

V3527

ES-2 – FULL SCALE VEHICLE TESTS
REPORT NO. 6

NCAP SIDE IMPACT

2000 Pontiac Grand Am 2 Door

MGA Research Corporation
5000 Warren Road
Burlington, WI 53105



Test Date: September 14, 2000

Report Date: November 16, 2000

FINAL REPORT

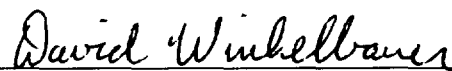
Prepared For

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SECTION 1

PURPOSE AND TEST PROCEDURE

This side impact test is part of Contract No DTRS57-98-D-00041 sponsored by the U S Department of Transportation, Volpe National Transportation System Center. The purpose of this test was to evaluate the response of the ES-2 dummies in a 2000 Pontiac Grand Am 2 door when subjected to a NCAP Side Impact. This test is one of six dynamic tests which were conducted on different test vehicles to observe ES-2 responses utilizing different impact devices and impact conditions: Specifically, two tests utilizing the European Moving Deformable Barrier, two tests utilizing the FMVSS No. 214 Moving Deformable Barrier and two tests utilizing the FMVSS No 214 Moving Deformable Barrier under NCAP test impact conditions

Date	Test Type	Vehicle
August 8, 2000	European Side	1996 Geo Metro 3 Door
August 11, 2000	European Side	1996 Ford Taurus 4 Door
August 15, 2000	FMVSS 214	1996 Ford Taurus 4 Door
August 25, 2000	FMVSS 214	1996 Ford Taurus 4 Door
September 12, 2000	NCAP Side	1998 Chevrolet Cavalier 4 Door
September 14, 2000	NCAP Side	2000 Pontiac Grand Am 2 Door

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

SECTION 2

SUMMARY OF SIDE IMPACT TEST

A 2000 Pontiac Grand Am 2 door was impacted on the left side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.1 kph (38.6 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin, on September 14, 2000. Pre- and post-test photographs of the test vehicle, the MDB and the side impact dummies (ES-2s) are included in Appendix A.

Two ES-2 side impact dummies were placed in the left front and left rear designated seating positions according to instructions specified in the OVSC Side Impact Laboratory Test Procedure which is dated August 2, 1999. The side impact event was documented by eleven 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 side impact dummy (ES-2) 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. Appendix E contains a copy of the dummy positioning procedure used. Appendix F contains the ES-2 Peak Responses.

The following tables summarize the results of the Left Side Impact test

		Left Front Driver	Left Rear Passenger
1) Head Performance Criteria			
≤ 1000	T_1 (msec)	No contact	52
	T_2 (msec)	No contact	100
	HPC	No contact	148
2) Thorax Performance Criteria			
2.1) Chest Deflection ≤ 42 mm	Upper Rib Deflection	51	28
	Mid Rib Deflection	29	21
	Lower Rib Deflection	16	~~20~~ 20.5
2.2) Viscous Criteria ≤ 1.0 m/sec	Upper Rib	~~0.99~~ 0.78	~~0.3~~ 0.24
	Mid Rib	~~0.55~~ 0.43	~~0.26~~ 0.21
	Lower Rib	~~0.27~~ 0.22	~~0.23~~ 0.18
3) Abdominal Protection Criterion			
Sum ≤ 2500 N	Front Abdominal Force	639	556
	Mid Abdominal Force	990	939
	Rear Abdominal Force	1170	613
	Sum of Abdominal Force	2587	1987
4) Pelvis Performance Criterion			
≤ 6000 N	Pubic Symphysis Force	1786	4789

HIC		Left Front Driver	Left Rear Passenger
	T_1 (msec)	44.4	52.0
	T_2 (msec)	80.4	61.8
	$T_2 - T_1$ (msec)	36.0	9.8
	HIC	546	727

FIR Filtered	Left Front Driver	Left Rear Passenger
Upper Rib Y (g's)	155 3	76.2
Middle Rib Y (g's)	148 9	109 3
Lower Rib Y (g's)	146 5	123 2
Lower Spine Y (g's)	68.6	79.3
Pelvis Y (g's)	101 6	93 0
TTI (g's)	112	101

TEST NOTES

The data plots shown in Appendix B relate to the ES-2 injury criteria and the vehicle accelerations. A complete data set, including all ES-2 instrumentation, can be found by accessing the electronic data from the U S Department of Transportation.

SECTION 3

SIDE IMPACT DUMMY (ES-2) AND VEHICLE TEST DATA

DATA SHEET NO 1

GENERAL VEHICLE TEST PARAMETER DATATEST VEHICLE INFORMATION

Year/Make/Model/Body Style 2000/Pontiac/Grand Am/2 Door
 Vehicle Identification No (VIN) 1G2NE12TSYM709438
 Vehicle Body Color White
 Build Date 8/99
 Engine Data 4 cylinders; 2.4 liters;
 Placement longitudinal, X lateral
 Transmission Data 4 speed
 manual, X Automatic; O/D
 Final Drive rear wheel drive, X front wheel drive;
 four wheel drive
 Odometer Reading 44,803 km
 Options. X air conditioning, X power steering, X power brakes;
 power windows; X cruise control; X tilt wheel,
X power door locks

DATA FROM TIRE PLACARD

Tire Pressure (at capacity) Front 30 psi
 Rear. 30 psi
 Recommended Tire Size. P215/60R15
 Tires on Test Vehicle P215/60R15
 Manufacturer BF Goodrich

VEHICLE CAPACITY DATA:

Number of Occupants. 2 Front; 3 Rear; 3rd Seat, 5 Total
 Type of Front Seats X Bucket, Bench, Split Bench
 Type of Front Seat Back: Fixed; X Adjustable with:
X Lever, Knob, Power
 Vehicle Maximum Capacity Loading 407.8 kg (A)
 No. of Occupants x 68.04 kg 340.2 kg (B)
 Cargo Capacity (A-B) 67.6 kg

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

WEIGHT OF VEHICLE WITH MAXIMUM FLUIDS AND FUEL

Right Front	<u>454.0</u>	kg	Right Rear	<u>242.7</u>	kg
Left Front	<u>435.0</u>	kg	Left Rear	<u>245.4</u>	kg
TOTAL FRONT.	<u>889.0</u>	kg	TOTAL REAR	<u>488.1</u>	kg
% of Total Weight	<u>64.6</u>	%	% of Total Weight:	<u>35.4</u>	%
TOTAL WEIGHT	<u>1377.1</u>	kg			

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT

Total Test Vehicle Delivered Weight with Maximum Fluids	=	<u>1377.1</u>	kg
Cargo Carrying Capacity of Test Vehicle	=	<u>67.6</u>	kg
Weight of 2 Side Impact Dummies (2 x 80.7 kg)	=	<u>161.4</u>	kg
TEST VEHICLE TARGET WEIGHT	=	<u>1606.1</u>	kg

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

Right Front:	<u>493.1</u>	kg	Right Rear	<u>306.2</u>	kg
Left Front	<u>459.0</u>	kg	Left Rear:	<u>347.8</u>	kg
TOTAL FRONT	<u>952.1</u>	kg	TOTAL REAR	<u>654.0</u>	kg
% of Total Weight	<u>59.3</u>	%	% of Total Weight	<u>40.7</u>	%
TOTAL WEIGHT	<u>1606.1</u>	kg			

TEST VEHICLE ATTITUDE

	<u>Curb Weight</u>	<u>Fully Loaded Weight Attitude</u>	<u>Test Attitude</u>
Right Front (mm)	<u>680</u>	<u>671</u>	<u>669</u>
Left Front (mm)	<u>678</u>	<u>661</u>	<u>667</u>
Right Rear (mm)	<u>701</u>	<u>667</u>	<u>660</u>
Left Rear (mm):	<u>703</u>	<u>656</u>	<u>658</u>

GENERAL VEHICLE TEST PARAMETER DATA (Cont'd)

Test Vehicle Wheelbase 2723 mm
 C G As Tested 1109 mm rearward of front wheel centerline

TOTAL VEHICLE LENGTH

Right Side 3925 mm
 Centerline 4711 mm
 Left Side 3920 mm

FRONT SEAT CUSHION PLACEMENT

Total Length of Adjustment Travel: 240 mm
 Test Position 13th notch rearward of 25 total

FRONT SEAT BACK ADJUSTMENT POSITION:

Seat Back Angle 25 1 degrees

REAR SEAT

Total Length of Fore/Aft Adjustment Travel non-adjustable
 Seat Back Adjustment Position: non-adjustable

ADJUSTABLE STEERING COLUMN POSITION mid-position

WINDOW POSITIONS

Left Front	<u>Closed</u>	Left Rear:	<u>Removed</u>
Right Front	<u>Closed</u>	Right Rear:	<u>Removed</u>

AMOUNT OF WATER IN FUEL TANK:

Test Volume = 26.5 liters

LOCATIONS OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED

Wheelbase 2723 mm
 Impact Point is 422 mm rearward of front axle centerline

DATA SHEET NO. 2

TEST VEHICLE SUMMARY OF RESULTSYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000Overall Length 4711 mm, Overall Width. 1748 mmTEST WEIGHT

Right Front	<u>462.7</u> kg	Right Rear	<u>308.9</u> kg
Left Front	<u>484.4</u> kg	Left Rear	<u>341.6</u> kg
TOTAL FRONT	<u>947.1</u> kg	TOTAL REAR	<u>650.5</u> kg
% of Total Weight	<u>59.3</u> %	% of Total Weight:	<u>40.7</u> %
TOTAL WEIGHT	<u>1597.6</u> kg		

Wheelbase: 2723 mmLongitudinal C G. from Center of Front Axle 1109 mmImpact Angle with Respect to Impactor 90 degreesMAXIMUM EXTERIOR STATIC CRUSH

1	LEVEL 1 (<u>281</u> mm above ground)	<u>239</u> mm
2.	LEVEL 2 (<u>479</u> mm above ground)	<u>418</u> mm
3	LEVEL 3 (<u>591</u> mm above ground)	<u>395</u> mm
4	LEVEL 4 (<u>880</u> mm above ground)	<u>339</u> mm
5	LEVEL 5 (<u>1304</u> mm above ground)	<u>134</u> mm
Maximum Post-Test Intrusion:		<u>418</u> mm @ Level 2

OCCUPANTS

	<u>Left Front Driver</u>	<u>Left Rear Passenger</u>
Type of Dummy	<u>ES-2</u>	<u>ES-2</u>
Restraints Used	<u>Type II belt</u>	<u>Type II belt</u>

TEST VEHICLE SUMMARY OF RESULTS (Cont'd)INSTRUMENTATION

Number of Vehicle Data Channels: 29

Number of Cameras.

Onboard Vehicle	<u>3</u>
Offboard Vehicle	<u>6</u>
Deformable Barrier.	<u>2</u>
TOTAL	<u>11</u>

DATA SHEET NO 3

MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTSImpactor FMVSS 214 Moving Deformable BarrierTest Date September 14, 2000POSITION OF IMPACT (MDB) ON MONORAILCrabbed: 27 degrees to leftMDB DETAILS

Overall Width of Framework Carriage	<u>1252</u> mm
Overall Length of MDB (incl Honeycomb impact face)	<u>4115</u> mm
Wheelbase of Framework Carriage	<u>2591</u> mm
Tread of Framework Carriage (Front & Rear)	<u>1880</u> mm
C G Location Rearward of Front Axle	<u>1100</u> mm
C G Location From Centerline	<u>-10</u> mm
C G Location Above Ground Level	<u>477</u> mm
Tire Manufacturer.	<u>Fidelity</u>
Tire Size	<u>P215/75D15</u>
Tire Pressure.	<u>25</u> psi

MDB WEIGHT

Right Front	<u>458.8</u> kg	Right Rear	<u>230.3</u> kg
Left Front.	<u>324.4</u> kg	Left Rear	<u>350.6</u> kg
TOTAL FRONT	<u>783.2</u> kg	TOTAL REAR.	<u>580.9</u> kg
TOTAL MDB WEIGHT	<u>1364.1</u> kg		

Impact Angle (MDB C/L to Target Vehicle C/L) = 90 degreesImpact Speed = Primary 38.6 mph (62.1 kph); Secondary 38.6 mph (62.1 kph)

MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTS (Cont'd)MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE.

1	Row A Top of Stack (813 mm)	=	<u>160</u> mm
2.	Row B Mid Stack (686 mm)	=	<u>103</u> mm
3.	Row C Top of Bumper (533 mm)	=	<u>64</u> mm
4.	Row D Center of Bumper (432 mm)	=	<u>129</u> mm

INSTRUMENTATION

Number of MDB Data Channels 5

DATA SHEET NO 4

POST TEST OBSERVATIONSYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000VISIBLE DUMMY CONTACT POINTS

	<u>Left Front Driver</u>	<u>Right Rear Passenger</u>
Head	<u>Side header</u>	<u>C post</u>
Arm	<u>Door above armrest</u>	<u>Interior panel</u>
Upper Rib	<u>Door above armrest</u>	<u>Interior panel</u>
Mid Rib	<u>Door above armrest</u>	<u>Interior panel</u>
Lower Rib	<u>Door above armrest</u>	<u>Interior panel</u>
Abdomen	<u>Door below armrest</u>	<u>Armrest</u>
Pelvis	<u>Door below armrest</u>	<u>Interior panel</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 POINTHorizontal 7 mm rearwardVertical 21 mm upARM REST LOCATIONSFront 233 mm from bottom of windowRear 317 mm from bottom of windowSEAT CRUSH.Front Seat Back 161 mm Front Seat Cushion 179 mmLeft Rear Seat Back 178 mm Rear Seat Cushion 154 mm

POST TEST OBSERVATIONS (Cont'd)GLAZING DAMAGE

Both left side windows broke, rear window broke, and windshield cracked

PILLAR PERFORMANCE

No failures noted

SILL SEPARATION

None noted

OTHER NOTABLE IMPACT EFFECTS

None noted

SECTION 4

OCCUPANT AND VEHICLE INFORMATION

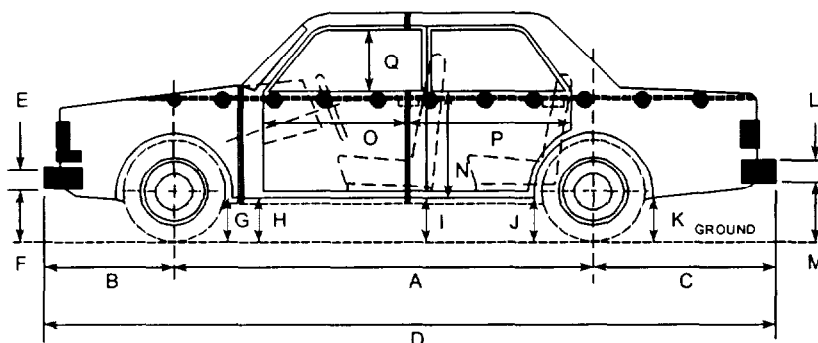
DATA SHEET NO 5

SIDE IMPACT DUMMY (ES-2) INSTRUMENTATION DATAYear/Make/Model/Body Style. 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000

	LEFT FRONT DRIVER ID #001			
	Positive		Negative	
	Max	Time (msec)	Max	Time (msec)
RIB ACCELERATIONS (g's)				
Left Upper Rib (LUR) Y	155.3	29	40.8	34
Left Middle Rib (LMR) Y	148.9	31	28.1	79
Left Lower Rib (LLR) Y	146.5	34	72.4	41
SPINE ACCELERATIONS (g's)				
Lower Lateral Y	68.6	31	16.1	66
PELVIS ACCELERATIONS (g's)				
Lateral Y	101.6	26	37.1	42
	LEFT REAR PASSENGER ID#002			
	Positive		Negative	
	Max	Time (msec)	Max	Time (msec)
RIB ACCELERATIONS (g's)				
Left Upper Rib (LUR) Y	76.2	42	11.3	59
Left Middle Rib (LMR) Y	109.3	41	16.3	58
Left Lower Rib (LLR) Y	123.2	38	13.0	80
SPINE ACCELERATIONS (g's)				
Lower Lateral Y	79.3	41	13.2	69
PELVIS ACCELERATIONS (g's)				
Lateral Y	93.0	33	13.2	197

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

DATA SHEET NO. 6

VEHICLE PRE AND POST-TEST MEASUREMENTS**LEFT SIDE VIEW**

D=Length at Centerline
T=Width at B Post

R=Right Side Length
J1=To Pinch Weld

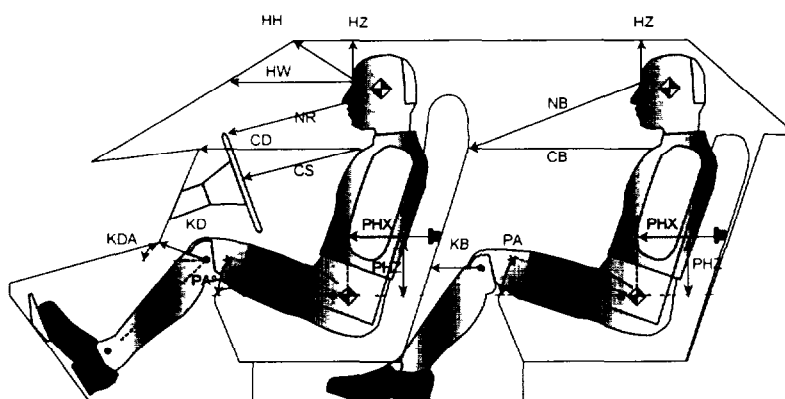
S=Left Side Length
J2= To Sill

E&L=Bumper Thickness

	PRE-TEST	POST-TEST	Δ CHANGE
A	2723	2676	47
B	996	970	26
C	992	1000	8
D	4711	4646	65
E	150	150	0
F	388	400	12
G	184	210	26
H	184	204	20
I	178	149	29
J1	178	160	18
J2	179	158	21
K	231	230	1
L	164	164	0
M	373	385	12
N	687	591	96
O	770	752	18
P	625	625	0
Q	450	405	45
R	3925	3935	10
S	3920	3824	96
T	1748	1387	361

All measurements in millimeters

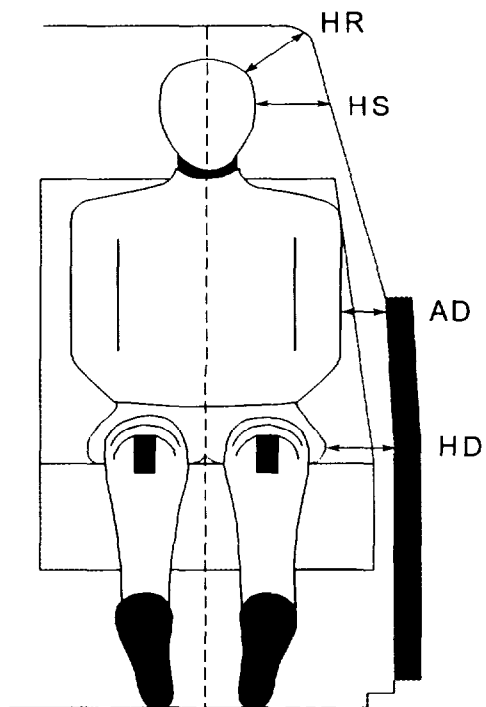
DATA SHEET NO 7

SIDE IMPACT DUMMY (ES-2) LONGITUDINAL CLEARANCE DIMENSIONSYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date: September 14, 2000Note All dimensions are in millimeters with tolerance of ± 3 mm

	Left Front Driver ID #001	Left Rear Passenger ID #002
HH	291	NA
HW	556	NA
HZ	137	115
NR/NB	423	678
CD/CB	552	594
CS	363	NA
KDL/(KDA)	207 (0.0)	177 (0.0)
KDR/(KDA)	193 (0 0)	174 (0.0)
PA (longitudinal)	22.3	36 6
PA (lateral)	-0.1	2 9
Spine Angle (longitudinal)	27 1	39 0
Spine Angle (lateral)	-0 5	3 5
PHX	514	331
PHZ	102	107

Two door vehicle shown Rear dummy PHX & PHZ measurements for 4-door vehicle use the C-Post striker as reference point

DATA SHEET NO 8

SIDE IMPACT DUMMY (ES-2) LATERAL CLEARANCE DIMENSIONSYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000

Note All dimensions are in millimeters

	Left Front Driver ID #001	Left Rear Passenger ID #002
HR	166	226
HS	303	244
AD	88	96
HD	133	131
Abdomen to Door	167	147
Shoulder to Door	90	112
Shoulder to Window	156	163

Door Thickness (mm)	Thorax	Pelvis H Point
Front	231	253
Rear	Not Available	Not Available

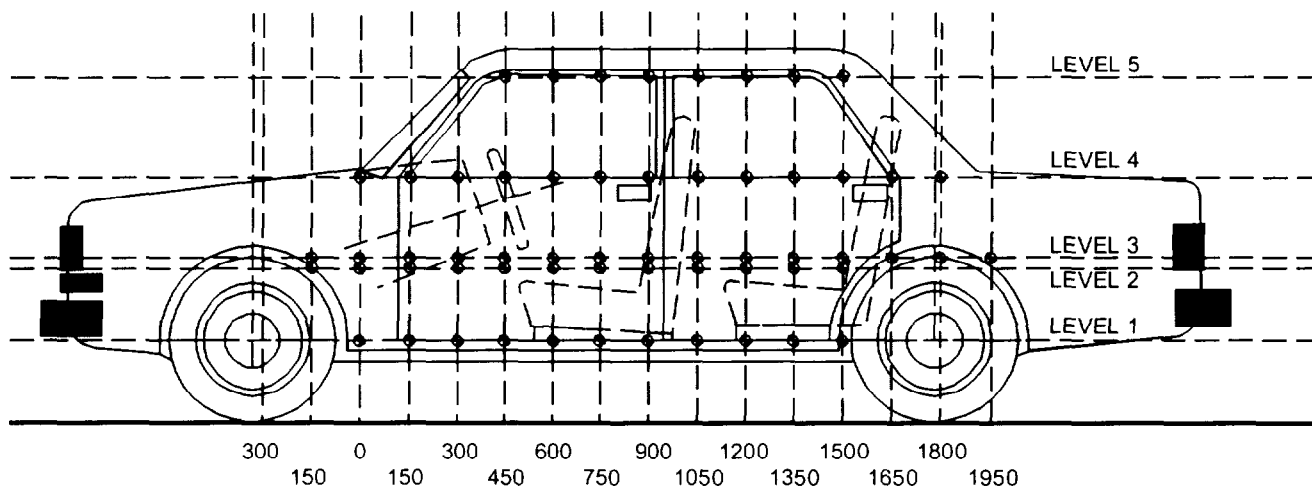
DATA SHEET NO 9

DUMMY POSITIONING

	Left Front Driver ID #001		Left Rear Passenger ID #002	
	H-point	Dummy	H-point	Dummy
HP to Floor Z	122	131		
HP to Hinge X	773	780	1640	1606
HP to Sill Y	150	155	128	131
HP to Striker X	608	603	398	362
HP to Dash X	536	544	1395	1360
HP to Header Z	766	752	710	699
HP to Front Axle		1306		2151
HP to Ground		549		544
H-POINT MACHINE (deg)				
Left Knee	120		122	
Right Knee	118		120	
Left Foot	170		137	
Right Foot	162		132	
Left Leg (mm)	170		88	
Right Leg (mm)	162		64	
Hip Angle	26		103	
Back Angle	25		30	

The H-Point measurements were obtained from the H-Point machine. The dummy measurements are for the dummies H-Point.

DATA SHEET NO. 10

VEHICLE SIDE MEASUREMENTSYear/Make/Model/Body Style: 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000**LEFT SIDE VIEW**

NOTE: All measurements are in millimeters (mm)

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

MEASUREMENTS ARE TAKEN WHEN THE VEHICLE IS IN THE "AS TESTED" CONFIGURATION
 MEASUREMENTS ALONG THE VERTICAL 750 mm LINE SHOWN ABOVE

Level 1 @ Axle Centerline Height (or Sill Top Height):	<u>281</u> mm
Level 2 @ Occupant H-Point	<u>479</u> mm
Level 3 @ Mid Door.	<u>591</u> mm
Level 4 @ Window Sill	<u>880</u> mm
Level 5 @ Window Top	<u>1304</u> mm

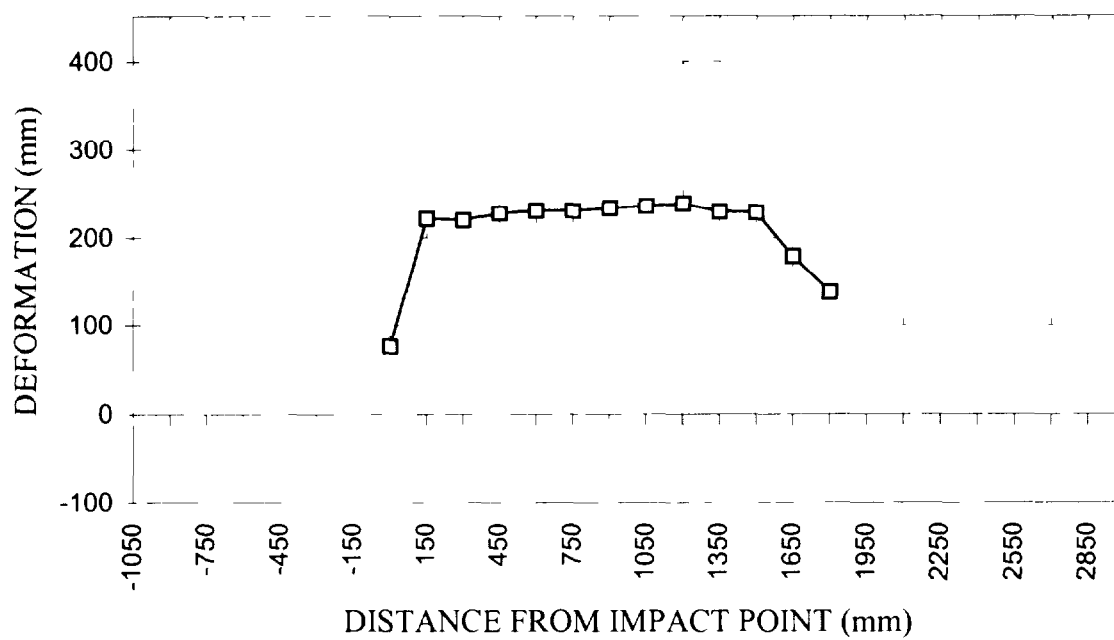
DATA SHEET NO 11
VEHICLE EXTERIOR CRUSH PROFILES

	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)	710	786	76
150	729	951	222
300	732	952	220
450	730	958	228
600	730	961	231
750	730	961	231
900	730	964	234
1050	730	966	236
1200	729	968	239
1350	729	959	230
1500	729	958	229
1650	728	907	179
1800	725	863	138
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 CRUSH PROFILES (Cont'd)

LEVEL 1 – AXLE CENTERLINE



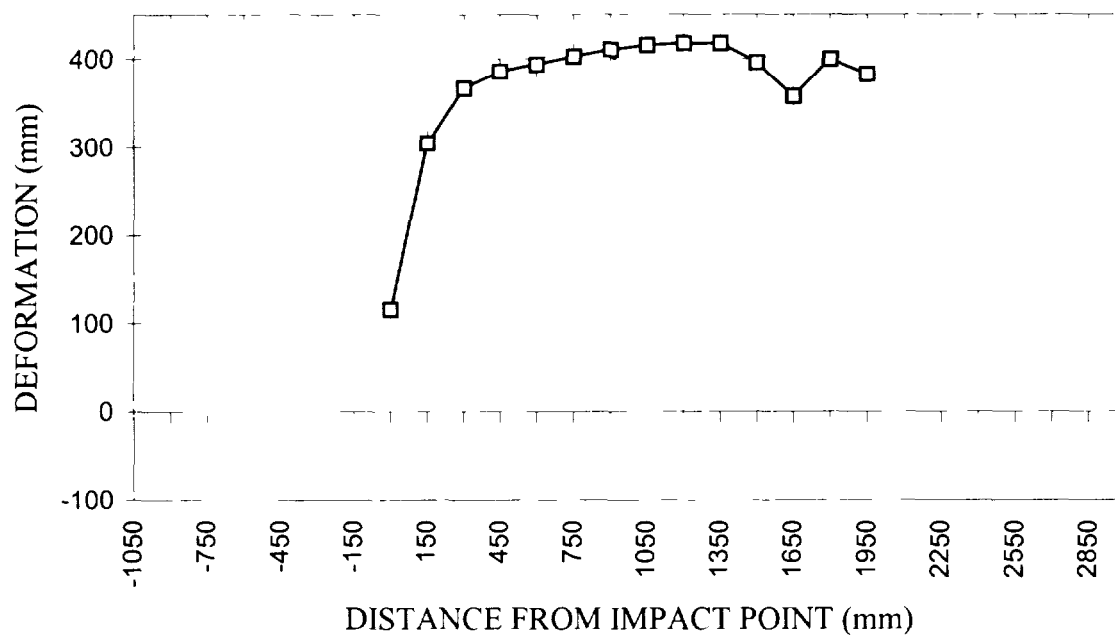
DATA SHEET NO 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

Longitudinal Distance (mm)	Level 2 – Occupant H Point		
	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050			
-900			
-750			
-600			
-450			
-300			
-150			
0 (impact point)	684	800	116
150	689	994	305
300	688	1055	367
450	685	1071	386
600	684	1078	394
750	682	1085	403
900	680	1091	411
1050	678	1094	416
1200	677	1095	418
1350	677	1095	418
1500	678	1074	396
1650	680	1038	358
1800	679	1079	400
1950	665	1048	383
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 CRUSH PROFILES (Cont'd)

LEVEL 2 – OCCUPANT H POINT



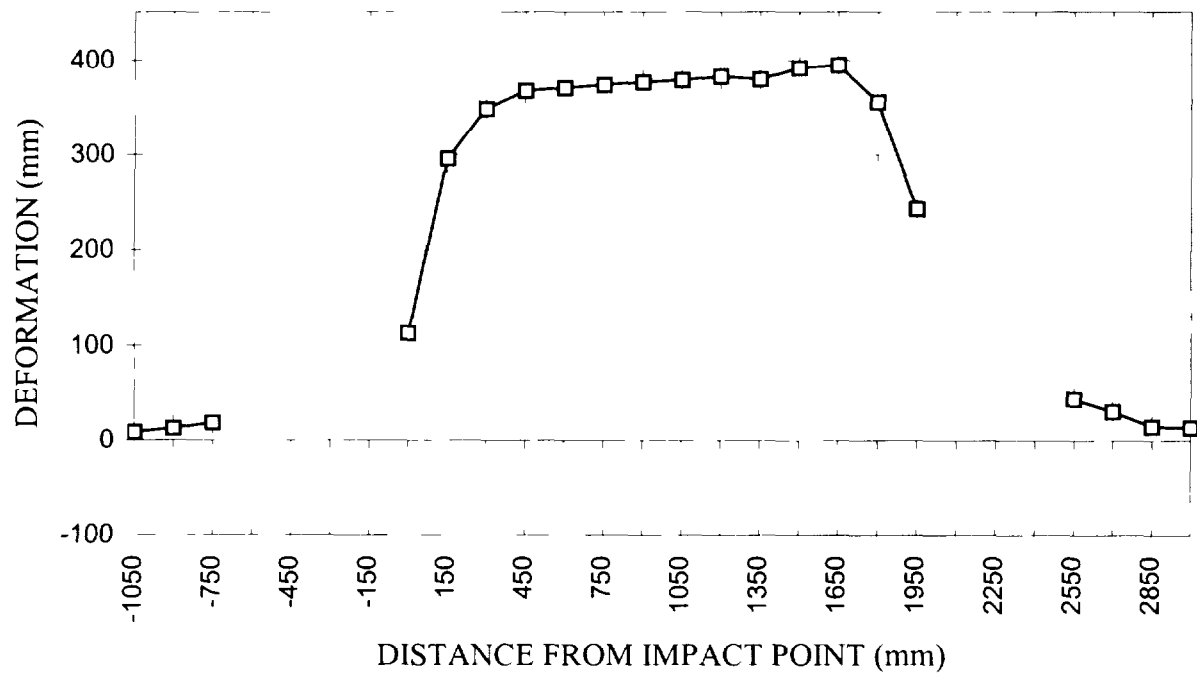
DATA SHEET NO 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 3 – Mid Door		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050	736	745	9
-900	714	727	13
-750	675	694	19
-600			
-450			
-300			
-150			
0 (impact point)	684	797	113
150	688	984	296
300	685	1034	349
450	684	1052	368
600	684	1055	371
750	682	1056	374
900	682	1059	377
1050	680	1059	379
1200	679	1062	383
1350	679	1059	380
1500	677	1069	392
1650	677	1072	395
1800	677	1033	356
1950	668	911	243
2100			
2250			
2400			
2550	667	711	44
2700	690	721	31
2850	703	718	15
3000	729	743	14

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

VEHICLE EXTERIOR CRUSH PROFILES (Cont'd)

LEVEL 3 – MID DOOR



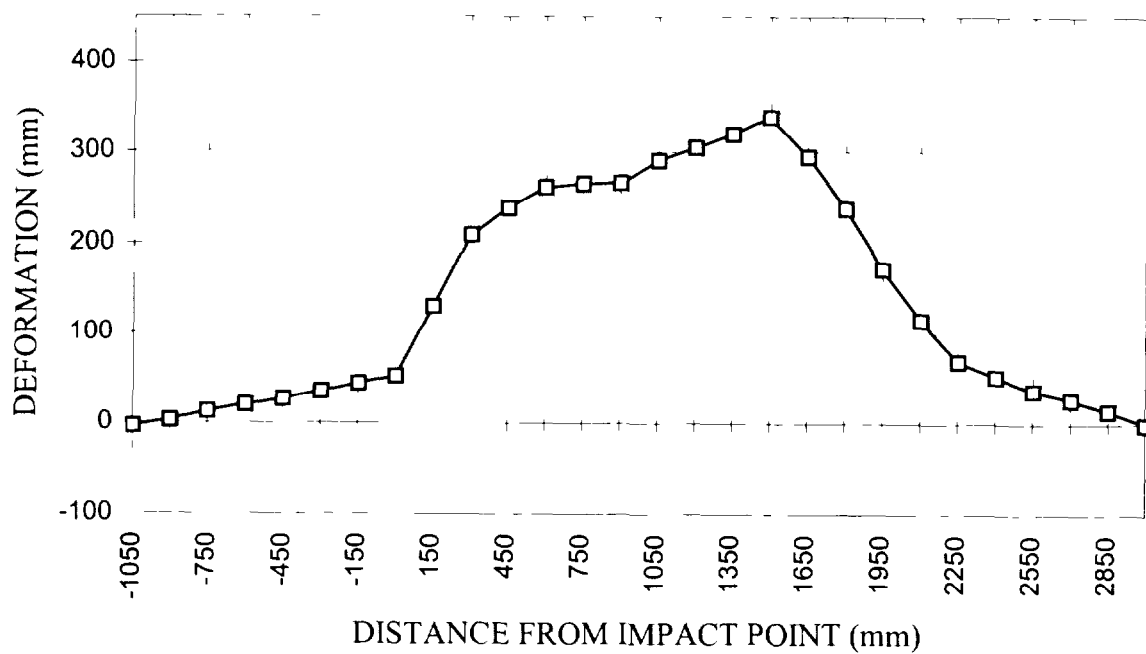
DATA SHEET NO 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	Level 4 – Window Sill		
Longitudinal Distance (mm)	Pre-Test (mm)	Post-Test (mm)	Static Crush (mm)
-1050	843	840	-3
-900	825	828	3
-750	808	821	13
-600	798	818	20
-450	789	816	27
-300	782	817	35
-150	772	816	44
0 (impact point)	764	816	52
150	756	886	130
300	752	961	209
450	752	991	239
600	750	1011	261
750	747	1012	265
900	746	1012	266
1050	746	1037	291
1200	749	1054	305
1350	752	1072	320
1500	754	1093	339
1650	756	1051	295
1800	759	997	238
1950	762	934	172
2100	760	875	115
2250	763	832	69
2400	772	824	52
2550	781	818	37
2700	794	821	27
2850	814	829	15
3000	836	836	0

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

VEHICLE EXTERIOR CRUSH PROFILES (Cont'd)

LEVEL 4 – WINDOW SILL



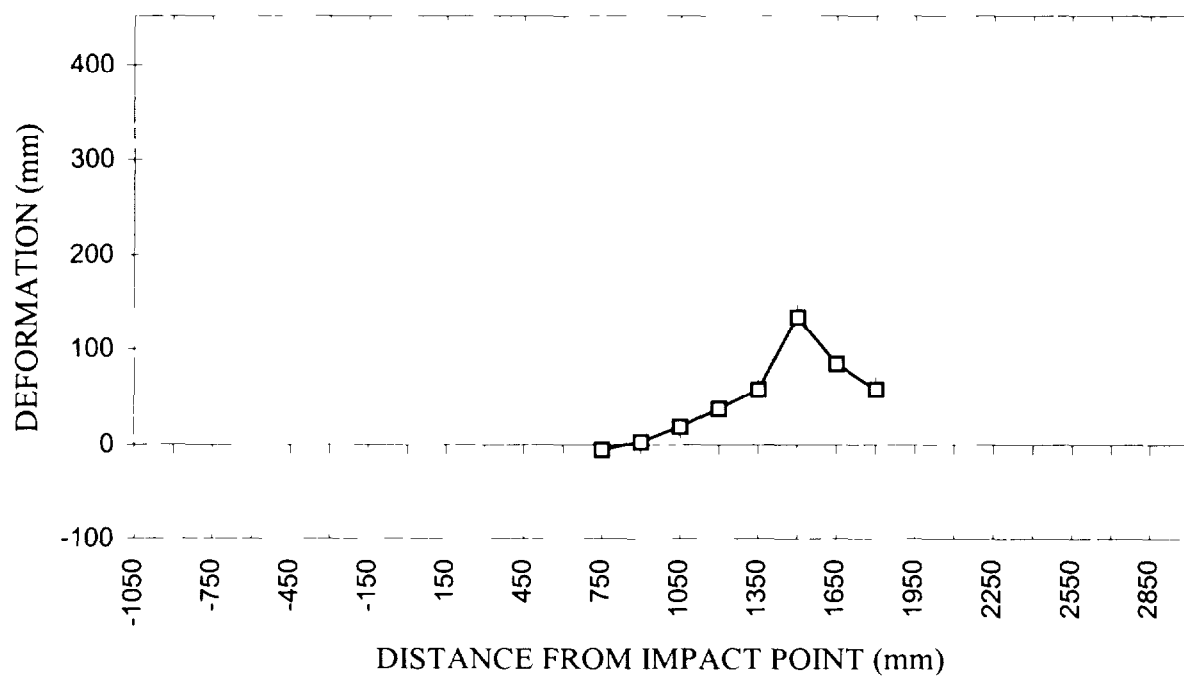
DATA SHEET NO 11 (Cont'd)
VEHICLE EXTERIOR CRUSH PROFILES

	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	983	978	-5
900	984	987	3
1050	985	1004	19
1200	987	1025	38
1350	988	1046	58
1500	985	1119	134
1650	993	1078	85
1800	997	1055	58
1950			
2100			
2250			
2400			
2550			
2700			
2850			
3000			

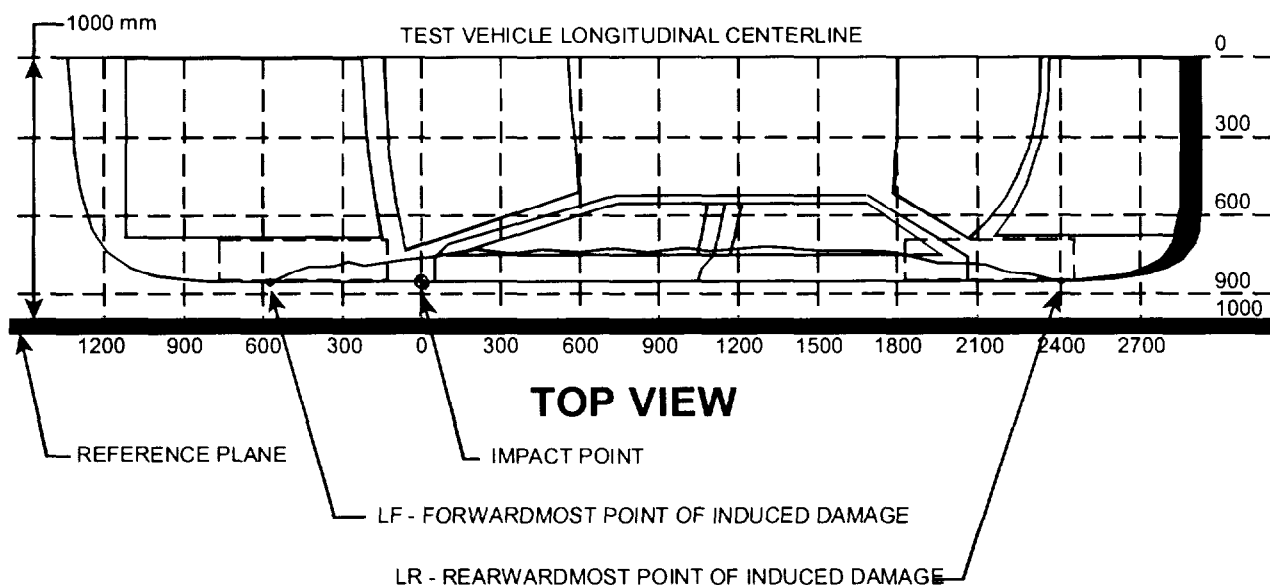
Reference plane is parallel to test vehicle longitudinal centerline
 Given dimensions = Reference plane to car body

VEHICLE EXTERIOR CRUSH PROFILES (Cont'd)

LEVEL 5 – WINDOW TOP



DATA SHEET NO 12

VEHICLE DAMAGE PROFILE DISTANCESYear/Make/Model/Body Style: 2000/Pontiac/Grand Am/2 DoorTest Date: September 14, 2000

MEASUREMENT CONVENTIONS

Forward of the impact point (towards front of vehicle) is considered negative (—)

Rearward of the impact point (toward rearend of vehicle) is considered positive (+)

DPD MEASUREMENTS	POST-TEST (mm)	PRE-TEST (mm)	STATIC CRUSH (mm)
1 (LR = 3000 mm)	836	836	0
2 2240 mm	828	763	65
3 1390 mm	1097	677	420
4 610 mm	1078	684	394
5 -132 mm	814	771	43
6 (LF = -900 mm)	840	843	-3

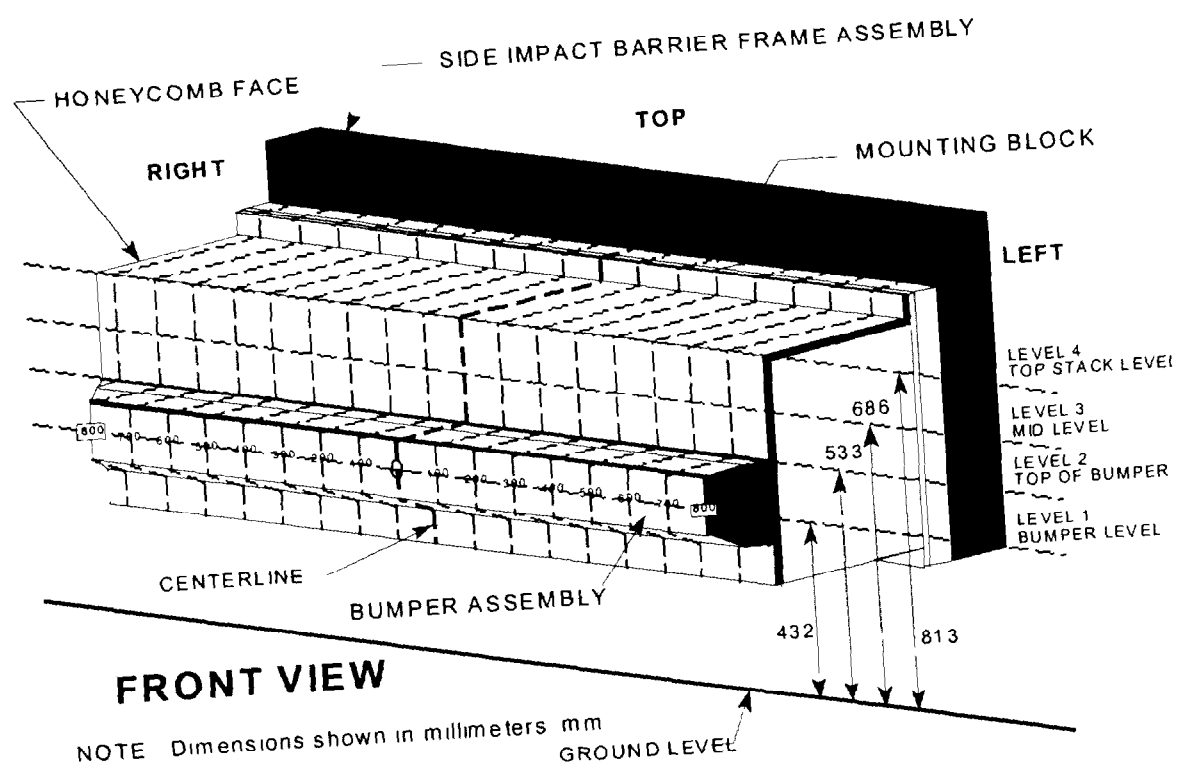
DATA SHEET NO 13

EXTERIOR STATIC CRUSH FOR SIDE IMPACTORYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000

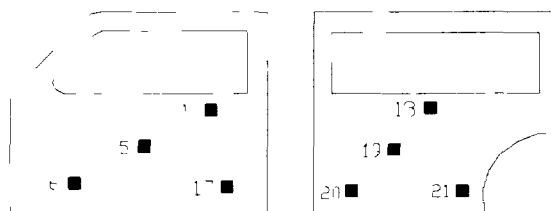
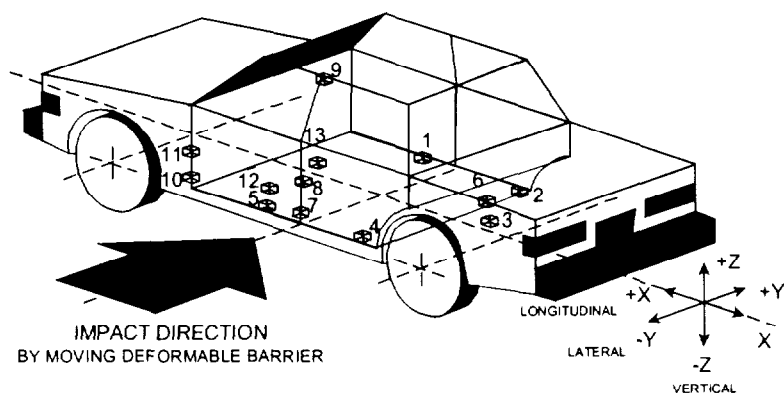
Location	Height At CL*	Distance Right of Center (mm)									Distance Left of Center (mm)							
		800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
Top Stack Level 4	813 mm	84	26	-1	-1	2	-2	-3	0	5	10	13	18	21	-1	69	100	160
Mid Level Level 3	686 mm	40	3	2	1	0	-3	-3	-2	0	4	6	9	11	15	21	45	103
Top Bumper Level 2	533 mm	57	43	34	30	26	25	27	26	26	27	30	31	33	36	40	47	64
Mid Bumper Level 1	432 mm	129	114	98	88	80	73	71	69	69	67	65	69	68	70	76	92	96

* See next page for Barrier Face Graphic

EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR (Cont'd)



DATA SHEET NO 14

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARYYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000

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

DATA SHEET NO 14 (Cont'd)

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARYYear/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date. September 12, 2000

Accel No	Description	Long (X)		Lat (Y)		Vert. (Z)		Resultant (g's) (CFC 60)
		Maximums (g's) (CFC 60)		Maximums (g's) (CFC 60)		Maximums (g's) (CFC 60)		
		Pos	Neg	Pos	Neg	Pos.	Neg	Max
1	Right Side Sill @ Front Seat	3 2	5 0	20 3	2 4	5 2	9 9	20 4
2	Right Side Sill @ Rear Seat	3 3	4 1	22 9	4 2	5 0	10.5	23 0
3	Rear Floorpan Above Axle	3 8	22 3	5 2	3 6	3 9	8 2	23 0
4	Left Side Sill @ Rear Seat	---	---	26.3	7 4	---	---	---
5	Left Side Sill @ Front Seat	---	---	47 8	42 3	---	---	---
6	Right Rear Occ Compartment	---	---	19 2	2 5	---	---	---
7	Left Lower B Post	---	---	**	**	---	---	---
8	Left Mid B Post	---	---	171 1	69 3	---	---	---
9	Left Upper B Post	---	---	40 9	32 2	---	---	---
10	Left Lower A Post	---	---	33.2	2 5	---	---	---
11	Left Mid A Post	---	---	41 6*	8 9*	---	---	---
12	Driver Left Seat Track	---	---	59 7	46.2	---	---	---
13	Vehicle CG	3 2	10 2	29 1	2 3	17.6	10 9	30.4
14	Left Front Door Upper	---	---	185.6	155 1	---	---	---
15	Left Front Door Mid	---	---	**	**	---	---	---
16	Left Front Door Lower			217 5	100 4		---	---
17	Left Front Door Rear Lower	---	---	101 0 ***	40 9***	---	---	---
18	Left Rear Door Upper	---	---	74 9	40.3	---	---	---
19	Left Rear Door Mid	---	---	113 1	82.2	---	---	---
20	Left Rear Door Lower	---	---	216 5	87 9	---	---	---
21	Left Rear Door Rear Lower	---	---	102 7	61 0	---	---	---

* No Valid Data After 40 msec

** No Valid Data Collected

*** No Valid Data After 10 msec

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY (Cont'd)

Year/Make/Model/Body Style 2000/Pontiac/Grand Am/2 Door

Test Date September 14, 2000

Accel No	Description	Coordinates (mm)*		
		X	Y	Z
1	Right Side Sill @ Front Seat	2396	606	230
2	Right Side Sill @ Rear Seat	1409	632	222
3	Rear Floorpan Above Axle	1090	0	512
4	Left Side Sill @ Rear Seat	1438	-638	224
5	Left Side Sill @ Front Seat	2416	-638	228
6	Right Rear Occ Compartment	1840	424	350
7	Left Lower B Post	1819	-720	421
8	Left Mid B Post	1805	-720	860
9	Left Upper B Post	1758	-543	1328
10	Left Lower A Post	3134	-618	317
11	Left Mid A Post	3137	-788	849
12	Driver Left Seat Track	2267	-482	183
13	Vehicle CG	2537	-10	386
14	Left Front Door Upper	2130	-763	838
15	Left Front Door Mid	2466	-743	667
16	Left Front Door Lower	2799	-734	490
17	Left Front Door Rear Lower	2857	-763	508
18	Left Rear Door Upper	1253	-706	930
19	Left Rear Door Mid	1540	-737	780
20	Left Rear Door Lower	1724	-710	597
21	Left Rear Door Rear Lower	1431	-736	473

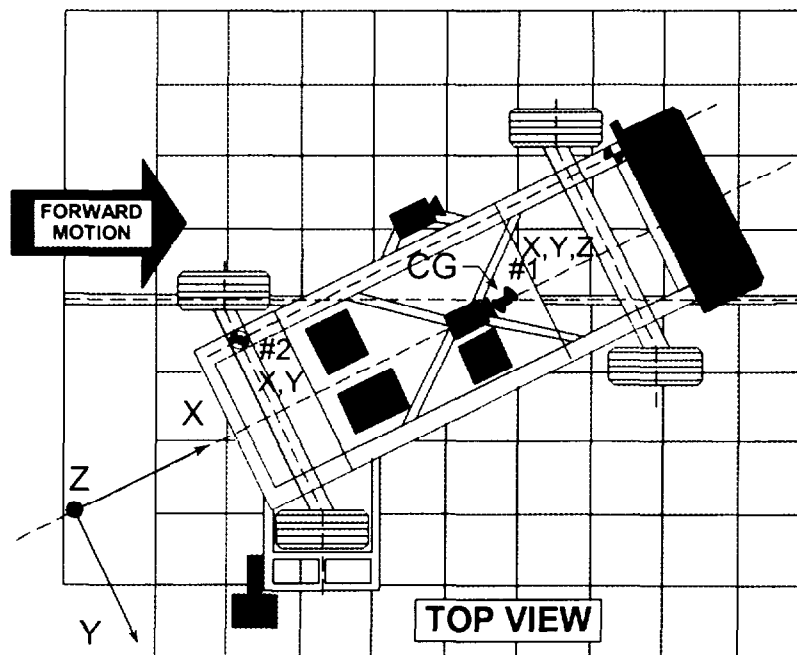
* Reference X – Rear Bumper (+ Forward)

Y – Vehicle Centerline (+ to right)

Z – Ground Level (+ up)

DATA SHEET NO 15

MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS AND DATA SUMMARY

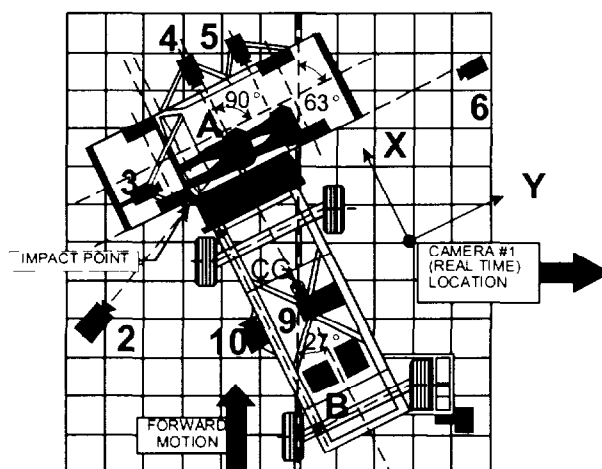
Year/Make/Model/Body Style 2000/Pontiac/Grand Am/2 DoorTest Date September 14, 2000

Accel No	Description	Coordinates (mm)*			(+) Positive		(-) Negative	
		X	Y	Z	Max. (g) (CFC 60)	Time (msec)	Max. (g) (CFC 60)	Time (msec)
1	MDB Center of Gravity	-1092	0	483				
	Longitudinal (X)	---	---	---	5.5	176	15.6	32
	Lateral (Y)	---	---	---	13.2	68	17.1	33
	Vertical (Z)	---	---	---	14.8	33	15.4	68
	Resultant (R)	---	---	---	27.3	33	--	--
2	Rear Frame Member	-2591	-625	622				
	Longitudinal (X)	---	---	---	2.2	120	21.1	32
	Lateral (Y)	---	---	---	**	**	**	**

* Reference X – Front Axle (+ Forward)
Y – Vehicle Centerline (+ to Right)
Z – Ground Level (+ Up)

** No Valid Data Collected

DATA SHEET NO 16

HIGH SPEED CAMERA LOCATIONS AND DATAYear/Make/Model/Body Style: 2000/Pontiac/Grand Am/2 DoorTest Date: September 14, 2000

Camera No	View	Coordinates (mm)*			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real Time				10	24
2	Left Impact	-1120	-2420	1610	13	1005
3	Onboard Hood				13	514
4	Onboard Front Occupant				8	521
5	Onboard Rear Occupant				8	515
6	Right Impact	-150	10400	1840	25	1005
6	Right Impact	-150	10400	1840	25	505
	Right Angle					1005
7	Top Overall	-720	970	5000	8	913
8	Top Impact	-690	-340	5000	13	957
9	Cart Overall				13	1015
10	Cart Impact				35	1005

* Reference (from impact point)

+X = Forward

+Y = To Right

+Z = Upward from floor level

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



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



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



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

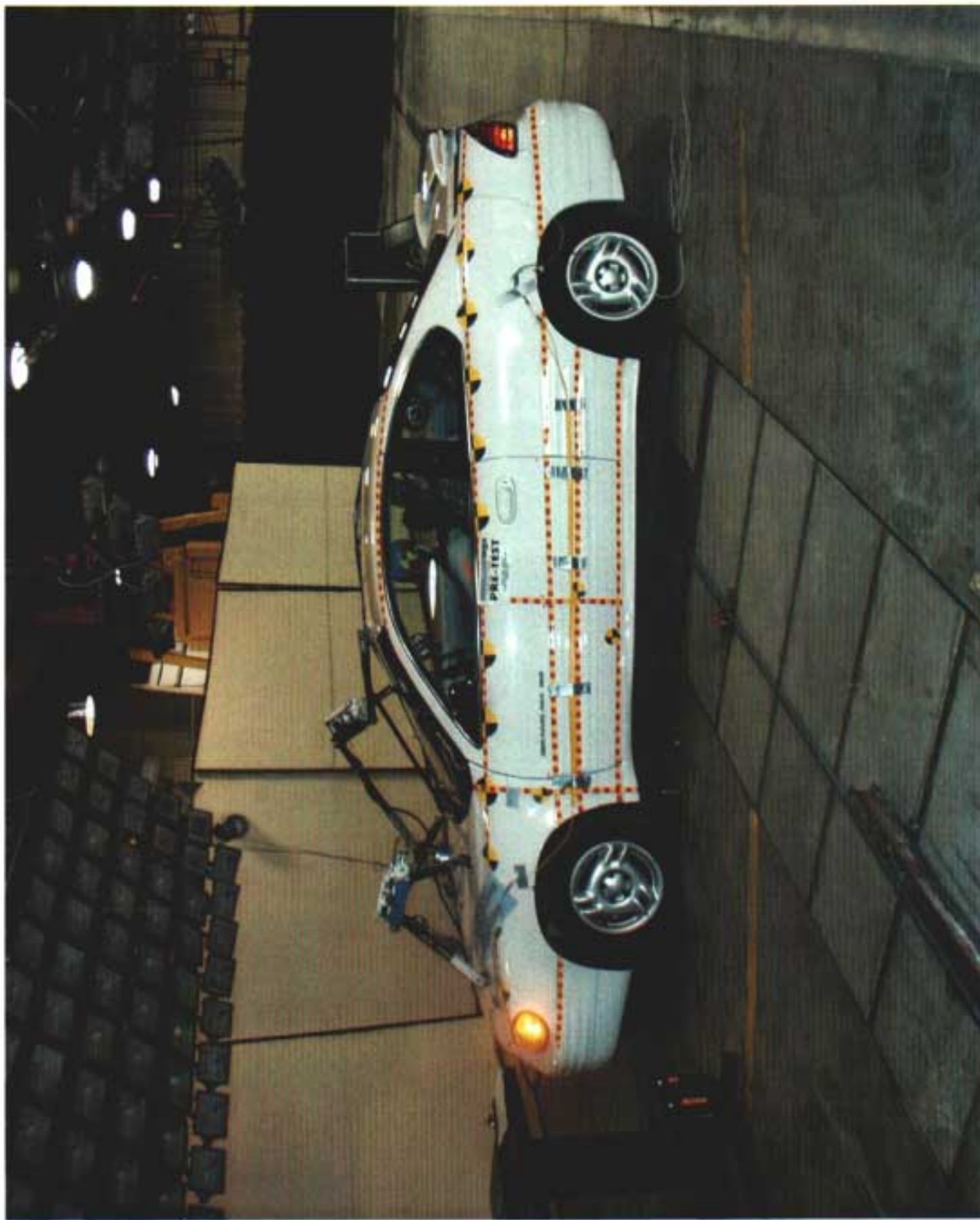


Photo No. A-5 - Pre-Test Left Side View of Test Vehicle



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

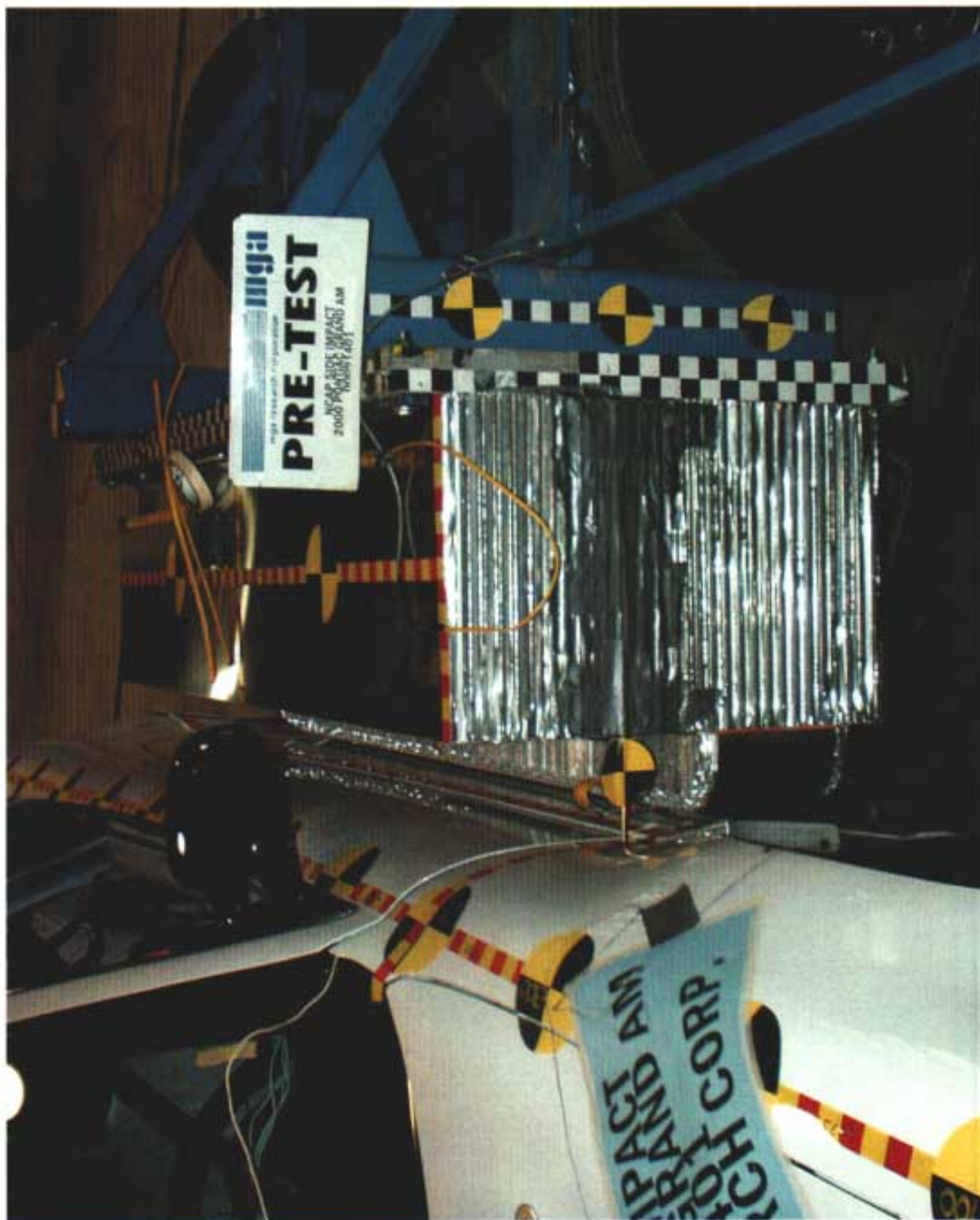


Photo No. A-7 - Pre-Test MDB Positioned Against Vehicle (left side)



