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REPORT NO.: 214-MGA-99-09
SAFETY COMPLIANCE TESTING FOR FMVSS NO. 214
"SIDE IMPACT PROTECTION"

Hyundai Motor Company
1999 Hyundai Elantra 4 Door
NHTSA NO: CX0512

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105



Test Date: March 16, 1999

Report Date: March 22, 1999

FINAL REPORT

Prepared For:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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16. Abstract A 48/24 kph 90° Impact (Moving Deformable Barrier) Compliance Test was conducted on the subject 1999 Hyundai Elantra 4 Door in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-214D-04 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on March 16, 1999. The impact velocity of the Moving Deformable Barrier (MDB) was 53.4 kph, and the ambient temperature at the struck side of the target vehicle at the time of impact was 22°C. The target vehicle post test maximum crush was 349 mm at level 2. The test vehicle's performance follows: <table border="0" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>DRIVER.</u></th> <th style="text-align: center;"><u>LEFT REAR PASS.</u></th> </tr> </thead> <tbody> <tr> <td>Left Upper Rib (LUR) Accel., g</td> <td style="text-align: center;">77</td> <td style="text-align: center;">79</td> </tr> <tr> <td>Left Lower Rib (LLR) Accel., g</td> <td style="text-align: center;">75</td> <td style="text-align: center;">81</td> </tr> <tr> <td>Lower Spine (T₁₂) Accel., g</td> <td style="text-align: center;">72</td> <td style="text-align: center;">67</td> </tr> <tr> <td>Thoracic Trauma Index (TTI)</td> <td style="text-align: center;">74</td> <td style="text-align: center;">74</td> </tr> <tr> <td>Pelvis (PEV) Accel., g</td> <td style="text-align: center;">81</td> <td style="text-align: center;">68</td> </tr> </tbody> </table> The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.					<u>DRIVER.</u>	<u>LEFT REAR PASS.</u>	Left Upper Rib (LUR) Accel., g	77	79	Left Lower Rib (LLR) Accel., g	75	81	Lower Spine (T ₁₂) Accel., g	72	67	Thoracic Trauma Index (TTI)	74	74	Pelvis (PEV) Accel., g	81	68
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17. Key Words Compliance Testing Side Impact Protection FMVSS 214 Side Impact Dummy (SID)		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Adm. Technical Ref. Division, Room 5108 (NAD-52) 400 Seventh Street, S.W. Washington, D.C. 20590 Telephone No. 202-366-4946																			
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SECTION 1
PURPOSE AND TEST PROCEDURE

This side impact test is part of the FY 99 FMVSS 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-97-C-11033. The purpose of this test was to evaluate side impact protection of a 1999 Hyundai Elantra 4 Door.

This side impact test was conducted in accordance with the Vehicle Safety Compliance's FMVSS 214 test procedure (TP-214D-04, dated September 1, 1995).

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes only.

SECTION 2

SUMMARY OF SIDE IMPACT TEST

A 1999 Hyundai Elantra 4 Door was impacted on the left side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 53.4 kph (33.2 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin, on March 16, 1999. Pre- and post-test photographs of the test vehicle, the MDB and the side impact dummies (SIDs) are included in Appendix A.

Two Side Impact Dummies (SIDs) were placed in the left front and left rear designated seating positions according to instructions specified in the OVSC Side Impact Laboratory Test Procedure which is dated September 1, 1995. The side impact event was documented by nine high speed cameras. Camera locations and other pertinent camera information can be found in this report.

The SIDs were instrumented with the following accelerometers.

1. Left Upper Rib (LUR) uniaxial accelerometer (Y-direction)
2. Left Lower Rib (LLR) uniaxial accelerometer (Y-direction)
3. Lower Thoracic Spine (T₁₂) uniaxial accelerometer (Y-direction)
4. Pelvic (PEV) section uniaxial accelerometer (Y-direction)

Appendix B contains the vehicle and dummy response data traces. A summary of the side impact dummy (SID) configuration and performance verification test data is shown in Appendix C. Dummy and vehicle calibration data can be found in Appendix D of this report.

The following table summarizes the results of the FMVSS 214 Left Side Impact test:

Injury Criteria	Front SID	Rear SID
TTI (g)	74	74
Pelvis (g)	81	68

TEST NOTES

1. The following accelerometers were not used for this test:

Left Front Door on Centerline

Midrear of Left Front Door

Left Front Door Upper Centerline

Midrear of Left Rear Door

Left Rear Door Upper Centerline

Left Rear Seat Track

SECTION 3
SIDE IMPACT DUMMY (SID) AND
VEHICLE TEST DATA

DATA SHEET NO. 1
GENERAL VEHICLE TEST PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door
Vehicle NHTSA No.: CX0512 VIN: KMHJF25F5XU780450
Vehicle Body Color: Maroon Build Date: 11/20/98
Engine Data: 4 Cylinders; CID; 2.0 Liter; cc
Placement Longitudinal; X Lateral
Transmission: 4 speed; Manual; X Automatic; X Overdrive
Final Drive: Rear Wheel Drive; X Frt. Wheel Drive; Four Wheel Drive

Odometer Reading 112 miles
Options: X A/C; X Pwr. Steering; X Pwr. Brakes; X Pwr. Windows;
 X Cruise Control; X Tilt Wheel; X Power Door Locks;

DATA FROM TIRE PLACARD:

Tire Pressure (at capacity): 30 Psi FRONT
30 Psi REAR
Recommended Tire Size: P195/60R14
Tires on Test Vehicle: P195/60R14 Manufacturer: Michelin

Vehicle Capacity Data:

Number of Occupants: 2 Front; 3 Rear; 3rd Seat 5 Total
Type of Front Seats: X Bucket; Bench; Split Bench
Type of Front Seat Back: Fixed; X Adjustable with X Lever Knob Power
Vehicle Maximum Capacity Loading = 385.6 kg (A)
No. of Occupants x 68.04 kg. = 340.2 kg (B)
Cargo Capacity (A-B) = 45.4 kg

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)WEIGHT OF TEST VEHICLE WITH MAXIMUM FLUIDS:Right Front = 383.7 kgRight Rear = 226.3 kgLeft Front = 387.4 kgLeft Rear = 237.2 kgTOTAL FRONT = 771.1 kgTOTAL REAR = 463.5 kg% of Total Weight = 62.5 %;% of Total Weight = 37.5 %TOTAL WEIGHT = 1234.6 kg

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Test Vehicle Delivered Weight with Maximum Fluids	= <u>1234.6</u> kg
Cargo Carrying Capacity of Test Vehicle	= <u>45.4</u> kg
Weight of 2 Side Impact Dummies (2 x <u>80.7</u> kg.)	= <u>161.4</u> kg
TEST VEHICLE TARGET WEIGHT	= <u>1441.4</u> kg

ACTUAL WEIGHT OF TEST VEHICLE WITH 2 DUMMIES AND CARGO: (FULLY LOADED)

Right Front = <u>387.4</u> kg	Right Rear = <u>283.9</u> kg
Left Front = <u>439.1</u> kg	Left Rear = <u>329.8</u> kg
TOTAL FRONT = <u>826.5</u> kg	TOTAL REAR = <u>613.7</u> kg
% of Total Weight = <u>57.4</u> %	% of Total Weight = <u>42.6</u> %
TOTAL WEIGHT = <u>1440.2</u> kg	

TEST VEHICLE ATTITUDE:

CURB WEIGHT ATTITUDE:

Right Front 656 mm Left Front 657 mm Right Rear 663 mm Left Rear 651 mm

FULLY LOADED WEIGHT ATTITUDE:

Right Front 653 mm Left Front 637 mm Right Rear 635 mm Left Rear 606 mm

TEST ATTITUDE:

Right Front 650 mm Left Front 640 mm Right Rear 641 mm Left Rear 612 mm

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

Test Vehicle Wheelbase: 2550 mm

C.G. As Tested = 1061 mm rearward of front wheel centerline

TOTAL VEHICLE LENGTH:

Right Side = 3735 mm

Centerline = 4395 mm

Left Side = 3732 mm

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999

FRONT SEAT CUSHION PLACEMENT:

Total Length of Adjustment Travel: 230 mm

Test Position: 9th position rearward of 16

FRONT SEAT BACK ADJUSTMENT POSITION:

Seat Back Angle = 28.4°

REAR POSITION SEAT:

Total Length of Fore/Aft Adjustment Travel: Non-adjustable

Seat Back Adjustment Position: Non-adjustable

ADJUSTABLE STEERING COLUMN POSITION: Mid-position

WINDOW POSITIONS: Left Front Closed Left Rear Closed
 Right Front Open Right Rear Removed

AMOUNT OF STODDARD SOLVENT IN FUEL TANK:

Fuel system usable capacity = 14.5 gallons

Test Volume: 13.5 gallons 93% of capacity

LOCATIONS OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED:

Wheelbase: = 2550 mm

Impact Point is 335 mm rearward of front axle centerline

DATA SHEET NO. 2
TEST VEHICLE SUMMARY OF RESULTS

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999

Overall Length = 4395 mm; Overall Width = 1666 mm

TEST WEIGHT:

Right Front = 402.3 kg

Right Rear = 282.6 kg

Left Front = 435.9 kg

Left Rear = 314.8 kg

TOTAL FRONT = 838.2 kg

TOTAL REAR = 597.4 kg

% of Total Weight = 58.4 %

% of Total Weight = 41.6 %

TOTAL VEHICLE WEIGHT = 1435.6 kg

Wheelbase = 2550 mm

Longitudinal C.G. from Center of Front Axle = 1061 mm

Impact Angle with Respect to Impactor = 90° degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (249 mm above ground) = 179 mm

2. LEVEL 2 (475 mm above ground) = 313 mm

3. LEVEL 3 (584 mm above ground) = 287 mm

4. LEVEL 4 (852 mm above ground) = 228 mm

5. LEVEL 5 (1286 mm above ground) = 45 mm

Maximum Post-Test Intrusion = 349 mm

OCCUPANTS:

Driver

Left Rear Passenger

Type of Dummy

SID

SID

Restraints Used

type II belt

type II belt

with frontal airbag

TEST VEHICLE SUMMARY OF RESULTS (Cont'd)INSTRUMENTATION:

Number of Vehicle Data Channels: = 20

Number of Cameras: Onboard Vehicle = 3

 Offboard Vehicle = 4

 Deformable Barrier = 2

 TOTAL = 9

DATA SHEET NO. 3

MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTSYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999POSITION OF IMPACT (MDB) ON MONORAIL:Crabbed 27° to leftMDB DETAILS:

Overall Width of Framework Carriage	= <u>1252</u> mm
Overall Length of MDB (incl. honeycomb impact face)	= <u>4115</u> mm
Wheelbase of Framework Carriage	= <u>2591</u> mm
Tread of Framework Carriage (Front & Rear)	= <u>1880</u> mm
C.G. Location Rearward of Front Axle	= <u>1098</u> mm
C.G. Location From Center Line	= <u>-15</u> mm
C.G. Location Above Ground Level	= <u>485</u> mm

MDB WEIGHT:

Left Front	= <u>457.7</u> kg	Left Rear	= <u>235.1</u> kg
Right Front	= <u>328.1</u> kg	Right Rear	= <u>342.6</u> kg
TOTAL FRONT	= <u>785.8</u> kg	TOTAL REAR	= <u>577.7</u> kg
TOTAL MDB WEIGHT = <u>1363.5</u> kg			
Impact Angle (MDB C/L to Target Vehicle C/L) = <u>90°</u> degrees			
Impact Speed = Primary: <u>33.2</u> mph (53.4 kph) Secondary: <u>33.3</u> mph (53.6 kph)			

CRASH TEST SUMMARY FOR SIDE IMPACTOR (Cont'd)MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

- | | | | | |
|----|---------------------------------|---|------------|----|
| 1. | Row A Top of Stack (813 mm) | = | <u>110</u> | mm |
| 2. | Row B Mid Stack (686 mm) | = | <u>134</u> | mm |
| 3. | Row C Top of Bumper (533 mm) | = | <u>99</u> | mm |
| 4. | Row D Center of Bumper (432 mm) | = | <u>85</u> | mm |

INSTRUMENTATION:

Number of MDB Data Channels = 5

DATA SHEET NO. 4
POST-TEST OBSERVATIONS

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999

VISIBLE DUMMY CONTACT POINTS:

	<u>DRIVER</u>	<u>LEFT REAR SID</u>	
Head	<u>to right front headrest</u>	<u>to C-Post/side header</u>	
Arm	<u>to rear of door above armrest</u>	<u>to rear of door above armrest</u>	Pelvis
	<u>to armrest</u>	<u>to armrest</u>	Left Knee <u>to</u>
	<u>mid-door above armrest</u>	<u>to mid-door below armrest</u>	
Right Knee	<u>to left knee</u>	<u>to left knee</u>	

DOOR OPENING:

	<u>LEFT SIDE</u>	<u>RIGHT SIDE</u>
Front	<u>remained closed</u>	<u>remained closed</u>
Rear	<u>remained closed</u>	<u>remained closed</u>

MDB DISTANCE FROM TARGET IMPACT POINT:

Horizontal: 11 mm rearward Vertical: 4 mm low

ARM REST LOCATIONS:

Front: 245 mm from bottom of window

Rear: 254 mm from bottom of window

POST-TEST OBSERVATIONS (Cont'd)SEAT CRUSH:Front Seat Back: 21 mm Front Seat Cushion: 60 mmLeft Rear Seat Back: 78 mm Rear Seat Cushion: 153 mmGLAZING DAMAGE:Windshield cracked; both left side windows brokePILLAR PERFORMANCE:No failure notedSILL SEPARATION:No separation notedFRONTAL AIRBAGS:Driver Deployed: Yes Passenger Deployed: YesOTHER NOTABLE IMPACT EFFECTS:None noted

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 5
SIDE IMPACT DUMMY (SID) INSTRUMENTATION DATA

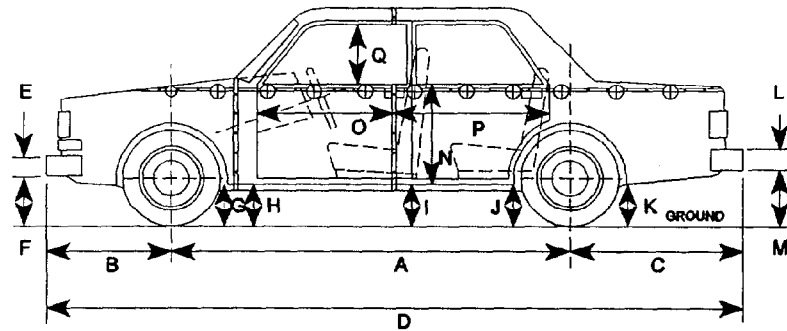
Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999

	Front SID ID #049				Rear SID ID #048			
	Pos. Direct.		Neg. Direct		Pos. Direct.		Neg. Direct	
	Max (g)	Time (msec)	Max (g)	Time (msec)	Max (g)	Time (msec)	Max (g)	Time (msec)
RIB ACCELERATIONS								
Left Upper Rib (LUR) Y	76.7	39	-17.3	81	78.5	41	-10.9	111
Left Lower Rib (LLR) Y	74.9	39	-13.4	81	80.8	41	-16.8	68
SPINE ACCELERATIONS								
Lower Lateral Y	71.5	35	-17.0	74	67.4	46	-13.8	66
PELVIS ACCELERATIONS								
Lateral Y	80.7	34	-6.4	89	67.6	39	-6.8	75

REFERENCE: Positive Direction- Longitudinal (X) = forward
 Lateral (Y) = to right
 Vertical (Z) = down

DATA SHEET NO. 6
VEHICLE PRE AND POST-TEST MEASUREMENTS



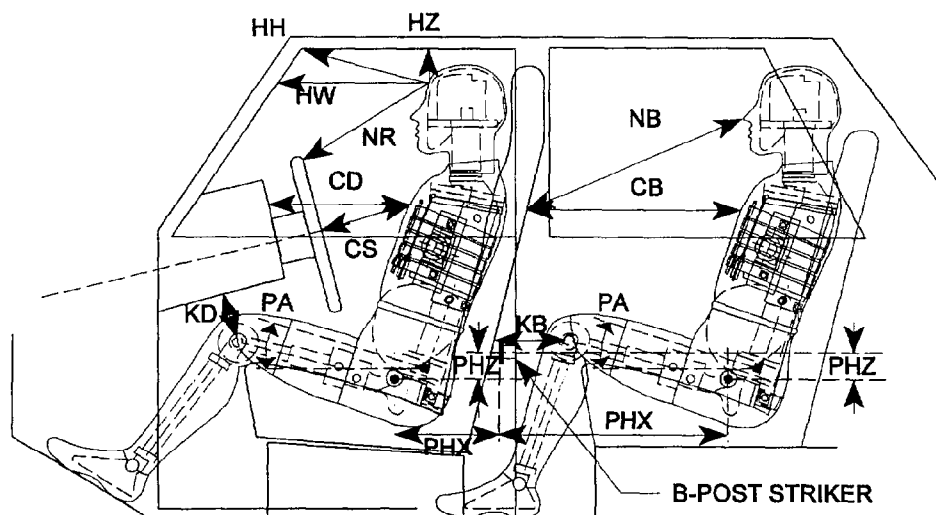
LEFT SIDE VIEW

D = Length at Centerline
 R = Right Side Length
 S = Left Side Length
 T = Width at B Post
 J1 = To Pinch Weld
 E & L = Bumper Thickness
 J2 = To Sill

ALL MEASUREMENTS IN (mm)

	PRE-TEST	POST-TEST	Δ CHANGE
A	2550	2527	23
B	870	881	11
C	975	987	12
D	4395	4395	0
E	105	105	0
F	390	400	10
G	164	168	4
H	164	167	3
I	154	138	16
J1/J2	147/146	152/134	5/12
K	203	205	2
L	140	140	0
M	320	306	14
N	616	562	54
O	723	698	25
P	1195	1128	67
Q	435	416	19
R	3735	3747	12
S	3732	3676	56
T	1666	1436	230

DATA SHEET NO. 7

SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONSYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorNHTSA NO.: CX0512 Test Date: March 16, 1999NOTE: All dimensions are in mm with tolerance of ± 3 mm

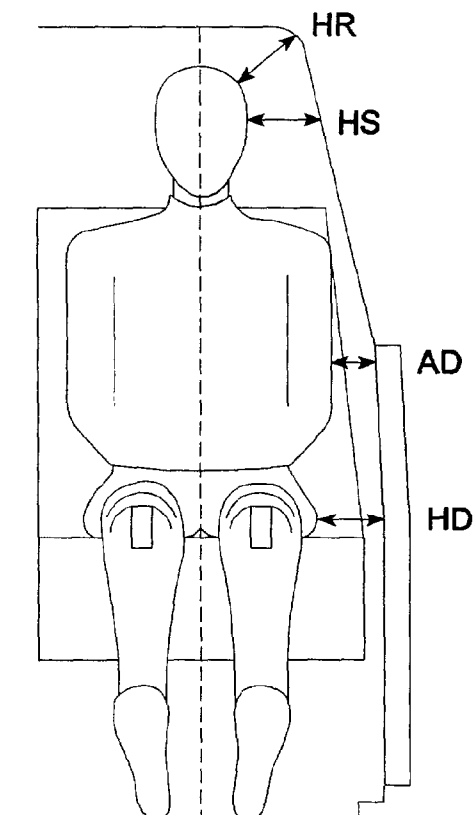
	DRIVER ID #049		REAR PASSENGER ID #048
HH	379	HZ	149
HW	572	NB	567
HZ	151	CB	486
NR	522	KBL (KBA)	197 (0.0°)
CD	572	KBR (KBA)	198 (0.0°)
CS	393	PA°	24.3°
KDL (KDA°)	214 (0.0°)	PHX	196
KDR (KDA°)	202 (0.0°)	PHZ	234
PA°	24.5°		
PHX	203		
PHZ	141		

NOTE: 2-door vehicle shown. Rear dummy PHX & PHZ measurements for 4-door vehicle would use the C-post striker as reference point.

DATA SHEET NO. 8
SIDE IMPACT DUMMY (SID) LATERAL CLEARANCE DIMENSIONS

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

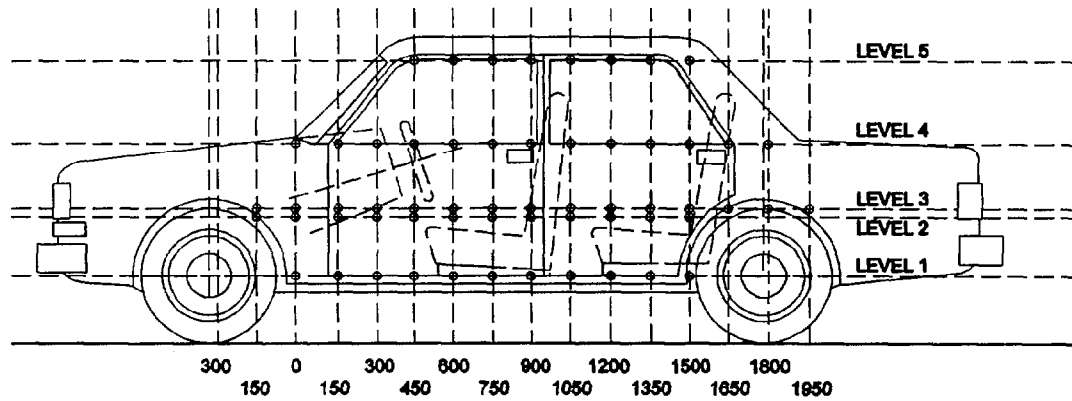
NHTSA NO.: CX0512 Test Date: March 16, 1999



NOTE: All dimensions are in mm

	DRIVER ID #049	REAR PASSENGER ID #048
HR	185	171
HS	304	284
AD	104	101
HD	137	176

DATA SHEET NO. 9

VEHICLE SIDE MEASUREMENTSYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorNHTSA NO.: CX0512 Test Date: March 16, 1999**LEFT SIDE VIEW**

NOTE: All measurements are in millimeters (mm)

LEVEL 5 - WINDOW TOP
 LEVEL 4 - WINDOW SILL
 LEVEL 3 - MID-DOOR
 LEVEL 2 - OCCUPANT H-POINT
 LEVEL 1 - AXLE CENTERLINE HEIGHT OR SILL TOP HEIGHT

MEASUREMENTS ARE TAKEN WHEN THE VEHICLE IS IN THE "AS TESTED"
CONFIGURATION

MEASUREMENTS ALONG THE VERTICAL 750 mm. LINE SHOWN ABOVE

Level 1 @ Axle Centerline Height

(or Sill Top Height) = 249 mm

Level 2 @ Occupant H-Point = 475 mm

Level 3 @ Mid Door = 584 mm

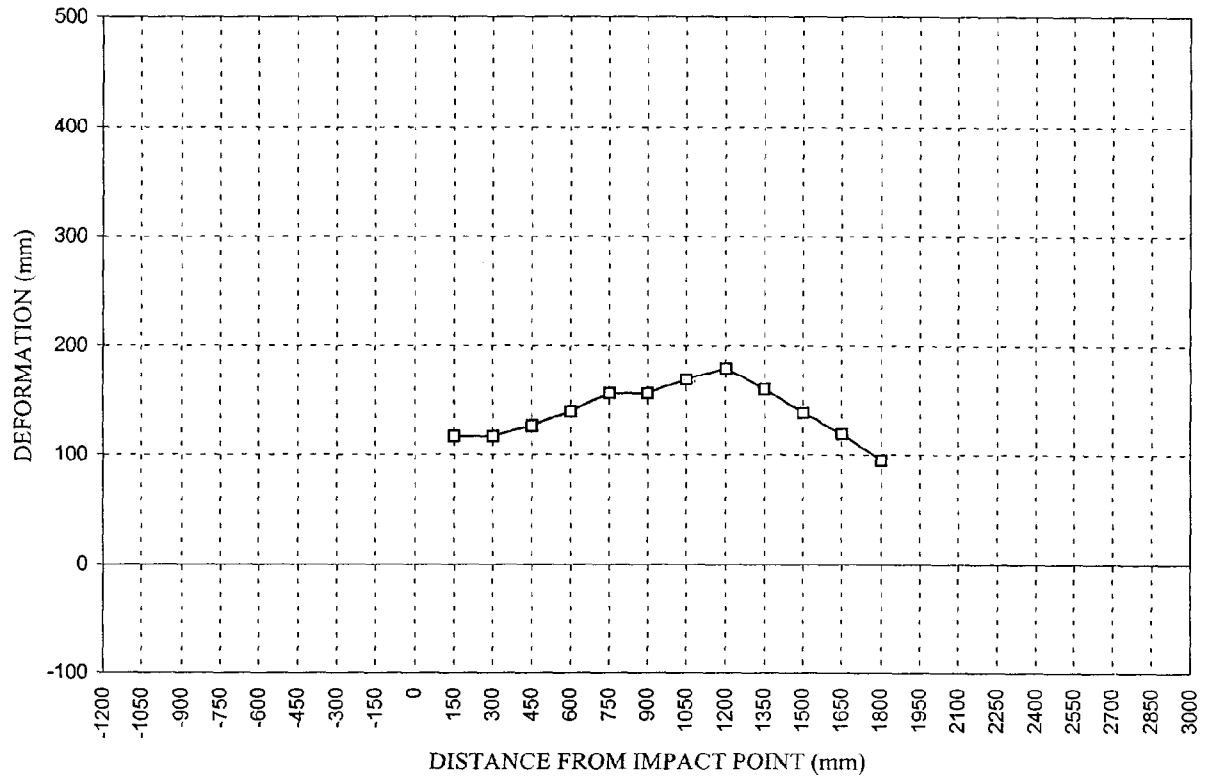
Level 4 @ Window Sill = 852 mm

Level 5 @ Window Top = 1286 mm

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH PROFILES

Longitudinal Distance (mm)	Level 1 - Axle Centerline		
	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1200			
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)			
150	806	923	117
300	806	923	117
450	804	930	126
600	803	942	139
750	802	958	156
900	803	959	156
1050	803	972	169
1200	803	982	179
1350	802	962	160
1500	802	940	138
1650	801	920	119
1800	799	894	95
1950			
2100			
2250			
2400			
2550			
2700			
2850			
3000			

Reference plane is parallel to test vehicle longitudinal centerline. Given dimensions = Reference plane to car body

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)

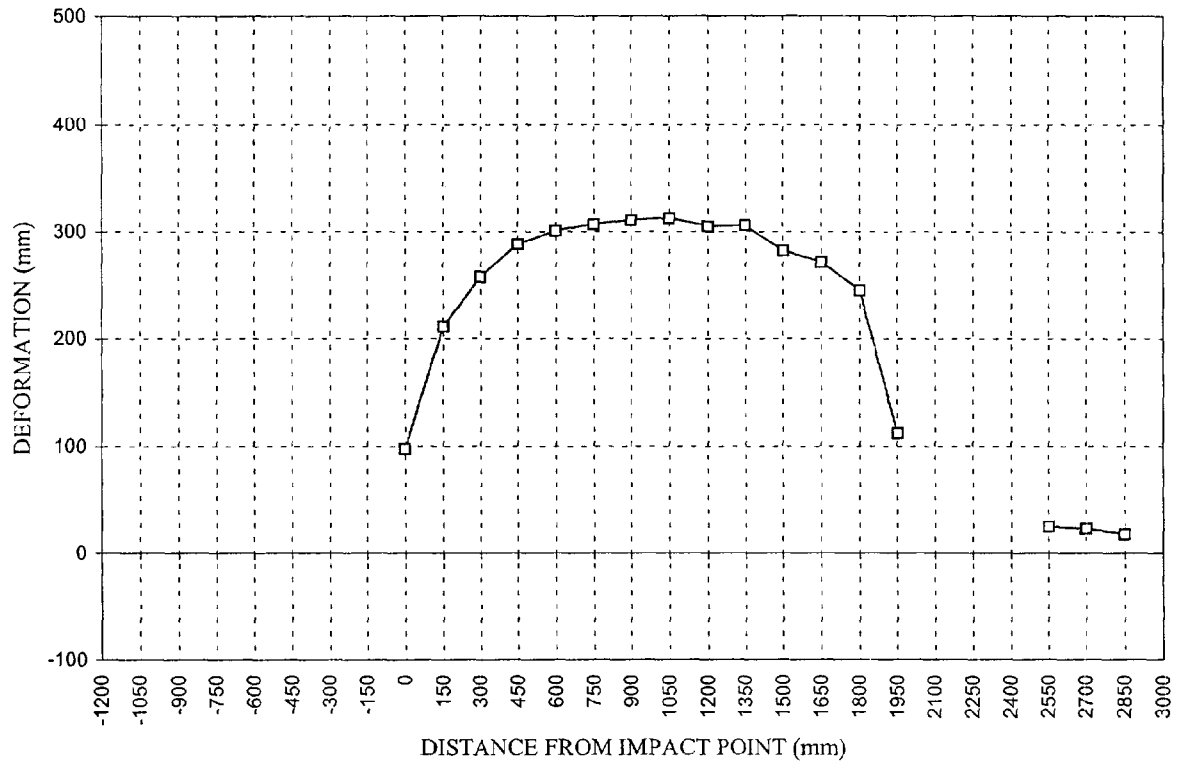
LEVEL 1 - AXLE CENTERLINE

DATA SHEET NO. 10 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 2 - Occupant H Point		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1200			
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)	768	866	98
150	772	983	211
300	773	1030	257
450	774	1062	288
600	774	1075	301
750	772	1079	307
900	772	1083	311
1050	771	1084	313
1200	770	1075	305
1350	767	1073	306
1500	766	1048	282
1650	765	1036	271
1800	763	1008	245
1950	756	868	112
2100			
2250			
2400			
2550	773	798	25
2700	792	815	23
2850	812	730	18
3000			

Reference plane is parallel to test vehicle longitudinal centerline. Given dimensions = Reference plane to car body

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



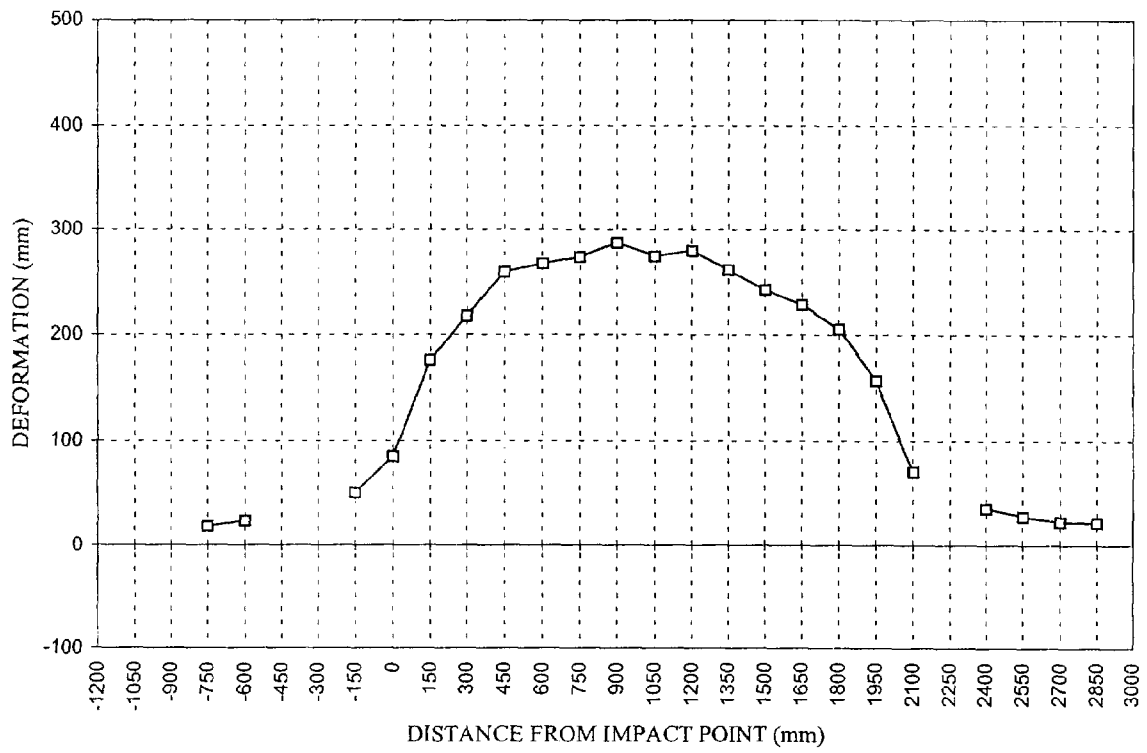
LEVEL 2 - OCCUPANT H-POINT

DATA SHEET NO. 10 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 3 - Mid Door		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1200			
-1050			
-900			
-750	801	819	18
-600	770	793	23
-450			
-300			
-150	750	800	50
0 (impact point)	755	840	85
150	755	930	175
300	757	974	217
450	758	1017	259
600	759	1026	267
750	759	1032	273
900	761	1048	287
1050	762	1036	274
1200	762	1041	279
1350	761	1022	261
1500	758	1000	242
1650	754	982	228
1800	753	958	205
1950	752	908	156
2100	750	820	70
2250			
2400	756	791	35
2550	774	801	27
2700	797	819	22
2850	833	854	21
3000			

Reference plane is parallel to test vehicle longitudinal centerline. Given dimensions = Reference plane to car body

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



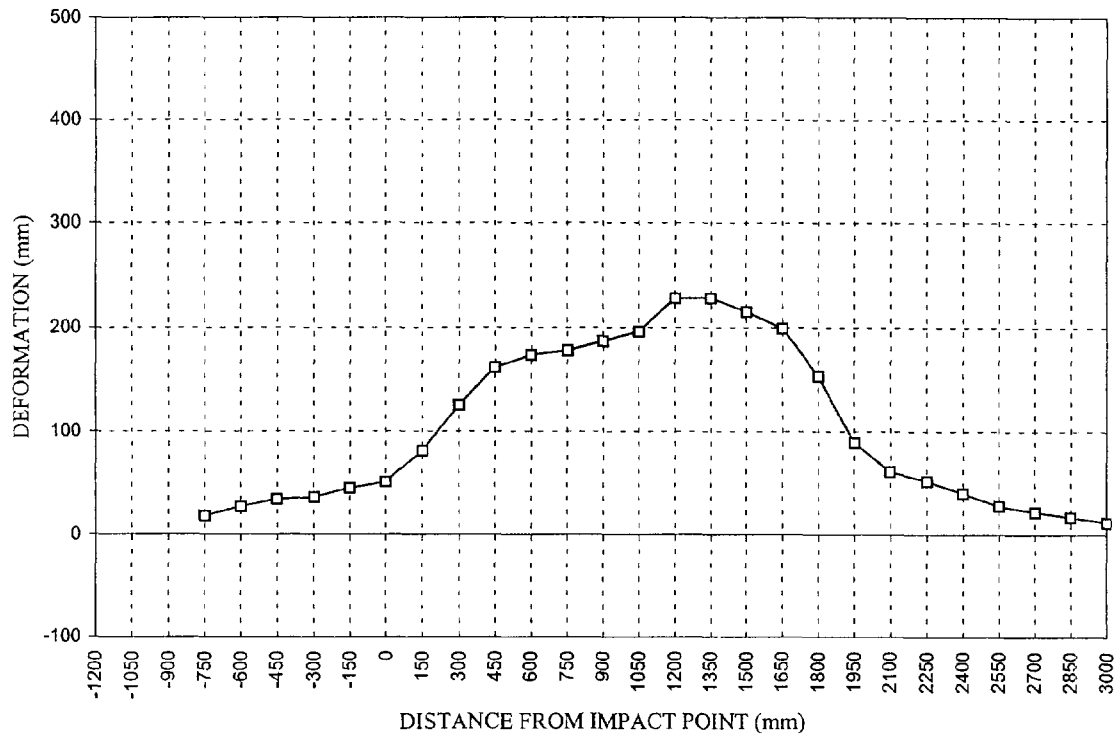
LEVEL 3 - MID DOOR

DATA SHEET NO. 10 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 4 - Window Sill		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1200			
-1050			
-900			
-750	894	912	18
-600	873	900	27
-450	857	891	34
-300	849	885	36
-150	839	884	45
0 (impact point)	835	886	51
150	829	910	81
300	827	953	126
450	824	986	162
600	826	1000	174
750	826	1004	178
900	824	1011	187
1050	825	1021	196
1200	825	1053	228
1350	825	1052	227
1500	825	1040	215
1650	824	1023	199
1800	829	983	154
1950	833	922	89
2100	837	898	61
2250	844	896	52
2400	855	895	40
2550	867	895	28
2700	884	906	22
2850	905	922	17
3000	947	959	12

Reference plane is parallel to test vehicle longitudinal centerline. Given dimensions = Reference plane to car body

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



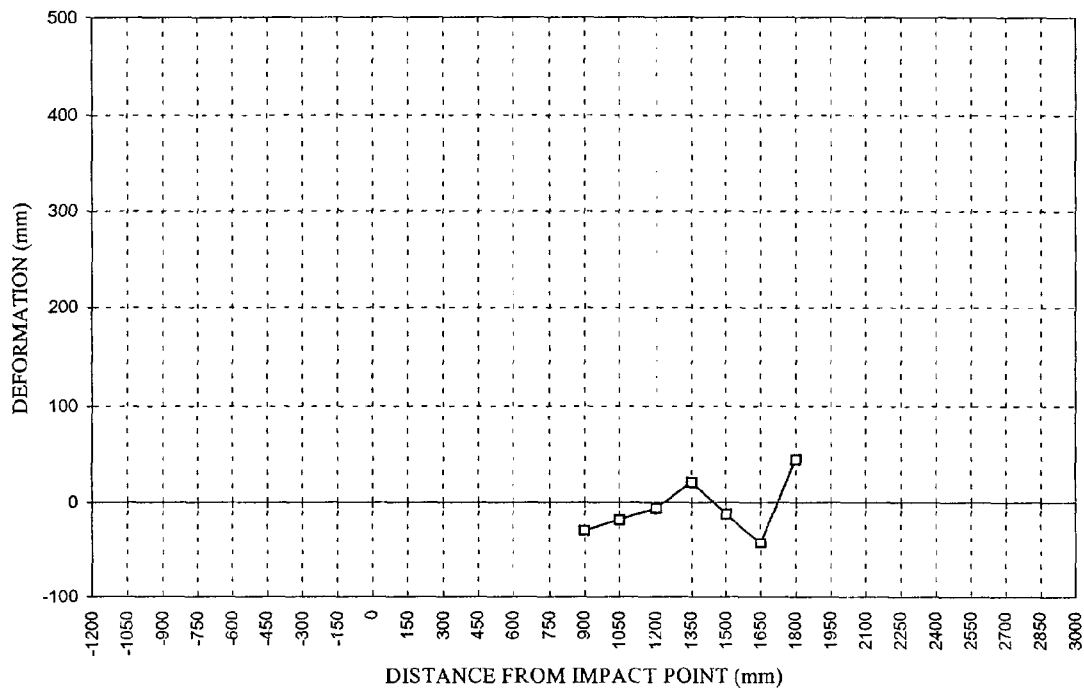
LEVEL 4 - WINDOW SILL

DATA SHEET NO. 10 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

Longitudinal Distance (mm)	Level 5 - Window Top		
	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1200			
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)			
150			
300			
450			
600			
750			
900	1048	1019	-29
1050	1047	1029	-18
1200	1048	1042	-6
1350	1044	1065	21
1500	1046	1034	-12
1650	1046	1003	-43
1800	1052	1097	45
1950	1057	1092	35
2100			
2250			
2400			
2550			
2700			
2850			
3000			

Reference plane is parallel to test vehicle longitudinal centerline. Given dimensions = Reference plane to car body

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



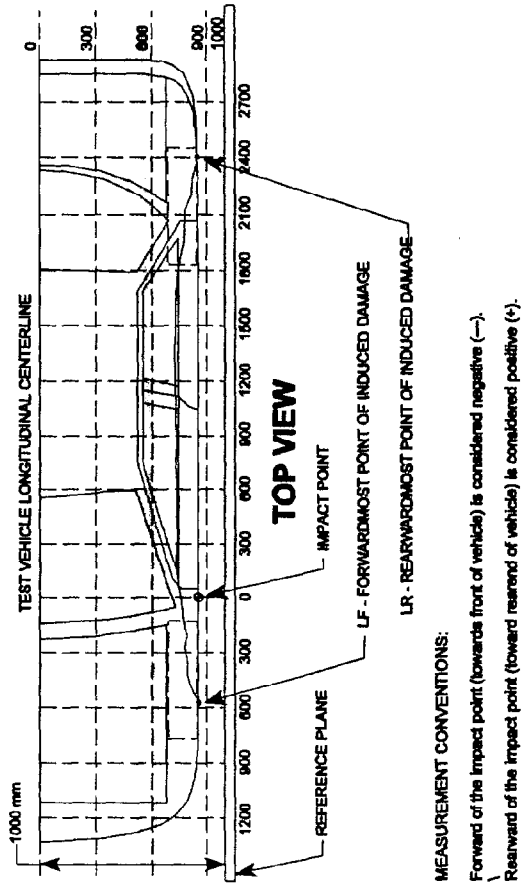
LEVEL 5 - WINDOW TOP

DATA SHEET NO. 11

VEHICLE DAMAGE PROFILE DISTANCES

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

NHTSA NO.: CX0512 Test Date: March 16, 1999



DPD MEASUREMENTS	POST-TEST (mm)	PRE-TEST (mm)	STATIC CRUSH (mm)
1. (LF = -750 mm)	912	894	18
2. 0 mm	866	768	98
3. 711 mm	1082	773	349
4. 1441 mm	1059	766	293
5. 2244 mm	897	843	54
6. (LR = 3000 mm)	959	947	12

DATA SHEET NO. 12

EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

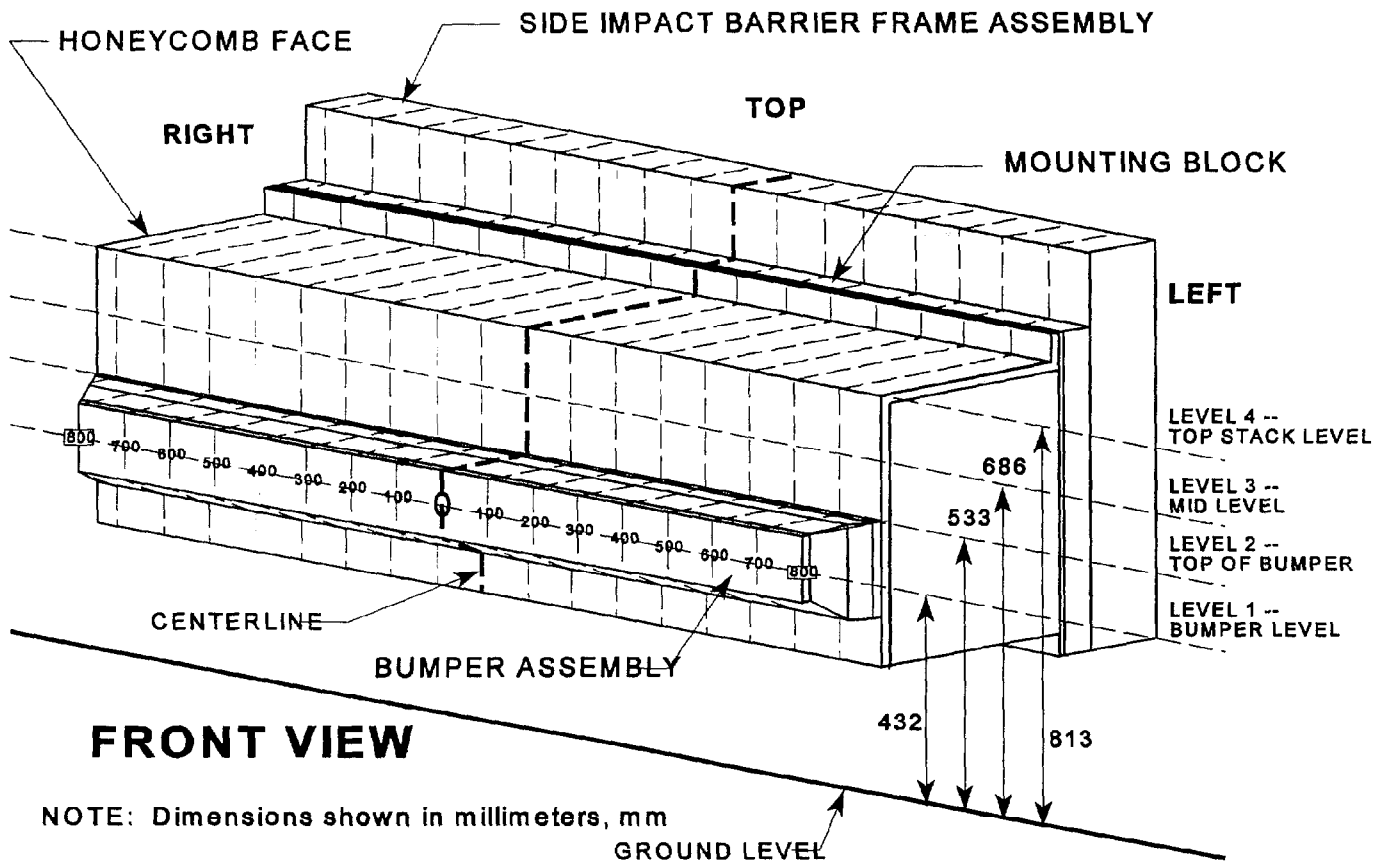
Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999

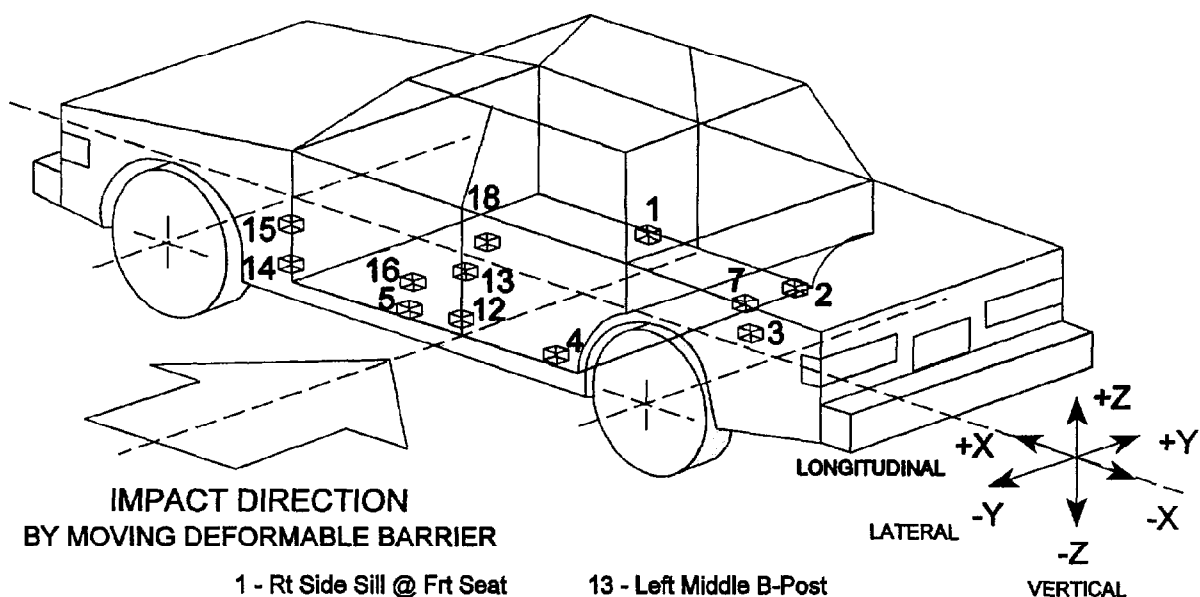
Location	Height at CL	Distance Right of Center (mm)									Distance Left of Center (mm)							
		800	700	600	500	400	300	200	100	0	10	200	300	400	500	600	700	800
Top Stack Level 4	813 mm	47	2	-4	-2	-2	-1	1	2	4	5	8	10	12	23	49	73	110
Mid Level Level 3	686 mm	26	10	-3	-2	-6	-4	0	0	0	-2	-2	-1	4	15	31	60	134
Top Bumper Level 2	533 mm	49	35	22	13	13	13	9	7	6	10	15	19	22	28	37	58	99
Mid Bumper Level 1	432 mm	81	70	57	46	42	47	44	40	34	36	39	42	46	55	70	66	85

See next page for Barrier Face Graphic

DATA SHEET NO. 12 (Cont'd)



DATA SHEET 13

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARYYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999

**IMPACT DIRECTION
BY MOVING DEFORMABLE BARRIER**

- | | |
|-------------------------------|-------------------------|
| 1 - Rt Side Sill @ Frt Seat | 13 - Left Middle B-Post |
| 2 - Rt Side Sill @ Rr Seat | 14 - Left Lower A-Post |
| 3 - Rr Floorpan Above Axle | 15 - Left Middle A-Post |
| 4 - Left Side Sill @ Rr Seat | 16 - Frt Seat Track |
| 5 - Left Side Sill @ Frt Seat | 18 - Vehicle C.G. |
| 7 - Rt Rr Occ Compartment | |
| 12 - Left Lower B-Post | |

DATA SHEET NO. 13 (Cont'd)

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARYYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999

Accel. No.	Description	Coordinates (mm)*			Long. (X) Maximums (g's)		Lat. (Y) Maximums (g's)		Vert. (Z) Maximums (g's)		Resultant (g's)
		X	Y	Z	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	
1	Right Side Sill @ Front Seat	2329	668	185	2.5	-6.9	18.4	-3.0	7.5	-2.7	18.9
2	Right Side Sill @ Rear Seat	1394	649	158	4.9	-3.5	26.1	-5.4	8.7	-4.0	27.9
3	Rear Floorpan Above Axle	954	0	473	3.2	-12.2	29.5	-5.9	5.5	-11.3	31.4
4	Left Side Sill @ Rear Seat	1314	-649	162	---	---	46.9	-7.5	---	---	---
5	Left Side Sill @ Front Seat	2363	-668	170	---	---	51.1	-4.4	---	---	---
7	Right Rear Occupant Compartment	1735	427	252	---	---	25.8	-5.1	---	---	---
12	Left Lower B-Post	1978	-648	281	---	---	62.0	-15.7	---	---	---
13	Left Mid B-Post	1972	-696	793	---	---	115.9	-75.7	---	---	---
14	Left Lower A-Post	2983	-643	304	---	---	22.0	-3.7	---	---	---
15	Left Mid A-Post	3017	-771	832	---	---	26.5	-27.4	---	---	---
16	Driver Seat Track	2058	-611	287	---	---	106.8	-93.6	---	---	---
18	Vehicle CG	2272	0	366	5.5	-12.9	35.3	-6.5	26.7	-17.0	39.3

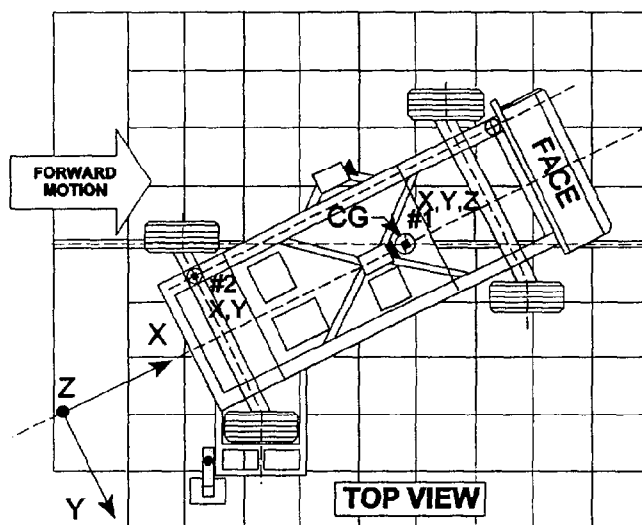
** Data questionable

*Reference: X - Rear Bumper (+ Forward)

Y - Vehicle Centerline (+ To right)

Z - Ground Level (+ Up)

DATA SHEET NO. 14

MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS AND DATA SUMMARYYear/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999

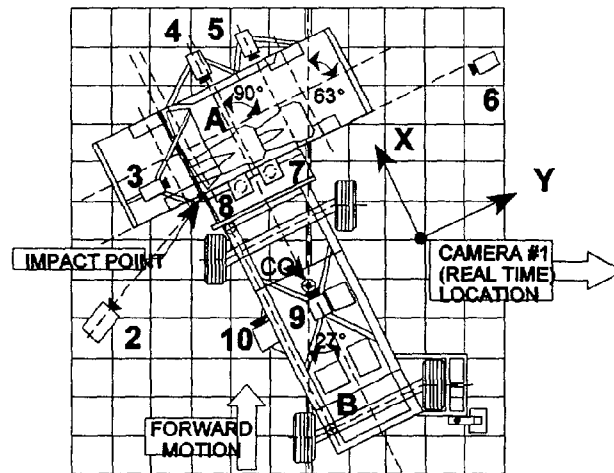
Accel. No.	Description	Coordinates (mm)*			(+) Positive		(-) Negative	
		X	Y	Z	Max. (g)	Time (msec)	Max. (g)	Time (msec)
1	MDB Center of Gravity	-1092	0	483				
	Longitudinal (X)**	---	---	---	6.1	199	-17.1	43
	Lateral (Y)**	---	---	---	3.1	59	-4.8	39
	Vertical (Z)**	---	---	---	19.4	73	-17.7	79
	Resultant (R)**	---	---	---	23.3	42	---	---
2	Rear Frame Member	-2591	-625	622				
	Longitudinal (X)	---	---	---	1.9	189	-19.8	37
	Lateral (Y)	---	---	---	5.3	40	-2.0	186

*Reference: X - Front Axle (+ Forward)
Y - Vehicle Centerline (+ To right)
Z - Ground Level (+ Up)

DATA SHEET NO. 15
HIGH SPEED CAMERA LOCATIONS AND DATA

Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 Door

Vehicle NHTSA No.: CX0512 Test Date: March 16, 1999



Camera No.	View	Coordinates (mm)*			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real Time				10	24
2	Left Impact	-270	-2220	1650	13	976
3	Onboard Hood				13	1070
4	Onboard Front Occupant				8	1176
5	Onboard Rear Occupant				8	930
6	Right Impact	-480	10500	1740	25	1026
7	Top Overall	-160	70	5000	8	935
8	Top Impact	-130	1280	5000	13	971
9	Cart Overall				13	952
10	Cart Impact				35	1010

* Reference: (from impact point)
 +X = Forward
 +Y = To Right
 +Z = Upward from floor level

DATA SHEET 16

FUEL SYSTEM INTEGRITY POST IMPACT TEST DATAVehicle Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999TEST REQUIREMENTS:

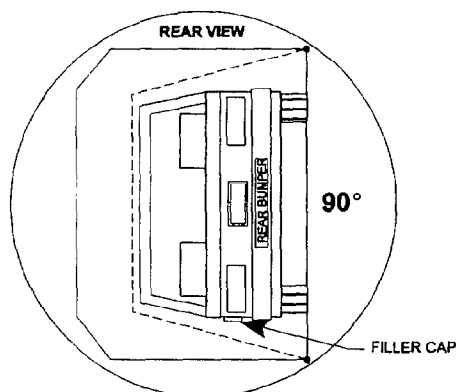
Drain the test vehicle's fuel system and operate the engine until the fuel system is dry. Add Stoddard solvent, which has been dyed purple, until 92-94% of the stated usable capacity is reached. Operate the engine to assure the Stoddard solvent is present throughout the entire fuel system.

TEST VEHICLE IMPACT TYPE: X Left Side Impact MDB 33.2 mph (53.4 kph)FUEL SPILLAGE MEASUREMENT:

POST IMPACT TEST	TEST RESULTS	MAXIMUM ALLOWABLE
1. From impact until vehicle motion ceases	0 oz	1 oz
2. For 5 minute period after vehicle motion ceases	0 oz	5 oz
3. For next 25 minutes	0 oz	1 oz./1 min

FUEL SPILLAGE LOCATION(S): None

DATA SHEET 16

FMVSS 301 STATIC ROLLOVER TEST DATAVehicle Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999TEST PHASE: 0° - 90°DETERMINATION OFSOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time = 2 minutes 52 seconds
 (Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time = 5 minutes 0 seconds

TOTAL TIME = 7 minutes 52 seconds

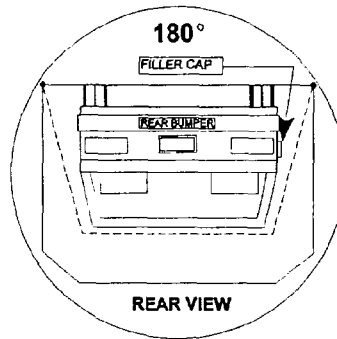
Next Whole Minute Interval = 8 minutes

FUEL SPILLAGE MEASUREMENT:

0° TO 90° ROTATION (FILLER CAP DOWN)	TEST RESULTS	MAXIMUM ALLOWABLE
1. First 5 Minutes From Onset of Rotation	0 oz	5 oz
2. Sixth Minute From Onset of Rotation	0 oz	1 oz
3. Seventh Minute From Onset of Rotation	0 oz	1 oz
4. Eighth Minute if Required	0 oz	1 oz

FUEL SPILLAGE LOCATIONS(S): None

DATA SHEET 16

FMVSS 301 STATIC ROLLOVER TEST DATA (Cont'd)Vehicle Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999TEST PHASE: 90° - 180°DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:Rollover Fixture 90° Rotation Time = 2 minutes 29 seconds

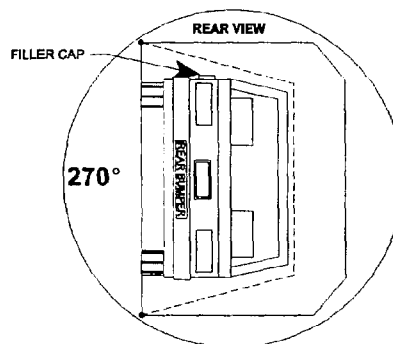
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time = 5 minutes 0 secondsTOTAL TIME = 7 minutes 29 secondsNext Whole Minute Interval = 8 minutesFUEL SPILLAGE MEASUREMENT:

90° TO 180° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. First 5 Minutes From Onset of Rotation	0 oz	5 oz
2. Sixth Minute From Onset of Rotation	0 oz	1 oz
3. Seventh Minute From Onset of Rotation	0 oz	1 oz
4. Eighth Minute if Required	0 oz	1 oz

FUEL SPILLAGE LOCATIONS(S): None

DATA SHEET 16

FMVSS 301 STATIC ROLLOVER TEST DATA (Cont'd)Vehicle Year/Make/Model/Body Style: 1999/Hyundai/Elantra/4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999TEST PHASE: 180° - 270°DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:Rollover Fixture 90° Rotation Time = 2 minutes 15 seconds

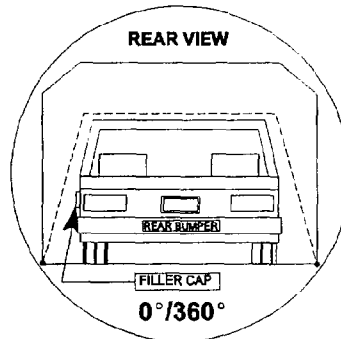
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time = 5 minutes 0 secondsTOTAL TIME = 7 minutes 15 secondsNext Whole Minute Interval = 8 minutesFUEL SPILLAGE MEASUREMENT:

180° TO 270° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. First 5 Minutes From Onset of Rotation	0 oz	5 oz
2. Sixth Minute From Onset of Rotation	0 oz	1 oz
3. Seventh Minute From Onset of Rotation	0 oz	1 oz
4. Eighth Minute if Required	0 oz	1 oz

FUEL SPILLAGE LOCATIONS(S): None

DATA SHEET 16

FMVSS 301 STATIC ROLLOVER TEST DATAVehicle Year/Make/Model/Body Style: 1999 Hyundai Elantra 4 DoorVehicle NHTSA No.: CX0512 Test Date: March 16, 1999TEST PHASE: 270° - 360°DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:Rollover Fixture 90° Rotation Time = 2 minutes 33 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time = 5 minutes 0 secondsTOTAL TIME = 7 minutes 33 secondsNext Whole Minute Interval = 8 minutesFUEL SPILLAGE MEASUREMENT:

270° TO 360° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. First 5 Minutes From Onset of Rotation	0 oz	5 oz
2. Sixth Minute From Onset of Rotation	0 oz	1 oz
3. Seventh Minute From Onset of Rotation	0 oz	1 oz
4. Eighth Minute if Required	0 oz	1 oz

FUEL SPILLAGE LOCATIONS(S): None

APPENDIX A - PHOTOGRAPHS

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Photo No. A-50 - Left Rear Attitude Point	A-50
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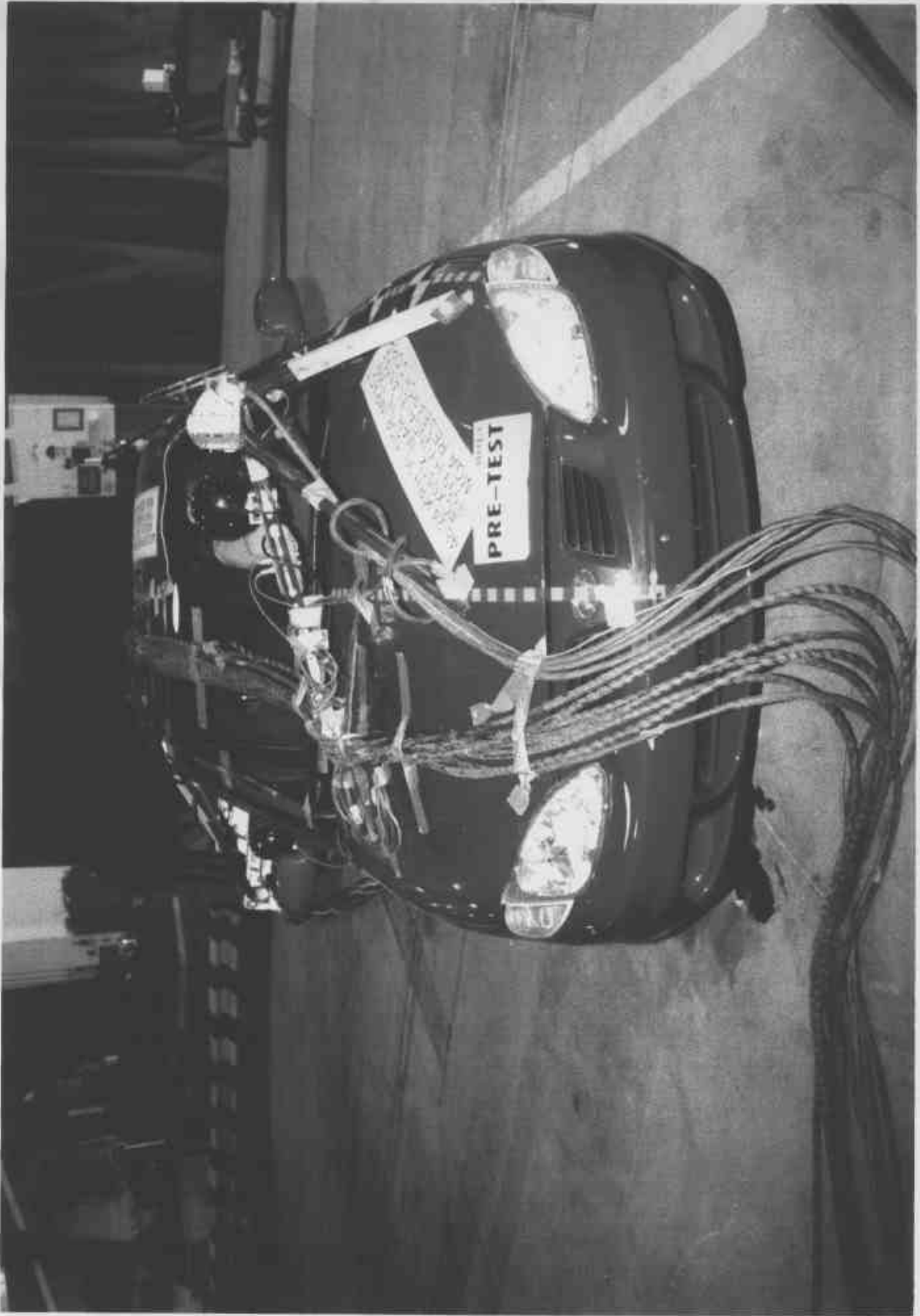


Photo No. A-1 - Pre-Test Front View of Test Vehicle



Photo No. A-2 - Post-Test Front View of Test Vehicle



Photo No. A-3 - Pre-Test Rear View of Test Vehicle



Photo No. A-4 - Post-Test Rear View of Test Vehicle

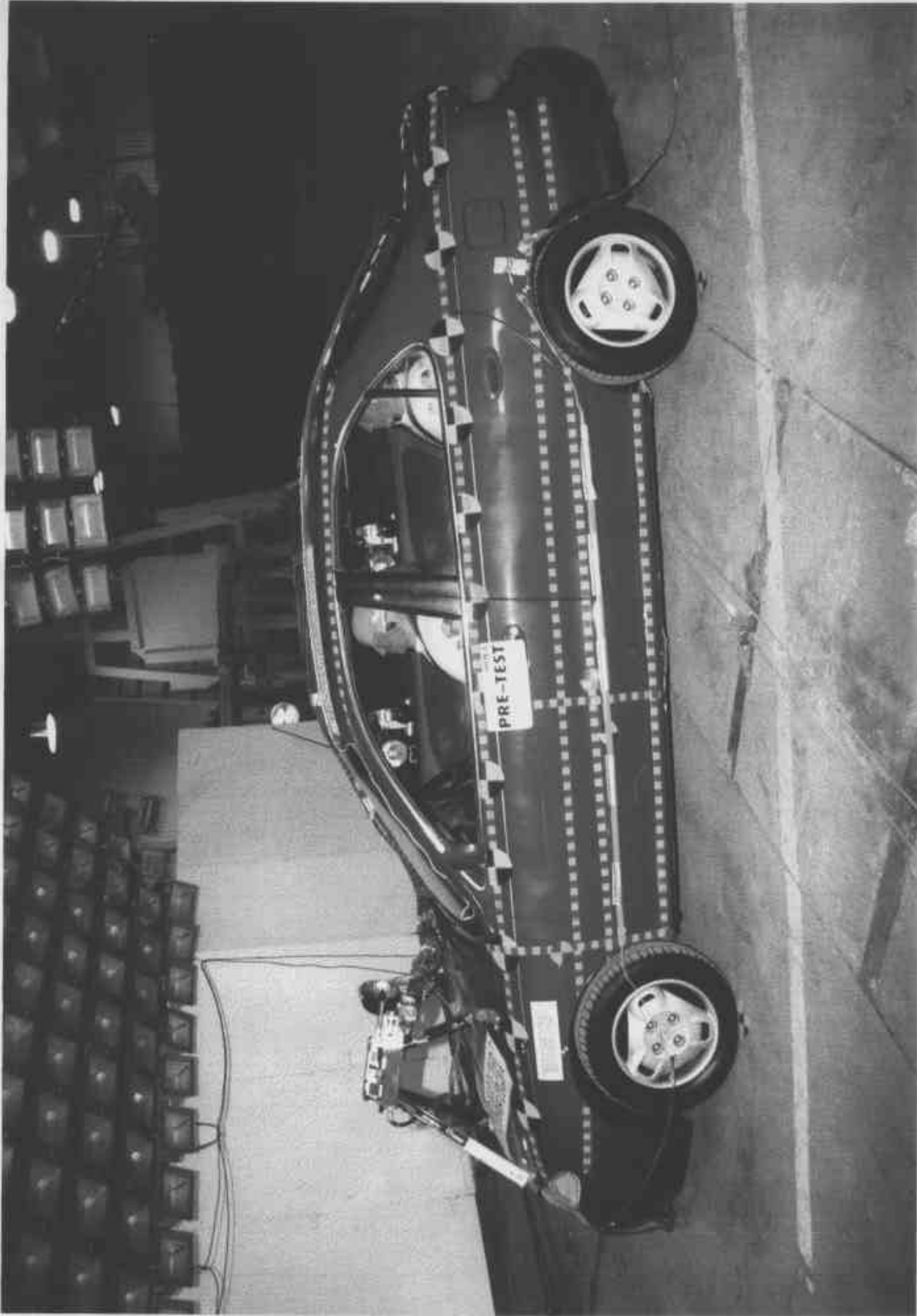


Photo No. A-5 - Pre-Test Left Side View of Test Vehicle

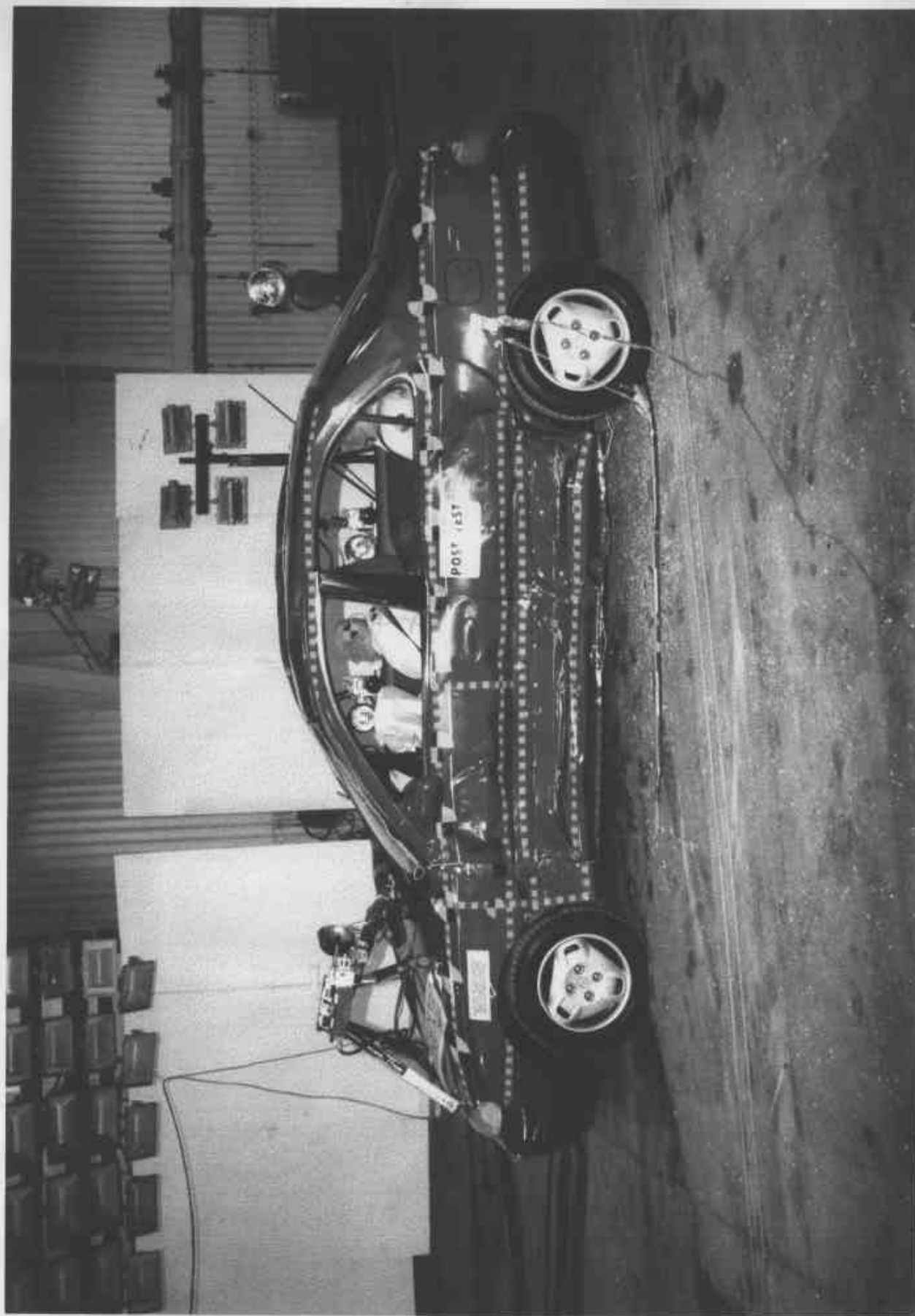


Photo No. A-6 - Post-Test Left Side View of Test Vehicle

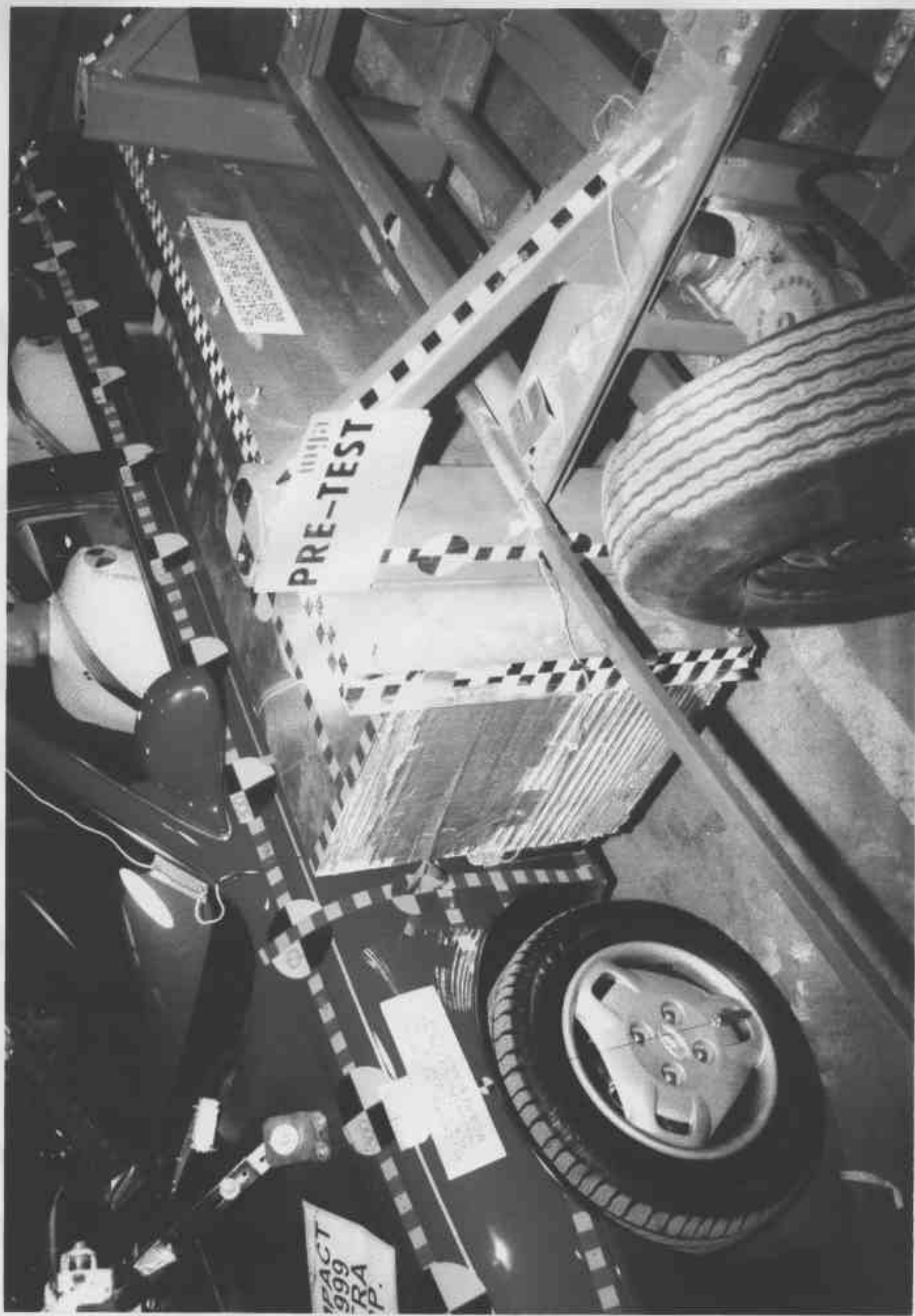


Photo No. A-7 - Pre-Test MDB Positioned Against Vehicle (left side)

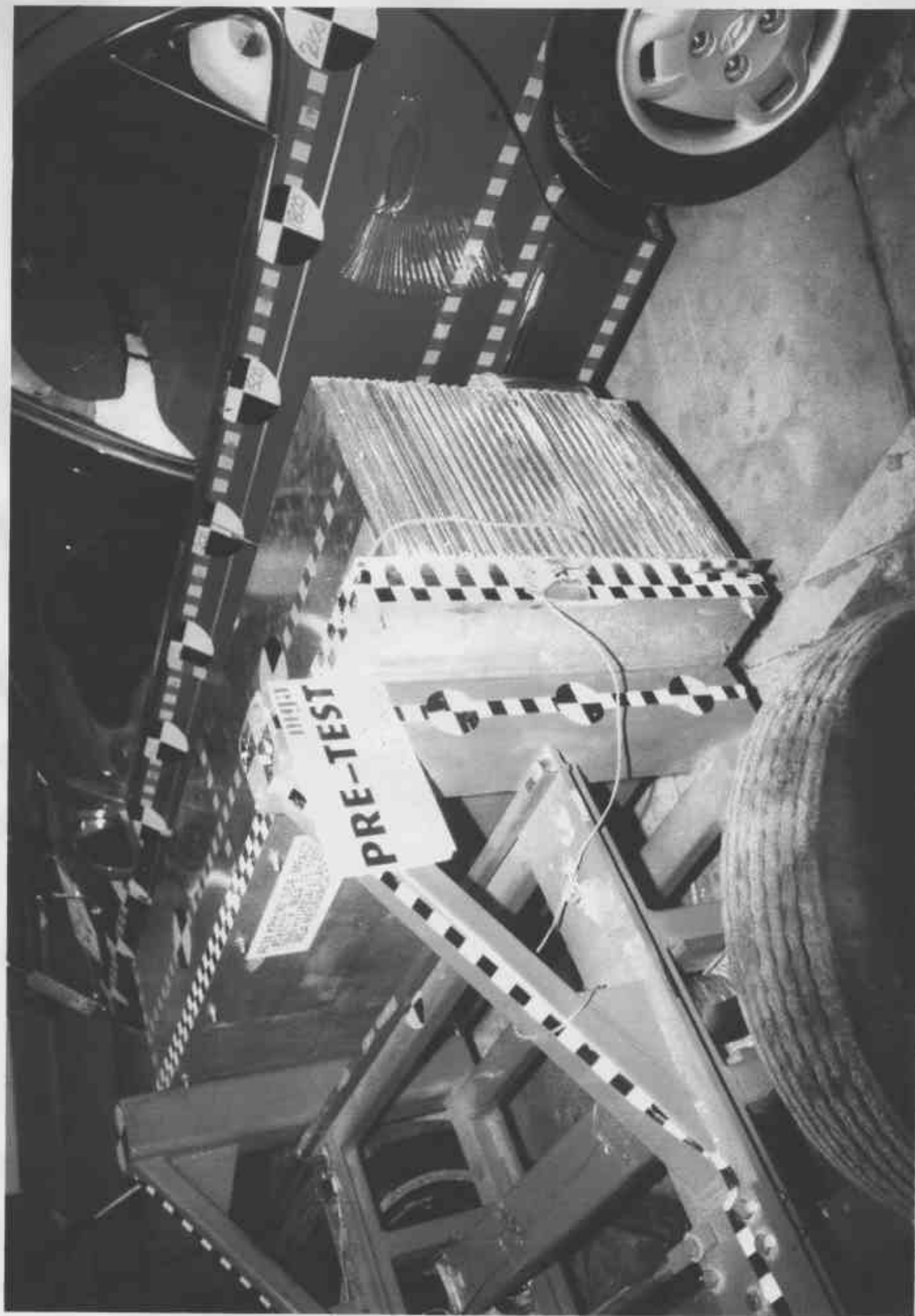


Photo No. A-8 - Pre-Test MDB Positioned Against Vehicle (right side)

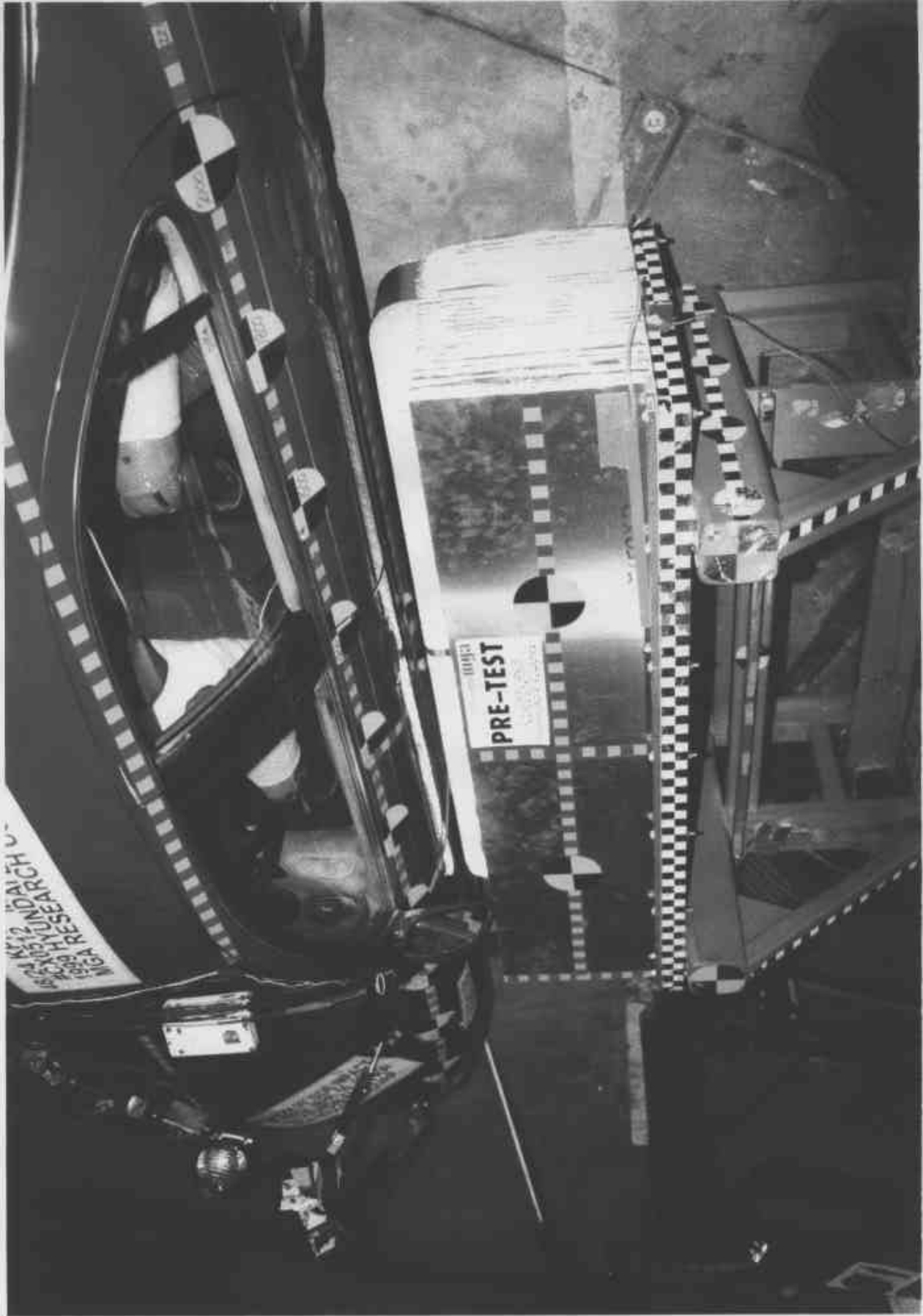


Photo No. A-9 - Pre-Test MDB Positioned Against Vehicle Overhead View

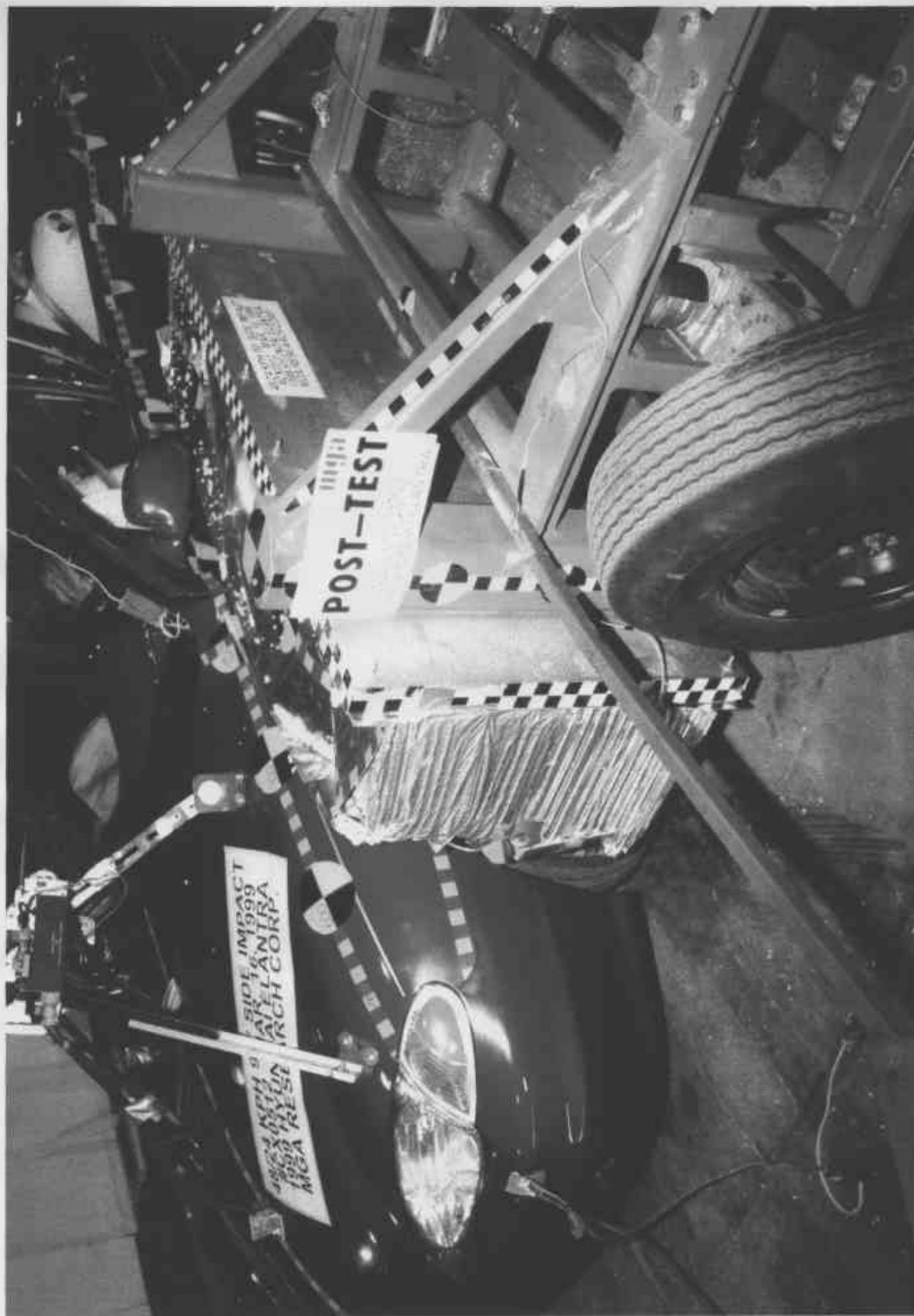


Photo No. A-10 - Post-Test MDB Positioned Against Vehicle (left side)

