

REPORT NUMBER: 201-¹⁰²CAL-03-01

**SAFETY COMPLIANCE TESTING FOR FMVSS 201
OCCUPANT PROTECTION IN INTERIOR IMPACT**

**FORD MOTOR CORPORATION
2003 FORD RANGER XLT SUPERCAB**

NHTSA NUMBER: C30205

VERIDIAN TEST NUMBER: 8655-01

VERIDIAN ENGINEERING
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225



Test Date: 20 March 2003

FINAL REPORT

PREPARED FOR:

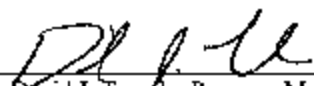
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220, Room 6111
400 Seventh Street, SW
Washington, DC 20590

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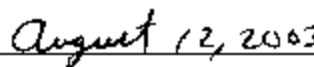
Prepared by


James Czarniecki, Project Engineer

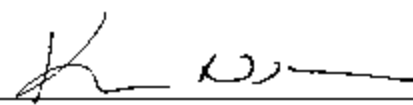
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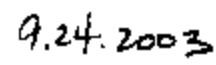

David J. Traville, Program Manager
Transportation Science Center

Approval Date


August 12, 2003

FINAL REPORT ACCEPTANCE BY NHTSA:


Office of Vehicle Safety Compliance


9.24.2003
Date of Report Acceptance

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SECTION 1

PURPOSE AND TEST PROCEDURE

This head impact compliance test is part of the FMVSS 201, Occupant Protection in Interior Impact, Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. D1NH22-01-C-01025. The purpose of this compliance test was to determine whether the subject vehicle, a 2003 Ford Ranger XLT Supercab, NHTSA No. C30205, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact. The compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-201-02 dated March 3, 1989.

SECTION 2

SUMMARY OF OCCUPANT PROTECTION IN INTERIOR IMPACTS

A 2003 Ford Ranger XLT Supercab, NHTSA No. C30205, was impacted at various locations throughout its instrument cluster/dash panel and seat back area by a 15 lb, 6.5 inch diameter steel headform. A total of four (4) impacts were performed in this test series. The target area impacts were chosen by the NHTSA Contracting Officer's Technical Representative (COTR). The four (4) chosen impact points were:

Seat Back / Head Rest Area

Instrument Panel Cluster Area

Airbag Cover / Dash Panel Area (2 impacts)

The selected impact areas on the test vehicle appeared to comply with the performance requirements of FMVSS 201.

The 6.5 inch diameter steel headform weighed 15 lb and had an accelerometer mounted along the centerline of the head.

One (1) channel of data for each target impact test was recorded on a Keyser Threde data acquisition system. Data plots can be found in Appendix C along with still photographs can be found in Appendix A of this report.

To document each target area impact test, one digital photo was taken pre- and post-test at various locations to view the headform contact with the selected target areas.

DATA SHEET 2-1

TEST VEHICLE RECEIVING INSPECTION DATA SHEET

VEHICLE YEAR/MAKE/MODEL/STYLE:	2003 Ford Ranger XLT Supercab
NHTSA NO.:	CJG205
VIN:	1FTYR44V43PA35111
DATE OF MANUFACTURE:	October 2002 (SEE CERTIFICATION LABEL)
COLOR:	Blue
ODOMETER READING:	8 miles
LABORATORY:	Veridian Engineering
TEST DATE:	20 March 2003

NUMBER OF SEATING POSITIONS:

FRONT: 3 REAR: 2 (jump seats)

INSTRUMENT PANEL:

NOTE UNUSUAL FEATURES: None

TYPE OF FRONT SEATS:

BENCH: - BUCKET: - SPLIT BACKS: X

TYPE OF HEAD RESTRAINTS:

FIXED: X ADJUSTABLE: -

VEHICLE EQUIPPED WITH ARMRESTS?

NO: - YES: X NUMBER: 3

LOCATION: Front door panels and center console arm rest

VEHICLE EQUIPPED WITH SUN VISORS?

NO: - YES: X

VEHICLE EQUIPPED WITH INTERIOR DOOR LATCHES?

NO: - YES: X NUMBER: 2

LOCATION: Glove Box, Center Console

DATA SHEET 2-2

HEADFORM IMPACT TEST RESULTS INSTRUMENT PANEL

VEHICLE YEAR/MAKE/MODEL/STYLE:	2003 Ford Ranger XLT Supercab
NHTSA NO.:	C30205
VIN:	1FTYR44V43PA35111
DATE OF MANUFACTURE:	October 2002 (SEE CERTIFICATION LABEL)
COLOR:	Blue
ODOMETER READING:	8 miles
LABORATORY:	Veridian Engineering
TEST DATE:	20 March 2003

IMPACT LOCATION AND NUMBER				VELOCITY (mph)	PEAK ACCELERATION (3 ms Clip) Gs
NUMBER	X (inches)	Y (inches)	ANGLE (degrees)		
1 - IP Vent	23.25	0.5	-14.1	11.59	43.42
2 - Left Airbag	26.5	9.9	-49.0	11.46	53.32
3 - Right Airbag	26.3	19.8	-53.0	11.55	73.41

REFERENCE POINT: Seating Reference Position (SGRP) on front passenger side is the reference point (x=0 positive forward from SGRP and y=0 positive to the right of the vehicle centerline).

REMARKS:

DATA SHEET 2-4

SUNVISOR AND ARMREST EVALUATION

VEHICLE YEAR/MAKE/MODEL/STYLE:	2003 Ford Ranger XLT Supercab
NHTSA NO.:	C30205
VIN:	1FTYR44V43PA35111
DATE OF MANUFACTURE:	October 2002 (SEE CERTIFICATION LABEL)
COLOR:	Blue
ODOMETER READING:	8 miles
LABORATORY:	Veridian Engineering
TEST DATE:	20 March 2003

SUN VISOR INFORMATION:

1. Are sun visors constructed of or covered with energy absorbing material?

YES (PASS): X NO (FAIL): -

2. Are any edges statically contactable by a spherical 6.5 inch diameter headform of radius less than 0.125 inch?

YES (FAIL): - NO (PASS): X

ARMREST INFORMATION:

A. FIXED ARMREST

1. Is it constructed of energy absorbing material with the capability of laterally deflecting 2 inches without contacting any underlying rigid material?

YES: N/A NO: N/A

2. Is it constructed of energy absorbing material that deflects or collapses within 1.25 inches of the rigid test panel surface without contacting underlying rigid material between 0.50 and 1.25 inches from the panel which has a vertical height of less than 1 inch?

YES: N/A NO: N/A

3. Does it provide adequate pelvic area impact protection?

YES: X NO: -

4. Does it meet at least one of the criteria No. 1 to 3?

YES (PASS): X NO (FAIL): -

B. FOLDING ARMREST

Is it made of or covered with energy absorbing material? Or does it meet at least one of the criteria No. 1 to 3?

YES (PASS): X NO (FAIL): -

DOOR LATCH EVALUATION

VEHICLE YEAR/MAKE/MODEL/STYLE:	2003 Ford Ranger XLT Supercab
NHTSA NO.:	C30205
VIN:	1FTYR44V43PA35111
DATE OF MANUFACTURE:	October 2002 (SEE CERTIFICATION LABEL)
COLOR:	Blue
ODOMETER READING:	8 miles
LABORATORY:	Veridian Engineering
TEST DATE:	20 March 2003

LATCH ENGAGEMENT INTERFERENCE

DESCRIPTION OF LATCH LOCATION	NO LOAD	10G HORIZONTAL TRANSVERSE	10G VERTICAL	30G HORIZONTAL LONGITUDINAL
GLOVE BOX	PASS	PASS	PASS	PASS
CONSOLE	PASS	PASS	PASS	PASS

(APPENDIX B CONTAINS CALCULATION SHEETS WHICH ARE BASED ON MANUFACTURER'S DATA)

DATA SHEET 2-6**SUMMARY OF RESULTS**

VEHICLE YEAR/MAKE/MODEL/STYLE:	2003 Ford Ranger XL Supercab
NHTSA NO.:	C30205
VIN:	1FTYR44V43PA35111
DATE OF MANUFACTURE:	October 2002 (SEE CERTIFICATION LABEL)
COLOR:	Blue
ODOMETER READING:	8 miles
LABORATORY:	Veridian Engineering
TEST DATE:	20 March 2003

	NUMBER OF IMPACTS	PASS/FAIL
INSTRUMENT PANEL	3	Pass
SEAT BACK	1 Indicant test only	Pass
SUN VISORS	NA	Pass
ARMRESTS	NA	Pass
INTERIOR COMPARTMENT DOORS	NA	Pass

REMARKS:

APPENDIX A
PHOTOGRAPHS

PHOTOGRAPHS

<u>FIGURE</u>	<u>VIEW</u>
A-1	LEFT SIDE VIEW OF VEHICLE
A-2	RIGHT SIDE VIEW OF VEHICLE
A-3	3/4 FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
A-4	3/4 REAR VIEW FROM RIGHT SIDE OF VEHICLE
A-5	VEHICLE'S CERTIFICATION LABEL
A-6	VEHICLE'S TIRE INFORMATION LABEL
A-7	SUNVISOR CONSTRUCTION
A-8	ARMREST LEFT FRONT DOOR
A-9	CENTER ARMREST
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A-14	INSTRUMENT PANEL AIRBAG UPPER LEFT IMPACT POST-TEST
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A-16	INSTRUMENT PANEL AIRBAG UPPER RIGHT IMPACT POST-TEST
A-17	INSTRUMENT PANEL CONSOLE VENT IMPACT PRE-TEST
A-18	INSTRUMENT PANEL CONSOLE VENT IMPACT POST-TEST
A-19	HEADREST
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A-21	HEADREST IMPACT AREA POST-TEST