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



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



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



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



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



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

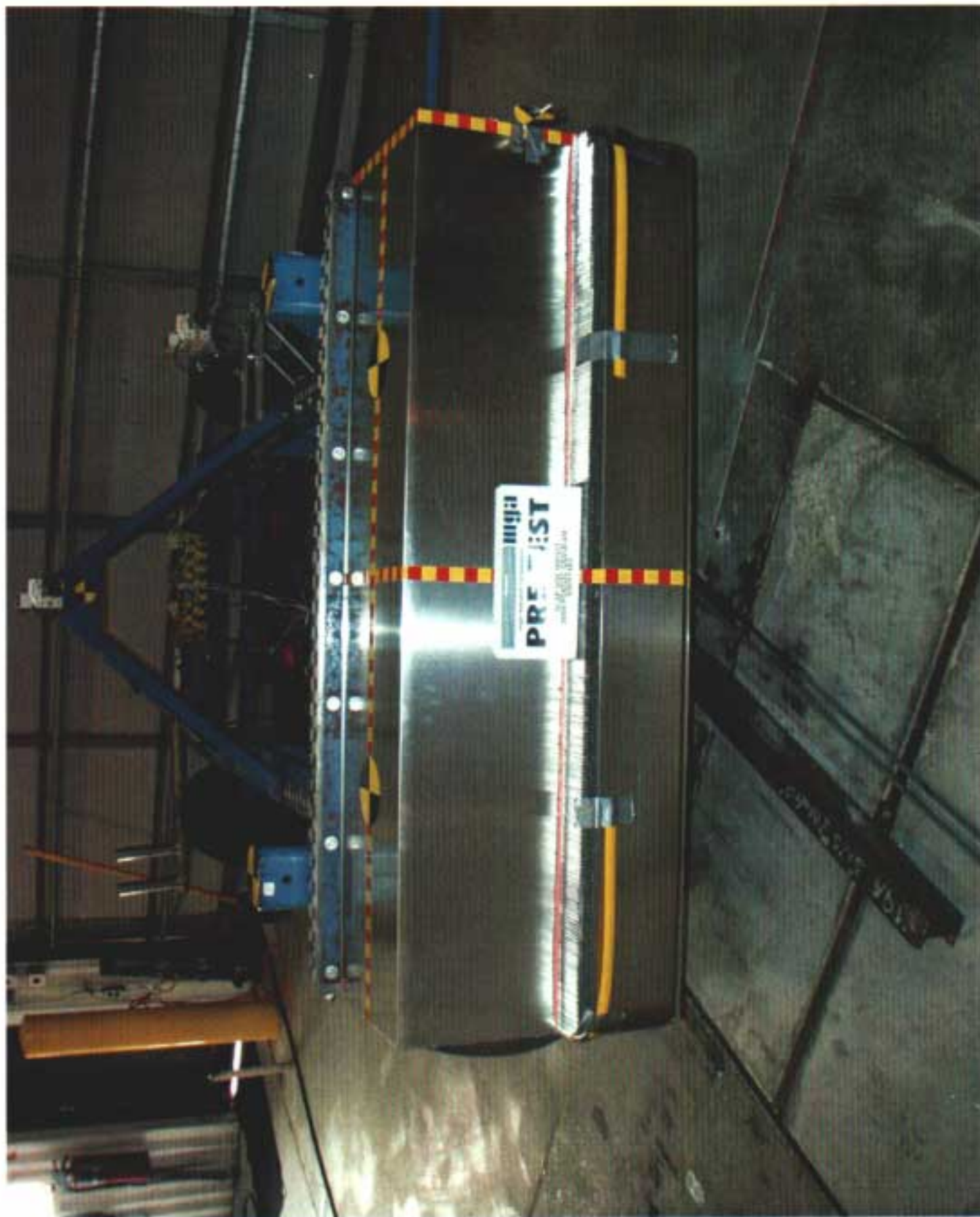


Photo No. A-14 - Pre-Test MDB Front View

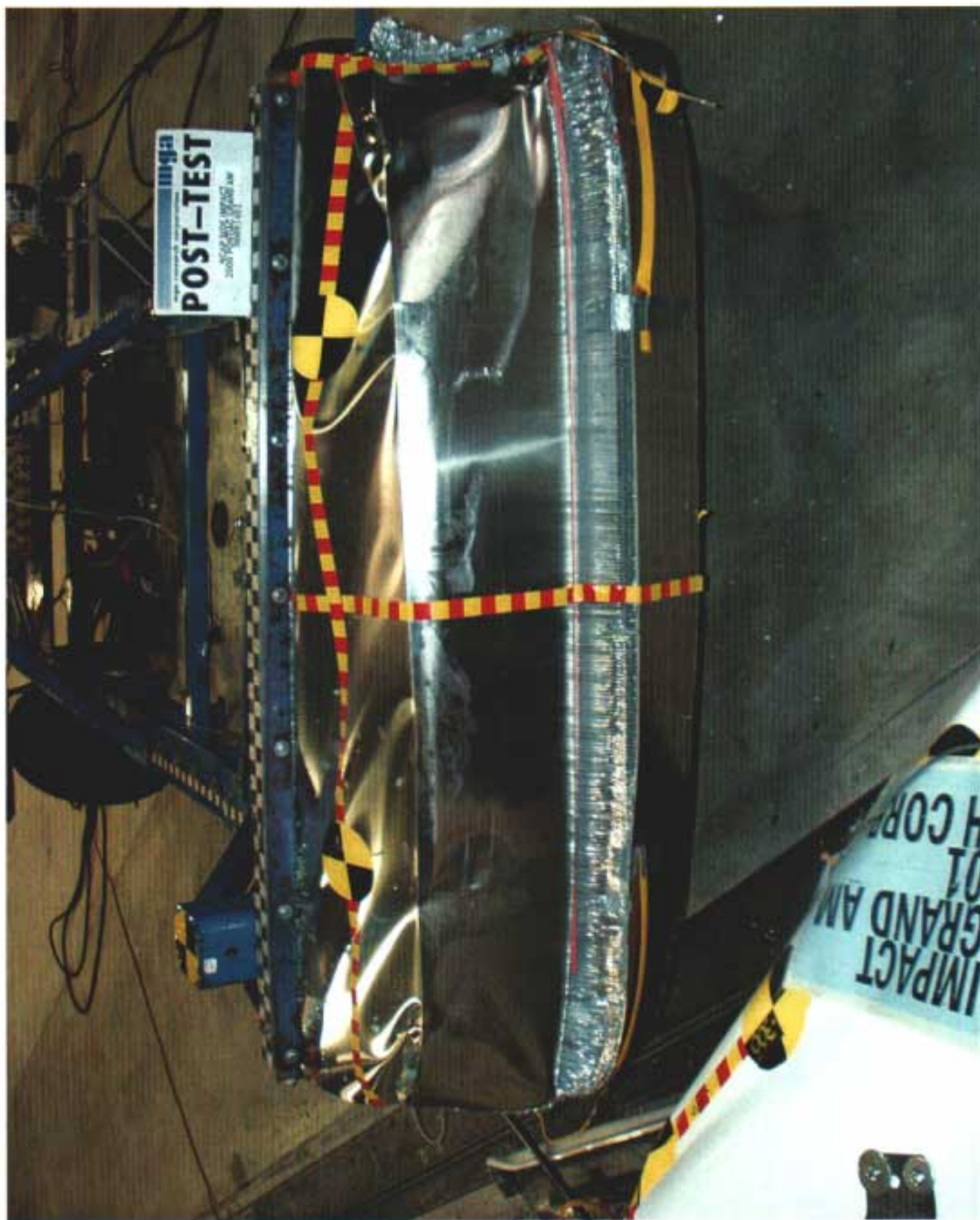


Photo No. A-15 - Post-Test MDB Front View



Photo No. A-16 - Pre-Test MDB Left Side View

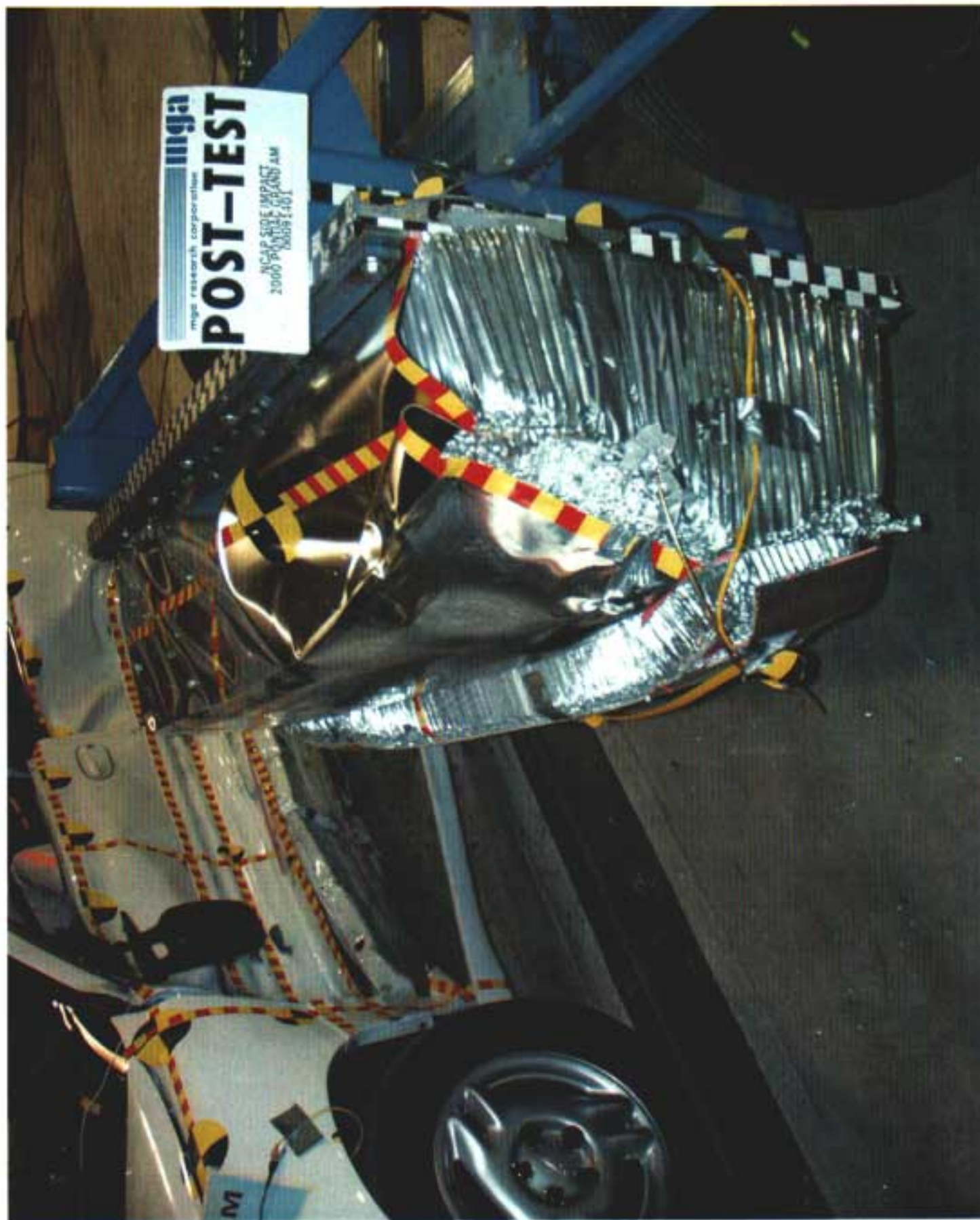


Photo No. A-17 - Post-Test MDB Left Side View



Photo No. A-18 - Pre-Test MDB Right Side View



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



Photo No. A-20 - Pre-Test Driver Dummy Right Side View

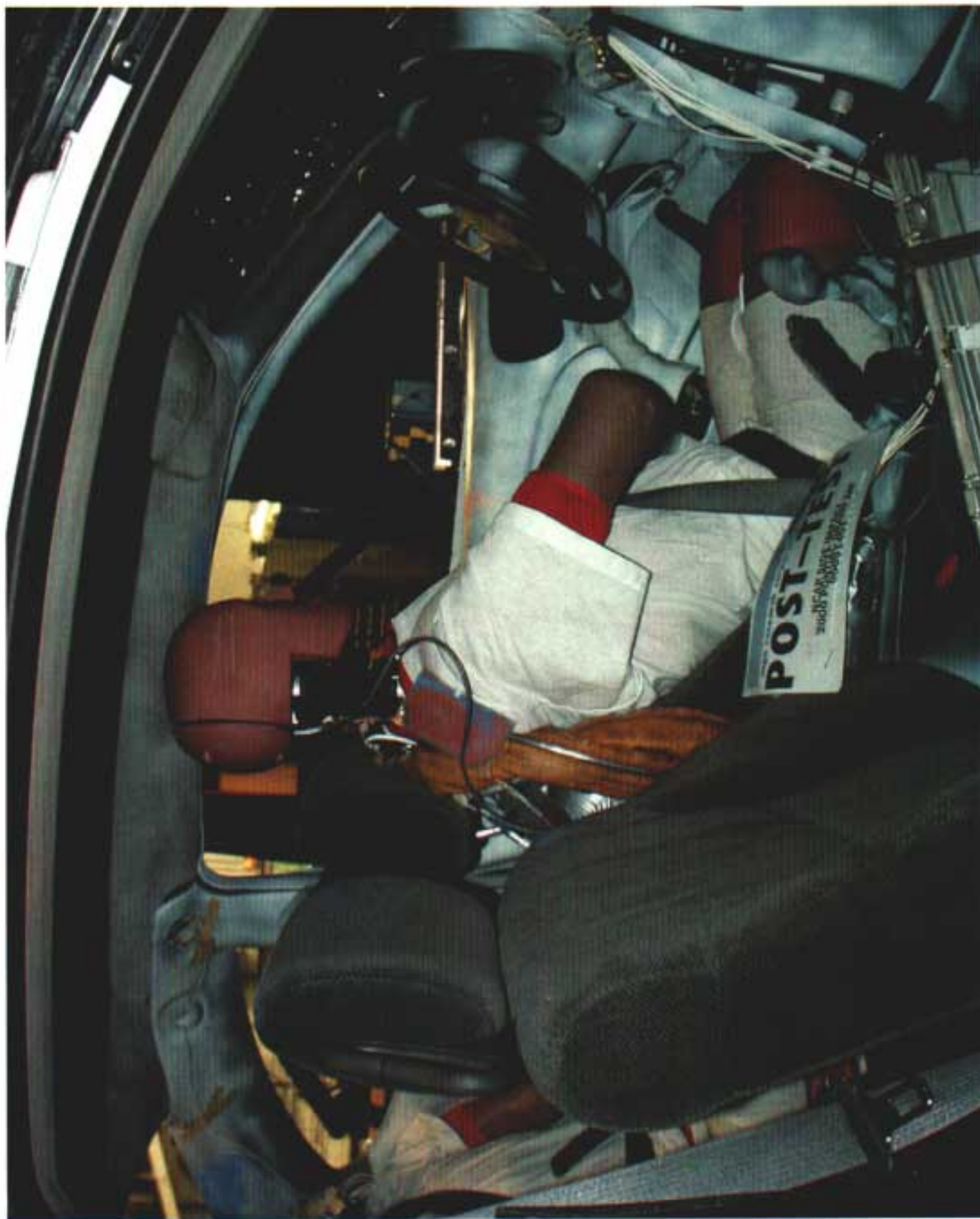


Photo No. A-21 - Post-Test Driver Dummy Right Side View



Photo No. A-22 - Pre-Test Driver Dummy Left Side View



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

PRE-TEST
NCAP SIDE IMPACT
2000 PONTIAC GRAND AM
00091401

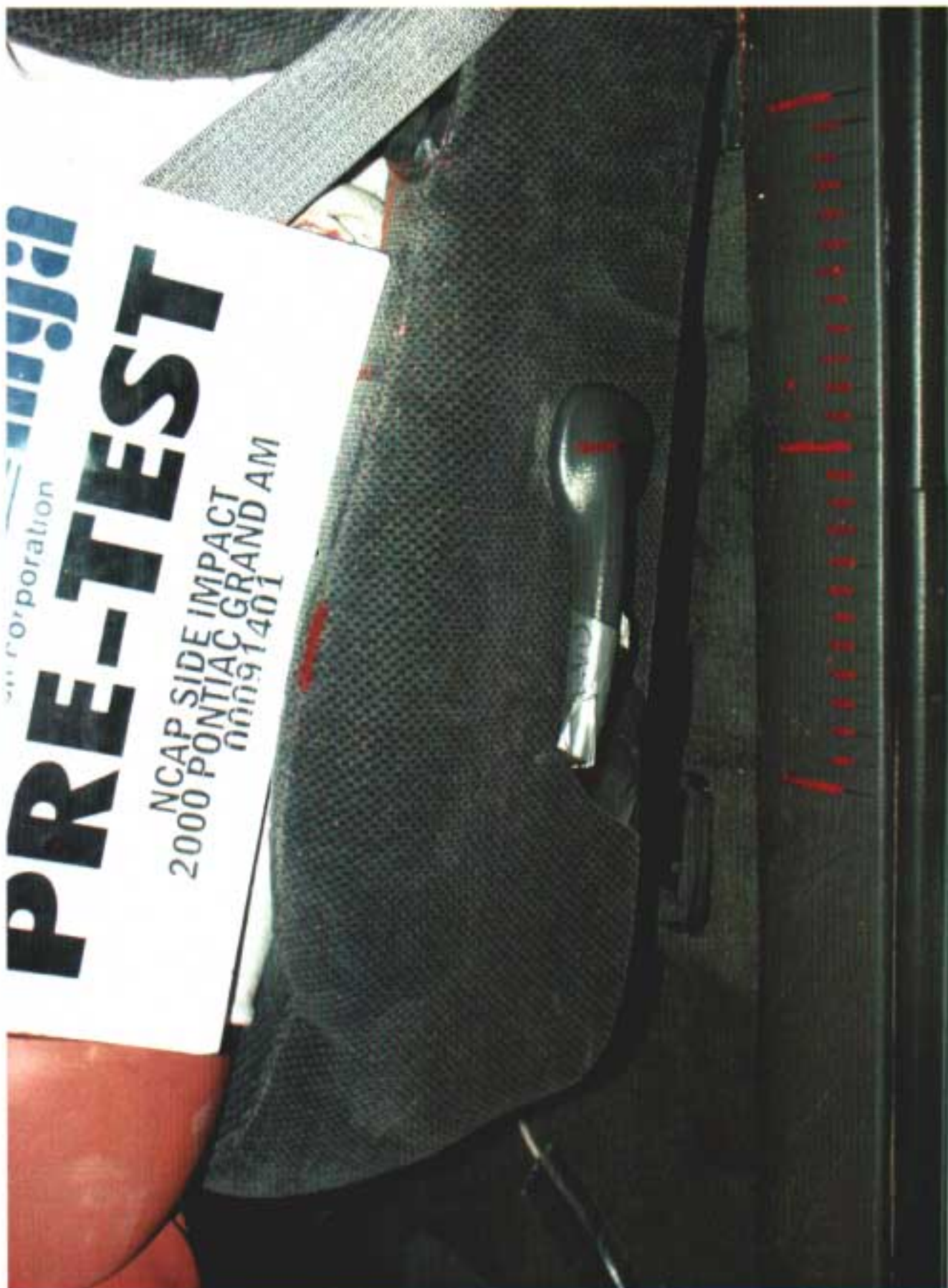


Photo No. A-24 - Pre-Test Driver Dummy Seat Track



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



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



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



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



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



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



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

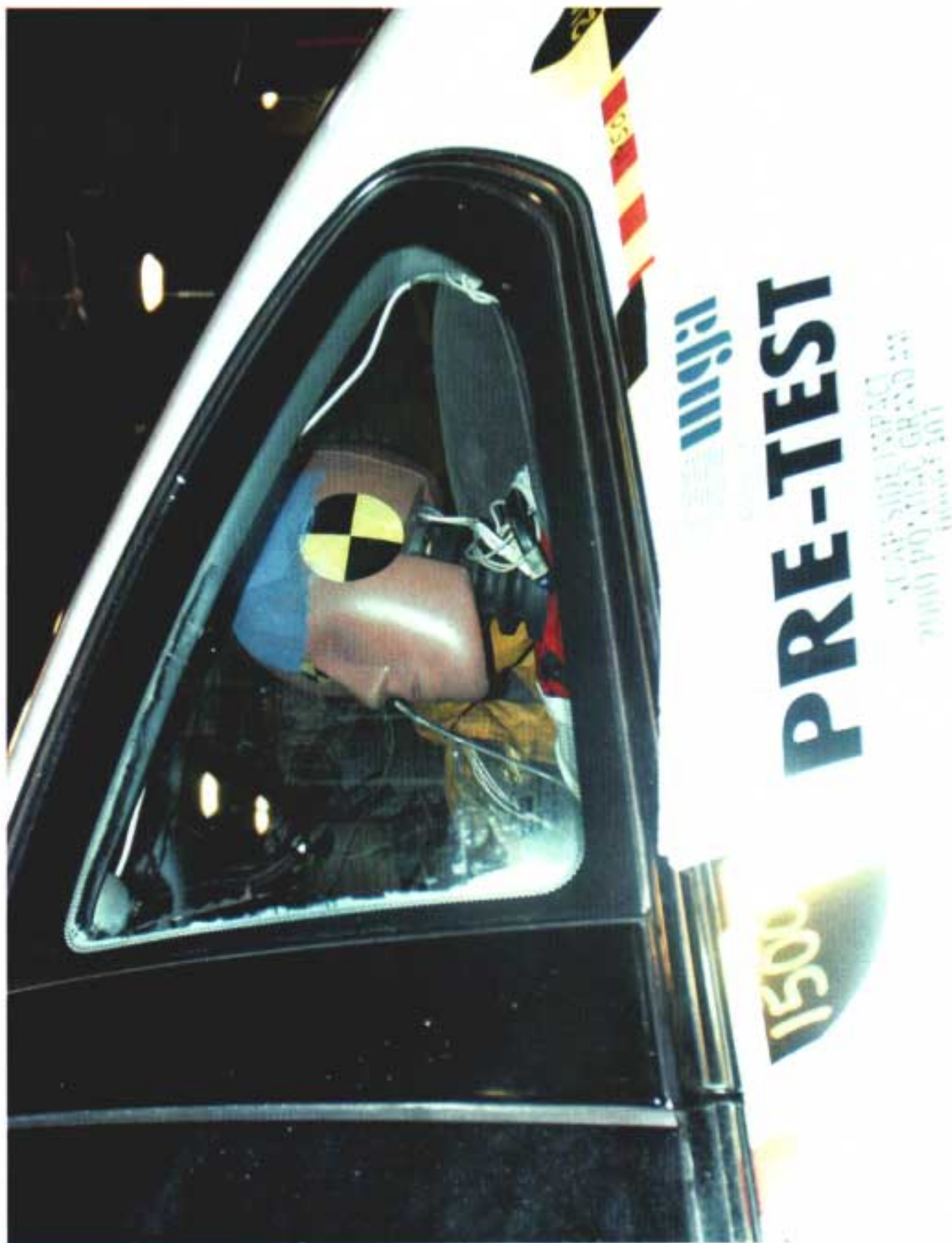


Photo No. A-32 - Pre-Test Rear Passenger Dummy Left Side View



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



Photo No. A-34 - Pre-Test Rear Passenger Dummy Shoulder View and Door Top View



Photo No. A-35 - Post-Test Rear Passenger Dummy Shoulder View and Door Top View



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

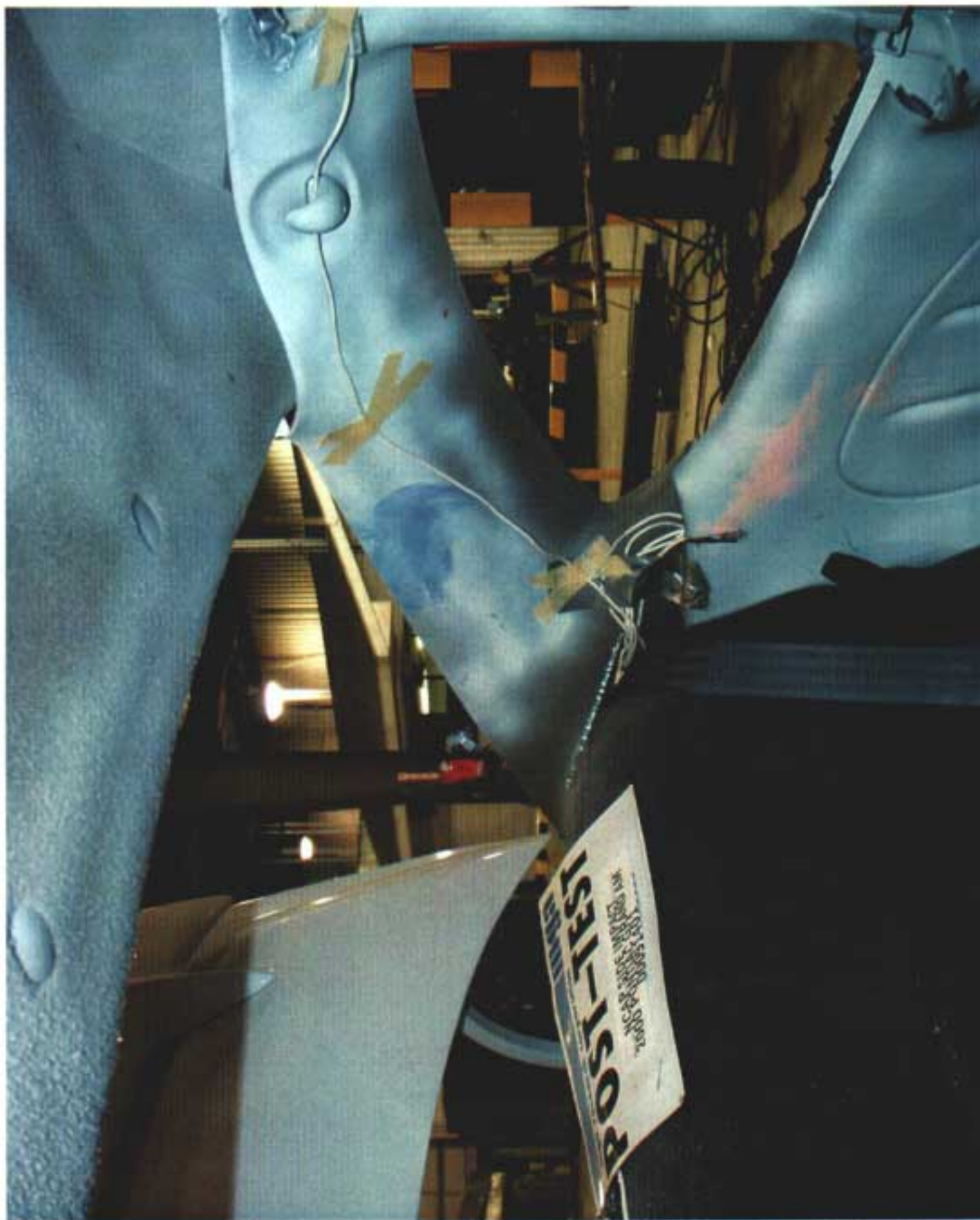


Photo No. A-37 - Post-Test Rear Passenger Dummy Head Contact



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

US - LES

NCAP SIDE IMPACT
2000 PONTIAC GRAND AM
00091401



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



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 - Left Front Sill Accelerometer



Photo No. A-45 - Left Rear Sill Accelerometer



Photo No. A-46 - Right Front Sill Accelerometer



Photo No. A-47 - Right Rear Sill Accelerometer

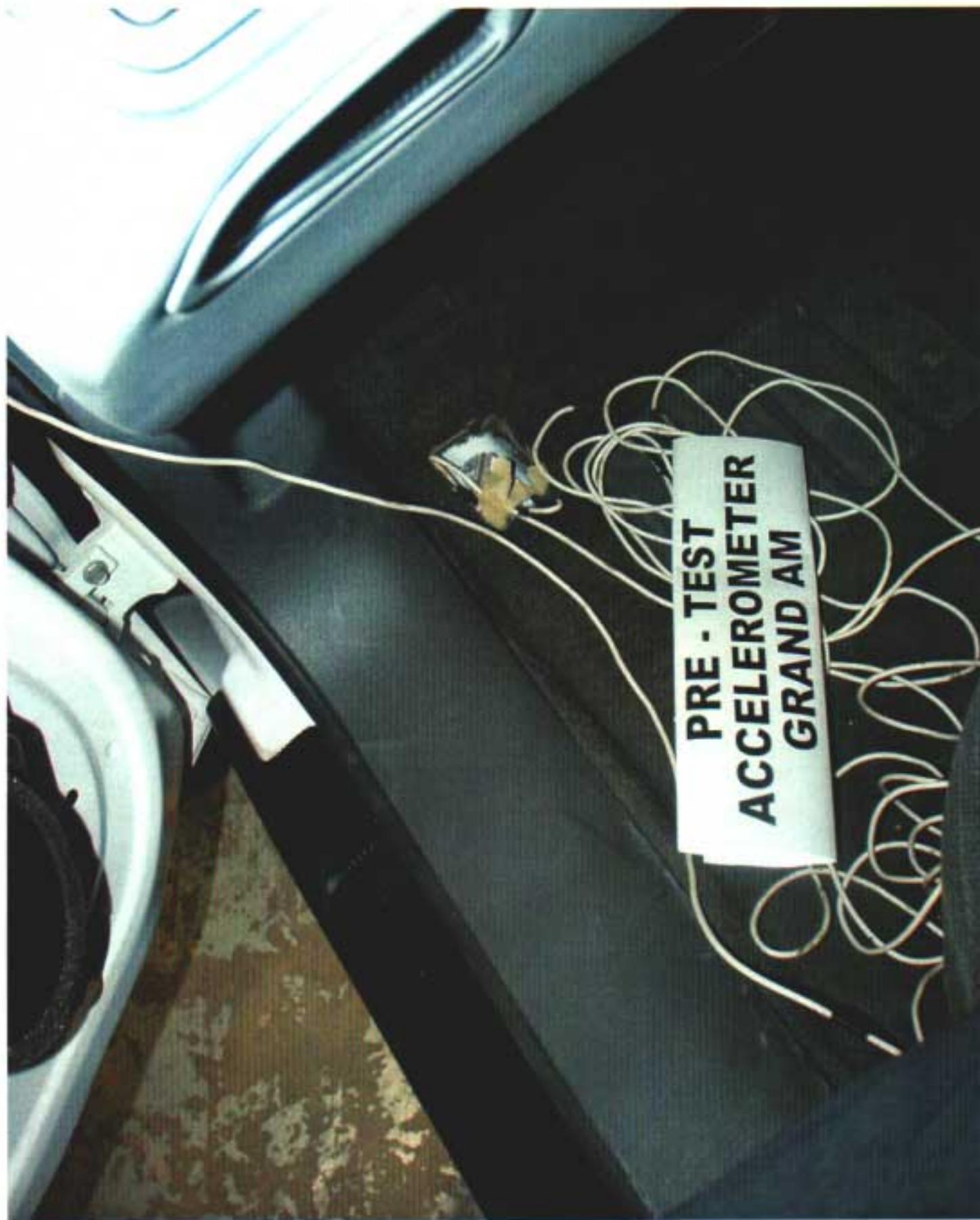


Photo No. A-48 - Left Lower A Post Accelerometer



Photo No. A-49 - Left Mid A Post Accelerometer



Photo No. A-50 - Left Front Door Accelerometer



Photo No. A-51 - Left Upper B Post Accelerometer



Photo No. A-52 - Left Lower B Post Accelerometer



Photo No. A-53 - Left Rear Door Accelerometer

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* No Valid Data Collected

** No Valid Data After 40 msec

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* No Valid Data Collected

** No Valid Data After 10 msec

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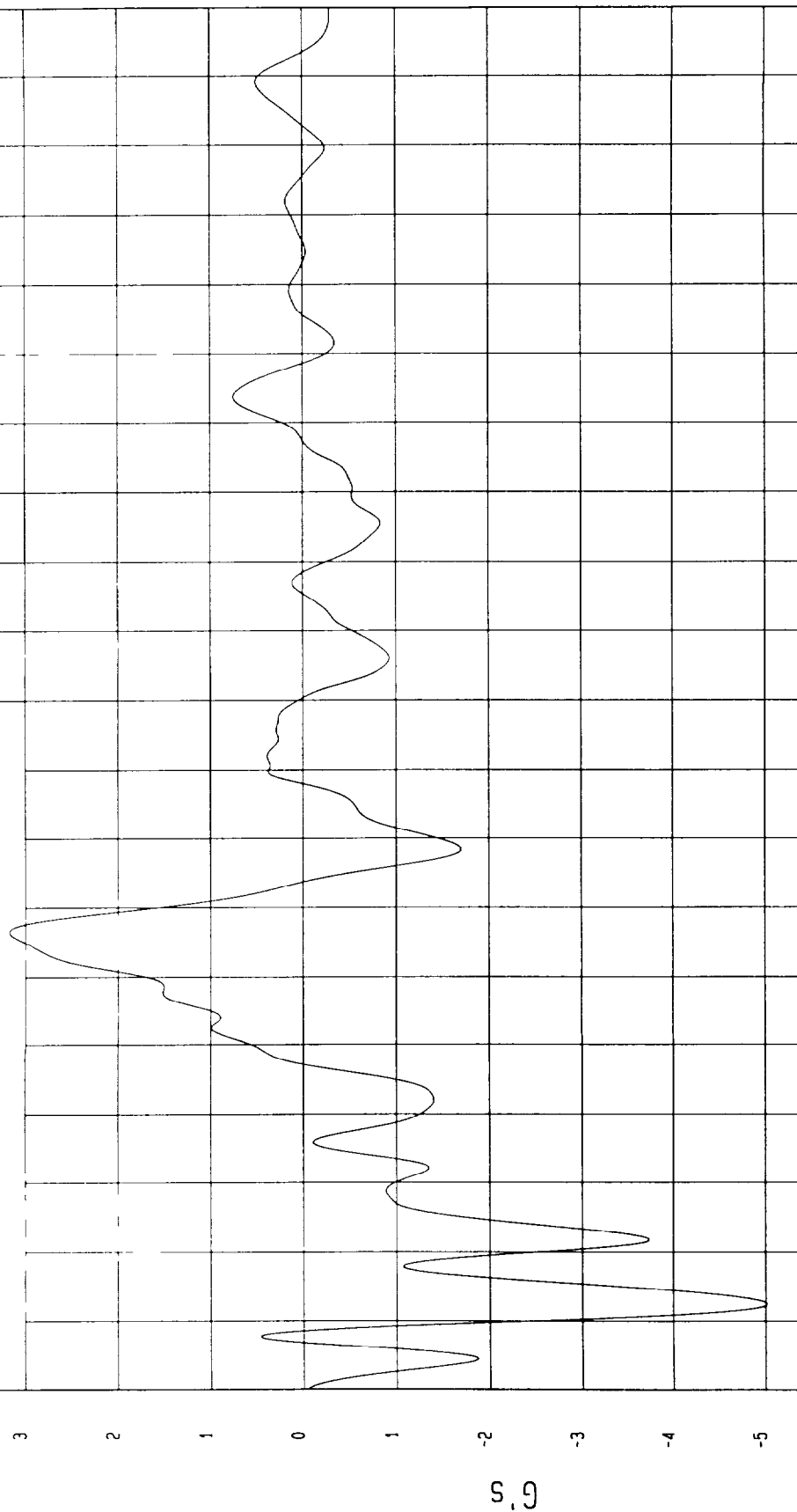
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 5 MPH 62 1 KPH

Minimum 5.02 G s at 12 msec Maximum = 3.17 G s at 67 msec

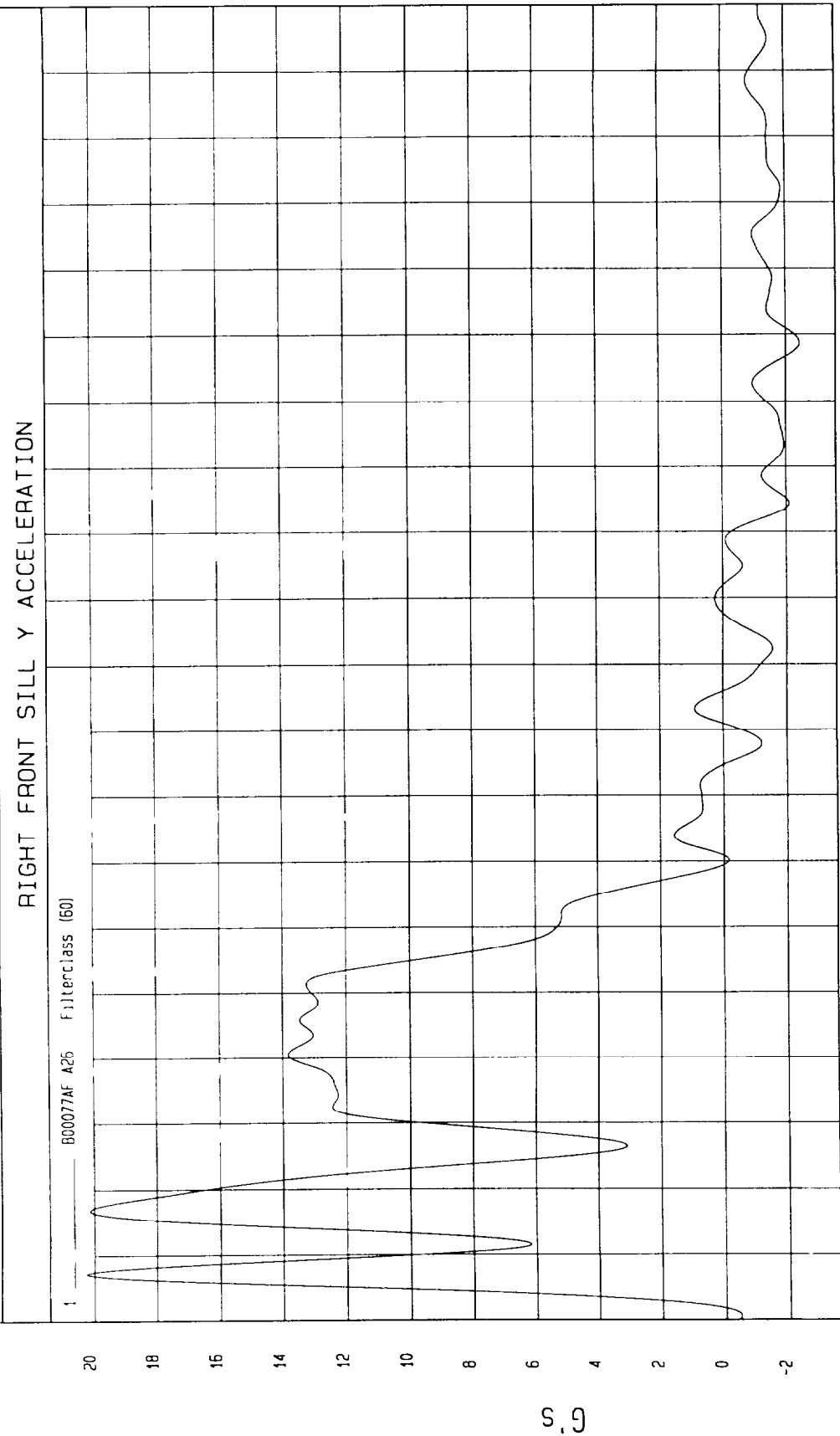
RIGHT FRONT SILL X ACCELERATION

1 ——— B00077AF A25 Filterclass (60)



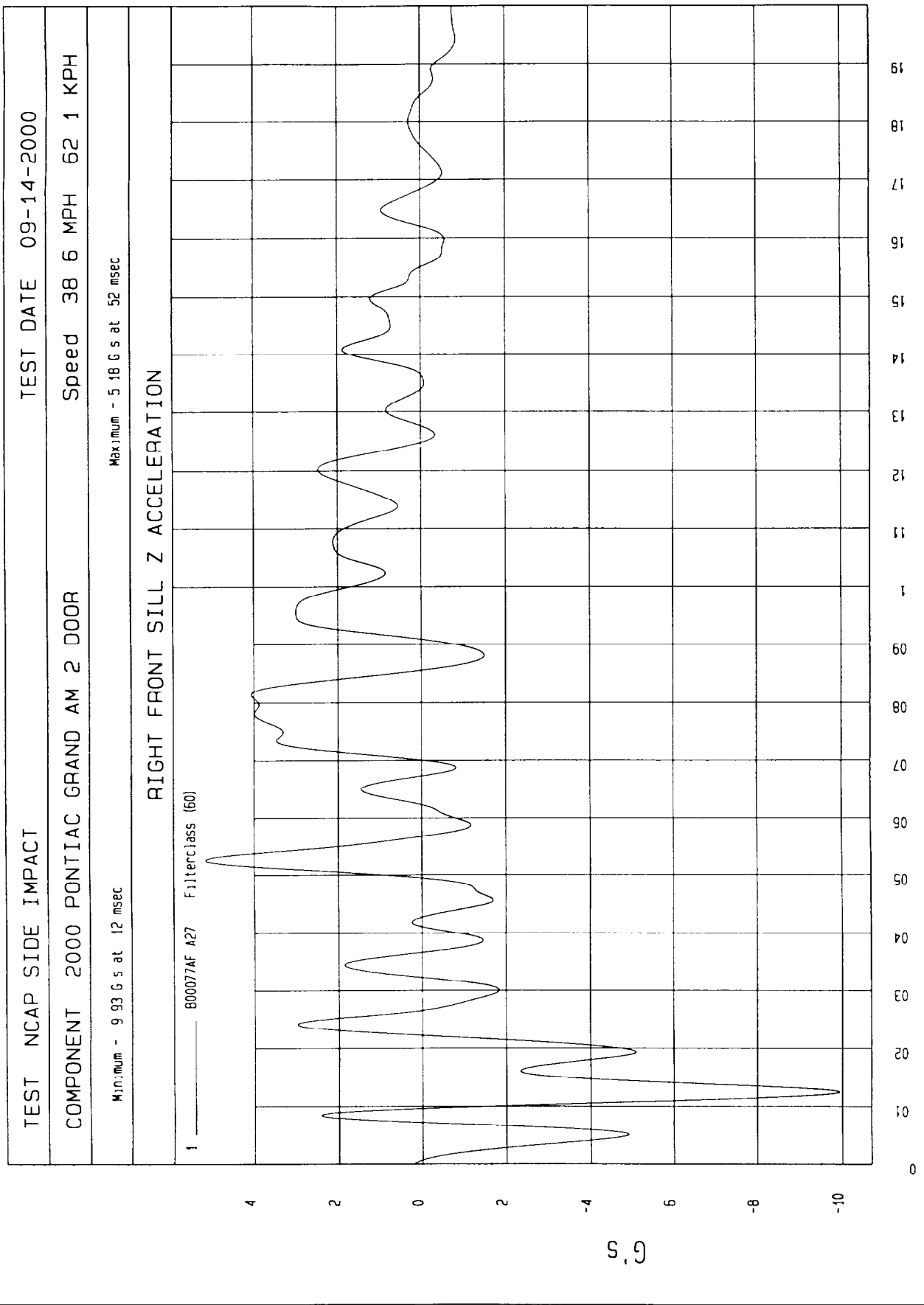
Seconds
MGA Research
09-14-2000 20 12

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 2 44 G s at 149 msec	Maximum 20 26 G s at 7 msec



Seconds

MCA Research
09-14-2000 20 12



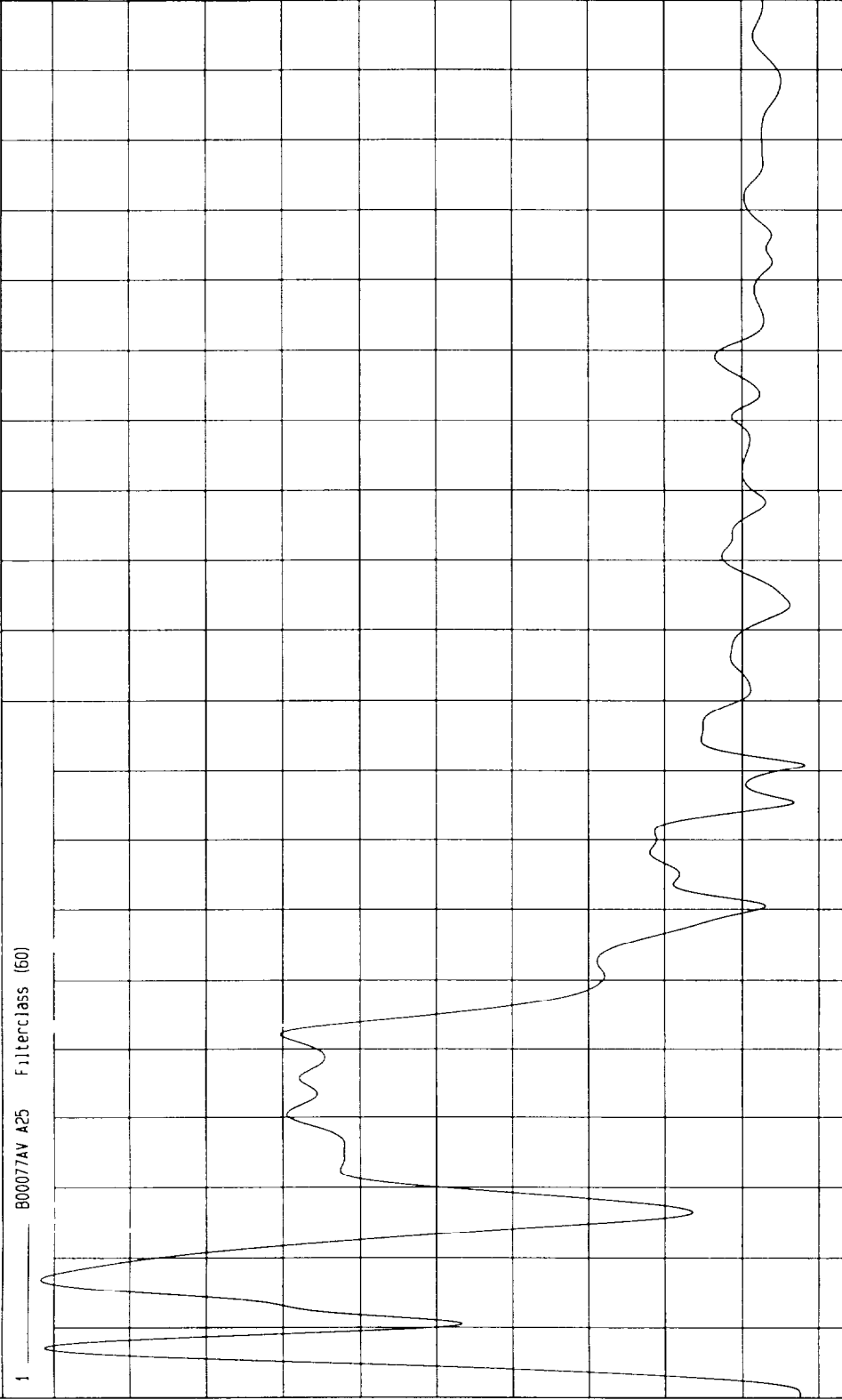
NGA Research
09-14-2000 20 12

Seconds

G.s

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	35 G s at 91 msec	Maximum	20 37 G s at 17 msec

RIGHT FRONT SILL RESULTANT ACCELERATION

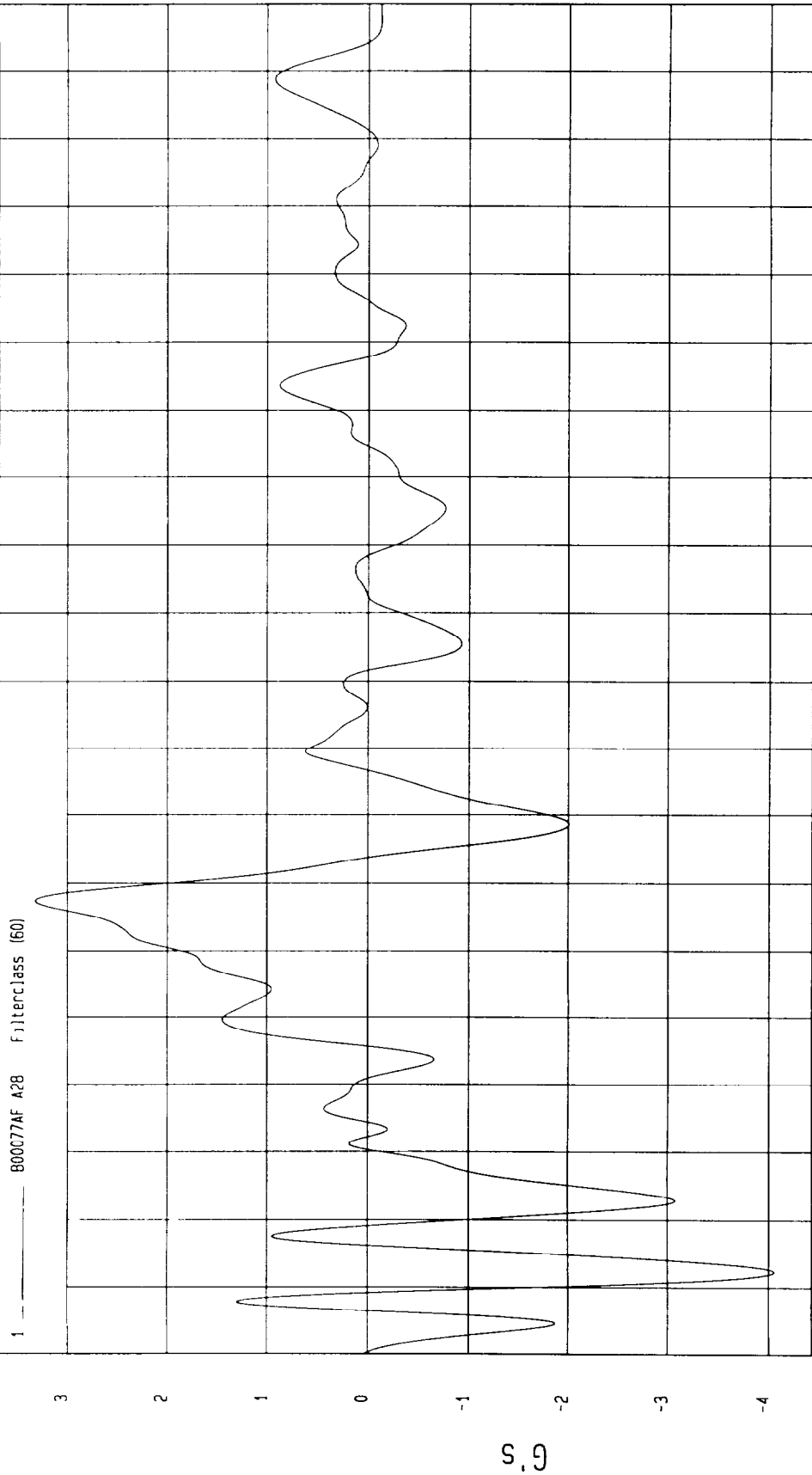


Seconds

MCA Research
09-14-2000 20 12

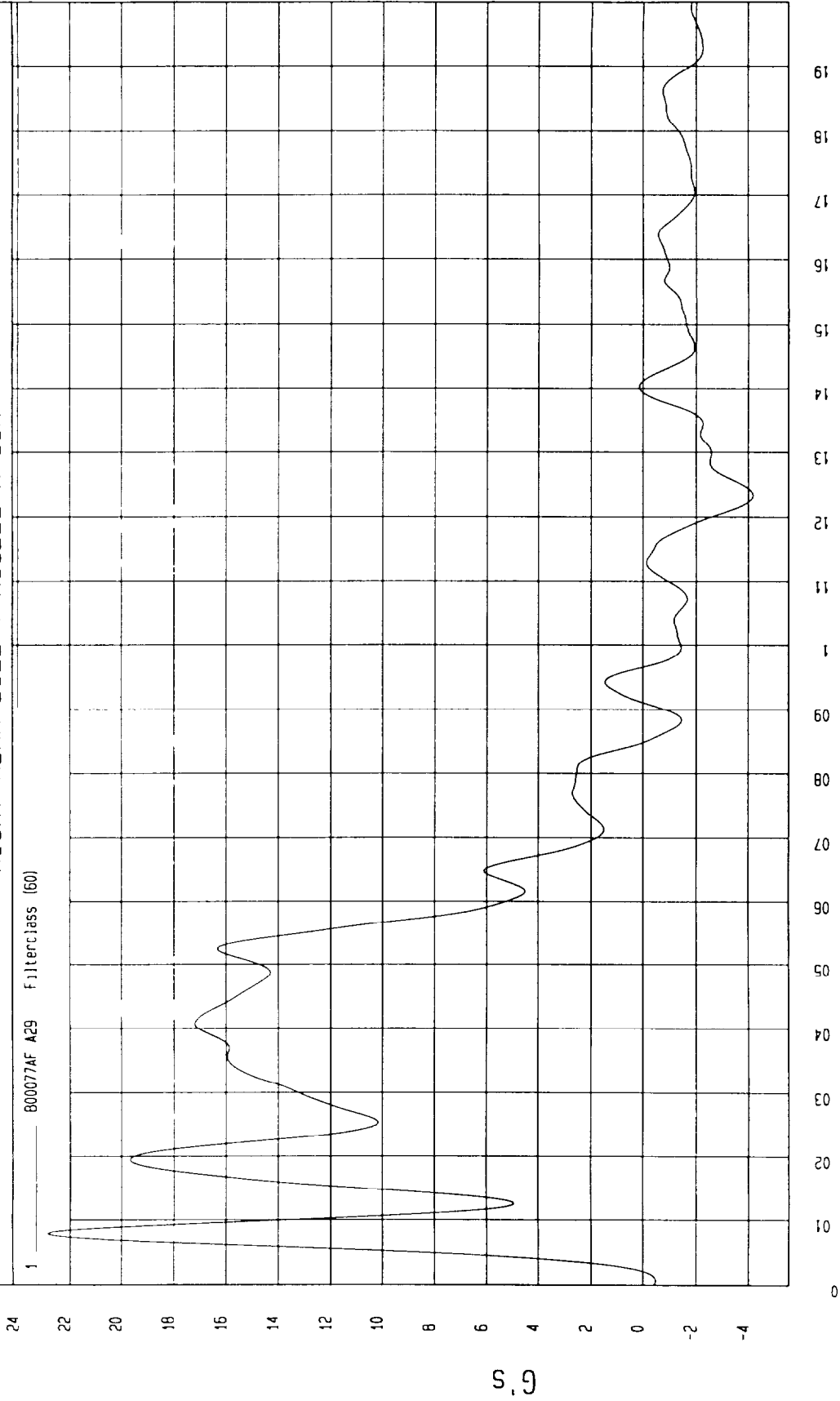
TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 4 06 G s at 12 msec	Maximum = 3 32 G s at 67 msec

RIGHT REAR SILL X ACCELERATION



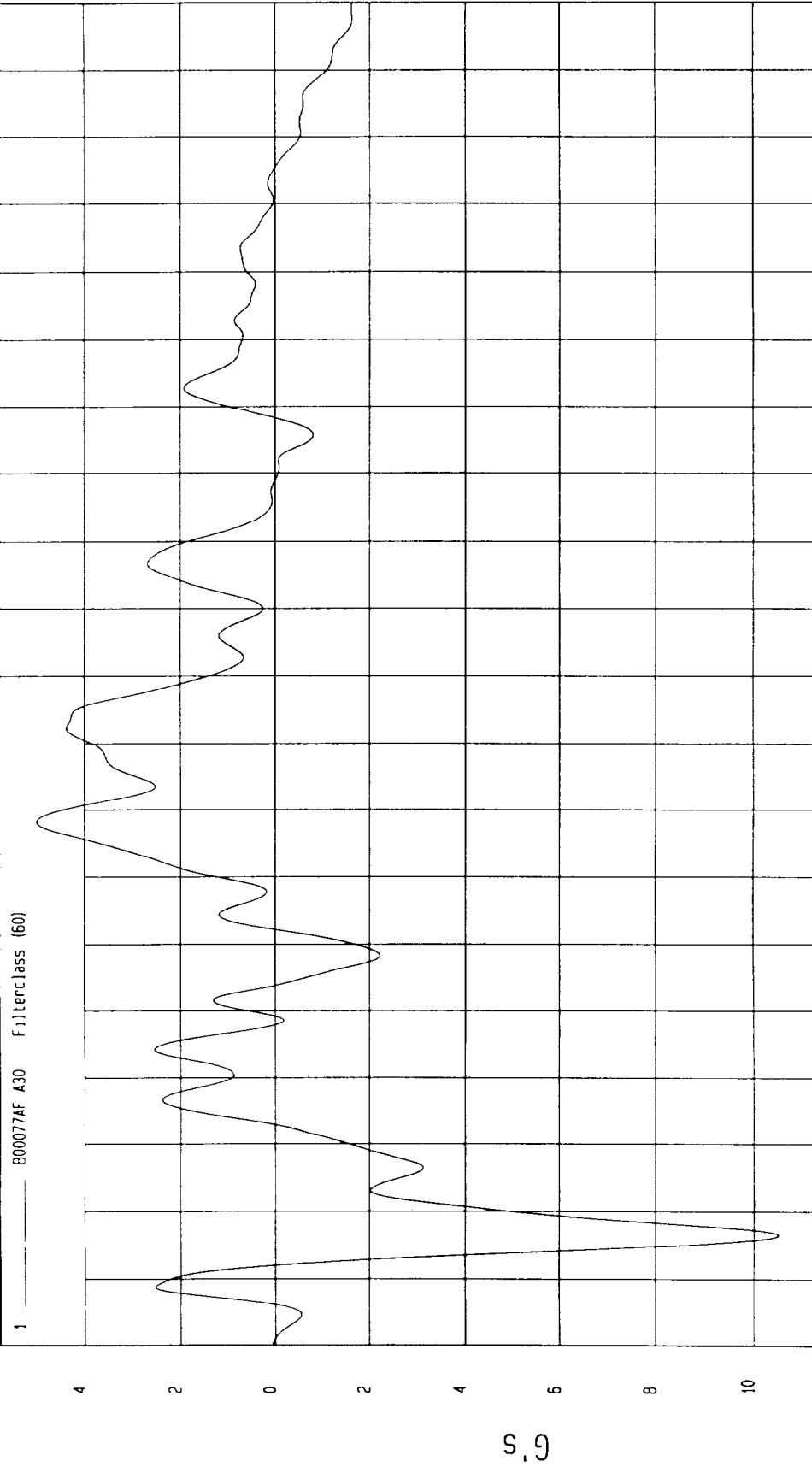
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	4 18 G s at 123 msec	Maximum	- 22 87 G s at 8 msec

RIGHT REAR SILL Y ACCELERATION



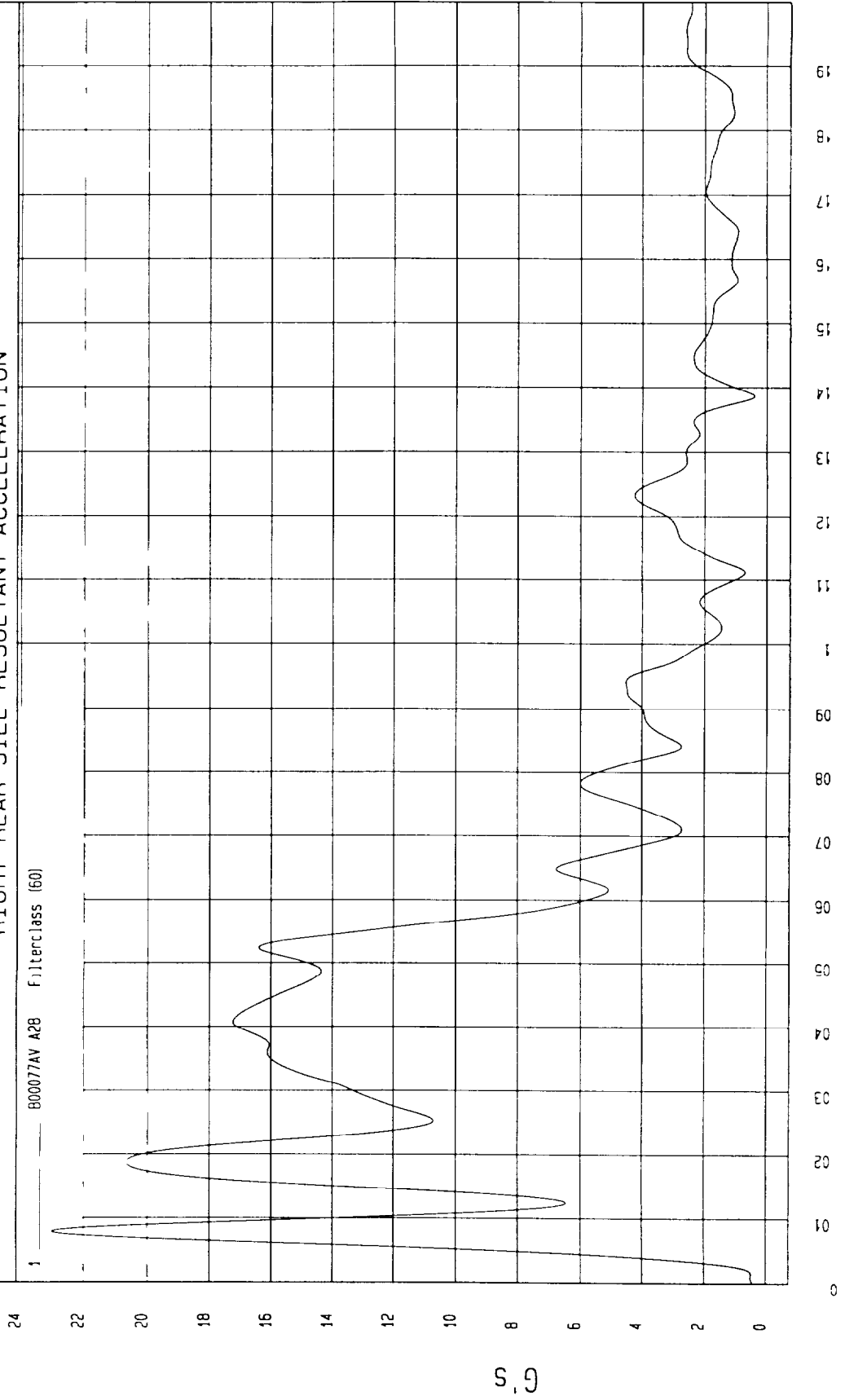
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	10.52 G's at 17 msec	Maximum	5.01 G's at 78 msec

RIGHT REAR SILL Z ACCELERATION



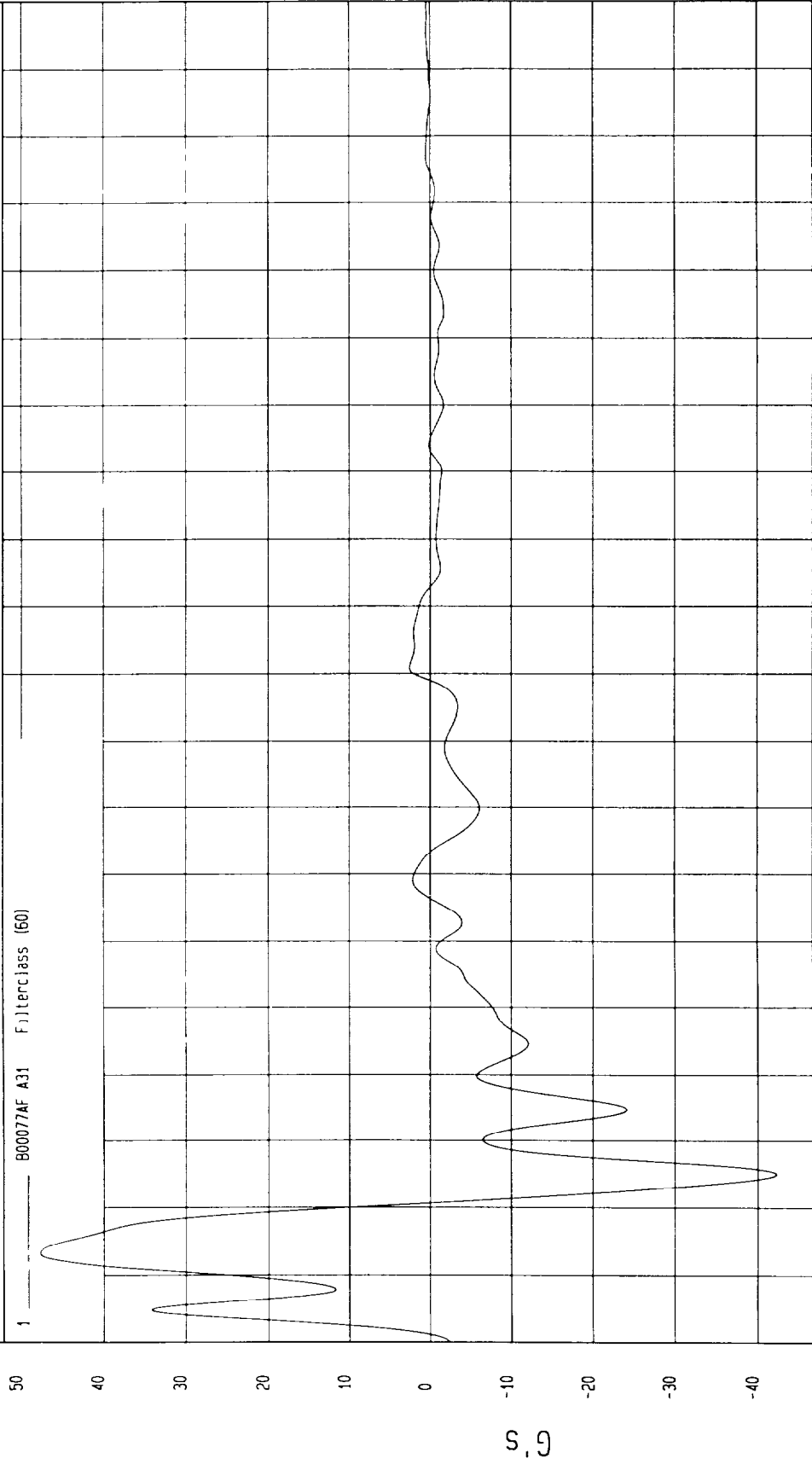
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	4 G s at 139 msec	Maximum	23 G s at 8 msec

RIGHT REAR SILL RESULTANT ACCELERATION



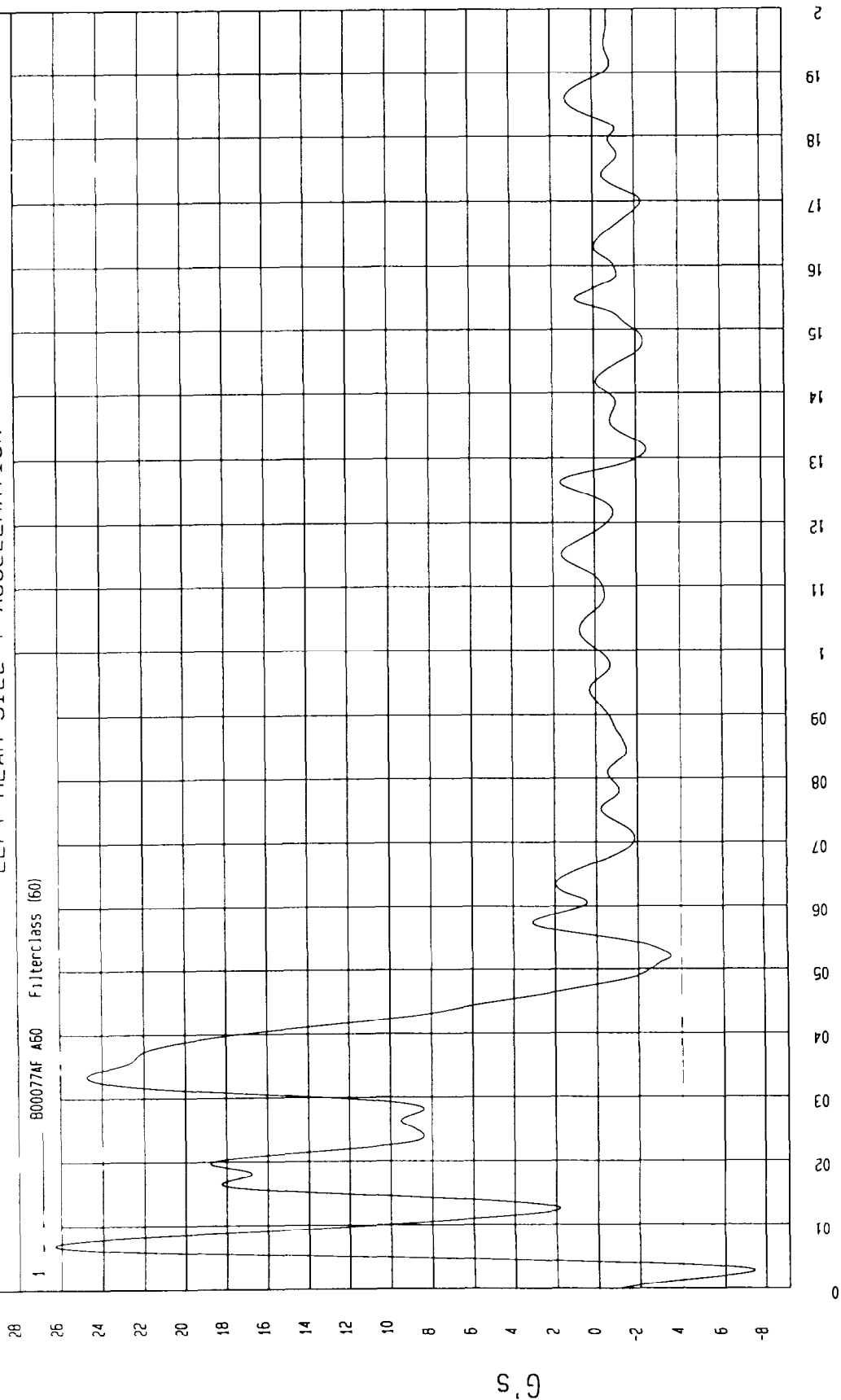
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	42.29 G s at 25 msec	Maximum	47.76 G s at 13 msec

LEFT FRONT SILL Y ACCELERATION



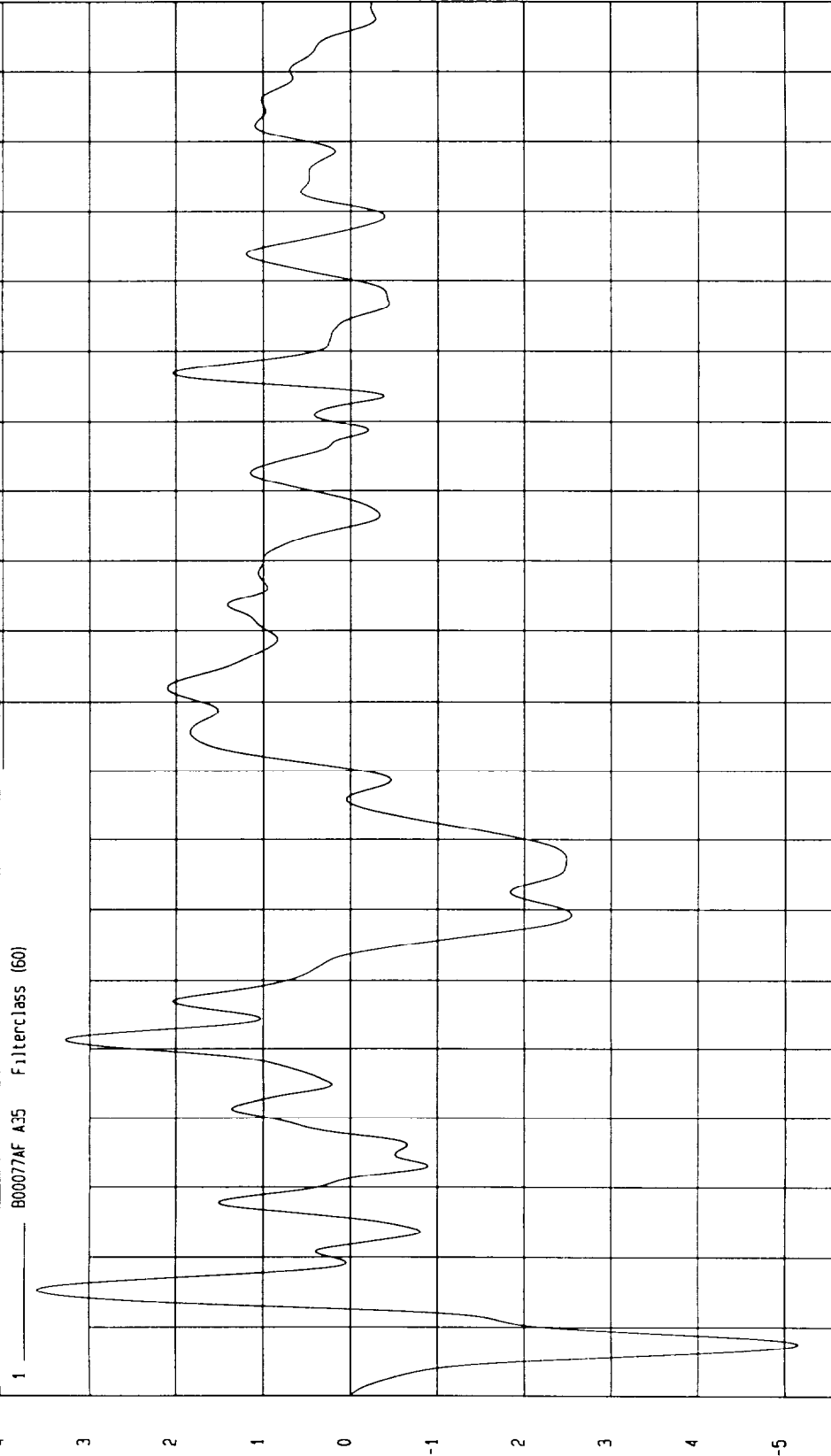
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	7 44 G s at 3 msec	Maximum	26 32 G s at 7 msec

LEFT REAR SILL Y ACCELERATION



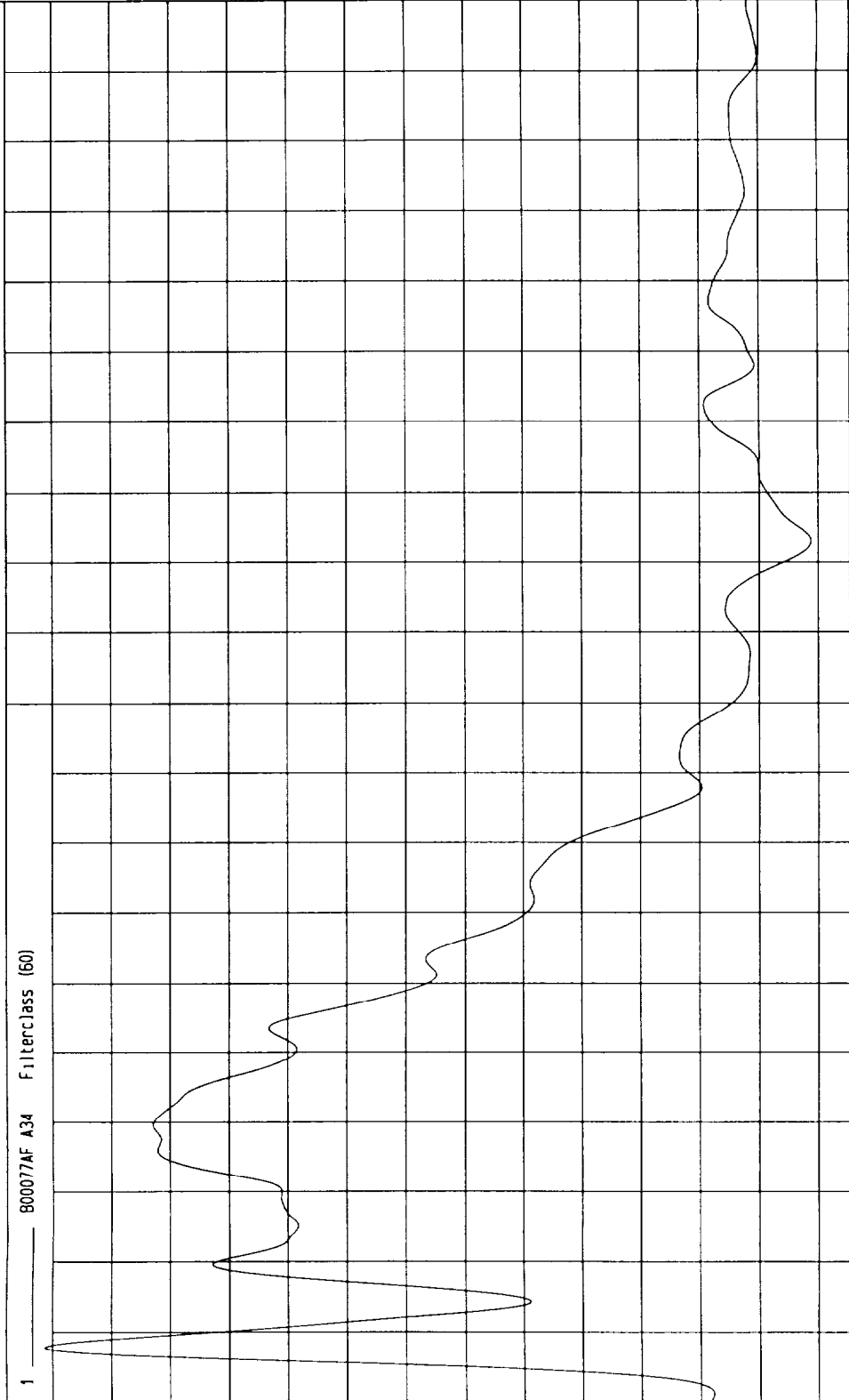
TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum = 5 15 G s at 8 msec	
Maximum = 3 61 G s at 15 msec	

FLOORPAN @ REAR AXLE X ACCELERATION



TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum = -3.76 G's at 123 msec		Maximum = 22.26 G's at 8 msec	