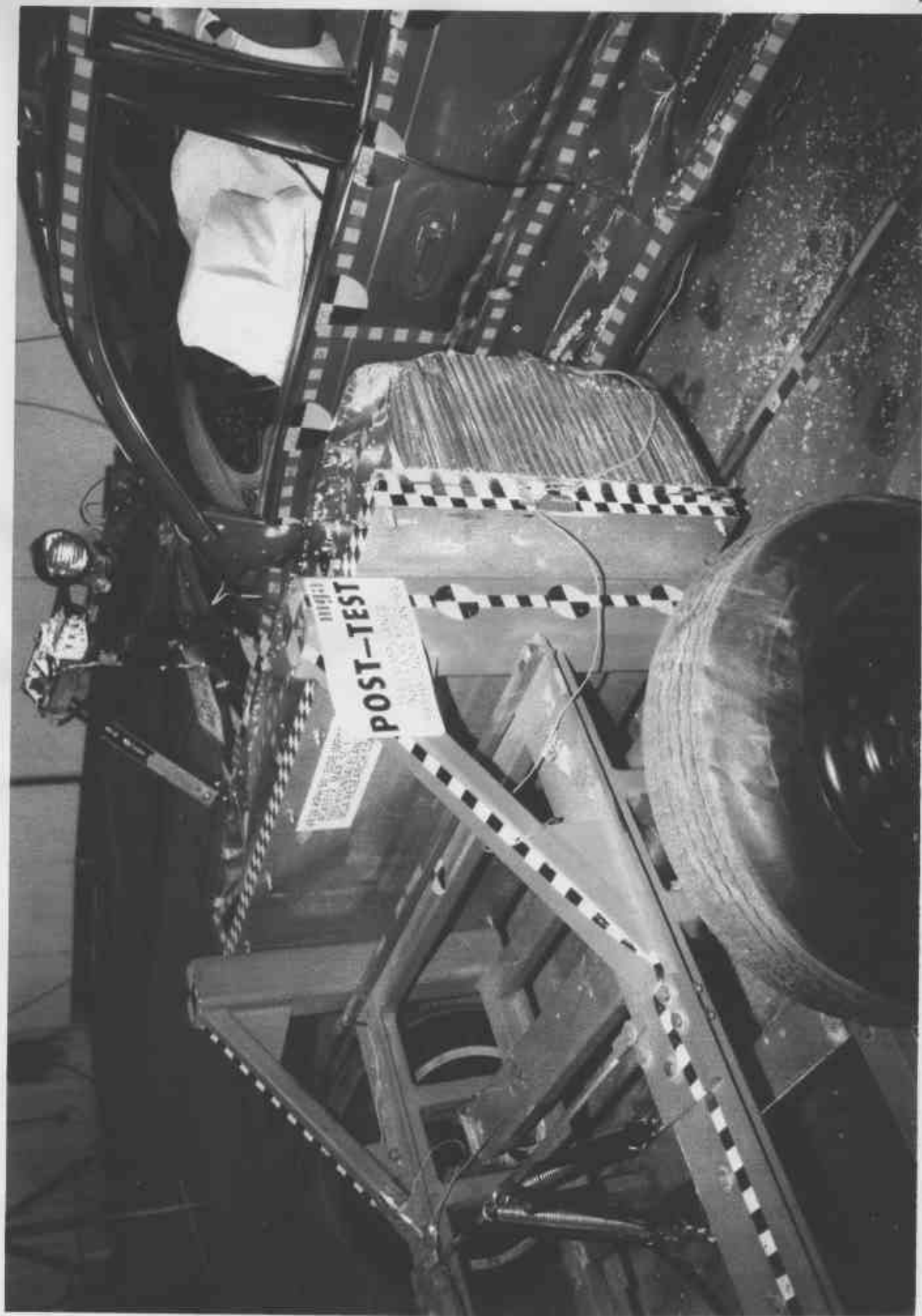


Photo No. A-11 - Post-Test MDB Positioned Against Vehicle (right side)



Photo No. A-12 - Post-Test MDB Positioned Against Vehicle Overhead View

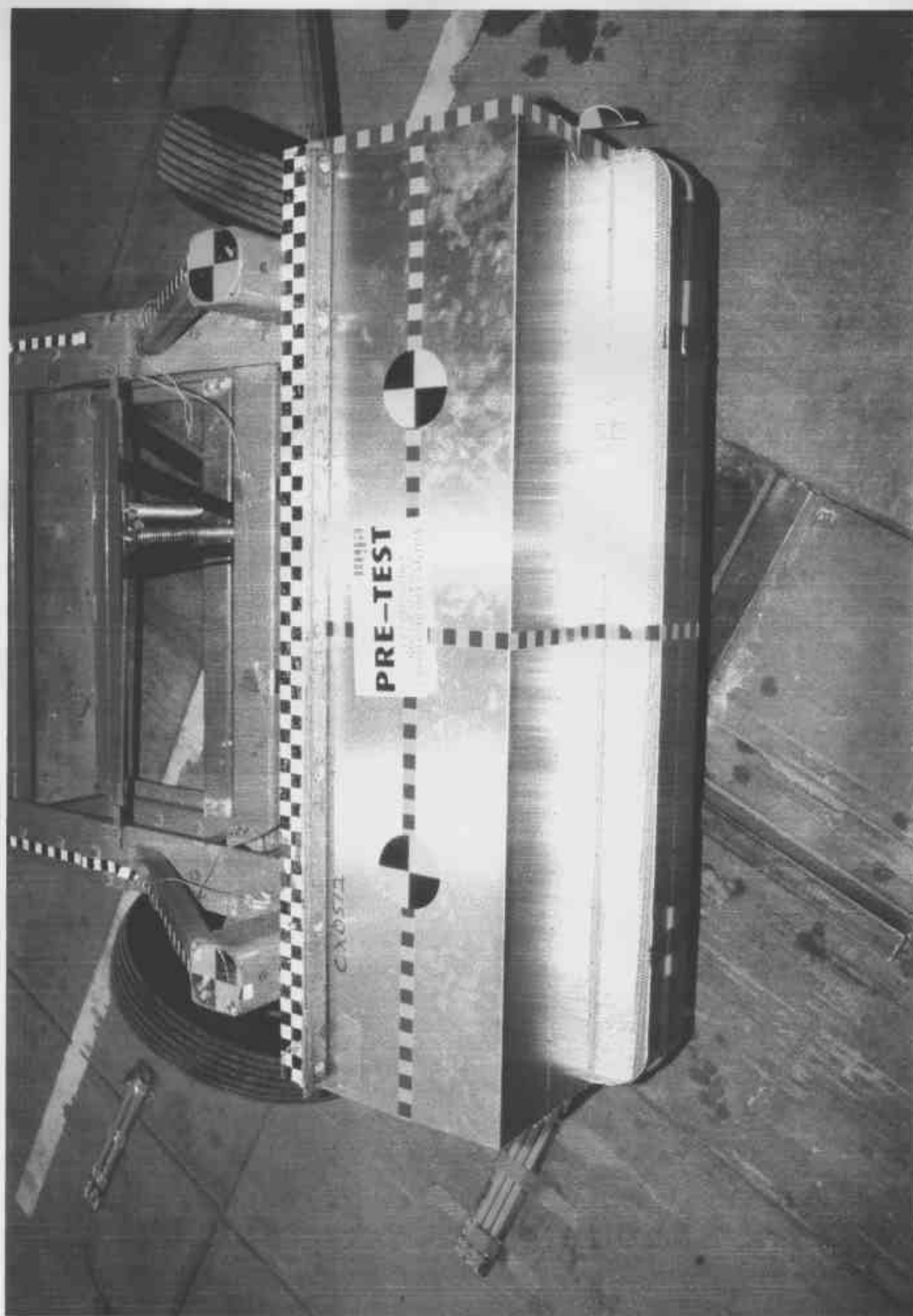


Photo No. A-13 - Pre-Test MDB Top View

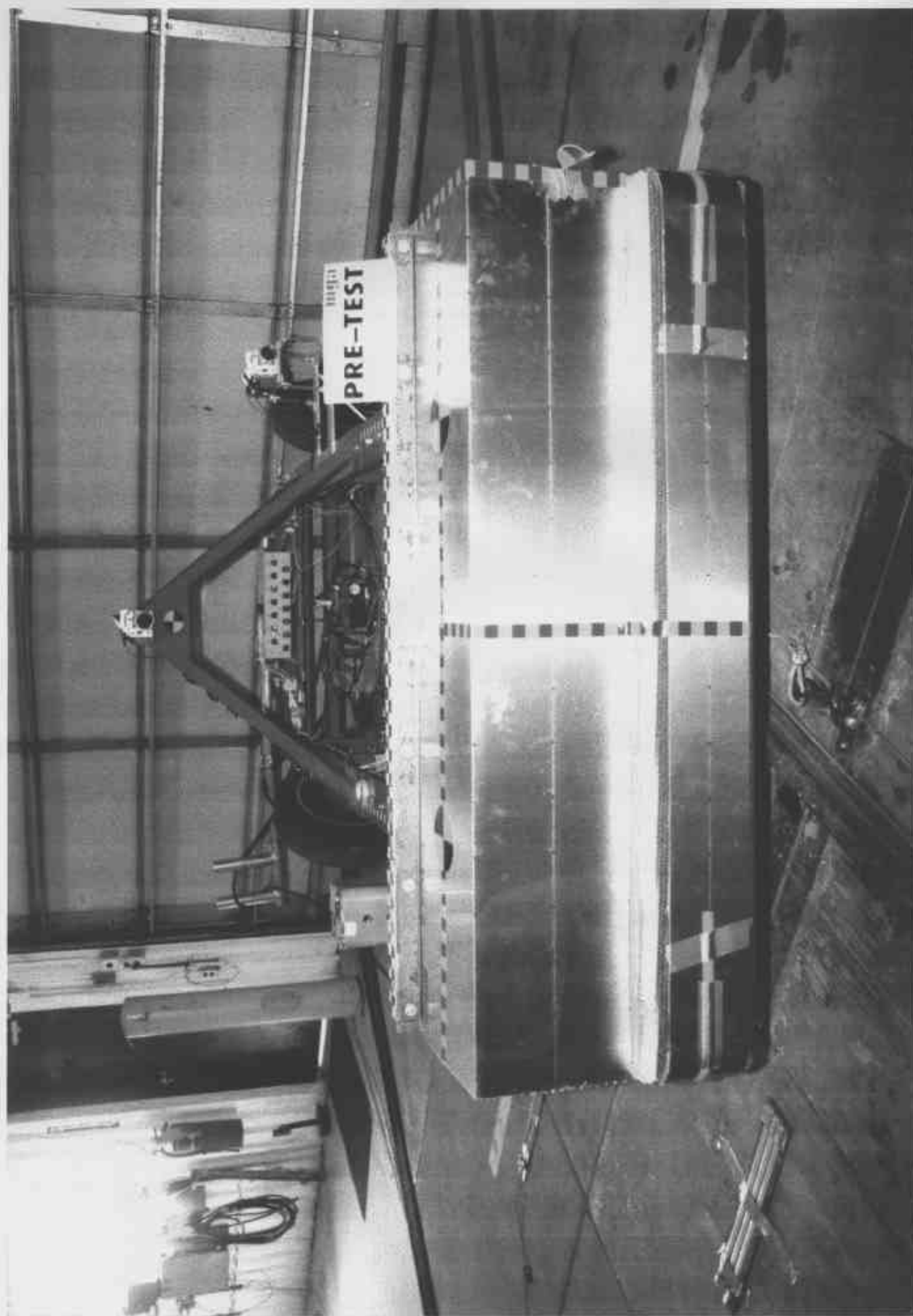


Photo No. A-15 - Pre-Test MDB Front View



Photo No. A-16 - Post-Test MDB Front View

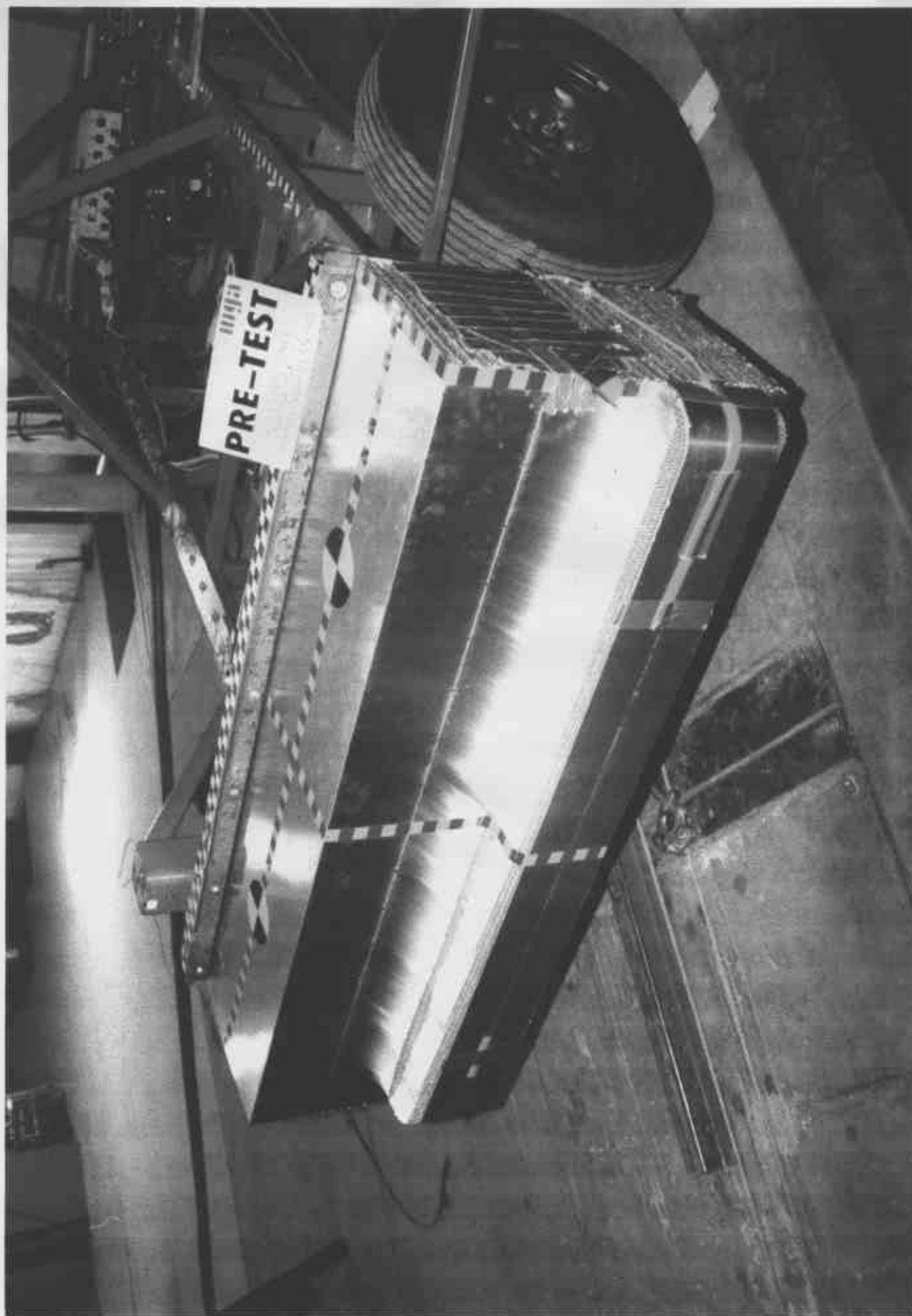


Photo No. A-17 - Pre-Test MDB Left Side View

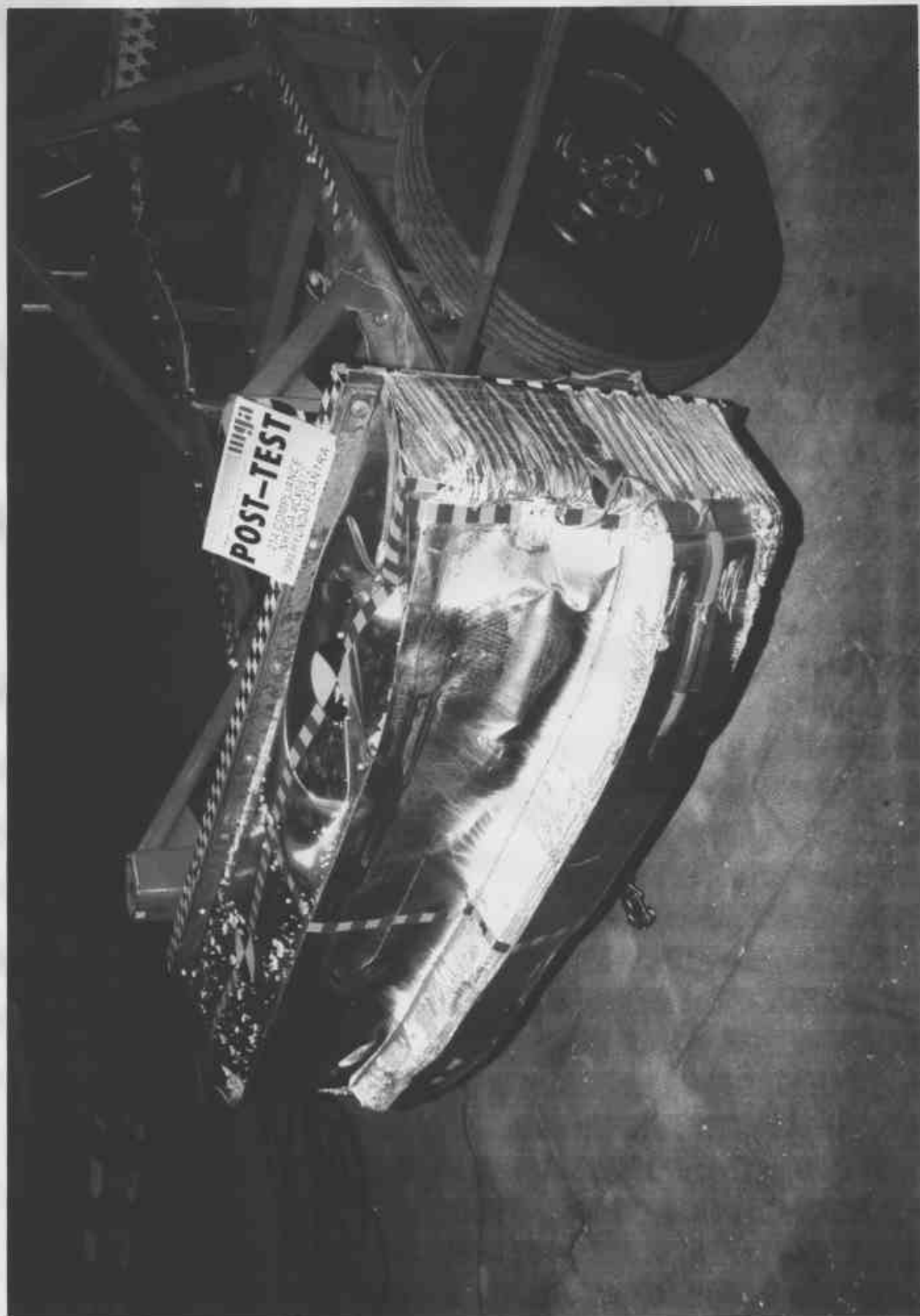


Photo No. A-18 - Post-Test MDB Left Side View

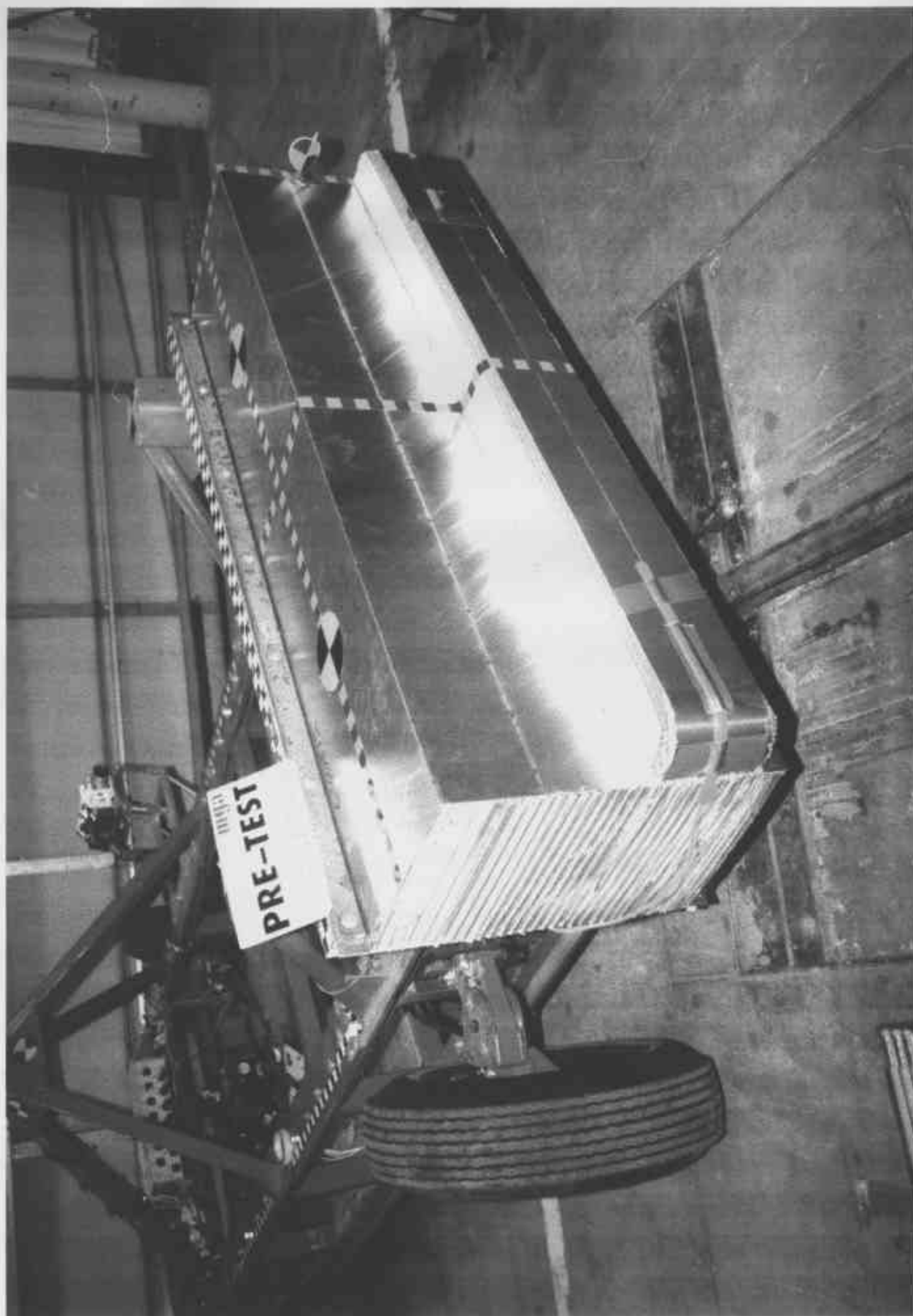


Photo No. A-19 - Pre-Test MDB Right Side View



Photo No. A-20 - Post-Test MDB Right Side View



Photo No. A-21 - Pre-Test Driver Dummy Right Side View



Photo No. A-22 - Post-Test Driver Dummy Right Side View



Photo No. A-23 - Pre-Test Driver Dummy Left Side View



Photo No. A-24 - Post-Test Driver Dummy Left Side View



Photo No. A-25 - Pre-Test Driver Dummy Left Side View (Door Open)



Photo No. A-26 - Pre-Test Driver Shoulder and Door Top View



Photo No. A-27 - Post-Test Driver Shoulder and Door Top View



Photo No. A-28 - Post-Test Driver Dummy Contact

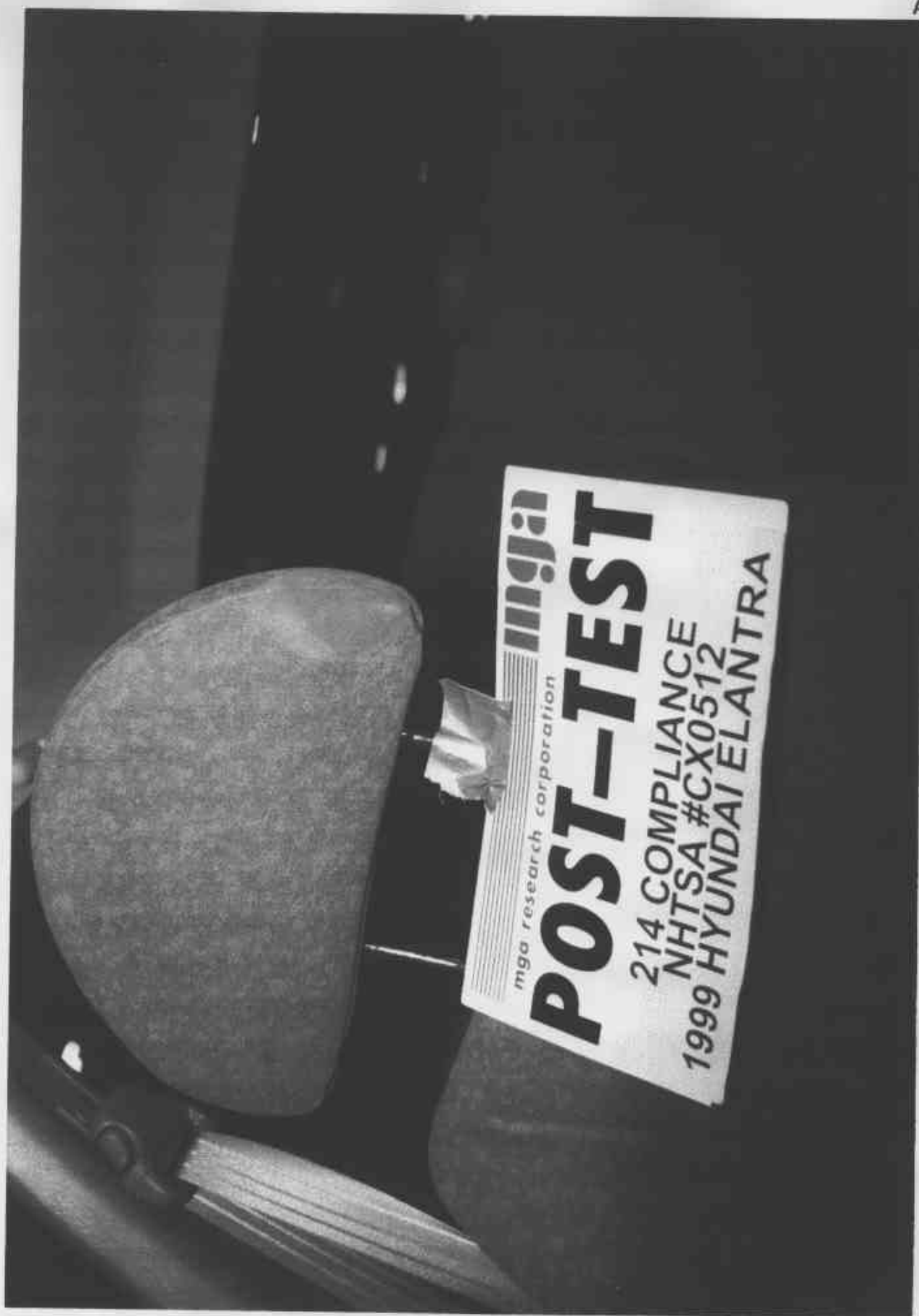


Photo No. A-29 - Post-Test Driver Dummy Head Contact



Photo No. A-30 - Pre-Test Rear Passenger Dummy Right Side View



Photo No. A-31 - Post-Test Rear Passenger Dummy Right Side View



Photo No. A-32 - Pre-Test Rear Passenger Dummy Left Side View



Photo No. A-33 - Post-Test Rear Passenger Dummy Left Side View



Photo No. A-34 - Post-Test Rear Passenger Dummy Left Side View (Door Open)

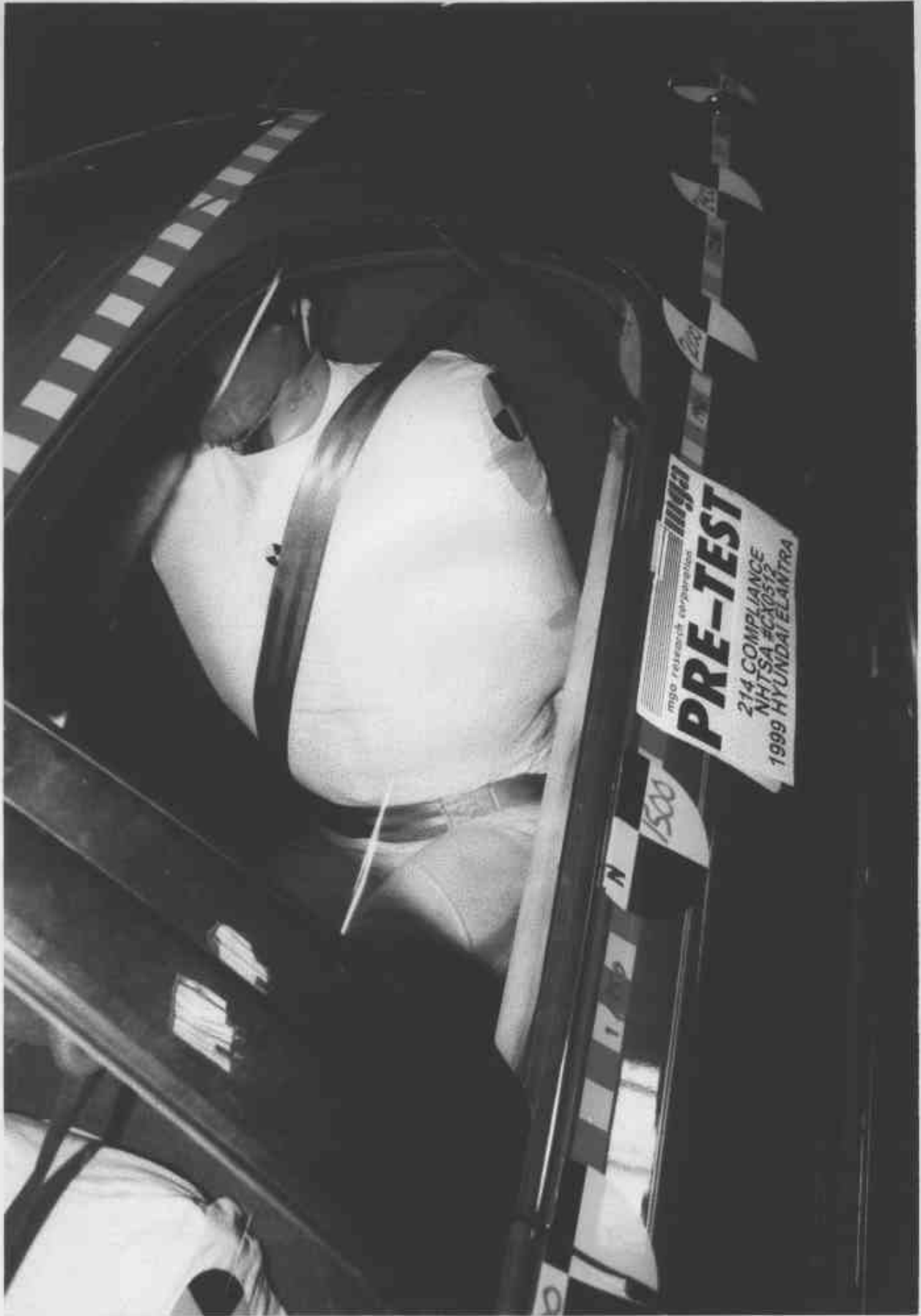


Photo No. A-35 - Pre-Test Rear Passenger Dummy Shoulder View



Photo No. A-36 - Post-Test Rear Passenger Dummy Shoulder View



Photo No. A-37 - Post-Test Rear Passenger Dummy Contact



Photo No. A-38 - Post-Test Rear Passenger Dummy Head Contact



Photo No. A-39 - Pre-Test Left Front Impact Point on Vehicle



Photo No. A-40 - Post-Test Left Front Impact Point on Vehicle

A-41

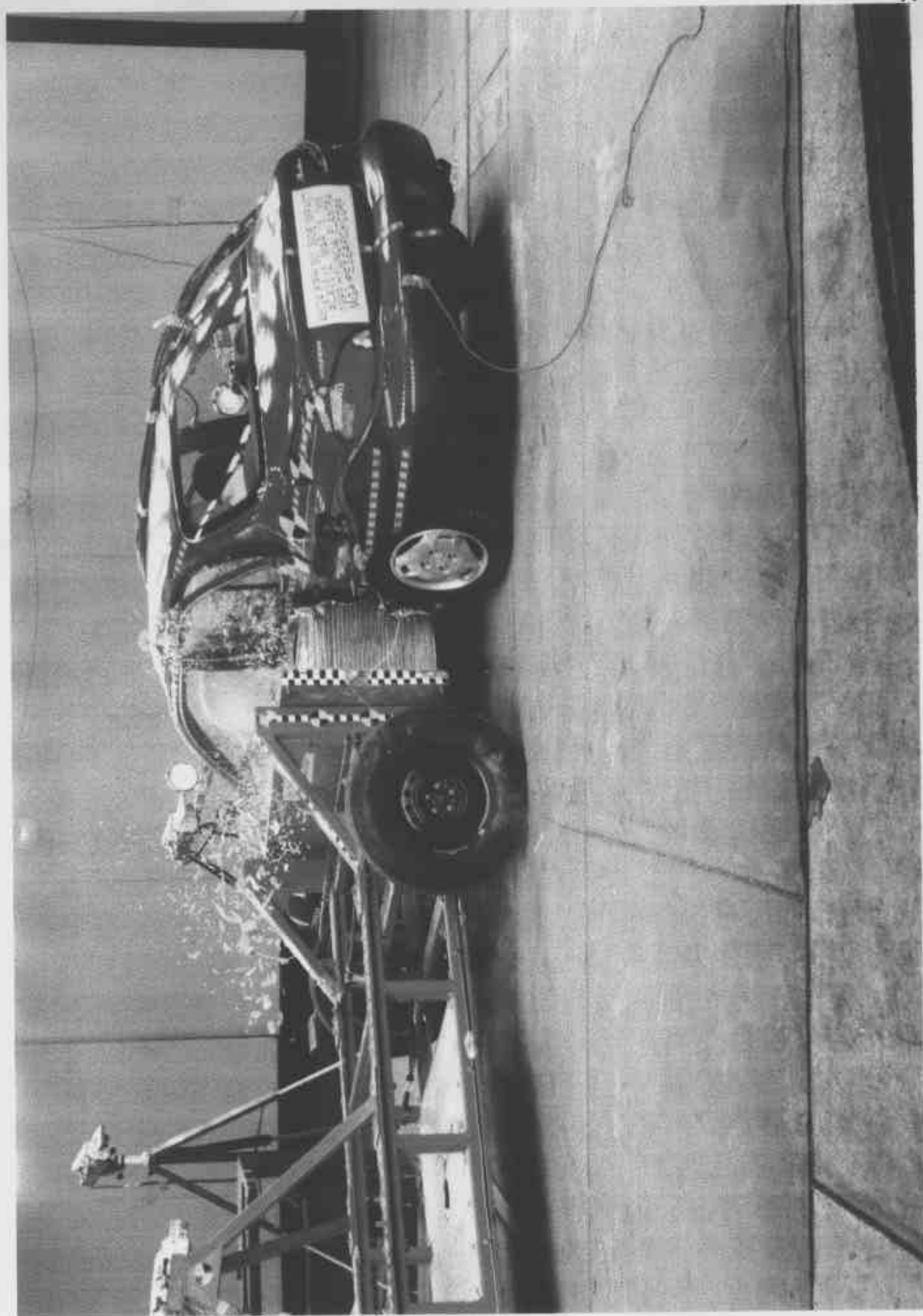


Photo No. A-41 - Impact



Photo No. A-42 - Vehicle Certification Label

1	TIRE INFLATION PRESSURE		PSI	
	VEHICLE CAPACITY WEIGHT		PSI	
	SEATING CAPACITY TOTAL		PSI	
TIRE PRESSURES-COLD, KPA				
TIRE SIZE	LOAD UP TO 2 PERSONS		MAX. VEHICLE WEIGHT LIMIT	
	FRONT	REAR	FRONT	REAR
195/60 R14	210(30)	210(30)	210(30)	210(30)
P195/60 R14	210(30)	210(30)	210(30)	210(30)
T125/70 D15	420(60)	420(60)	420(60)	420(60)

Photo No. A-43 - Tire Placard



Photo No. A-44 - Rollover 90°

A-45

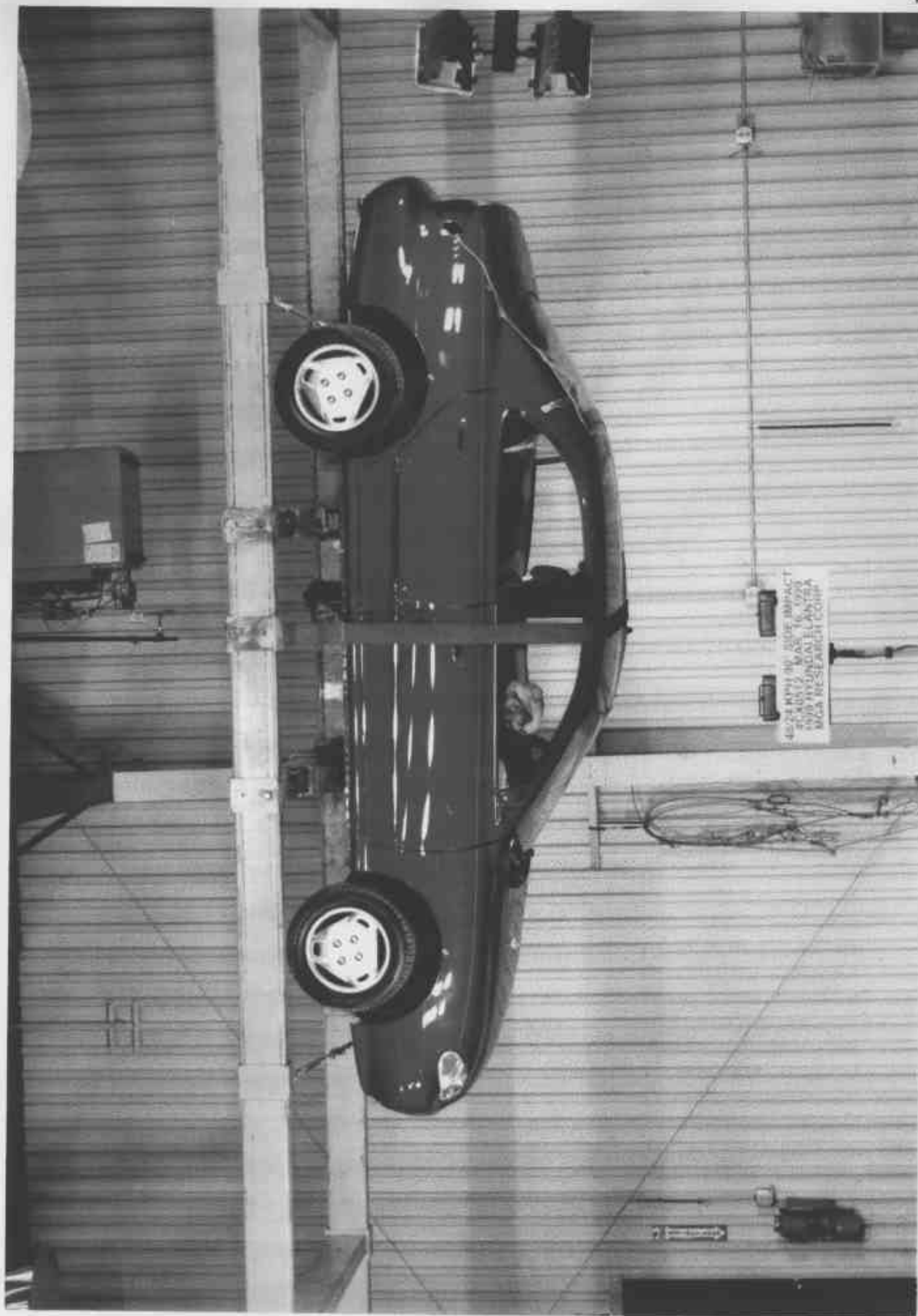


Photo No. A-45 - Rollover 180°

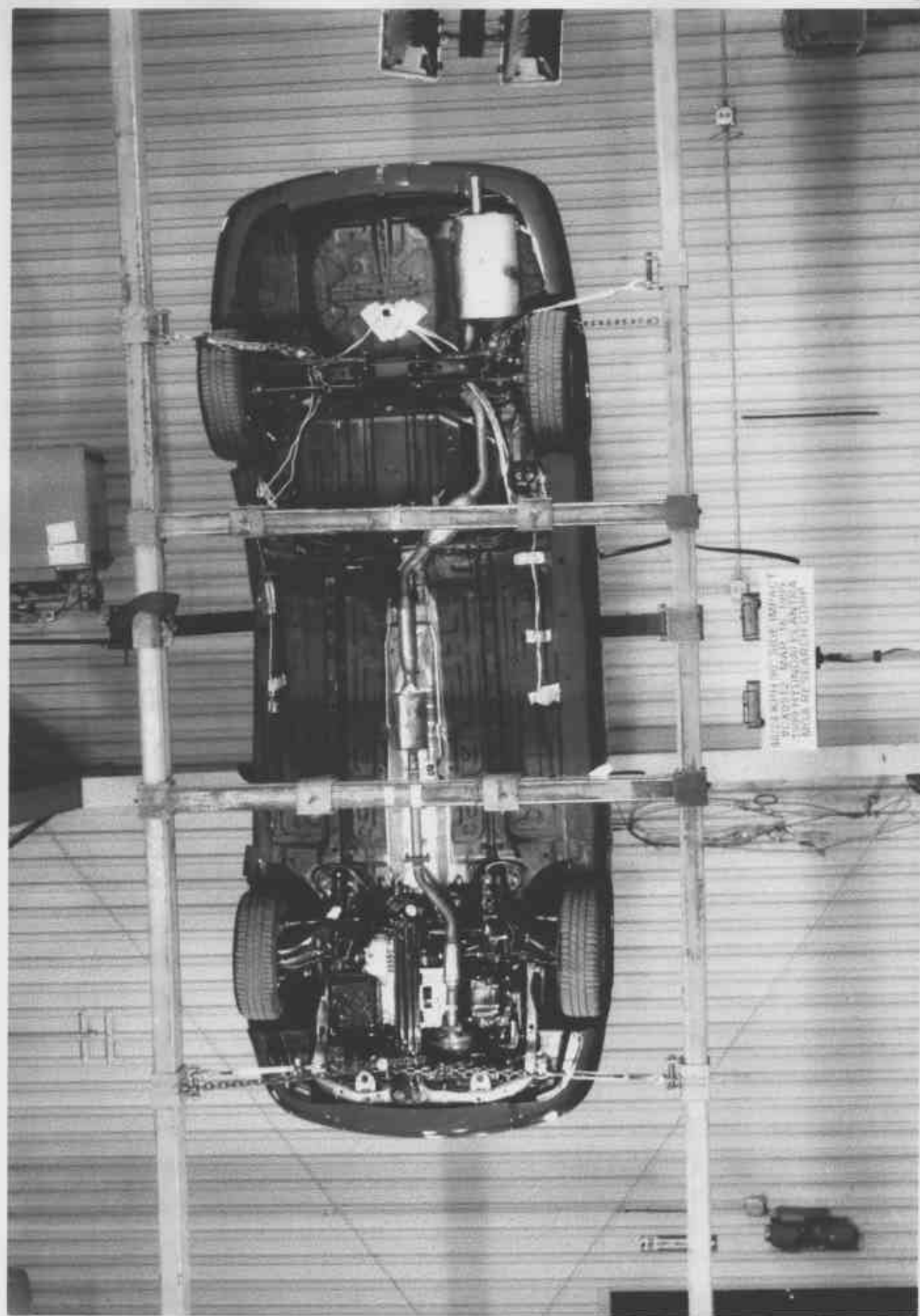


Photo No. A-46 - Rollover 270°

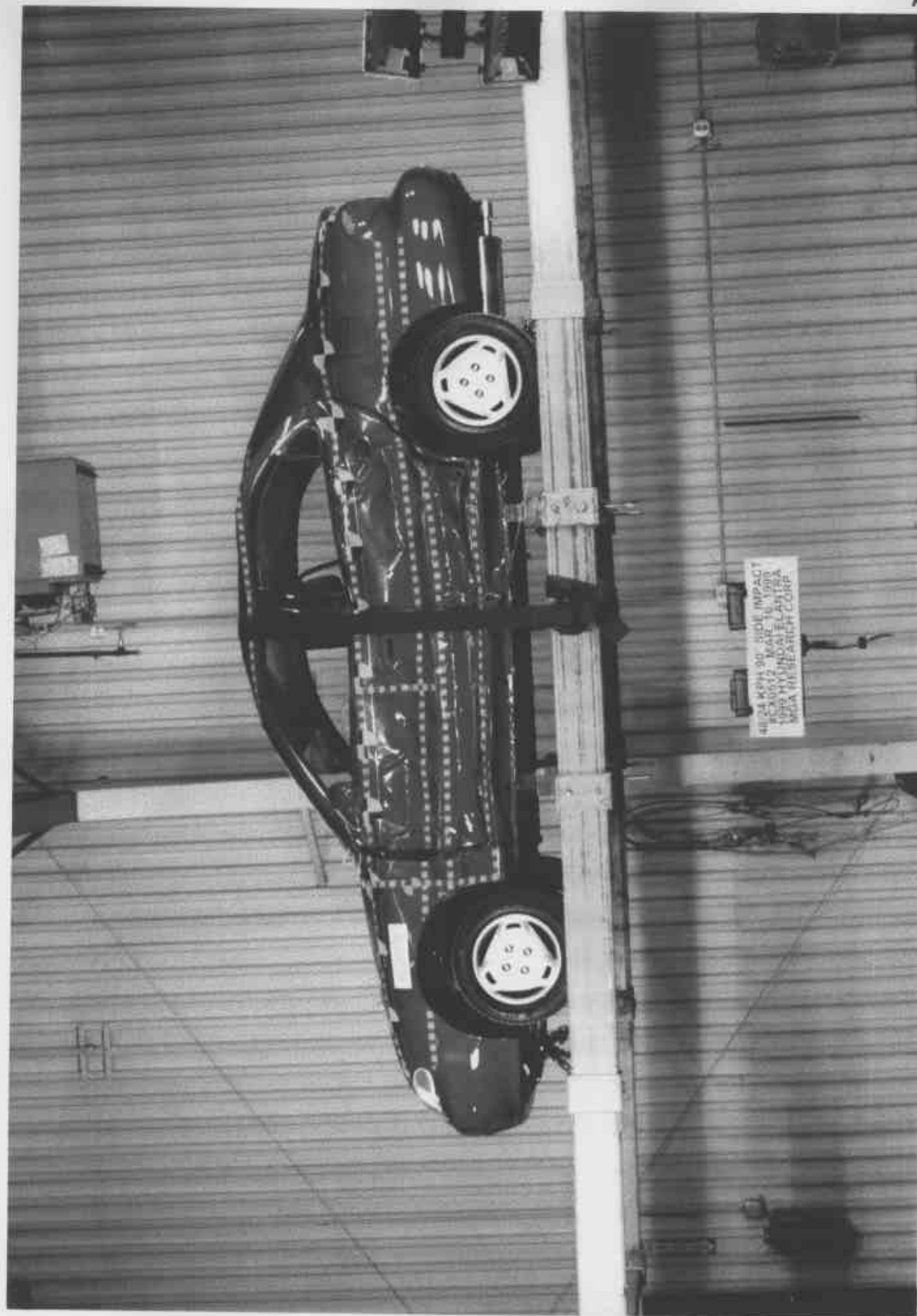


Photo No. A-47 - Rollover 360°

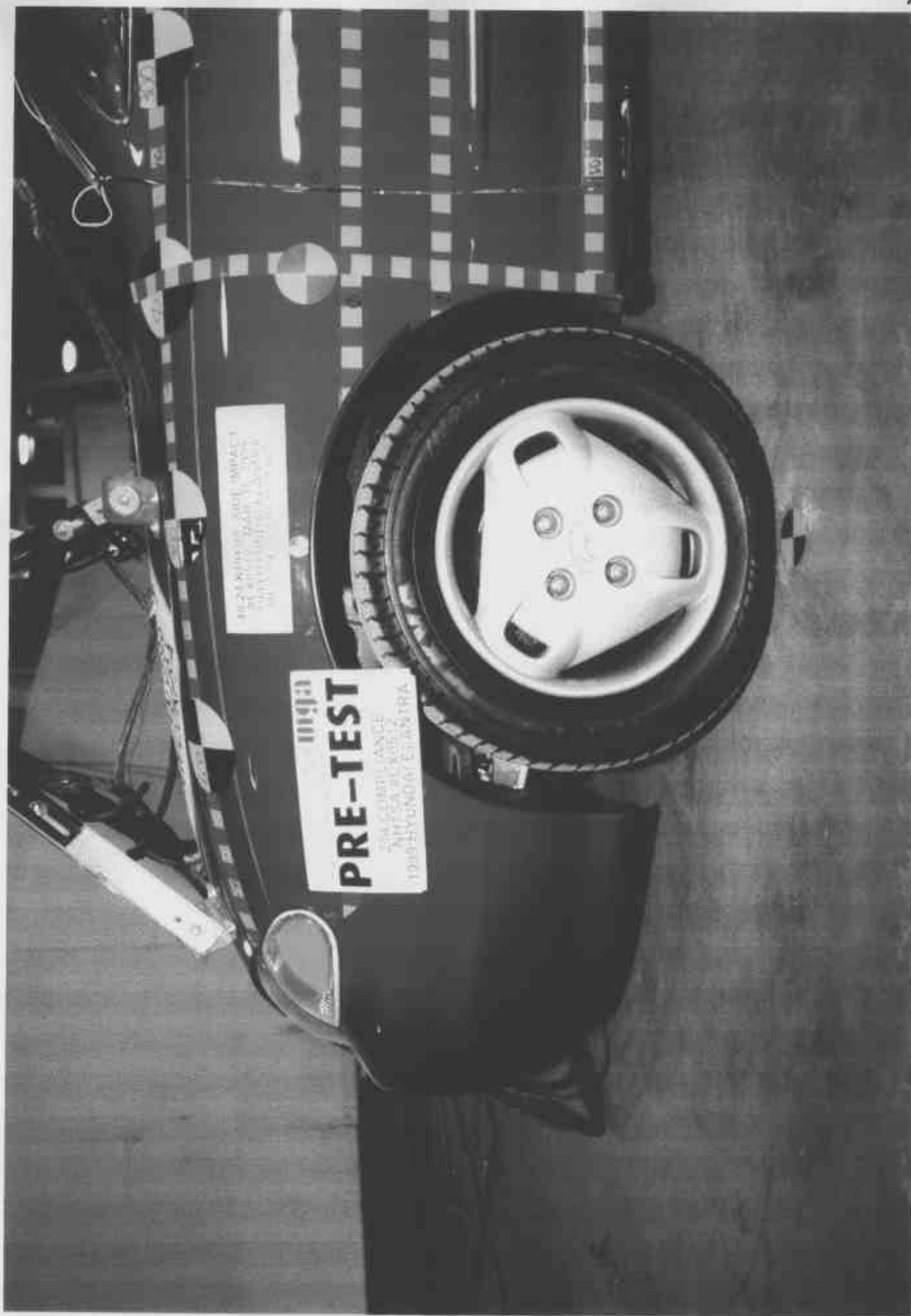


Photo No. A-48 - Left Front Attitude Point



Photo No. A-49 - Right Front Attitude Point



Photo No. A-50 - Left Rear Attitude Point



Photo No. A-51 - Right Rear Attitude Point

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TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

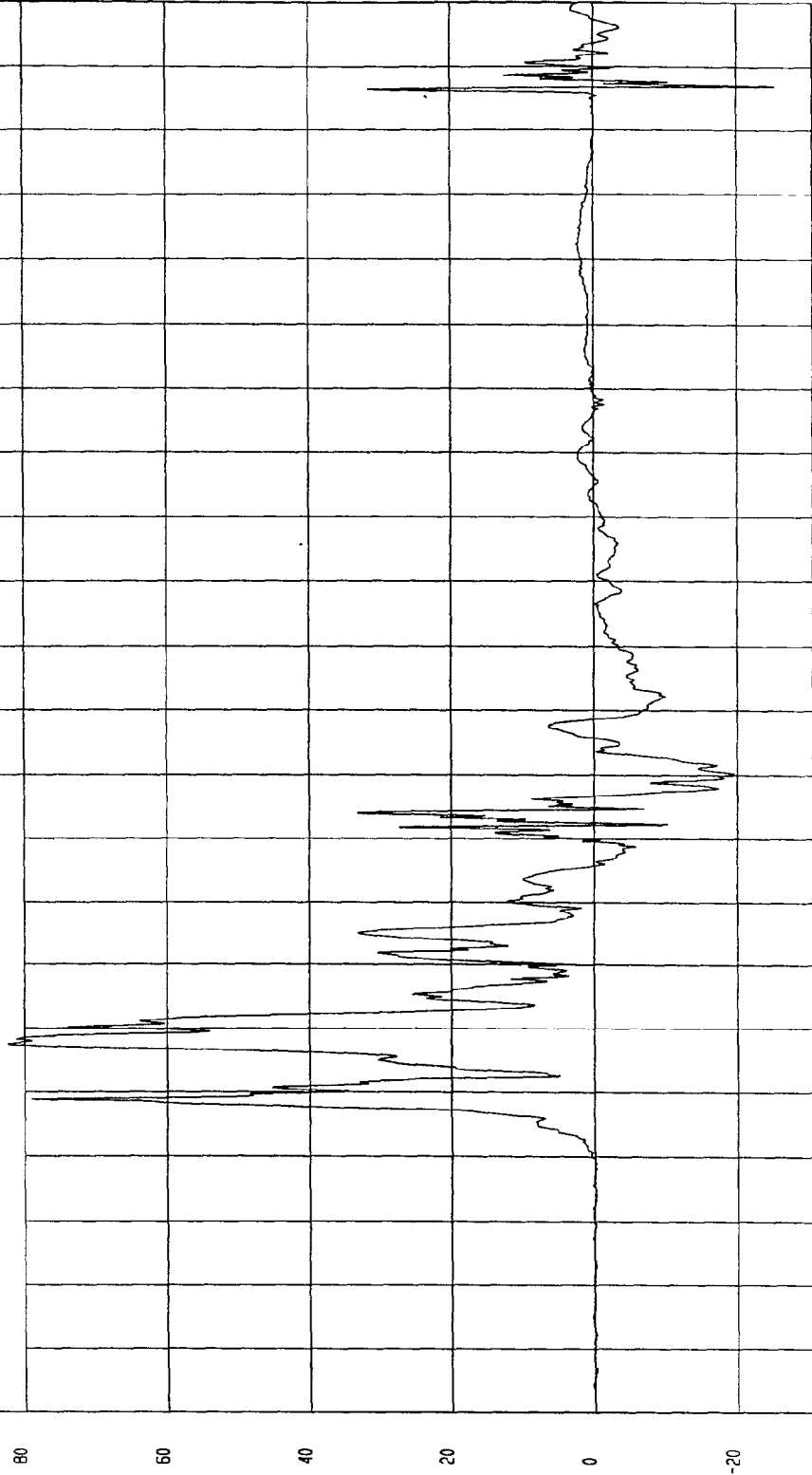
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 82.3 G'S at 37 msec

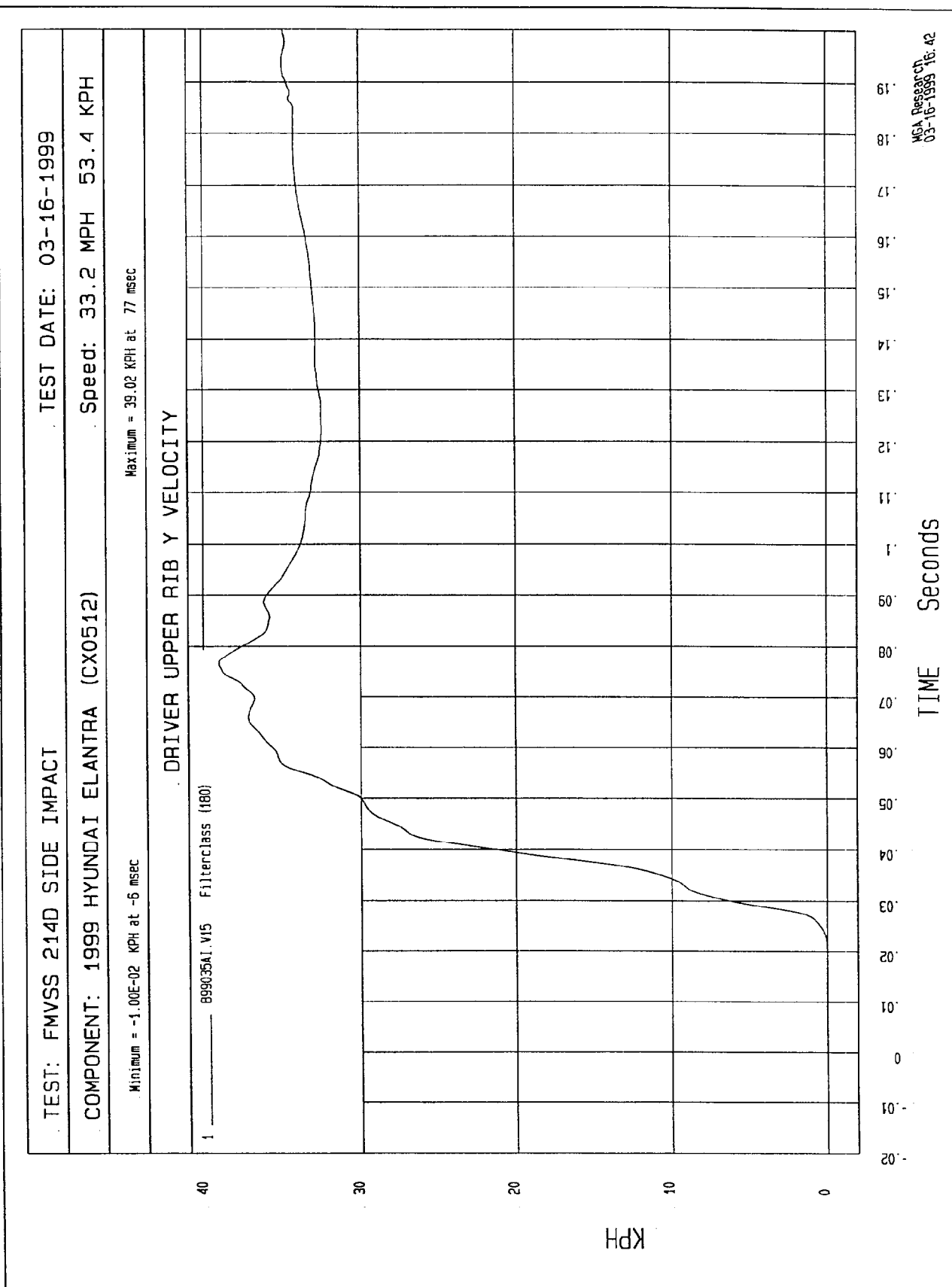
Minimum = -25.28 G'S at 187 msec

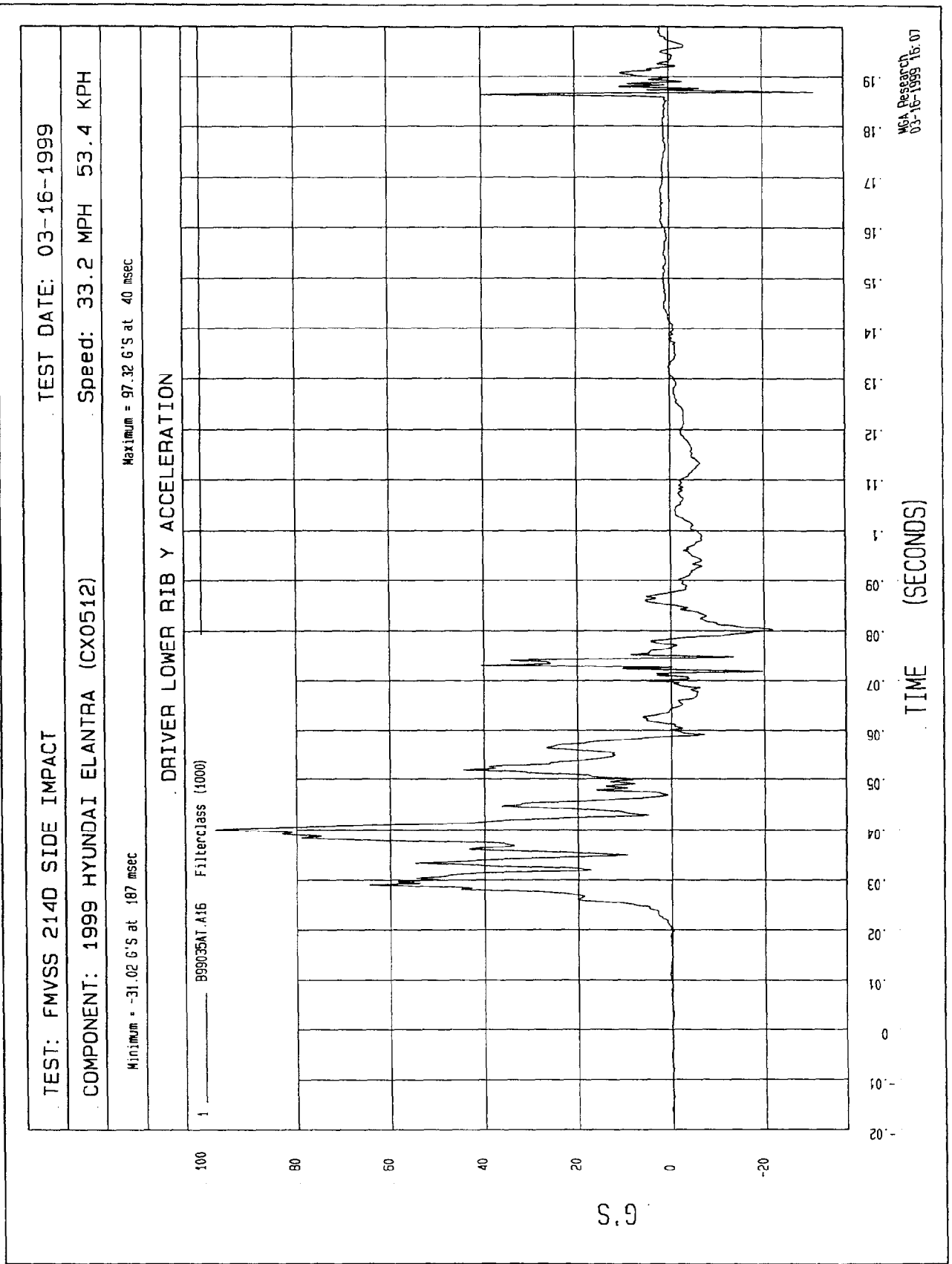
DRIVER UPPER RIB Y ACCELERATION

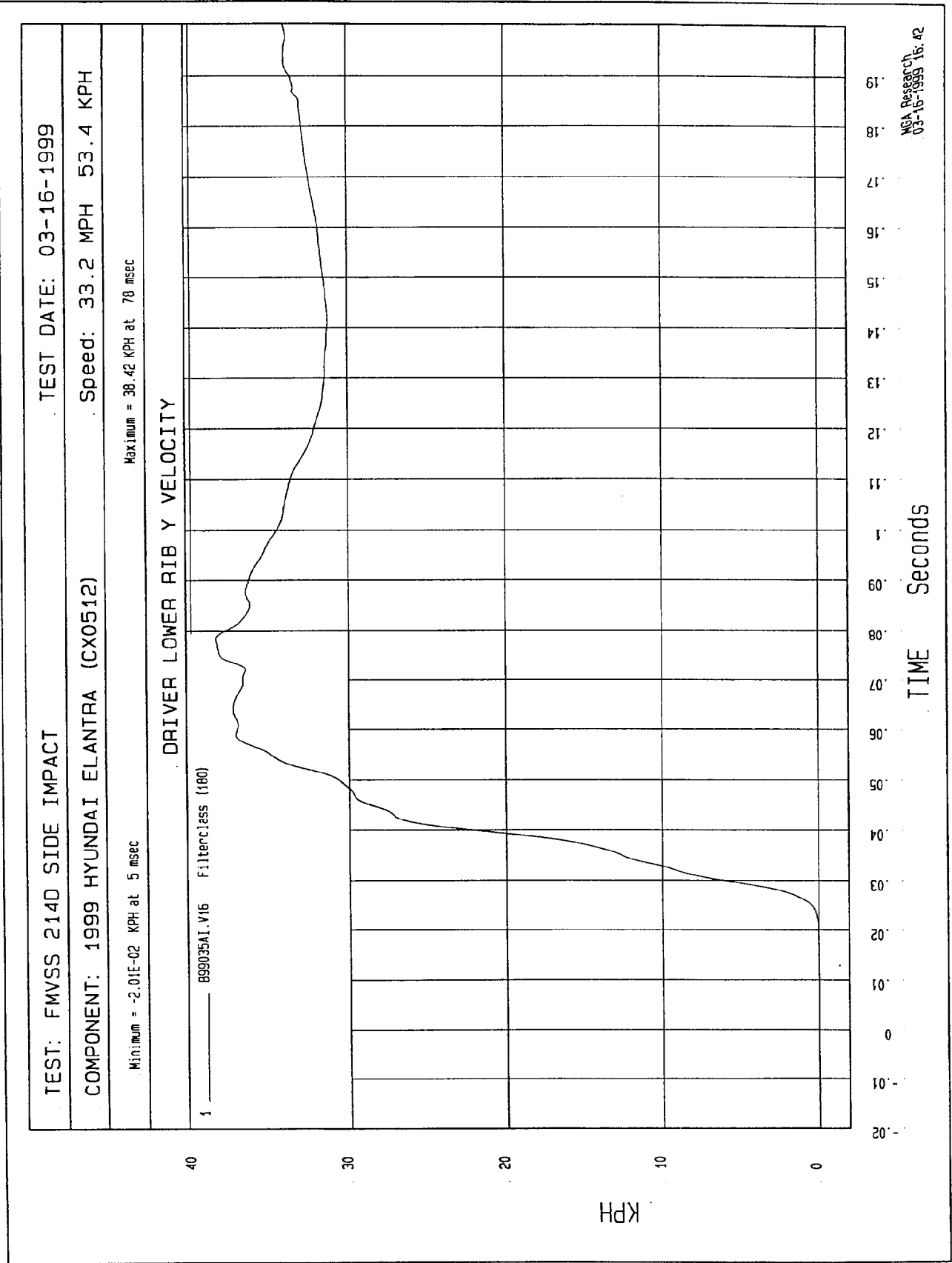
1 — 899035AT A15 Filterclass (1000)



MGA Research
03-16-1999 15:06







TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

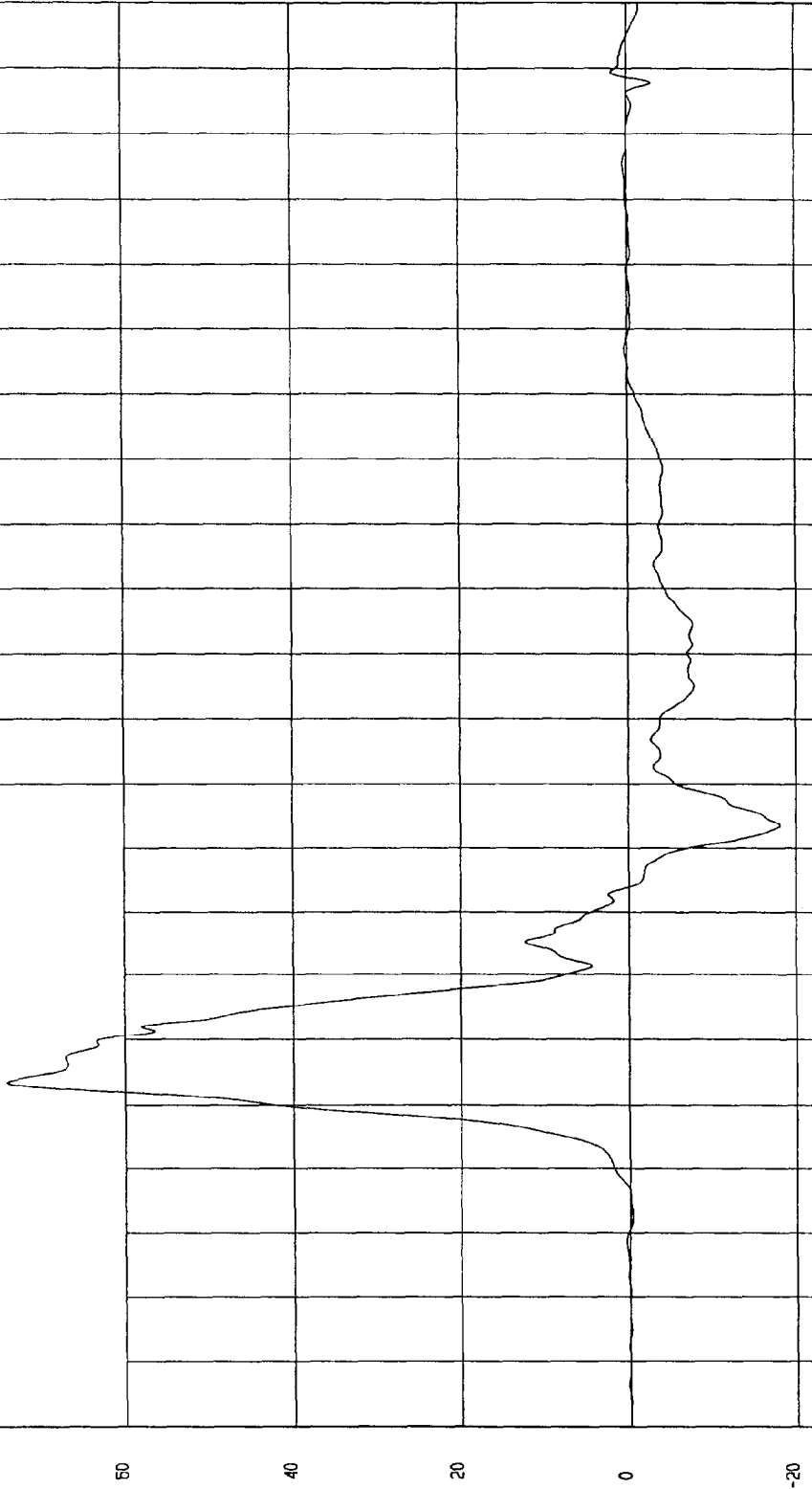
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 73.99 G'S at 33 msec

Minimum = -18.11 G'S at 74 msec

DRIVER LOWER SPINE Y ACCELERATION

1 ——— B99035AF.A17 Filter: class (180)



TIME (SECONDS)

MCA Research
03-16-1999 16:07

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

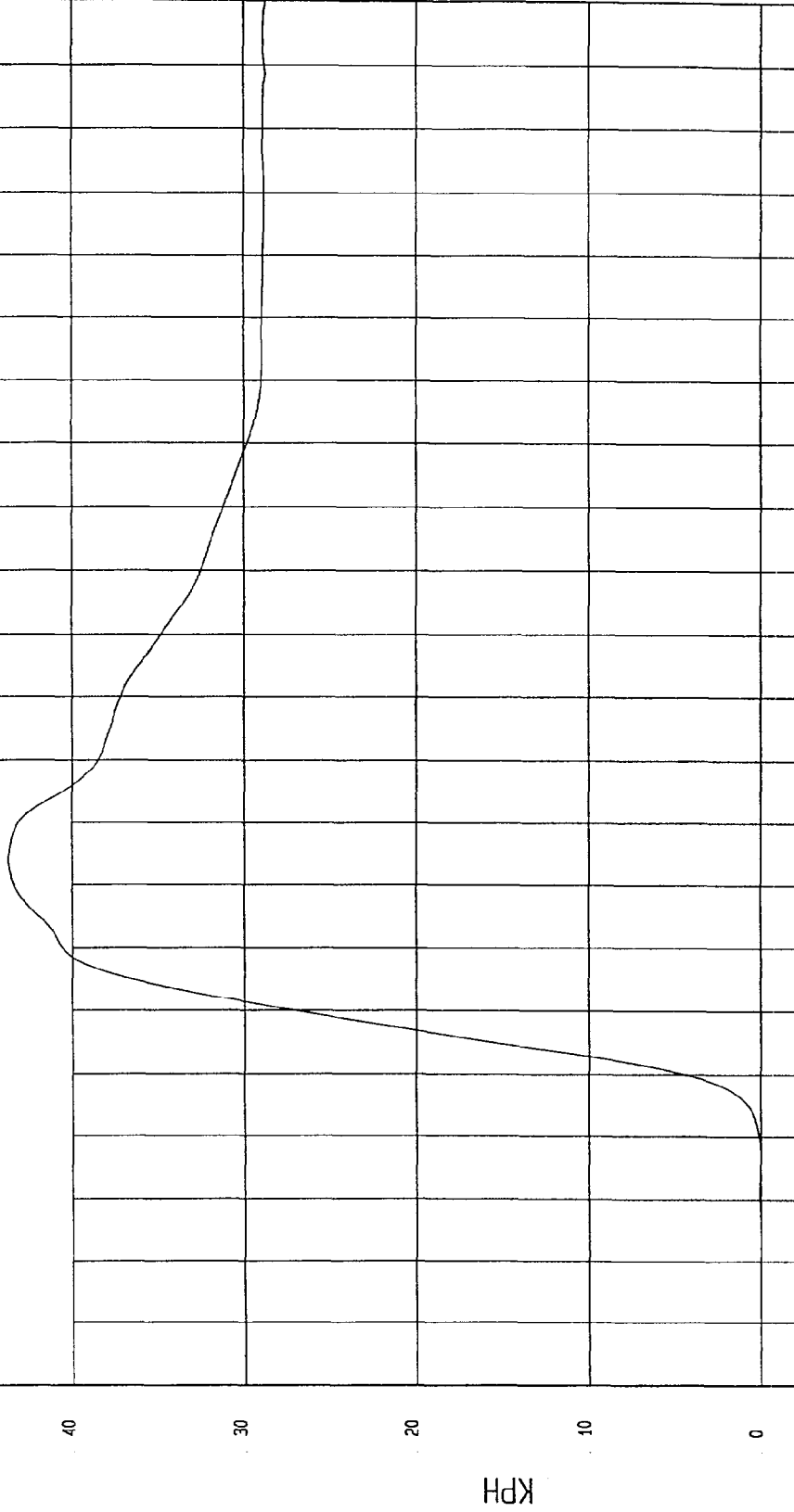
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 43.67 KPH at 64 msec

Minimum = -1.84E-02 KPH at 2 msec

DRIVER LOWER SPINE Y VELOCITY

1 B99035A1.V17 Filterclass (180)



MCA Research
03-16-1999 16:42

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

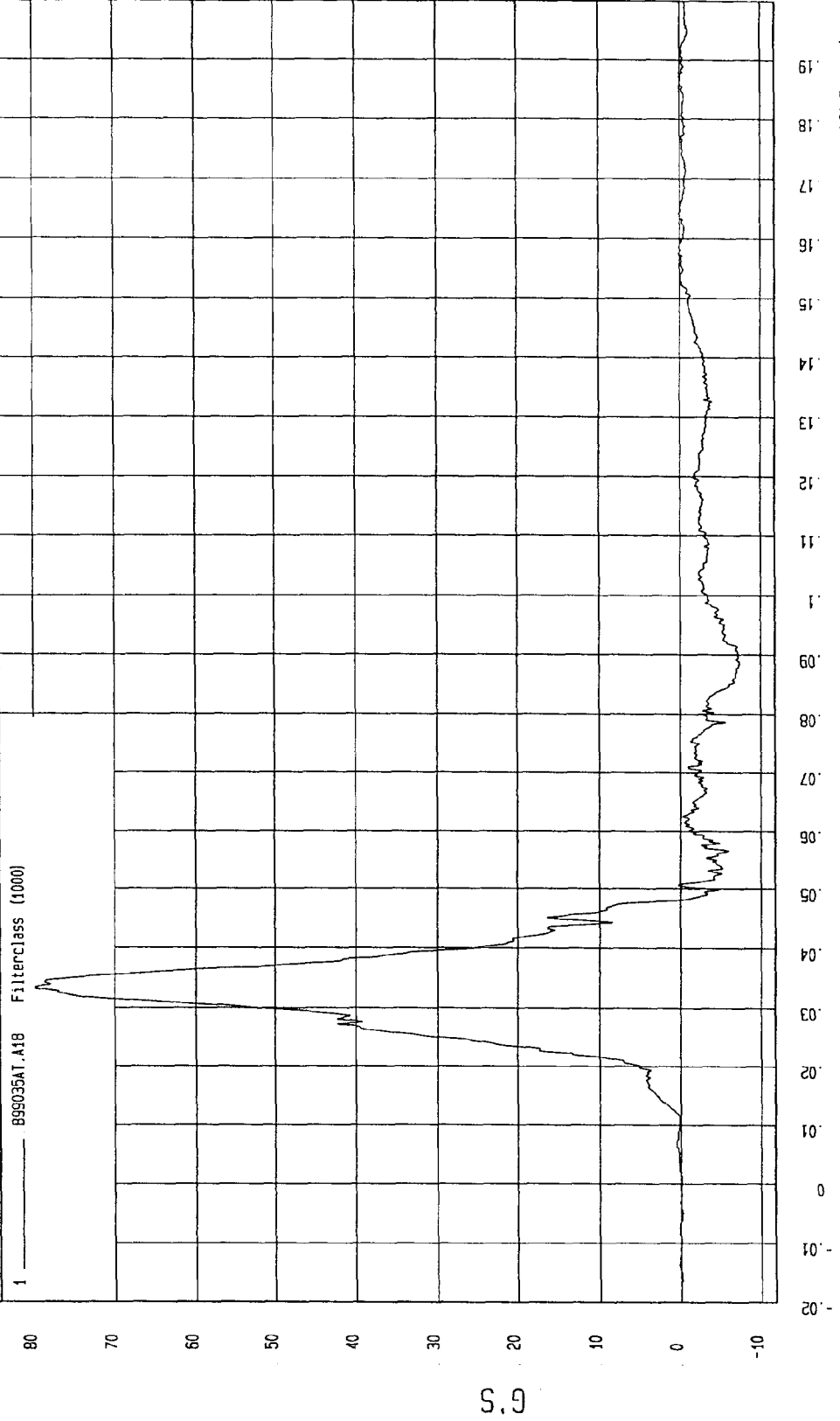
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 79.9 G'S at 33 msec

Minimum = -7.4 G'S at 88 msec

DRIVER PELVIS Y ACCELERATION



MGA Research
03-16-1999 16:07

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

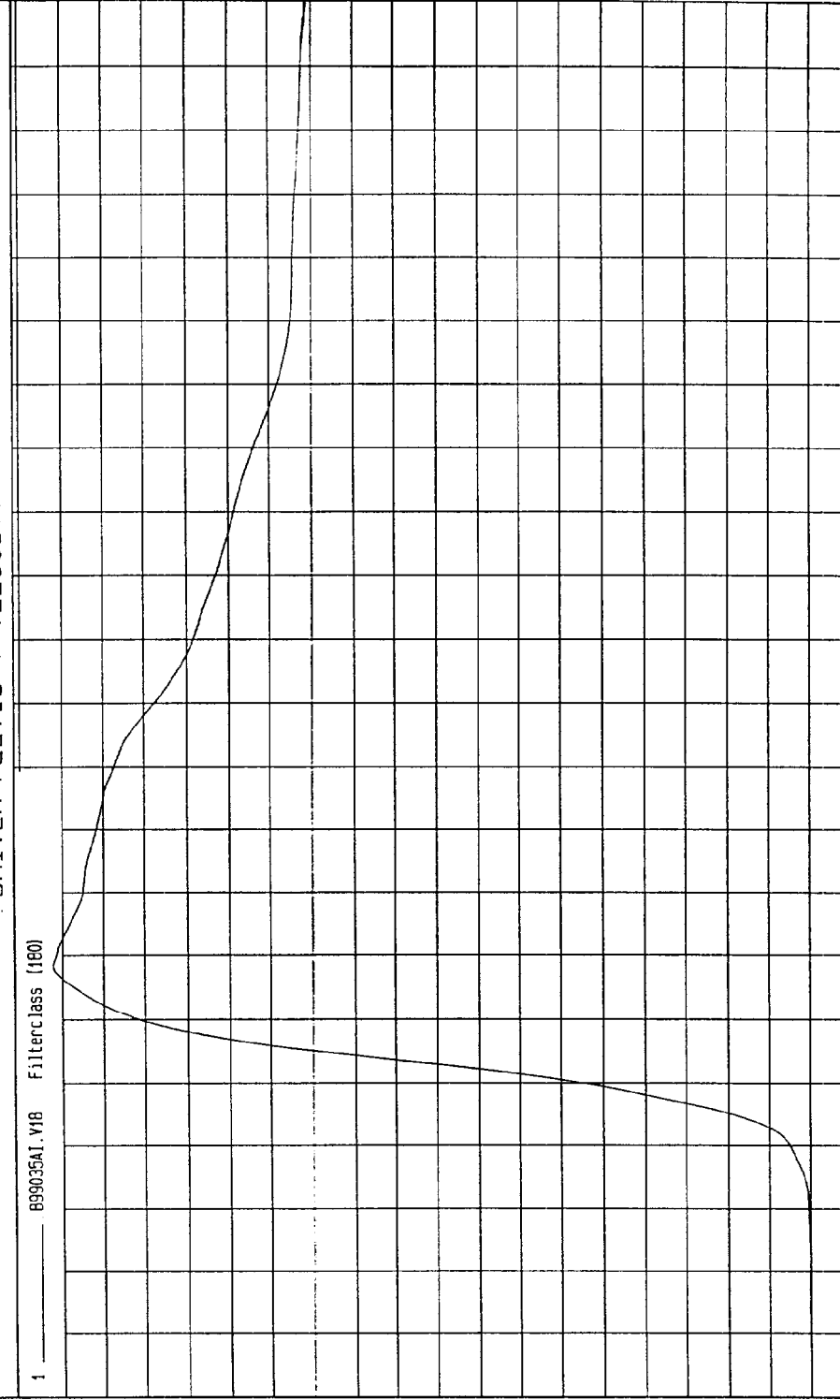
Maximum = 36.45 KPH at 48 msec

Minimum = -6.03E-03 KPH at -15 msec

DRIVER PELVIS Y VELOCITY

KPH

1 899035A1.V18 Filterclass (160)



