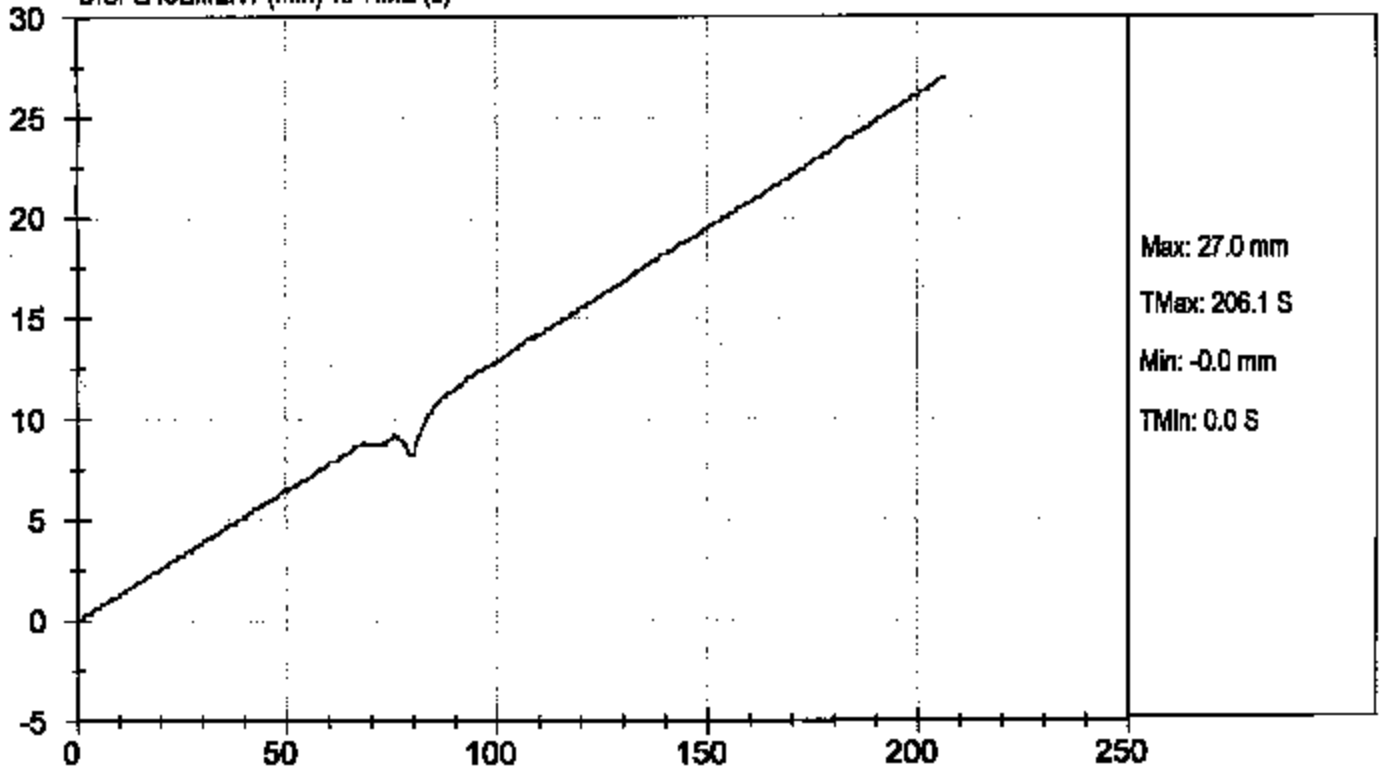




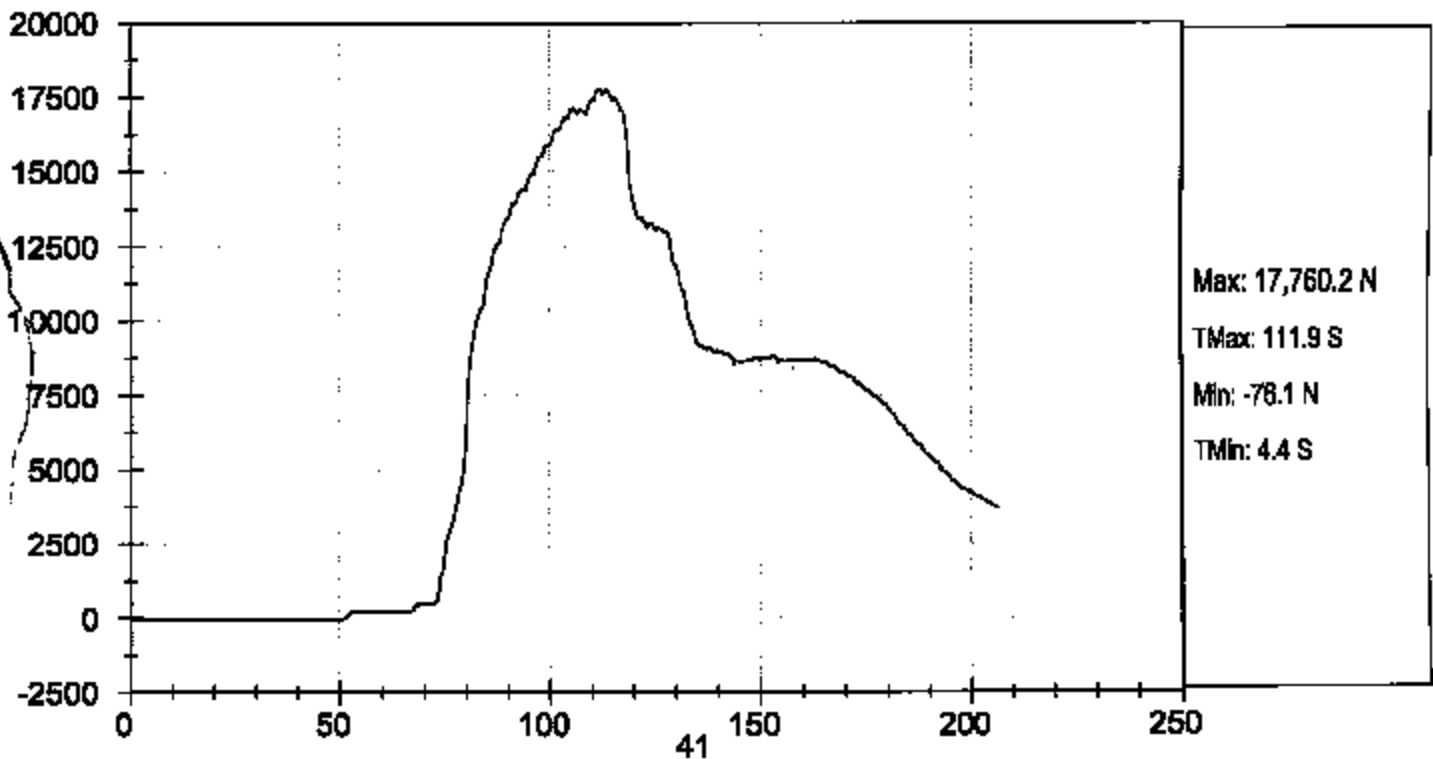
Test Desc: FMVSS 221 (Required Load 23844N)
Sample: Corbell Sample 4

Test Date: 7-6-05
NHTSA#: C40902