FLOORPAN @ REAR AXLE Y ACCELERATION

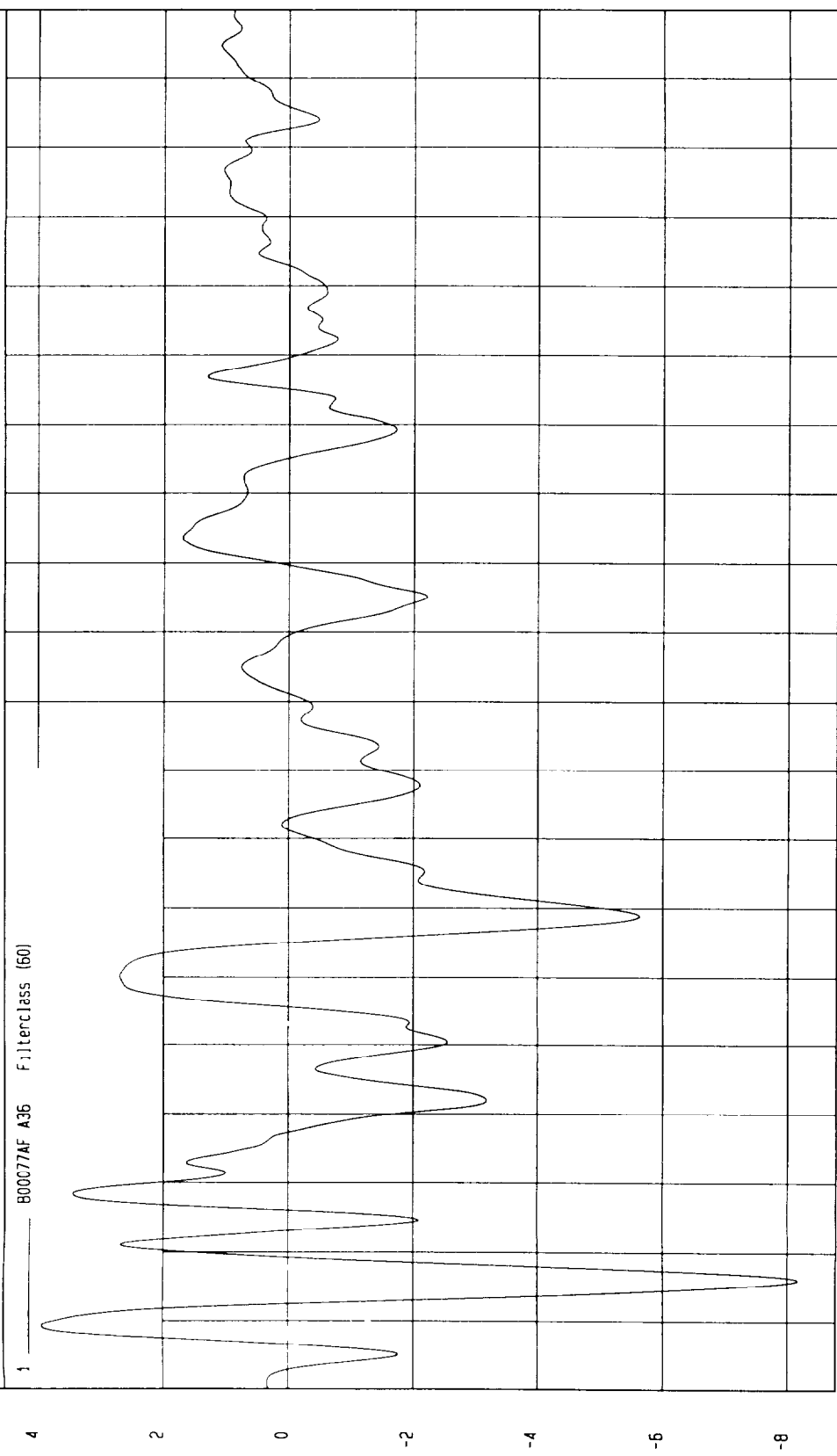


Seconds

WCA Research
11-20-2000 13 25

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	8.17 G s at 16 msec	Maximum	-3.94 G s at 9 msec

FLOORPAN @ REAR AXLE Z ACCELERATION



Seconds

WCA Research
09-14-2000 20 13

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38.6 MPH 62.1 KPH

Minimum 46 G s at 2 msec Maximum 23 G s at 8 msec

FLOORPAN @ REAR AXLE RESULTANT ACCELERATION

1 B00077AV A34 Filterclass (60)

24

22

20

18

16

14

12

10

8

6

4

2

0

G.s

19

18

17

16

15

14

13

12

11

1

09

08

07

06

05

04

03

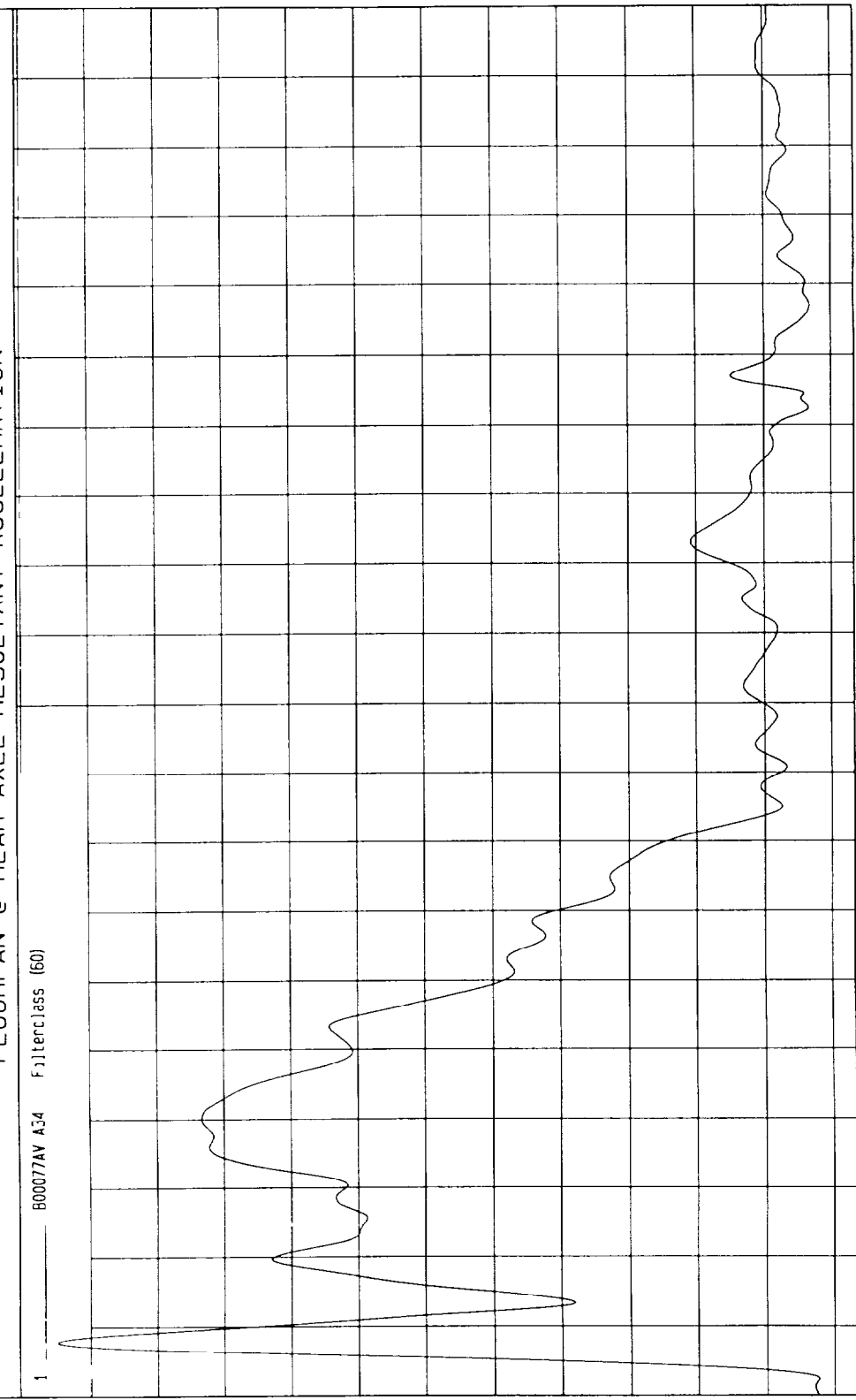
02

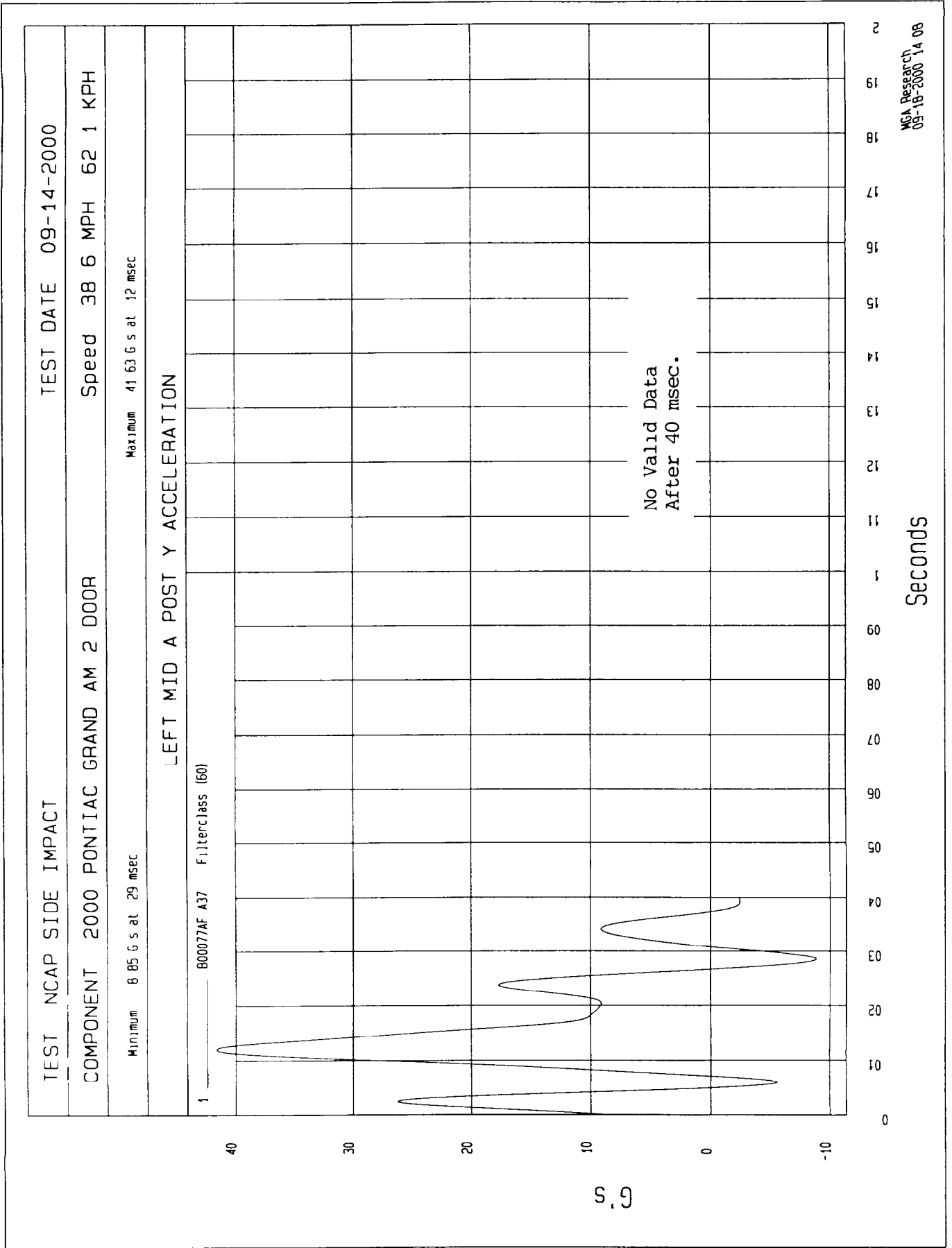
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Seconds

MGA Research
09-14-2000 20 13



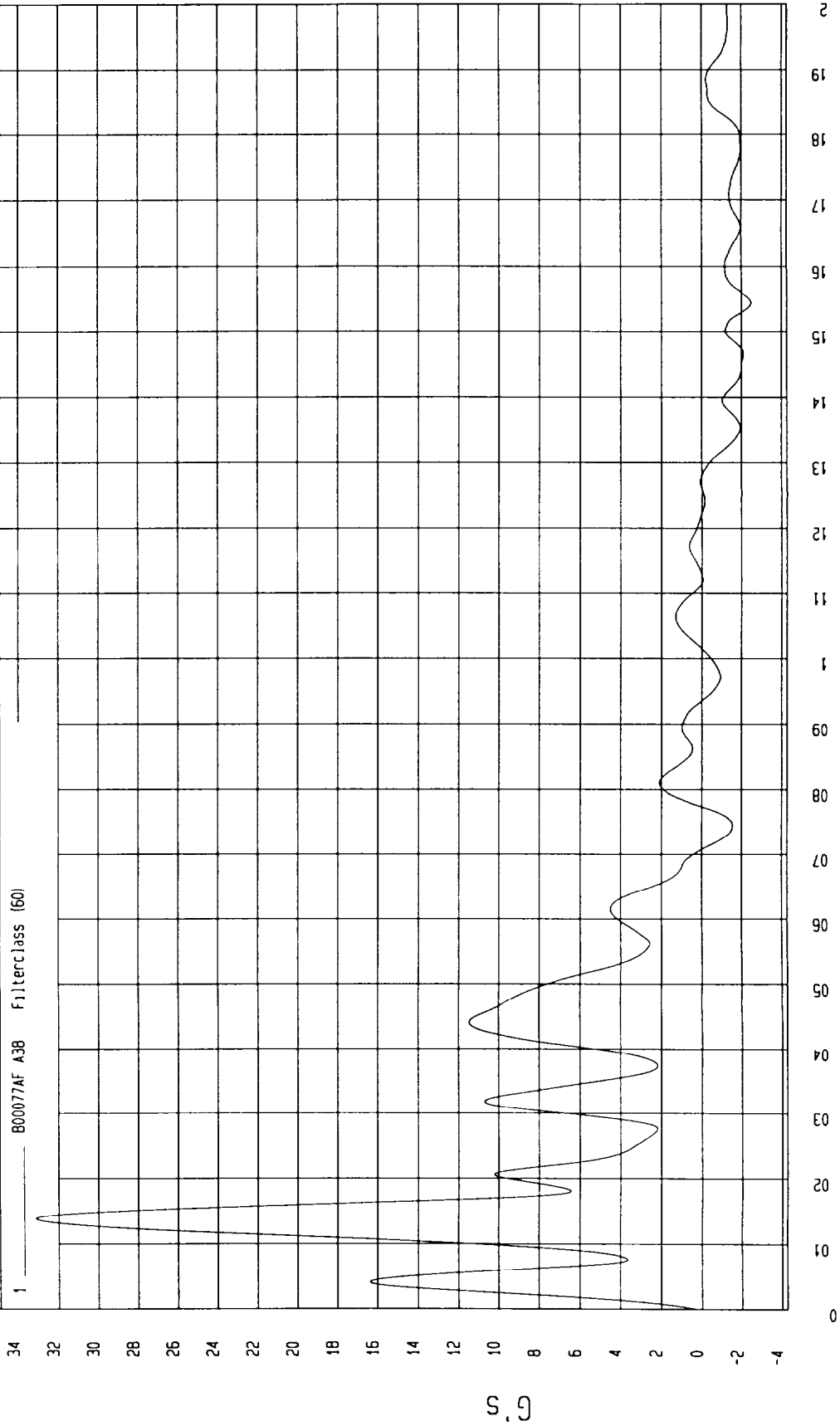


TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 2 48 G s at 154 msec Maximum 33 15 G s at 14 msec

LEFT LOWER A POST Y ACCELERATION

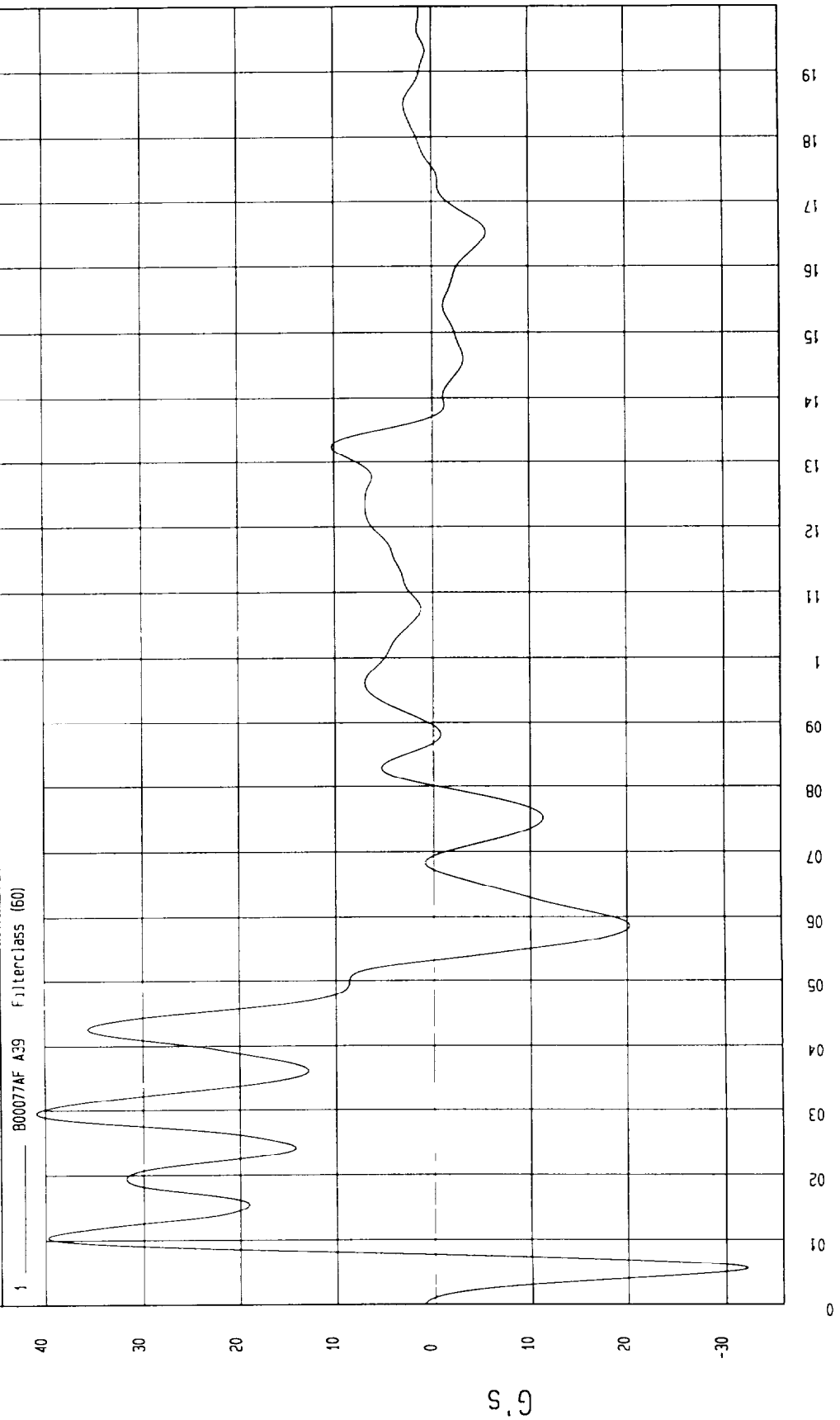


Seconds

MCA Research
09-18-2000 14 08

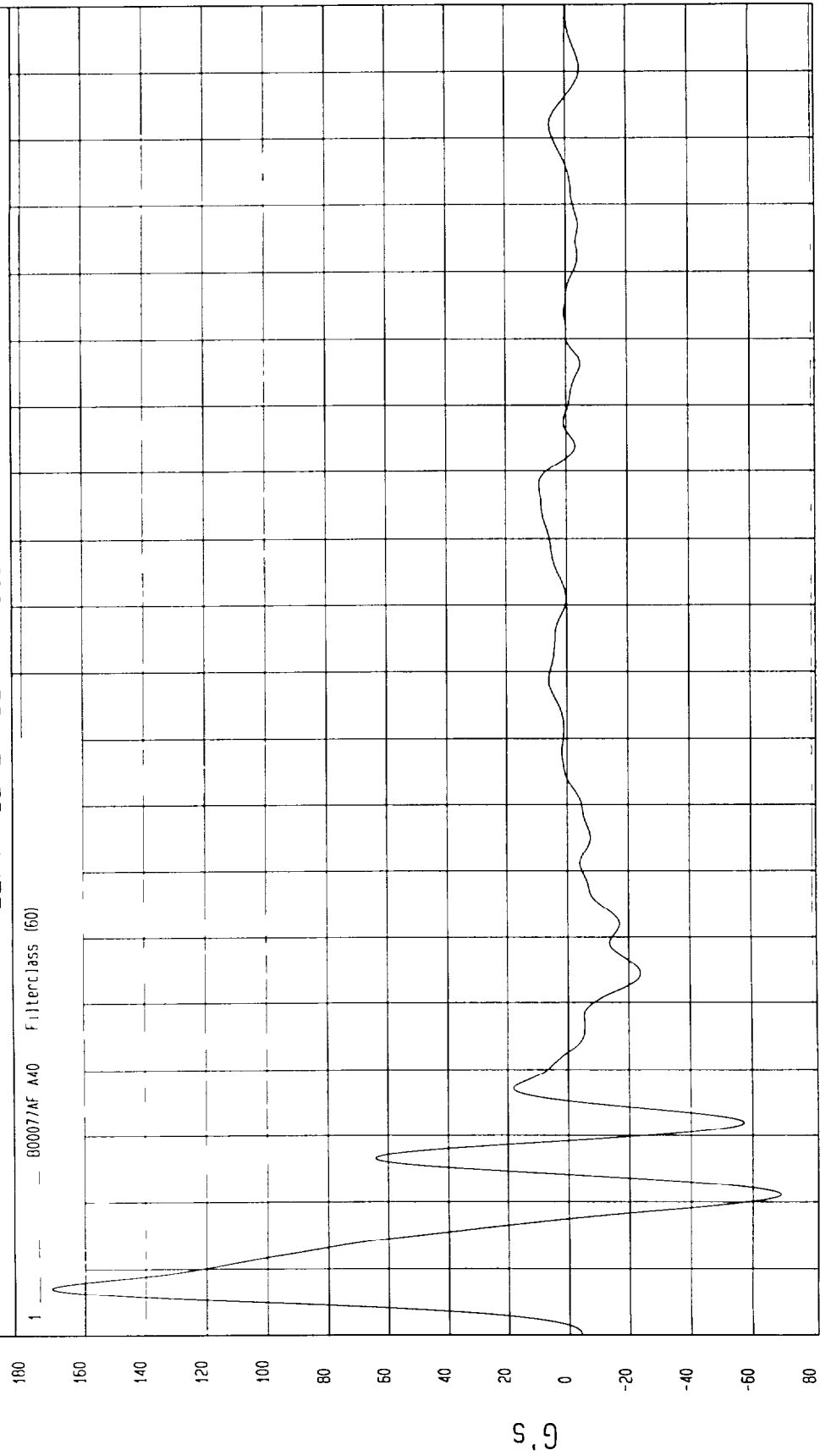
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum - 32 18 G s at 6 msec		Maximum - 40 93 G s at 30 msec	

LEFT UPPER B POST Y ACCELERATION



TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	69 25 G s at 21 msec	Maximum	171 12 G s at 7 msec

LEFT MID B POST Y ACCELERATION



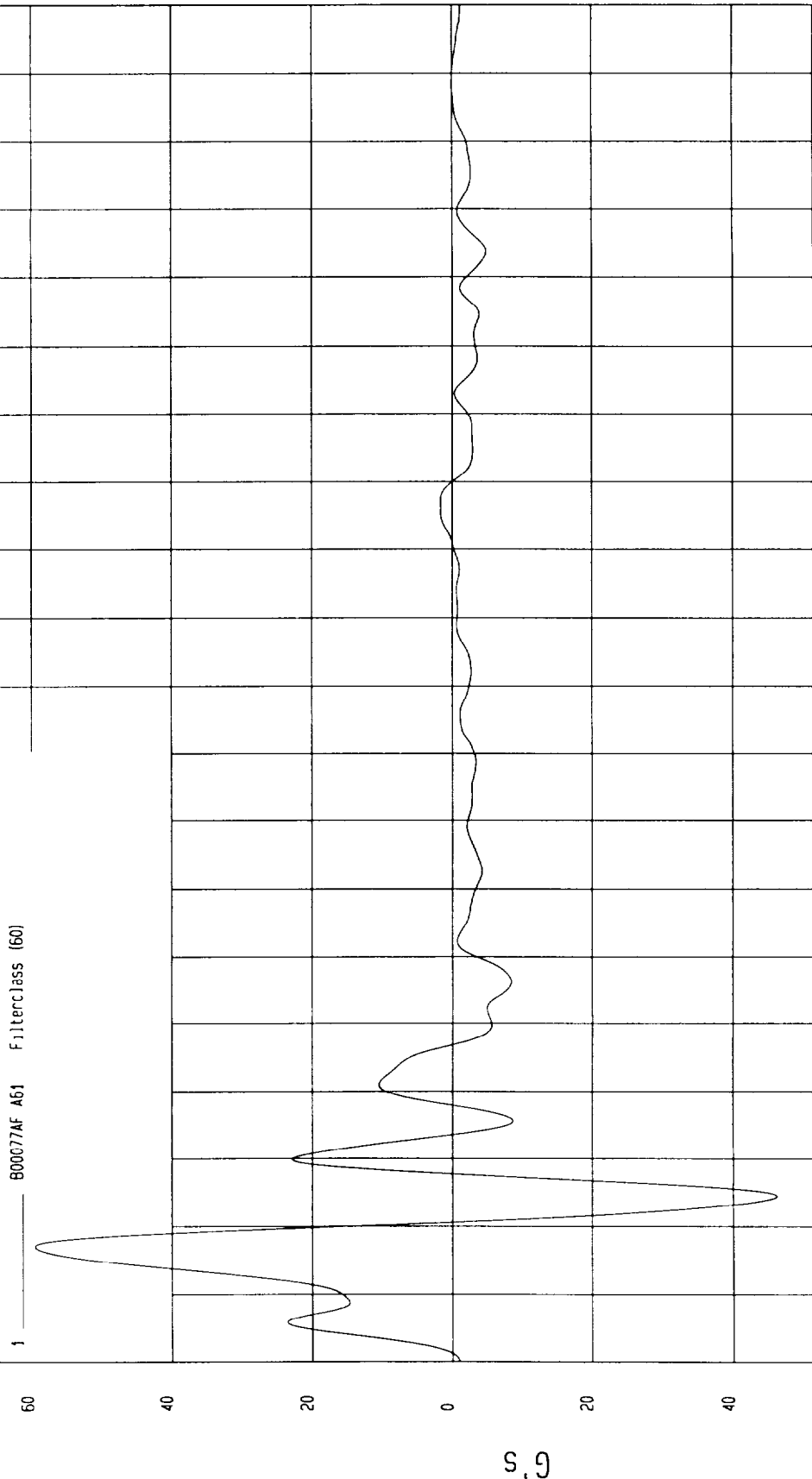
Seconds

MGA Research
09-14-2000 20 14

LEFT LOWER B-POST Y ACCELERATION VS TIME
NO VALID DATA COLLECTED

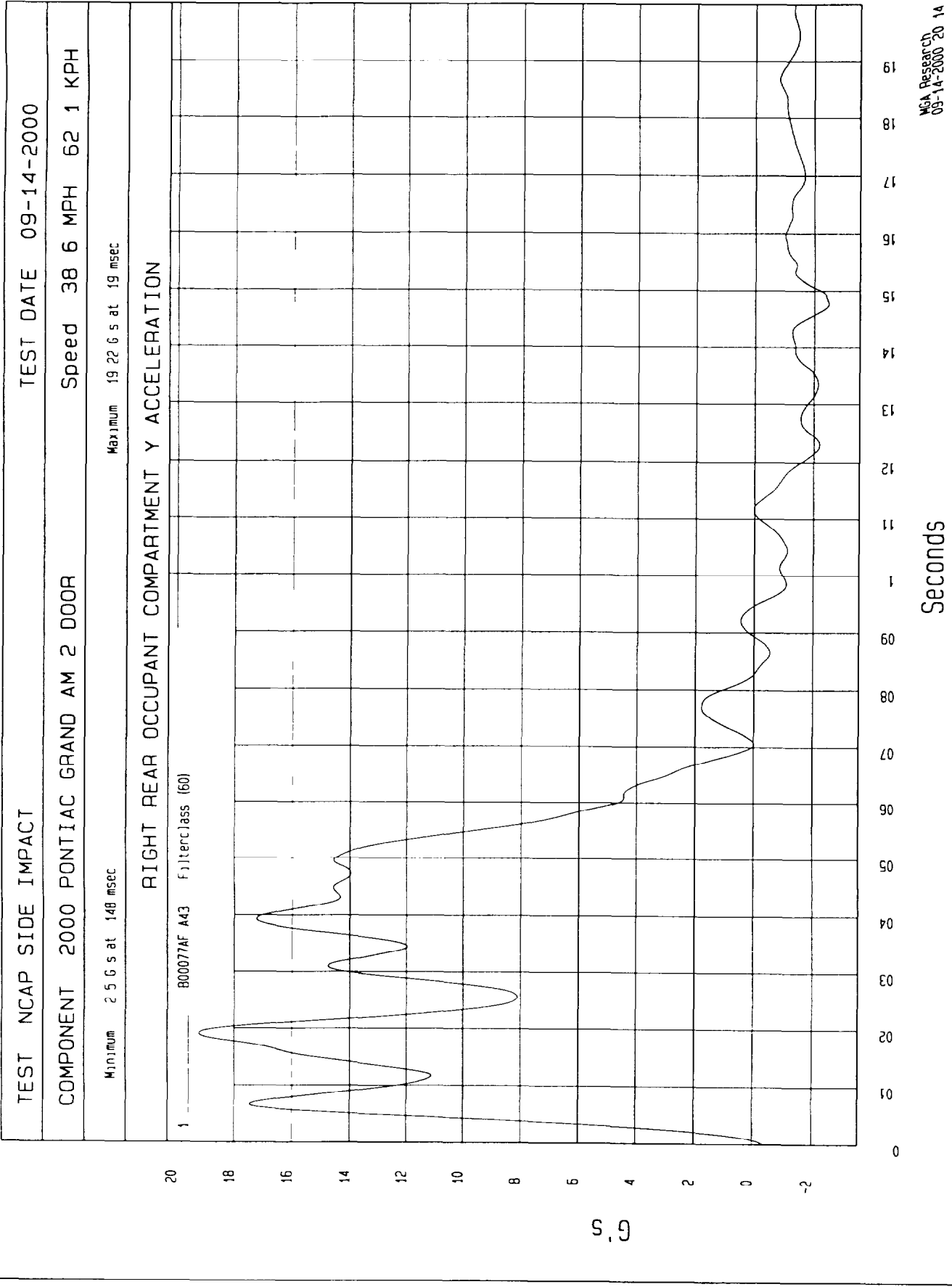
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	46 19 G s at 24 msec	Maximum	59 69 G s at 17 msec

DRIVER SEAT TRACK Y ACCELERATION



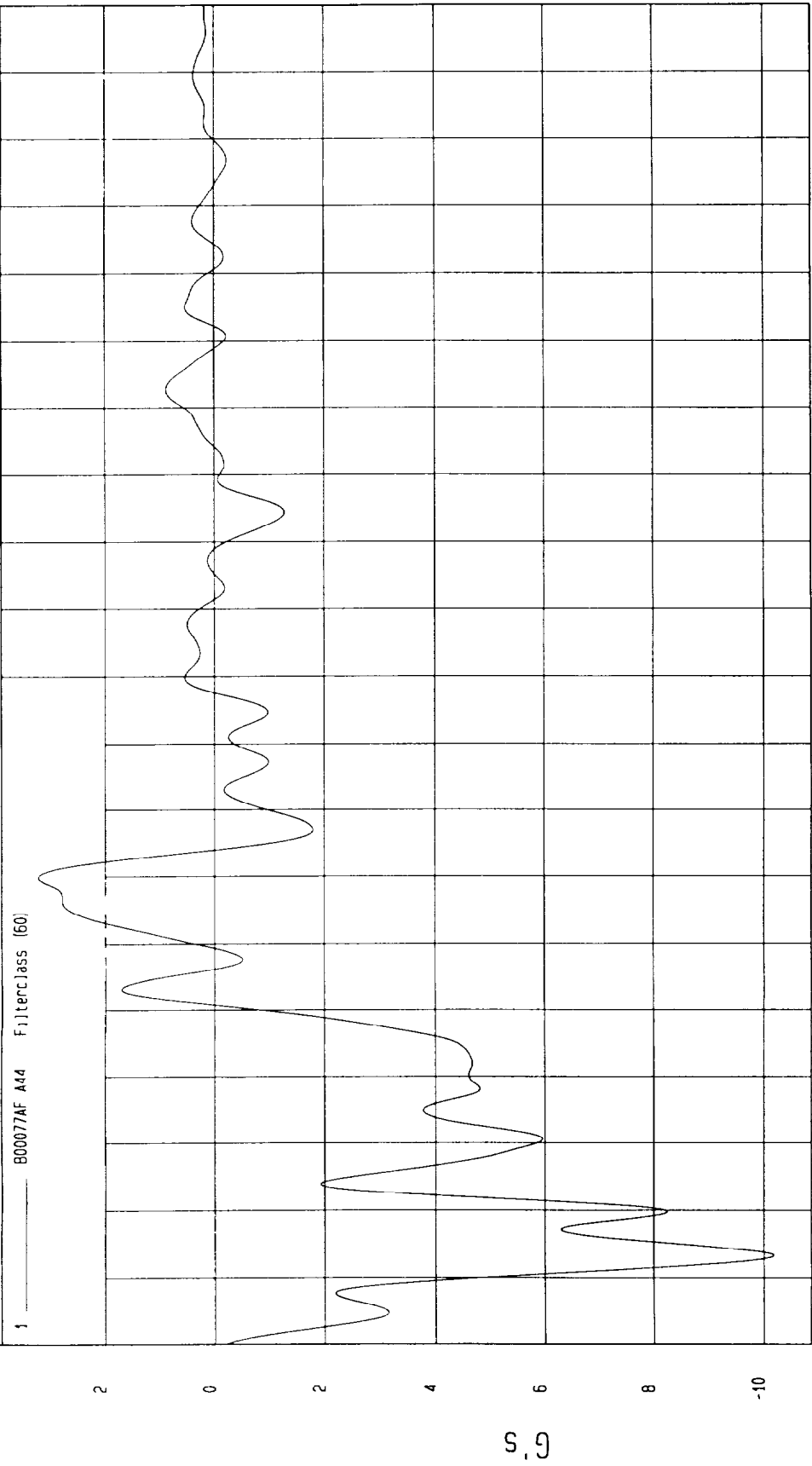
Seconds

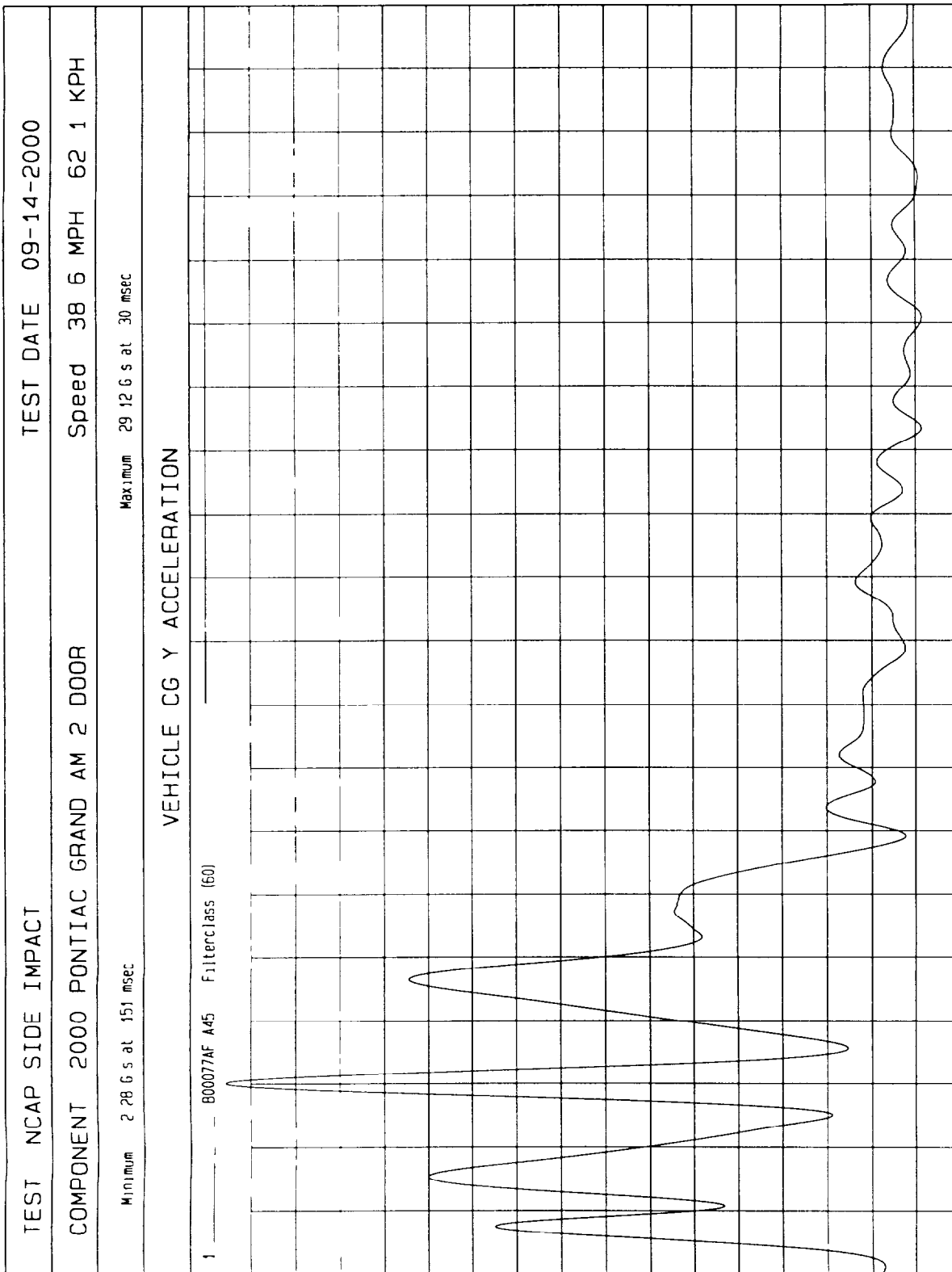
MGA Research
09-18-2000 14 16

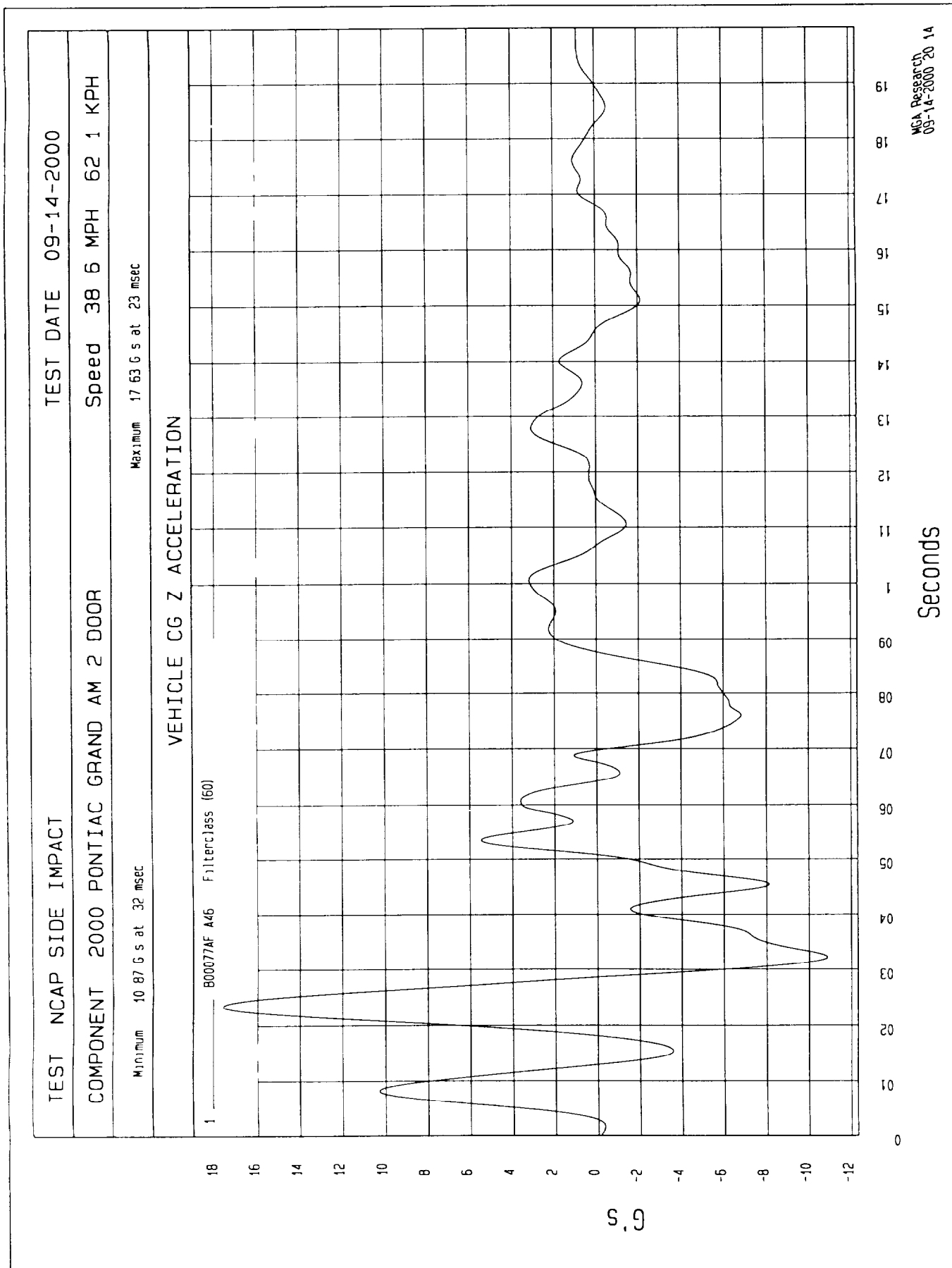


TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	10.18 G's at 13 msec	Maximum	3.23 G's at 70 msec

VEHICLE CG X ACCELERATION





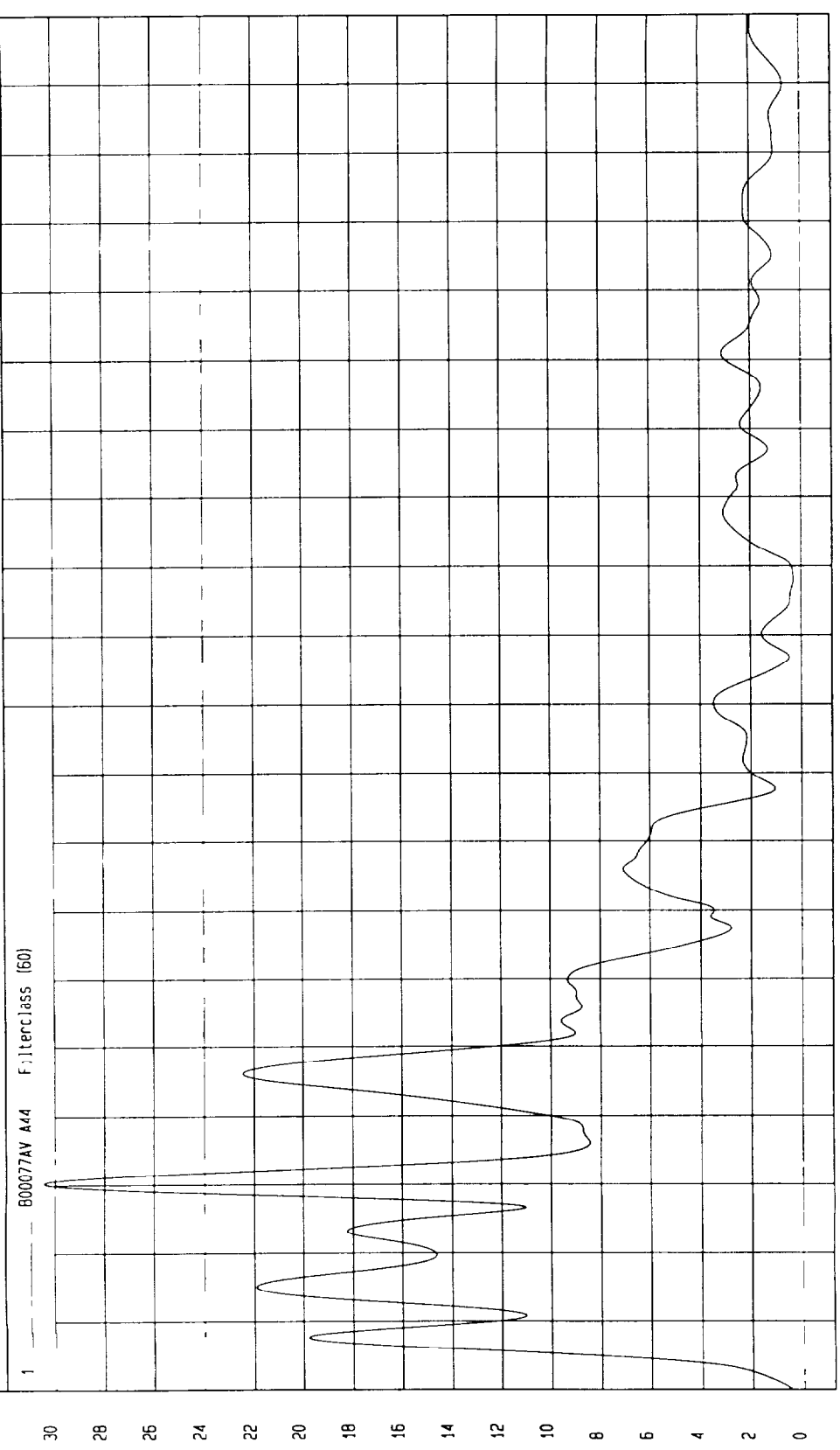


TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

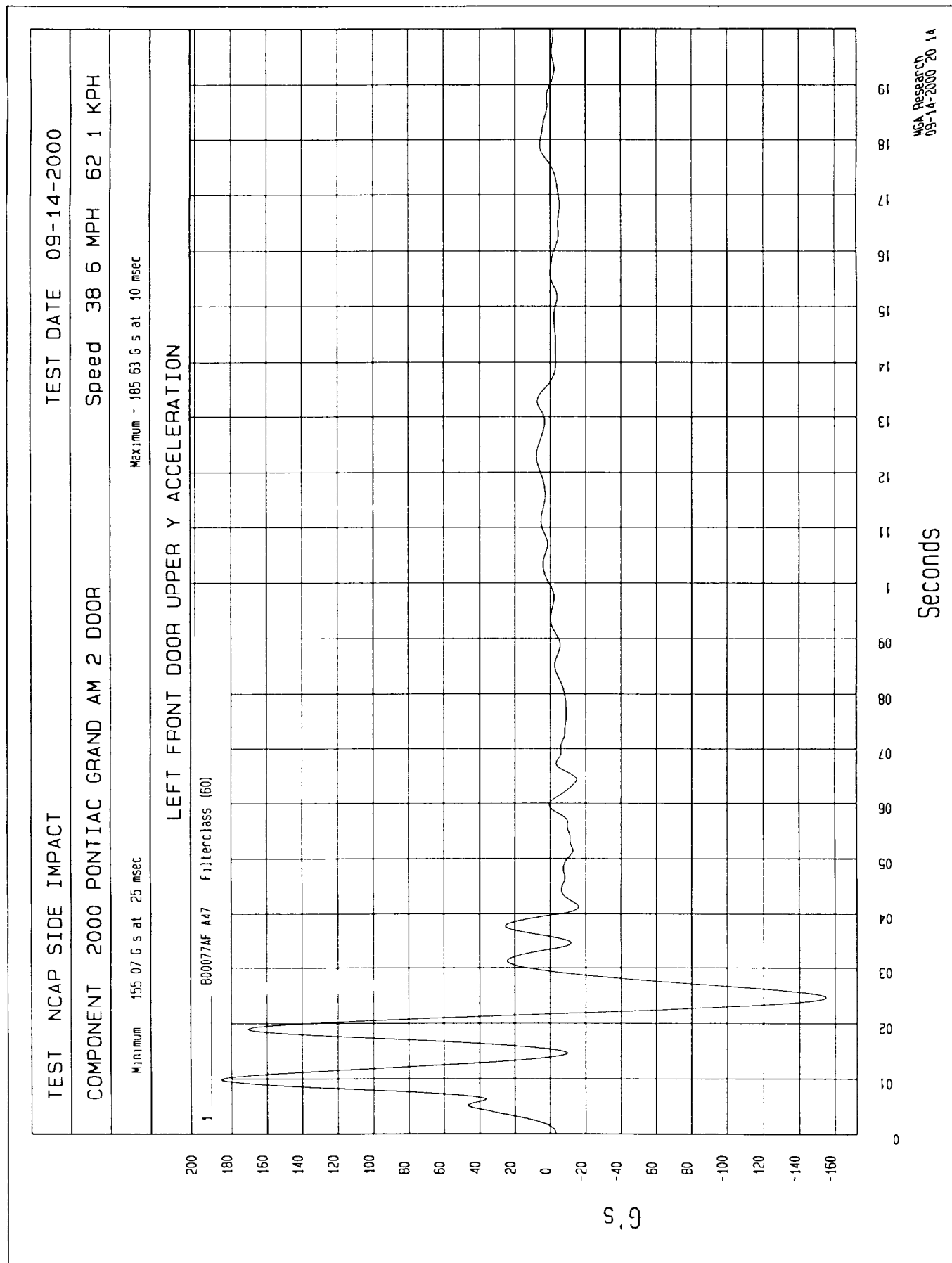
Minimum 31 G s at 118 msec Maximum - 30 44 G s at 30 msec

VEHICLE CG RESULTANT ACCELERATION



Seconds

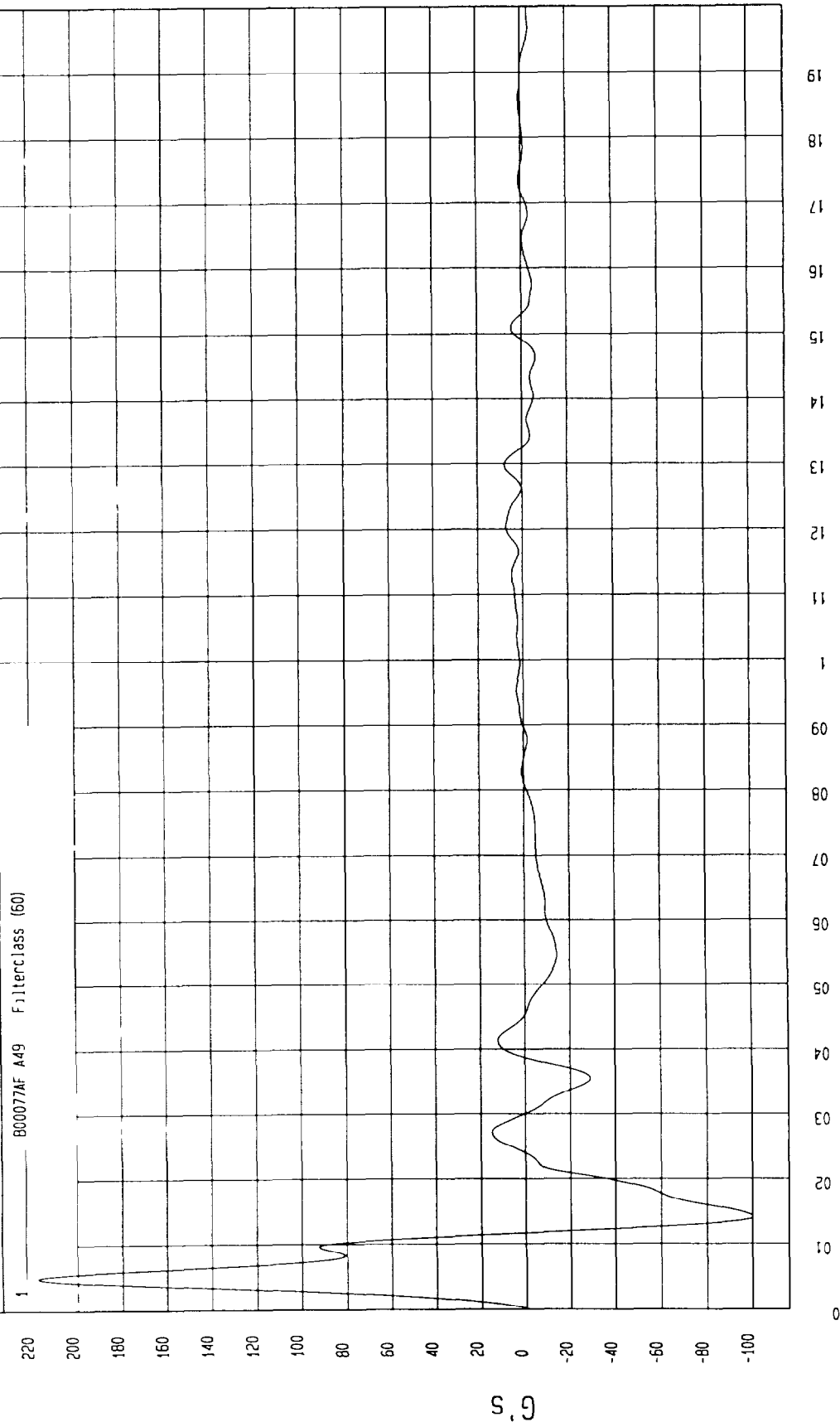
MGA Research
09-14-2000 20 14



LEFT FRONT DOOR MID Y ACCELERATION VS TIME
NO VALID DATA COLLECTED

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 100 38 G s at 14 msec	Maximum 217 46 G s at 5 msec

LEFT FRONT DOOR LOWER Y ACCELERATION

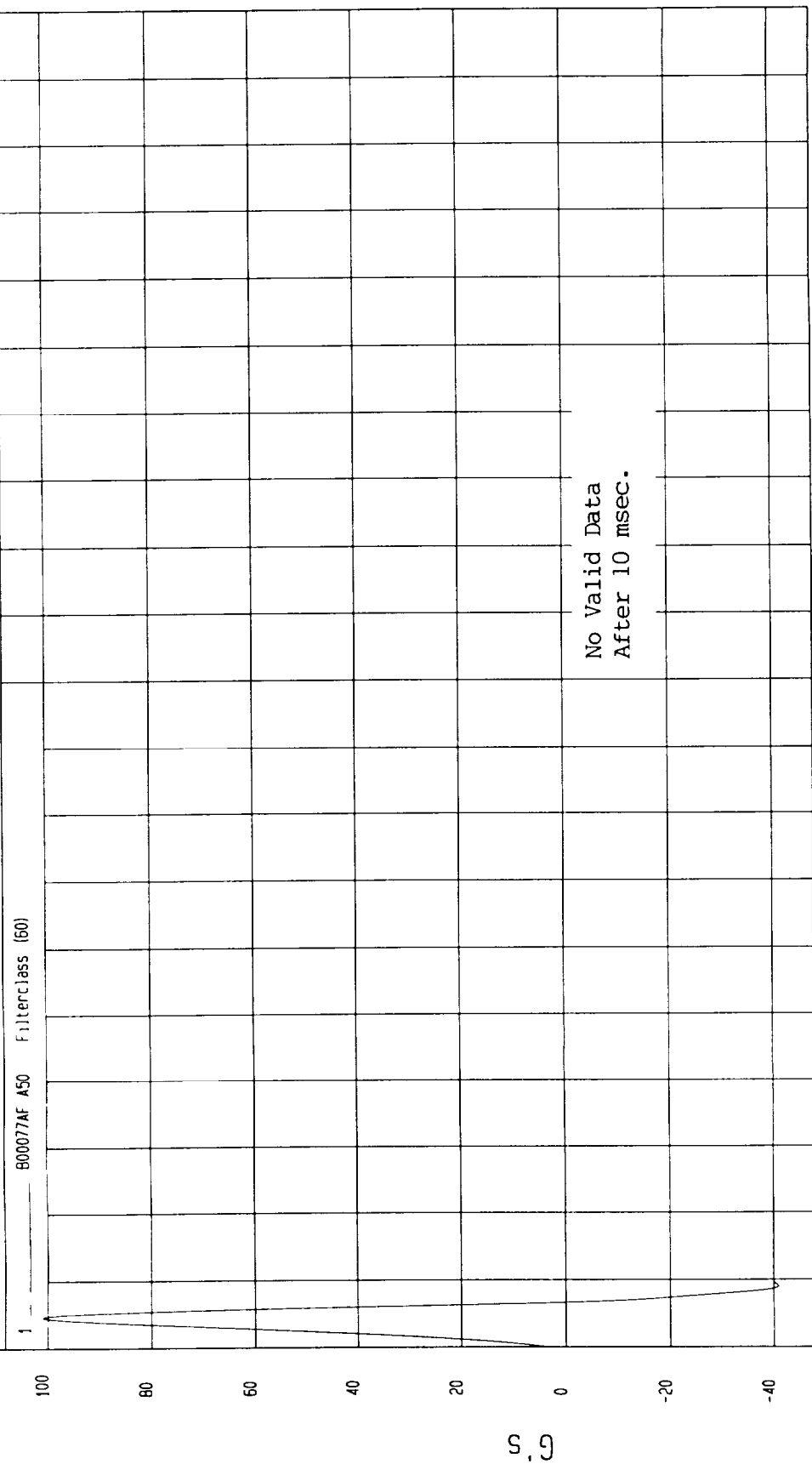


MGA Research
09-14-2000 20 14

Seconds

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	40 89 G s at 9 msec	Maximum	101 02 G s at 5 msec

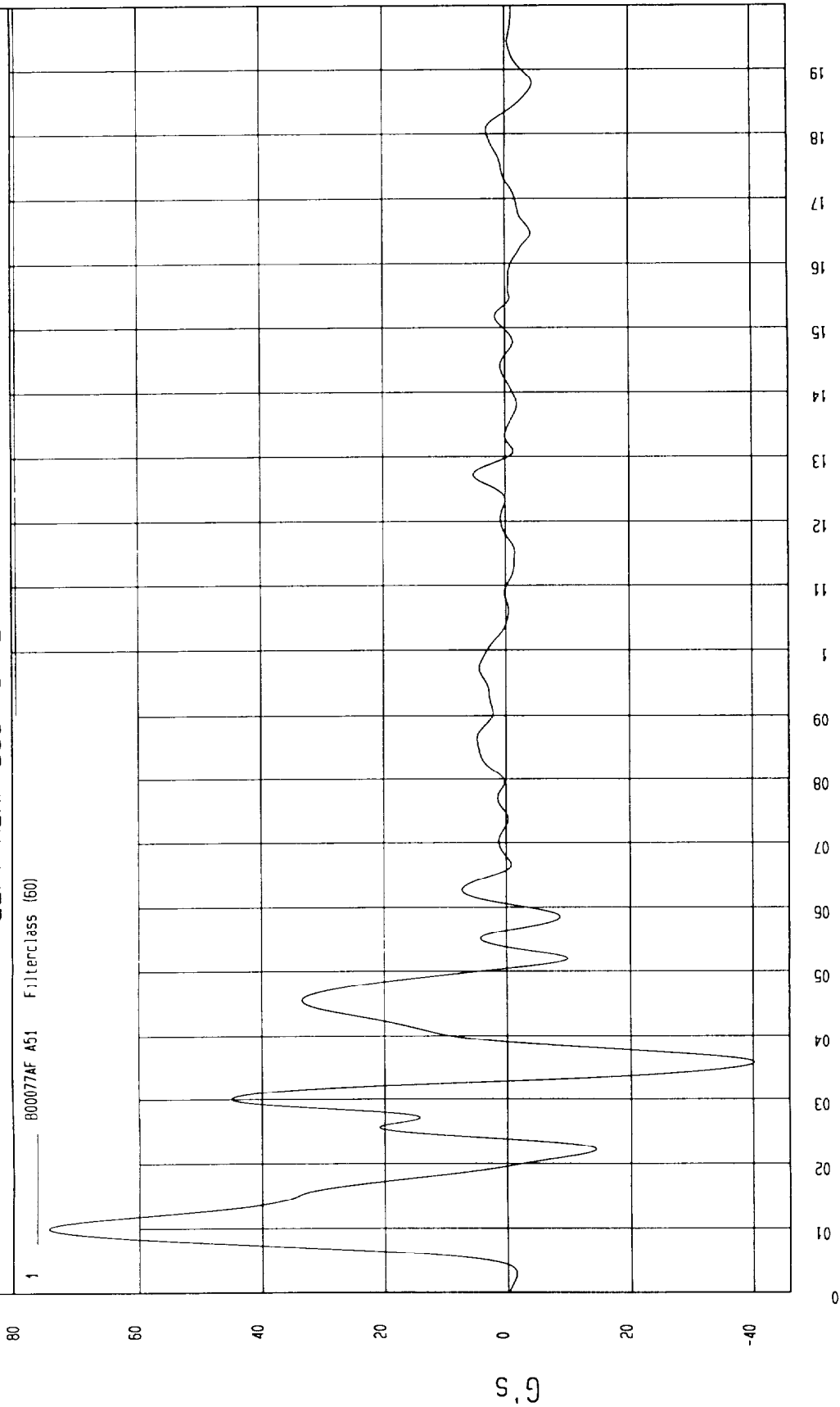
LEFT FRONT DOOR REAR LOWER Y ACCELERATION



MCA Research
09-18-2000 14 30

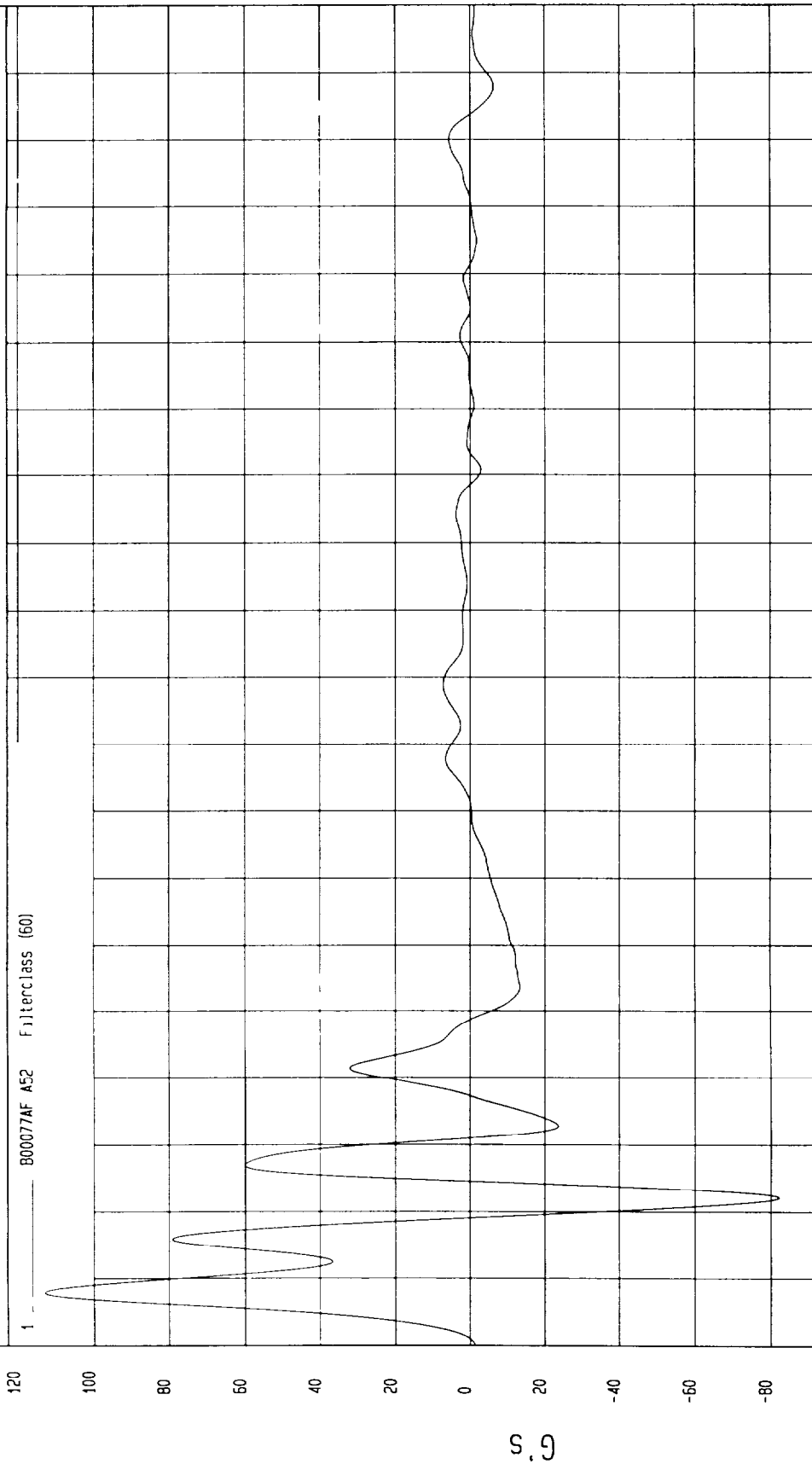
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	40.25 G's at 36 msec	Maximum	74.89 G's at 10 msec

LEFT REAR DOOR UPPER Y ACCELERATION



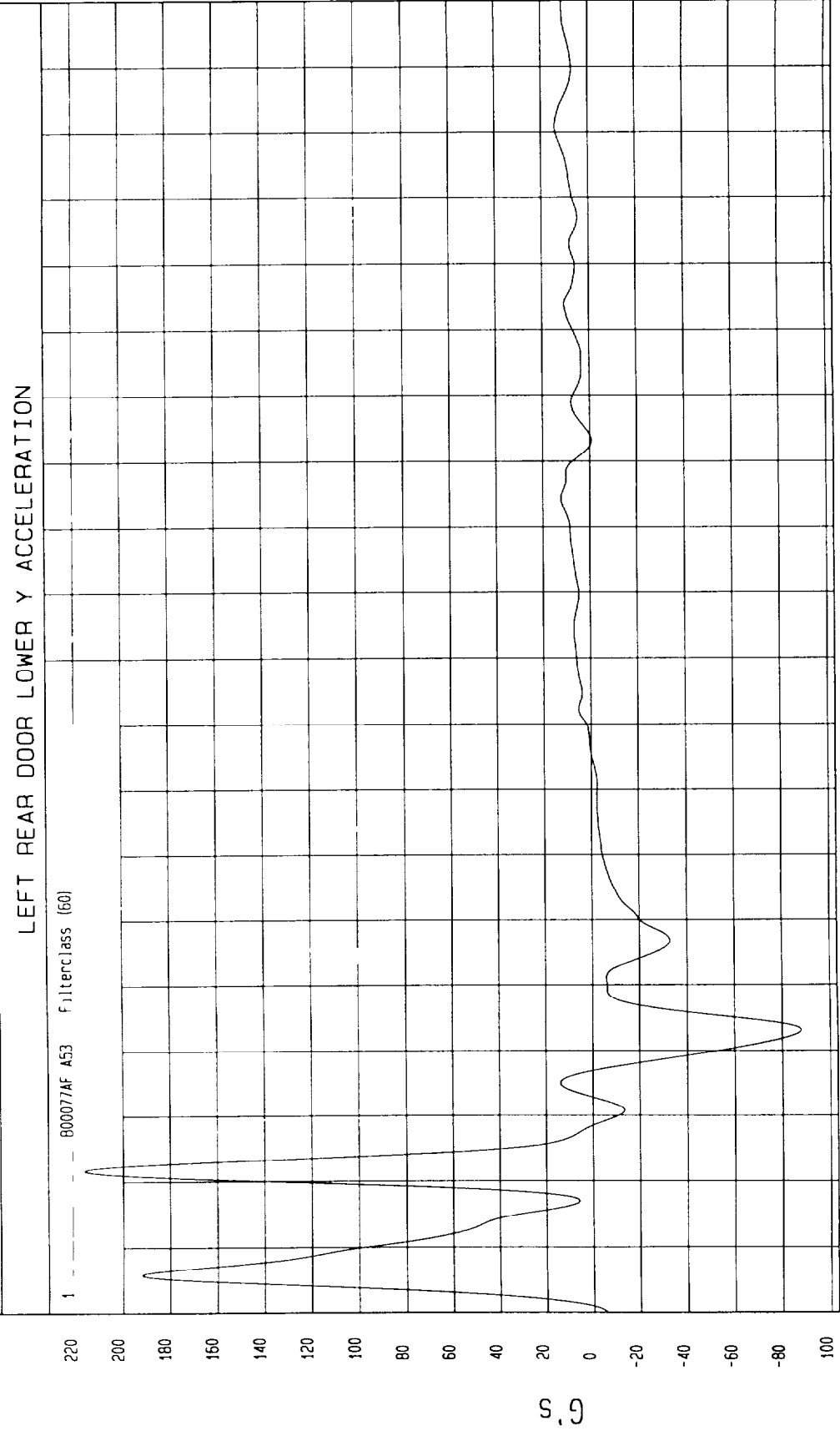
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	82 21 G s at 22 msec	Maximum	113 1 G s at 8 msec