TIME Seconds

MCA Research
03-16-1999 16:42

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

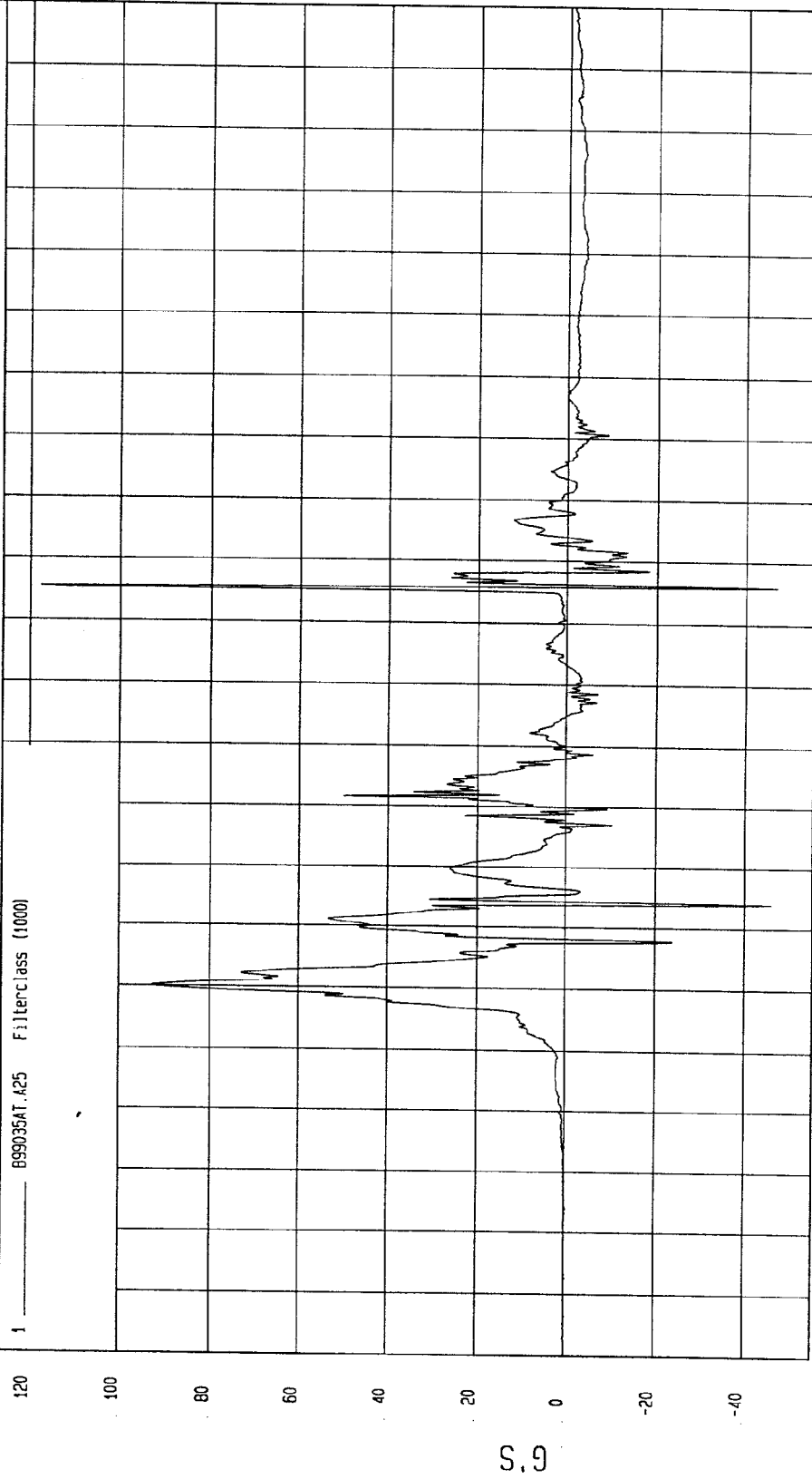
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 117.78 G'S at 106 msec

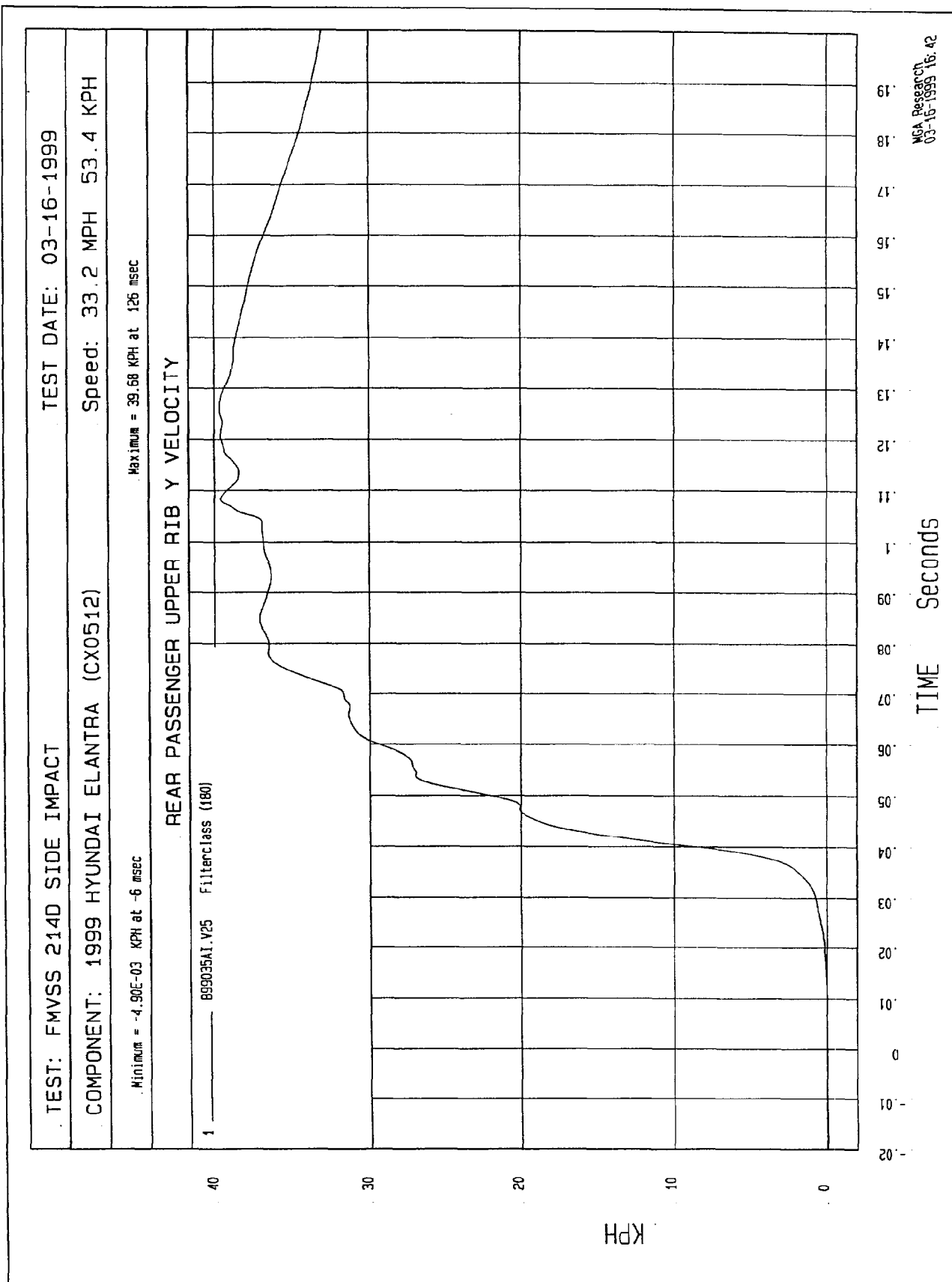
Minimum = -47.08 G'S at 106 msec

REAR PASSENGER UPPER RIB Y ACCELERATION

1 B99035AT.A25 Filterclass (1000)



NGA Research
03-16-1999 16:07

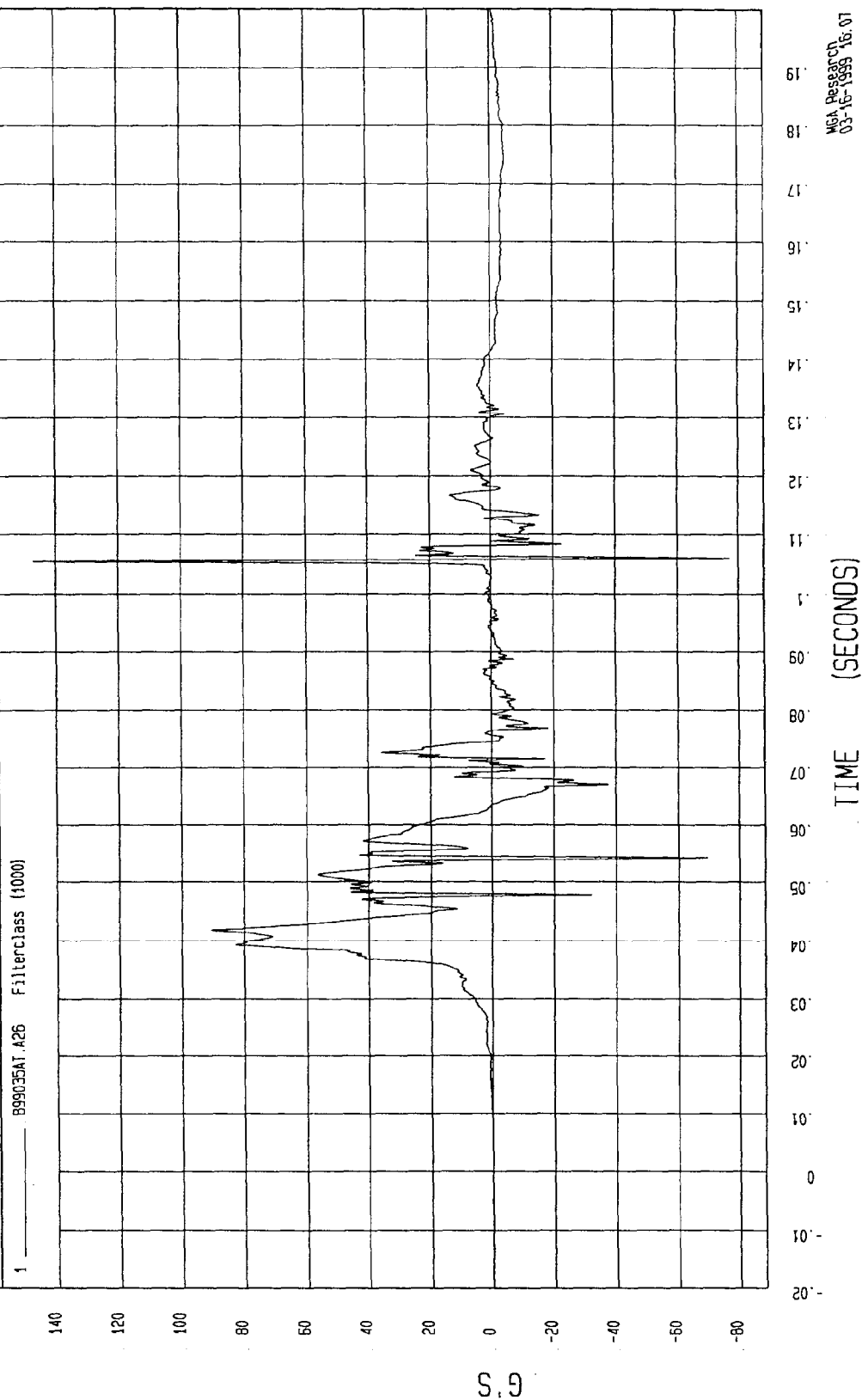


TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -77.04 G'S at 106 msec Maximum = 147.09 G'S at 106 msec

REAR PASSENGER LOWER RIB Y ACCELERATION



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

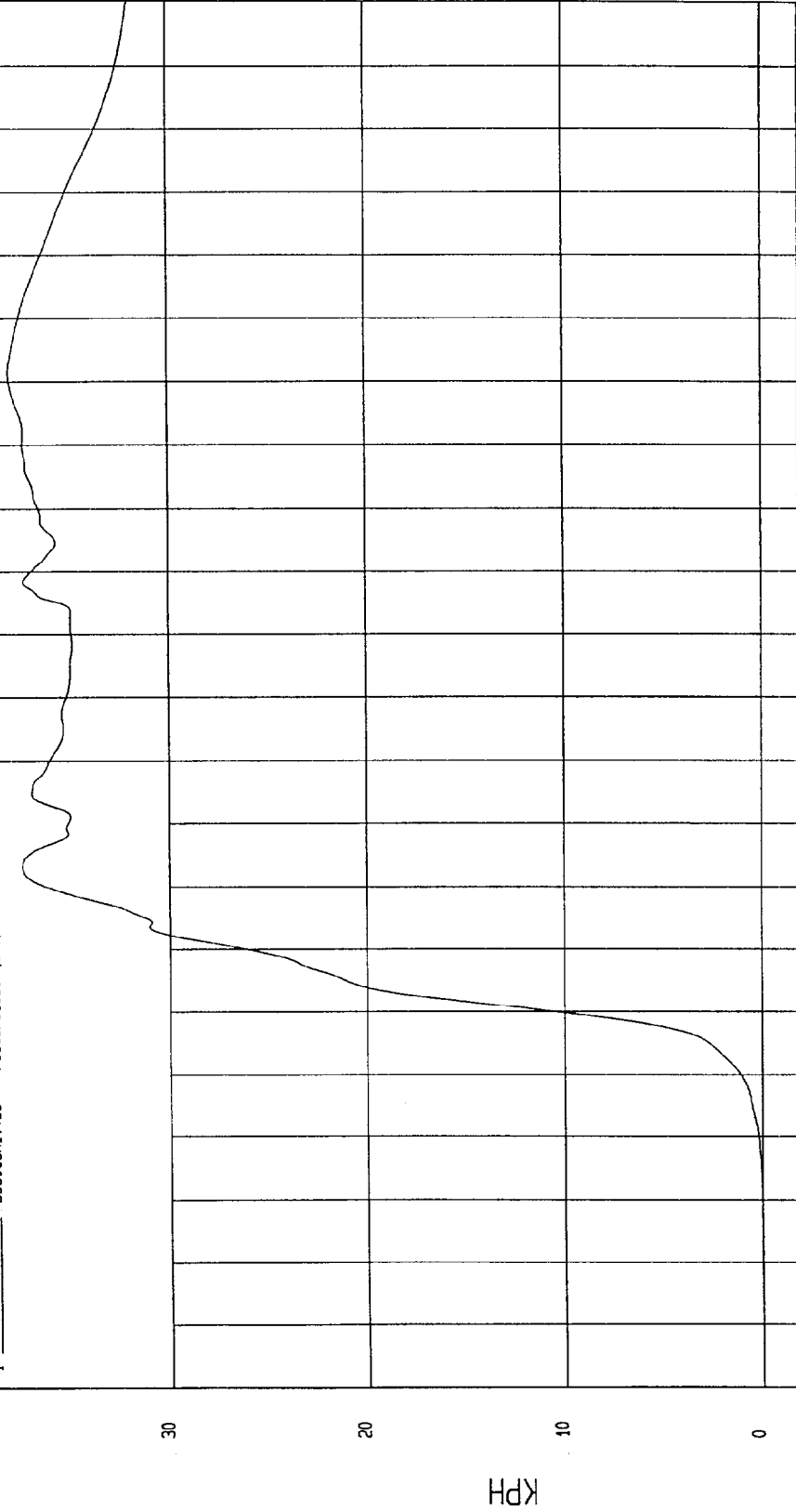
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.04 KPH at 141 msec

Minimum = -8.53E-03 KPH at -6 msec

REAR PASSENGER LOWER RIB Y VELOCITY

1 ——— B99035A1.V26 Filterclass (180)



TIME Seconds

0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02

MOA Research
03-16-1999 16:42

TEST DATE: 03-16-1999

TEST: FMVSS 214D SIDE IMPACT

Speed: 33.2 MPH 53.4 KPH

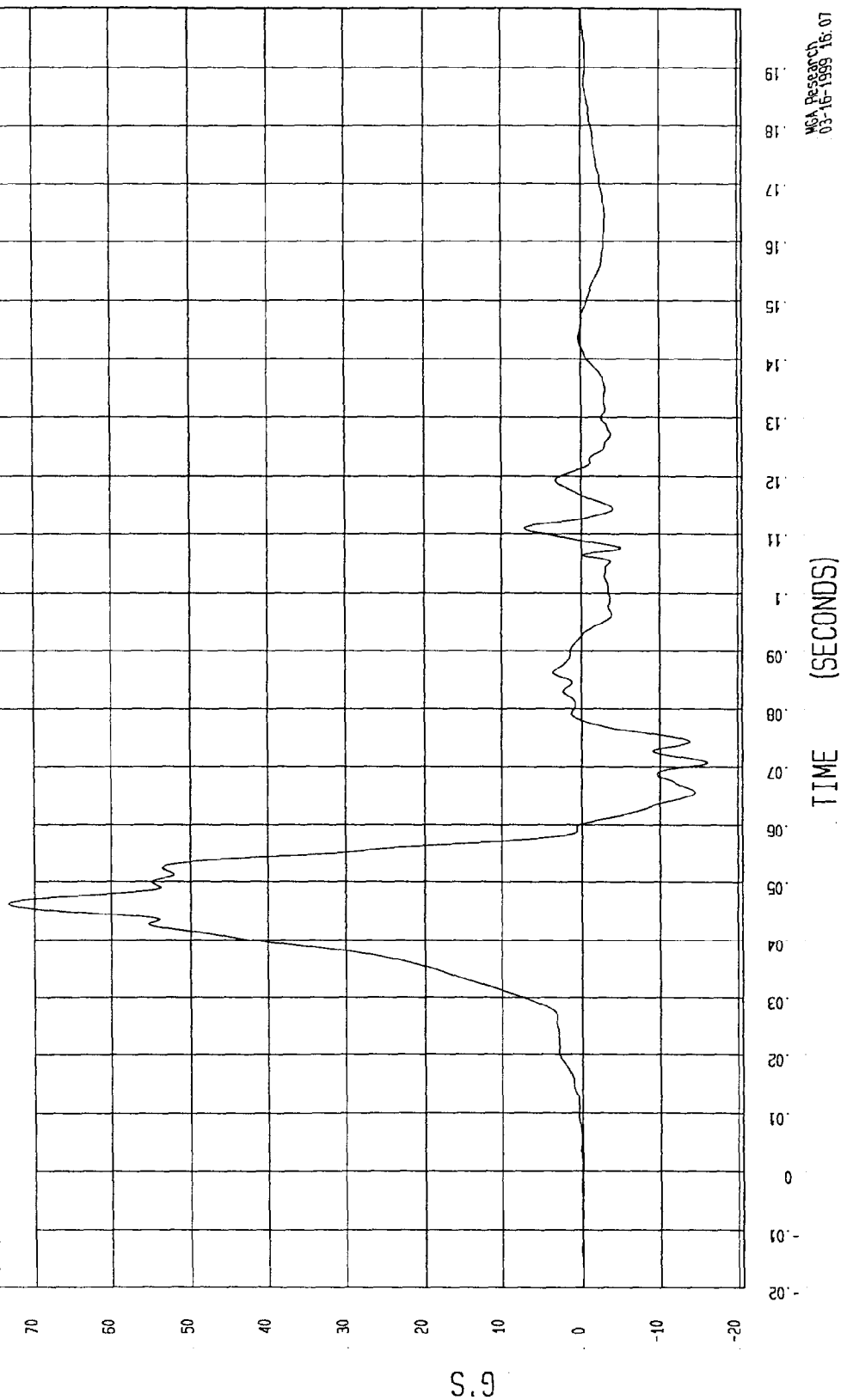
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

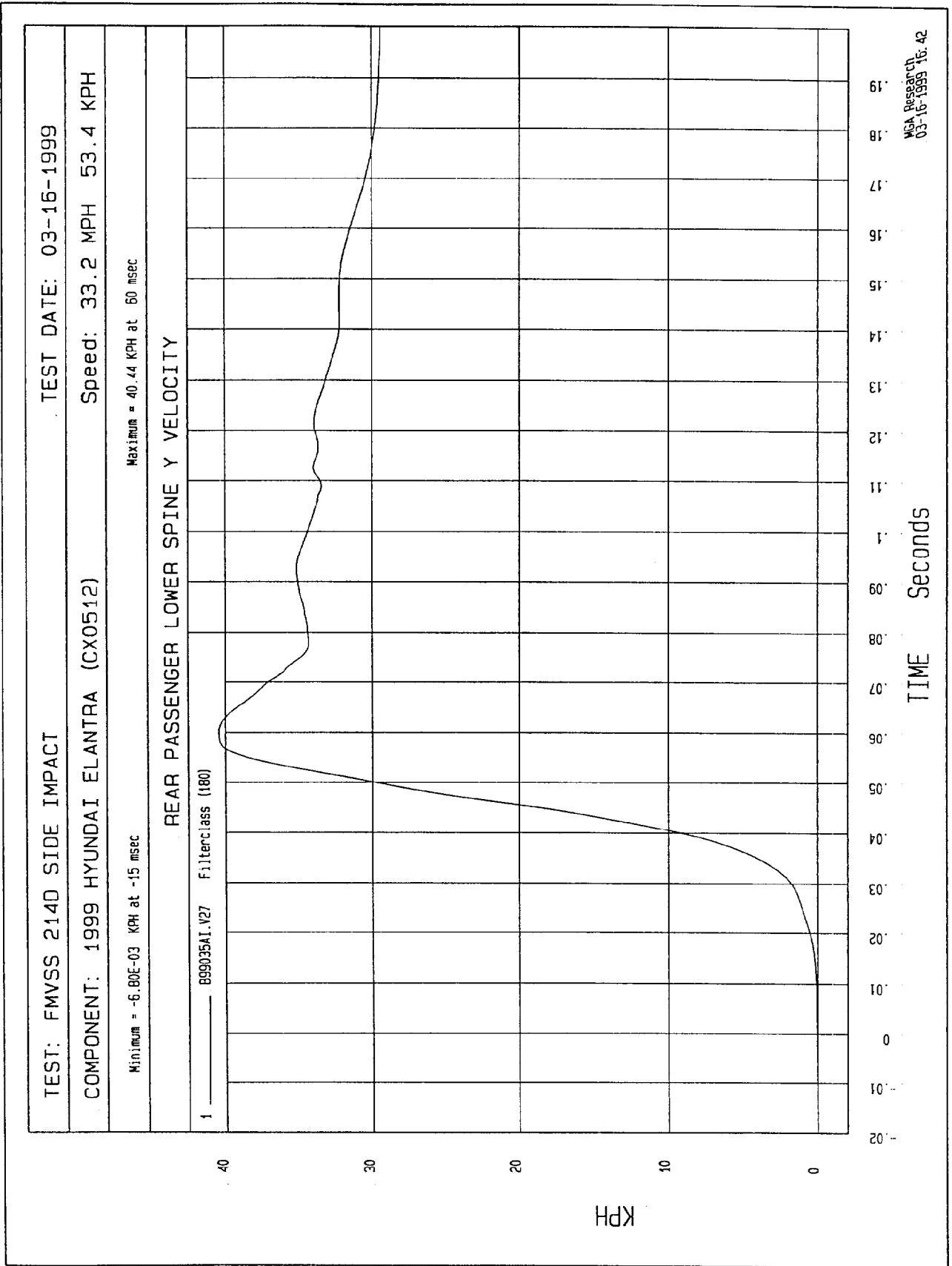
Maximum = 73.3 G'S at 46 msec

Minimum = -16.13 G'S at 71 msec

REAR PASSENGER LOWER SPINE Y ACCELERATION

1 ——— B99035AF.A27 Filterclass (180)

MCA Research
03-16-1999 16:07



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

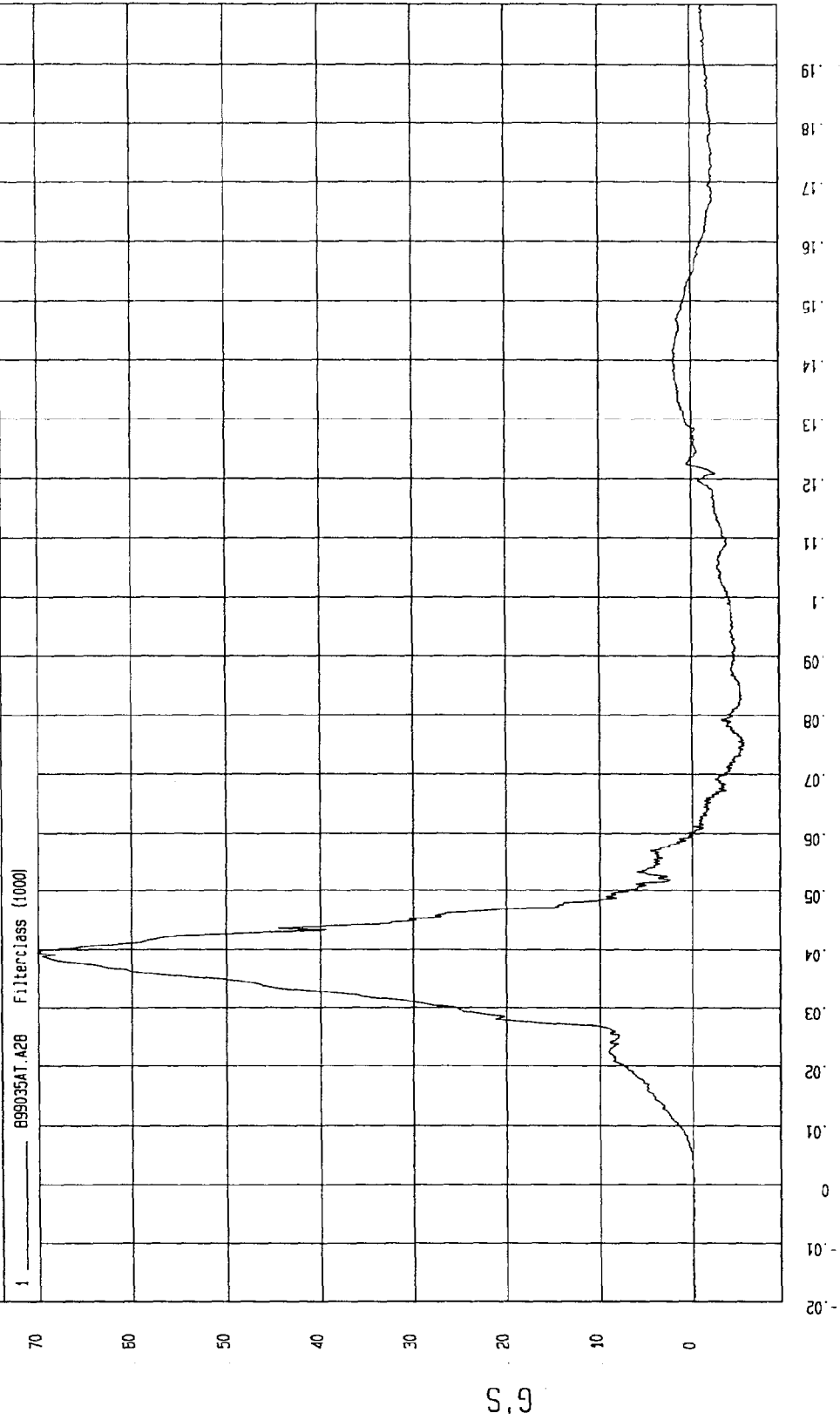
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 70.16 G'S at 39 msec

Minimum = -5.65 G'S at 75 msec

REAR PASSENGER PELVIS Y ACCELERATION



MCA Research
03-16-1999 16:07

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

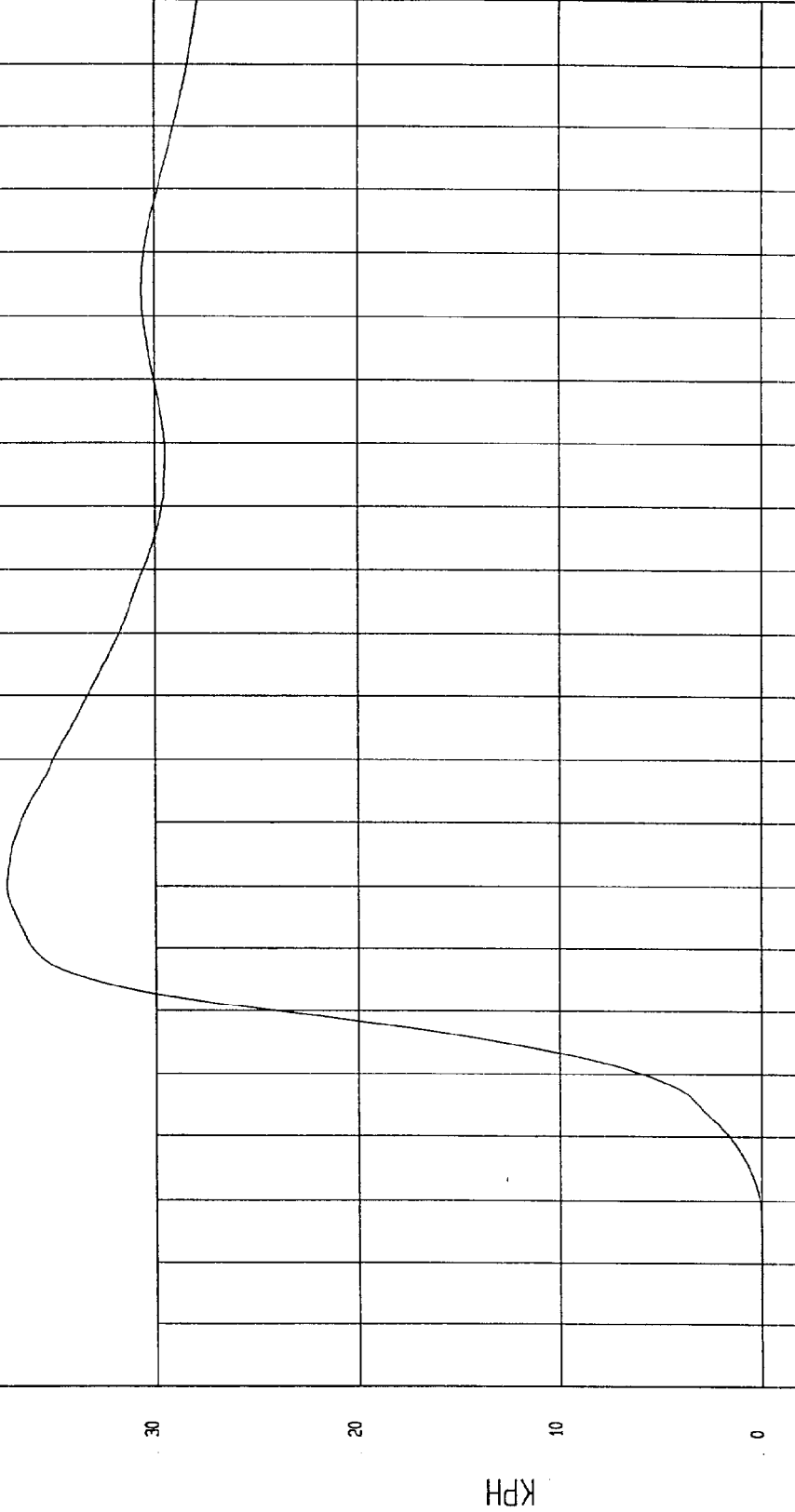
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 37.25 KPH at 60 msec

Minimum = -1.42E-02 KPH at 2 msec

REAR PASSENGER PELVIS Y VELOCITY

1 ——— B99035A1.V28 Filterclass (180)



WCA Research
03-16-1999 16:42

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

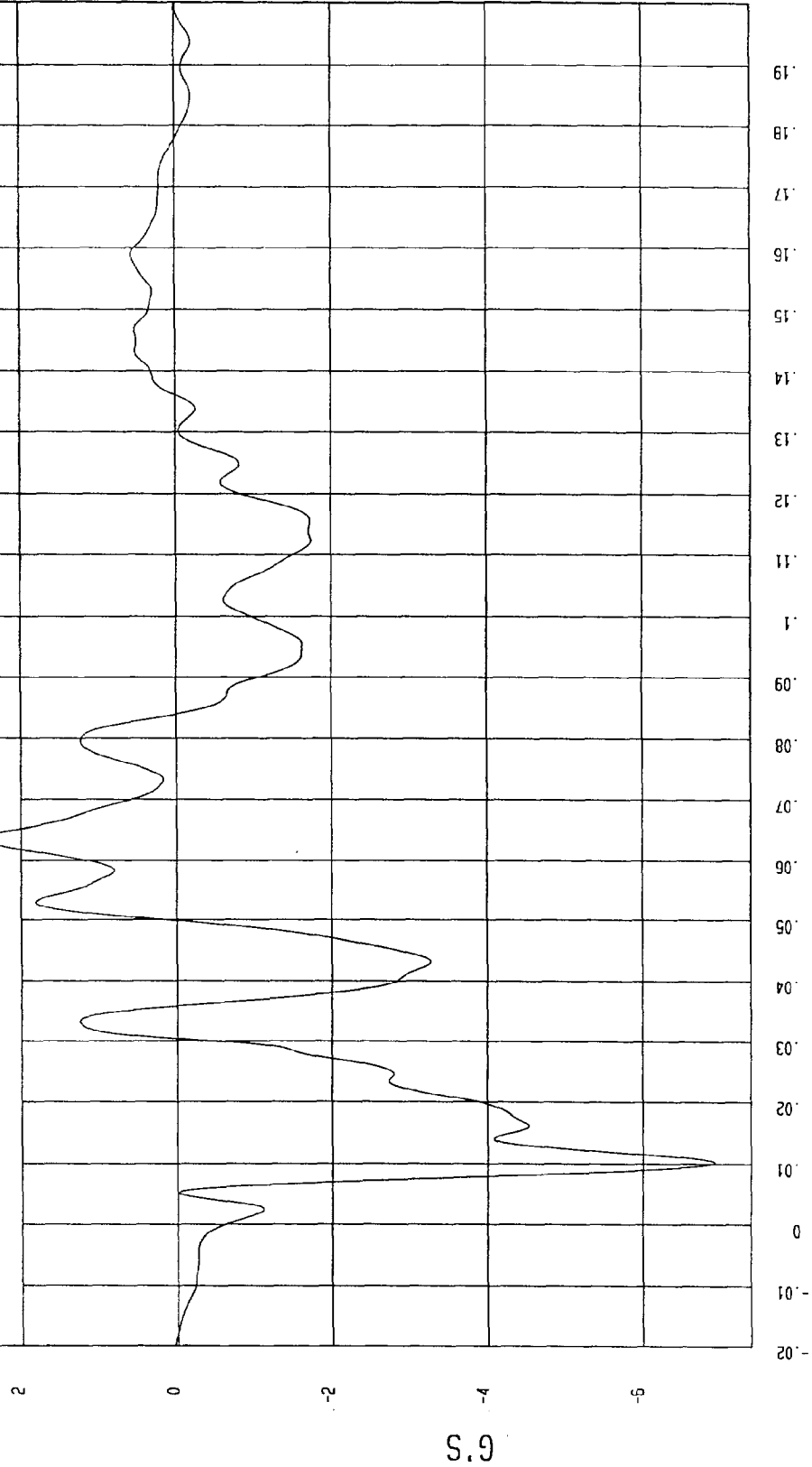
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 2.43 G'S at 63 msec

Minimum = -6.93 G'S at 10 msec

RIGHT SIDE SILL AT FRONT SEAT X ACCELERATION

1 B99035AF.A32 Filterclass (60)



MGA Research
03-16-1999 16:49

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

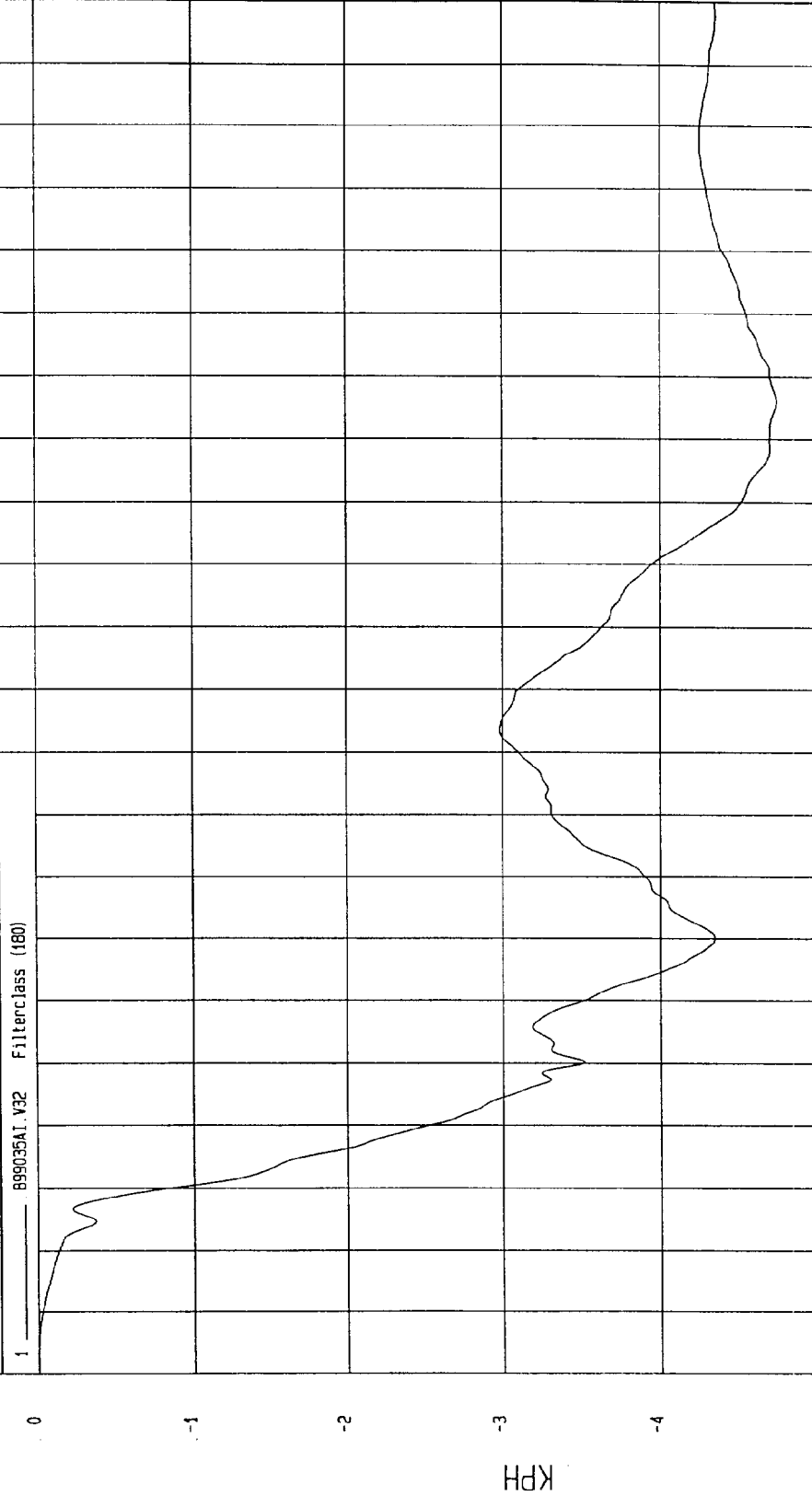
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 2.15E-03 KPH at -18 msec

Minimum = -4.74 KPH at 136 msec

RIGHT SIDE SILL AT FRONT SEAT X VELOCITY



TIME Seconds

WCA Research
03-16-1999 16:57

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

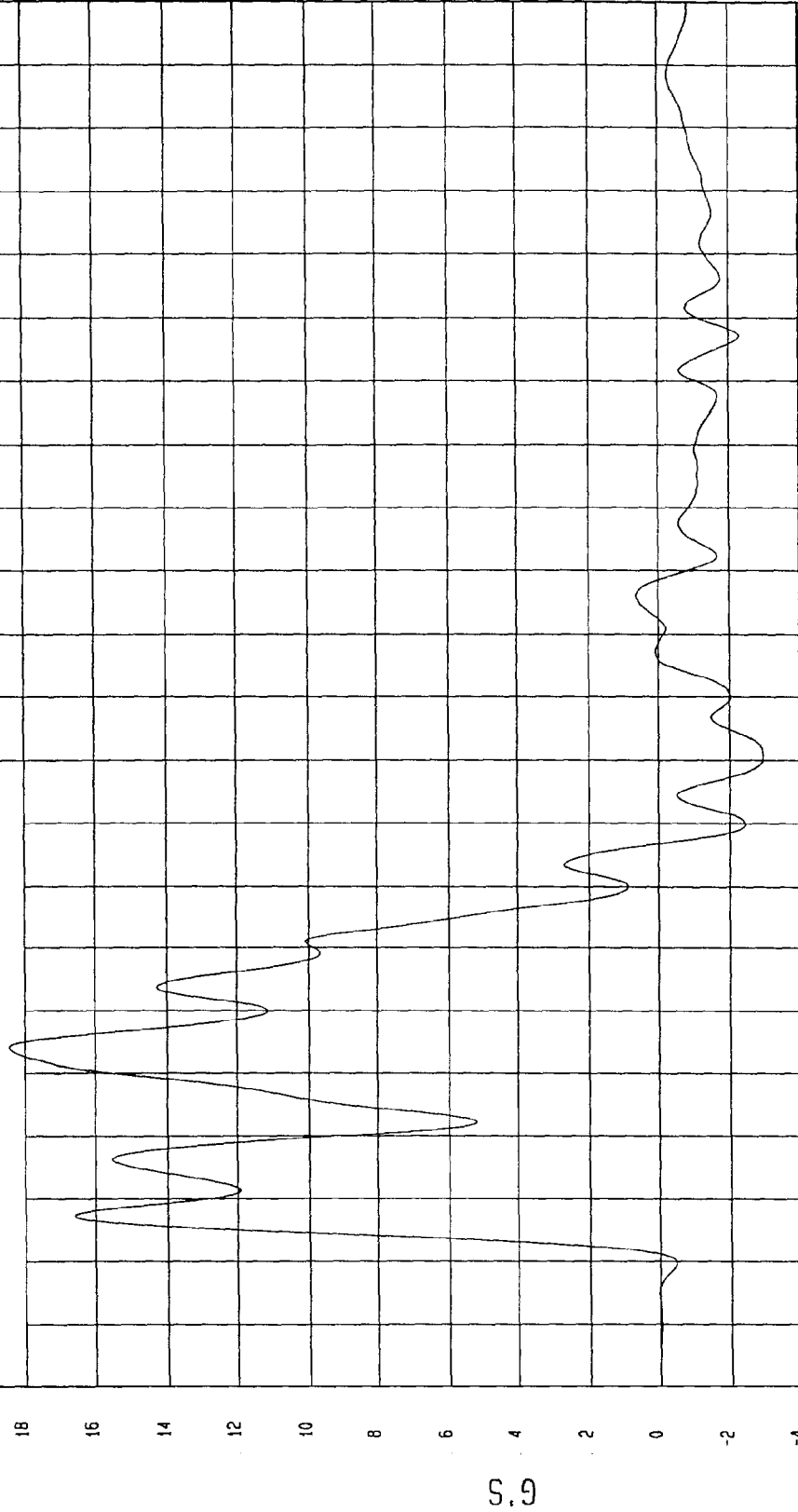
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 18.43 G'S at 34 msec

Minimum = -2.96 G'S at 81 msec

RIGHT SIDE SILL AT FRONT SEAT Y ACCELERATION

1 B99035AF.A33 Filterclass (60)



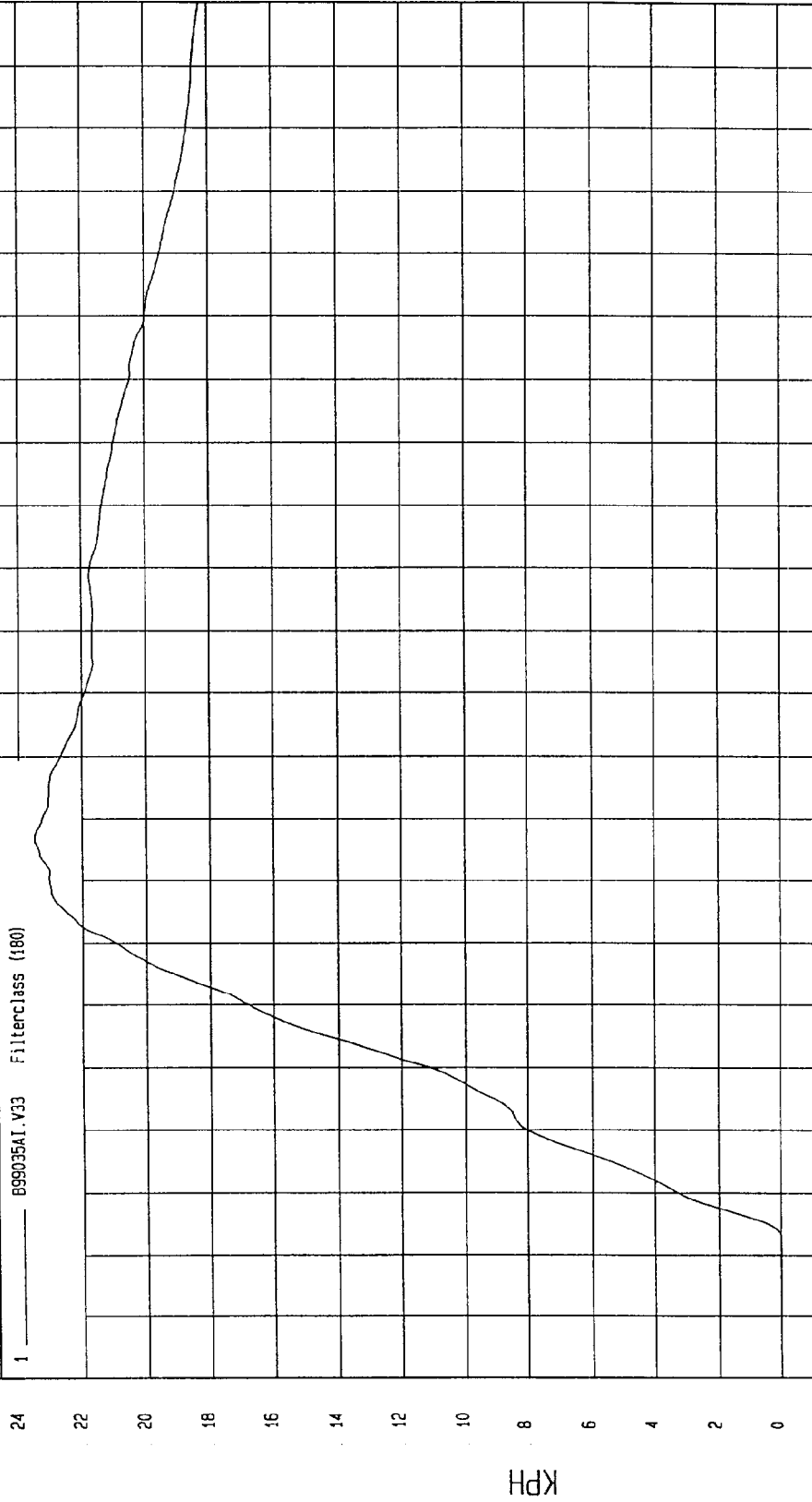
WCA Research
03-16-1999 16:49

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -8.13E-03 KPH at -6 msec Maximum = 23.51 KPH at 67 msec

RIGHT SIDE SILL AT FRONT SEAT Y VELOCITY

1 _____ B99035A1.V33 Filterclass (180)



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 7.53 G'S at 42 msec

Minimum = -2.68 G'S at 24 msec

RIGHT SIDE SILL AT FRONT SEAT Z ACCELERATION

1 ——— B99035AF.A34 FilterClass (60)

8

6

4

2

G.S

0

-2

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

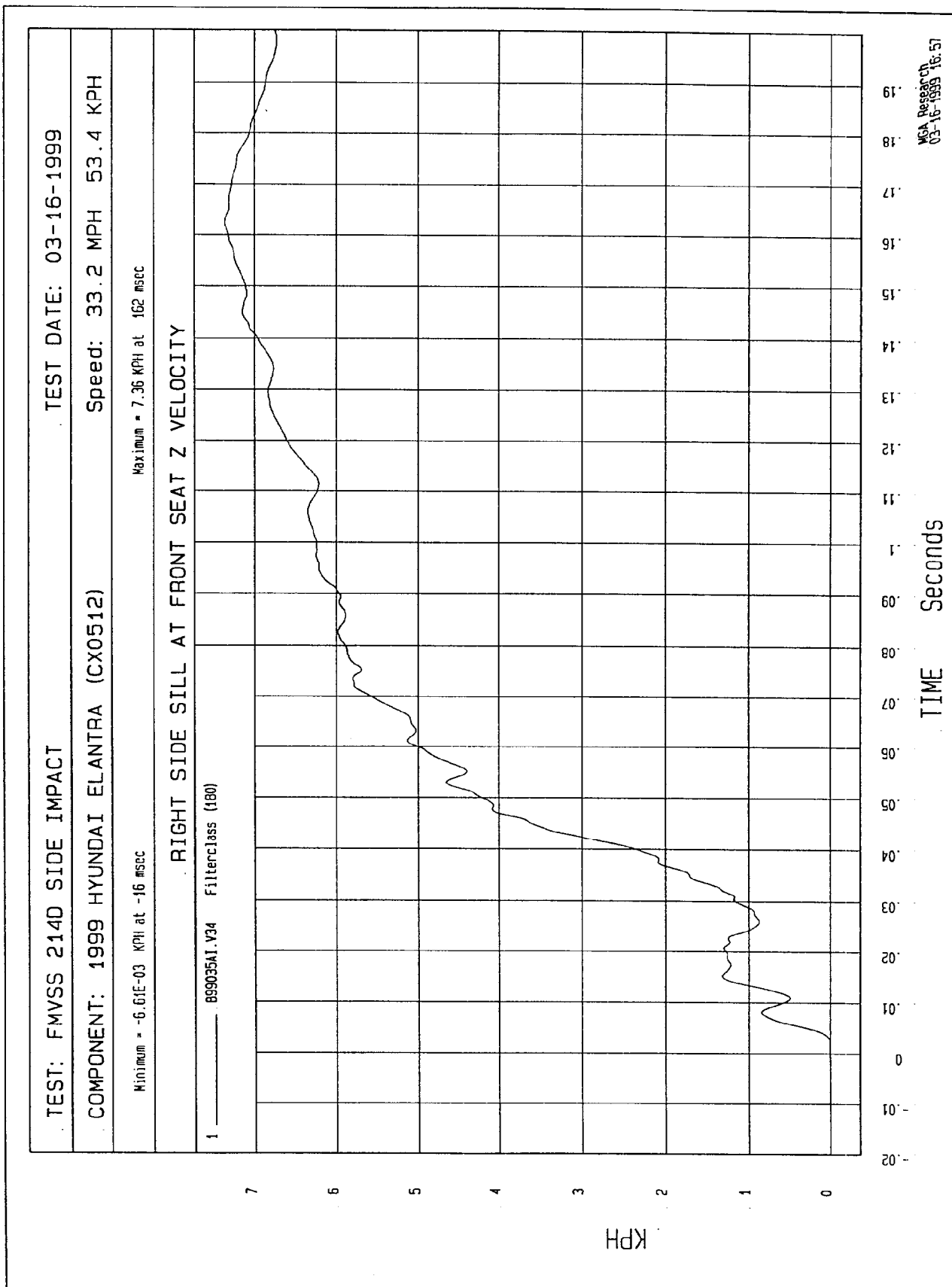
0

-01

-02

TIME (SECONDS)

MGA Research
03-16-1999 16:49



MOA Research
03-16-1999 16:57

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

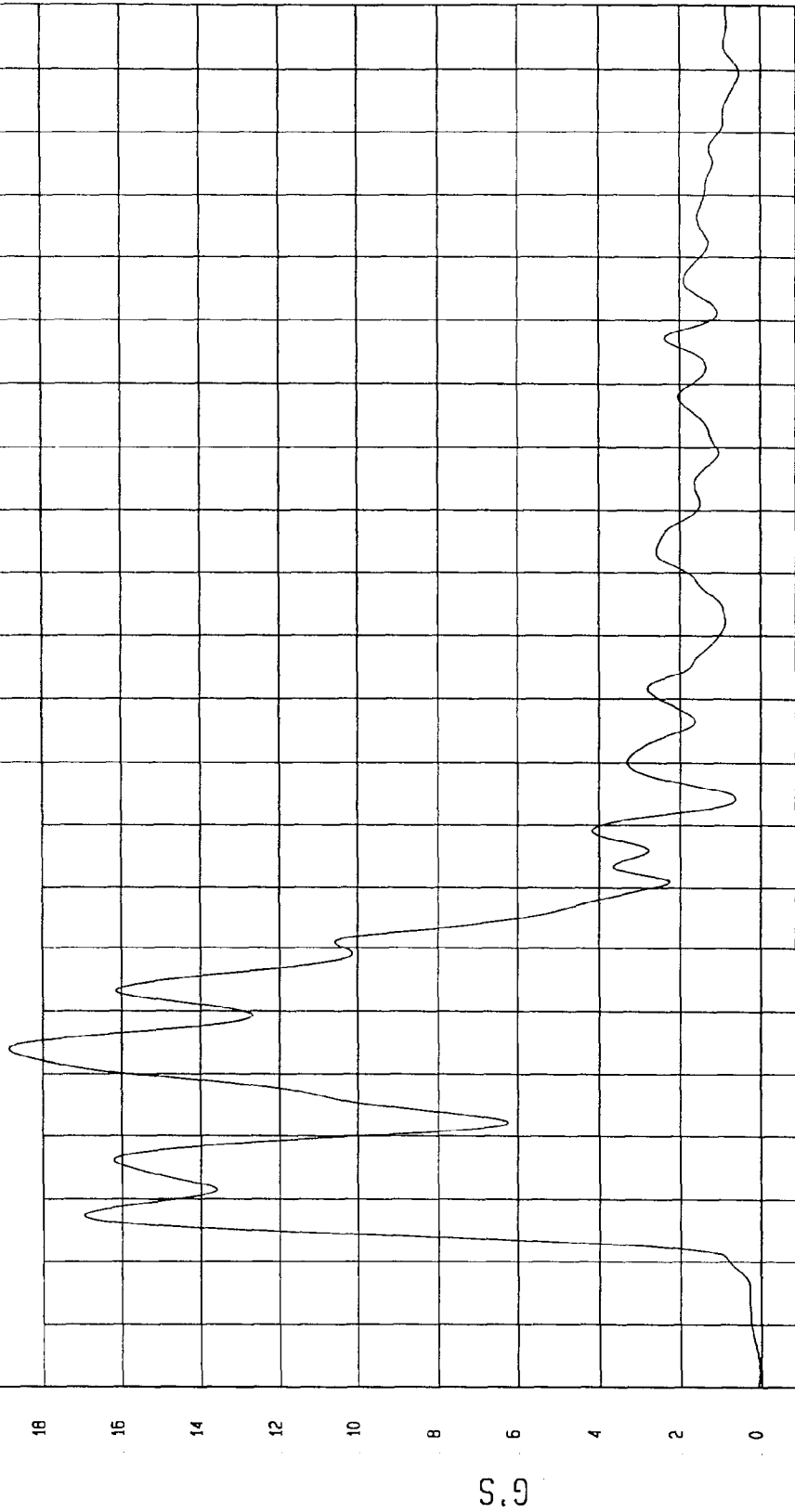
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 18.85 G's at 34 msec

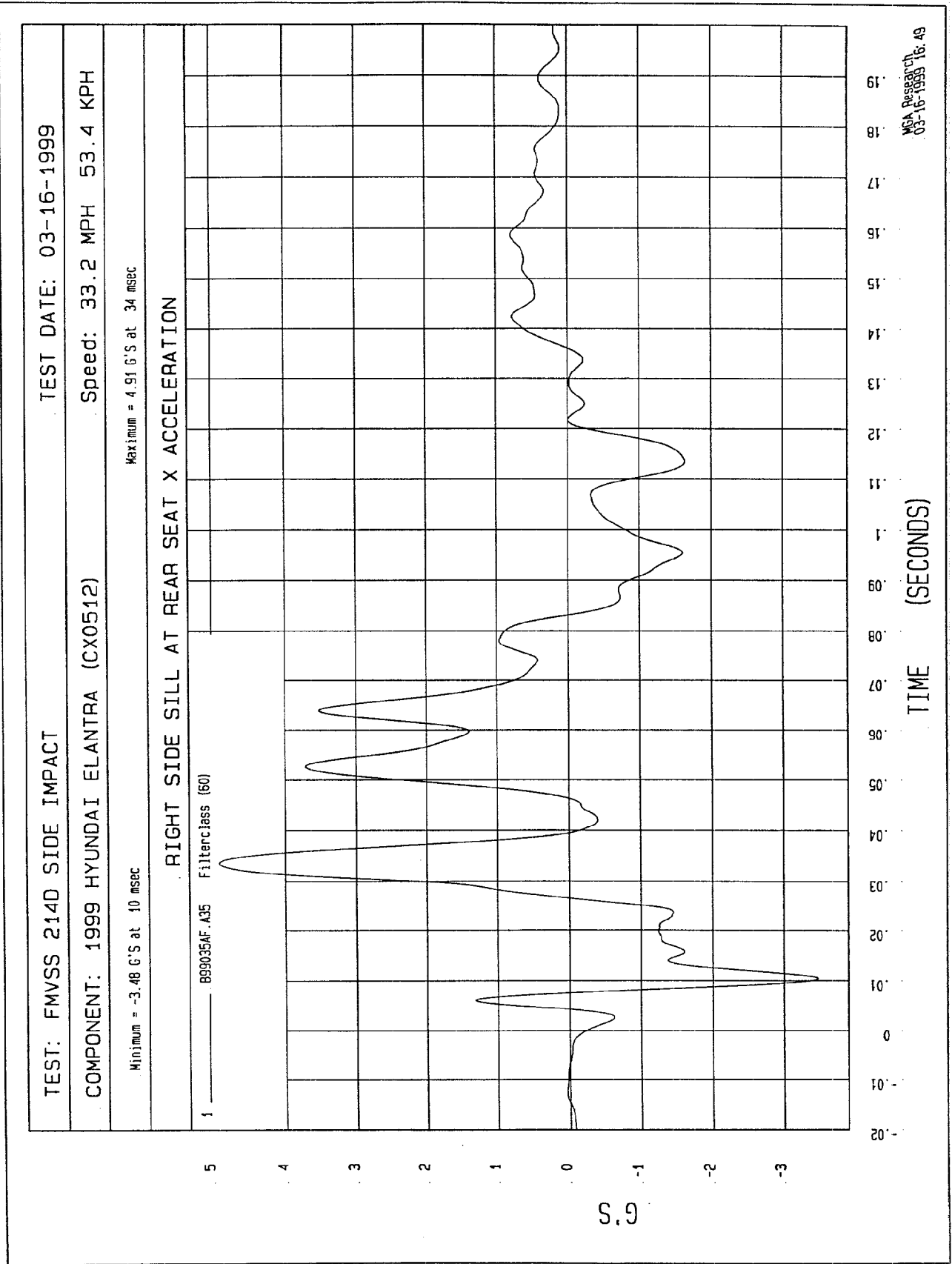
Minimum = 4.04E-02 G's at -17 msec

RIGHT SIDE SILL AT FRONT SEAT RESULTANT ACCELERATION

1 — 699035AV A32 Filterclass (60)



NSA Research
03-16-1999 16:49



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

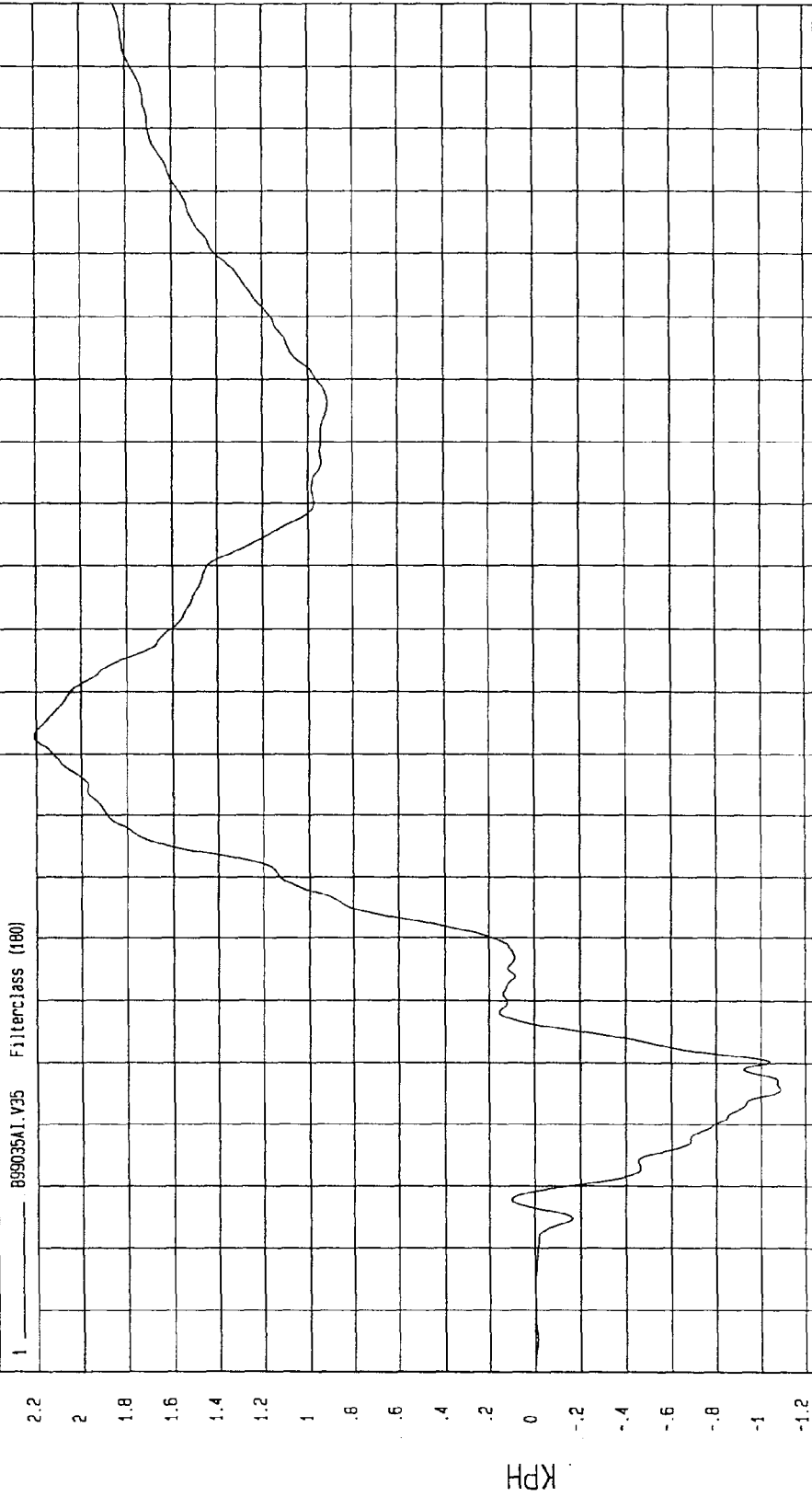
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 2.21 KPH at 83 msec

Minimum = -1.09 KPH at 26 msec

RIGHT SIDE SILL AT REAR SEAT X VELOCITY

1 ——— B89035A1.V35 Filterclass (100)



MCA Research
03-16-1999 18:57

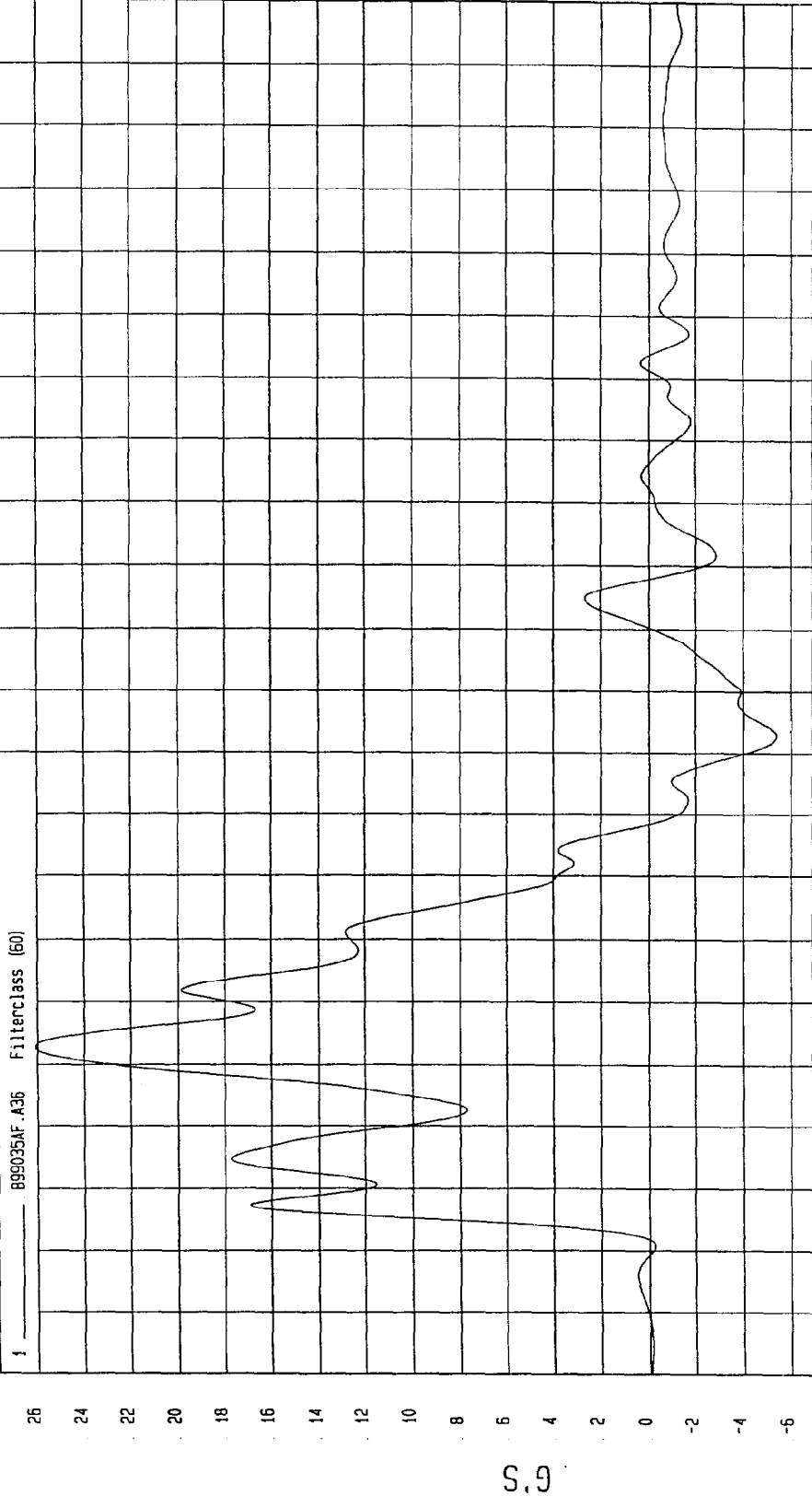
TIME Seconds

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -5.39 G'S at 83 msec Maximum = 26.09 G'S at 33 msec

RIGHT SIDE SILL AT REAR SEAT Y ACCELERATION



TIME (SECONDS)

WCA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

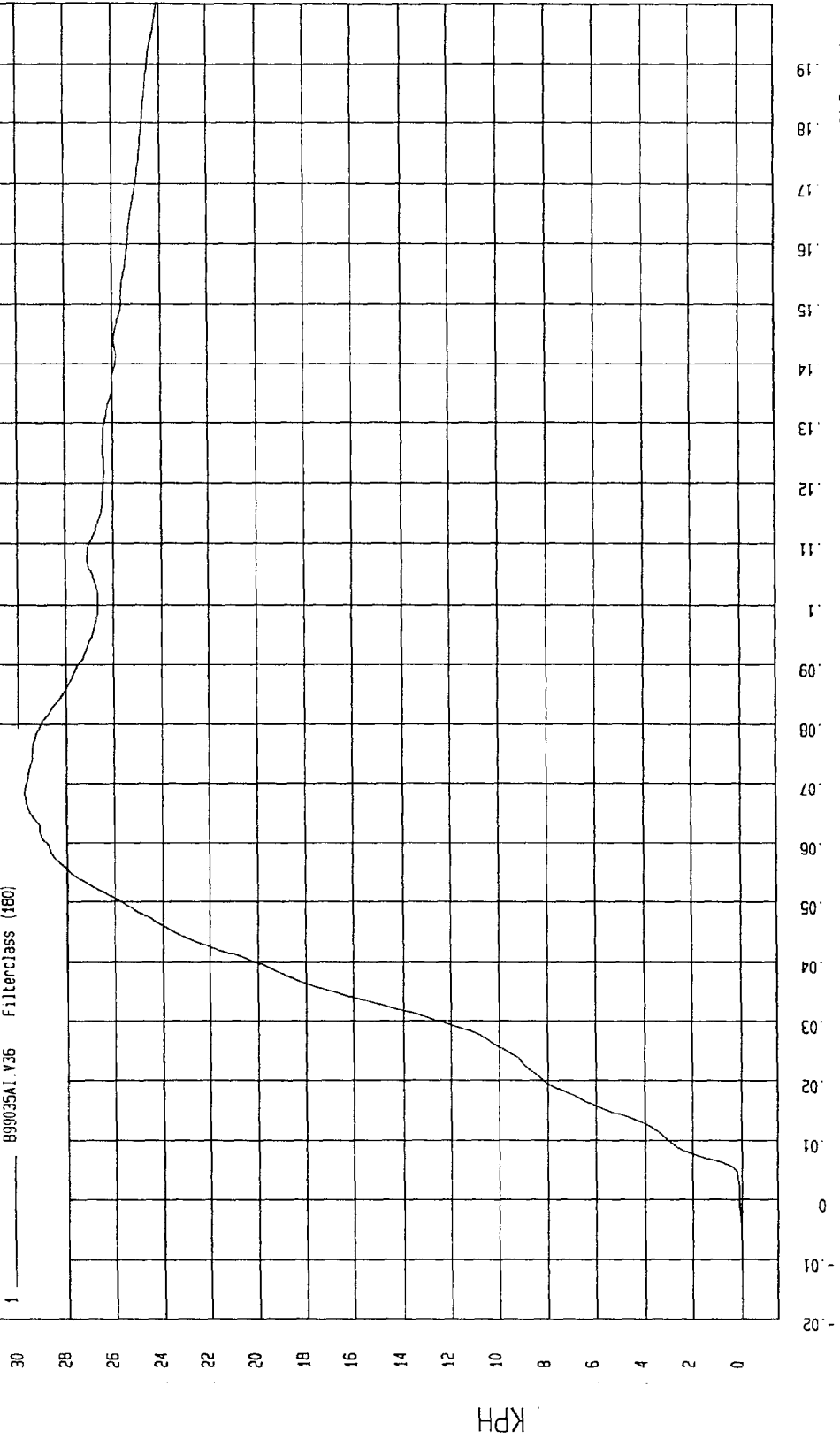
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 29.75 KPH at 68 msec

Minimum = -2.81E-02 KPH at -11 msec

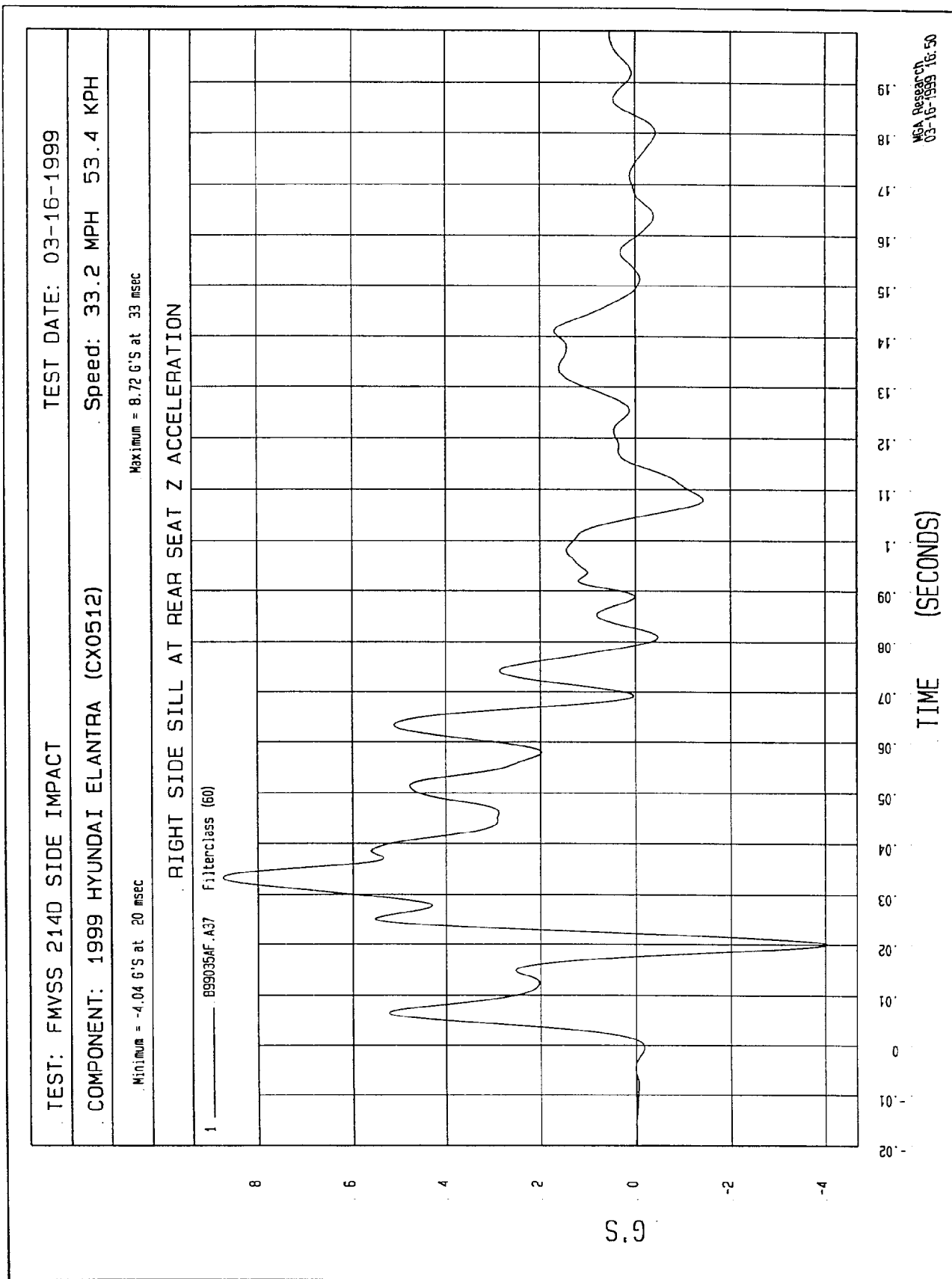
RIGHT SIDE SILL AT REAR SEAT Y VELOCITY

1 B99035A1.V36 FilterClass (180)



MCA Research
03-16-1999 15:57

TIME Seconds



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

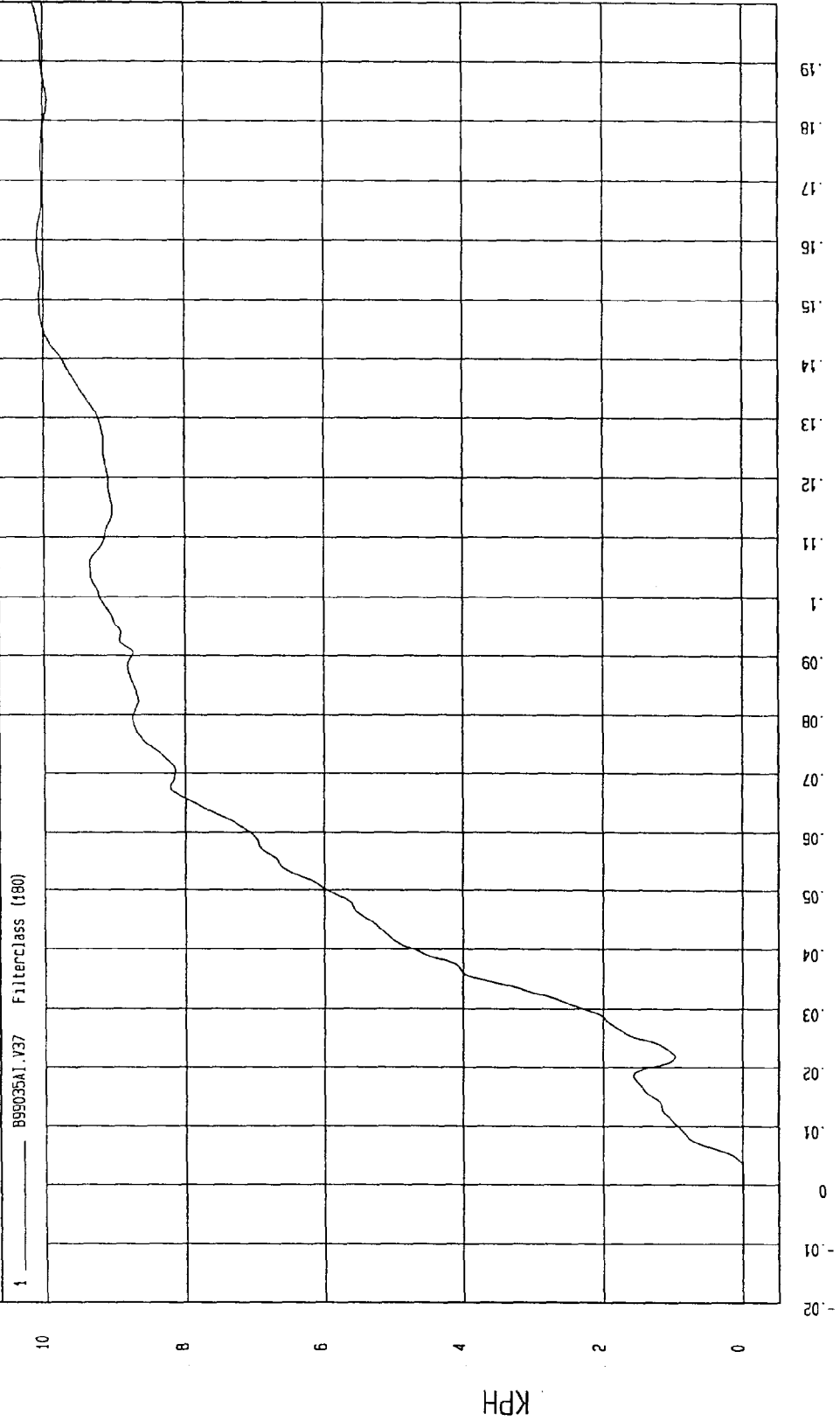
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 10.14 KPH at 200 msec

Minimum = -1.20E-02 KPH at -6 msec

RIGHT SIDE SILL AT REAR SEAT Z VELOCITY

1 B99035A1.V37 Filterclass (180)



MCA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

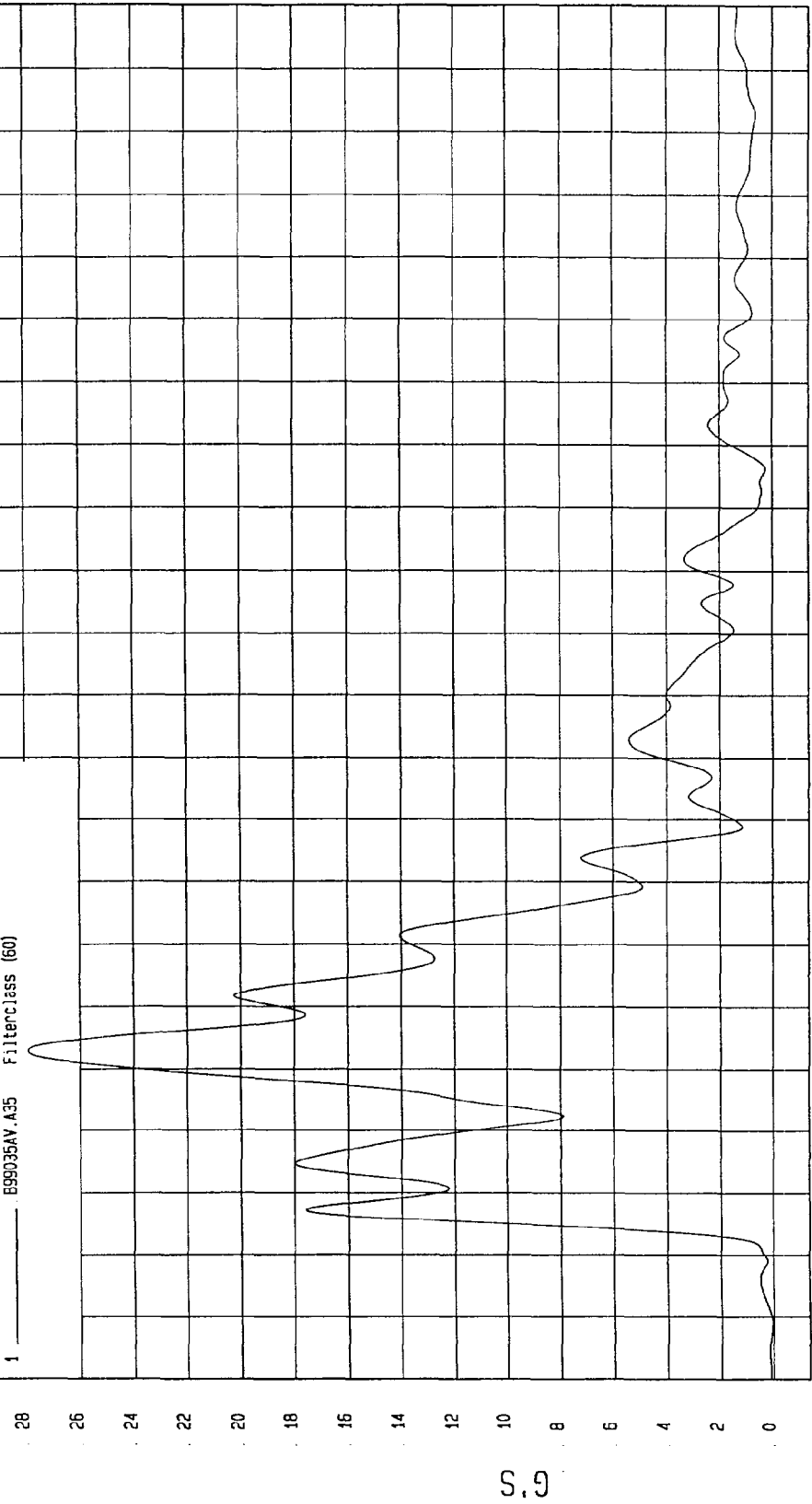
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 27.91 G's at 33 msec

Minimum = .05 G's at -11 msec

RIGHT SIDE SILL AT REAR SEAT RESULTANT ACCELERATION

1 B95035AV.A35 Filterclass (60)



MECA Research
03-16-1999 16:50

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 3.22 G's at 27 msec

Minimum = -12.23 G's at 20 msec

REAR FLOORPAN ABOVE AXLE X ACCELERATION

1 B99035AF.A08 FilterClass (60)



MCA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

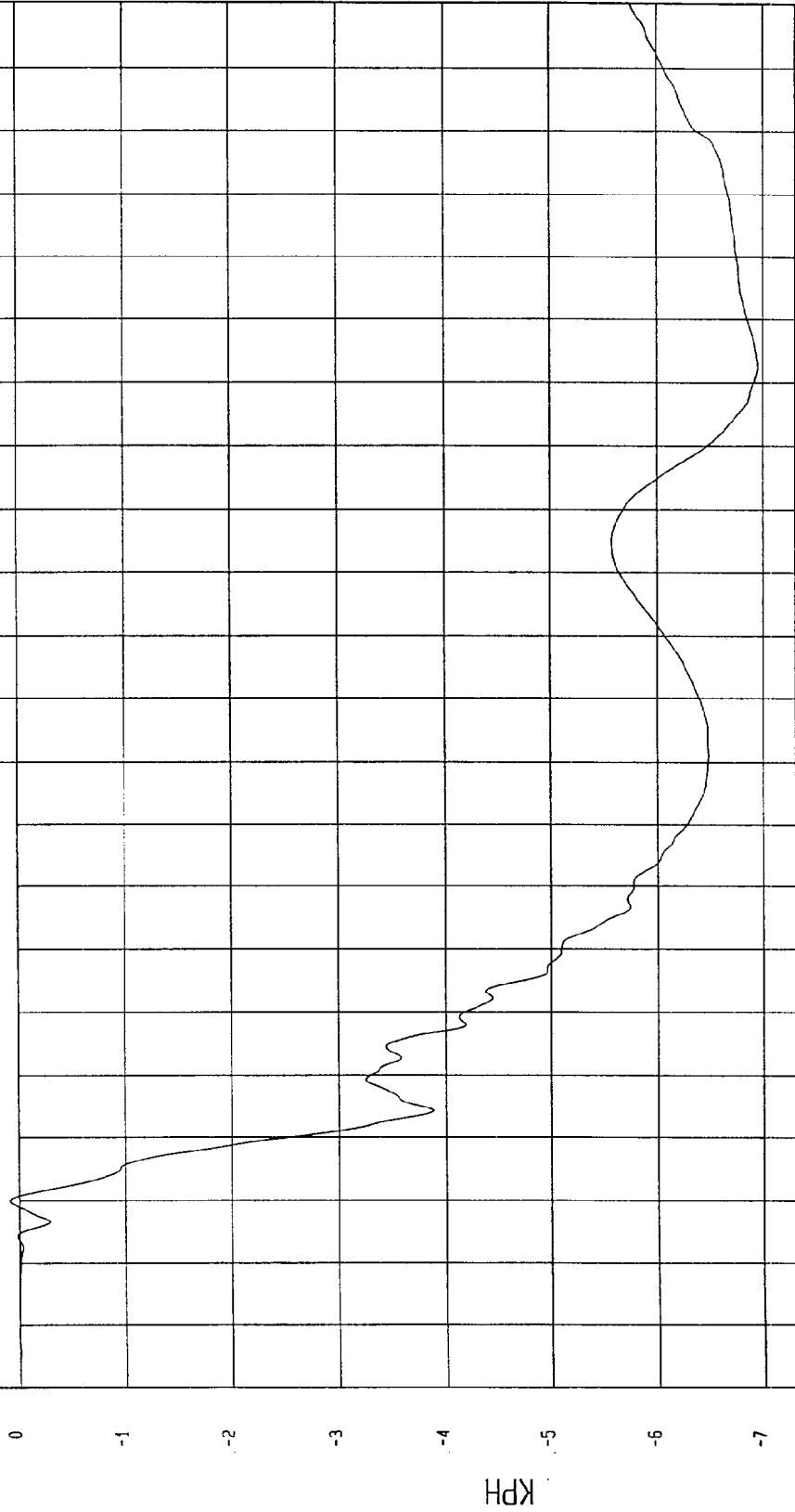
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 8.63E-02 KPH at 10 msec

Minimum = -6.96 KPH at 143 msec

REAR FLOORPAN ABOVE AXLE X VELOCITY

1 B99035A1.V08 FilterClass (180)



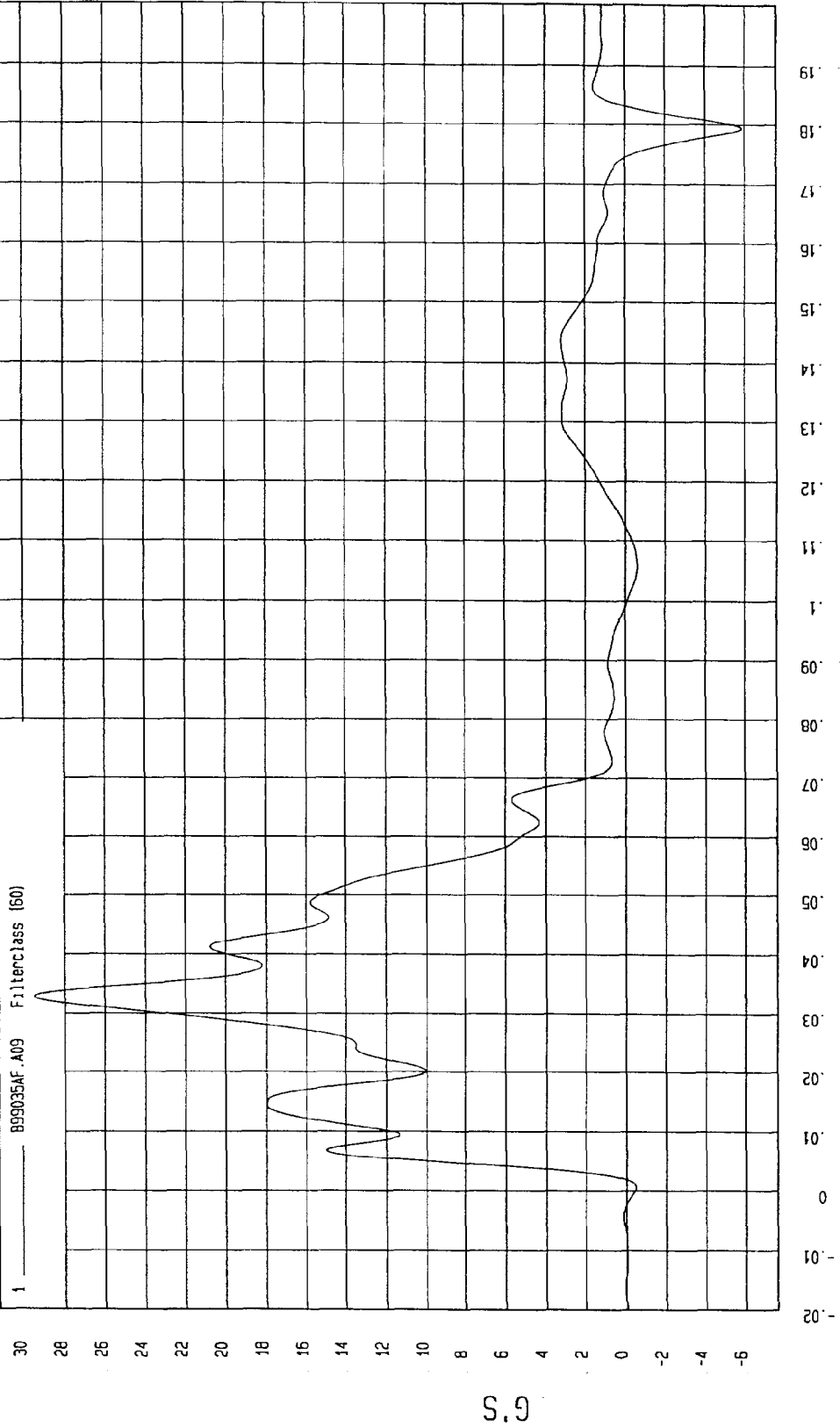
MSA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

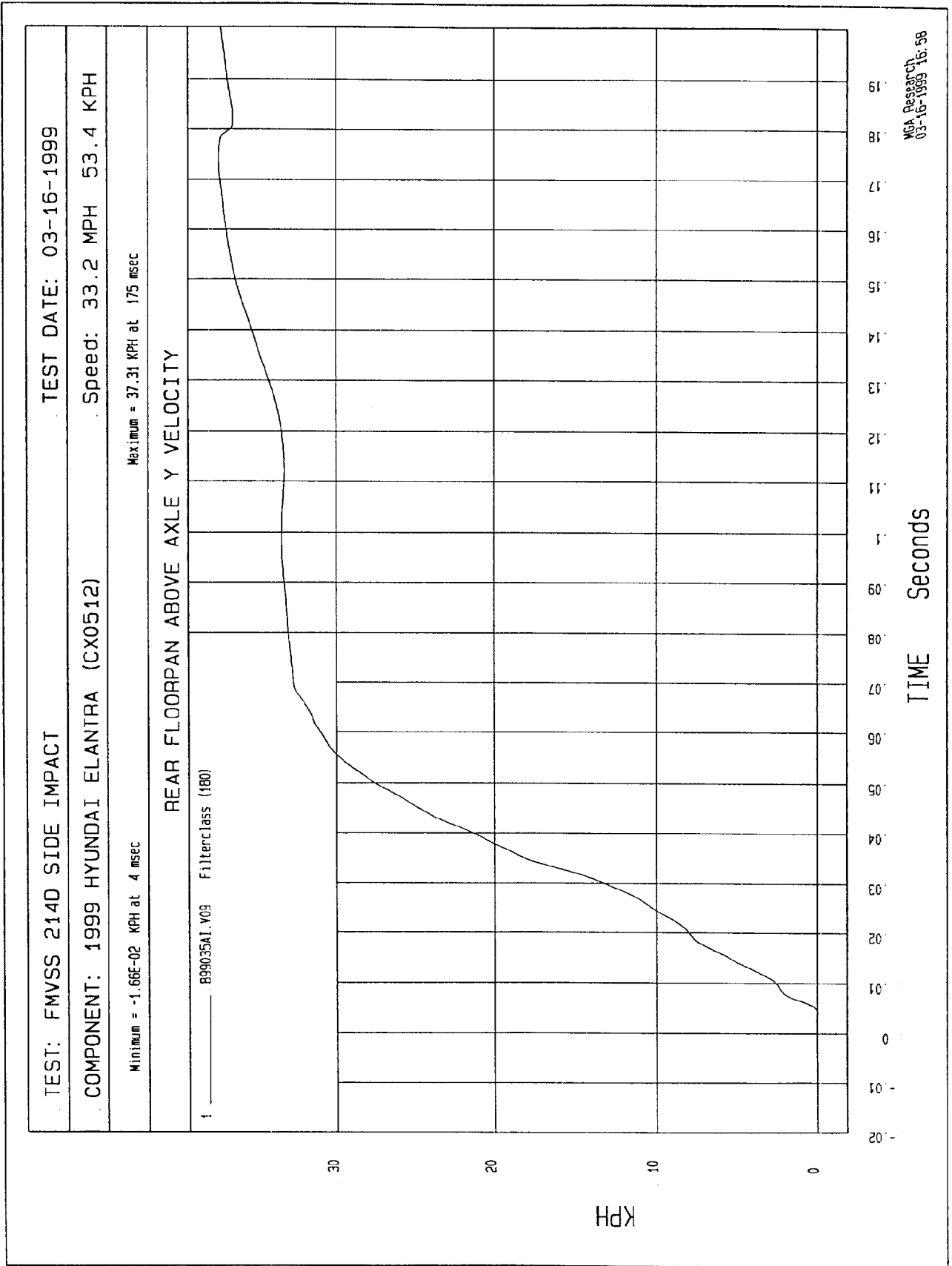
Minimum = -5.86 G'S at 179 msec Maximum = 29.48 G'S at 33 msec

REAR FLOORPAN ABOVE AXLE Y ACCELERATION

1 _____ B99035AF.A09 Filterclass (50)



MGA Research
03-16-1999 16:50



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

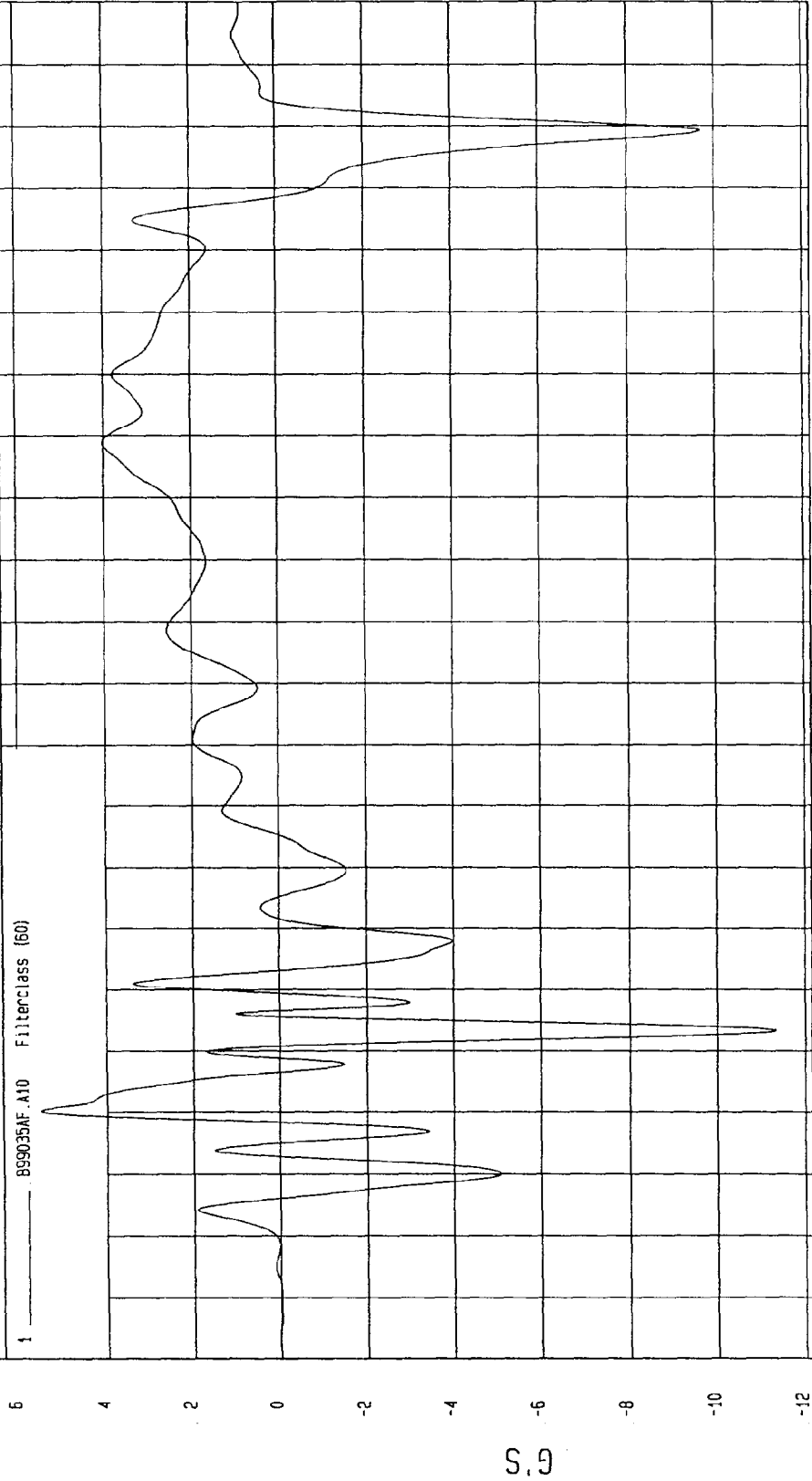
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 5.51 G'S at 20 msec

Minimum = -11.33 G'S at 33 msec

REAR FLOORPAN ABOVE AXLE Z ACCELERATION

1 899035AF.A10 FilterClass (60)



MGA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 6.32 KPH at 168 msec

Minimum = -1.67 KPH at 66 msec

REAR FLOORPAN ABOVE AXLE Z VELOCITY

1 899035A1.V10 FilterClass (180)



MOA Research
03-16-1999 16:58

TIME Seconds

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

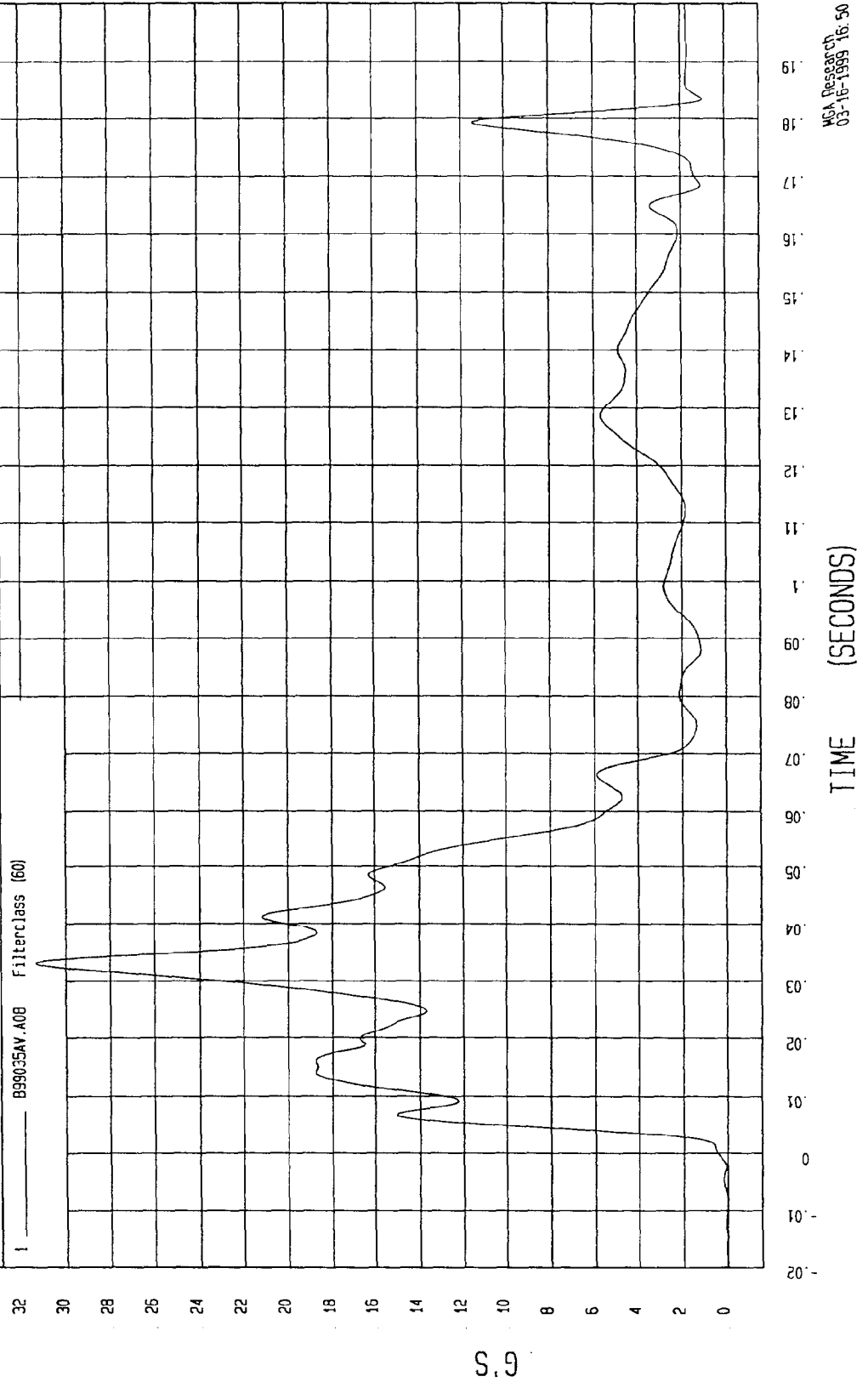
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 31.38 G'S at 33 msec

Minimum = 8.86E-03 G'S at -15 msec

REAR FLOORPAN ABOVE AXLE RESULTANT ACCELERATION



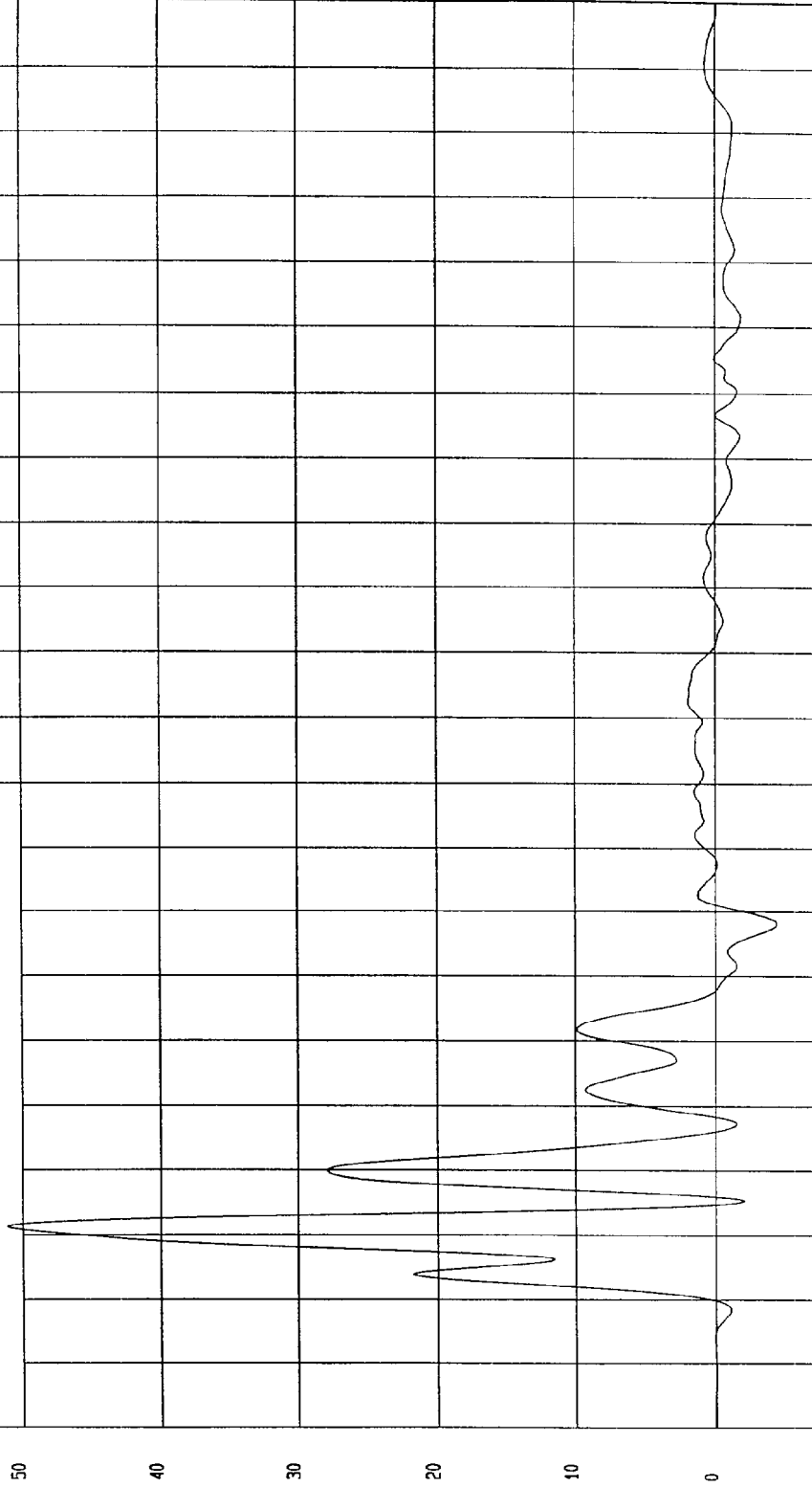
TEST: FMVSS 2140 SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -4.44 G'S at 58 msec Maximum = 51.07 G'S at 11 msec

LEFT SIDE SILL AT FRONT SEAT Y ACCELERATION

1 B99035AF A38 Filterclass (60)



MGA Research
03-16-1999 16:49

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

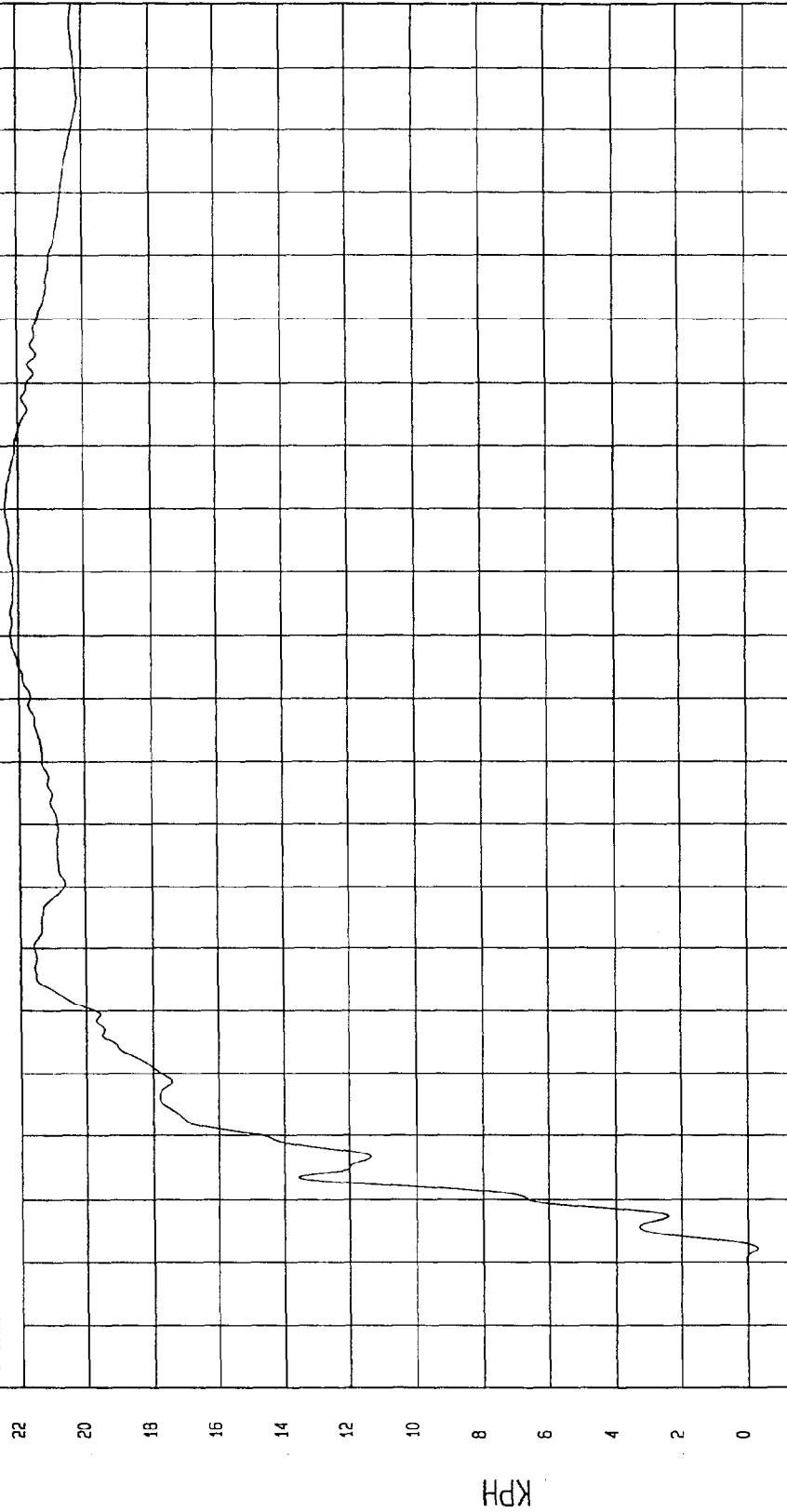
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Minimum = -3 KPH at 2 msec

Maximum = 22.39 KPH at 120 msec

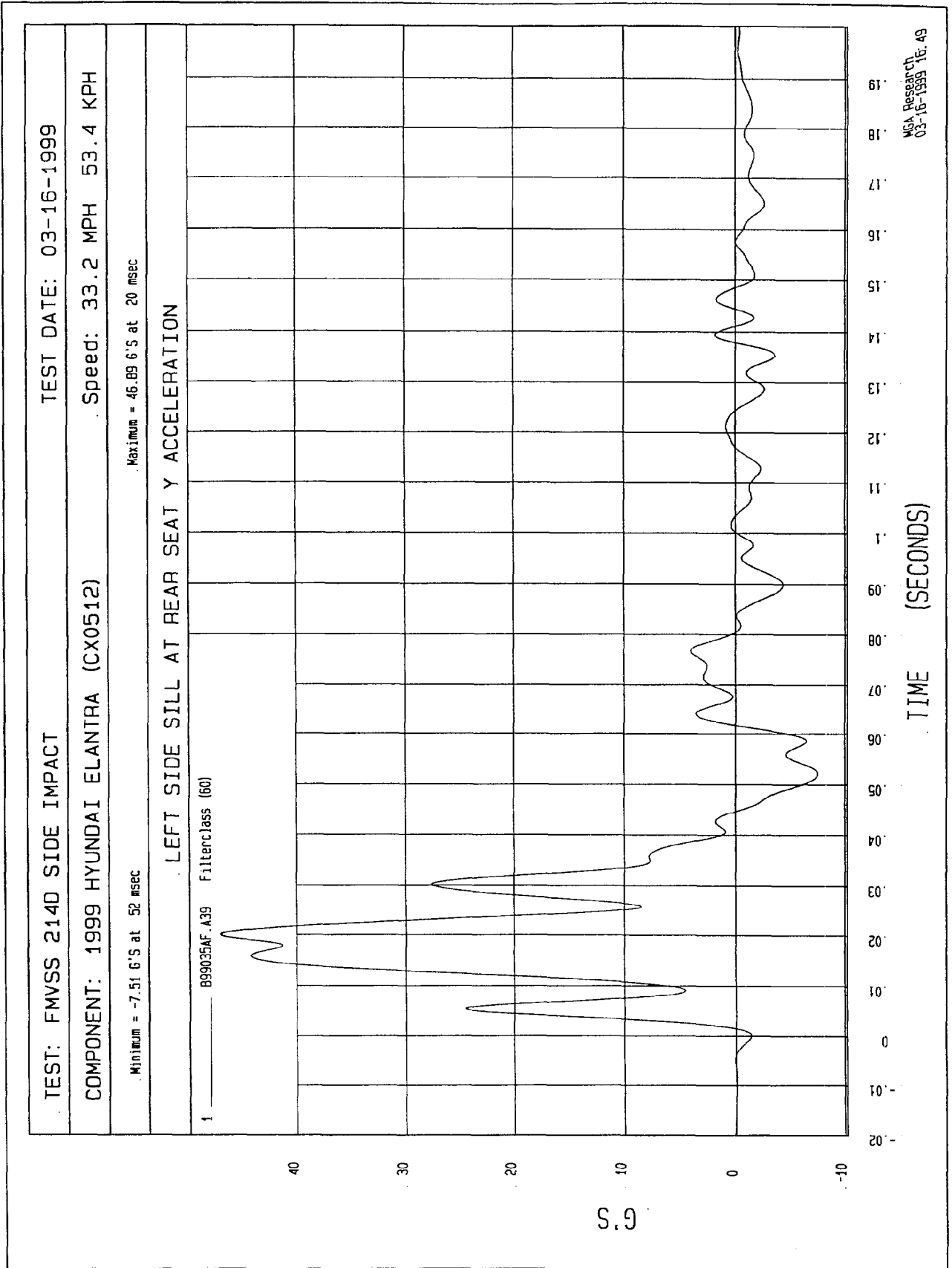
LEFT SIDE SILL AT FRONT SEAT Y VELOCITY

1 899035AI.V38 Filterclass (180)



WCA Research
03-16-1999 16:57

TIME Seconds



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

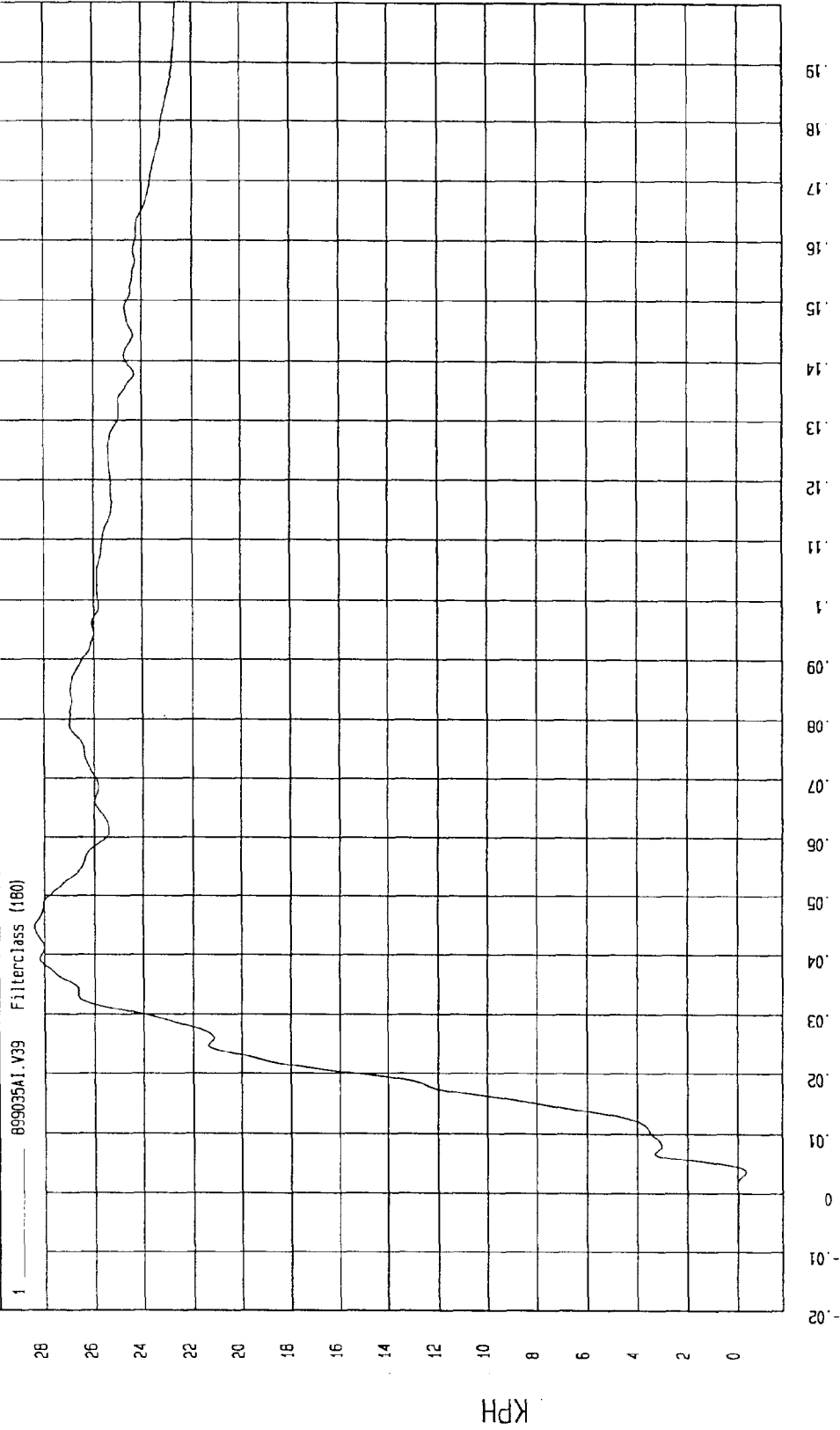
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 28.39 KPH at 45 msec

Minimum = -3.34 KPH at 4 msec

LEFT SIDE SILL AT REAR SEAT Y VELOCITY



NCA Research
03-16-1999 16.57

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

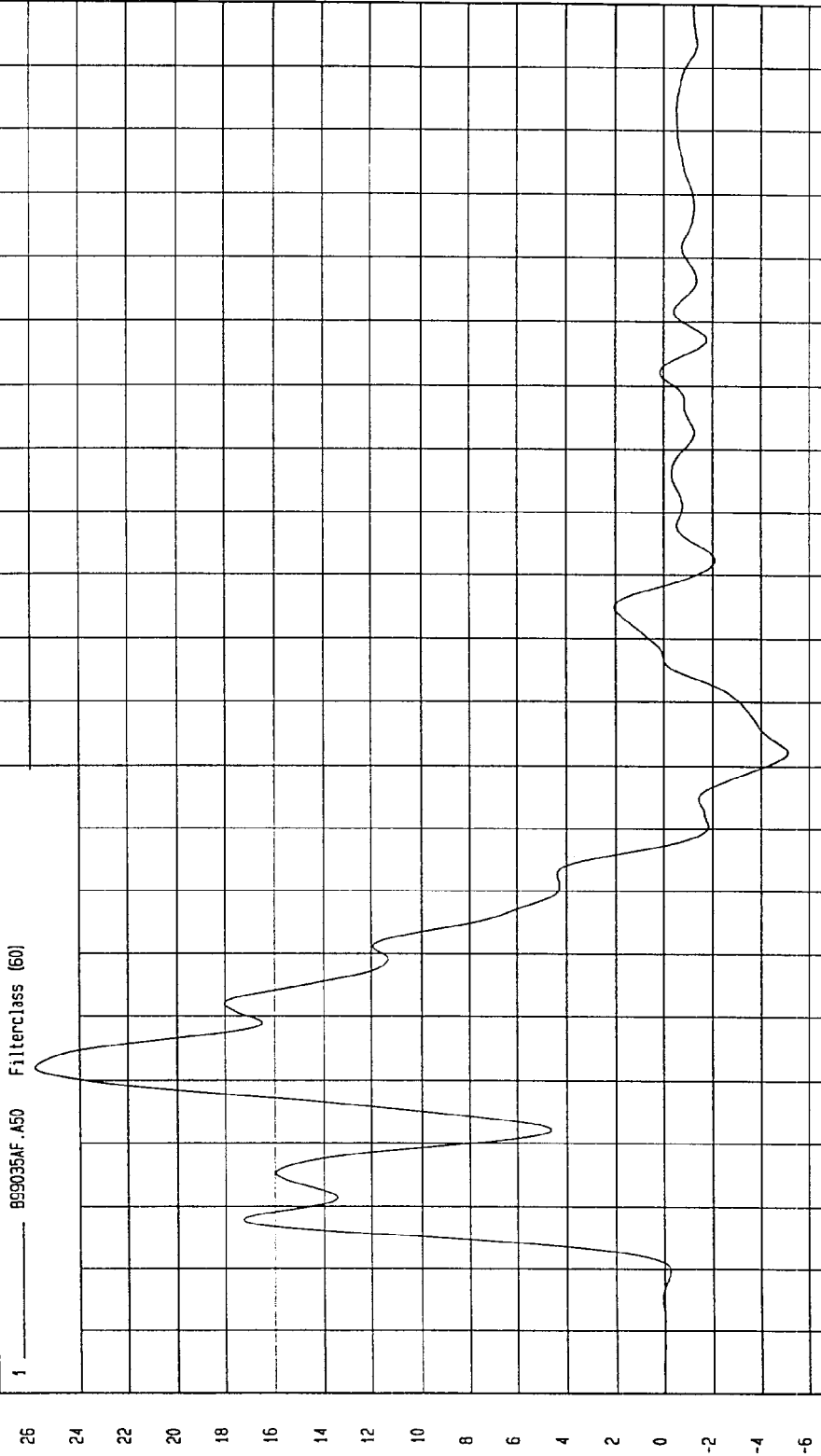
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 25.84 G'S at 32 msec

Minimum = -5.11 G'S at 82 msec

RIGHT REAR OCCUPANT COMPARTMENT Y ACCELERATION

1 899035AF.A50 Filterclass (60)



NSA Research
03-16-1999 16:50

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

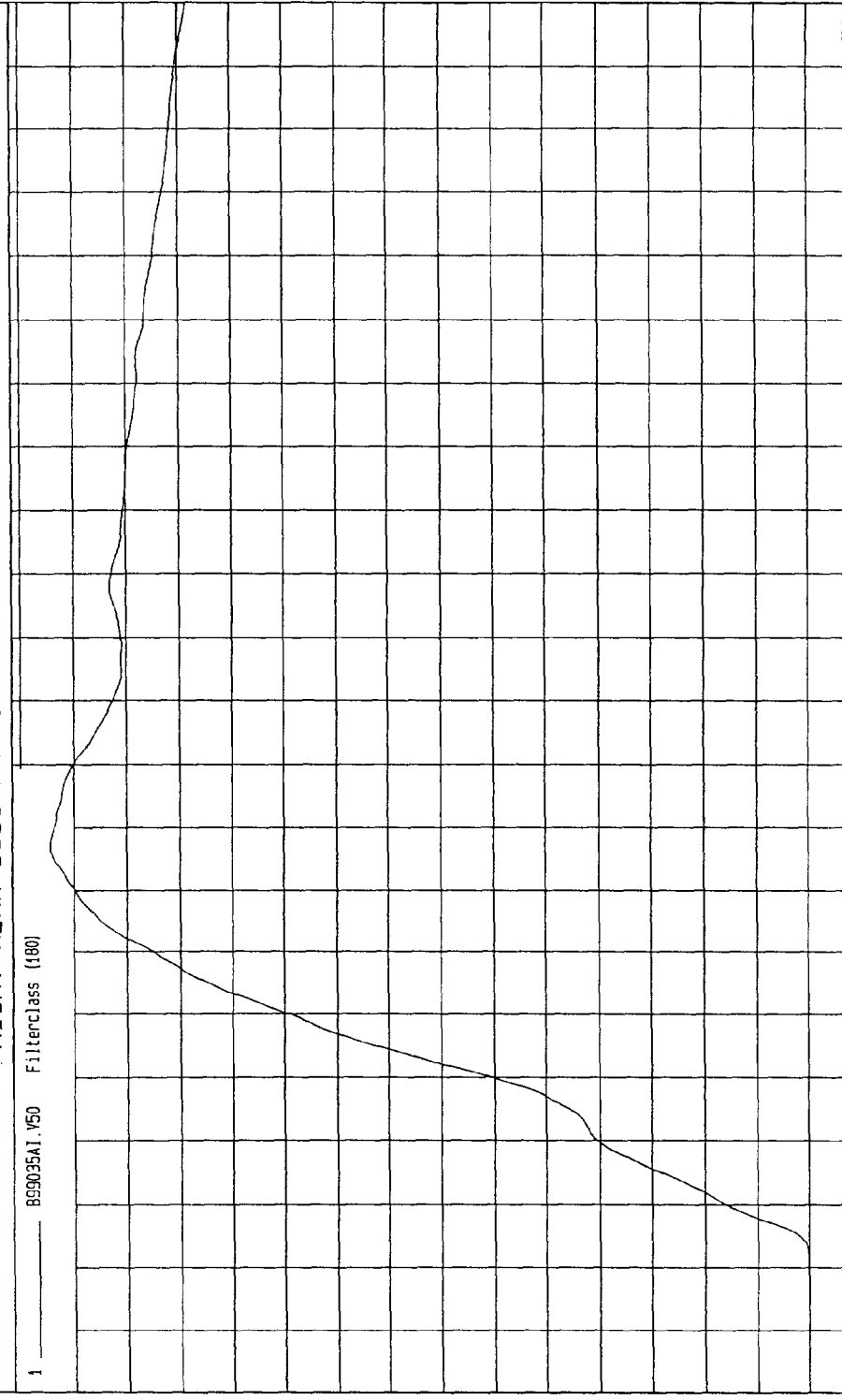
Maximum = 28.89 KPH at 67 msec

Minimum = -5.24E-03 KPH at -6 msec

RIGHT REAR OCCUPANT COMPARTMENT Y VELOCITY

1 _____ B99035A1.V50 Filterclass (180)

KPH



TIME Seconds

NCA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

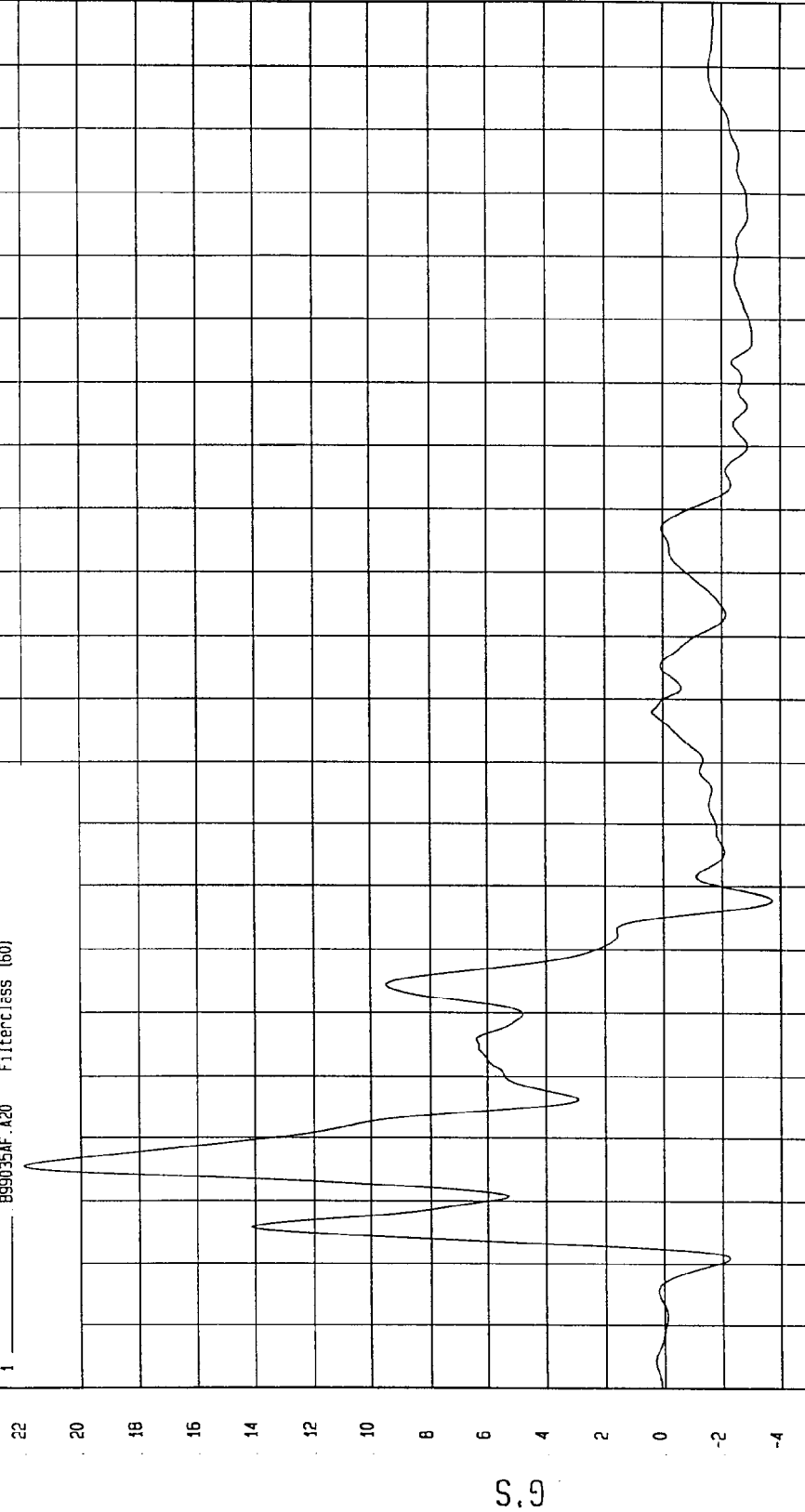
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 21.98 G'S at 16 msec

Minimum = -3.7 G'S at 58 msec

LEFT LOWER A-POST Y ACCELERATION

1 B99035AF.A20 Filterclass (60)



MCA Research
03-16-1999 16:50

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 14.62 KPH at 56 msec

Minimum = -4.4 KPH at 3 msec

LEFT LOWER A-POST Y VELOCITY

1 ——— B99035A1.V20 Filterclass (180)

14

12

10

8

6

4

2

0

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

-01

-02

MGA Research
03-16-1999 16:56

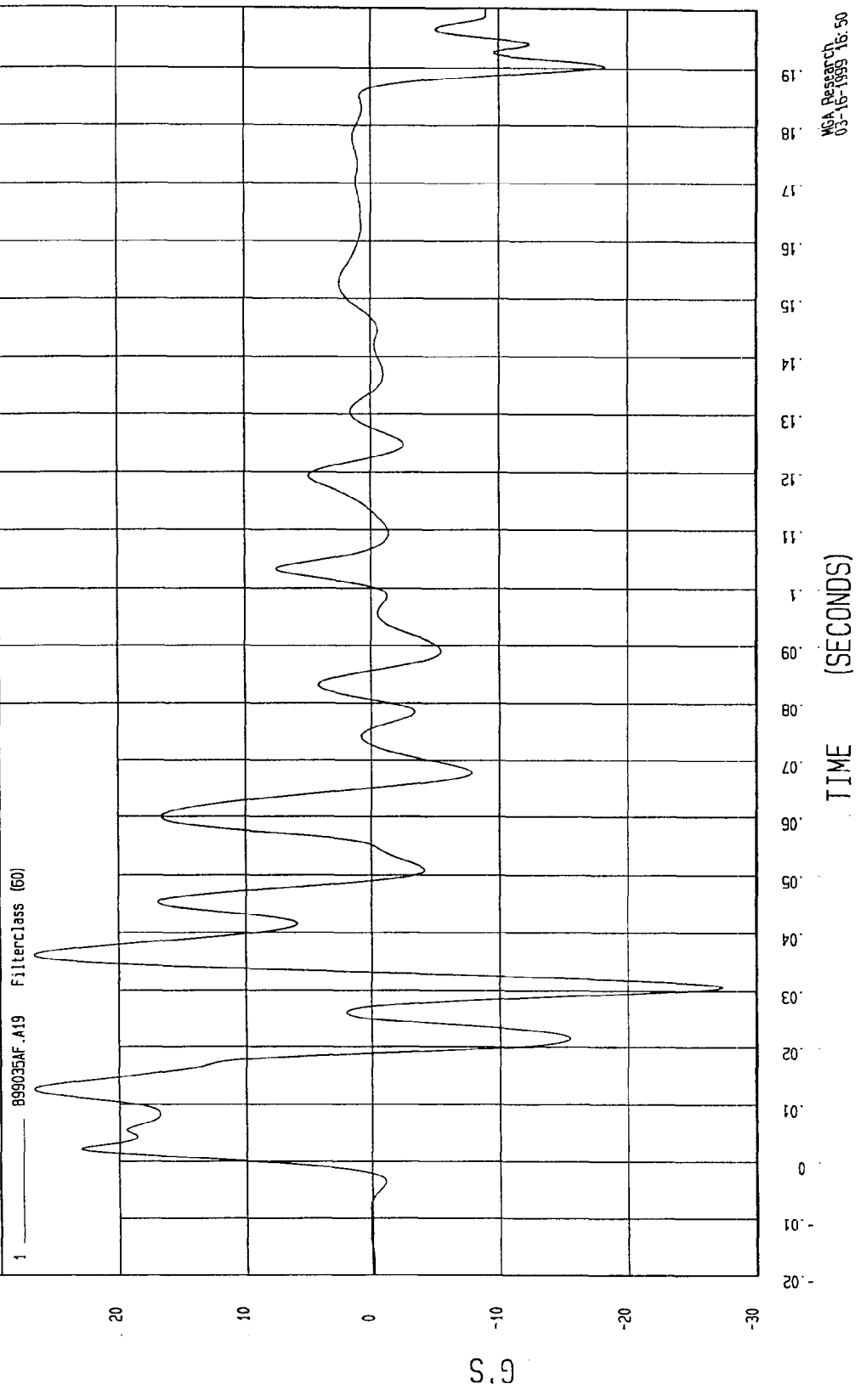
TIME Seconds

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -27.4 G'S at 31 msec Maximum = 26.47 G'S at 36 msec

LEFT MID A-POST Y ACCELERATION



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

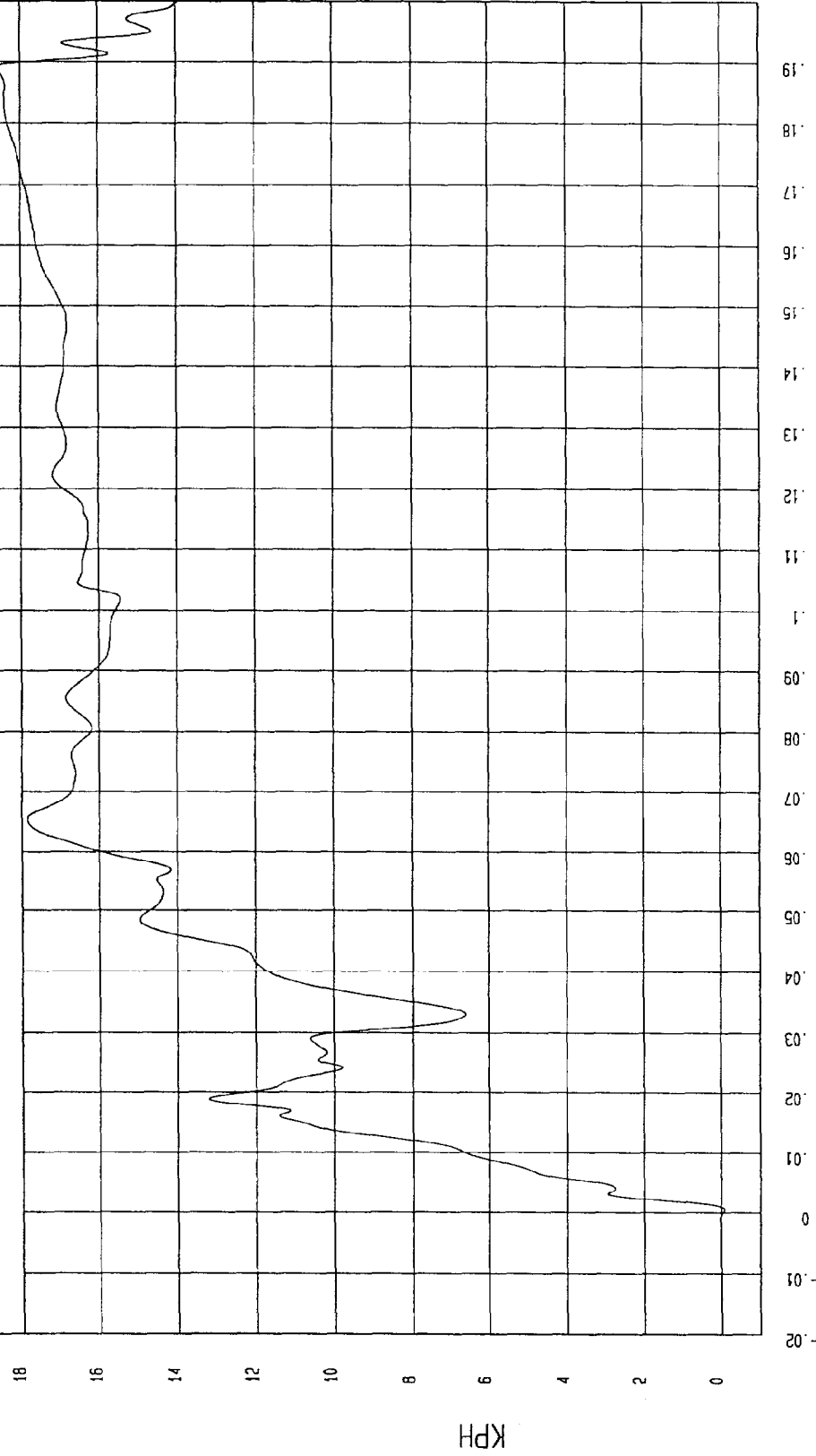
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 18.63 KPH at 189 msec

Minimum = -.09 KPH at 0 msec

LEFT MID A-POST Y VELOCITY

1 ——— B99035A1.V19 Filterclass (180)



MGA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

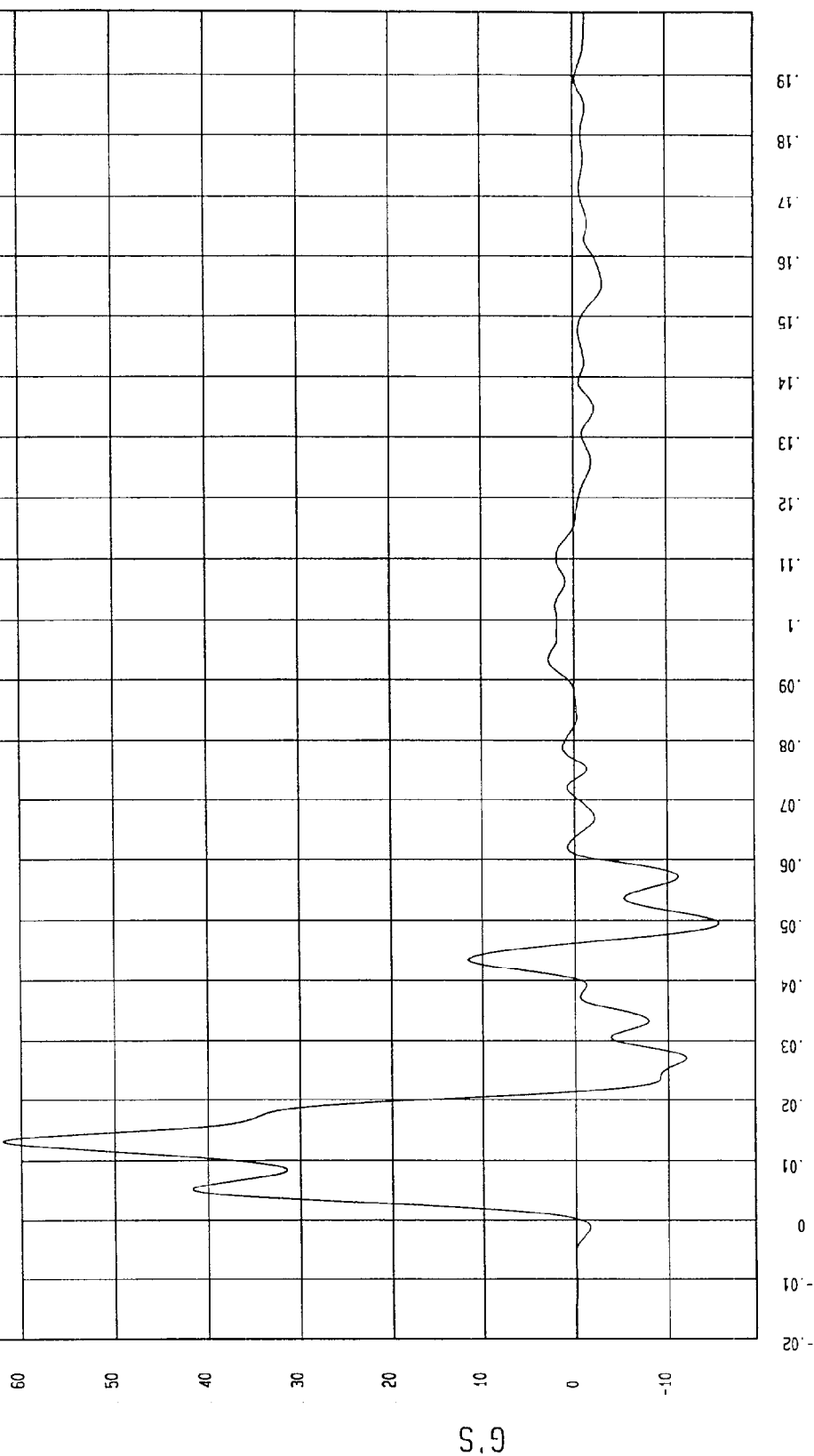
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 61.96 G'S at 13 msec

Minimum = -15.71 G'S at 50 msec

LEFT LOWER B-POST Y ACCELERATION

1 B99035AF.A30 Filterclass (60)

WGA Research
03-16-1999 16:50

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

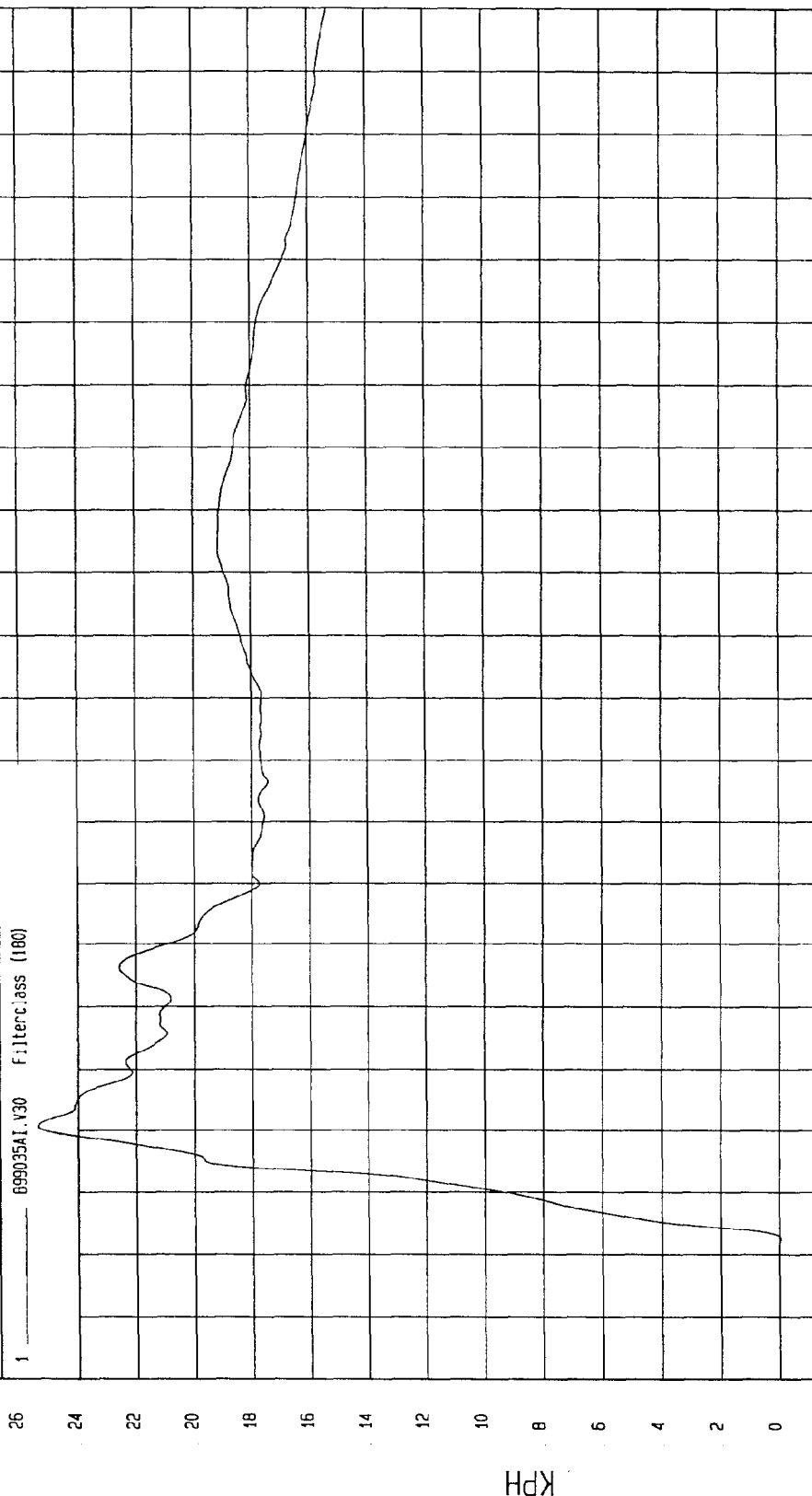
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 25.38 KPH at 21 msec

Minimum = -4.86E-02 KPH at 2 msec

LEFT LOWER B-POST Y VELOCITY

1 899035A1.V30 Filter: class (180)



TIME Seconds

MCA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

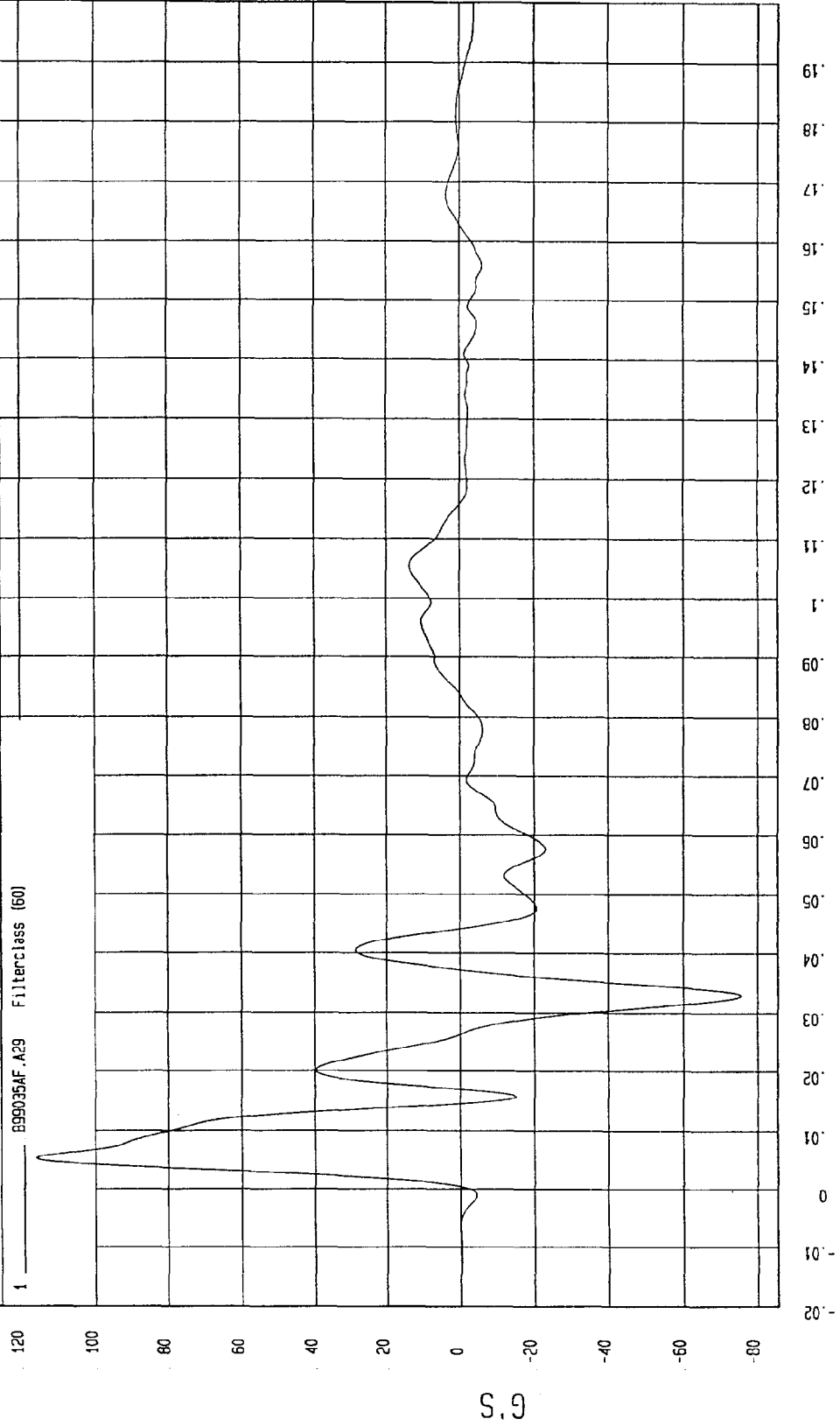
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 115.92 G'S at 5 msec

Minimum = -75.72 G'S at 33 msec

LEFT MID B-POST Y ACCELERATION



MCA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

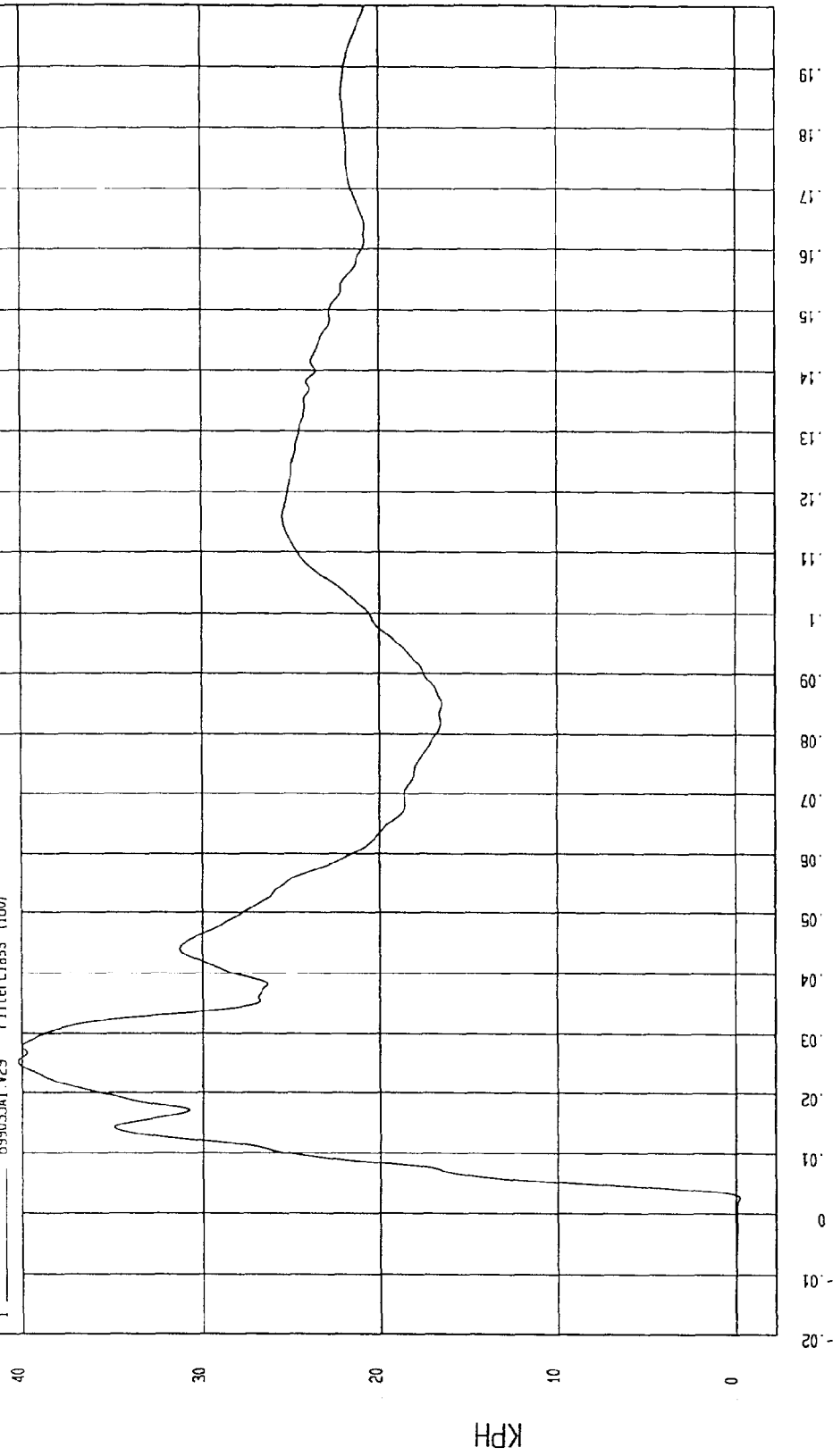
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 40.19 KPH at 25 msec

Minimum = -2 KPH at 3 msec

LEFT MID B-POST Y VELOCITY

1 899035A1.V29 Filterclass (180)



MCA Research
03-16-1999 16:58

TIME Seconds

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

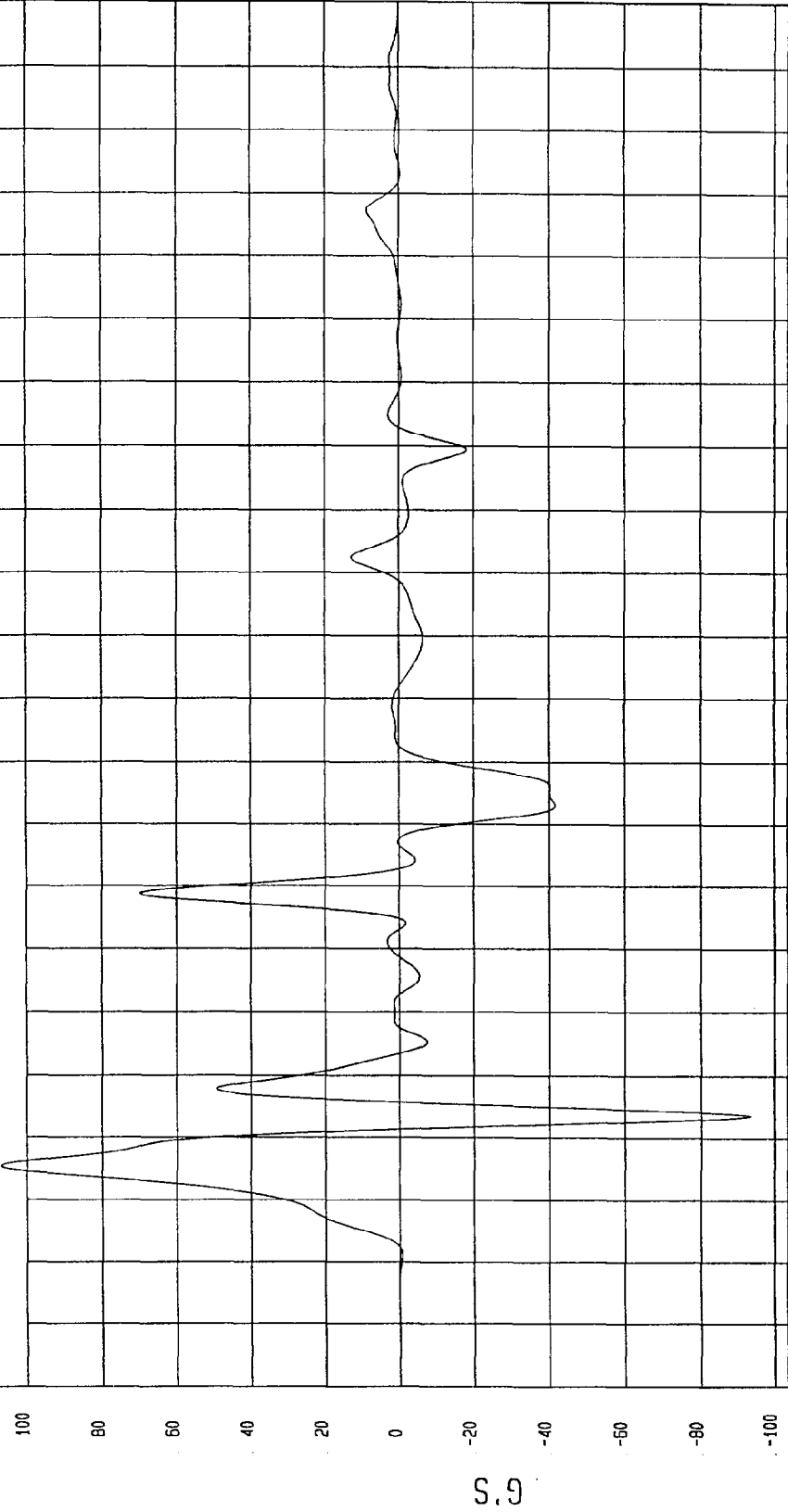
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 106.82 G'S at 15 msec

Minimum = -93.57 G'S at 24 msec

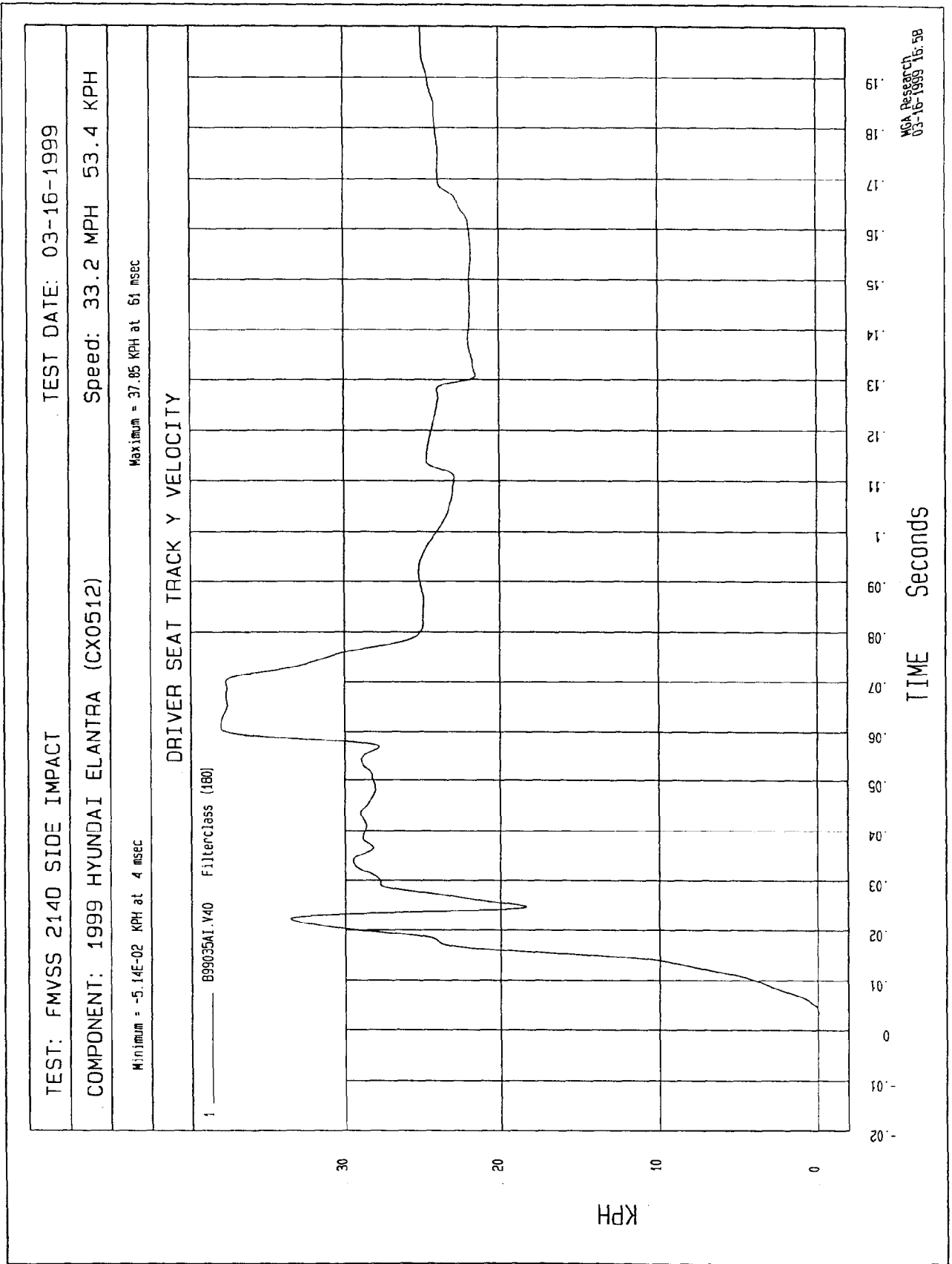
DRIVER SEAT TRACK Y ACCELERATION

1 999035AF.A40 Filterclass (60)



MCA Research
03-16-1999 16:50

TIME (SECONDS)



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

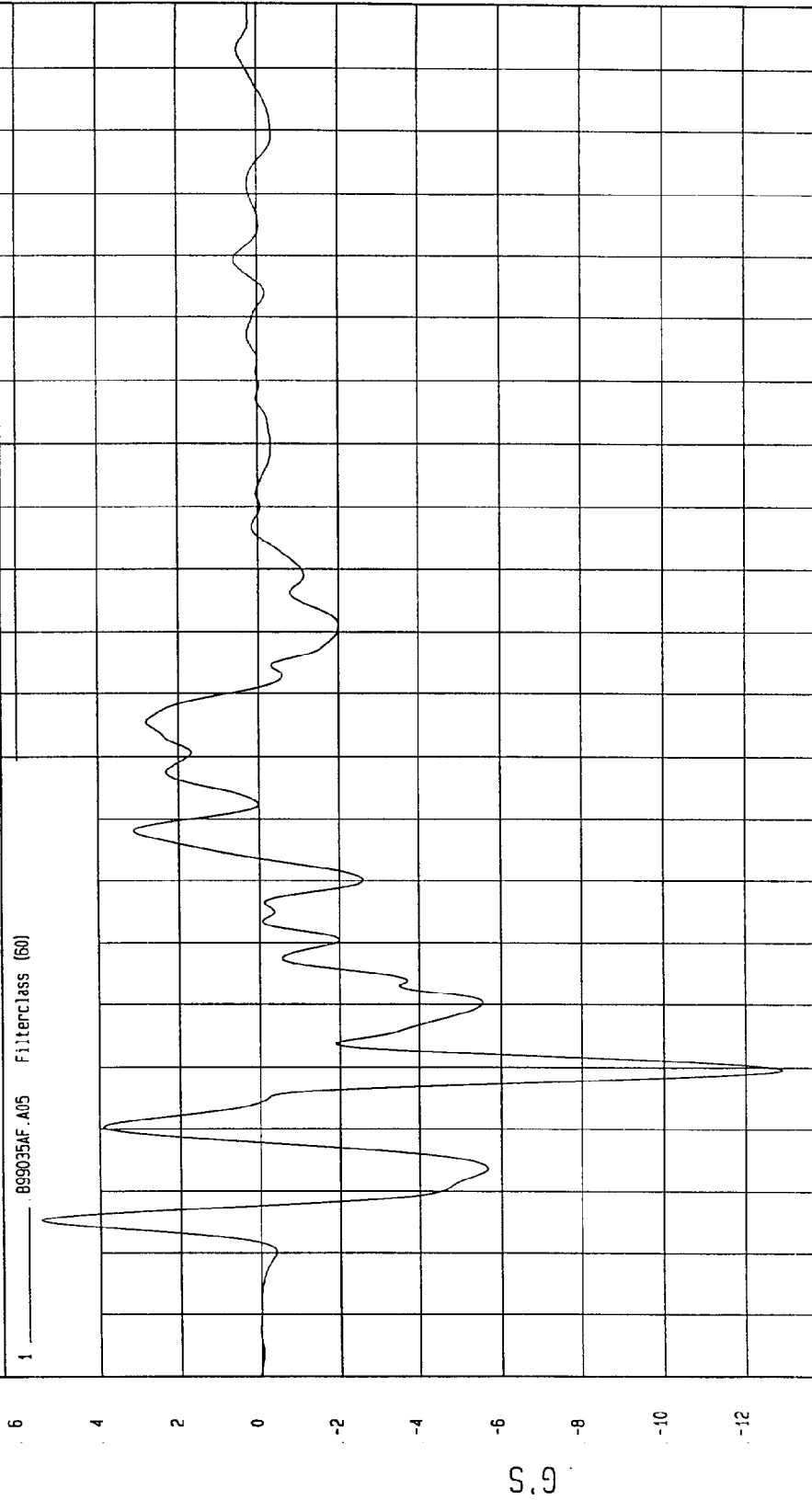
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 5.45 G'S at 5 msec

Minimum = -12.91 G'S at 30 msec

VEHICLE CG X ACCELERATION

1 899035AF.A05 Filterclass (60)



MGA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

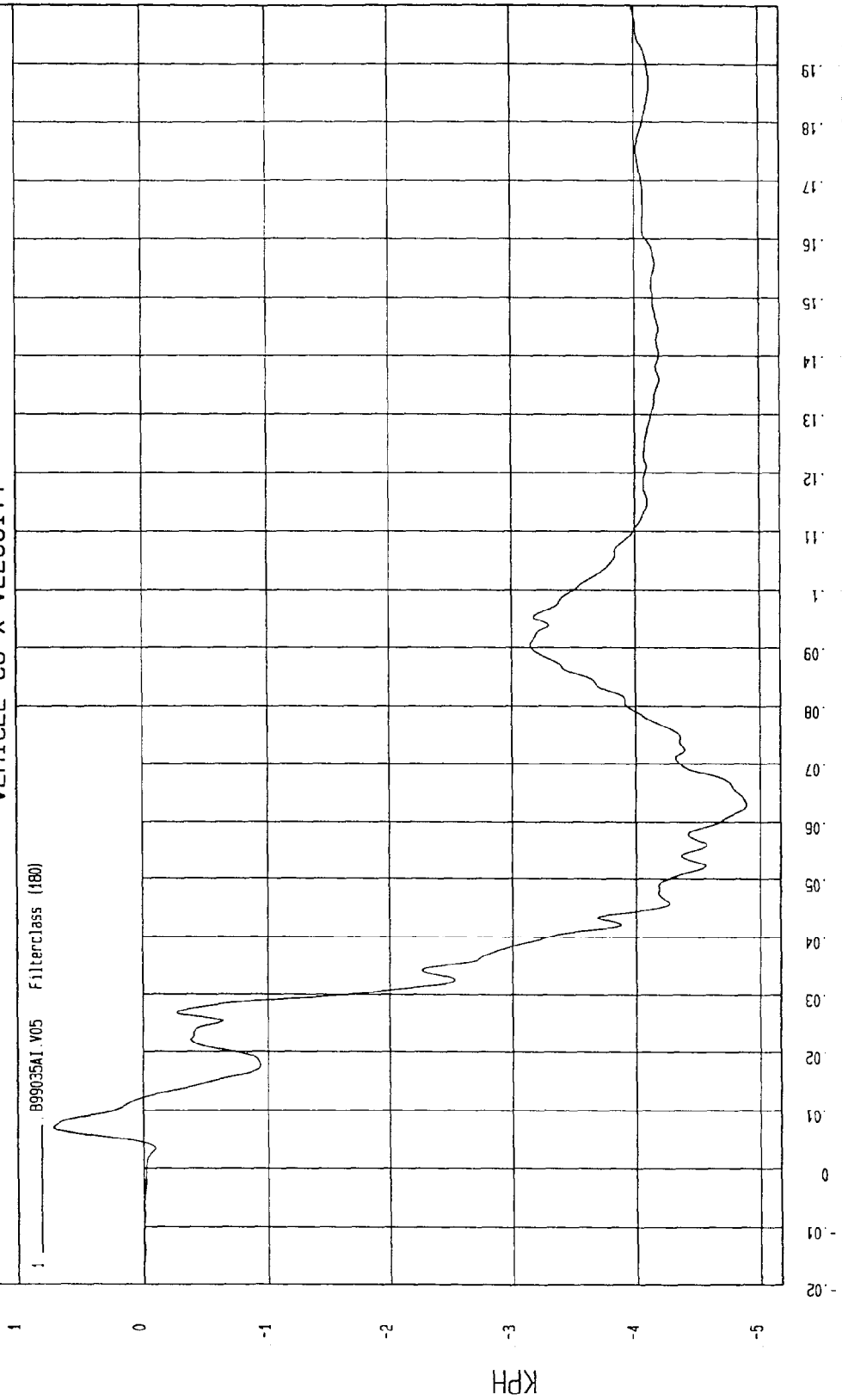
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = .72 KPH at 7 msec

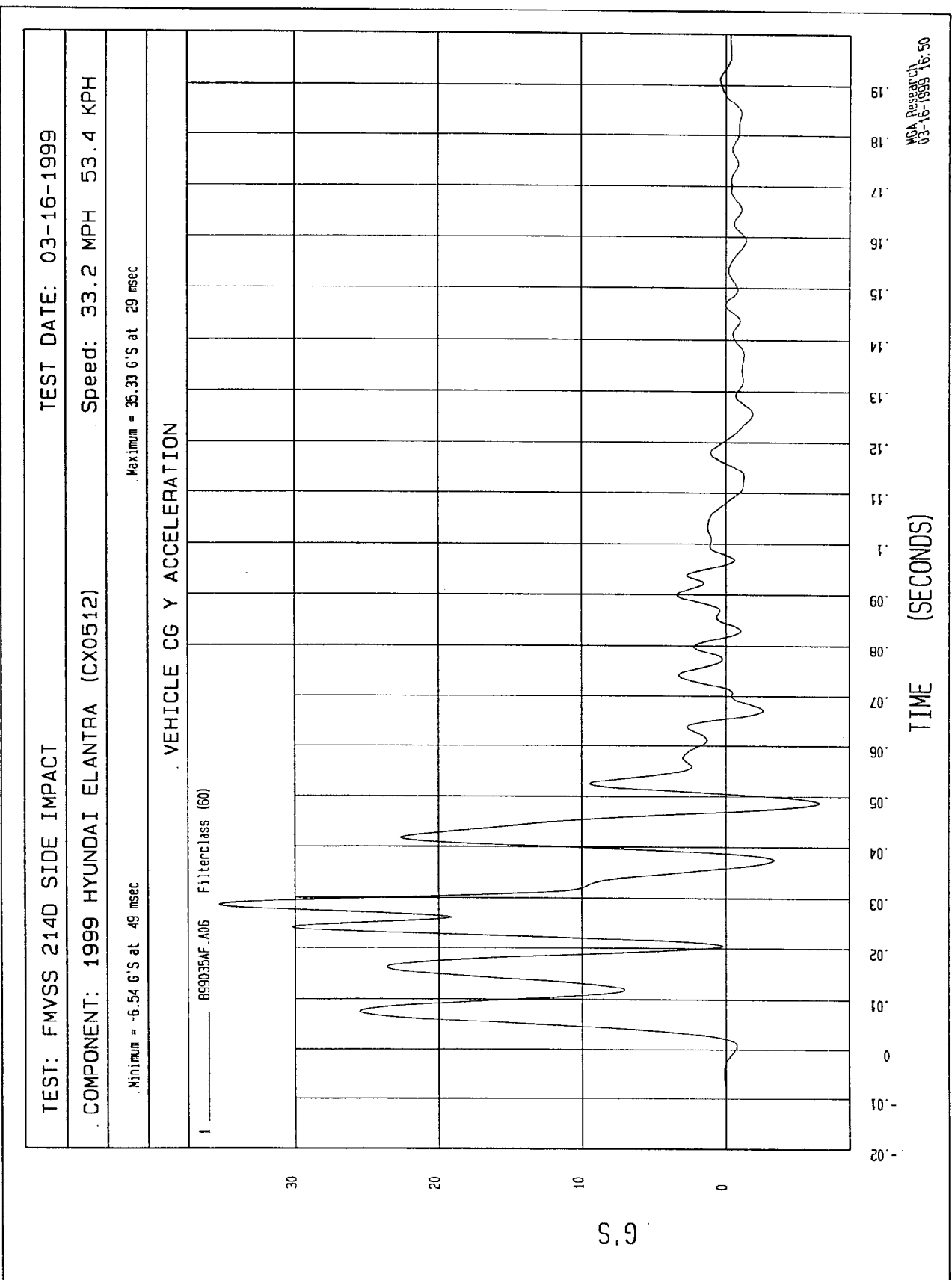
Minimum = -4.89 KPH at 63 msec

VEHICLE CG X VELOCITY

1 — B99035A1.V05 Filterclass (180)



MCA Research
03-16-1999 16:58



TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

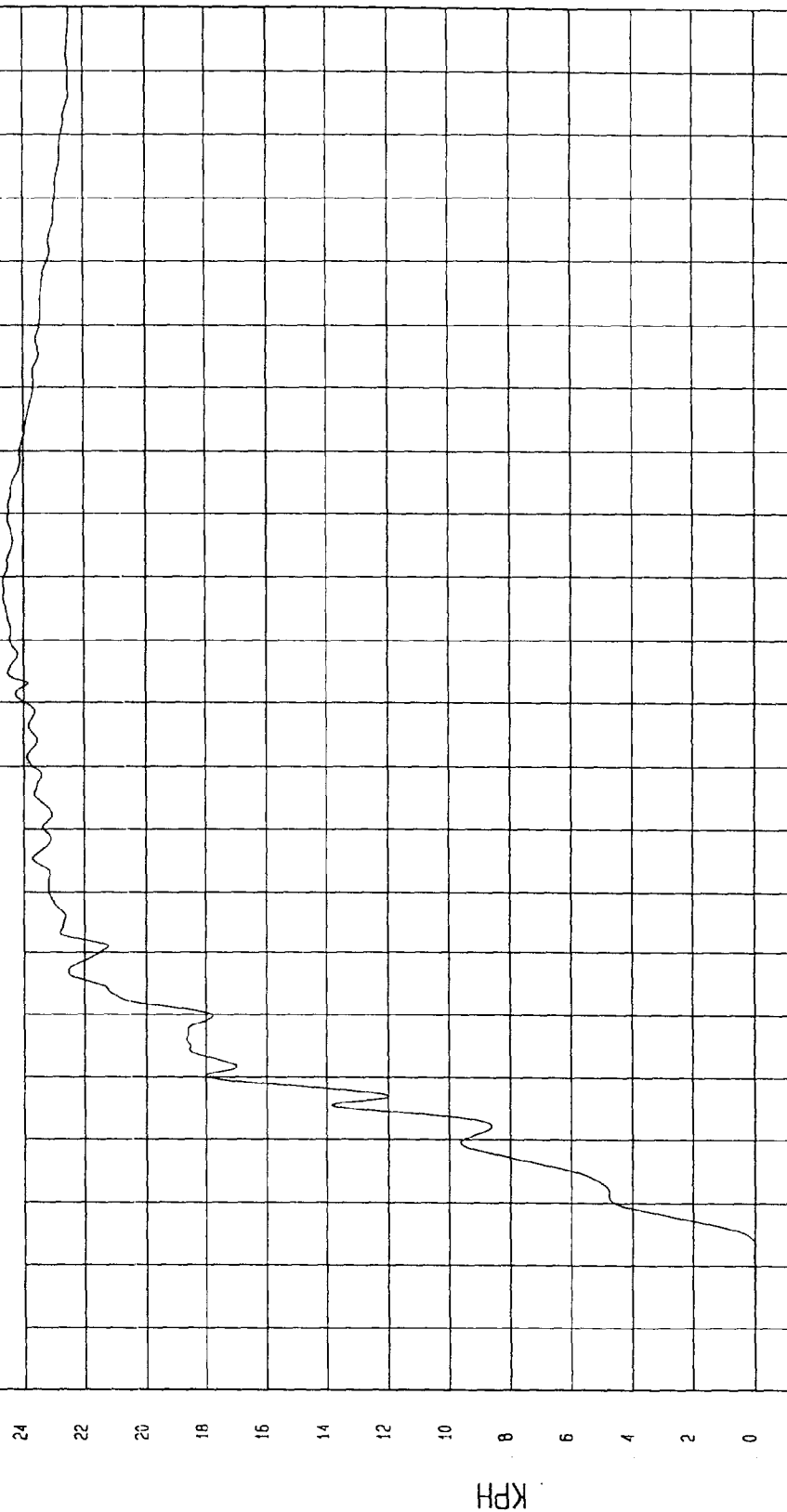
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -1.74E-04 KPH at -19 msec

Maximum = 24.66 KPH at 109 msec

VEHICLE CG Y VELOCITY

1 B99035A1.V06 FilterClass (180)



NCA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 26.7 G'S at 33 msec

Minimum = -16.98 G'S at 27 msec

VEHICLE CG Z ACCELERATION

1 ——— B99035AF.A07 Filterclass (60)

20

10

0

-10

G'S

-0.02

0

0.01

0.02

0.03

0.04

0.05

0.06

0.07

0.08

0.09

0.10

0.11

0.12

MCA Research
03-16-1999 16:50

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

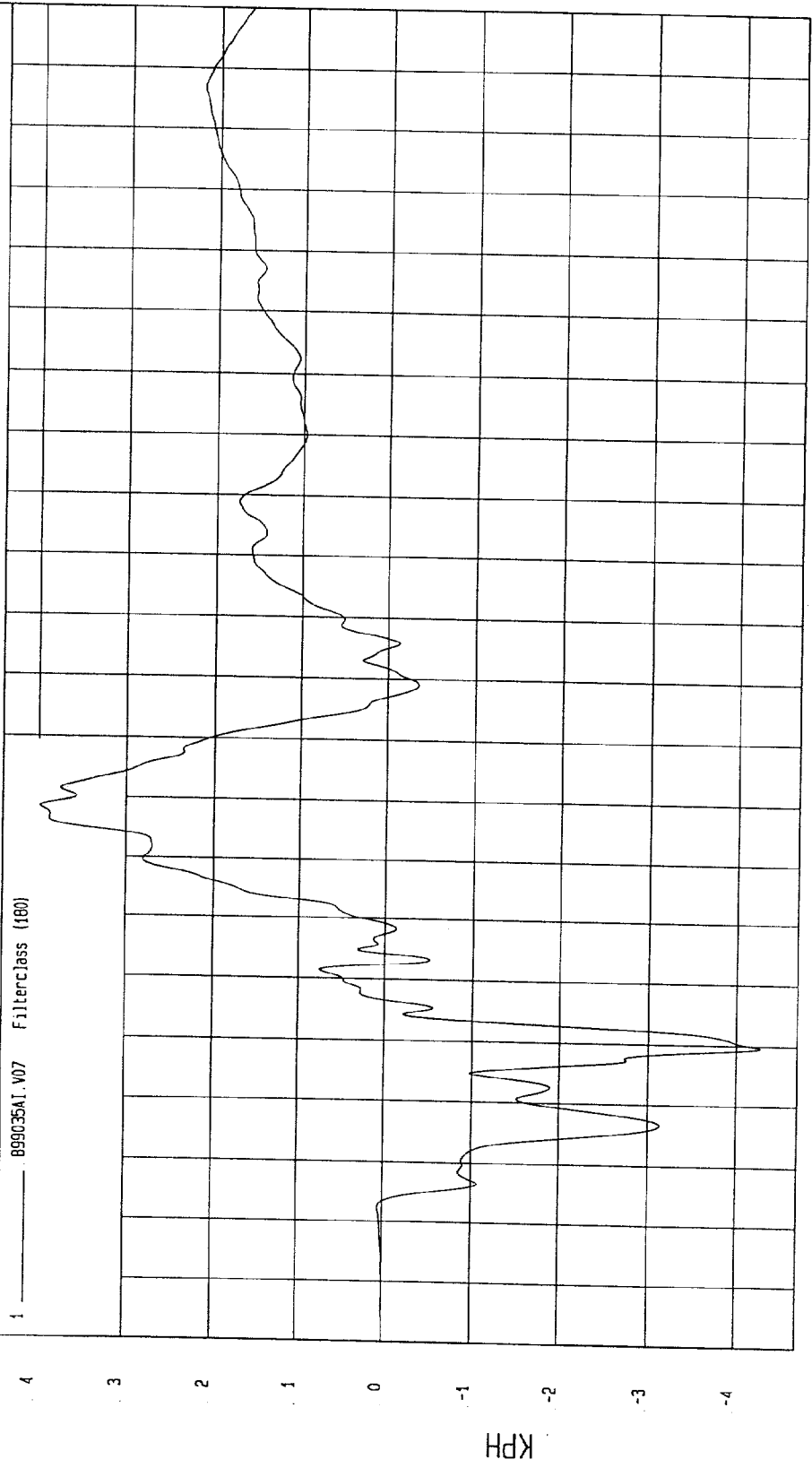
Speed: 33.2 MPH 53.4 KPH

Minimum = -4.28 KPH at 30 msec

Maximum = 3.98 KPH at 68 msec

VEHICLE CG Z VELOCITY

1 ——— 899035A1.V07 FilterClass (180)



NSA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 39.28 G'S at 28 msec

Minimum = 1.00E-02 G'S at -11 msec

VEHICLE CG RESULTANT ACCELERATION

1 899035AV.A05 Filterclass (60)

40

30

20

10

0

G'S

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

-01

-02

TIME (SECONDS)

NSA Research
03-16-1999 16:50

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

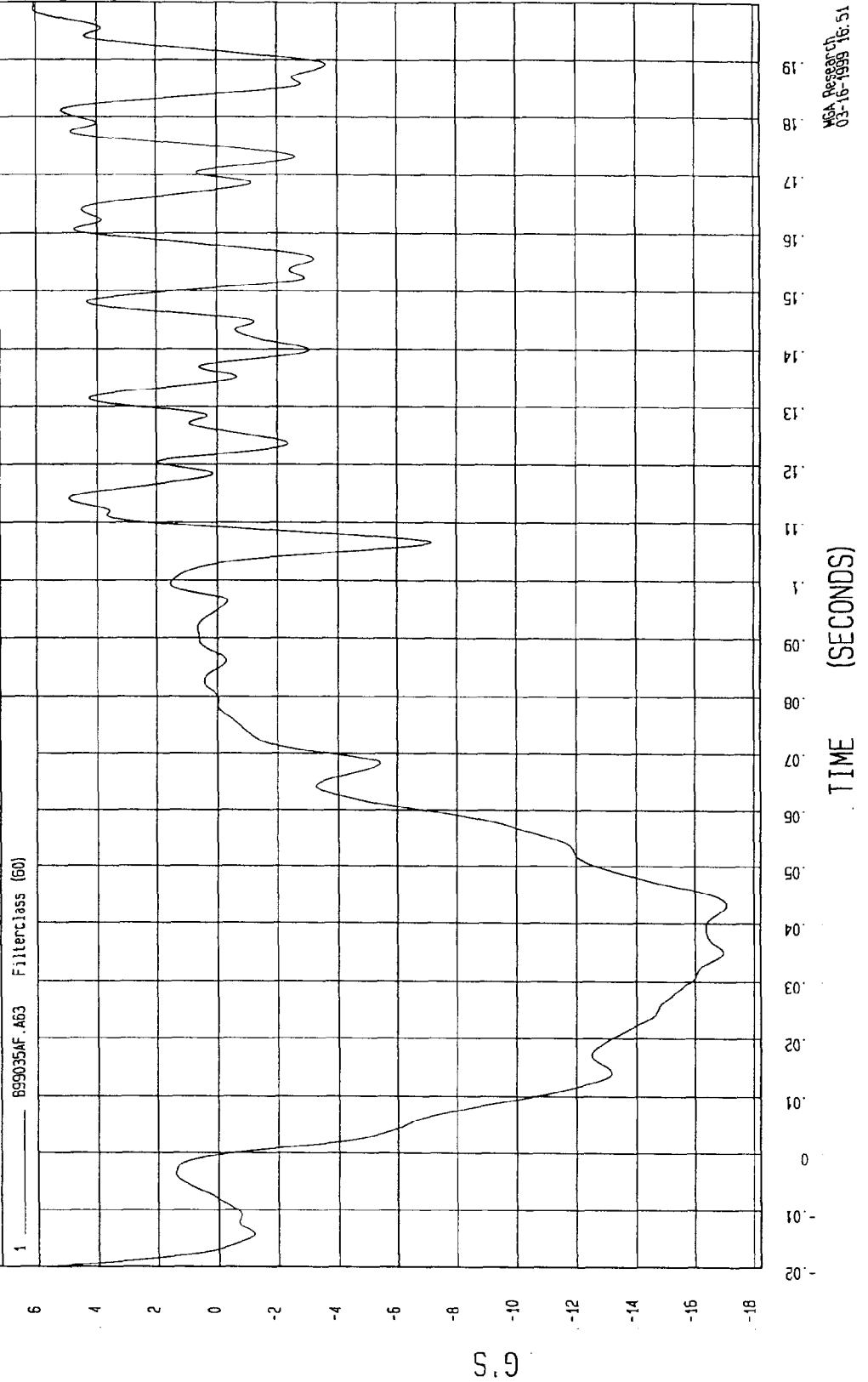
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 6.09 G'S at 199 msec

Minimum = -17.07 G'S at 43 msec

MOVING BARRIER CG X ACCELERATION

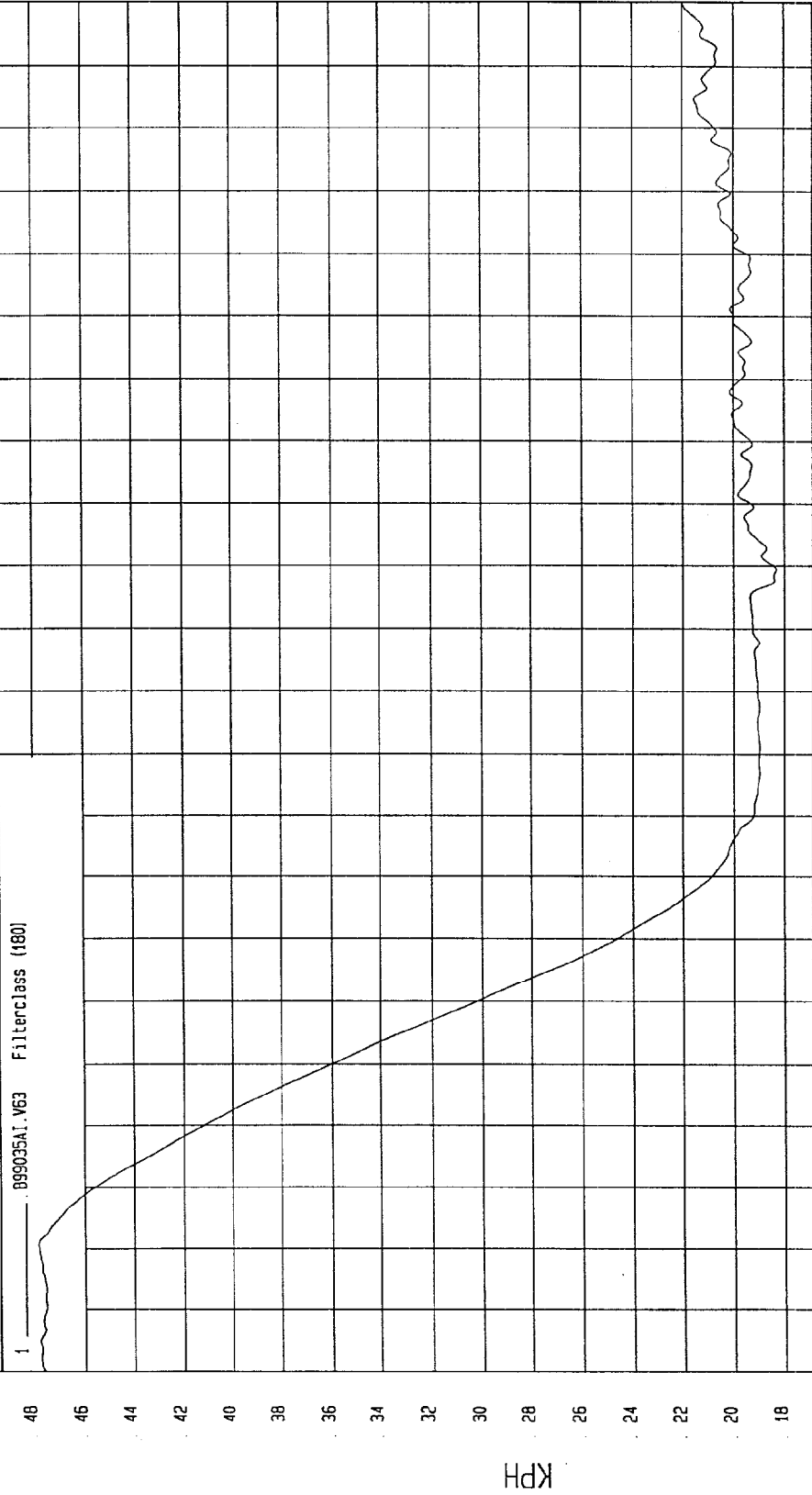


TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

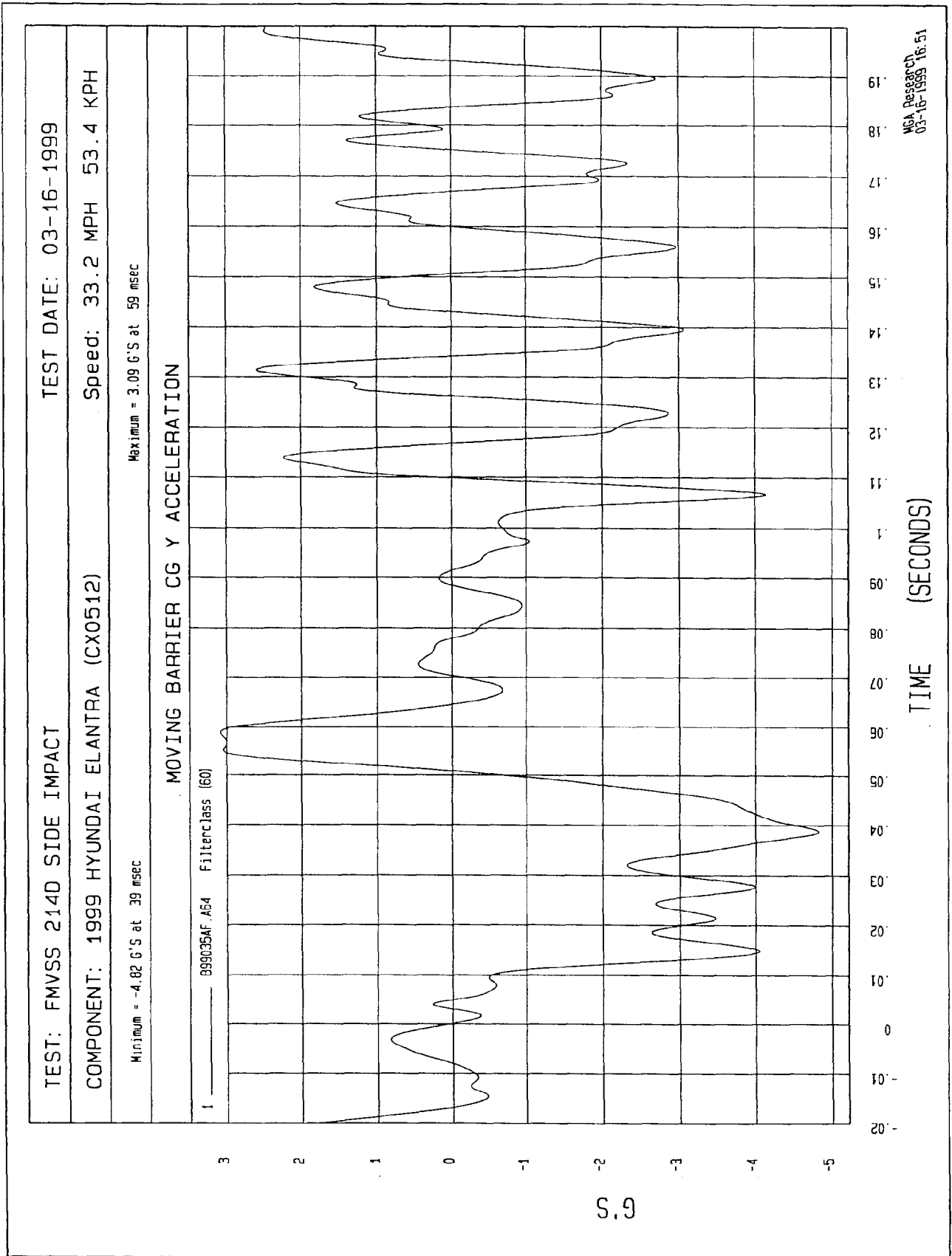
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = 18.33 KPH at .09 msec Maximum = 47.85 KPH at 1 msec

MOVING BARRIER CG X VELOCITY



NGA Research
03-16-1999 16:58

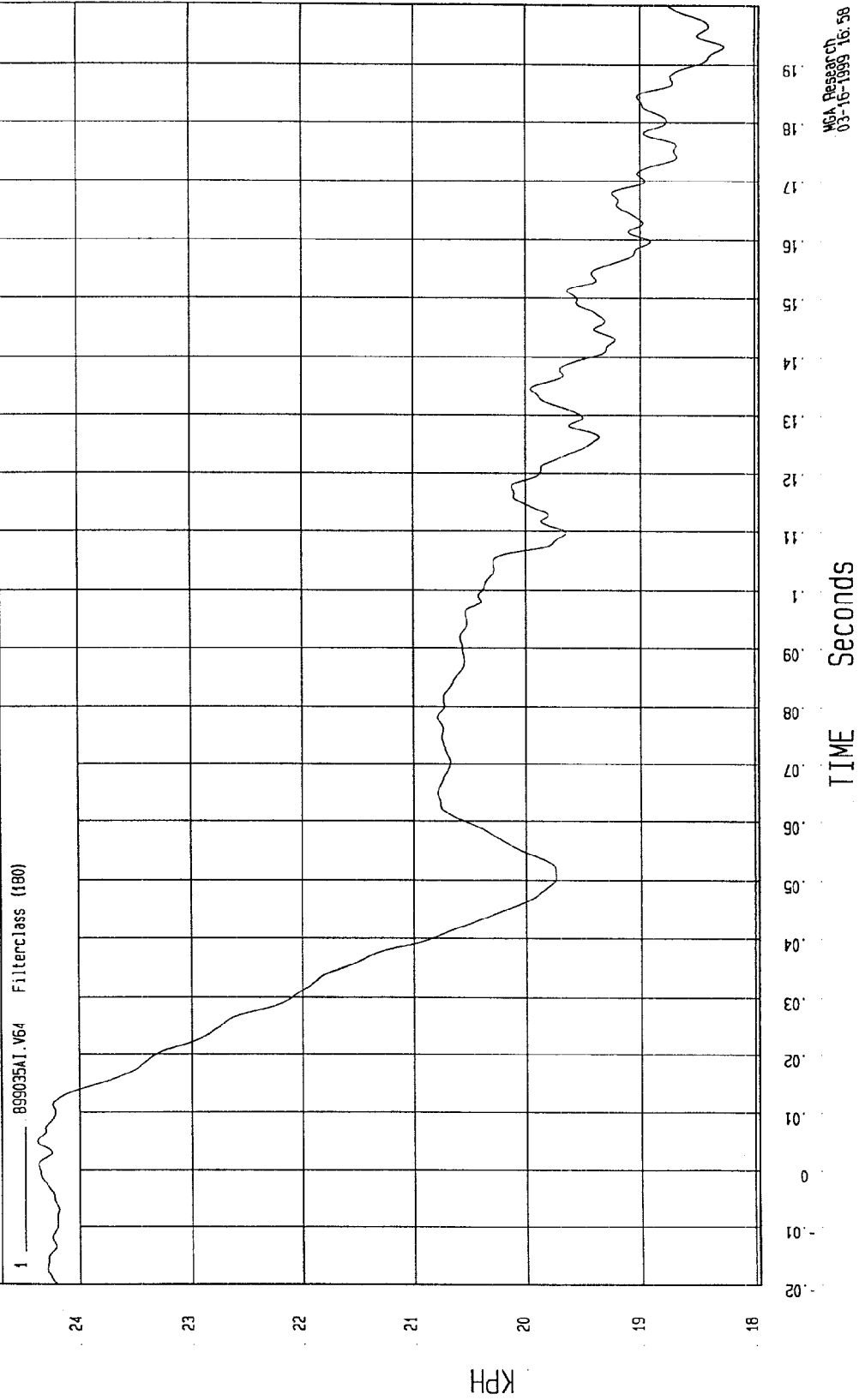


TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = 19.27 KPH at 193 msec Maximum = 24.37 KPH at 5 msec

MOVING BARRIER CG Y VELOCITY



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

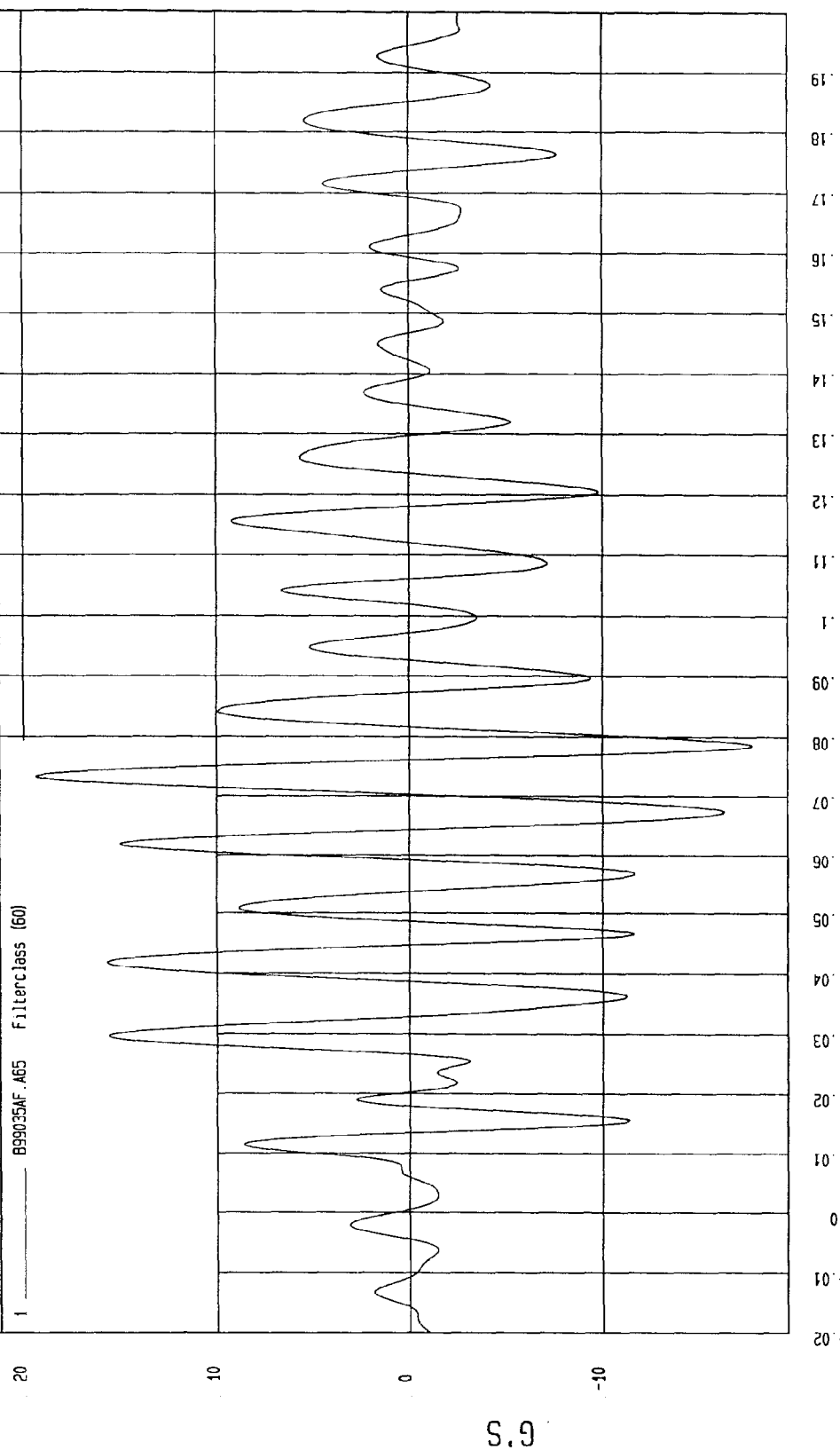
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 19.36 G'S at 73 msec

Minimum = -17.66 G'S at 79 msec

MOVING BARRIER CG Z ACCELERATION

1 ——— B99035AF.A65 Filterclass (60)

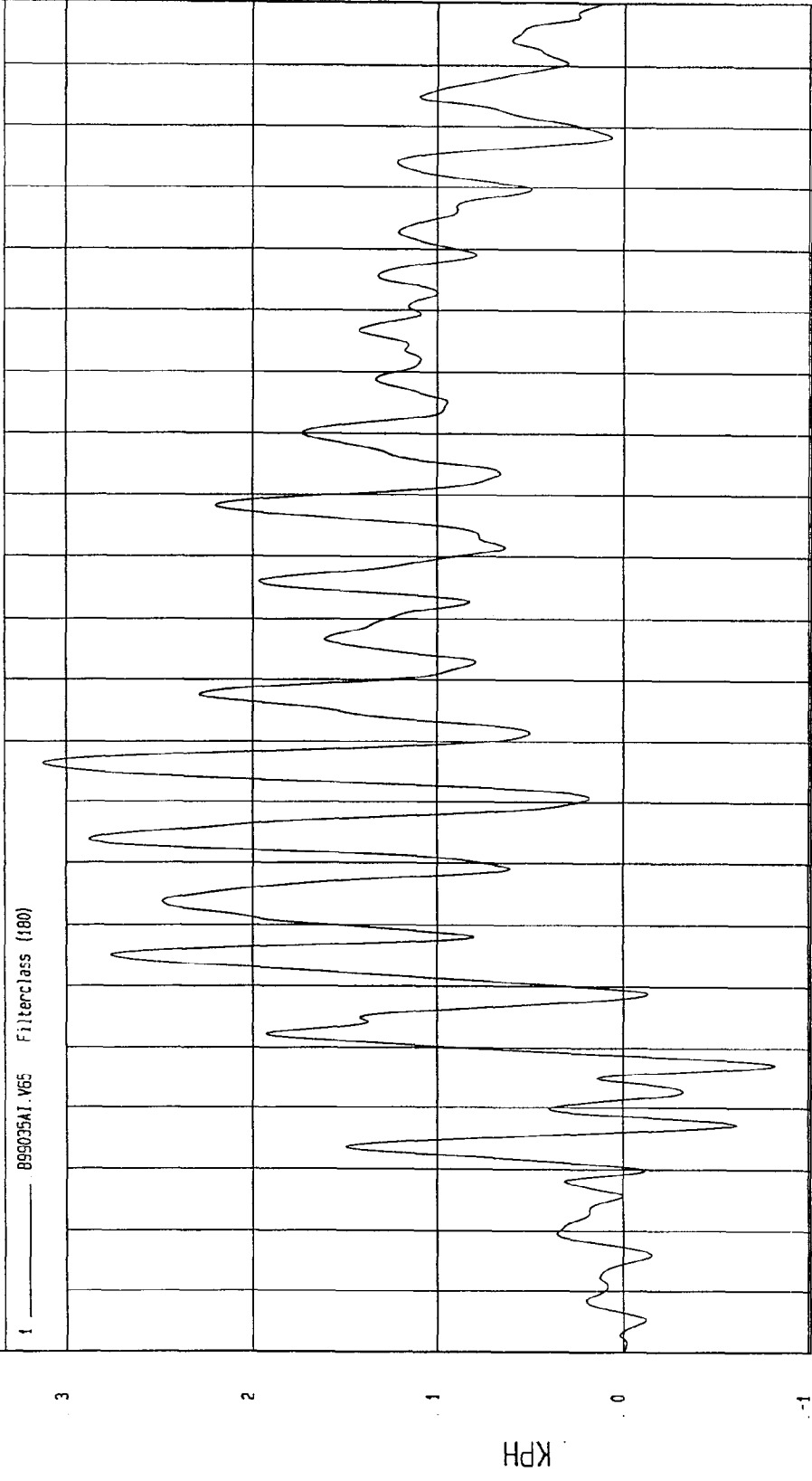
WCA Research
03-16-1999 16:51

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -82 KPH at 27 msec Maximum = 3.13 KPH at 76 msec

MOVING BARRIER CG Z VELOCITY



NSA Research
03-16-1999 16:58

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

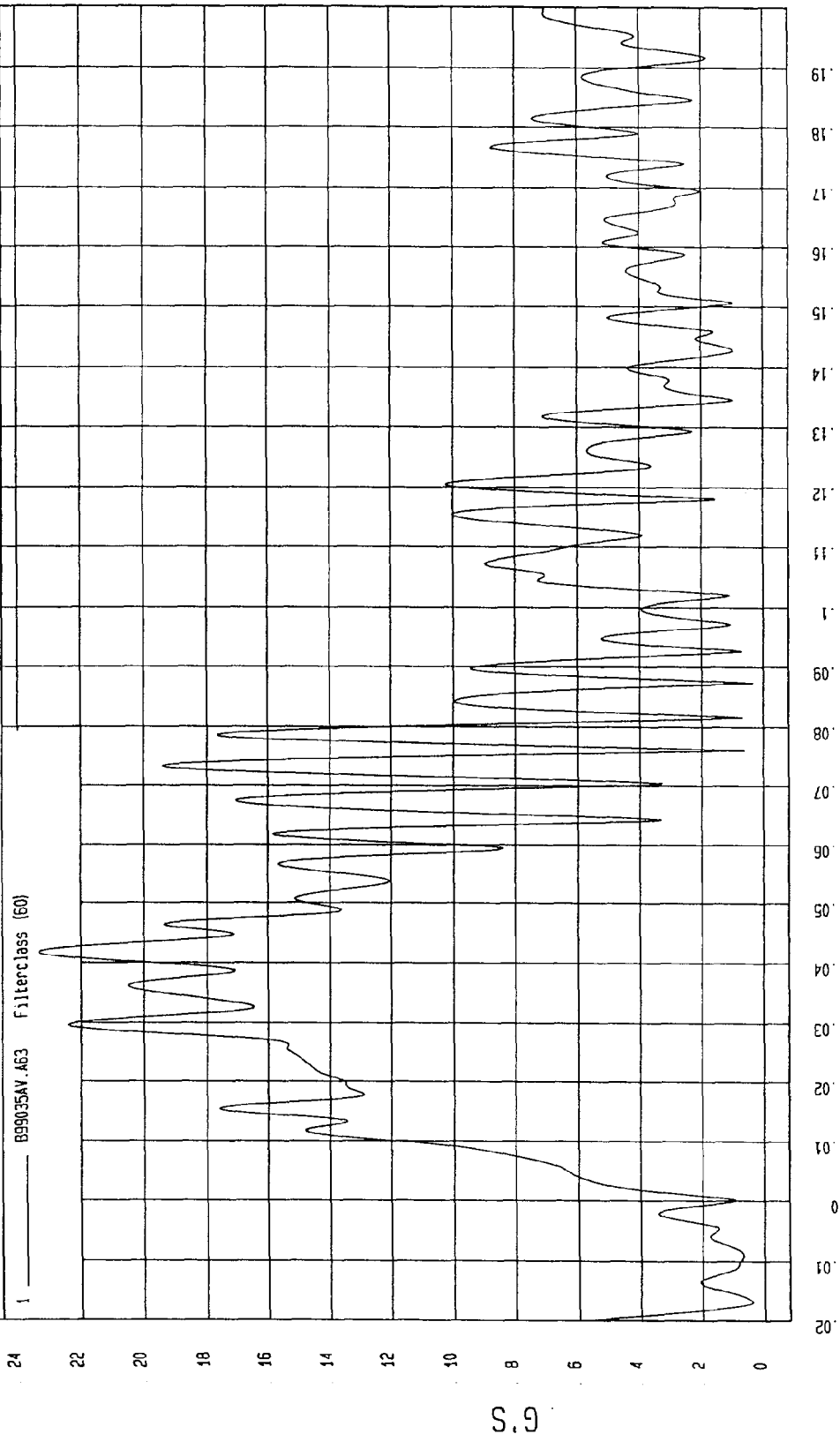
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 23.34 G'S at 42 msec

Minimum = .33 G'S at 87 msec

MOVING BARRIER CG RESULTANT ACCELERATION

1 B99035AV.A63 Filterclass (60)



MCA Research
03-16-1999 16:51

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

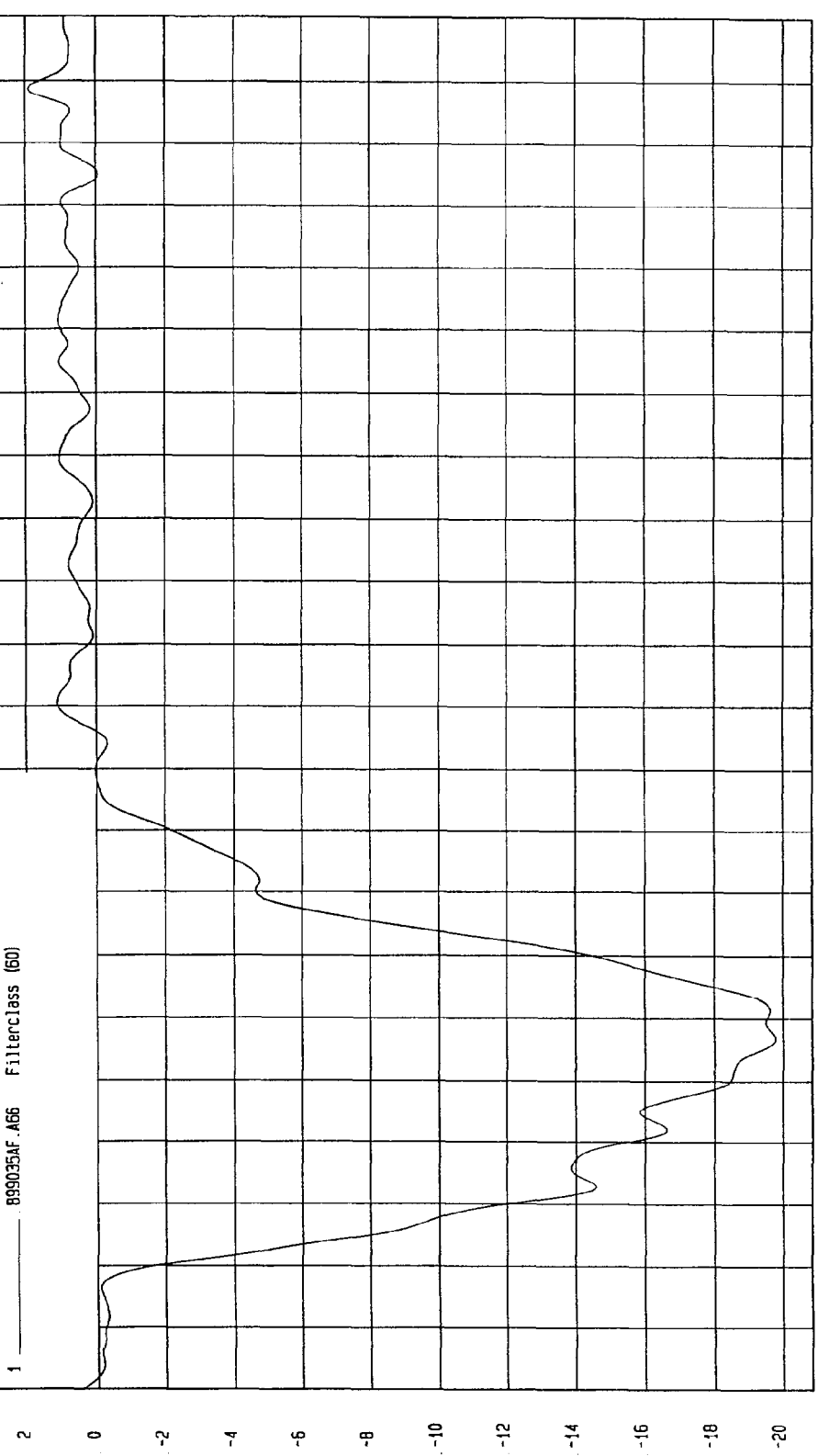
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 1.91 G's at 109 msec

Minimum = -19.78 G's at 37 msec

MOVING BARRIER REAR AXLE X ACCELERATION

1 899035AF A66 Filterclass (60)



MCA Research
03-16-1999 16:51

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

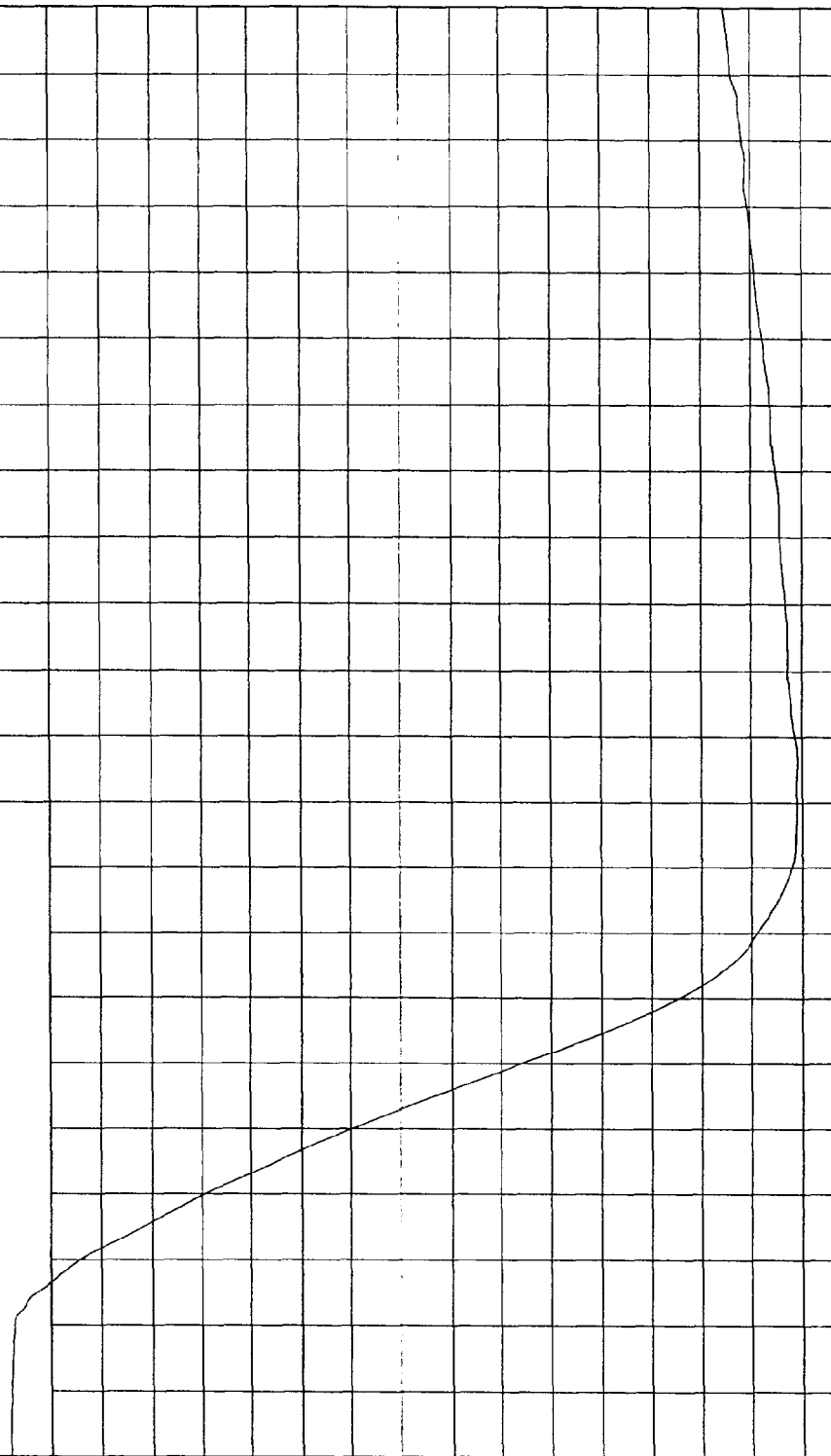
Maximum = 47.61 KPH at -19 msec

Minimum = 16.19 KPH at 86 msec

MOVING BARRIER REAR AXLE X VELOCITY

1 ——— B99035A1.V66 Filterclass (180)

KPH



MSA Research
03-16-1999 16:58

TIME Seconds

TEST: FMVSS 2140 SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

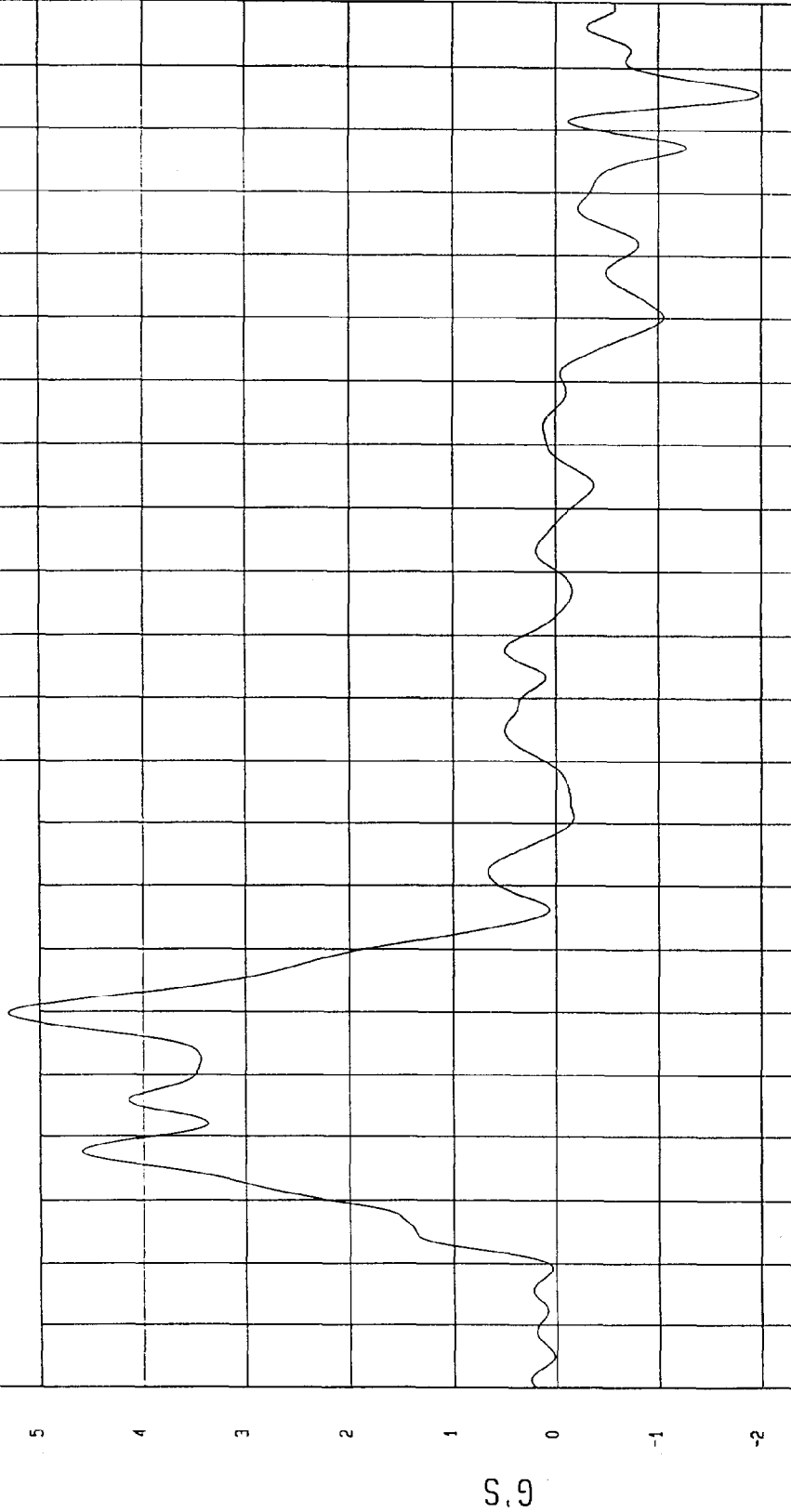
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 5.3 G'S at 40 msec

Minimum = -1.97 G'S at 186 msec

MOVING BARRIER REAR AXLE Y ACCELERATION

1 B99035AF.A67 Filterclass (60)



MCA Research
03-16-1999 16:51

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Minimum = 24.2 KPH at -20 msec

Maximum = 30.52 KPH at 118 msec

MOVING BARRIER REAR AXLE Y VELOCITY

1 ——— B99035A1.V67 Filterclass (180)

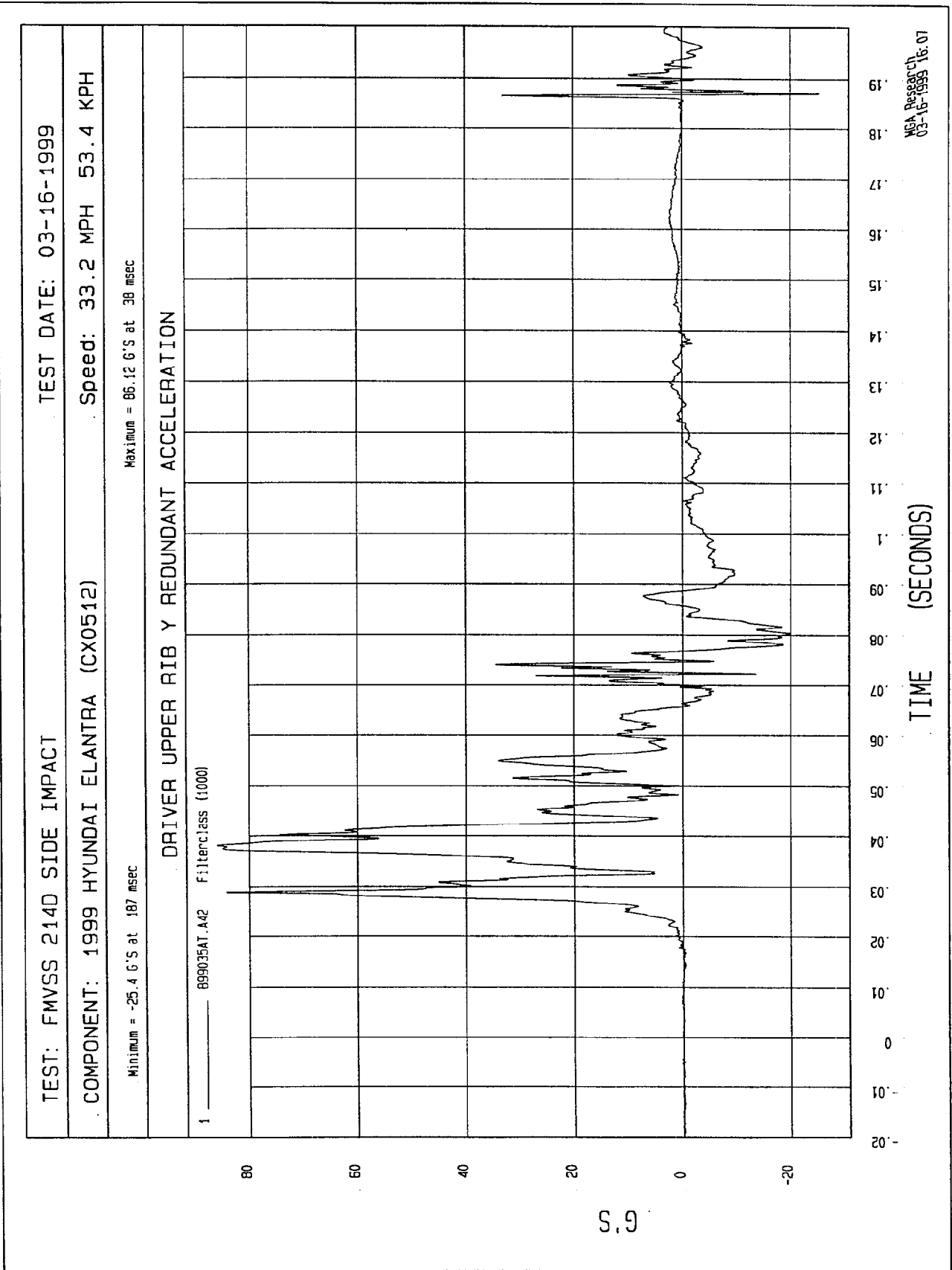
KPH

30
29
28
27
26
25
24

TIME Seconds

0.02
0.04
0.06
0.07
0.08
0.09
0.10
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19

MCA Research
03-16-1999 16:58



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 39.65 KPH at 77 msec

Minimum = -2.13E-02 KPH at 18 msec

DRIVER UPPER RIB Y REDUNDANT VELOCITY

1 ——— B99035A1.V42 Filterclass (180)

40

30

20

10

0

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

-01

-02

TIME Seconds

MCA Research
03-16-1999 16:42

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

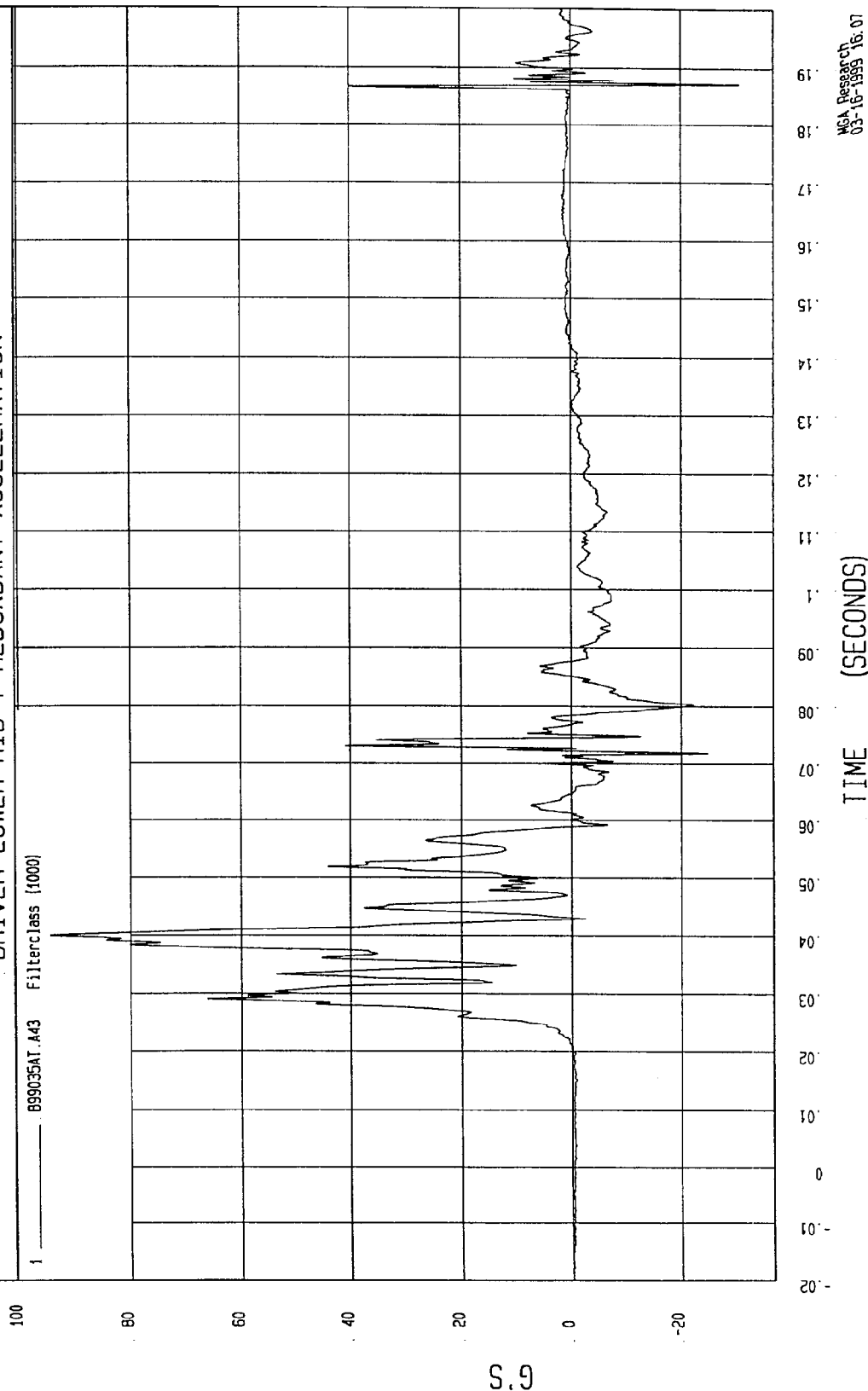
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

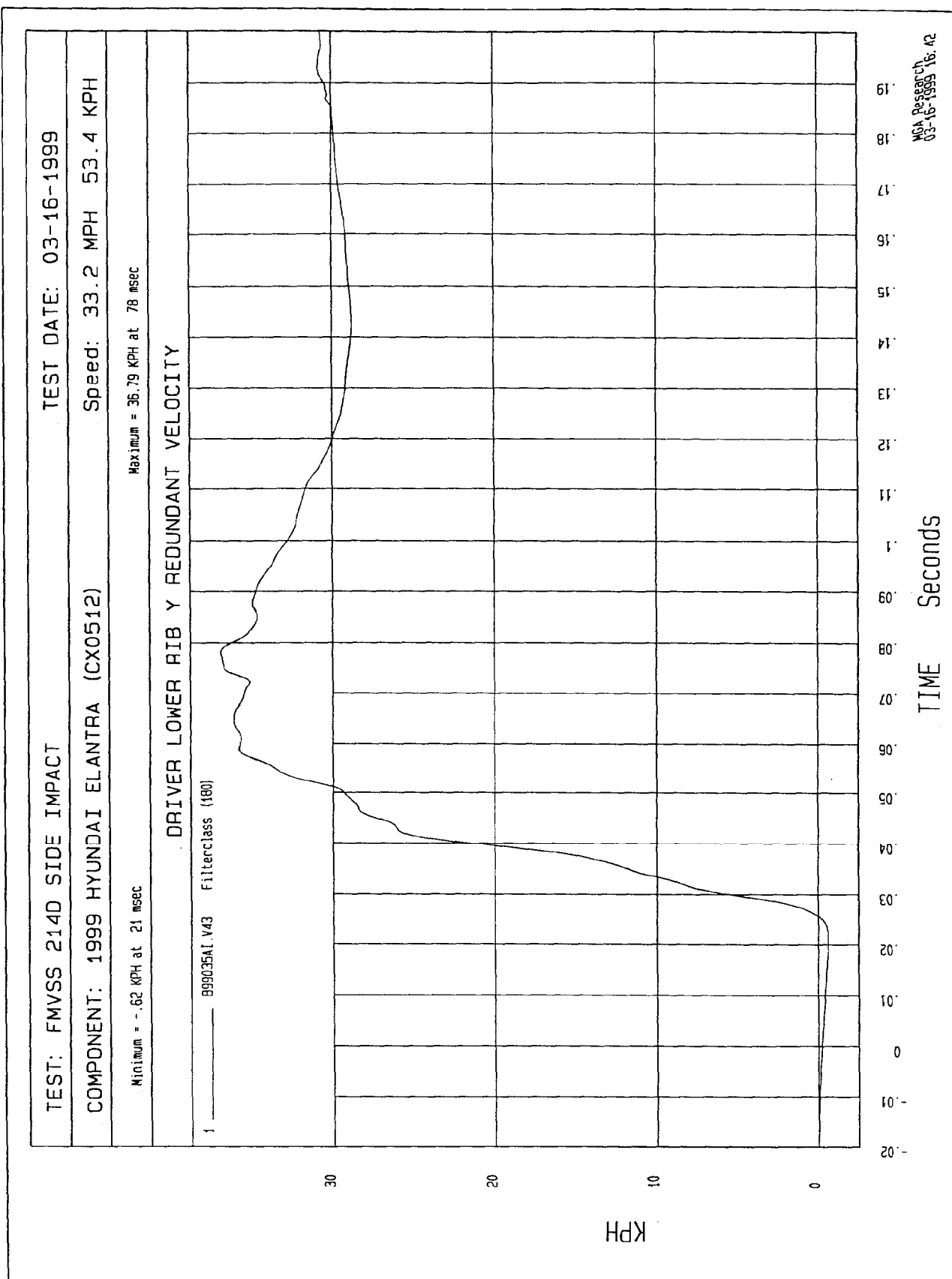
Maximum = 94.38 G'S at 40 msec

Minimum = -30.76 G'S at 187 msec

DRIVER LOWER RIB Y REDUNDANT ACCELERATION



MCA Research
03-16-1999 16:07



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

SPEED: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

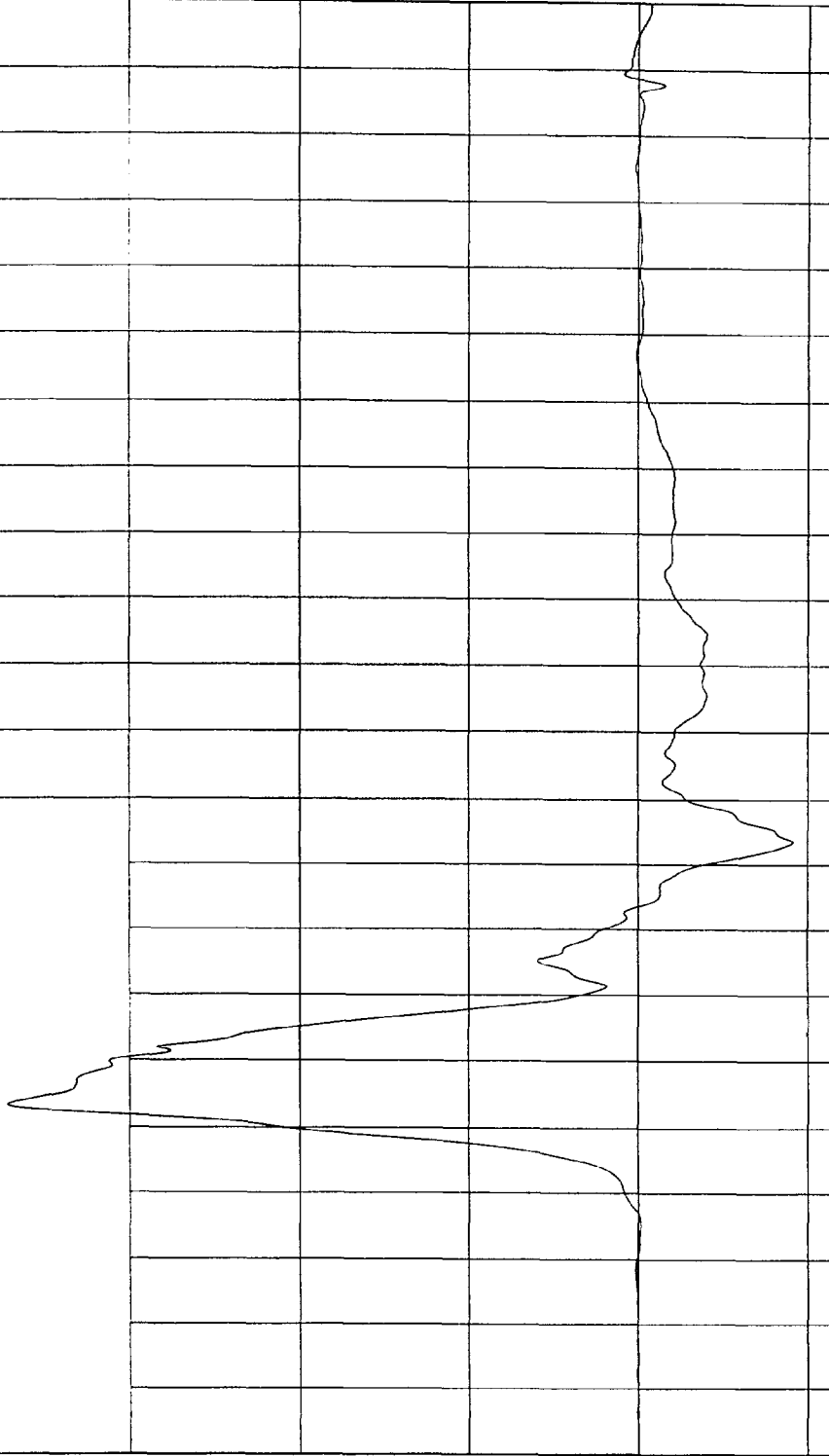
Maximum = 74.2 G'S at 33 msec

Minimum = -18.3 G'S at 74 msec

DRIVER LOWER SPINE Y REDUNDANT ACCELERATION

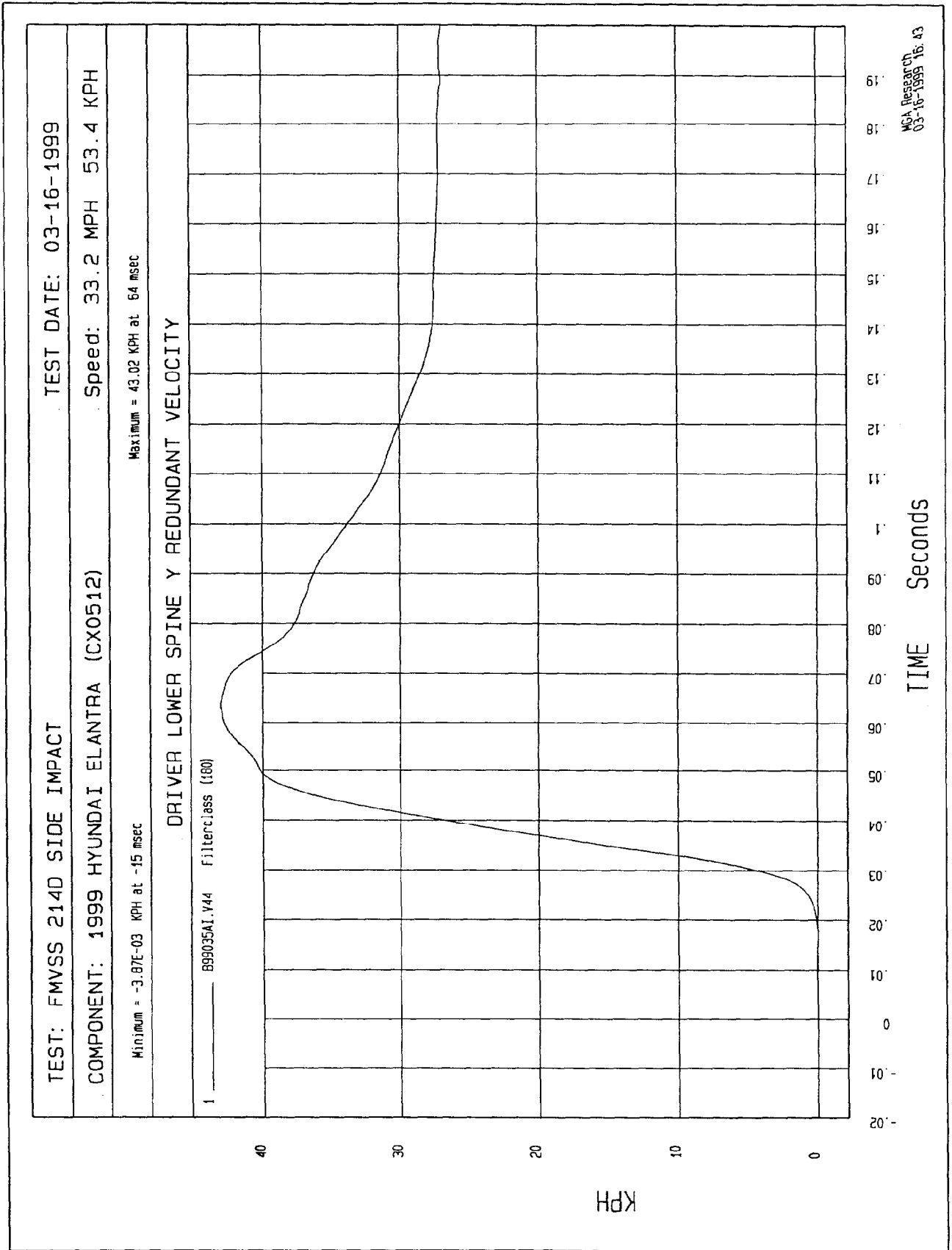
1 B99035AF.A44 Filterclass (180)

G.S



TIME (SECONDS)

NGA Research
03-16-1999 16:07



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

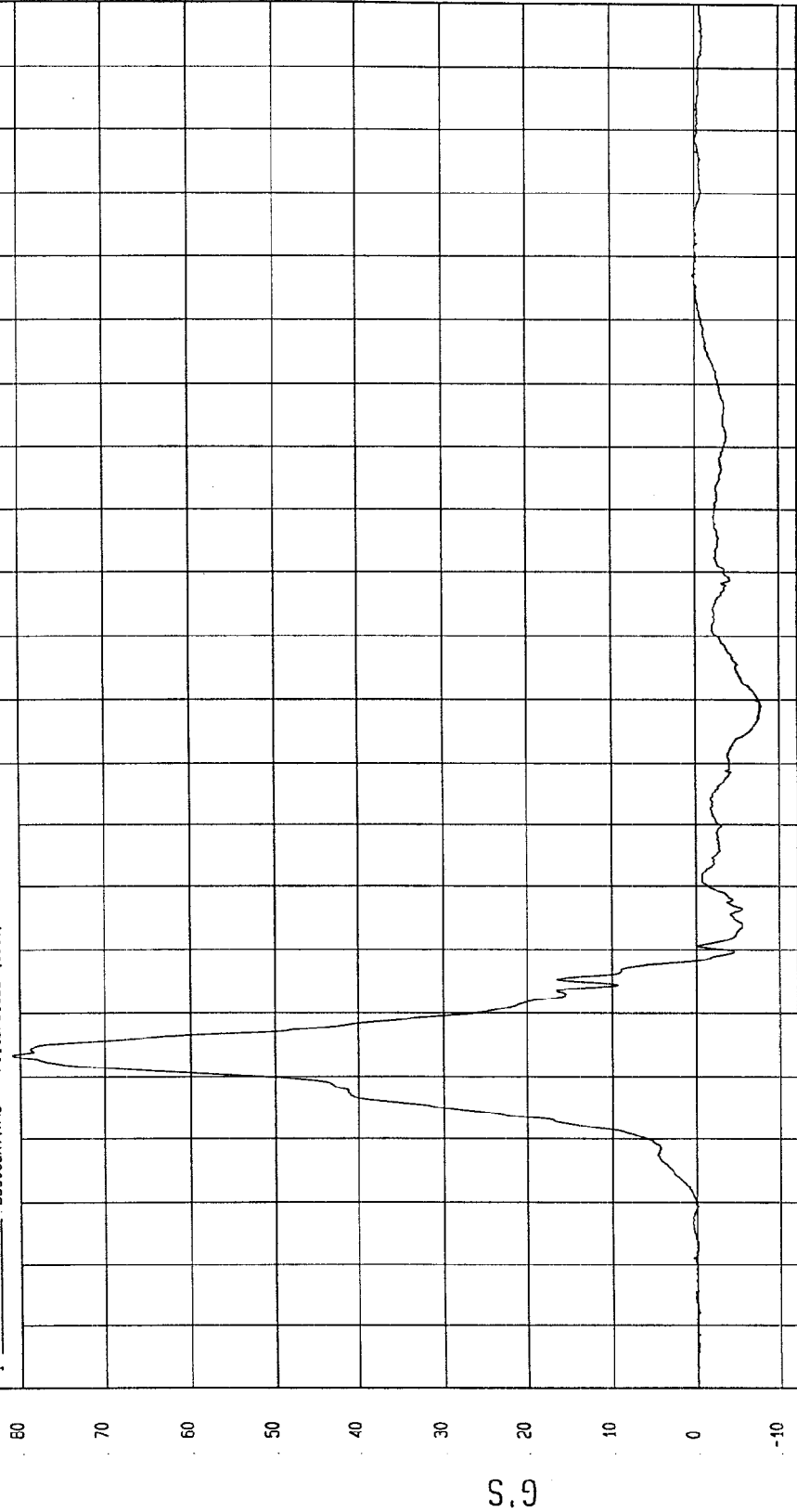
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 80.91 G'S at 33 msec

Minimum = -7.79 G'S at 89 msec

DRIVER PELVIS Y REDUNDANT ACCELERATION

1 899035AT.A45 Filterclass (1000)



NSA Research
03-16-1999 16:07

TEST DATE: 03-16-1999

TEST: FMVSS 214D SIDE IMPACT

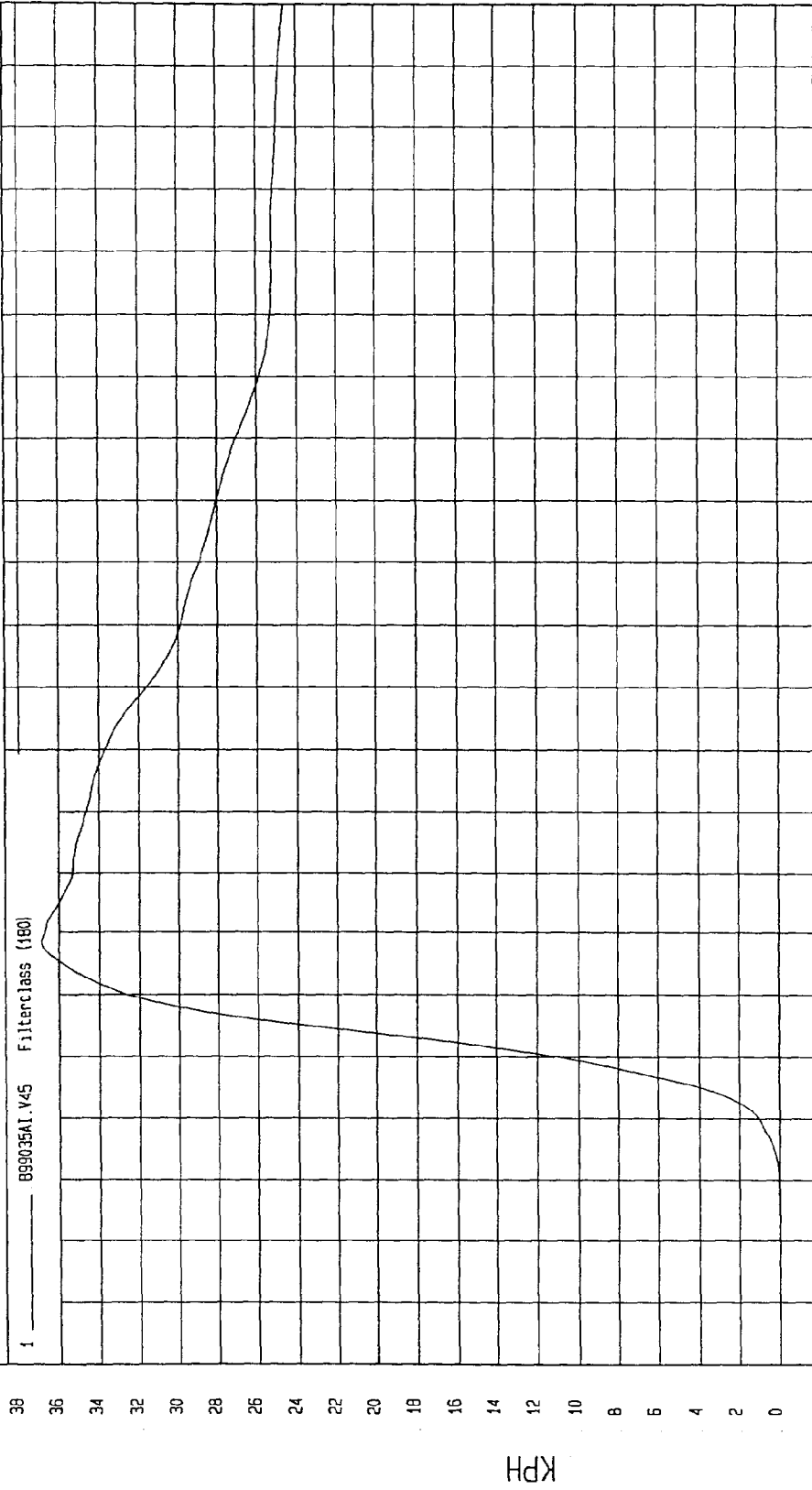
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 36.86 KPH at 48 msec

Minimum = -9.91E-03 KPH at -7 msec

DRIVER PELVIS Y REDUNDANT VELOCITY



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

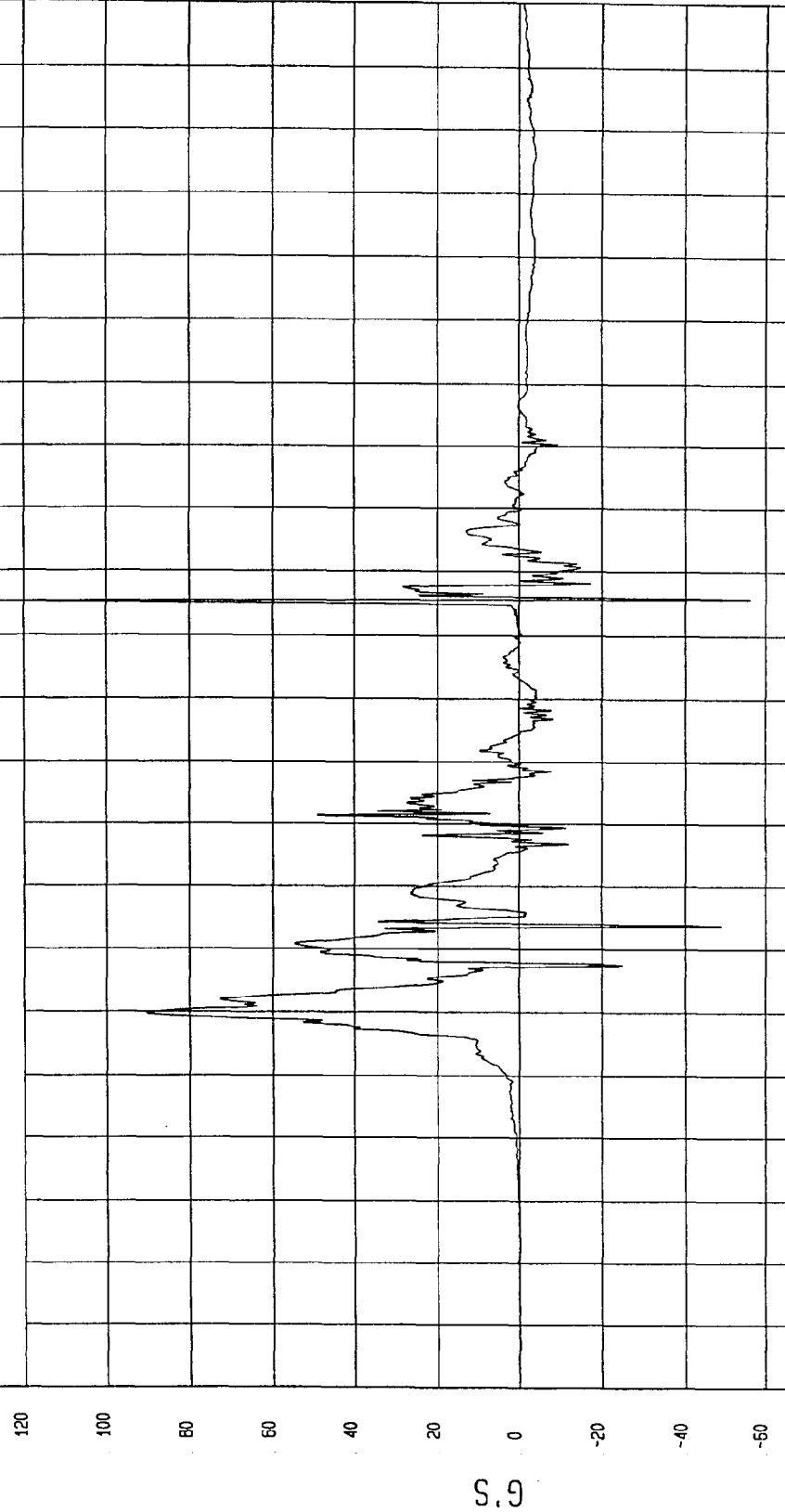
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 125.95 G'S at 105 msec

Minimum = -56.11 G'S at 106 msec

REAR PASSENGER UPPER RIB Y REDUNDANT ACCELERATION

1 899035AT.A46 FilterClass (1000)



MCA Research
03-16-1999 16.07

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

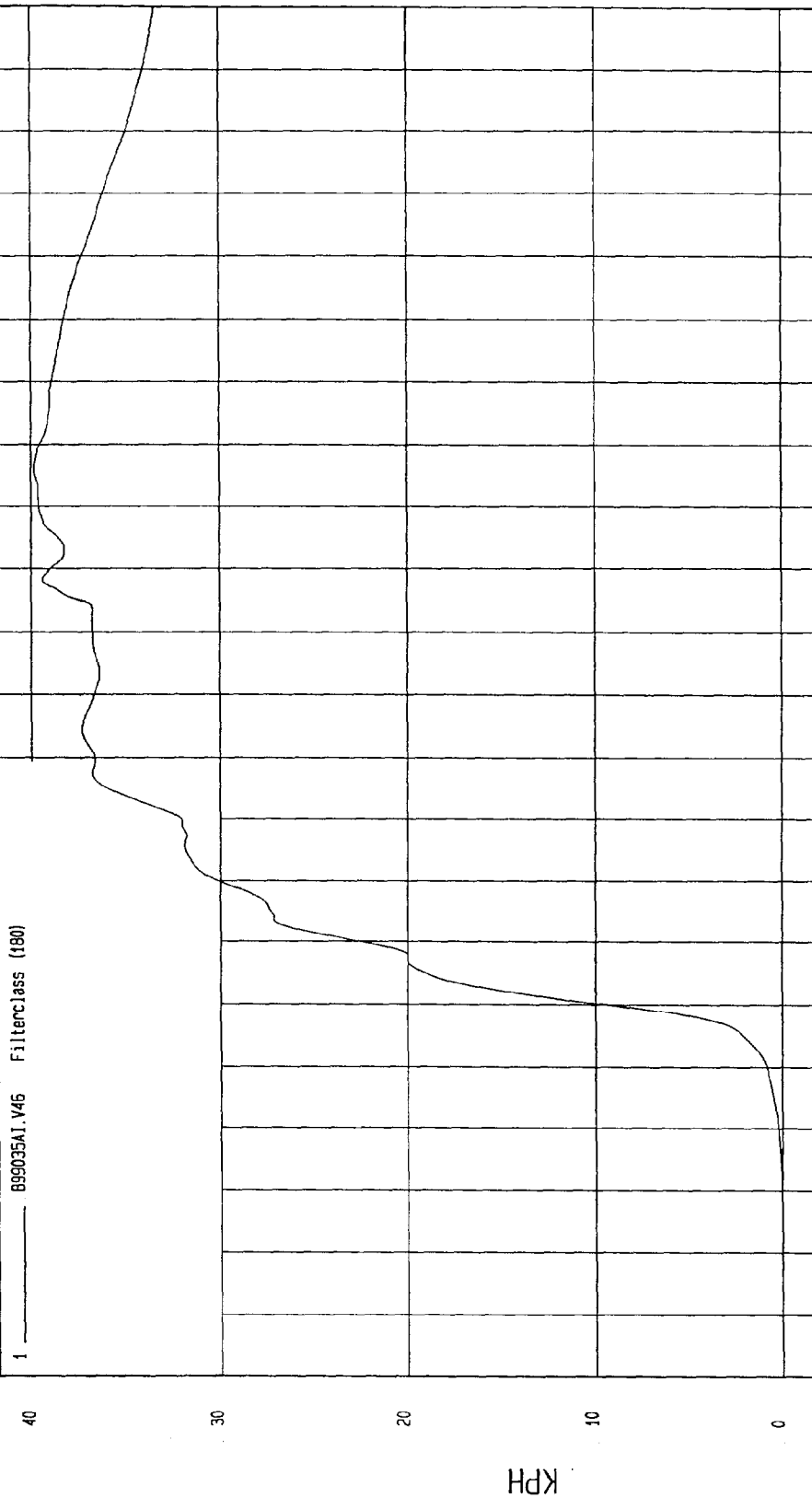
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 39.84 KPH at 126 msec

Minimum = -5.05E-04 KPH at -7 msec

REAR PASSENGER UPPER RIB Y REDUNDANT VELOCITY

1 — 899035A1.V46 Filterclass (180)



WCA Research
03-16-1999 16:43

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

SPEED: 33.2 MPH 53.4 KPH

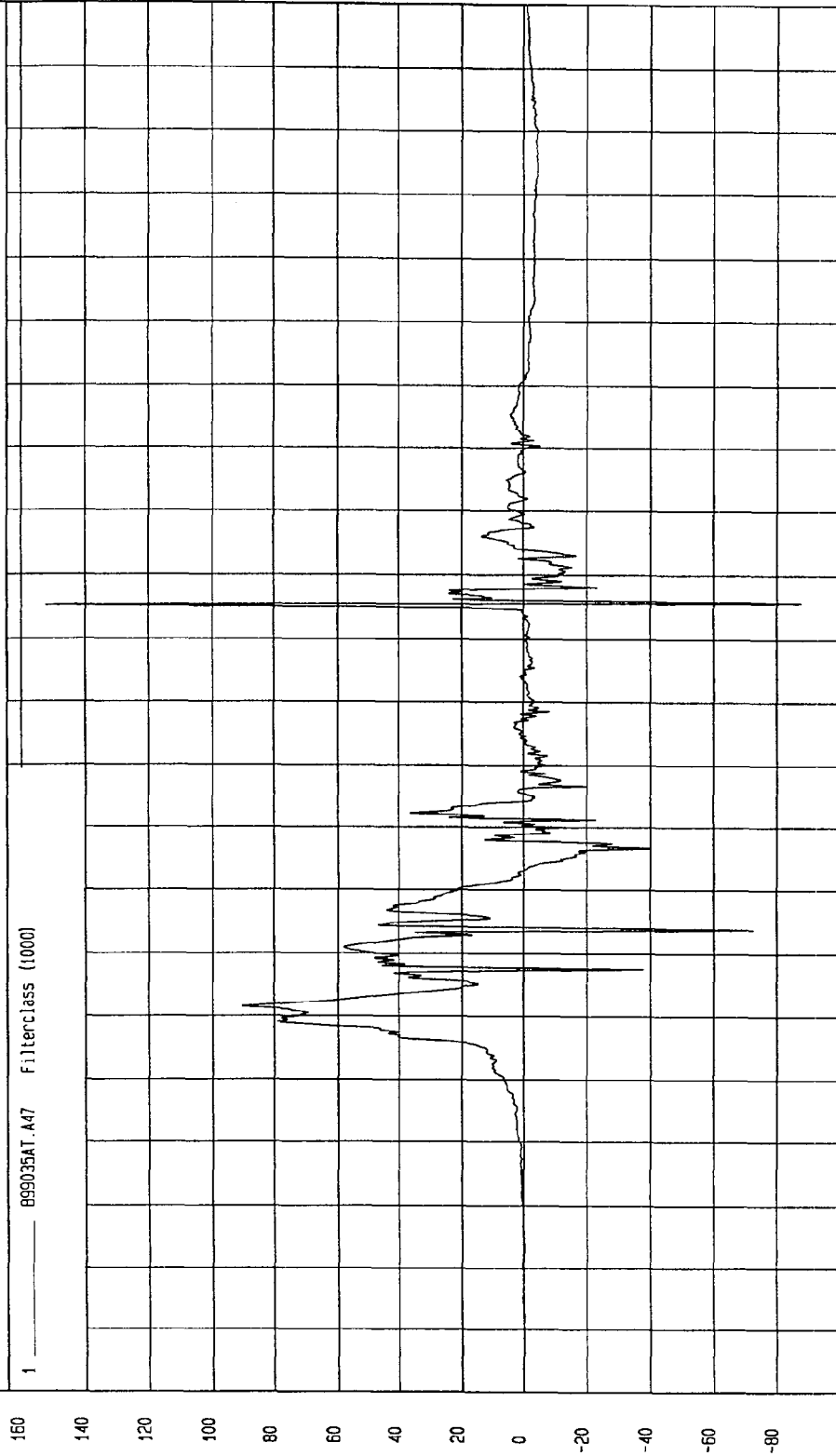
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 152.48 G'S at 105 msec

Minimum = -87.51 G'S at 106 msec

REAR PASSENGER LOWER RIB Y REDUNDANT ACCELERATION

1 _____ 899035AT.A47 Filterclass (1000)



MCA Research
03-16-1999 16:07

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

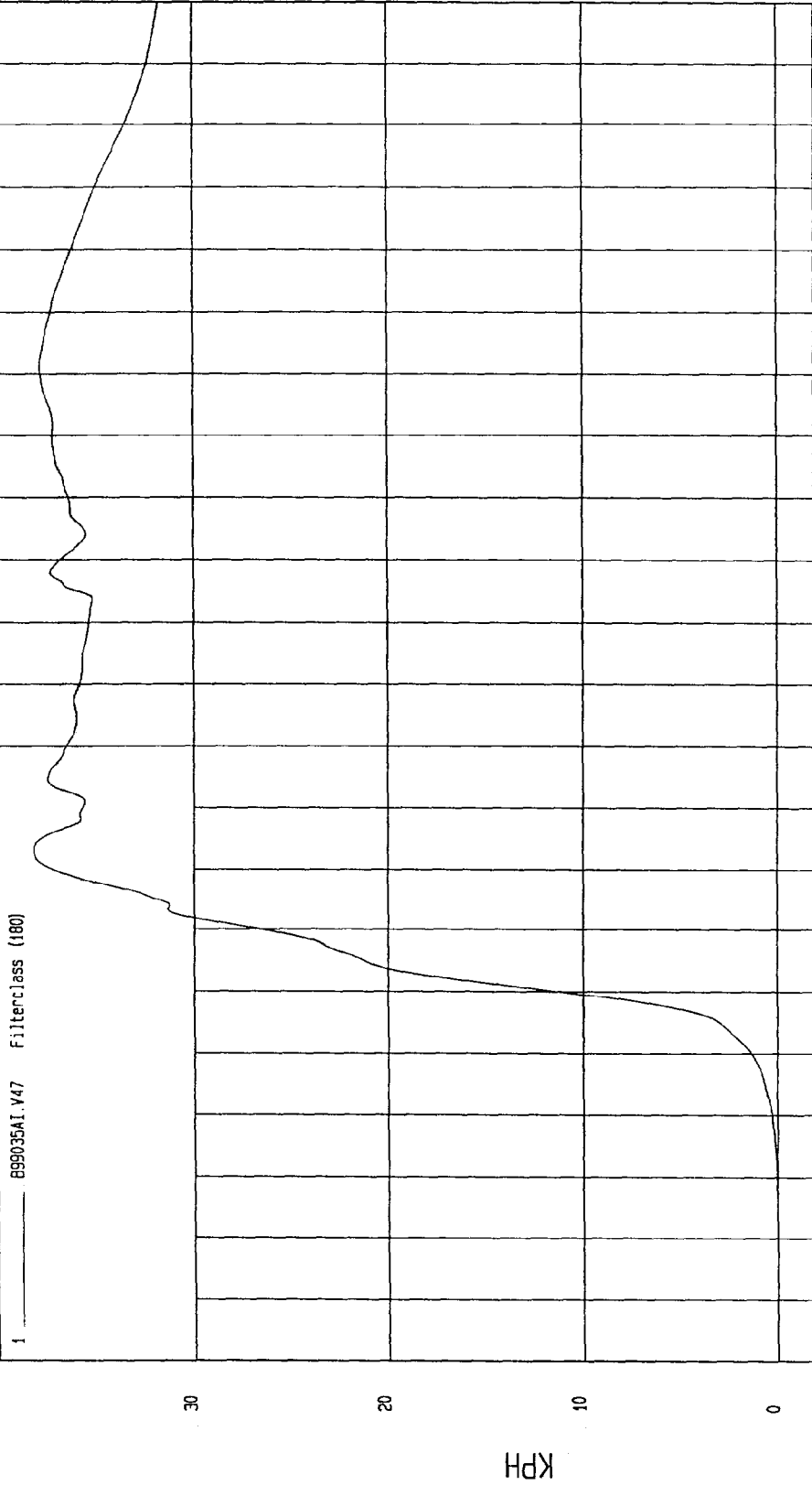
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.09 KPH at 63 msec

Minimum = -7.59E-03 KPH at -7 msec

REAR PASSENGER LOWER RIB Y REDUNDANT VELOCITY

1 ——— B99035A1 V47 Filterclass (180)



MSA Research
03-16-1999 16:43

TIME Seconds

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

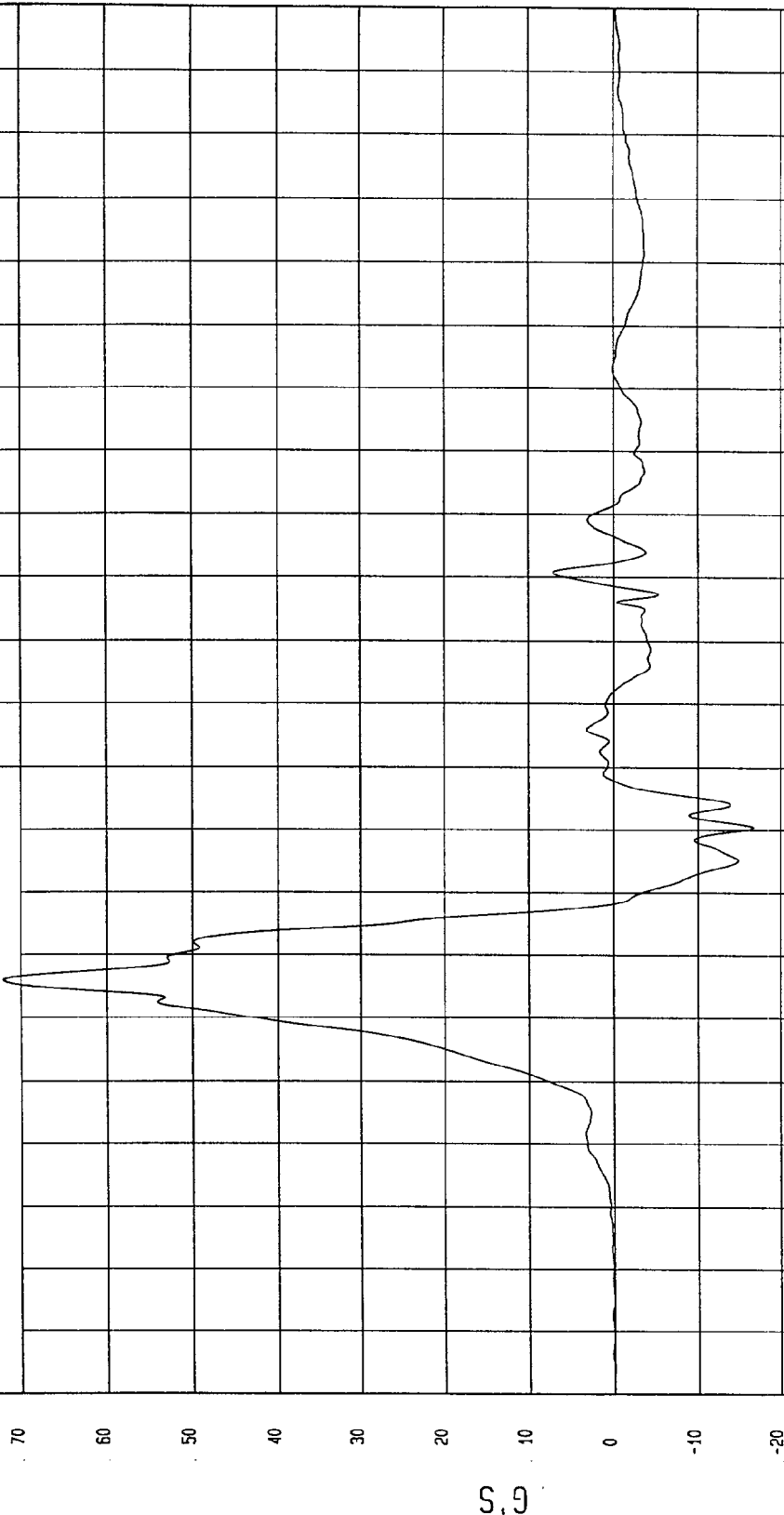
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 72.13 G'S at 46 msec

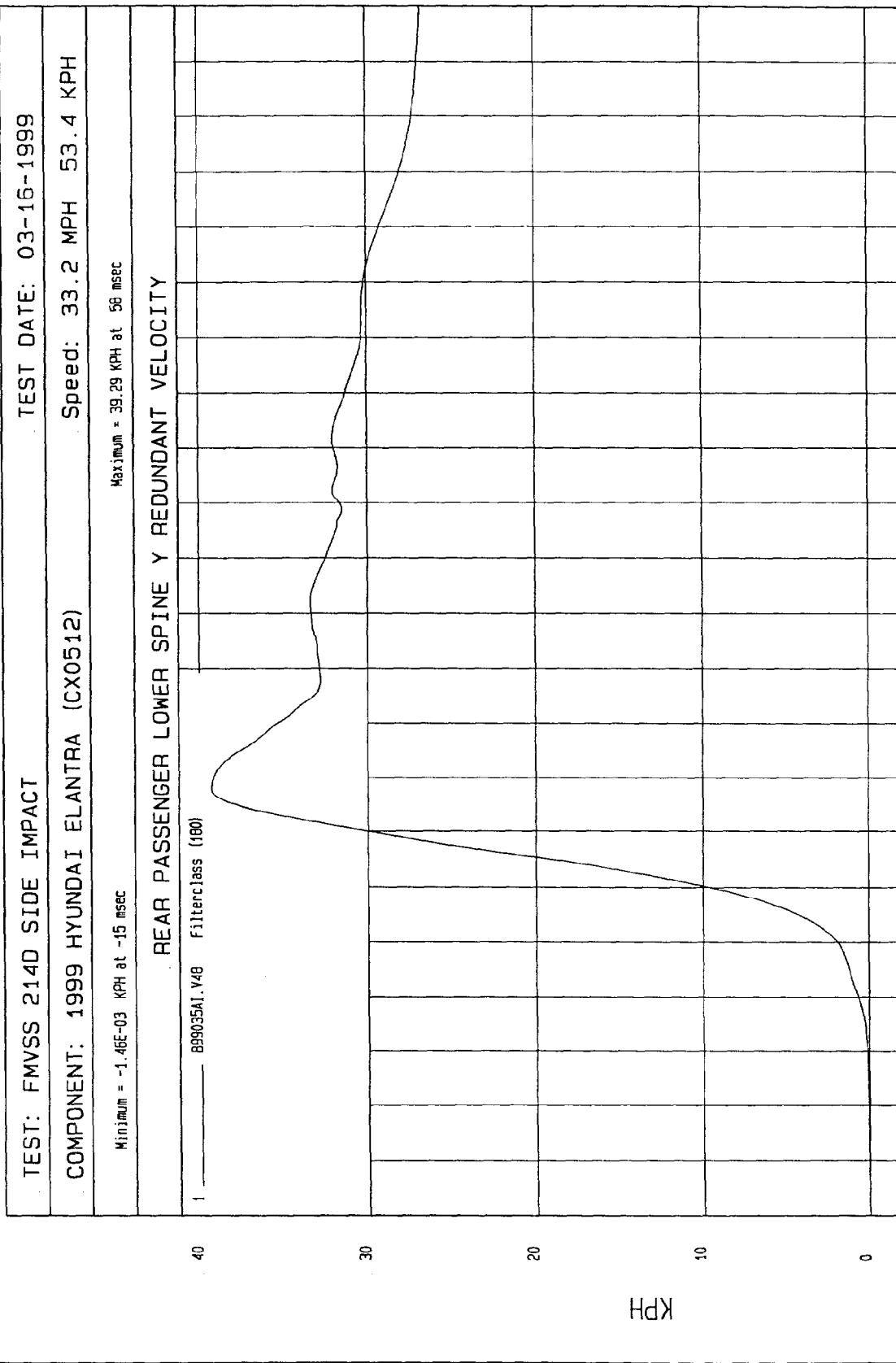
Minimum = -16.69 G'S at 70 msec

REAR PASSENGER LOWER SPINE Y REDUNDANT ACCELERATION

1 _____ 899035AF.A48 FilterClass (180)



MGA Research
03-16-1999 16:08



MGA Research
03-16-1999 16.43

TIME Seconds

KPH

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

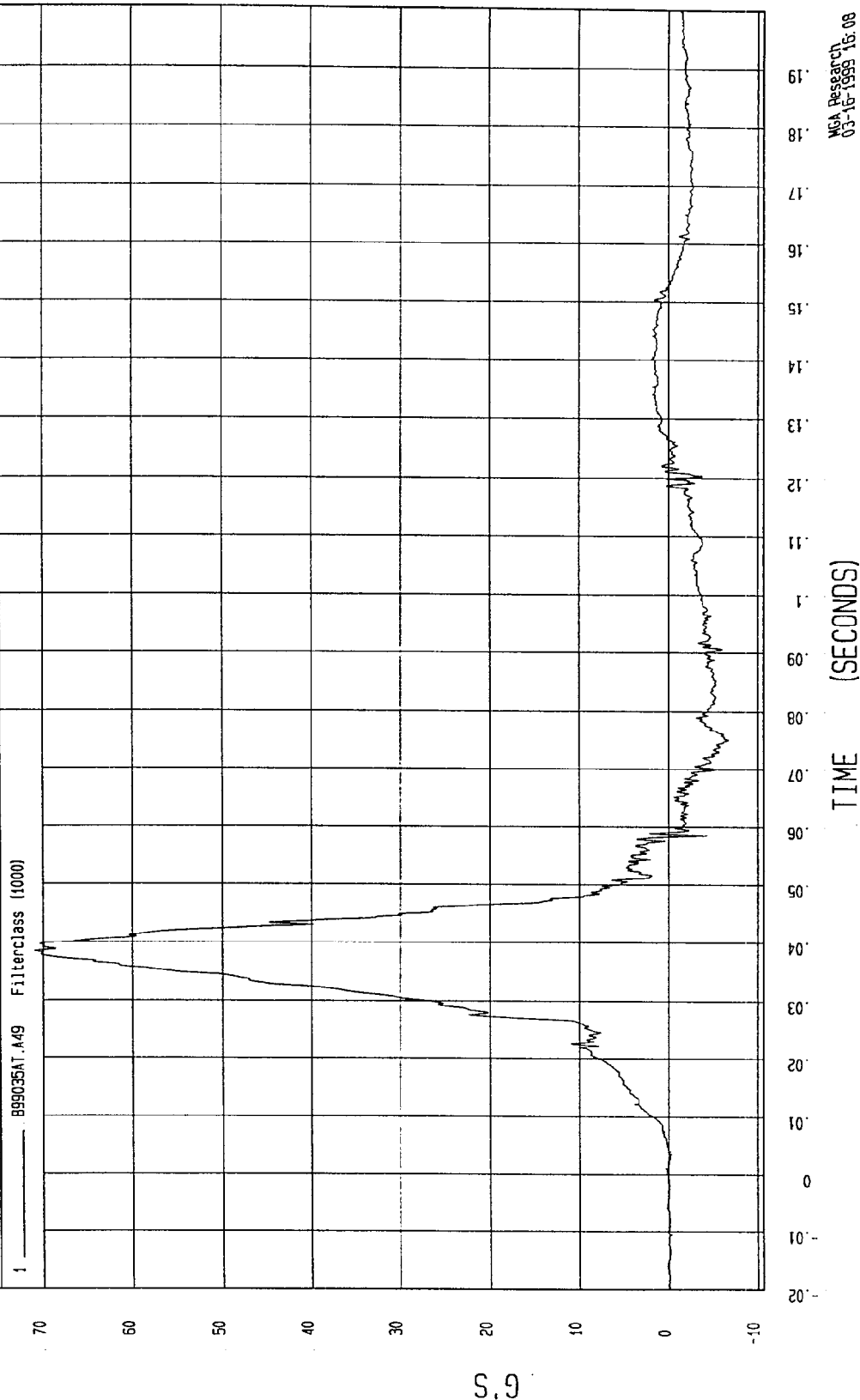
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 70.98 G'S at 38 msec

Minimum = -6.72 G'S at 75 msec

REAR PASSENGER PELVIS Y REDUNDANT ACCELERATION



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 37.58 KPH at 58 msec

Minimum = -6.85E-03 KPH at -7 msec

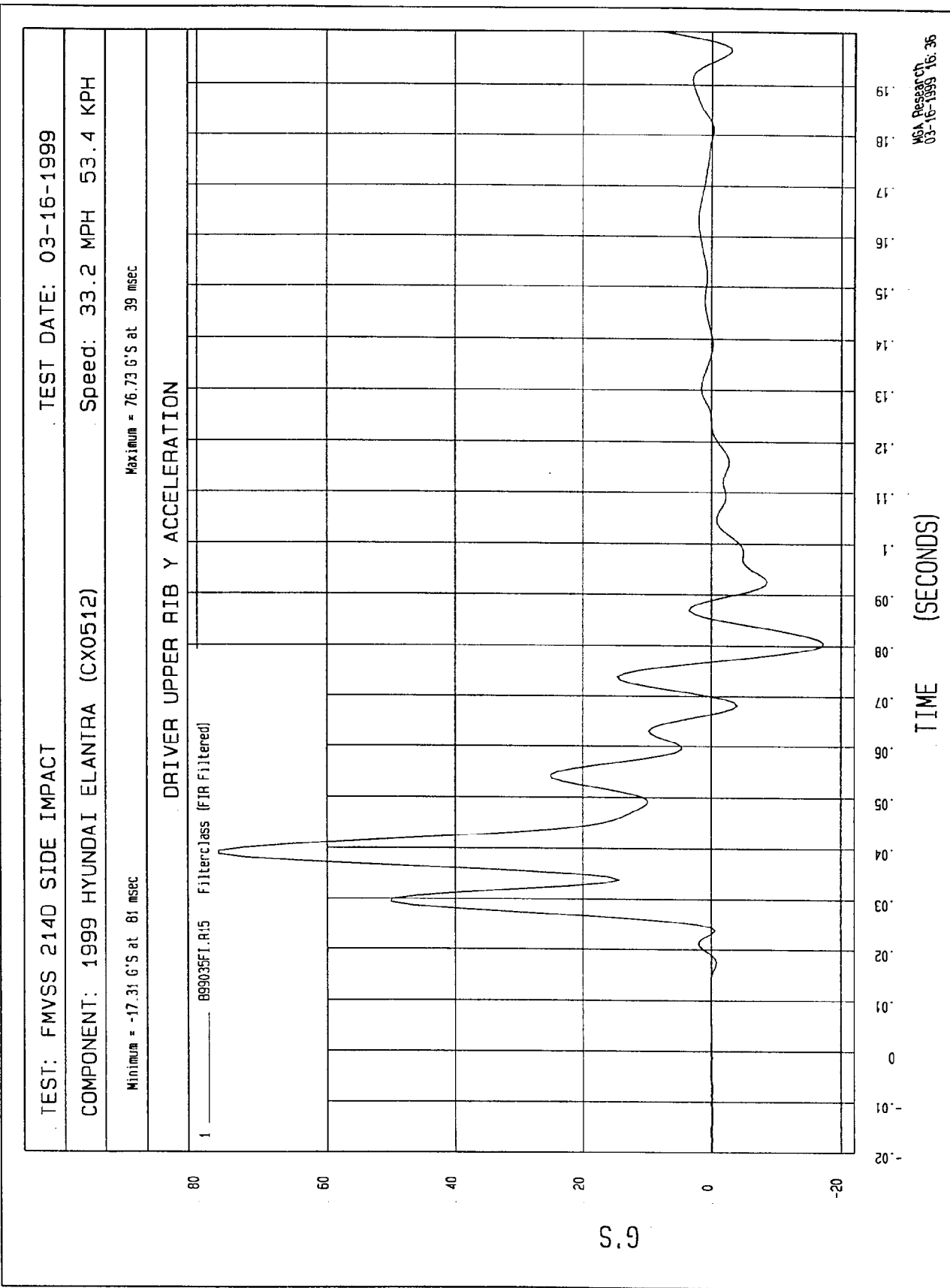
REAR PASSENGER PELVIS Y REDUNDANT VELOCITY

1 B99035A1.V49 Filter: class (160)



TIME Seconds

MCA Research
03-16-1999 16:43



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

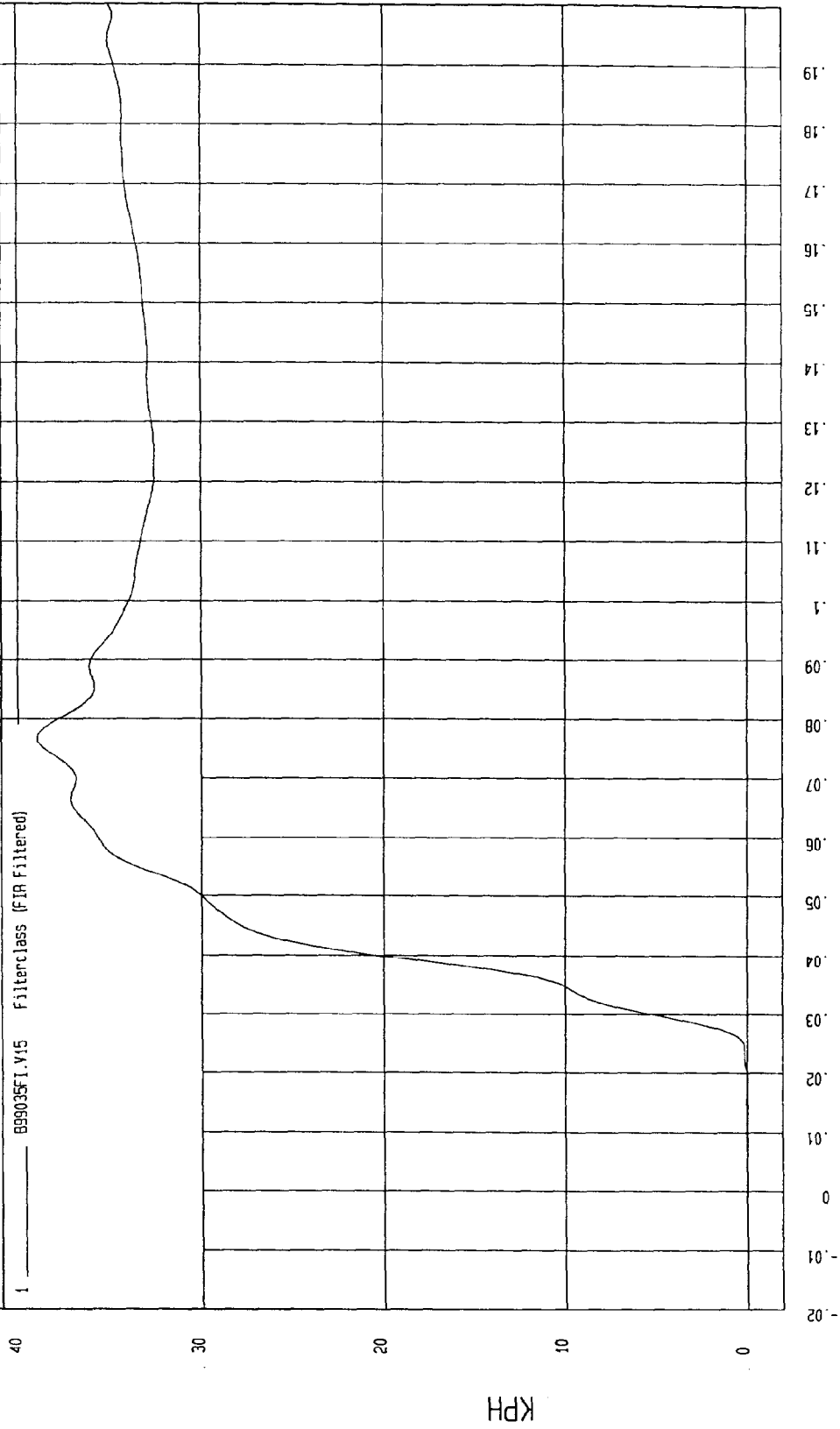
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.98 KPH at 77 msec

Minimum = -1.98E-02 KPH at 19 msec

DRIVER UPPER RIB Y VELOCITY



MCA Research
03-16-1999 16:39

TIME Seconds

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

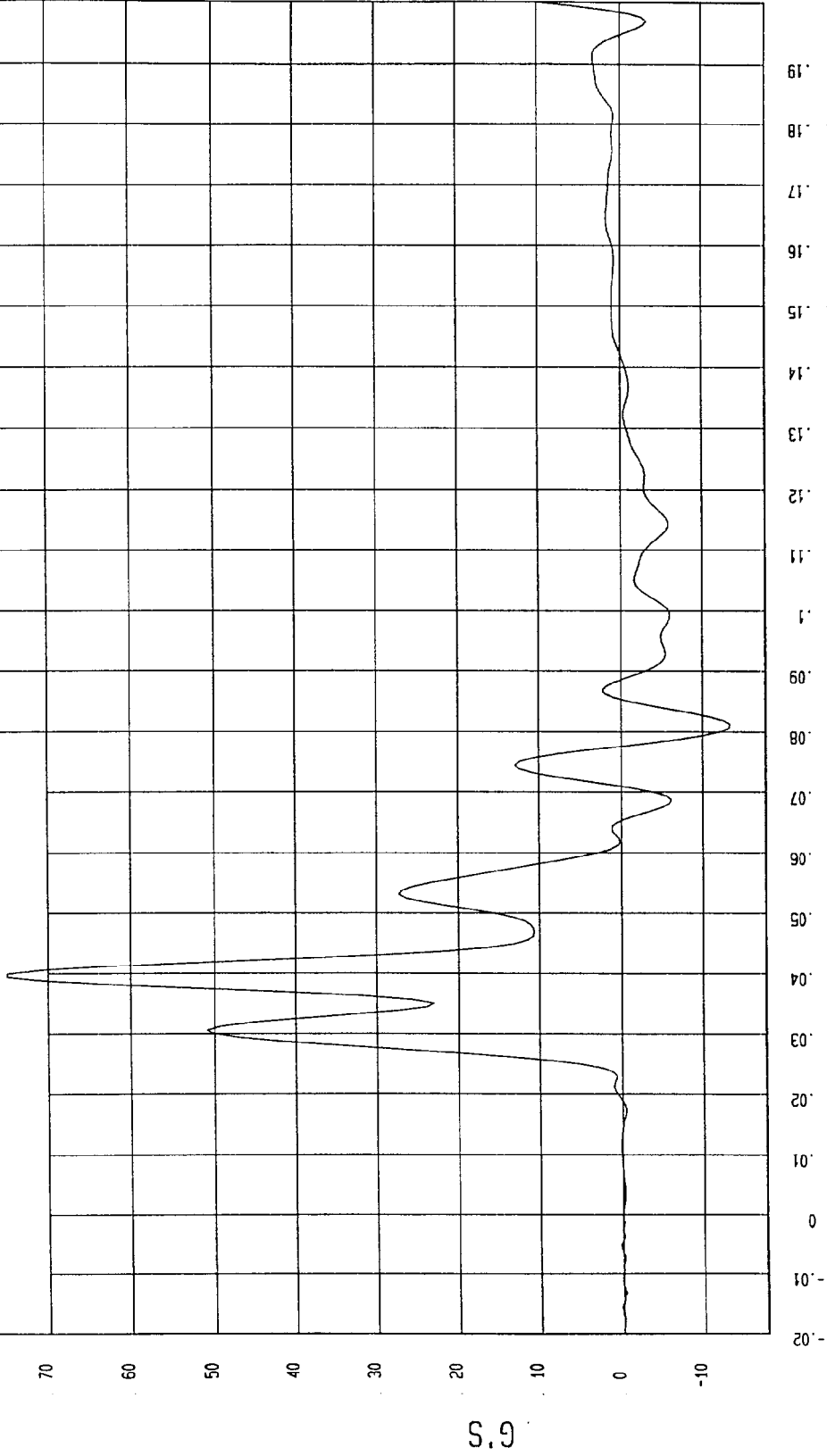
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 74.94 G'S at 39 msec

Minimum = -13.39 G'S at 81 msec

DRIVER LOWER RIB Y ACCELERATION

1 899035FI.R16 Filterclass (FIR Filtered)



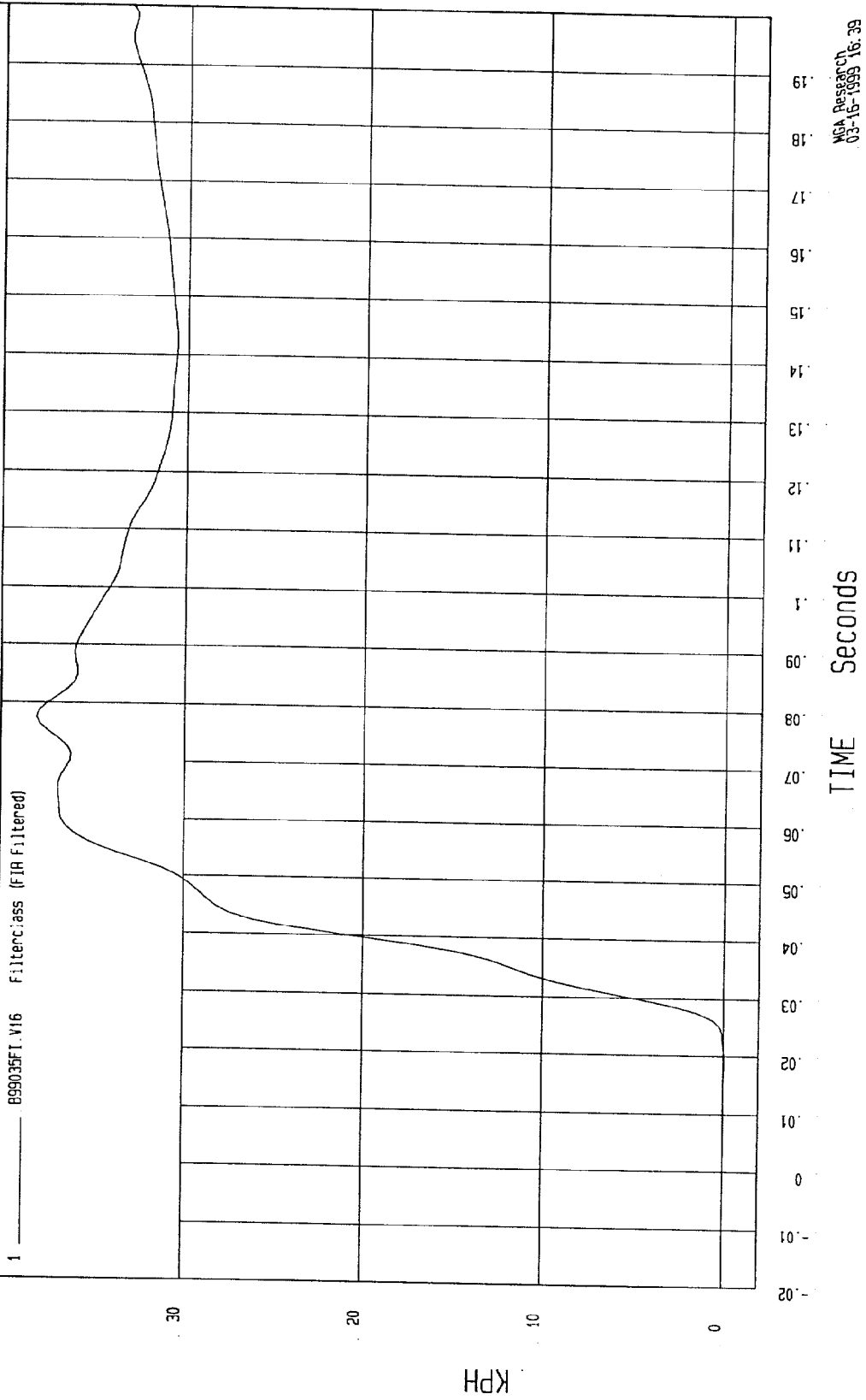
MGA Research
03-16-1999 16:36

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -.05 KPH at 19 msec Maximum = 38.12 KPH at 78 msec

DRIVER LOWER RIB Y VELOCITY

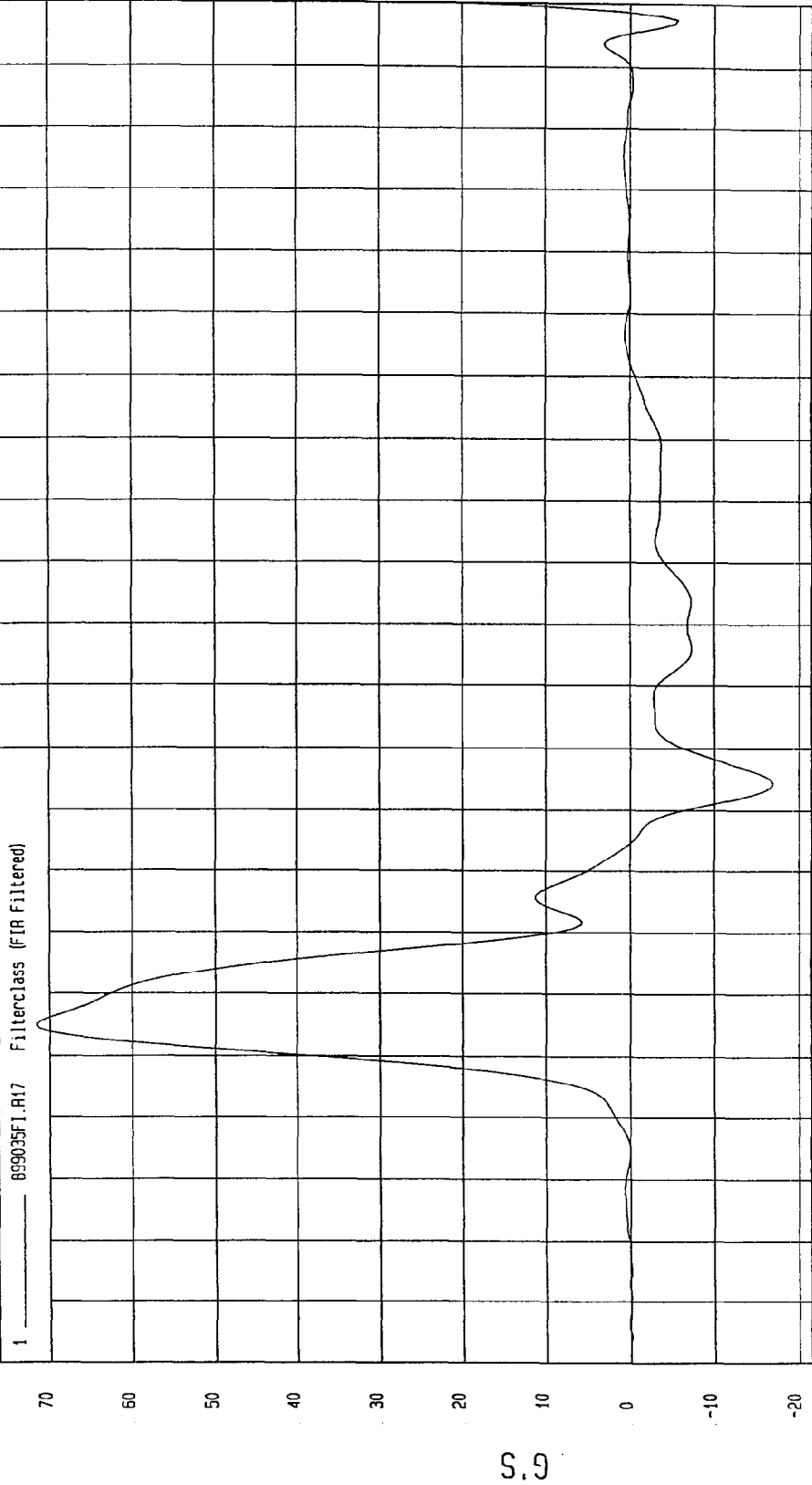


TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -17.04 G'S at 74 msec Maximum = 71.54 G'S at 35 msec

DRIVER LOWER SPINE Y ACCELERATION



MCA Research
03-16-1999 18:35

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

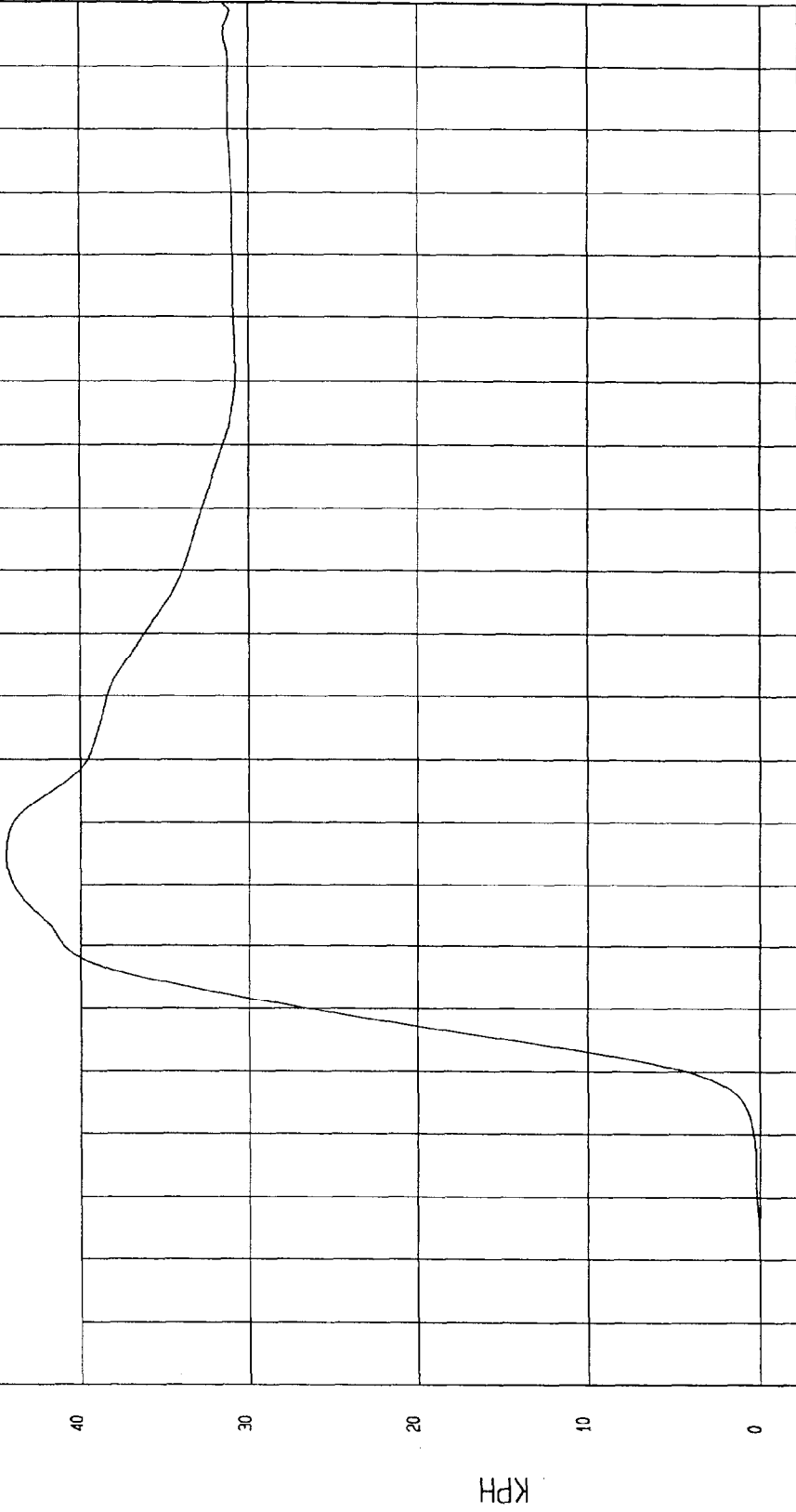
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Minimum = -6.94E-03 KPH at 0 msec

Maximum = 44.38 KPH at 65 msec

DRIVER LOWER SPINE Y VELOCITY

1 _____ 899035F1.V17 FilterClass (FIR filtered)



TIME Seconds

NSA Research
03-16-1999 16:39

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

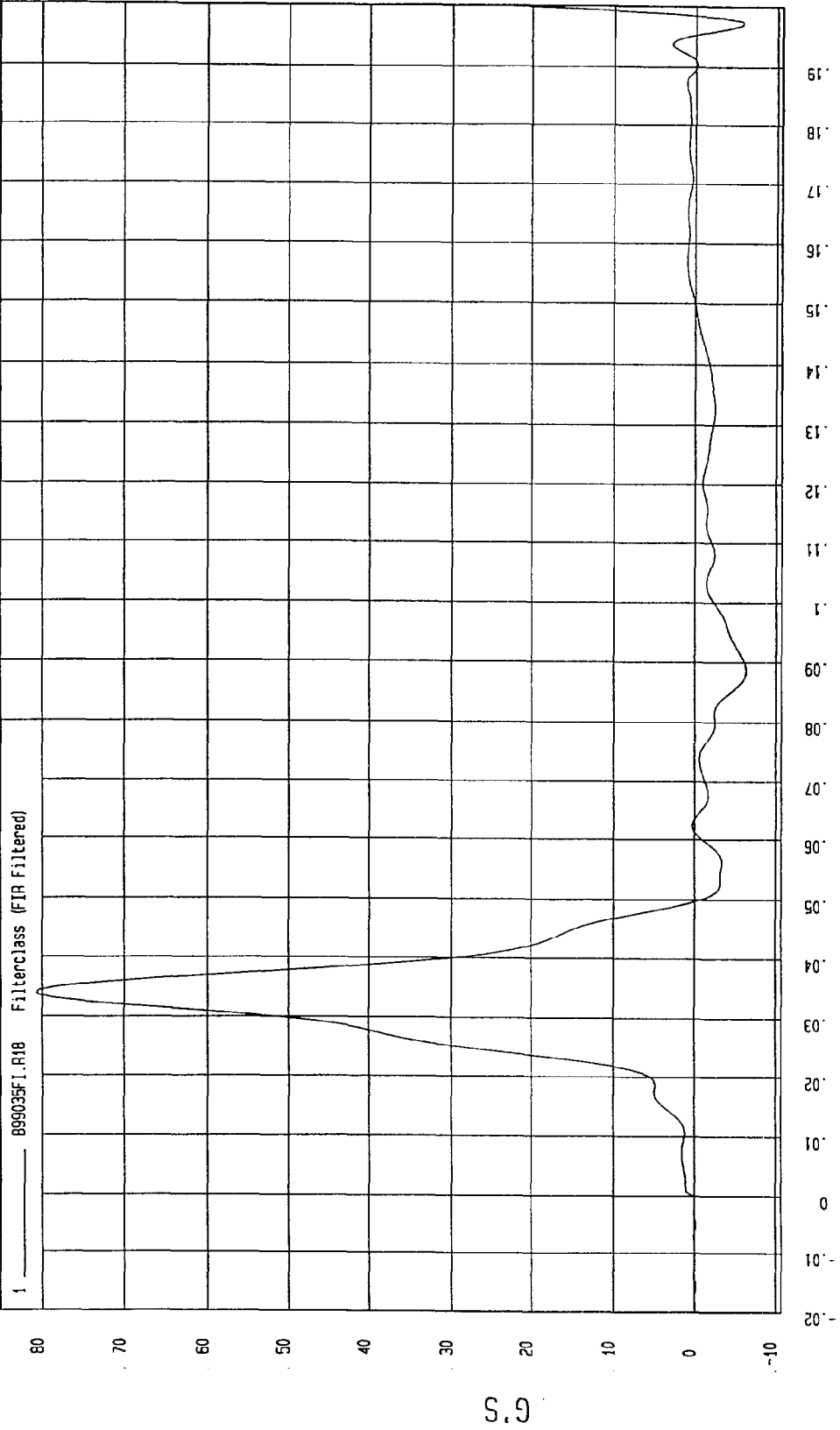
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 80.74 G'S at 34 msec

Minimum = -6.35 G'S at 89 msec

DRIVER PELVIS Y ACCELERATION



MSA Research
03-16-1999 16:36

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

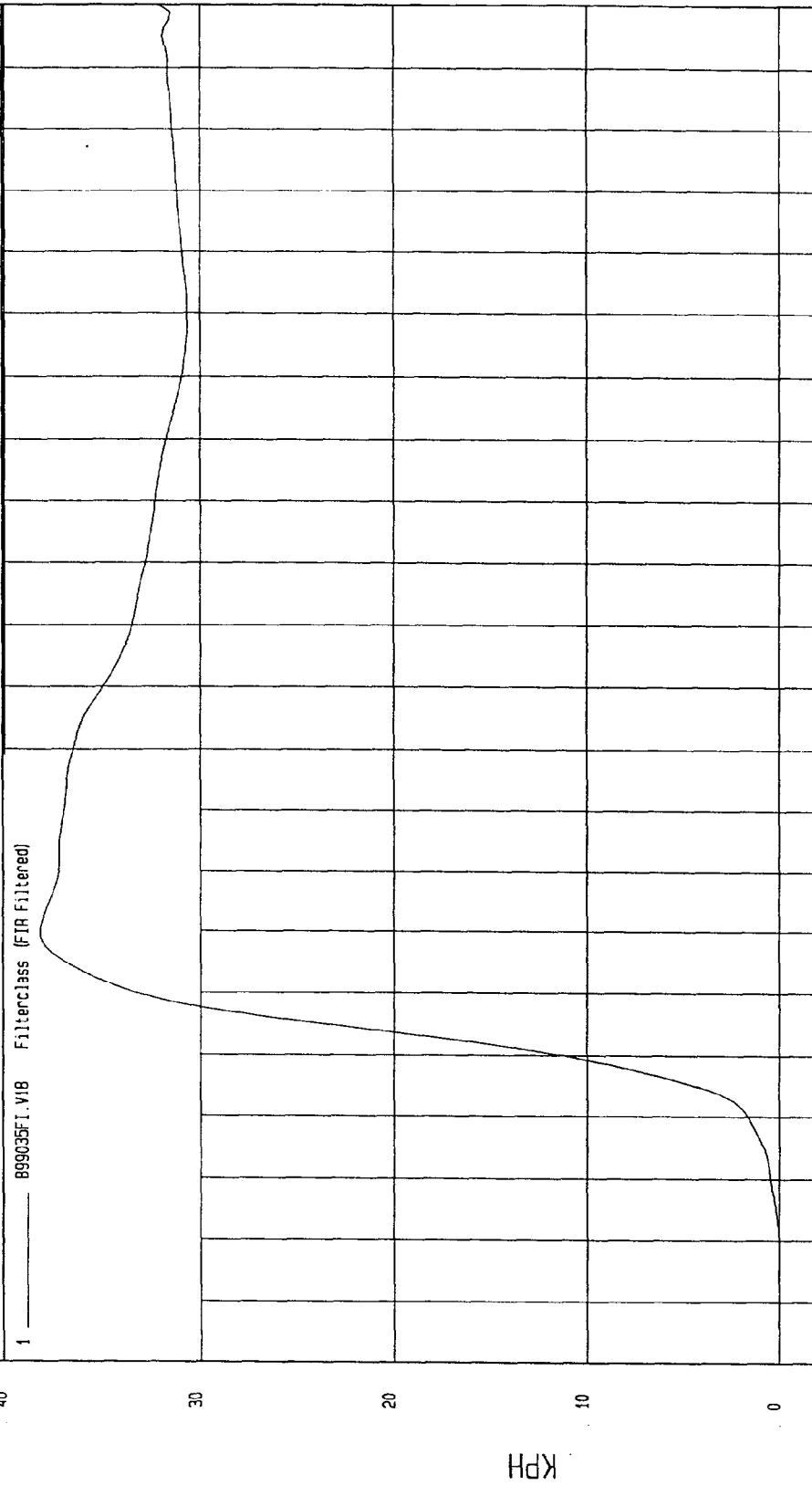
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.21 KPH at 50 msec

Minimum = -7.60E-03 KPH at -14 msec

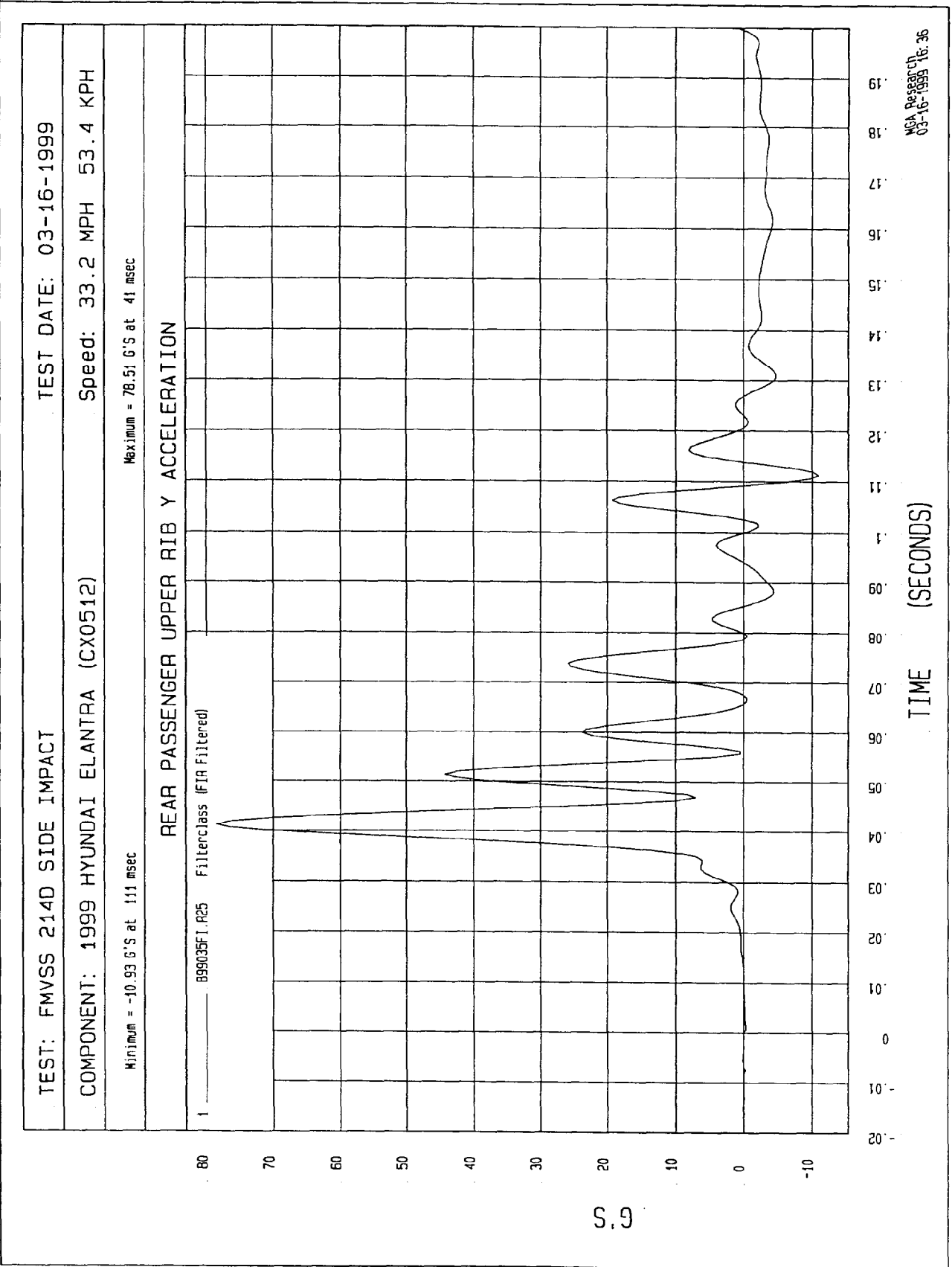
DRIVER PELVIS Y VELOCITY



MCA Research
03-16-1999 16:39

TIME Seconds

FINITE IMPULSE RESPONSE (FIR) FILTERED DATA



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

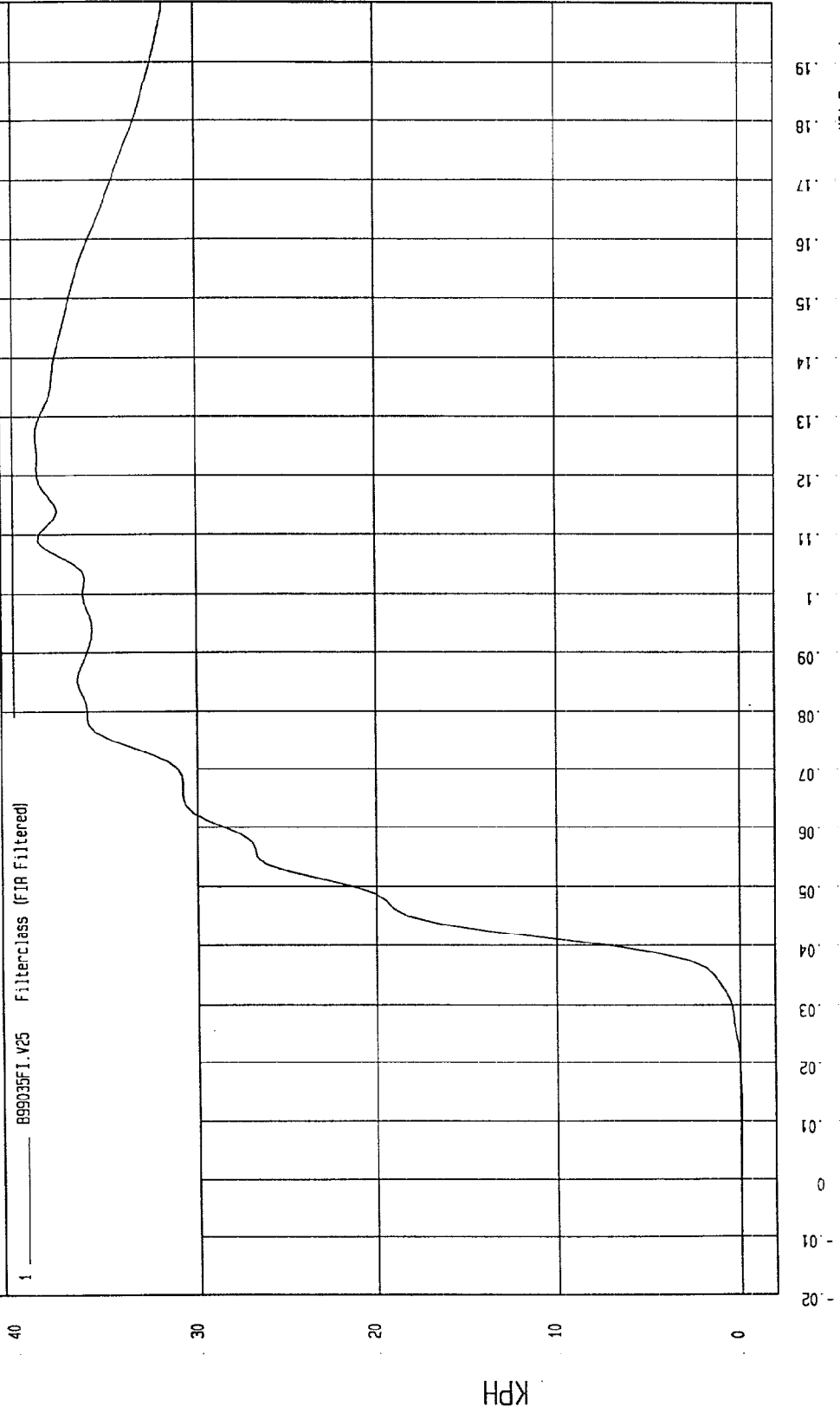
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.75 KPH at 127 msec

Minimum = -5.70E-02 KPH at 12 msec

REAR PASSENGER UPPER RIB Y VELOCITY



MCA Research
03-16-1999 16:39

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

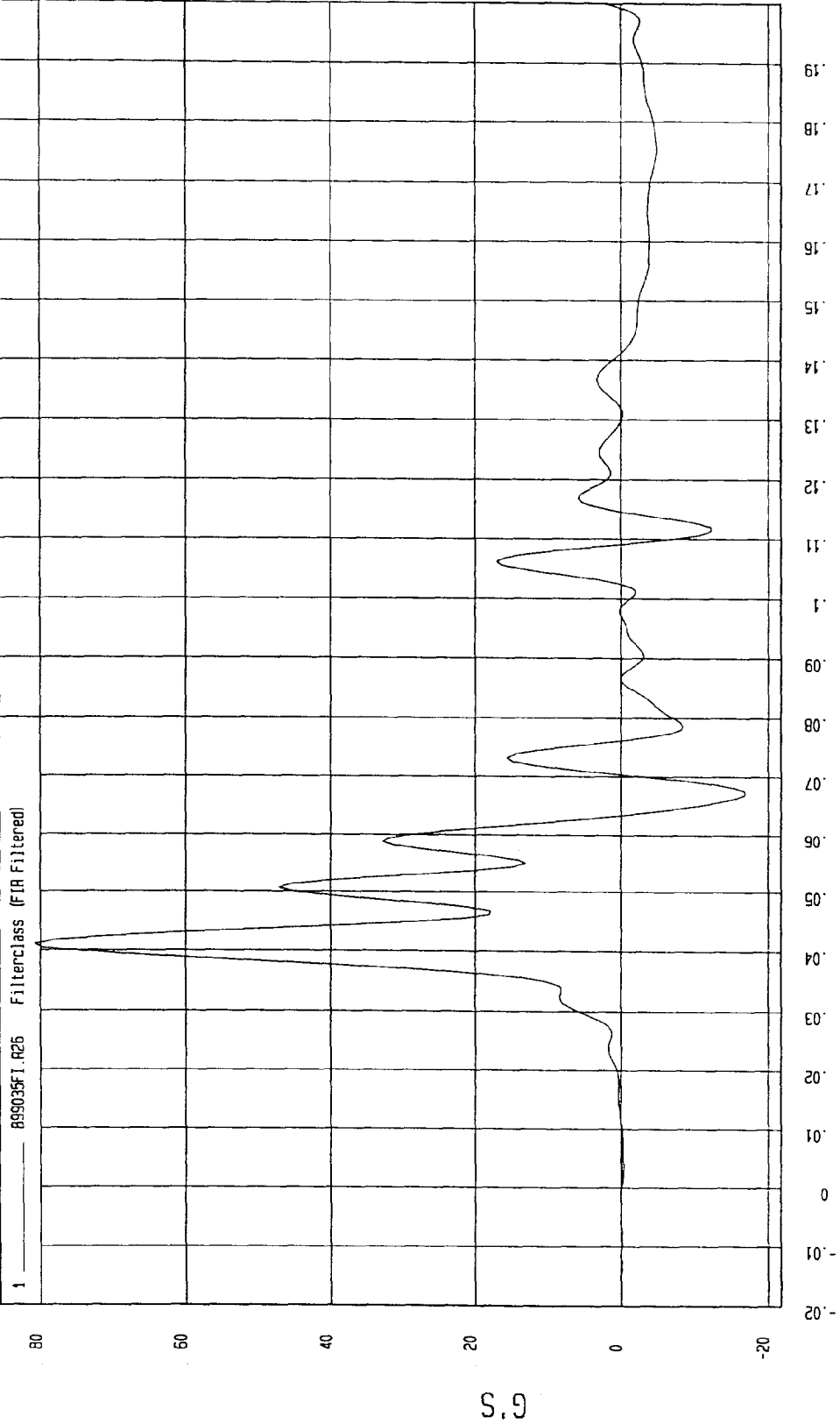
Speed: 33.2 MPH 53.4 KPH

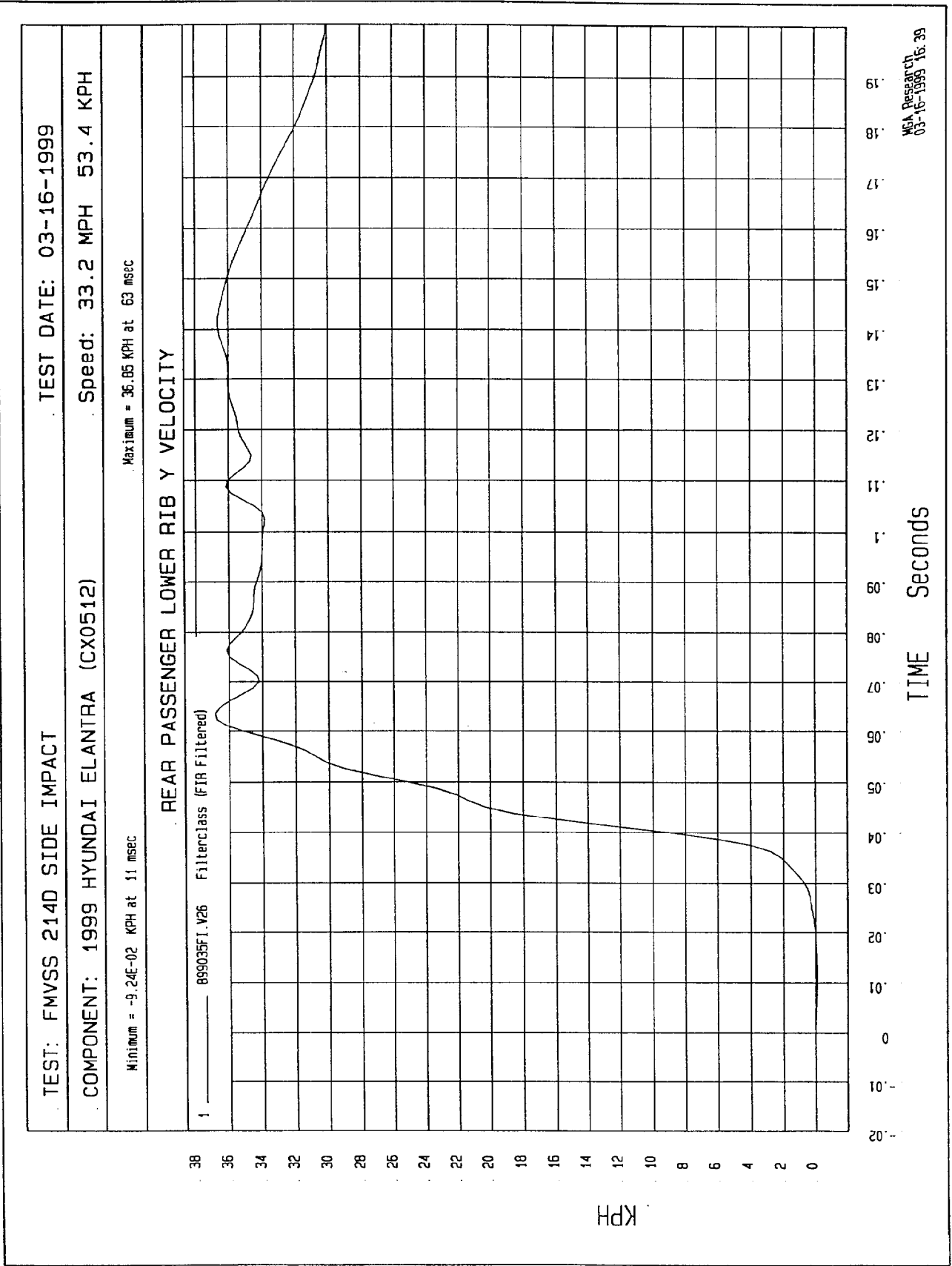
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 80.75 G'S at 41 msec

Minimum = -16.81 G'S at 68 msec

REAR PASSENGER LOWER RIB Y ACCELERATION





TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

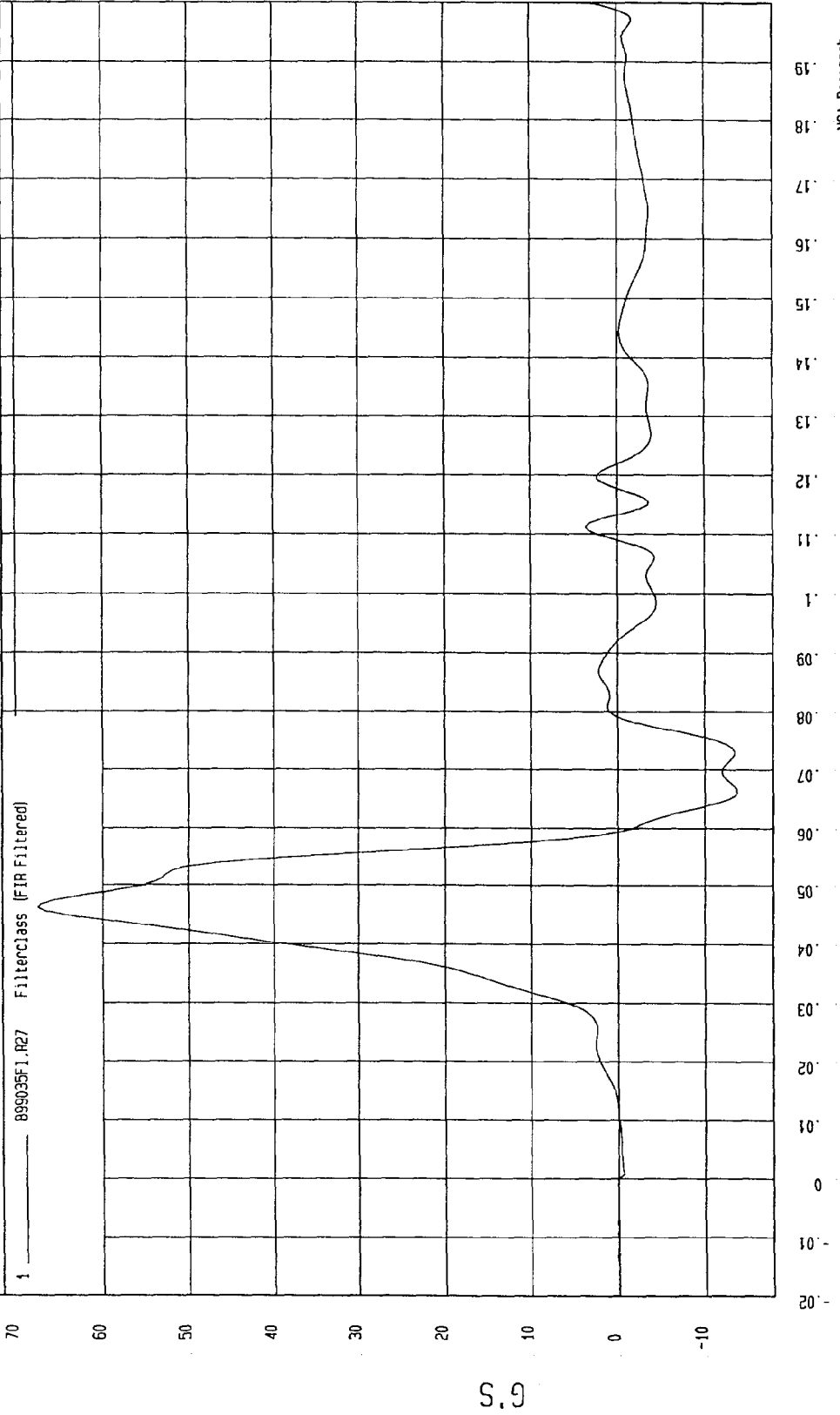
Speed: 33.2 MPH 53.4 KPH

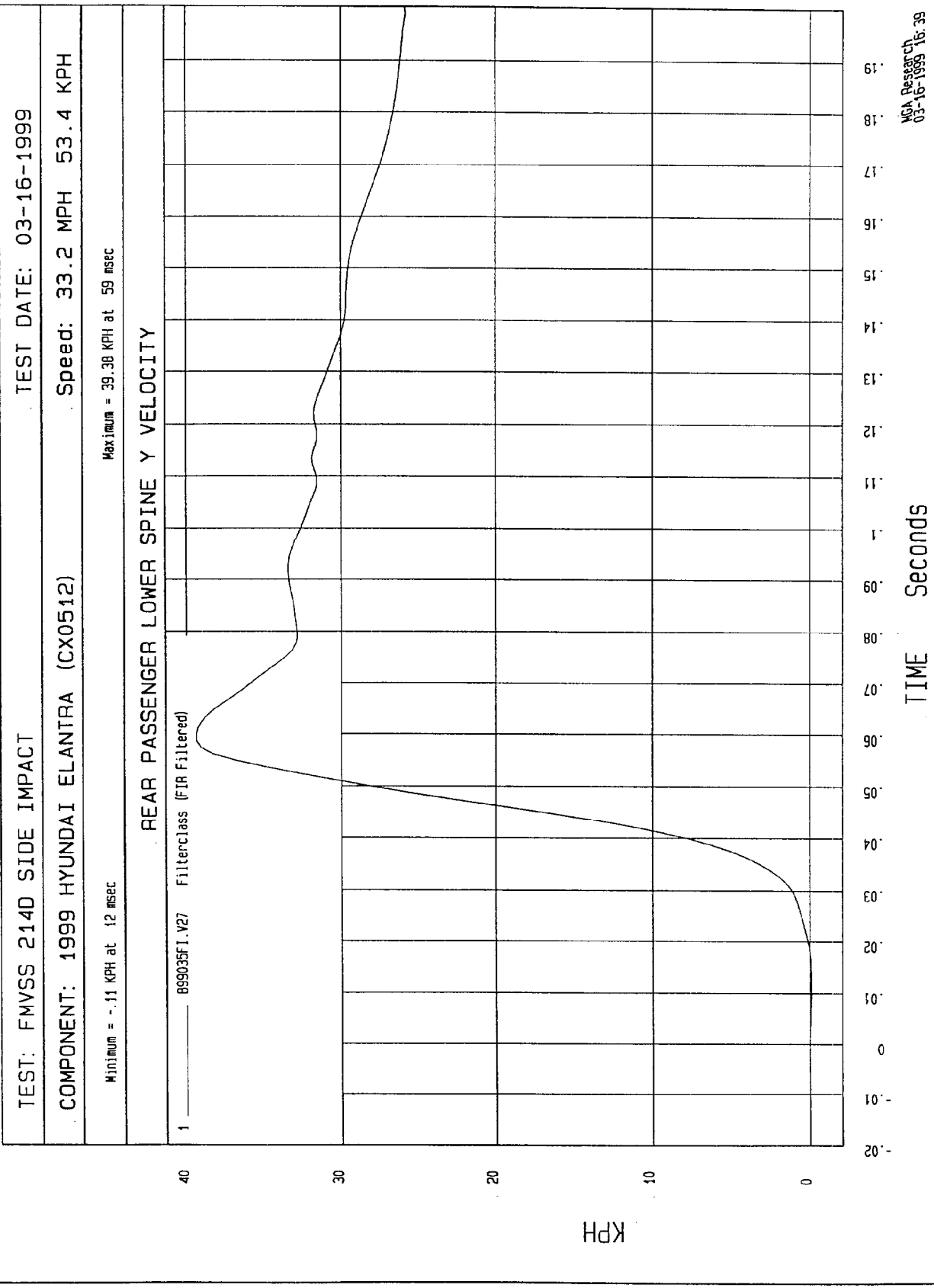
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 67.44 G'S at 46 msec

Minimum = -13.82 G'S at 66 msec

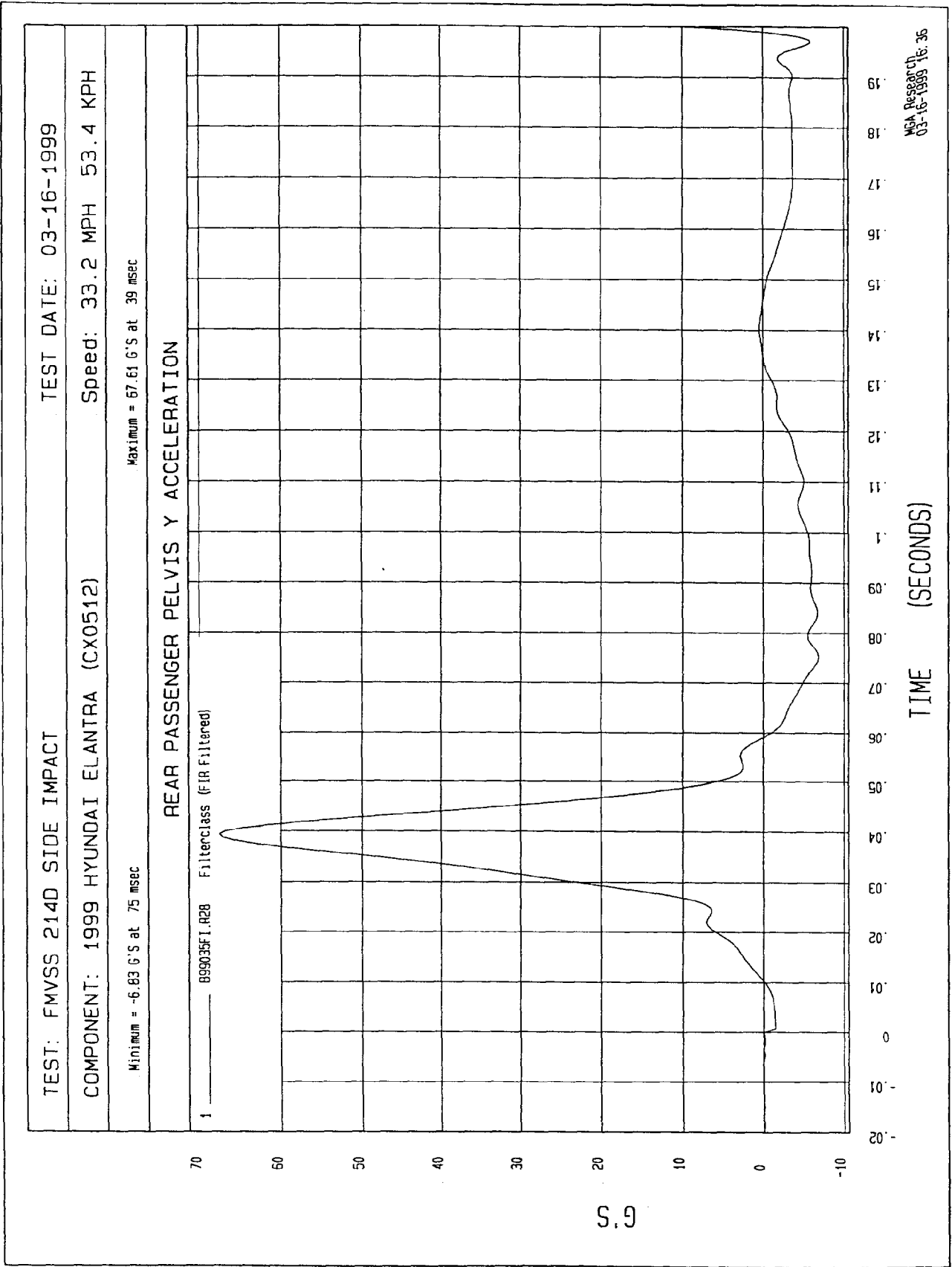
REAR PASSENGER LOWER SPINE Y ACCELERATION





1 _____ B99035F1.V27 FilterClass (FIR Filtered)

TIME Seconds

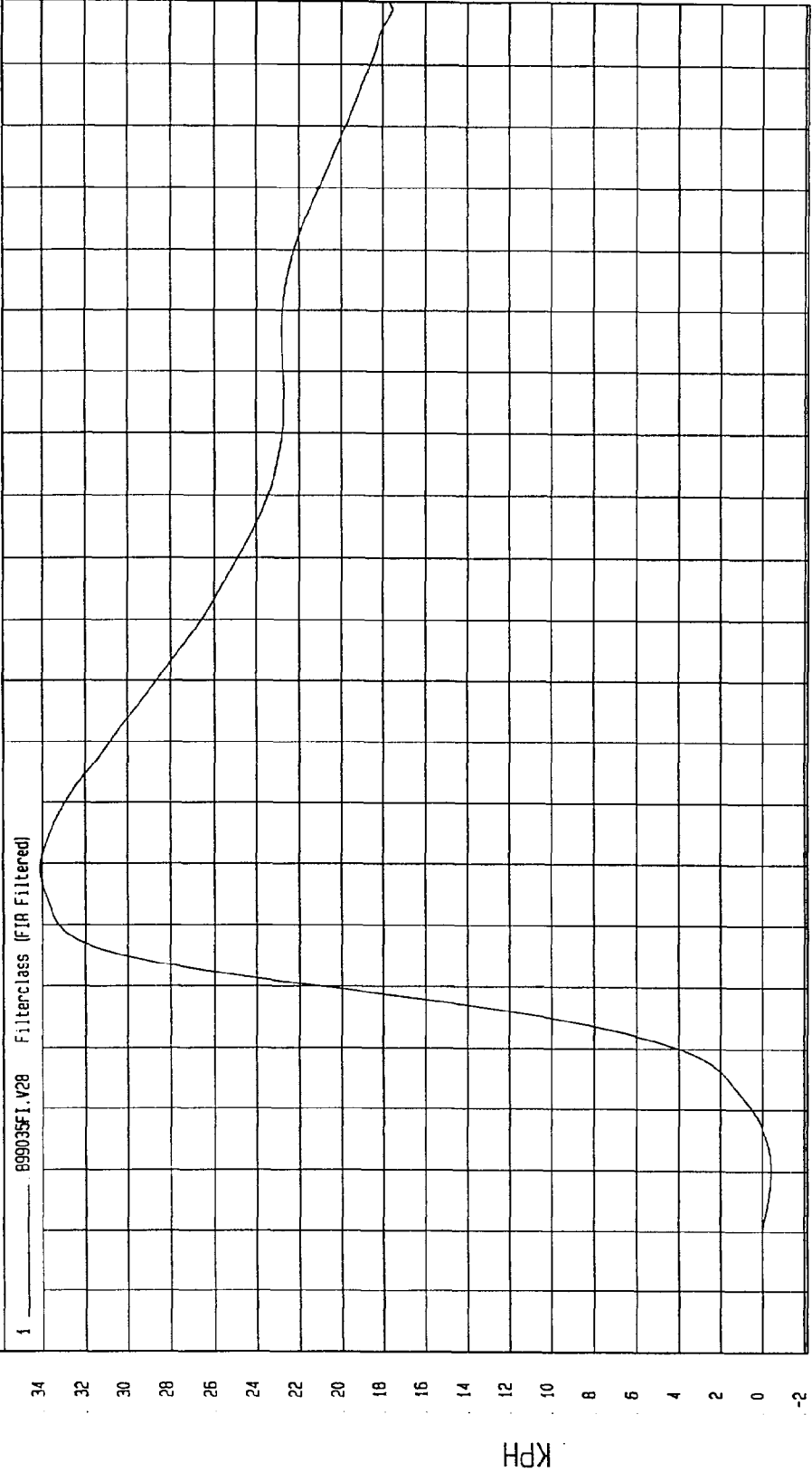


TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -42 KPH at 11 msec Maximum = 34.09 KPH at 59 msec

REAR PASSENGER PELVIS Y VELOCITY



WCA Research
03-16-1999 16:39

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

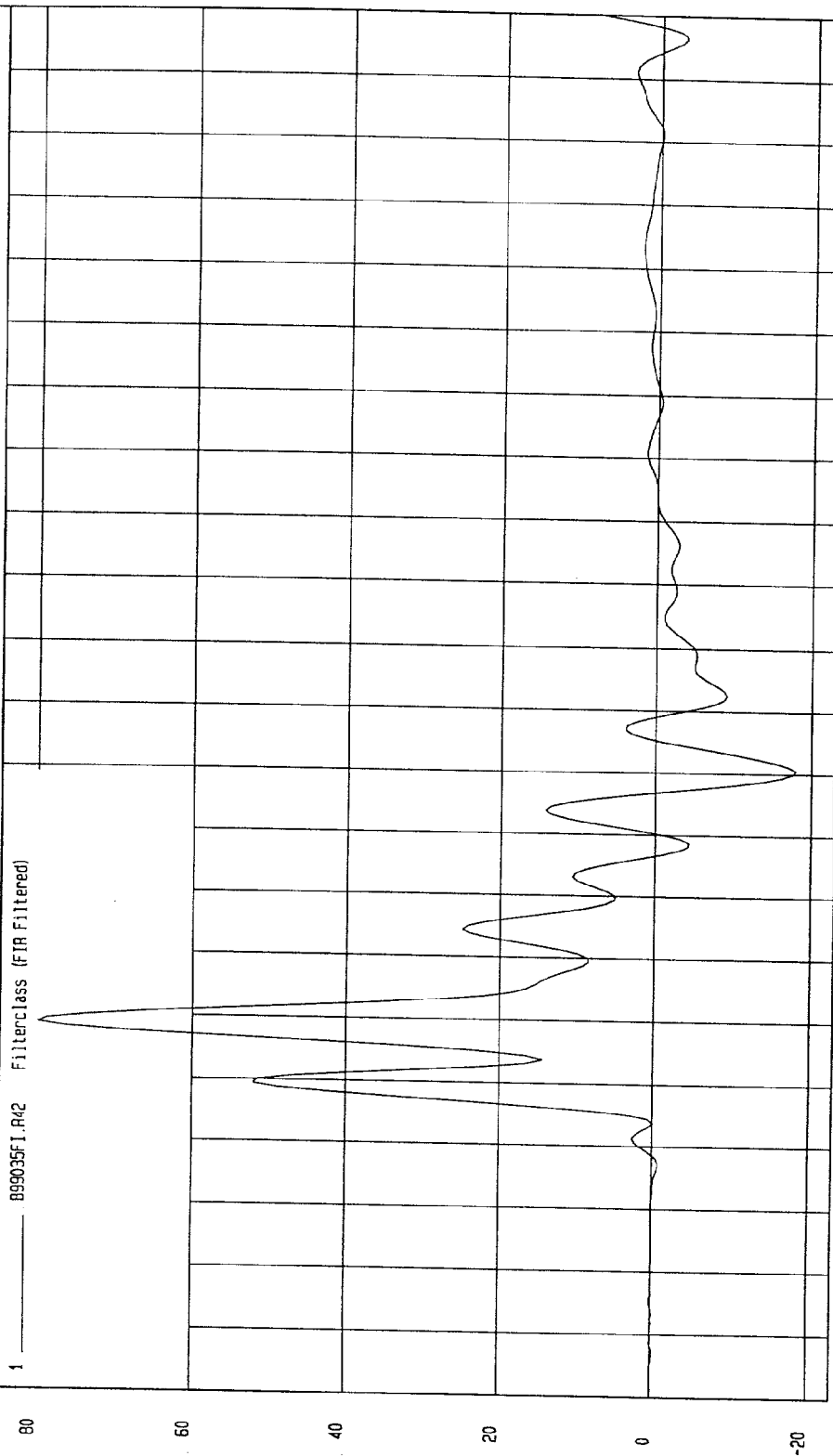
Speed: 33.2 MPH 53.4 KPH

Minimum = -10.05 G'S at 81 msec

Maximum = 79.85 G'S at 39 msec

DRIVER UPPER RIB Y REDUNDANT ACCELERATION

1 ——— B99035F1.R42 Filterclass (FIR Filtered)



MCA Research
03-16-1999 16:36

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

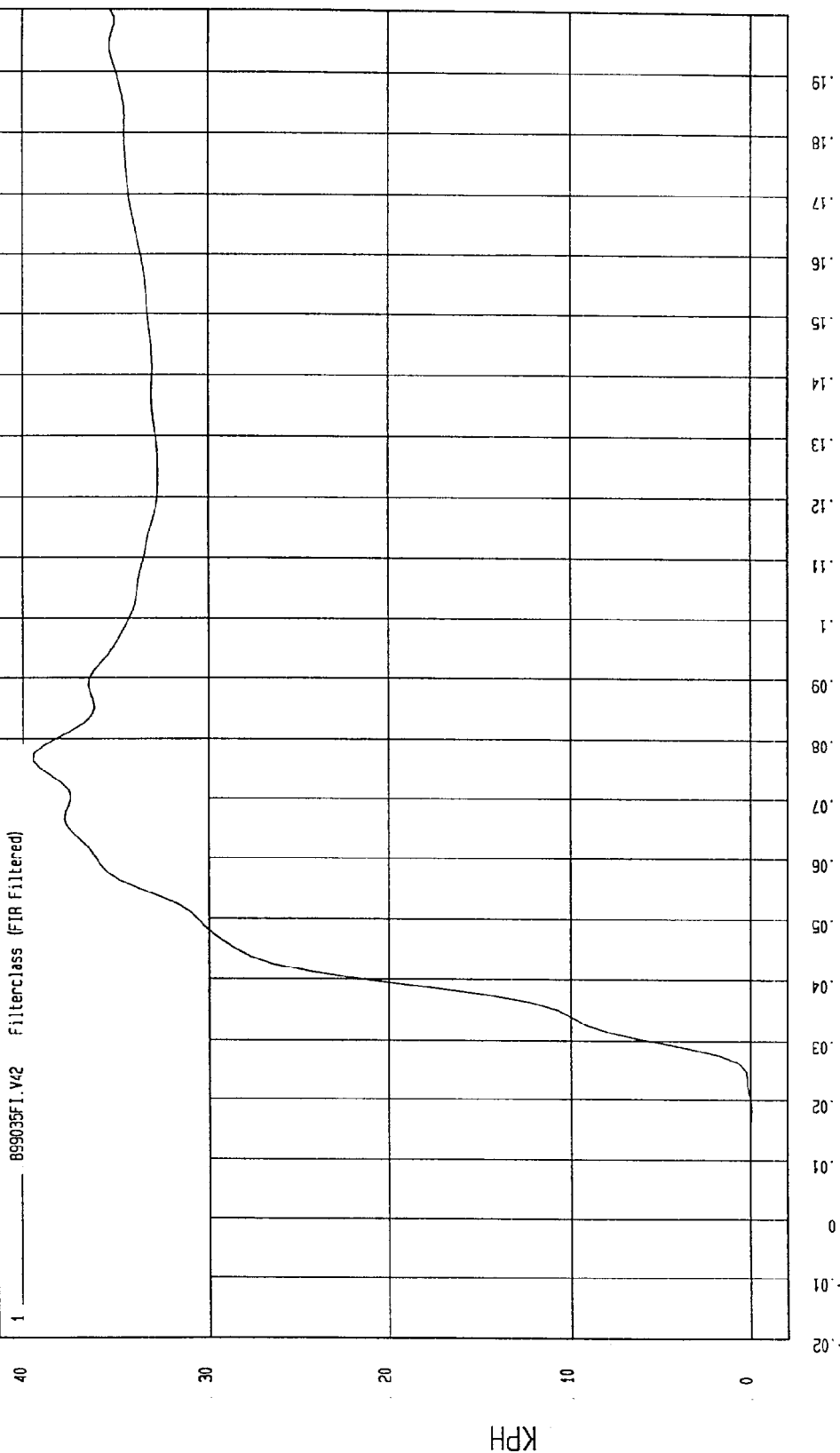
Speed: 33.2 MPH 53.4 KPH

Minimum = -6.20E-02 KPH at 19 msec

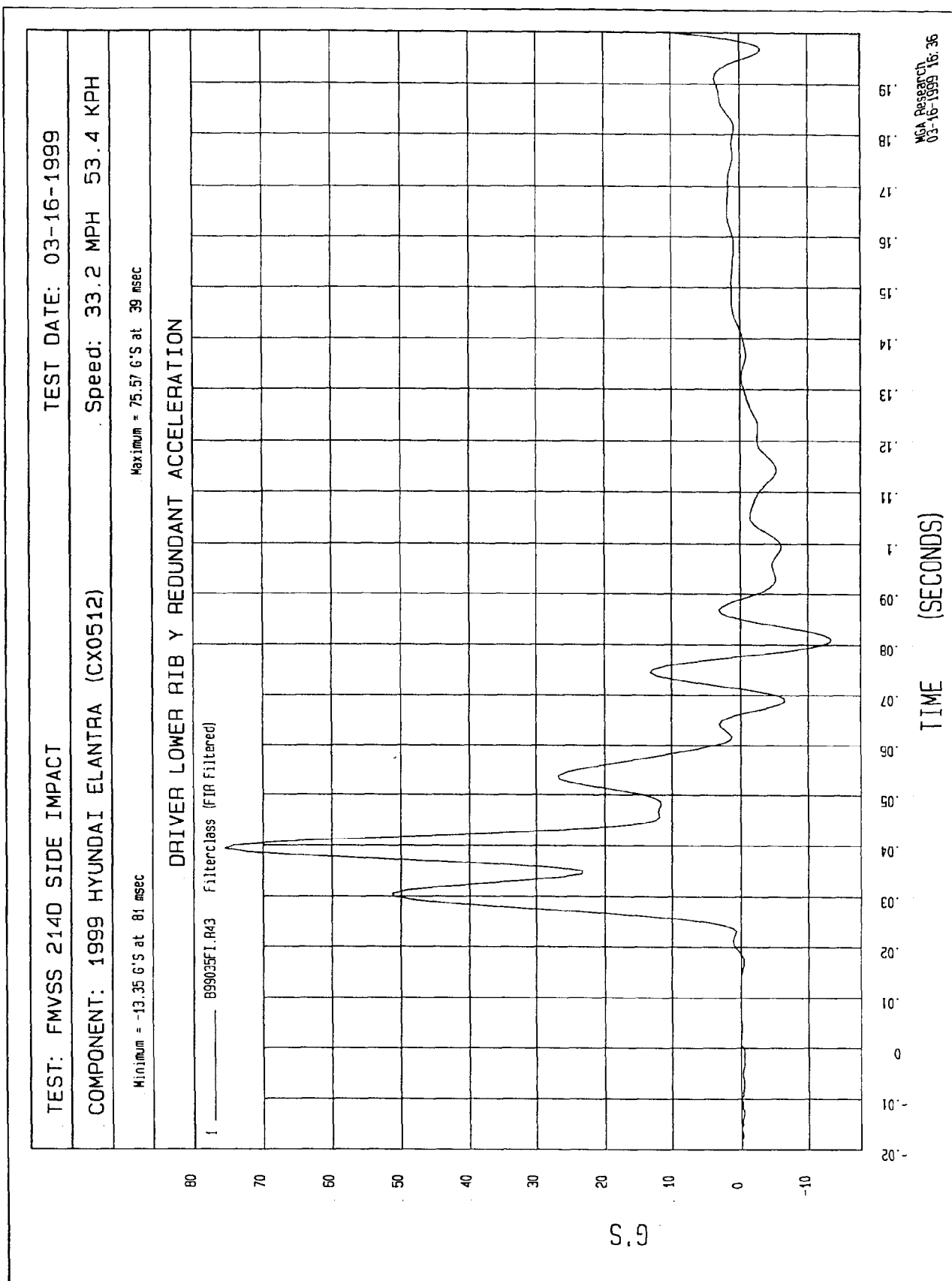
Maximum = 39.48 KPH at 77 msec

DRIVER UPPER RIB Y REDUNDANT VELOCITY

1 ——— B99035F1.V42 FilterClass (FIR Filtered)



MCA Research
03-16-1999 16:39



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

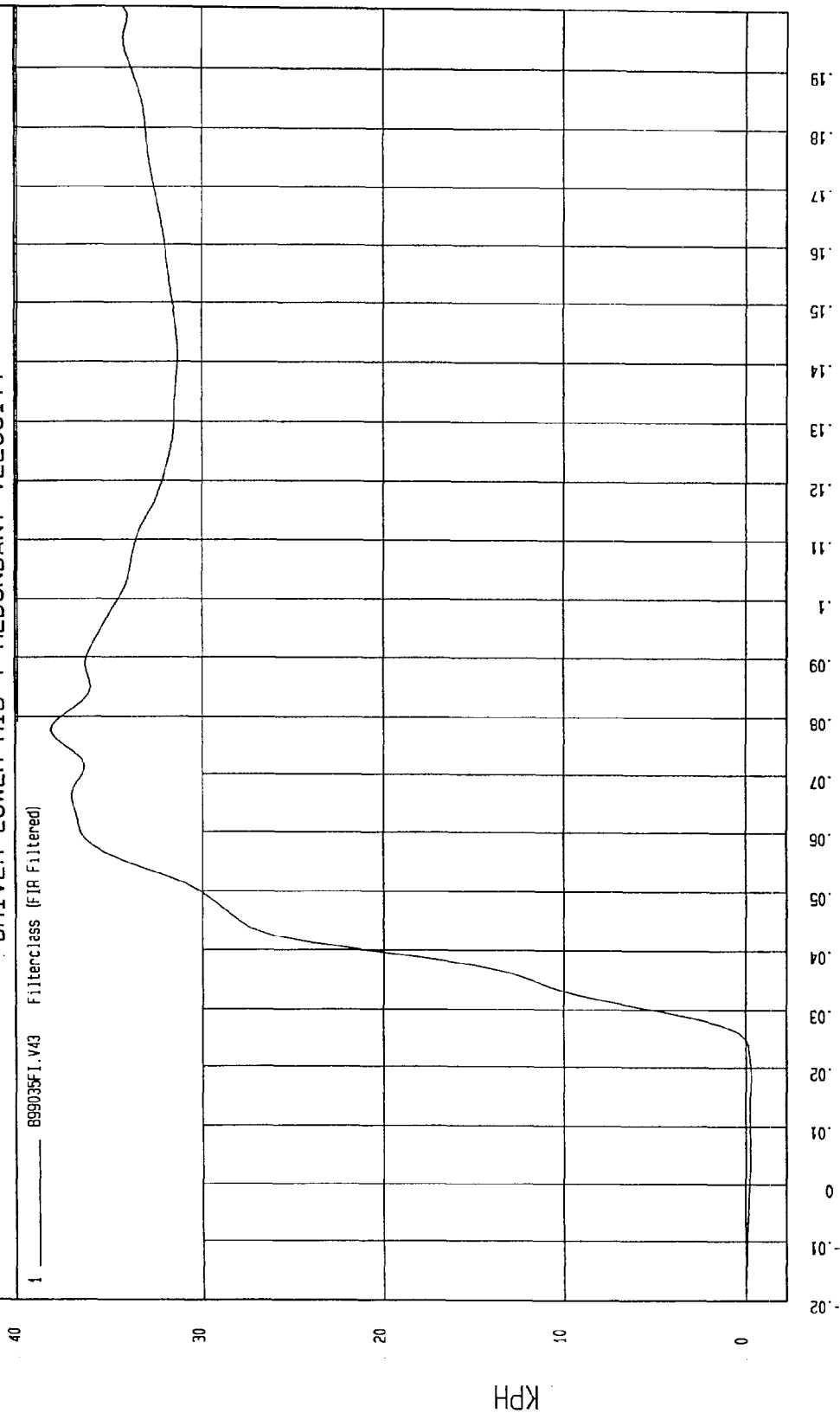
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 38.21 KPH at 78 msec

Minimum = -0.27 KPH at 19 msec

DRIVER LOWER RIB Y REDUNDANT VELOCITY

1 — 899035F1.V43 Filterclass (FIR Filtered)

MCA Research
03-16-1999 16:39

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

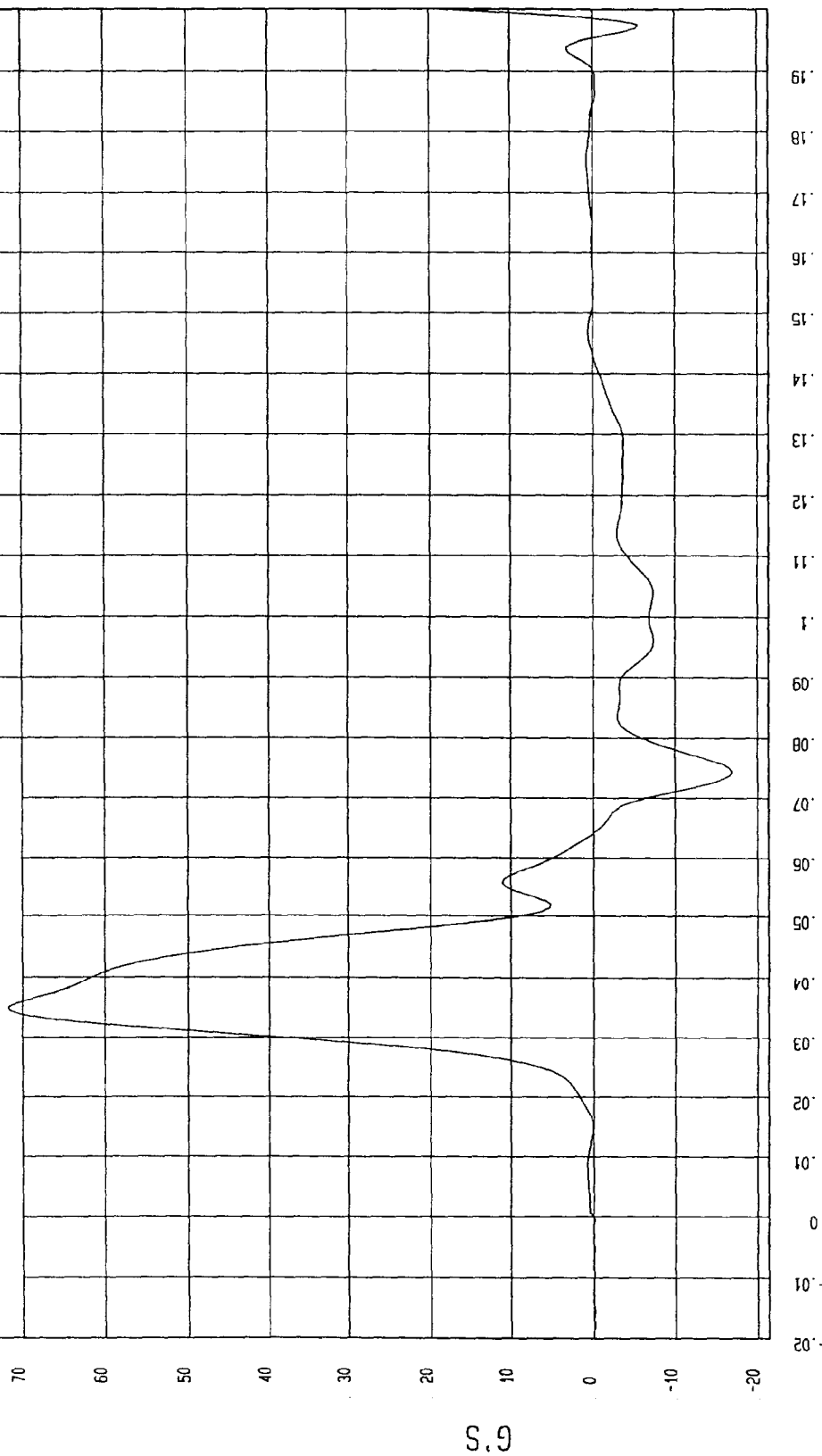
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 71.65 G'S at 35 msec

Minimum = -16.93 G'S at 74 msec

DRIVER LOWER SPINE Y REDUNDANT ACCELERATION

1 B99035F1.R44 Filterclass (FIR Filtered)

NSA Research
03-16-1999 16:36

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

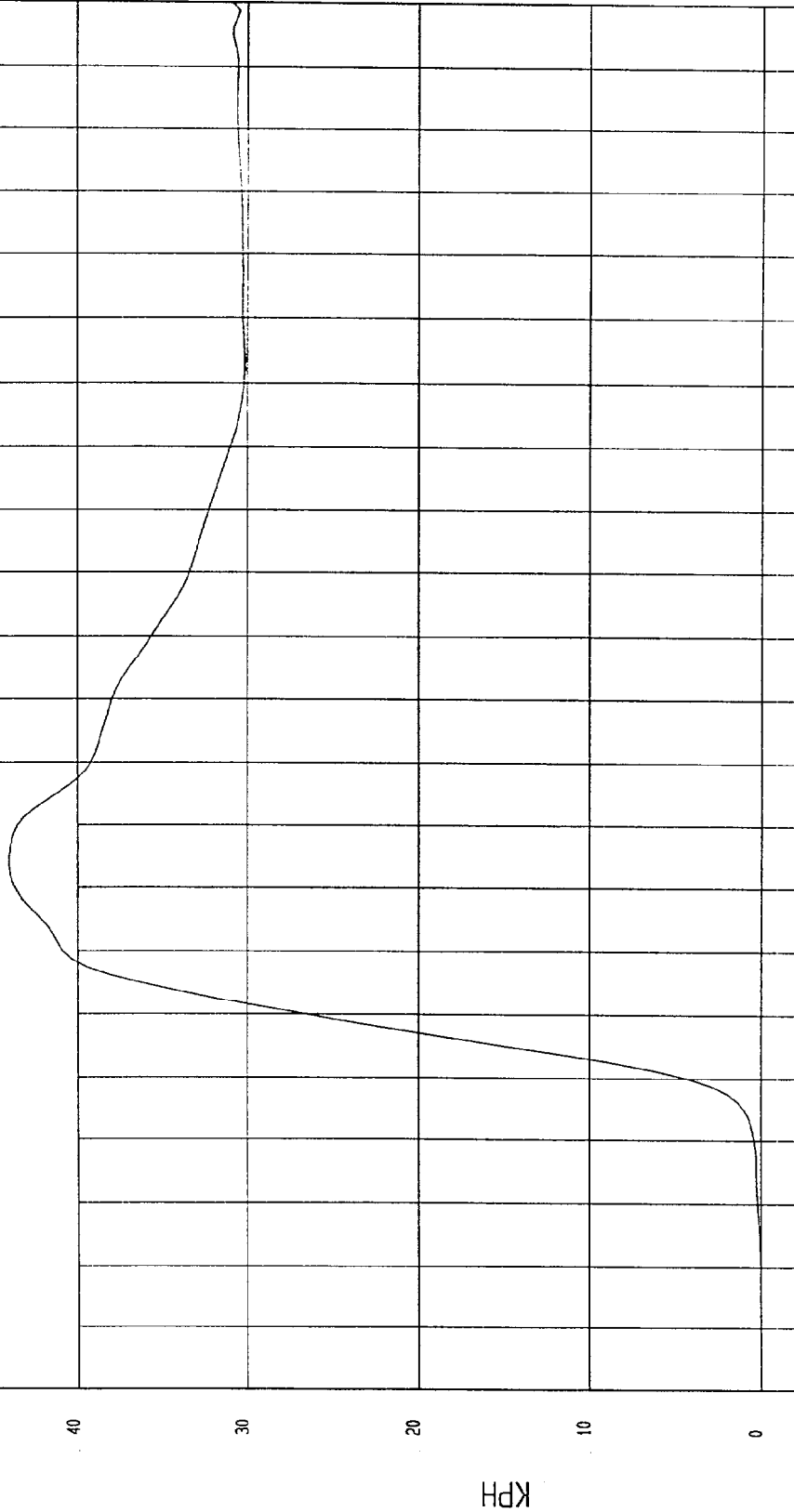
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 44.1 KPH at 64 msec

Minimum = -7.93E-03 KPH at -14 msec

DRIVER LOWER SPINE Y REDUNDANT VELOCITY

1 B99035F1.V44 Filterclass (FIR Filtered)



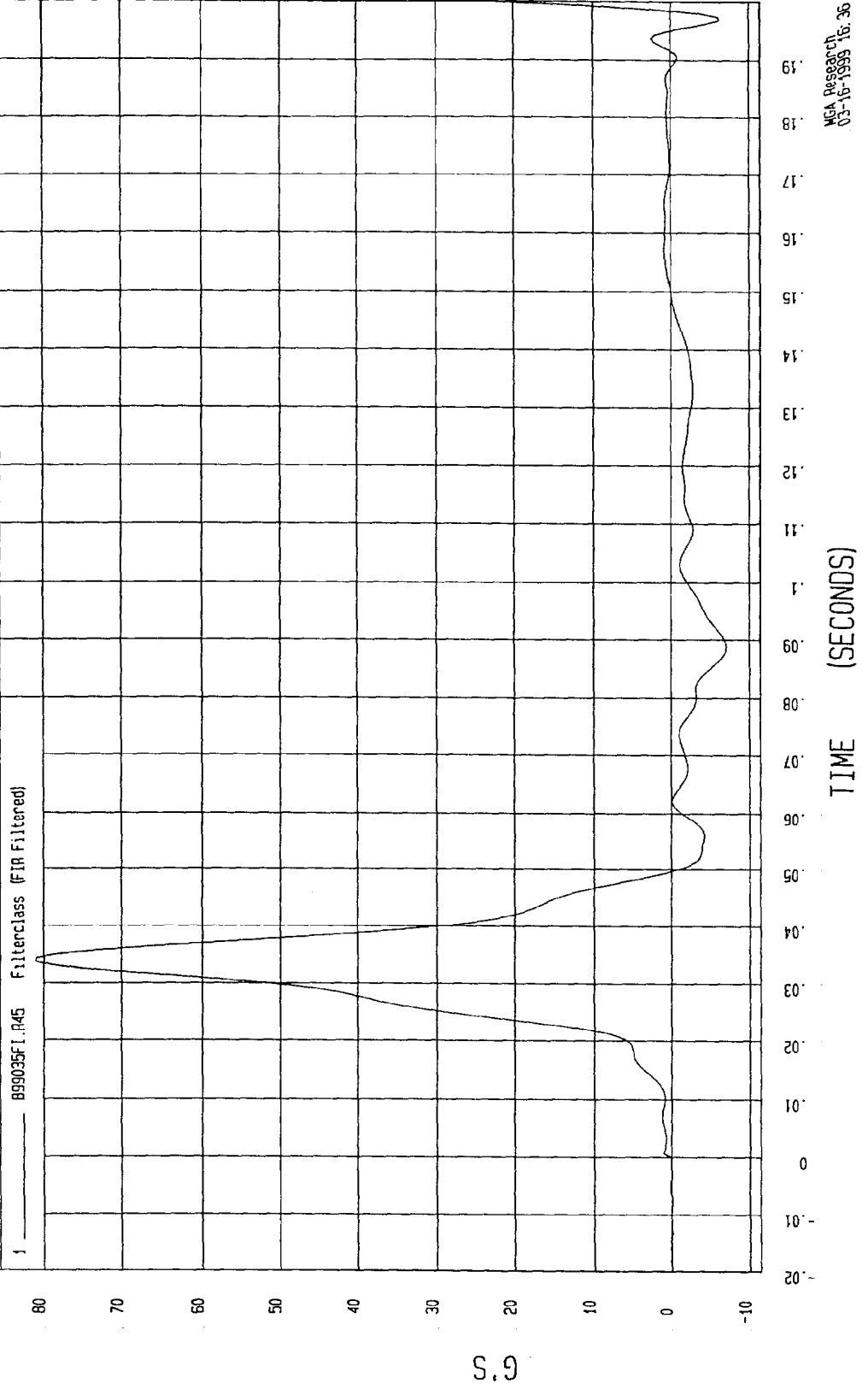
MCA Research
03-16-1999 16:39

TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -7.04 G'S at 89 msec Maximum = 81.02 G'S at 34 msec

DRIVER PELVIS Y REDUNDANT ACCELERATION



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

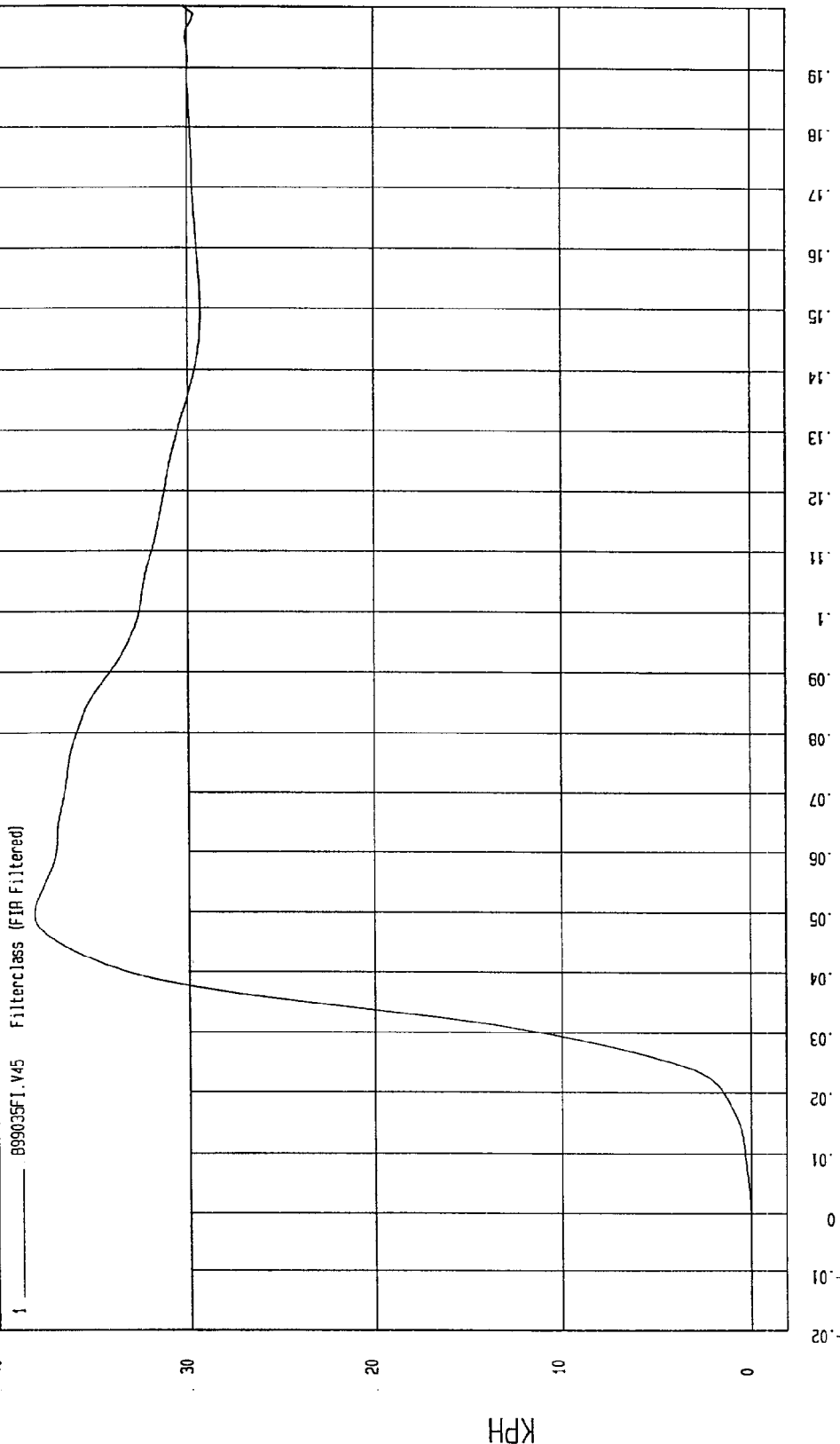
Speed: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

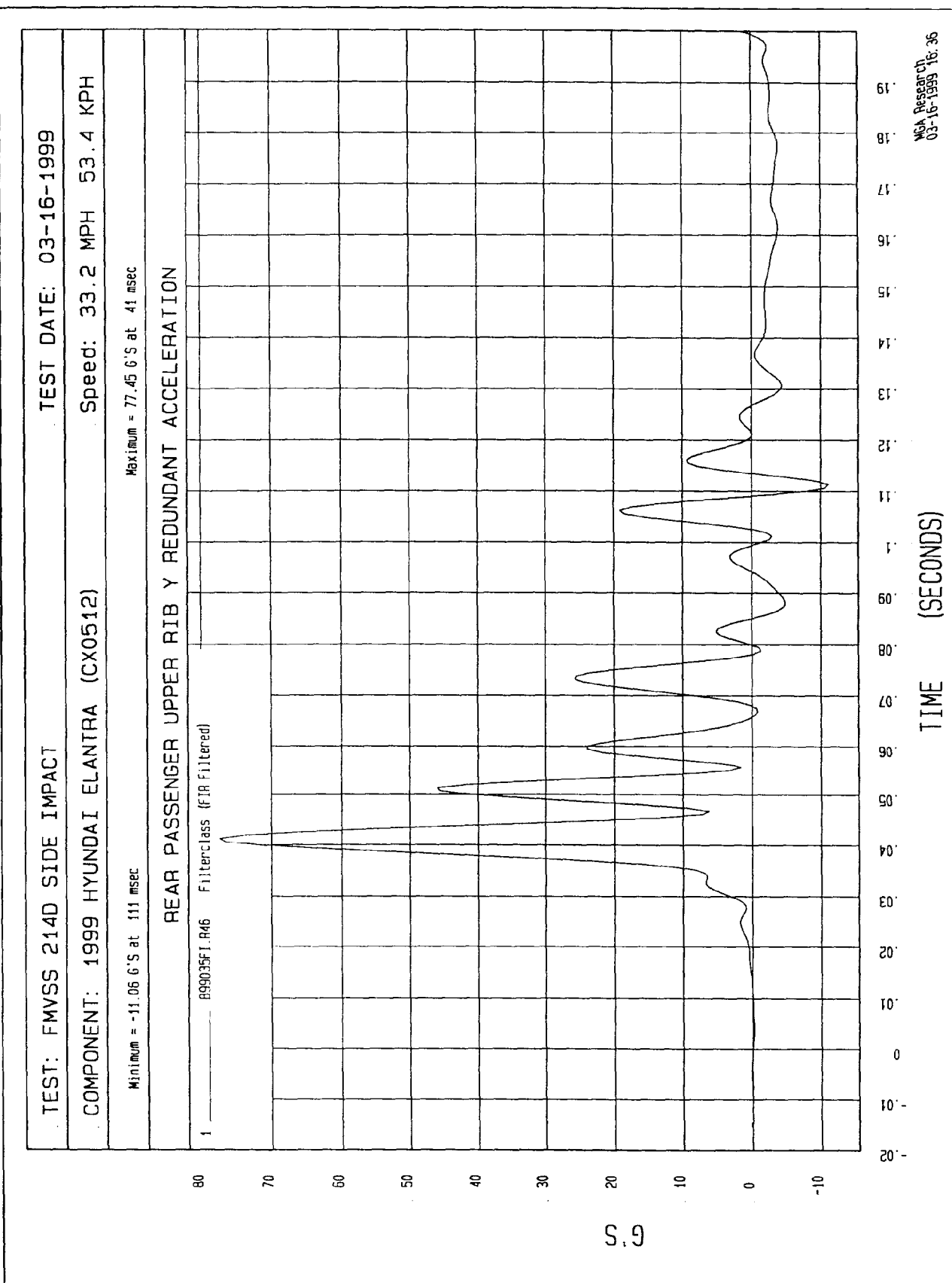
Maximum = 38.1 KPH at 49 msec

Minimum = -6.10E-03 KPH at -7 msec

DRIVER PELVIS Y REDUNDANT VELOCITY



WCA Research
03-16-1999 16:39



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

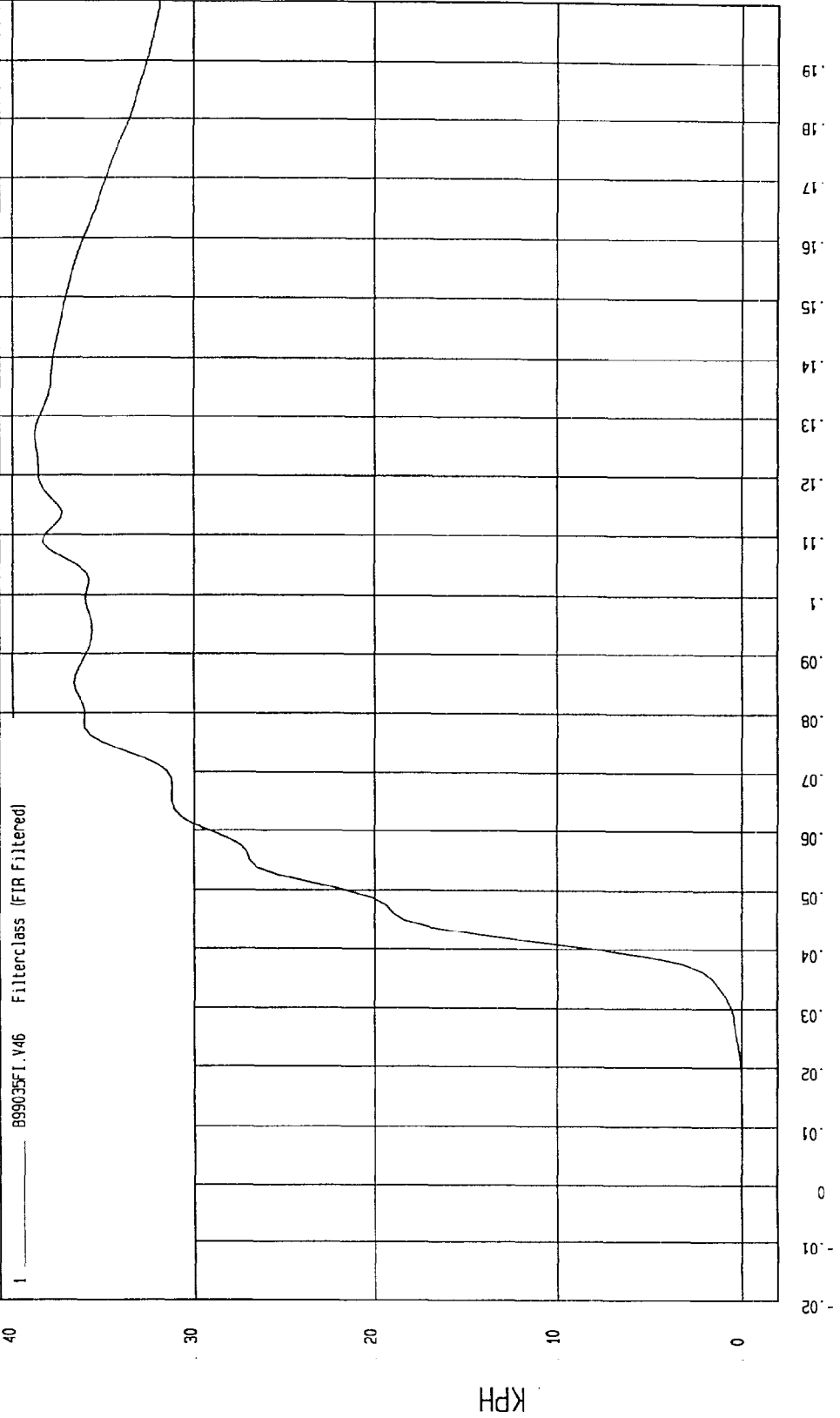
SPEED: 33.2 MPH 53.4 KPH

COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Minimum = -3.27E-02 KPH at 12 msec

Maximum = 38.77 KPH at 127 msec

REAR PASSENGER UPPER RIB Y REDUNDANT VELOCITY



TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

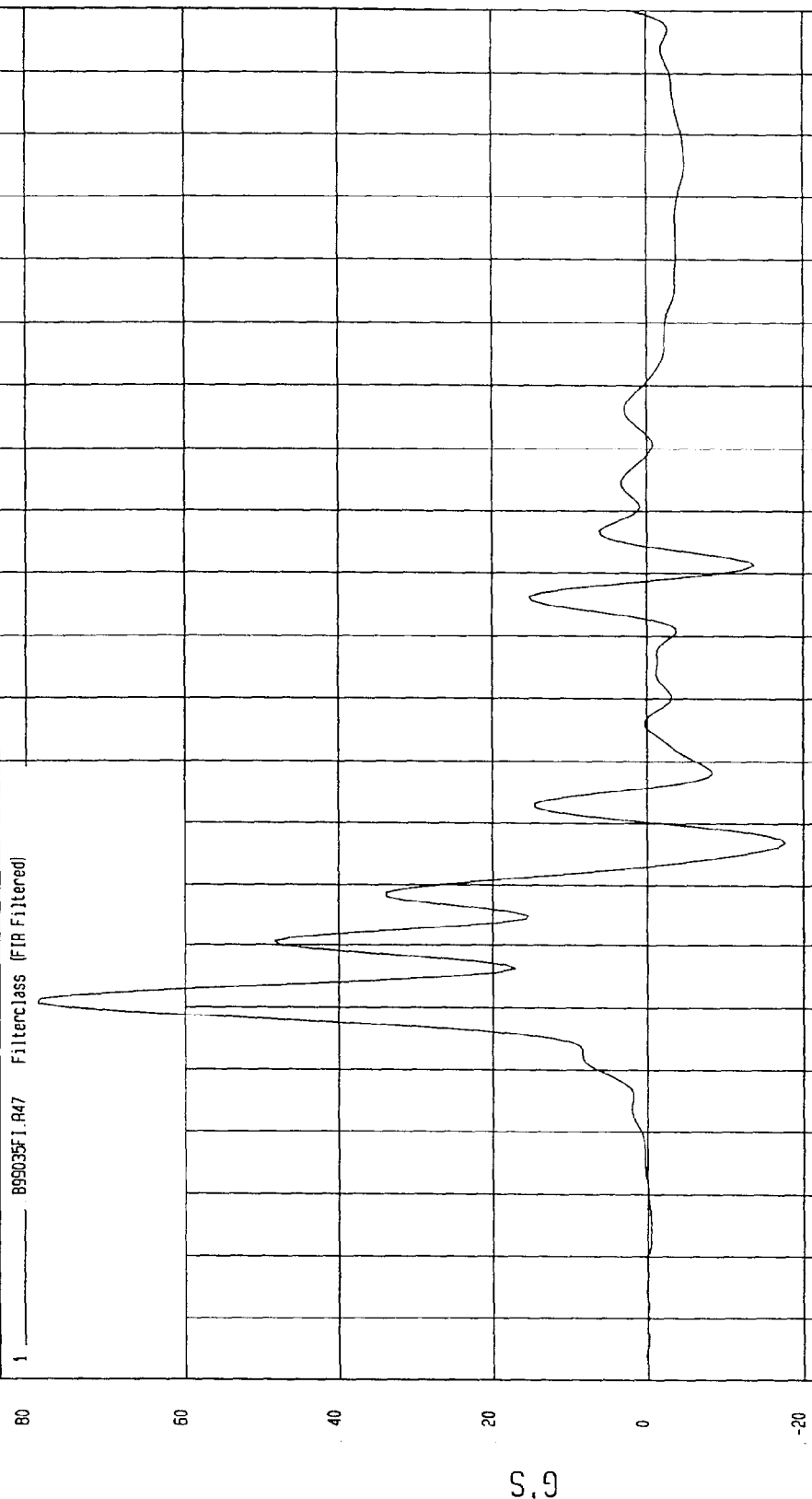
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 78.7 G'S at 41 msec

Minimum = -17.63 G'S at 67 msec

REAR PASSENGER LOWER RIB Y REDUNDANT ACCELERATION

1 ——— B99035F1.R47 Filterclass (FIR Filtered)



MCA Research
03-16-1999 16:35

TIME (SECONDS)

TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

Speed: 33.2 MPH 53.4 KPH

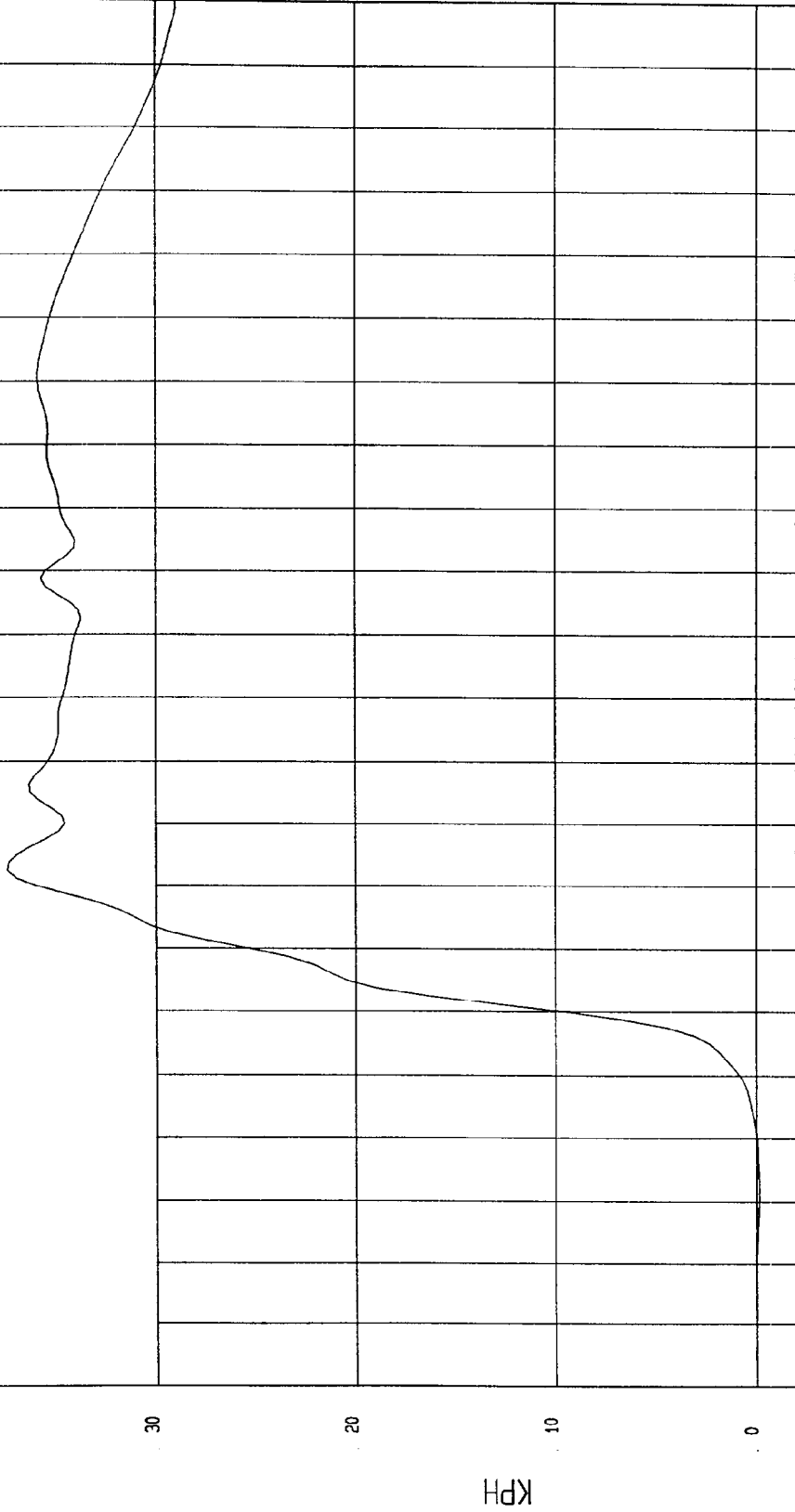
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Maximum = 37.26 KPH at 63 msec

Minimum = -13 KPH at 11 msec

REAR PASSENGER LOWER RIB Y REDUNDANT VELOCITY

1 899035F1.V47 Filterclass (FIR Filtered)



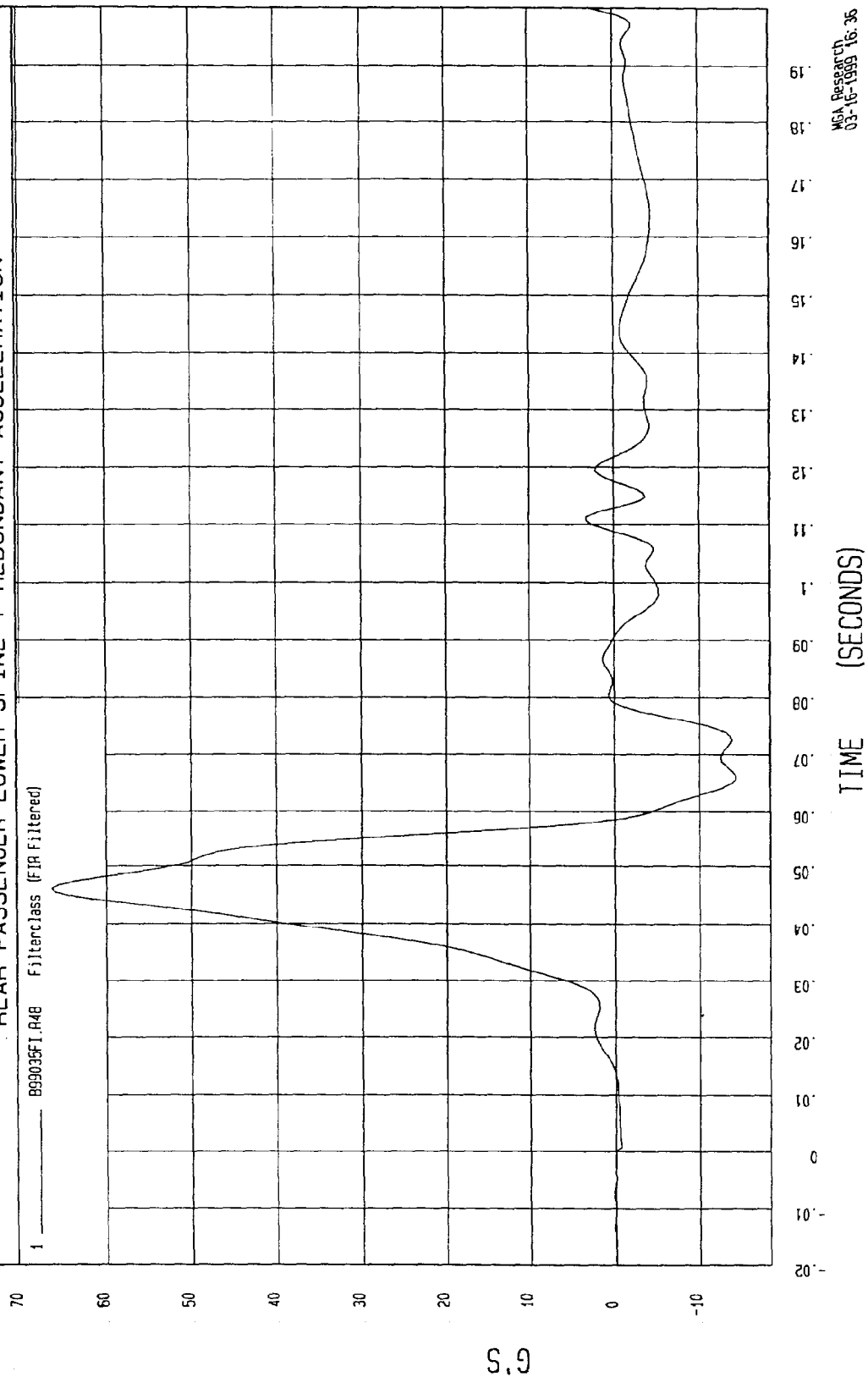
MSA Research
03-16-1999 16:39

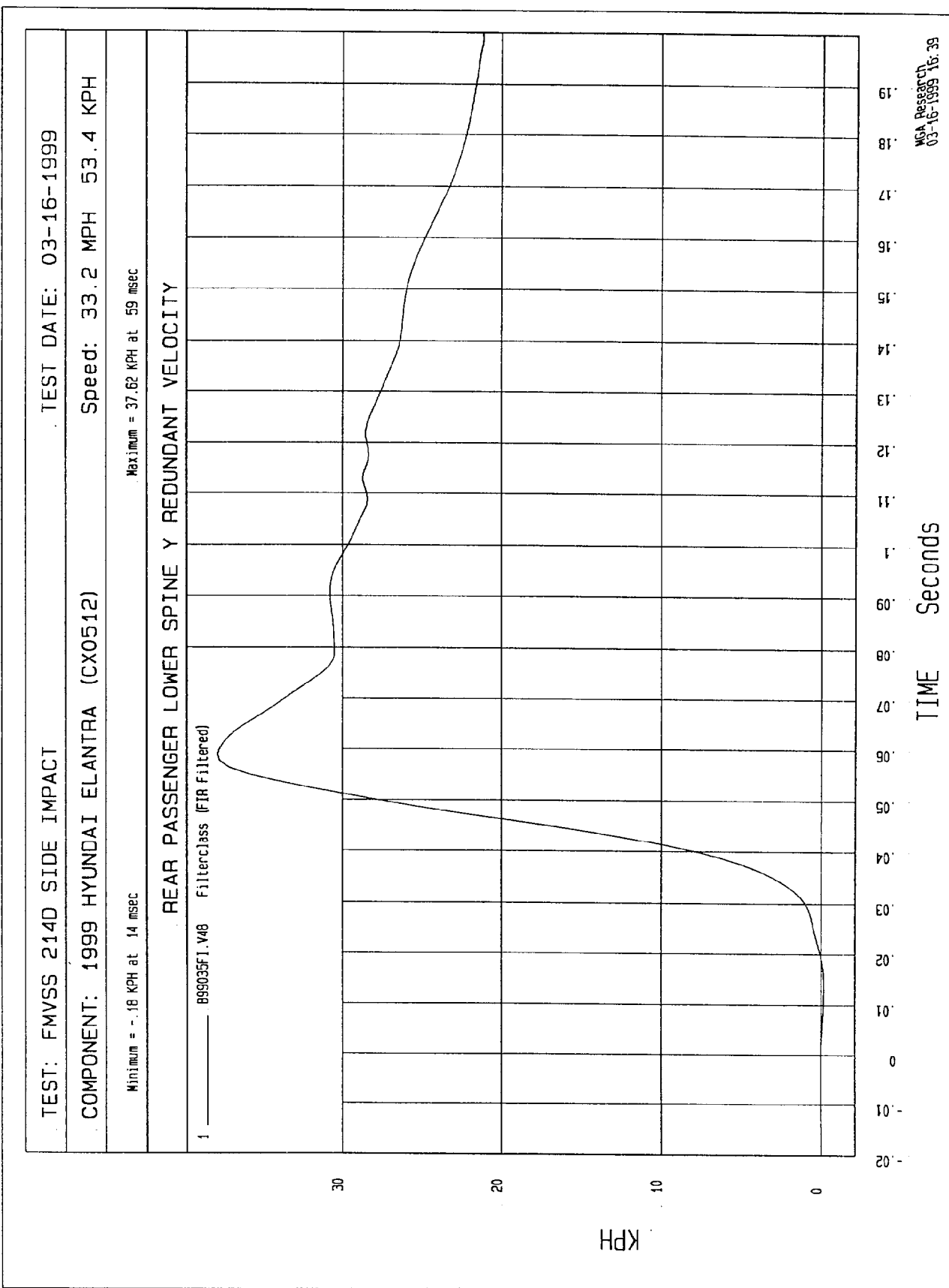
TIME Seconds

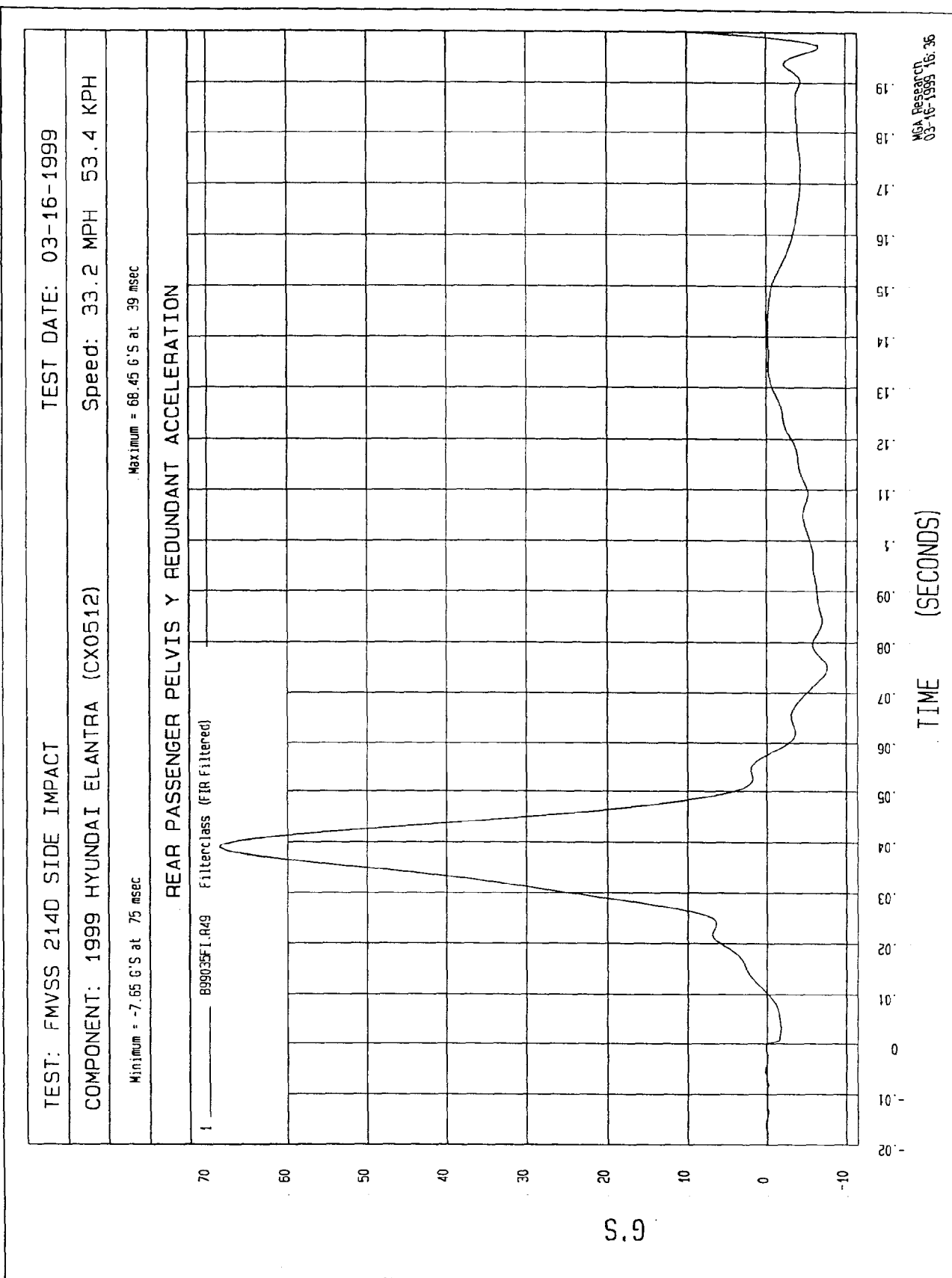
TEST: FMVSS 214D SIDE IMPACT TEST DATE: 03-16-1999
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512) Speed: 33.2 MPH 53.4 KPH

Minimum = -14.28 G'S at 56 msec Maximum = 66.34 G'S at 46 msec

REAR PASSENGER LOWER SPINE Y REDUNDANT ACCELERATION







TEST: FMVSS 214D SIDE IMPACT

TEST DATE: 03-16-1999

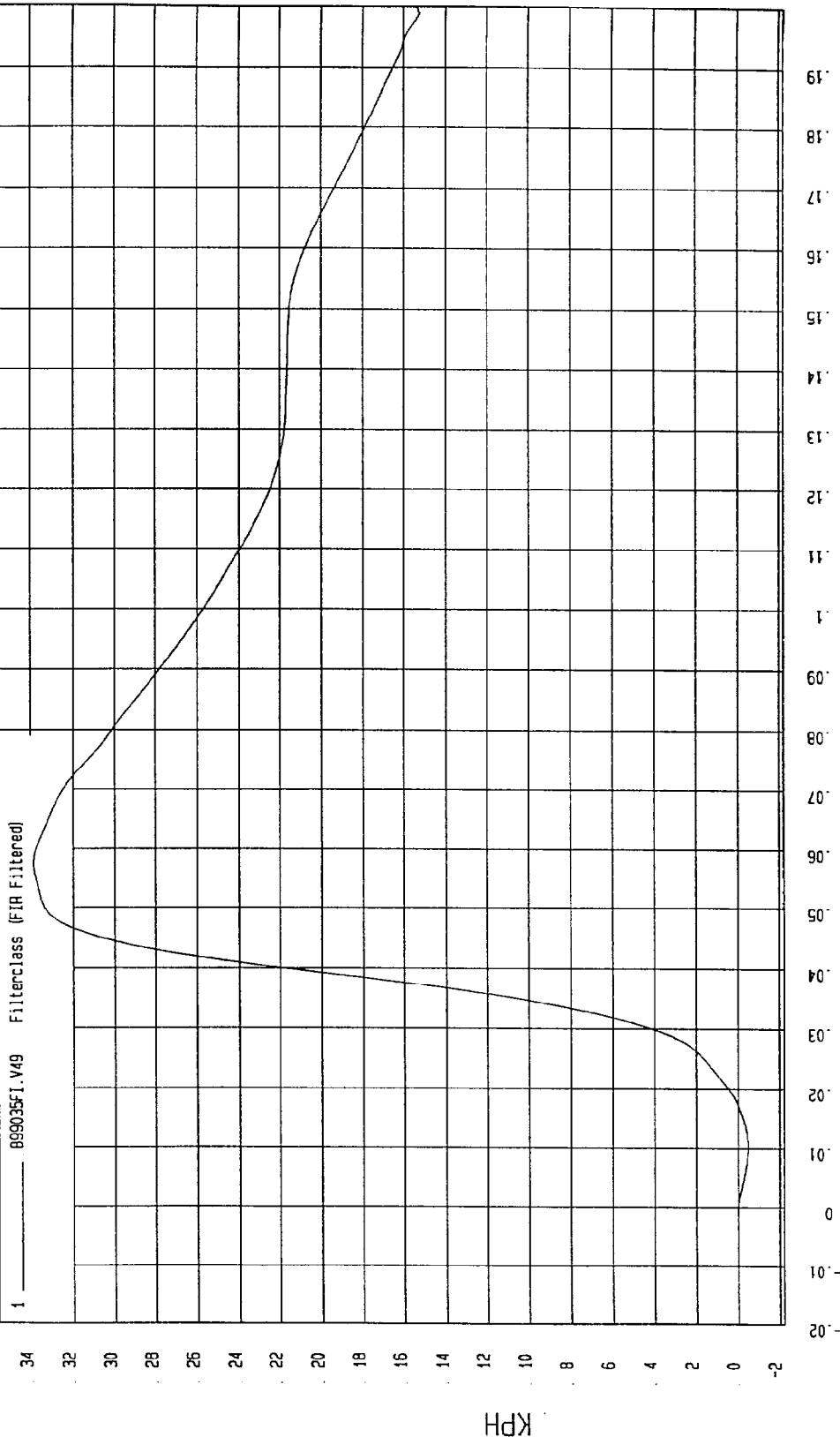
COMPONENT: 1999 HYUNDAI ELANTRA (CX0512)

Speed: 33.2 MPH 53.4 KPH

Minimum = -40 KPH at 10 msec

Maximum = 33.88 KPH at 58 msec

REAR PASSENGER PELVIS Y REDUNDANT VELOCITY



NSA Research
03-16-1999 16:39

APPENDIX C

SID CONFIGURATION AND PERFORMANCE VERIFICATION

SUMMARY
SIDE PRE & POST-TEST CALIBRATION
CONFIGURED TO LEFT SIDE IMPACT

Report Date: March 22, 1999Technician: Tim MichnayTest Date: March 16, 1999

Test Parameter	Specification	Dummy Serial No: 049		Dummy Serial No: 048	
		Pre-Test	Post-Test	Pre-Test	Post-Test
SH-Seated Height (mm)	889 - 909	904	904	904	904
RH-Rib Height (mm)	501 - 521	518	518	516	516
HP-Hip Pivot Height (mm)	99 ref.	99	99	99	99
RD-Rib from Back Line (mm)	229 - 241	231	231	233	233
KV-Knee Pivot from Back Line (mm)	511 - 526	524	524	524	524
SW-Knee Pivot to Floor (mm)	490 - 505	493	493	493	493
HW-Hip Width (mm)	356 - 391	373	373	371	371
Thorax Impacts					
Temperature (°C)	18.9 - 25.5	21.0	21.0	21.0	21.0
Relative Humidity (%)	10 - 70	31	25	31	25
Probe Speed (m/s)	4.27 - 4.33	4.28	4.30	4.28	4.32
Upper Rib (g's)	37 - 46	39	38	42	43
Lower Rib (g's)	37 - 46	41	41	39	41
Lower Spine (g's)	15 - 22	21	21	20	22
Pelvis Impact					
Temperature (°C)	18.9 - 25.5	21.0	21.0	21.0	21.0
Relative Humidity (%)	10 - 70	31	25	31	25
Probe Speed (m/s)	4.27 - 4.33	4.29	4.28	4.27	4.29
Pelvis ('gs)	40 - 60	47	47	49	53

REMARKS:

PRE-TEST CERTIFICATION DATA

Dummy Serial Number: 049

Calibration Test Results Summary

Dummy Serial Number: 049

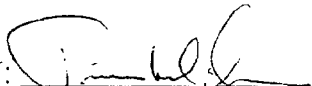
Pre-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY SERIAL NO.: 049DATE OF VERIFICATION: February 12, 1999

DESCRIPTION	SPECIFICATION	TEST RESULTS
SH - Seated Height (mm)	889 - 909	904
RH - Rib Height (mm)	501 - 521	518
HP - Hip Pivot Height (mm)	99 ref.	99
RD - Rib From Back Line (mm)	229 - 241	231
KV - Knee Pivot From Back Line (mm)	511 - 526	524
SW - Knee Pivot to Floor (mm)	490 - 505	493
HW - Hip Width (mm)	356 - 391	373

MEASUREMENTS BY: APPROVED BY: 

MGA RESEARCH CORPORATION
THORAX IMPACT TEST
SIDE IMPACT DUMMY (SID)

DATE: February 8, 1999

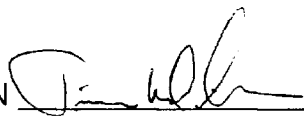
DUMMY SERIAL NUMBER: 049

TEST NUMBER: D98352

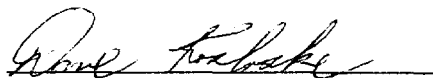
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	31
PROBE SPEED (m/s)	4.27 - 4.33	4.28
UPPER RIB (g's)	37 - 46 g's	39
LOWER RIB (g's)	37 - 46 g's	41
LOWER SPINE (g's)	15 - 22 g's	21

TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY



TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 02-08-1999 - 13:16

COMPONENT: DUMMY # 049 Velocity: 14.026 FT/SEC 4.28 M/SEC

Minimum = -13.88 G'S at 53.7 msec

Maximum = 39.32 G'S at 46.8 msec

UPPER RIB ACCELERATION

1 _____ 099352F1.R08

60

50

40

30

20

10

0

-10

-20

G.S

Upper Limit

Lower Limit

12

11

10

09

08

07

06

05

04

03

02

01

0

TIME (SECONDS)

NCA Research
02-08-1999 13:21

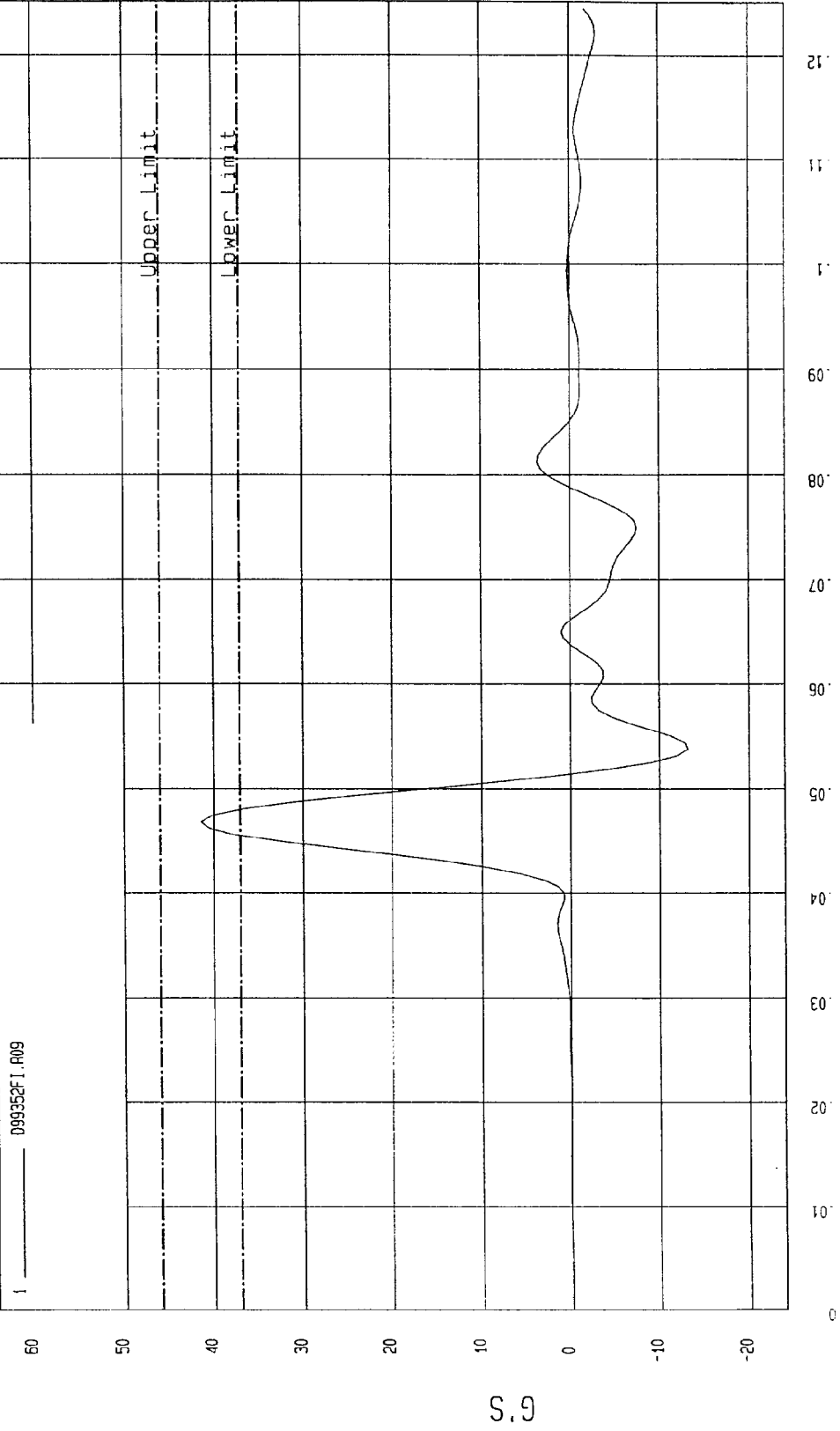
TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 02-08-1999 - 13:16

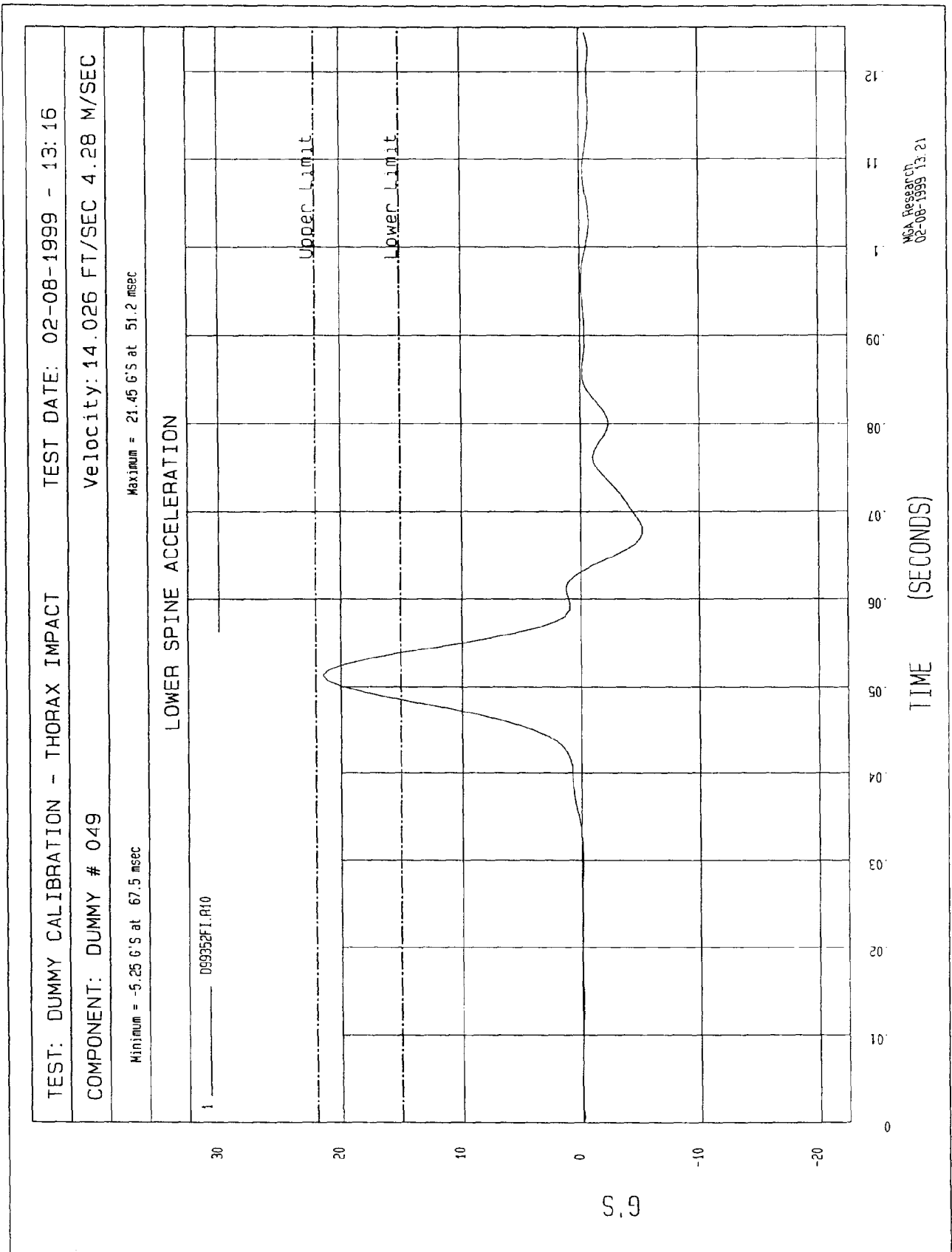
COMPONENT: DUMMY # 049 Velocity: 14.026 FT/SEC 4.28 M/SEC

Minimum = -13.14 G'S at 53.7 msec

Maximum = 41.43 G'S at 46.8 msec

LOWER RIB ACCELERATION





MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

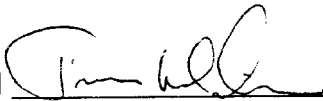
SIDE IMPACT DUMMY (SID)

DATE: February 8, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99353

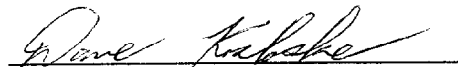
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	31
PROBE SPEED (m/s)	4.27 - 4.33	4.29
PELVIS ACCELERATION (g's)	40 - 60	47

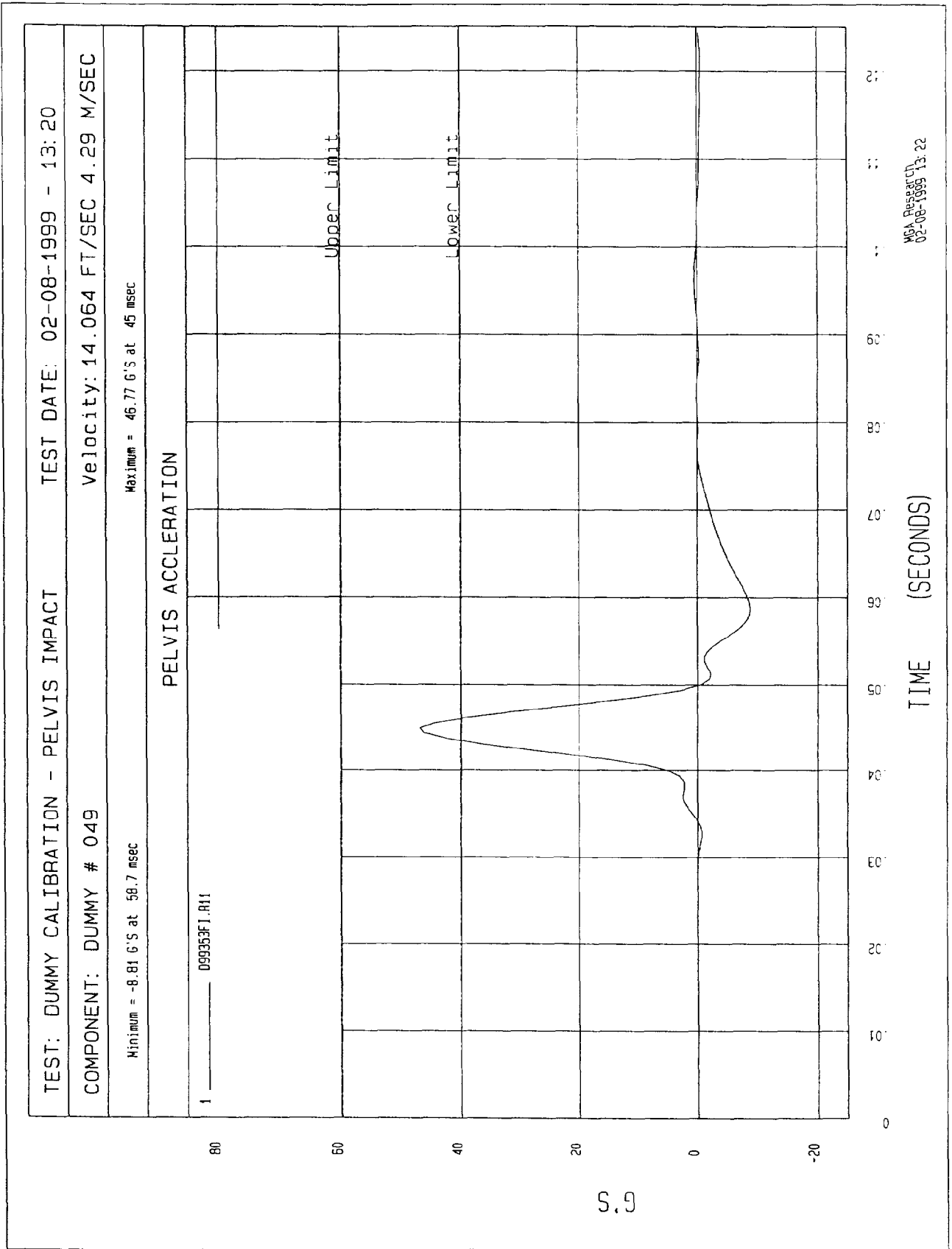
TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY





MGA RESEARCH CORPORATION

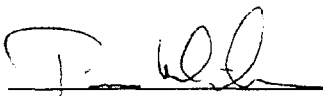
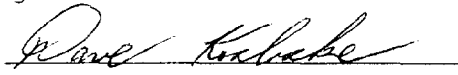
ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: February 11, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99354

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	55
FORCE @ 12.7 mm	104 - 162	139
FORCE @ 19.0 mm	163 - 222	196
FORCE @ 25.4 mm	222 - 280	265
FORCE @ 33 mm	325 - 391	364

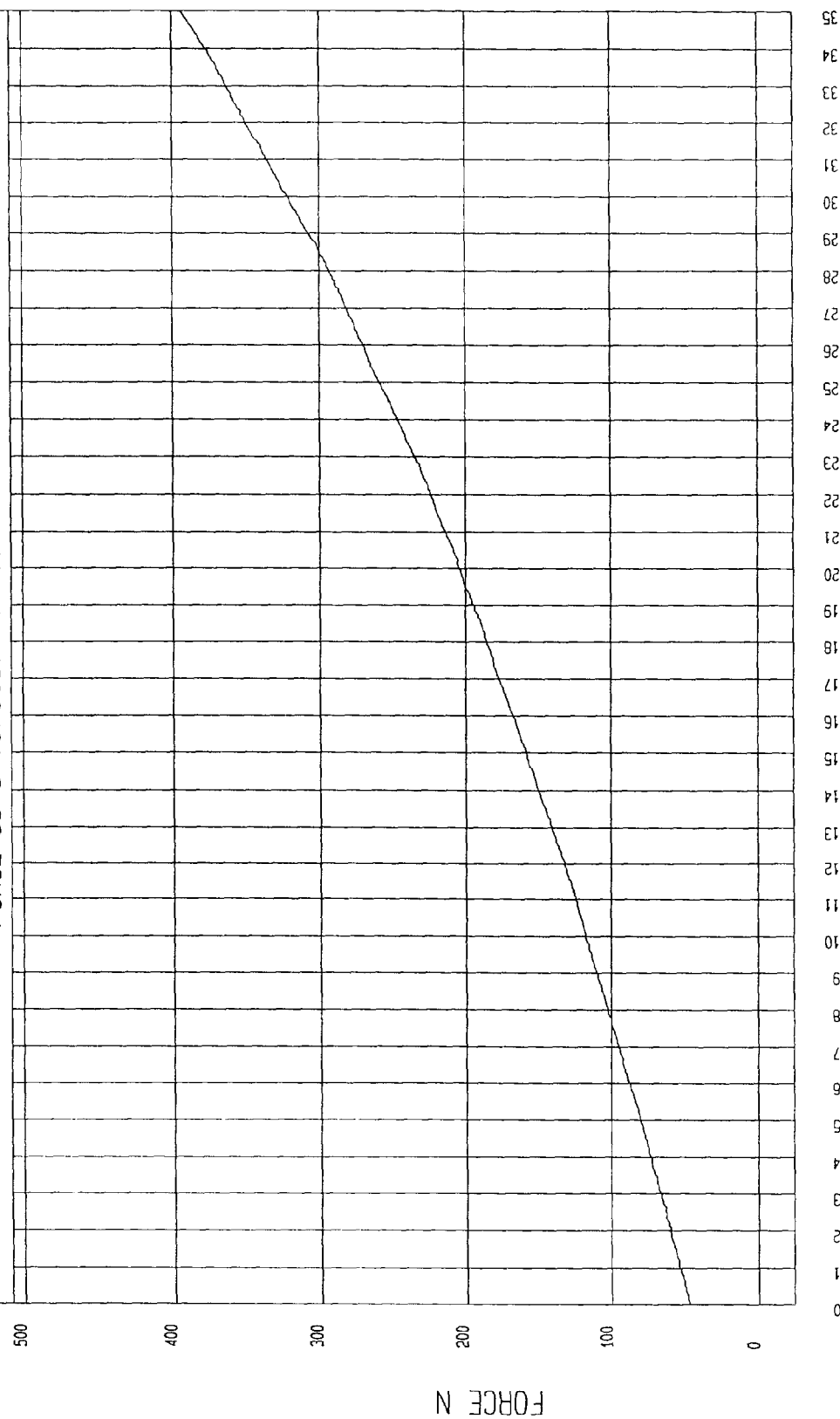
TEST MEETS SPECIFICATIONS

TECHNICIAN APPROVED BY 

TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSION TEST DATE: 02-11-1999 - 13:41:03

COMPONENT: DUMMY # 049

FORCE as a function of DISPLACEMENT



MSA Research
02-11-1999 14:03

DISPLACEMENT mm

MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: February 12, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99355

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	32
FORCE @ 0°	0 - 26.7	0
FORCE @ 20°	97.9 - 151.2	99.3
FORCE @ 30°	151.2 - 204.6	151.5
FORCE @ 40°	204.6 - 258.0	231.8
RETURN ANGLE	12° maximum	4°

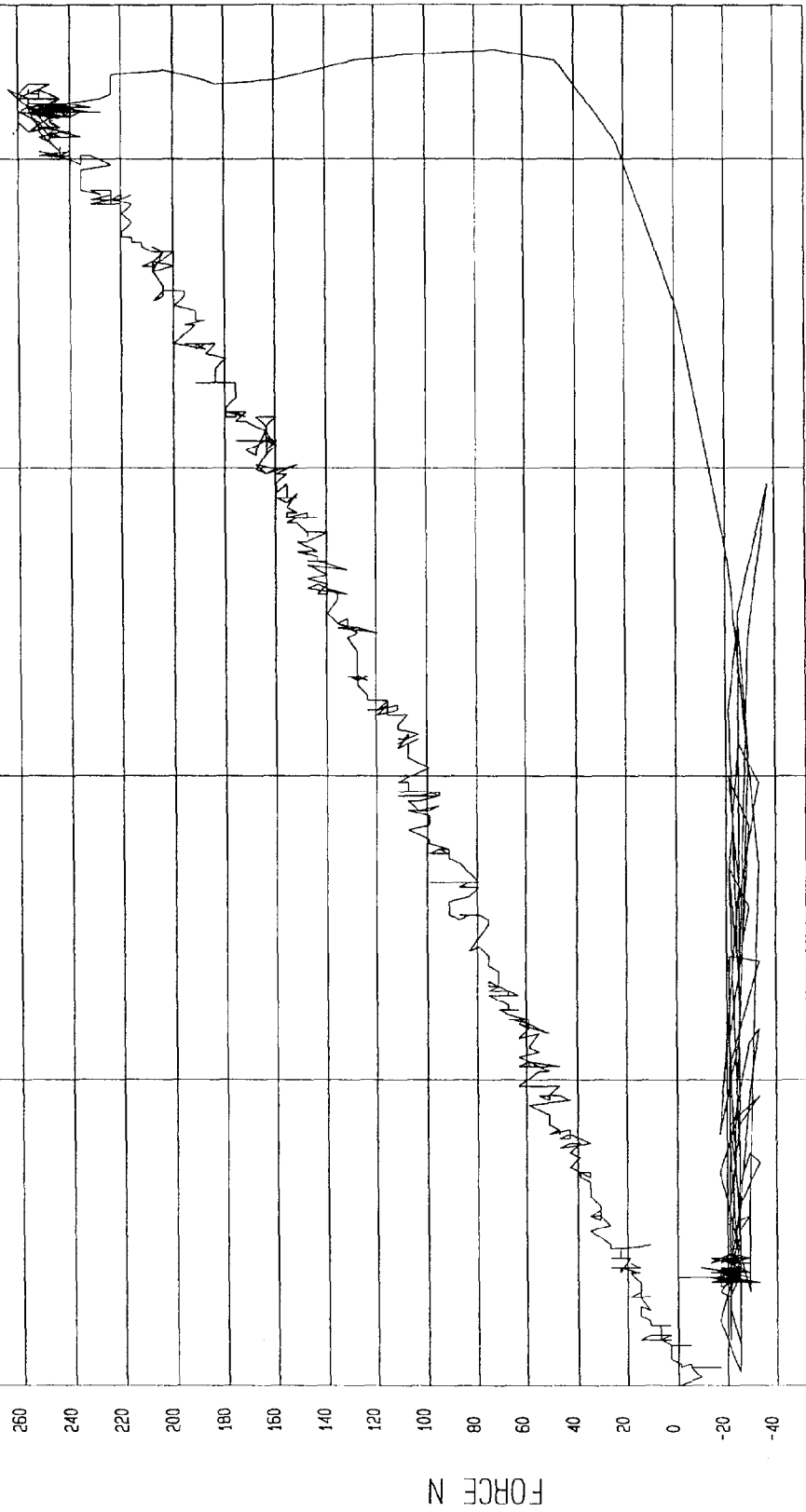
TEST MEETS SPECIFICATIONS

TECHNICIAN Jim W. [Signature]APPROVED BY [Signature]

TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 02-12-1999 - 08:48:45

COMPONENT: DUMMY # 049

FORCE as a function of TORSO ROTATION



0 10 20 30 40
TORSO ROTATION DEGREES
NCA Research
02-12-1999 11:54

PRE-TEST CERTIFICATION DATA

Dummy Serial Number: 048

Calibration Test Results Summary

Dummy Serial Number: 048

Pre-Test Calibration

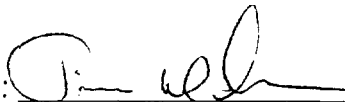
External Dimensions:	The dummy passed all external dimension requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY SERIAL NO.: 048DATE OF VERIFICATION: February 12, 1999

DESCRIPTION	SPECIFICATION	TEST RESULTS
SH - Seated Height (mm)	889 - 909	904
RH - Rib Height (mm)	501 - 521	516
HP - Hip Pivot Height (mm)	99 ref.	99
RD - Rib From Back Line (mm)	229 - 241	233
KV - Knee Pivot From Back Line (mm)	511 - 526	524
SW - Knee Pivot to Floor (mm)	490 - 505	493
HW - Hip Width (mm)	356 - 391	371

MEASUREMENTS BY:



APPROVED BY:



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: February 8, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99342

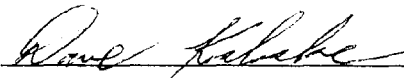
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	31
PROBE SPEED (m/s)	4.27 - 4.33	4.28
UPPER RIB (g's)	37 - 46	42
LOWER RIB (g's)	37 - 46	39
LOWER SPINE (g's)	15 - 22	20

TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY



TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 02-08-1999 - 11:39

COMPONENT: DUMMY # 048 Velocity: 14.041 FT/SEC 4.28 M/SEC

Minimum = -18.63 G'S at 56.8 msec

Maximum = 42.26 G'S at 50 msec

UPPER RIB ACCELERATION

1 _____ D99342F1.R08

60

50

40

30

20

10

0

-10

-20

G'S

Upper Limit

Lower Limit

12

11

10

09

08

07

06

05

04

03

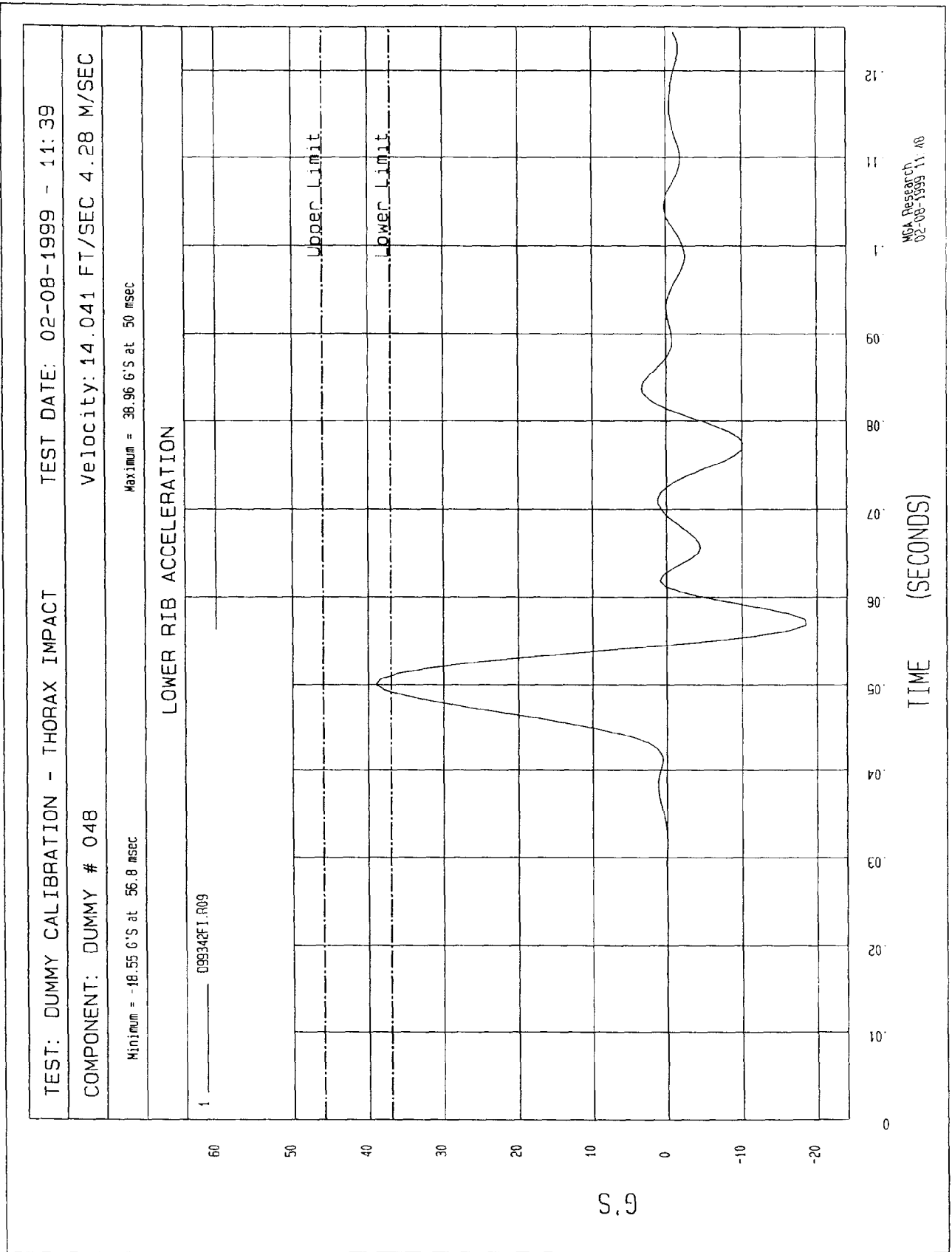
02

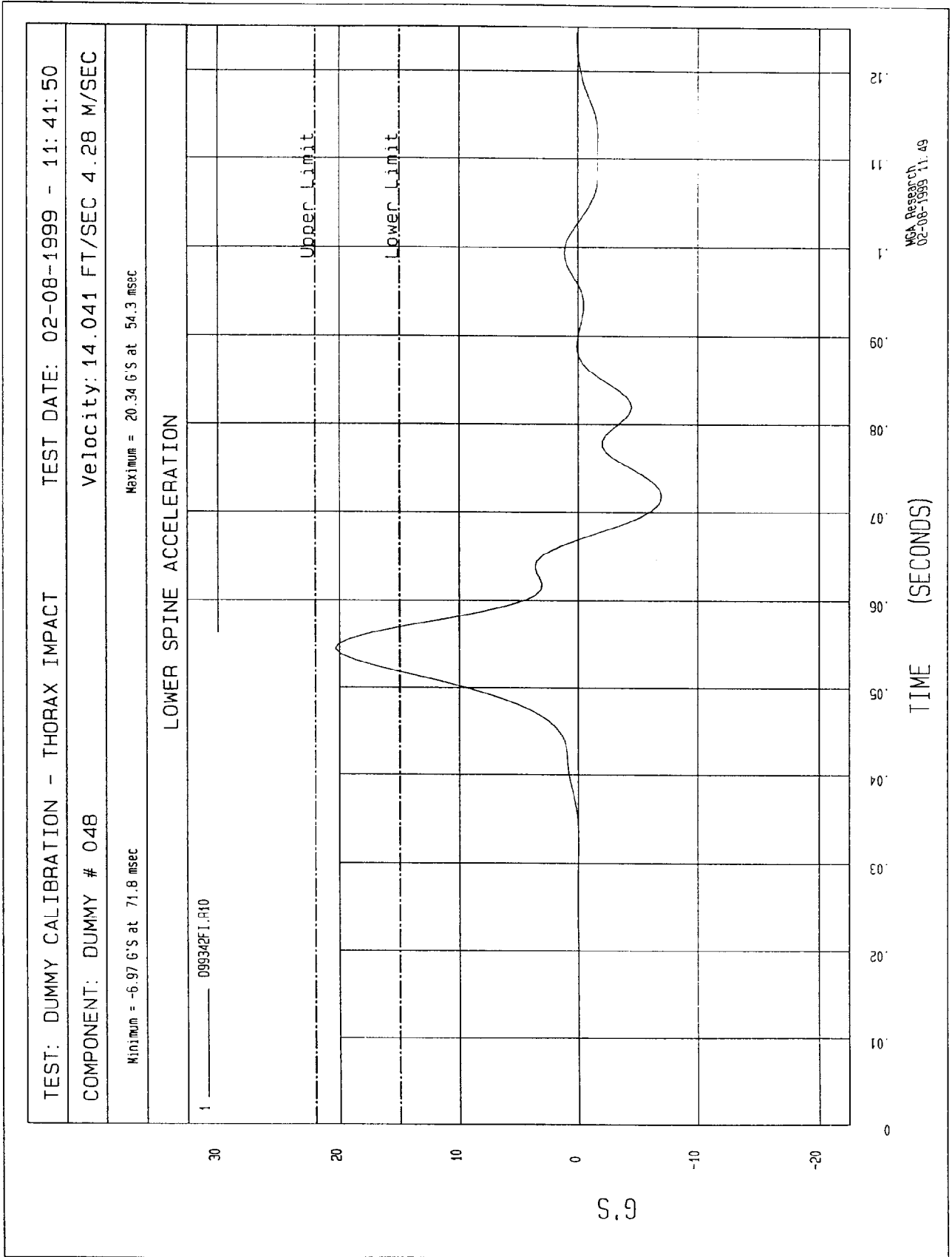
01

0

TIME (SECONDS)

MSA Research
02-08-1999 11:48





MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

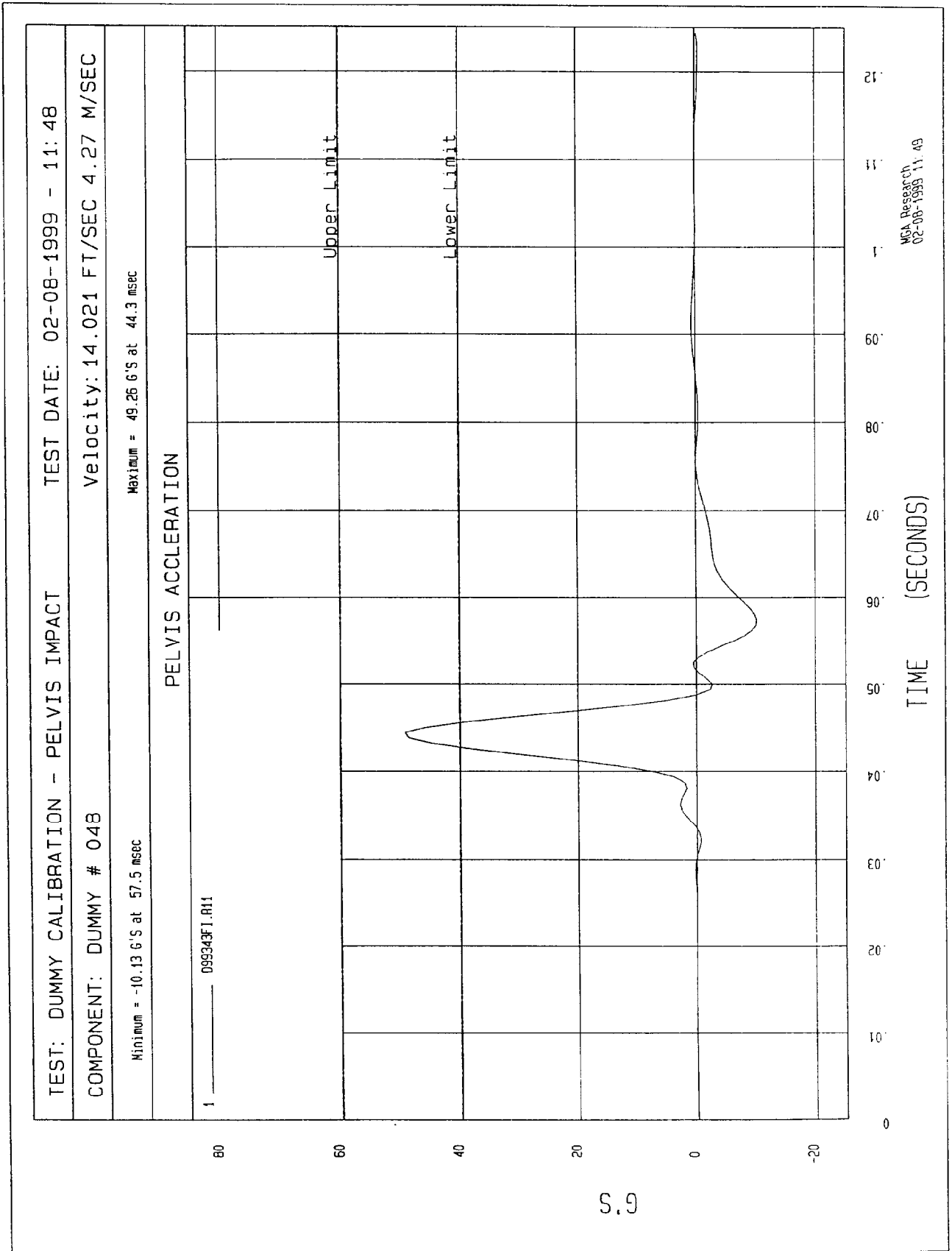
SIDE IMPACT DUMMY (SID)

DATE: February 8, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99343

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	31
PROBE SPEED (m/s)	4.27 - 4.33	4.27
PELVIS ACCELERATION (g's)	40 - 60	49

TEST MEETS SPECIFICATIONS

TECHNICIAN Jim W. C.APPROVED BY Rene K. Kabeke



MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: February 11, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99344

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	55
FORCE @ 12.7 mm	104 - 162	140
FORCE @ 19.0 mm	163 - 222	195
FORCE @ 25.4 mm	222 - 280	264
FORCE @ 33 mm	325 - 391	366

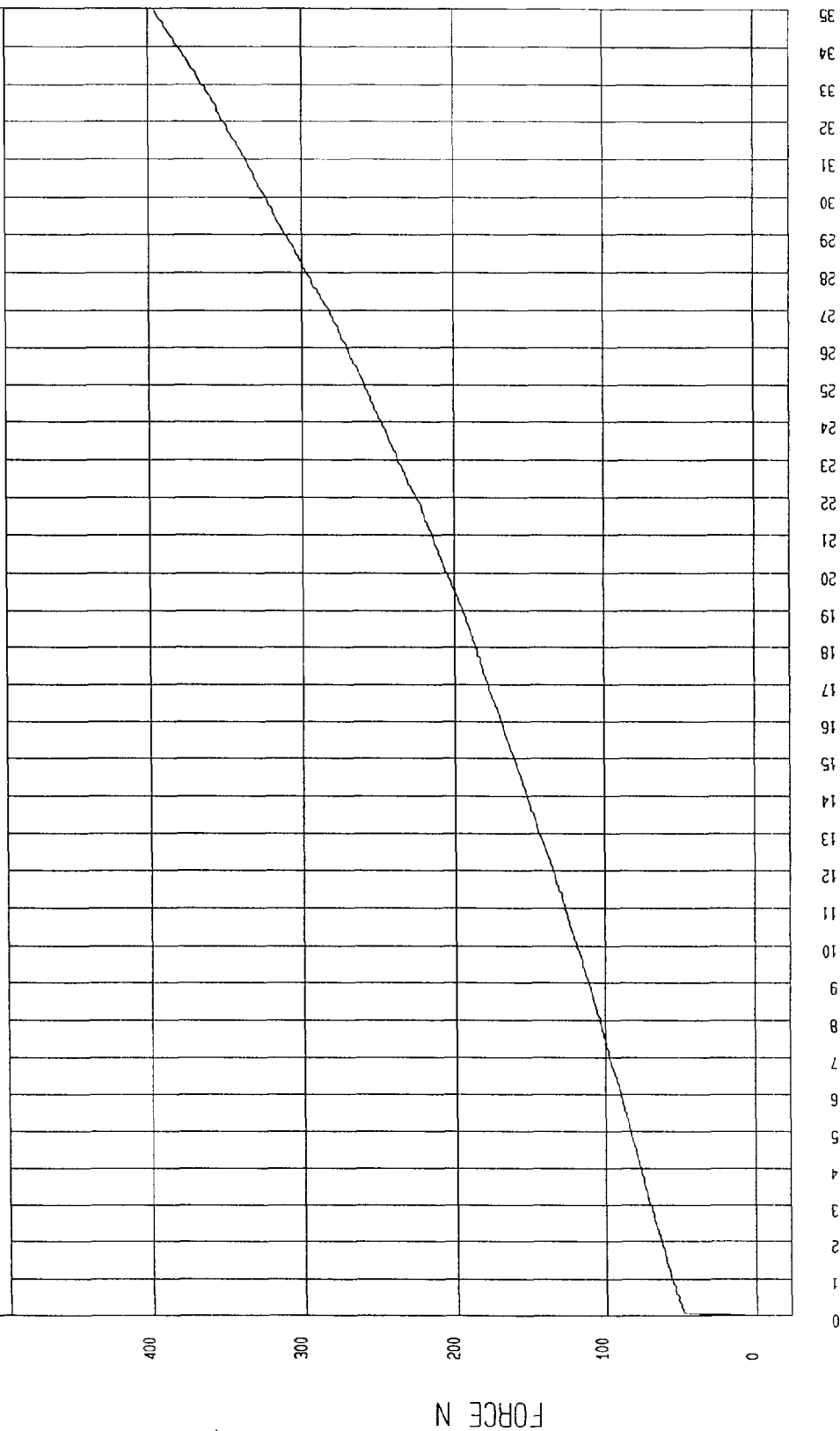
TEST MEETS SPECIFICATIONS

TECHNICIAN Jim WalshAPPROVED BY Rene K. K. K.

TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSION TEST DATE: 02-11-1999 - 13:29:35

COMPONENT: DUMMY # 048

FORCE as a function of DISPLACEMENT



MCA Research
02-11-1999 14:03

DISPLACEMENT mm

MGA RESEARCH CORPORATION

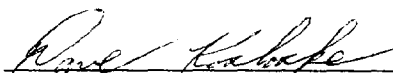
LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: February 12, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99345

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	31
FORCE @ 0°	0 - 26.7	0
FORCE @ 20°	97.9 - 151.2	106.1
FORCE @ 30°	151.2 - 204.6	152.5
FORCE @ 40°	204.6 - 258.0	222.5
RETURN ANGLE	12° maximum	3°

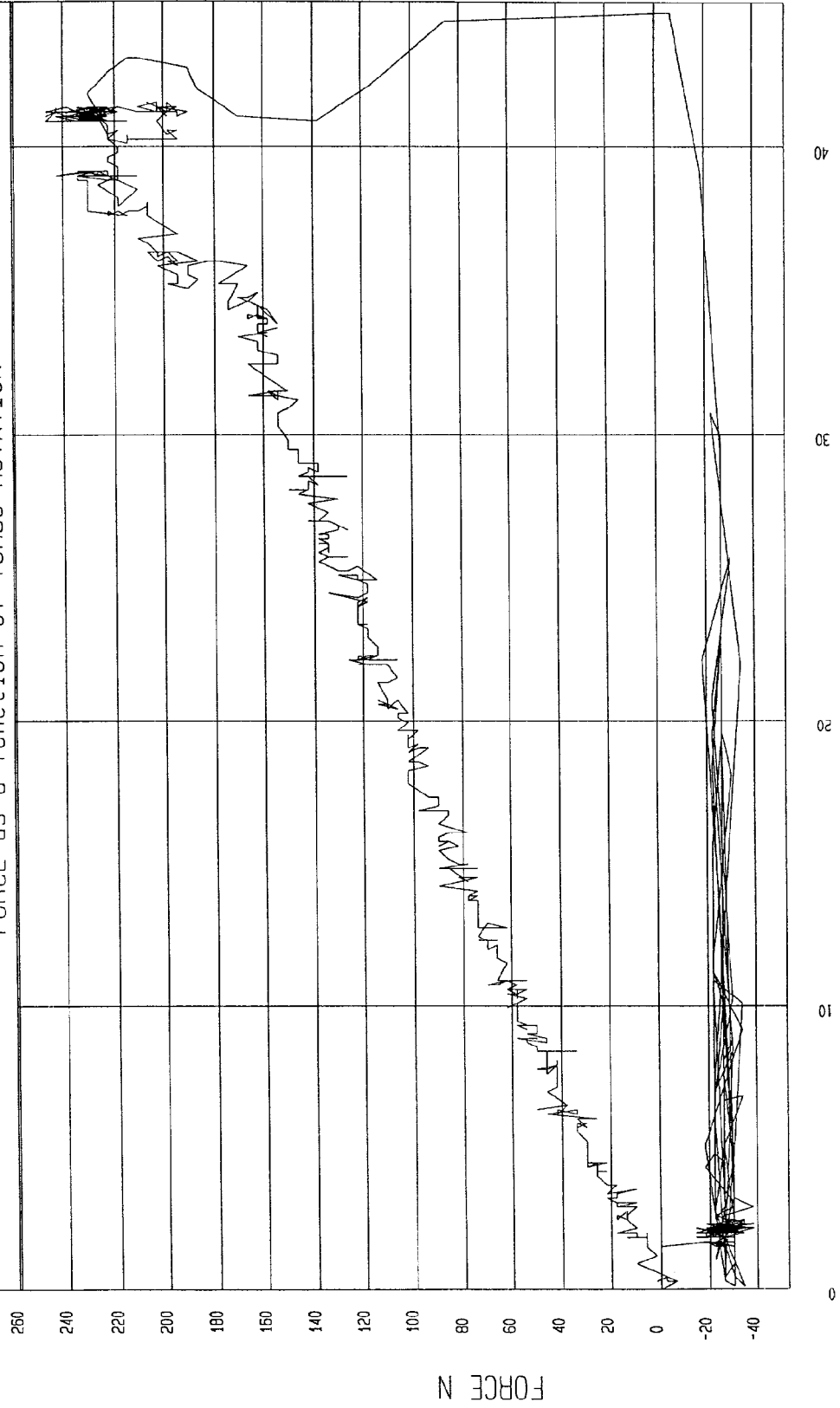
TEST MEETS SPECIFICATIONS

TECHNICIAN APPROVED BY 

TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 02-12-1999 - 07:44:01

COMPONENT: DUMMY # 048

FORCE as a function of TORSO ROTATION



WCA Research
02-12-1999 09:15

POST-TEST CERTIFICATION DATA

Dummy Serial Number: 049

Calibration Test Results Summary

Dummy Serial Number: 049

Post-Test Calibration

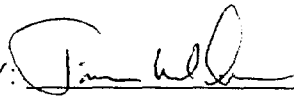
External Dimensions:	The dummy passed all external dimension requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

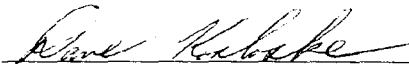
DUMMY SERIAL NO.: 049DATE OF VERIFICATION: February 26, 1999

DESCRIPTION	SPECIFICATION	TEST RESULTS
SH - Seated Height (mm)	889 - 909	904
RH - Rib Height (mm)	501 - 521	518
HP - Hip Pivot Height (mm)	99 ref.	99
RD - Rib From Back Line (mm)	229 - 241	231
KV - Knee Pivot From Back Line (mm)	511 - 526	524
SW - Knee Pivot to Floor (mm)	490 - 505	493
HW - Hip Width (mm)	356 - 391	373

MEASUREMENTS BY:



APPROVED BY:



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

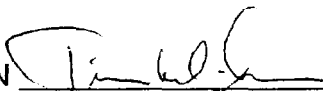
SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99642

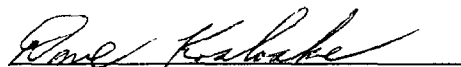
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
PROBE SPEED (m/s)	4.27 - 4.33 fps	4.30
UPPER RIB (g's)	37 - 46 g's	38
LOWER RIB (g's)	37 - 46 g's	41
LOWER SPINE (g's)	15 - 22 g's	21

TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY



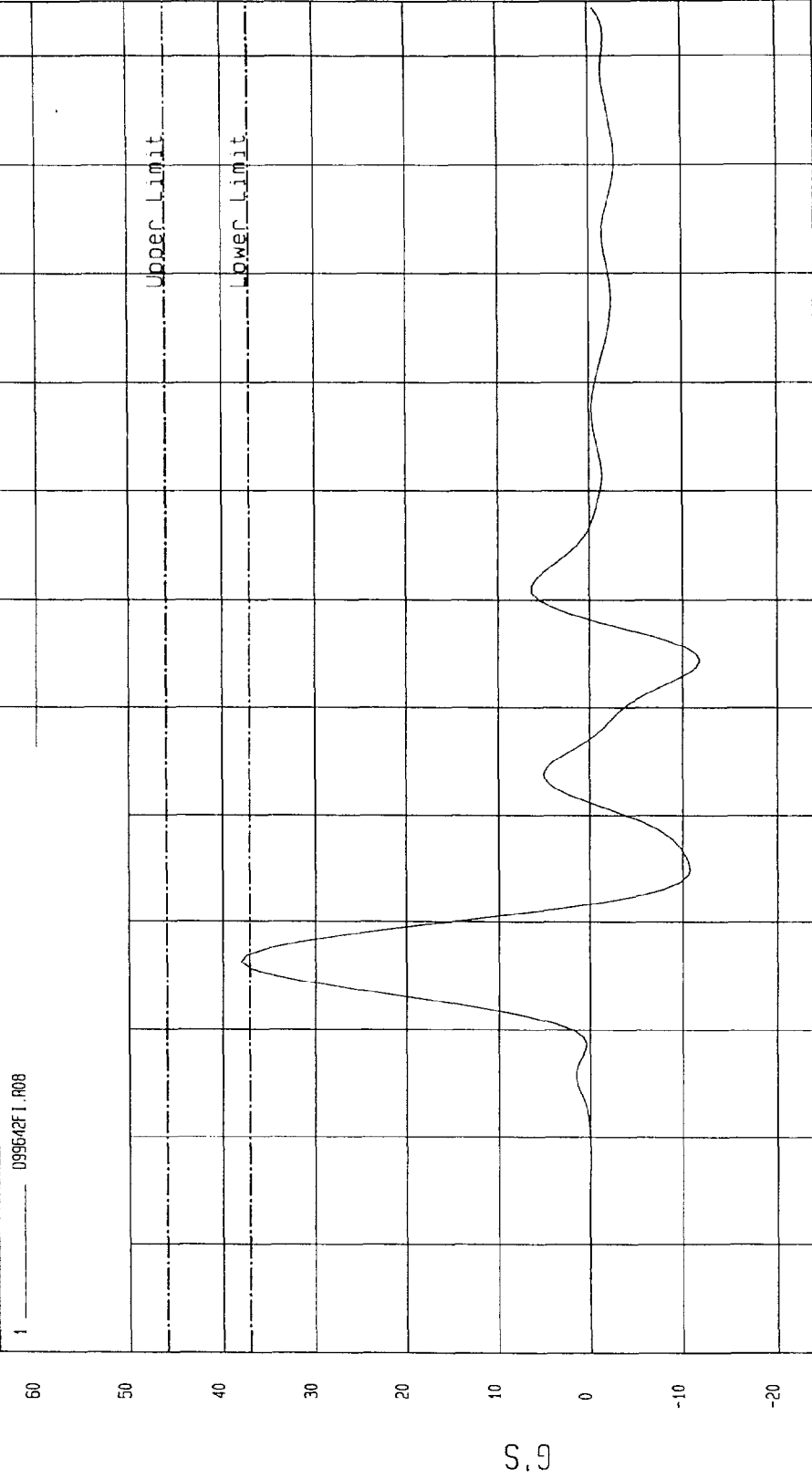
TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:56

COMPONENT: DUMMY # 049 Velocity: 14.102 FT/SEC 4.3 M/SEC

Minimum = -11.90 G'S at 64.3 msec

Maximum = 37.93 G'S at 36.2 msec

UPPER RIB ACCELERATION



MCA Research
03-26-1999 10:03

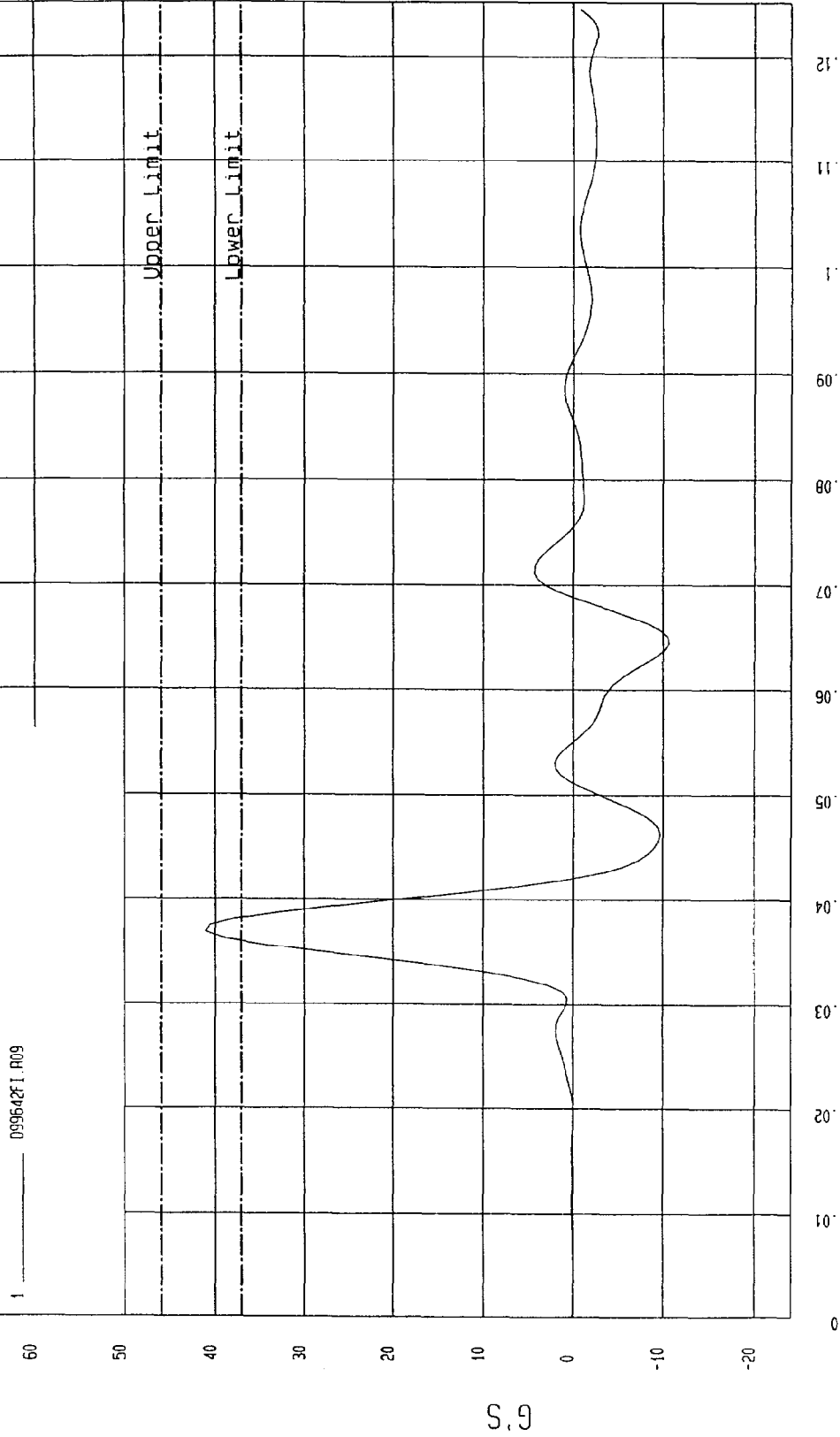
TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:56

COMPONENT: DUMMY # 049 Velocity: 14.102 FT/SEC 4.3 M/SEC

Minimum = -10.60 G'S at 64.3 msec

Maximum = 41.00 G'S at 36.8 msec

LOWER RIB ACCELERATION



NSA Research
03-26-1999 10:03

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:56
COMPONENT: DUMMY # 049 Velocity: 14.102 FT/SEC 4.3 M/SEC

Minimum = -2.96 G'S at 58.1 msec

Maximum = 20.90 G'S at 41.2 msec

LOWER SPINE ACCELERATION

1 ——— D99642F1 R10

30

20

10

0

-10

-20

G'S

Upper Limit

Lower Limit

12

11

10

60

80

107

106

105

104

103

102

101

0

TIME (SECONDS)

NSA Research
03-26-1999 10:03

MGA RESEARCH CORPORATION

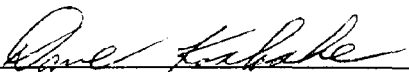
PELVIS IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99643

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5° F	21.0
RELATIVE HUMIDITY (%)	10 - 70%	25
PROBE SPEED (m/s)	4.27 - 4.33 f/s	4.28
PELVIS ACCELERATION (g's)	40 - 60 g's	47

TEST MEETS SPECIFICATIONS

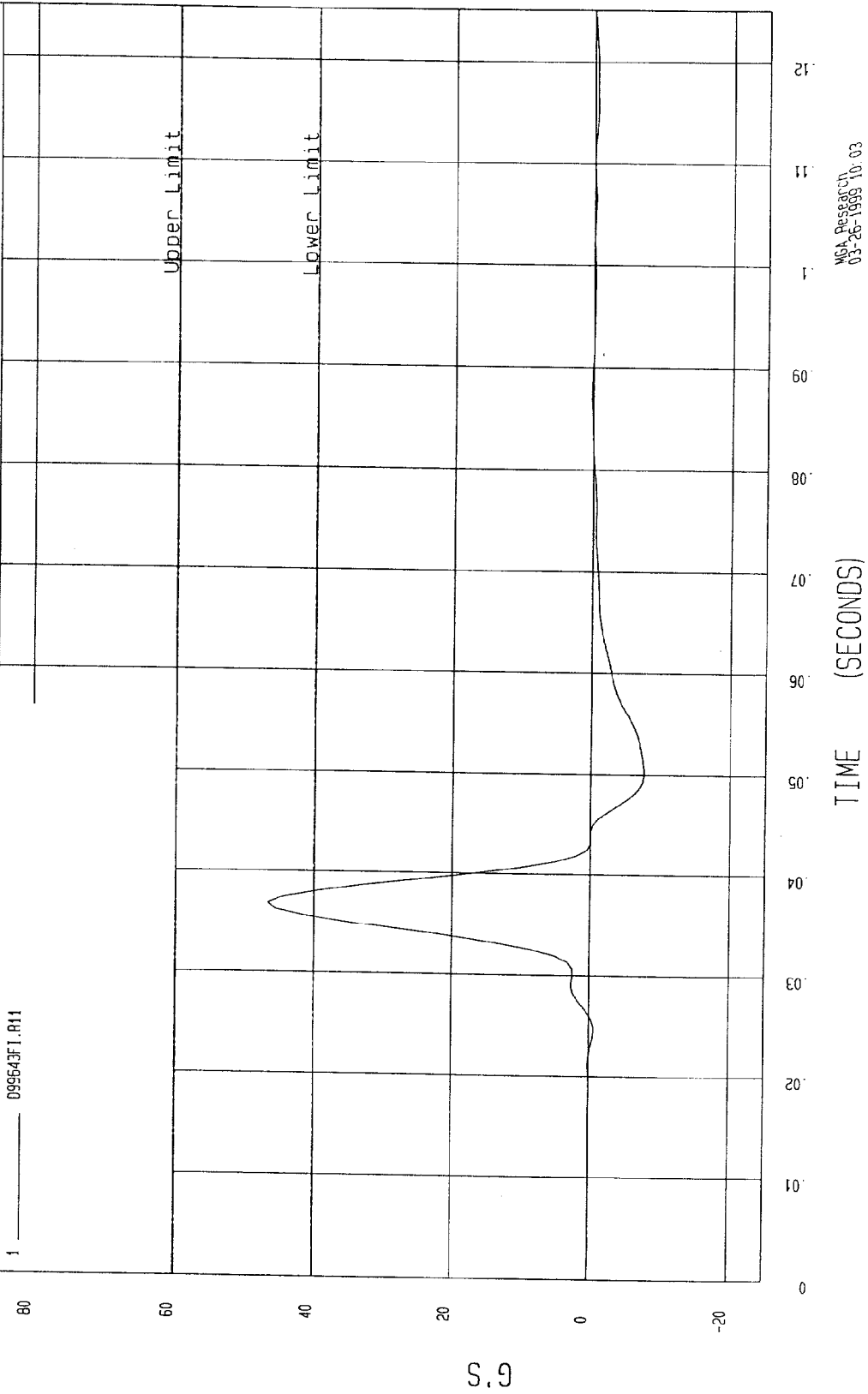
TECHNICIAN APPROVED BY 

TEST: DUMMY CALIBRATION - PELVIS IMPACT TEST DATE: 03-26-1999 - 10:02

COMPONENT: DUMMY # 049 Velocity: 14.056 FT/SEC 4.28 M/SEC

Minimum = -7.62 G'S at 50 msec
Maximum = 46.56 G'S at 36.8 msec

PELVIS ACCELERATION



MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

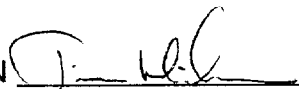
SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99644

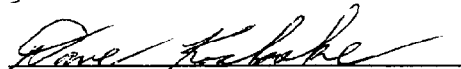
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
FORCE @ 12.7 mm	104 - 162	147
FORCE @ 19.0 mm	163 - 222	205
FORCE @ 25.4 mm	222 - 280	269
FORCE @ 33 mm	325 - 391	371

TEST MEETS SPECIFICATIONS

TECHNICIAN



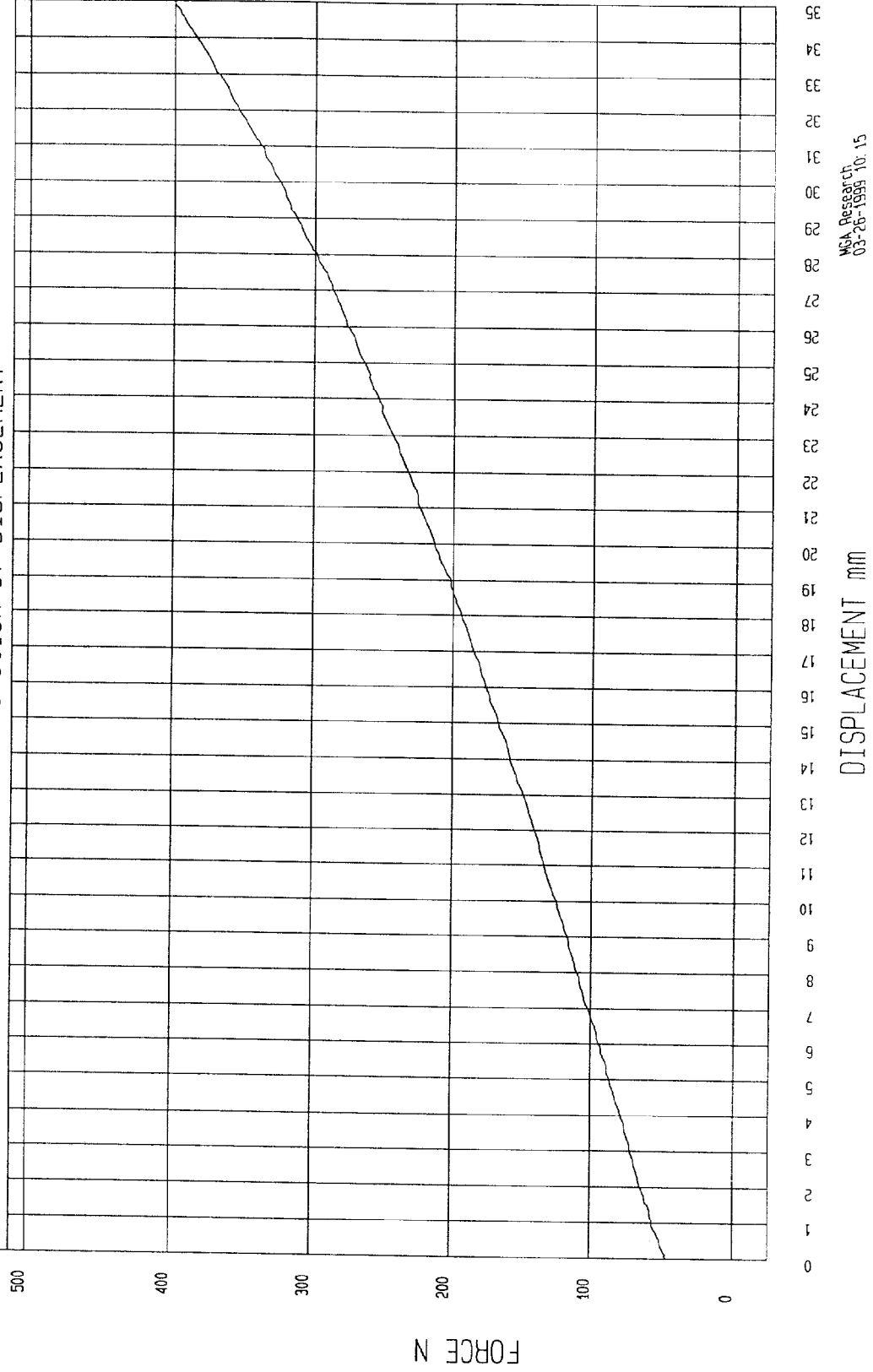
APPROVED BY



TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSION TEST DATE: 03-26-1999 - 10:12:58

COMPONENT: DUMMY # 049

FORCE as a function of DISPLACEMENT



MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 049TEST NUMBER: D99645

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
FORCE @ 0°	0 - 26.7	0
FORCE @ 20°	97.9 - 151.2	104.2
FORCE @ 30°	151.2 - 204.6	190.2
FORCE @ 40°	204.6 - 258.0	247.6
RETURN ANGLE	12° maximum	2°

TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY

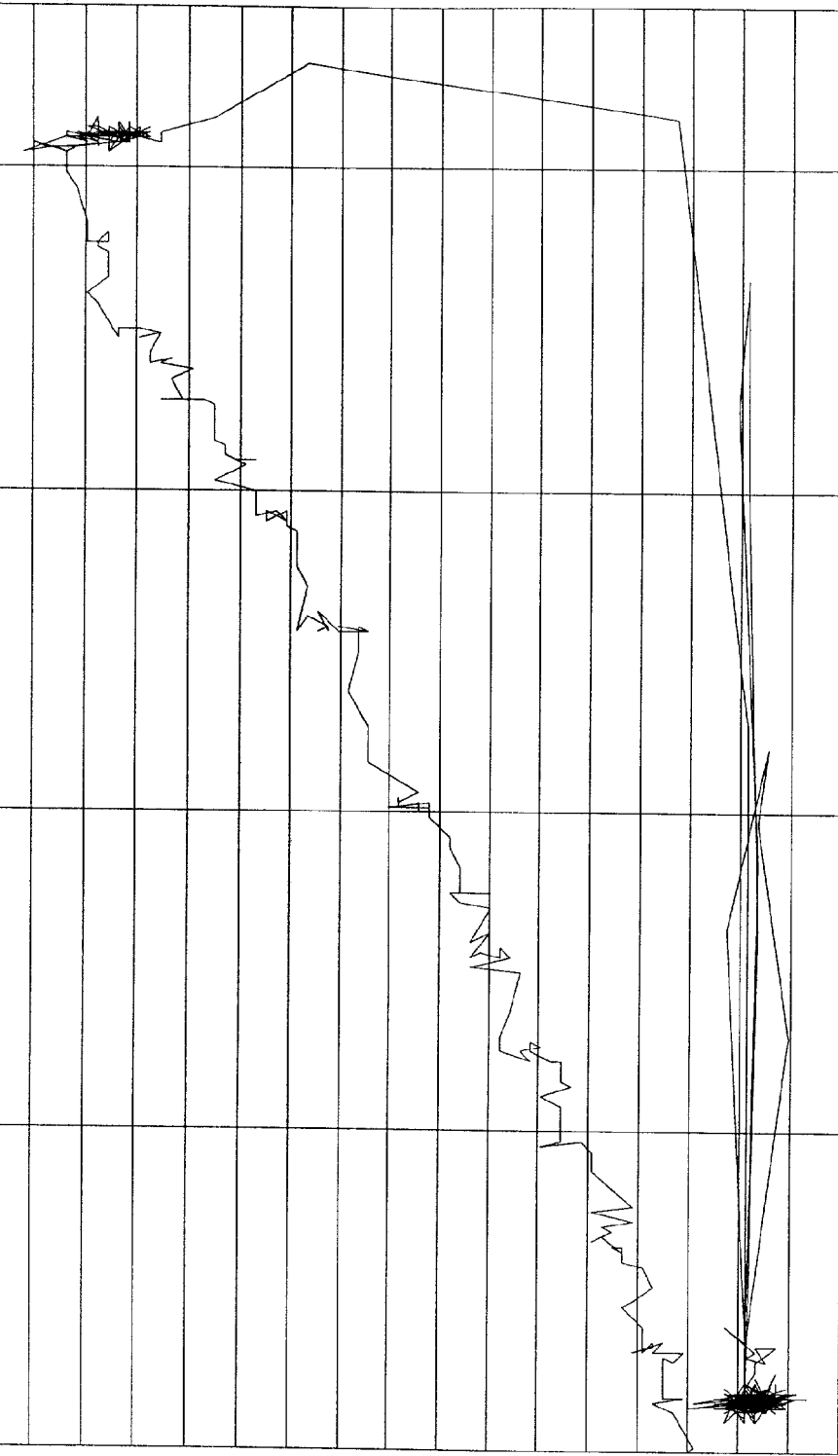


TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 03-26-1999 - 11:06:30

COMPONENT: DUMMY # 049

FORCE as a function of TORSO ROTATION

FORCE N



40

30

20

10

0

TORSO ROTATION DEGREES

MCA Research
03-26-1999 11:07

POST-TEST CERTIFICATION DATA

Dummy Serial Number: 048

Calibration Test Results Summary

Dummy Serial Number: 048

Post-Test Calibration

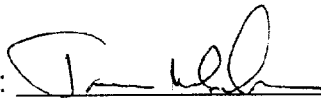
External Dimensions:	The dummy passed all external dimension requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

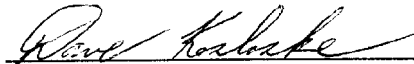
DUMMY SERIAL NO.: 048DATE OF VERIFICATION: February 26, 1999

DESCRIPTION	SPECIFICATION	TEST RESULTS
SH - Seated Height (mm)	889 - 909	904
RH - Rib Height (mm)	501 - 521	516
HP - Hip Pivot Height (mm)	99 ref.	99
RD - Rib From Back Line (mm)	229 - 241	233
KV - Knee Pivot From Back Line (mm)	511 - 526	524
SW - Knee Pivot to Floor (mm)	490 - 505	493
HW - Hip Width (mm)	356 - 391	371

MEASUREMENTS BY:



APPROVED BY:



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

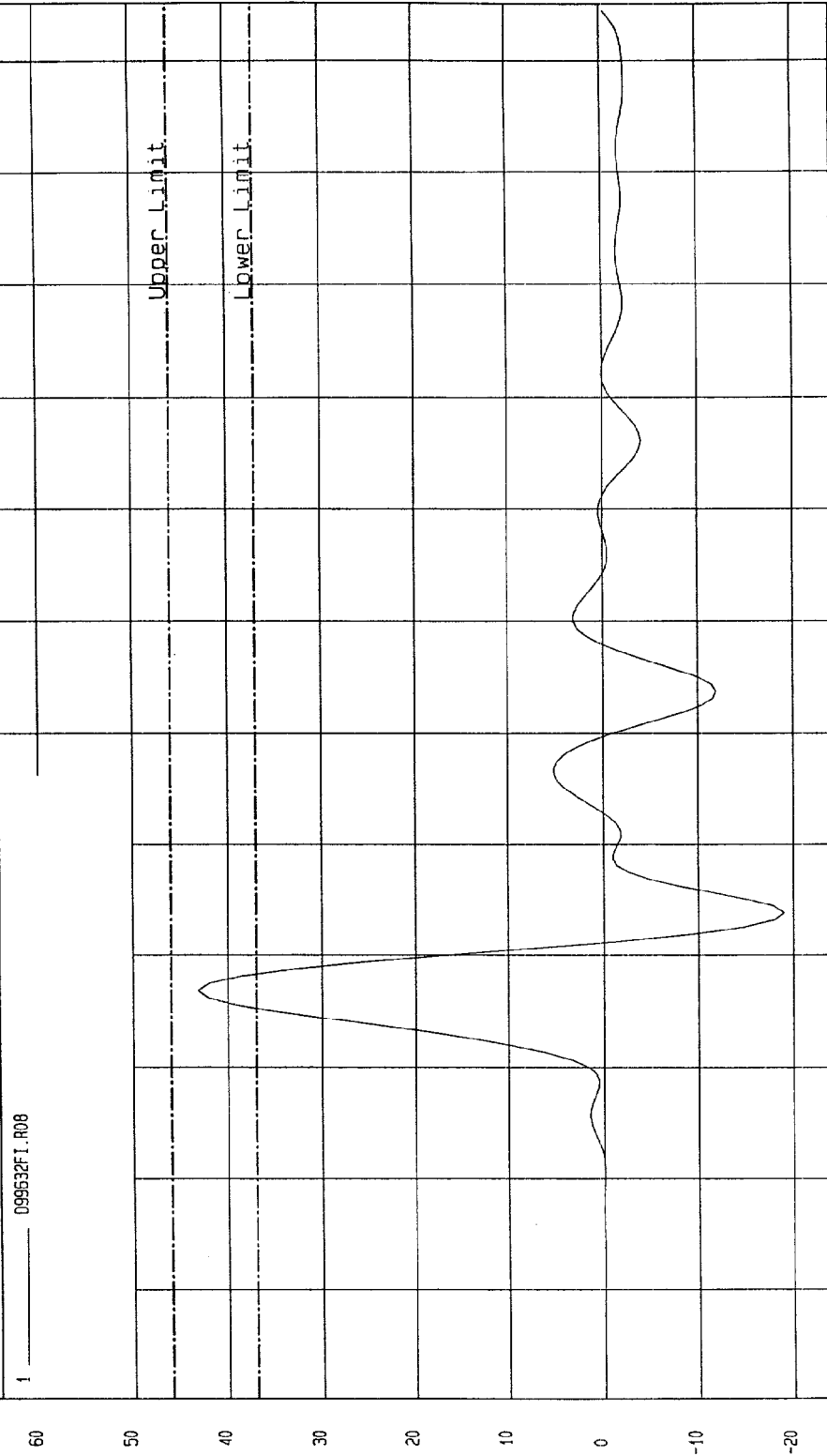
DATE: February 26, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99632

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
PROBE SPEED (m/s)	4.27 - 4.33	4.32
UPPER RIB (g's)	37 - 46 g's	43
LOWER RIB (g's)	37 - 46 g's	41
LOWER SPINE (g's)	15 - 22 g's	22

TECHNICIAN Tim AllenAPPROVED BY Rene Kalkreuth

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:33
 COMPONENT: DUMMY # 048 Velocity: 14.176 FT/SEC 4.32 M/SEC
 Minimum = -18.99 G'S at 43.7 msec Maximum = 43.17 G'S at 36.8 msec

UPPER RIB ACCELERATION



TIME (SECONDS)

NCA Research
03-26-1999 09:39

G

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:33

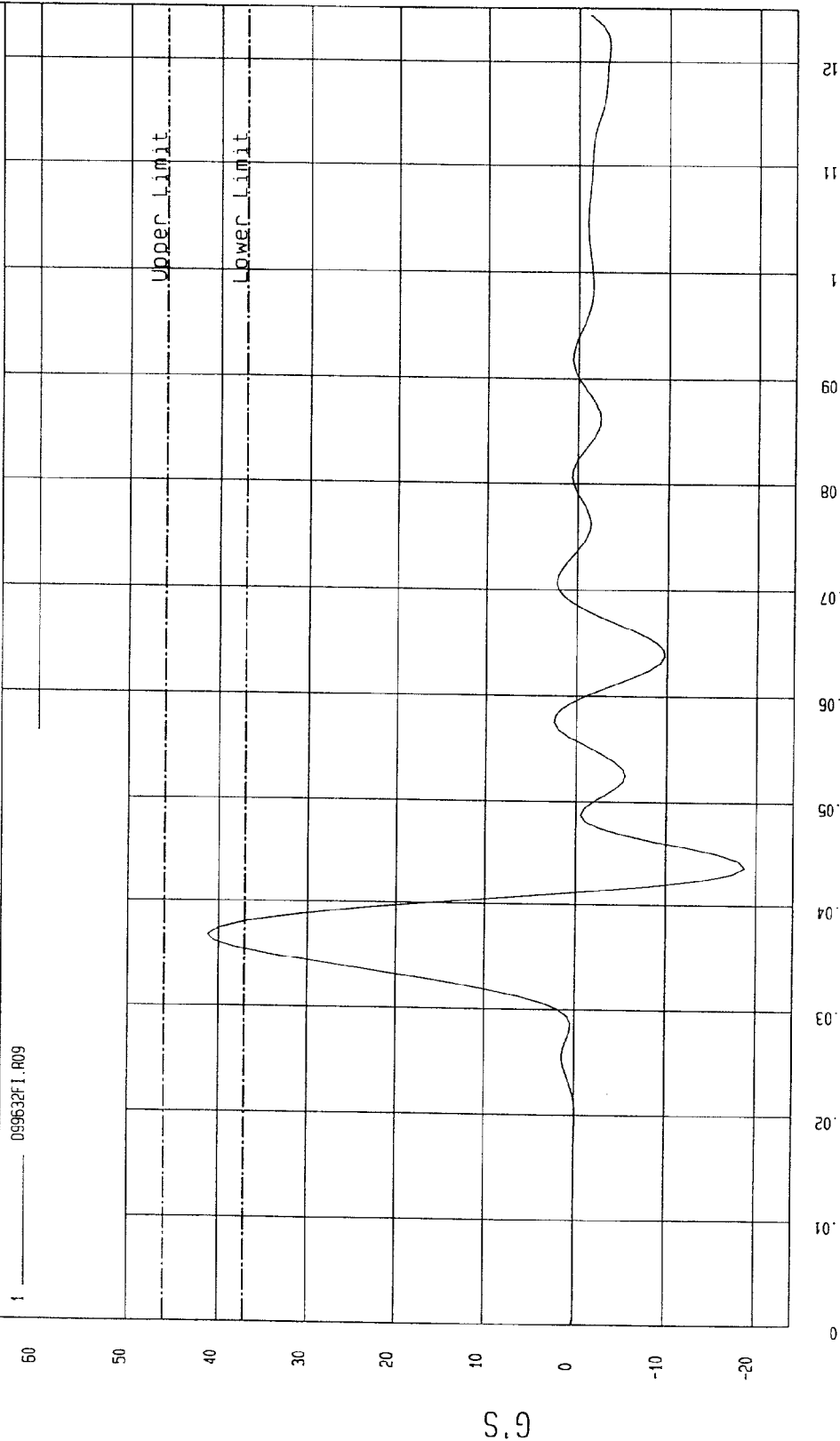
COMPONENT: DUMMY # 048 Velocity: 14.176 FT/SEC 4.32 M/SEC

Minimum = -18.72 G'S at 43.7 msec

Maximum = 41.22 G'S at 36.8 msec

LOWER RIB ACCELERATION

1 099632F1.R09



WGA Research
03-26-1999 09:39

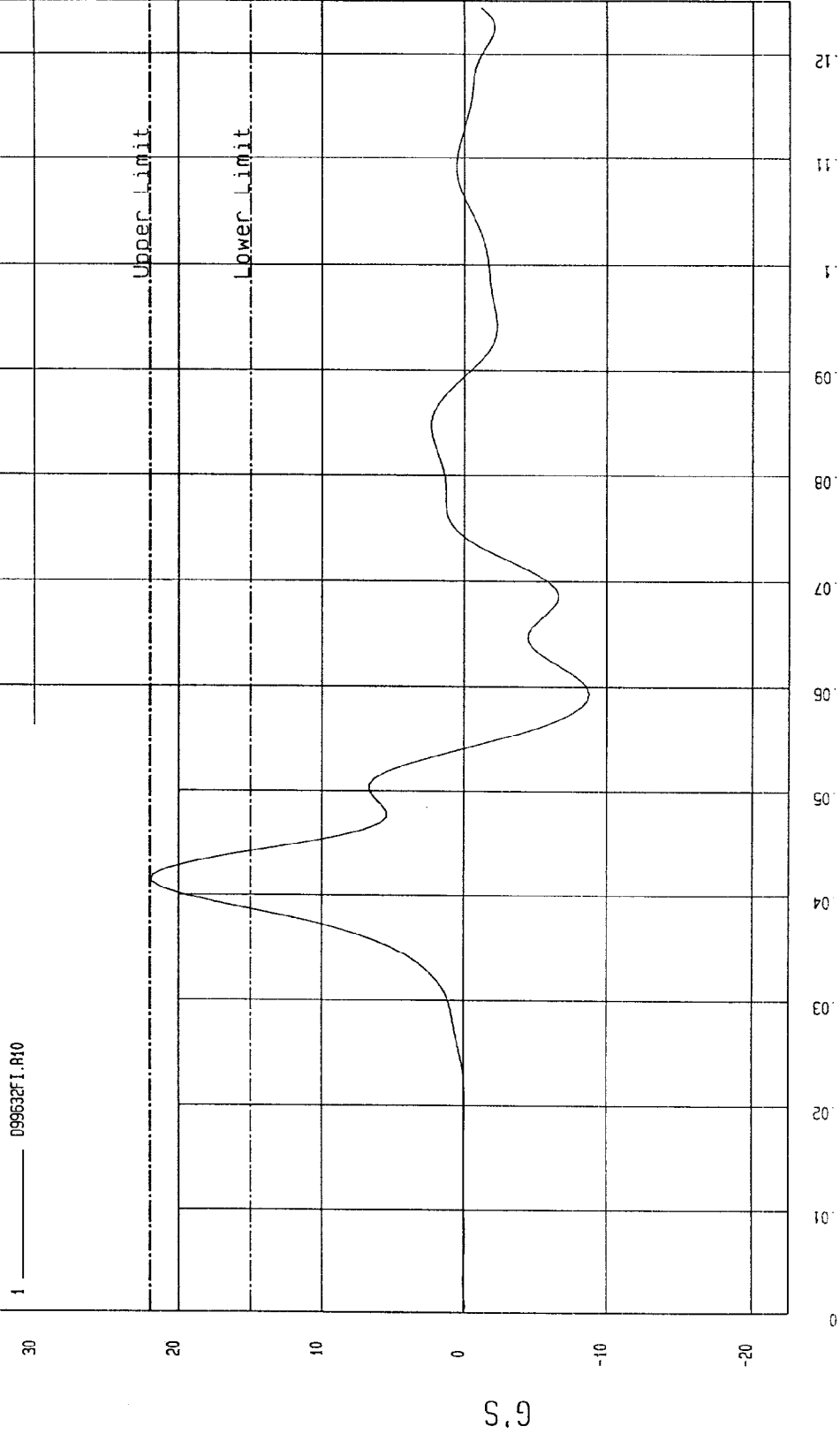
TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 03-26-1999 - 09:33

COMPONENT: DUMMY # 048 Velocity: 14.176 FT/SEC 4.32 M/SEC

Minimum = -8.77 G'S at 59.3 msec

Maximum = 21.92 G'S at 41.2 msec

LOWER SPINE ACCELERATION



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

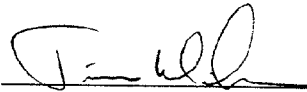
SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99633

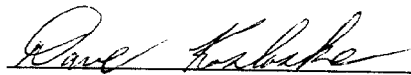
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
PROBE SPEED (m/s)	4.27 - 4.33	4.29
PELVIS ACCELERATION (g's)	40 - 60	53

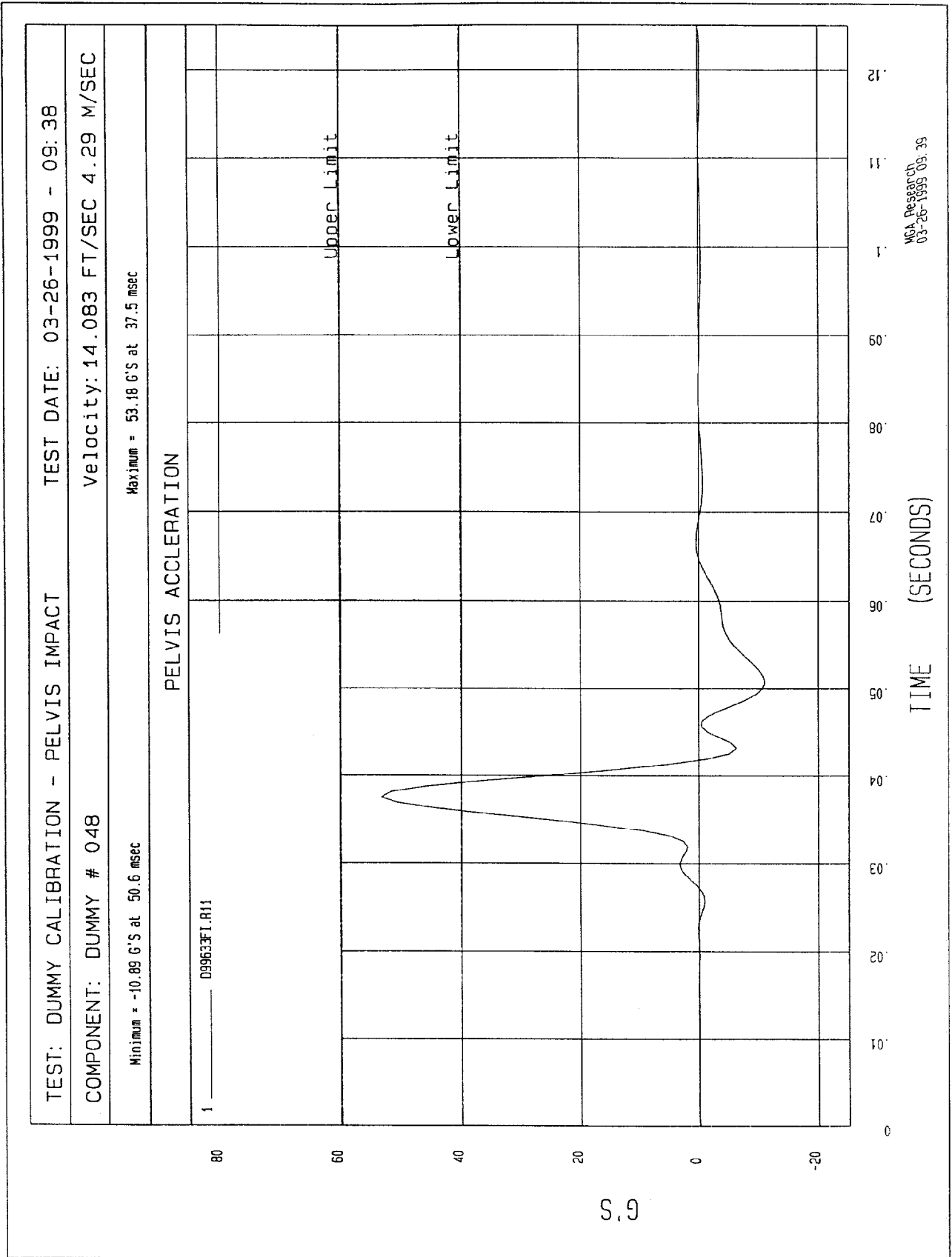
TEST MEETS SPECIFICATIONS

TECHNICIAN



APPROVED BY





MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: February 26, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99634

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
FORCE @ 12.7 mm	104 - 162	142
FORCE @ 19.0 mm	163 - 222	198
FORCE @ 25.4 mm	222 - 280	264
FORCE @ 33 mm	325 - 391	361

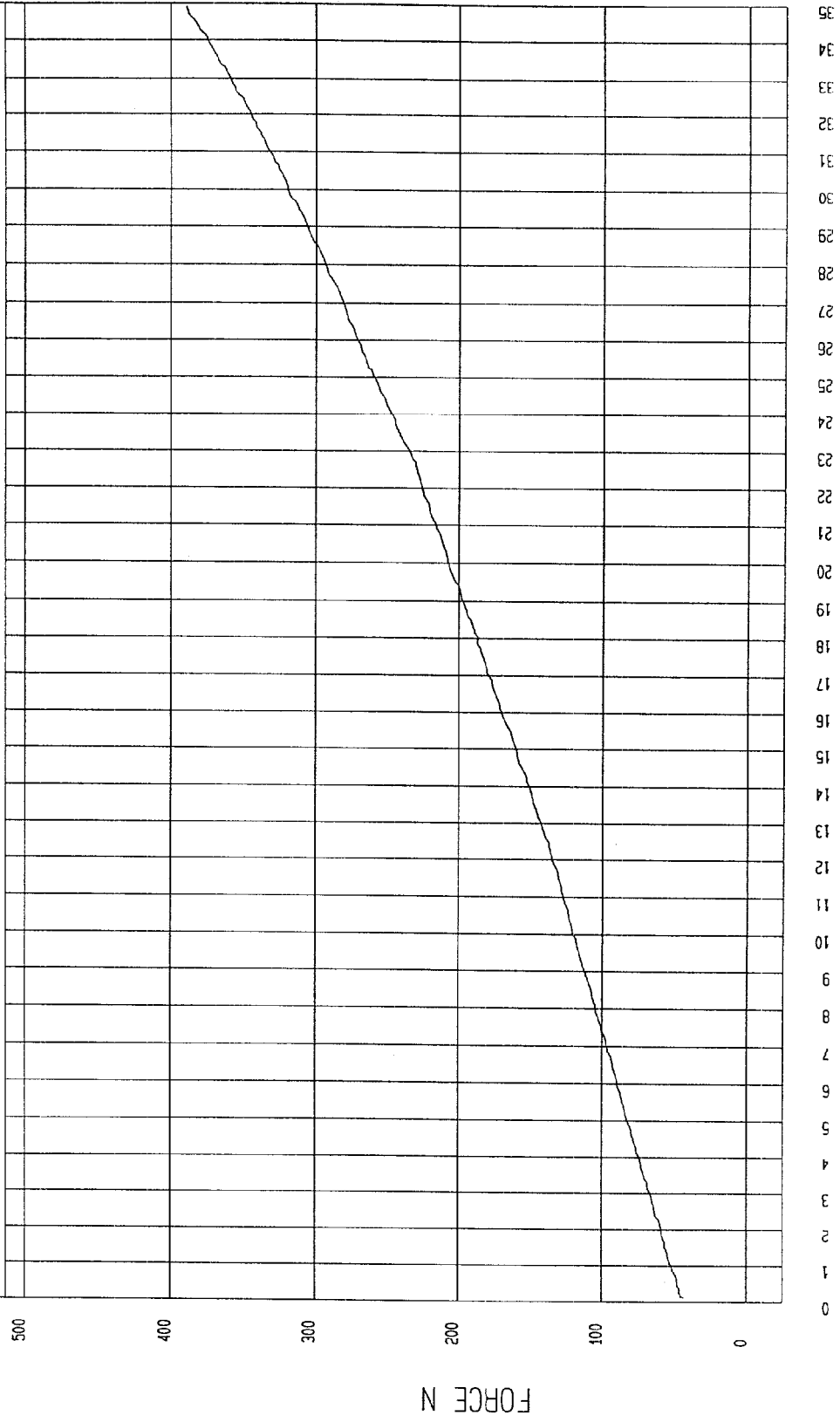
TEST MEETS SPECIFICATIONS

TECHNICIAN Jim WellAPPROVED BY Alfred Hababe

TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSION TEST DATE: 03-26-1999 - 10:14:30

COMPONENT: DUMMY # 048

FORCE as a function of DISPLACEMENT



NSA Research
03-26-1999 10:15

DISPLACEMENT mm

MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

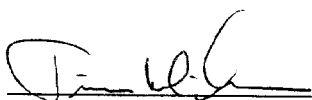
SIDE IMPACT DUMMY (SID)

DATE: March 26, 1999DUMMY SERIAL NUMBER: 048TEST NUMBER: D99635

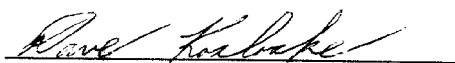
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE (°C)	18.9 - 25.5	21.0
RELATIVE HUMIDITY (%)	10 - 70	25
FORCE @ 0°	0 - 26.7	0
FORCE @ 20°	97.9 - 151.2	105.9
FORCE @ 30°	151.2 - 204.6	171.5
FORCE @ 40°	204.6 - 258.0	224.7
RETURN ANGLE	12° maximum	5°

TEST MEETS SPECIFICATIONS

TECHNICIAN



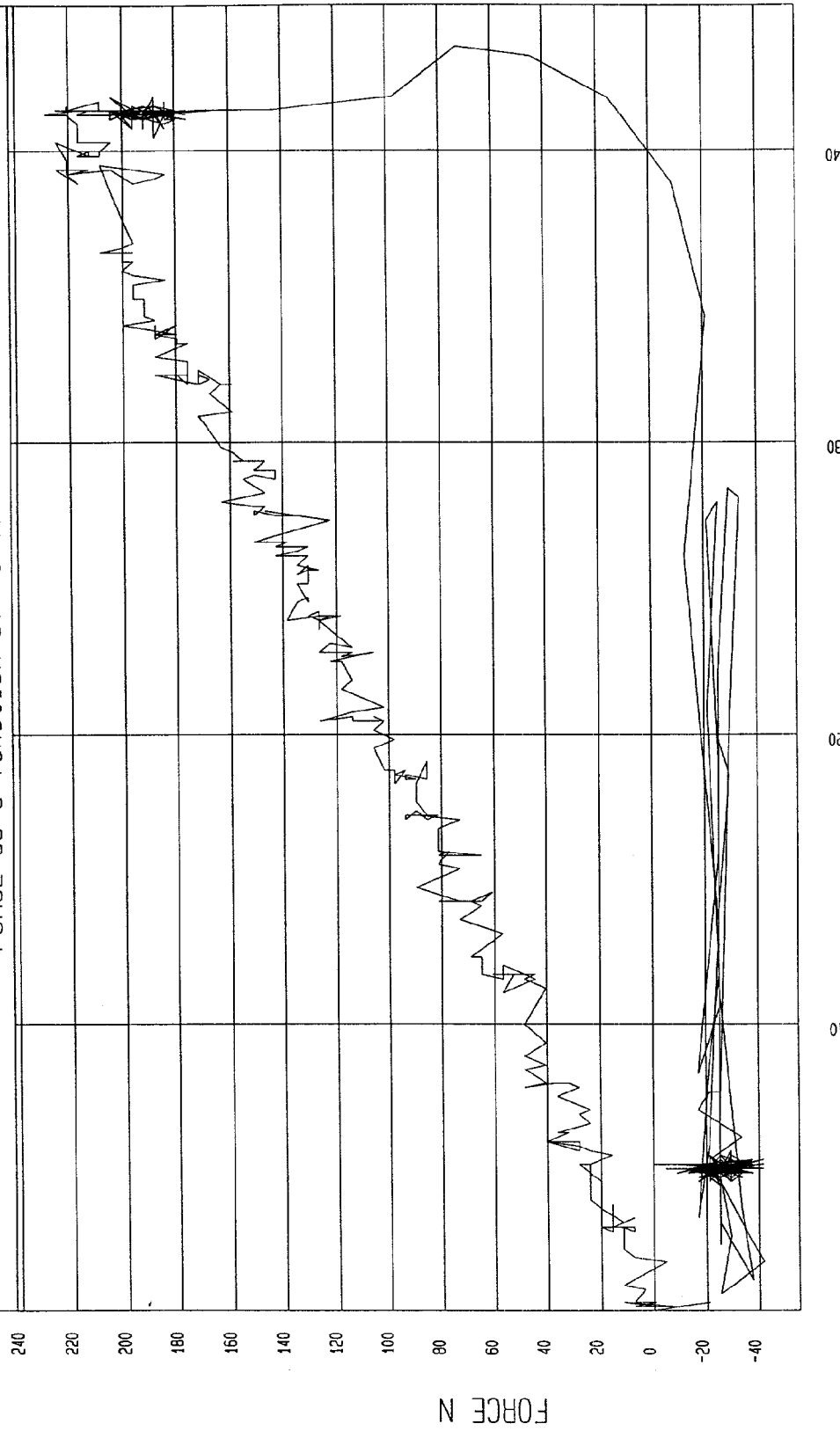
APPROVED BY



TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 03-26-1999 - 10:50:36

COMPONENT: DUMMY # 048

FORCE as a function of TORSO ROTATION



NCA Research
03-26-1999 11:07

POST-TEST DRIVER DUMMY INSPECTION CHECKLIST

Type: Side Impact Dummy

Dummy Serial Number: 049

Inspected By: Tim Michnay

Date: March 26, 1999

<u>Part</u>	<u>Items Checked</u>	<u>Comments</u>
Skin	visual inspection	OK
Head	visual, ballast, accelerometer mount	OK
Neck	visual	OK
Spine box	visual, ballast, weldment, accelerometer mount	OK
Rib cage	visual, measure	OK
Sternum	visual	OK
Lumbar spine	visual	OK
Abdomen	visual	OK
Pelvis	visual, palpate, accelerometer mount	OK
Upper legs	visual	OK
Knees	visual	OK
Lower legs	visual, range of motion	OK
Ankles	visual, range of motion	OK
Feet	visual, range of motion	OK
Joints	1 to 2 g range	OK
Other		

NOTES: (include component/problem/action/reason):

POST-TEST PASSENGER DUMMY INSPECTION CHECKLIST

Type: Side Impact Dummy

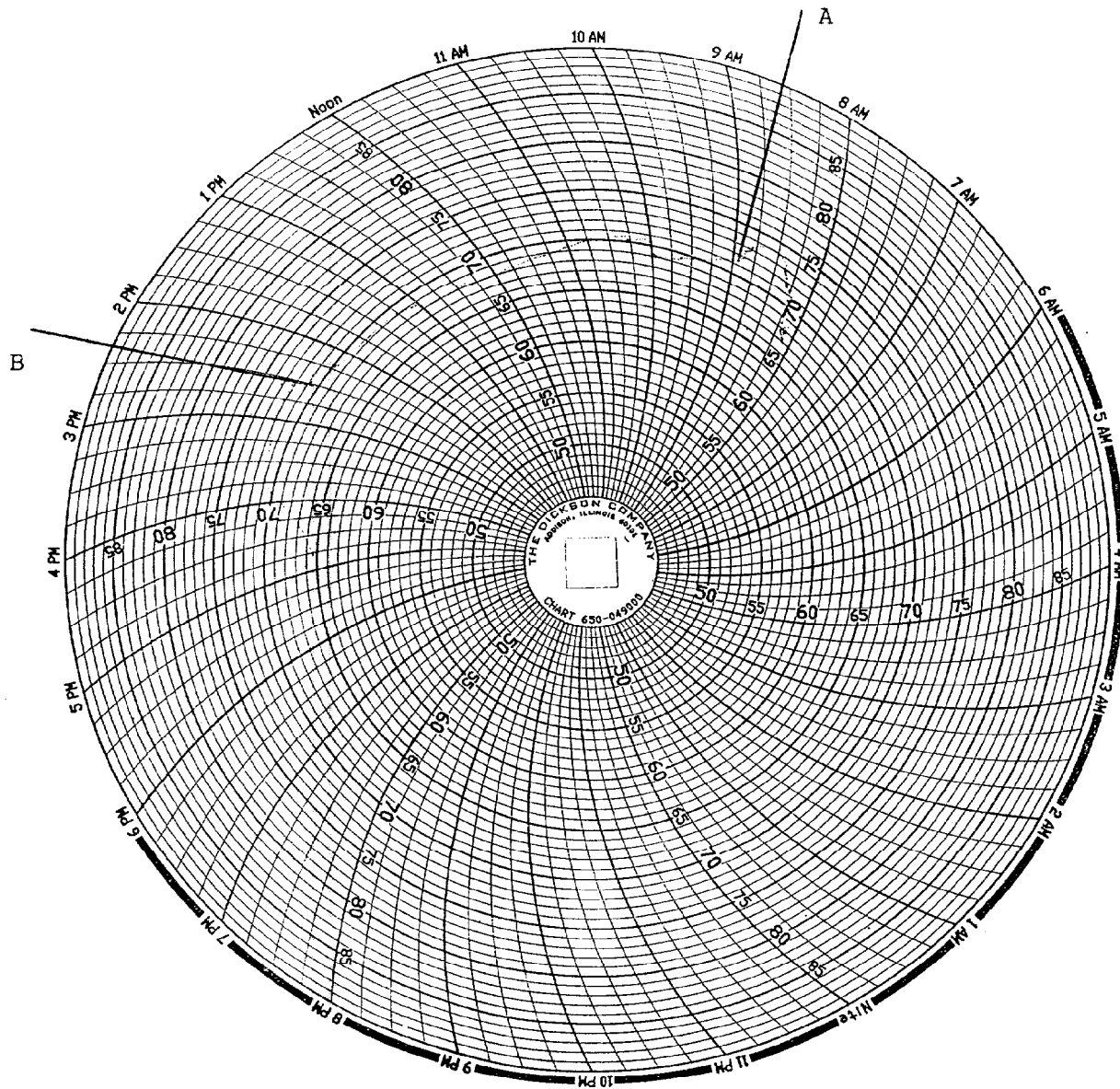
Dummy Serial Number: 048

Inspected By: Tim Michnay

Date: March 26, 1999

<u>Part</u>	<u>Items Checked</u>	<u>Comments</u>
Skin	visual inspection	OK
Head	visual, ballast, accelerometer mount	OK
Neck	visual	OK
Spine box	visual, ballast, weldment, accelerometer mount	OK
Rib cage	visual, measure	OK
Sternum	visual	OK
Lumbar spine	visual	OK
Abdomen	visual	OK
Pelvis	visual, palpate, accelerometer mount	OK
Upper legs	visual	OK
Knees	visual	OK
Lower legs	visual, range of motion	OK
Ankles	visual, range of motion	OK
Feet	visual, range of motion	OK
Joints	1 to 2 g range	OK
Other		

NOTES: (include component/problem/action/reason):

VEHICLE AND DUMMY TEMPERATURE

A = Dummies installed in vehicle
B = Test conducted

APPENDIX D

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY AND VEHICLE CALIBRATION DATA
INSTRUMENTS FOR DRIVER DUMMY NO. 049

	DRIVER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Upper Rib Y	AHRP6	Endevco	December 8, 1998
Lower Rib Y	J12465	Endevco	December 8, 1998
Lower Spine Y	AN8L6	Endevco	December 8, 1998
Pelvis Y	AKAD6	Endevco	December 8, 1998
Upper Rib Redundant Y	AJ412	Endevco	December 8, 1998
Lower Rib Redundant Y	J11361	Endevco	December 8, 1998
Lower Spine Redundant Y	APY13	Endevco	December 8, 1998
Pelvis Redundant Y	AJ9A7	Endevco	December 8, 1998

INSTRUMENTS FOR LEFT REAR PASSENGER DUMMY NO. 048

	LEFT REAR PASSENGER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Upper Rib Y	AKAC4	Endevco	December 8, 1998
Lower Rib Y	J11630	Endevco	December 8, 1998
Lower Spine Y	J10431	Endevco	December 8, 1998
Pelvis Y	AJ9P7	Endevco	December 8, 1998
Upper Rib Redundant Y	J13642	Endevco	December 8, 1998
Lower Rib Redundant Y	J11166	Endevco	December 8, 1998
Lower Spine Redundant Y	AN9E3	Endevco	December 8, 1998
Pelvis Redundant Y	AJ462	Endevco	December 8, 1998

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE AND MDB ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Moving Barrier CG X	I25-J05	Entran	September 24, 1998
Moving Barrier CG Y	F11-G08	Entran	December 21, 1998
Moving Barrier CG Z	E10-F03	Entran	December 21, 1998
Moving Barrier Rear Axle X	H02-J02	Entran	December 15, 1998
Moving Barrier Rear Axle Y	J04-F16	Entran	December 15, 1998
Left Mid A-Post Y	F20-G12	Entran	September 16, 1998
Left Lower A-Post Y	F07-A21	Entran	February 24, 1999
Left Mid B-Post Y	C14-207	Entran	February 2, 1999
Left Lower B-Post Y	I18-G01	Entran	January 7, 1999
Rear Floorpan Above Axle X	G01-J09	Entran	December 21, 1998
Rear Floorpan Above Axle Y	G01-J05	Entran	August 26, 1998
Rear Floorpan Above Axle Z	F18-G06	Entran	December 16, 1998
Driver Seat Track Y	K11-J11	Entran	August 27, 1998
Right Side Sill at Front Seat X	F20-G05	Entran	January 29, 1999
Right Side Sill at Front Seat Y	A09-G06	Entran	February 24, 1999
Right Side Sill at Front Seat Z	I25-J01	Entran	February 2, 1999
Right Side Sill at Rear Seat X	J04-F14	Entran	December 21, 1998
Right Side Sill at Rear Seat Y	G08-B07	Entran	February 24, 1999
Right Side Sill at Rear Seat Z	K16-X03	Entran	January 2, 1999
Left Side Sill at Front Seat Y	F10-D04	Entran	January 7, 1999

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE AND MDB ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Side Sill at Rear Seat Y	I25-J14	Entran	December 8, 1998
Rear Occupant Compartment Y	I18-E15	Entran	September 16, 1998
Vehicle CG X	F12-G06	Entran	February 17, 1999
Vehicle CG Y	E10-F17	Entran	January 7, 1999
Vehicle CG Z	D05-R10	Entran	February 24, 1999

Note: All Endevco accelerometers are Model No. 7264-2000. All Entran accelerometers are Model No. EGE-72