DISPLACEMENT (mm) vs TIME (s)



FORCE (N) vs TIME (s)



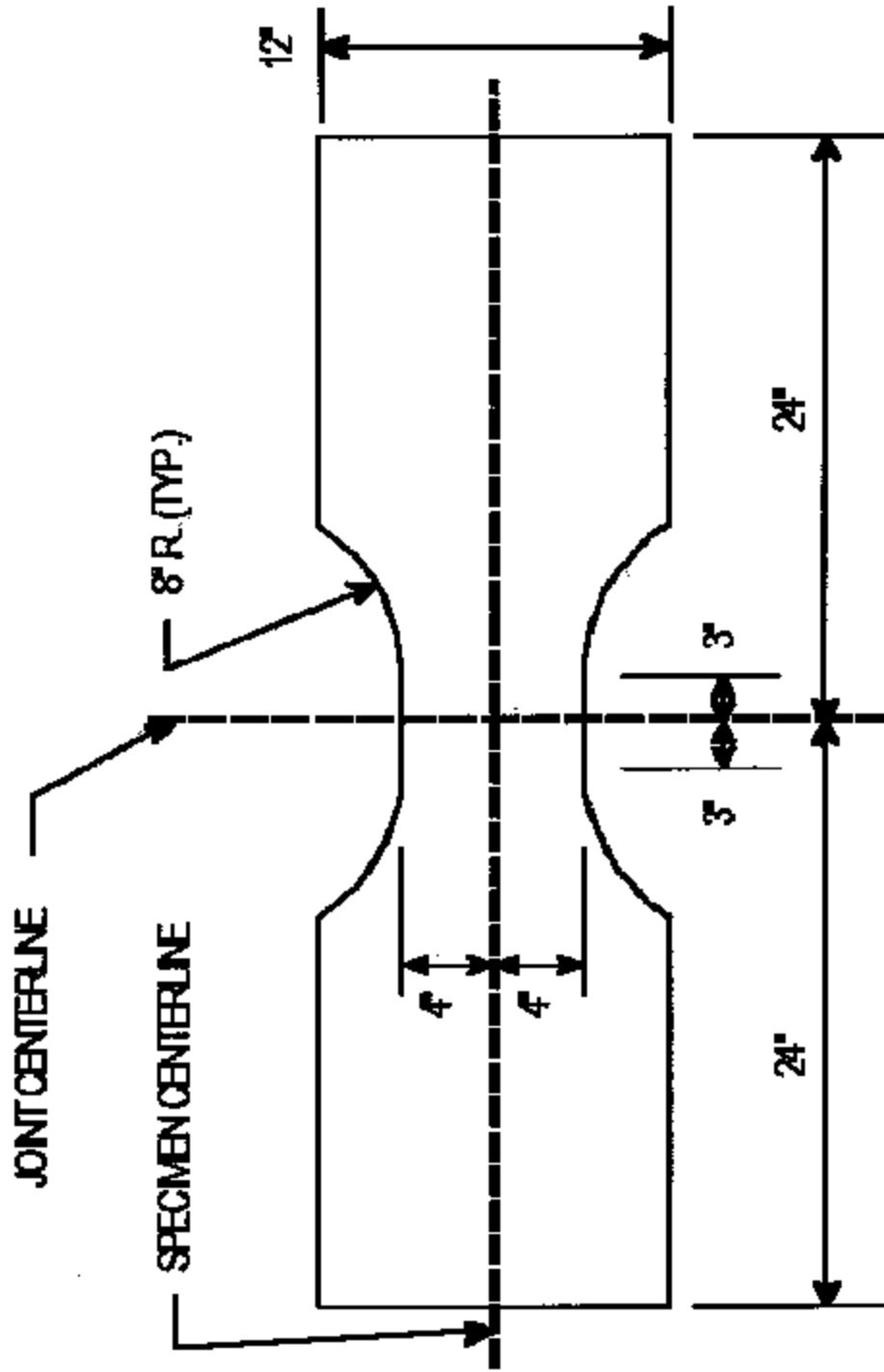
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Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