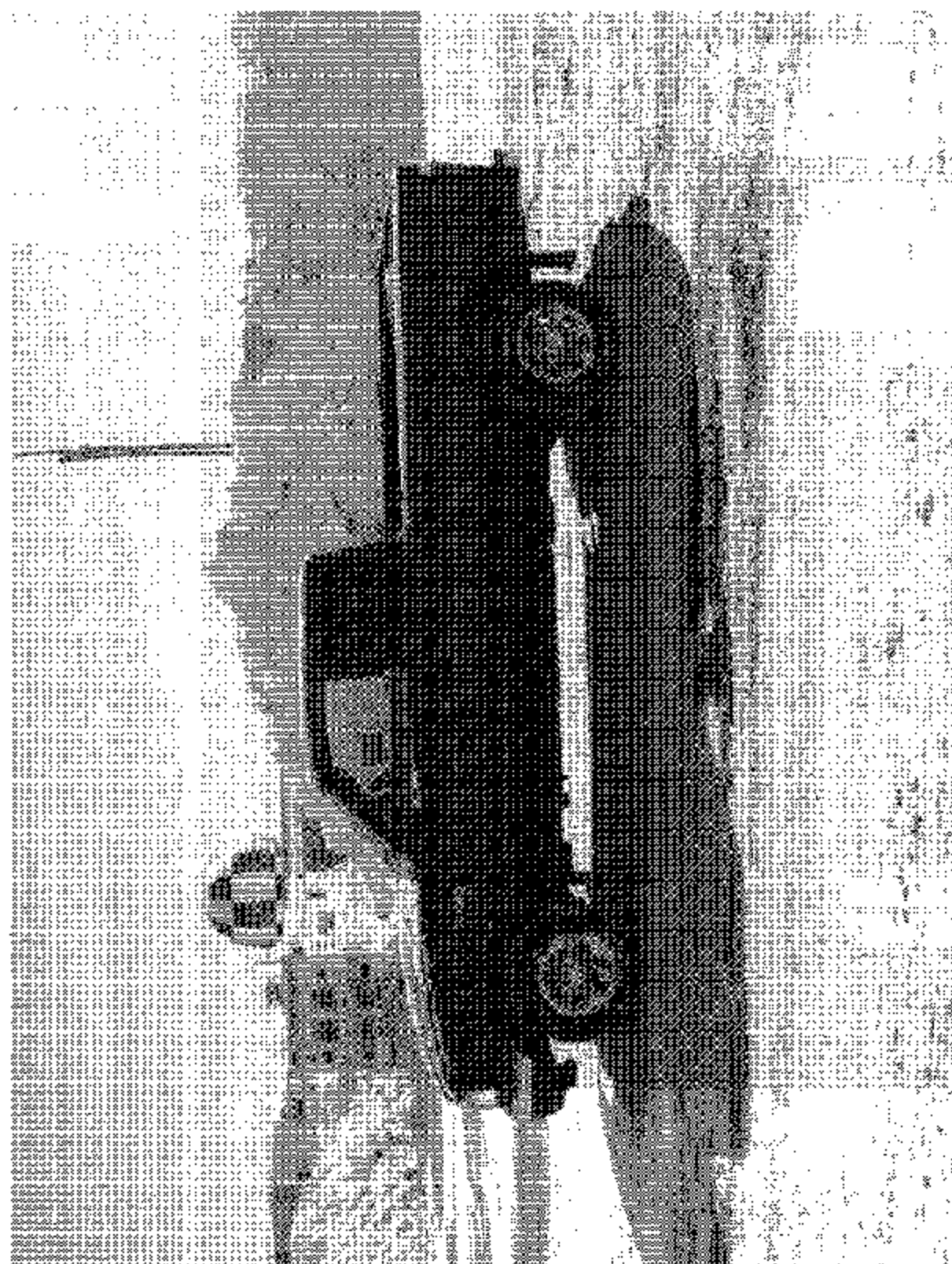


Figure A-1 : LEFT SIDE VIEW OF VEHICLE

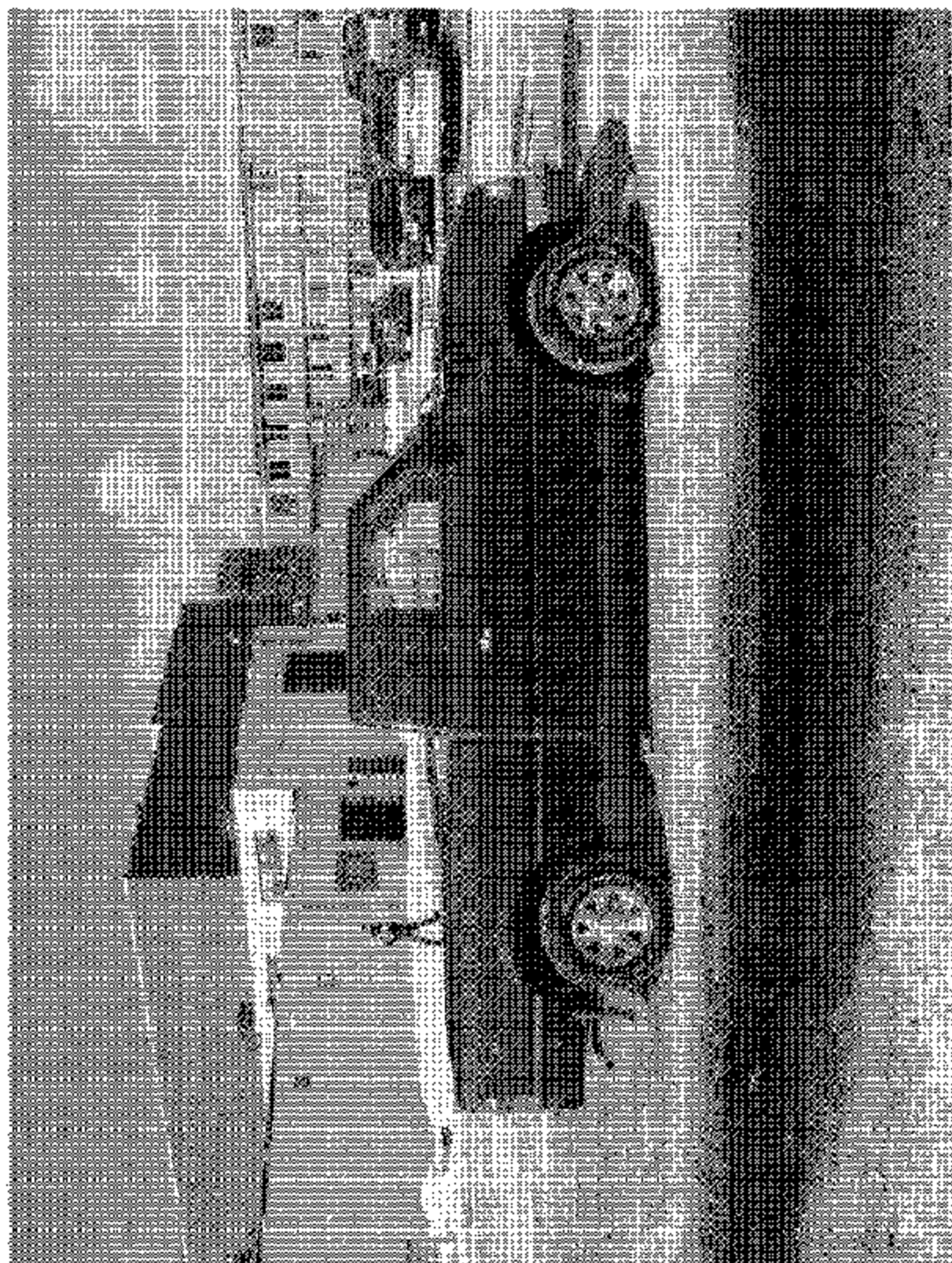


Figure A-2 : RIGHT SIDE VIEW OF VEHICLE

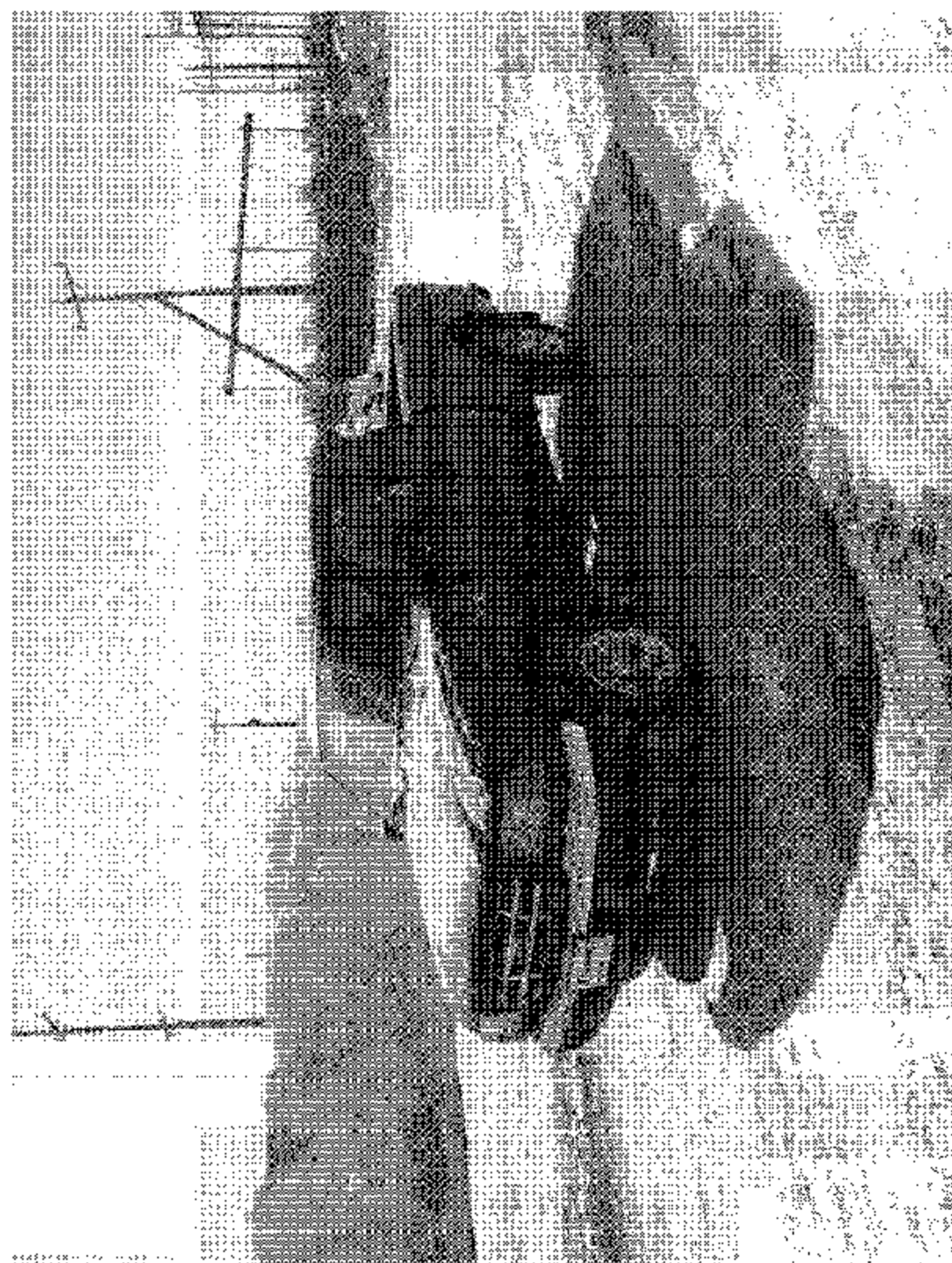


Figure A-3 : 3/4 FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

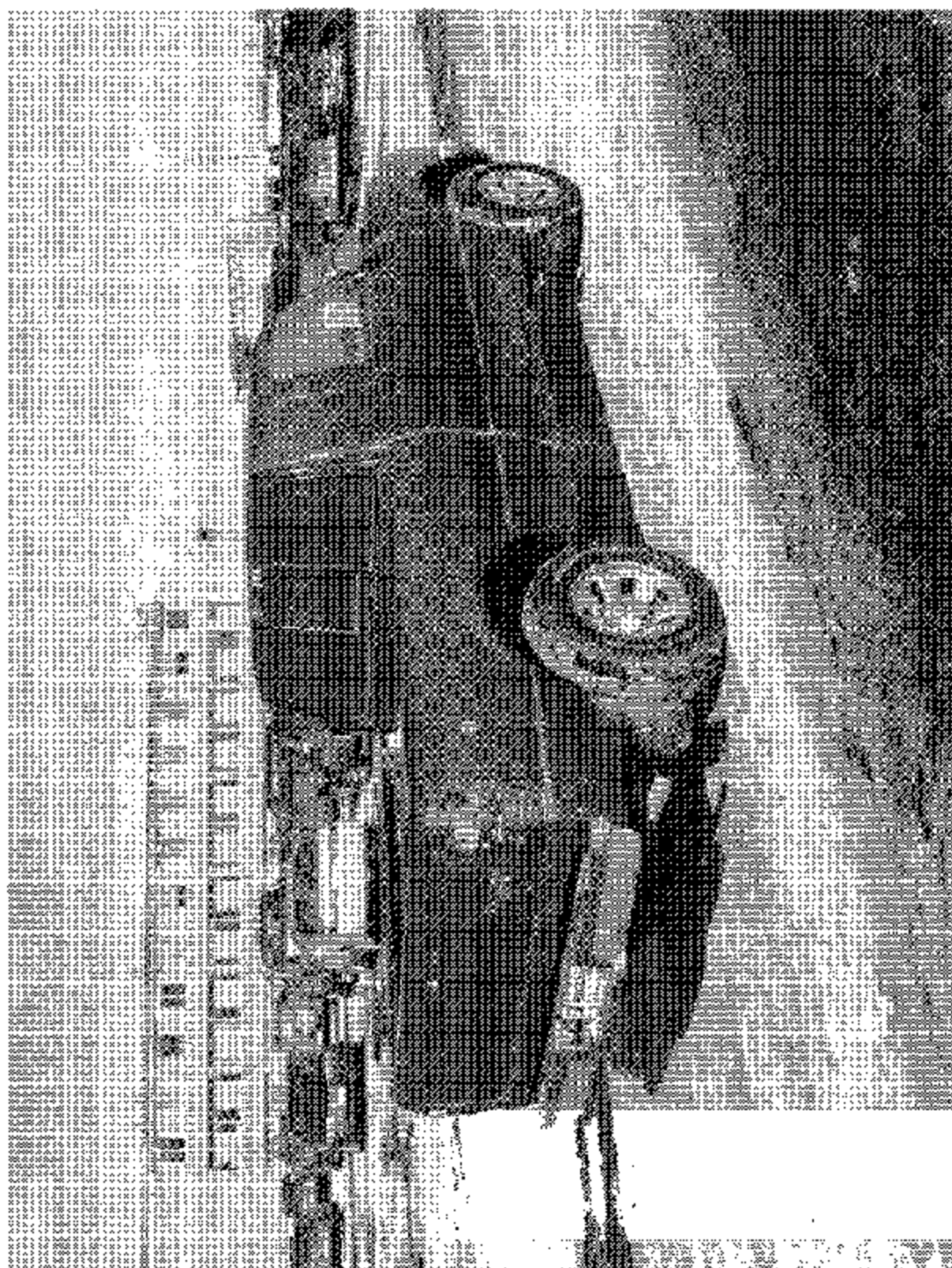


Figure A-4 3/4 REAR VIEW FROM RIGHT SIDE OF VEHICLE

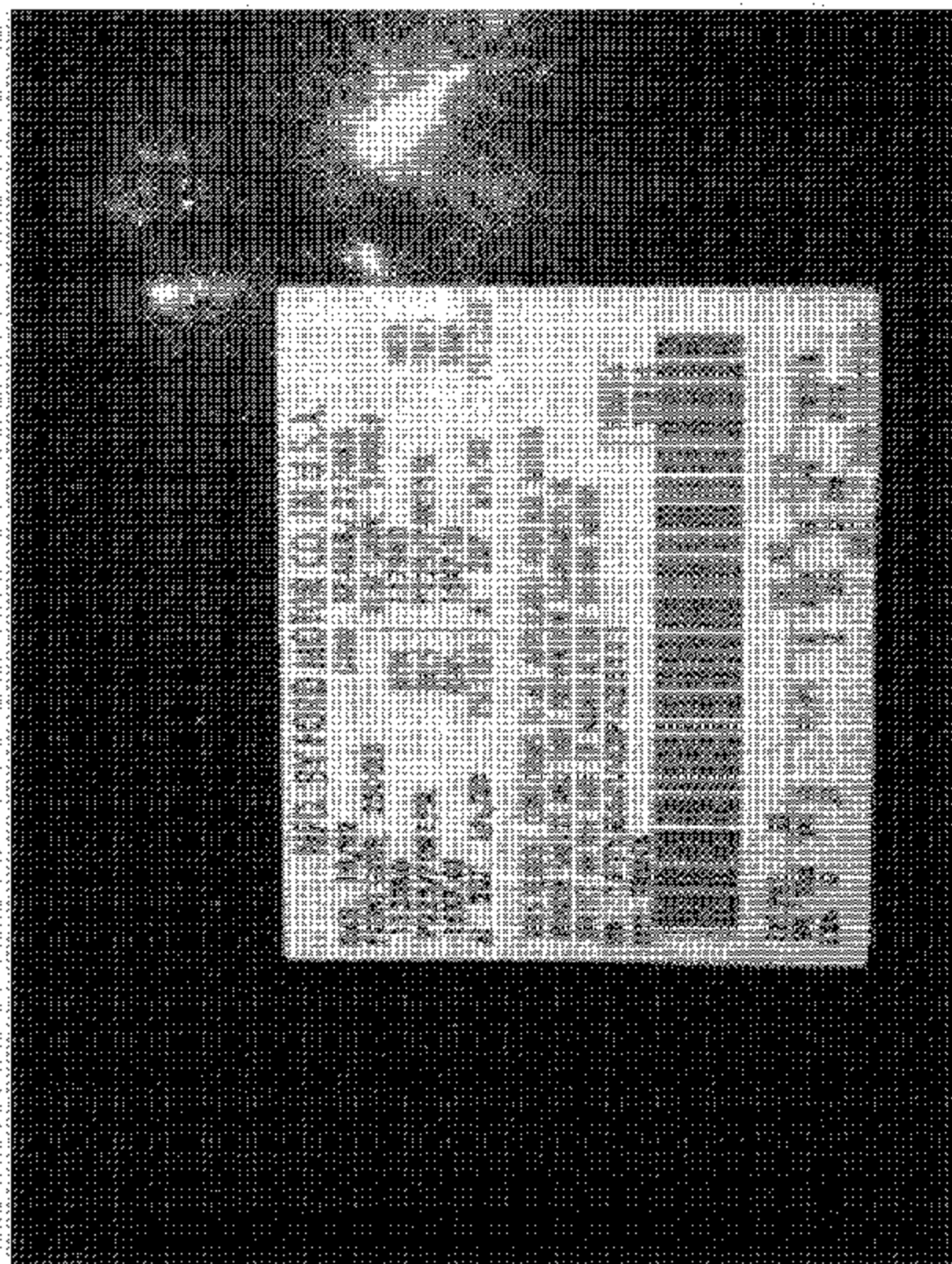


Figure A-3 VEHICLE'S CERTIFICATION LABEL

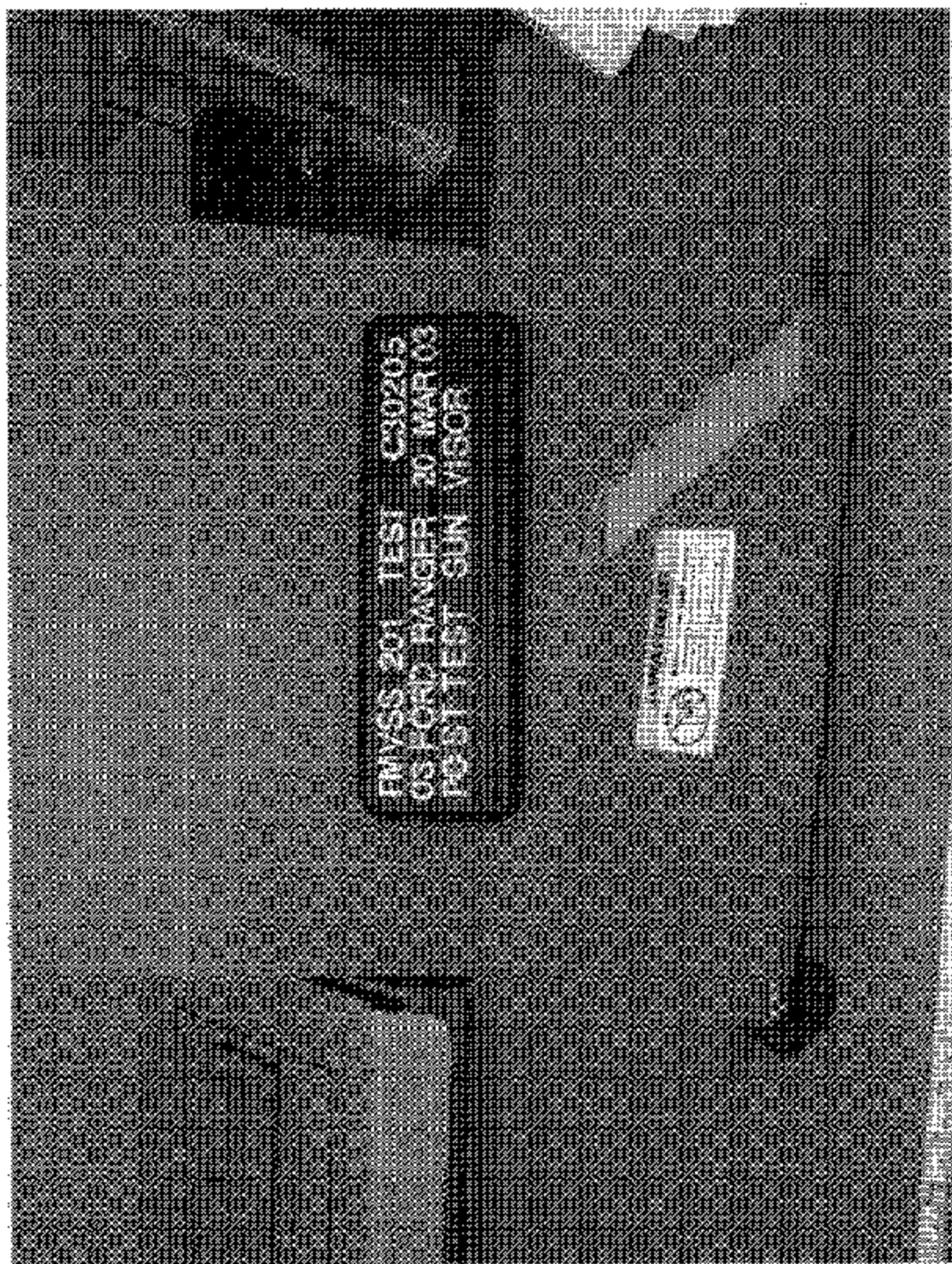


Figure A-7. SUNVISOR CONSTRUCTION

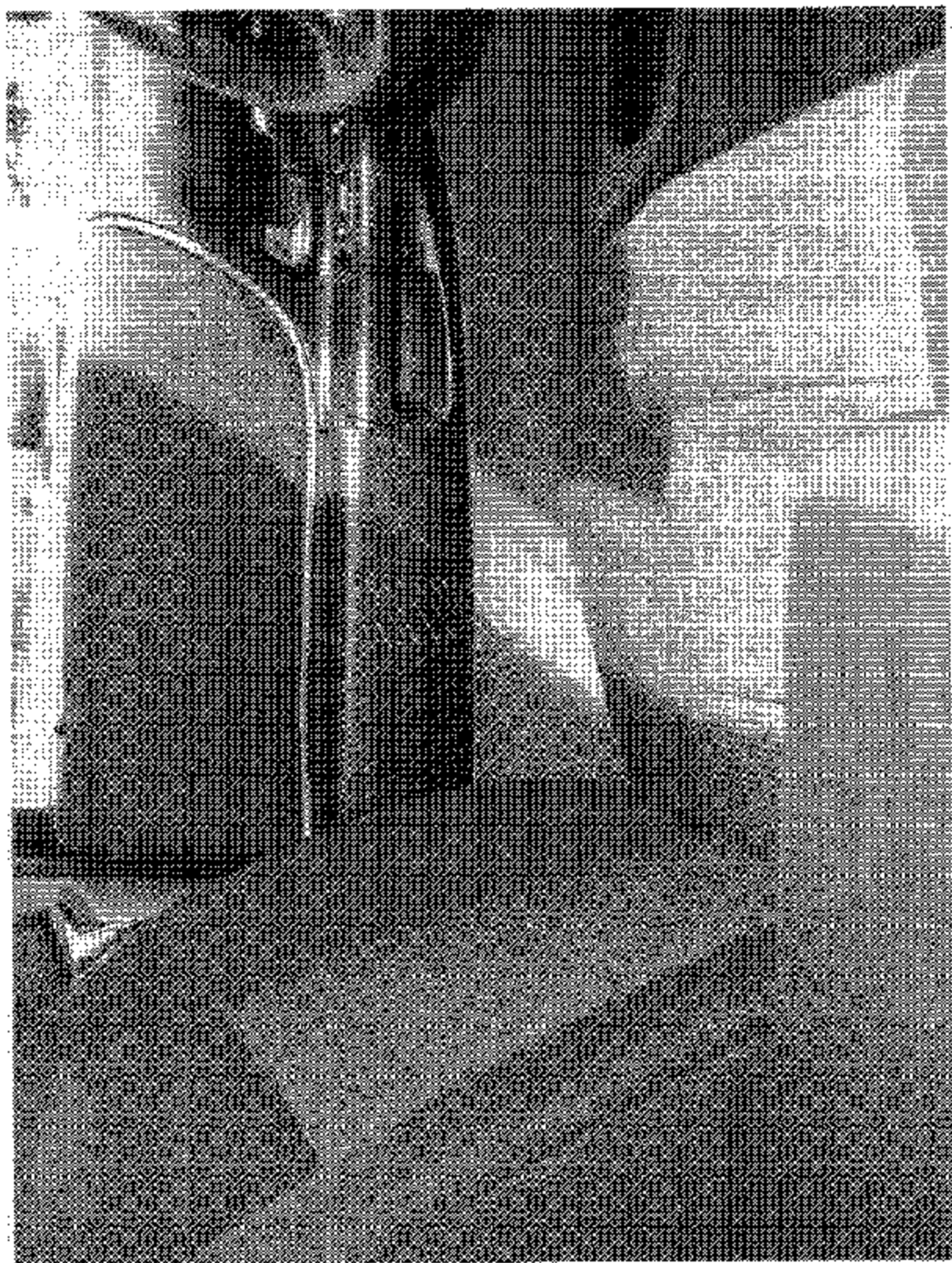


Figure A-8: ARMREST LEFT FRONT DOOR



Figure A-9 : CENTER ARMREST

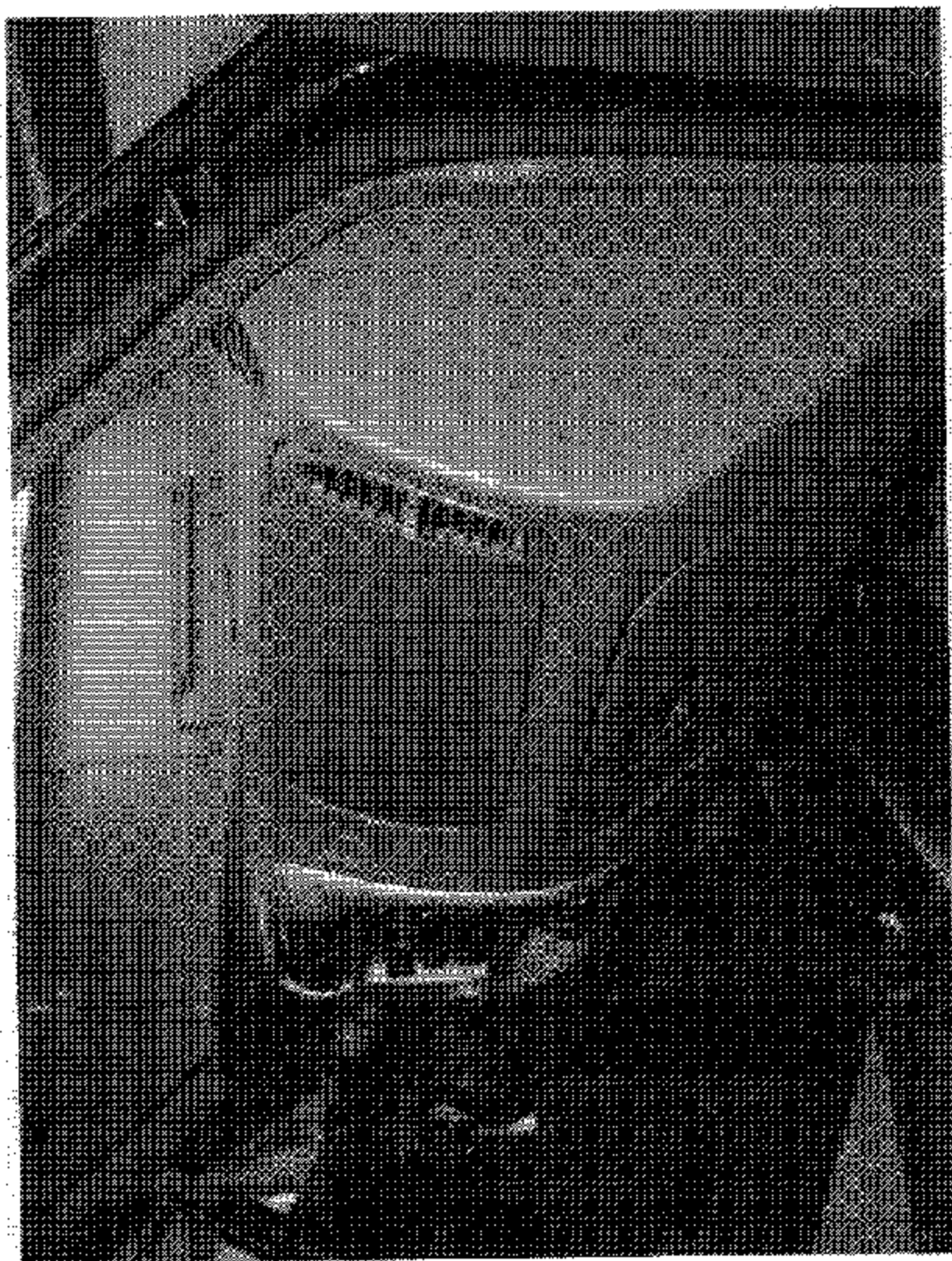


Figure A-10: INSTRUMENT PANEL