LEFT REAR DOOR MID Y ACCELERATION



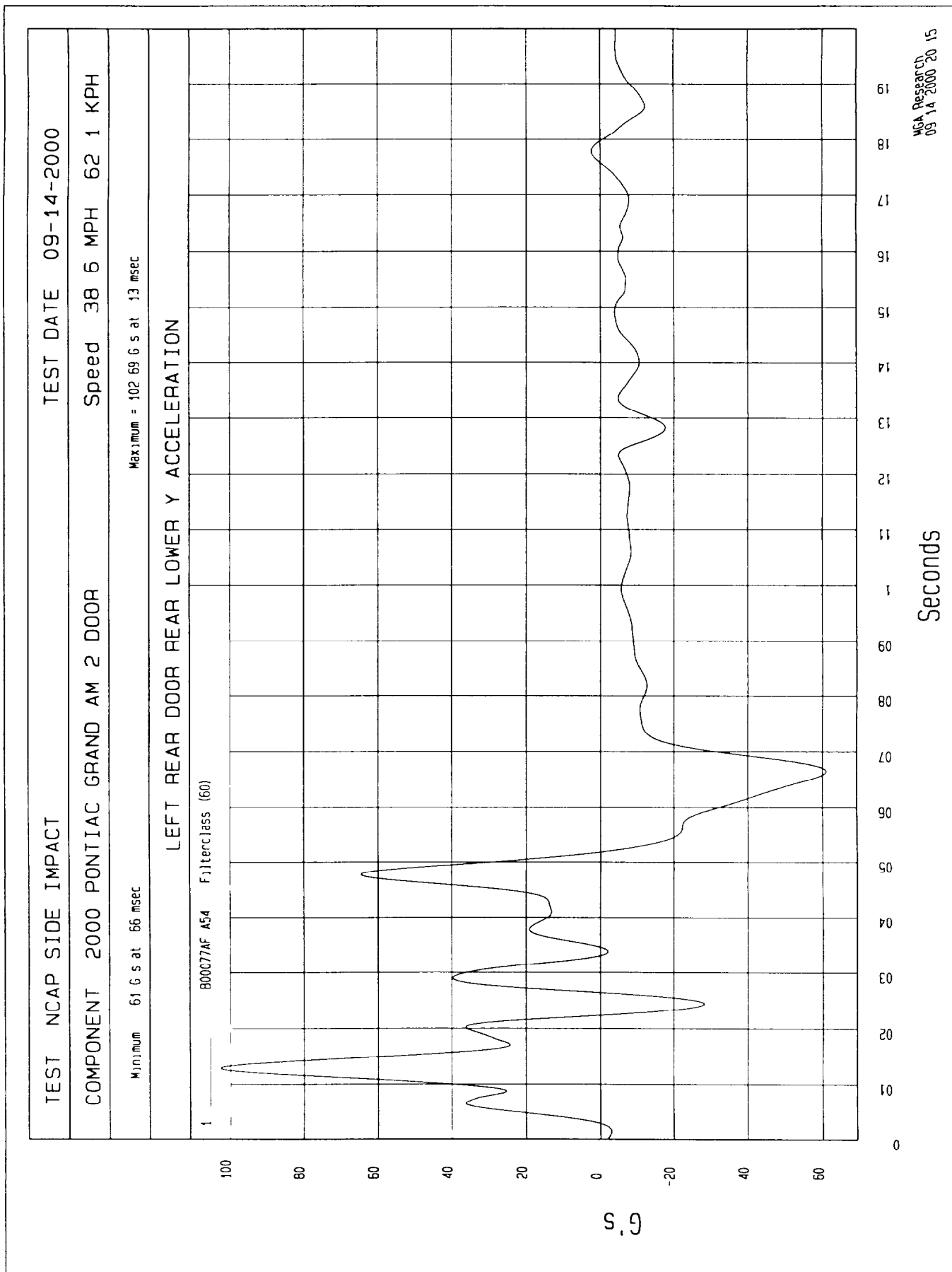
MGA Research
09-14-2000 20 15

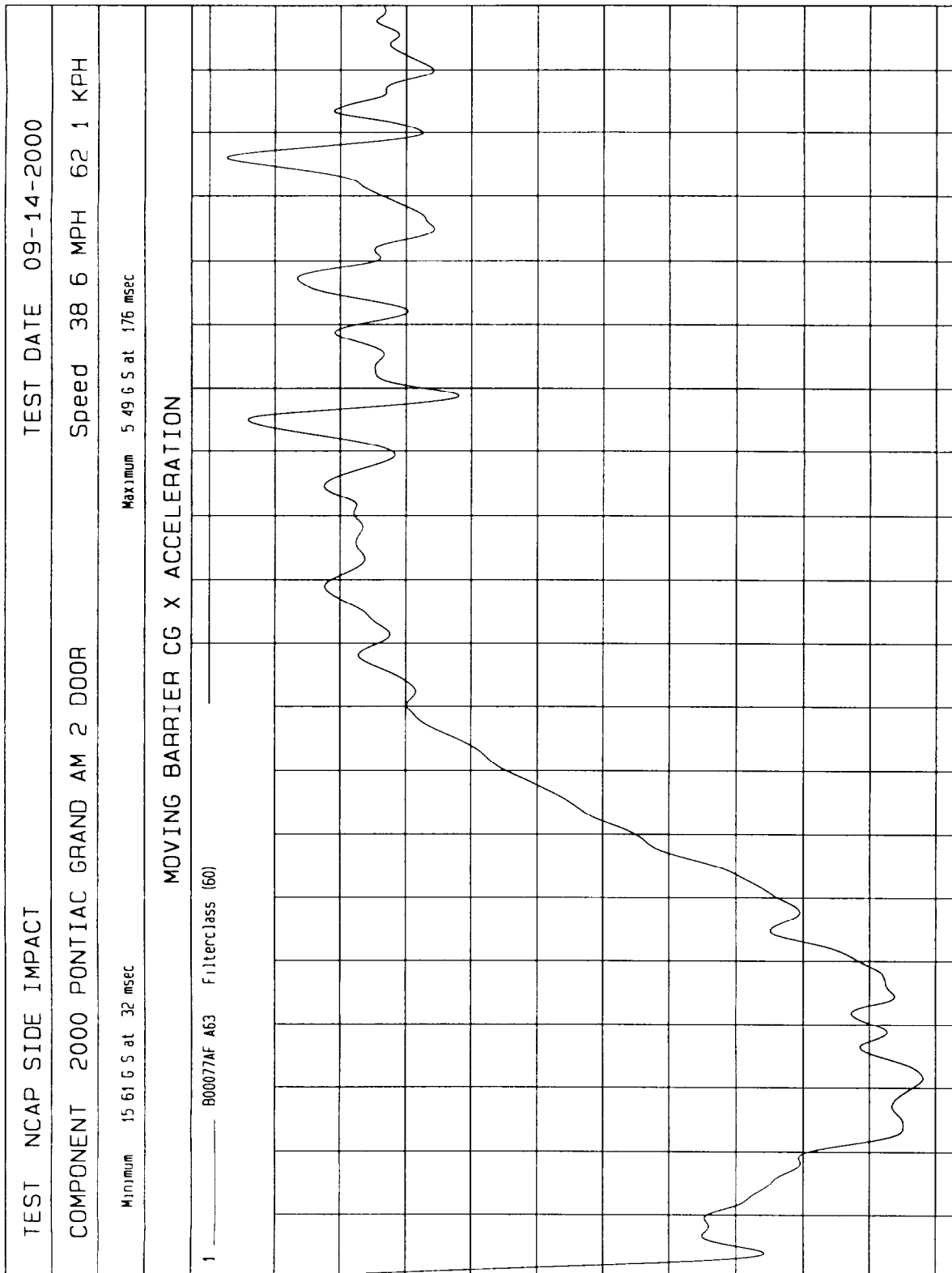
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	87 92 G s at 43 msec	Maximum	- 216 45 G s at 22 msec



Seconds

MGA Research
09-14-2000 20 15

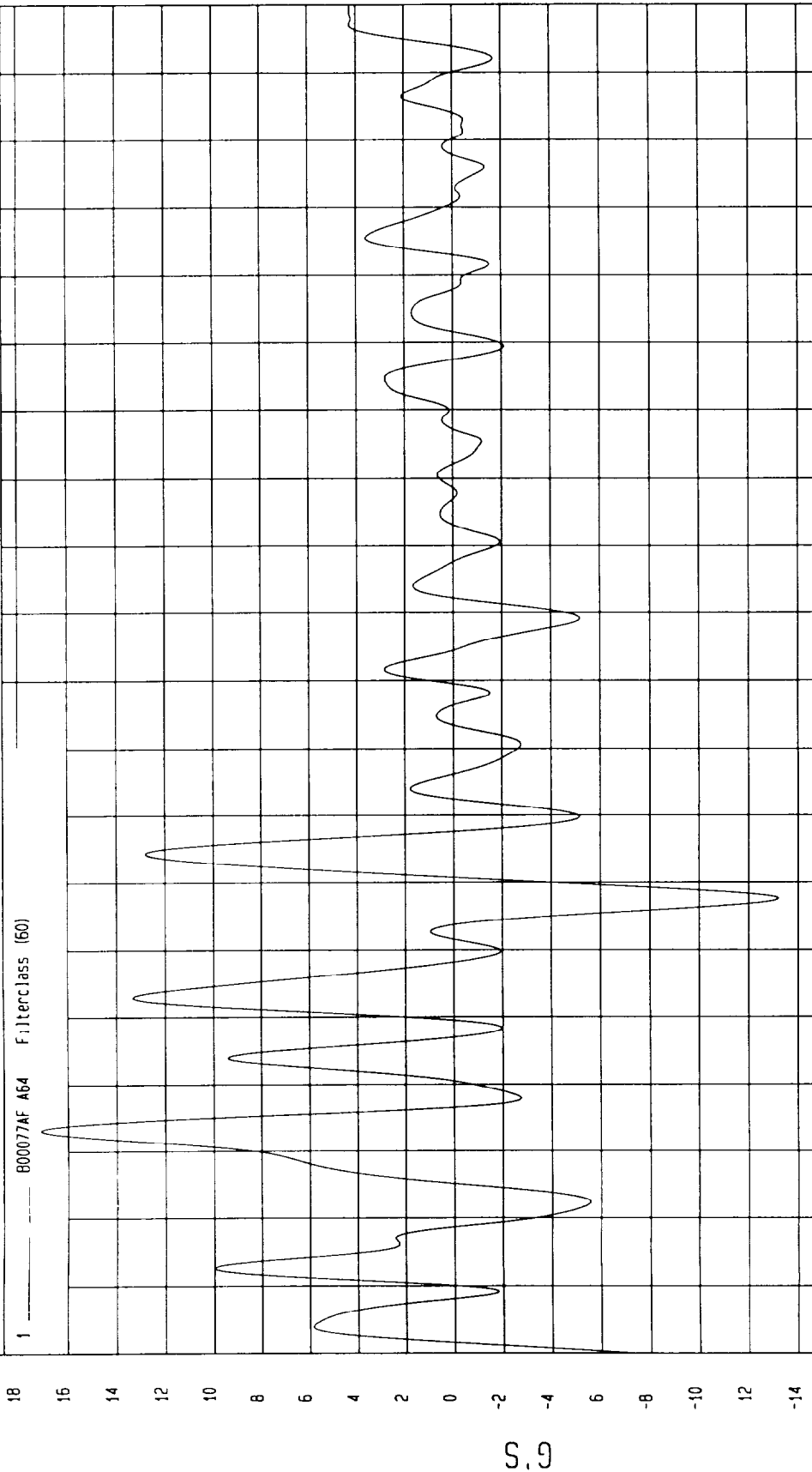




WGA Research
09-18-2000 14 35

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	13 21 G S at 68 msec	Maximum	17 08 G S at 33 msec

MOVING BARRIER CG Y ACCELERATION

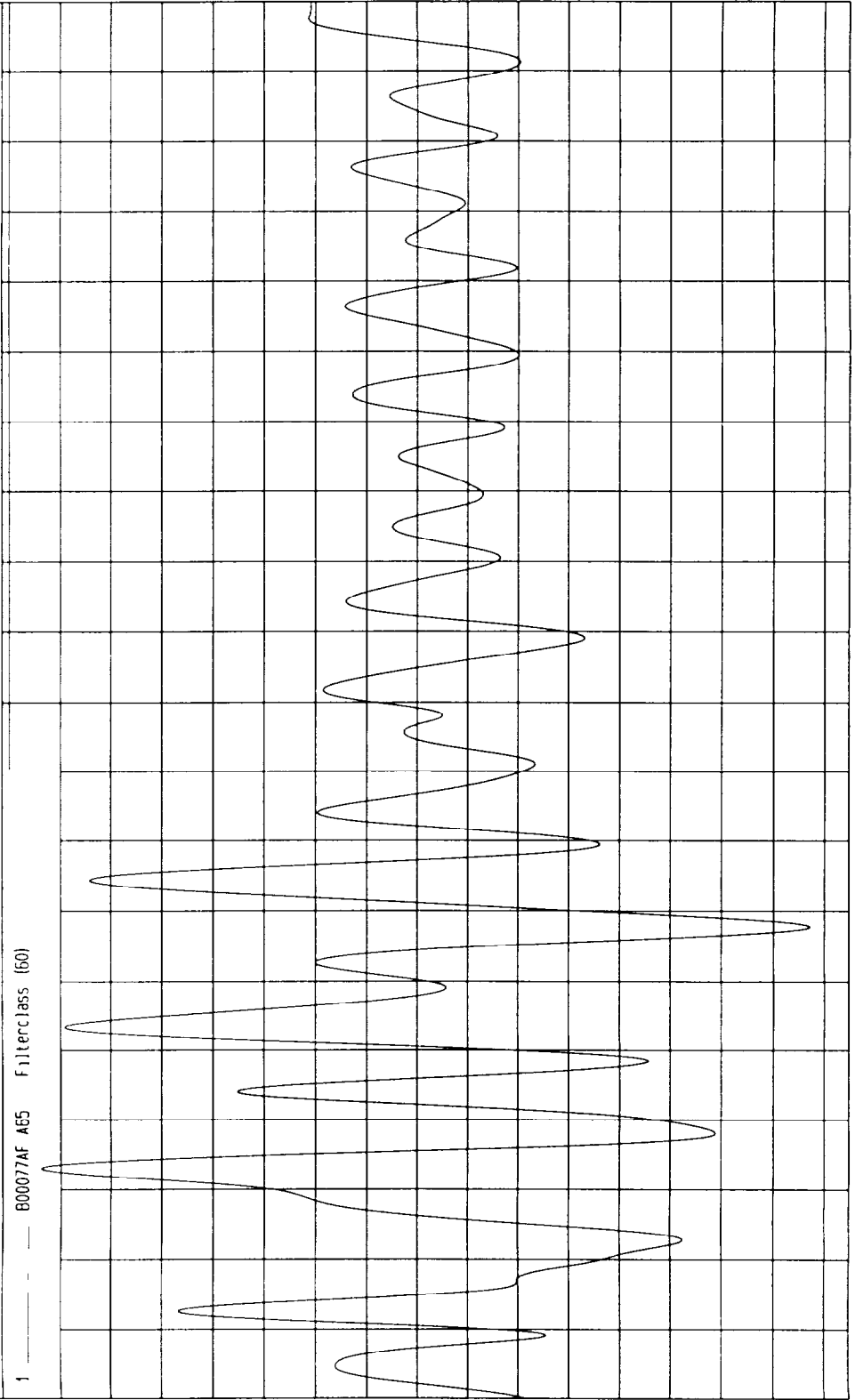


TIME (SECONDS)

MCA Research
09-18-2000 14 35

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	15 44 G S at 68 msec	Maximum	14 77 G S at 33 msec

MOVING BARRIER CG Z ACCELERATION



TIME (SECONDS)

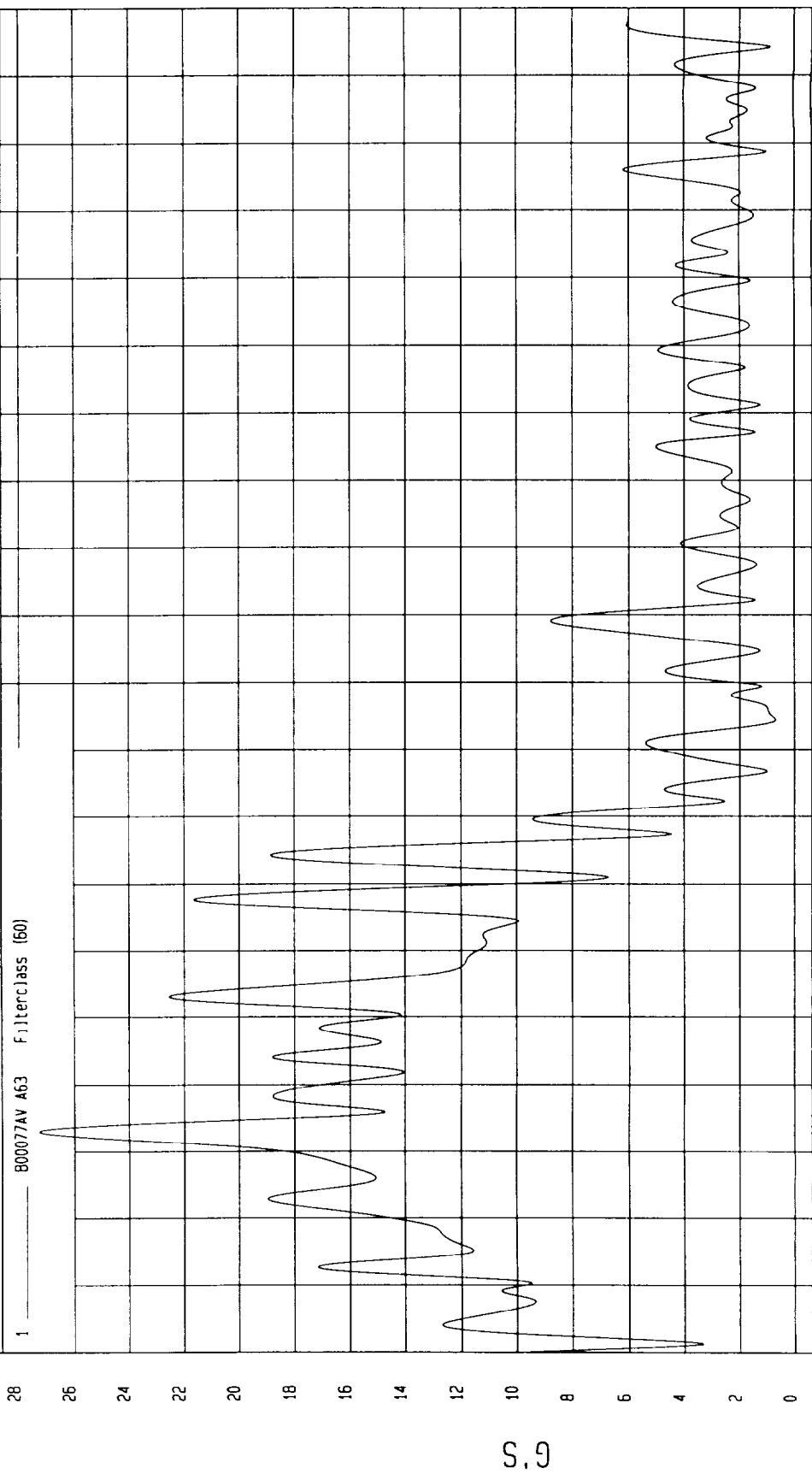
WCA Research
09 18-2000 14 36

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 68 G S at 94 msec Maximum - 27 3 G S at 33 msec

MOVING BARRIER CG RESULTANT ACCELERATION



TIME (SECONDS)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

MCA Research
09-18-2000 14 36

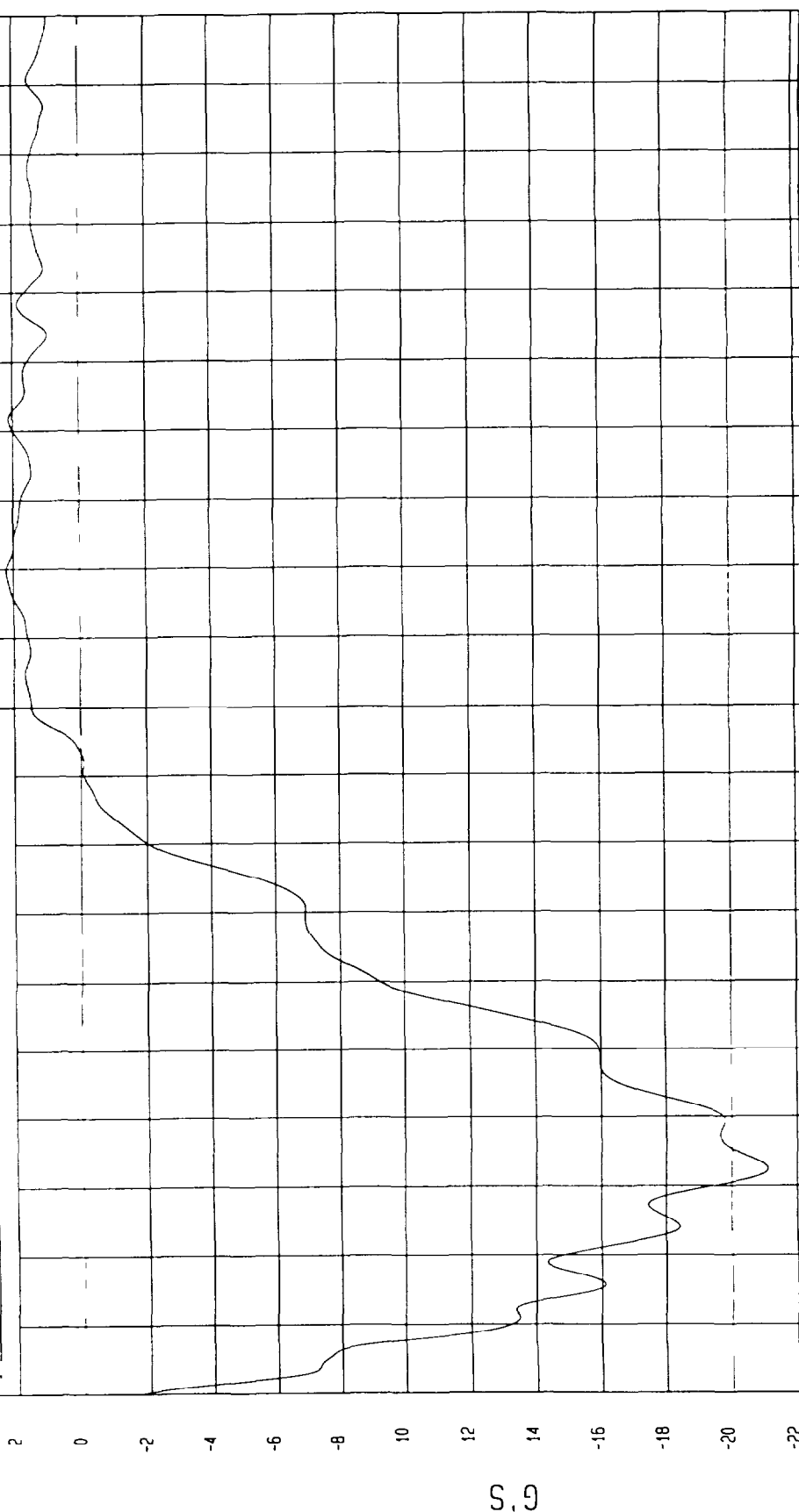
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 21 11 G S at 32 msec Maximum - 2 22 G S at 120 msec

MOVING BARRIER LEFT REAR FRAME X ACCELERATION

1 800077AF A66 FilterClass (60)

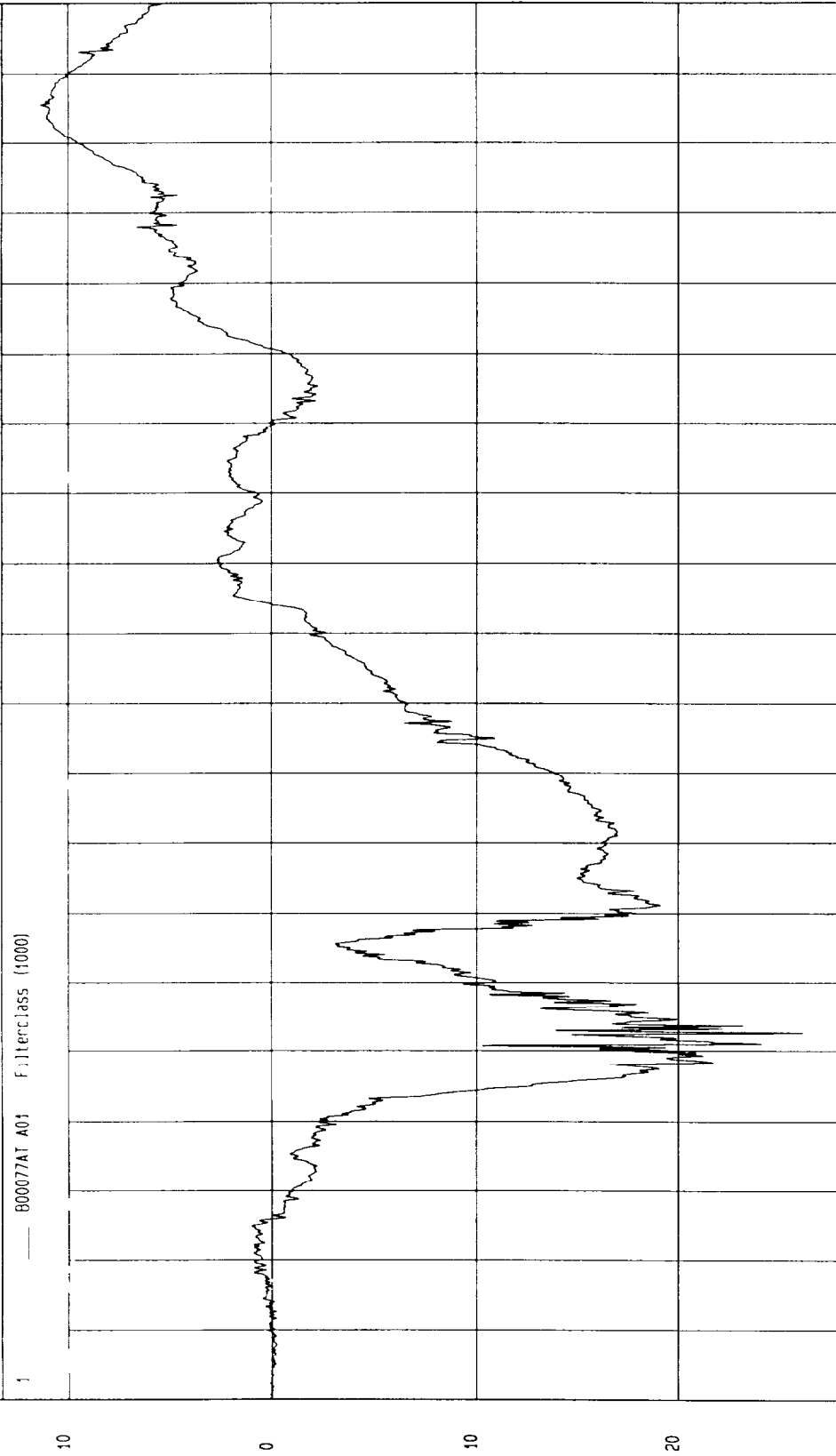


NGA Research
09-18-2000 14 36

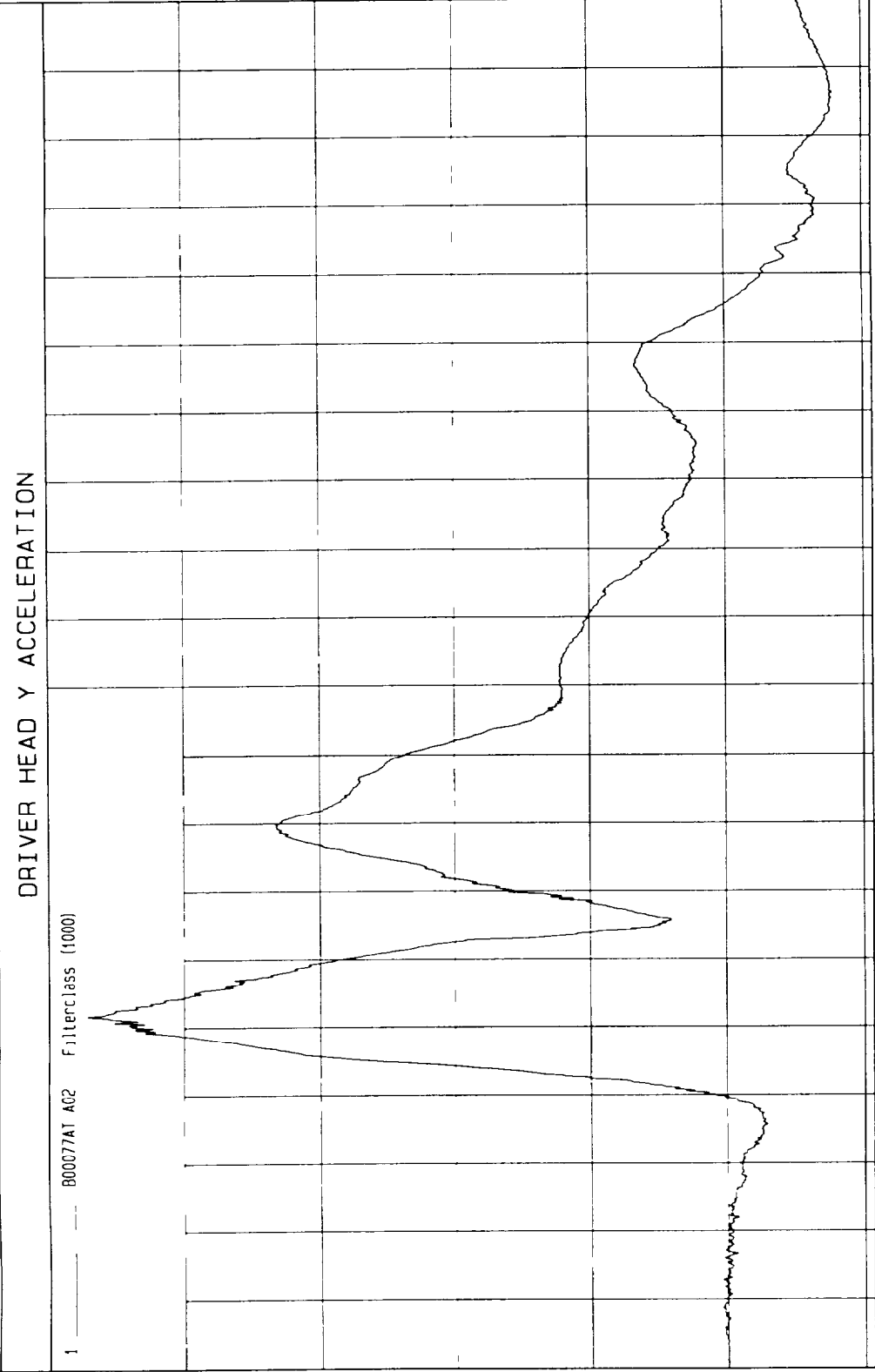
MOVING BARRIER LEFT REAR FRAME Y ACCELERATION VS TIME
NO VALID DATA COLLECTED

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	26.09 G's at 53 msec	Maximum	11.37 G's at 186 msec

DRIVER HEAD X ACCELERATION

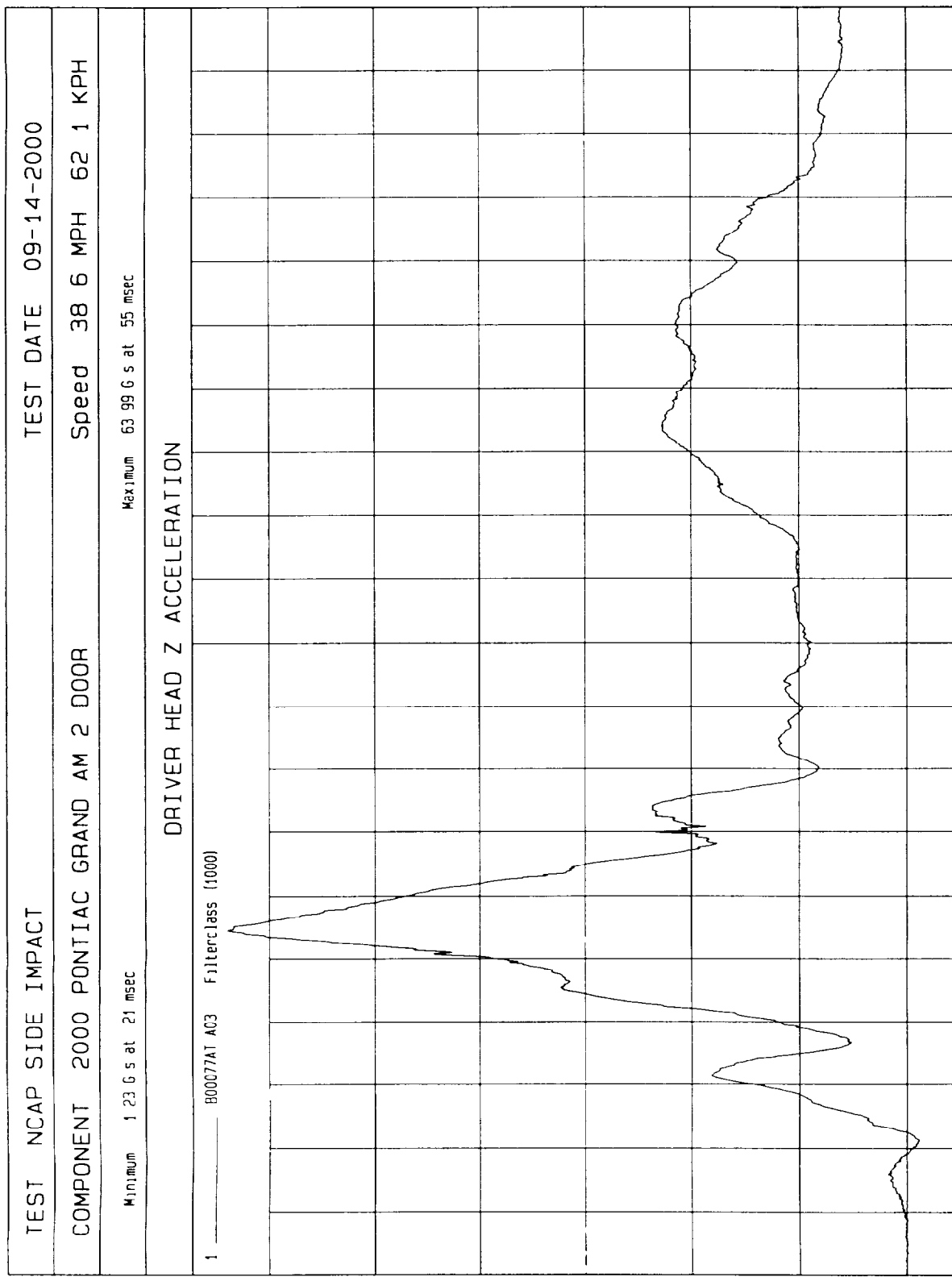


TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	7.93 G s at 186 msec	Maximum	47.15 G s at 52 msec



Seconds

MCA Research
09-14-2000 19 47



WCA Research
09-14-2000 19 47

Seconds

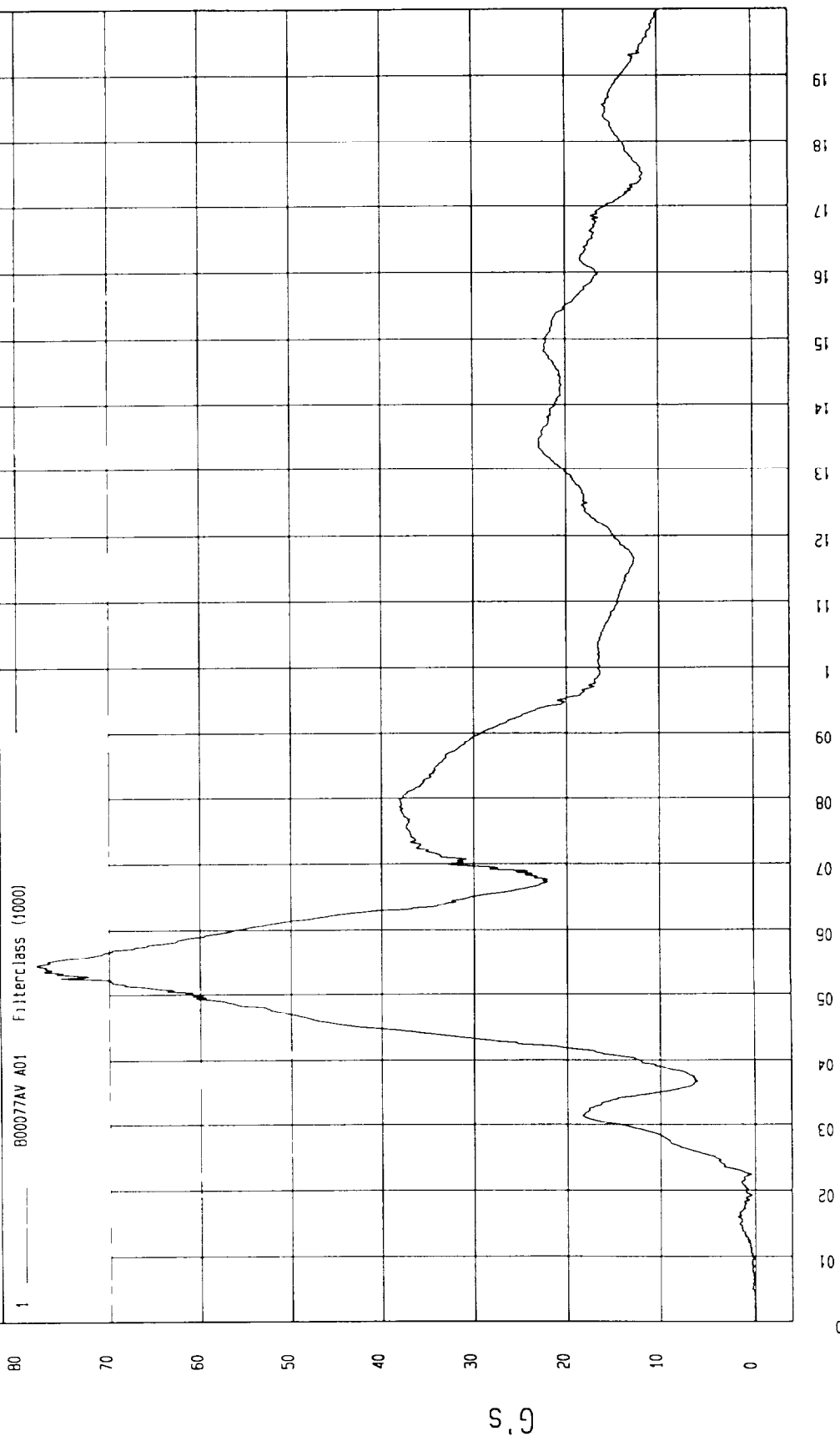
G's

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 9.43E 03 G s at 0 msec Maximum - 77 89 G s at 55 msec

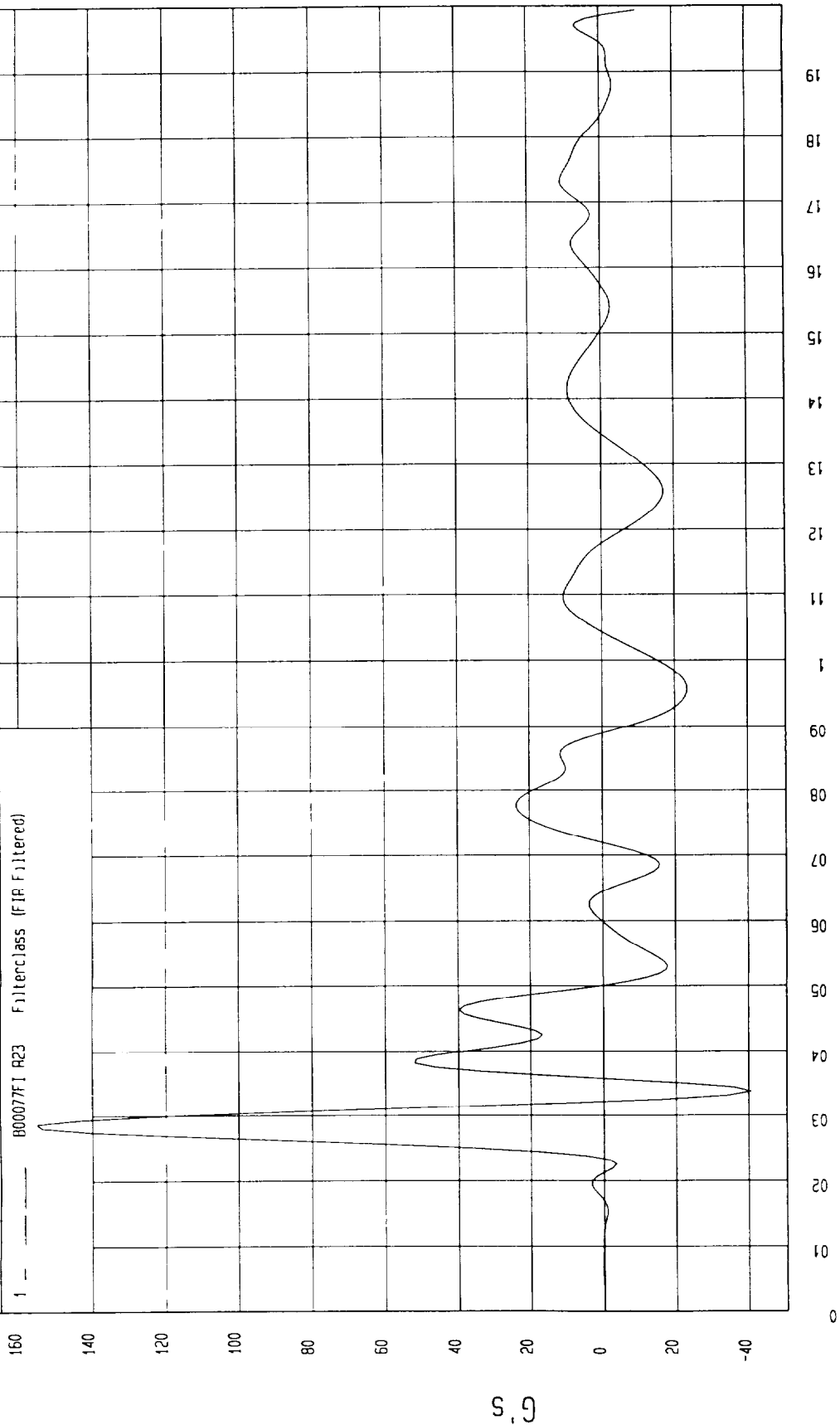
DRIVER HEAD RESULTANT



MCA Research
09-14-2000 19:47

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum = 40 77 G s at 34 msec		Maximum = 155 28 G s at 29 msec	

DRIVER UPPER RIB Y ACCELERATION



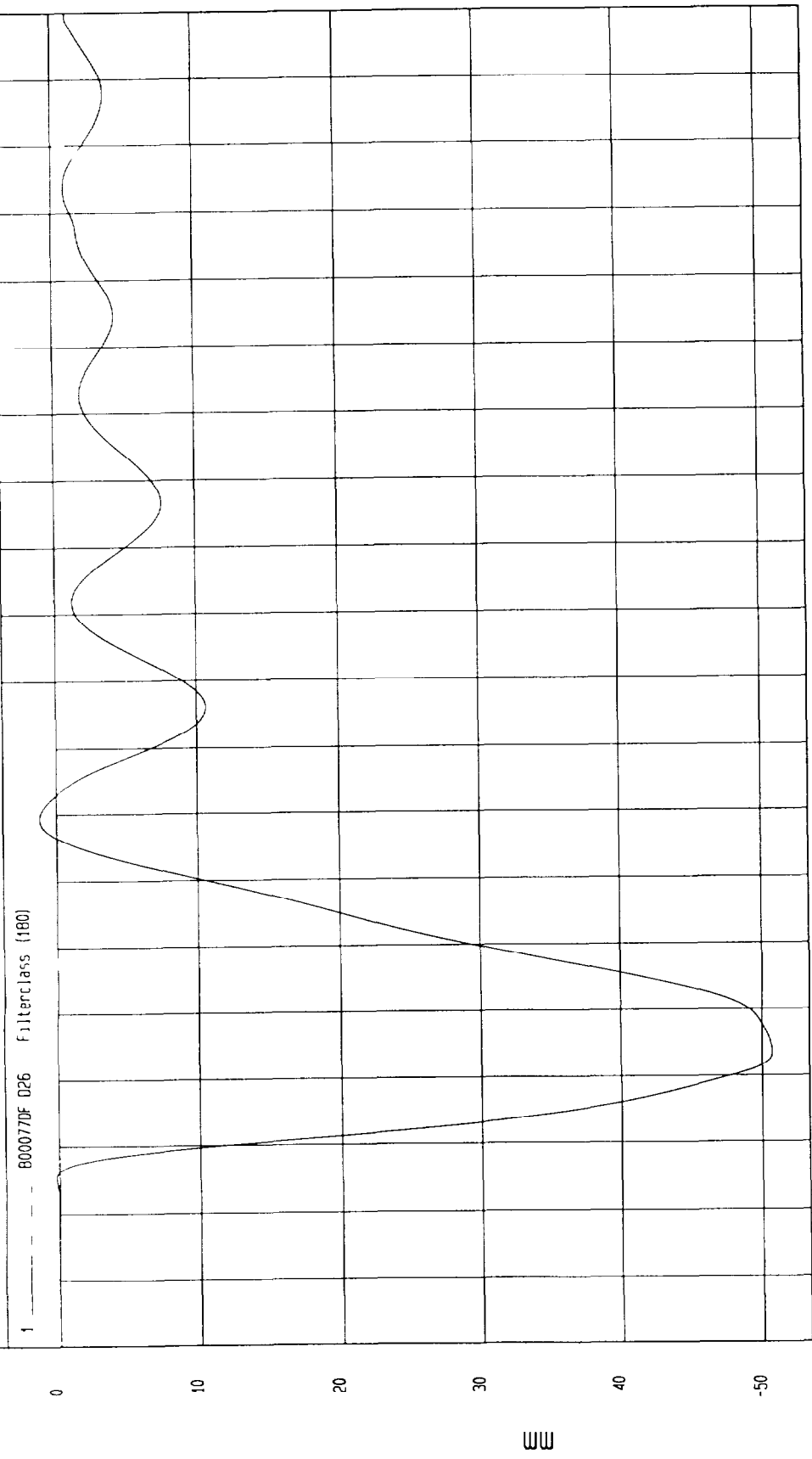
MCA Research
09-14-2000 19 33

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 50.75 mm at 44 msec Maximum - 119 mm at 79 msec

DRIVER UPPER RIB DISPLACEMENT

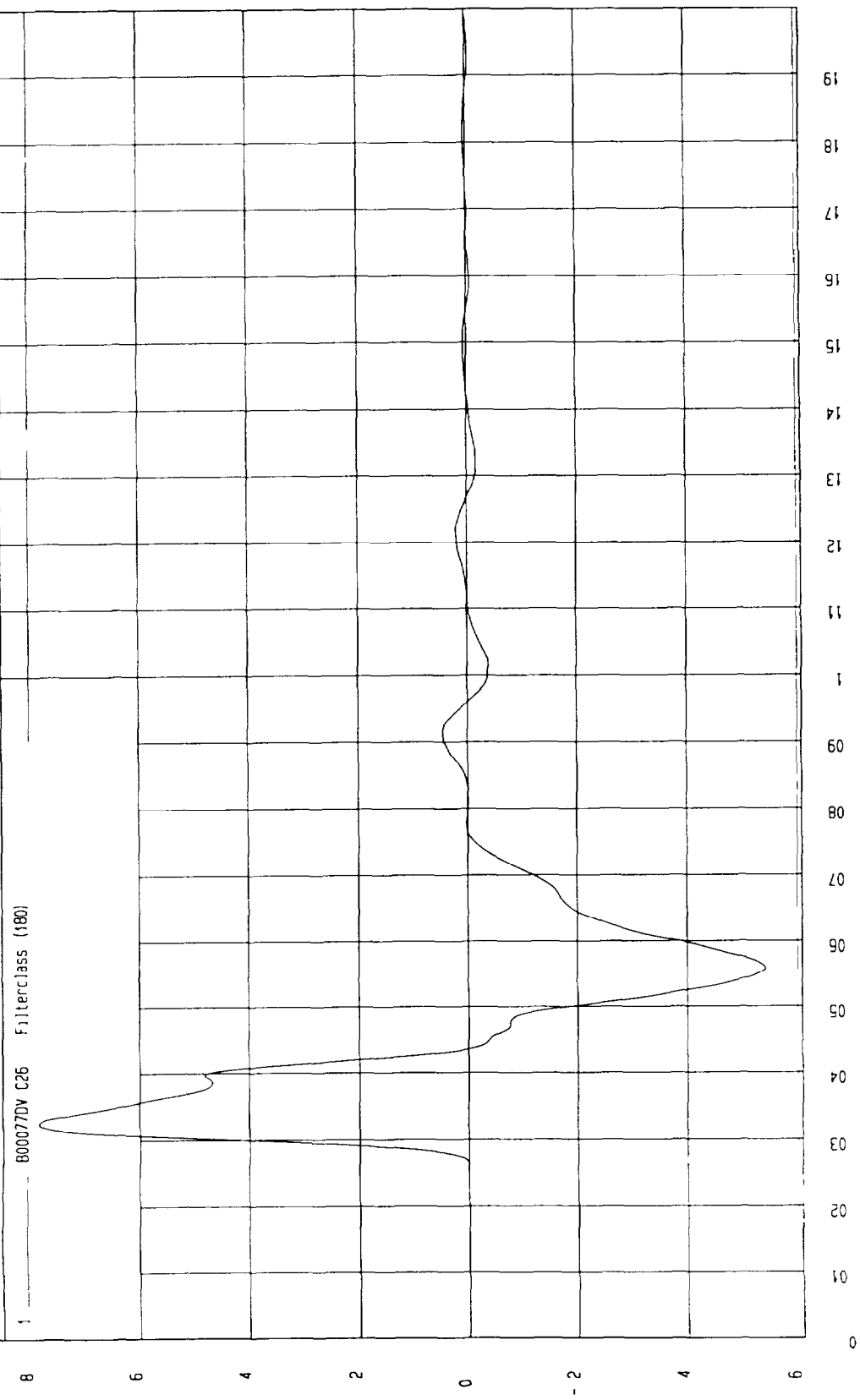


WCA Research
09-14-2000 19 48

Seconds

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	54 at 56 msec	Maximum	78 at 33 msec

DRIVER UPPER RIB VISCOUS CRITERIA



MCA Research
09-14-2000 19 48

Seconds

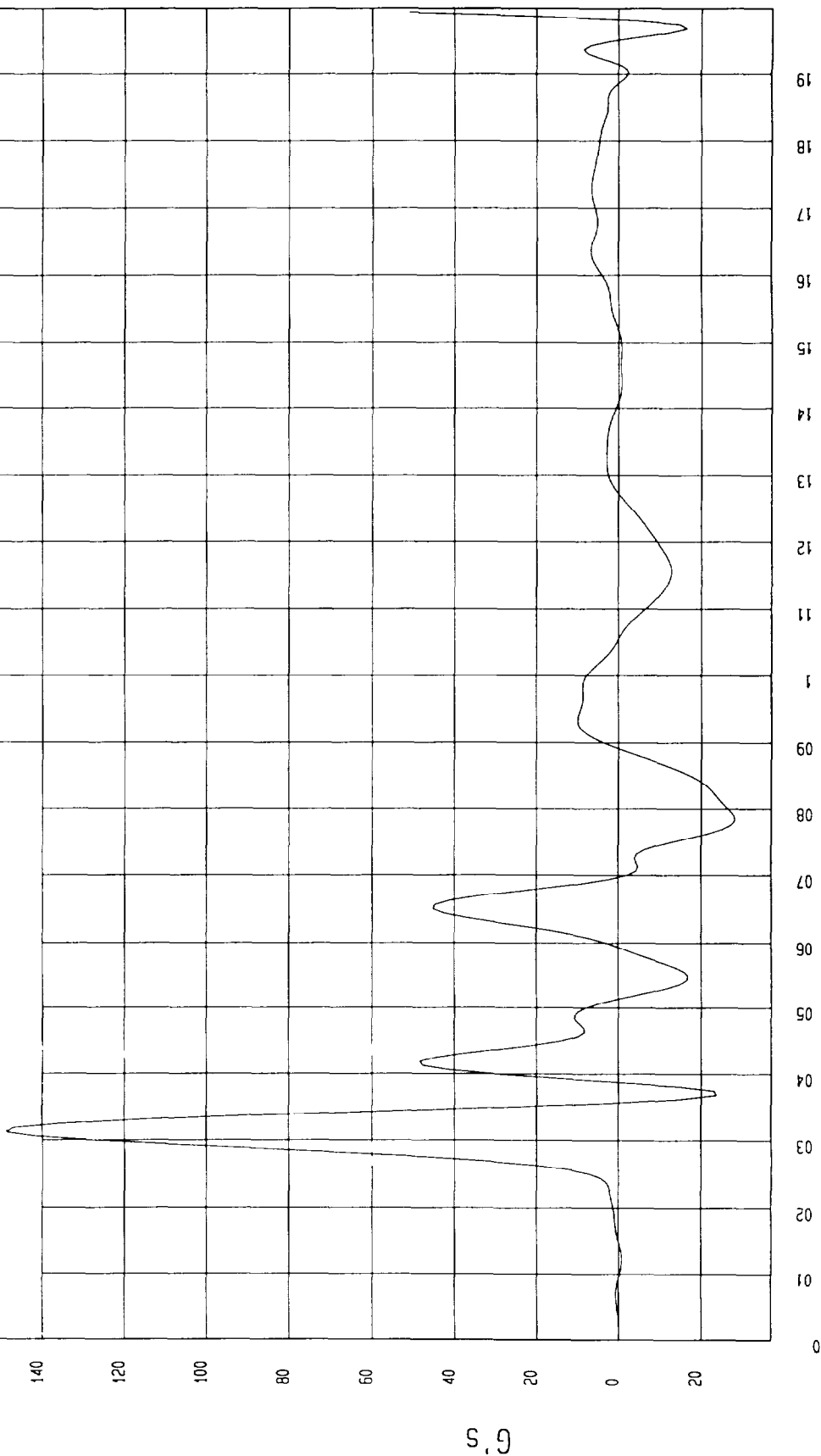
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum - 28 05 G s at 79 msec Maximum 148 9 6 s at 31 msec

DRIVER MID RIB Y ACCELERATION

1 80007F1 R24 Filterclass (FIR Filtered)



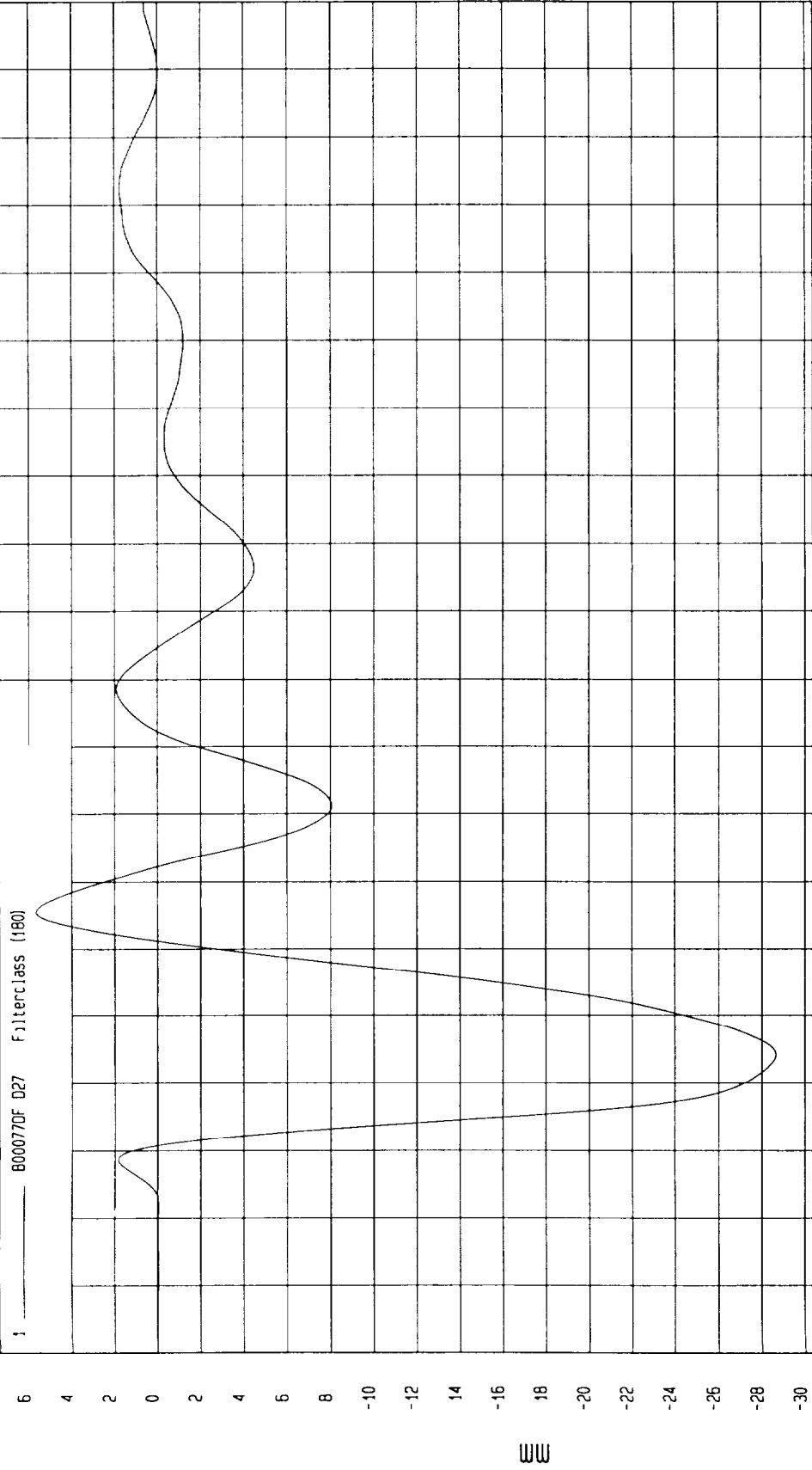
MGA Research
09-14-2000 19 33

Seconds

G.s

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	28 66 mm at 44 msec	Maximum	5 67 mm at 66 msec

DRIVER MID RIB DISPLACEMENT



Seconds

MCA Research
09-14-2000 19 49

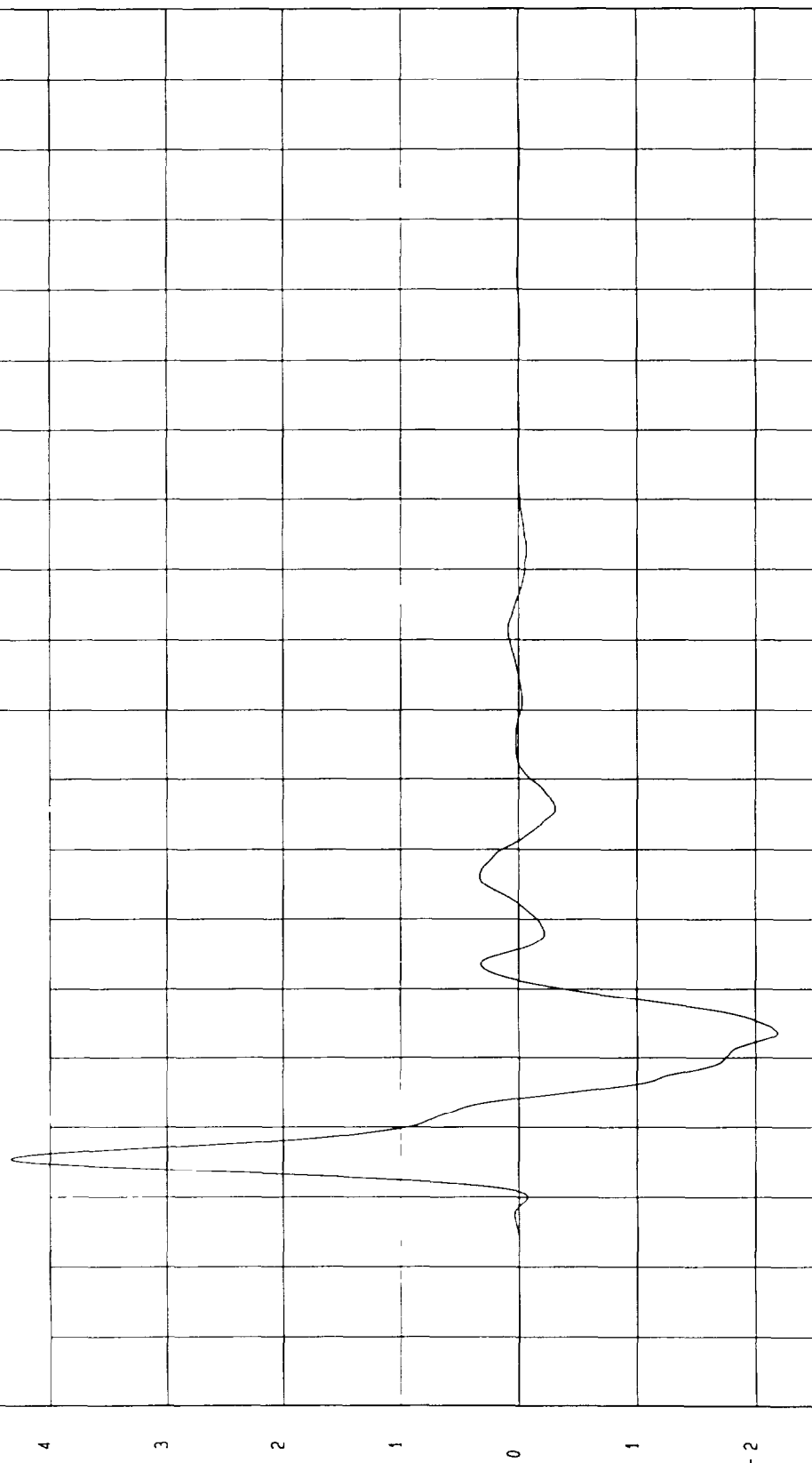
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 22 at 54 msec Maximum - 43 at 36 msec

DRIVER MID RIB VISCOUS CRITERIA

1 B0007DV C27 Filterclass (180)

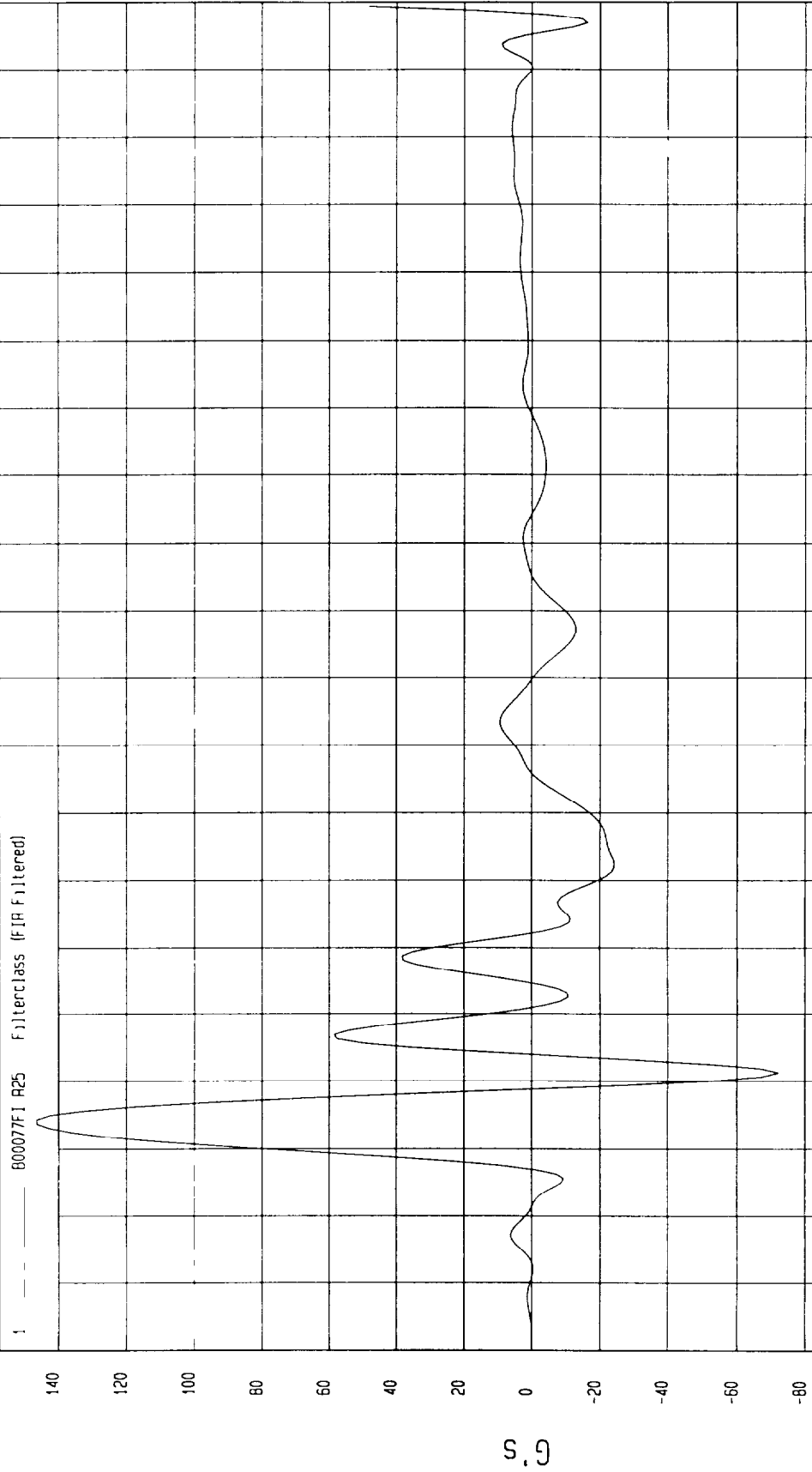


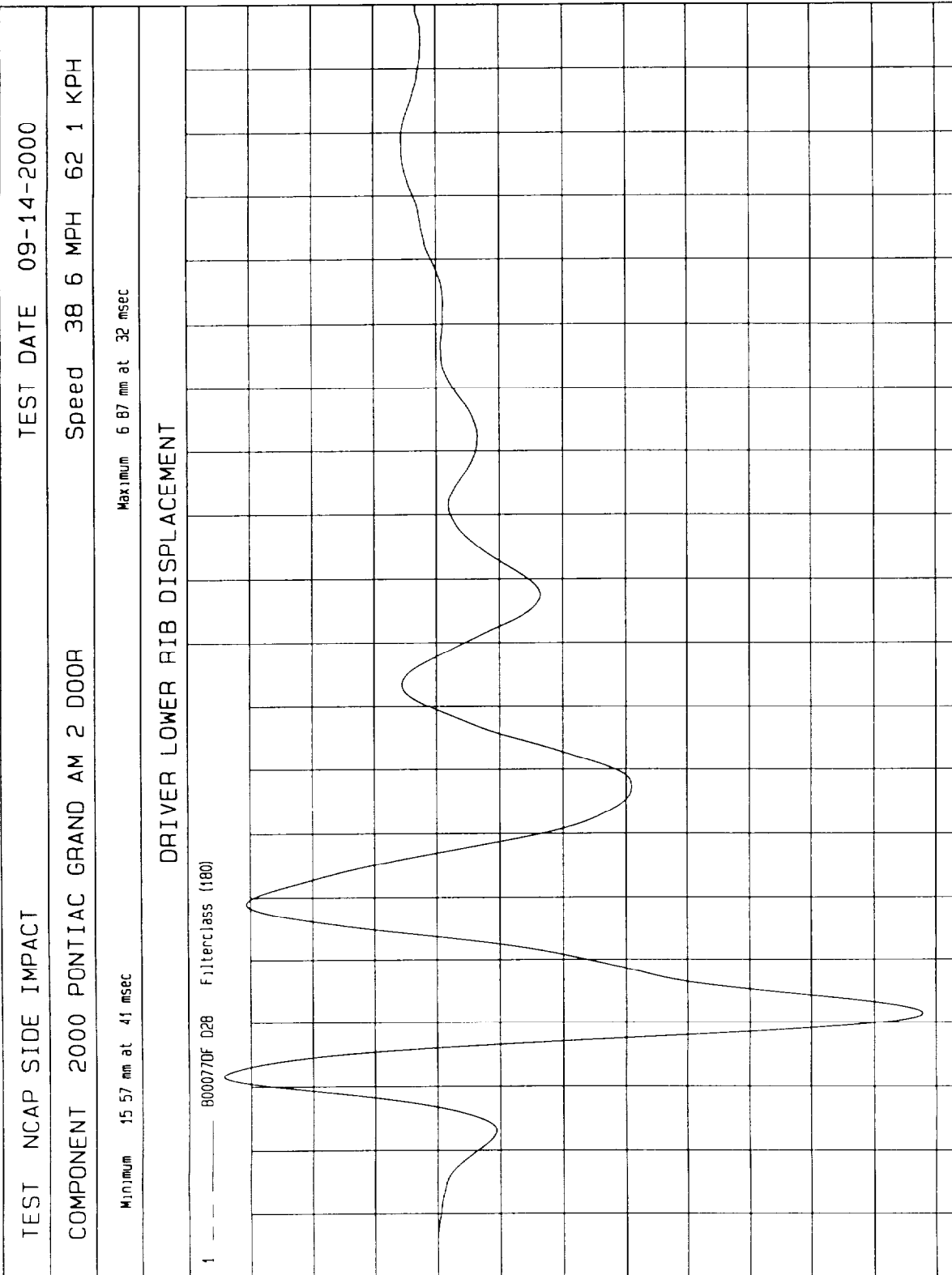
WCA Research
09/14/2000 19:49

Seconds

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	72 37 G s at 41 msec	Maximum	146 52 G s at 34 msec

DRIVER LOWER RIB Y ACCELERATION

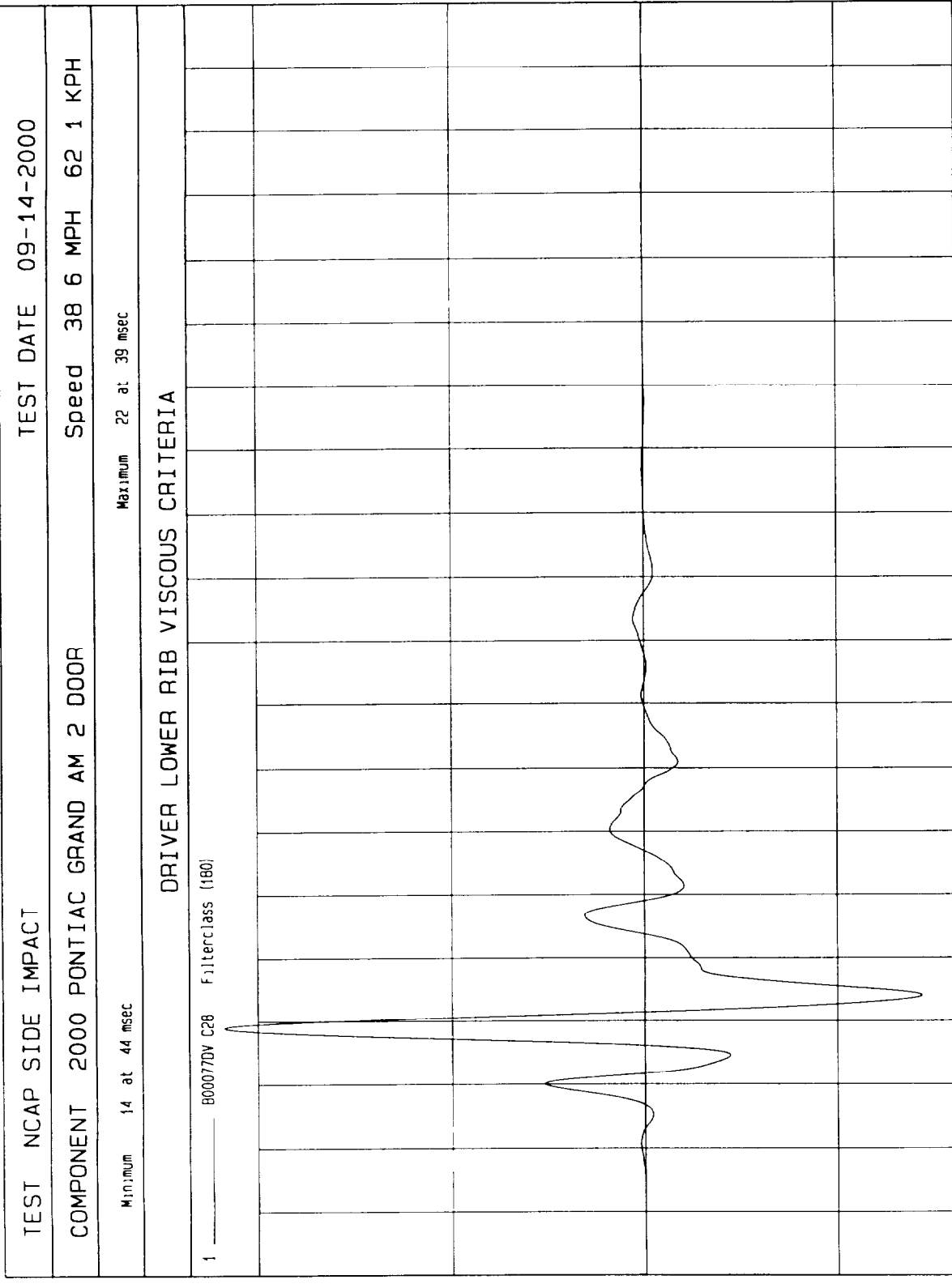




WCA Research
09-14-2000 19 49

Seconds

mm

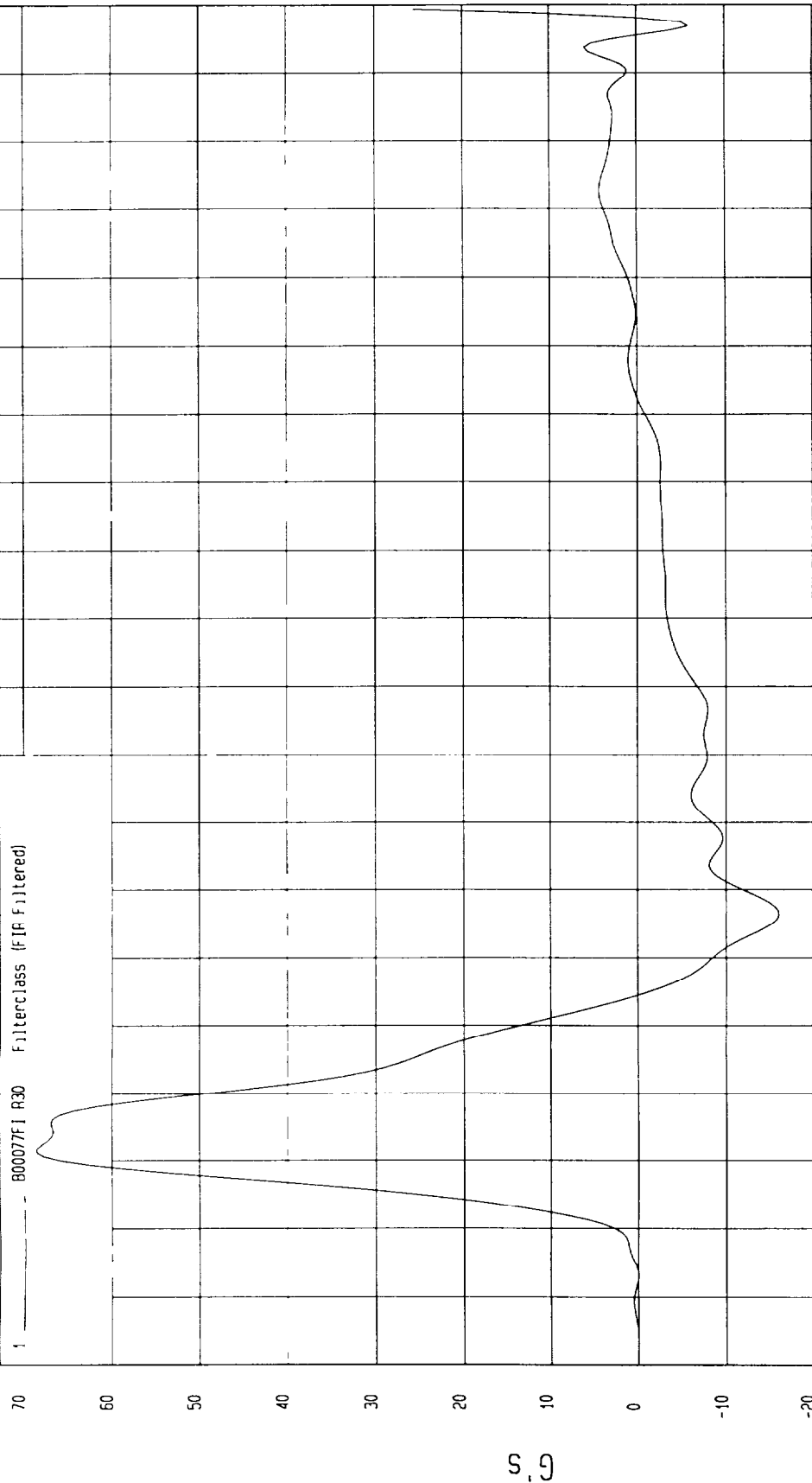


MCA Research
09-14-2000 19:49

Seconds

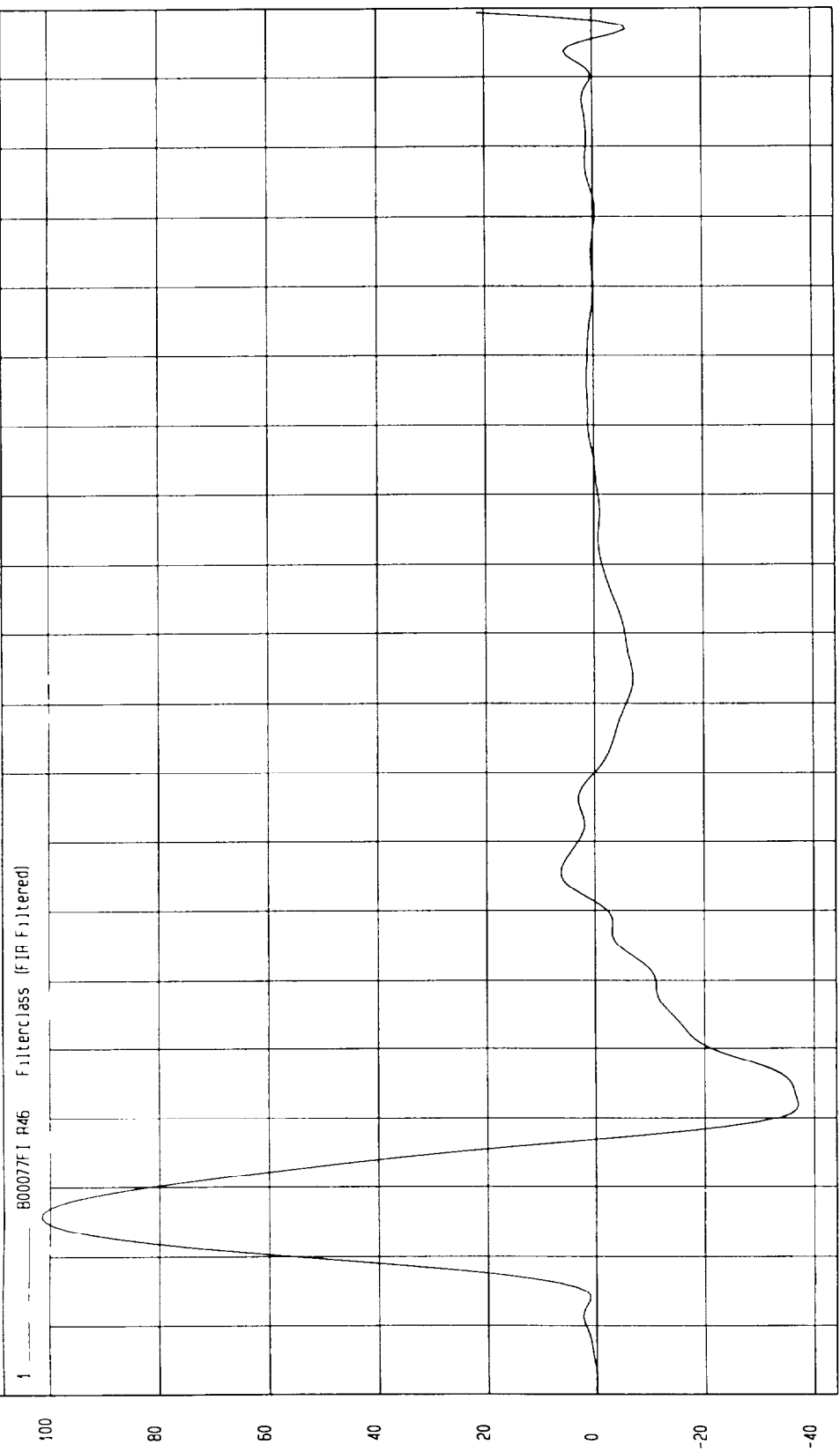
TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 16 09 G s at 66 msec	Maximum 68 55 G s at 31 msec

DRIVER LOWER SPINE Y ACCELERATION



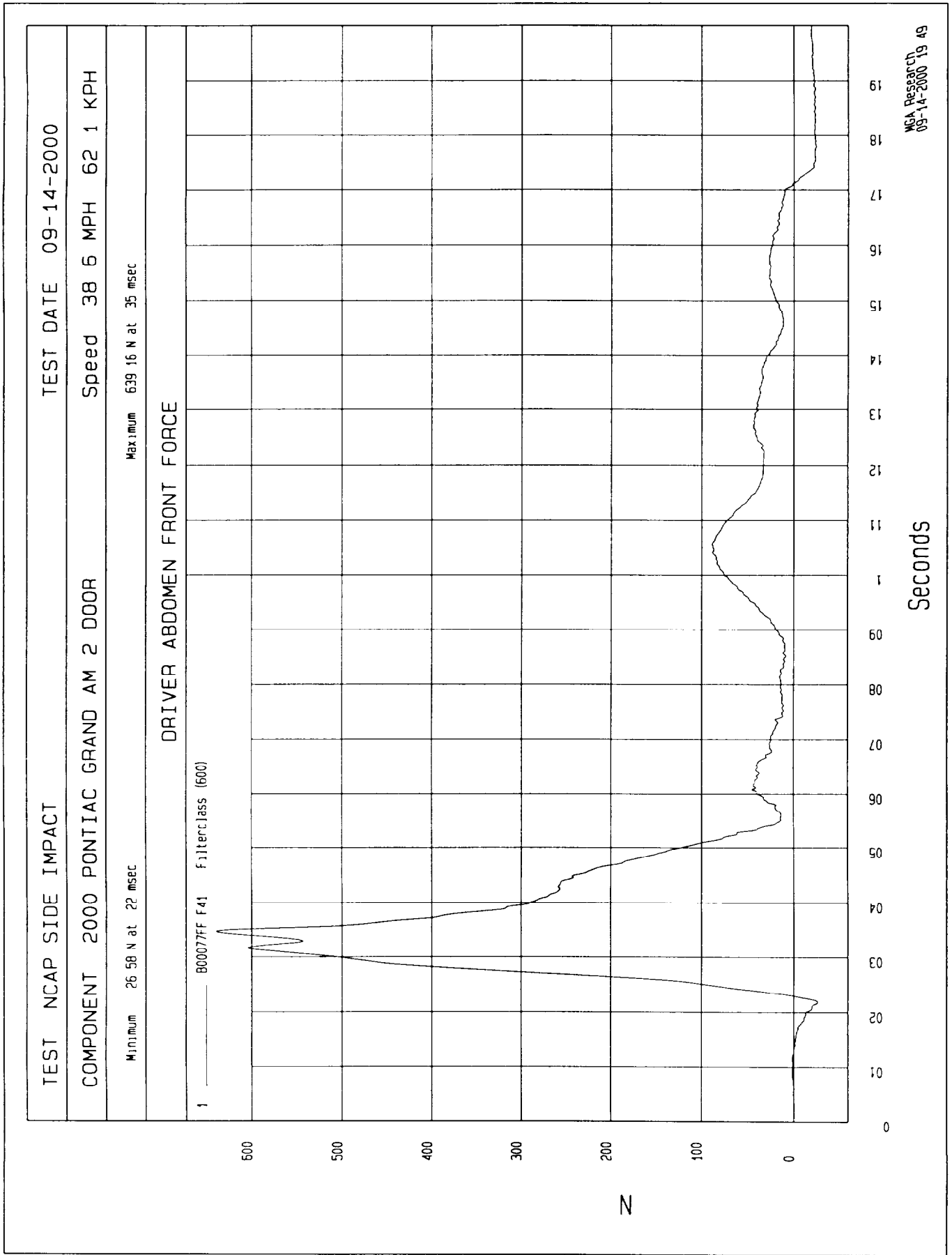
TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 37 07 G s at 42 msec	Maximum 101 55 G s at 26 msec

DRIVER PELVIS Y ACCELERATION



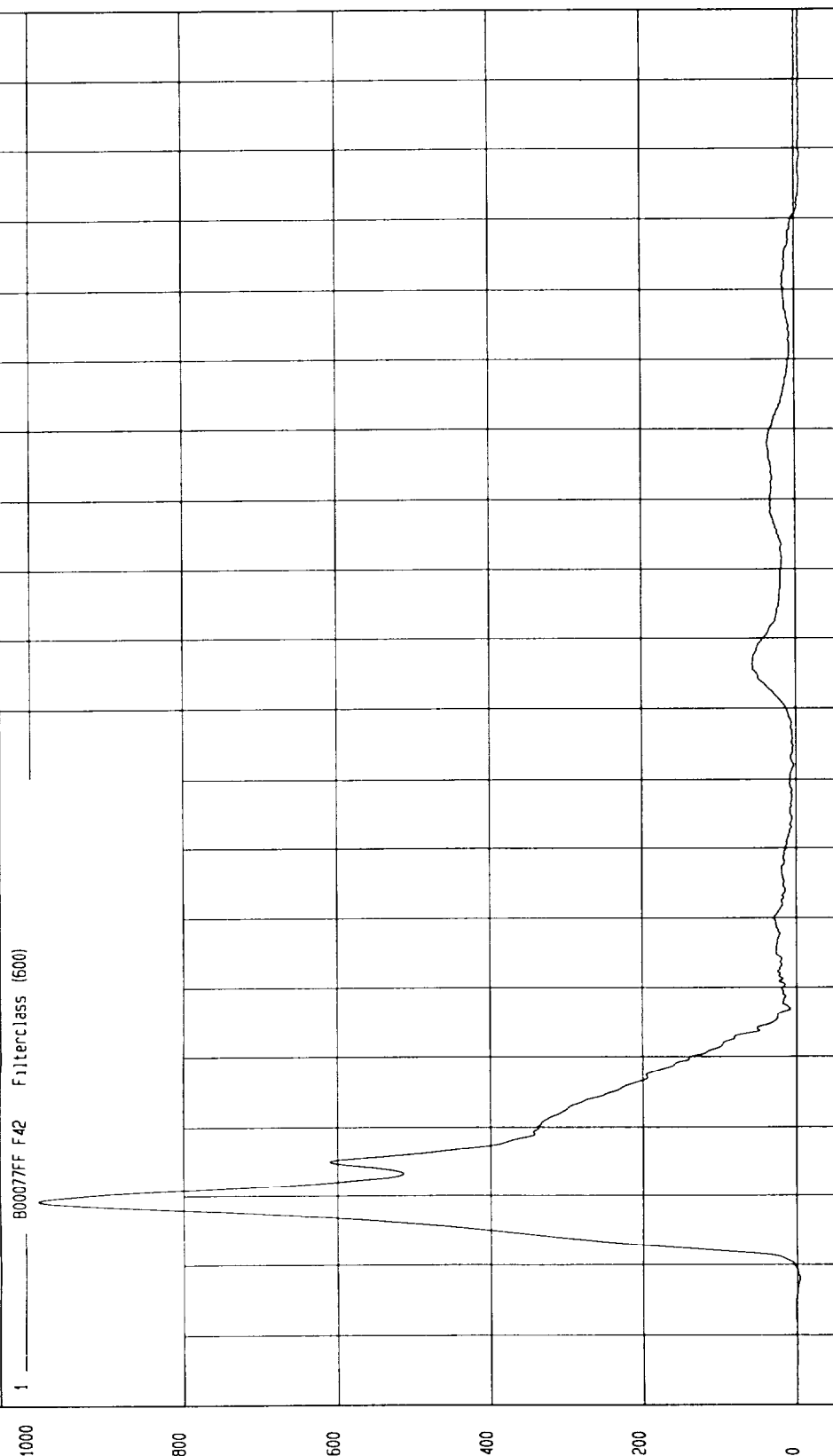
Seconds

MGA Research
09-14-2000 19:33



TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	7.2 N at 179 msec	Maximum	990.23 N at 29 msec

DRIVER ABDOMEN MID FORCE



Seconds

MGA Research
09-14-2000 19:49

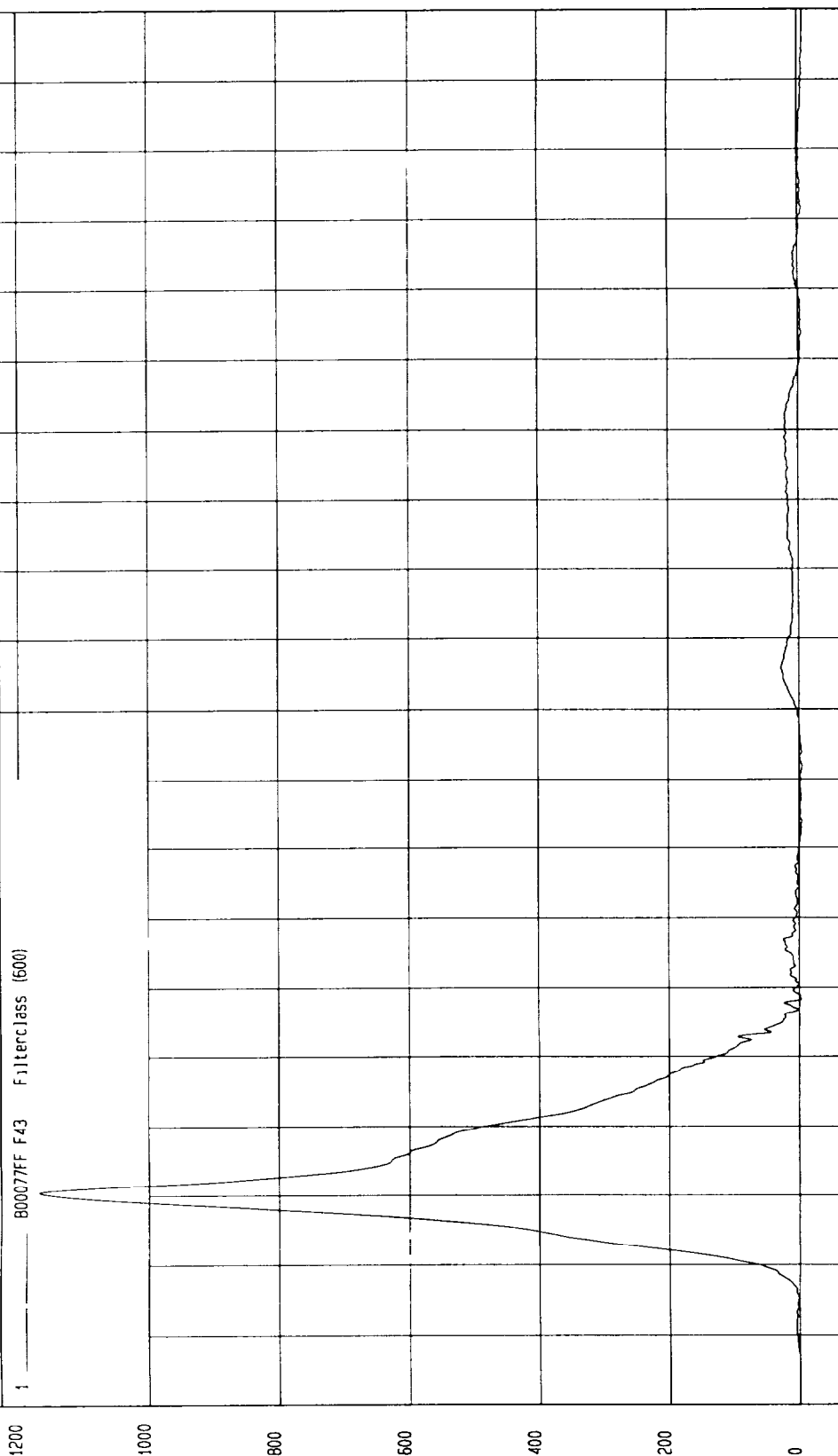
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38.6 MPH 62.1 KPH

Minimum 8.6 N at 199 msec Maximum 1159.85 N at 30 msec

DRIVER ABDOMEN REAR FORCE

1 ——— 800077FF F43 Filterclass (600)

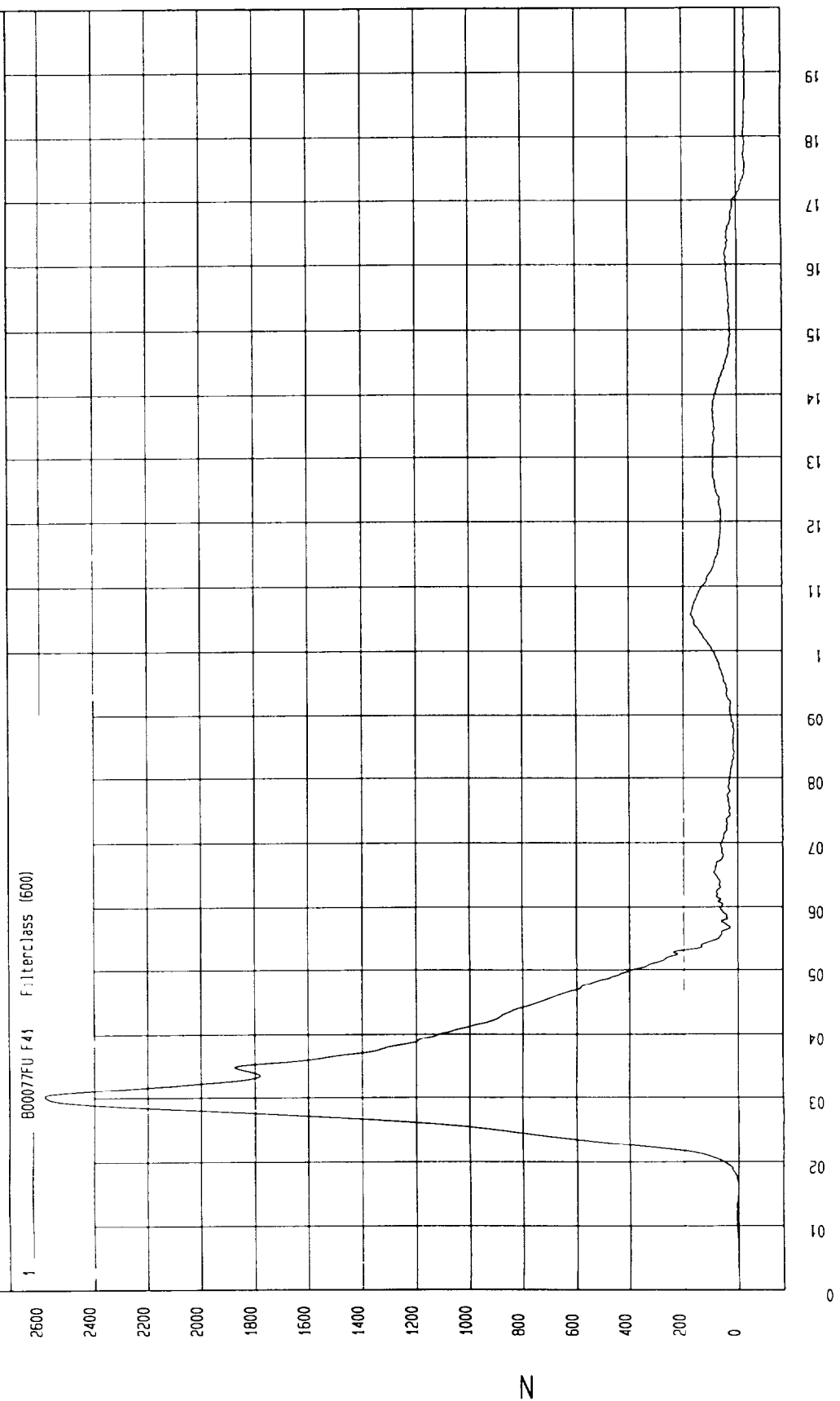


MGA Research
09-14-2000 19:49

Seconds

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 36 14 N at 188 msec	Maximum 2586 63 N at 30 msec

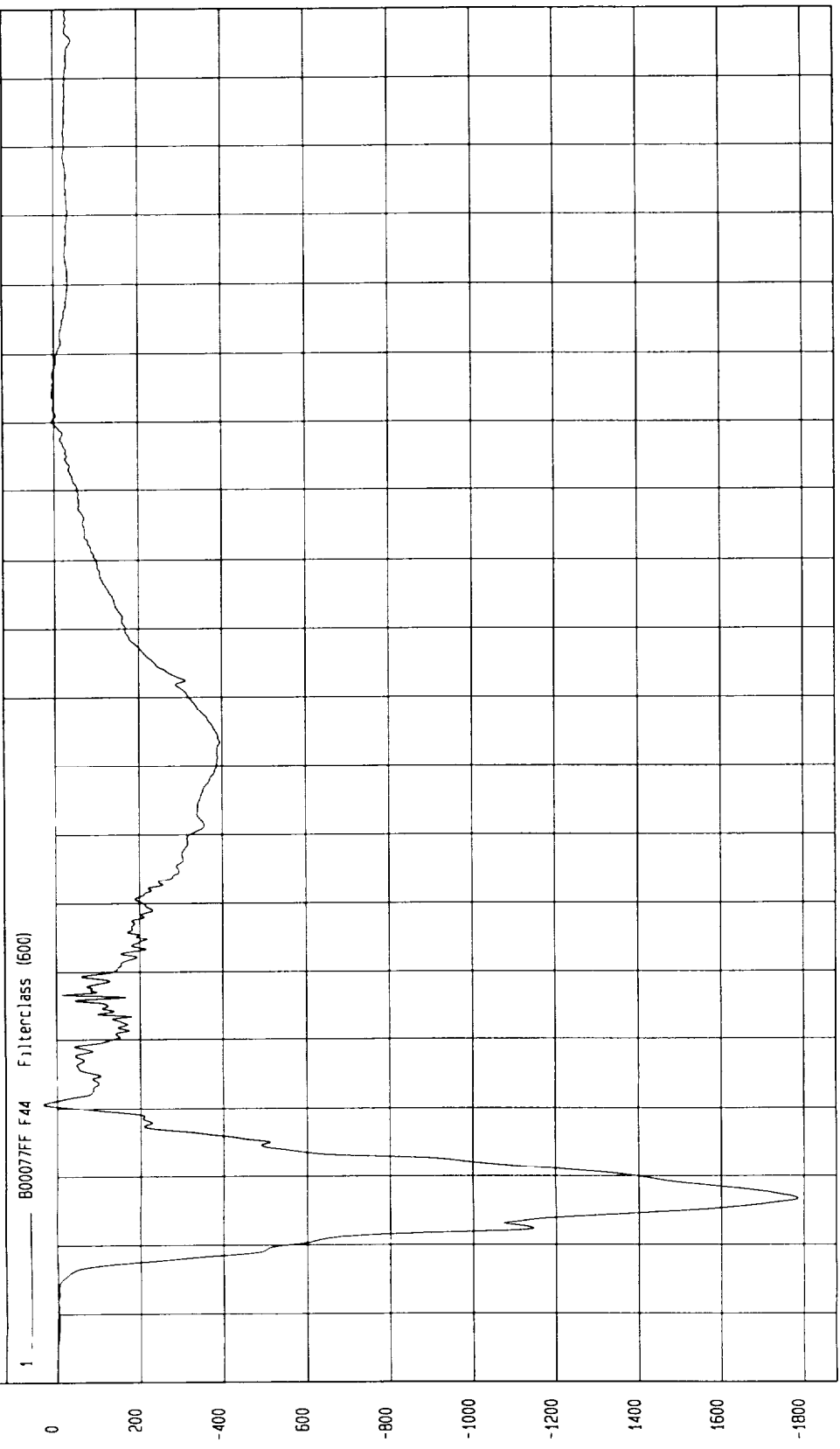
DRIVER SUMMED ABDOMEN FORCE



MCA Research
09-14-2000 19 49

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 1786 04 N at 27 msec	Maximum = 33 65 N at 41 msec

DRIVER PUBIC SYMPHYSIS FORCE

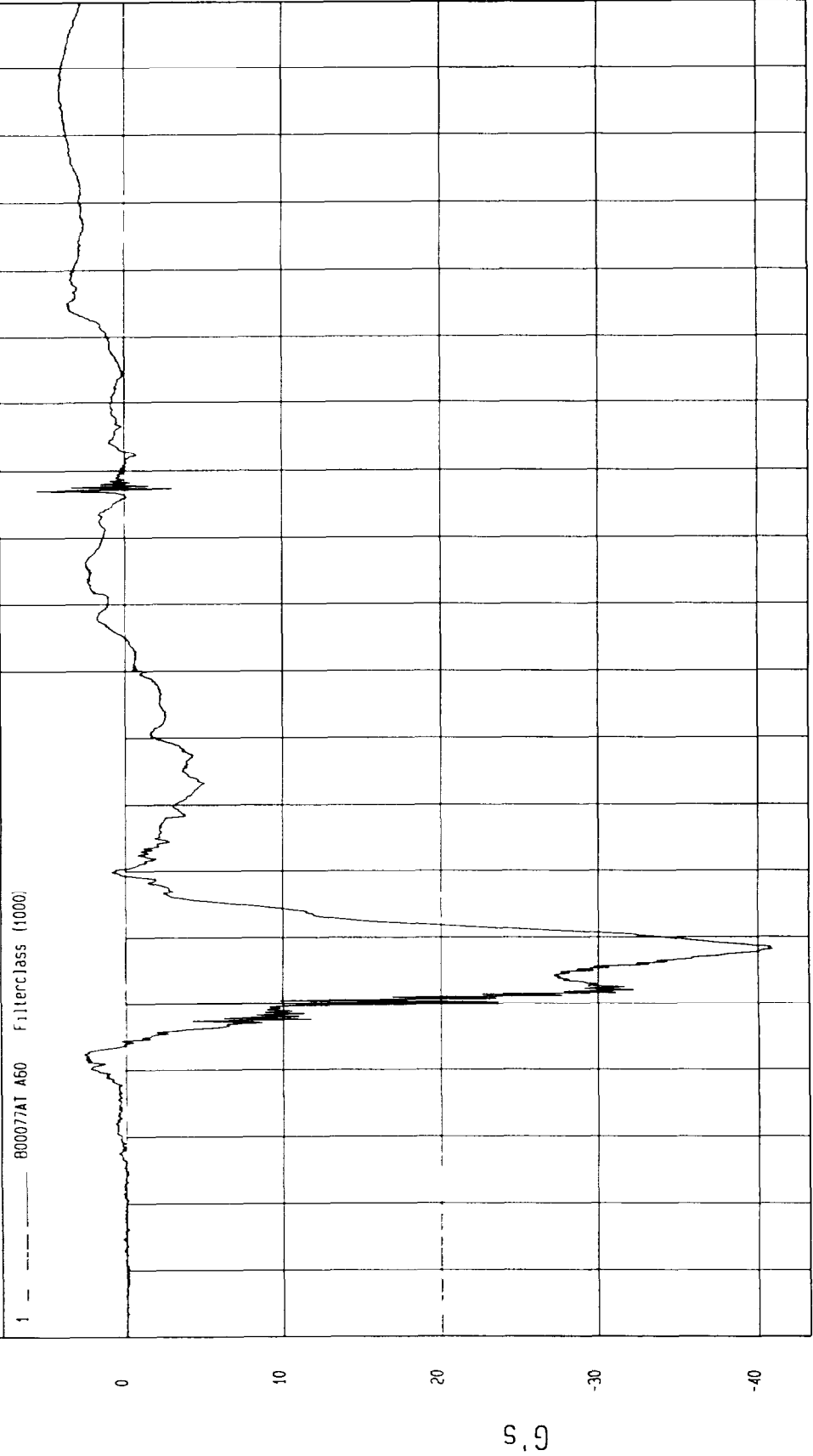


MGA Research
09-14-2000 19 49

Seconds

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 40 94 G s at 58 msec	Maximum 5 48 G s at 127 msec

PASSENGER HEAD X ACCELERATION



Seconds

MGA Research
09-14-2000 19:50

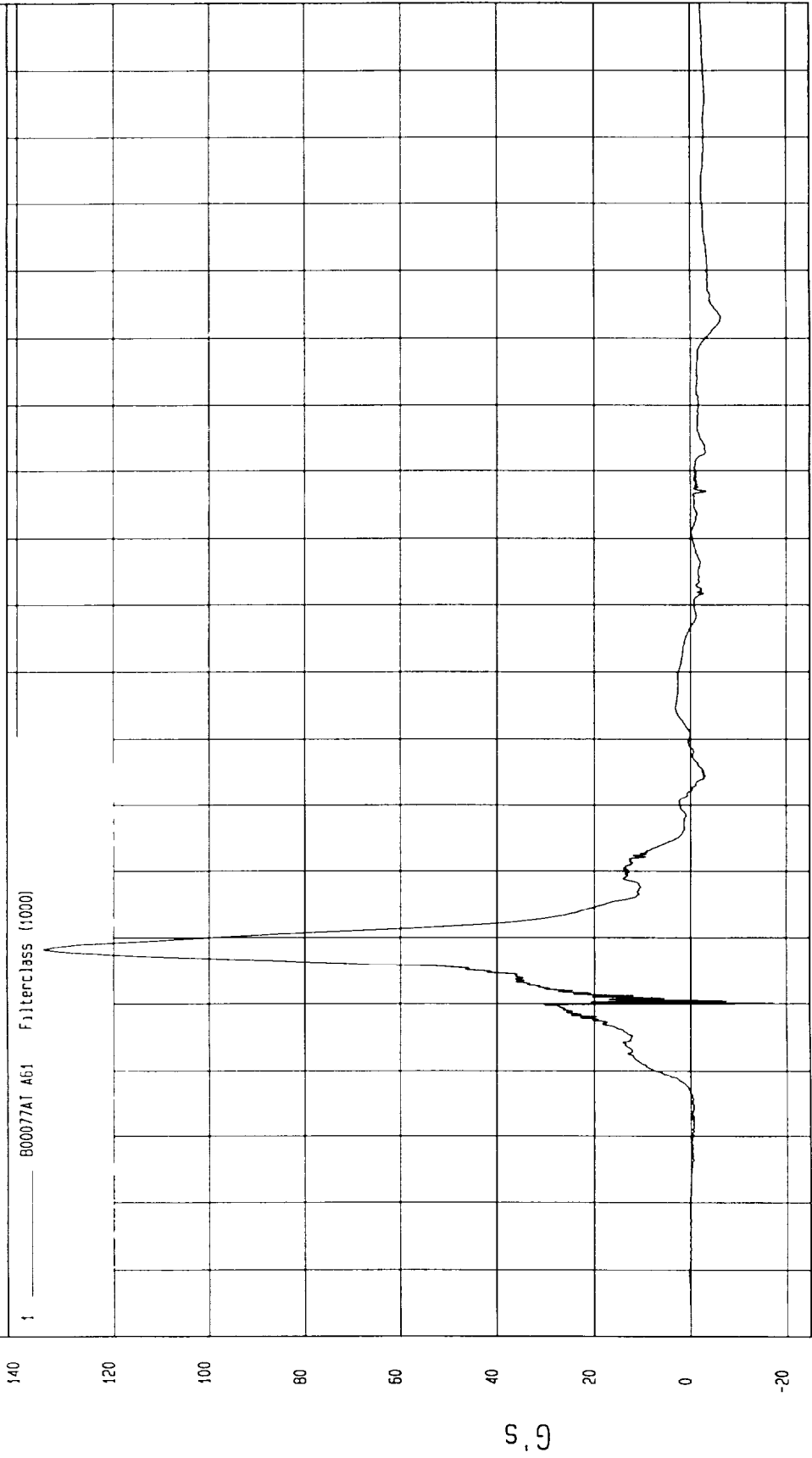
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 1/226, at 50 msec Maximum 134.55 G s at 58 msec

PASSENGER HEAD Y ACCELERATION

1 B00077AT A61 Filterclass (1000)



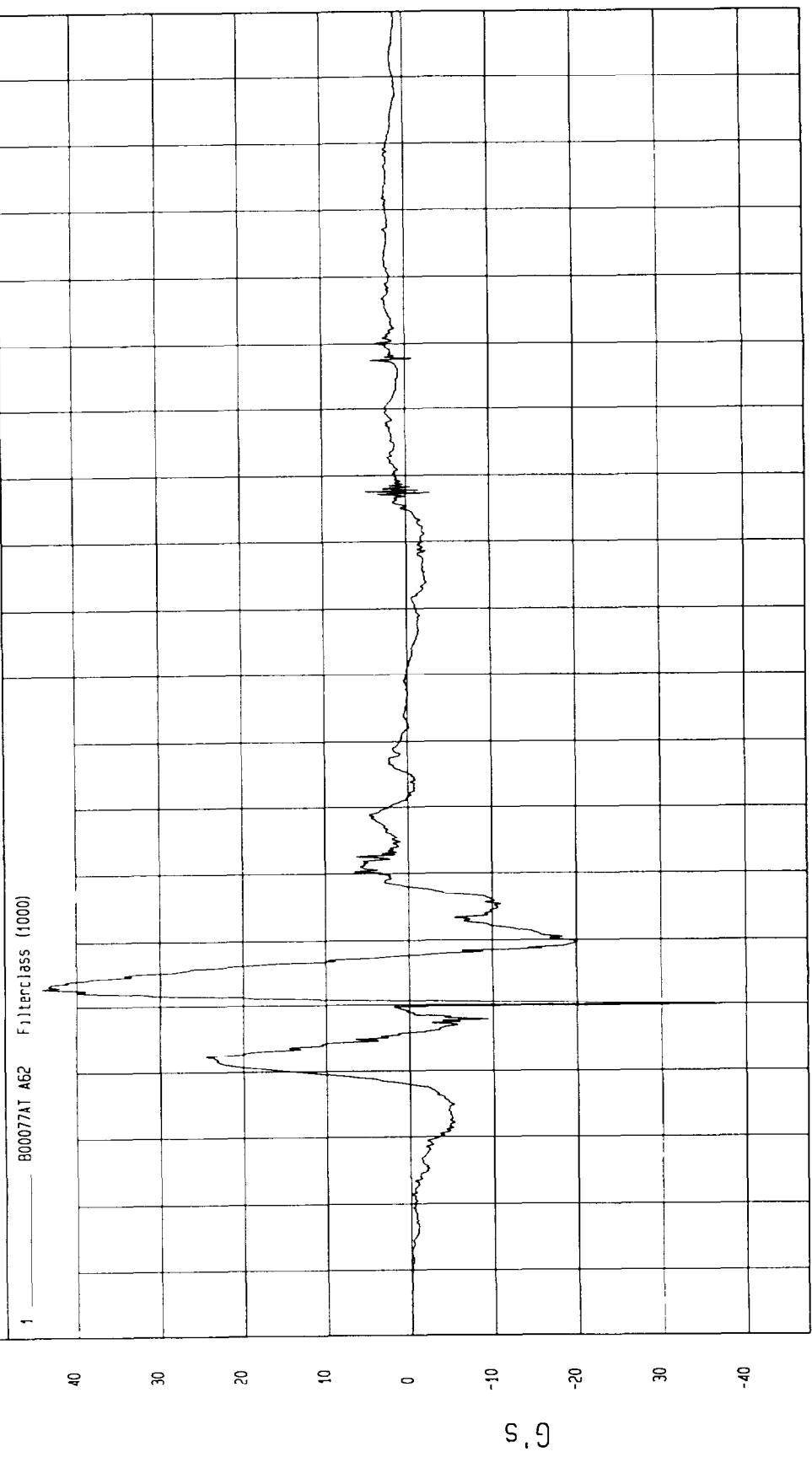
MCA Research
09-14-2000 19 50

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 42 96 G s at 50 msec Maximum 44 19 G s at 53 msec

PASSENGER HEAD Z ACCELERATION



Seconds

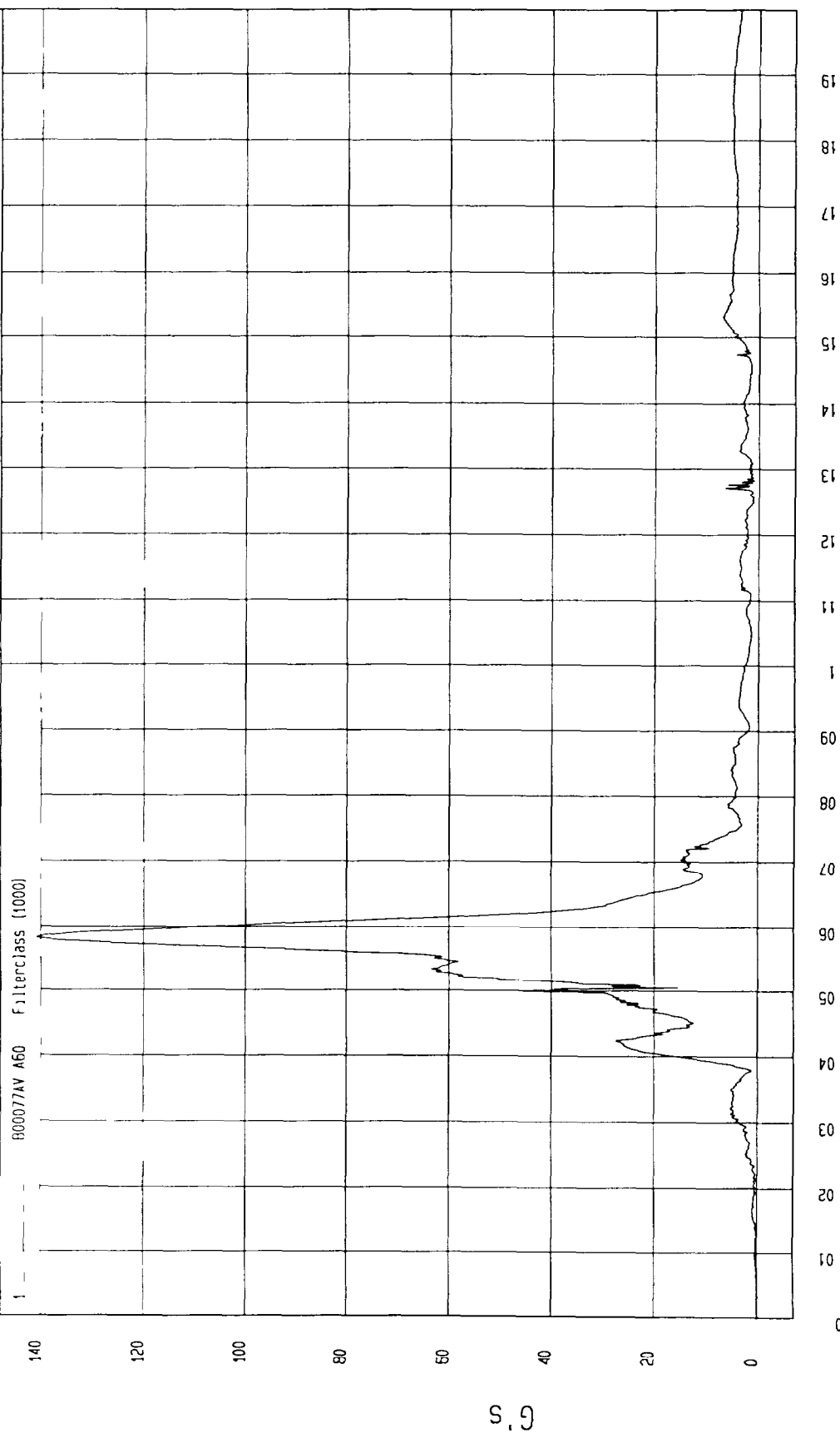
MGA Research
09-14-2000 19 50

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 3 886 02 G s at 7 msec Maximum 140 81 6 s at 58 msec

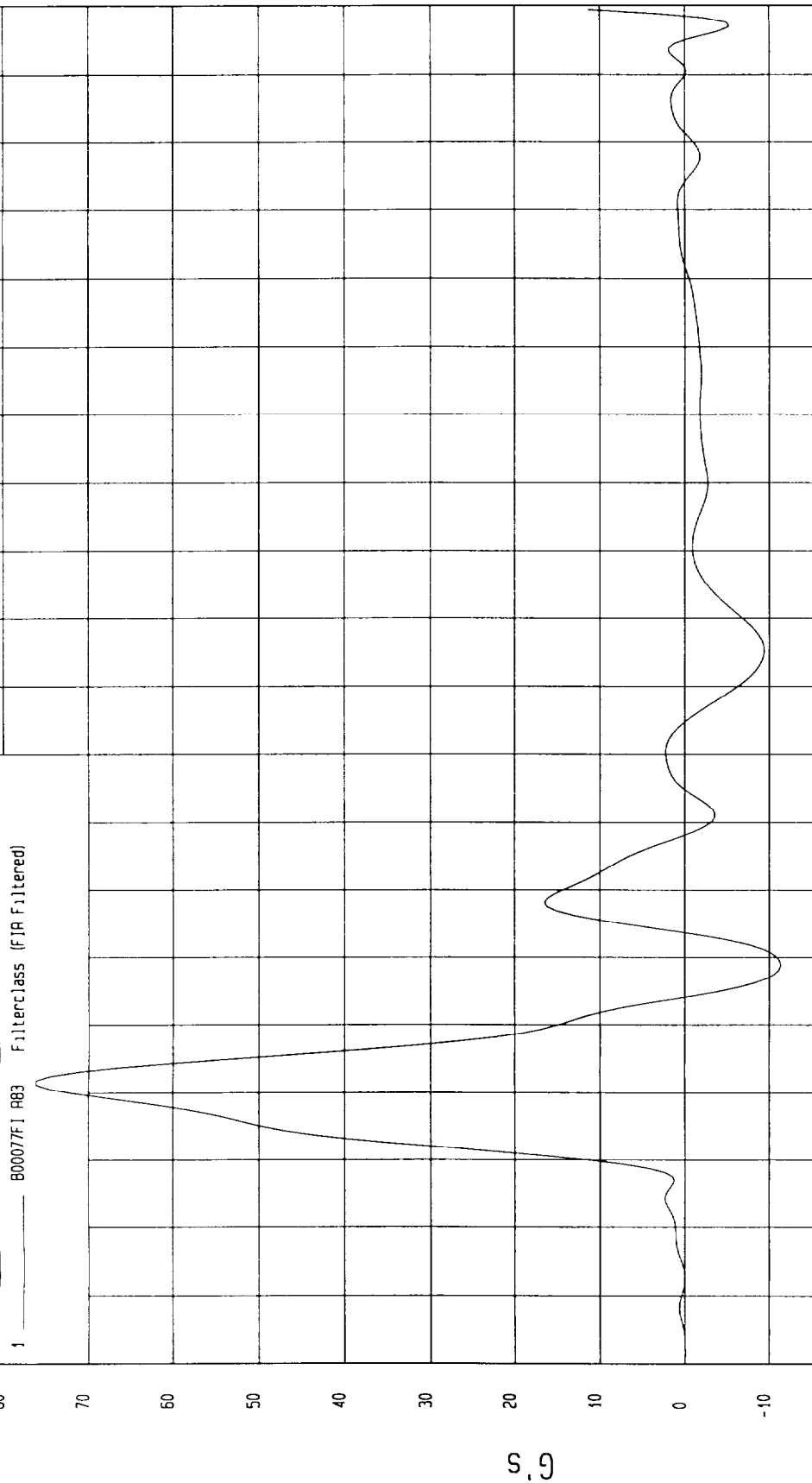
PASSENGER HEAD RESULTANT

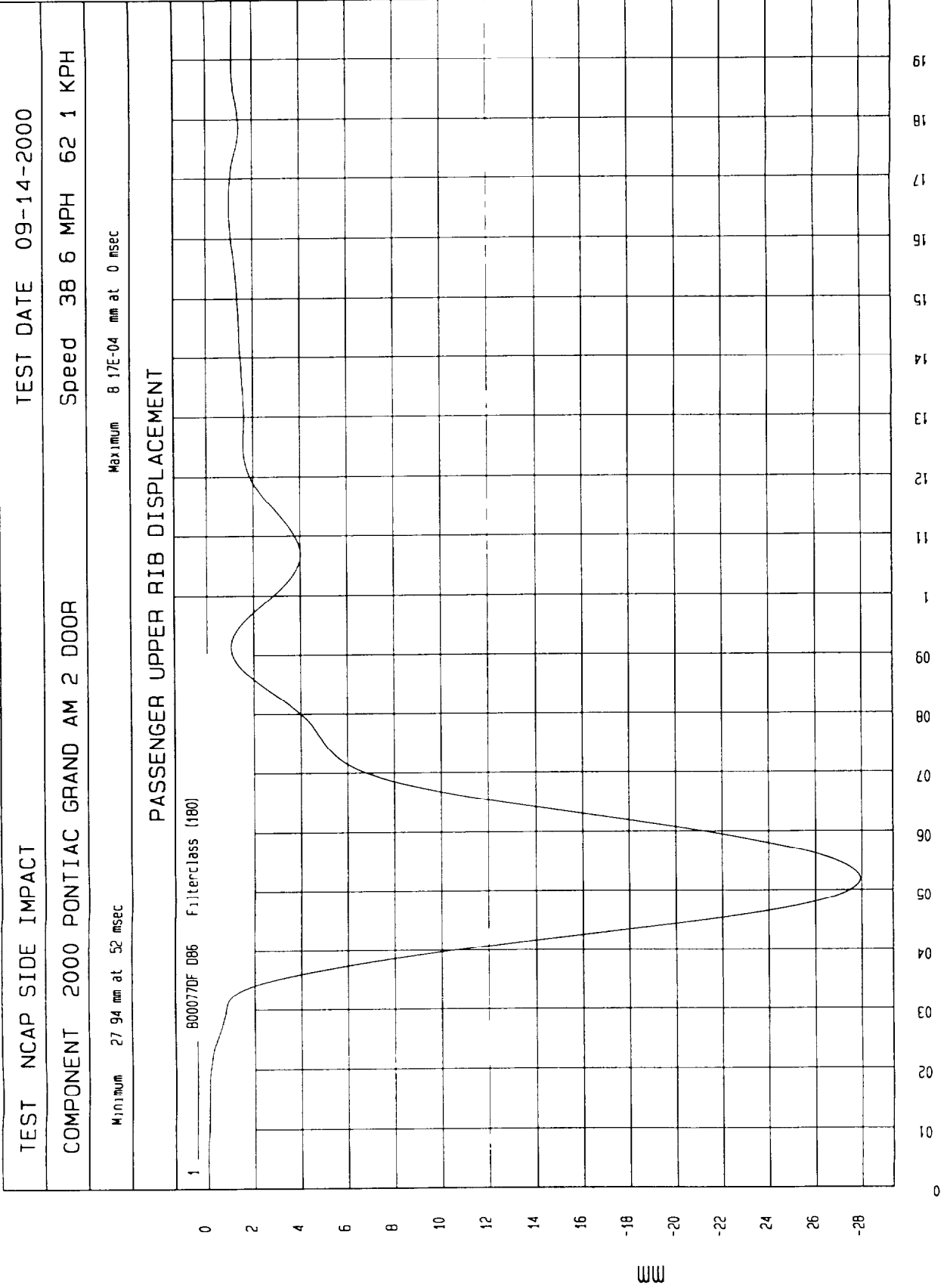


MGA Research
09-14-2000 19:50

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 11 32 6 s at 59 msec	Maximum - 76 19 6 s at 42 msec

PASSENGER UPPER RIB Y ACCELERATION





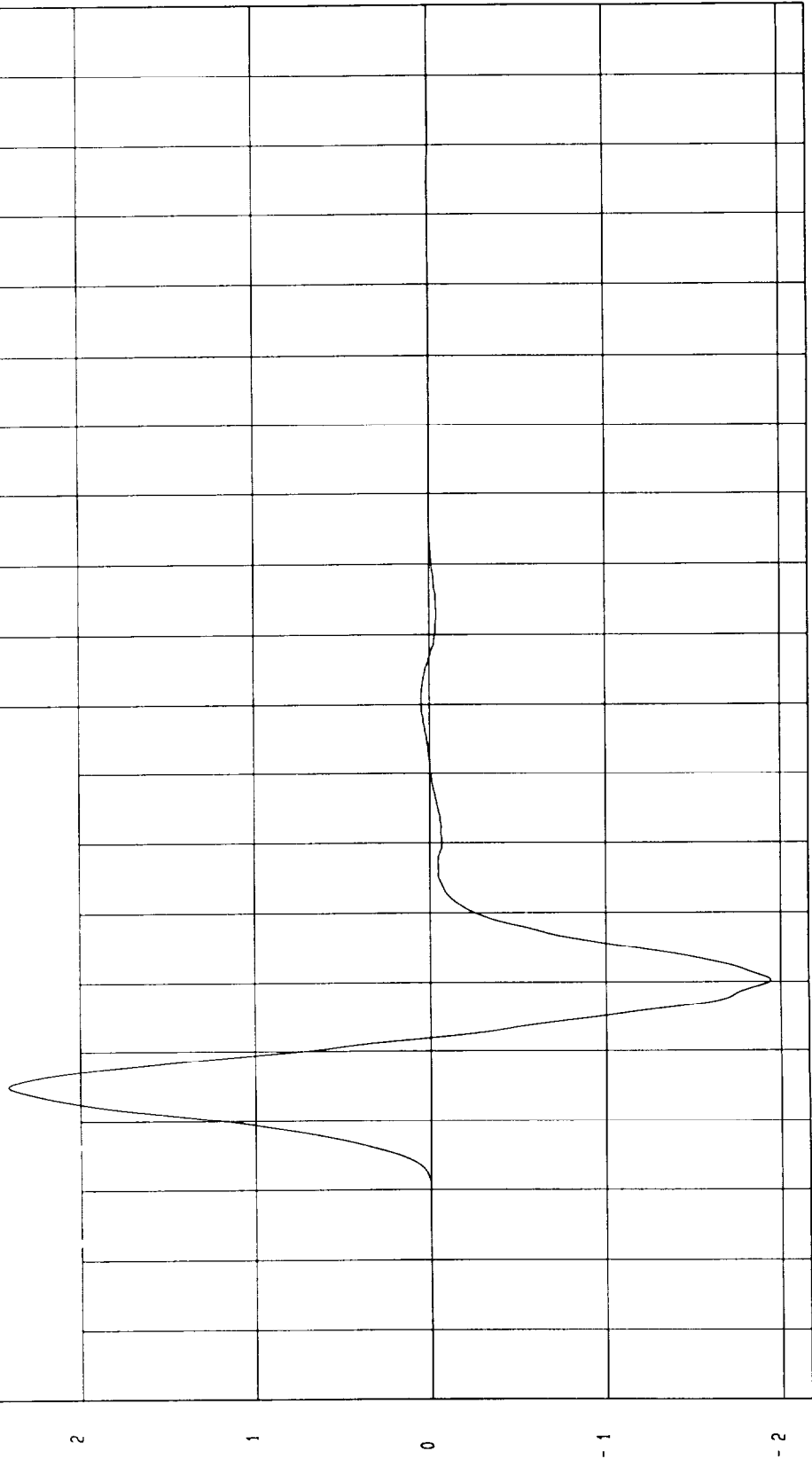
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH

Minimum 19 at 60 msec Maximum 24 at 45 msec

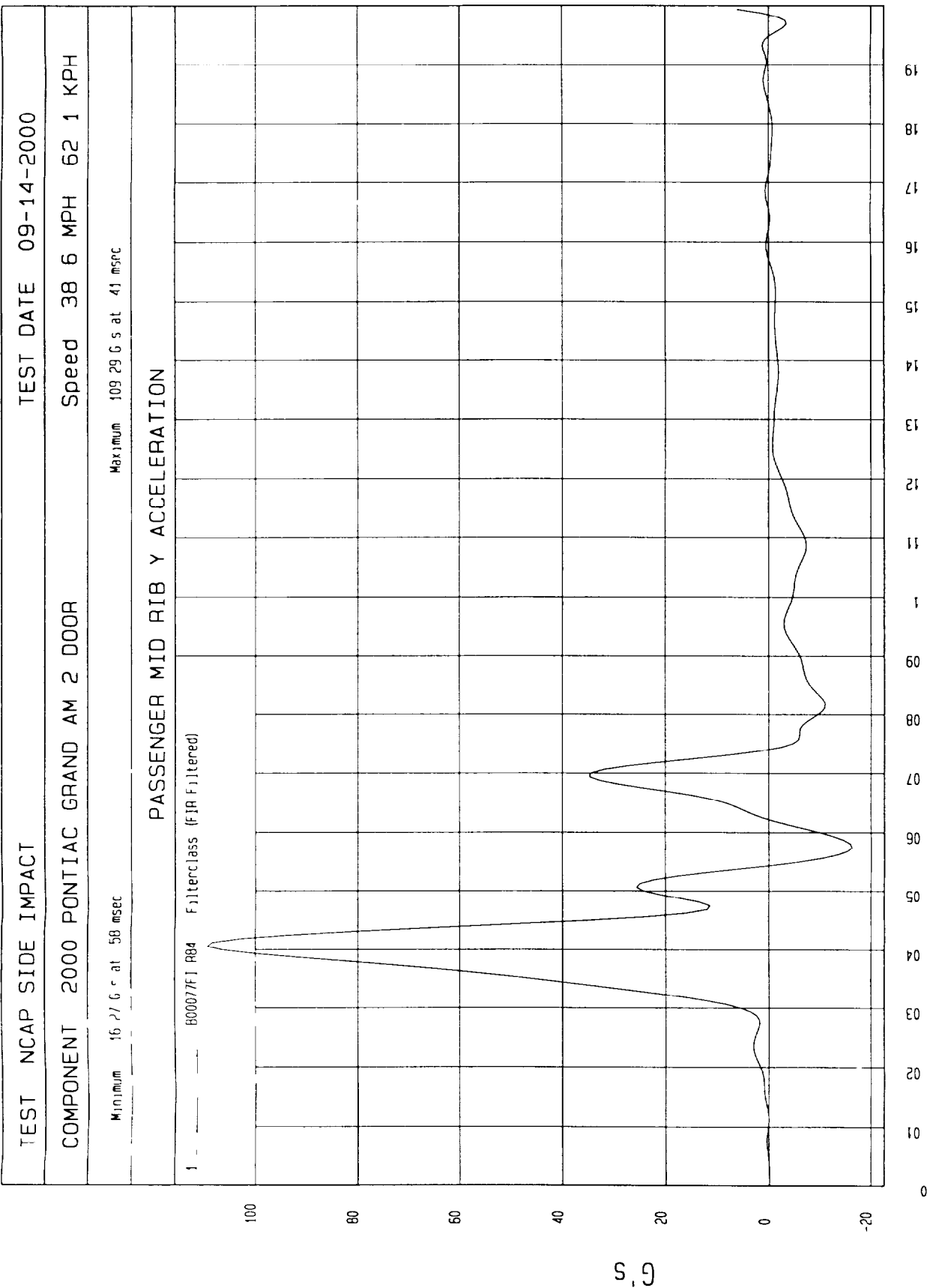
PASSENGER UPPER RIB VISCOUS CRITERIA

1 8000770V C86 Filterclass (180)



MSA Research
09-14-2000 19:52

Seconds

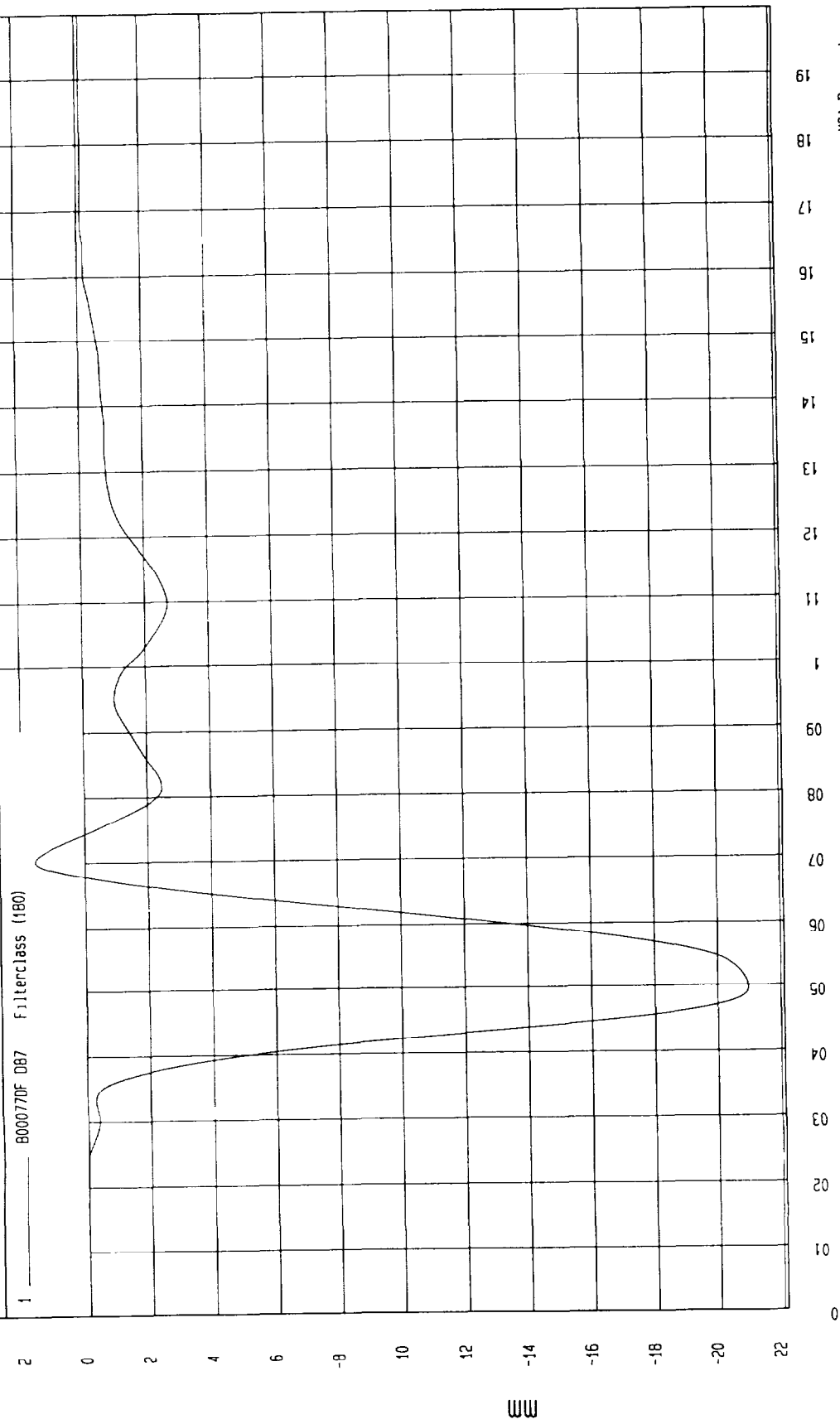


NGA Research
09-14-2000 19:34

Seconds

TEST NCAP SIDE IMPACT TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38 6 MPH 62 1 KPH
Minimum 20 99 mm at 50 msec Maximum 1 57 mm at 70 msec

PASSENGER MID RIB DISPLACEMENT

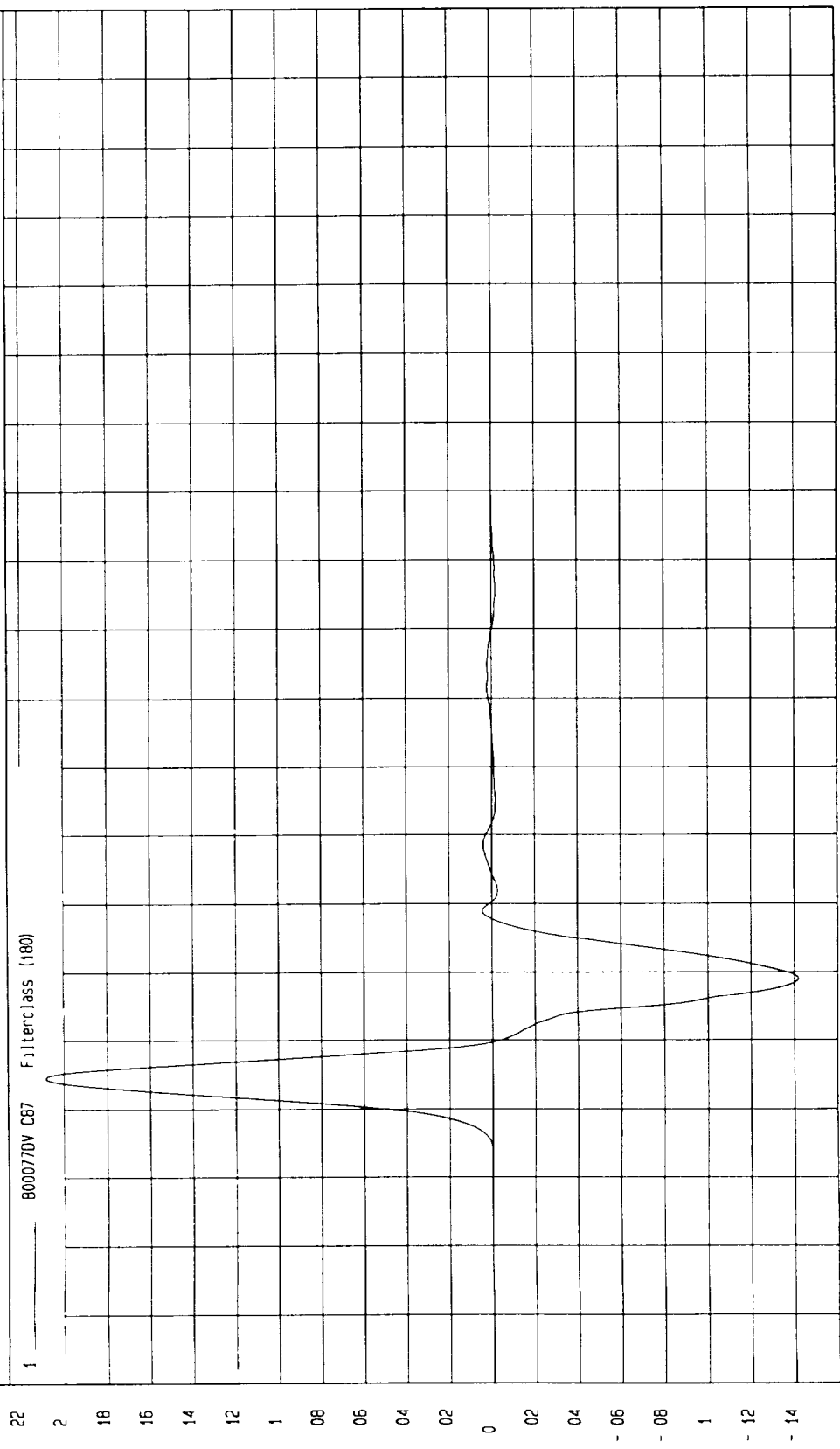


MCA Research
09-14-2000 19 52

Seconds

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 14 at 59 msec	Maximum 21 at 44 msec

PASSENGER MID RIB VISCOUS CRITERIA

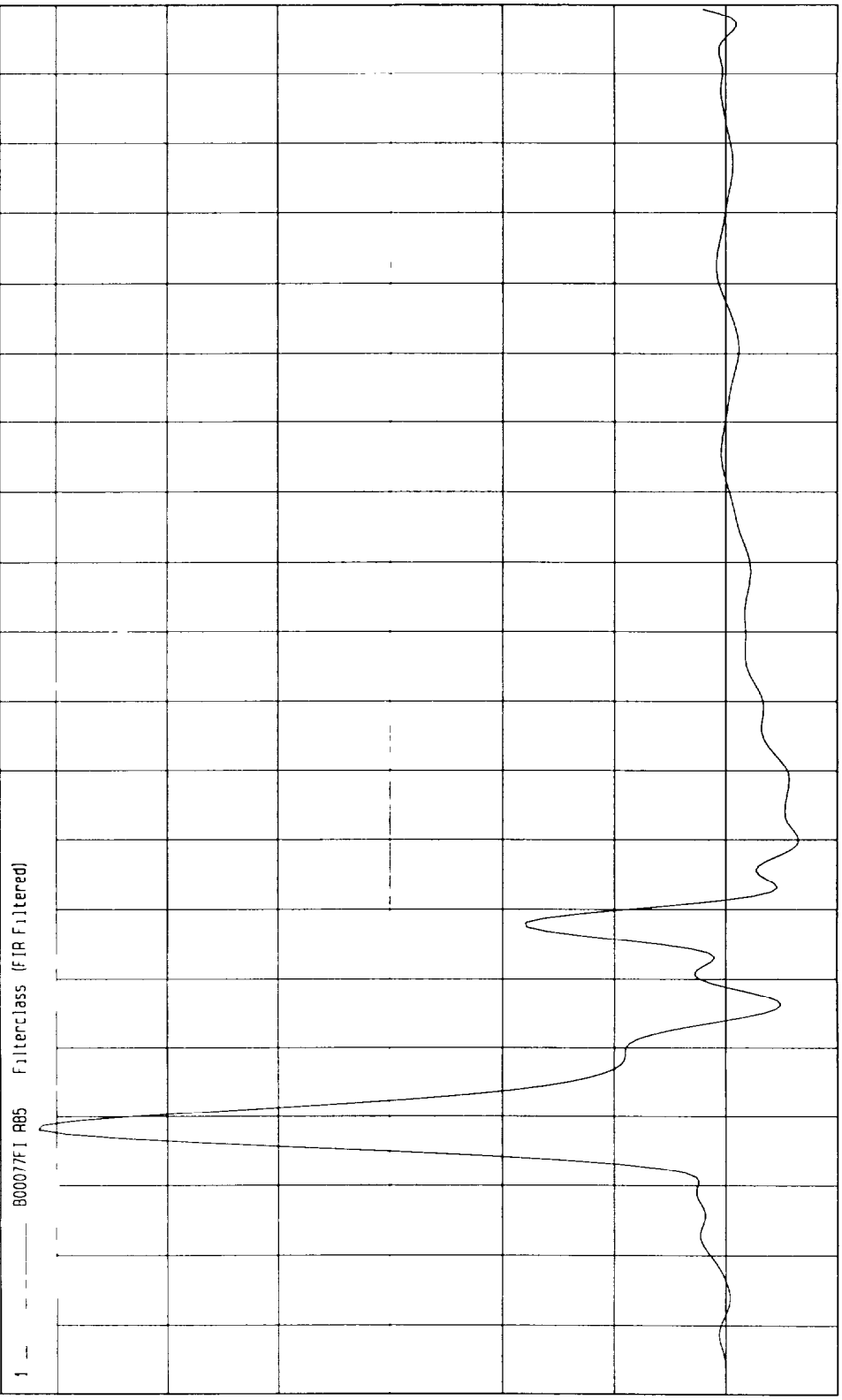


MGA Research
09-14-2000 19:52

Seconds

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	13 02 G s at 80 msec	Maximum	123 22 G s at 38 msec

PASSENGER LOWER RIB Y ACCELERATION



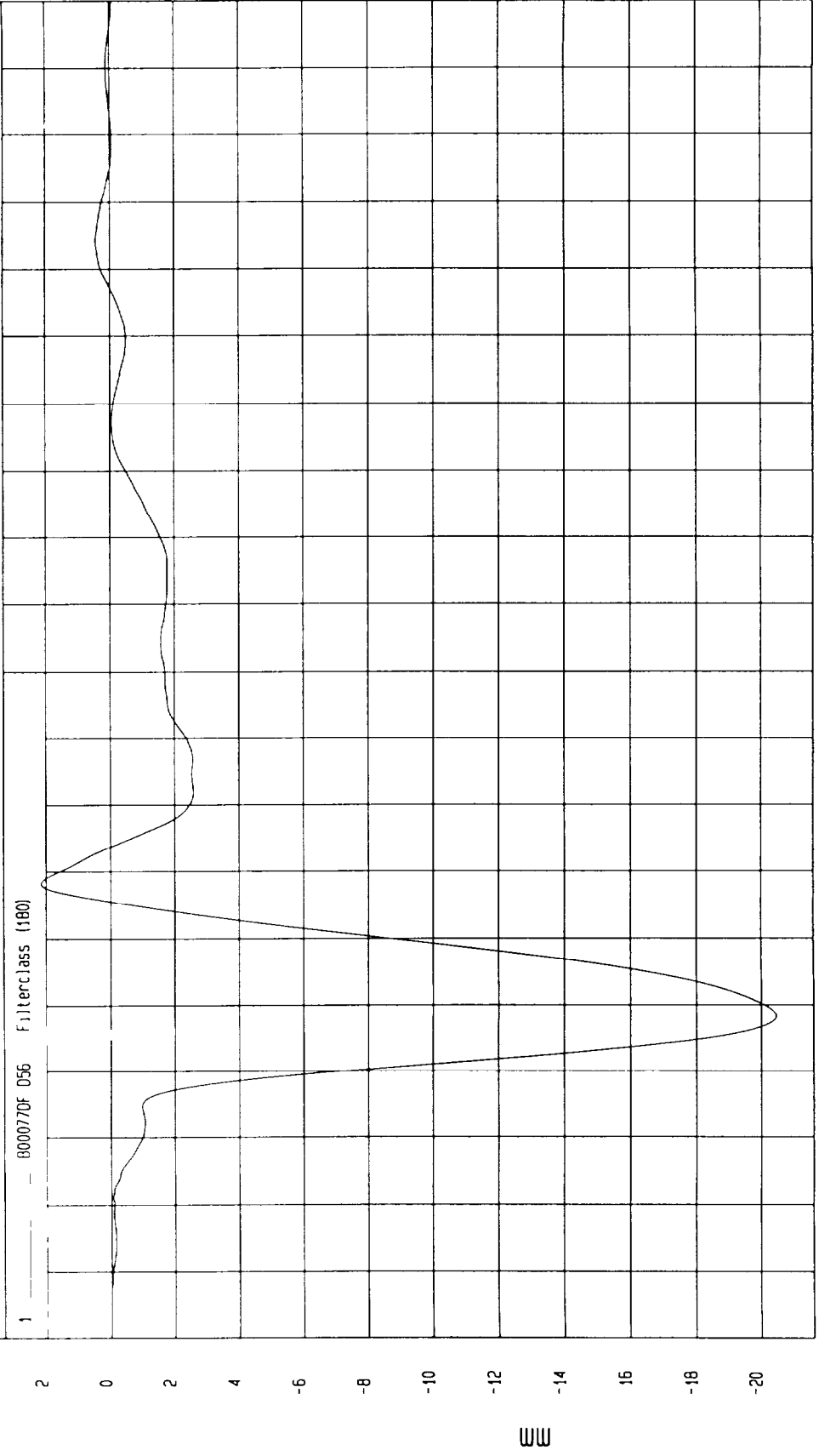
Seconds

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

MECA Research
09-14-2000 19 34

TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 20 45 mm at 48 msec	Maximum 2 15 mm at 68 msec

PASSENGER LOWER RIB DISPLACEMENT



Seconds

WCA Research
09-18-2000 10:27

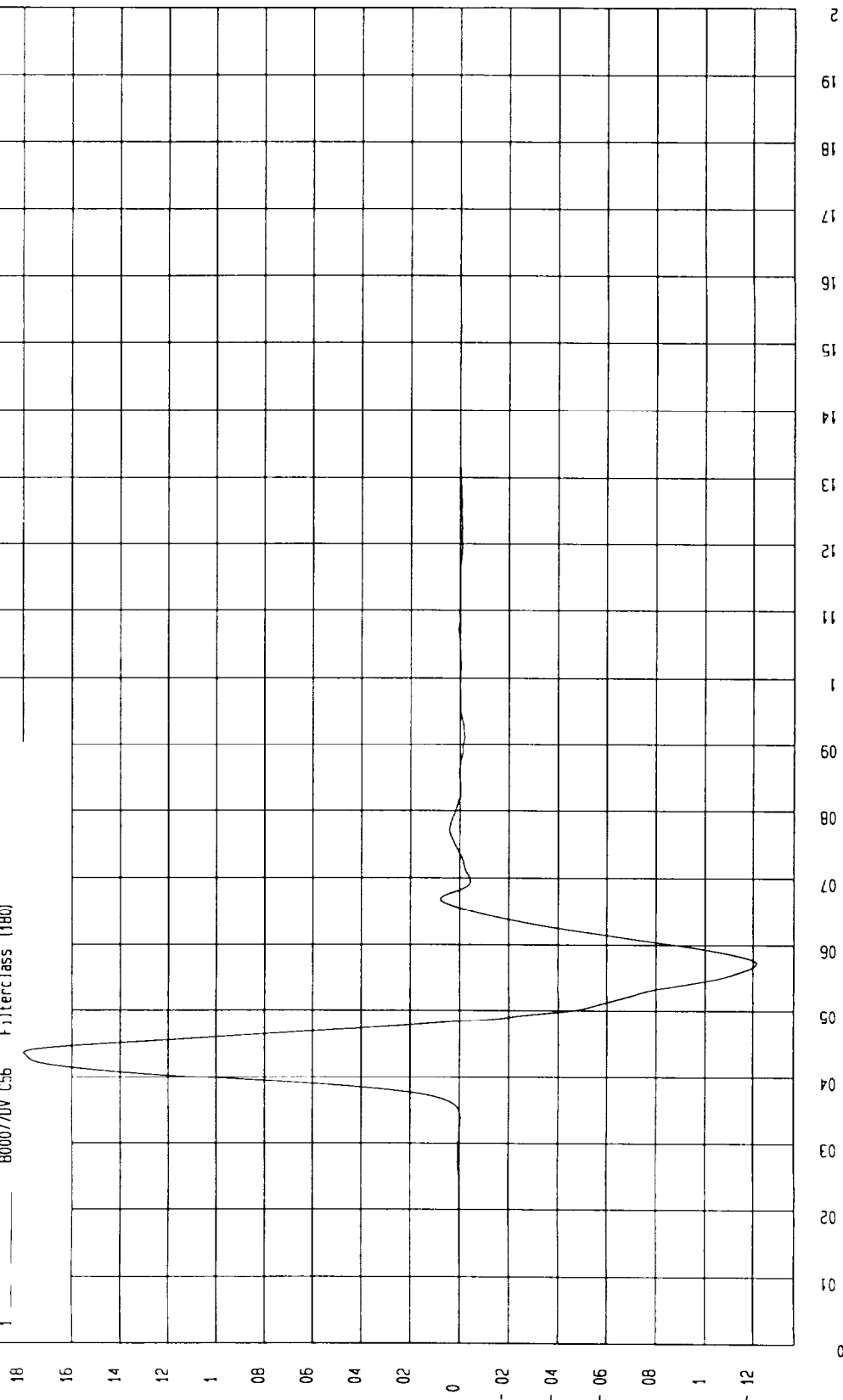
TEST NCAP SIDE IMPACT TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR Speed 38.6 MPH 62.1 KPH

Minimum 12 at 5.7 msec Maximum 18 at 44 msec

PASSENGER LOWER RIB VISCOUS CRITERIA

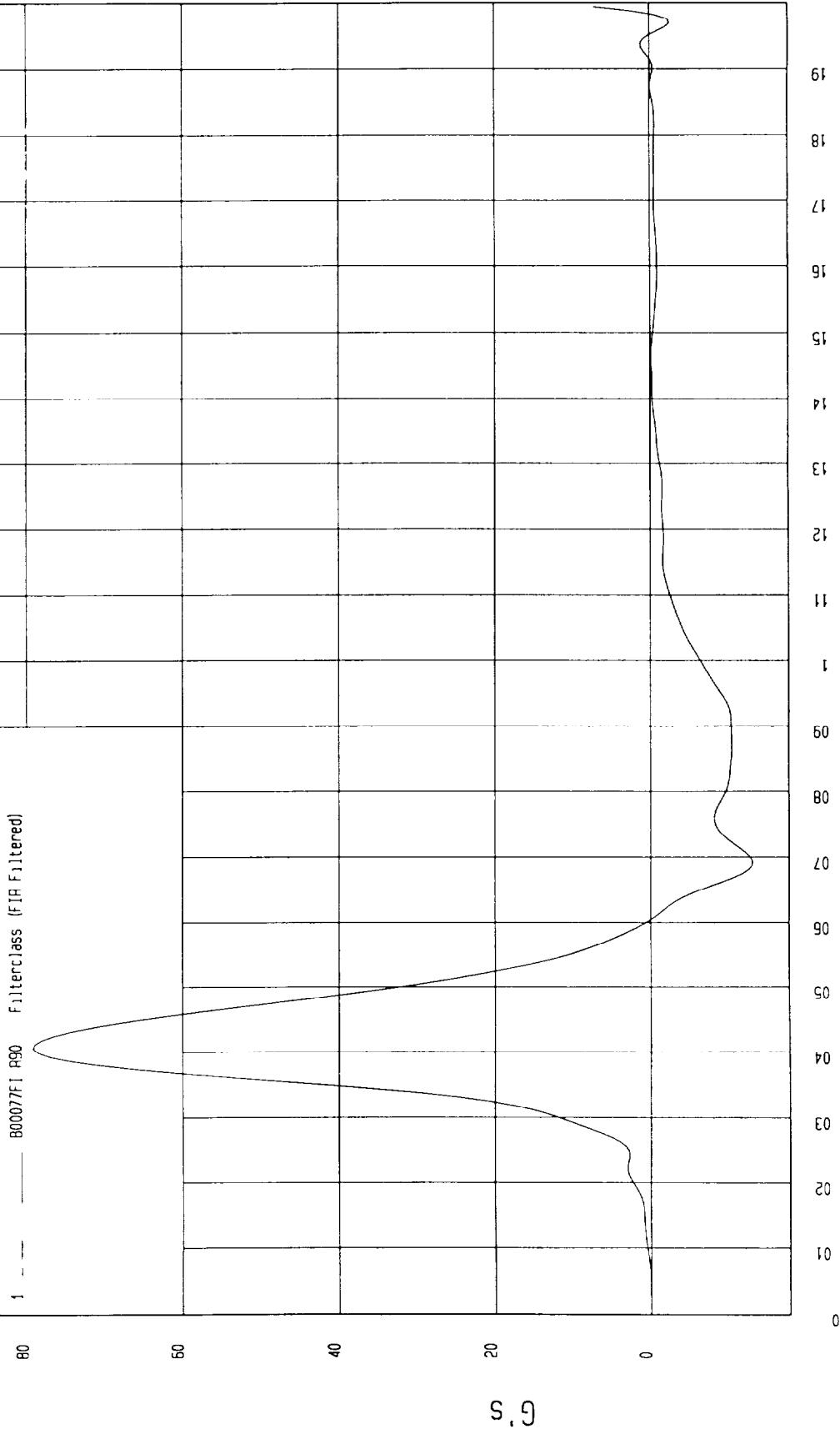
1 — 8000770V C56 Filterclass (180)



MCA Research
09-18-2000 10:29

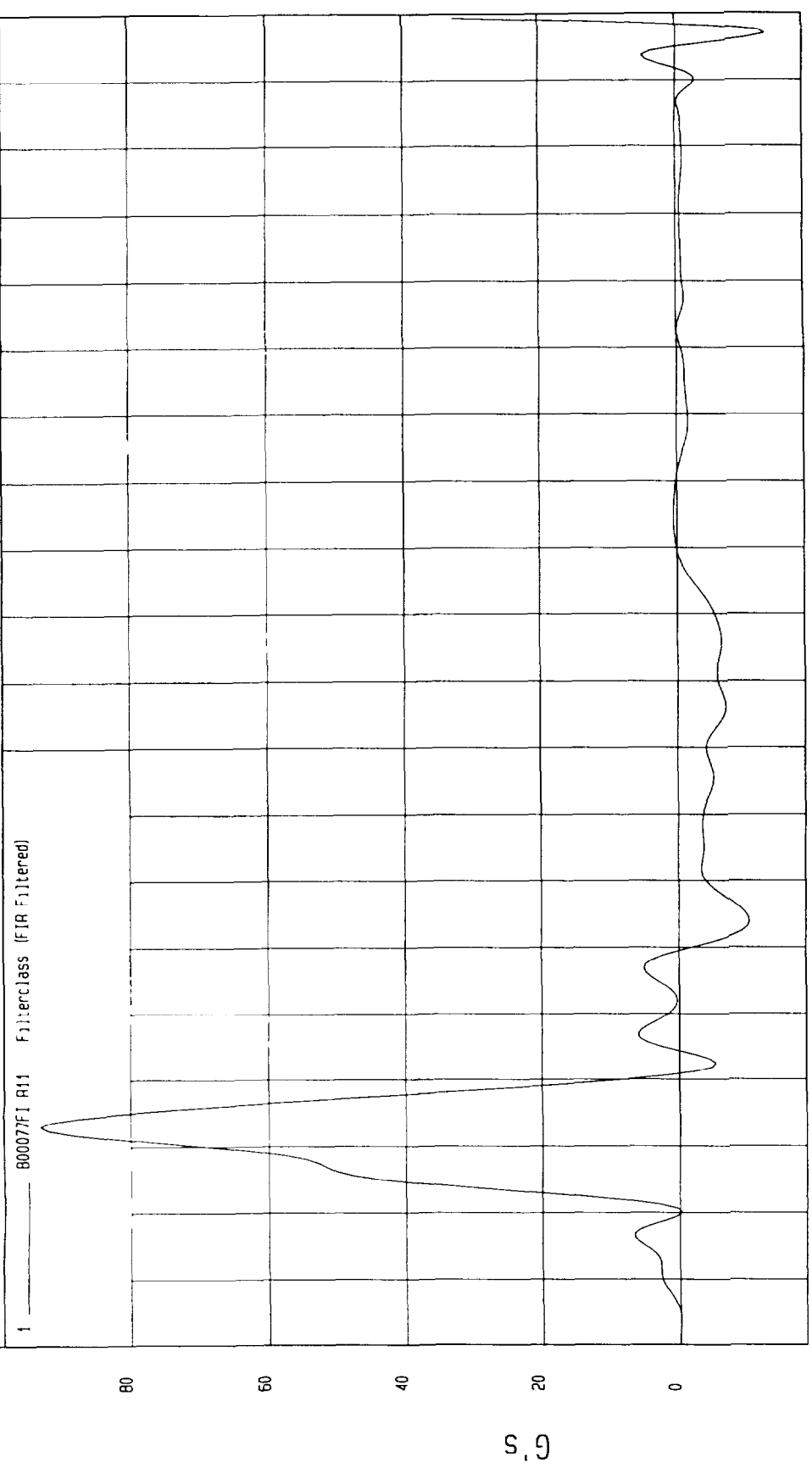
TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38 6 MPH 62 1 KPH
Minimum	13 2 G s at 69 msec	Maximum	79 26 G s at 41 msec

PASSENGER LOWER SPINE Y ACCELERATION



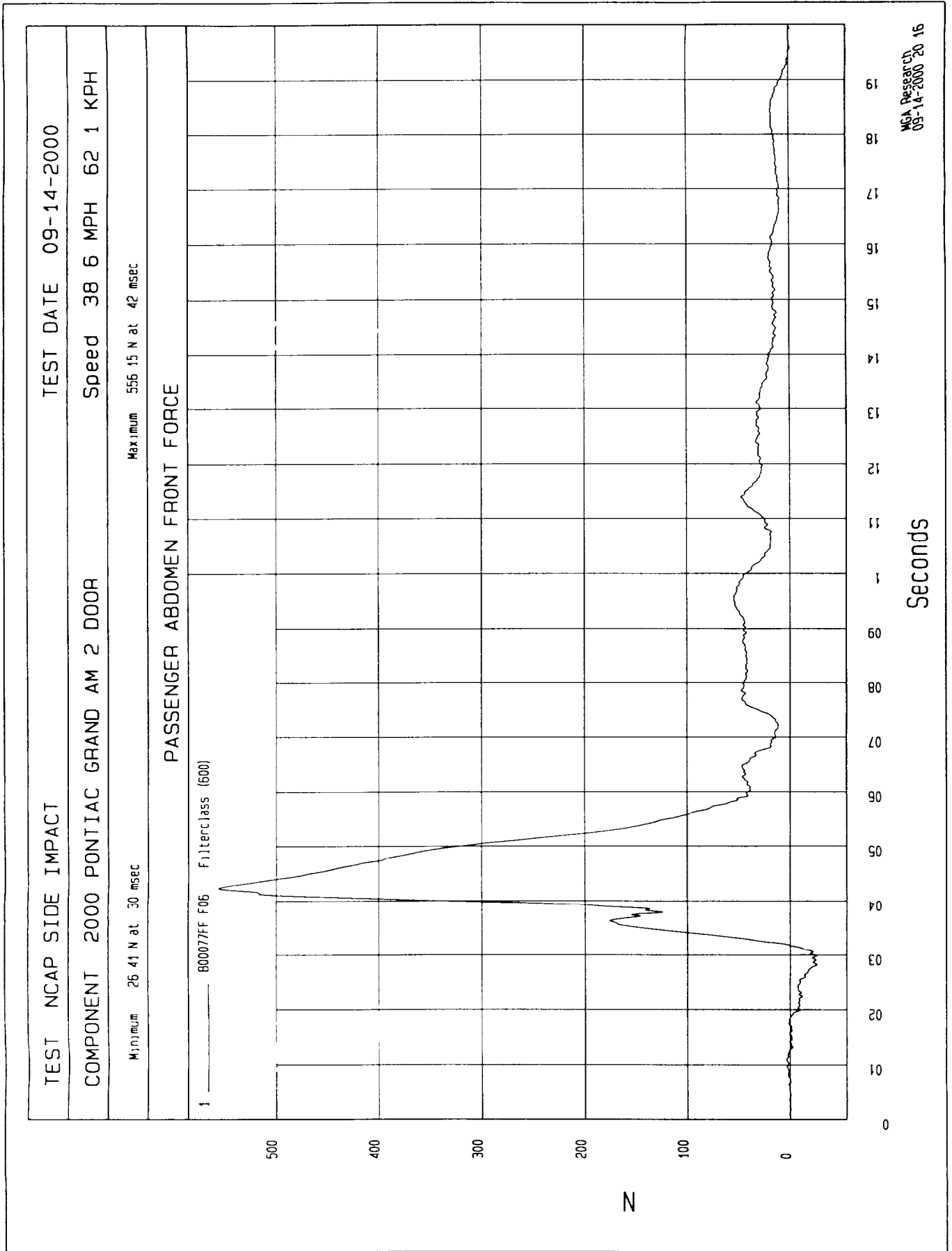
TEST NCAP SIDE IMPACT	TEST DATE 09-14-2000
COMPONENT 2000 PONTIAC GRAND AM 2 DOOR	Speed 38 6 MPH 62 1 KPH
Minimum 13 2 G s at 197 msec	Maximum 92 99 G s at 33 msec

PASSENGER PELVIS Y ACCELERATION



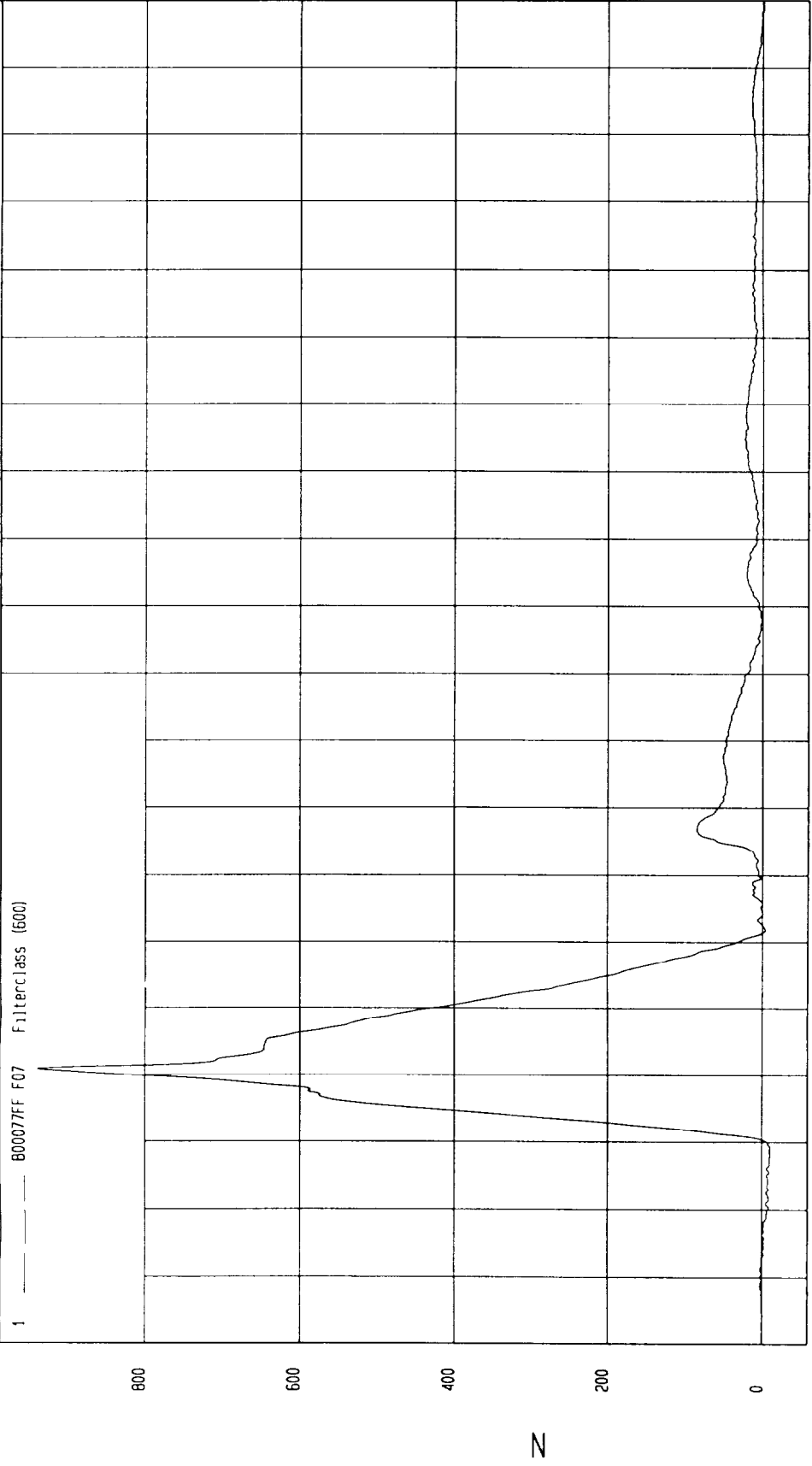
Seconds

MGA Research
09-14-2000 20 11



TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	11.25 N at 28 msec	Maximum	938.98 N at 41 msec

PASSENGER ABDOMEN MID FORCE

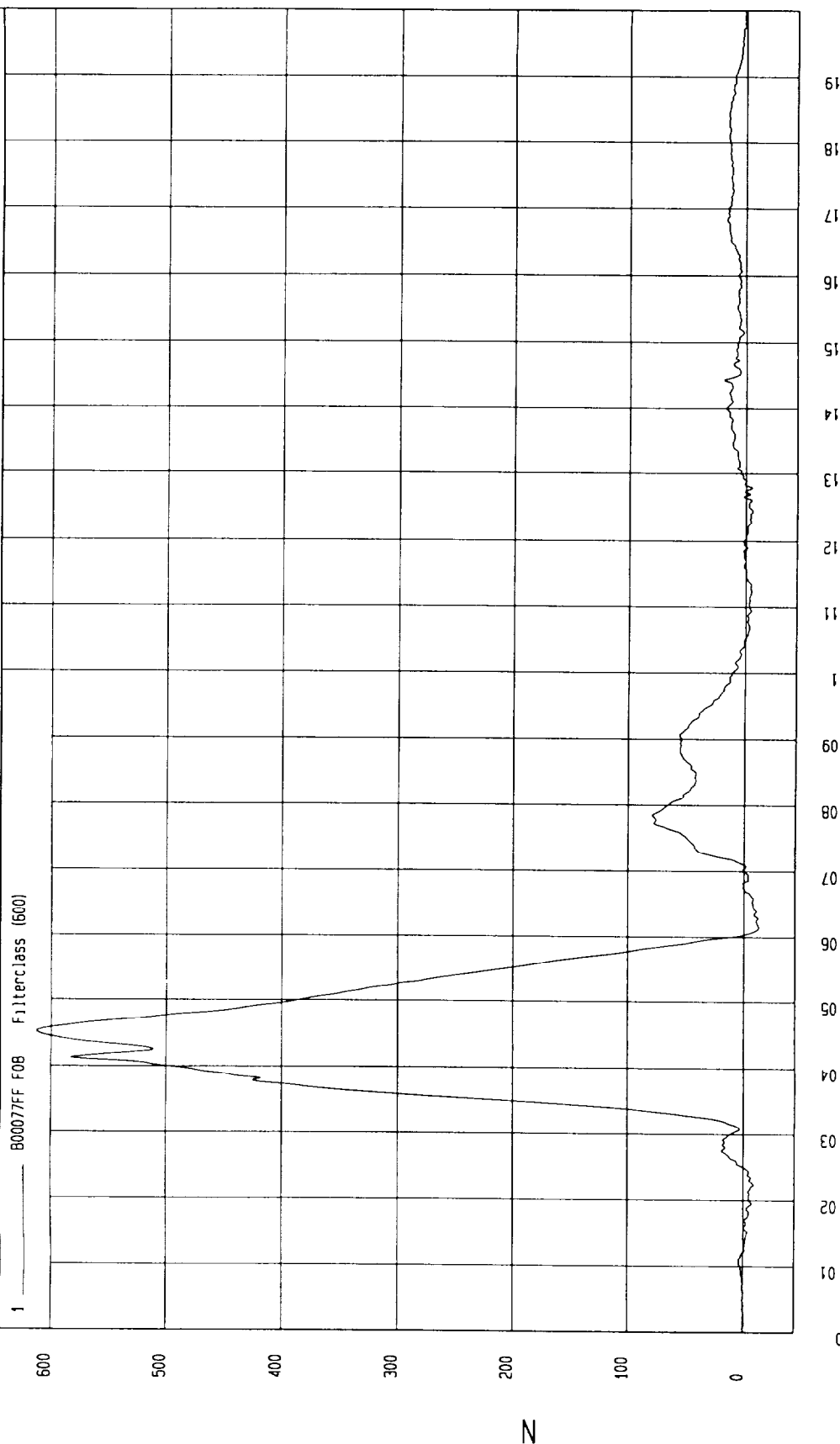


Seconds

WCA Research
09-14-2000 20 16

TEST	NCAP SIDE IMPACT	TEST DATE	09-14-2000
COMPONENT	2000 PONTIAC GRAND AM 2 DOOR	Speed	38.6 MPH 62.1 KPH
Minimum	13.07 N at 62 msec	Maximum	612.84 N at 45 msec

PASSENGER ABDOMEN REAR FORCE



TEST NCAP SIDE IMPACT

TEST DATE 09-14-2000

COMPONENT 2000 PONTIAC GRAND AM 2 DOOR

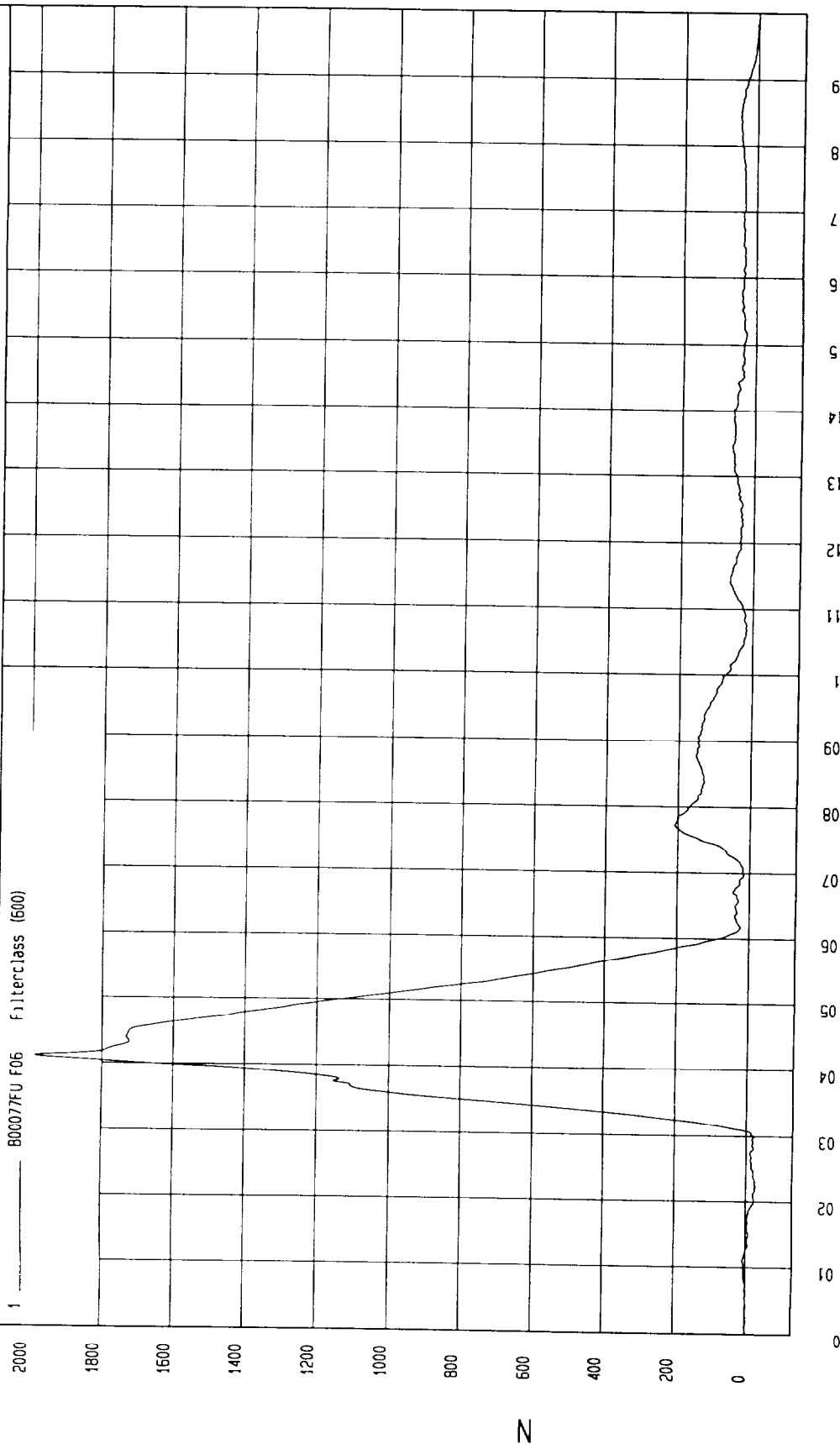
Speed 38.6 MPH 62.1 KPH

Minimum 27.33 N at 22 msec

Maximum 1987.45 N at 41 msec

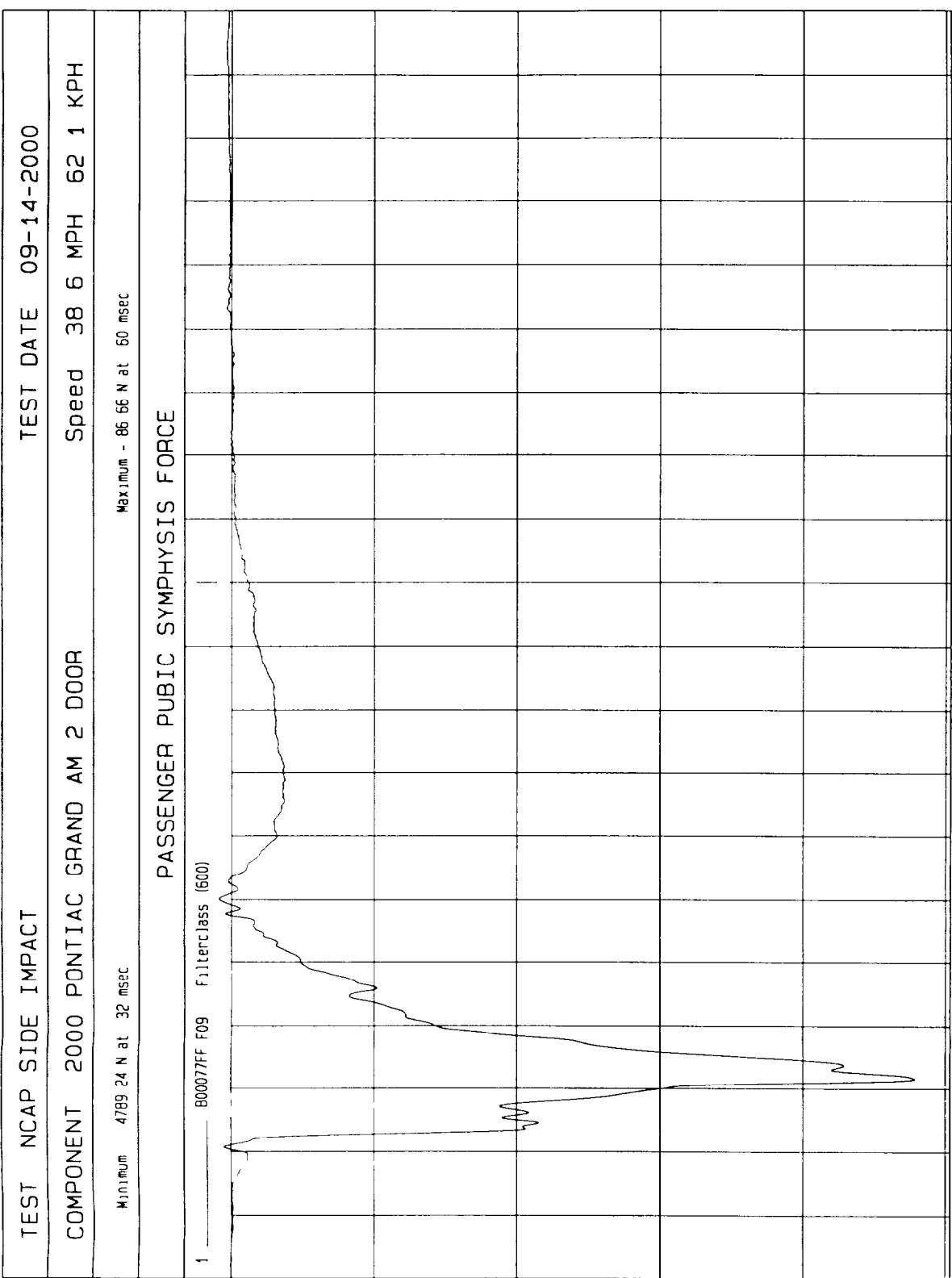
PASSENGER SUMMED ABDOMEN FORCE

1 — B00077F0 F06 Filterclass (600)



Seconds

MCA Research
09-14-2000 20 15



MCA Research
09-14-2000 20 16

Seconds

N

APPENDIX C – ES-2 CONFIGURATION AND PERFORMANCE VERIFICATION

CERTIFICATION DATA

Dummy Serial Number ES2-001

Calibration Test Results SummaryDummy Serial Number ES2-001

Pre-Test Calibration

External Dimensions	The dummy passed all external dimension requirements
Head Drop Test:	The head passed all drop test requirements
Neck Pendulum Test	The neck passed all impact test requirements
Shoulder Impact Test	The shoulder passed all impact test requirements
Rib Tests:	All ribs did not pass all impact test requirements.
Abdomen Test	The abdomen passed all impact test requirements
Lumbar Spine Test	The lumbar spine passed all impact test requirements
Pelvis Test	The pelvis passed all impact test requirements

MGA RESEARCH CORPORATION
HEAD DROP TEST
EUROSID 2 DUMMY

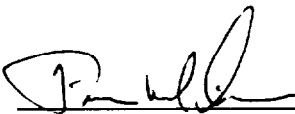
Date September 13, 2000

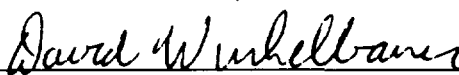
Dummy Serial Number ES2-001

Test Number: D001101

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Peak Resultant Acceleration	100 – 150 g's	135
Time of Max Res Acceleration		2.7 ms

TEST MEETS SPECIFICATIONS

Technician 

Approved By 

TEST Dummy Calibration - Head Drop TEST DATE 09-13-2000 - 17 05 39

COMPONENT Dummy #ES2-001

Minimum 6.75E 02 G S at 10 msec

Maximum 135.17 G S at 2.7 msec

PEAK RESULTANT ACCELERATION

1 D00101AT A01 FilterClass (1000)

180

160

140

120

100

80

60

40

20

0

10

01

02

03

04

TIME (sec)

WGA Research
09-13-2000 17:05

59

MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date September 13, 2000

Dummy Serial Number ES2-001

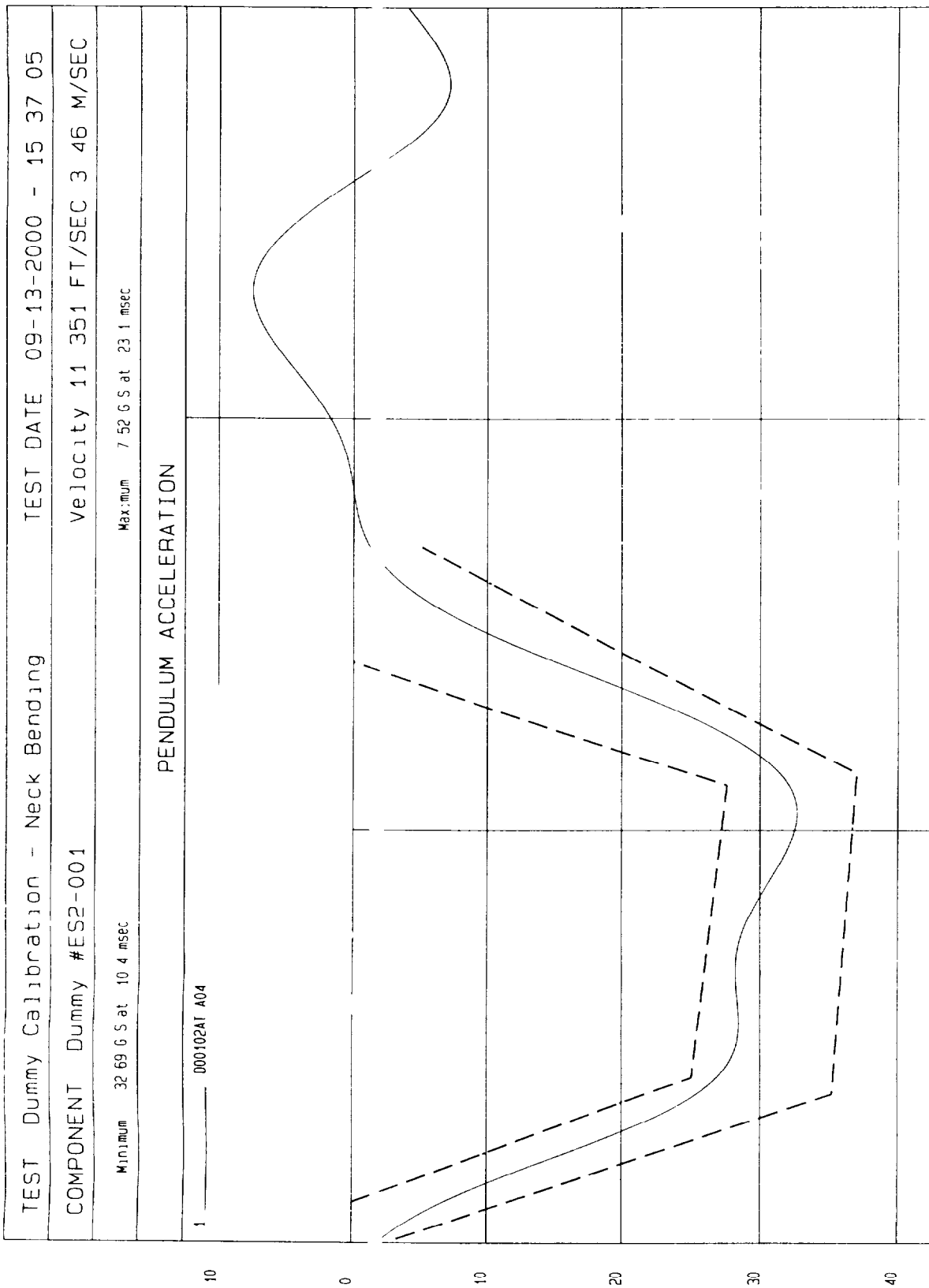
Test Number D001102

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	3.3 – 3.5	3.5
Max Pendulum Acceleration		-32.7
Time Max Pendulum Acceleration		10.4
Maximum Flexion Angle	51.0 – 59.0 deg	58.1
Time of Max Flexion Angle	53.0 – 65.0 ms	62.9
Maximum Angle Theta (A)	32.5 – 36.5 deg	35.6
Time of Max. Theta (A)	54.0 – 64.0 ms	63.3
Maximum Angle Theta (B)	28.0 – 32.0 deg	31.4
Time of Max Theta (B)	54.0 – 64.0 ms	59.5

TEST MEETS SPECIFICATIONS

Technician 

Approved By: David Winkelbauer



TEST Dummy Calibration - Neck Berding TEST DATE 09 13 2000 - 15 37 05

COMPONENT Dummy #ES2-001

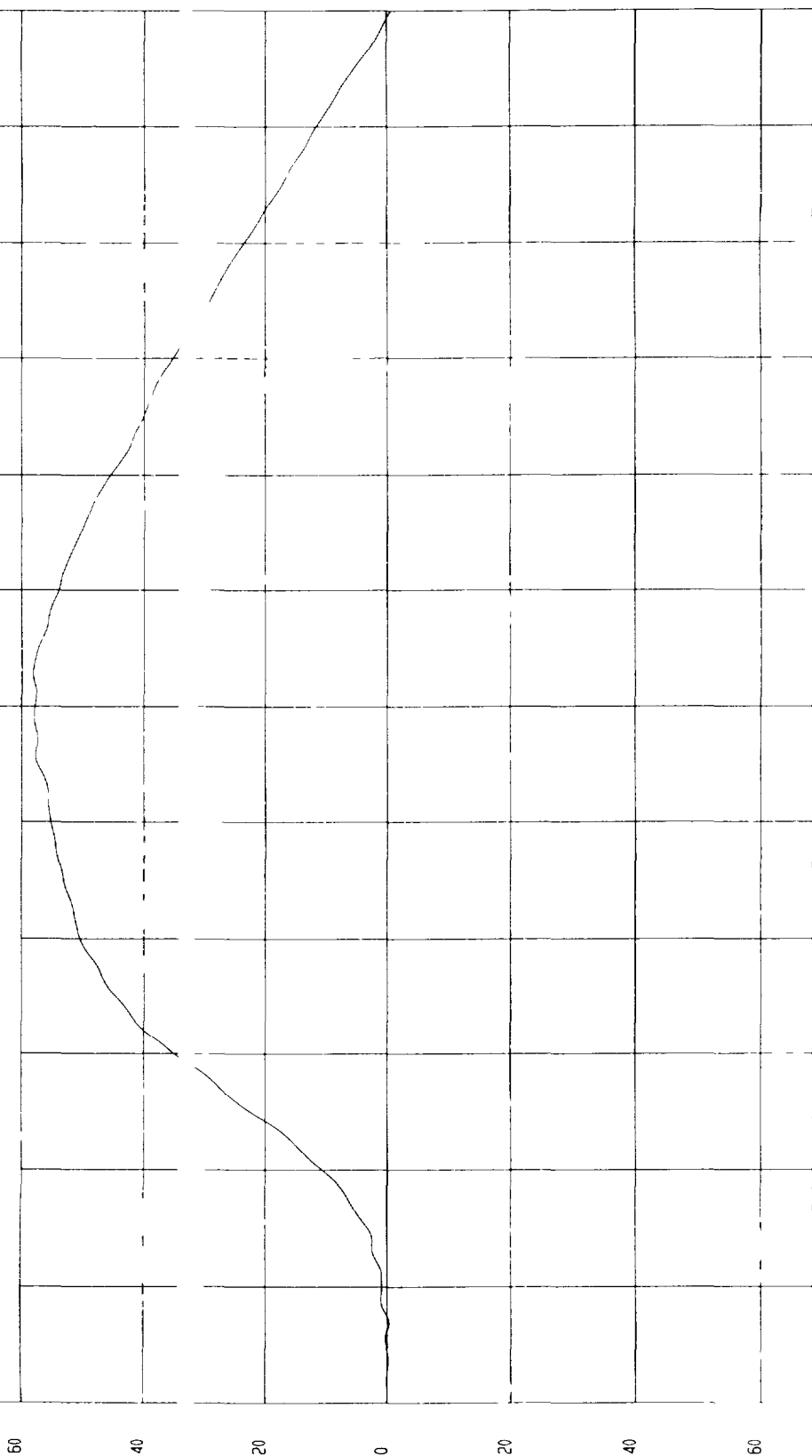
Velocity 1135 FT/SEC 346 M/SEC

Minimum 31.09 DEG at 166 msec

Maximum 58.11 DEG at 62.9 msec

FLEXION ANGLE

1 00010201 D08 Filterclass (1000)



TEST Dummy Calibration - Neck Bending

TEST DATE 09/13/2000 15:37:05

COMPONENT Dummy #ES2-001

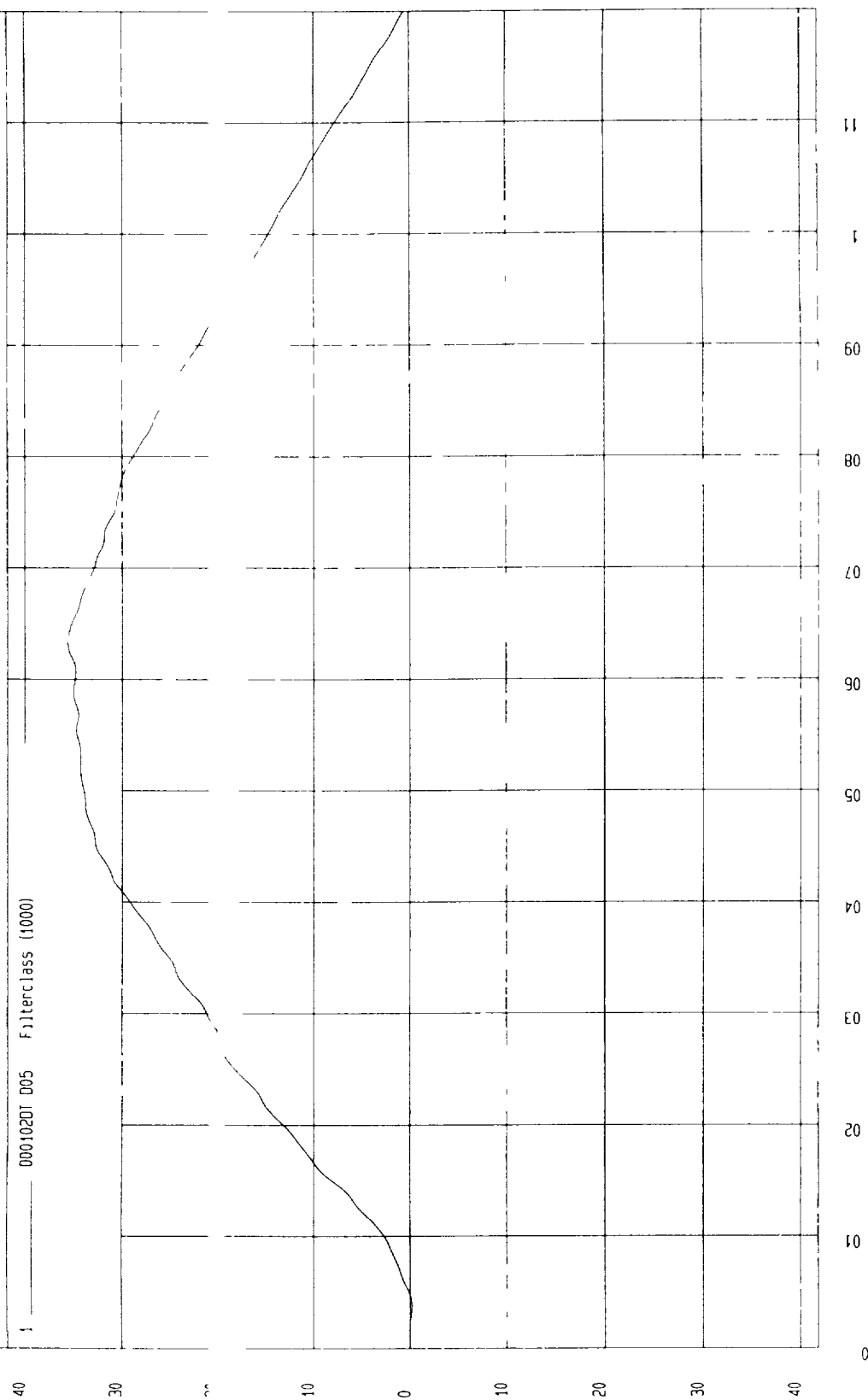
Velocity 11.35 FT/SEC 3.46 M/SEC

Minimum 18.19 DEG at 166 msec

Maximum 35.56 DEG at 63.3 msec

THETA A

00010201 D05 Filterclass (1000)



IFST Dummy Calibration Neck Bending TEST DATE 09 13 2000 15 37 05

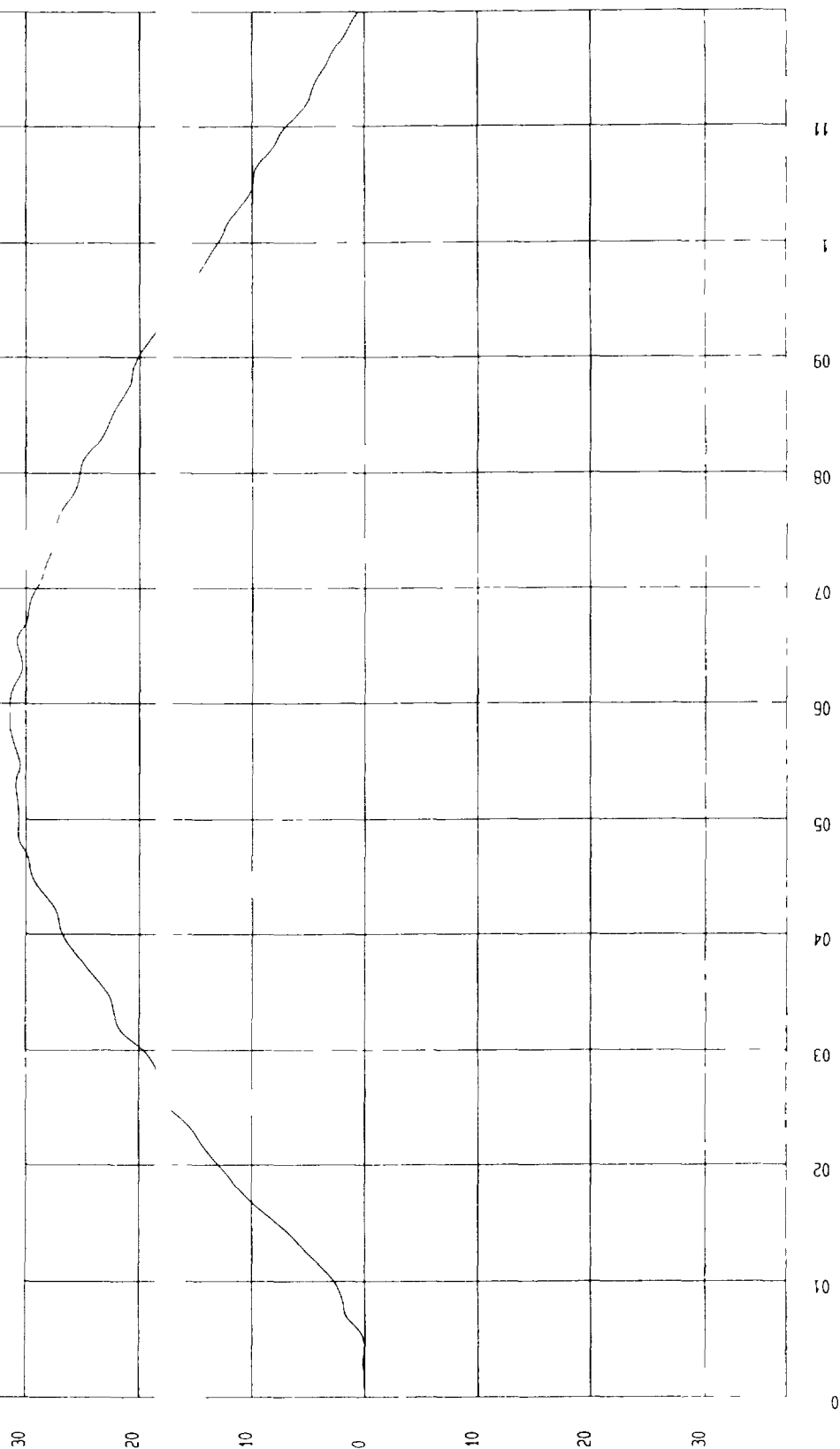
COMPONENT: DUMMY #ES2-001 VELOCITY 11 35 F'/SEC 3 46 M/SEC

Minimum 19 15 DEG at 165 msec

Maximum 31 40 DEG at 59 5 msec

THETA B

1 00010201 006 Filterclass (1000)



MCA Research
09-13-2000 15 39

DEG

TIME (SEC)

MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date September 13, 2000

Dummy Serial Number ES2-001

Test Number. D001103

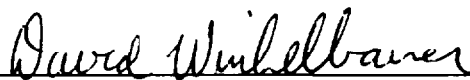
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	4.2 – 4.4 m/s	4.2
Max Resultant Acceleration	7.5 – 10.5 g's	9.4
Time of Max Pendulum Acceleration		12.3 ms

TEST MEETS SPECIFICATIONS

Technician



Approved By



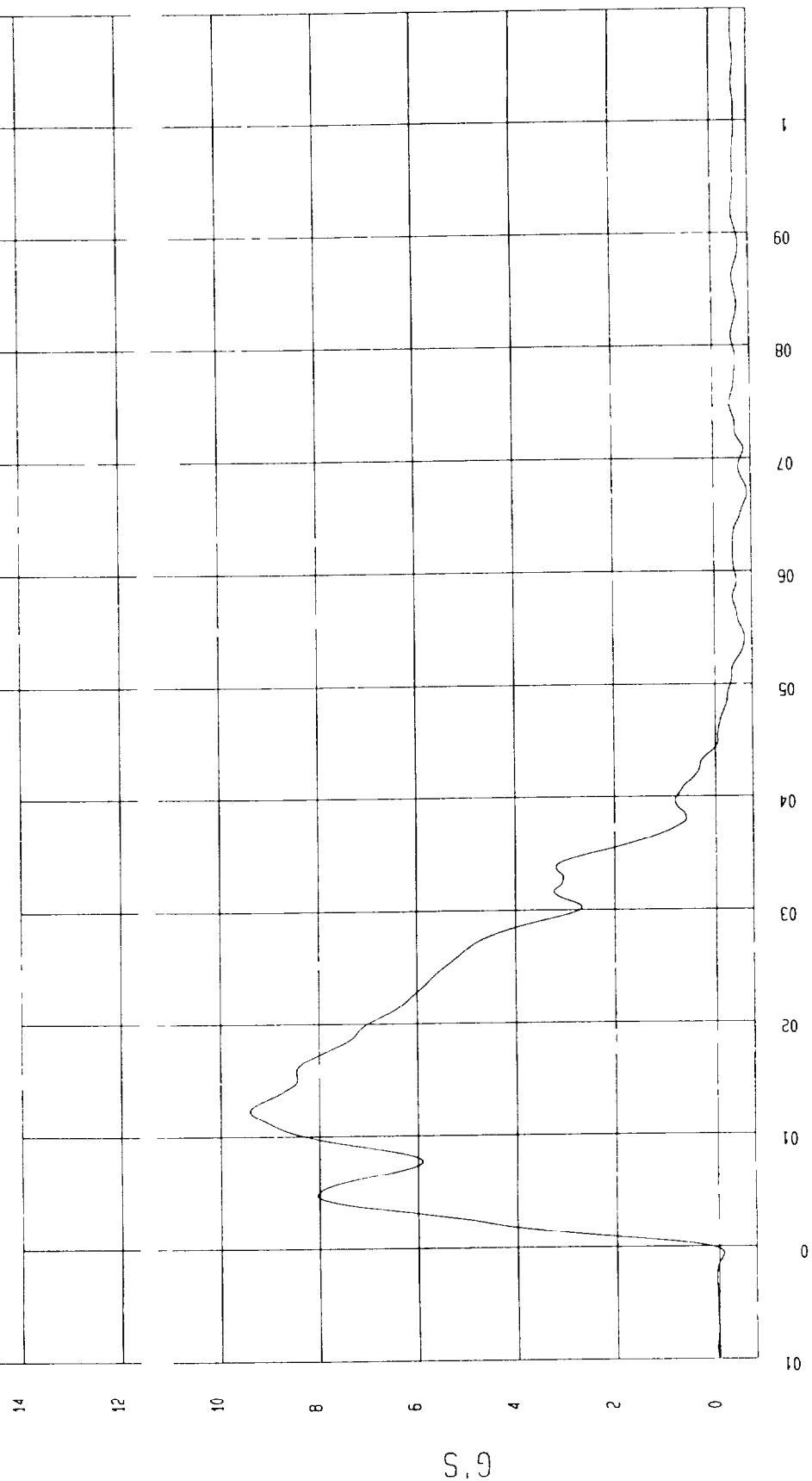
TEST Dummy Calibration - SHOULDER IMPACT TEST DATE 09-13-2000 - 09 43 29

COMPONENT Dummy #ES2-001 Velocity 13 86 FT/SEC 4 22 M/SEC

Minimum 67 G S at 67 msec Maximum 9 40 G S at 123 msec

PENDULUM ACCELERATION

1 ——— D00103AT 401 Filterclass (1000)



MGA RESEARCH CORPORATION
UPPER/MIDDLE/LOWER RIB TESTS
EUROSID 2 DUMMY

Date September 13, 2000

Dummy Serial Number ES2-001

Test Number D001104/5/6

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23.5 – 27.5 mm	27.3
Displacement at 3 m/s	36.0 – 40.0 mm	39.3
Displacement at 4 m/s	46.0 – 51.0 mm	50.8

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23.5 – 27.5 mm	27.2
Displacement at 3 m/s	36.0 – 40.0 mm	38.8
Displacement at 4 m/s	46.0 – 51.0 mm	50.6

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23.5 – 27.5 mm	27.4
Displacement at 3 m/s	36.0 – 40.0 mm	39.6
Displacement at 4 m/s	46.0 – 51.0 mm	51.9*

* DID NOT MEET SPECIFICATIONS

Technician: 

Approved By David Winkelbauer

TEST DATE 09-13 2000 - 10 33 46

TEST Dummy Calibration - RIB MODULE

Velocity 6 56 FT/SEC 2 M/SEC

COMPONENT Dummy #ES2-001

Maximum 27 31 mm at 40 8 msec

Minimum 5 23 mm at 78 3 msec

UPPER RIB DISPLACEMENT

1 0001040F 005 Filterclass (1000)

40

30

20

10

0

10

mm

14

13

12

11

10

09

08

07

06

05

04

03

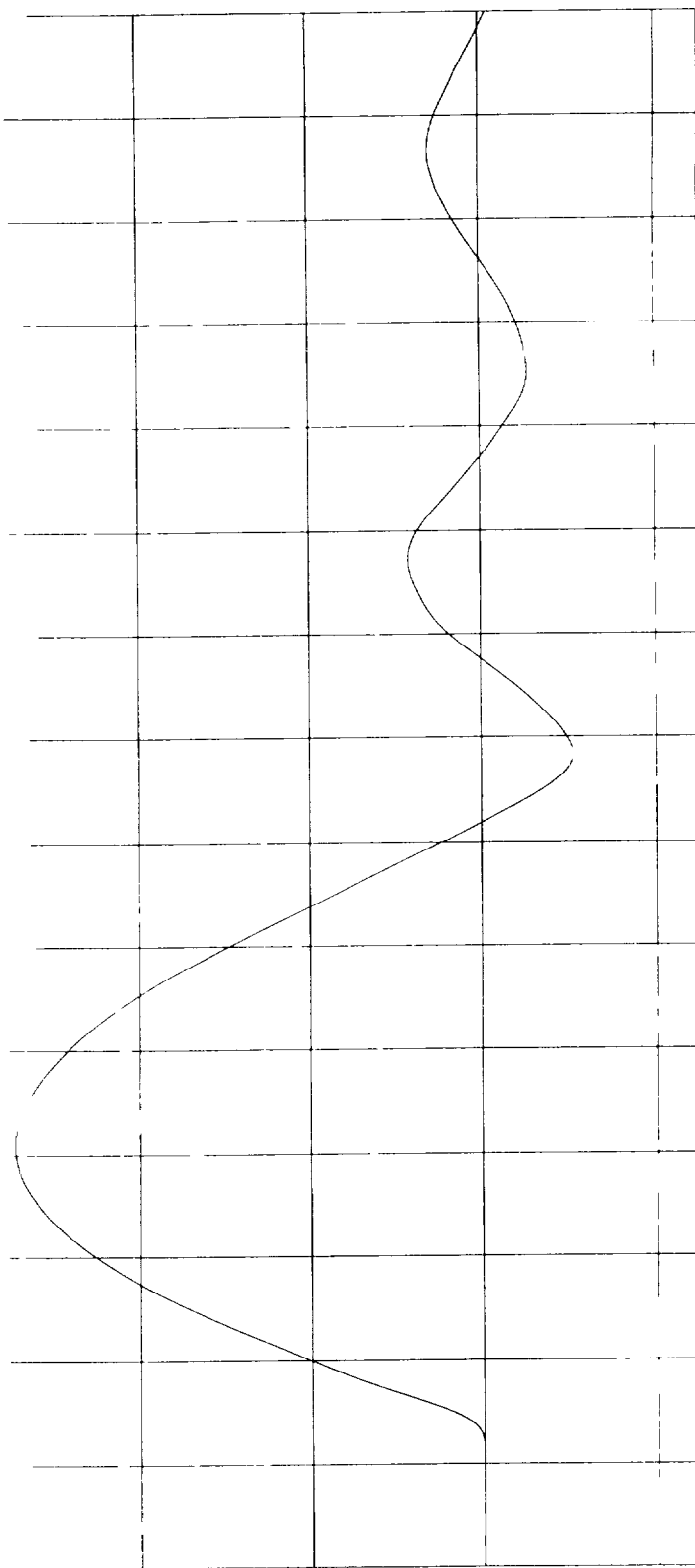
02

01

0

MCA Research
09-13-2000 11 31

TIME (sec)



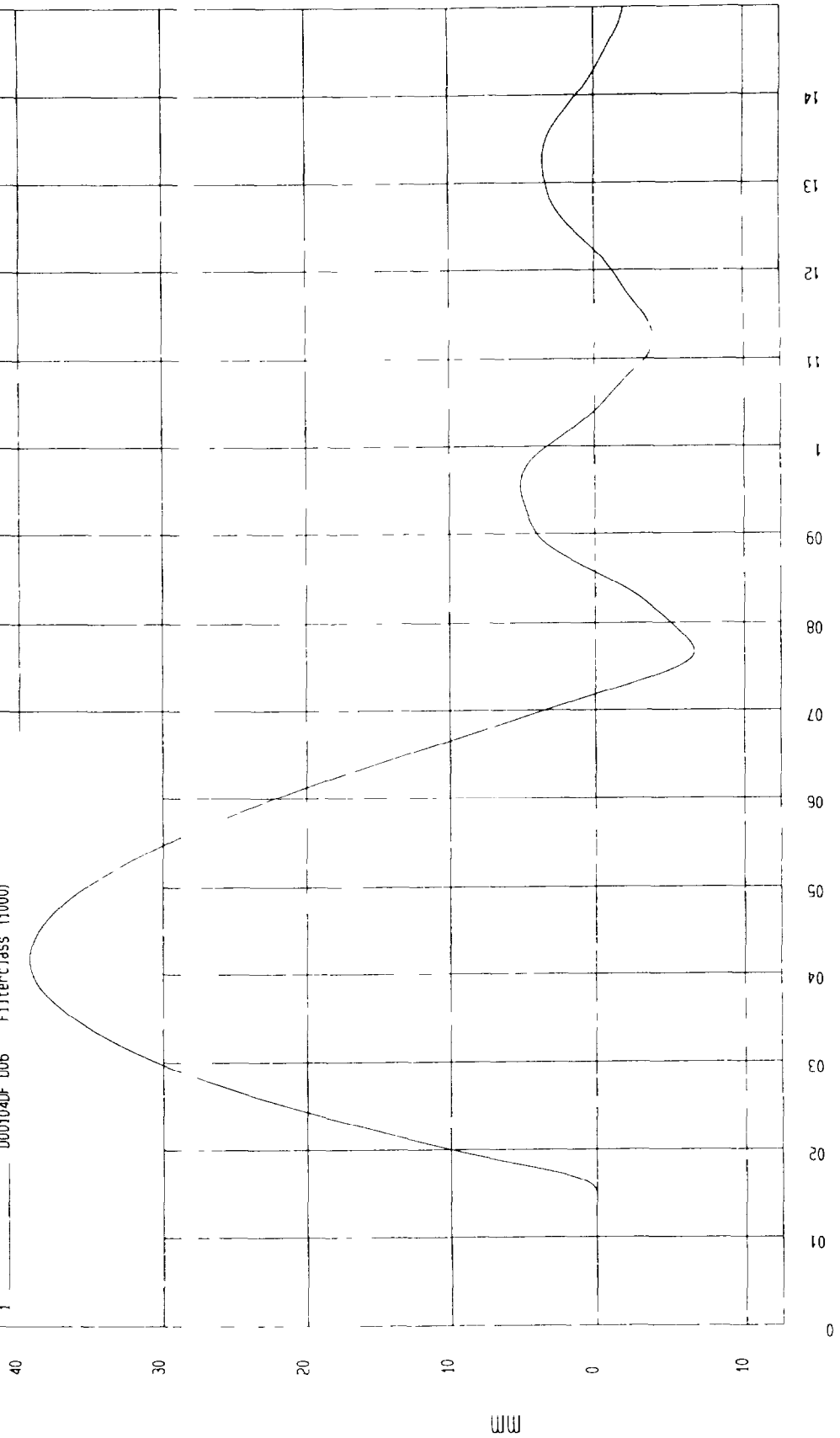
TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 - 10 42 49

COMPONENT Dummy #ES2-001 Velocity 9 84 FT/SEC 3 M/SEC

Minimum 5 53 mm at 76 7 msec Maximum 39 28 mm at 41 7 msec

UPPER RIB DISPLACEMENT

1 D001040F D06 Filterclass (1000)



NSA Research
09 13 2000 11 31

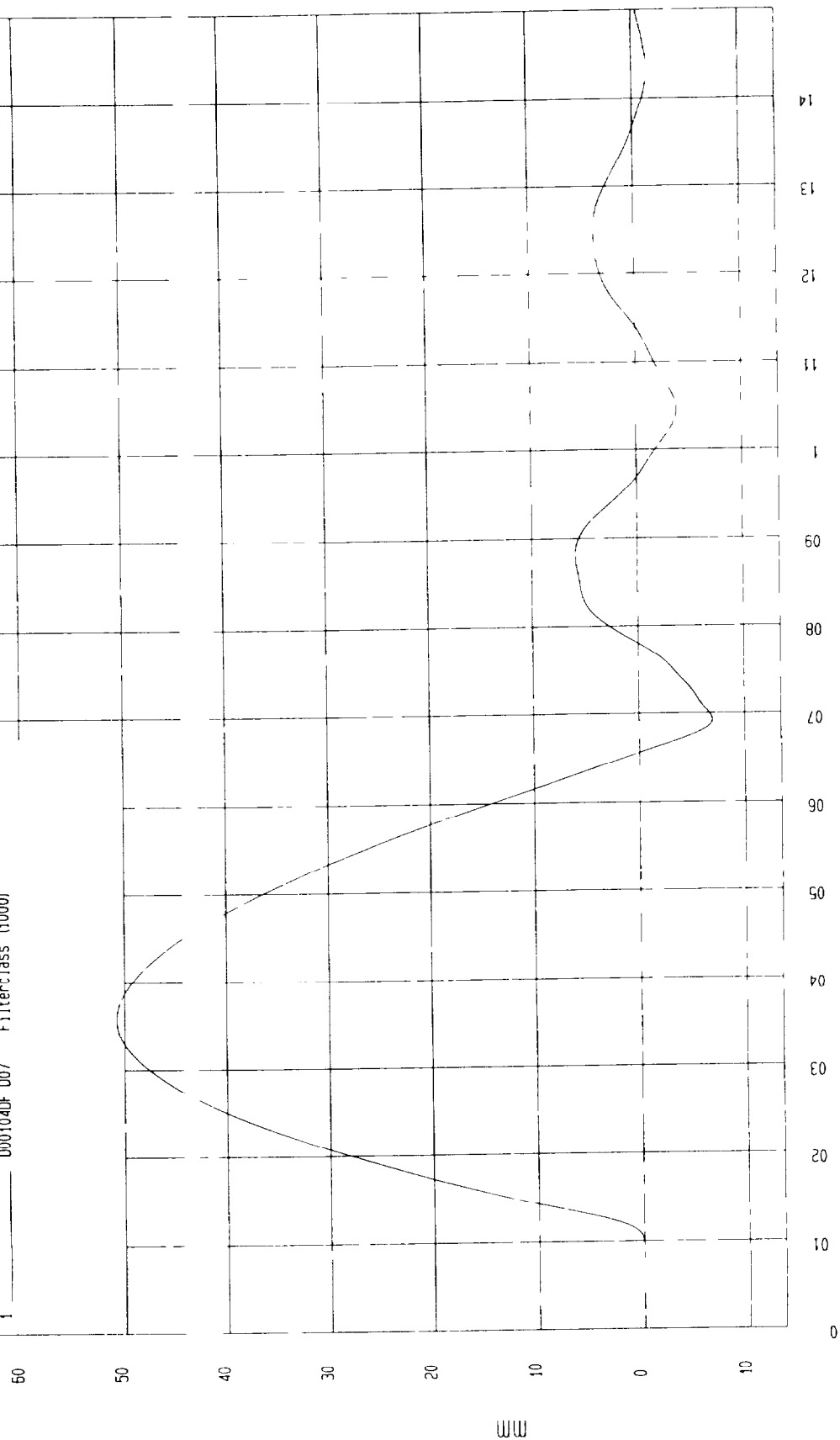
TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 - 10 19 50

COMPONENT Dummy #ES2-001 Velocity 13 12 FT/SEC 4 M/SEC

Minimum 6 90 mm at 69 3 msec Maximum 50 76 mm at 35 6 msec

UPPER RIB DISPLACEMENT

1 D00104DF 007 Filterclass (1000)



MCA Research
09 13 2000 11 31

TEST Dummy Calibration - RIB MODULE TEST DATE 09 13 2000 - 12 54 49

COMPONENT Dummy #ES2-001 Velocity 6 56 FT/SEC 2 M/SEC

Minimum 4 84 mm at 88 4 msec Maximum 27 20 mm at 51 3 msec

MIDDLE RIB DISPLACEMENT

1 ——— 0001050F D05 Filterclass (1000)

40

30

20

10

0

10

mm

14

13

12

11

10

09

08

07

06

05

04

03

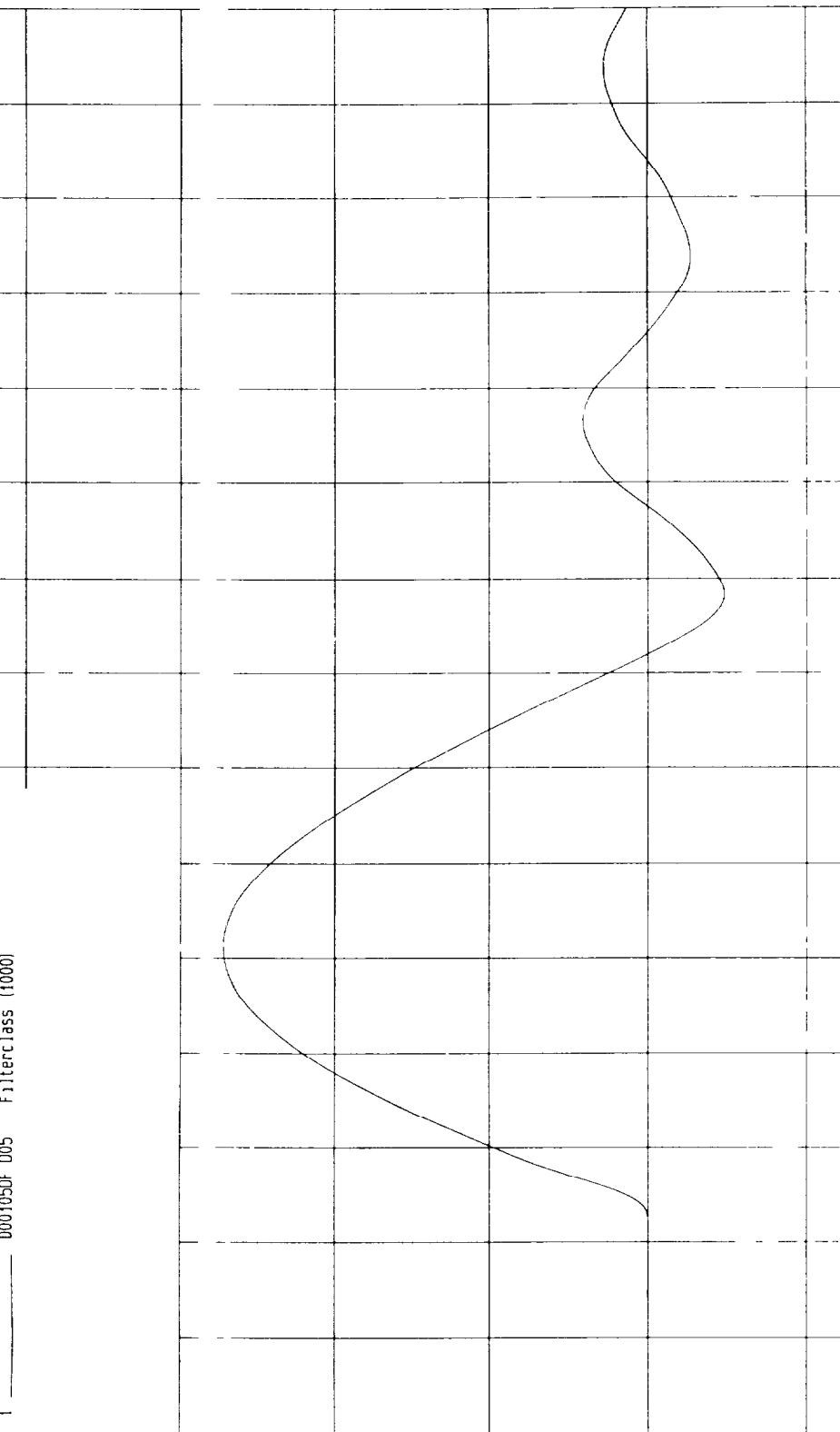
02

01

0

TIME (sec)

WCA Research
09-13-2000 14 18



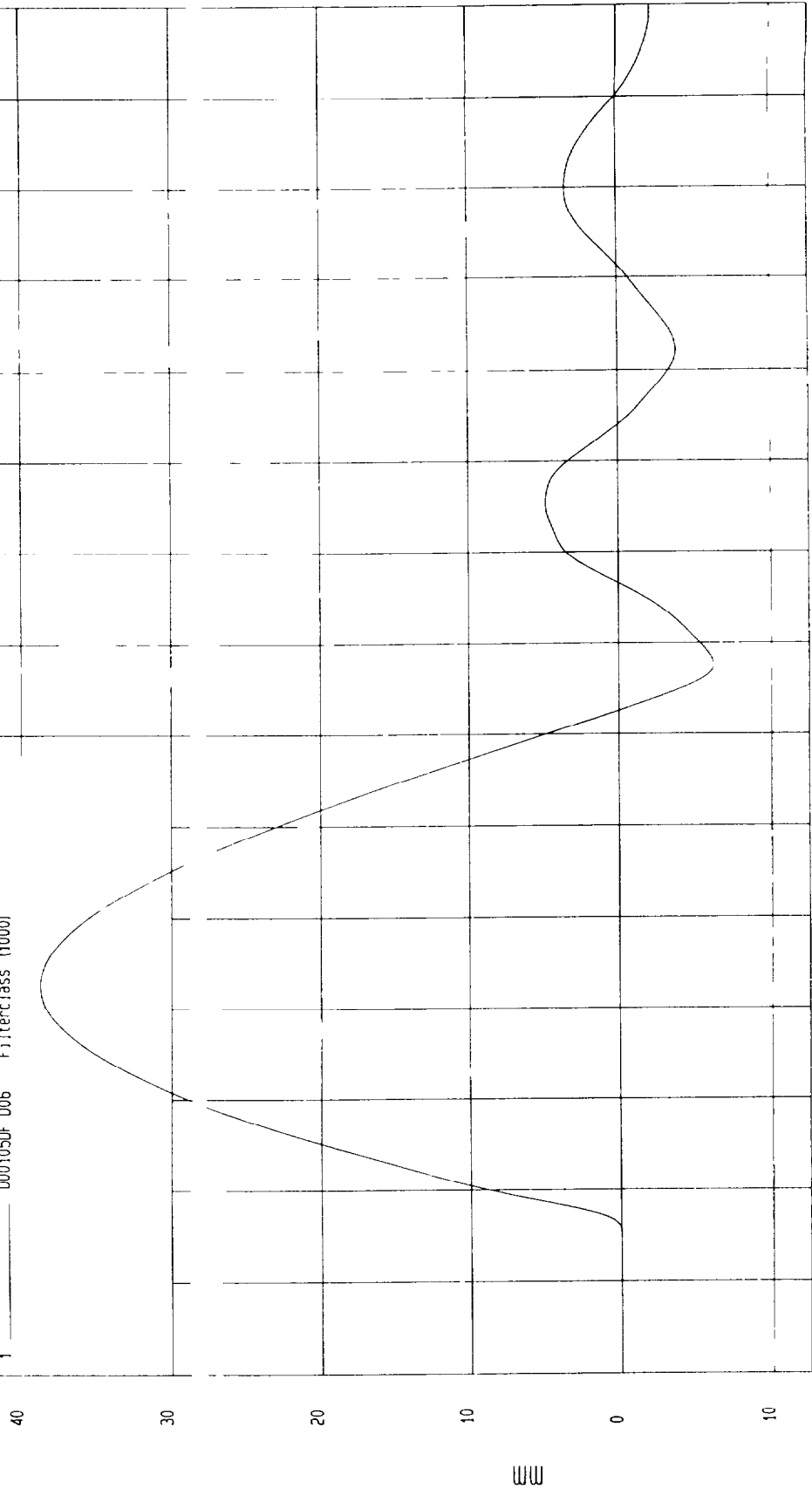
TEST Dummy Calibration - Neck Bending TEST DATE 09 13 2000 13 24 42

COMPONENT Dummy #152 001 Velocity 9 84 11/11/00 3 M/SEC

Minimum 6.25 mm at 77.6 msec Maximum 38.76 mm at 42.6 msec

MIDDLE RIB DISPLACEMENT

1 D001050F D06 Filterclass (1000)



MGA Research
09-13-2000 14 18

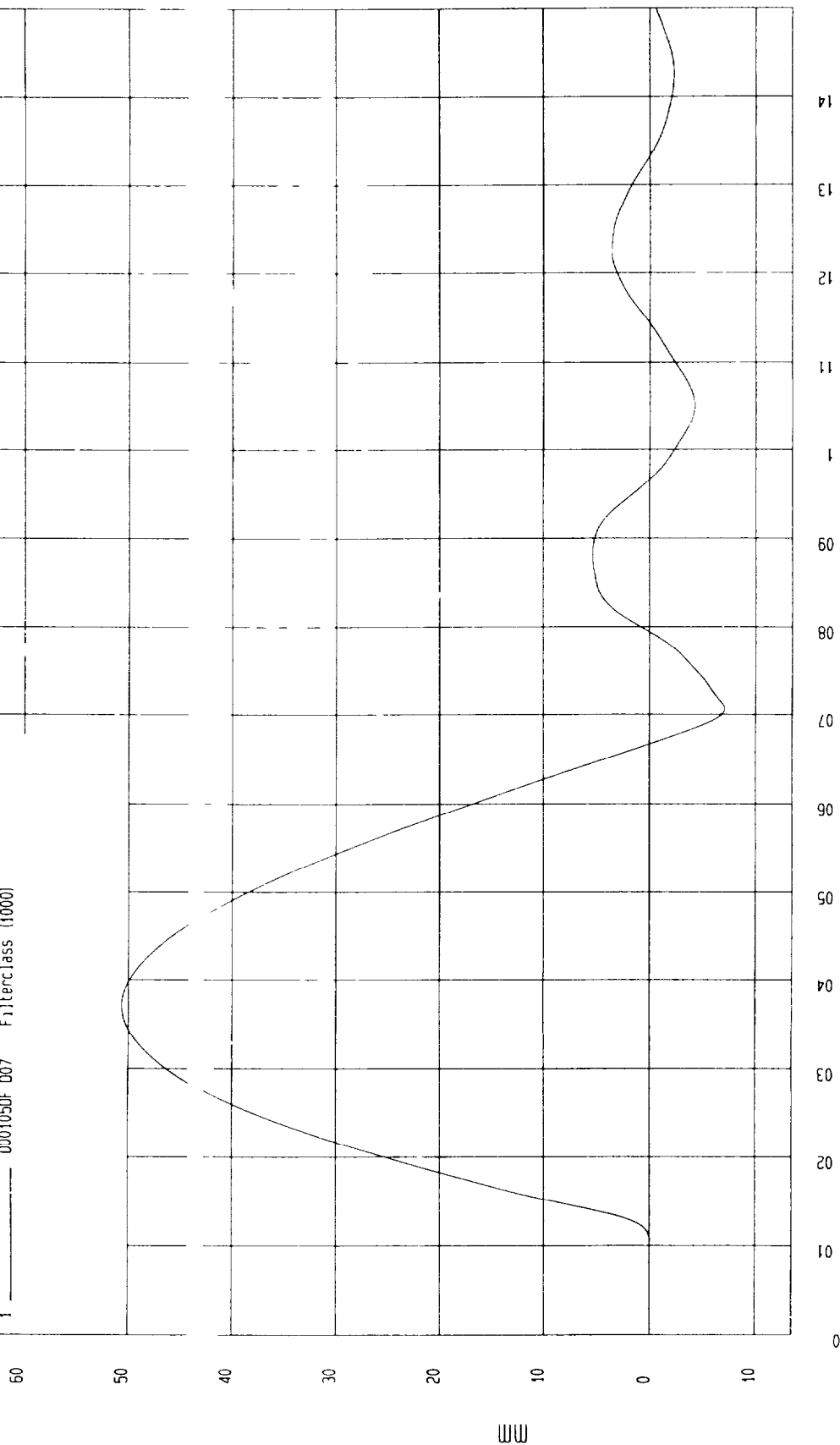
TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 - 11 37 59

COMPONENT Dummy #ES2 001 Velocity 13 12 11/SEC 4 M/SEC

Minimum 7 04 mm at 70 6 msec Maximum 50 64 mm at 37 1 msec

MIDDLE RIB DISPLACEMENT

1 0001050F D07 Filterclass (1000)



TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 - 13 49 45

COMPONENT Dummy #ES2-001 Velocity 6 56 FT/SEC 2 M/SEC

Minimum 4 71 mm at 88 4 msec

Maximum 27 35 mm at 51 msec

LOWER RIB DISPLACEMENT

1 ——— D001060F D05 Filterclass (1000)

40

30

20

10

0

10

mm

0

01

02

03

04

05

06

07

08

09

1

11

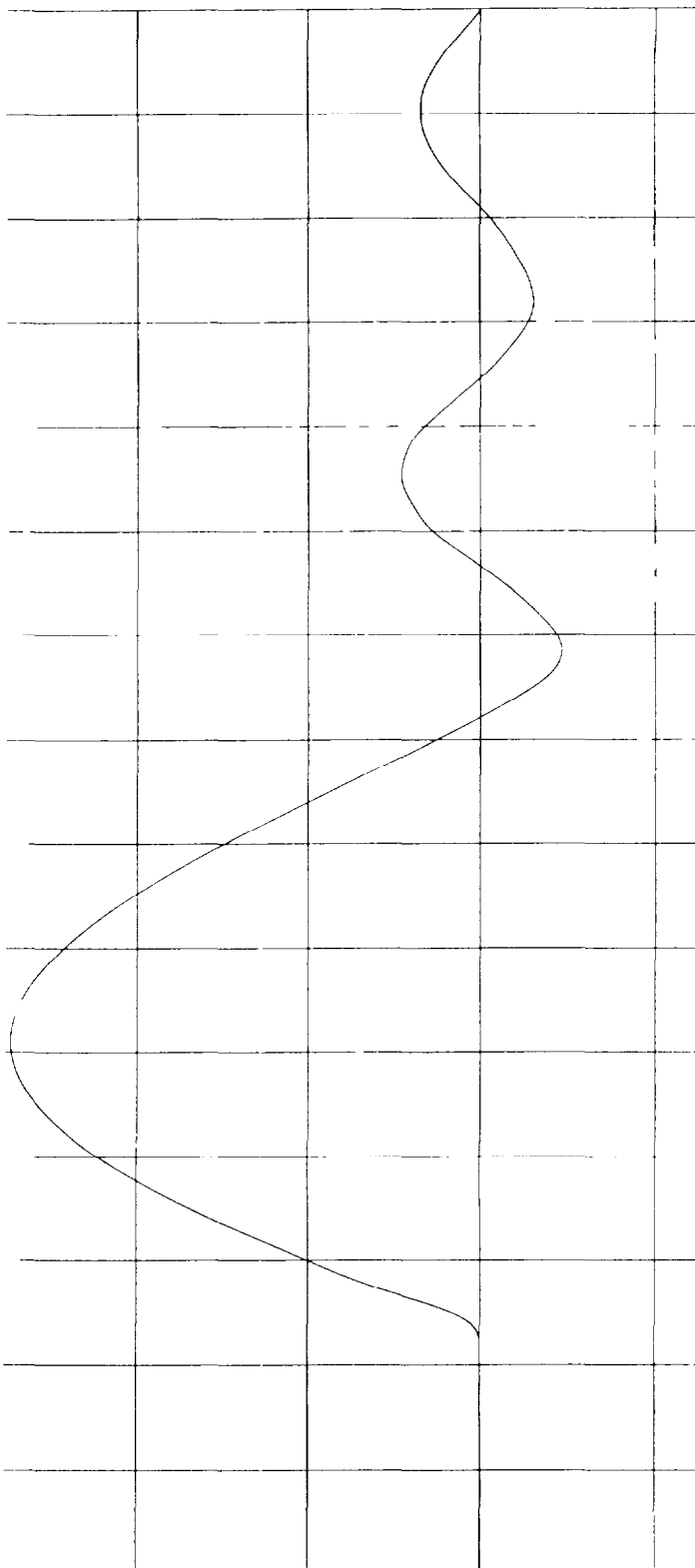
12

13

14

TIME (sec)

MCA Research
09 13 2000 14 04



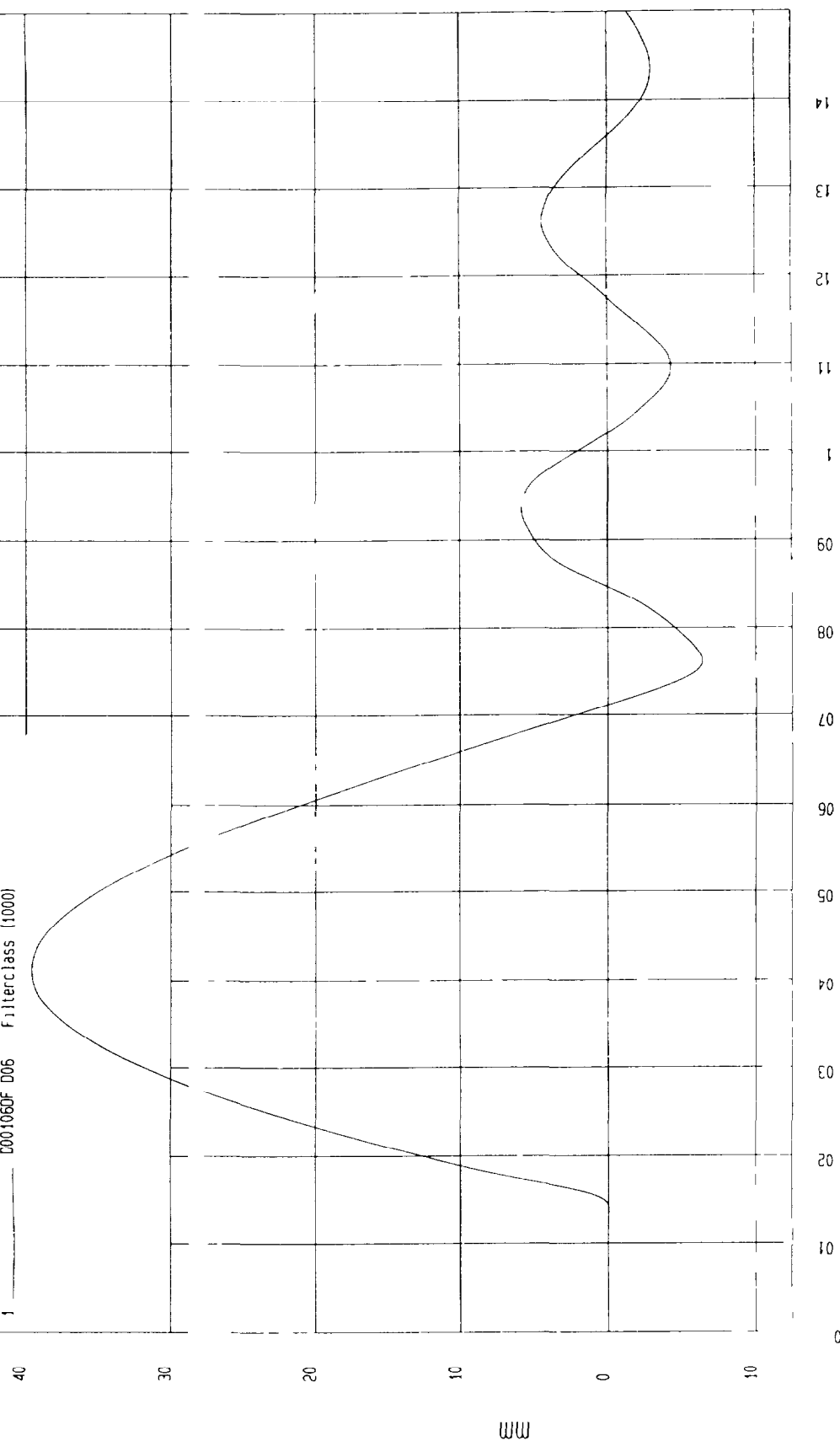
TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 13 55 44

COMPONENT Dummy #ES2-001 velocity 9 84 FT/SEC 3 M/SEC

Minimum 6 39 mm at 76 2 msec Maximum 39 59 mm at 41 1 msec

LOWER RIB DISPLACEMENT

1 ——— C001060F D06 Filterclass (1000)



WCA Research
09 13 2000 14 04

TEST Dummy Calibration - RIB MODULE TEST DATE 09 13-2000 - 13 34 16

COMPONENT Dummy #ES2-001 Velocity 13 12 FT/SEC 4 M/SEC

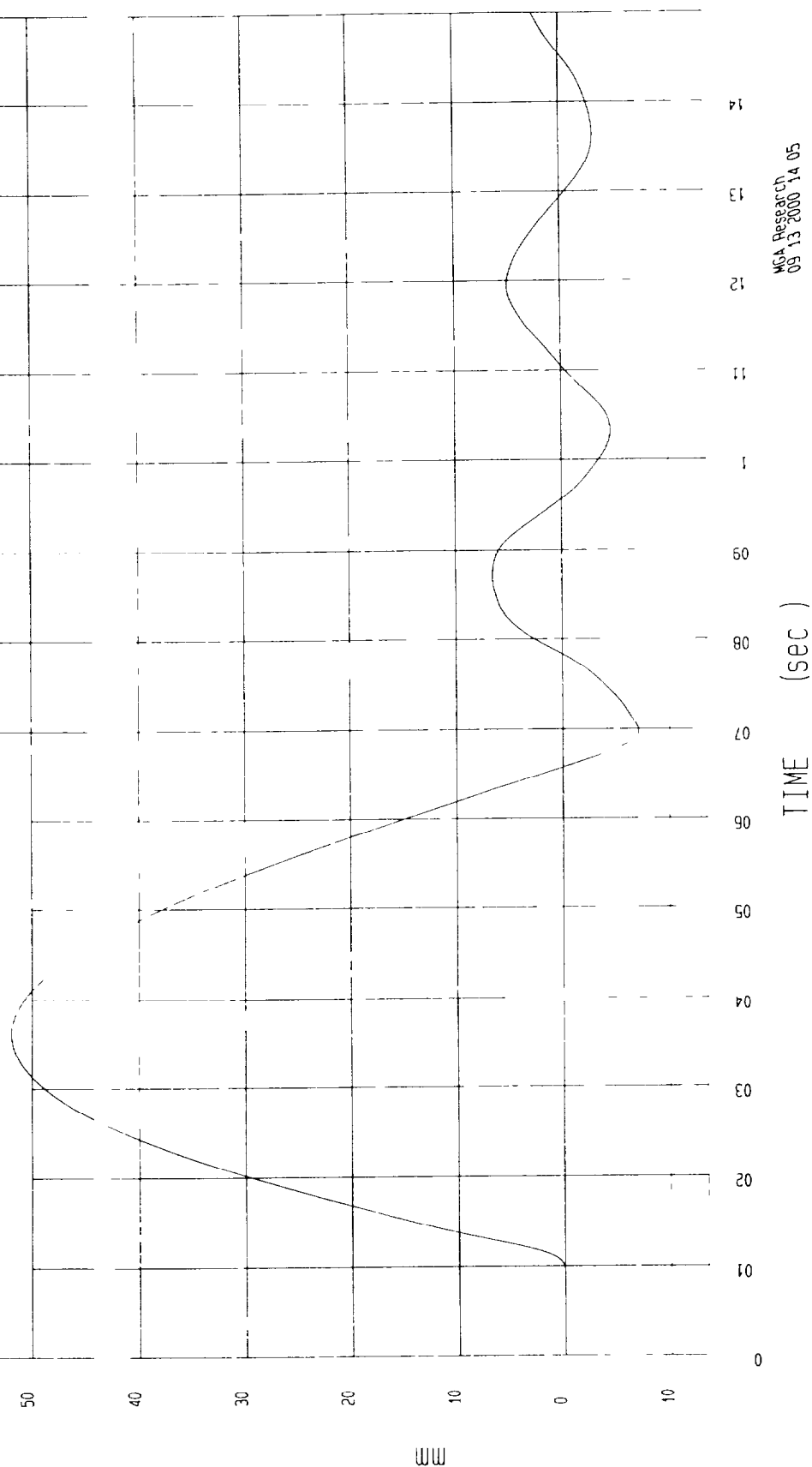
Minimum 7 17 mm at 69 7 msec

Maximum 51 94 mm at 36 1 msec

LOWER RIB DISPLACEMENT

0001060F D07 Filterclass (1000)

1



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

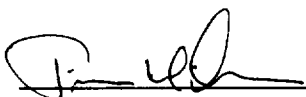
Date September 13, 2000

Dummy Serial Number ES2-001

Test Number D001107

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Probe Speed (m/s)	6.2 – 6.4	6.3
Maximum Impact Force	9.5 – 11.1 kN	10.3
Time of Maximum Force	8.8 – 10.4 ms	9.1
Maximum Total Abdomen Force	5.9 – 7.9 kN	6.9
Time of Max. Total Force	8.5 – 10.1 ms	8.9

TEST MEETS SPECIFICATIONS

Technician 

Approved By: 

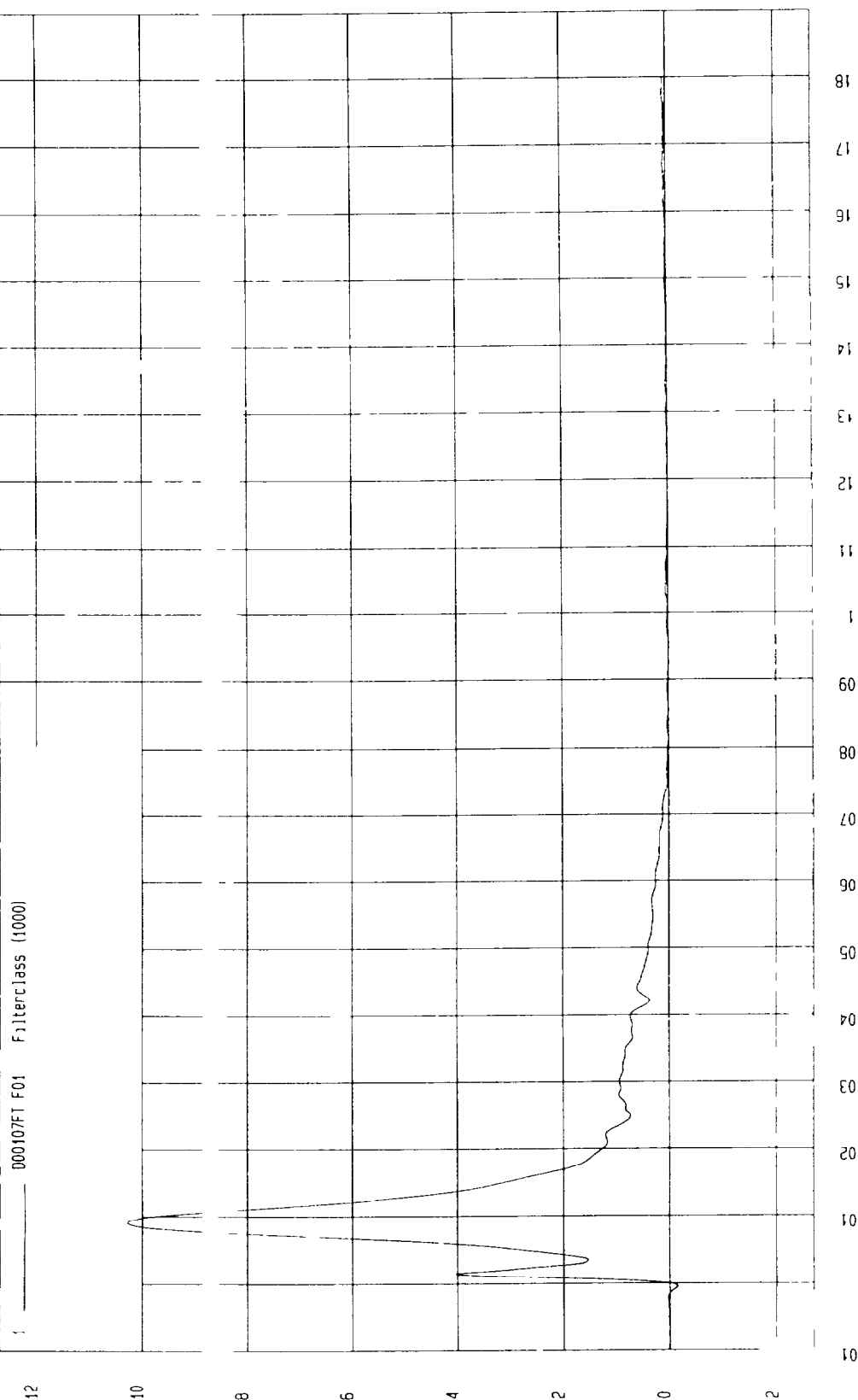
Test Dummy Calibration - ABDOMEN IMPACT TEST DATE 09 13 2000 09 06 04

COMPONENT Dummy #ES2-001 Velocity 20 72 FT/SEC 6 32 M/SEC

Minimum 15 kN at 5 msec Maximum 10 28 kN at 9 1 msec

PROBE FORCE

000107FT F01 Filterclass (1000)



WCA Research
09 13 2000 09 18

TEST Dummy (calibration) ABDOMEN IMPACT TEST DATE 09 13-2000 - 09 18 17

COMPONENT Dummy #ES2-001 Velocity 20 72 FI/SEC 6 32 M/SEC

Minimum 2 68E 02 kN at 100 msec

ABDOMEN FORCE

1 000107FI F02 Filterclass (1000)

10

8

6

4

2

0

2

kN

TIME (sec)

18

17

16

15

14

13

12

11

10

09

08

07

06

05

04

03

02

01

00

MCA Research
09-13-2000 09 18

MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

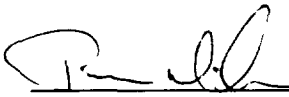
Date: September 13, 2000

Dummy Serial Number ES2-001

Test Number D001108

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	5.95 – 6.15 m/s	6.07
Max. Pendulum Acceleration		-29.4
Time Max. Pendulum Acceleration		10.5
Maximum Flexion Angle	45.0 – 55.0 deg	52.6
Time of Max. Flexion Angle	39.0 – 53.0 ms	47.8
Maximum Angle Theta (A)	31.0 – 35.0 deg	33.0
Time of Max. Theta (A)	45.0 – 55.0 ms	47.9
Maximum Angle Theta (B)	27.0 – 31.0 deg	30.2
Time of Max. Theta (B)	45.0 – 55.0 ms	46.5

TEST MEETS SPECIFICATIONS

Technician 

Approved By 

TEST Dummy Calibration - Lumbar Flexion TEST DATE 09 13 2000 16 20 28

COMPONENT Dummy #ESC 001 VELOCITY 19 G's FT/SEC 6 07 M/SEC

Minimum 29.40 G's at 10.5 msec Maximum 41.6 G's at 36.4 msec

PENDULUM ACCELERATION

1 D0010BAT A04

10

0

10

20

30

40

G's

TIME (sec)

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

MSA Research
09-14 2000 08 35

Max muir Dec 1991 at 47.8 m.p.h.

FLEXION ANGLE

00010801 D08 Filterclass (1000)

W 11m T 311 DEC 0 115 T

60

40

20

0

20

40

60

DEG

11

1

09

08

07

06

05

04

03

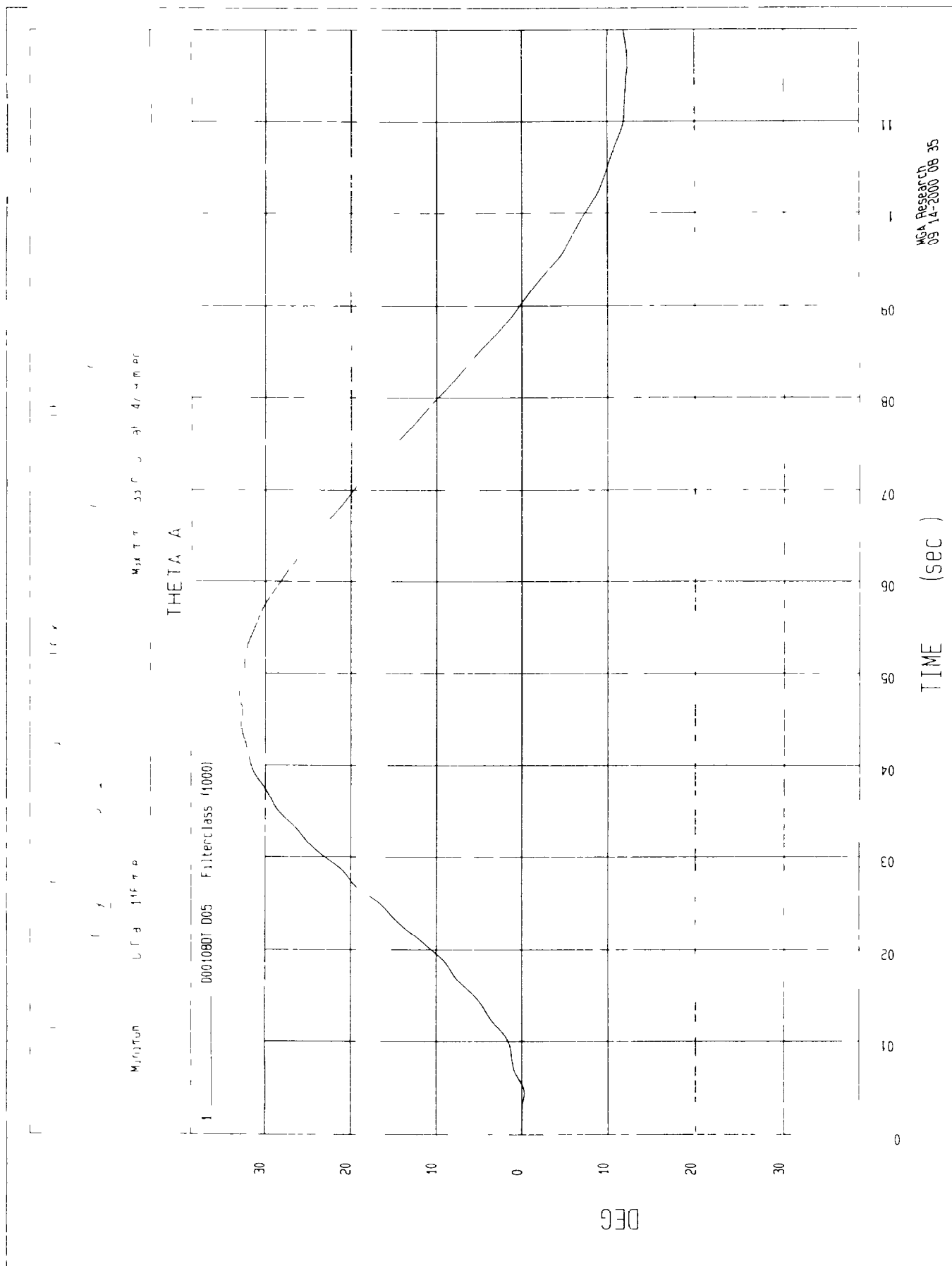
02

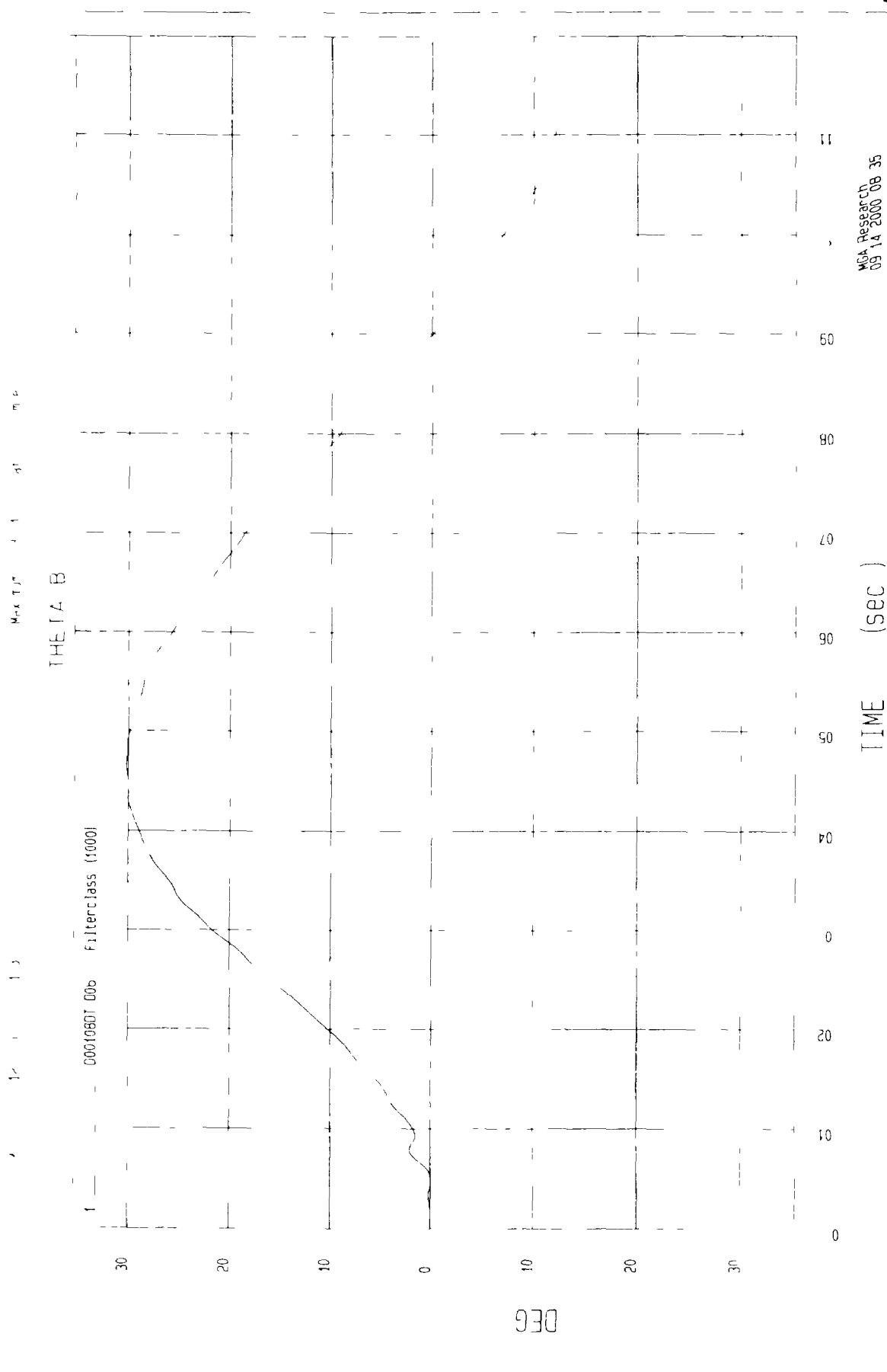
01

0

TIME (sec)

MCA Research
09 14 2000 08 35





MGA RESEARCH CORPORATION

PELVIS TEST

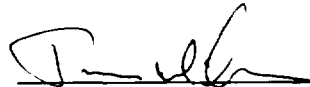
EUROSID 2 DUMMY

Date: September 13, 2000Dummy Serial Number: ES2-001Test Number D001109

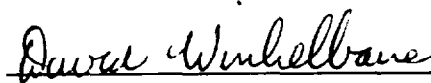
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	4.2 – 4.4 m/s	4.2
Maximum Impactor Force	4.4 – 5.1 kN	4.9
Time of Max Impactor Force	10.3 – 15.5 ms	14.5
Maximum Pubic Force	1.04 – 1.64 kN	1.19
Time of Max Pubic Force	9.9 – 15.9 ms	15.7

TEST MEETS SPECIFICATIONS

Technician



Approved By



TEST Dummy Calibration - Pelvis Impact TEST DATE 09-13-2000 - 09 32 30

COMPONENT Dummy #ES2-001 Velocity 13 92 FT/SEC 4 24 M/SEC

Minimum 9 72E 03 kN at 50 9 msec

Maximum 4 89 kN at 14 5 msec

IMPACTOR FORCE

1 000109FT F01 Filterclass (1000)

6

5

4

3

2

1

0

1

kN

10

0

10

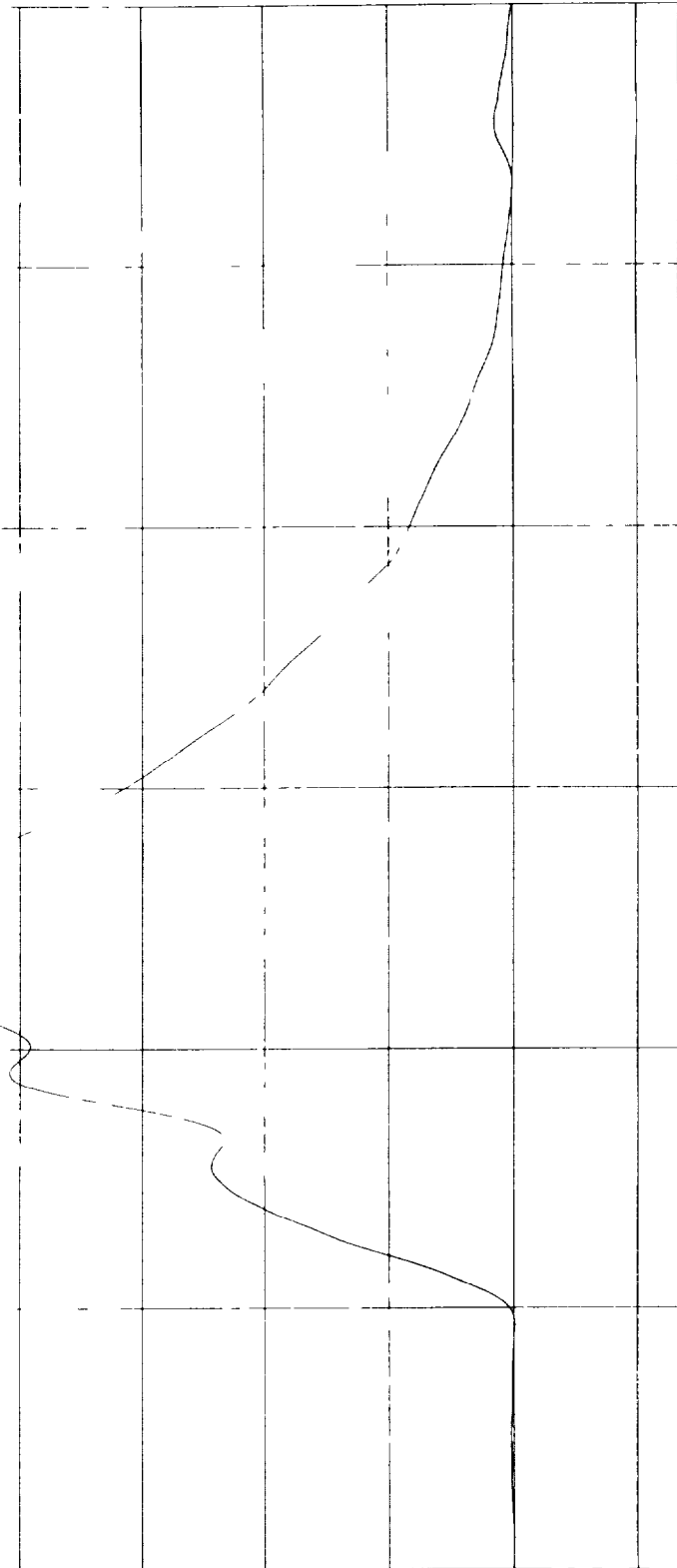
20

30

40

TIME (sec)

NSA Research
09-13-2000 09 34



TEST Dummy Calibration - Pelvis Impact TEST DATE 09-13-2000 - 09 34 26

COMPONENT Dummy #ES2-001 Velocity 13 92 FT/SEC 4 24 M/SEC

Minimum 2 54E 02 kN at 36 3 msec Maximum 1 19 kN at 15 7 msec

PUBIC FORCE

1 000109FT F02 Filterclass (1000)

2

18

16

14

12

10

8

6

4

2

0

2

4

6

kN

01

0

01

02

03

04

TIME (sec)

NCA Research
09-13-2000 09 34

CERTIFICATION DATA

Dummy Serial Number ES2-002

Calibration Test Results SummaryDummy Serial Number ES2-002

Pre-Test Calibration

External Dimensions	The dummy passed all external dimension requirements
Head Drop Test	The head passed all drop test requirements.
Neck Pendulum Test	The neck did not pass all impact test requirements
Shoulder Impact Test	The shoulder passed all impact test requirements
Rib Tests	All ribs passed all impact test requirements
Abdomen Test	The abdomen passed all impact test requirements
Lumbar Spine Test	The lumbar spine passed all impact test requirements
Pelvis Test	The pelvis passed all impact test requirements.

MGA RESEARCH CORPORATION
HEAD DROP TEST
EUROSID 2 DUMMY

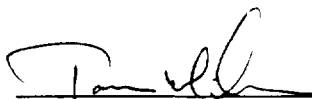
Date: September 13, 2000

Dummy Serial Number ES2-002

Test Number: D001111

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Peak Resultant Acceleration	100 – 150 g's	142
Time of Max Res Acceleration		2.4

TEST MEETS SPECIFICATIONS

Technician: 

Approved By: 

TEST DATE 09-13-2000 - 17 17 56

TEST Dummy Calibration Head Drop

COMPONENT Dummy #ES2 002

Maximum 142.39 G S at 2.4 msec

Minimum 5.86E 02 G S at 9.2 msec

PEAK RESULTANT ACCELERATION

000111AT A01 Filterclass (1000)

130

150

140

120

100

80

60

40

20

0

G.S

MCA Research
09 13 2000 17 18

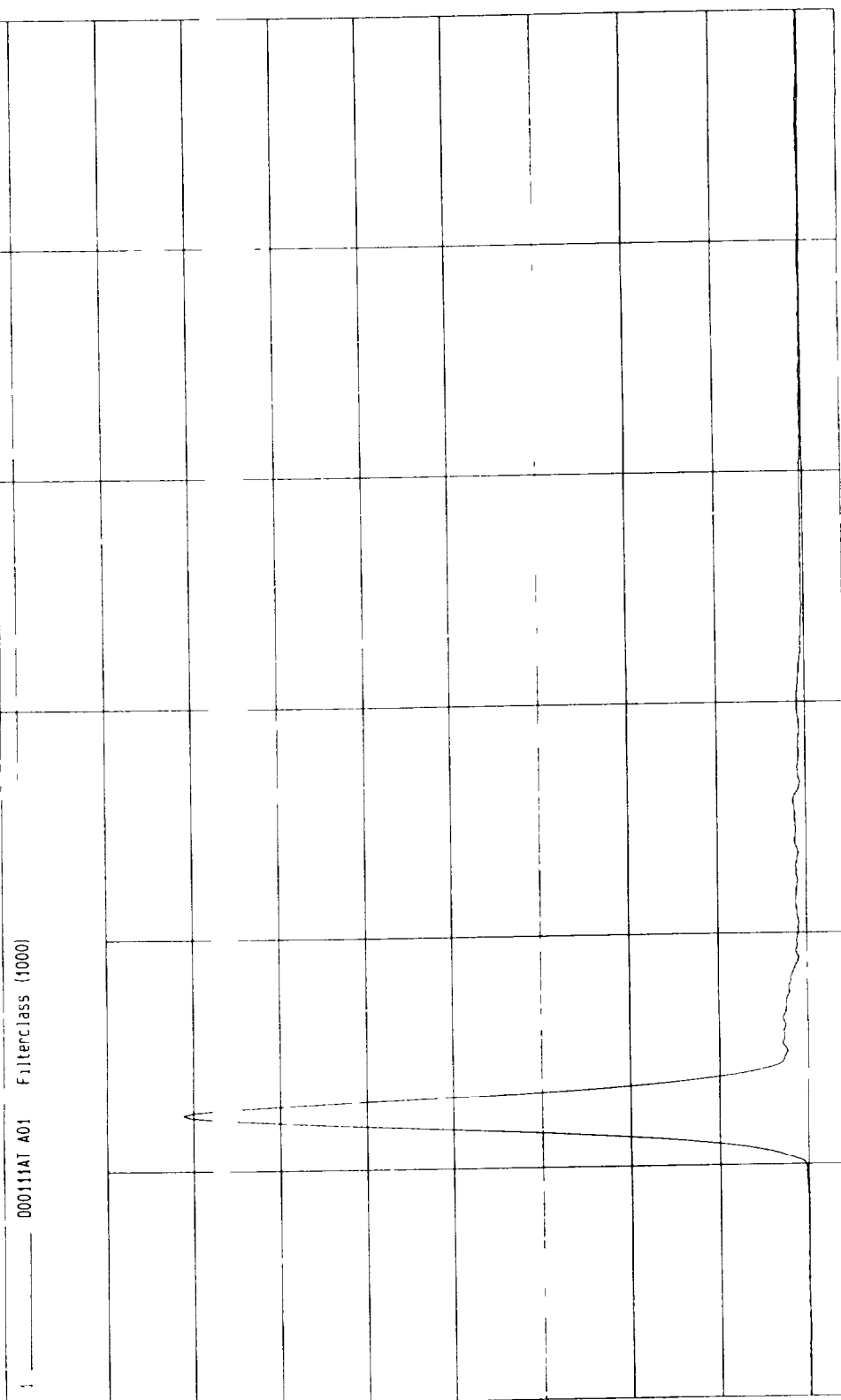
03

02

01

0

TIME (sec)



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

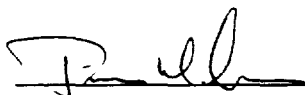
Date: September 13, 2000

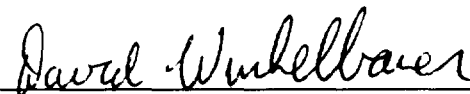
Dummy Serial Number ES2-002

Test Number: D001112

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	3.3 – 3.5	3.4
Max. Pendulum Acceleration		-34.7
Time Max Pendulum Acceleration		10.1
Maximum Flexion Angle	51.0 – 59.0 deg	59.2*
Time of Max Flexion Angle	53.0 – 65.0 ms	59.3
Maximum Angle Theta (A)	32.5 – 36.5 deg	35.5
Time of Max Theta (A)	54.0 – 64.0 ms	52.4*
Maximum Angle Theta (B)	28.0 – 32.0 deg	31.9
Time of Max Theta (B)	54.0 – 64.0 ms	58.3

* DID NOT MEET SPECIFICATIONS

Technician 

Approved By 

TEST Dummy Calibration - Neck Bending TEST DATE 09-13-2000 - 15 53 41

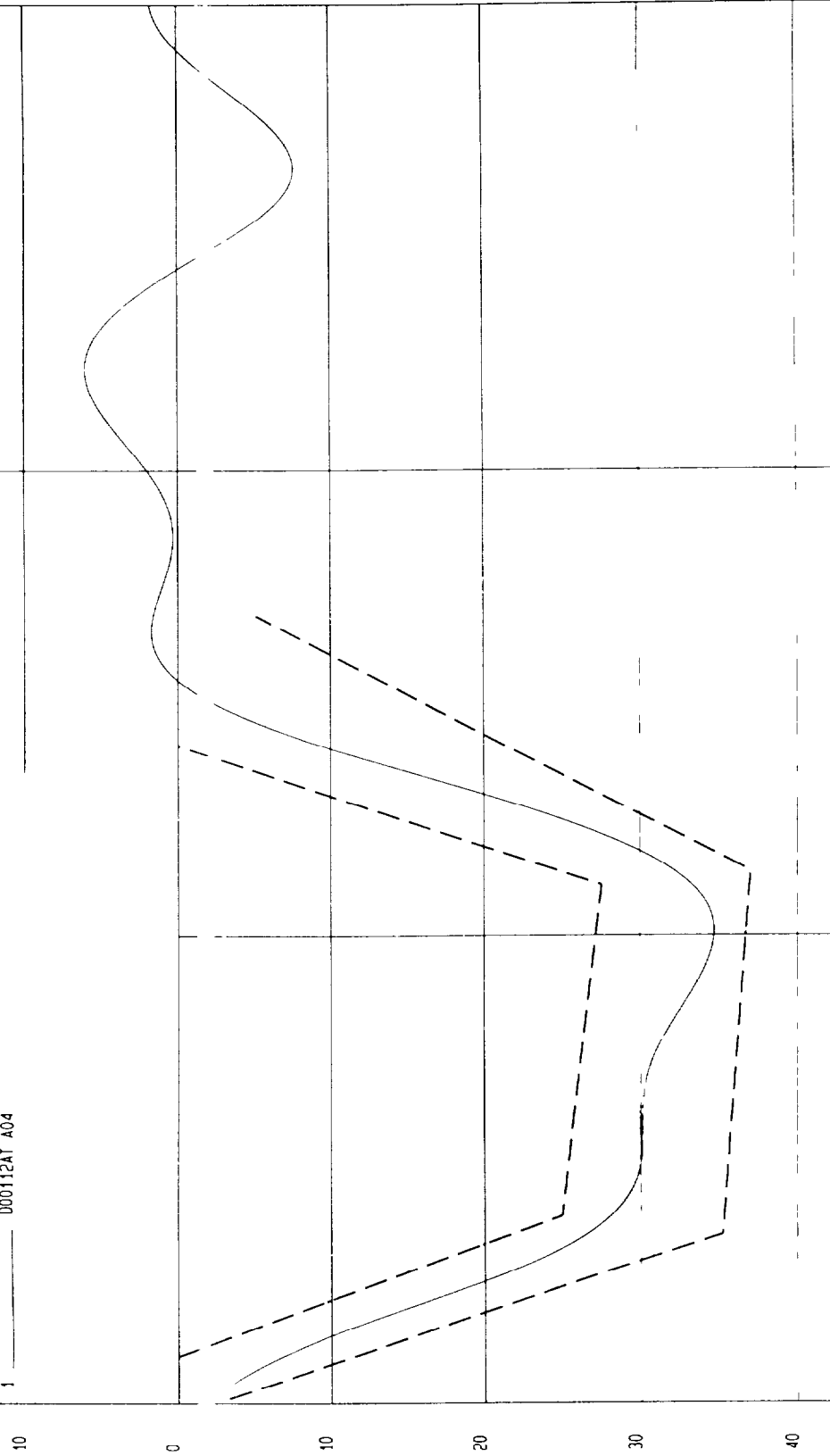
COMPONENT Dummy #ES2-002 Velocity 10 982 FT/SEC 3 35 M/SEC

Minimum 34.67 G S at 10.1 msec

Maximum 8.38 G S at 46.3 msec

PENDULUM ACCELERATION

1 ——— D00112AT A04



20

10

0

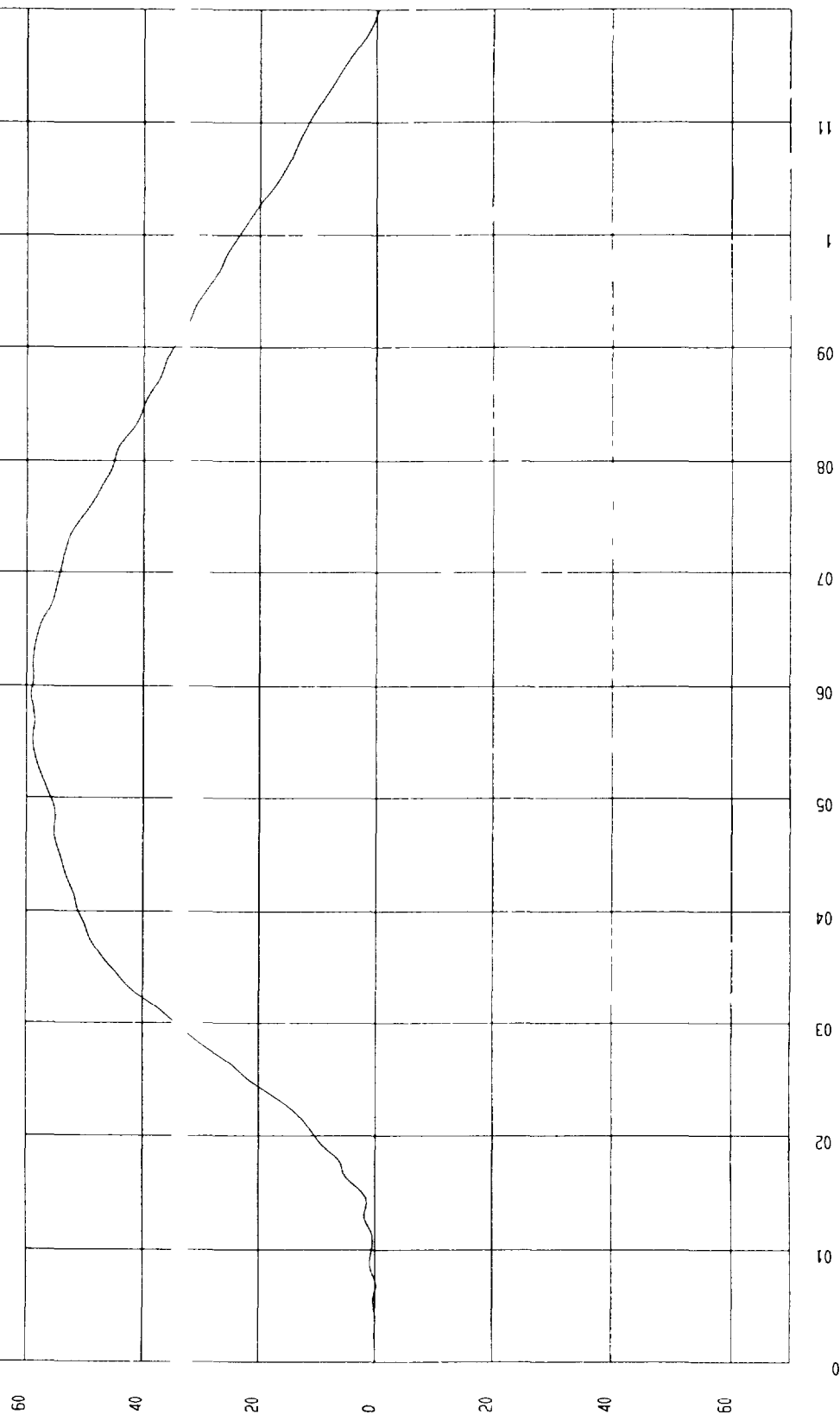
TEST Dummy Calibration - Neck Bending TEST DATE 09 13 2000 - 15 53 41

COMPONENT Dummy #ES2-002 Velocity 10 98 FT/SEC 3 35 M/SEC

Minimum 33.00 DEG at 167 msec Maximum 59.23 DEG at 59.3 msec

FLEXION ANGLE

1 ——— 00011201 D08 Filterclass (1000)



NSA Research
09 13-2000 15 55

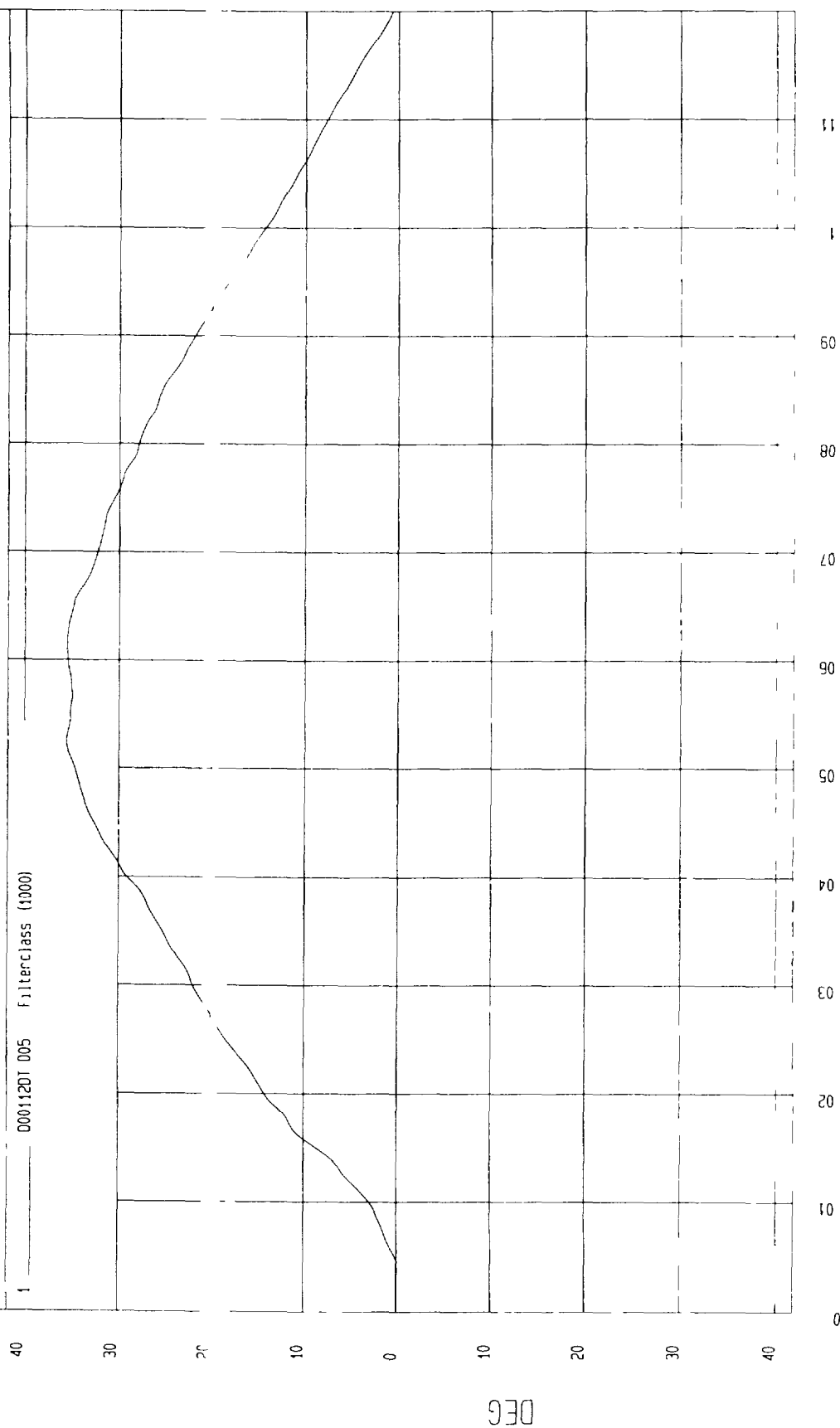
TEST Dummy Calibration - Neck Bending TEST DATE 09 13 2000 15 53 41

COMPONENT Dummy #ES2-002 Velocity 10 98 FT/SEC 3 35 M/SEC

Minimum 18 70 DEG at 167 msec Maximum 35 54 DEG at 52 4 msec

THETA A

1 00011201 005 Filterclass (1000)



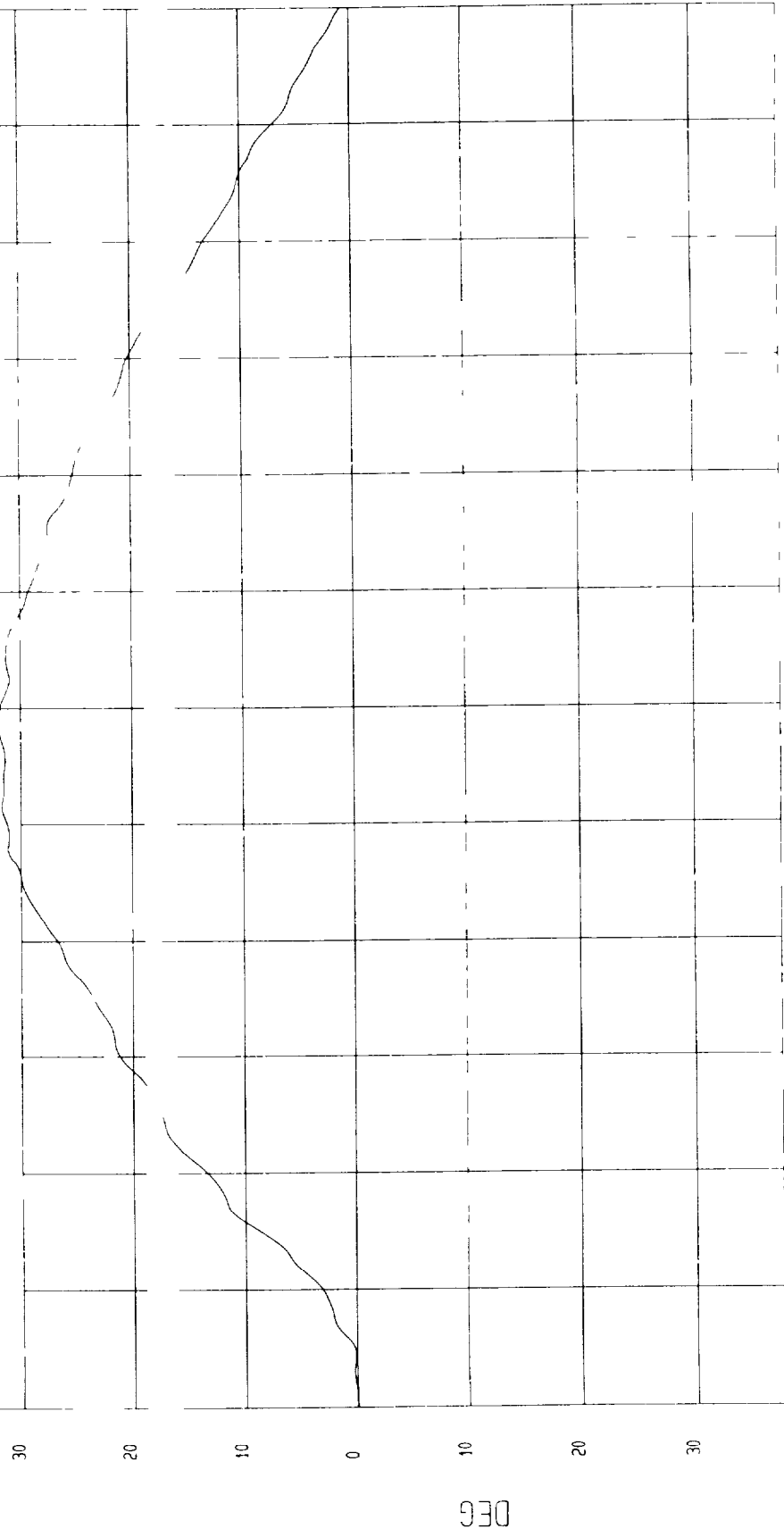
MCA Research
09 13 2000 15 55

TEST Dummy Calibration Neck Bending TEST DATE 09-13-2000 15 53 41
COMPONENT Dummy #ES2-002 velocity 10 98 FT/SEC 3 35 M/SEC

Minimum 19 73 DEG at 165 msec Maximum 31 92 DEG at 58 3 msec

THETA B

1 000112DT 006 Filterclass (1000)



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

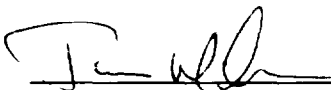
Date: September 13, 2000

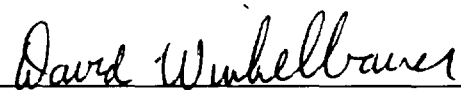
Dummy Serial Number ES2-002

Test Number D001113

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	4.2 – 4.4 m/s	4.3
Max Resultant Acceleration	7.5 – 10.5 g's	8.8
Time of Max Pendulum Acceleration		4.7

TEST MEETS SPECIFICATIONS

Technician. 

Approved By 

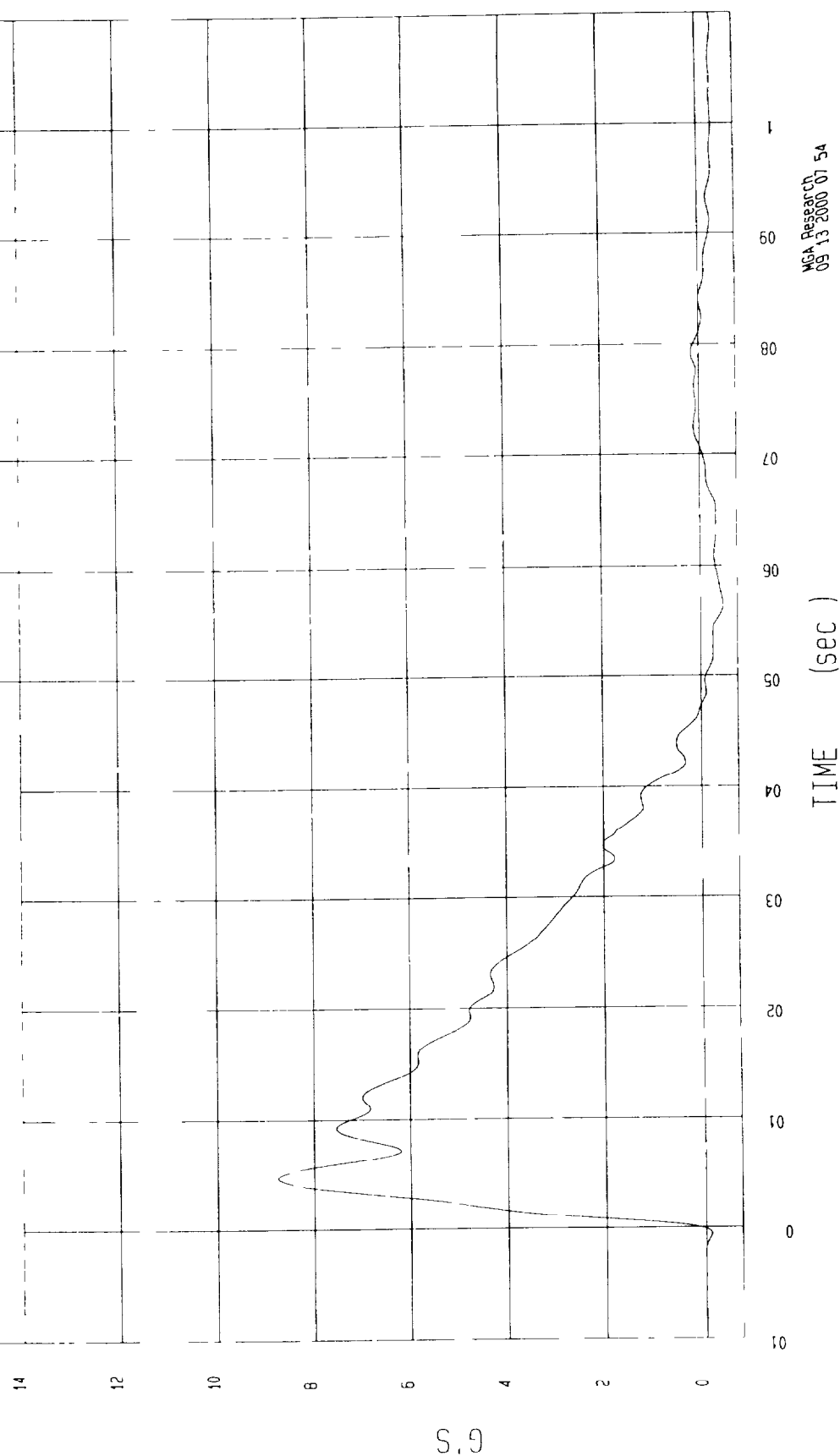
TEST Dummy Calibration - SHOULDER IMPACT TEST DATE 09-13-2000 - 07 54 35

COMPONENT Dummy #ES2-002 Velocity 14 03 FT/SEC 4 28 M/SEC

Minimum 46 G S at 56.4 msec Maximum 8 75 G S at 4.7 msec

PENDULUM ACCELERATION

000113AT A01 Filterclass (1000)



MGA Research
09 13 2000 07 54

MGA RESEARCH CORPORATION
UPPER/MIDDLE/LOWER RIB TESTS
EUROSID 2 DUMMY

Date: September 13, 2000

Dummy Serial Number ES2-002

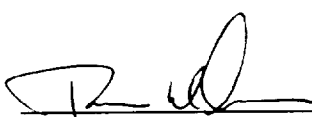
Test Number. D001114/5/6

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23 5 – 27 5 mm	25.9
Displacement at 3 m/s	36 0 – 40.0 mm	38.9
Displacement at 4 m/s	46 0 – 51 0 mm	50.7

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23 5 – 27 5 mm	25 2
Displacement at 3 m/s	36 0 – 40.0 mm	38.5
Displacement at 4 m/s	46 0 – 51 0 mm	50.6

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Displacement at 2 m/s	23 5 – 27 5 mm	24.7
Displacement at 3 m/s	36 0 – 40 0 mm	38.2
Displacement at 4 m/s	46 0 – 51 0 mm	50 4

TEST MEETS SPECIFICATIONS

Technician: 

Approved By David Winkelman

TEST Dummy Calibration RIB MODULE TEST DATE 09 13 2000 14 19 12

COMPONENT Dummy #ES2-002 Velocity 6 56 F1/SEC 2 M/SEC

Minimum 2 15 mm at 77 5 msec

Maximum 25 85 mm at 41 8 msec

UPPER RIB DISPLACEMENT

1 0001140F 005 Filterclass (1000)

40

30

20

10

0

10

mm

14

13

12

11

10

09

08

07

06

05

04

03

02

01

0

TIME (sec)

MGA Research
09 13-2000 14 26

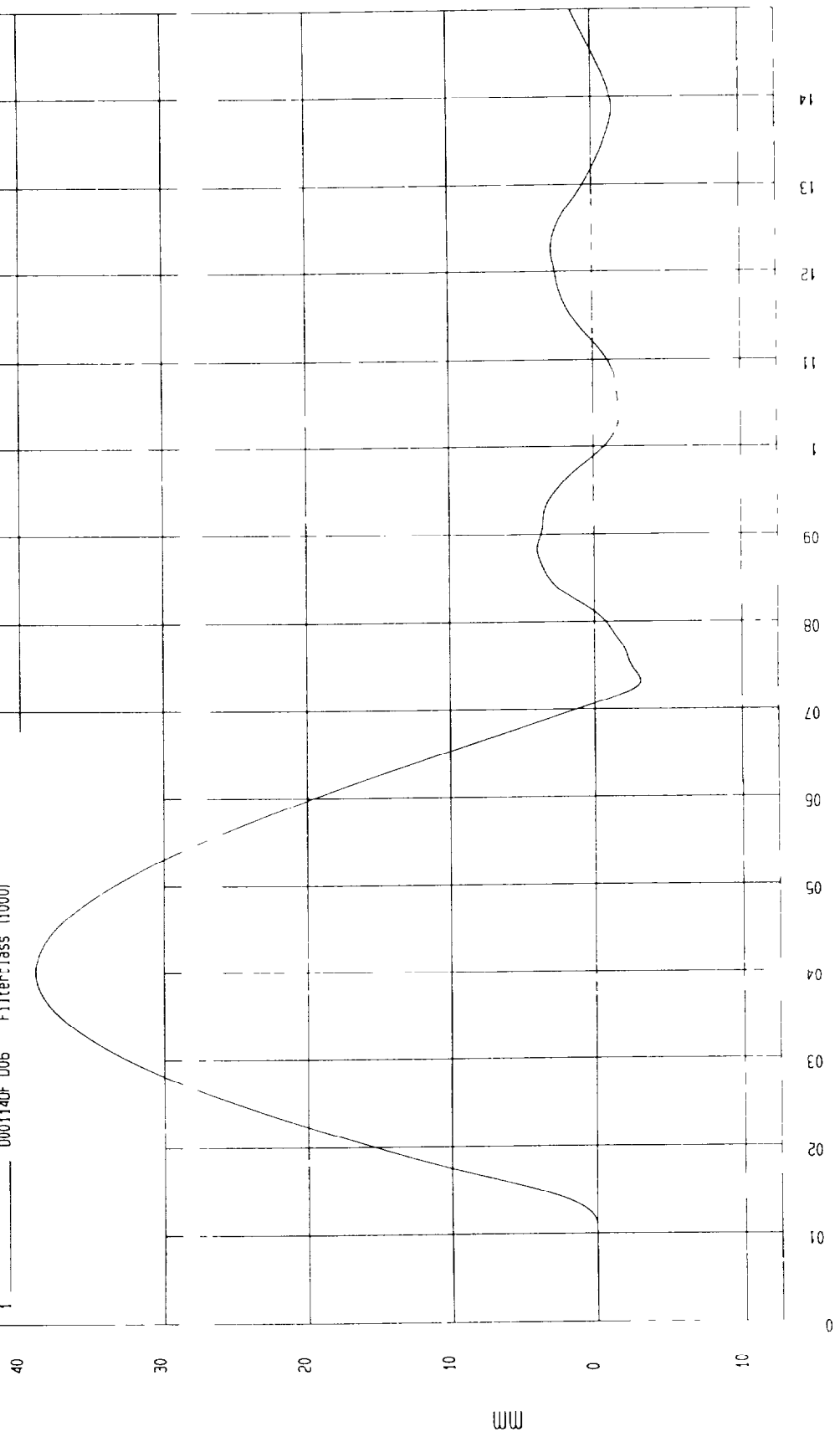
TEST Dummy Calibration - RIB MODULE TEST DATE 09-13-2000 - 14 26 00

COMPONENT Dummy #ES2-002 Velocity 9 84 F"/SEC 3 M/SEC

Minimum 3 10 mm at 73 2 msec Maximum 38 94 mm at 40 1 msec

UPPER RIB DISPLACEMENT

1 0001140F D06 Filterclass (1000)



MCA Research
09 13 2000 14 26

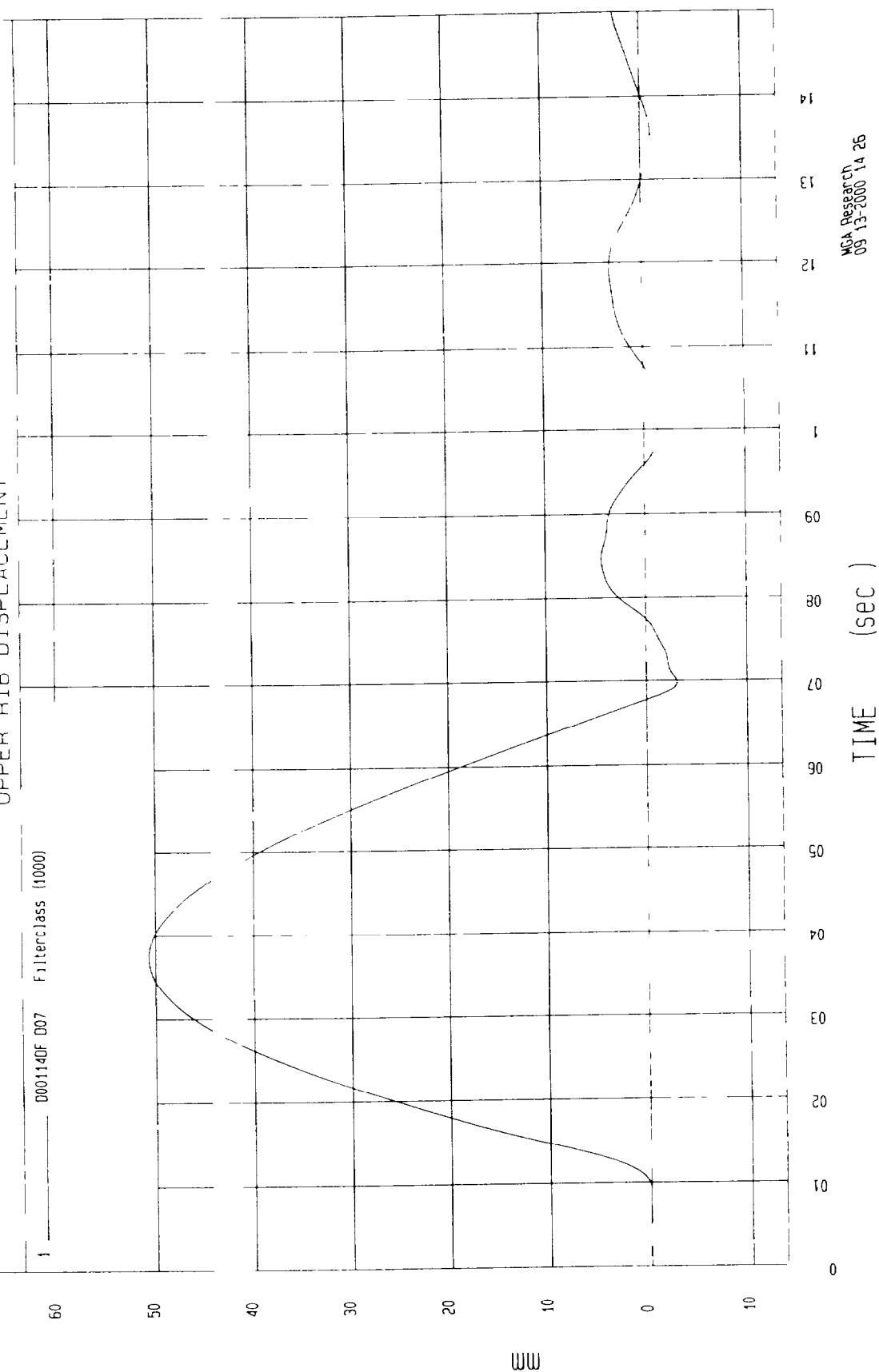
TEST Dummy Calibration RIB MODULE TEST DATE 04 13 2000 14 09 49

COMPONENT Dummy #ES2-002 Velocity 13 12 FT/SEC 4 M/SEC

Minimum 3 00 mm at 69 8 msec Maximum 50 69 mm at 3/4 msec

UPPER RIB DISPLACEMENT

1 000114DF D07 Filterclass (1000)



MGA Research
09 13-2000 14 25

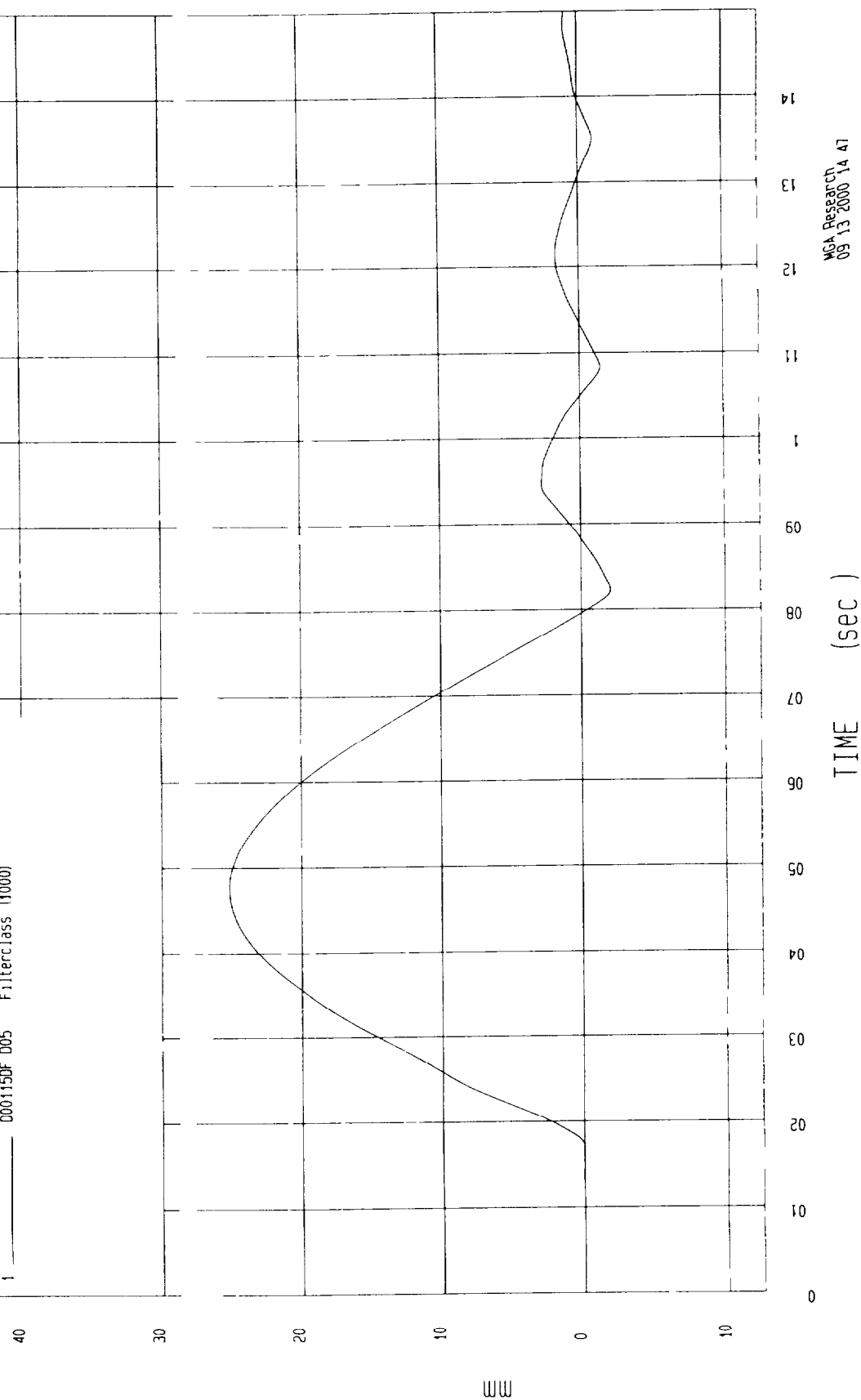
TEST Dummy Calibration RIB MODULE TEST DATE 09-13 2000 14 38 35

COMPONENT Dummy #ES2-002 Velocity 6 56 FT/SEC 2 M/SEC

Minimum 2 05 mm at 82 3 msec Maximum 25 16 mm at 47 8 msec

MIDDLE RIB DISPLACEMENT

1 0001150F D05 Filterclass (1000)



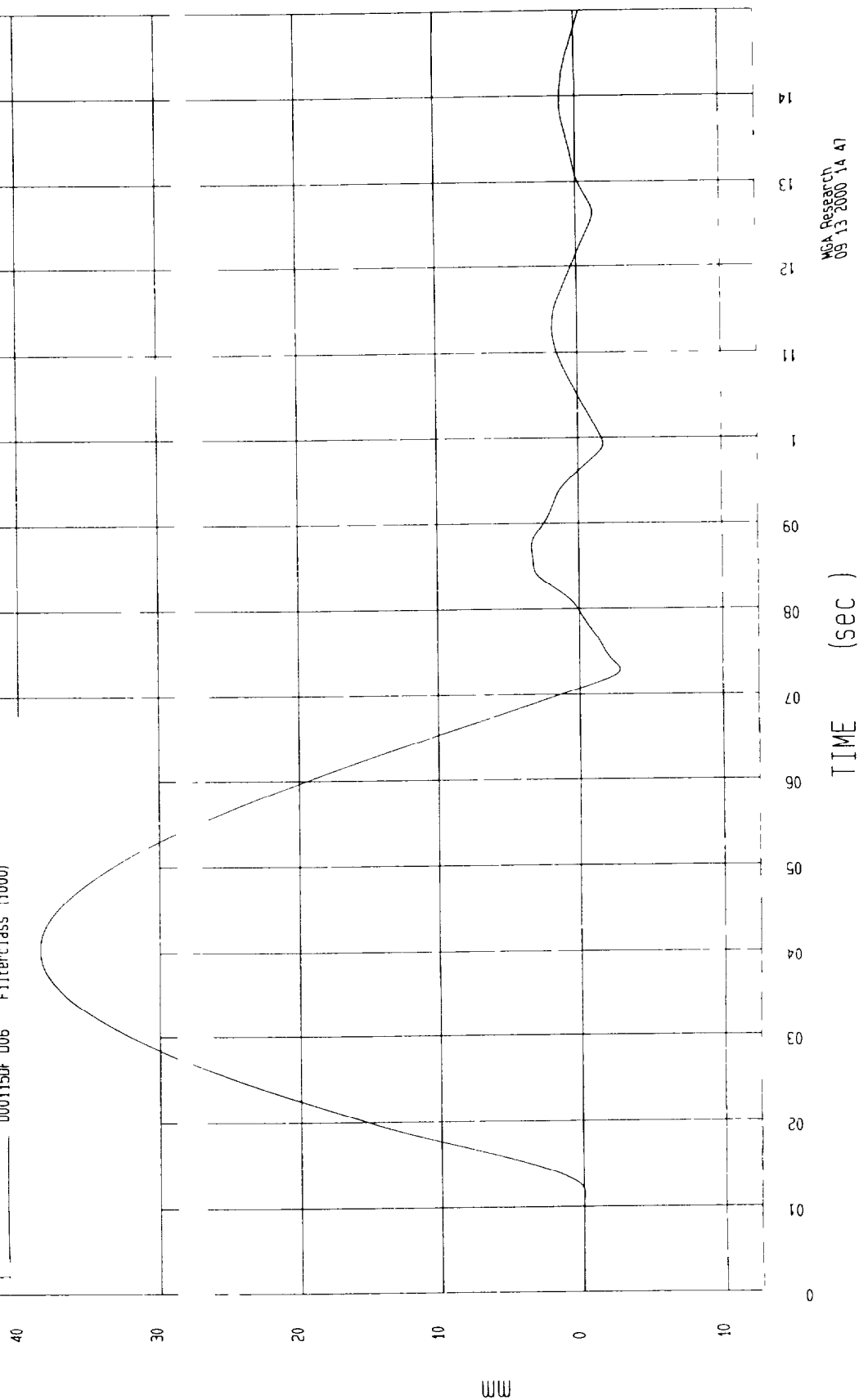
TEST Dummy Calibration - RIB MODULE TEST DATE 09 13-2000 14 46 57

COMPONENT Dummy #ES2-002 Velocity 9 84 FT/SEC 3 M/SEC

Minimum 2 86 mm at 72 9 msec Maximum 38 47 mm at 40 5 msec

MIDDLE RIB DISPLACEMENT

1 0001150F D06 Filterclass (1000)

MGA Research
09 13 2000 14 47

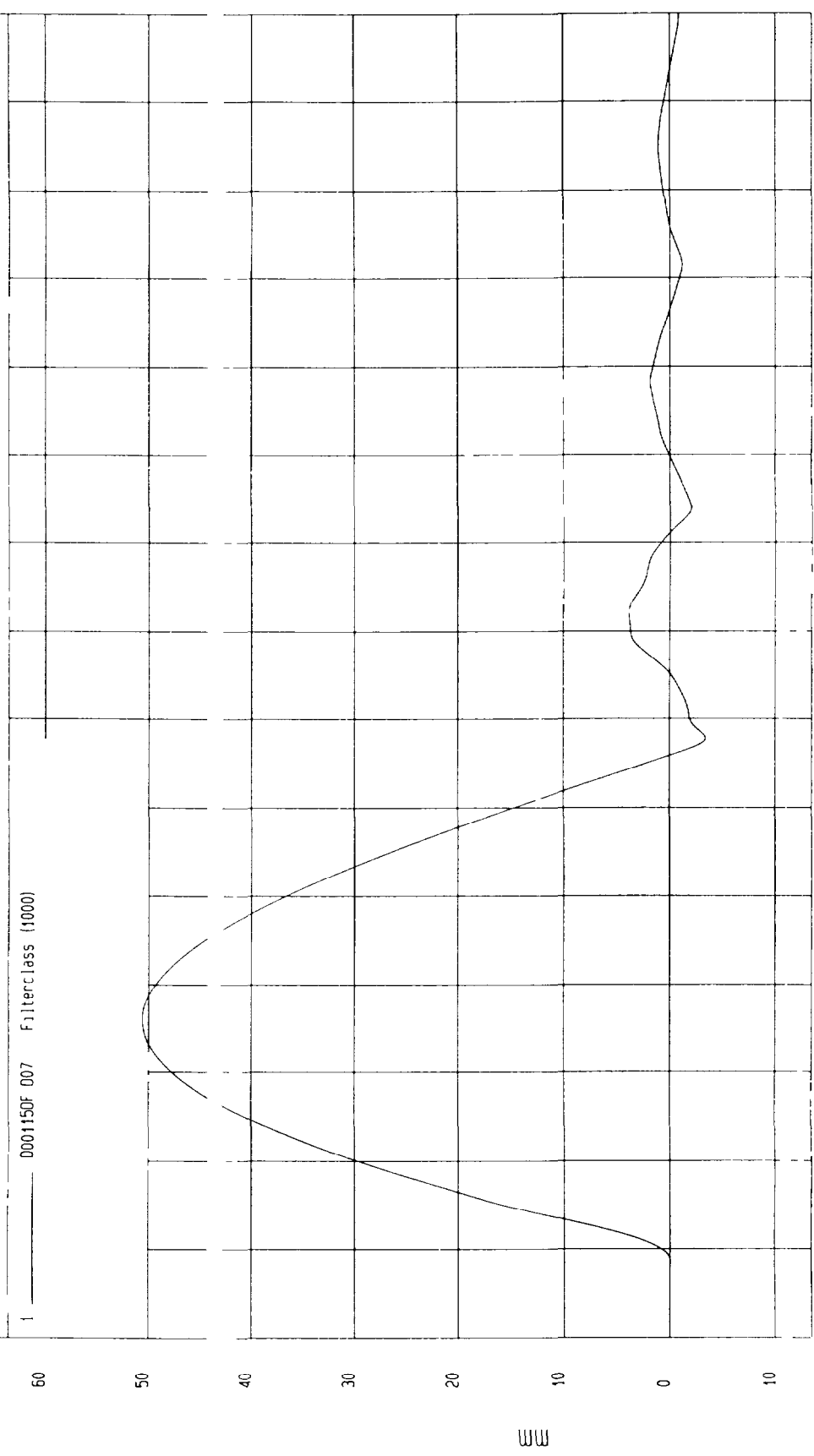
TEST Dummy Calibration RIB MODULIF TEST DATE 09 13 2000 14 32 46

COMPONENT Dummy #ES2-002 Velocity 13 12 FT/SEC 4 M/SEC

Minimum 3 40 mm at 67 9 msec Maximum 50 60 mm at 36 msec

MIDDLE RIB DISPLACEMENT

1 0001150F 007 Filterclass (1000)



MCA Research
09-13 2000 14 47

TEST Dummy Calibration RIB MODULE TEST DATE 09 13 2000 15 01 56

COMPONENT Dummy #LS2 002 Velocity 6 56 FT/SEC 2 M/SEC

Minimum 2 32 mm at 85 8 msec

Maximum 24 70 mm at 50 5 msec

LOWER RIB DISPLACEMENT

1 000160F D05 Filterclass (1000)

40

30

20

10

0

10

mm

0 01 02 03 04 05 06 07 08 09 10 11 12 13 14

TIME (sec)

MCA Research
09 13 2000 15 25

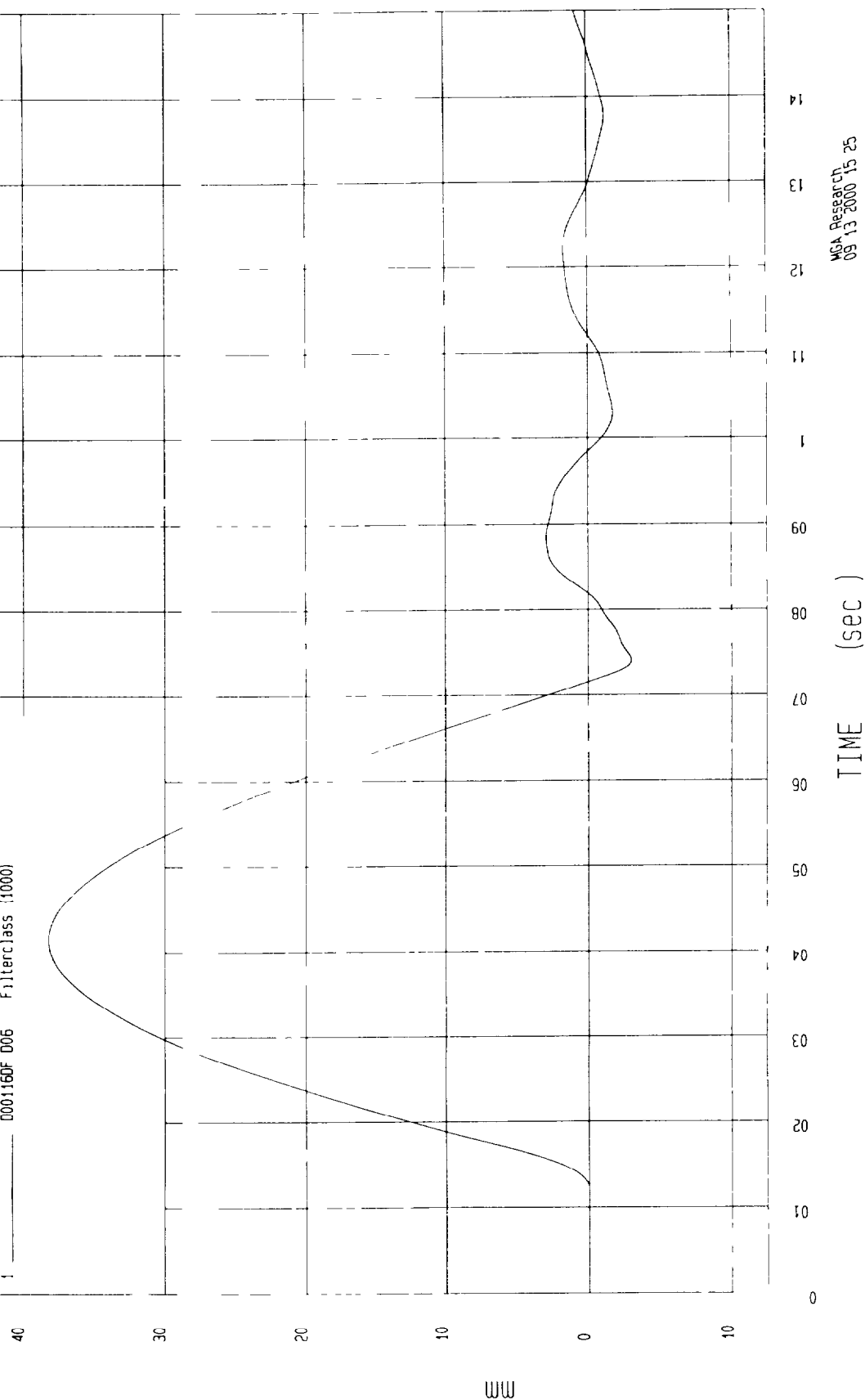
TEST DUMY Calibration RIB MODULE TEST DATE 09-13-2000 - 15 24 01

COM ONENT DUMY #ES2-002 Velocity 9 84 FT/SEC 3 M/SEC

Minimum 2 99 mm at 74 msec Maximum 38 24 mm at 41 5 msec

LOWER RIB DISPLACEMENT

1 0001160F D06 Filterclass (1000)

MGA Research
09-13-2000 15 25

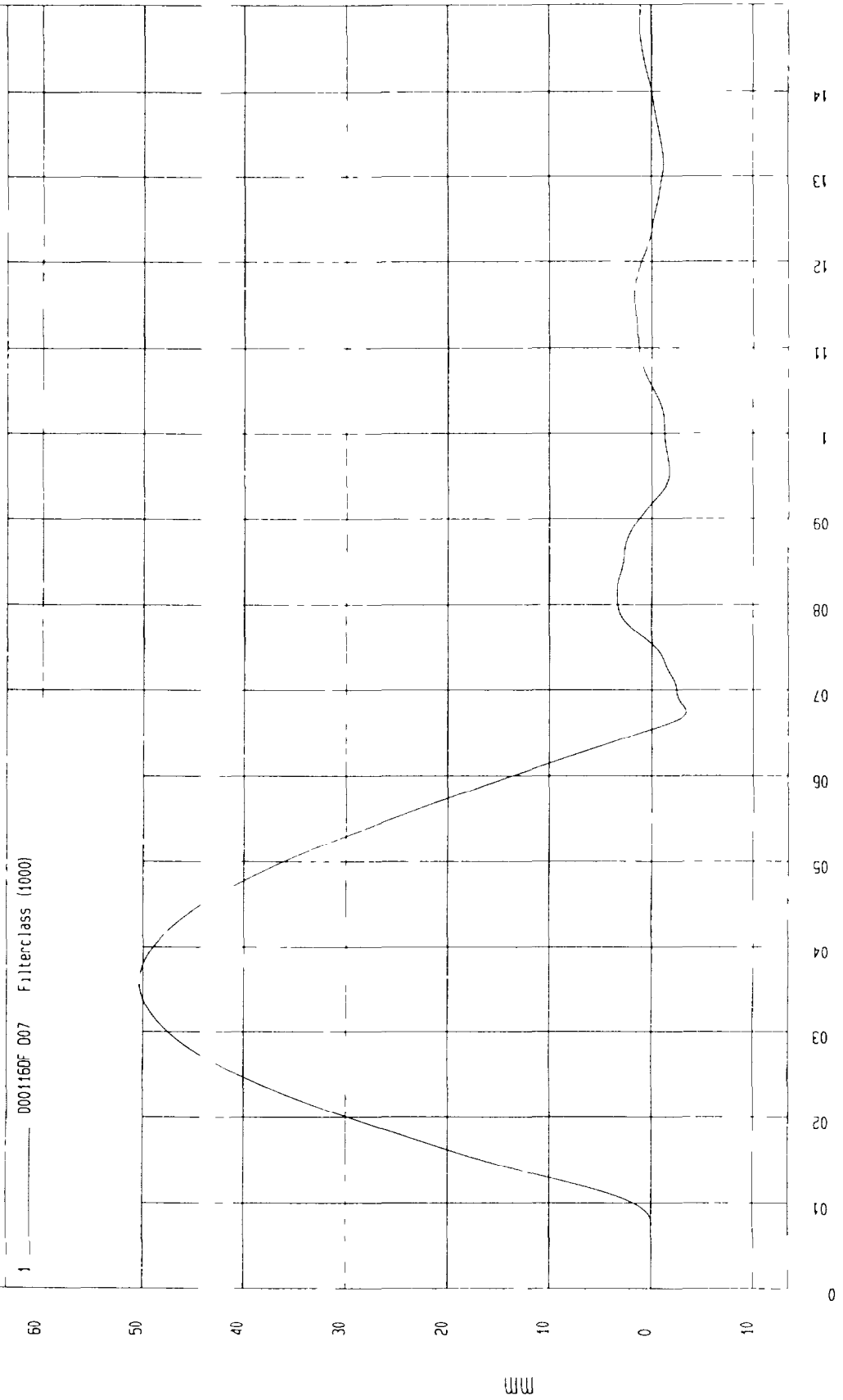
TEST Dummy Calibrat cr - RIB MODULE TEST DATE 09-13 2000 - 14 54 08

COMPONENT Dummy #EC2 002 Velocity 13 12 FT/SEC 4 M/SEC

Minimum 3 39 mm at 67 4 msec Maximum 50 39 mm at 35 8 msec

LOWER RIB DISPLACEMENT

1 000116DF 007 Filterclass (1000)



MGA RESEARCH CORPORATION

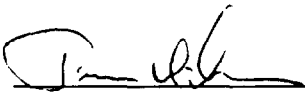
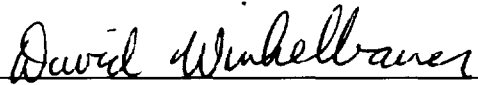
ABDOMEN TEST

EUROSID 2 DUMMY

Date: September 13, 2000Dummy Serial Number ES2-002Test Number D001117

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Probe Speed (m/s)	6.2 – 6.4	6.3
Maximum Impact Force	9.5 – 11.1 kN	10.6
Time of Maximum Force	8.8 – 10.4 ms	9.7
Maximum Total Abdomen Force	5.9 – 7.9 kN	6.0
Time of Max Total Force	8.5 – 10.1 ms	9.1

TEST MEETS SPECIFICATIONS

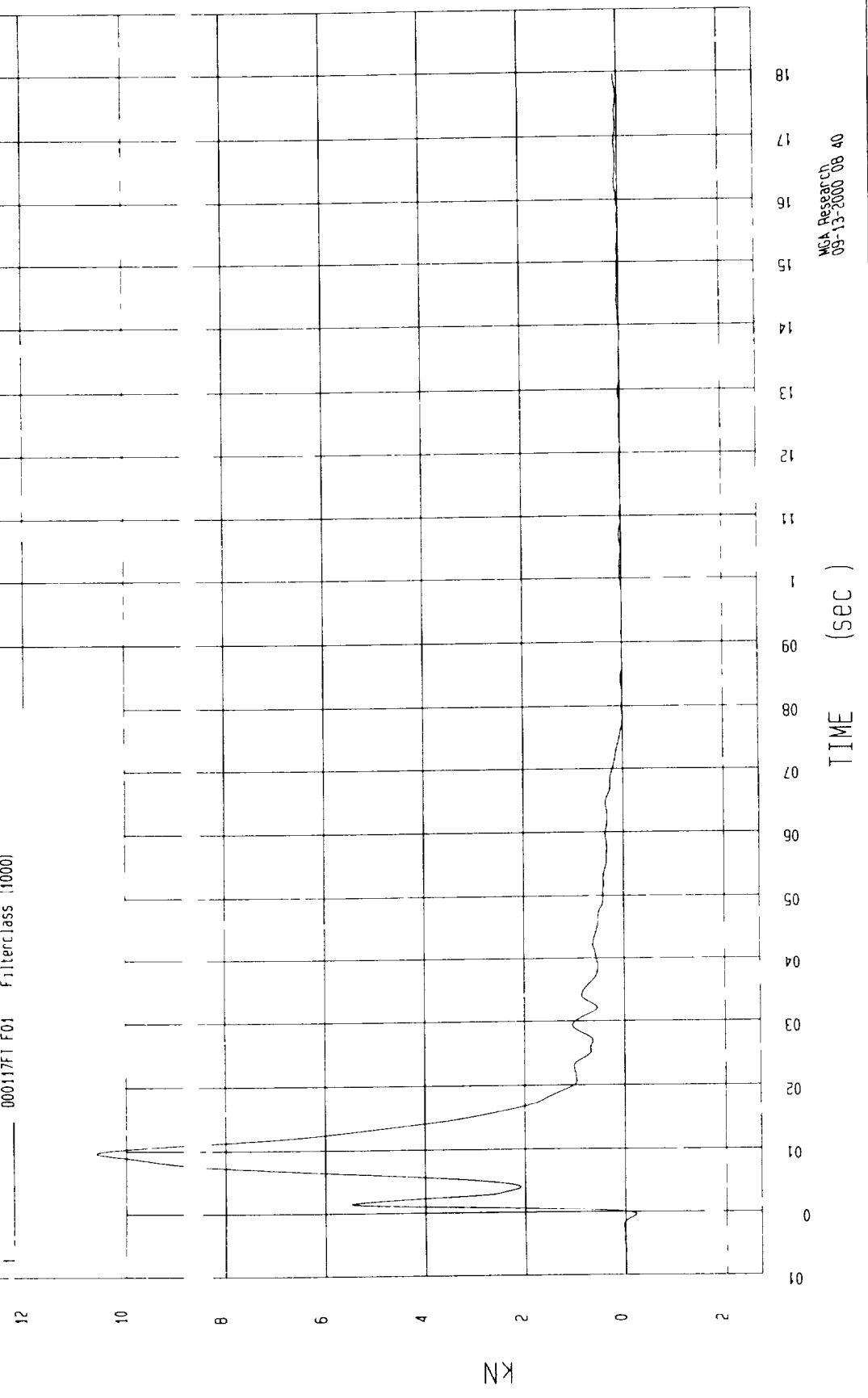
Technician Approved By 

TEST Dummy Calibration - ABDOMEN IMPACT TEST DATE 09-13-2000 - 08 38 54
COMPONENT Dummy #ES2-002 velocity 20 7 FT/SEC 6 31 M/SEC

Minimum 21 kN at 4 msec Maximum 10 58 kN at 9 7 msec

PROBE FORCE

1 000117FT F01 Filterclass (1000)



MCA Research
09-13-2000 08 40

TEST Dummy Calibration - ABDOMEN IMPACT TEST DATE 09 13 2000 08 39 43
COMPONENT Dummy #ES2-002 Velocity 20.7 FT/SEC 6.31 M/SEC

Minimum 4.34E 02 kN at 113 msec Maximum 5.95 kN at 9.1 msec

ABDOMEN FORCE

1 000117F1 F02 Filterclass (1000)

10

8

6

4

2

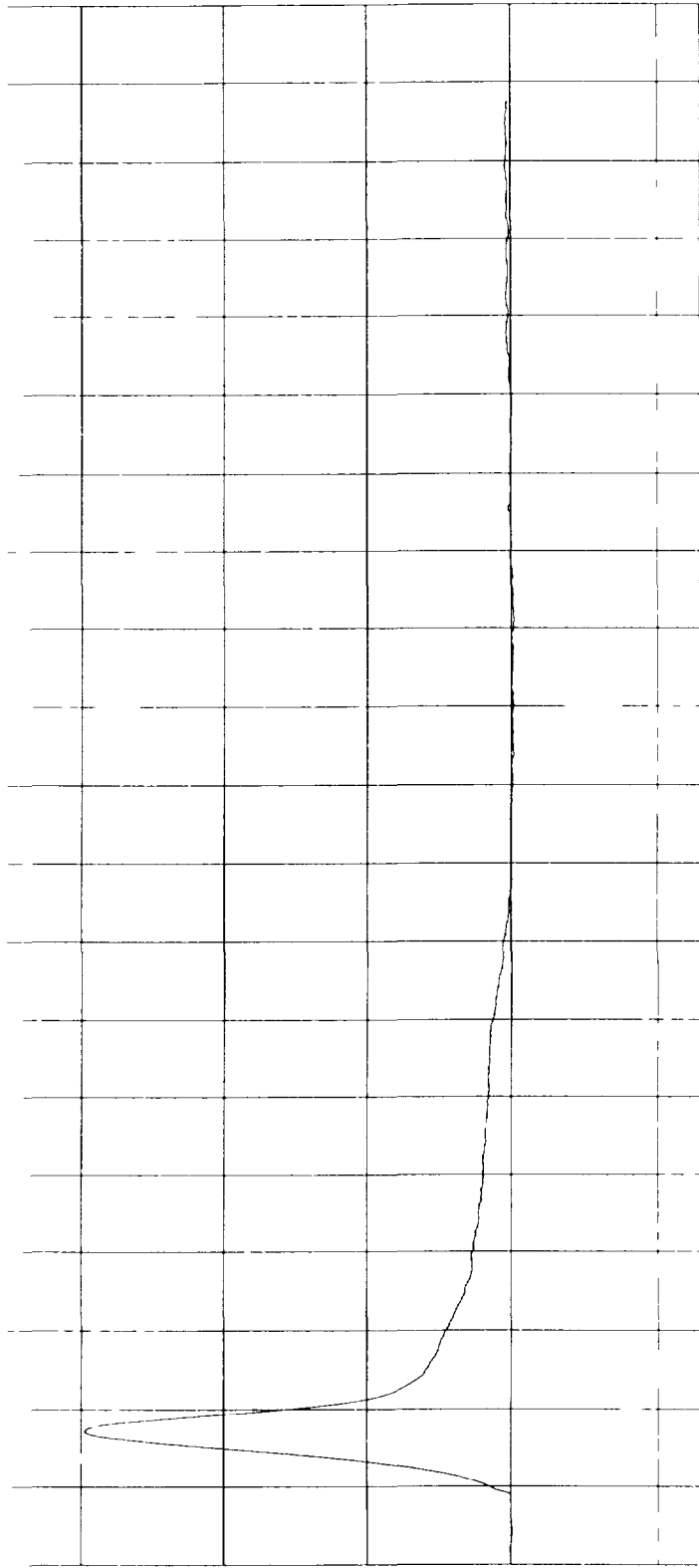
0

2

kN

TIME (sec)

MGA Research
09-13-2000 08:40



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date September 13, 2000
Dummy Serial Number ES2-002
Test Number D001118

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	5.95 – 6.15 m/s	6.14
Max Pendulum Acceleration		-29.4
Time Max Pendulum Acceleration		9.9
Maximum Flexion Angle	45.0 – 55.0 deg	52.3
Time of Max Flexion Angle	39.0 – 53.0 ms	47.6
Maximum Angle Theta (A)	31.0 – 35.0 deg	33.1
Time of Max Theta (A)	45.0 – 55.0 ms	47.9
Maximum Angle Theta (B)	27.0 – 31.0 deg	29.9
Time of Max Theta (B)	45.0 – 55.0 ms	46.6

TEST MEETS SPECIFICATIONS

Technician



Approved By



TEST Dummy Calibration - LUMBAR FLEXION TEST DATE 09-13-2000 - 16 38 06

COMPONENT Dummy #ES2-002 Velocity 20 148 FT/SEC 6 14 M/SEC

Minimum 29 41 G S at 9 9 msec

Maximum 4 64 G S at 36 msec

PENDULUM ACCELERATION

1 ——— D0011BAT A04

10

0

10

20

S.G

-30

40

0

01

02

03

04

05

06

07

08

09

TIME (sec)

MCA Research
09 13-2000 16 39

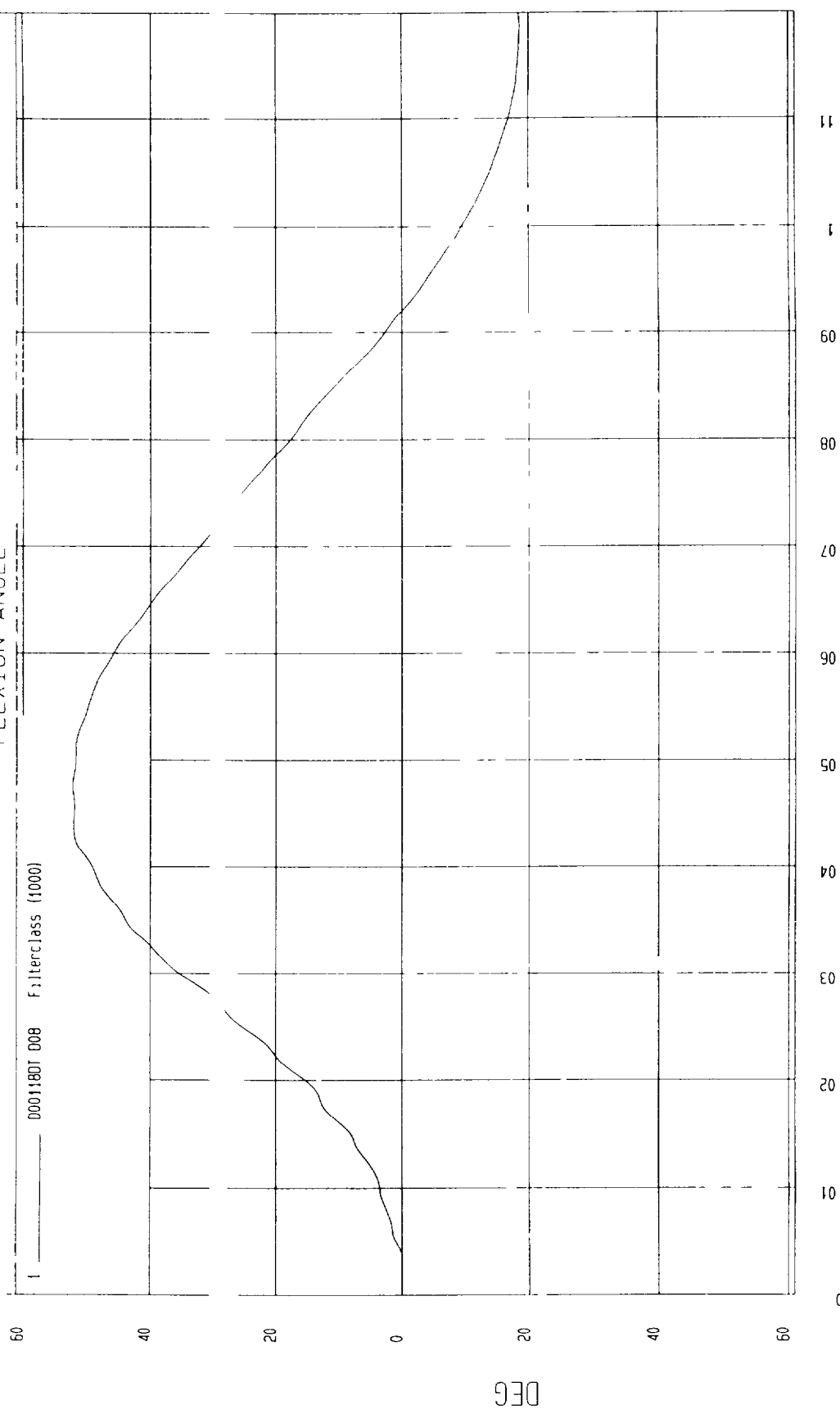
TEST Dummy Calibration HUMRAP FLEXION TEST DATE 09 13 2000 15 38 06

EMPGH NT Dummy #E - 002 Velocity 20 1.11/SEC 6 4 M/SEC

Minimum 18 59 DEG at 118 msec Maximum 52 25 DEG at 47 6 msec

FLEXION ANGLE

1 00011801 008 Filterclass (1000)



MGA Research
09 13-2000 16 39

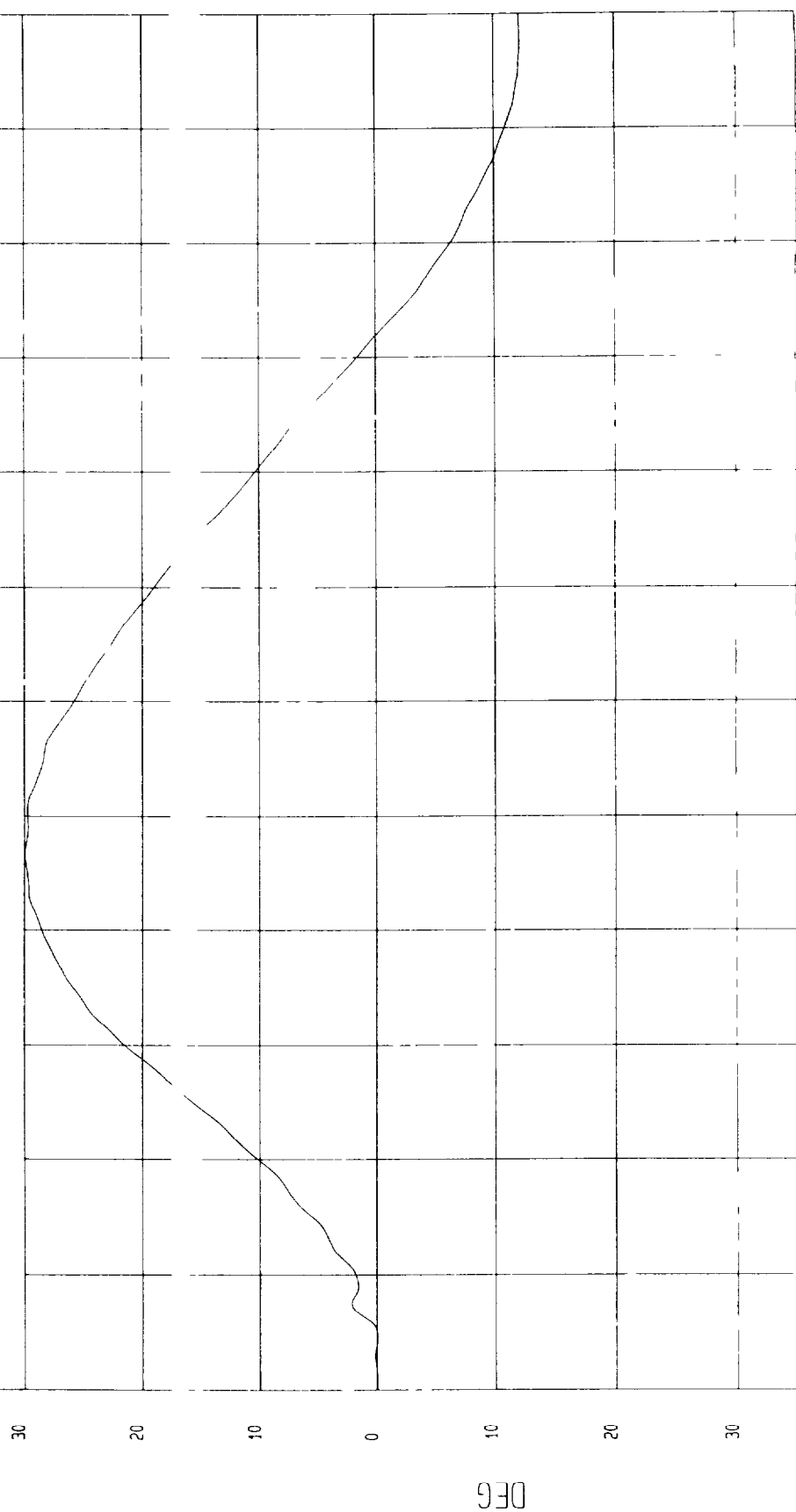
TEST Dummy Calibration - LUMBAR FLEXION TEST DAY 09 13-2000 - 15 38 05

COMMENT Dummy #EJ2-6 2 VELOCITY 20 15 / L 5 14 M/SEC

Minimum 12 20 DEG at 117 msec Maximum 29 93 DEG at 46 6 msec

THETA B

1 0001801 006 Filterclass (f000)



WGA Research
09 13 2000 16 39

MGA RESEARCH CORPORATION

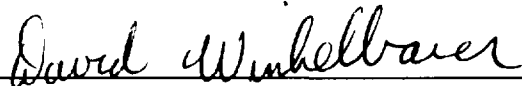
PELVIS TEST

EUROSID 2 DUMMY

Date September 13, 2000Dummy Serial Number ES2-002Test Number. D001119

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18 – 22	21
Relative Humidity (%)	10 – 70	48
Pendulum Speed	4.2 – 4.4 m/s	4.2
Maximum Impactor Force	4.4 – 5.1 kN	5.1
Time of Max Impactor Force	10.3 – 15.5 ms	14.2
Maximum Pubic Force	1.04 – 1.64 kN	1.40
Time of Max Pubic Force	9.9 – 15.9 ms	13.8

TEST MEETS SPECIFICATIONS

Technician Approved By 

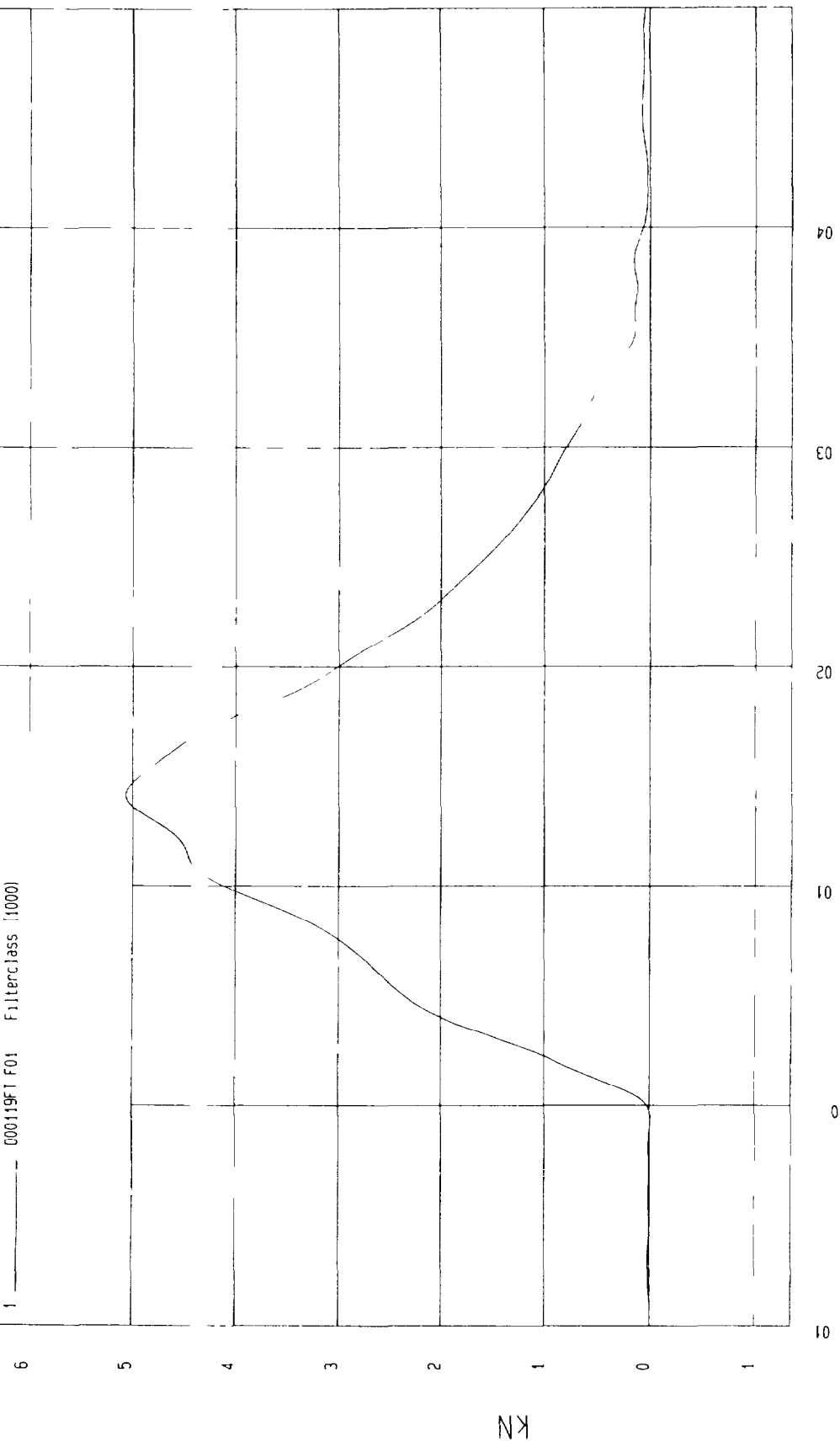
TEST Dummy Calibration - Pelvis Impact TEST DATE 09-13-2000 - 08 10 25

COMPONENT Dummy #ES2-002 Velocity 13 88 FT/SEC 4 23 M/SEC

Minimum 7 47E 03 kN at 102 msec Maximum 5 06 kN at 14 2 msec

IMPACTOR FORCE

1 --- 000119F1 F01 Filterclass (1000)



TEST Dummy Calibration - Pelvis Impact TEST DATE 09-13-2000 - 08 11 22

COMPONENT Dummy #ES2-002 Velocity 13 88 FT/SEC 4 23 M/SEC

Minimum 5 21E 02 kN at 40 msec

Maximum 1 40 kN at 13 8 msec

PUBIC FORCE

1 ——— 000119F1 F02 Filterclass (1000)

2

1 8

1 6

4

1 2

1

8

6

4

2

0

2

4

6

KN

10

0

10

20

30

40

TIME (sec)

MCA Research
09-13-2000 08 11

APPENDIX D – CALIBRATION INFORMATION

ES-2 INSTRUMENT CALIBRATION DATA

DRIVER	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	J13930	Endevco	June 2, 2000
Head Y Accelerometer	J13631	Endevco	June 2, 2000
Head Z Accelerometer	J13990	Endevco	June 2, 2000
Upper Neck Load Cell	076	Denton	November 1, 1999
Lower Neck Load Cell	102	First Technologies	December 21, 1999
Shoulder Load Cell	104	First Technologies	February 17, 2000
Shoulder Rotation	001	Space	August 1, 2000
Upper Spine X Accelerometer	J13710	Endevco	June 1, 2000
Upper Spine Y Accelerometer	J13547	Endevco	June 1, 2000
Upper Spine Z Accelerometer	J13705	Endevco	June 1, 2000
Upper Rib Y Accelerometer	J11625	Endevco	June 1, 2000
Mid Rib Y Accelerometer	J10730	Endevco	June 1, 2000
Lower Rib Y Accelerometer	J11014	Endevco	June 1, 2000
Upper Rib Displacement	ES2-001UR	Data Systems	March 1, 2000
Mid Rib Displacement	ES2-001MR	Data Systems	March 1, 2000
Lower Rib Displacement	ES2-001LR	Data Systems	March 1, 2000
Lower Spine X Accelerometer	J11046	Endevco	June 1, 2000
Lower Spine Y Accelerometer	J11784	Endevco	June 1, 2000
Lower Spine Z Accelerometer	J11047	Endevco	June 1, 2000
Torso Load Cell	096	Denton	November 1, 1999
T-12 Load Cell	078	Denton	October 29, 1999
Abdomen Front Load Cell	692	Denton	March 1, 2000
Abdomen Mid Load Cell	702	Denton	March 1, 2000
Abdomen Rear Load Cell	706	Denton	March 1, 2000
Pubic Symphysis Load Cell	144	Denton	June 7, 2000
Pelvis X Accelerometer	ALDM8	Endevco	July 12, 2000
Pelvis Y Accelerometer	ALDC3	Endevco	July 12, 2000
Pelvis Z Accelerometer	ALA92	Endevco	July 12, 2000
Right Femur Load Cell	121	First Technologies	July 13, 2000
Left Femur Load Cell	124	First Technologies	July 13, 2000

ES-2 INSTRUMENT CALIBRATION DATA

LEFT REAR PASSENGER	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	AMR94	Endevco	June 1, 2000
Head Y Accelerometer	AMTB1	Endevco	June 1, 2000
Head Z Accelerometer	AC9B7	Endevco	June 1, 2000
Upper Neck Load Cell	079	Denton	December 10, 1999
Lower Neck Load Cell	103	First Technologies	July 14, 2000
Shoulder Load Cell	108	First Technologies	March 16, 2000
Shoulder Rotation	002	Space	August 1, 2000
Upper Spine X Accelerometer	J14896	Endevco	July 7, 2000
Upper Spine Y Accelerometer	J14771	Endevco	July 7, 2000
Upper Spine Z Accelerometer	J14774	Endevco	July 7, 2000
Upper Rib Y Accelerometer	AHTN3	Endevco	July 7, 2000
Mid Rib Y Accelerometer	AHT12	Endevco	July 7, 2000
Lower Rib Y Accelerometer	AH0C3	Endevco	July 7, 2000
Upper Rib Displacement	ES2-002UR	Data Systems	March 1, 2000
Mid Rib Displacement	ES2-002UR	Data Systems	March 1, 2000
Lower Rib Displacement	ES2-002UR	Data Systems	March 1, 2000
Lower Spine X Accelerometer	J13653	Endevco	June 2, 2000
Lower Spine Y Accelerometer	J13713	Endevco	June 2, 2000
Lower Spine Z Accelerometer	J13649	Endevco	June 2, 2000
Torso Load Cell	100	Denton	December 10, 1999
T-12 Load Cell	079	Denton	June 2, 2000
Abdomen Front Load Cell	110	First Technologies	July 11, 2000
Abdomen Mid Load Cell	111	First Technologies	March 1, 2000
Abdomen Rear Load Cell	112	First Technologies	March 1, 2000
Pubic Symphysis Load Cell	108	First Technologies	November 1, 1999
Pelvis X Accelerometer	AGRW3	Endevco	June 2, 2000
Pelvis Y Accelerometer	AHY71	Endevco	June 2, 2000
Pelvis Z Accelerometer	AMPY0	Endevco	June 2, 2000
Right Femur Load Cell	125	First Technologies	July 13, 2000
Left Femur Load Cell	126	First Technologies	July 13, 2000

VEHICLE INSTRUMENT CALIBRATION DATA

	VEHICLE ACCELEROMETERS		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Right Front Sill X	I26-D11	Entran	August 18, 2000
Right Front Sill Y	I25-J18	Entran	August 18, 2000
Right Front Sill Z	F07-A24	Entran	August 18, 2000
Right Rear Sill X	G13-F02	Entran	August 14, 2000
Right Rear Sill Y	G13-F12	Entran	August 14, 2000
Right Rear Sill Z	G13-F15	Entran	August 14, 2000
Left Front Sill Y	I25-J06	Entran	August 10, 2000
Left Rear Sill Y	I18-E03	Entran	April 7, 2000
Floorpan @ Rear Axle X	C14-Z07	Entran	August 15, 2000
Floorpan @ Rear Axle Y	D06-A03	Entran	August 15, 2000
Floorpan @ Rear Axle Z	C05-Z13	Entran	August 15, 2000
Left Mid A Post Y	I18-E02	Entran	August 10, 2000
Left Lower A Post Y	I14-D13	Entran	August 18, 2000
Left Upper B Post Y	G01-J18	Entran	August 10, 2000
Left Mid B Post Y	C18-G12	Entran	August 8, 2000
Left Lower B Post Y	E10-F17	Entran	August 18, 2000
Driver Seat Track Y	G01-J12	Entran	February 11, 2000
Right Rear Occupant Compartment Y	G13-B03	Entran	March 17, 2000
Vehicle CG X	I26-D17	Entran	March 16, 2000
Vehicle CG Y	C25-A06	Entran	May 18, 2000
Vehicle CG Z	G13-F07	Entran	August 15, 2000
Left Front Door Upper Y	G13-F01	Entran	August 15, 2000
Left Front Door Mid Y	G13-F11	Entran	August 14, 2000
Left Front Door Lower Y	G13-F09	Entran	August 15, 2000

Note All Entran accelerometers are Model No EGE-72.

VEHICLE INSTRUMENT CALIBRATION DATA

	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Left Front Door Rear Lower Y	F20-G03	Entran	August 8, 2000
Left Rear Door Upper Y	C06-G01	Entran	August 10, 2000
Left Rear Door Mid Y	K11-J11	Entran	August 10, 2000
Left Rear Door Lower Y	J04-F10	Entran	August 10, 2000
Left Rear Door Rear Lower Y	K16-X02	Entran	May 18, 2000

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

APPENDIX E – PROCEDURE USED FOR ES-2 POSITIONING

APPENDIX E – PROCEDURE USED FOR ES-2 POSITIONING

Installation of the Side-Impact Dummy (recommended practice)

1 GENERAL

- 1 1 The dummy to be used for the following installation procedure is described in Annex 6 to this regulation
- 1 2 Adjust the knee joints so that they just support the leg when it is extended horizontally (1 to 2 g).
- 1 3 Clothe the dummy in form fitting cotton stretch mid-calf length pants. Each foot is equipped with a shoe

2 INSTALLATION

- 2 1 Place the dummy in the outboard front seat of the impact side as described in the test specifications.
- 2 2 The mid-sagittal plane of the dummy shall coincide with the centerplane of the occupant (as determined according to Annex 3, paragraph 2.8) with a tolerance of 2°
- 2 3 The pelvis of the dummy shall be positioned according to the following:
 - 2 3 1 The pelvis pitch angle shall be $20\ 0^{\circ} \pm 2\ 5^{\circ}$
 - 2 3 2 A line passing through the dummy H-points shall pass through an imaginary circle in the mid-sagittal plane of the dummy. This circle has a radius of 10 mm and is located 20 mm horizontally forward and 5 mm vertically above the reference H-point, determined by the 3D H-point machine.
- 2 4 The upper torso of the dummy shall be positioned according to the following
 - 2 4 1 The upper torso shall be bent forward and then laid back against the seat back. The shoulder of the dummy shall be set fully rearward.
 - 2.4 2 The torso reference line pitch angle shall be $25\ 0^{\circ} \pm 2.5^{\circ}$. The torso reference line is defined as the thoracic spine center line
- 2 5 The arms shall be positioned in such a way that the angle between the projection of the arm centerline on the mid-sagittal plane of the dummy and the torso reference line is $40^{\circ} \pm 5^{\circ}$

- 2.6 For the driver's seating position, without inducing pelvis or torso movement, place the right foot of the dummy on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. Set the left foot perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. Set the knees of the dummy such that their outside surfaces are 150 ± 10 mm from the plane of symmetry of the dummy. If possible, within these constraints, place the thighs of the dummy in contact with the seat cushion.
- 2.7 For other seating positions, without inducing pelvis or torso movement, place the heels of the dummy as far forward as possible on the floorpan without compressing the seat cushion more than the compression due to the weight of the leg. Set the knees of the dummy such that their outside surfaces are 150 ± 10 mm from the plane of symmetry of the dummy.

APPENDIX F – ES-2 PEAK REPONSES

DRIVER (ES-2) PEAK RESPONSE TABLE

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Head	1000	X	G	-26.09	53
	1000	Y	G	47.15	52
	1000	Z	G	64	55
	1000	RES	G	77.9	55
Head Injury Criteria (HIC)				546	
Upper Neck Force	1000	X	N	-786 53	50
	1000	Y	N	1177 27	52
	1000	Z	N	-2193.99	57
	1000	RES	N	2449.67	54
Upper Neck Moment	600	X	Nm	-108.47	48
	600	Y	Nm	-59 23	49
	600	Z	Nm	21.22	64
	600	RES	Nm	123.61	48
Lower Neck Force	1000	X	N	593.41	48
	1000	Y	N	-1314 16	61
	1000	Z	N	2003.05	54
	1000	RES	N	2315.56	54
Lower Neck Moment	600	X	Nm	-244.9	75
	600	Y	Nm	*	*
	600	Z	Nm	-20.31	70
	600	RES	Nm	245 47	75
Shoulder Force	1000	X	N	765.3	29
	1000	Y	N	4090.5	39
	1000	Z	N	599.5	30
	1000	RES	N	4097.8	39

* No Valid Data Collected

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Upper Spine	180	X	G	-19.08	39
	180	Y	G	80.3	41
	180	Z	G	9.2	29
Lower Spine	180	X	G	-15.4	31
	180	Y	G	69.4	30
	180	Z	G	-8.3	43
Upper Rib	180	Y	G	171.6	28
Mid Rib	180	Y	G	149.3	31
Lower Rib	180	Y	G	165	31
Upper Rib Deflection	180	Y	mm	-50.75	44
Mid Rib Deflection	180	Y	mm	-28.66	44
Lower Rib Deflection	180	Y	mm	-15.57	41
Upper Rib VC	180	Y	m/sec	0.78	33
Mid Rib VC	180	Y	m/sec	0.43	36
Lower Rib VC	180	Y	m/sec	0.22	39
Torso Force	600	X	N	265.6	40
	600	Y	N	-658.3	39
Torso Moment	600	Y	Nm	8	36
	600	Z	Nm	-10.05	160
T12 Force	600	X	N	455.27	85
	600	Y	N	3654.2	31
T12 Moment	600	X	Nm	-395.44	36
	600	Y	Nm	123.22	85

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Abdomen Front Force	600	Y	N	639.16	35
Abdomen Mid Force	600	Y	N	990.23	29
Abdomen Rear Force	600	Y	N	1169.85	30
Abdomen Summed Force	600	Y	N	2586.63	30
Pubic Symphysis Force	600	Y	N	-1786.04	27
Right Femur Force	600	X	N	682.42	51
	600	Y	N	-936.93	34
	600	Z	N	-1722.82	32
	600	RES	N	1775.6	32
Right Femur Moment	600	X	Nm	188.77	27
	600	Y	Nm	-126.19	35
	600	Z	Nm	-63.82	54
	600	RES	Nm	192.65	34
Left Femur Force	600	X	N	-350.15	41
	600	Y	N	-1559.93	19
	600	Z	N	1310.79	18
	600	RES	N	1578.39	19
Left Femur Moment	600	X	Nm	-174.22	26
	600	Y	Nm	47.25	24
	600	Z	Nm	-47.81	30
	600	RES	Nm	179.1	26
Pelvis	1000	X	G	-50.09	35
	1000	Y	G	114.6	24
	1000	Z	G	23.5	53

PASSENGER (ES-2) PEAK RESPONSE TABLE

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Head	1000	X	G	-40.94	58
	1000	Y	G	134.55	58
	1000	Z	G	44.19	53
	1000	RES	G	140.81	58
Head Injury Criteria (HIC)				727	
Upper Neck Force	1000	X	N	-1001.41	53
	1000	Y	N	1099.16	54
	1000	Z	N	1668.98	50
	1000	RES	N	1867.82	54
Upper Neck Moment	600	X	Nm	-111.03	52
	600	Y	Nm	26.37	53
	600	Z	Nm	-46.82	52
	600	RES	Nm	122.84	52
Lower Neck Force	1000	X	N	1301.31	53
	1000	Y	N	-1855.76	52
	1000	Z	N	2038.68	56
	1000	RES	N	2900.8	53
Lower Neck Moment	600	X	Nm	-111.19	53
	600	Y	Nm	-91.05	53
	600	Z	Nm	-25.13	60
	600	RES	Nm	143.92	53
Shoulder Force	1000	X	N	2203.82	42
	1000	Y	N	4428.75	43
	1000	Z	N	2551.75	46
	1000	RES	N	5522.11	43

PASSENGER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Upper Spine	180	X	G	-25.78	42
	180	Y	G	63.56	43
	180	Z	G	-15.04	41
Lower Spine	180	X	G	-21.22	40
	180	Y	G	82.13	41
	180	Z	G	-17.09	41
Upper Rib	180	Y	G	76.17	41
Mid Rib	180	Y	G	112.09	40
Lower Rib	180	Y	G	126.35	38
Upper Rib Deflection	180	Y	mm	-27.94	52
Mid Rib Deflection	180	Y	mm	-20.99	50
Lower Rib Deflection	180	Y	mm	-20.46	48
Upper Rib VC	180	Y	m/sec	0.24	45
Mid Rib VC	180	Y	m/sec	0.21	44
Lower Rib VC	180	Y	m/sec	0.18	44
Torso Force	600	X	N	268.32	42
	600	Y	N	-1032.79	41
Torso Moment	600	Y	Nm	-8.46	39
	600	Z	Nm	7.1	40
T12 Force	600	X	N	-1041.42	40
	600	Y	N	3959.67	41
T12 Moment	600	X	Nm	-470.81	41
	600	Y	Nm	-244.59	46

PASSENGER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values (G's)				
	Class	Axis	Units	Peak	Time (msec)
Abdomen Front Force	600	Y	N	556.15	42
Abdomen Mid Force	600	Y	N	938.98	41
Abdomen Rear Force	600	Y	N	612.84	45
Abdomen Summed Force	600	Y	N	1987.45	41
Pubic Symphysis Force	600	Y	N	-4789.24	32
Right Femur Force	600	X	N	-410.72	42
	600	Y	N	-2124.53	30
	600	Z	N	-1676.14	30
	600	RES	N	2553.05	30
Right Femur Moment	600	X	Nm	125.48	25
	600	Y	Nm	-64.63	42
	600	Z	Nm	-38.49	36
	600	RES	Nm	129.33	25
Left Femur Force	600	X	N	-976.54	30
	600	Y	N	5805.12	33
	600	Z	N	-3032.4	34
	600	RES	N	6393.96	33
Left Femur Moment	600	X	Nm	403.12	30
	600	Y	Nm	176.46	33
	600	Z	Nm	-87.17	29
	600	RES	Nm	440.71	33
Pelvis	1000	X	G	*	*
	1000	Y	G	104.86	32
	1000	Z	G	-58.68	38

* No Valid Data Collected