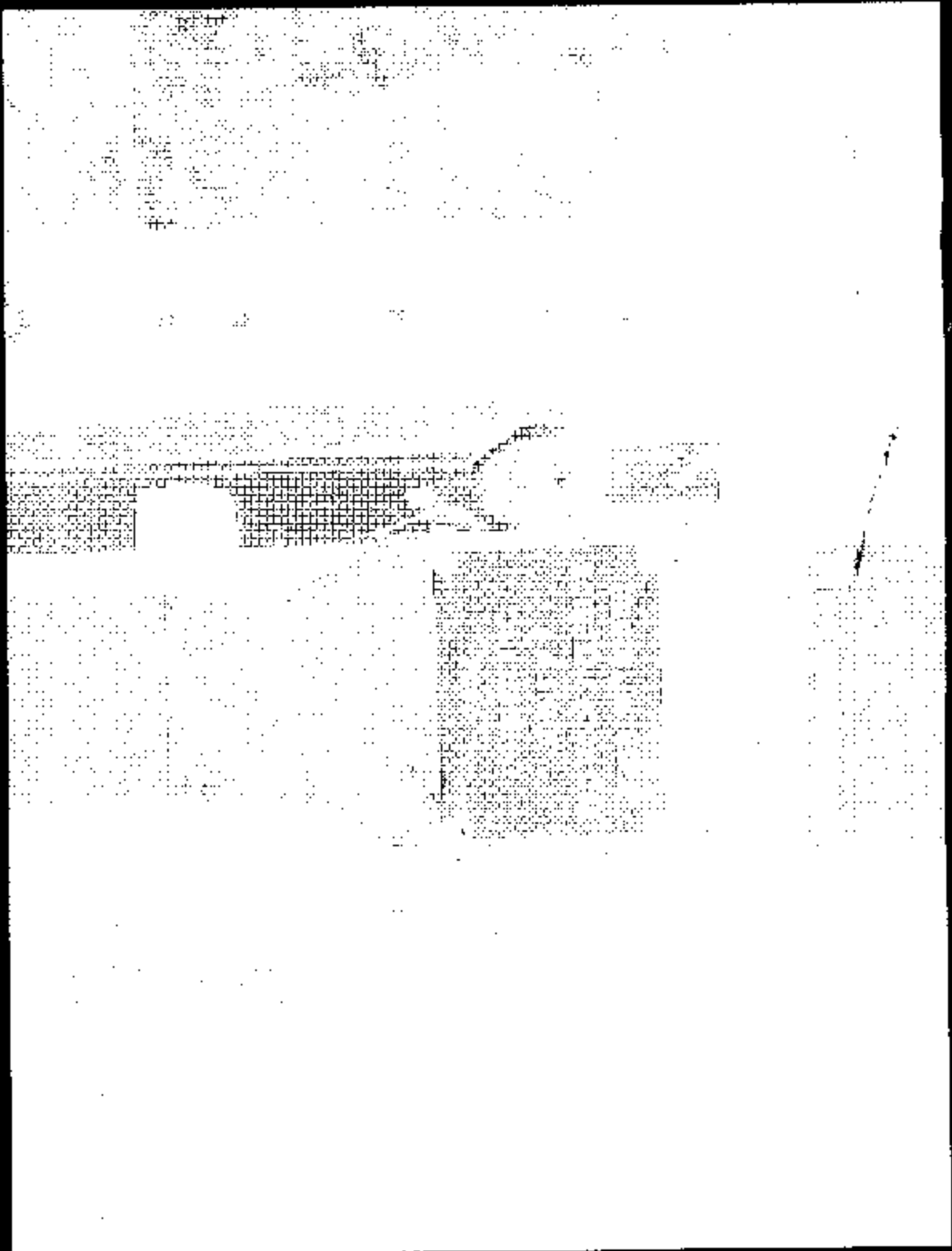
NHTSA No.: C-40902

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



Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

NHTSA No.: C40902



Front View of Joint #1

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

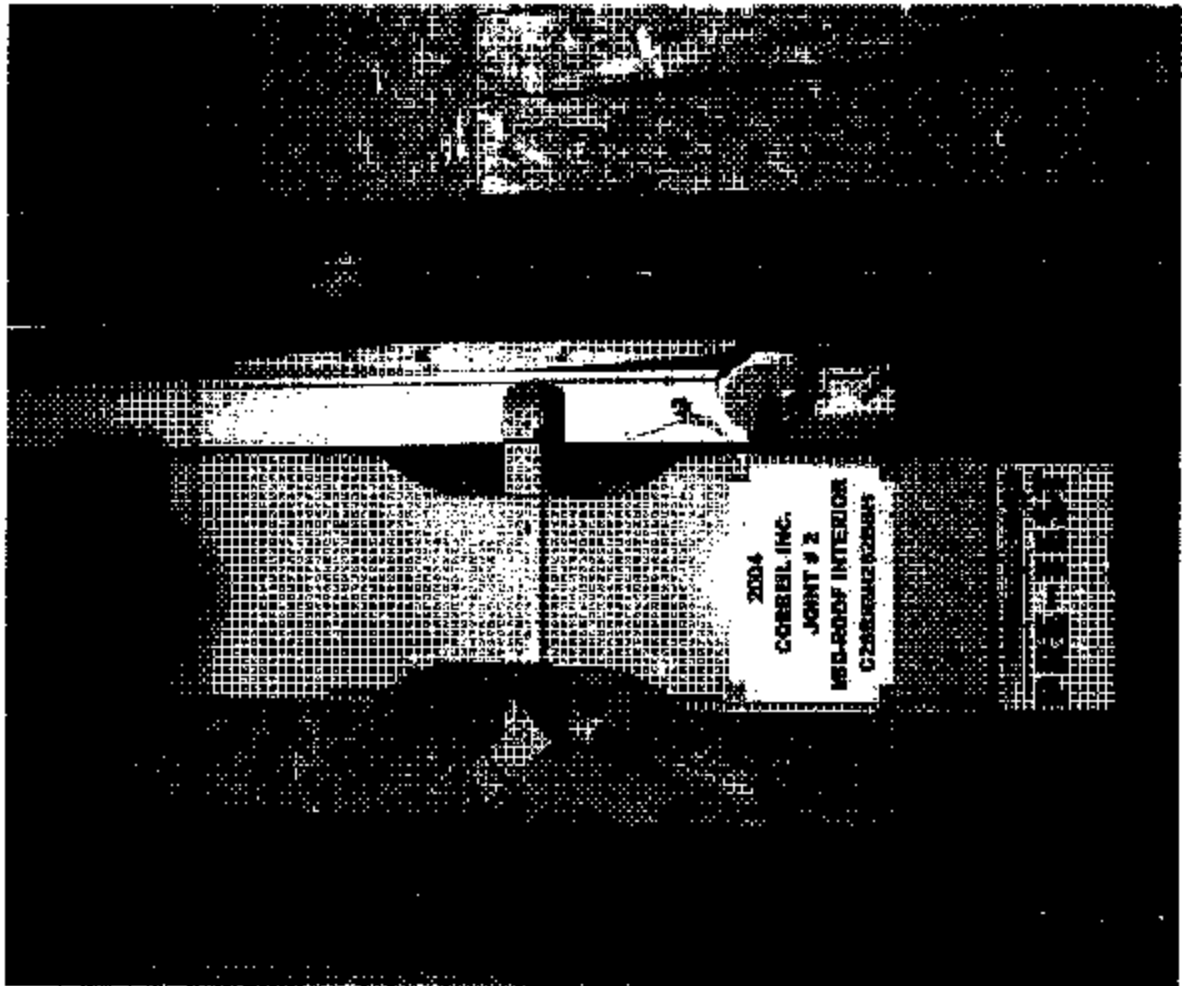
NHTSA No.: C40902



End View of Joint #1