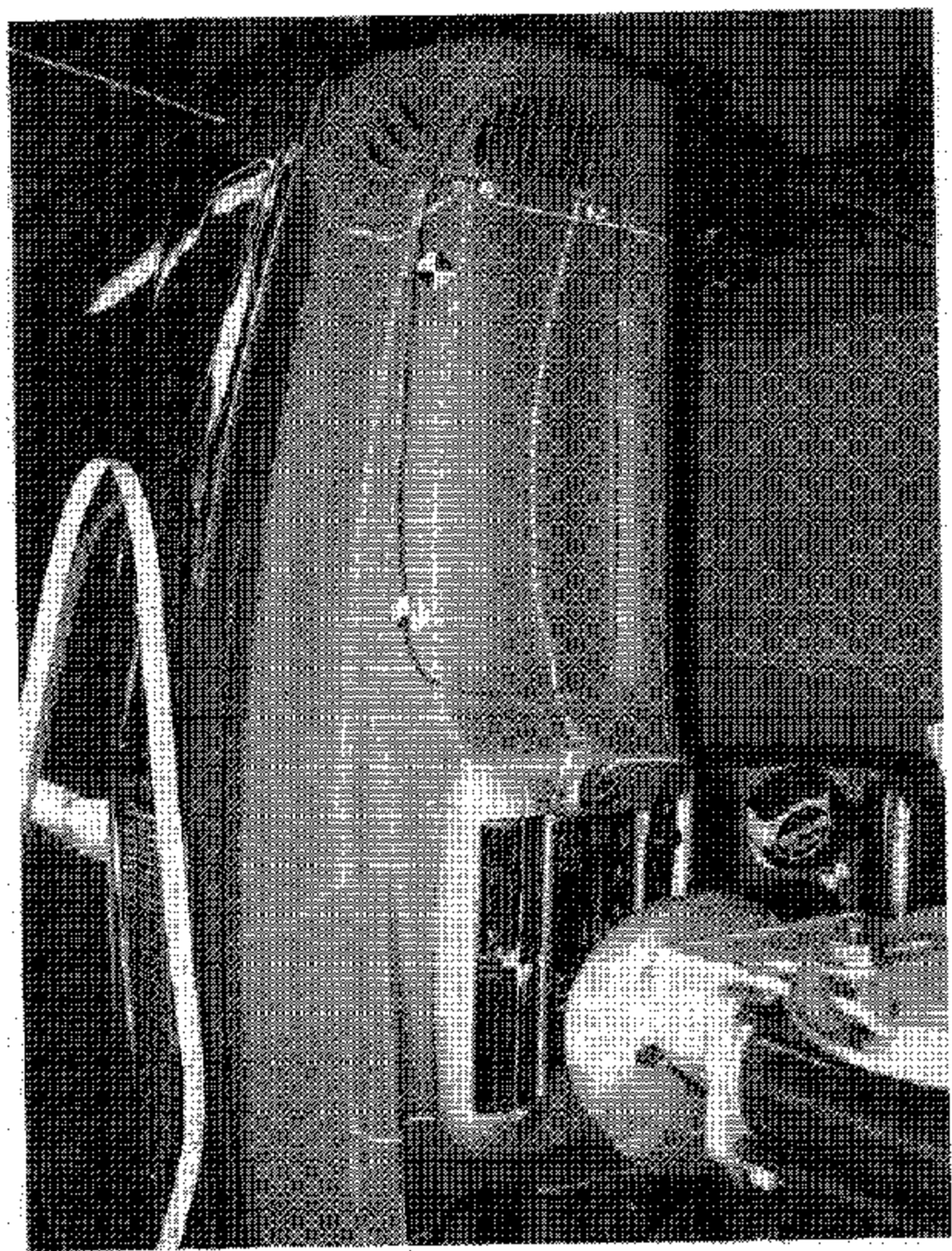


Figure A-41 DELINEATED INSTRUMENT PANEL IMPACT ZONE PRE-TEST

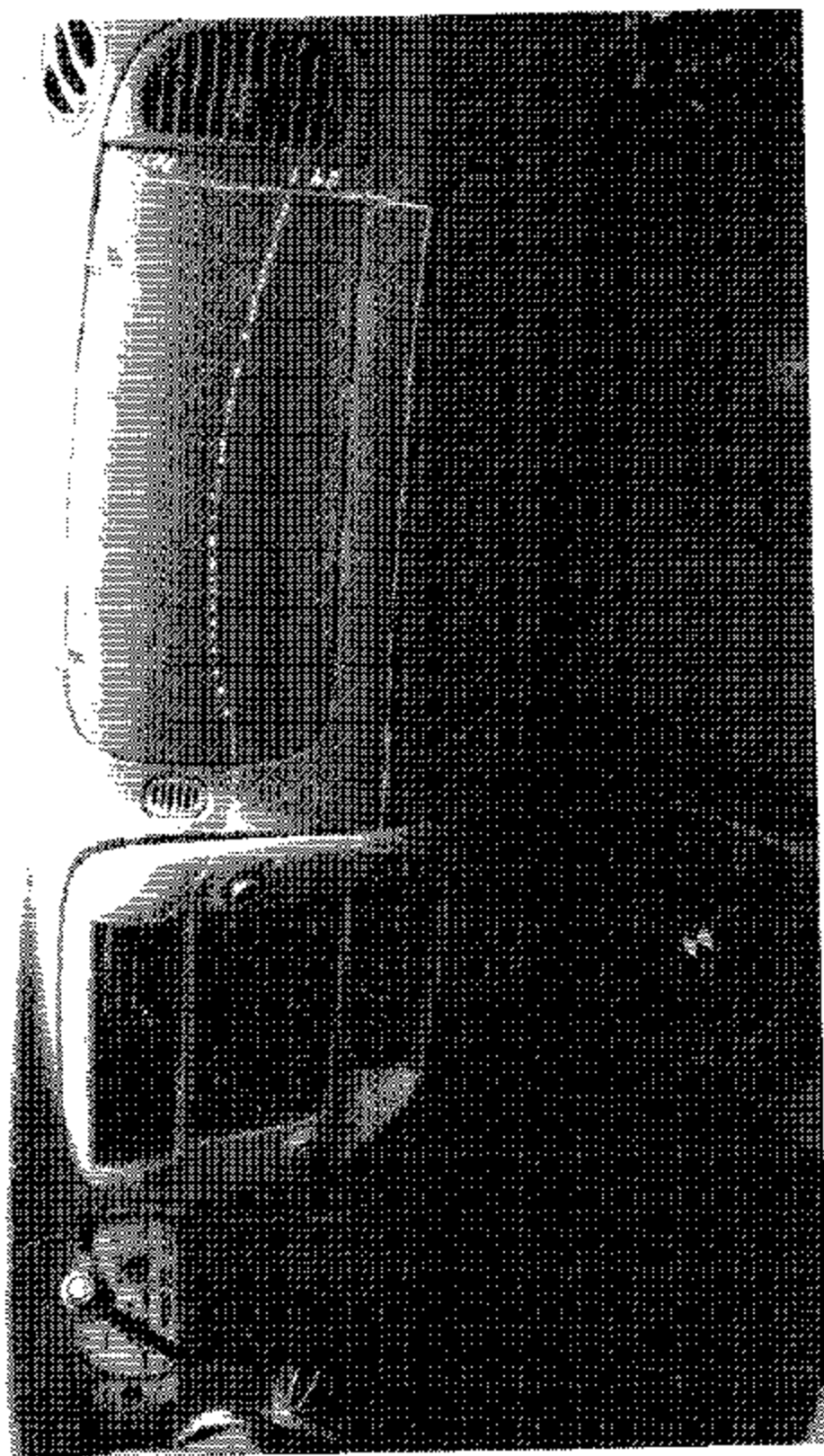


Figure A-12 DELINEATED INSTRUMENT PANEL IMPACT ZONE POST-TEST

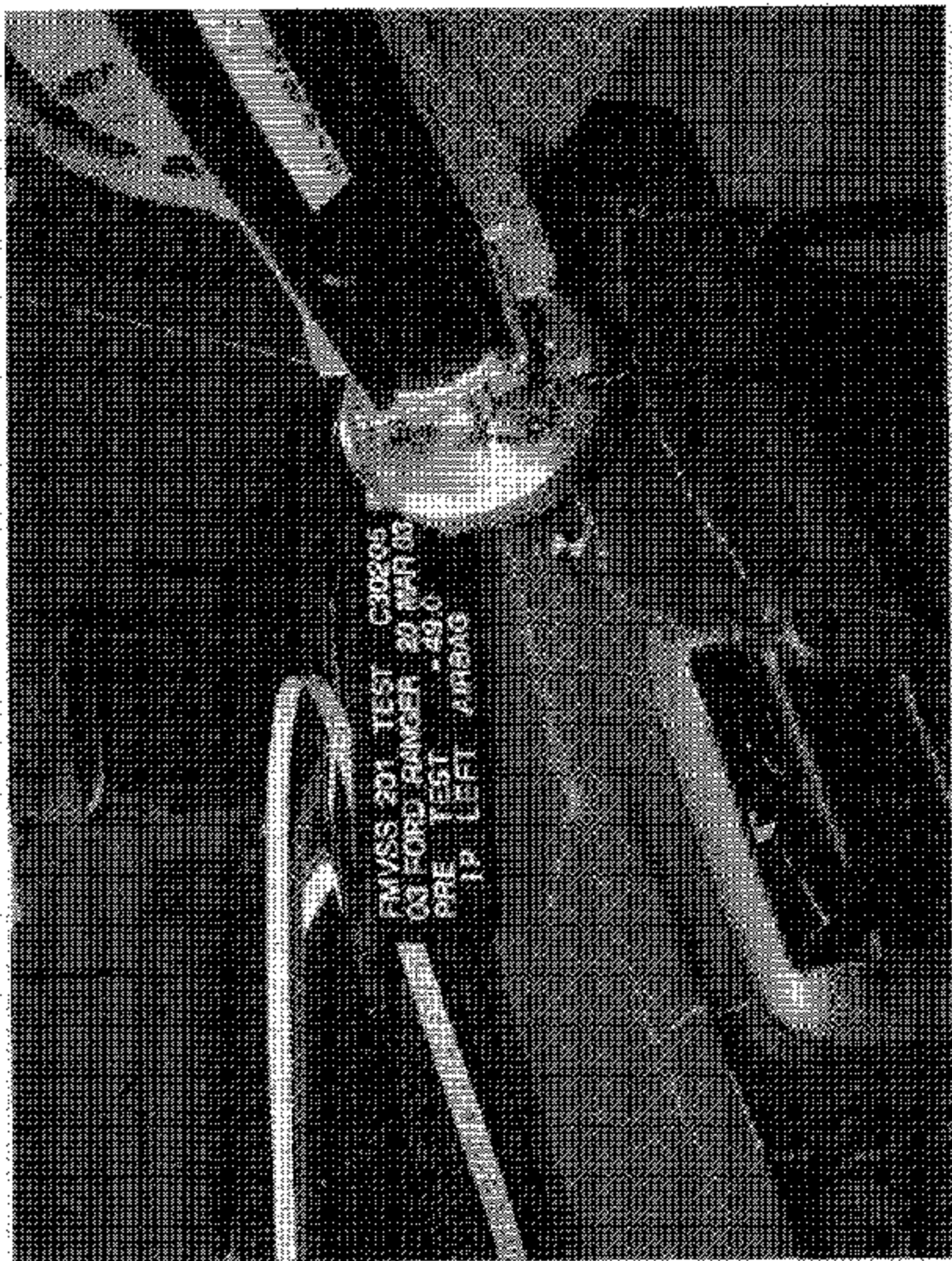


Figure A-13: INSTRUMENT PANEL AIRBAG UPPER LEFT IMPACT PRE-TEST



Figure A-14: INSTRUMENT PANEL AIRBAG UPPER LEFT IMPACT POST-TEST

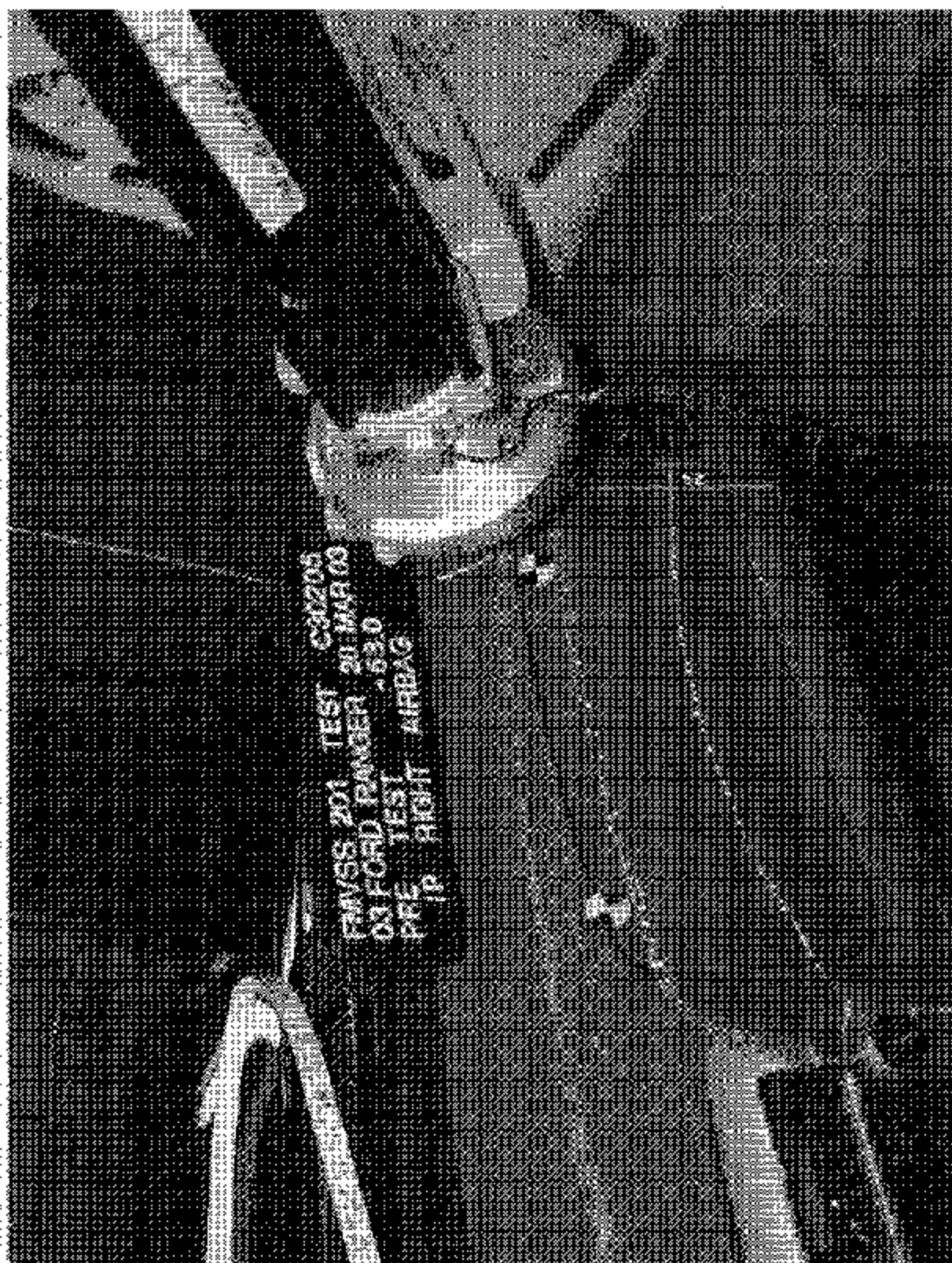


Figure A-15 : INSTRUMENT PANEL AIRBAG UPPER RIGHT IMPACT PRE-TEST

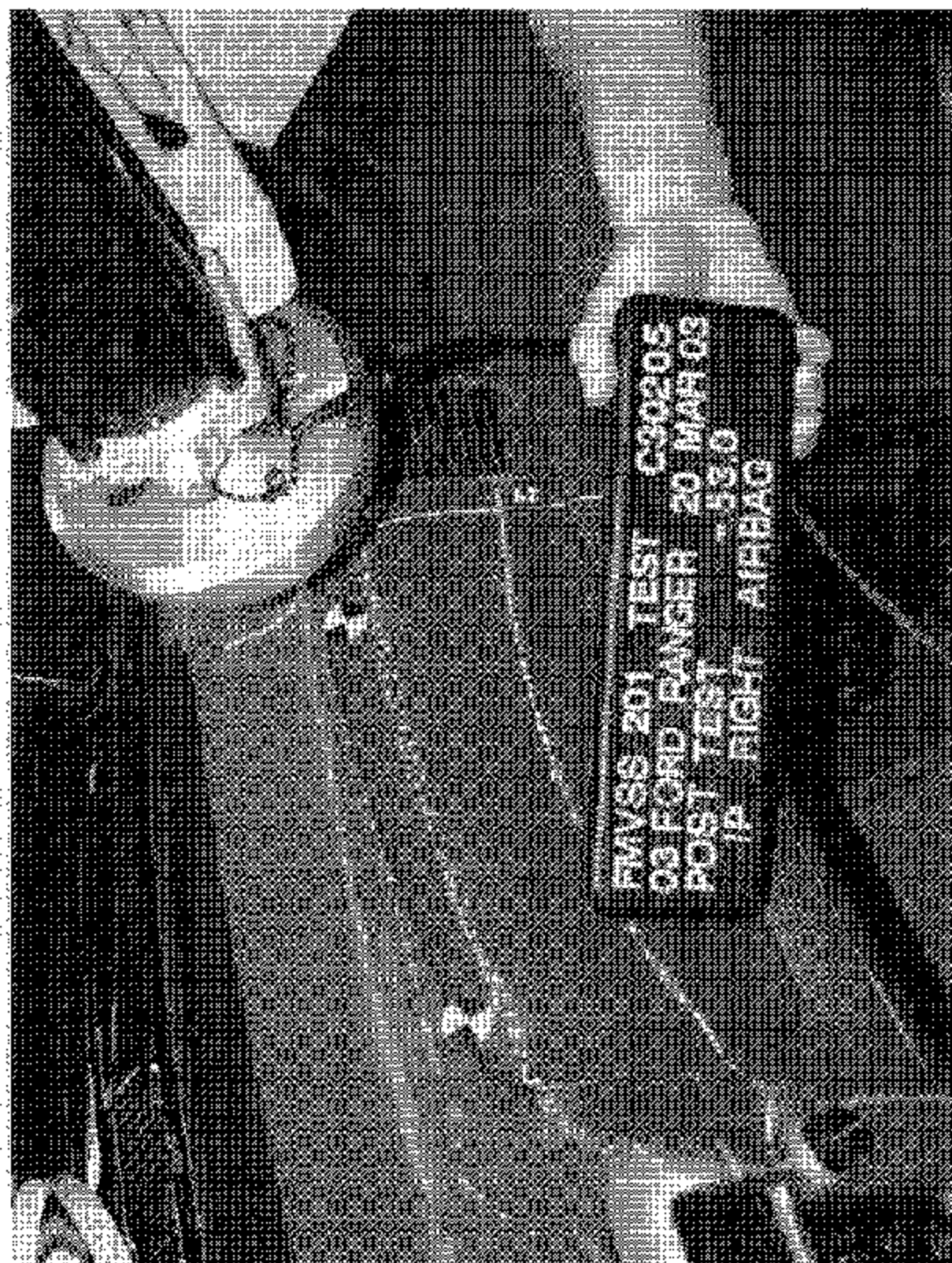


Figure A-16 : INSTRUMENT PANEL AIRBAG UPPER RIGHT IMPACT POST-TEST

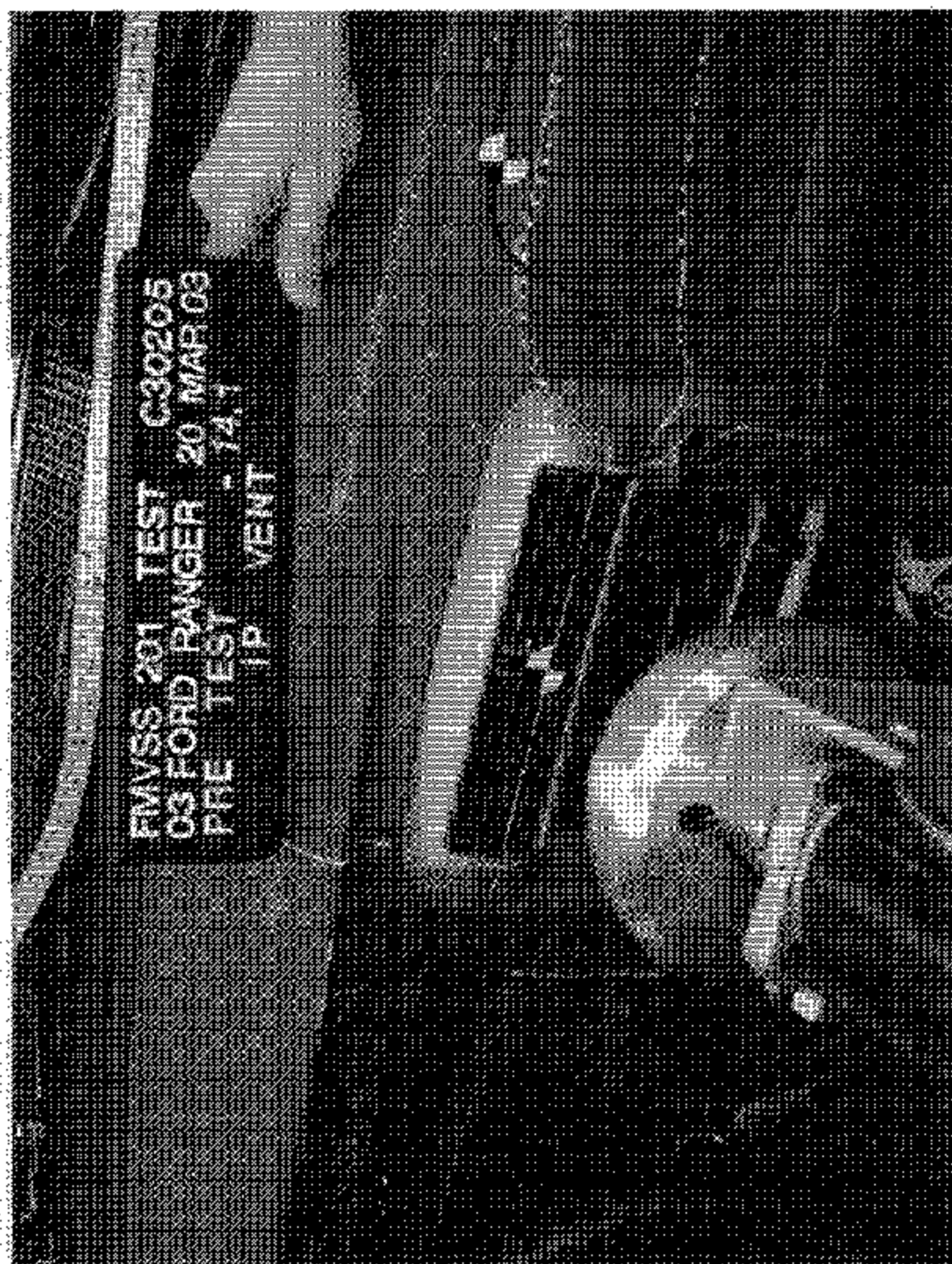


Figure A-17: INSTRUMENT PANEL CONSOLE VENT IMPACT PRE-TEST

