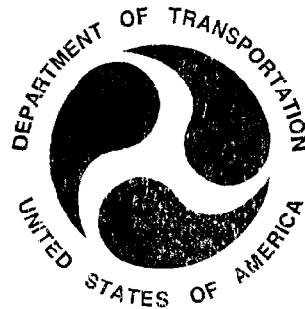


V 2705

1997 HYUNDAI SONATA GL 4 DOOR
"EU 96/27/EC SIDE IMPACT TEST"

20/97

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105



Test Date: August 21, 1997

Report Date: August 26, 1997

FINAL REPORT

Prepared For:

U.S. DEPARTMENT OF TRANSPORTATION
VOLPE NATIONAL TRANSPORTATION SYSTEM CENTER
55 BROADWAY, KENDALL SQUARE
CAMBRIDGE, MA 02142

This Final Report was prepared for the U.S. Department of Transportation, Volpe National Transportation System Center, under Contract No. DTRS-57-95-C-00010.

This document is disseminated under the sponsorship of the U. S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof.

Approved By: John Fleck
John Fleck, Facility Director

Approval Date: 10-21-97

FINAL REPORT ACCEPTED BY (OVSC):

Accepted By: _____
Contract Technical Manager

Acceptance Date: _____

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND TEST PROCEDURE	1-1
2	SUMMARY OF LATERAL TEST	2-1
3	LATERAL IMPACT DUMMY (EUROSID-1) AND VEHICLE TEST DATA	3-1
4	OCCUPANT AND VEHICLE INFORMATION	4-1
APPENDIX A	PHOTOGRAPHS	
APPENDIX B	VEHICLE AND EUROSID-1 RESPONSE DATA	
APPENDIX C	OVERPLOT DATA	
APPENDIX D	EUROSID-1 CONFIGURATION AND PERFORMANCE VERIFICATION	
APPENDIX E	TEST EQUIPMENT LIST AND CALIBRATION INFORMATION	
APPENDIX F	STATIC CRUSH	

SECTION 1
PURPOSE AND TEST PROCEDURE

This lateral impact test is part of Contract No. DTRS-57-97-C-00010, sponsored by the National Highway Traffic Safety Administration (NHTSA). The purpose of this test was to evaluate a 1997 Hyundai Sonata GL 4 Door when subjected to a 50 kph lateral impact was conducted in accordance with Directive 96/27/EC of the European Parliament and of the council of May 20, 1996.

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

SECTION 2

SUMMARY OF LATERAL IMPACT TEST

A 1997 Hyundai Sonata GL 4 Door was impacted on the left or driver's side by a Moving Deformable Barrier (MDB) which was moving forward at a velocity of 31.4 mph (50.5 kph). The target vehicle was stationary and was positioned perpendicular to the line of forward motion of the moving deformable barrier. The lateral impact test was conducted by MGA Research Corporation in Burlington, Wisconsin, on August 21, 1997. Pre- and post-test photographs of the test vehicle, the MDB and the European Side Impact Dummies (EuroSID-1s) are included in Appendix A.

Two European Side Impact Dummies (EuroSID-1s) were placed in the driver and left rear designated seating positions according to instructions specified in the Lateral Impact Directive which is dated May 20, 1996. The lateral impact event was documented by 10 high speed cameras and one real-time camera. Camera locations and other pertinent camera information can be found in this report.

Appendix B contains the vehicle and dummy response data traces. A summary of the lateral impact dummy (EuroSID-1) 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 tables summarize the results of the Lateral Side Impact test:

		DRIVER	PASSENGER
(1) Head Performance Criteria			
≤ 1000	T ₁	No Contact	66.6
	T ₂		81.5
	HPC		188.6
(2) Thorax Performance Criteria			
(2.1) Chest Deflection ≤ 42 mm	Upper Rib Deflection	27.2 @ 42 msec.	17.5 @ 81 msec.
	Mid Rib Deflection	29.7 @ 42 msec.	10.4 @ 79 msec.
	Lower Rib Deflection	26.8 @ 41 msec.	.9 @ 74 msec.
(2.2) Viscous Criteria ≤ 1.0	Upper Rib	.49 @ 38 msec.	.19 @ 72 msec.
	Middle Rib	.6 @ 37 msec.	.07 @ 74 msec.
	Lower Rib	.57 @ 37 msec.	.14 @ 51 msec.
(3) Abdominal Protection Criterion			
Sum ≤ 2500 N	Front Abdominal Force	226 @ 44 msec.	49.8 @ 71 msec.
	Mid Abdominal Force	666 @ 32 msec.	32.1 @ 71 msec.
	Rear Abdominal Force	814 @ 38 msec.	283.8 @ 51 msec.
	Sum of Abdominal Force	1369 @ 43 msec.	317.1 @ 51 msec.
(4) Pelvis Performance Criterion			
≤ 6000 N	Pubic Symphysis Force	3490 @ 40 msec.	673 @ 47 msec.

HIC		DRIVER	PASSENGER
	T_1	47.0	66.6
	T_2	83.0	81.5
	$T_2 - T_1$	36.0	14.9
	HIC	177.6	188.6

FIR FILTERED	DRIVER	PASSENGER
UPPER RIB (g's)	107.7 @ 34 msec.	31.1 @ 69 msec.
MIDDLE RIB (g's)	132.9 @ 34 msec.	28.1 @ 69 msec.
LOWER RIB (g's)	160.3 @ 34 msec.	23.9 @ 73 msec.
LOWER SPINE (g's)	98.5 @ 39 msec.	23.6 @ 72 msec.
PELVIS (g's)	78.9 @ 36 msec.	37.7 @ 52 msec.
TTI (g's)	129.4	27.4
FILTERED AT SAE CLASS 180		
UPPER RIB (g's)	117.2 @ 35 msec.	32.0 @ 68 msec.
MID RIB (g's)	221.3 @ 68 msec.	28.0 @ 69 msec.
LOWER RIB (g's)	193.5 @ 66 msec.	25.1 @ 73 msec.
LOWER SPINE (g's)	104.4 @ 38 msec.	25.1 @ 72 msec.
PELVIS (g's)	85.3 @ 41 msec.	47.8 @ 51 msec.

CONTACTS	DRIVER	PASSENGER
HEAD (ms)	None	58.4 - 90.7
SHOULDER (ms)	22	32
UPPER RIB (ms)	34	None
MIDDLE RIB (ms)	29	None
LOWER RIB (ms)	26	None
ABDOMEN (ms)	24	None
PELVIS (ms)	23	48

TEST NOTES

Although not used in the European Lateral Impact testing, a rear struck side (passenger) EuroSID-1 dummy was placed in the target test vehicles for informational purposes. The driver, passenger and vehicle were instrumented with additional transducers to provide data beyond the requirements of the European Lateral Impact requirements. Whenever possible, the European Lateral Impact Standards were followed.

The driver seat in the test vehicle is not the same as the FMVSS 214D driver seat. The test vehicle driver seat has a total of 16 locking positions instead of the 214D 15 locking positions. This accounts for the driver "X" location dimensions being different from the FMVSS 214D driver "X" location dimensions.

The measured "R" point location (impact of barrier centerline) using the "H" point machine does not match the "R" point location supplied by the manufacturer.

Measured = 164 mm forward of front door striker

Supplied = 127 mm forward of front door striker

The test was conducted using the manufacturer supplied "R" point location.

Both the upper and lower barrier face height dimensions were 242 mm. A 16 mm gap existed between the upper and lower faces, but the total height between top and bottom of the barrier face was 500 mm.

SECTION 3
LATERAL IMPACT DUMMY (EUROSID-1) AND
VEHICLE TEST DATA

DATA SHEET NO. 1
GENERAL VEHICLE TEST PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

VIN: KMHCF24F1VU787199

Vehicle Body Color: Black Build Date: 11-96

Engine Data: 4 Cylinders; CID; 2.0 Liter; cc

Placement Longitudinal; X Lateral

Transmission: 3 speed; Manual; X Automatic; X Overdrive

Final Drive: Rear Wheel Drive; X Frt. Wheel Drive; Four Wheel Drive

Odometer Reading 768 miles

Options: X A/C; X Pwr. Steering; X Pwr. Brakes; Pwr. Windows;

 Cruise Control; X Tilt Wheel; Power Door Locks;

DATA FROM TIRE PLACARD:

Tire Pressure (at capacity): 30 Psi FRONT

30 Psi REAR

Recommended Tire Size: P195/70R14 or P205/60R15

Tires on Test Vehicle: P195/60R14 Manufacturer: General

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

Vehicle Maximum Capacity Loading = 390.0 kg (A)

No. of Occupants x 68.04 kg. = 340.2 kg (B)

Cargo Capacity (A-B) = 49.8 kg

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

WEIGHT OF TEST VEHICLE WITH MAXIMUM FLUIDS AND FUEL:

Right Front	=	<u>410.0</u>	kg	Right Rear	=	<u>256.7</u>	kg
Left Front	=	<u>410.0</u>	kg	Left Rear	=	<u>254.9</u>	kg
TOTAL FRONT	=	<u>820.0</u>	kg	TOTAL REAR	=	<u>511.6</u>	kg
% of Total Vehicle Weight	=	<u>62</u>	%;	% of Total Weight	=	<u>38</u>	%
TOTAL WEIGHT	=	<u>1331.6</u>	kg				

WEIGHT OF TEST VEHICLE WITHOUT FUEL:

TOTAL WEIGHT = 1285.0 kg

WEIGHT OF FUEL:

TOTAL WEIGHT = 46.6 kg

WEIGHT OF TEST VEHICLE WITH 90% OF FUEL MASS (UNLADEN WEIGHT):

TOTAL WEIGHT = 1326.9 kg

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Weight of Test Vehicle with 90% Fuel Mass (mass unladen) = 1326.9 kg
Weight of 2 EuroSID Dummies and Instrumentation = 200.0 kg
(100 kg allotted for each EuroSID-1 plus instrumentation per EU Directive 96/27/EC)
TEST VEHICLE TARGET WEIGHT = 1526.9 kg

ACTUAL WEIGHT OF TEST VEHICLE WITH 2 DUMMIES

Right Front	= <u>421.8</u> kg	Right Rear	= <u>312.1</u> kg
Left Front	= <u>464.0</u> kg	Left Rear	= <u>342.0</u> kg
TOTAL FRONT	= <u>885.8</u> kg	TOTAL REAR	= <u>654.1</u> kg
% of Total Weight	= <u>57.5</u> %	% of Total Weight	= <u>42.5</u> %
TOTAL TEST WEIGHT	= <u>1539.9</u> kg		

TEST VEHICLE ATTITUDE:

CURB WEIGHT ATTITUDE:

Right Front 690 mm Left Front 688 mm Right Rear 672 mm Left Rear 675 mm

TEST ATTITUDE:

Right Front 681 mm Left Front 671 mm Right Rear 641 mm Left Rear 635 mm

Test Vehicle Wheelbase: 2700 mm

C.G. As Tested = 1147 mm rearward of front wheel centerline

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

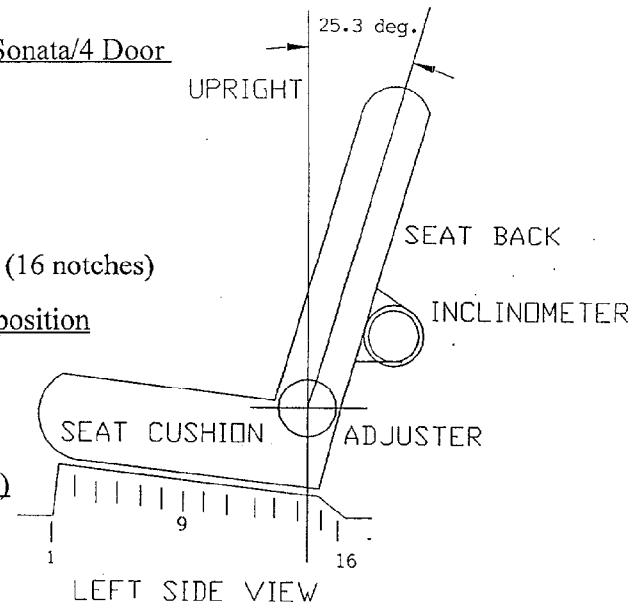
FRONT SEAT CUSHION PLACEMENT:

Total Length of Adjustment Travel: 1220 mm (16 notches)

Test Position: 9th notch from foremost locking position

FRONT SEAT BACK ADJUSTMENT POSITION:

Seat Back Angle = 25.3° (13 positions from first)



REAR SEAT: Contoured

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 Closed Right Rear Closed

AMOUNT OF WATER IN FUEL TANK:

Weight of full fuel = 46.7 kg

90% of fuel mass = 42.0 kg

Test mass added = 42.0 kg

LOCATION OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED (R Point):

Impact Point is 127 mm forward of striker

DATA SHEET NO. 2
TEST VEHICLE SUMMARY OF RESULTS

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

Overall Length of Vehicle = 4672 mm

Overall Width at B-Post = 1732 mm

WEIGHT AS TESTED:

Right Front = 421.8 kg Right Rear = 312.1 kg

Left Front = 464.0 kg Left Rear = 342.0 kg

TOTAL FRONT = 885.8 kg TOTAL REAR = 654.1 kg

% of Total Weight = 57.5 % % of Total Weight = 42.5 %

TOTAL VEHICLE WEIGHT = 1539.9 kg

Wheelbase = 2700 mm

Longitudinal C.G. from Center of Front Axle = 1147 mm

Impact Angle with Respect to Impactor = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (258 mm above ground) = 281 mm

2. LEVEL 2 (470 mm above ground) = 443 mm

3. LEVEL 3 (570 mm above ground) = 435 mm

4. LEVEL 4 (865 mm above ground) = 358 mm

5. LEVEL 5 (1325 mm above ground) = 161 mm

Maximum Post-Test Intrusion = 435 mm @ Level 3

OCCUPANTS:

	<u>Left Front Passenger</u>	<u>Left Rear Passenger</u>
Type of Dummy	<u>EuroSID-1</u>	<u>EuroSID-1</u>
Restraints Used	<u>type II belt</u>	<u>type II belt</u>

TEST VEHICLE SUMMARY OF RESULTS (Cont'd)

CAMERAS:

Number of Cameras: Onboard Vehicle	=	<u>3</u>
Offboard Vehicle	=	<u>6</u>
Deformable Barrier	=	<u>1</u>
TOTAL	=	<u>10</u>

DATA SHEET NO. 3

MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTS

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

POSITION OF IMPACT (MDB) ON MONORAIL:

Crabbed 0°

MDB DETAILS:

Wheelbase of Framework Carriage	= <u>2998 mm</u>
Track width (Front & Rear)	= <u>1499 mm</u>
C.G. Location Rearward of Front Axle	= <u>1003 mm</u>
C.G. Location From Center Line	= <u>-1.5 mm</u>
C.G. Location Above Ground Level	= <u>501 mm</u>

MDB WEIGHT:

Left Front	= <u>340.2 kg</u>	Left Rear	= <u>145.6 kg</u>
Right Front	= <u>305.3 kg</u>	Right Rear	= <u>178.7 kg</u>
TOTAL FRONT	= <u>645.5 kg</u>	TOTAL REAR	= <u>324.3 kg</u>
TOTAL MDB WEIGHT = <u>969.8 kg</u>			

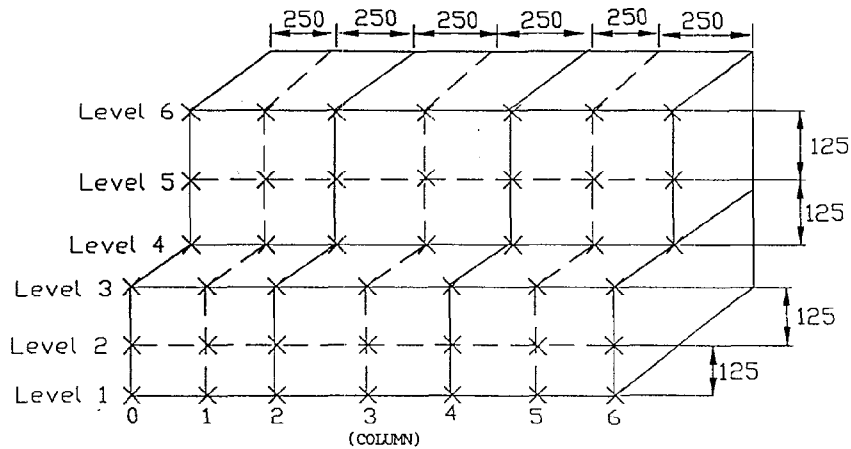
Impact Angle (MDB C/L to Target Vehicle C/L) = 90° degrees

Impact Speed = Primary: 50.5 kph Secondary: 50.3 kph

CRASH TEST SUMMARY FOR SIDE IMPACTOR (Cont'd)

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

Level 1	Column 0	= <u>369</u> mm
Level 2	Column 6	= <u>324</u> mm
Level 3	Column 6	= <u>327</u> mm
Level 4	Column 6	= <u>268</u> mm
Level 5	Column 6	= <u>315</u> mm
Level 6	Column 6	= <u>350</u> mm



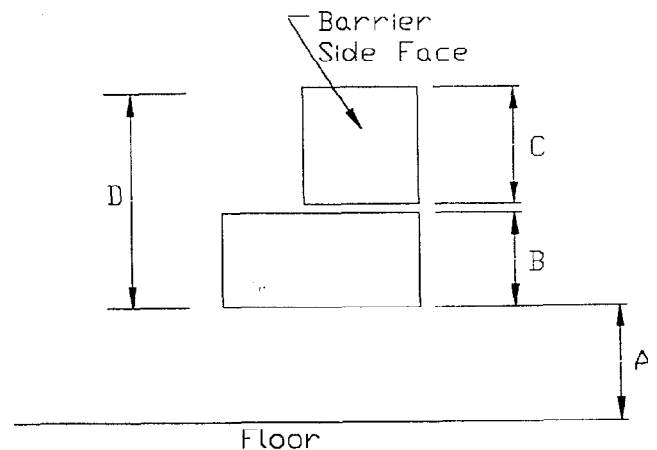
INSTRUMENTATION:

Number of MDB Data Channels = 11

BARRIER FACE MEASUREMENTS POSITIONED AGAINST VEHICLE

Dimensions in (mm)

	Right	Left
(A)	301	300
(B)	242	243
(C)	242	242
(D)	500	500



DATA SHEET NO. 4
POST-TEST OBSERVATIONS

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

VISIBLE DUMMY CONTACT POINTS:

	<u>LEFT FRONT EUROSID-1</u>	<u>LEFT REAR EUROSID-1</u>
Head	<u>None</u>	<u>to C Pillar & Header</u>
Arm	<u>to Door trim</u>	<u>to Door trim</u>
Upper rib	<u>None</u>	<u>to Door trim</u>
Mid Rib	<u>to Door trim</u>	<u>to Door trim</u>
Lower Rib	<u>to Door trim</u>	<u>to Door trim</u>
Abdomen	<u>to Door armrest</u>	<u>to Door trim</u>
Pelvis	<u>to Door trim</u>	<u>To Door trim</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: 5 mm forward Vertical: 15 mm low

ARM REST LOCATIONS:

Front: 235 mm from bottom of window

Rear: 245 mm from bottom of window

POST-TEST OBSERVATIONS (Cont'd)

SEAT CRUSH:

Front Seat Back: 14 mm Front Seat Cushion: 143 mm

Left Rear Seat Back: 90 mm Rear Seat Cushion: 47 mm

GLAZING DAMAGE:

Impact side door glass shattered, windshield cracked

PILLAR PERFORMANCE:

No failure noted

SILL SEPARATION:

No separation noted

OTHER NOTABLE IMPACT EFFECTS:

Airbags did not deploy

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 5
LATERAL IMPACT DUMMY (EUROSID) INSTRUMENTATION DATA

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

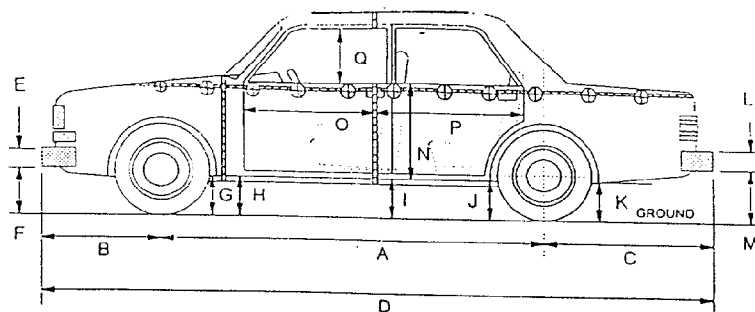
FIR FILTERED

	Front EuroSID-1 ID #E1-169			Rear EuroSID-1 ID #E1-213		
	Pos. Direct.		Neg. Direct	Pos. Direct.		Neg. Direct
	Max (g)	Time (msec)	Max (g)	Max (g)	Time (msec)	Max (g)
RIB ACCELERATIONS						
Left Upper Rib (LUR) Y	107.7	34	36.1	31.1	69	2.6
Left Middle Rib (LMR) Y	132.9	34	-49.4	28.1	69	2.4
Left Lower Rib (LLR) Y	160.3	34	54.1	23.9	73	2.6
SPINE ACCELERATIONS						
Lower Lateral Y	98.5	39	10.2	23.6	72	3.0
PELVIS ACCELERATIONS						
Lateral Y	78.9	36	32.1	37.7	52	2.3
						84

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

EuroSID-1 Manufacture Dates: E1-169 - 4/19/96
E1-213 - 5/12/96

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

E & L = Bumper Thickness

J1 = To Pinch Weld

J2 = To Sill

ALL MEASUREMENTS IN (mm)

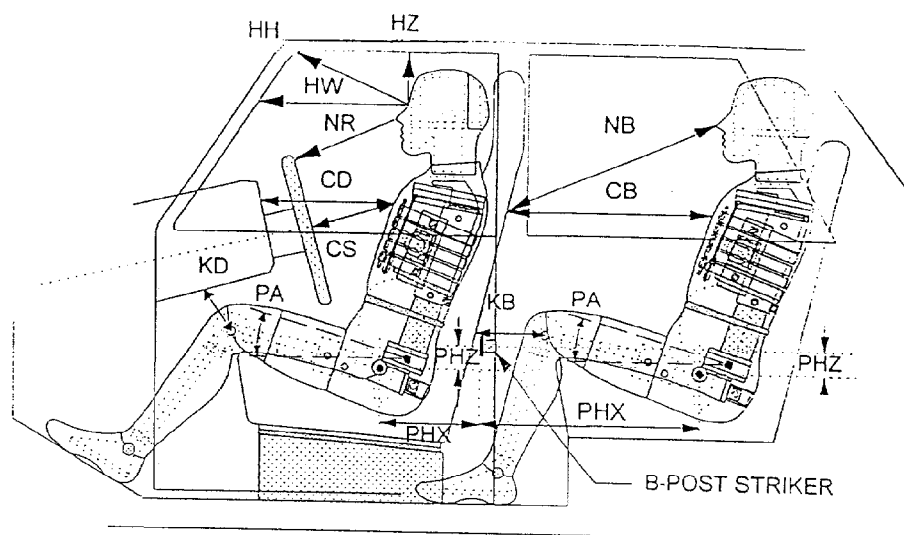
	PRE-TEST	POST-TEST	Δ CHANGE
A	2700	2608	92
B	936	875	61
C	1036	987	49
D	4672	4470	202
E	114	114	0
F	385	422	37
G	180	179	1
H	175	171	4
I	170	190	20
J1/J2	177/176	190/188	13/12
K	222	206	16
L	205	205	0
M	372	360	12
N	620	570	50
O	720	693	27
P	1189	1156	33
Q	418	387	31
R	4390	4400	10
S	4390	4297	93
T	1732	1503	229

DATA SHEET NO. 7

SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



NOTE: All dimensions are in mm with tolerance of ± 3 mm

	FRONT EuroSID-1 ID # E1-169
HH	368
HW	558
HZ	155
NR	507
CD	592
CS	394
KDL (KDA°)	158 (28.2°)
KDR (KDA°)	187 (16.9°)
PA°	N/A
PHX	275
PHZ	131

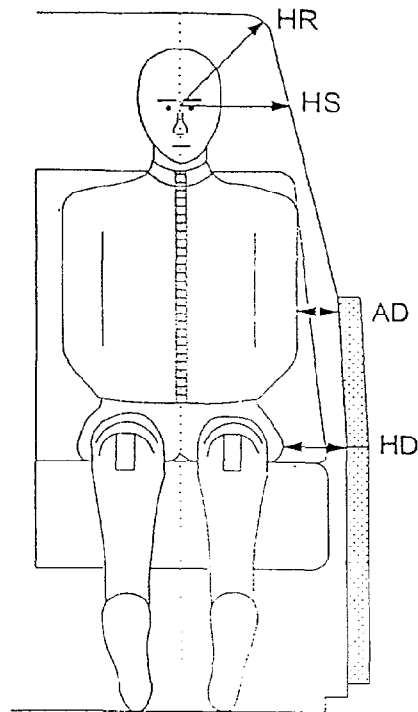
	REAR EuroSID-1 ID #E1-213
HZ	126
NB	622
CB	535
KBL (KBA)	229 (0.0°)
KBR (KBA)	227 (0.0°)
PA°	N/A
PHX	664
PHZ	116

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

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

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



NOTE: All dimensions are in mm

	FRONT EuroSID-1 ID #E1-169	REAR EuroSID-1 ID #E1-213
HR	203	183
HS	322	225
AD	124	133
HD	171	198
KK	255	282

DATA SHEET NO. 9
DUMMY POSITIONING - DRIVER

Driver H-Point

HP to Floor Z = 152
 HP to Hinge X = 734
 HP to Sill Y = 194
 *HP to Striker X = 254
 *HP to Striker Z = 399
 HP to Dash X = 567
 HP to Header Z = 755

Driver Dummy Position

HP to Floor Z = 160
 HP to Hinge X = 712
 HP to Sill Y = 198
 *HP to Striker X = 275
 *HP to Striker Z = 408
 HP to Dash X = 545
 HP to Header Z = 745

H-Point Machine

Left Knee = 134°
 Right Knee = 134°
 Left Foot = 114°
 Right Foot = 122°
 Left Leg = 97°
 Right Leg = 135°
 Hip Angle = 106°
 Back Angle = 28°

* Trammel measurements from front door striker

DATA SHEET NO. 9 (Cont'd)
DUMMY POSITIONING - LEFT REAR PASSENGER

Left Rear Passenger H-Point

HP to Floor Z = N/A
 HP to Hinge X = 734
 HP to Sill Y = 230
 *HP to Striker X = 685
 *HP to Striker Z = 416
 HP to Dash X = 640
 HP to Header Z = 787

Left Rear Passenger Position

HP to Floor Z = N/A
 HP to Hinge X = 718
 HP to Sill Y = 247
 HP to Striker X = 664
 HP to Striker Z = 423
 HP to Dash X = 625
 HP to Header Z = 770

H-Point Machine

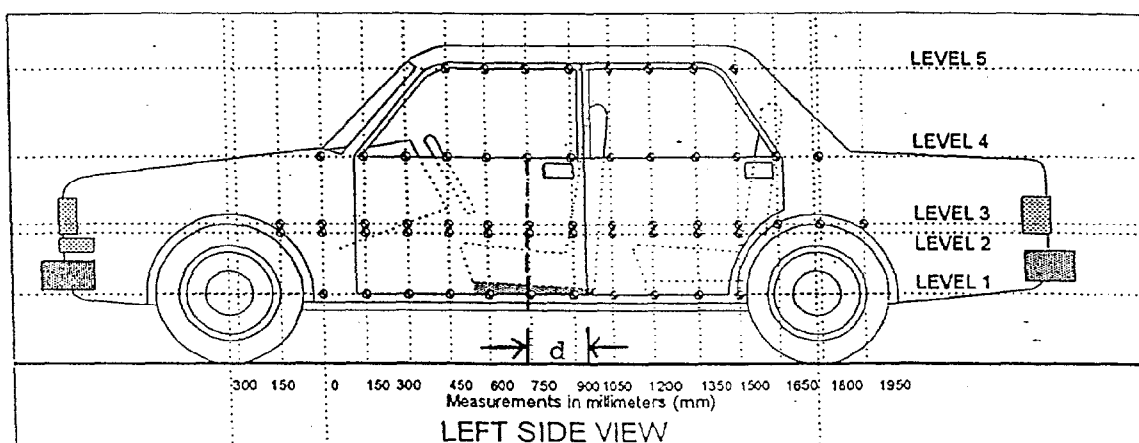
Left Knee = 129°
 Right Knee = 129°
 Left Foot = 142°
 Right Foot = 142°
 Left Leg = 134°
 Right Leg = 130°
 Hip Angle = 104°
 Back Angle = 25°

* Trammel measurements from front door striker

DATA SHEET NO. 10
VEHICLE SIDE MEASUREMENTS

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



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

Lateral Impact Line | = 1396 mm rearward of
 front wheel centerline
 d = 127 mm forward of door striker

MEASUREMENTS ARE TAKEN WHEN THE VEHICLE IS IN THE "AS TESTED"
 CONFIGURATION
 MEASUREMENTS ALONG THE VERTICAL IMPACT LINE

Level 1 @ Axle Centerline Height
 (or Sill Top Height) = 258 mm
 Level 2 @ Occupant H-Point = 470 mm
 Level 3 @ Mid Door = 570 mm
 Level 4 @ Window Sill = 865 mm
 Level 5 @ Window Top = 1325 mm

Vehicle Pitch Angle: 0.1° nose up (measured at the left side sill)

Vehicle Roll Angle: 0.1° left side down (measured at the center of hood)

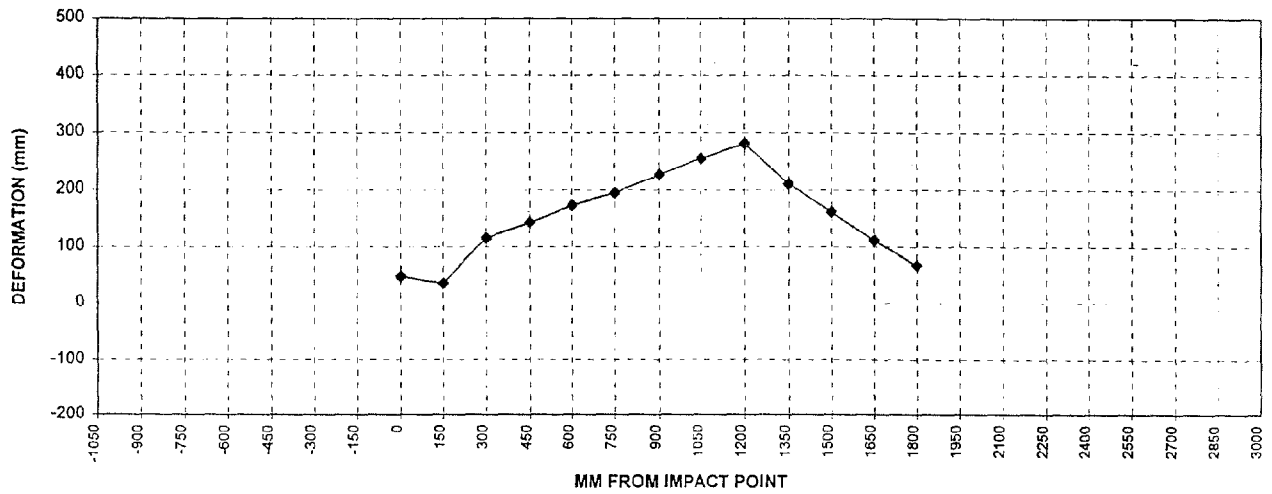
"Zero point" is 410 mm rearward of front wheel centerline

DATA SHEET NO. 11
VEHICLE EXTERIOR CRUSH PROFILES

	Level 1 - Axle Centerline		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)	557	604	47
150	563	598	35
300	565	681	116
450	567	710	143
600	569	742	173
750	573	768	195
900	573	800	227
1050	573	828	255
1200	573	854	281
1350	574	785	211
1500	573	735	162
1650	573	685	112
1800	573	640	67
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)



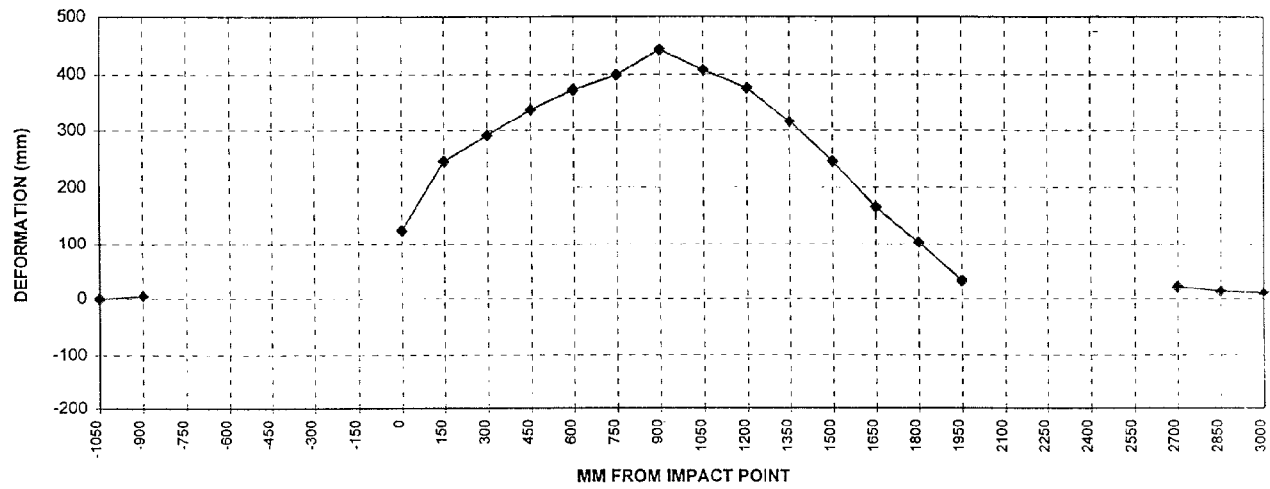
LEVEL 1 - AXLE CENTERLINE

DATA SHEET NO. 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 2 - Occupant H Point		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050	585	585	0
-900	554	559	5
-750			
-600			
-450			
-300			
-150			
0 (impact point)	518	643	125
150	519	765	246
300	517	808	291
450	517	856	339
600	515	888	373
750	516	915	399
900	515	958	443
1050	515	923	408
1200	518	894	376
1350	515	832	317
1500	516	762	246
1650	518	684	166
1800	519	622	103
1950	530	562	32
2100			
2250			
2400			
2550			
2700	545	566	21
2850	564	577	13
3000	589	599	10

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

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



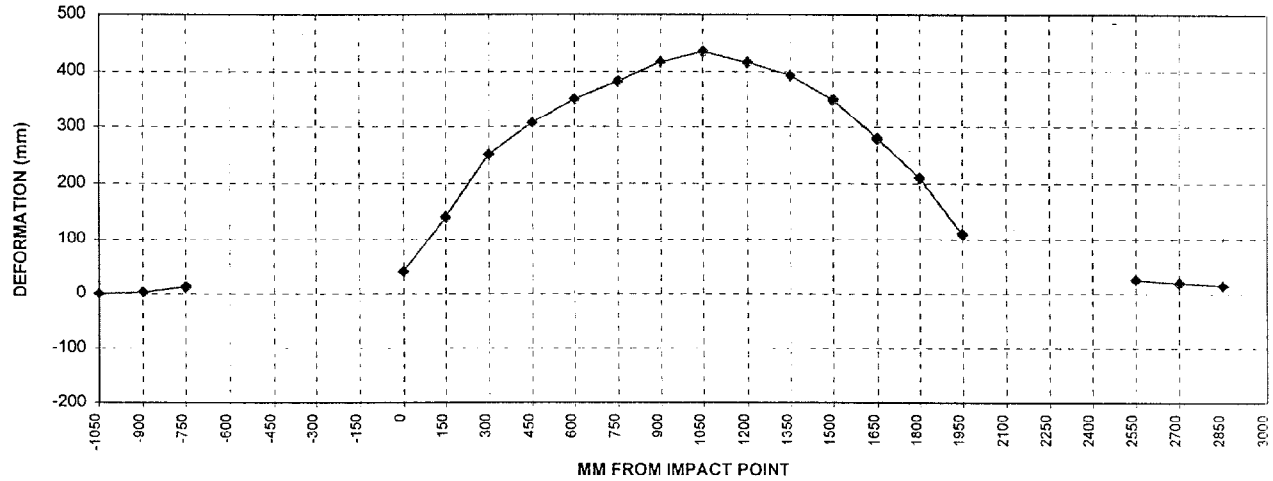
LEVEL 2 - OCCUPANT H-POINT

DATA SHEET NO. 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 3 - Mid Door		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050	604	604	0
-900	570	573	3
-750	537	550	13
-600			
-450			
-300			
-150			
0 (impact point)	534	575	41
150	534	674	140
300	533	785	252
450	532	840	308
600	530	881	351
750	530	912	382
900	530	947	417
1050	530	965	435
1200	530	946	416
1350	529	922	393
1500	530	880	350
1650	532	812	280
1800	532	742	210
1950	530	640	110
2100			
2250			
2400			
2550	534	560	26
2700	561	581	20
2850	585	600	15
3000			

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

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



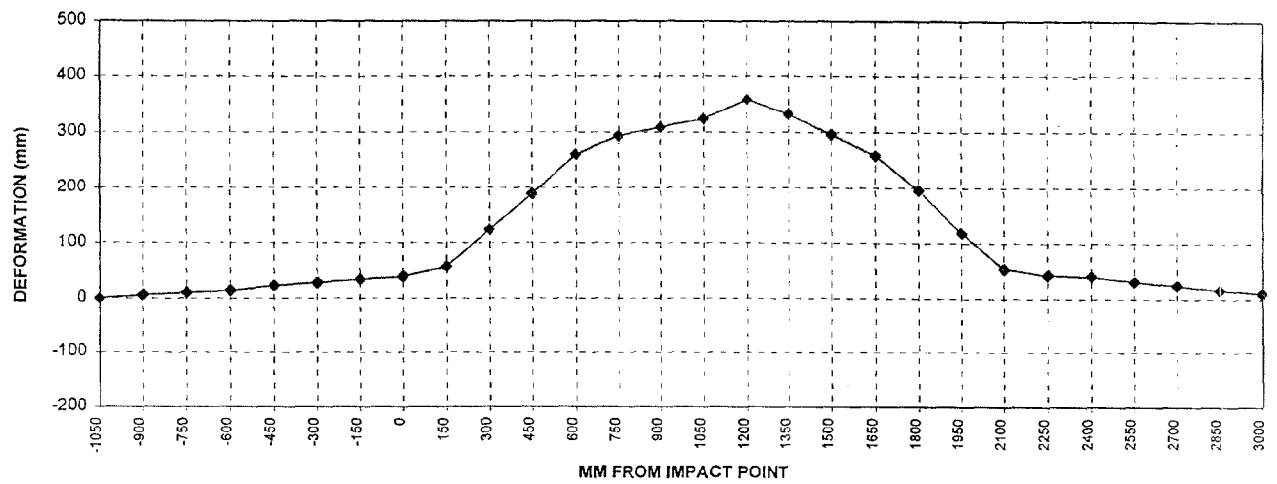
LEVEL 3 - MID DOOR

DATA SHEET NO. 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 4 - Window Sill		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050	674	674	0
-900	647	653	6
-750	622	632	10
-600	606	620	14
-450	593	616	23
-300	586	614	28
-150	578	612	34
0 (impact point)	575	614	39
150	570	627	57
300	568	692	124
450	567	755	188
600	567	828	261
750	566	860	294
900	567	877	310
1050	569	894	325
1200	572	930	358
1350	575	908	333
1500	578	875	297
1650	581	840	259
1800	585	780	195
1950	587	706	119
2100	591	645	54
2250	599	642	43
2400	608	649	41
2550	620	651	31
2700	635	659	24
2850	652	668	16
3000	678	688	10

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

VEHICLE EXTERIOR STATIC CRUSH (Cont'd)



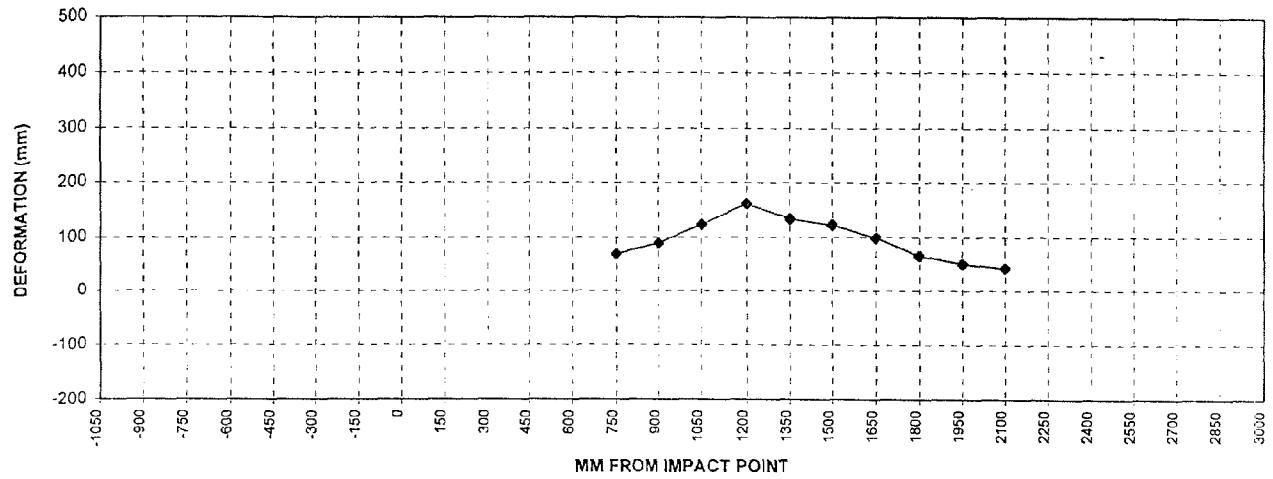
LEVEL 4 - WINDOW SILL

DATA SHEET NO. 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 5 - Window Top		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)			
150			
300			
450			
600			
750	811	880	69
900	811	900	89
1050	815	939	124
1200	815	976	161
1350	818	952	134
1500	821	944	123
1650	823	922	99
1800	826	892	66
1950	835	886	51
2100	856	899	43
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)



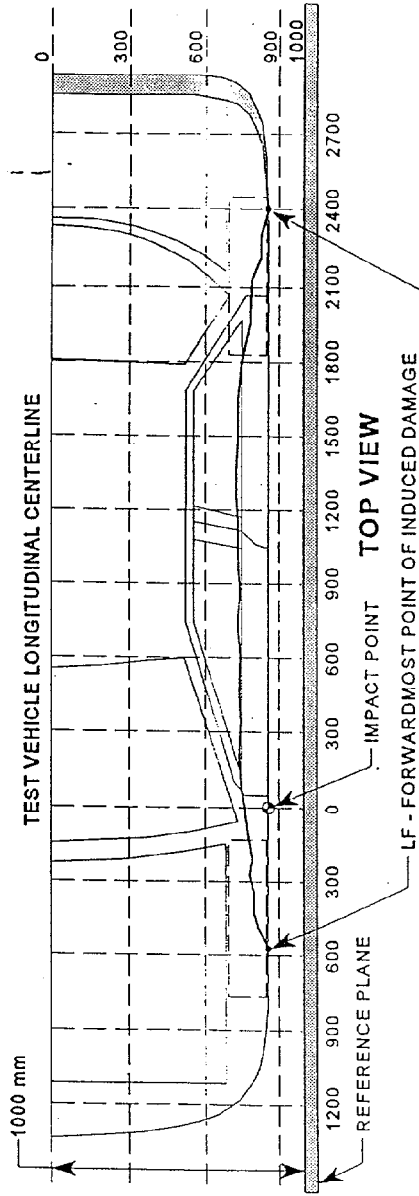
LEVEL 5 - WINDOW TOP

DATA SHEET NO. 12
VEHICLE DAMAGE PROFILE DISTANCES

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

NOTE: All measurements are in millimeters (mm) and should be accurate to ± 3 mm.



MEASUREMENT CONVENTIONS: LR - REARWARDMOST POINT OF INDUCED DAMAGE
 Forward of the impact point (towards front of vehicle) is considered negative (-).
 Rearward of the impact point (towards rear of vehicle) is considered positive (+).

Maximum Crush Level: 575 mm Location: 900 mm Depth: 450 mm

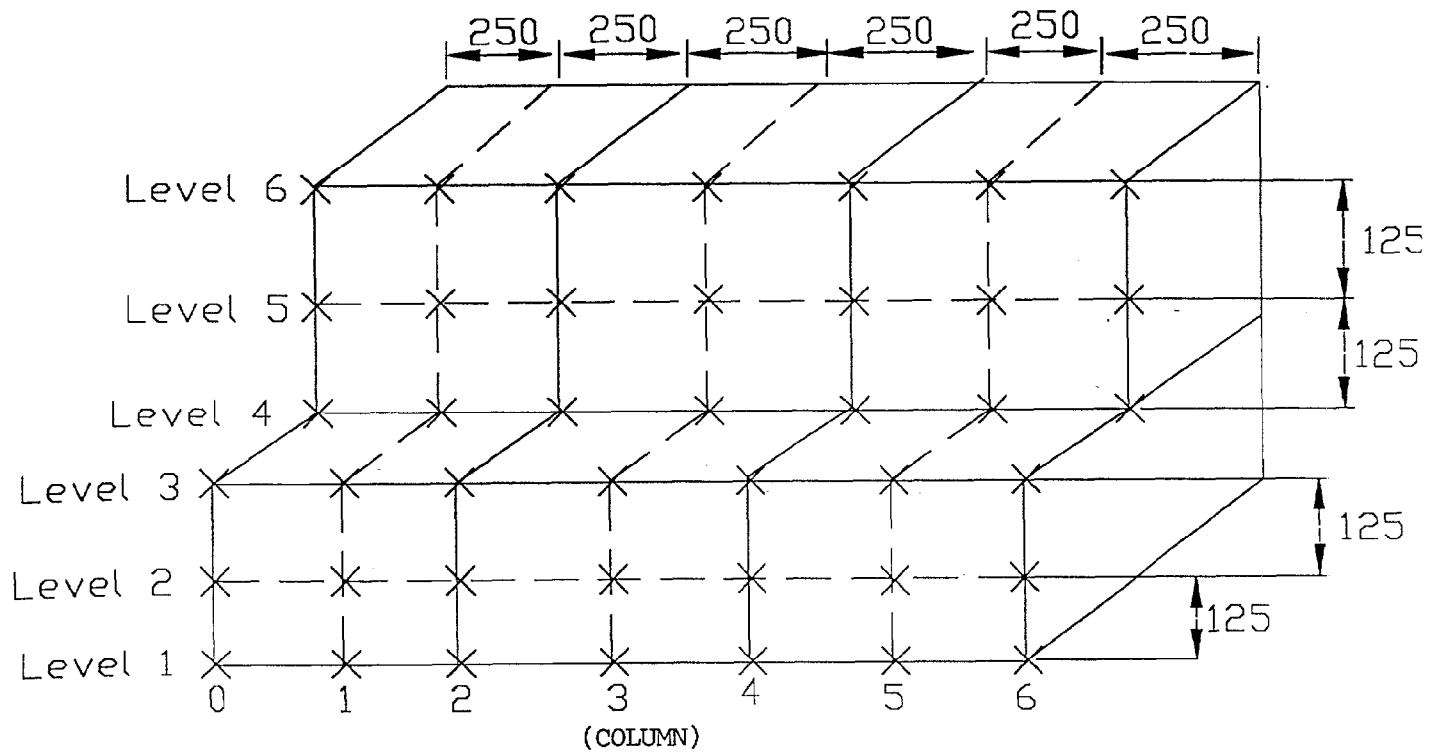
LEVEL	DPD MEASUREMENTS	STATIC CRUSH (mm)
575	1. (LF = 120 mm)	0.0
575	2. 480 mm	274
575	3. 840 mm	367
575	4. 1200 mm	375
575	5. 1560 mm	263
575	6. (LR = 1920 mm)	0.0

DATA SHEET NO. 13

EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



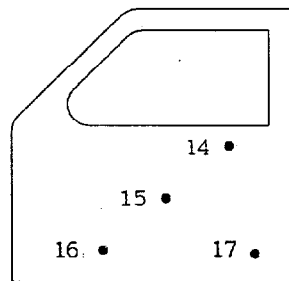
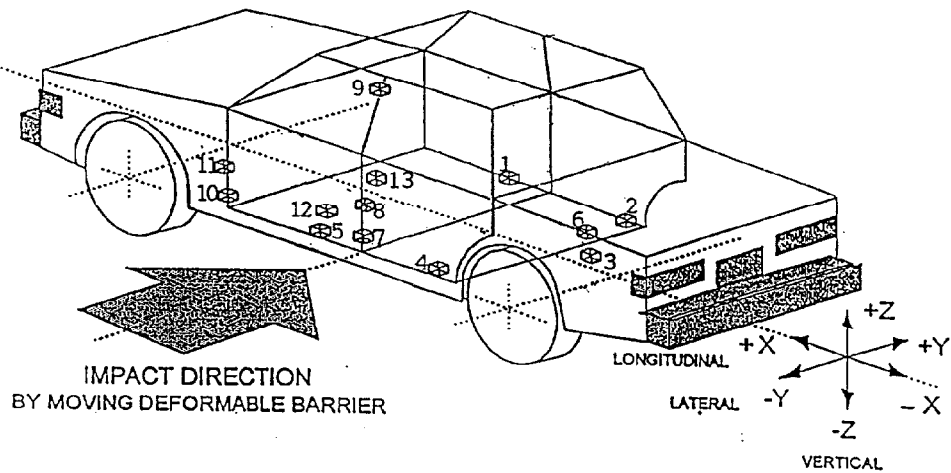
Post-Test Static Deformation (mm)

LEVEL	COLUMN						
	0	1	2	3	4	5	6
6	185	122	117	112	162	209	350
5	202	103	96	78	115	179	315
4	212	106	65	42	81	159	268
3	270	168	103	78	128	213	327
2	316	198	123	93	123	198	324
1	369	277	162	177	194	239	360

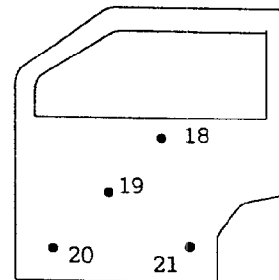
DATA SHEET 14
TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



Front



Rear

- | | | |
|----------------------------------|---------------------------------|--------------------------------|
| 1 - Right Side Sill @ Front Seat | 10 - Left Lower A Post | 18 - Left Rear Door Upper |
| 2 - Right Side Sill @ Rear Seat | 11 - Left Mid A Post | 19 - Left Rear Door Mid |
| 3 - Rear Floorpan Above Axle | 12 - Driver Seat Track | 20 - Left Rear Door Lower |
| 4 - Left Side Sill @ Rear Seat | 13 - Vehicle C.G. | 21 - Left Rear Door Rear Lower |
| 5 - Left Side Sill @ Front Seat | 14 - Left Front Door Upper | |
| 6 - Right Rear Occ. Compartment | 15 - Left Front Door Mid | |
| 7 - Left Lower B Post | 16 - Left Front Door Lower | |
| 8 - Left Mid B Post | 17 - Left Front Door Rear Lower | |
| 9 - Left Upper B Post | | |

DATA SHEET NO. 14

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

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	2956	714	212	5.1	1.1	11.5	2.4	3.8	2.4	11.5
2	Right Side Sill @ Rear Seat	1602	702	229	3.6	2.2	15.2	2.1	4.3	5.6	15.7
3	Rr. Floorpan Above Axle	1150	0	467	5.1	3.8	13.1	2.0	4.0	2.6	13.2
4	Left Side Sill @ Rr. Seat	1574	-708	231	---	---	18.6	1.9	---	---	---
5	Left Side Sill @ Frt. Seat	2961	-726	214	---	---	18.0	2.5	---	---	---
6	Right Rear Occupant Compartment	1831	297	321			16.0	1.7			
7	Left Lower B Post	2105	-704	314	---	---	93.6	115.5	---	---	---
8	Left Mid B Post	2083	-736	823	---	---	85.7	24.2	---	---	---
9	Left Upper B Post	2057	-542	1329	---	---	38.2	23.7	---	---	---
10	Left Lower A Post	3094	-742	373	---	---	41.7	7.5	---	---	---
11	Left Mid A Post	3161	-812	856	---	---	16.4	4.4	---	---	---
12	Driver Left Seat Track	2325	-621	345	---	---	78.4	52.5	---	---	---
13	Vehicle CG	2541	0	315	1.0	5.3	14.5	1.3	10.6	4.1	14.8
14	Left Front Door Upper	2311	-777	865	---	---	104.3	77.4	---	---	---
15	Left Front Door Mid ^o	2432	-778	632	---	---	140.9	124.8	---	---	---
16	Left Front Door Lower ^o	2522	-780	423	---	---	180.0	65.0	---	---	---
17	Left Front Door Rear Lower	2362	-781	491	---	---	95.1	66.2	---	---	---
18	Left Rear Door Upper	1373	-756	903	---	---	57.2	26.4	---	---	---
19	Left Rear Door Mid	1537	-758	652	---	---	48.4	21.8	---	---	---
20	Left Rear Door Lower	1745	-761	438	---	---	100.7	124.9	---	---	---
21	Left Rear Door Rear Lower	1608	-762	449	---	---	61.2	41.3	---	---	---

*Reference: X - Rear Bumper (+ Forward) ^o Wire cut at 30 msec. ^o Wire cut at 15 msec.

Y - Vehicle Centerline (+ To right)

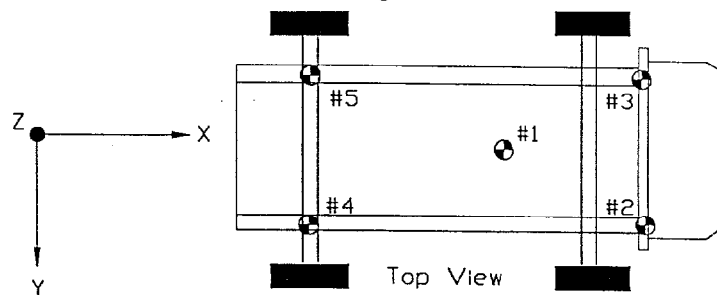
group vel (

DATA SHEET NO. 15

MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS AND DATA SUMMARY

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997



Accelerometer No.	Description	Coordinates (mm)*			(+) Positive		(-) Negative	
		X	Y	Z	Max. (g)	Time (msec)	Max. (g)	Time (msec)
1	MDB Center of Gravity	2220	0	462				
	Longitudinal (X)	---	---	---	4	161	16.5	40
	Lateral (Y)	---	---	---	4.0	49	1.7	20
	Vertical (Z)	---	---	---	4.3	73	5.3	18
	Resultant (R)	---	---	---	16.7	40	---	---
2	Right Rear Frame Member	215	595	670				
	Right Longitudinal (X)	---	---	---	0.8	165	18.0	41
	Right Lateral (Y)	---	---	---	3.7	90	1.6	187
3	Left Rear Frame Member	230	-525	670				
	Left Longitudinal (X)	---	---	---	0.8	172	16.5	39
	Left Lateral (Y)	---	---	---	3.2	94	2.1	50
4	Right Front Face	3650	765	770				
	Right Face (X)	---	---	---	1.0	164	19.4	44
	Right Face (Y)	---	---	---	2.4	66	1.5	168
5	Left Front Face	3655	-780	770				
	Left Face (X)	---	---	---	1.2	137	17.9	43
	Left Face (Y)	---	---	---	1.8	66	3.0	34

*Reference: X - Rear of Cart (+ Forward)
Y - Vehicle Centerline (+ To right)
Z - Ground Level (+ Up)

DATA SHEET NO. 16
HIGH SPEED CAMERA LOCATIONS AND DATA

Year/Make/Model/Body Style: 1997/Hyundai/Sonata/4 Door

Test Date: August 21, 1997

View	Coordinates (mm)*			Angle	Lens (mm)	Film Speed (fps)
	X	Y	Z			
Real Time					13	
Left Overall	-130	-5900	1570	90°	13	881
Left Impact Oblique	-3800	-8220	1110		25	1005
Onboard Hood					13	858
Onboard Hood Angle					13	738
Onboard Rear					13	893
Right Overall	-100	7700	1550	90°	13	926
Right Impact Oblique	-4820	8300	1140		25	1020
Top Overall	-470	0	5000		8	NR
Top Impact	0	0	4950		13	1099
Cart					13	985

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

NR = Not recorded

APPENDIX A - PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

	<u>Page No.</u>
Photo No. A-1 - Pre-Test Front View of Test Vehicle	A-1
Photo No. A-2 - Post-Test Front View of Test Vehicle	A-1
Photo No. A-3 - Pre-Test Rear View of Test Vehicle	A-2
Photo No. A-4 - Post-Test Rear View of Test Vehicle	A-2
Photo No. A-5 - Pre-Test Left Side View of Test Vehicle	A-3
Photo No. A-6 - Post-Test Left Side View of Test Vehicle	A-3
Photo No. A-7 - Pre-Test MDB Positioned Against Vehicle (left side)	A-4
Photo No. A-8 - Pre-Test MDB Positioned Against Vehicle (right side)	A-4
Photo No. A-9 - Pre-Test MDB Position Against Vehicle Overhead View	A-5
Photo No. A-10 - Post-Test MDB Positioned Against Vehicle (left side)	A-6
Photo No. A-11 - Post-Test MDB Positioned Against Vehicle (right side)	A-6
Photo No. A-12 - Post-Test Vehicle Overhead View	A-7
Photo No. A-13 - Pre-Test MDB Top View	A-8
Photo No. A-14 - Post-Test MDB Top View	A-8
Photo No. A-15 - Pre-Test MDB Front View	A-9
Photo No. A-16 - Post-Test MDB Front View	A-9
Photo No. A-17 - Pre-Test MDB Left Side View	A-10
Photo No. A-18 - Post-Test MDB Left Side View	A-10
Photo No. A-19 - Pre-Test MDB Right Side View	A-11
Photo No. A-20 - Post-Test MDB Right Side View	A-11
Photo No. A-21 - Pre-Test Driver Dummy Right Side View	A-12
Photo No. A-22 - Post-Test Driver Dummy Right Side View	A-12
Photo No. A-23 - Pre-Test Driver Dummy Left Side View	A-13
Photo No. A-24 - Post-Test Driver Dummy Left Side View	A-13
Photo No. A-25 - Pre-Test Driver Dummy Left Side View (Door Open)	A-14
Photo No. A-26 - Pre-Test Driver Shoulder and Door Top View	A-15
Photo No. A-27 - Post-Test Driver Shoulder and Door Top View	A-15
Photo No. A-28 - Post-Test Driver Dummy Contact	A-16

TABLE OF PHOTOGRAPHS

	<u>Page No.</u>
Photo No. A-29 - Pre-Test Left Rear Passenger Dummy Right Side View	A-17
Photo No. A-30 - Post-Test Left Rear Passenger Dummy Right Side View	A-17
Photo No. A-31 - Pre-Test Left Rear Passenger Dummy Left Side View	A-18
Photo No. A-32 - Post-Test Left Rear Passenger Dummy Left Side View	A-18
Photo No. A-33 - Pre-Test Left Rear Passenger Dummy Shoulder View	A-19
Photo No. A-34 - Post-Test Left Rear Passenger Dummy Shoulder View	A-19
Photo No. A-35 - Post-Test Left Rear Passenger Dummy Contact	A-20
Photo No. A-36 - Post-Test Left Rear Passenger Dummy Head Contact	A-20
Photo No. A-37 - Pre-Test Left Front Impact Point on Vehicle	A-21
Photo No. A-38 - Post-Test Left Front Impact Point on Vehicle	A-21
Photo No. A-39 - Impact	A-22
Photo No. A-40 - Left Front Attitude Point	A-23
Photo No. A-41 - Right Front Attitude Point	A-23
Photo No. A-42 - Left Rear Attitude Point	A-24
Photo No. A-43 - Right Rear Attitude Point	A-24
Photo No. A-44 - Vehicle Certification Label	A-25
Photo No. A-45 - Tire Placard	A-25



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

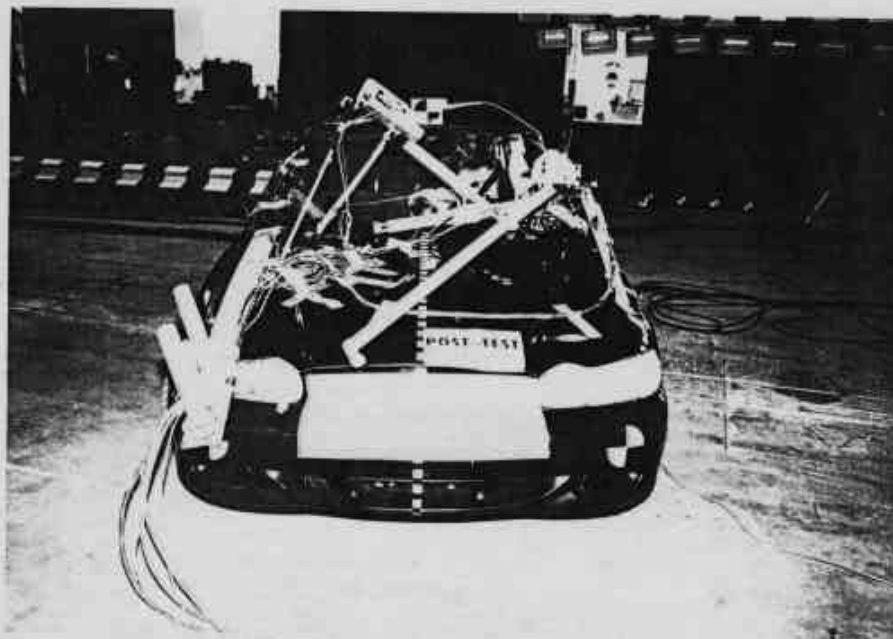


Photo No. A-2 - Post-Test Front View of Test Vehicle



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

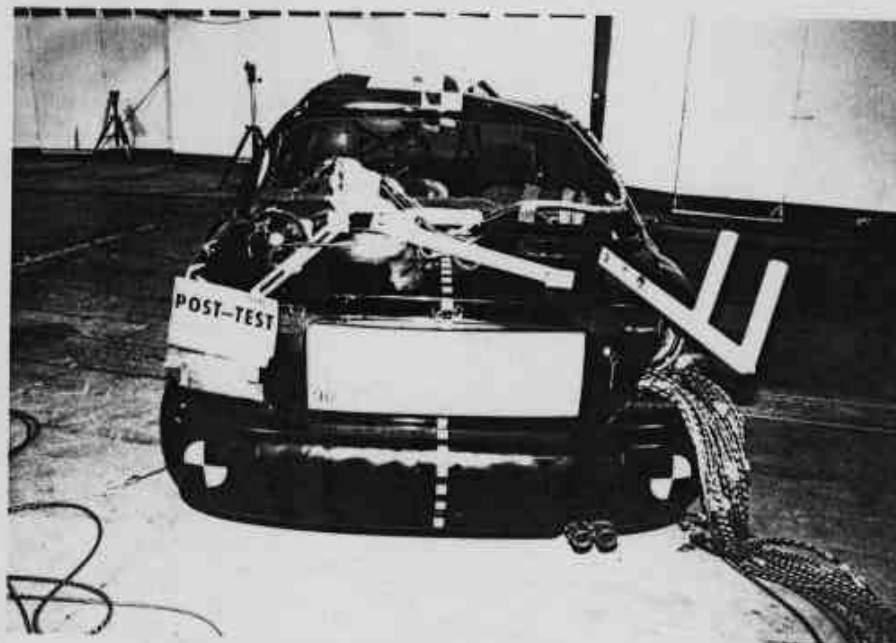


Photo No. A-4 - Post-Test Rear View of Test Vehicle

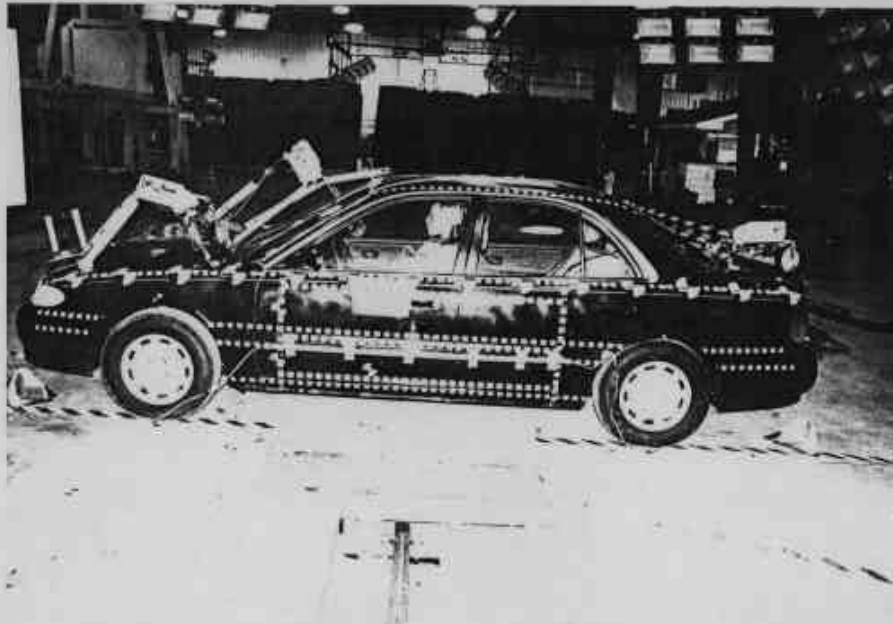


Photo No. A-5 - Pre-Test Left Side View of Test Vehicle



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)

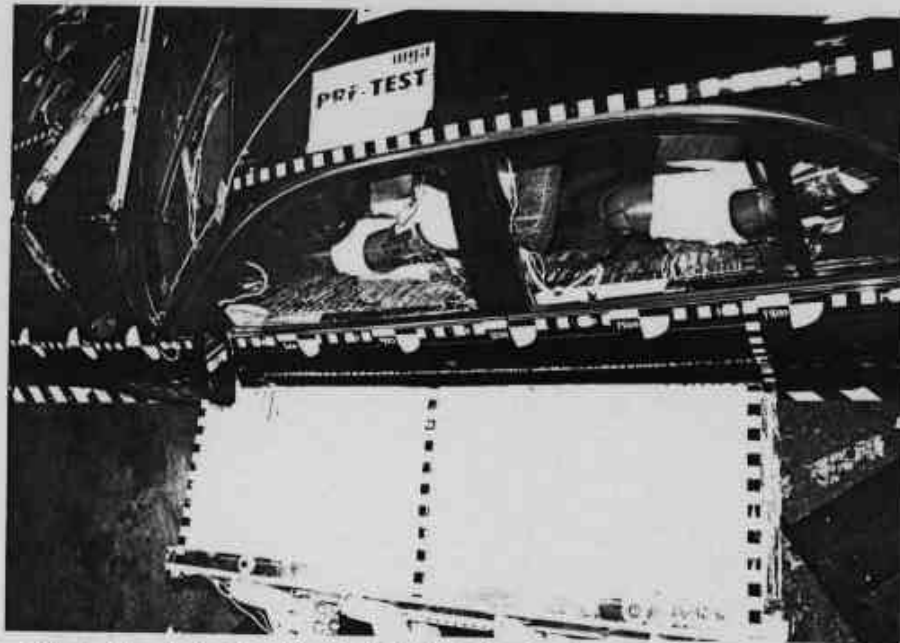


Photo No. A-9 - Pre-Test MDB Position Against Vehicle Overhead View



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

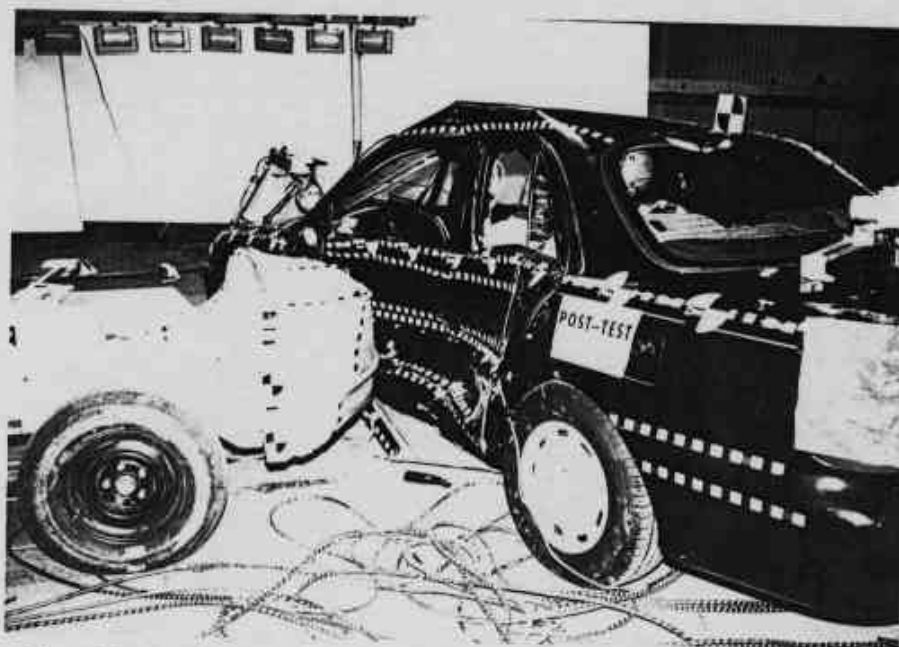


Photo No. A-11 - Post-Test MDB Positioned Against Vehicle (right side)

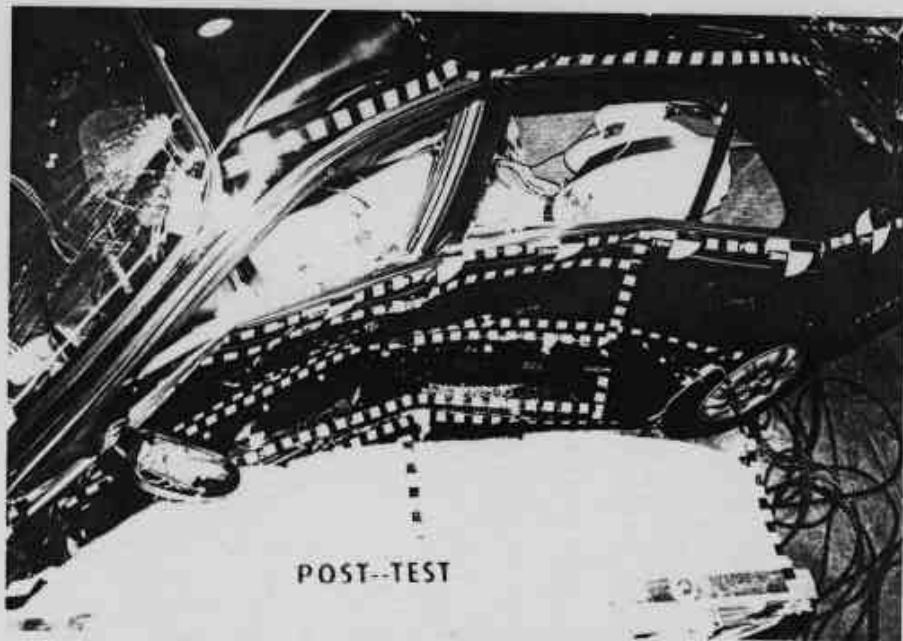


Photo No. A-12 - Post-Test Vehicle Overhead View

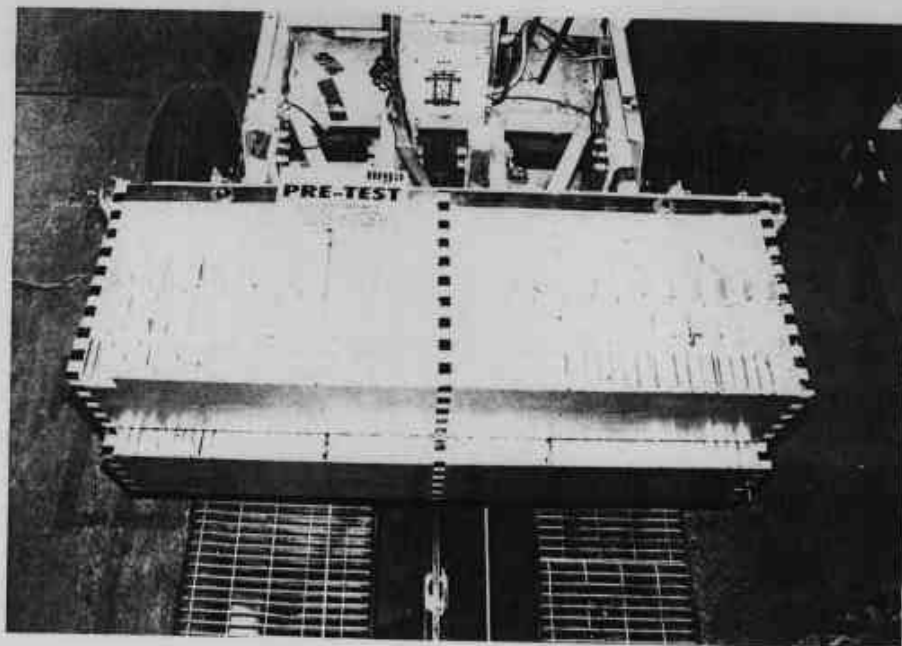


Photo No. A-13 - Pre-Test MDB Top View

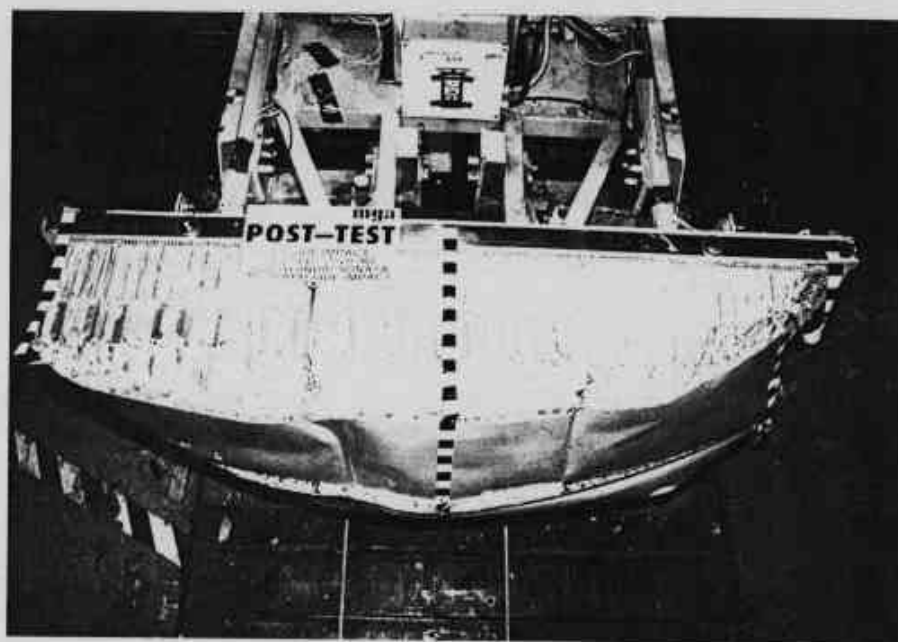


Photo No. A-14 - Post-Test MDB Top View



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

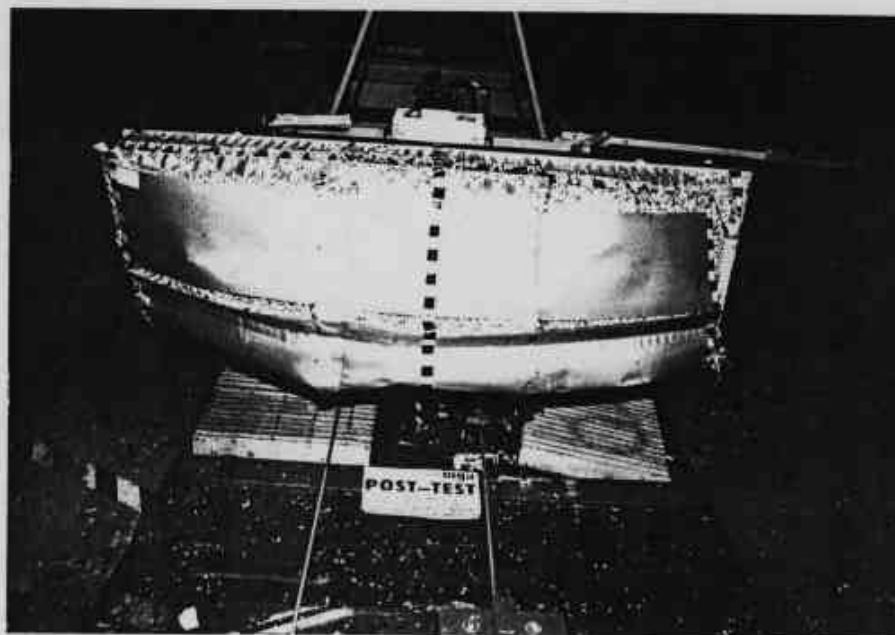


Photo No. A-16 - Post-Test MDB Front View



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

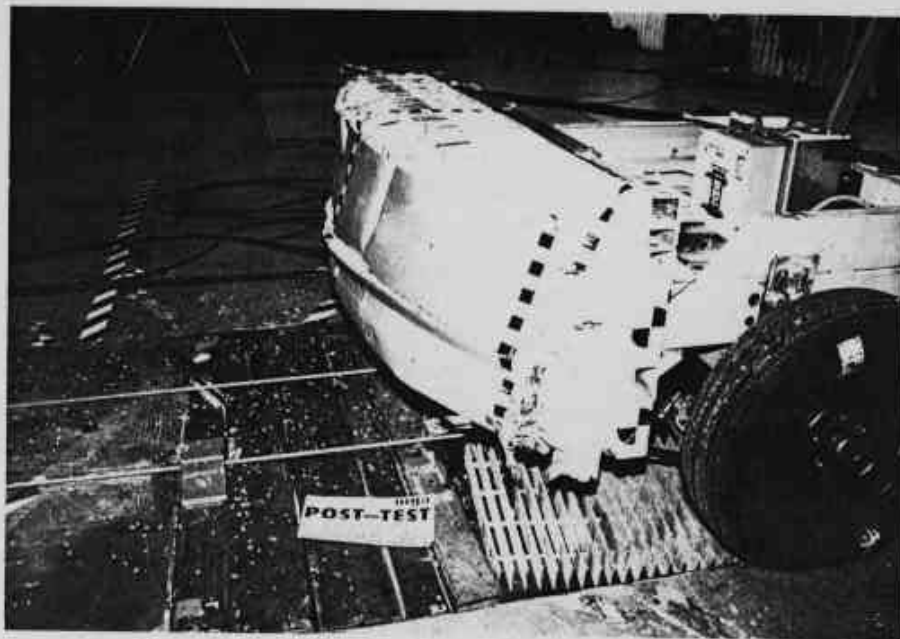


Photo No. A-18 - Post-Test MDB Left Side View

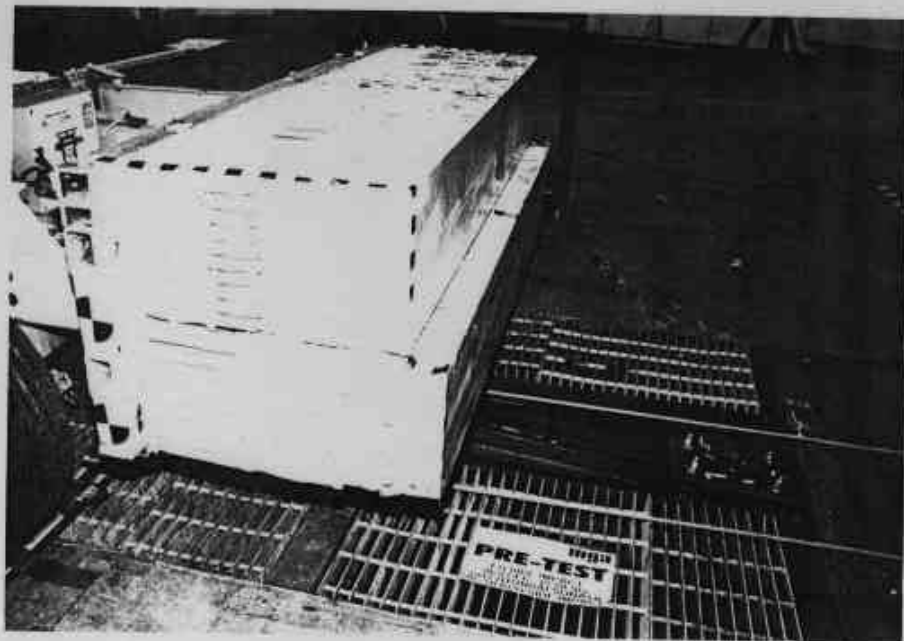


Photo No. A-19 - Pre-Test MDB Right Side View

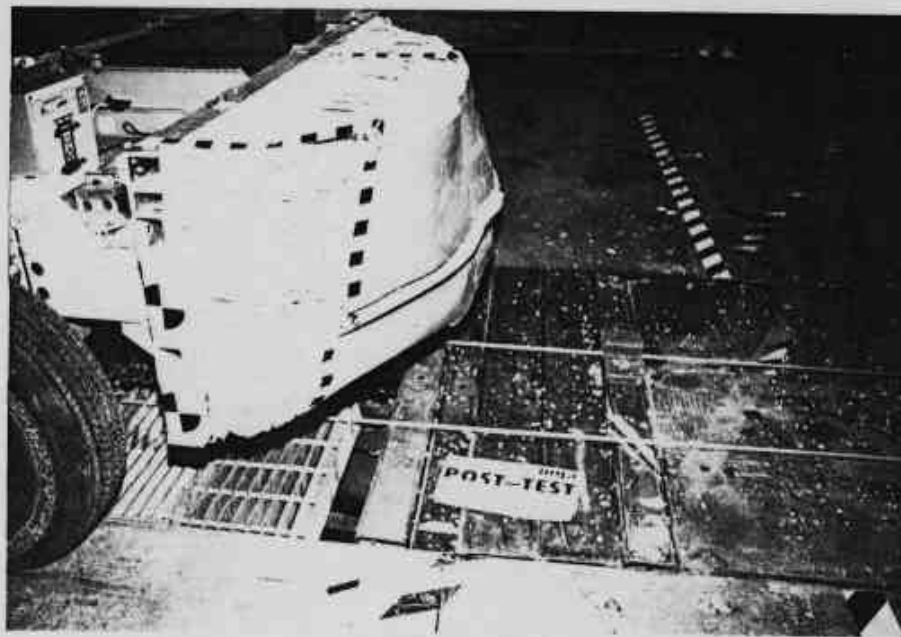


Photo No. A-20 - Post-Test MDB Right Side View



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

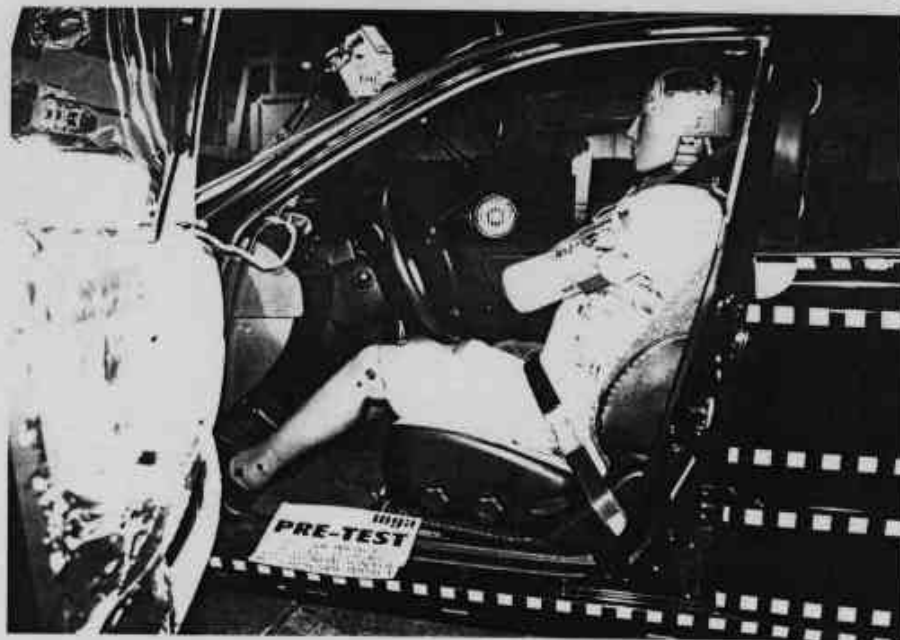


Photo No. A-25 - Pre-Test Driver Dummy Left Side View (Door Open)



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

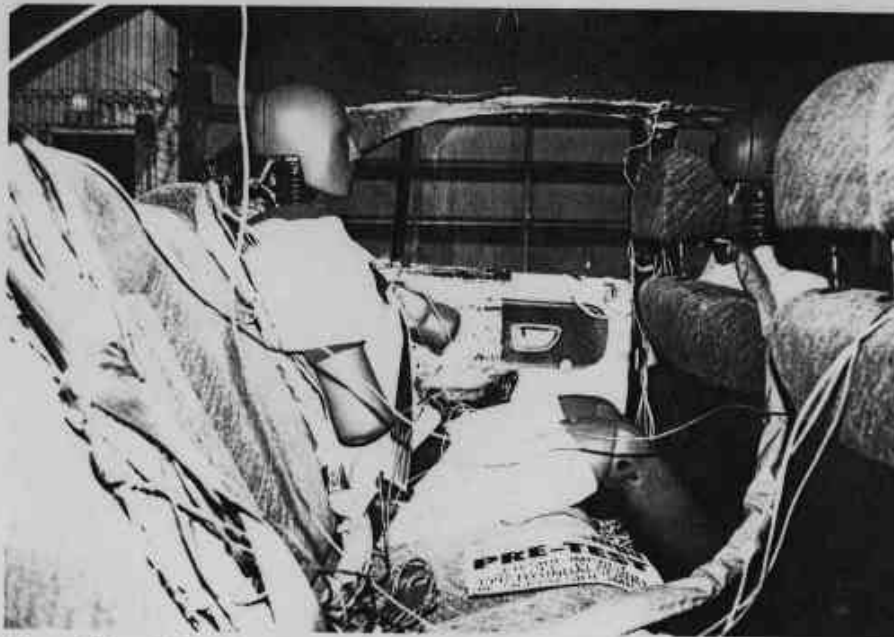


Photo No. A-29 - Pre-Test Left Rear Passenger Dummy Right Side View

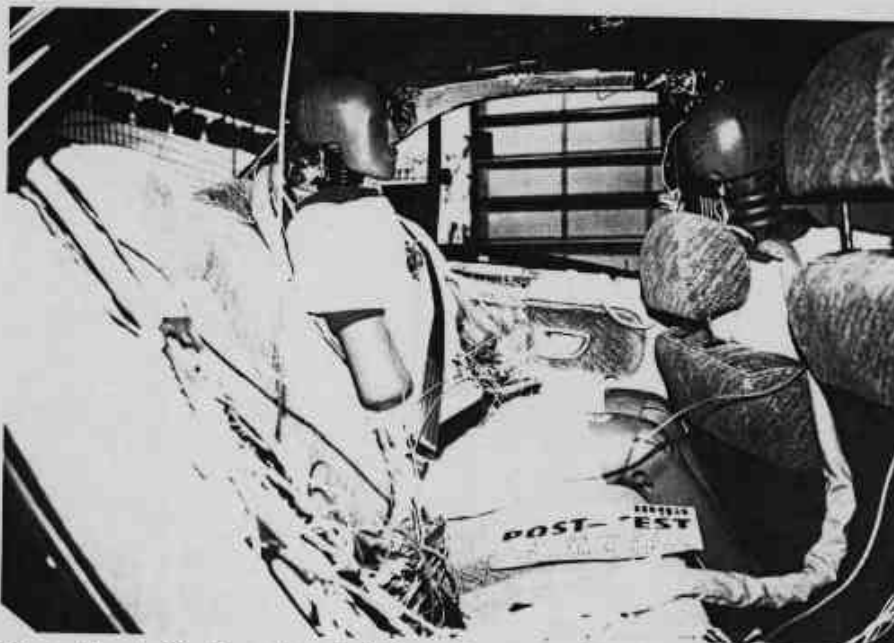


Photo No. A-30 - Post-Test Left Rear Passenger Dummy Right Side View



Photo No. A-31 - Pre-Test Left Rear Passenger Dummy Left Side View



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



Photo No. A-33 - Pre-Test Left Rear Passenger Dummy Shoulder View



Photo No. A-34 - Post-Test Left Rear Passenger Dummy Shoulder View



Photo No. A-35 - Post-Test Left Rear Passenger Dummy Contact



Photo No. A-36 - Post-Test Left Rear Passenger Dummy Head Contact



Photo No. A-37 - Pre-Test Left Front Impact Point on Vehicle

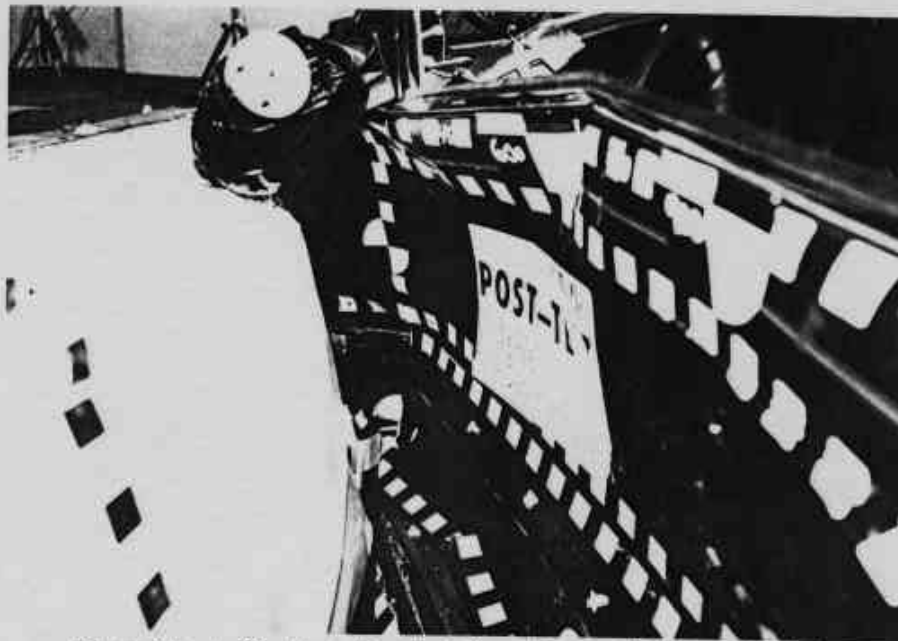


Photo No. A-38 - Post-Test Left Front Impact Point on Vehicle

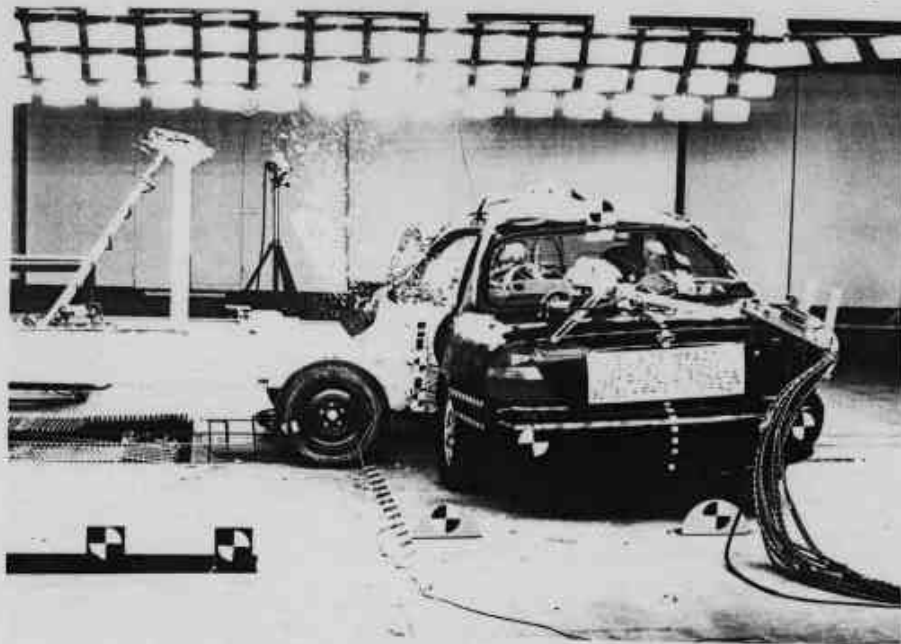


Photo No. A-39 - Impact



Photo No. A-40 - Left Front Attitude Point



Photo No. A-41 - Right Front Attitude Point



Photo No. A-42 - Left Rear Attitude Point



Photo No. A-43 - Right Rear Attitude Point

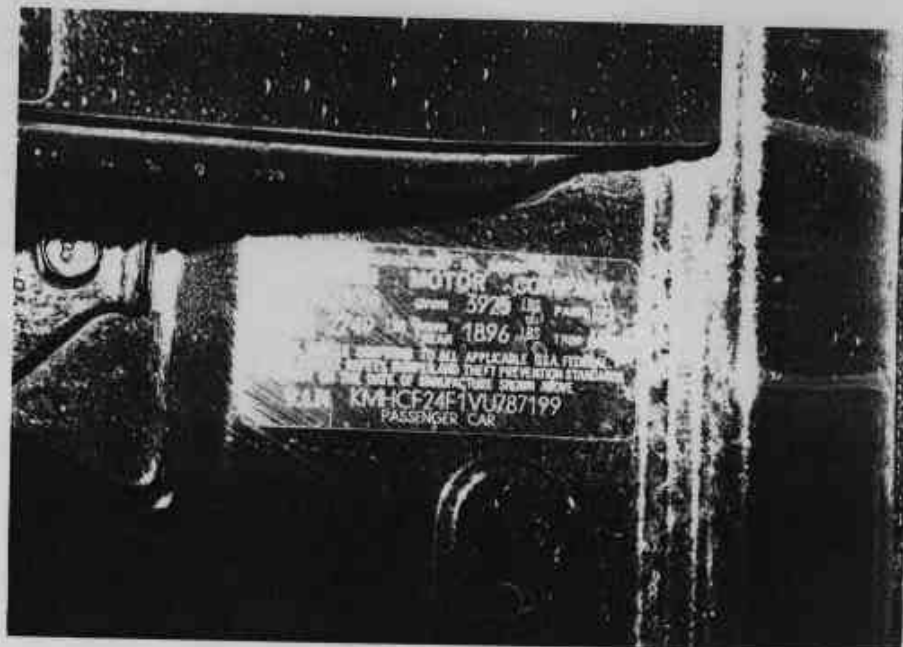


Photo No. A-44 - Vehicle Certification Label

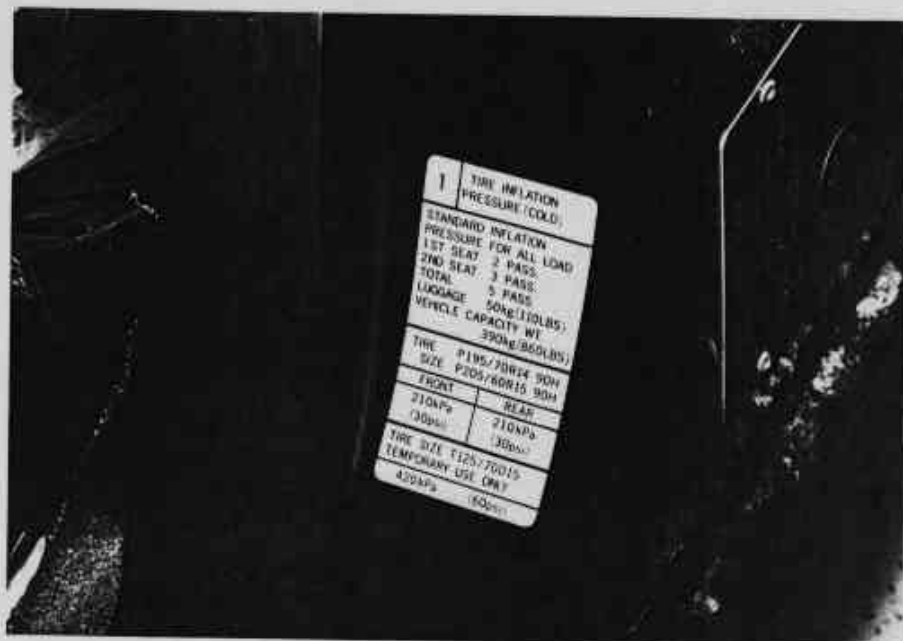


Photo No. A-45 - Tire Placard

APPENDIX B - VEHICLE AND EUROSID-1 RESPONSE DATA

Table of Data Plots

<u>Vehicle:</u>	<u>Page No.</u>
Figure B-1 - Left Lower A-Post Y Acceleration vs. Time	B-1
Figure B-2 - Left Lower A-Post Y Velocity vs. Time	B-2
Figure B-3 - Left Mid A-Post Y Acceleration vs. Time	B-3
Figure B-4 - Left Mid A-Post Y Velocity vs. Time	B-4
Figure B-5 - Left Upper B-Post Y Acceleration vs. Time	B-5
Figure B-6 - Left Upper B-Post Y Velocity vs. Time	B-6
Figure B-7 - Left Upper B-Post Y Displacement vs. Time	B-7
Figure B-8 - Left Lower B-Post Y Acceleration vs. Time	B-8
Figure B-9 - Left Lower B-Post Y Velocity vs. Time	B-9
Figure B-10 - Left Mid B-Post Y Acceleration vs. Time	B-10
Figure B-11 - Left Mid B-Post Y Velocity vs. Time	B-11
Figure B-12 - Left Side Sill at Front Seat Y Acceleration vs. Time	B-12
Figure B-13 - Left Side Sill at Front Seat Y Velocity vs. Time	B-13
Figure B-14 - Left Side Sill at Rear Seat Y Acceleration vs. Time	B-14
Figure B-15 - Left Side Sill at Rear Seat Y Velocity vs. Time	B-15
Figure B-16 - Right Side Sill at Front Seat X Acceleration vs. Time	B-16
Figure B-17 - Right Side Sill at Front Seat X Velocity vs. Time	B-17
Figure B-18 - Right Side Sill at Front Seat Y Acceleration vs. Time	B-18
Figure B-19 - Right Side Sill at Front Seat Y Velocity vs. Time	B-19
Figure B-20 - Right Side Sill at Front Seat Z Acceleration vs. Time	B-20
Figure B-21 - Right Side Sill at Front Seat Z Velocity vs. Time	B-21
Figure B-22 - Right Side Sill at Front Seat Resultant Acceleration vs. Time	B-22
Figure B-23 - Right Side Sill at Rear Seat X Acceleration vs. Time	B-23
Figure B-24 - Right Side Sill at Rear Seat X Velocity vs. Time	B-24
Figure B-25 - Right Side Sill at Rear Seat Y Acceleration vs. Time	B-25
Figure B-26 - Right Side Sill at Rear Seat Y Velocity vs. Time	B-26
Figure B-27 - Right Side Sill at Rear Seat Z Acceleration vs. Time	B-27
Figure B-28 - Right Side Sill at Rear Seat Z Velocity vs. Time	B-28
Figure B-29 - Right Side Sill at Rear Seat Resultant Acceleration vs. Time	B-29
Figure B-30 - Vehicle CG X Acceleration vs. Time	B-30

Table of Data Plots

<u>Vehicle (Cont'd):</u>	<u>Page No.</u>
Figure B-31 - Vehicle CG X Velocity vs. Time	B-31
Figure B-32 - Vehicle CG Y Acccleration vs. Time	B-32
Figure B-33 - Vehicle CG Y Velocity vs. Time	B-33
Figure B-34 - Vehicle CG Z Acceleration vs. Time	B-34
Figure B-35 - Vehicle CG Z Velocity vs. Time	B-35
Figure B-36 - Vehicle CG Resultant Acceleration vs. Time	B-36
Figure B-37 - Left Driver Seat Track Y Acceleration vs. Time	B-37
Figure B-38 - Left Driver Seat Track Y Velocity vs. Time	B-38
Figure B-39 - Right Rear Occupant Compartment Y Acceleration vs. Time	B-39
Figure B-40 - Right Rear Occupant Compartment Y Velocity vs. Time	B-40
Figure B-41 - Rear Floorpan Above Axle X Acceleration vs. Time	B-41
Figure B-42 - Rear Floorpan Above Axle X Velocity vs. Time	B-42
Figure B-43 - Rear Floopan Above Axle Y Acceleration vs. Time	B-43
Figure B-44 - Rear Floorpan Above Axle Y Velocity vs. Time	B-44
Figure B-45 - Rear Floorpan Above Axle Z Acceleration vs. Time	B-45
Figure B-46 - Rear Floorpan Above Axle Z Velocity vs. Time	B-46
Figure B-47 - Rear Floorpan Above Axle Resultant Acceleration vs. Time	B-47
Figure B-48 - Left Front Door @ Upper Torso Y Acceleration vs. Time	B-48
Figure B-49 - Left Front Door @ Upper Torso Y Velocity vs. Time	B-49
Figure B-50 - Left Front Door @ Mid Torso Y Acceleration vs. Time	B-50
Figure B-51 - Left Front Door @ Mid Torso Y Velocity vs. Time	B-51
Figure B-52 - Left Front Door @ Lower Torso Y Acceleration vs. Time	B-52
Figure B-53 - Left Front Door @ Lower Torso Y Velocity vs. Time	B-53
Figure B-54 - Left Front Door Lower Rear Y Acceleration vs. Time	B-54
Figure B-55 - Left Front Door Lower Rear Y Velocity vs. Time	B-55
Figure B-56 - Left Rear Door @ Upper Torso Y Acceleration vs. Time	B-56
Figure B-57 - Left Rear Door @ Upper Torso Y Velocity vs. Time	B-57
Figure B-58 - Left Rear Door @ Mid Torso Y Acceleration vs. Time	B-58
Figure B-59 - Left Rear Door @ Mid Torso Y Velocity vs. Time	B-59

Table of Data Plots

<u>Vehicle (Cont'd):</u>	<u>Page No.</u>
Figure B-60 - Left Rear Door @ Lower Torso Y Acceleration vs. Time	B-60
Figure B-61 - Left Rear Door @ Lower Torso Y Velocity vs. Time	B-61
Figure B-62 - Left Rear Door Lower Rear Y Acceleration vs. Time	B-62
Figure B-63 - Left Rear Door Lower Rear Y Velocity vs. Time	B-63
Figure B-64 - Moving Barrier CG X Acceleration vs. Time	B-64
Figure B-65 - Moving Barrier CG X Velocity vs. Time	B-65
Figure B-66 - Moving Barrier CG Y Acceleration vs. Time	B-66
Figure B-67 - Moving Barrier CG Y Velocity vs. Time	B-67
Figure B-68 - Moving Barrier CG Z Acceleration vs. Time	B-68
Figure B-69 - Moving Barrier CG Z Velocity vs. Time	B-69
Figure B-70 - Moving Barrier CG Resultant Acceleration vs. Time	B-70
Figure B-71 - Moving Barrier Left Face X Acceleration vs. Time	B-71
Figure B-72 - Moving Barrier Left Face X Velocity vs. Time	B-72
Figure B-73 - Moving Barrier Left Face Y Acceleration vs. Time	B-73
Figure B-74 - Moving Barrier Left Face Y Velocity vs. Time	B-74
Figure B-75 - Moving Barrier Right Face X Acceleration vs. Time	B-75
Figure B-76 - Moving Barrier Right Face X Velocity vs. Time	B-76
Figure B-77 - Moving Barrier Right Face Y Acceleration vs. Time	B-77
Figure B-78 - Moving Barrier Right Face Y Velocity vs. Time	B-78
Figure B-79 - Moving Barrier Left Rear Frame X Acceleration vs. Time	B-79
Figure B-80 - Moving Barrier Left Rear Frame X Velocity vs. Time	B-80
Figure B-81 - Moving Barrier Left Rear Frame Y Acceleration vs. Time	B-81
Figure B-82 - Moving Barrier Left Rear Frame Y Velocity vs. Time	B-82
Figure B-83 - Moving Barrier Right Rear Frame X Acceleration vs. Time	B-83
Figure B-84 - Moving Barrier Right Rear Frame X Velocity vs. Time	B-84
Figure B-85 - Moving Barrier Right Rear Frame Y Acceleration vs. Time	B-85
Figure B-86 - Moving Barrier Right Rear Frame Y Velocity vs. Time	B-86
Figure B-87 - MDB CG and Vehicle Right Sill X Velocity vs. Time	B-87

Table of Data Plots

<u>Occupant:</u>	<u>Page No.</u>
Figure B-88 - Driver Head X Acceleration vs. Time	B-88
Figure B-89 - Driver Head X Velocity vs. Time	B-89
Figure B-90 - Driver Head Y Acceleration vs. Time	B-90
Figure B-91 - Driver Head Y Velocity vs. Time	B-91
Figure B-92 - Driver Head Z Acceleration vs. Time	B-92
Figure B-93 - Driver Head Z Velocity vs. Time	B-93
Figure B-94 - Driver Head Resultant Acceleration vs. Time	B-94
Figure B-95 - Driver Upper Spine X Acceleration vs. Time	B-95
Figure B-96 - Driver Upper Spine X Velocity vs. Time	B-96
Figure B-97 - Driver Upper Spine Y Acceleration vs. Time	B-97
Figure B-98 - Driver Upper Spine Y Velocity vs. Time	B-98
Figure B-99 - Driver Upper Spine Z Acceleration vs. Time	B-99
Figure B-100 - Driver Upper Spine Z Velocity vs. Time	B-100
Figure B-101 - Driver Upper Rib Y Acceleration vs. Time	B-101
Figure B-102 - Driver Upper Rib Y Velocity vs. Time	B-102
Figure B-103 - Driver Upper Rib Y Displacement vs. Time	B-103
Figure B-104 - Driver Mid Rib Y Acceleration vs. Time	B-104
Figure B-105 - Driver Mid Rib Y Velocity vs. Time	B-105
Figure B-106 - Driver Mid Rib Y Displacement vs. Time	B-106
Figure B-107 - Driver Lower Rib Y Acceleration vs. Time	B-107
Figure B-108 - Driver Lower Rib Y Velocity vs. Time	B-108
Figure B-109 - Driver Lower Rib Y Displacement vs. Time	B-109
Figure B-110 - Driver Front Abdominal Force vs. Time	B-110
Figure B-111 - Driver Mid Abdominal Force vs. Time	B-111
Figure B-112 - Driver Rear Abdominal Force vs. Time	B-112
Figure B-113 - Sum of Driver Abdominal Forces vs. Time	B-113
Figure B-114 - Driver Pubic Symphysis Force vs. Time	B-114
Figure B-115 - Driver Lower Spine X Acceleration vs. Time	B-115
Figure B-116 - Driver Lower Spine X Velocity vs. Time	B-116

Table of Data Plots

<u>Occupant (Cont'd):</u>	<u>Page No.</u>
Figure B-117 - Driver Lower Spine Y Acceleration vs. Time	B-117
Figure B-118 - Driver Lower Spine Y Velocity vs. Time	B-118
Figure B-119 - Driver Lower Spine Z Acceleration vs. Time	B-119
Figure B-120 - Driver Lower Spine Z Velocity vs. Time	B-120
Figure B-121 - Driver Pelvis X Acceleration vs. Time	B-121
Figure B-122 - Driver Pelvis X Velocity vs. Time	B-122
Figure B-123 - Driver Pelvis Y Acceleration vs. Time	B-123
Figure B-124 - Driver Pelvis Y Velocity vs. Time	B-124
Figure B-125 - Driver Pelvis Z Acceleration vs. Time	B-125
Figure B-126 - Driver Pelvis Z Velocity vs. Time	B-126
Figure B-127 - Passenger Head X Acceleration vs. Time	B-127
Figure B-128 - Passenger Head X Velocity vs. Time	B-128
Figure B-129 - Passenger Head Y Acceleration vs. Time	B-129
Figure B-130 - Passenger Head Y Velocity vs. Time	B-130
Figure B-131 - Passenger Head Z Acceleration vs. Time	B-131
Figure B-132 - Passenger Head Z Velocity vs. Time	B-132
Figure B-133 - Passenger Head Resultant Acceleration vs. Time	B-133
Figure B-134 - Passenger Upper Spine X Acceleration vs. Time	B-134
Figure B-135 - Passenger Upper Spine X Velocity vs. Time	B-135
Figure B-136 - Passenger Upper Spine Y Acceleration vs. Time	B-136
Figure B-137 - Passenger Upper Spine Y Velocity vs. Time	B-137
Figure B-138 - Passenger Upper Spine Z Acceleration vs. Time	B-138
Figure B-139 - Passenger Upper Spine Z Velocity vs. Time	B-139
Figure B-140 - Passenger Upper Rib Y Acceleration vs. Time	B-140
Figure B-141 - Passenger Upper Rib Y Velocity vs. Time	B-141
Figure B-142 - Passenger Upper Rib Y Displacement vs. Time	B-142
Figure B-143 - Passenger Mid Rib Y Acceleration vs. Time	B-143
Figure B-144 - Passenger Mid Rib Y Velocity vs. Time	B-144
Figure B-145 - Passenger Mid Rib Y Displacement vs. Time	B-145

Table of Data Plots

<u>Occupant (Cont'd):</u>	<u>Page No.</u>
Figure B-146 - Passenger Lower Rib Y Acceleration vs. Time	B-146
Figure B-147 - Passenger Lower Rib Y Velocity vs. Time	B-147
Figure B-148 - Passenger Lower Rib Y Displacement vs. Time	B-148
Figure B-149 - Passenger Front Abdominal Force vs. Time	B-149
Figure B-150 - Passenger Mid Abdominal Force vs. Time	B-150
Figure B-151 - Passenger Rear Abdominal Force vs. Time	B-151
Figure B-152 - Sum of Passenger Abdominal Forces vs. Time	B-152
Figure B-153 - Passenger Pubic Symphysis Force vs. Time	B-153
Figure B-154 - Passenger Lower Spine X Acceleration vs. Time	B-154
Figure B-155 - Passenger Lower Spine X Velocity vs. Time	B-155
Figure B-156 - Passenger Lower Spine Y Acceleration vs. Time	B-156
Figure B-157 - Passenger Lower Spine Y Velocity vs. Time	B-157
Figure B-158 - Passenger Lower Spine Z Acceleration vs. Time	B-158
Figure B-159 - Passenger Lower Spine Z Velocity vs. Time	B-159
Figure B-160 - Passenger Pelvis X Acceleration vs. Time	B-160
Figure B-161 - Passenger Pelvis X Velocity vs. Time	B-161
Figure B-162 - Passenger Pelvis Y Acceleration vs. Time	B-162
Figure B-163 - Passenger Pelvis Y Velocity vs. Time	B-163
Figure B-164 - Passenger Pelvis Z Acceleration vs. Time	B-164
Figure B-165 - Passenger Pelvis Z Velocity vs. Time	B-165
 <u>FIR Filtered:</u>	
Figure B-166- Driver Upper Spine X Acceleration vs. Time	B-166
Figure B-167 - Driver Upper Spine Y Acceleration vs. Time	B-167
Figure B-168 - Driver Upper Spine Z Acceleration vs. Time	B-168
Figure B-169 - Driver Upper Rib Y Acceleration vs. Time	B-169
Figure B-170 - Driver Mid Rib Y Acceleration vs. Time	B-170
Figure B-171 - Driver Lower Rib Y Acceleration vs. Time	B-171
Figure B-172 - Driver Lower Spine X Acceleration vs. Time	B-172

Table of Data Plots

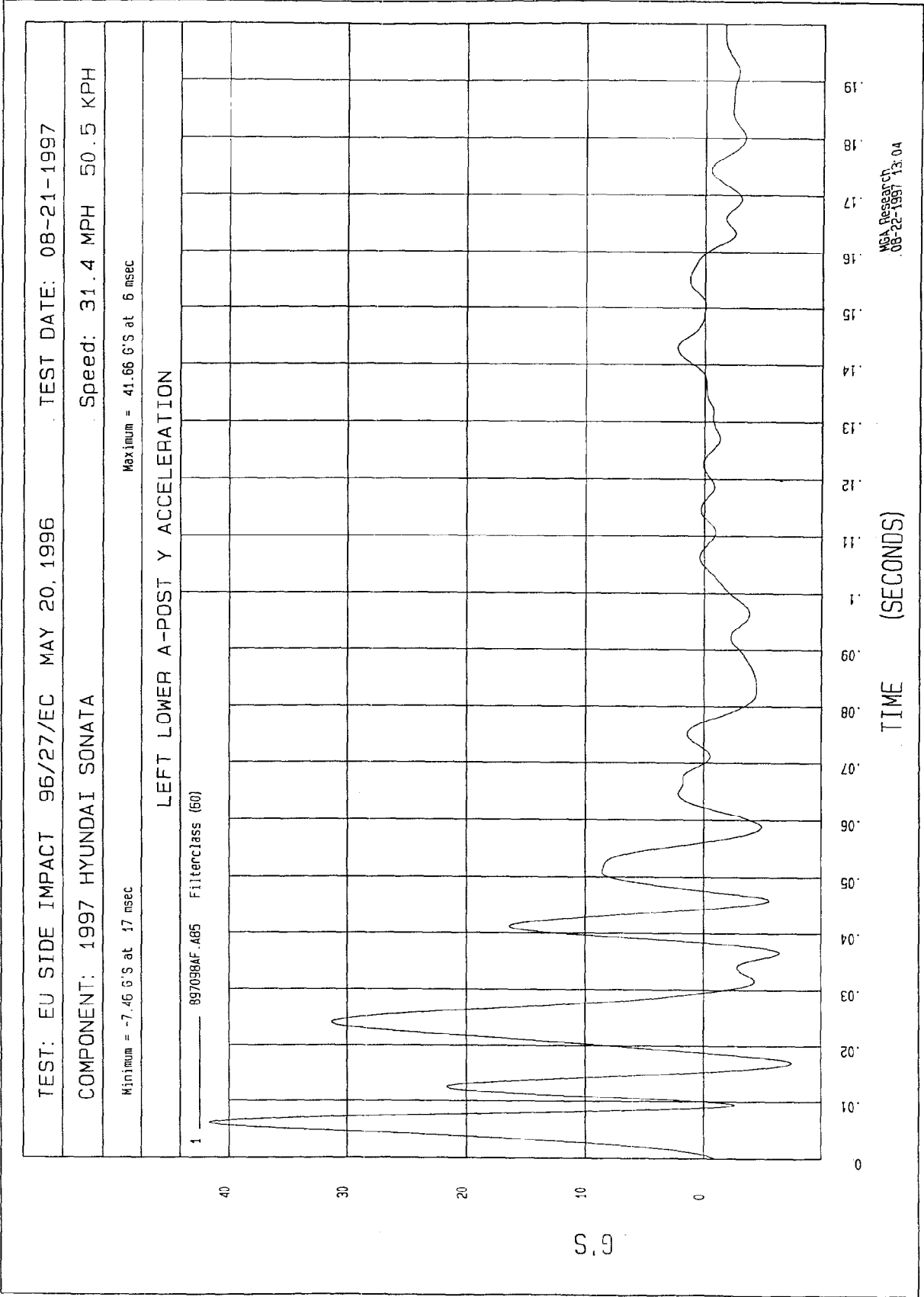
<u>FIR Filtered (Cont'd):</u>	<u>Page No.</u>
Figure B-173 - Driver Lower Spine Y Acceleration vs. Time	B-173
Figure B-174 - Driver Lower Spine Z Acceleration vs. Time	B-174
Figure B-175 - Driver Pelvis X Acceleration vs. Time	B-175
Figure B-176 - Driver Pelvis Y Acceleration vs. Time	B-176
Figure B-177 - Driver Pelvis Z Acceleration vs. Time	B-177
Figure B-178 - Passenger Upper Spine X Acceleration vs. Time	B-178
Figure B-179 - Passenger Upper Spine Y Acceleration vs. Time	B-179
Figure B-180 - Passenger Upper Spine Z Acceleration vs. Time	B-180
Figure B-181 - Passenger Upper Rib Y Acceleration vs. Time	B-181
Figure B-182 - Passenger Mid Rib Y Acceleration vs. Time	B-182
Figure B-183 - Passenger Lower Rib Y Acceleration vs. Time	B-183
Figure B-184 - Passenger Lower Spine X Acceleration vs. Time	B-184
Figure B-185 - Passenger Lower Spine Y Acceleration vs. Time	B-185
Figure B-186 - Passenger Lower Spine Z Acceleration vs. Time	B-186
Figure B-187 - Passenger Pelvis X Acceleration vs. Time	B-187
Figure B-188 - Passenger Pelvis Y Acceleration vs. Time	B-188
Figure B-189 - Passenger Pelvis Z Acceleration vs. Time	B-189
 <u>Relative Displacements:</u>	
Figure B-190 - MDB CG X Minus Right Front Sill Y Displacement vs. Time	B-190
Figure B-191 - Left Front Door @ Upper Torso Minus Right Front Sill Displacement	B-191
Figure B-192 - Driver Upper Rib Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-192
Figure B-193 - Driver Upper Rib Y Displacement vs. Front Door @ Upper Torso Intrusion	B-193
Figure B-194 - Driver Mid Rib Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-194
Figure B-195 - Driver Mid Rib Y Displacement vs. Front Door @ Upper Torso Intrusion	B-195
Figure B-196 - Driver Lower Rib Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-196

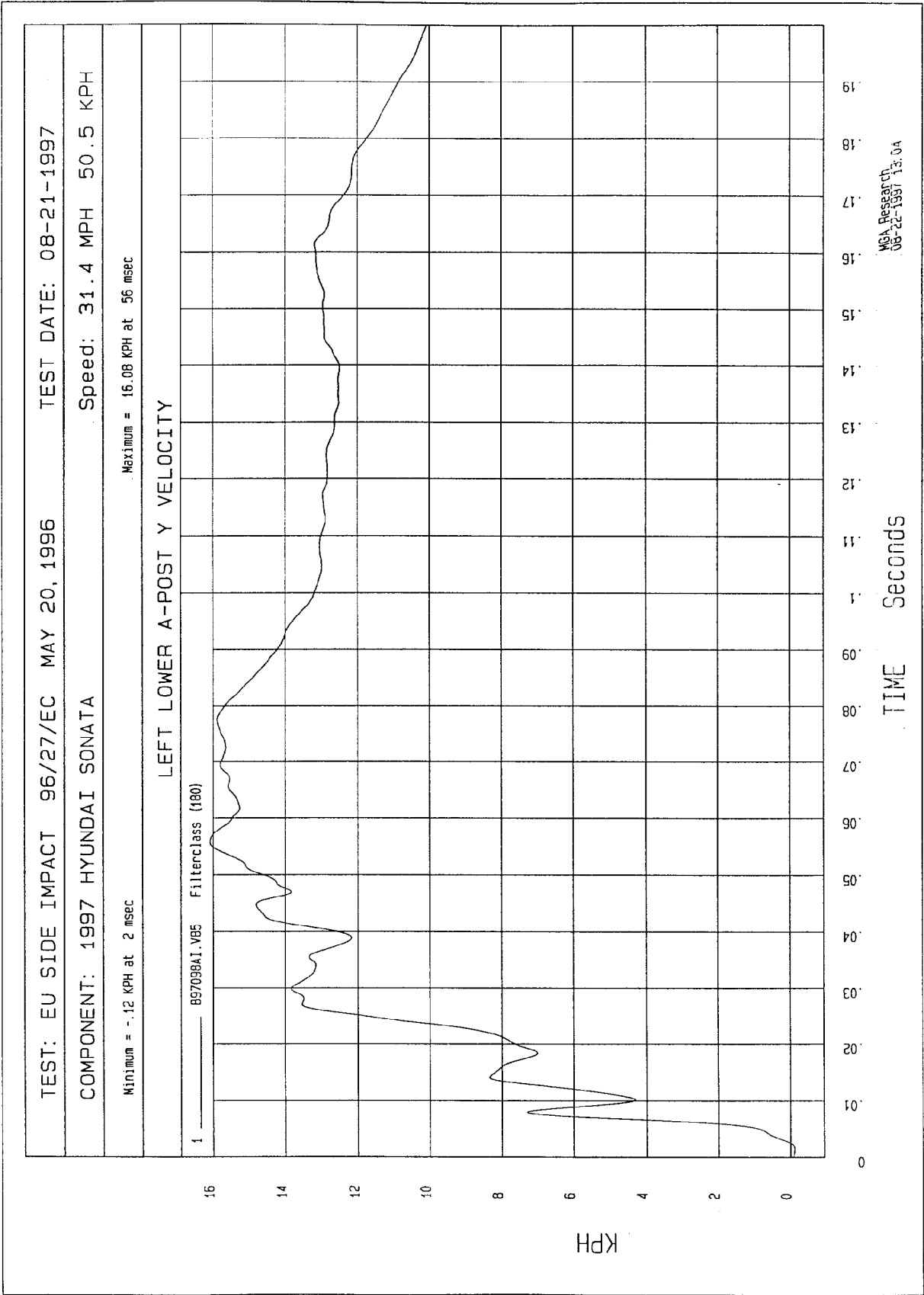
Table of Data Plots

<u>Relative Displacements (Cont'd):</u>	<u>Page No.</u>
Figure B-197 - Driver Lower Rib Y Displacement vs. Front Door @ Upper Torso Intrusion	B-197
Figure B-198 - Driver Upper Spine Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-198
Figure B-199 - Driver Lower Spine Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-199
Figure B-200 - Driver Pelvis Y Acceleration vs. Front Door @ Upper Torso Intrusion	B-200
Figure B-201 - Driver Pubis Symphysis Force vs. Front Door @ Upper Torso Intrusion	B-201
Figure B-202 - Driver Summed Abdominal Force vs. Front Door @ Upper Torso Intrusion	B-202
Figure B-203 - Driver Head Resultant Acceleration vs. Front Door @ Upper Torso Intrusion	B-203
Figure B-204 - Left Rear Door @ Mid Torso Minus Right Rear Sill Displacement	B-204
Figure B-205 - Passenger Upper Rib Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-205
Figure B-206 - Passenger Upper Rib Y Displacement vs. Rear Door @ Mid Torso Intrusion	B-206
Figure B-207 - Passenger Mid Rib Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-207
Figure B-208 - Passenger Mid Rib Y Displacement vs. Rear Door @ Mid Torso Intrusion	B-208
Figure B-209 - Passenger Lower Rib Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-209
Figure B-210 - Passenger Lower Rib Y Displacement vs. Rear Door @ Mid Torso Intrusion	B-210
Figure B-211 - Passenger Upper Spine Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-211
Figure B-212 - Passenger Lower Spine Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-212

Table of Data Plots

<u>Relative Displacements (Cont'd):</u>	<u>Page No.</u>
Figure B-213 - Passenger Pelvis Y Acceleration vs. Rear Door @ Mid Torso Intrusion	B-213
Figure B-214 - Passenger Pubic Symphysis Force vs. Rear Door @ Mid Torso Intrusion	B-214
Figure B-215 - Passenger Summed Abdominal Force vs. Rear Door @ Mid Torso Intrusion	B-215
Figure B-216 - Passenger Head Resultant Acceleration vs. Rear Door @ Mid Torso Intrusion	B-216
 <u>Viscous Criteria:</u>	
Figure B-217 - Driver Viscous Chest Criteria (Upper Rib) vs. Time	B-217
Figure B-218 - Driver Viscous Chest Criteria (Mid Rib) vs. Time	B-218
Figure B-219 - Driver Viscous Chest Criteria (Lower Rib) vs. Time	B-219
Figure B-220 - Passenger Viscous Chest Criteria (Upper Rib) vs. Time	B-220
Figure B-221 - Passenger Viscous Chest Criteria (Mid Rib) vs. Time	B-221
Figure B-222 - Passenger Viscous Chest Criteria (Lower Rib) vs. Time	B-222
 <u>Dummy Contacts:</u>	
Figure B-223 - Driver Head Contact vs. Time	B-223
Figure B-224 - Driver Shoulder Contact vs. Time	B-224
Figure B-225 - Driver Upper Rib Contact vs. Time	B-225
Figure B-226 - Driver Mid Rib Contact vs. Time	B-226
Figure B-227 - Driver Lower Rib Contact vs. Time	B-227
Figure B-228 - Driver Pelvis Contact vs. Time	B-228
Figure B-229 - Driver Abdomen Contact vs. Time	B-229
Figure B-230 - Passenger Head Contact vs. Time	B-230
Figure B-231 - Passenger Shoulder Contact vs. Time	B-231
Figure B-232 - Passenger Upper Rib Contact vs. Time	B-232
Figure B-233 - Passenger Mid Rib Contact vs. Time	B-233
Figure B-234 - Passenger Lower Rib Contact vs. Time	B-234
Figure B-235 - Passenger Pelvis Contact vs. Time	B-235
Figure B-236 - Passenger Abdomen Contact vs. Time	B-236



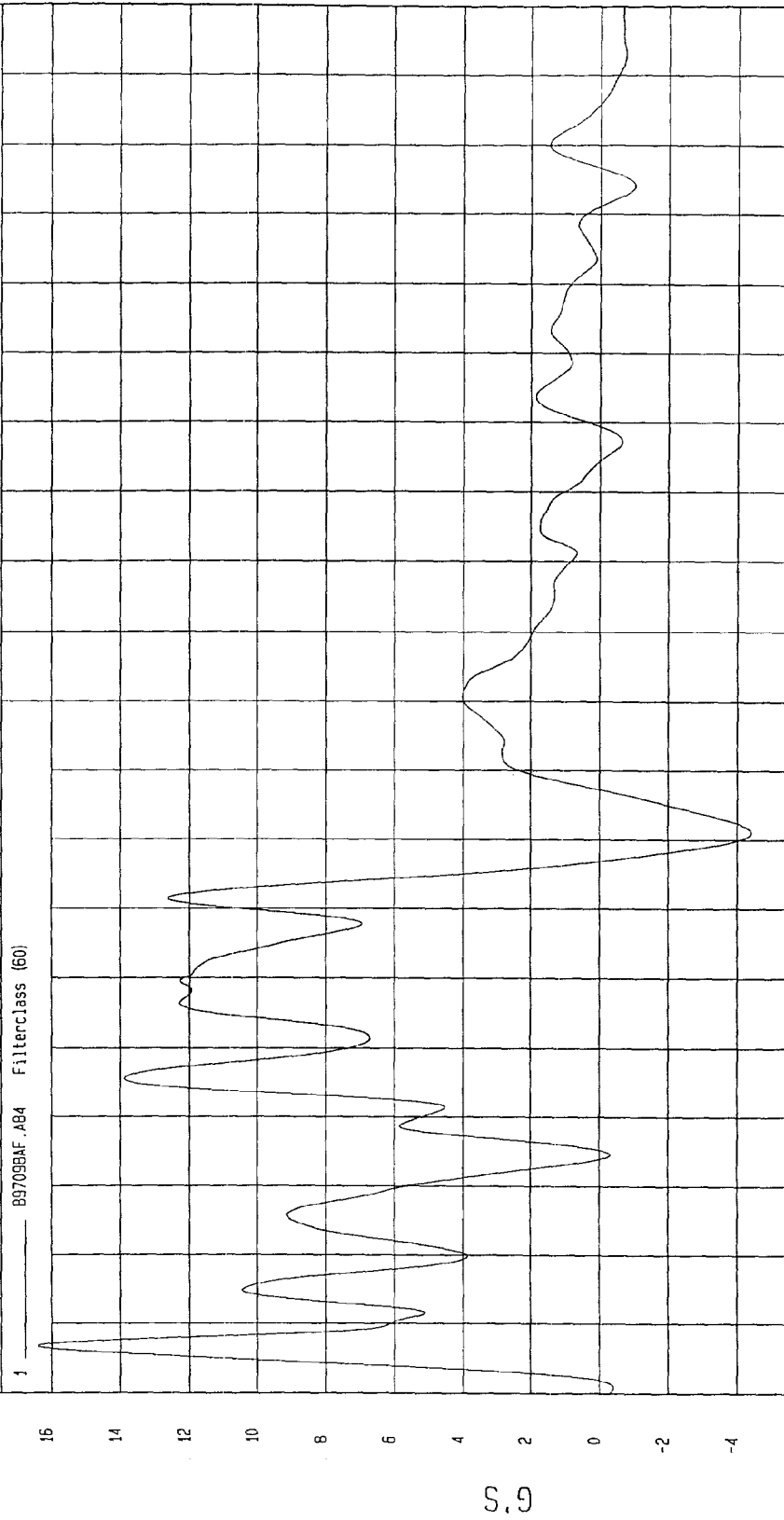


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

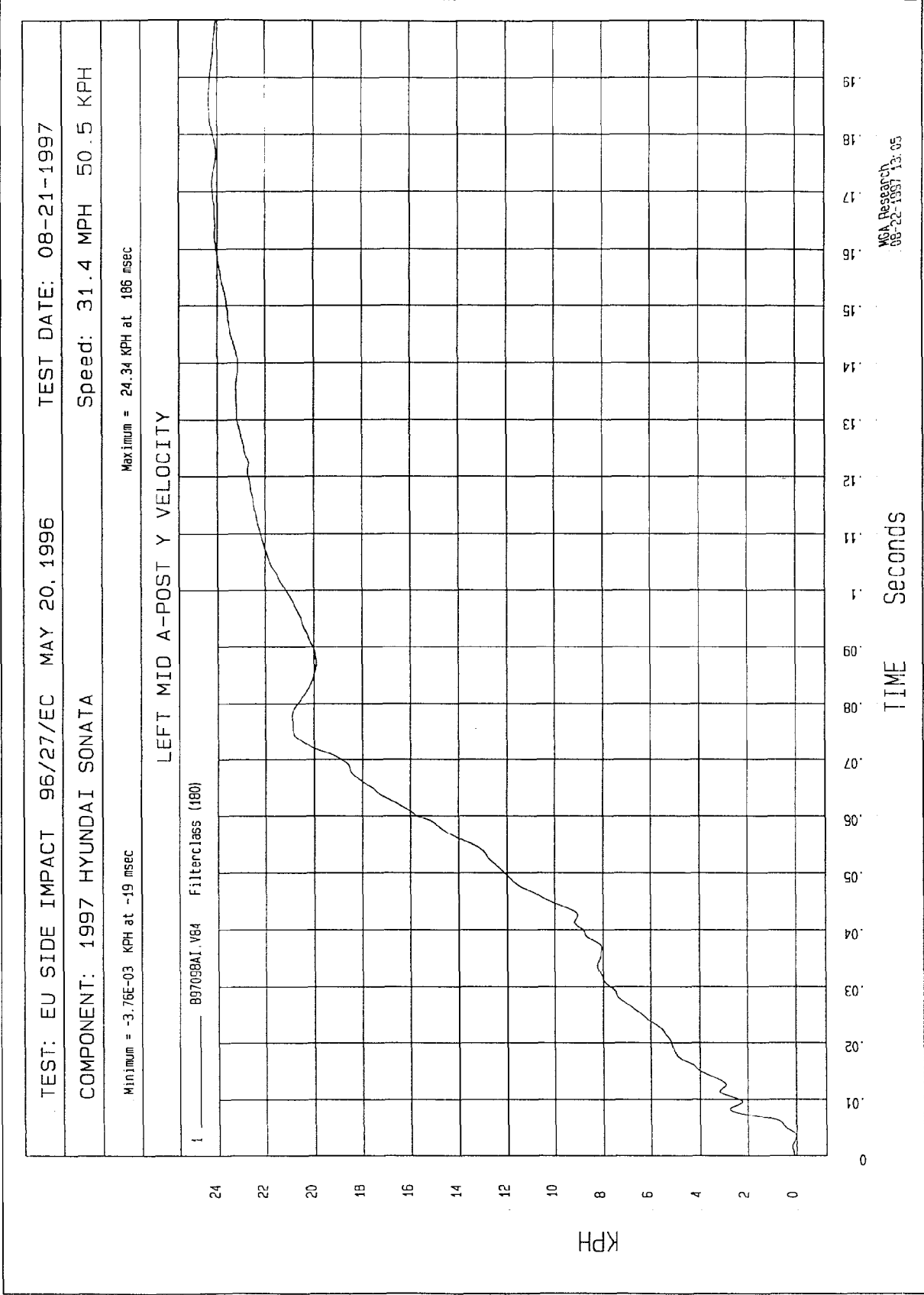
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -4.41 G'S at 81 msec Maximum = 16.41 G'S at 7 msec

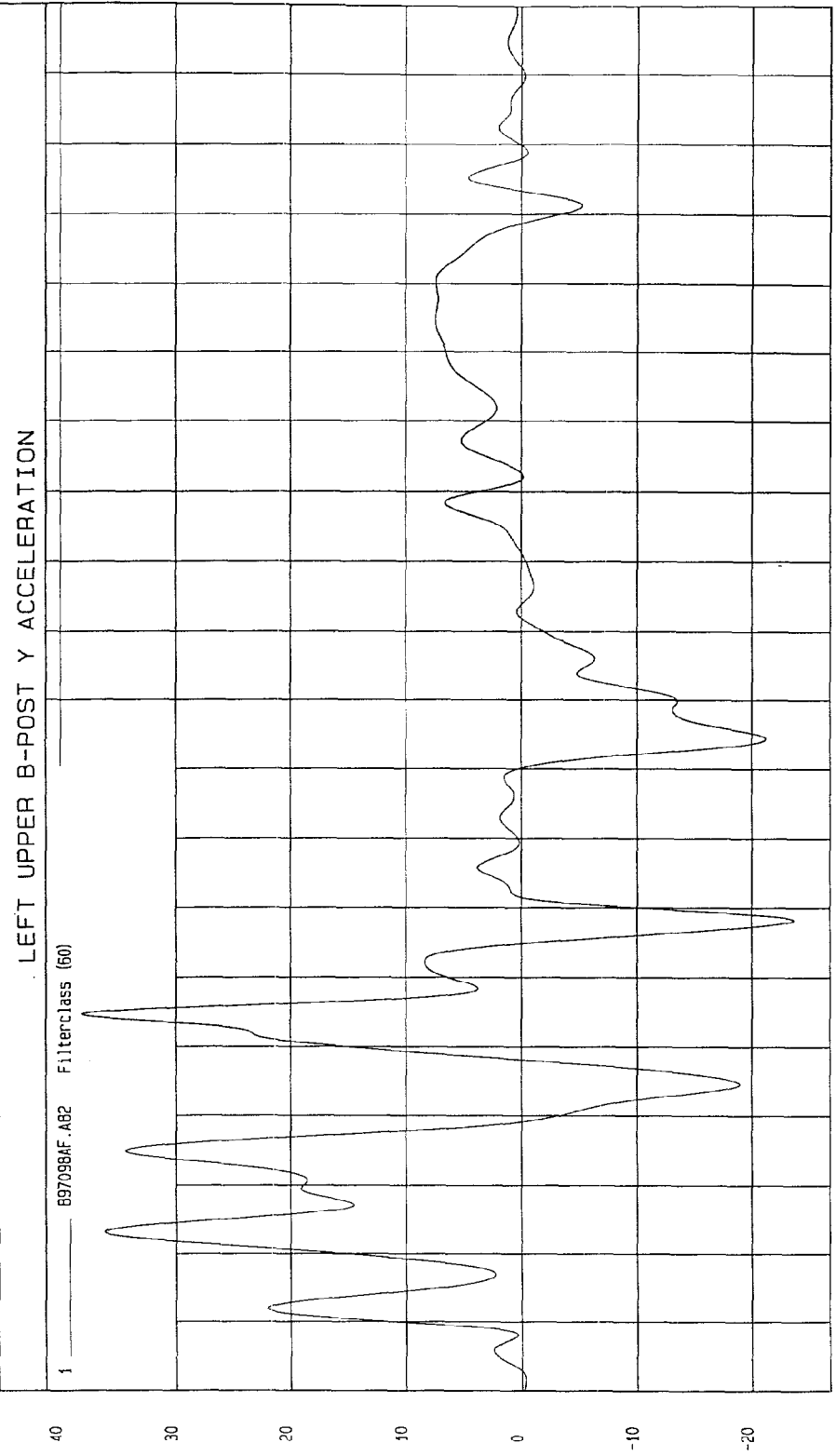
LEFT MID A-POST Y ACCELERATION



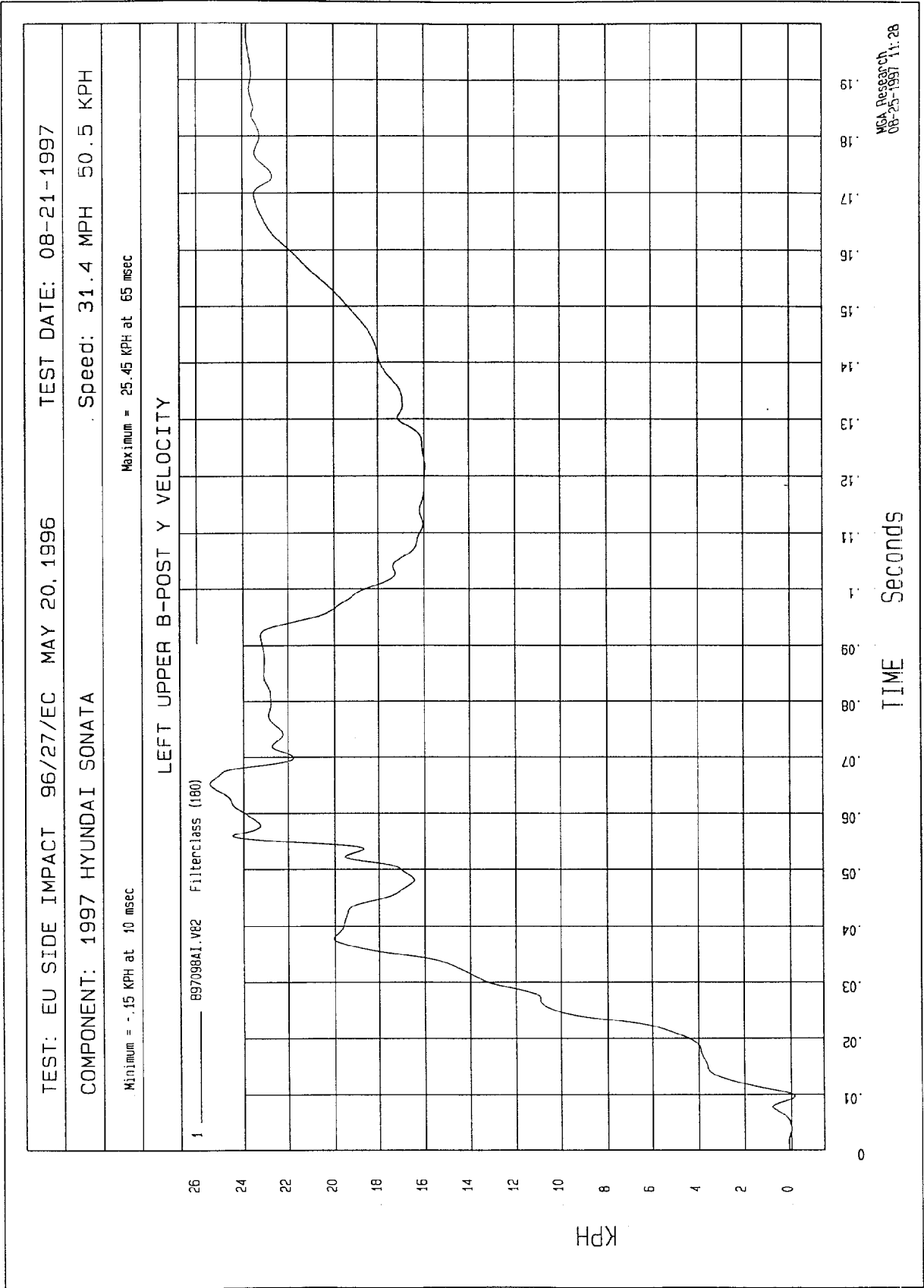
MGA Research
08-22-1997 13:05



TEST: EU SIDE IMPACT 96/27/EC	MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH	50.5 KPH
Minimum = -23.65 G'S at 68 msec		
Maximum = 38.48 G'S at 55 msec		

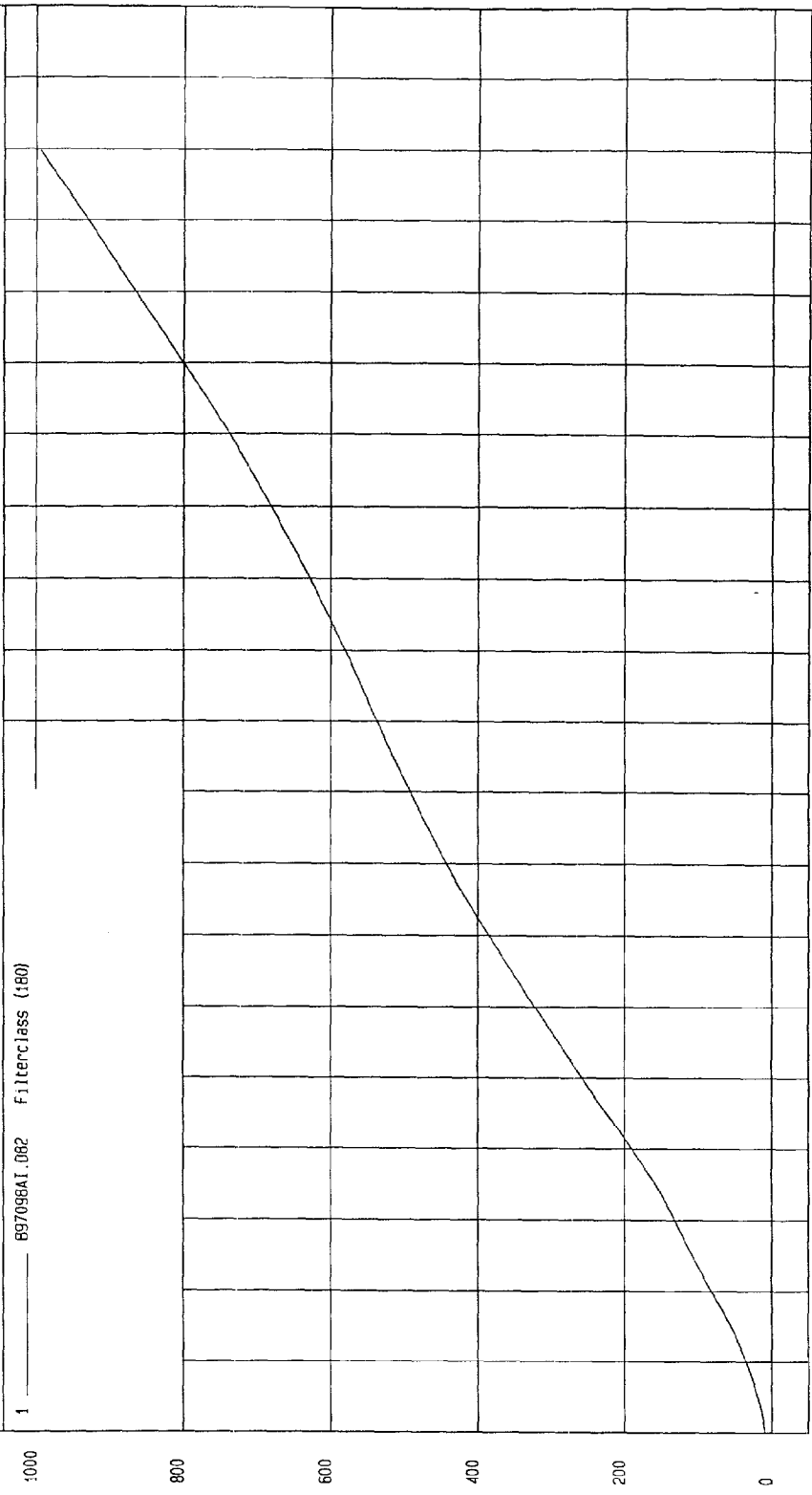


MCA Research
08-23-1997 11:28



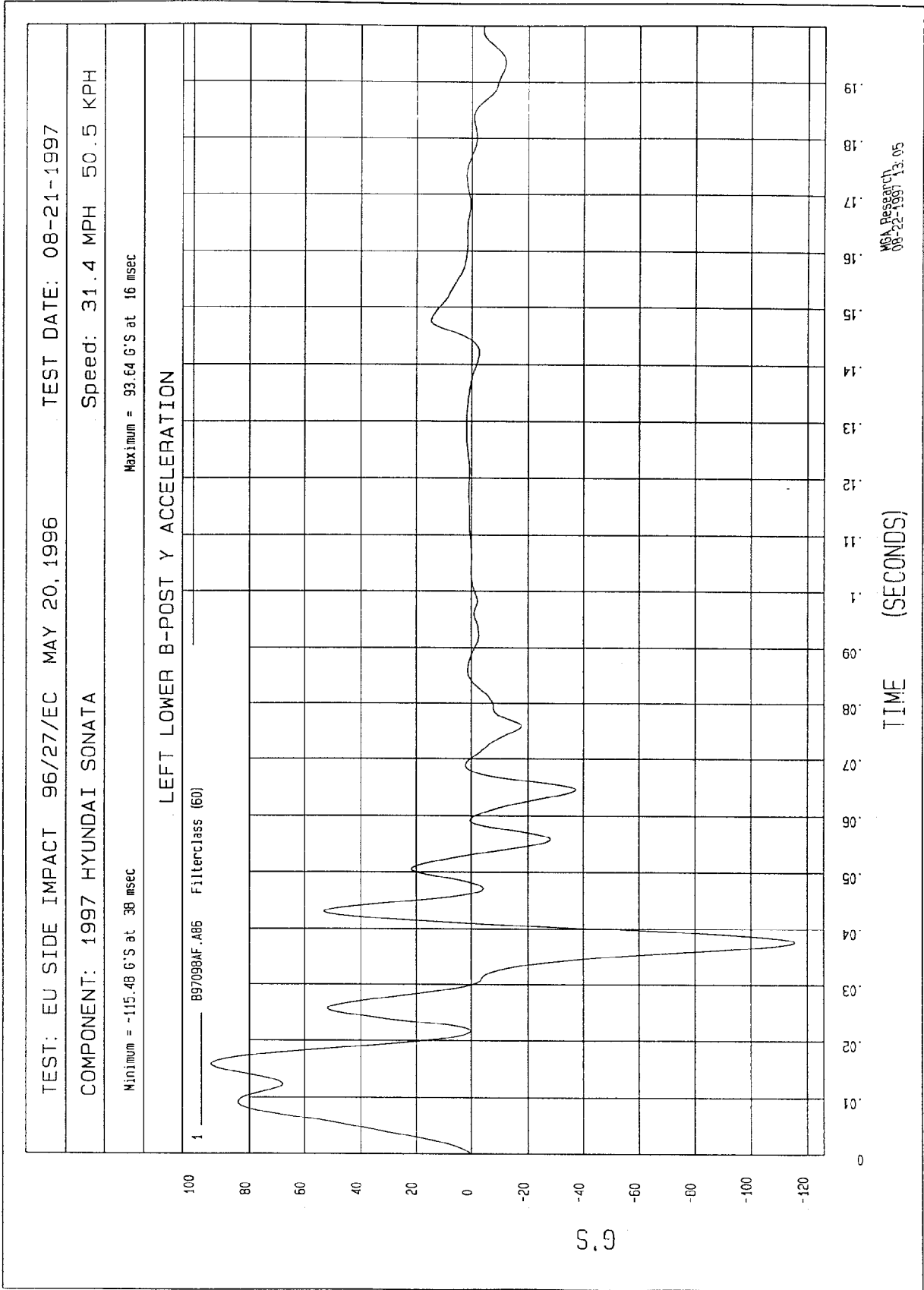
TEST: EU SIDE IMPACT 96/27/EC	MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA		Speed: 31.4 MPH 50.5 KPH
Minimum = 0 MM at 0 msec		Maximum = 995.33 MM at 200 msec

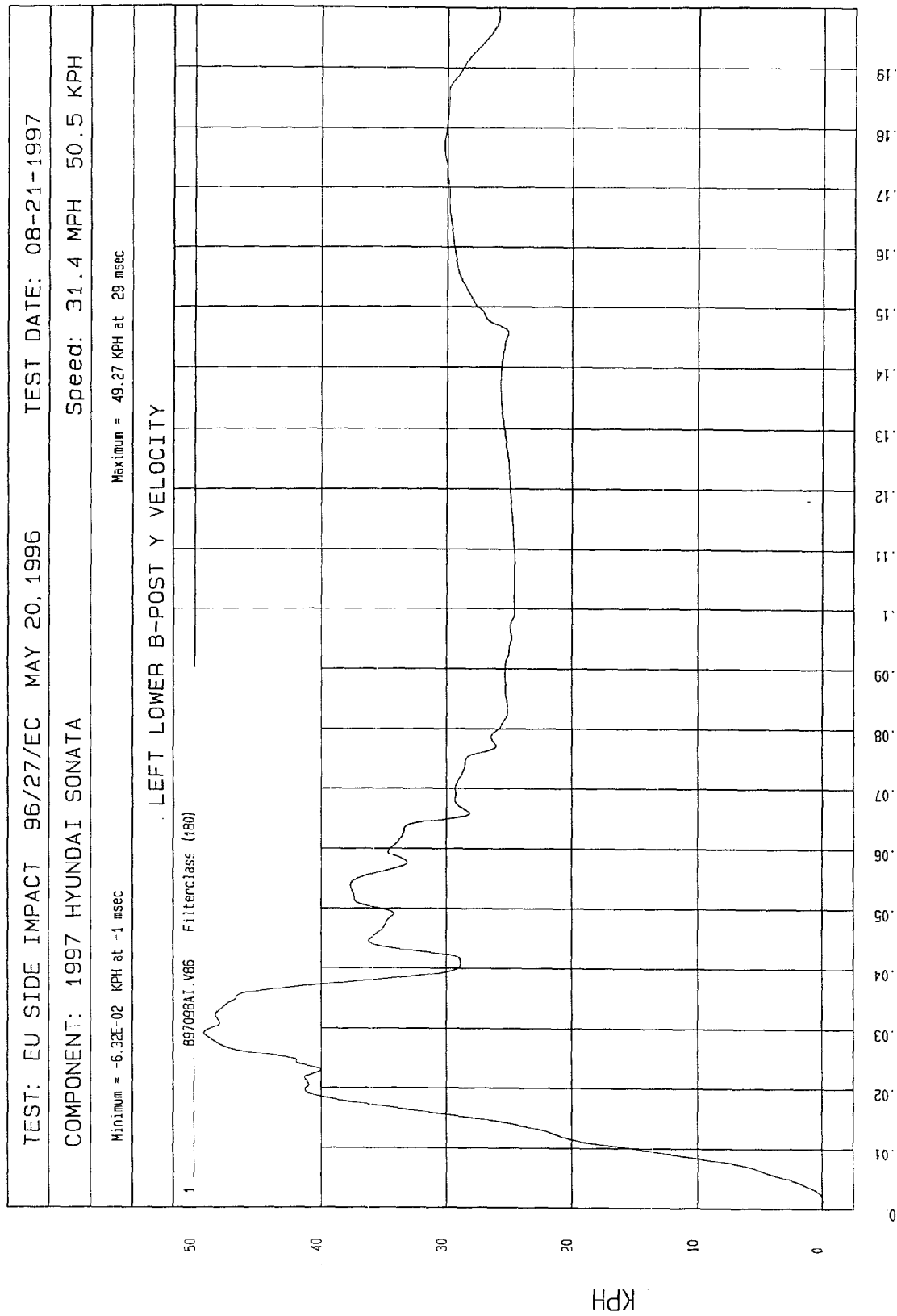
LEFT UPPER B-POST Y DISPLACEMENT



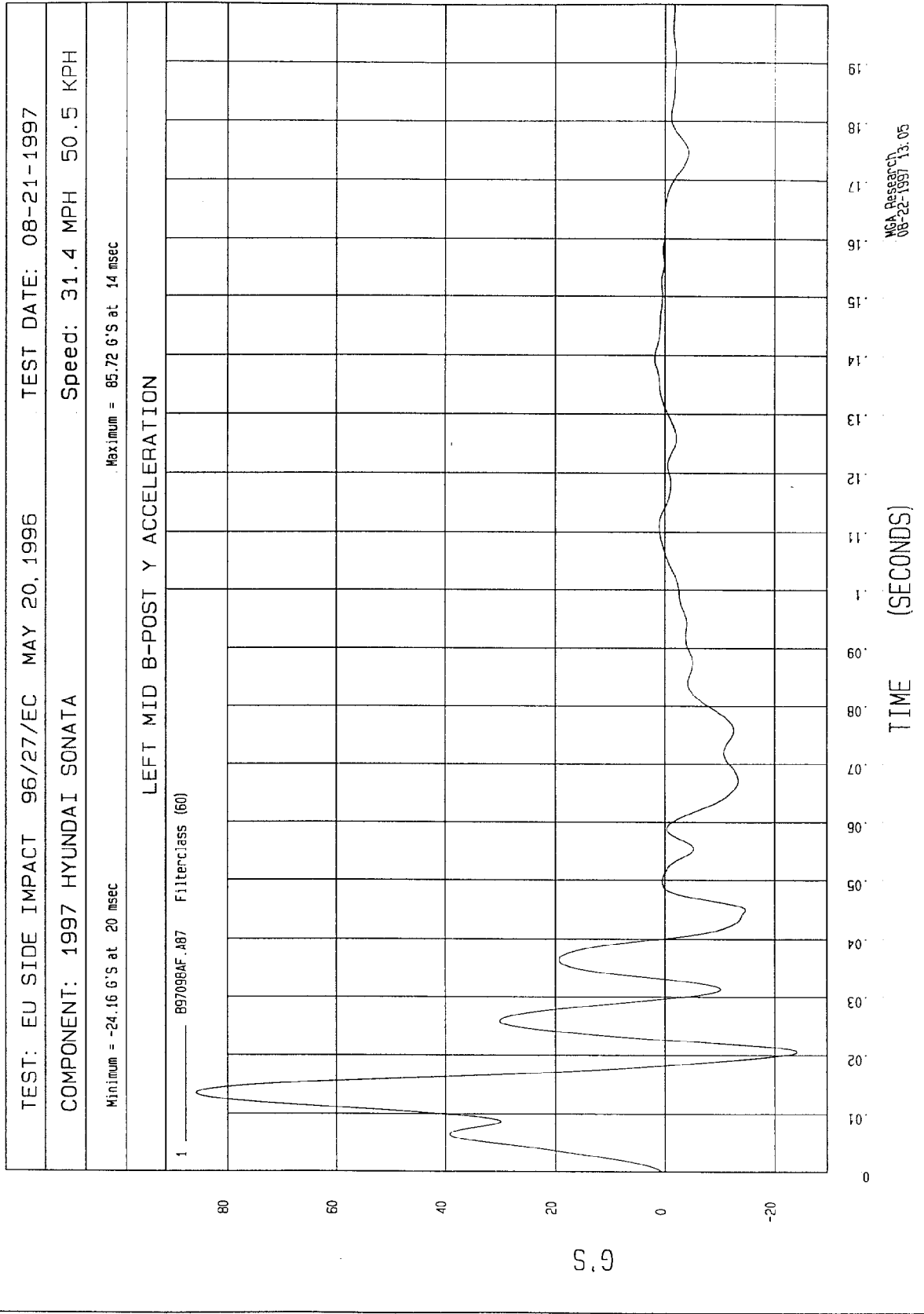
TIME Seconds

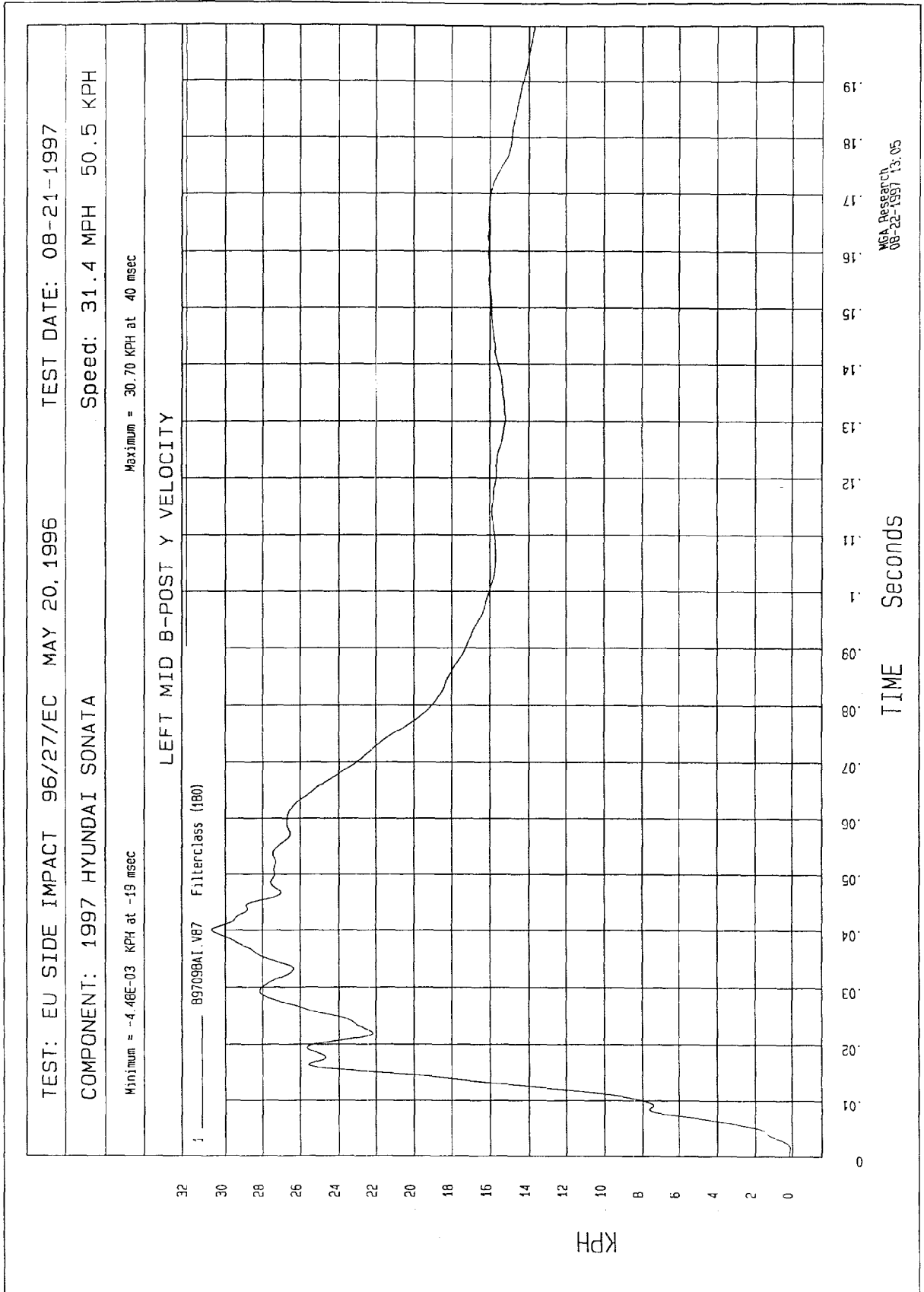
NSA Research
08-25-1997 11:28

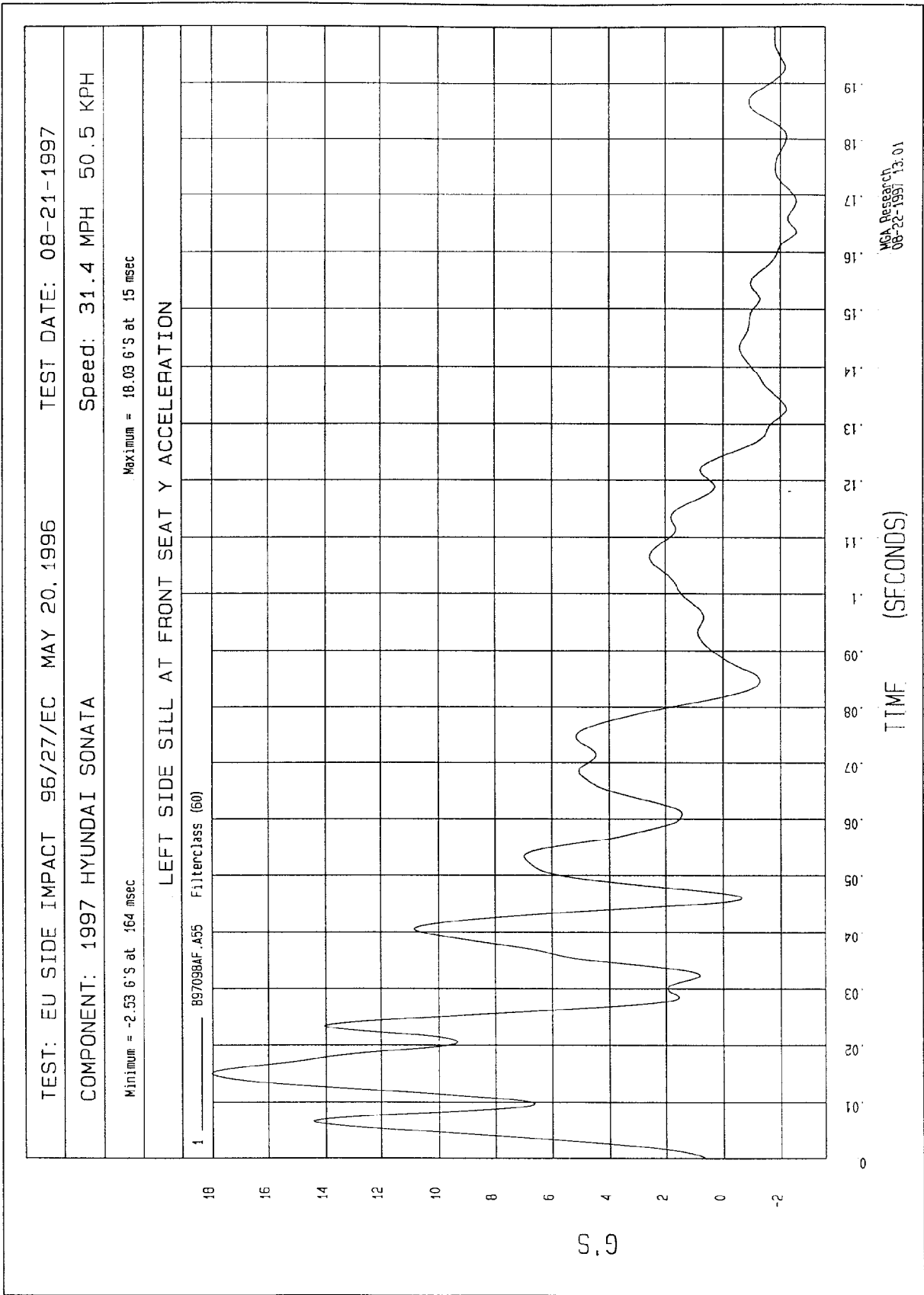




NSA Research
08-22-1997 13:05





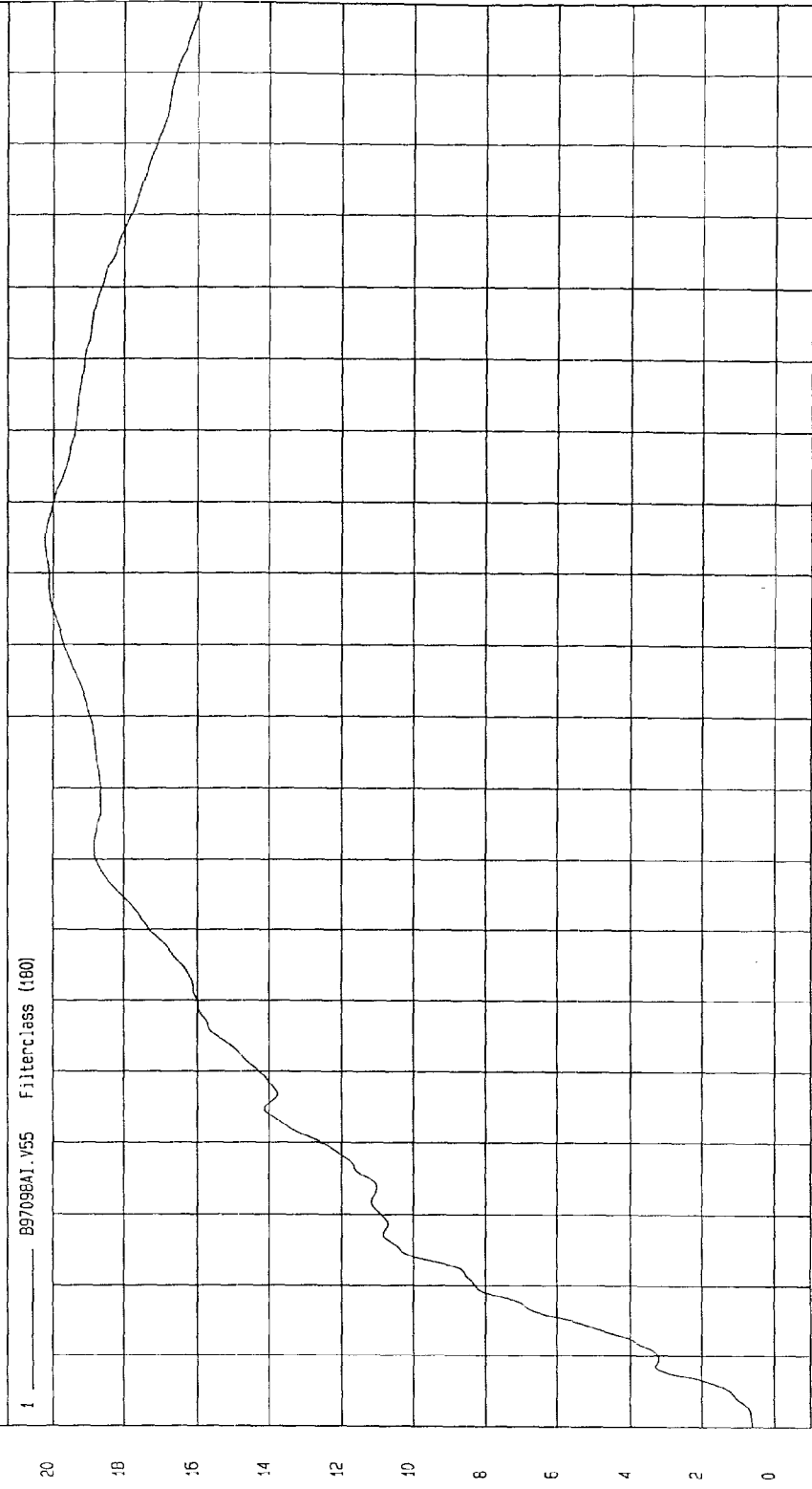


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

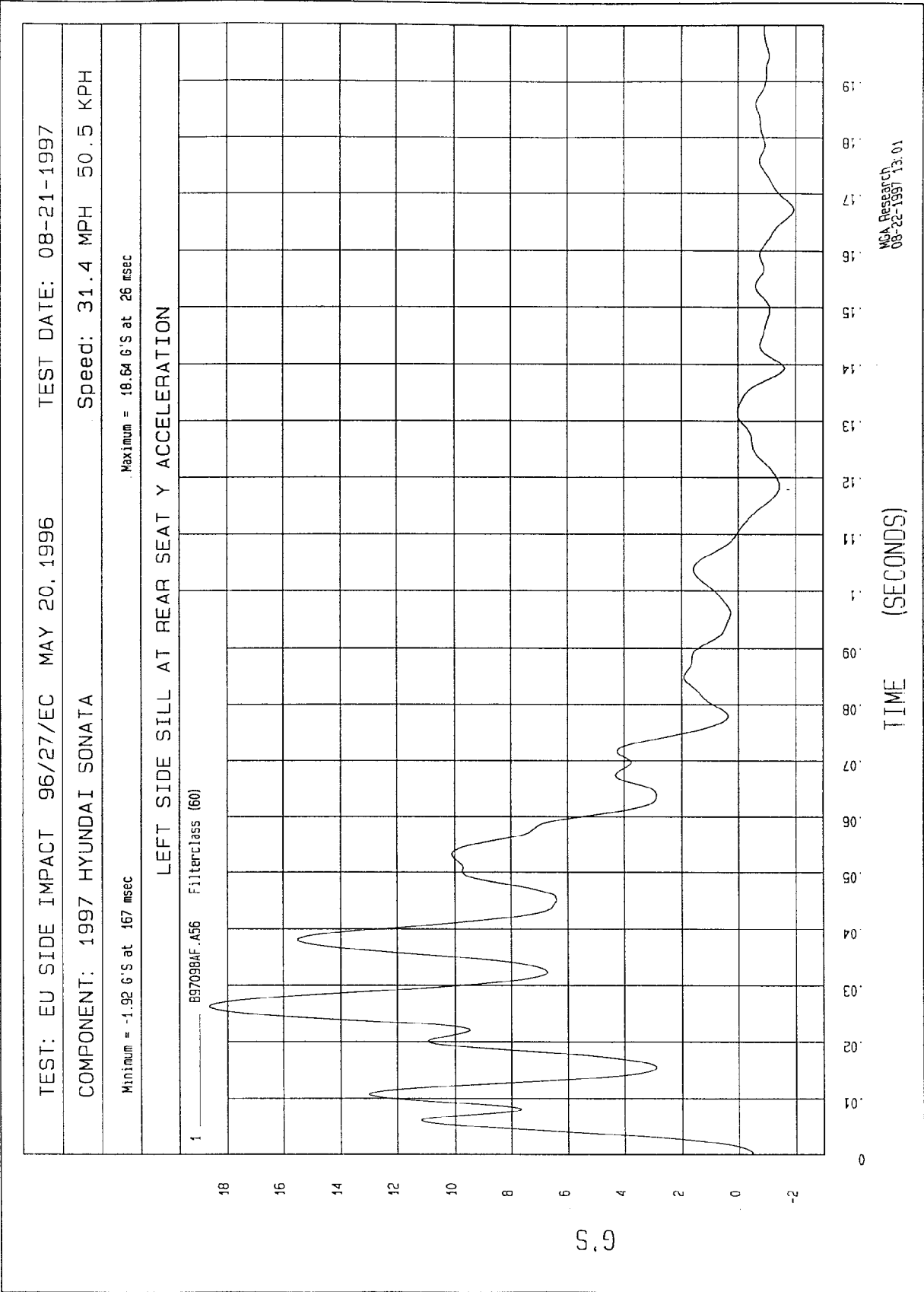
Minimum = 0 KPH at -20 msec Maximum = 20.22 KPH at 125 msec

LEFT SIDE SILL AT FRONT SEAT Y VELOCITY



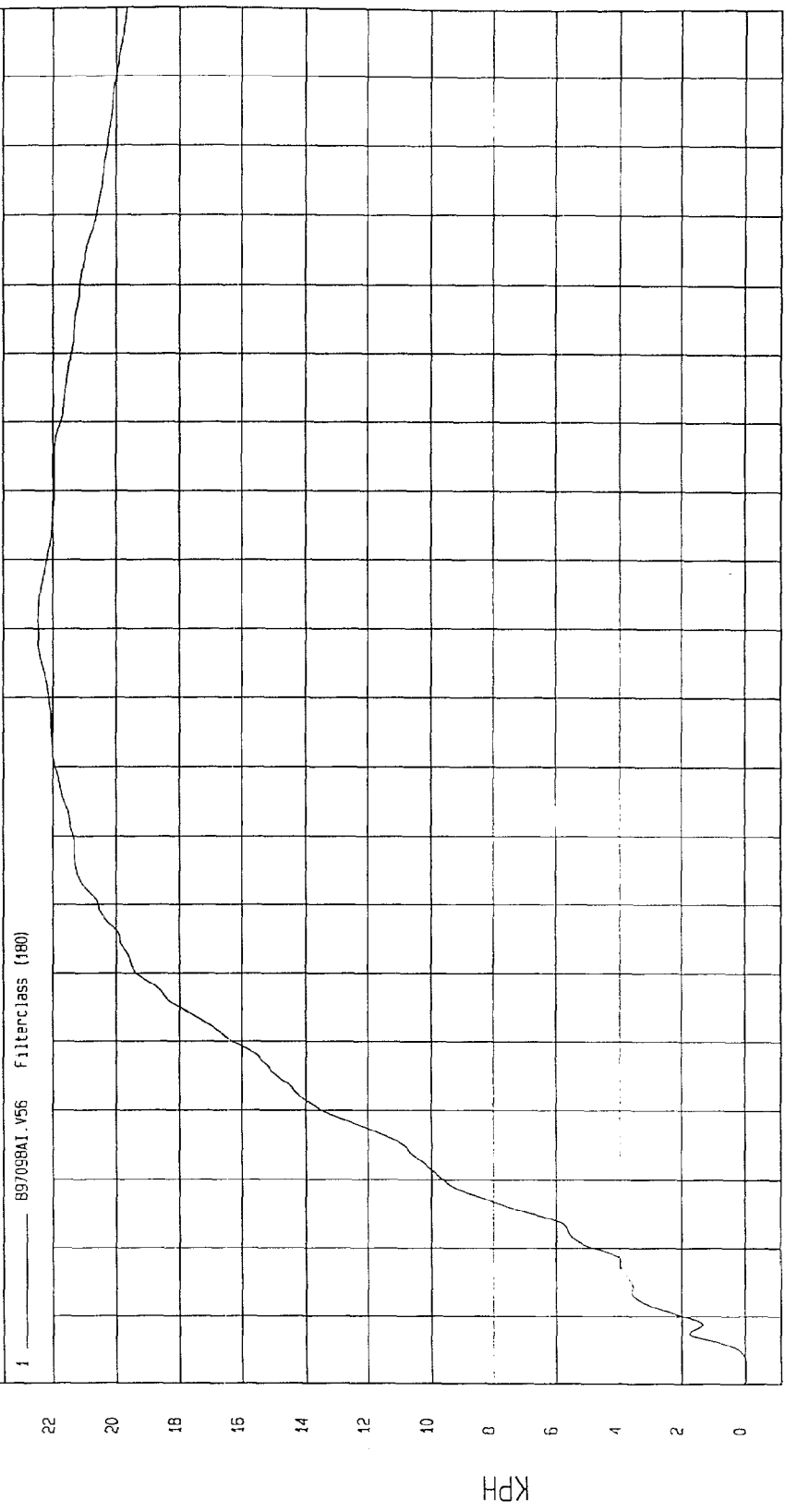
TIME Seconds

NSA Research
08-22-1997 13:01



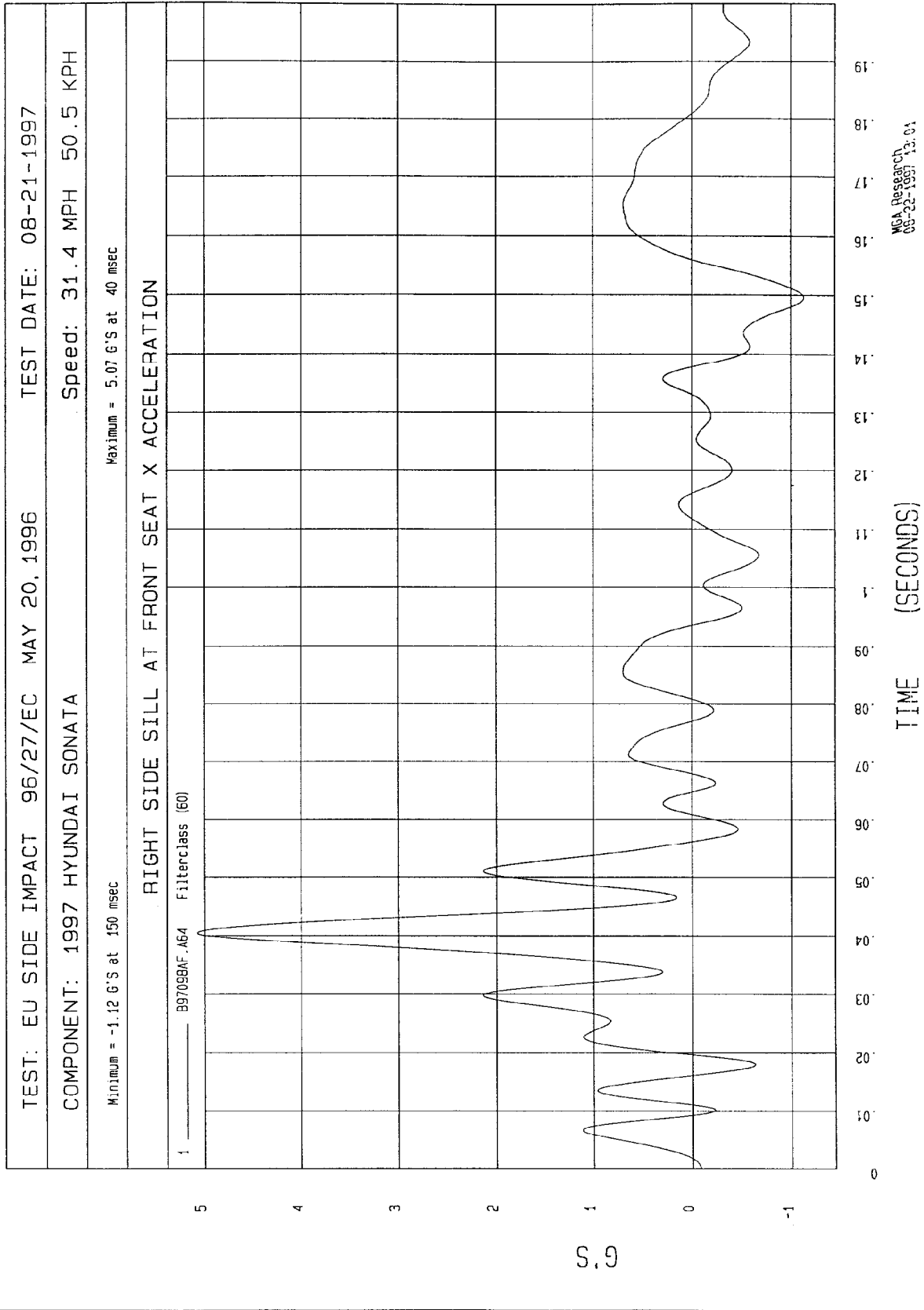
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -2.57E-02 KPH at 3 msec	Maximum = 22.48 KPH at 111 msec

LEFT SIDE SILL AT REAR SEAT Y VELOCITY



TIME Seconds

MCA Research
08-22-1997 13.01

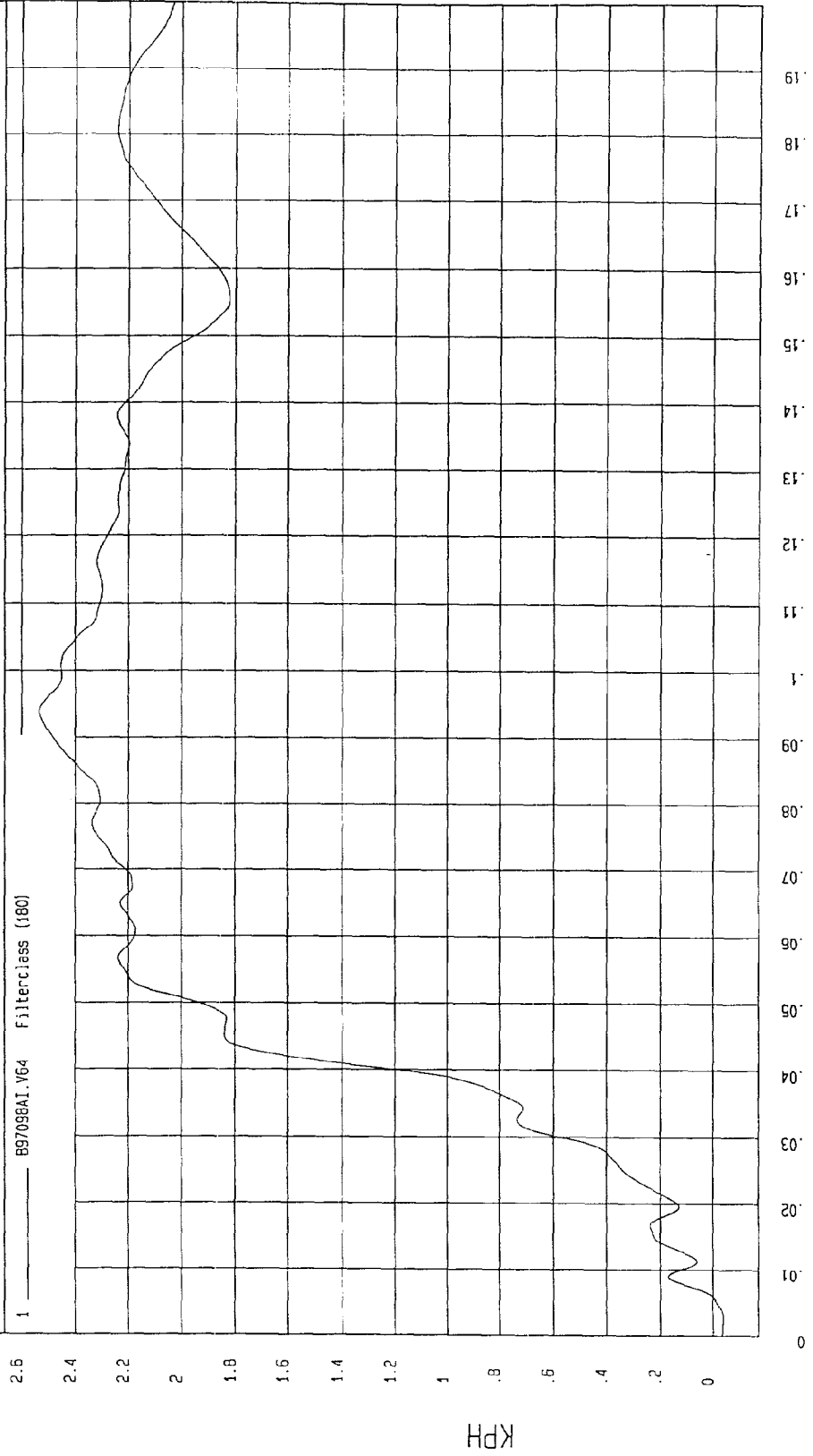


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

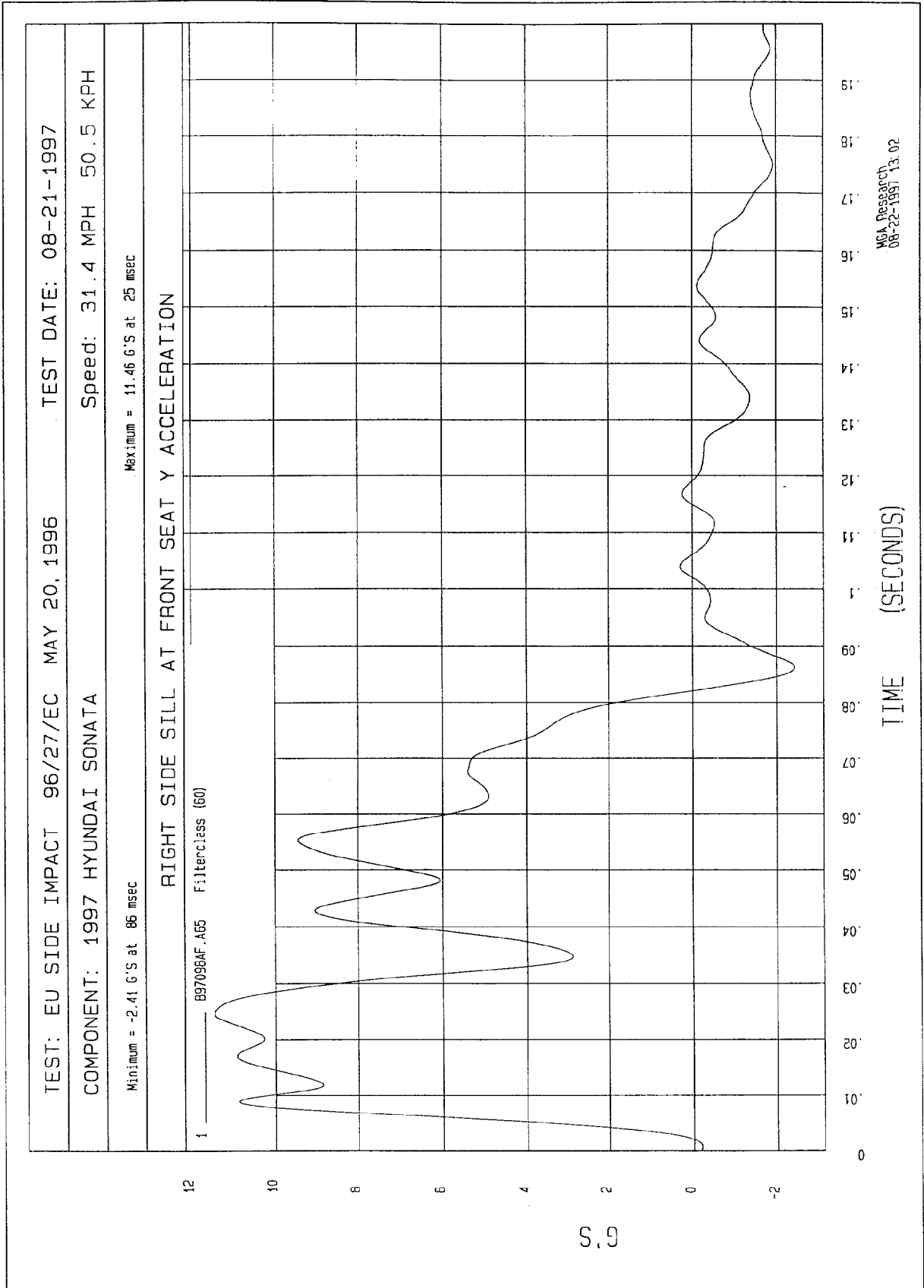
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -3.88E-02 KPH at 3 msec Maximum = 2.53 KPH at 94 msec

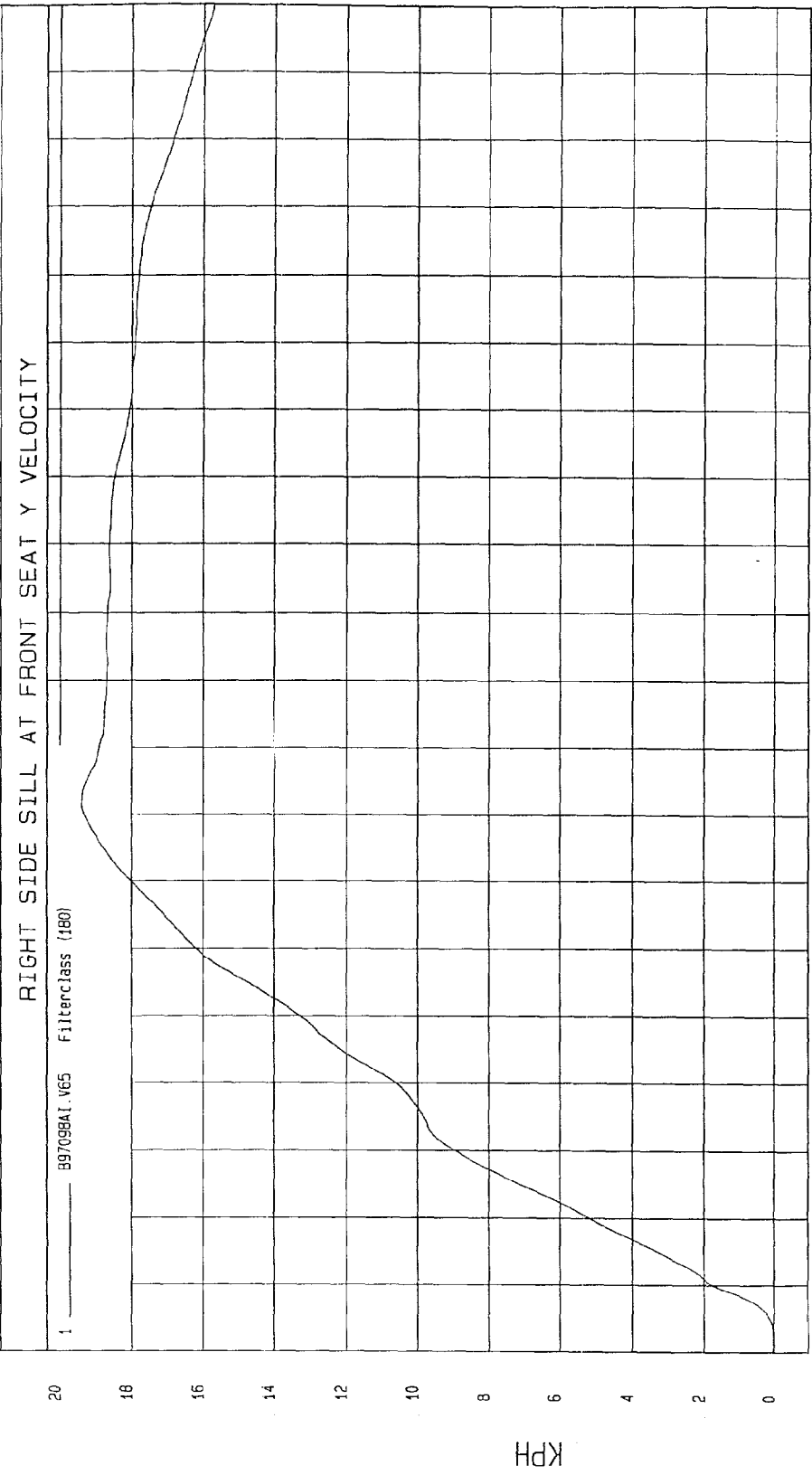
RIGHT SIDE SILL AT FRONT SEAT X VELOCITY



MGA Research
08-22-1997 13:02

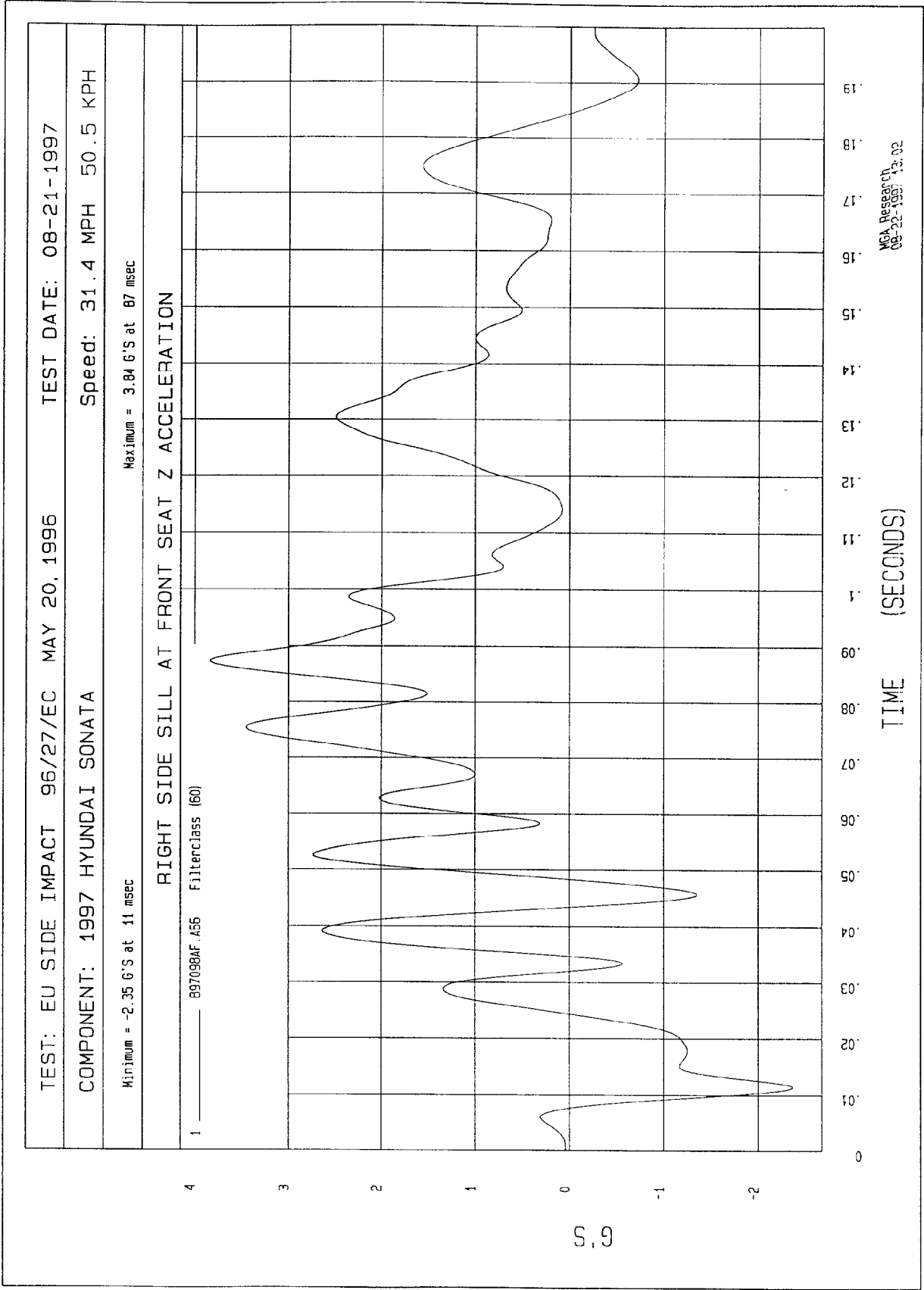


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = 0 KPH at -20 msec	Maximum = 19.40 KPH at 82 msec



TIME Seconds

NCA Research
08-22-1997 13:02

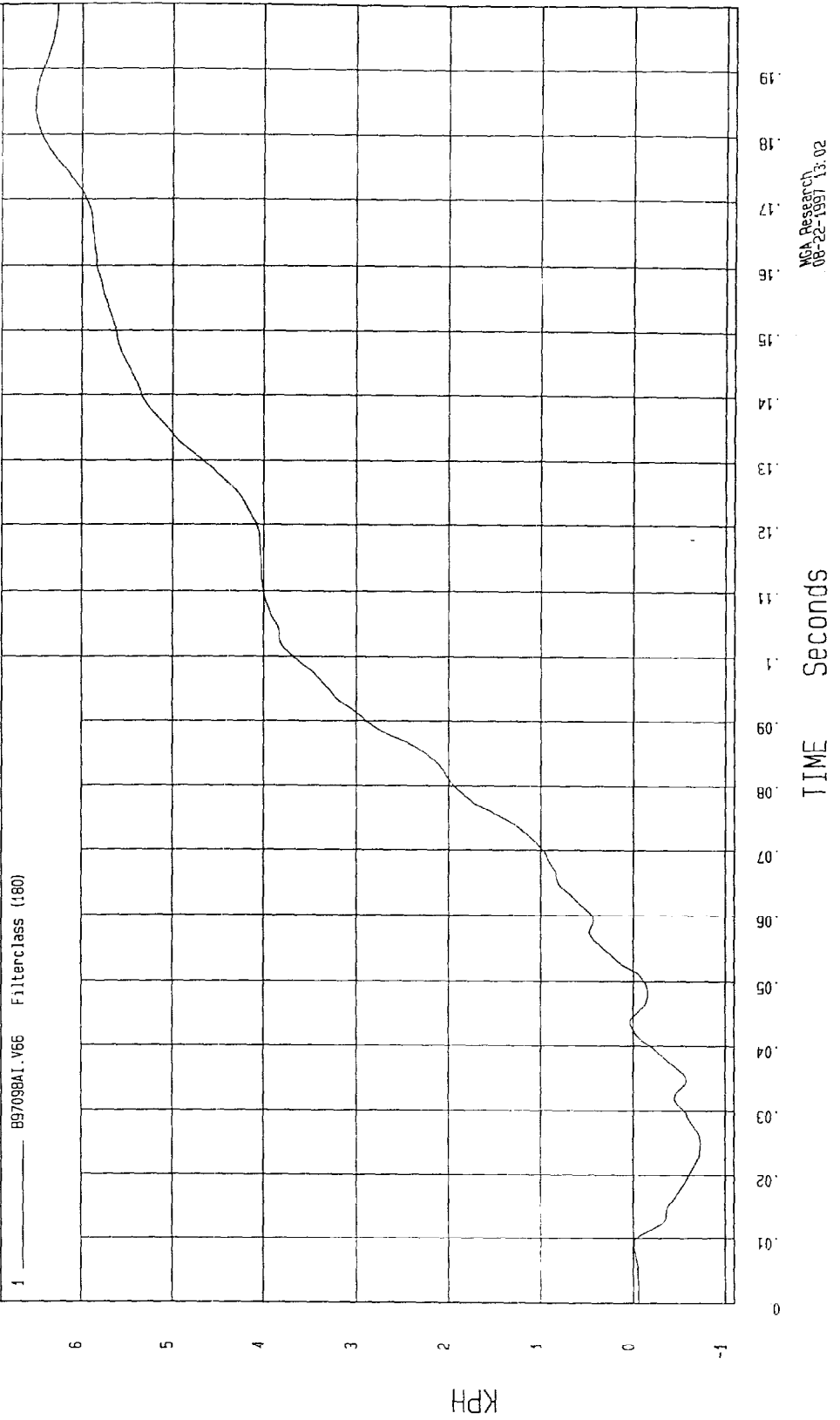


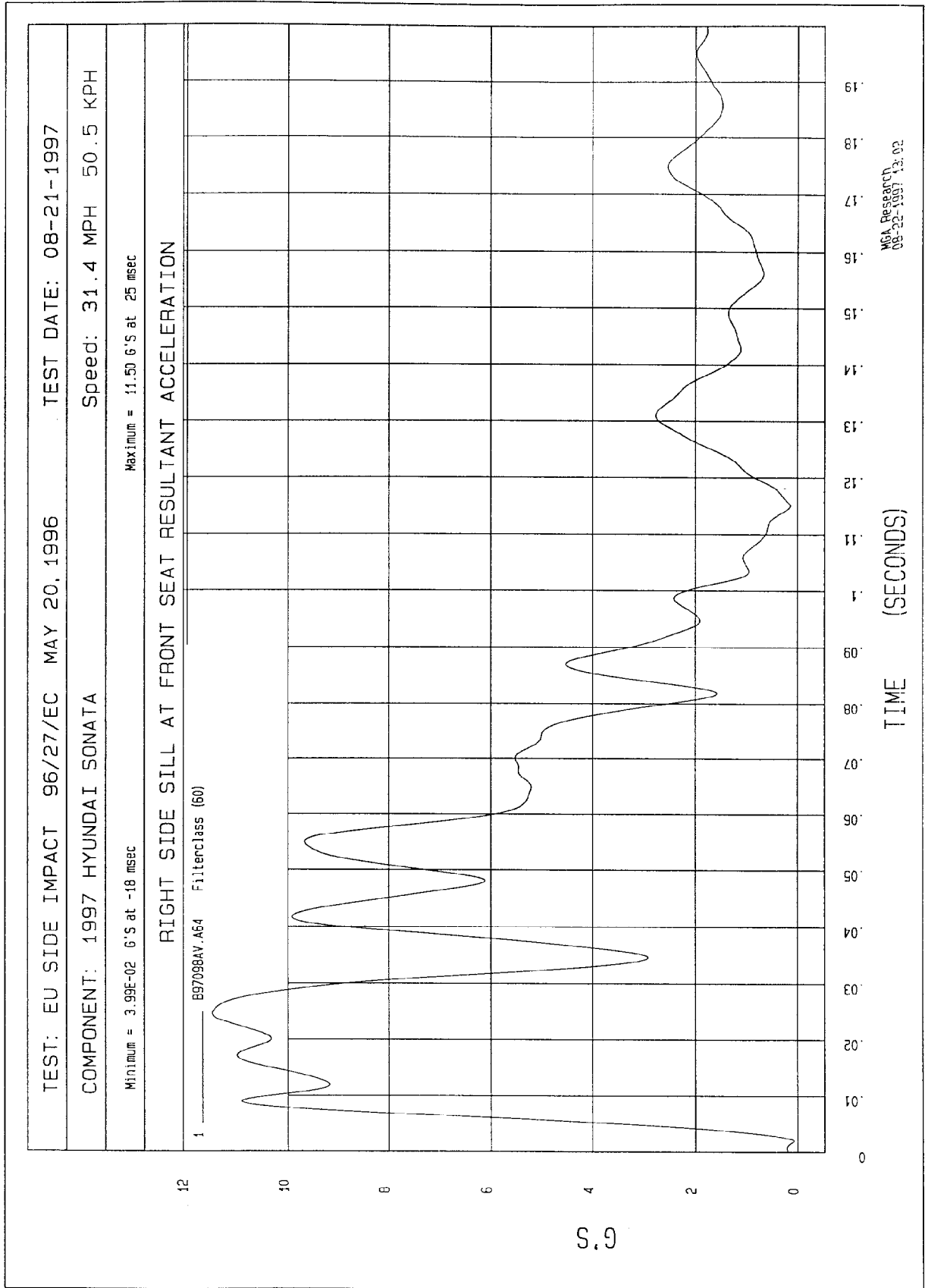
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.73 KPH at 25 msec Maximum = 6.49 KPH at 184 msec

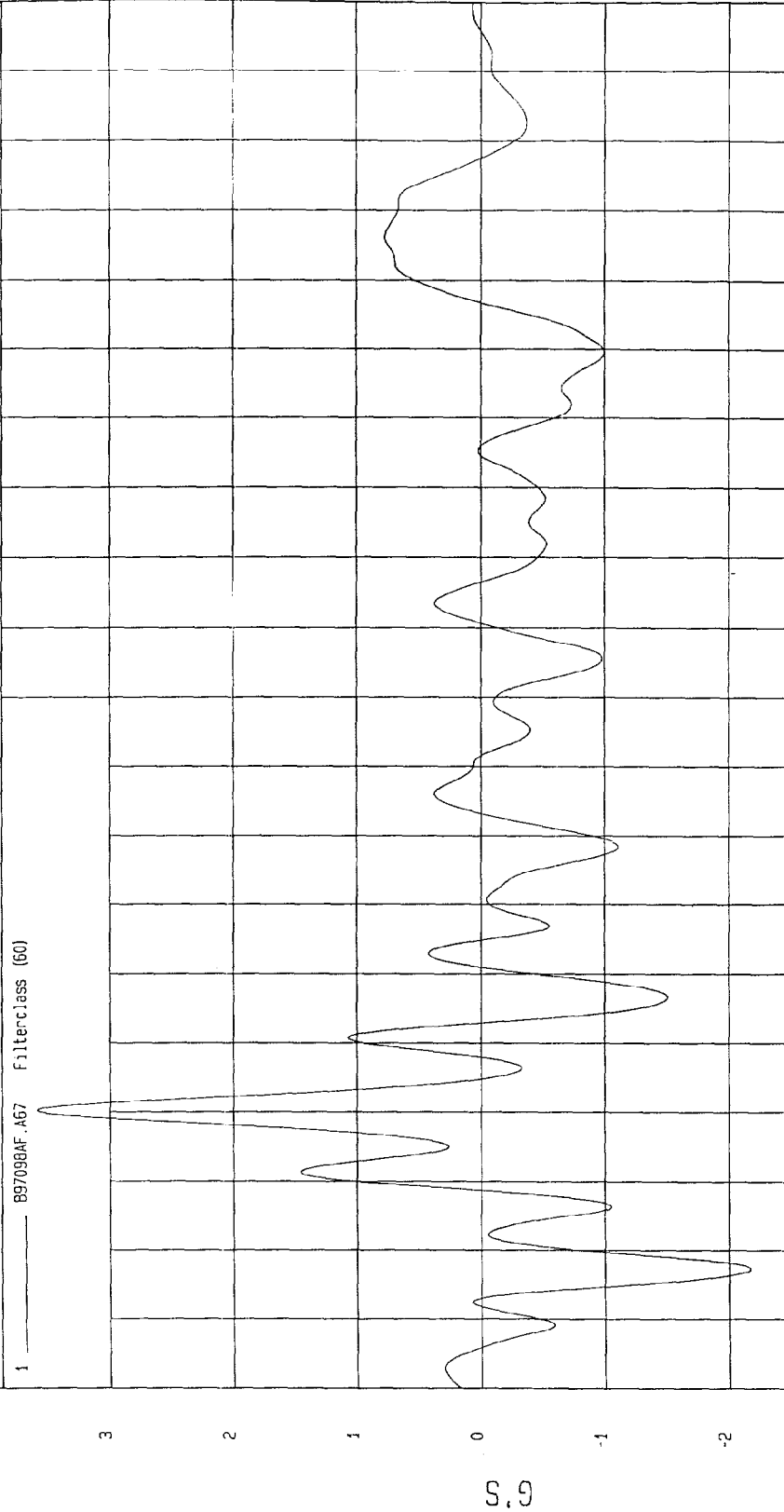
RIGHT SIDE SILL AT FRONT SEAT Z VELOCITY





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -2.17 G'S at 17 msec	
Maximum = 3.58 G'S at 40 msec	

RIGHT SIDE SILL AT REAR SEAT X ACCELERATION



MOA Research
08-22-1997 13:02

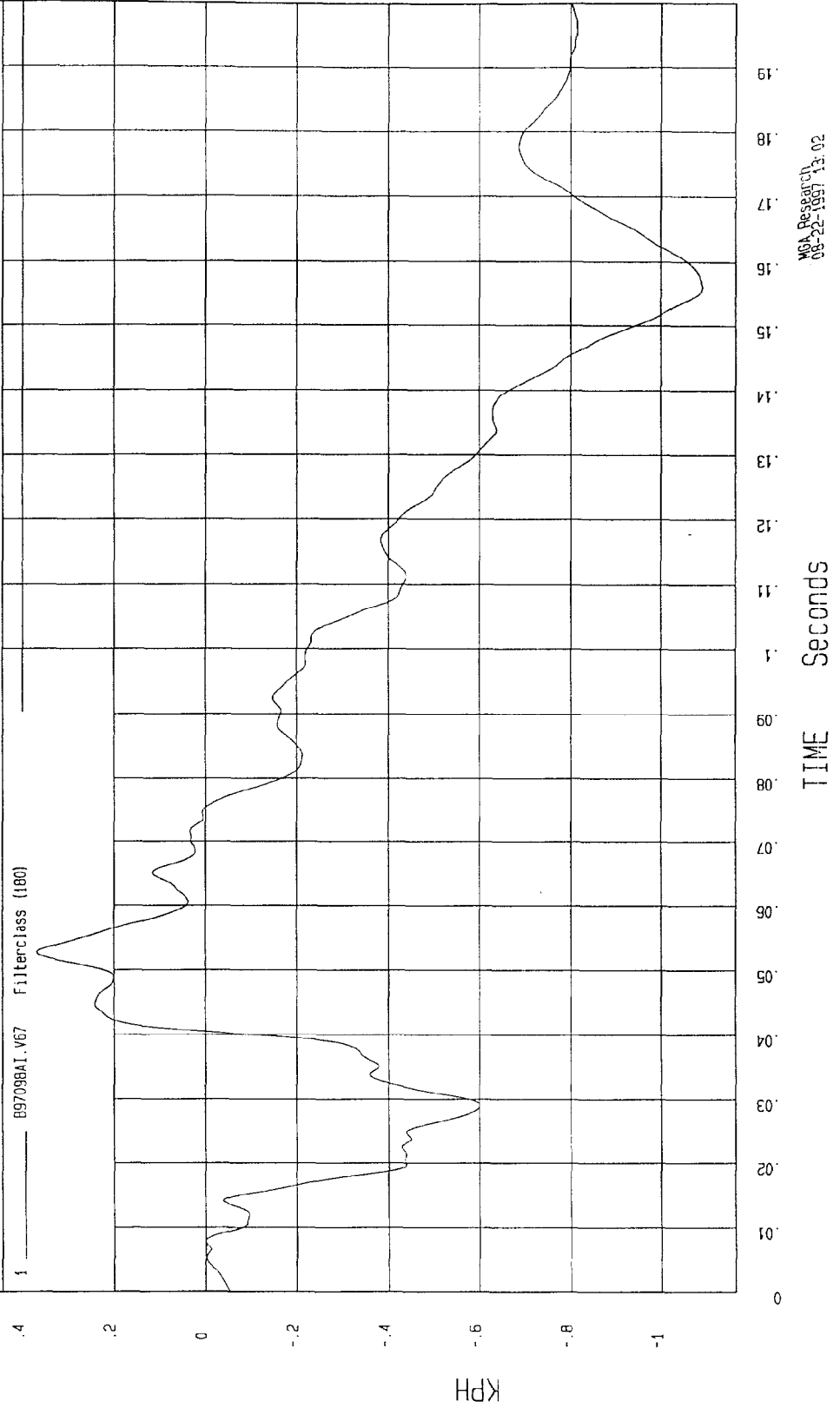
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.08 KPH at 156 msec

Maximum = .37 KPH at 53 msec

RIGHT SIDE SILL AT REAR SEAT X VELOCITY

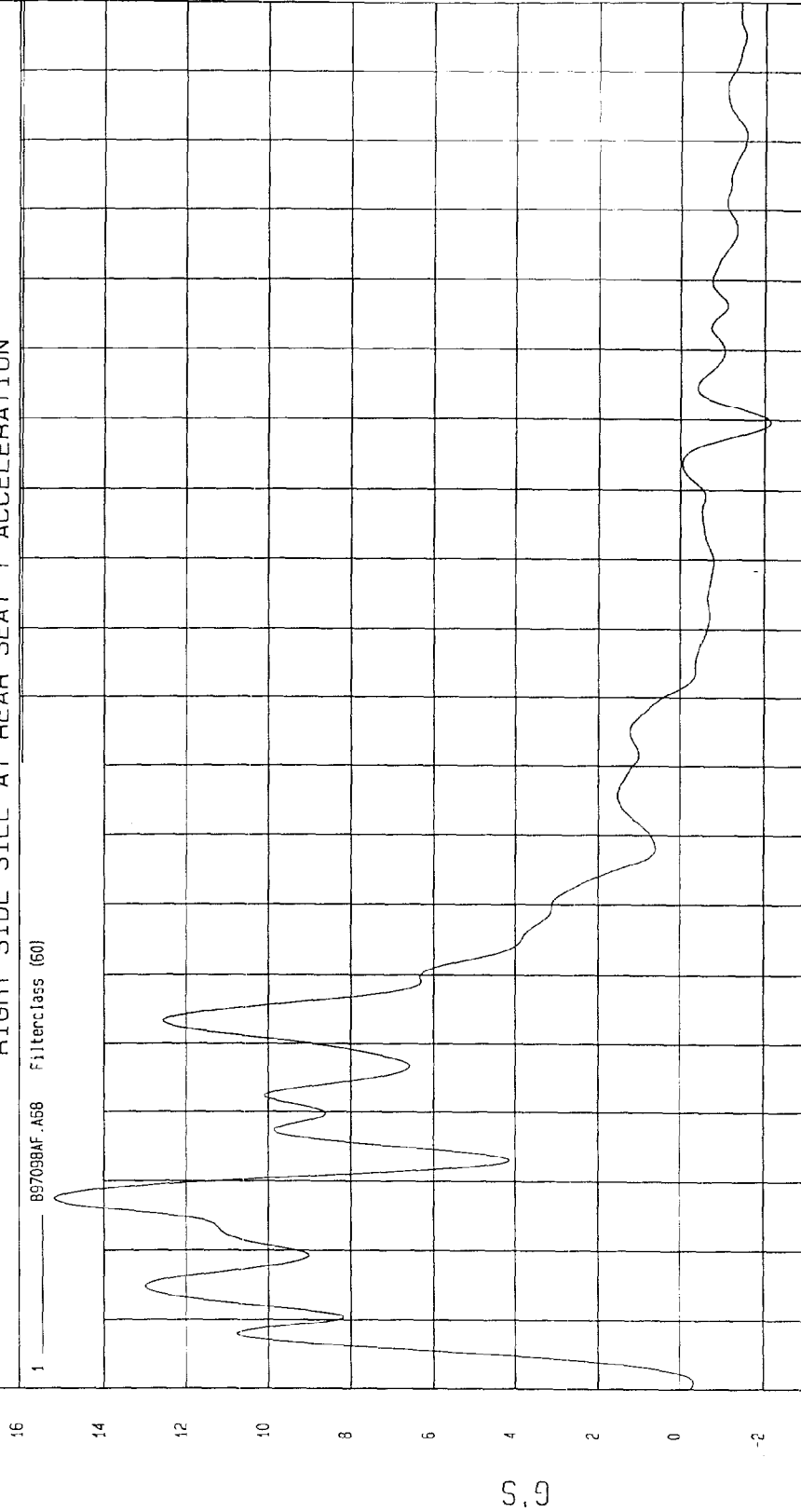


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.14 G's at 140 msec Maximum = 15.20 G's at 28 msec

RIGHT SIDE SILL AT REAR SEAT Y ACCELERATION



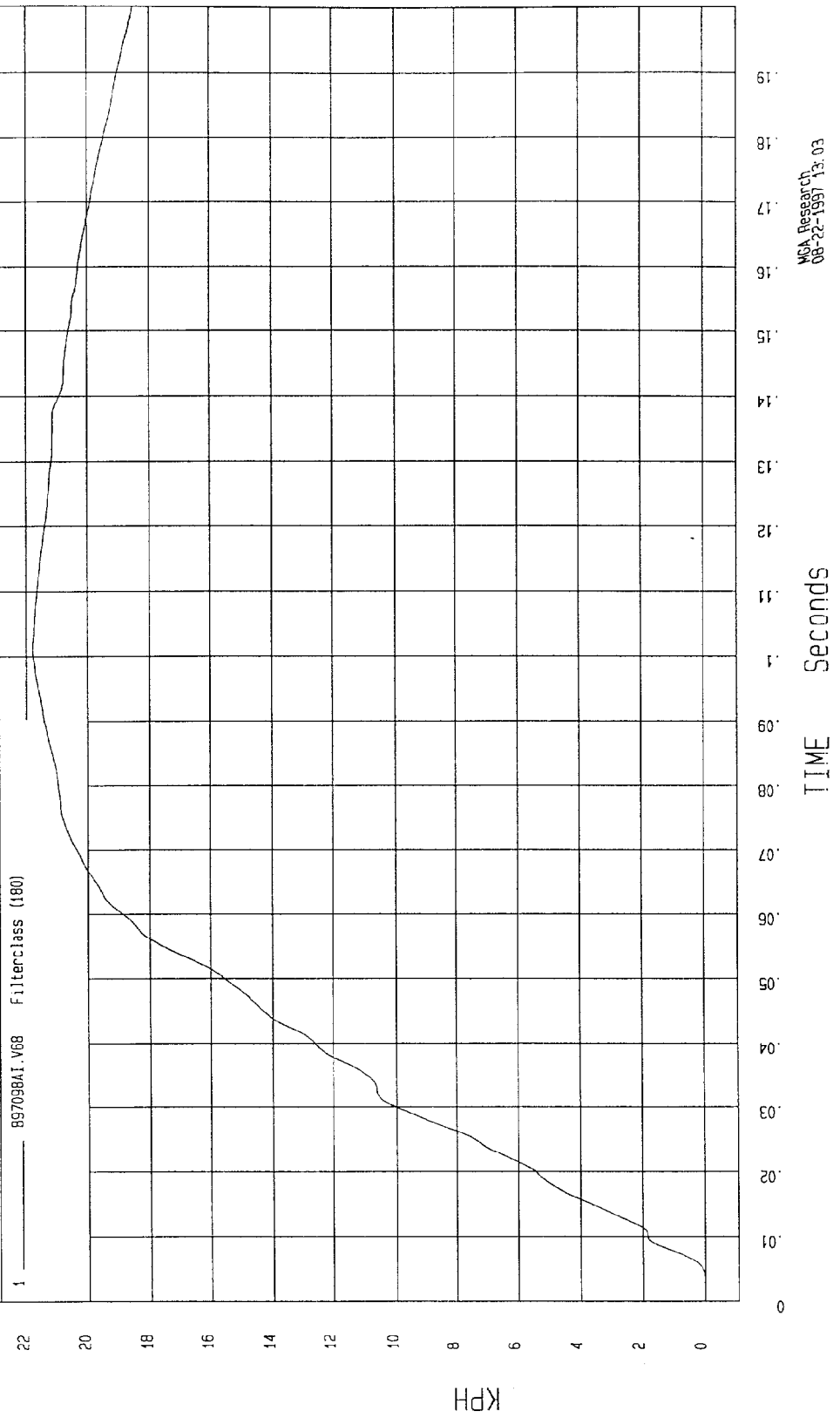
MGA Research
08-22-1997 13:02

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

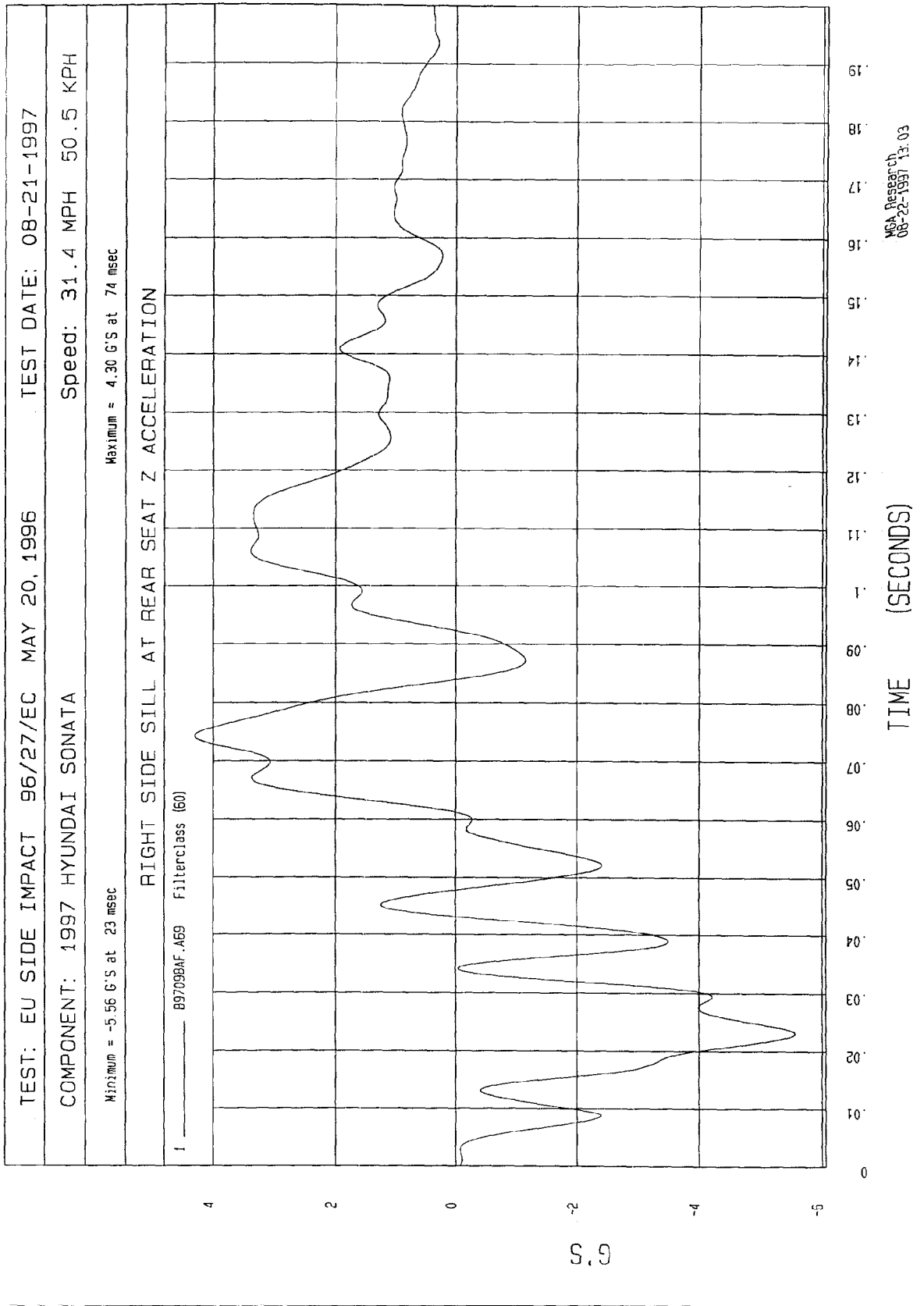
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.92E-03 KPH at -9 msec Maximum = 21.78 KPH at 101 msec

RIGHT SIDE SILL AT REAR SEAT Y VELOCITY



MCA Research
08-22-1997 13:03



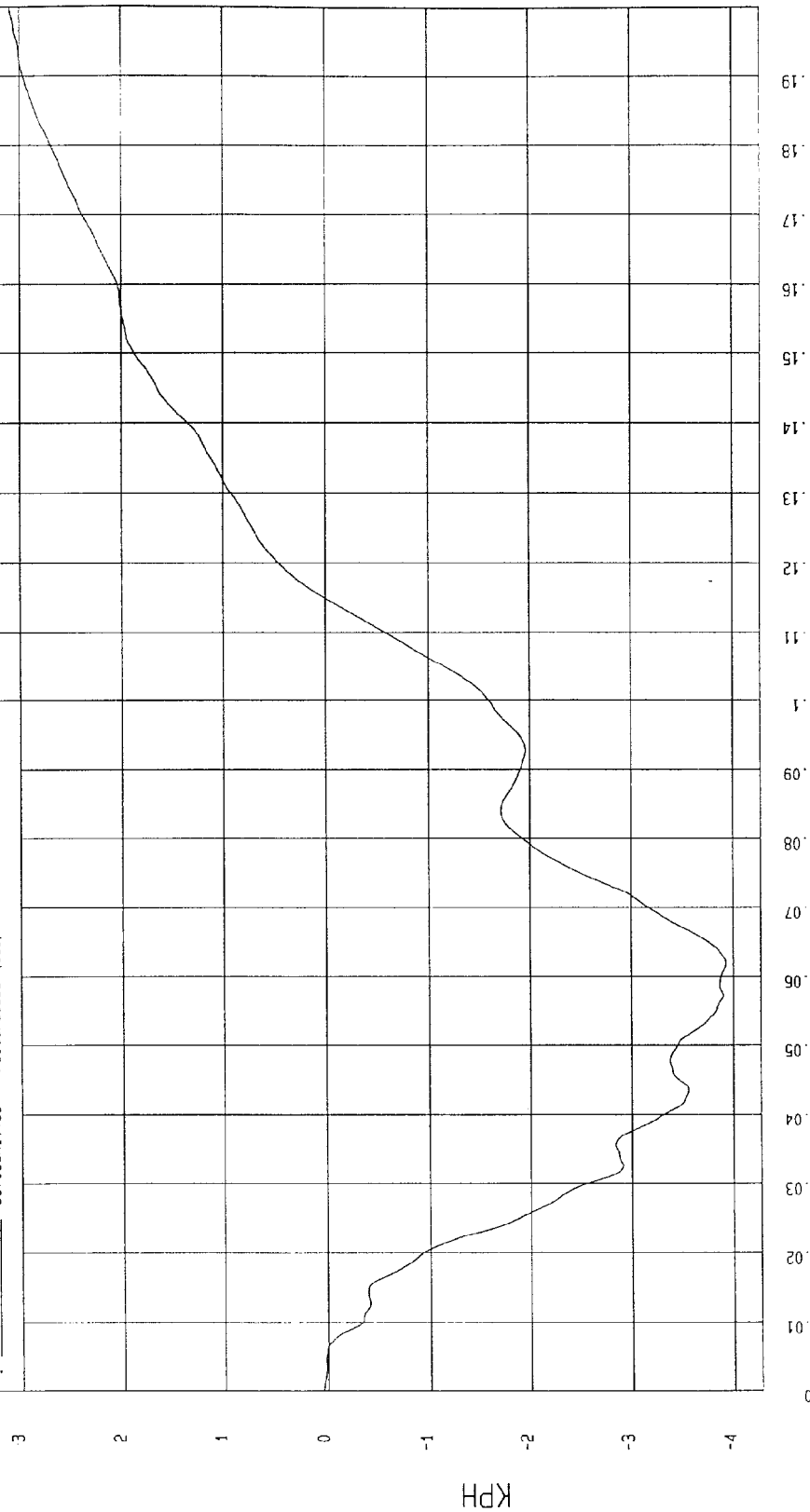
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -3.92 KPH at 62 msec Maximum = 3.09 KPH at 200 msec

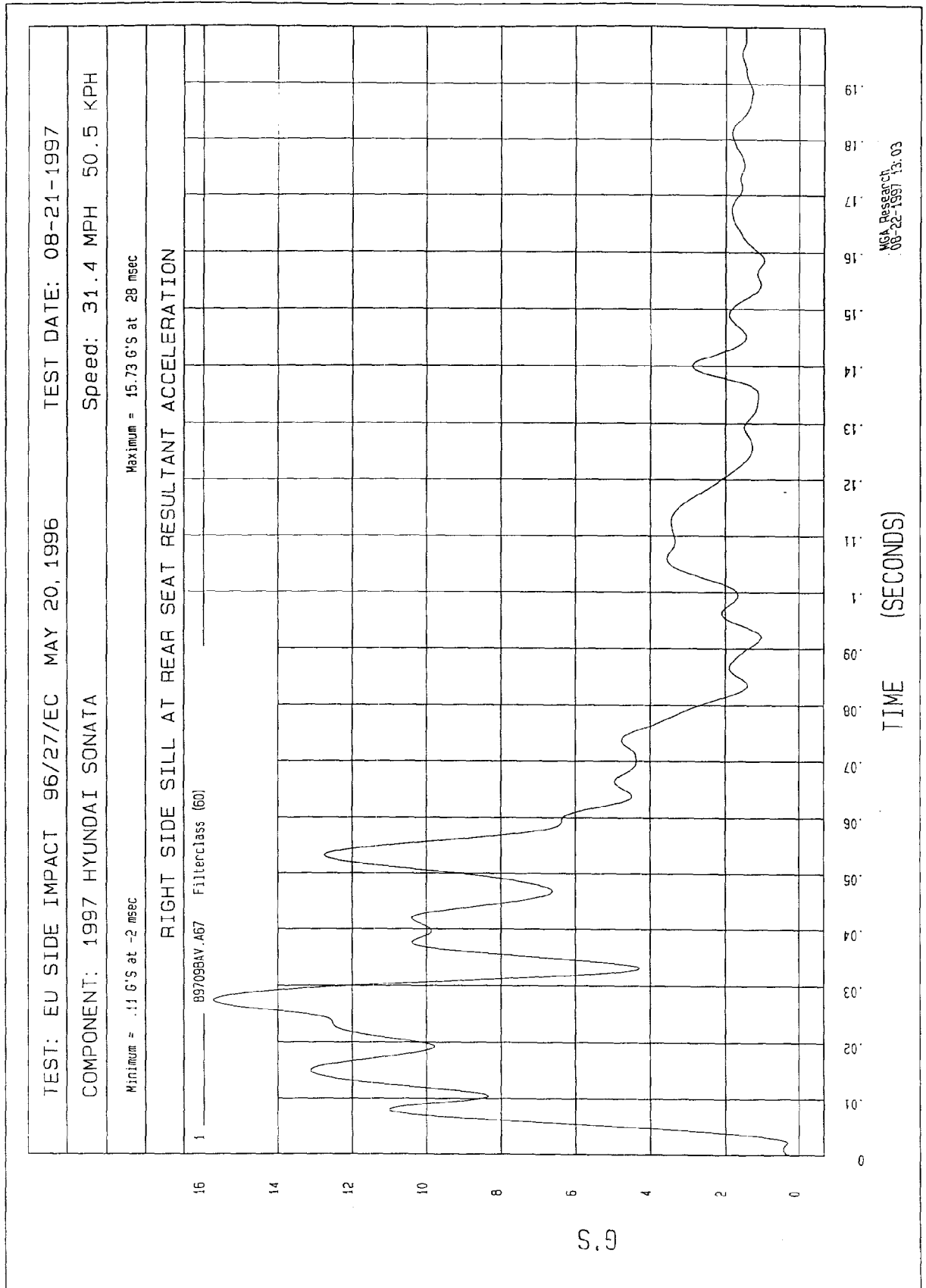
RIGHT SIDE SILL AT REAR SEAT Z VELOCITY

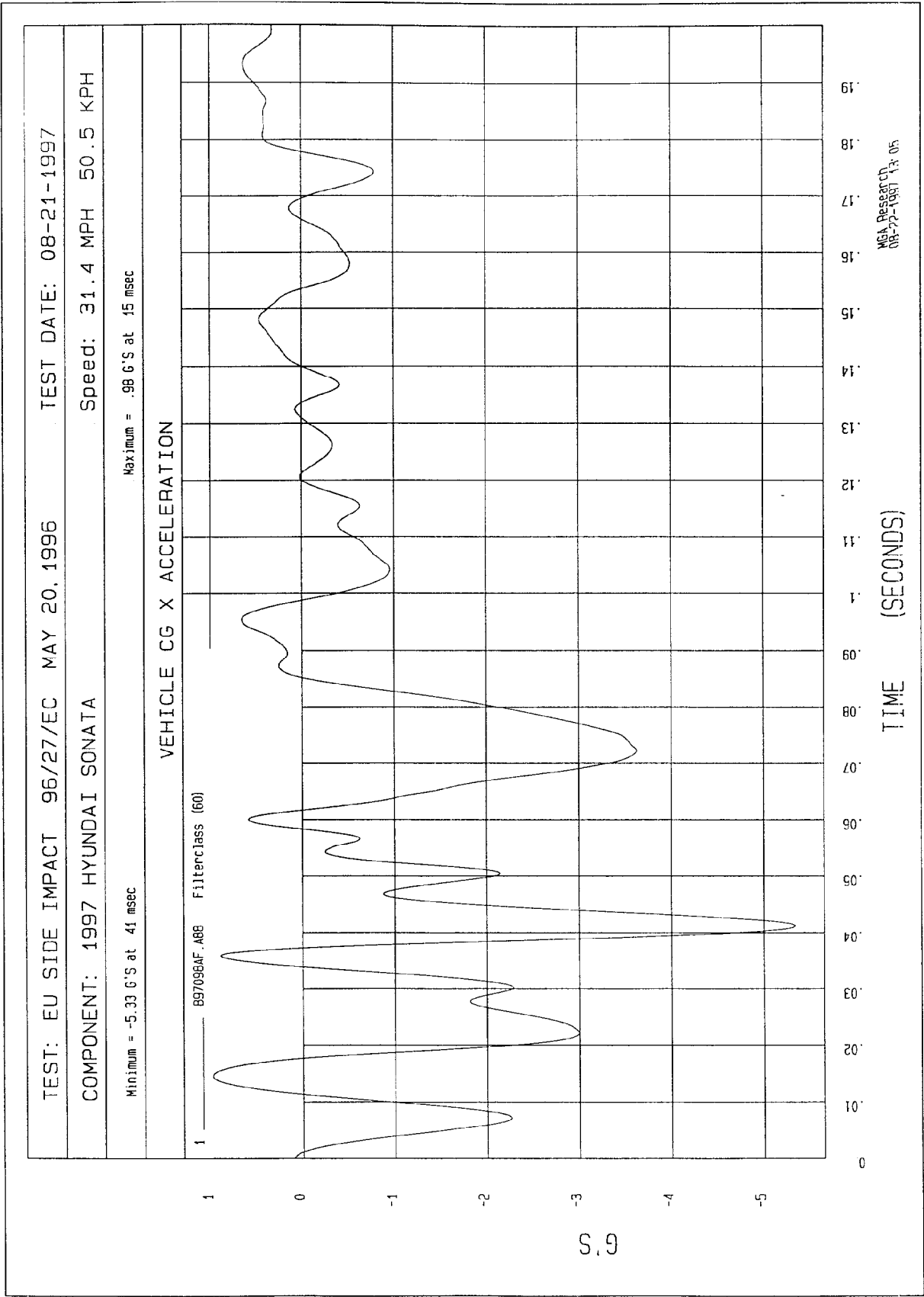
1 ——— B9709BA1.V59 Filterclass (180)



MCA Research
08-21-1997 13:03

TIME Seconds



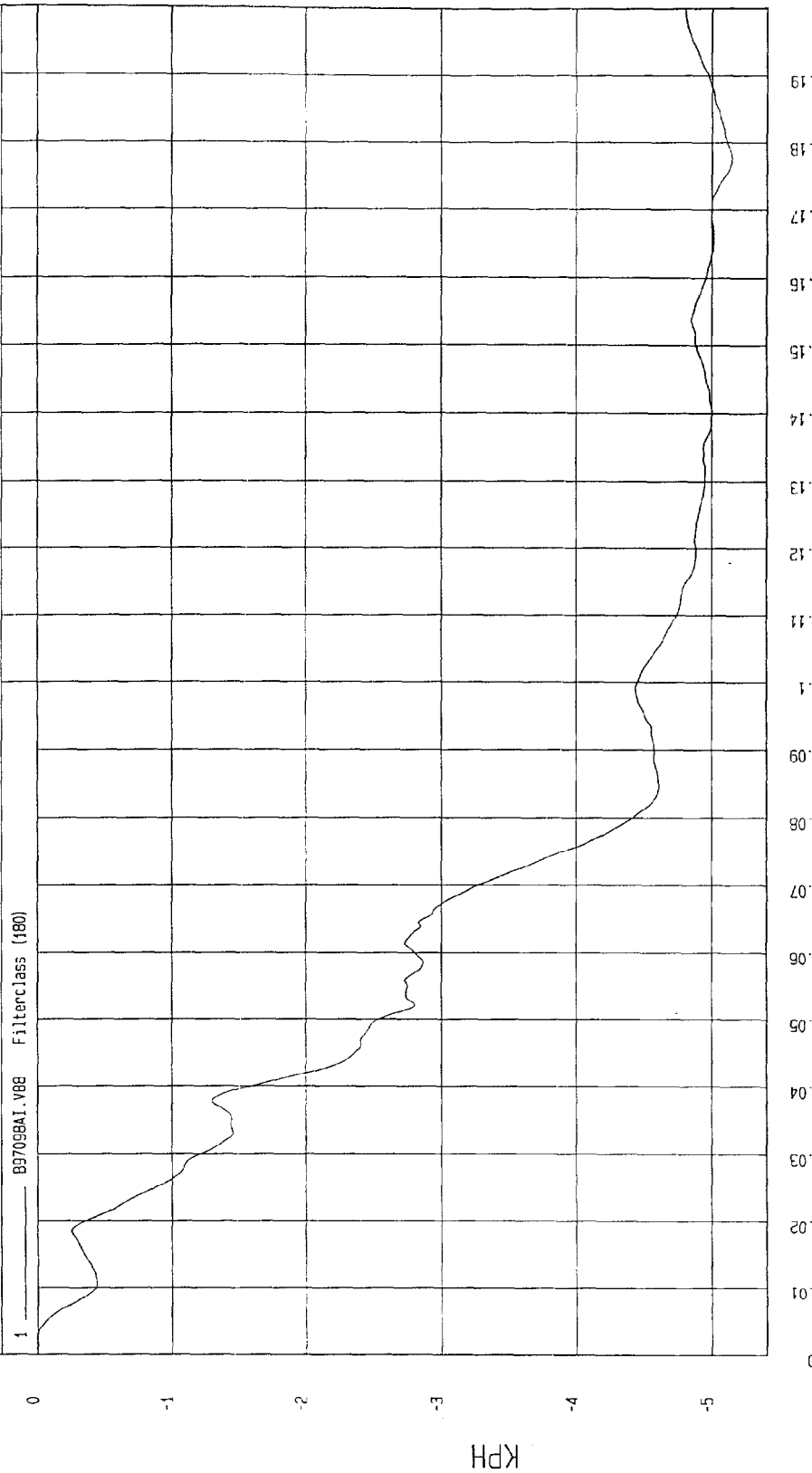


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

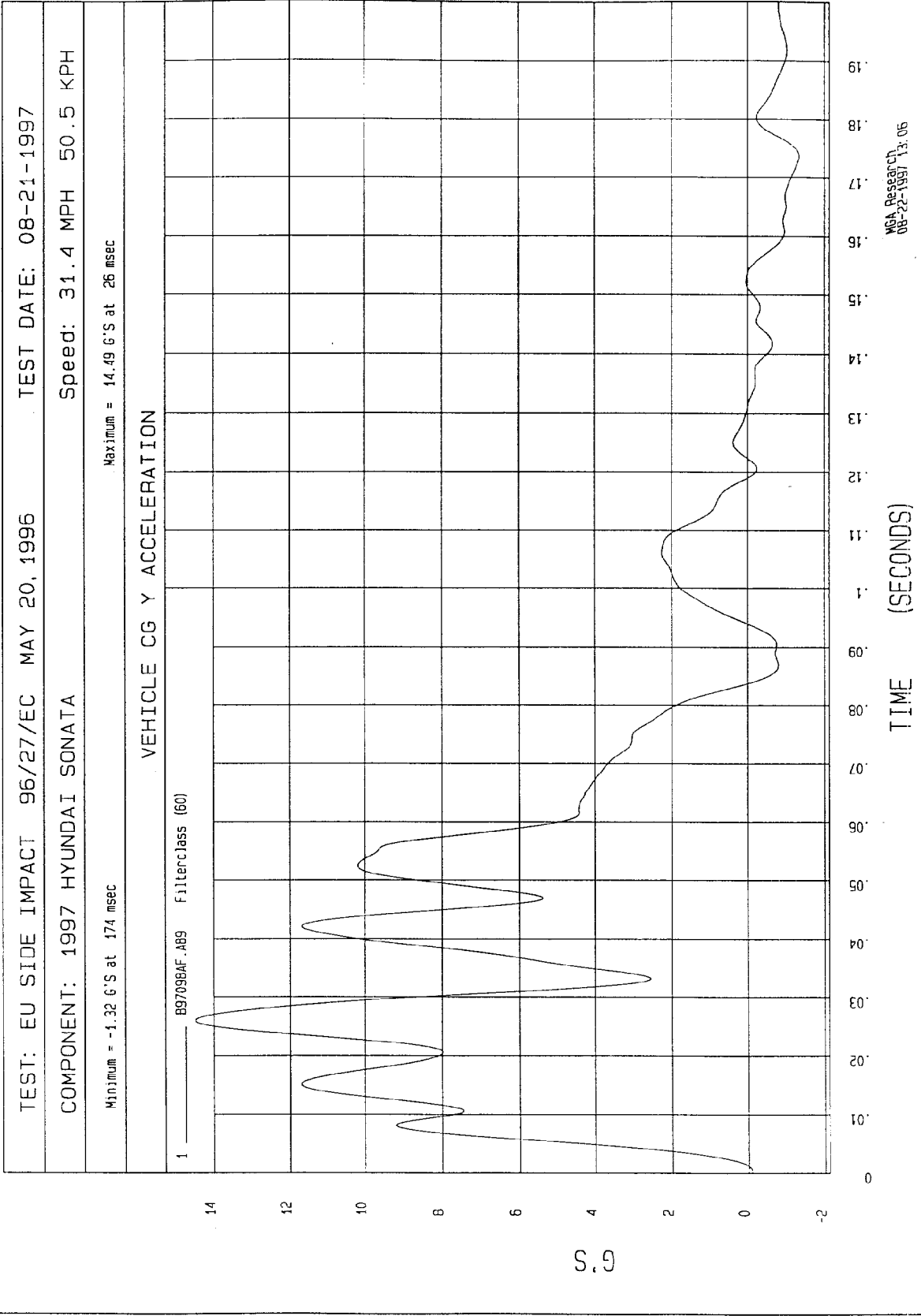
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -5.14 KPH at 178 msec Maximum = 8.56E-03 KPH at 2 msec

VEHICLE CG X VELOCITY



MSA Research
08-22-1997 13:06

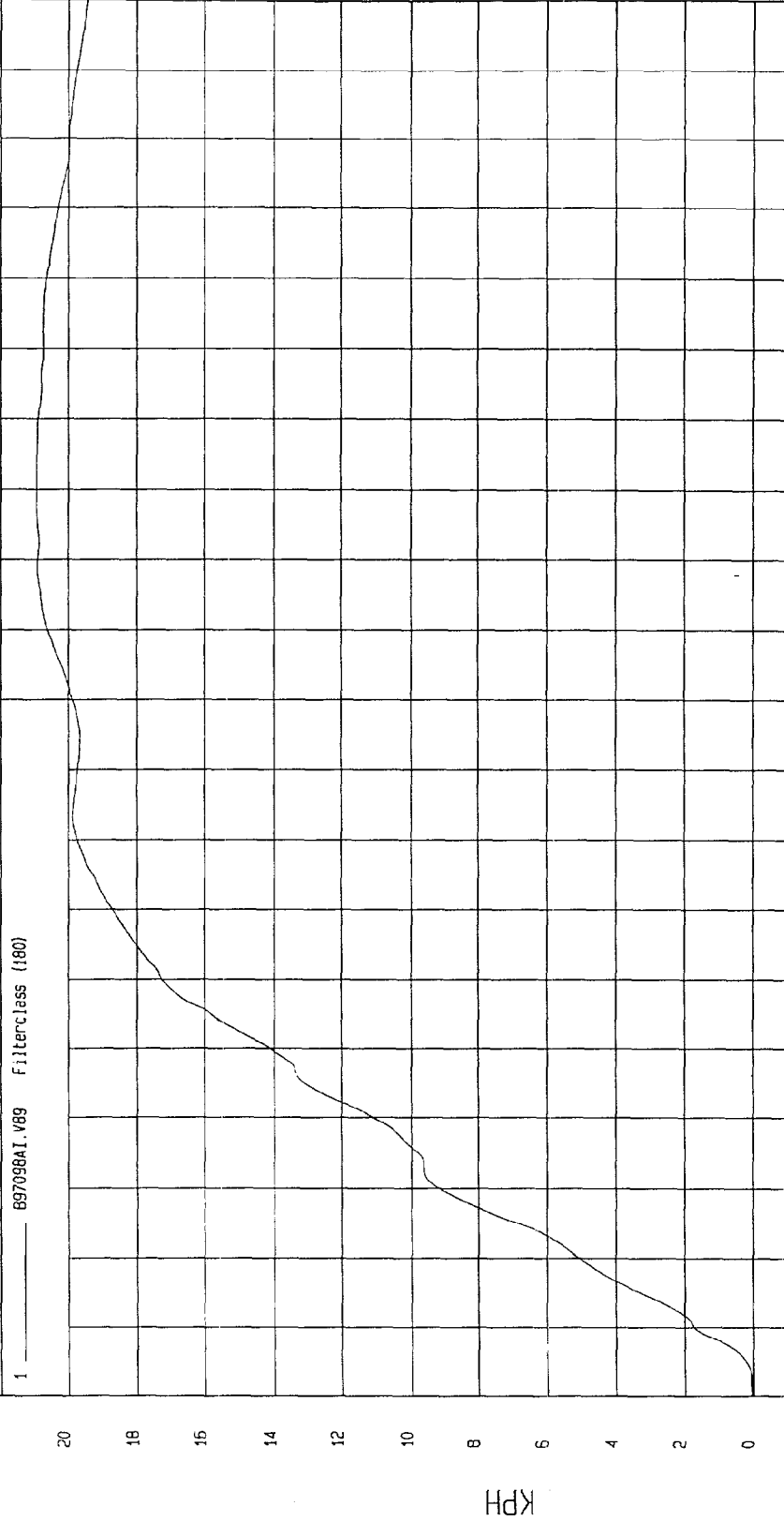


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

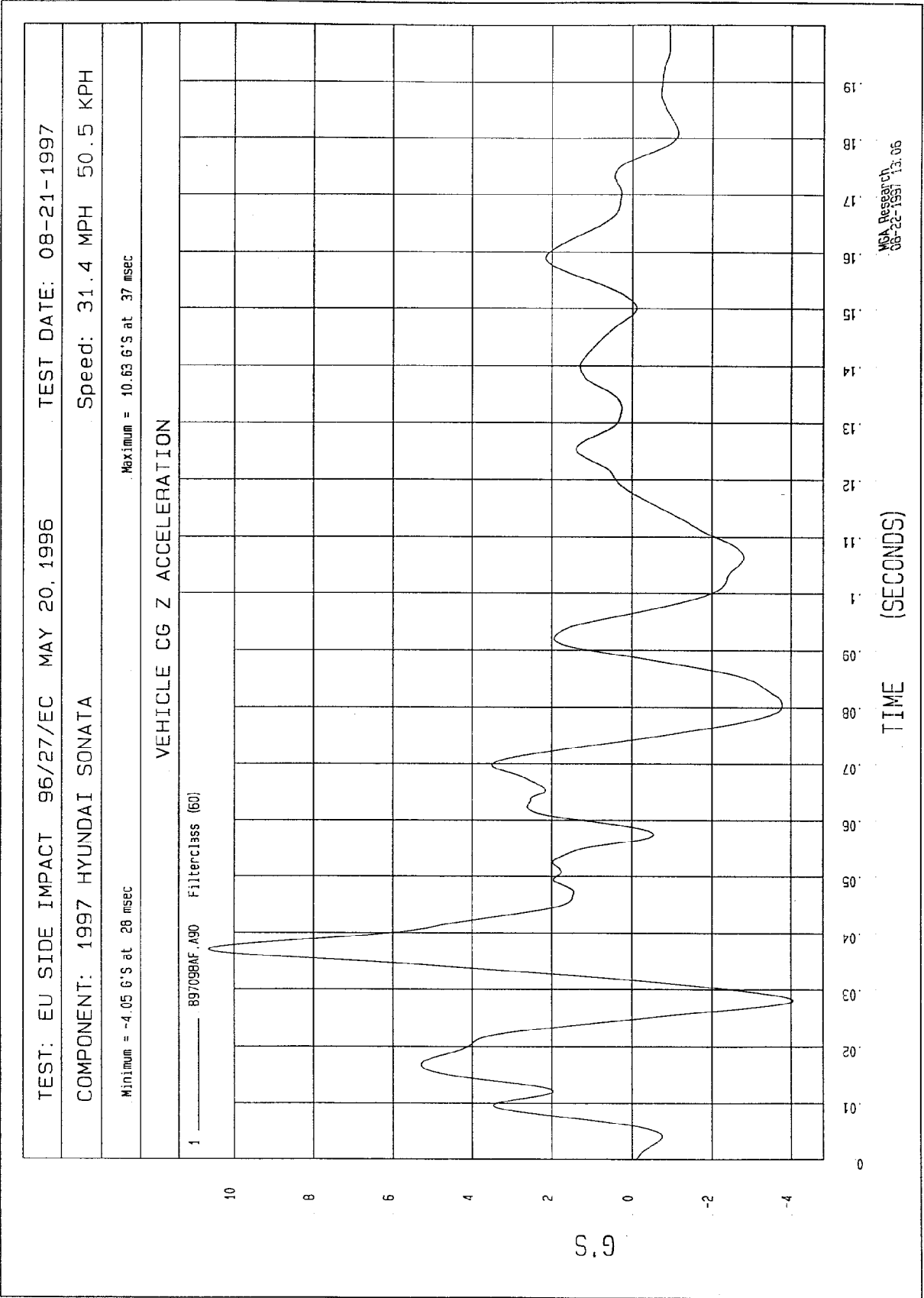
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 0 KPH at -20 msec Maximum = 20.93 KPH at 132 msec

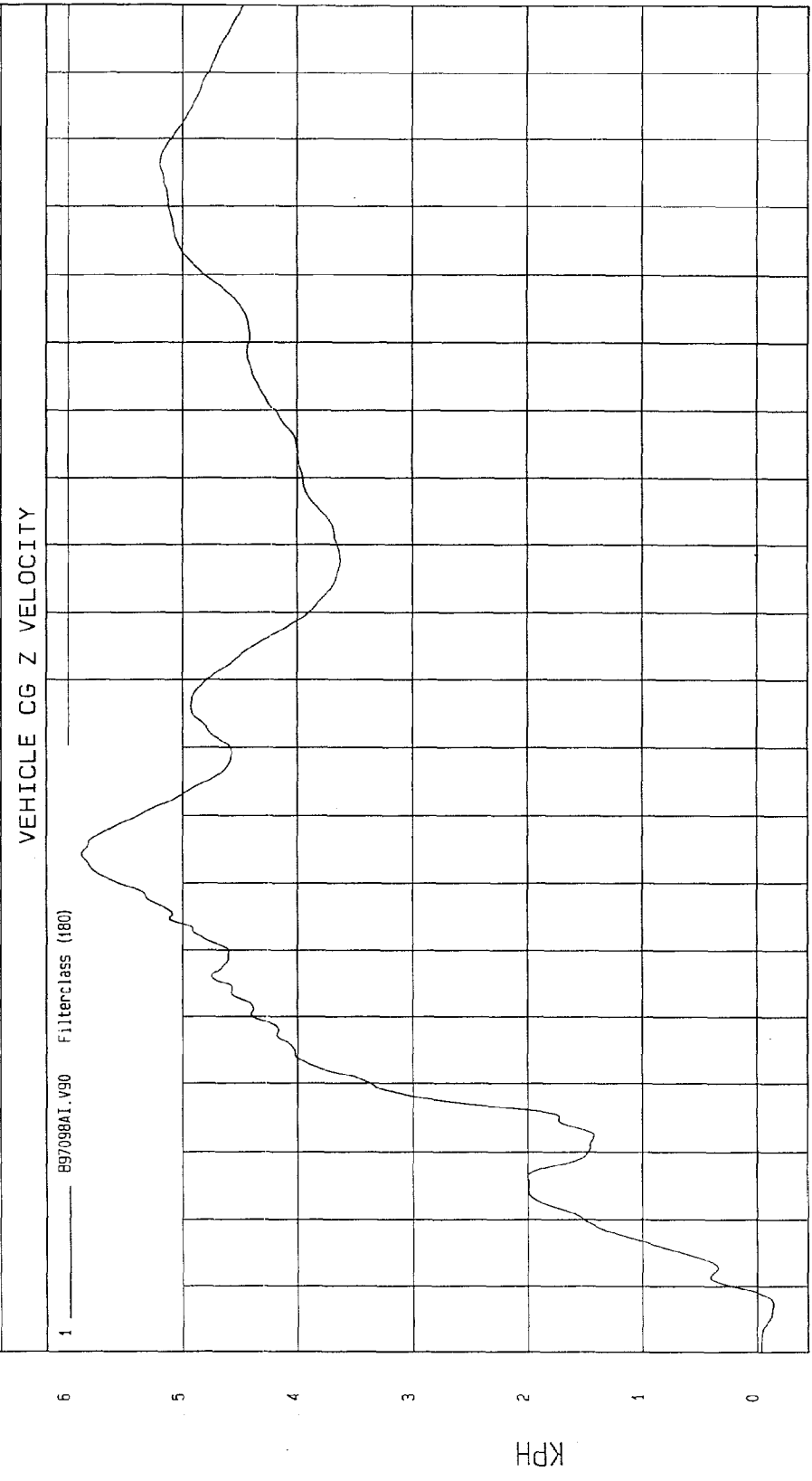
VEHICLE CG Y VELOCITY



NSA Research
08-22-1997 13:06



TEST: EU SIDE IMPACT 96/27/EC	MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA		Speed: 31.4 MPH 50.5 KPH
Minimum = -14 KPH at 7 msec		Maximum = 5.88 KPH at 74 msec



TIME Seconds

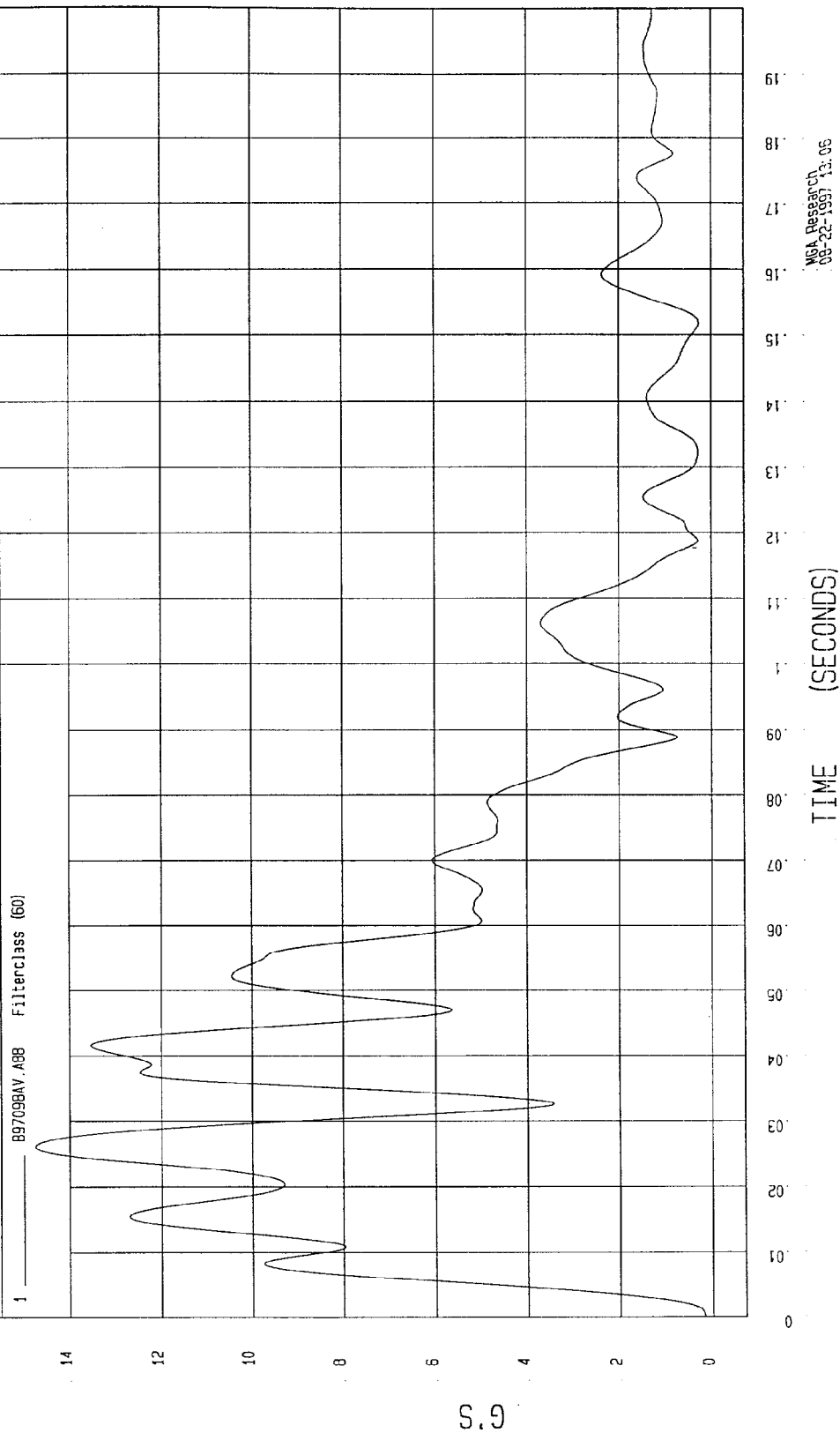
MCA Research
08-22-1997 13:06

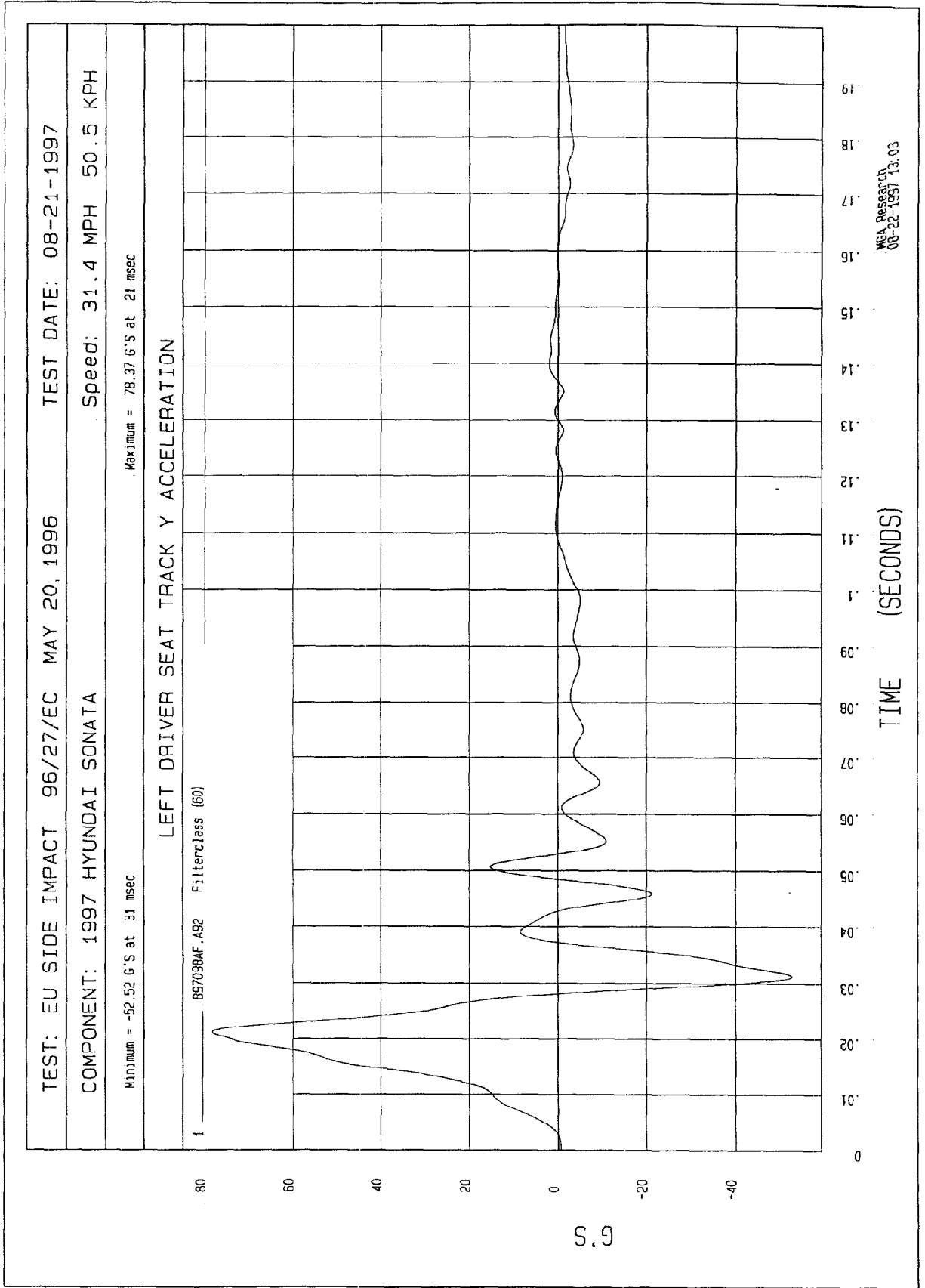
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 3.13E-02 G's at -14 msec Maximum = 14.76 G's at 26 msec

VEHICLE CG RESULTANT ACCELERATION



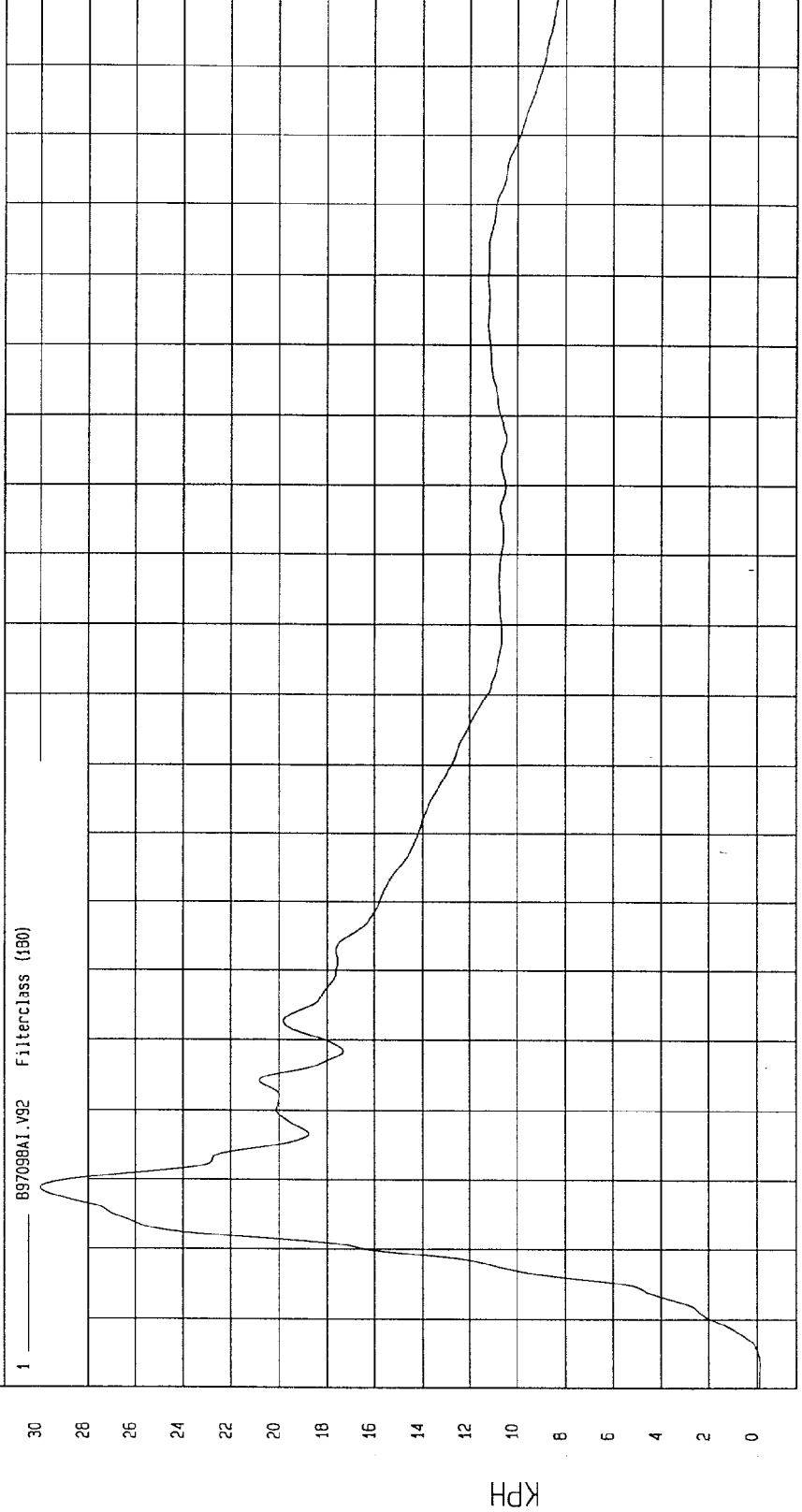


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

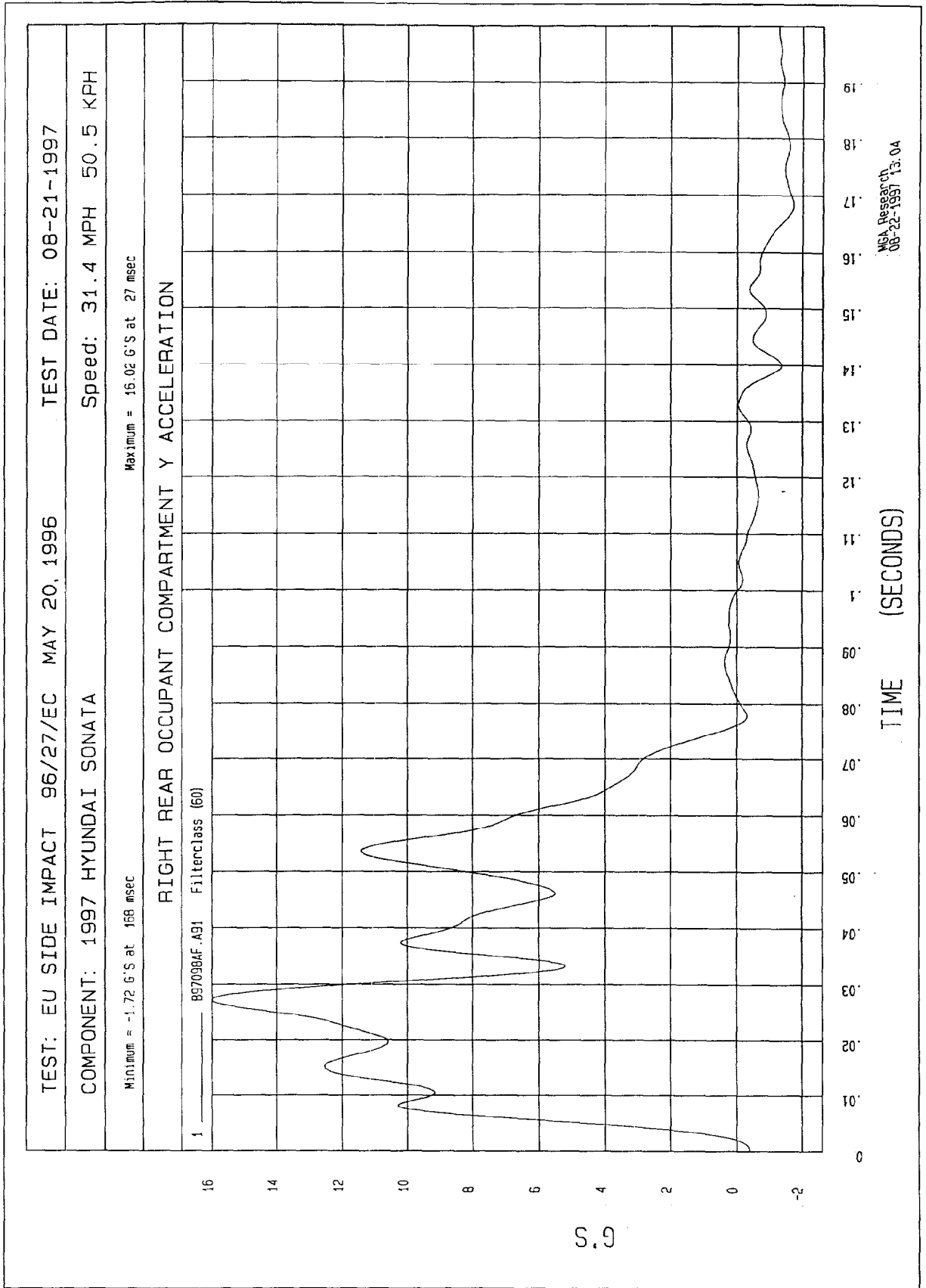
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.11 KPH at 3 msec Maximum = 30.00 KPH at 29 msec

LEFT DRIVER SEAT TRACK Y VELOCITY



MOA Research
08-22-1997 13:03

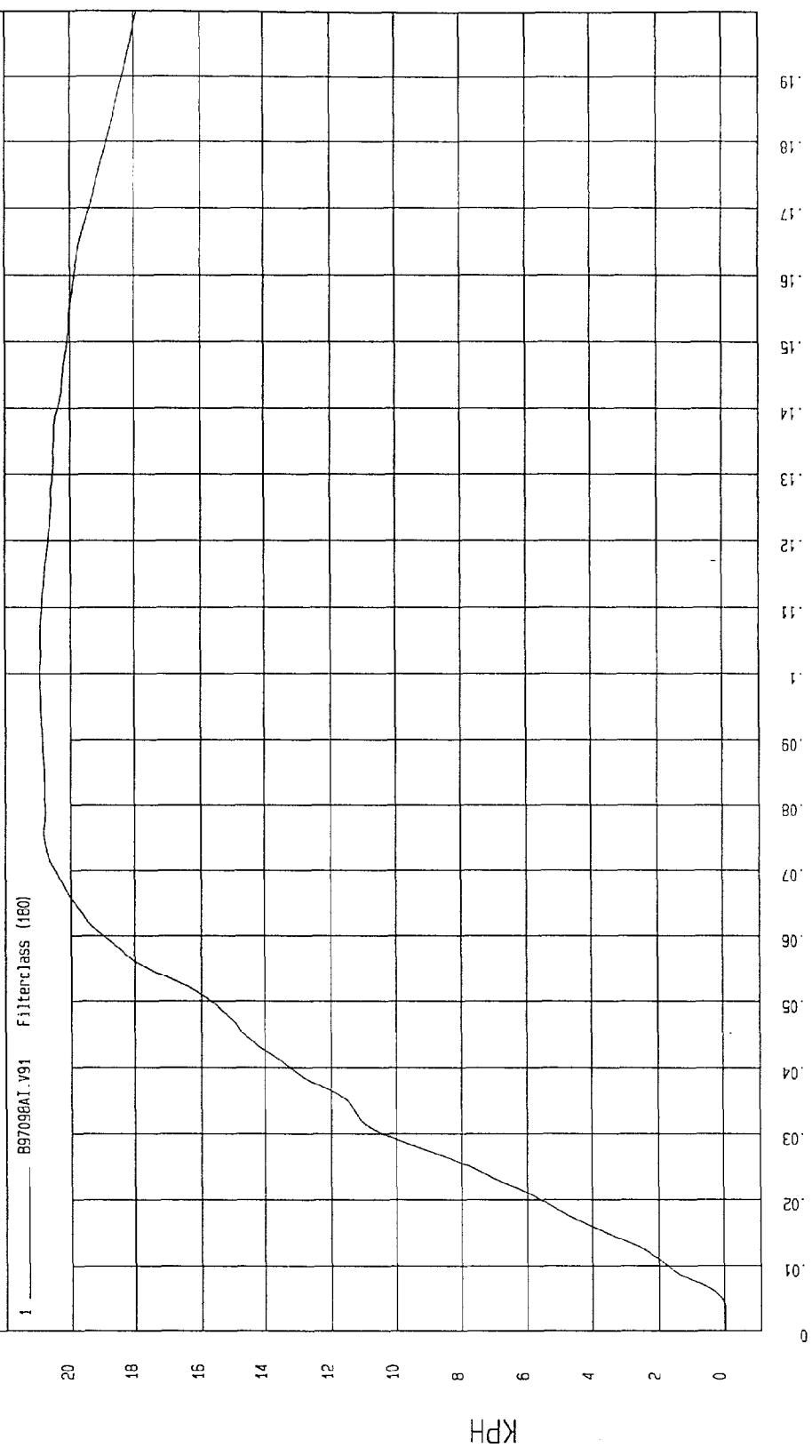


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -4.38E-02 KPH at 3 msec Maximum = 20.93 KPH at 100 msec

RIGHT REAR OCCUPANT COMPARTMENT Y VELOCITY



MCA Research
08-22-1997 13.04

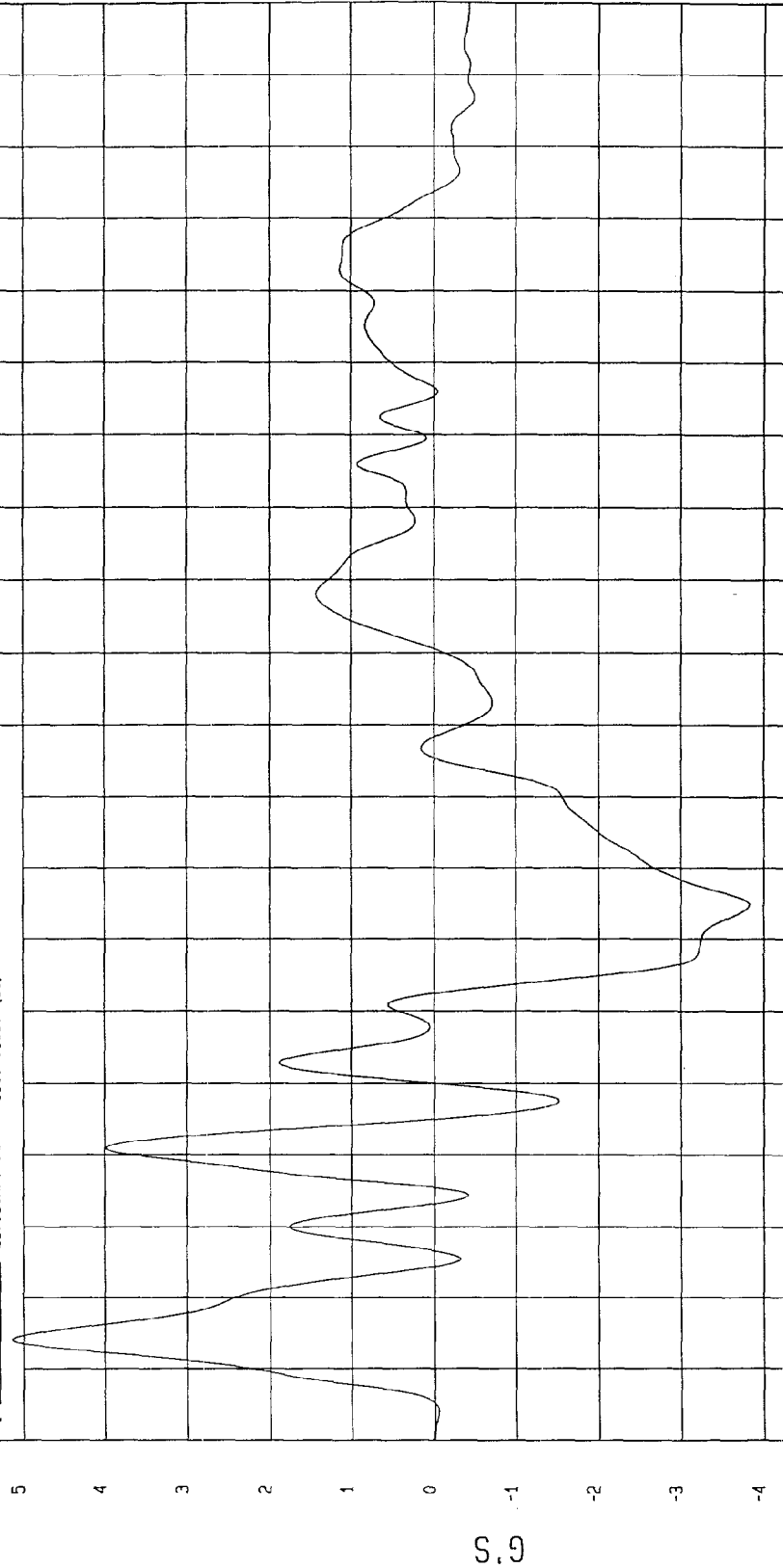
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

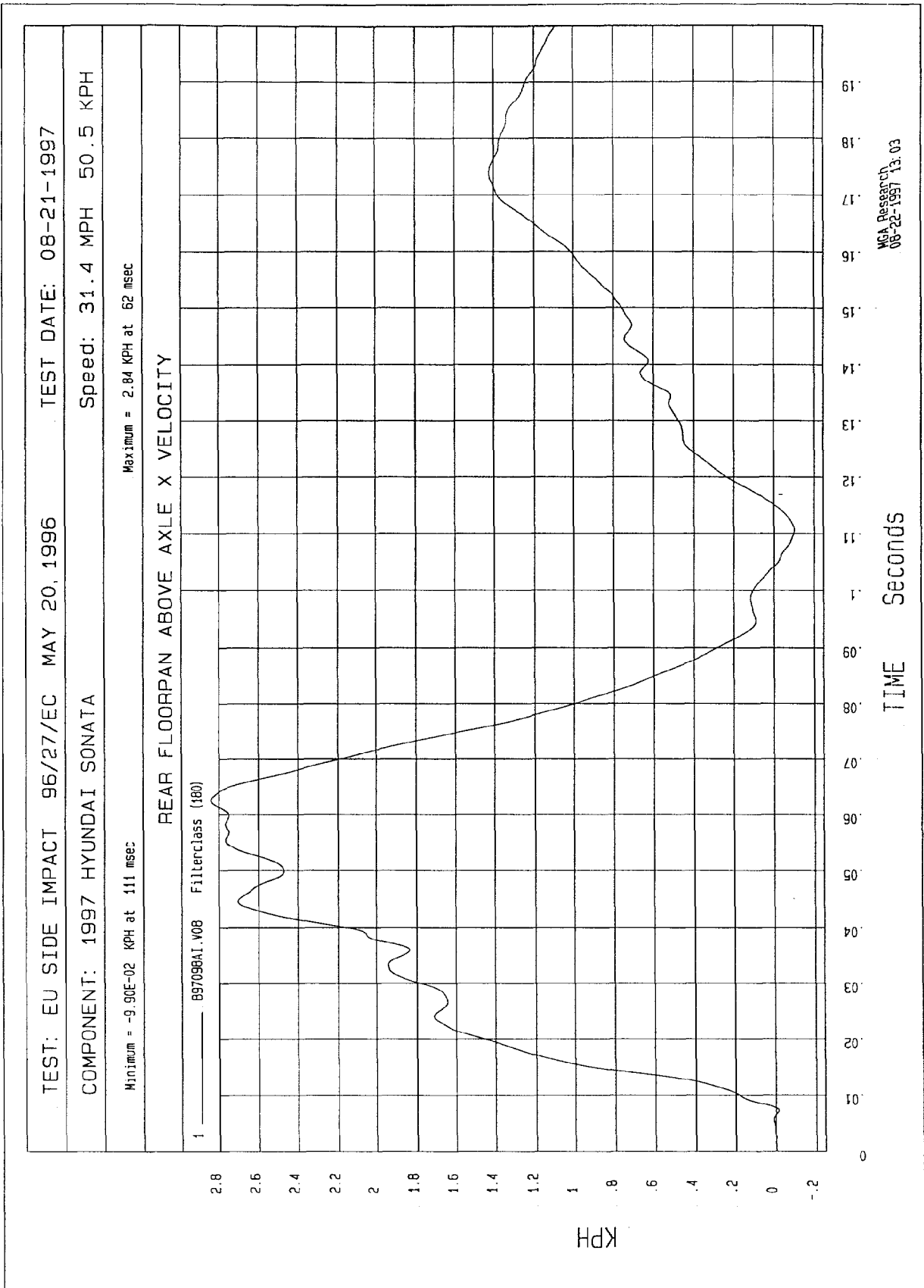
Minimum = -3.83 G'S at 75 msec Maximum = 5.14 G'S at 14 msec

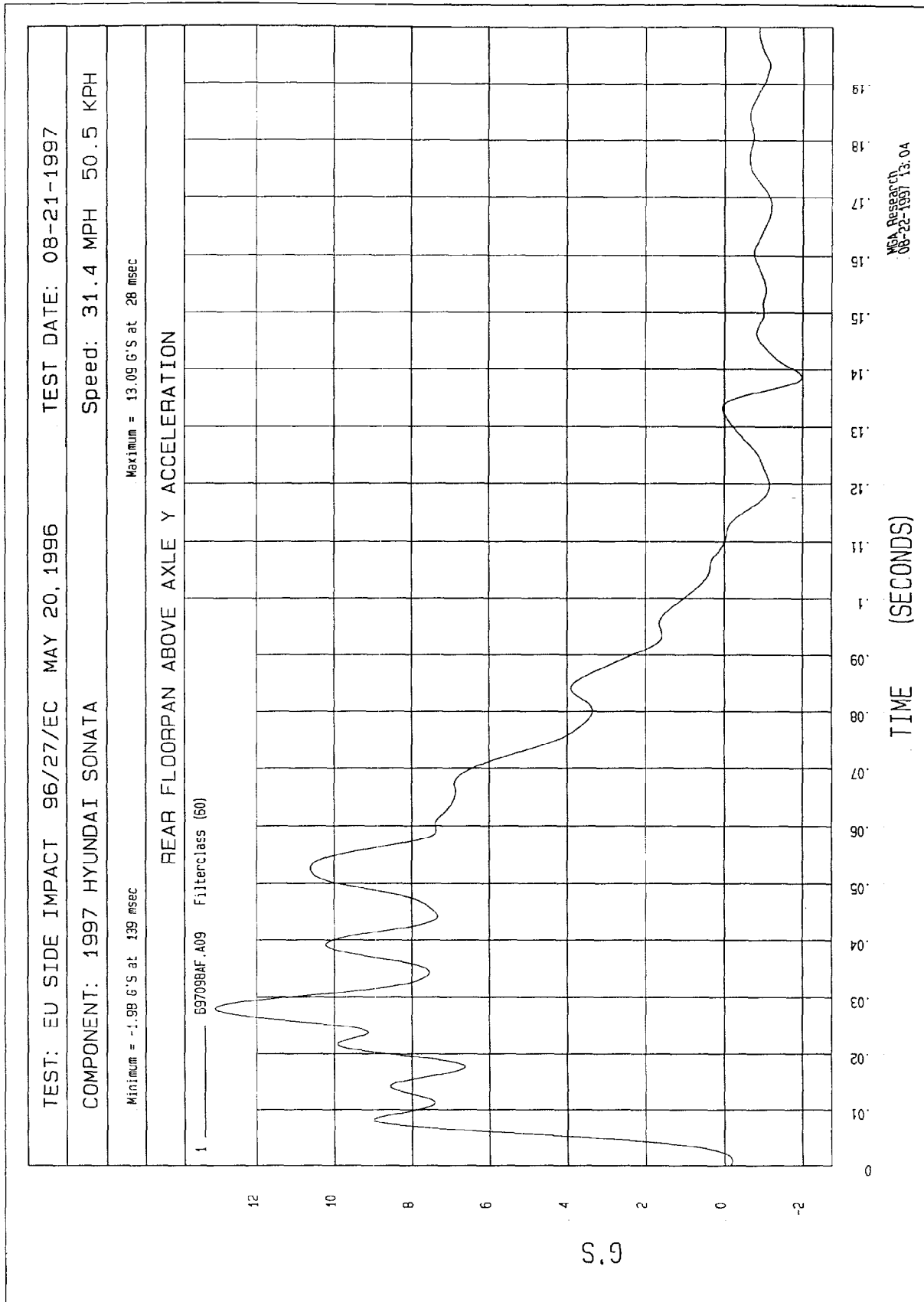
REAR FLOORPAN ABOVE AXLE X ACCELERATION

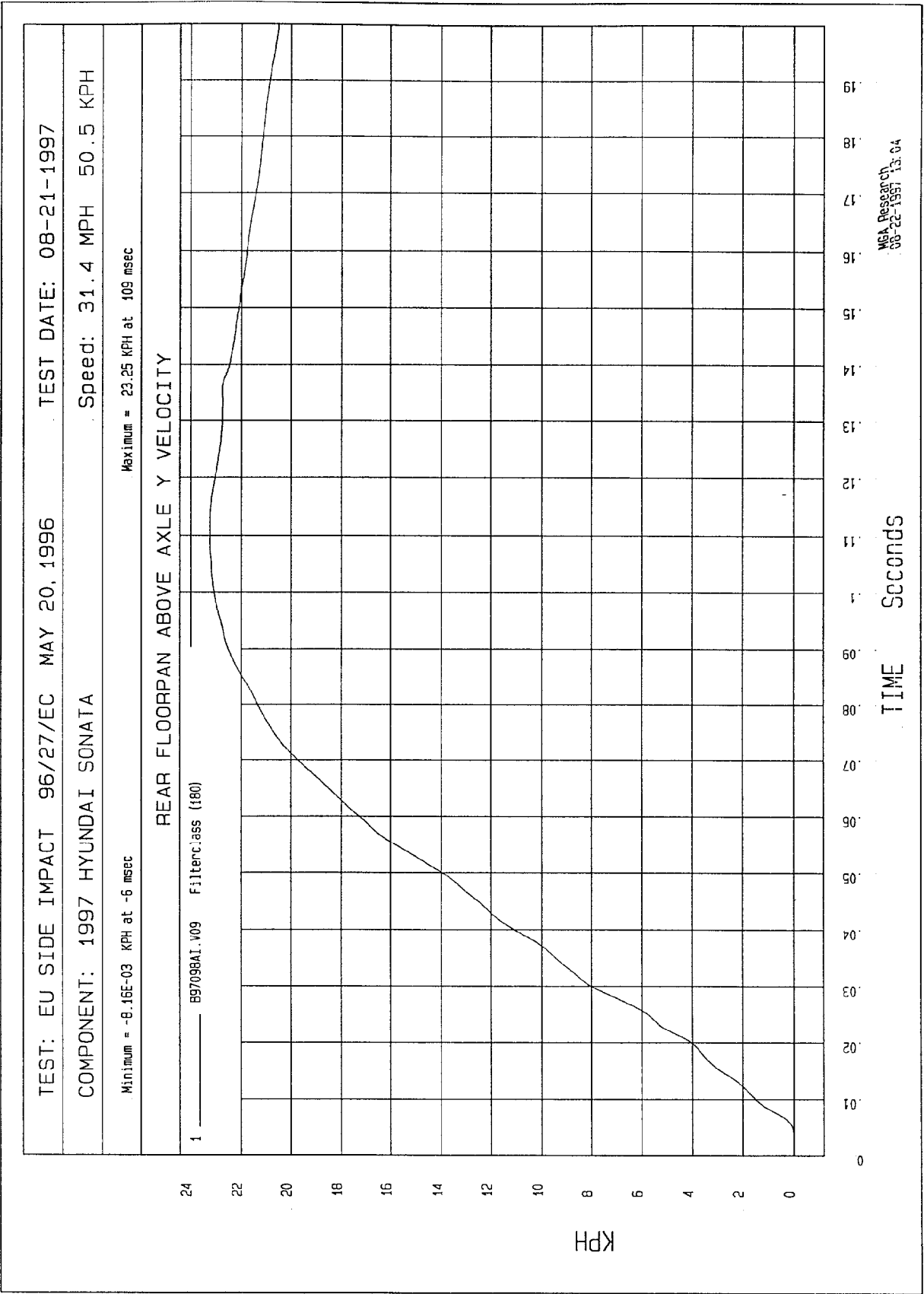
1 897098AF.A08 FilterClass (60)



WCA Research
08-22-1997 13.03







TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

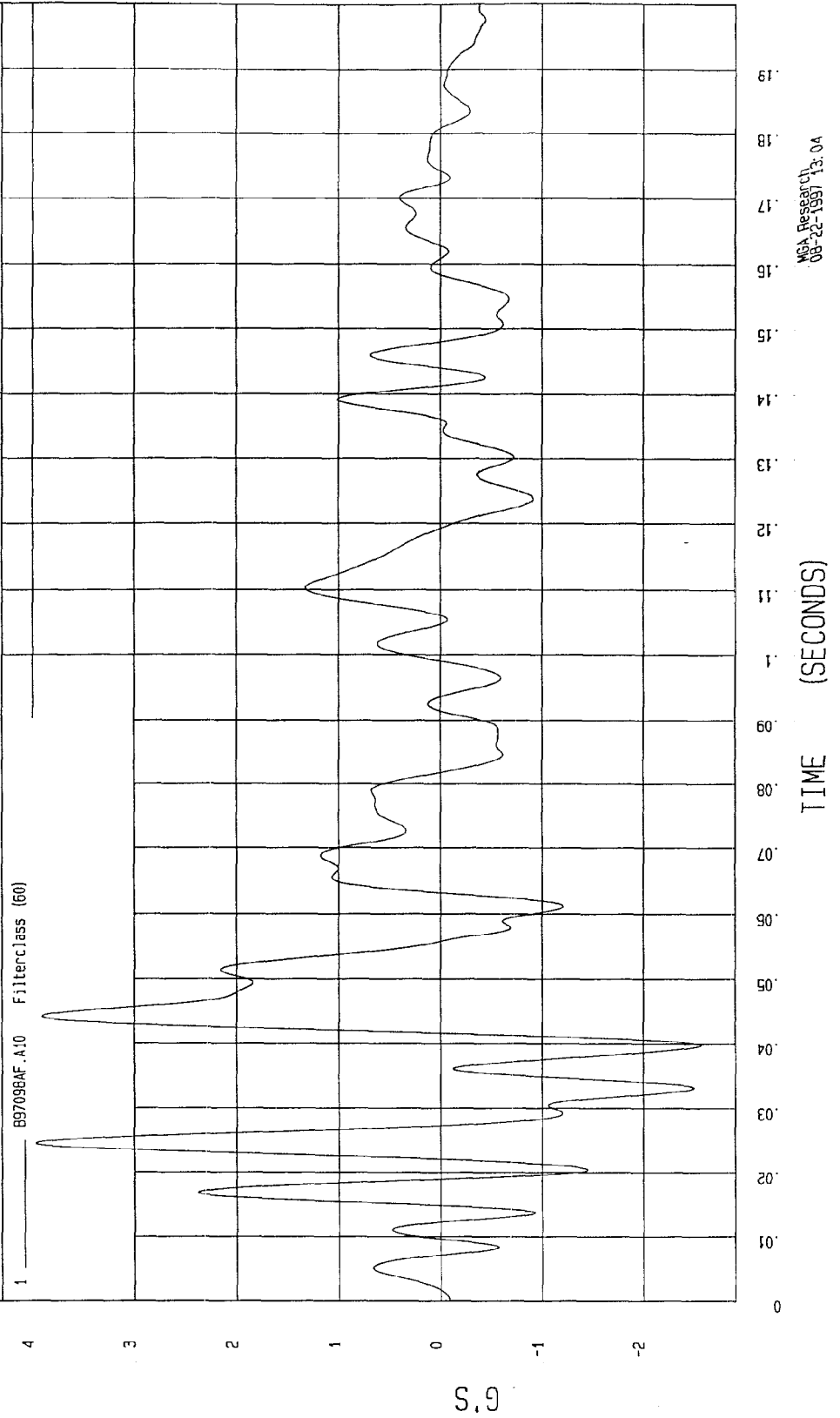
SPEED: 31.4 MPH 50.5 KPH

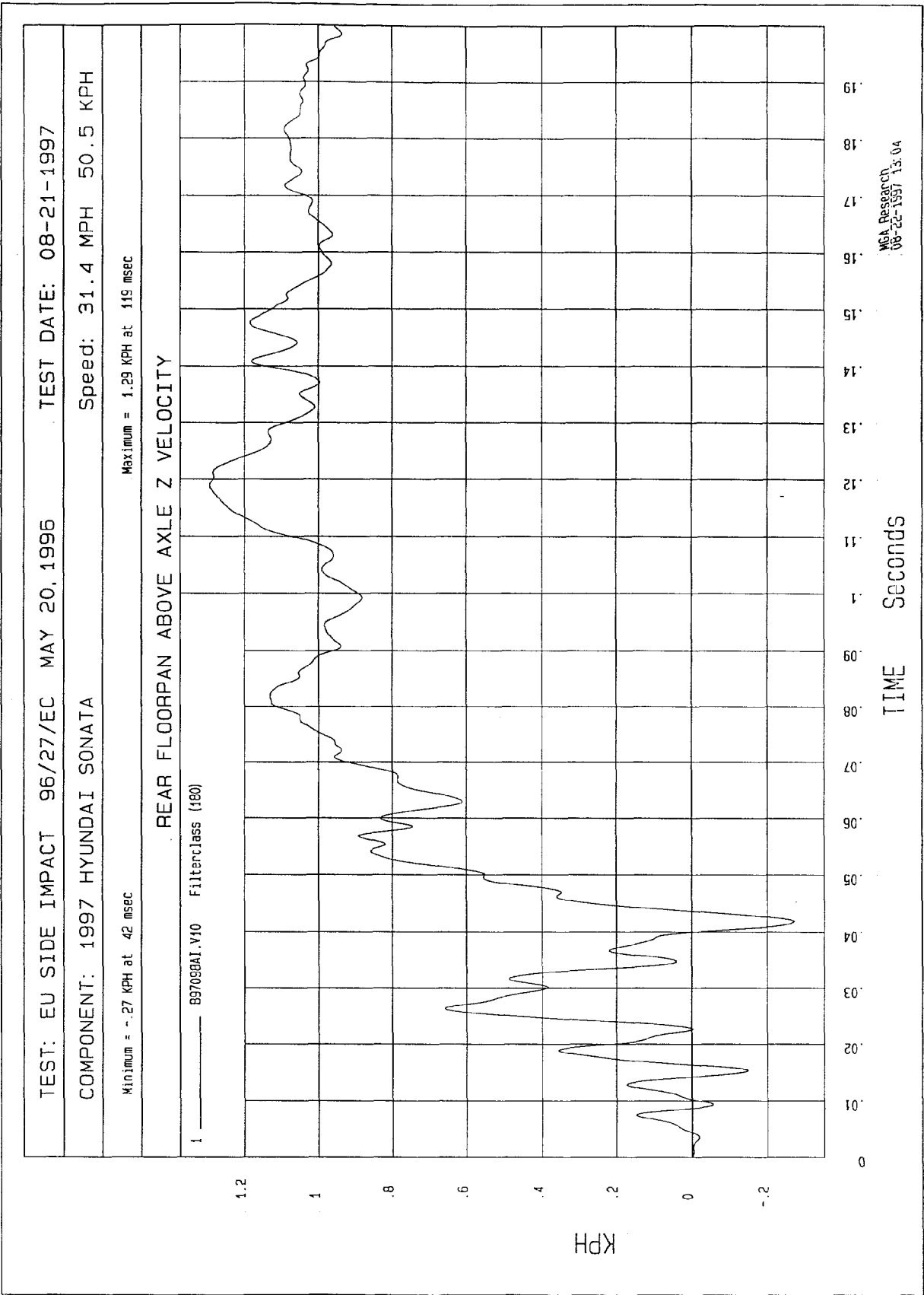
COMPONENT: 1997 HYUNDAI SONATA

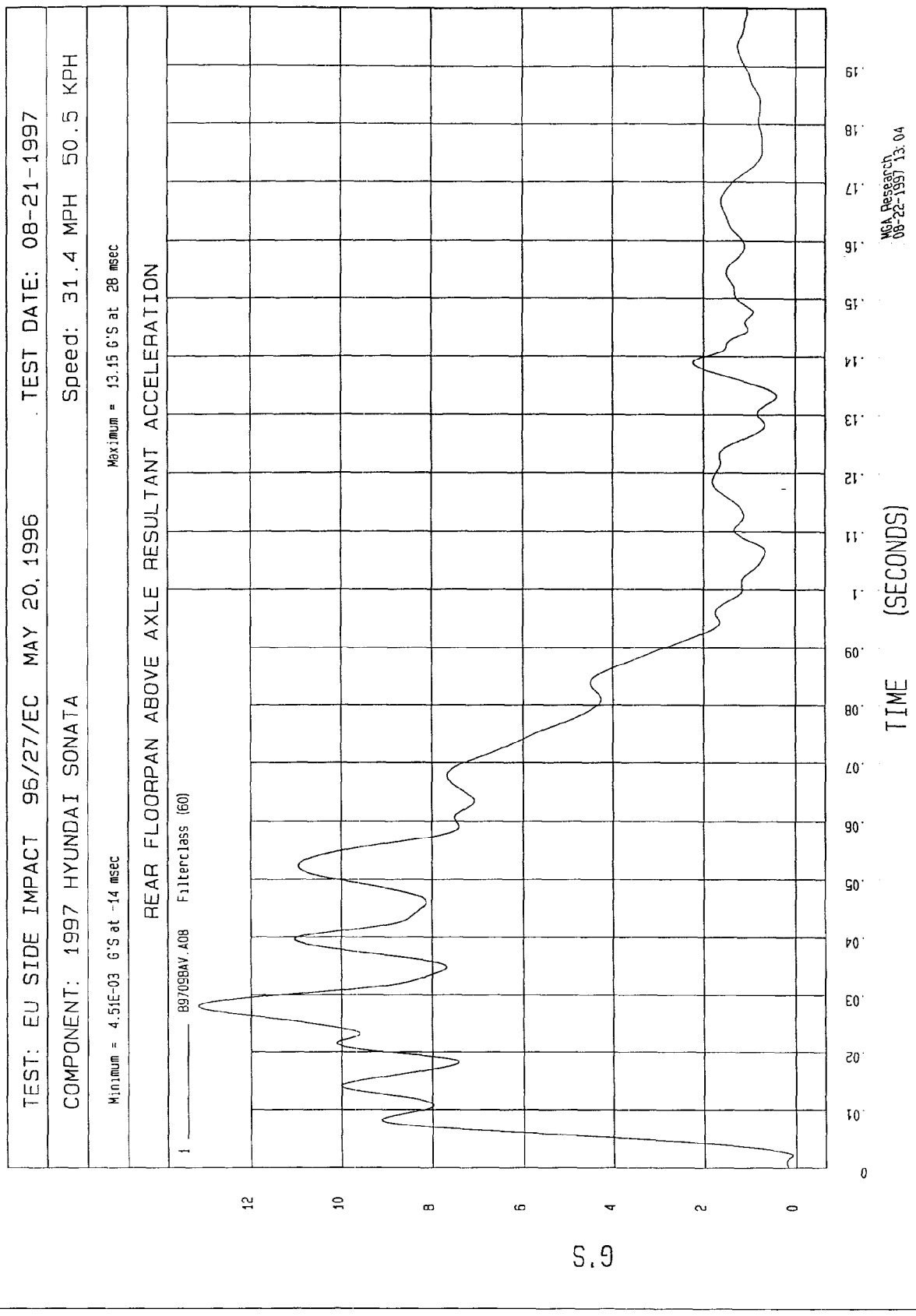
Minimum = -2.57 G'S at 40 msec

Maximum = 3.96 G'S at 24 msec

REAR FLOORPAN ABOVE AXLE Z ACCELERATION





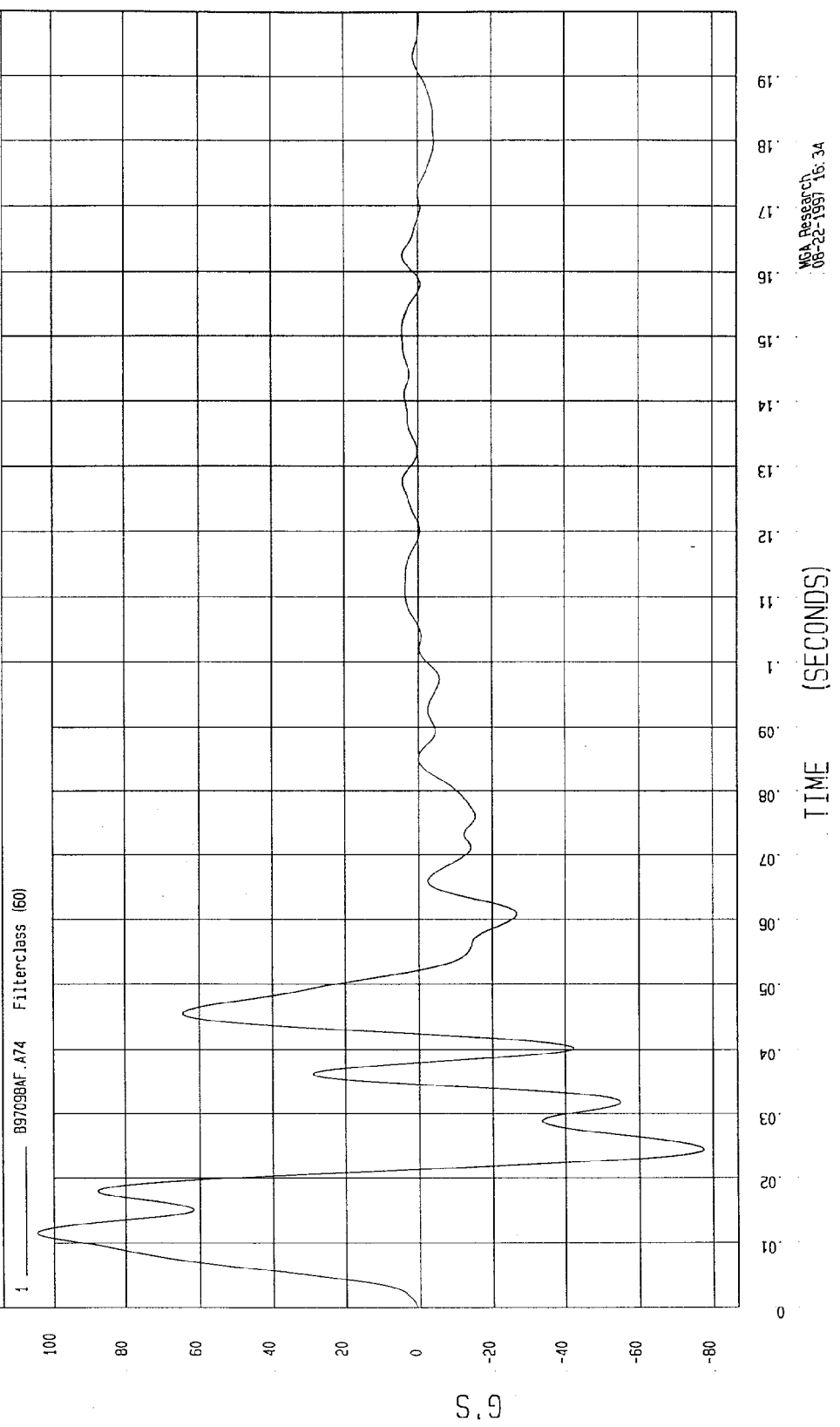


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

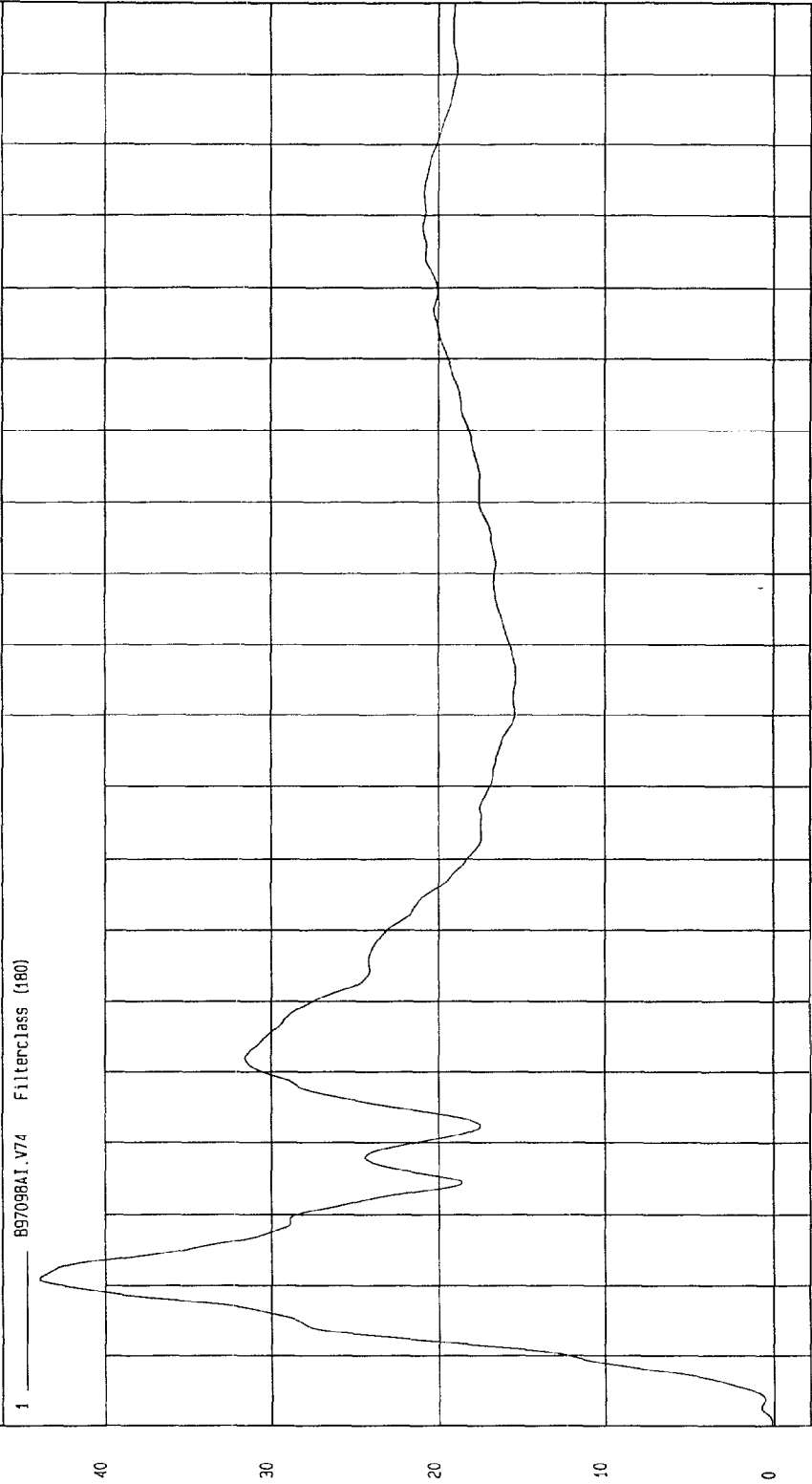
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -77.44 G'S at 24 msec Maximum = 104.34 G'S at 12 msec

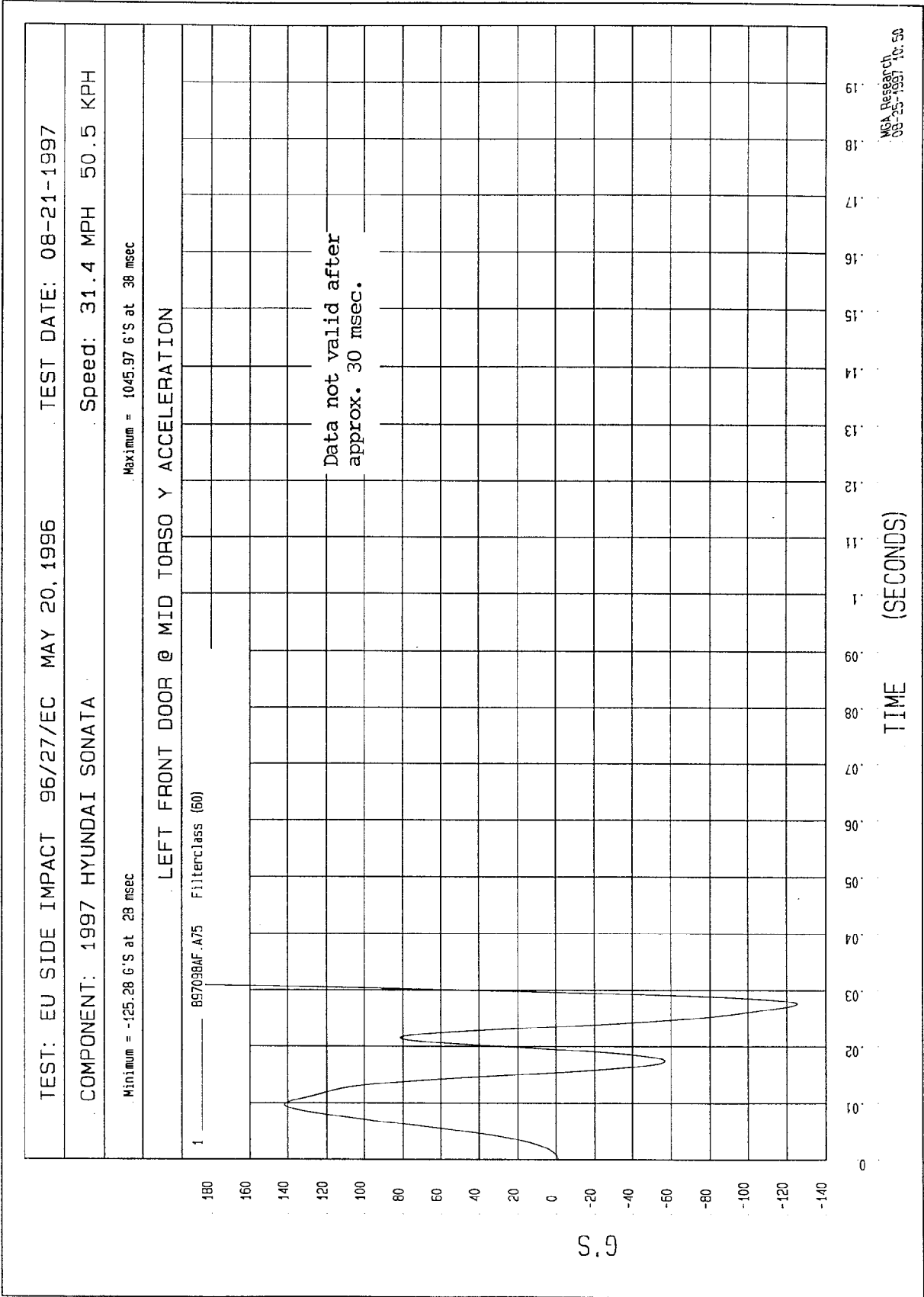
LEFT FRONT DOOR @ UPPER TORSO Y ACCELERATION



TEST: EU SIDE IMPACT 96/27/EC	MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA		Speed: 31.4 MPH 50.5 KPH
Minimum = 0 KPH at -20 msec		Maximum = 43.96 KPH at 21 msec
LEFT FRONT DOOR @ UPPER TORSO Y VELOCITY		



NSA Research
08-22-1997 13:06

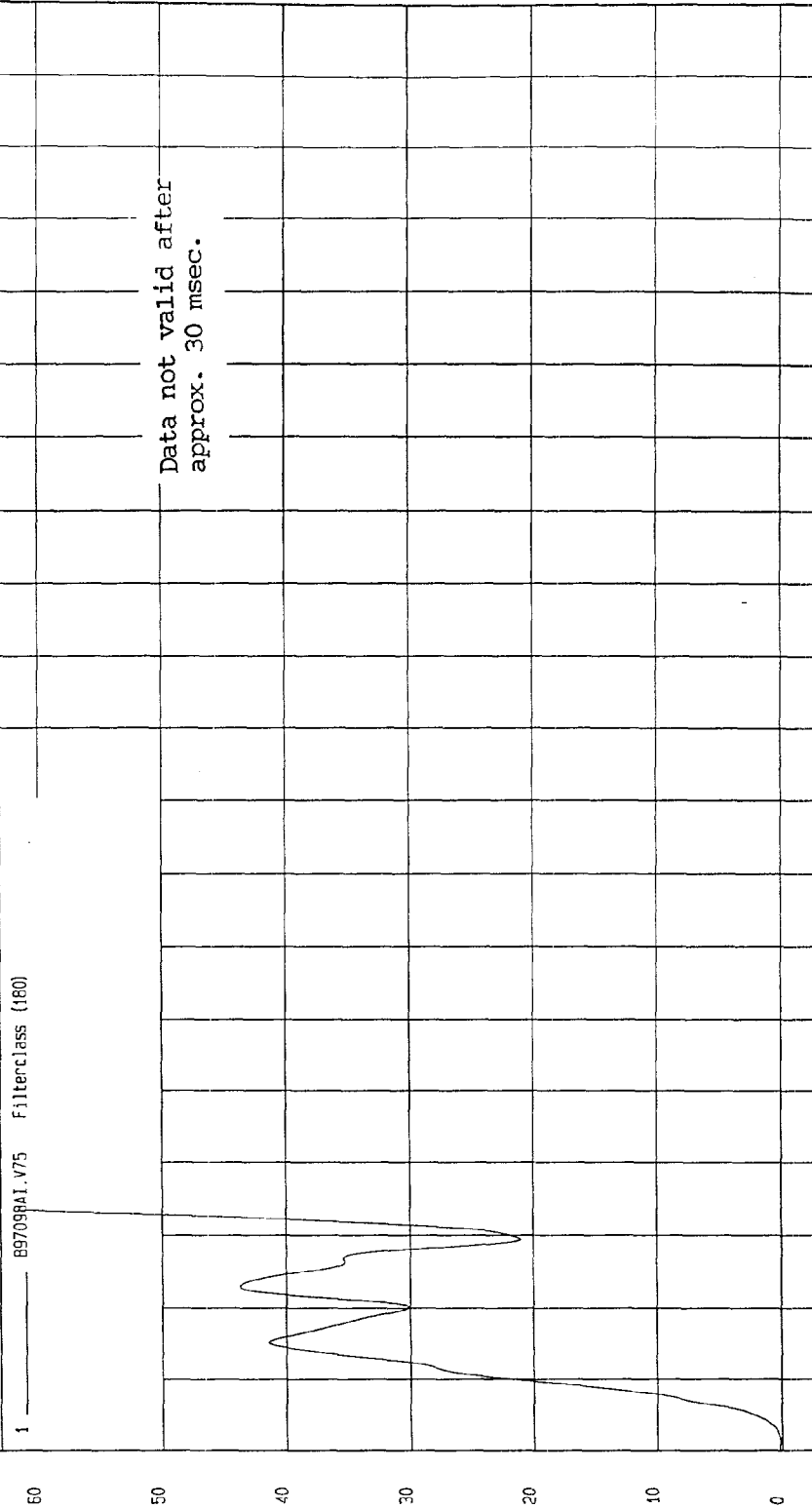


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

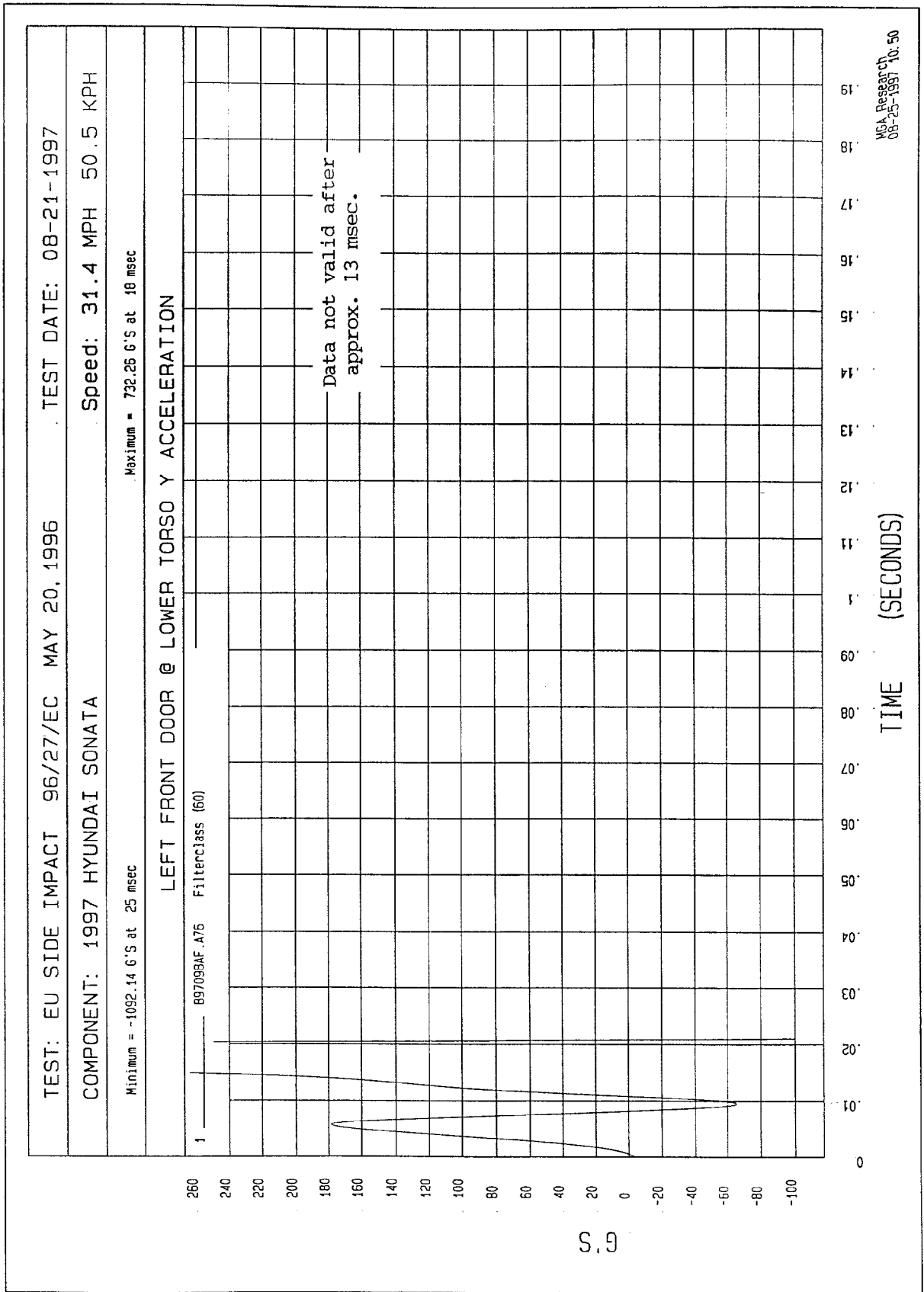
Minimum = 0 KPH at -20 msec Maximum = 6065.98 KPH at 200 msec

LEFT FRONT DOOR @ MID TORSO Y VELOCITY



TIME Seconds

MGA Research
08-22-1997 16:34



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

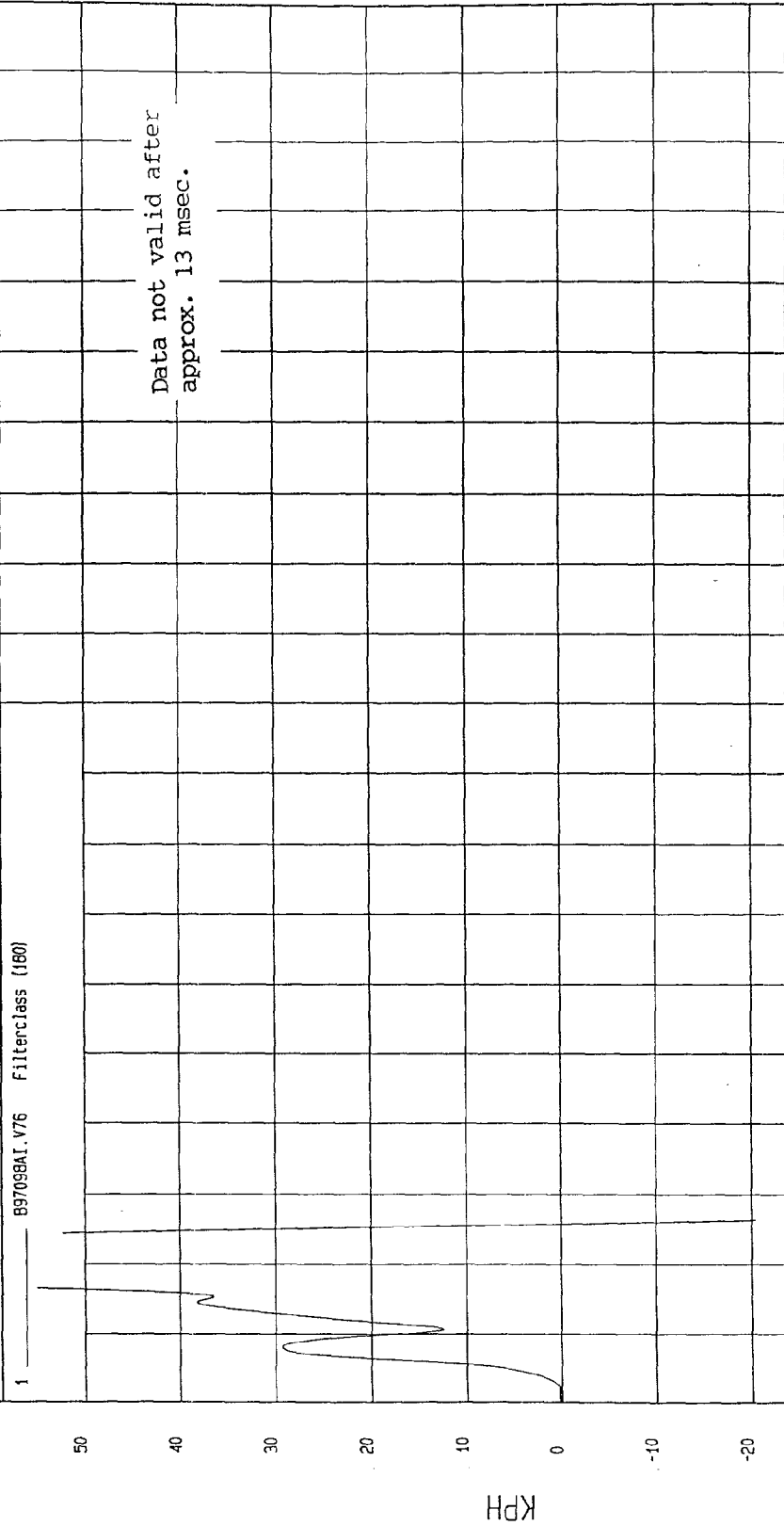
SPEED: 31.4 MPH 50.5 KPH

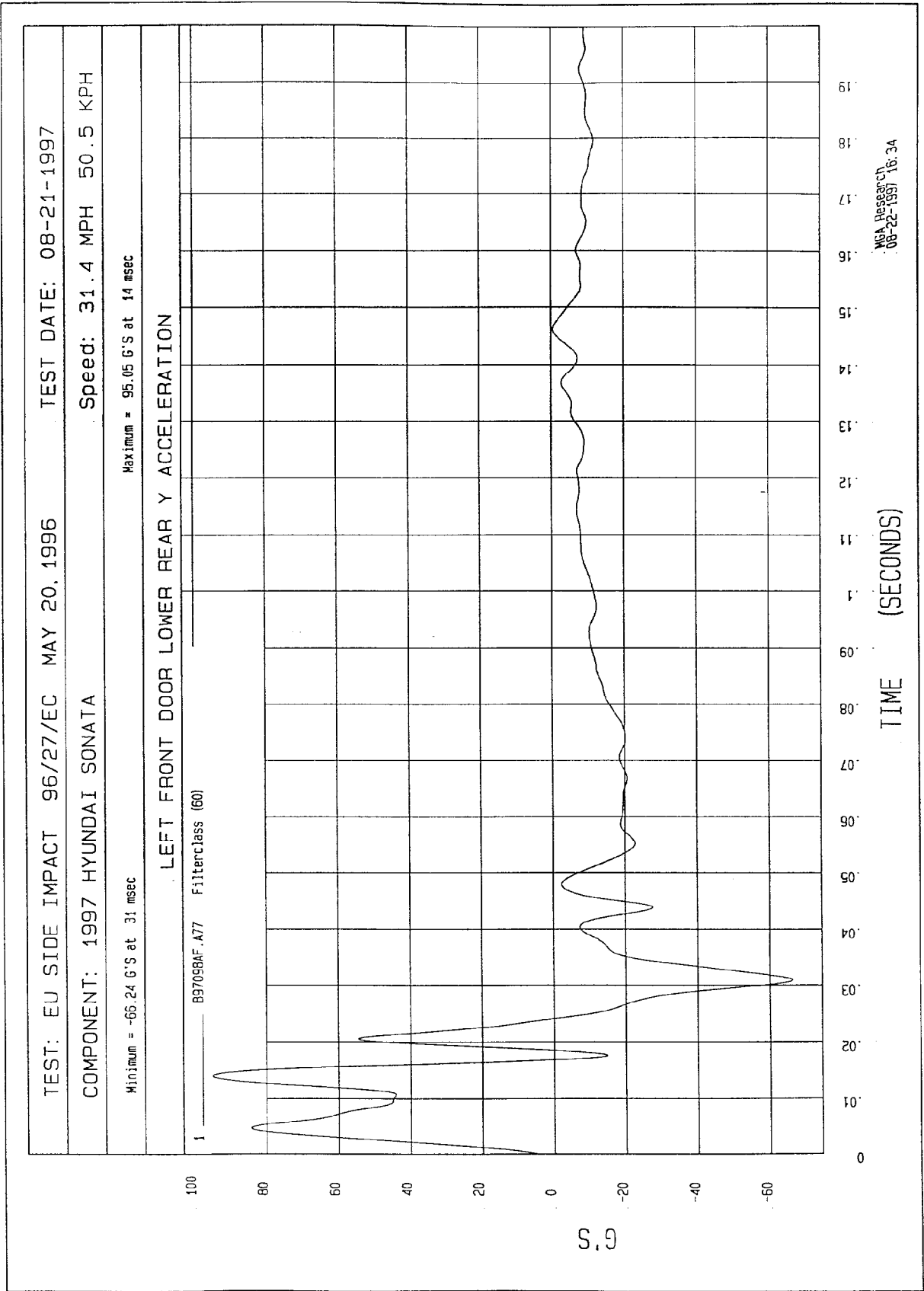
COMPONENT: 1997 HYUNDAI SONATA

Minimum = -6332.81 KPH at 200 msec

Maximum = 167.54 KPH at 21 msec

LEFT FRONT DOOR @ LOWER TORSO Y VELOCITY





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -36.51 KPH at 200 msec Maximum = 40.48 KPH at 21 msec

LEFT FRONT DOOR LOWER REAR Y VELOCITY

1 B97098AI.V77 Filterclass (180)



WEA Research
08-22-1997 13:07

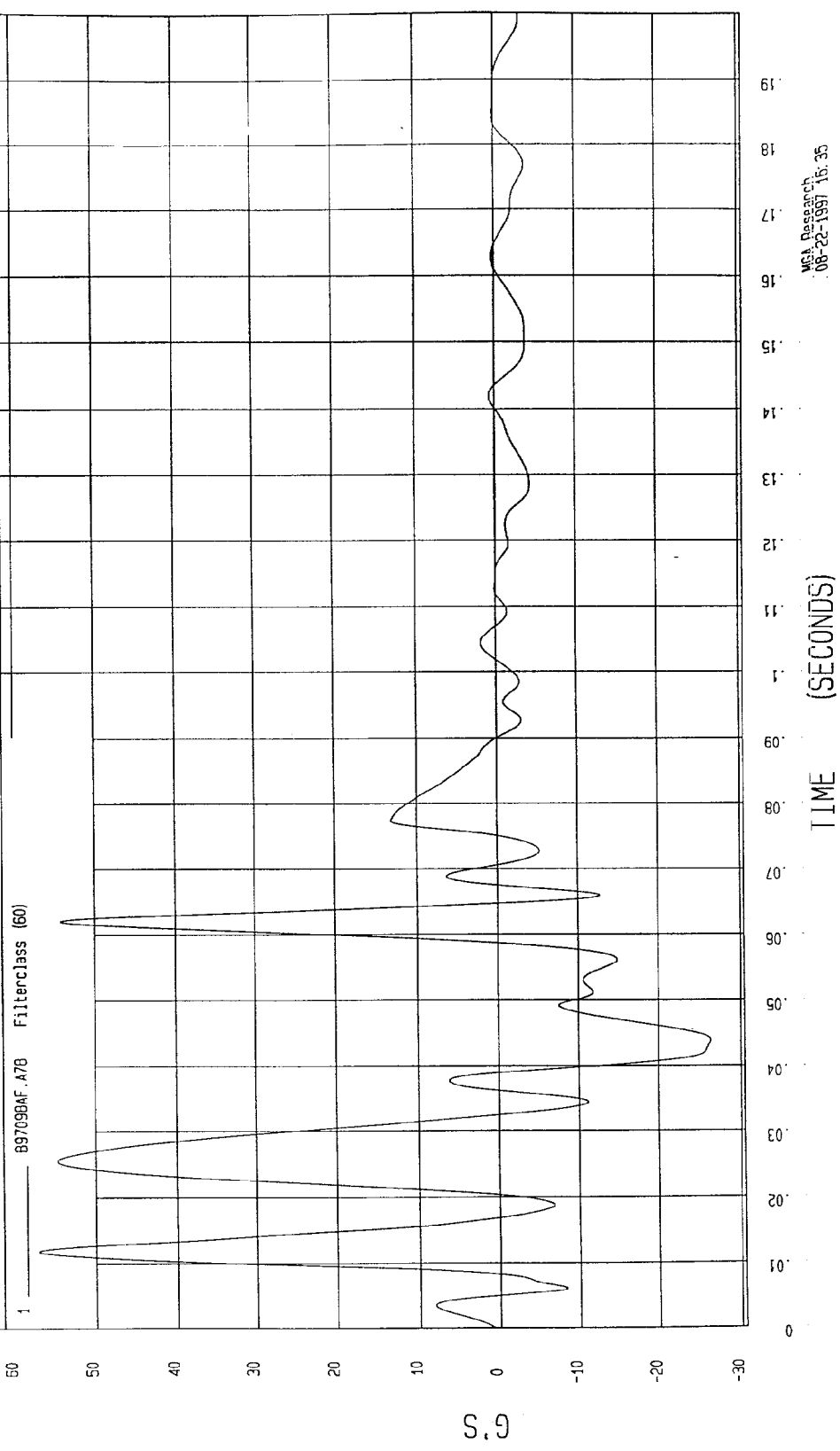
TIME Seconds

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -26.35 G'S at 44 msec Maximum = 57.19 G'S at 12 msec

LEFT REAR DOOR @ UPPER TORSO Y ACCELERATION

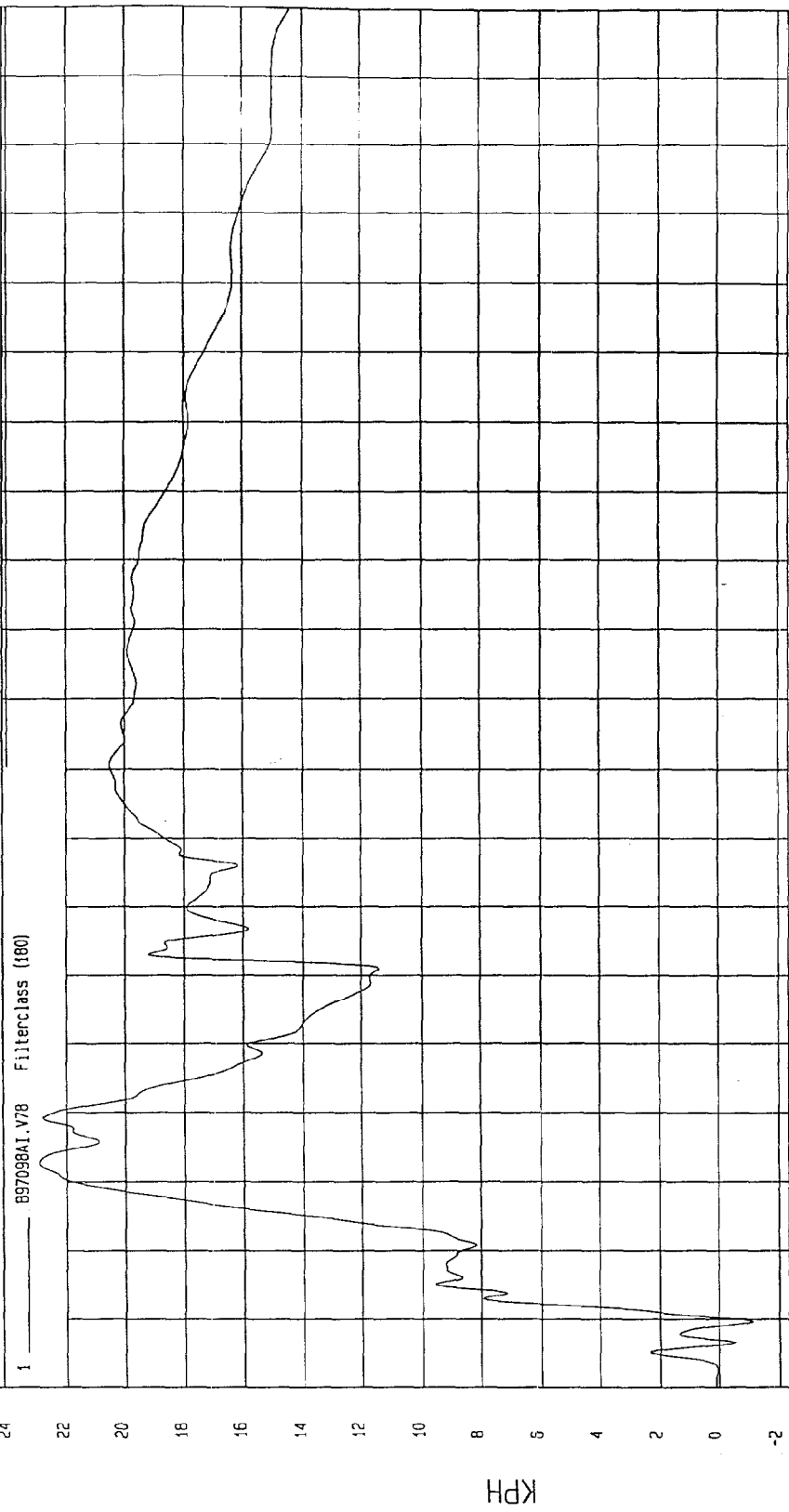


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.13 KPH at 10 msec Maximum = 22.93 KPH at 33 msec

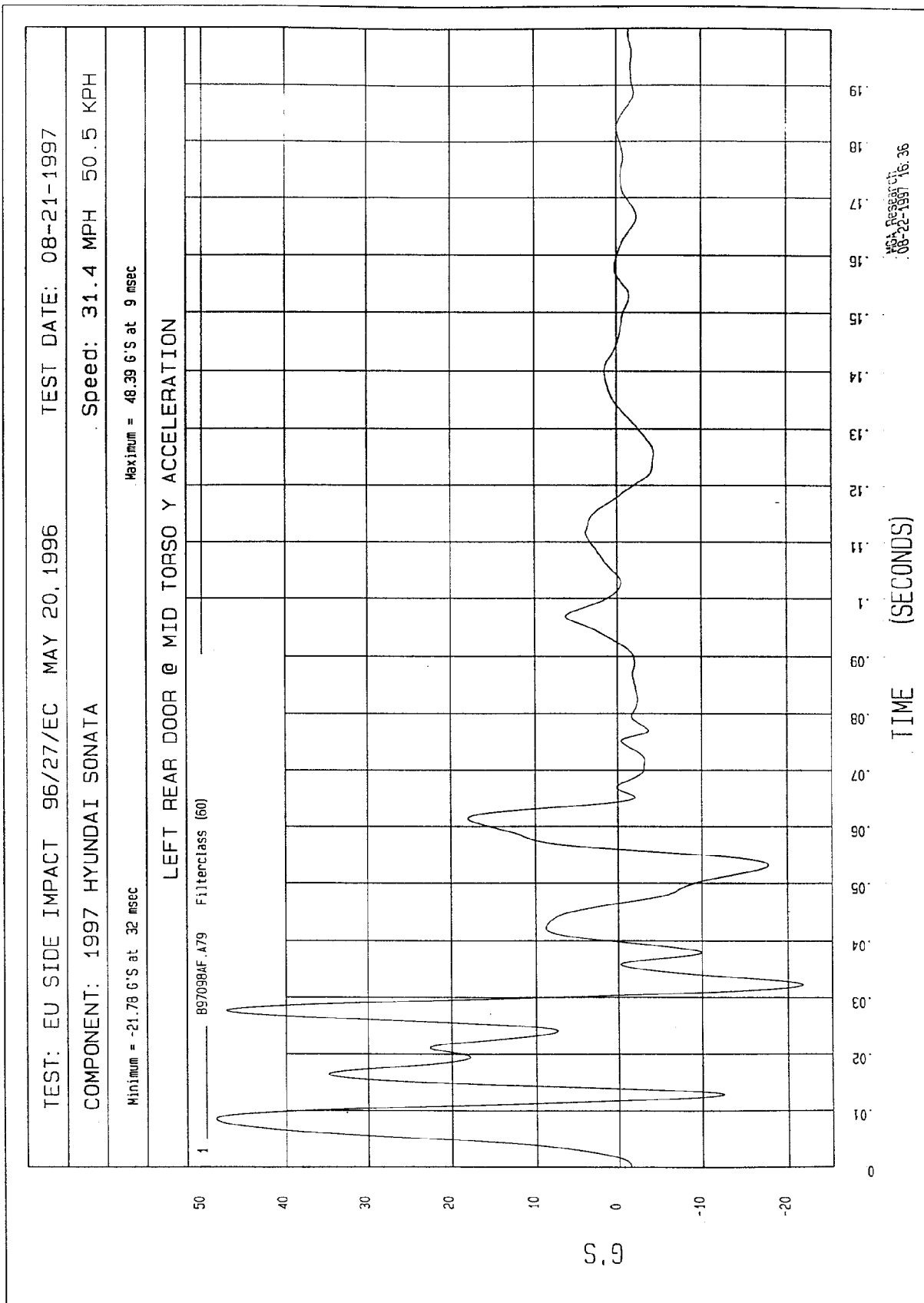
LEFT REAR DOOR @ UPPER TORSO Y VELOCITY



TIME Seconds

19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0

08-22-1997 13:07

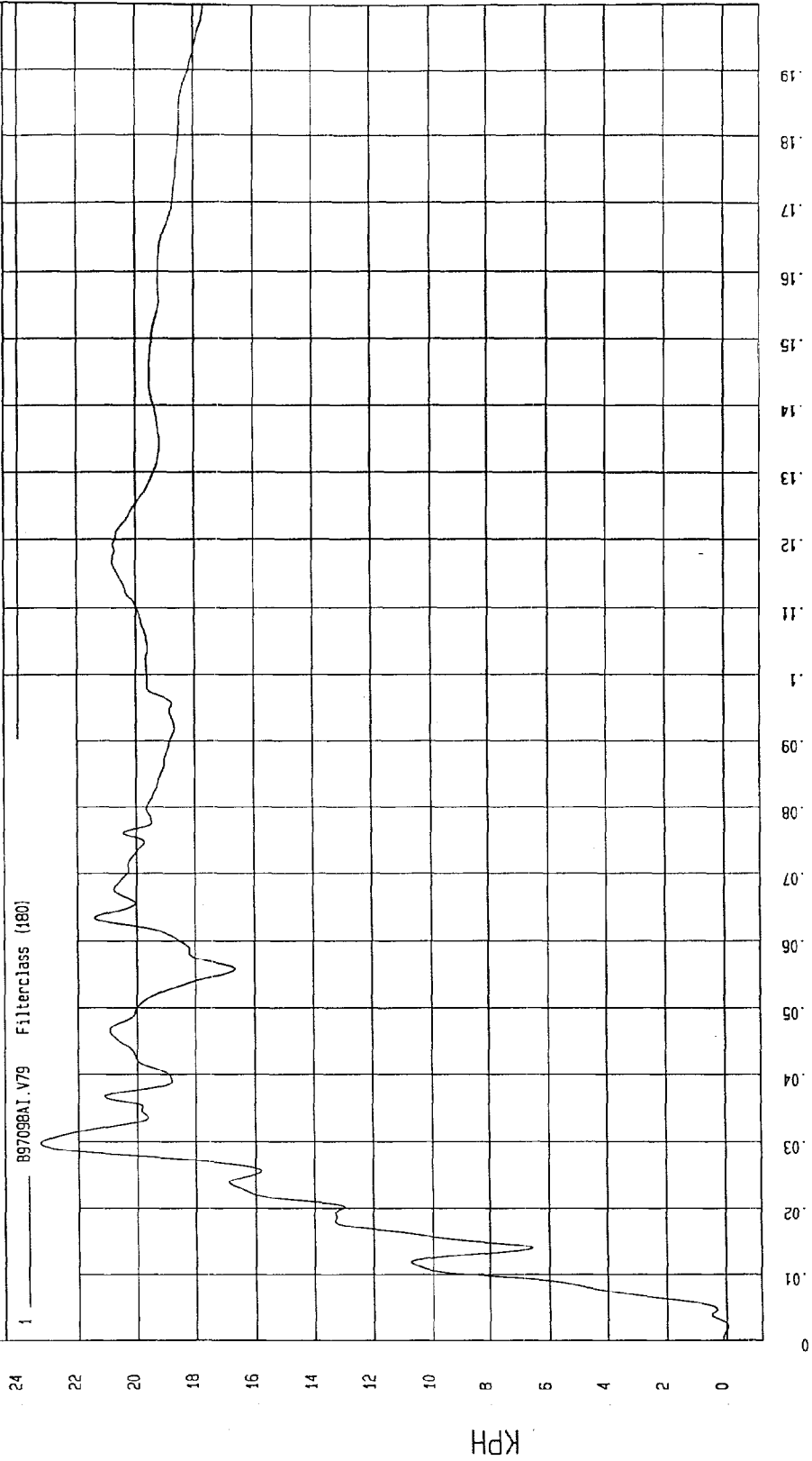


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -5.27E-02 KPH at 2 msec Maximum = 23.31 KPH at 30 msec

LEFT REAR DOOR @ MID TORSO Y VELOCITY



NGA Research
08-22-1997 13:07

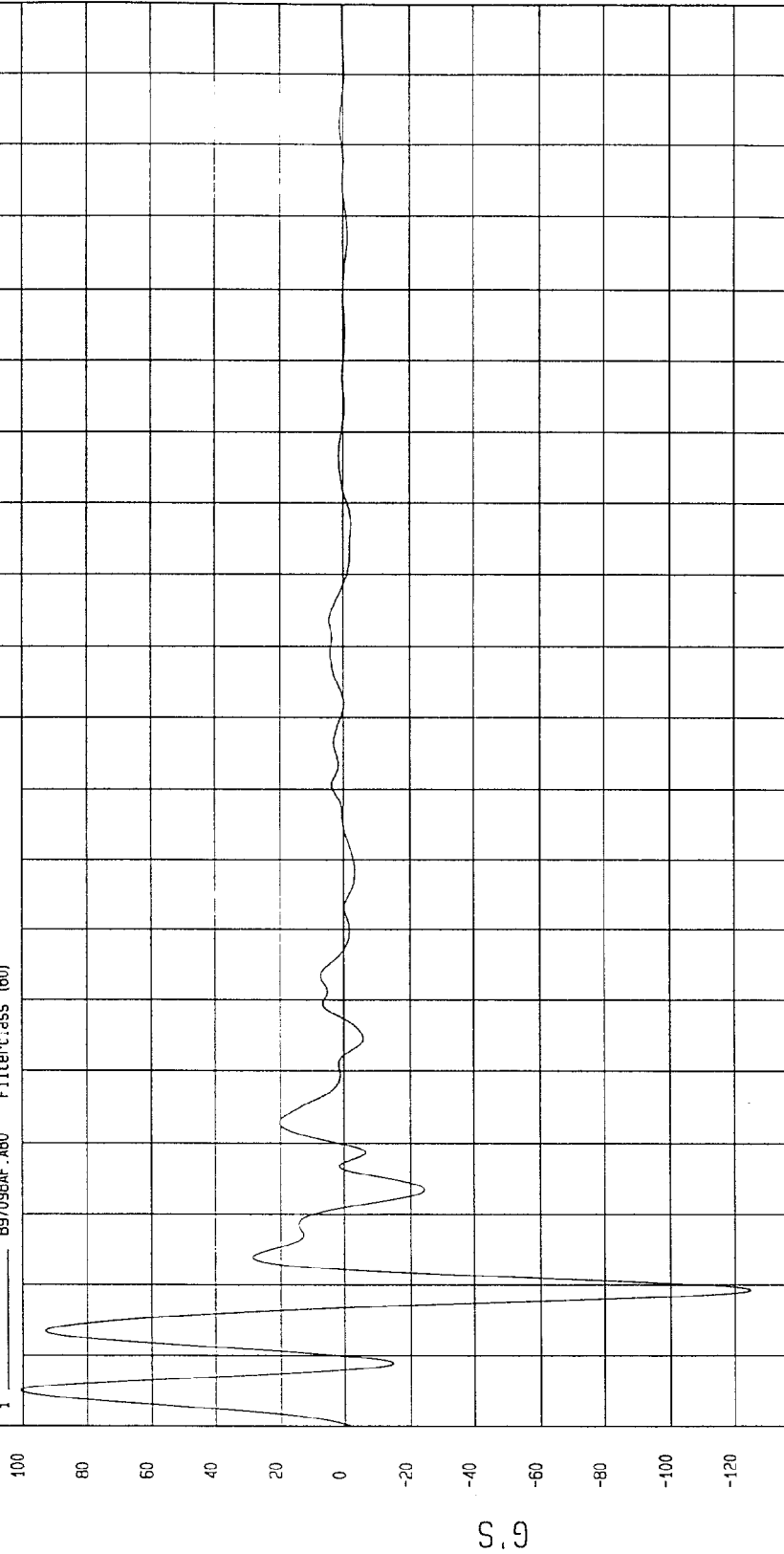
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

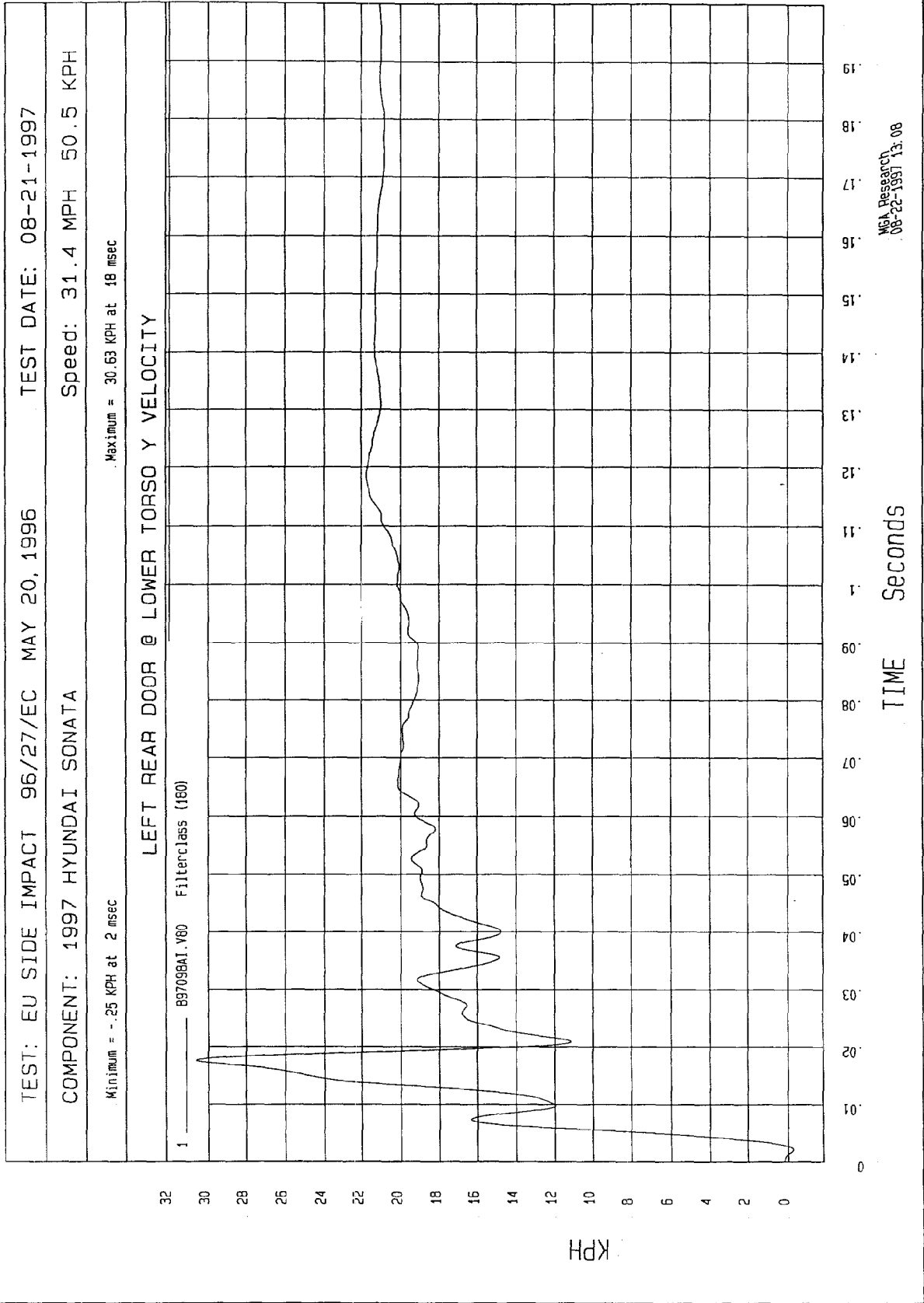
Minimum = -124.94 G'S at 19 msec Maximum = 100.71 G'S at 5 msec

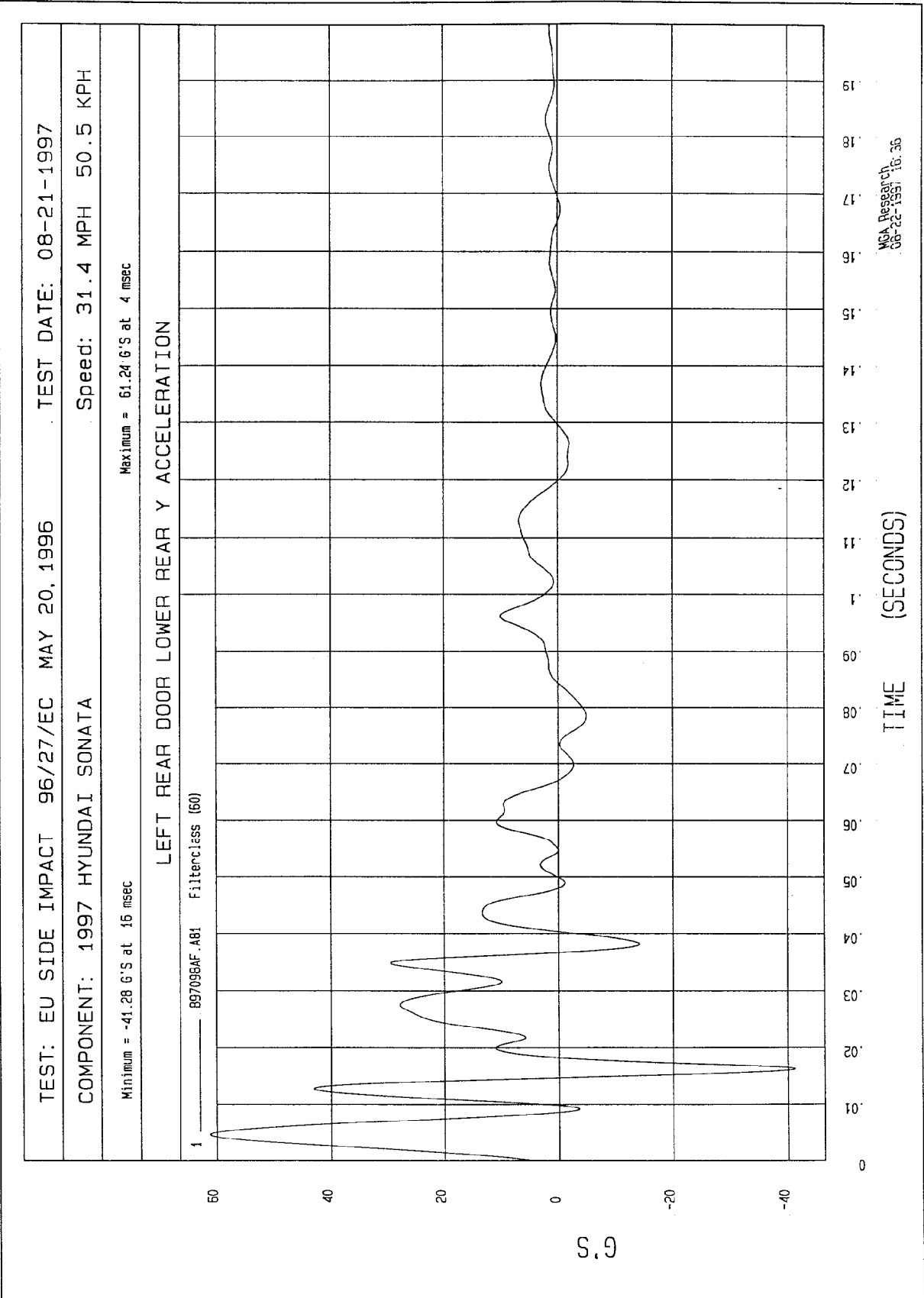
LEFT REAR DOOR @ LOWER TORSO Y ACCELERATION

1 B9709GAF.A60 Filterclass (60)



MECA Research
08-22-1997 15:36

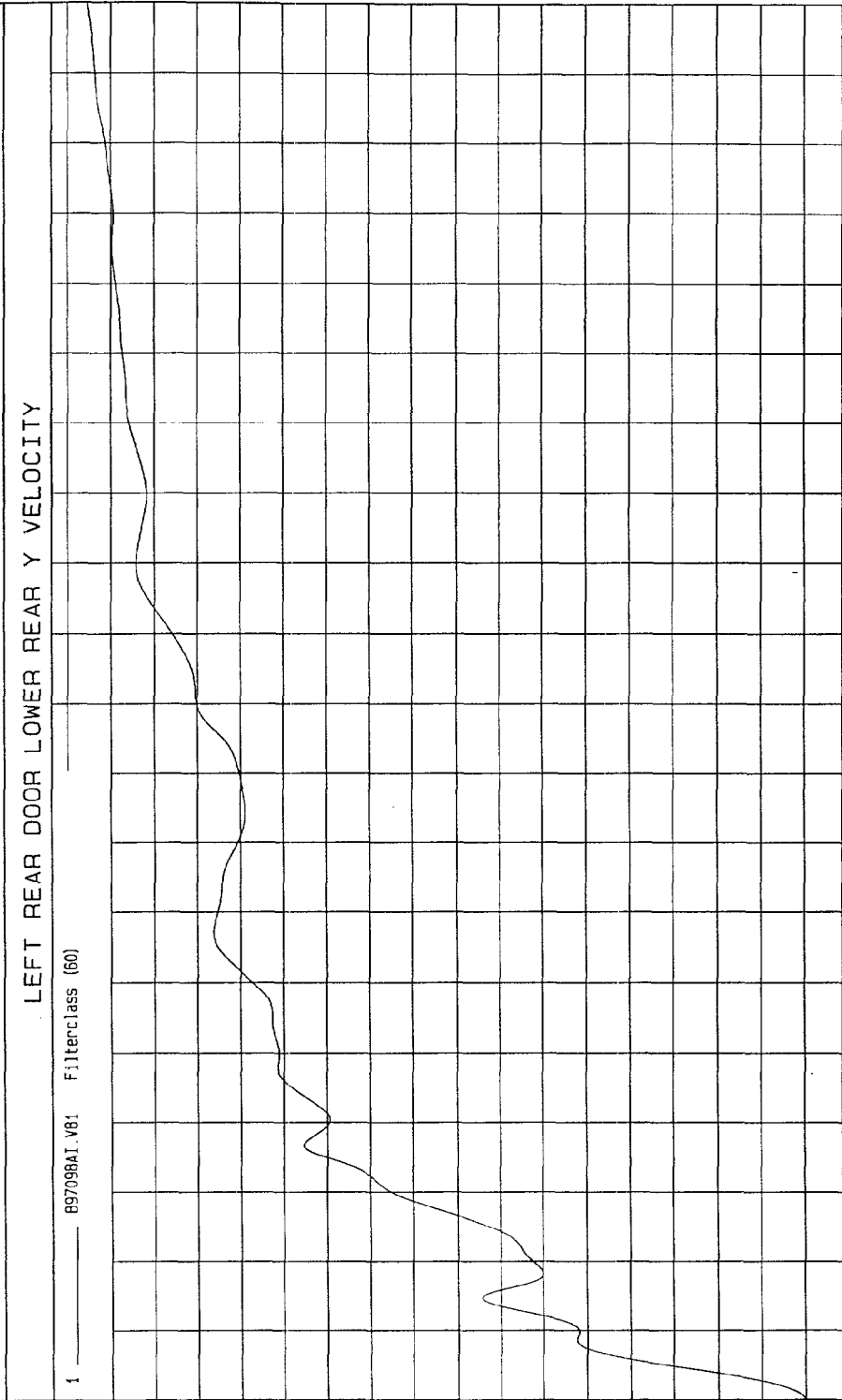




TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -9.06E-02 KPH at -1 msec Maximum = 33.08 KPH at 200 msec



TIME Seconds

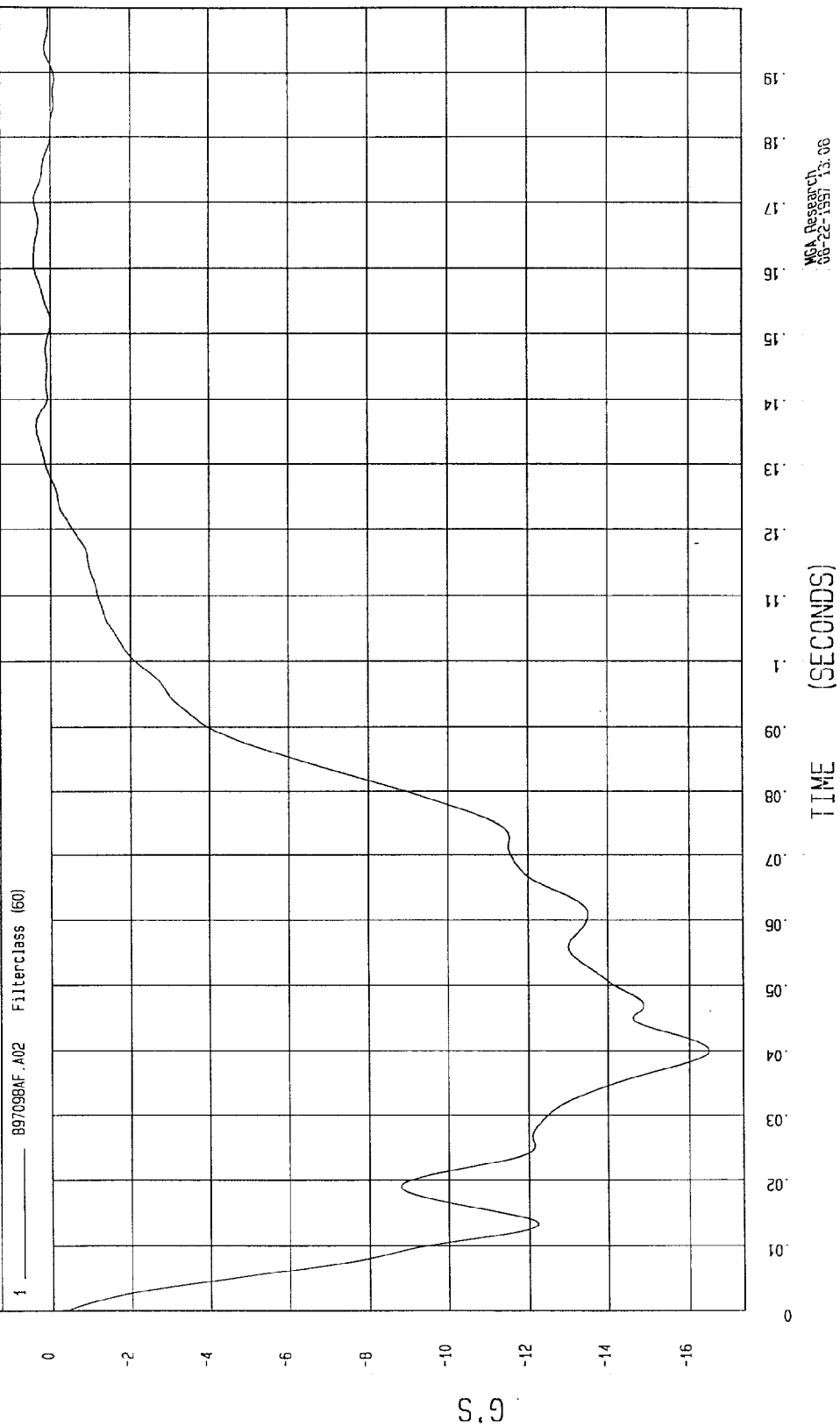
NGA Research
10-15-1997 13:49

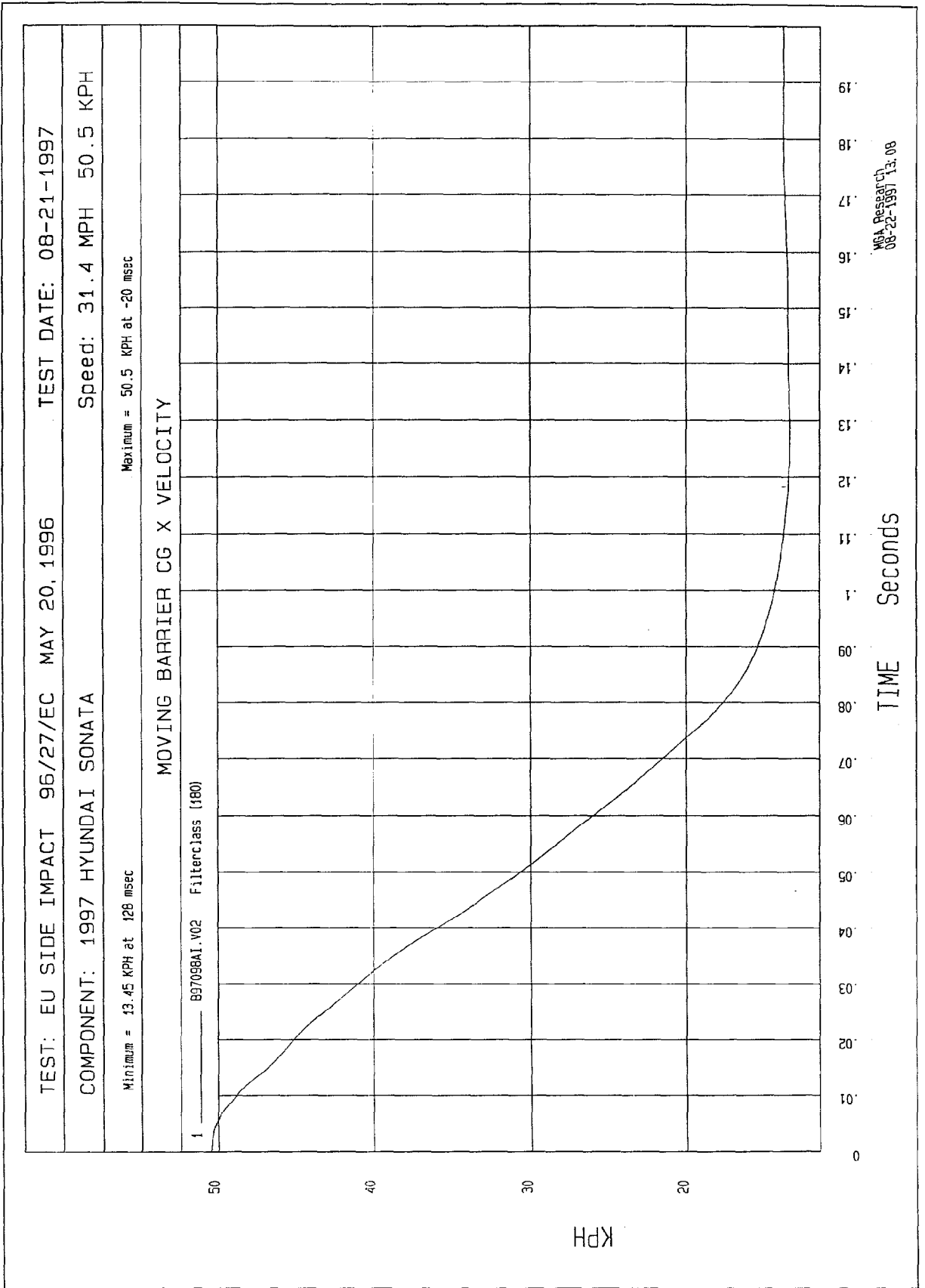
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

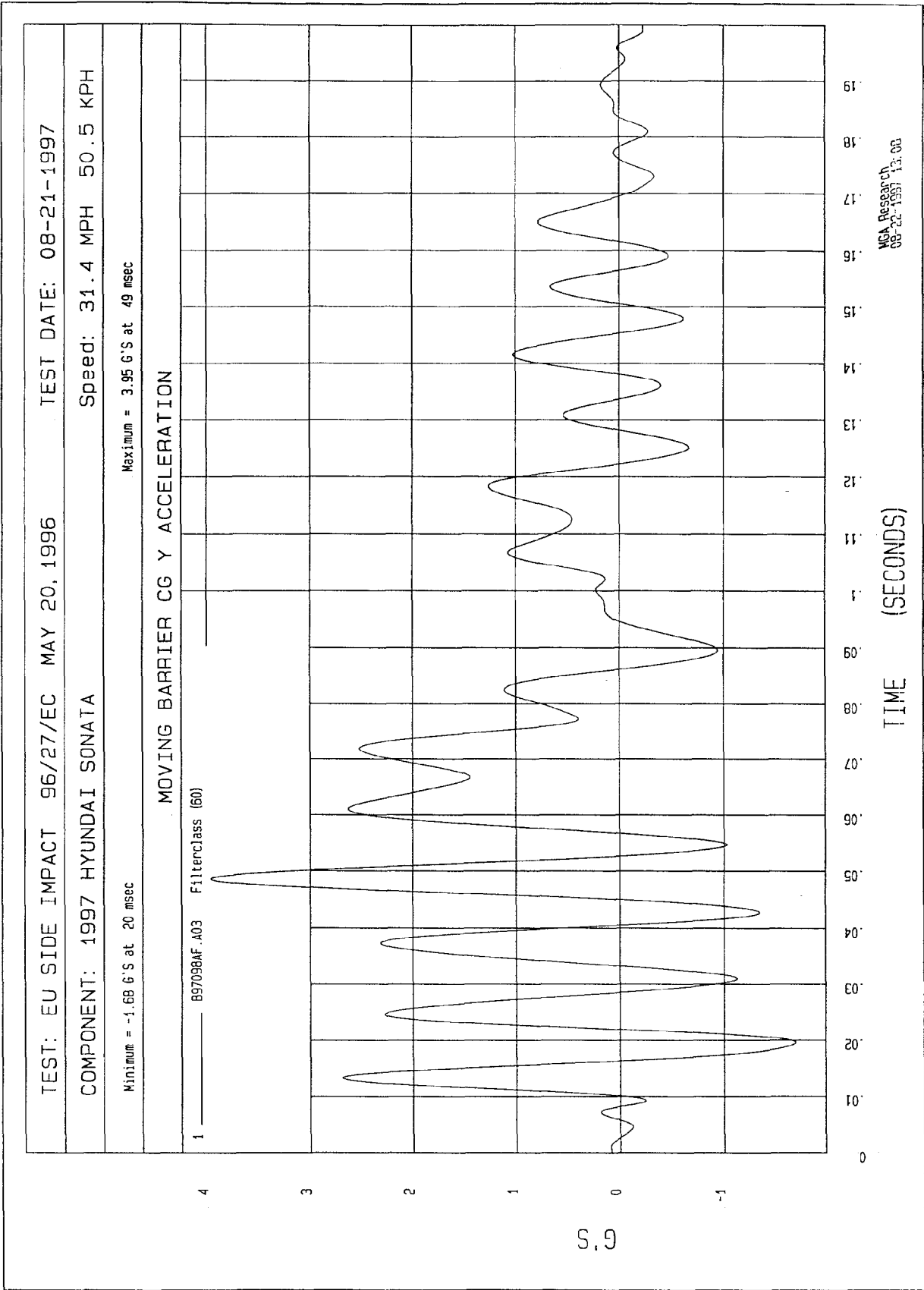
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

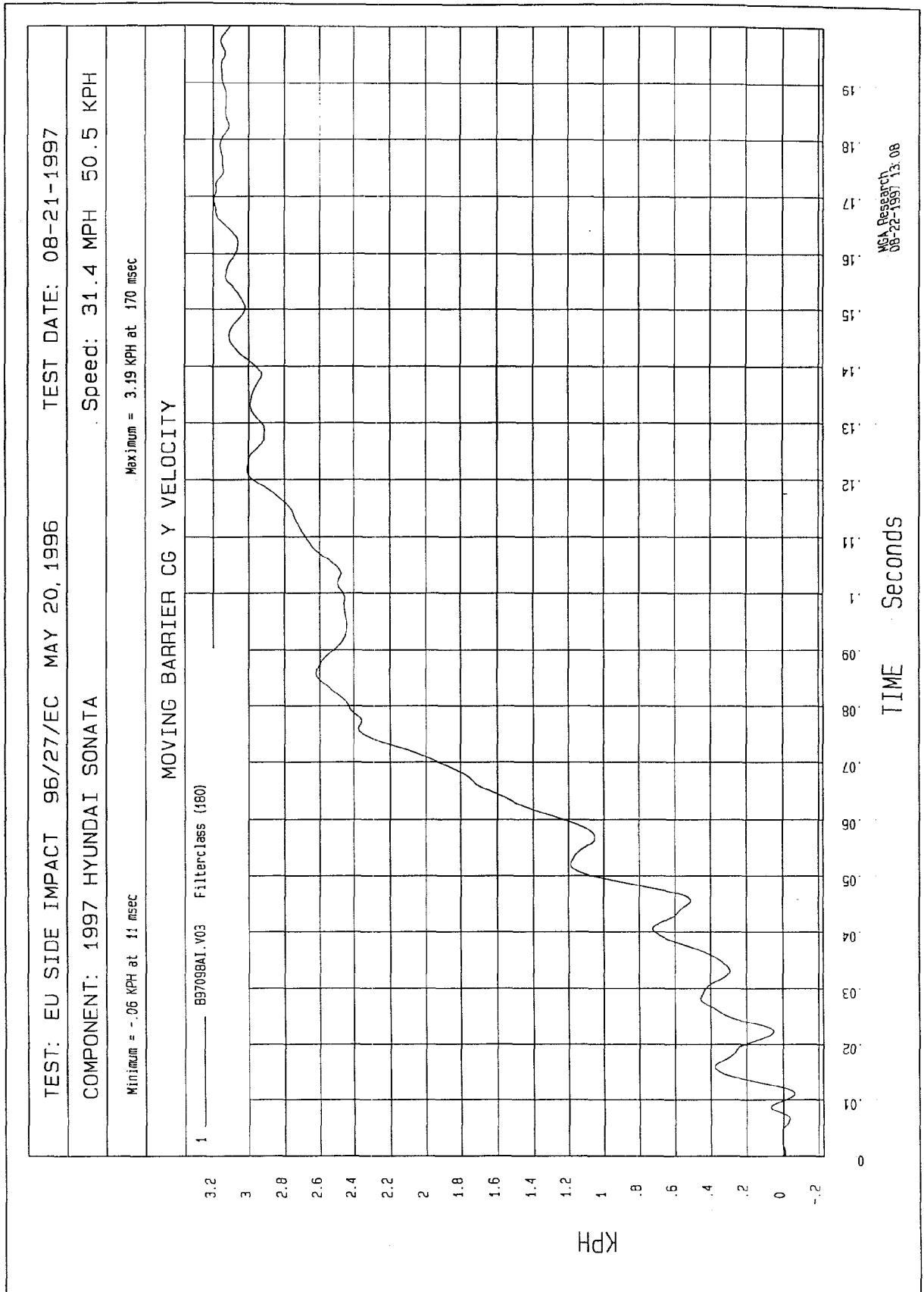
Minimum = -16.50 G'S at 40 msec Maximum = .42 G'S at 161 msec

MOVING BARRIER CG X ACCELERATION



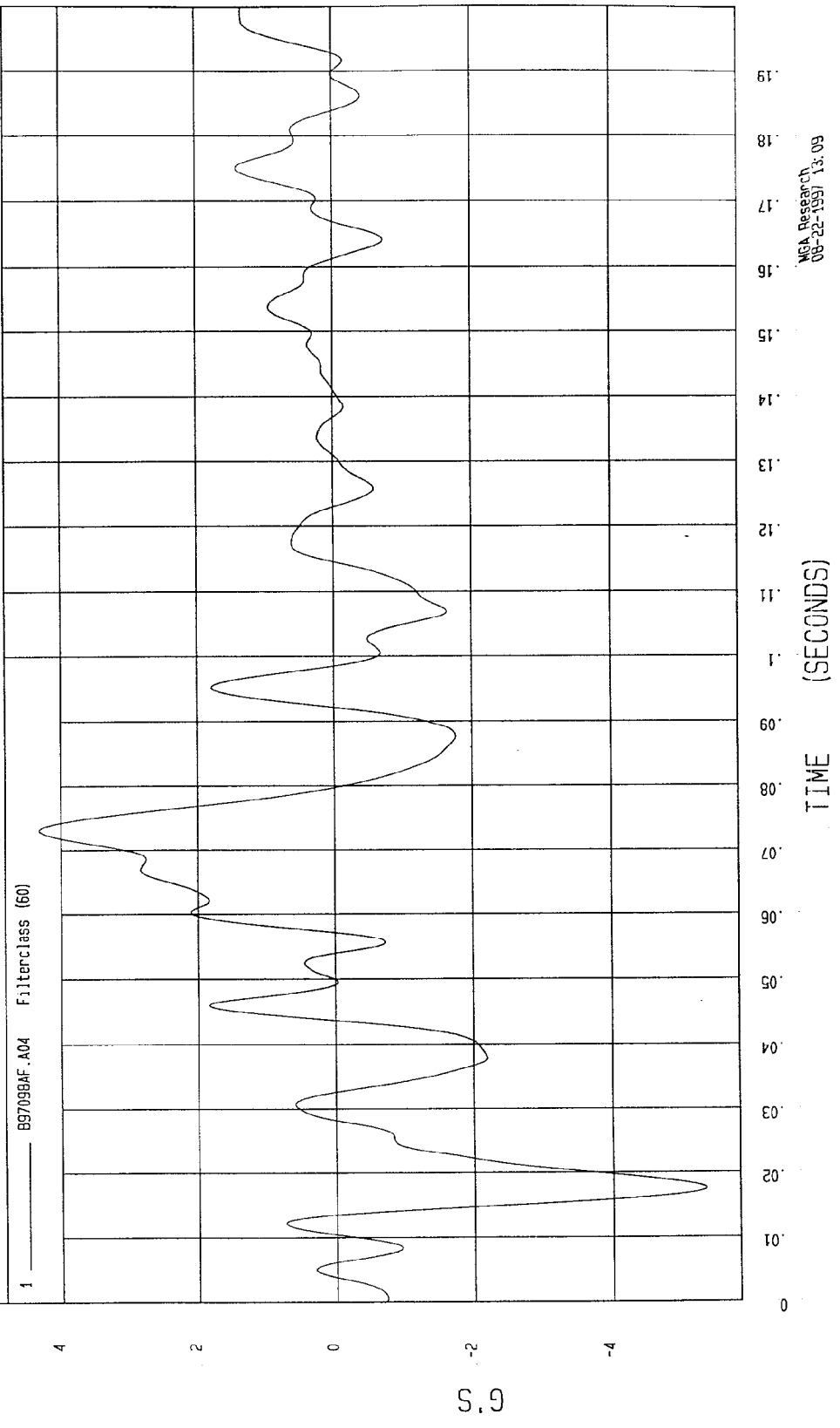






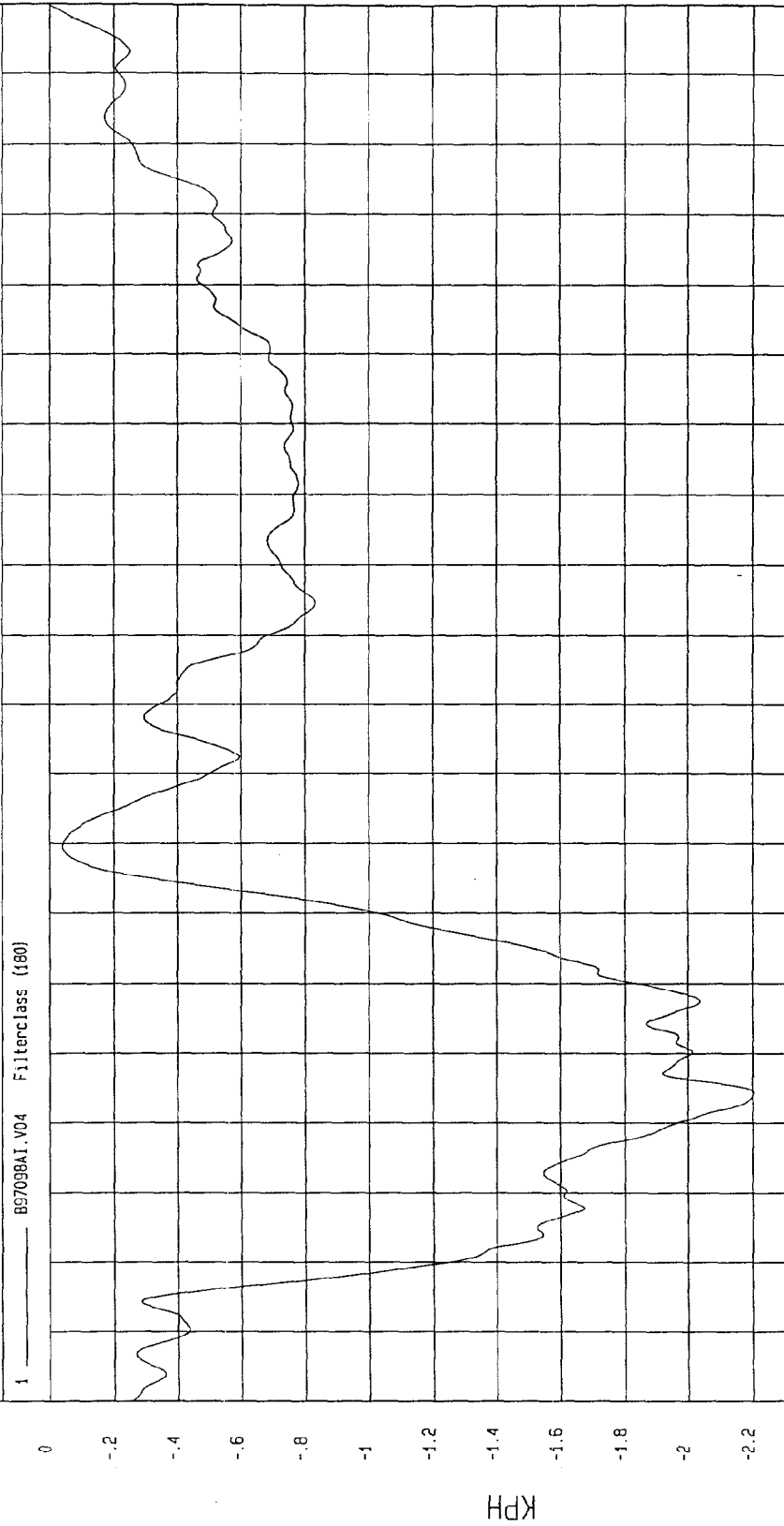
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -5.33 G'S at 18 msec	Maximum = 4.31 G'S at 73 msec

MOVING BARRIER CG Z ACCELERATION



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -2.20 KPH at 44 msec	Maximum = 3.66E-02 KPH at -17 msec

MOVING BARRIER CG Z VELOCITY



TIME Seconds

NGA Research
08-22-1997 13:09

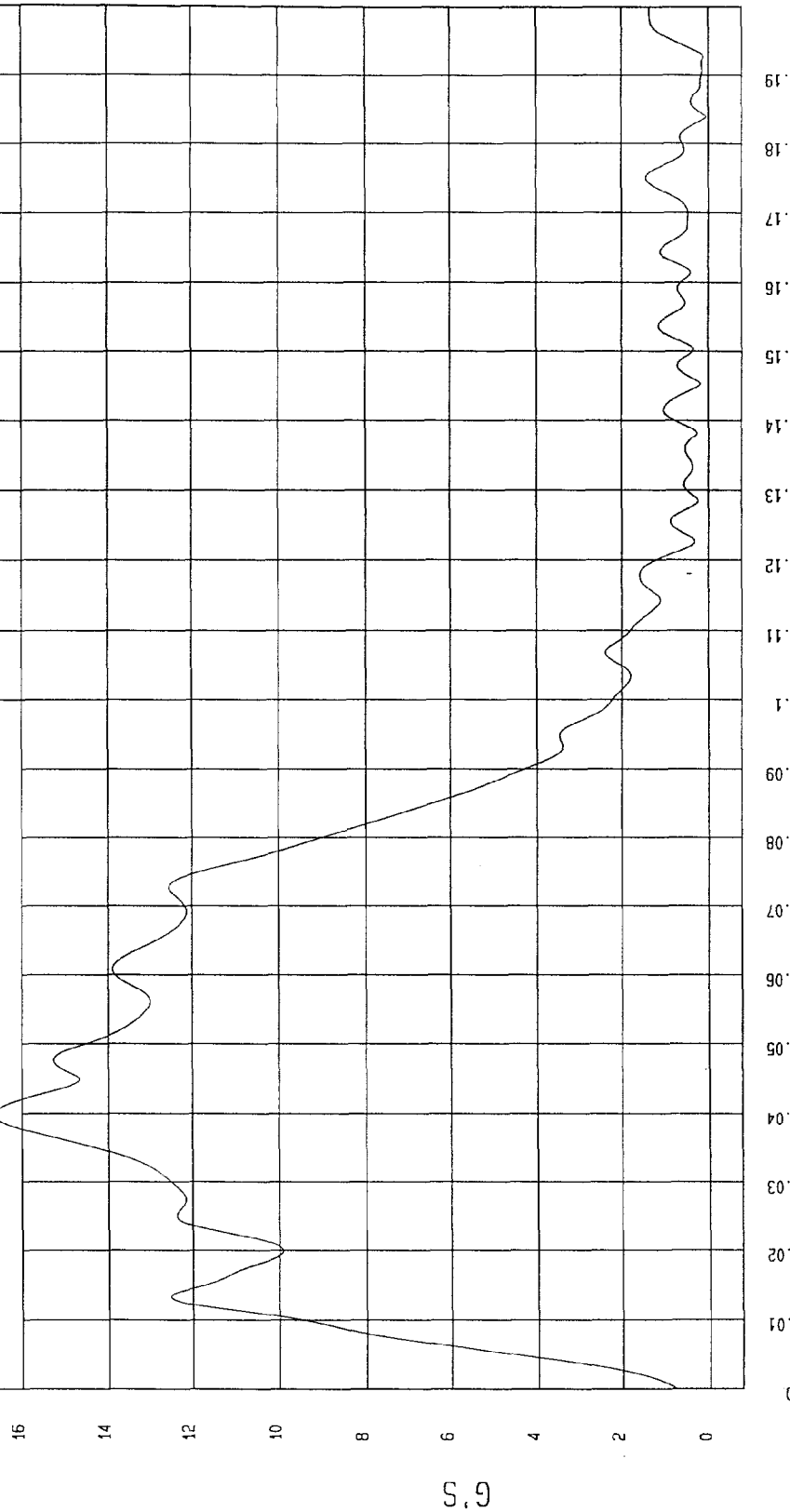
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

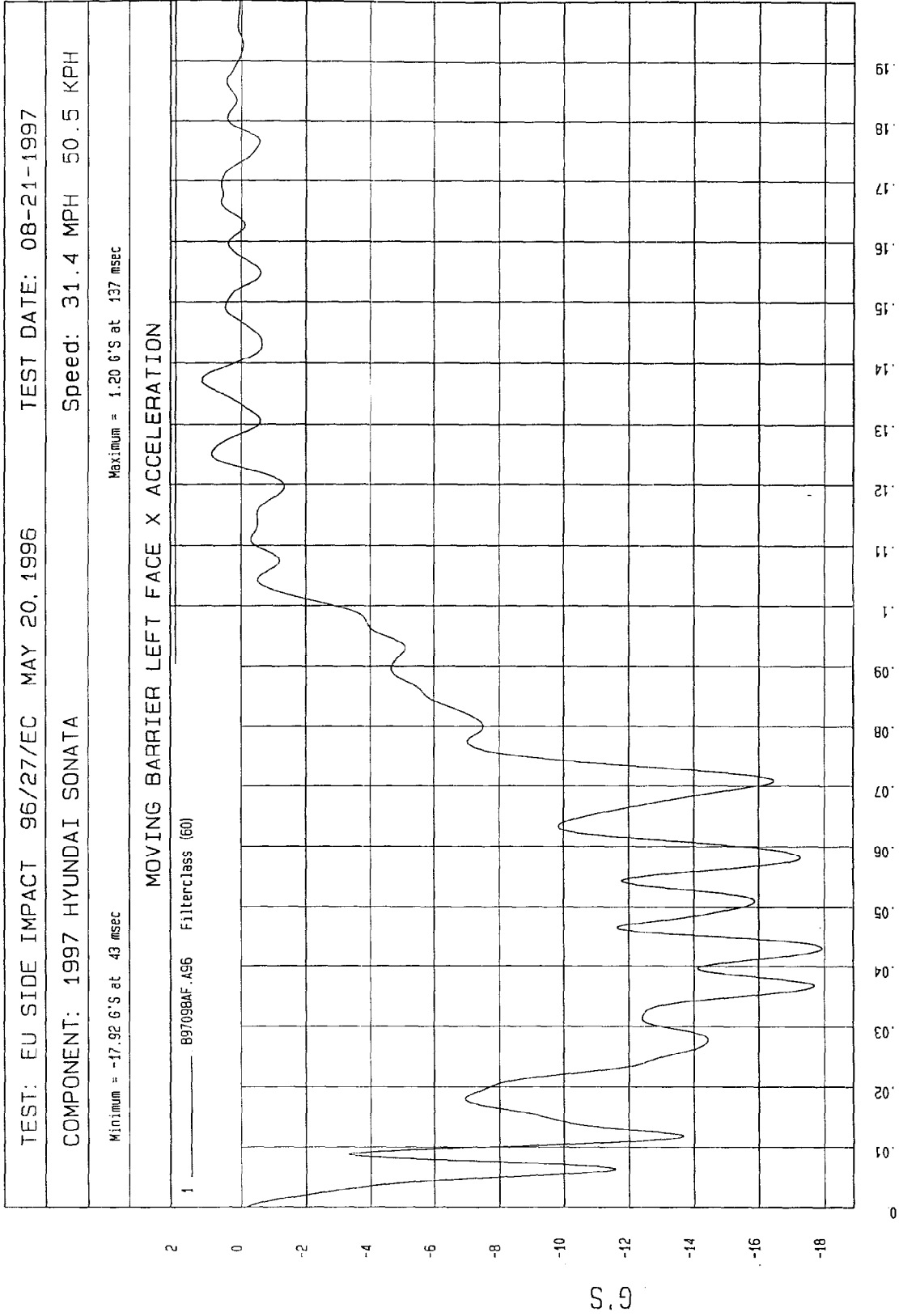
Minimum = 6.12E-02 G's at 184 msec Maximum = 16.65 G's at 40 msec

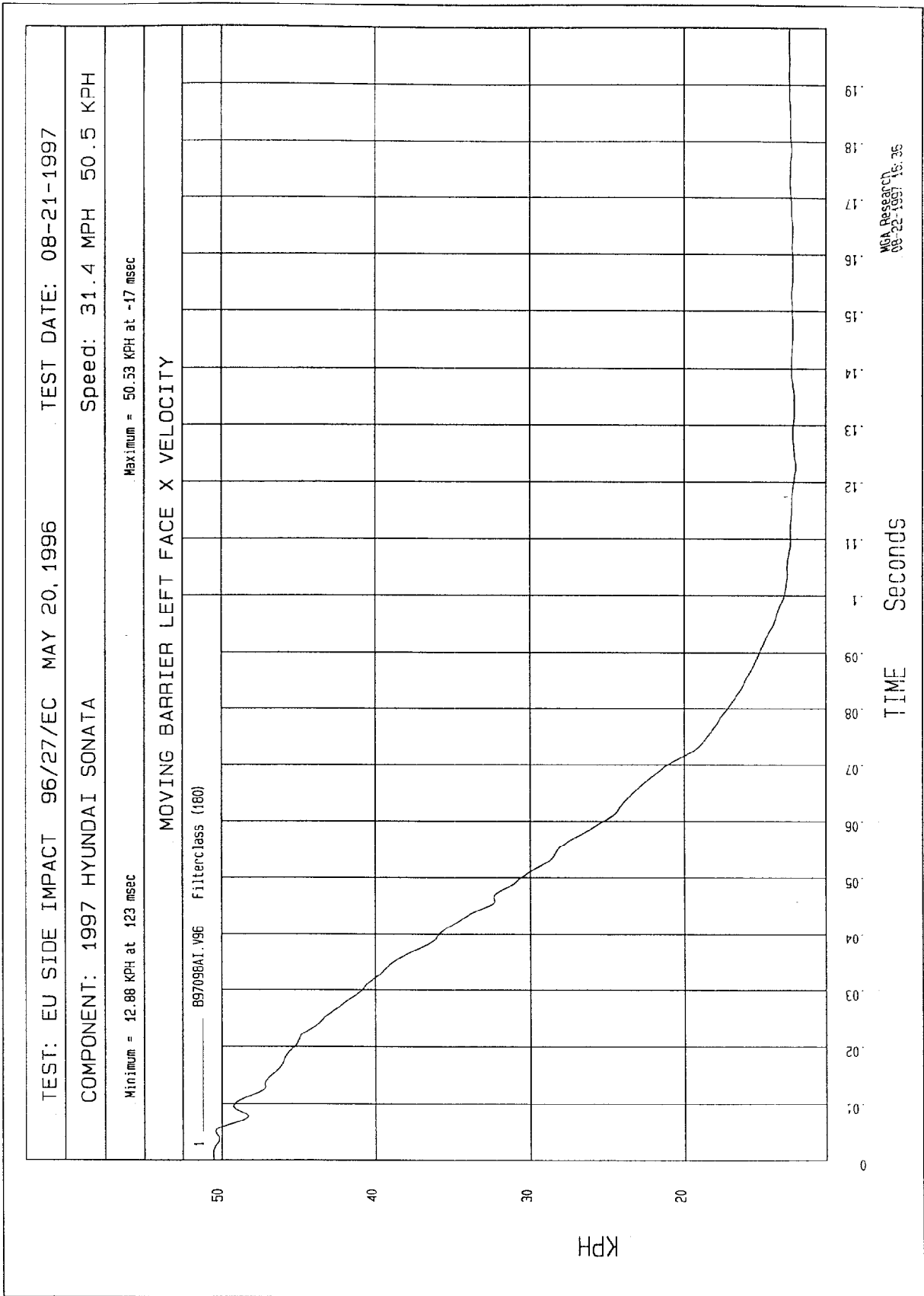
MOVING BARRIER CG RESULTANT ACCELERATION

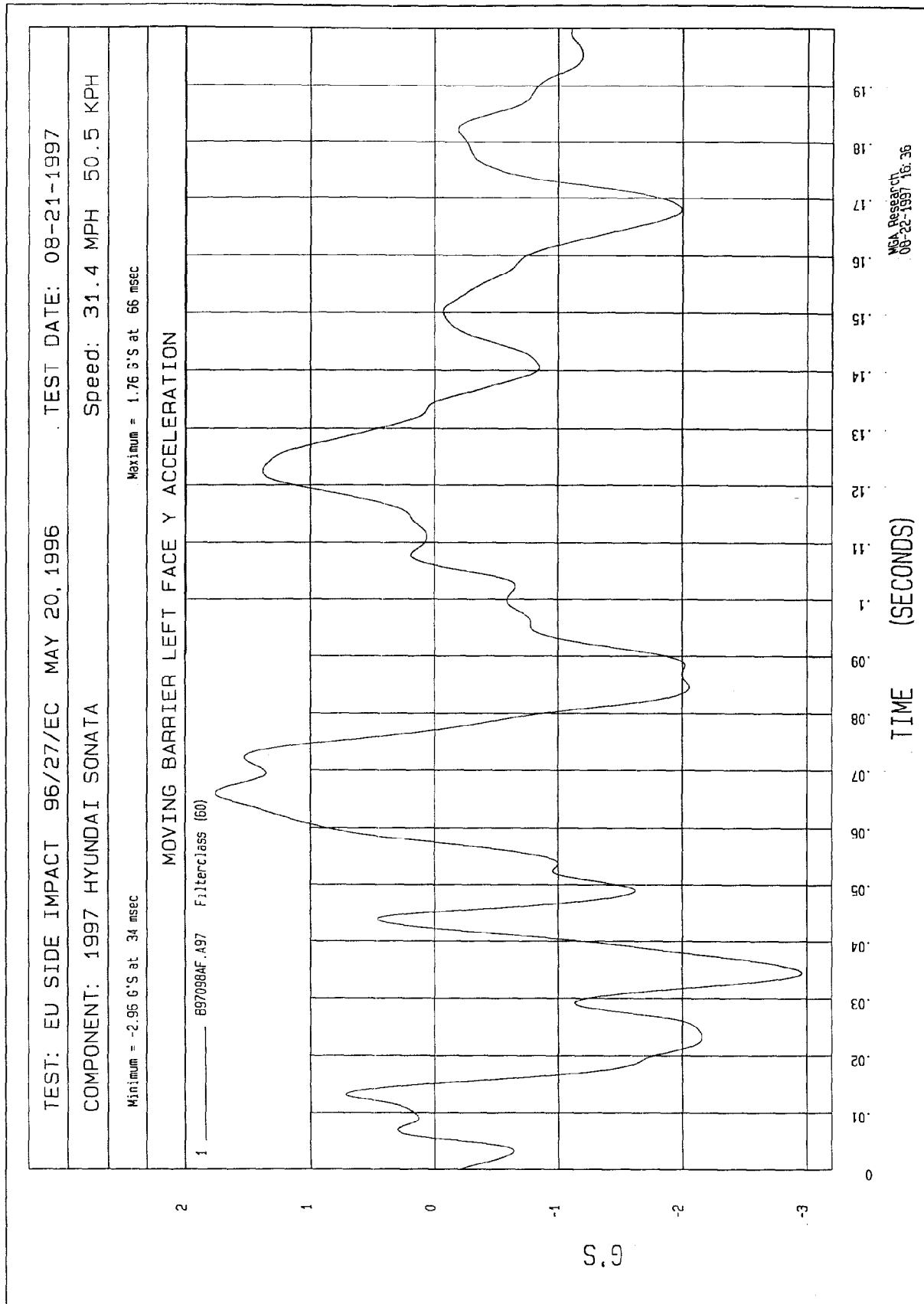
1 B97098AV A02 Filterclass (60)



MGA Research
08-22-1997 13:09





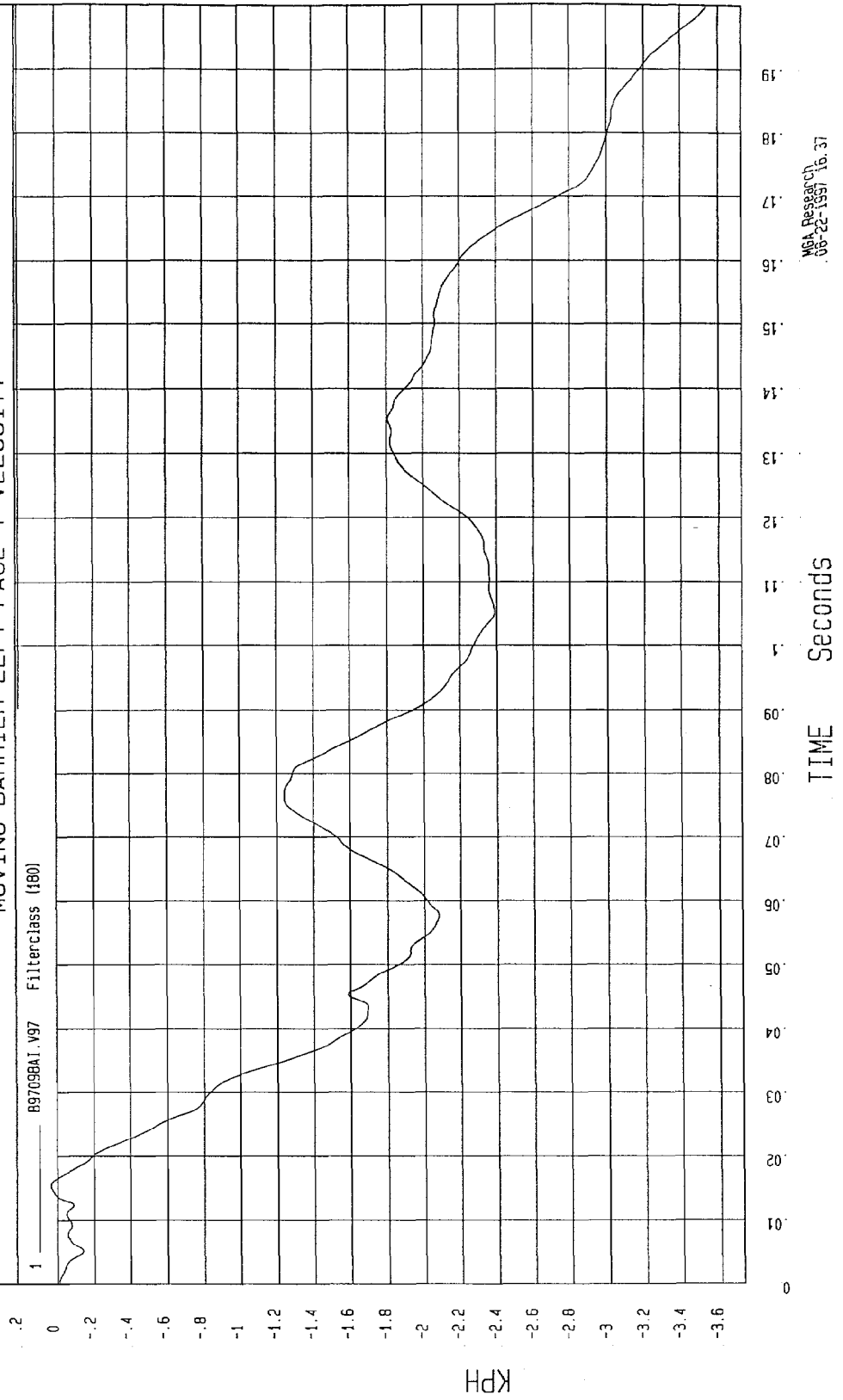


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -3.54 KPH at 200 msec Maximum = 3.64E-02 KPH at 15 msec

MOVING BARRIER LEFT FACE Y VELOCITY

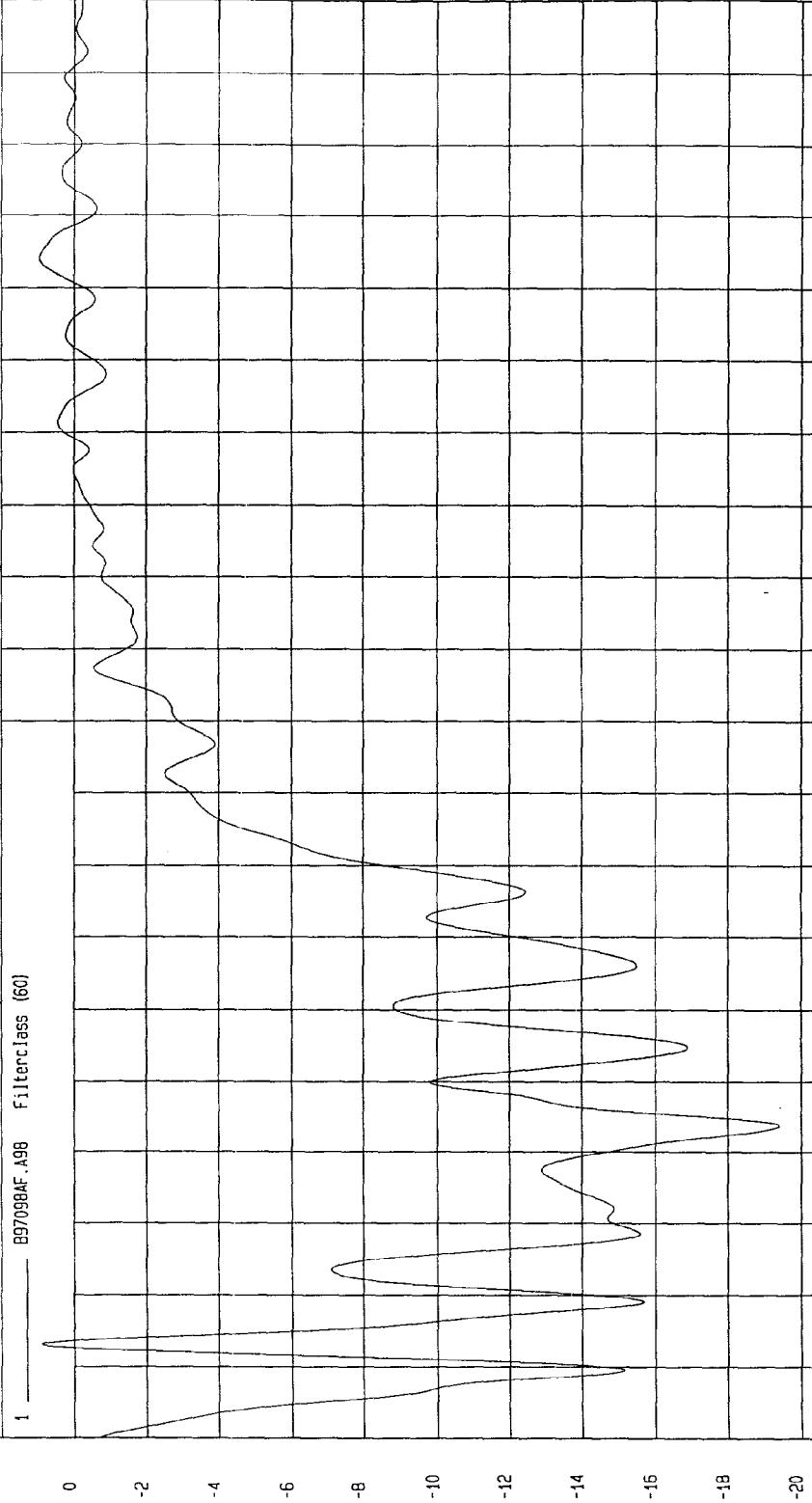


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

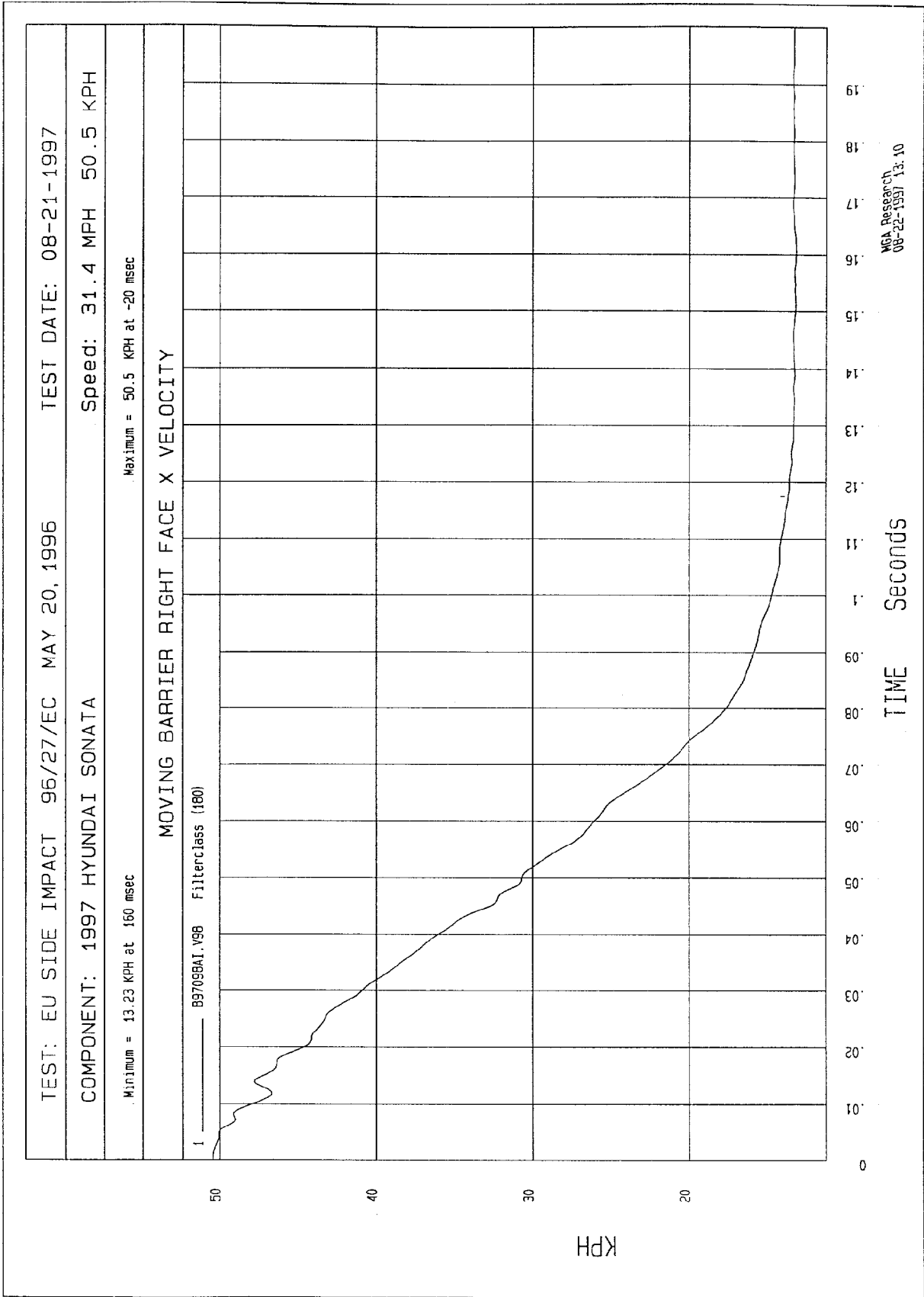
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -19.39 G'S at 44 msec Maximum = .96 G'S at 164 msec

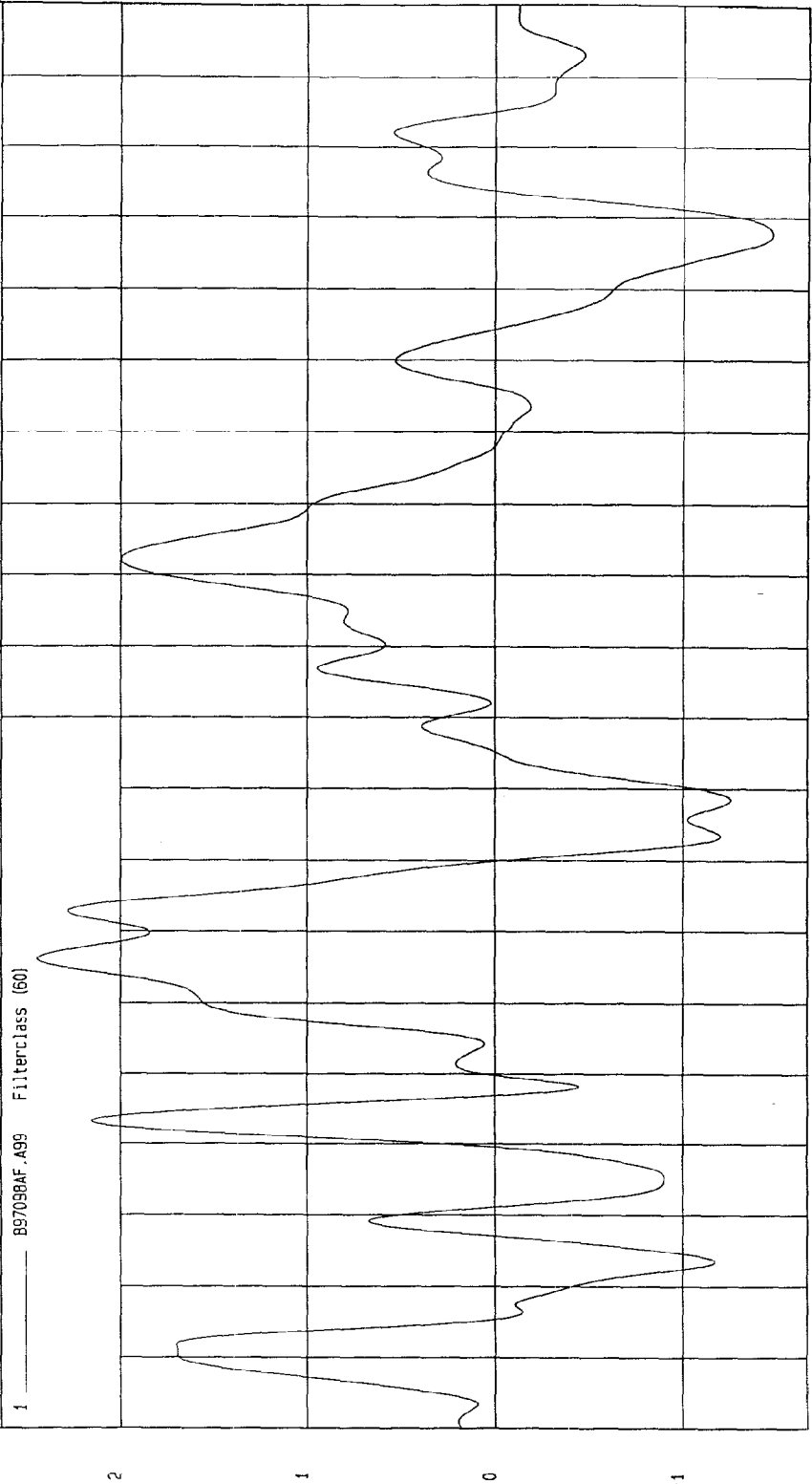
MOVING BARRIER RIGHT FACE X ACCELERATION



MOA Research
08-22-1997 13:10



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -1.46 G'S at 158 msec	
Maximum = 2.44 G'S at 66 msec	
MOVING BARRIER RIGHT FACE Y ACCELERATION	



1 ——— B97090AF.A99 Filterclass (60)

TIME (SECONDS)

MCA Research
08-22-1997 13:10

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -3.14E-02 KPH at -17 msec

Maximum = 2.71 KPH at 154 msec

MOVING BARRIER RIGHT FACE Y VELOCITY

1 89709BA1.V99 Filterclass (180)

2.8

2.6

2.4

2.2

2.0

1.8

1.6

1.4

1.2

1.0

.8

.6

.4

.2

0

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

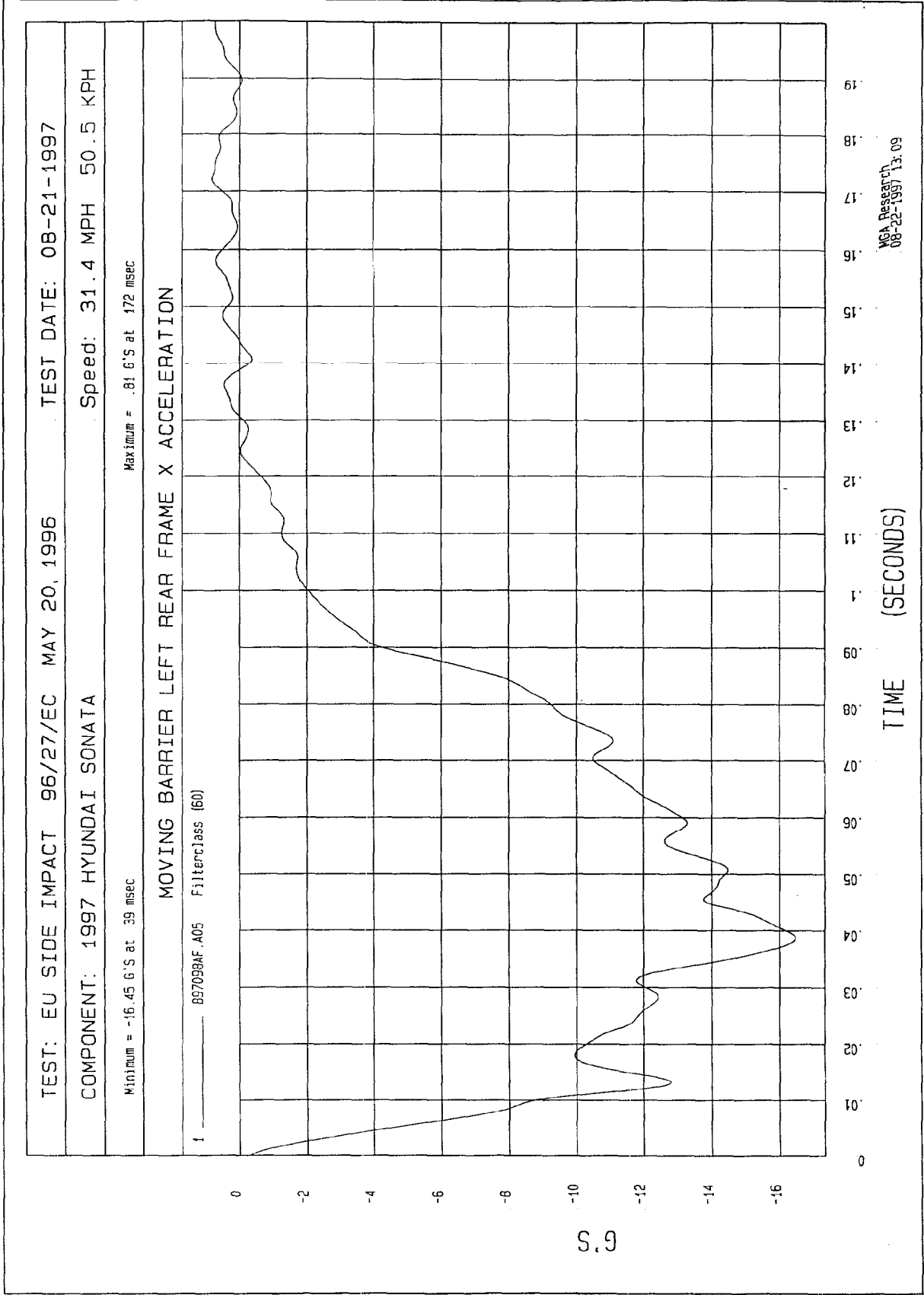
02

01

0

TIME Seconds

WGA Research
08-22-1997 13.10

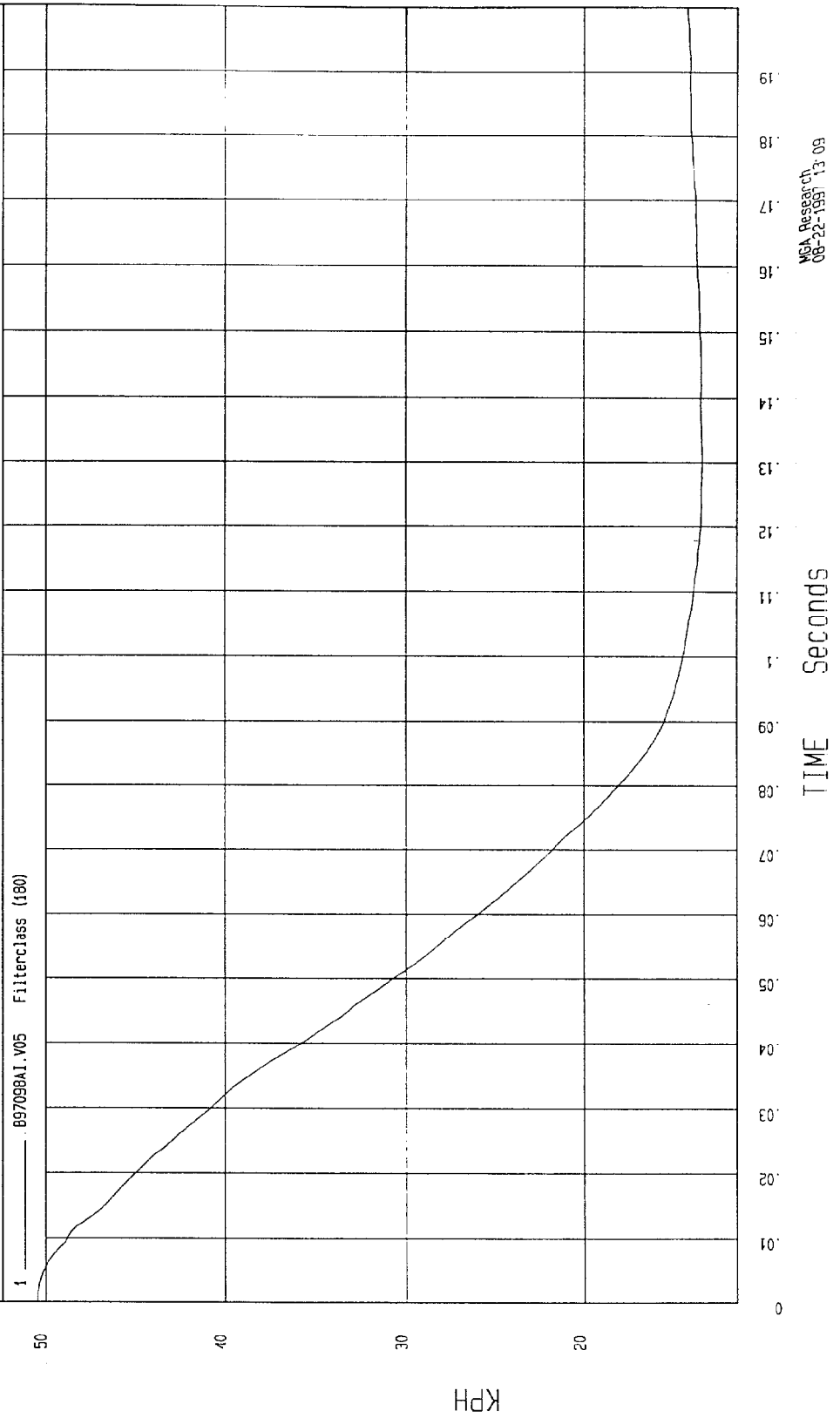


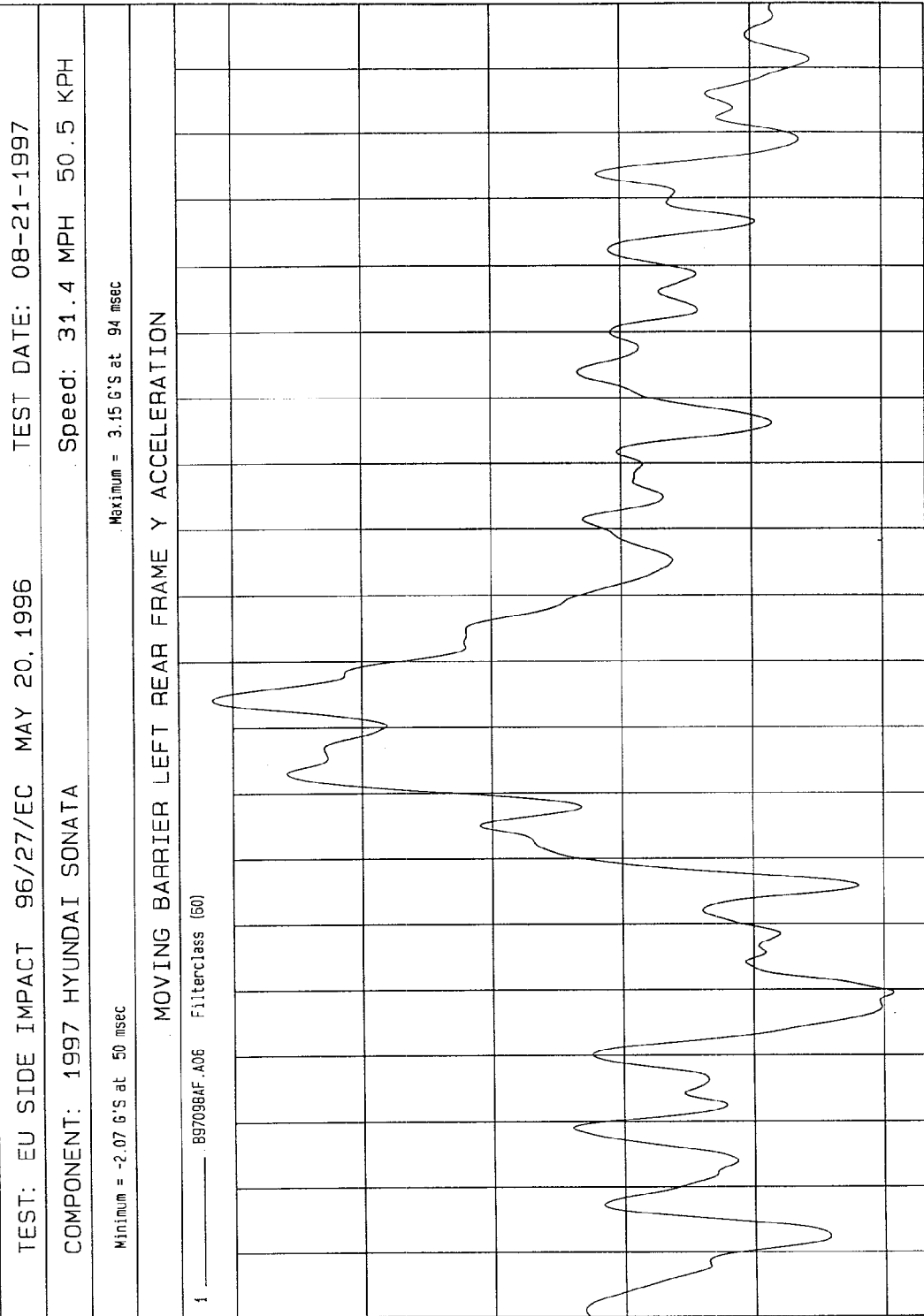
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 13.46 KPH at 130 msec Maximum = 50.51 KPH at -12 msec

MOVING BARRIER LEFT REAR FRAME X VELOCITY





TIME (SECONDS)

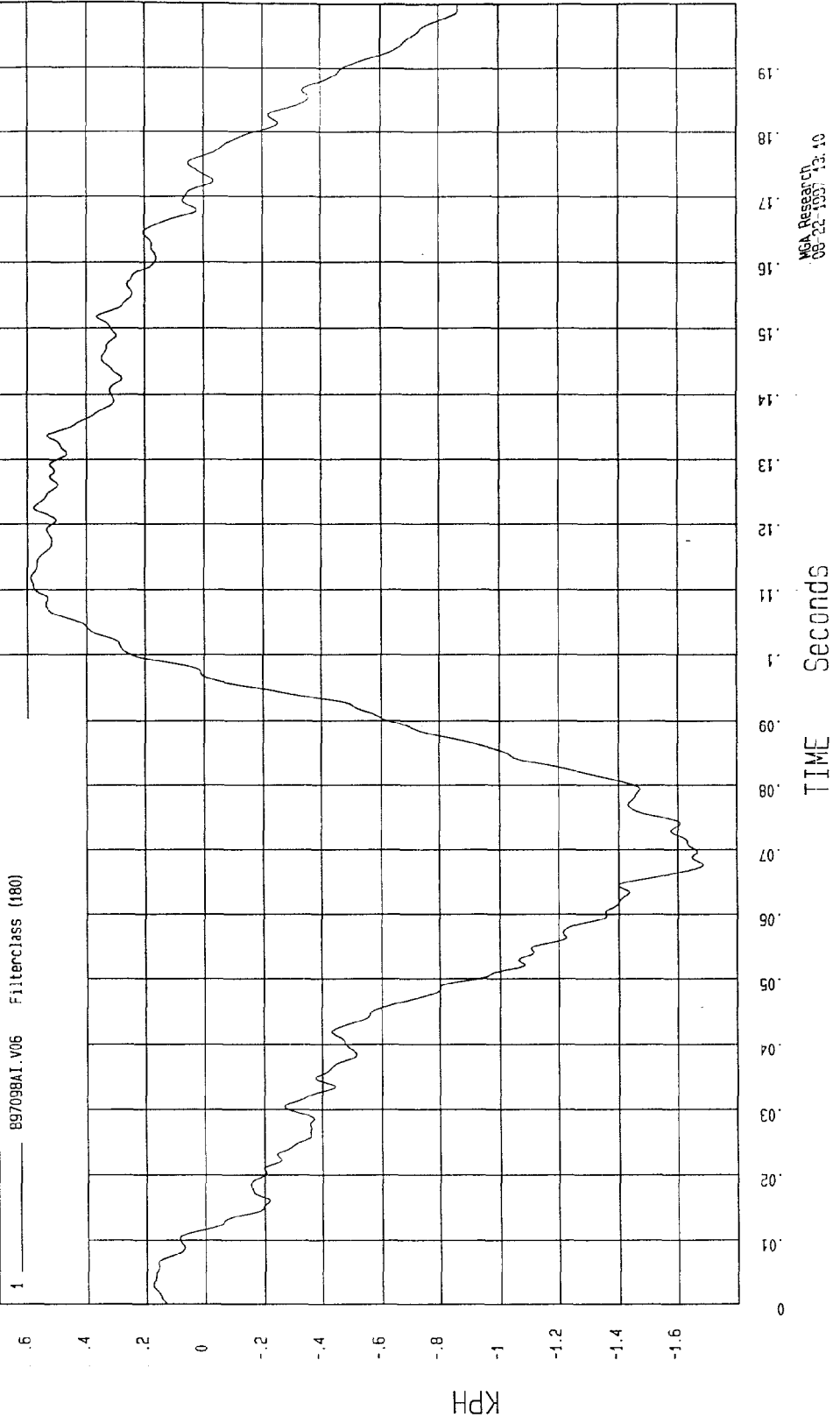
WCA Research
08-22-1997 13:09

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.68 KPH at 68 msec Maximum = .58 KPH at 112 msec

MOVING BARRIER LEFT REAR FRAME Y VELOCITY



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

SPEED: 31.4 MPH 50.5 KPH

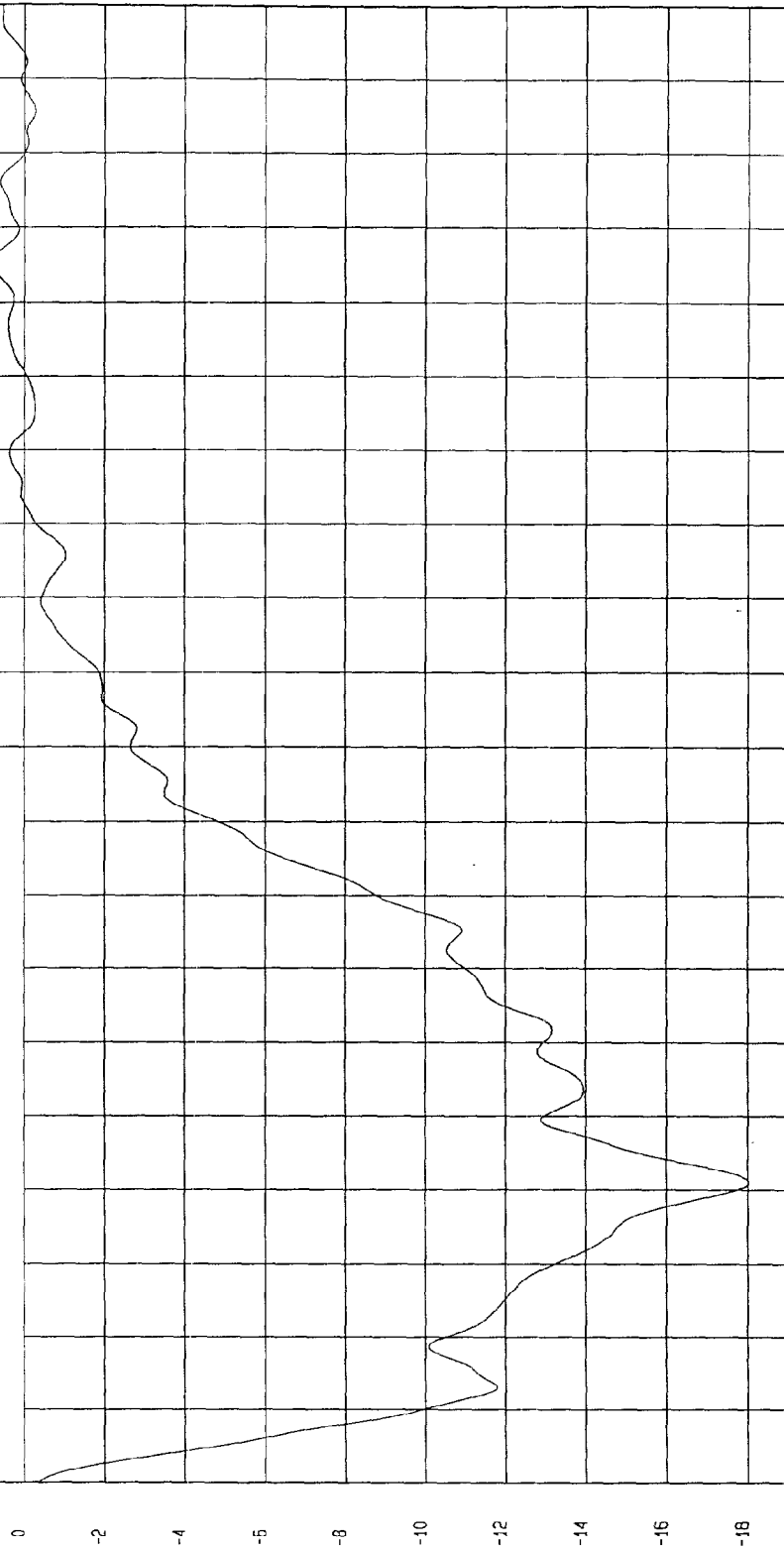
COMPONENT: 1997 HYUNDAI SONATA

Maximum = .85 G'S at 165 msec

Minimum = -18.03 G'S at 41 msec

MOVING BARRIER RIGHT REAR FRAME X ACCELERATION

1 B970384F.A94 Filterclass (60)



WDA Research
08-22-1997 13:09

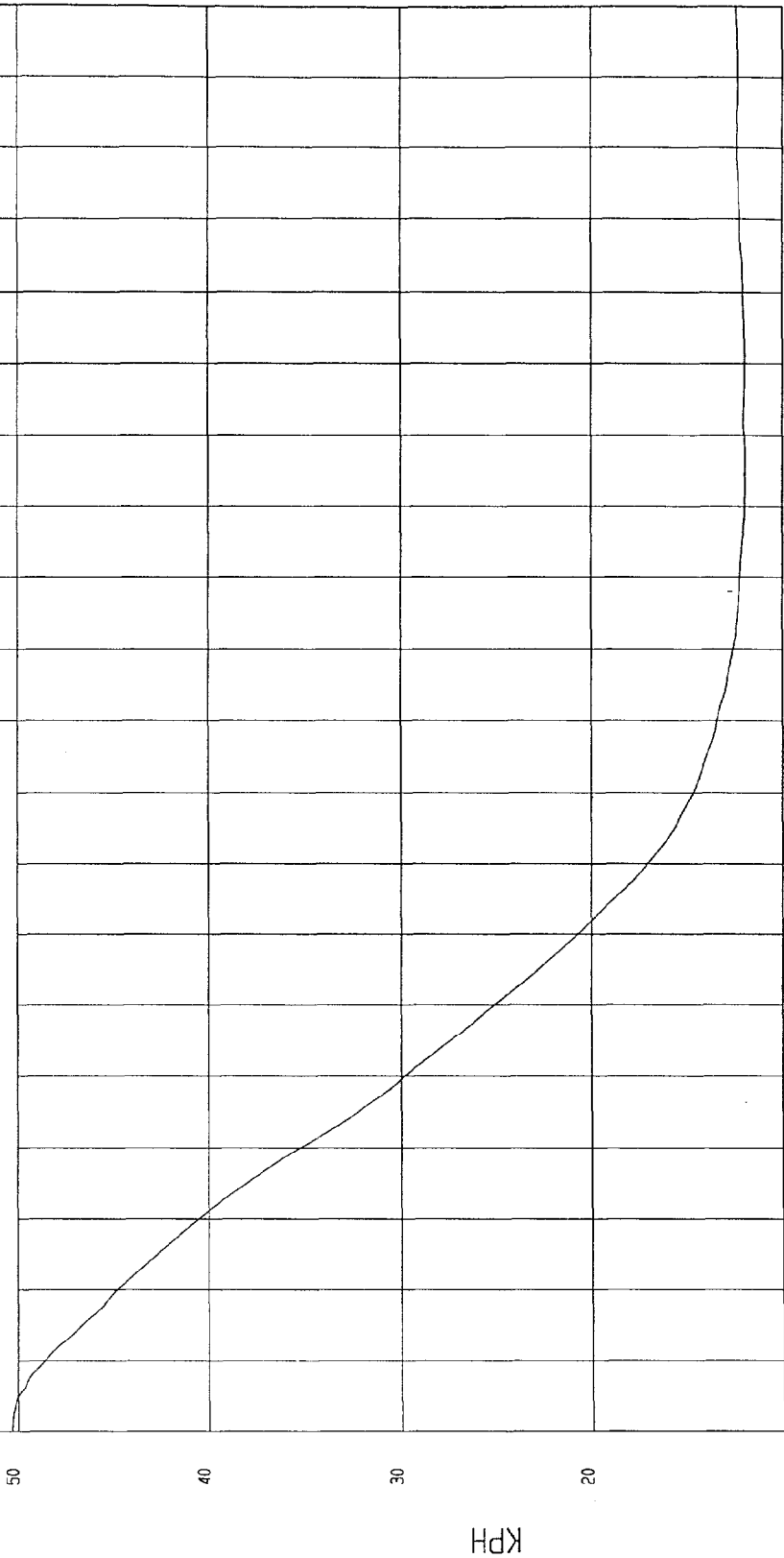
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 12.04 KPH at 133 msec Maximum = 50.5 KPH at -20 msec

MOVING BARRIER RIGHT REAR FRAME X VELOCITY

1 897098A1.V94 Filterclass (480)

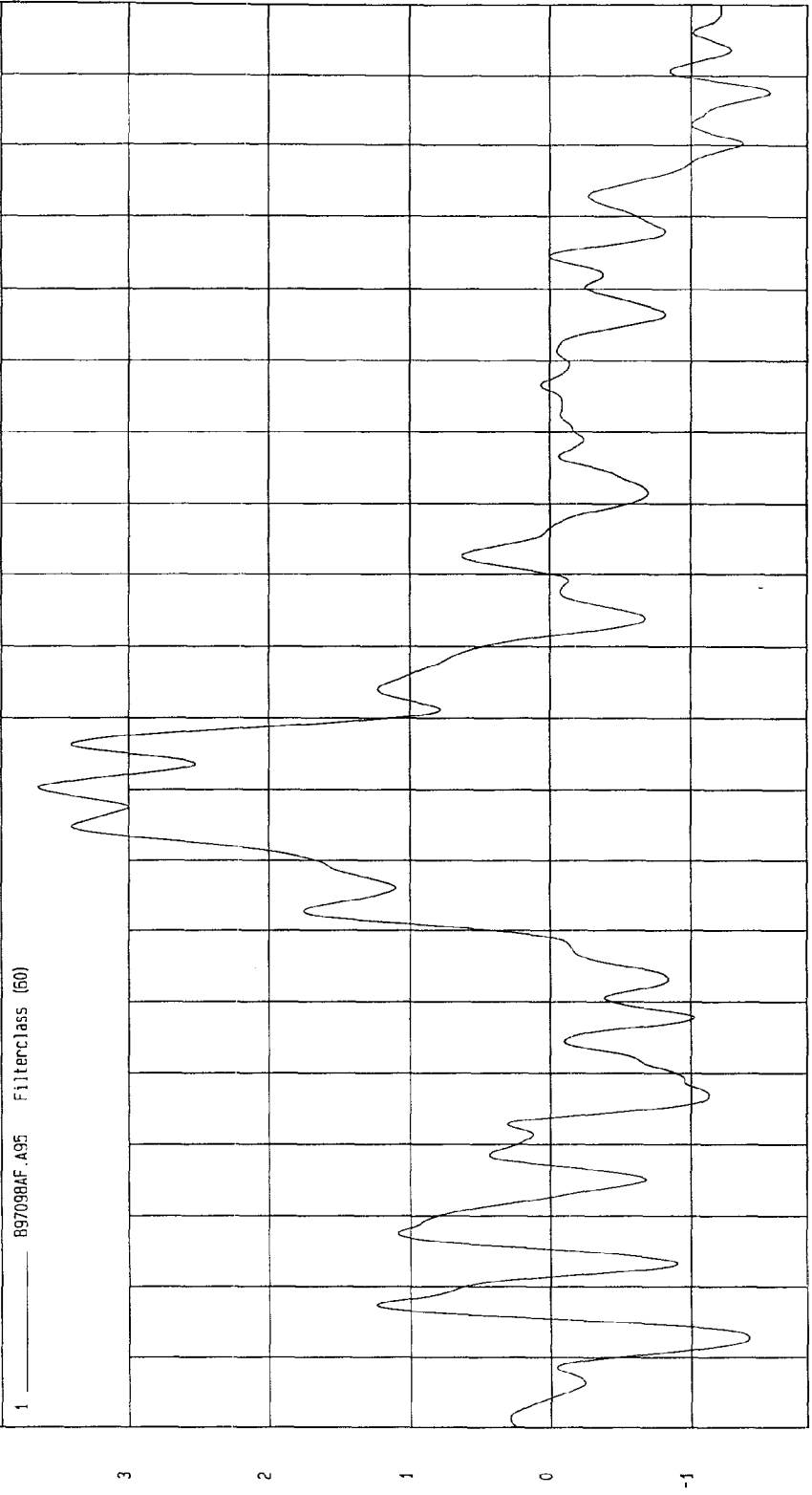


TIME Seconds

MCA Research
08-22-1997 13:09

TEST: EU SIDE IMPACT 96/27/EC	MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH	50.5 KPH
Minimum = -1.57 G'S at 137 msec		
Maximum = 3.65 G'S at 90 msec		

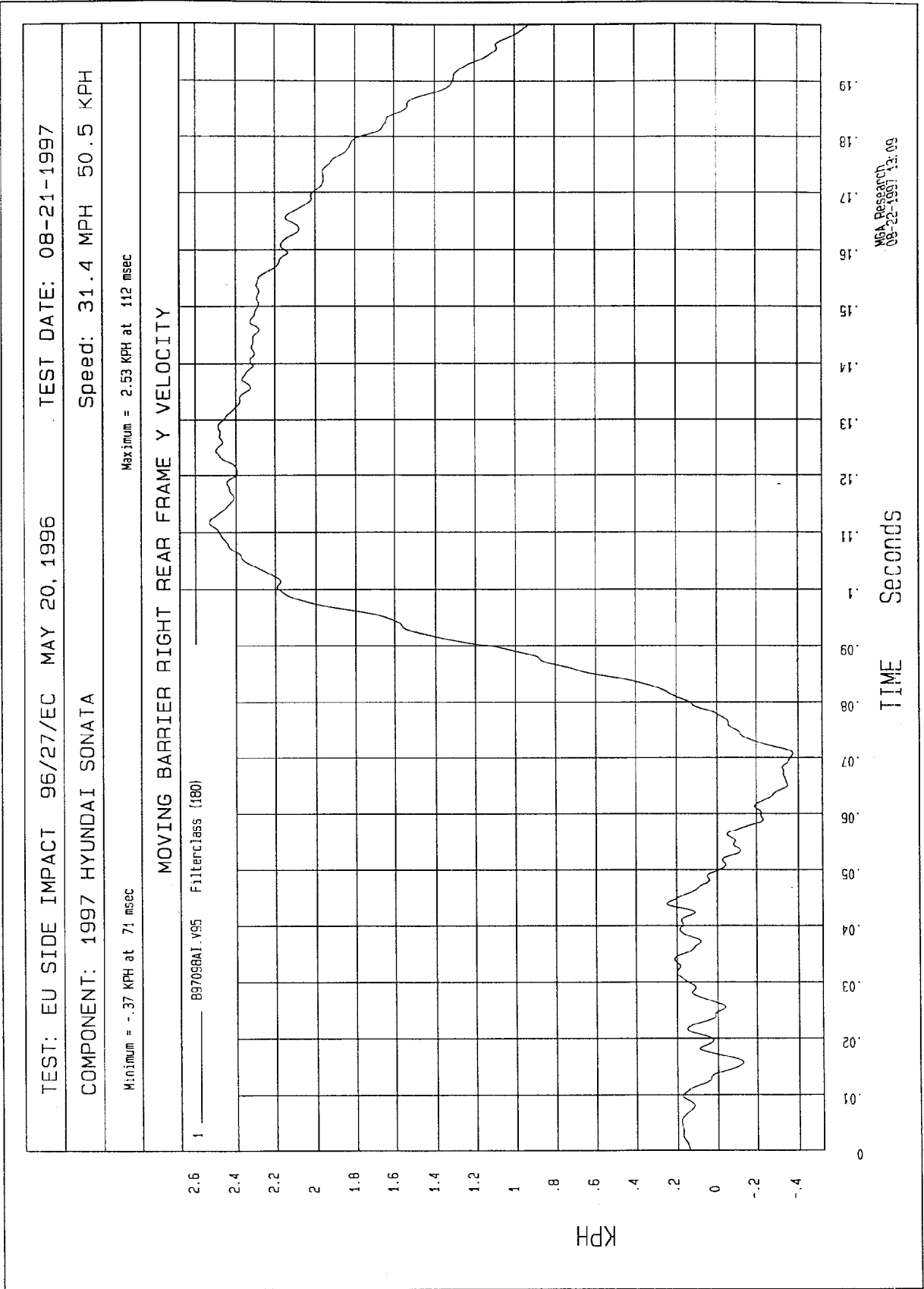
MOVING BARRIER RIGHT REAR FRAME Y ACCELERATION

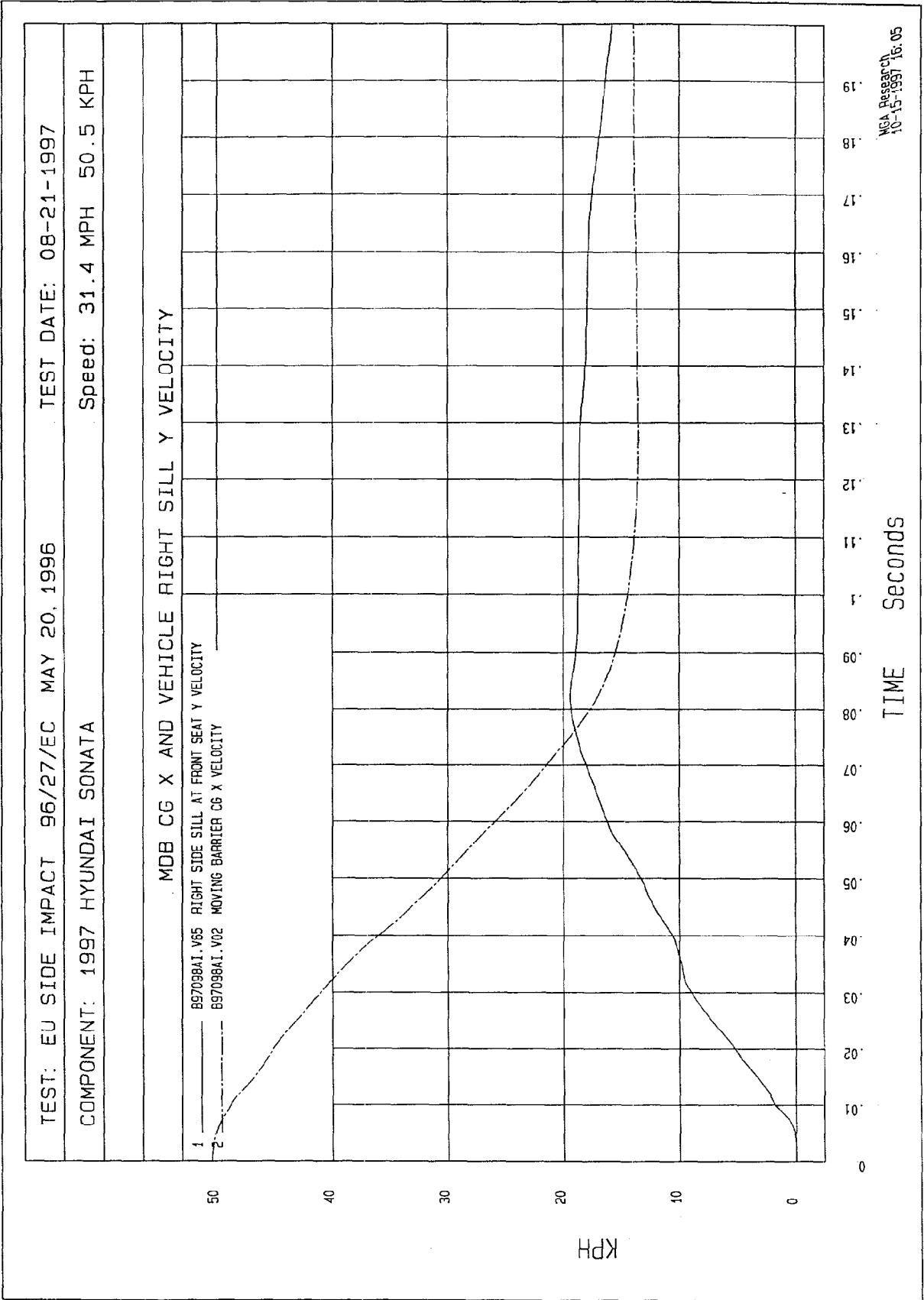


TIME (SECONDS)

0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01

NGA Research
08-22-1997 13:09





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA

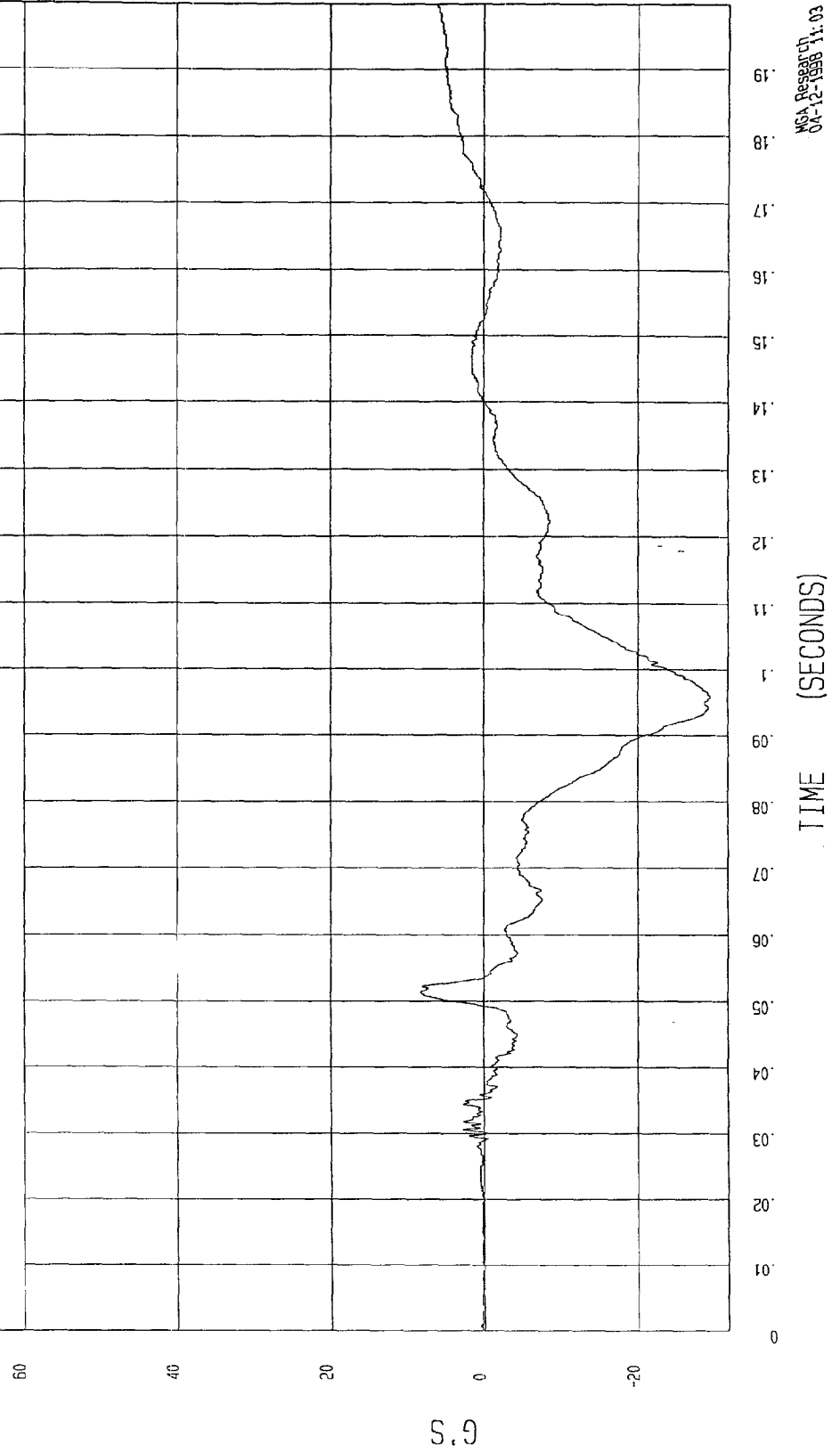
Speed: 31.4 MPH 50.5 KPH

Minimum = -29.25 G'S at 96 msec

Maximum = 8.14 G'S at 51 msec

DRIVER HEAD X ACCELERATION

1 B97098AT.A12 Filterclass (1000)



MGA Research
08-12-1998 11:03

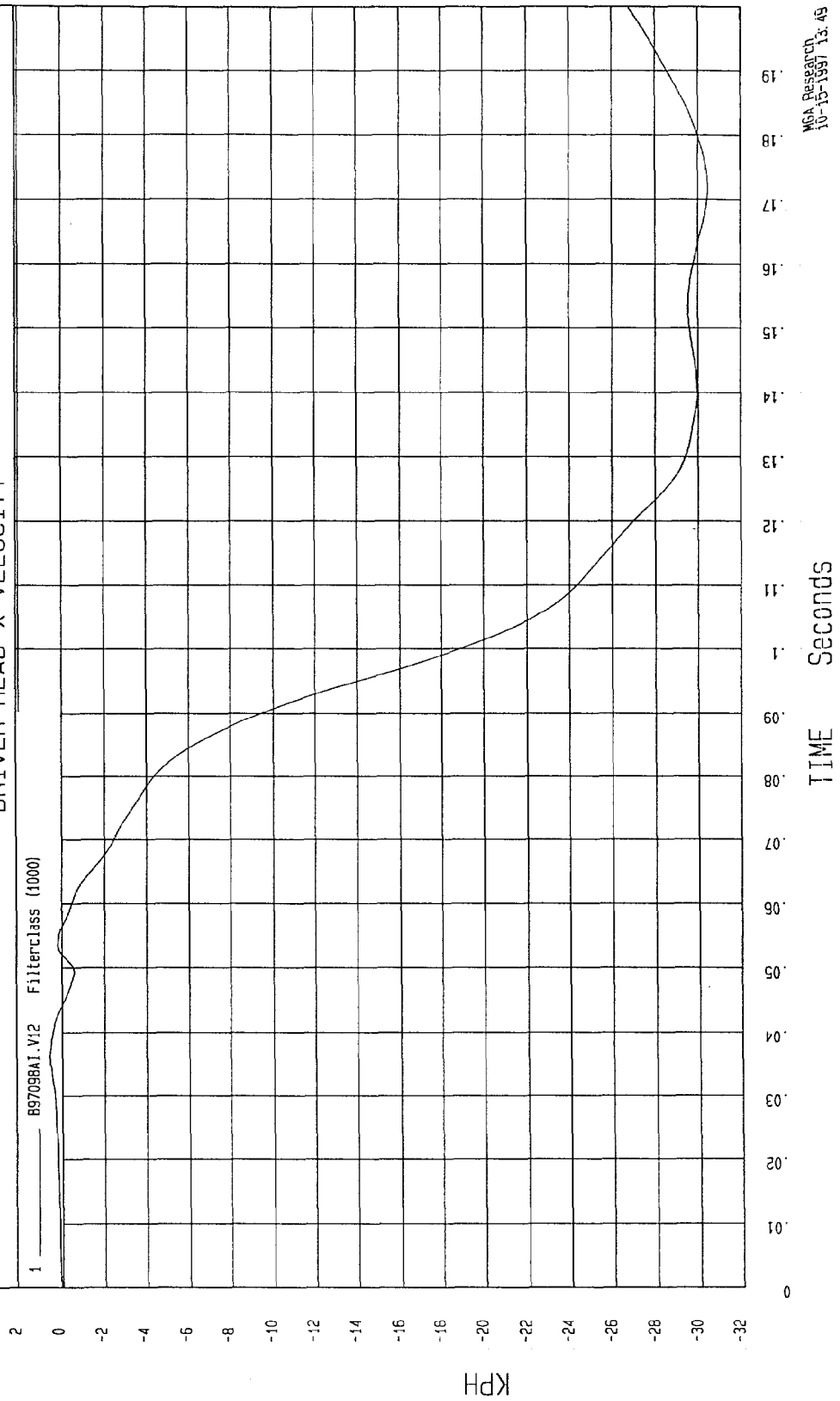
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -30.46 KPH at 172 msec

Maximum = .56 KPH at 35 msec

DRIVER HEAD X VELOCITY

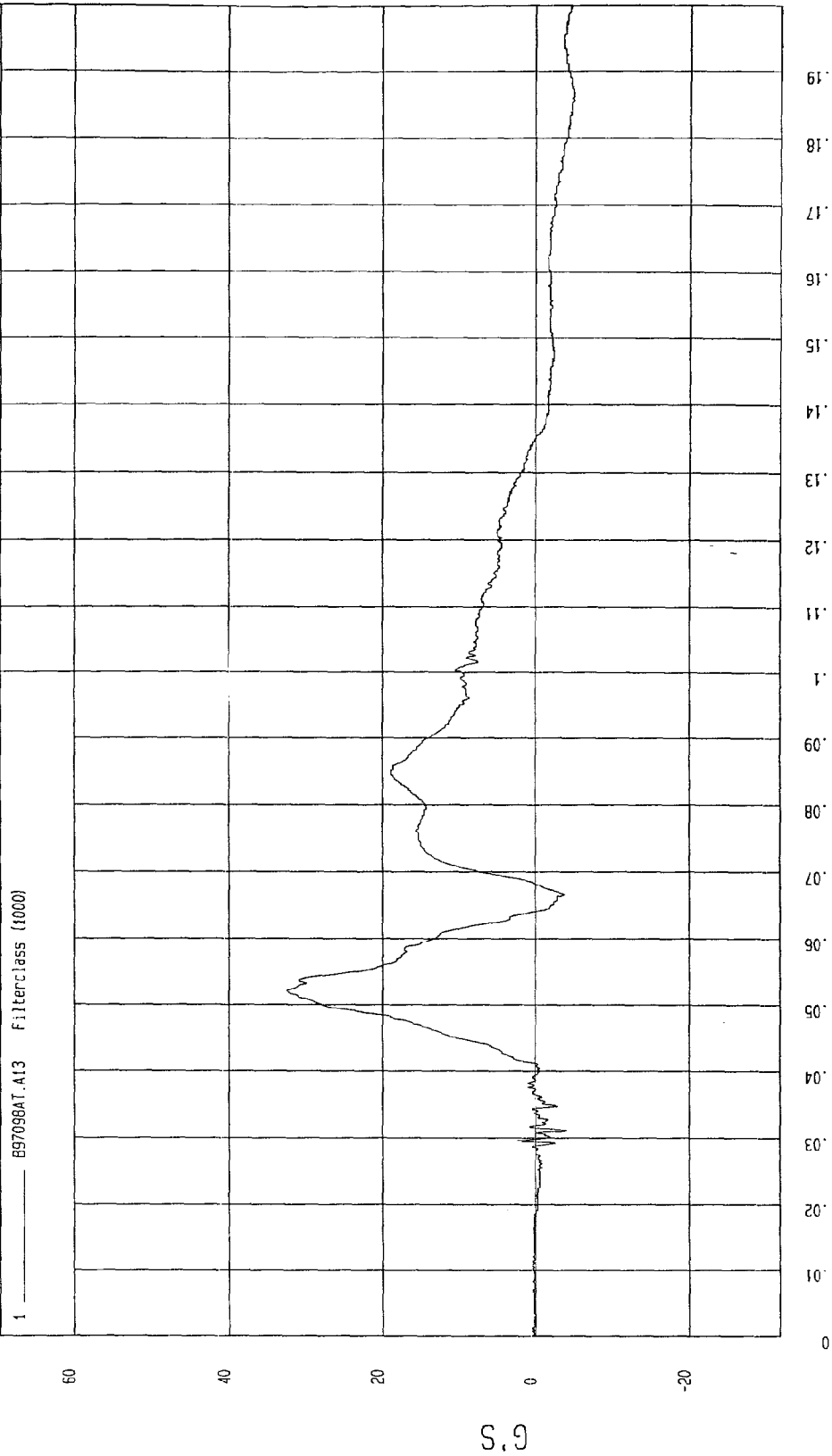


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -4.93 G'S at 186 msec Maximum = 32.51 G'S at 52 msec

DRIVER HEAD Y ACCELERATION

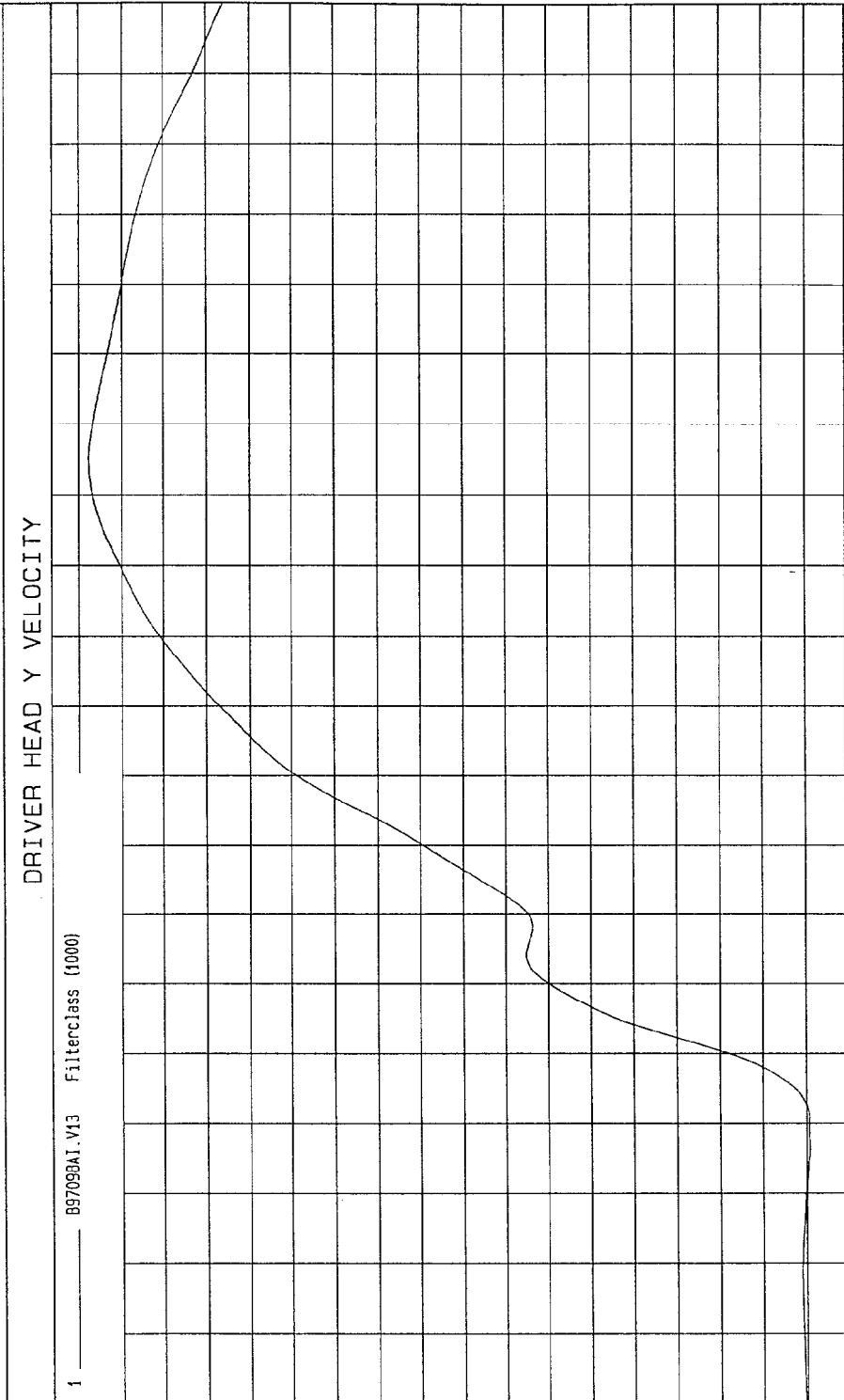


MCA Research
04-12-1998 11:03

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

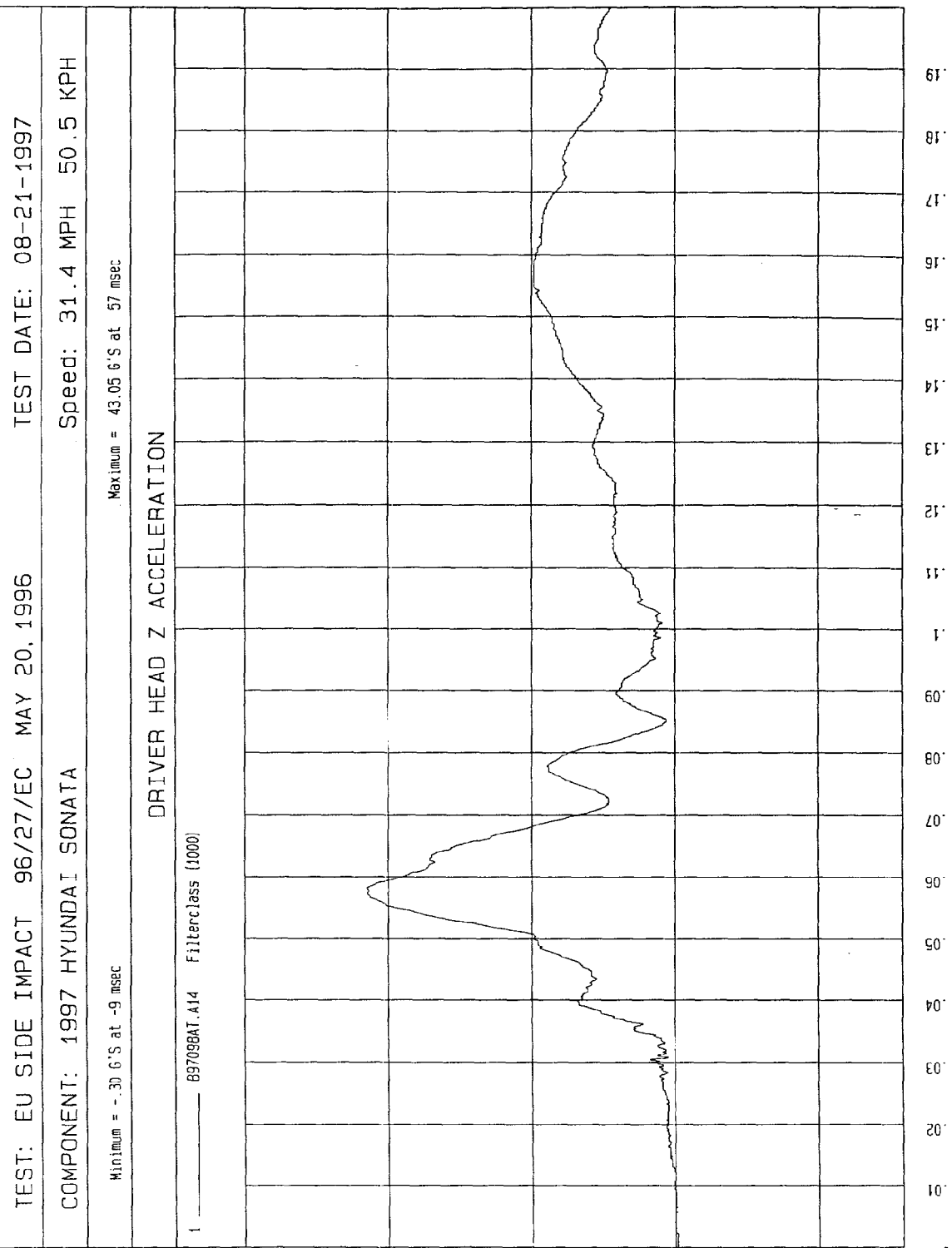
Minimum = -17 KPH at 36 msec Maximum = 33.56 KPH at 135 msec



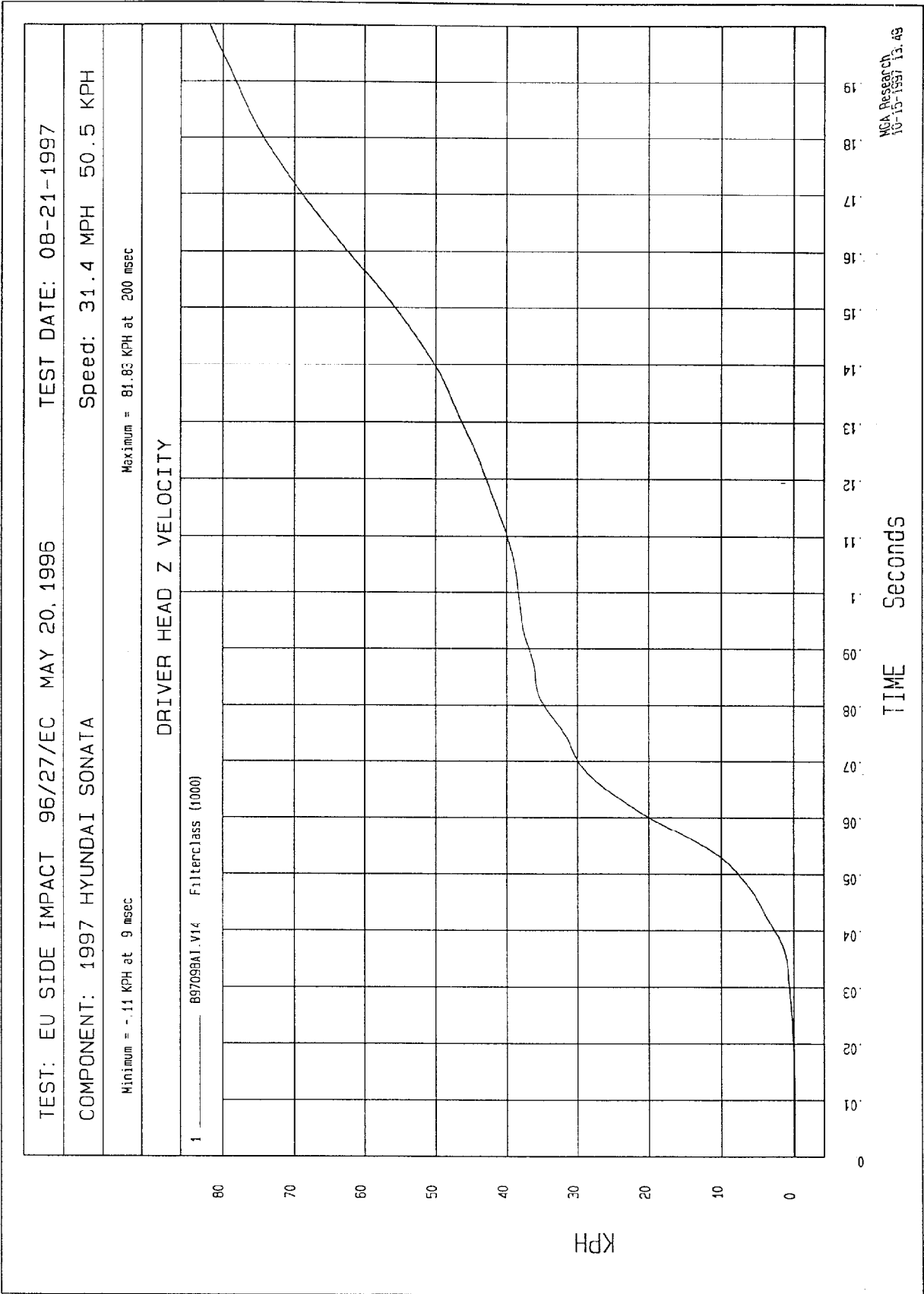
KPH

TIME Seconds

WCA Research
10-15-1997 13.49



MCA Research
04-12-1998 11:03

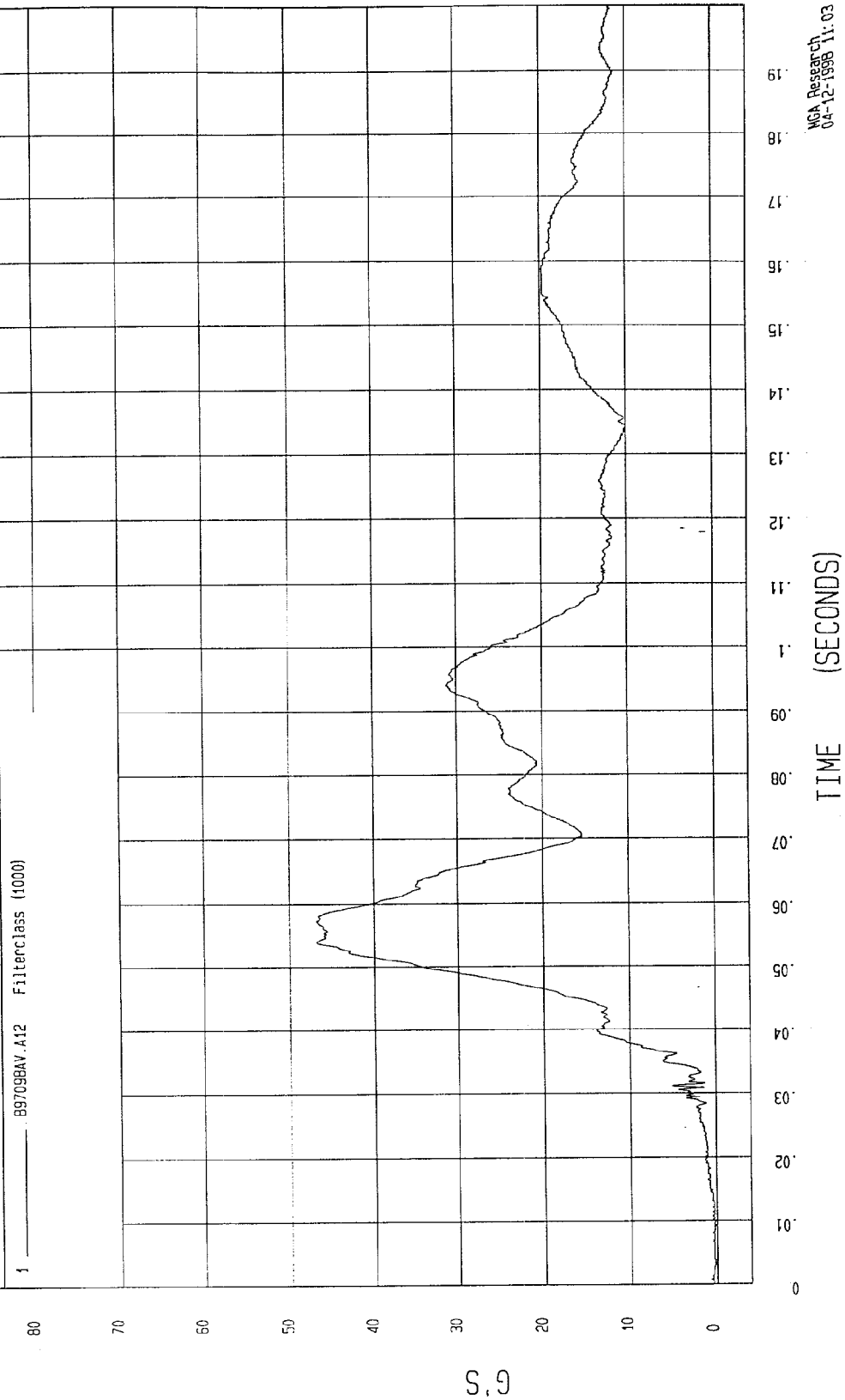


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 8.31E-02 G'S at -20 msec Maximum = 46.74 G'S at 57 msec

DRIVER HEAD RESULTANT ACCELERATION

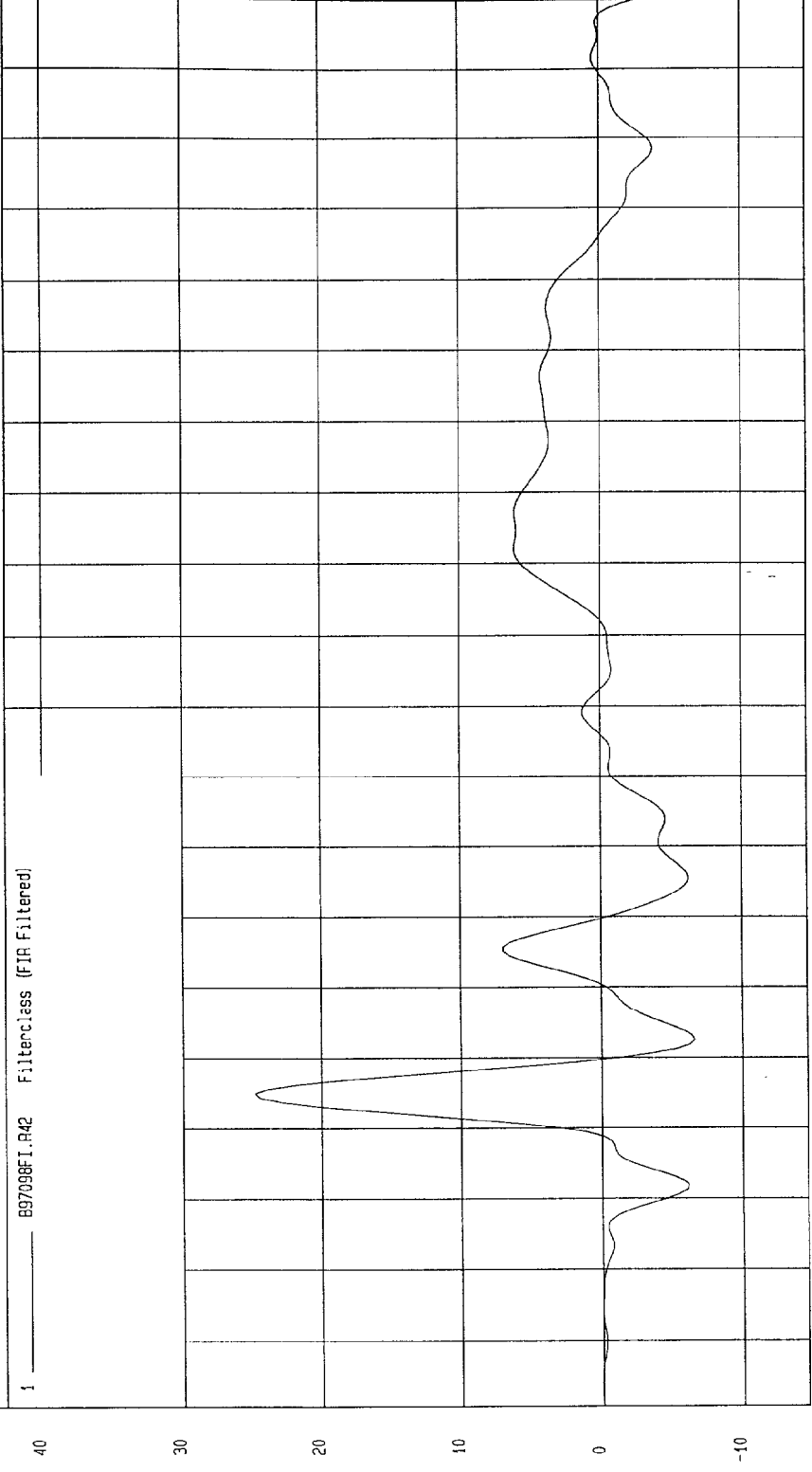


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -6.61 G'S at 52 msec Maximum = 24.89 G'S at 45 msec

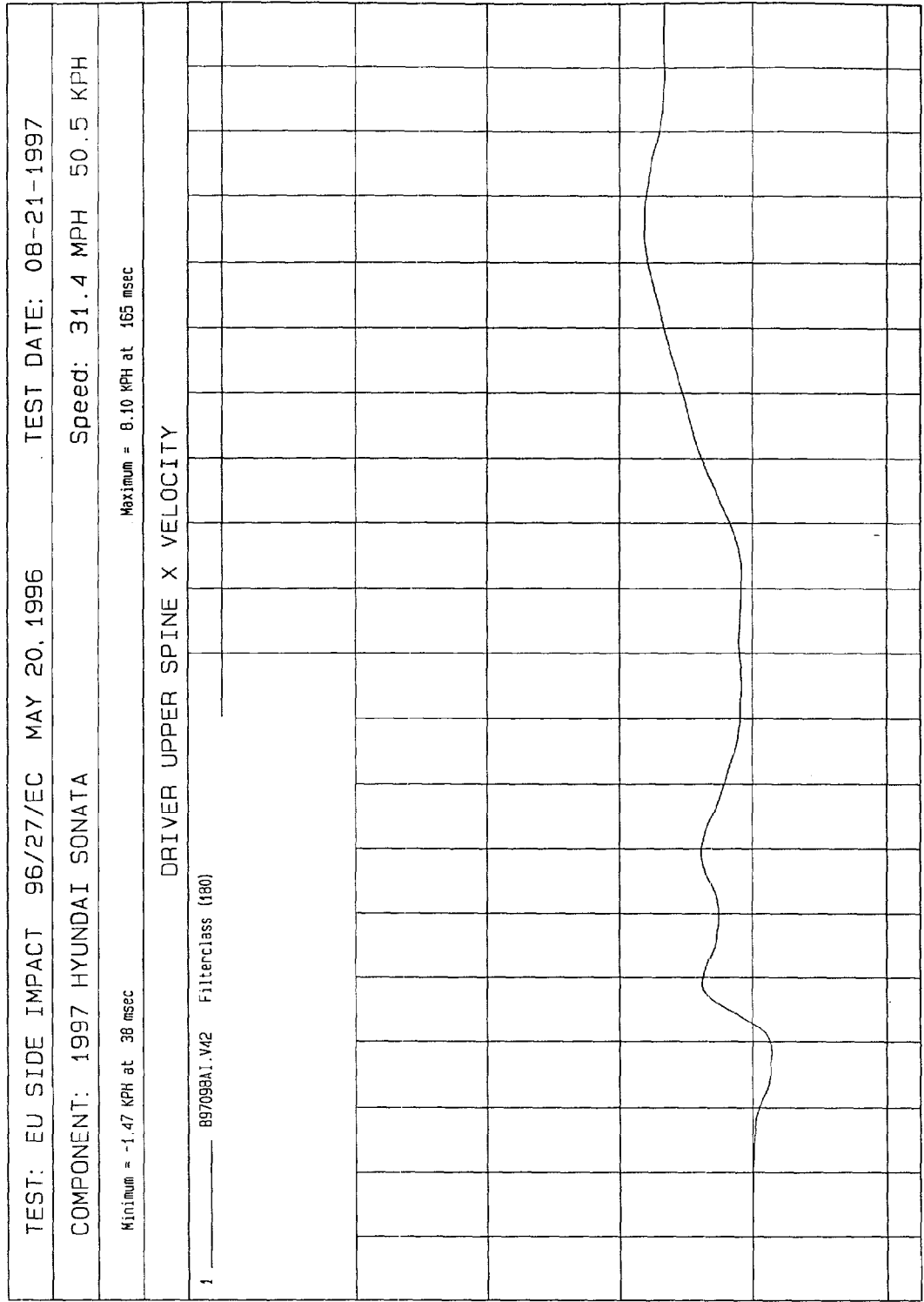
DRIVER UPPER SPINE X ACCELERATION



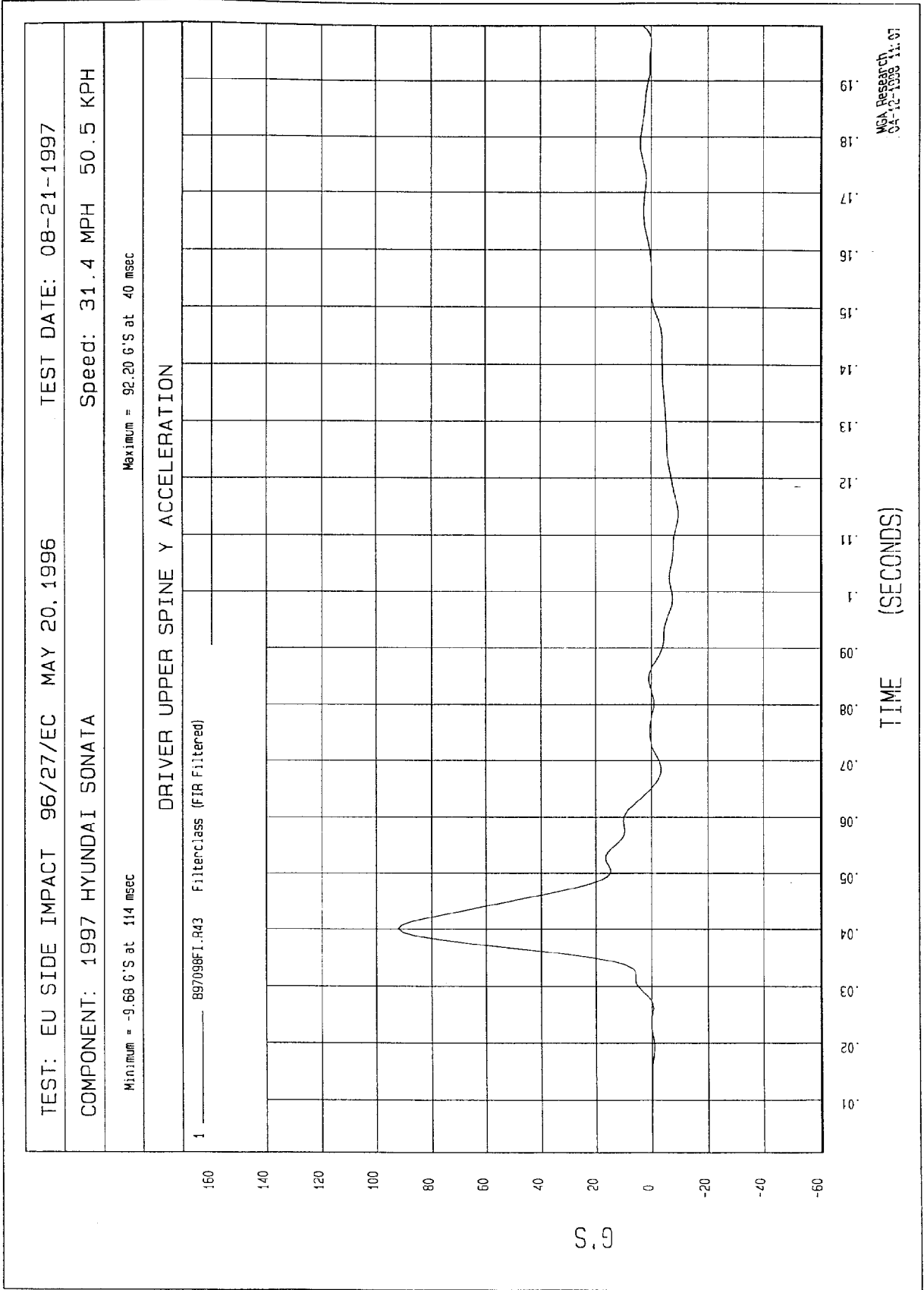
MCA Research
04-12-1998 11:07

TIME (SECONDS)

G



MGA Research
08-22-1997 13:15

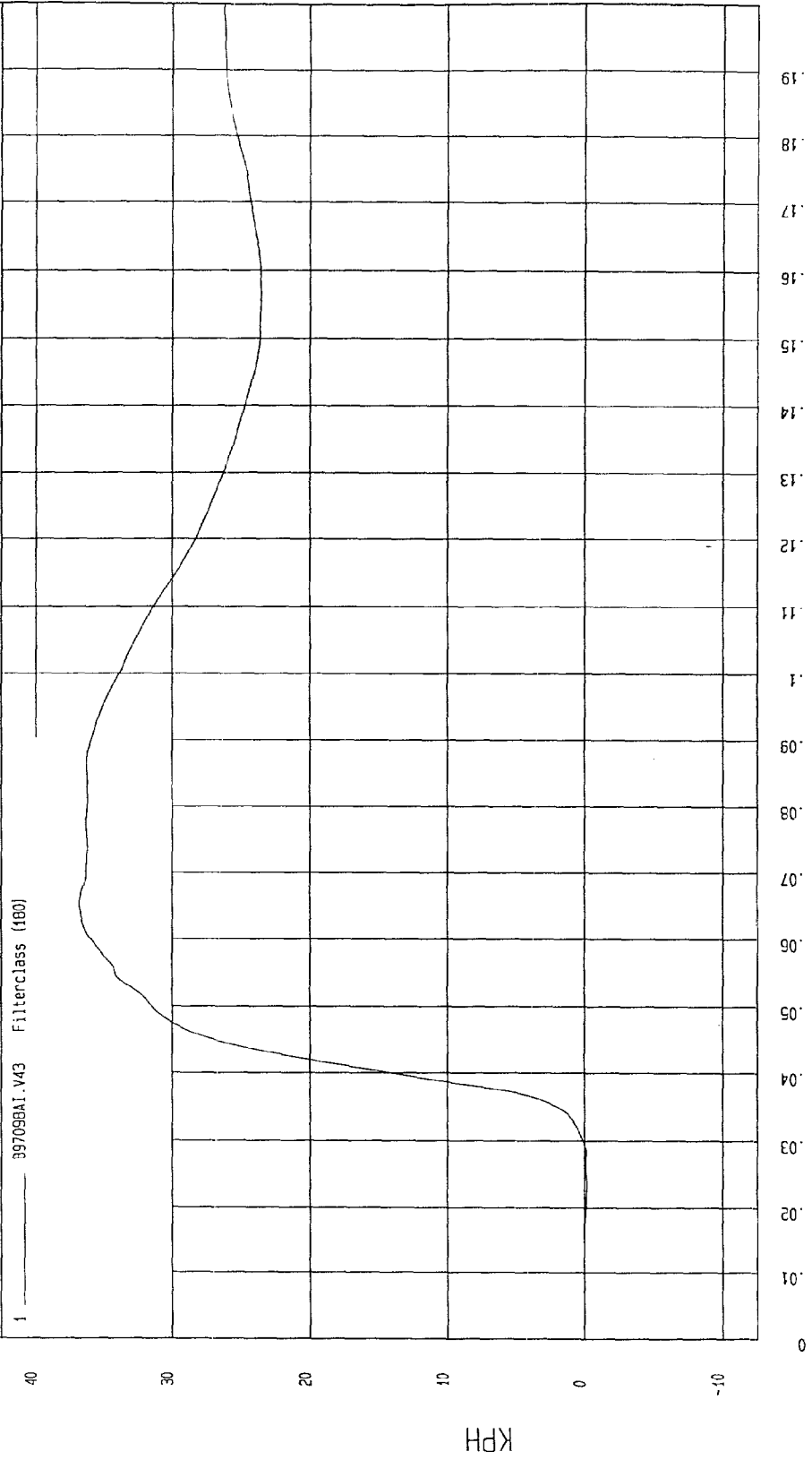


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.15 KPH at 23 msec Maximum = 36.83 KPH at 65 msec

DRIVER UPPER SPINE Y VELOCITY



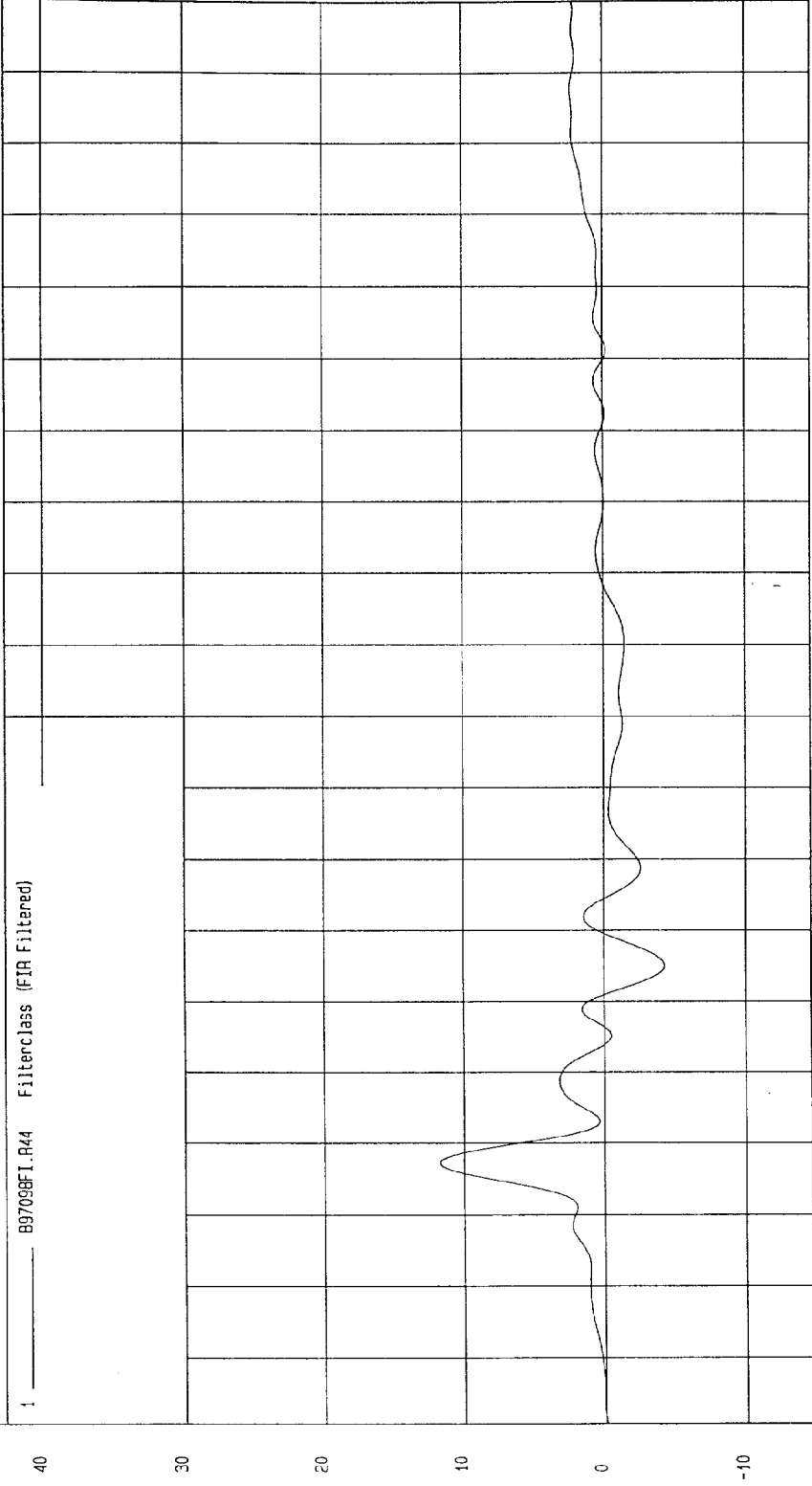
MGA Research
08-22-1997 13:15

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

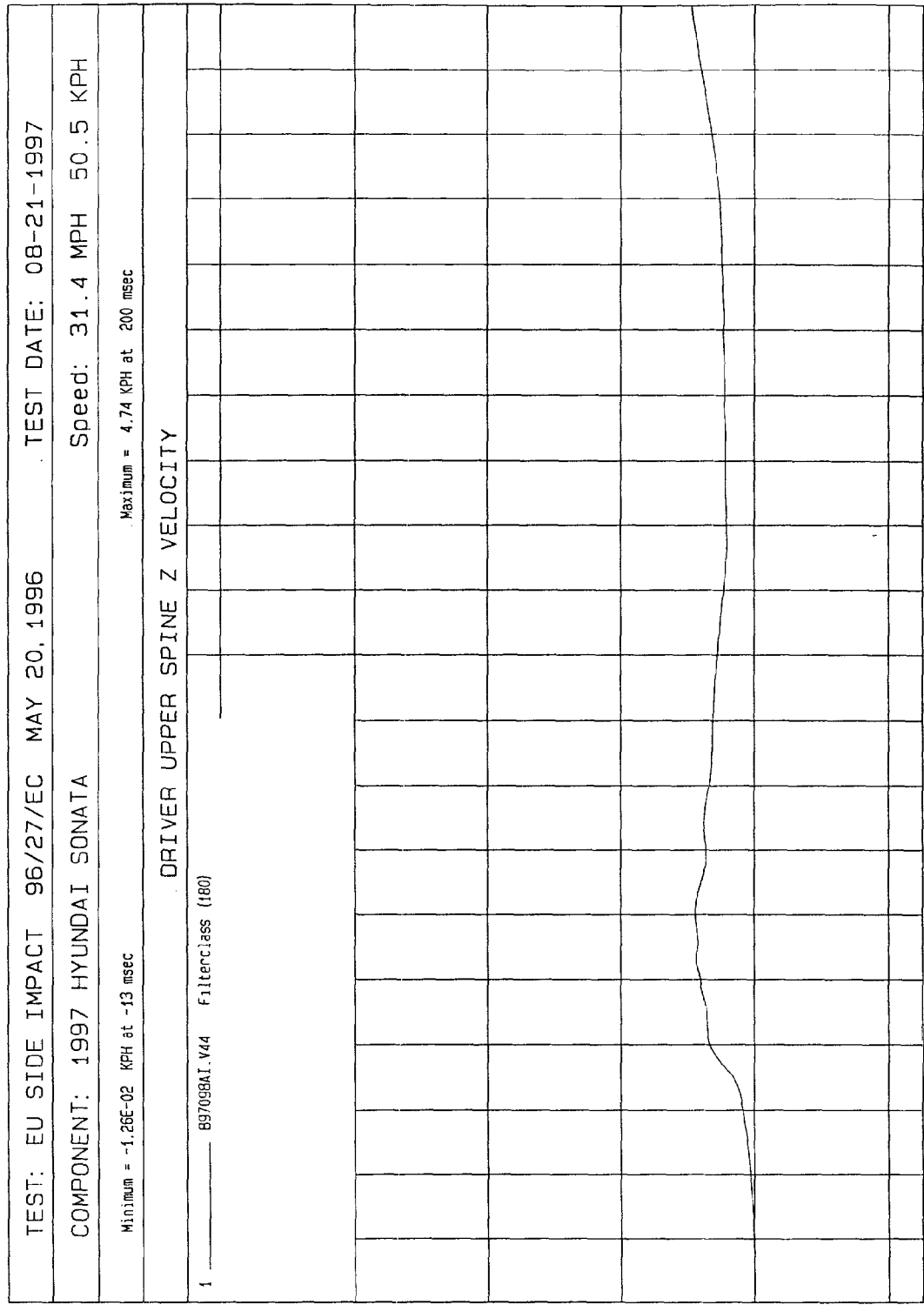
Minimum = -4.29 G'S at 65 msec Maximum = 11.77 G'S at 39 msec

DRIVER UPPER SPINE Z ACCELERATION



TIME (SECONDS)

MCA Research
04-12-1998 11:07



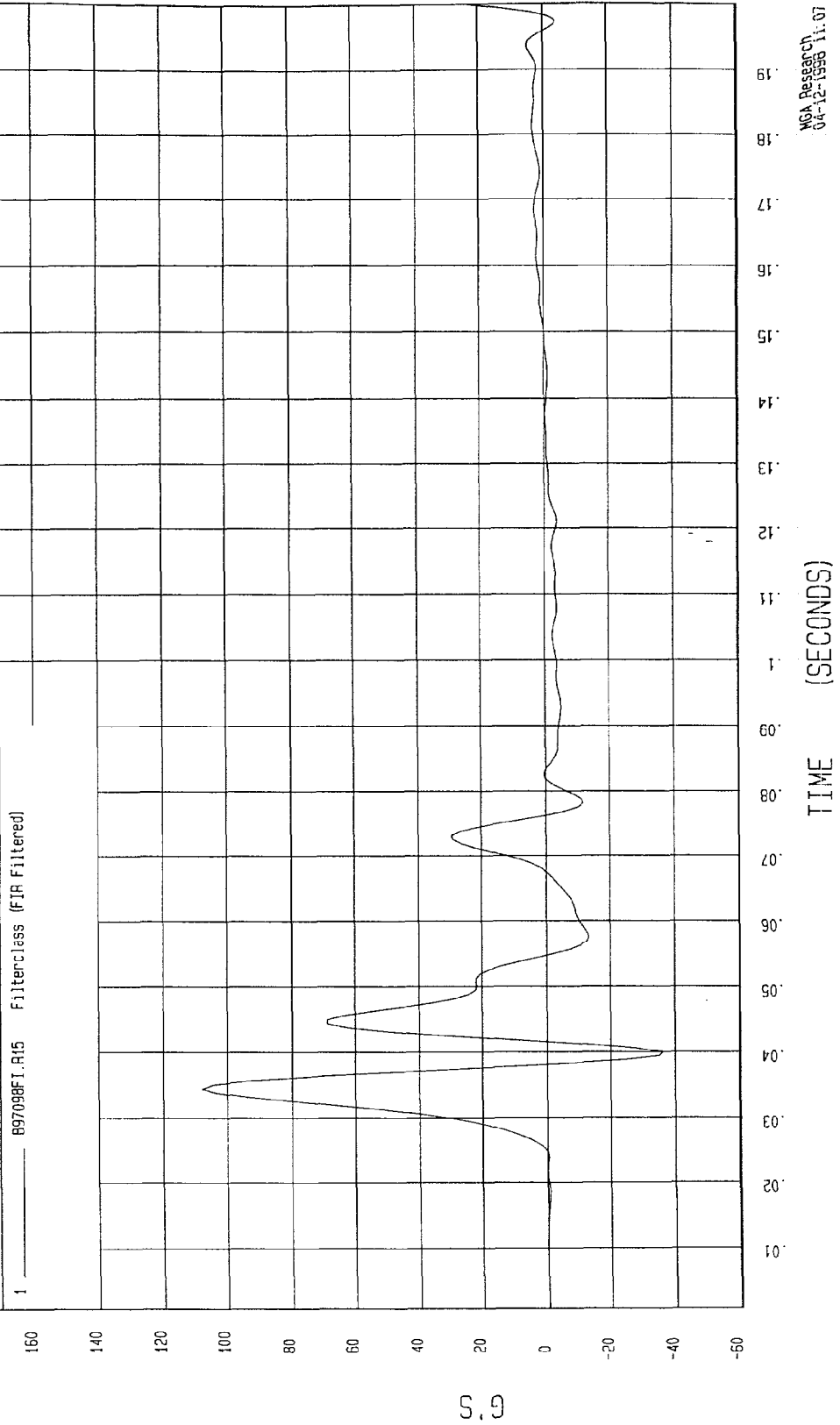
MCA Research
08-22-1997 13:15

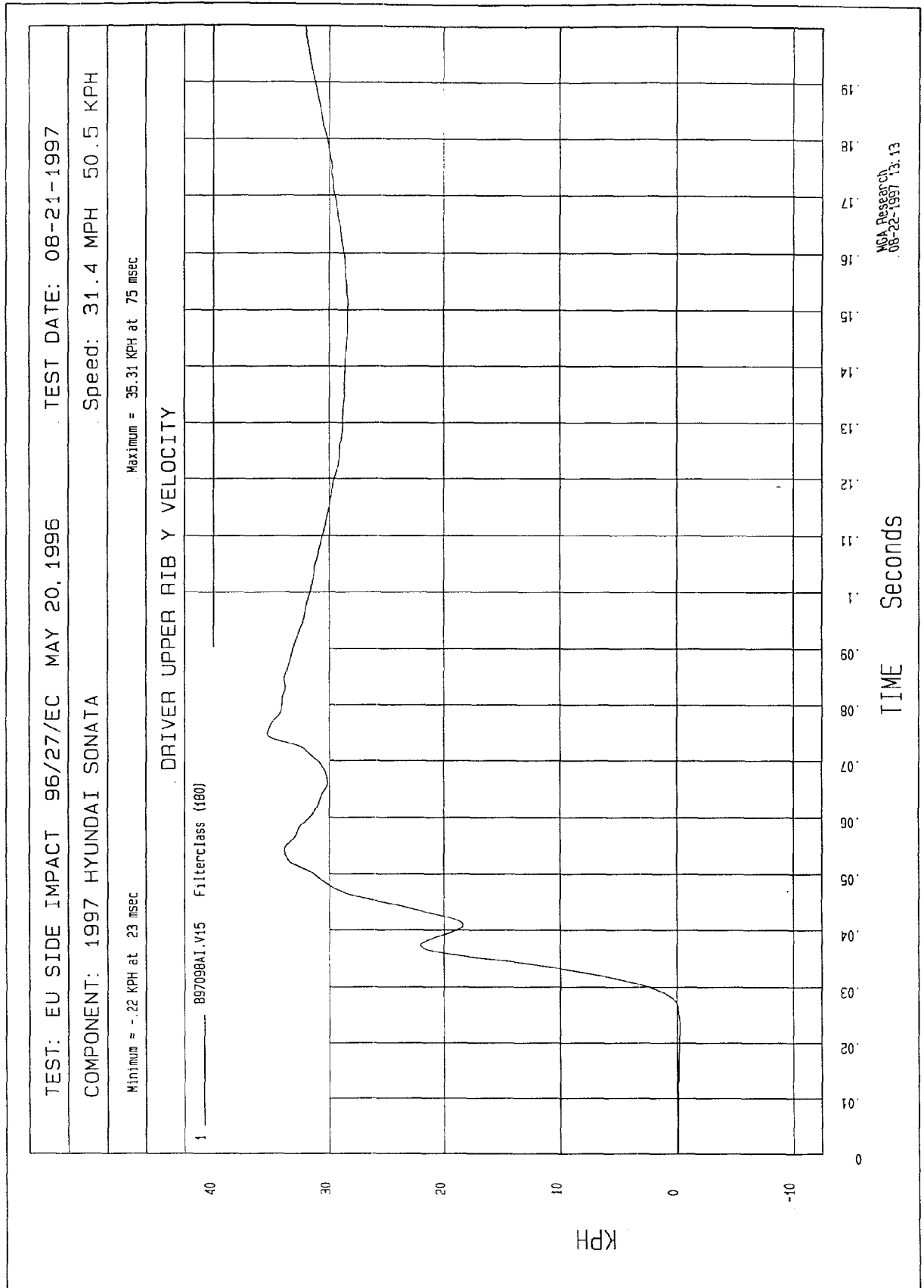
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

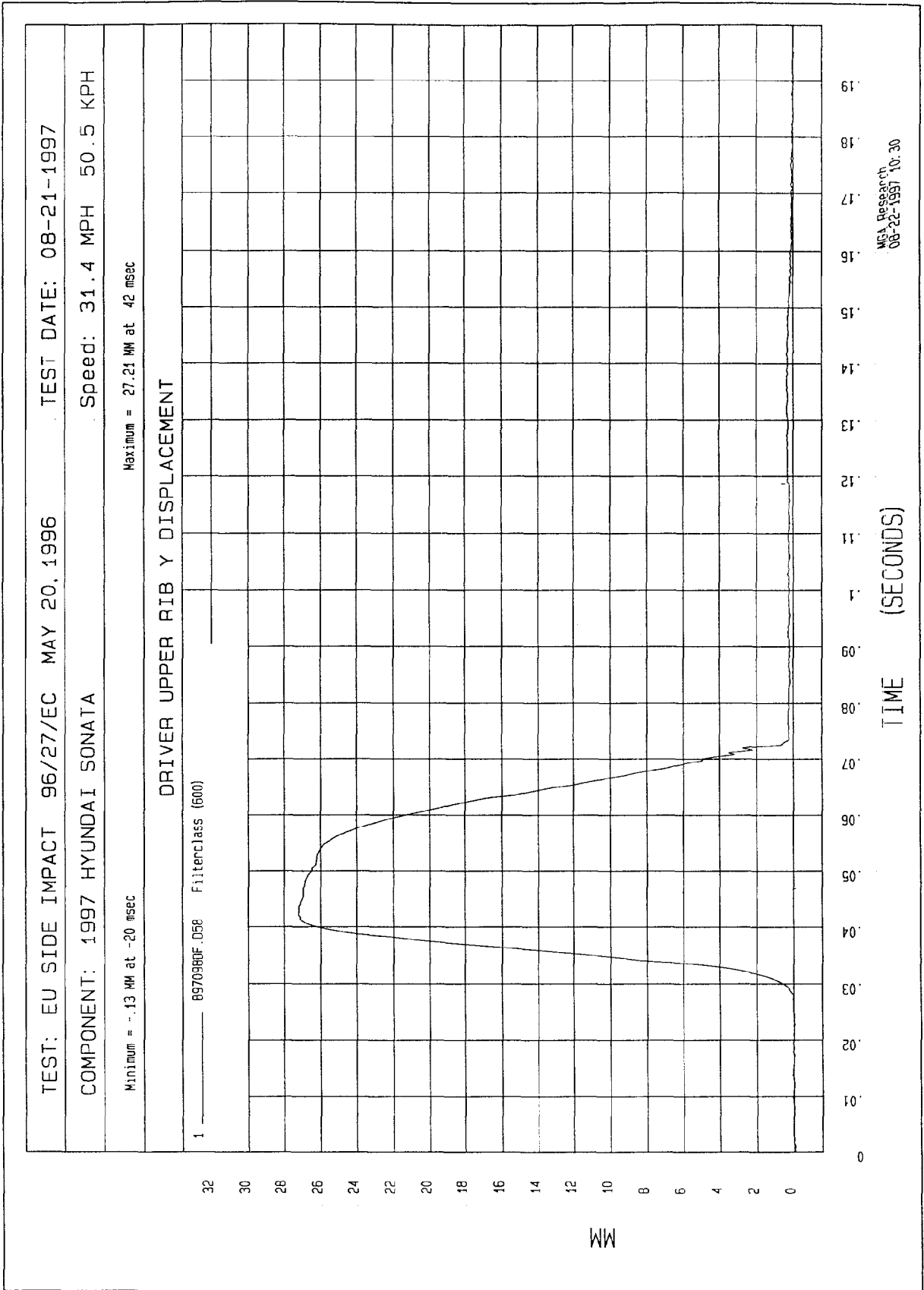
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -36.07 G's at 40 msec Maximum = 107.71 G's at 34 msec

DRIVER UPPER RIB Y ACCELERATION



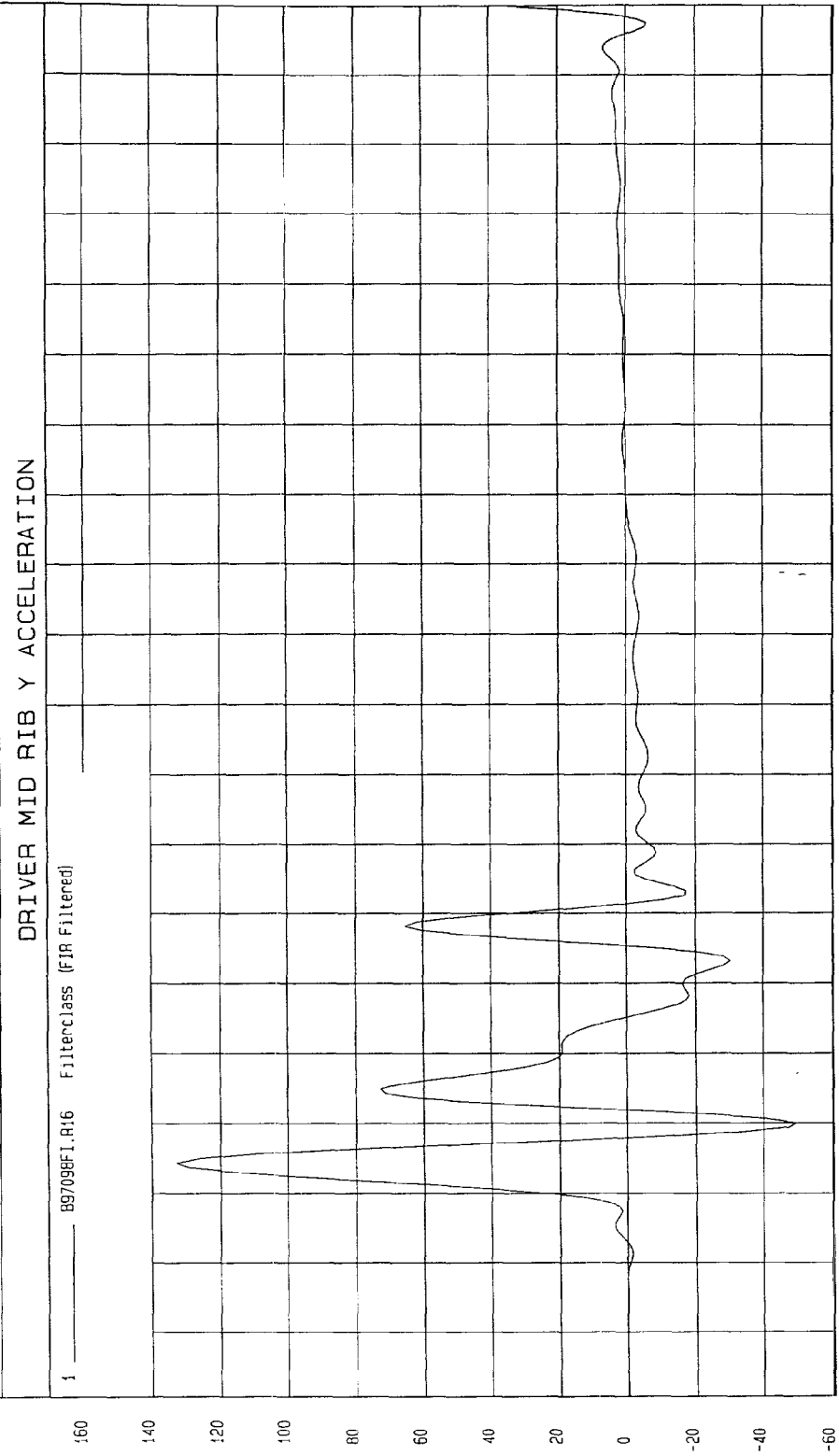




TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -49.44 G'S at 40 msec Maximum = 132.91 G'S at 34 msec



TIME (SECONDS)

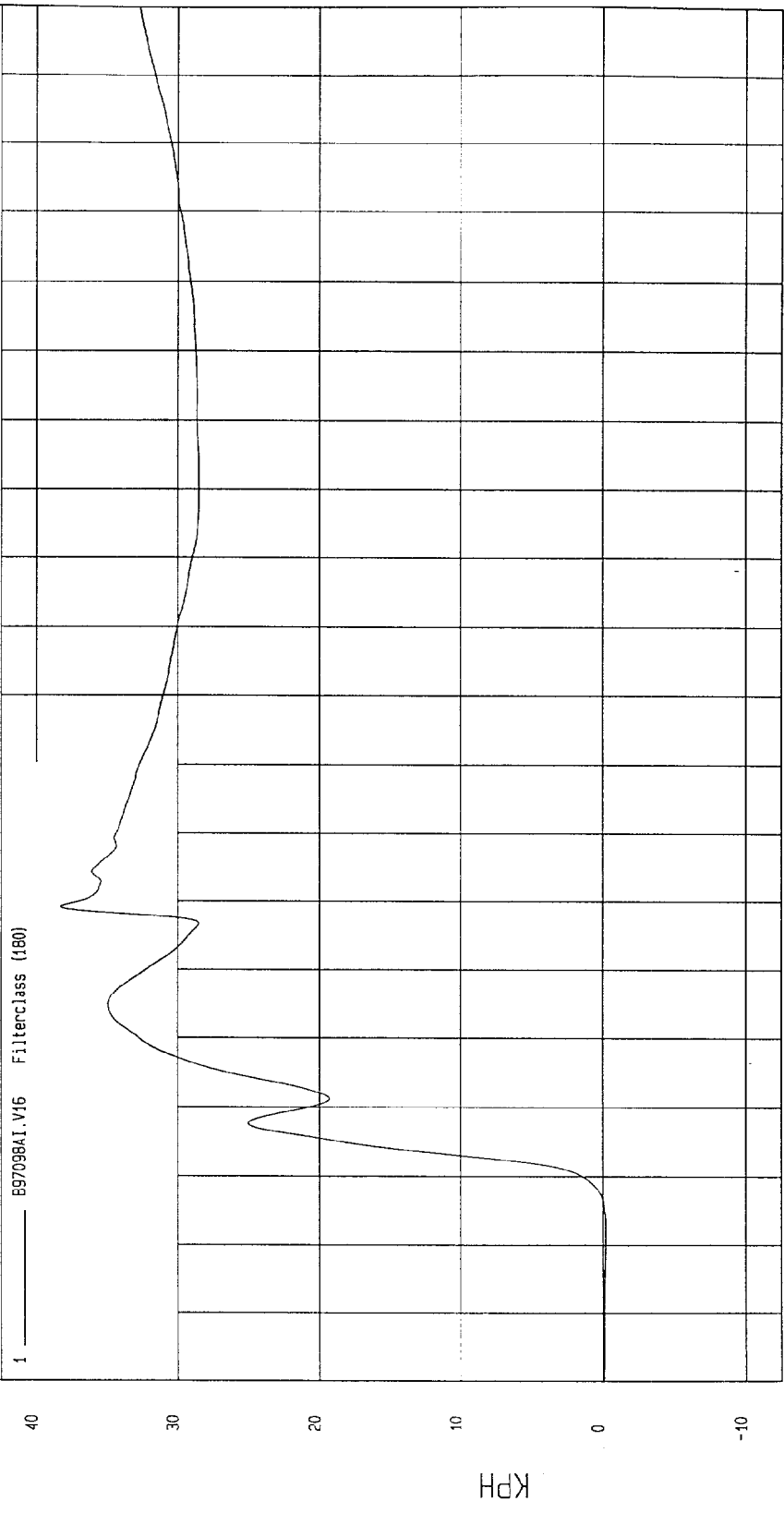
MCA Research
04-12-1998 11:07

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -18 KPH at 22 msec Maximum = 38.33 KPH at 69 msec

DRIVER MID RIB Y VELOCITY



TIME Seconds
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0

NCA Research
08-22-1997 13:13

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

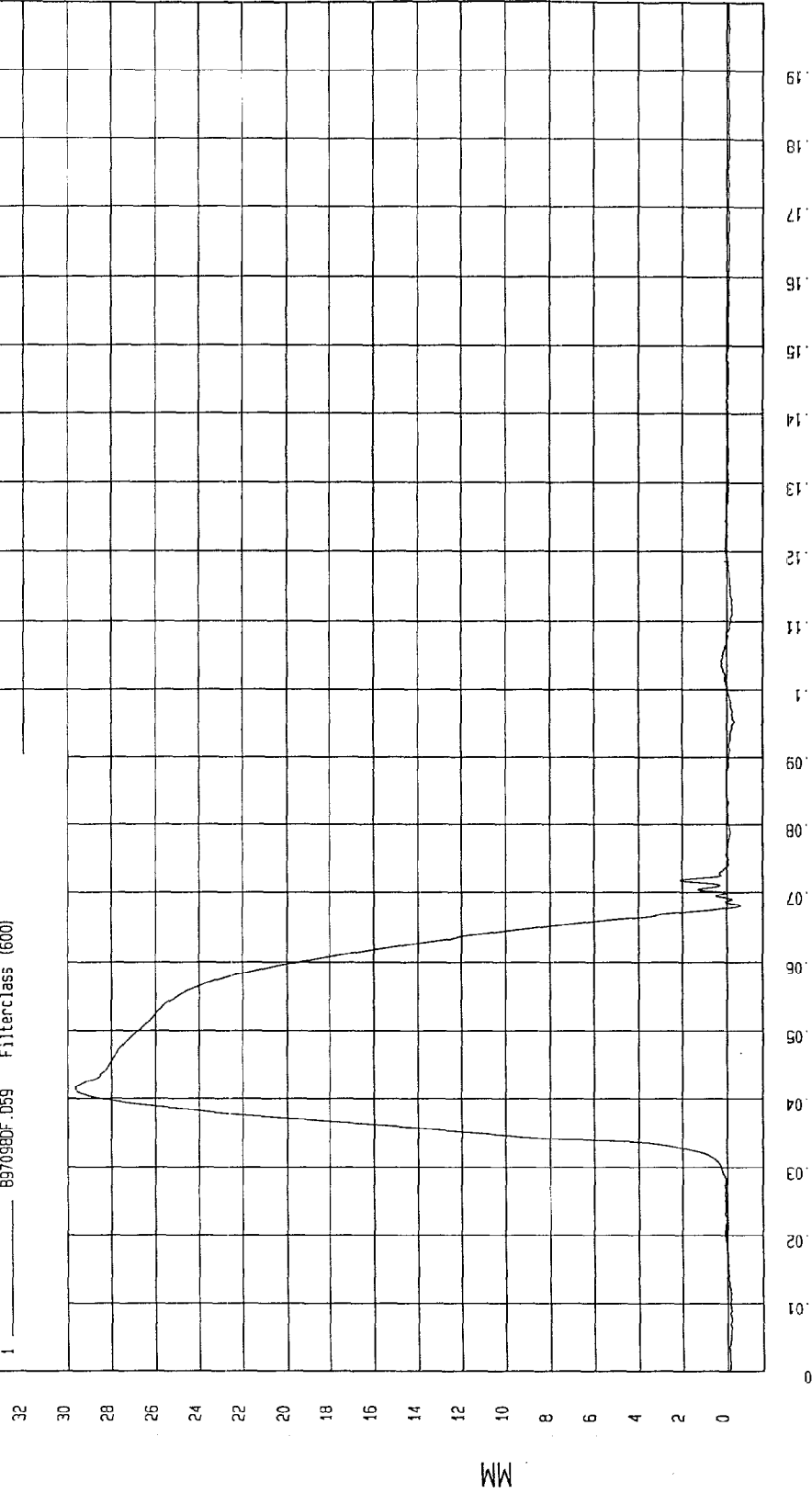
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.60 MM at 68 msec

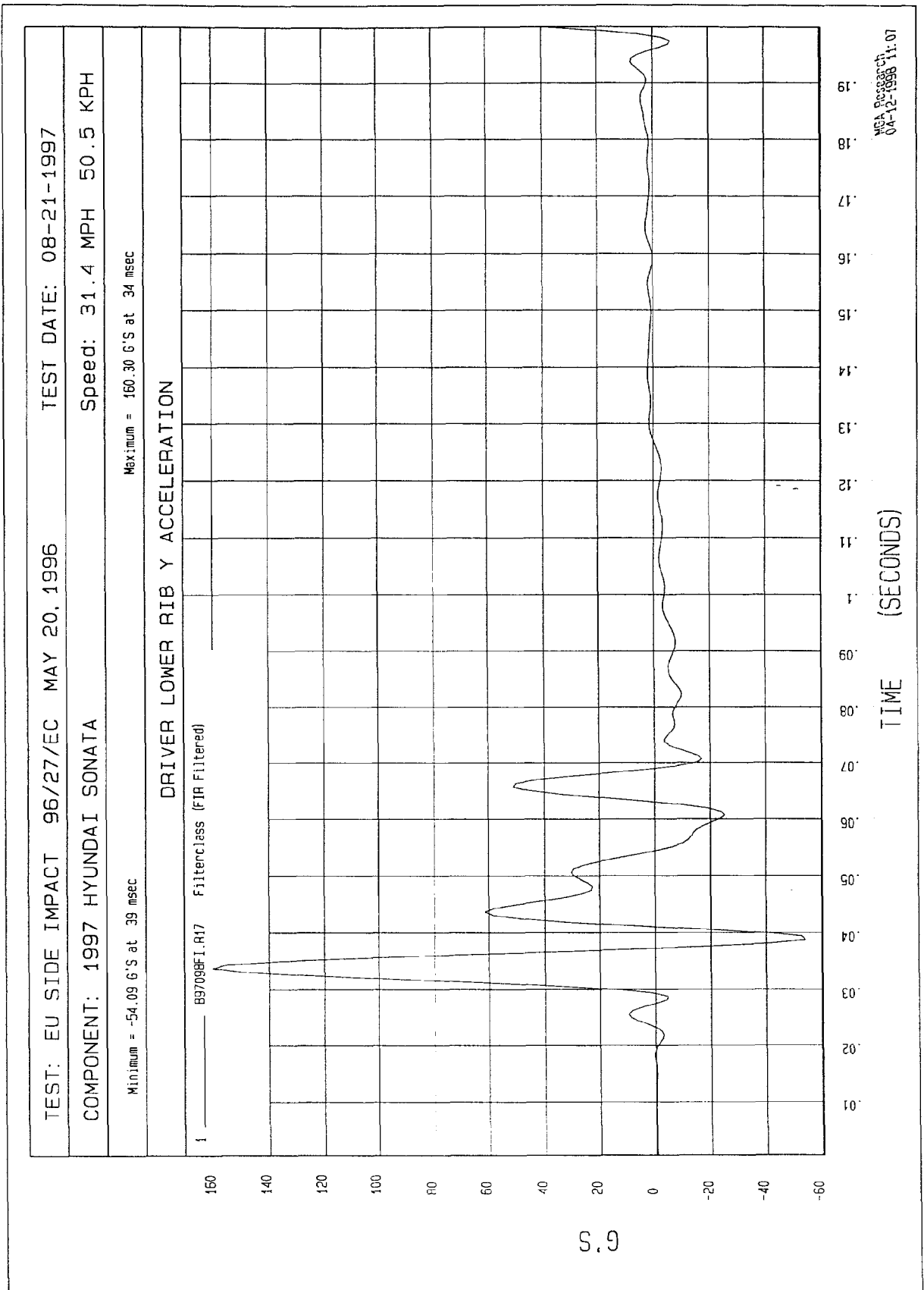
Maximum = 29.67 MM at 42 msec

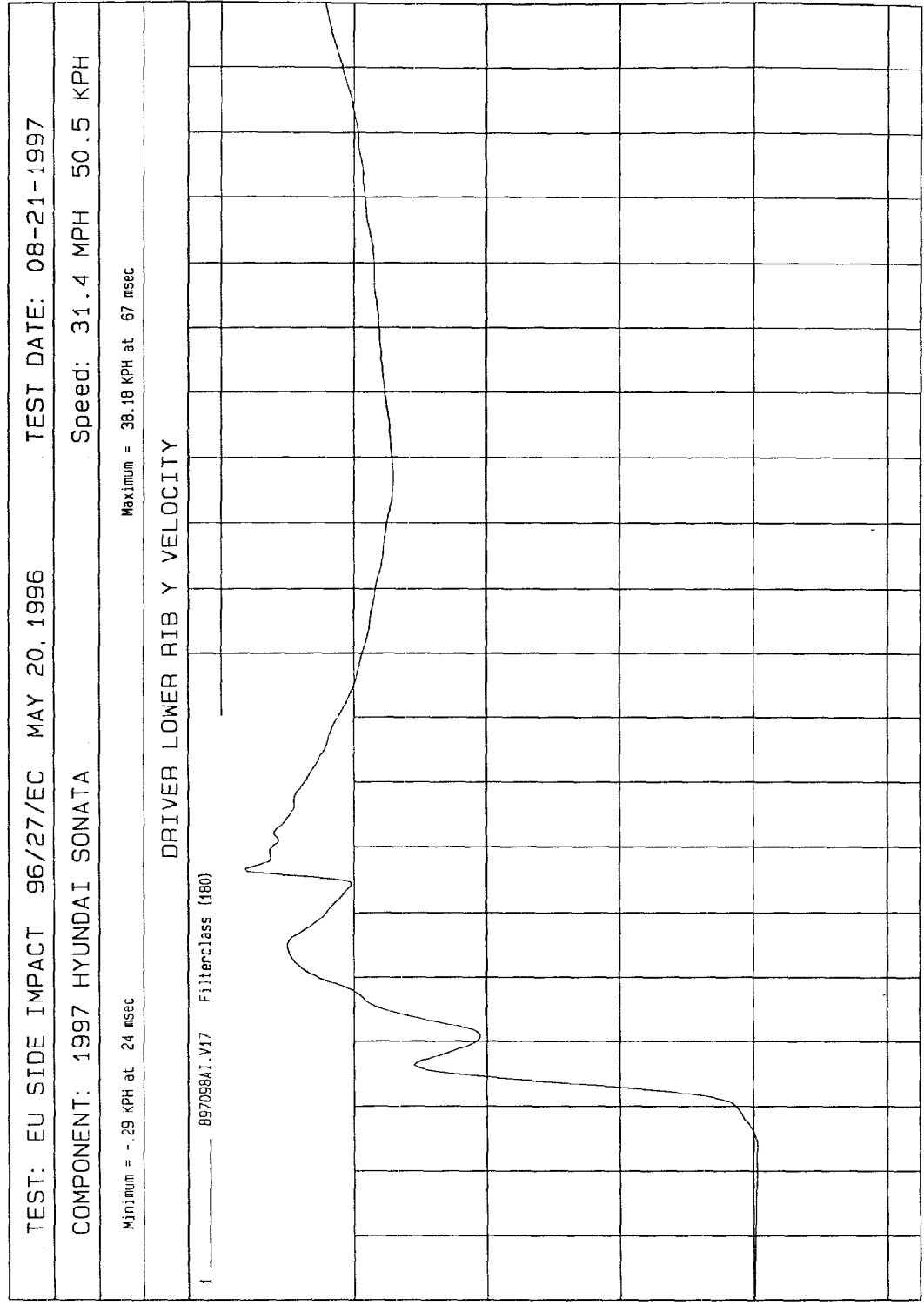
DRIVER MID RIB Y DISPLACEMENT

1 ——— B970980F.059 Filterclass (600)



MCA Research
08-22-1997 10:30





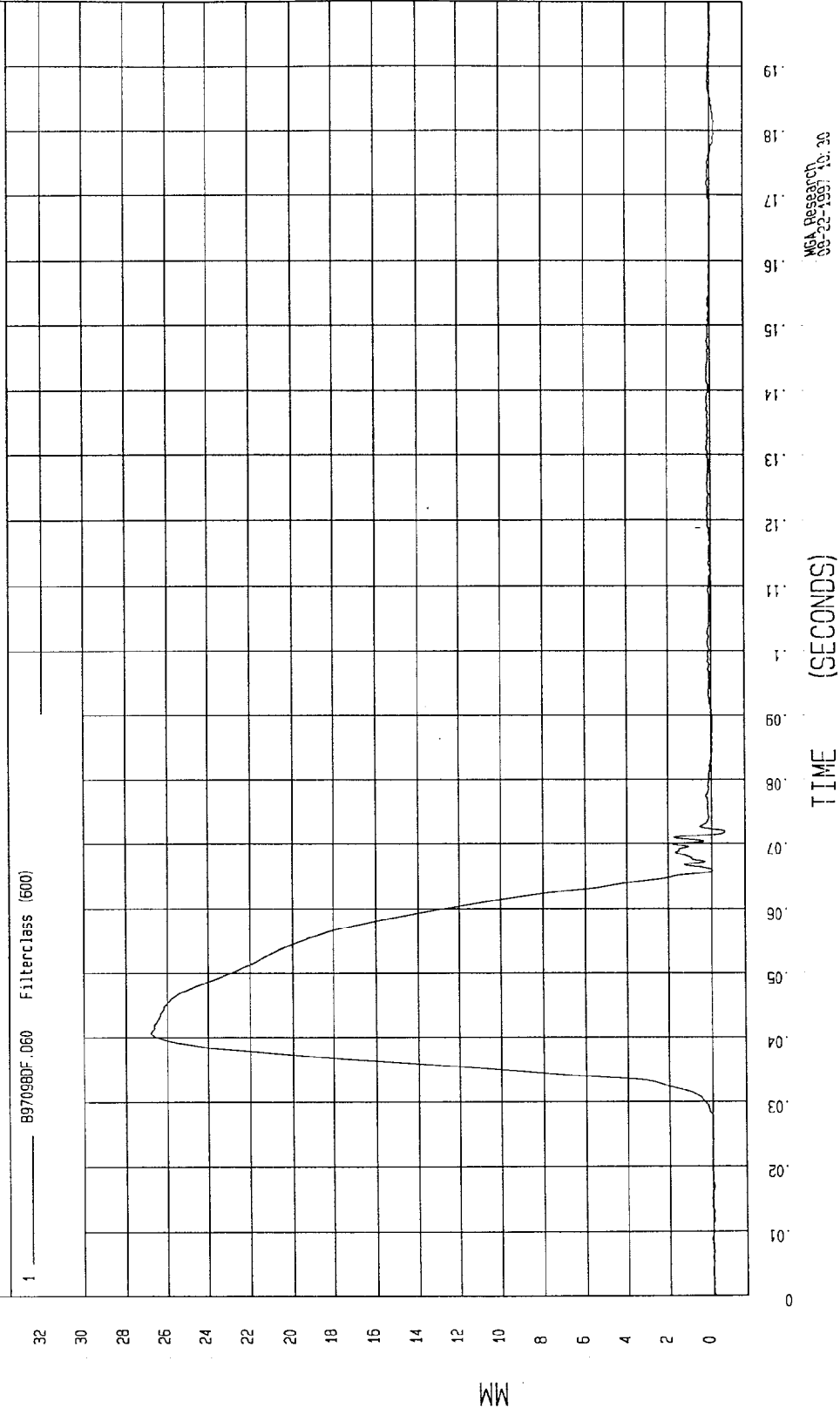
TIME Seconds

0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0

NSA Research
08-22-1997 13:13

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH
Minimum = -.64 MM at 72 msec Maximum = 26.78 MM at 41 msec

DRIVER LOWER RIB Y DISPLACEMENT

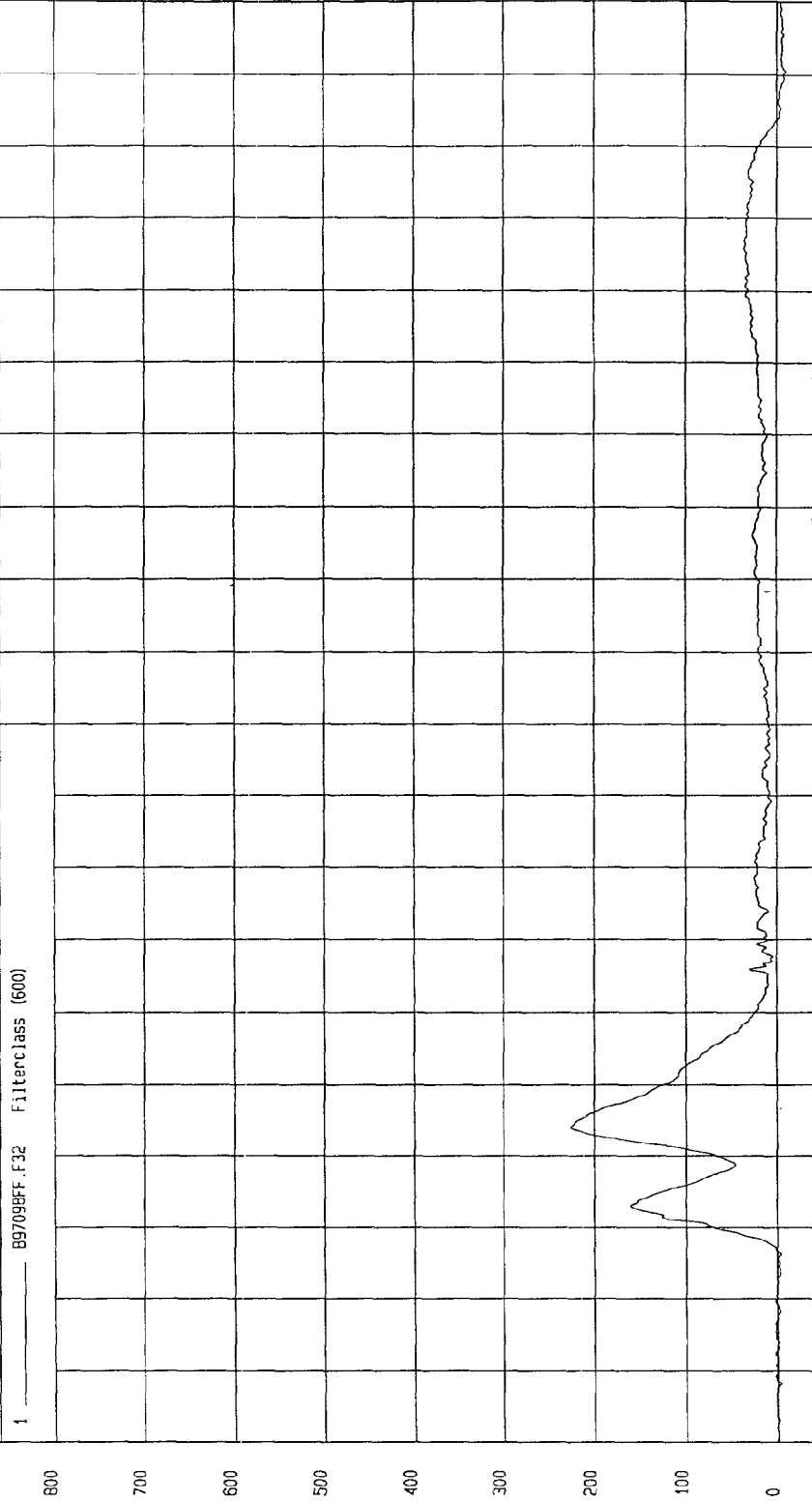


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

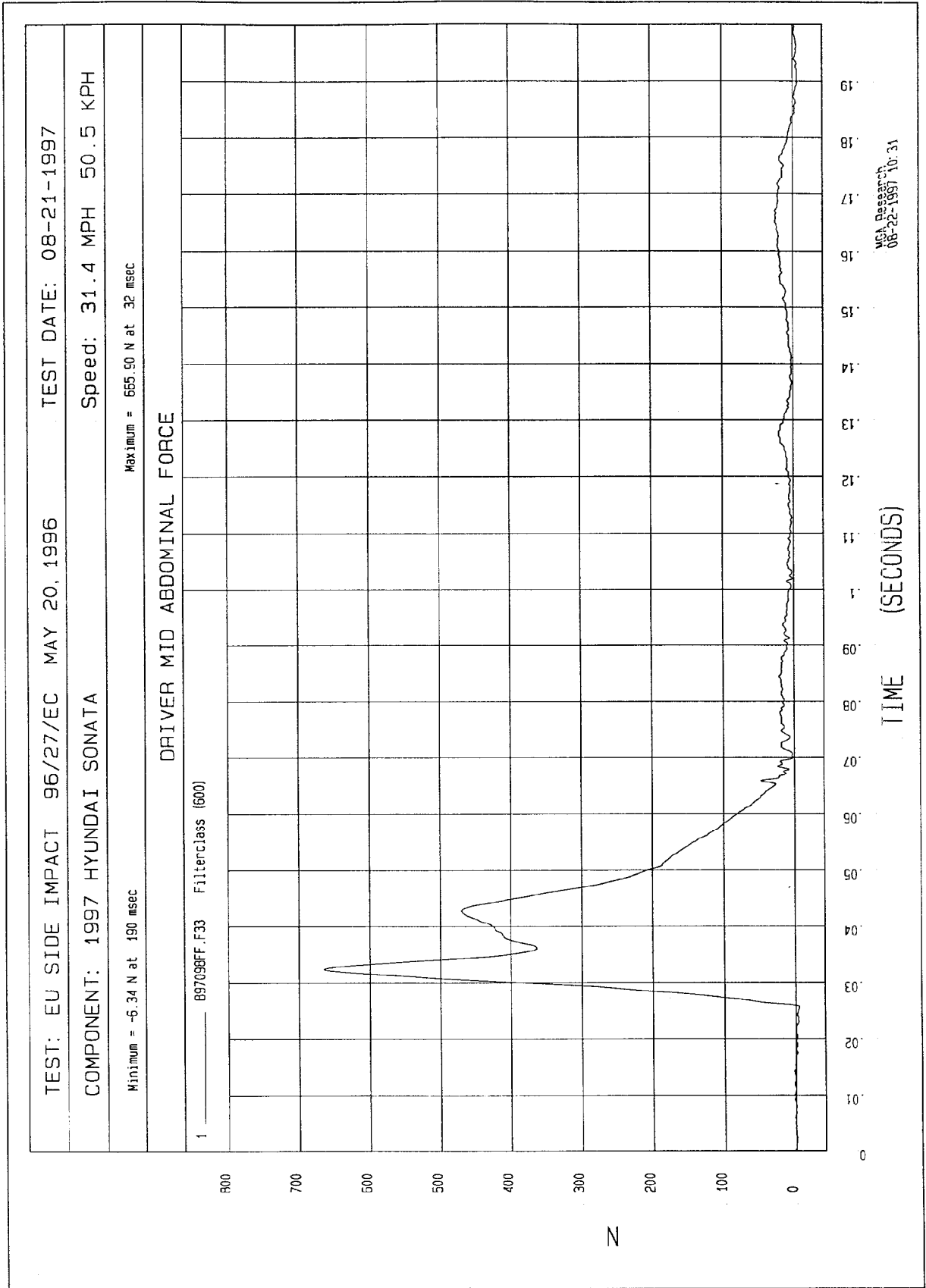
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -10.02 N at 191 msec Maximum = 225.87 N at 44 msec

DRIVER FRONT ABDOMINAL FORCE



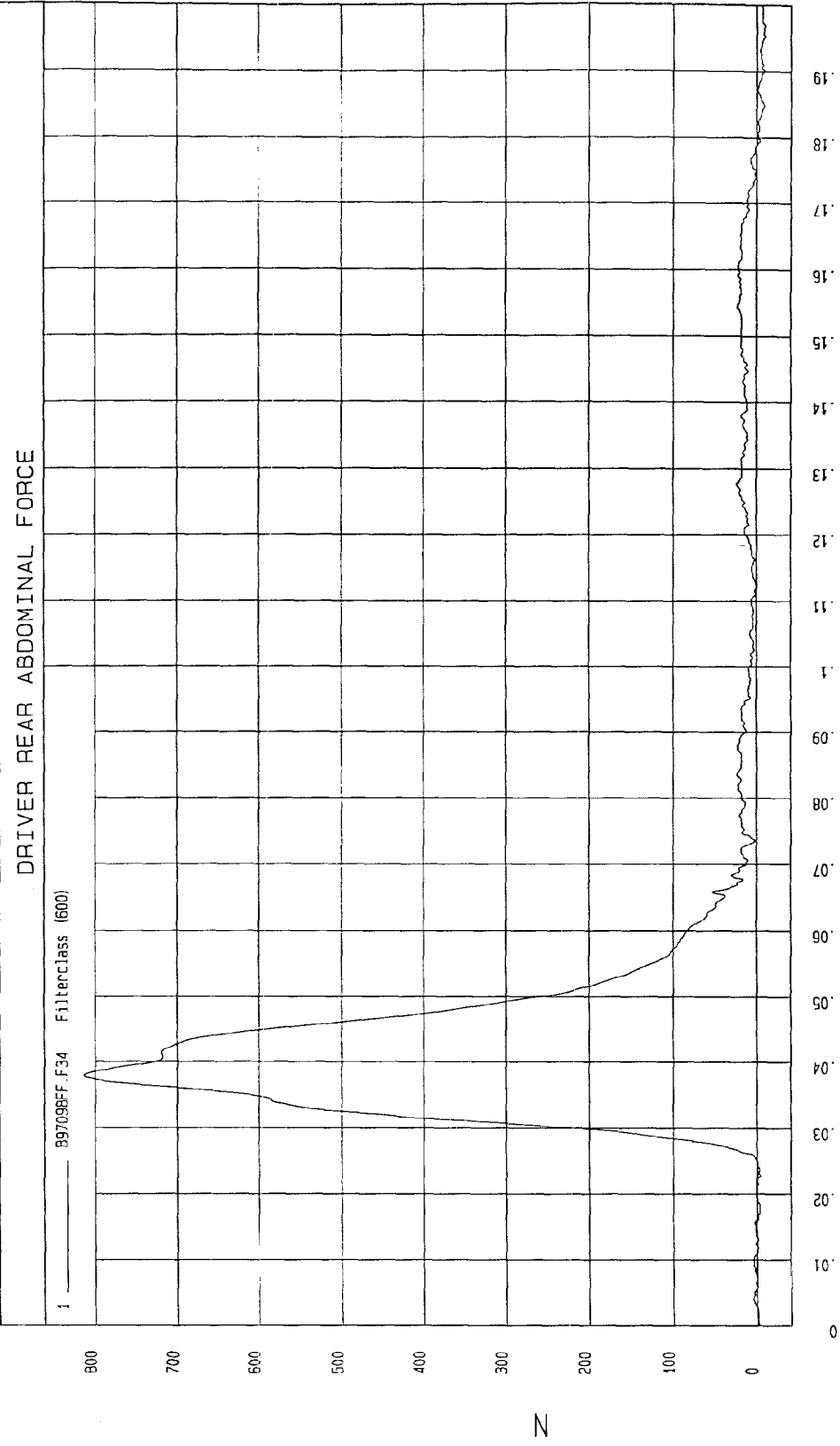
MSA Research
08-22-1997 10:31



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

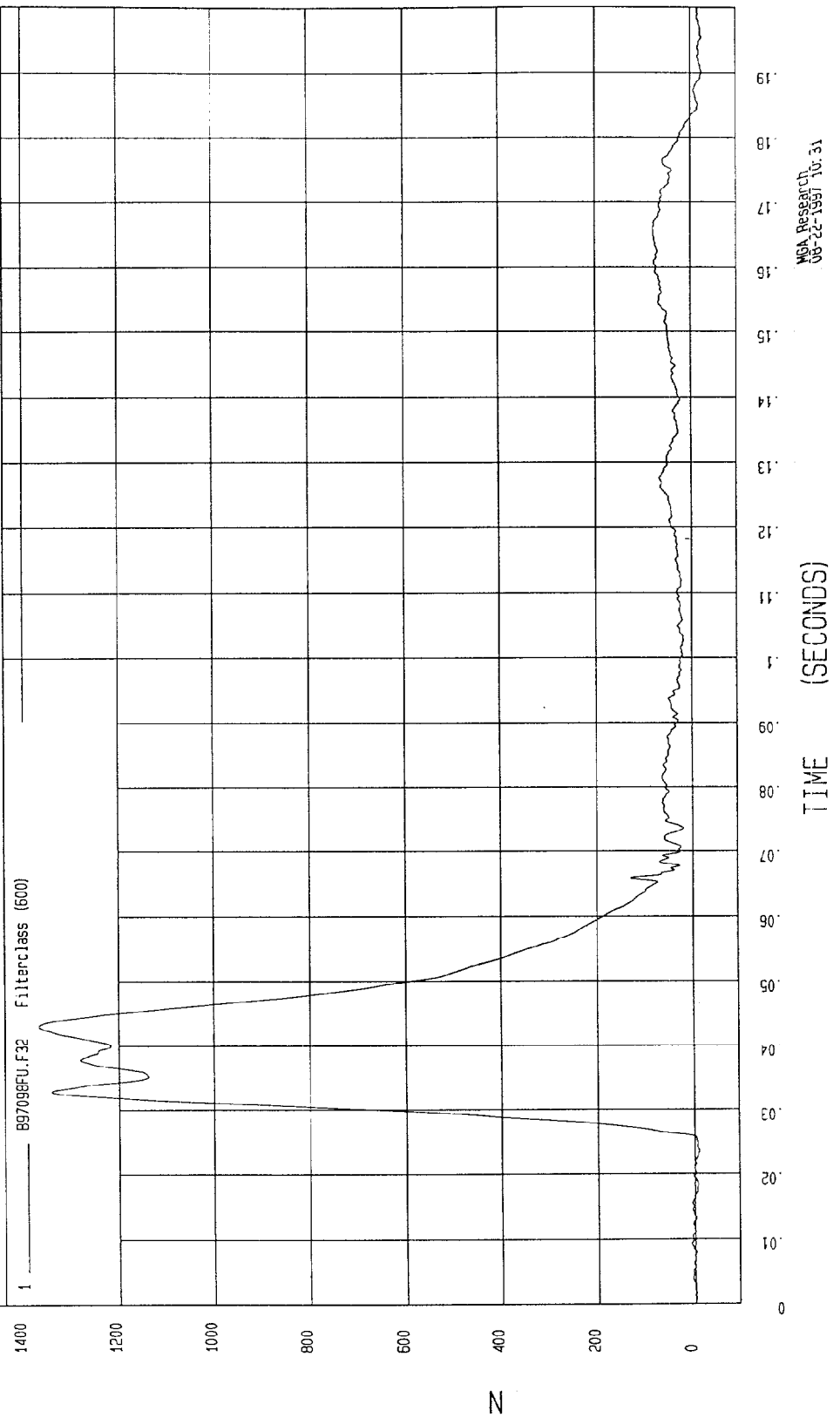
Minimum = -10.23 N at 195 msec Maximum = 813.92 N at 38 msec



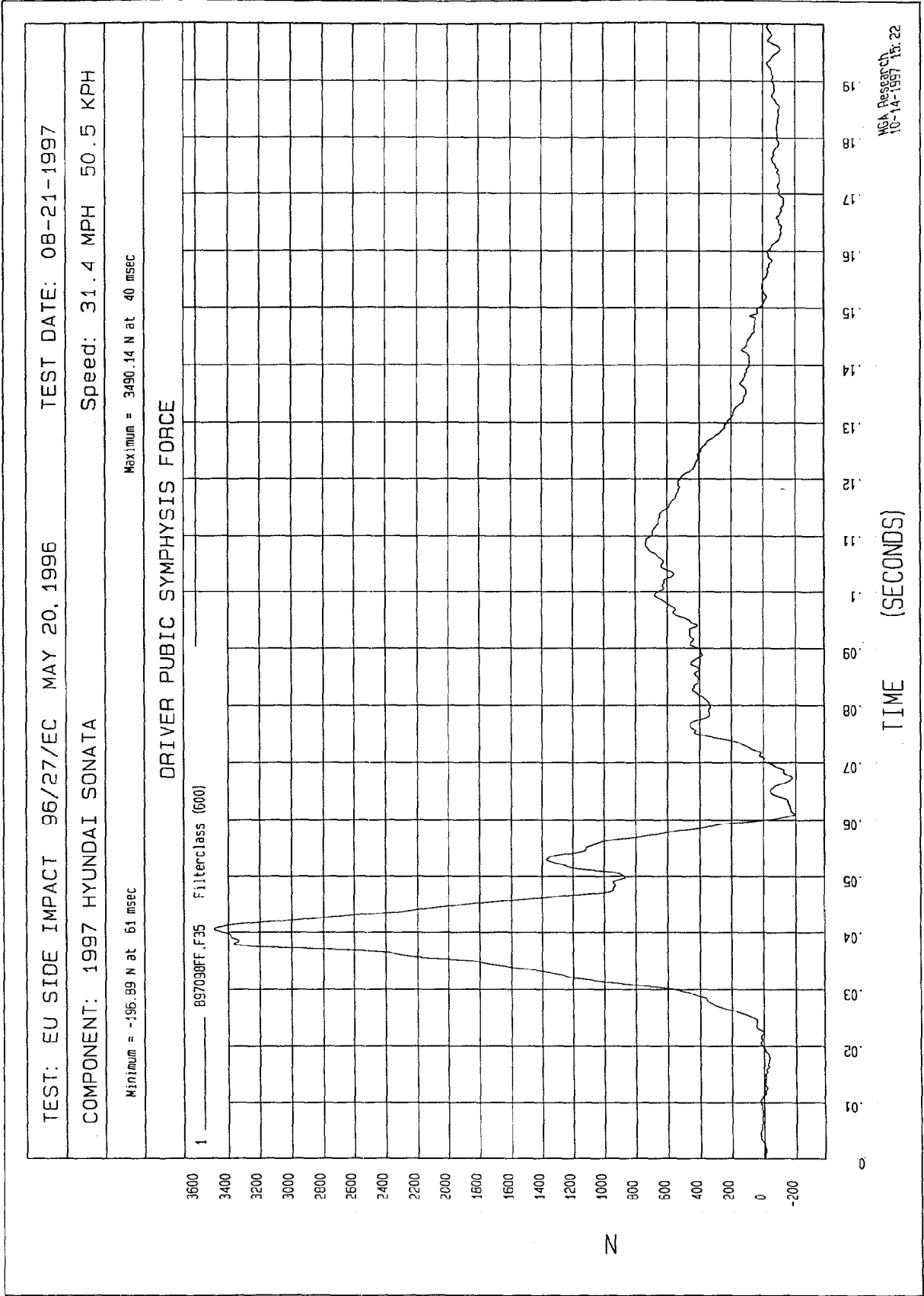
MCA Research
08-22-1997 10:31

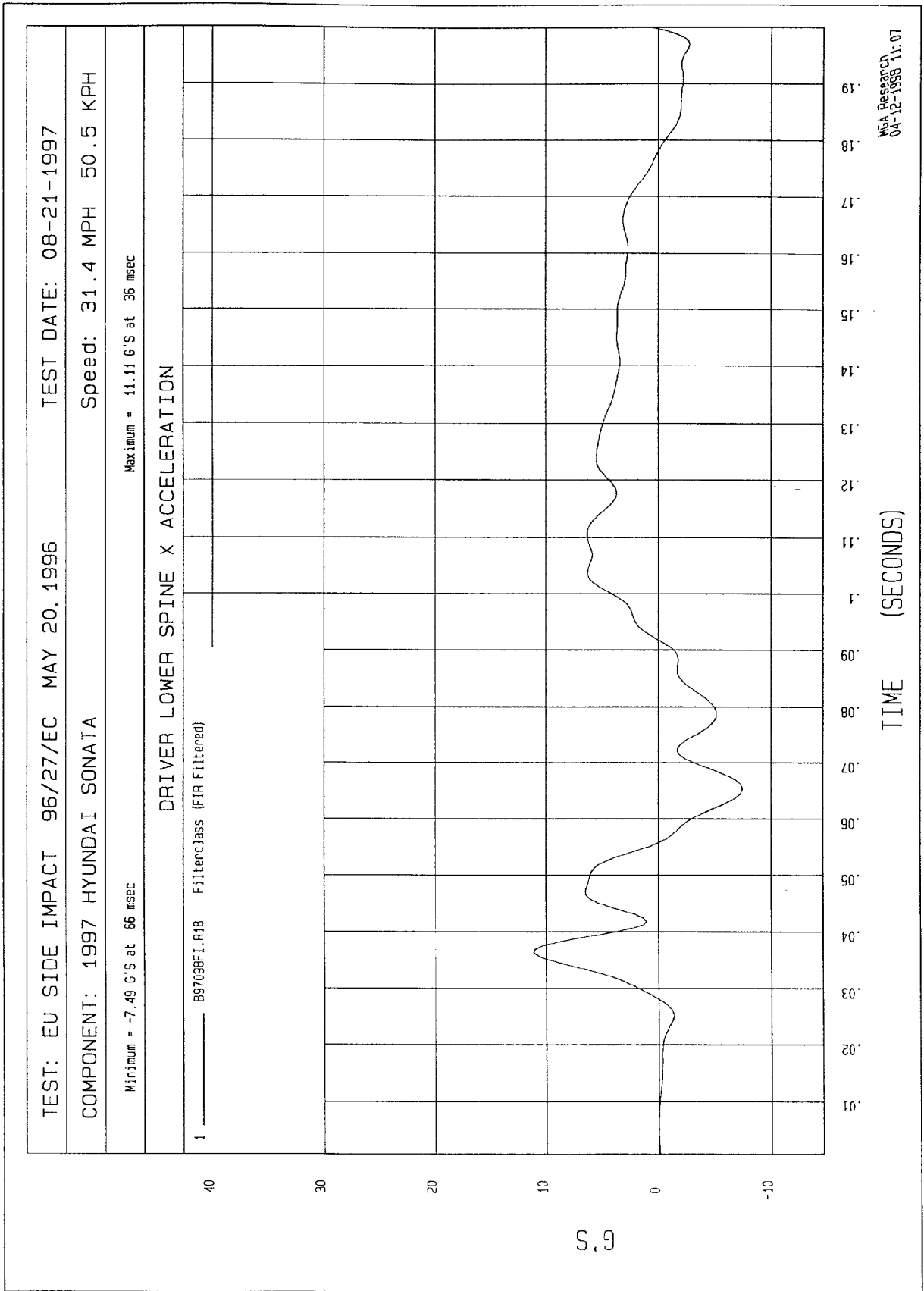
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -22.76 N at 190 msec	Maximum = 1368.93 N at 43 msec

SUM OF DRIVER ABDOMINAL FORCES



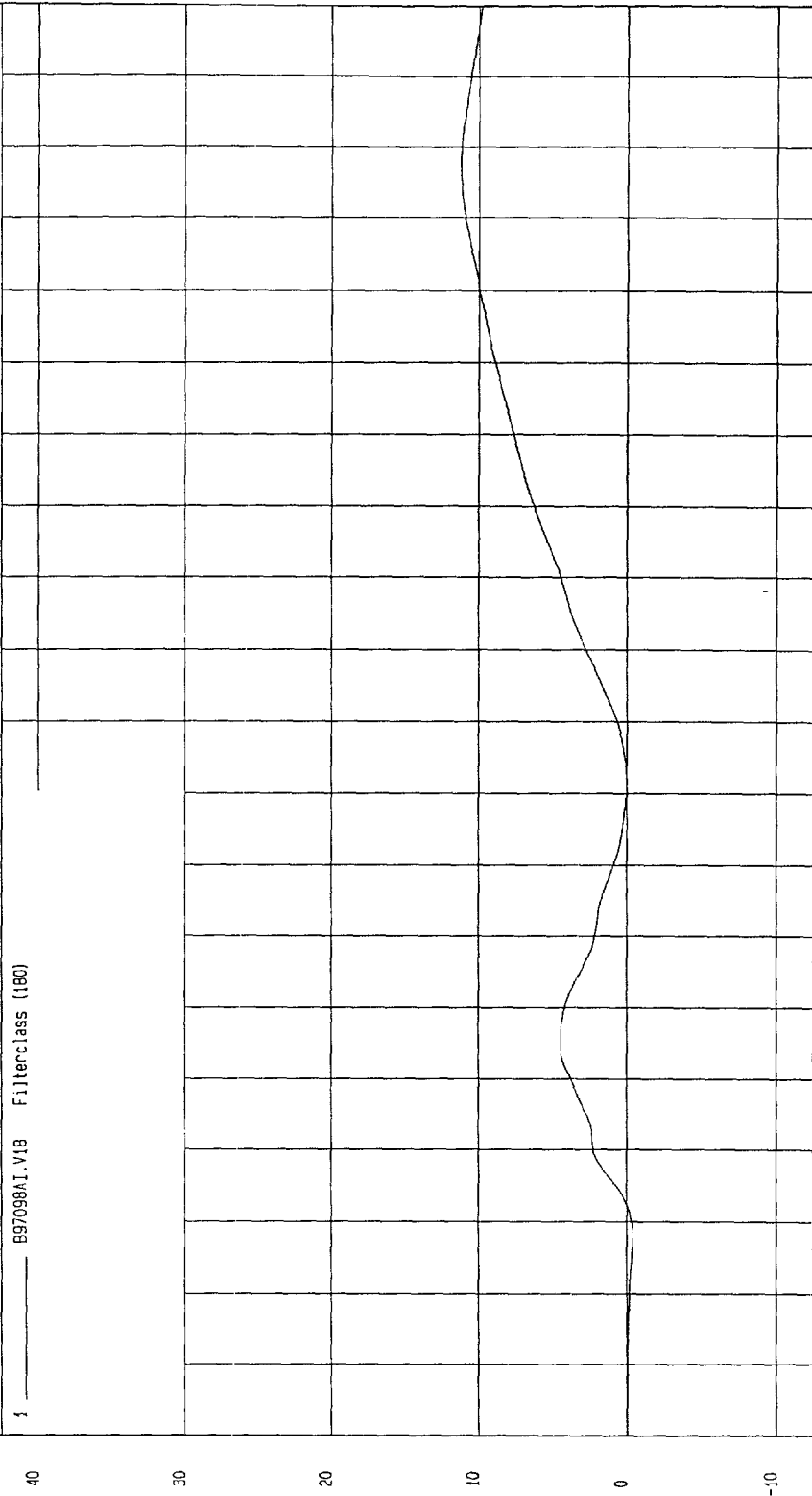
MGA Research
08-22-1997 10:31





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -.41 KPH at 28 msec	Maximum = 11.20 KPH at 178 msec

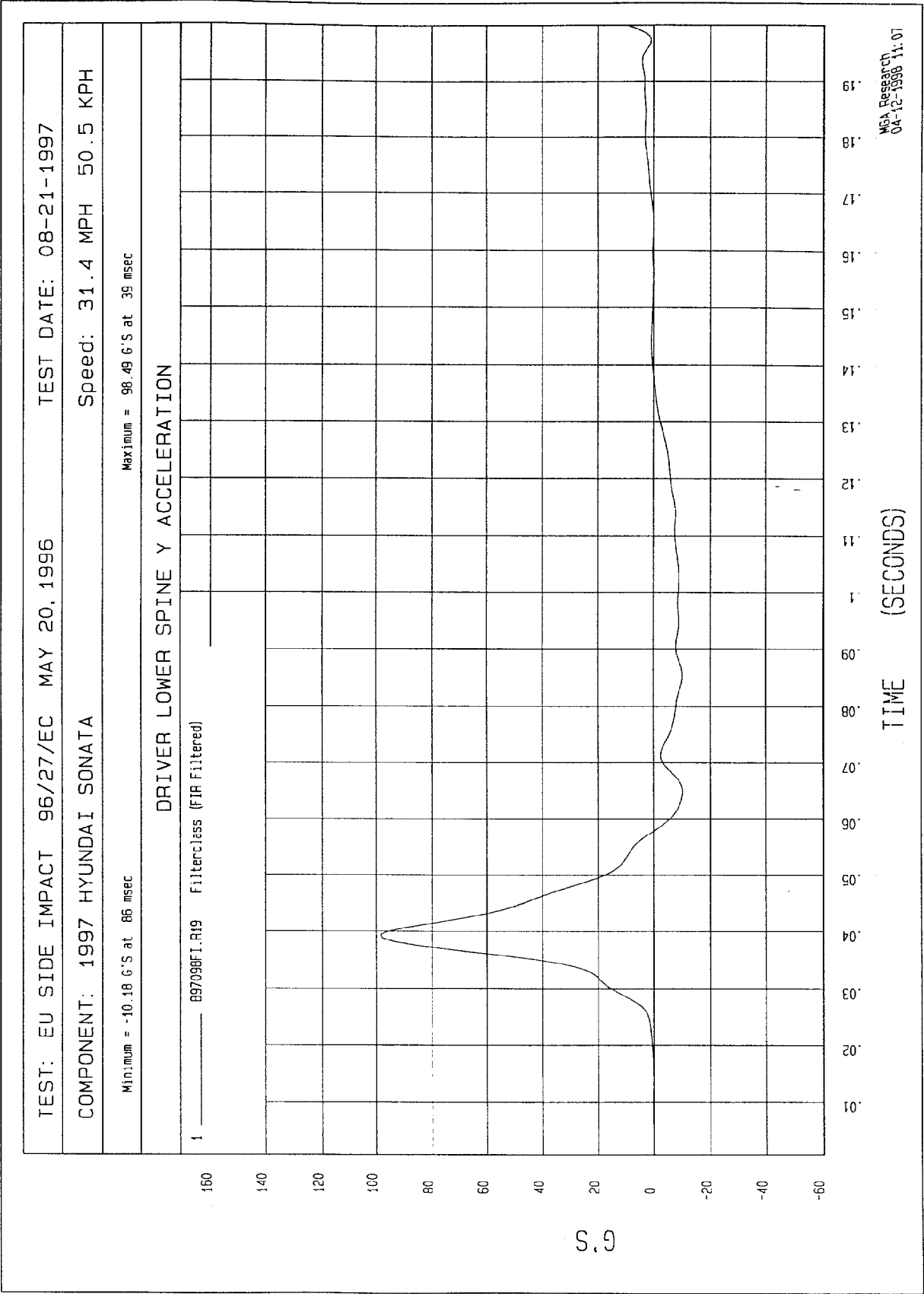
DRIVER LOWER SPINE X VELOCITY

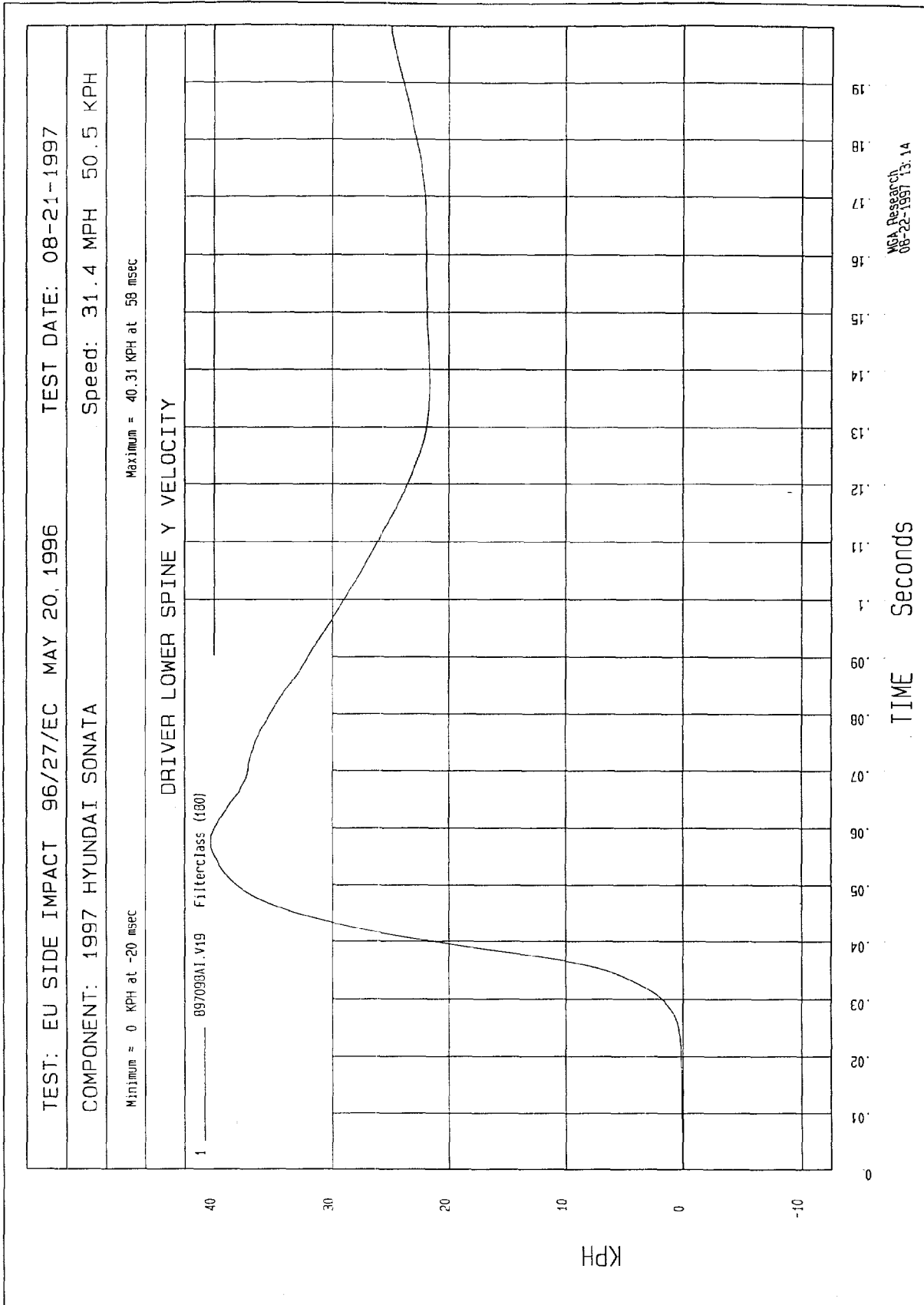


TIME Seconds

0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0

WCA Research
08-22-1997 13:13



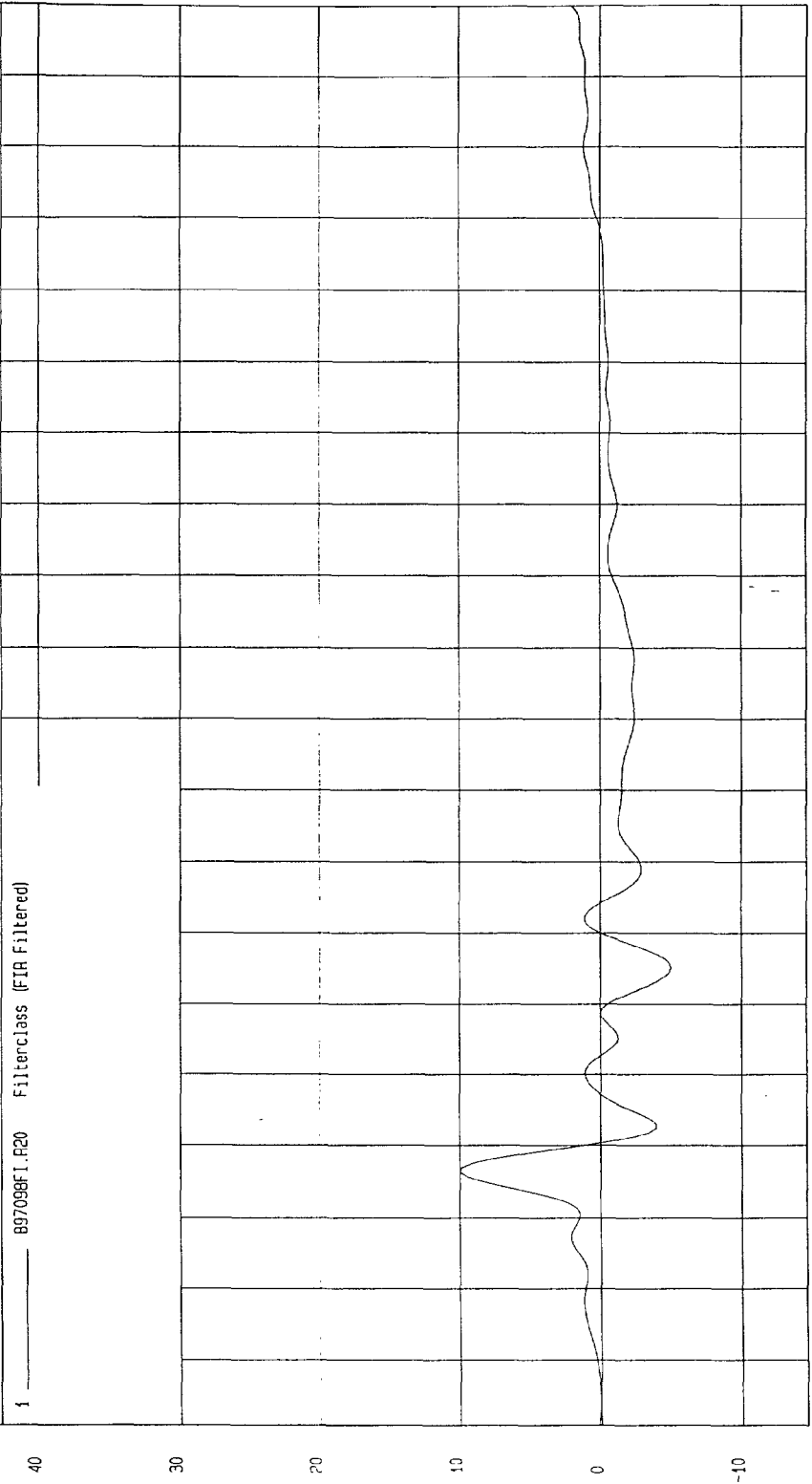


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

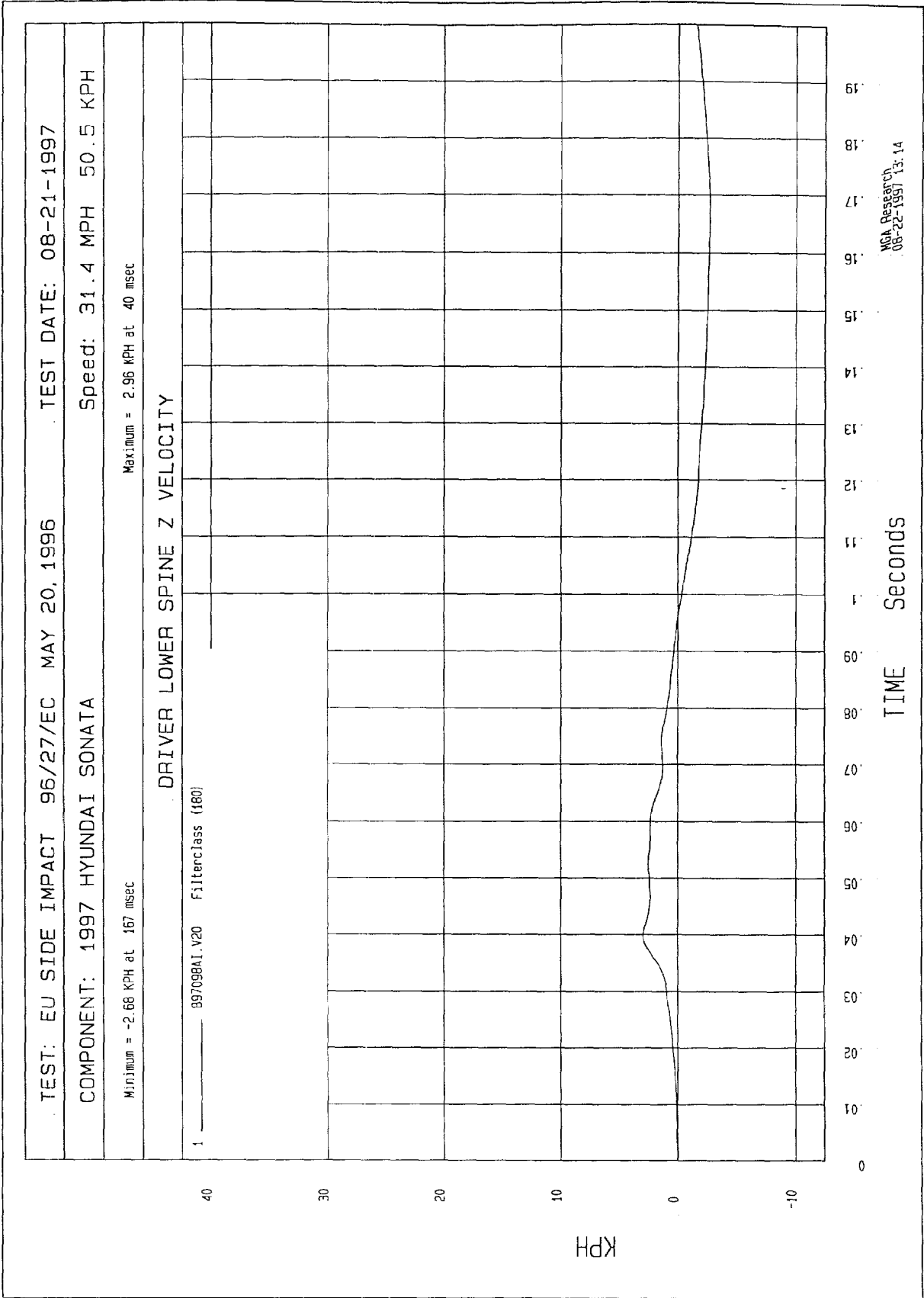
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

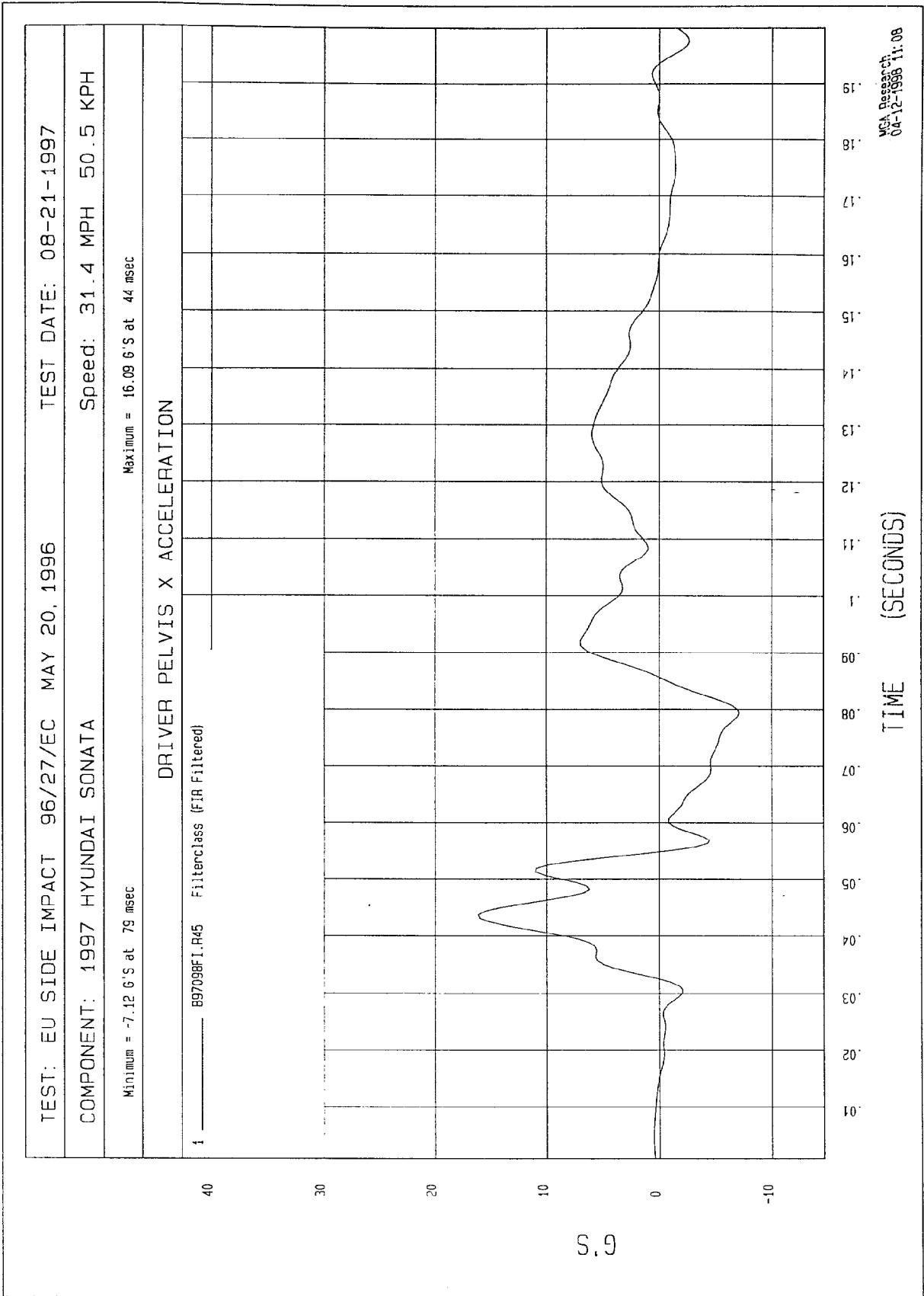
Minimum = -5.03 G's at 65 msec Maximum = 10.00 G's at 36 msec

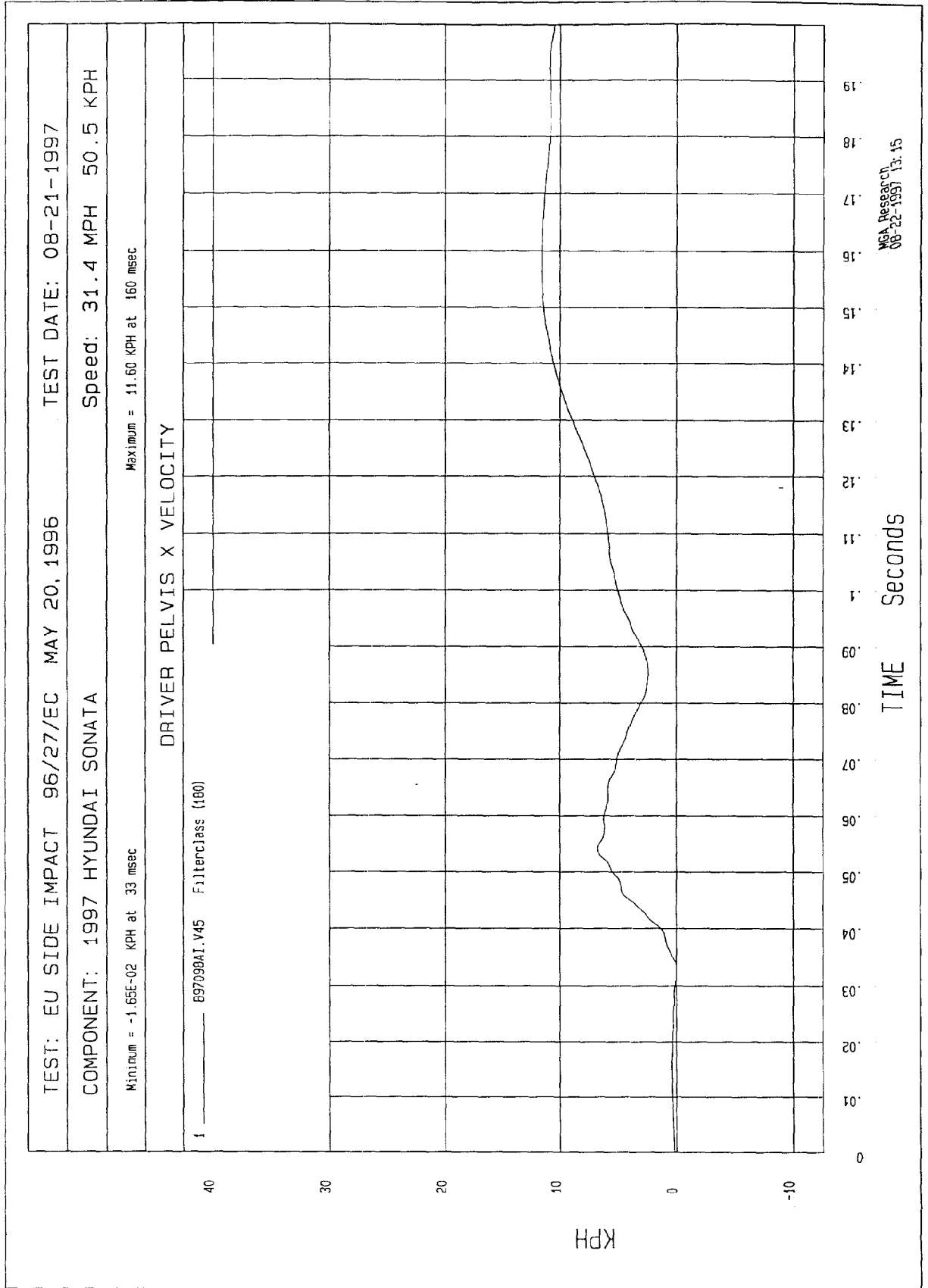
DRIVER LOWER SPINE Z ACCELERATION

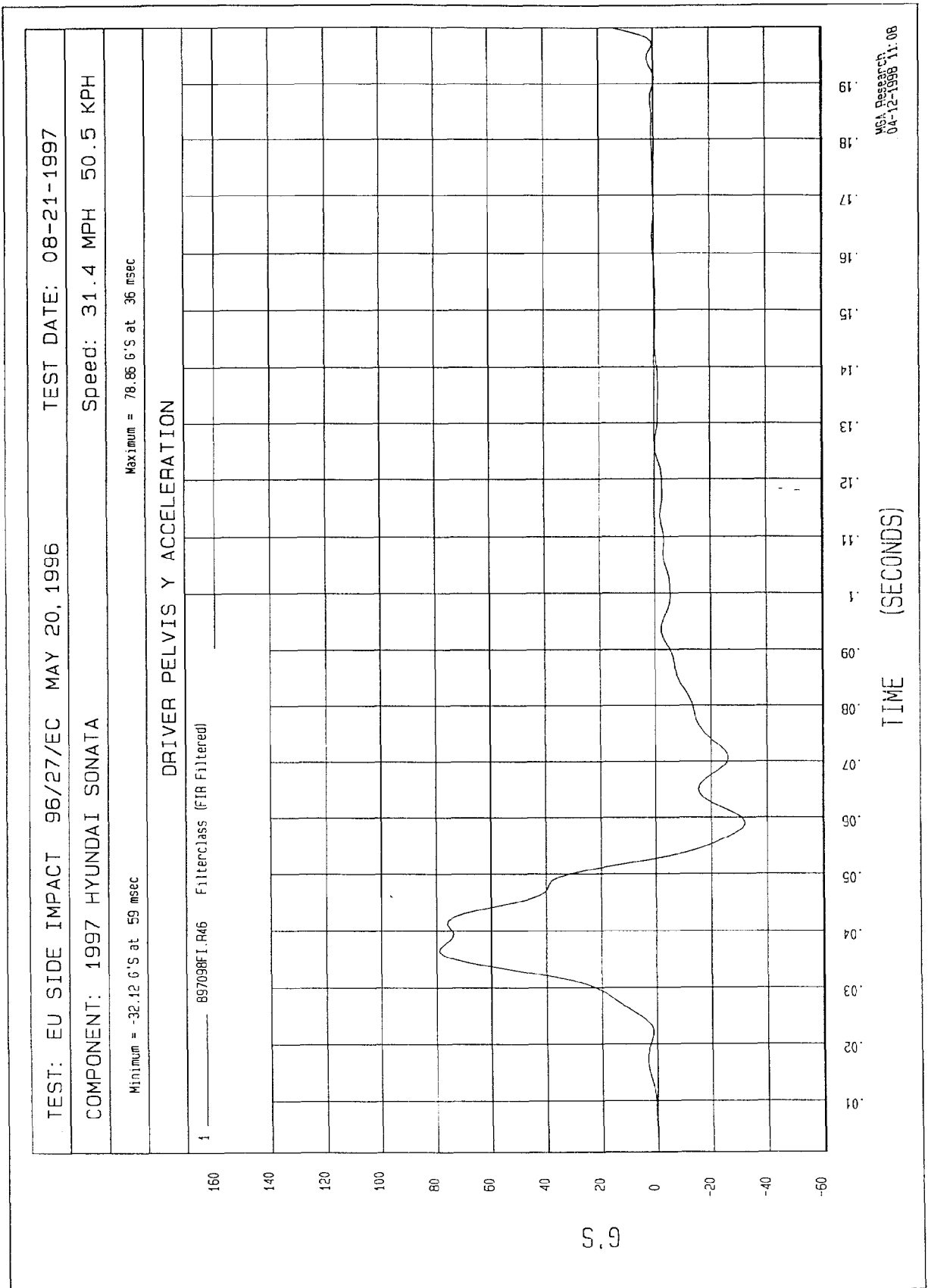


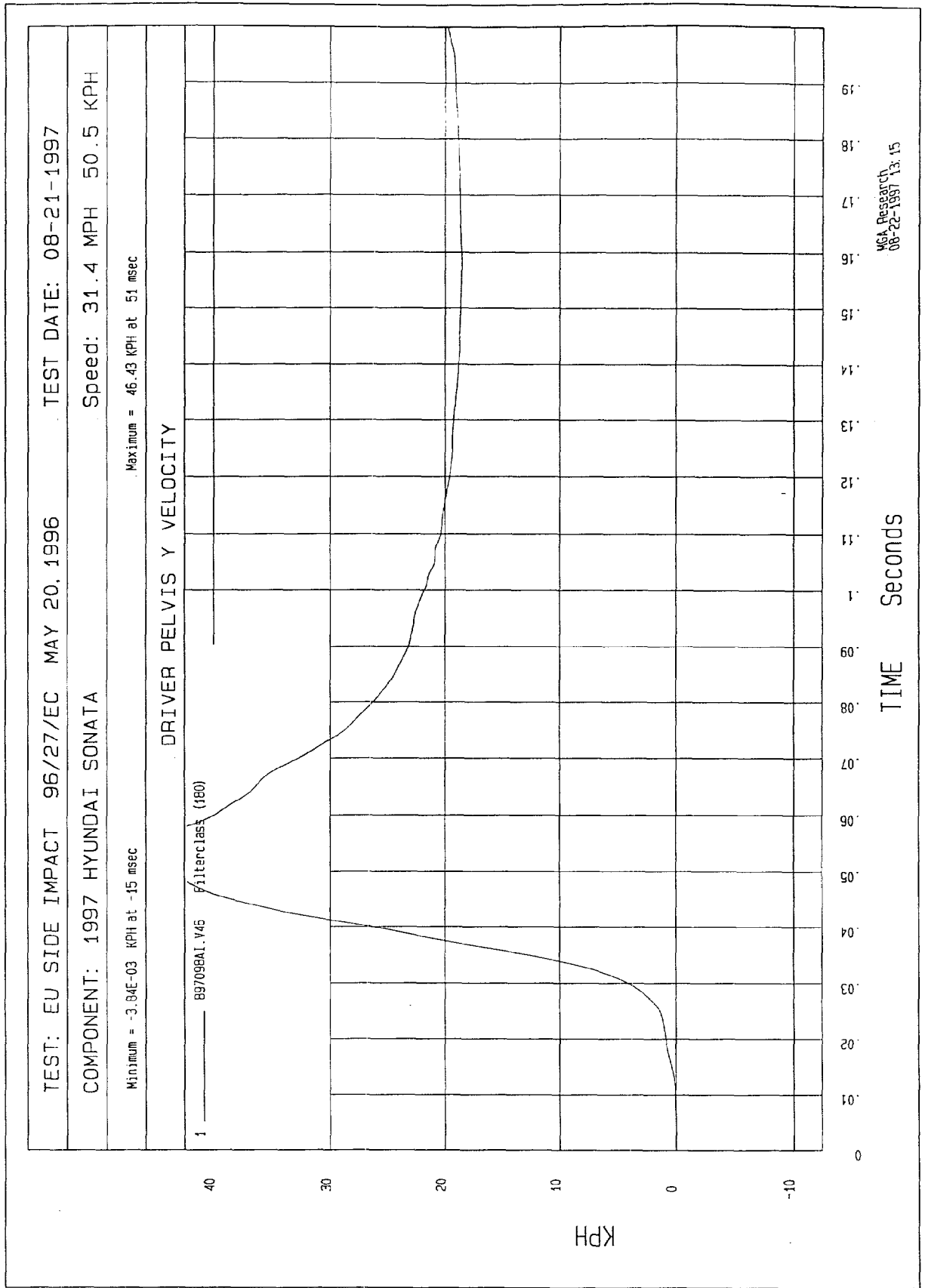
MSA Research
04-12-1998 11:08

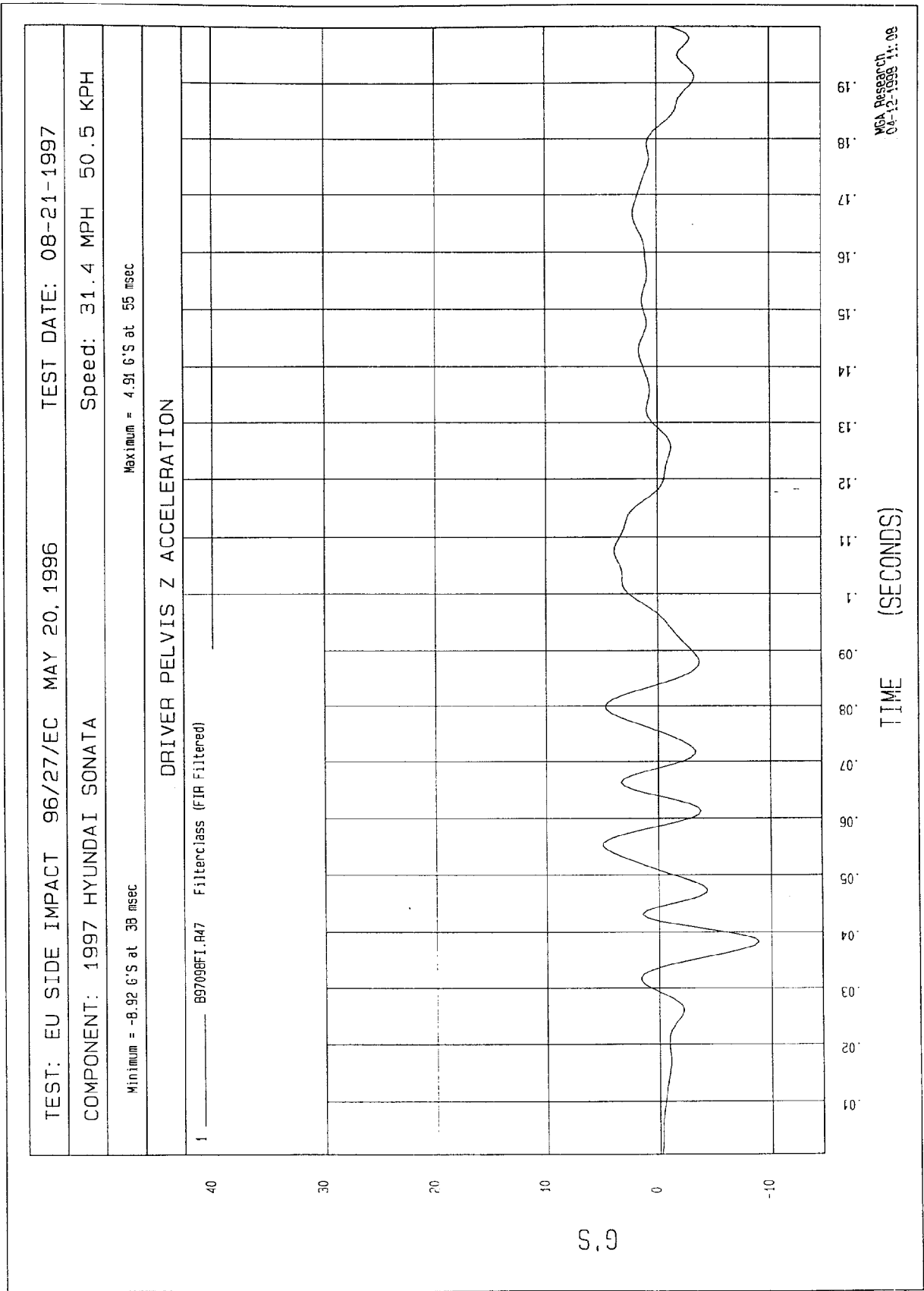


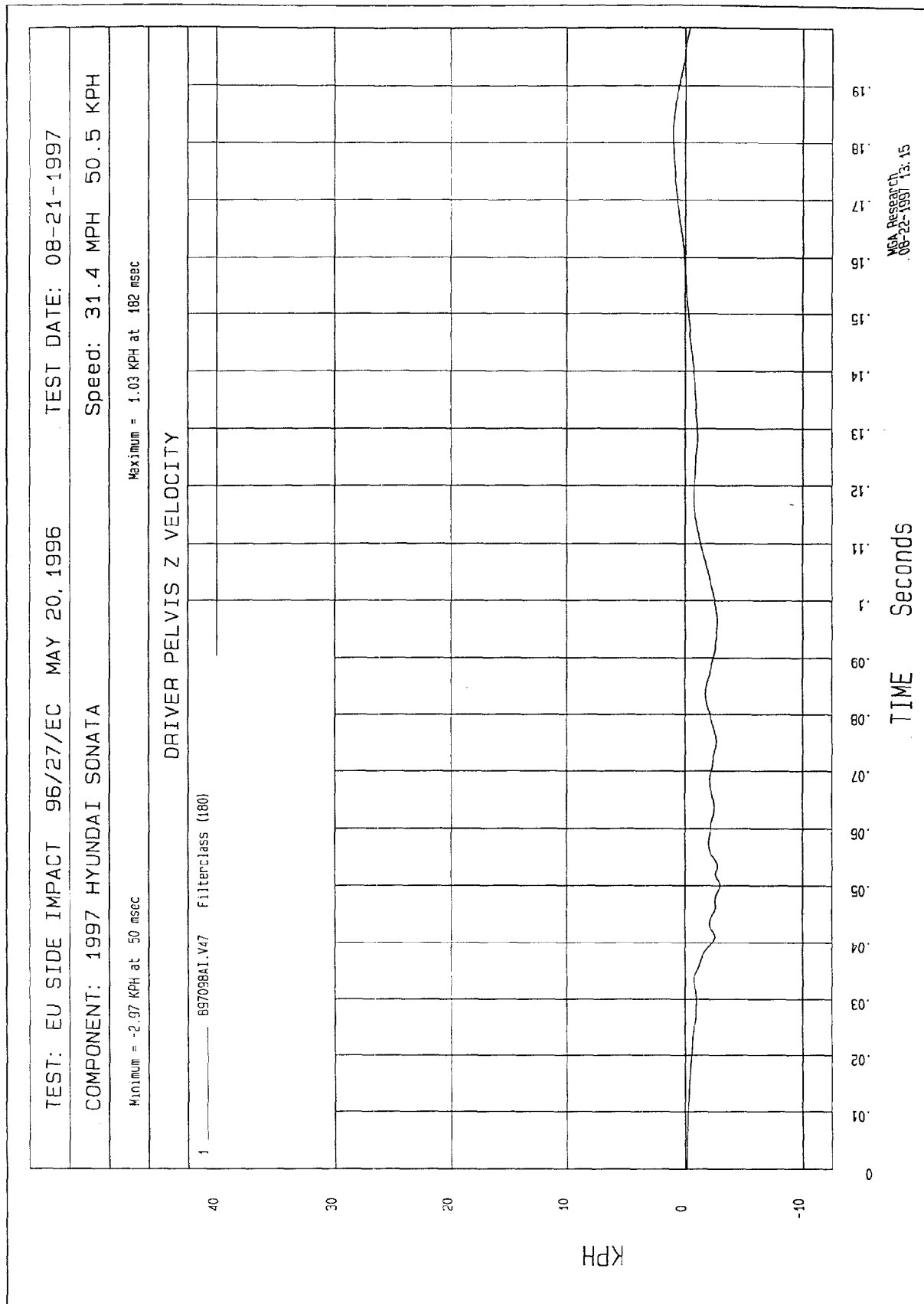


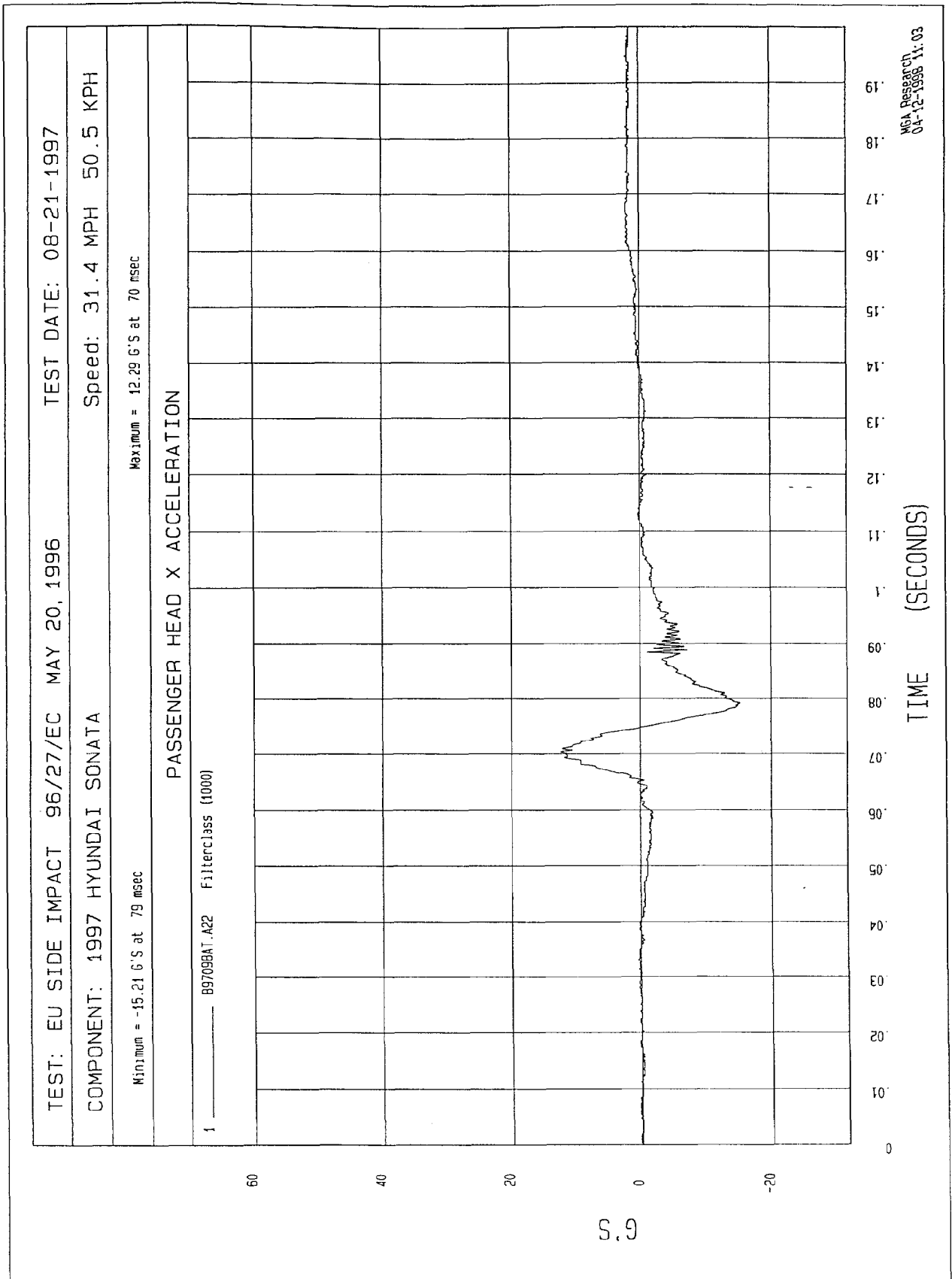


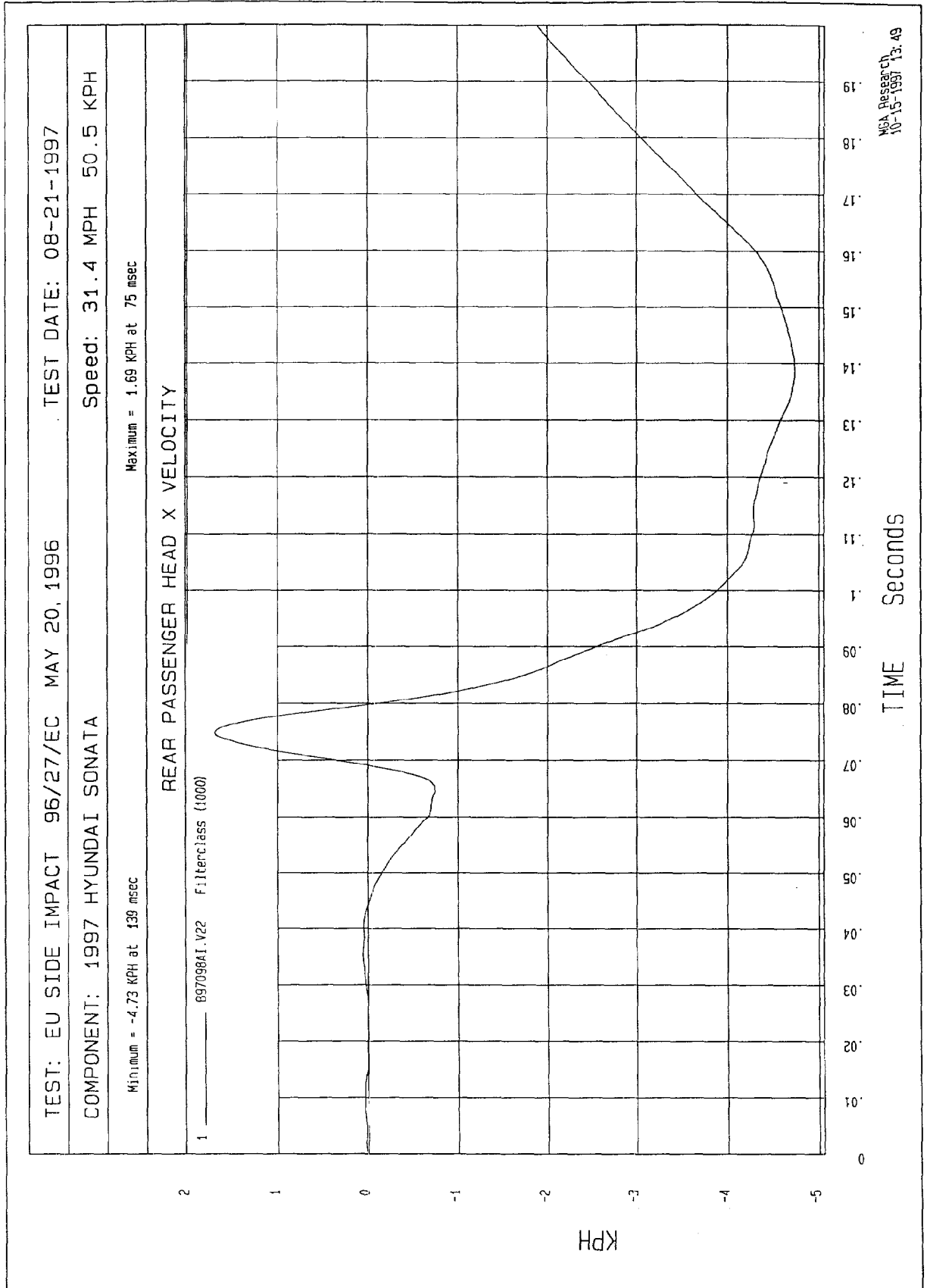


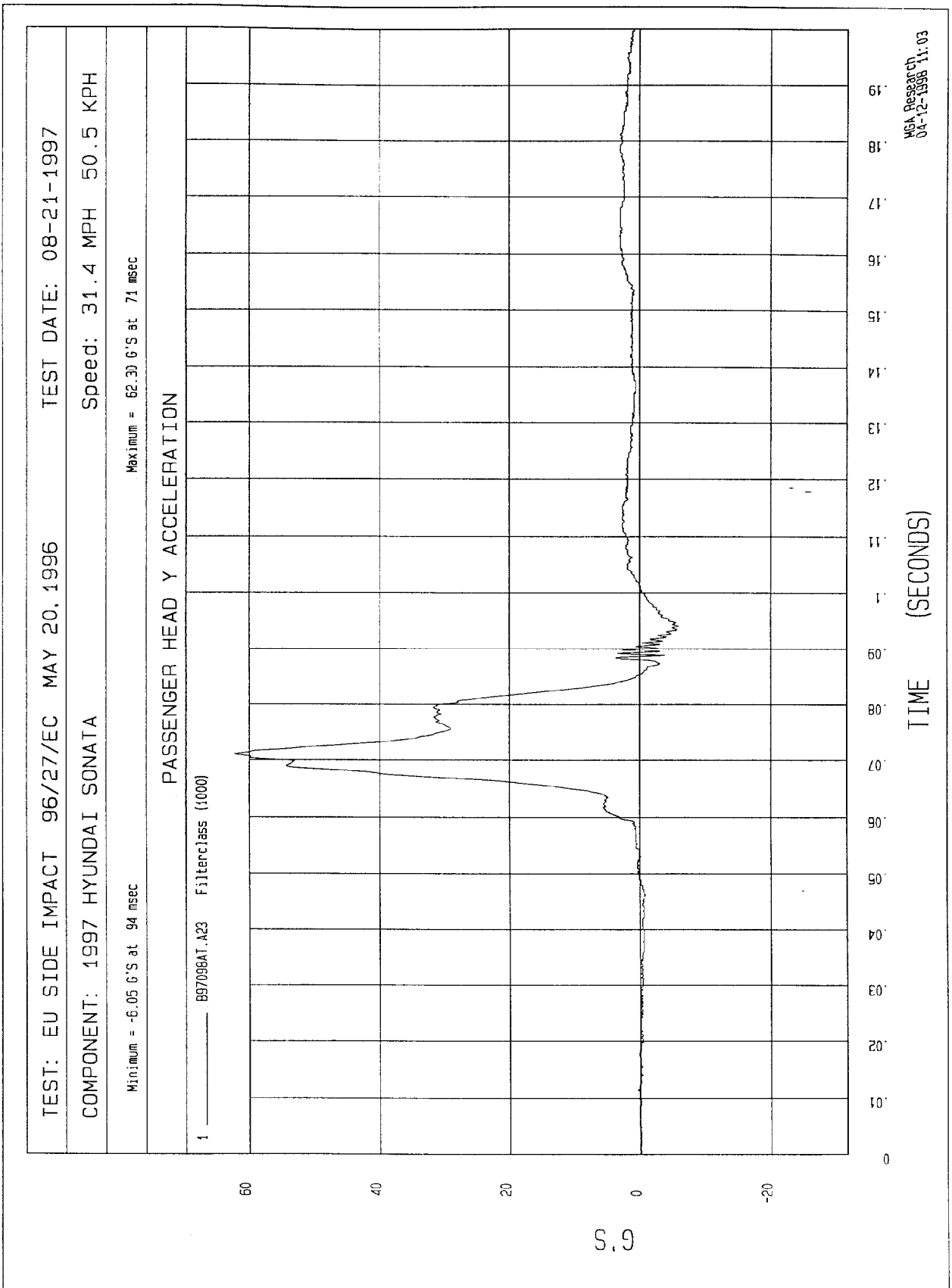










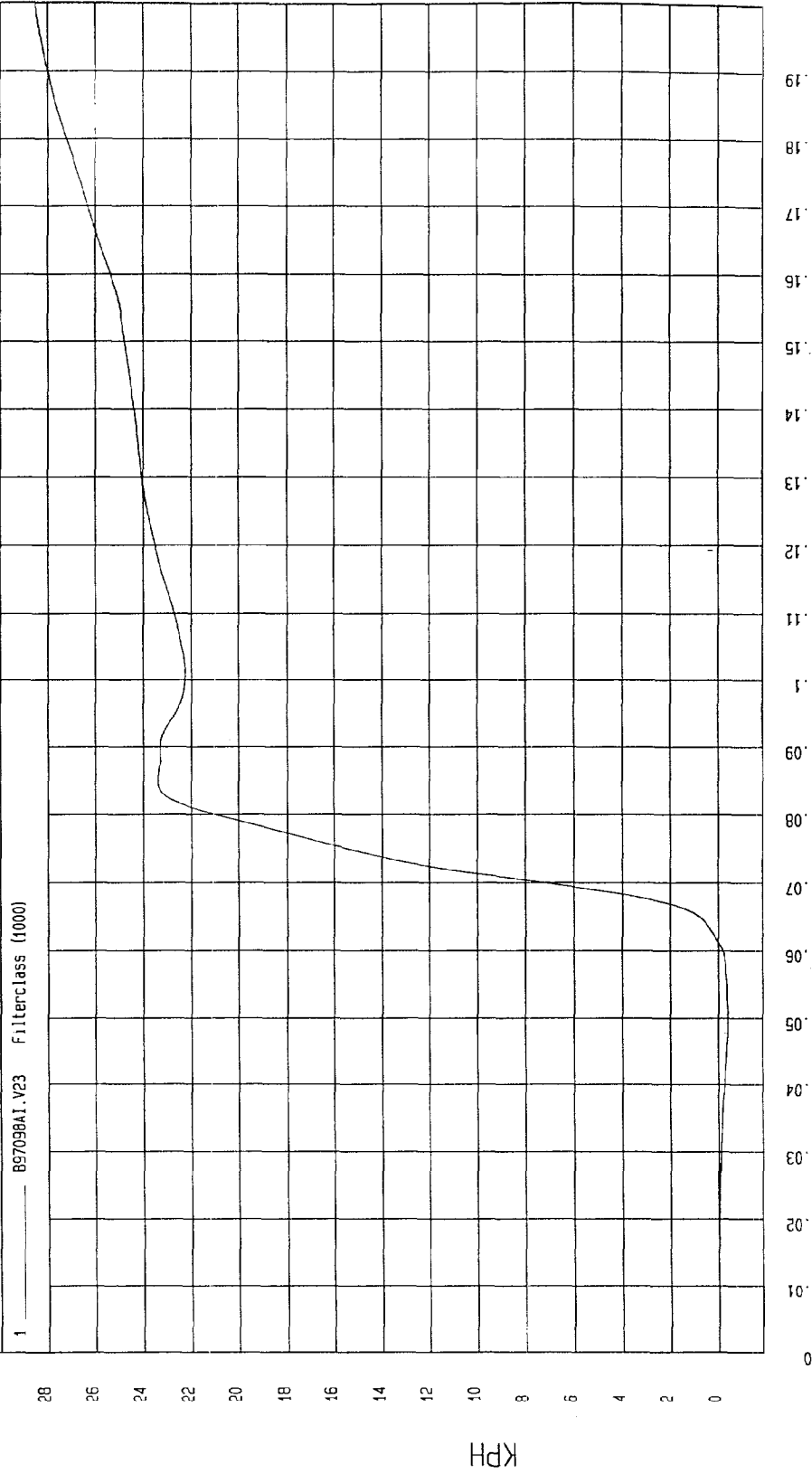


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

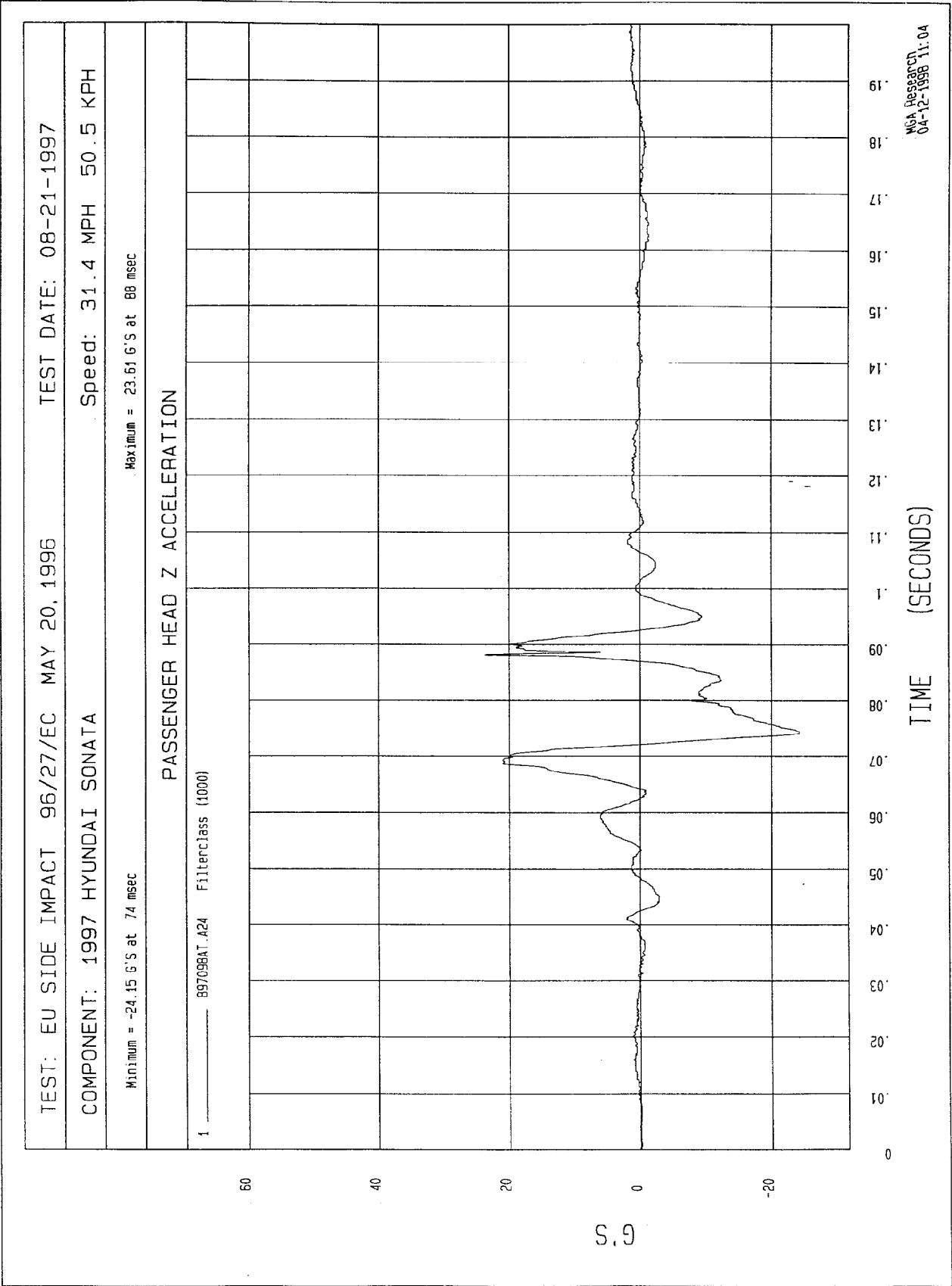
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

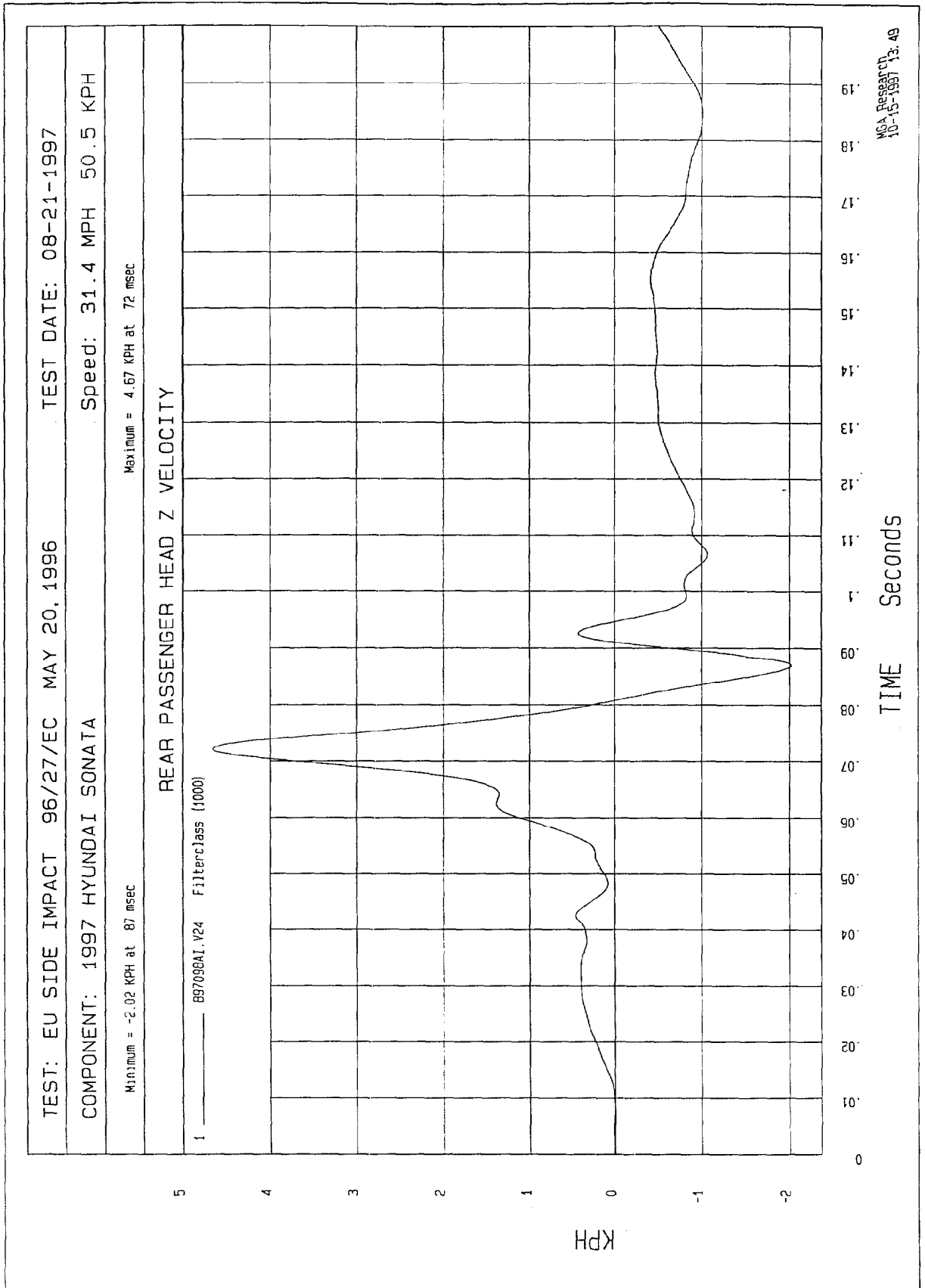
Minimum = -.39 KPH at 49 msec Maximum = 28.51 KPH at 200 msec

REAR PASSENGER HEAD Y VELOCITY



MCA Research
10-15-1997 13.49



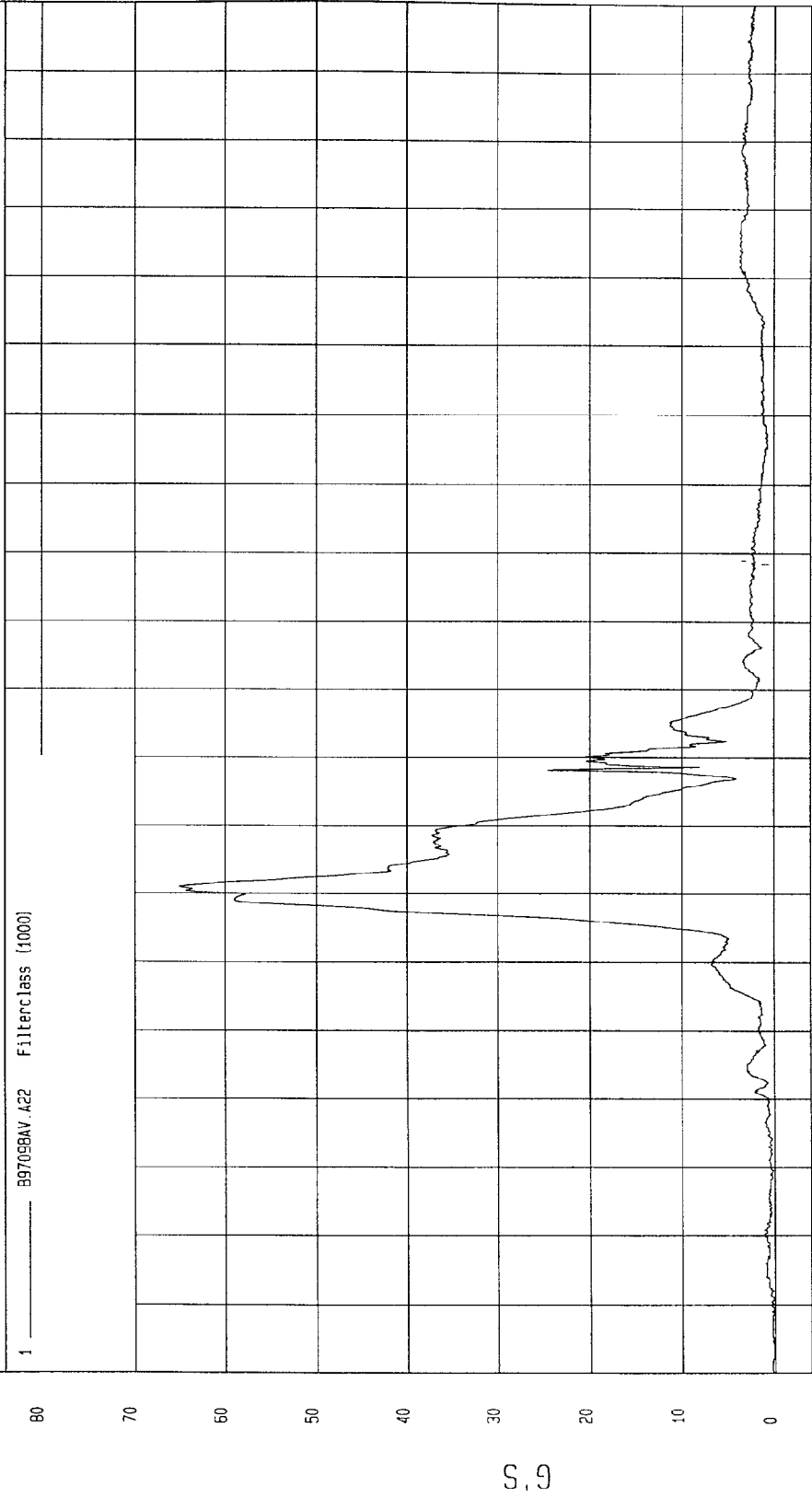


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

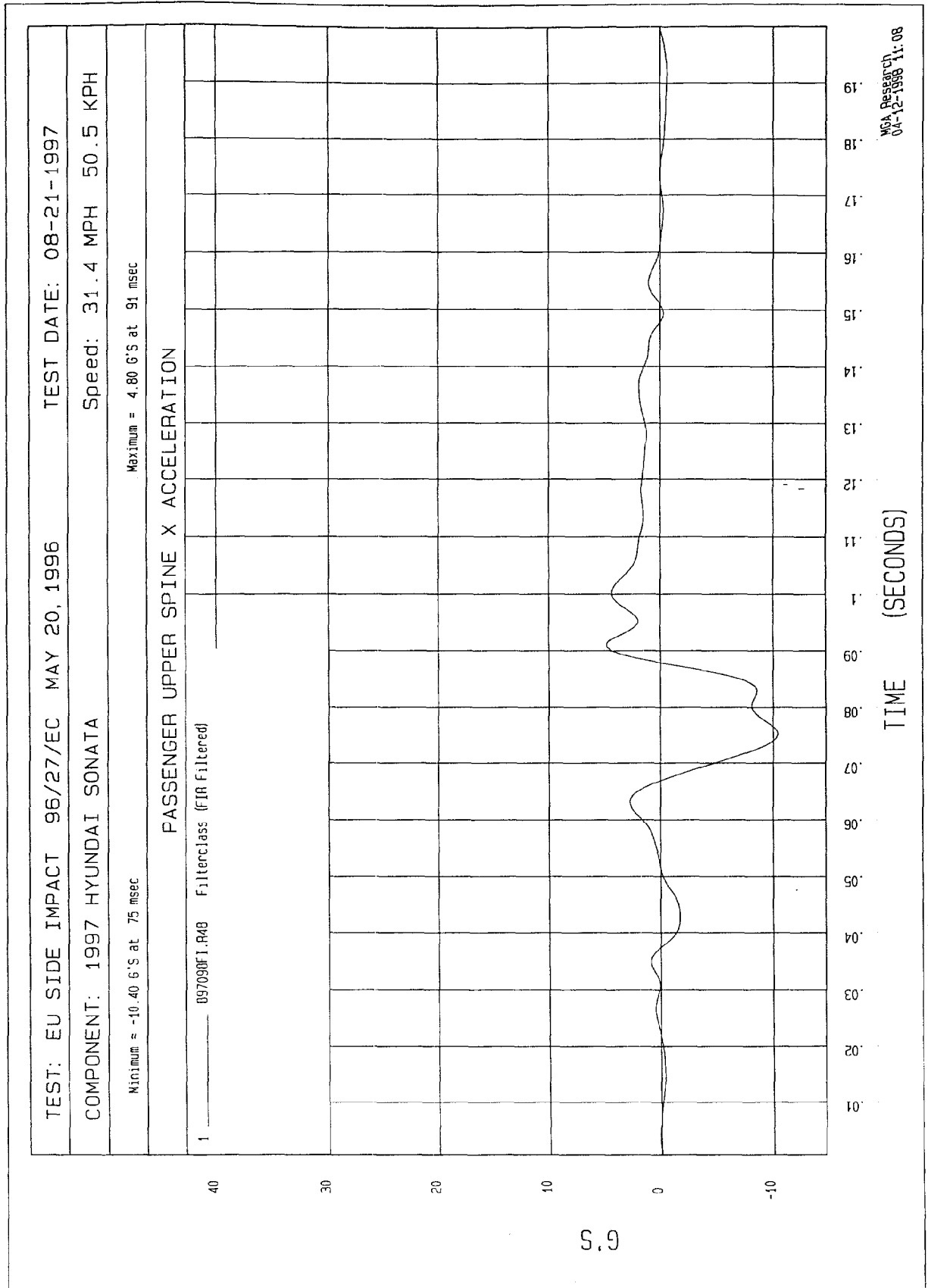
Minimum = .16 G'S at -20 msec Maximum = 65.10 G'S at 71 msec

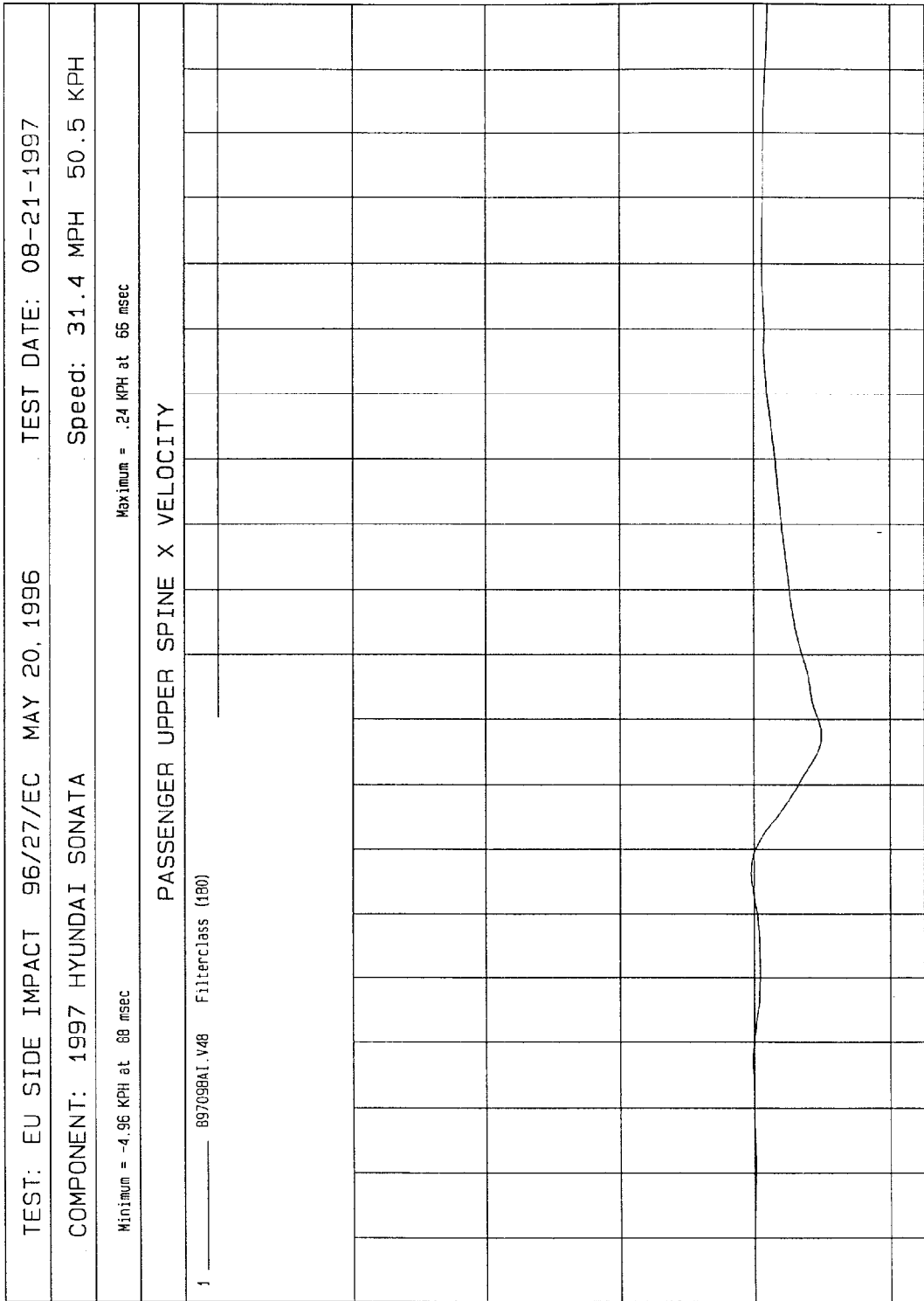
PASSENGER HEAD RESULTANT ACCELERATION



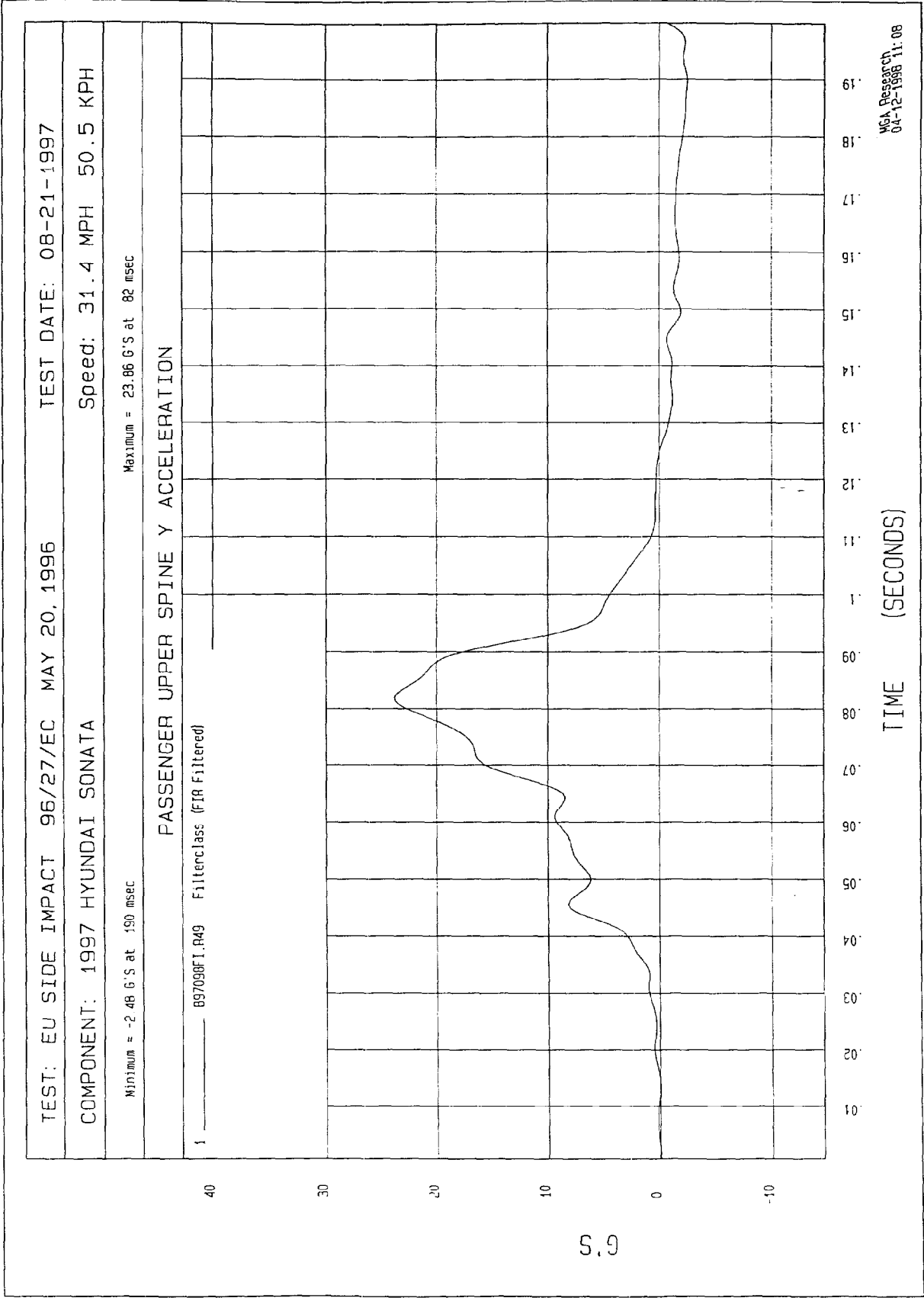
TIME (SECONDS)

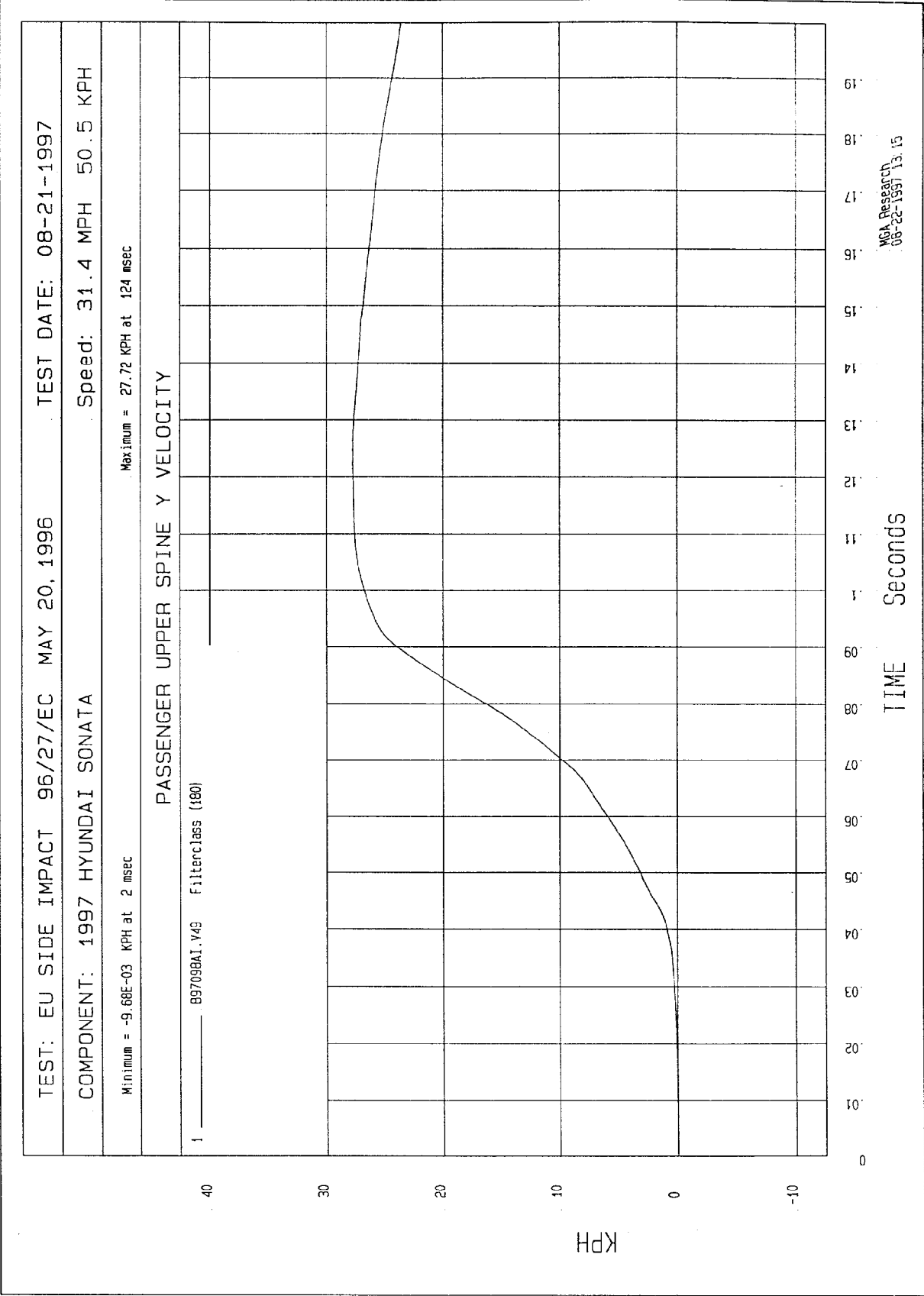
WCA Research
04-12-1998 11:04

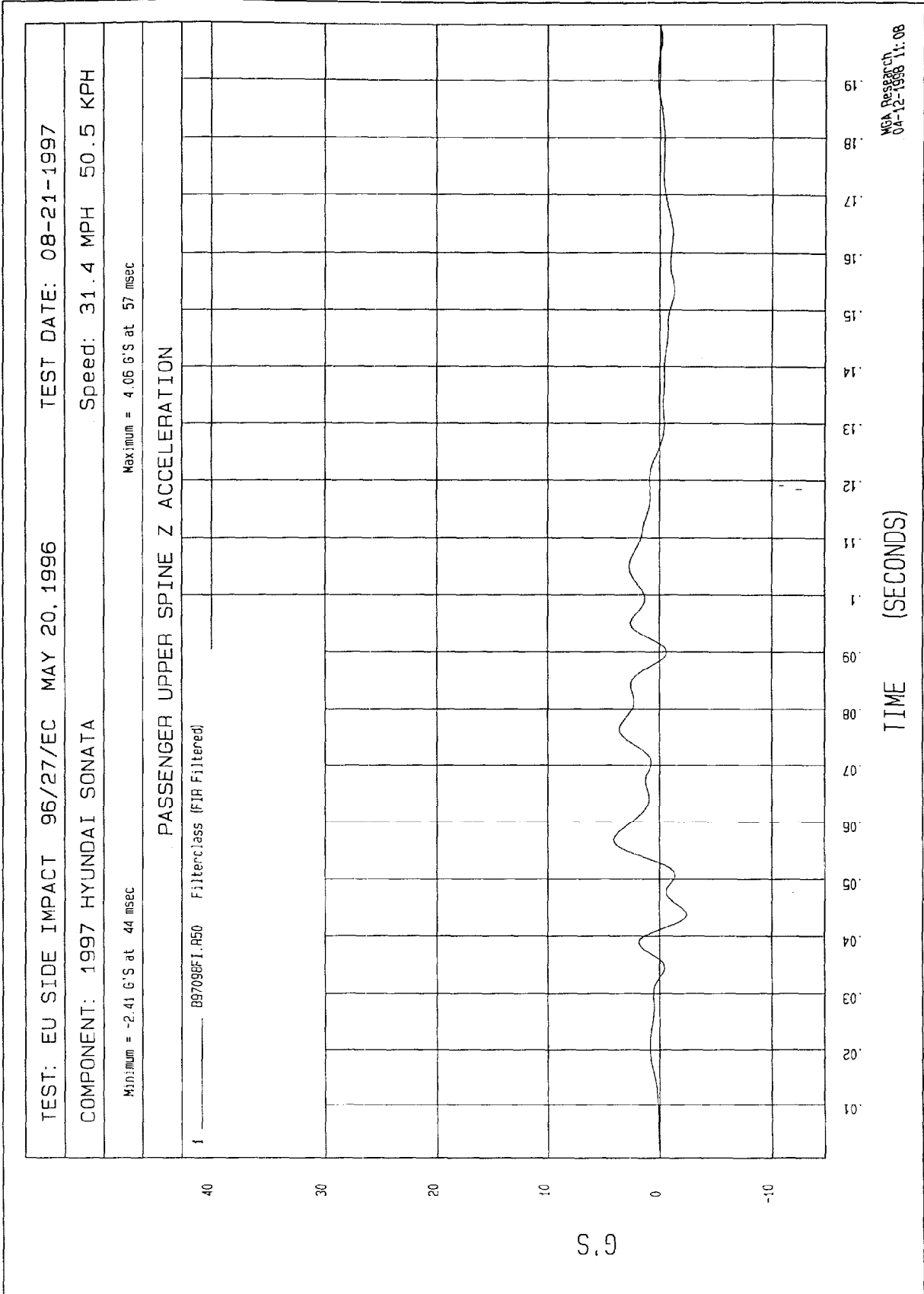


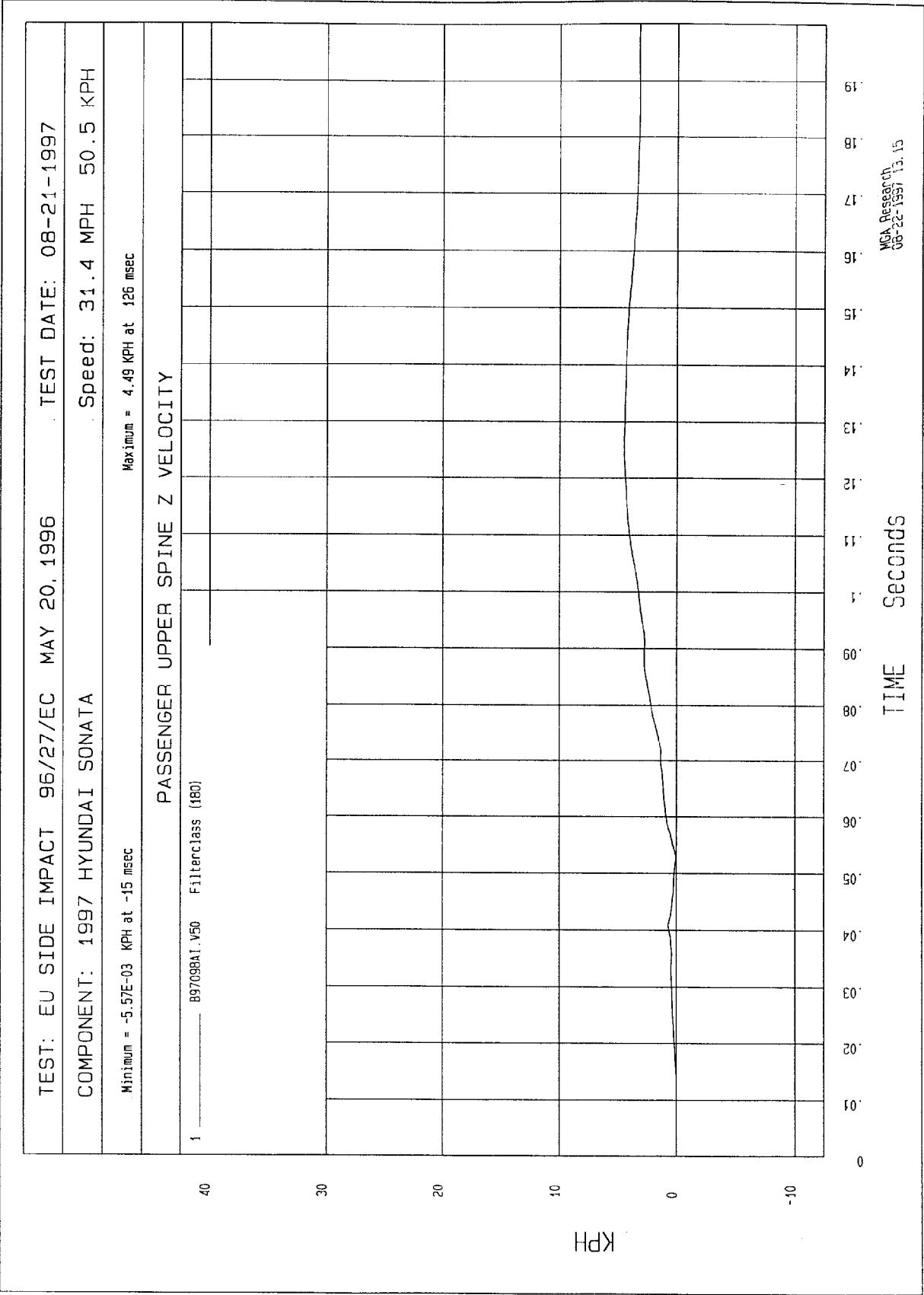


MSA Research
08-22-1997 13:15









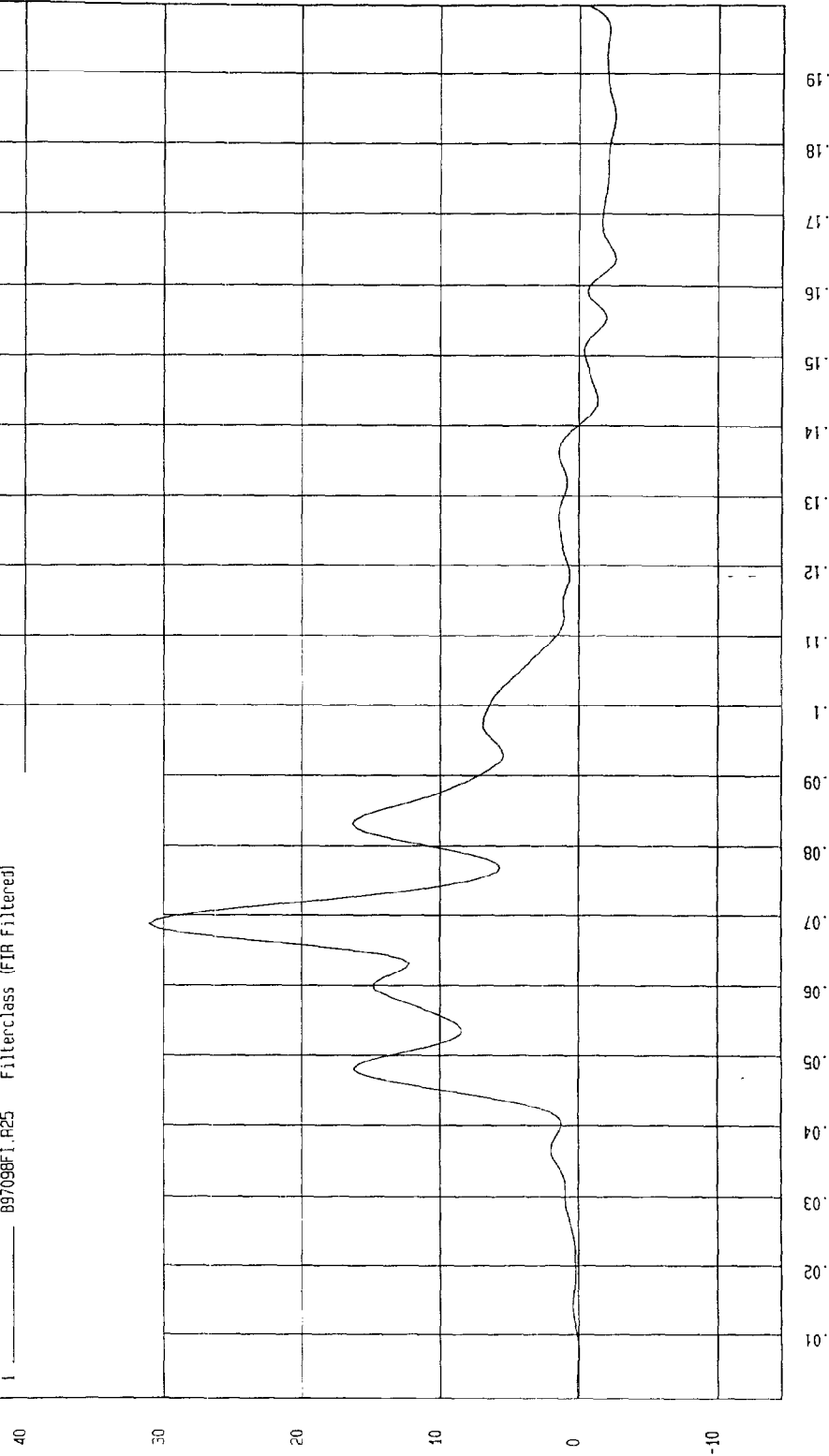
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

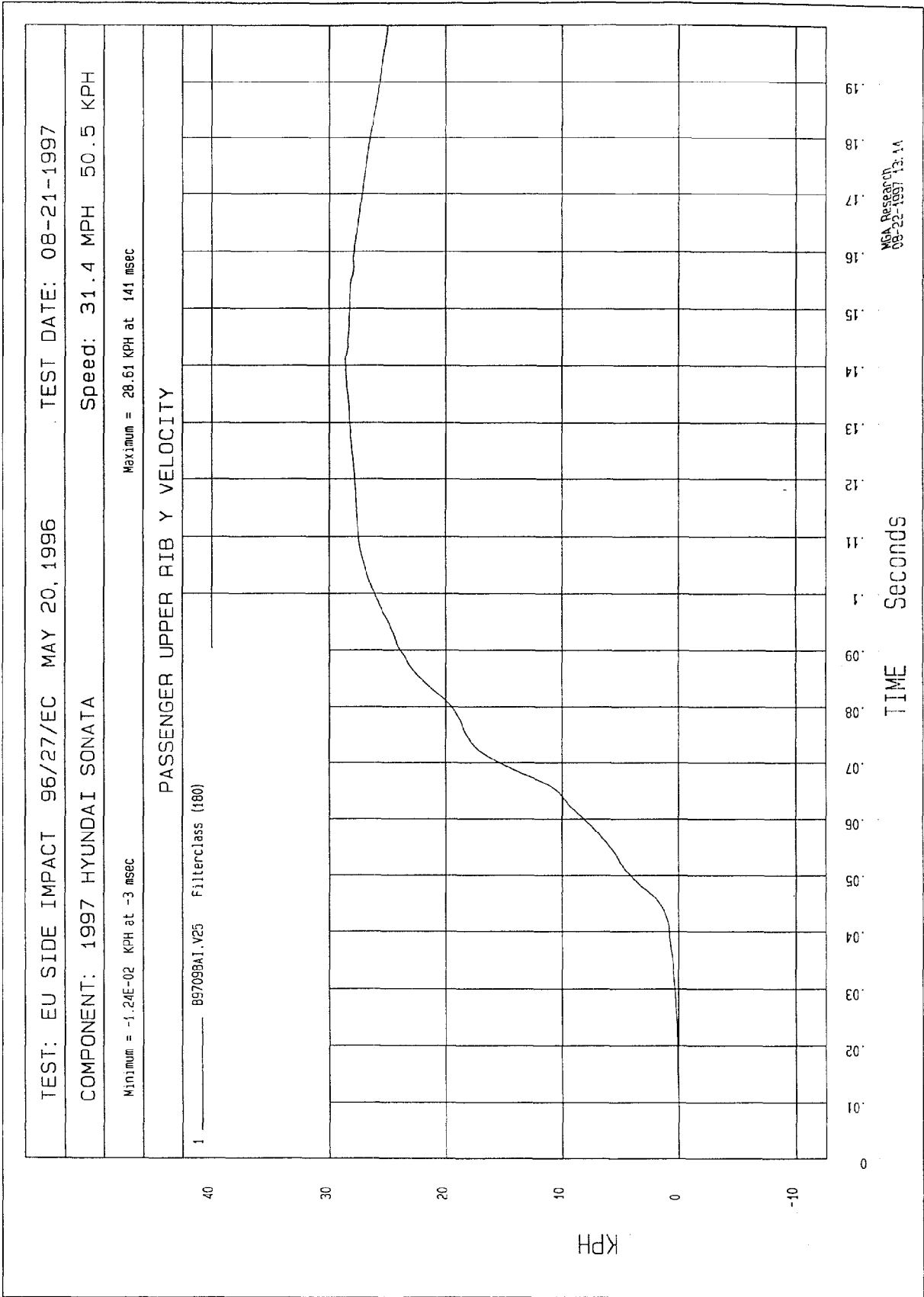
Minimum = -2.61 G'S at 164 msec Maximum = 31.07 G'S at 69 msec

PASSENGER UPPER RIB Y ACCELERATION

1 B97098F1.R25 Filterclass (FIR Filtered)



MECA Research
04-12-1998 11:08

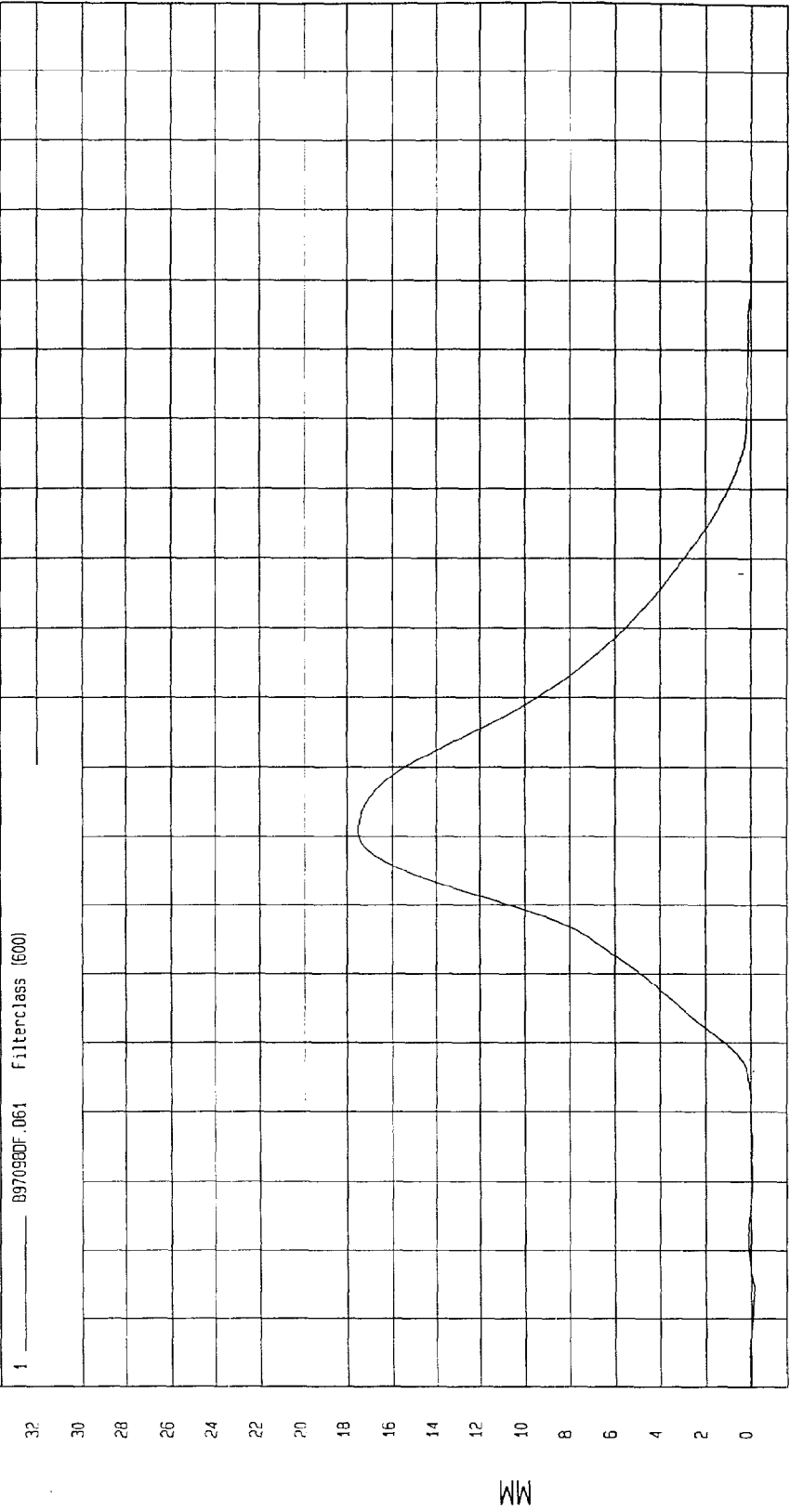


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.14 MM at 14 msec Maximum = 17.50 MM at 81 msec

PASSENGER UPPER RIB Y DISPLACEMENT



TIME (SECONDS)

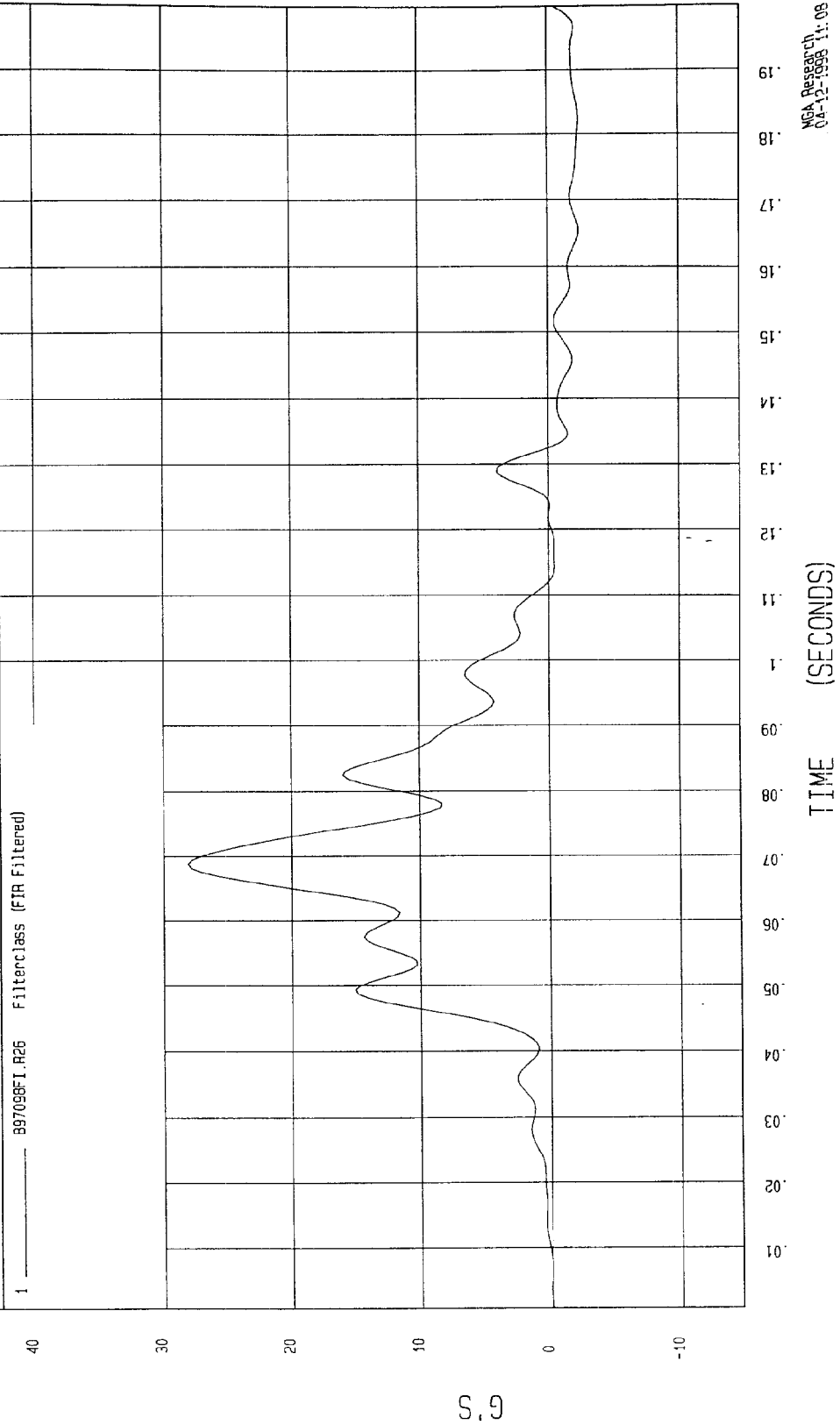
MSA Research
08-22-1997 10:31

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.35 G'S at 182 msec Maximum = 28.09 G'S at 69 msec

PASSENGER MID RIB Y ACCELERATION

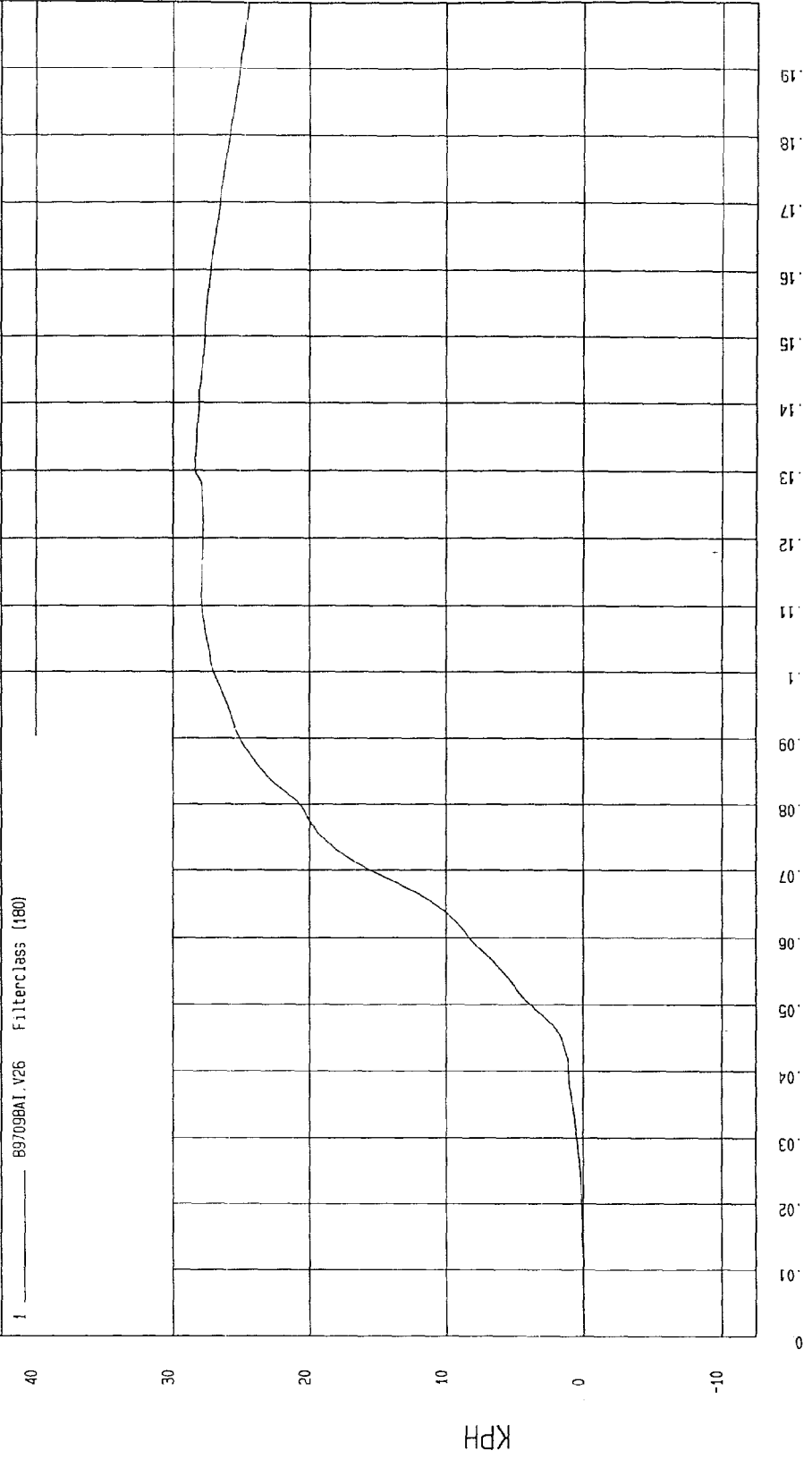


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.74E-02 KPH at -2 msec Maximum = 28.34 KPH at 130 msec

PASSENGER MID RIB Y VELOCITY



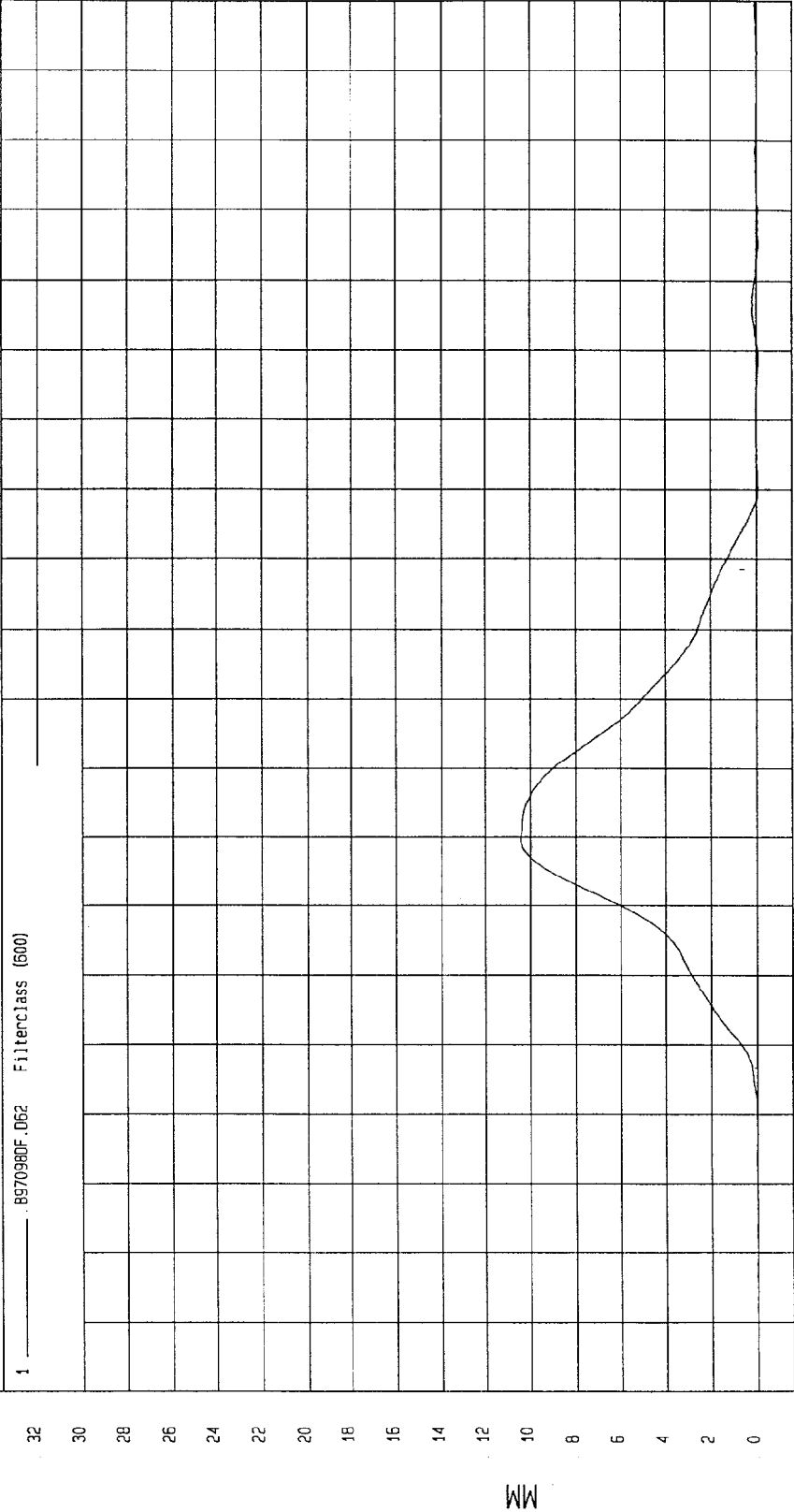
MGA Research
08-22-1997 13:14

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -9.36E-02 MM at 165 msec Maximum = 10.41 MM at 79 msec

PASSENGER MID RIB Y DISPLACEMENT



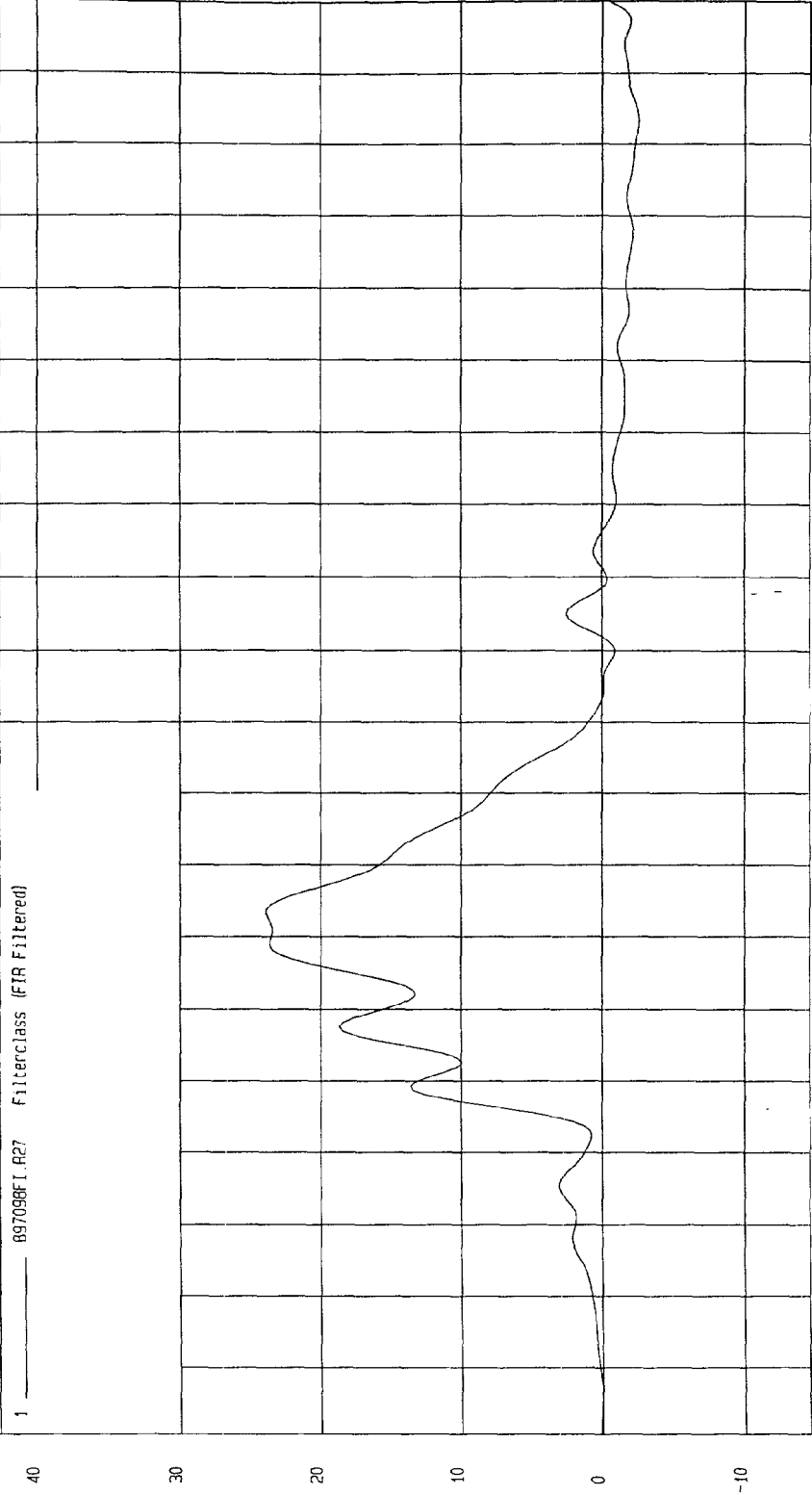
WCA Research
08-22-1997 10:32

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

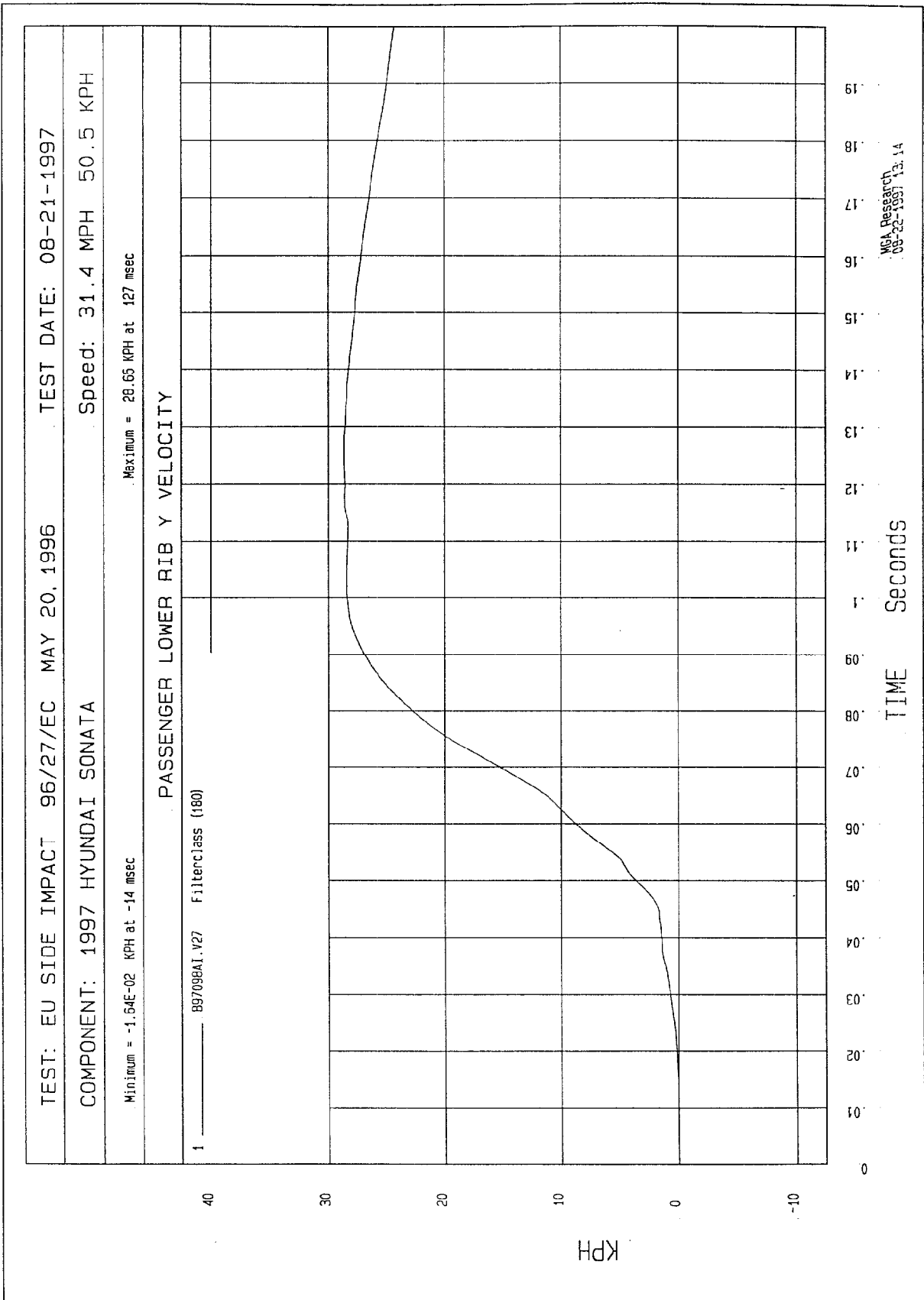
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.56 G'S at 183 msec Maximum = 23.85 G'S at 73 msec

PASSENGER LOWER RIB Y ACCELERATION



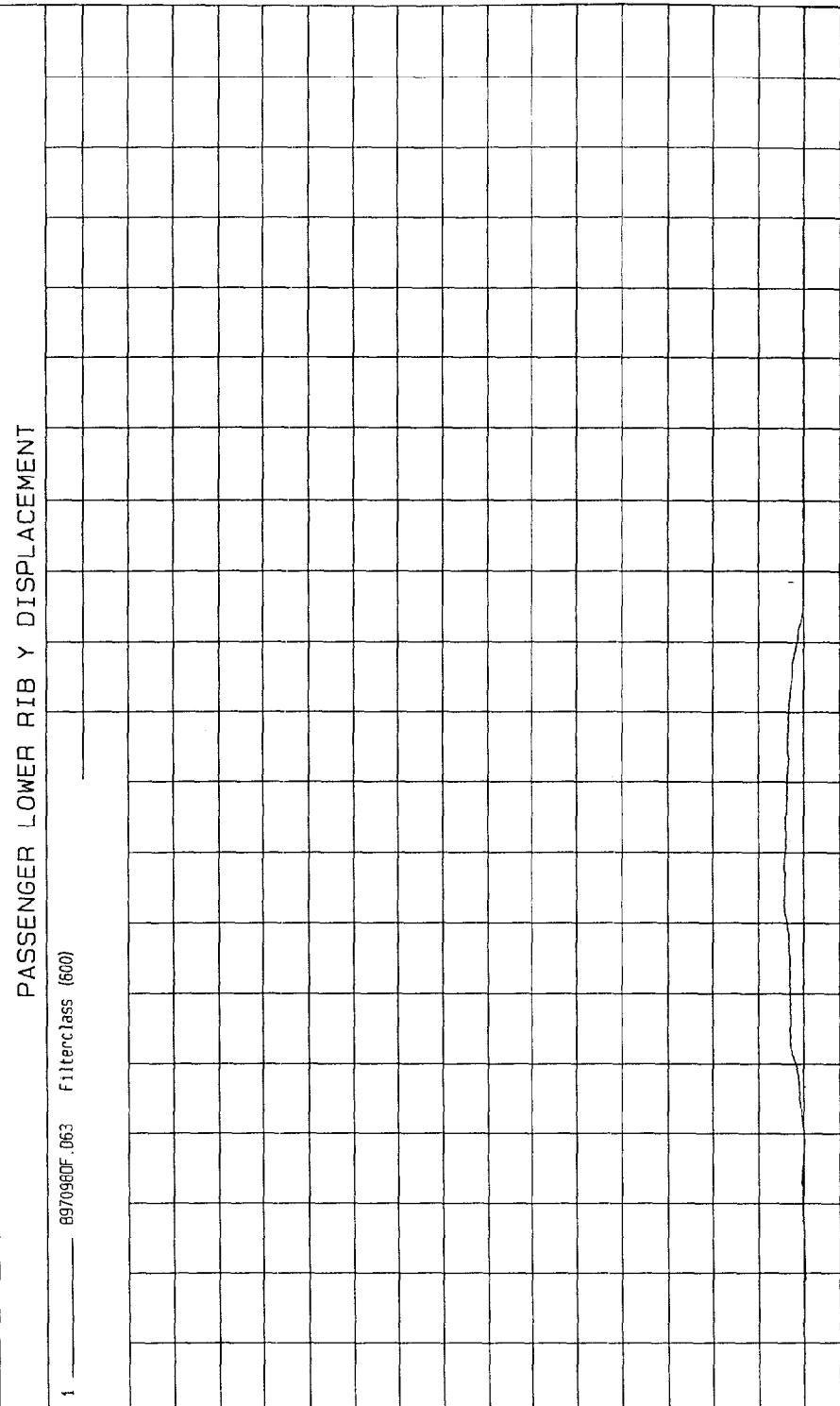
MGA Research
04-12-1998 11:08



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

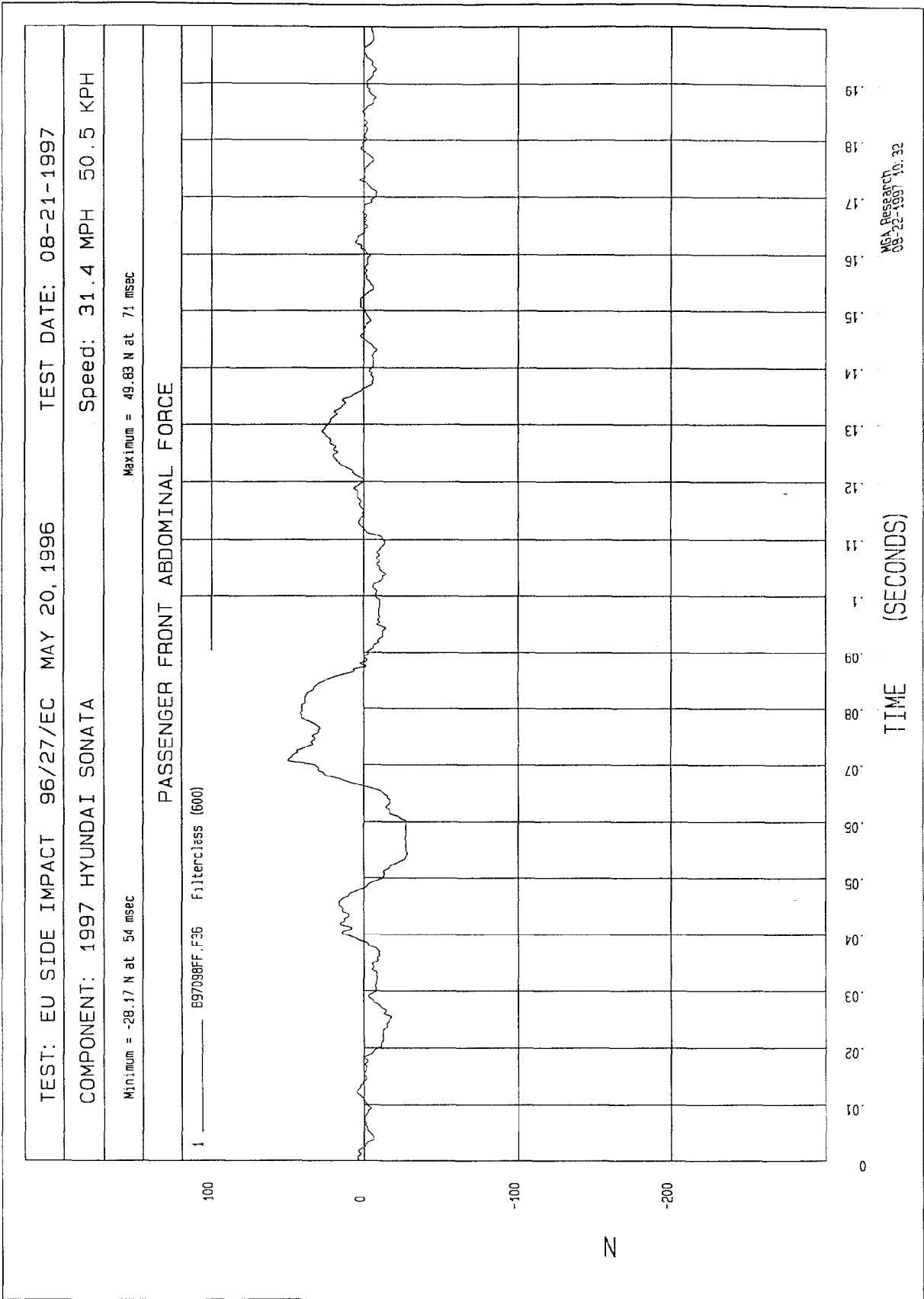
Minimum = -6.95E-02 MM at 19 msec Maximum = .86 MM at 74 msec



MM

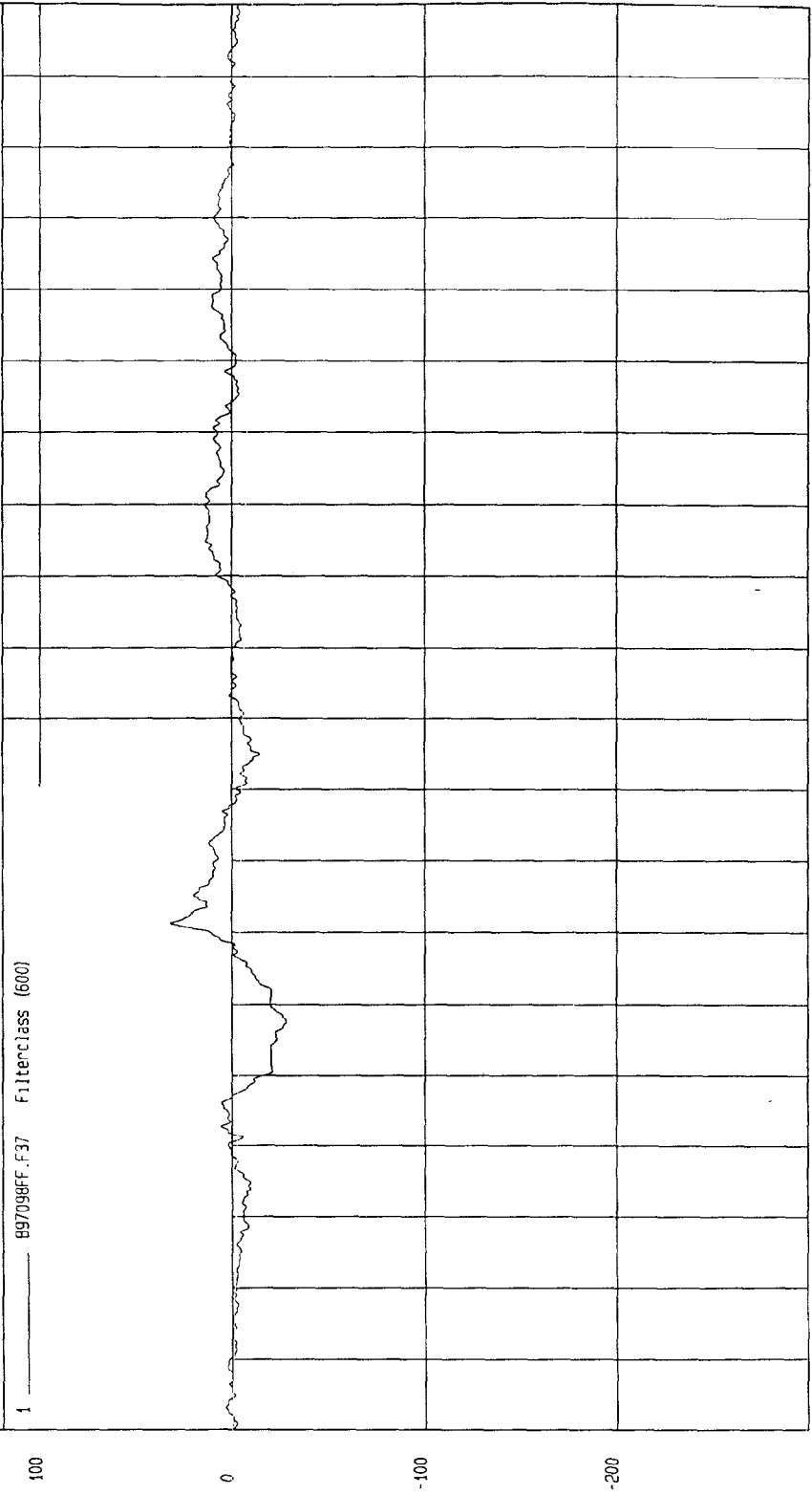
TIME (SECONDS)

MCA Research
08-22-1997 10:32



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -27.69 N at 58 msec	Maximum = 32.14 N at 71 msec

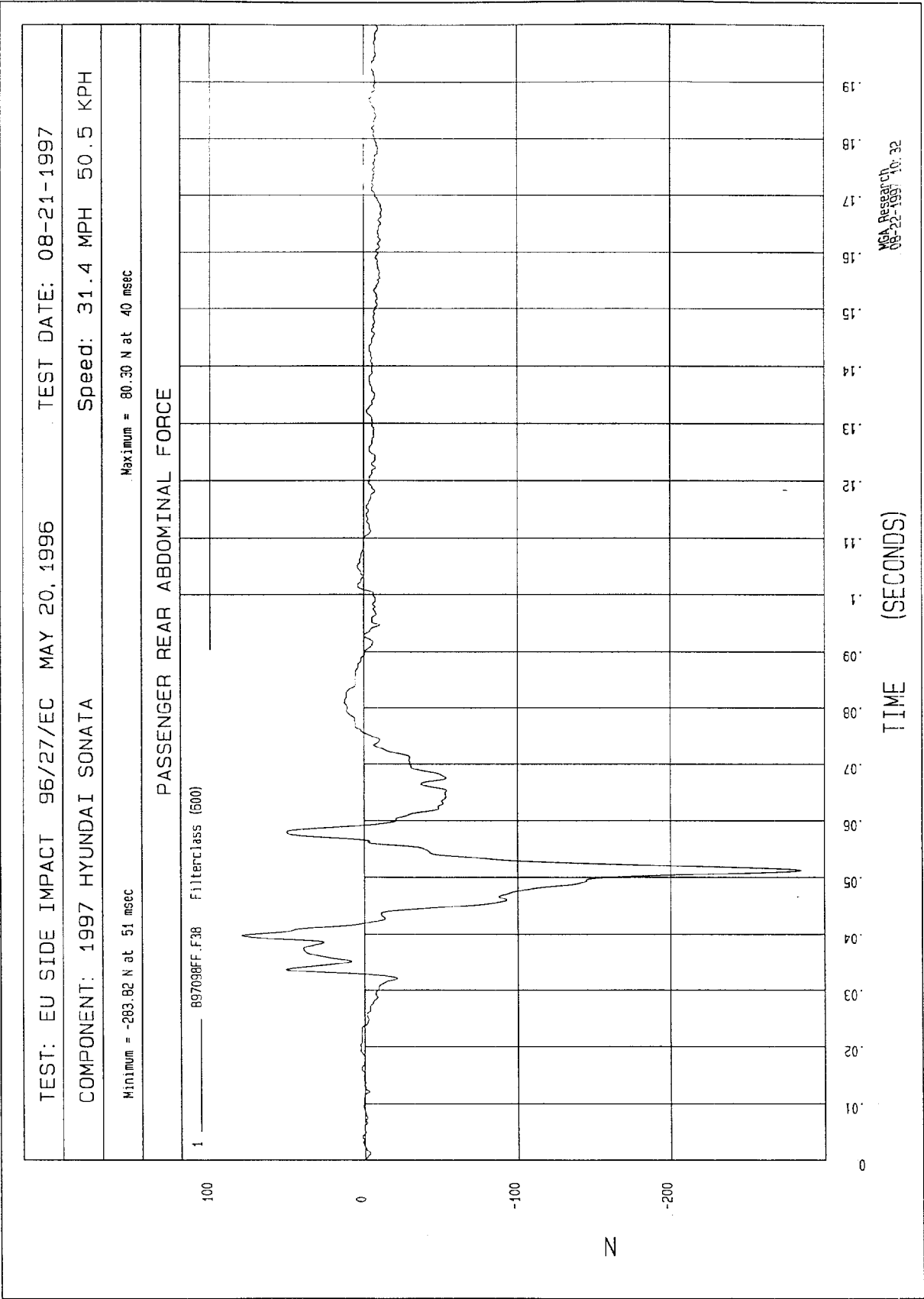
PASSENGER MID ABDOMINAL FORCE



TIME (SECONDS)

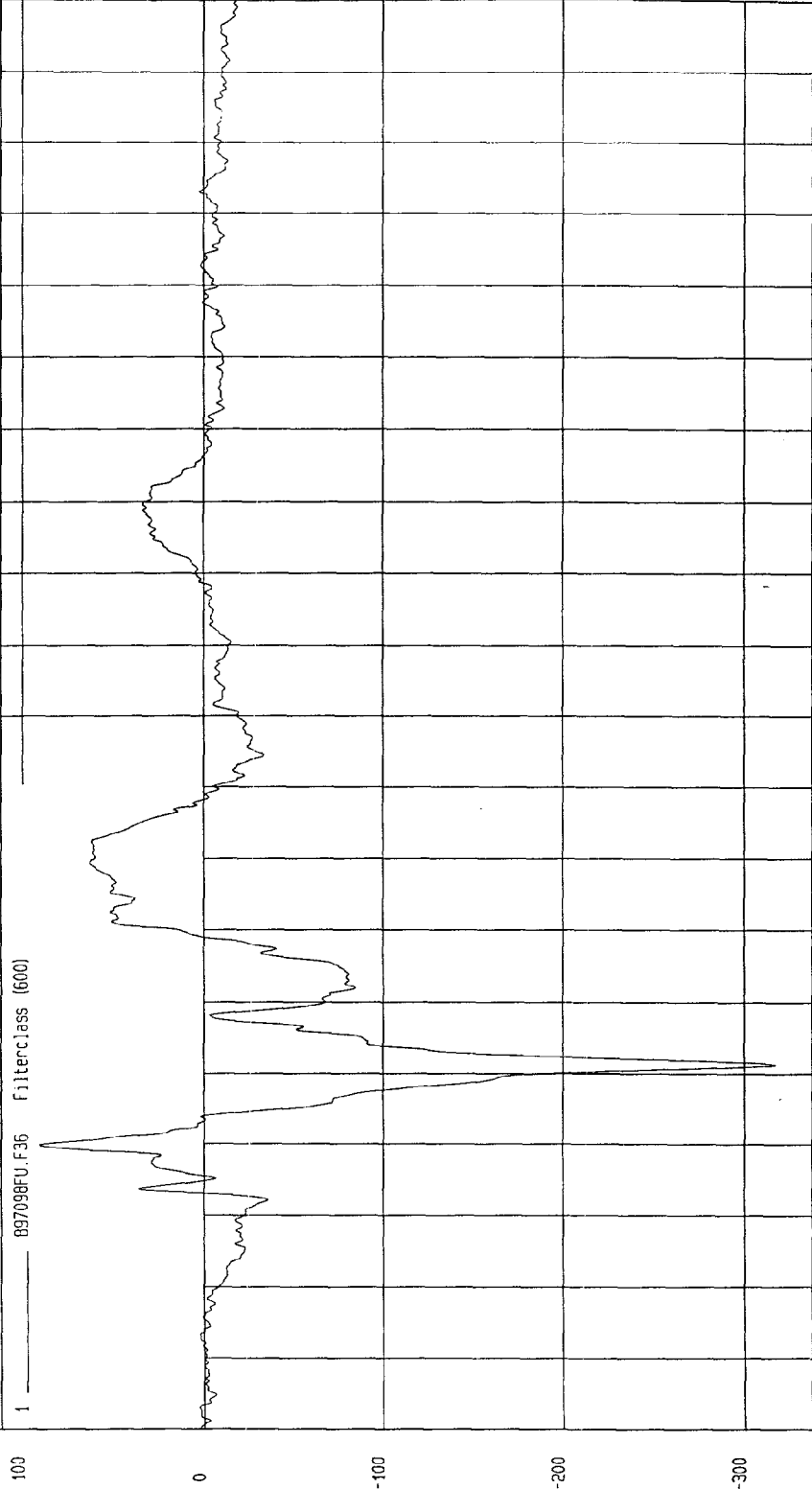
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0

MEA Research
08-22-1997 10:32

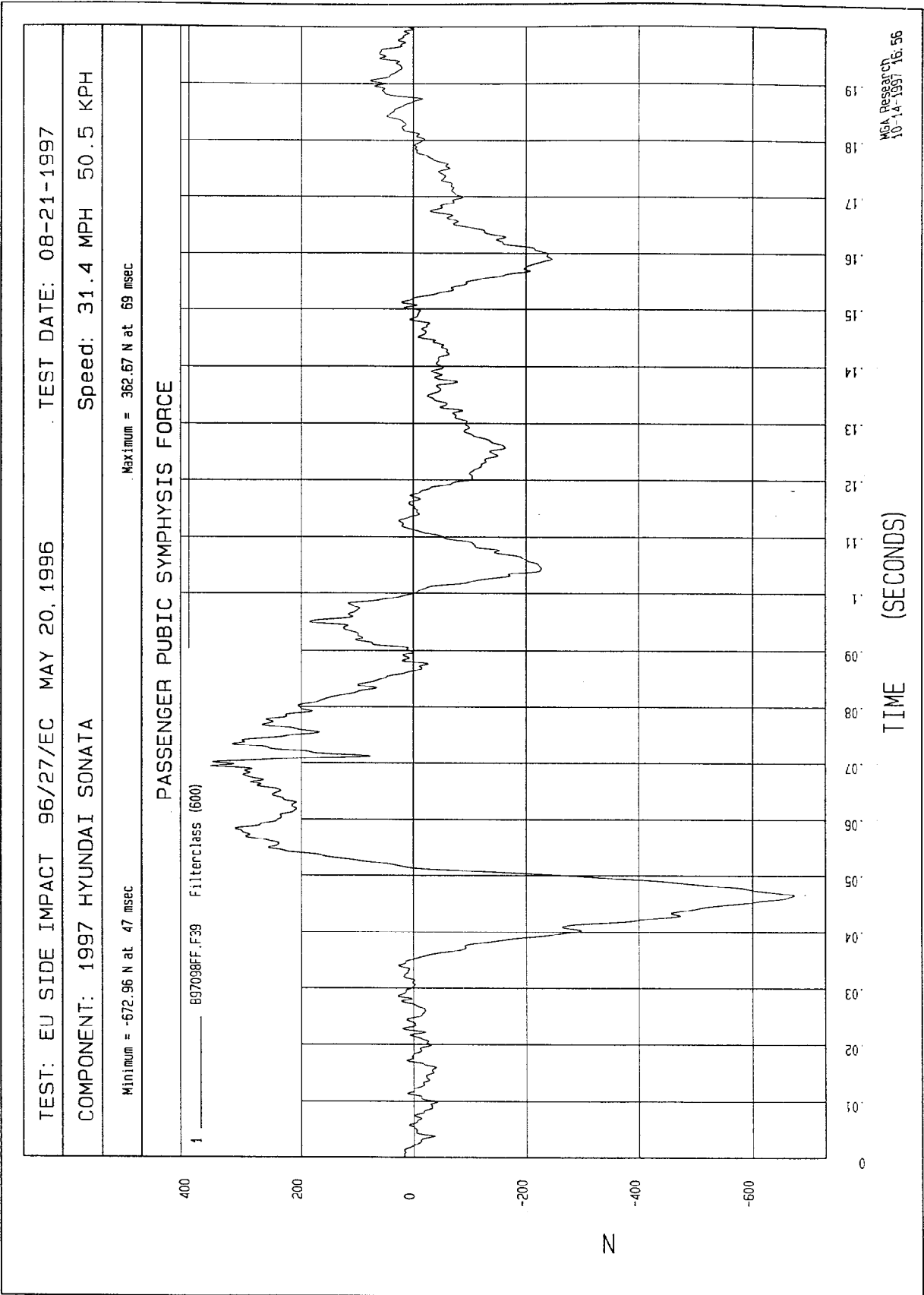


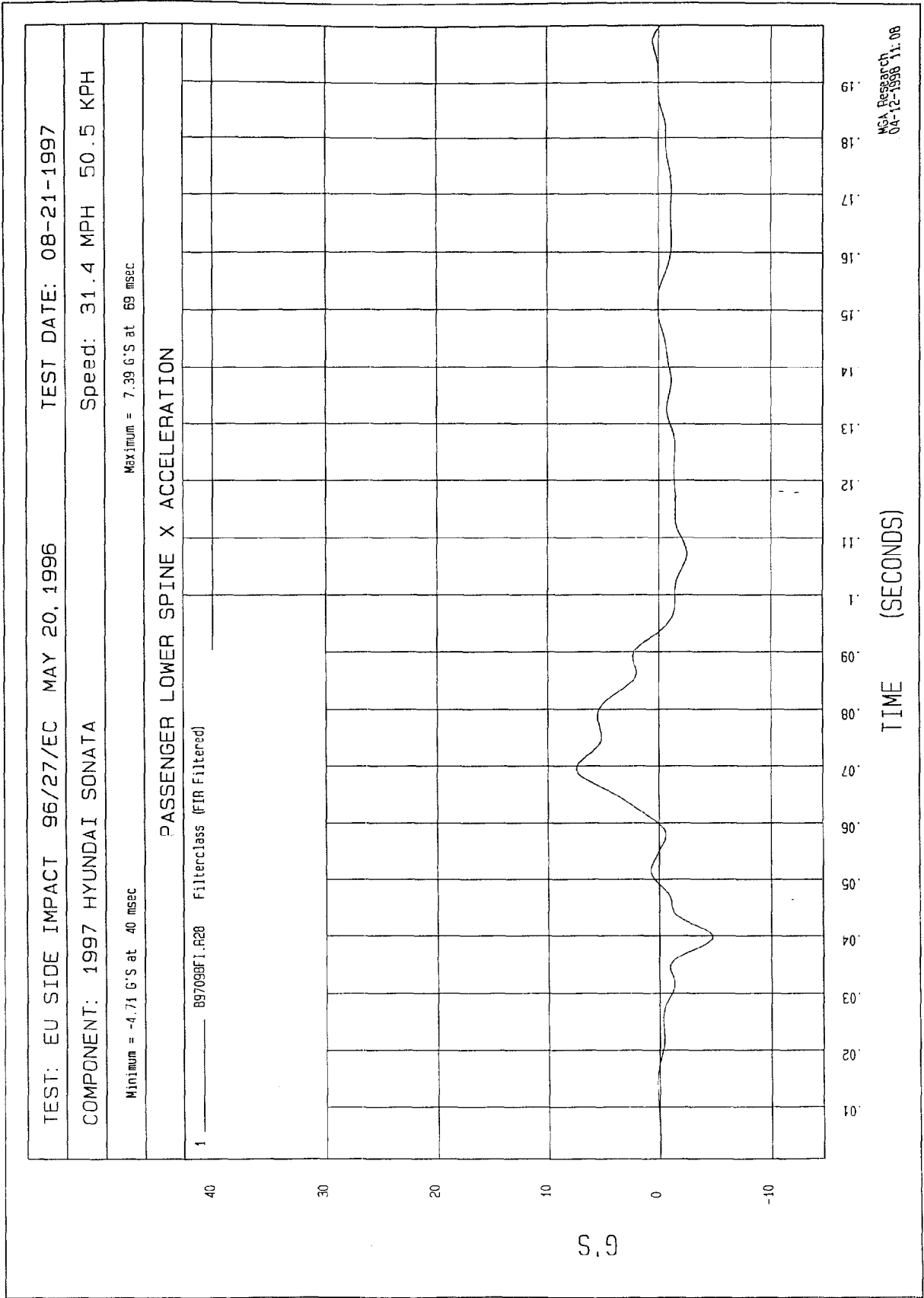
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -317.05 N at 51 msec	Maximum = 91.34 N at 40 msec

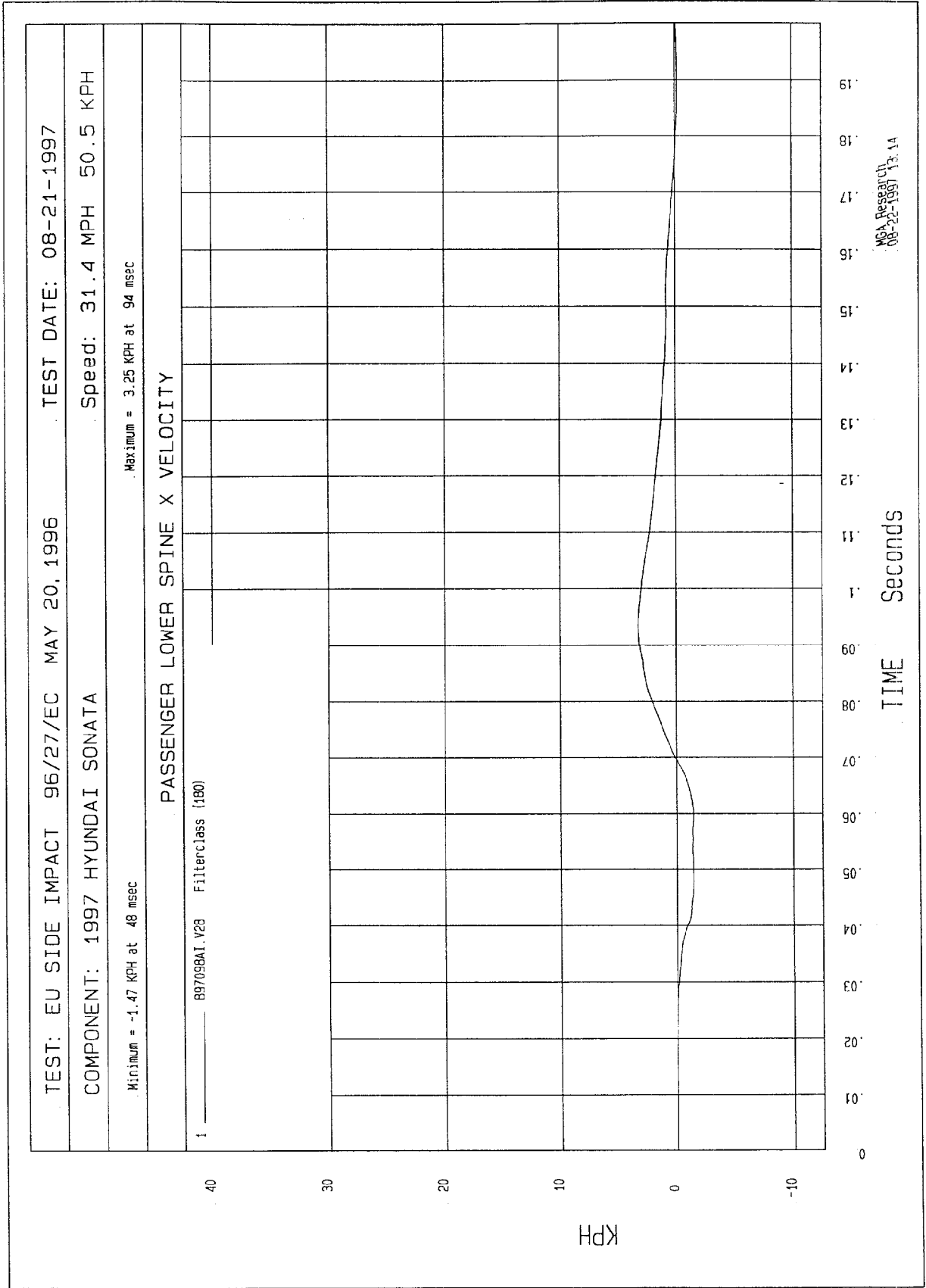
SUM OF PASSENGER ABDOMINAL FORCES

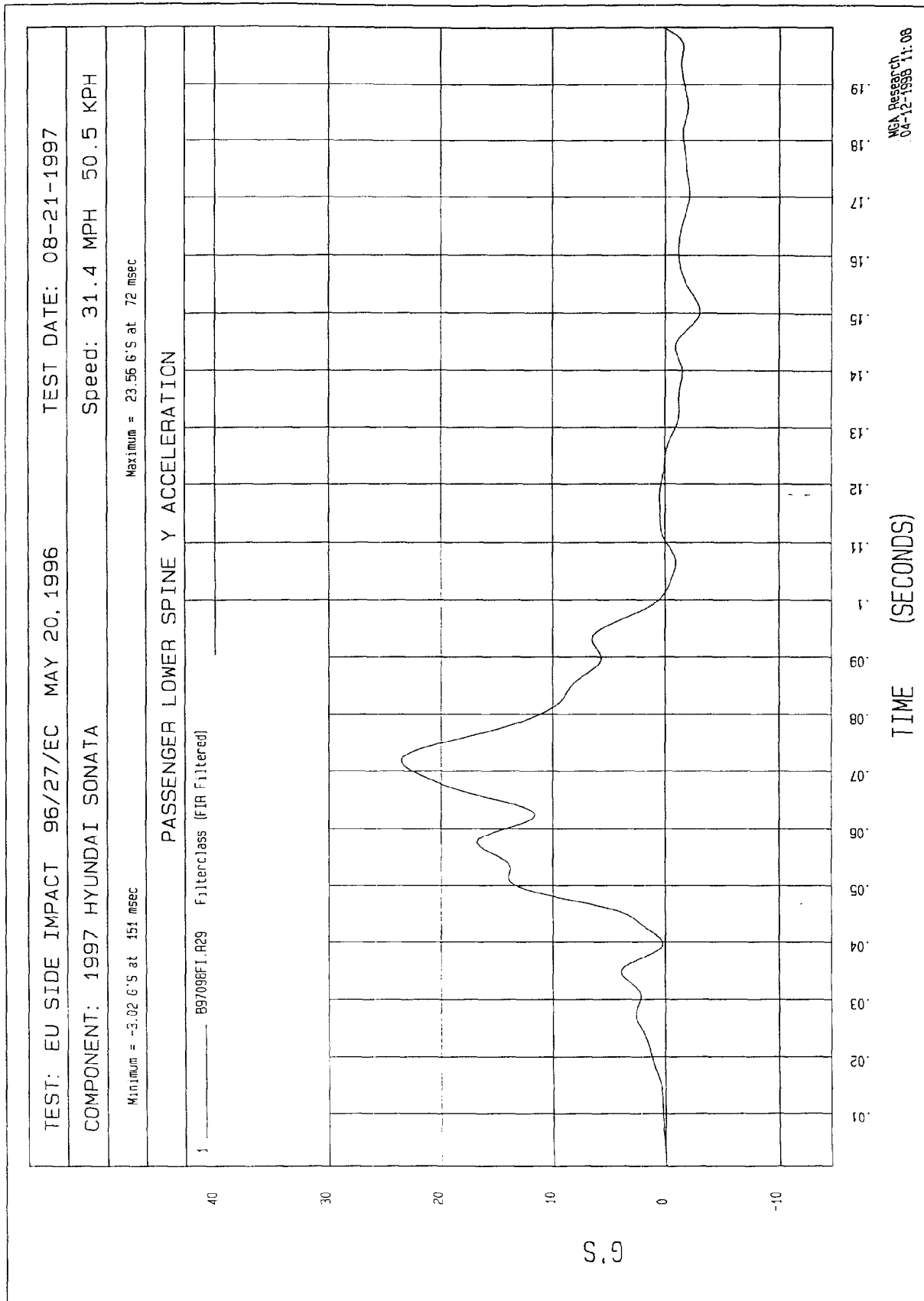


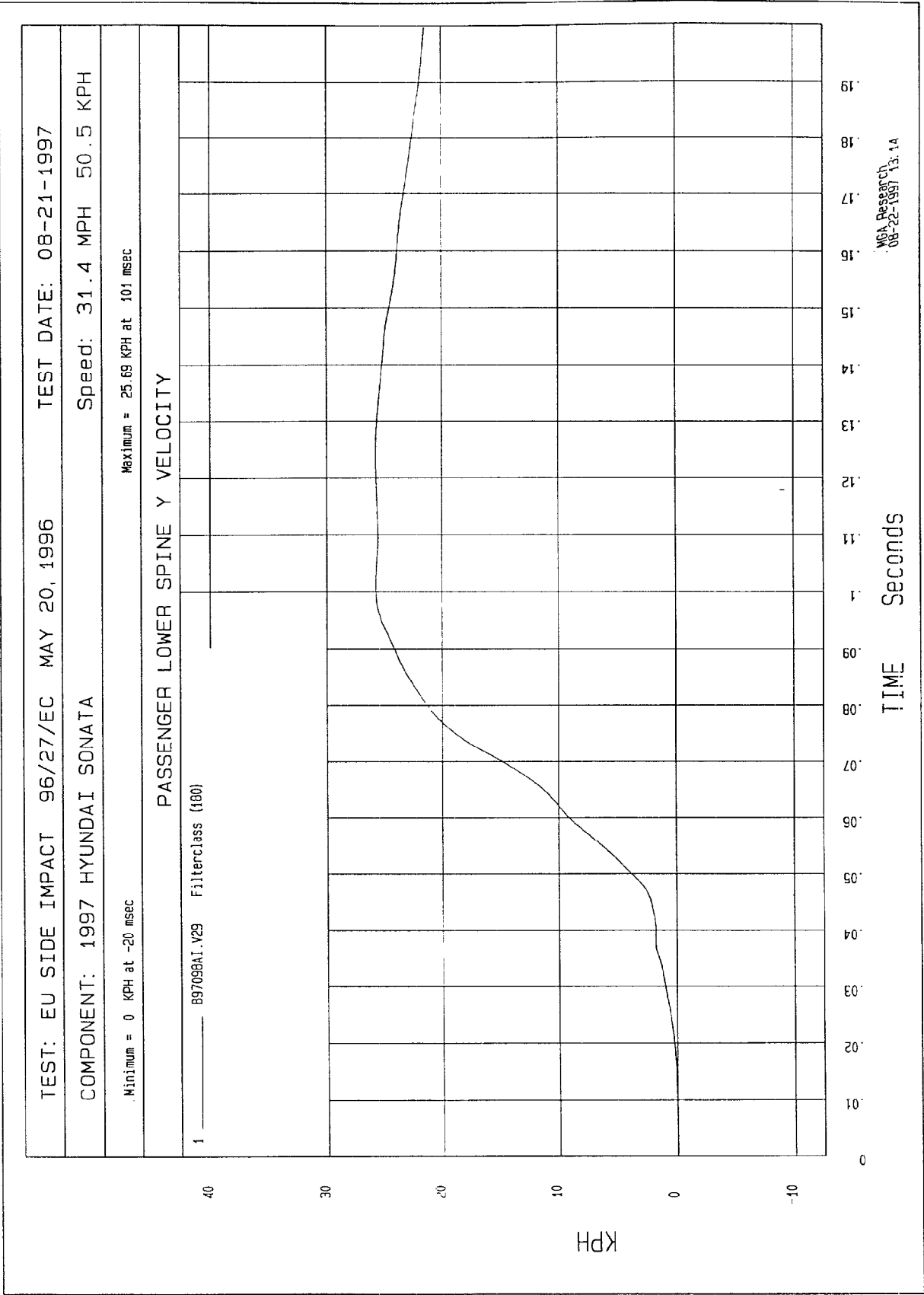
WCA Research
08-22-1997 10:32









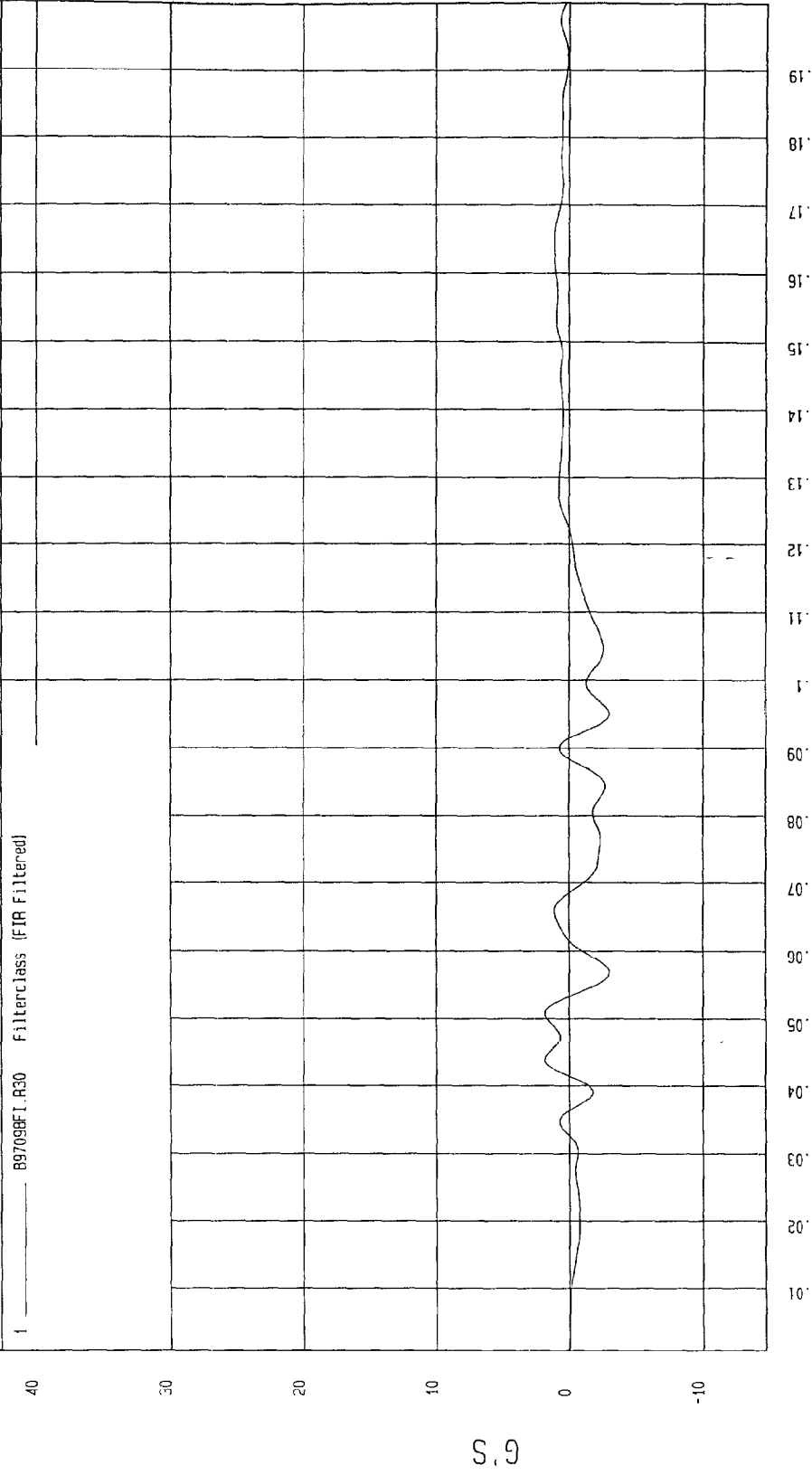


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

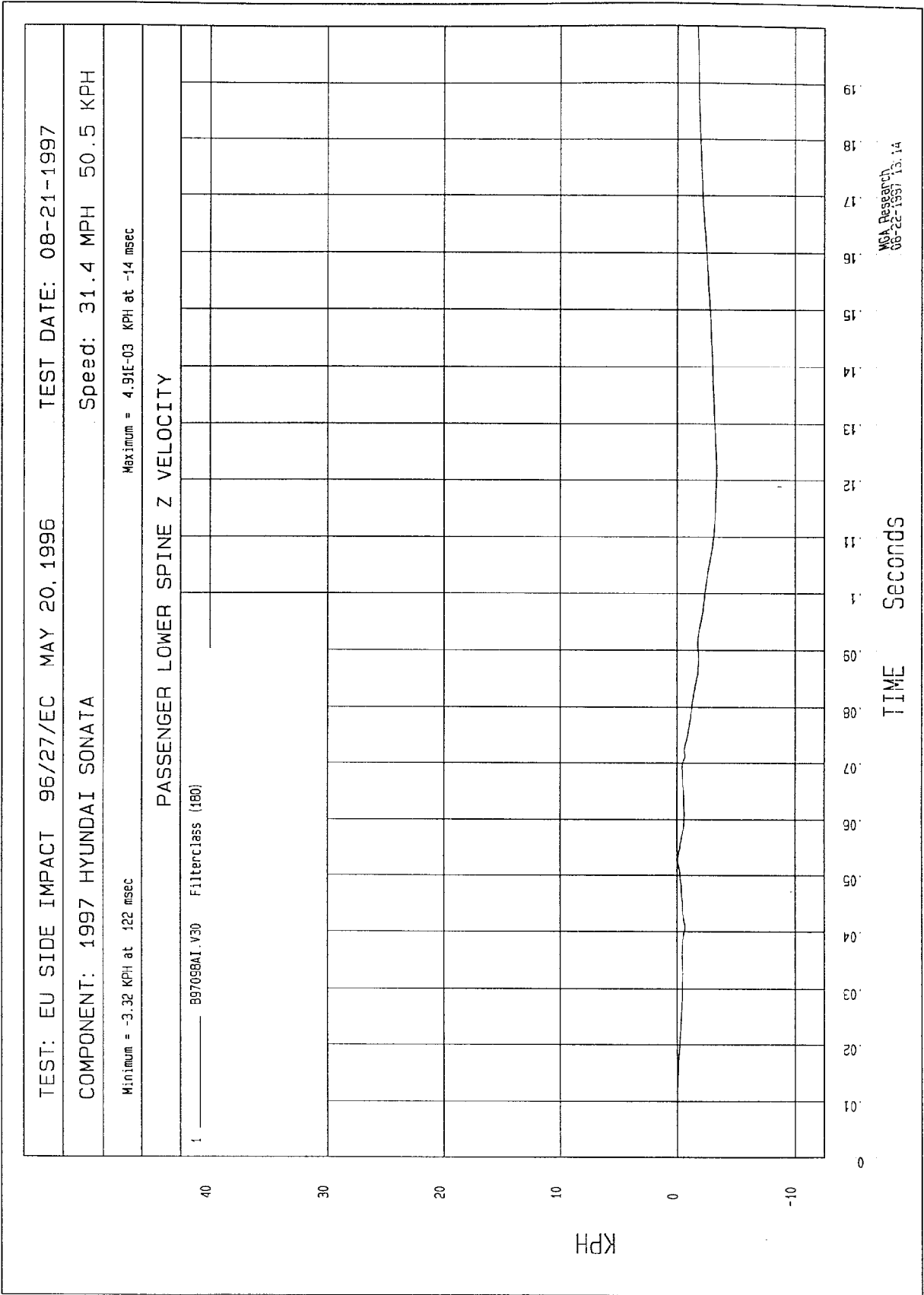
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

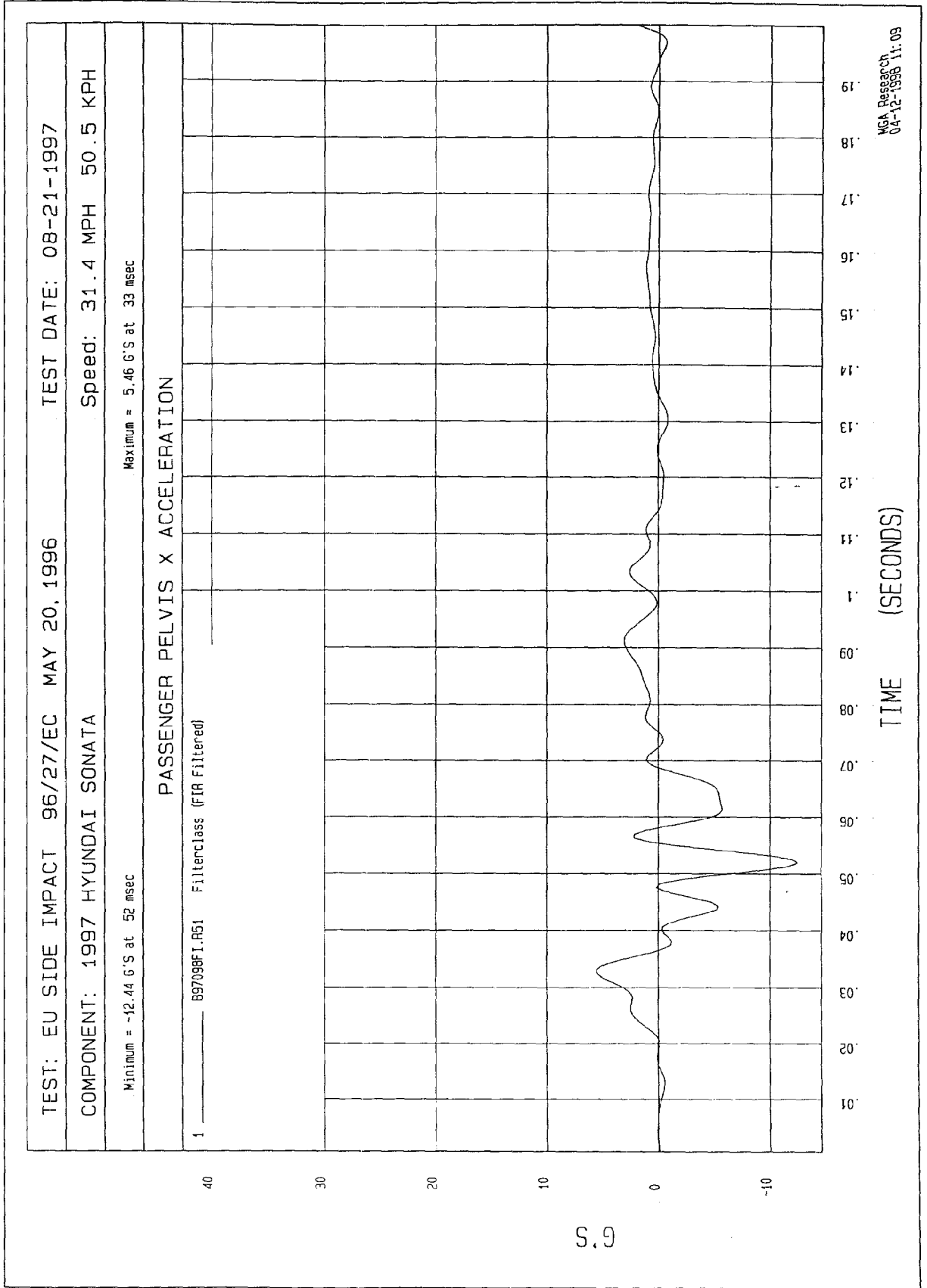
Minimum = -2.98 G's at 57 msec Maximum = 1.82 G's at 44 msec

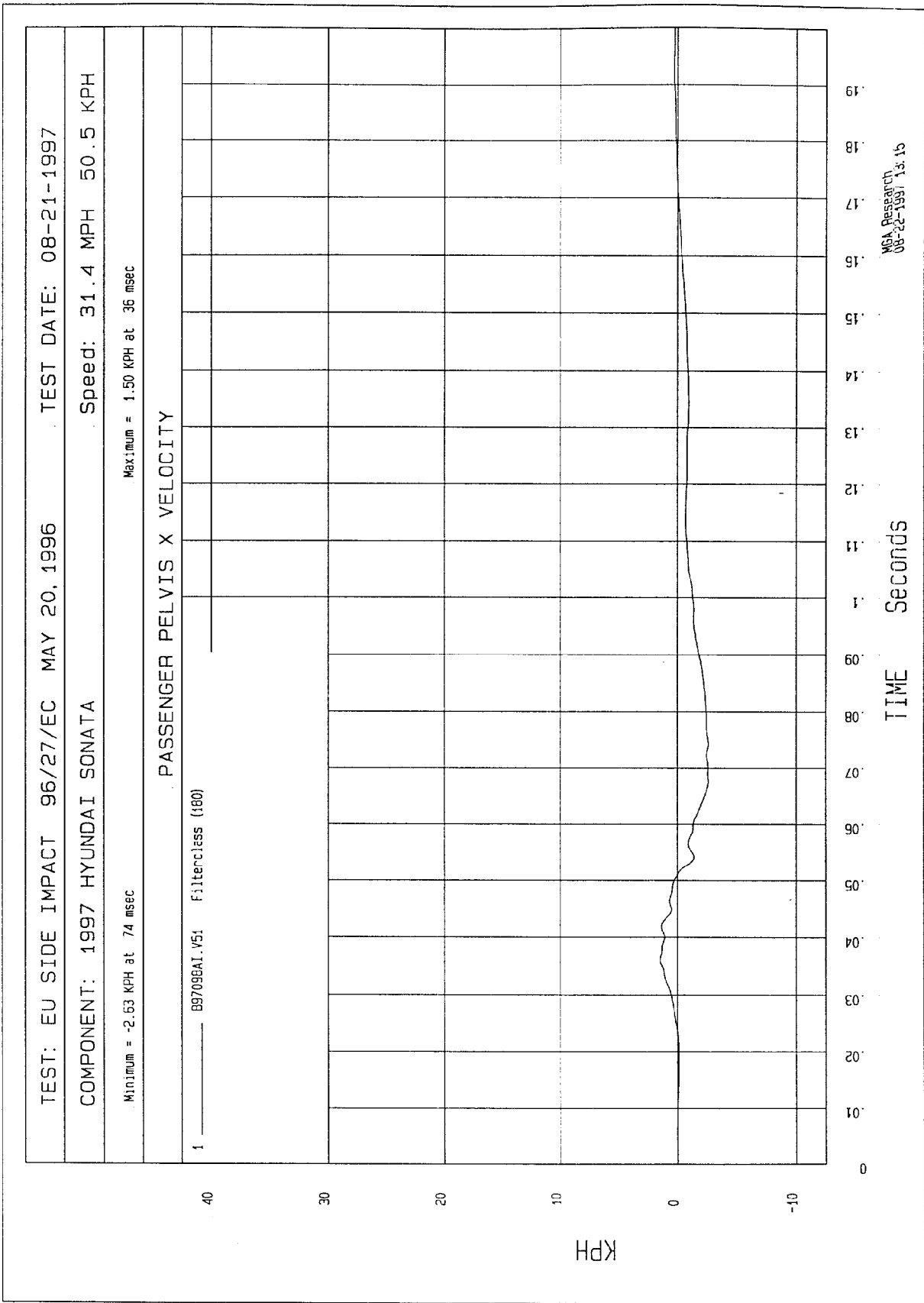
PASSENGER LOWER SPINE Z ACCELERATION

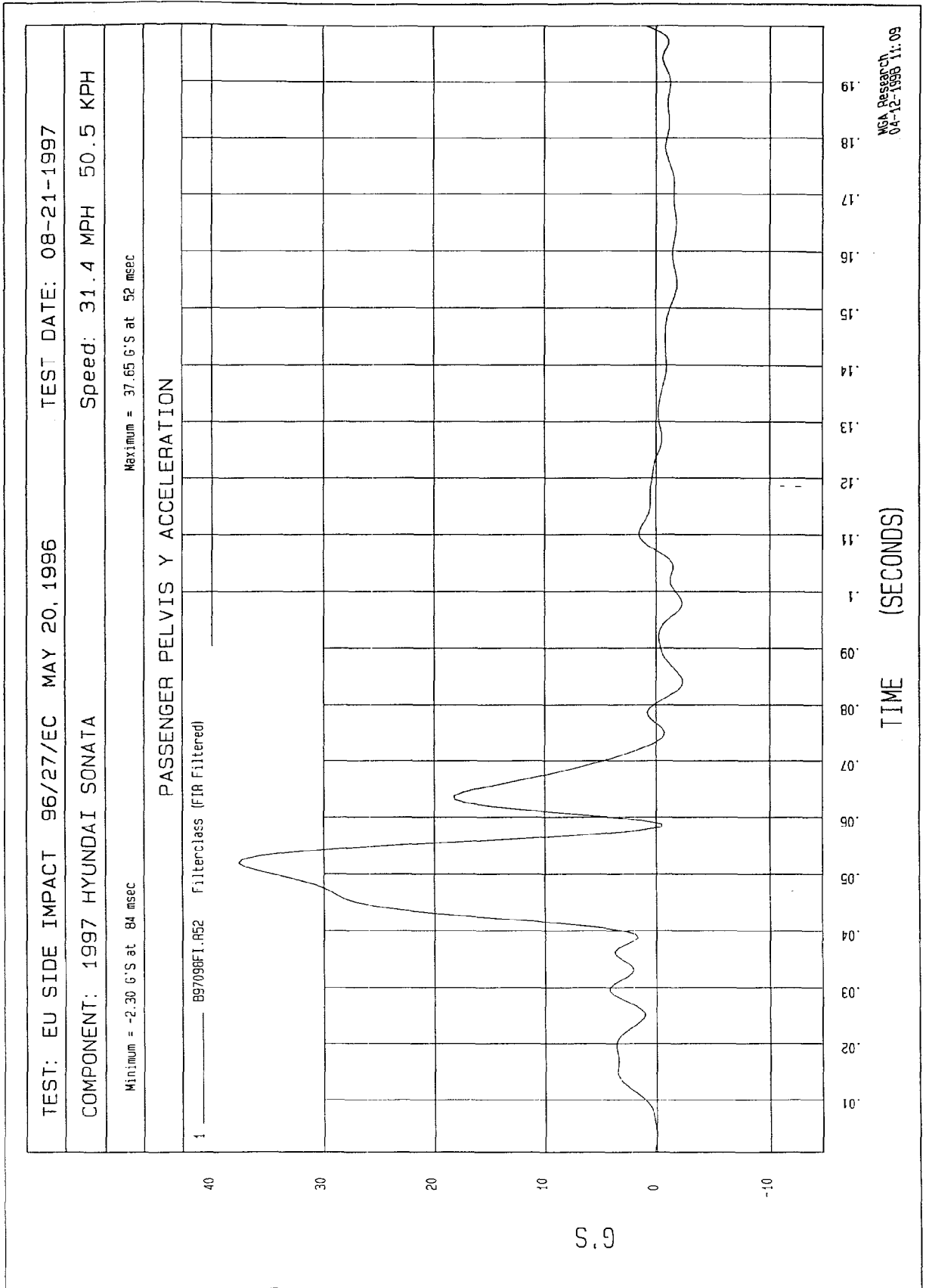


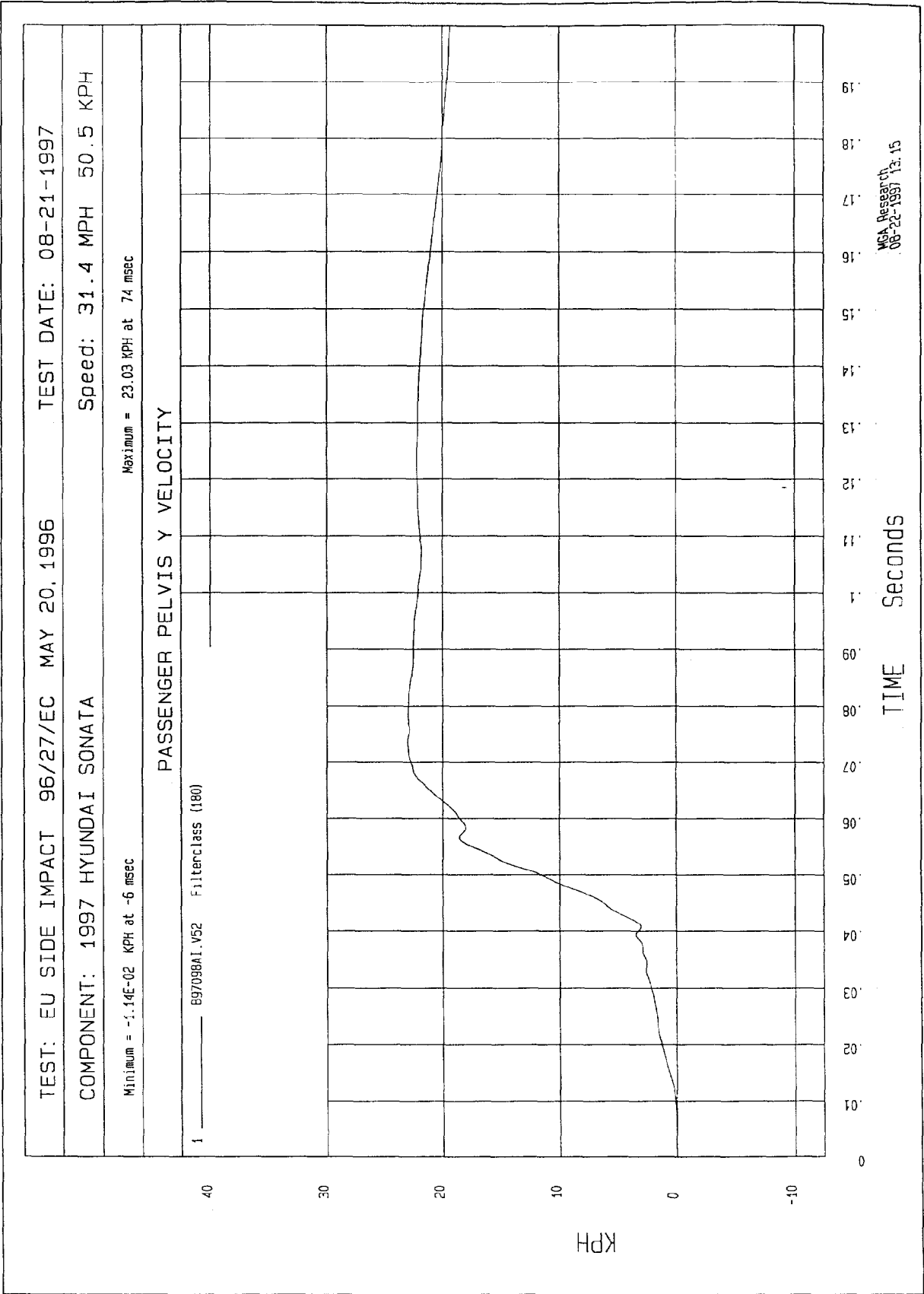
MGA Research
04-12-1998 11:09

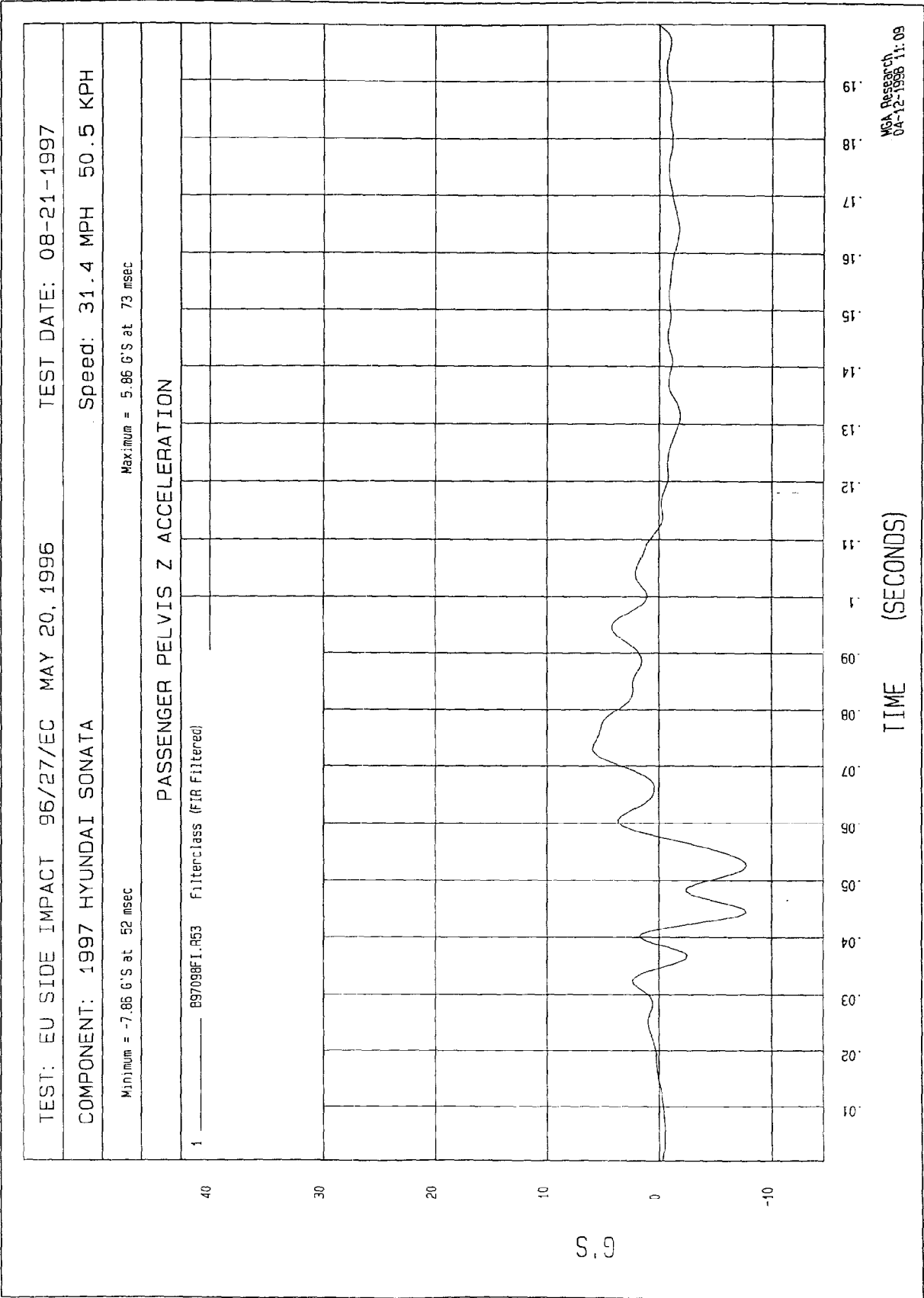


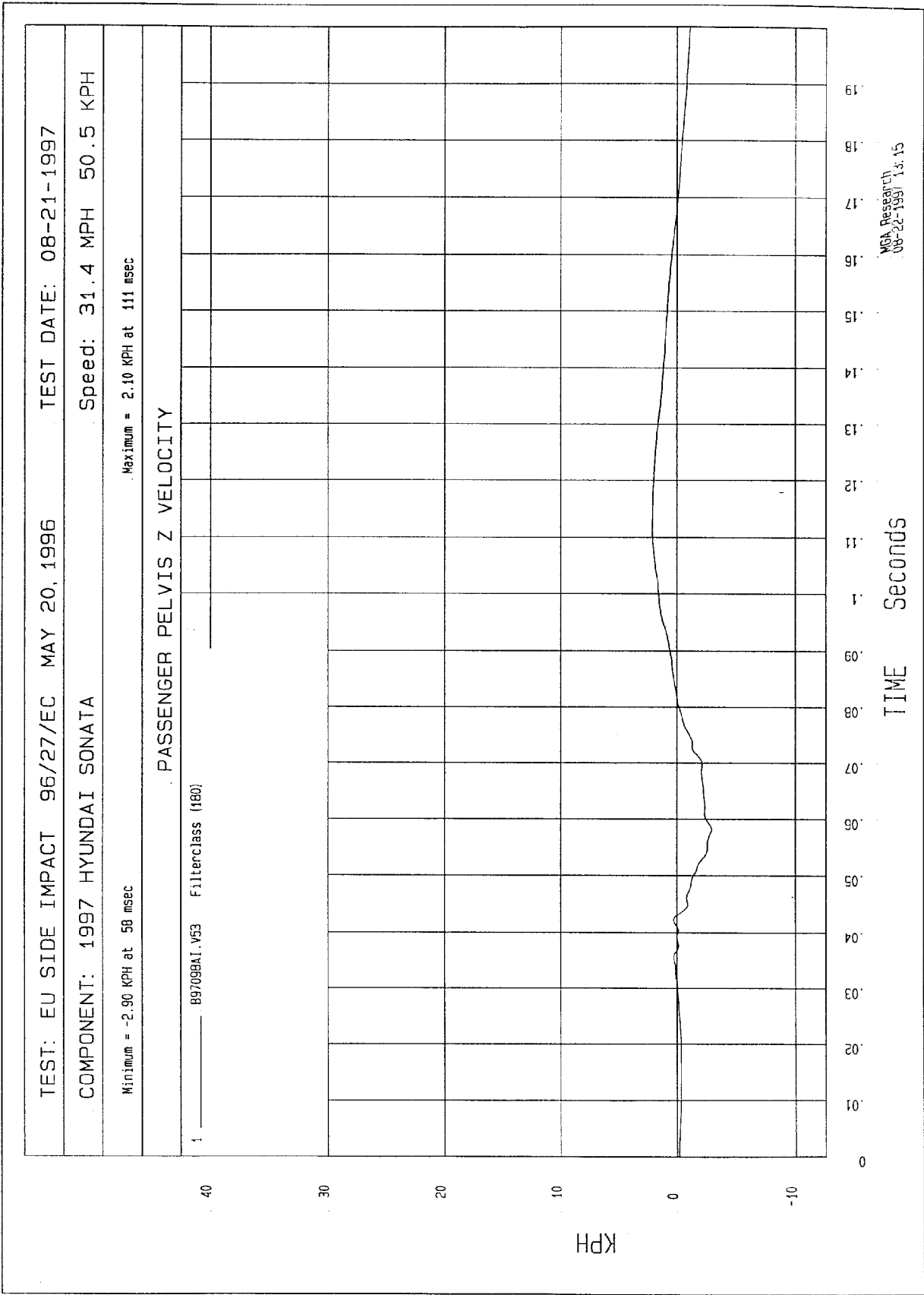












TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

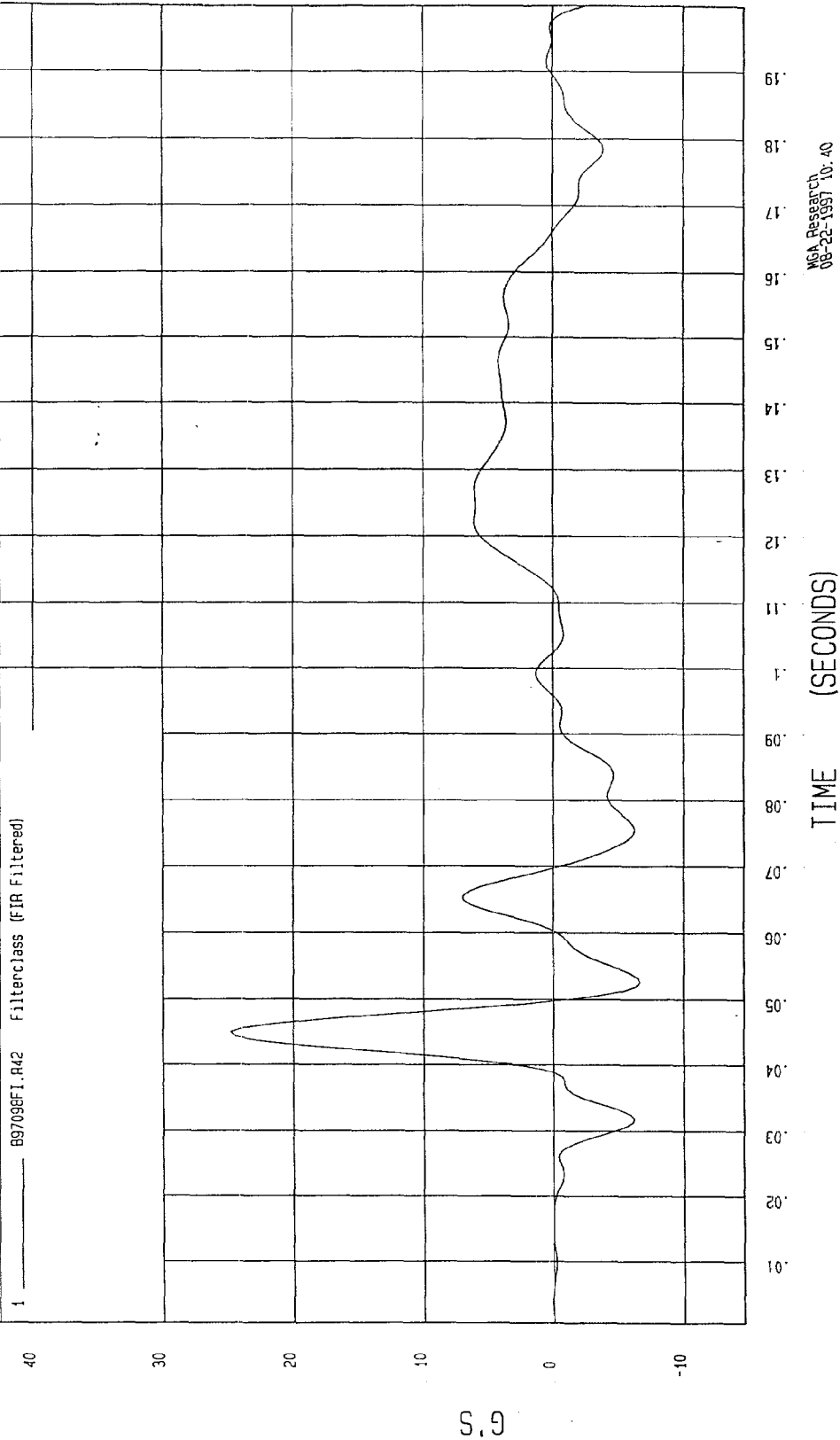
SPEED: 31.4 MPH 50.5 KPH

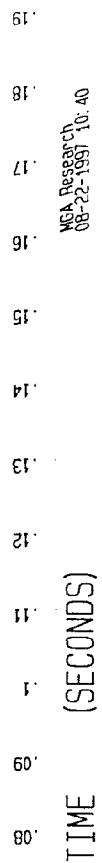
COMPONENT: 1997 HYUNDAI SONATA

Maximum = 24.85 G'S at 45 msec

Minimum = -6.61 G'S at 52 msec

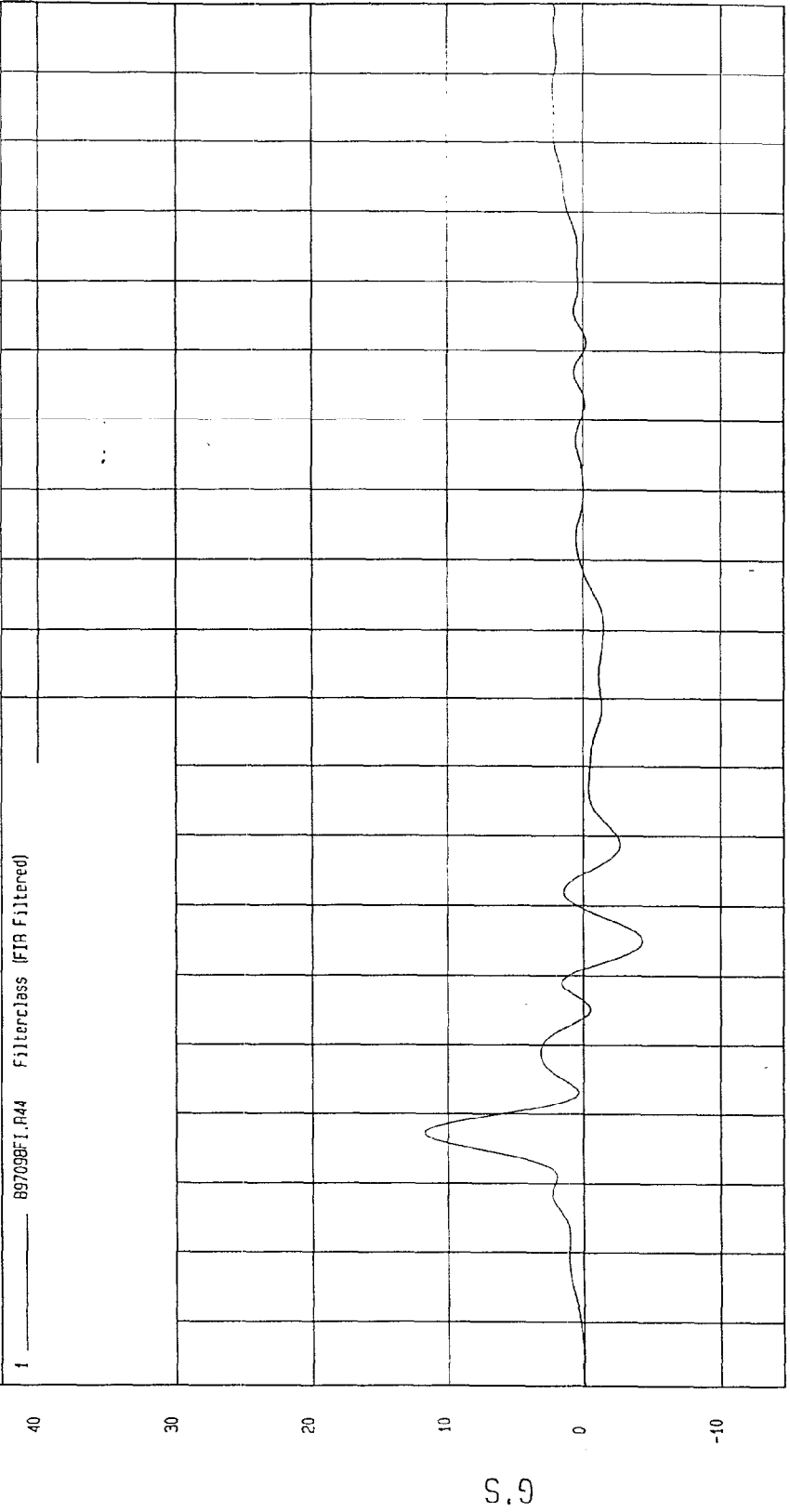
DRIVER UPPER SPINE X ACCELERATION





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996	TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA	Speed: 31.4 MPH 50.5 KPH
Minimum = -4.29 G'S at 65 msec	Maximum = 11.74 G'S at 38 msec

DRIVER UPPER SPINE Z ACCELERATION



MSA Research
08-22-1997 10:40

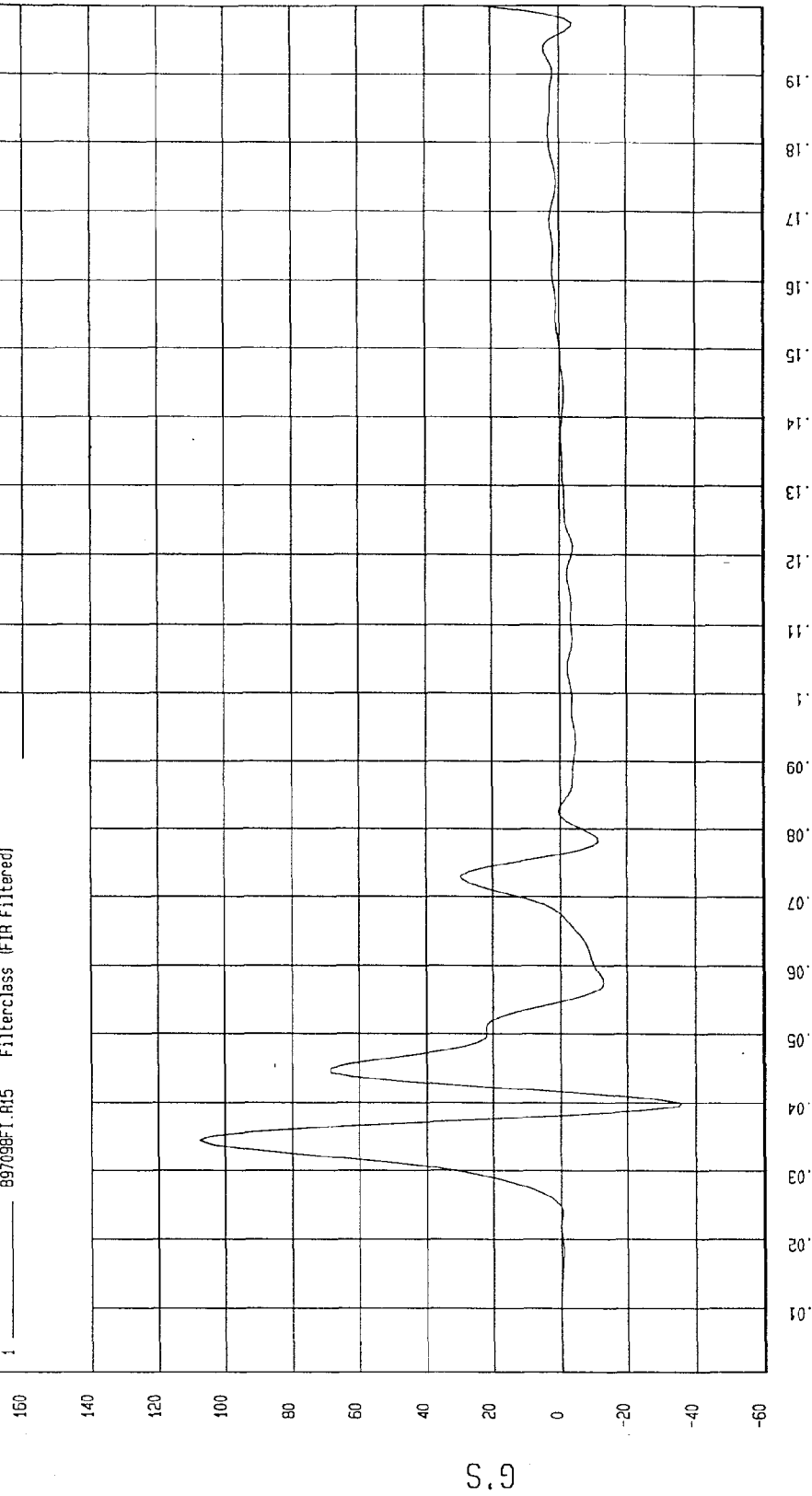
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -35.72 G'S at 40 msec

Maximum = 107.46 G'S at 34 msec

DRIVER UPPER RIB Y ACCELERATION

1 ——— B97098F1.R15 Filterclass (FIR Filtered)



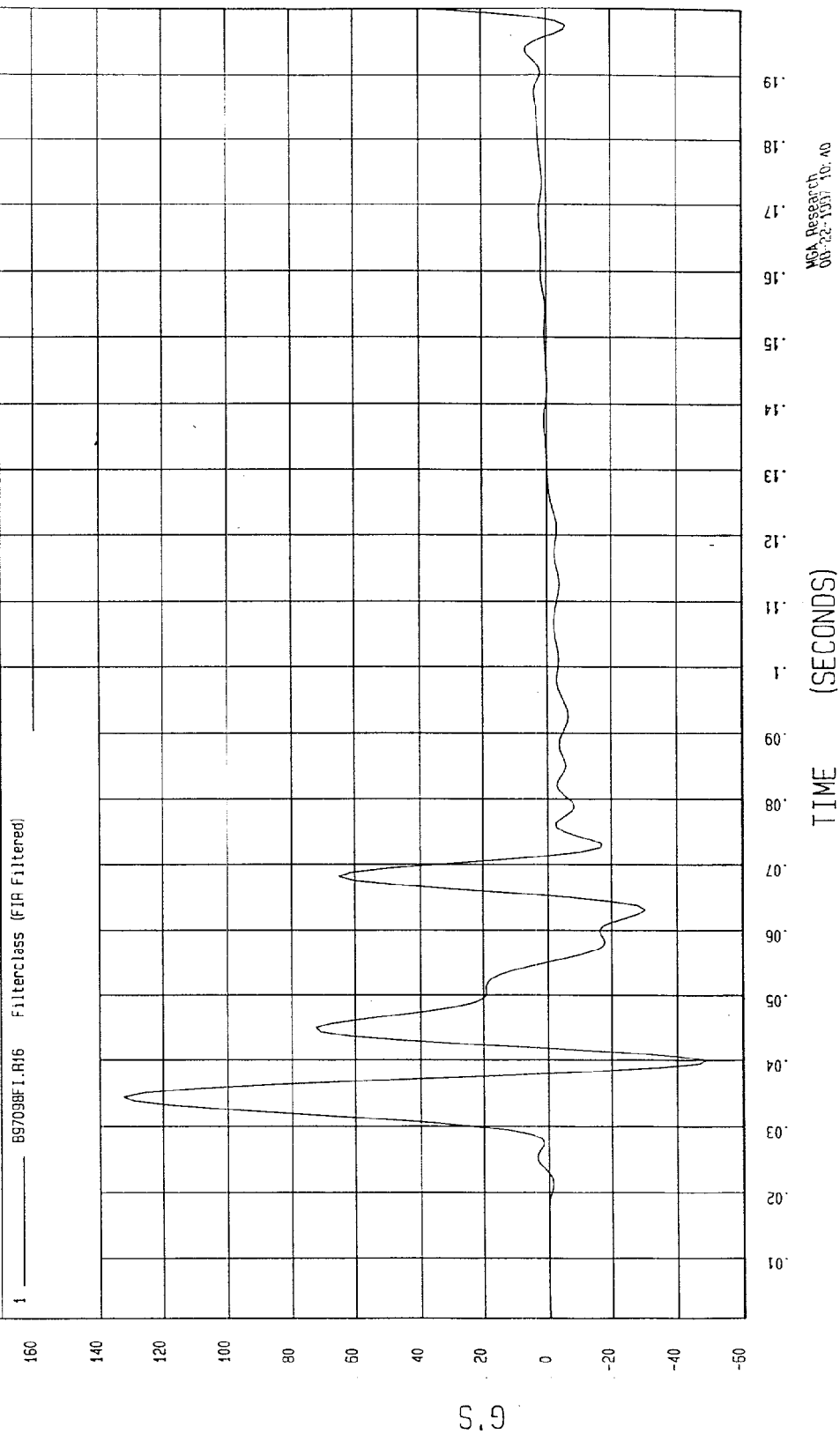
MGA Research
08-22-1997 10:40

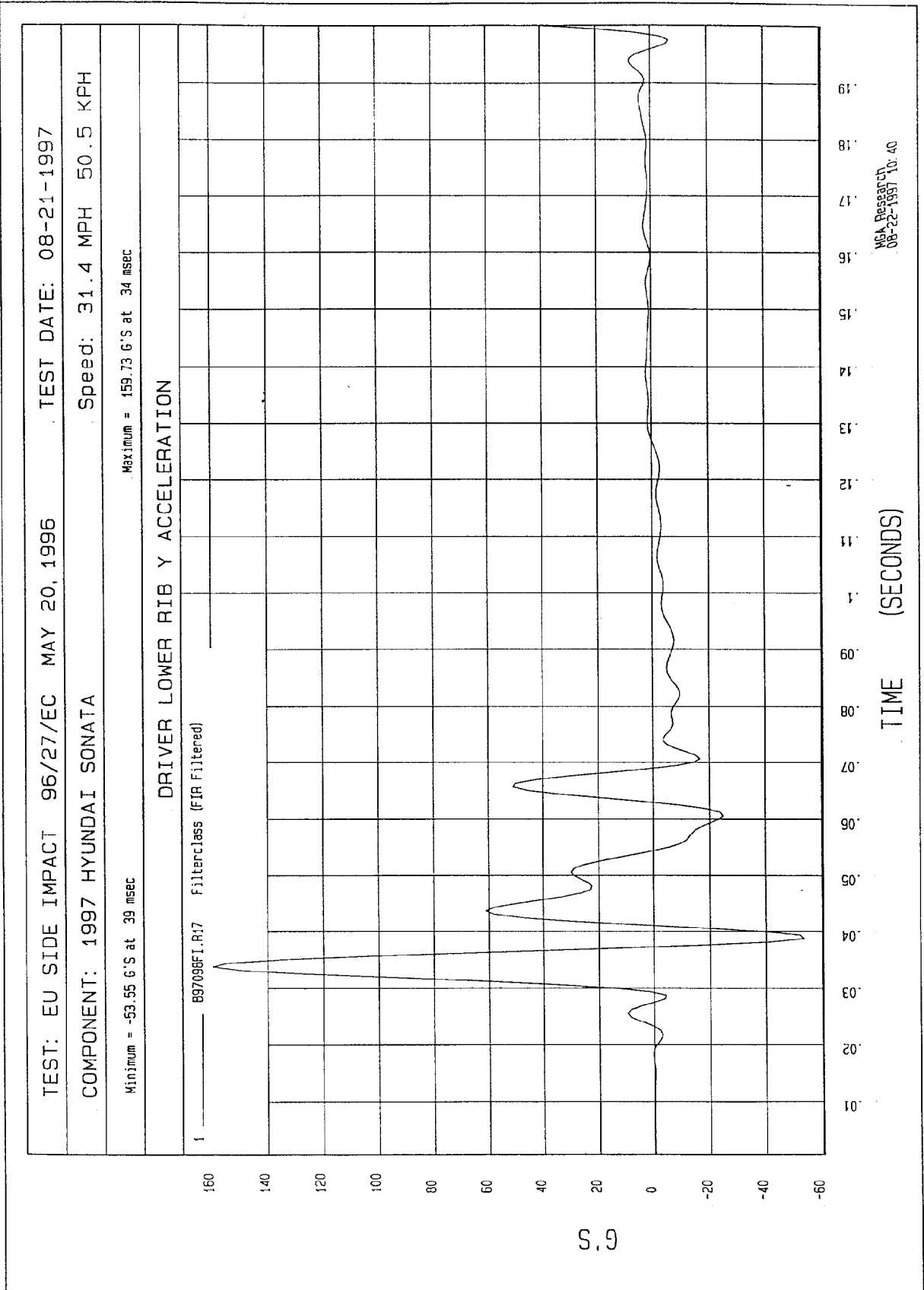
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -49.05 G'S at 40 msec Maximum = 132.62 G'S at 34 msec

DRIVER MID RIB Y ACCELERATION



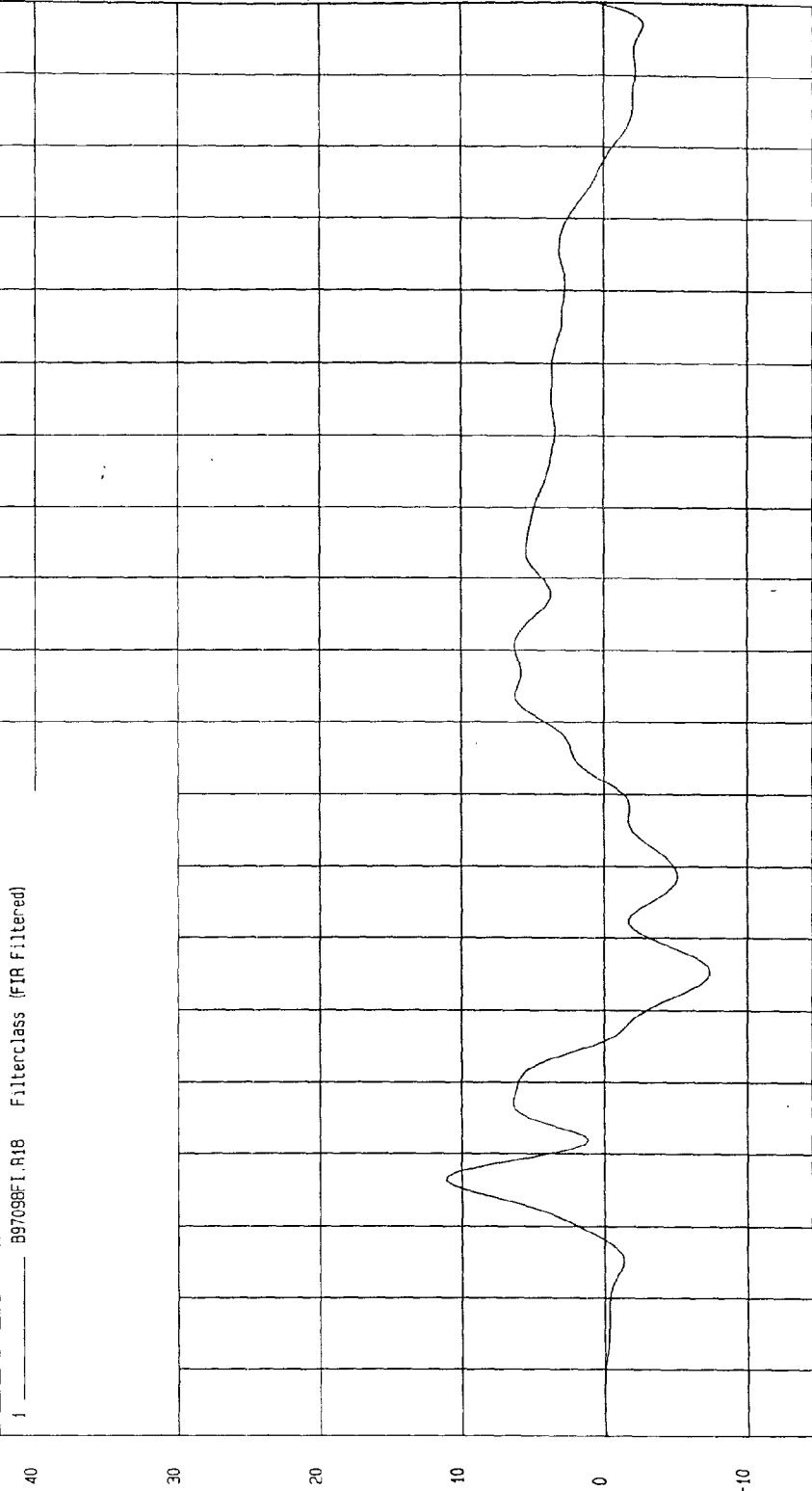


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

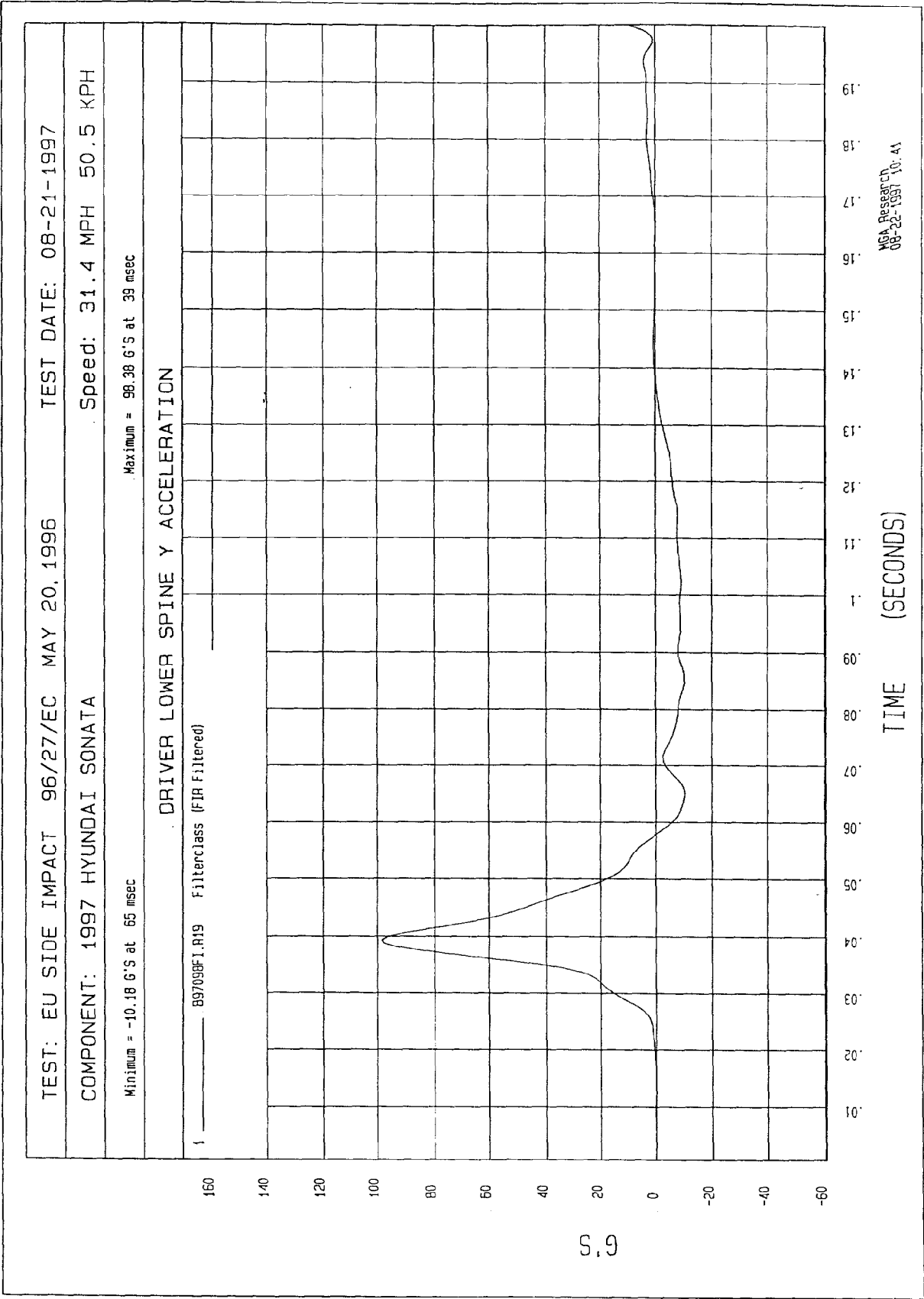
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -7.48 G'S at 56 msec Maximum = 11.09 G'S at 36 msec

DRIVER LOWER SPINE X ACCELERATION



MSA Research
08-22-1997 10:41



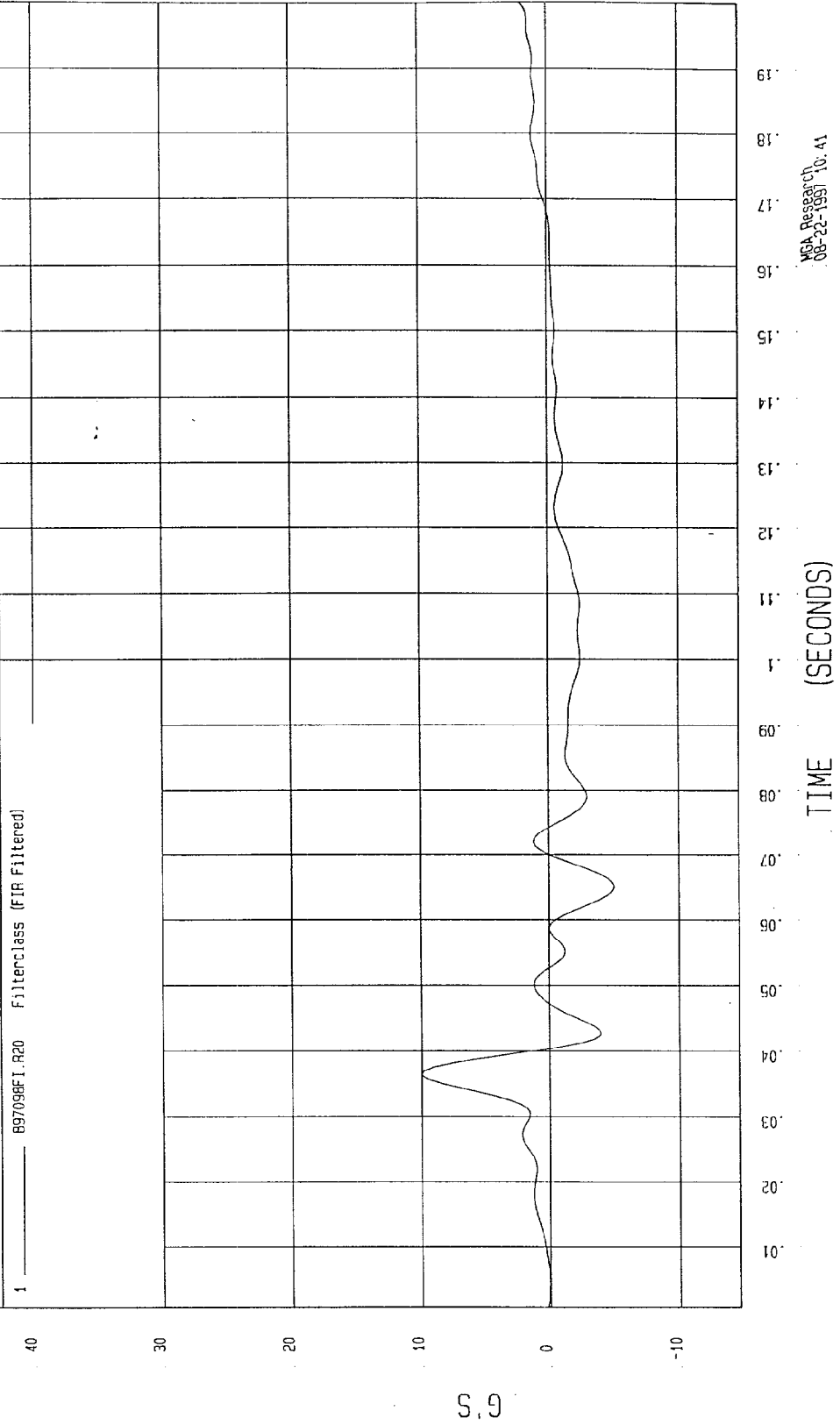
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -5.03 G'S at 65 msec

Maximum = 9.98 G'S at 36 msec

DRIVER LOWER SPINE Z ACCELERATION

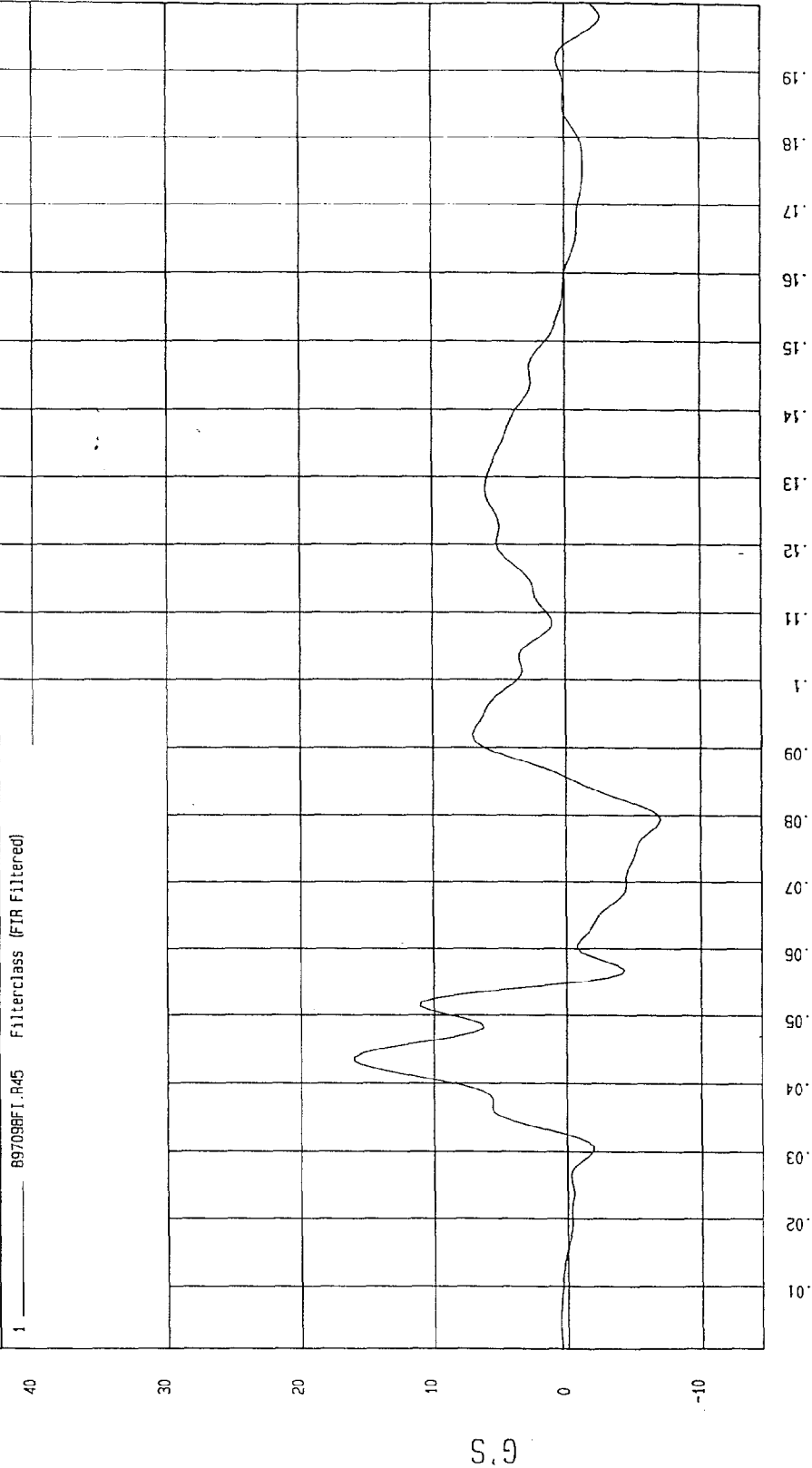


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -7.11 G'S at 79 msec Maximum = 16.06 G'S at 44 msec

DRIVER PELVIS X ACCELERATION



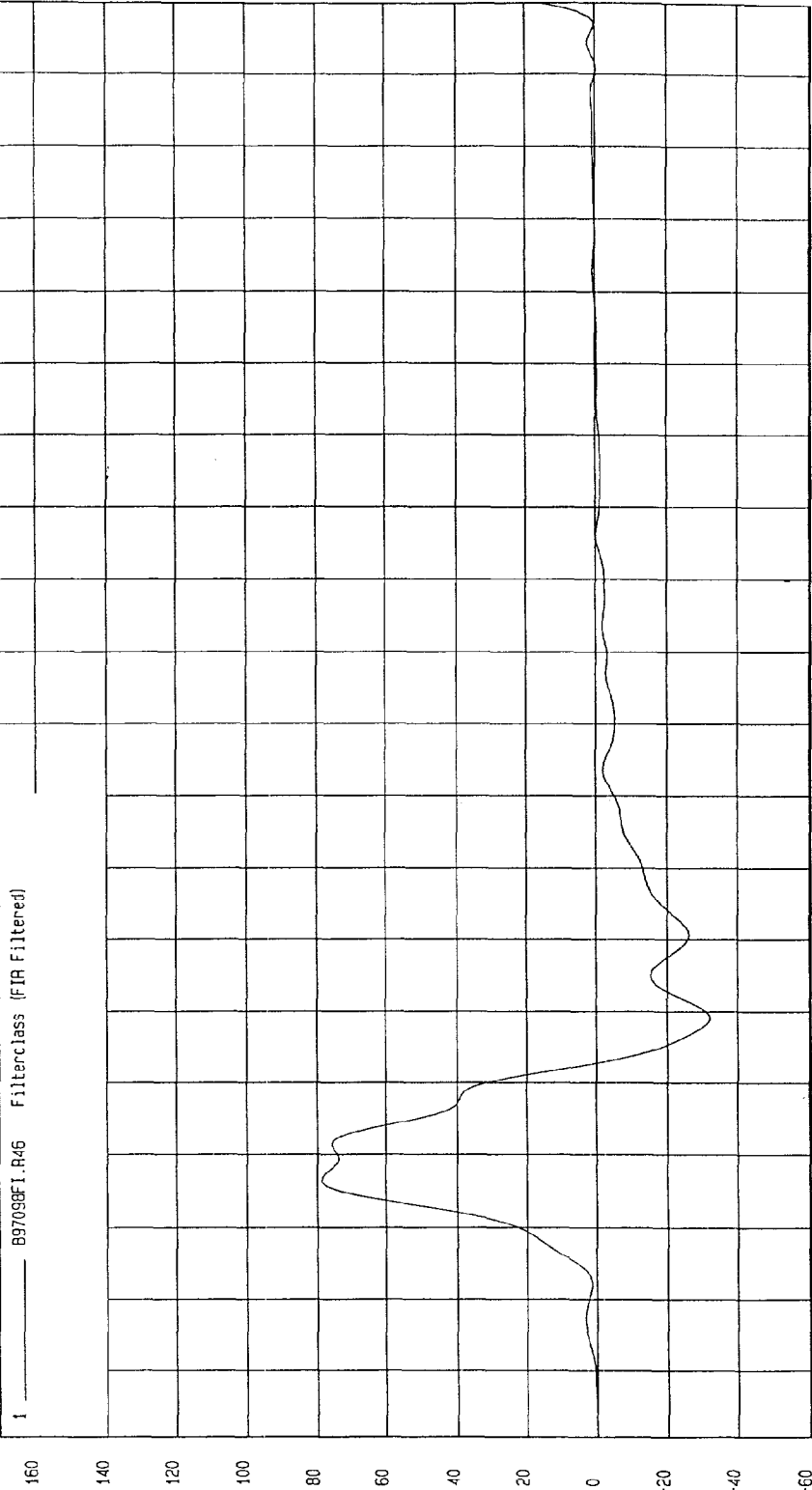
MCA Research
08-22-1997 10:41

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -32.09 G'S at 59 msec Maximum = 78.79 G'S at 35 msec

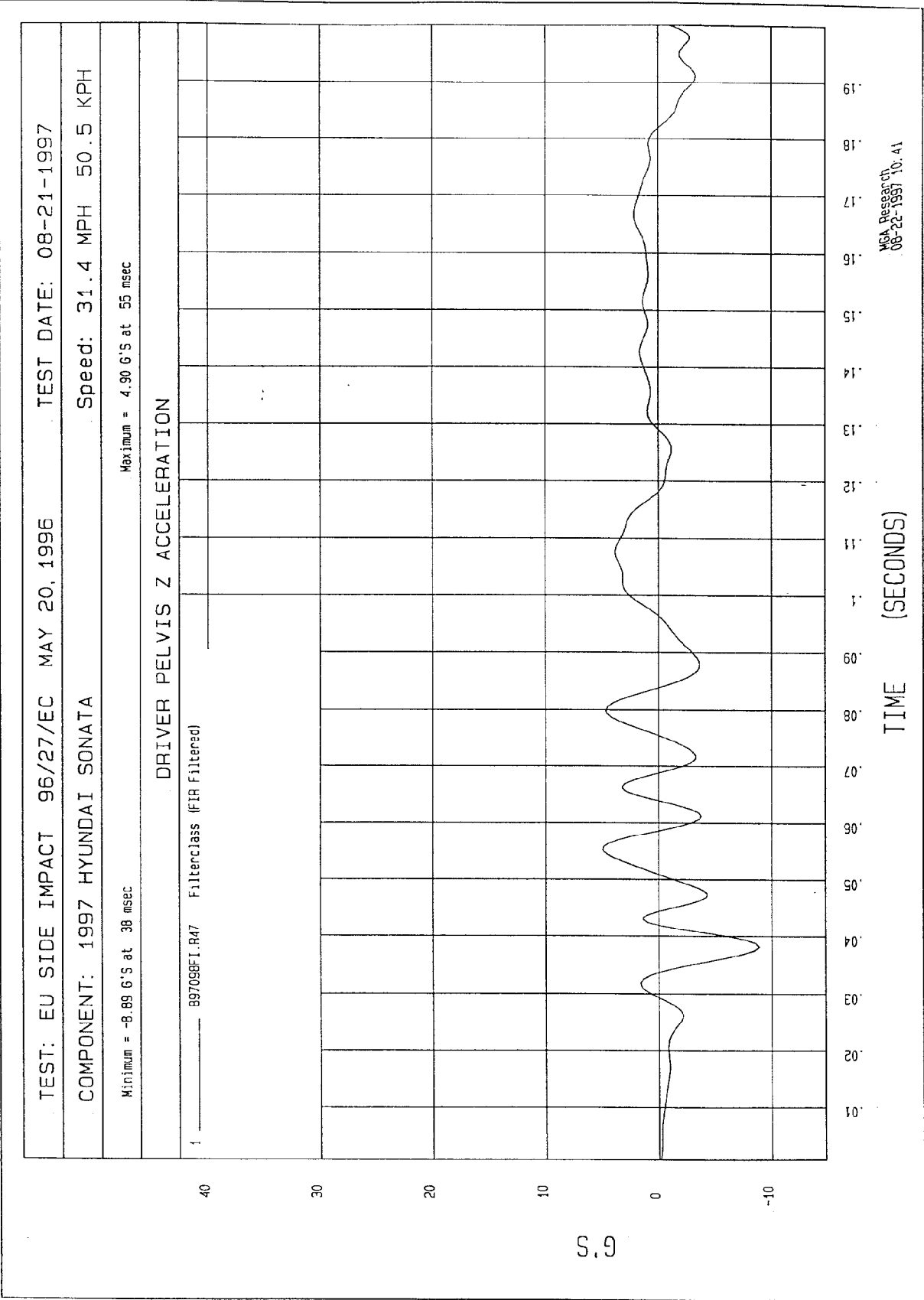
DRIVER PELVIS Y ACCELERATION

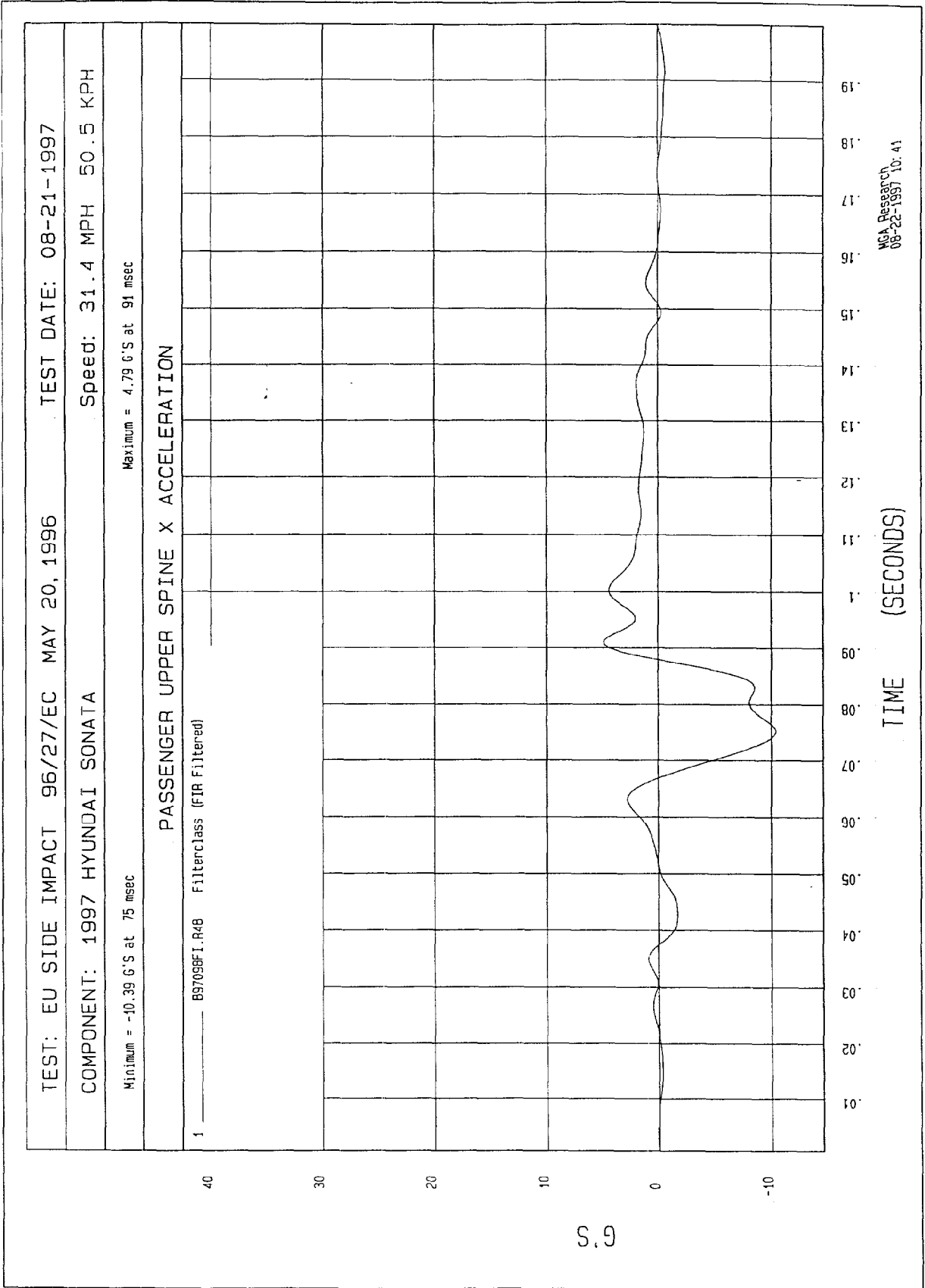


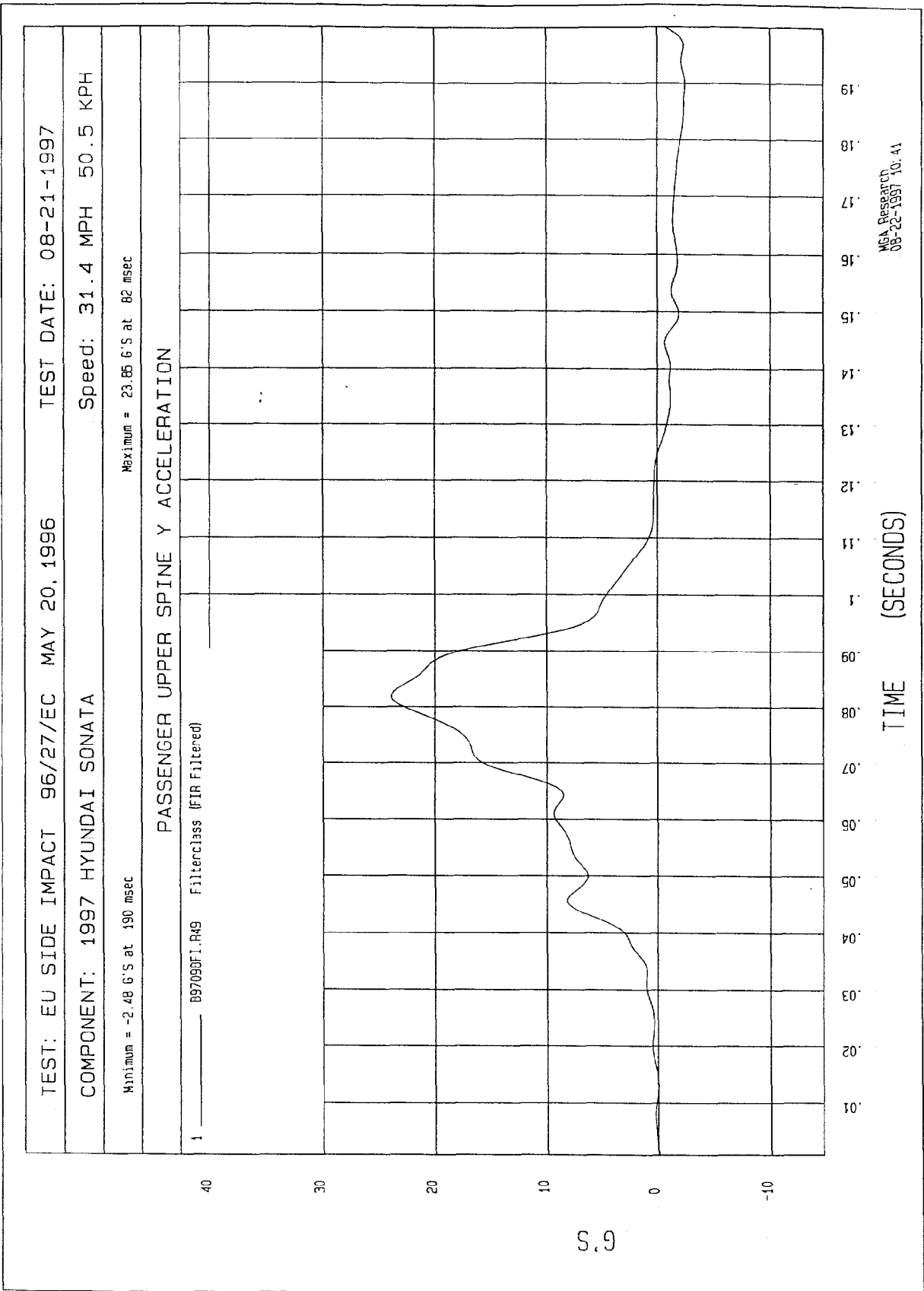
MSA Research
08-22-1997 10:41

TIME (SECONDS)

G





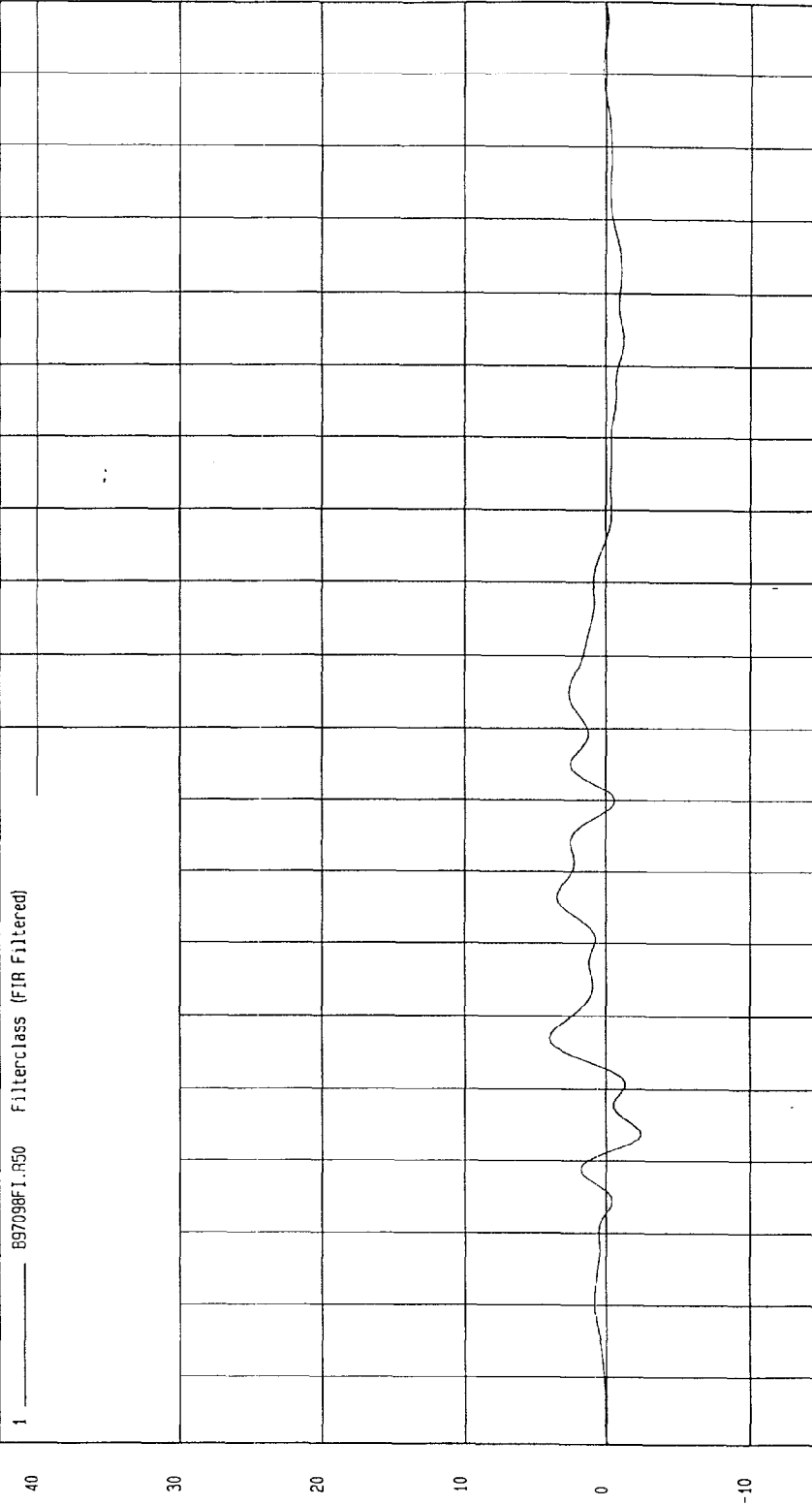


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

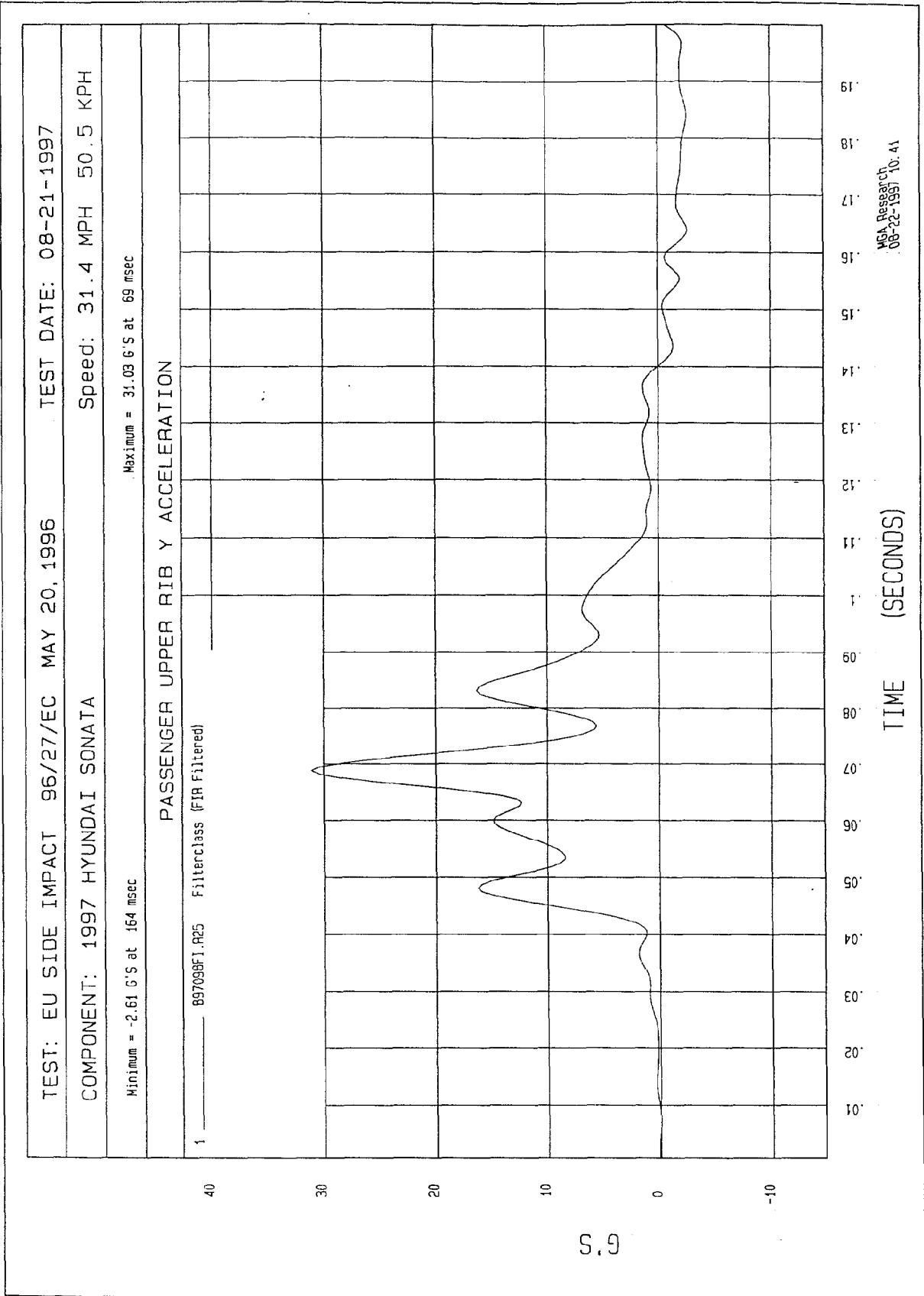
Minimum = -2.39 G'S at 44 msec Maximum = 4.06 G'S at 57 msec

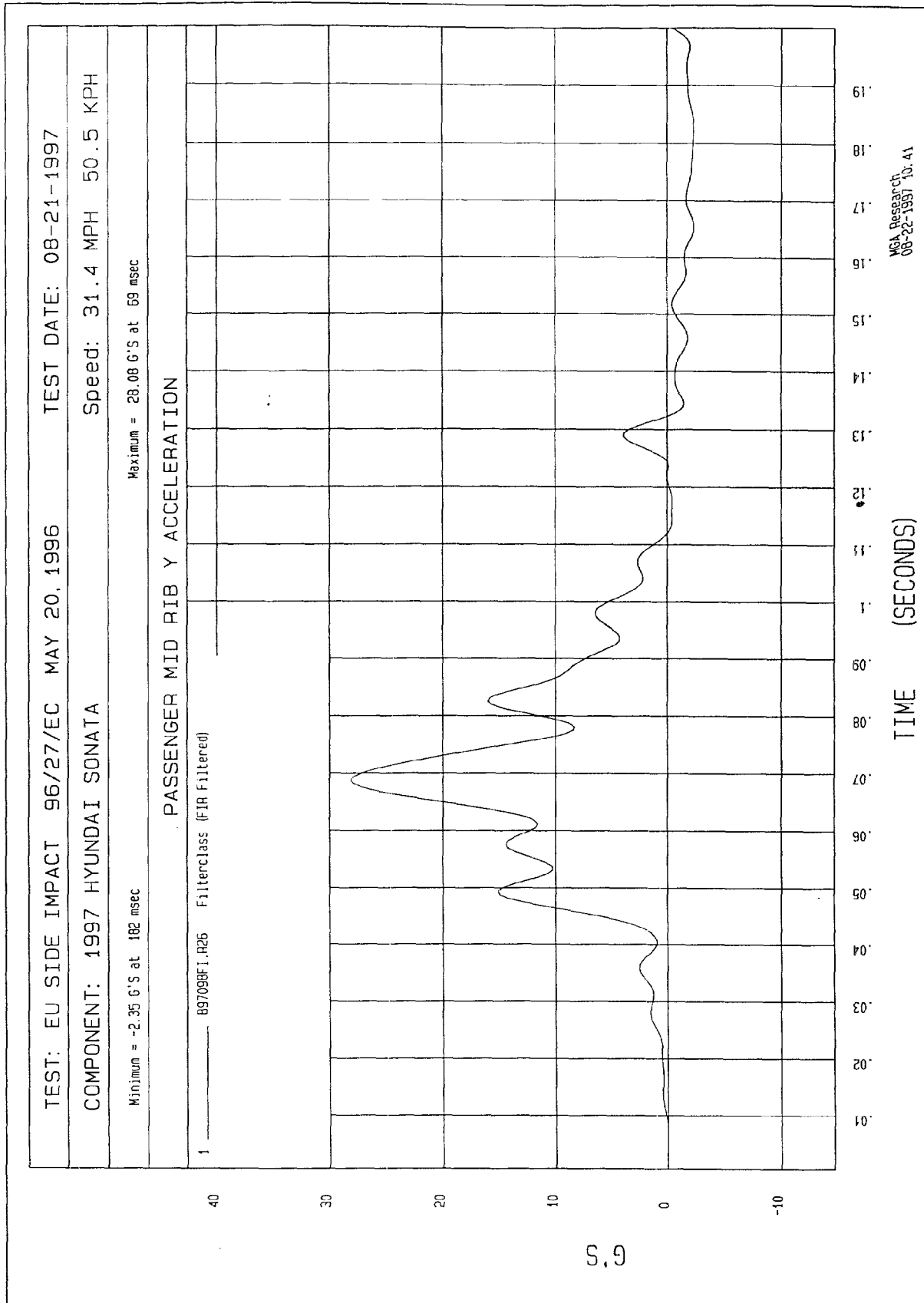
PASSENGER UPPER SPINE Z ACCELERATION

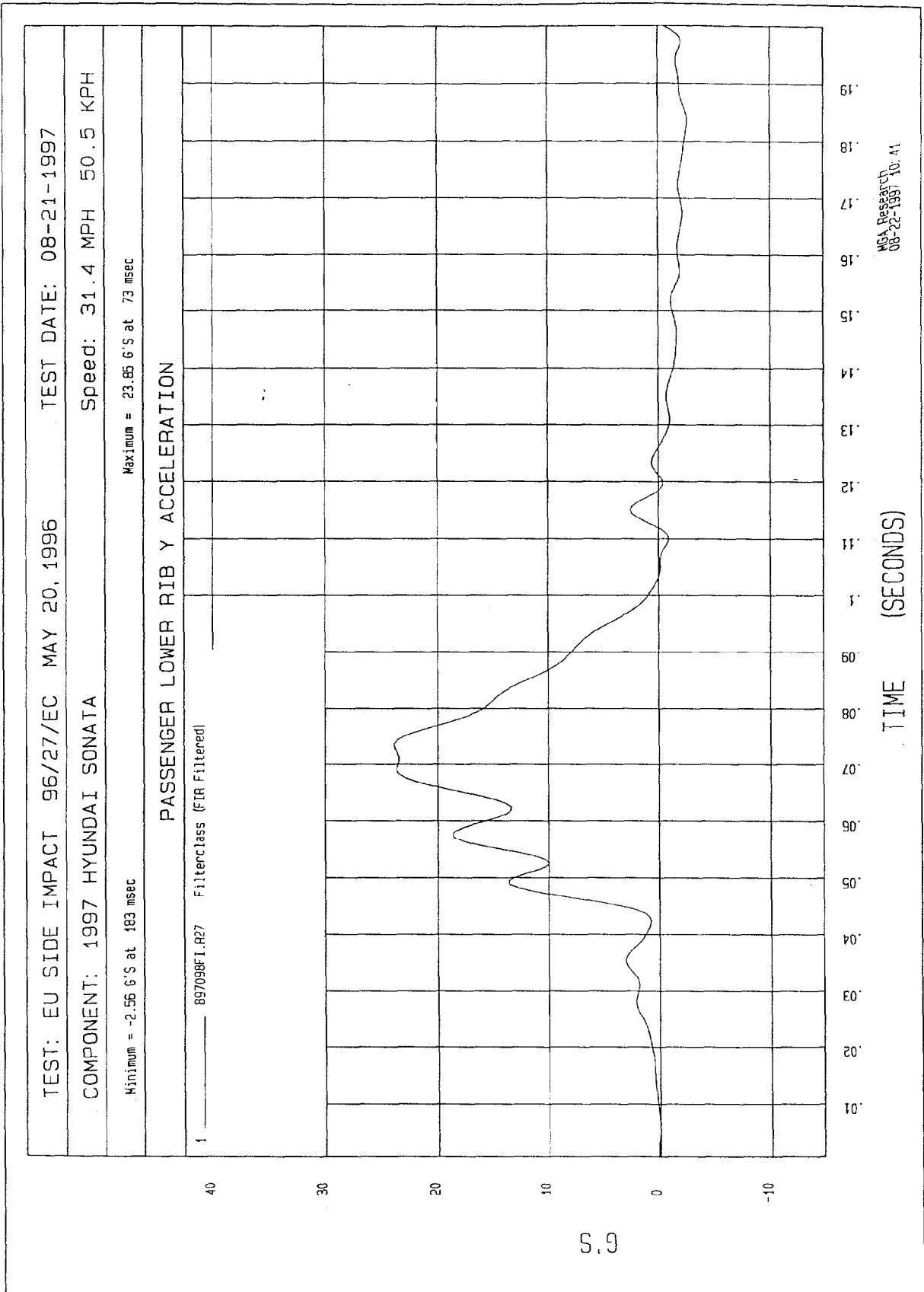


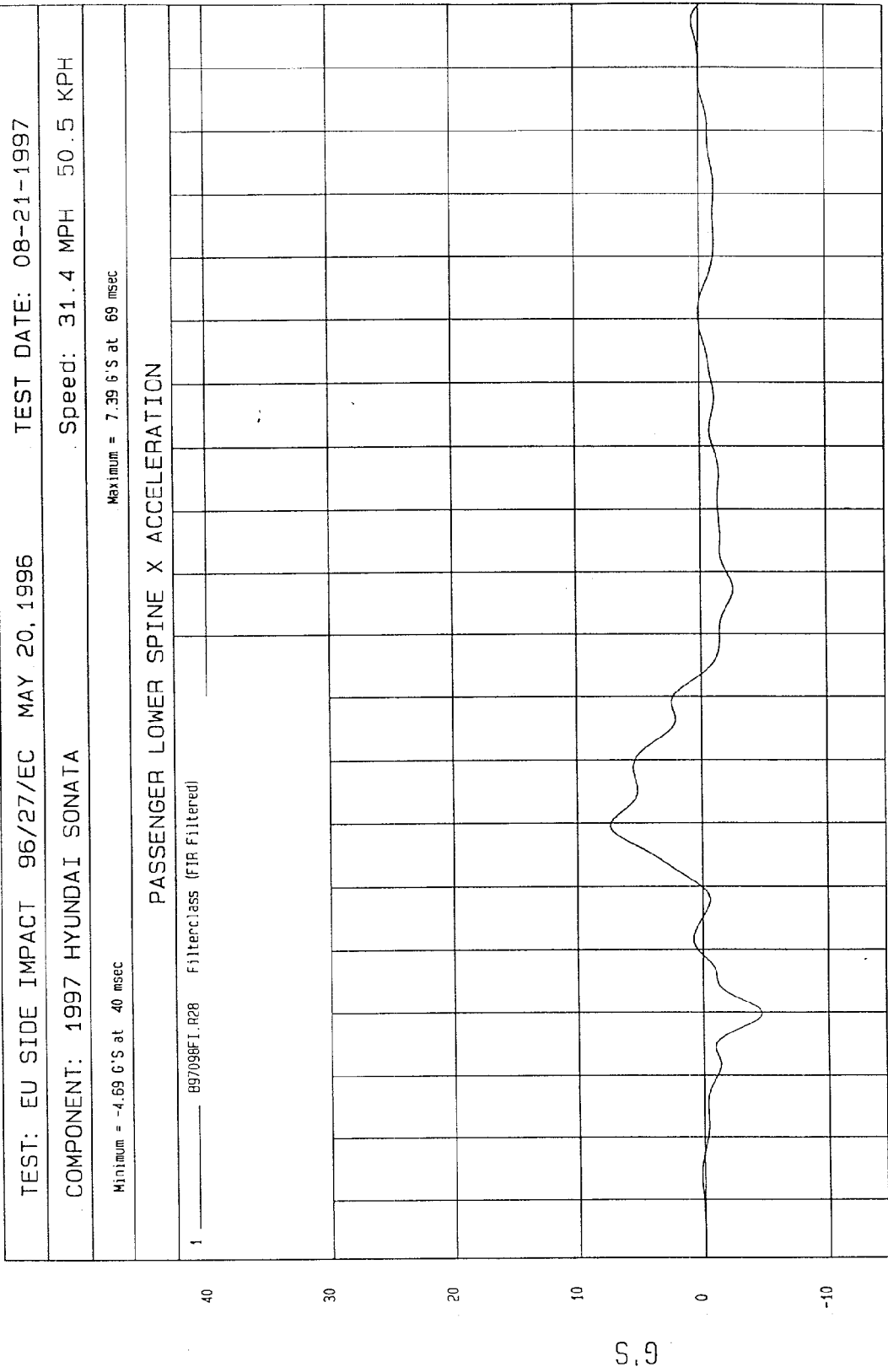
TIME (SECONDS)

MGA Research
08-22-1997 10:41

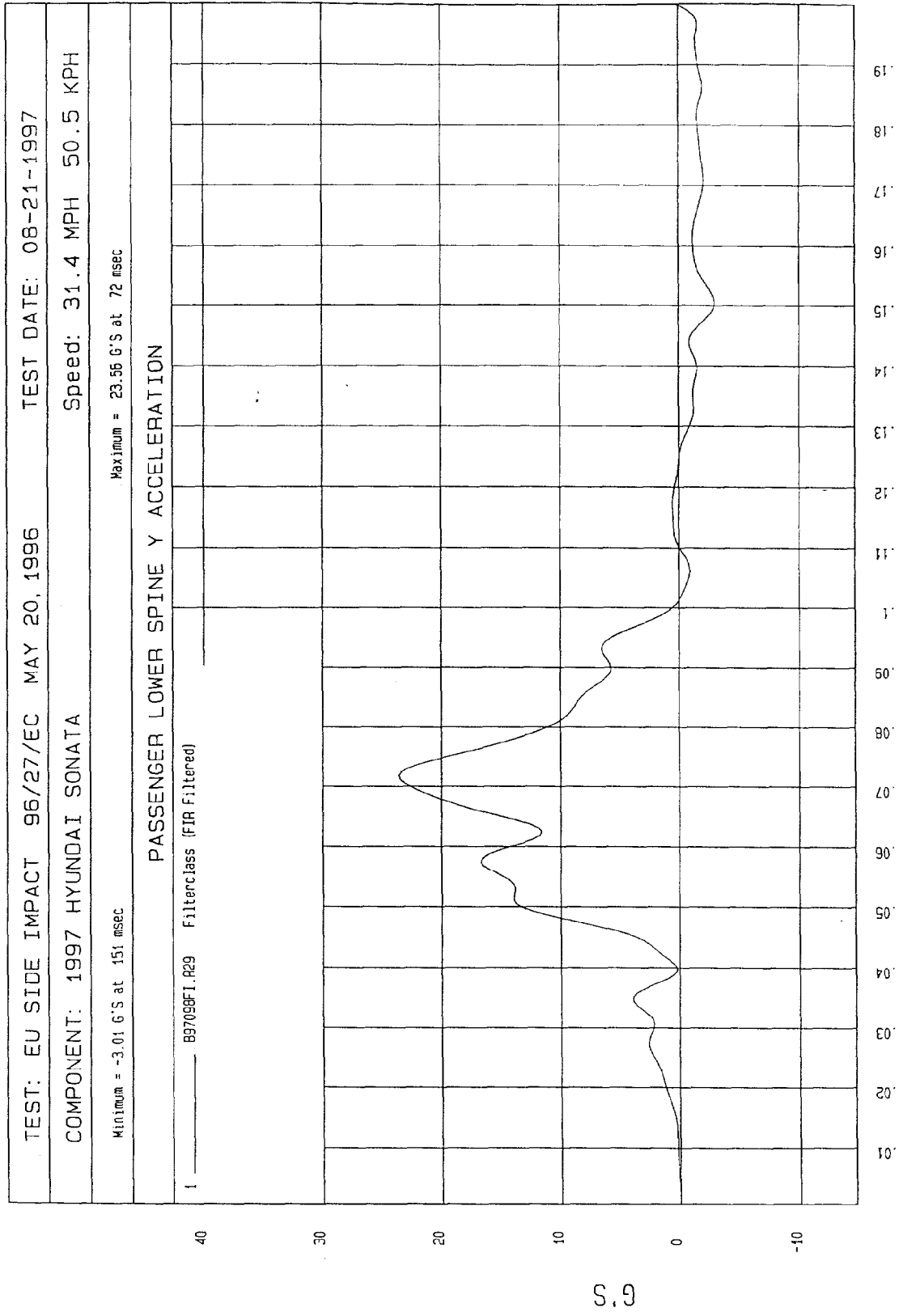




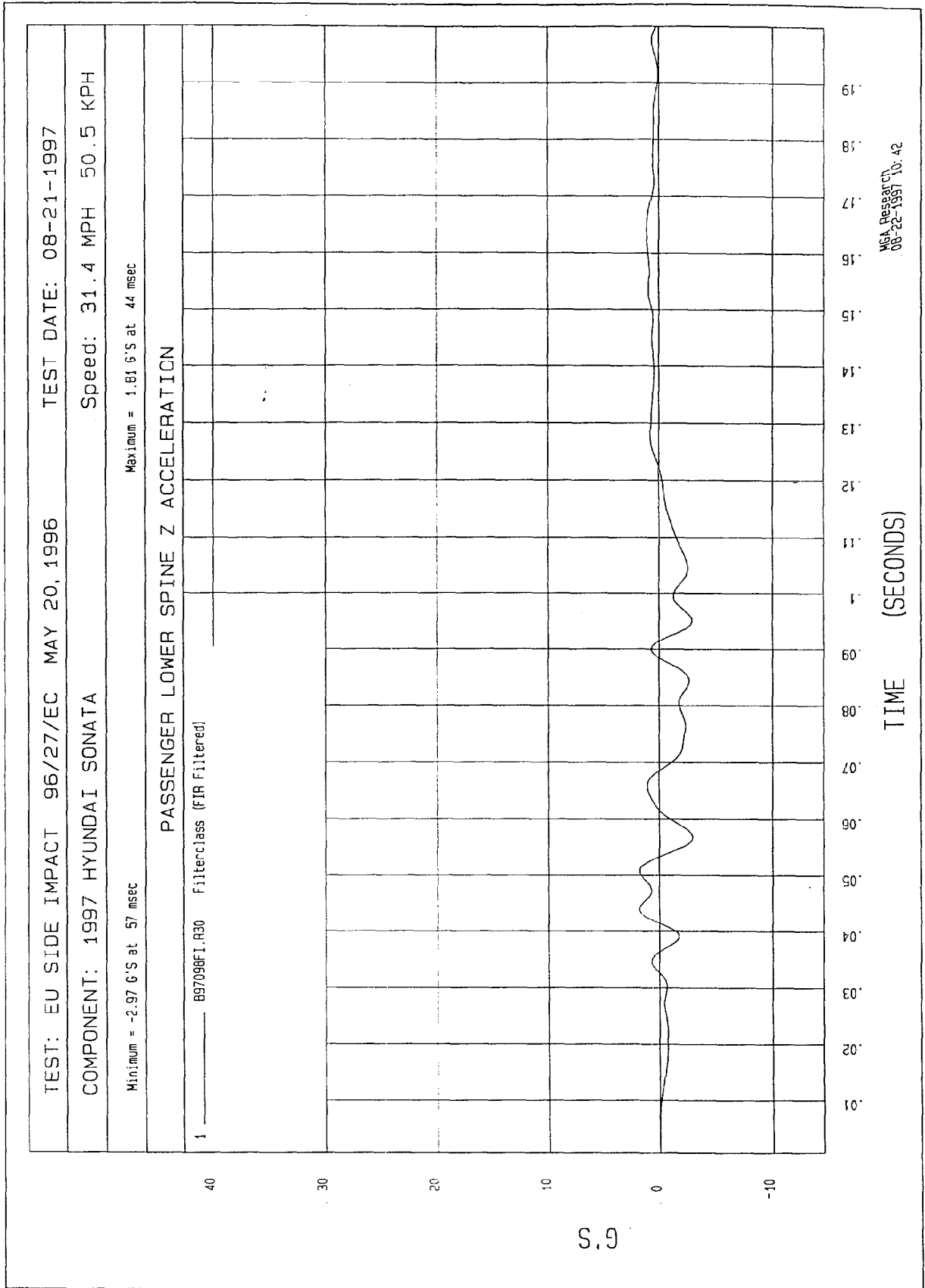


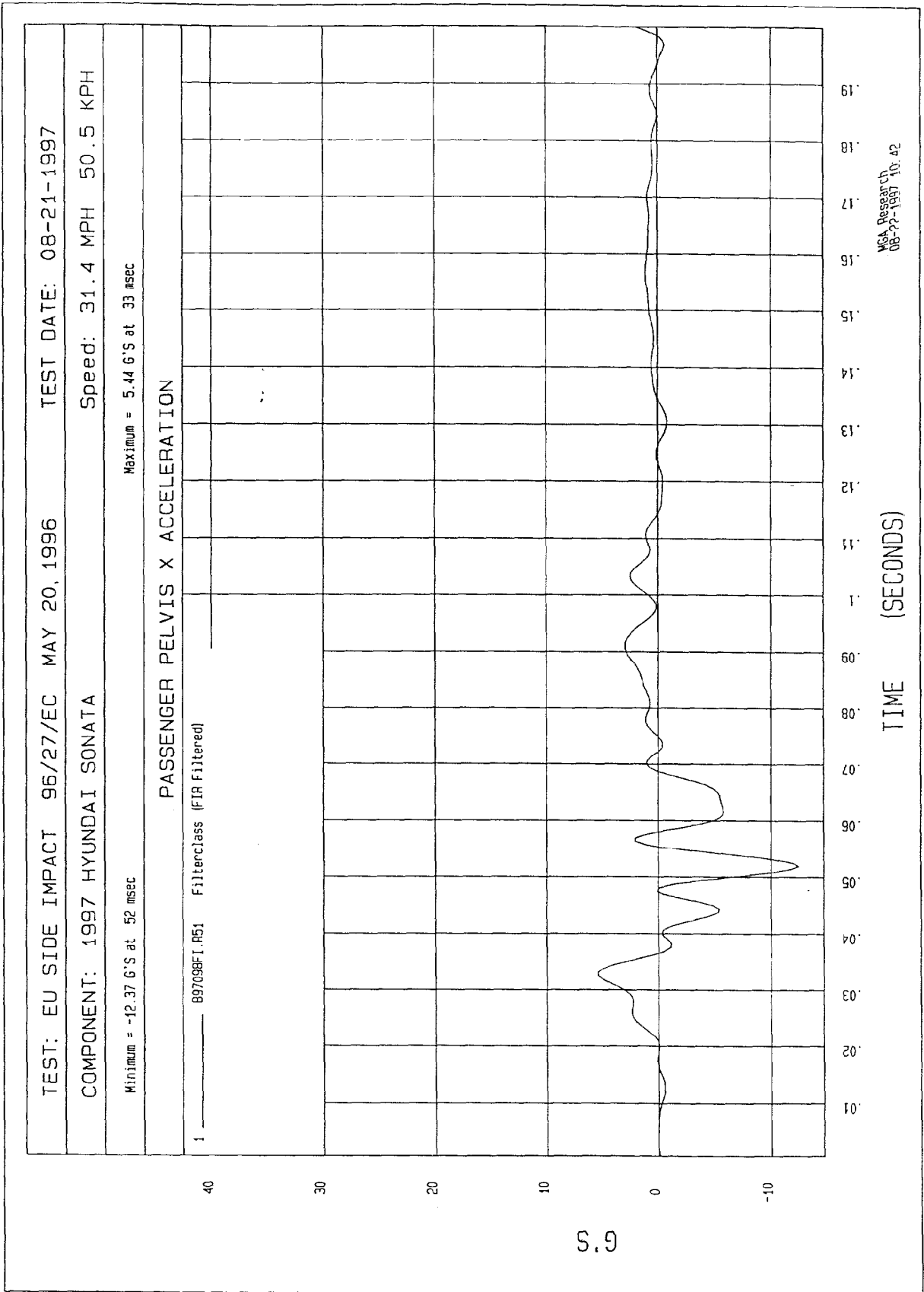


NSA Research
08-22-1997 10: 41



MGA Research
08-22-1997 10.42



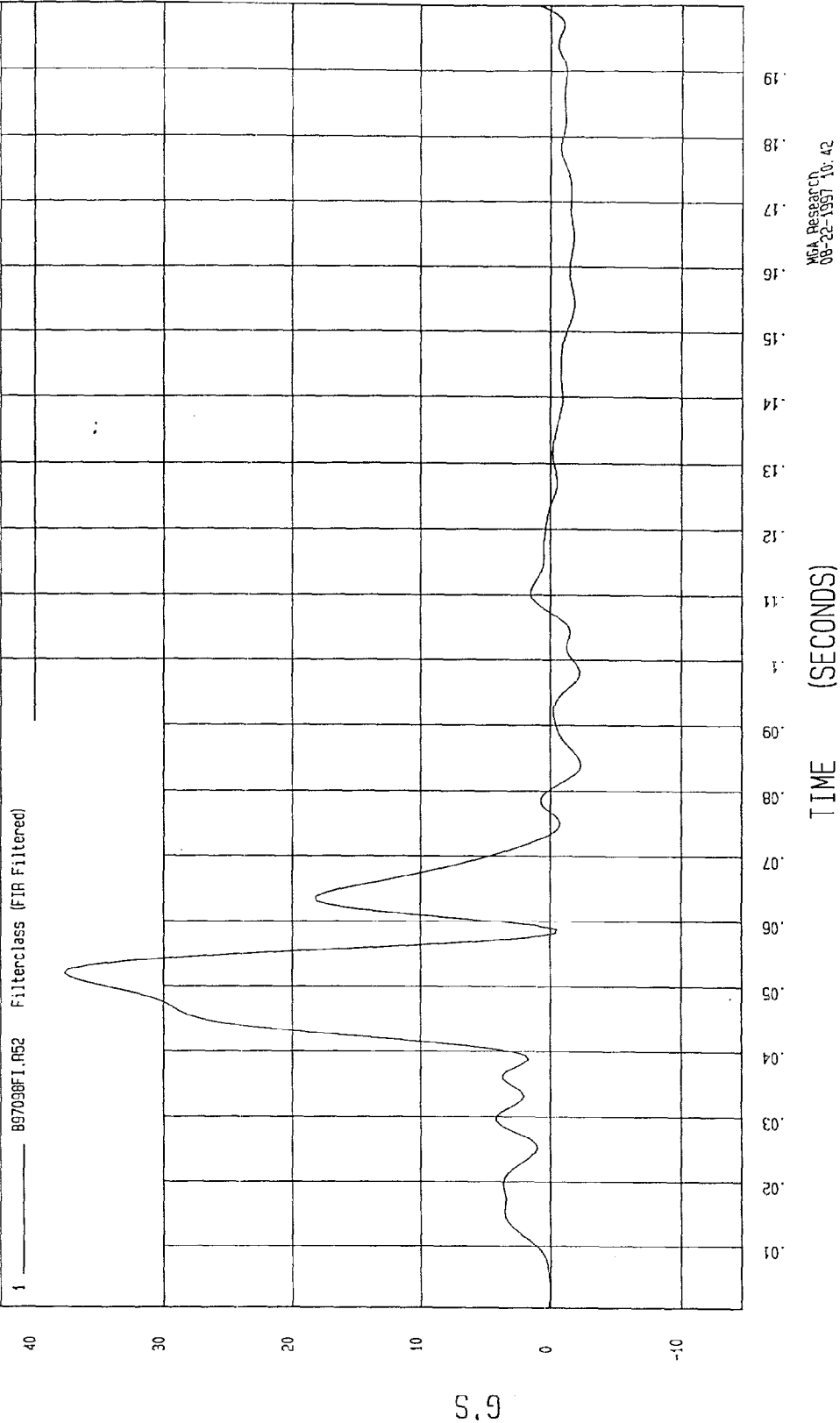


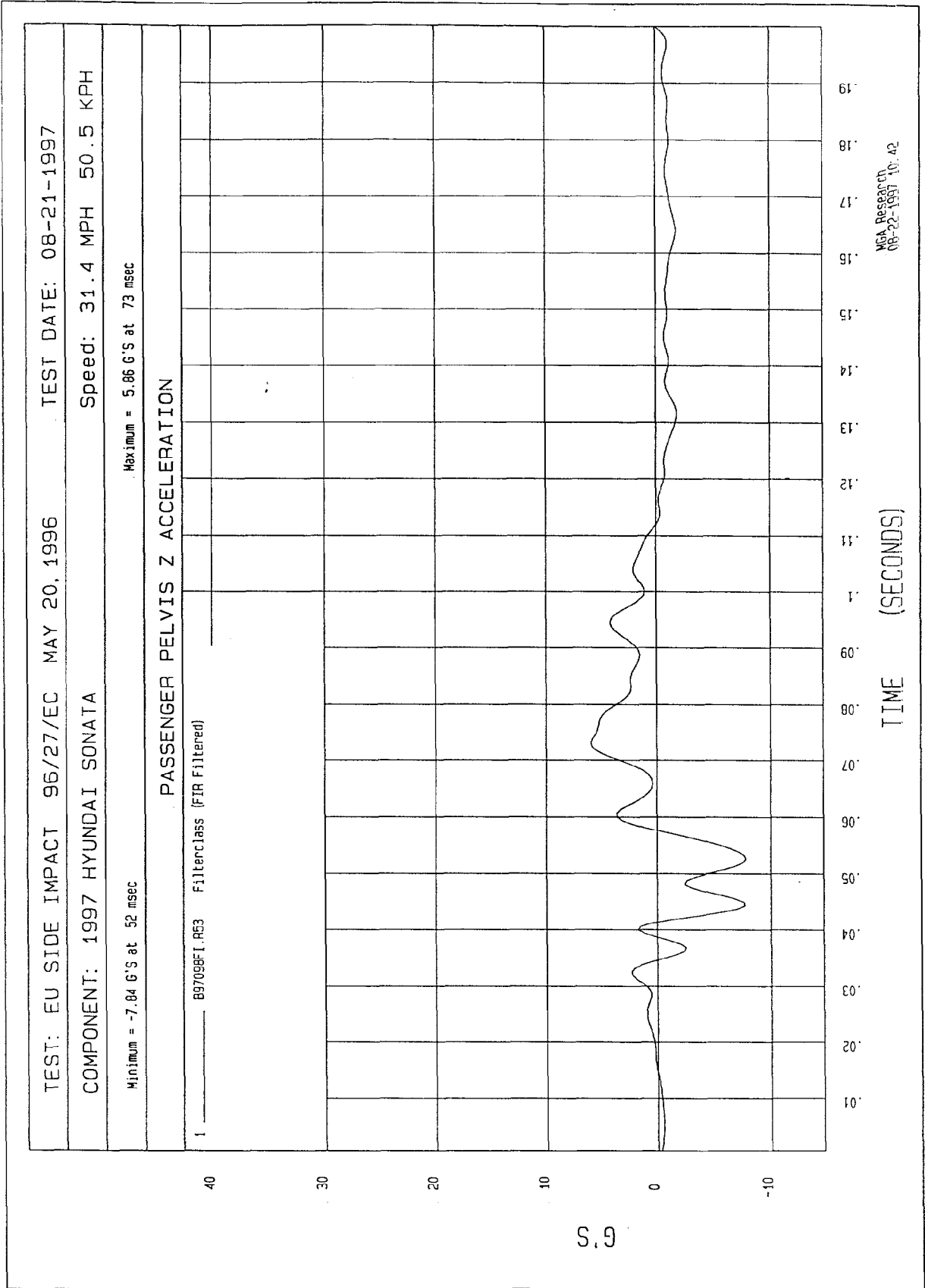
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

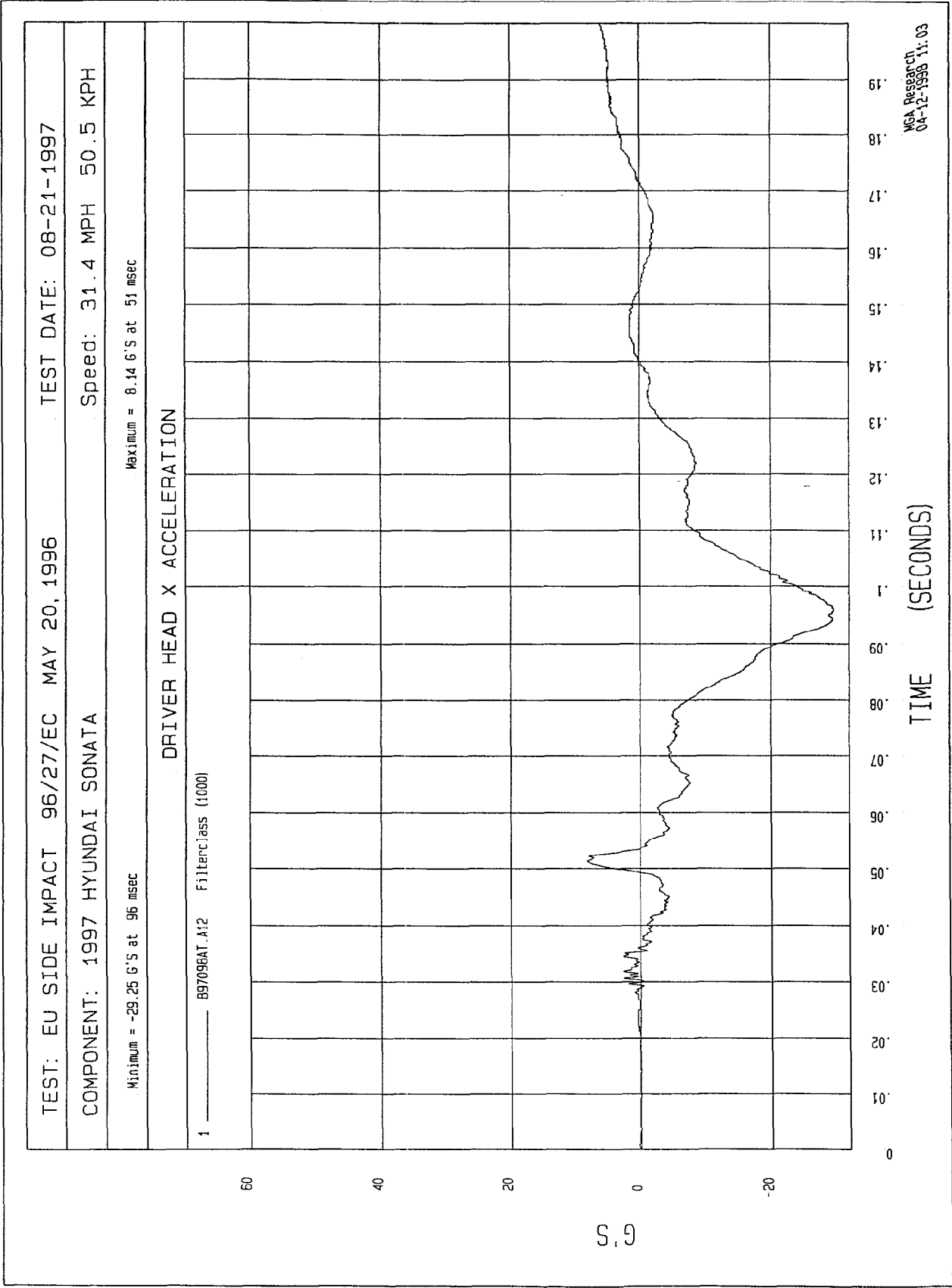
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.30 G's at 84 msec Maximum = 37.65 G's at 52 msec

PASSENGER PELVIS Y ACCELERATION



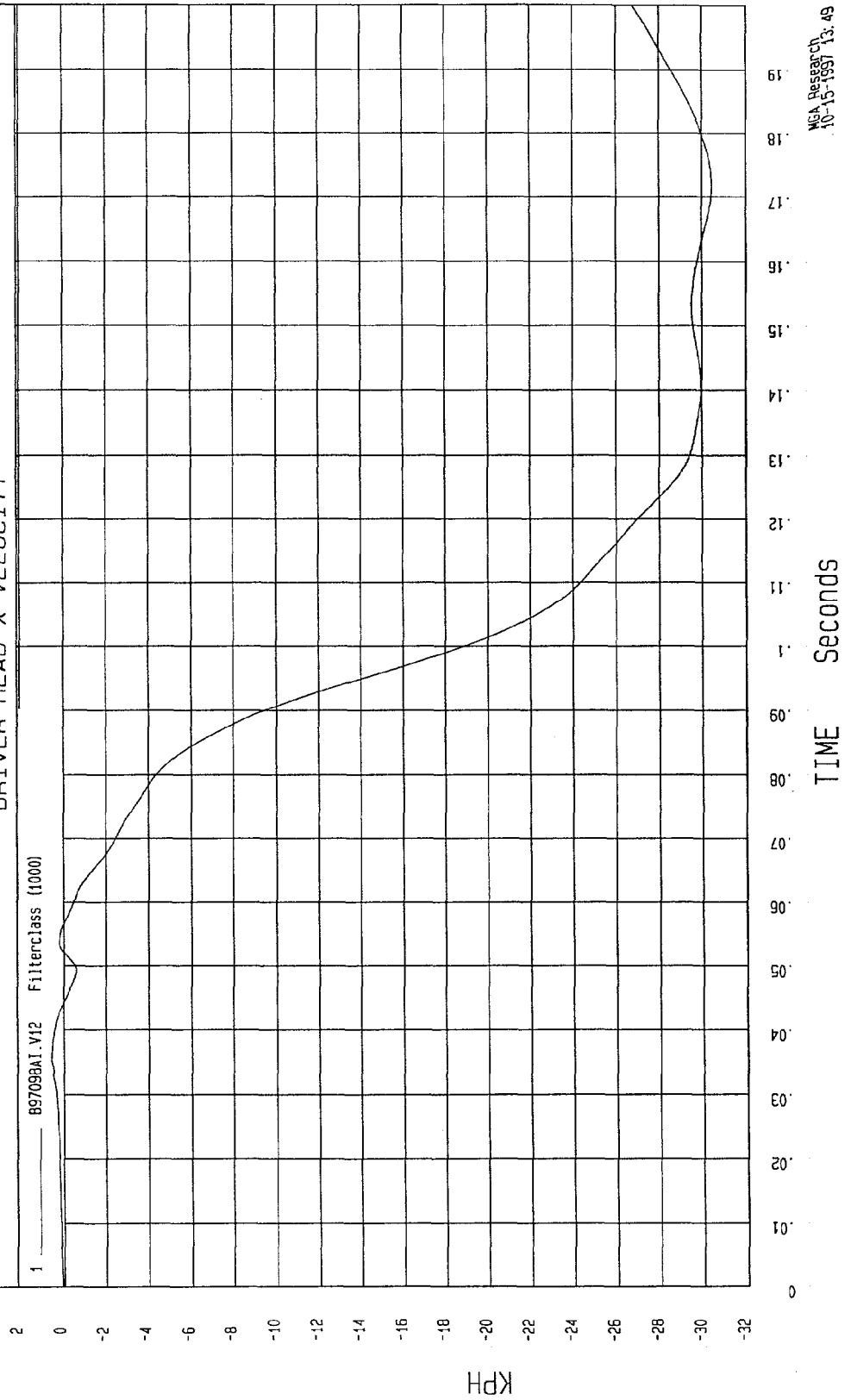




TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -30.46 KPH at 172 msec Maximum = .56 KPH at 35 msec

DRIVER HEAD X VELOCITY

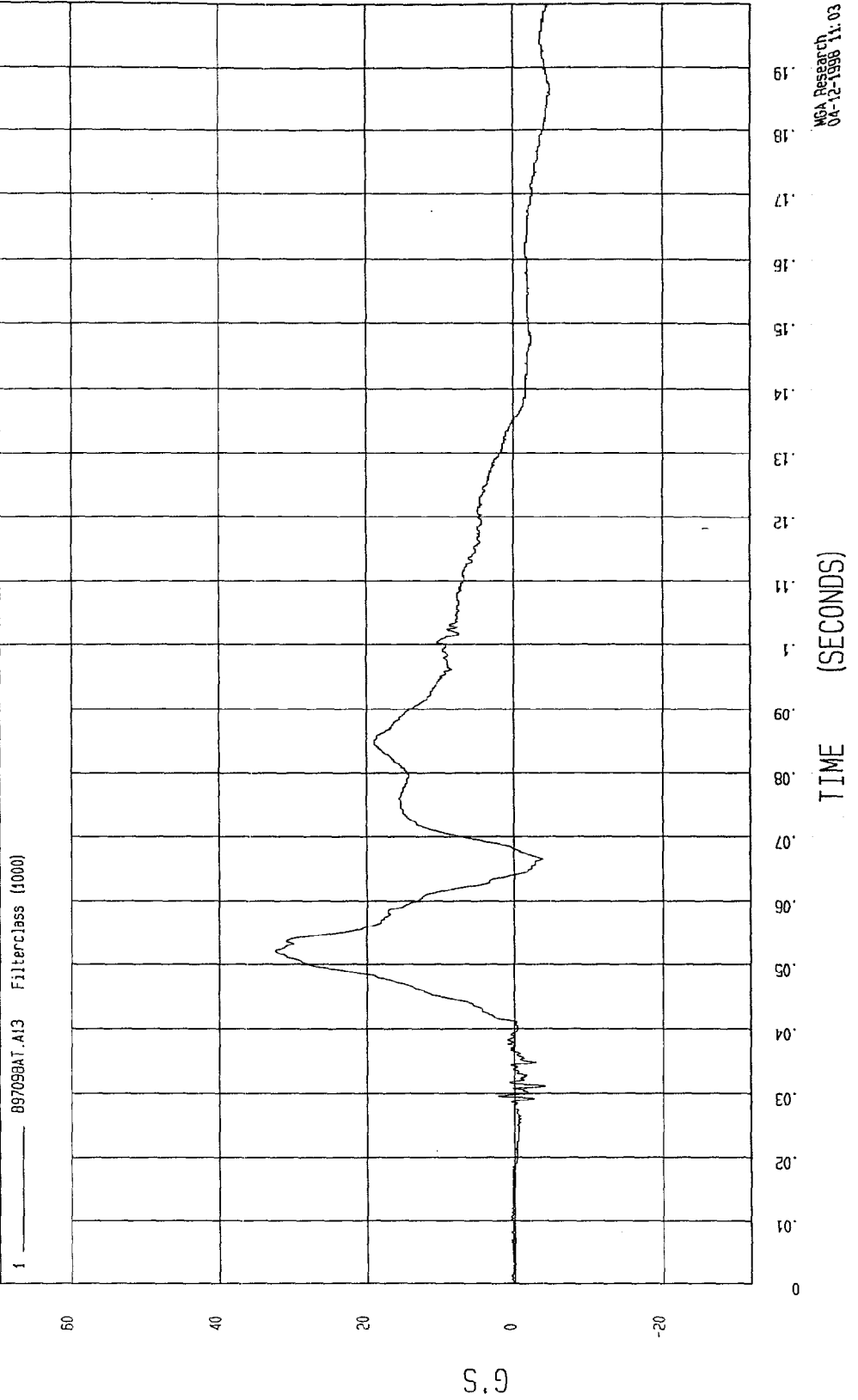


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -4.93 G'S at 186 msec Maximum = 32.51 G'S at 52 msec

DRIVER HEAD Y ACCELERATION



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

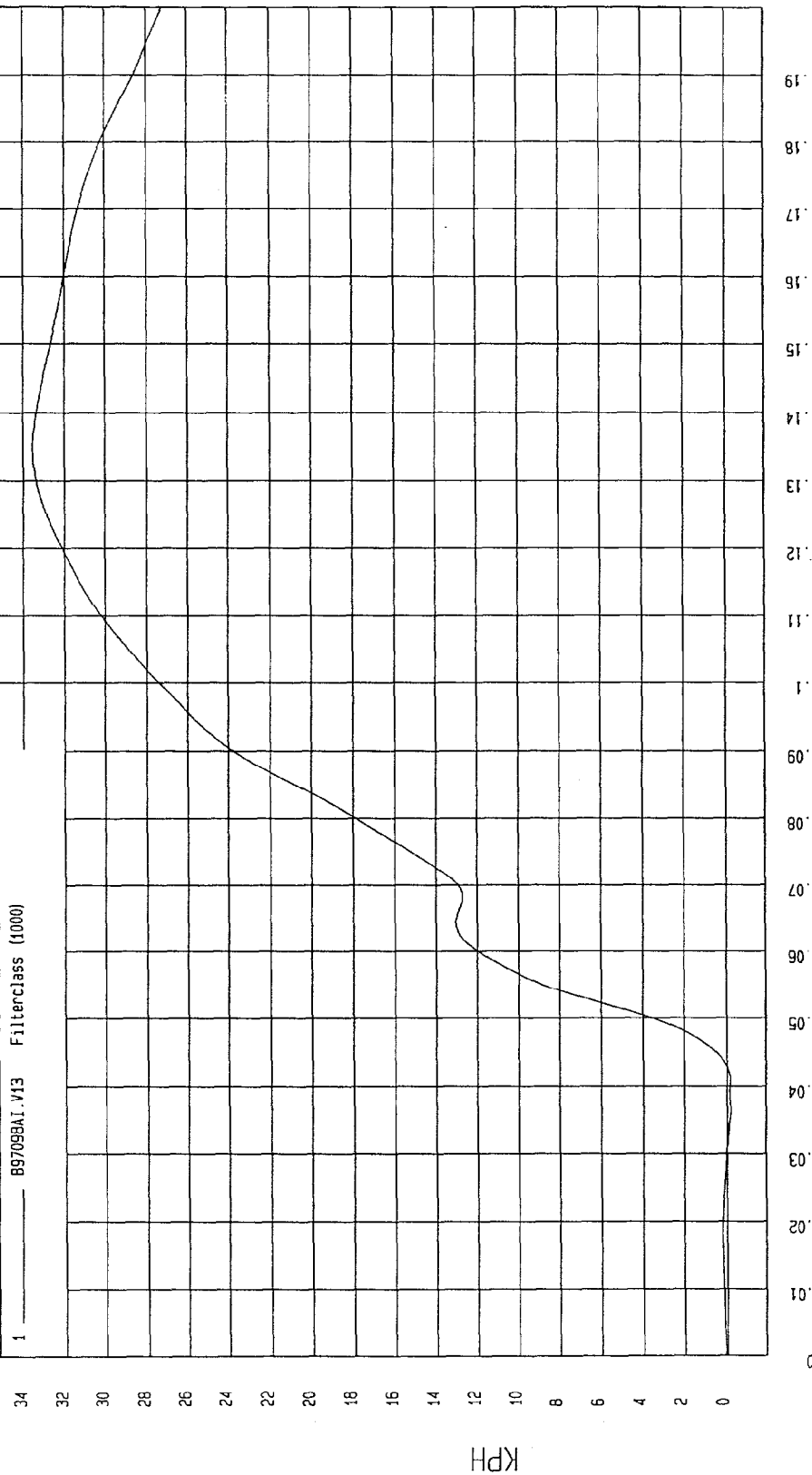
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.17 KPH at 36 msec

Maximum = 33.56 KPH at 135 msec

DRIVER HEAD Y VELOCITY

1 B97098AI.V13 FilterClass (1000)



MGA Research
10-15-1997 13: 49

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

SPEED: 31.4 MPH 50.5 KPH

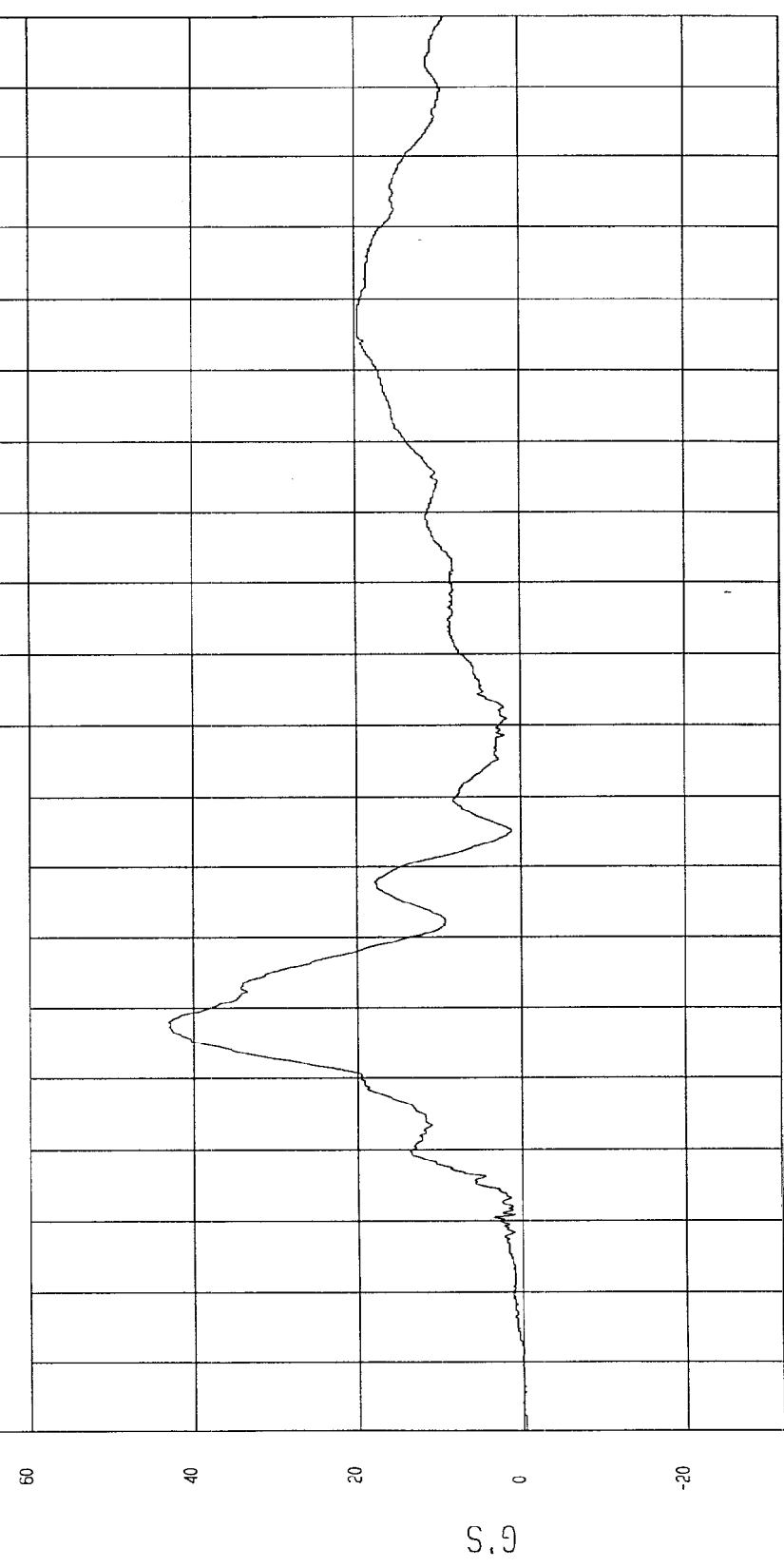
COMPONENT: 1997 HYUNDAI SONATA

Maximum = 43.05 G'S at 57 msec

Minimum = -.30 G'S at -9 msec

DRIVER HEAD Z ACCELERATION

1 ——— BS709BAT.A14 Filterclass (1000)



MCA Research
04-12-1998 11:03

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

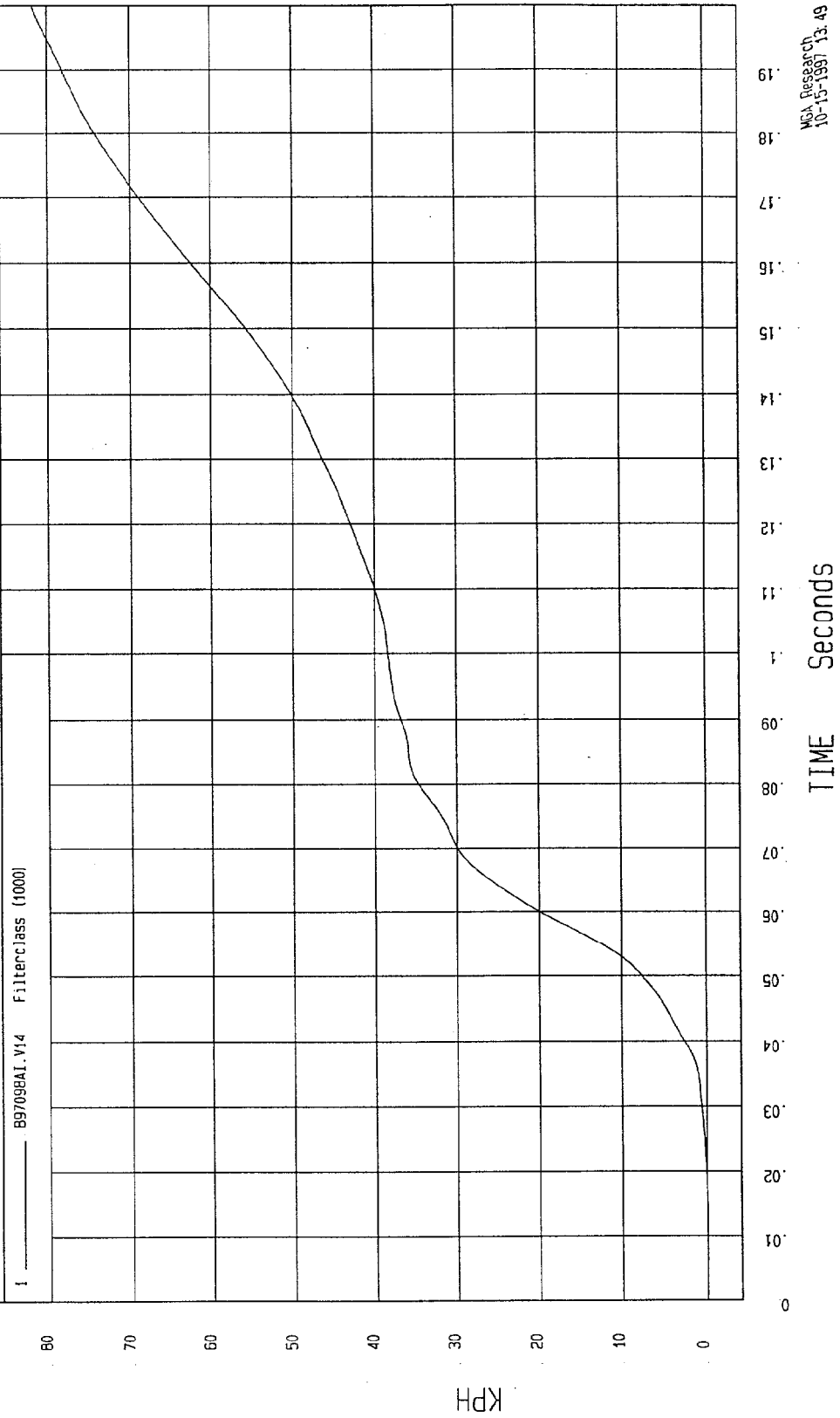
SPEED: 31.4 MPH 50.5 KPH

COMPONENT: 1997 HYUNDAI SONATA

Maximum = 81.83 KPH at 200 msec

Minimum = -11 KPH at 9 msec

DRIVER HEAD Z VELOCITY



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 8.31E-02 G's at -20 msec Maximum = 46.74 G's at 57 msec

DRIVER HEAD RESULTANT ACCELERATION

1 — B97098AV.M12 Filterclass (1000)

80

70

60

50

40

30

20

10

0

G's

0

0.01

0.02

0.03

0.04

0.05

0.06

0.07

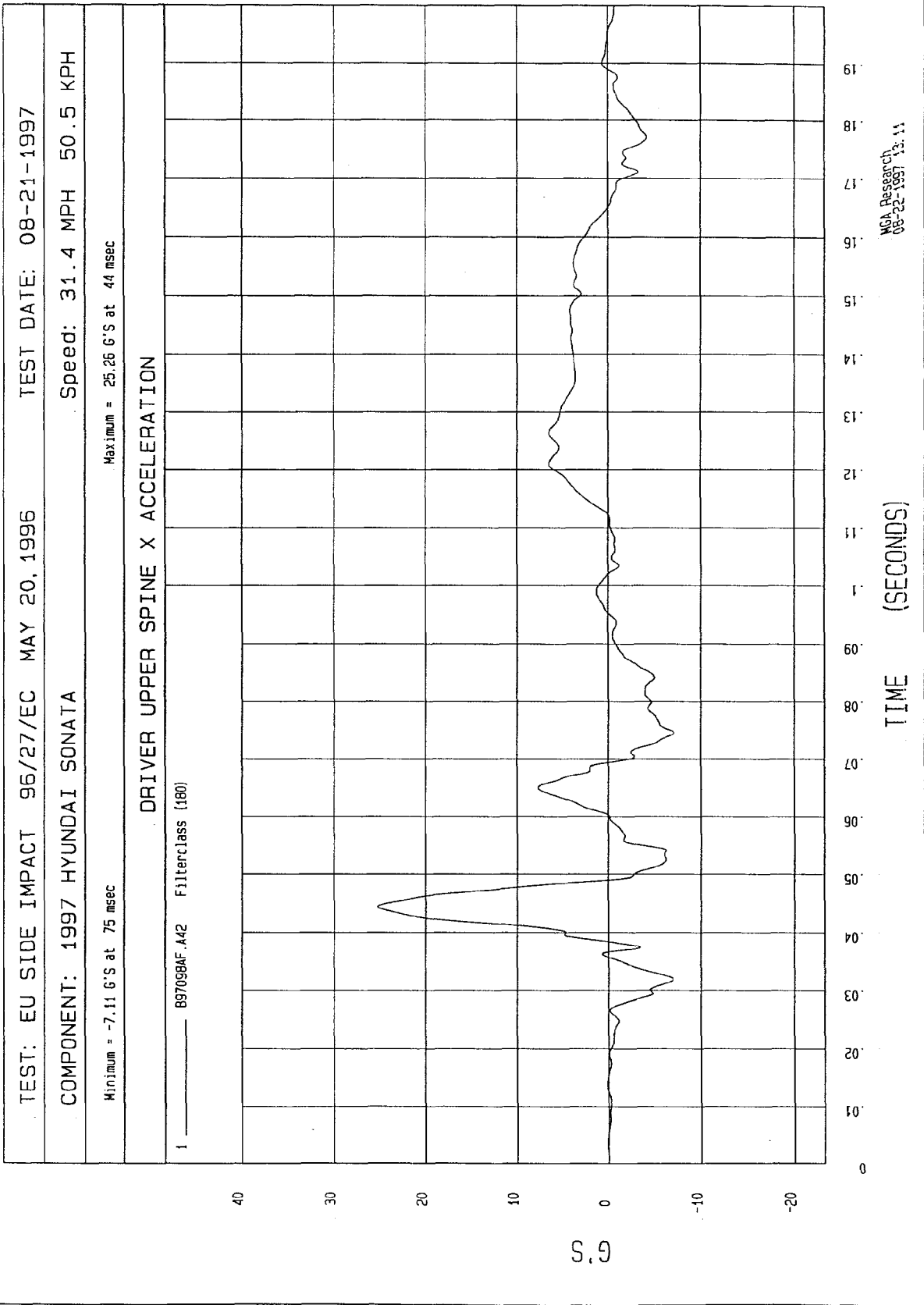
0.08

0.09

0.10

TIME (SECONDS)

MCA Research
04-12-1998 11:03



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.47 KPH at 38 msec
Maximum = 8.10 KPH at 165 msec

DRIVER UPPER SPINE X VELOCITY

1 — 897098A1.V42 Filterclass (180)

40

30

20

10

0

-10

KPH

0.19

0.18

0.17

0.16

0.15

0.14

0.13

0.12

0.11

0.1

0.09

0.08

0.07

0.06

0.05

0.04

0.03

0.02

0.01

0

MECA Research
08-22-1997 13:15

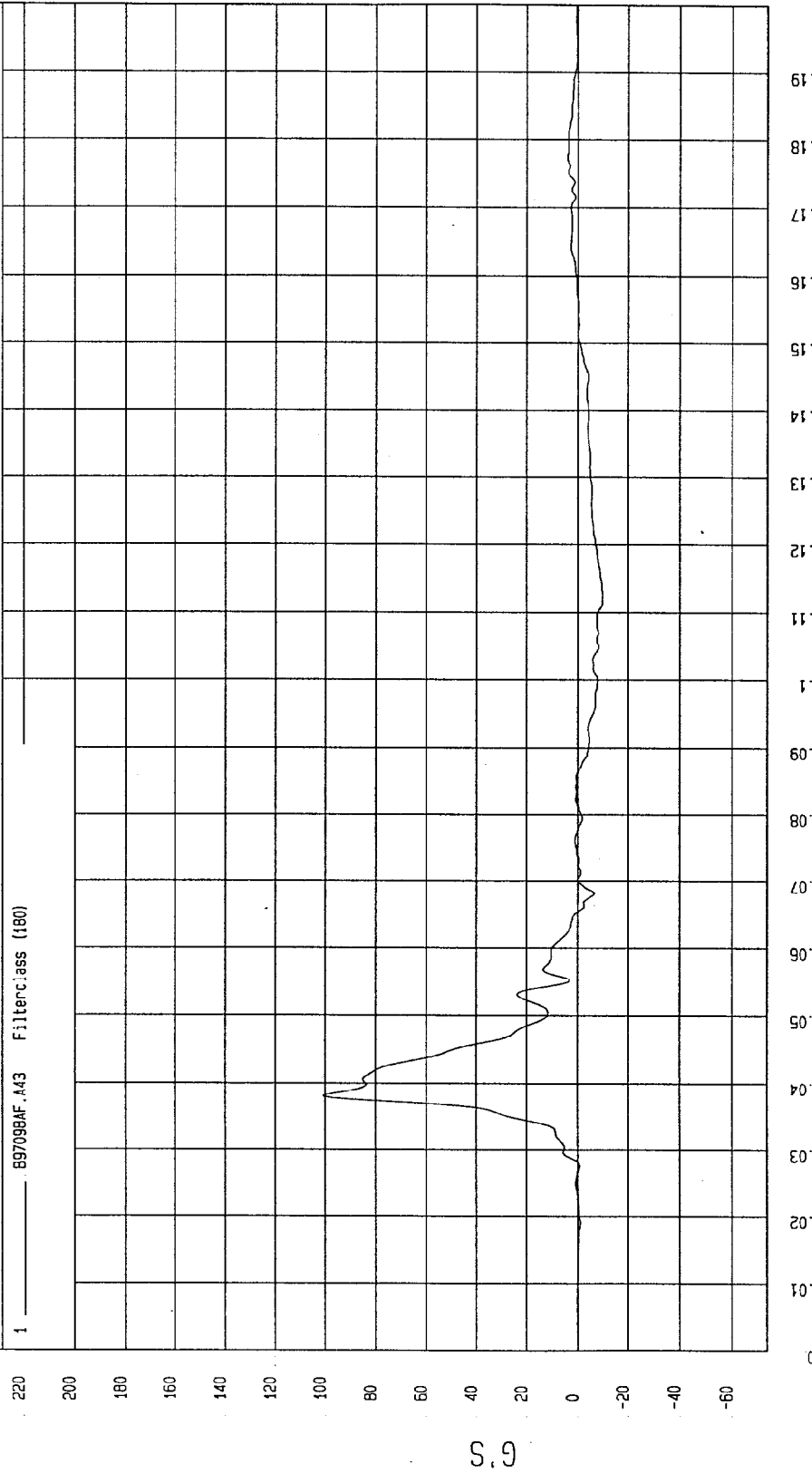
TIME Seconds

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -9.82 G'S at 113 msec Maximum = 100.63 G'S at 39 msec

DRIVER UPPER SPINE Y ACCELERATION

1 89709BAF.A43 Filter: class (180)



MCA Research
08-22-1997 14:06

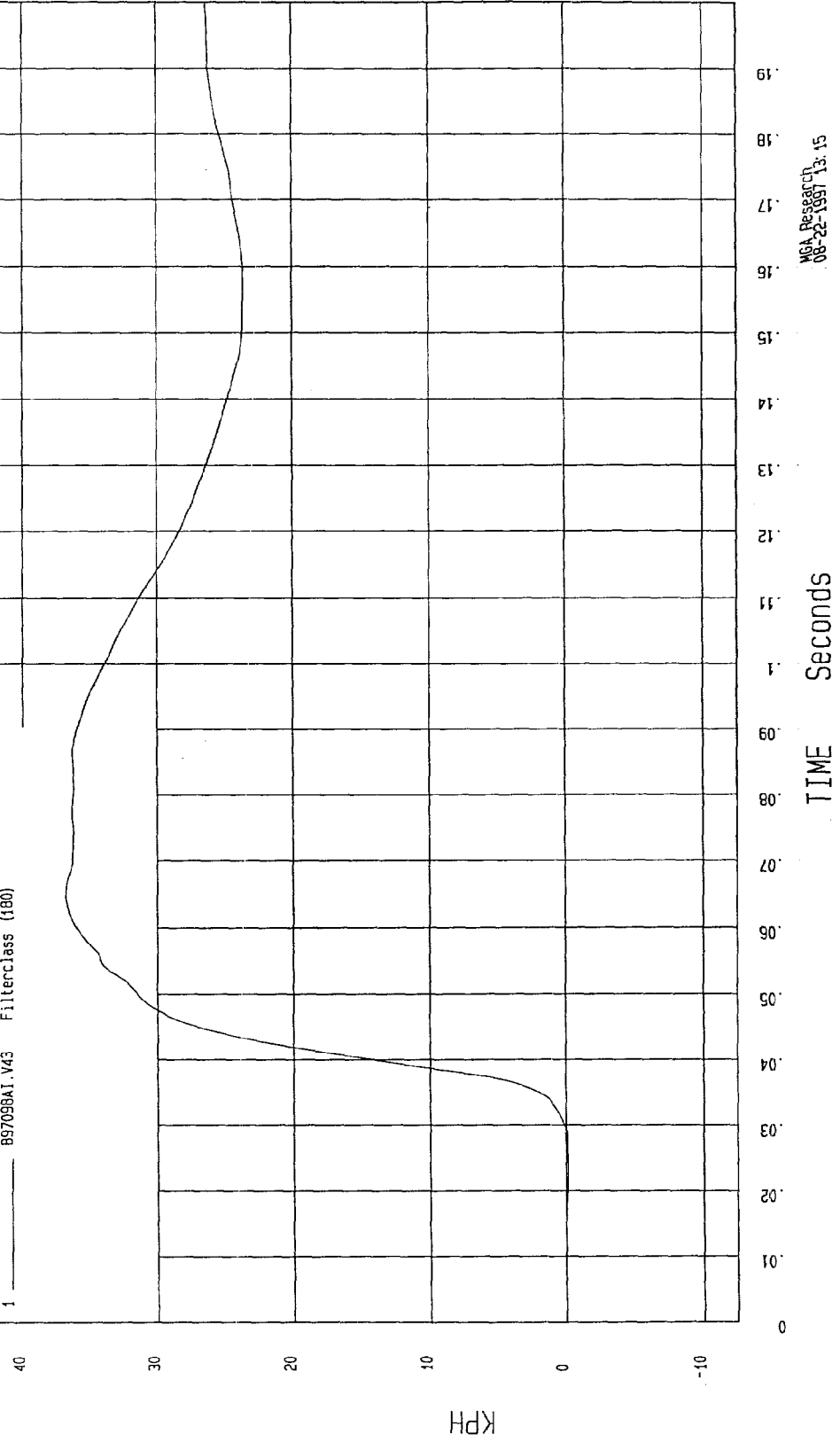
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

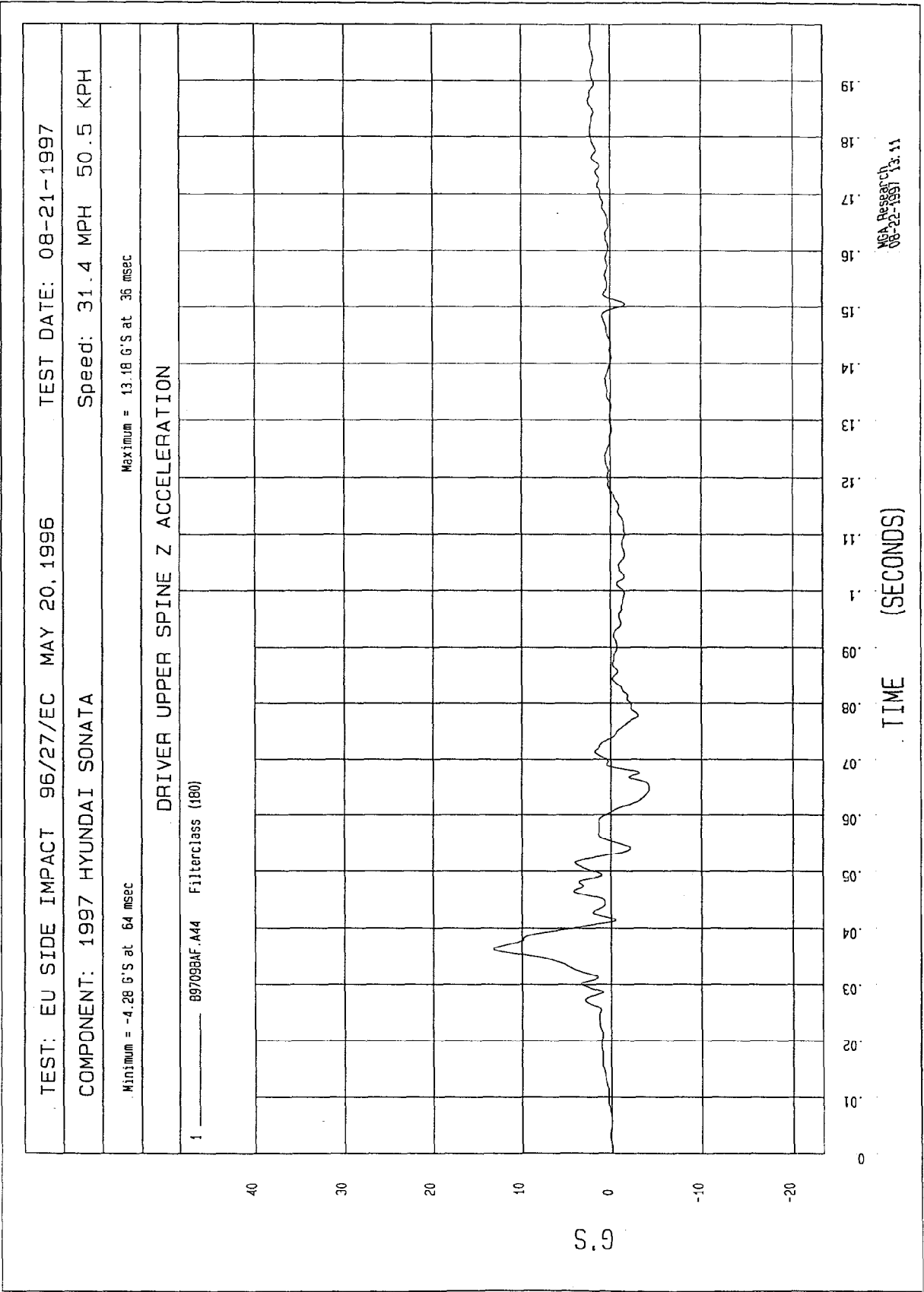
Minimum = -.15 KPH at 23 msec Maximum = 35.83 KPH at 65 msec

DRIVER UPPER SPINE Y VELOCITY

1 957099A1.V43 Filterclass (180)



WGA Research
08-22-1997 13:15



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.26E-02 KPH at -13 msec Maximum = 4.74 KPH at 200 msec

DRIVER UPPER SPINE Z VELOCITY

1 B97098A1.V44 Filterclass (180)

40

30

20

10

0

-10

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

TIME Seconds

MGA Research
08-22-1997 13:15

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -45.05 G'S at 39 msec Maximum = 117.15 G'S at 35 msec

DRIVER UPPER RIB Y ACCELERATION

1 B97098AF.A15 Filterclass (180)

220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60

G.S

0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.18 0.19

TIME (SECONDS)

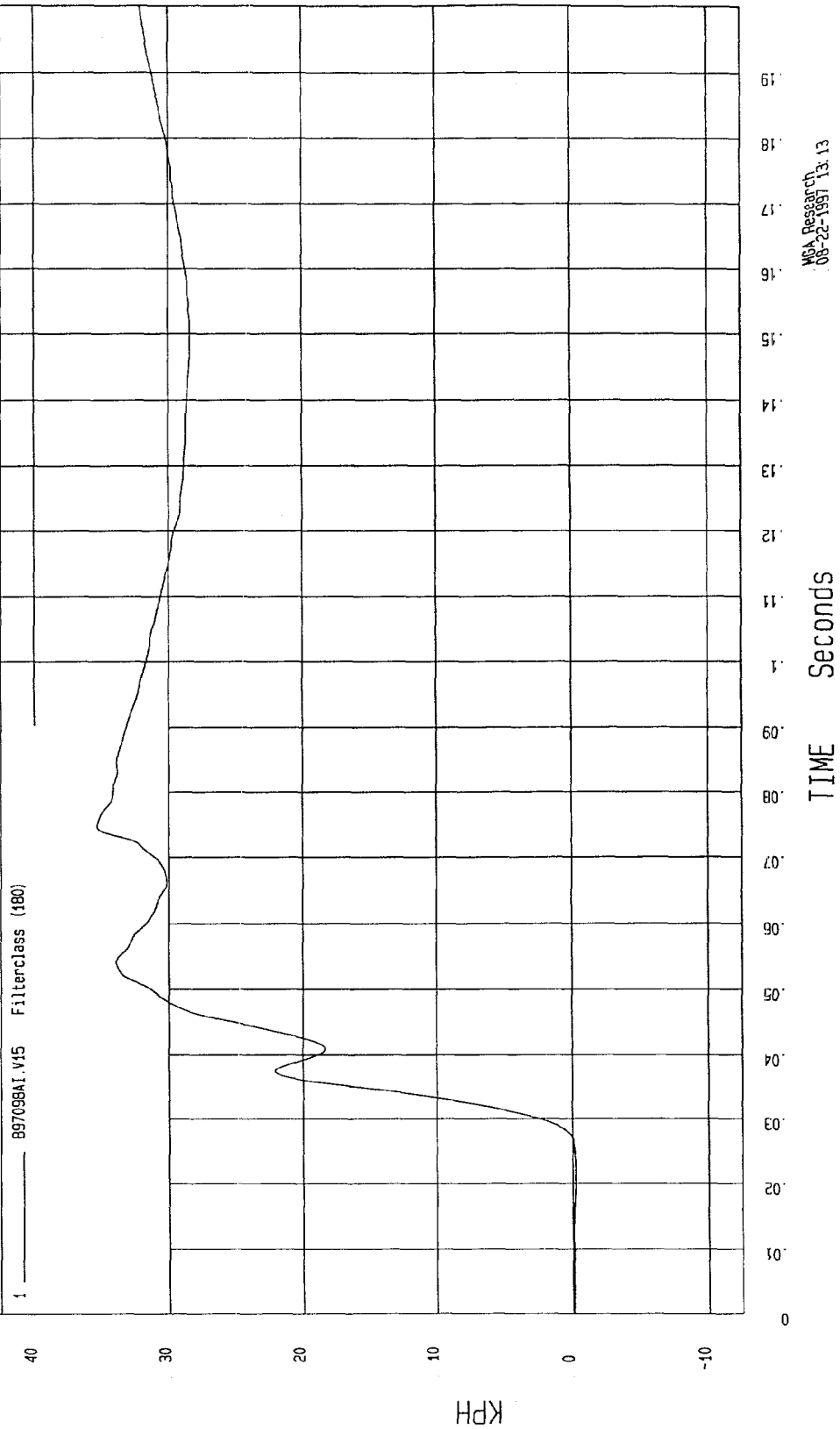
MGA Research
08-22-1997 10:30

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.22 KPH at 23 msec Maximum = 35.31 KPH at 75 msec

DRIVER UPPER RIB Y VELOCITY

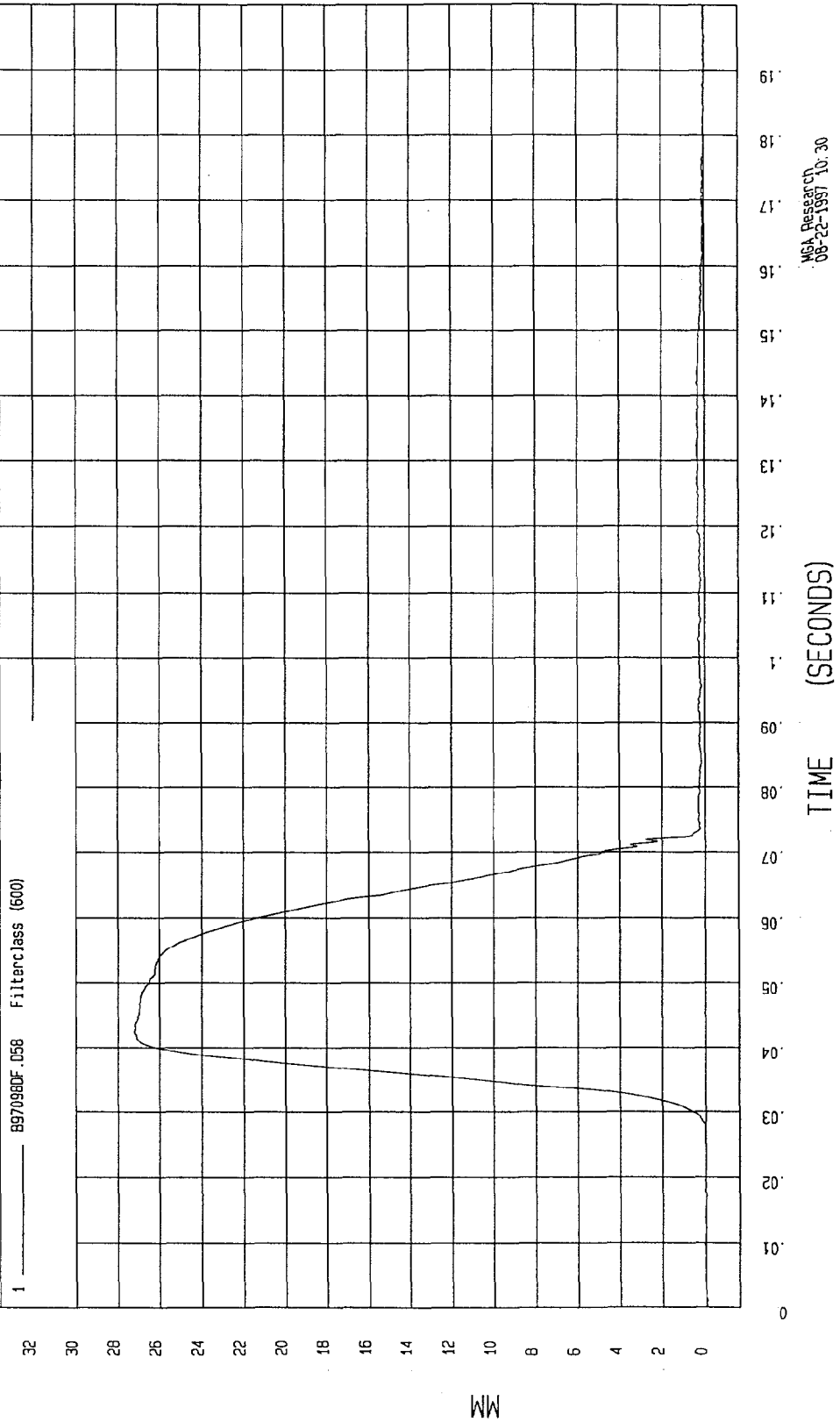


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.13 MM at -20 msec Maximum = 27.21 MM at 42 msec

DRIVER UPPER RIB Y DISPLACEMENT

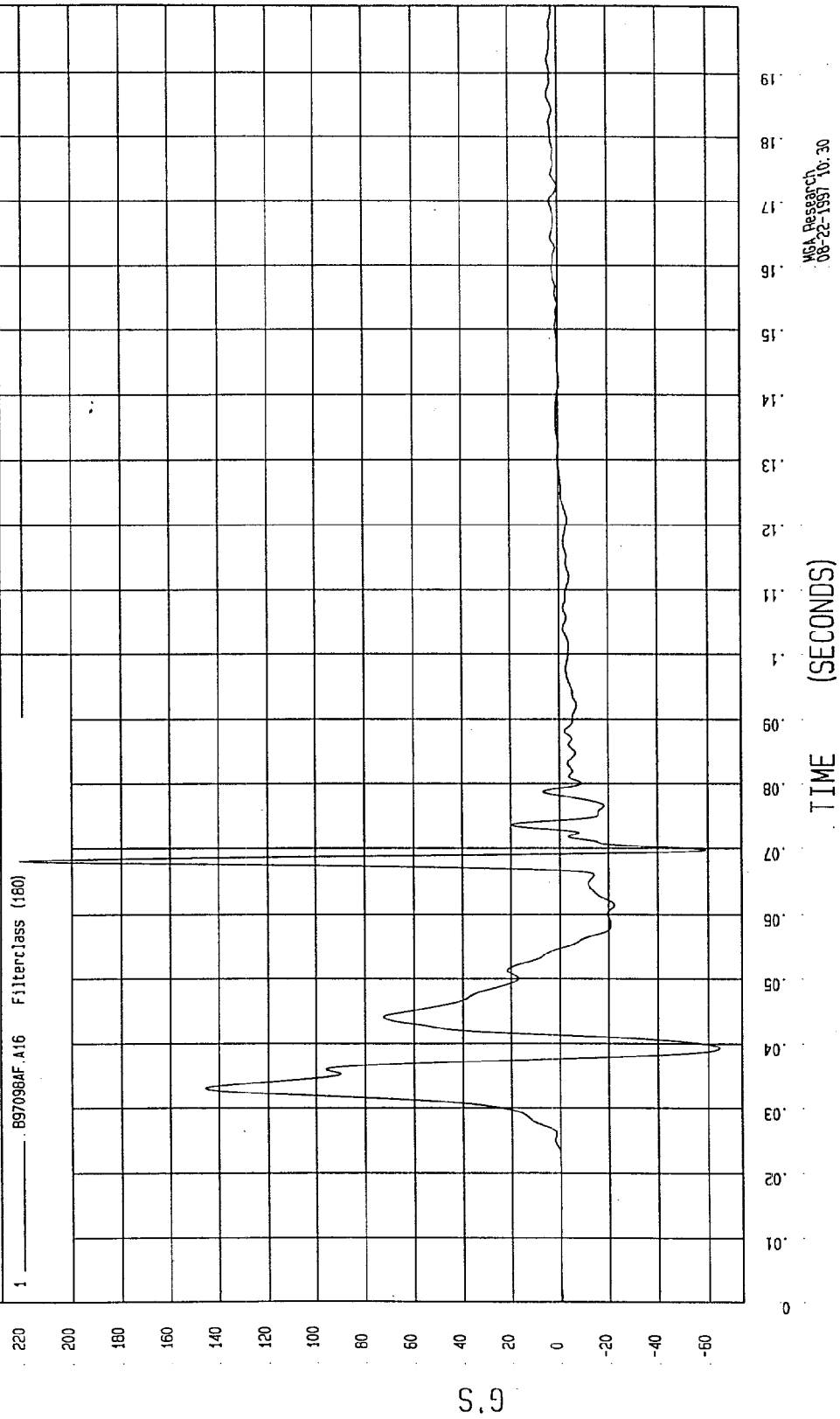


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -64.57 G'S at 39 msec Maximum = 221.25 G'S at 68 msec

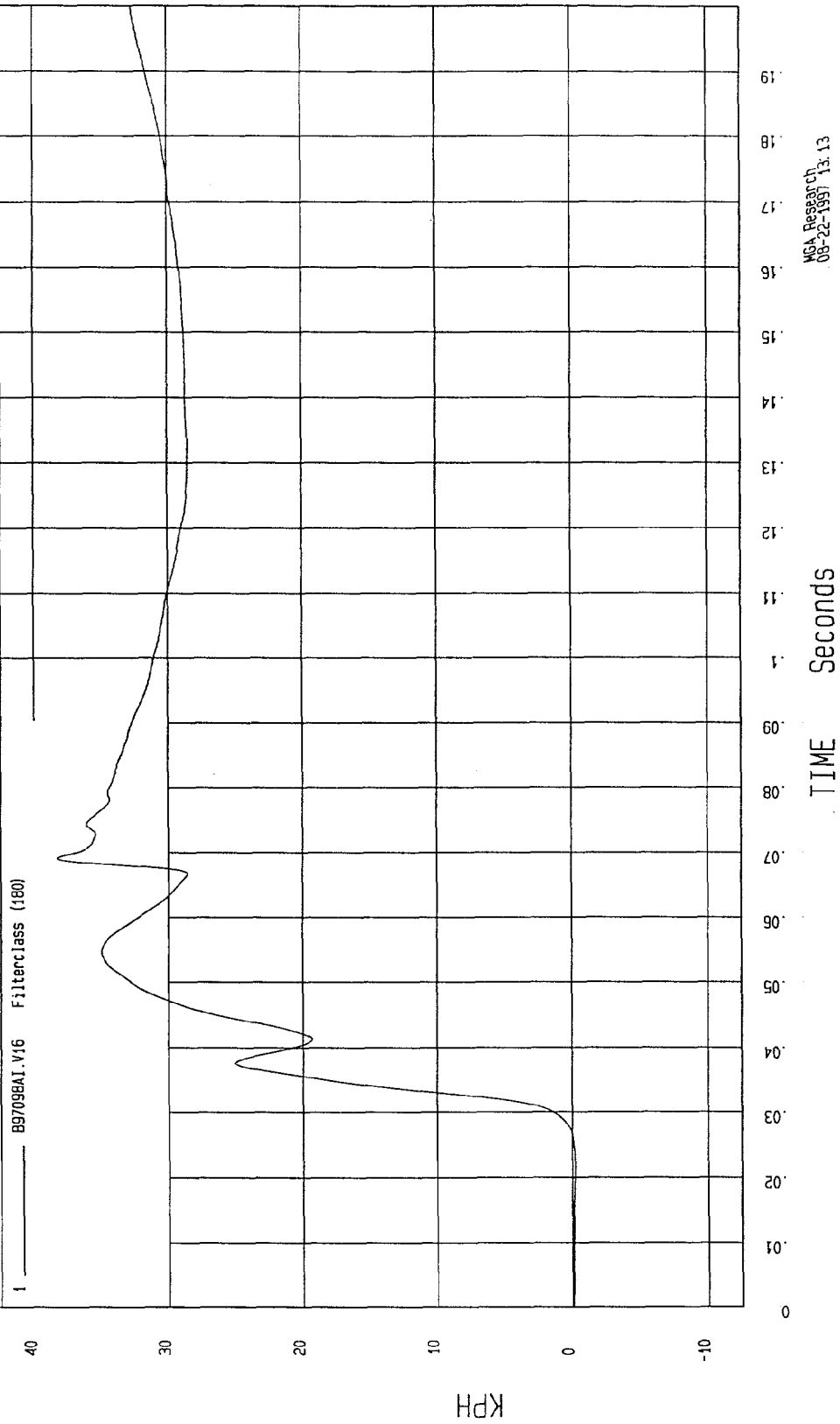
DRIVER MID RIB Y ACCELERATION



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -18 KPH at 22 msec Maximum = 38.33 KPH at 69 msec

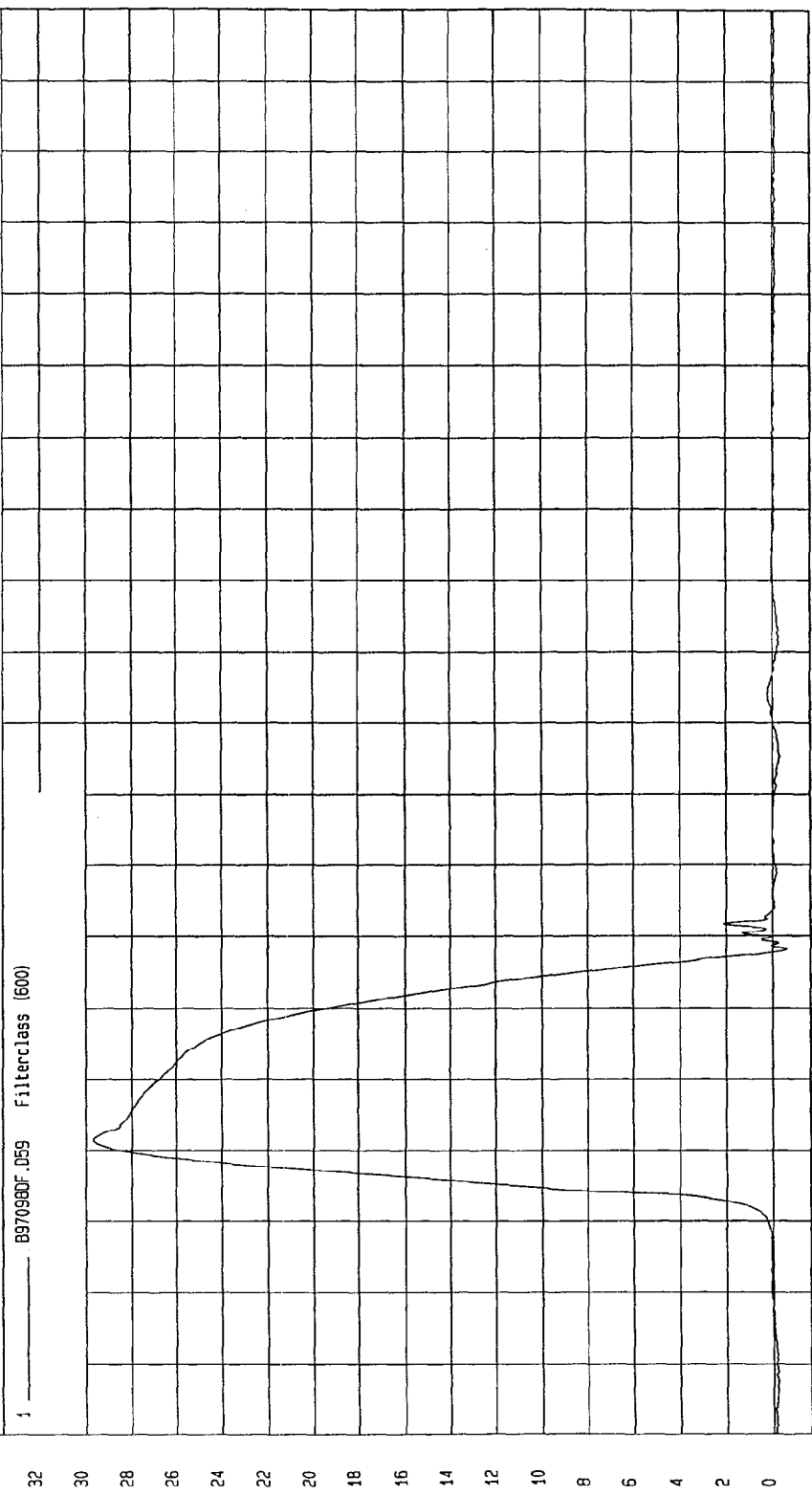
DRIVER MID RIB Y VELOCITY



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.60 MM at 68 msec Maximum = 29.67 MM at 42 msec

DRIVER MID RIB Y DISPLACEMENT



MCA Research
08-22-1997 10:30

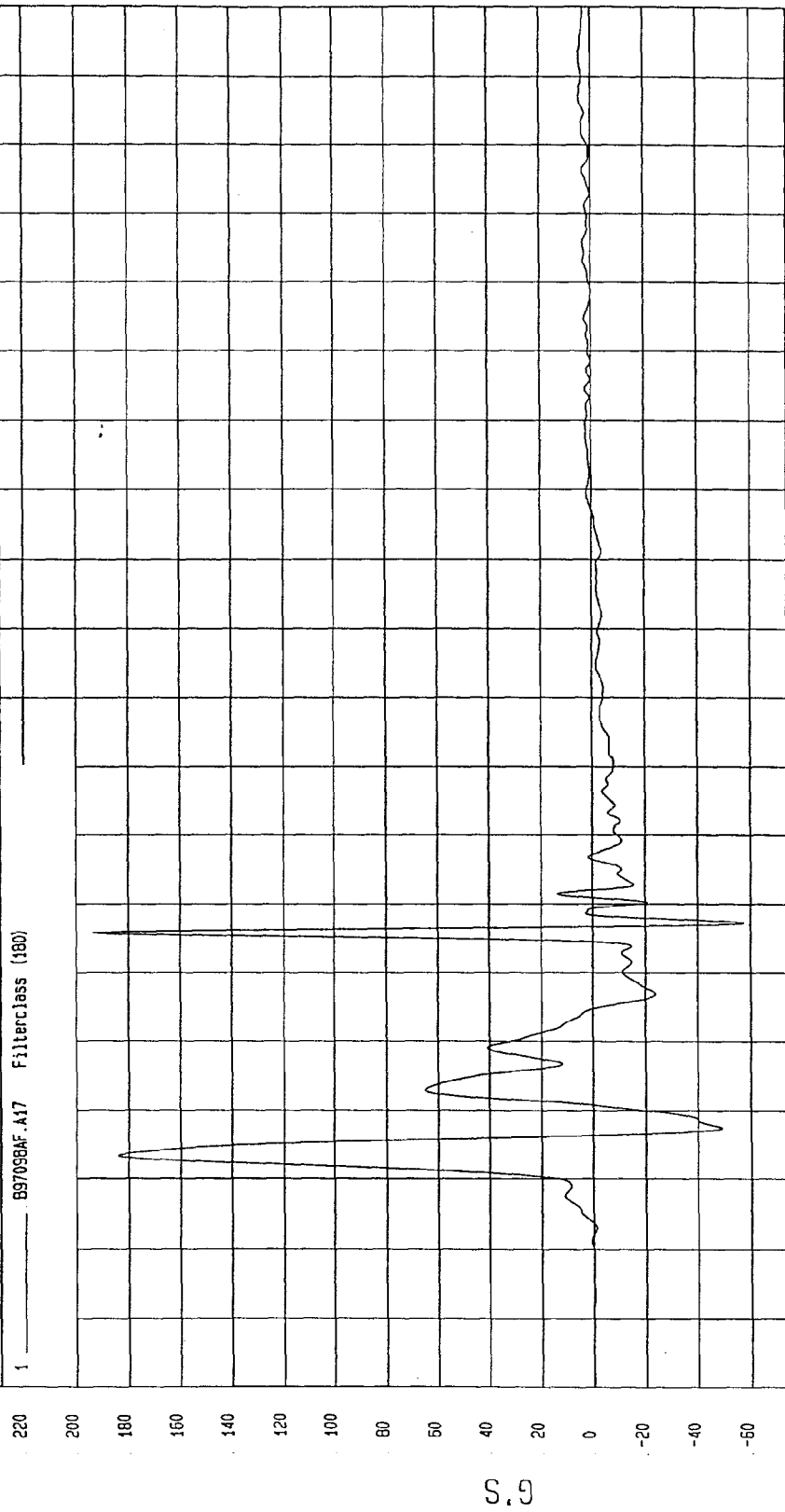
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -57.29 G's at 67 msec
Maximum = 193.48 G's at 66 msec

DRIVER LOWER RIB Y ACCELERATION

1 B9708BAF.A17 Filterclass (180)



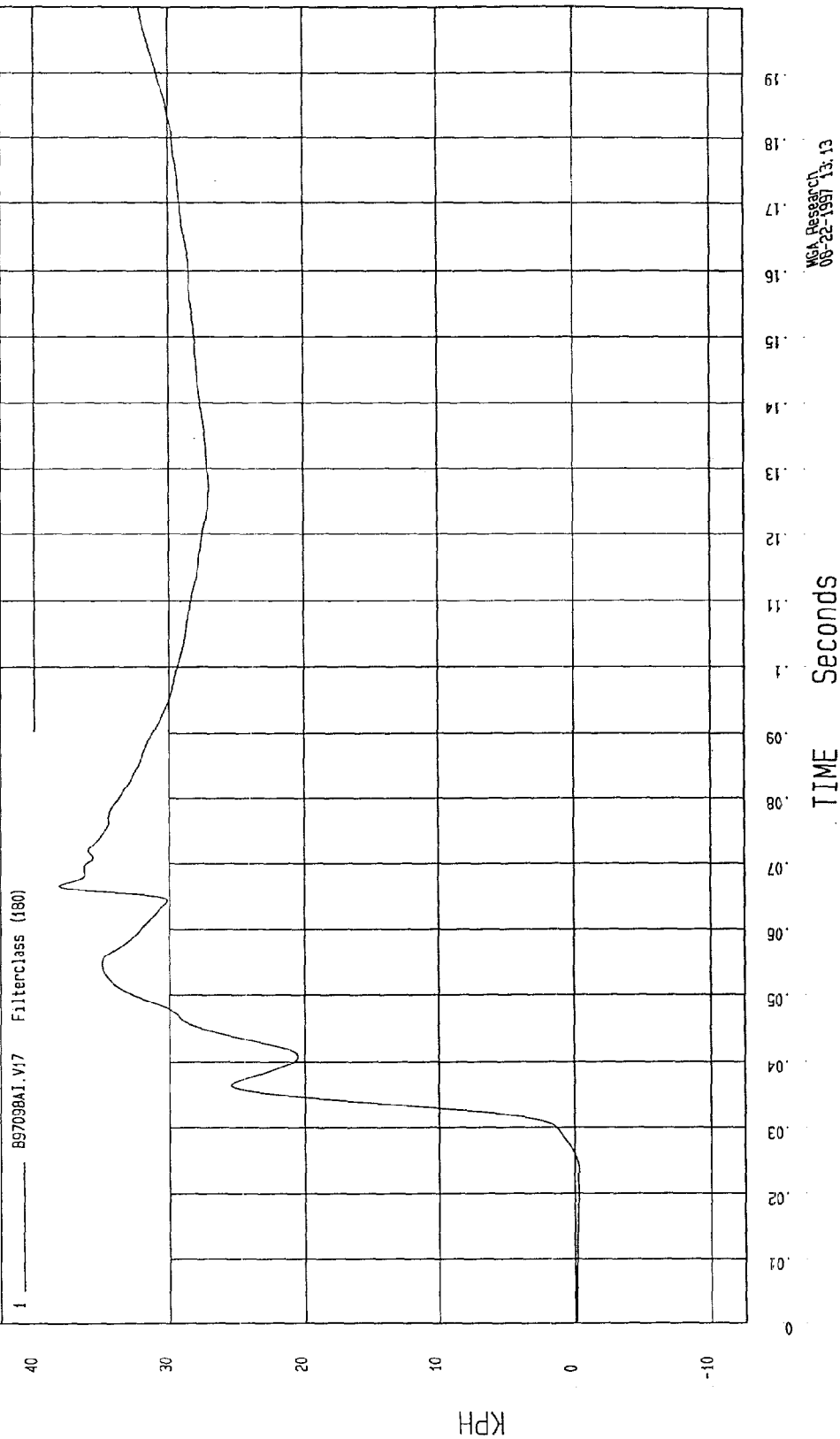
MCA Research
08-22-1997 10:30

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -29 KPH at 24 msec Maximum = 38.18 KPH at 67 msec

DRIVER LOWER RIB Y VELOCITY



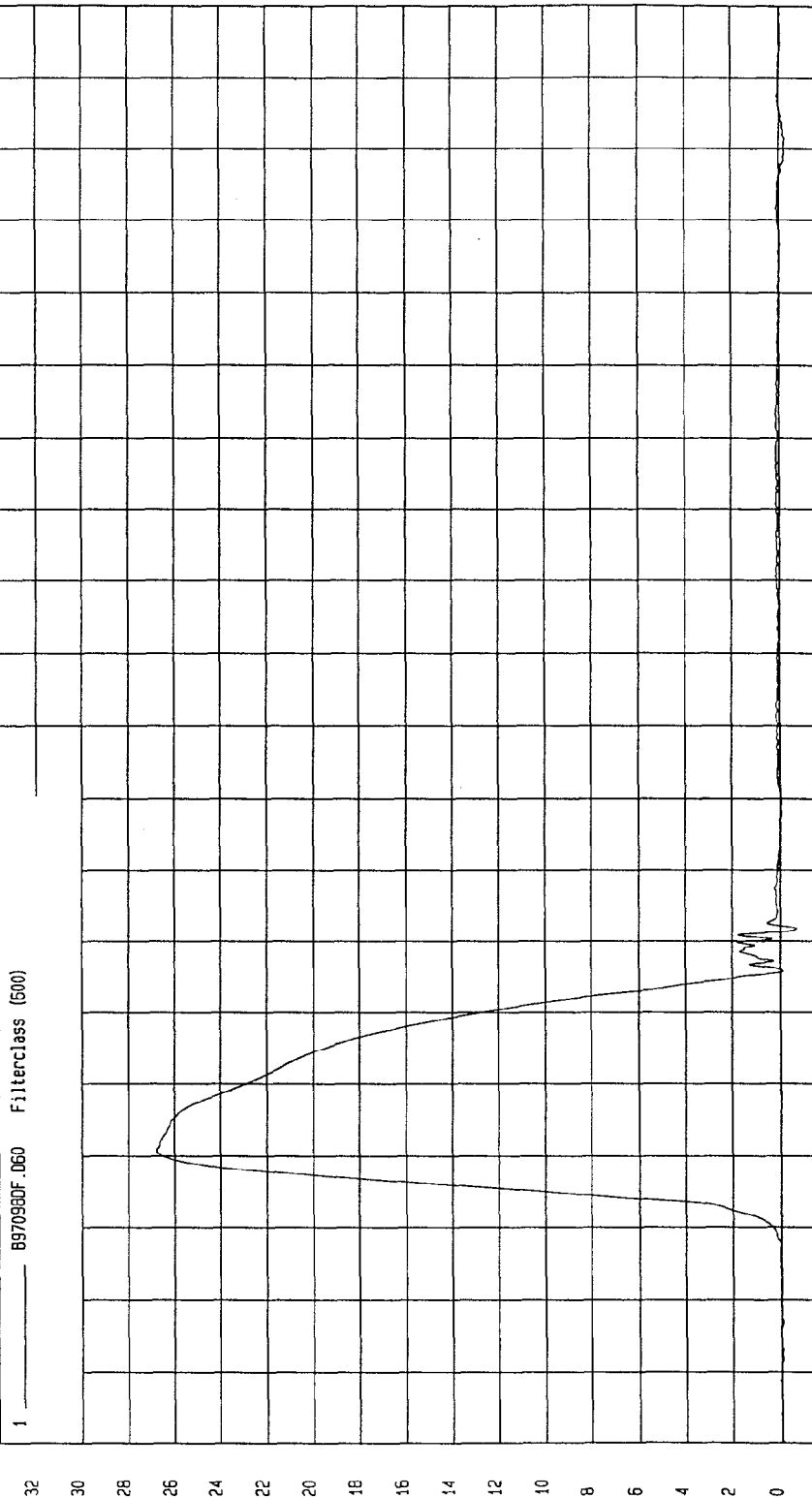
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.64 MM at 72 msec Maximum = 26.78 MM at 41 msec

DRIVER LOWER RIB Y DISPLACEMENT

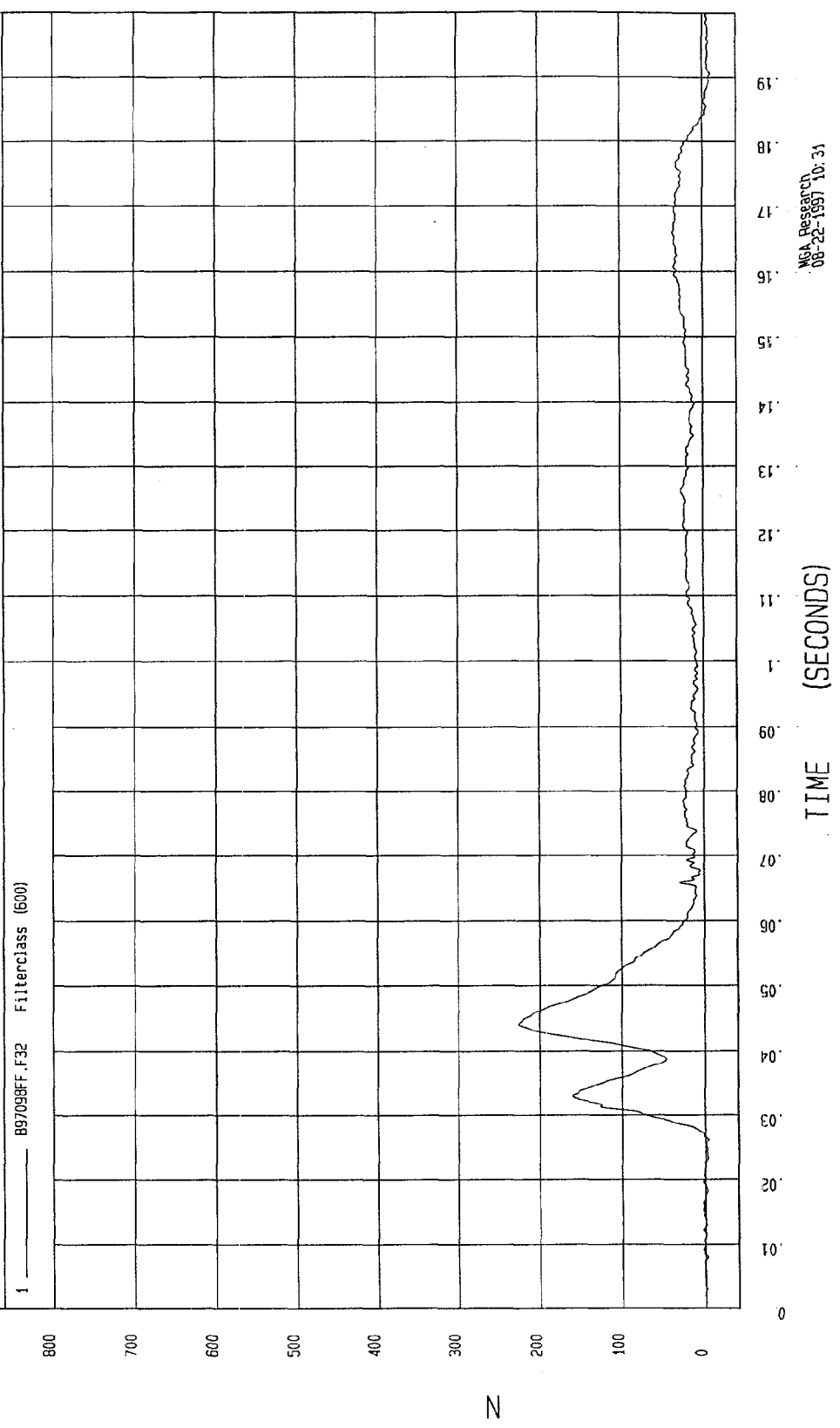
1 ——— B9709BDF.D60 Filterclass (500)



MSA Research
08-22-1997 10:30

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH
Minimum = -10.02 N at 191 msec Maximum = 225.87 N at 44 msec

DRIVER FRONT ABDOMINAL FORCE

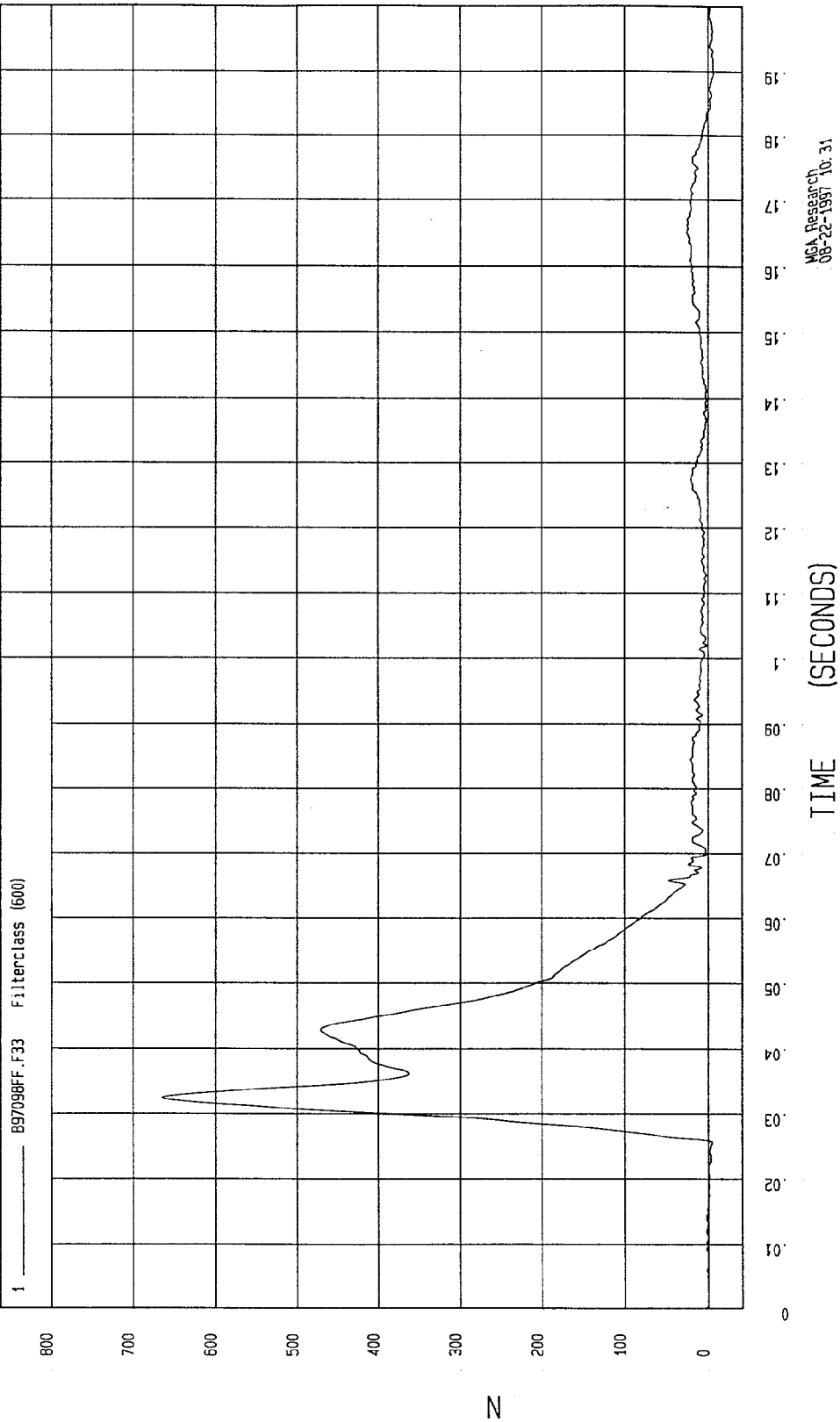


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -6.34 N at 190 msec Maximum = 665.90 N at 32 msec

DRIVER MID ABDOMINAL FORCE



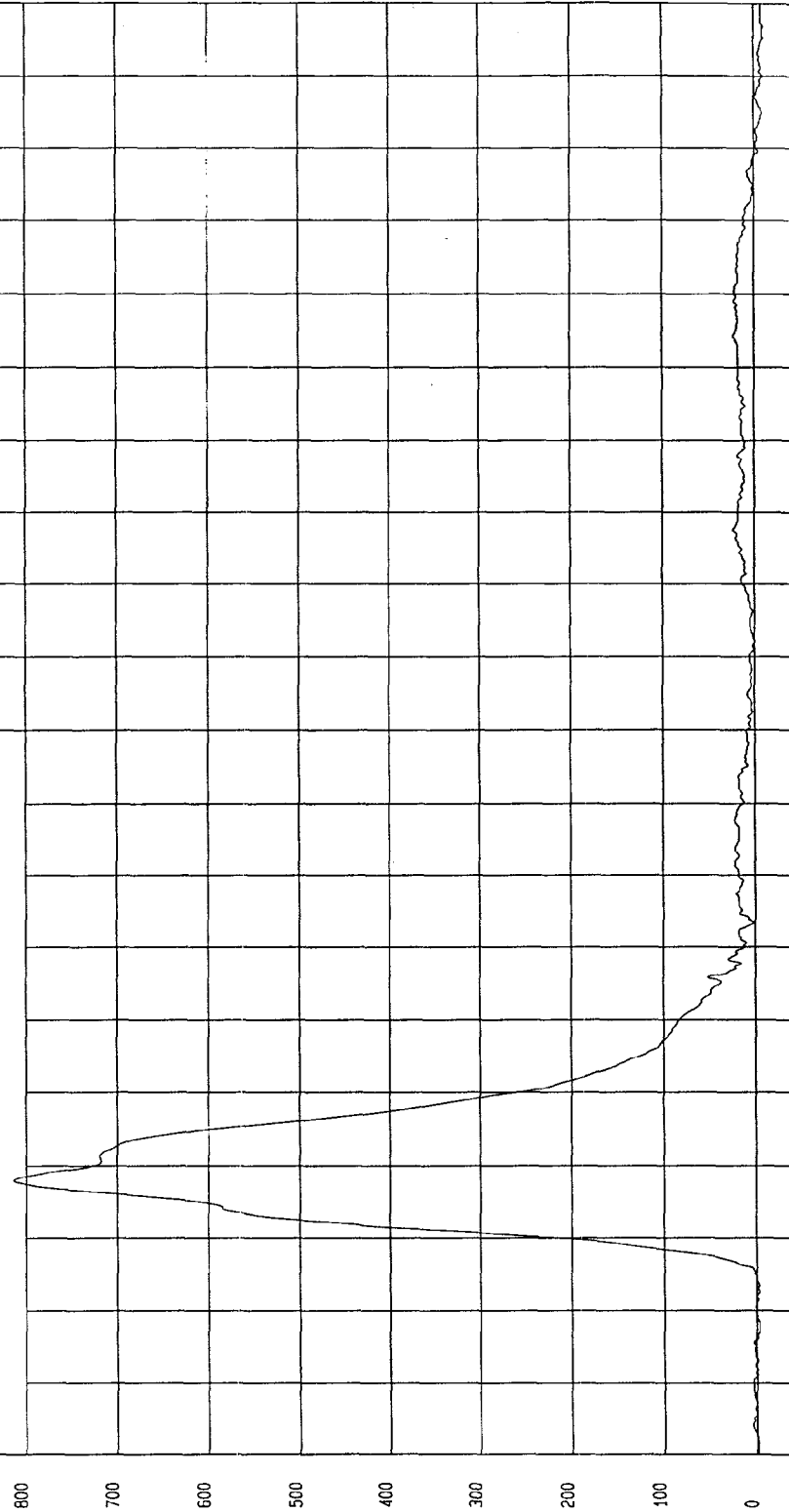
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -10.23 N at 195 msec Maximum = 813.92 N at 38 msec

DRIVER REAR ABDOMINAL FORCE

1 ——— B97098FF.F34 Filterclass (500)



MCA Research
08-22-1997 10:31

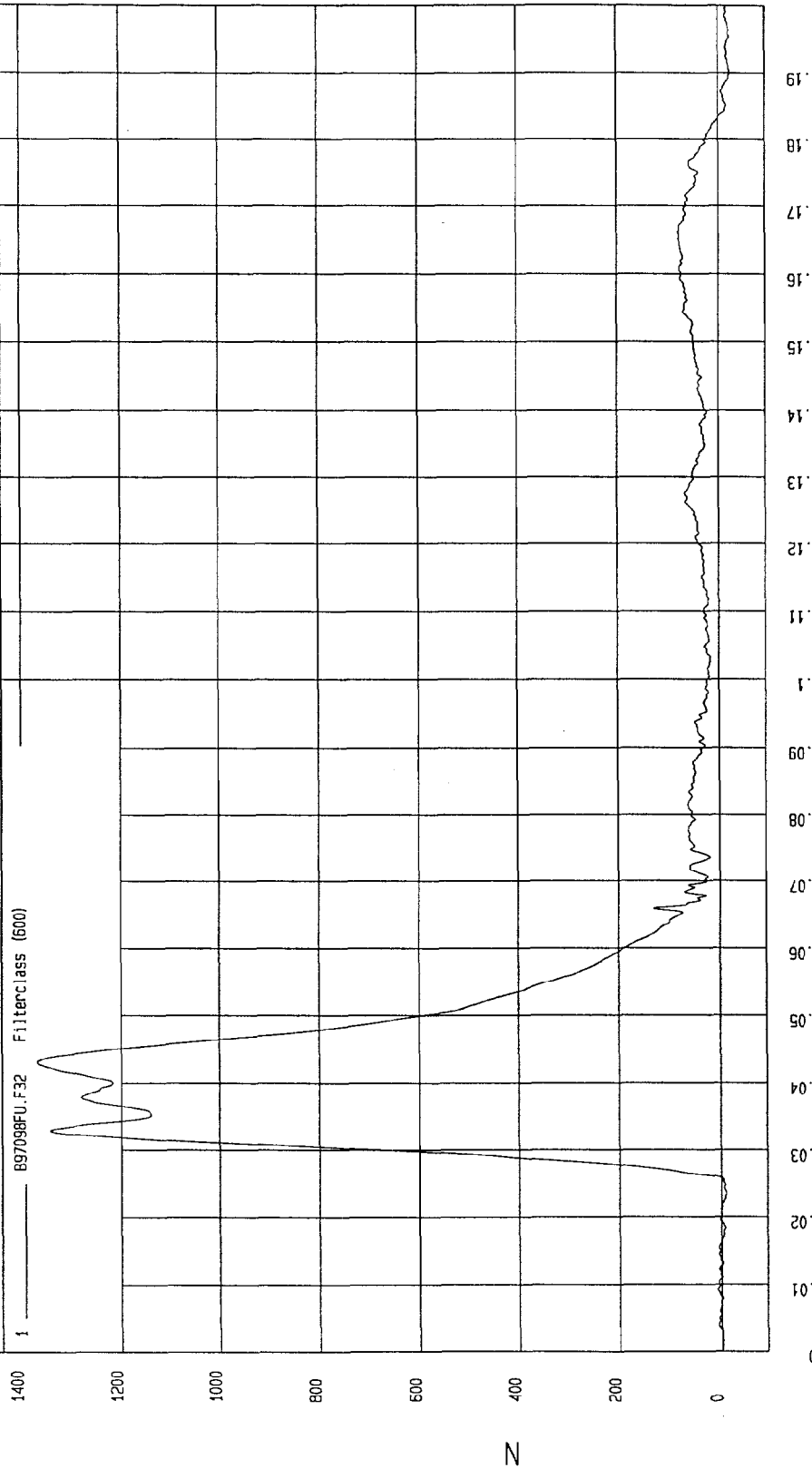
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -22.76 N at 190 msec Maximum = 1388.93 N at 43 msec

SUM OF DRIVER ABDOMINAL FORCES

1 897098FU.F32 Filterclass (500)

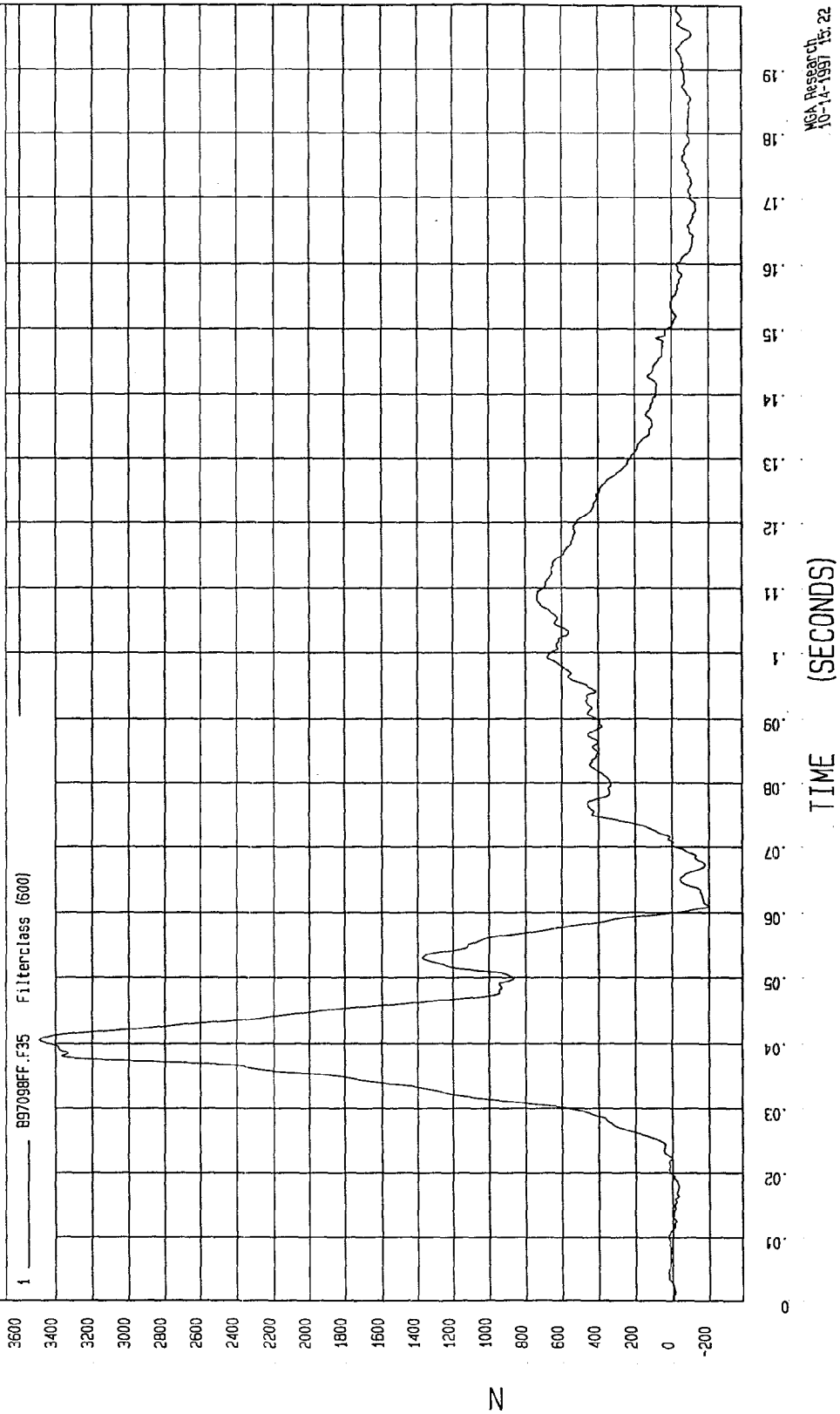


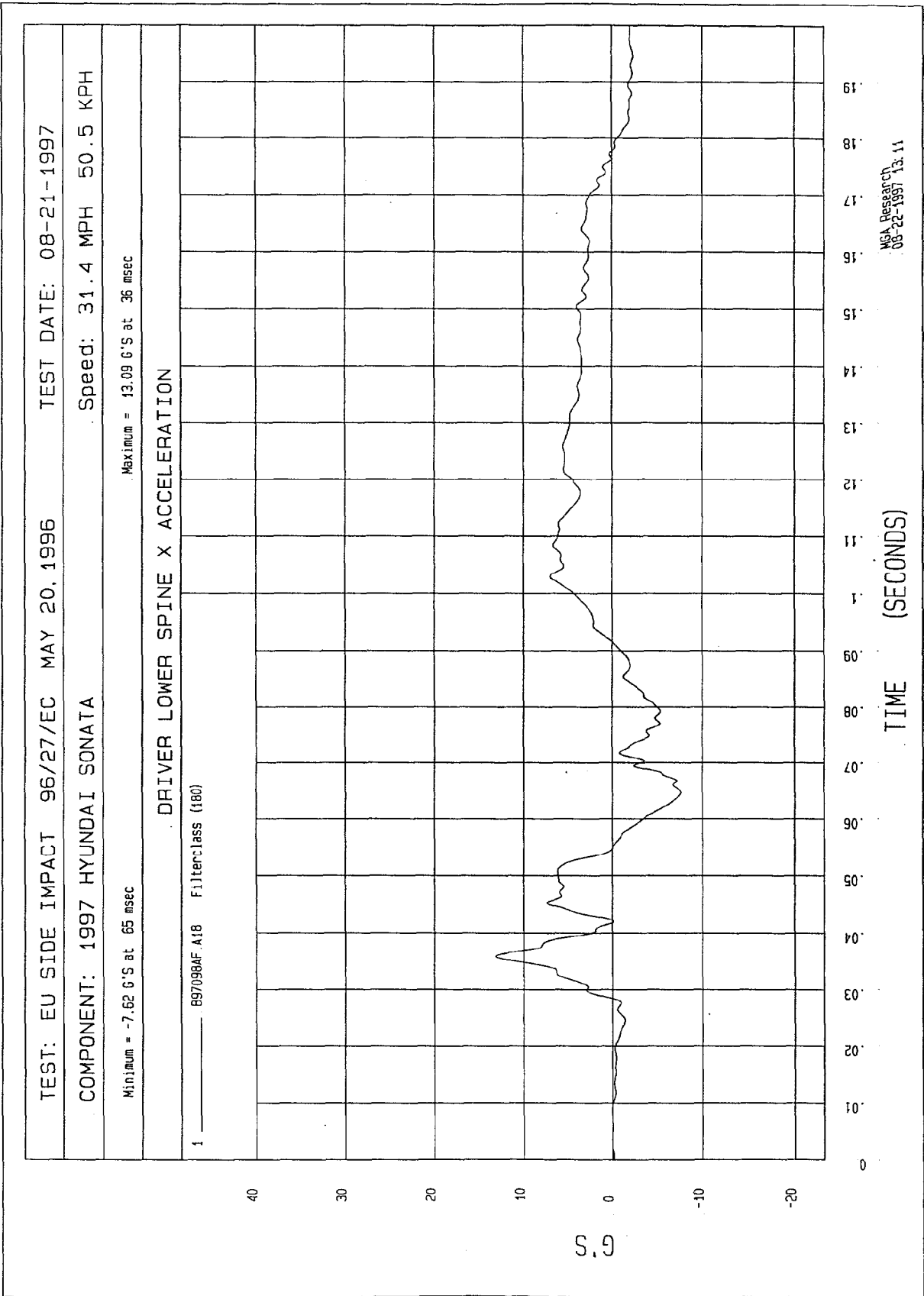
MGA Research
08-22-1997 10:31

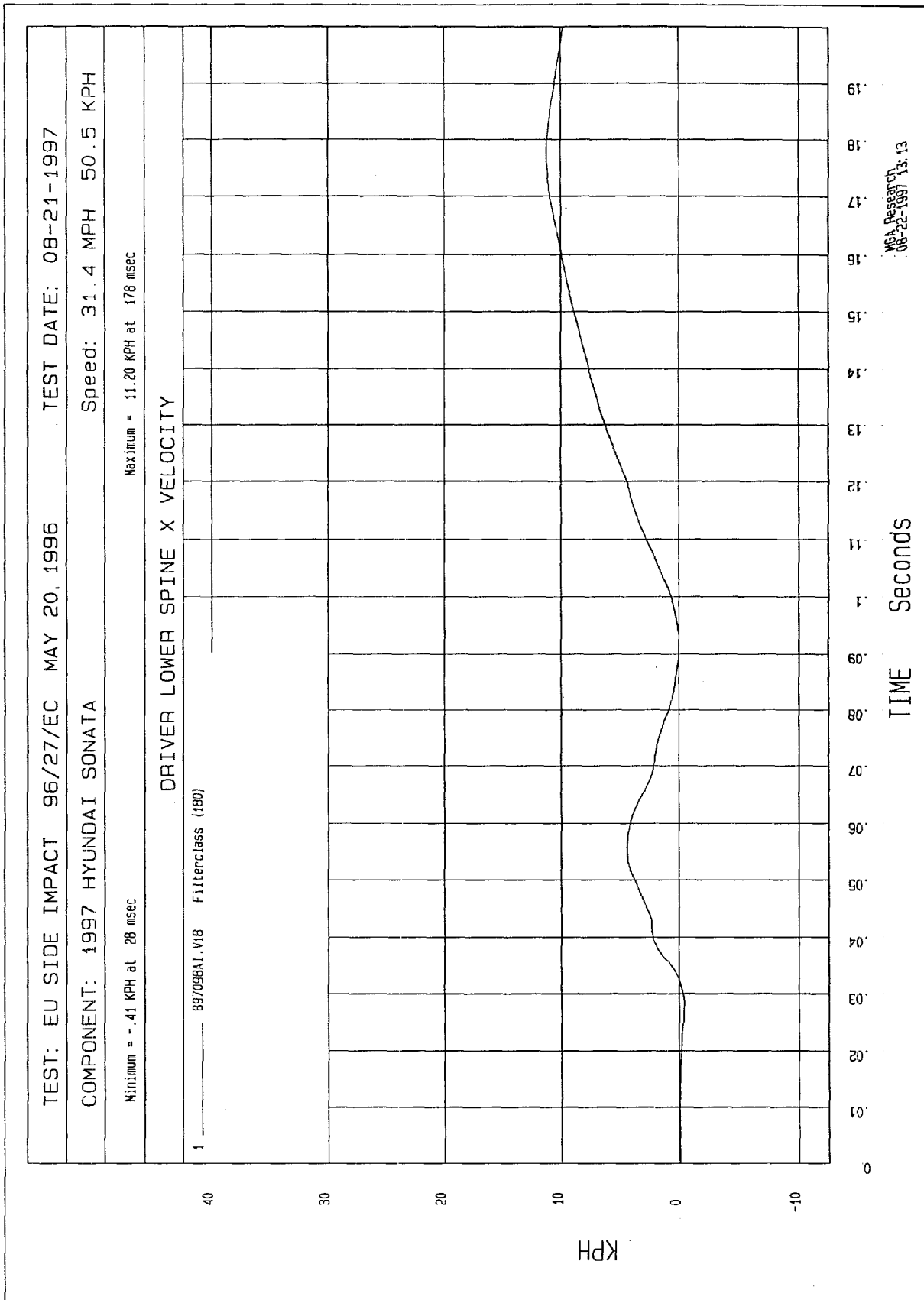
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -196.89 N at 61 msec Maximum = 3490.14 N at 40 msec

DRIVER PUBIC SYMPHYSIS FORCE





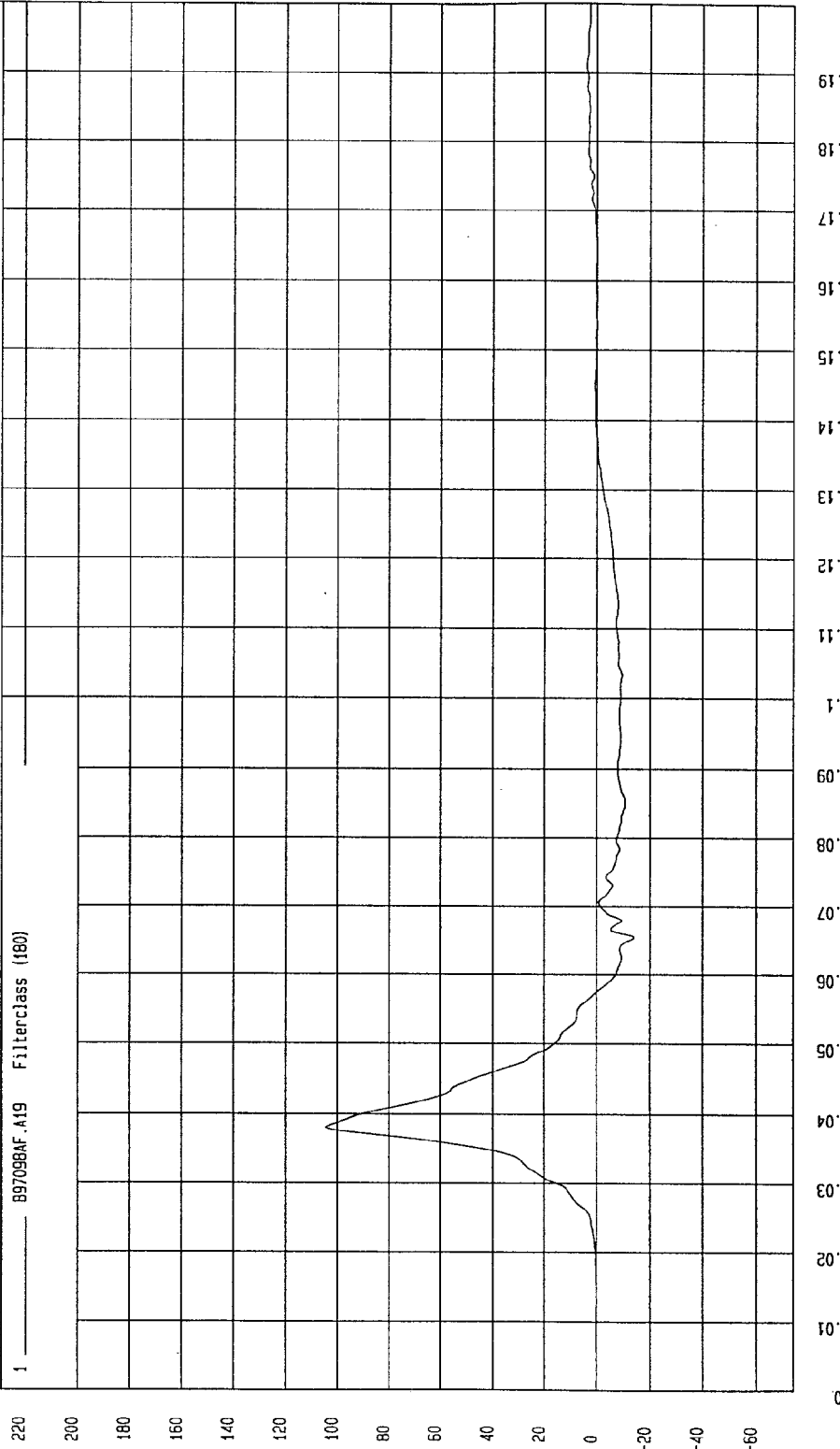


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -13.91 G'S at 65 msec Maximum = 104.36 G'S at 38 msec

DRIVER LOWER SPINE Y ACCELERATION

1 897098AF.A19 Filterclass (180)



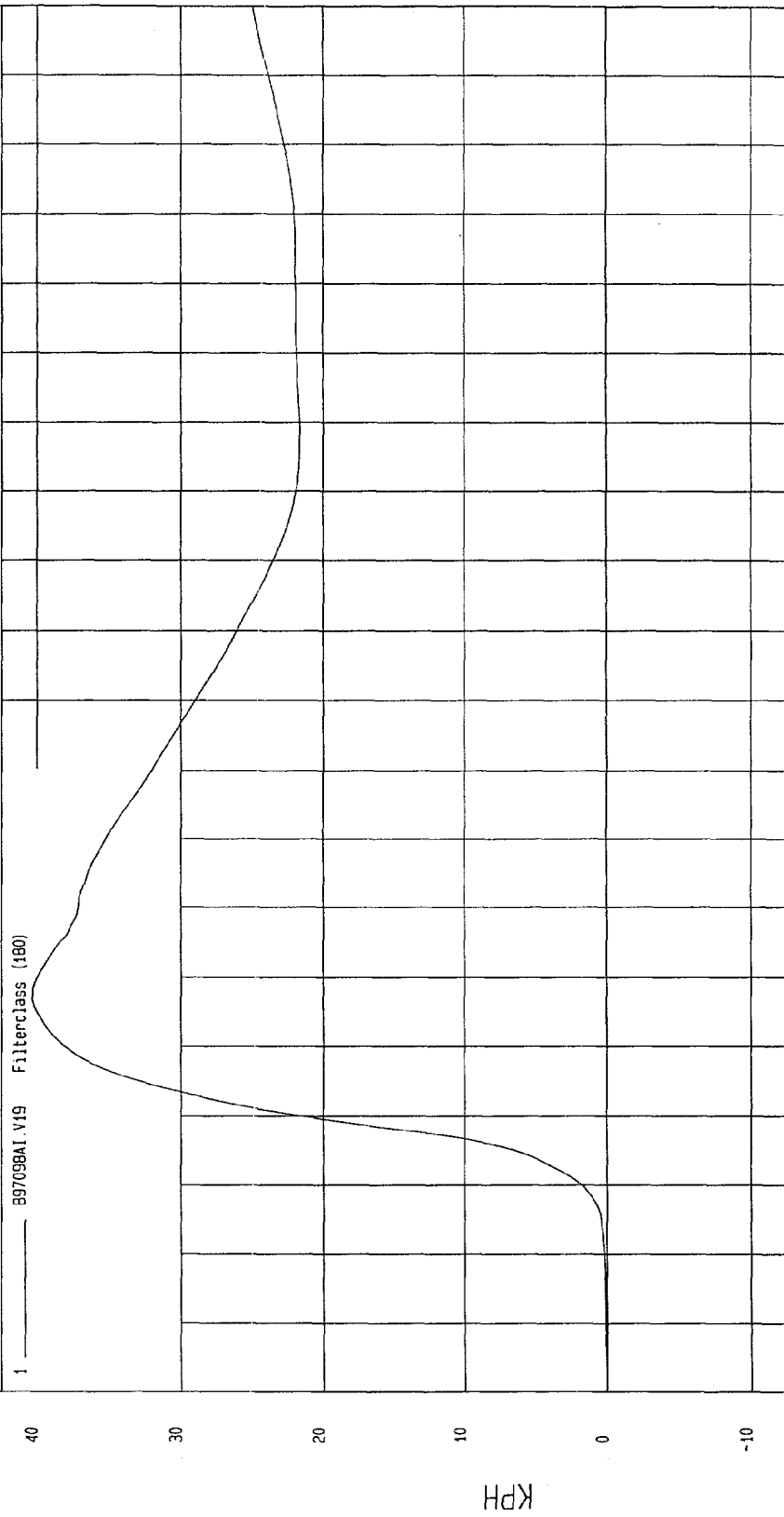
WEA Research
08-22-1997 14:06

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 0 KPH at -20 msec Maximum = 40.31 KPH at 58 msec

DRIVER LOWER SPINE Y VELOCITY



MOA Research
08-22-1997 13.14

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -5.28 G'S at 65 msec Maximum = 11.37 G'S at 36 msec

DRIVER LOWER SPINE Z ACCELERATION

1 B97098AF.A20 Filterclass (180)

G.S

40

30

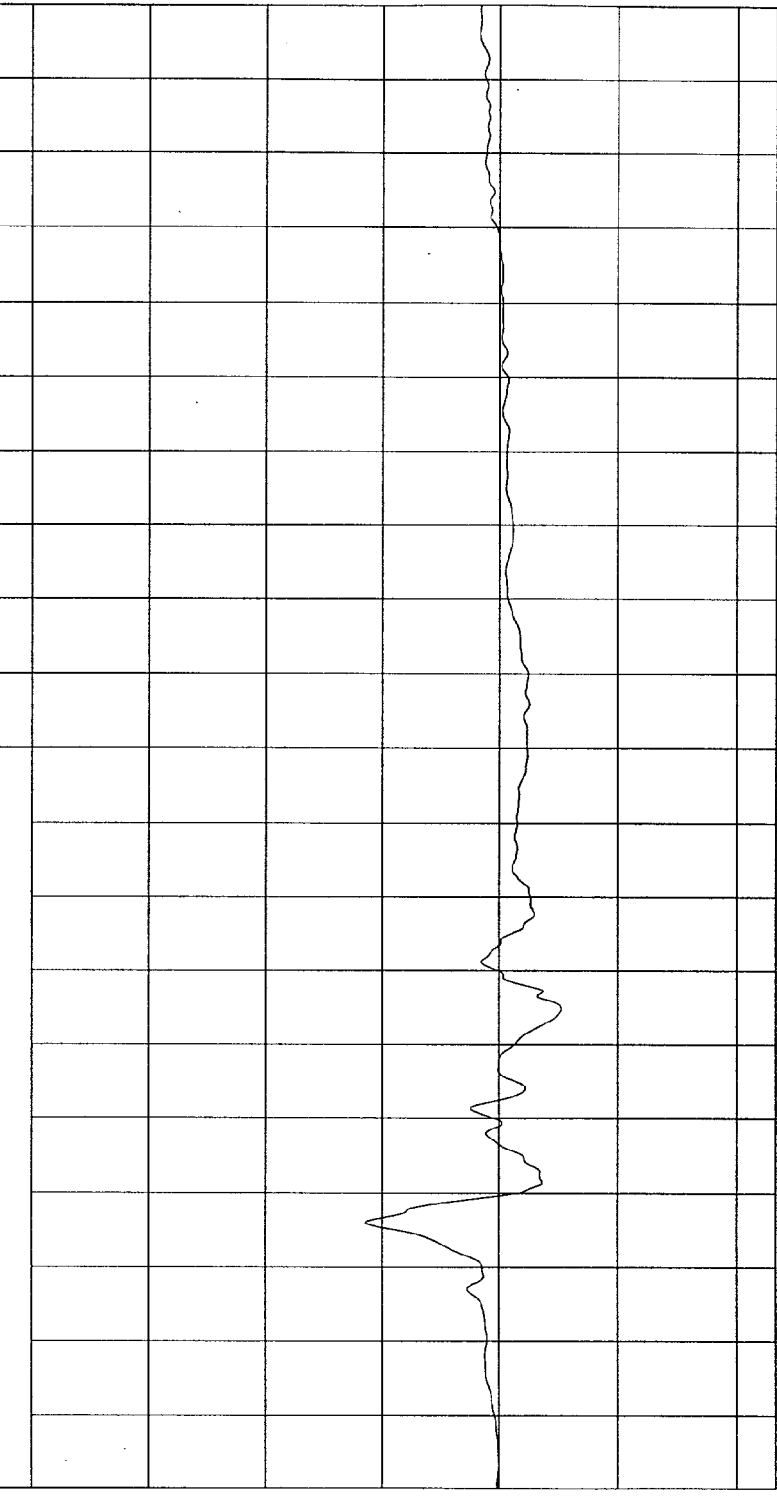
20

10

0

-10

-20



NSA Research
08-22-1997 13:11

TIME (SECONDS)

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.68 KPH at 167 msec Maximum = 2.96 KPH at 40 msec

DRIVER LOWER SPINE Z VELOCITY

1 897098AI.V20 Filterclass (180)

40

30

20

10

0

-10

KPH

0 .01 .02 .03 .04 .05 .06 .07 .08 .09 .1 .11 .12 .13 .14 .15 .16 .17 .18 .19

TIME Seconds

MCA Research
08-22-1997 13:14

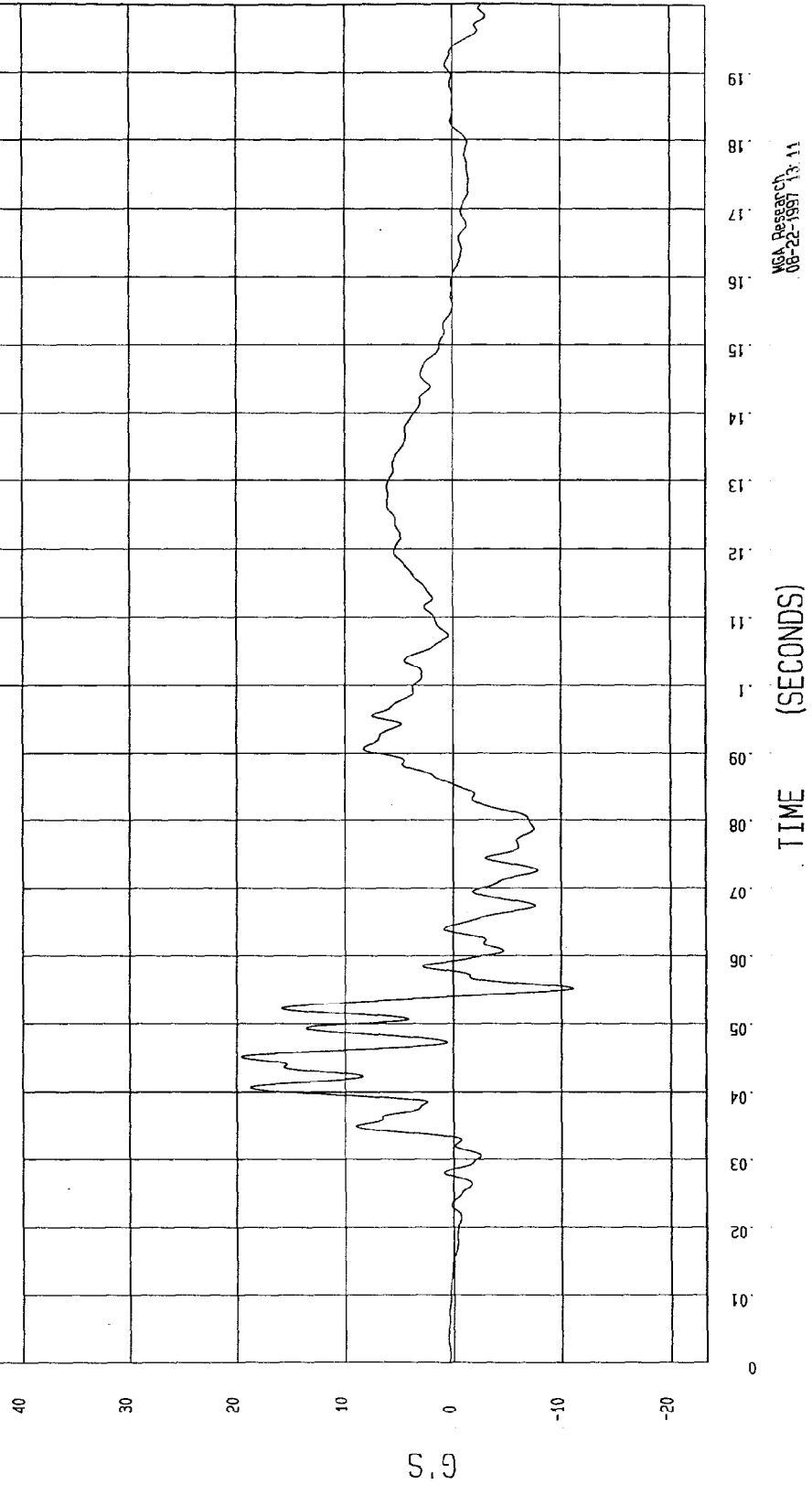
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -11.03 G'S at 55 msec Maximum = 13.57 G'S at 45 msec

DRIVER PELVIS X ACCELERATION

1 89709BAF.A45 FilterClass (180)



NSA Research
08-22-1997 13:11

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.65E-02 KPH at 33 msec Maximum = 11.60 KPH at 160 msec

DRIVER PELVIS X VELOCITY

1 _____ B97098A1.V45 Filterclass (160)

40

30

20

10

0

-10

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

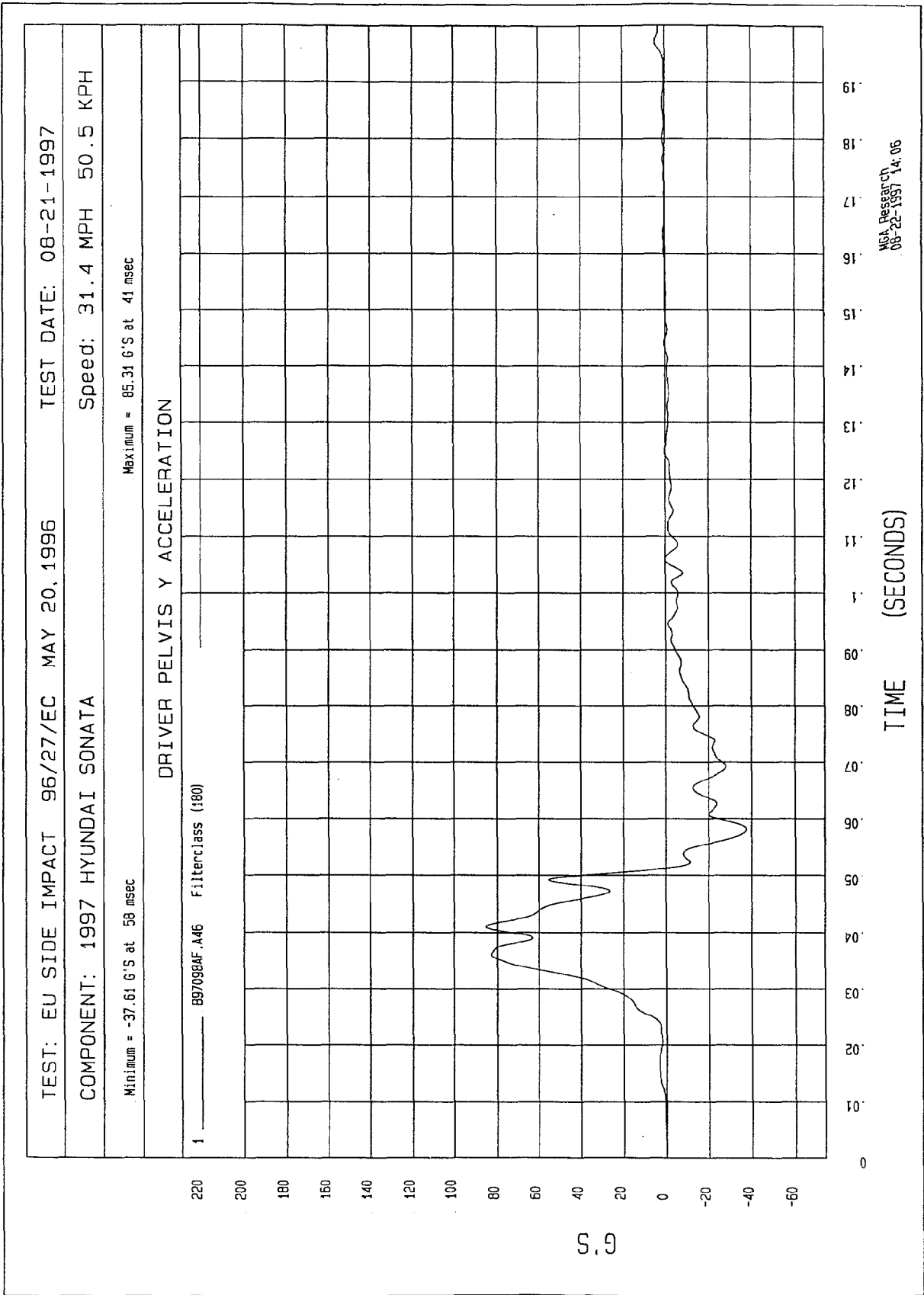
02

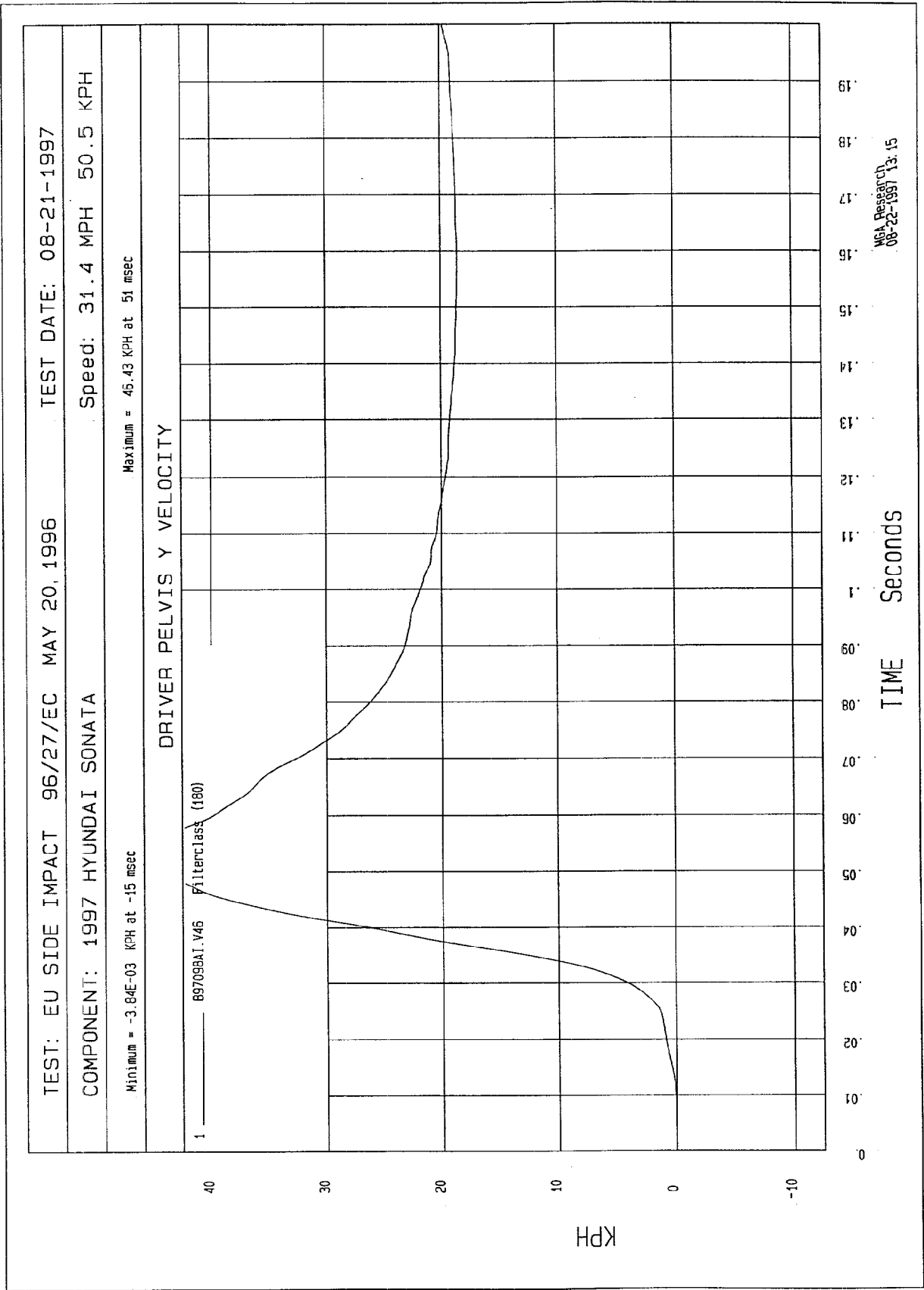
01

0

TIME Seconds

NCA Research
08-22-1997 13:15





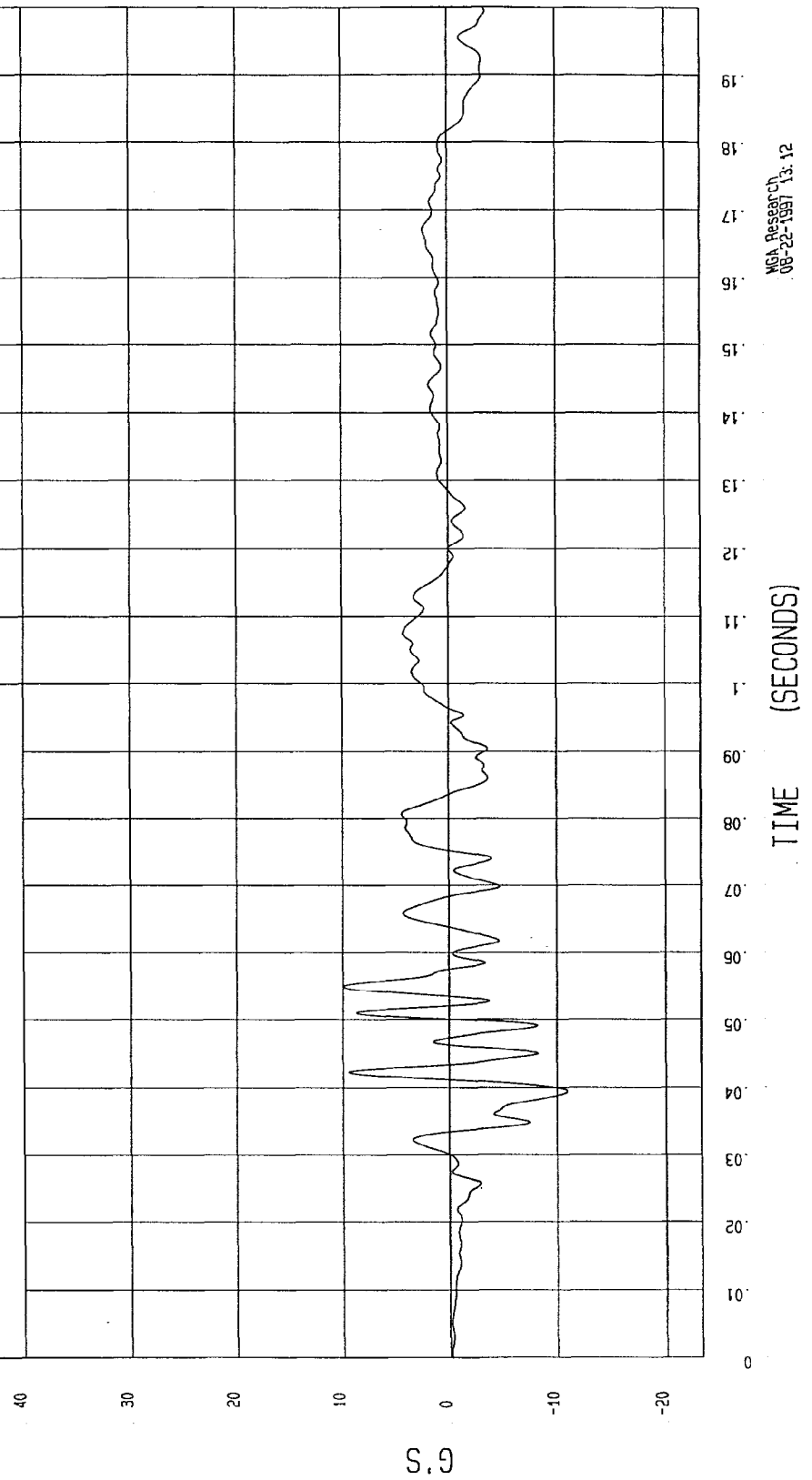
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

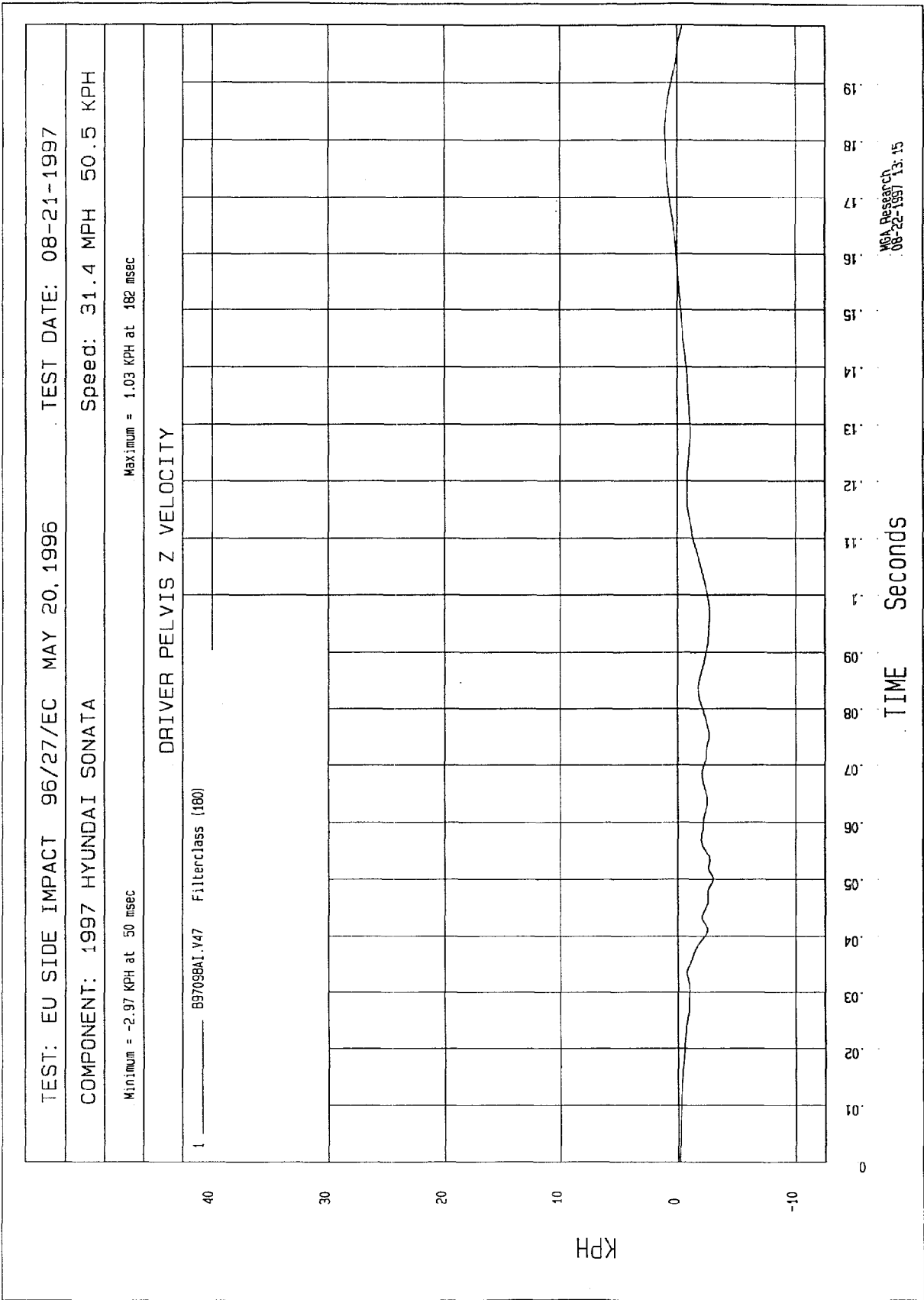
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -10.96 G'S at 40 msec Maximum = 9.98 G'S at 55 msec

DRIVER PELVIS Z ACCELERATION

1 ——— B97098AF.A47 Filterclass (180)





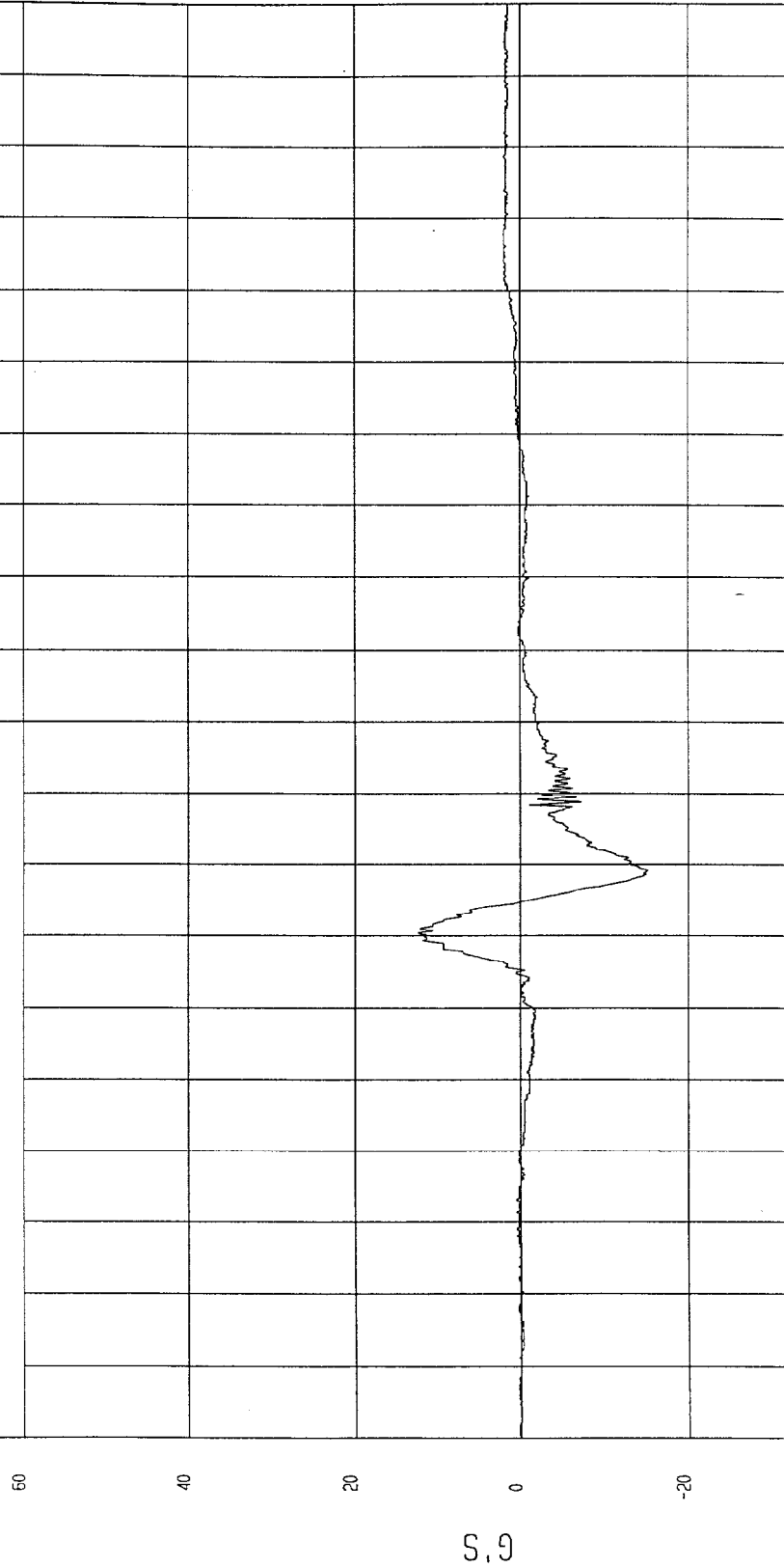
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -15.21 G'S at 79 msec
Maximum = 12.29 G'S at 70 msec

PASSENGER HEAD X ACCELERATION

1 _____ 097090AT.A22 Filterclass (1000)



NCA Research
08-12-1998 11.03

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -4.73 KPH at 139 msec Maximum = 1.69 KPH at 75 msec

REAR PASSENGER HEAD X VELOCITY

1 B97098A1.V22 Filterclass (1000)

KPH

TIME Seconds

NEA Research
10-15-1997 13:49

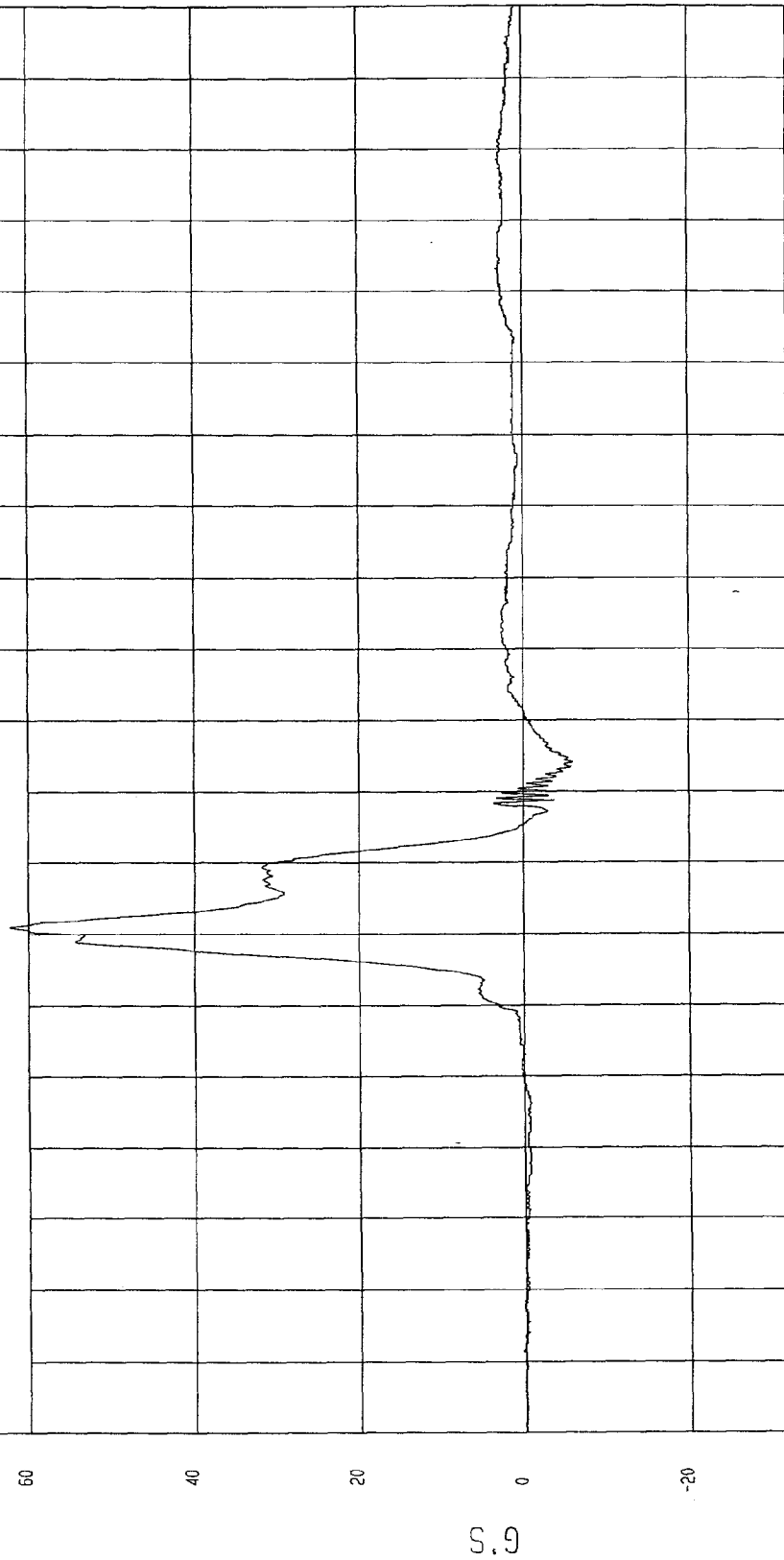
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -6.05 G'S at 94 msec
Maximum = 62.30 G'S at 71 msec

PASSENGER HEAD Y ACCELERATION

1 _____ .B9709BAT.A23 Filterclass (1000)



WGA Research
04-12-1996 11:03

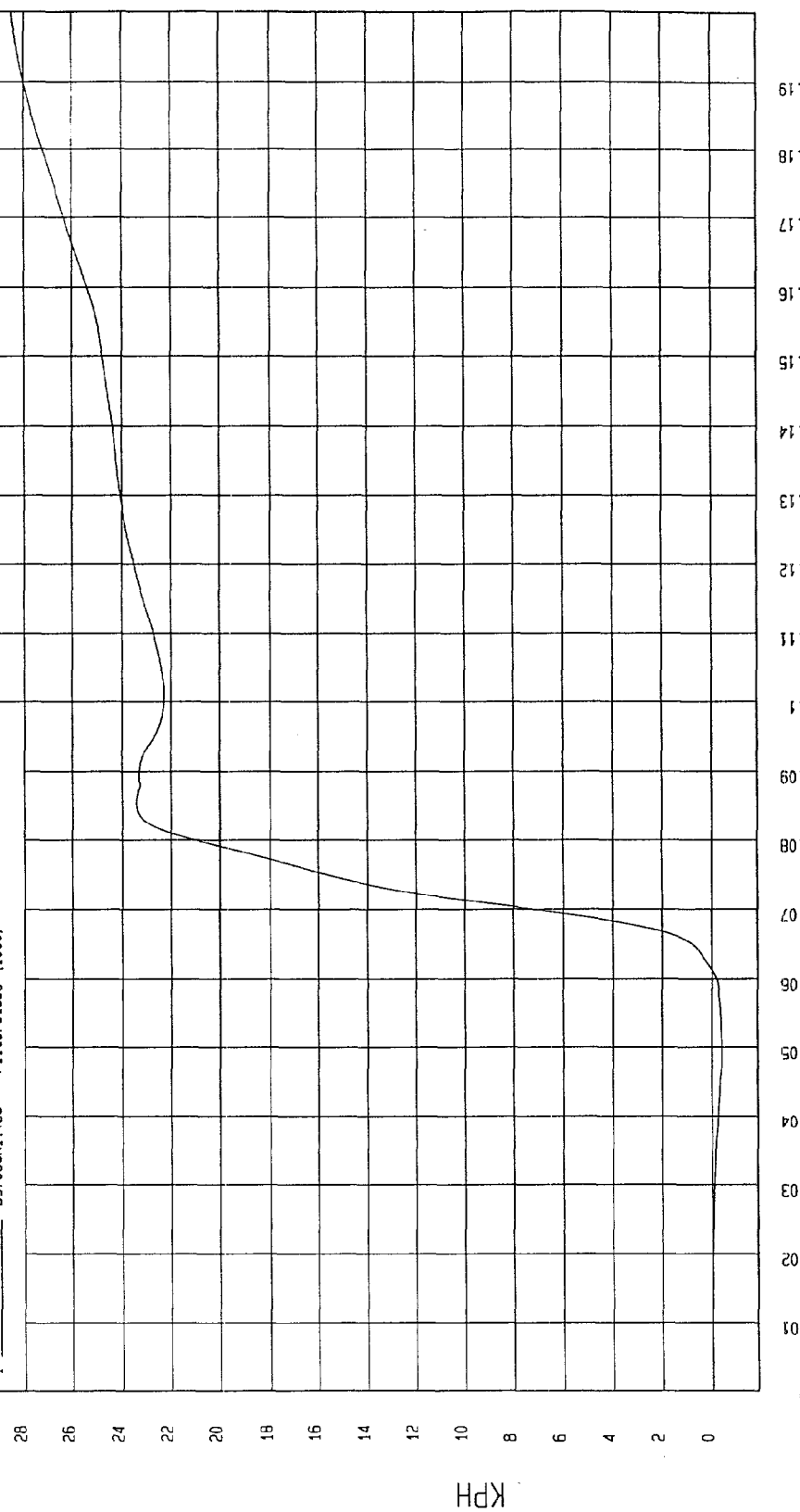
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -39 KPH at 49 msec Maximum = 28.51 KPH at 200 msec

REAR PASSENGER HEAD Y VELOCITY

1 B97098AI.V23 Filterclass (1000)



MCA Research
10-15-1997 13.49

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

SPEED: 31.4 MPH 50.5 KPH

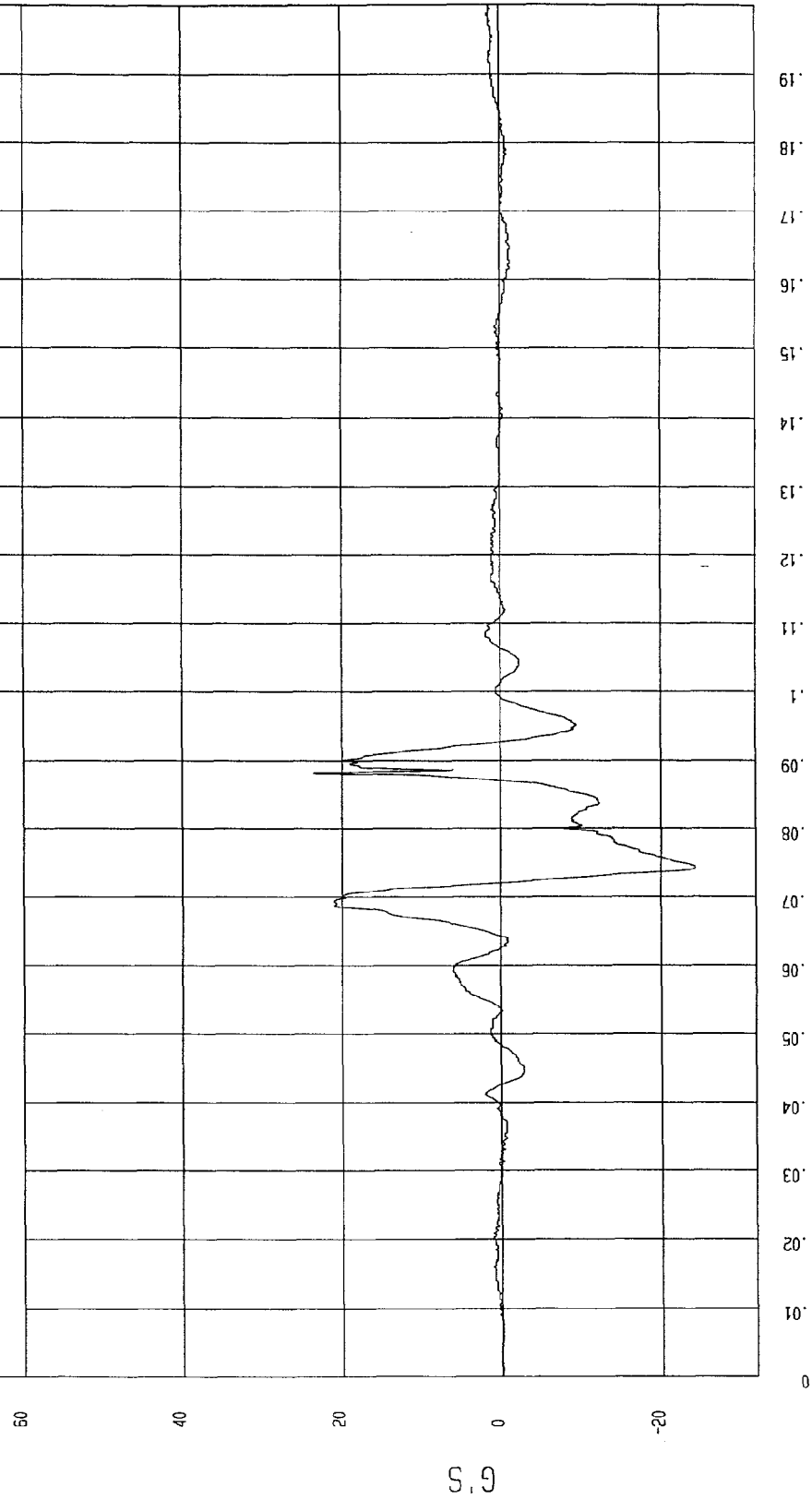
Maximum = 23.61 G'S at 88 msec

Minimum = -24.15 G'S at 74 msec

COMPONENT: 1997 HYUNDAI SONATA

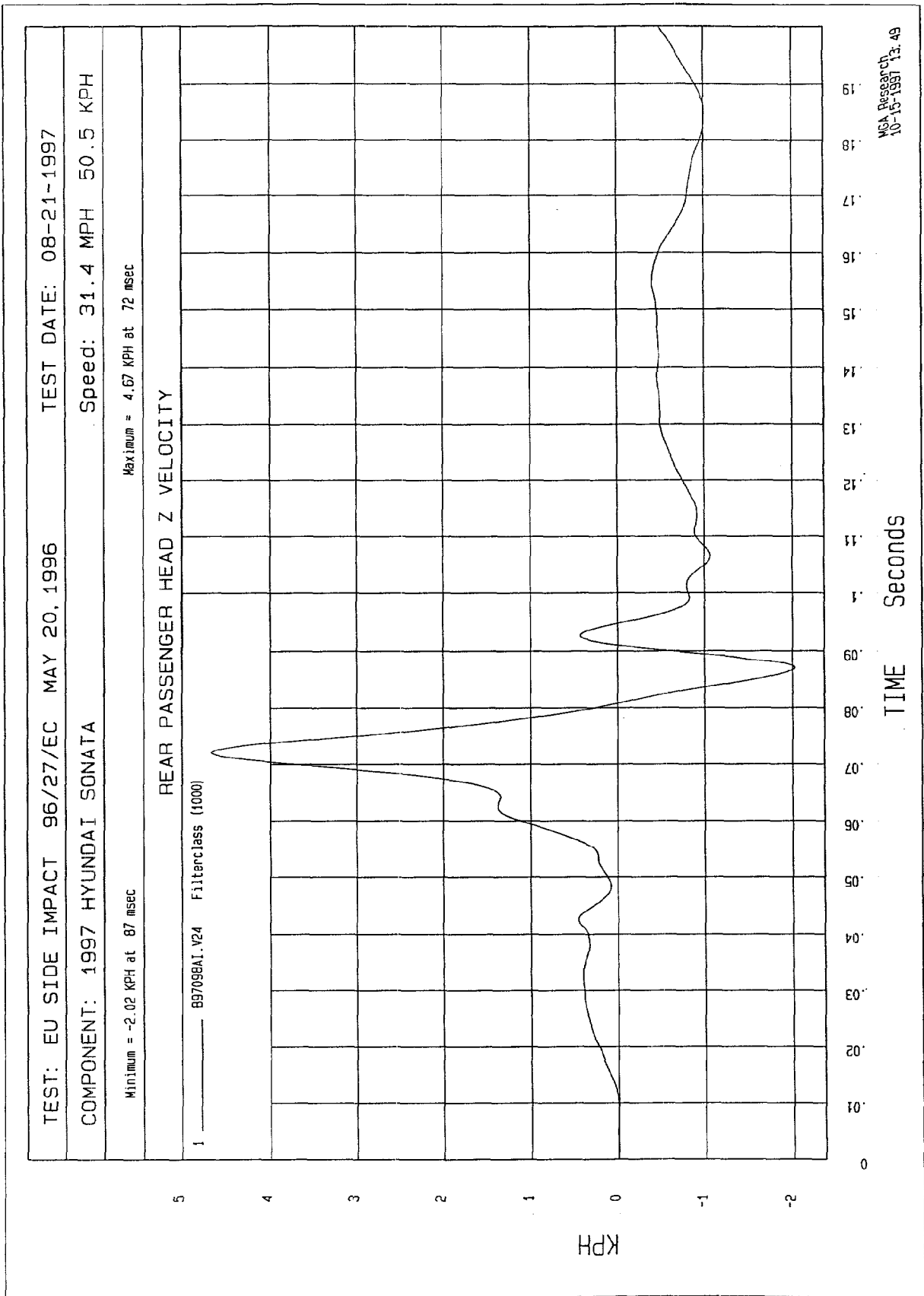
PASSENGER HEAD Z ACCELERATION

1 ——— B97098AT.A24 Filterclass (1000)



TIME (SECONDS)

MOA Research
08-21-1997 11:04



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

SPEED: 31.4 MPH 50.5 KPH

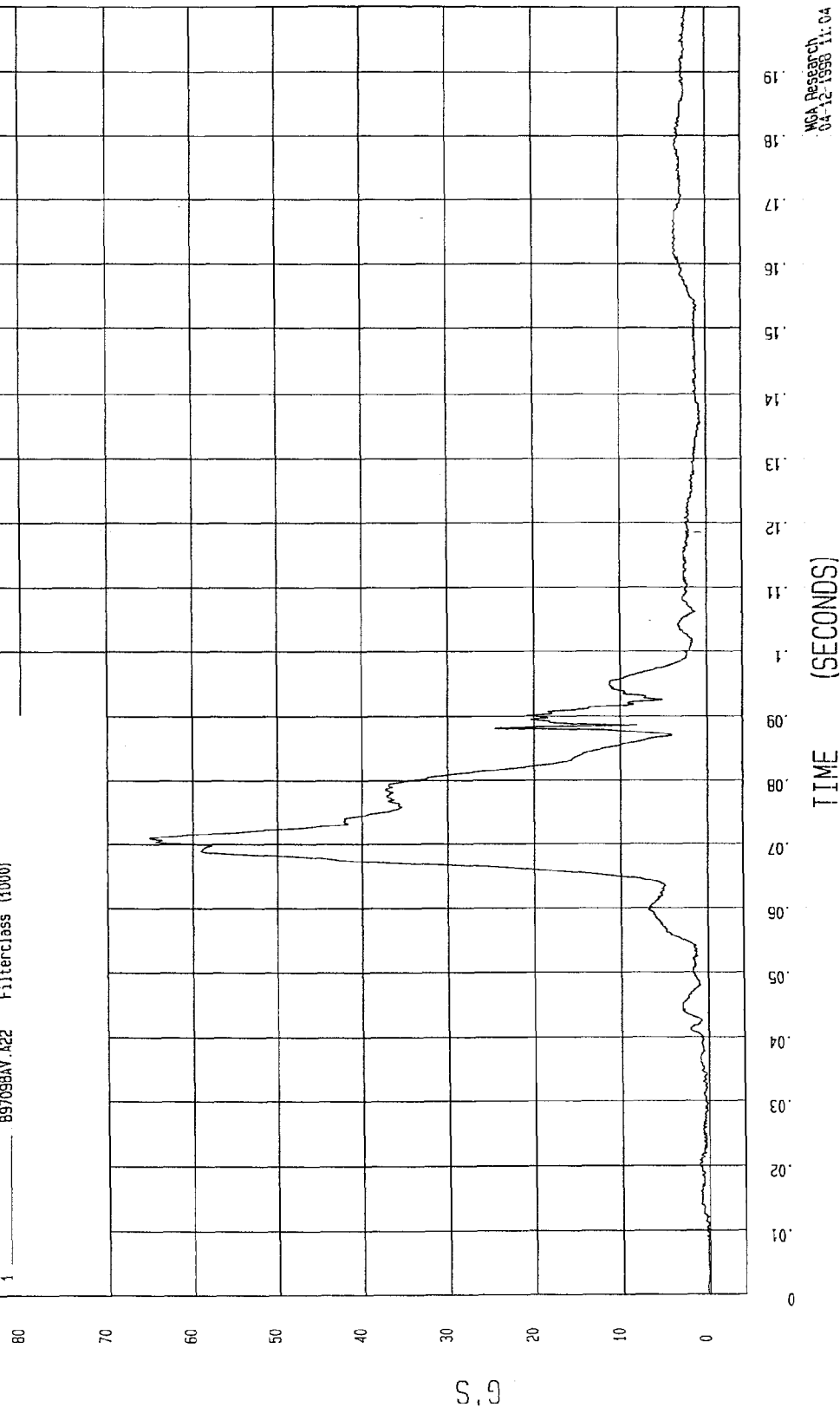
COMPONENT: 1997 HYUNDAI SONATA

Maximum = 65.10 G'S at 71 msec

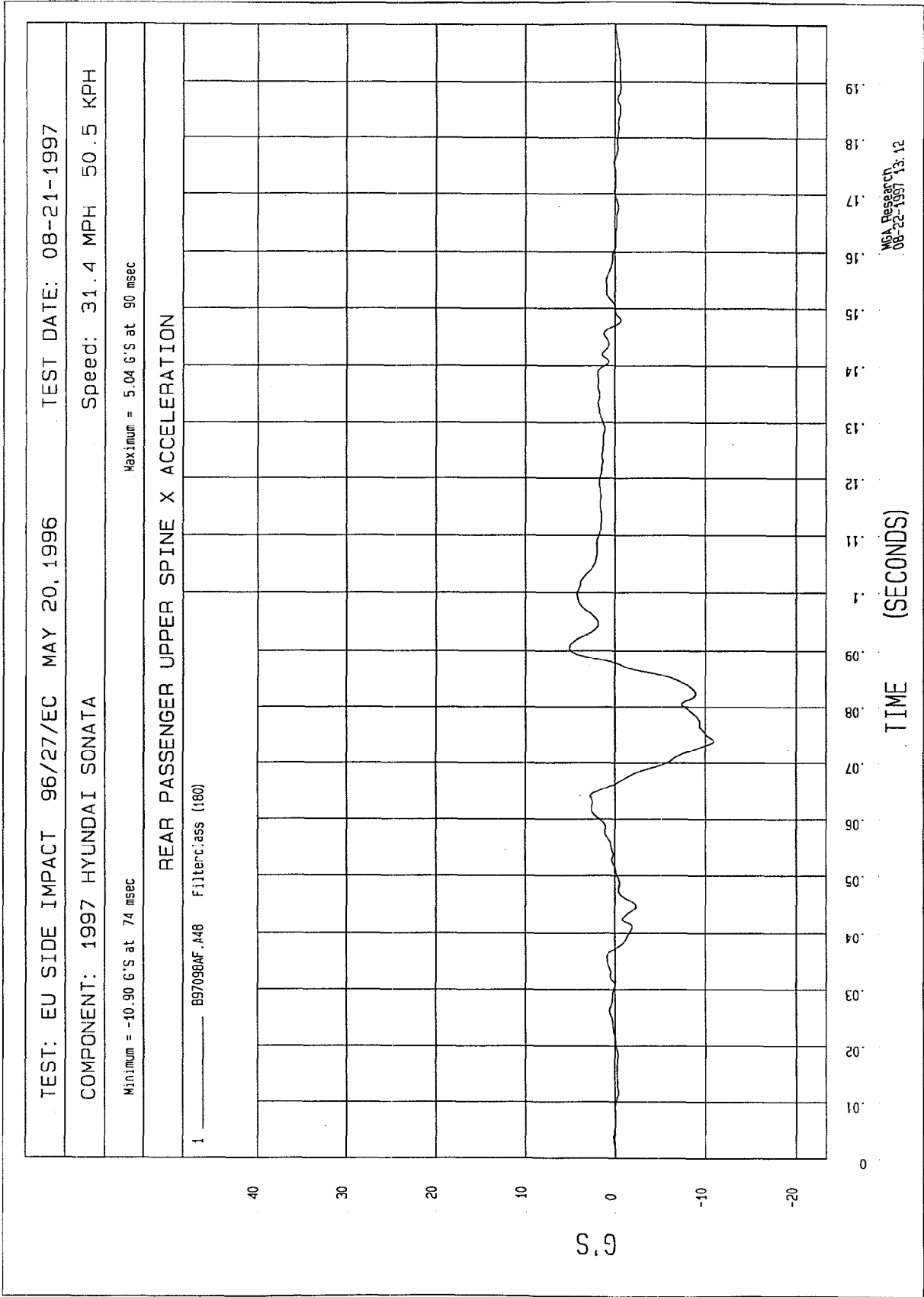
Minimum = .16 G'S at -20 msec

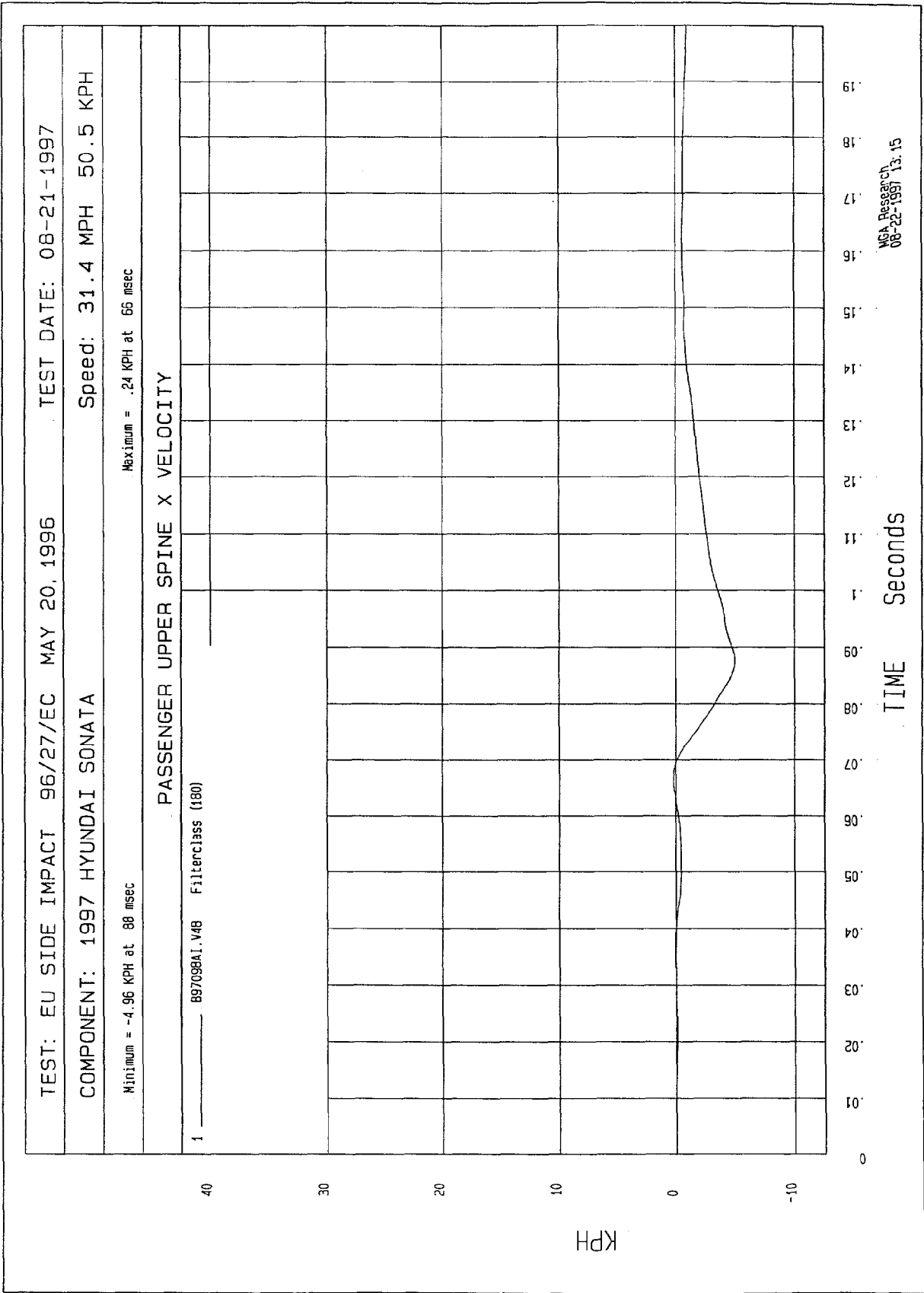
PASSENGER HEAD RESULTANT ACCELERATION

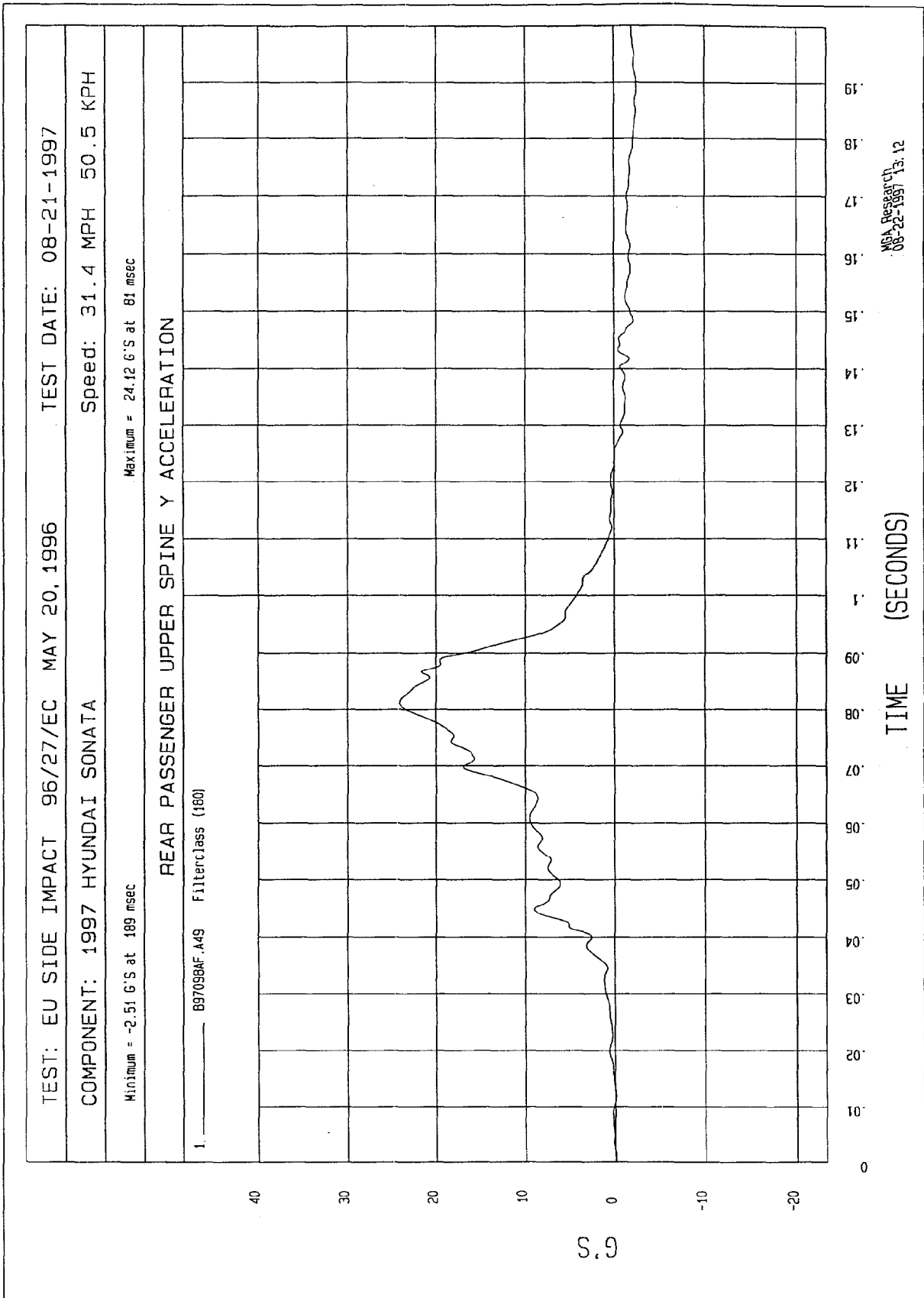
1 ——— B97098AV.A22 Filterclass (1000)

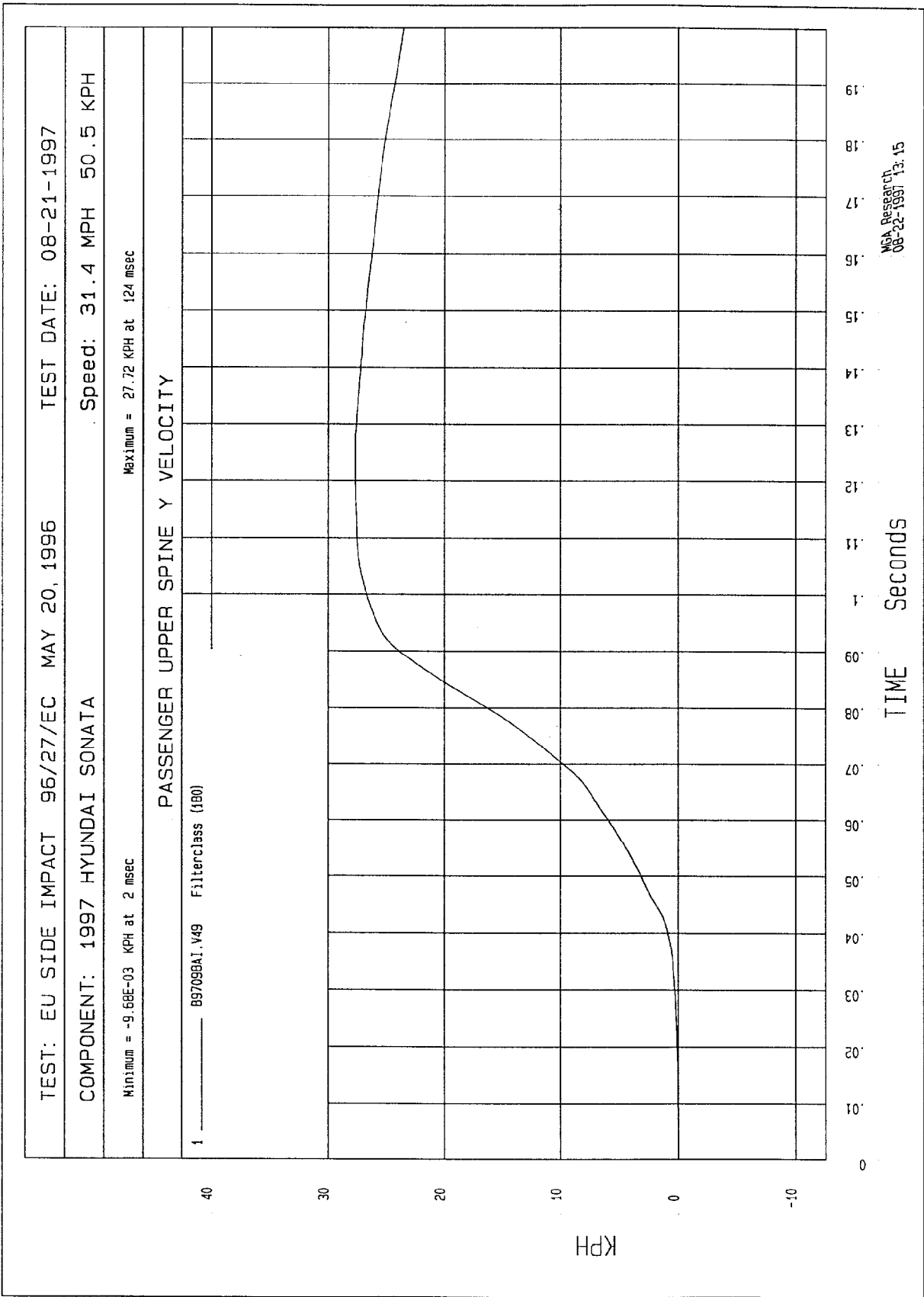


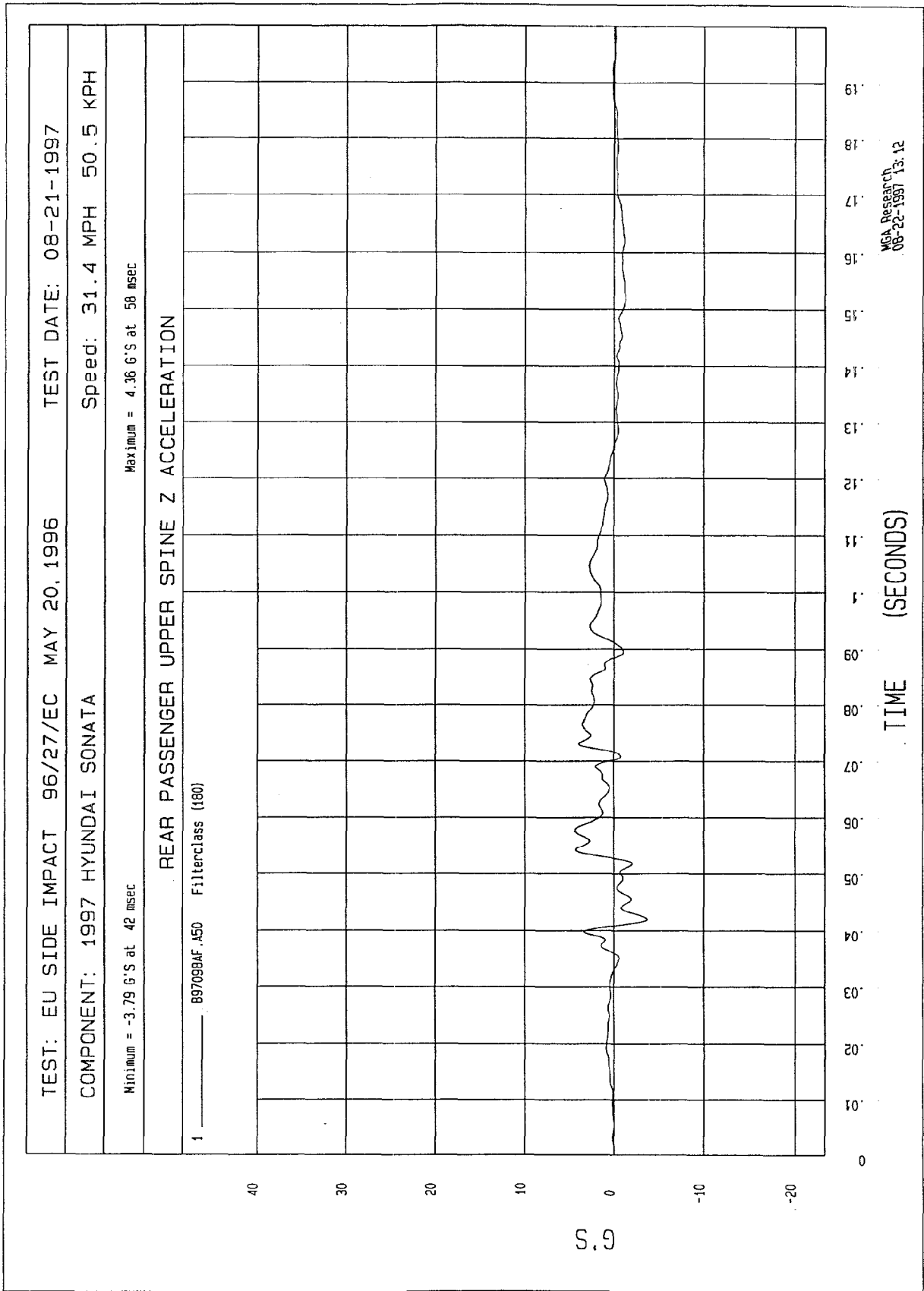
MCA Research
04-12-1996 11:04











TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -5.57E-03 KPH at -15 msec Maximum = 4.49 KPH at 126 msec

PASSENGER UPPER SPINE Z VELOCITY

1 897098AT.V50 Filterclass (180)

40

30

20

10

0

-10

KPH

19

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

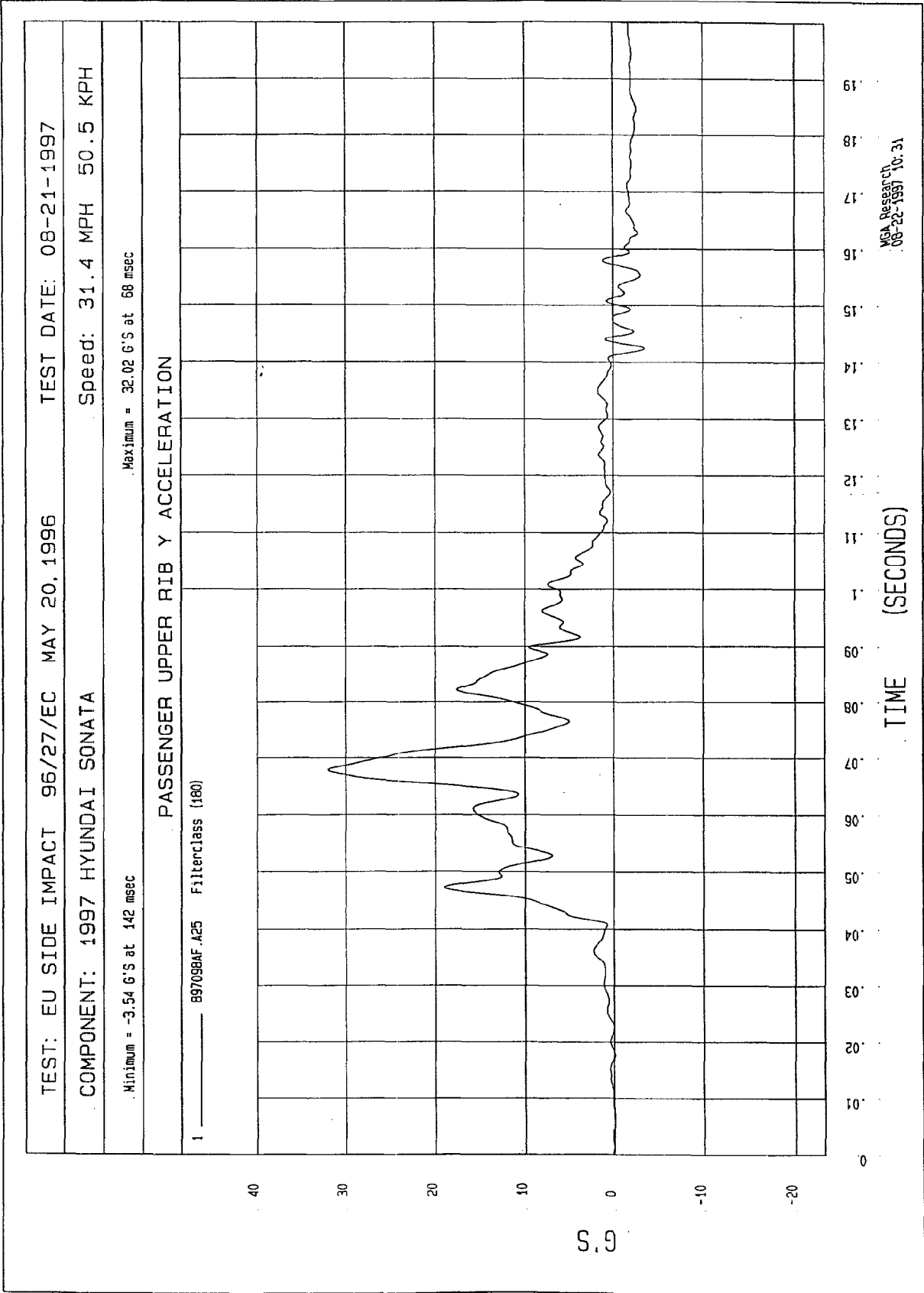
02

01

0

MCA Research
08-22-1997 13:15

TIME Seconds



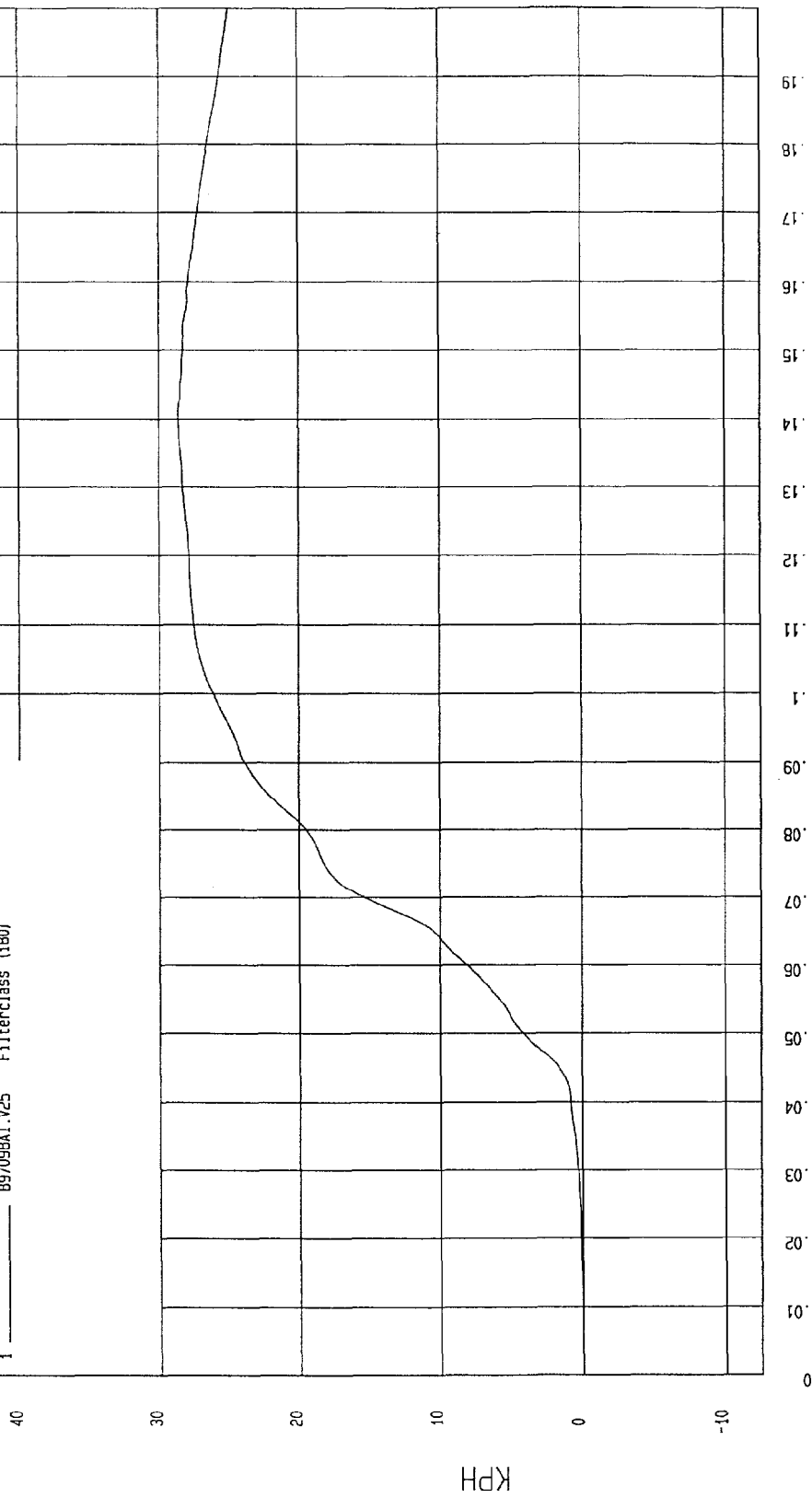
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.24E-02 KPH at -3 msec
Maximum = 28.61 KPH at 141 msec

PASSENGER UPPER RIB Y VELOCITY

1 ——— B9709BA1.V25 Filterclass (180)



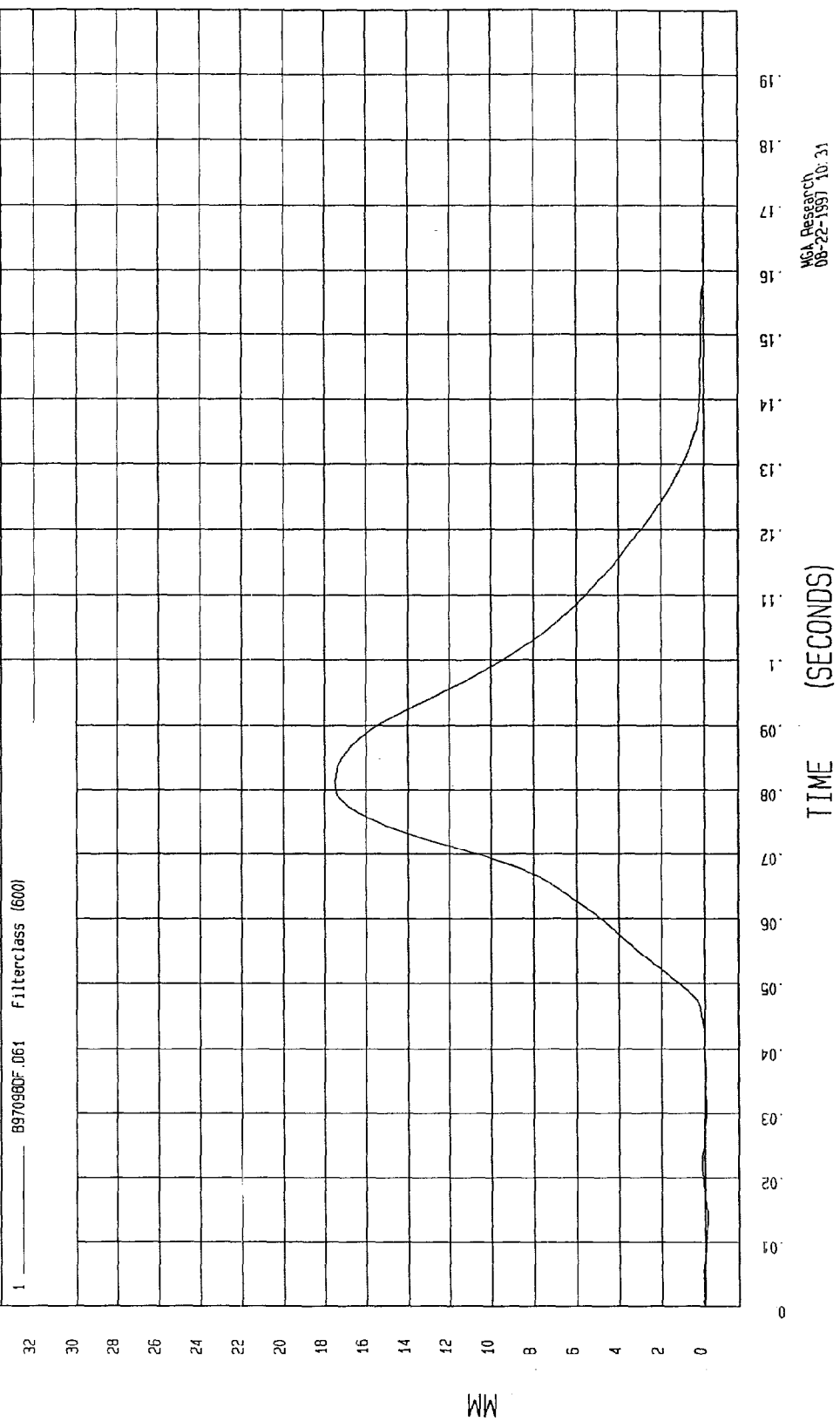
MSA Research
08-22-1997 13:14

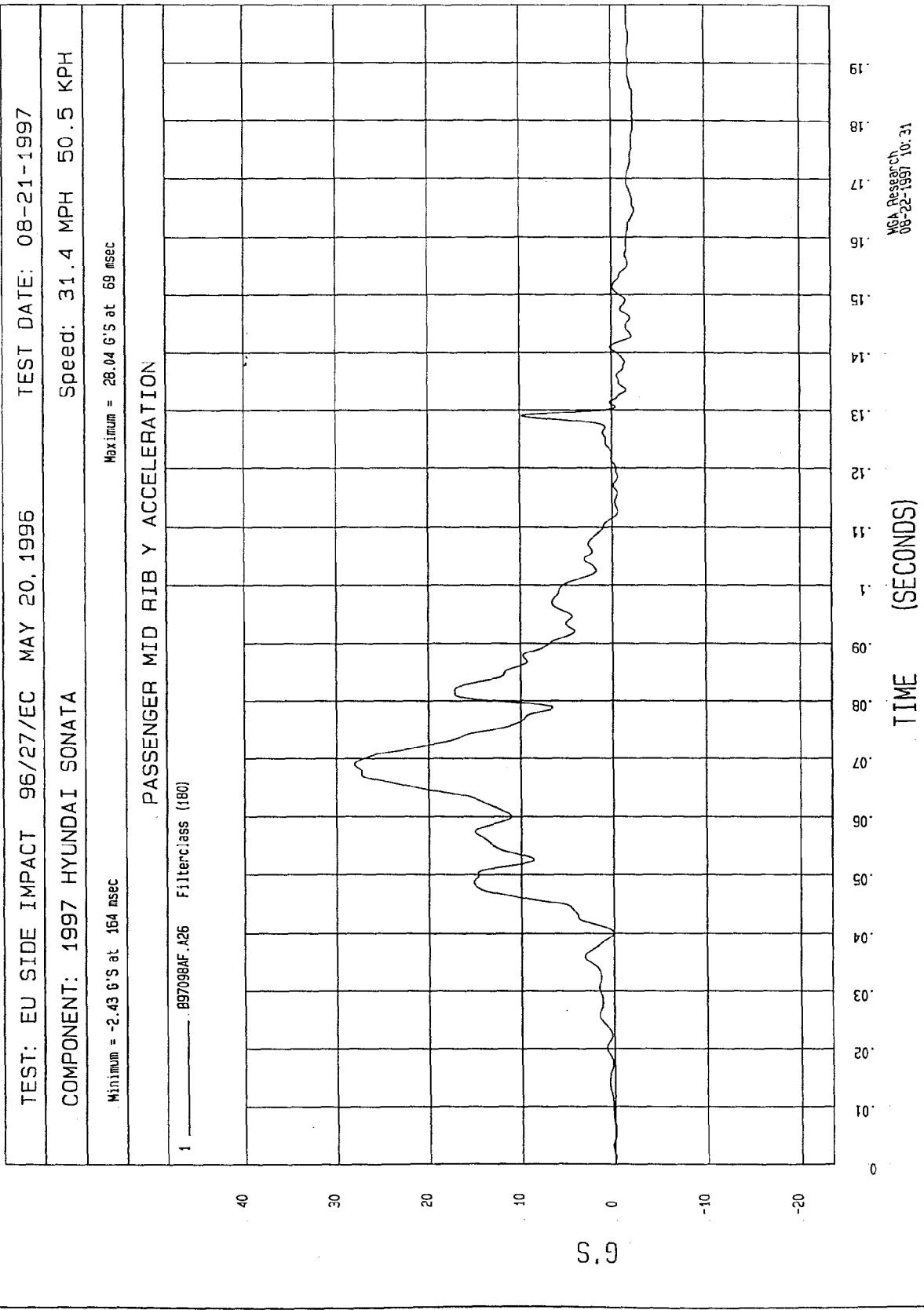
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -14 MM at 14 msec Maximum = 17.50 MM at 81 msec

PASSENGER UPPER RIB Y DISPLACEMENT





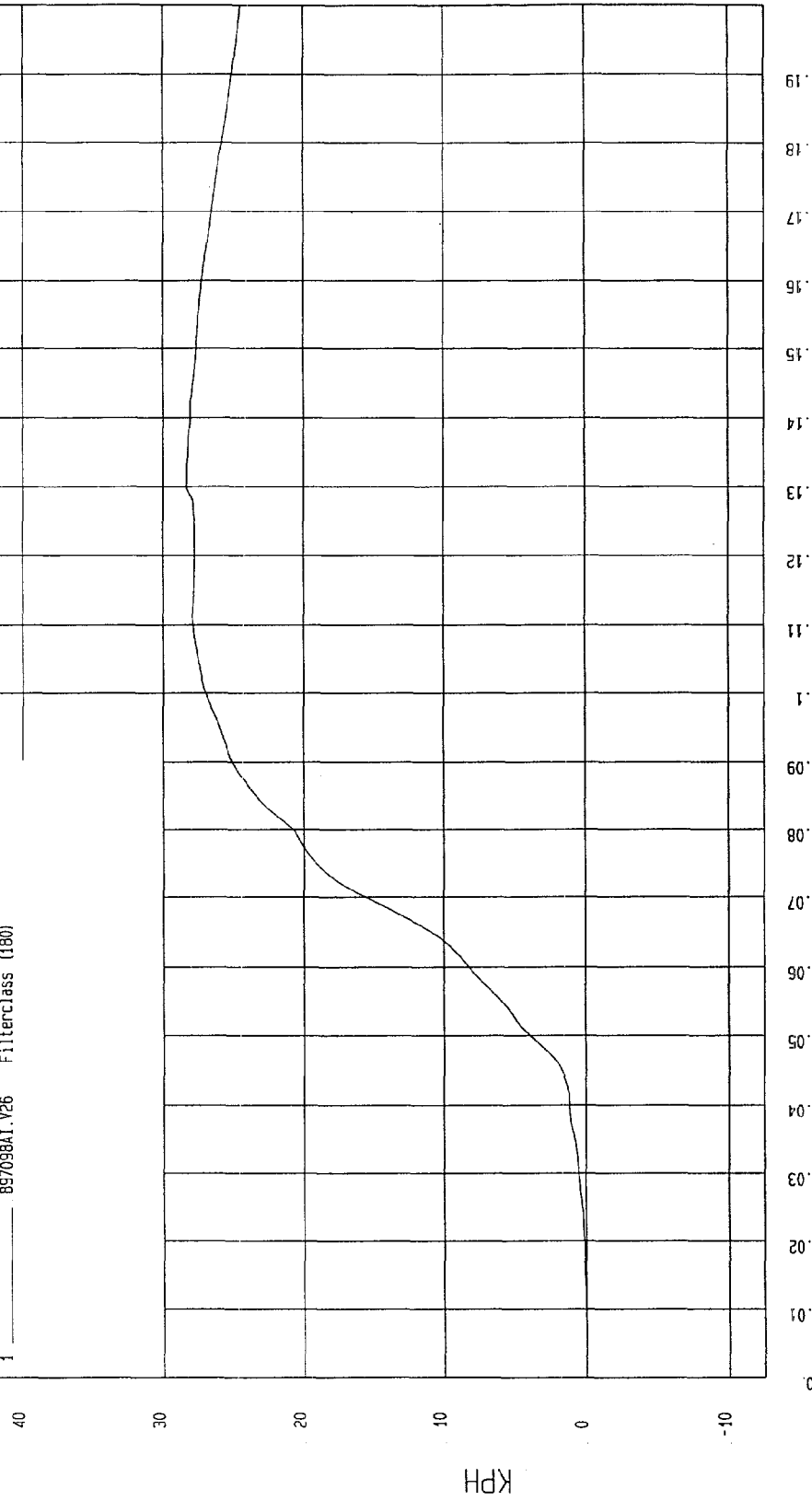
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.74E-02 KPH at -2 msec Maximum = 28.34 KPH at 130 msec

PASSENGER MID RIB Y VELOCITY

1 897098A1.V26 Filterclass (180)



MGA Research
08-22-1997 13:14

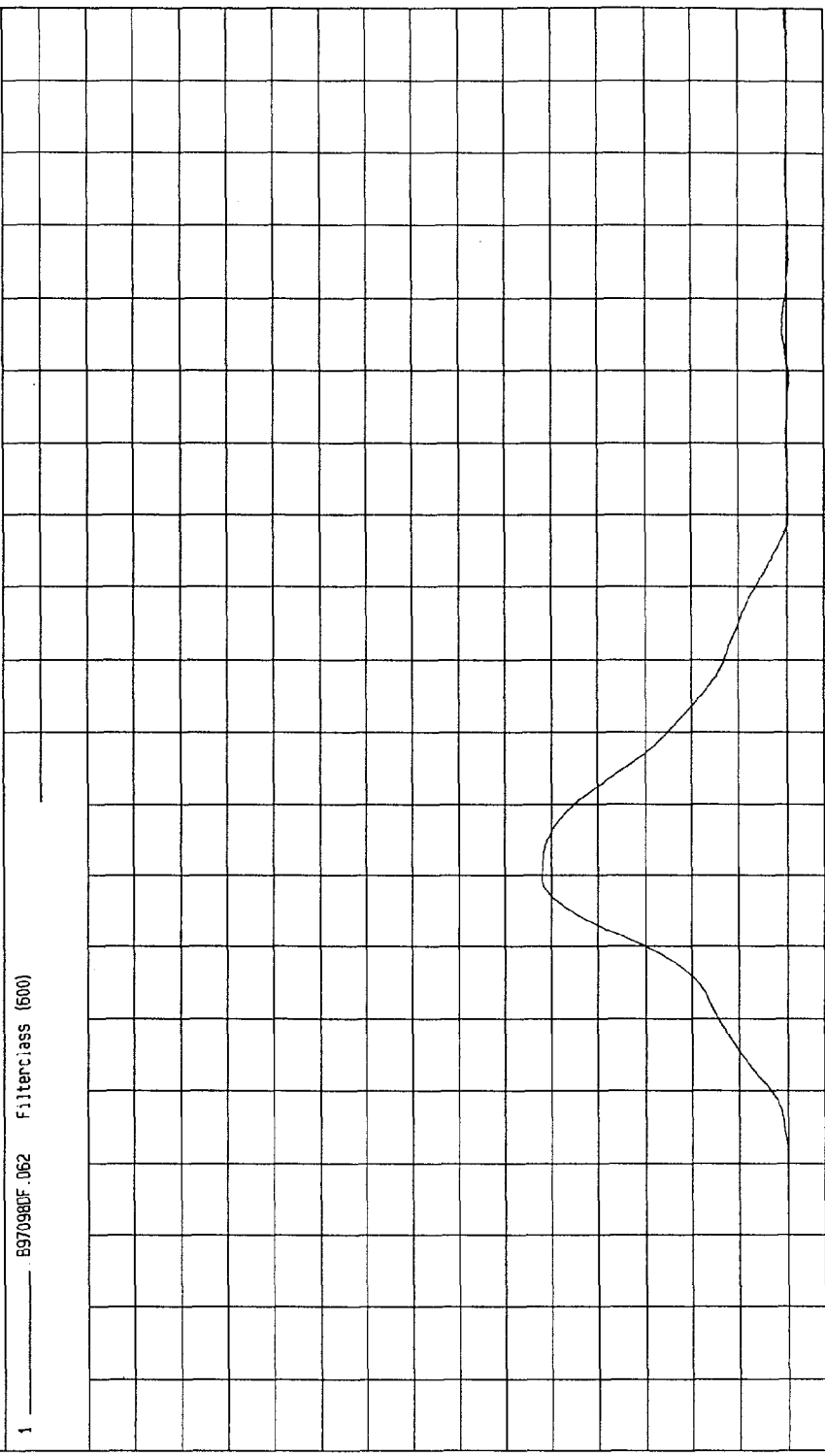
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

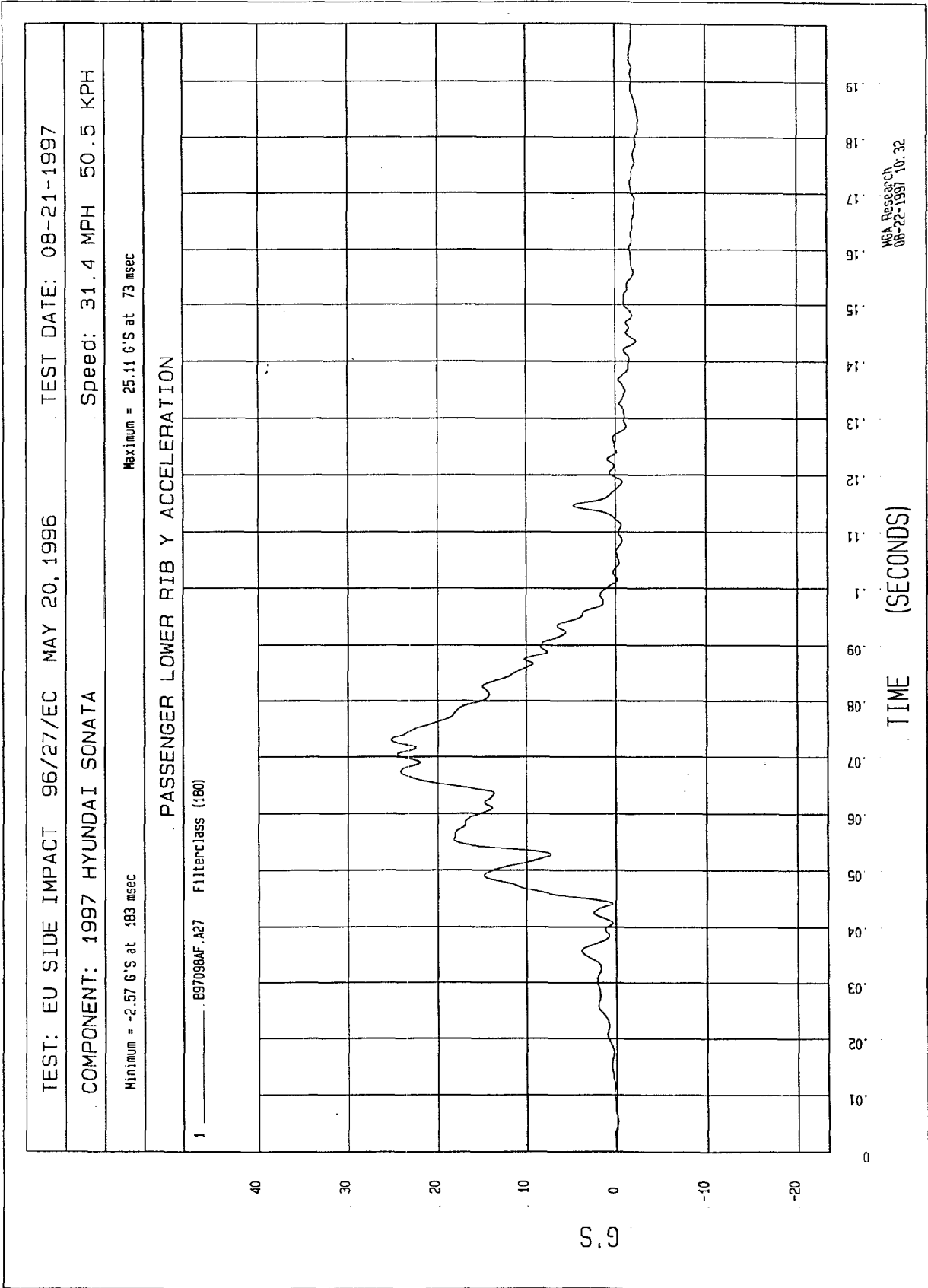
Minimum = -9.36E-02 MM at 165 msec Maximum = 10.41 MM at 79 msec

PASSENGER MID RIB Y DISPLACEMENT

1 ——— B97098DF.062 FilterClass (600)



MEV Research
08-22-1997 10:32



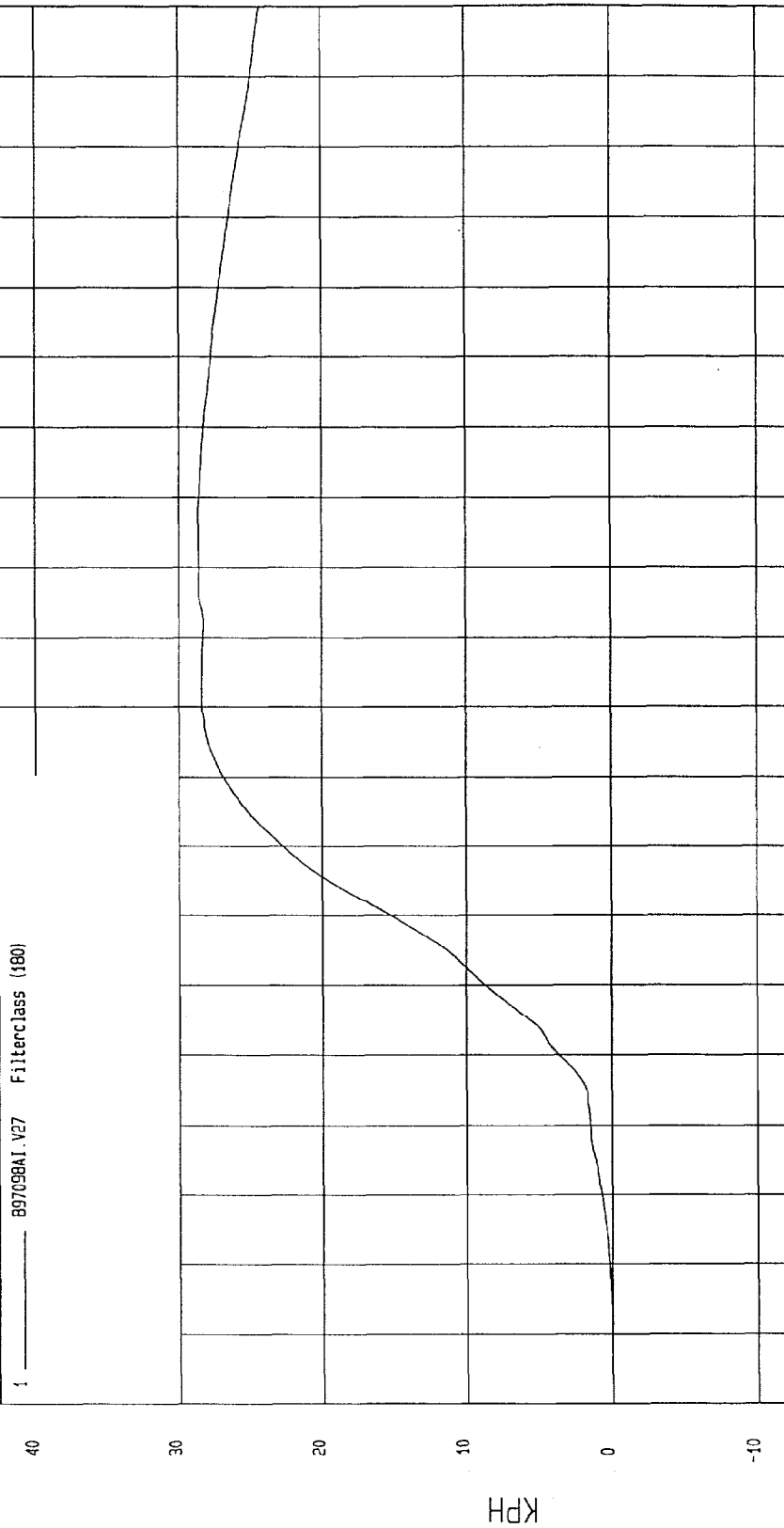
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.64E-02 KPH at -14 msec Maximum = 28.65 KPH at 127 msec

PASSENGER LOWER RIB Y VELOCITY

1 B9709BA1.V27 Filterclass (180)



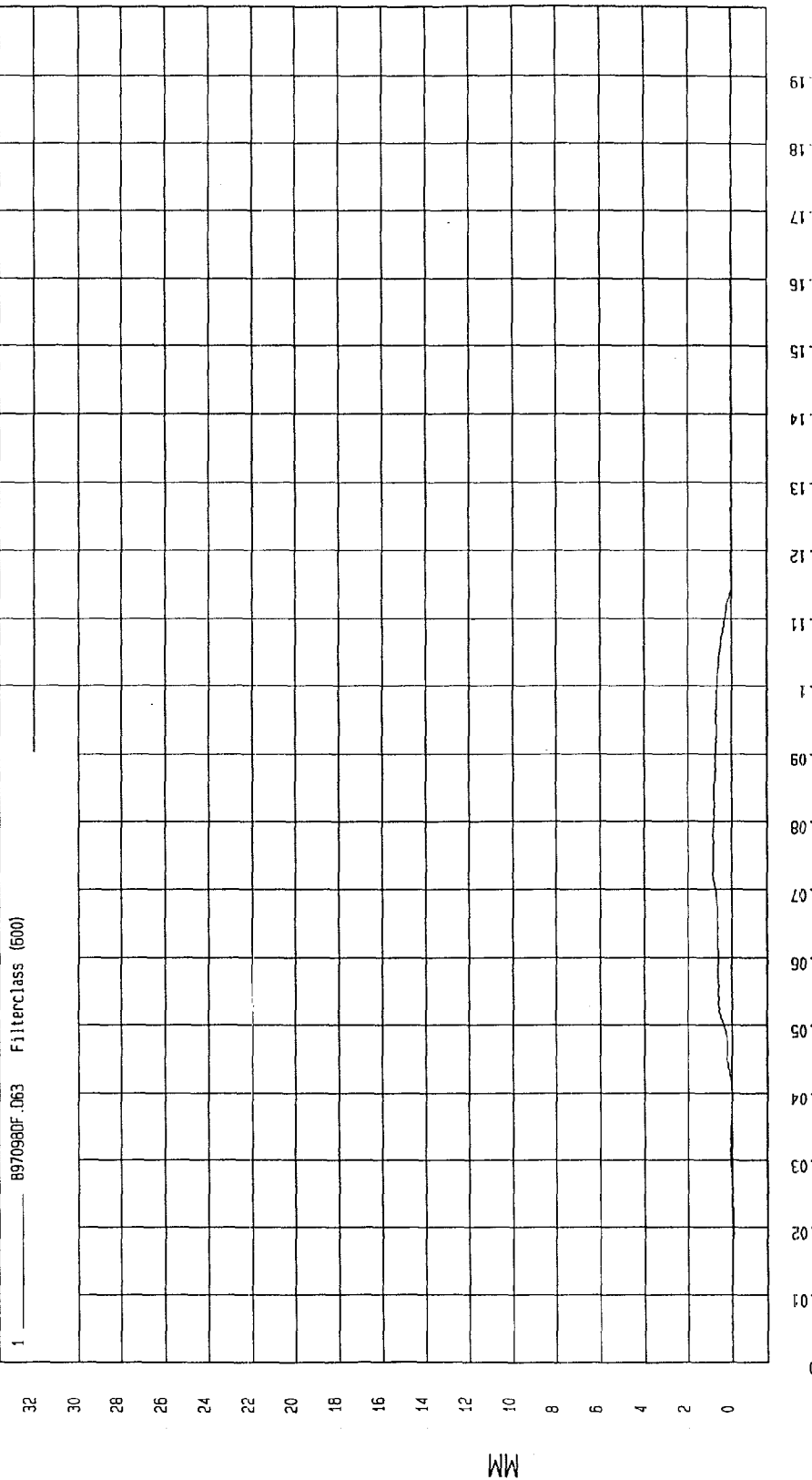
VEA Research
08-22-1997 13:14

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -6.85E-02 MM at 19 msec Maximum = .86 MM at 74 msec

PASSENGER LOWER RIB Y DISPLACEMENT



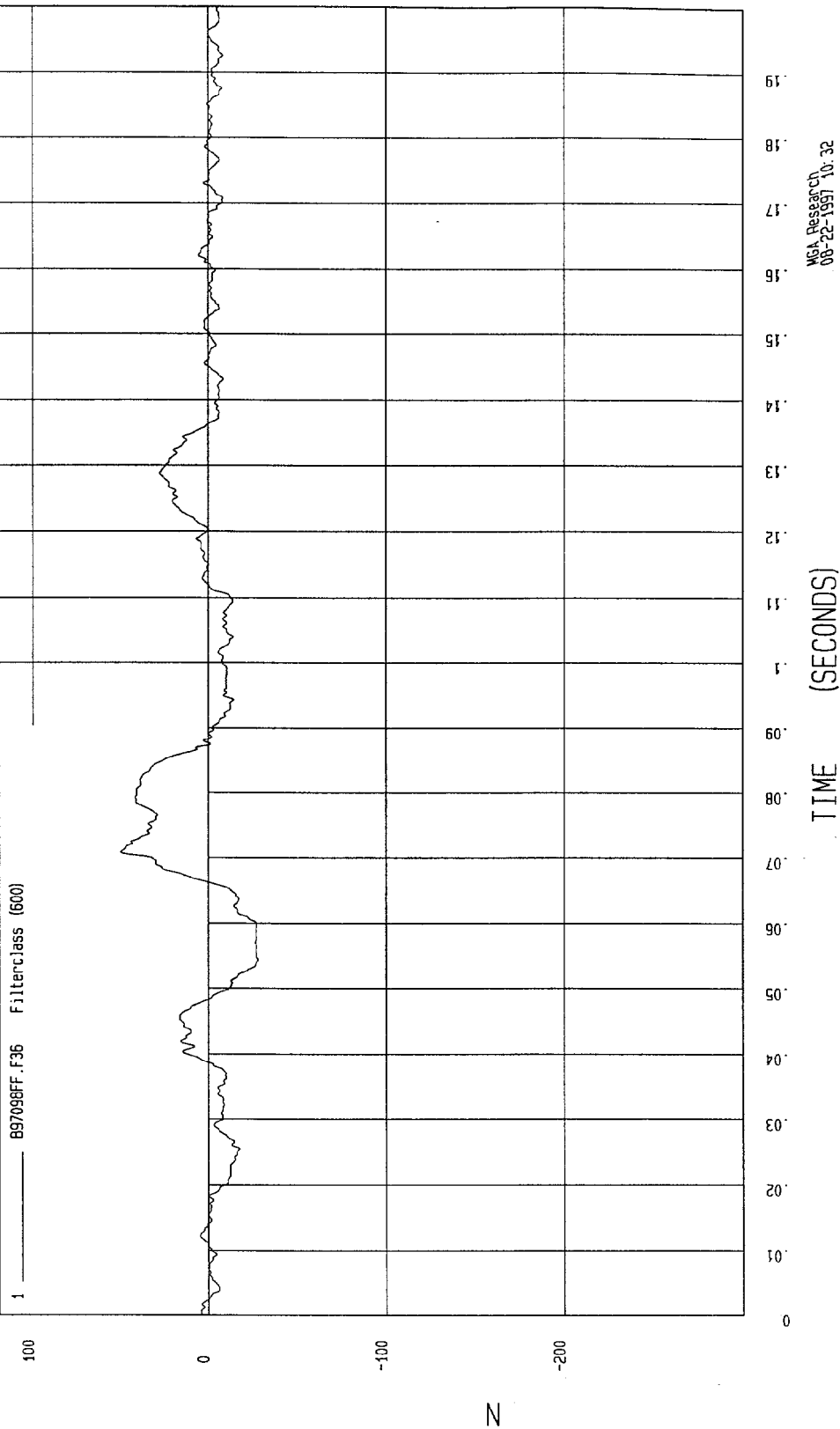
MGA Research
08-22-1997 10:32

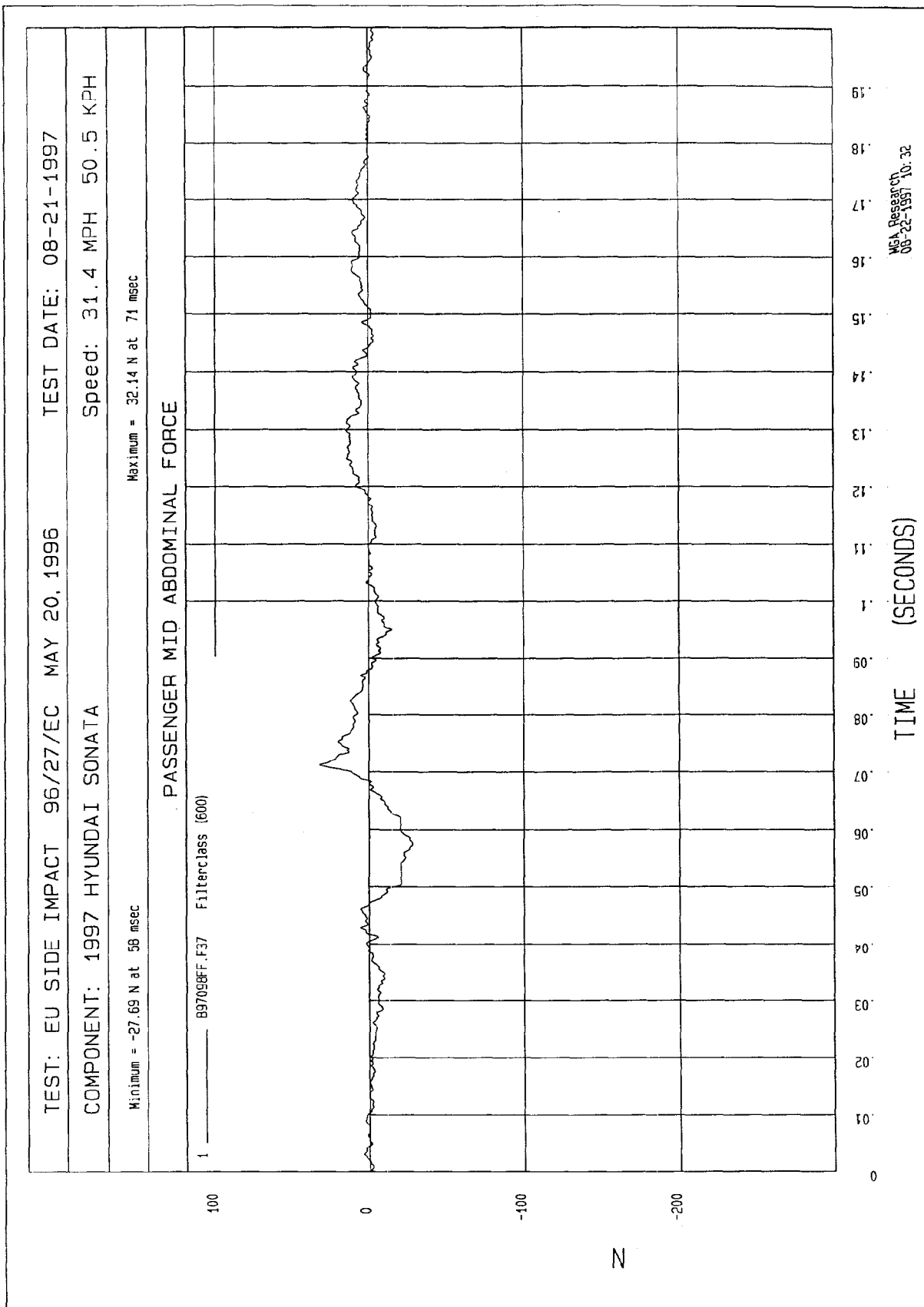
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

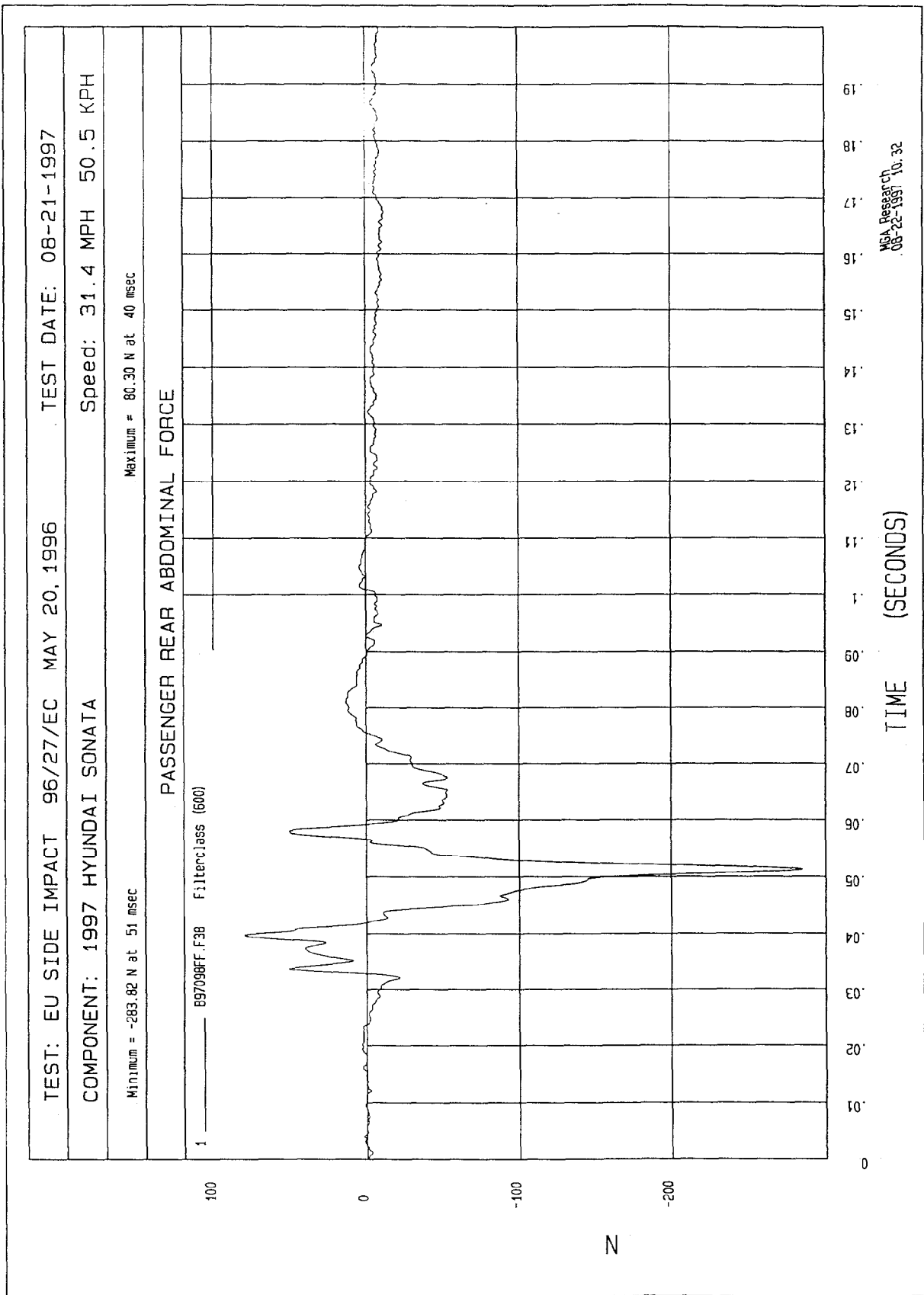
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

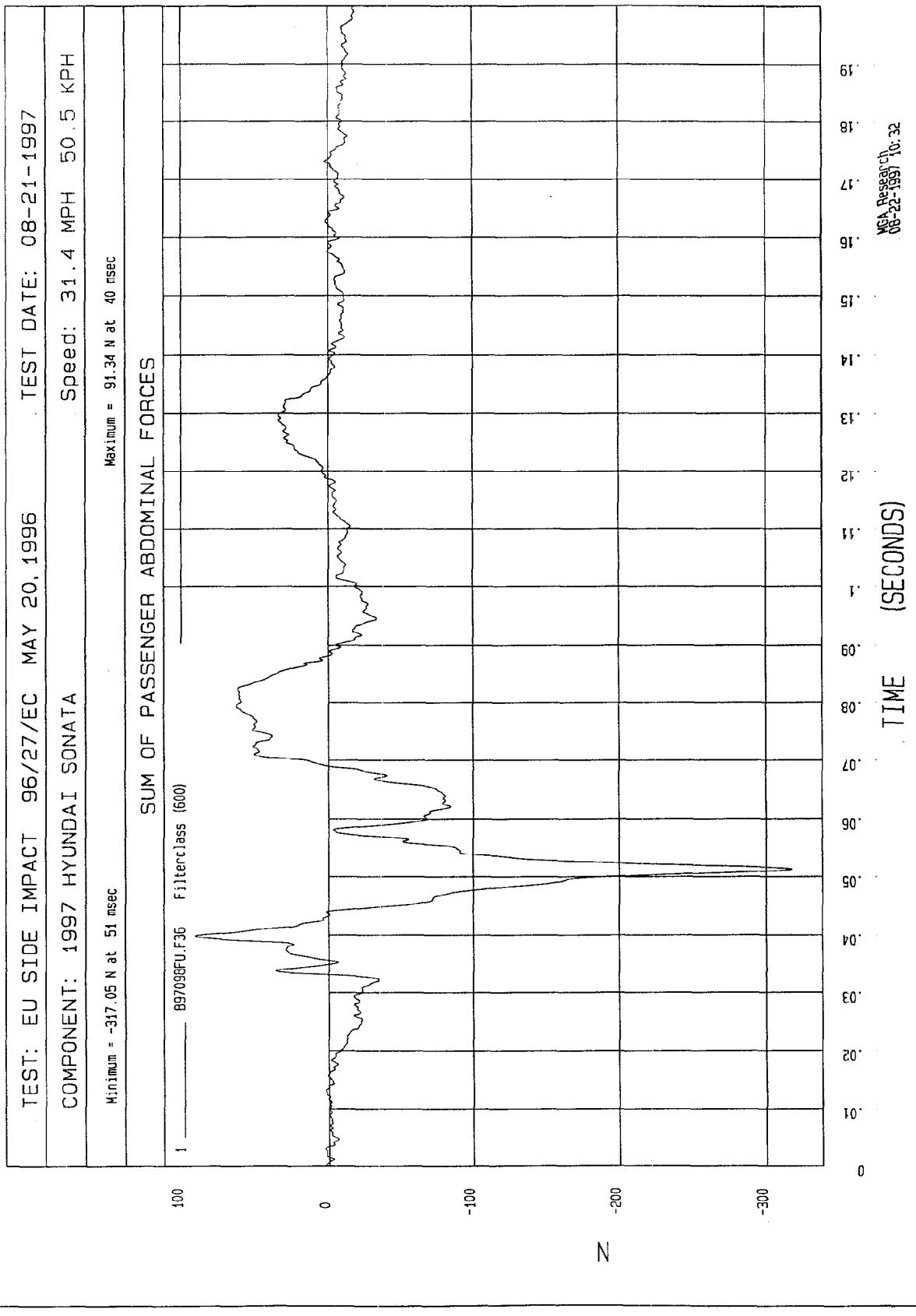
Minimum = -28.17 N at 54 msec Maximum = 49.93 N at 71 msec

PASSENGER FRONT ABDOMINAL FORCE









TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

SPEED: 31.4 MPH 50.5 KPH

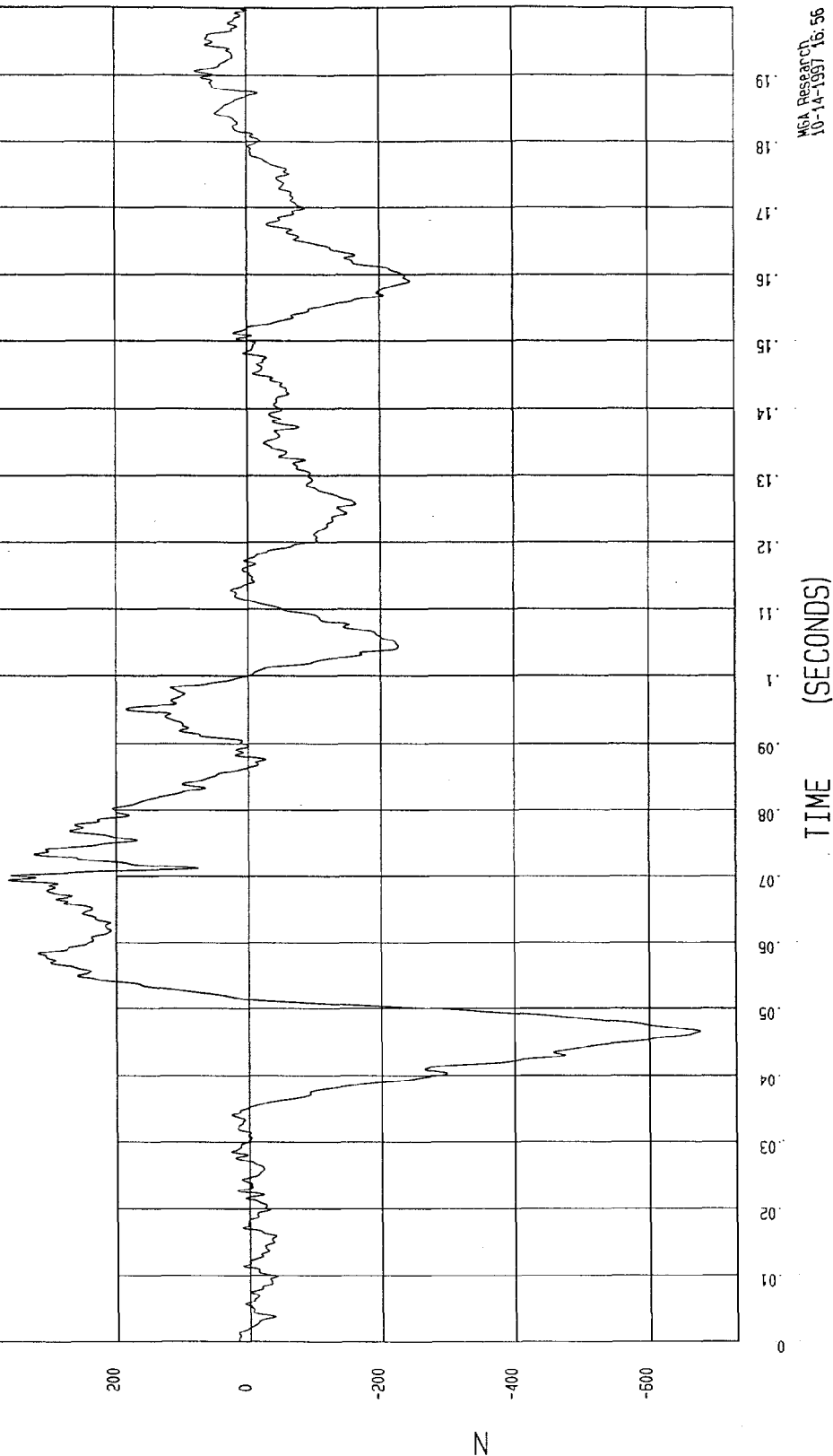
COMPONENT: 1997 HYUNDAI SONATA

Minimum = -672.96 N at 47 msec

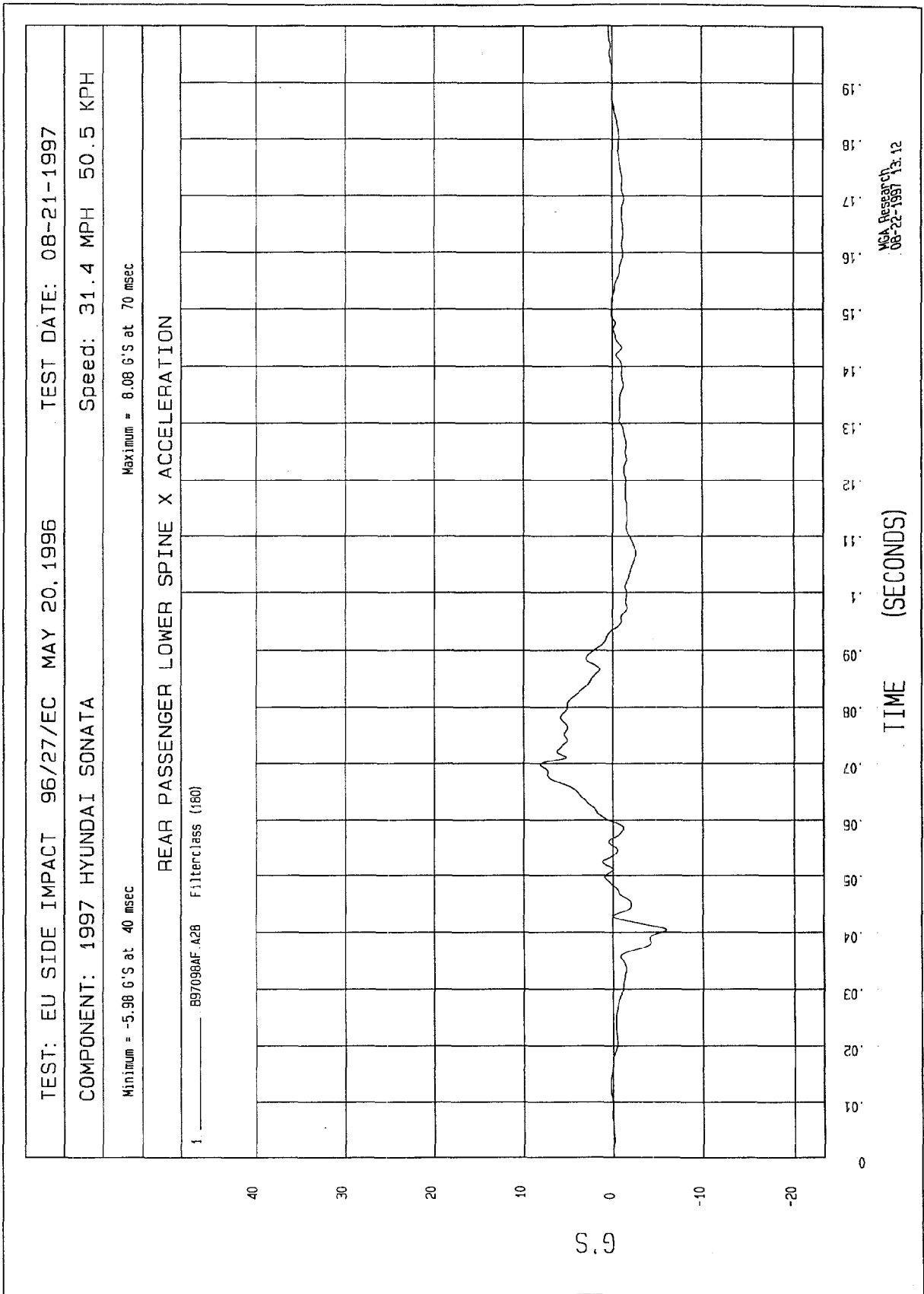
Maximum = 362.67 N at 69 msec

PASSENGER PUBIC SYMPHYSIS FORCE

1 ——— .097098FF.F39 Filterclass (600)



MCA Research
10-14-1997 16:56



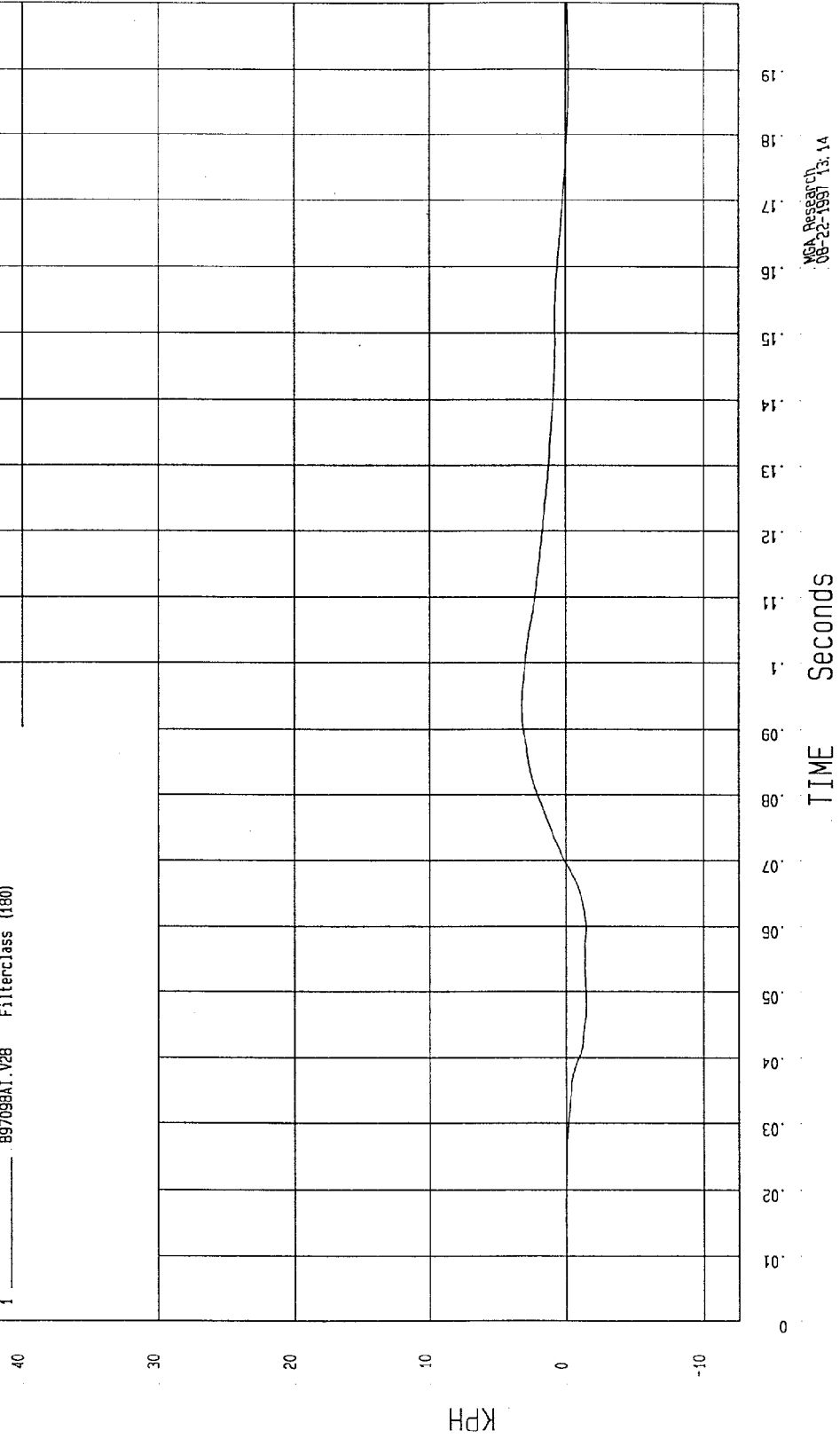
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

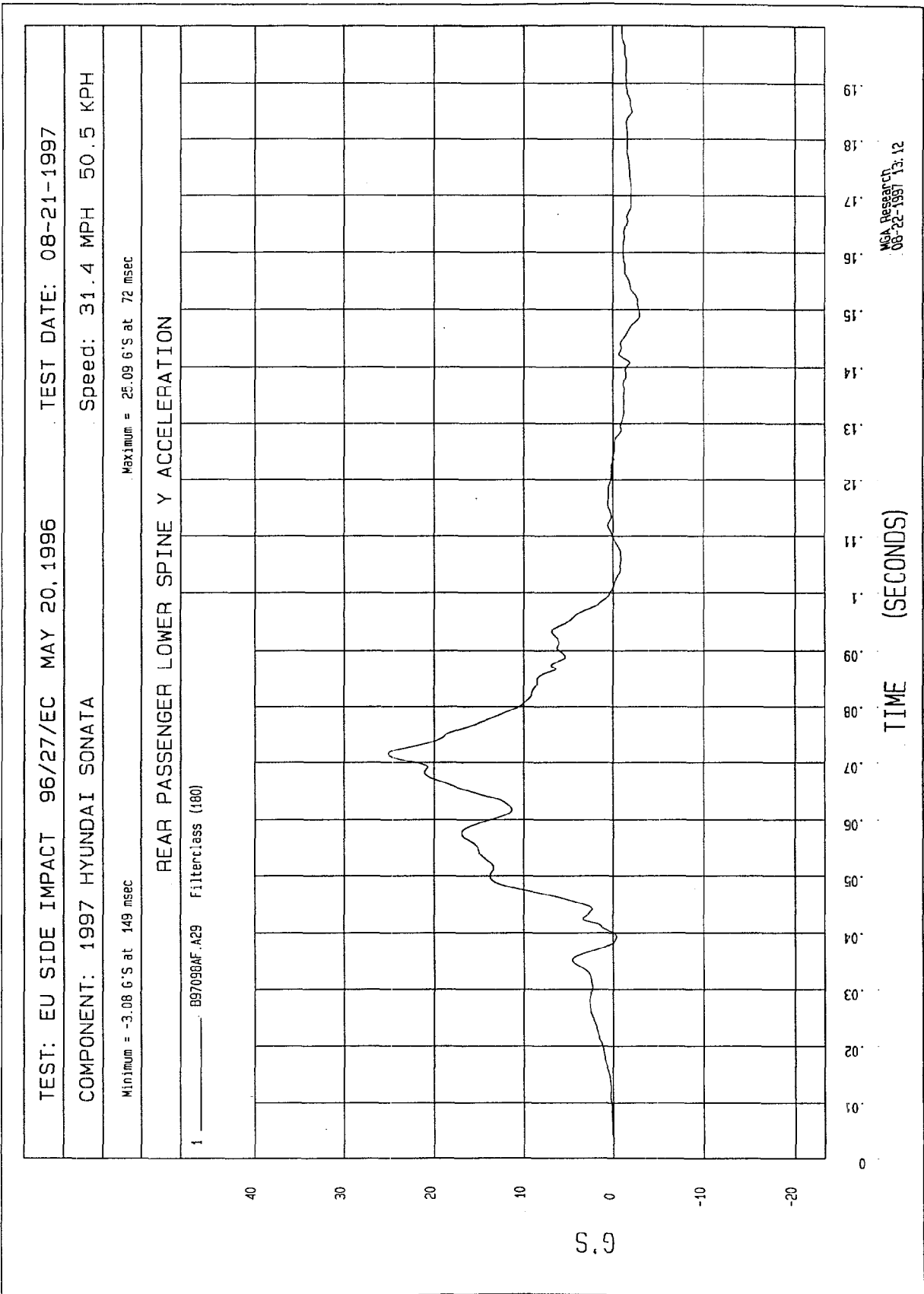
Minimum = -1.47 KPH at 48 msec Maximum = 3.25 KPH at 94 msec

PASSENGER LOWER SPINE X VELOCITY

1 — 897098A1.V28 Filterclass (180)



MGA Research
08-22-1997 13:14



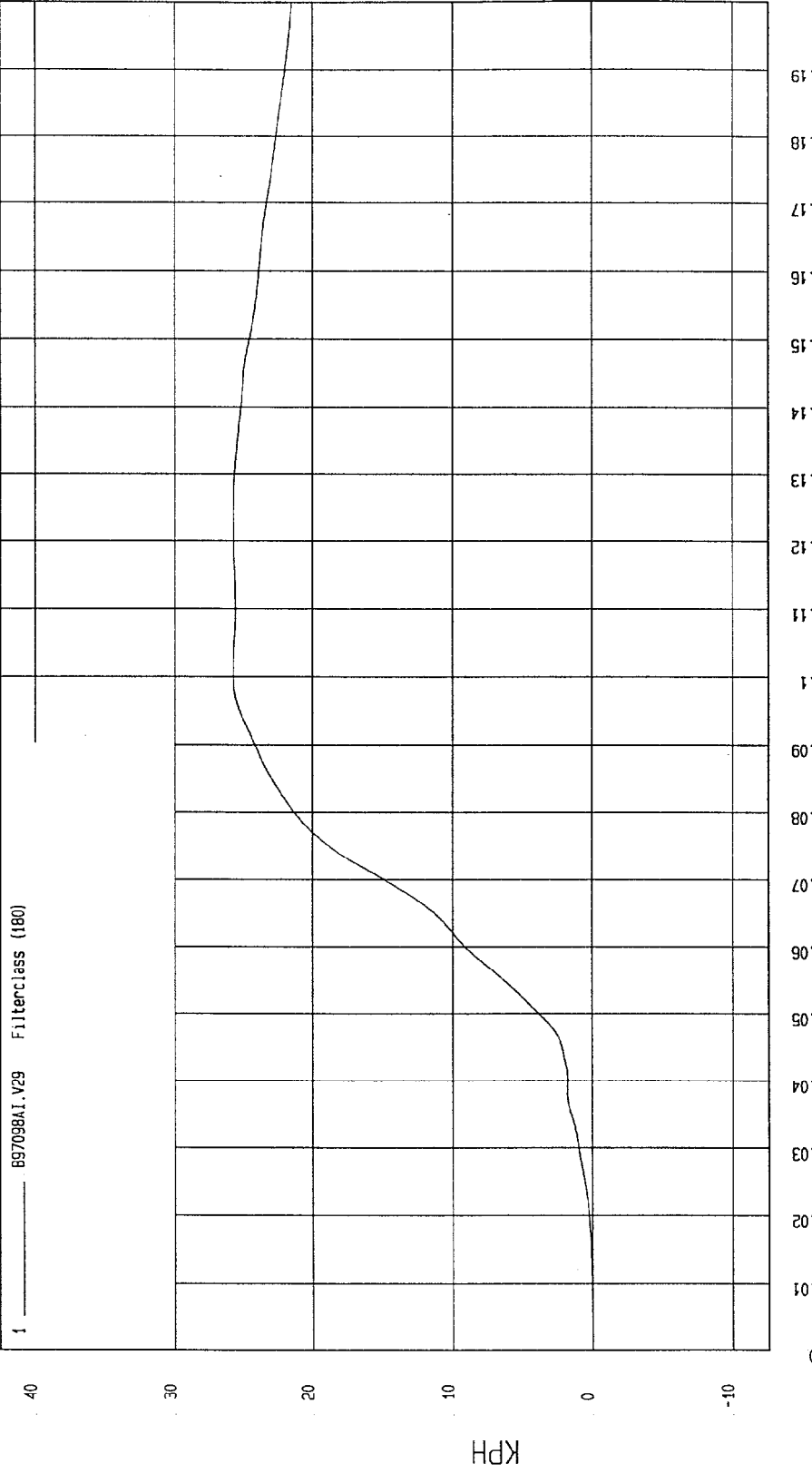
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

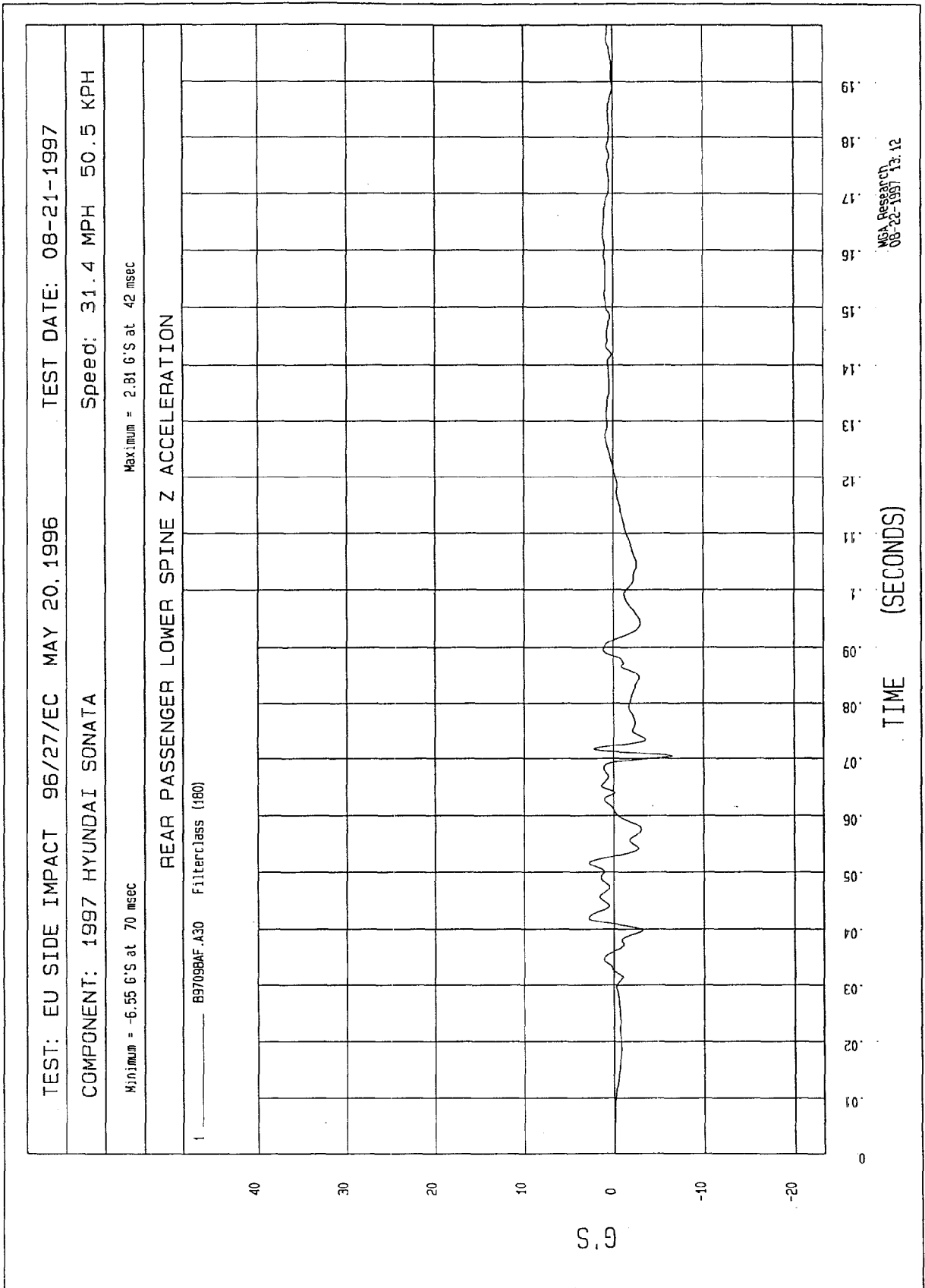
Minimum = 0 KPH at -20 msec Maximum = 25.68 KPH at 101 msec

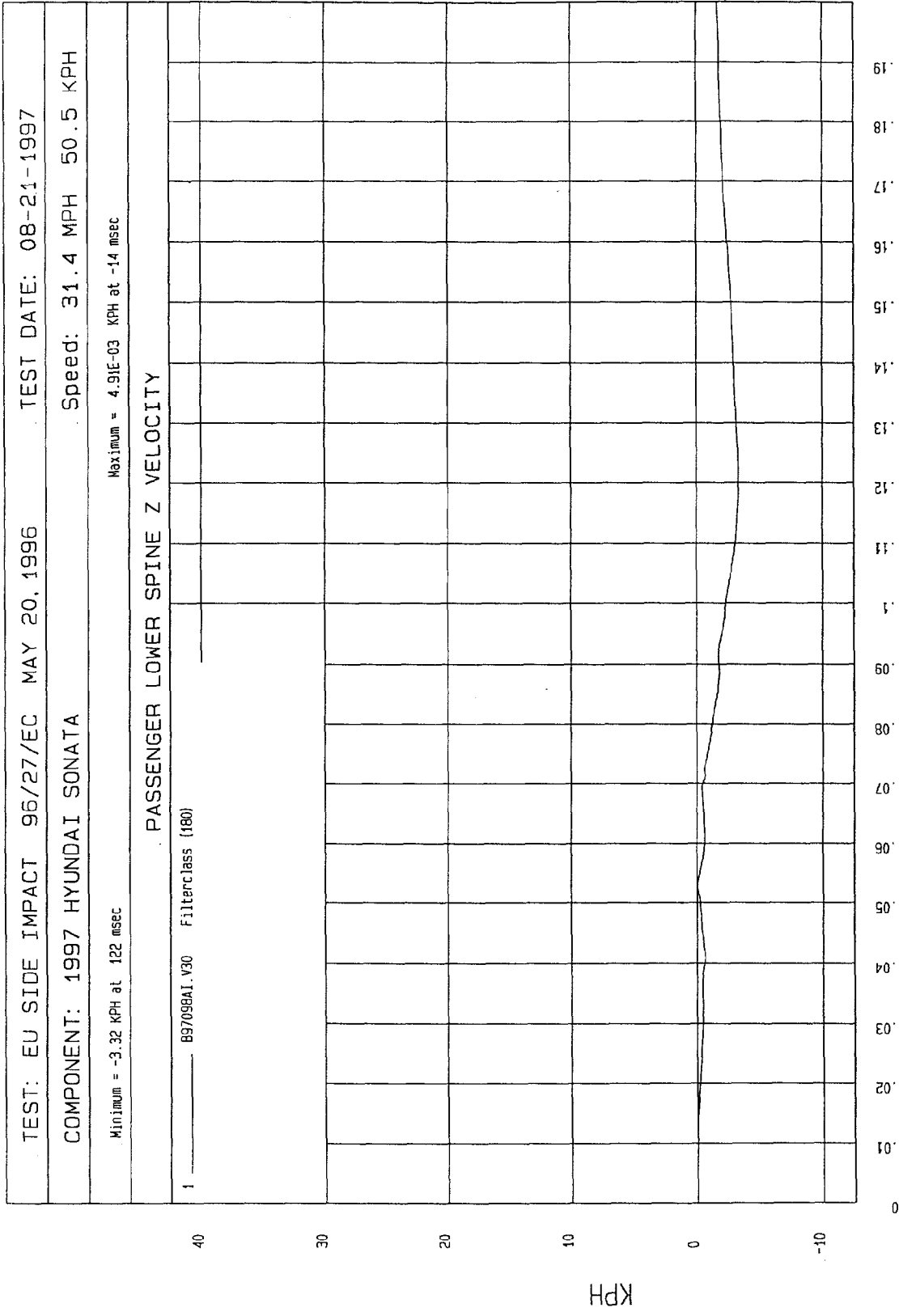
PASSENGER LOWER SPINE Y VELOCITY

1 ——— 897098AI.V29 Filterclass (180)

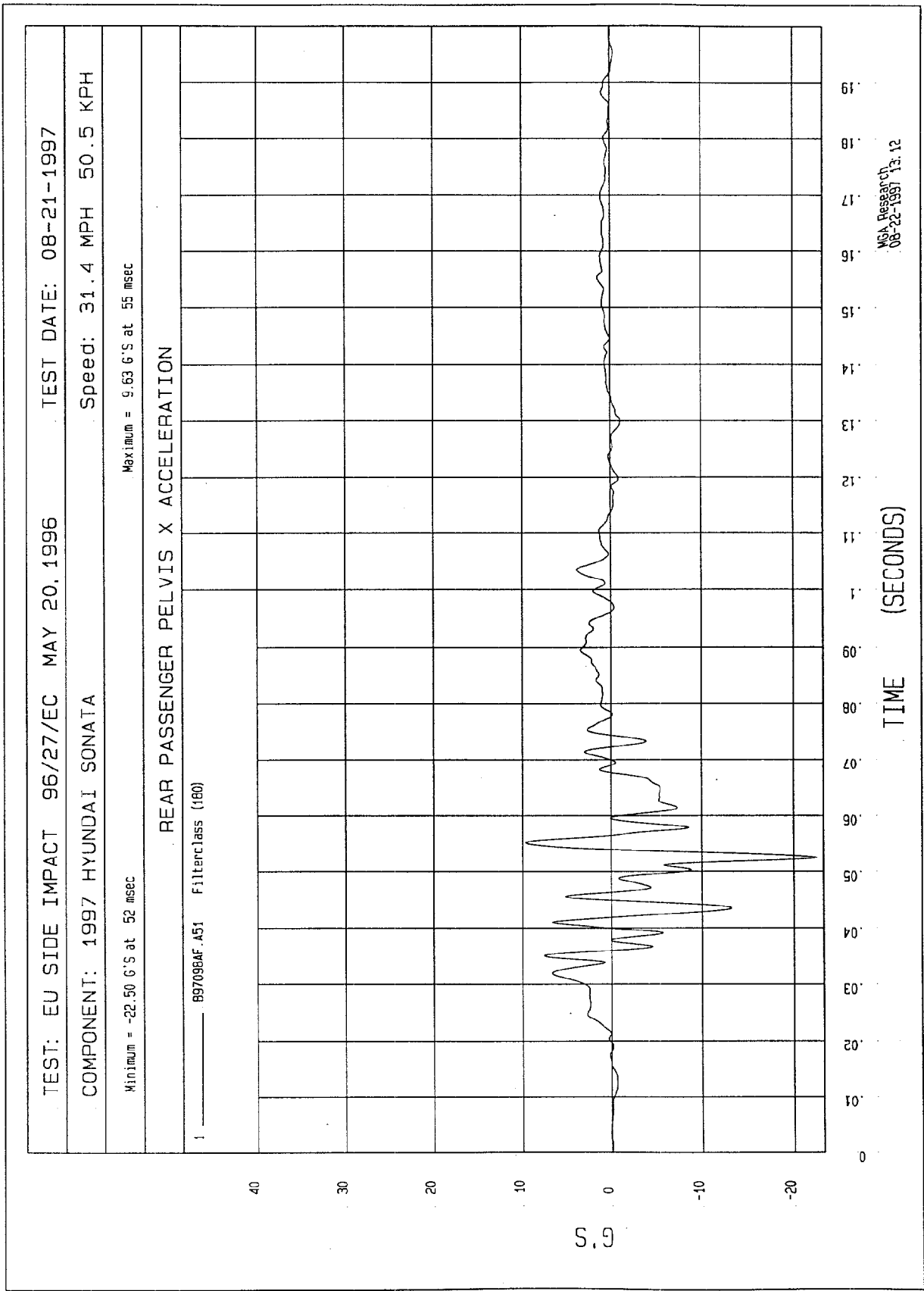


WGA Research
08-22-1997 13:14





MGA Research
08-22-1997 13:14



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA

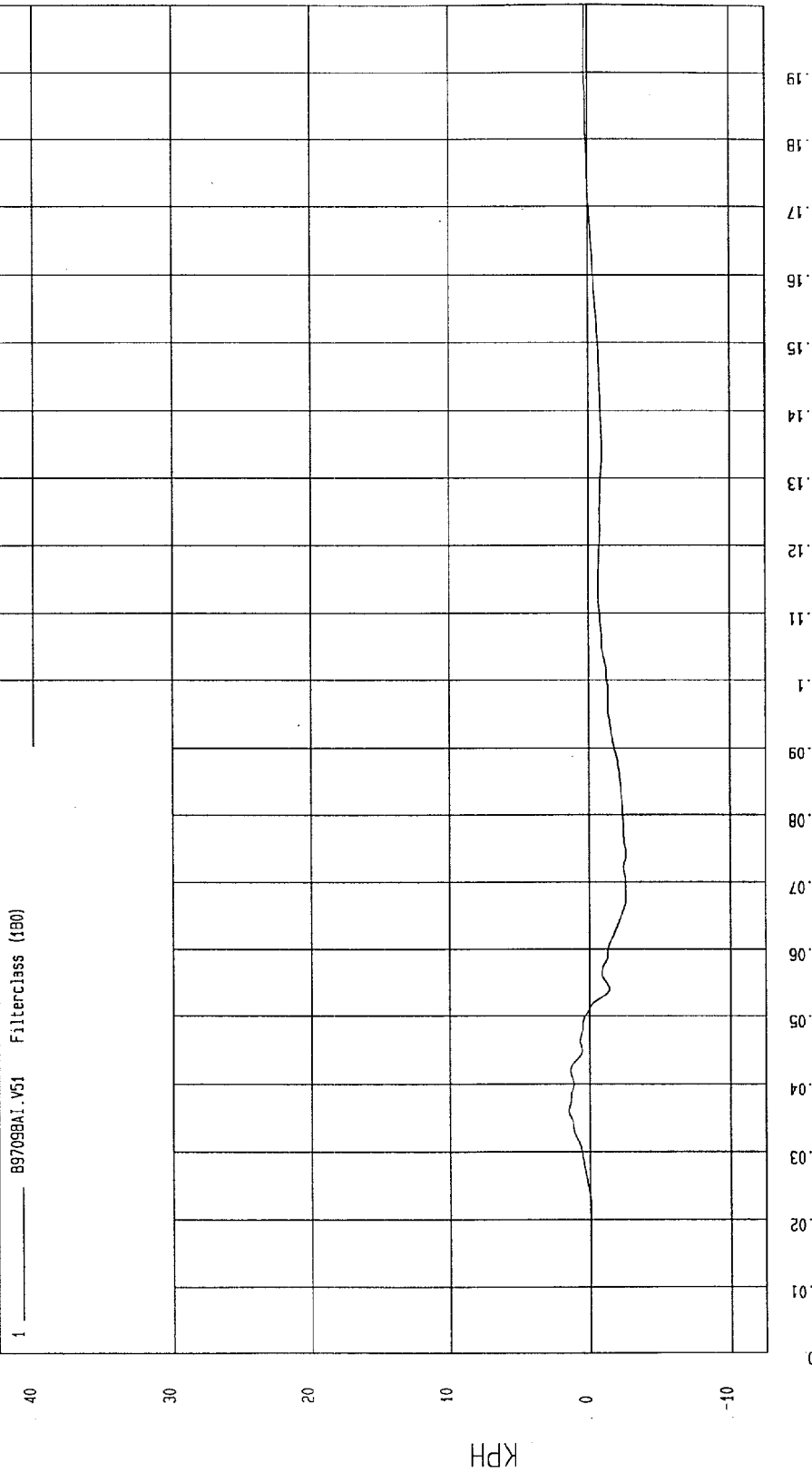
Speed: 31.4 MPH 50.5 KPH

Minimum = -2.63 KPH at 74 msec

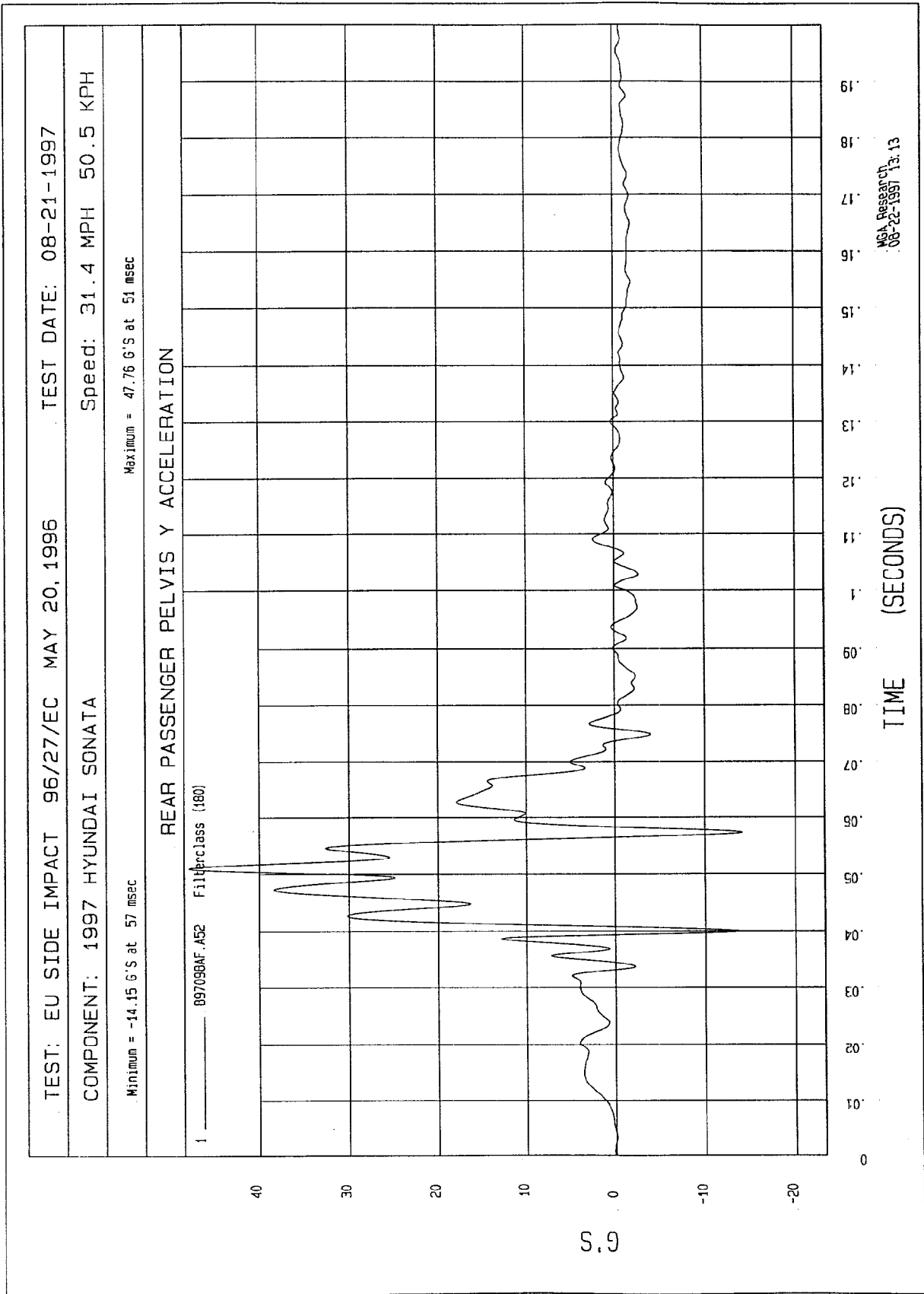
Maximum = 1.50 KPH at 36 msec

PASSENGER PELVIS X VELOCITY

1 B9709BA1.V51 Filterclass (130)



WCA Research
06-22-1997 13:15



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -1.14E-02 KPH at -5 msec Maximum = 23.03 KPH at 74 msec

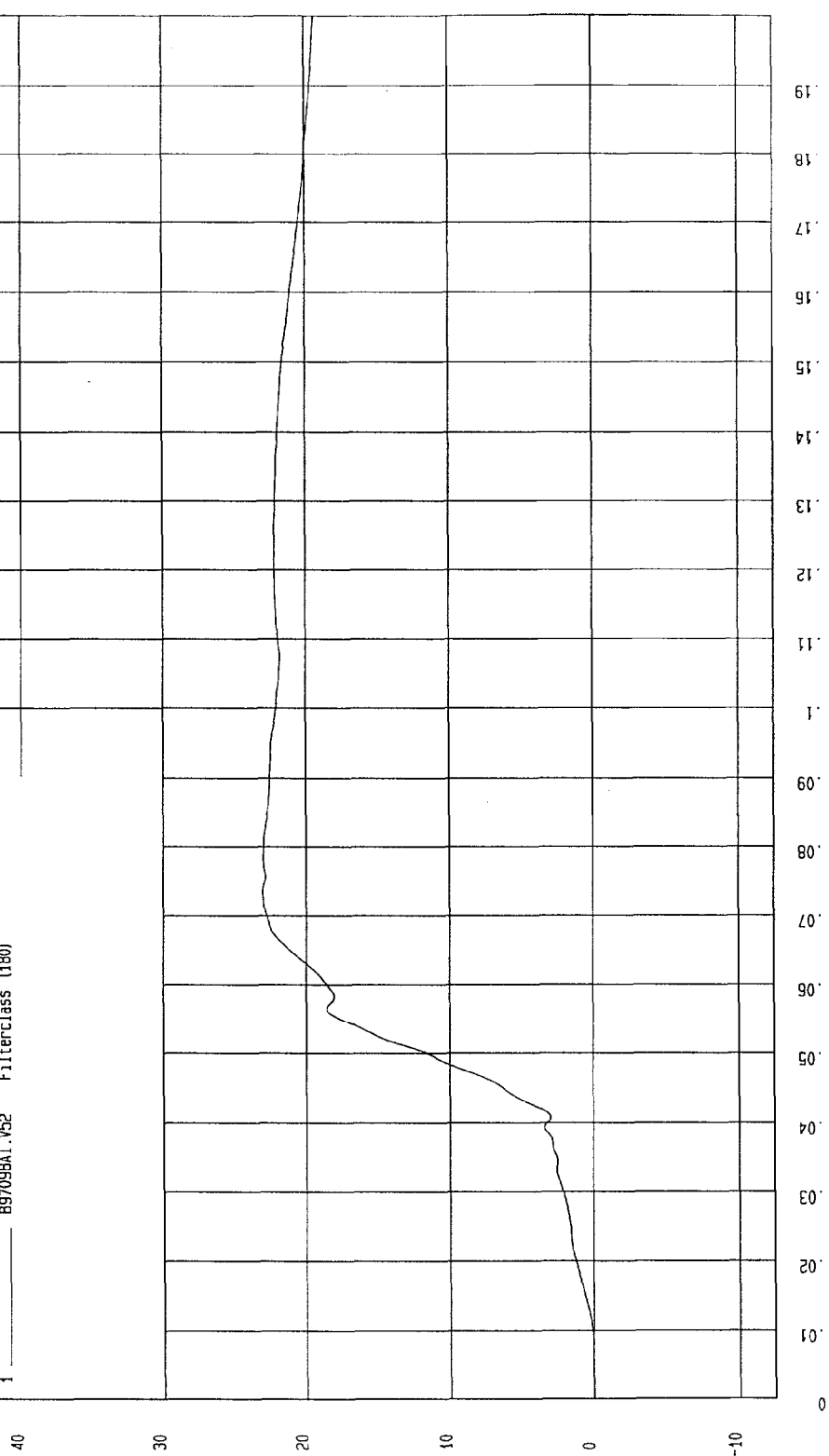
PASSENGER PELVIS Y VELOCITY

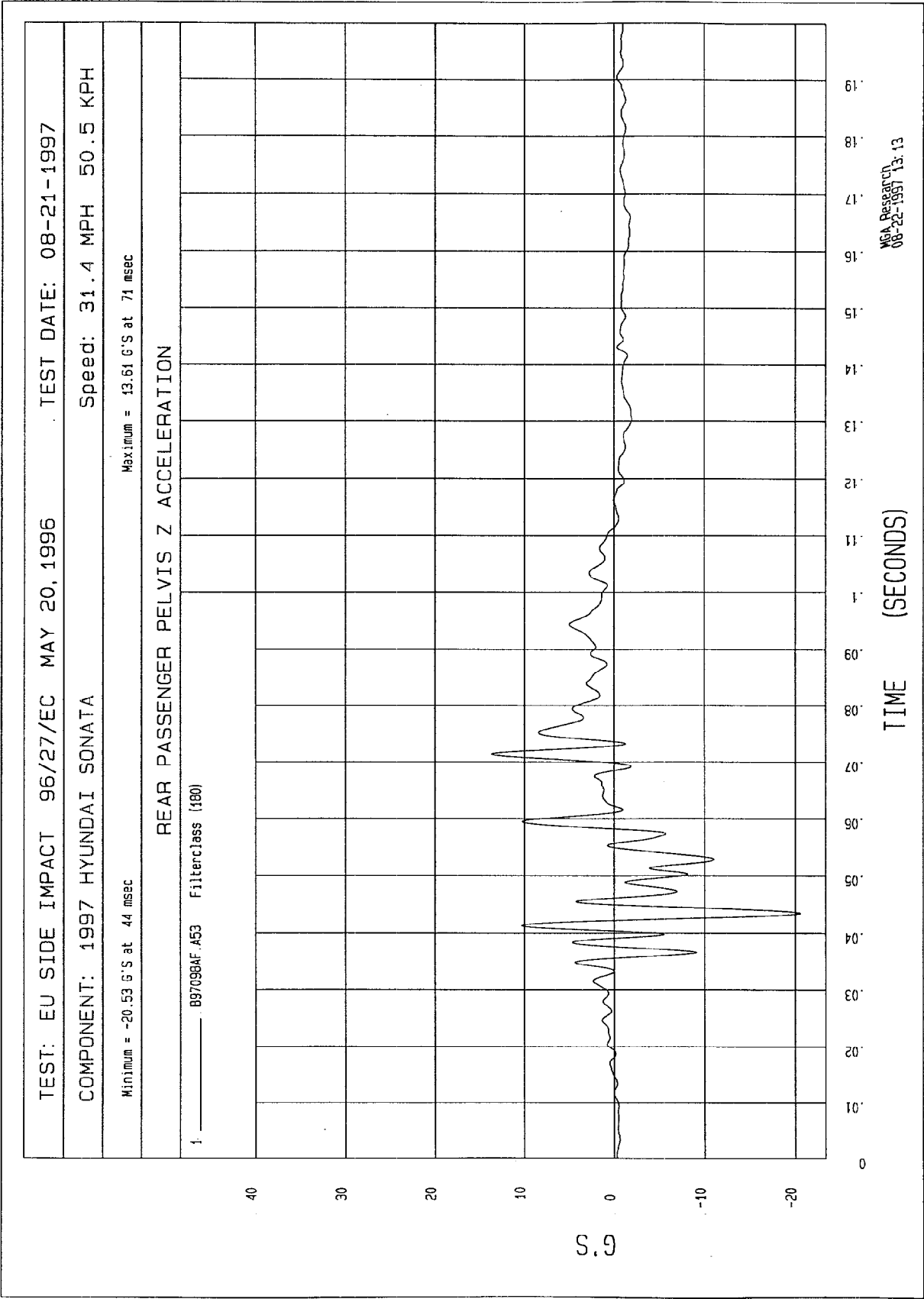
1 B9709BAI.V62 Filterclass (180)

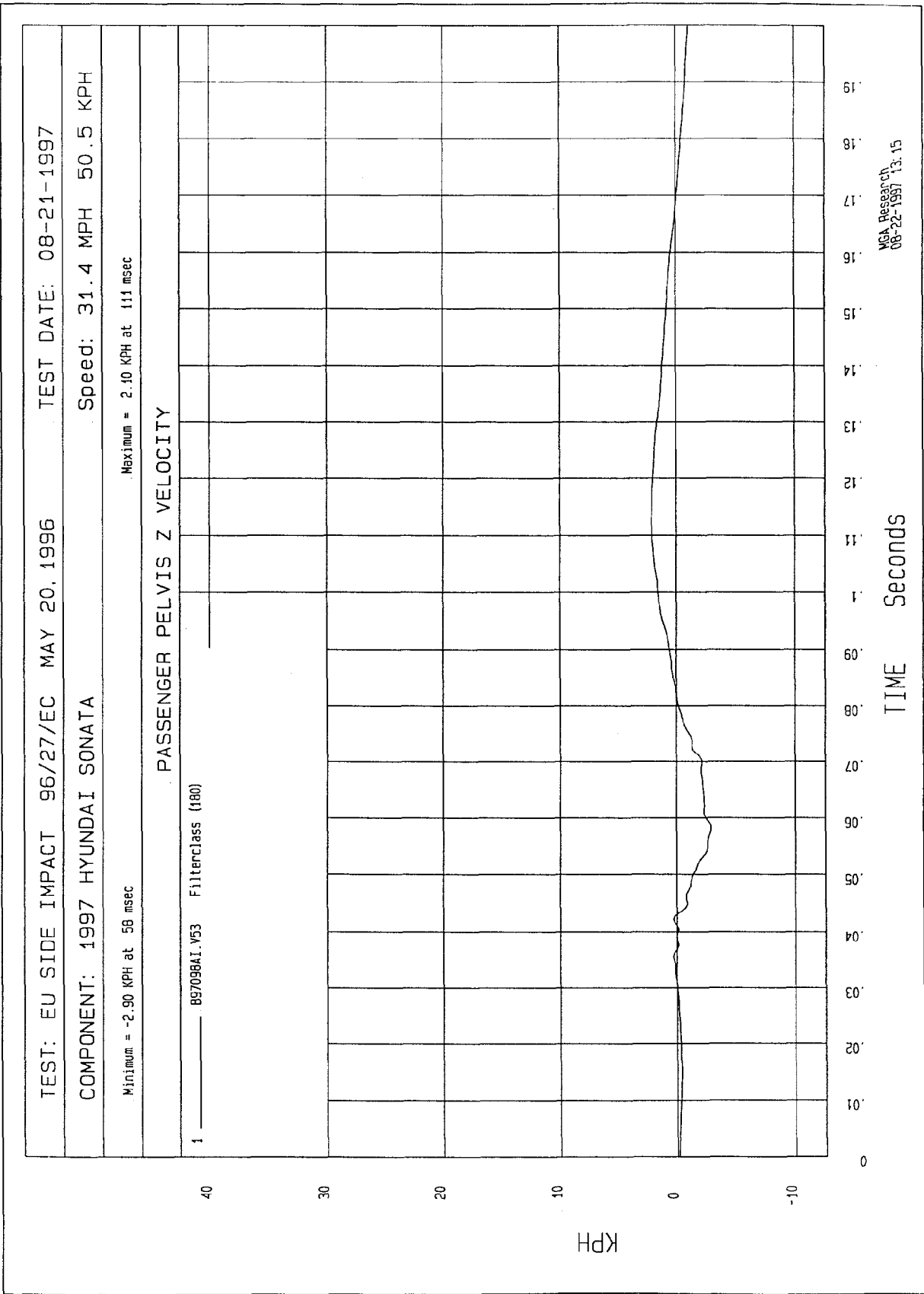
KPH

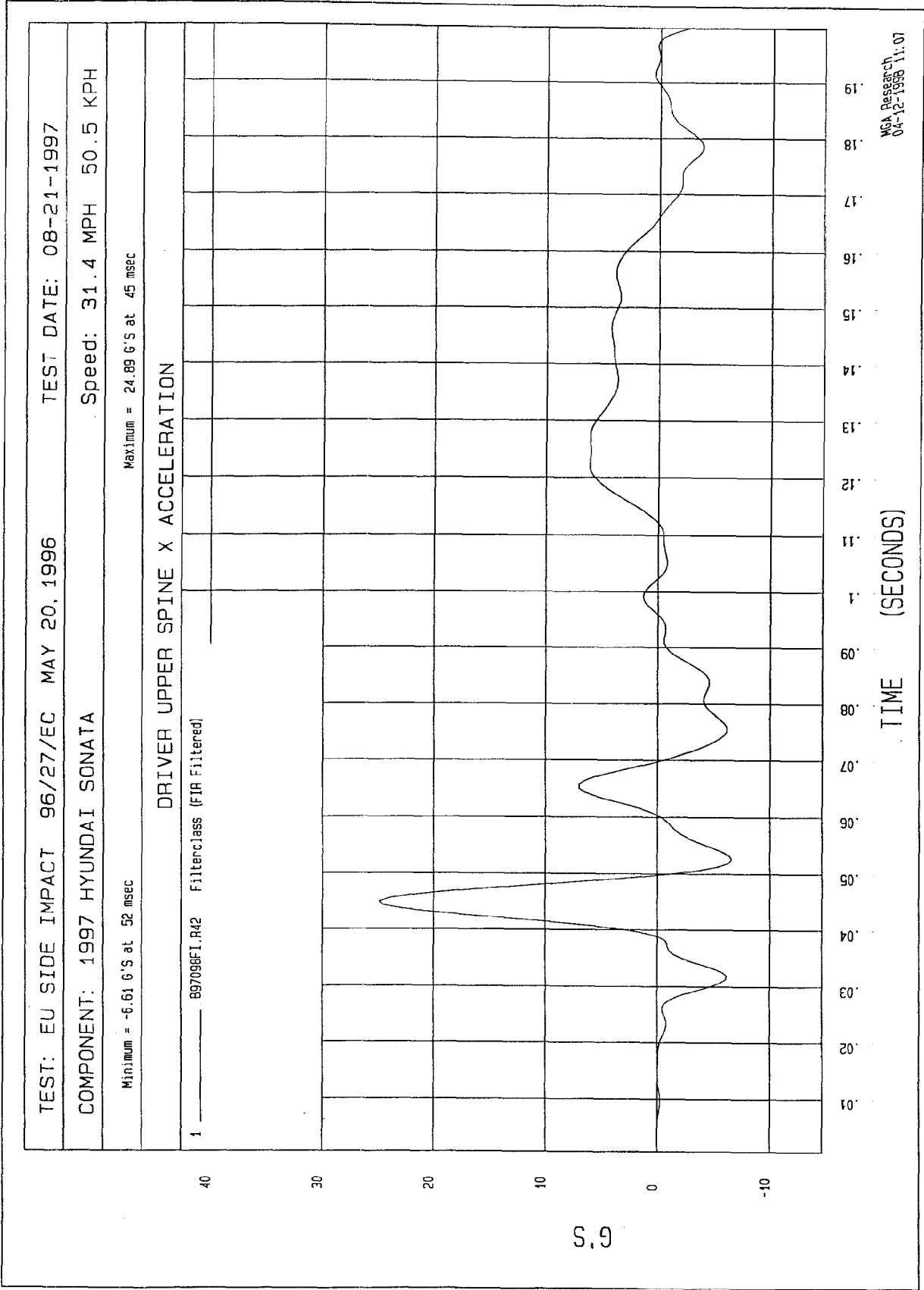
TIME Seconds

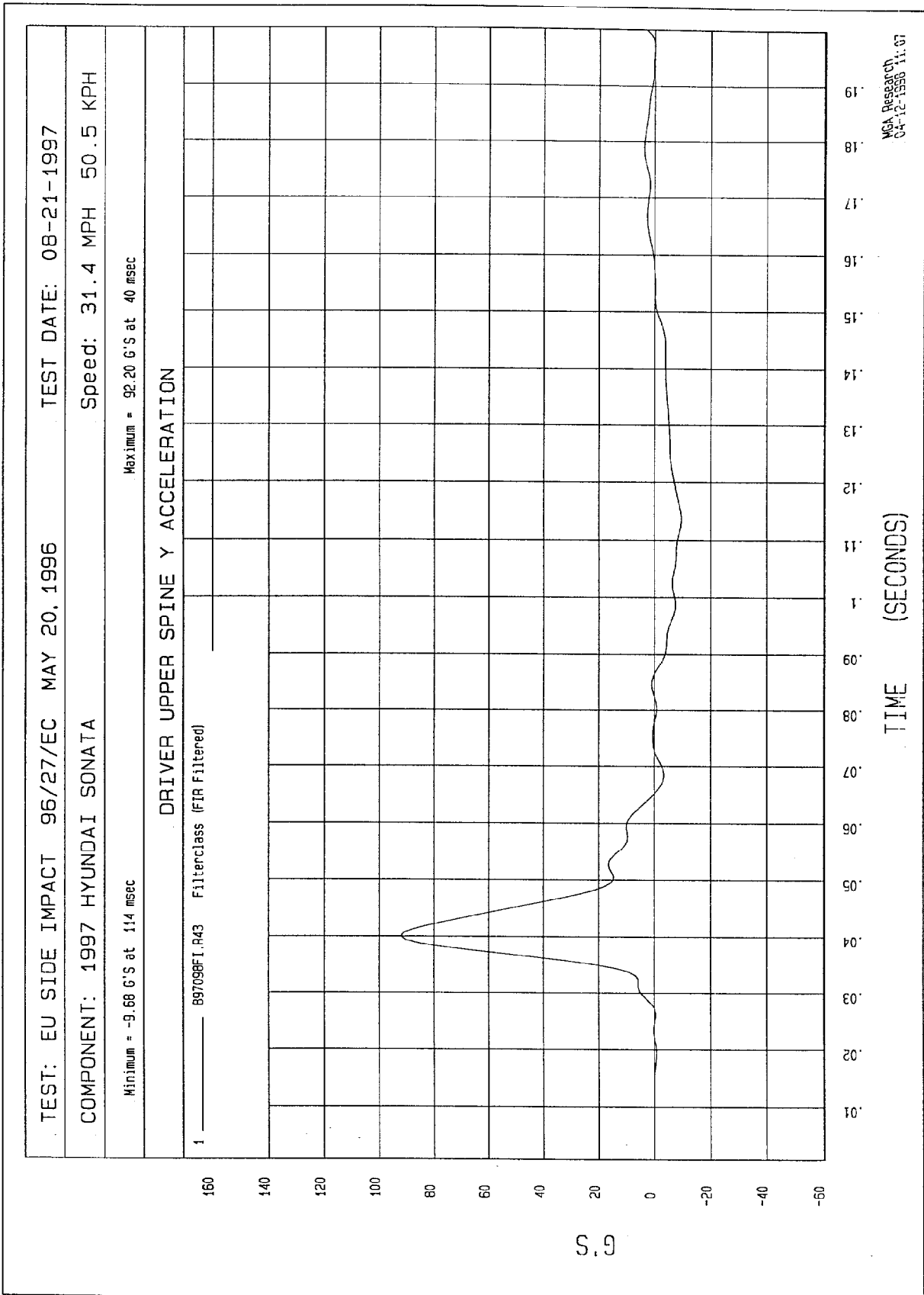
MGA Research
08-22-1997 13:15

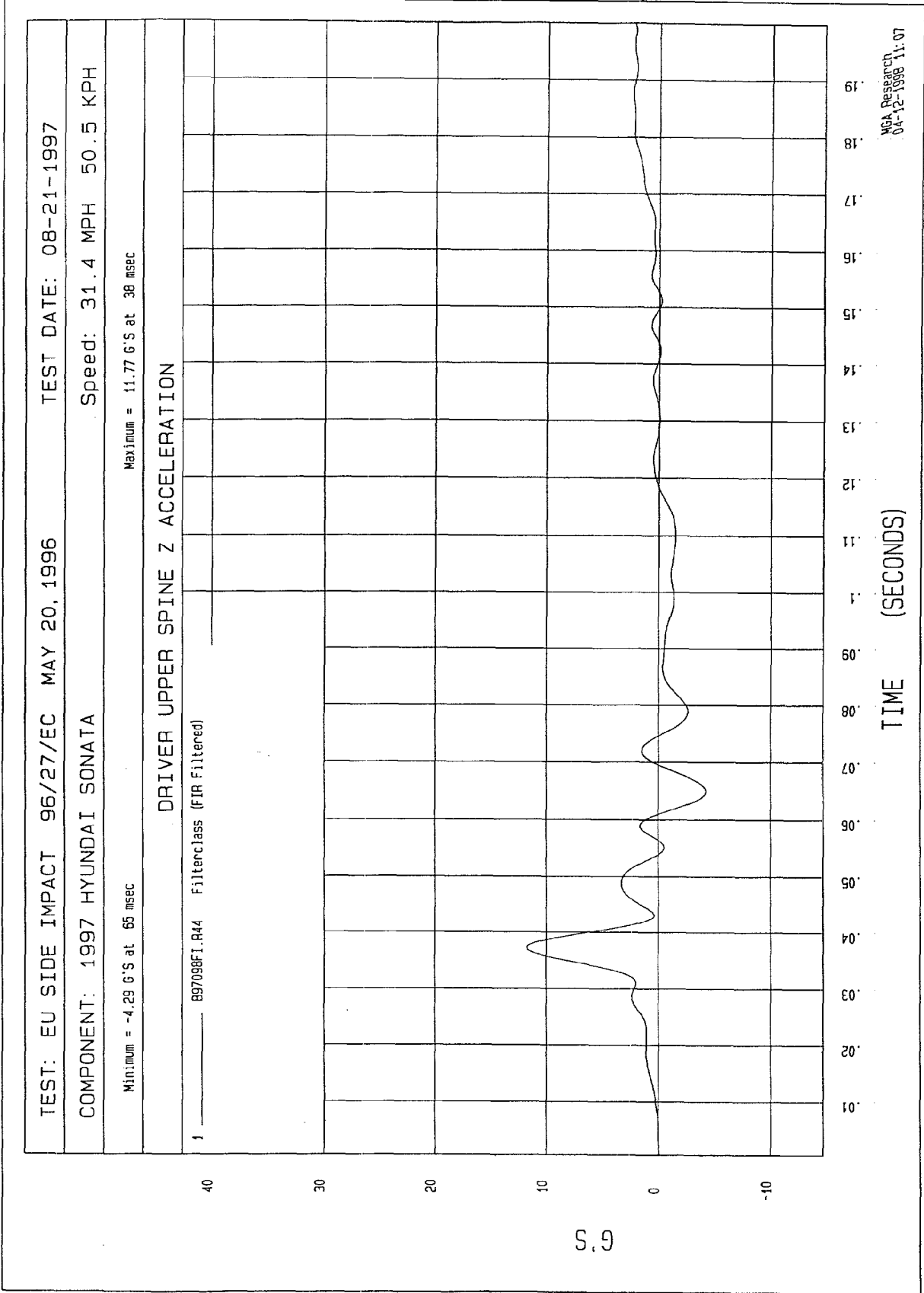


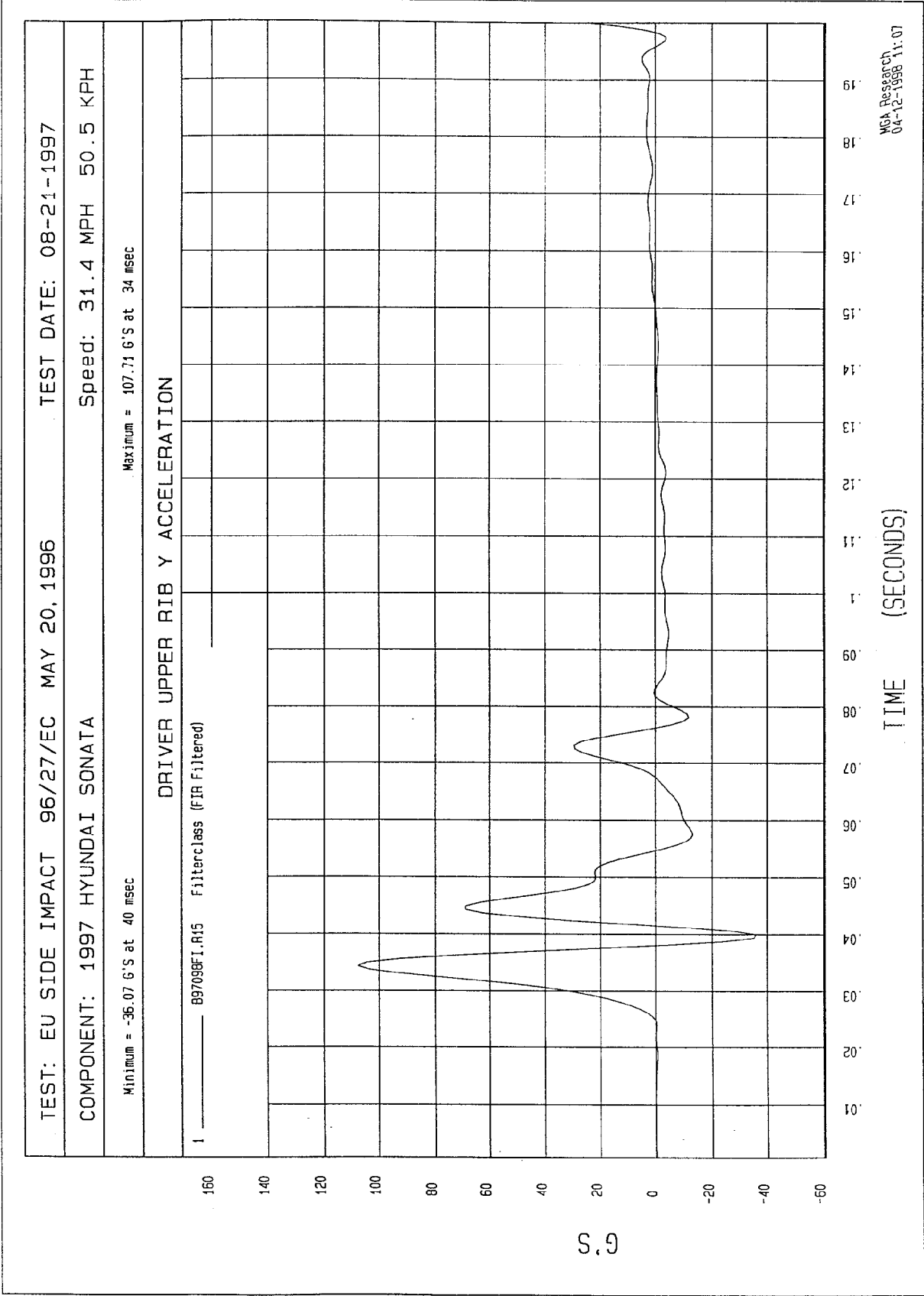










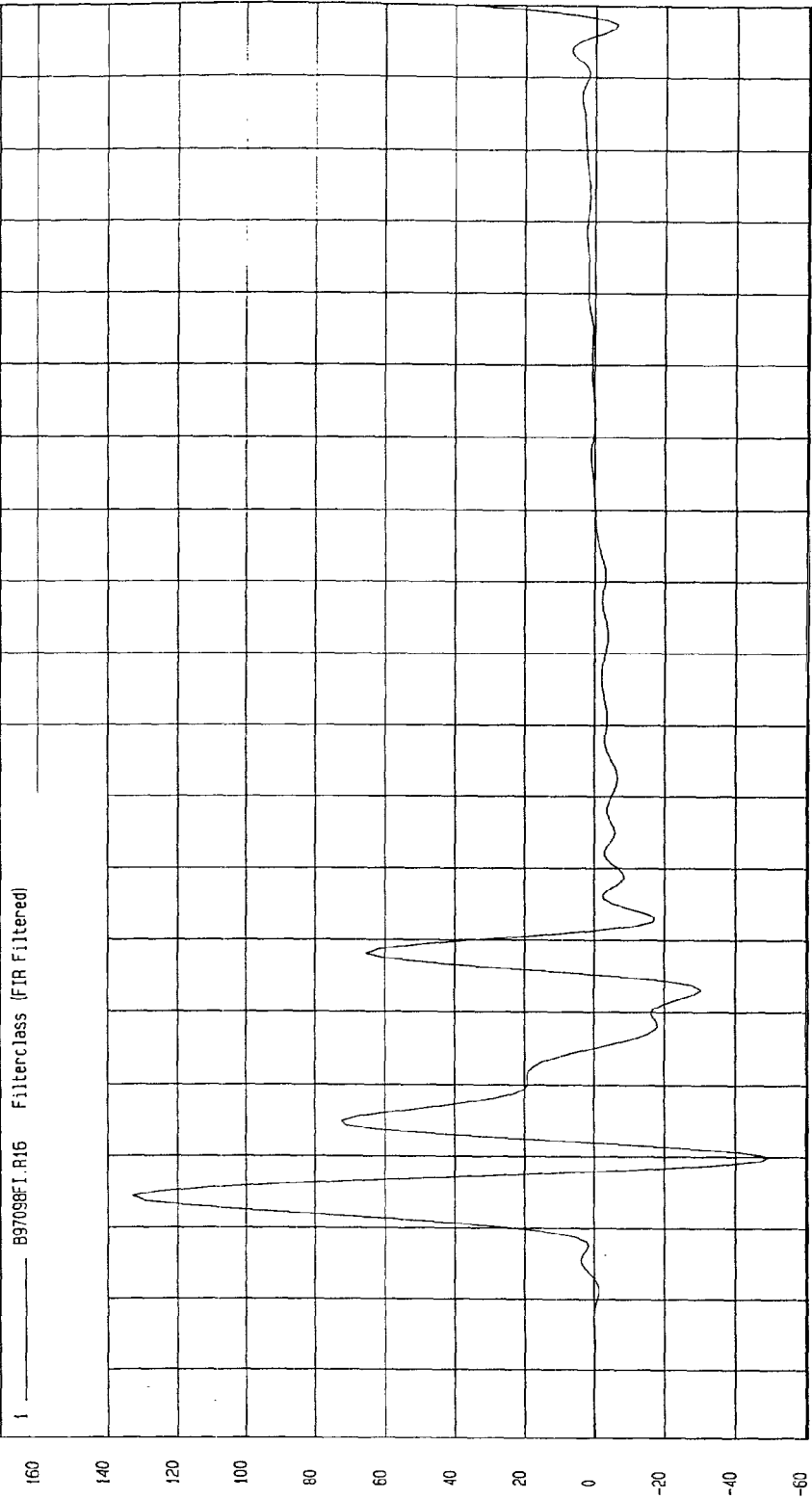


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -49.44 G'S at 40 msec Maximum = 132.91 G'S at 34 msec

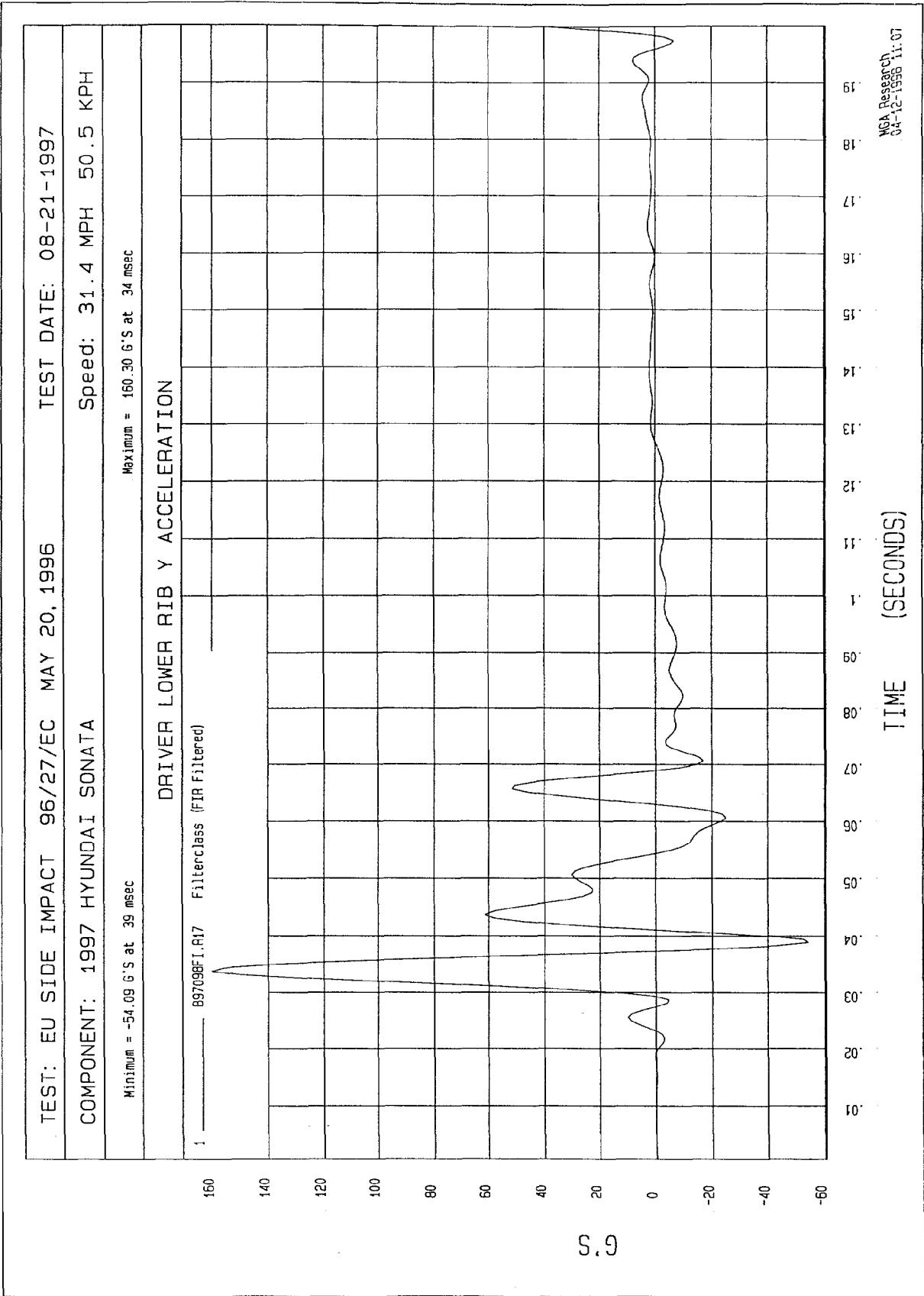
DRIVER MID RIB Y ACCELERATION

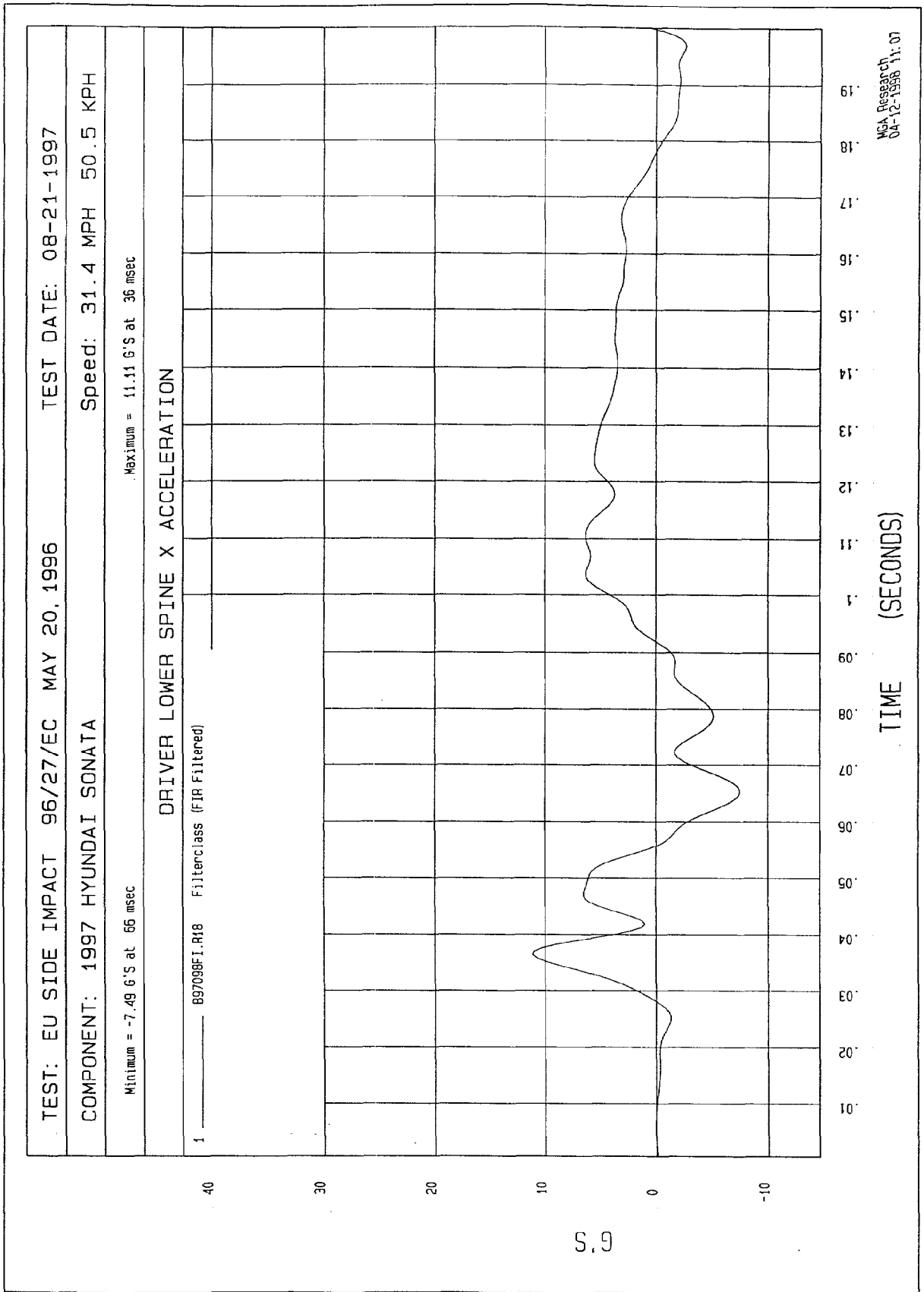


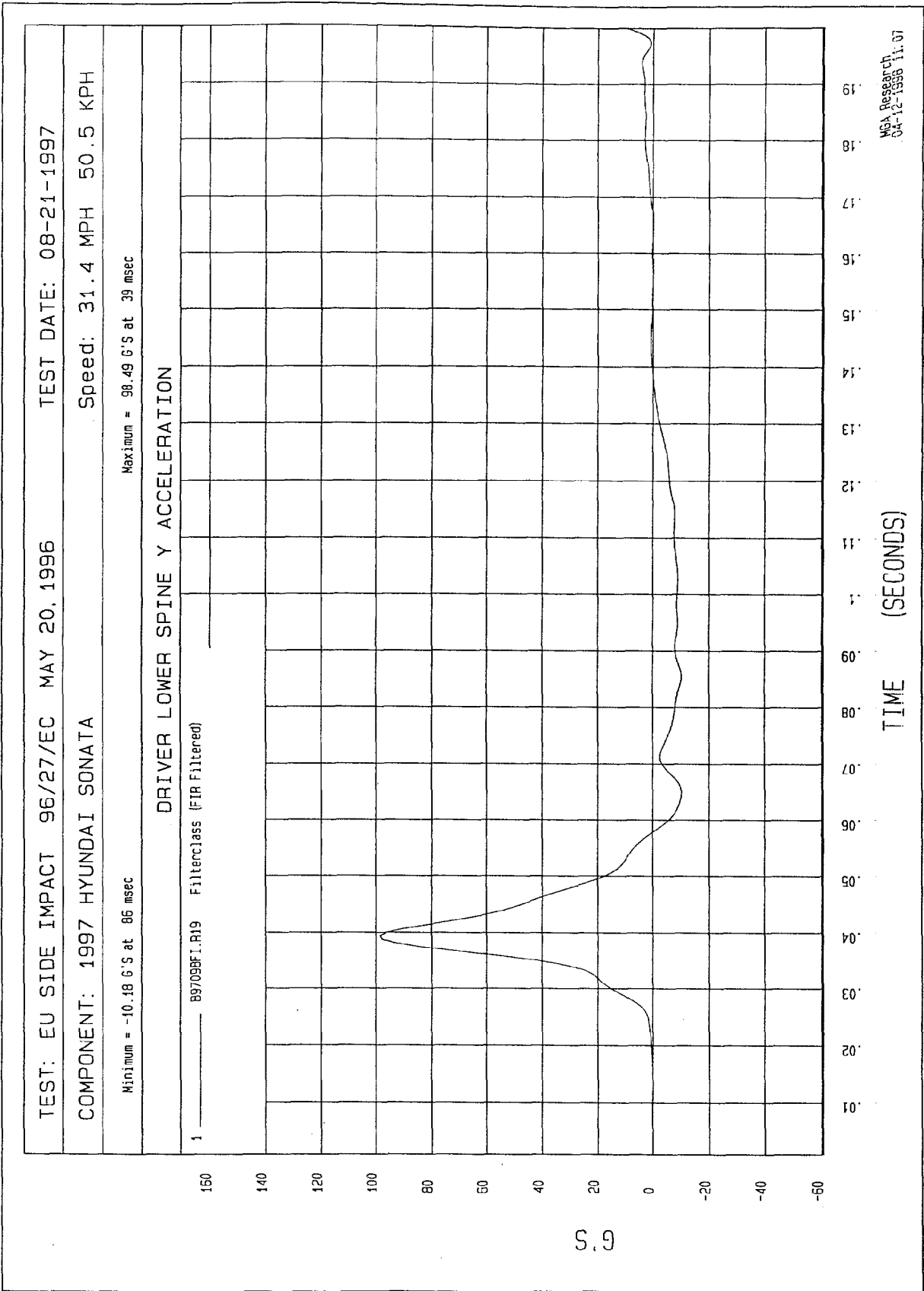
MCA Research
04-12-1998 11:07

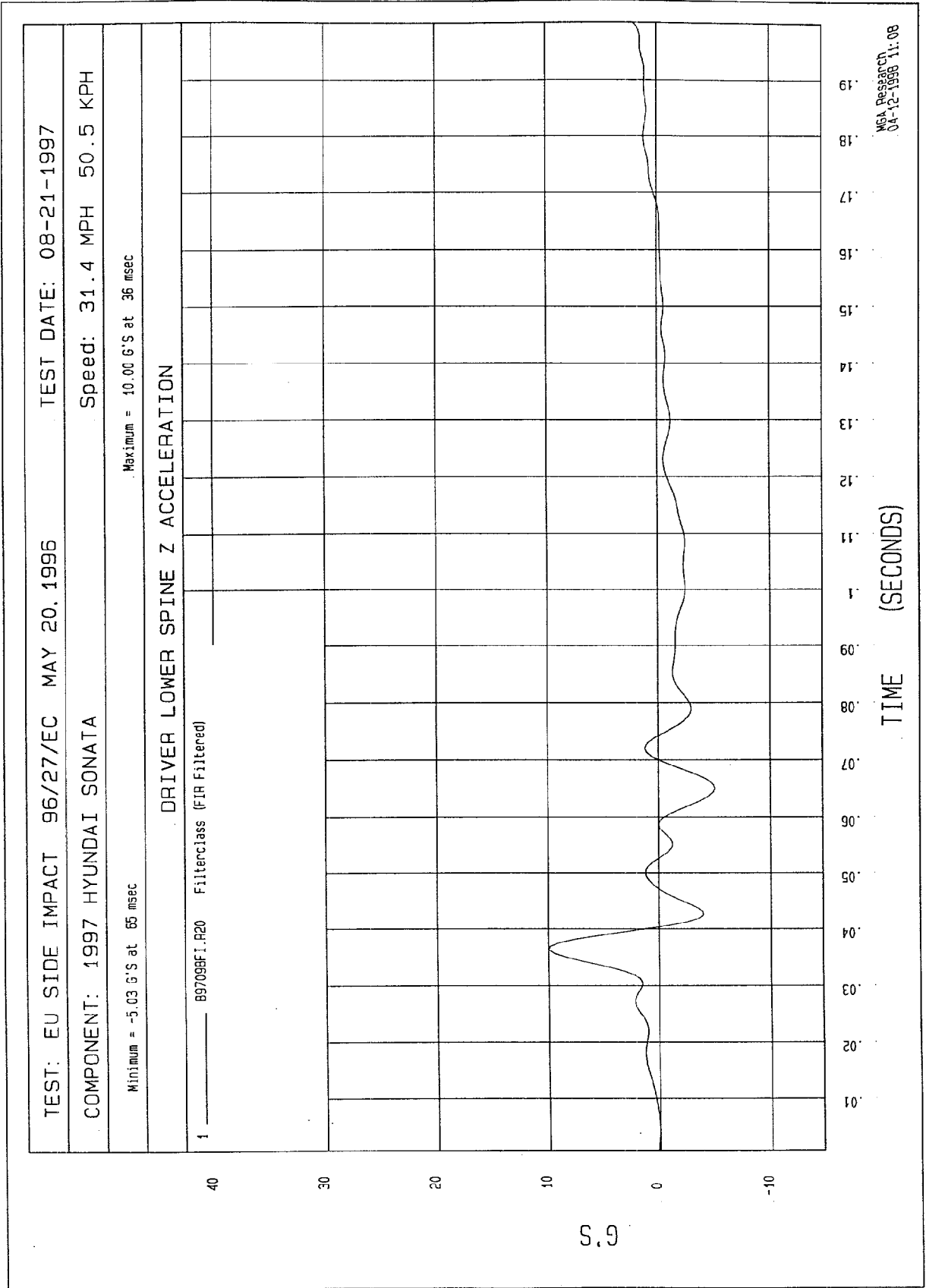
TIME (SECONDS)

G.S







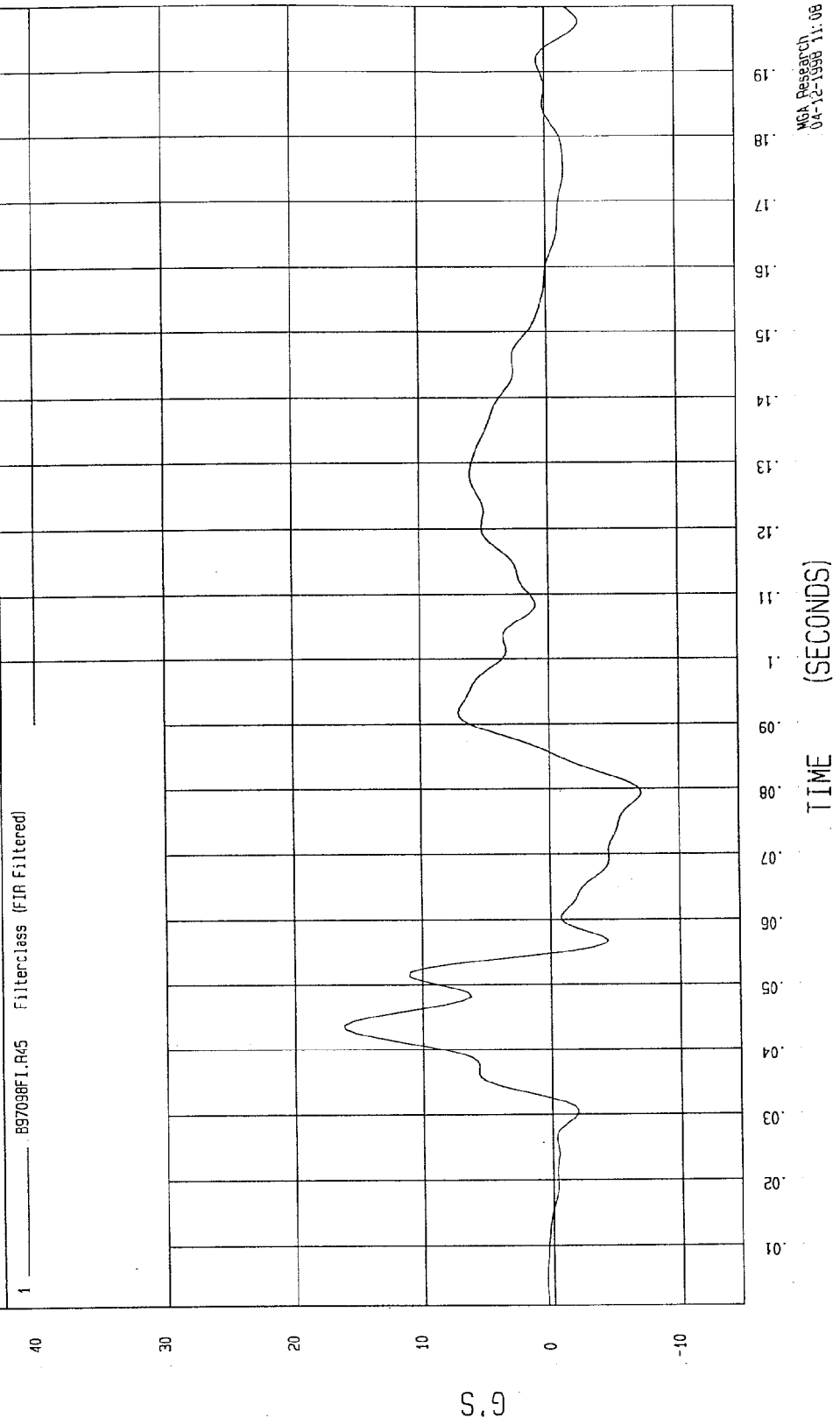


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -7.12 G'S at 79 msec Maximum = 16.03 G'S at 44 msec

DRIVER PELVIS X ACCELERATION



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -32.12 G'S at 59 msec

Maximum = 78.85 G'S at 36 msec

DRIVER PELVIS Y ACCELERATION

1 897098FI.R46 Filterc.ass (FIR Filtered)

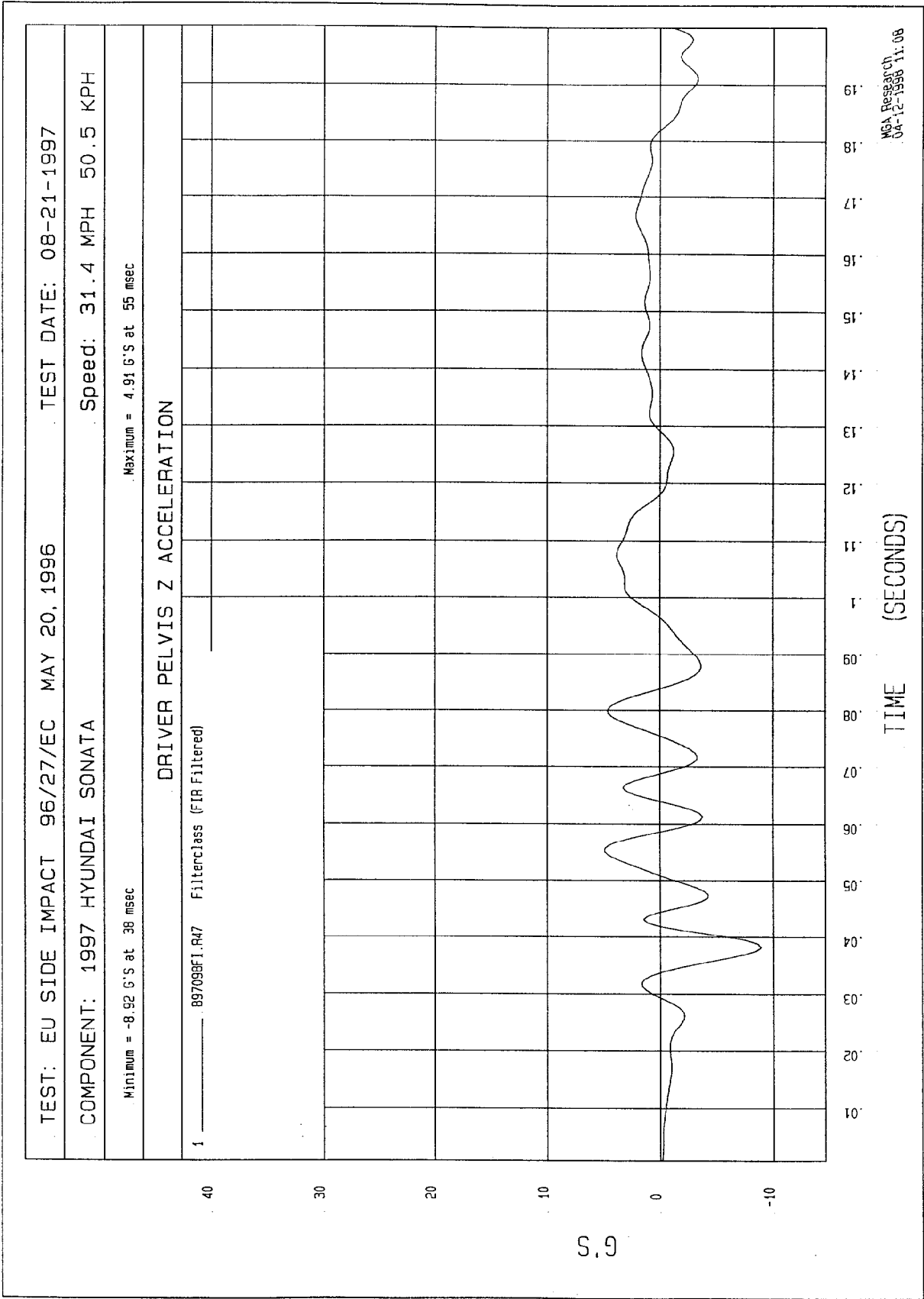
160
140
120
100
80
60
40
20
0
-20
-40
-60

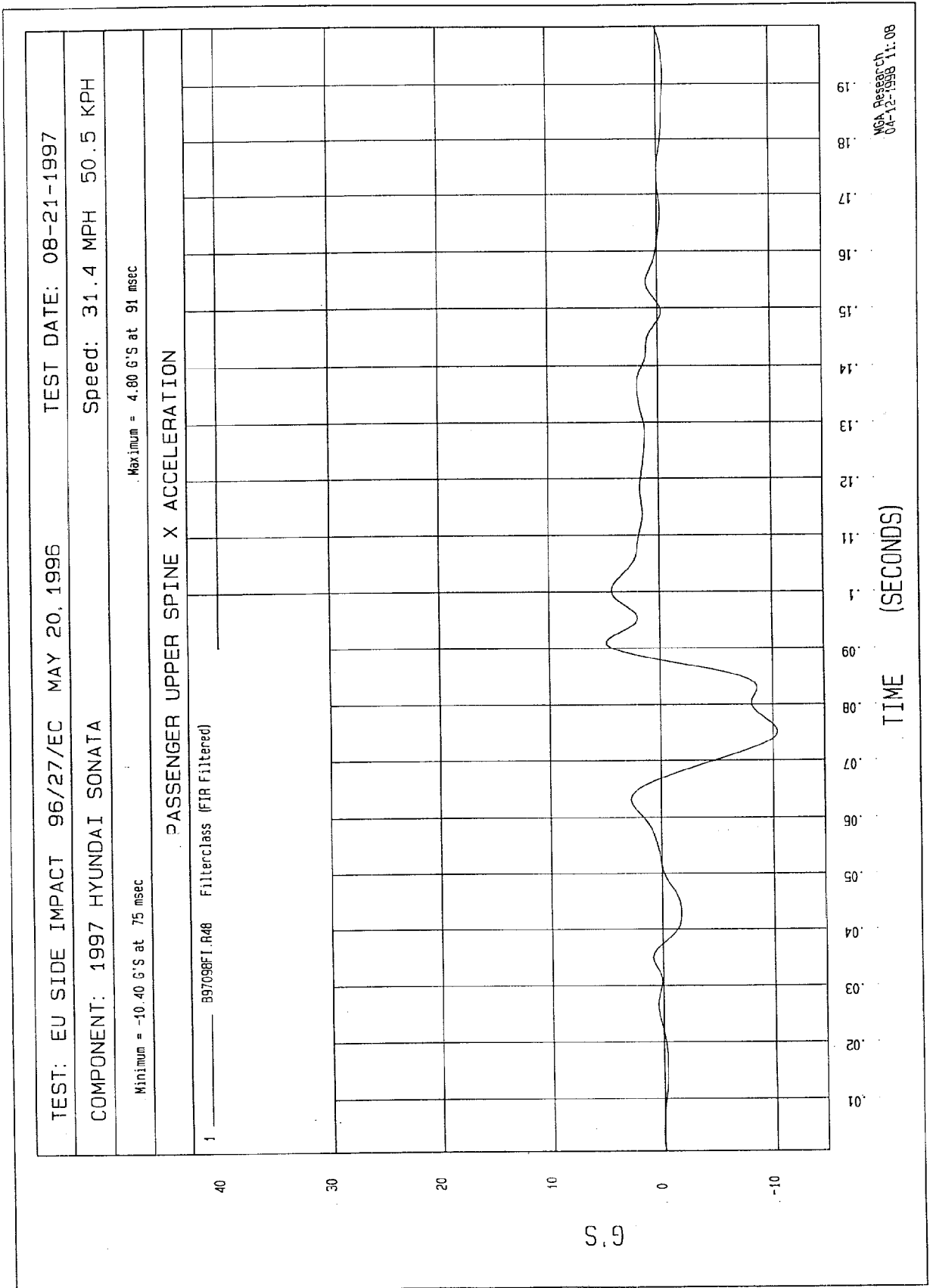
G

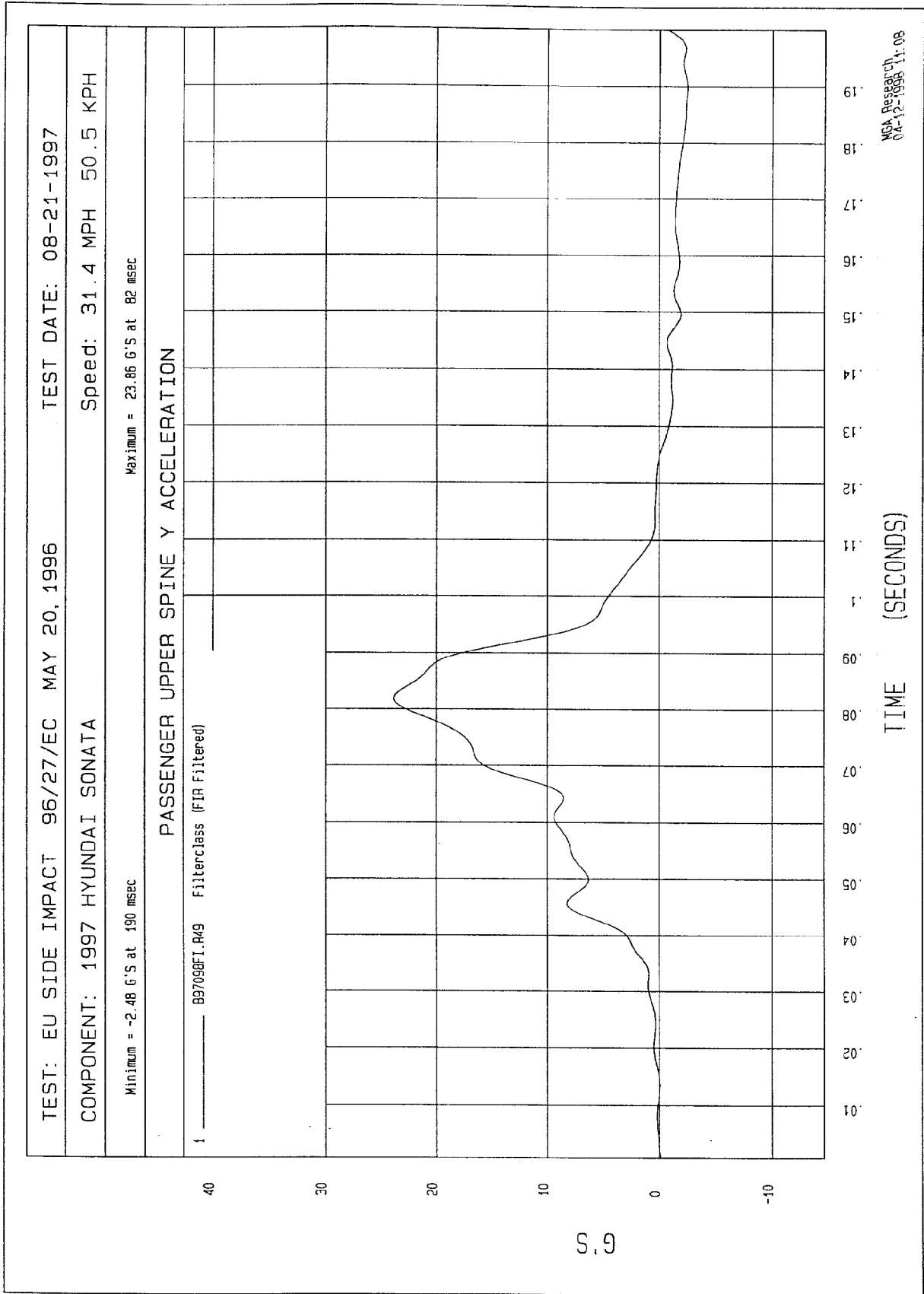
TIME (SECONDS)

19
18
17
16
15
14
13
12
11
10
09
08
07
06
05
04
03
02
01

WCA Research
04-12-1998 11:08







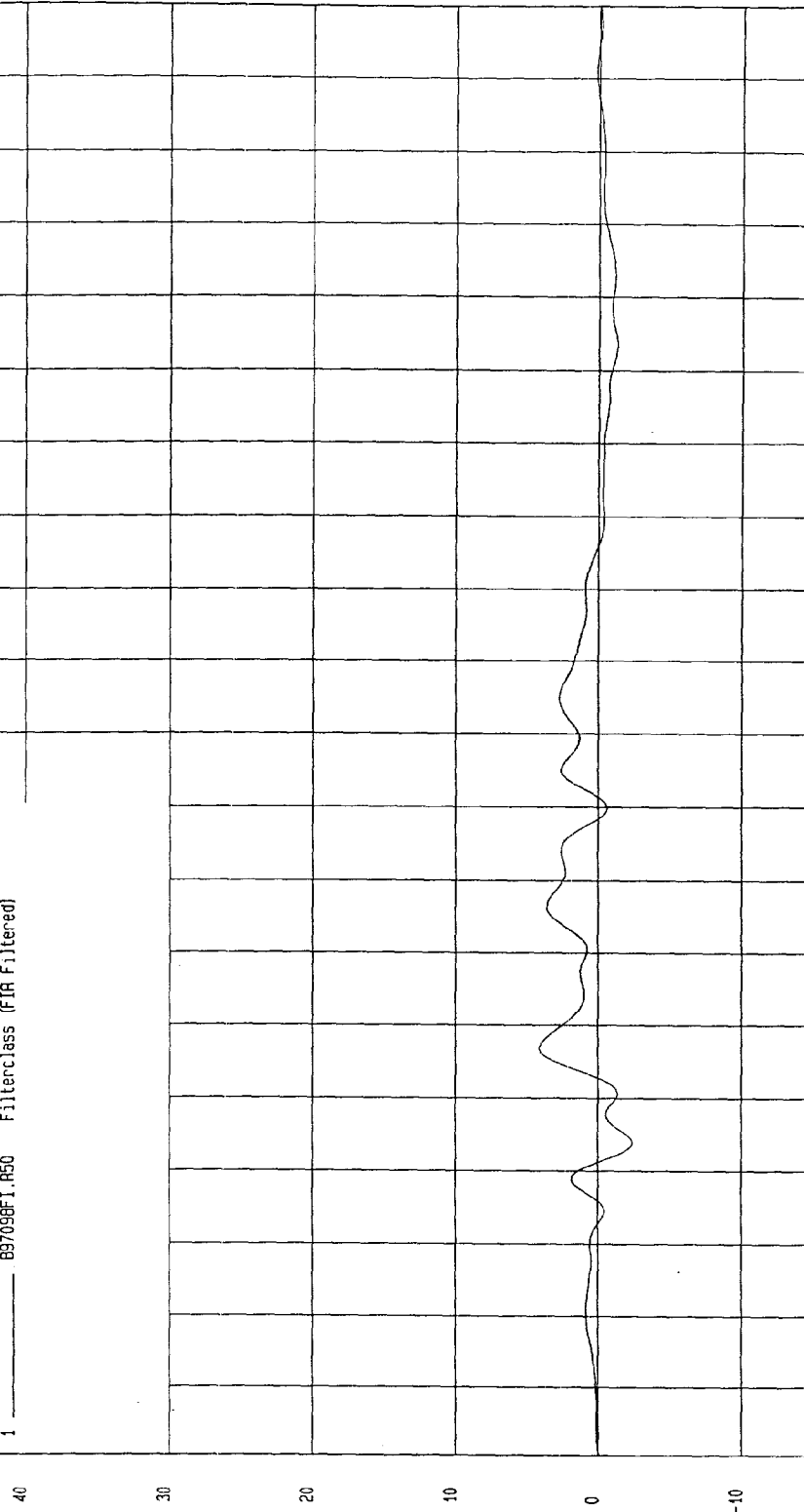
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.41 G'S at 44 msec Maximum = 4.06 G'S at 57 msec

PASSENGER UPPER SPINE Z ACCELERATION

1 B97090FI.R50 Filterclass (FIR Filtered)



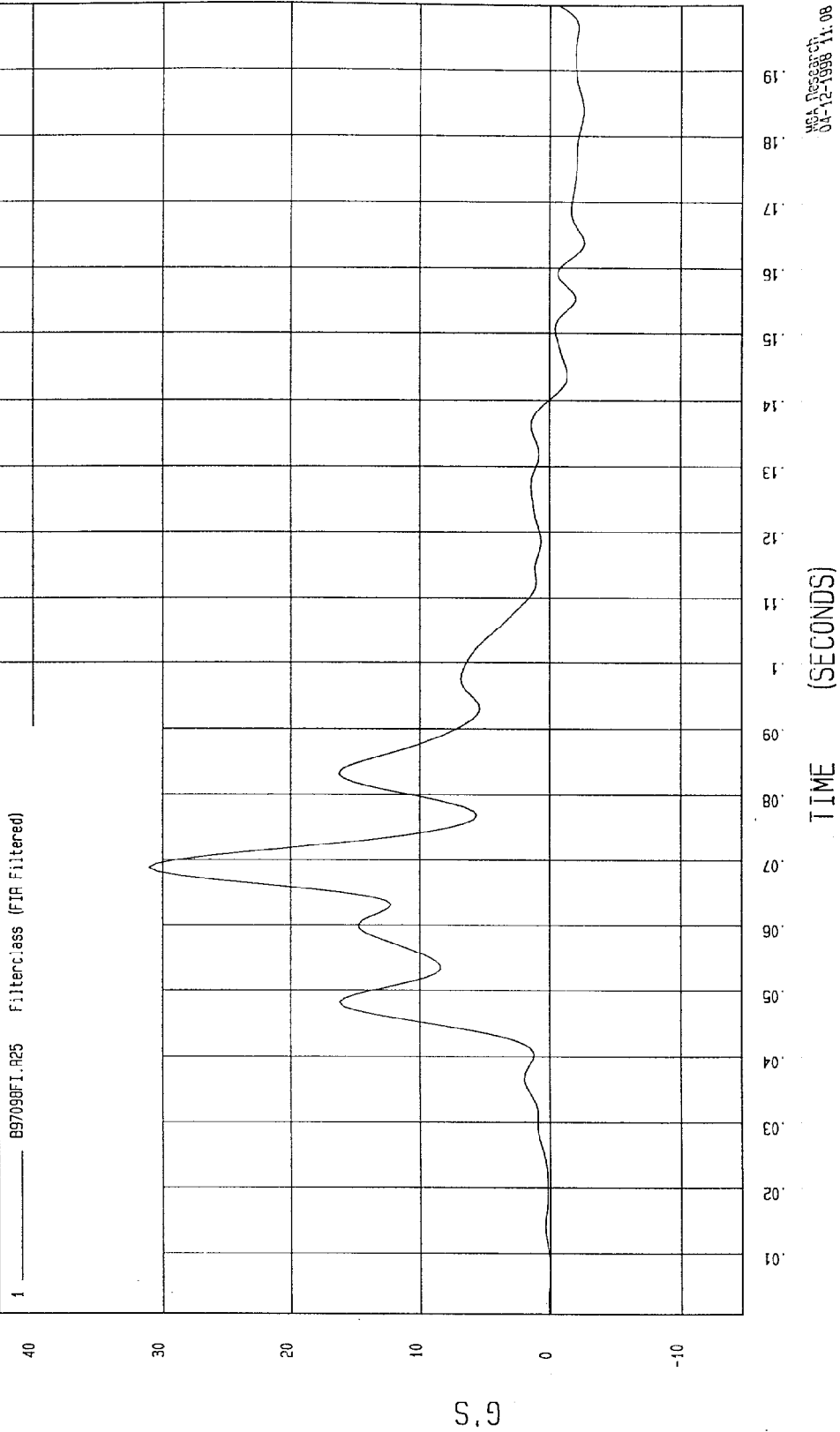
MGA Research
04-12-1998 11:08

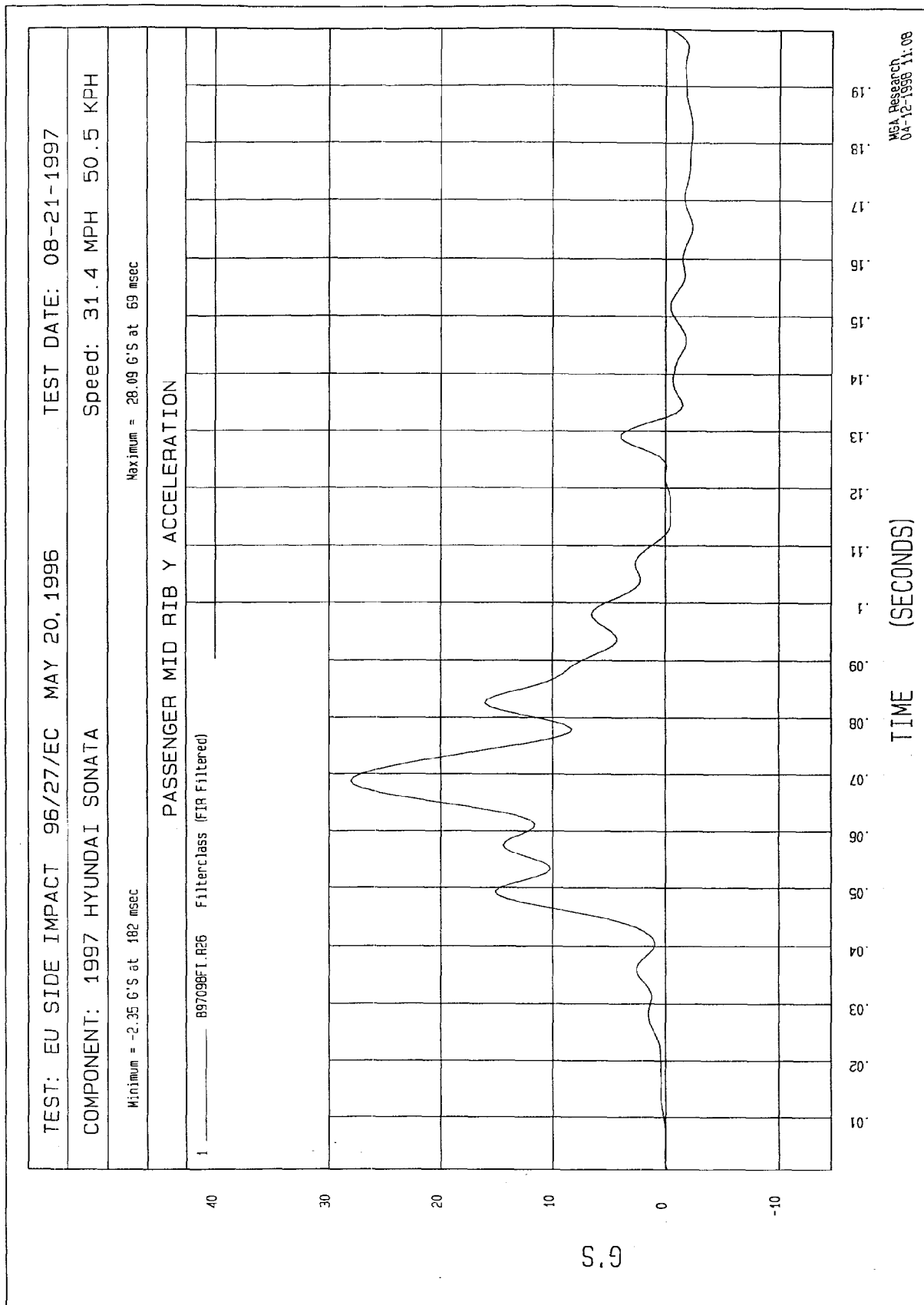
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

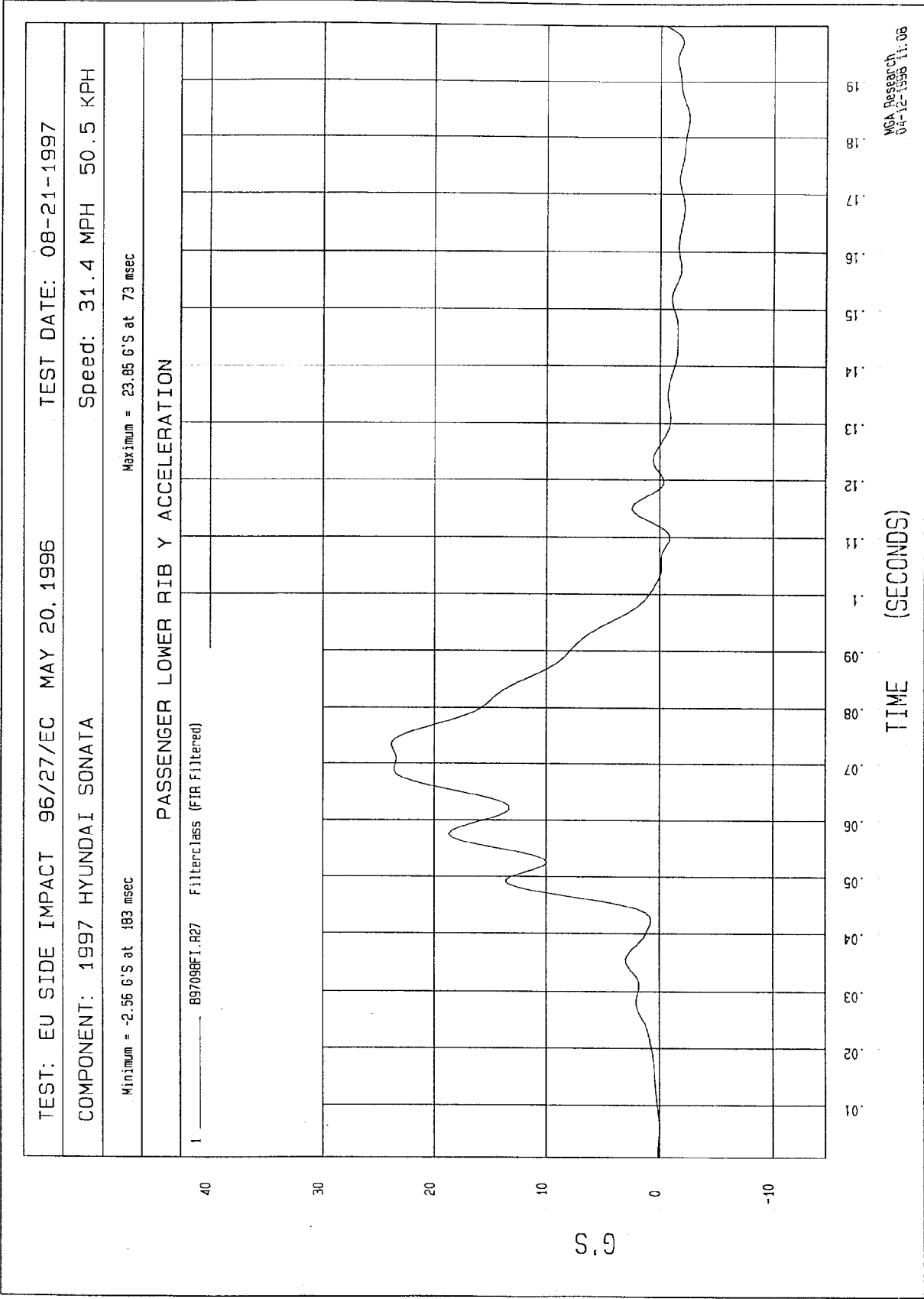
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -2.61 G'S at 164 msec Maximum = 31.07 G'S at 69 msec

PASSENGER UPPER RIB Y ACCELERATION





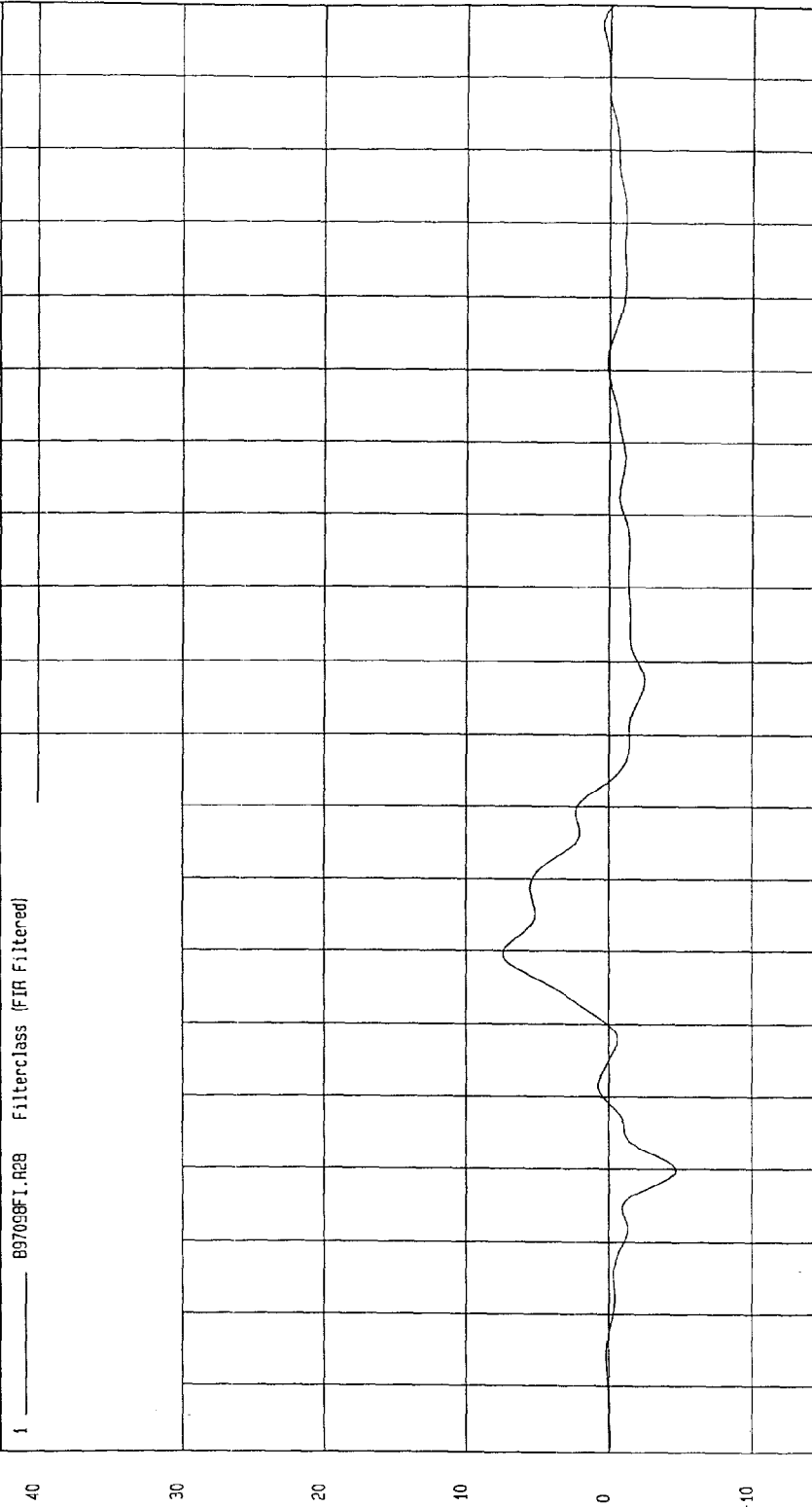


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

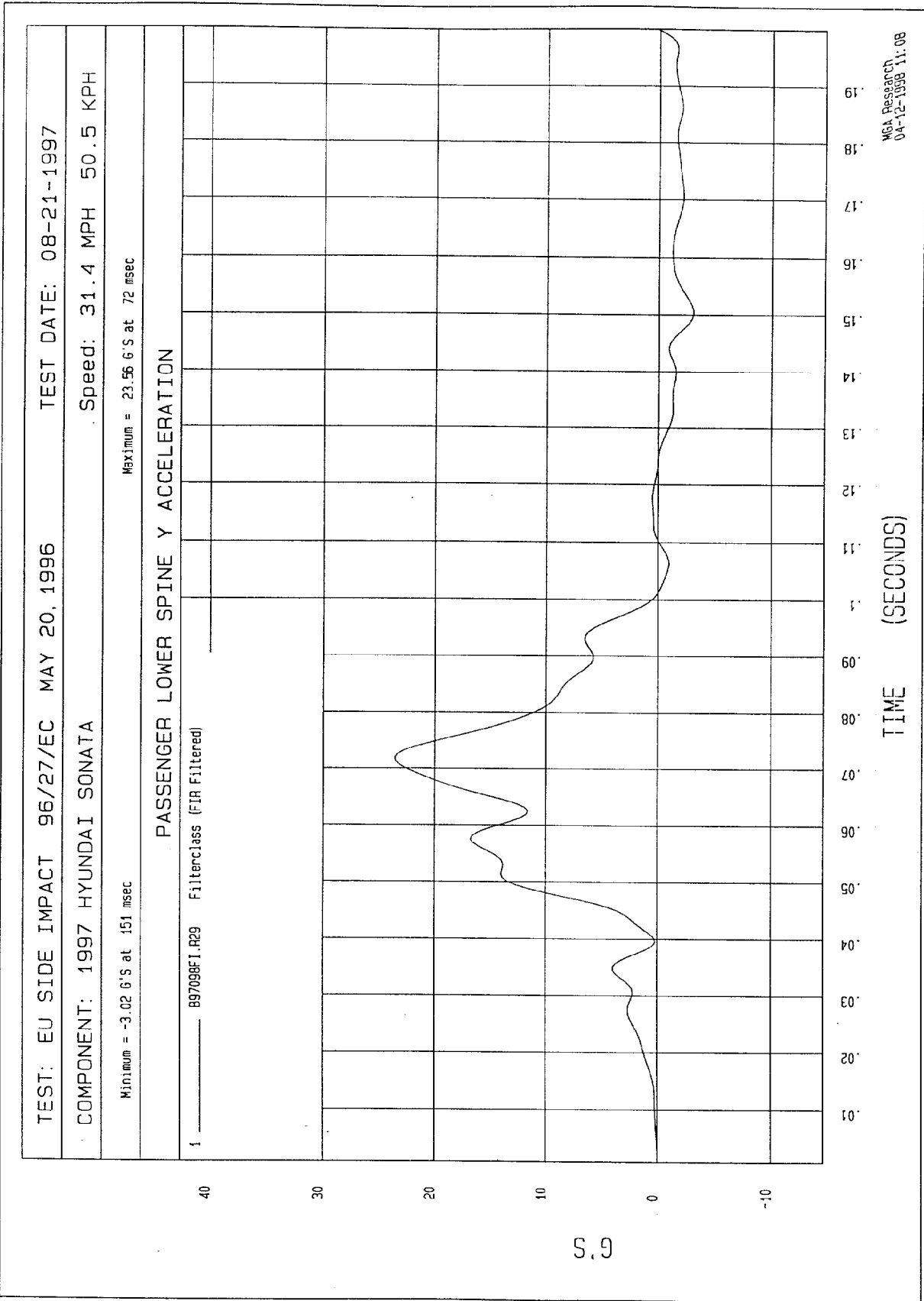
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

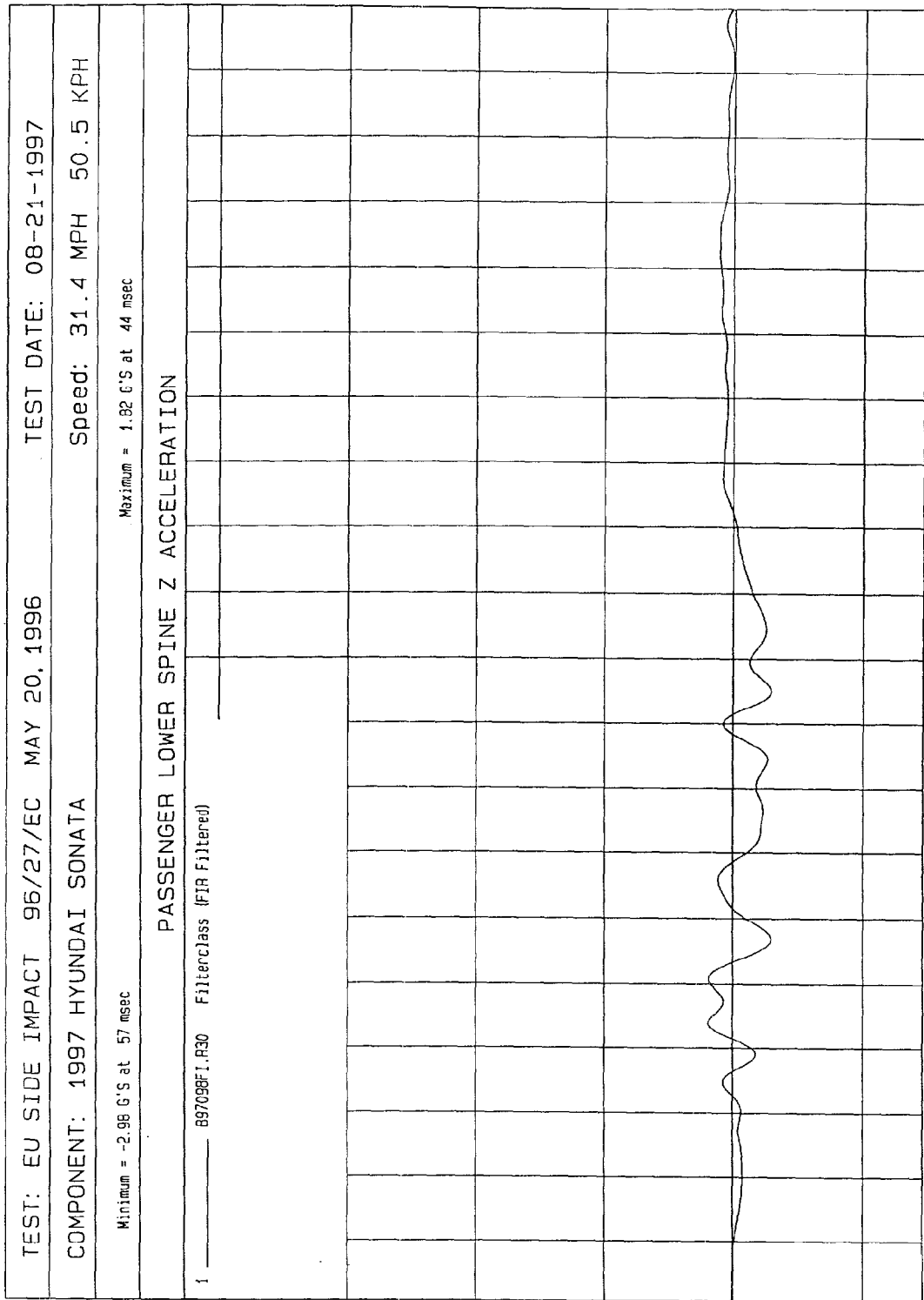
Minimum = -4.71 G'S at 40 msec Maximum = 7.39 G'S at 69 msec

PASSENGER LOWER SPINE X ACCELERATION

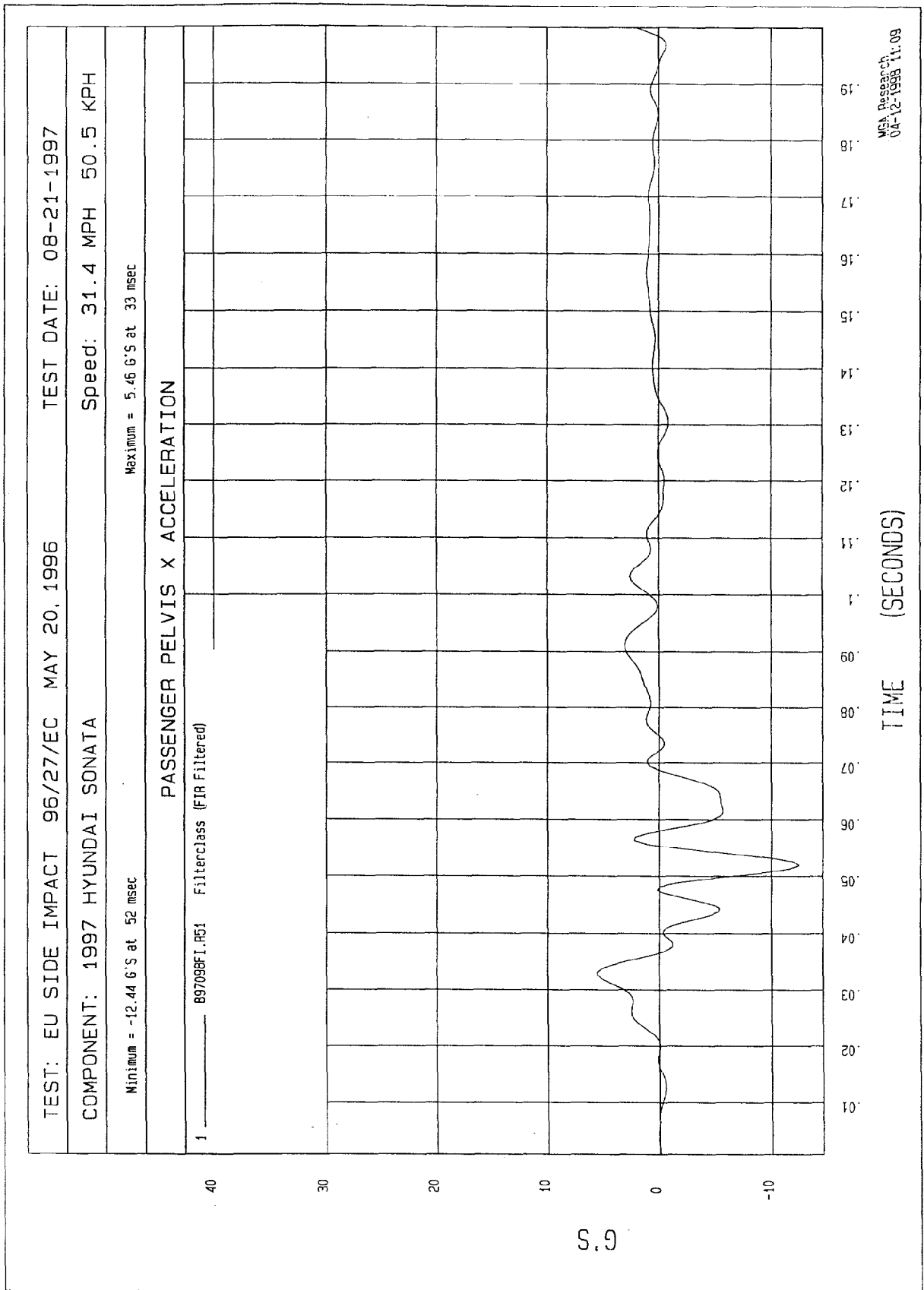


WGA Research
04-12-1998 11:08





MGA Research
04-12-1998 11:09

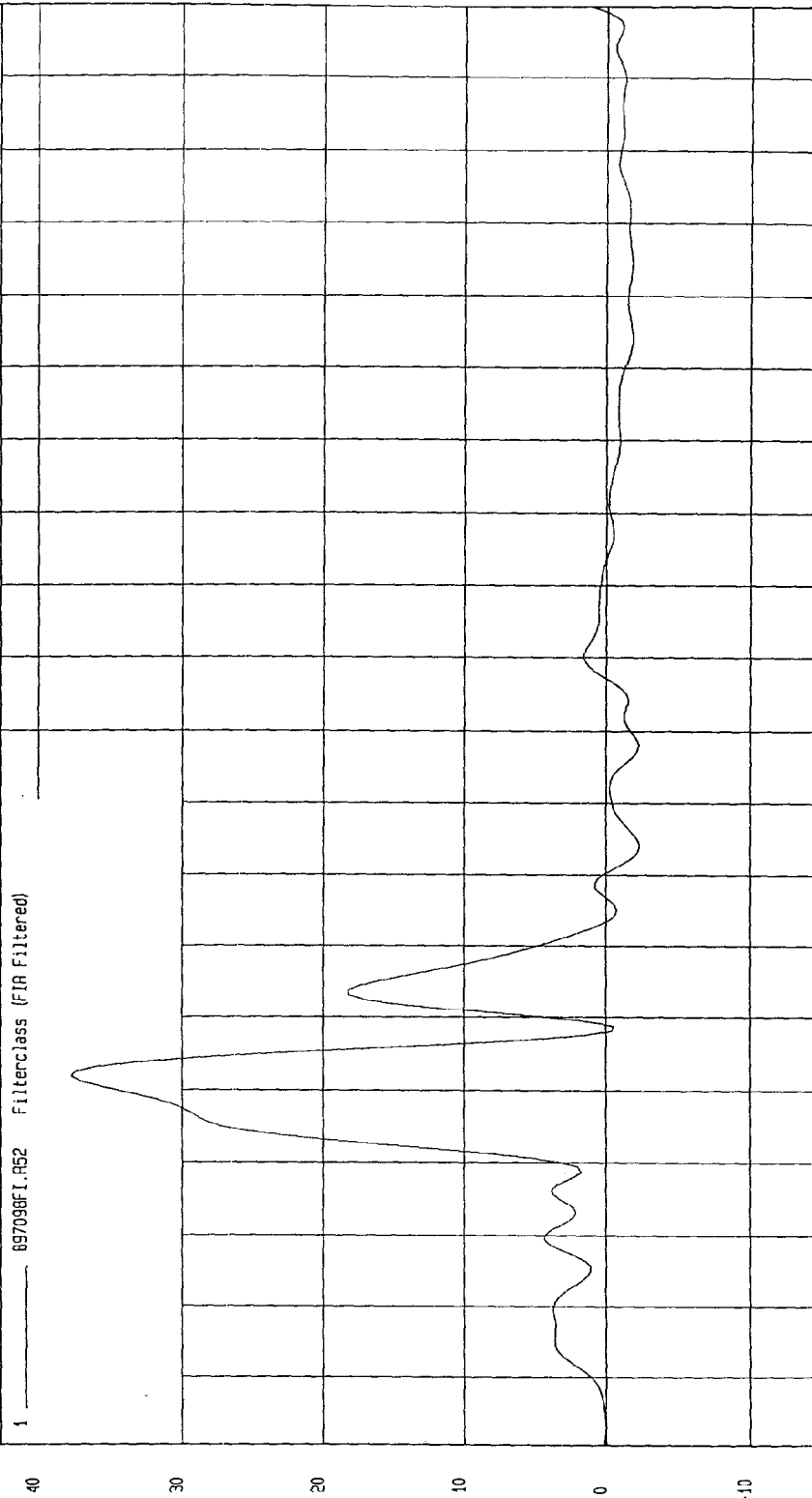


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

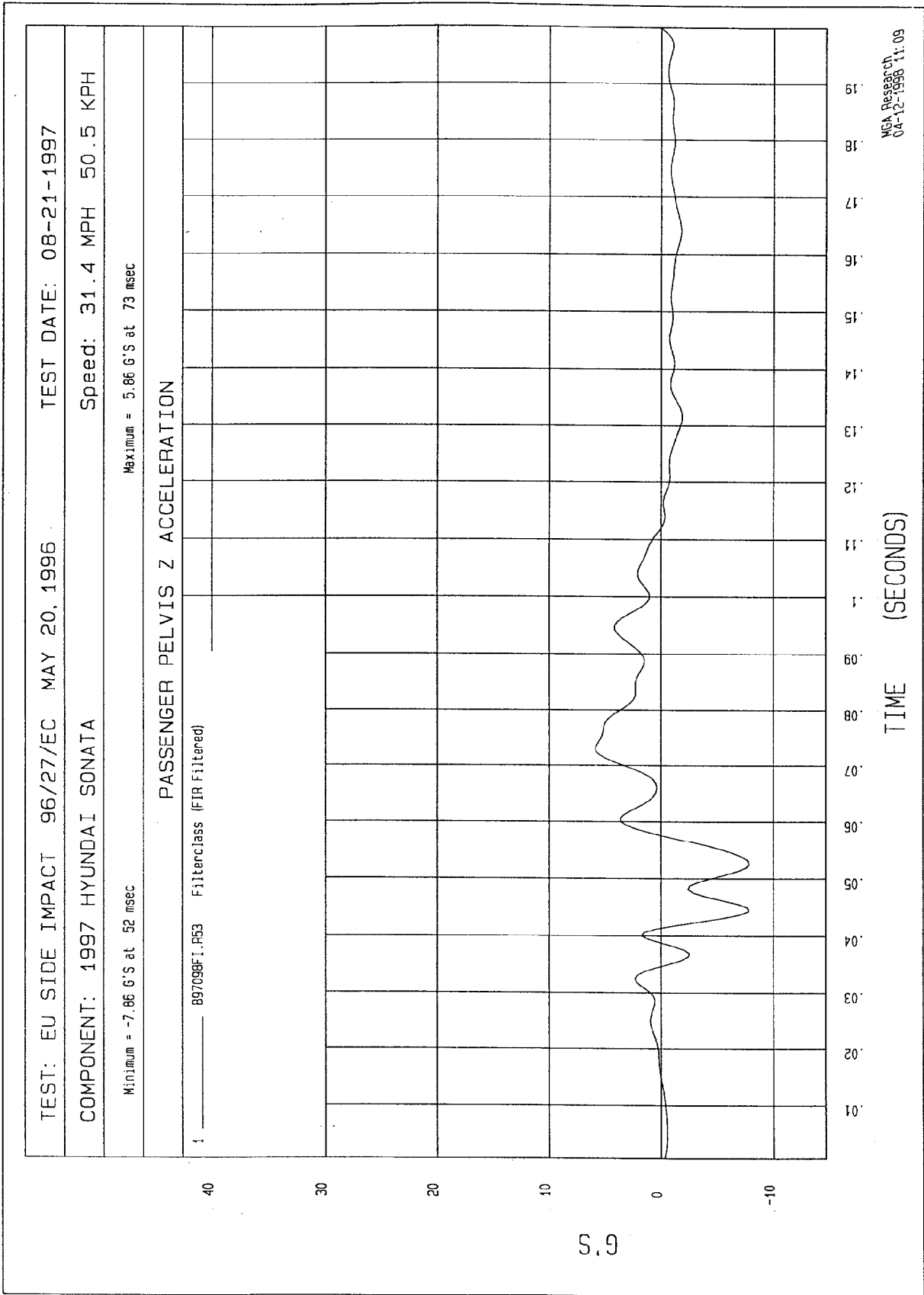
Minimum = -2.30 G'S at 84 msec Maximum = 37.65 G'S at 52 msec

PASSENGER PELVIS Y ACCELERATION



TIME (SECONDS)

WCA Research
04-12-1998 11:09



RELATIVE DISPLACEMENTS

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

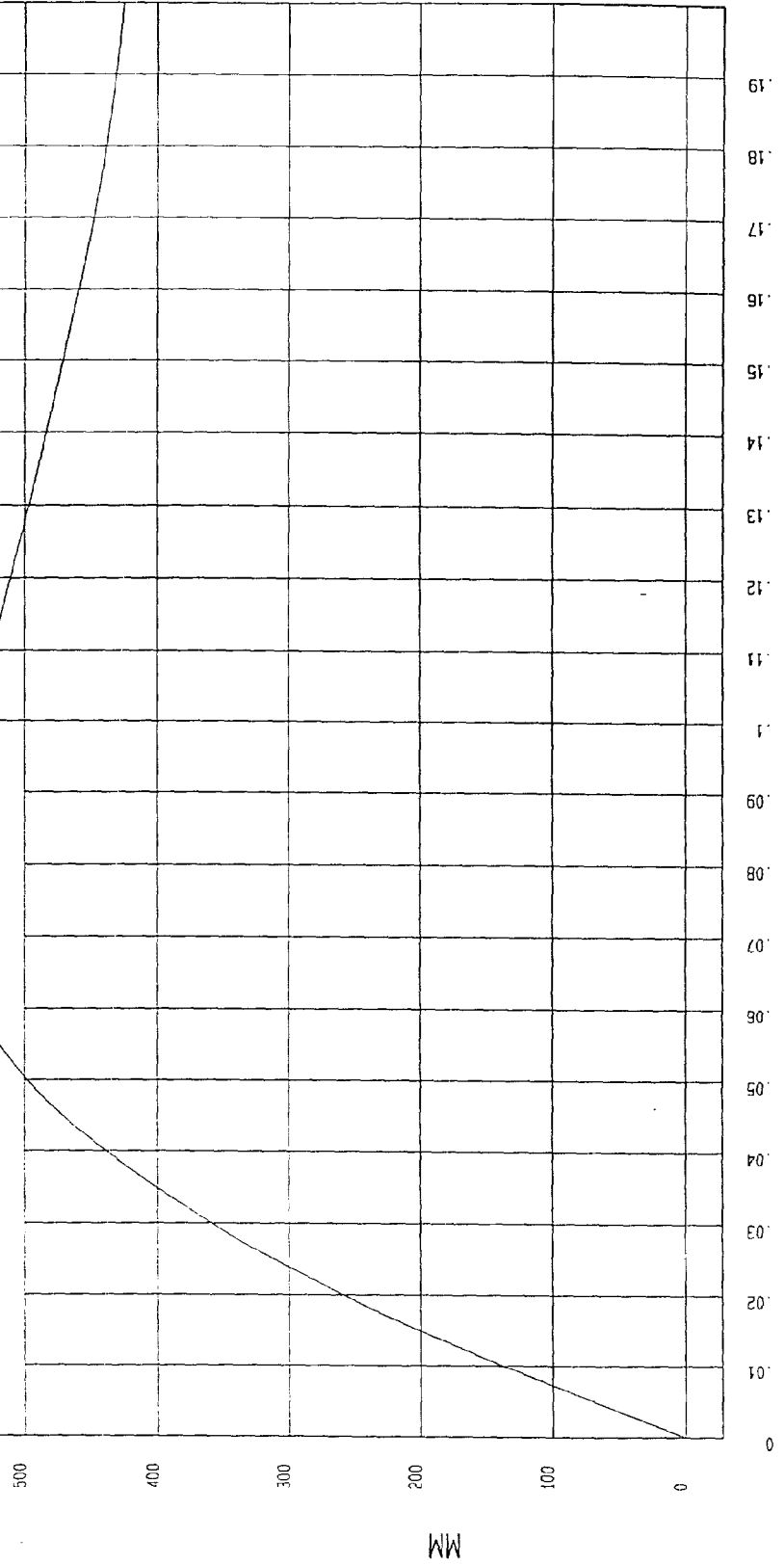
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 0 MM at 0 msec

Maximum = 557.32 MM at 76 msec

CART CG X MINUS RIGHT FRONT SILL Y DISPLACEMENT

1 ——— B97098AU.D99 Filterclass (180)



MCA Research
08-24-1997 11:56

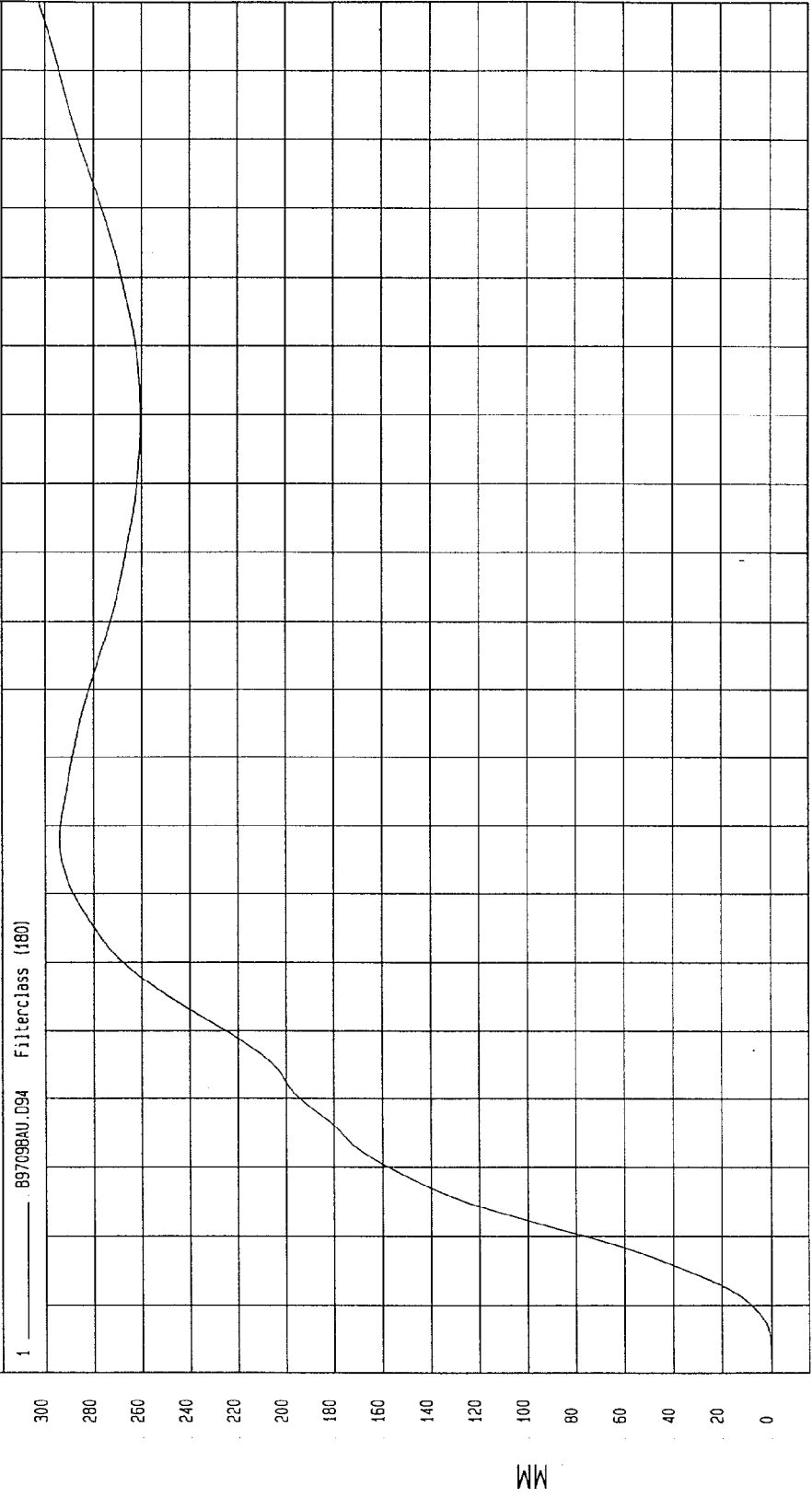
TIME Seconds

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = 0 MM at 0 msec Maximum = 302.38 MM at 200 msec

LEFT FRONT DOOR @ UPPER TORSO MINUS RIGHT FRONT SILL DISPLACEMENT



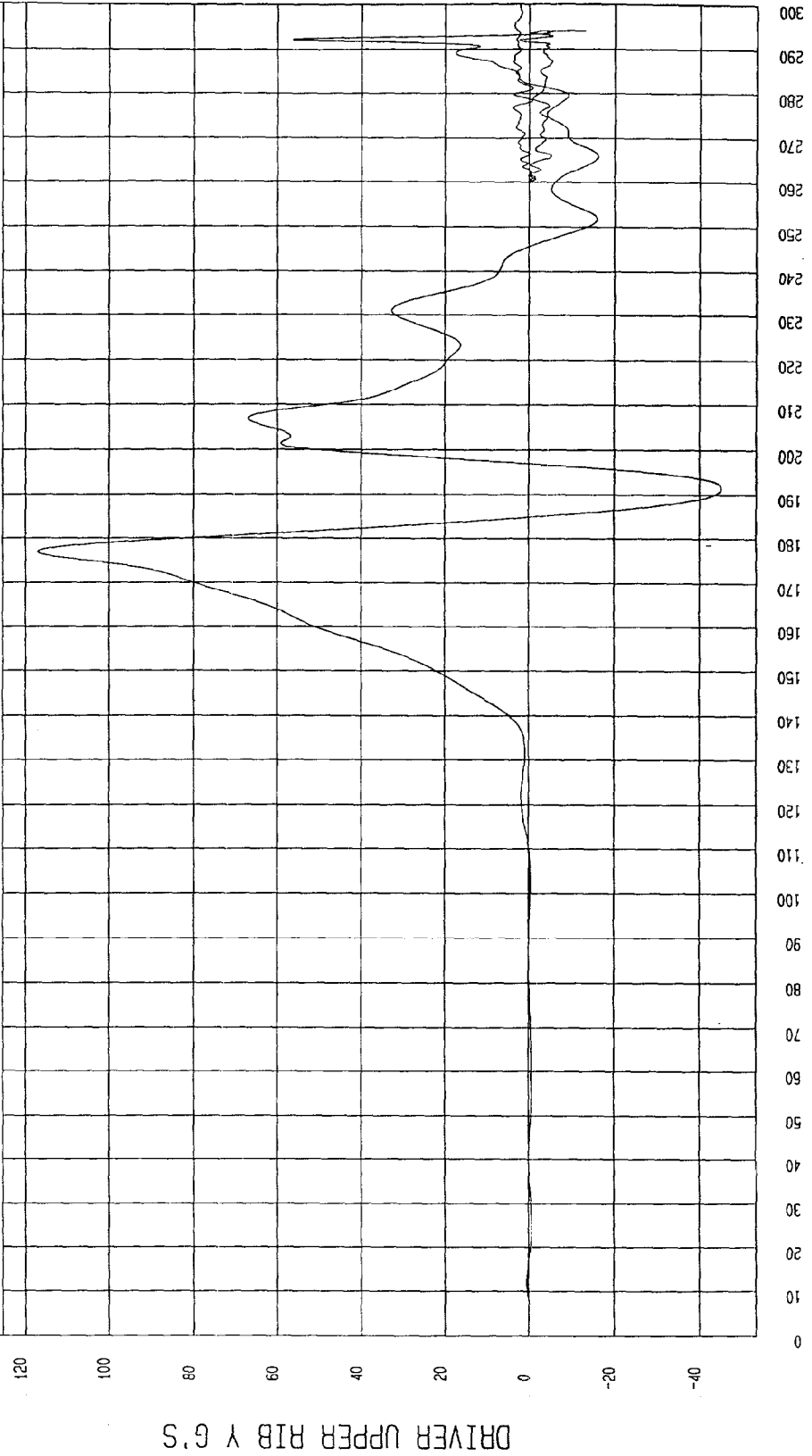
TIME Seconds

WGA Research
10-11-1997 11:35

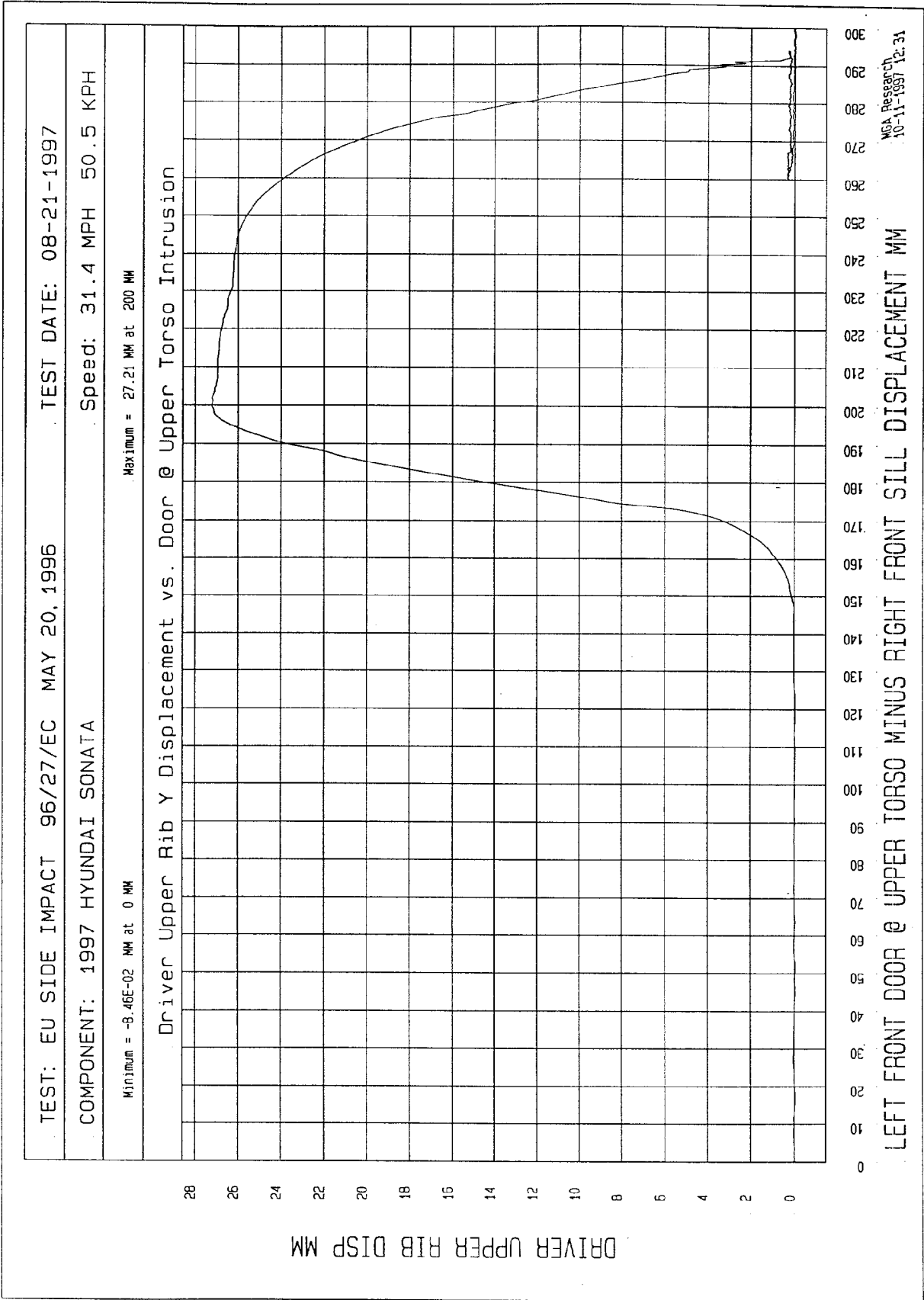
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -45.05 G'S at 191 MM Maximum = 117.15 G'S at 177 MM

Driver Upper Rib Y Acceleration vs. Door @ Upper Torso Intrusion



LEFT FRONT DOOR @ UPPER TORSO MINUS RIGHT FRONT SILL DISPLACEMENT MM M&A Research, Inc. 10-11-1997 12:31



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

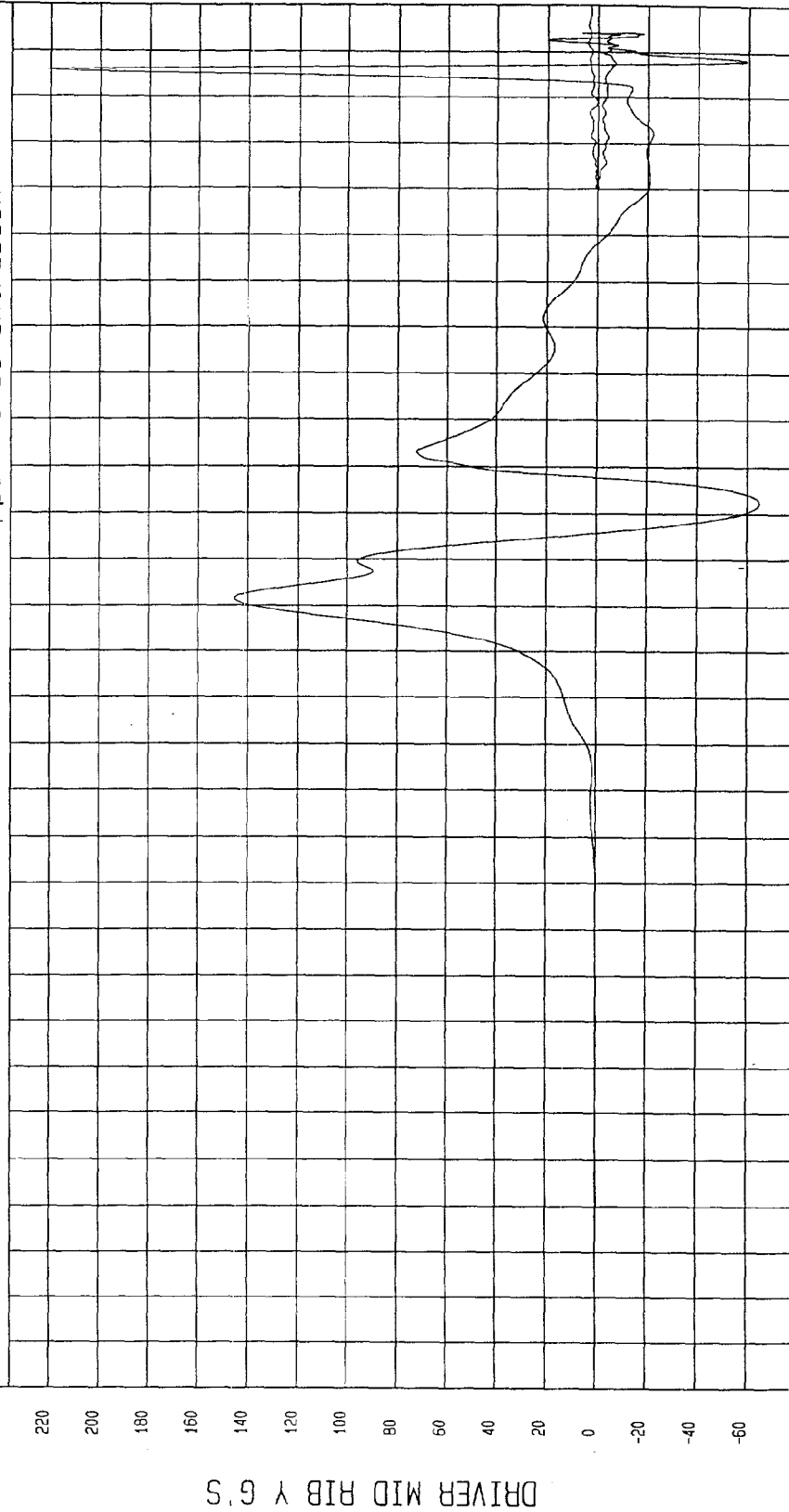
COMPONENT: 1997 HYUNDAI SONATA

Speed: 31.4 MPH 50.5 KPH

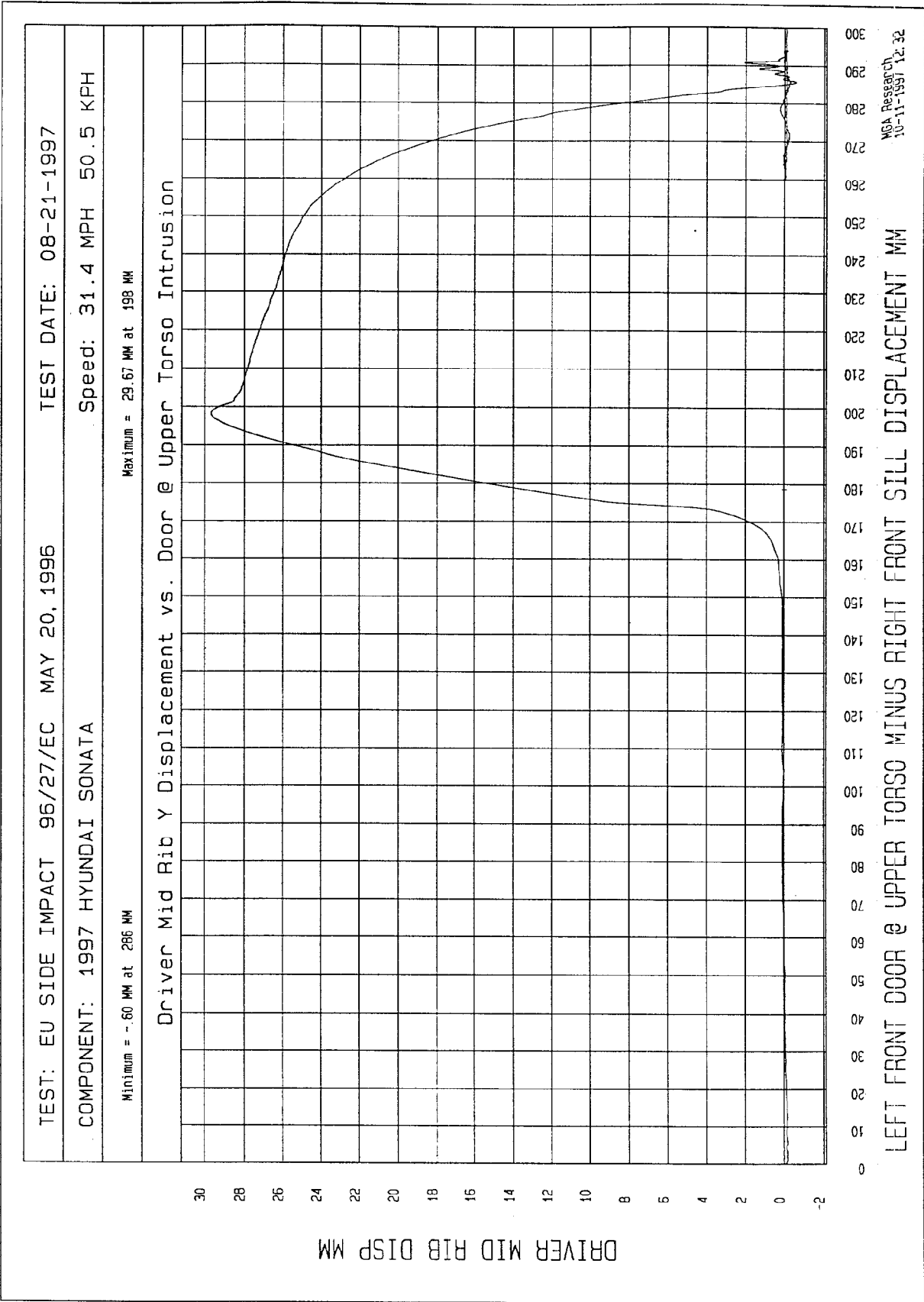
Minimum = -64.57 G'S at 192 MM

Maximum = 221.25 G'S at 286 MM

Driver Mid Rib Y Acceleration vs. Door @ Upper Torso Intrusion



WCA Research
10-11-1997 12:32

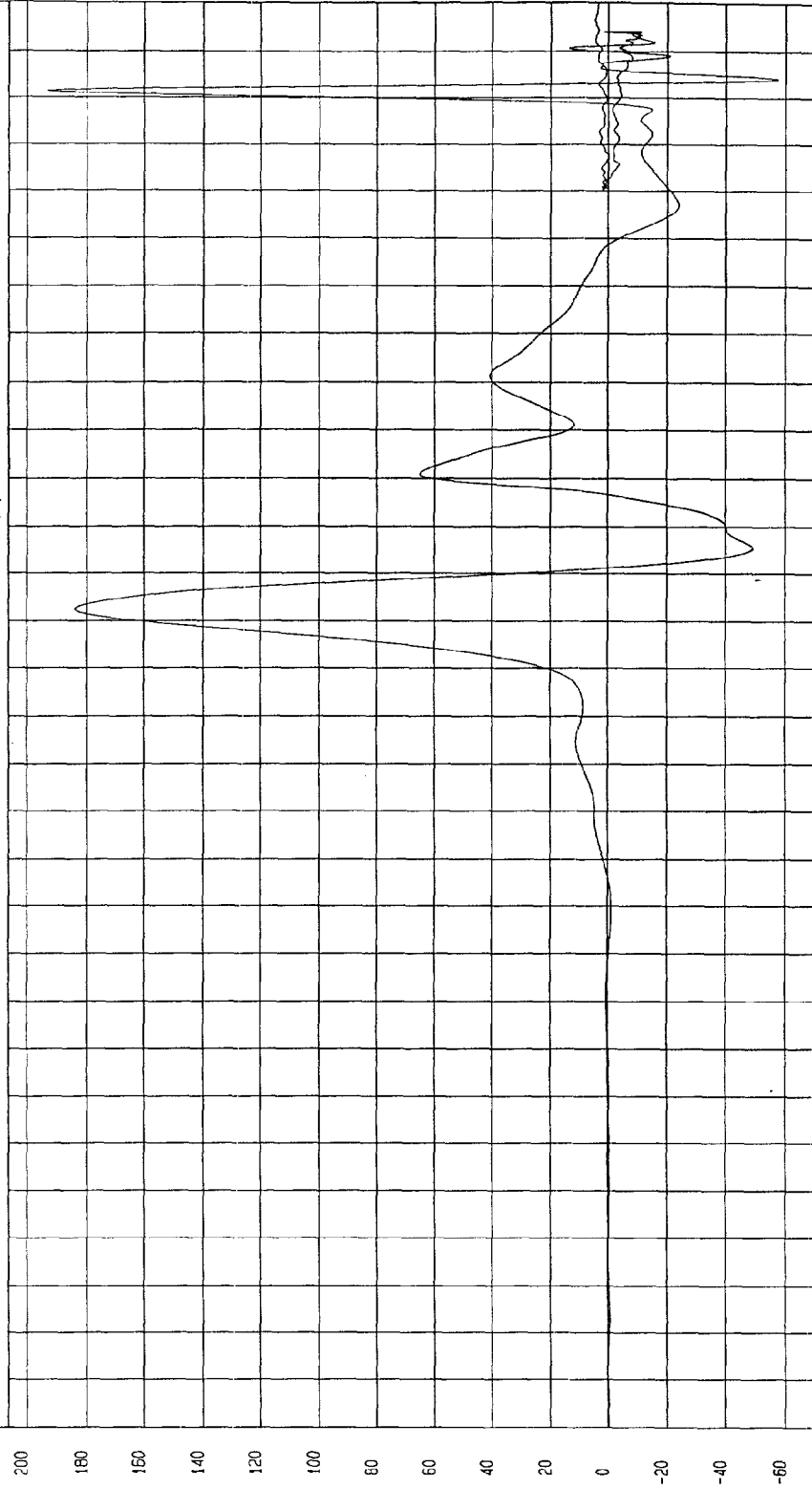


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -57.29 G'S at 284 MM Maximum = 193.48 G'S at 281 MM

Driver Lower Rib Y Acceleration vs. Door @ Upper Torso Intrusion



LEFT FRONT DOOR @ UPPER TORSO MINUS RIGHT FRONT SILL DISPLACEMENT MM

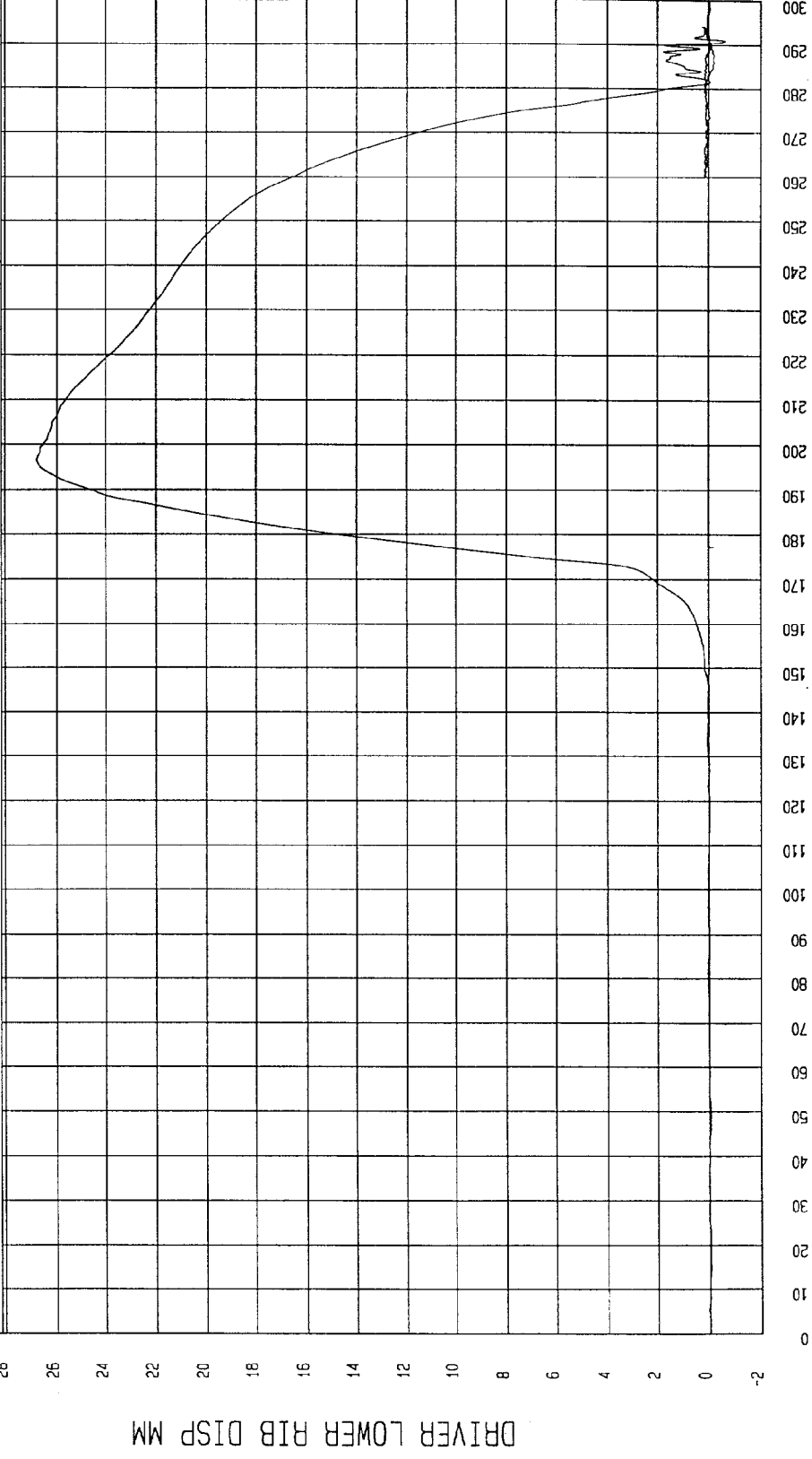
MSA Research
10-11-1997 12:32

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

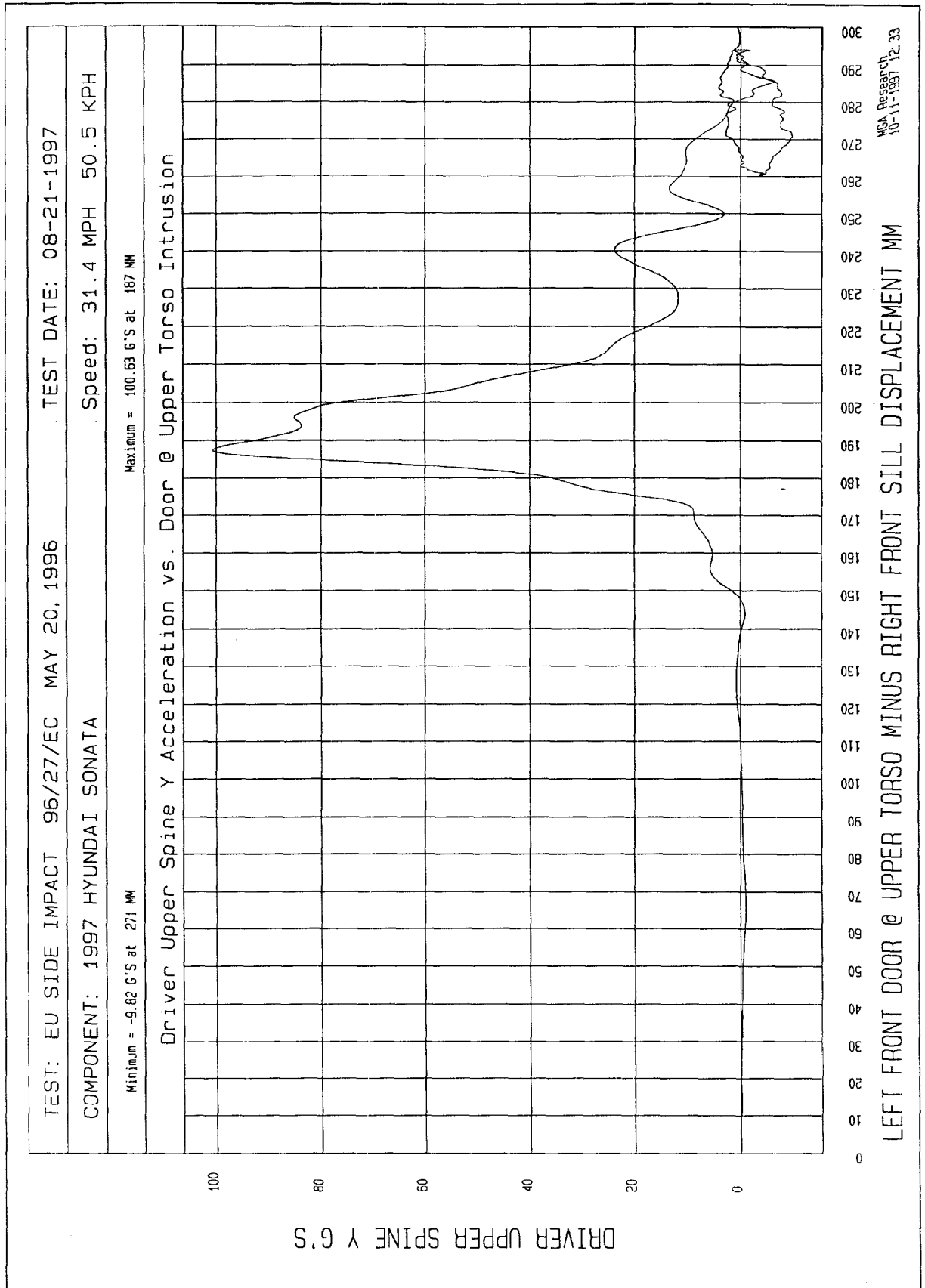
Minimum = -.64 MM at 291 MM Maximum = 26.73 MM at 196 MM

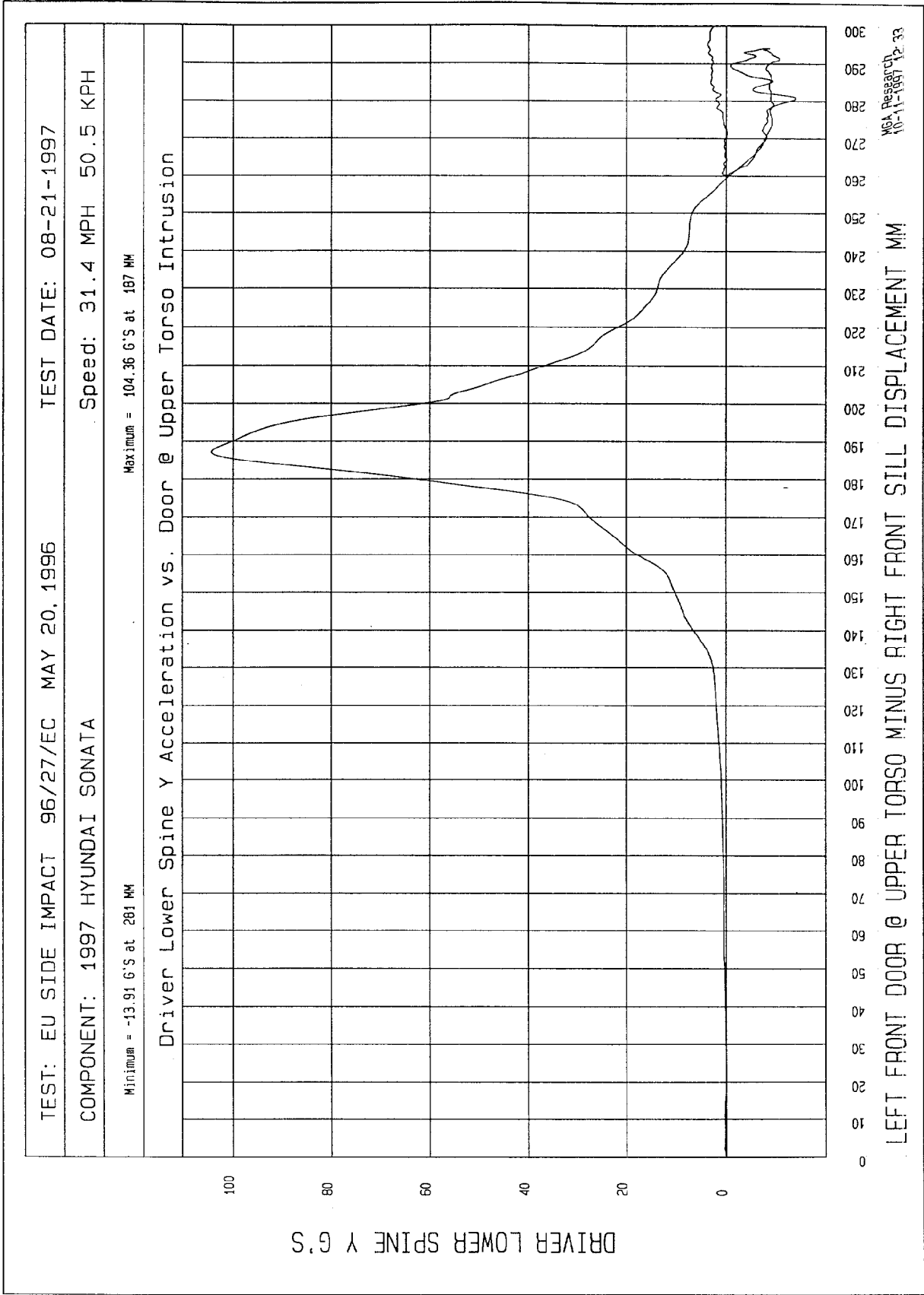
Driver Lower Rib Y Displacement vs. Door @ Upper Torso Intrusion



LEFT FRONT DOOR @ UPPER TORSO MINUS RIGHT FRONT SILL DISPLACEMENT MM

MCA Research
10-11-1997 12:33





TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

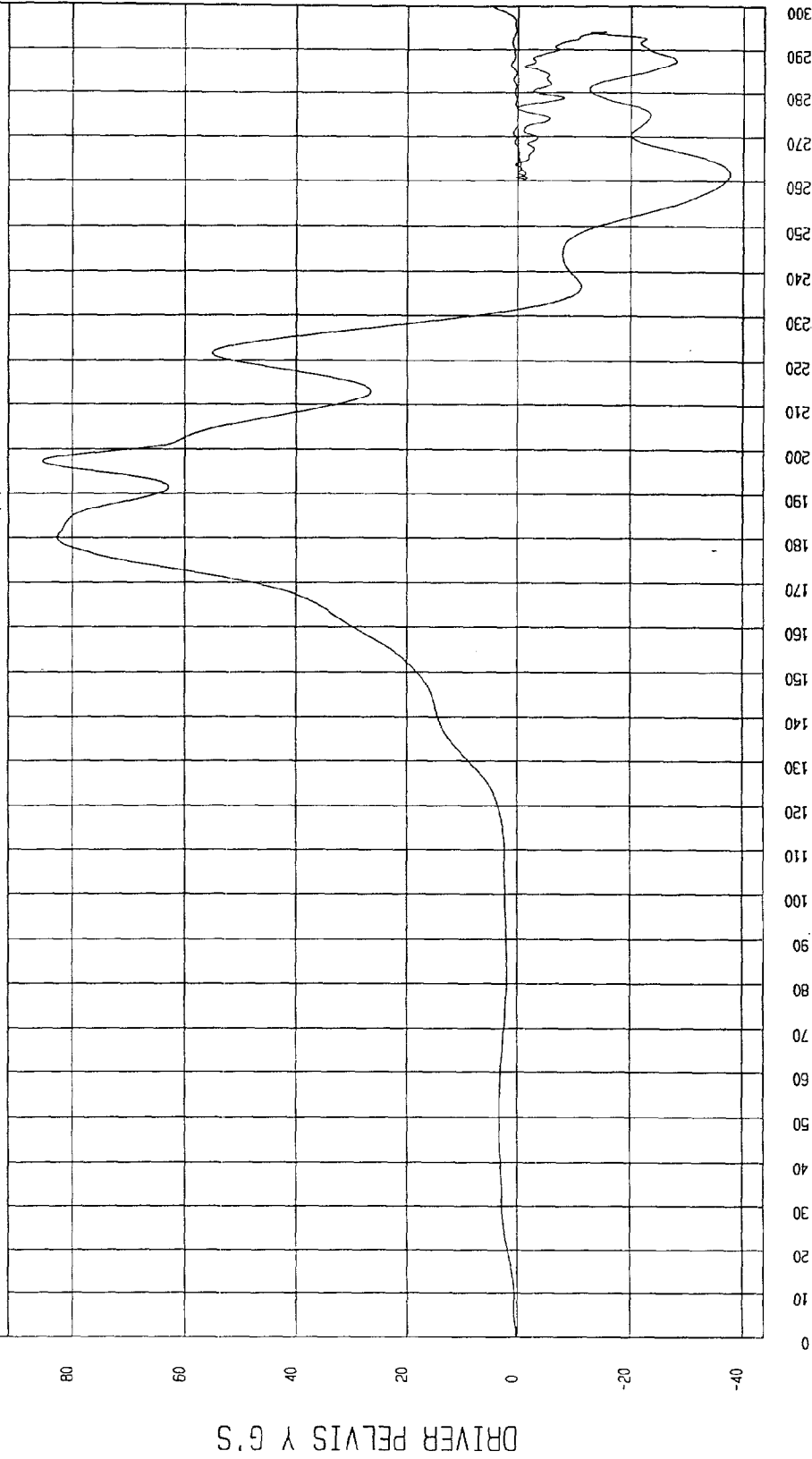
COMPONENT: 1997 HYUNDAI SONATA

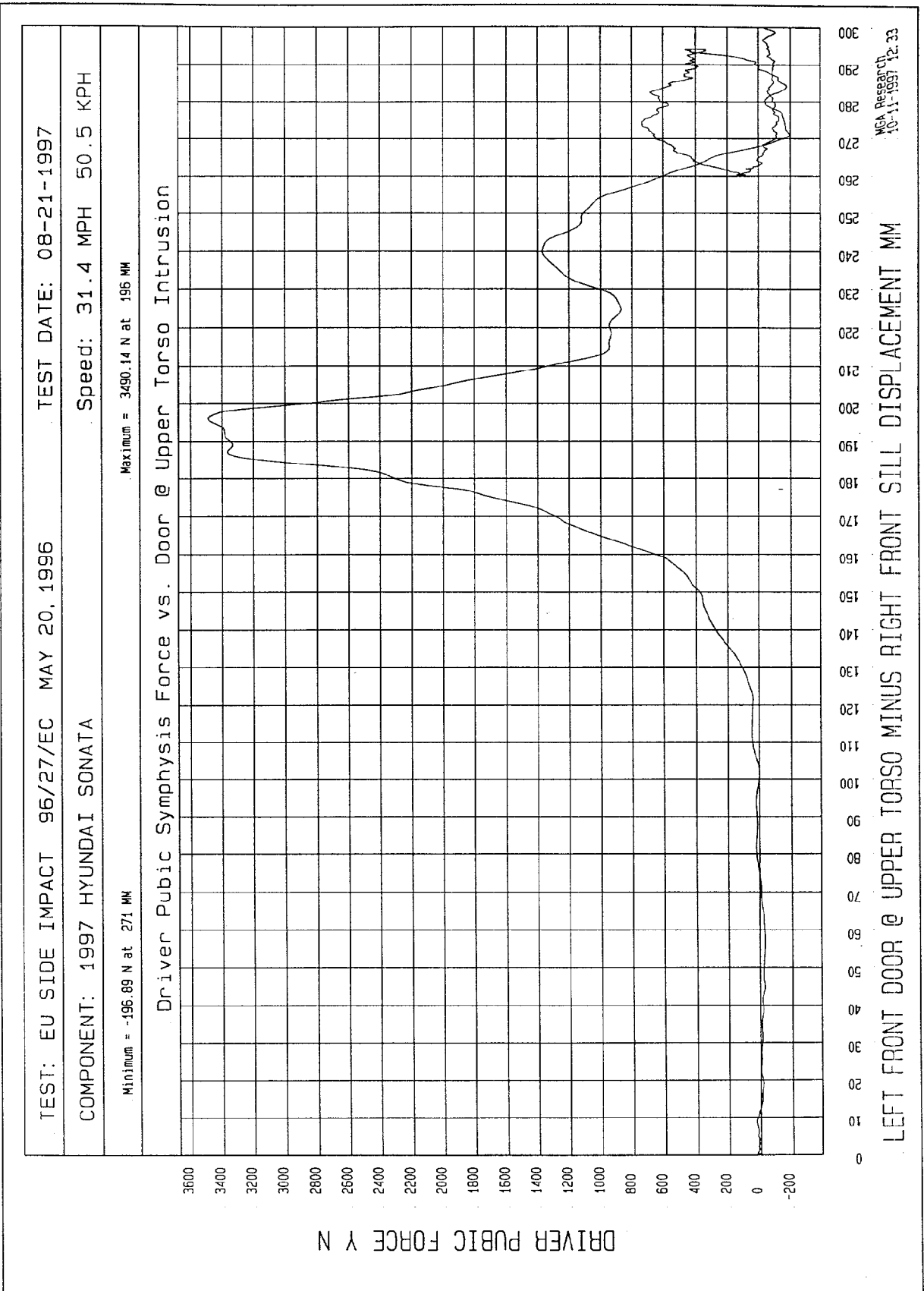
Speed: 31.4 MPH 50.5 KPH

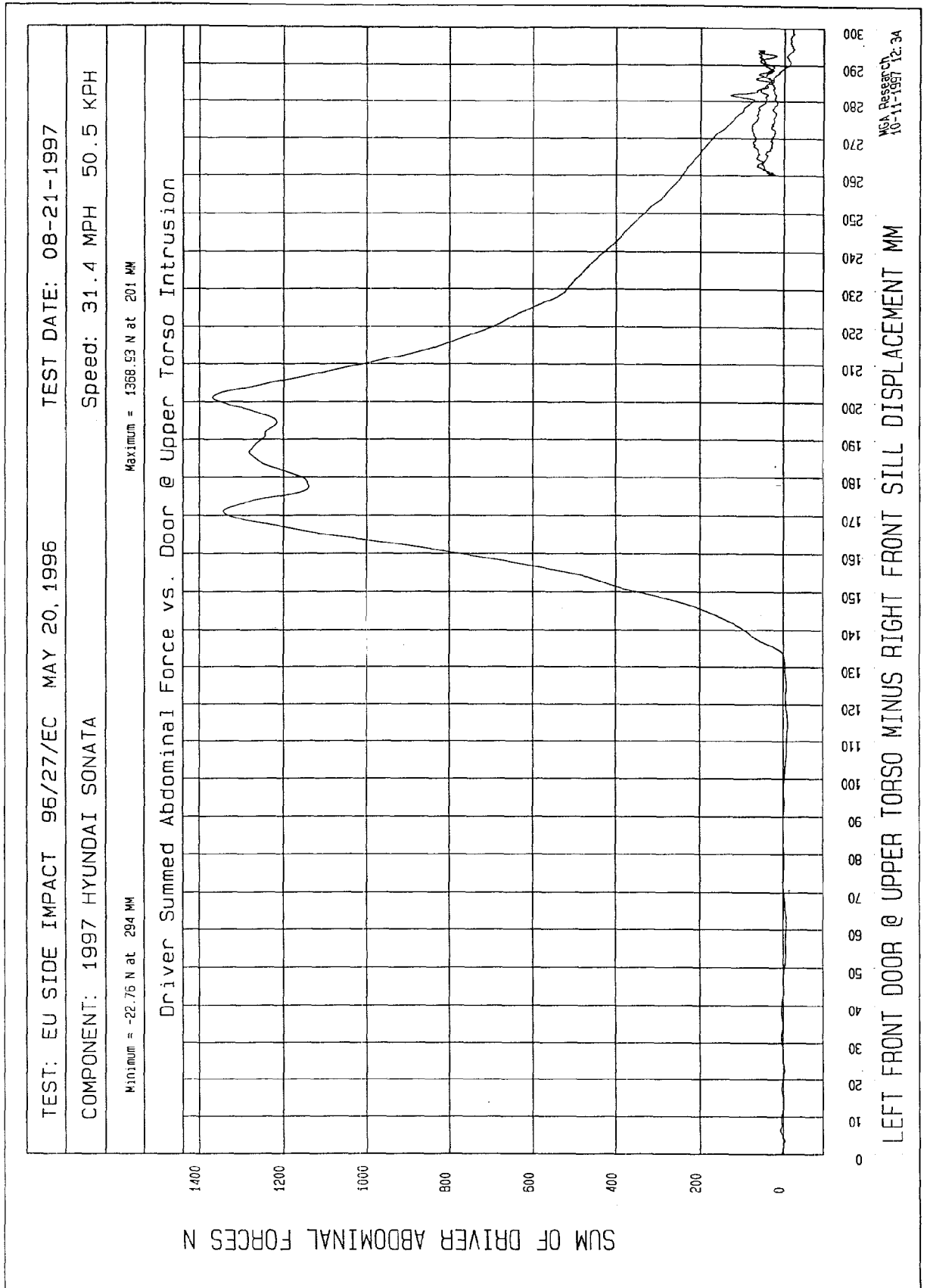
Minimum = -37.61 G'S at 261 MM

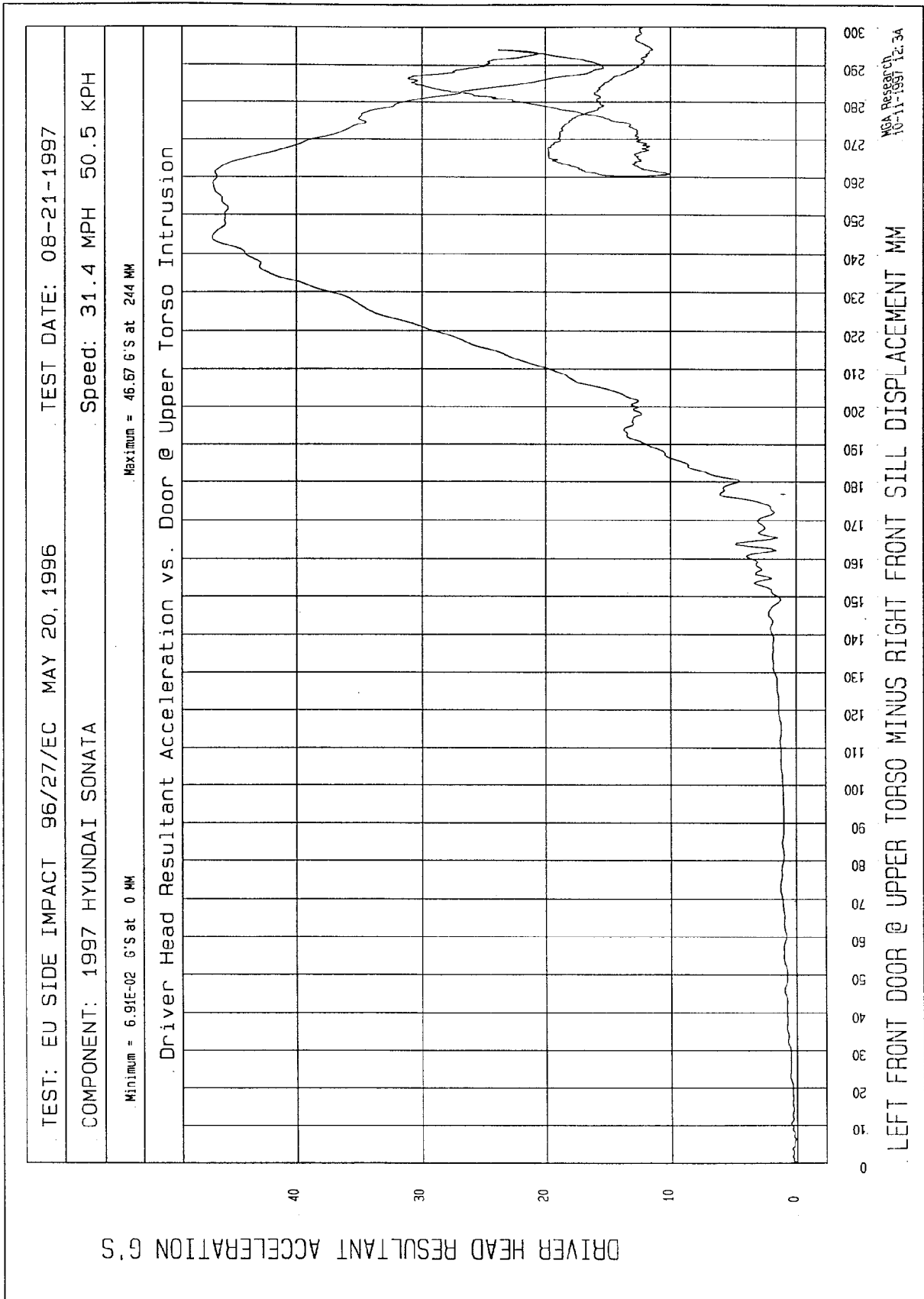
Maximum = 85.31 G'S at 197 MM

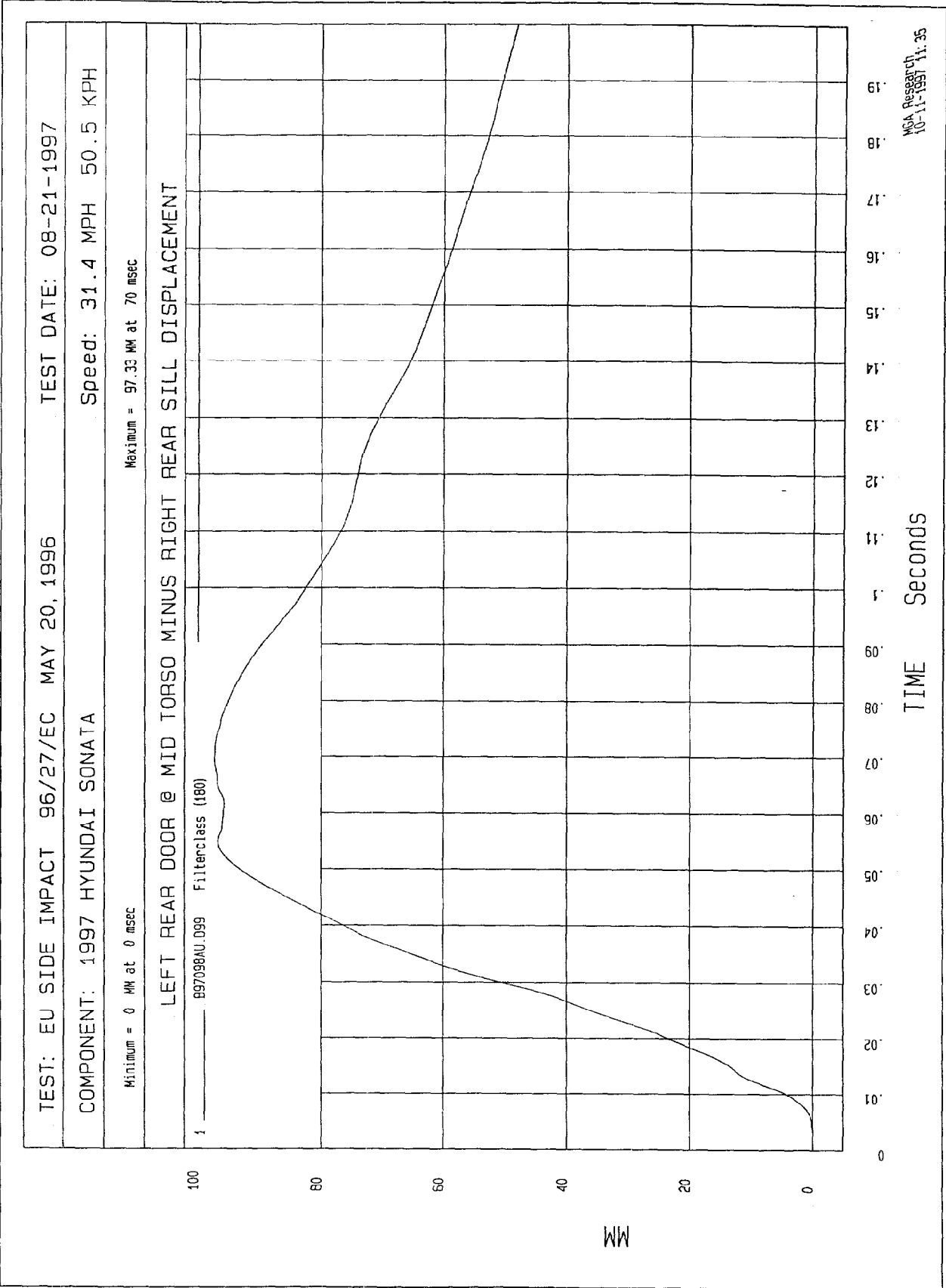
Driver Pelvis Y Acceleration vs. Door @ Upper Torso Intrusion

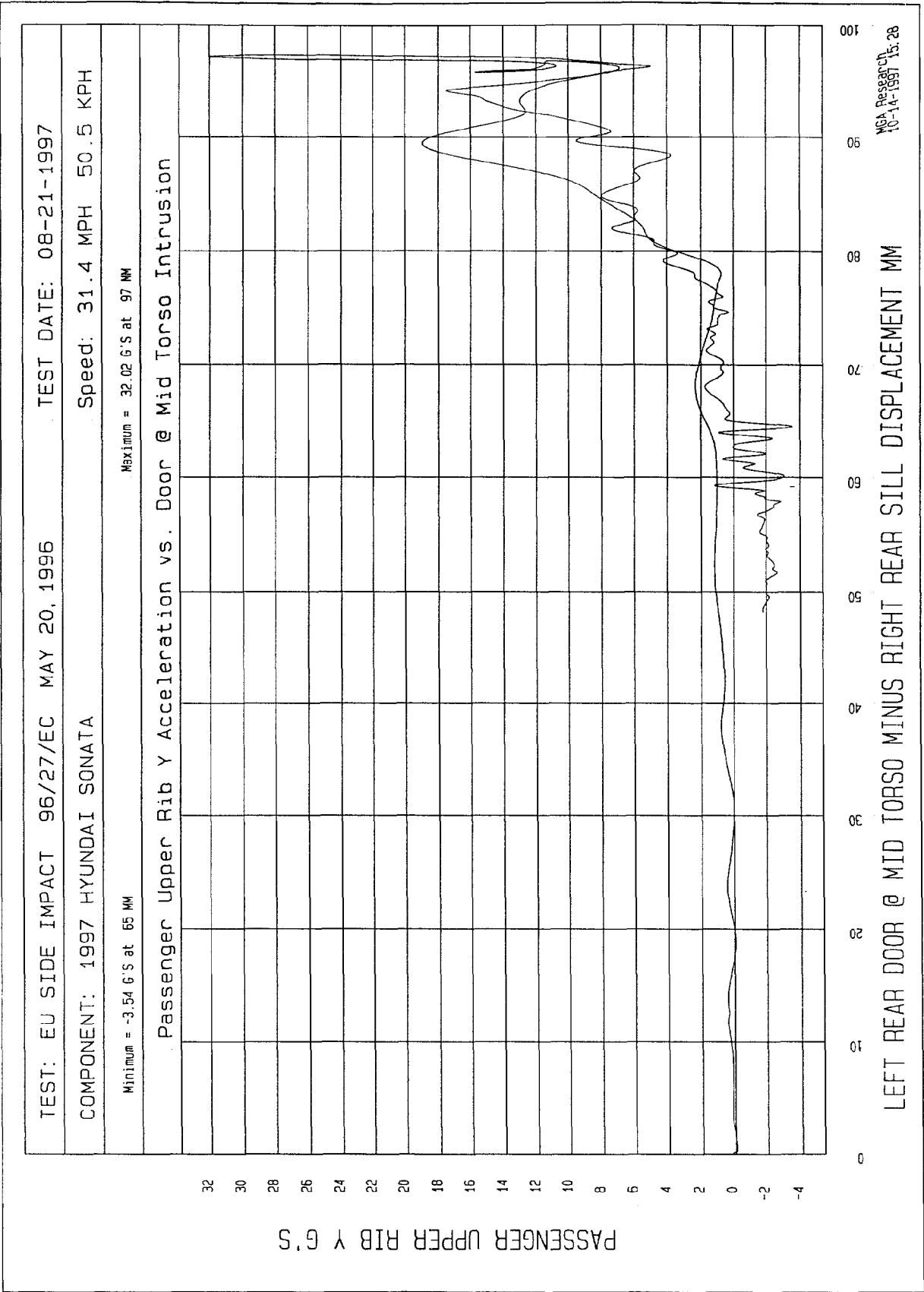


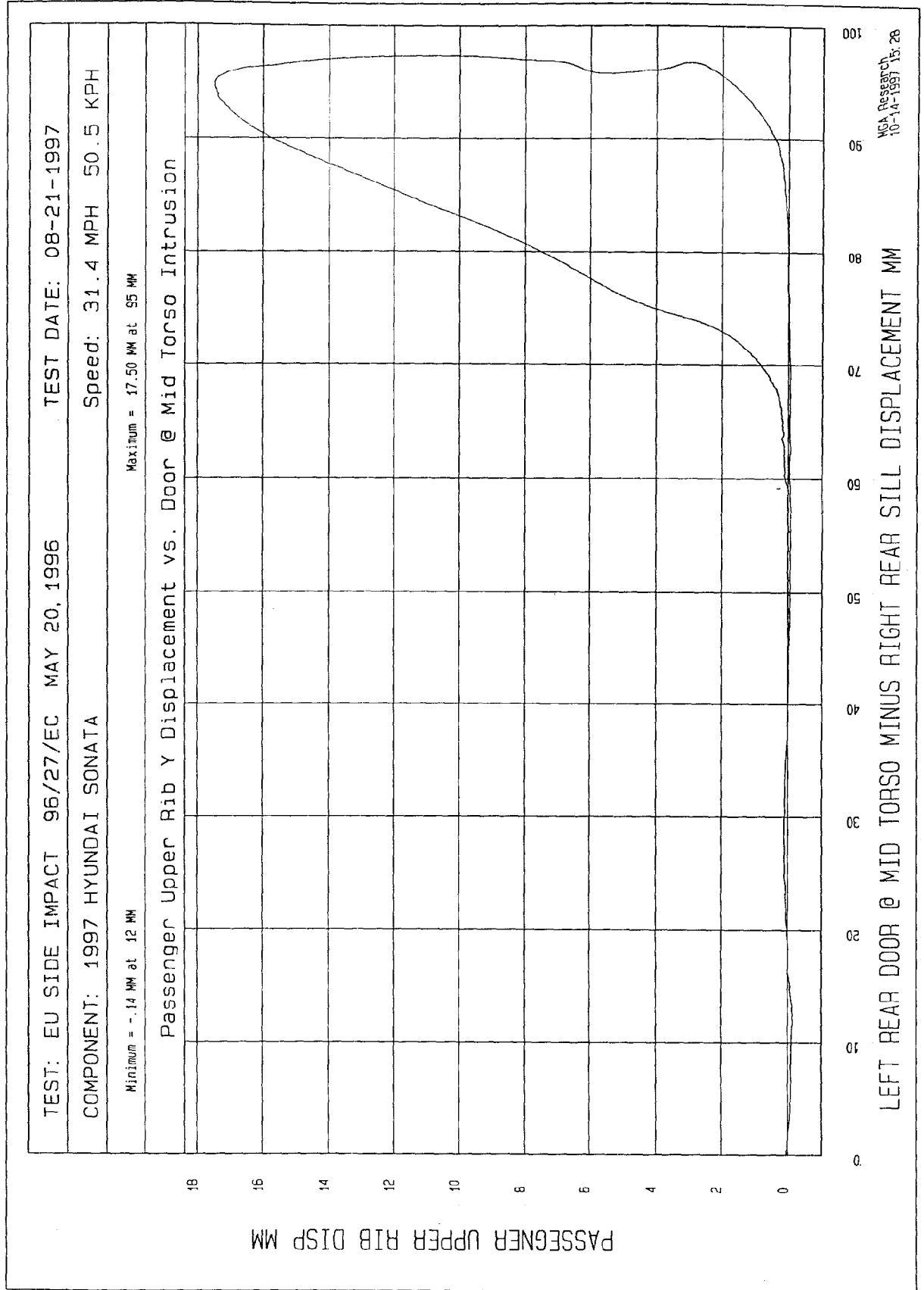




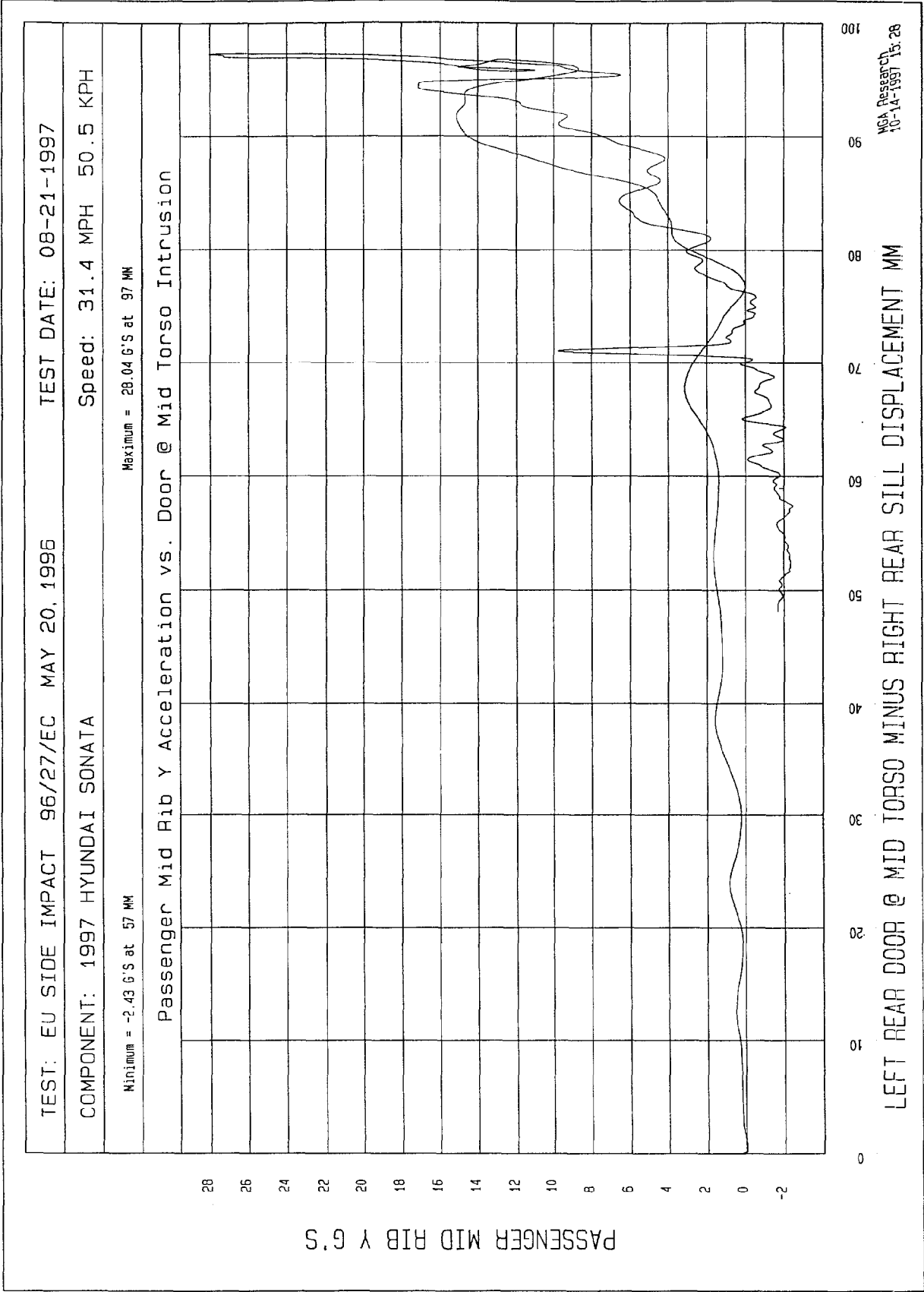








MCA Research
10-14-1997 15:28

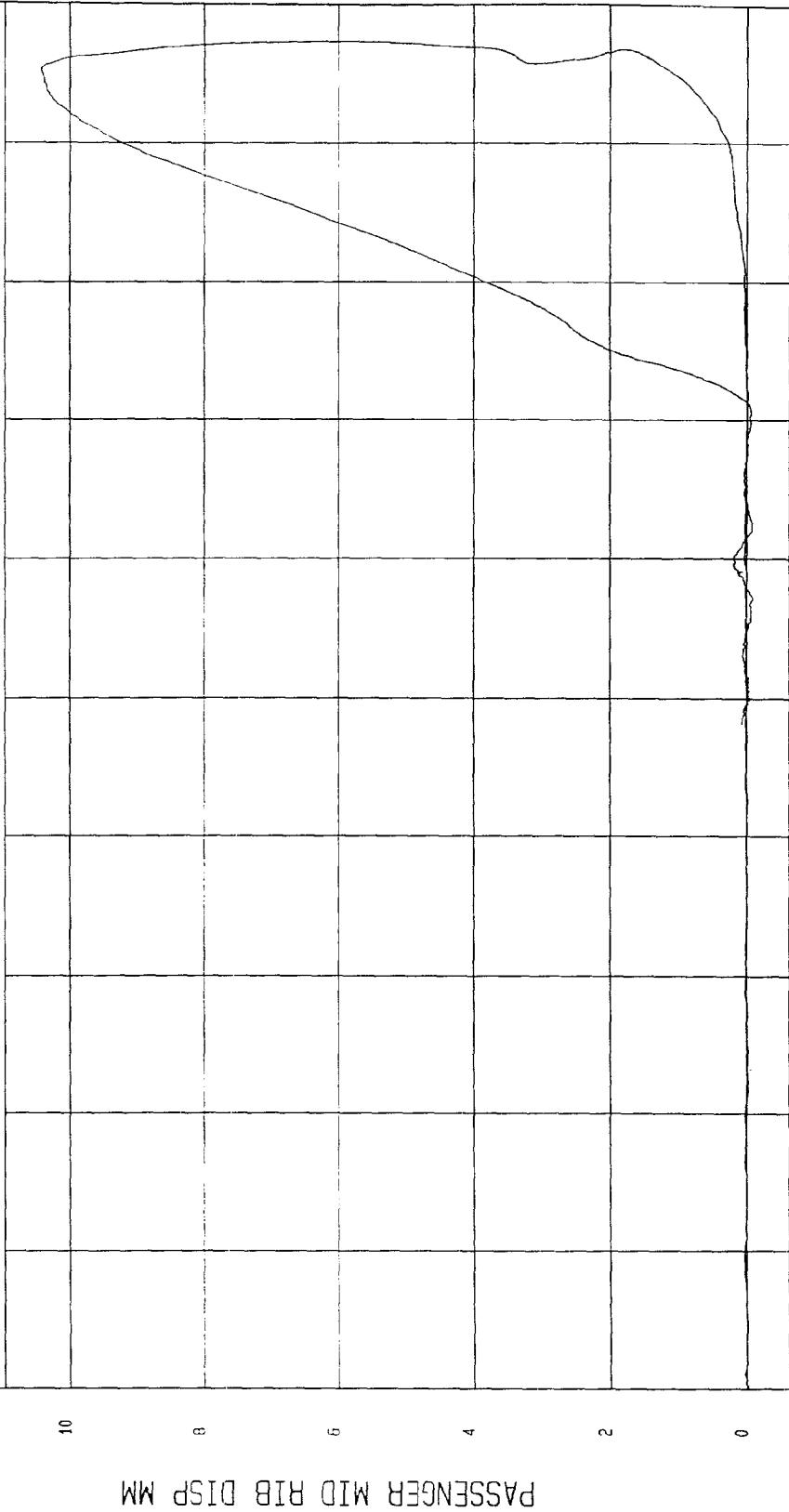


TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

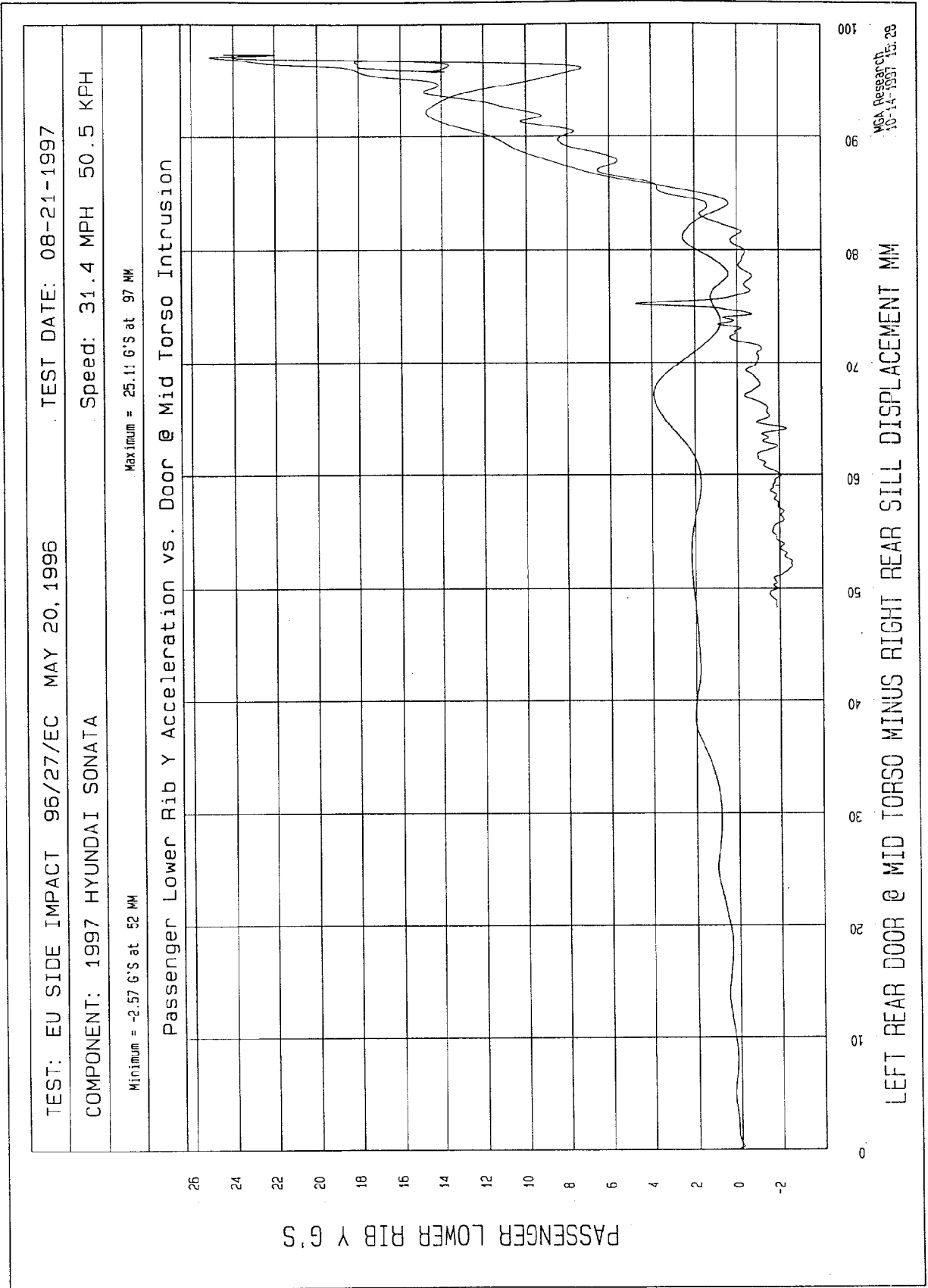
Minimum = -9.36E-02 MM at 57 MM Maximum = 10.41 MM at 95 MM

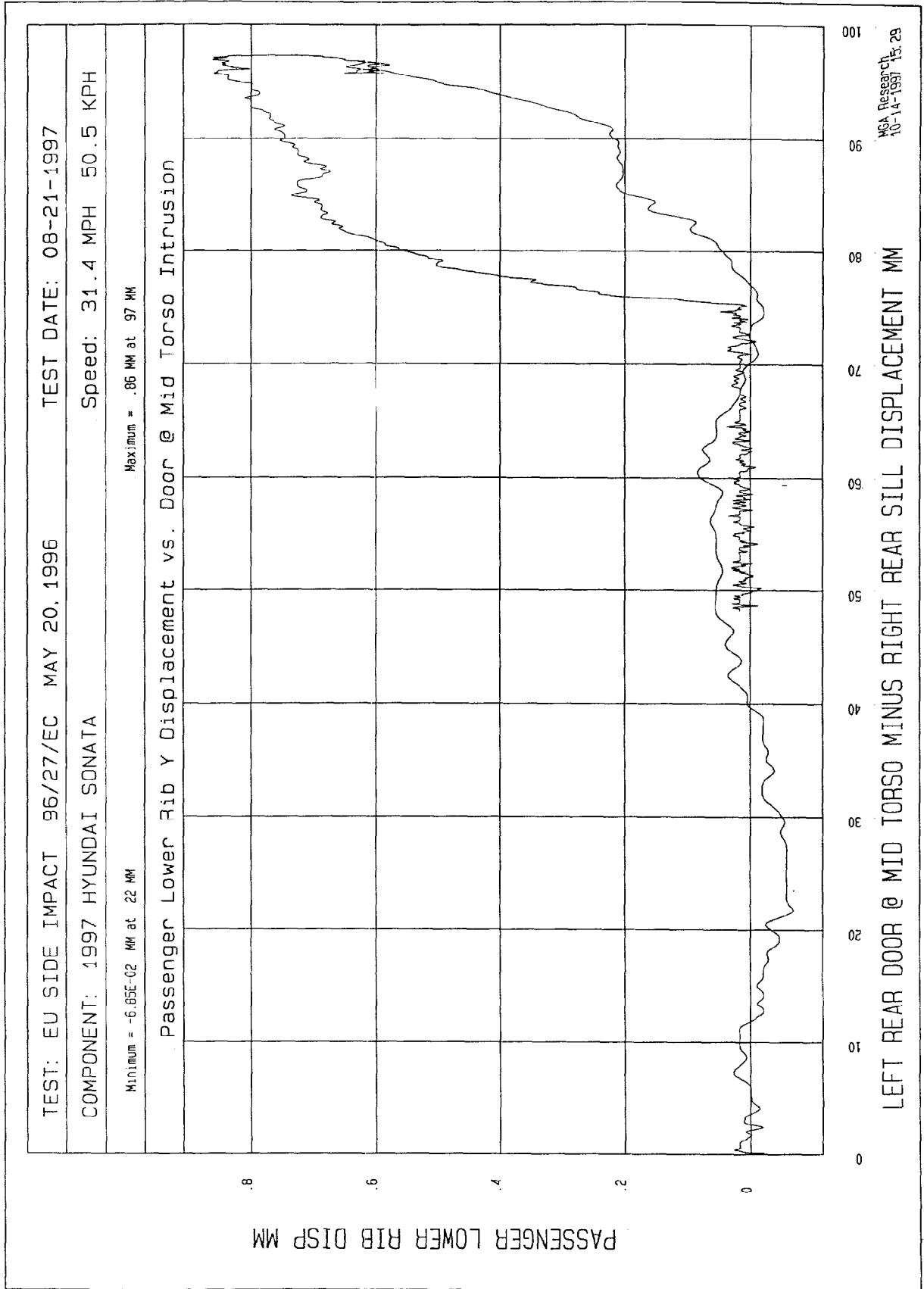
Passenger Mid Rib Y Displacement vs. Door @ Mid Torso Intrusion

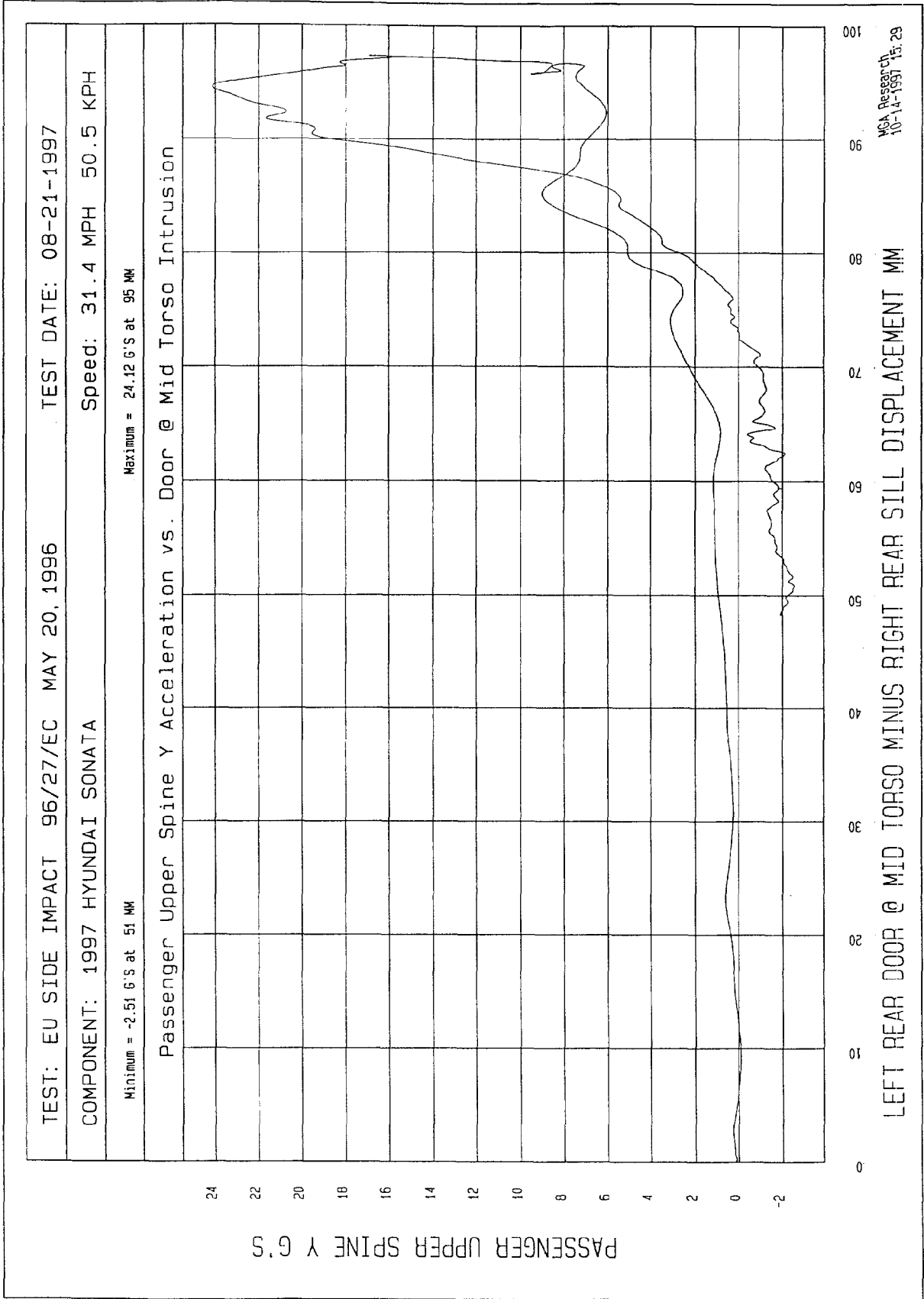


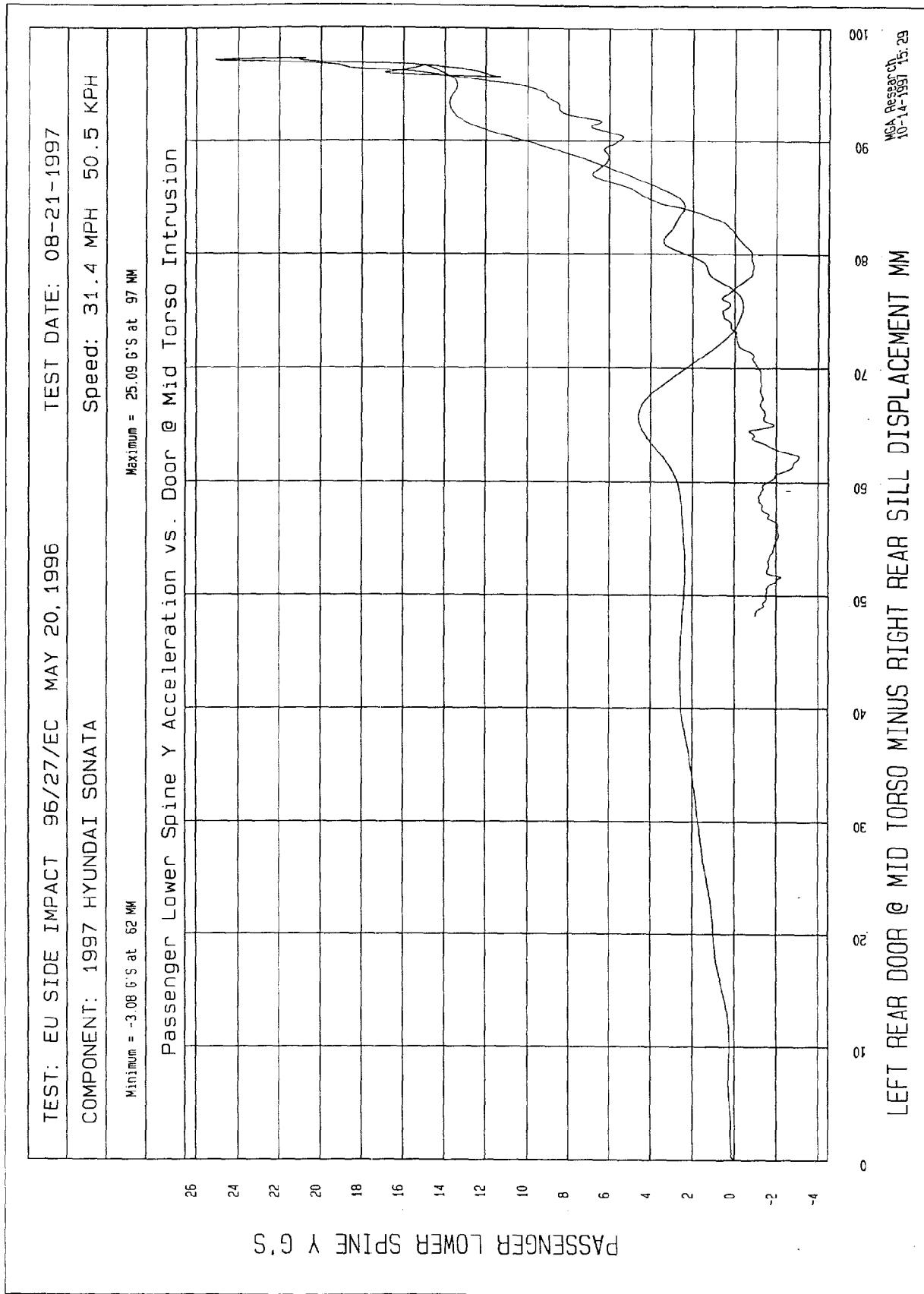
LEFT REAR DOOR @ MID TORSO MINUS RIGHT REAR SILL DISPLACEMENT MM

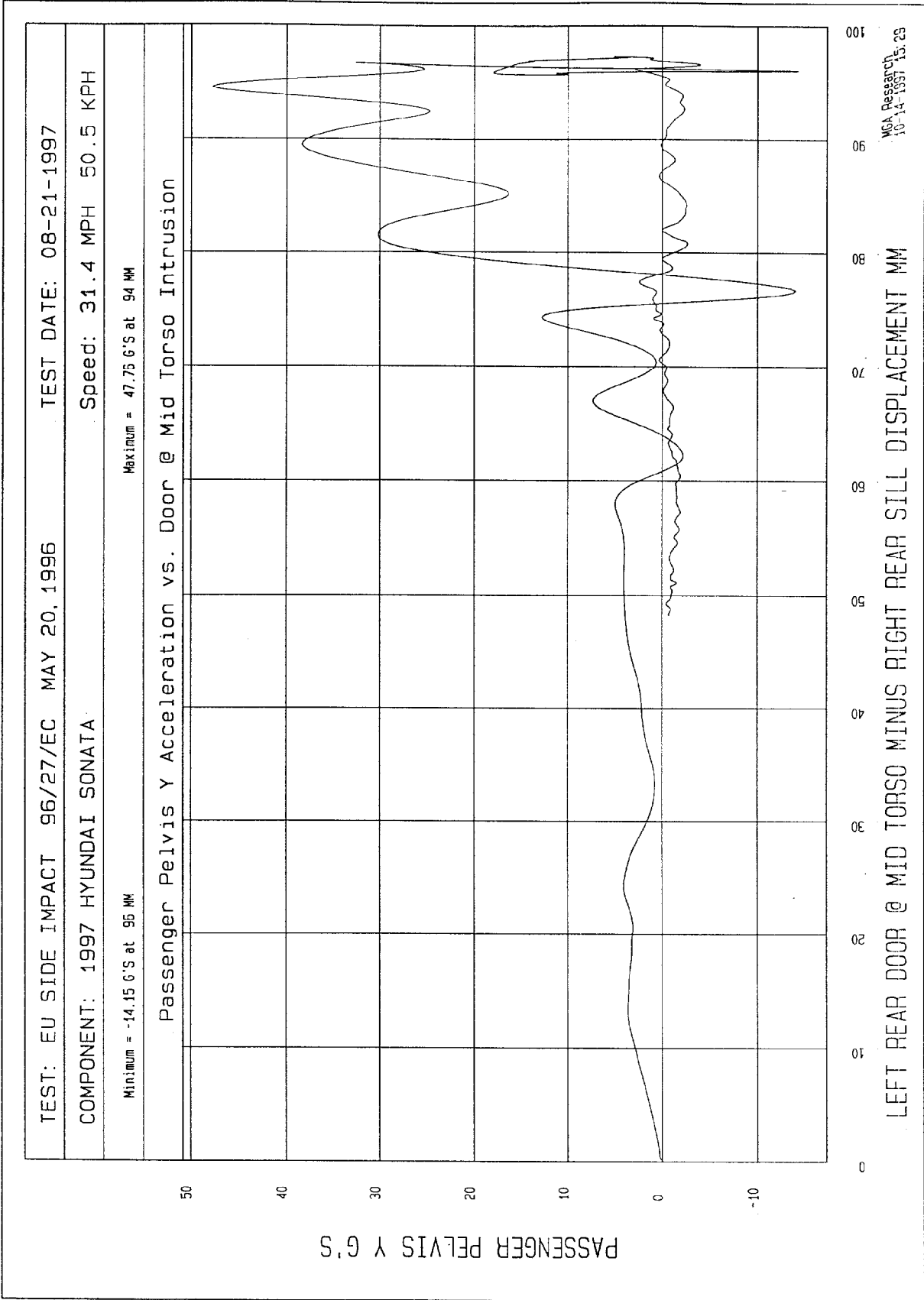
MGA Research
10-14-1997 15:28

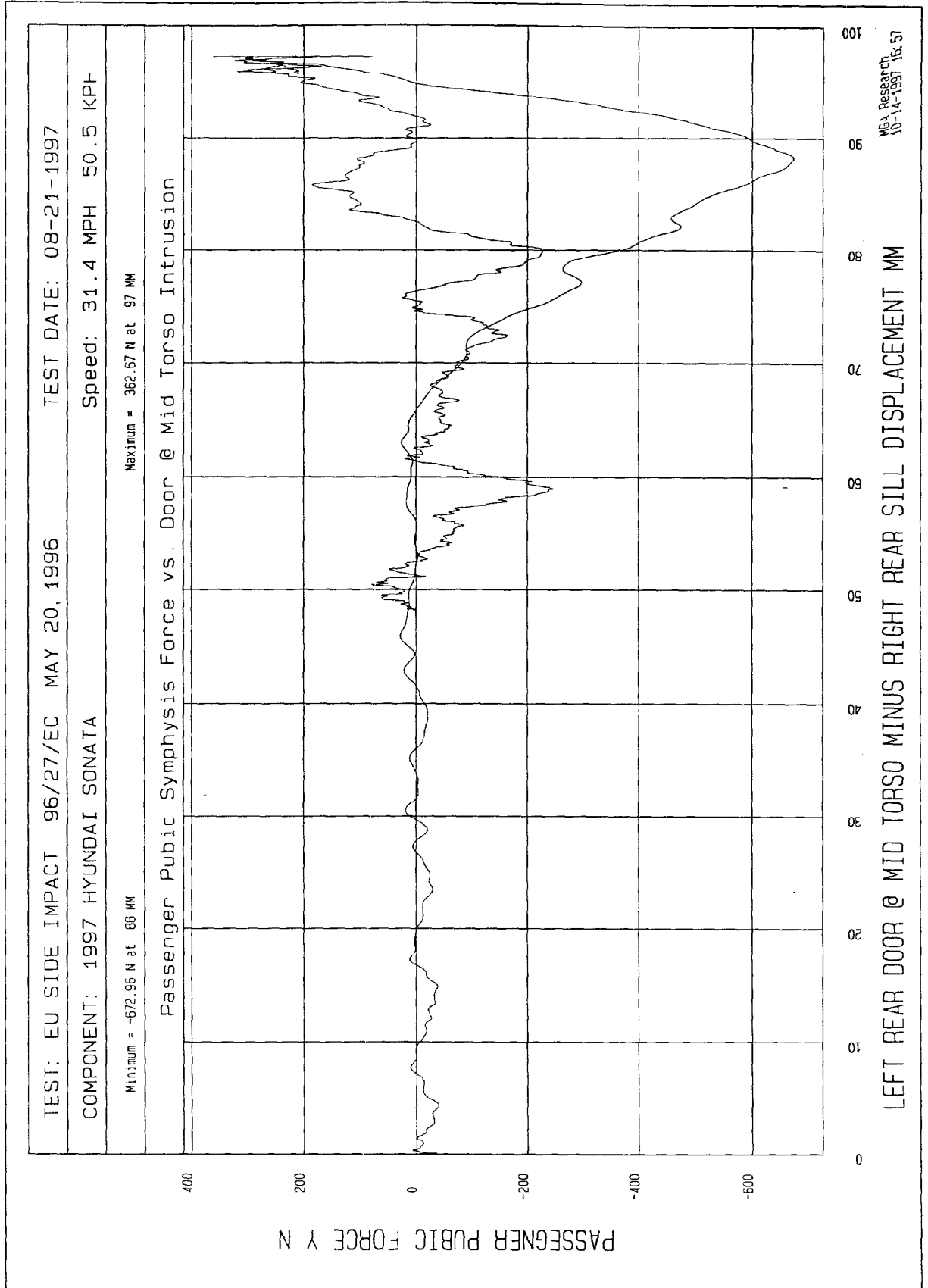


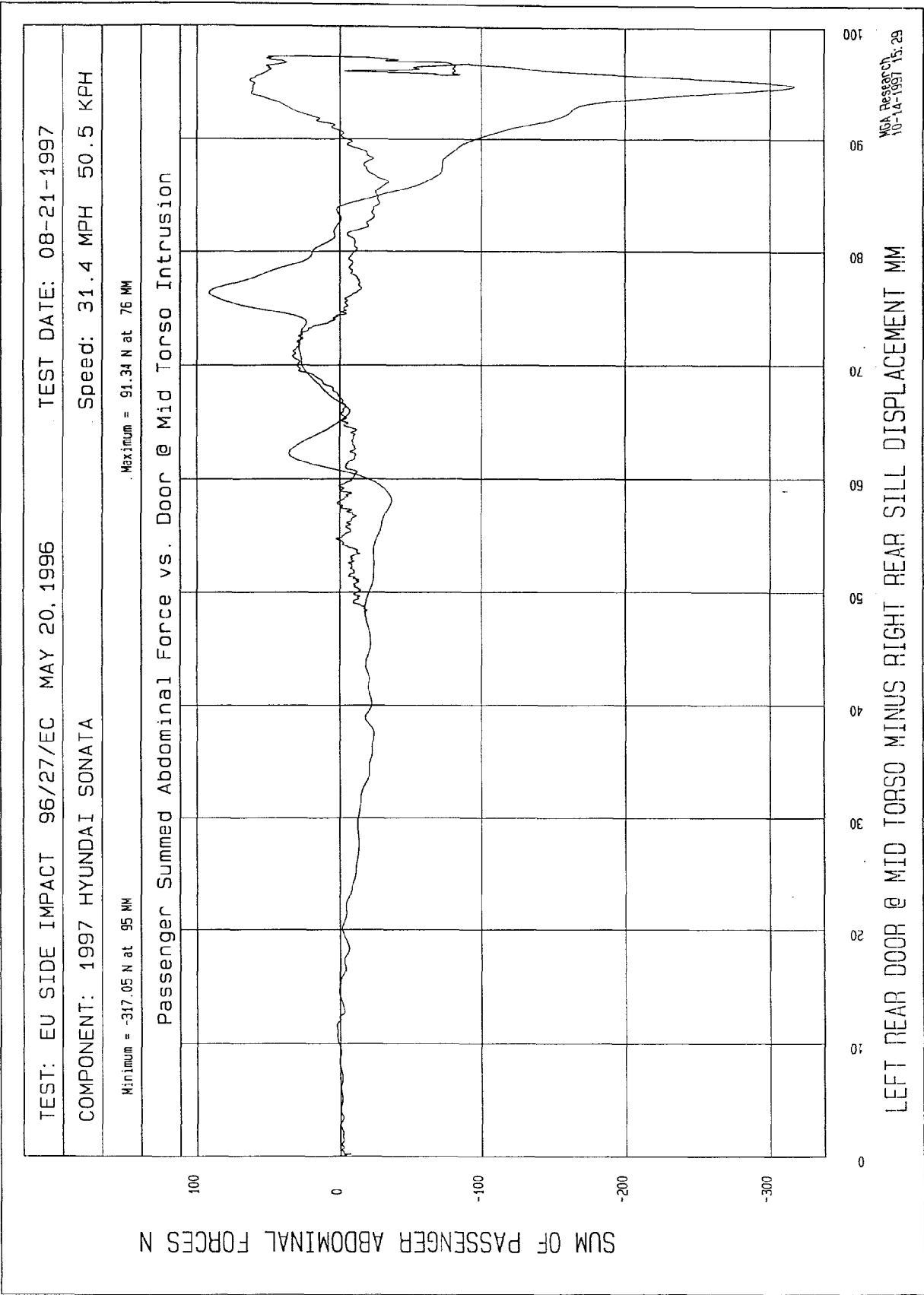












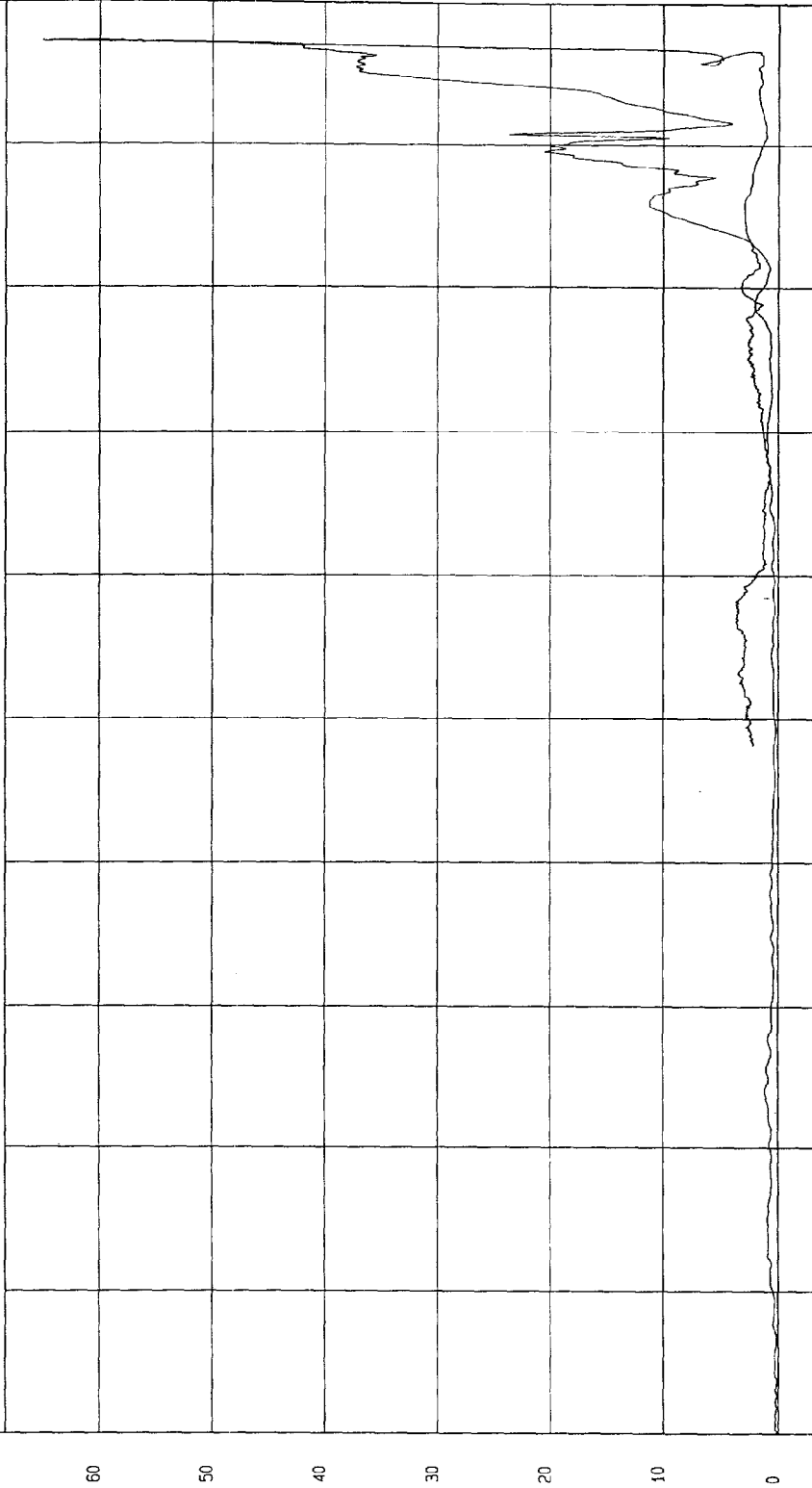
PASSENGER HEAD RESULTANT ACCELERATION G'S

TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

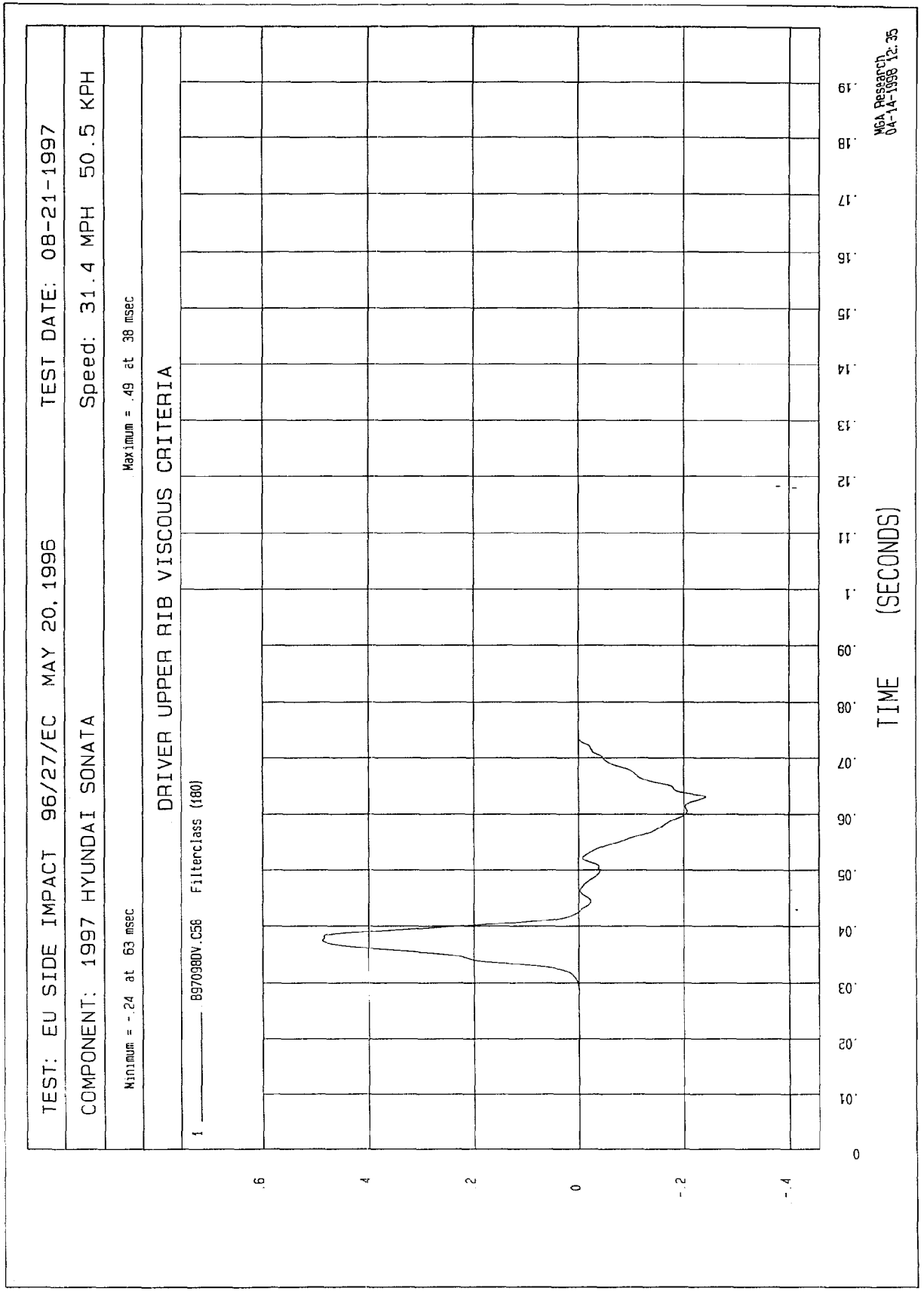
Minimum = 4.98E-02 G'S at 0 MM Maximum = 64.93 G'S at 97 MM

Passenger Head Resultant Acceleration vs. Door @ Mid Torso Intrusion



LEFT REAR DOOR @ MID TORSO MINUS RIGHT REAR SILL DISPLACEMENT MM

MSA Research
10-14-1997 15:30



TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

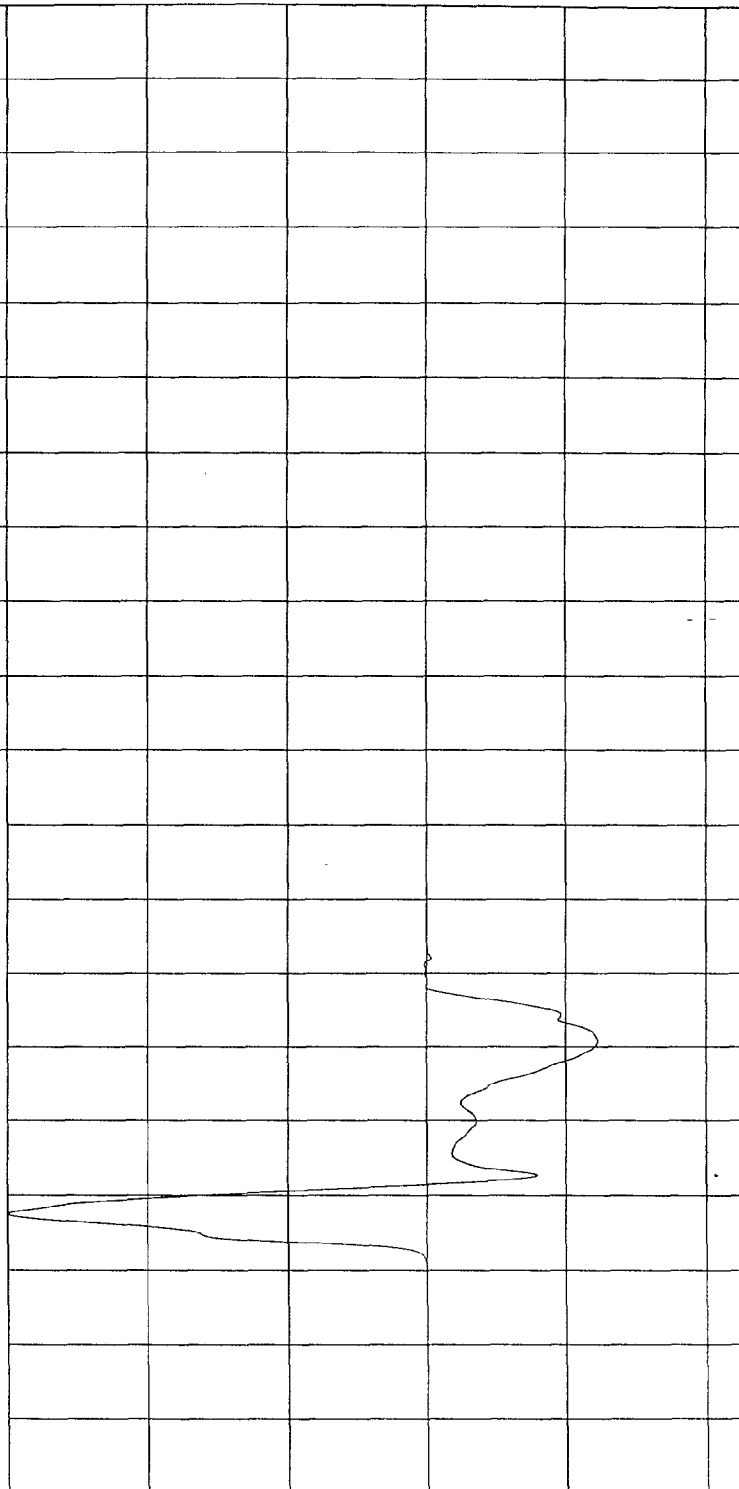
COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -.25 at 61 msec
Maximum = .6 at 37 msec

DRIVER MID RIB VISCOUS CRITERIA

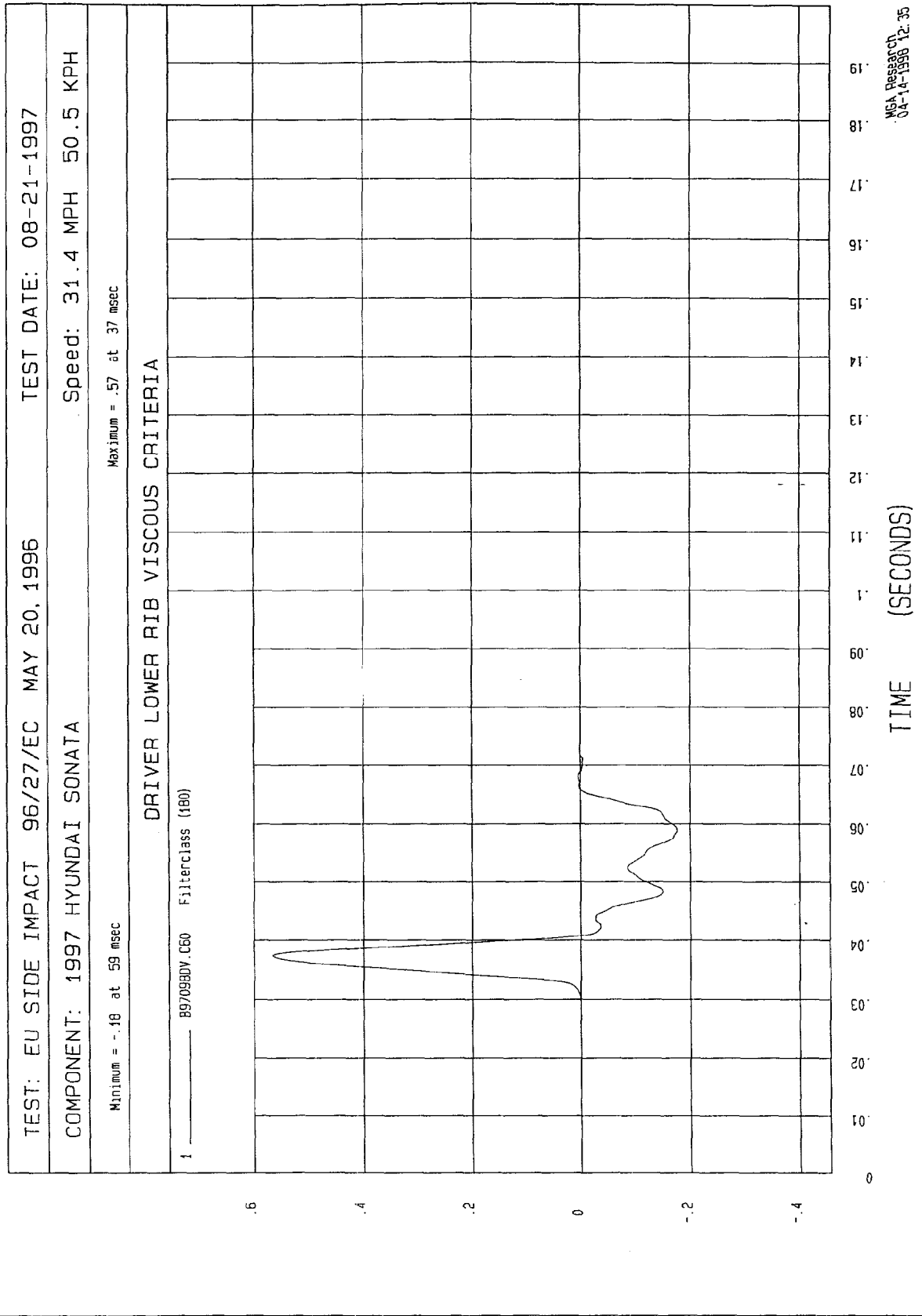
1 ——— B970980V.C59 Filterclass (180)

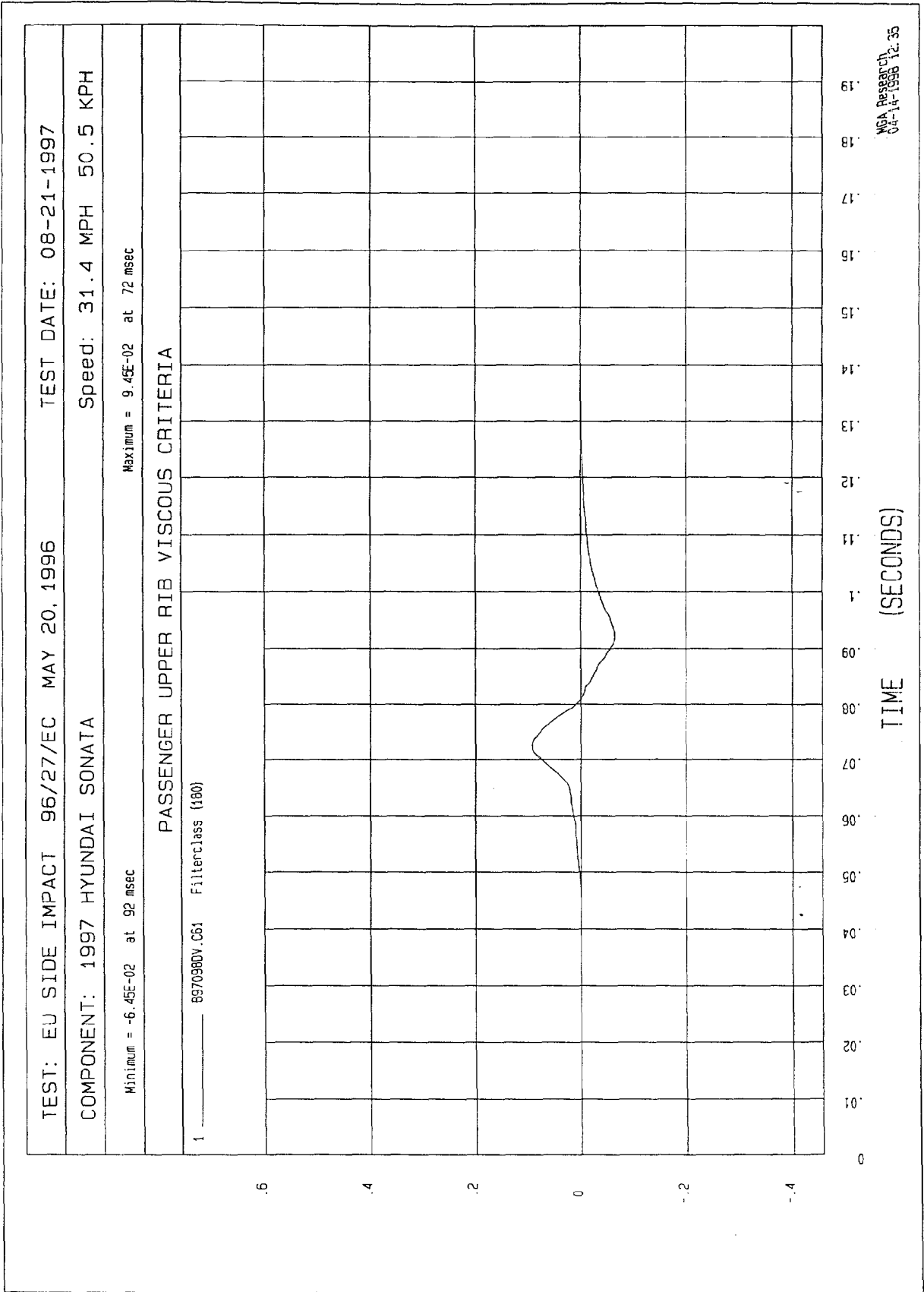
.6
.4
.2
0
-.2
-.4

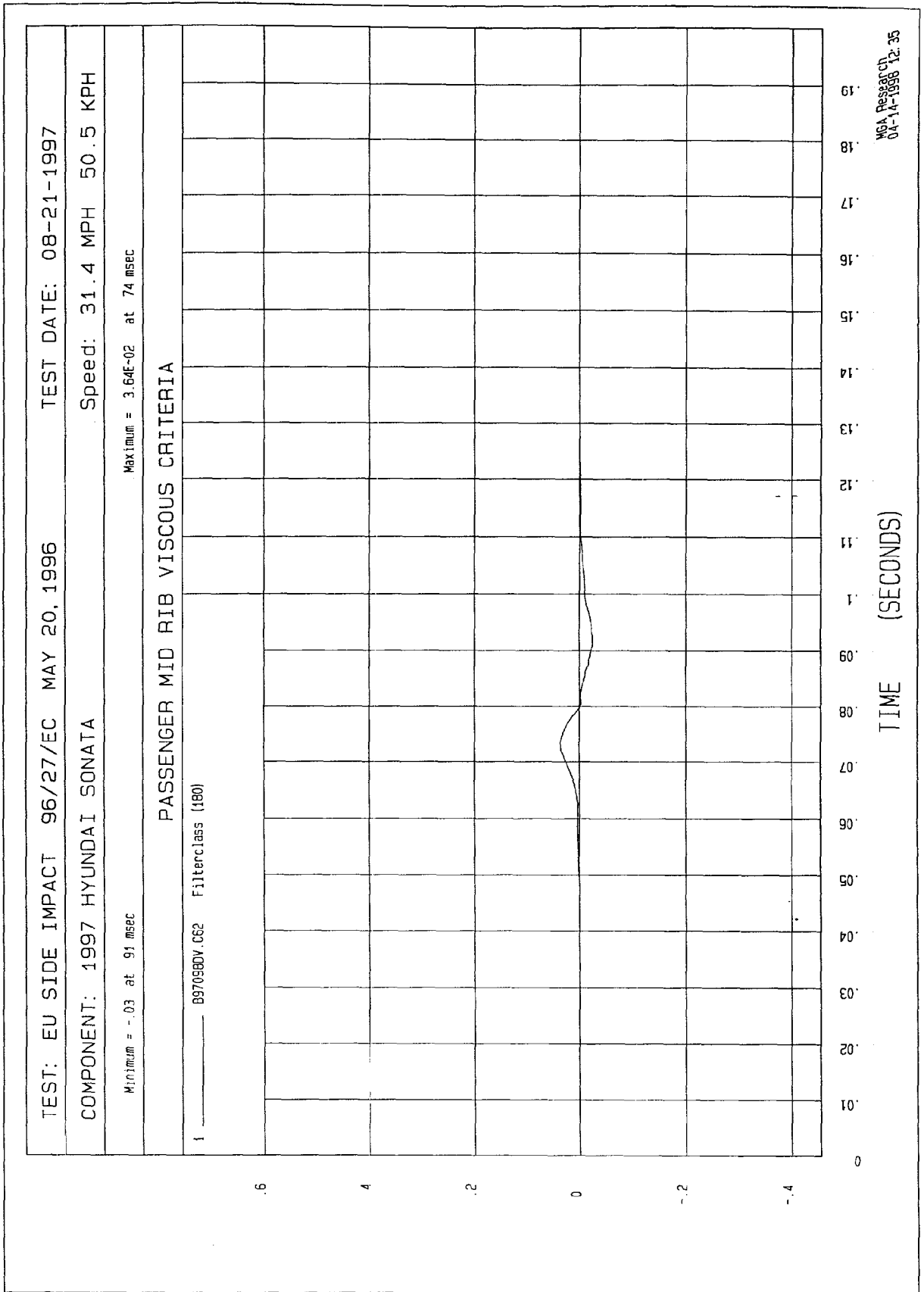


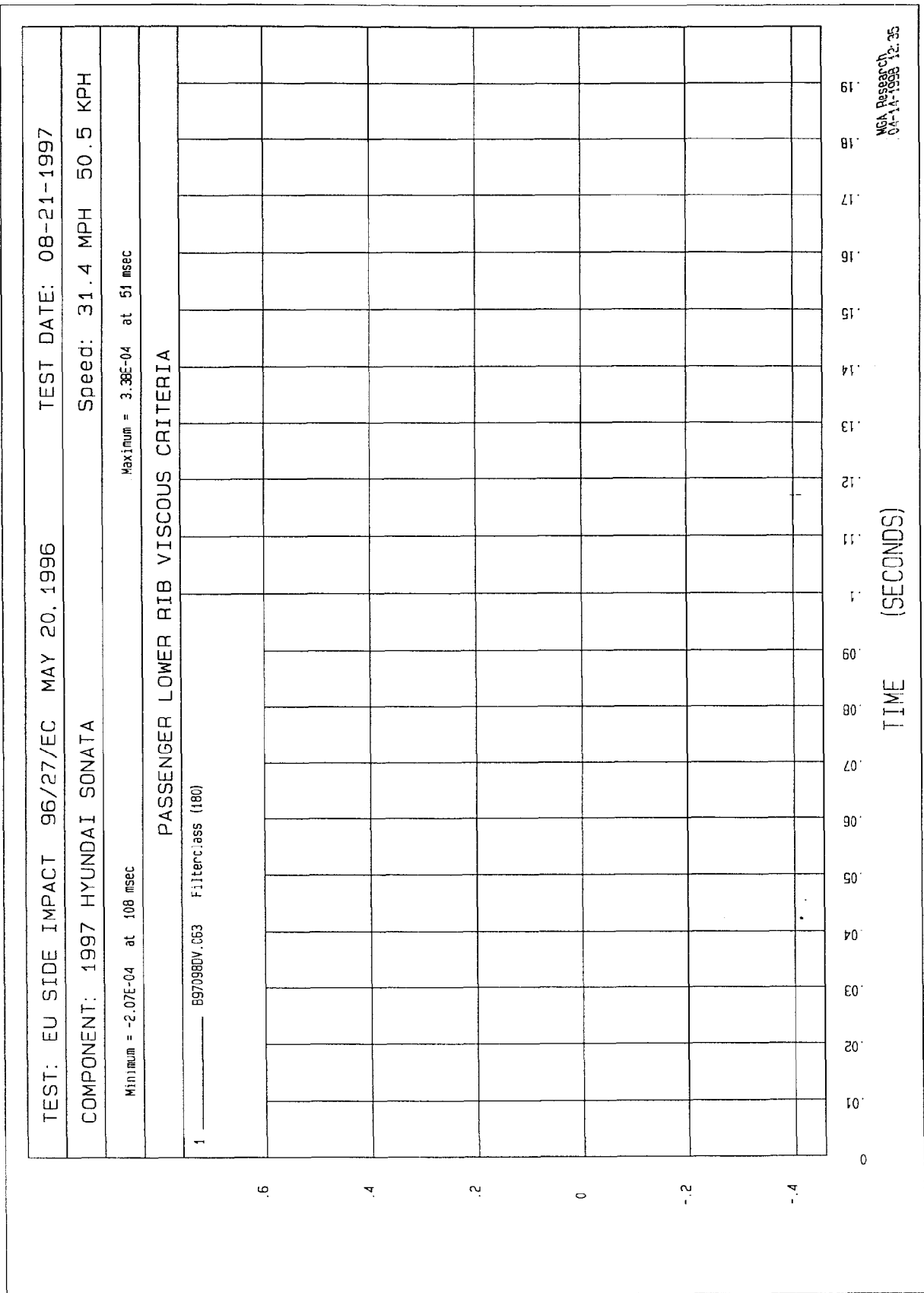
TIME (SECONDS)

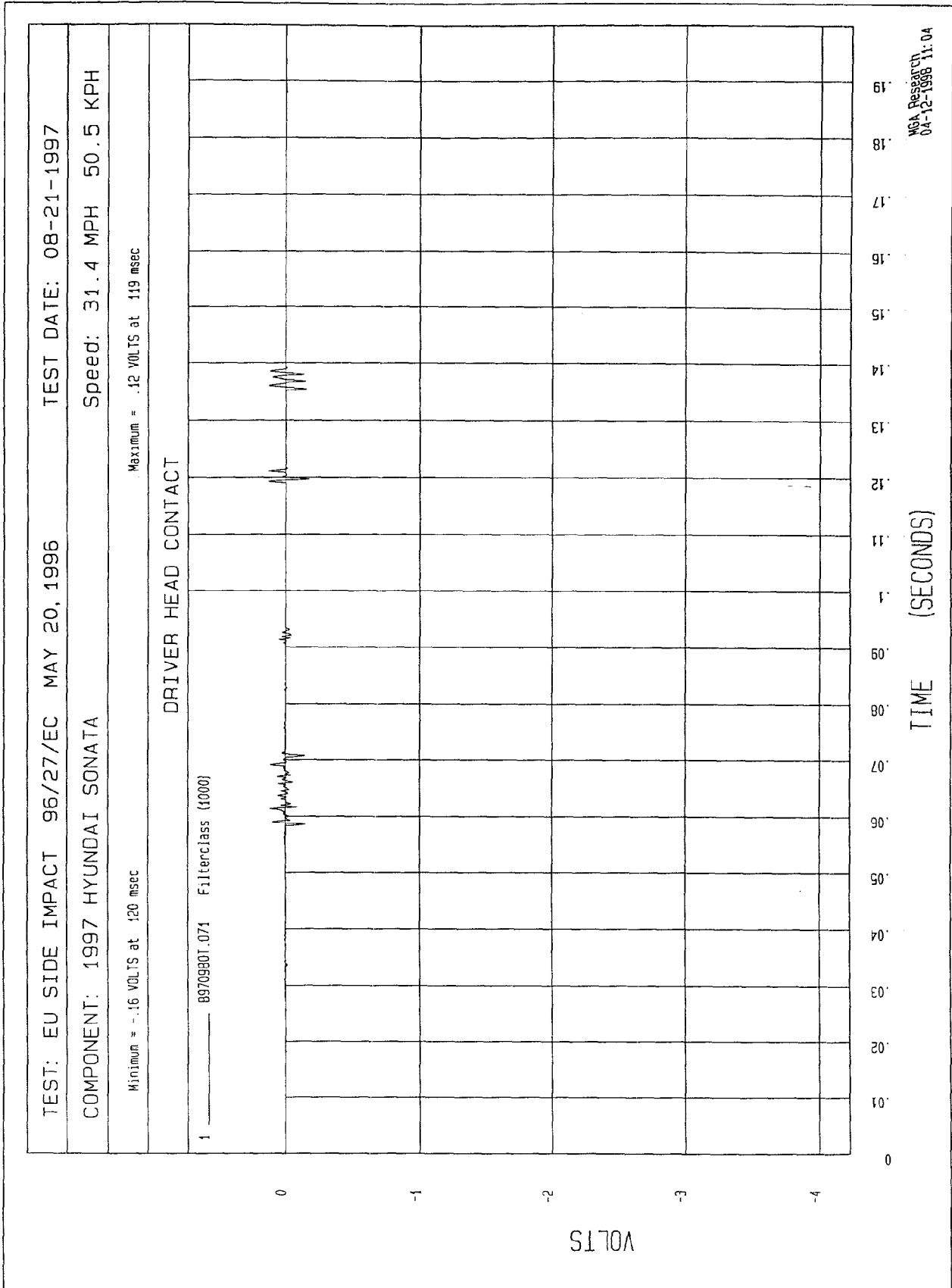
NCA Research
04-14-1998 12:35

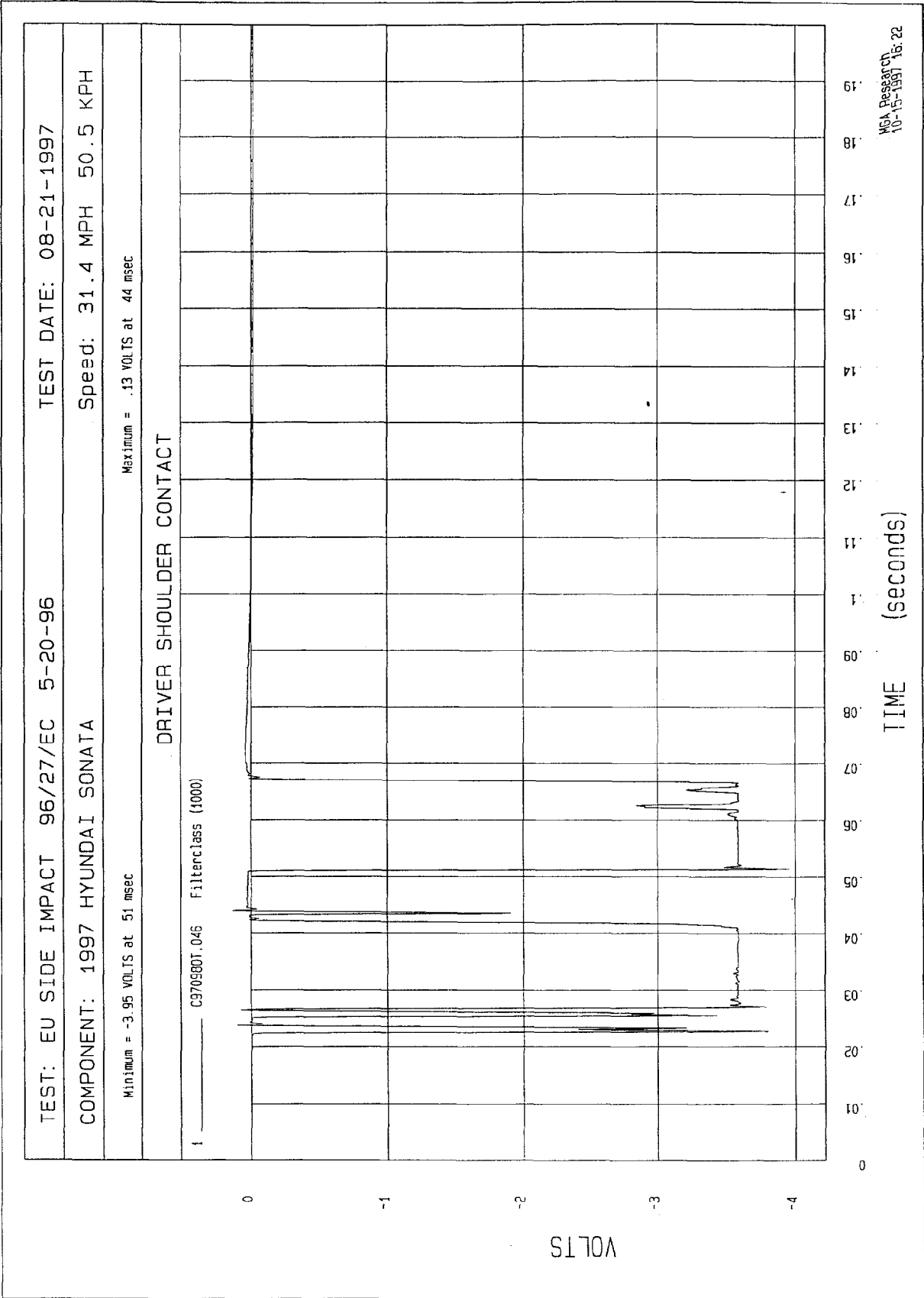


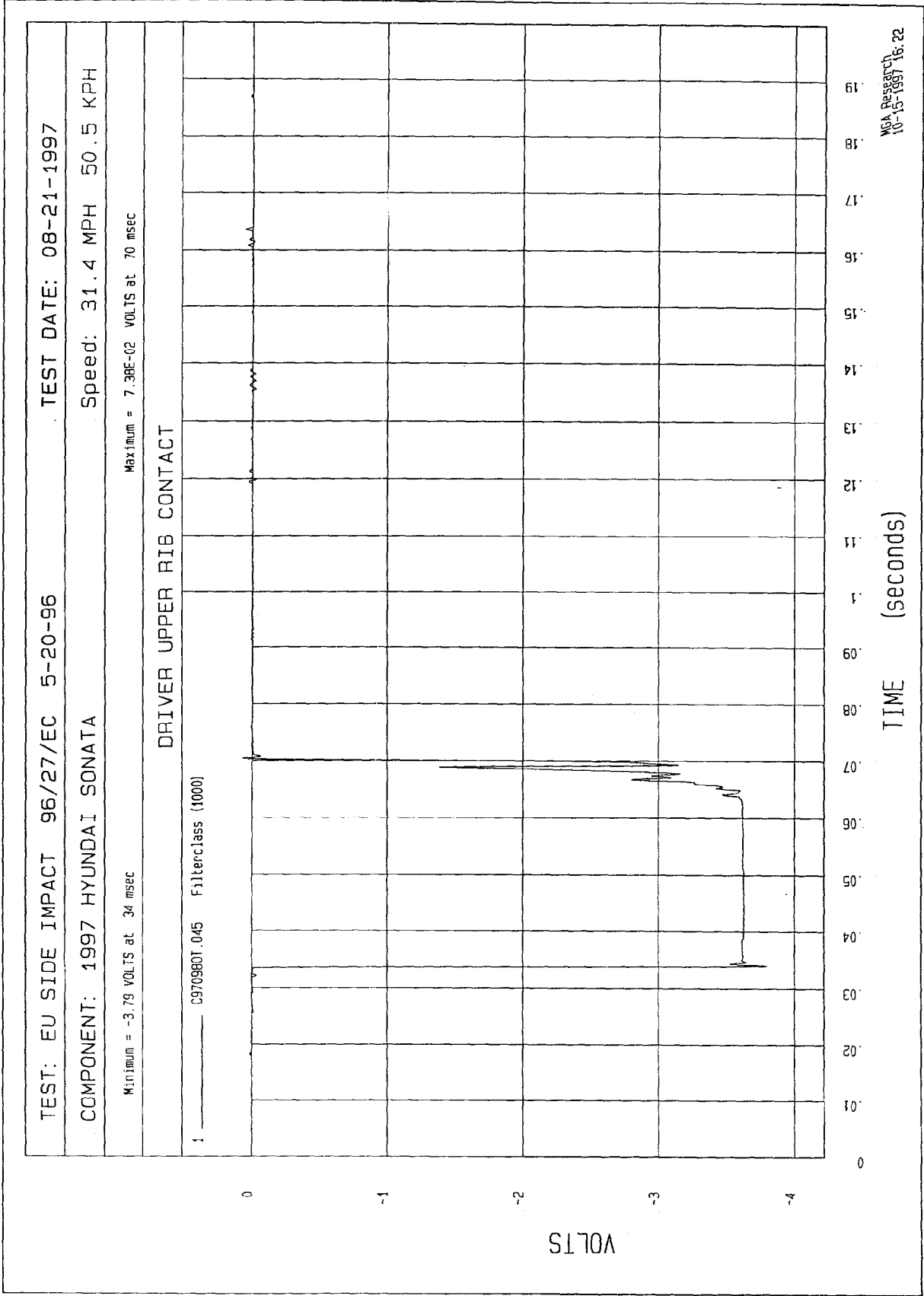


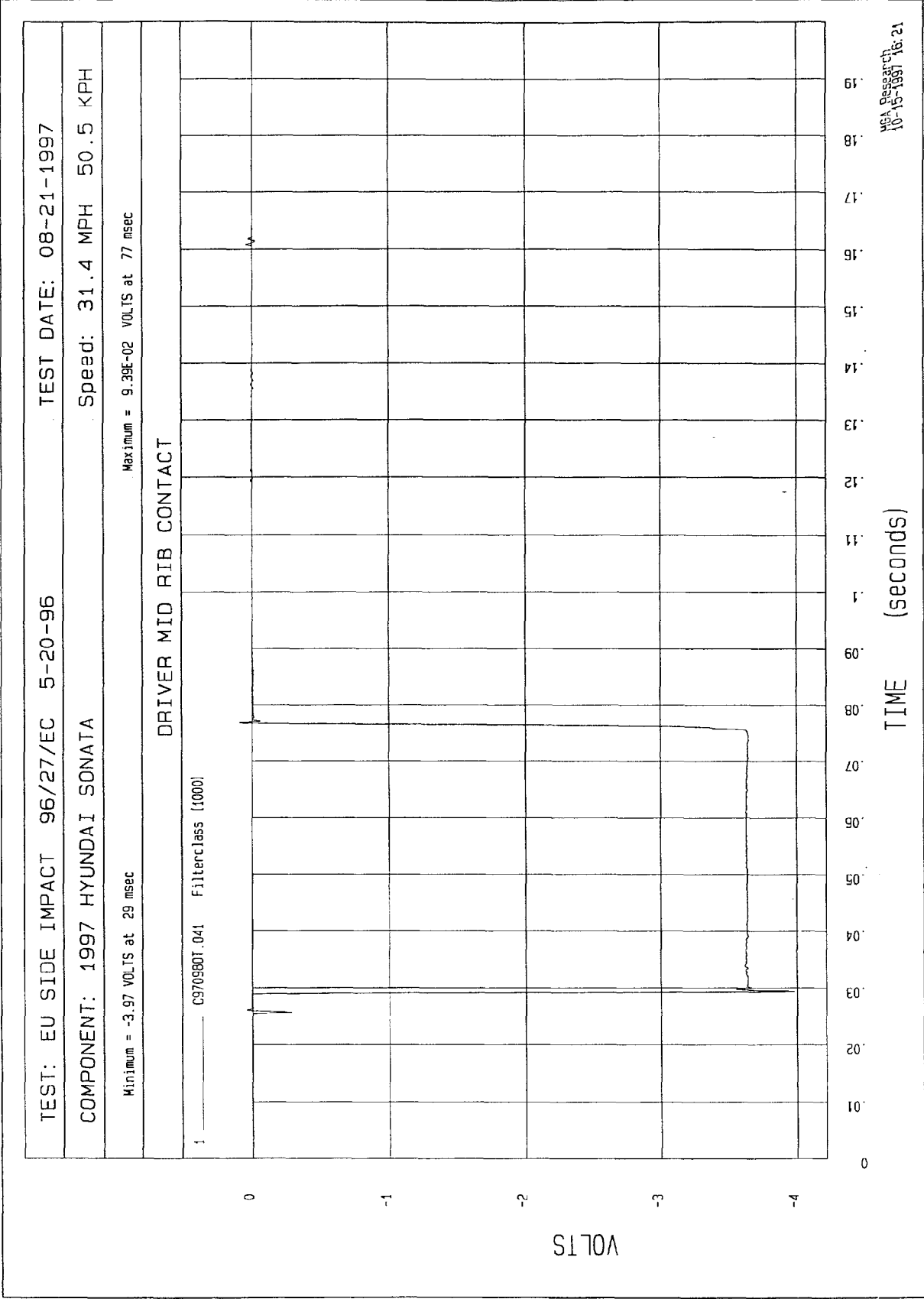


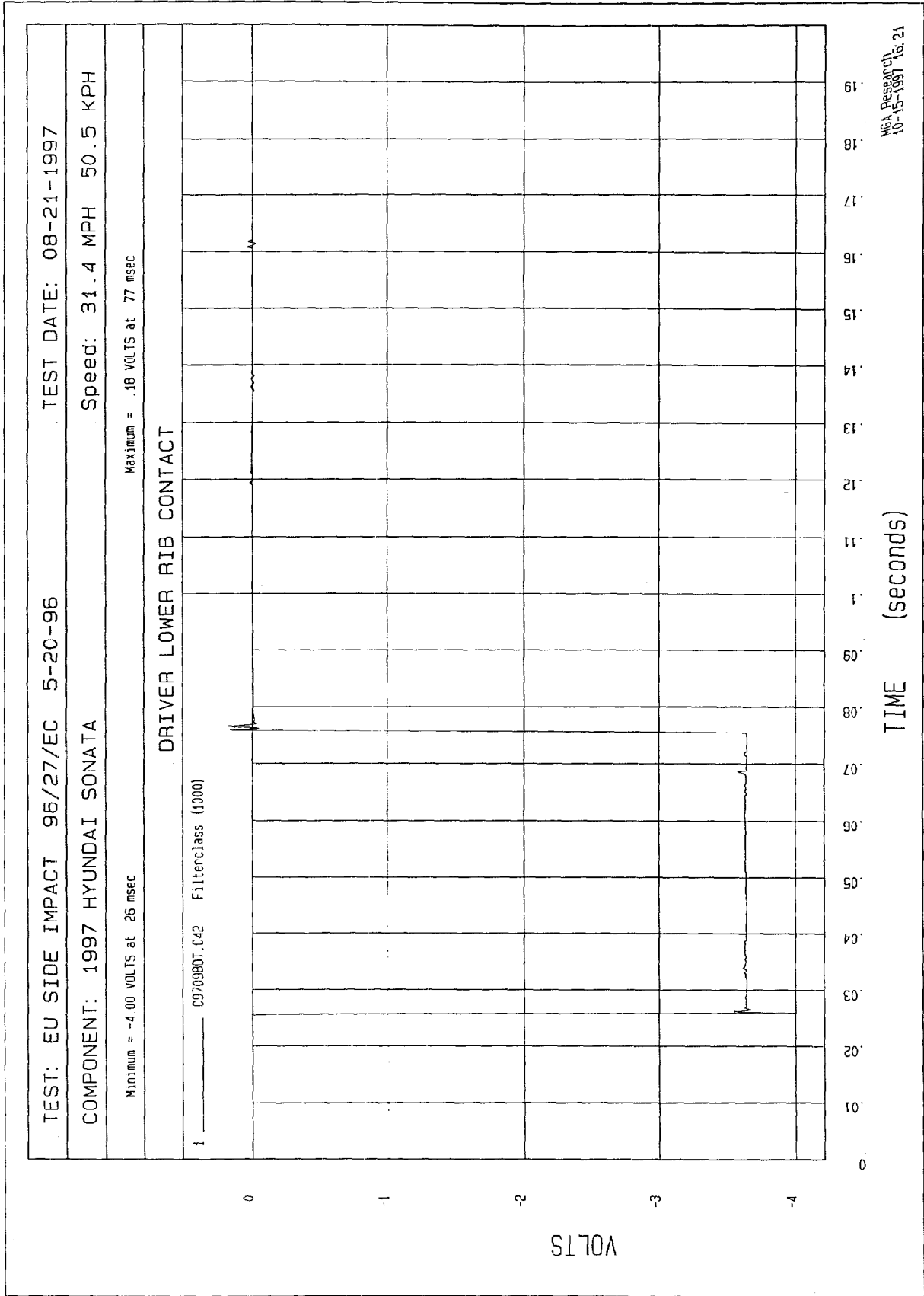


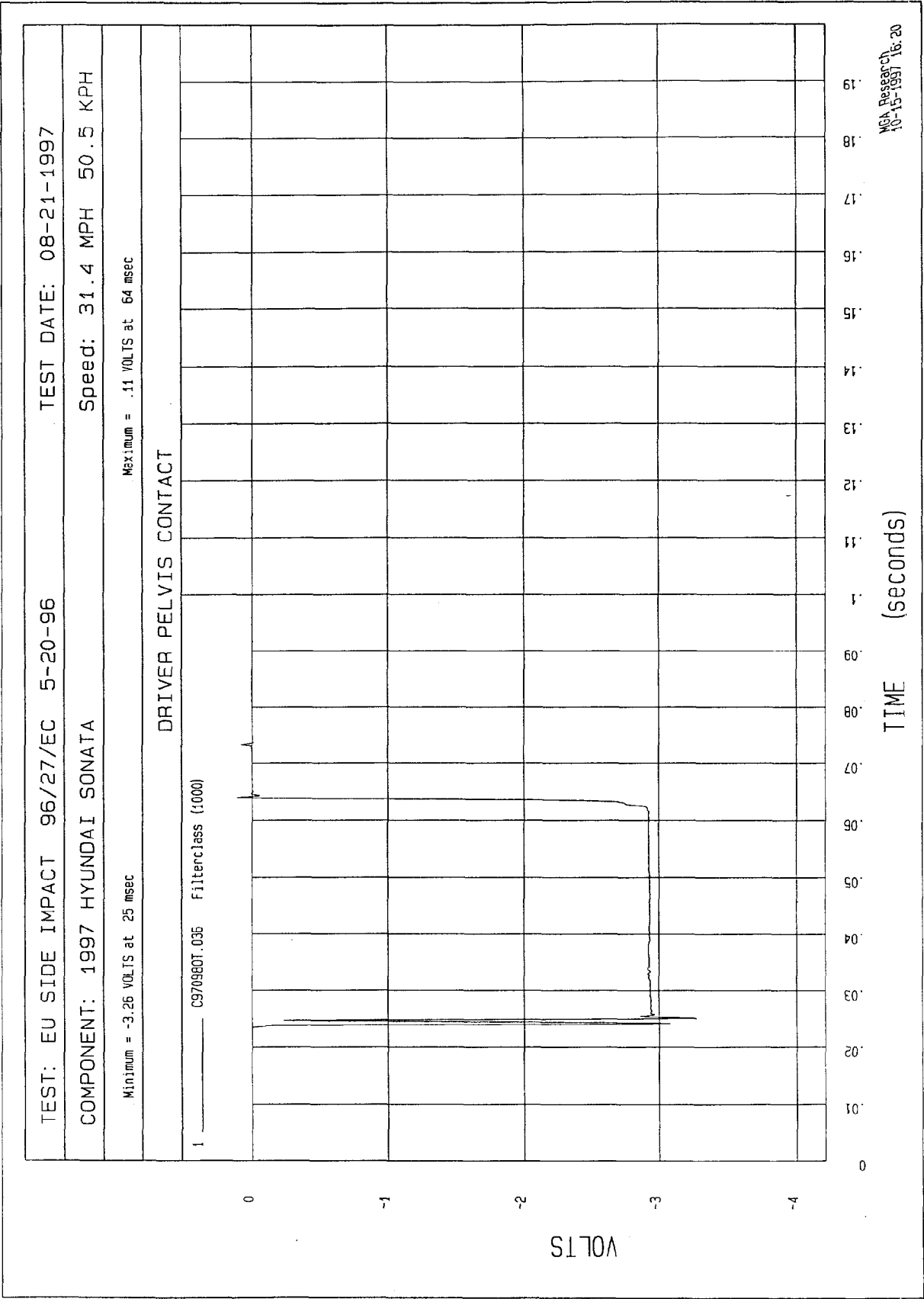


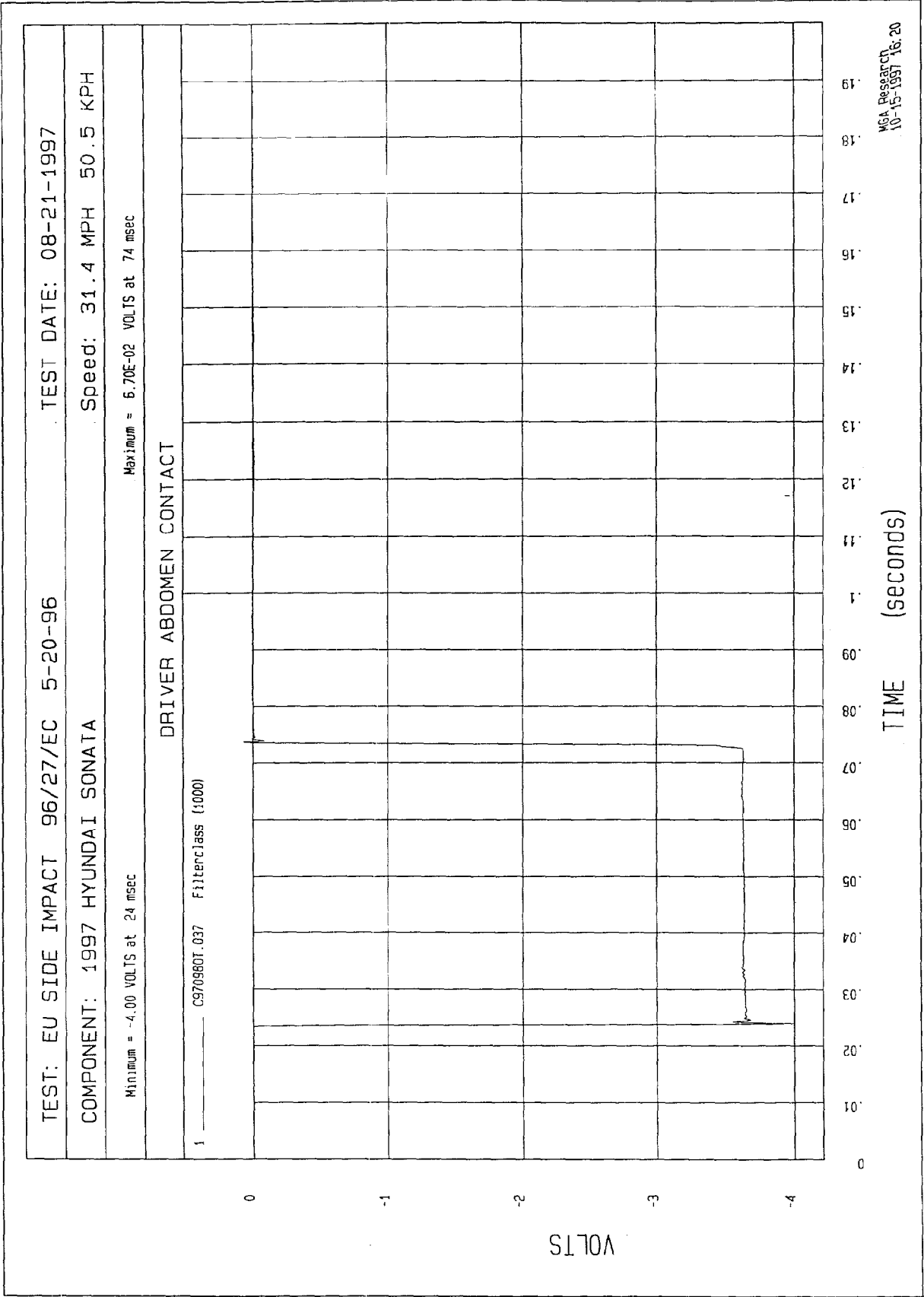












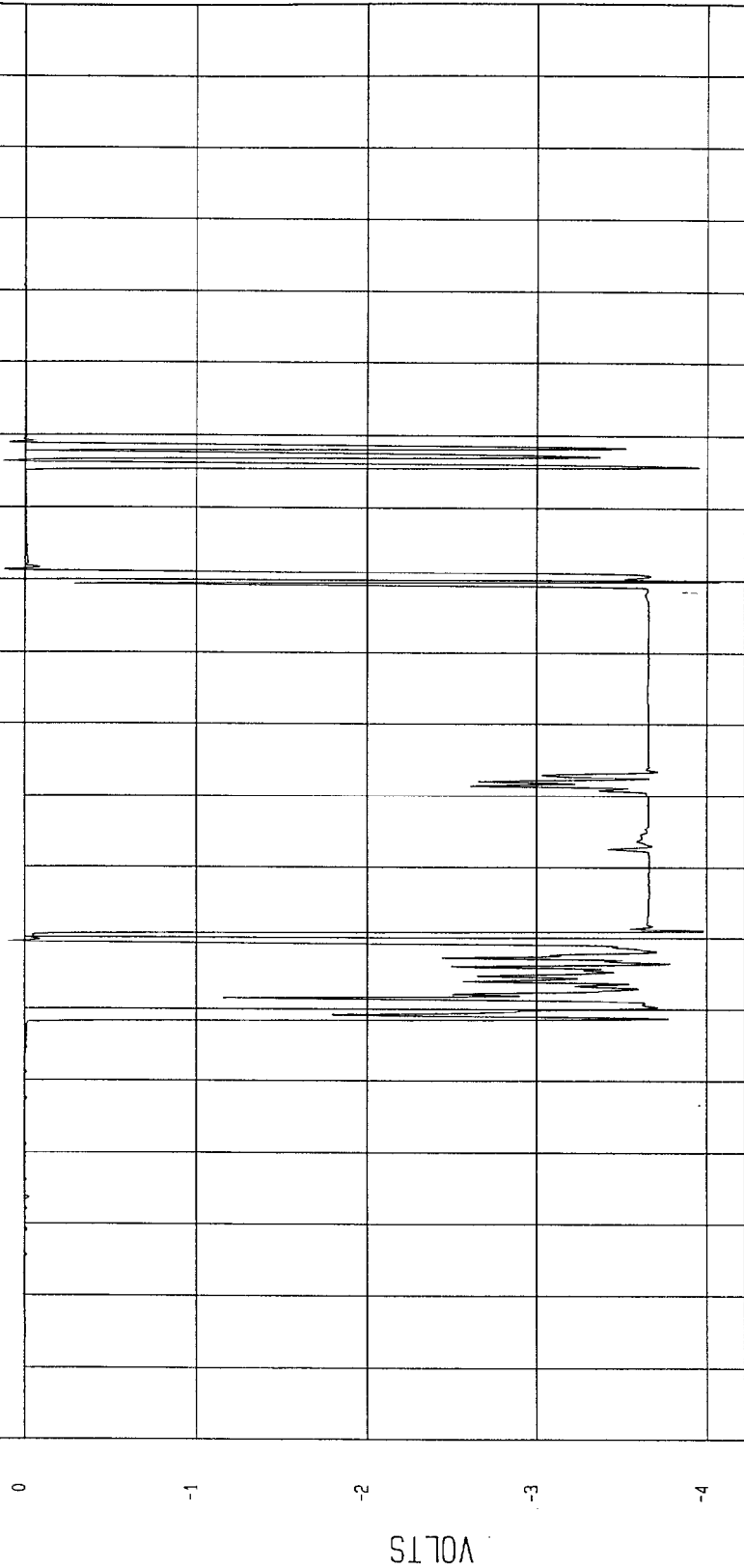
TEST: EU SIDE IMPACT 96/27/EC MAY 20, 1996 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

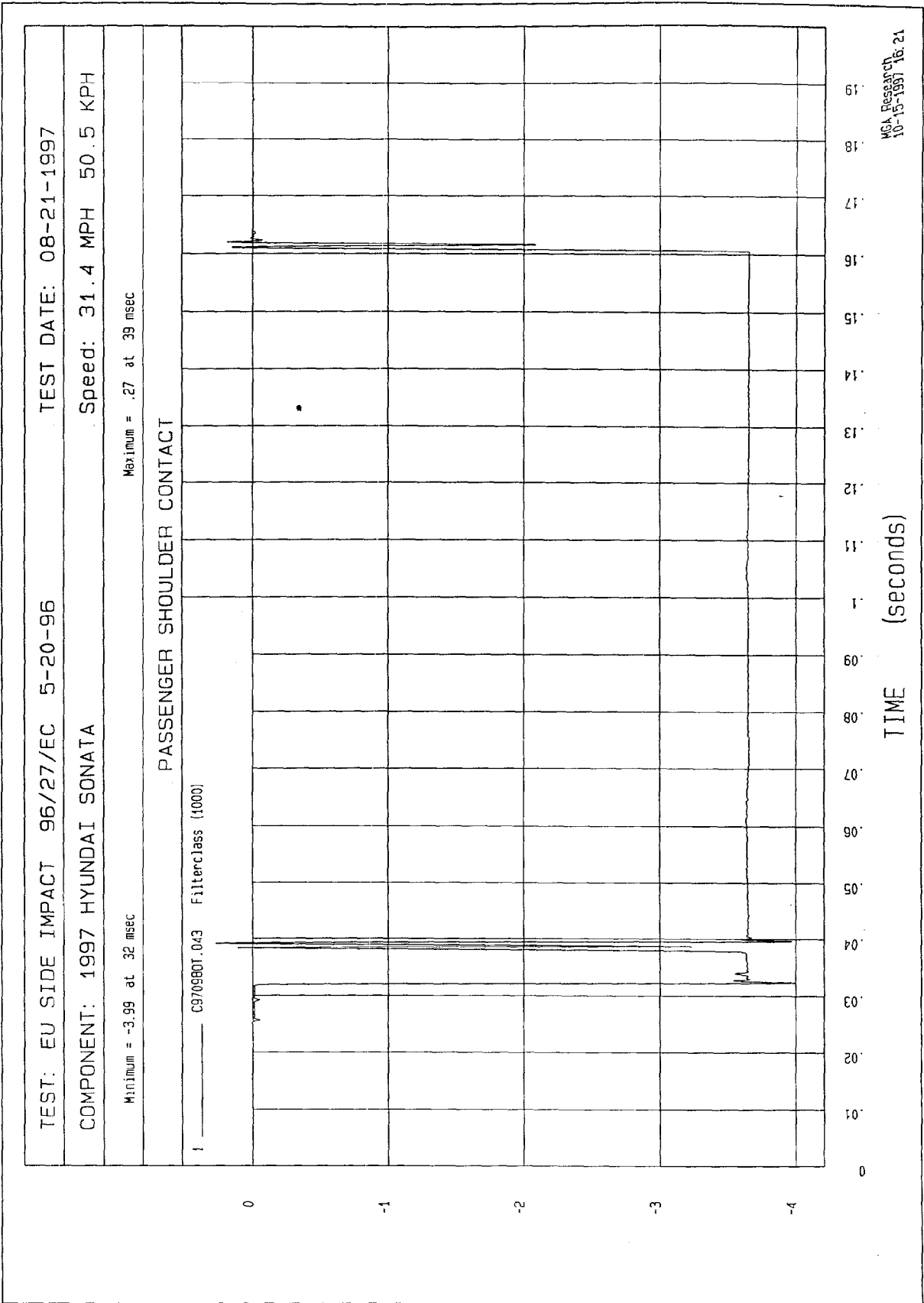
Minimum = -4.07 VOLTS at 120 msec Maximum = .12 VOLTS at 136 msec

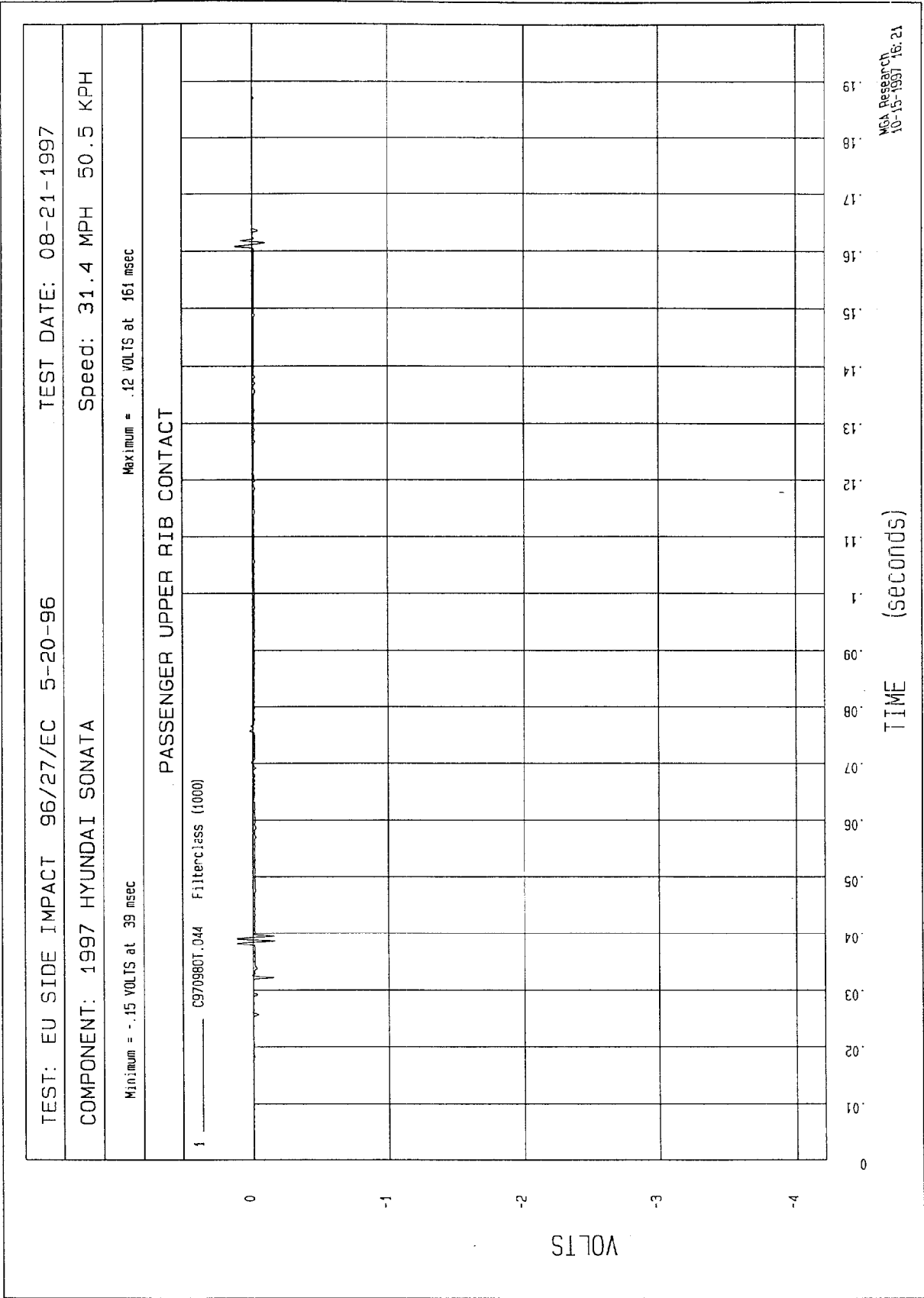
PASSENGER HEAD CONTACT

1 89709801.072 Filterclass (1000)



MOA Research
04-12-1998 11:04





TEST: EU SIDE IMPACT 96/27/EC 5-20-96 TEST DATE: 08-21-1997

COMPONENT: 1997 HYUNDAI SONATA Speed: 31.4 MPH 50.5 KPH

Minimum = -3.05E-02 VOLTS at 26 msec Maximum = 2.55E-02 VOLTS at 63 msec

PASSENGER MIDDLE RIB CONTACT

1 _____ C970980T.035 Filterclass (1000)

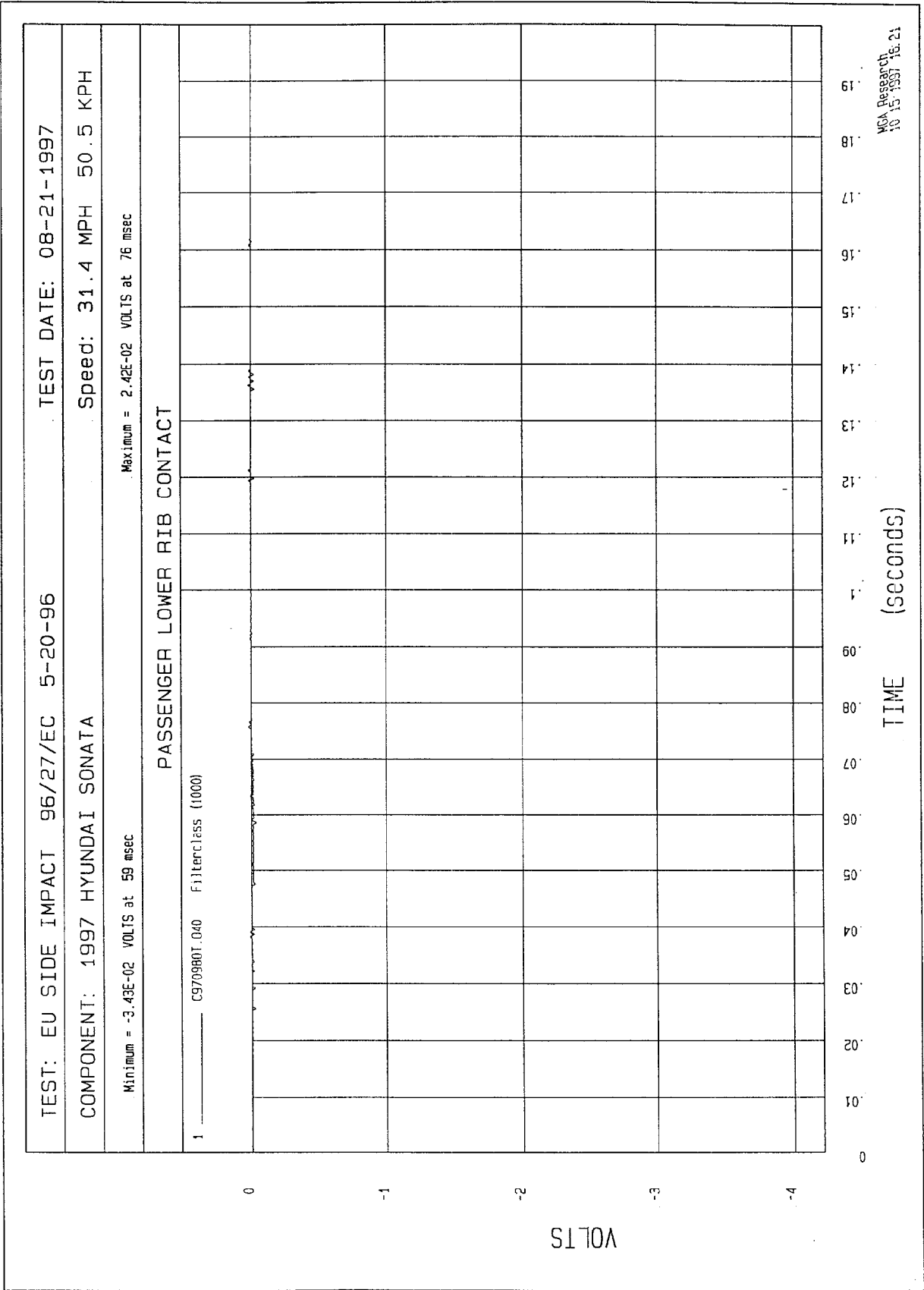
0 -1 -2 -3 -4

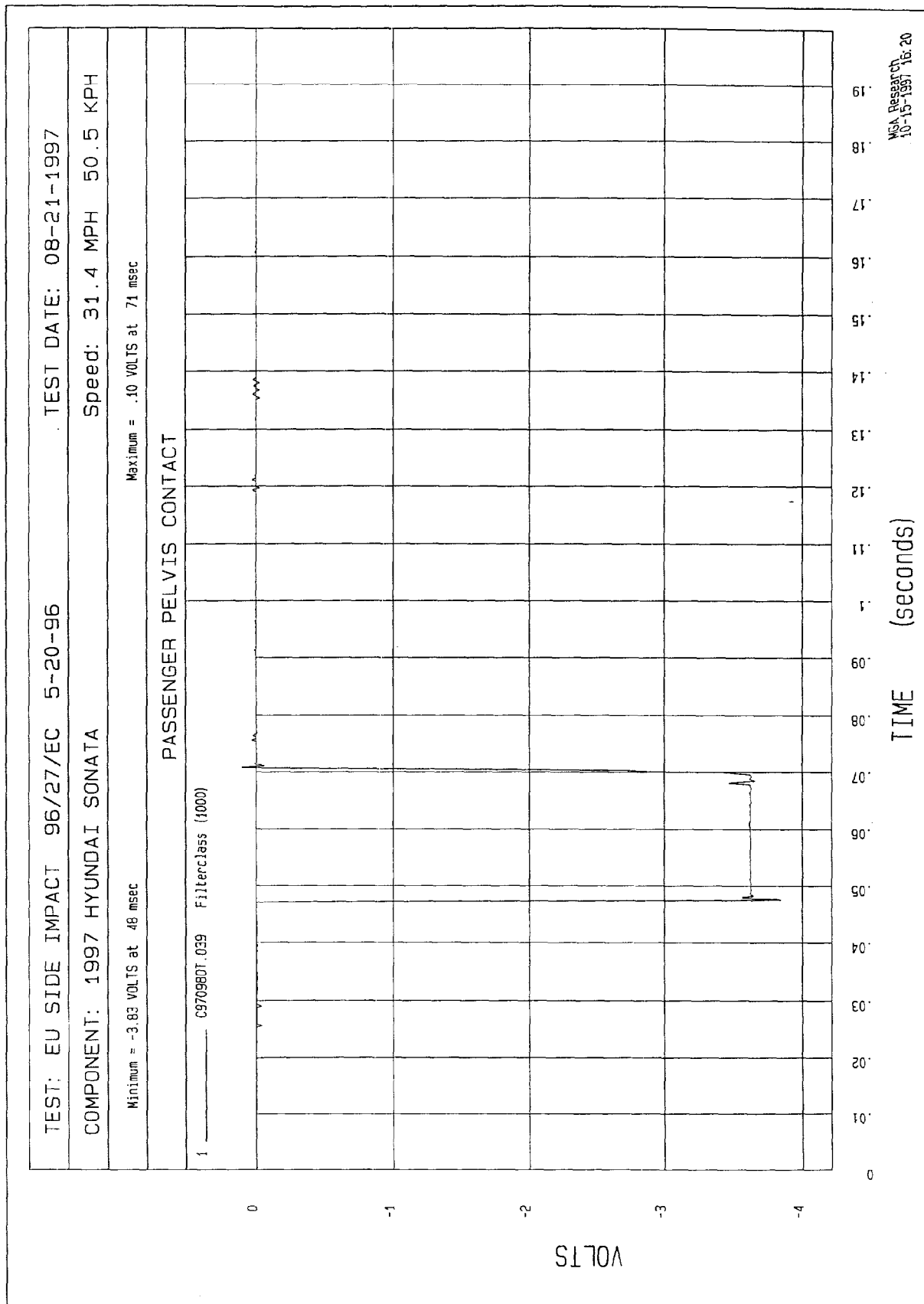
VOLTS

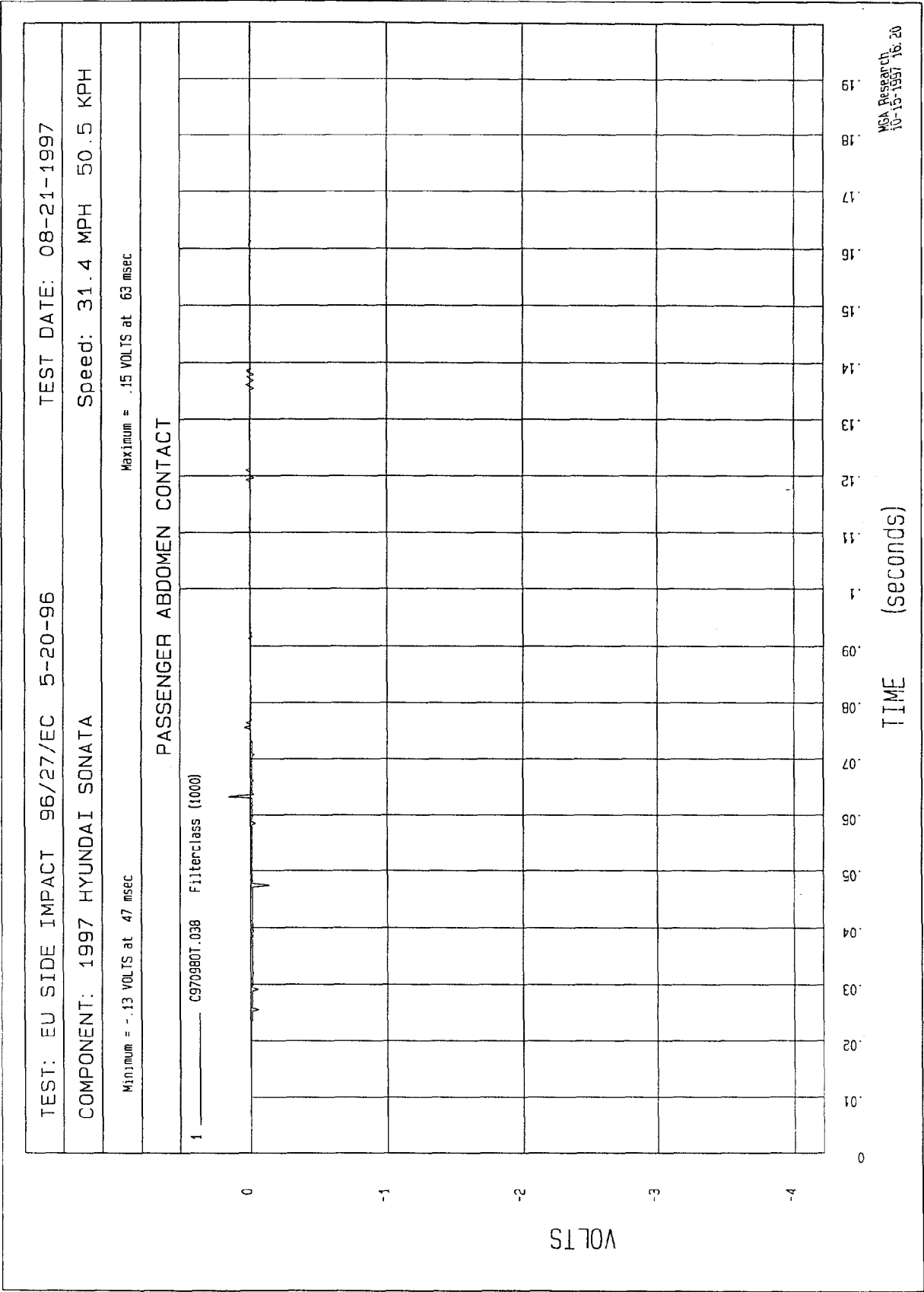
0 .01 .02 .03 .04 .05 .06 .07 .08 .09 .1 .11 .12 .13 .14 .15 .16 .17 .18 .19

TIME (seconds)

WCA Research
10-15-1997 16:20







APPENDIX C
OVERPLOT DATA

This section contains overplot data from the European Lateral Impact testing conducted at MGA Research on August 21, 1997 and the FMVSS 214D Side Impact testing conducted at MGA Research on February 27, 1997.

	<u>European Lateral Impact</u>	<u>FMVSS 214D</u>
Vehicle	1997 Hyundai Sonata	1995 Hyundai Sonata
Test Weight (kg)	1540	1002
Impact Speed (kph)	50.5	53.0
Driver Dummy	EuroSID-1	SID
Passenger Dummy	EuroSID-1	SID
Impact Angle (°)	90°	90°
Crab Angle (°)	0°	27°
Driver (TTI)*	129	80
Passenger (TTI)*	27	69

* These values are calculated using the FMVSS 214D injury criteria.

This section contains overplot data from the European Lateral Impact testing conducted at MGA Research on August 21, 1997 and the FMVSS 214D Side Impact testing conducted at MGA Research on February 27, 1997.

	<u>European Lateral Impact</u>	<u>FMVSS 214D</u>
Vehicle	1997 Hyundai Sonata	1995 Hyundai Sonata
Test Weight (kg)	1540	1002
Impact Speed (kph)	50.5	53.0
Driver Dummy	EuroSID-1	SID
Passenger Dummy	EuroSID-1	SID
Impact Angle (°)	90°	90°
Crab Angle (°)	0°	27°
Driver (TTI)*	129	80
Passenger (TTI)*	27	69

* These values are calculated using the FMVSS 214D injury criteria.

Table of Data Plots

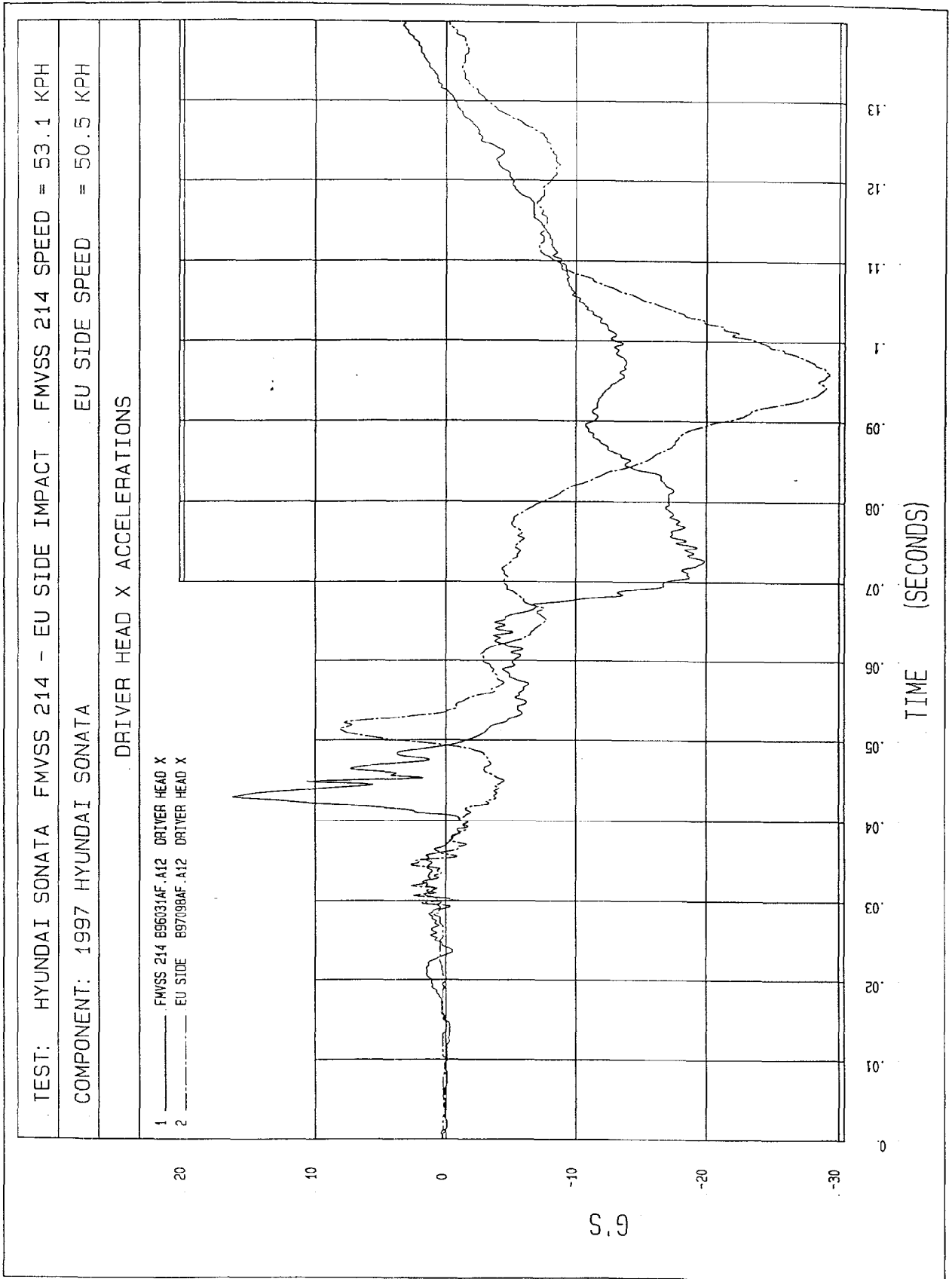
<u>Overplot Data:</u>	<u>Page No.</u>
Figure C-1 - Driver Head X Accelerations vs. Time	C-1
Figure C-2 - Driver Head Y Accelerations vs. Time	C-2
Figure C-3 - Driver Head Z Accelerations vs. Time	C-3
Figure C-4 - Driver Head Resultant Accelerations vs. Time	C-4
Figure C-5 - Driver Upper Rib Y Accelerations vs. Time (FIR Filtered)	C-5
Figure C-6 - Driver Upper Rib Y Velocities vs. Time (Filterclass 180)	C-6
Figure C-7 - Driver Lower Rib Y Accelerations vs. Time (FIR Filtered)	C-7
Figure C-8 - Driver Lower Rib Y Velocities vs. Time (Filterclass 180)	C-8
Figure C-9 - Driver Lower Spine Y Accelerations vs. Time (FIR Filtered)	C-9
Figure C-10 - Driver Lower Spine Y Velocities vs. Time (Filterclass 180)	C-10
Figure C-11 - Driver Pelvis Y Accelerations vs. Time (FIR Filtered)	C-11
Figure C-12 - Driver Pelvis Y Velocities vs. Time (Filterclass 180)	C-12
Figure C-13 - Passenger Head X Accelerations vs. Time	C-13
Figure C-14 - Passenger Head Y Accelerations vs. Time	C-14
Figure C-15 - Passenger Head Z Accelerations vs. Time	C-15
Figure C-16 - Passenger Head Resultant Accelerations vs. Time	C-16
Figure C-17 - Passenger Upper Rib Y Accelerations (FIR Filtered)	C-17
Figure C-18 - Passenger Upper Rib Y Velocities (Filterclass 180)	C-18
Figure C-19 - Passenger Lower Rib Y Accelerations vs. Time (FIR Filtered)	C-19
Figure C-20 - Passenger Lower Rib Y Velocities vs. Time (Filterclass 180)	C-20
Figure C-21 - Passenger Lower Spine Y Accelerations vs. Time (FIR Filtered)	C-21
Figure C-22 - Passenger Lower Spine Y Velocities (Filterclass 180)	C-22
Figure C-23 - Passenger Pelvis Y Accelerations (FIR Filtered)	C-23
Figure C-24 - Passenger Pelvis Y Velocities (Filterclass 180)	C-24
Figure C-25 - Right Front Sill X Accelerations vs. Time (Filter Class 60)	C-25
Figure C-26 - Right Front Sill X Velocities vs. Time (Filter Class 180)	C-26
Figure C-27 - Right Front Sill Y Accelerations vs. Time (Filter Class 60)	C-27
Figure C-28 - Right Front Sill Y Velocities vs. Time (Filter Class 180)	C-28
Figure C-29 - Right Front Sill Z Accelerations vs. Time (Filter Class 60)	C-29

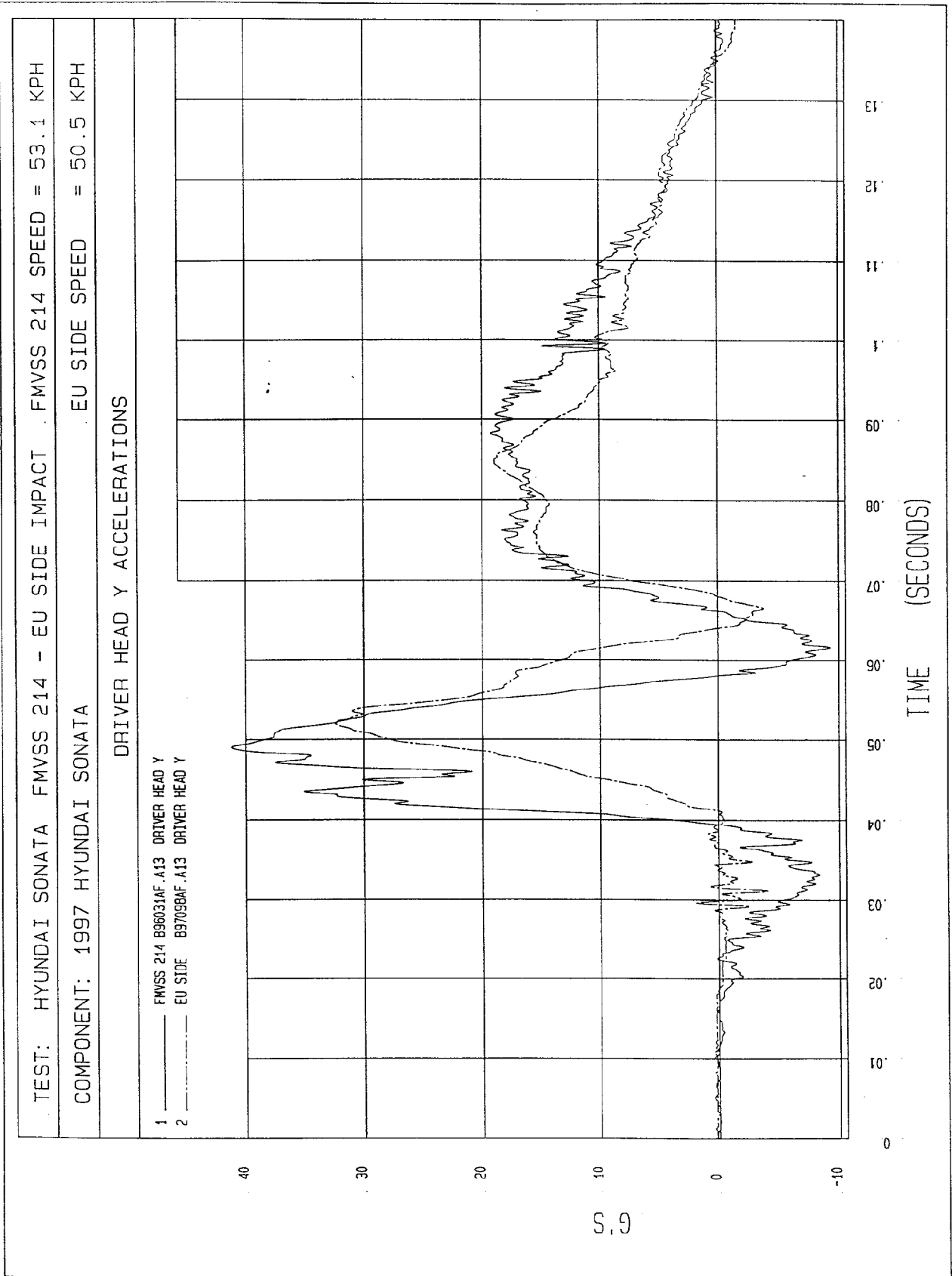
Table of Data Plots

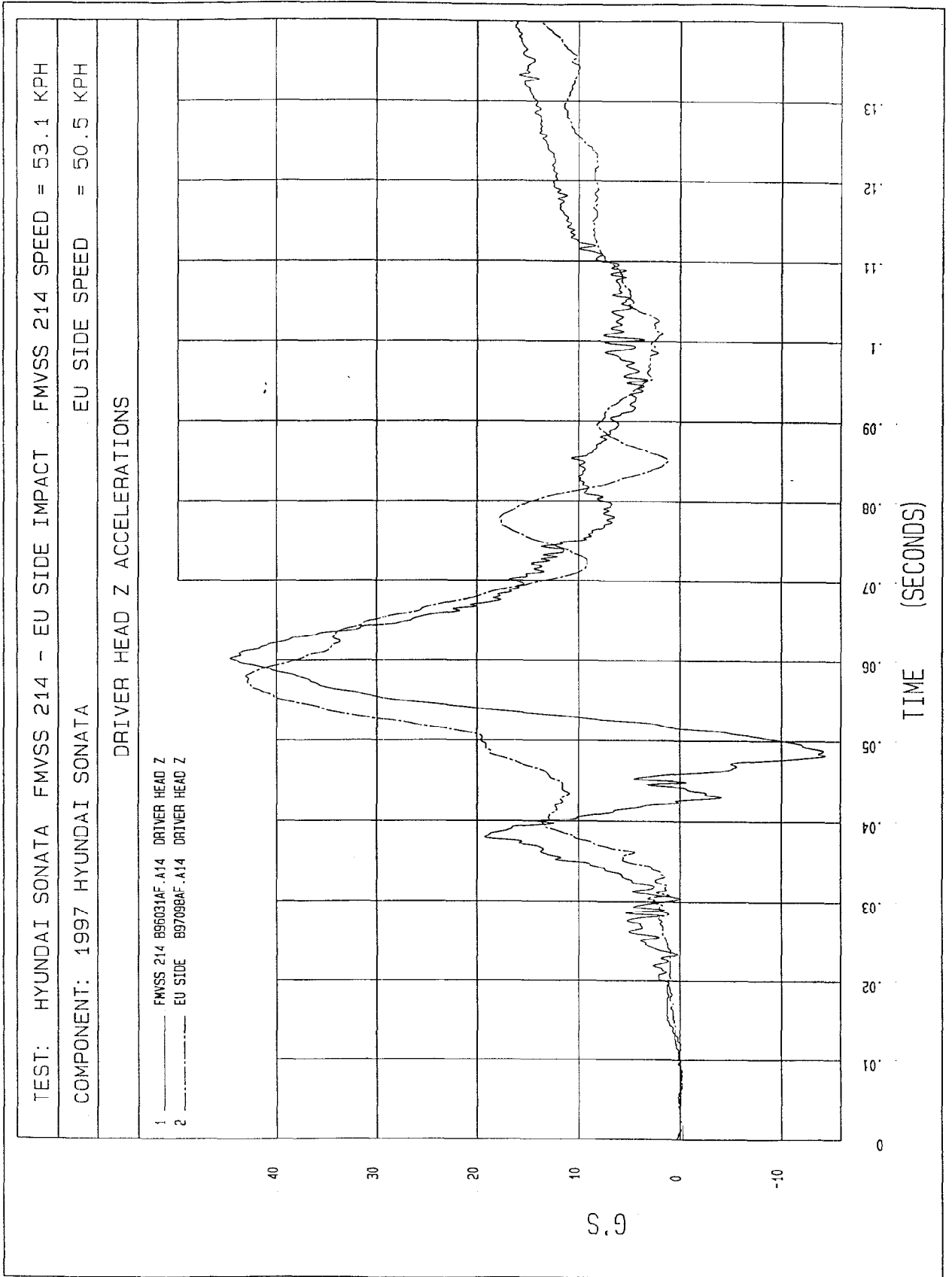
<u>Overplot Data:</u>	<u>Page No.</u>
Figure C-30 - Right Front Sill Z Velocities vs. Time (Filter Class 180)	C-30
Figure C-31 - Right Rear Sill X Accelerations vs. Time (Filter Class 60)	C-31
Figure C-32 - Right Rear Sill X Velocities vs. Time (Filter Class 180)	C-32
Figure C-33 - Right Rear Sill Y Acceleration vs. Time (Filter Class 60)	C-33
Figure C-34 - Right Rear Sill Y Velocities vs. Time (Filter Class 180)	C-34
Figure C-35 - Right Rear Sill Z Acceleration vs. Time (Filter Class 60)	C-35
Figure C-36 - Right Rear Sill Z Velocities vs. Time (Filter Class 180)	C-36
Figure C-37 - Left Front Sill Y Accelerations vs. Time (Filter Class 60)	C-37
Figure C-38 - Left Front Sill Y Velocities vs. Time (Filter Class 180)	C-38
Figure C-39 - Left Rear Sill Y Accelerations vs. Time (Filterclass 60)	C-39
Figure C-40 - Left Rear Sill Y Velocities vs. Time (Filter Class 180)	C-40
Figure C-41 - Driver Seat Track Y Acceleration vs. Time (Filter Class 60)	C-41
Figure C-42 - Vehicle CG X Accelerations vs. Time (Filterclass 60)	C-42
Figure C-43 - Vehicle CG X Velocities vs. Time (Filterclass 180)	C-43
Figure C-44 - Vehicle CG Y Accelerations vs. Time (Filterclass 60)	C-44
Figure C-45 - Vehicle CG Y Velocities vs. Time (Filter Class 180)	C-45
Figure C-46 - Vehicle CG Z Accelerations vs. Time (Filterclass 60)	C-46
Figure C-47 - Vehicle CG Z Velocities vs. Time (Filter Class 180)	C-47
Figure C-48 - Vehicle Rear Axle X Accelerations vs. Time (Filter Class 60)	C-48
Figure C-49 - Vehicle Rear Axle X Velocities vs. Time (Filter Class 180)	C-49
Figure C-50 - Vehicle Rear Axle Y Accelerations vs. Time (Filter Class 60)	C-50
Figure C-51 - Vehicle Rear Axle Y Velocities vs. Time (Filter Class 180)	C-51
Figure C-52 - Vehicle Rear Axle Z Accelerations vs. Time (Filter Class 60)	C-52
Figure C-53 - Vehicle Rear Axle Z Velocities vs. Time (Filter Class 180)	C-53
Figure C-54 - Left Mid A-Post Y Accelerations vs. Time (Filter Class 60)	C-54
Figure C-55 - Left Mid A-Post Y Velocities vs. Time (Filter Class 180)	C-55
Figure C-56 - Left Lower A-Post Y Accelerations vs. Time (Filterclass 60)	C-56
Figure C-57 - Left Lower A-Post Y Velocities vs. Time (Filterclass 180)	C-57
Figure C-58 - Left Mid B-Post Y Acceleration vs. Time (Filterclass 60)	C-58

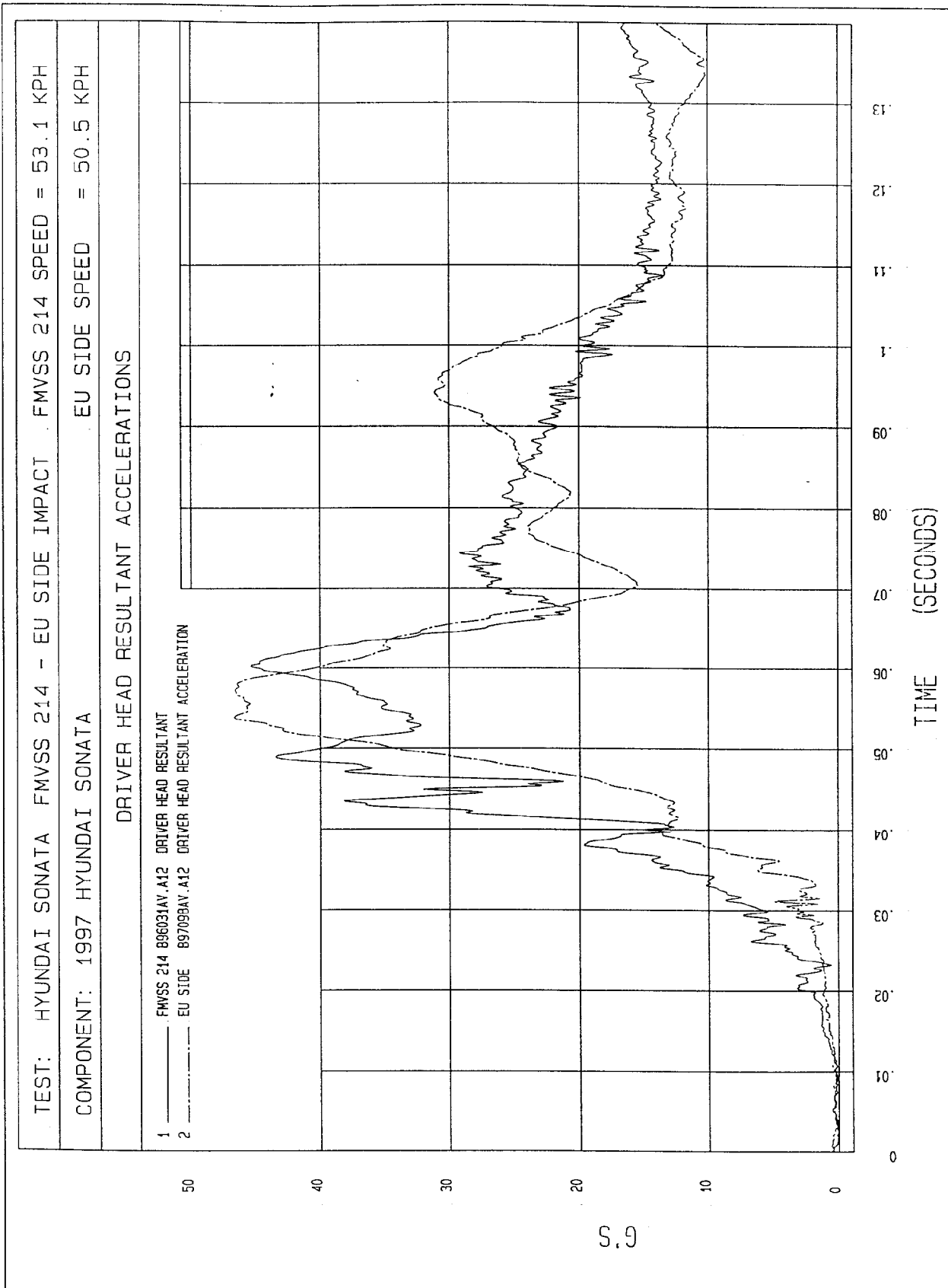
Table of Data Plots

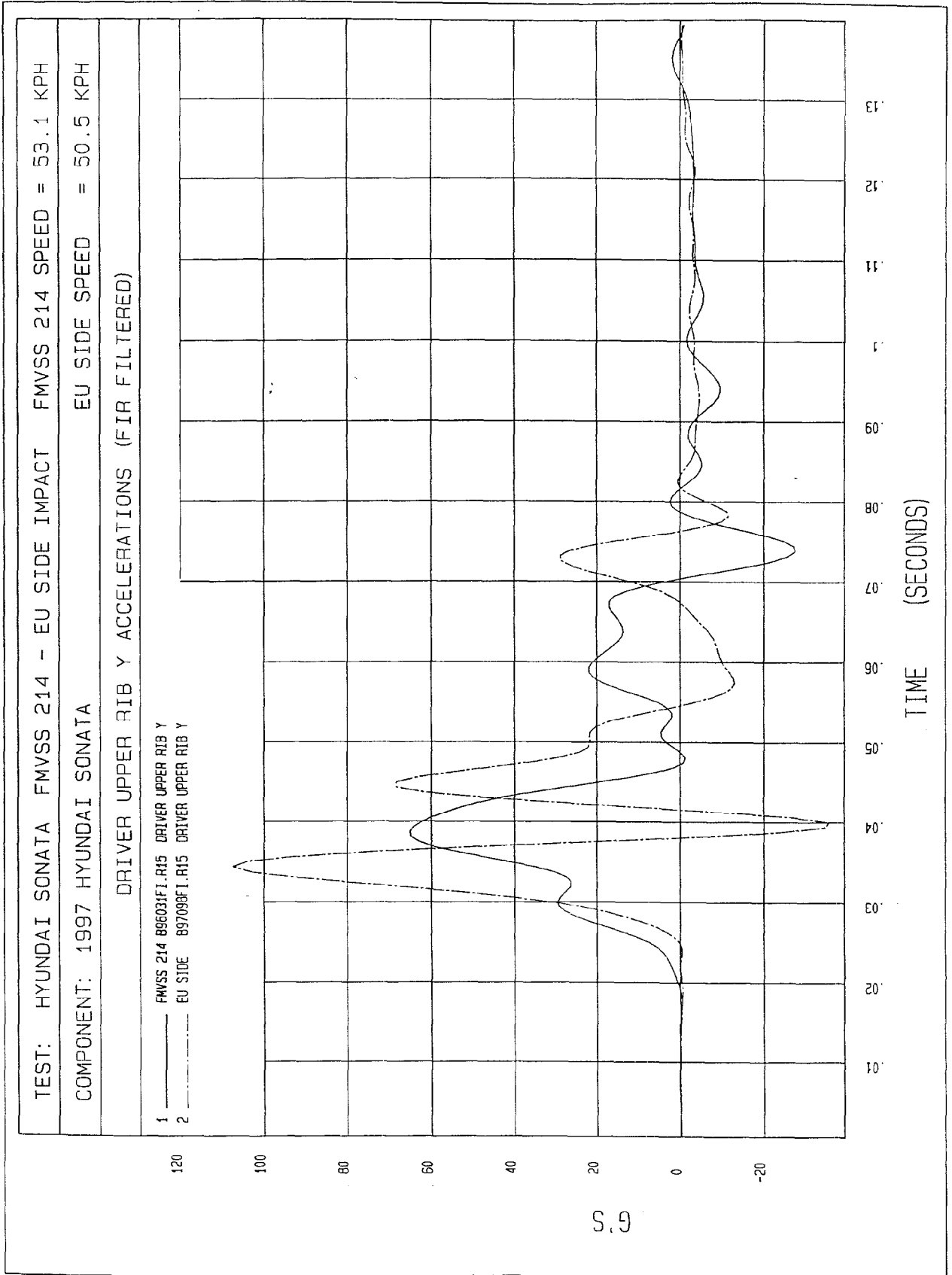
<u>Overplot Data:</u>	<u>Page No.</u>
Figure C-59 - Left Mid B-Post Y Velocities vs. Time (Filterclass 180)	C-59
Figure C-60 - Left Lower B-Post Y Accelerations vs. Time (Filterclass 60)	C-60
Figure C-61 - Left Lower B-Post Y Velocities vs. Time (Filterclass 180)	C-61
Figure C-62 - Level 1 Sill Deformation	C-62
Figure C-63 - Level 2 Sill Deformation	C-63
Figure C-64 - Level 3 Sill Deformation	C-64
Figure C-65 - Level 4 Sill Deformation	C-65
Figure C-66 - Level 5 Sill Deformation	C-66

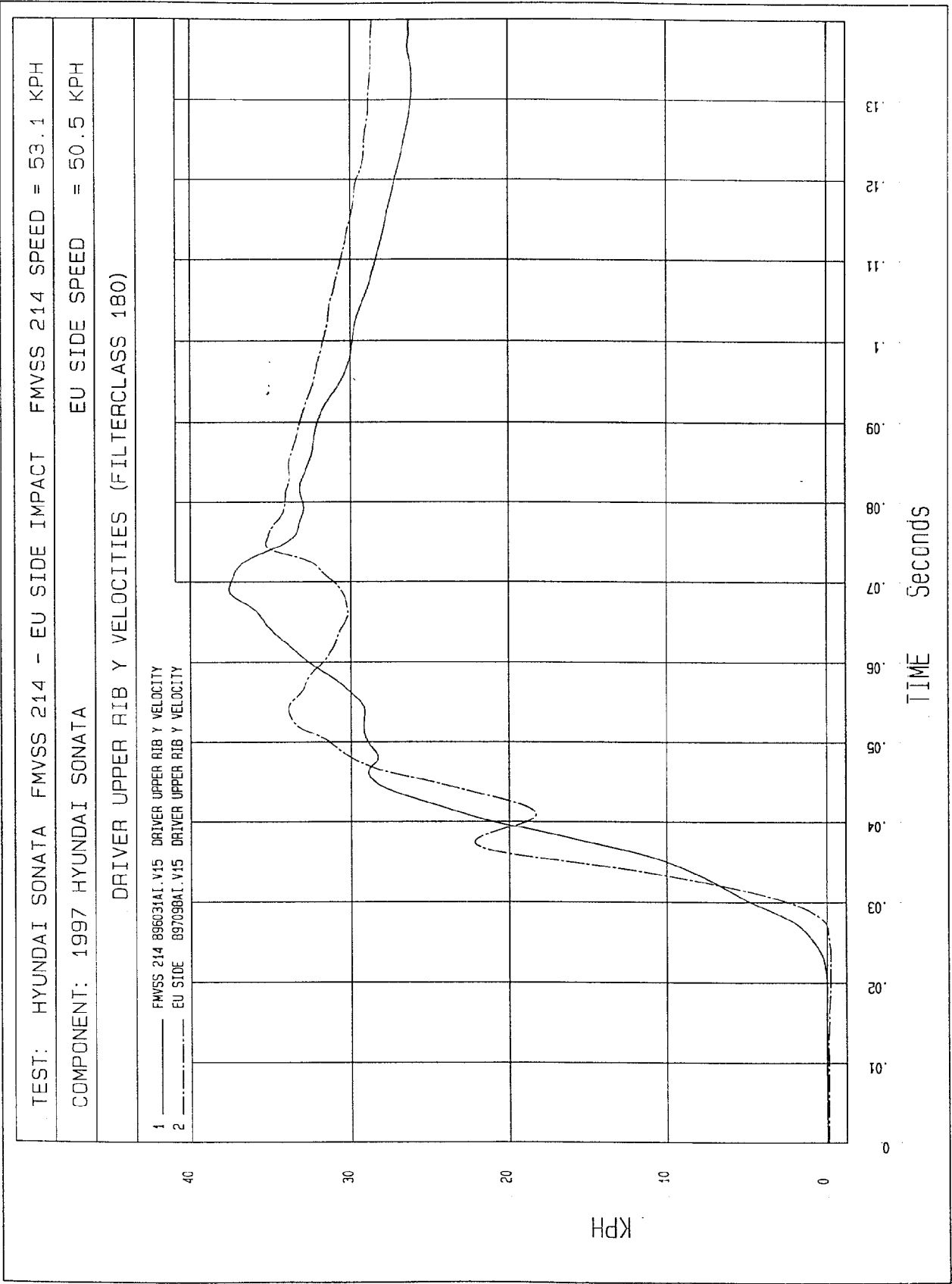




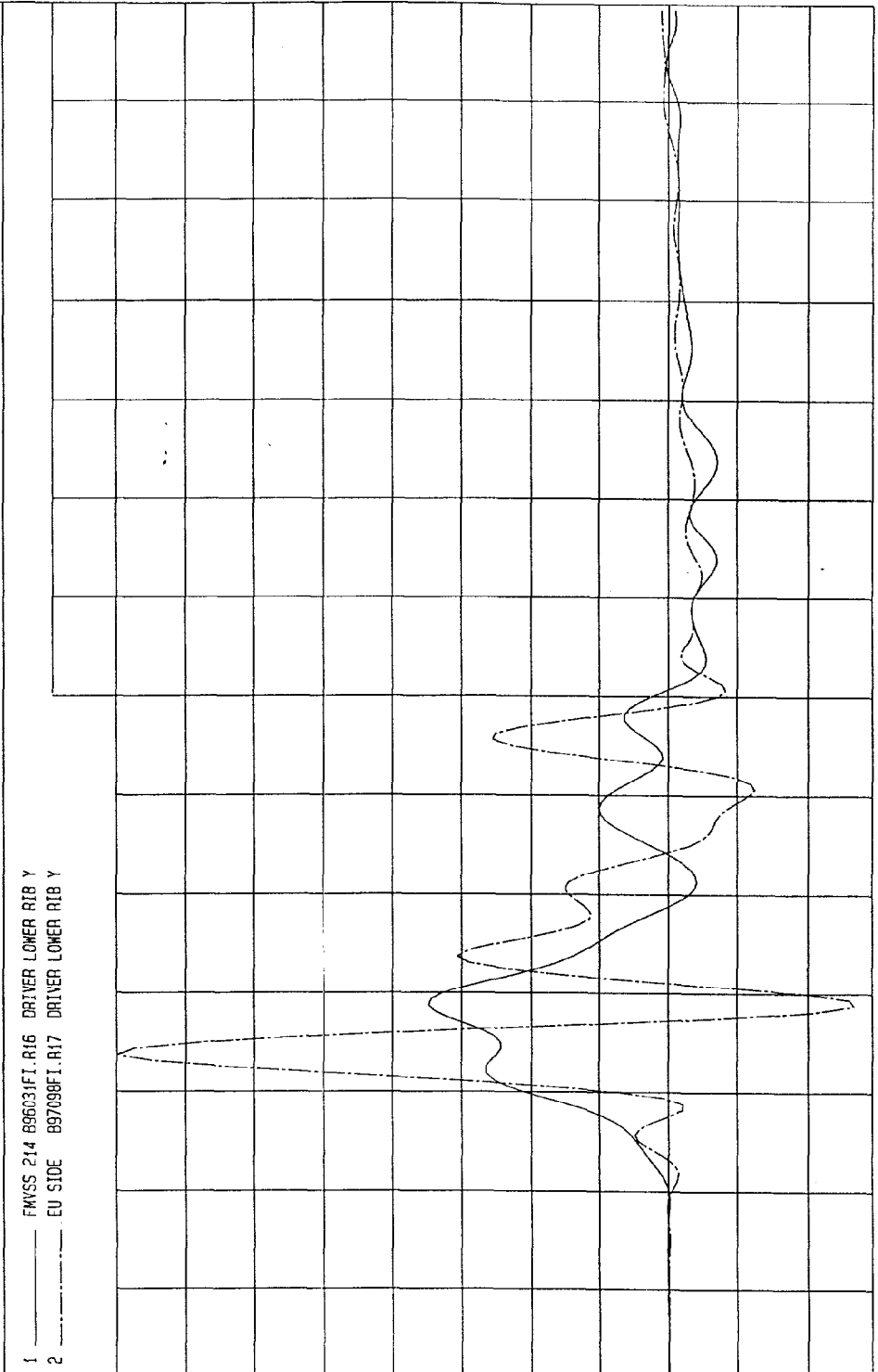






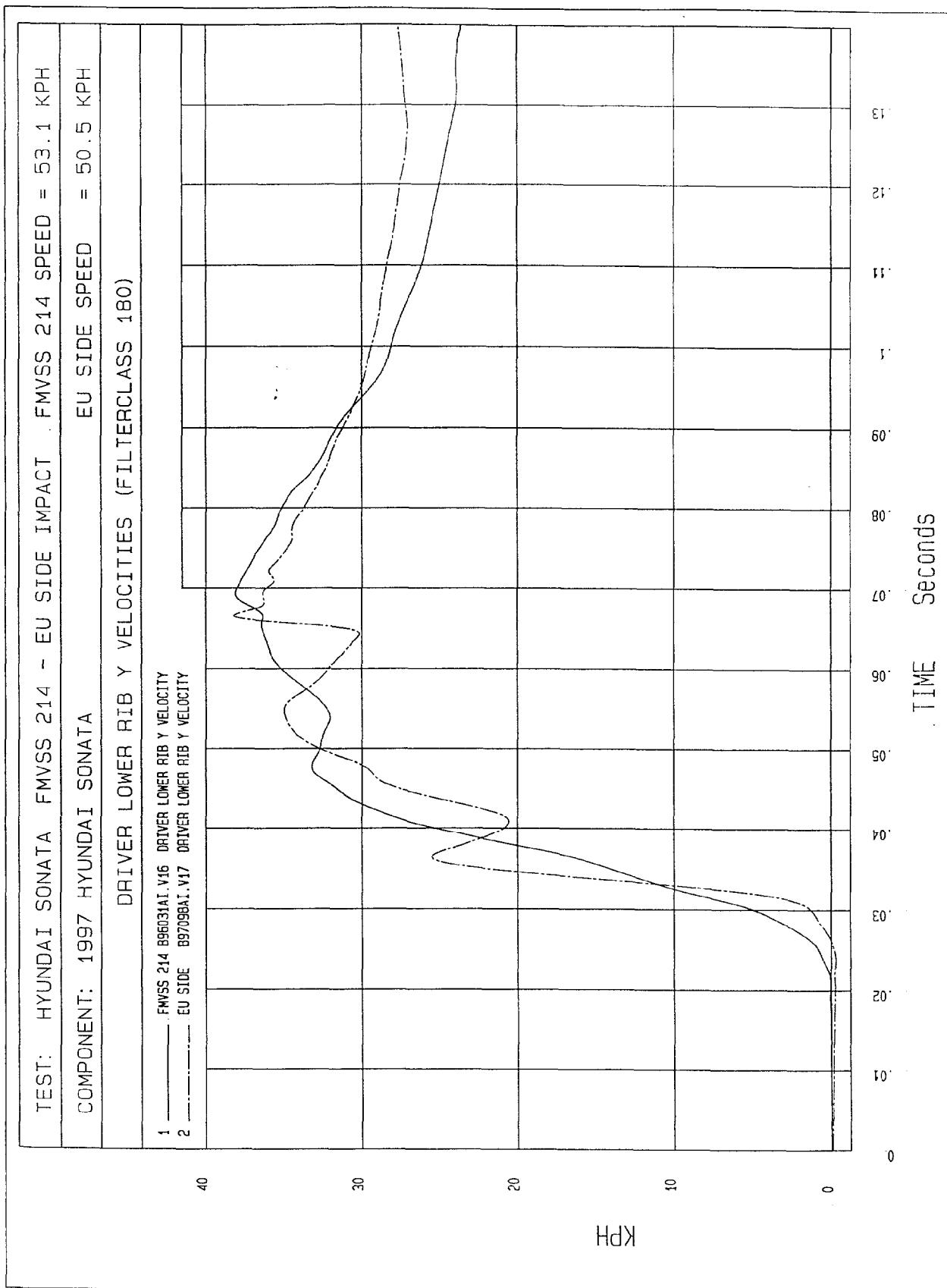


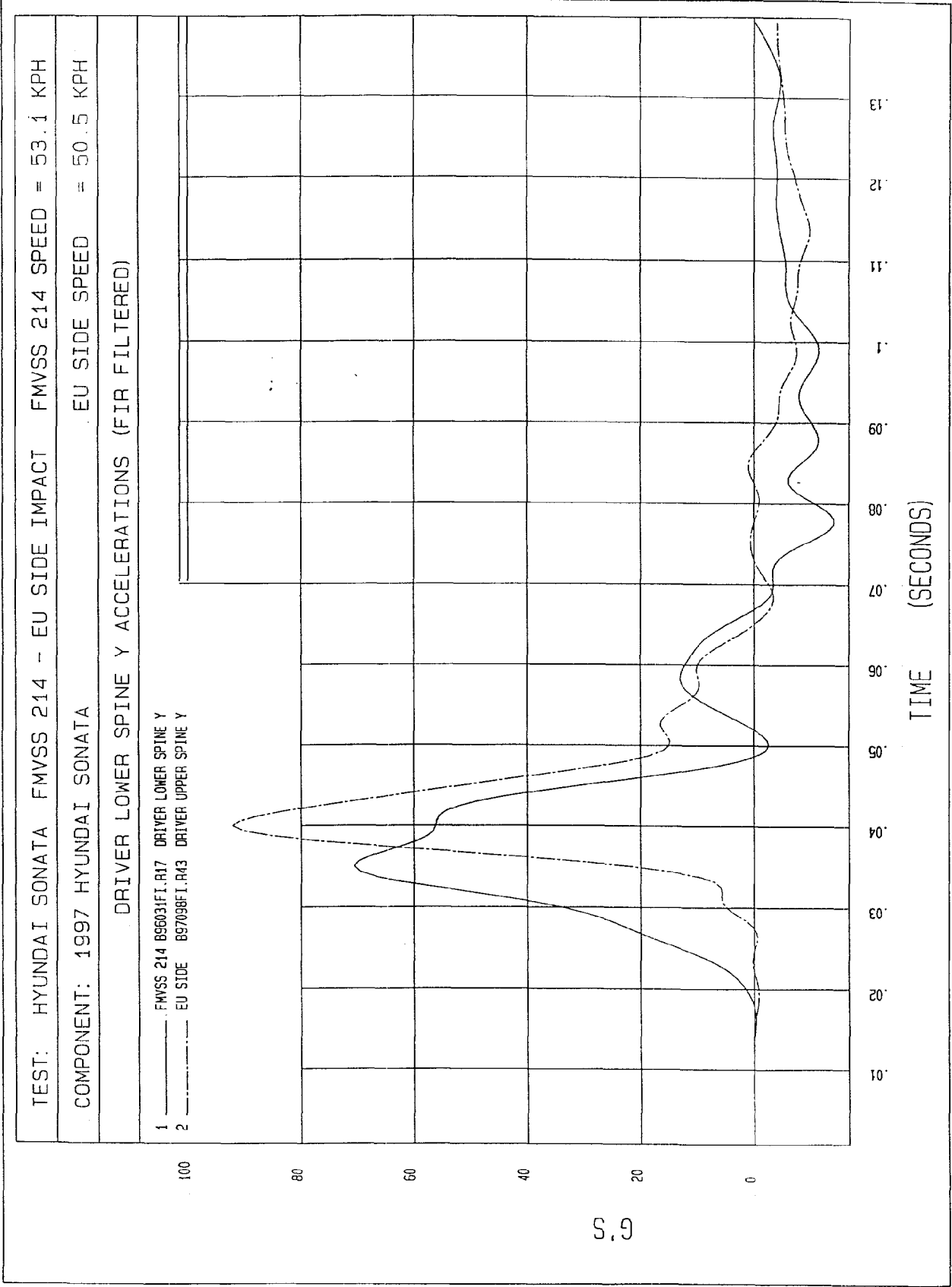
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH
 COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH
 DRIVER LOWER RIB Y ACCELERATIONS (FIR FILTERED)

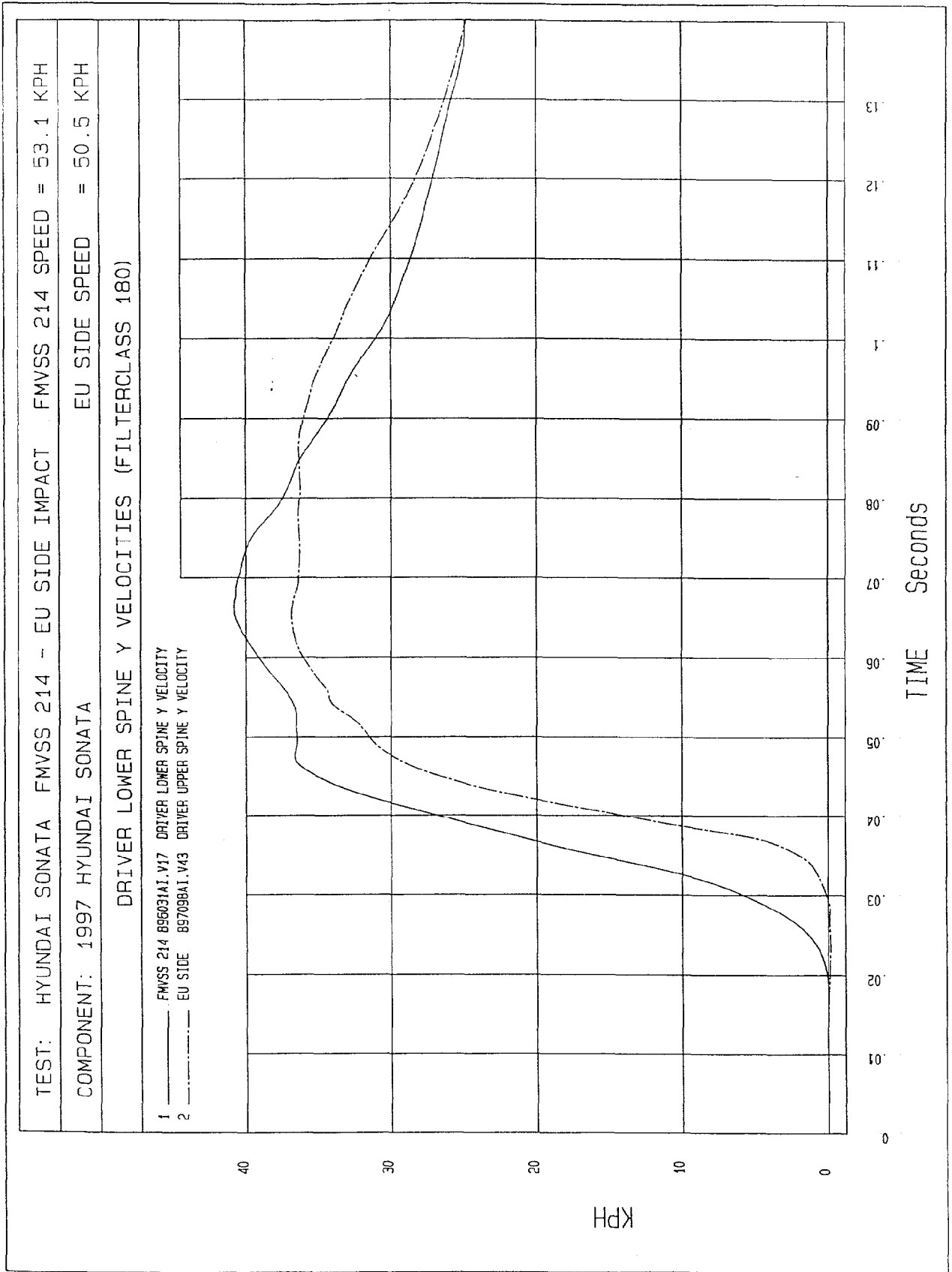


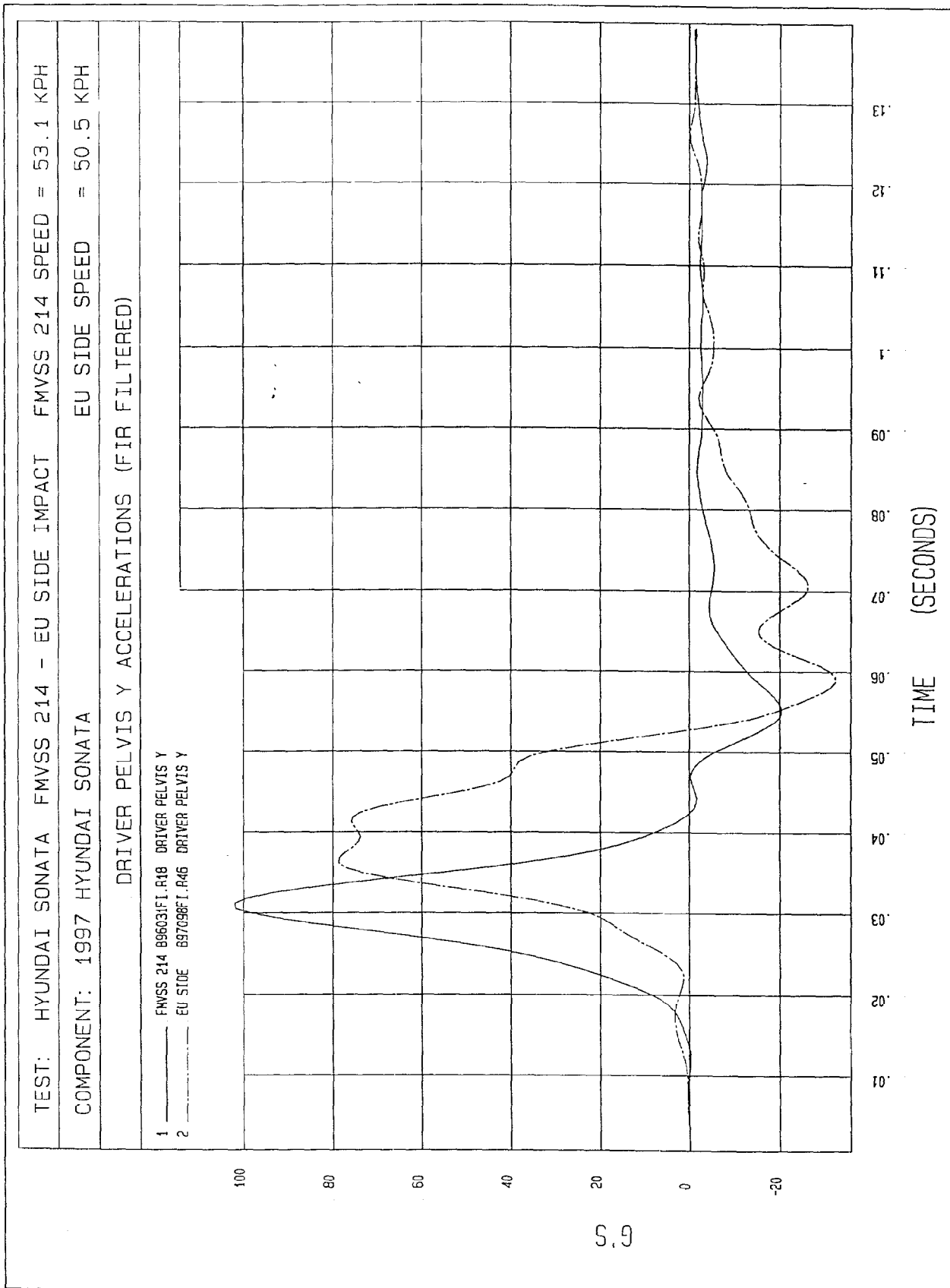
TIME (SECONDS)

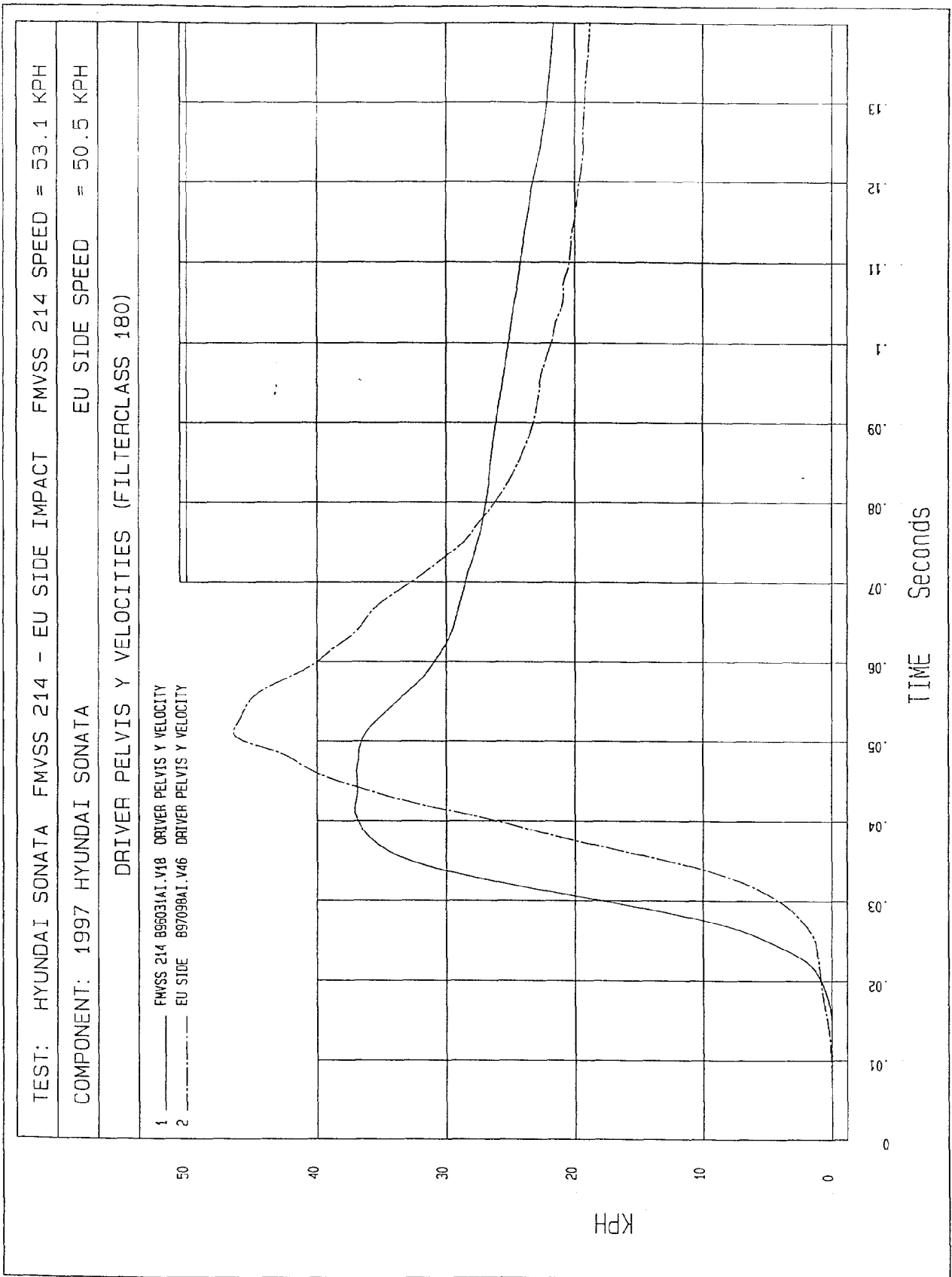
G's

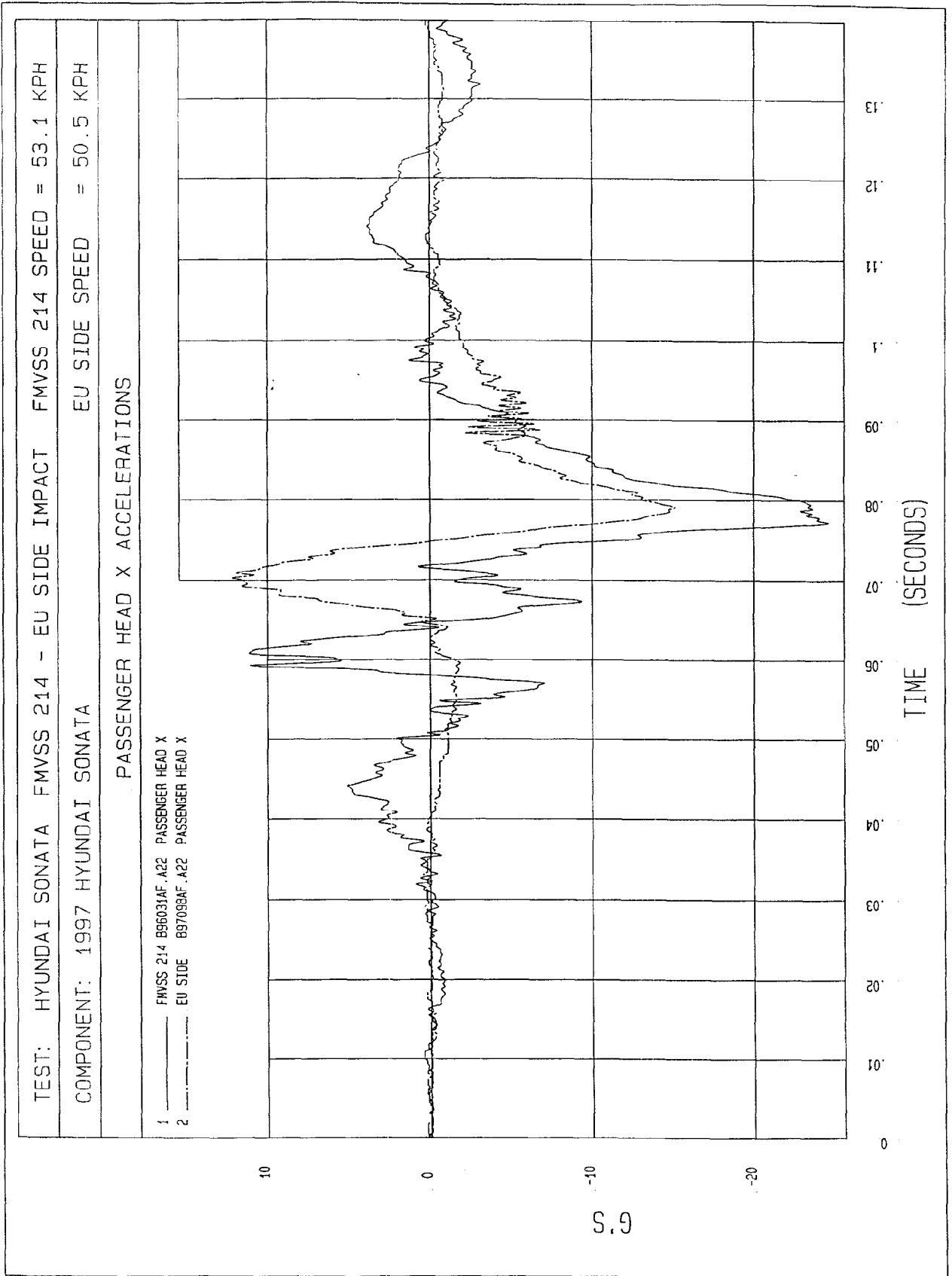


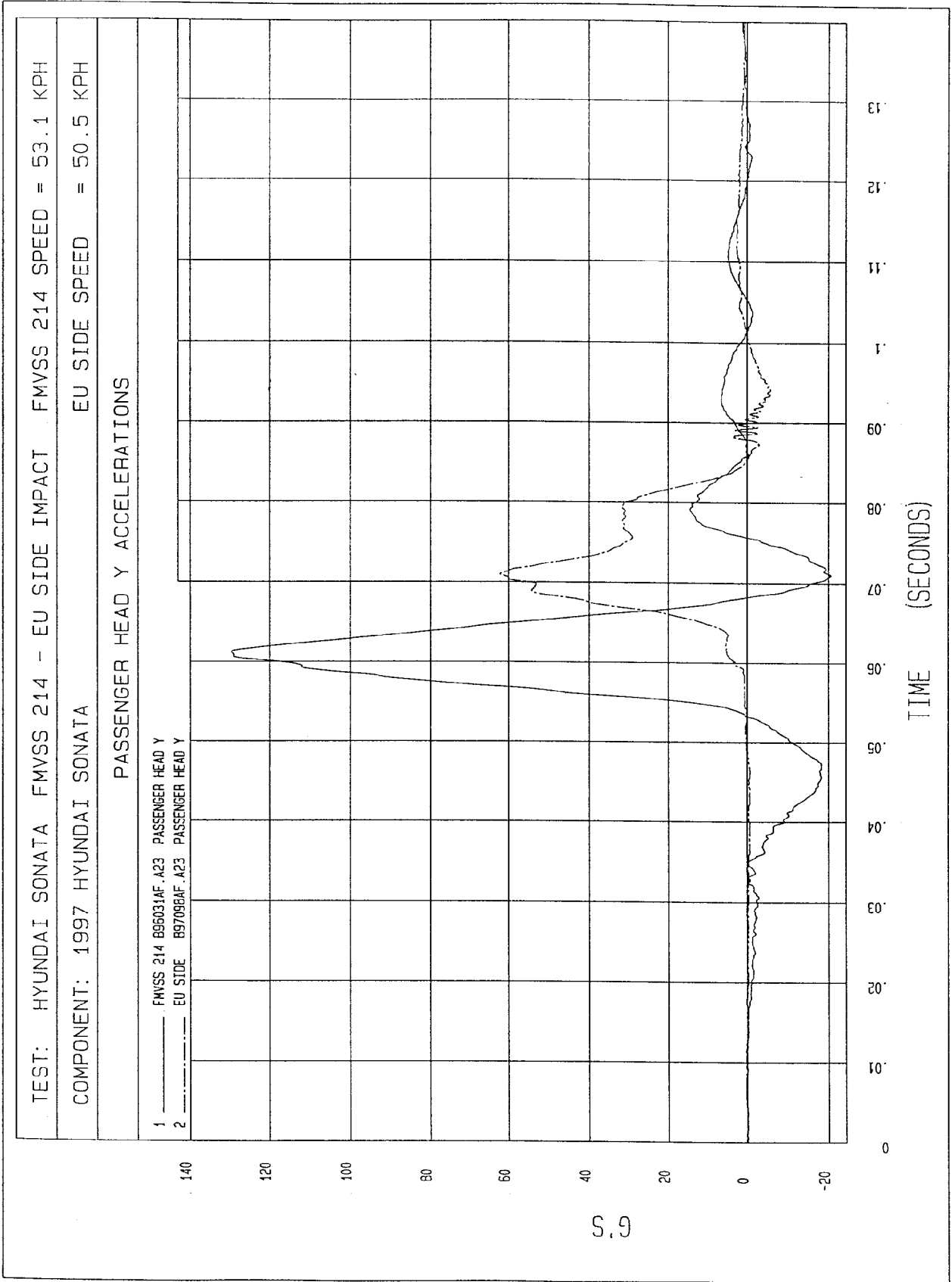


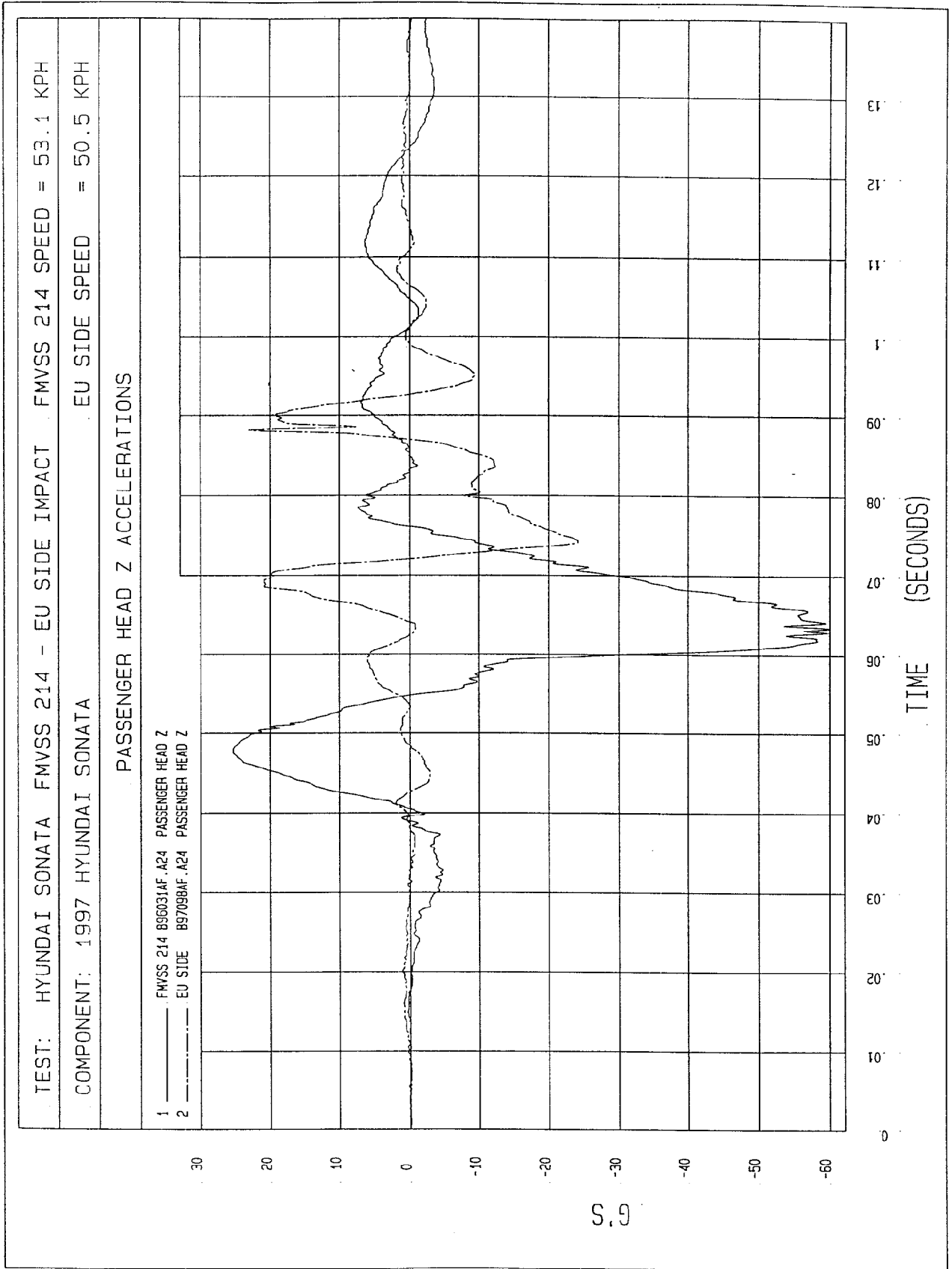


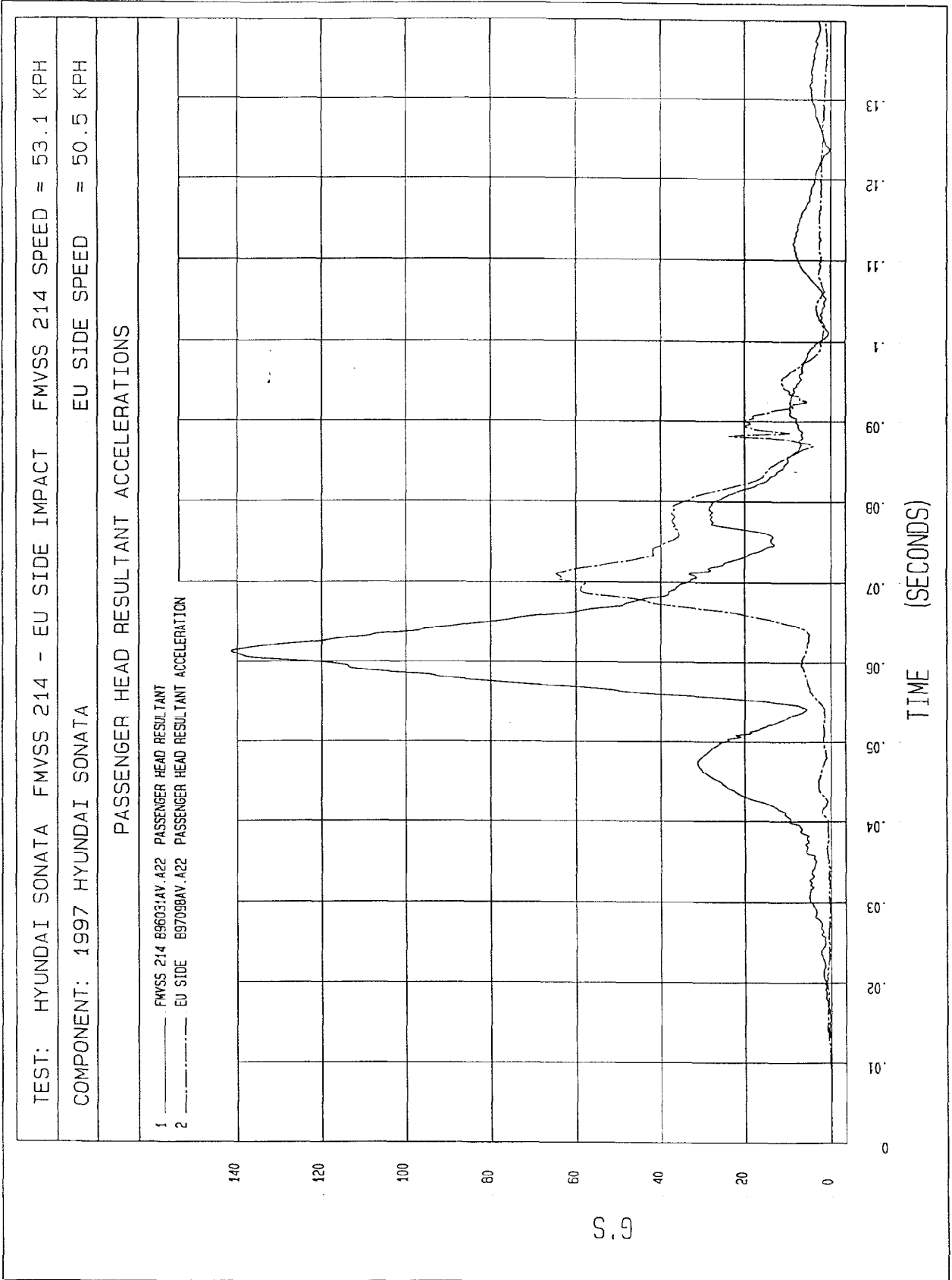


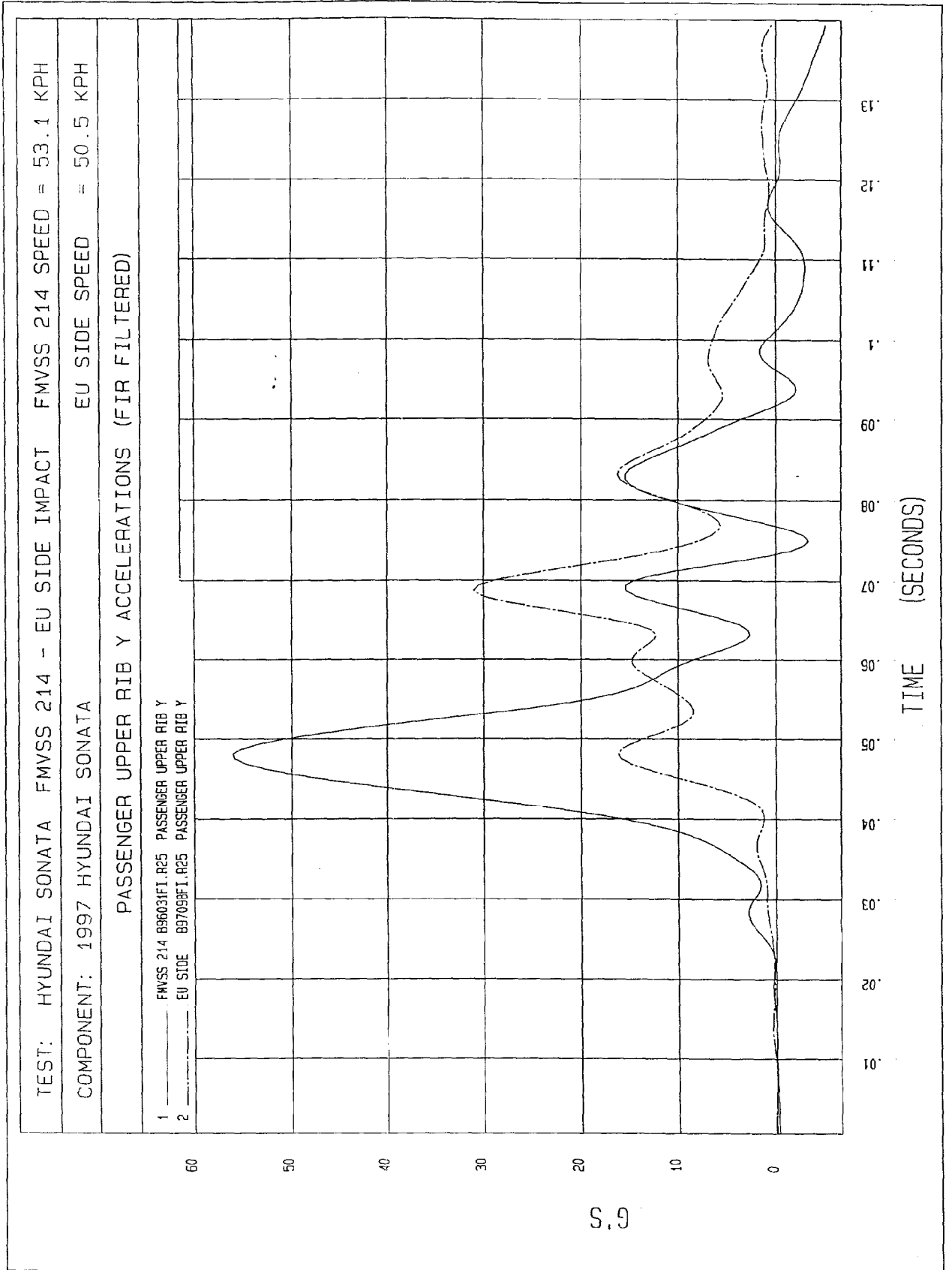










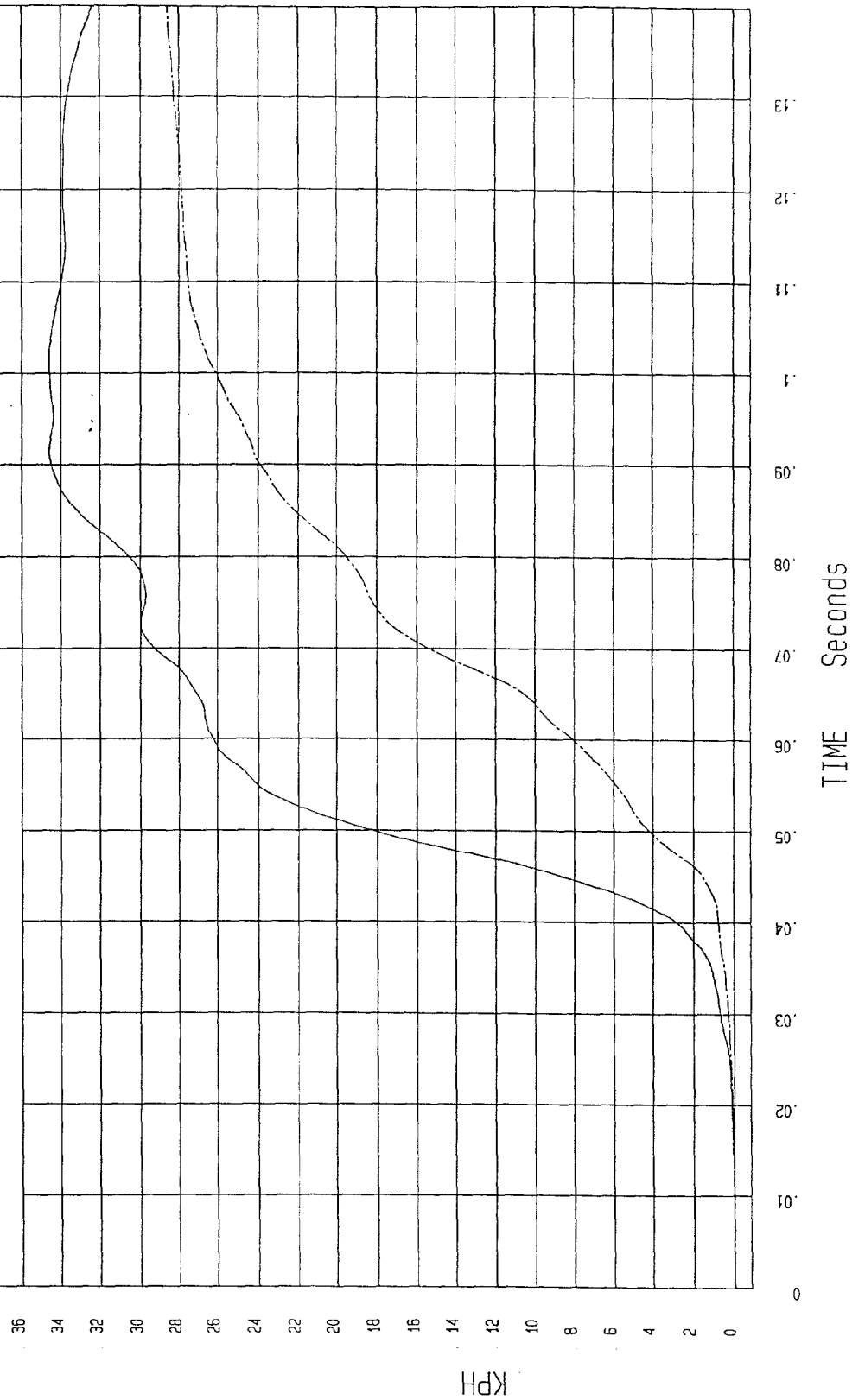


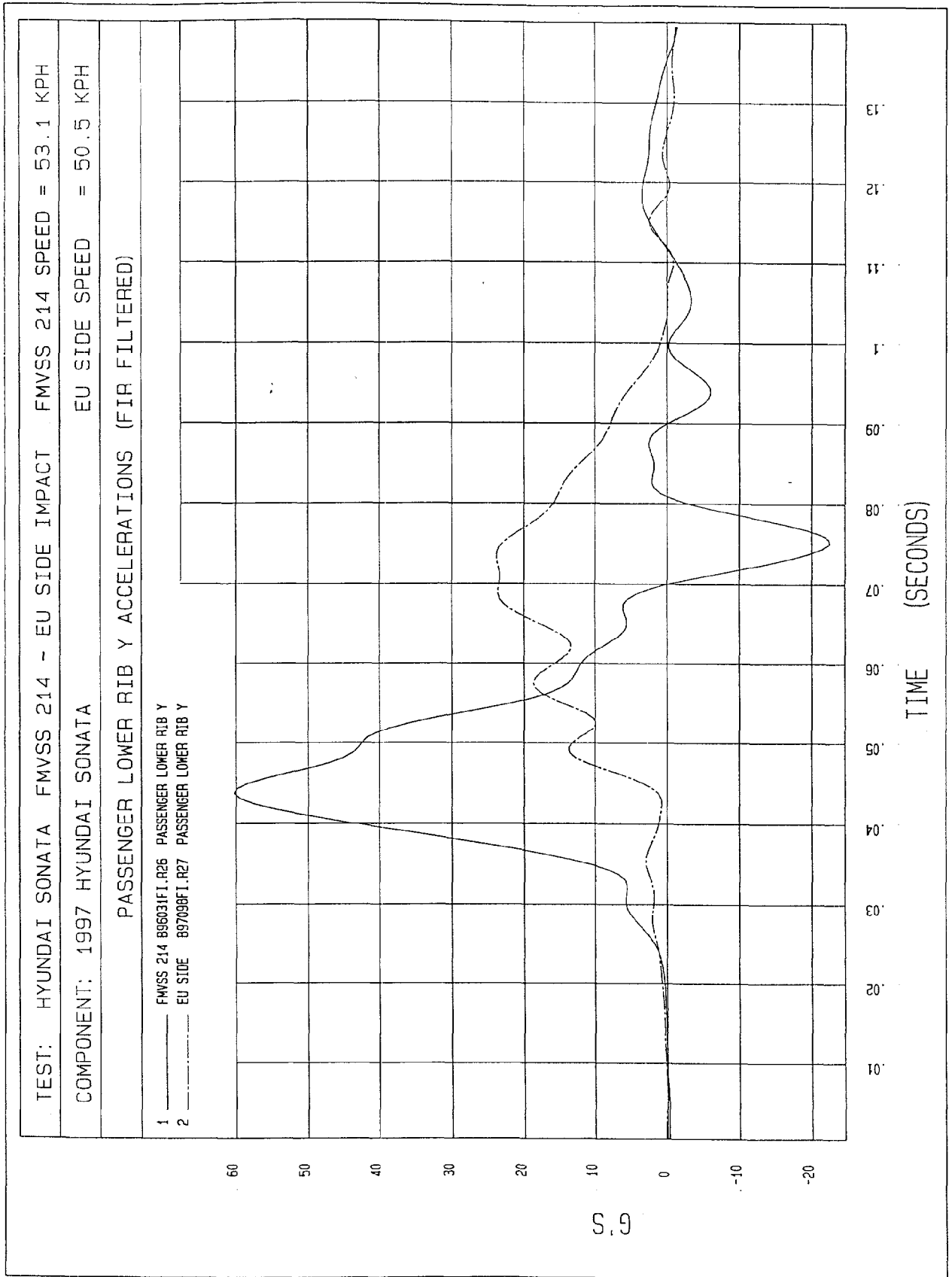
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

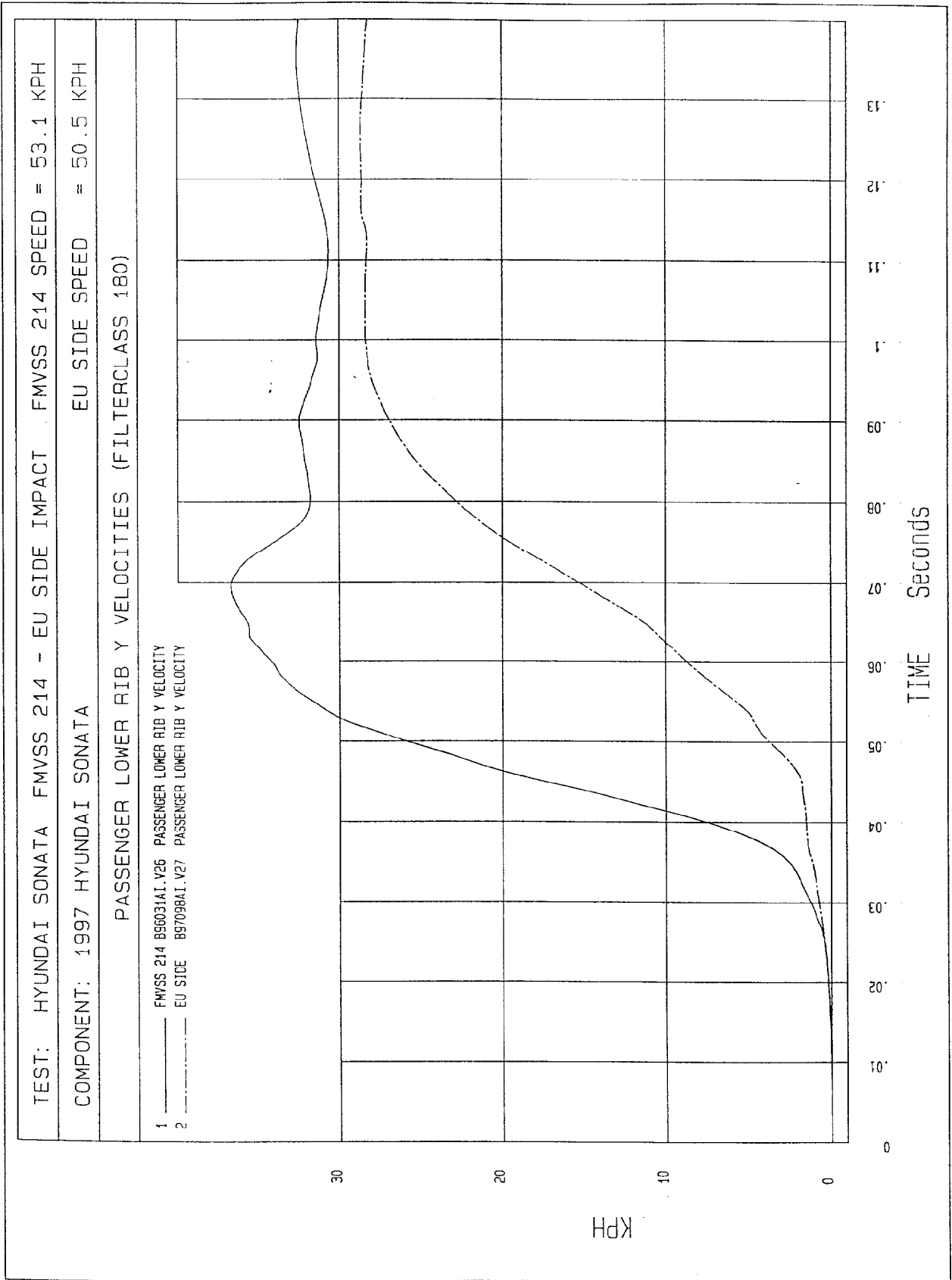
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

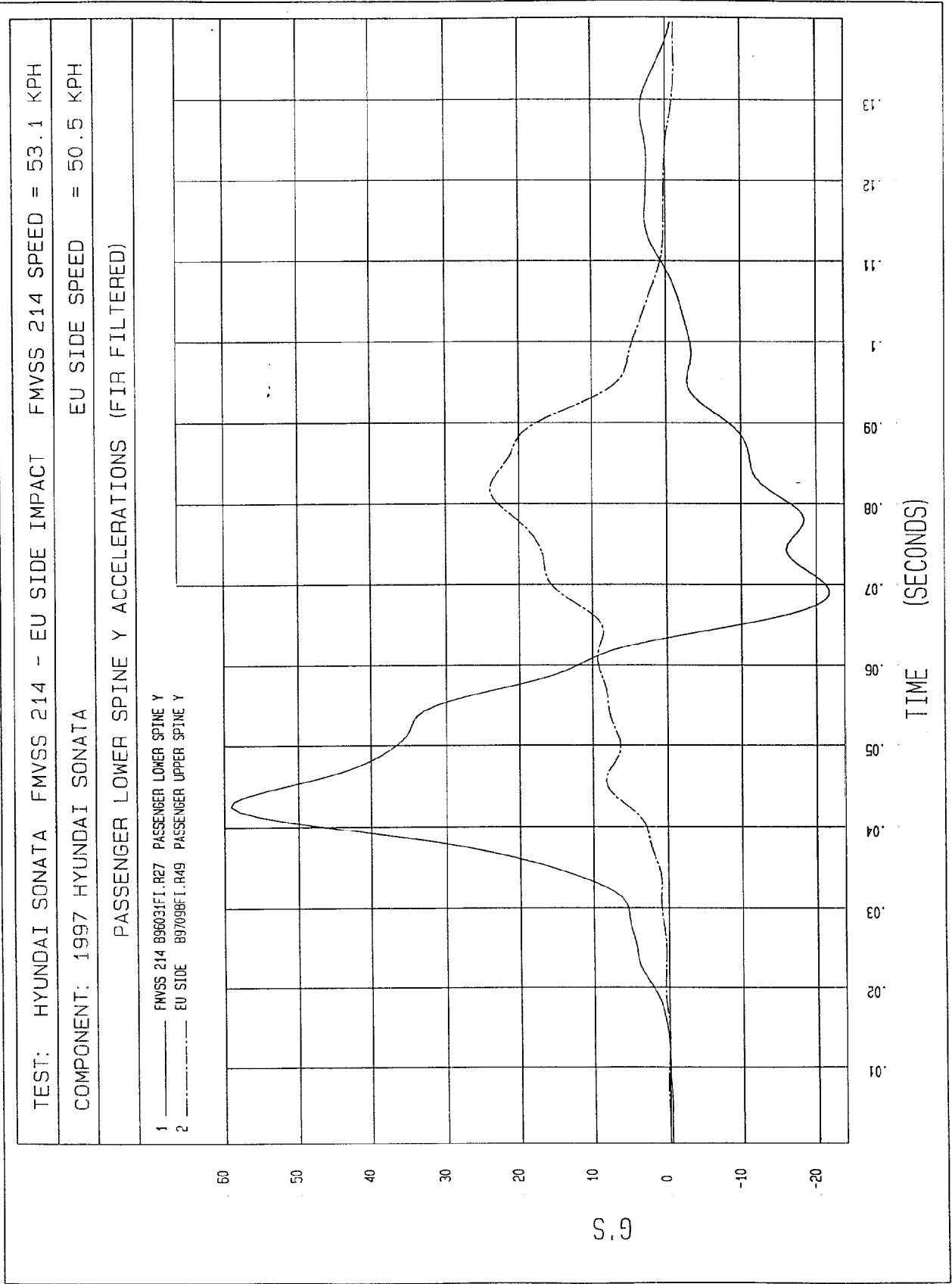
PASSENGER UPPER RIB Y VELOCITIES (FILTERCLASS 180)

1 FMVSS 214 B96031A1.V25 PASSENGER UPPER RIB Y VELOCITY
2 EU SIDE B97098A1.V25 PASSENGER UPPER RIB Y VELOCITY







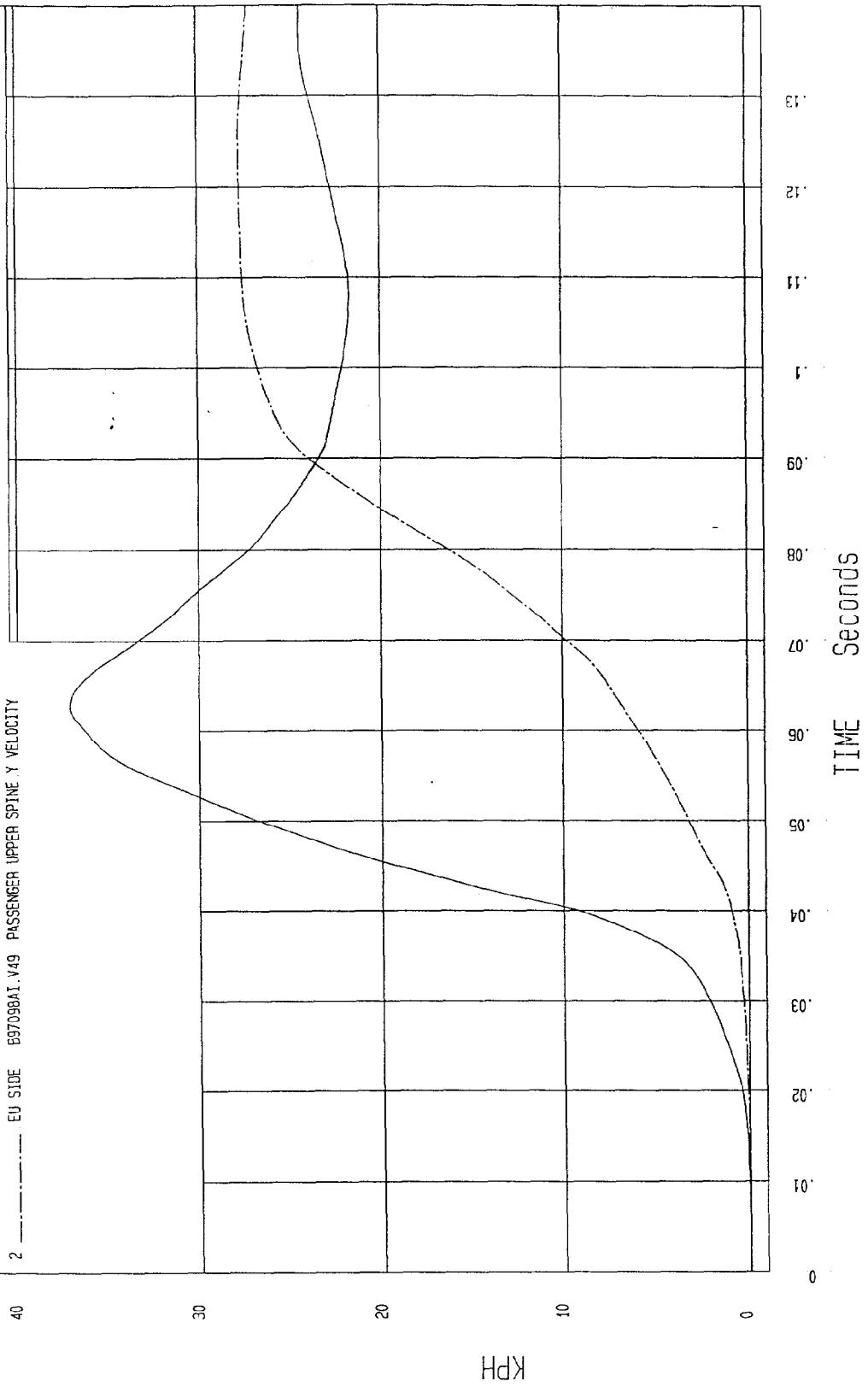


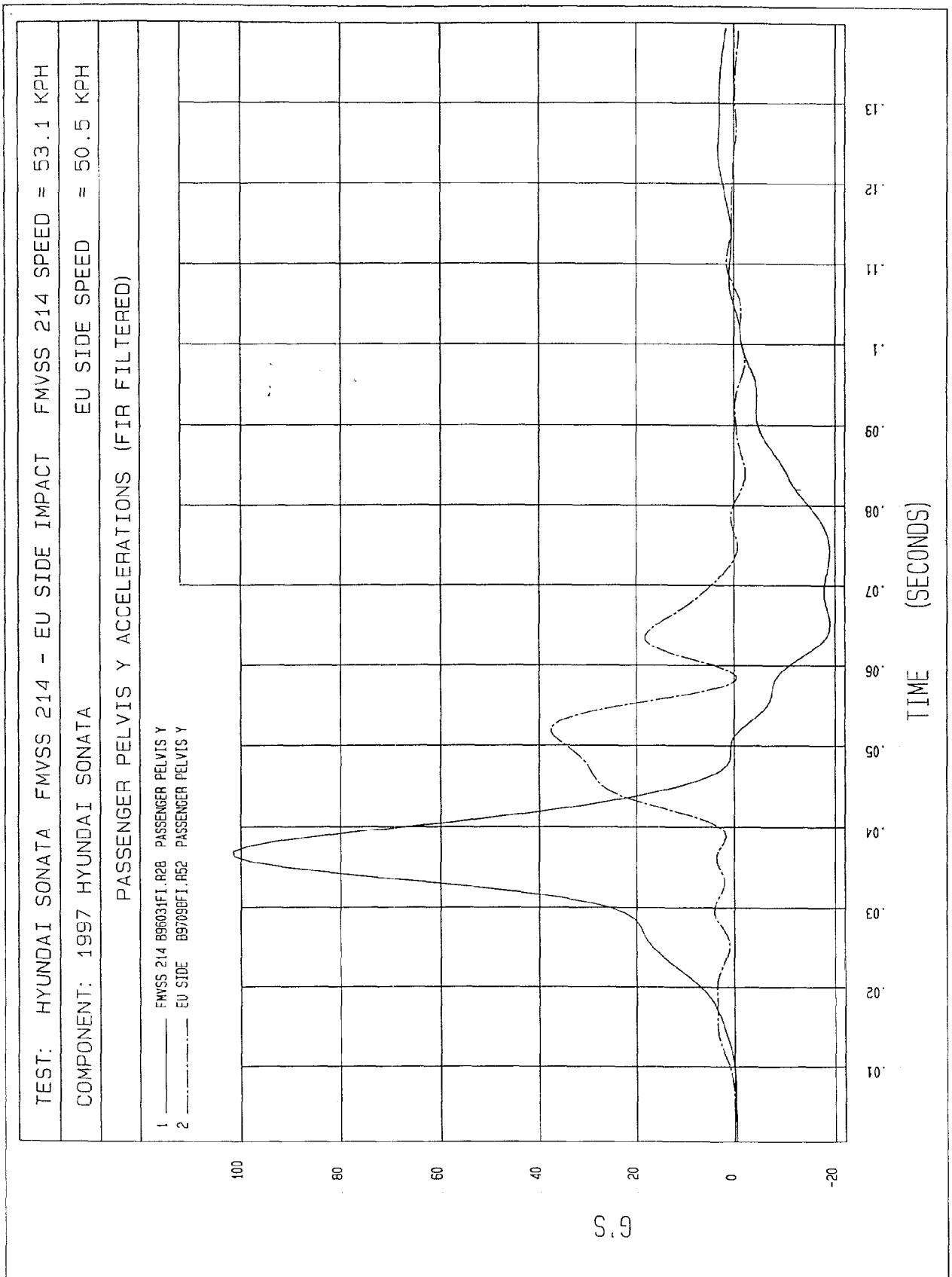
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

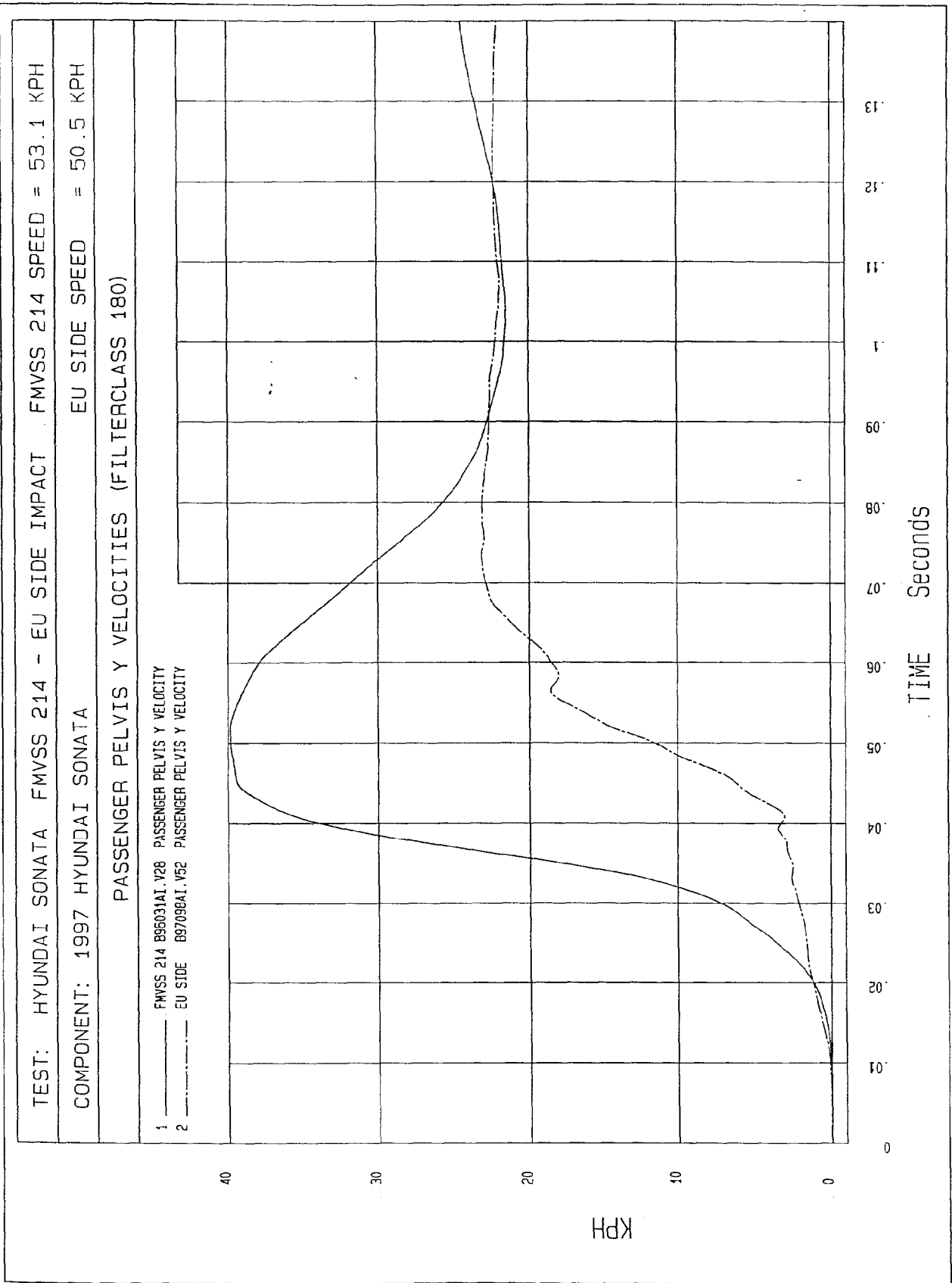
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

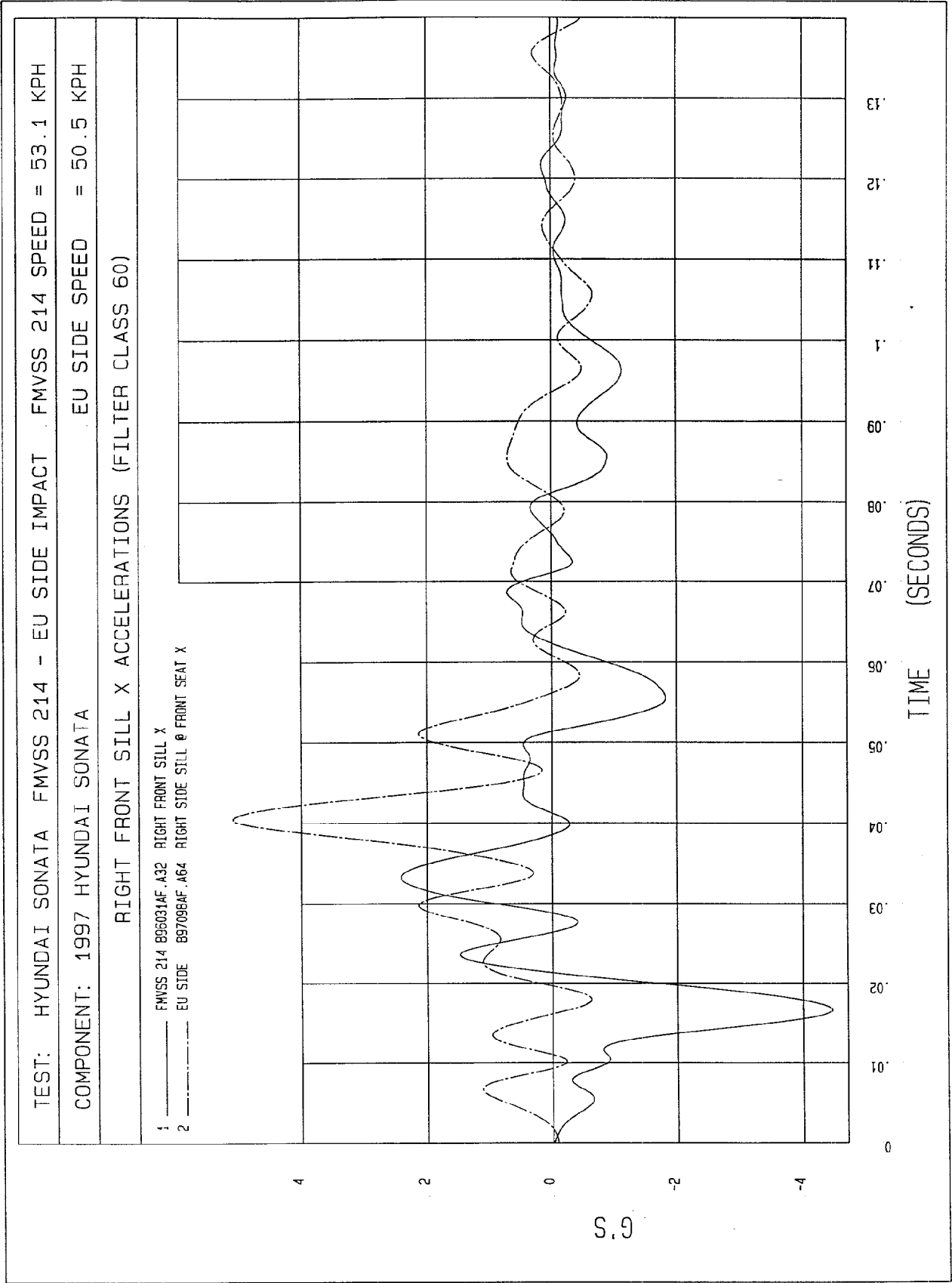
PASSENGER LOWER SPINE Y VELOCITIES (FILTERCLASS 180)

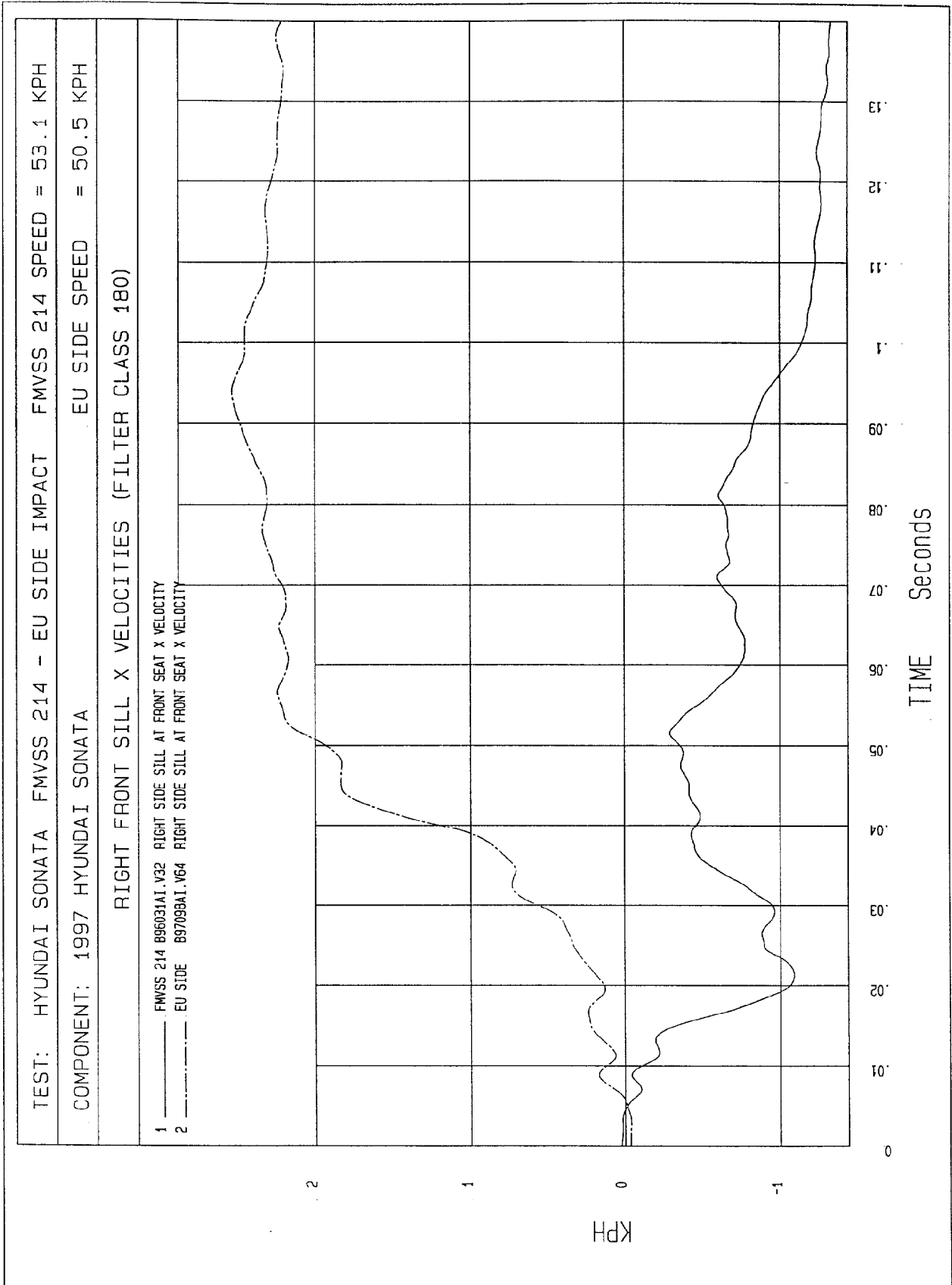
1 _____ FMVSS 214 B3603:AL V27 PASSENGER LOWER SPINE Y VELOCITY
2 - - - - - EU SIDE B97098A1 V49 PASSENGER UPPER SPINE Y VELOCITY

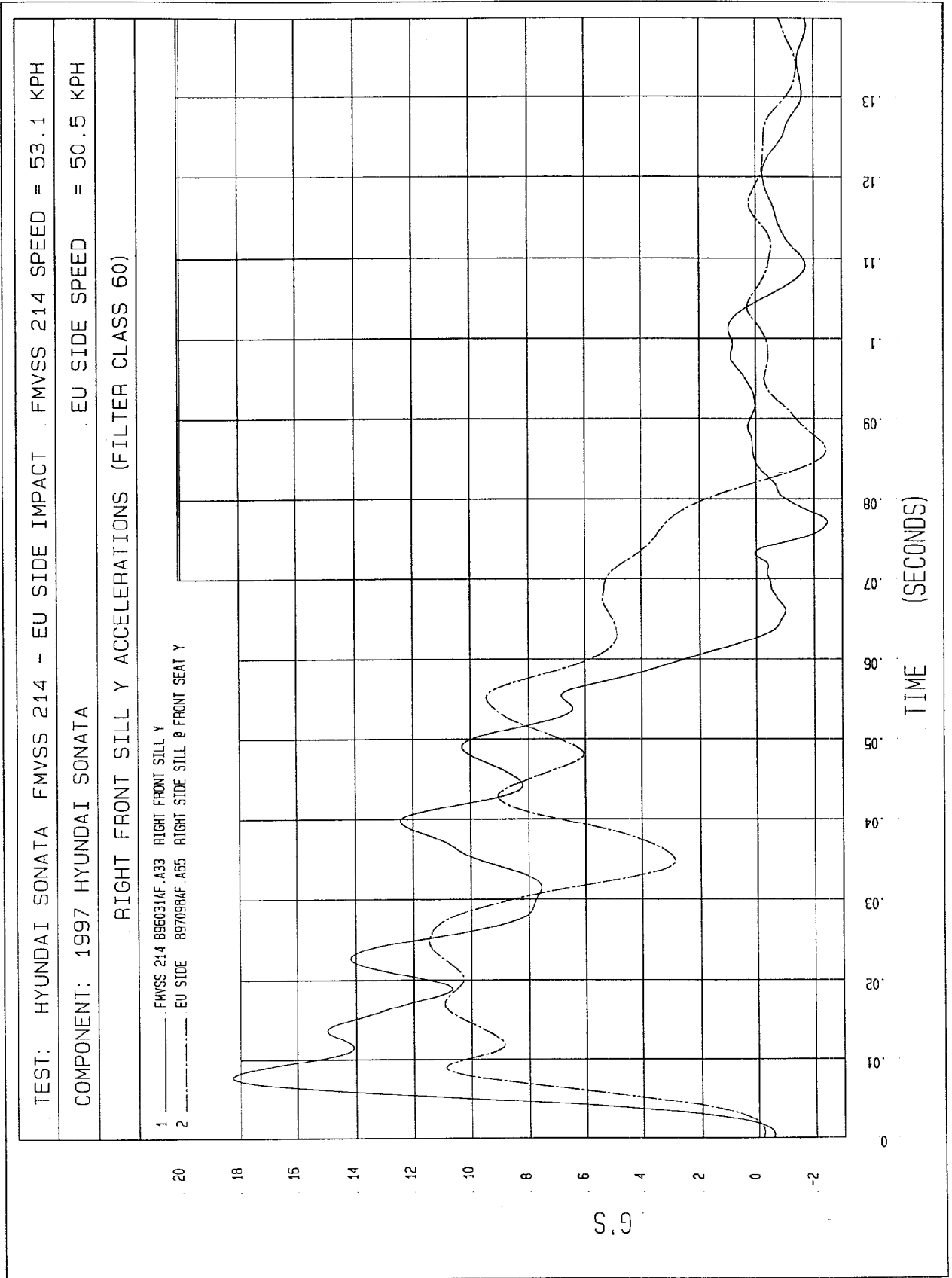


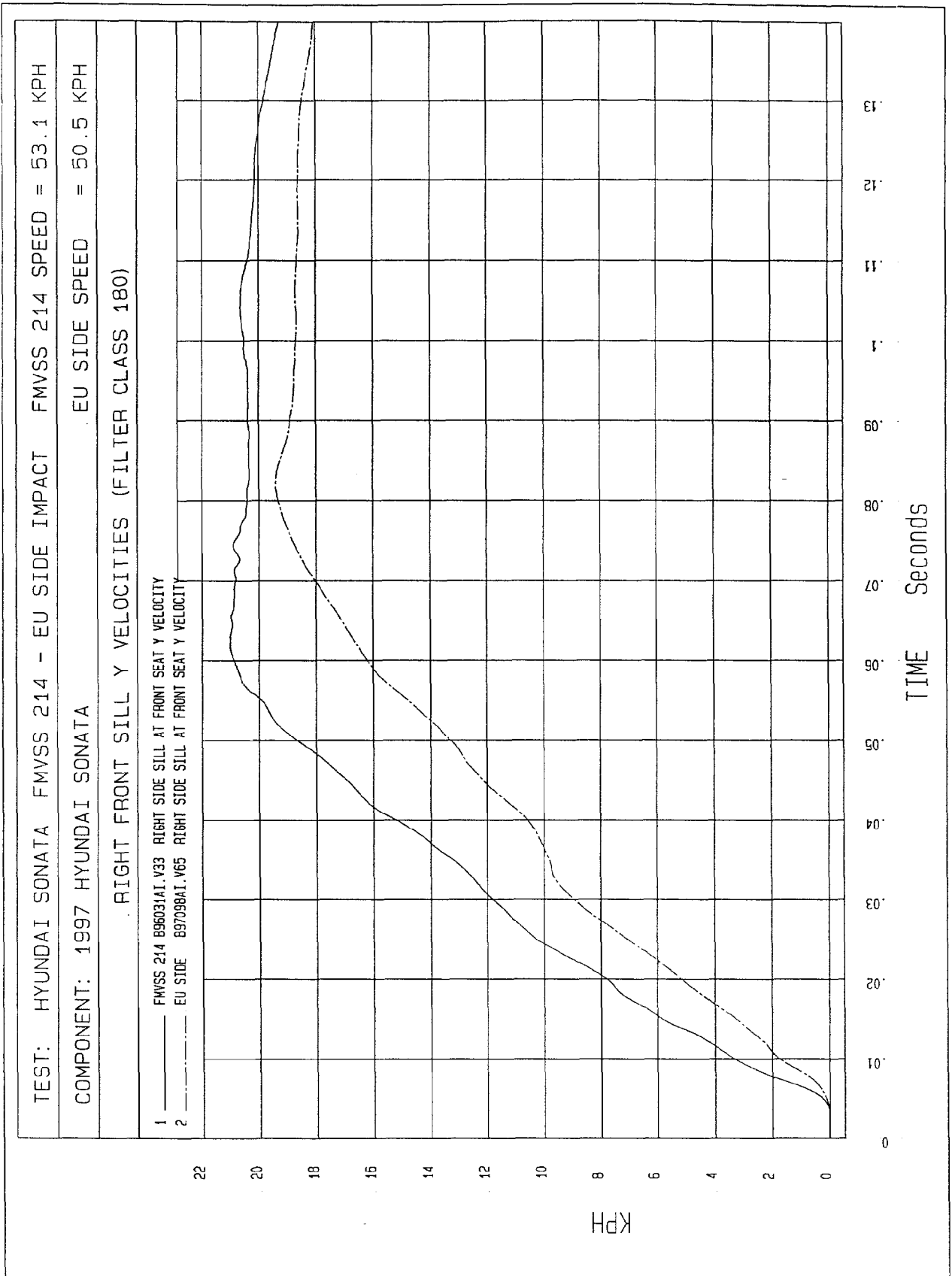


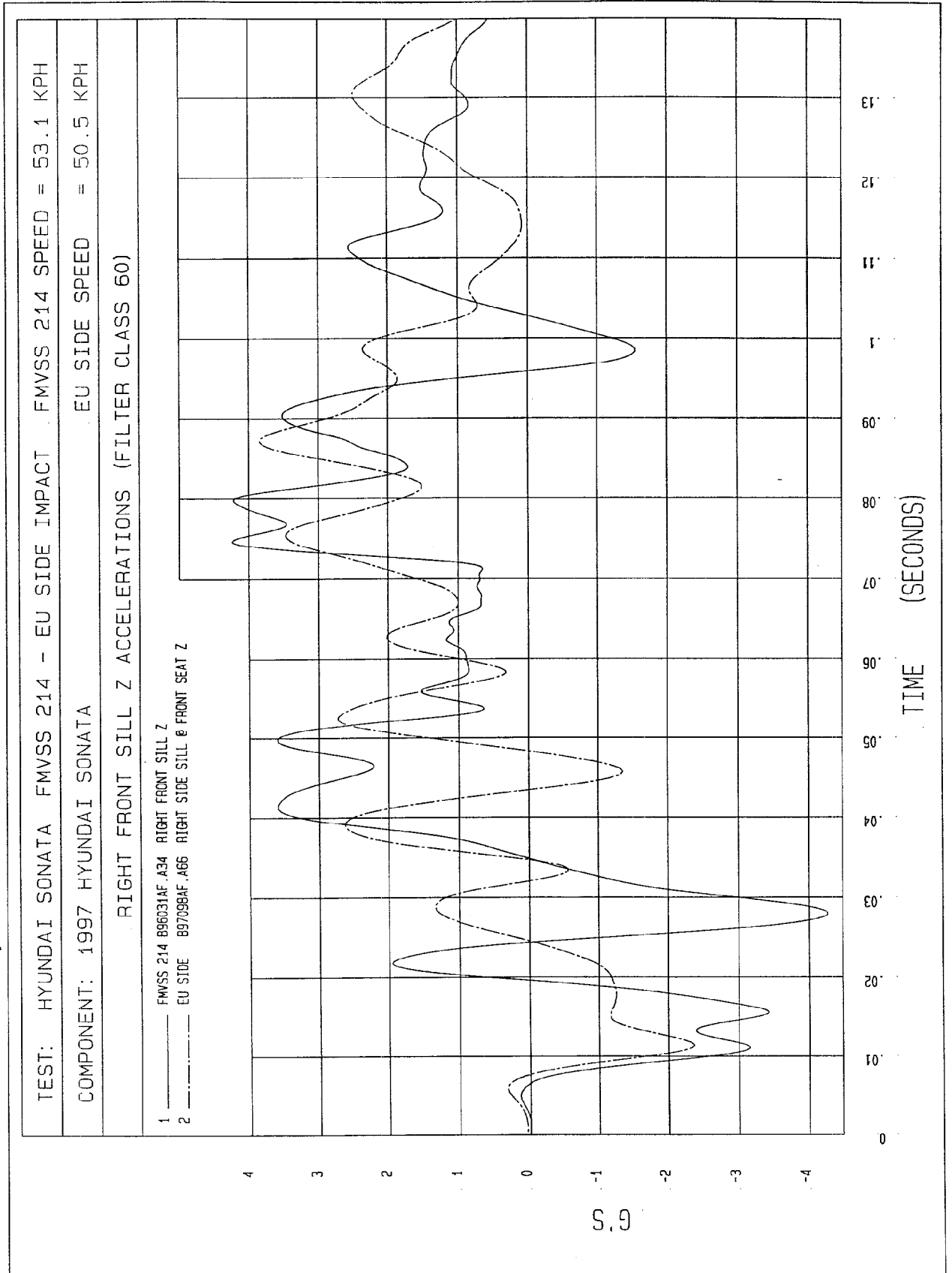






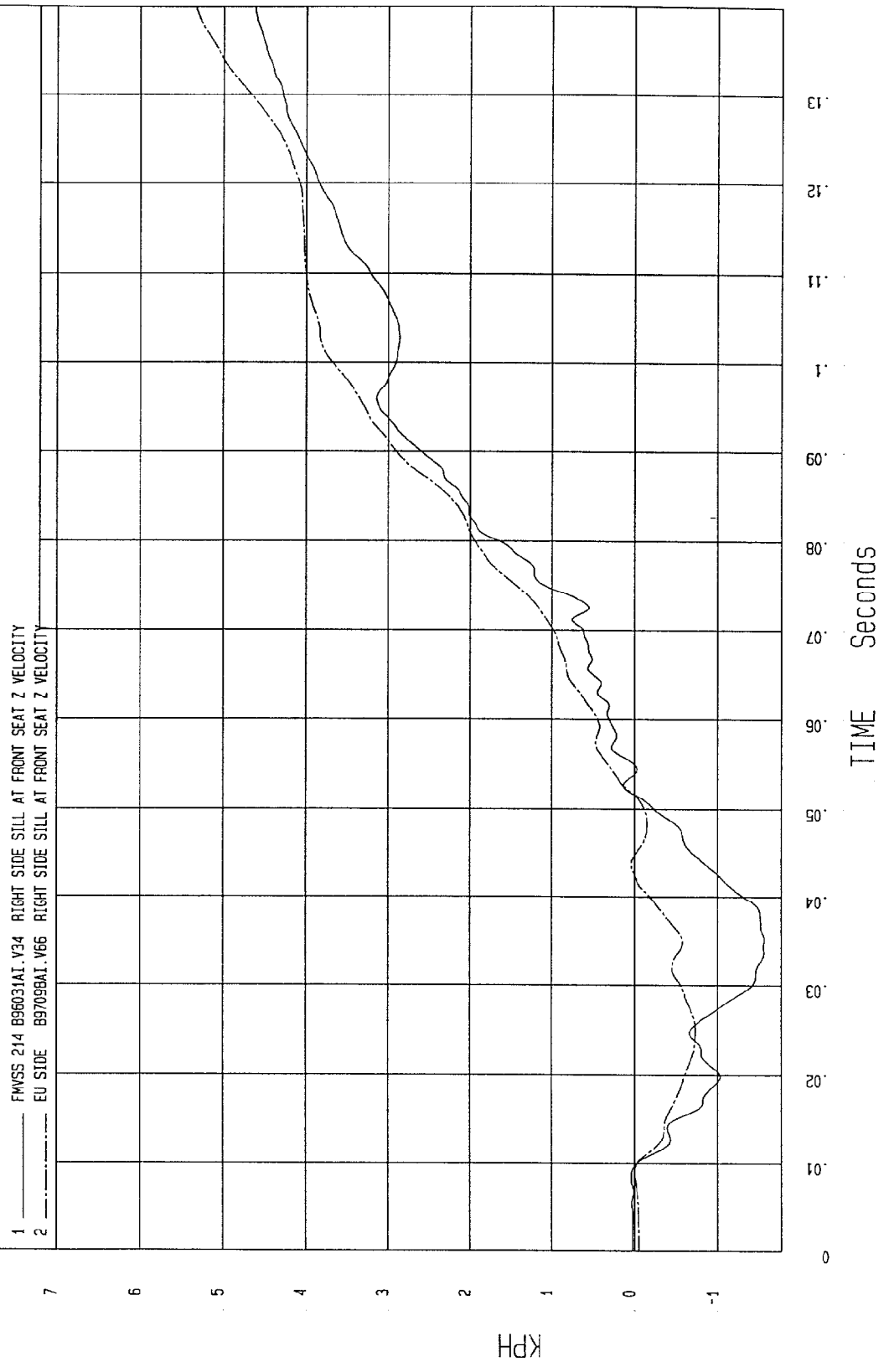


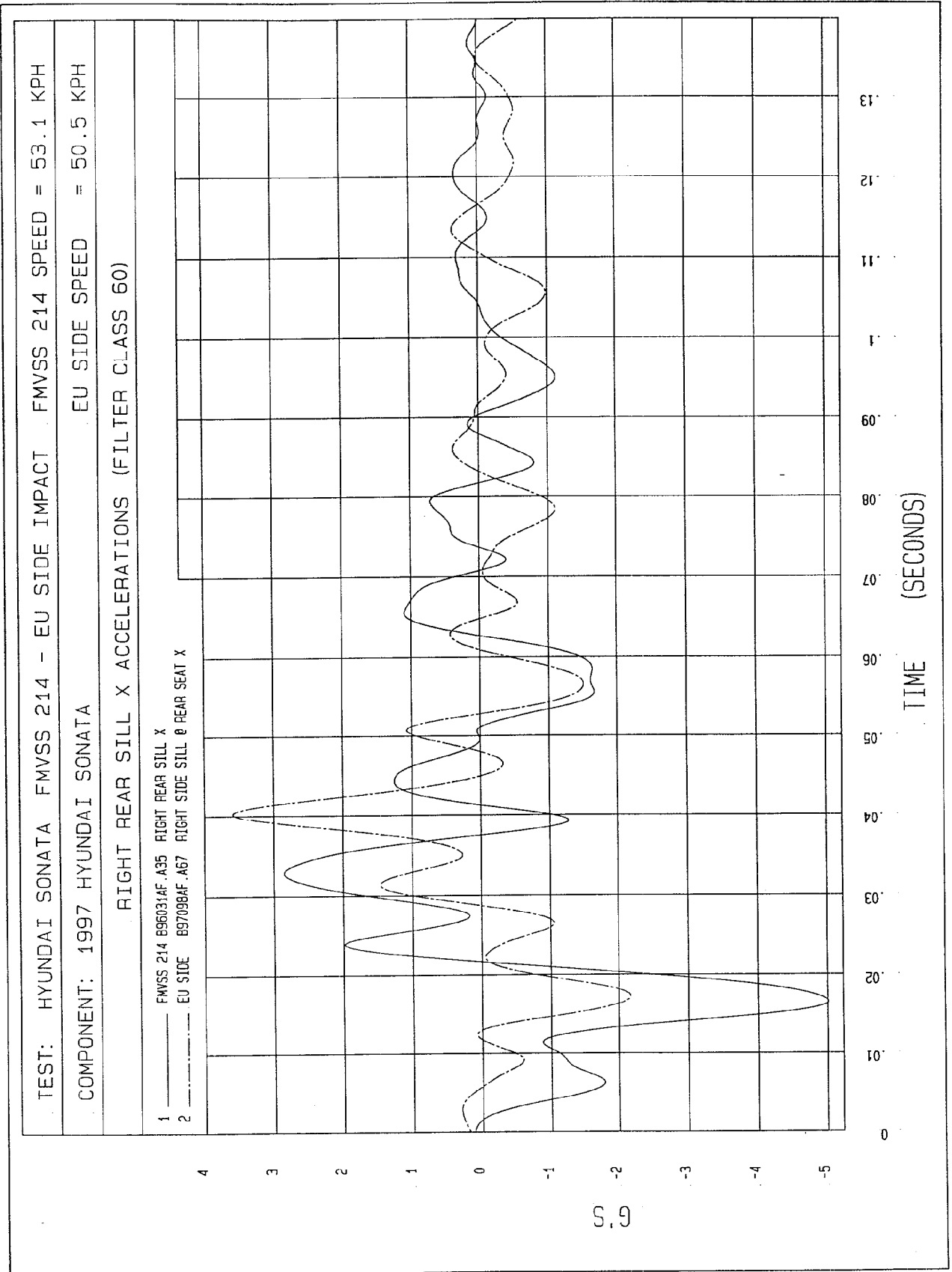


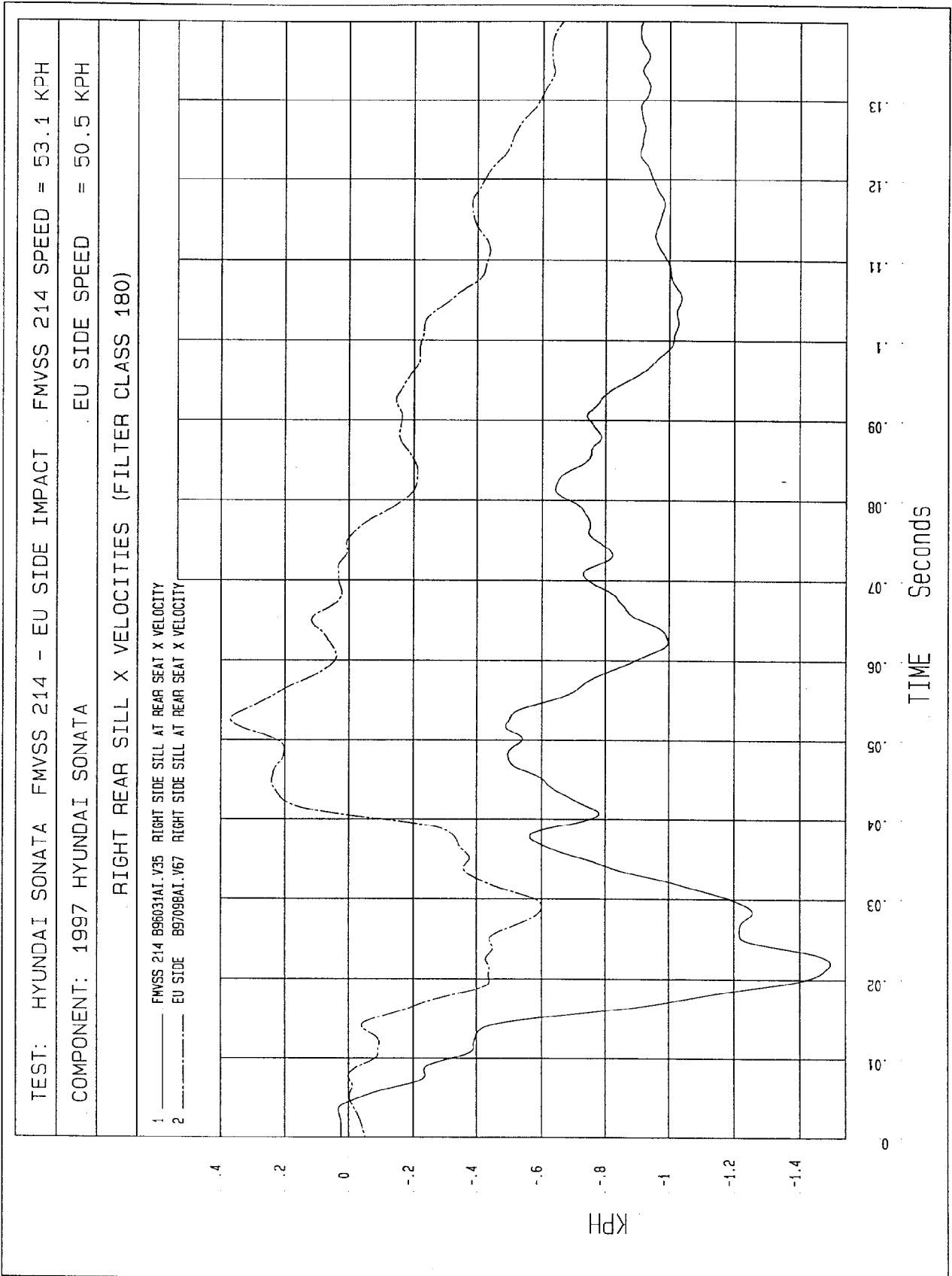


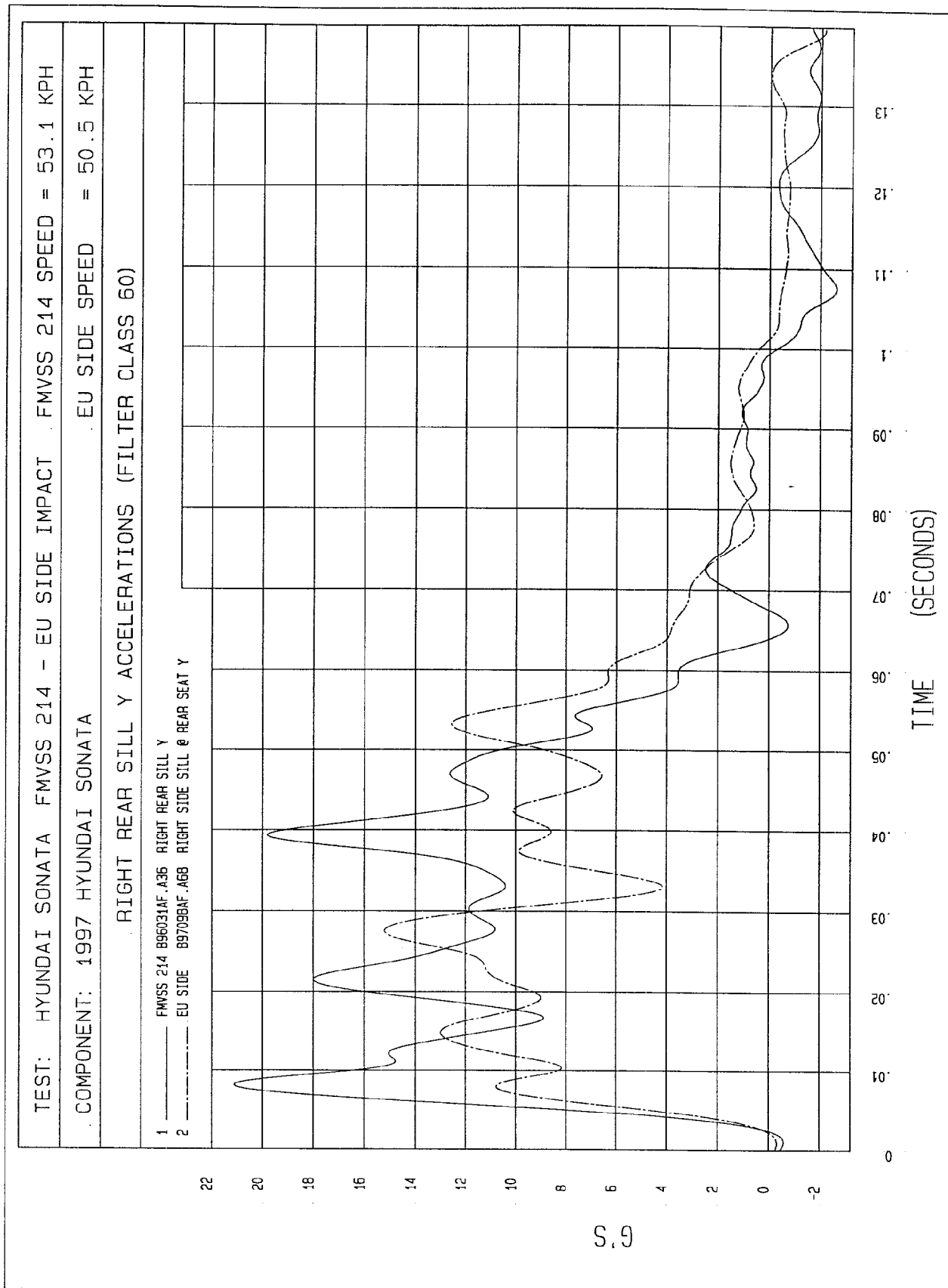
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

RIGHT FRONT SILL Z VELOCITIES (FILTER CLASS 180)







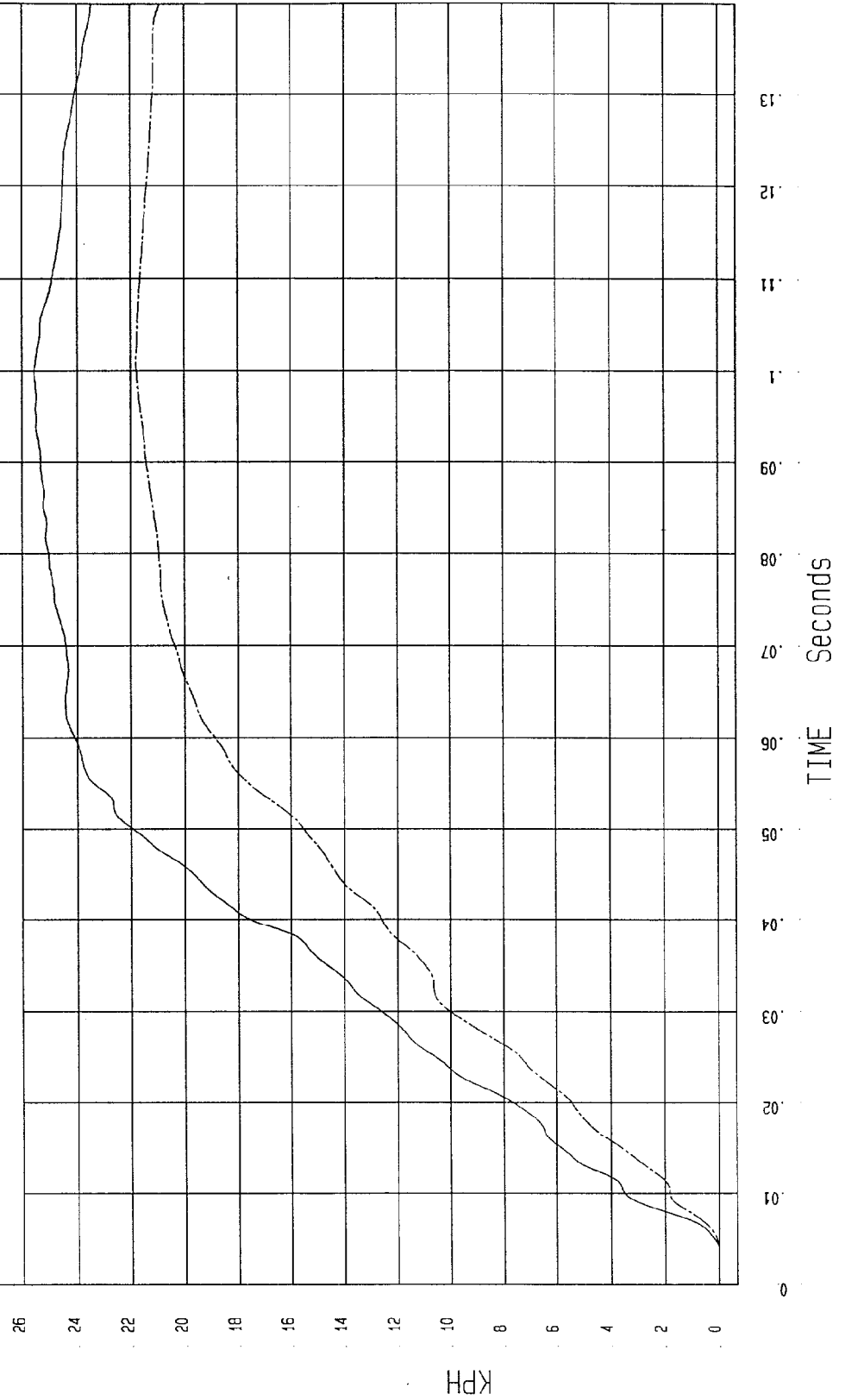


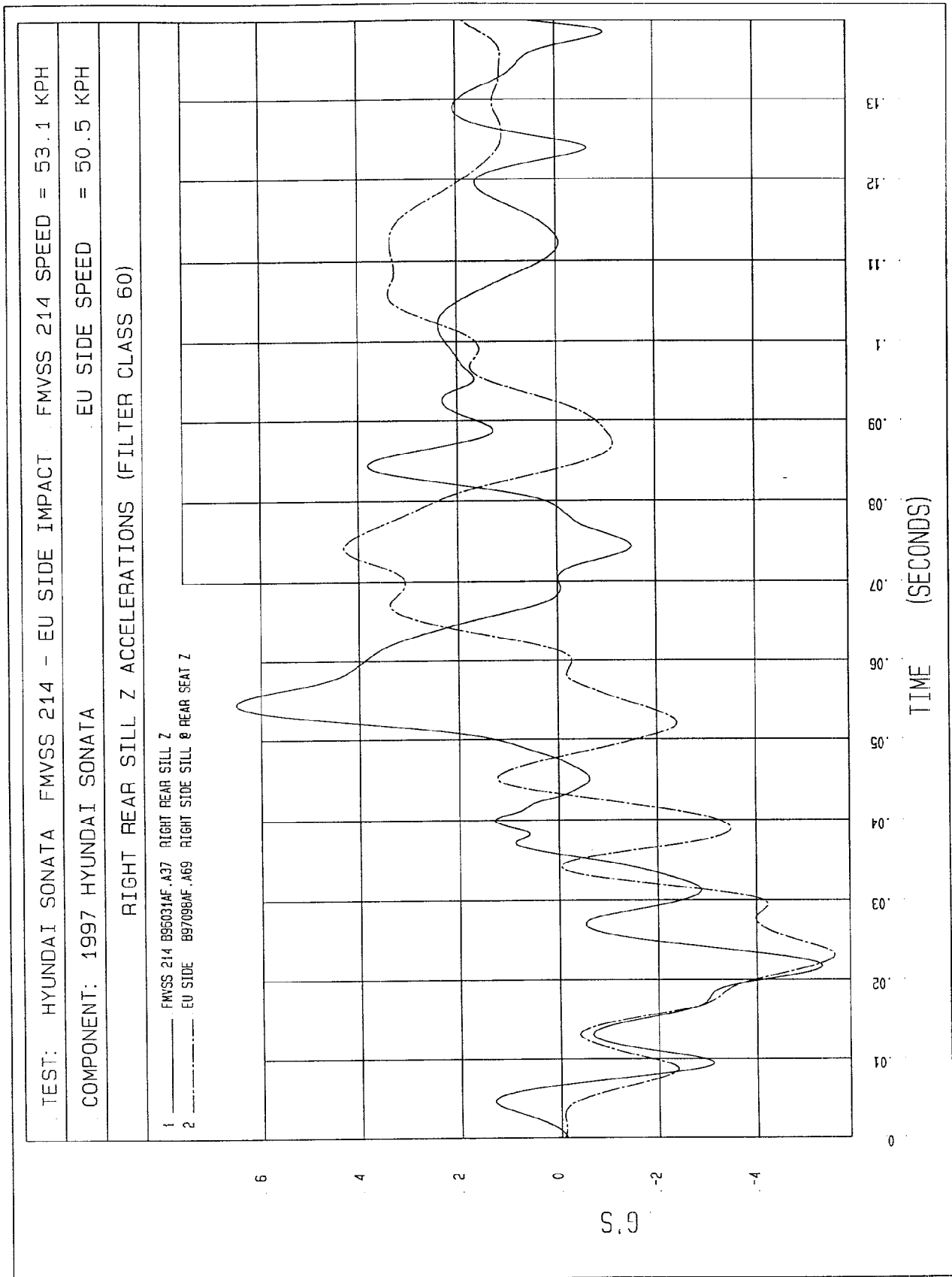
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

RIGHT REAR SILL Y VELOCITIES (FILTER CLASS 180)

1 — FMVSS 214 B96031A1.V36 RIGHT SIDE SILL AT REAR SEAT Y VELOCITY
2 — EU SIDE B97098A1.V68 RIGHT SIDE SILL AT REAR SEAT Y VELOCITY



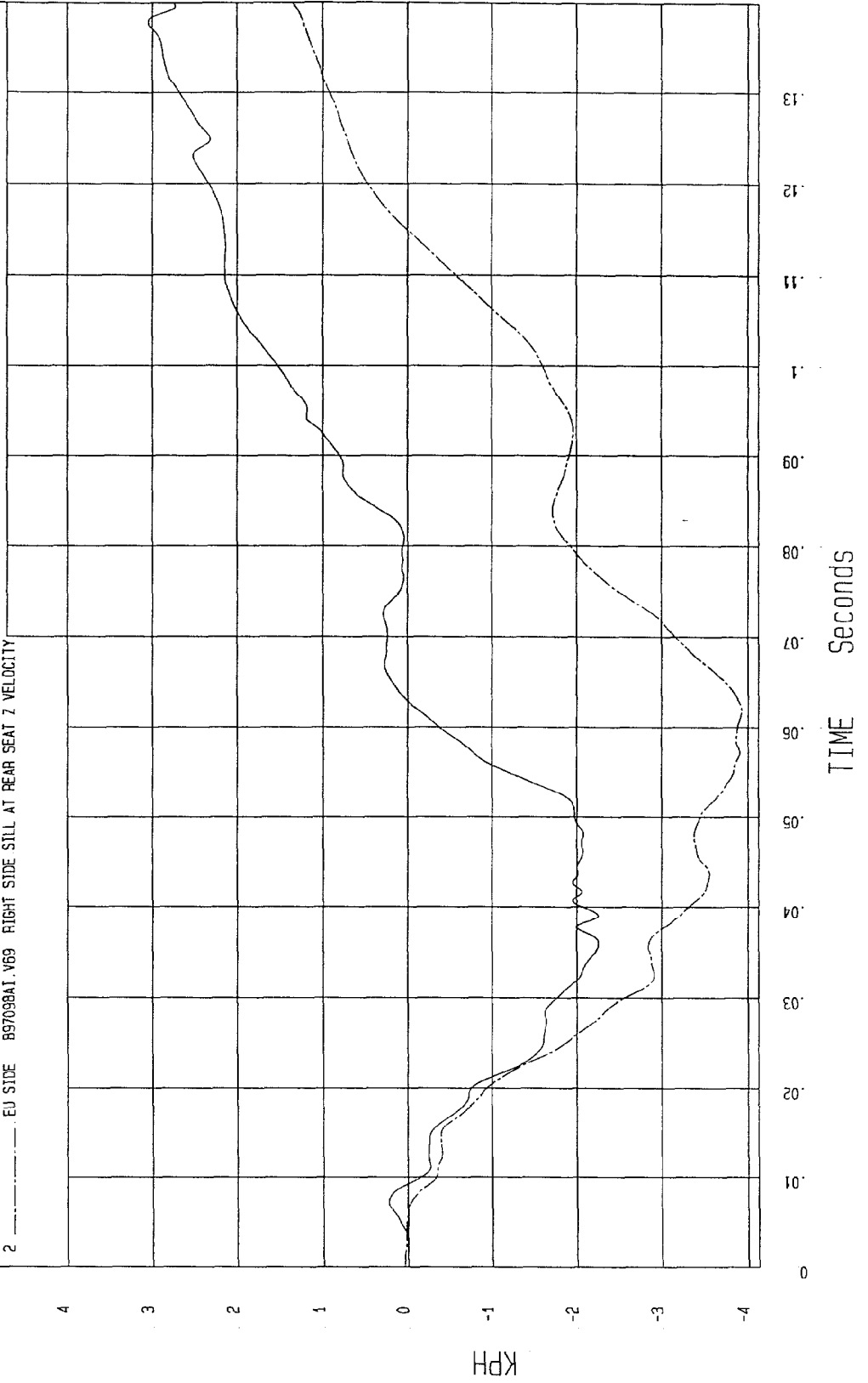


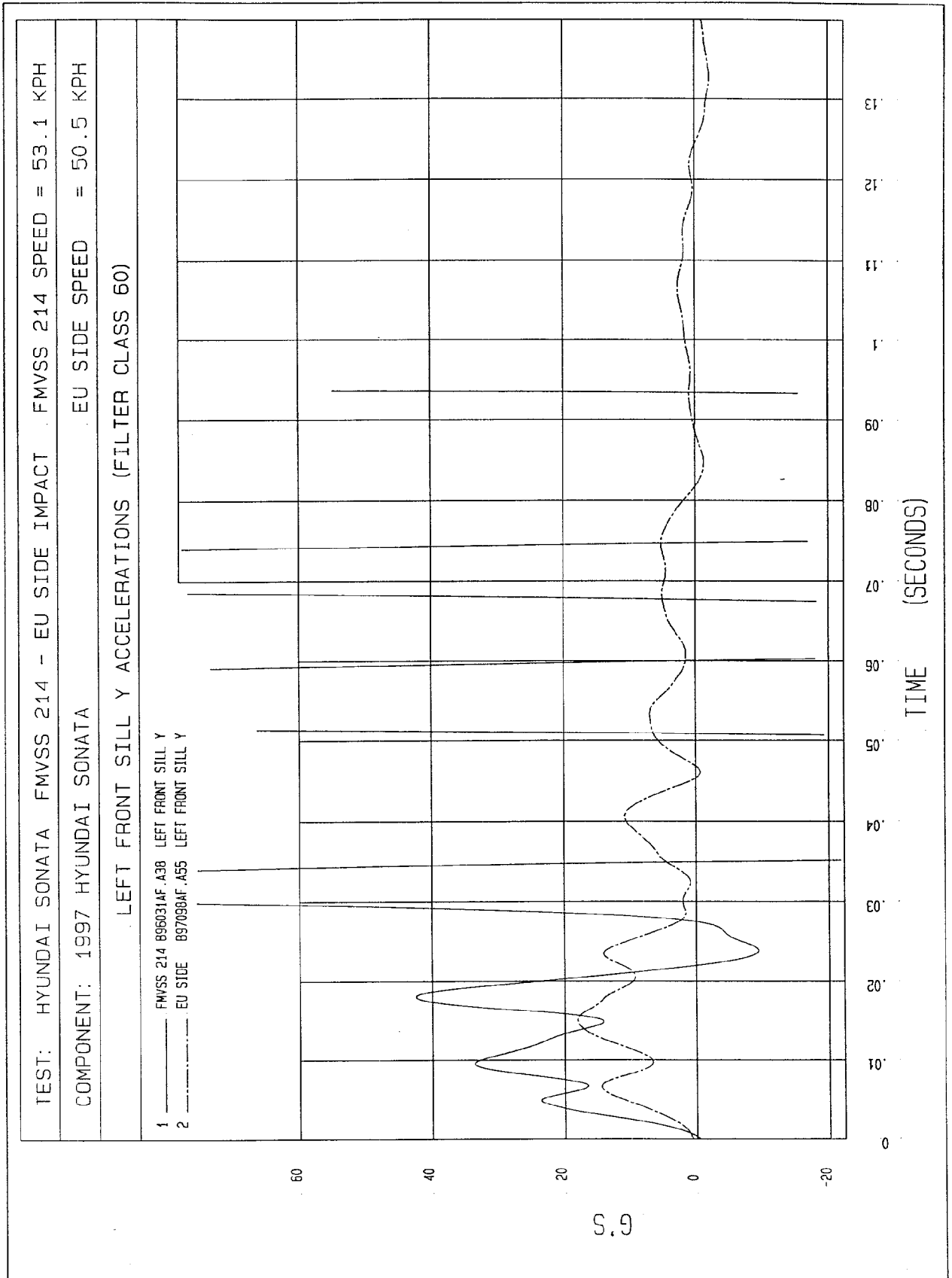
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

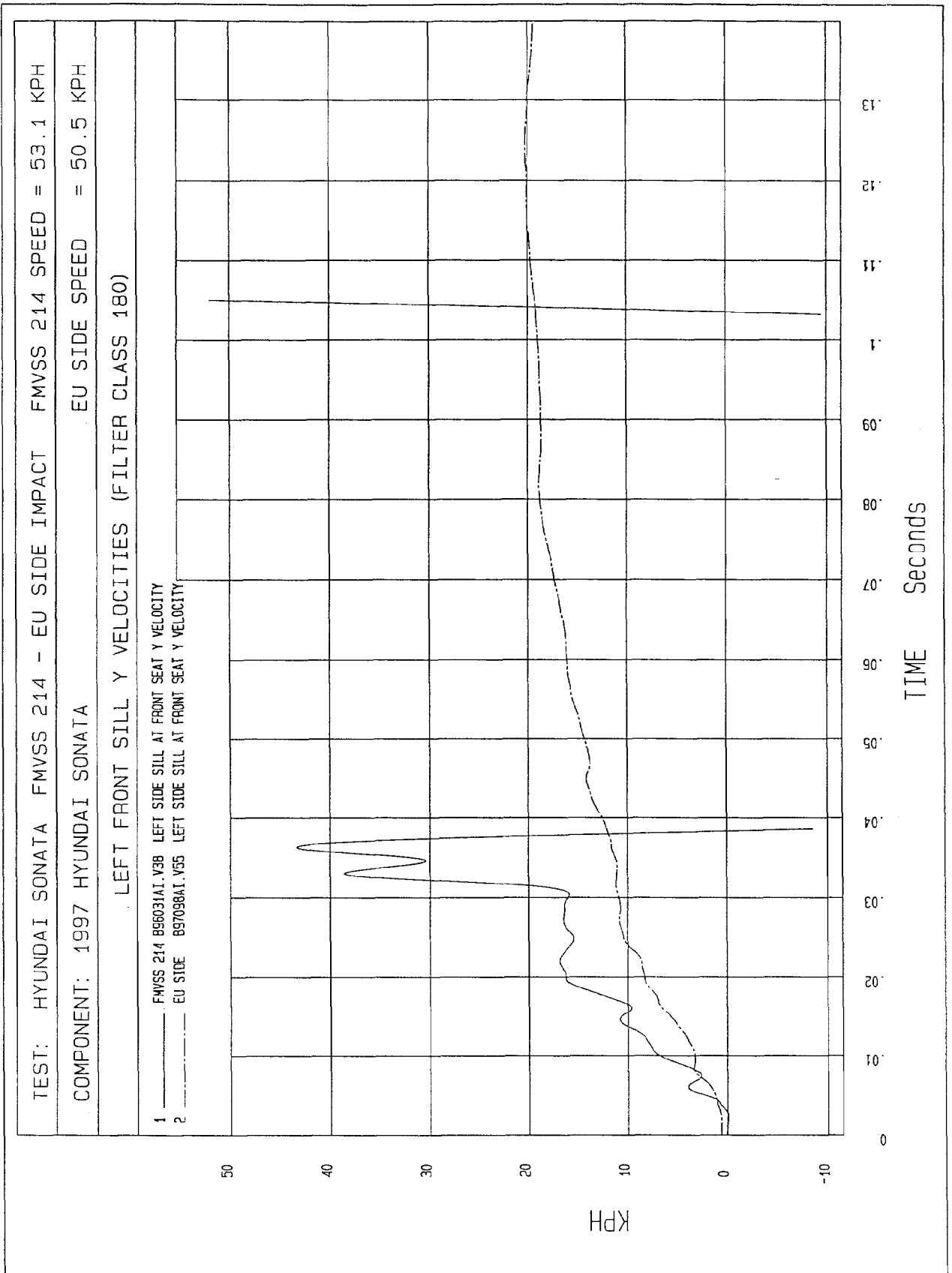
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

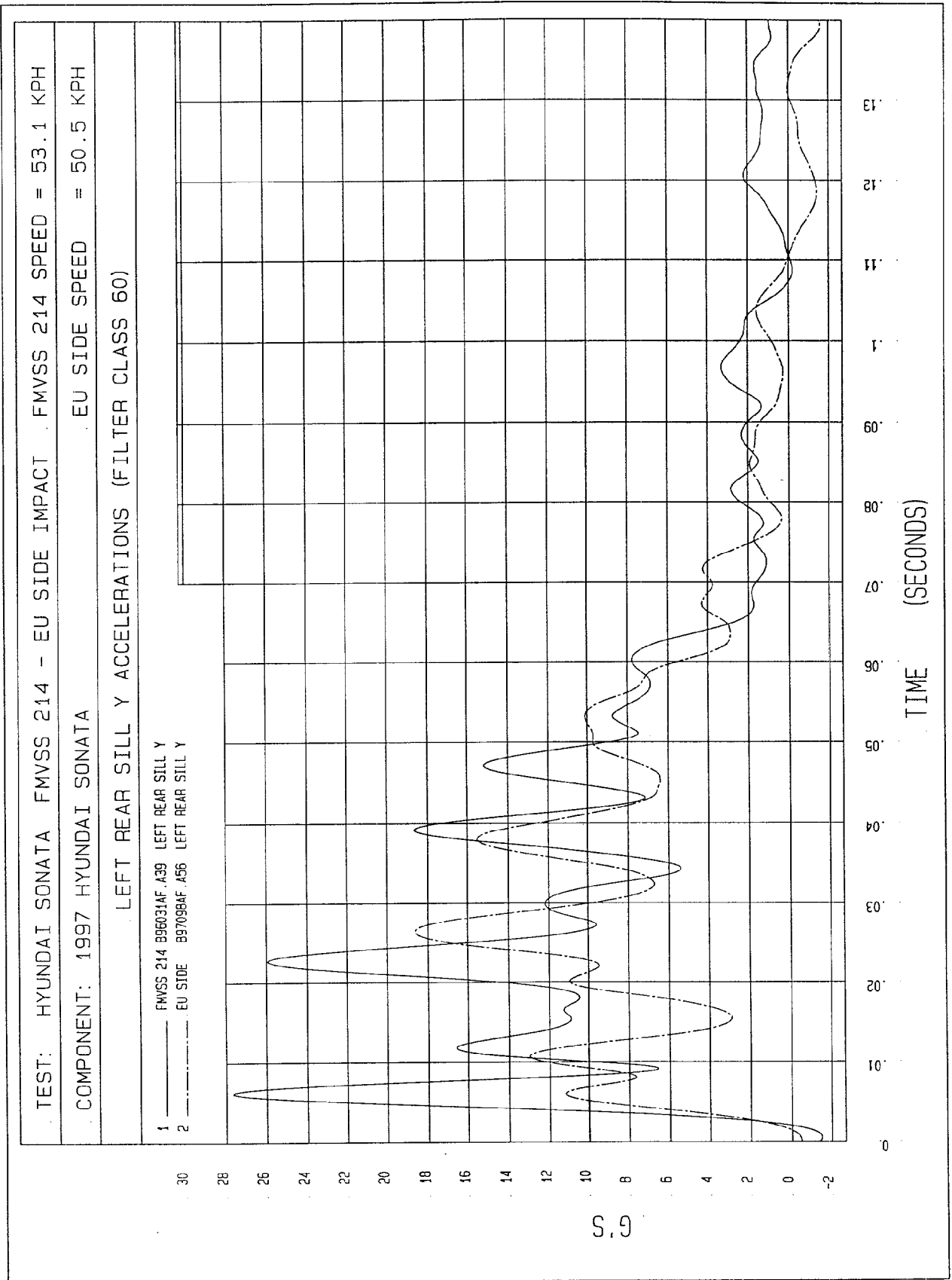
RIGHT REAR SILL Z VELOCITIES (FILTER CLASS 180)

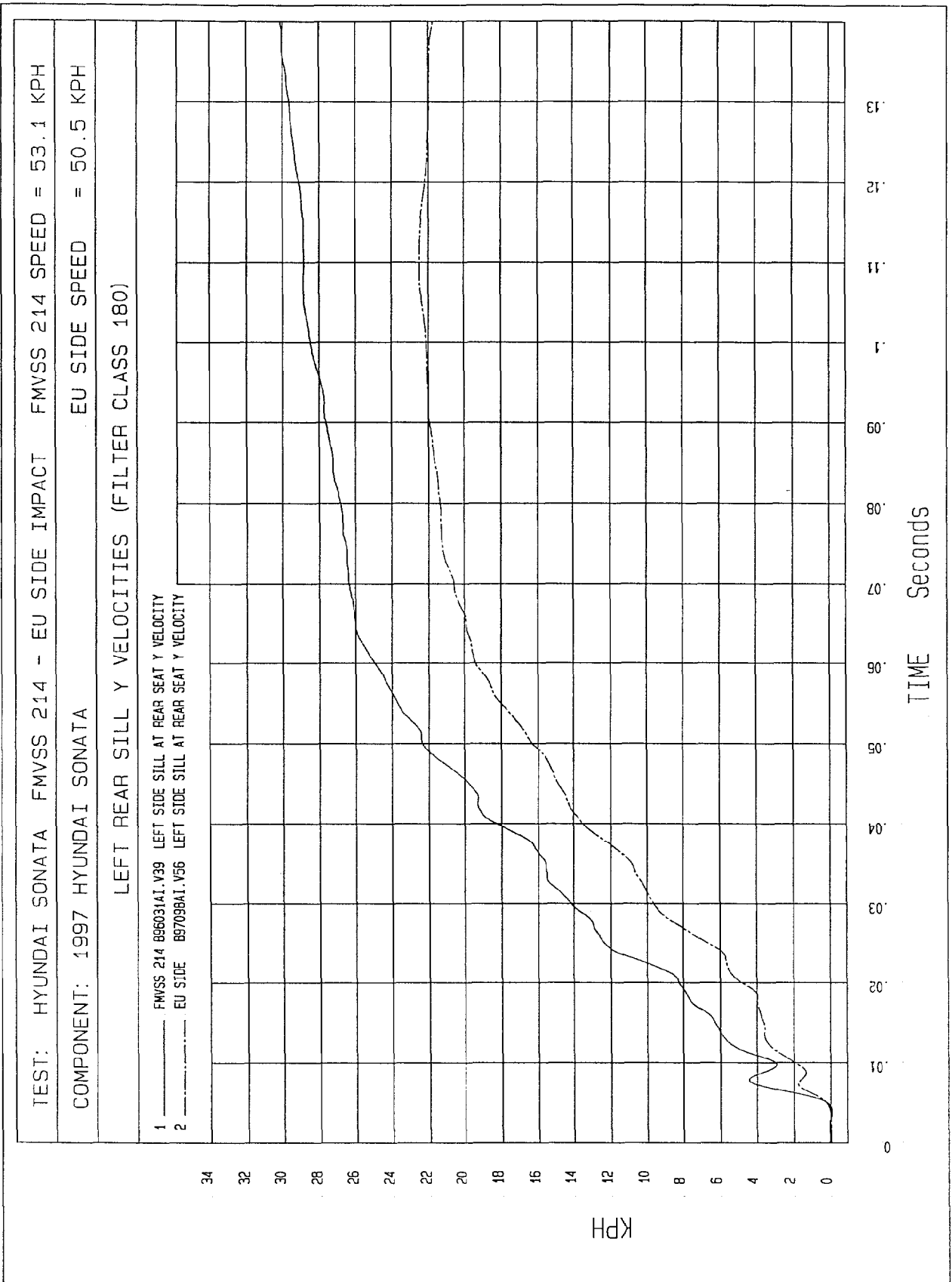
1 _____ FMVSS 214 B96031A1.V37 RIGHT SIDE SILL AT REAR SEAT Z VELOCITY
2 - - - - - EU SIDE B97038A1.V69 RIGHT SIDE SILL AT REAR SEAT Z VELOCITY

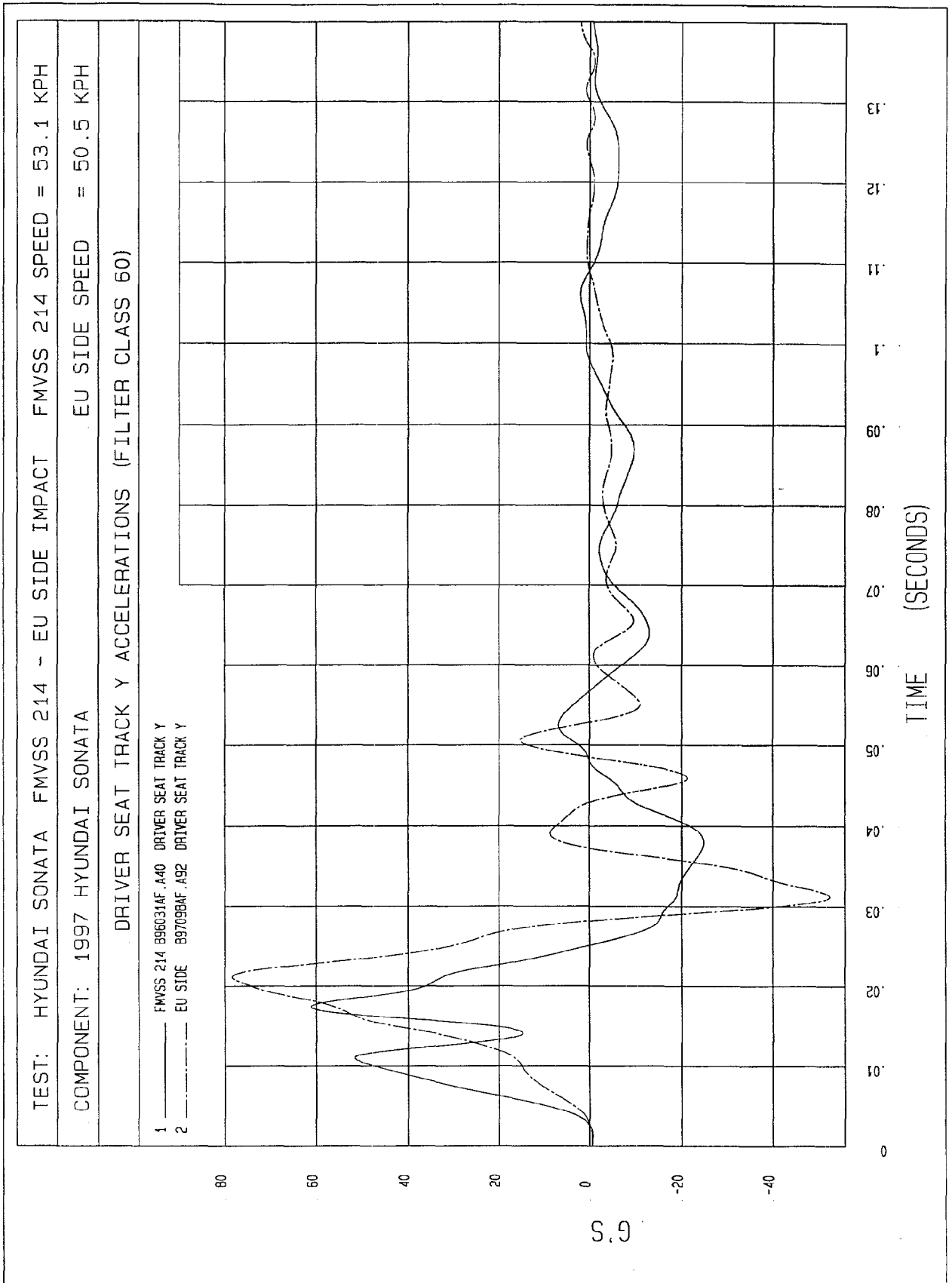


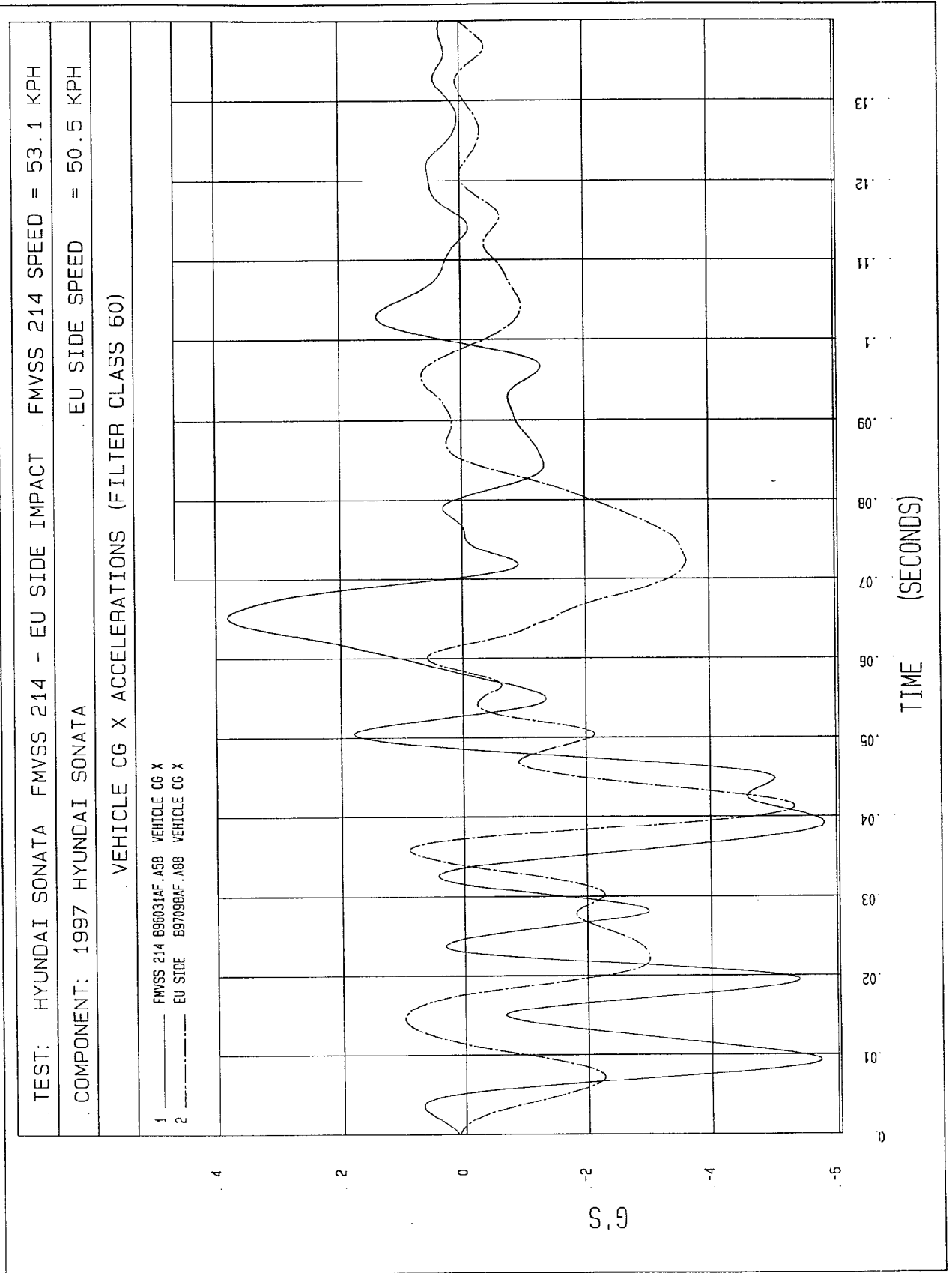


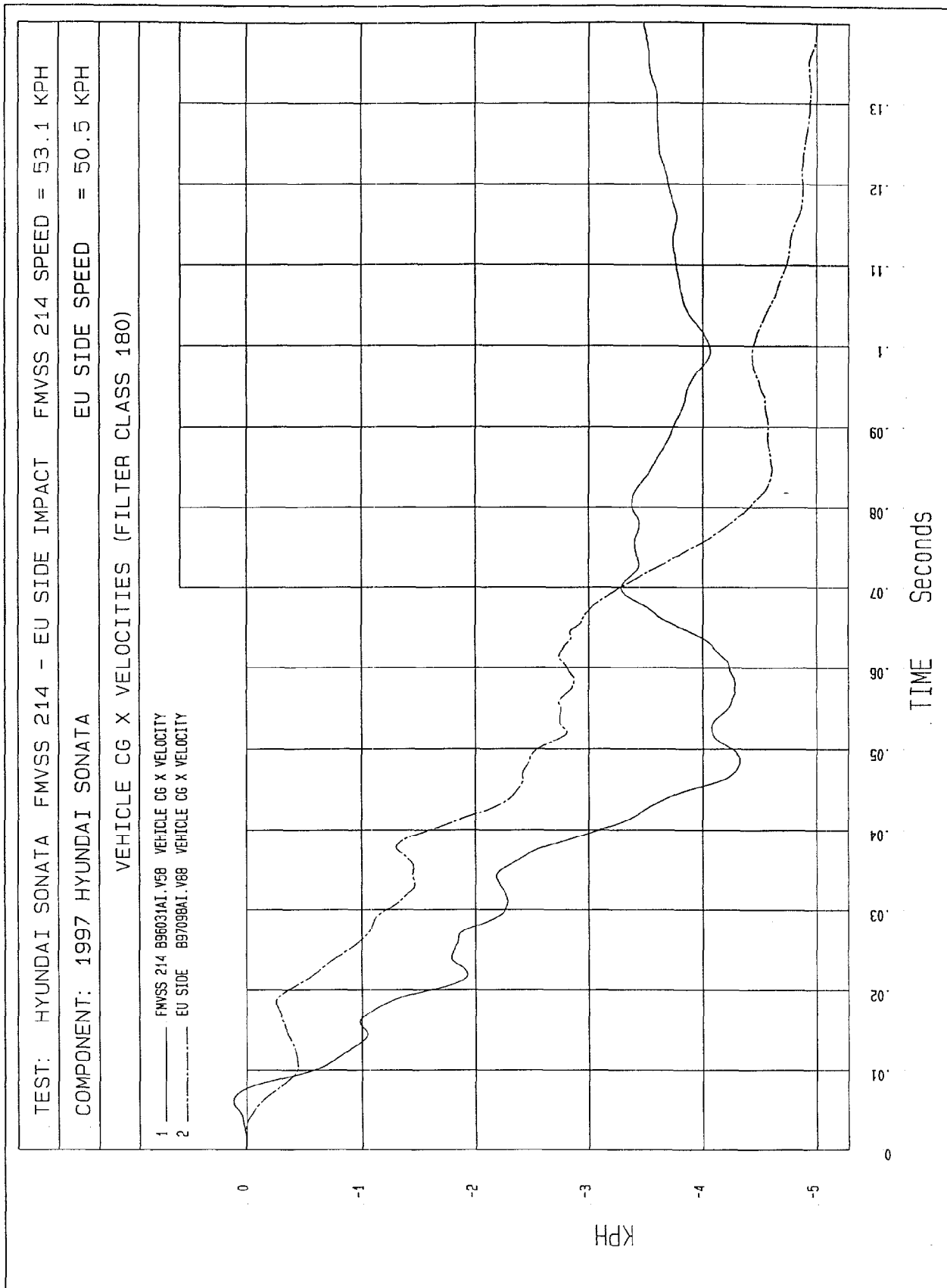


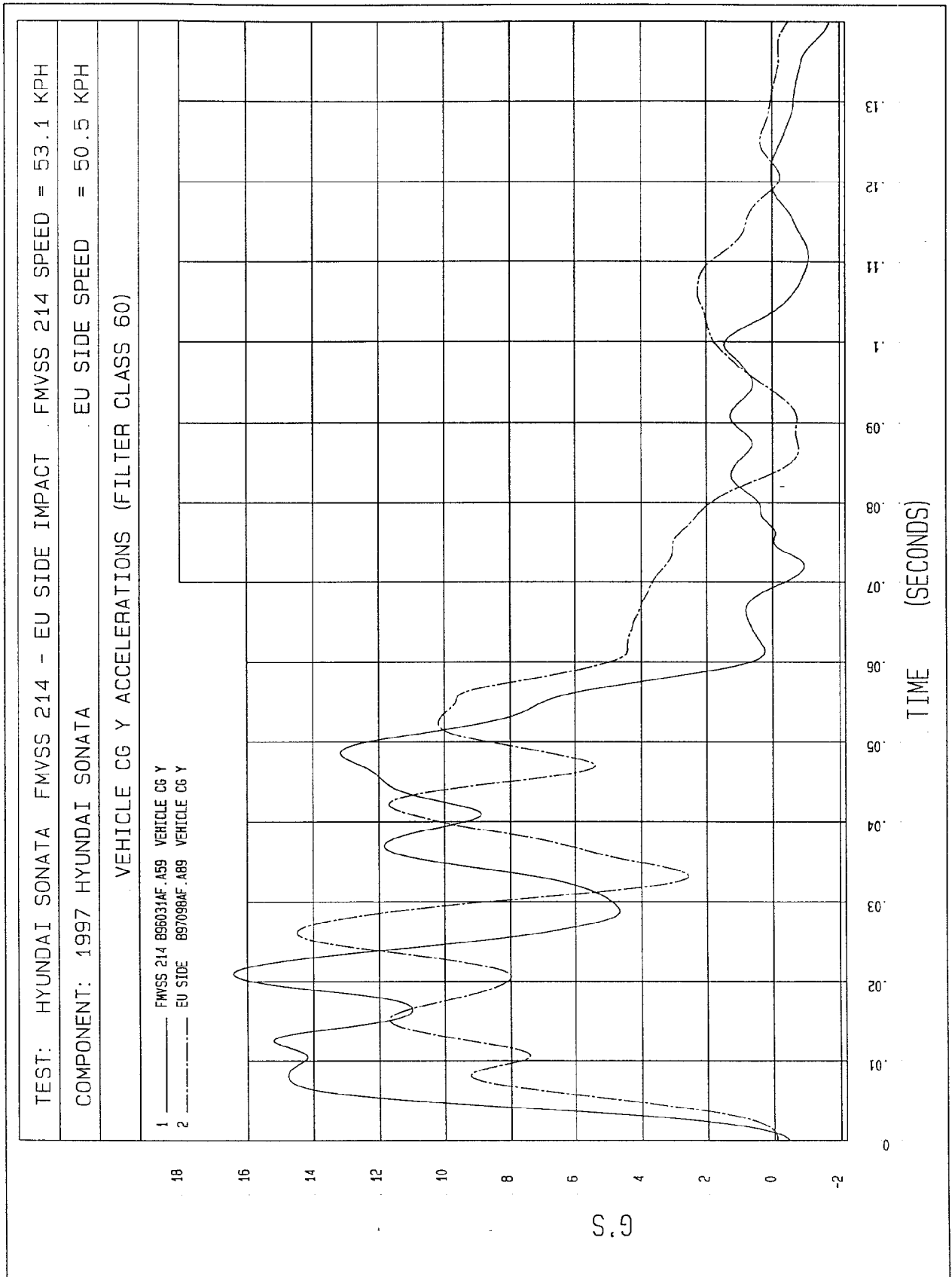










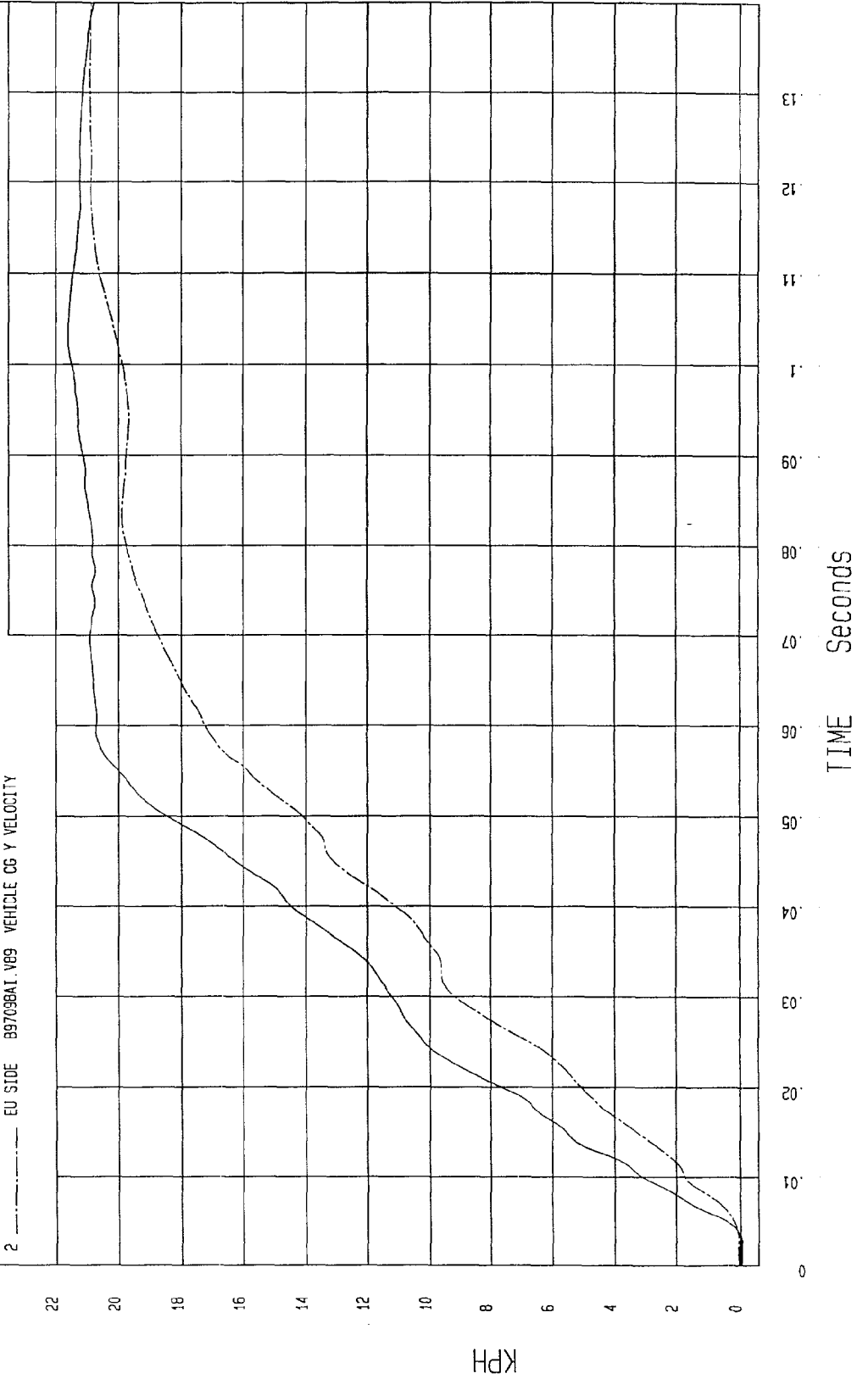


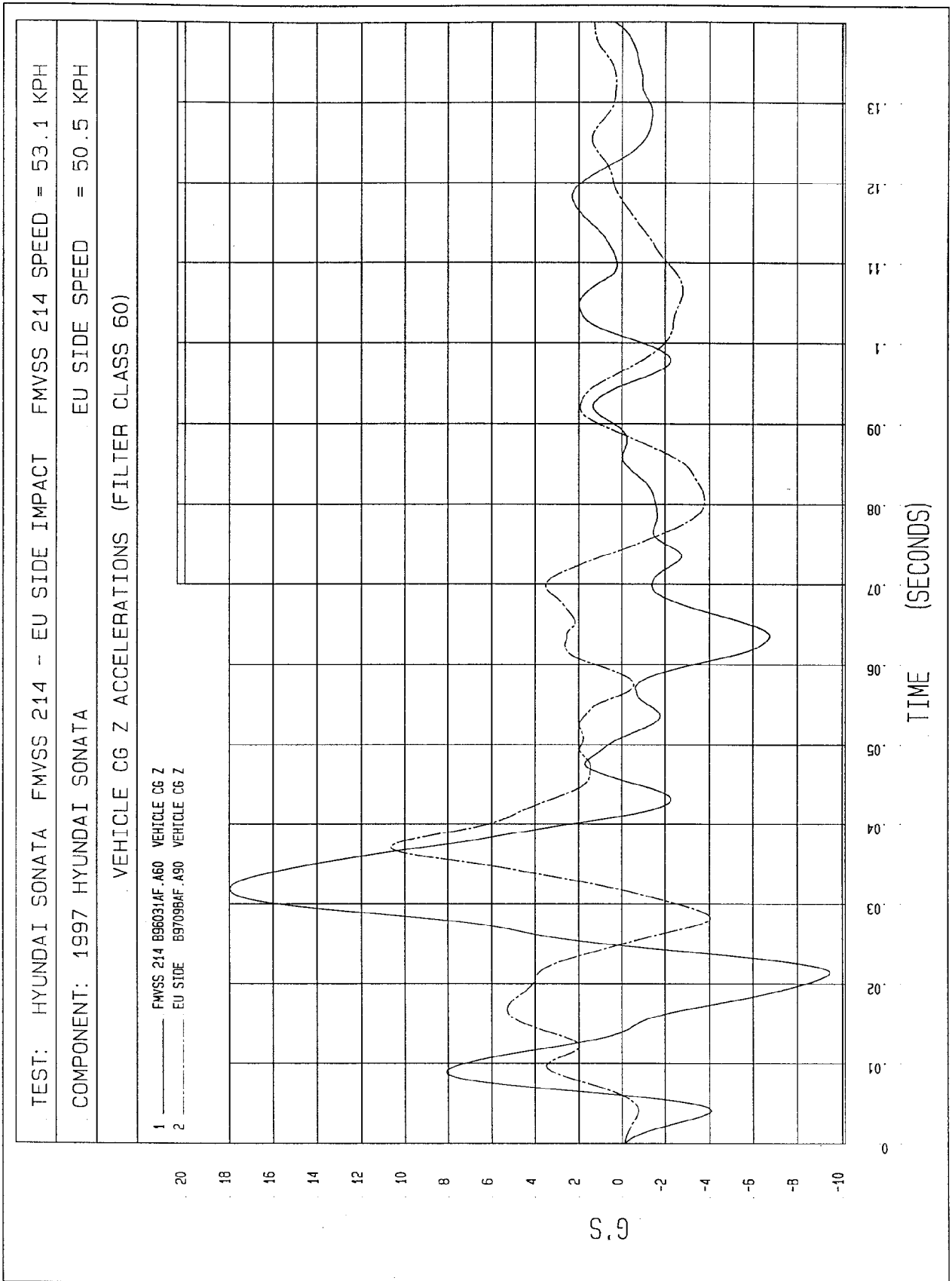
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

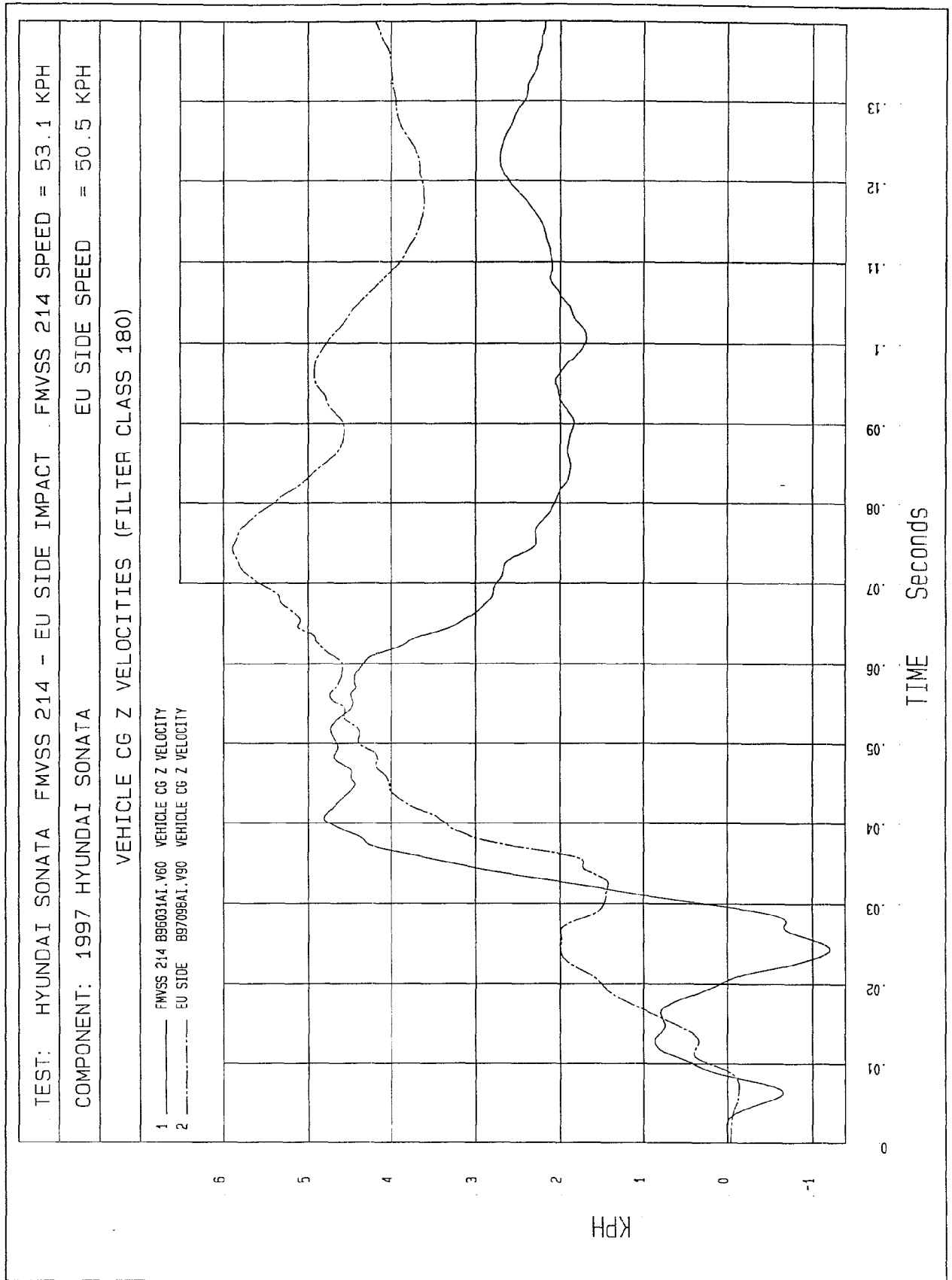
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

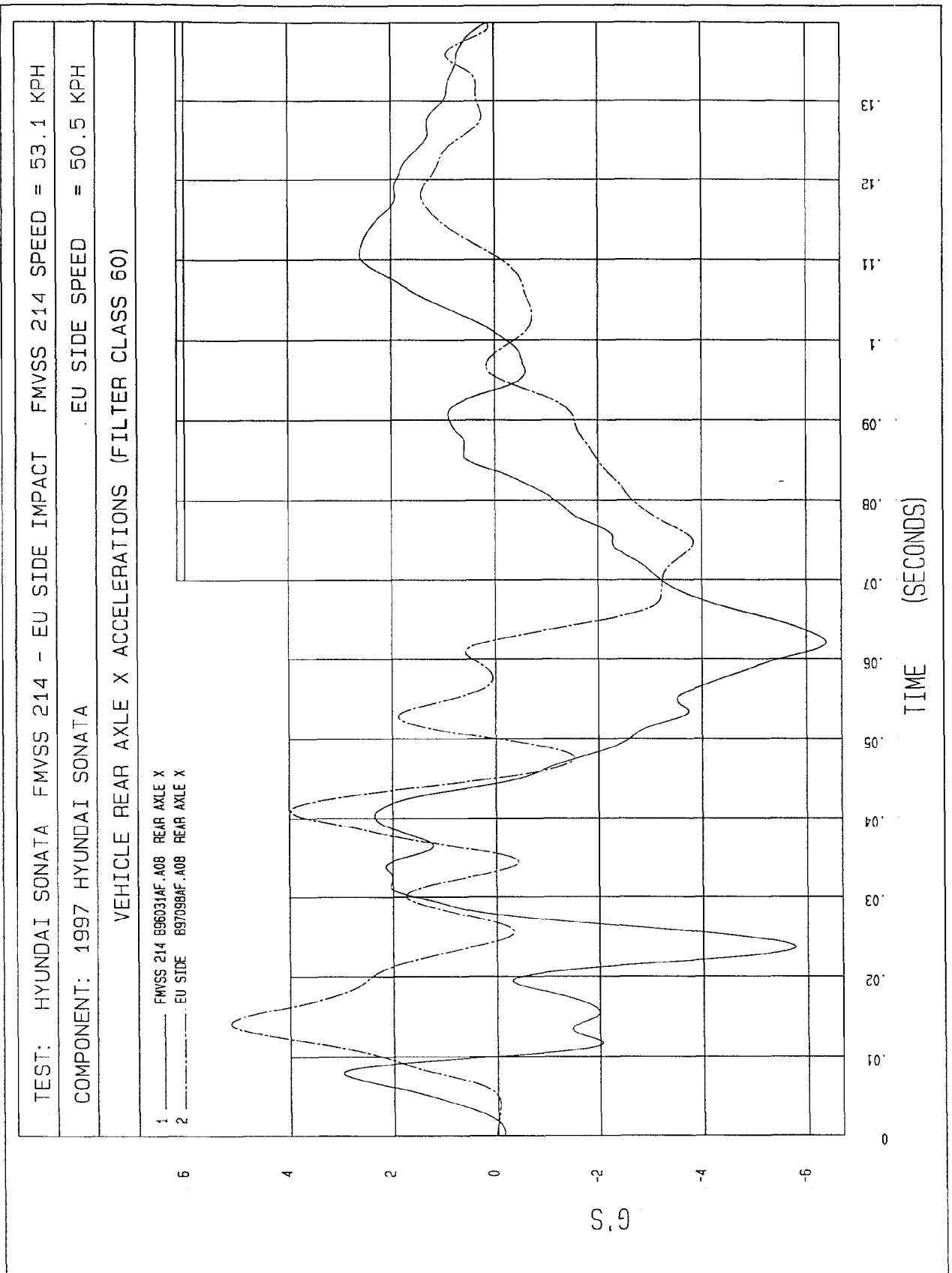
VEHICLE CG Y VELOCITIES (FILTER CLASS 180)

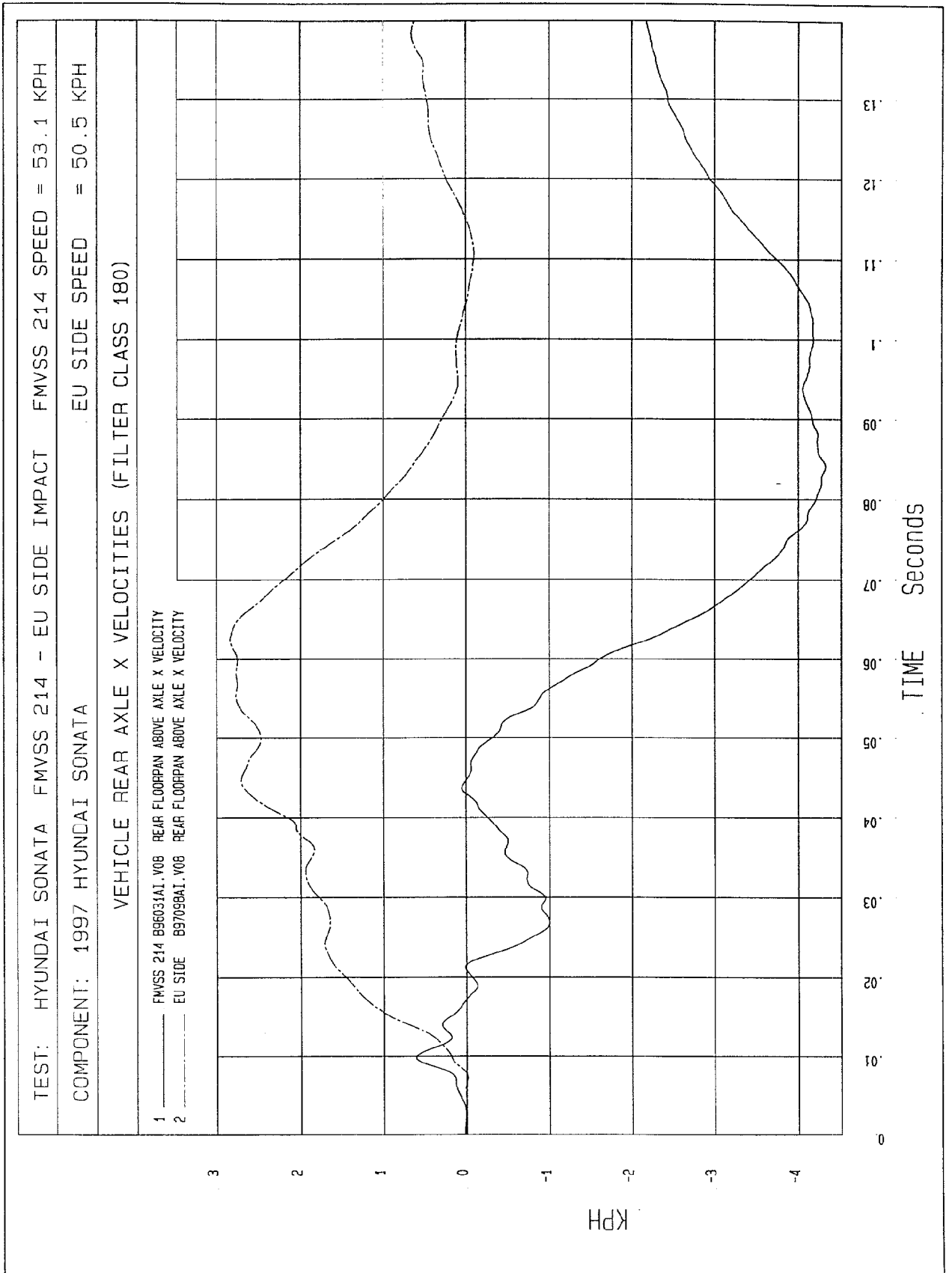
1 FMVSS 214 B96031A1.V59 VEHICLE CG Y VELOCITY
2 EU SIDE B9703BA1.V69 VEHICLE CG Y VELOCITY

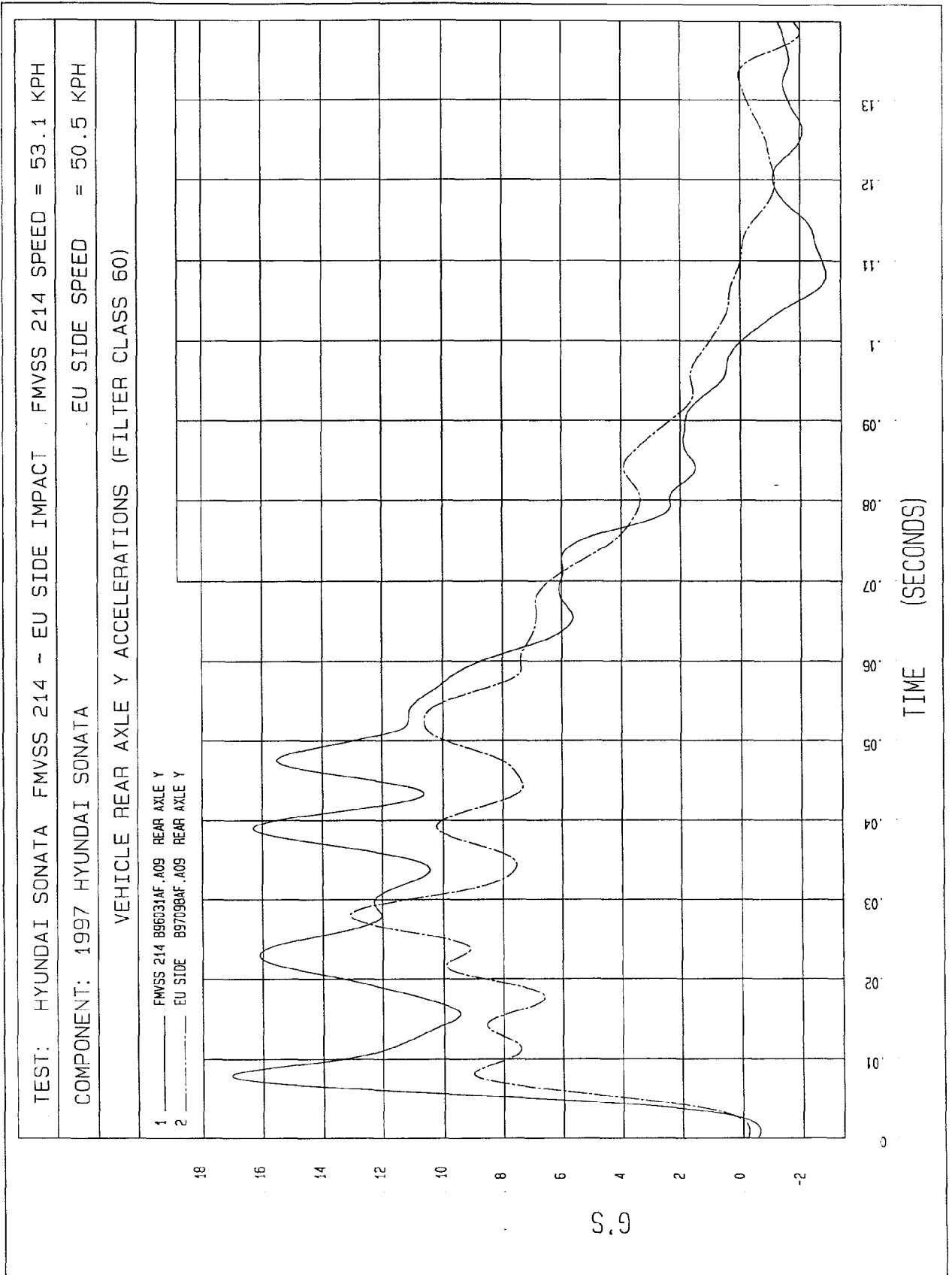










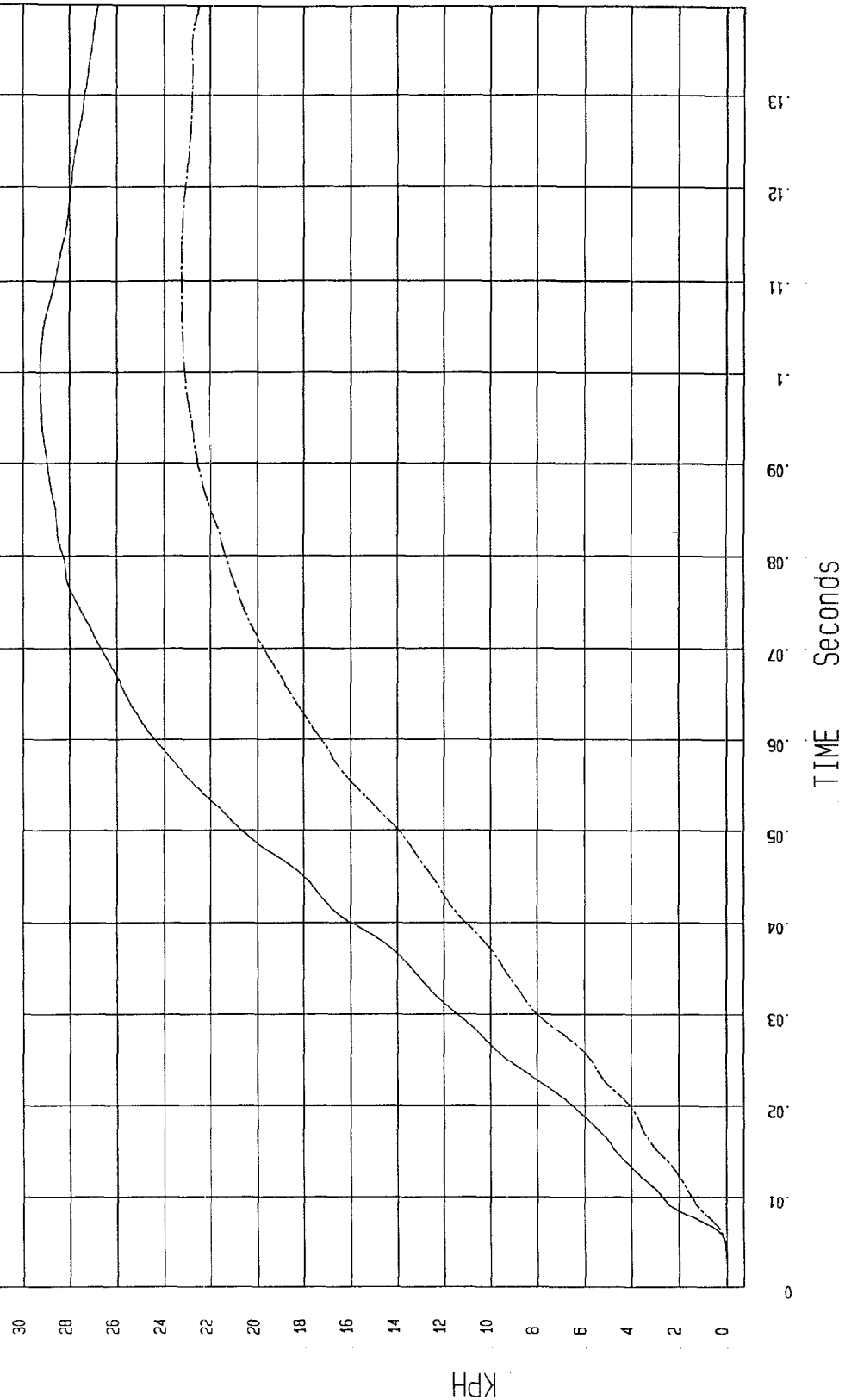


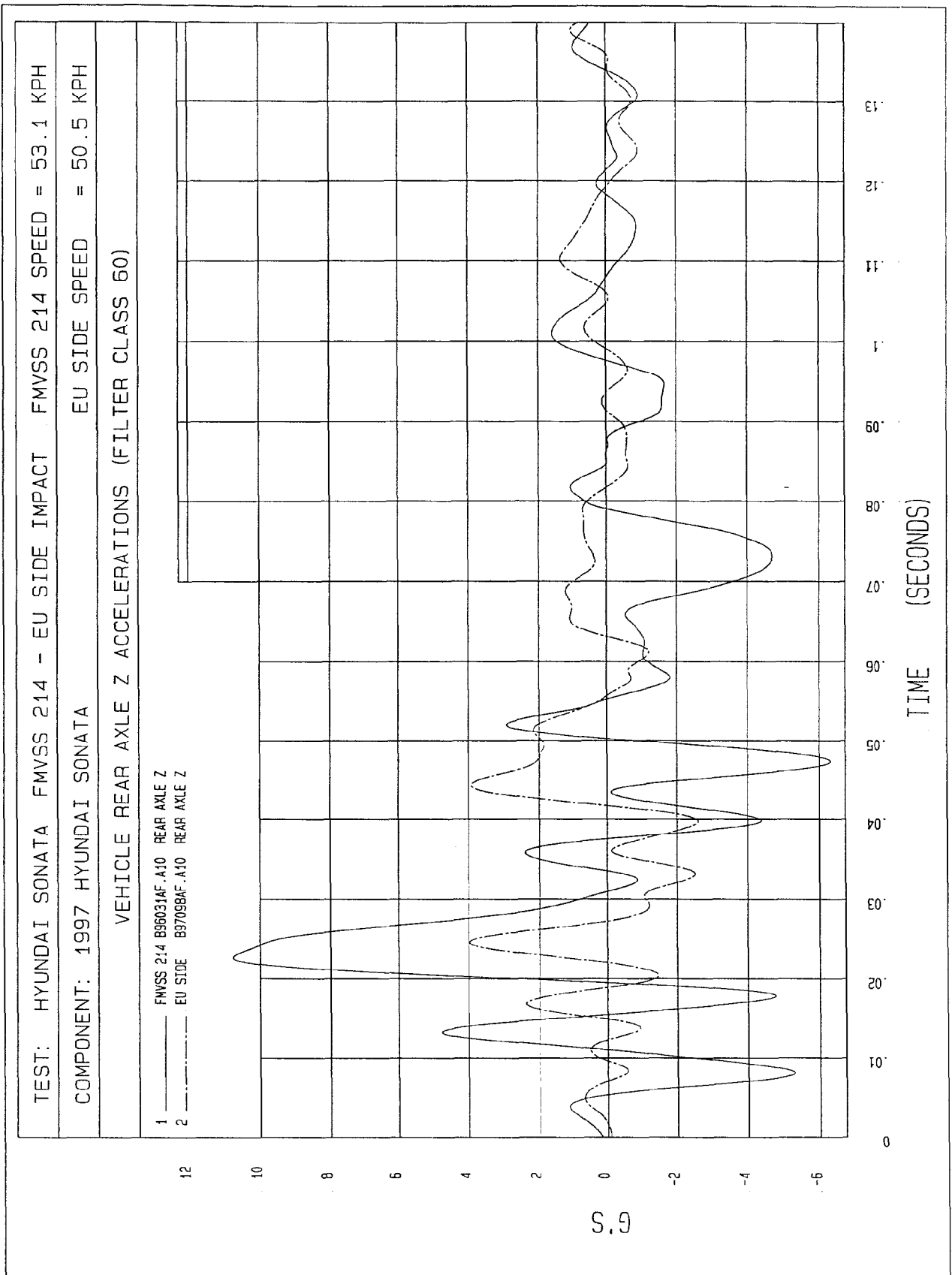
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

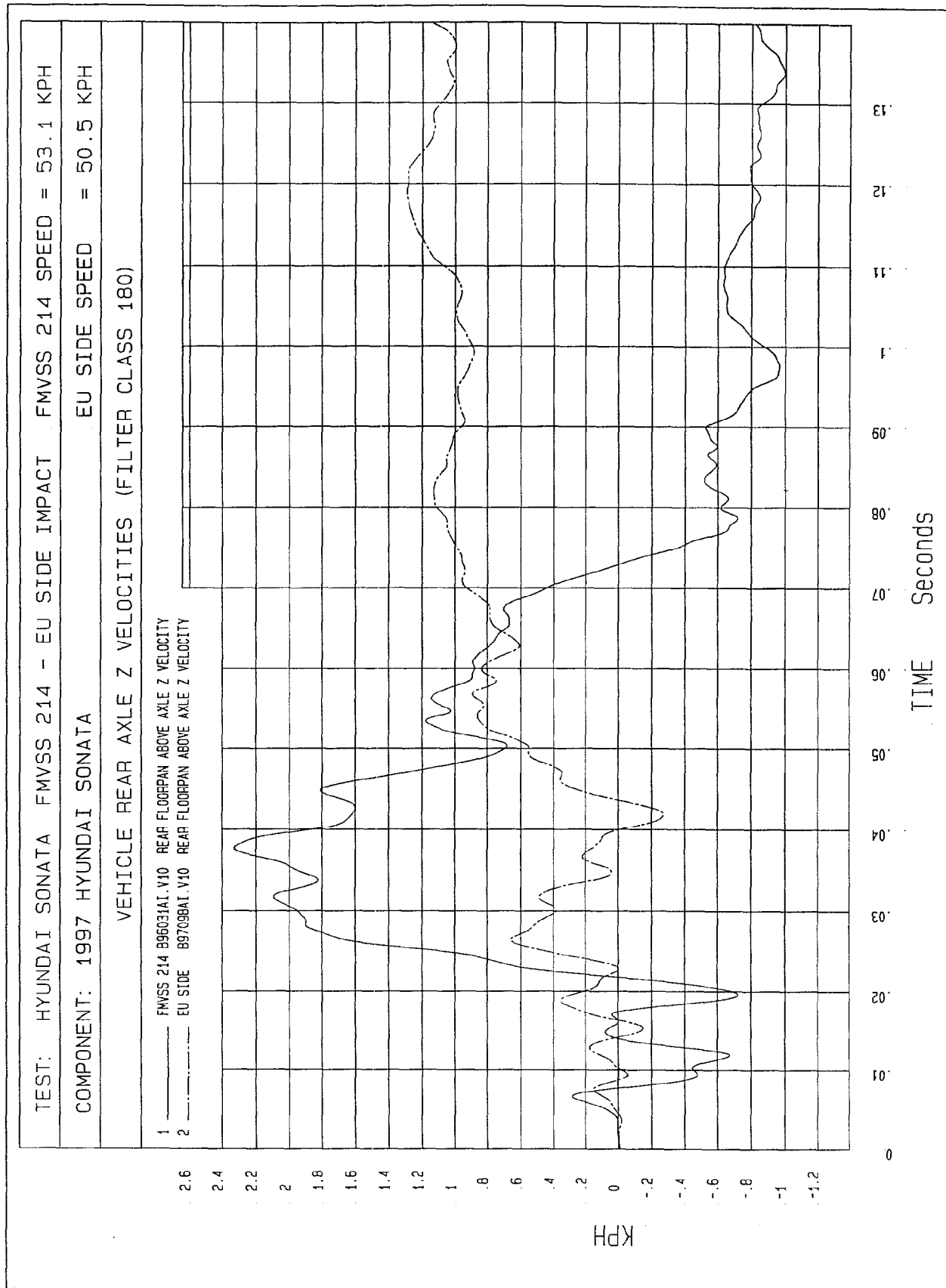
COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

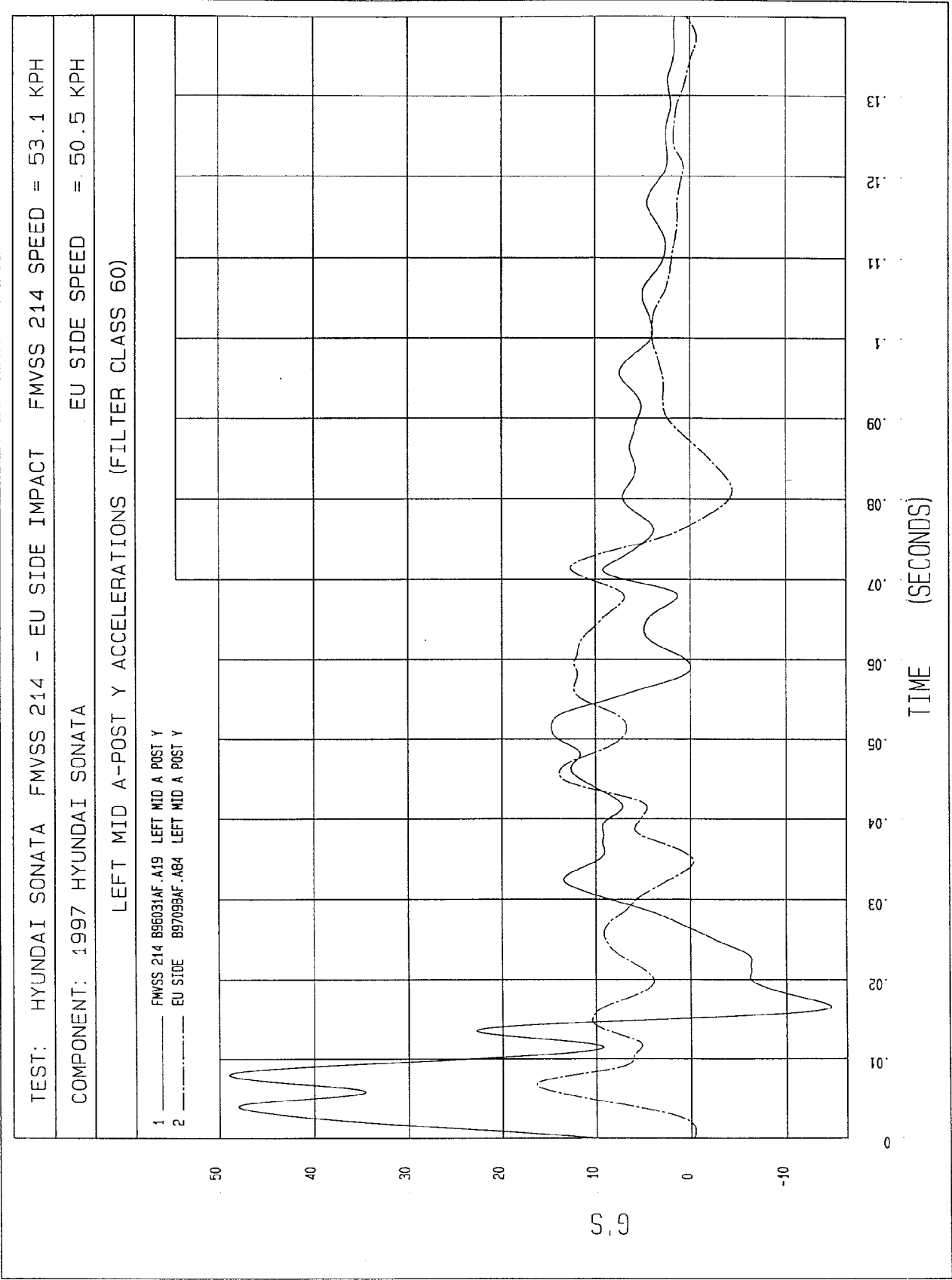
VEHICLE REAR AXLE Y VELOCITIES (FILTER CLASS 180)

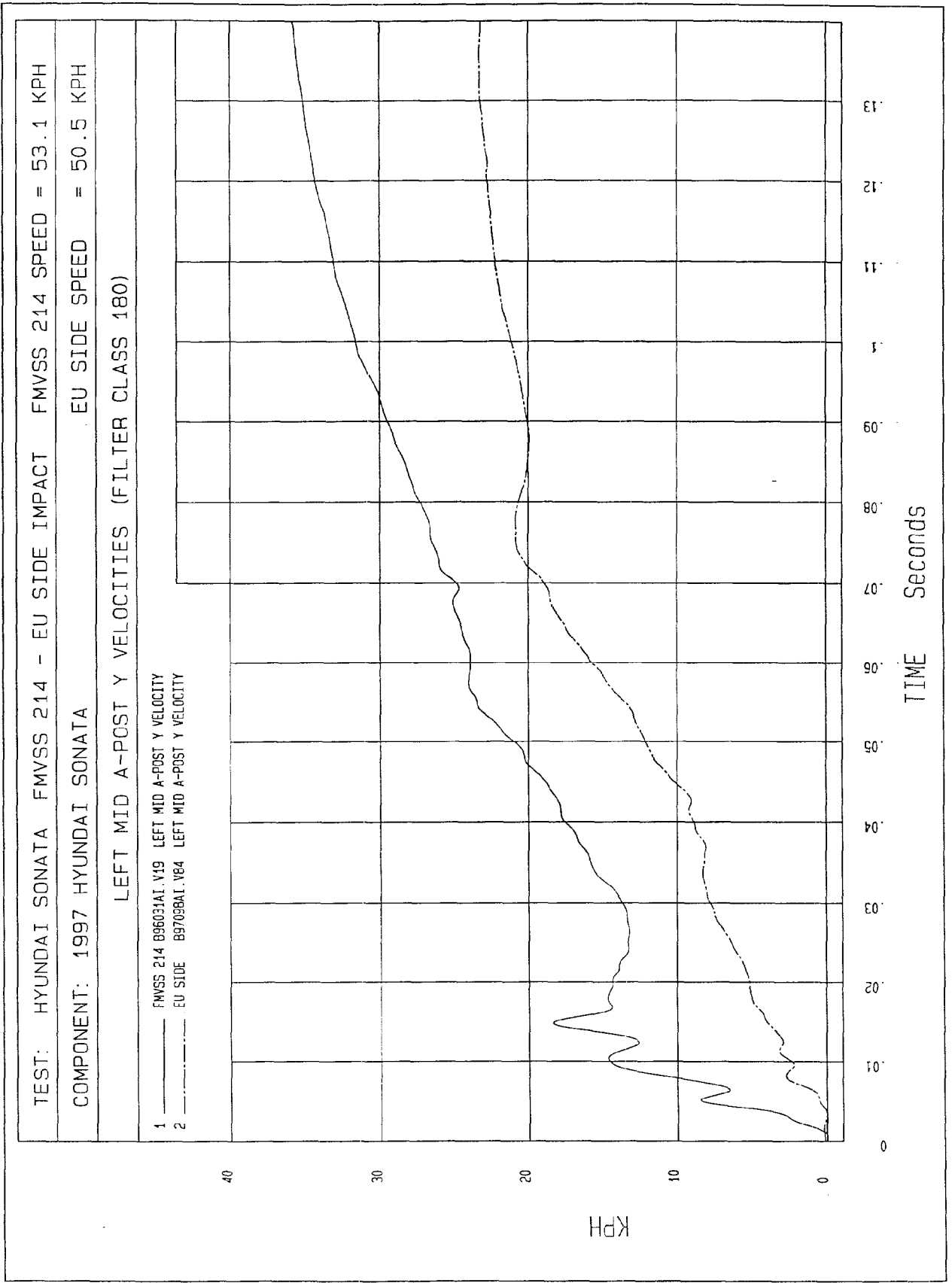
1 — FMVSS 214 B96031A1.V09 REAR FLOORPAN ABOVE AXLE Y VELOCITY
2 — EU SIDE B97098A1.V09 REAR FLOORPAN ABOVE AXLE Y VELOCITY

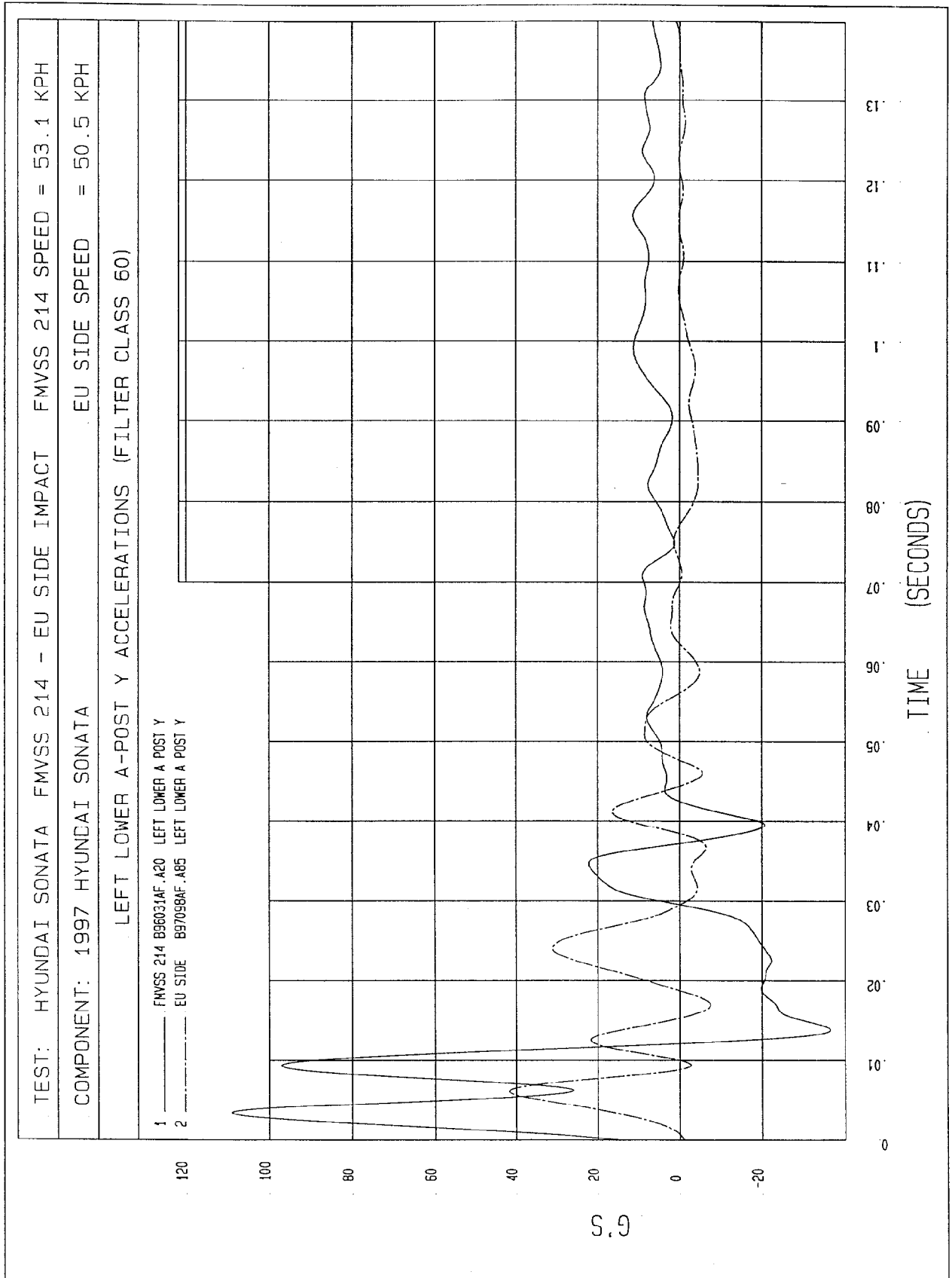


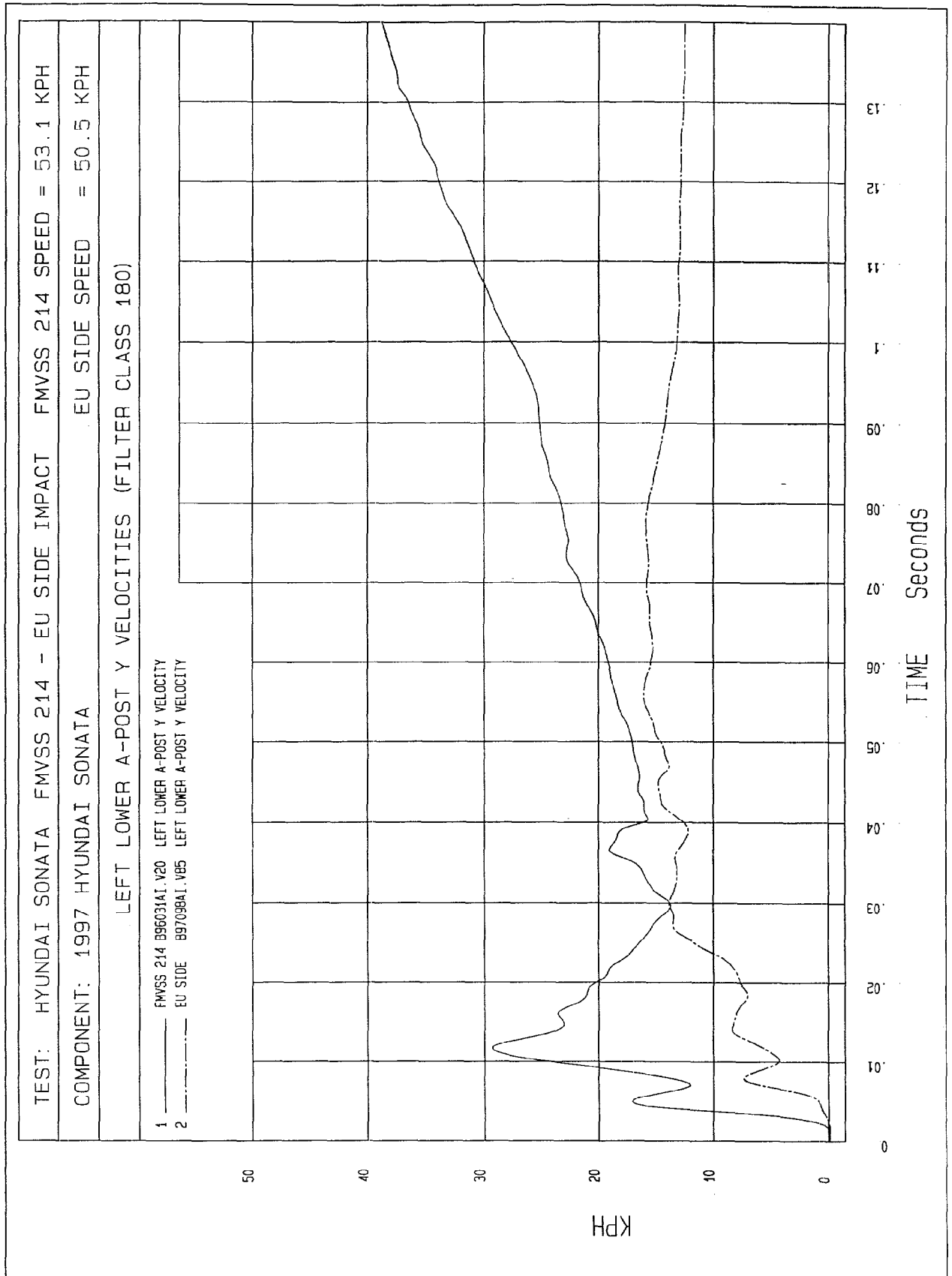


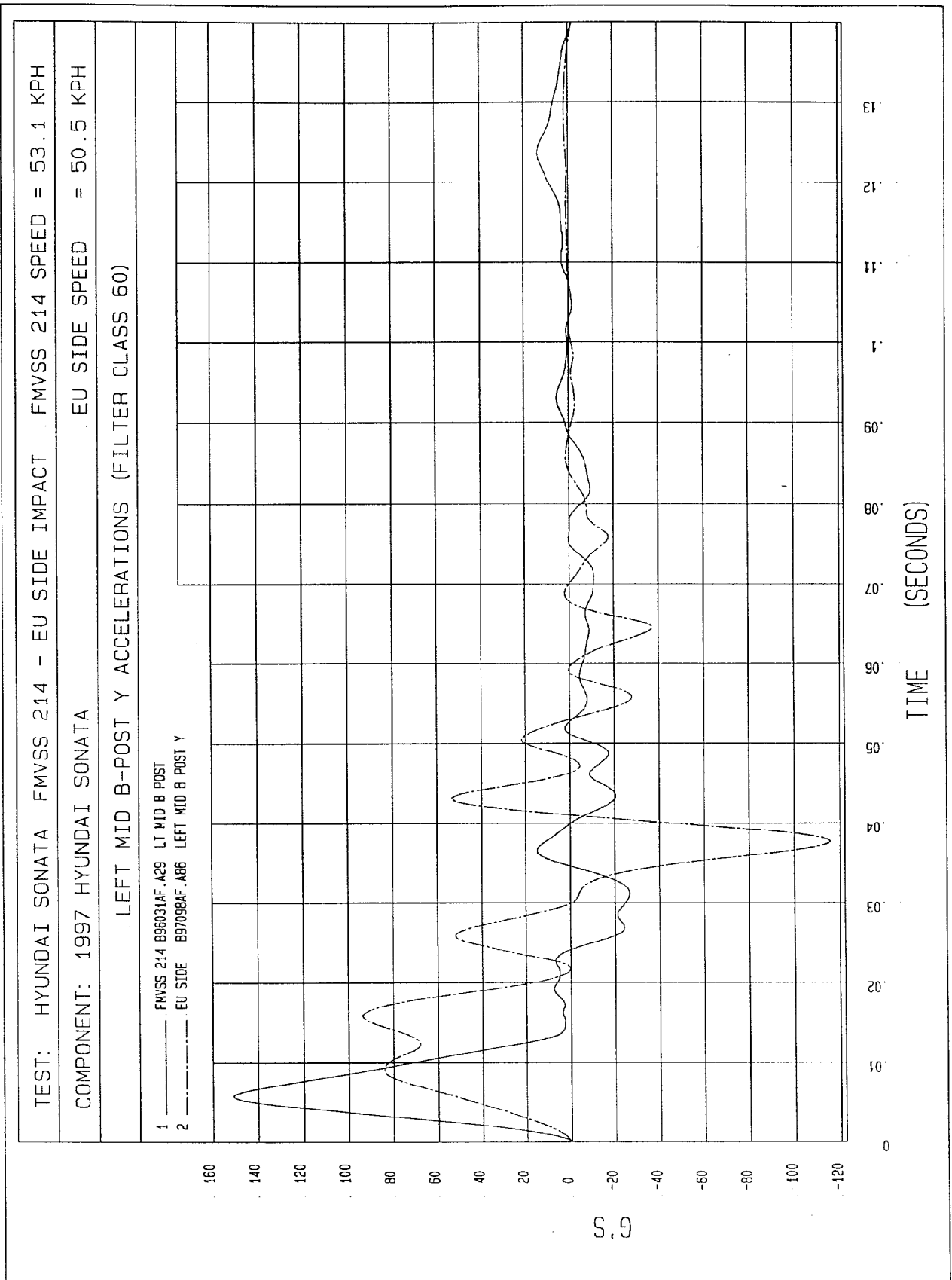










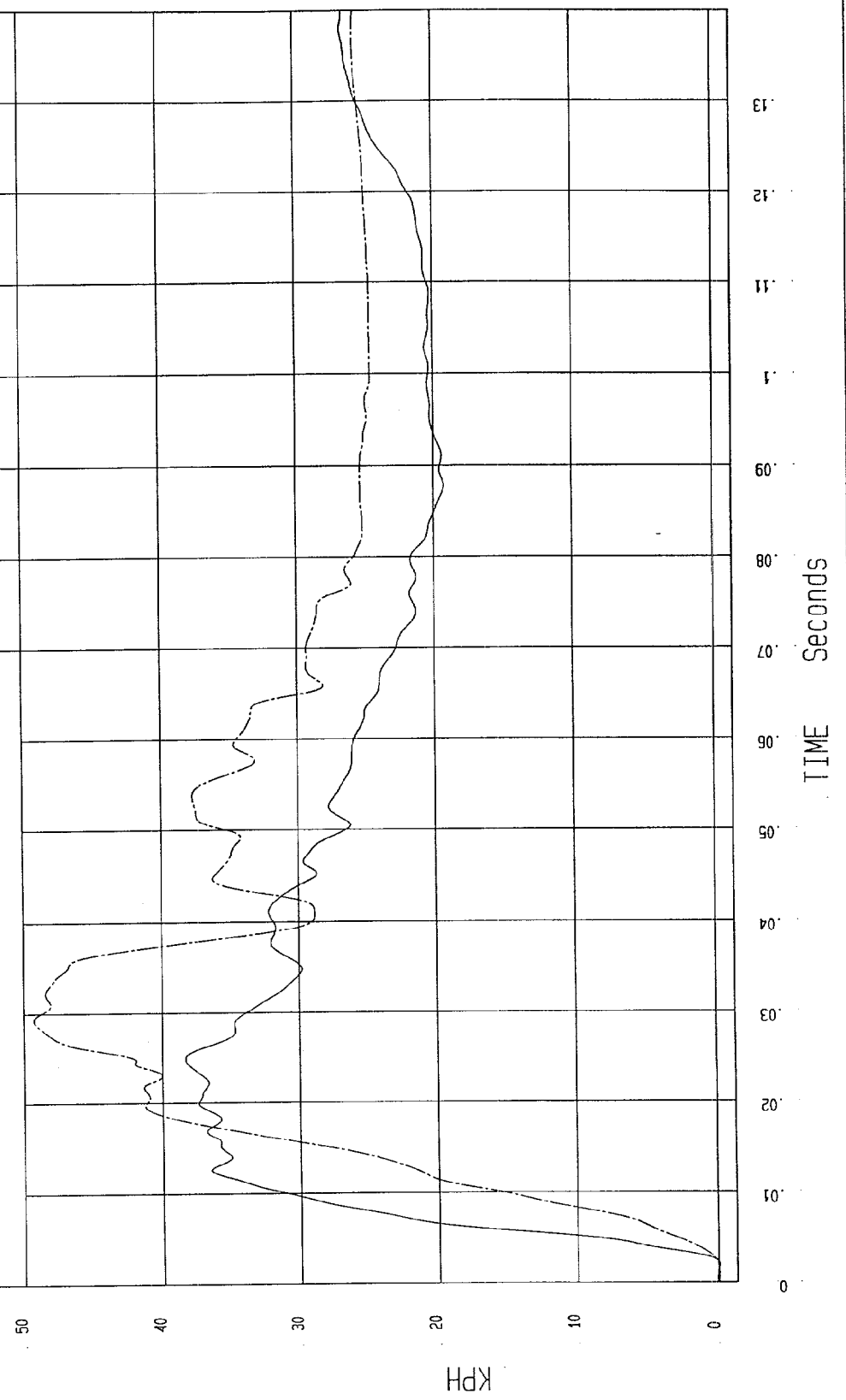


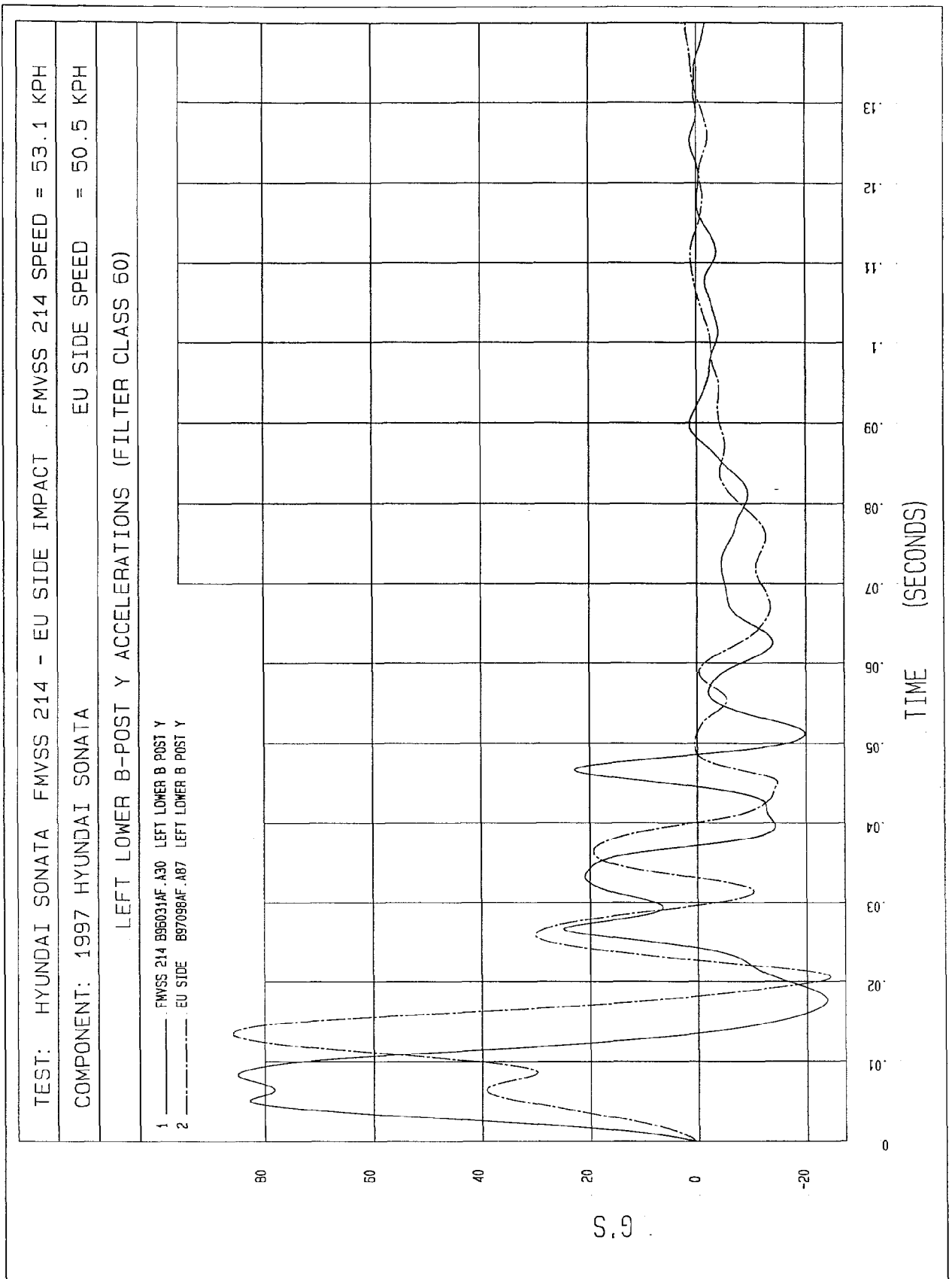
TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH

COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

LEFT MID B-POST Y VELOCITIES (FILTER CLASS 180)

1 FMVSS 214 896031A1.V29 LEFT MID B-POST Y VELOCITY
2 EU SIDE 897099A1.V85 LEFT LOWER B-POST Y VELOCITY

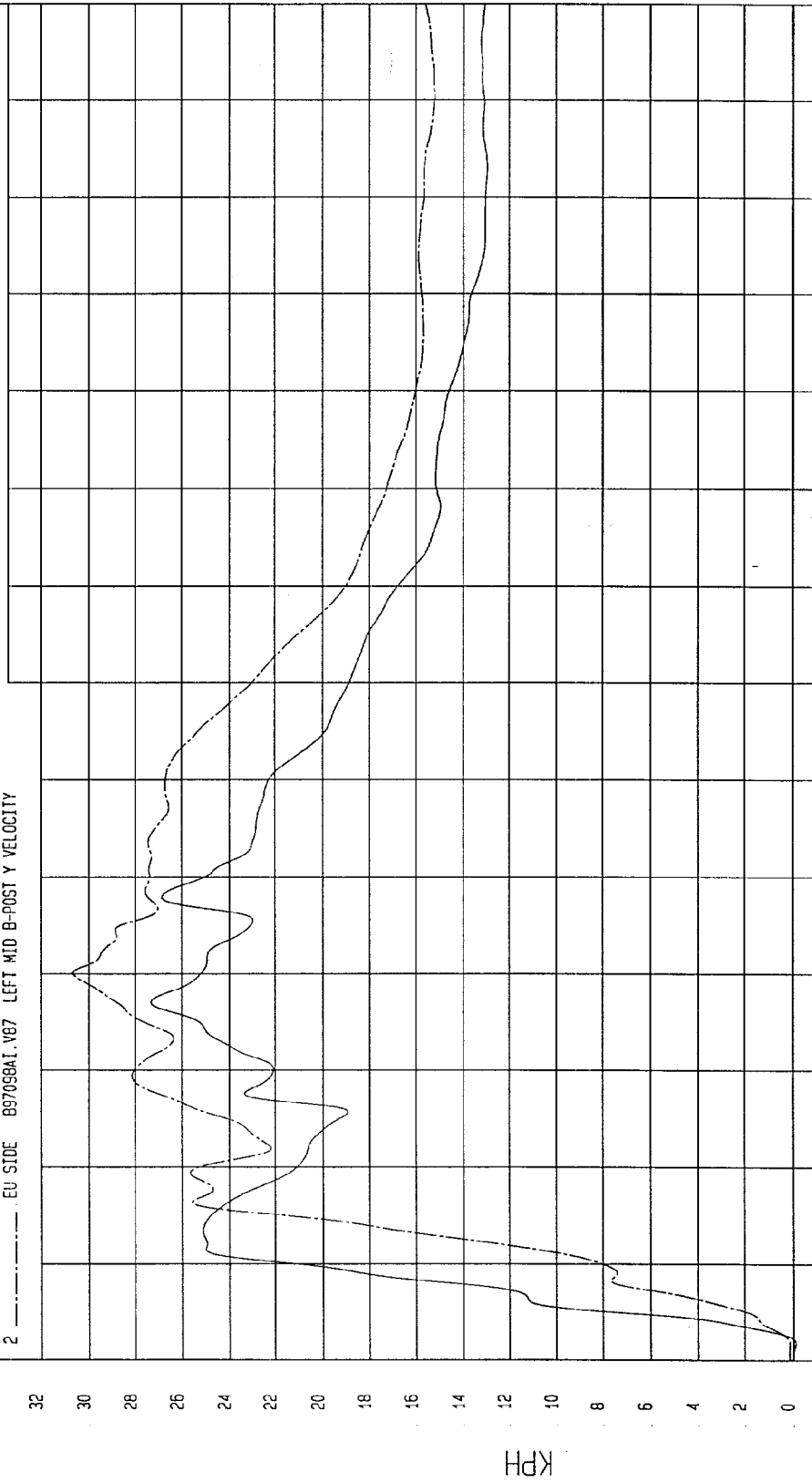




TEST: HYUNDAI SONATA FMVSS 214 - EU SIDE IMPACT FMVSS 214 SPEED = 53.1 KPH
 COMPONENT: 1997 HYUNDAI SONATA EU SIDE SPEED = 50.5 KPH

LEFT LOWER B-POST Y VELOCITIES (FILTER CLASS 180)

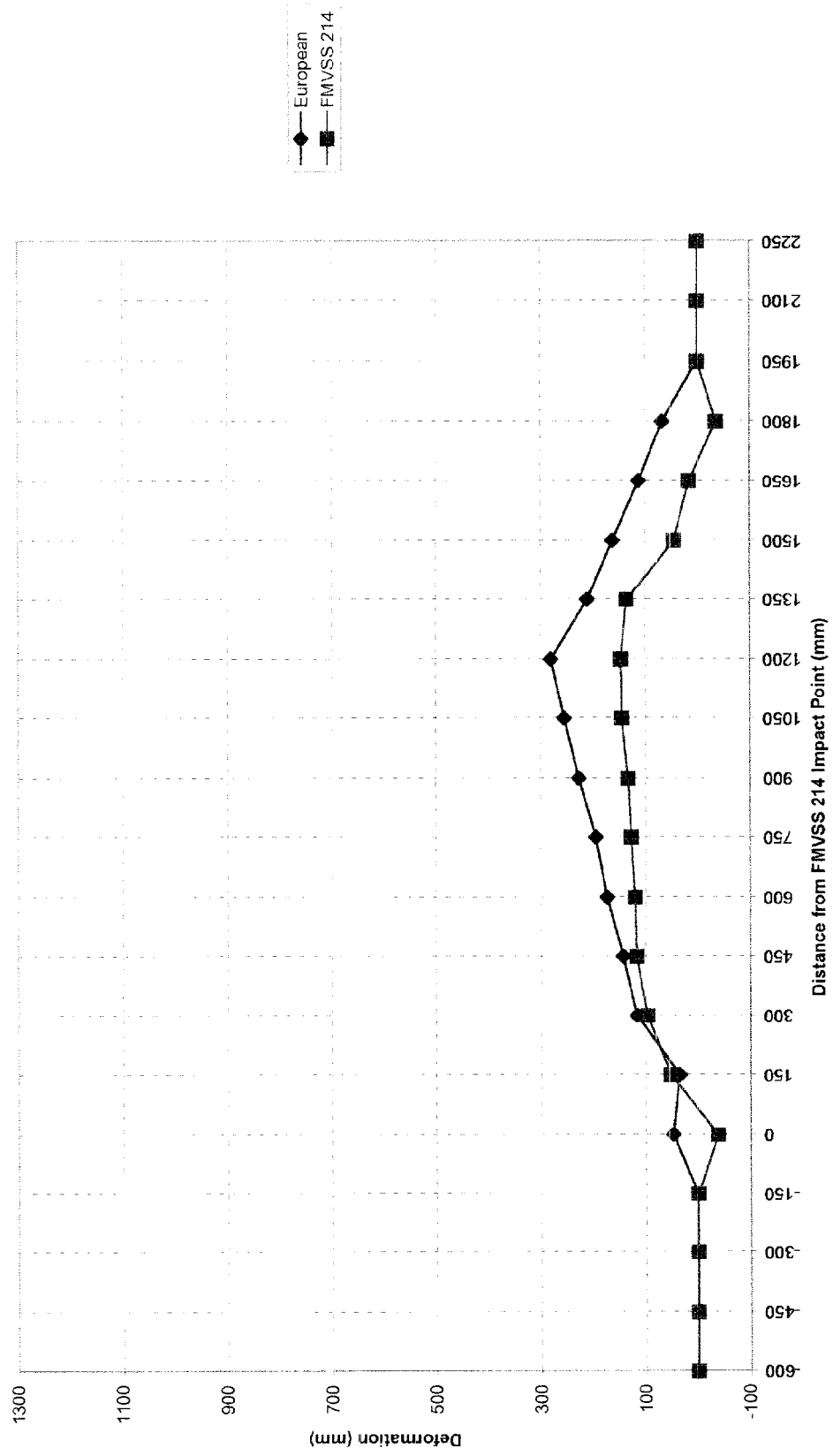
1 ——— FMVSS 214 B96031A1.V30 LEFT LOWER B-POST Y VELOCITY
 2 - - - - - EU SIDE B97098A1.V87 LEFT MID B-POST Y VELOCITY



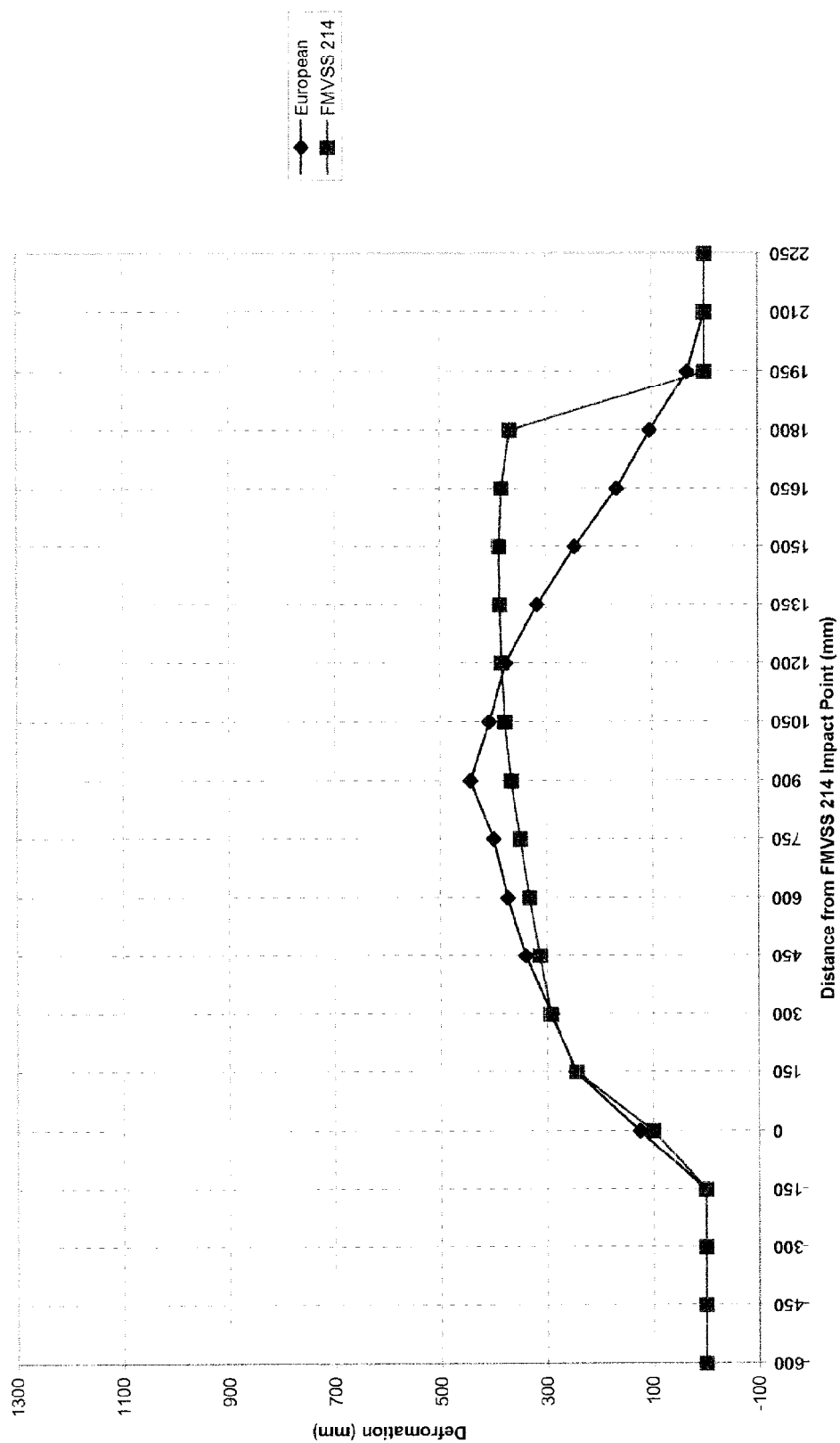
TIME Seconds

KPH

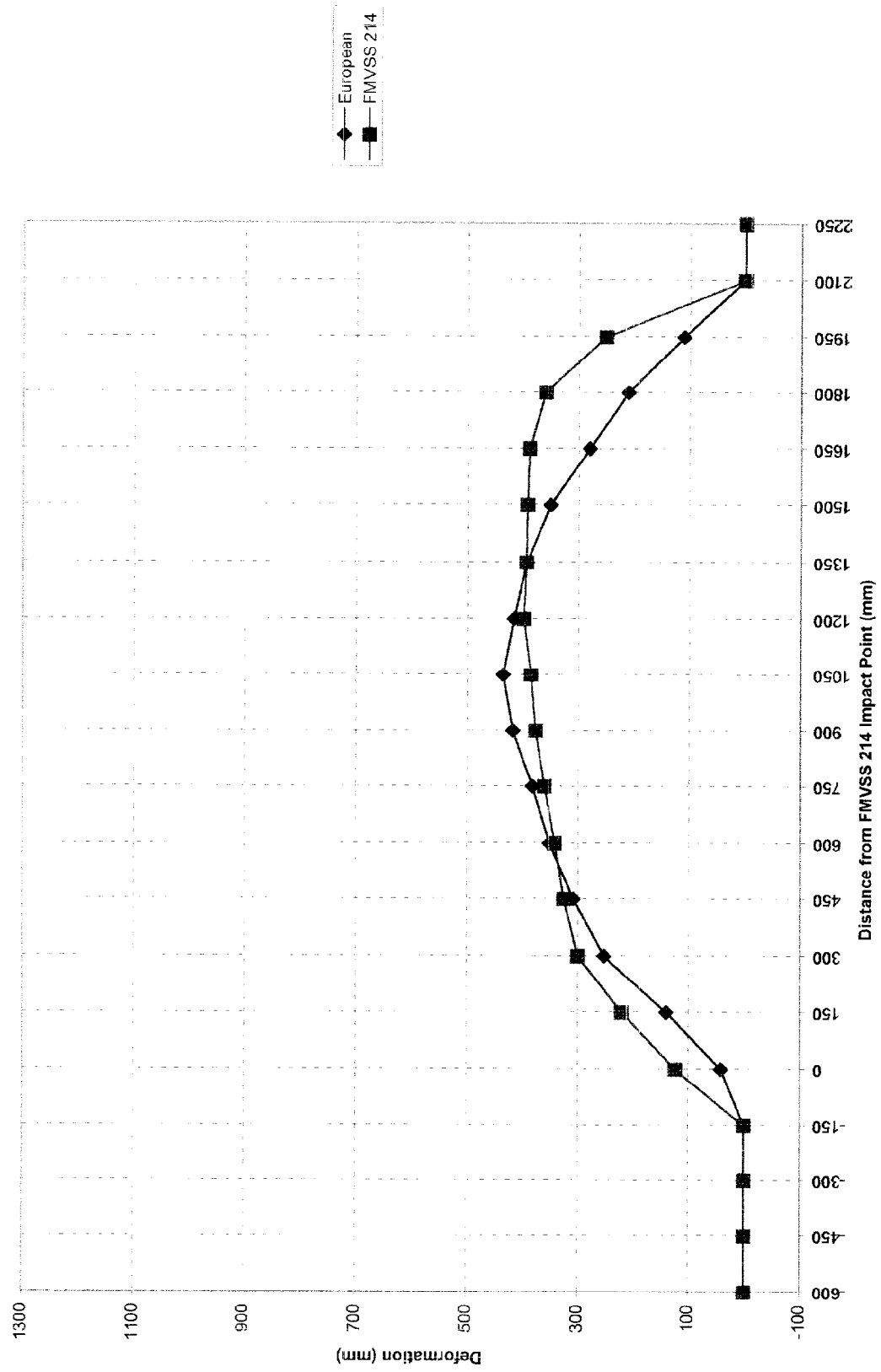
Level 1: Sill Deformation



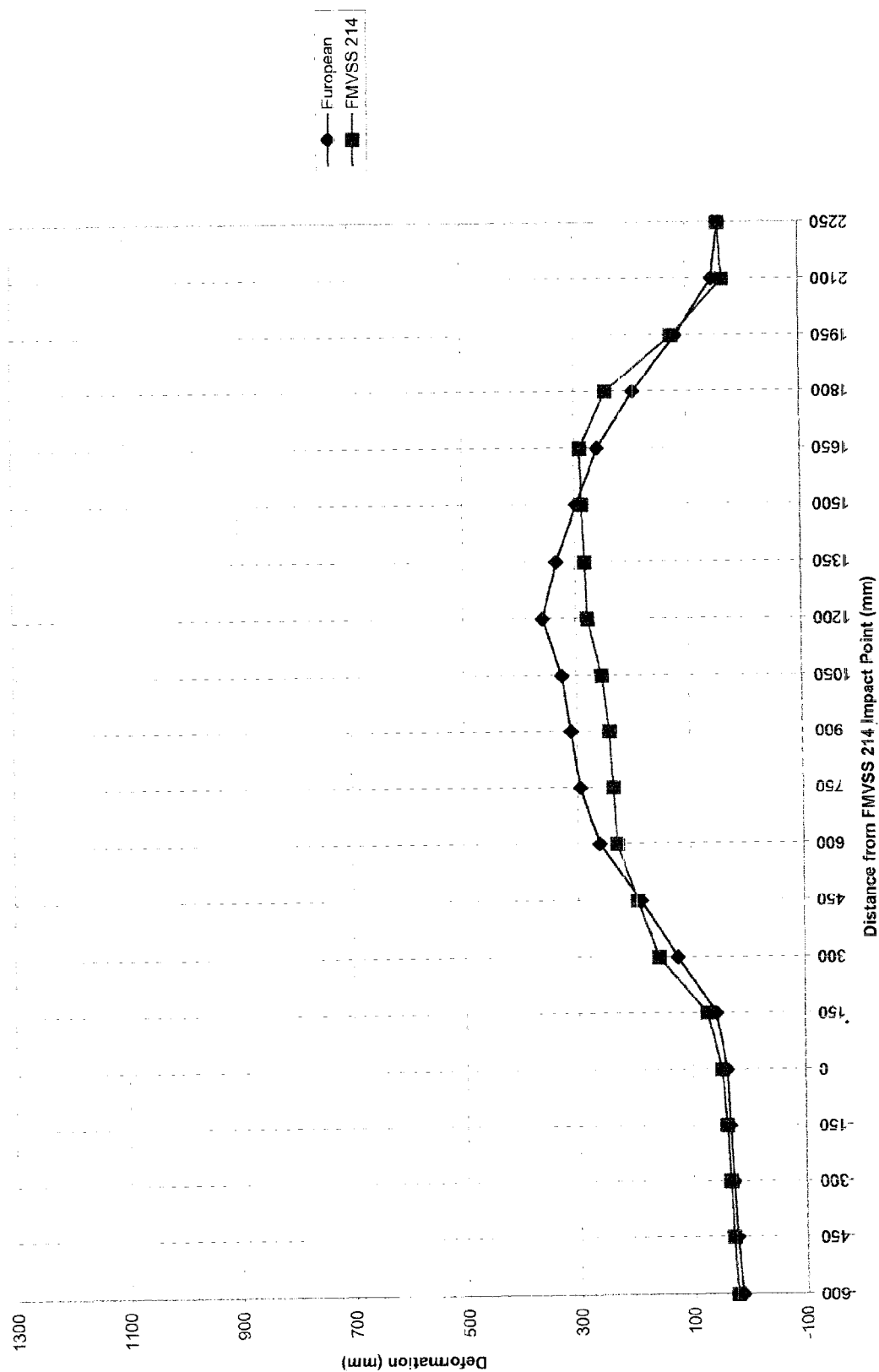
Level 2: Occupant H-Point Deformation



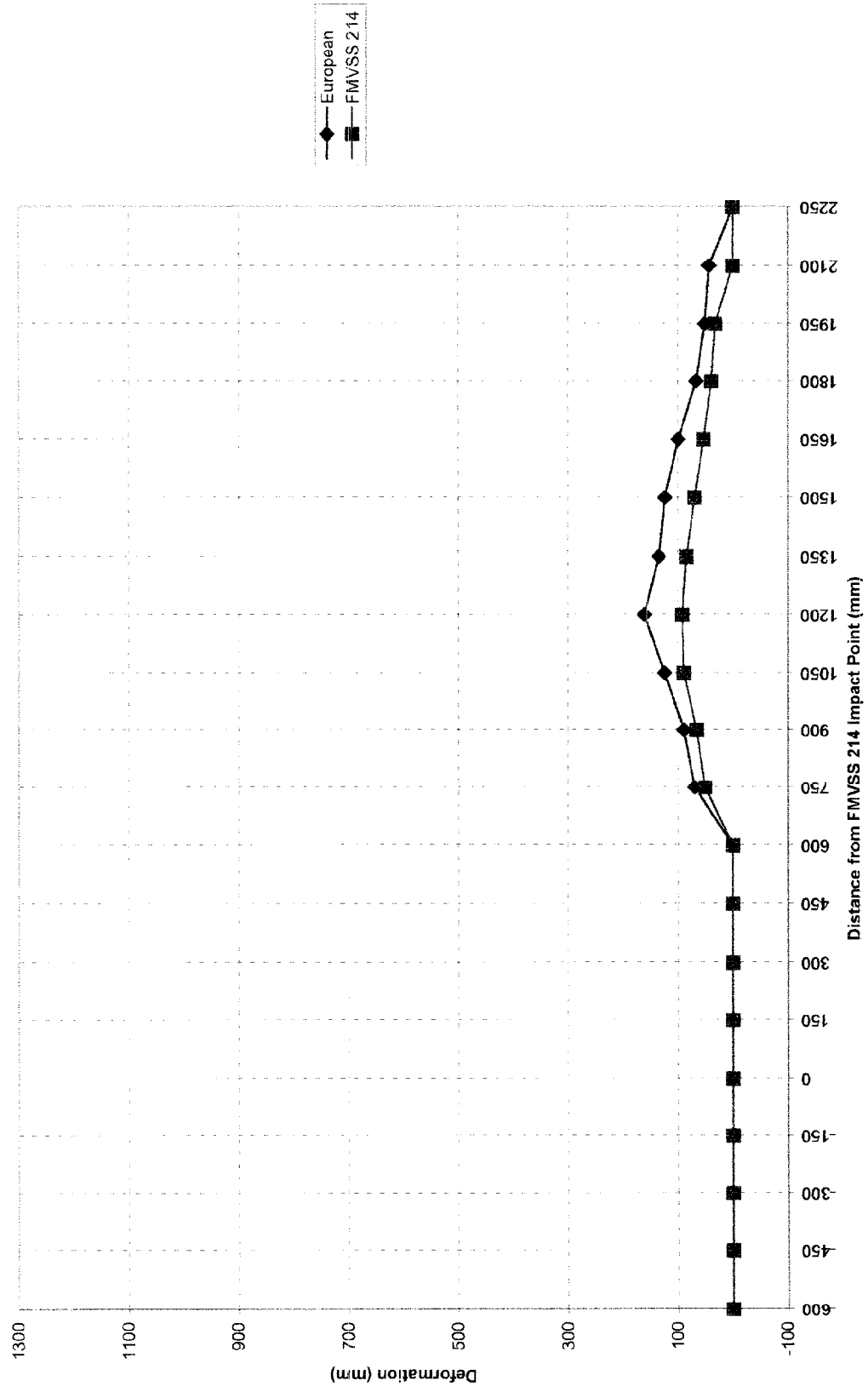
Level 3: Mid Door Deformation



Level 4: Window Sill Deformation



Level 5: Window Top Deformation



APPENDIX D
EUROSID-1 CONFIGURATION
AND PERFORMANCE VERIFICATION

EUROSID DUMMY PRE-TEST CALIBRATION DATA SUMMARY SHEET

Dummy #: E1- 169

Calibration Date: August 6, 1997

1.0 Head Drop Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	43%
Max. Resultant Acceleration	100 - 150 g's	139
Time of Max. Res. Acceleration		2.5 msec.

Calibrated By: Tim Michnay

Date: August 6, 1997

2.0 Neck Pendulum Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	42%
Pendulum Speed	10.83 - 11.48 ft/sec	10.98
Max. Pendulum Acceleration		-32.92
Time Max. Pend. Acceleration		9.73
Maximum Flexion Angle	46.0 - 56.0 deg.	51.0
Time of Max. Flexion Angle	50.0 - 62.0 ms	55.5
Maximum Angle Theta (A)	30.0 - 34.0 deg	30.6
Time of Max. Theta (A)	50.0 - 60.0 ms	54.9
Maximum Angle Theta (B)	26.0 - 30.0 deg.	27.7
Time of Max. Theta (B)	50.0 - 60.0 ms	52.1

Calibrated By: Tim Michnay

Date: August 1, 1997

3.0 Shoulder Impact Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Pendulum Speed	13.78 - 14.43 ft/sec	14.00
Max. Pendulum Acceleration	7.5 - 10.5 g's	8.1
Time of Max. Pendulum Acceleration		18.3

Calibrated By: Tim Michnay

Date: August 1, 1997

4.0 Upper Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	55%
Displacement at 3.28 ft/sec	.39 - .55 in	.44
Displacement at 6.56 ft/sec	.93 - 1.08 in	.98
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.54
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.96

Calibrated By: Tim Michnay

Date: August 4, 1997

5.0 Middle Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	42%
Displacement at 3.28 ft/sec	.39 - .55 in	.43
Displacement at 6.56 ft/sec	.93 - 1.08 in	.95
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.50
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.96

Calibrated By: Tim Michnay

Date: August 5, 1997

6.0 Lower Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	38%
Displacement at 3.28 ft/sec	.39 - .55 in	.41
Displacement at 6.56 ft/sec	.93 - 1.08 in	.96
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.47
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.87

Calibrated By: Tim MichnayDate: August 5, 1997**7.0 Abdomen Test**

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Probe Speed	20.34 - 20.99 ft/sec	20.36
Maximum Impact Force	2136 - 2495 lbs	2328
Time of Maximum Force	8.8 - 10.4 ms	9.5
Max. Total Abdomen Force	1326 - 1776 lbs	1332
Time of Max. Total Force	8.5 - 10.1 ms	9.9

Calibrated By: Tim MichnayDate: August 1, 1997

8.0 Lumbar Spine Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	71°
Laboratory Relative Humidity	10% - 70%	42%
Pendulum Speed	19.52 - 20.17 ft/sec	19.95
Max. Pendulum Acceleration		-28.87
Time Max. Pend. Acceleration		10.0
Maximum Flexion Angle	45.0 - 55.0 deg.	48.9
Time of Max. Flexion Angle	39.0 - 53.0 ms	46.7
Maximum Angle Theta (A)	31.0 - 35.0 deg	33.4
Time of Max. Theta (A)	45.0 - 55.0 ms	46.6
Maximum Angle Theta (B)	27.0 - 31.0 deg.	30.6
Time of Max. Theta (B)	45.0 - 55.0 ms	47.9

Calibrated By: First Technology Safety Systems

Date: August 25, 1997

9.0 Pelvis Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Pendulum Speed	13.77 - 14.43 ft/sec	13.98
Maximum Impactor Force	989 - 1214 lbs	1169
Time of Max. Impactor Force	10.3 - 15.5 ms	14.2
Maximum Pubic Force	233.8 - 368.7 lbs	302.0
Time of Max. Pubic Force	9.9 - 15.9 ms	14.9

Calibrated By: Tim Michnay

Date: July 16, 1997

TEST: DUMMY CALIBRATION - HEAD DROP TEST DATE: 08-06-1997 - 11:07:47

COMPONENT: DUMMY # E1-169

Minimum = 2.61E-02 G's at 65.1 msec

Maximum = 138.88 G's at 2.5 msec

PEAK RESULTANT ACCELERATION

1 ——— D97281A1.A01 FilterClass (1000)

200

180

150

140

120

100

80

60

40

20

0

G.S

.07

.06

.05

.04

.03

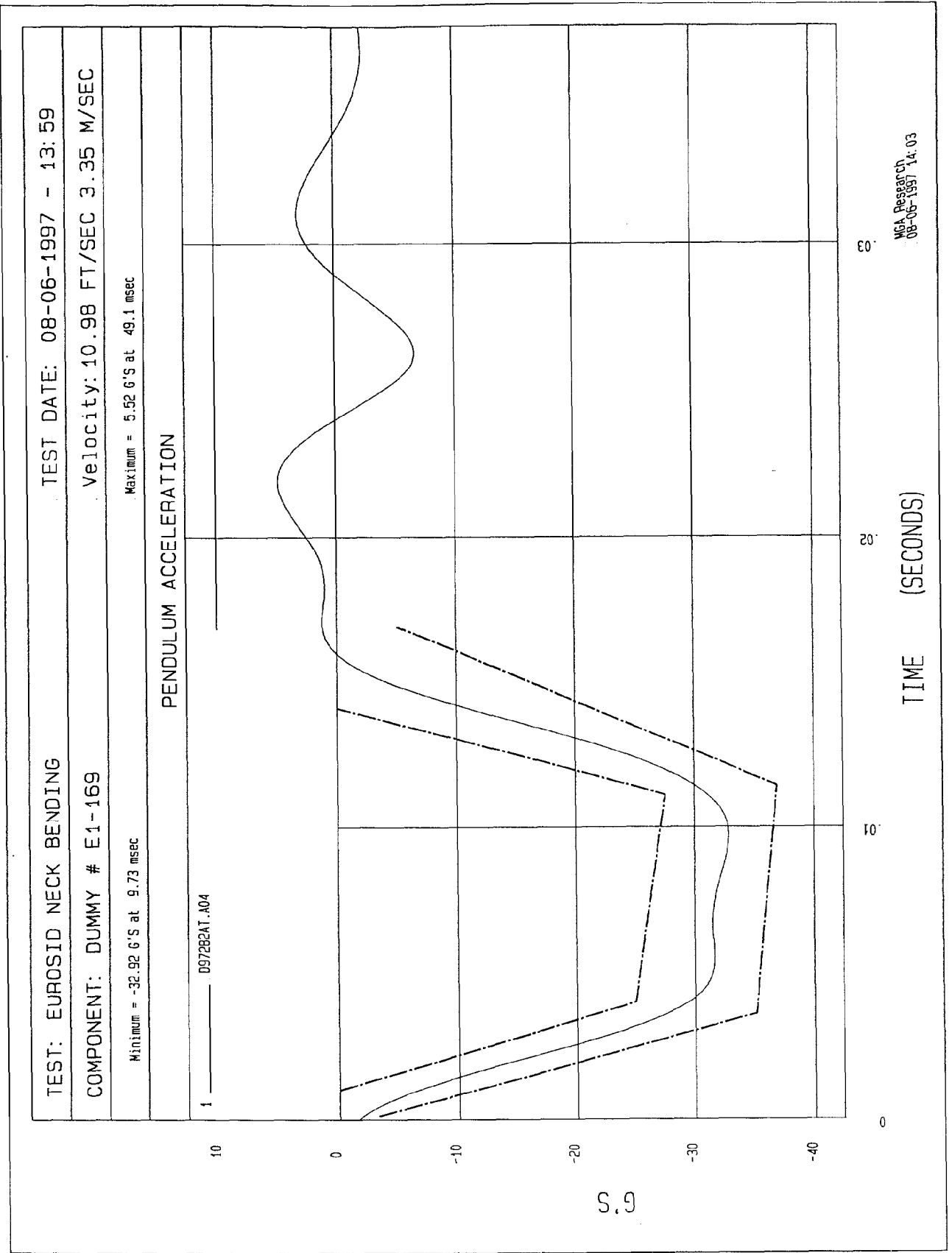
.02

.01

0

TIME (SECONDS)

MCA Research
08-06-1997 11:16



TEST: EUROSID NECK BENDING

TEST DATE: 08-06-1997 - 13:59

COMPONENT: DUMMY # E1-169

Velocity: 10.98 FT/SEC 3.35 M/SEC

Minimum = -32.99 DEG at 154. msec

Maximum = 50.96 DEG at 55.5 msec

FLEXION ANGLE

60

1 ——— 00728201.008 Filterclass (1000)

40

20

0

DEG

-20

-40

-60

0

.01

.02

.03

.04

.05

.06

.07

.08

.09

.1

.11

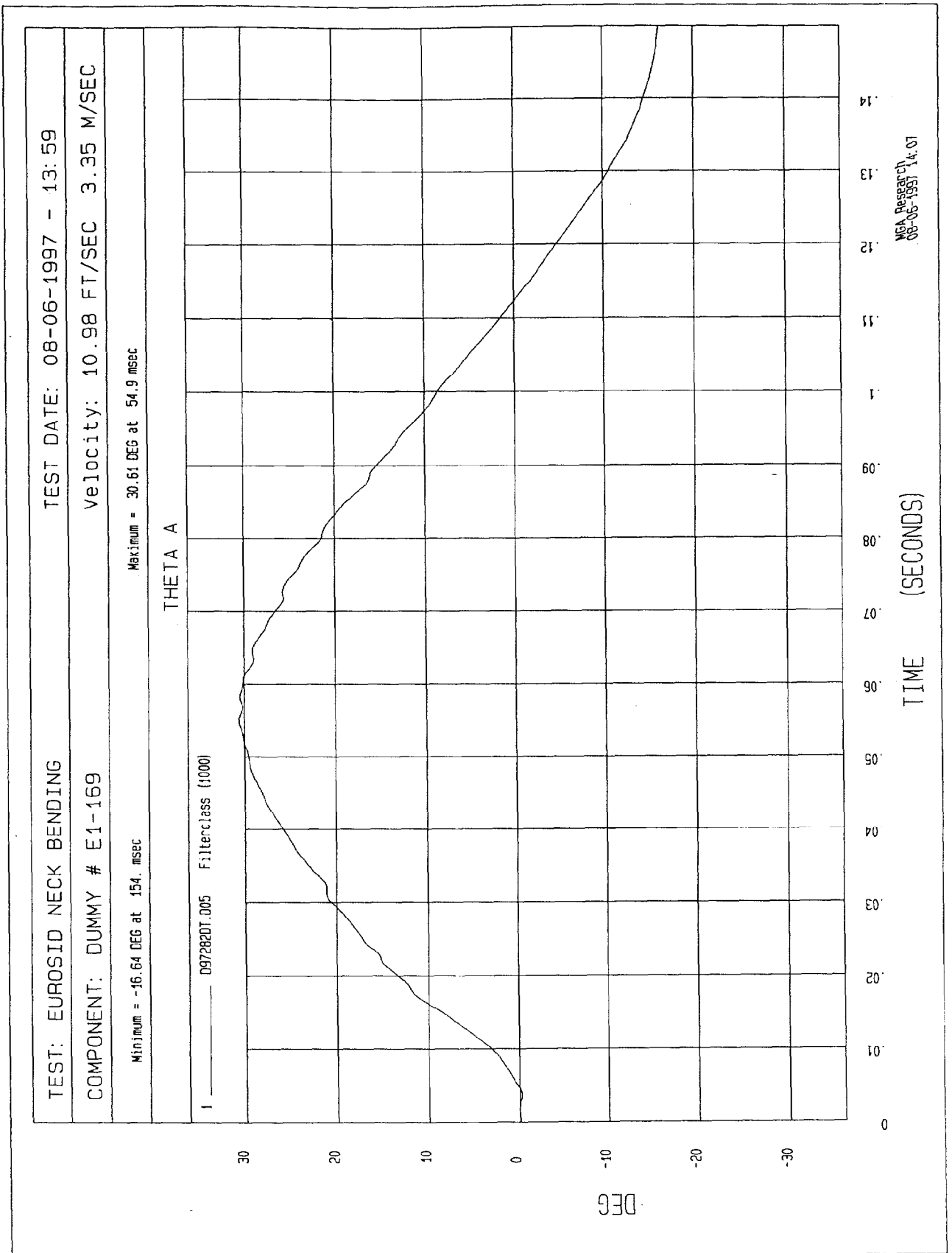
.12

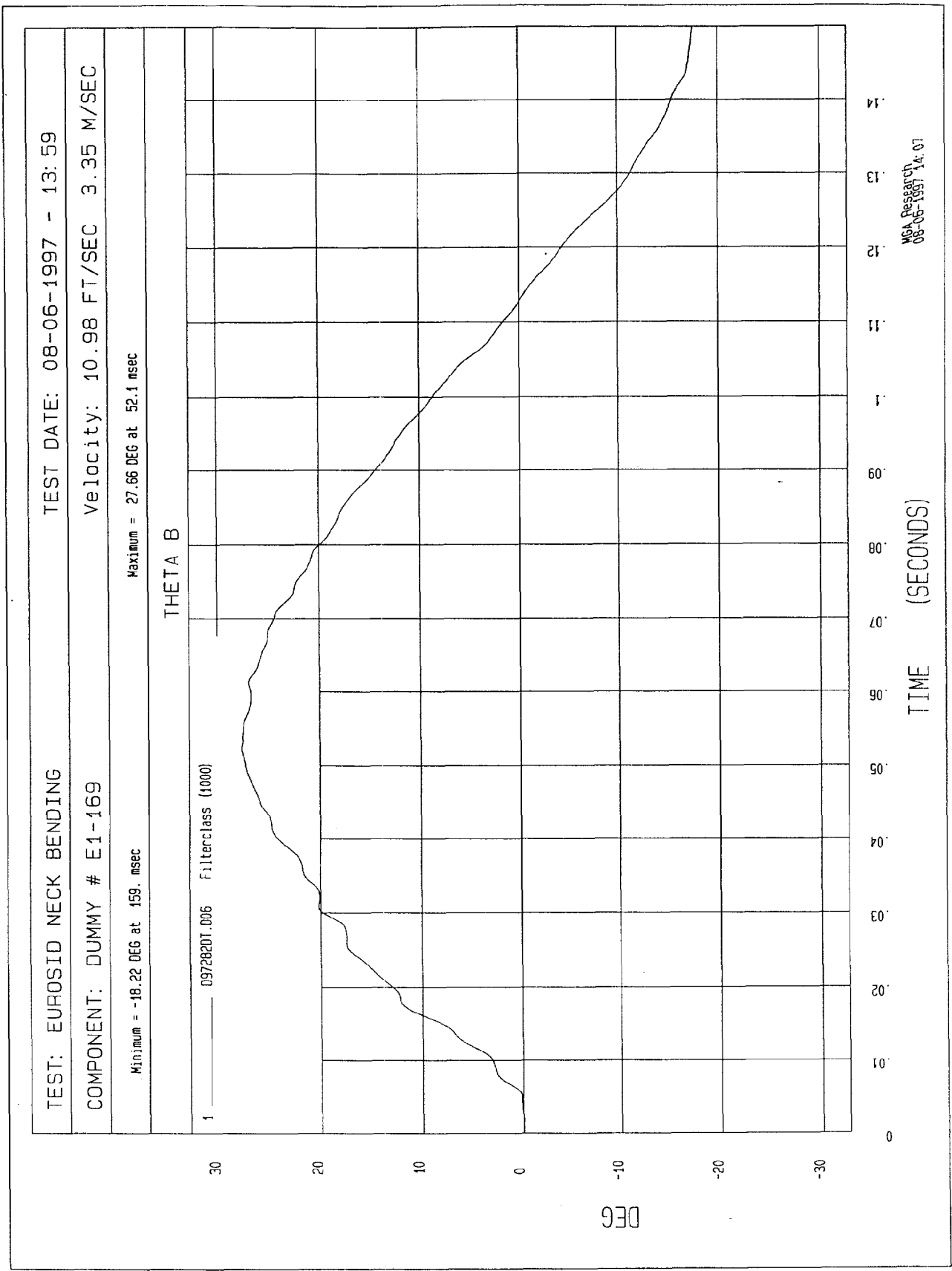
.13

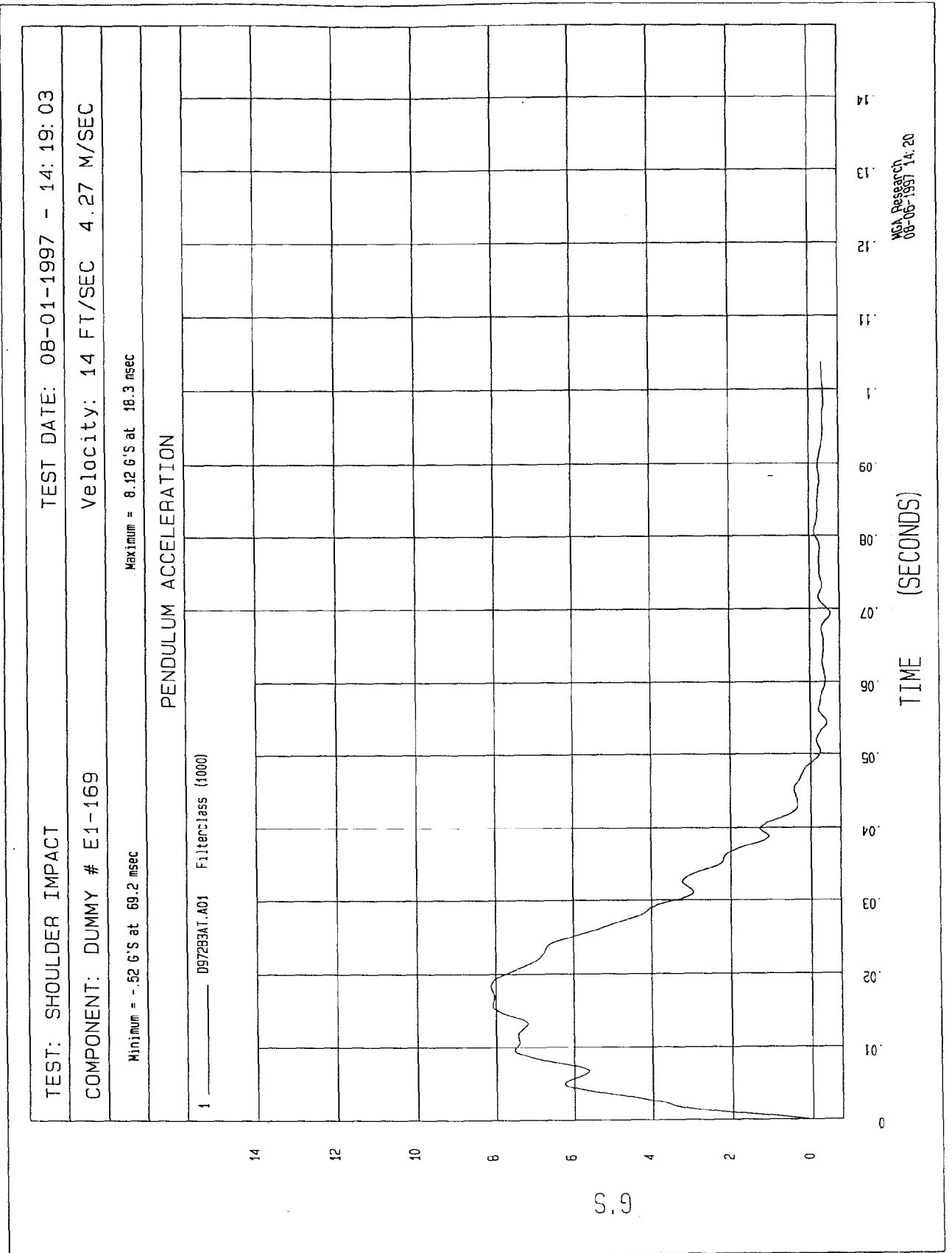
.14

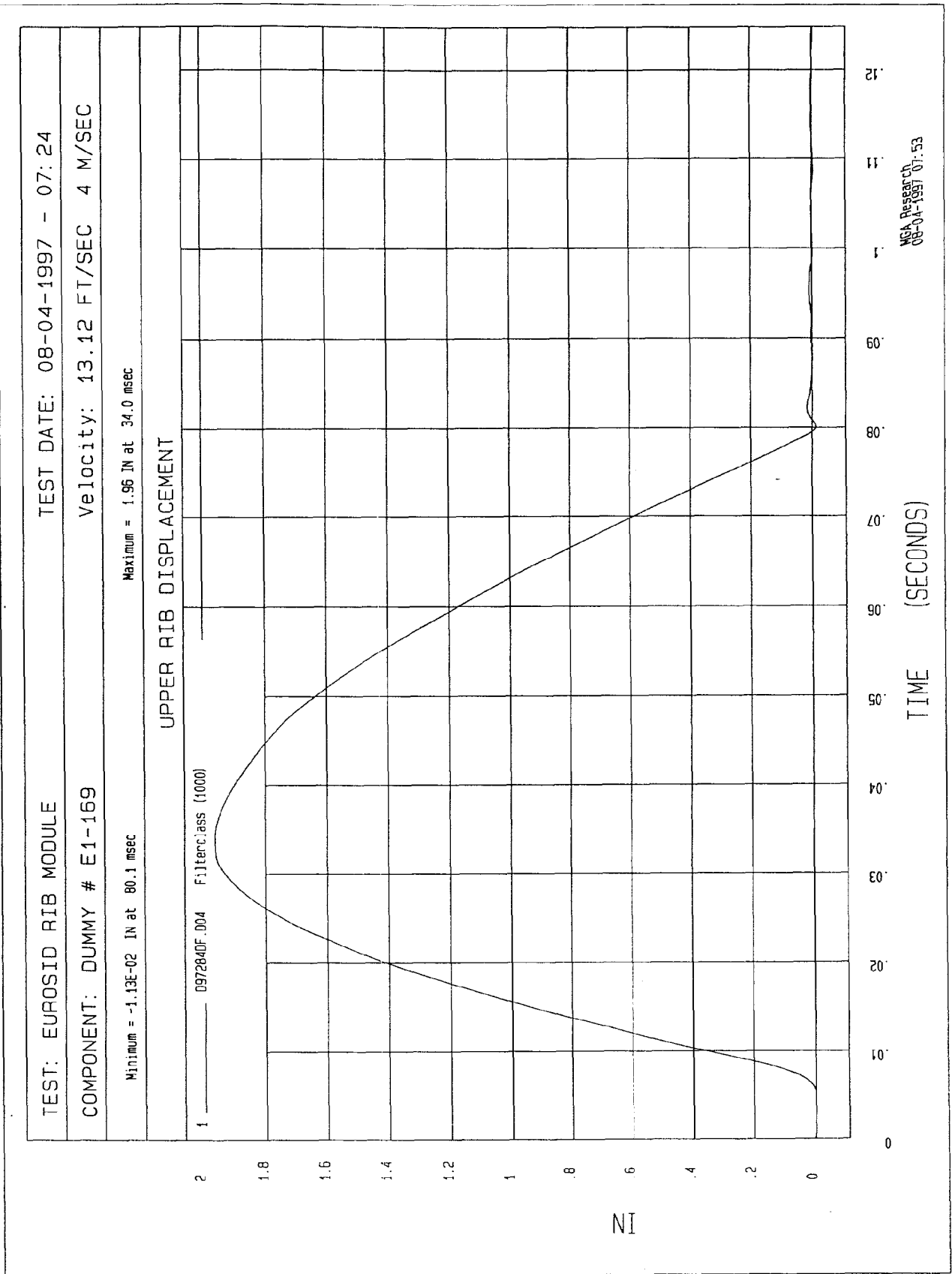
TIME (SECONDS)

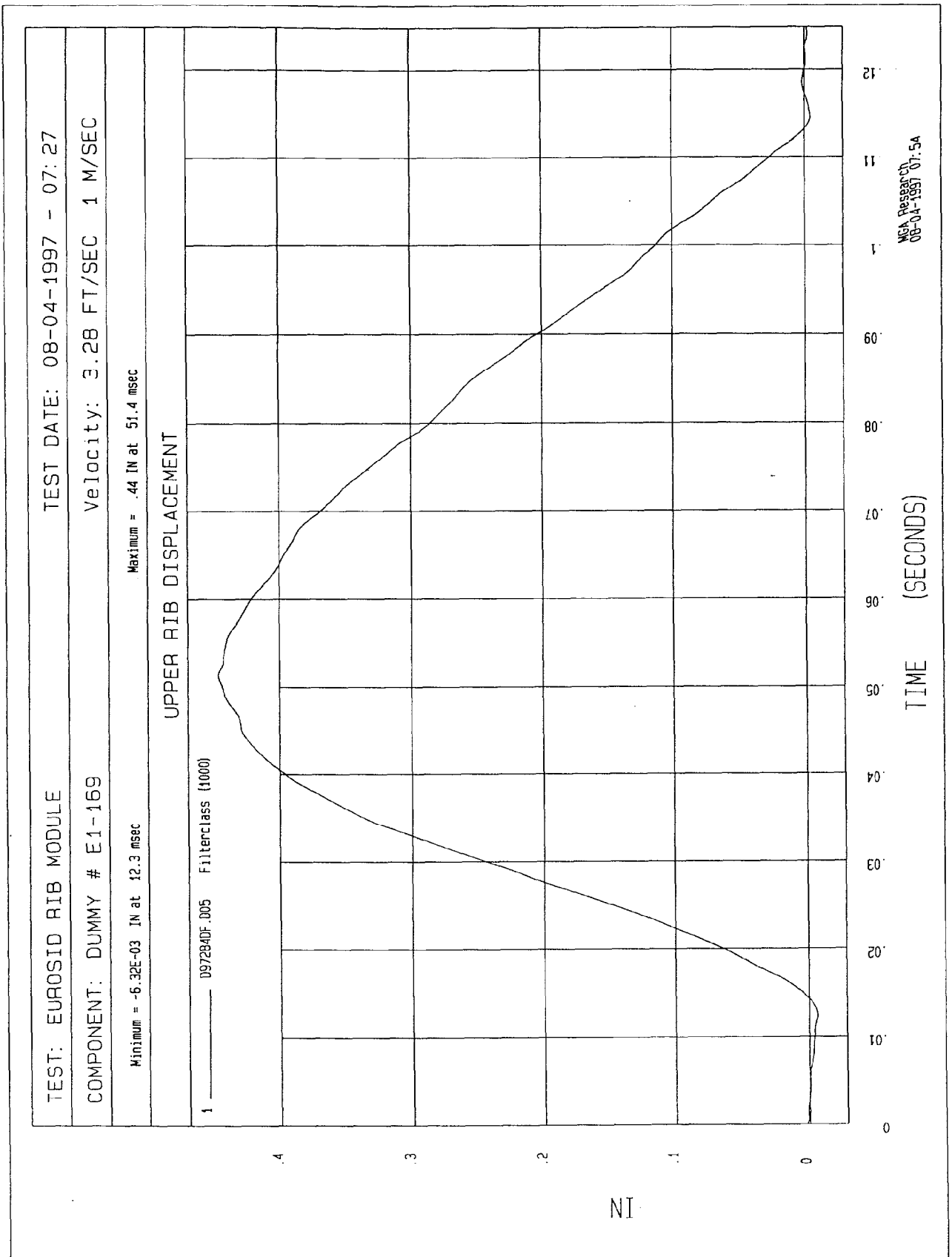
WGA Research
08-06-1997 14:06

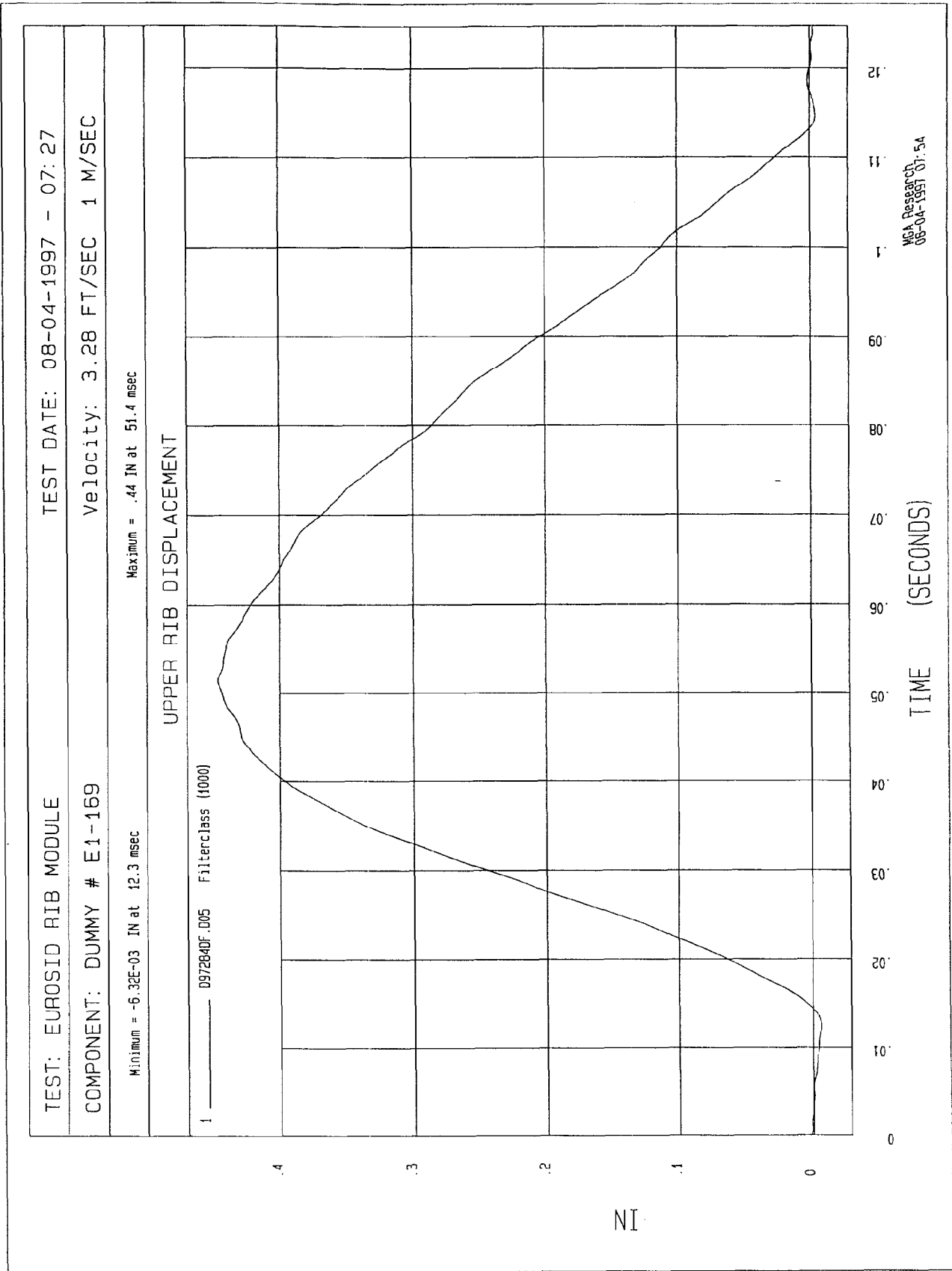


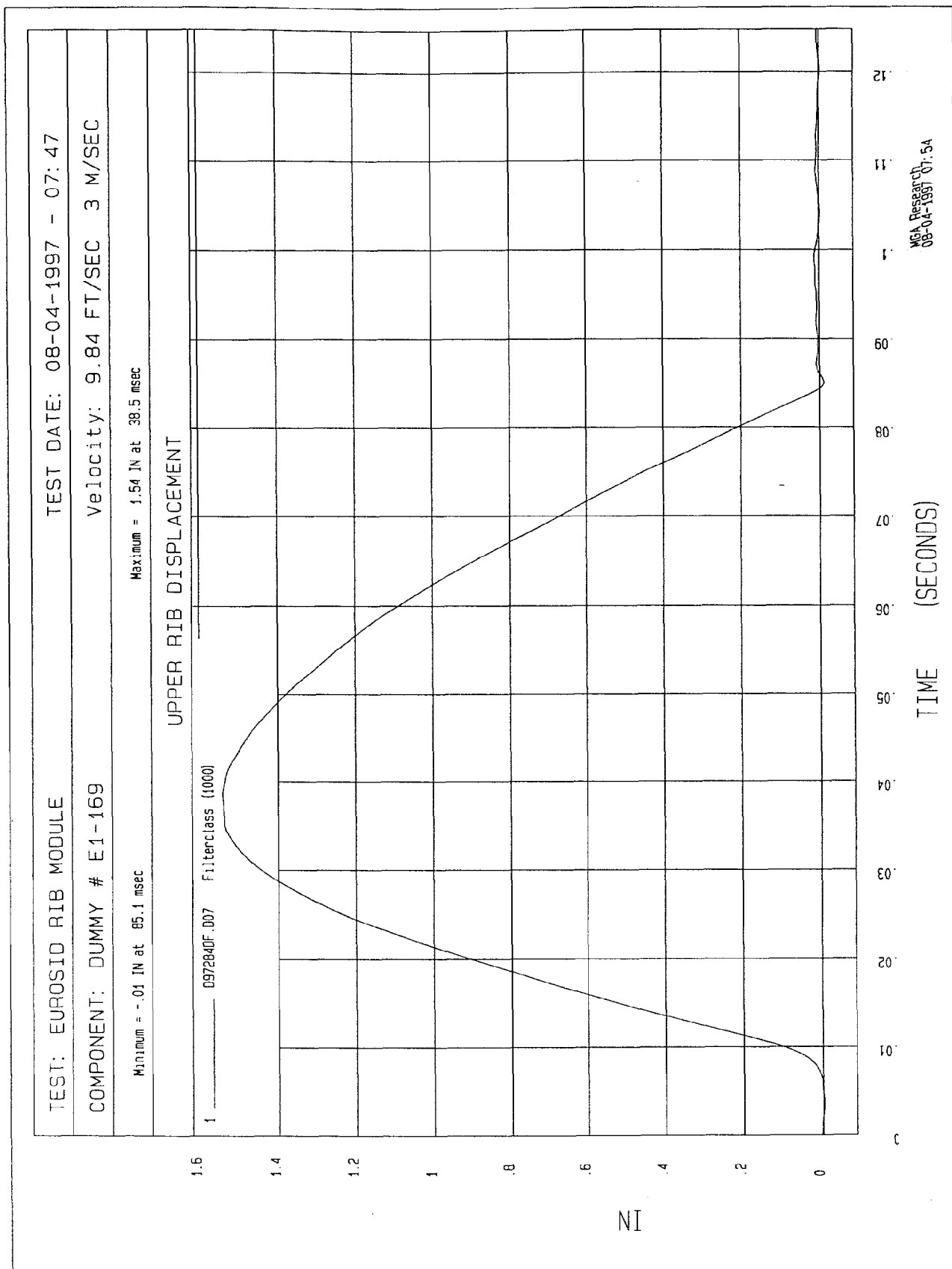


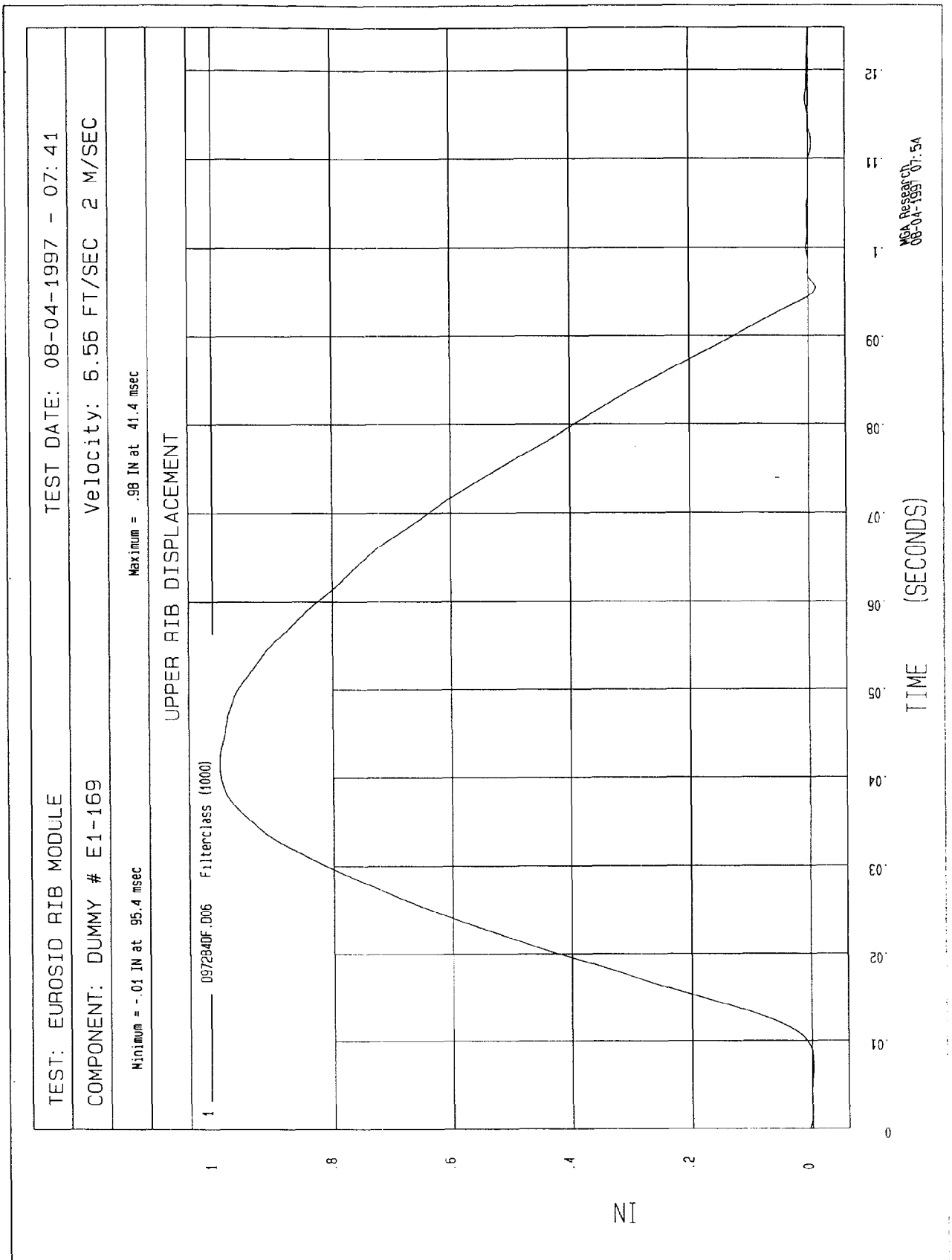


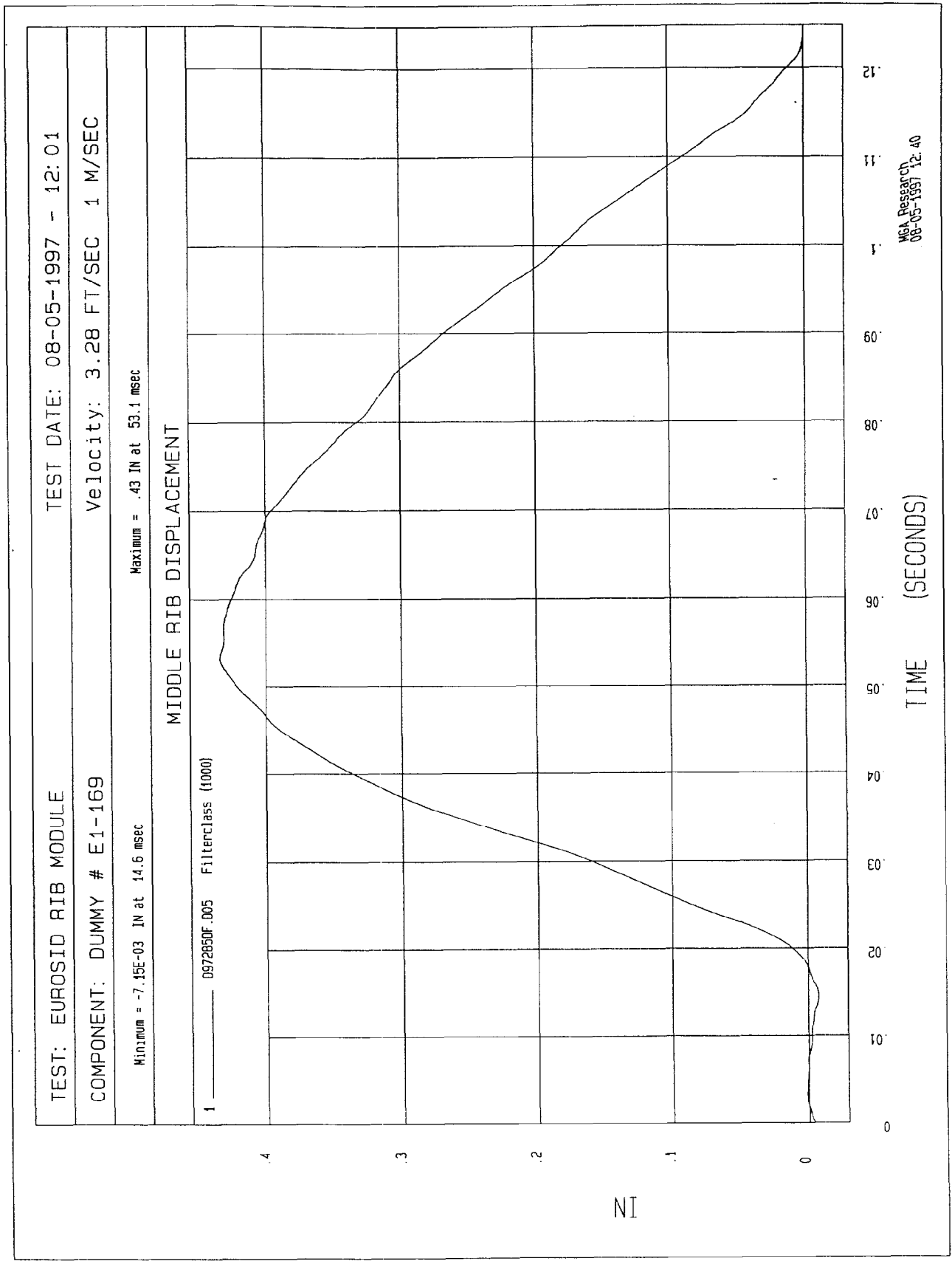


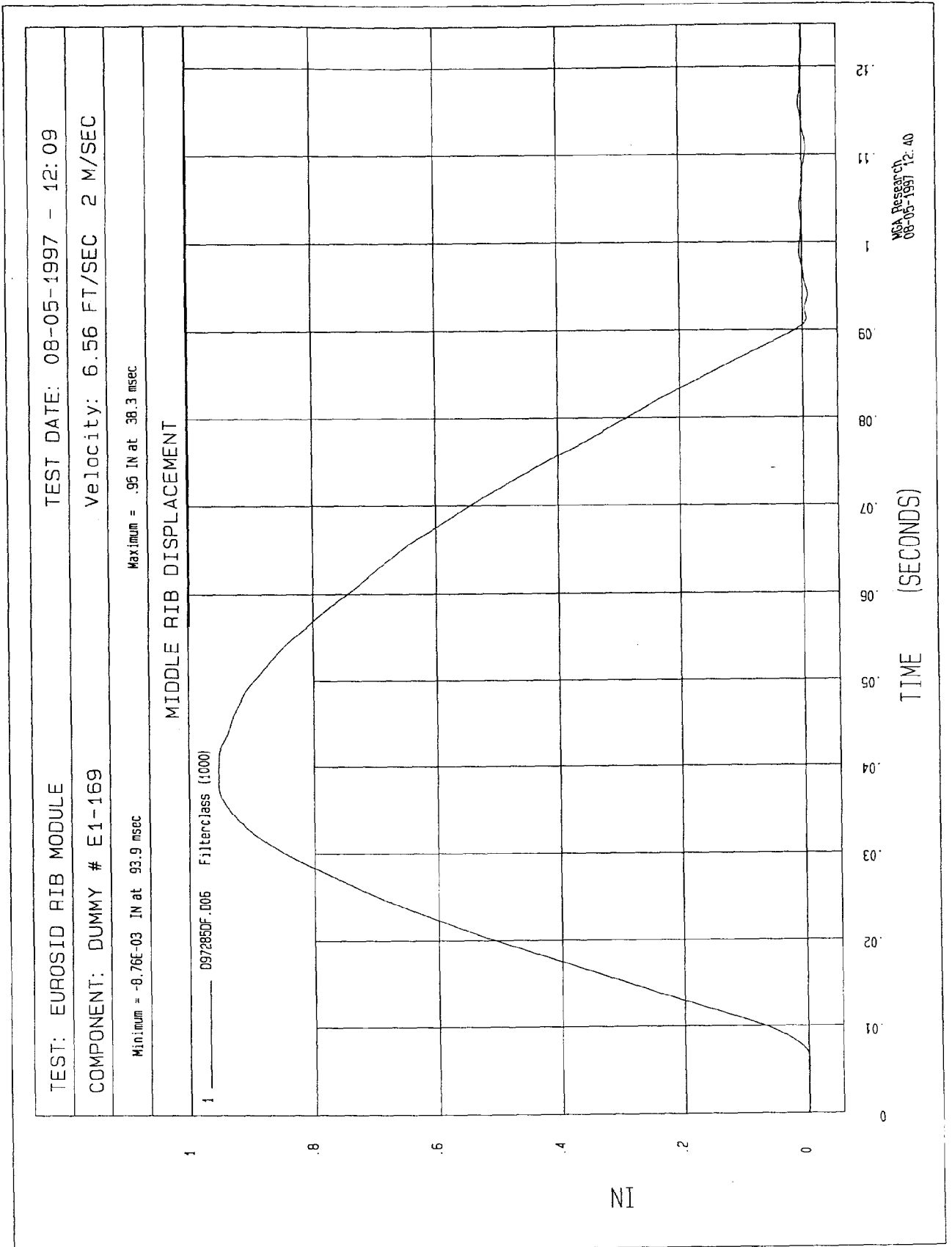


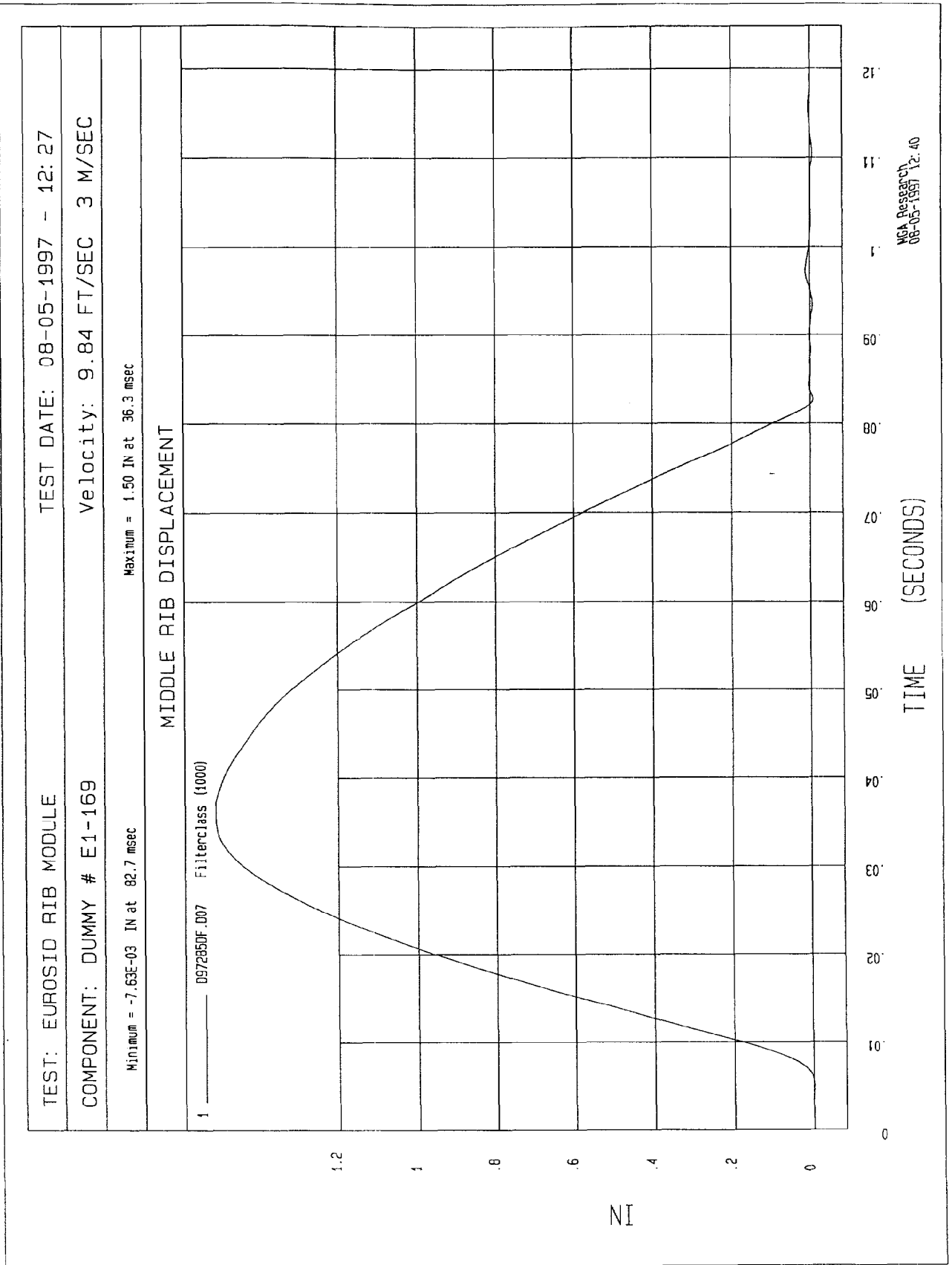


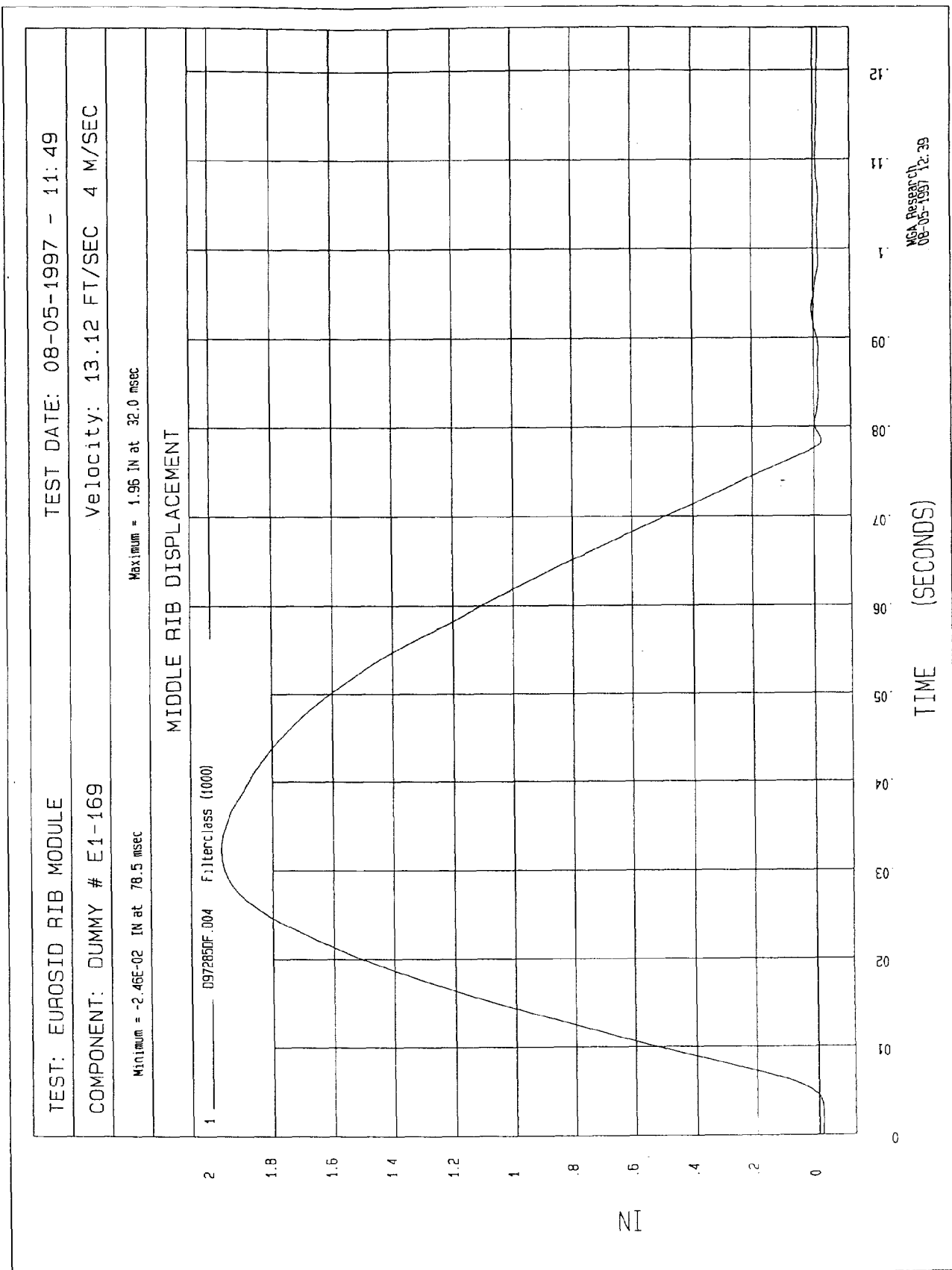


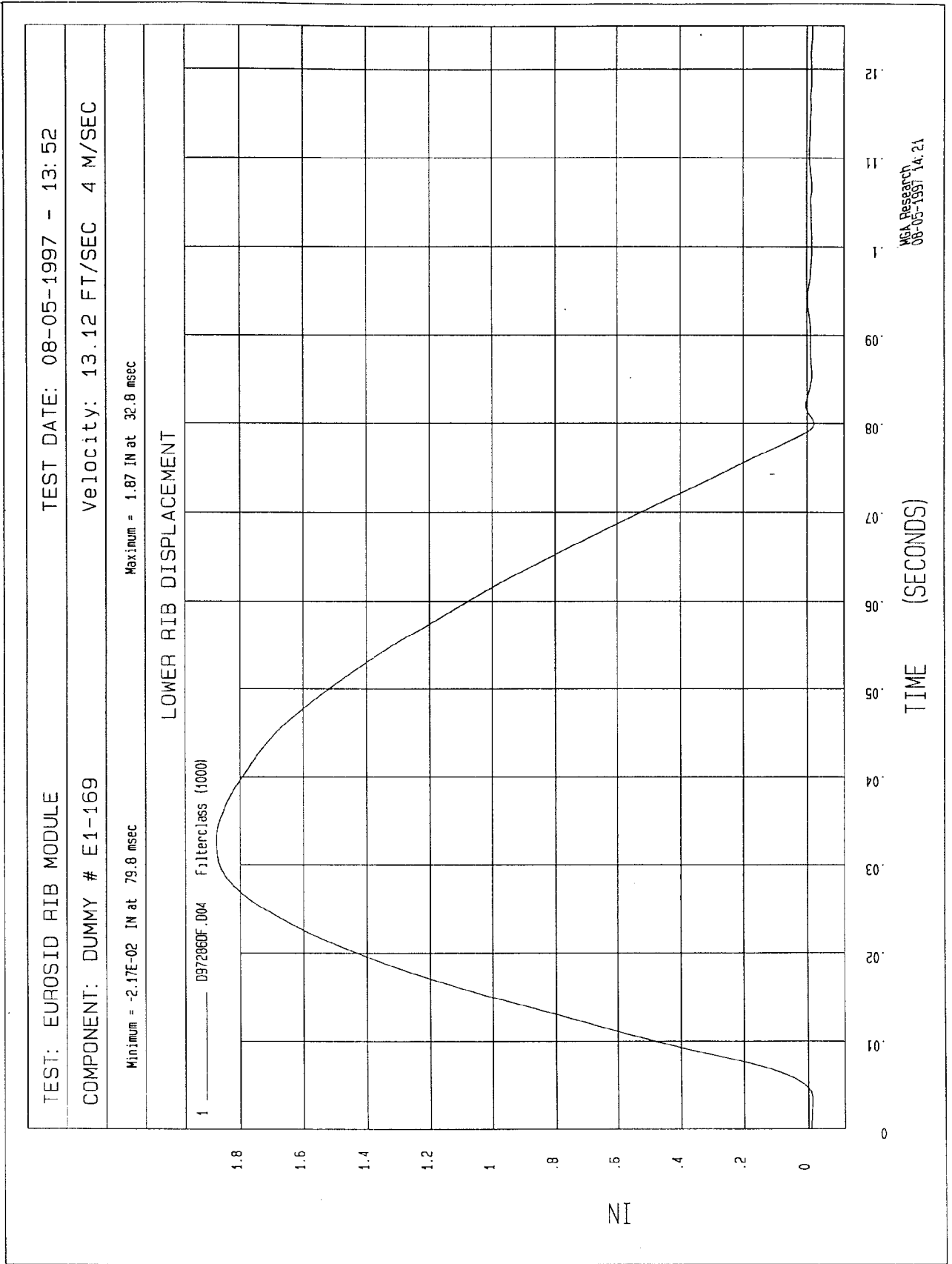












TEST: EUROSID RIB MODULE

TEST DATE: 08-05-1997 - 14:01

COMPONENT: DUMMY # E1-169

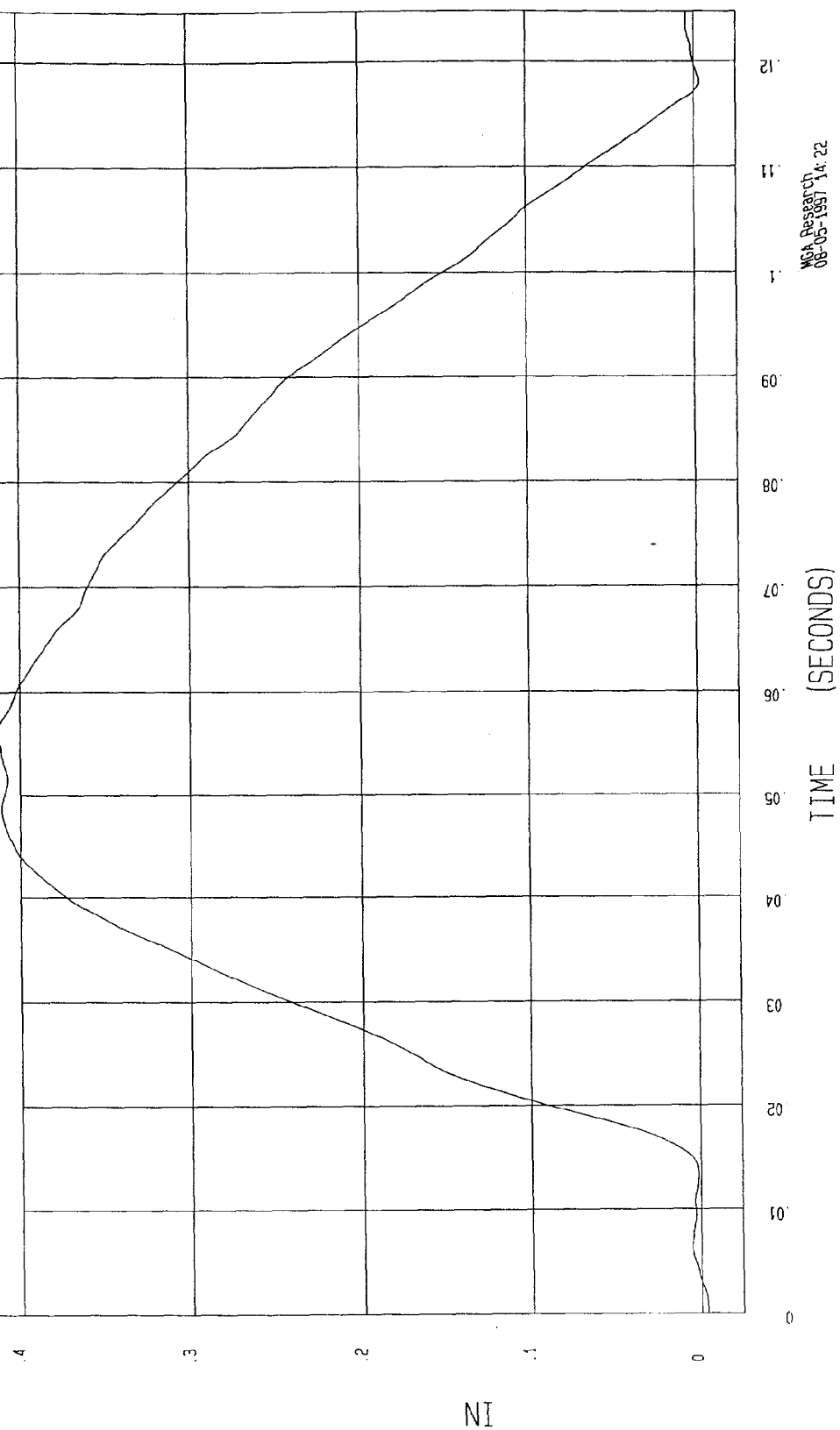
Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -3.51E-03 IN at .75 msec

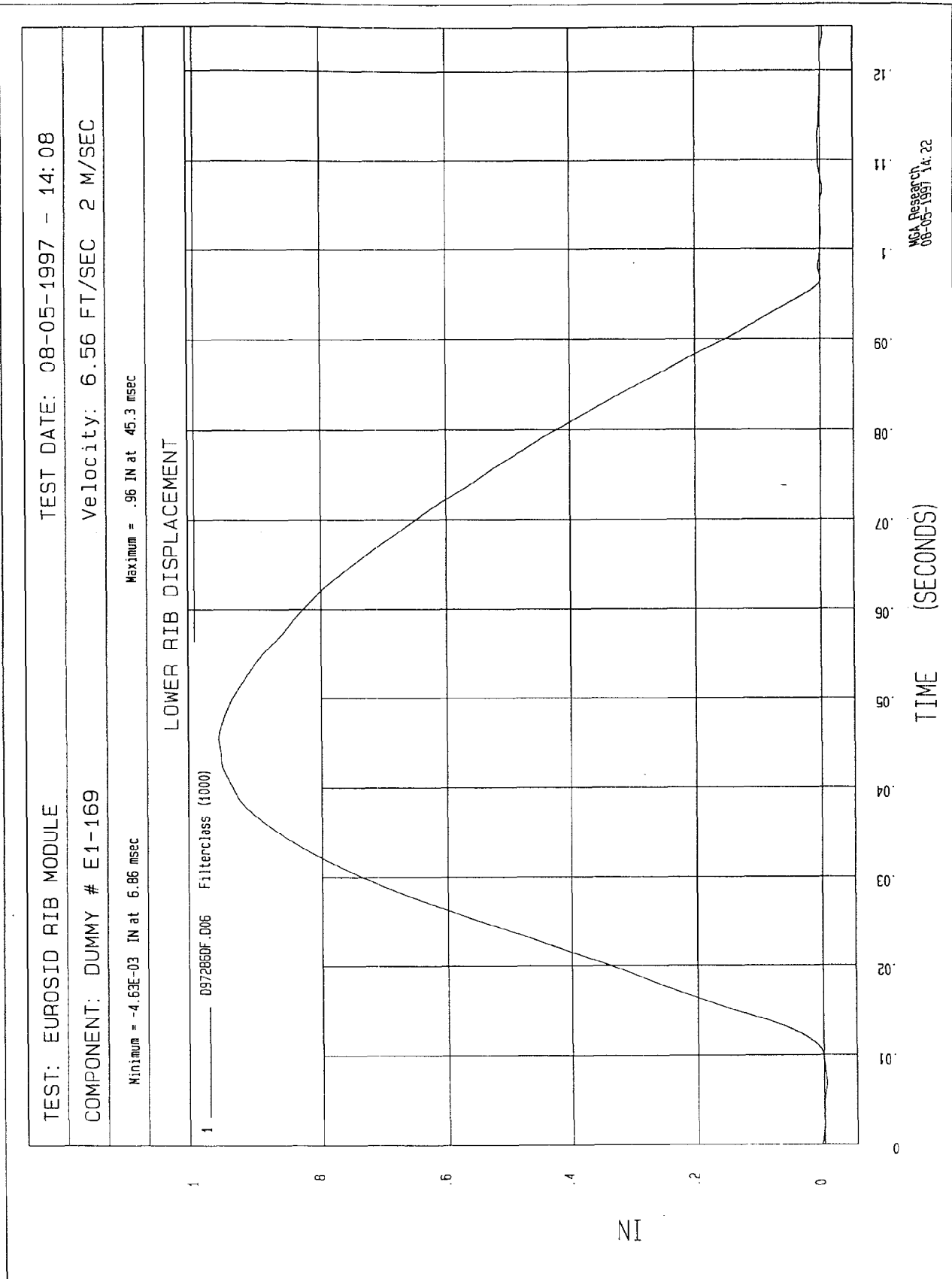
Maximum = .41 IN at 56.1 msec

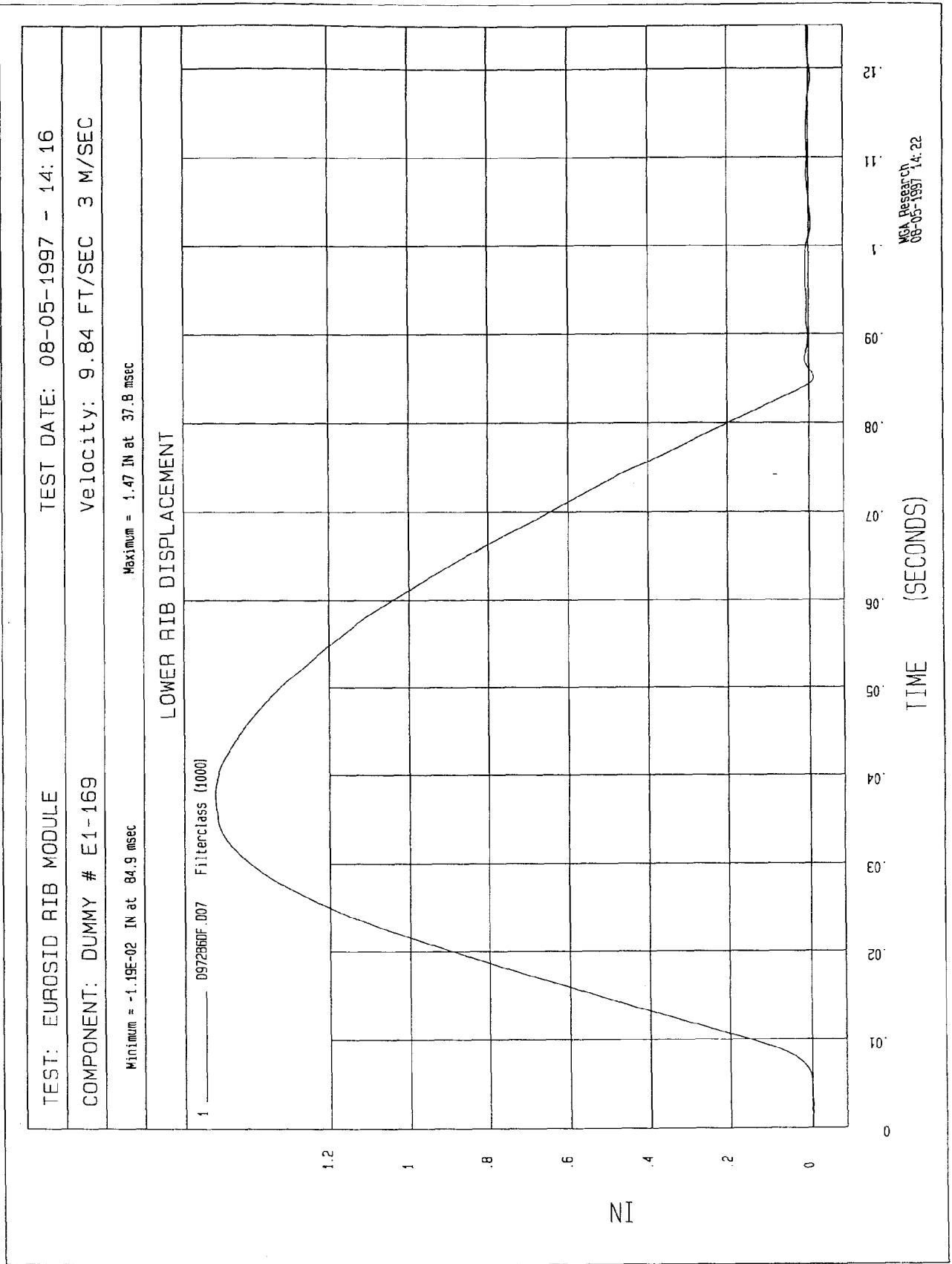
LOWER RIB DISPLACEMENT

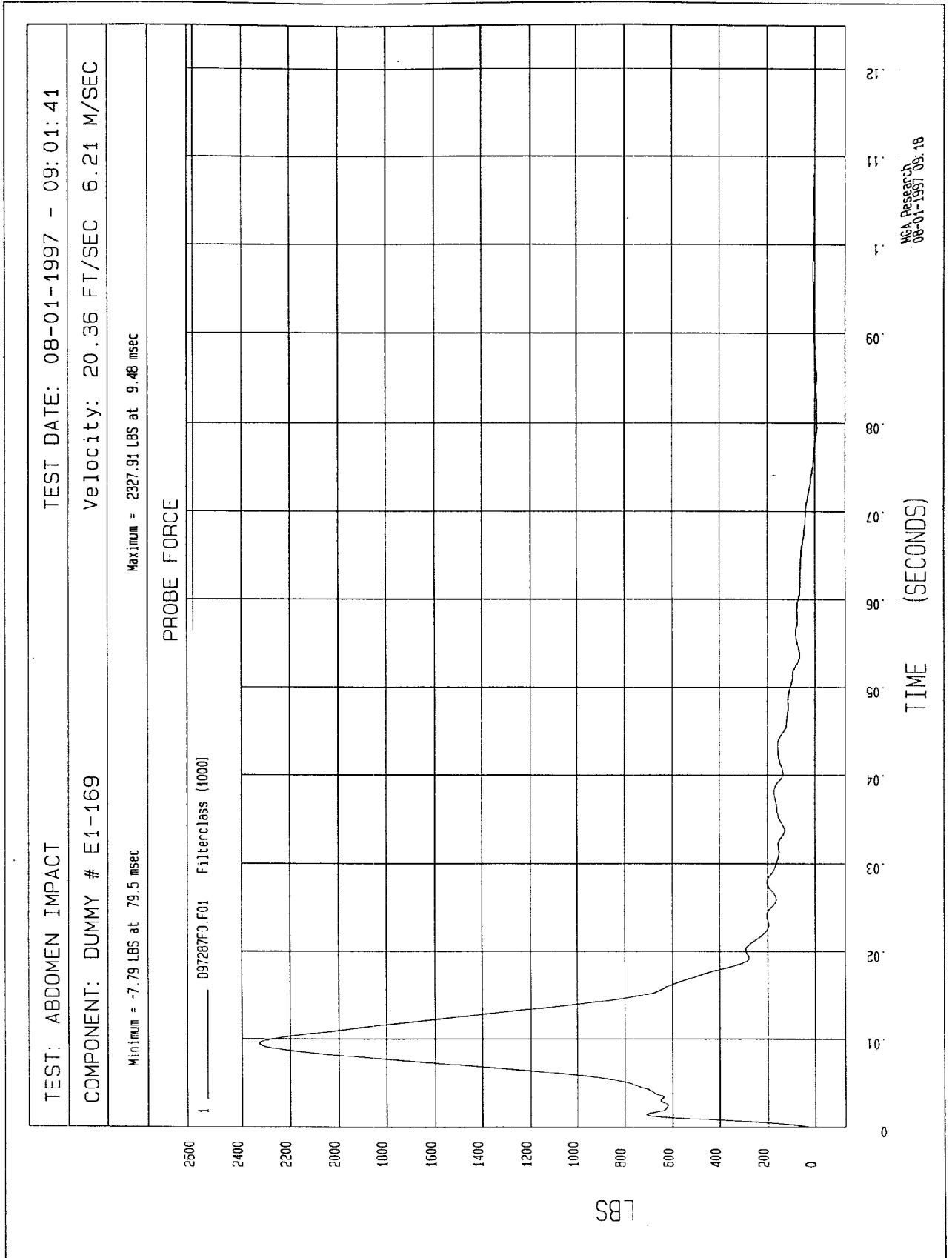
1 ——— D97266DF .005 Filterclass (1000)

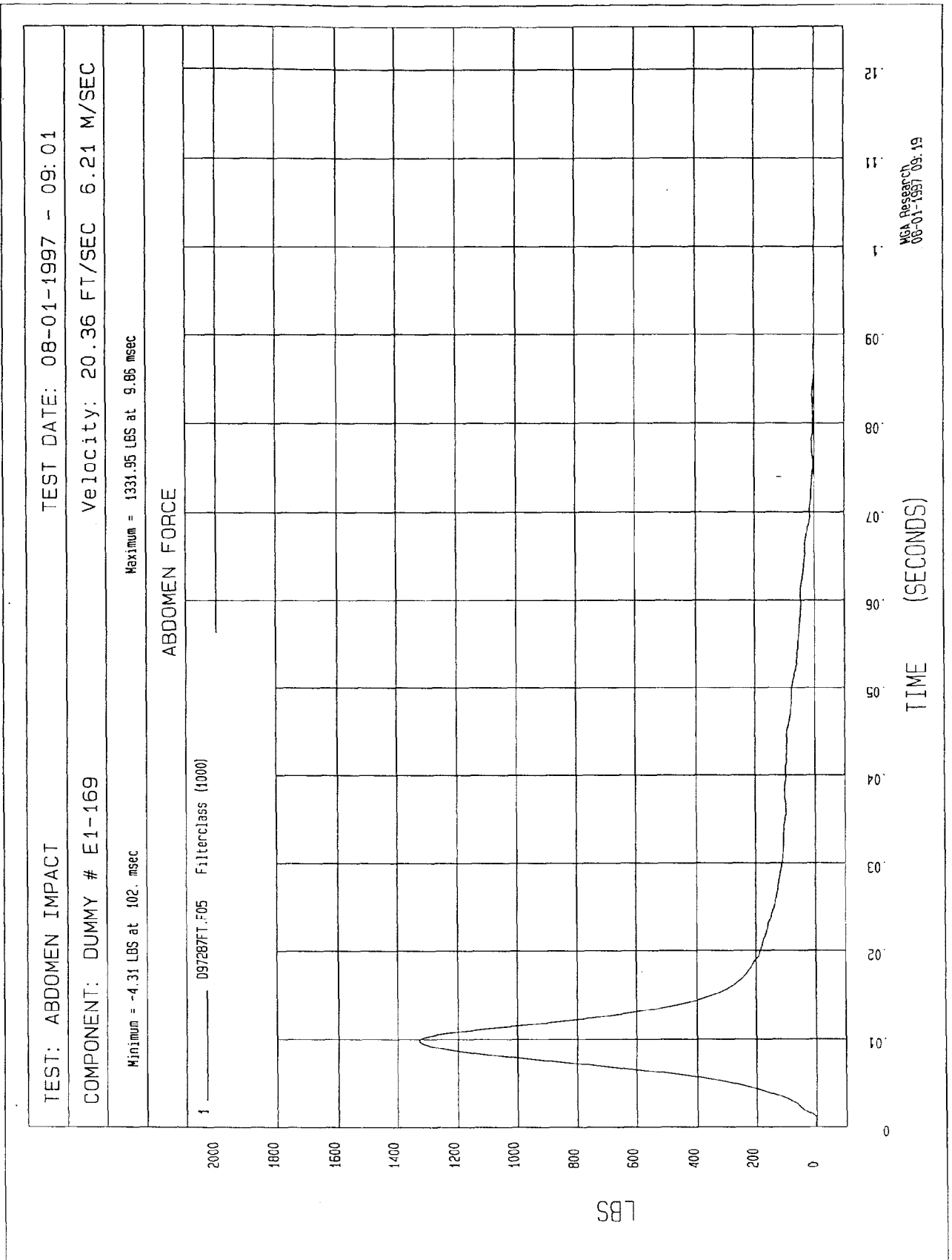


MCA Research
08-05-1997 14:22









EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM9617-1

Temperature : 22 deg C

Test number : 19916

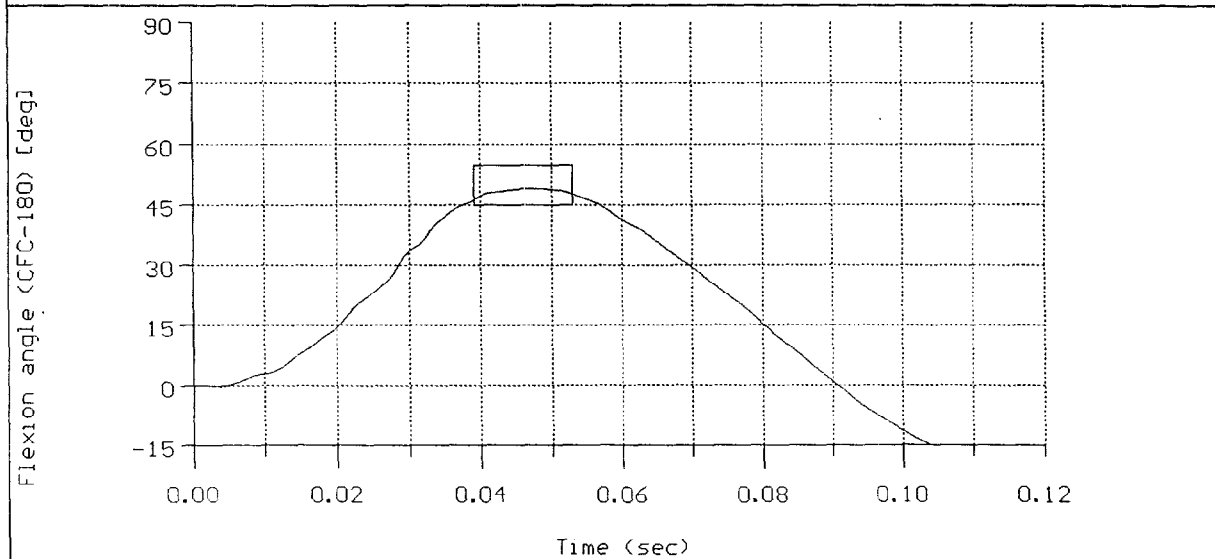
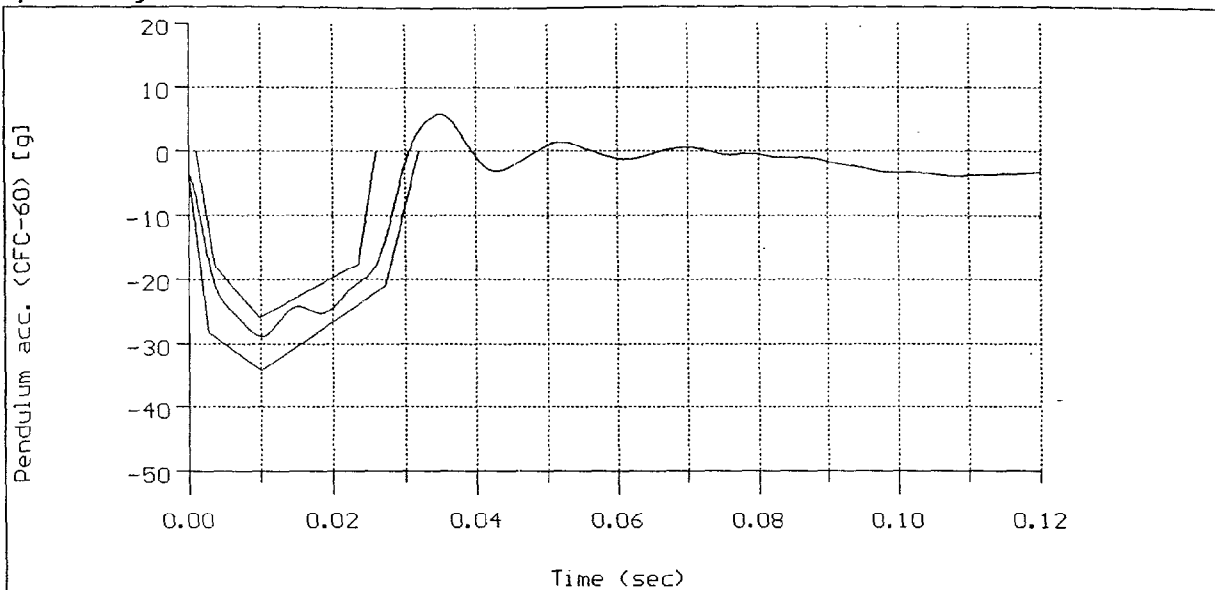
Rel. Humidity : 42 %

Impact side :

Technician :

Spine length :

Test date : 25-JULY-1997



Parameter	Specification	Result	Passed/Failed
Pendulum Speed	5.95 - 6.15 m/s	6.08 m/s	
Maximum pendulum acc.		-28.9 g	
Time of max pend. acc.		10.0 msec	
Maximum flexion angle	45.0 - 55.0 deg	48.9 deg	
Time of max. flex. angle	39.0 - 53.0 msec	46.7 msec	

EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM9647-1

Temperature : 22 deg C

Test number : 19916

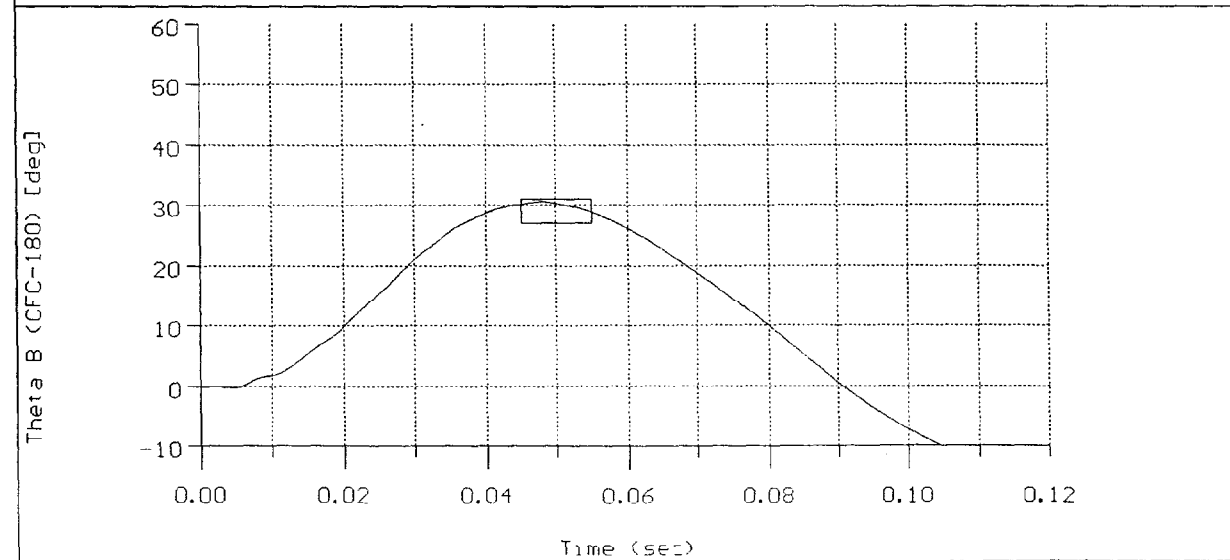
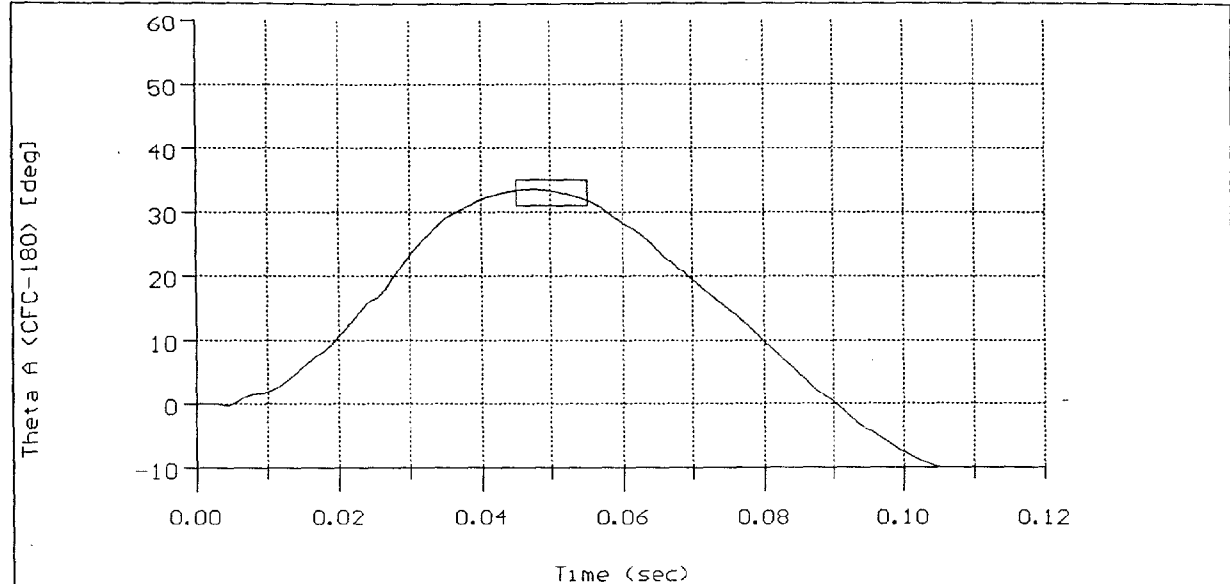
Rel. Humidity : 42 %

Impact side :

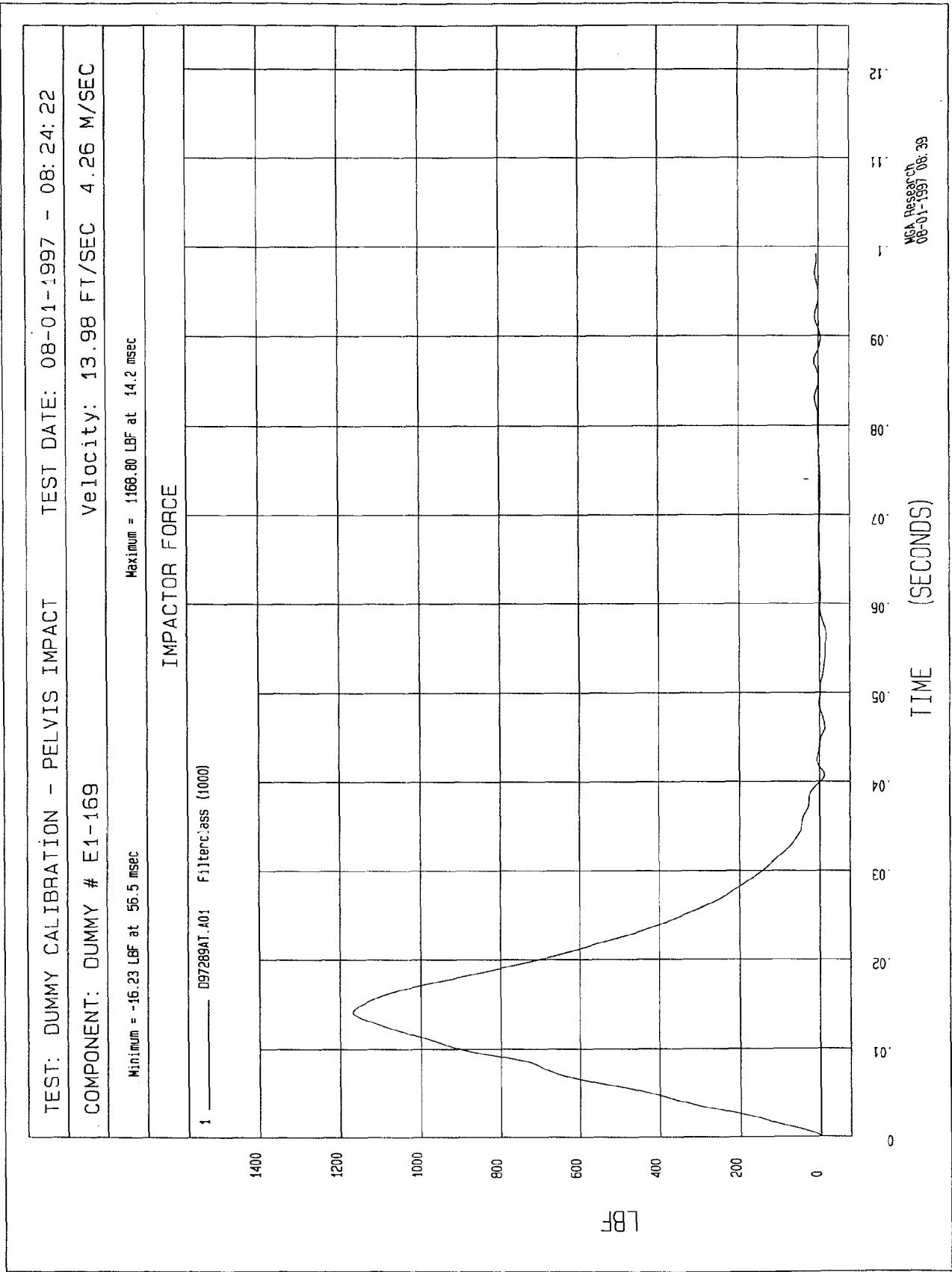
Technician :

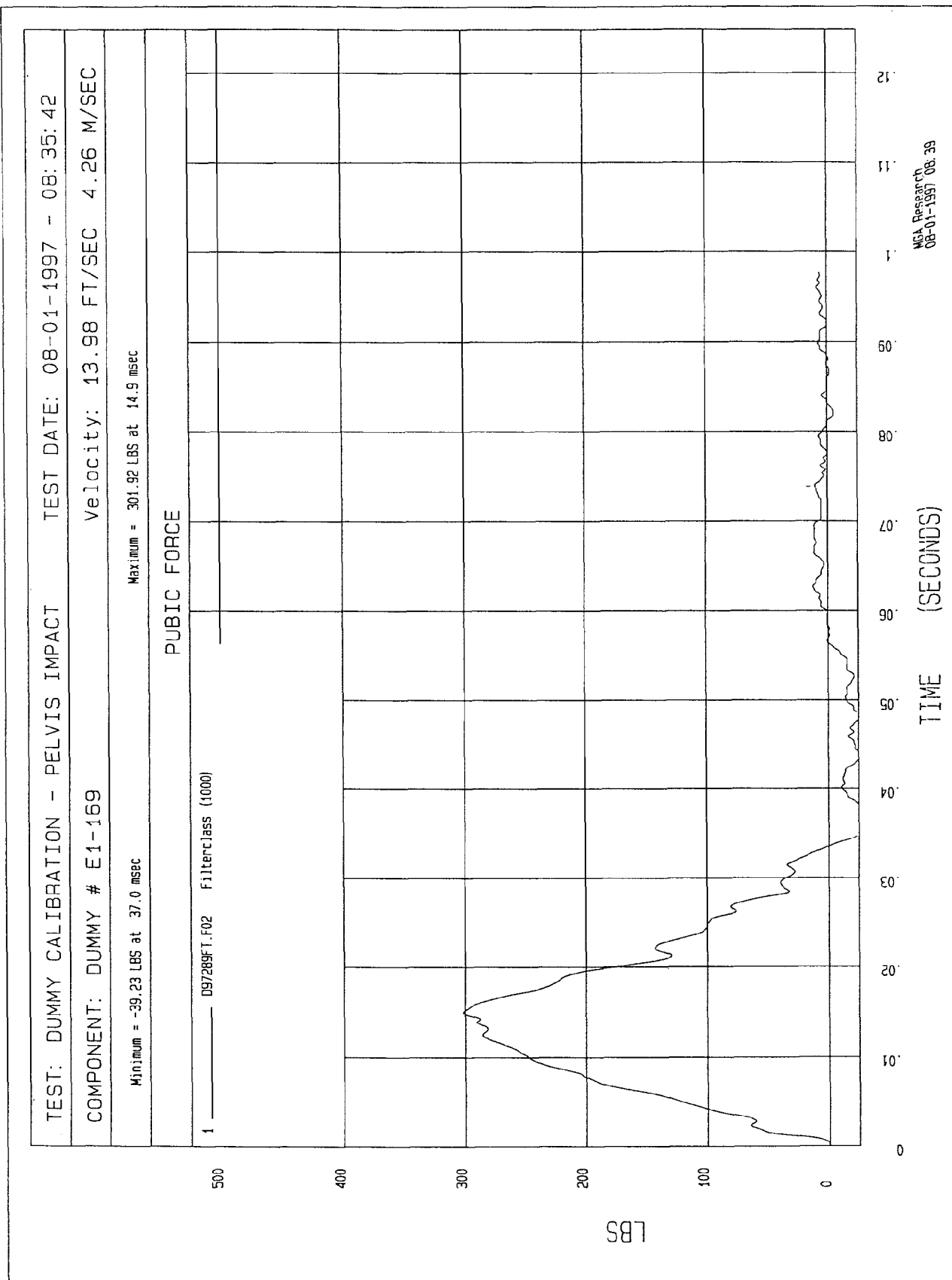
Spine length :

Test date : 25-JULY-1997



Parameter	Specification	Result	Passed/Failed
Maximum Theta(A)	31.0 - 35.0 deg	33.4 deg	
Time of max. Theta(A)	45.0 - 55.0 msec	46.6 msec	
Maximum Theta(B)	27.0 - 31.0 deg	30.6 deg	
Time of max. Theta(B)	45.0 - 55.0 msec	47.9 msec	





EUROSID DUMMY PRE-TEST CALIBRATION DATA SUMMARY SHEET

Dummy #: E1-213

Calibration Date: August 6, 1997

1.0 Head Drop Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	43%
Max. Resultant Acceleration	100 - 150 g's	126
Time of Max. Res. Acceleration		2.6 msec.

Calibrated By: Tim Michnay

Date: August 6, 1997

2.0 Neck Pendulum Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	42%
Pendulum Speed	10.83 - 11.48 ft/sec	11.00
Max. Pendulum Acceleration		-34.35
Time Max. Pend. Acceleration		9.73
Maximum Flexion Angle	46.0 - 56.0 deg.	53.4
Time of Max. Flexion Angle	50.0 - 62.0 ms	58.4
Maximum Angle Theta (A)	30.0 - 34.0 deg	31.6
Time of Max. Theta (A)	50.0 - 60.0 ms	55.0
Maximum Angle Theta (B)	26.0 - 30.0 deg.	28.9
Time of Max. Theta (B)	50.0 - 60.0 ms	53.5

Calibrated By: Tim Michnay

Date: August 6, 1997

3.0 Shoulder Impact Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	45%
Pendulum Speed	13.78 - 14.43 ft/sec	14.05
Max. Pendulum Acceleration	7.5 - 10.5 g's	8.0
Time of Max. Pendulum Acceleration		18.6

Calibrated By: Tim Michnay

Date: August 1, 1997

4.0 Upper Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	36%
Displacement at 3.28 ft/sec	.39 - .55 in	.41
Displacement at 6.56 ft/sec	.93 - 1.08 in	.93
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.47
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.83

Calibrated By: Tim Michnay

Date: August 5, 1997

5.0 Middle Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	36%
Displacement at 3.28 ft/sec	.39 - .55 in	.43
Displacement at 6.56 ft/sec	.93 - 1.08 in	.96
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.47
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.84

Calibrated By: Tim Michnay

Date: August 5, 1997

6.0 Lower Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	43%
Displacement at 3.28 ft/sec	.39 - .55 in	.41
Displacement at 6.56 ft/sec	.93 - 1.08 in	.95
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.45
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.87

Calibrated By: Tim MichnayDate: August 6, 1997**7.0 Abdomen Test**

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Probe Speed	20.34 - 20.99 ft/sec	20.53
Maximum Impact Force	2136 - 2495 lbs	2445
Time of Maximum Force	8.8 - 10.4 ms	9.1
Max. Total Abdomen Force	1326 - 1776 lbs	1351
Time of Max. Total Force	8.5 - 10.1 ms	9.1

Calibrated By: Tim MichnayDate: August 1, 1997

8.0 Lumbar Spine Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	42%
Pendulum Speed	19.52 - 20.17 ft/sec	19.95
Max. Pendulum Acceleration		-28.06
Time Max. Pend. Acceleration		10.10
Maximum Flexion Angle	45.0 - 55.0 deg.	50.1
Time of Max. Flexion Angle	39.0 - 53.0 ms	50.0
Maximum Angle Theta (A)	31.0 - 35.0 deg	34.3
Time of Max. Theta (A)	45.0 - 55.0 ms	50.1
Maximum Angle Theta (B)	27.0 - 31.0 deg.	32.7
Time of Max. Theta (B)	45.0 - 55.0 ms	49.5

Calibrated By: First Technology Safety Systems

Date: July 25, 1997

9.0 Pelvis Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Pendulum Speed	13.77 - 14.43 ft/sec	14.10
Maximum Impactor Force	989 - 1214 lbs	1125
Time of Max. Impactor Force	10.3 - 15.5 ms	11.2
Maximum Pubic Force	233.8 - 368.7 lbs	287.0
Time of Max. Pubic Force	9.9 - 15.9 ms	14.2

Calibrated By: Tim Michnay

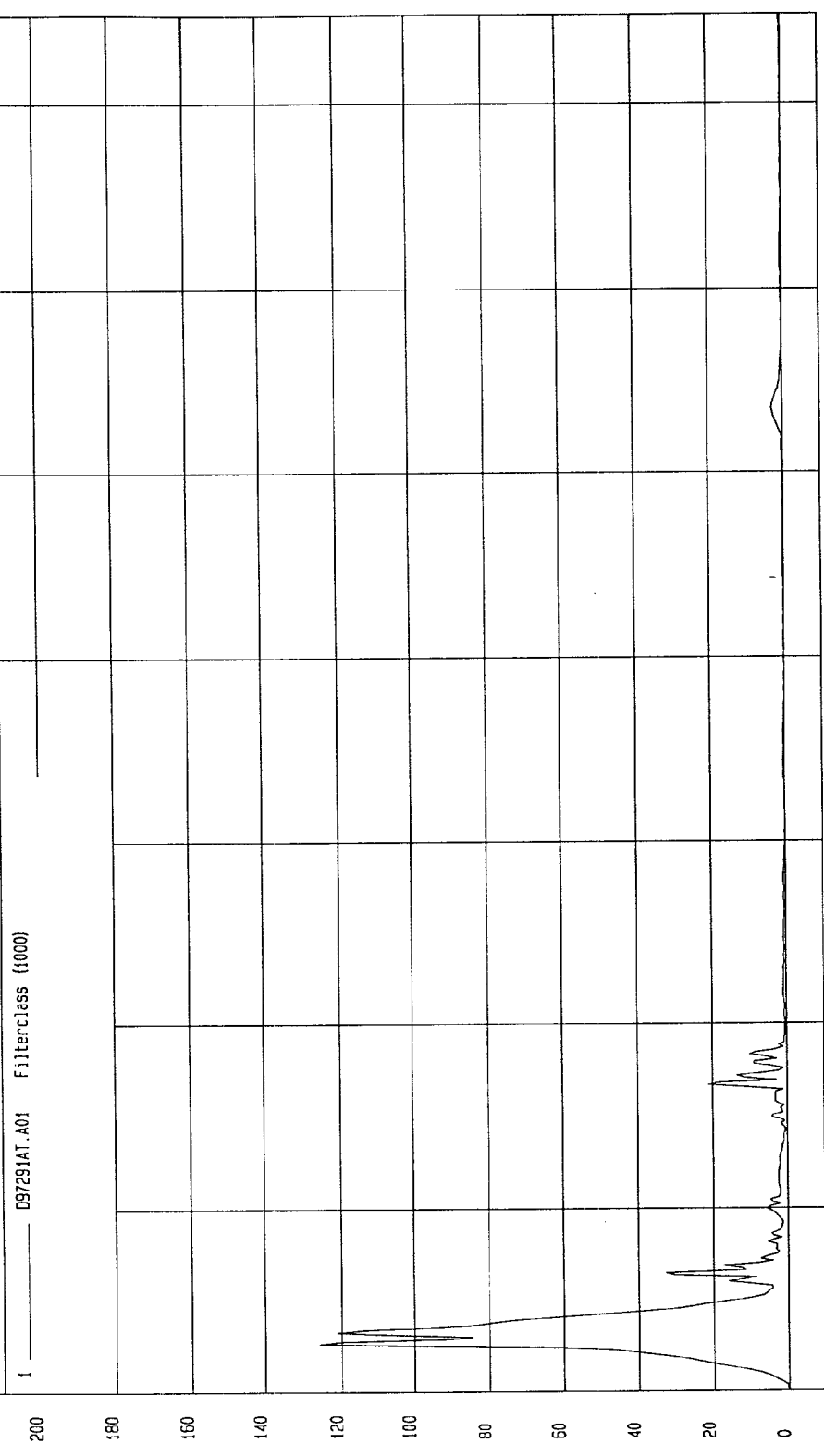
Date: August 1, 1997

TEST: DUMMY CALIBRATION - HEAD DROP TEST DATE: 08-06-1997 - 11:42:16

COMPONENT: DUMMY # E1-213

Minimum = 3.38E-02 G'S at 65.1 msec Maximum = 125.92 G'S at 2.62 msec

PEAK RESULTANT ACCELERATION



MGA Research
08-06-1997 11:43

TEST: EUROSID NECK BENDING

TEST DATE: 08-06-1997 - 14:29

COMPONENT: DUMMY # E1-213

Velocity: 11 FT/SEC 3.35 M/SEC

Minimum = -34.35 G'S at 9.73 msec

Maximum = 5.81 G'S at 49.4 msec

PENDULUM ACCELERATION

1 097292AT.A04

10

0

-10

-20

-30

-40

G

0.3

0.2

0.1

0

TIME (SECONDS)

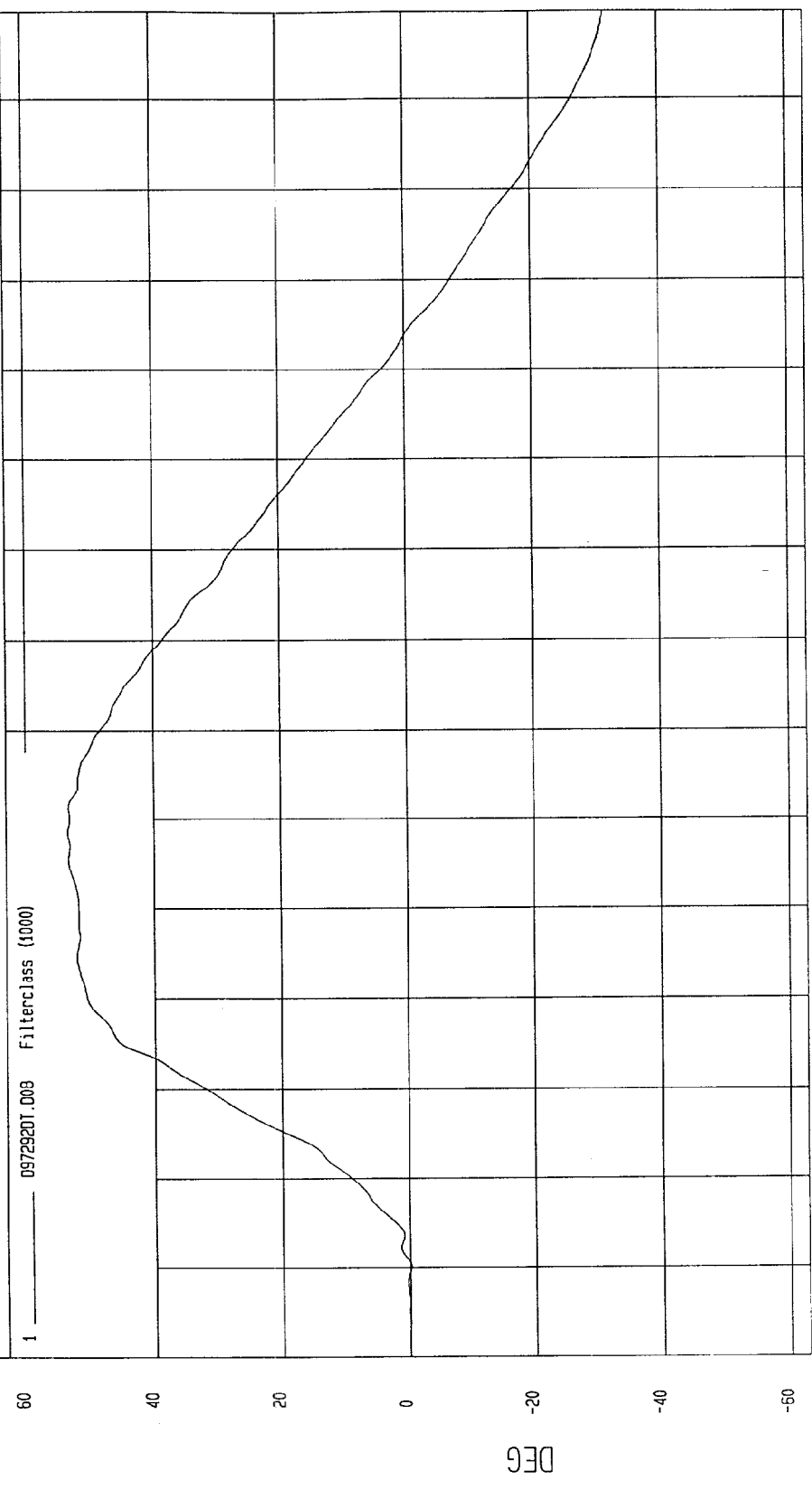
MGA Research
08-06-1997 14:32

TEST: EUROSID NECK BENDING TEST DATE: 08-06-1997 - 14: 29

COMPONENT: DUMMY # E1-213 Velocity: 11 FT/SEC 3.35 M/SEC

Minimum = -32.45 DEG at 156. msec Maximum = 53.35 DEG at 58.4 msec

FLEXION ANGLE



TIME (SECONDS)

MCA Research
08-06-1997 14: 33

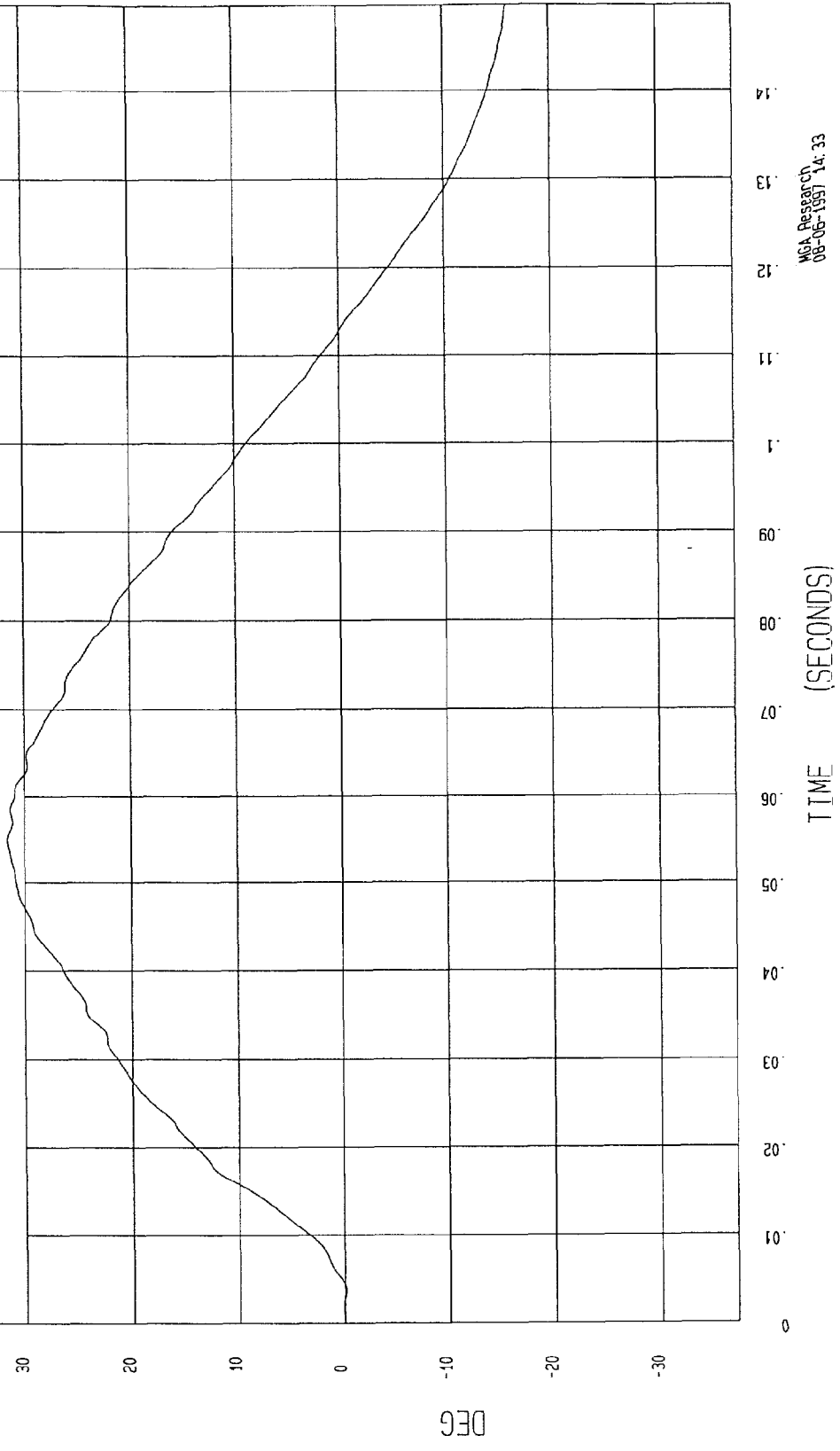
TEST: EUROSID NECK BENDING TEST DATE: 08-06-1997 - 14:29

COMPONENT: DUMMY # E1-213 Velocity: 11 FT/SEC 3.35 M/SEC

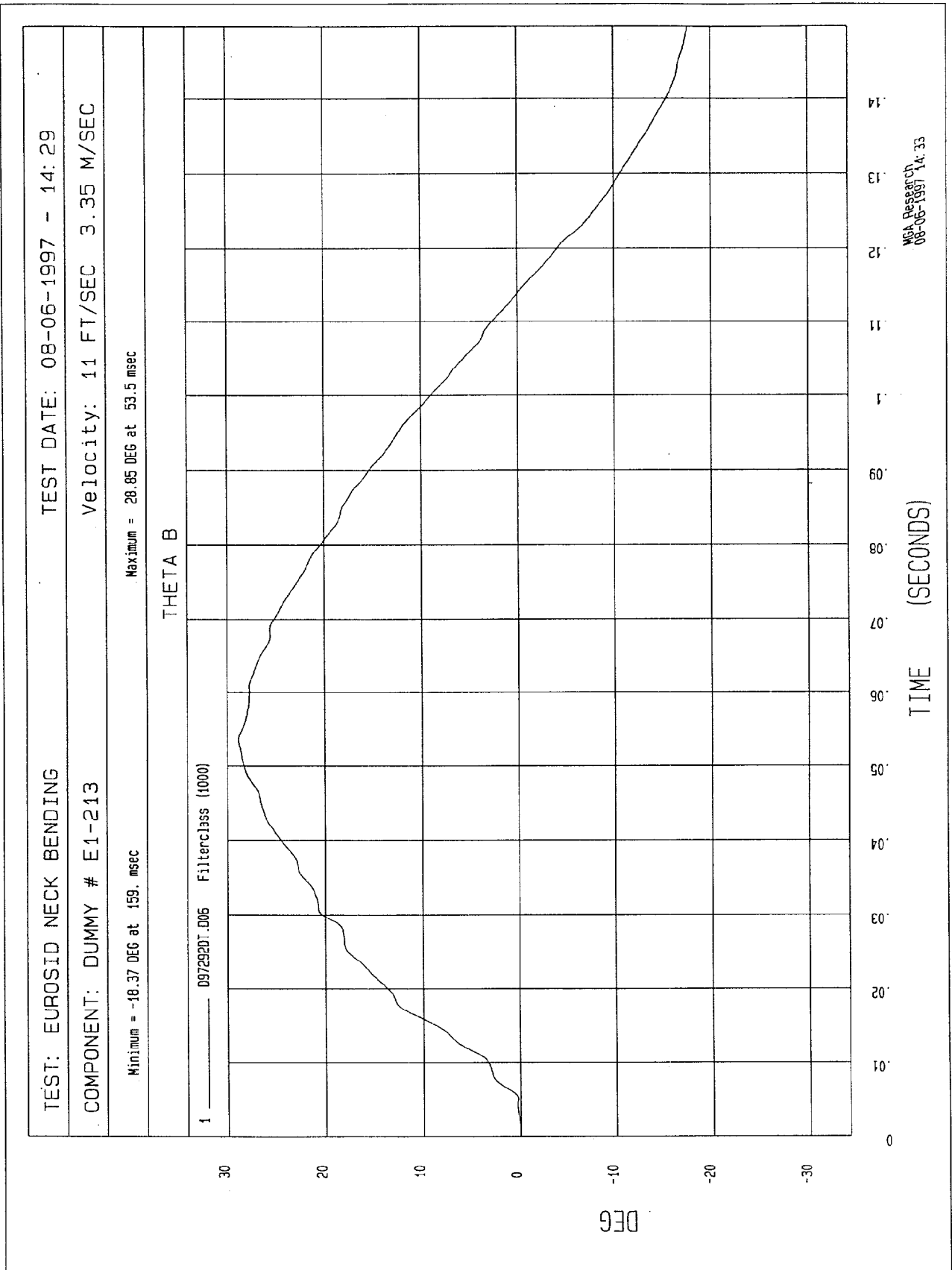
Minimum = -16.44 DEG at 157. msec Maximum = 31.63 DEG at 55.0 msec

THETA A

1 ——— 0972920T.D05 Filterclass (1000)



MGA Research
08-06-1997 14:33



TEST: SHOULDER IMPACT TEST DATE: 08-01-1997 - 13:47:32

COMPONENT: DUMMY # E1-213 Velocity: 14.05 FT/SEC 4.28 M/SEC

Minimum = -.36 G'S at 65.0 msec Maximum = 8.02 G'S at 18.6 msec

PENDULUM ACCELERATION

1 _____ D97293AT.A01 Filterclass (1000)

14
12
10
8
6
4
2
0

G.S

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

TIME (SECONDS)

VCA Record Ch
08-01-1997 13:48

TEST: EUROSID RIB MODULE

TEST DATE: 08-05-1997 - 15:12

COMPONENT: DUMMY # E1-213

Velocity: 13.12 FT/SEC 4 M/SEC

Minimum = -3.60E-02 IN at 81.9 msec

Maximum = 1.83 IN at 31.5 msec

UPPER RIB DISPLACEMENT

1 ——— 097294DF.004 Filterclass (1000)

1.8

1.6

1.4

1.2

1

.8

.6

.4

.2

0

NI

0

.01

.02

.03

.04

.05

.06

.07

.08

.09

.1

.11

.12

TIME (SECONDS)

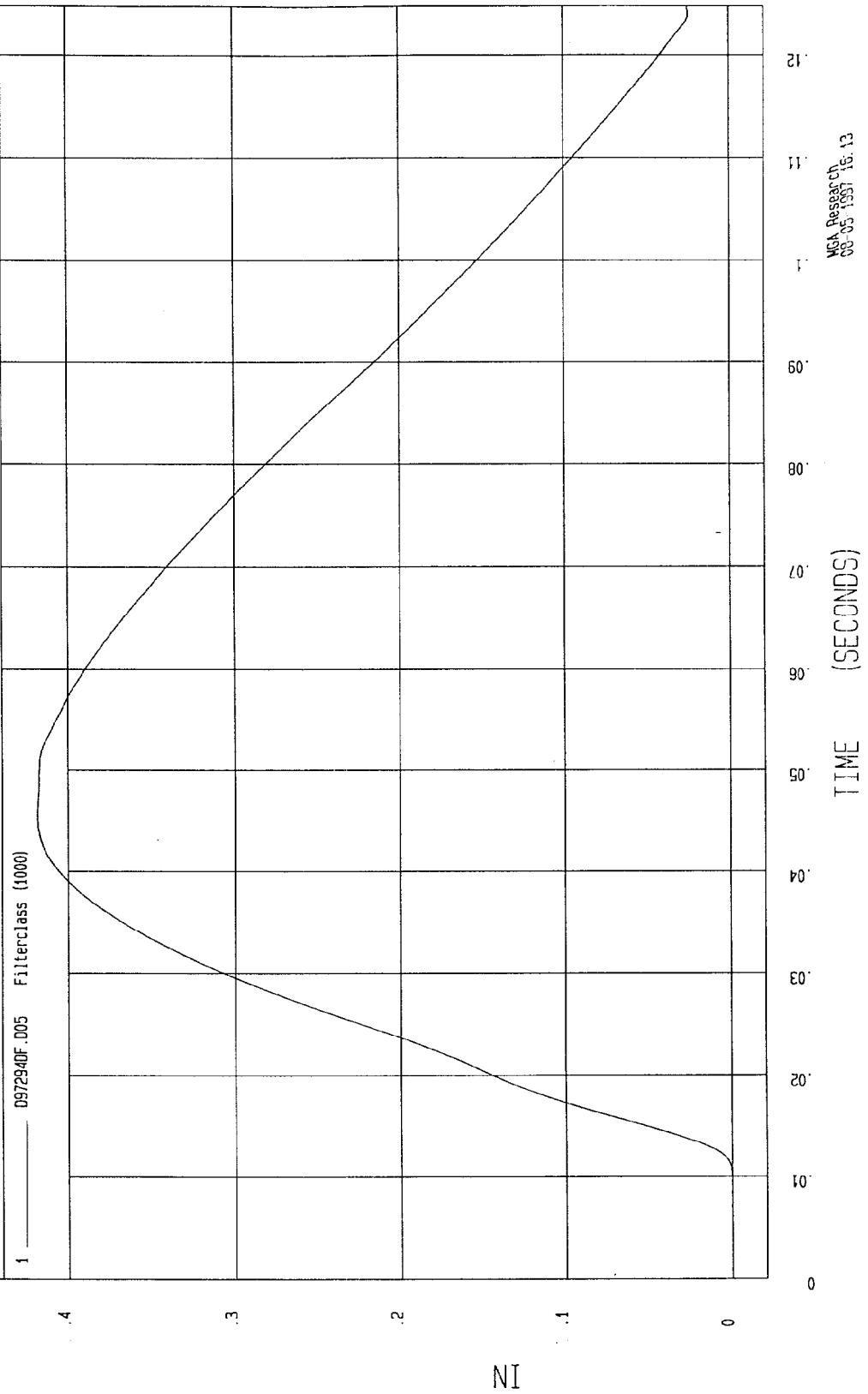
WCA Research
08-05-1997 16.13

TEST: EUROSID RIB MODULE TEST DATE: 08-05-1997 - 15:34

COMPONENT: DUMMY # E1-213 Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -6.58E-06 IN at 5.12 msec Maximum = .41 IN at 45.6 msec

UPPER RIB DISPLACEMENT



TEST: EUROSID RIB MODULE TEST DATE: 08-05-1997 - 15:50

COMPONENT: DUMMY # E1-213 Velocity: 6.56 FT/SEC 2 M/SEC

Minimum = -1.12E-03 IN at 108. msec Maximum = .93 IN at 38.8 msec

UPPER RIB DISPLACEMENT

1 ——— 0972940F.D06 Filterclass (1000)

8
.6
.4
.2
0

NI

0 .01 .02 .03 .04 .05 .06 .07 .08 .09 1 .11 .12

TIME (SECONDS)

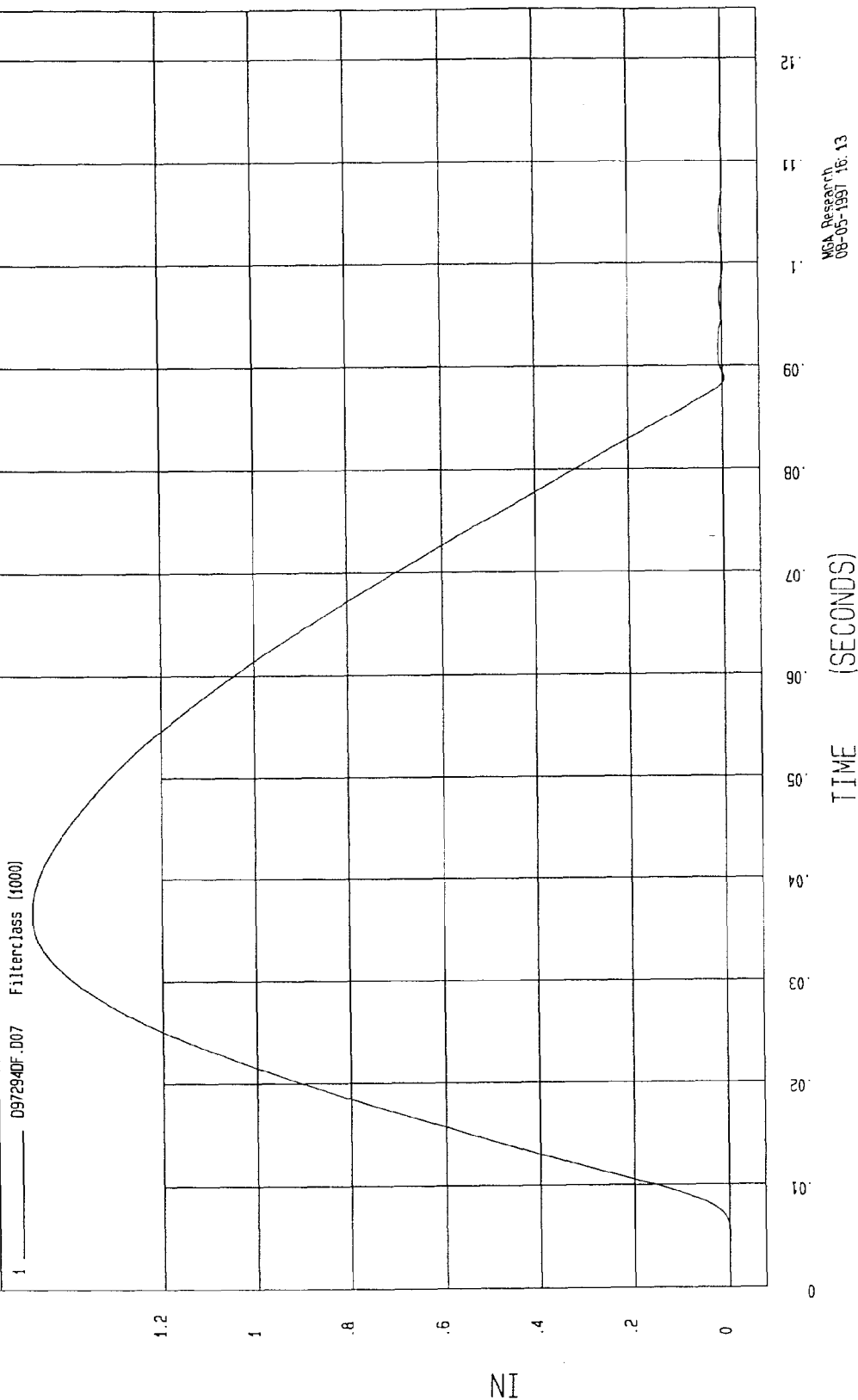
MGA Research
08-05-1997 16:13

TEST: EUROSID RIB MODULE TEST DATE: 08-05-1997 - 16:11

COMPONENT: DUMMY # E1-213 Velocity: 9.84 FT/SEC 3 M/SEC

Minimum = -3.40E-03 IN at 88.7 msec Maximum = 1.47 IN at 36.9 msec

UPPER RIB DISPLACEMENT



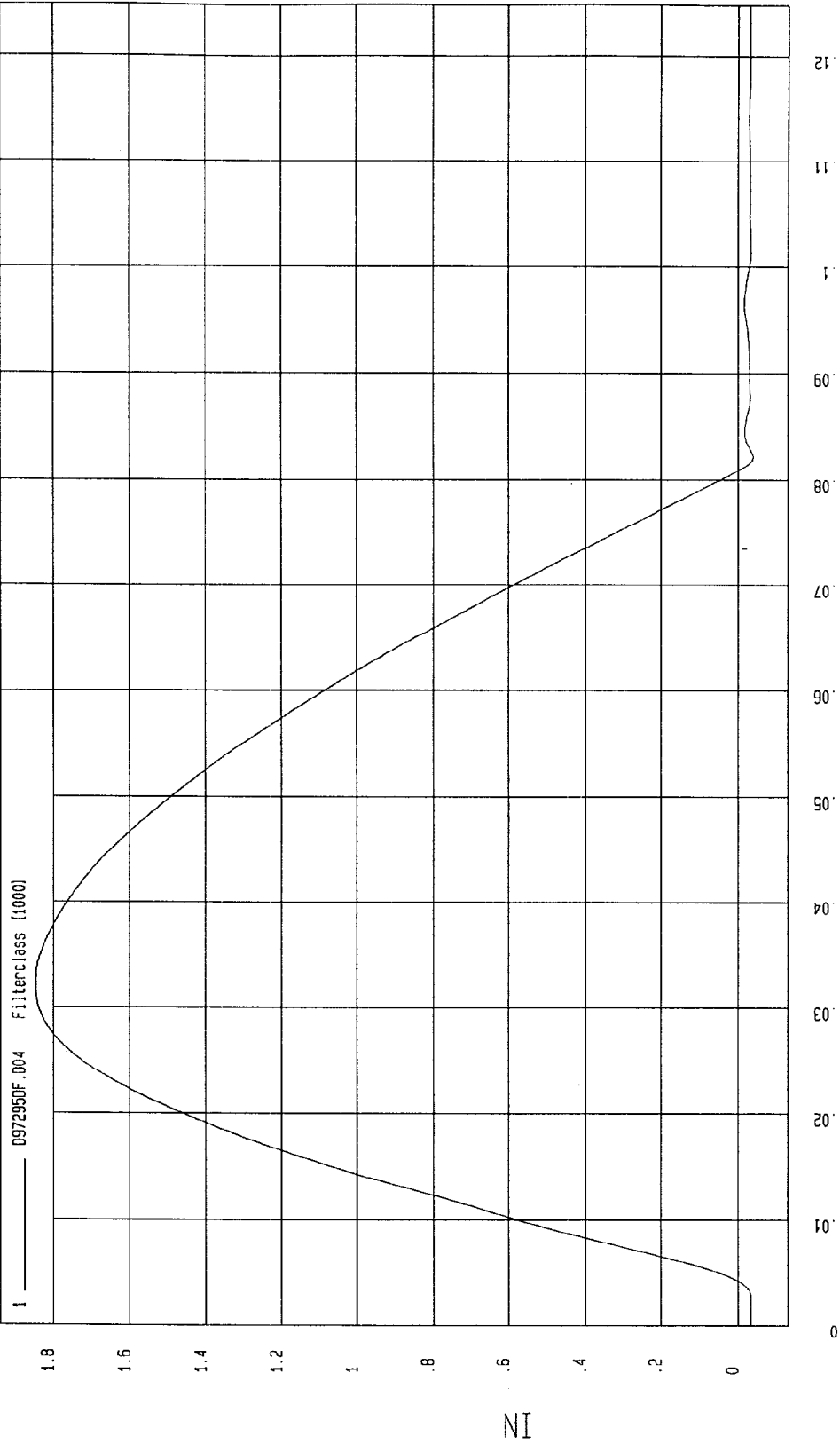
NCA Research
08-05-1997 16:13

TEST: EUROSID RIB MODULE TEST DATE: 08-05-1997 - 16:22

COMPONENT: DUMMY # E1-213 Velocity: 13.12 FT/SEC 4 M/SEC

Minimum = -.04 IN at 82.1 msec Maximum = 1.84 IN at 32.2 msec

MIDDLE RIB DISPLACEMENT



MCA Research
08-05-1997 16:56

TEST: EUROSID RIB MODULE

TEST DATE: 08-05-1997 - 16:35

COMPONENT: DUMMY # E1-213

Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -5.17E-04 IN at 122. msec

Maximum = .43 IN at 44.4 msec

MIDDLE RIB DISPLACEMENT

1 ——— D972950F.D05 Filterclass (1000)

.4

.3

.2

.1

0

NI

21

11

1

60

80

40

06

05

04

03

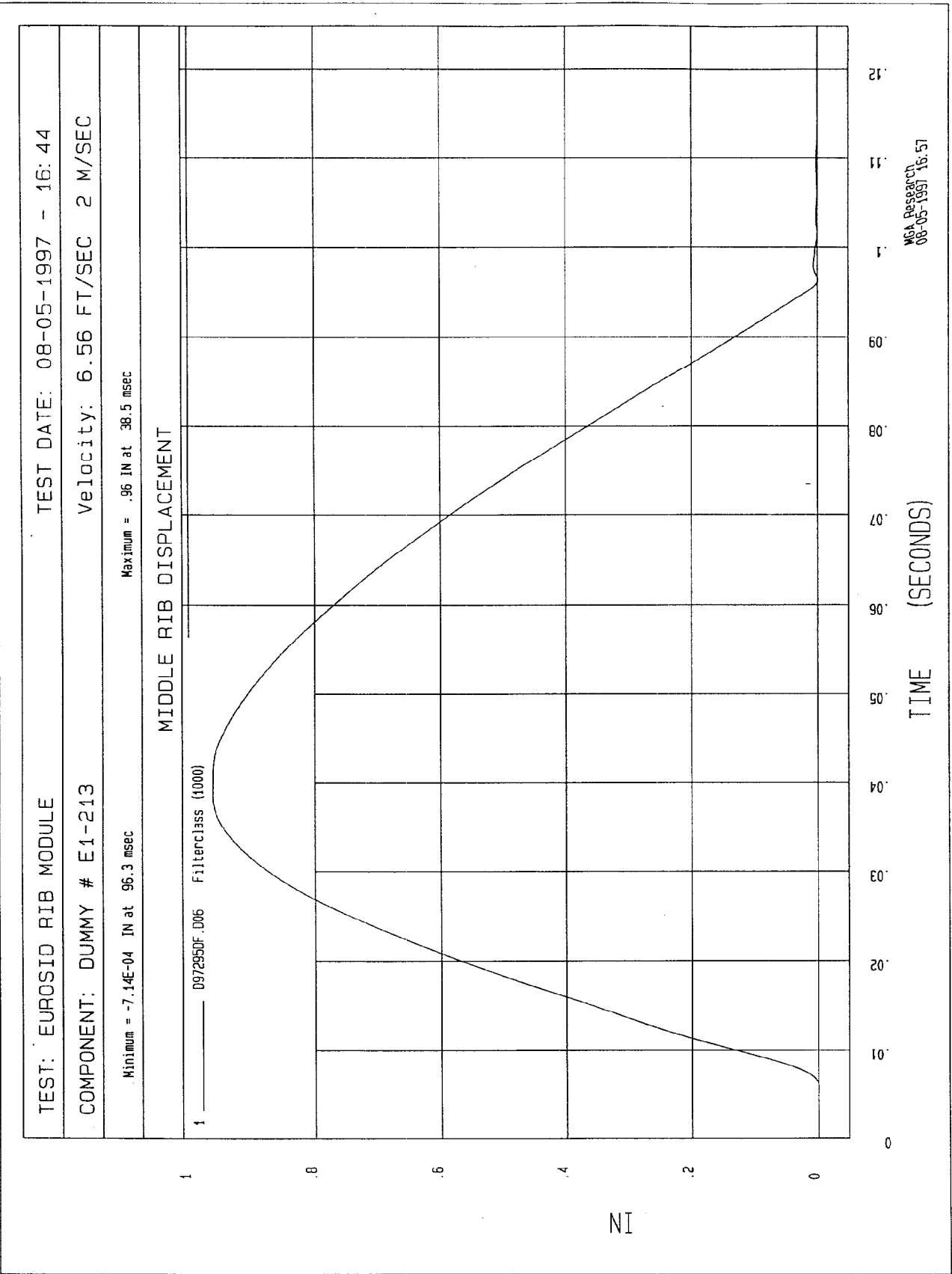
02

01

0

TIME (SECONDS)

MCA Research
08-05-1997 16:56

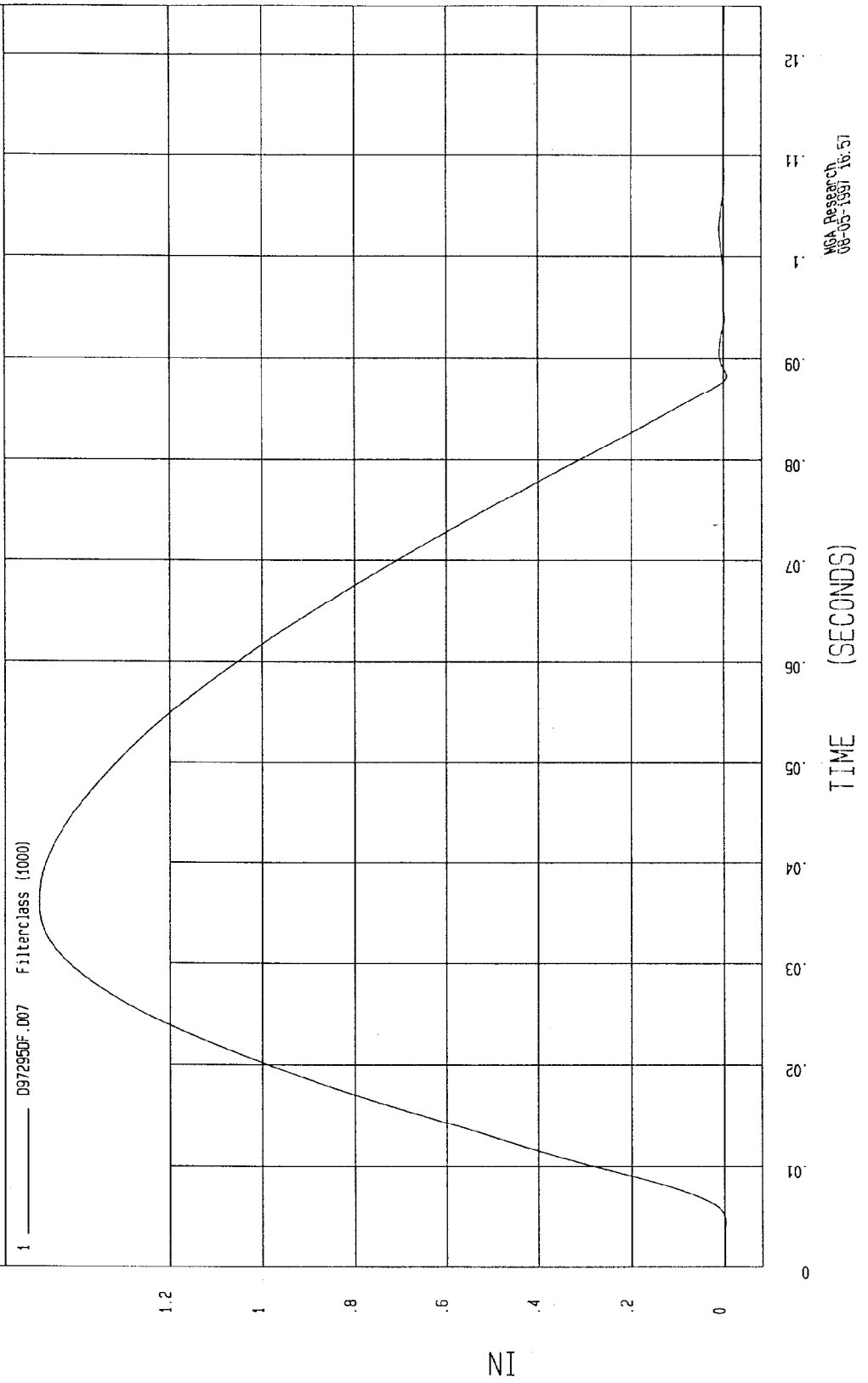


TEST: EUROSID RIB MODULE TEST DATE: 08-05-1997 - 16:55

COMPONENT: DUMMY # E1-213 Velocity: 9.84 FT/SEC 3 M/SEC

Minimum = -6.37E-03 IN at 88.3 msec
Maximum = 1.47 IN at 35.8 msec

MIDDLE RIB DISPLACEMENT



TEST: EUROSID RIB MODULE

TEST DATE: 08-06-1997 - 08:42

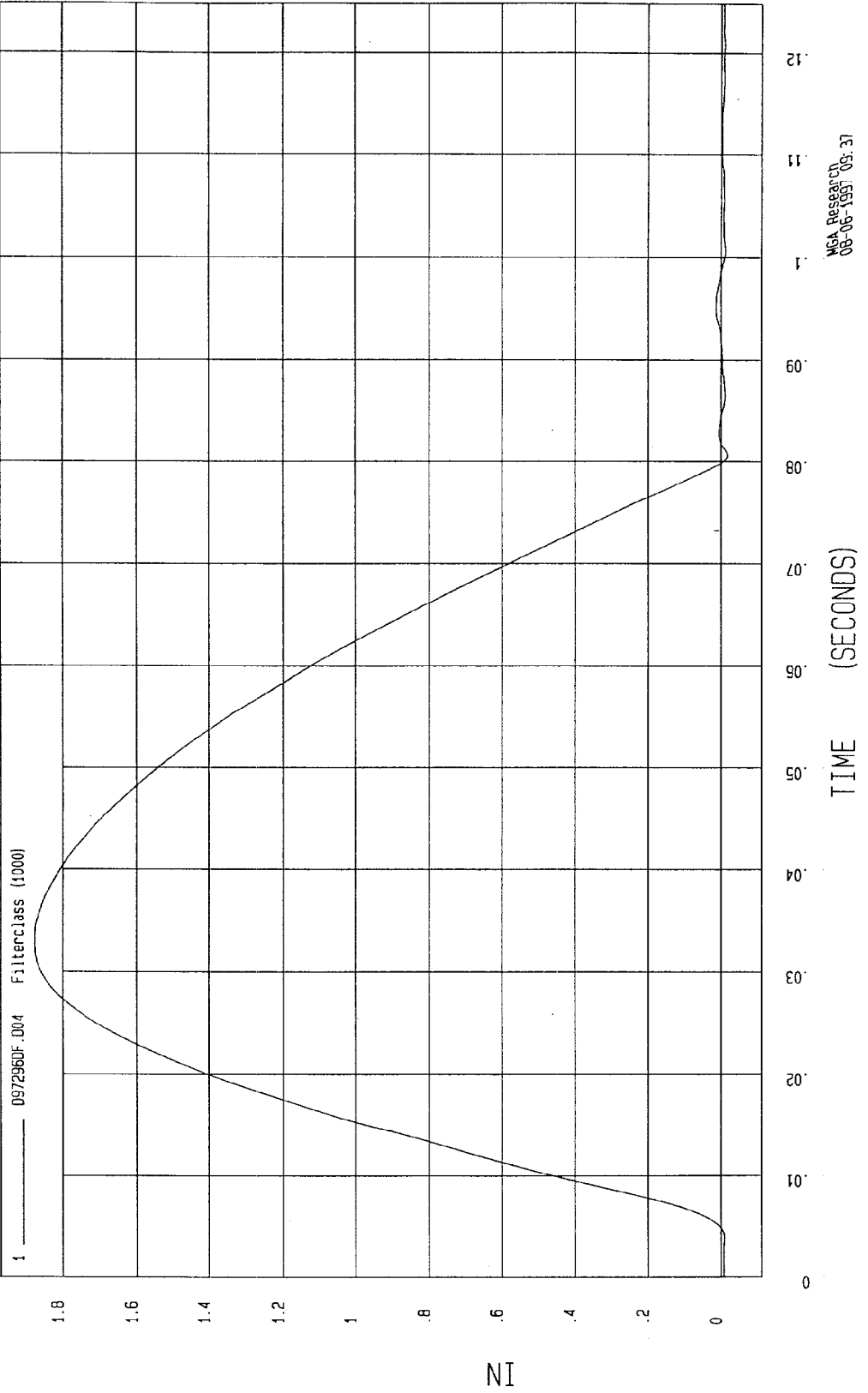
COMPONENT: DUMMY # E1-213

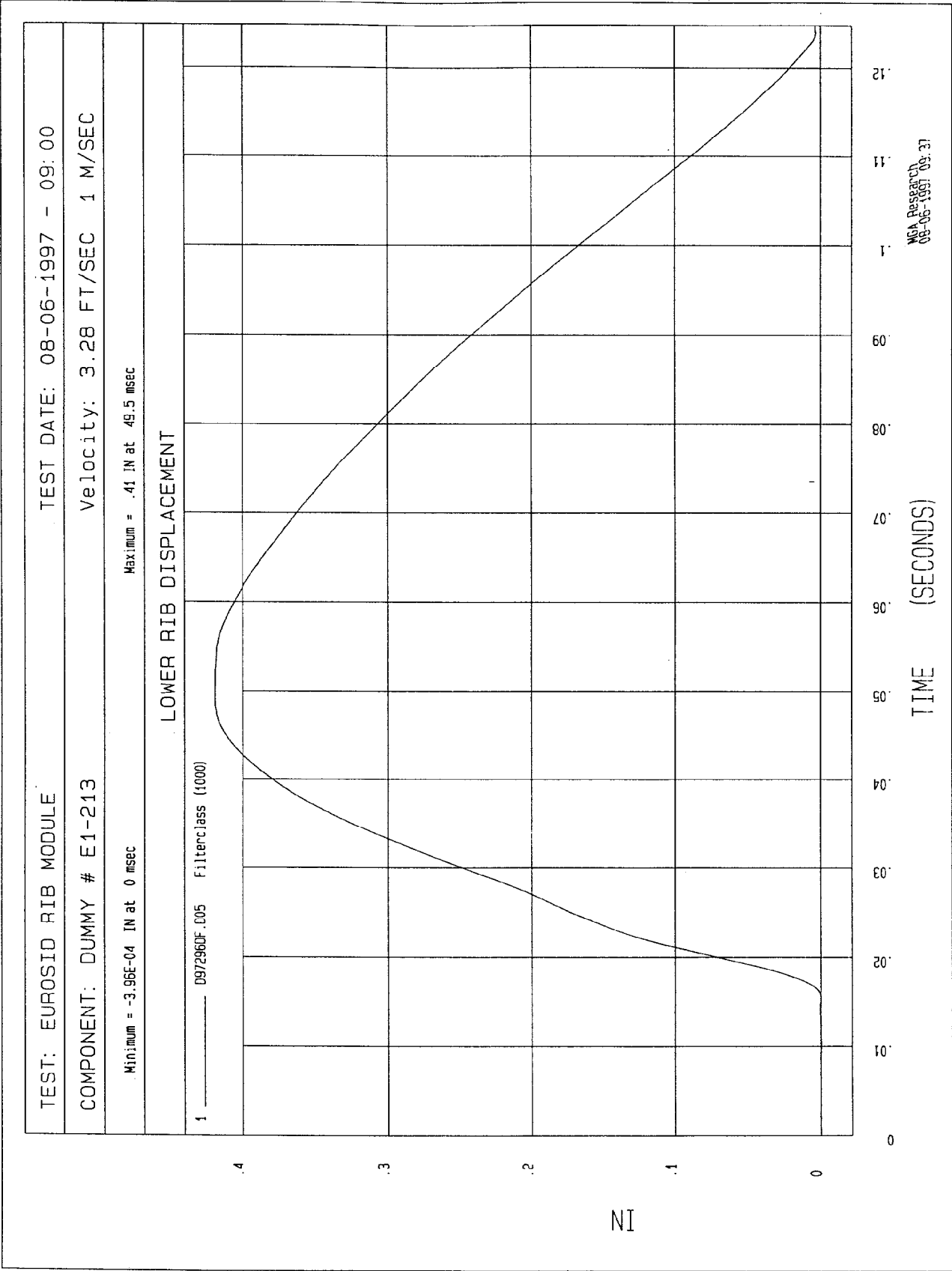
Velocity: 13.12 FT/SEC 4 M/SEC

Minimum = -1.69E-02 IN at 80.6 msec

Maximum = 1.87 IN at 33.3 msec

LOWER RIB DISPLACEMENT





TEST: EUROSID RIB MODULE

TEST DATE: 08-06-1997 - 09: 18

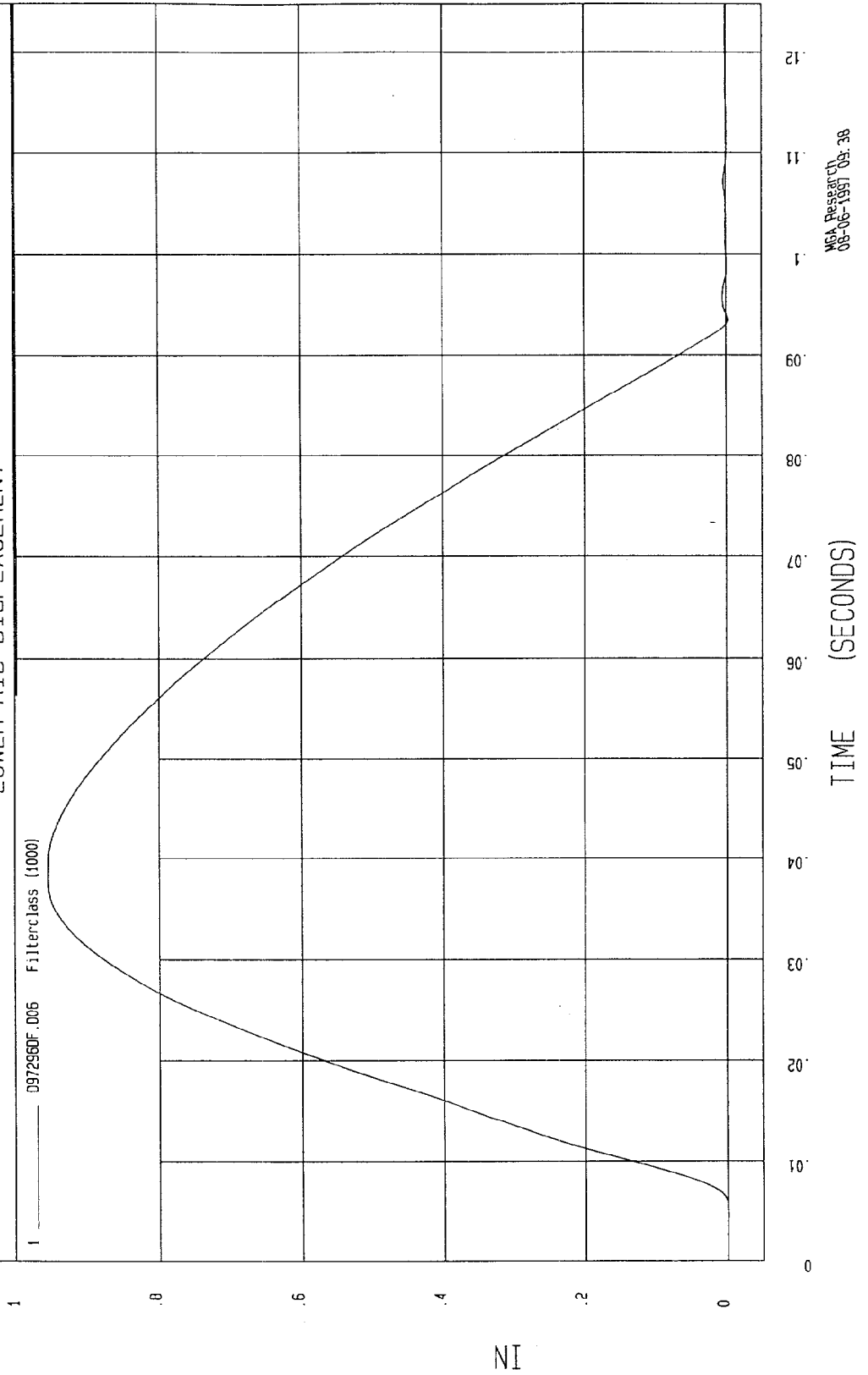
COMPONENT: DUMMY # E1-213

Velocity: 6.56 FT/SEC 2 M/SEC

Minimum = -2.63E-03 IN at 93.4 msec

Maximum = .95 IN at 38.3 msec

LOWER RIB DISPLACEMENT



TEST: E1-213 TEST DATE: 08-06-1997 - 09:36

COMPONENT: DUMMY # Velocity: 9.84 FT/SEC 3 M/SEC

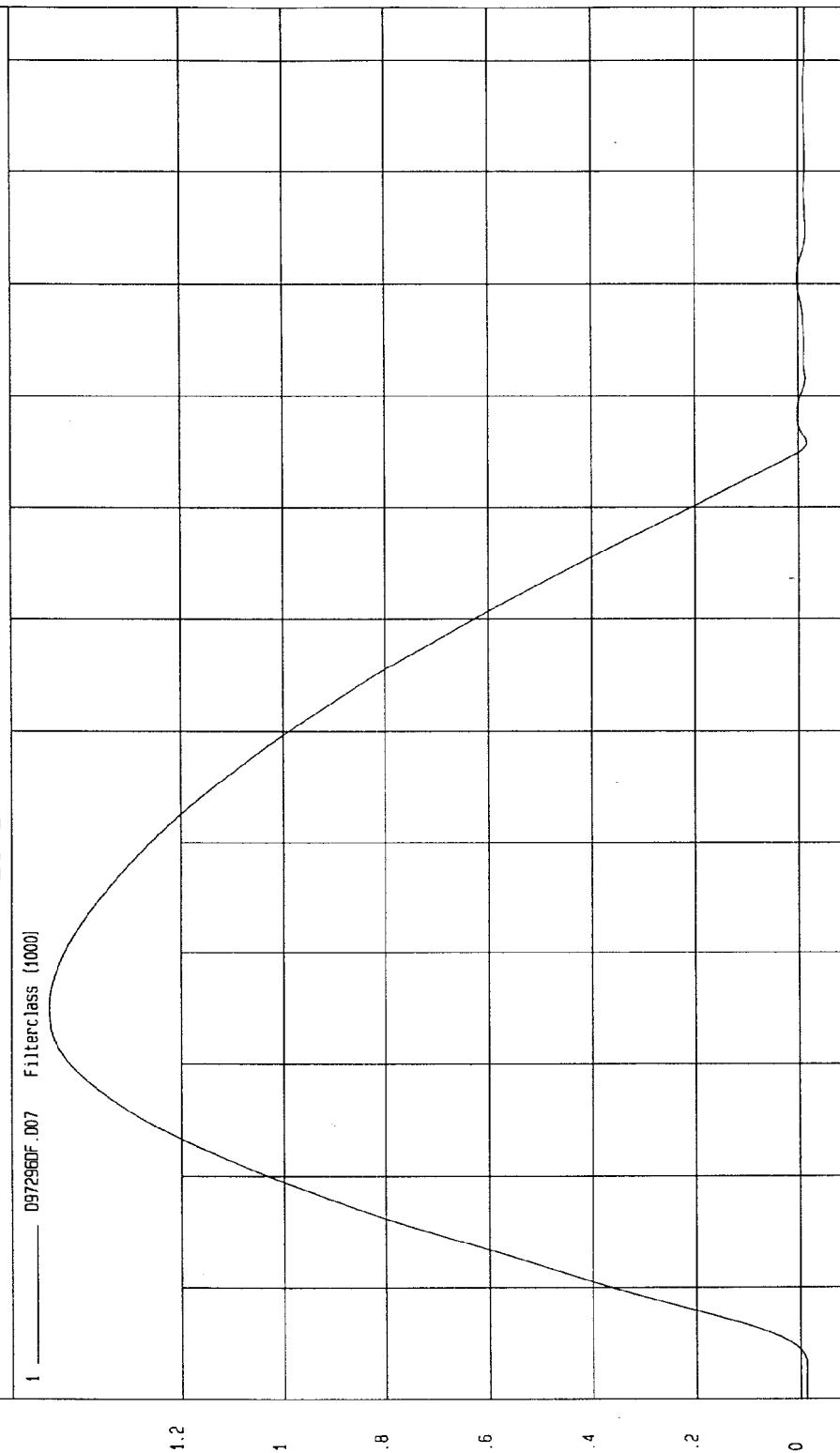
Minimum = -1.67E-02 IN at 85.7 nsec

Maximum = 1.45 IN at 35.0 msec

LOWER RIB DISPLACEMENT

1 _____ 0972960F.D07 Filterclass (1000)

NI



MCA Research
08-06-1997 09:38

TEST: ABDOMEN IMPACT

TEST DATE: 08-01-1997 - 10:18

COMPONENT: DUMMY # E1-213

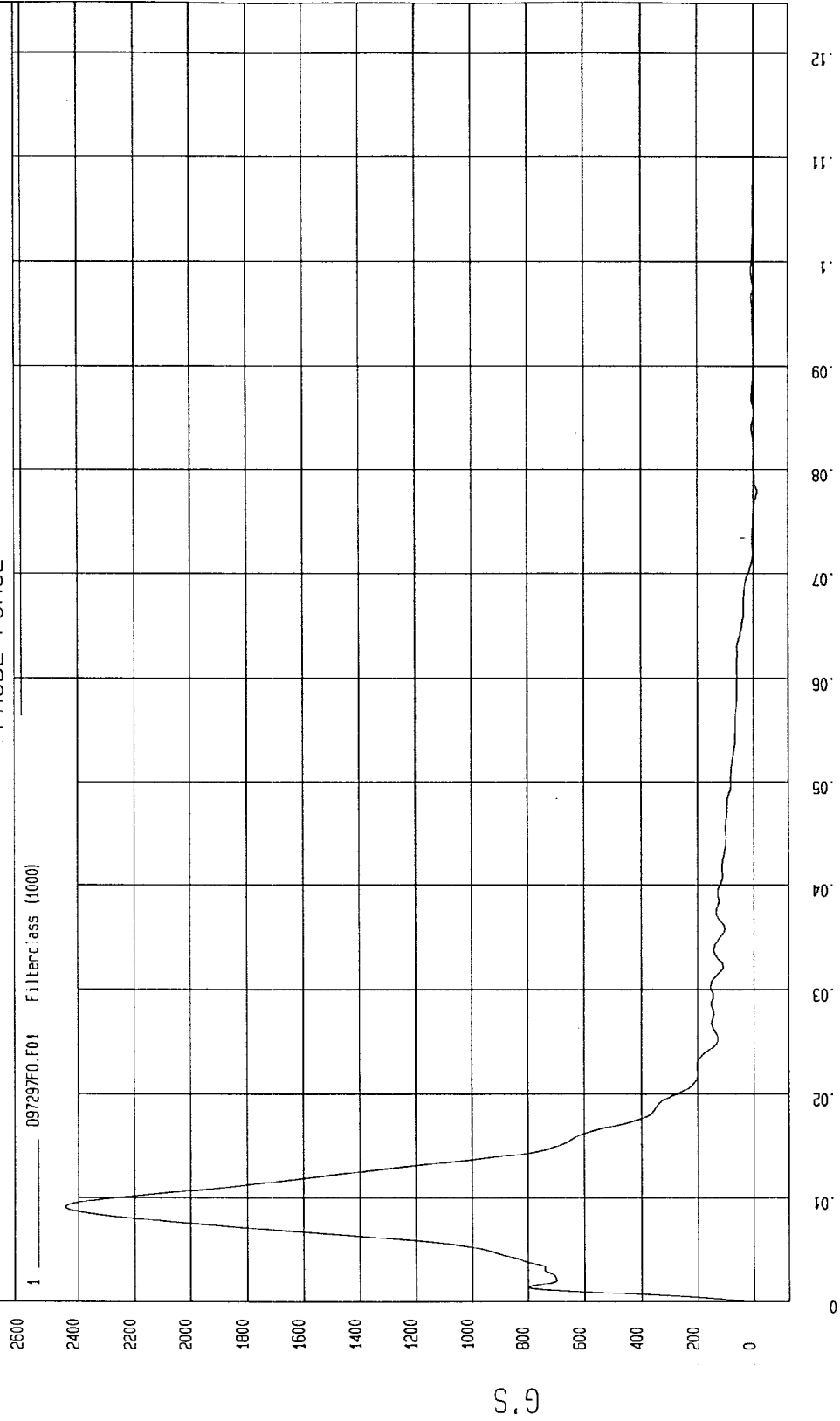
Velocity: 20.53 FT/SEC 6.26 M/SEC

Minimum = -13.24 G'S at 77.8 msec

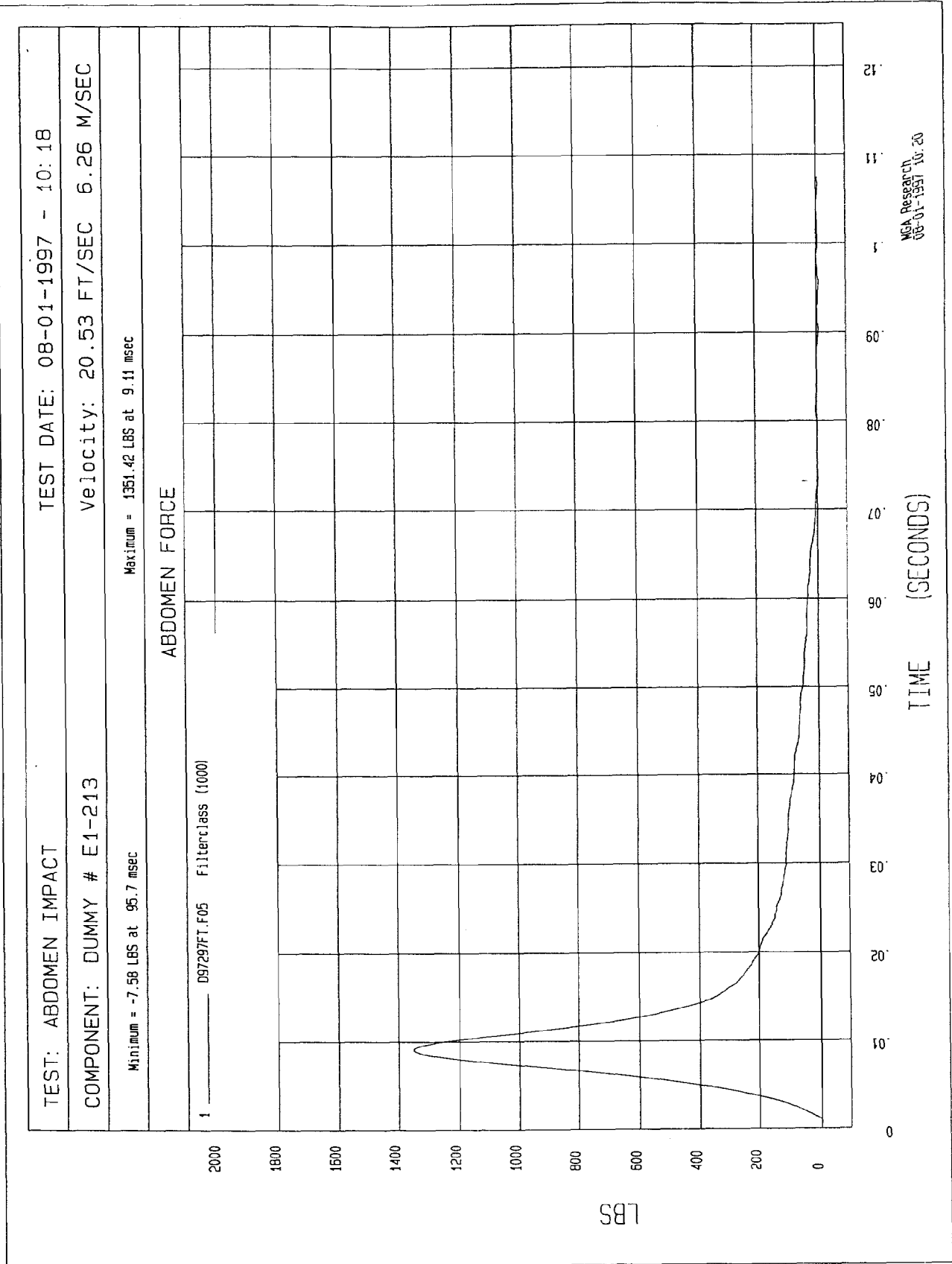
Maximum = 2445.00 G'S at 9.11 msec

PROBE FORCE

1 097297F0.F01 Filterclass (1000)



MEA Research
08-01-1997 10:22

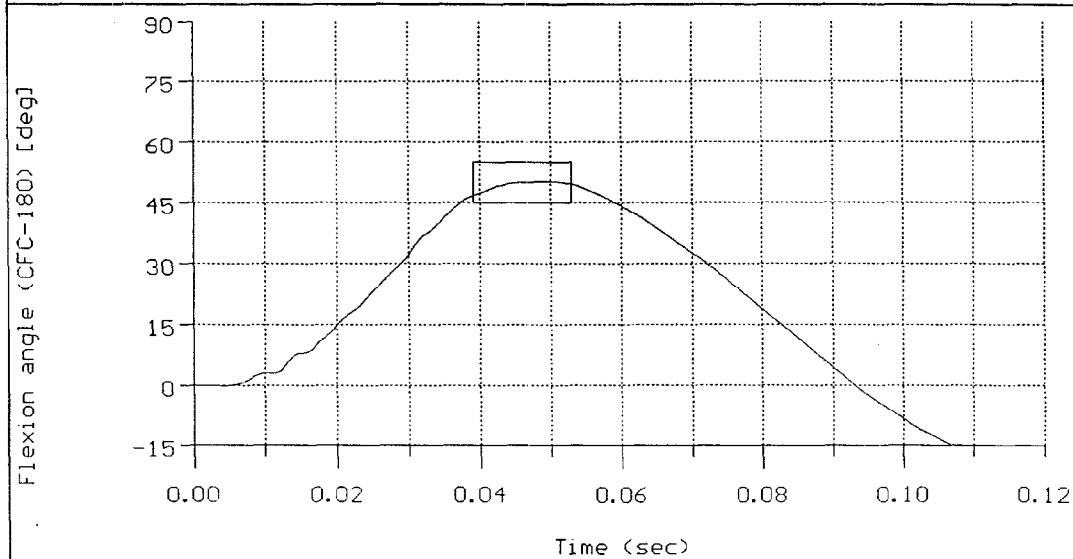
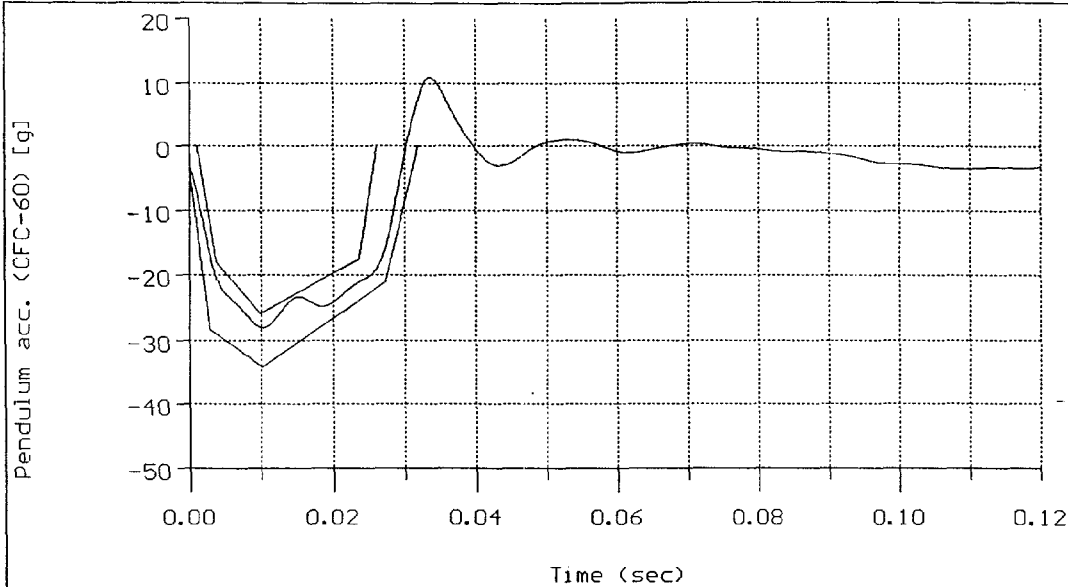


EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM6183-1 Temperature : 21 deg C
 Test number : 19917 Rel. Humidity : 42 %
 Impact side : Technician :
 Spine length : Test date : 25-JULY-1997



Parameter	Specification	Result	Passed/Failed
Pendulum Speed	5.95 - 6.15 m/s	6.08 m/s	
Maximum pendulum acc.		-28.1 g	
Time of max pend. acc.		10.1 msec	
Maximum flexion angle	45.0 - 55.0 deg	50.1 deg	
Time of max. flex. angle	39.0 - 53.0 msec	50.0 msec	

EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM6183-1

Temperature : 21 deg C

Test number : 19917

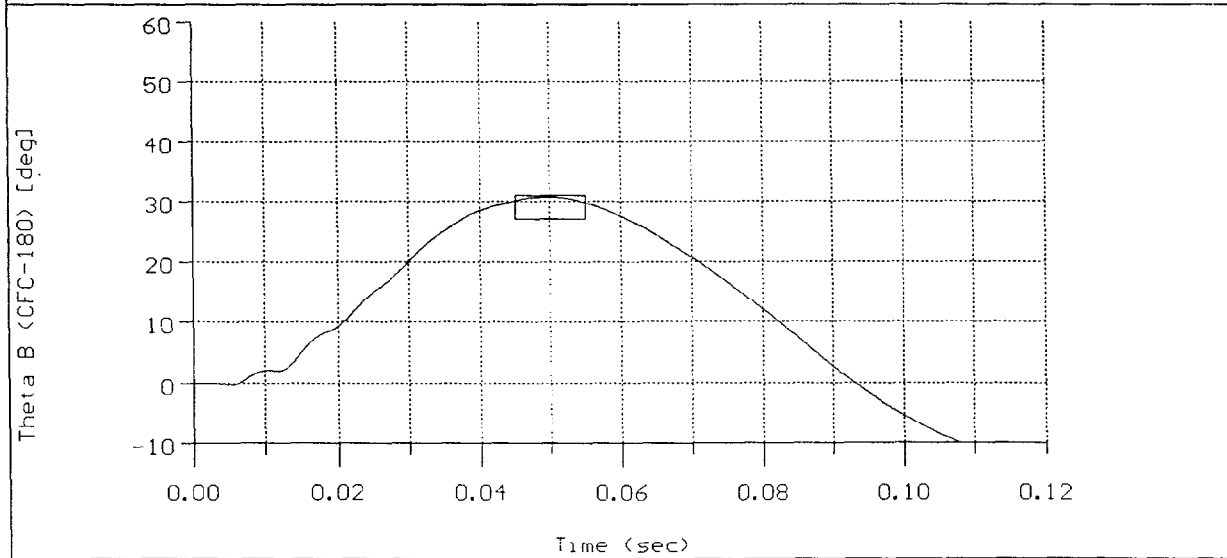
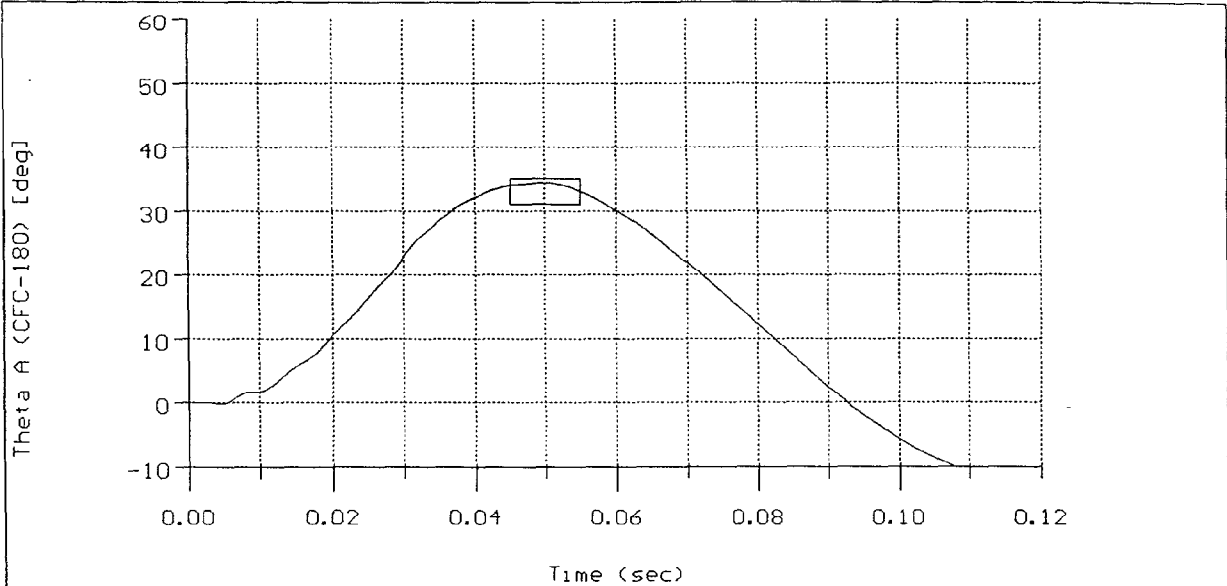
Rel. Humidity : 42 %

Impact side :

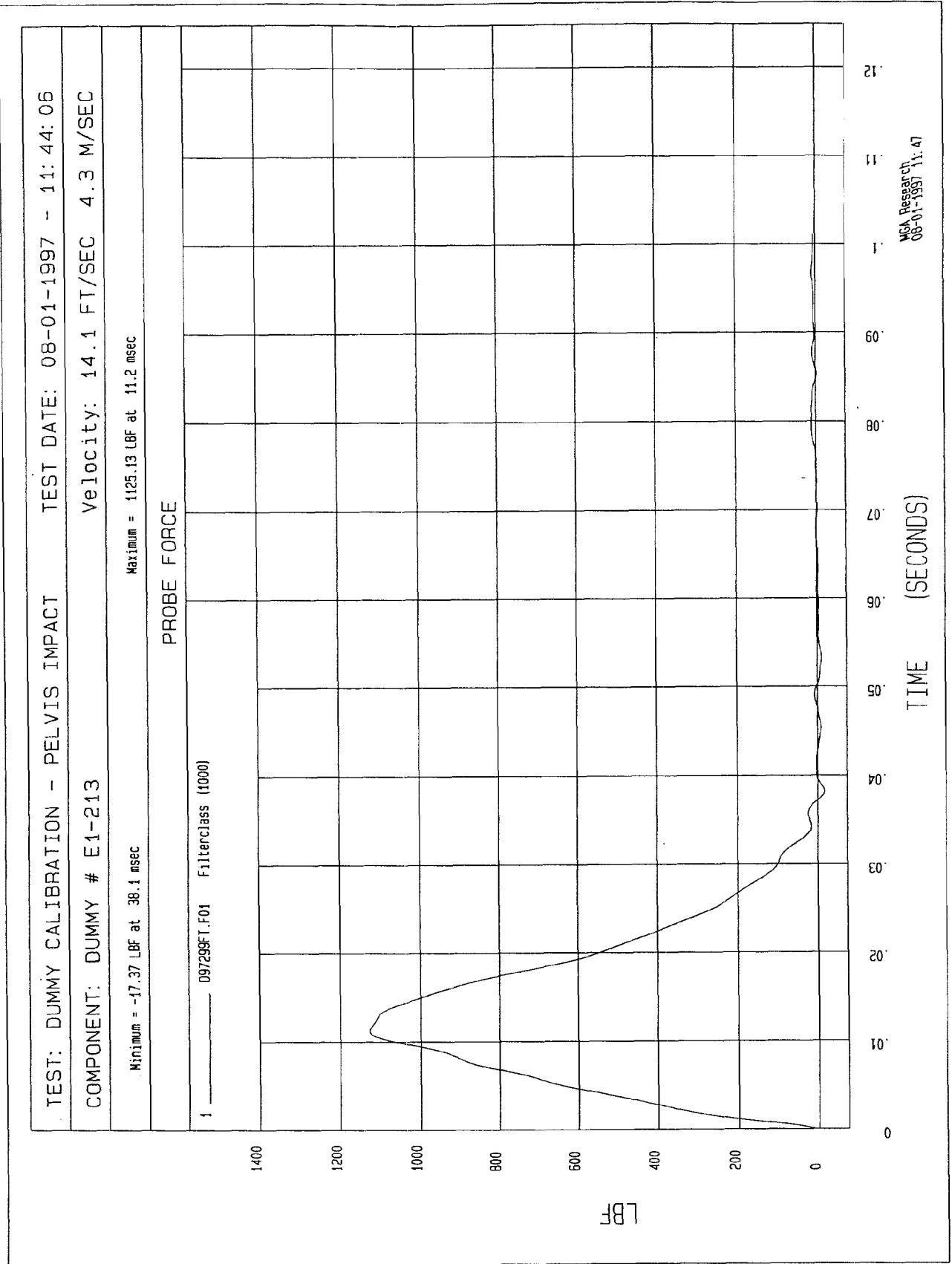
Technician :

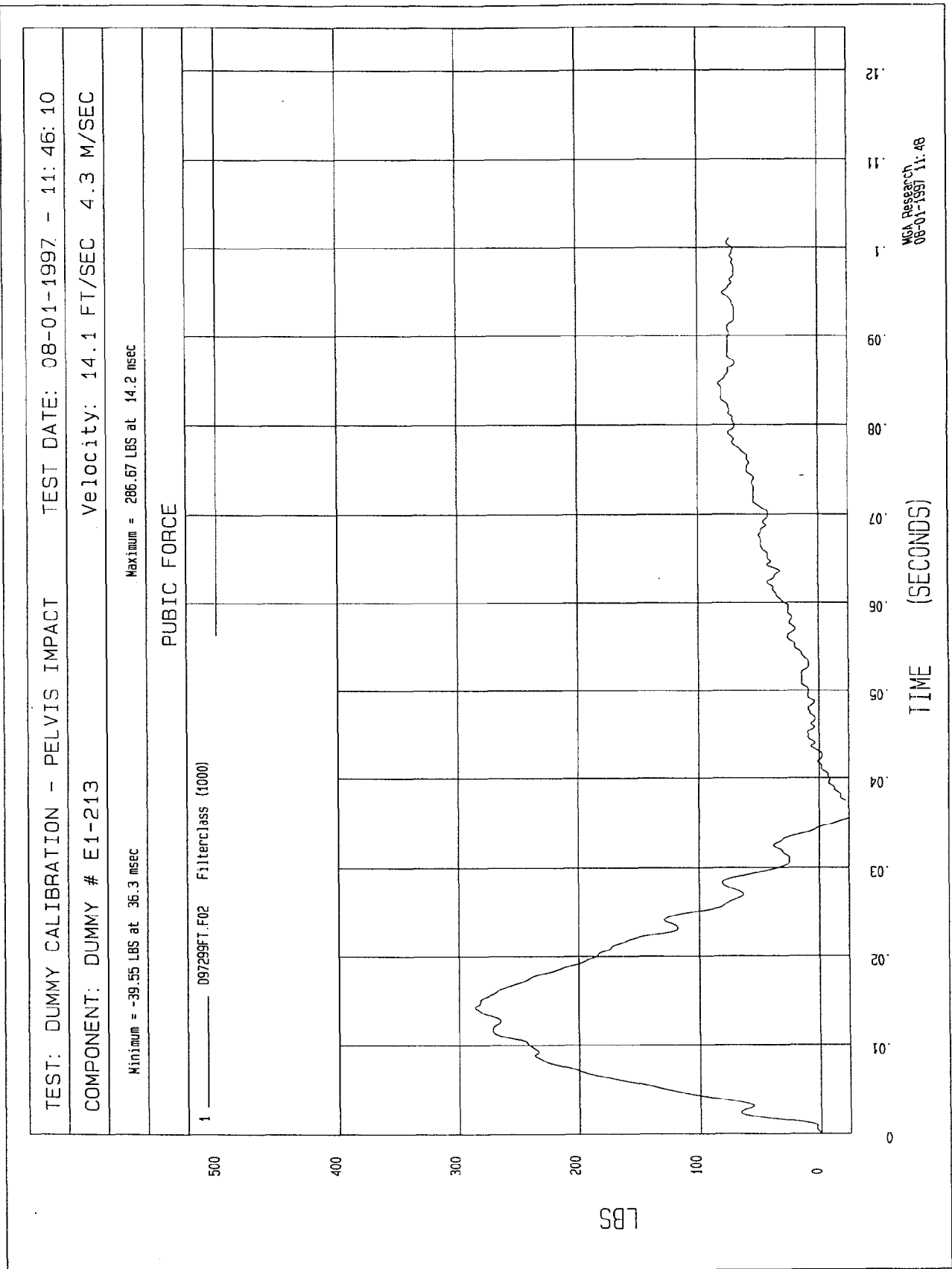
Spine length :

Test date : 25-JULY-1997



Parameter	Specification	Result	Passed/Failed
Maximum Theta(A)	31.0 - 35.0 deg	34.3 deg	
Time of max. Theta(A)	45.0 - 55.0 msec	50.1 msec	
Maximum Theta(B)	27.0 - 31.0 deg	30.7 deg	
Time of max. Theta(B)	45.0 - 55.0 msec	49.5 msec	





EUROSID DUMMY POST-TEST CALIBRATION DATA SUMMARY SHEET

Dummy #: E1-169

Calibration Date: September 2, 1997

1.0 Head Drop Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	49%
Max. Resultant Acceleration	100 - 150 g's	127
Time of Max. Res. Acceleration		2.4 msec.

Calibrated By: Tim Michnay

Date: August 25, 1997

2.0 Neck Pendulum Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	52%
Pendulum Speed	10.83 - 11.48 ft/sec	11.30
Max. Pendulum Acceleration		-33.64
Time Max. Pend. Acceleration		10.2
Maximum Flexion Angle	46.0 - 56.0 deg.	52.7
Time of Max. Flexion Angle	50.0 - 62.0 ms	56.0
Maximum Angle Theta (A)	30.0 - 34.0 deg	31.2
Time of Max. Theta (A)	50.0 - 60.0 ms	55.2
Maximum Angle Theta (B)	26.0 - 30.0 deg.	28.0
Time of Max. Theta (B)	50.0 - 60.0 ms	51.7

Calibrated By: Tim Michnay

Date: August 25, 1997

3.0 Shoulder Impact Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Pendulum Speed	13.78 - 14.43 ft/sec	13.90
Max. Pendulum Acceleration	7.5 - 10.5 g's	7.8
Time of Max. Pendulum Acceleration		16.4

Calibrated By: Tim Michnay

Date: August 22, 1997

4.0 Upper Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Displacement at 3.28 ft/sec	.39 - .55 in	.45
Displacement at 6.56 ft/sec	.93 - 1.08 in	1.01
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.53
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.98

Calibrated By: Tim Michnay

Date: August 26, 1997

5.0 Middle Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Displacement at 3.28 ft/sec	.39 - .55 in	.42
Displacement at 6.56 ft/sec	.93 - 1.08 in	1.03
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.56
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.98

Calibrated By: Tim Michnay

Date: August 26, 1997

6.0 Lower Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	48%
Displacement at 3.28 ft/sec	.39 - .55 in	.40
Displacement at 6.56 ft/sec	.93 - 1.08 in	.99
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.53
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.94

Calibrated By: Tim MichnayDate: August 26, 1997**7.0 Abdomen Test**

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	46%
Probe Speed	20.34 - 20.99 ft/sec	20.59
Maximum Impact Force	2136 - 2495 lbs	2445
Time of Maximum Force	8.8 - 10.4 ms	9.4
Max. Total Abdomen Force	1326 - 1776 lbs	1369
Time of Max. Total Force	8.5 - 10.1 ms	9.5

Calibrated By: Tim MichnayDate: August 22, 1997

8.0 Lumbar Spine Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	50%
Pendulum Speed	19.52 - 20.17 ft/sec	19.95
Max. Pendulum Acceleration		-30.63
Time Max. Pend. Acceleration		9.80
Maximum Flexion Angle	45.0 - 55.0 deg.	49.1
Time of Max. Flexion Angle	39.0 - 53.0 ms	45.5
Maximum Angle Theta (A)	31.0 - 35.0 deg	32.7
Time of Max. Theta (A)	45.0 - 55.0 ms	45.8
Maximum Angle Theta (B)	27.0 - 31.0 deg.	29.2
Time of Max. Theta (B)	45.0 - 55.0 ms	45.8

Calibrated By: First Technology Safety Systems

Date: September 2, 1997

9.0 Pelvis Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	46%
Pendulum Speed	13.77 - 14.43 ft/sec	14.26
Maximum Impactor Force	989 - 1214 lbs	1123
Time of Max. Impactor Force	10.3 - 15.5 ms	14.1
Maximum Pubic Force	233.8 - 368.7 lbs	276.2
Time of Max. Pubic Force	9.9 - 15.9 ms	13.8

Calibrated By: Tim Michnay

Date: August 22, 1997

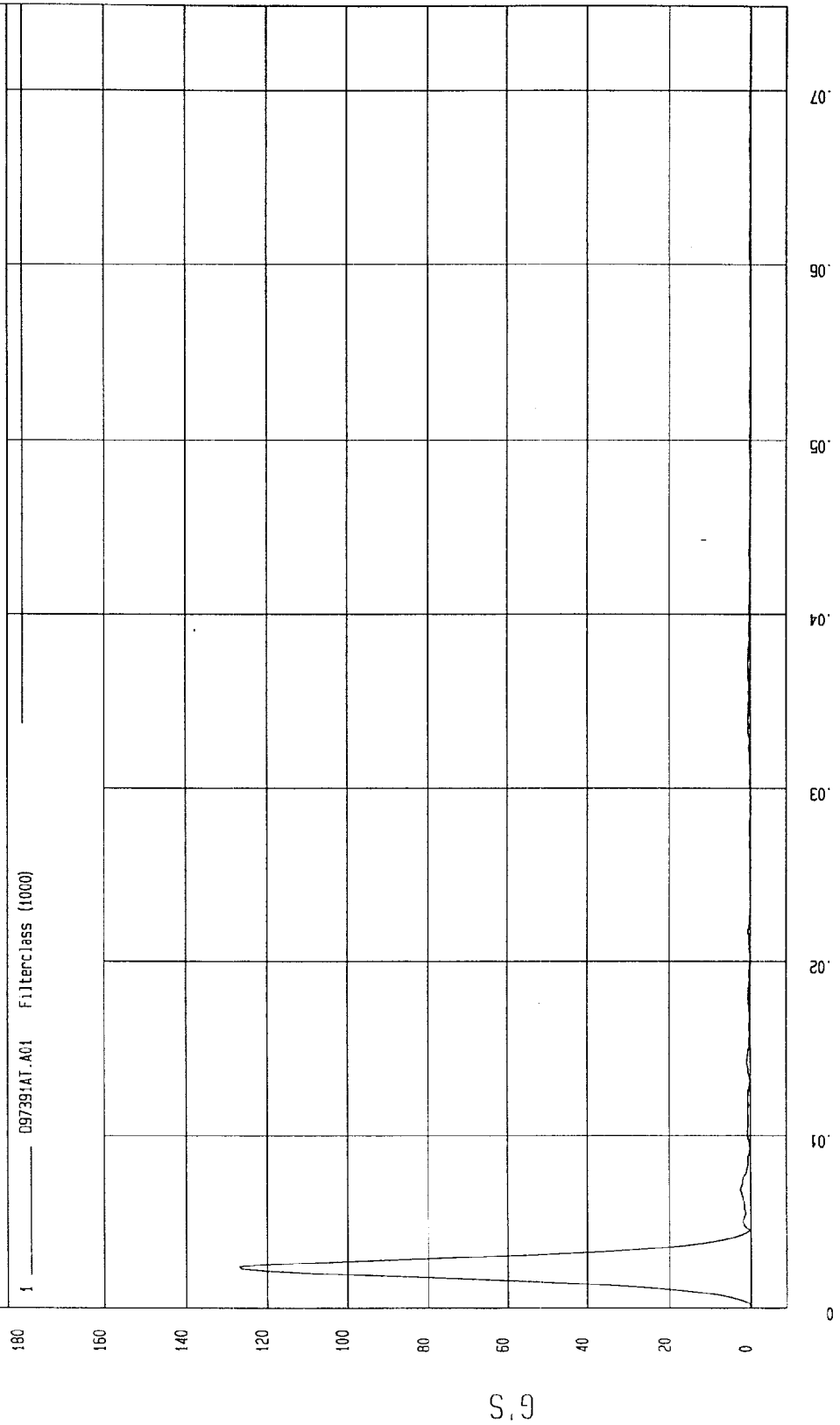
TEST: DUMMY CALIBRATION - HEAD DROP TEST DATE: 08-25-1997 - 14: 17: 35

COMPONENT: DUMMY # E1-169

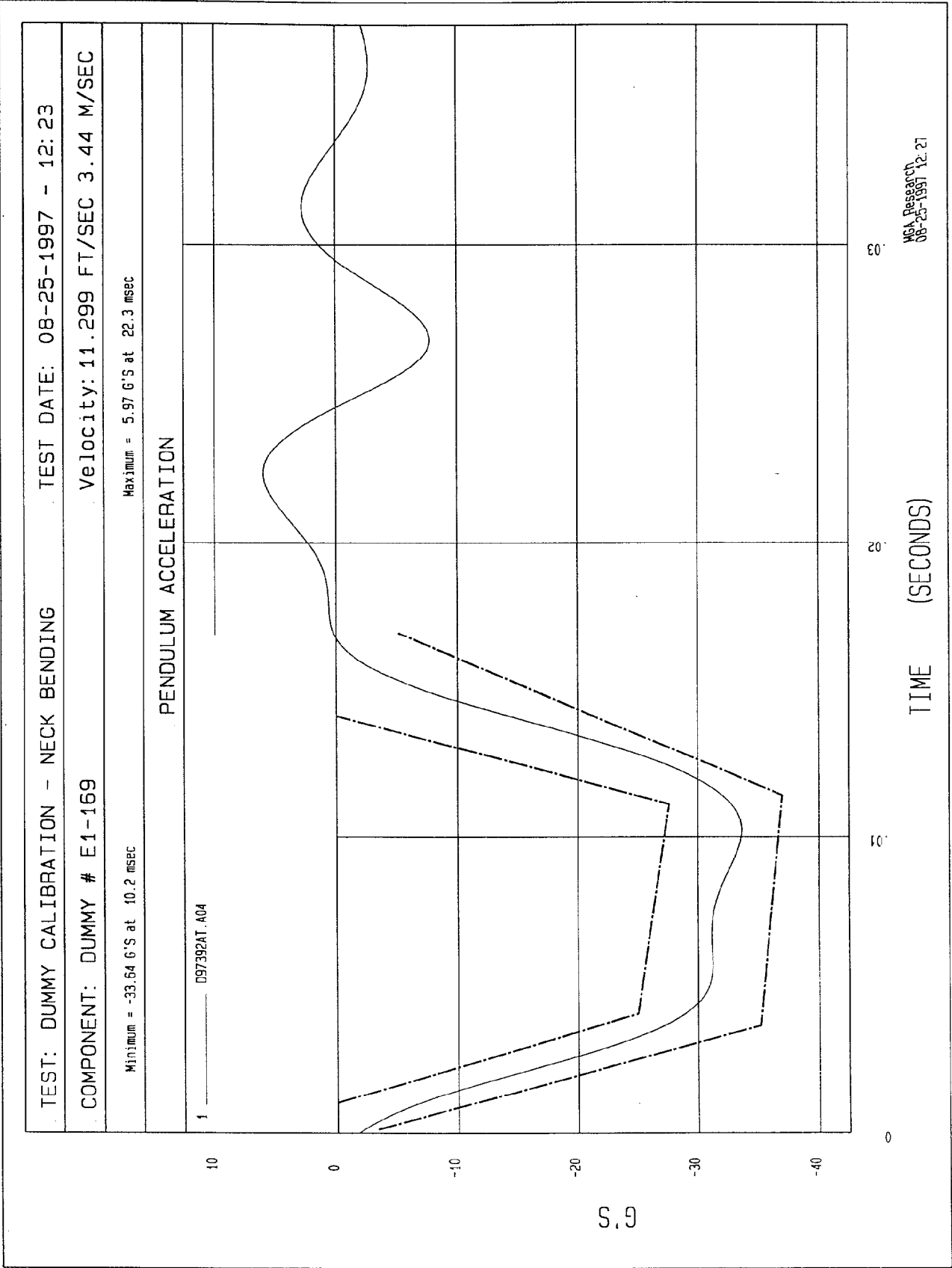
Minimum = 8.42E-03 G'S at 72.2 msec Maximum = 126.78 G'S at 2.37 msec

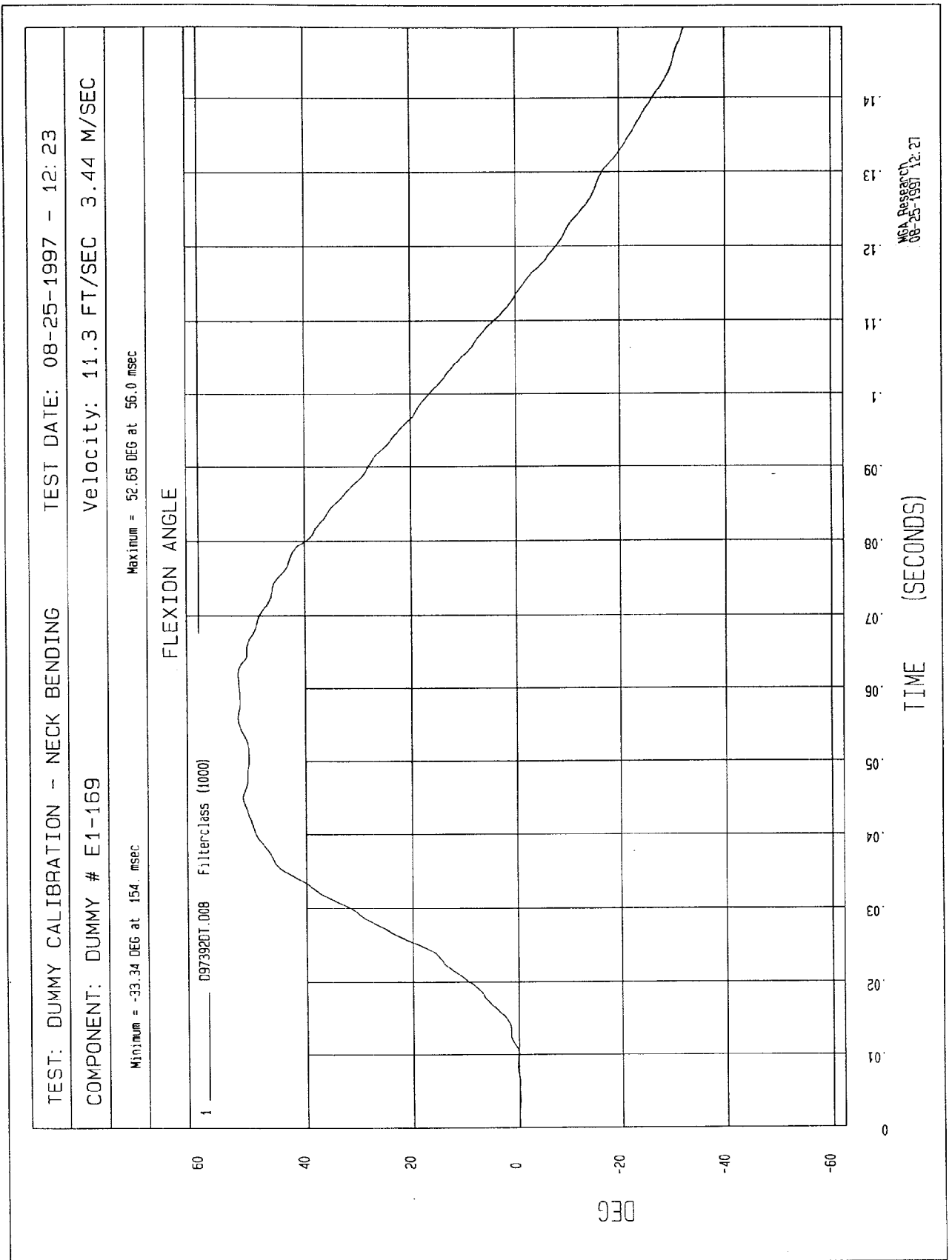
PEAK RESULTANT ACCELERATION

1 _____ 097391AT.A01 Filterclass (1000)



MGA Research
08-25-1997 14: 20





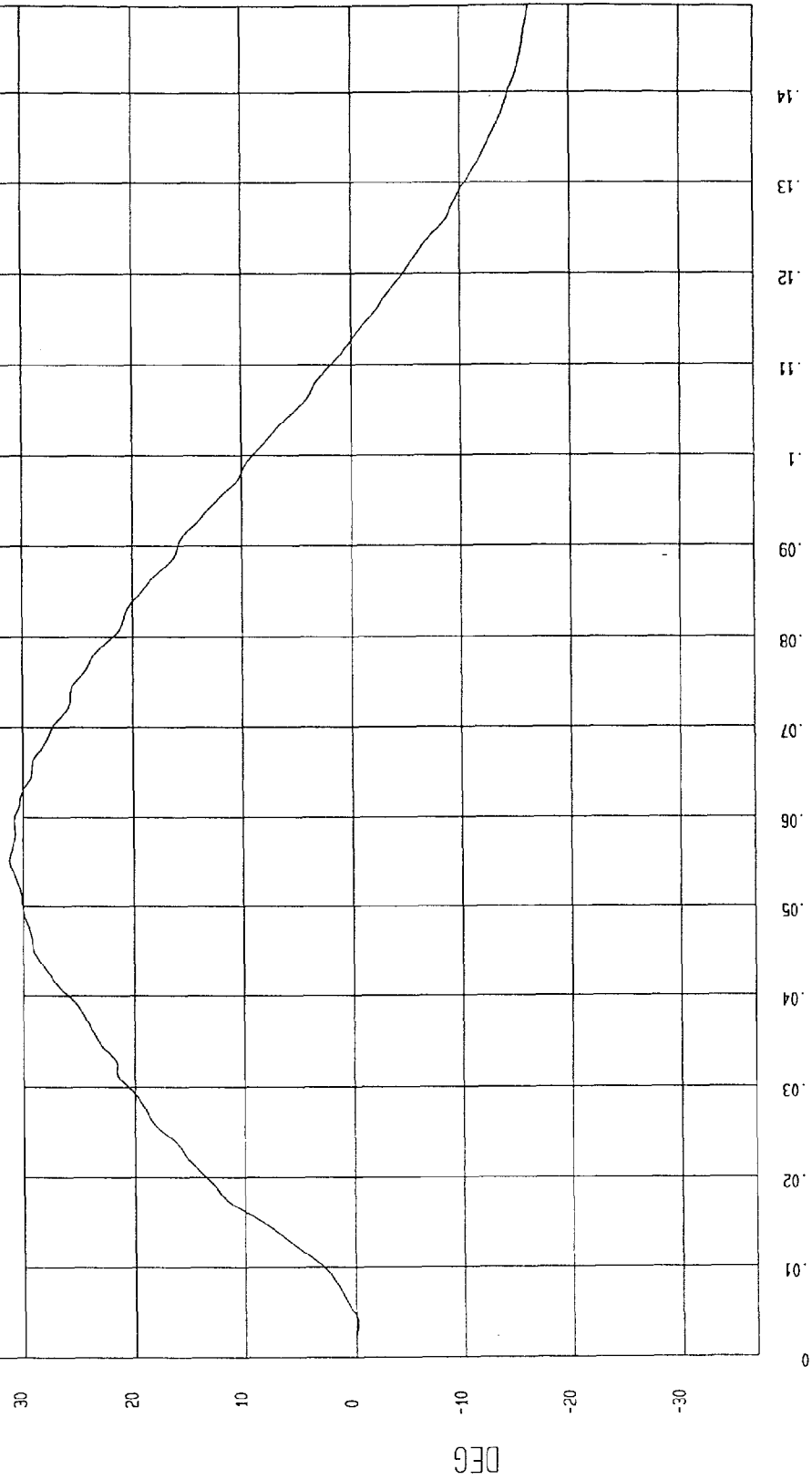
TEST: DUMMY CALIBRATION - NECK BENDING TEST DATE: 08-25-1997 - 12:23

COMPONENT: DUMMY # E1-169 Velocity: 11.3 FT/SEC 3.44 M/SEC

Minimum = -16.58 DEG at 154. msec Maximum = 31.23 DEG at 55.2 msec

THETA A

1 0973920T.005 Filterclass (1000)

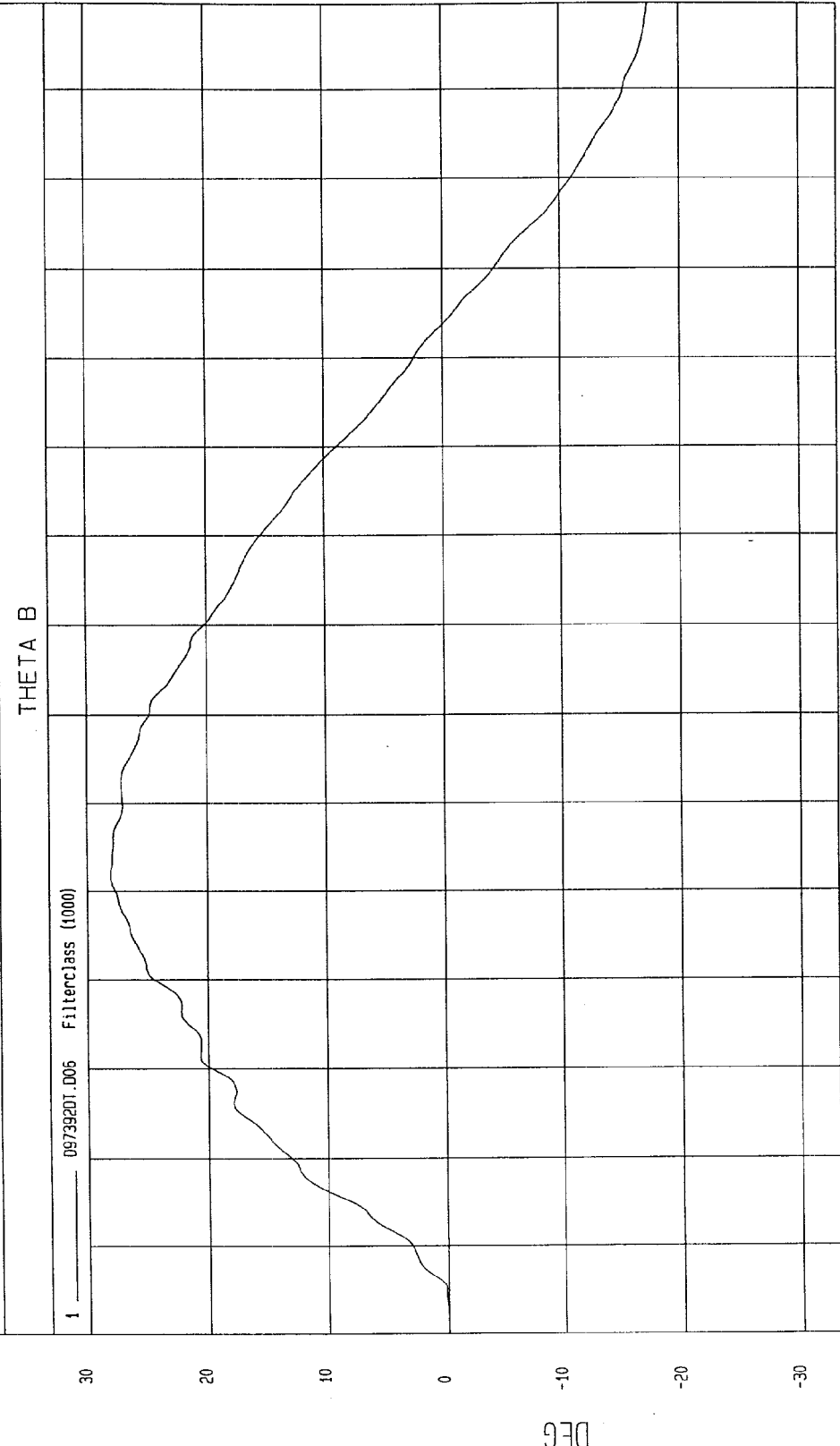


WGA Research
08-25-1997 12:27

TEST: DUMMY CALIBRATION - NECK BENDING TEST DATE: 08-25-1997 - 12:23

COMPONENT: DUMMY # E1-169 Velocity: 11.3 FT/SEC 3.44 M/SEC

Minimum = -18.04 DEG at 159. msec Maximum = 28.04 DEG at 51.7 msec



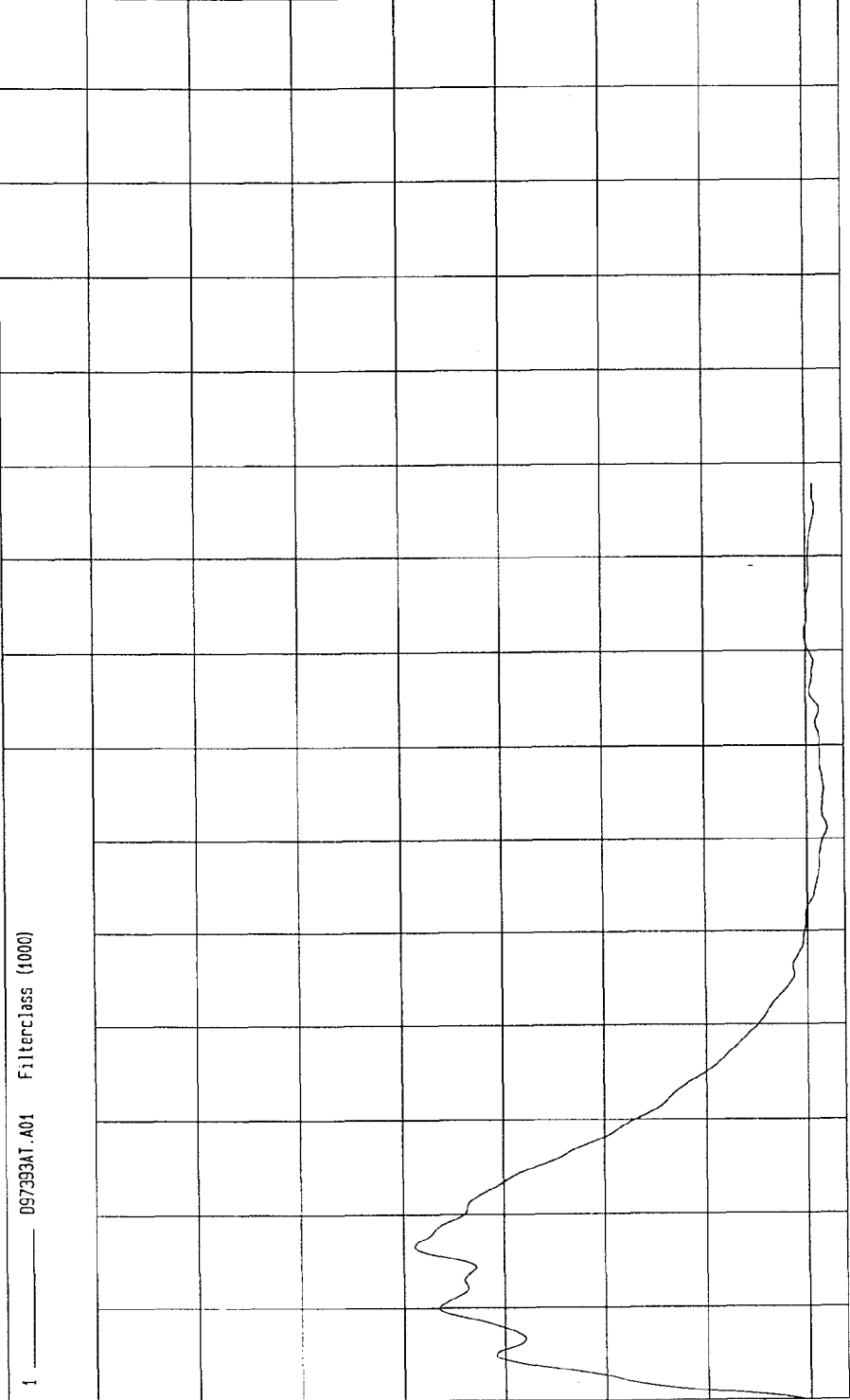
WSA Research
08-25-1997 12:28

TEST: EUROSID SHOULDER IMPACT TEST DATE: 08-22-1997 - 09:51:09

COMPONENT: DUMMY # E1-169 Velocity: 13.9 FT/SEC 4.24 M/SEC

Minimum = -.40 G'S at 61.2 msec Maximum = 7.77 G'S at 16.4 msec

PENDULUM ACCELERATION



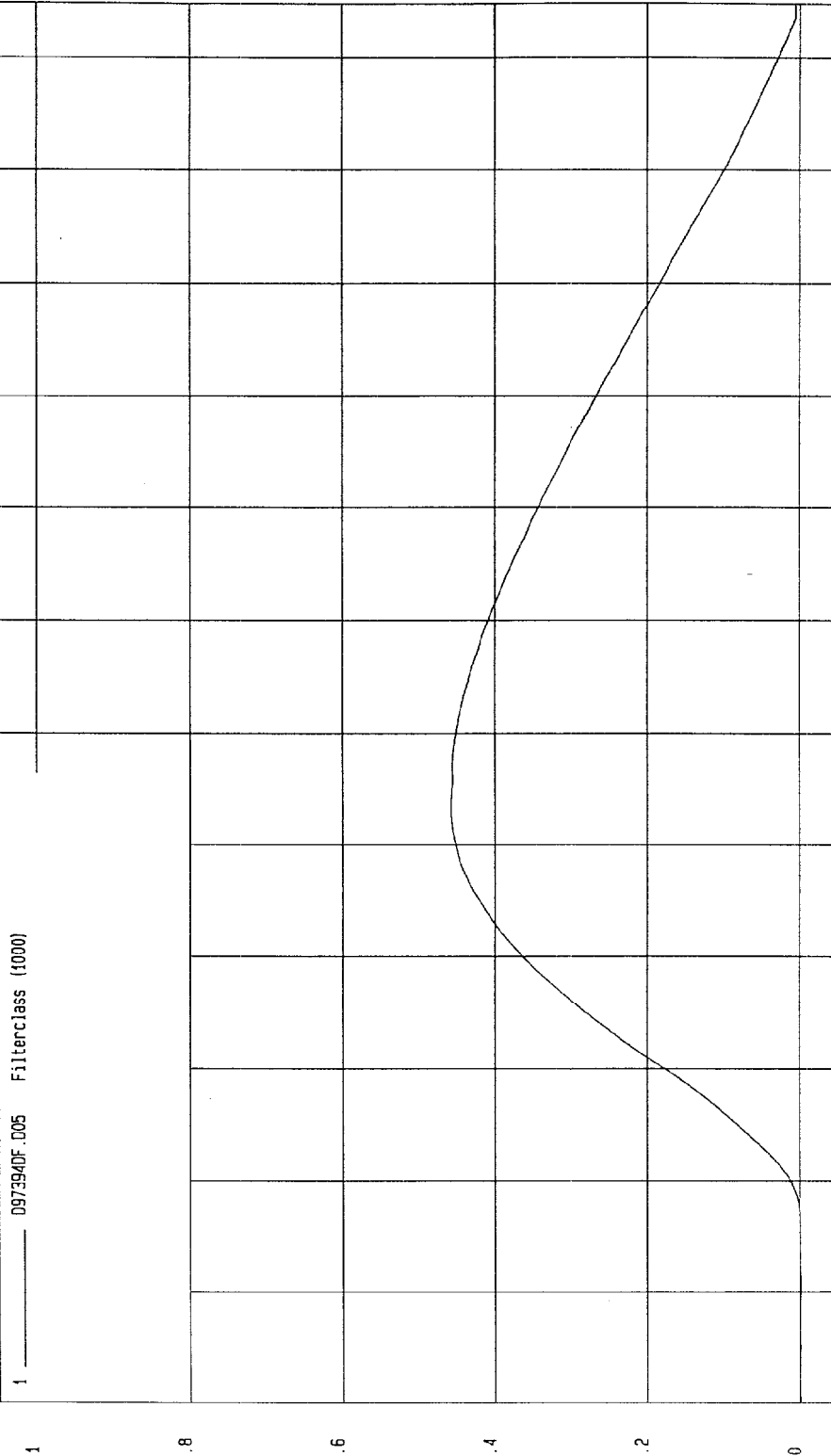
MECA Research
08-22-1997 09:51

TEST: EUORSID RIB MODULE TEST DATE: 08-26-1997 - 09:26

COMPONENT: DUMMY # E1-169 Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -1.33E-03 IN at 0 msec Maximum = .45 IN at 53.2 msec

UPPER RIB DISPLACEMENT

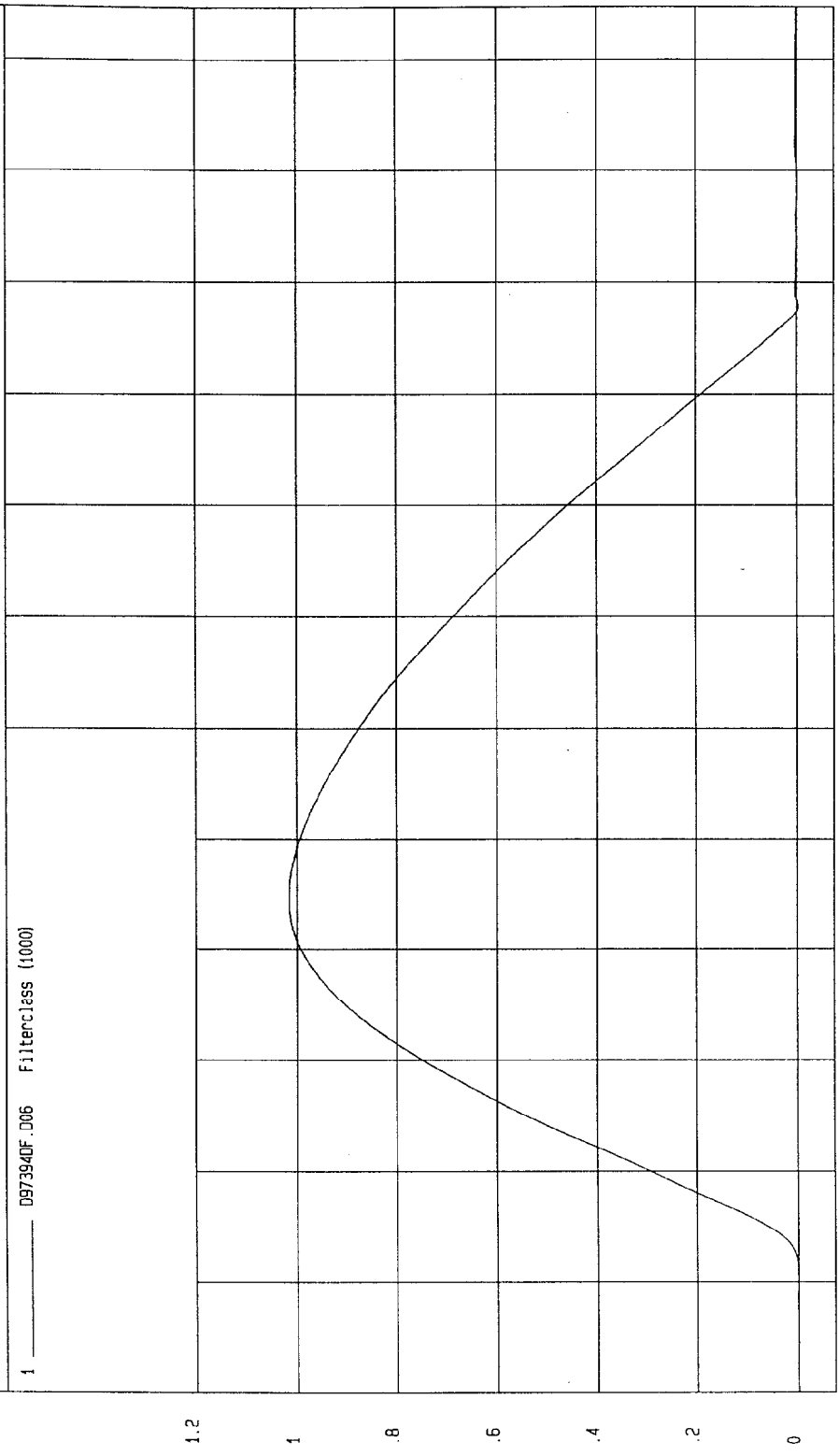


TIME (SECONDS)

MCA Research
08-26-1997 10:27

TEST: EUROSID RIB MODULE	TEST DATE: 08-26-1997 - 09:38
COMPONENT: DUMMY # E1-169	Velocity: 6.56 FT/SEC 2 M/SEC
Minimum = -3.46E-03 IN at 97.8 msec	Maximum = 1.01 IN at 44.0 msec

UPPER RIB DISPLACEMENT



TIME (SECONDS)

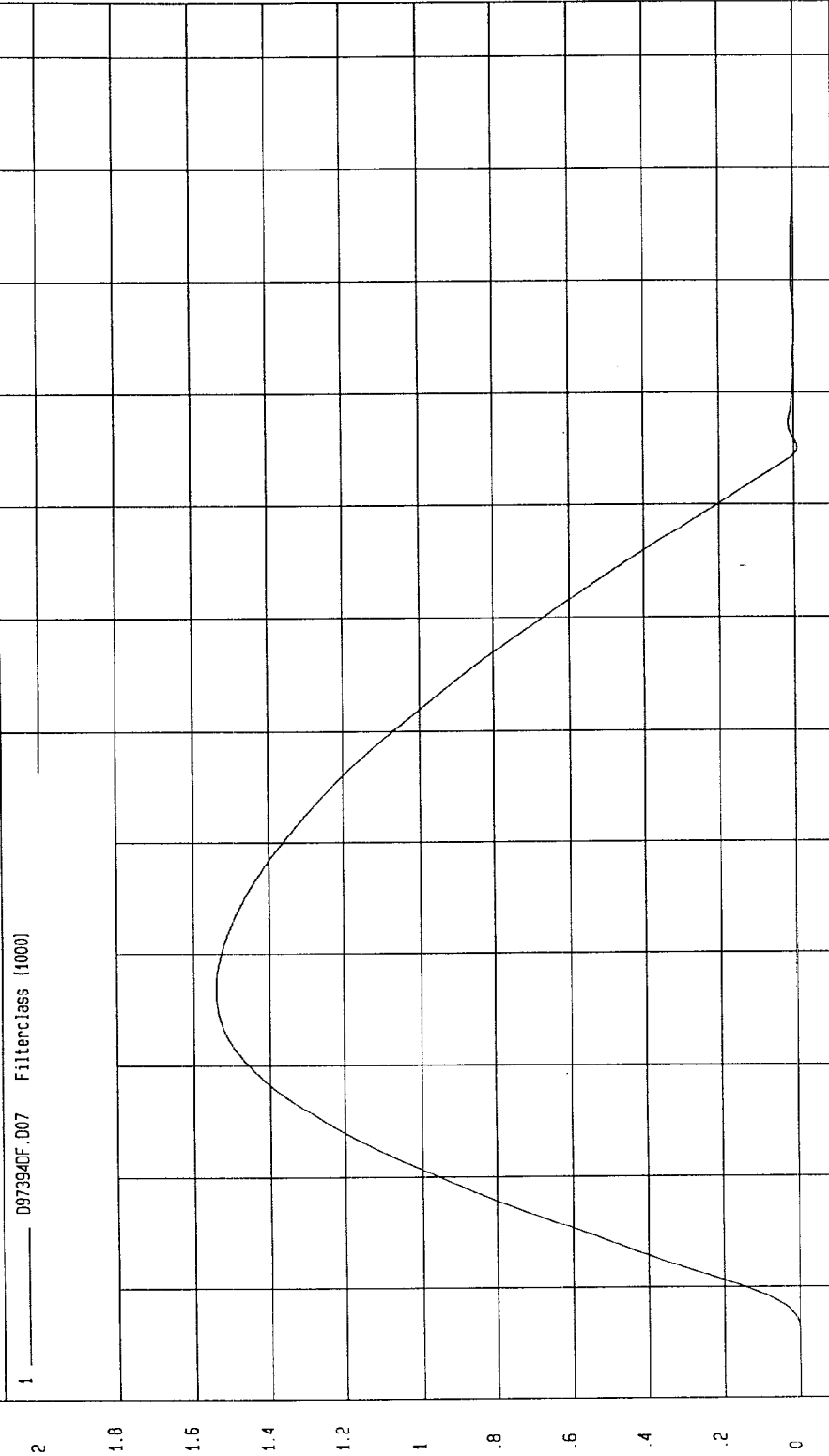
WCA Research
08-26-1997 10:27

TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 09: 53

COMPONENT: DUMMY # E1-169 Velocity: 9.84 FT/SEC 3 M/SEC

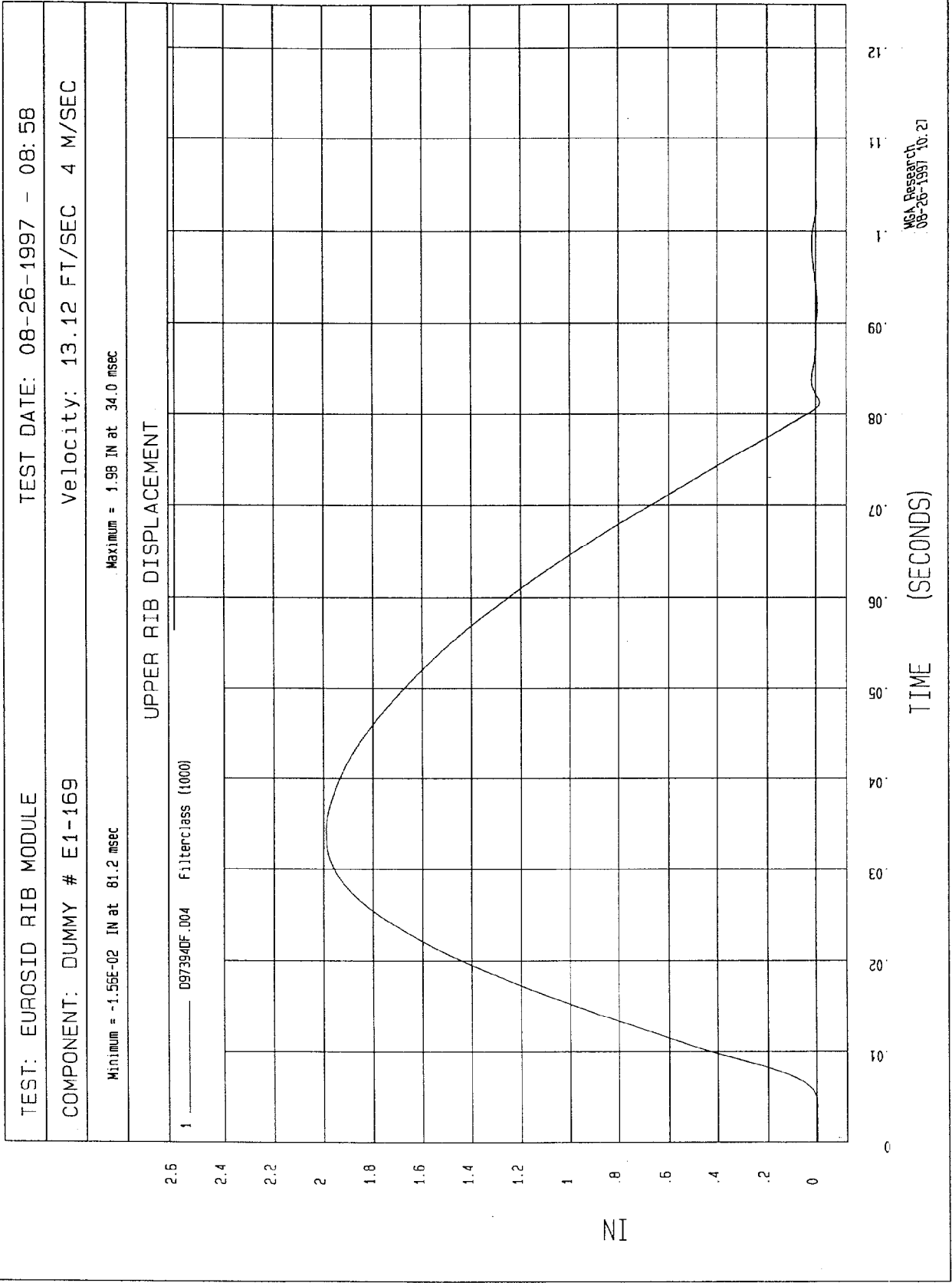
Minimum = -.00 IN at 84.9 msec Maximum = 1.53 IN at 36.4 msec

UPPER RIB DISPLACEMENT



TIME (SECONDS)

MECA Research
08-26-1997 10: 27

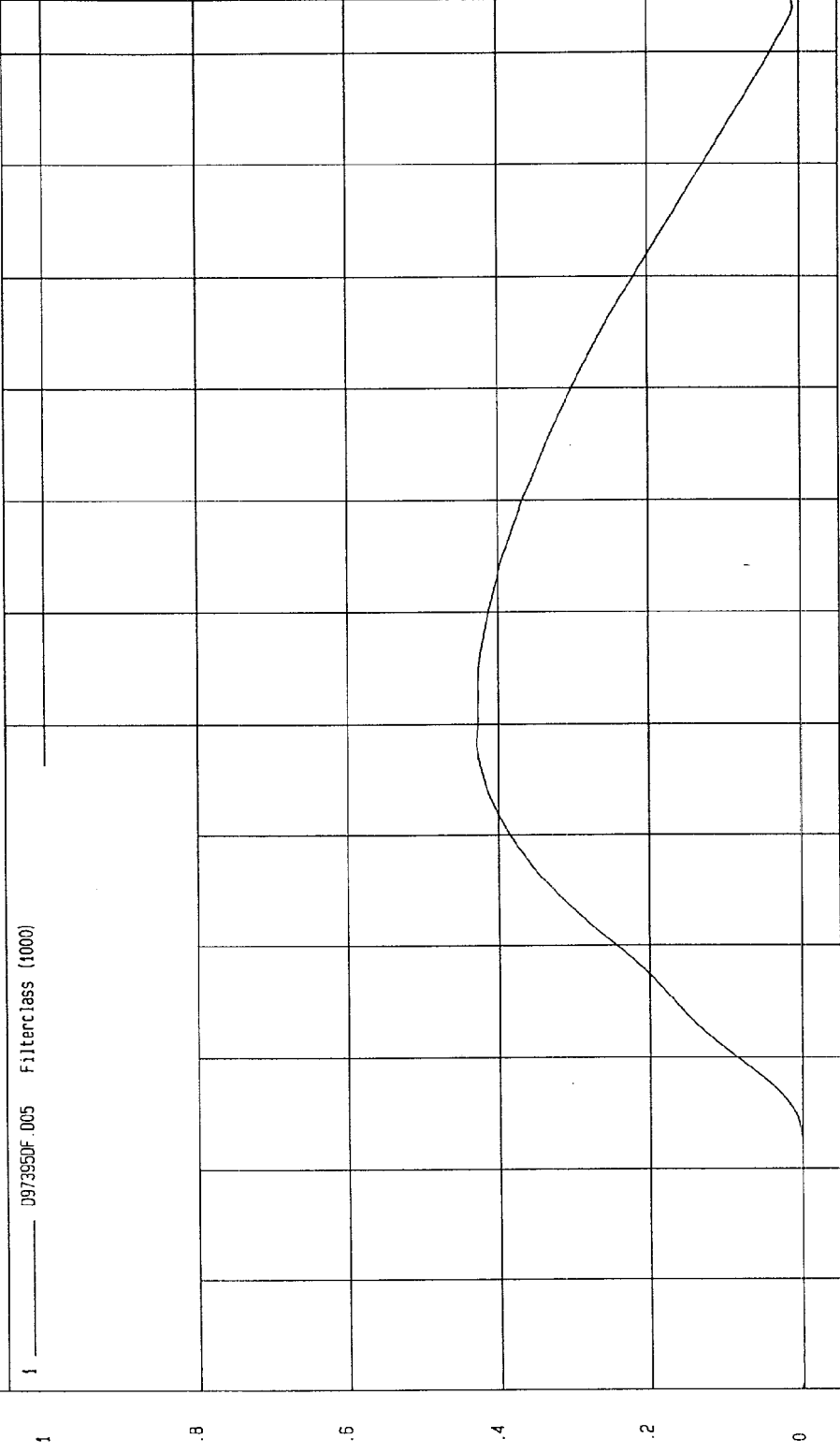


TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 10:44

COMPONENT: DUMMY # E1-169 Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -8.4/E-04 IN at 16.1 msec Maximum = .42 IN at 58.4 msec

MIDDLE RIB DISPLACEMENT



0 0.2 0.4 0.6 0.8 1.0

TIME (SECONDS)

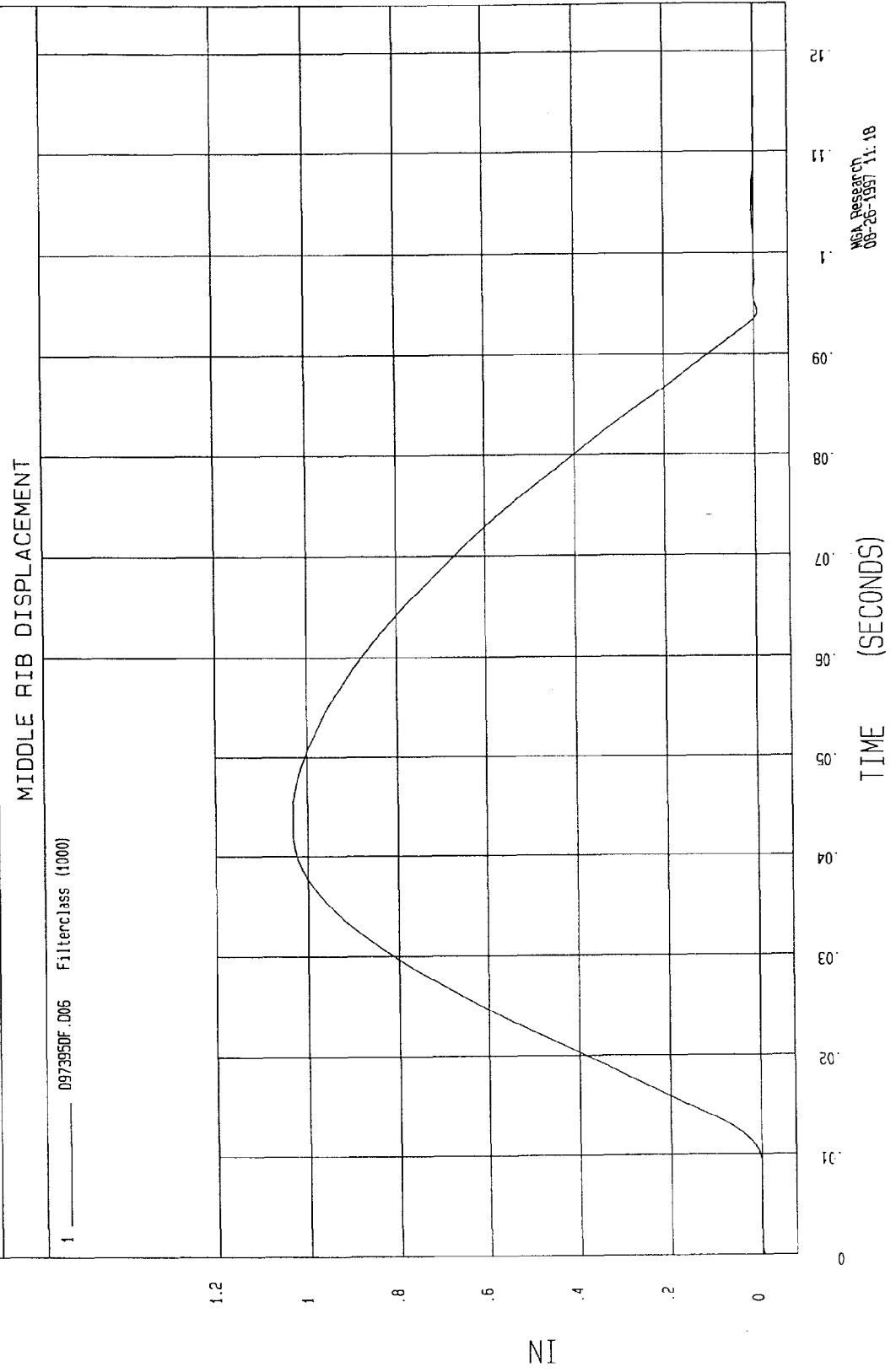
0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12

NGA Research
08-26-1997 11.17

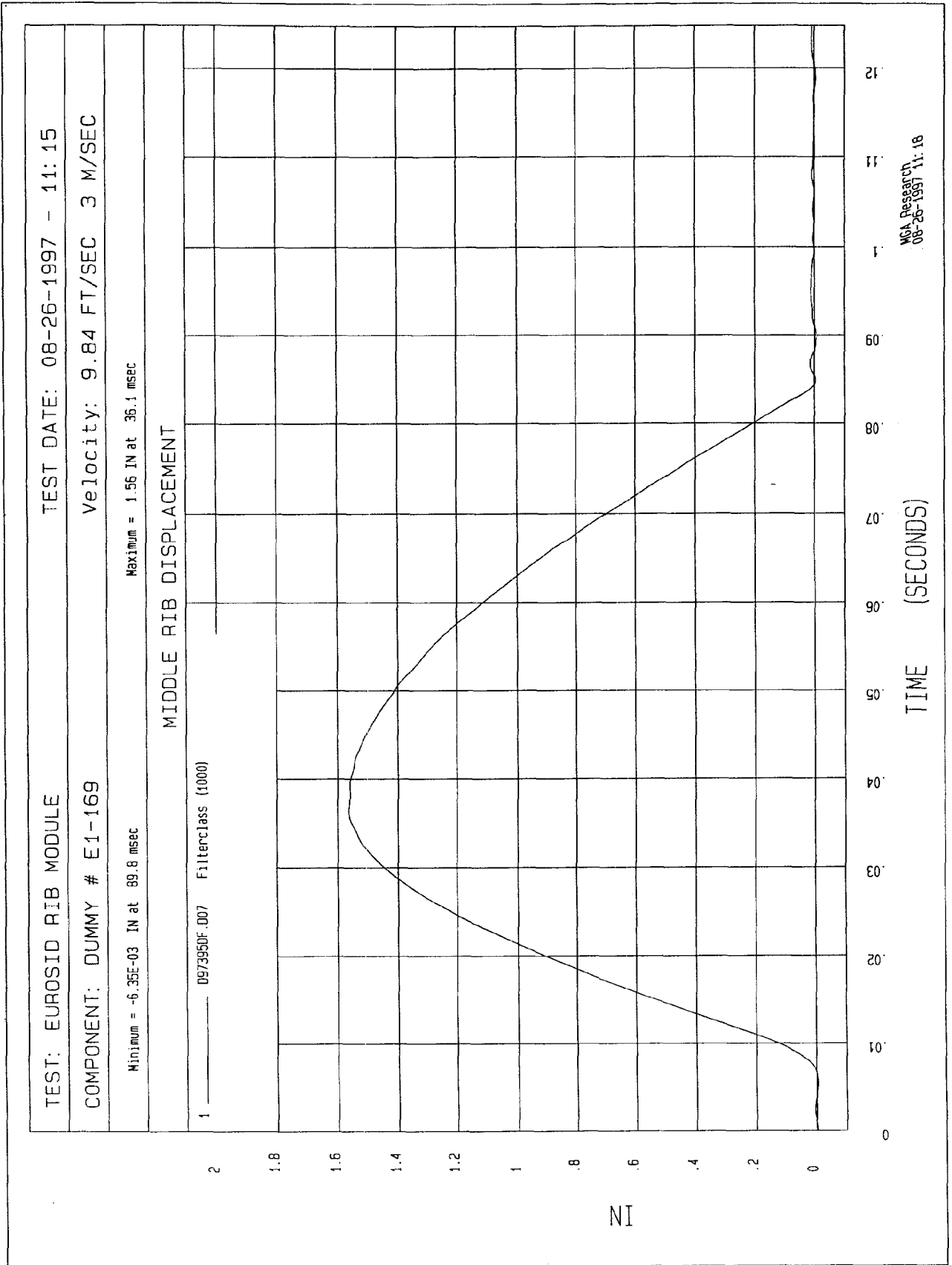
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 11:00

COMPONENT: DUMMY # E1-169 Velocity: 6.56 FT/SEC 2 M/SEC

Minimum = -7.00E-03 IN at 94.2 msec Maximum = 1.03 IN at 43.0 msec



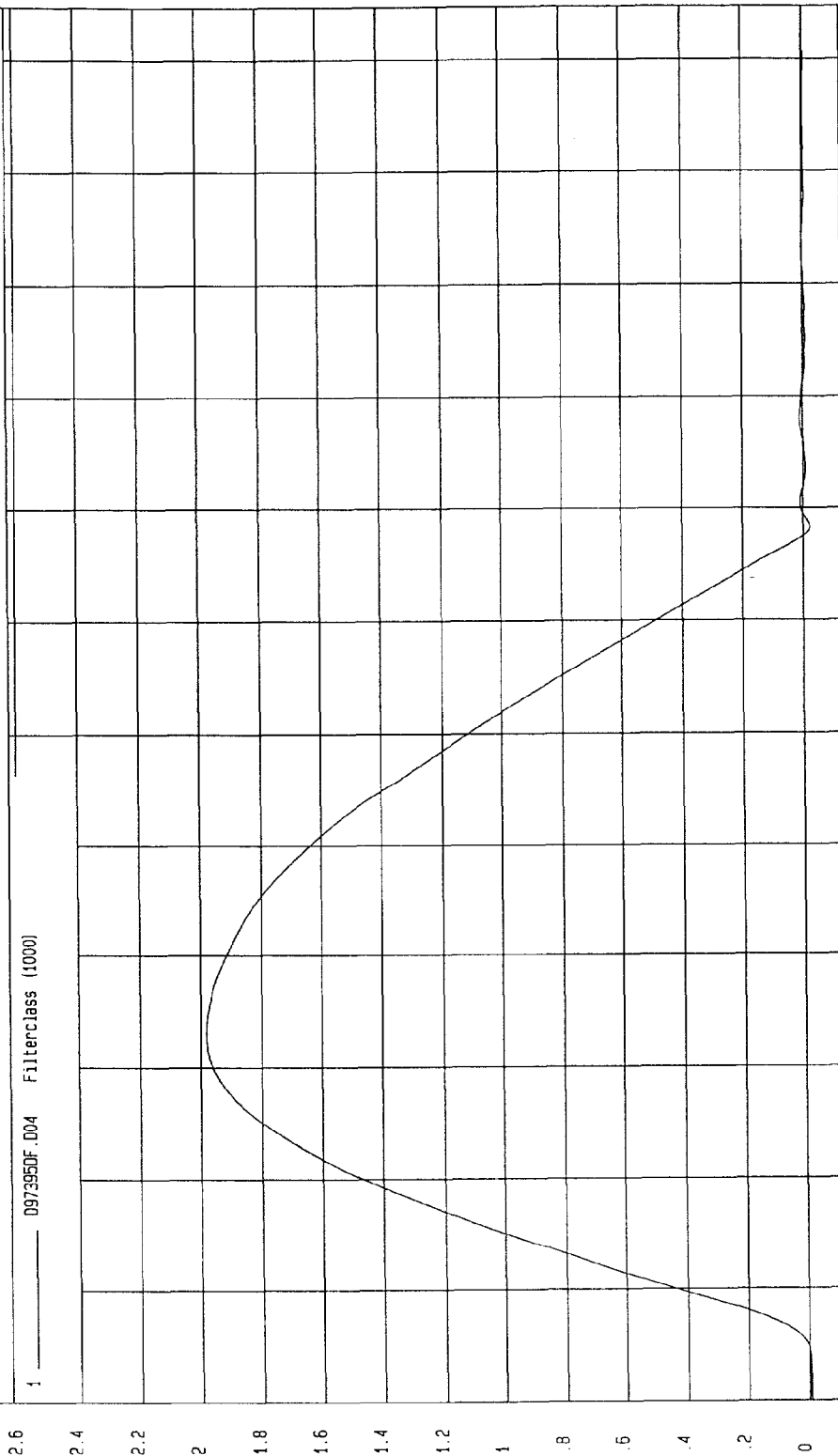
MSA Research
08-26-1997 11:18



TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 10:30:52
COMPONENT: DUMMY # E1-169 Velocity: 13.12 FT/SEC 4 M/SEC

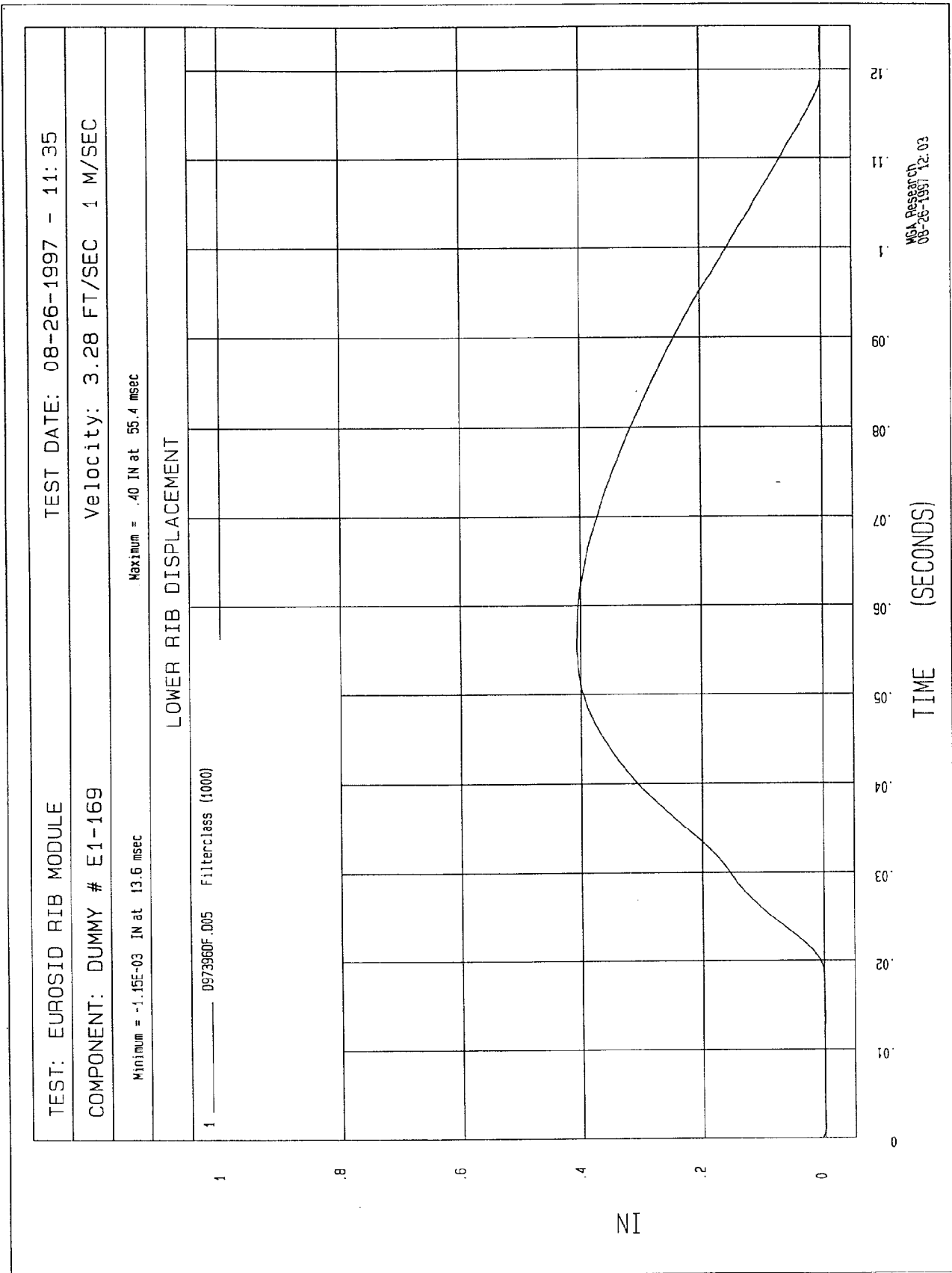
Minimum = -2.14E-02 IN at 78.3 msec Maximum = 1.98 IN at 32.9 msec

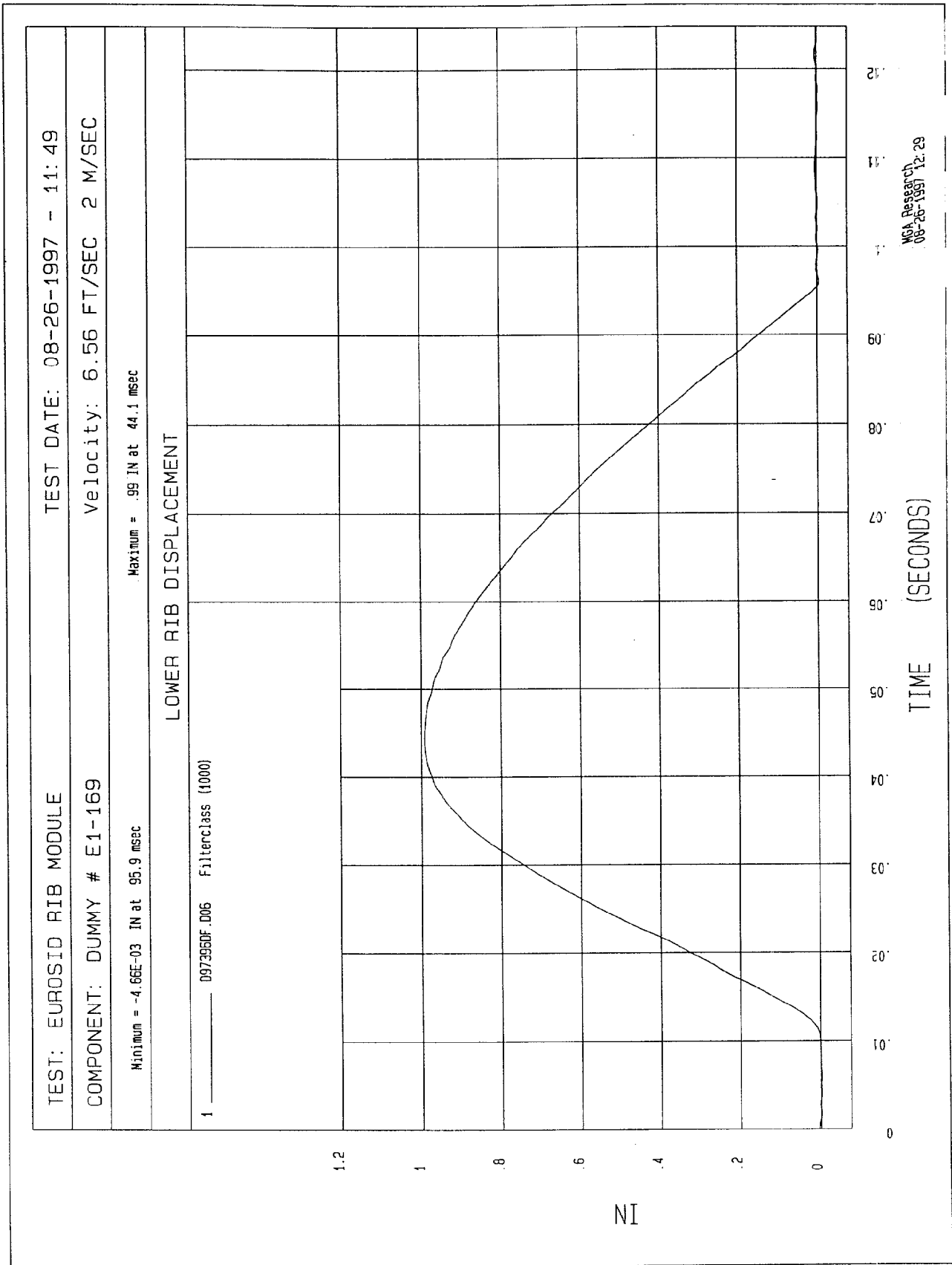
MIDDLE RIB DISPLACEMENT



TIME (SECONDS)

MSA Research
08-26-1997 11:17





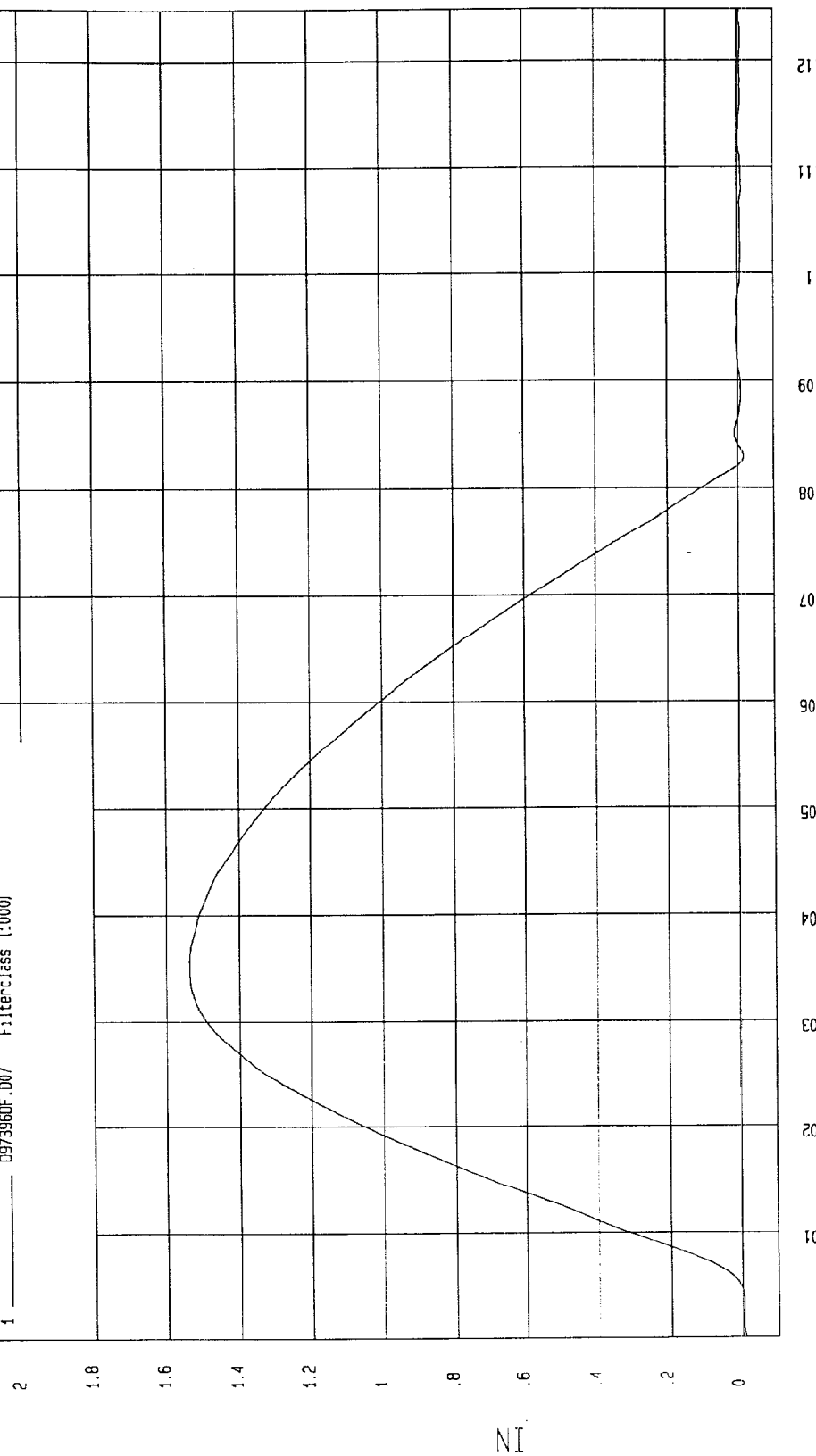
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 11:58

COMPONENT: DUMMY # E1-169 Velocity: 9.84 FT/SEC 3 M/SEC

Minimum = -1.59E-02 IN at 82.8 msec Maximum = 1.53 IN at 35.1 msec

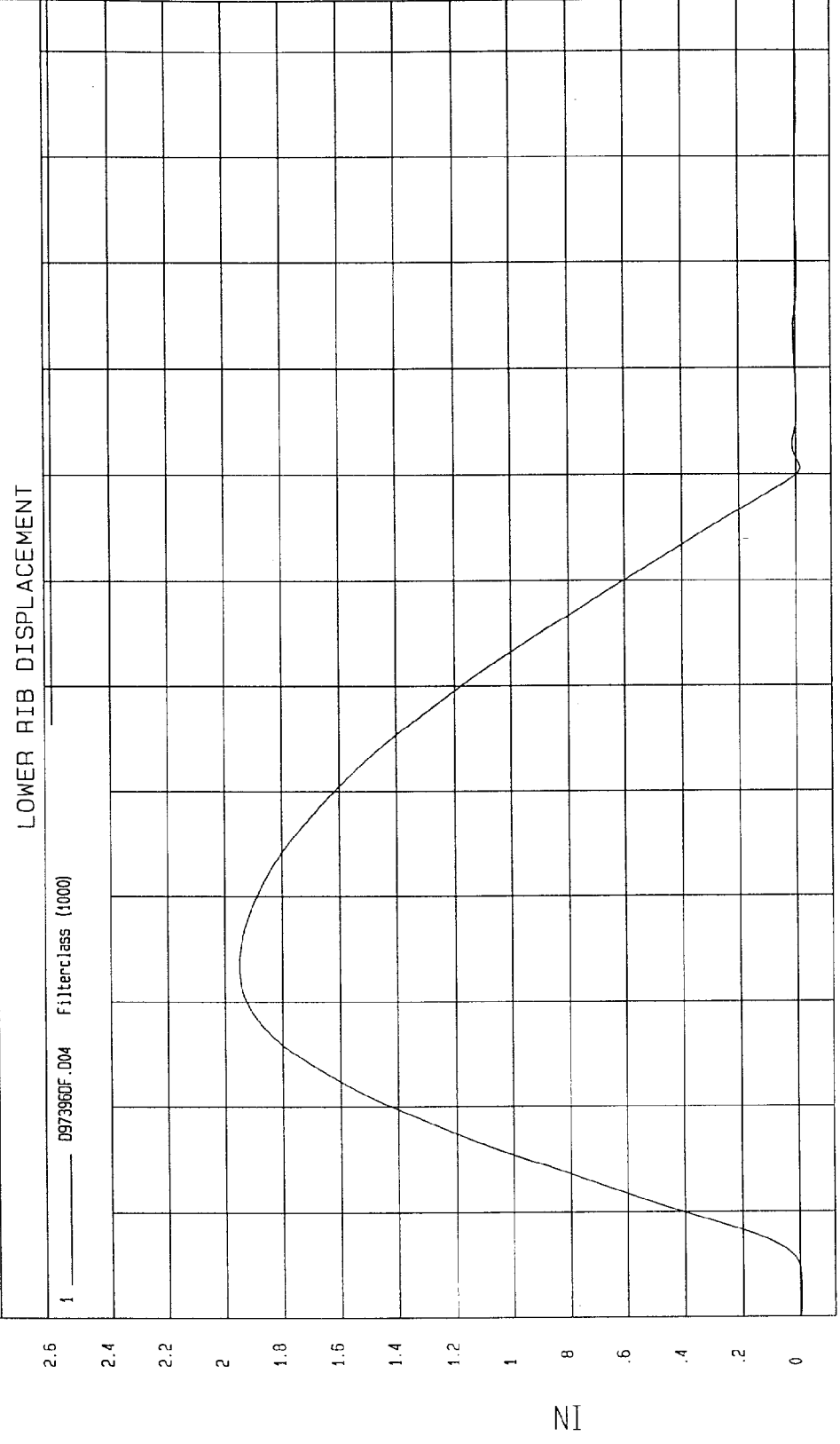
LOWER RIB DISPLACEMENT

1 ——— 0973960F.D07 Filterclass (1000)



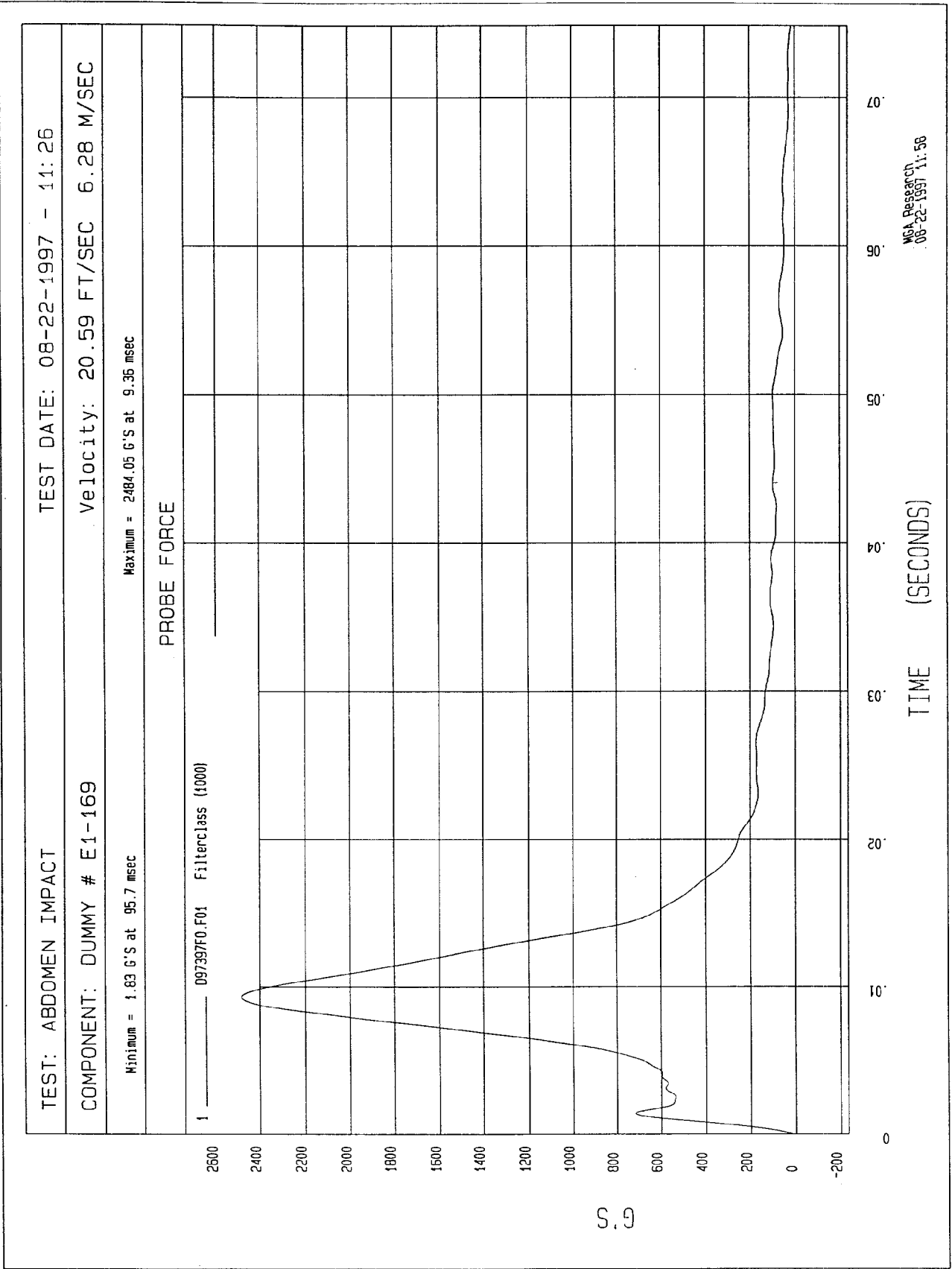
MEA Research
08-26-1997 12:23

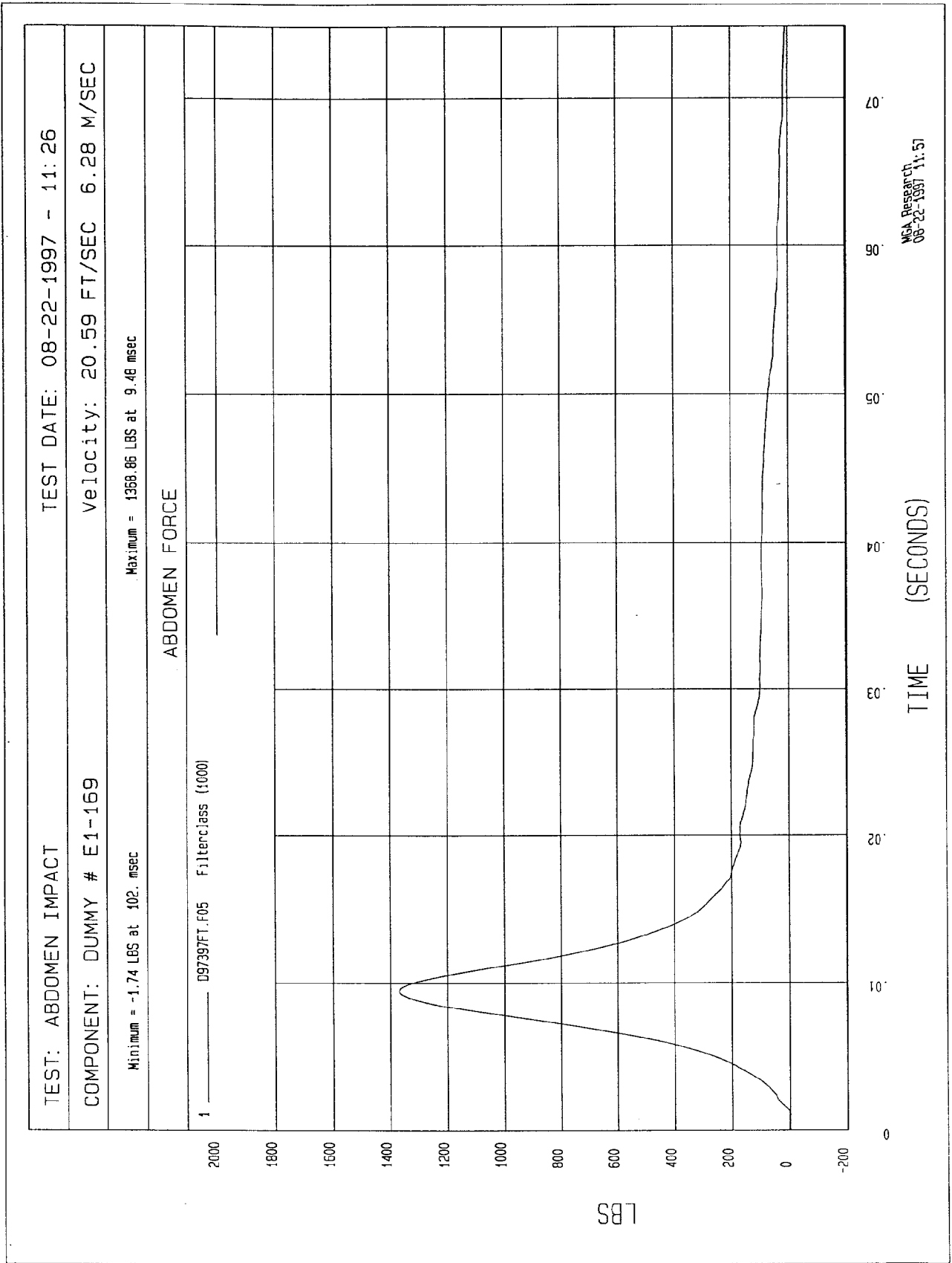
TEST: EUROSID RIB MODULE	TEST DATE: 08-26-1997 - 11:25
COMPONENT: DUMMY # E1-169	Velocity: 13.12 FT/SEC 4 M/SEC
Minimum = -1.53E-02 IN at 80.6 msec	Maximum = 1.94 IN at 33.3 msec



1 _____ D973960F.004 Filterclass (1000)

MGA Research
08-26-1997 12:03



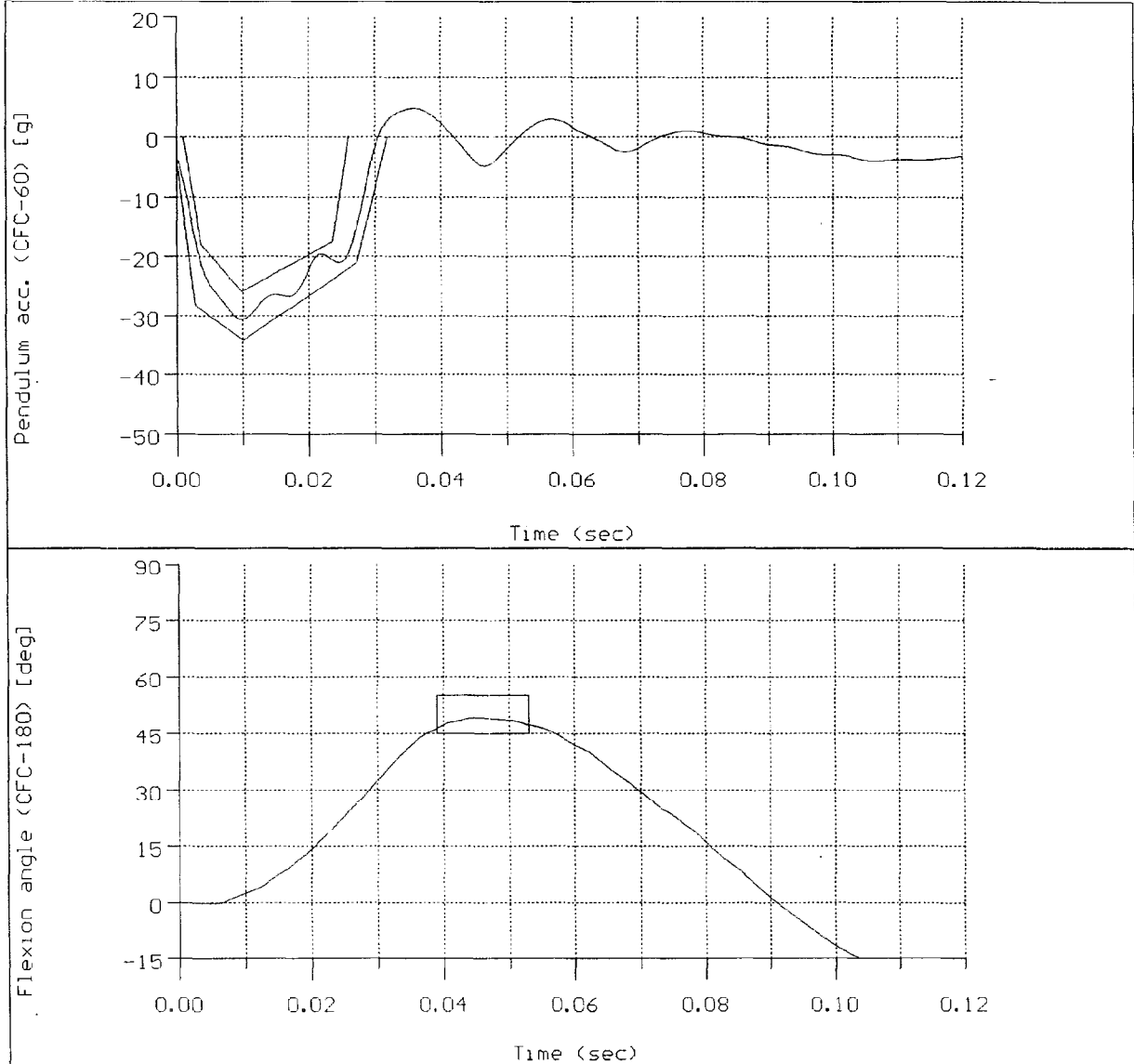


EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number	: SM9647-2	Temperature	: 21 deg C
Test number	: 20215	Rel. Humidity	: 50 %
Impact side	: LHS	Technician	: DP
Spine length	:	Test date	: 2-SEPTEMBER-1997



Parameter	Specification	Result	Passed/Failed
Pendulum Speed	5.95 - 6.15 m/s	6.08 m/s	
Maximum pendulum acc.		-30.6 g	
Time of max pend. acc.		9.8 msec	
Maximum flexion angle	45.0 - 55.0 deg	49.1 deg	
Time of max. flex. angle	39.0 - 53.0 msec	45.5 msec	

EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM9647-2

Temperature : 21 deg C

Test number : 20215

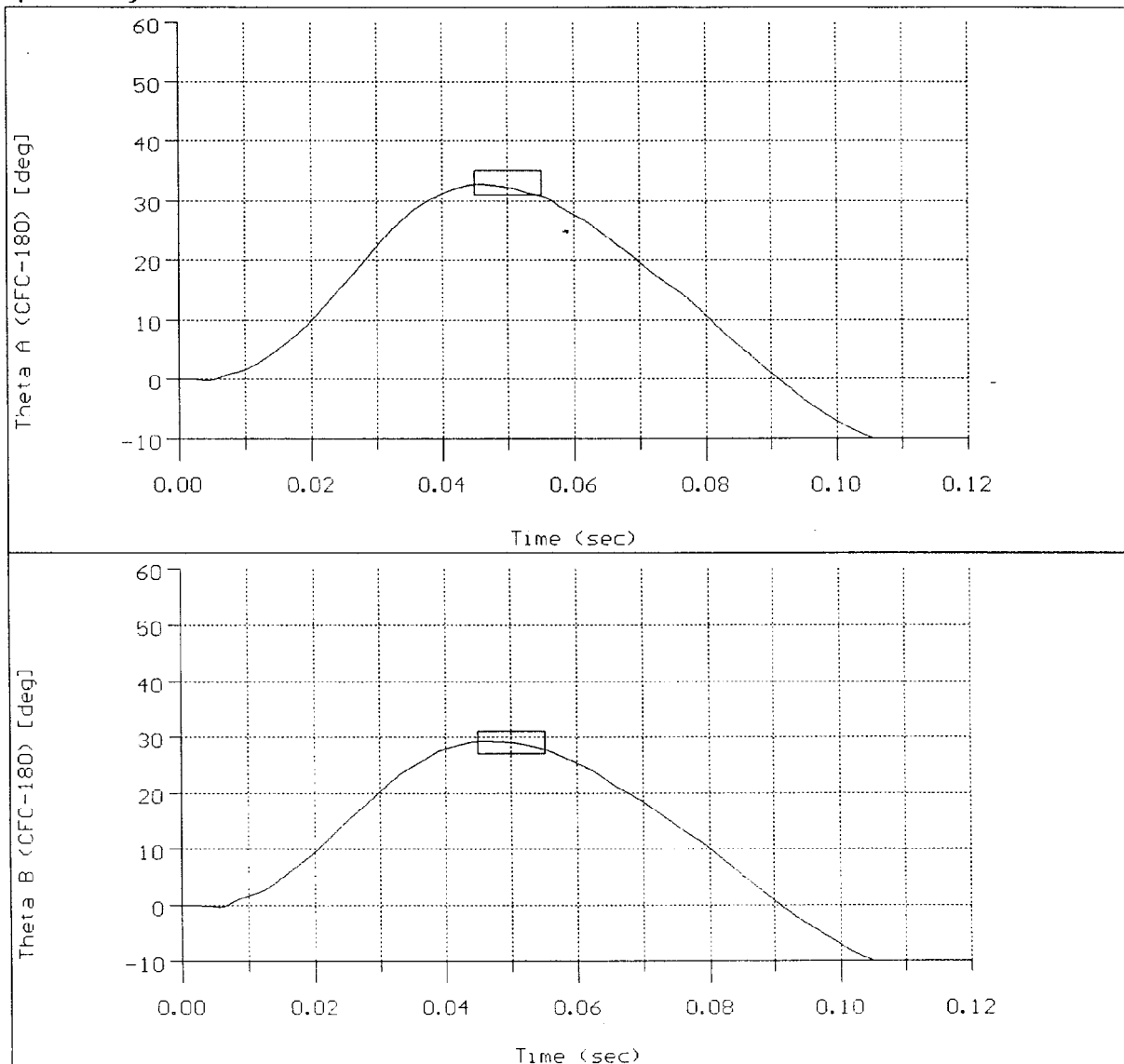
Rel. Humidity : 50 %

Impact side : LHS

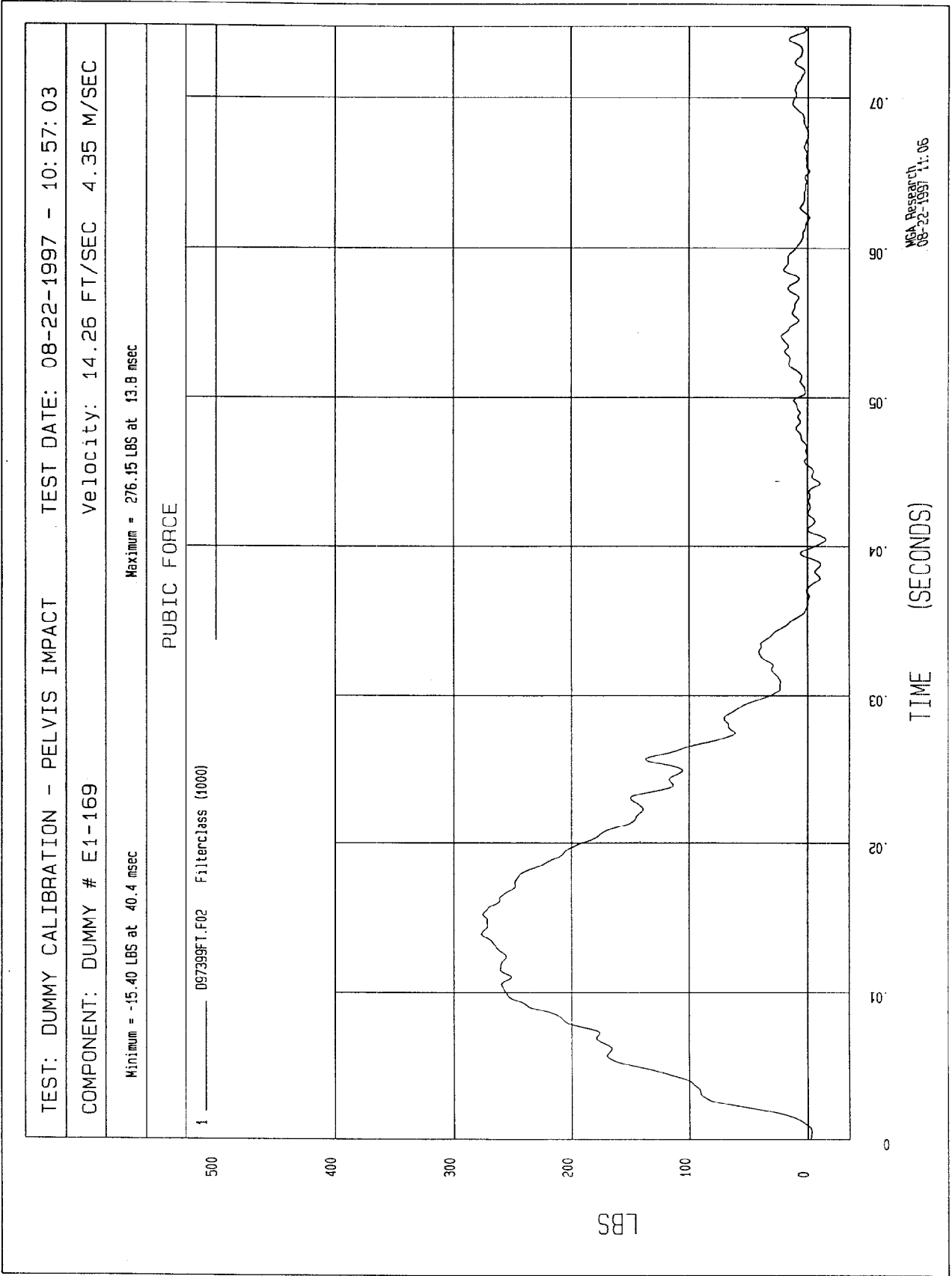
Technician : DP

Spine length :

Test date : 2-SEPTEMBER-1997



Parameter	Specification	Result	Passed/Failed
Maximum Theta(A)	31.0 - 35.0 deg	32.7 deg	
Time of max. Theta(A)	45.0 - 55.0 msec	45.8 msec	
Maximum Theta(B)	27.0 - 31.0 deg	29.2 deg	
Time of max. Theta(B)	45.0 - 55.0 msec	45.8 msec	



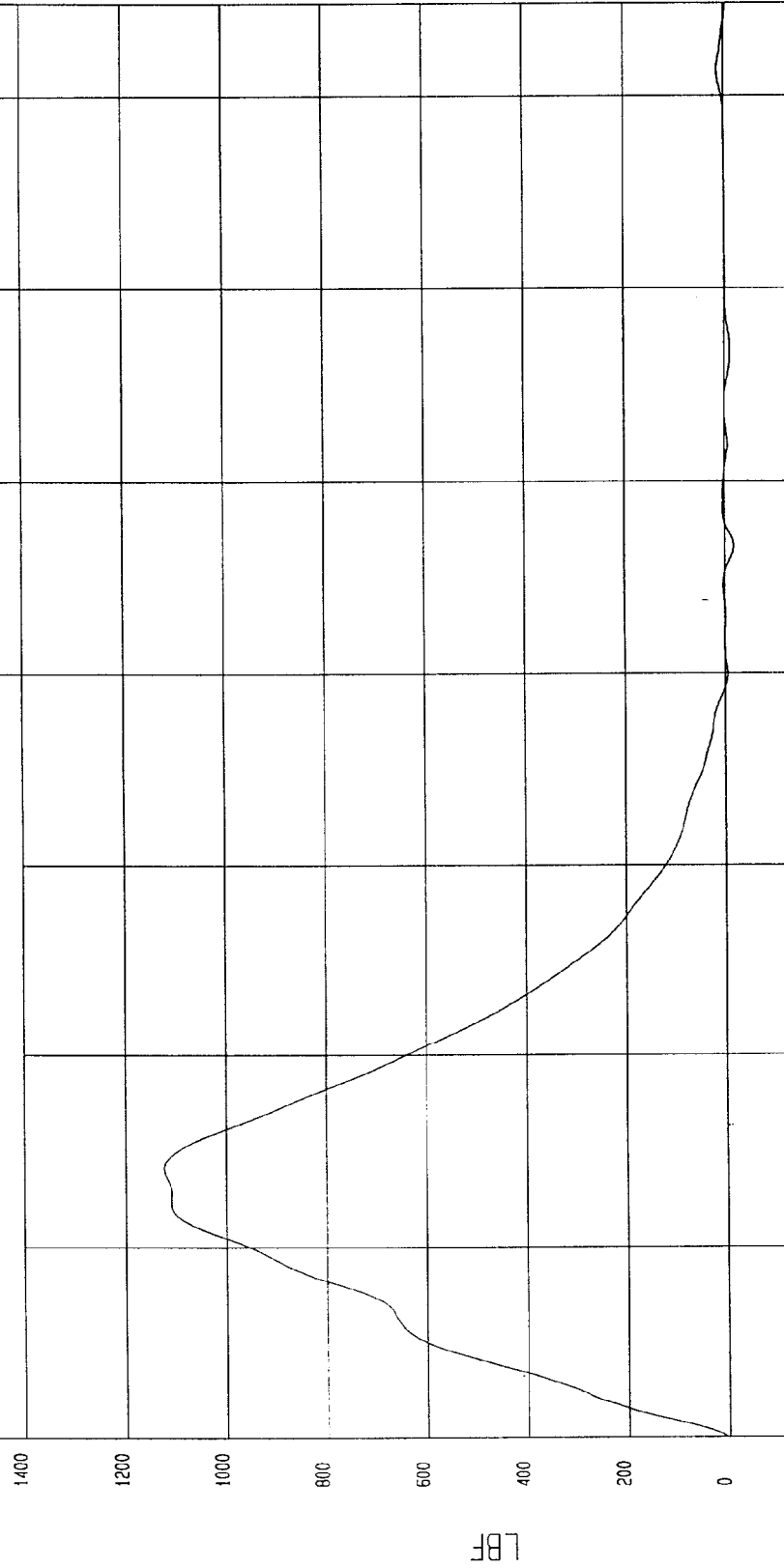
TEST: DUMMY CALIBRATION - PELVIS IMPACT TEST DATE: 08-22-1997 - 10:55:49

COMPONENT: DUMMY # E1-169 Velocity: 14.26 FT/SEC 4.35 M/SEC

Minimum = -16.35 LBF at 46.6 msec Maximum = 1122.75 LBF at 14.1 msec

IMPACTOR FORCE

1 ——— 097399AT.A01 Filter: class (1000)



TIME (SECONDS)

NCA Research
08-22-1997 11:06

EUROSID DUMMY POST-TEST CALIBRATION DATA SUMMARY SHEET

Dummy #: E1-213

Calibration Date: September 2, 1997

1.0 Head Drop Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	49%
Max. Resultant Acceleration	100 - 150 g's	143
Time of Max. Res. Acceleration		2.6 msec.

Calibrated By: Tim Michnay

Date: August 25, 1997

2.0 Neck Pendulum Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	52%
Pendulum Speed	10.83 - 11.48 ft/sec	11.30
Max. Pendulum Acceleration		-34.73
Time Max. Pend. Acceleration		9.73
Maximum Flexion Angle	46.0 - 56.0 deg.	54.27
Time of Max. Flexion Angle	50.0 - 62.0 ms	58.2
Maximum Angle Theta (A)	30.0 - 34.0 deg	31.9
Time of Max. Theta (A)	50.0 - 60.0 ms	58.0
Maximum Angle Theta (B)	26.0 - 30.0 deg.	29.2
Time of Max. Theta (B)	50.0 - 60.0 ms	53.6

Calibrated By: Tim Michnay

Date: August 25, 1997

3.0 Shoulder Impact Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Pendulum Speed	13.78 - 14.43 ft/sec	14.01
Max. Pendulum Acceleration	7.5 - 10.5 g's	7.9
Time of Max. Pendulum Acceleration		18.1

Calibrated By: Tim Michnay

Date: August 22, 1997

4.0 Upper Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Displacement at 3.28 ft/sec	.39 - .55 in	.44
Displacement at 6.56 ft/sec	.93 - 1.08 in	.93
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.48
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.82

Calibrated By: Tim Michnay

Date: August 26, 1997

5.0 Middle Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Displacement at 3.28 ft/sec	.39 - .55 in	.39
Displacement at 6.56 ft/sec	.93 - 1.08 in	.98
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.47
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.88

Calibrated By: Tim Michnay

Date: August 26, 1997

6.0 Lower Rib

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	47%
Displacement at 3.28 ft/sec	.39 - .55 in	.39
Displacement at 6.56 ft/sec	.93 - 1.08 in	.95
Displacement at 9.84 ft/sec	1.42 - 1.57 in	1.46
Displacement at 13.12 ft/sec	1.81 - 2.00 in	1.82

Calibrated By: Tim MichnayDate: August 26, 1997**7.0 Abdomen Test**

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Probe Speed	20.34 - 20.99 ft/sec	20.55
Maximum Impact Force	2136 - 2495 lbs	2313
Time of Maximum Force	8.8 - 10.4 ms	9.1
Max. Total Abdomen Force	1326 - 1776 lbs	1390
Time of Max. Total Force	8.5 - 10.1 ms	9.2

Calibrated By: Tim MichnayDate: August 22, 1997

8.0 Lumbar Spine Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	50%
Pendulum Speed	19.52 - 20.17 ft/sec	19.78
Max. Pendulum Acceleration		-30.36
Time Max. Pend. Acceleration		10.7
Maximum Flexion Angle	45.0 - 55.0 deg.	49.7
Time of Max. Flexion Angle	39.0 - 53.0 ms	46.9
Maximum Angle Theta (A)	31.0 - 35.0 deg	33.3
Time of Max. Theta (A)	45.0 - 55.0 ms	46.8
Maximum Angle Theta (B)	27.0 - 31.0 deg.	29.9
Time of Max. Theta (B)	45.0 - 55.0 ms	42.4

Calibrated By: First Technology Safety Systems

Date: September 2, 1997

9.0 Pelvis Test

	SPECIFICATION	MEASUREMENT
Laboratory Temperature	65° - 71° F	70°
Laboratory Relative Humidity	10% - 70%	44%
Pendulum Speed	13.77 - 14.43 ft/sec	14.08
Maximum Impactor Force	989 - 1214 lbs	1110
Time of Max. Impactor Force	10.3 - 15.5 ms	13.4
Maximum Pubic Force	233.8 - 368.7 lbs	303.0
Time of Max. Pubic Force	9.9 - 15.9 ms	14.8

Calibrated By: Tim Michnay

Date: August 22, 1997

TEST: DUMMY CALIBRATION - HEAD DROP TEST DATE: 08-25-1997 - 14:38:22

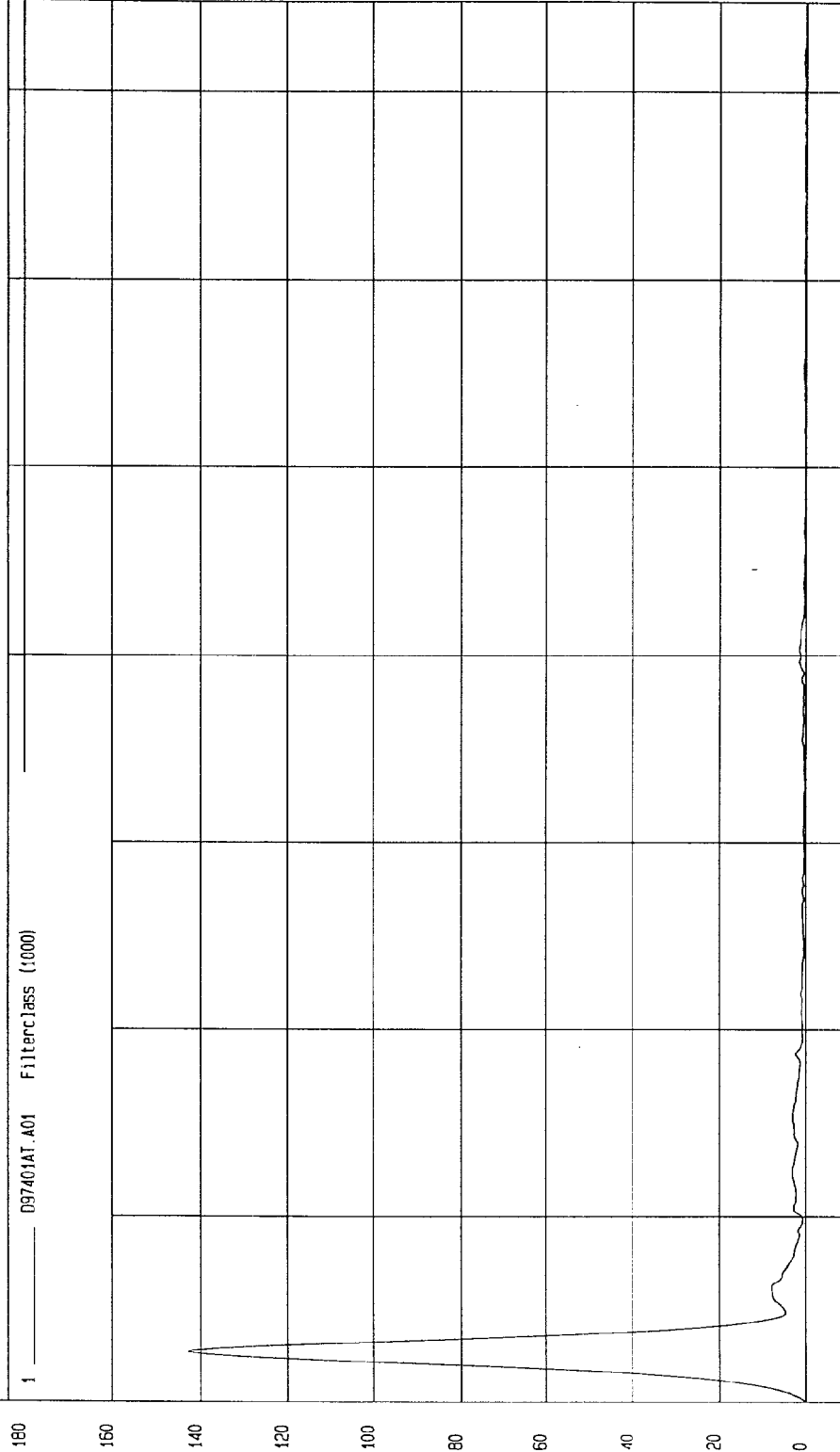
COMPONENT: DUMMY # E1-213

Minimum = 3.58E-02 G'S at 84.9 msec

Maximum = 142.90 G'S at 2.62 msec

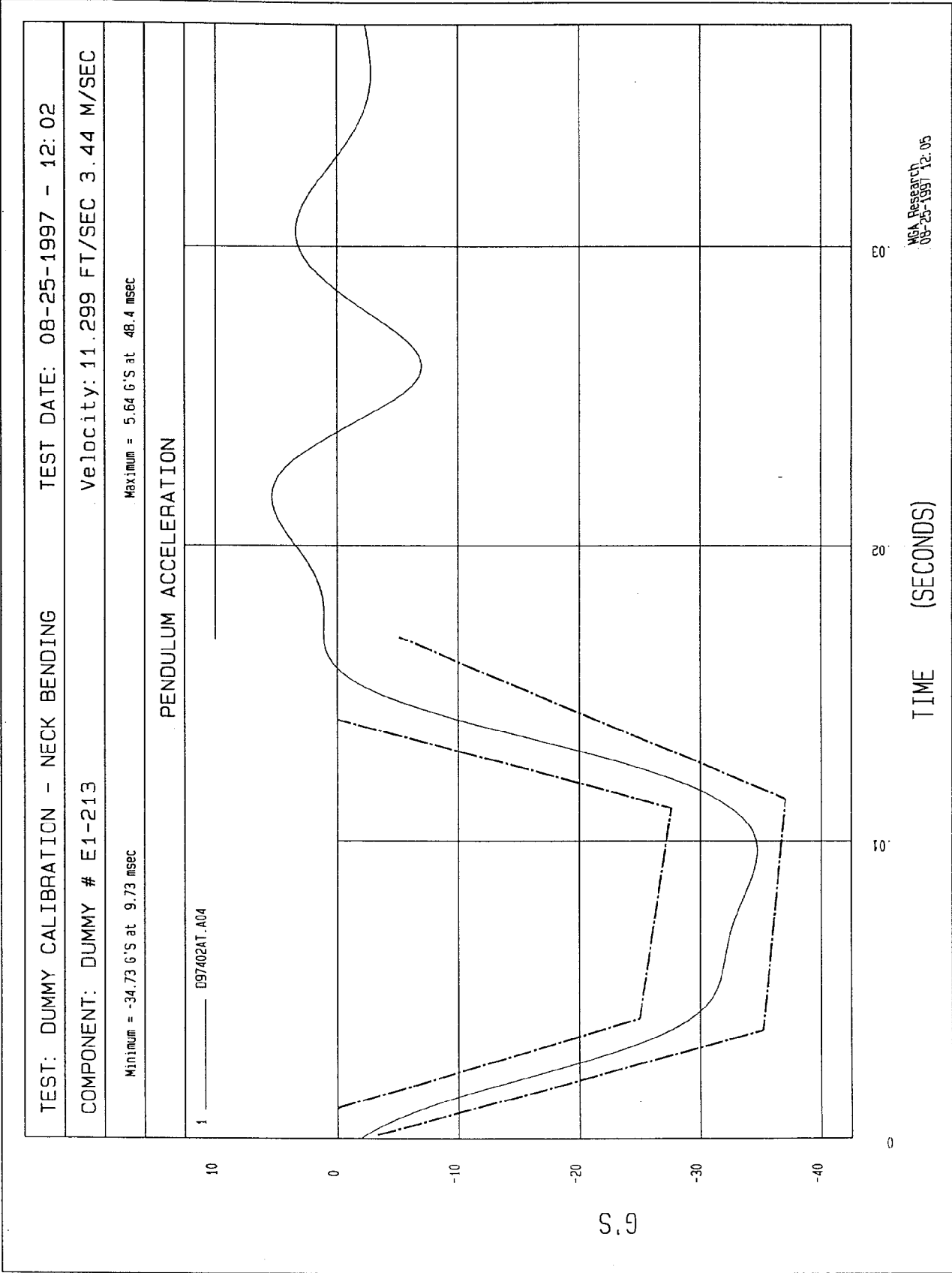
PEAK RESULTANT ACCELERATION

1 097401AT.A01 Filterclass (1000)



TIME (SECONDS)

WGA Research
08-25-1997 14:40



TEST: DUMMY CALIBRATION - NECK BENDING TEST DATE: 08-25-1997 - 12:02

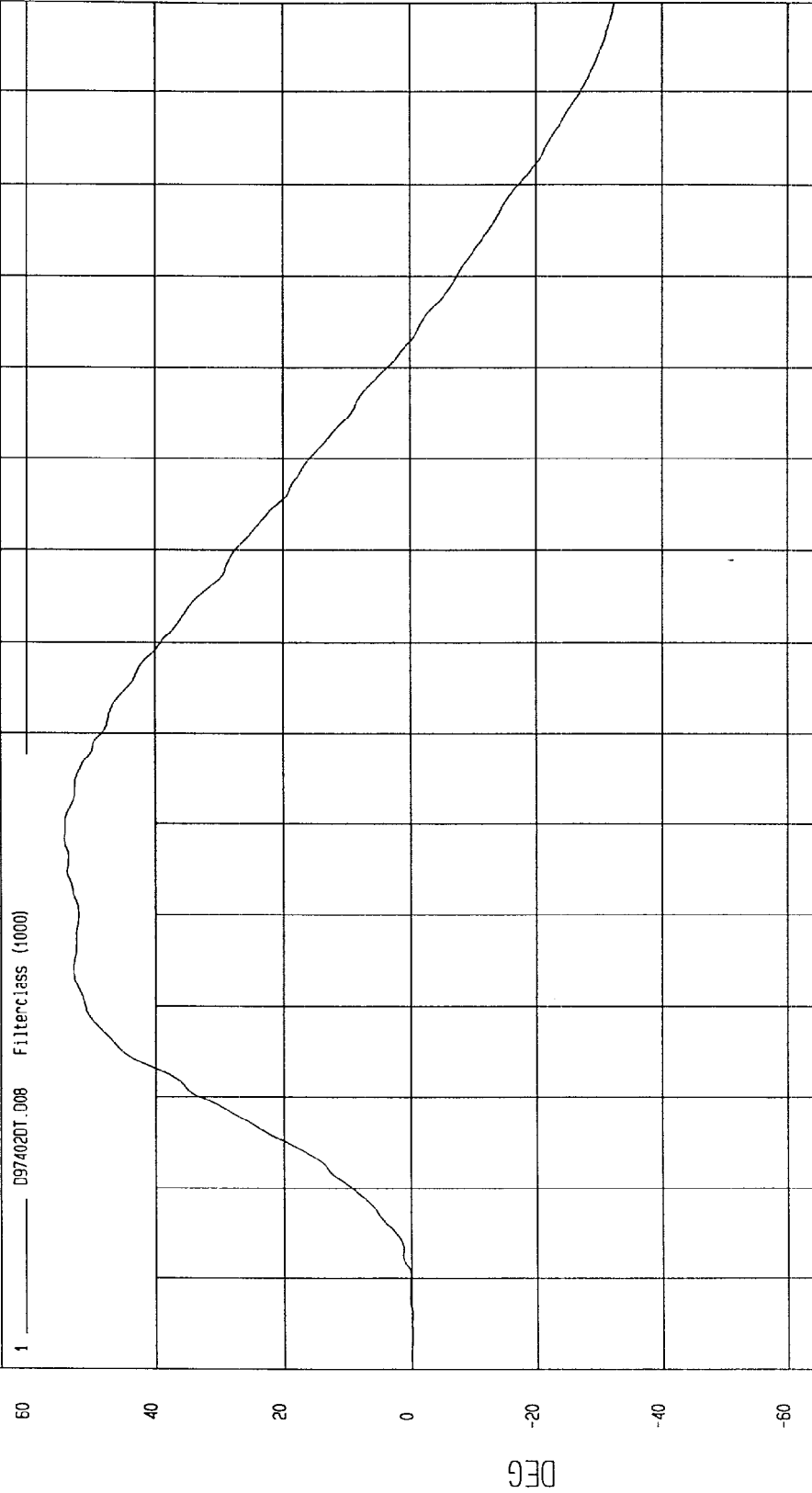
COMPONENT: DUMMY # E1-213 Velocity: 11.3 FT/SEC 3.44 M/SEC

Minimum = -33.01 DEG at 156 msec

Maximum = 54.27 DEG at 58.2 msec

FLEXION ANGLE

1 ——— D974020T.008 Filterclass (1000)



TIME (SECONDS)

NSA Research
08-25-1997 12:05

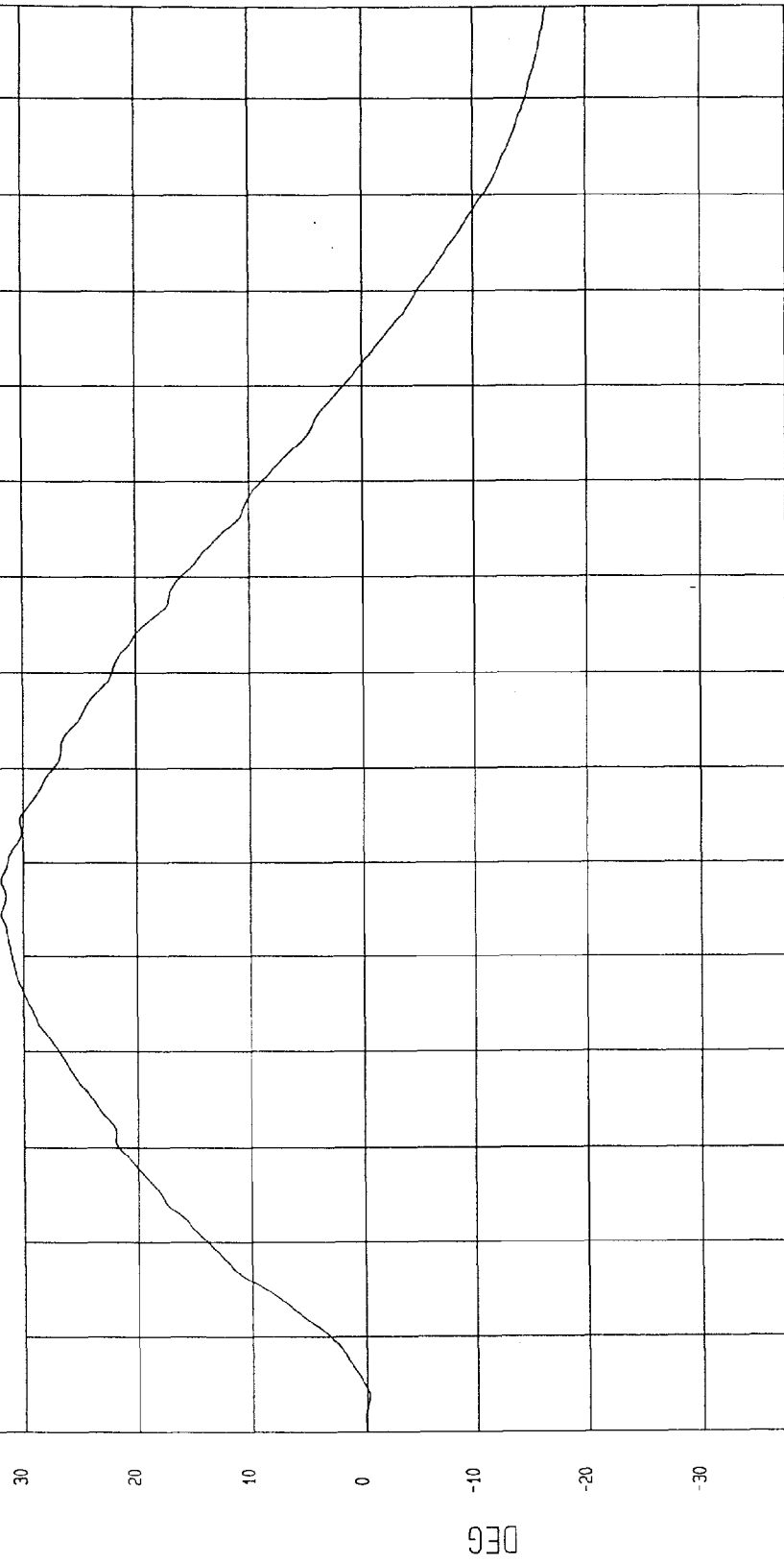
TEST: DUMMY CALIBRATION - NECK BENDING TEST DATE: 08-25-1997 - 12:02

COMPONENT: DUMMY # E1-213 Velocity: 11.3 FT/SEC 3.44 M/SEC

Minimum = -16.71 DEG at 155. msec Maximum = 31.92 DEG at 58.0 msec

THETA A

1 ——— 09740201.D05 Filterclass (1000)



TIME (SECONDS)

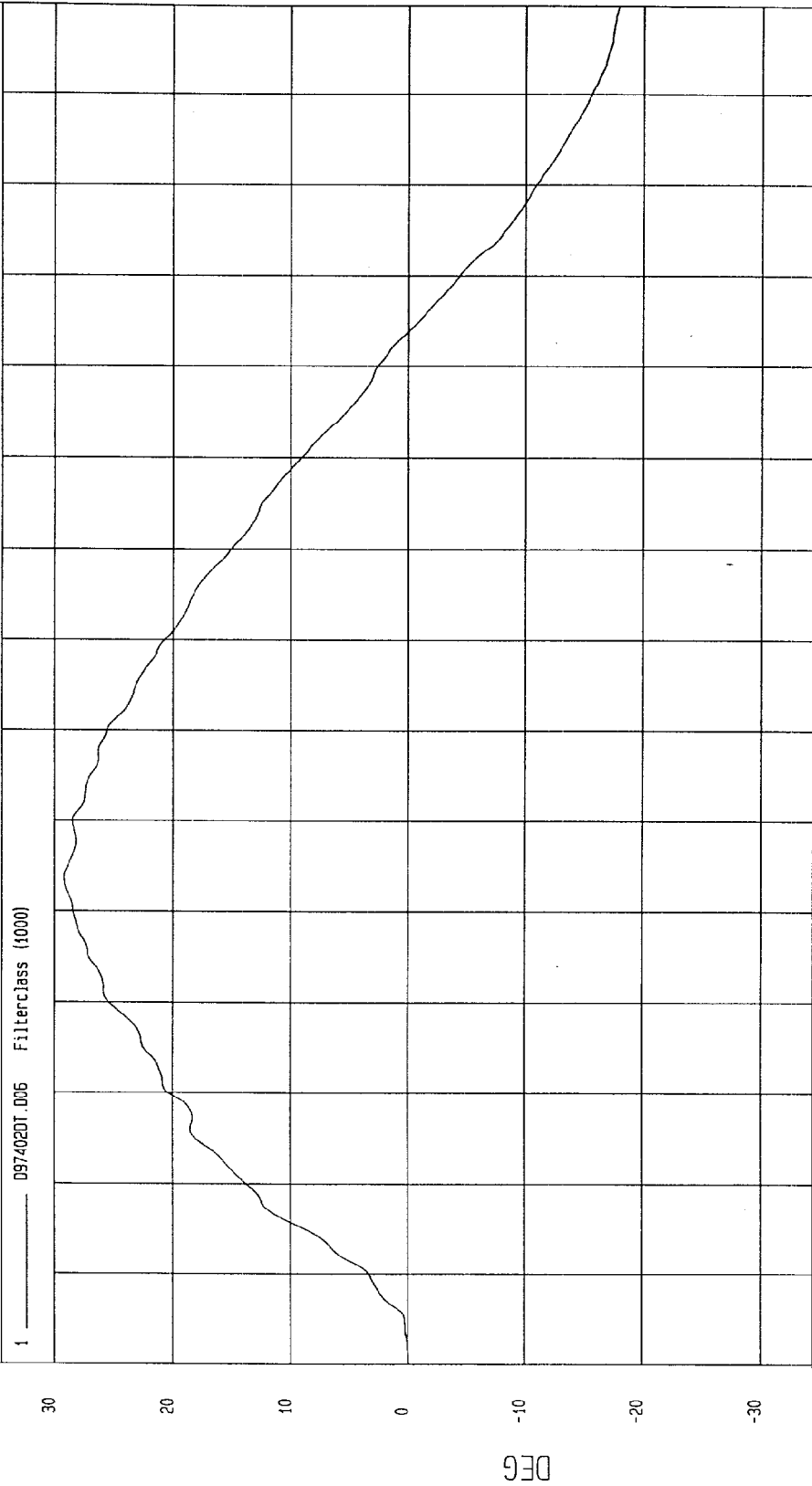
NSA Research
08-25-1997 12:06

TEST: DUMMY CALIBRATION - NECK BENDING TEST DATE: 08-25-1997 - 12:02

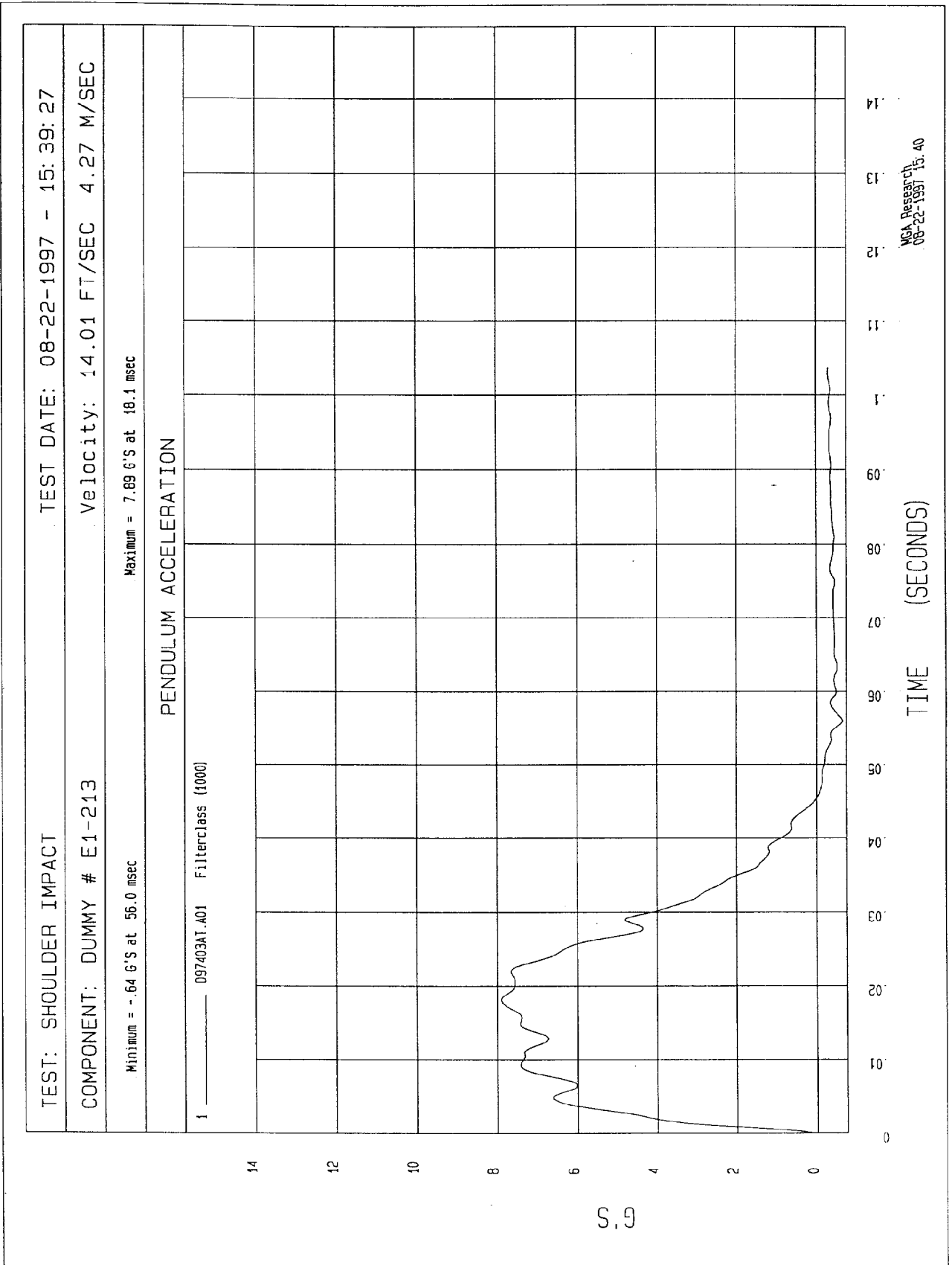
COMPONENT: DUMMY # E1-213 Velocity: 11.3 FT/SEC 3.44 M/SEC

Minimum = -18.46 DEG at 157. msec Maximum = 29.17 DEG at 53.6 msec

THETA B



NSA Research
08-25-1997 12:06



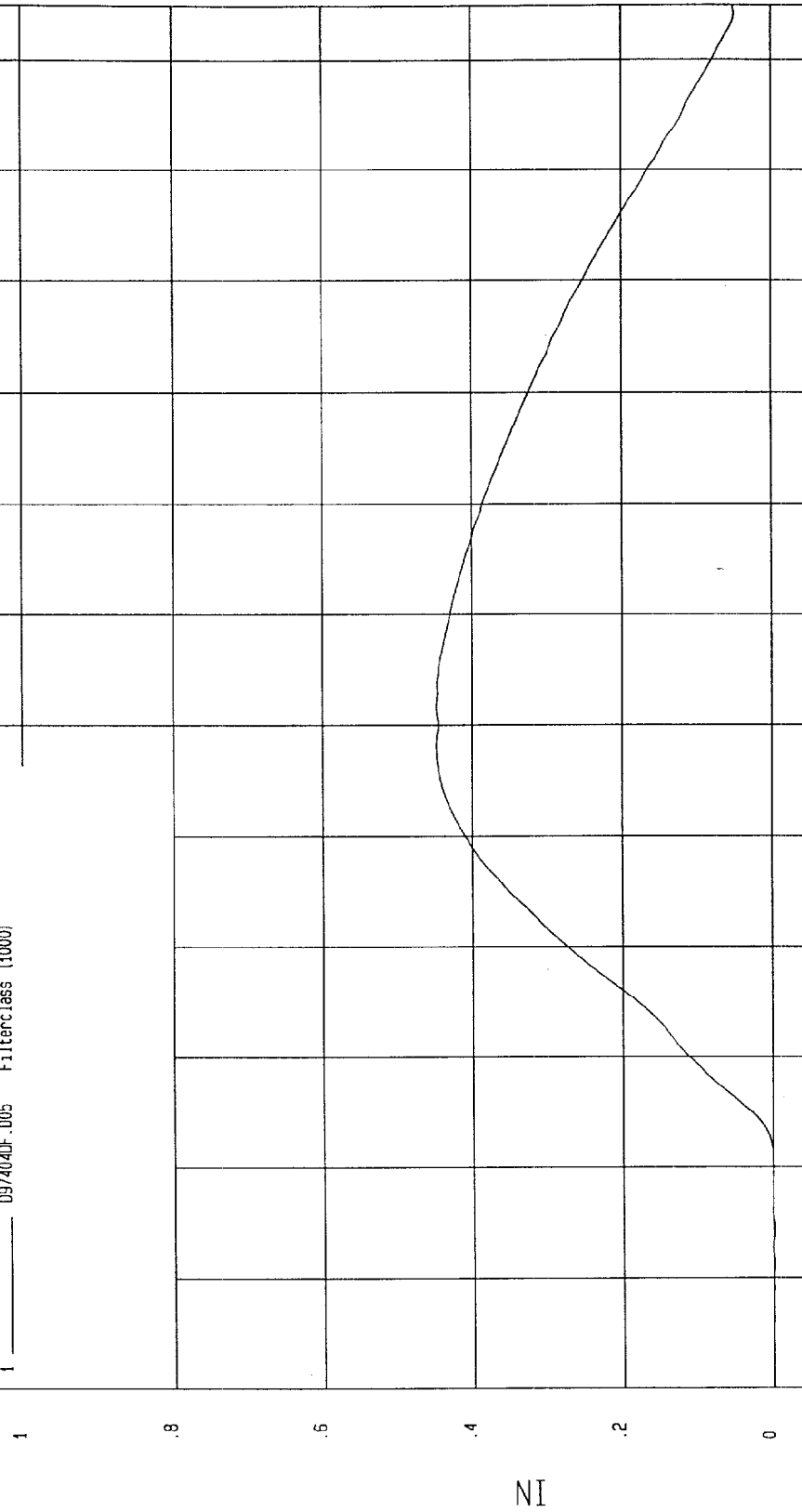
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 12:45

COMPONENT: DUMMY # E1-213 Velocity: 3.28 FT/SEC 1 M/SEC

Minimum = -2.23E-03 IN at 14.3 msec

UPPER RIB DISPLACEMENT

1 _____ 097404DF.D05 Filterclass (1000)



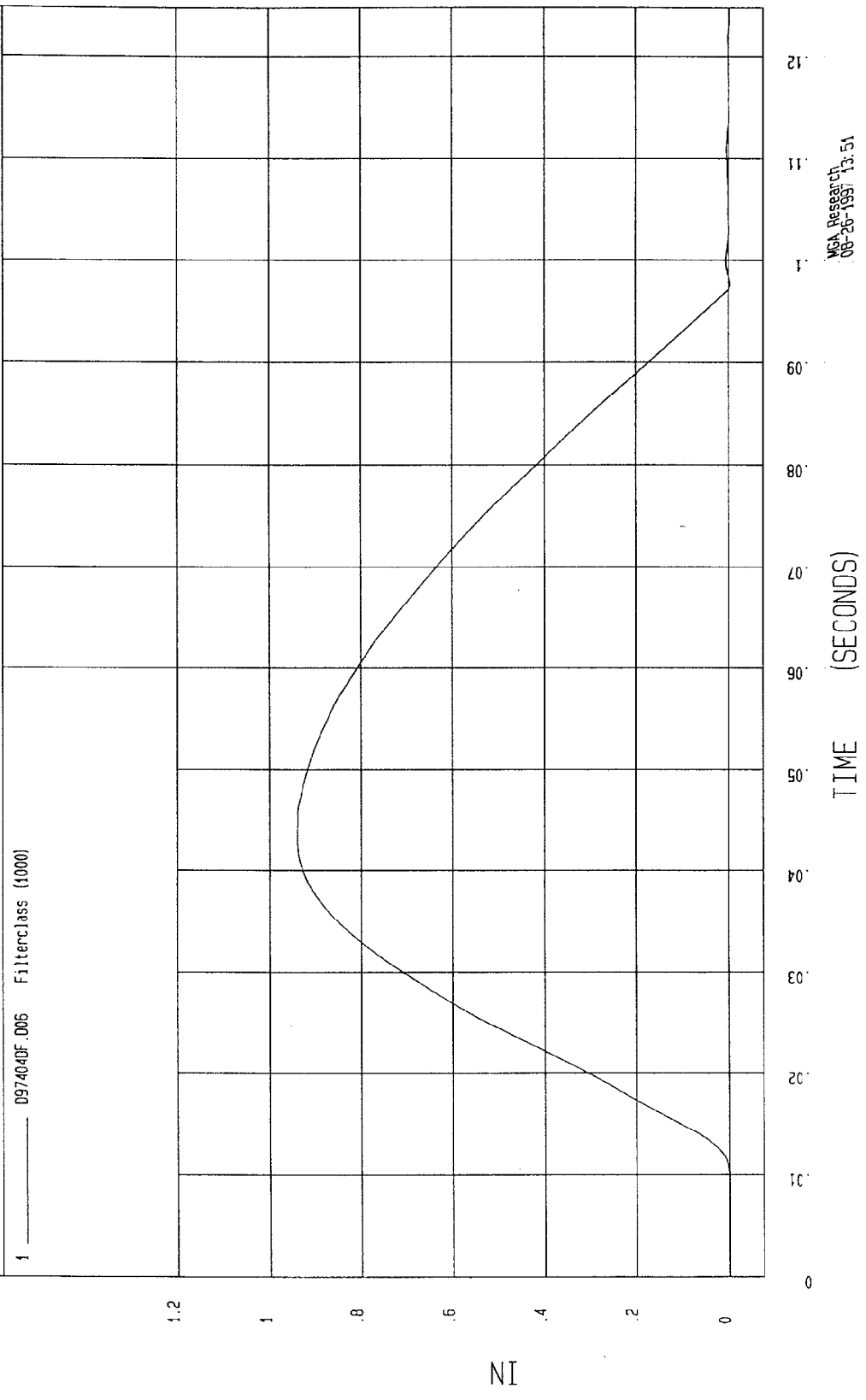
MGA Research
08-26-1997 13:51

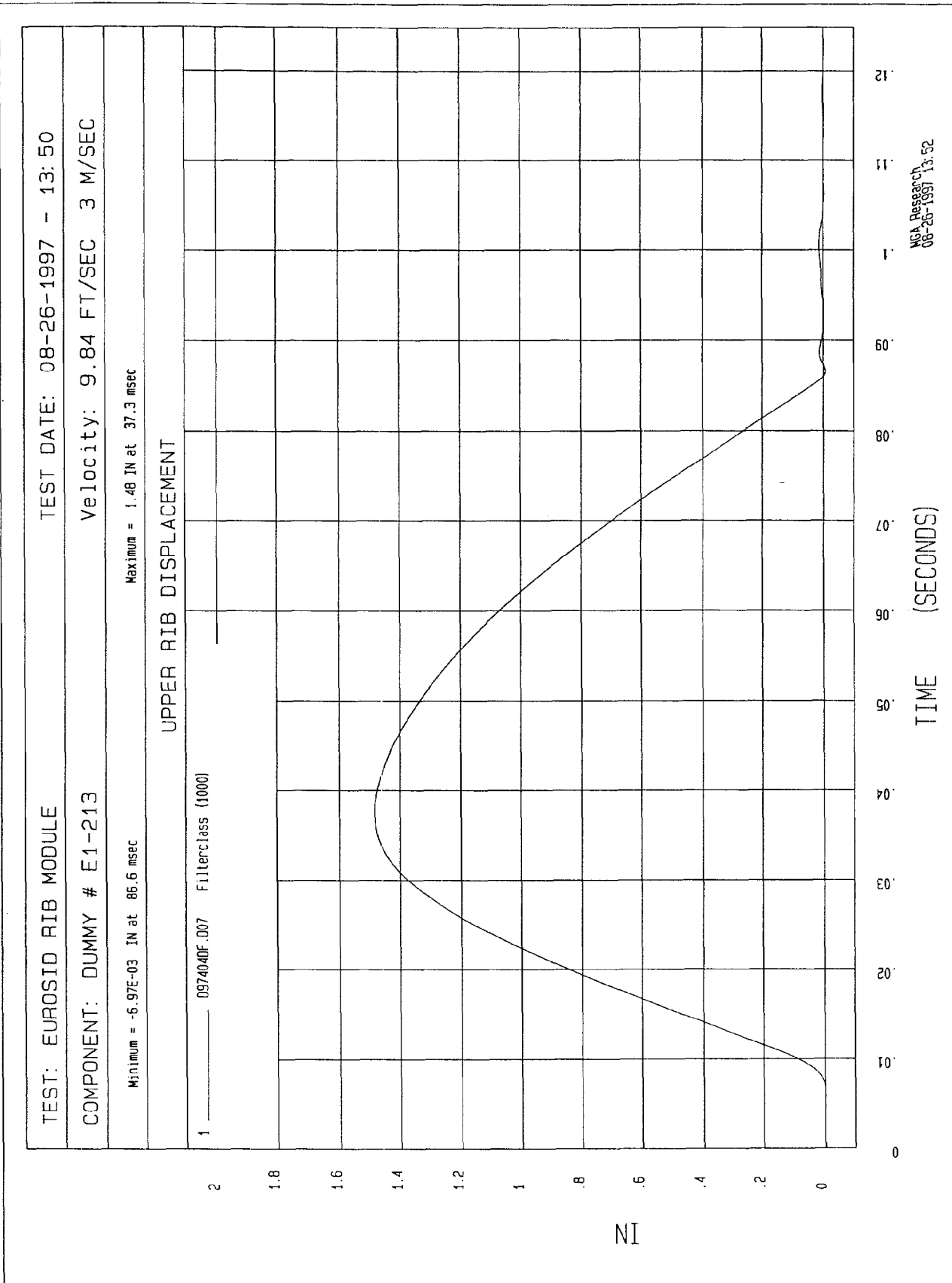
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 12:52

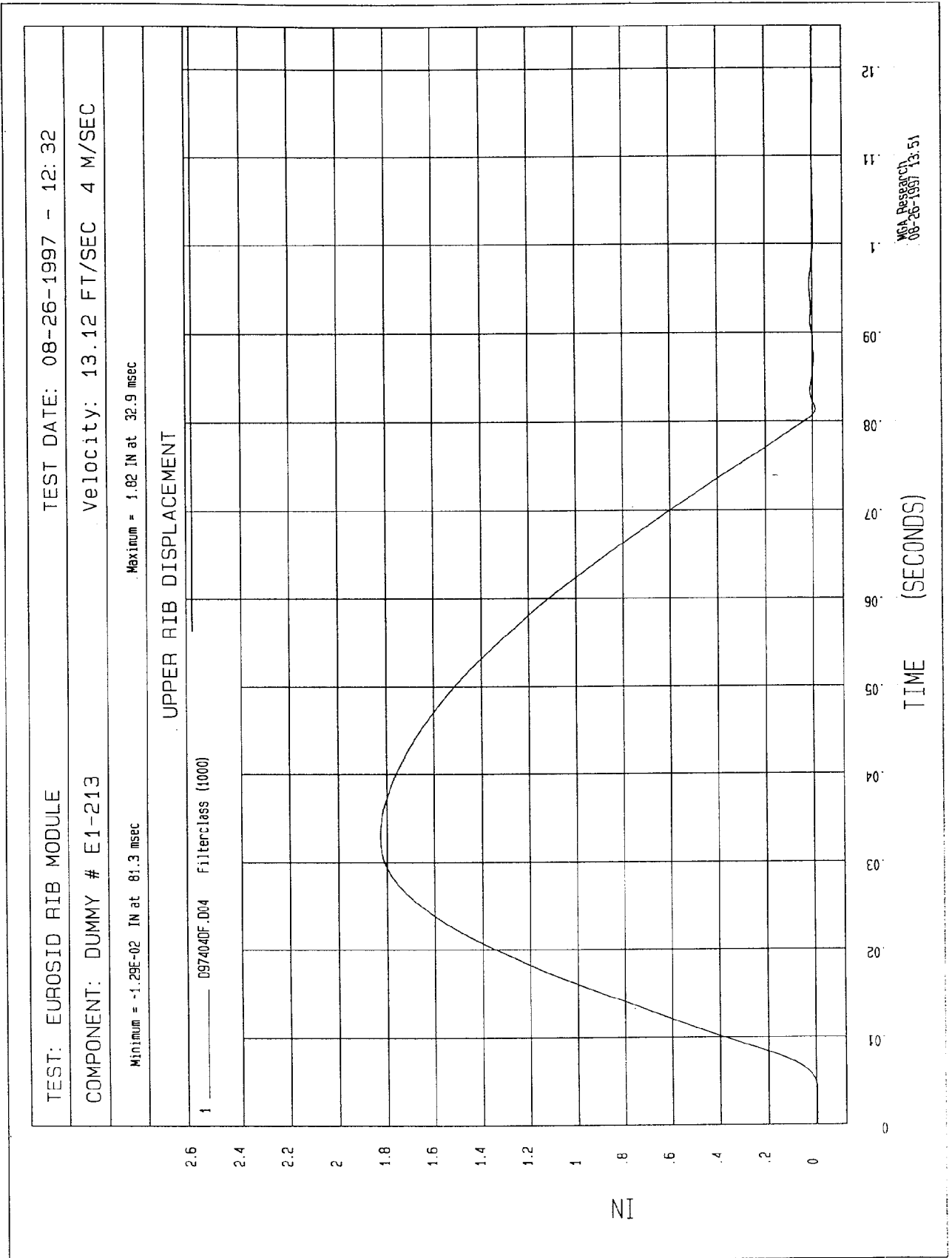
COMPONENT: DUMMY # E1-213 Velocity: 6.56 FT/SEC 2 M/SEC

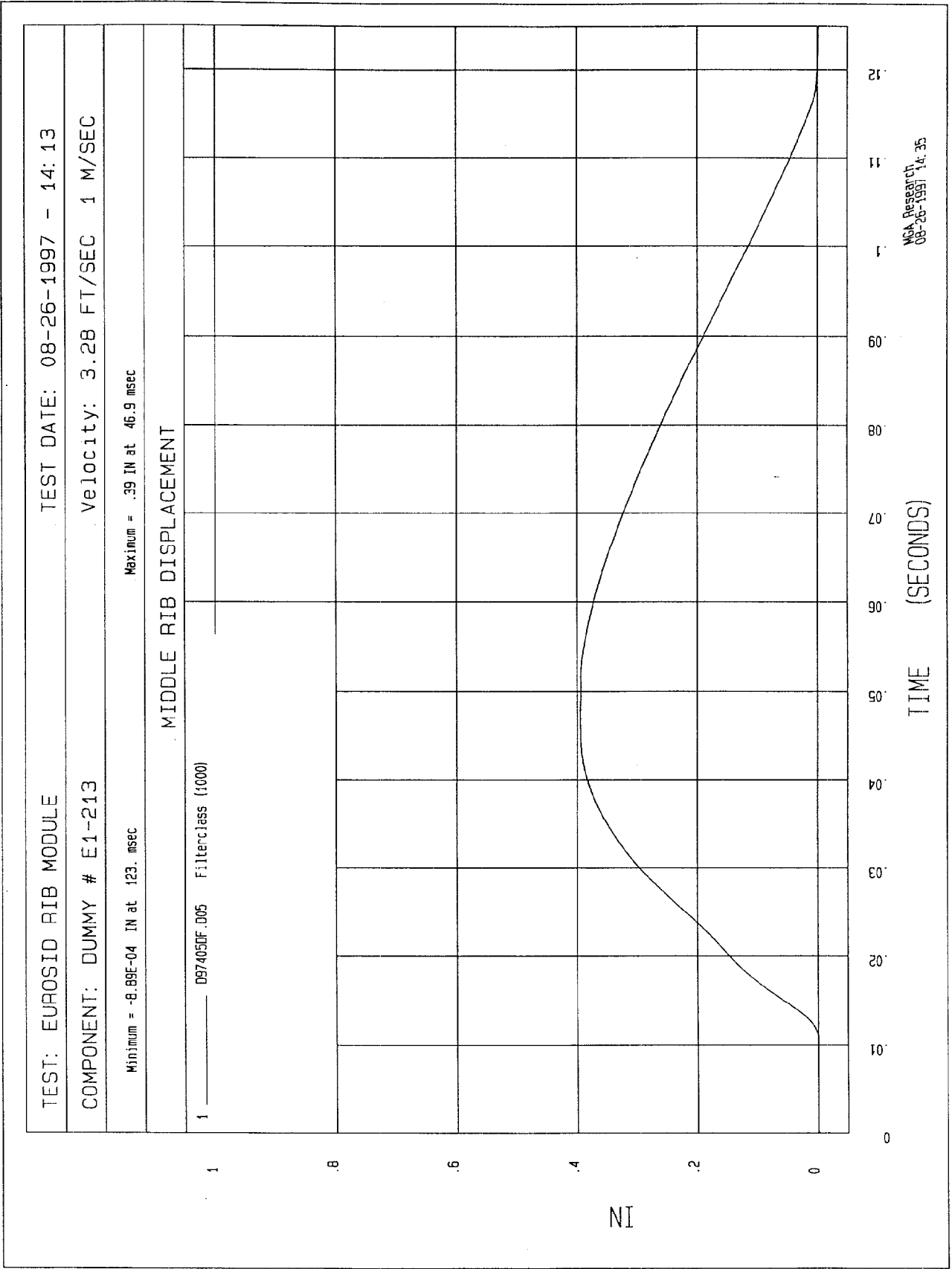
Minimum = -3.53E-03 IN at 97.7 msec Maximum = .93 IN at 42.8 msec

UPPER RIB DISPLACEMENT









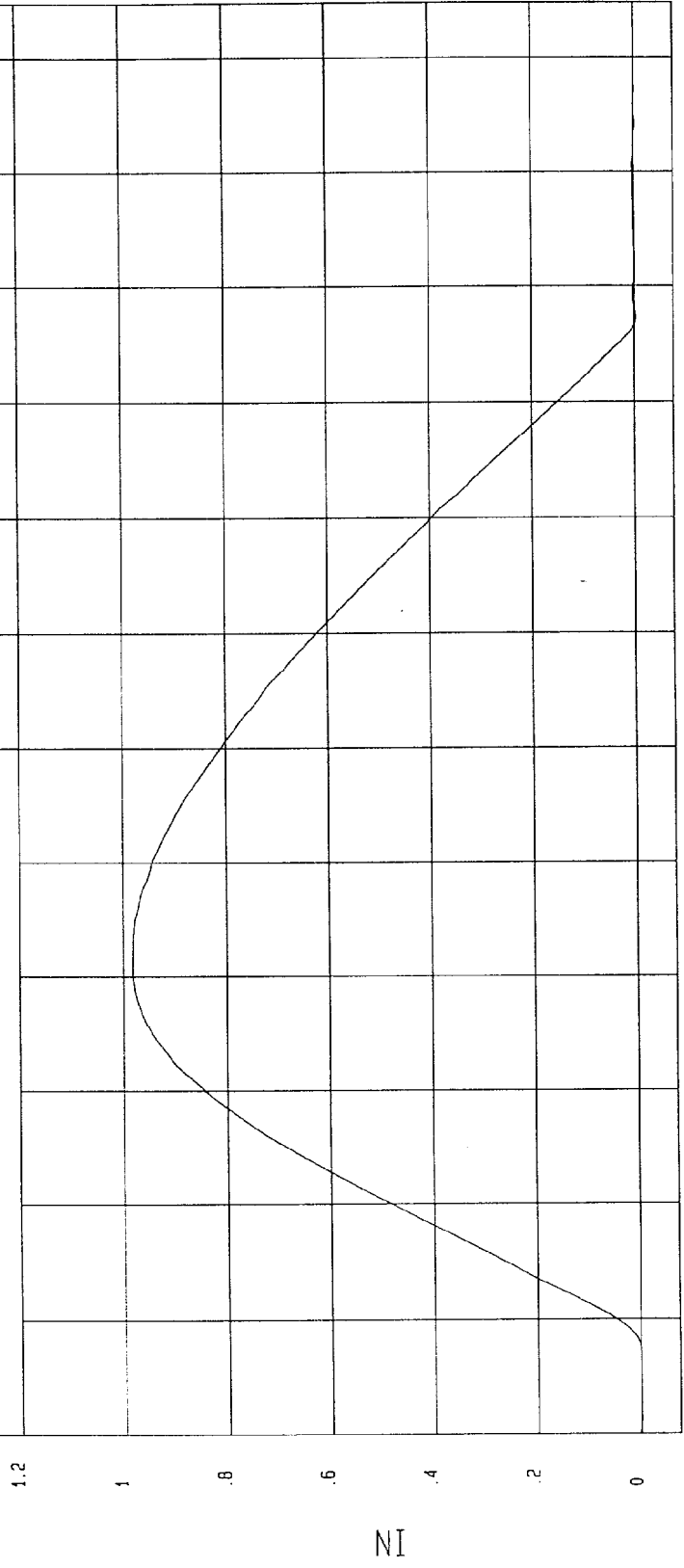
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 14:25

COMPONENT: DUMMY # E1-213 Velocity: 6.56 FT/SEC 2 M/SEC

Minimum = -2.81E-03 IN at 97.2 msec
Maximum = .98 IN at 40.6 msec

MIDDLE RIB DISPLACEMENT

1 _____ D97405DF.D06 Filterclass (1000)



TIME (SECONDS)

WCA Research
08-26-1997 14:36

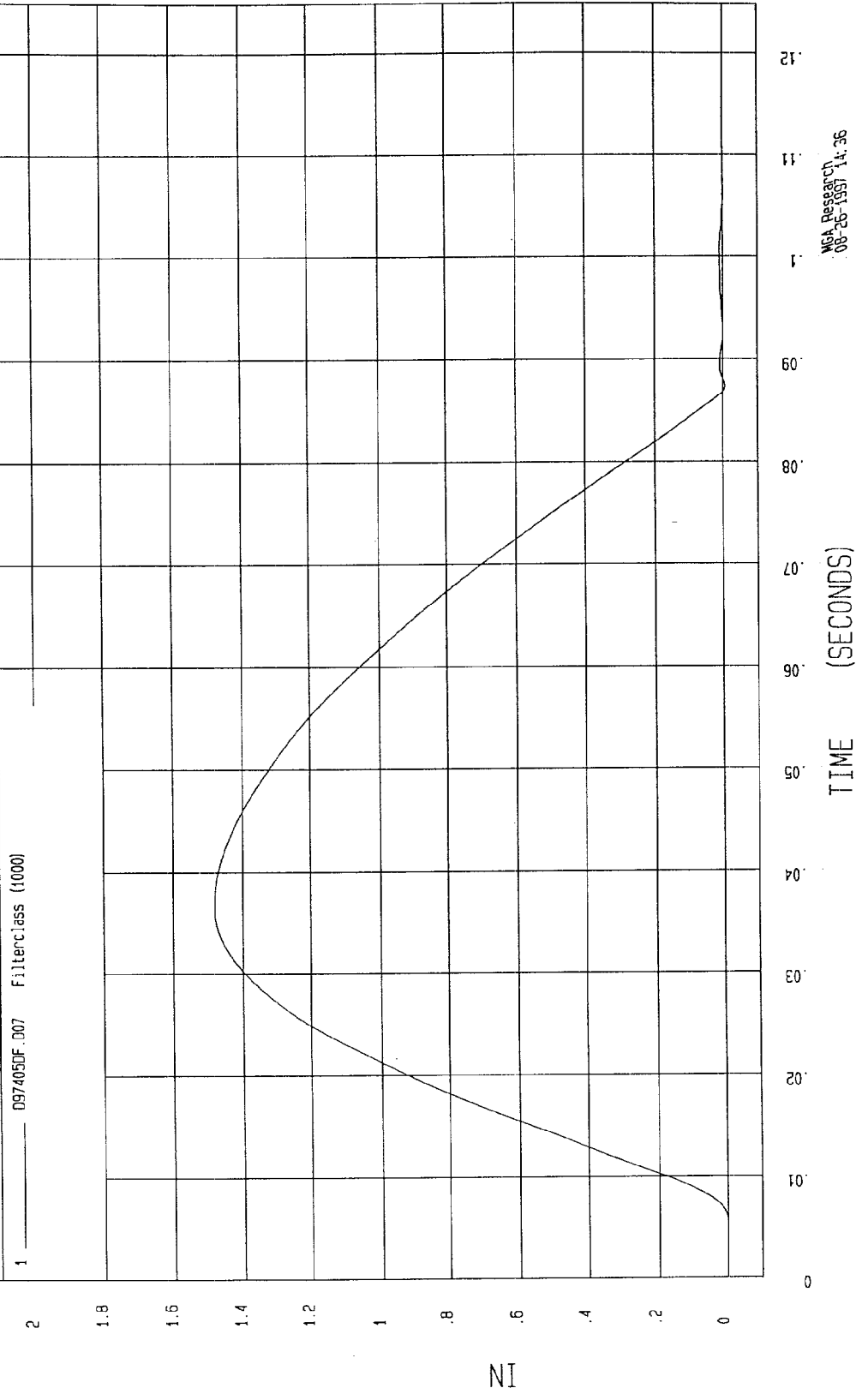
TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 14:33

COMPONENT: DUMMY # E1-213 Velocity: 9.84 FT/SEC 3 M/SEC

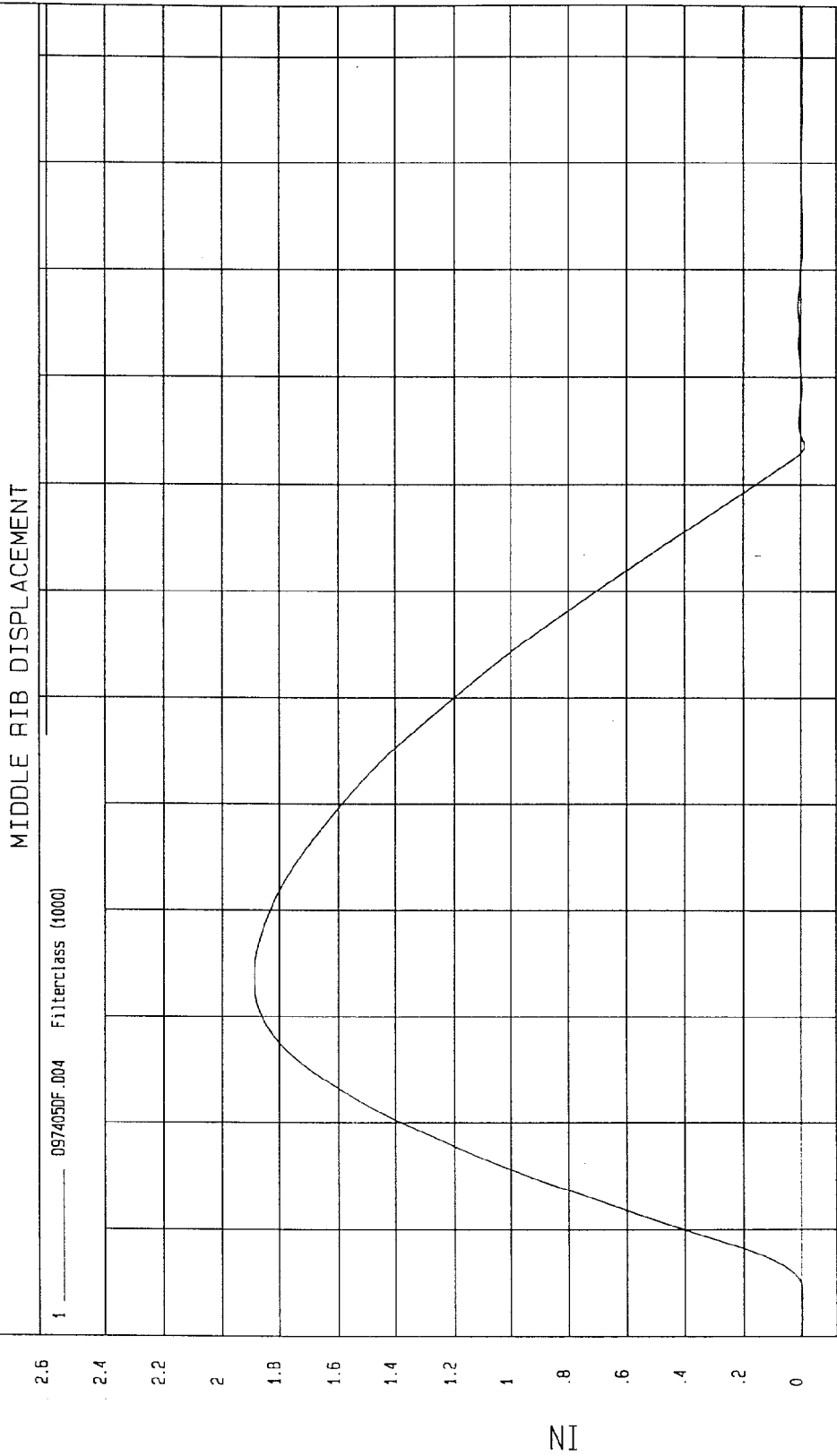
Minimum = -6.50E-03 IN at 87.3 msec

Maximum = 1.47 IN at 36.0 msec

MIDDLE RIB DISPLACEMENT

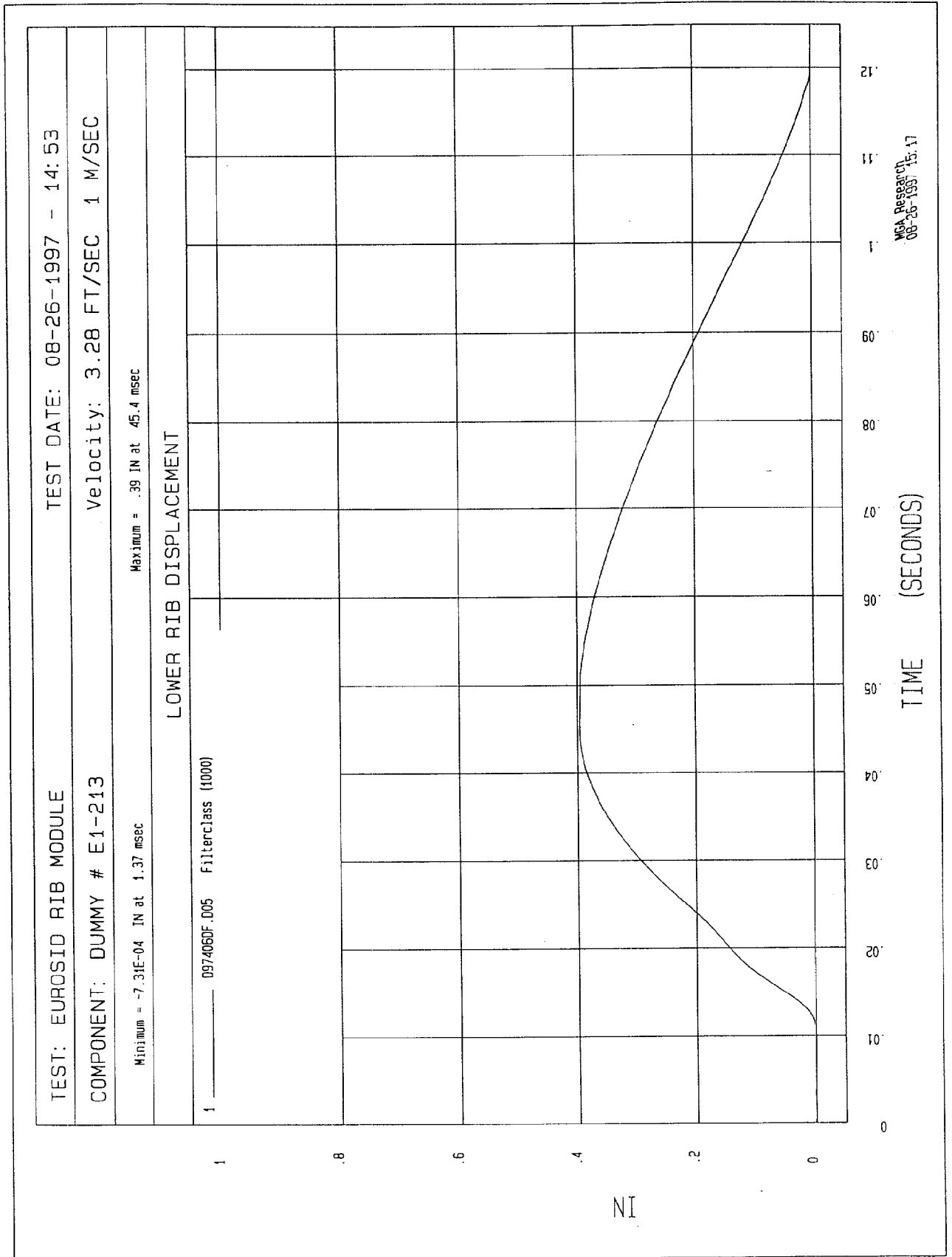


TEST: EUROSID RIB MODULE	TEST DATE: 08-26-1997 - 14:03
COMPONENT: DUMMY # E1-213	Velocity: 13.12 FT/SEC 4 M/SEC
Minimum = -1.29E-02 IN at 83.6 msec	Maximum = 1.88 IN at 33.9 msec



TIME (SECONDS)

WGA Research
08-26-1997 14:35

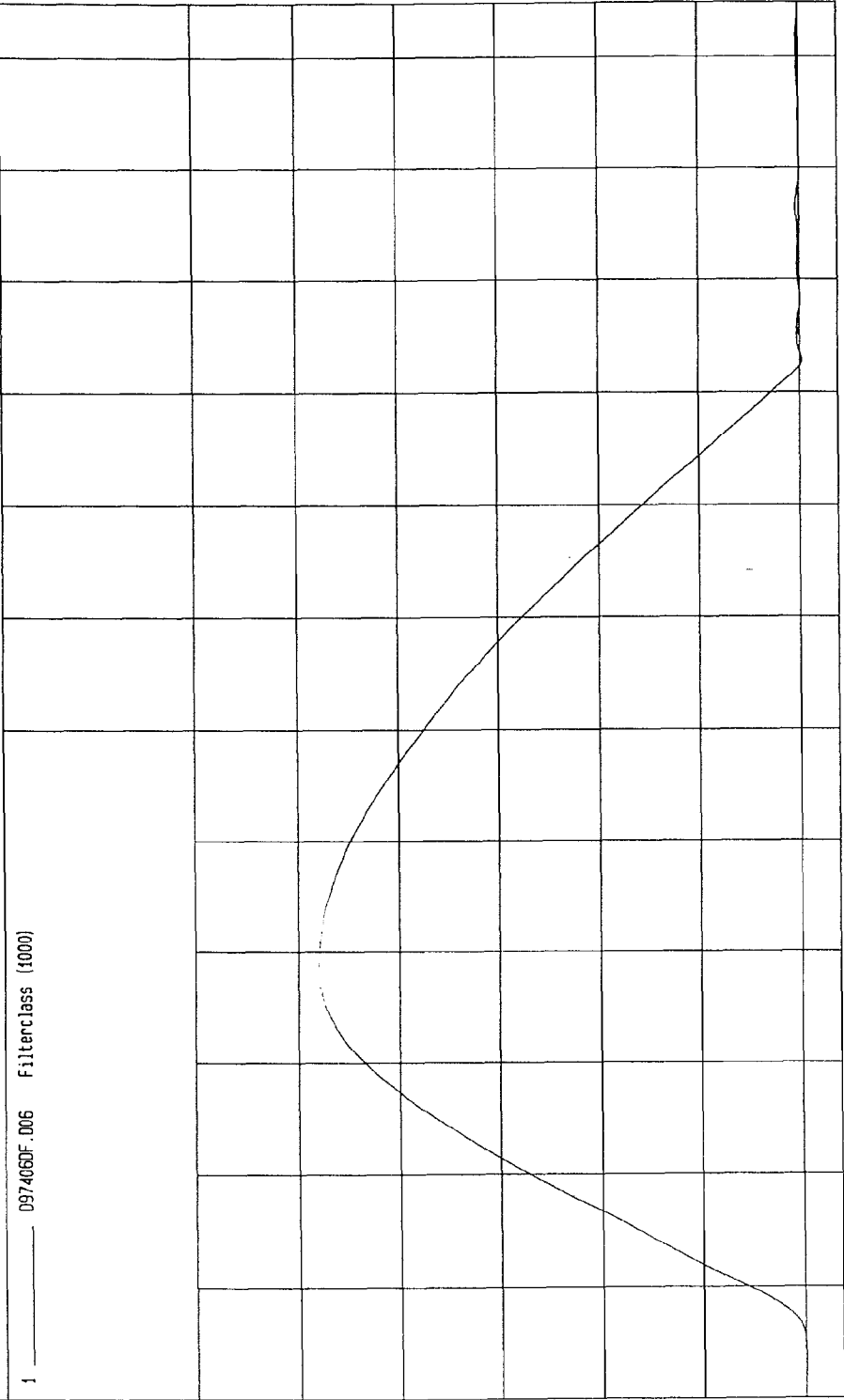


TEST: EUROSID RIB MODULE TEST DATE: 08-26-1997 - 15: 03

COMPONENT: DUMMY # E1-213 Velocity: 6.56 FT/SEC 2 M/SEC

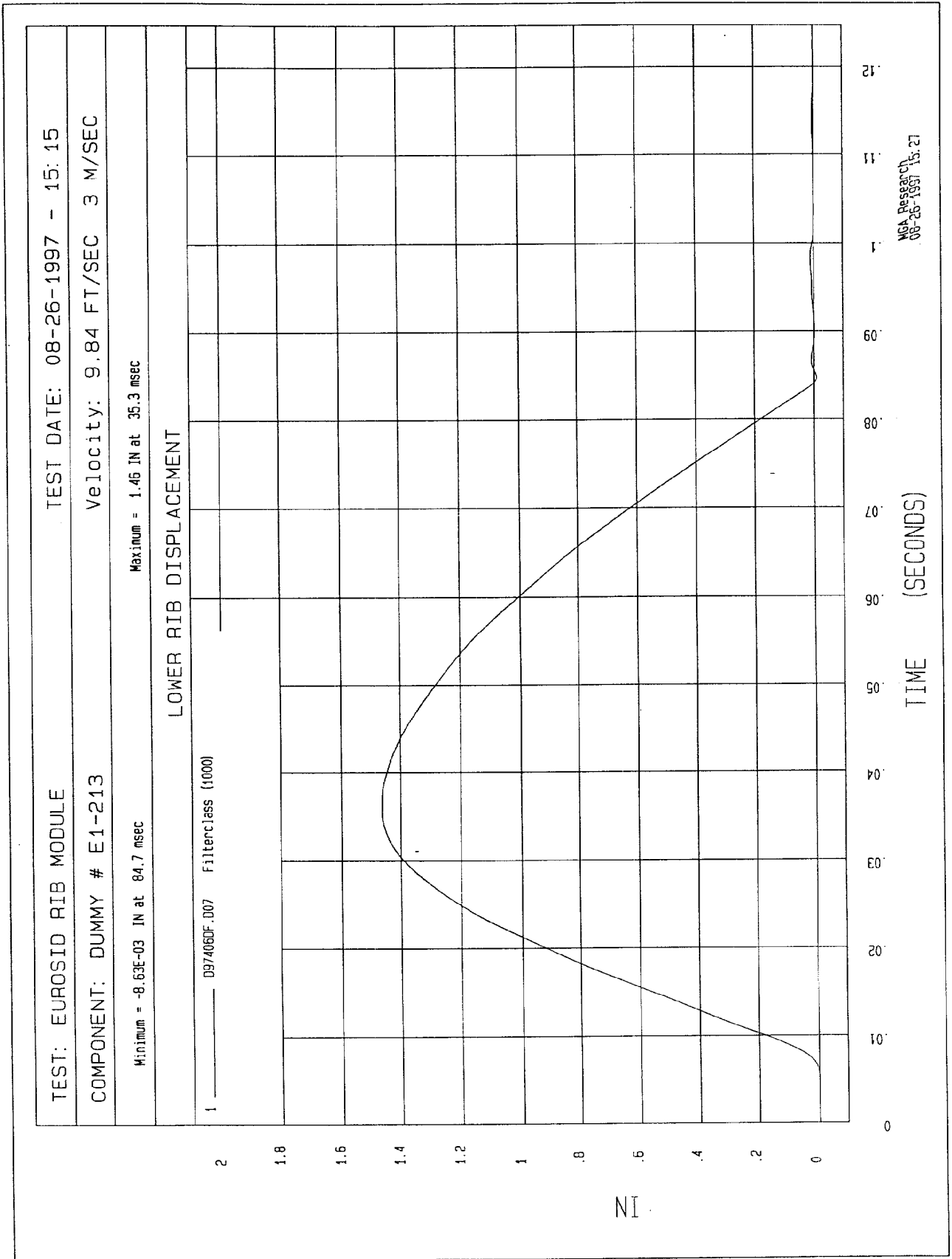
Minimum = -4.04E-03 IN at 92.7 msec Maximum = .95 IN at 38.3 msec

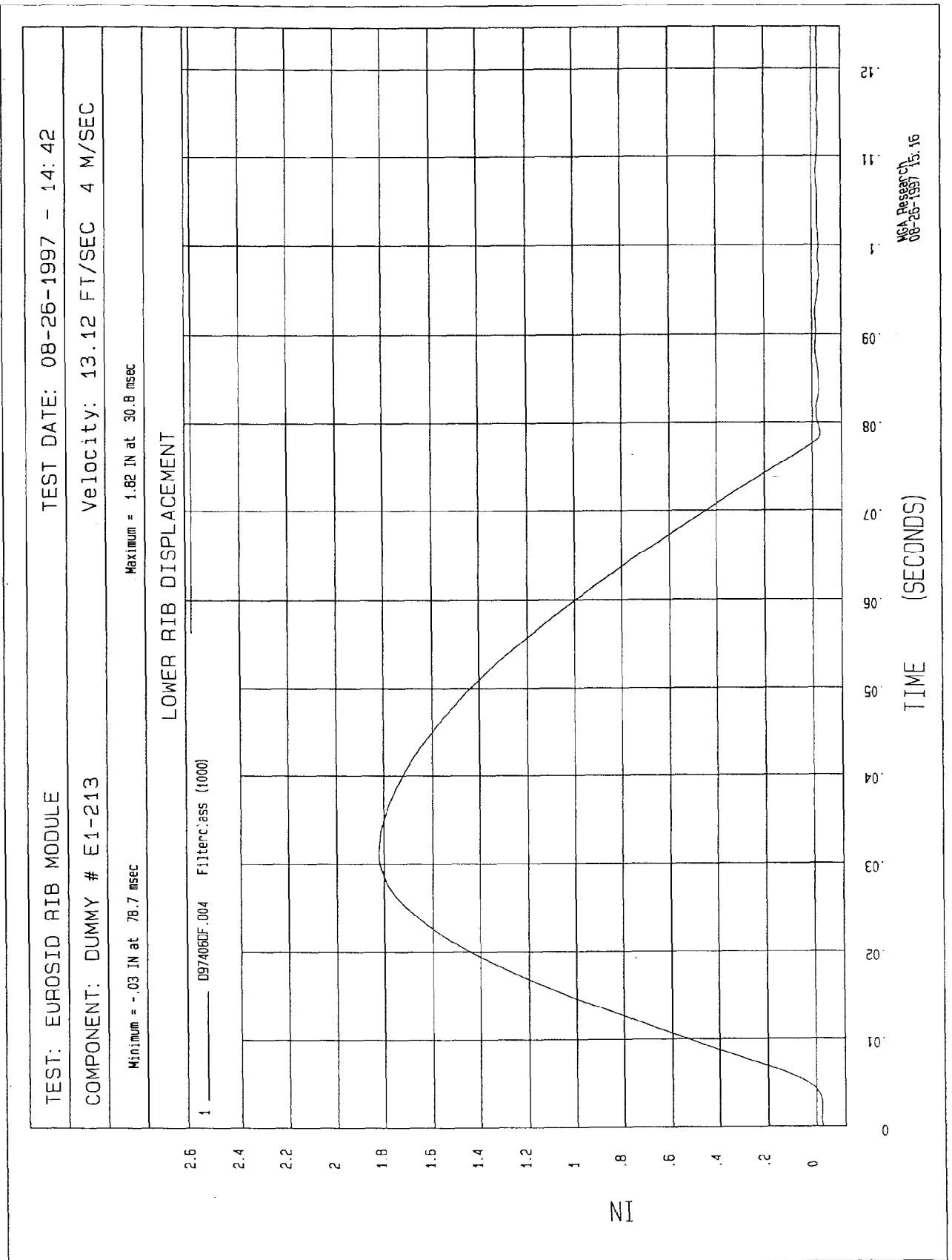
LOWER RIB DISPLACEMENT

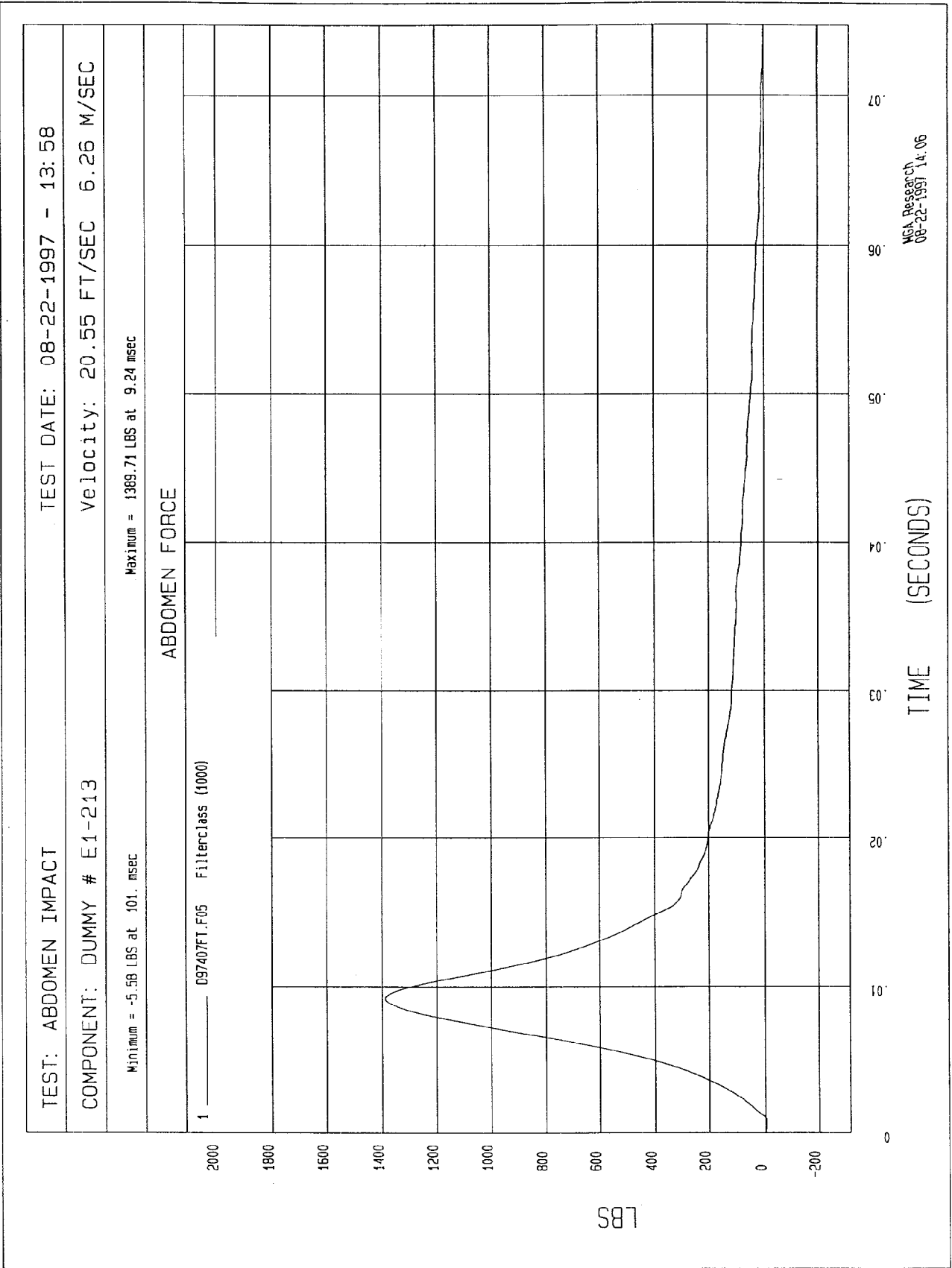


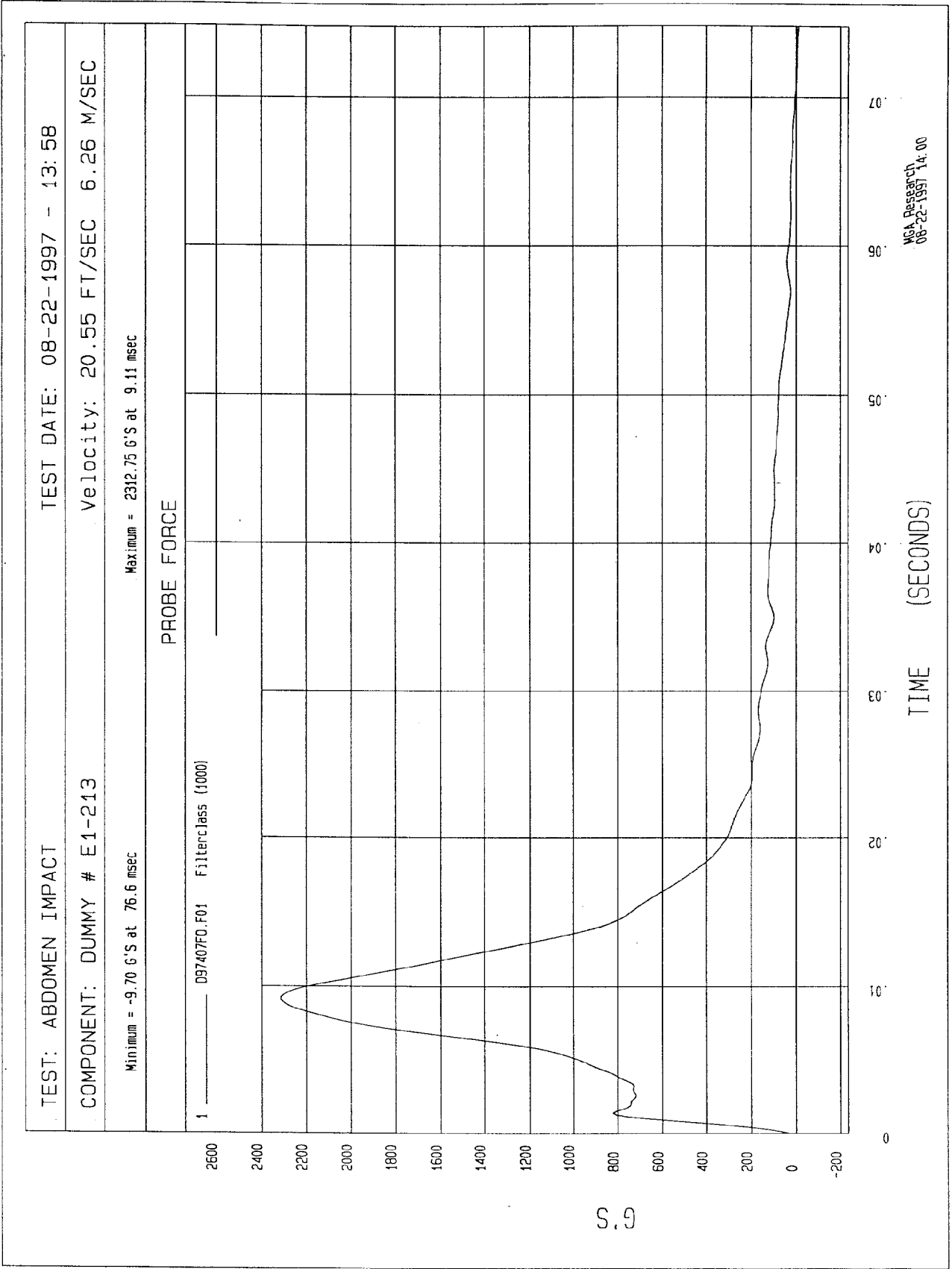
TIME (SECONDS)

MSA Research
08-26-1997 15: 27









EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM6183-2

Temperature : 21 deg C

Test number : 20216

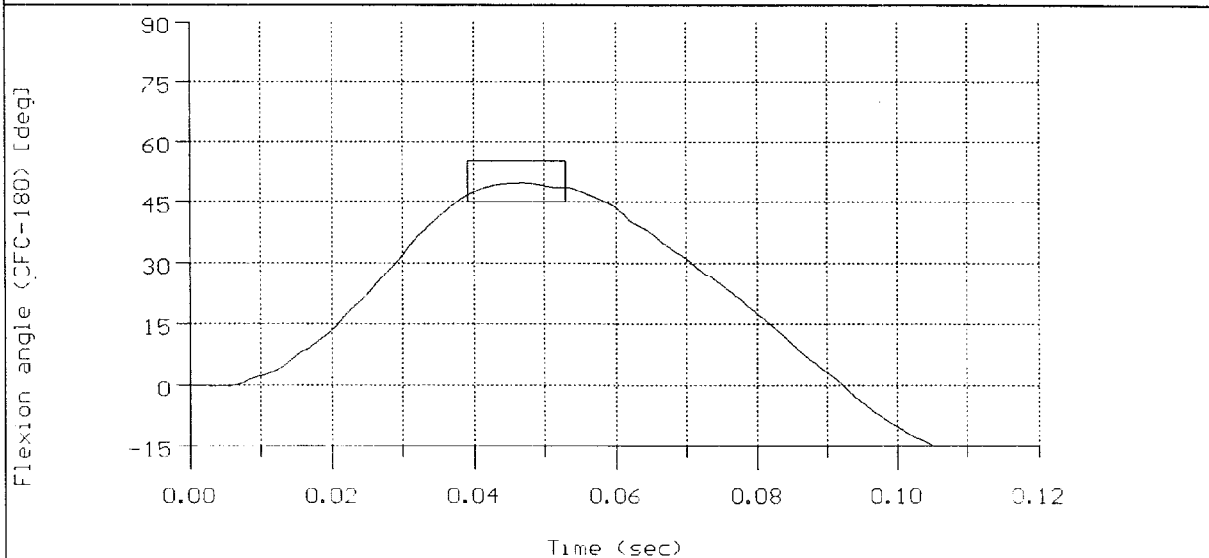
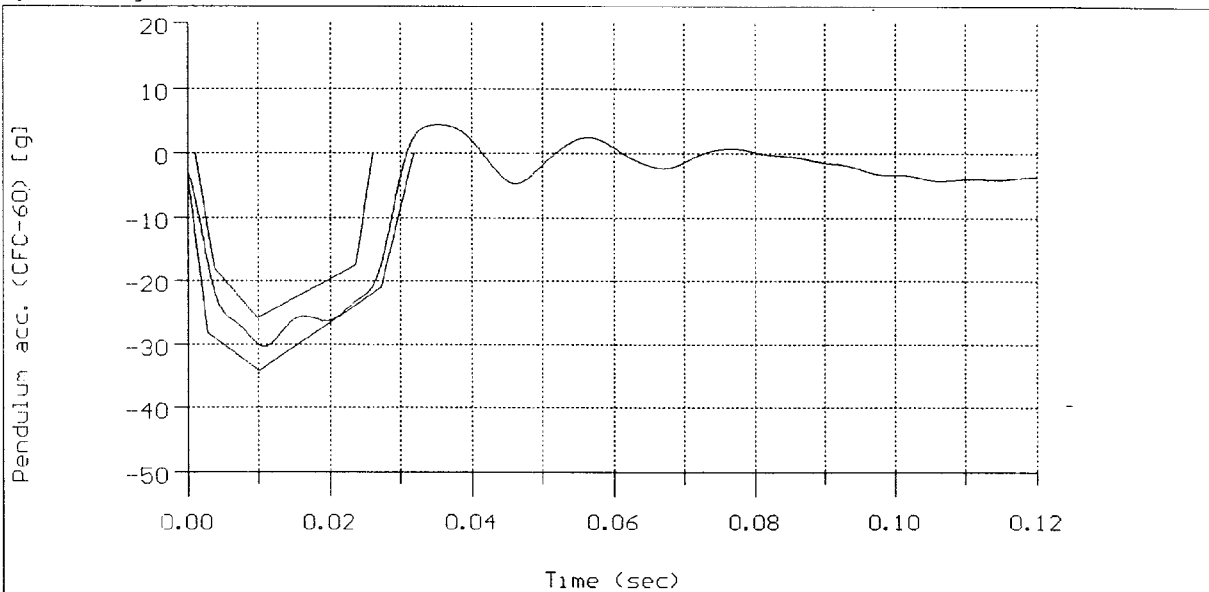
Rel. Humidity : 50 %

Impact side : LHS

Technician : DP

Spine length :

Test date : 2-SEPTEMBER-1997



Parameter	Specification	Result	Passed/Failed
Pendulum Speed	5.95 - 6.15 m/s	6.03 m/s	
Maximum pendulum acc.		-30.4 g	
Time of max pend. acc.		10.7 msec	
Maximum flexion angle	45.0 - 55.0 deg	49.7 deg	
Time of max. flex. angle	39.0 - 53.0 msec	46.9 msec	

EUROSID-1

COMMENTS: MGA

TEST : EUROSID-1 SPINE CERTIFICATION

Part number : SM6183-2

Temperature : 21 deg C

Test number : 20216

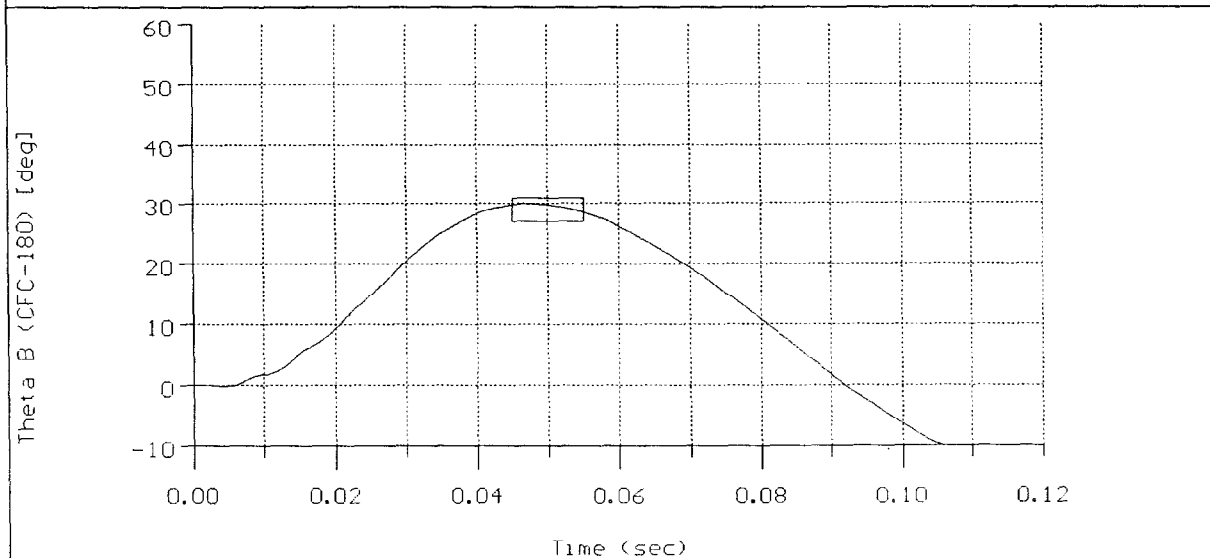
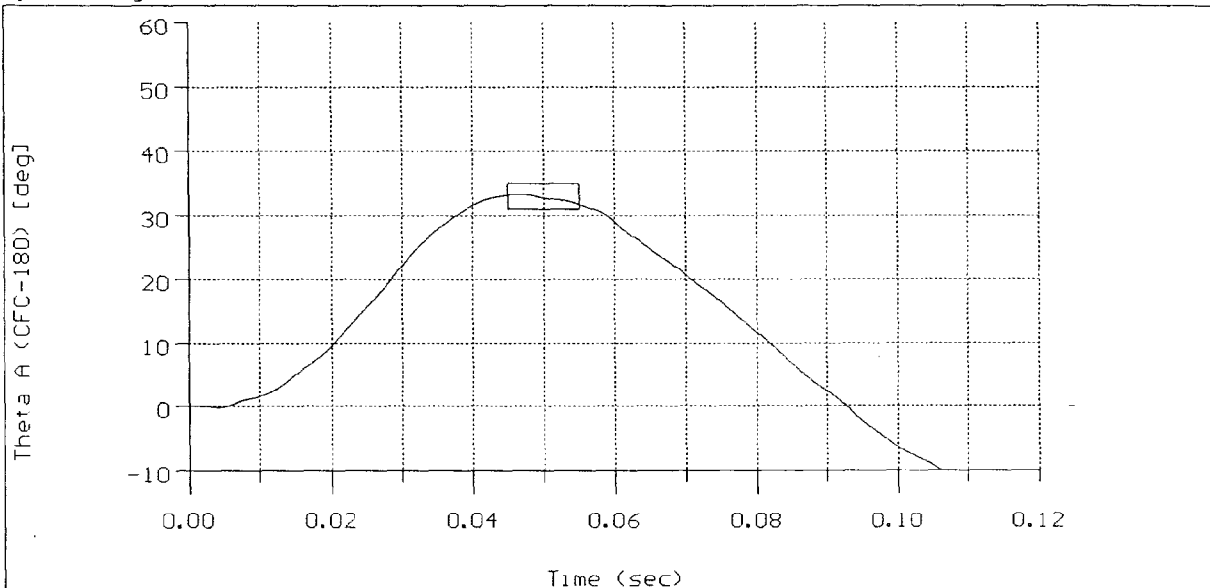
Rel. Humidity : 50 %

Impact side : LHS

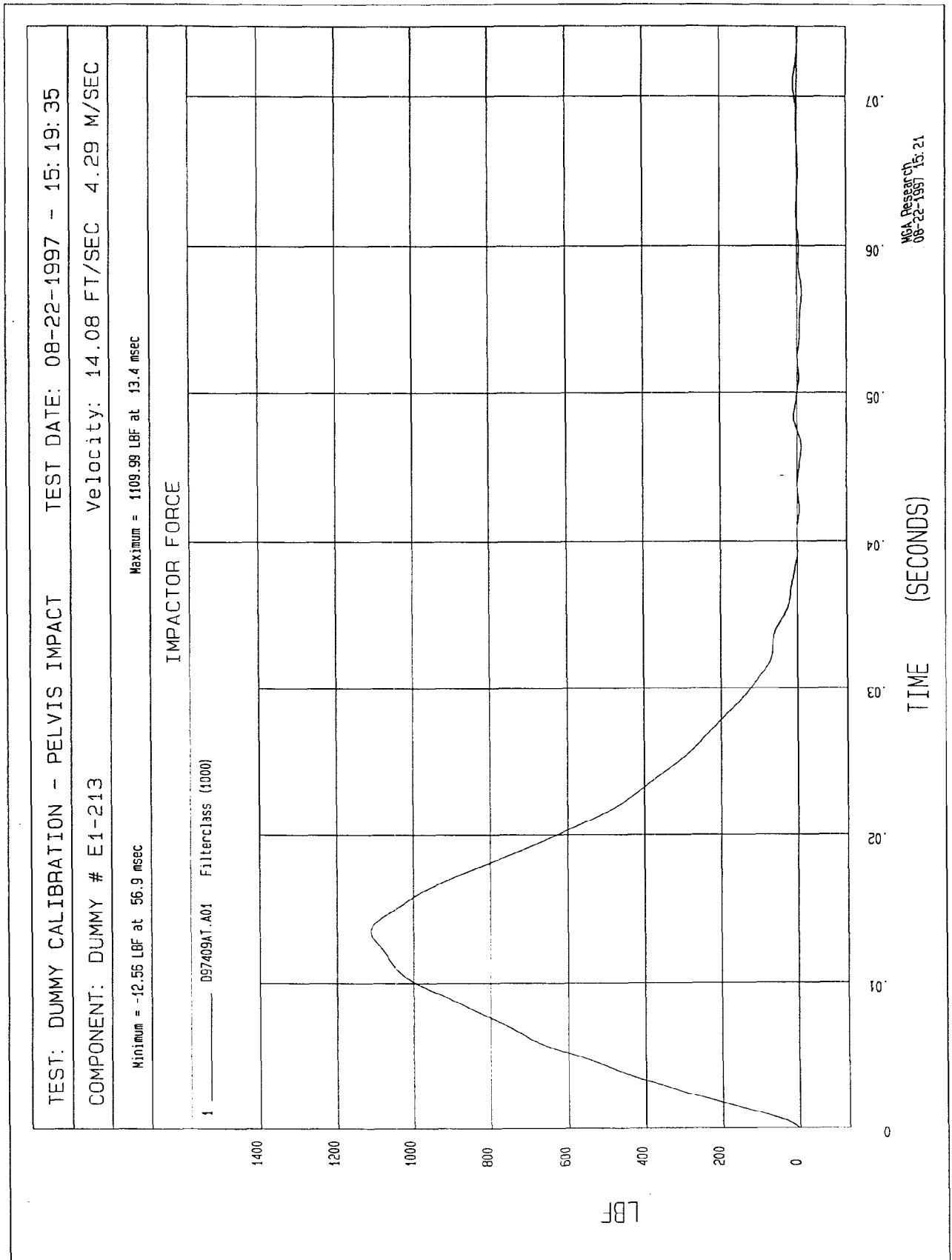
Technician : DP

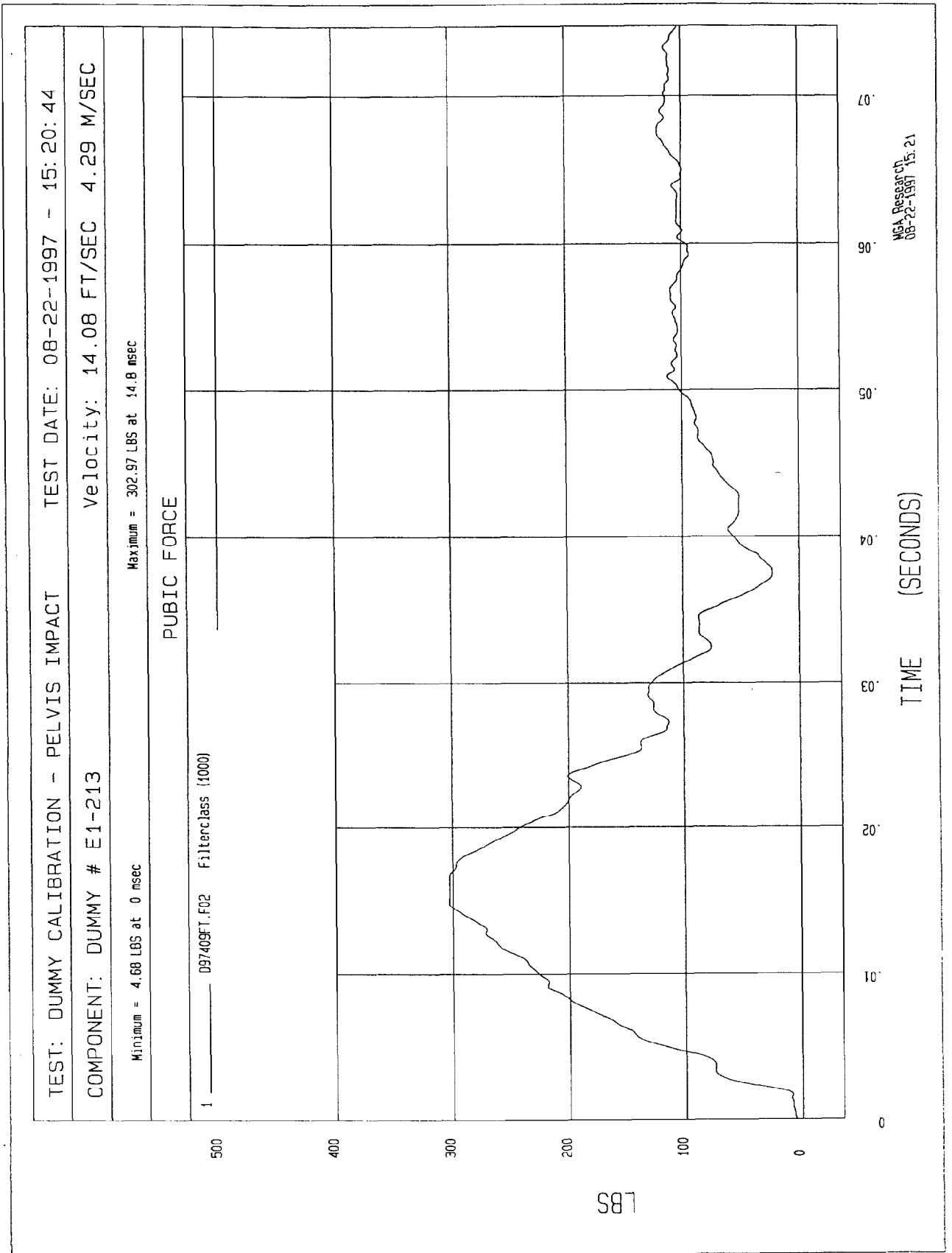
Spine length :

Test date : 2-SEPTEMBER-1997



Parameter	Specification	Result	Passed/Failed
Maximum Theta(A)	31.0 - 35.0 deg	33.3 deg	
Time of max. Theta(A)	45.0 - 55.0 msec	46.8 msec	
Maximum Theta(B)	27.0 - 31.0 deg	29.9 deg	
Time of max. Theta(B)	45.0 - 55.0 msec	47.4 msec	





POST-TEST DUMMY INSPECTION CHECKLIST

Type: EuroSID 1

Serial Number: E1-169

Inspected By: Tim Michnay

Date: September 2, 1997

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

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

POST-TEST DUMMY INSPECTION CHECKLIST

Type: EuroSID 1

Serial Number: E1-213

Inspected By: Tim Michnay

Date: September 2, 1997

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

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

APPENDIX E
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

SID INSTRUMENTATION

DUMMY #	E1-169	EXPOSURE	DATE	TYPE OF TEST	POSITION
CALIBRATION DATE:		1	8-21-97	TTD #4	FRONT
8/6/97		2			
		3			

POSITION	MFR.	MODEL	SERIAL #	CAL DATE	DLR
HEAD					
HX (B)	ENDEVCO	7264-2000	AP1T8	8/13/97	98.055
HY (L)	ENDEVCO	7264-2000	AP2D7	8/13/97	103.836
HZ (D)	ENDEVCO	7264-2000	AGTM8	8/13/97	115.746
HYR (R)	ENDEVCO	7264-2000	AJ411	8/13/97	114.127
RIBS					
UR (R)	ENDEVCO	7264-2000	J15170	7/9/97	81.587
UPPER DISP	NOVOTECHNIK	T-75	46877	8/4/97	-1.086"/V
MR (R)	ENDEVCO	7264-2000	J18925	7/9/97	94.652
MID DISP	NOVOTECHNIK	T-75	46874	8/4/97	-1.065"/V
LR (R)	ENDEVCO	7264-2000	J19173	7/9/97	106.98
LOWER DISP	NOVOTECHNIK	T-75	46878	8/4/97	-1.074"/V
SPINE					
USX (F)	ENDEVCO	7264-2000	ALDC3	8/13/97	106.391
USY (R)	ENDEVCO	7264-2000	ALDM8	8/13/97	115.405
USZ (D)	ENDEVCO	7264-2000	ALA92	8/13/97	111.753
LSX (F)	ENDEVCO	7264-2000	J13653	7/9/97	81.191
LSY (L)	ENDEVCO	7264-2000	J13713	7/9/97	86.905
LSZ (U)	ENDEVCO	7264-2000	J13649	7/9/97	80.37
PELVIS					
PX (F)	ENDEVCO	7264-2000	J13930	7/9/97	79.795
PY (L)	ENDEVCO	7264-2000	J13631	7/9/97	78.09
PZ (U)	ENDEVCO	7264-2000	J13990	7/9/97	84.276
ABDOMEN					
FRONT	DENTON	2631	81	7/8/97	-1330.0 N
MID	DENTON	2631	86	7/8/97	-1377.4 N
REAR	DENTON	2631	79	7/8/97	-1320.6 N
PUBIC	DENTON	3096	136	7/9/97	-14434.9 N

DUMMY INSTRUMENTED BY: TM

SID INSTRUMENTATION

DUMMY #	E1-213	EXPOSURE	DATE	TYPE OF TEST	POSITION
CALIBRATION DATE:		1	8/21/97	TTD #4	REAR
8/6/97		2			
		3			

<u>POSITION</u>	<u>MFR.</u>	<u>MODEL</u>	<u>SERIAL #</u>	<u>CAL DATE</u>	<u>DLR</u>
HEAD					
HX (B)	ENDEVCO	7264-2000	AGTM2	8/13/97	117.105
HY (L)	ENDEVCO	7264-2000	AGTB5	8/13/97	106.186
HZ (D)	ENDEVCO	7264-2000	AH1G2	8/13/97	116.333
HYR (R)	ENDEVCO	7264-2000	AM751	8/13/97	113.35
RIBS					
UR (R)	ENDEVCO	7264-2000	J18953	7/9/97	105.738
UPPER DISP	NOVOTECHNIK	T-75	213U	4/21/97	.601"/V
MR (R)	ENDEVCO	7264-2000	J18843	7/9/97	82.944
MID DISP	NOVOTECHNIK	T-75	213M	4/21/97	.602"/V
LR (R)	ENDEVCO	7264-2000	AHTB2	8/6/97	116.704
LOWER DISP	NOVOTECHNIK	T-75	213L	4/21/97	.601"/V
SPINE					
USX (F)	ENDEVCO	7264-2000	ANAN3	7/9/97	112.6
USY (R)	ENDEVCO	7264-2000	AJ9H0	7/9/97	105.188
USZ (D)	ENDEVCO	7264-2000	ANAN6	7/9/97	105.851
LSX (F)	ENDEVCO	7264-2000	AGWA4	7/9/97	110.85
LSY (L)	ENDEVCO	7264-2000	ALBA7	7/9/97	93.486
LSZ (U)	ENDEVCO	7264-2000	AGT18	7/9/97	111.904
PELVIS					
PX (F)	ENDEVCO	7264-2000	ALD31	7/9/97	110.692
PY (L)	ENDEVCO	7264-2000	AHY21	7/9/97	104.909
PZ (U)	ENDEVCO	7264-2000	AHTF1	7/9/97	110.446
ABDOMEN					
FRONT	DENTON	2631	692	7/8/97	1323.6 N
MID	DENTON	2631	702	7/8/97	1317.8 N
REAR	DENTON	2631	706	7/8/97	1283.1 N
PUBIC	DENTON	3096	144	7/9/97	-14700.4 N

DUMMY INSTRUMENTED BY:

TM

VEHICLE INSTRUMENT CALIBRATION

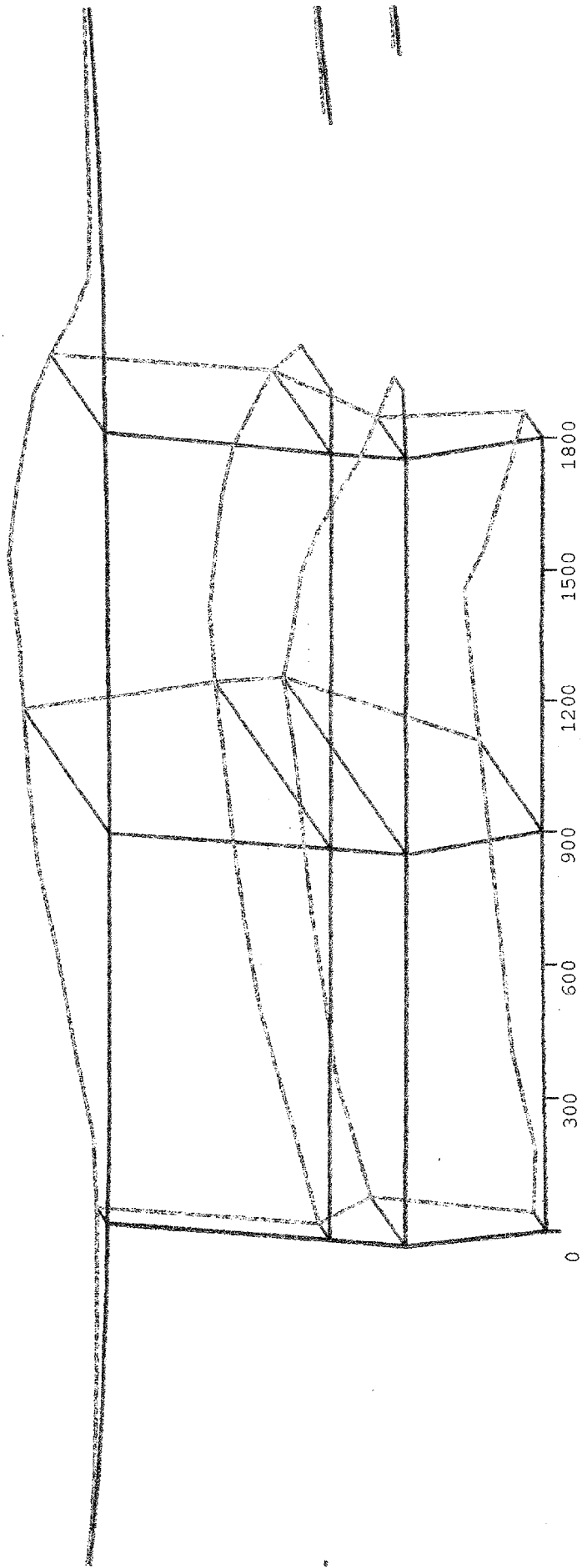
VEHICLE AND MDB ACCELEROMETERS			
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Lower A-Post	F20-G01	Entran	August 7, 1997
Left Mid A-Post	C06-G12	Entran	April 23, 1997
Left Lower B-Post	C25-A06	Entran	July 2, 1997
Left Mid B-Post	L14-D16	Entran	July 7, 1997
Left Side Sill at Front Seat Y	D05-R08	Entran	August 1, 1997
Left Side Sill at Rear Seat Y	F20-G03	Entran	August 7, 1997
Right Side Sill at Front Seat X	I25-J20	Entran	August 7, 1997
Right Side Sill at Front Seat Y	J04-F13	Entran	August 7, 1997
Right Side Sill at Front Seat Z	J04-F16	Entran	August 7, 1997
Right Side Sill at Rear Seat X	E13-D07	Entran	April 23, 1997
Right Side Sill at Rear Seat Y	L25-J11	Entran	July 7, 1997
Right Side Sill at Rear Seat Z	D05-R12	Entran	July 2, 1997
Left Driver Seat Track Y	H02-J03	Entran	August 6, 1997
Right Rear Occupant Compartment Y	F18-G05	Entran	August 7, 1997
Rear Floorpan Above Axle X	F12-G09	Entran	August 7, 1997
Rear Floorpan Above Axle Y	G08-B01	Entran	August 7, 1997
Rear Floorpan Above Axle Z	G13-G09	Entran	August 7, 1997
Vehicle C.G. X	B02-G09	Entran	August 1, 1997
Vehicle C.G. Y	J10-E06	Entran	August 1, 1997
Vehicle C.G. Z	J23-E06	Entran	August 1, 1997

VEHICLE INSTRUMENT CALIBRATION

VEHICLE AND MDB ACCELEROMETERS			
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Moving Barrier Left Rear Frame X	E10-F04	Entran	August 7, 1997
Moving Barrier Left Rear Frame Y	J04-F14	Entran	August 7, 1997
Moving Barrier Right Rear Frame X	H07-A25	Entran	July 14, 1997
Moving Barrier Right Rear Frame Y	C25-A11	Entran	August 5, 1997
Moving Barrier Left Face X	H02-J16	Entran	August 5, 1997
Moving Barrier Left Face Y	D05-R14	Entran	June 12, 1997
Moving Barrier Right Face X	F11-G08	Entran	August 7, 1997
Moving Barrier Right Face Y	I26-D02	Entran	August 7, 1997
Barrier C.G. X	E13-D01	Entran	August 1, 1997
Barrier C.G. Y	C14-Z08	Entran	August 1, 1997
Barrier C.G. Z	A09-G05	Entran	August 1, 1997

APPENDIX F STATIC CRUSH

Hyundai Sonata
European Side Impact
Static Vehicle Deformation Measurements



Hyundai Sonata
FMVSS 214D Side Impact
Static Vehicle Deformation Measurements