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

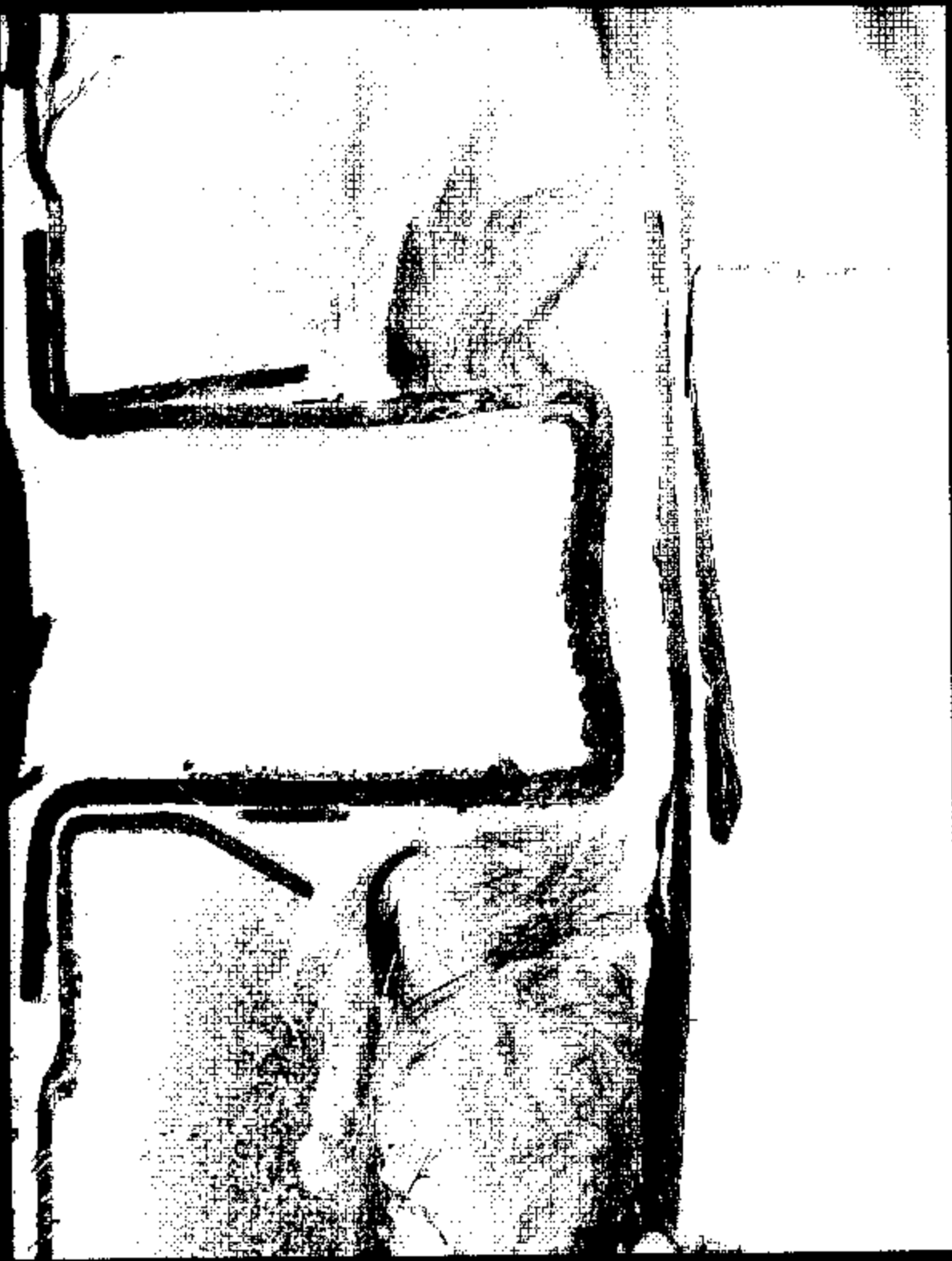
NHTSA No.: C-40902



Front View of Joint #2

Test Vehicle: 2004 Corbeil 30 Passenger
Procedure: FMVSS 221

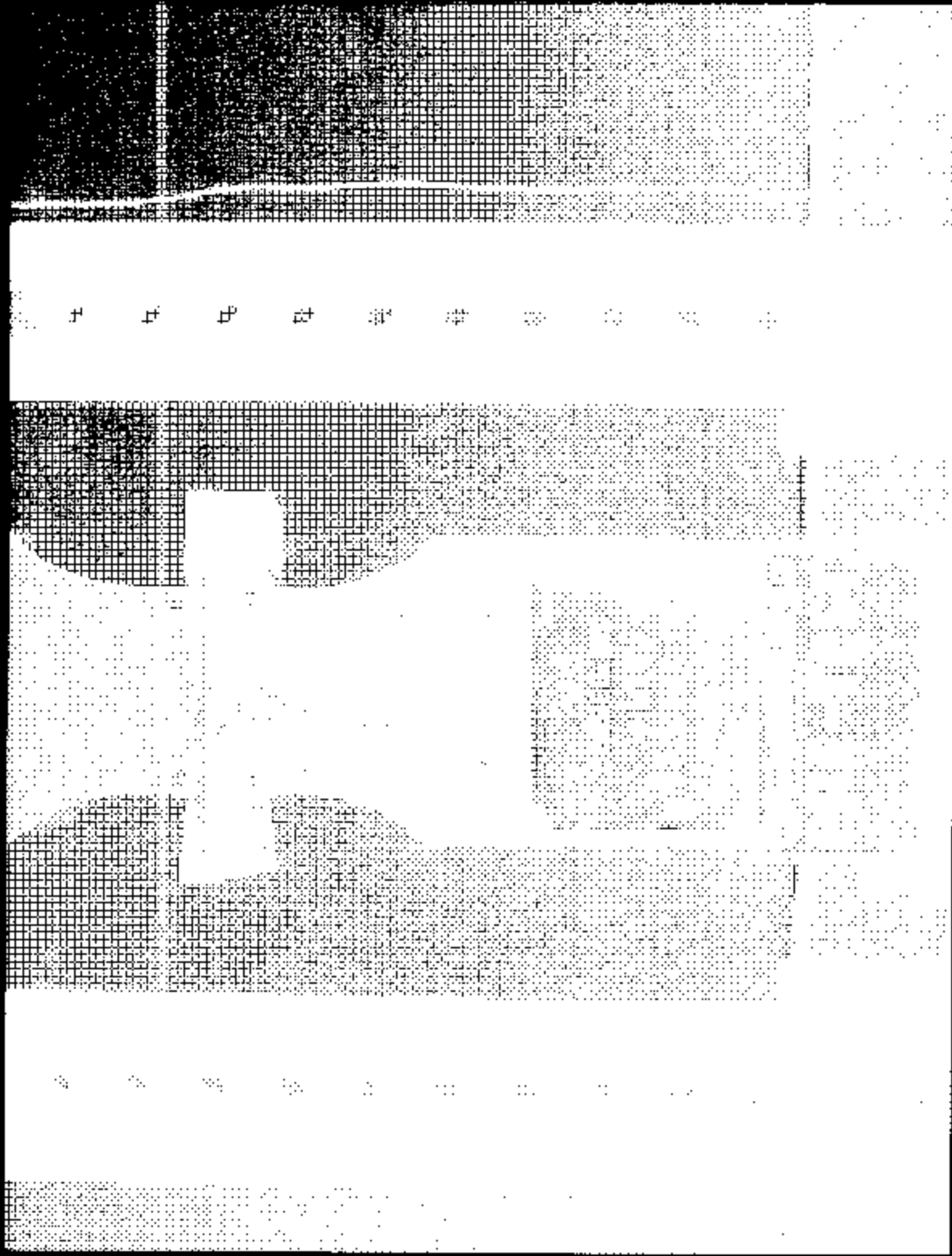
NHTSA No.: C40902



End View of Joint #2

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

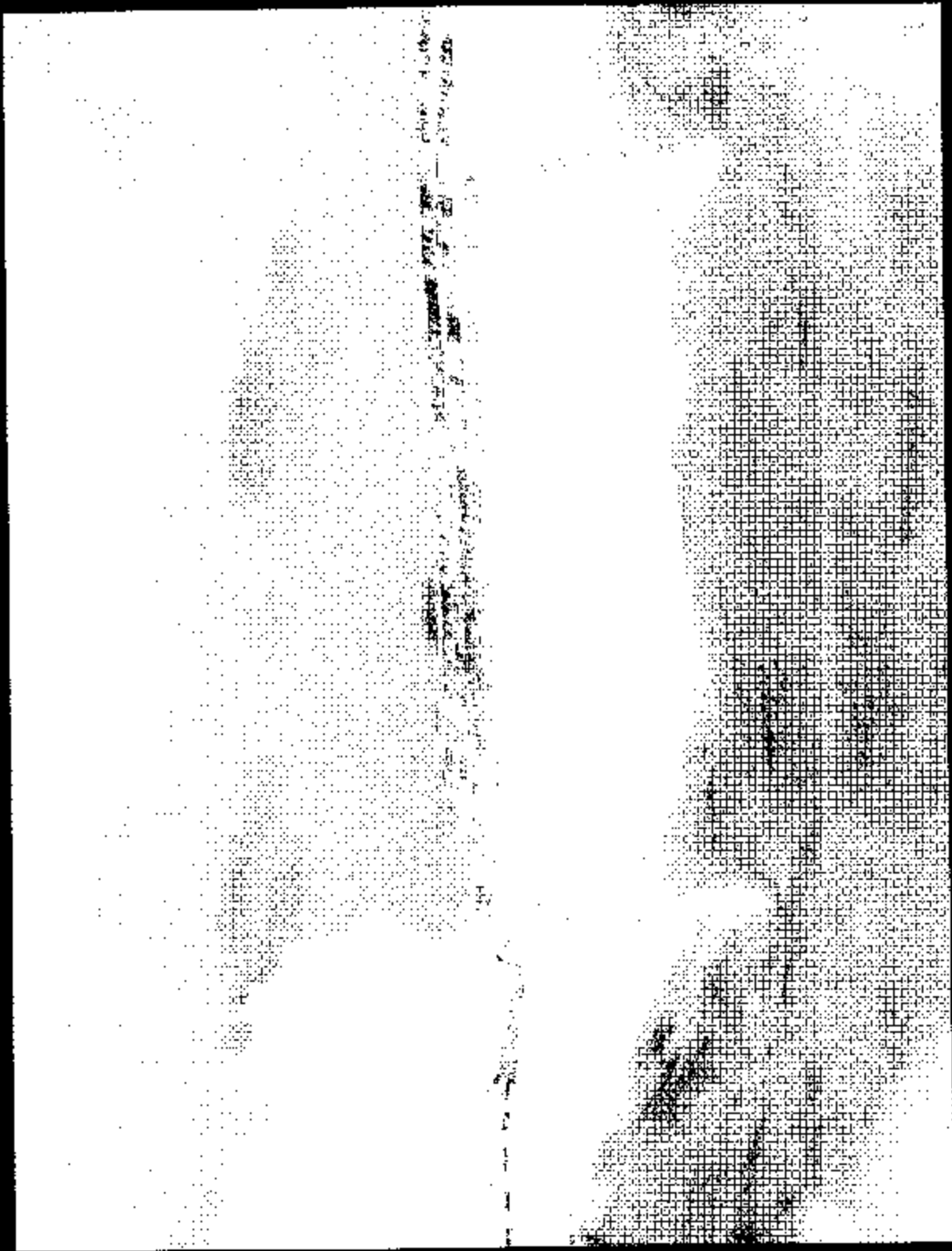
NHTSA No.: C409002