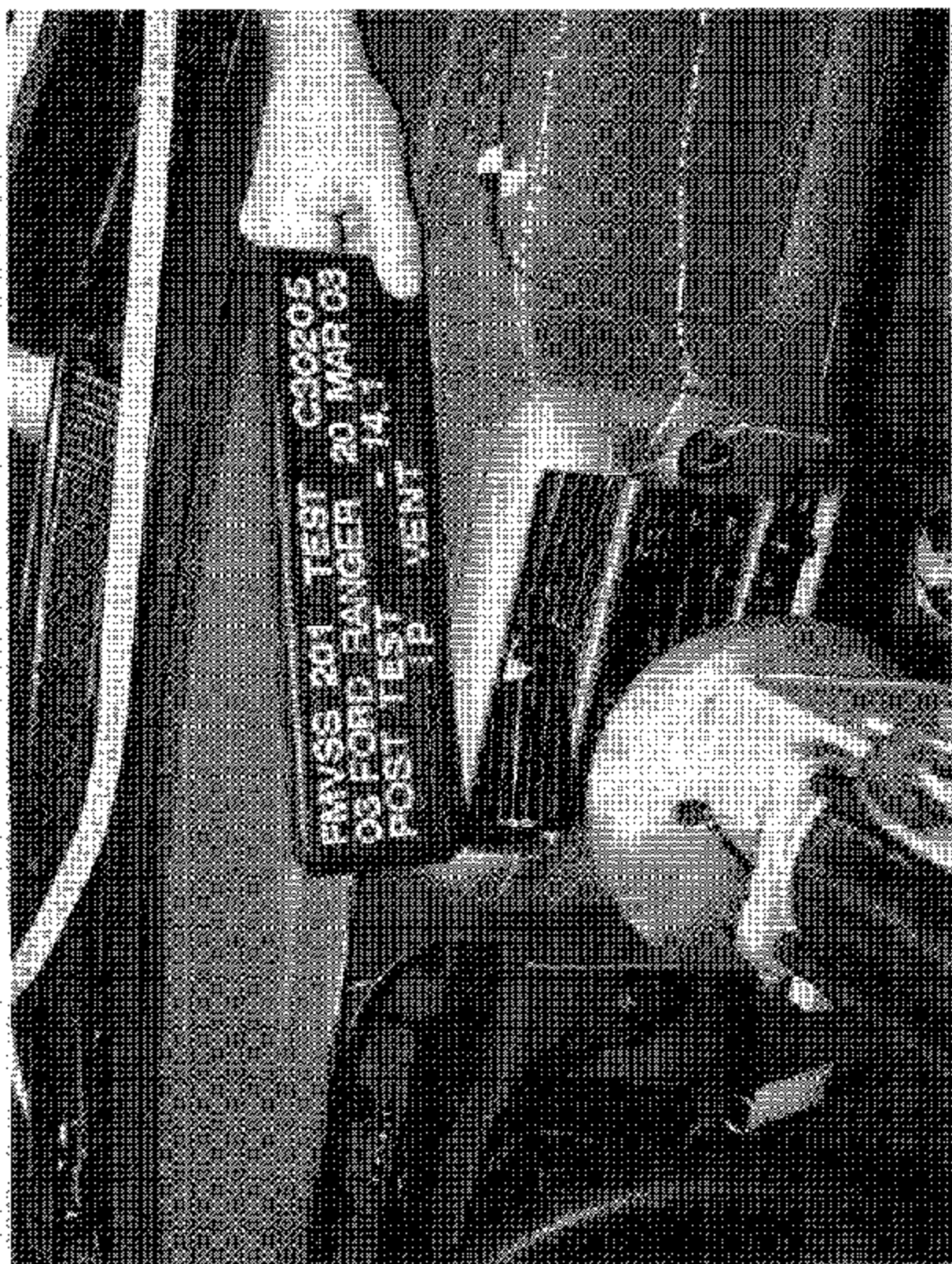


Figure A-18 : INSTRUMENT PANEL CONSOLE VENT IMPACT POST-TEST

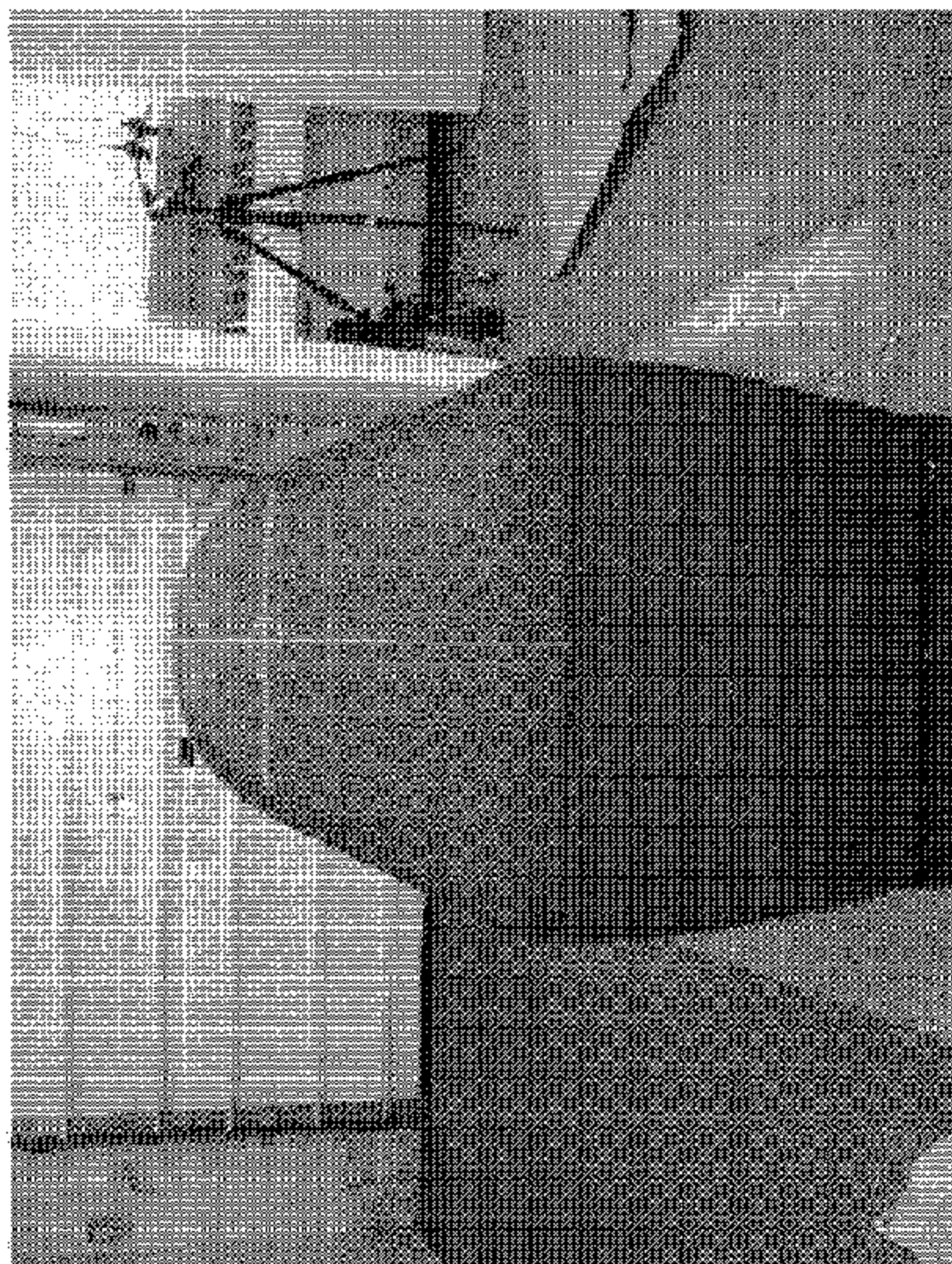


Figure A-19: HEAD RESTRAINT



Figure A-20: HEAD RESTRAINT IMPACT AREA PRE-TEST



Figure A-21 : HEAD RESTRAINT IMPACT AREA POST-TEST

APPENDIX B

INTERIOR COMPARTMENT DOOR CALCULATIONS

FORM 5

FIMVSS No. 201
Latch Component Analysis Information

Latch component inertial analysis information for each interior compartment door assembly located in an instrument panel, console assembly, seat back, or side panel adjacent to a designated seating position in accordance with the procedure described in section 5 of SAE Recommended Practice J439b, "Passenger Car Side Door Latch Systems."

Such data shall include: Please see attachments for Glove Box Latch (5 pages) and Console Latch (3 pages) Calculations.

1. Geometric details of the latch/link configuration.
2. Mass data for each element in the linkage.
3. Spring rates for each spring element in the configuration.
4. Any additional details unique to the design yet necessary for the calculations.

030205

Date: October 6, 1994
Form: Lab 401

Subject: Inertial study of F570-1000004-AA Latch Assembly for 1005 1/4 Explorer/Ranger Glove compartment door assembly F570-1000004-AA for FMVSS-201.

Input data:

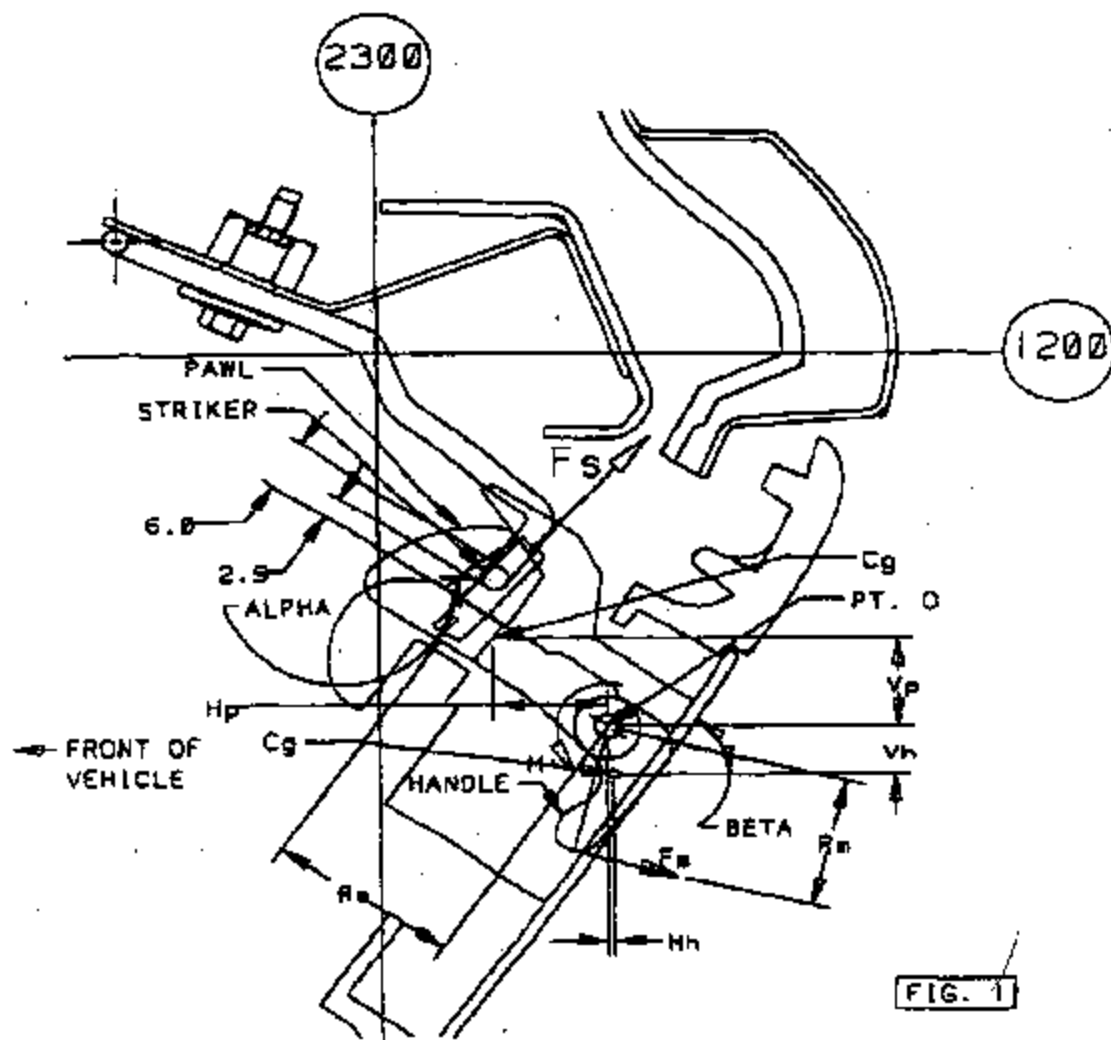
$F_n = 3.5N$ - force assumed at the handle required to displace the pawl from the full closed position

$R_a = 0.0155m$
 $R_s = 0.0020m$
 $\alpha = 35.1^\circ$
 $\beta = 58.6^\circ$

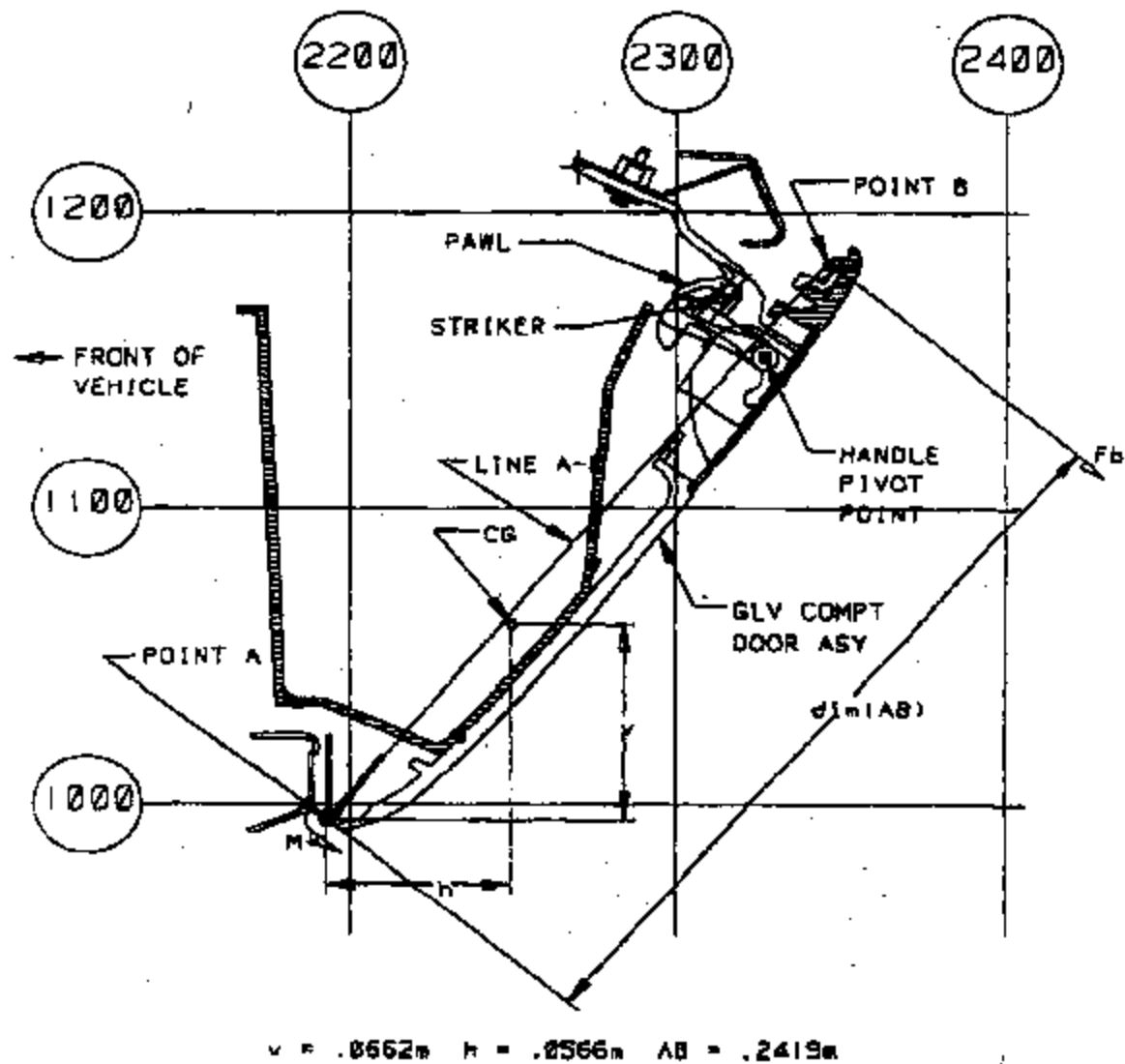
HANDLE
 $m_h = 0.0104kg$
 $V_h = 0.0002m$
 $H_h = 0.0000m$

PALL:
 $m_p = 0.0040kg$
 $V_p = 0.0117m$
 $H_p = 0.0137m$

DOOR ASSEMBLY
 $m = 1.30kg$
 $h = 0.0500m$
 $v = 0.0002m$



95 1/4 EXPLORER/RANGER UPN105
17P GLOVE COMPARTMENT DOOR ASY
FHVSS-201 F578-1006024



Frictional forces have been neglected in the calculations since they oppose the latch pawl rotation. Due to the geometry of pawl no moment is generated by the glove compartment door inertia that contributes to pawl rotation. All moments described below are about point "O" unless otherwise specified.

$$\text{Spring force: } F_s = F_{\text{Rm}}/R_s = \frac{3.5N(.0159)}{.0228} = 2.44N$$

$$\text{Spring moment: } M_s = -F_s R_s = -2.44(.0228) = -0.0556 \text{ NM}$$

SPECIFIC CASES

1. 30g inertia forces acting on the latch.

1.1 Inertia forces acting in the forward direction.

The inertia forces from the glove compartment door are being transferred into the instrument panel substrate/pad assembly through two rubber bushers located at the upper corners of the door.

$$\text{Pawl moment: } M_p = m_p(30g)V_p + M_{pg}H_p = M_{pg}(30V_p + H_p) = 1.0049(9.81)(30(.0159) + .0137) = 0.0238 \text{ NM}$$

$$\text{Handle moment: } M_h = -m_h(30g)V_h - m_h g H_h = m_h g(-30V_h - H_h) = (0.0104)(9.81)(-30(.0062) - .00068) = -0.01903 \text{ NM}$$

If $M_s + M_p + M_h < 0$ then the pawl will not move.

$$M_s + M_p + M_h = -0.0556 + 0.0238 - 0.01903 = -0.05083 \text{ NM} < 0$$

Pawl will not move.

1.2 Inertia forces acting in the rearward direction

$$M_p = -m_p 30g V_p + m_p g H_p = m_p g (-30V_p + H_p) = .0049 * 9.81 (-30 * .0117 + .0137) \\ = -0.01621 \text{ NM}$$

$$M_h = m_h 30g V_h + m_h g H_h = m_h g (30V_h + H_h) = .0104 * 9.81 (30 * .0062 + .00068) \\ M_h = 0.01904 \text{ NM}$$

If $M_s + M_p + M_h < 0$ then the pawl will not move.

$$M_s + M_p + M_h = -.01621 \text{ NM} + .01904 \text{ NM} - .0556 \text{ NM} = -.03372 \text{ NM} < 0 \\ \text{pawl will not move.}$$

2. 10g Inertia force acting on the latch pawl will not move

2.1 Inertia forces acting in the upward direction.

The Inertia forces from the glove compartment door are being transferred into the instrument panel substrate/pad assembly through two rubber bumpers located at the upper corners of the door.

$$M_p = -m_p 10g h_p + m_p g h_p = -9m_p g h_p = -9 * .0049 * 9.81 * .0137 \\ M_p = -0.00592 \text{ NM}$$

$$M_h = -m_p 10g h_p + m_p g h_p = -9m_p g h_p = -9 * .0104 * 9.81 * .00068 \\ = -0.0006234 \text{ NM}$$

$$M_s + M_p + M_h = -.0556 \text{ NM} - .00592 - .0006243 = -.06214 < 0 \\ \text{Pawl will not move}$$

2.2 Inertia forces acting in the downward direction.

$$M_p = (10+1) m_p g h_p = 11 * .0049 * 9.81 * .0137 = 0.007244 \text{ NM}$$

$$M_h = (10+1) m_h g h_h = 11 * .0104 * 9.81 * .00068 = 0.000763 \text{ NM}$$

$$M_s + M_p + M_h = -.0556 \text{ NM} + .00724 + .00076 = -.0476 \text{ NM} < 0 \\ \text{Pawl will not move.}$$

2.9 Inertia forces acting in horizontal transverse direction. The inertia force from the glove compartment door is transferred into the instrument panel substrate through the hinge assembly. The inertia forces from the latch components are acting in direction normal to the pivot axis of rotation and generate no moment that contributes to the pivot rotation.

3. Latch strength verification.

Out of the cases that must be considered, the highest opening moment acting on the glove compartment door about its hinge center (PT A) is generated by inertia forces in the rearward (+x) direction. In this particular case, the inertia moment about point A is:

$$M_i(+x) = -m30gv = -1.38kg * 30 * 9.81 * .0859 = -25.21 \text{ NM}$$

The weight moment of the complete door assembly about point

$$M_w = -mgh = -1.38kg * 9.81 * .0566 = -0.72$$

Total moment about point A:

$$M = M_i(+x) + M_w = -25.21 - 0.72 = -25.93 \text{ NM}$$

In order to exert moment M in a static test, force F_b min must be applied at any chosen point B in a direction perpendicular to line A-B. A test has been conducted where $\text{dim (AB)} = 0.2419\text{m}$.

$$F_b \text{ min} = -M/\text{dim (AB)} = 25.93/.2419 = -107.1 \text{ N}$$

Force $F_b = 150 \text{ N}$ applied at point B as shown on Fig 2 did not cause the door to open.



V. Palma, Engineer 10-5-94
PTPD. UPN185 I/P ENGINEERING

Inter Office



Office of Chief Squad Sergeant Detachment Chief (See Stamp) Date:	2 of 2
Access Number: 7-8-1-2-3	

Sady and Charles
Engineering

1903 February 10

To: Mr. J. J. Gonzalez
From: J. A. Colares/J. J. Hagston
Subject: Sign-off & Proof of Compliance to FMVSS 201, for Console Glove
Compartment Latch Assembly
Carline: 1990 Ranger/Scout II

Please find attached data and calculations to document compliance to FMVSS 201 paragraphs 53.3 and 53.3.1(c), in effect as of the date of this letter. S.J.S.1(a) does not apply as this latch assembly is designed to slide in only one direction and cannot be affected by the efforts prescribed in this standard.

Since the requirements of FMVSS are the same as those of GVSS Schedule D, Part III, Section 201, Subsections 4(a) and (b) (1), 3 and 6, the attached documentation will prove compliance for both.

FMVSS 201 requirements:

SUBJECT

Console panel glove box door shall remain closed when latch is subjected to inertia loading.

JUSTIFYING DATA

Inertia calculations attached define cumulative inertia load and retaining spring force as subjected to a force of 300 per 24K-1140.

Comment:
attachment

Drawn: JZ
by

CERTIFICATION DATA

1990 Ranger/Bronco II

FNVSZ 201. 33.3.1
Console Compartment Latch K97E-98061A03-A
Spring-Console Latch K68E-61060806-AA

DATA:

	VARIABLE	VALUE
Active Spring Length	L	52.0 mm
Spring Width	W	7.5 mm
Spring Thickness	T	0.38 mm
Spring Modulus	E	2.11E+07 g/mm ²
Deflection of Spring required to open latch (including preload)	X	4.5 mm
Handle Weight	W1	7.93 g
Latch Weight	W2	15.21 g
Acceleration (Per SAE-J819b)	A	30 g

OBJECTIVE:

Prove that inertial loading during impact will not overcome the latch spring forces at the point at which the latch will open. Mathematically, $F < X$.

FORMULAS AND CALCULATIONS:

Forces generated by inertia

$F_{MA} = (W/G)A$		
$= (W1/G)A = (7.93g)(30)$	F1	237.9 g
$= (W2/G)A = (15.21g)(30)$	F2	456.3 g
Total Force	F	694.2 g

Force required to open latch

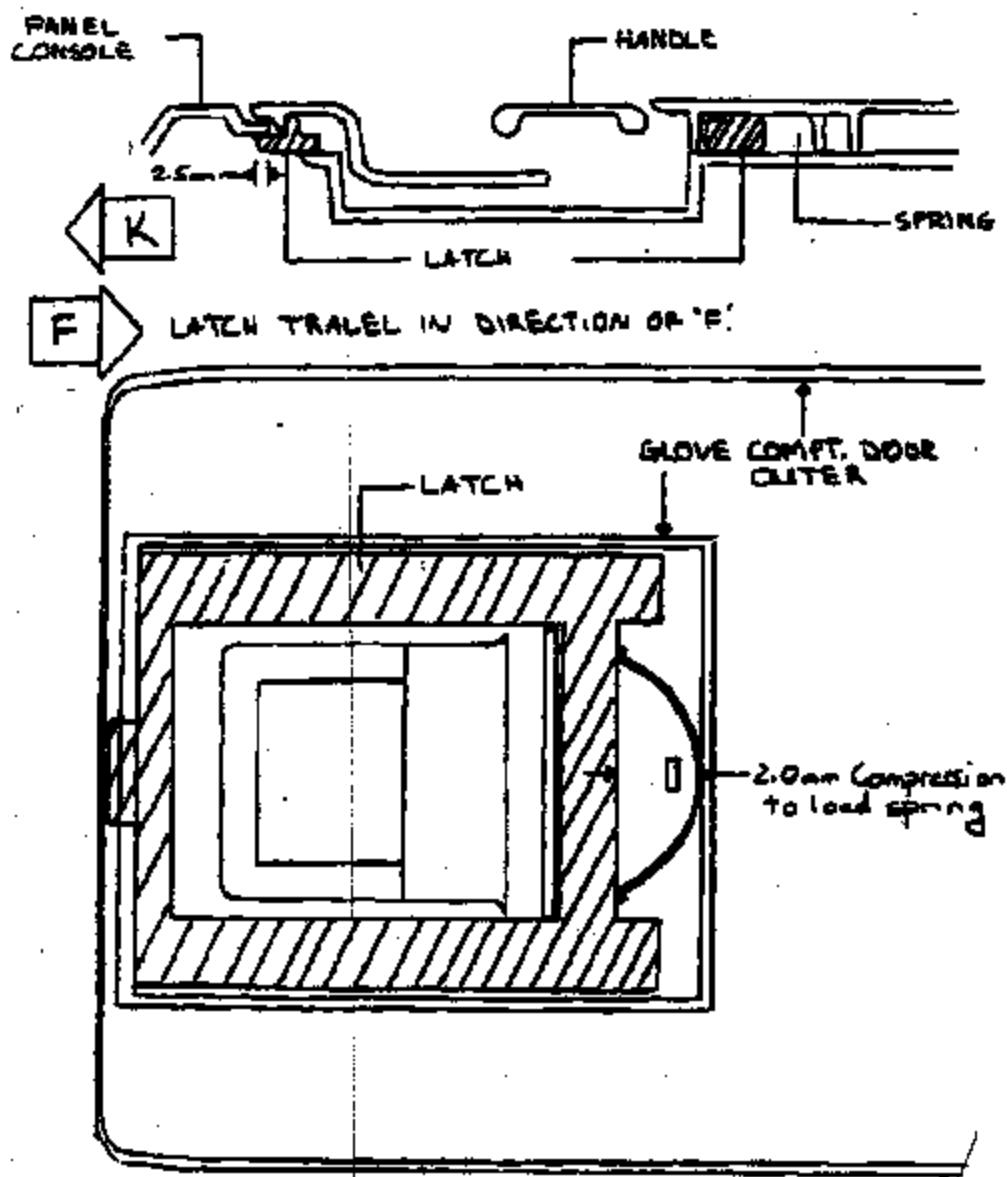
$K = (48EET^3)/L^3$		
$= [4(2.11E+07)(0.38mm)^3]/(52mm)^3$		
	K	1111.7 g

CONCLUSION:

F is less than K
 $F < K$ or $694.2 g < 1111.7 g$

1990

~~THE~~ RANGER/BRONCO II CONSOLE DOOR LOCK
SKETCH

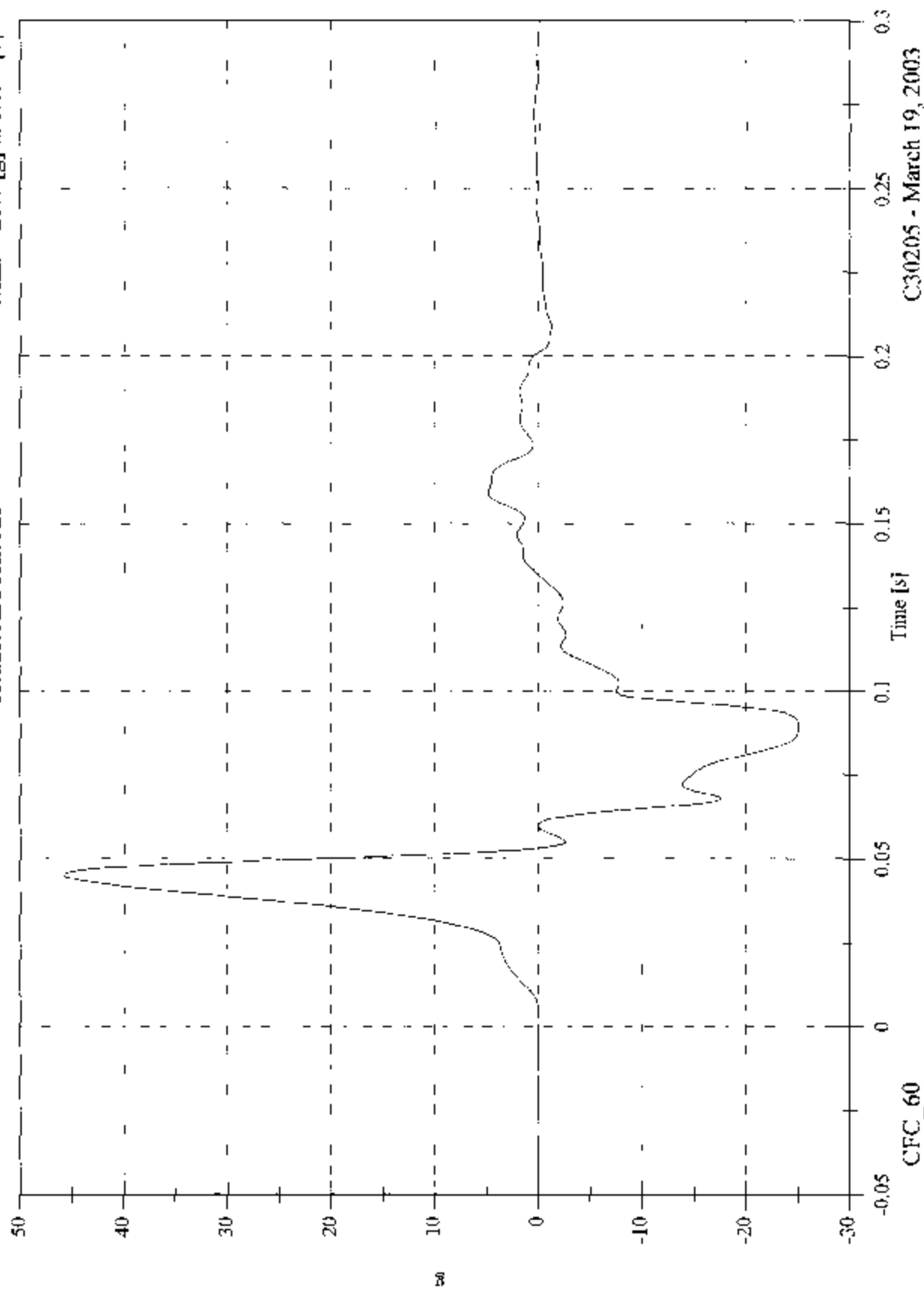


APPENDIX C

DATA PLOTS

FMVSS 201 Linear Impact - 2003 Ford Ranger - Passenger Seat Back 10.5 Deg
Headform Front Ax

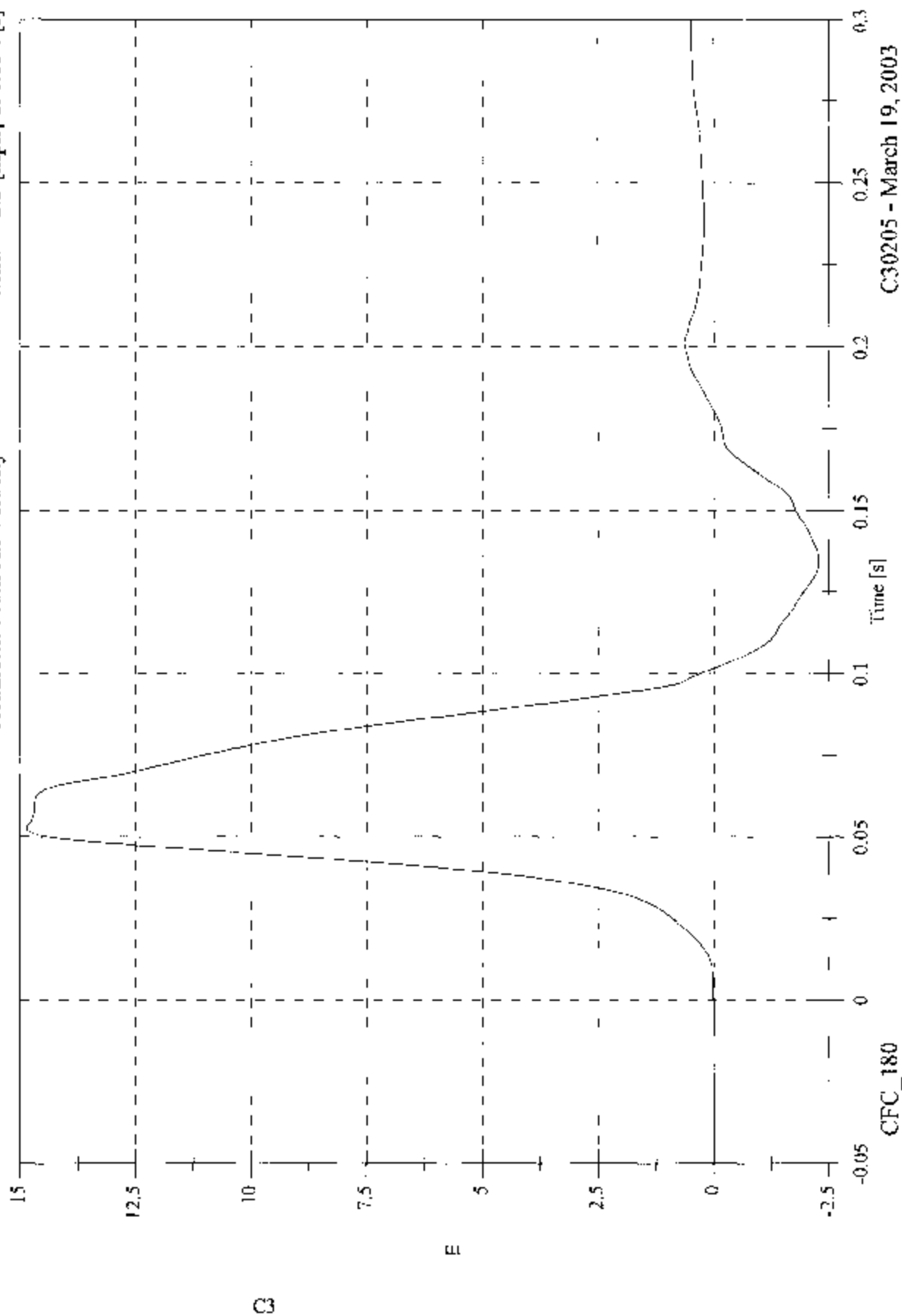
Max: 45.8 [g] at 0.045 [s]
Min: -25.0 [g] at 0.090 [s]



C30205 - March 19, 2003

FMVSS 201 Linear Impact - 2003 Ford Ranger - Passenger Seat Back 10.5 Deg
 Headform Front Ax Velocity

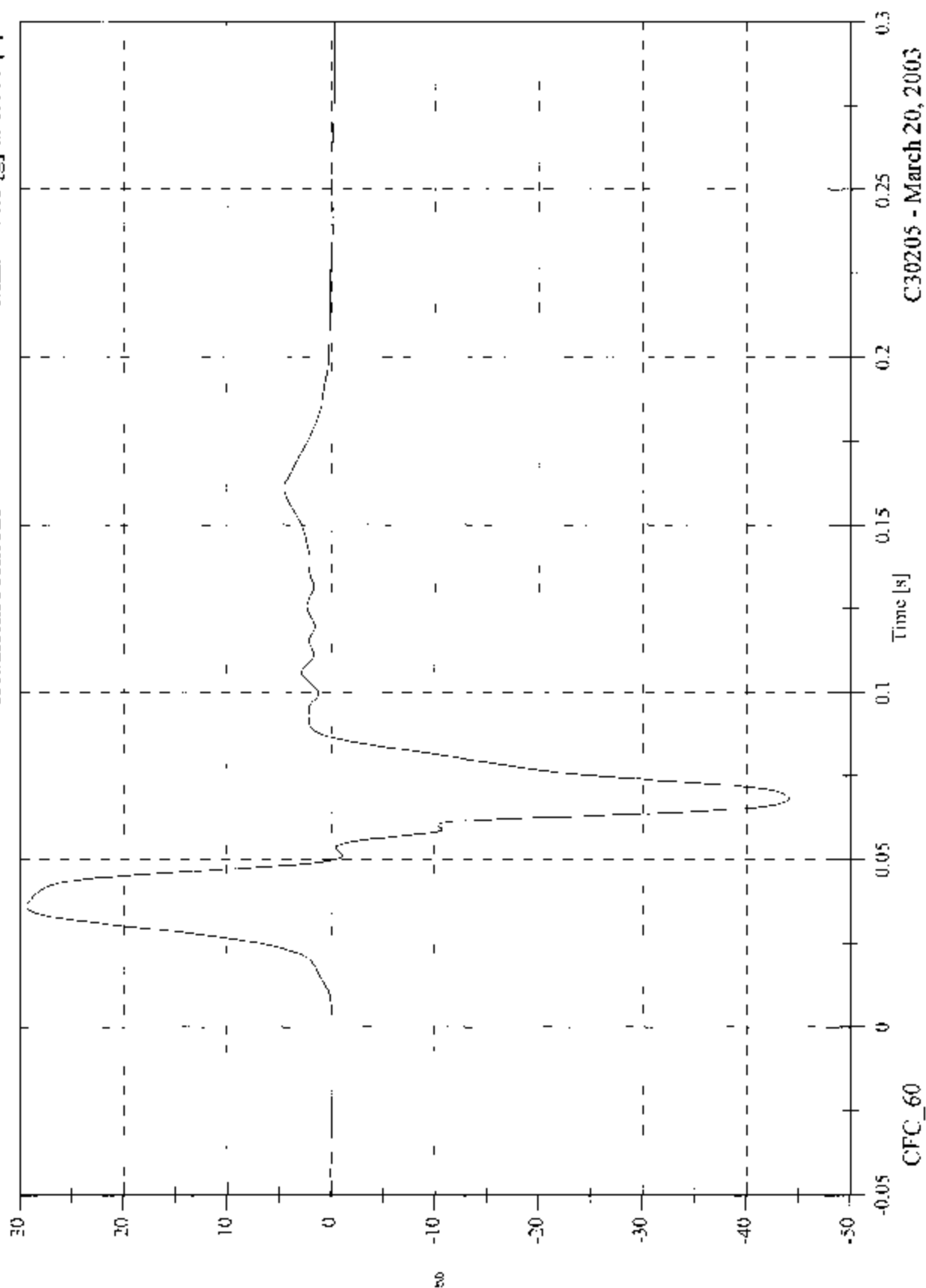
Max: 14.9 [mph] at 0.053 [s]
 Min: -2.3 [mph] at 0.134 [s]



FMVSS 201 Linear Impact - 2003 Ford Ranger - Instrument Panel Vent 14.1 deg
Headform Front Ax

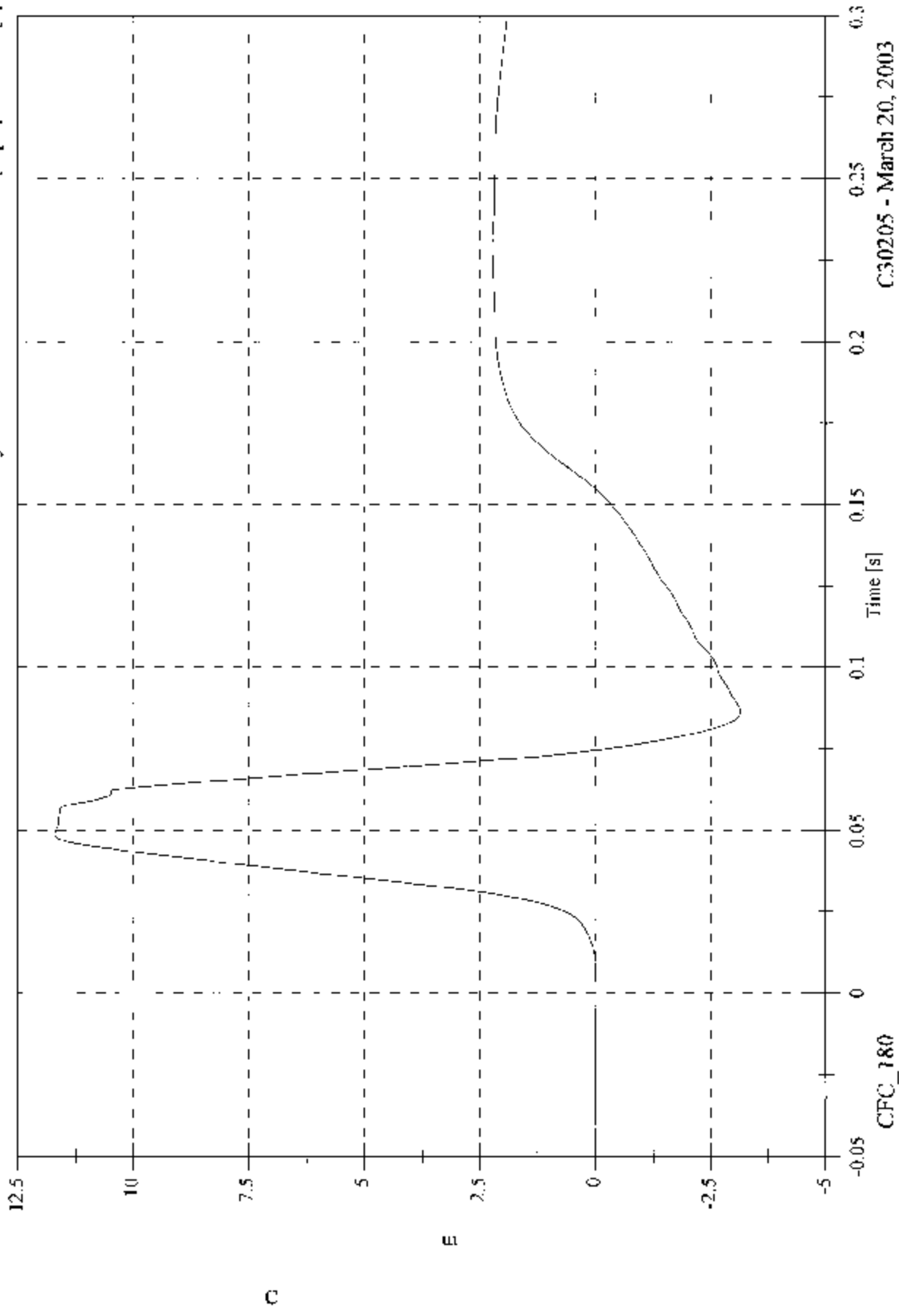
Max: 29.3 [g] at 0.036 [s]

Min: -44.1 [g] at 0.068 [s]



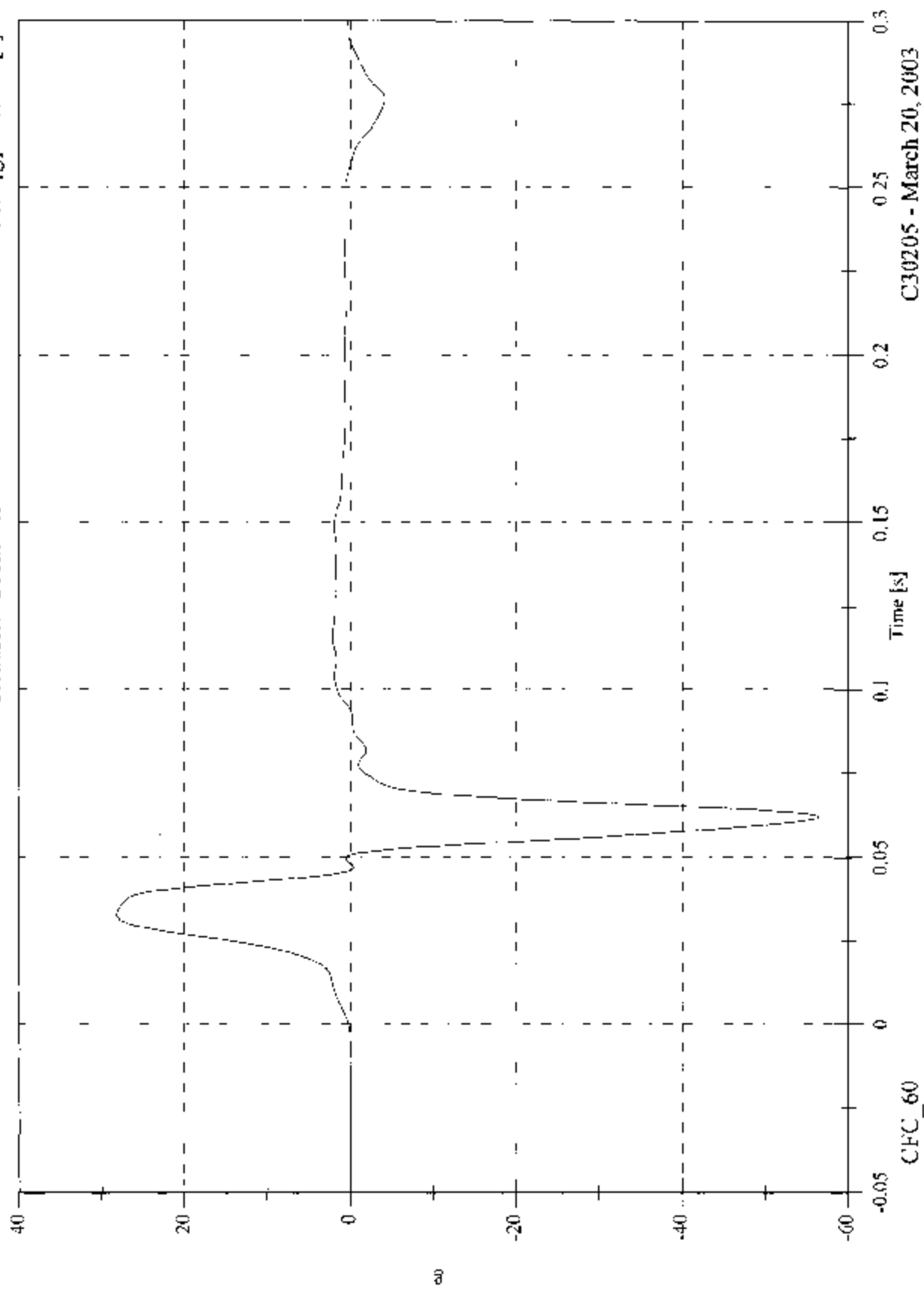
FMVSS 201 Linear Impact - 2003 Ford Ranger - Instrument Panel Vent 14.1 deg
Headform Front Ax Velocity

Max: 11.7 [mph] at 0.049 [s]
Min: -3.1 [mph] at 0.087 [s]



FMVSS 201 Linear Impact - 2003 Ford Ranger - IP Airbag Upper Left 49.0 Deg
Headform Front Ax

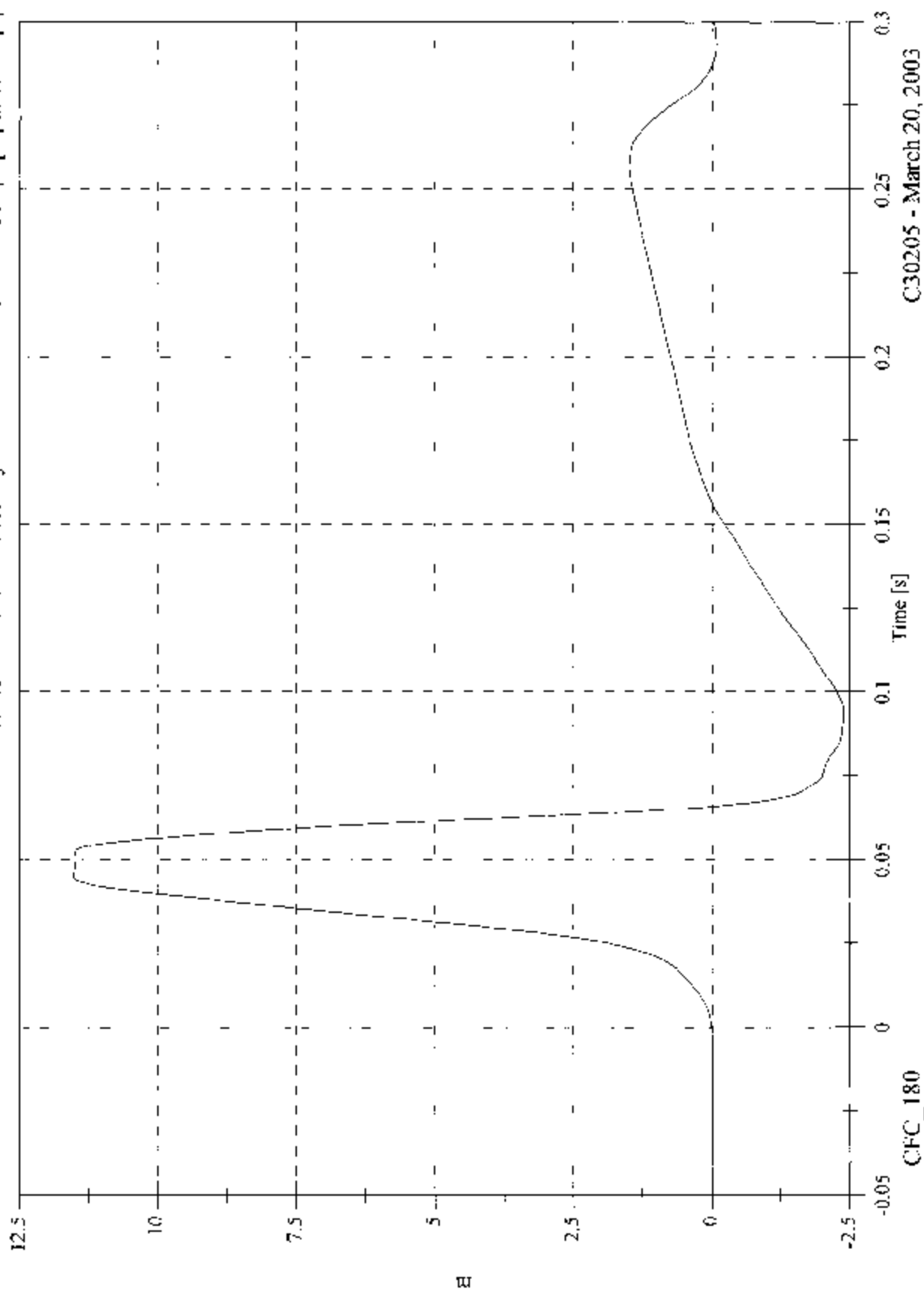
Max: 28.3 [g] at 0.033 [s]
Min: -56.4 [g] at 0.062 [s]



C30205 - March 20, 2003

FMVSS 201 Linear Impact - 2003 Ford Ranger - IP Airbag Upper Left 49.0 Deg
 Headform Front Ax Velocity

Max: 11.5 [mph] at 0.045 [s]
 Min: -2.4 [mph] at 0.094 [s]



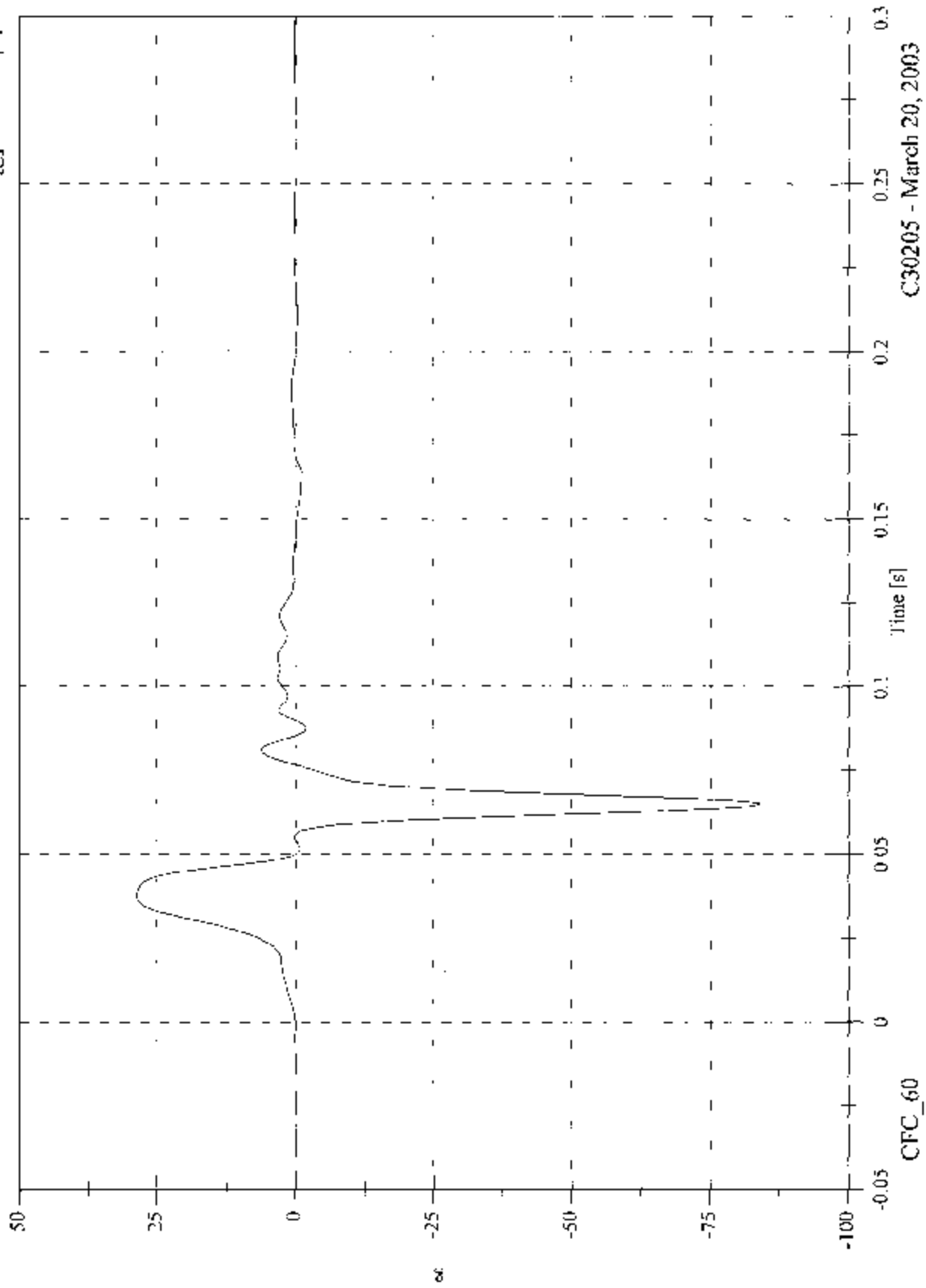
C30205 - March 20, 2003

FMVSS 201 Linear Impact - 2003 Ford Ranger - IP Airbag Upper Right 53.0 deg

Headform Front Ax

Max: 28.7 [g] at 0.037 [s]

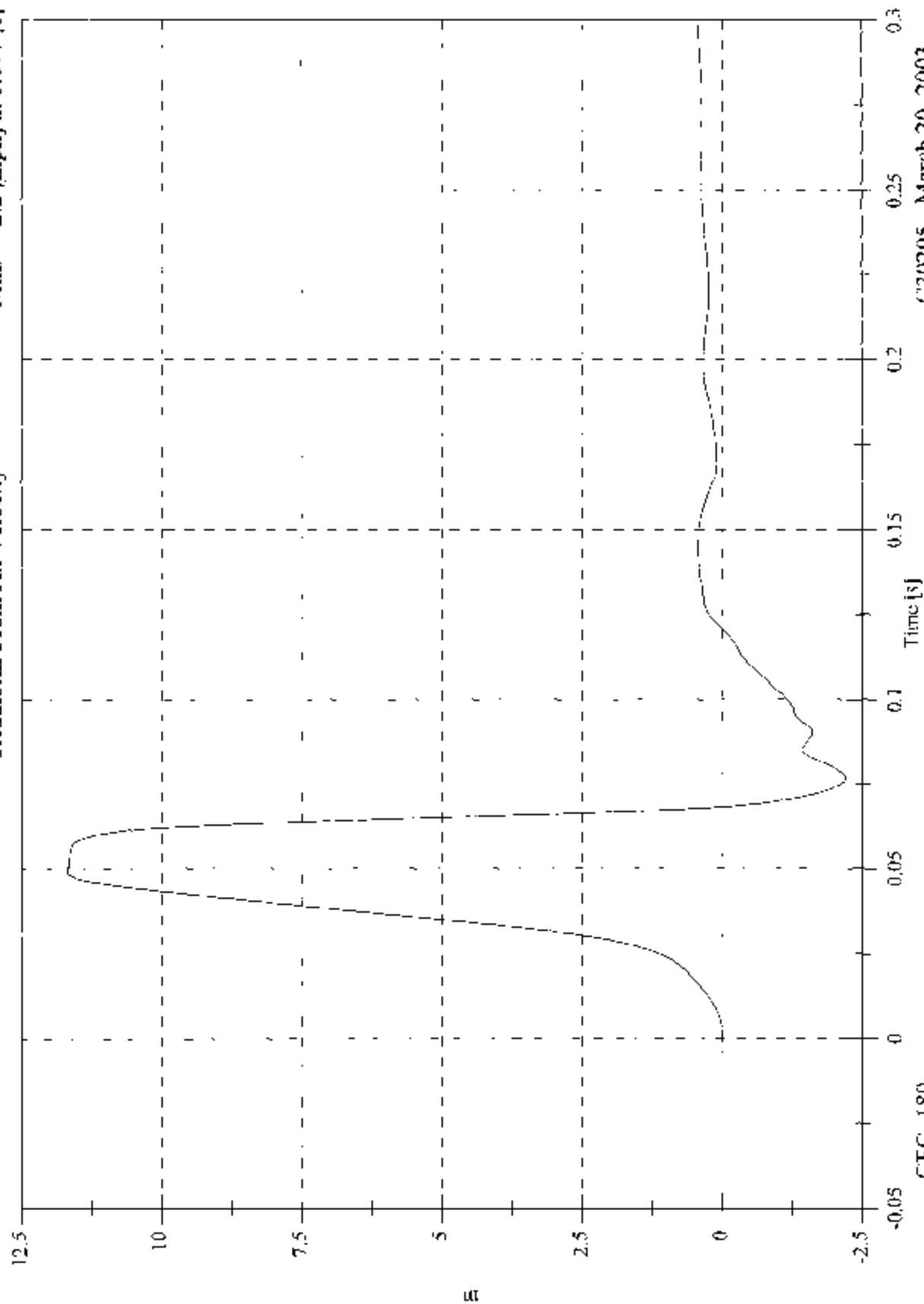
Min: -84.0 [g] at 0.065 [s]



C30205 - March 20, 2003

FMVSS 201 Linear Impact - 2003 Ford Ranger - IP Airbag Upper Right 53.0 deg
Headform Front Ax Velocity

Max: 11.7 [mph] at 0.049 [s]
Min: -2.2 [mph] at 0.077 [s]



C30205 - March 20, 2003