Front View of Joint #3

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

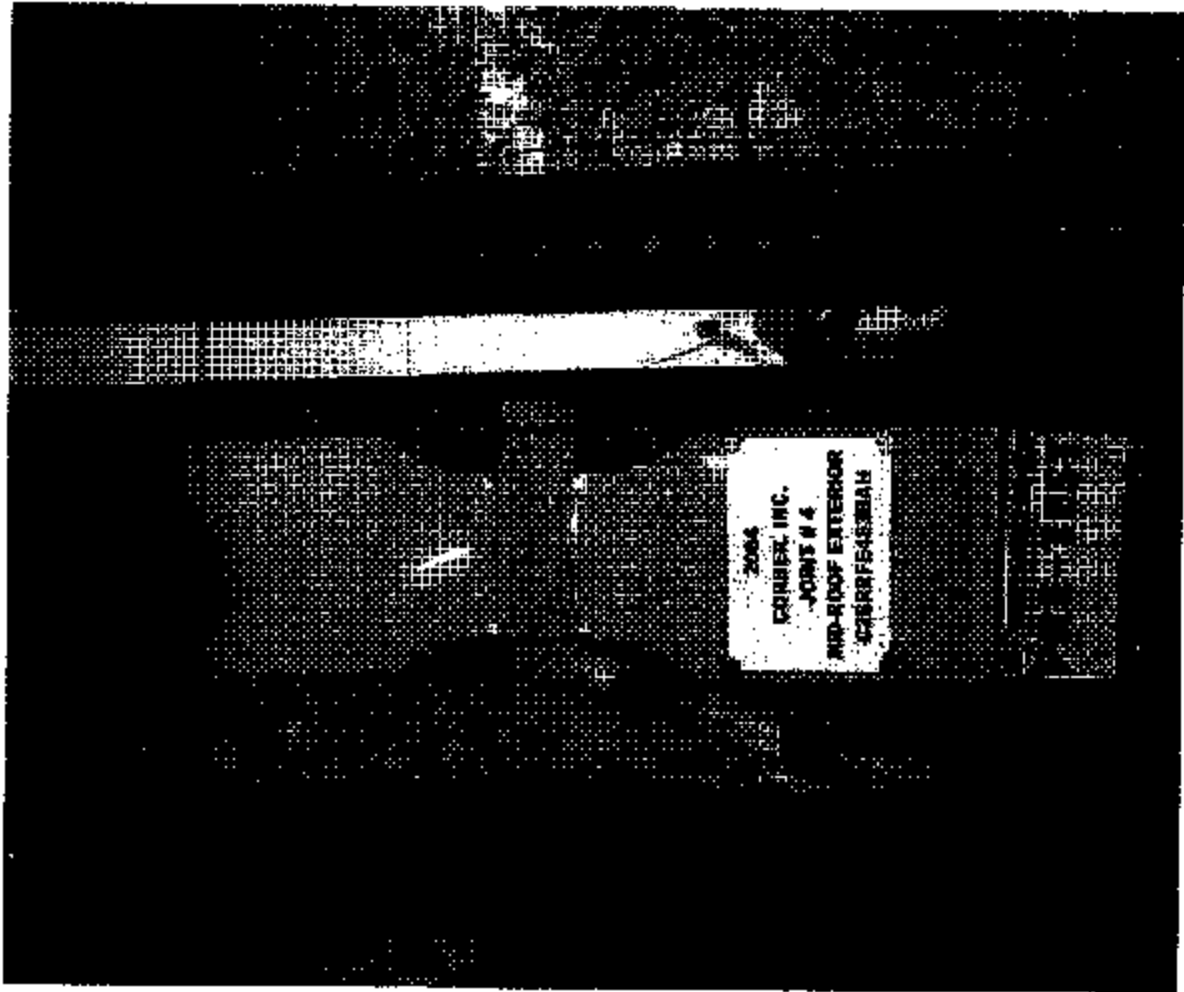
NHTSA No.: C40902



End View of Joint #3

Test Vehicle: 2004 Corbeil 30 Passenger
Procedure: FMVSS 221

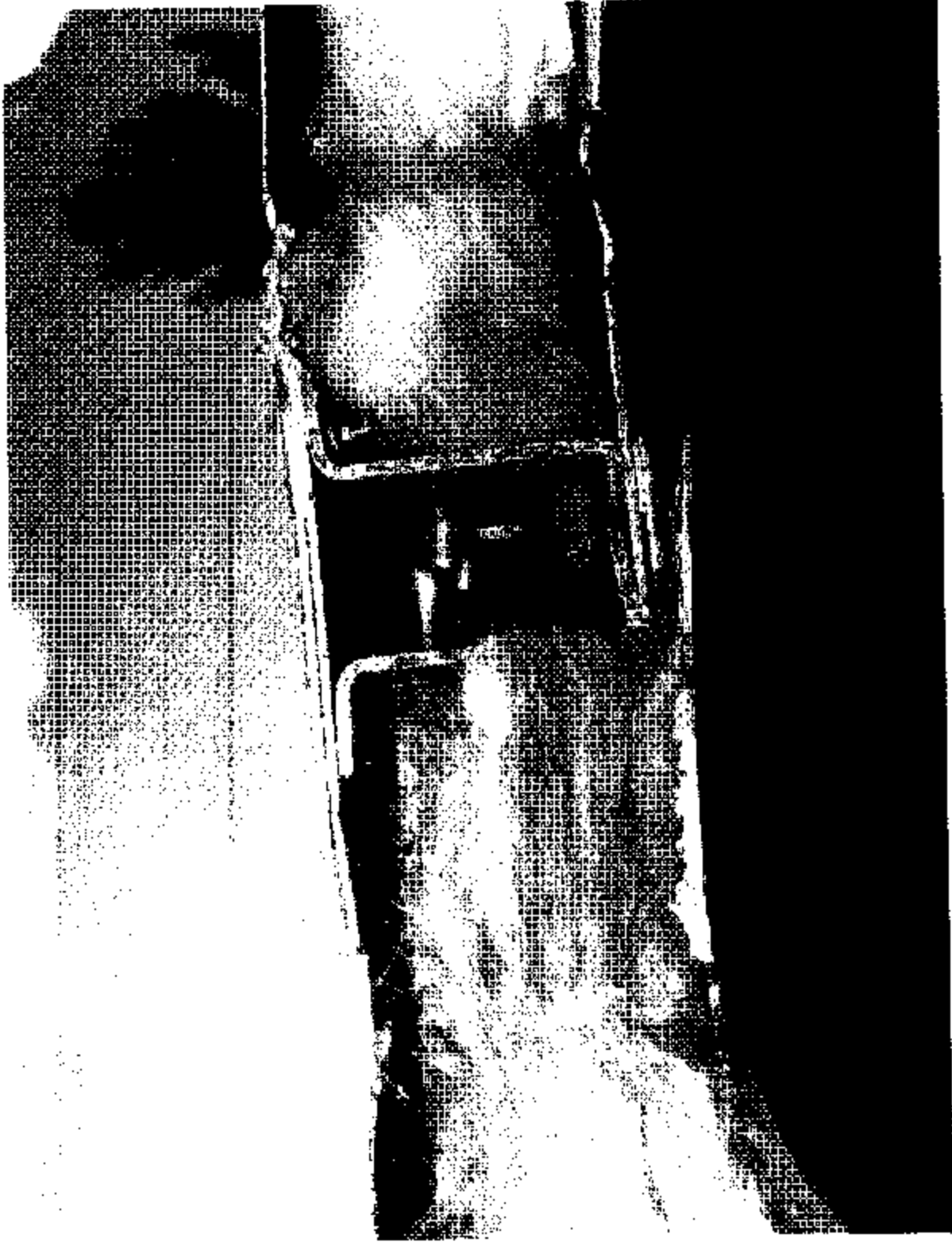
NHTSA No.: C40802



Front View of Joint #4

Test Vehicle: 2004 Corbell 30 Passenger
Procedure: FMVSS 221

NHTSA No.: C40902



End View of Joint #4

SECTION 9
NOTICE OF TEST FAILURE



mga research corporation

LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure:	FMVSS 221	Test Date:	July 6, 2005
Test Vehicle:	Corbeil	Test Lab:	MGA Research Corp.
NHTSA No.:	C40902	Project Engineer:	Jim Hansen
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	2
MFR.:	Corbeil	VIN:	1FDXE45P14HA89680
Buld Date:	05/04		

TEST FAILURE DESCRIPTION

The following body joint panels were tested and failed to meet the requirements of FMVSS 221:

Sample #	ID #	Required Load	Actual Load
1	C2SRLMI182BBH	16278 N	7003 N
2	C2SRRMI282BBH	16278 N	6495 N
3	C2SRLRE382BAV	24721 N	14516 N
4	C2SRRFE483BAH	23844 N	17760 N

FMVSS REQUIREMENTS DESCRIPTION

Paragraph S5.1.2: "When tested in accordance with the procedure of S6, each body panel joint shall hold each body panel to the component to which it is joined when subjected to a force that equates to 60 percent of the tensile strength of the weakest joined body panel, determined pursuant to S6.2."

Remarks: No remarks.

Notification to NHTSA (COTR): Amanda Prescott

Date: July 8, 2005

By: