Department
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ministration

DOT HS 807 978
Final Report

February 1993

Door Latch Integrity Moving Deformable Barrier into A 1986 Volkswagen Golf at 315° Impact Angle

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 807 978		

4. Title and Subtitle	5. Report Date
DOOR LATCH INTEGRITY MOVING DEFORMABLE BARRIER INTO A 1986 VOLKSWAGEN GOLF AT 315° IMPACT ANGLE	FEBRUARY 1993
	6. Performing Organization Code TRC
7. Author(s)	8. Performing Organization Report No.
K. W. Looker, Project Engineer, TRC	930112
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Vehicle Research and Test Center 10820 State Route 347 East Liberty, Ohio 43319	11. Contract or Grant No. DTNH22-88-C-07292
	13. Type of Report and Period Covered FINAL REPORT JANUARY-MARCH 1993
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, D.C. 20590	14. Sponsoring Agency Code DOT/NHTSA/VRTC

15. Supplementary Notes

16. Abstract

A 1986 Volkswagen Golf was impacted by a moving deformable barrier conforming to NHTSA's TP-214D-02 lab procedure with the exception of the barrier's wheels being oriented parallel to its framework. The test was conducted at Transportation Research Center Inc. on January 12, 1993. The purpose of this test was to measure the occupant response and loads between the latch/striker interface of the driver's side door in the 315°, 72 kph side impact mode. The actual test speed was 72.4 kph. The vehicle's maximum static crush was 500 mm. The ambient temperature was 2° C.

17. Key Words	18. Distribution Statement
Door Latch Integrity	

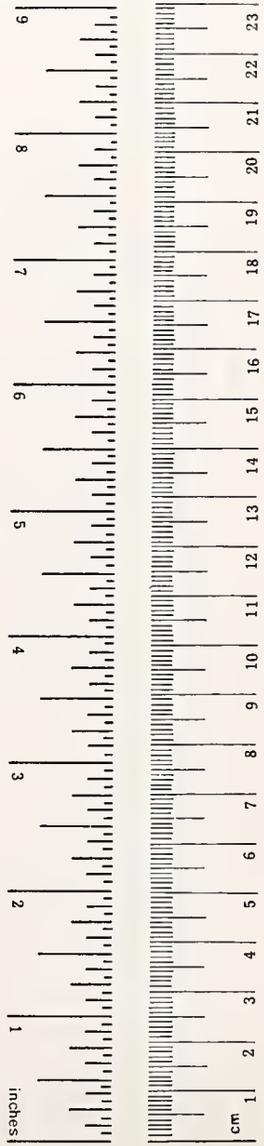
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	145	

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

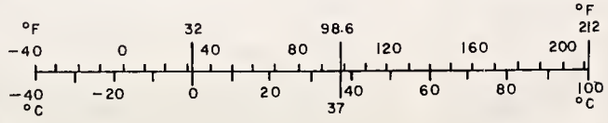
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures. Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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SECTION 1.0

PURPOSE & TEST PROCEDURE

PURPOSE

This door latch integrity test was conducted for Vehicle Research and Test Center by Transportation Research Center Inc. (TRC). This test was conducted to measure the occupant response and loads of the latch/striker interface of the subject vehicle's driver's side door in a 315°, 72 kph impact mode.

TEST PROCEDURE

The test vehicle was instrumented with twelve (12) accelerometers to measure longitudinal, lateral, and vertical axis accelerations. A triaxial load cell was placed in the driver's side B-pillar to measure loads at the latch/striker interface. The test vehicle was impacted by a moving deformabel barrier conforming to NHTSA's TP-214D-02 with the exception of its wheels being oriented parallel to its framework.

The test vehicle contained one (1) Biosid 50th percentile adult male anthropomorphic test device (dummy). The dummy was positioned in the left front outboard designated seating position according to the dummy placement procedure specified in Section C of the Biosid User's Manual. Seatbelts were not used.

The dummy was instrumented with head, pelvis, upper spine, and lower spine accelerometers to measure longitudinal, lateral, and vertical accelerations; upper, center, and lower left throax rib accelerometers and potentiometers to measure lateral accelerations and displacements; upper and lower left abdomen rib accelerometers and potentiometers to measure lateral accelerations and displacements; a left shoulder accelerometer, load cell and potentiometer to measure lateral acceleration, force, and shoulder to spine displacement; and pubic symphysis, pelvis sacrum, and pelvis iliac load cells to measure lateral forces.

The moving deformable barrier was instrumented with five (5) accelerometers to measure longitudinal, lateral, and vertical axis accelerations. The moving deformable barrier's specified velocity range was 71.6 to 73.2 kph.

The fifty-two (52) data channels were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 8000 samples per second and processed per sections 12.8 and 12.9 of the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time panning motion picture camera and five (5) high-speed motion picture cameras.

The door latch integrity test data are summarized in Section 2.0. The vehicle, occupant, and camera information are presented in Section 3.0. Appendix A contains the still photographic prints. Appendix B contains the dummy and vehicle data plots. Appendix C contains the dummy calibration data. Appendix D contains miscellaneous test information.

SECTION 2.0

DOOR LATCH INTEGRITY TEST SUMMARY

TEST RESULTS SUMMARY

This 72.4 kph 315° driver's side impact door latch integrity test was conducted at TRC on January 12, 1993.

The test vehicle, a 1986 Volkswagen Golf, was equipped with a 1.6-liter, transverse diesel engine, manual transmission, and power brakes. The vehicle's test weight was 1108 kg. The moving deformable barrier's impact speed was 72.4 kph. The vehicle's maximum static crush was 500 mm.

The driver dummy's Thoracic Trauma Index (TTI(d)) and Head Injury Criteria (HIC) were 143 and 1233, respectively. The driver's pelvis maximum lateral acceleration was 151.9 g.

The door on the struck side of the test vehicle did not separate from the vehicle's main body at the hinges or latch. The door on the opposite side did not open during the crash event.

The load cell located in the driver's side B-pillar measured peak latch/striker interface loads of -4235 N, 6090 N, and -14,301 N in the X, Y, and Z directions, respectively (See data summary for orientation of the load cell's axis).

TABLE 1 CRASH TEST SUMMARY

TEST TYPE: Door Latch Integrity Impact Test

TEST DATE: 01/12/93 TEST TIME: 1511 AMBIENT TEMP. (°C): 2

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1986/Volkswagen/Golf/3-door hatchback

VEHICLE TEST WEIGHT (KG): 1108

IMPACT ANGLE (DEG)*: 315

IMPACT VELOCITY (KPH)**: PRIMARY = 72.4 SECONDARY = 72.4

MAXIMUM STATIC CRUSH (MM): 500

DUMMIES: Driver #001

TYPE: Biosid

LOCATION: Left front

RESTRAINT: Unrestrained

NUMBER OF DATA CHANNELS: 52

NUMBER OF CAMERAS: HIGH-SPEED 5 REAL-TIME 1

*As measured clockwise from the vehicle's front longitudinal centerline.
**Speed trap measurement (± .08 kph accuracy)

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Volkswagen of America

MAKE/MODEL: Volkswagen/Golf VIN: 1VWAG0175GU043853

BODY STYLE: 3-door hatchback MODEL YEAR: 1986

COLOR: Light Blue Metallic

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.6-liter

TRANSMISSION DATA: _5_SPEED, _X_MANUAL, ___AUTOMATIC, _X_FWD, ___RWD, ___4WD

DATE VEHICLE RECEIVED: 01/06/93 ODOMETER READING: 165,995

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	No	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	Yes
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? No*
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE MANUFACTURED BY: Volkswagen of America

VIN: 1VWAG0175GU043853

GVWR: 1440 KG

GAWR: FRONT: 816 KG, REAR: 699 KG

*The vehicle was modified to mount a triaxial load cell to the driver's side door latch.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Michelin, MXL Radial X, 175/70R13

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 200 kPa
REAR: 241 kPa

SPARE TIRE (MFR., LINE, SIZE): Michelin, Temporary, 105/70R14 84F

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually-adjustable

MAXIMUM WIDTH: 1656 MM

WHEELBASE: 2476 MM

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:

The label was located on the driver's side B-pillar.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: P175/70R13

RECOMMENDED COLD TIRE PRESSURE: FRONT: 200 kPa; REAR: 241 kPa

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 417 KG.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN MILLIMETERS):

DELIVERED ATTITUDE:	LF	613;	RF	616;	LR	622;	RR 624
PRE-TEST ATTITUDE:	LF	605;	RF	597;	LR	586;	RR 591
POST-TEST ATTITUDE:	LF	557;	RF	568;	LR	584;	RR 603

TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE AS RECEIVED (WITH MAXIMUM FLUIDS):

RIGHT FRONT	301 KG	RIGHT REAR	172 KG
LEFT FRONT	304 KG	LEFT REAR	177 KG
TOTAL FRONT WEIGHT	605 KG	(63.4% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	349 KG	(36.6% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	954 KG		

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 78 KG OF CARGO WEIGHT:

RIGHT FRONT	334 KG	RIGHT REAR	216 KG
LEFT FRONT	338 KG	LEFT REAR	220 KG
TOTAL FRONT WEIGHT	672 KG	(60.6% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	436 KG	(39.4% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	1108 KG		

WEIGHT OF BALLAST SECURED IN VEHICLE CARGO AREA: 0

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None*

CG = 975 MM REARWARD OF FRONT WHEEL CENTERLINE

*VRTC did not specify a target test weight.

TABLE 3 POST-IMPACT DATA

TEST NUMBER: 930112

TEST DATE: 01/12/92 TEST TIME: 1511

TEST TYPE: Side Impact IMPACT ANGLE: 315° *

AMBIENT TEMPERATURE AT IMPACT AREA: 2° C

TEMPERATURE IN OCCUPANT COMPARTMENT: 20° C

IMPACT VELOCITY: PRIMARY = 72.4 KPH SECONDARY = 72.4 KPH

(SPECIFIED RANGE = 71.6 TO 73.2 KPH)

DISTANCE FROM BARRIER TO VEHICLE: ENTERING VELOCITY TRAP = 381 MM

EXITING VELOCITY TRAP = 51 MM

*Measured clockwise from vehicle's front longitudinal centerline.

TABLE 4 TEST CONDITIONS

TEST NUMBER: 930112

DATE OF TEST: 01/12/93 TIME OF TEST: 1511

WIND VELOCITY: NA HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA: 2° C

TEMPERATURE IN OCCUPANT COMPARTMENT: 20° C

VEHICLE DATA

	ACTUAL	INTENDED
SUBJECT VEHICLE TEST WEIGHT (KG)	1108	1108
MDB TEST WEIGHT (KG)	1334	1322-1335
MDB VELOCITY (KPH)*	72.4	71.6-73.2
IMPACT POINT (MM)**:	1218	1218

DUMMIES

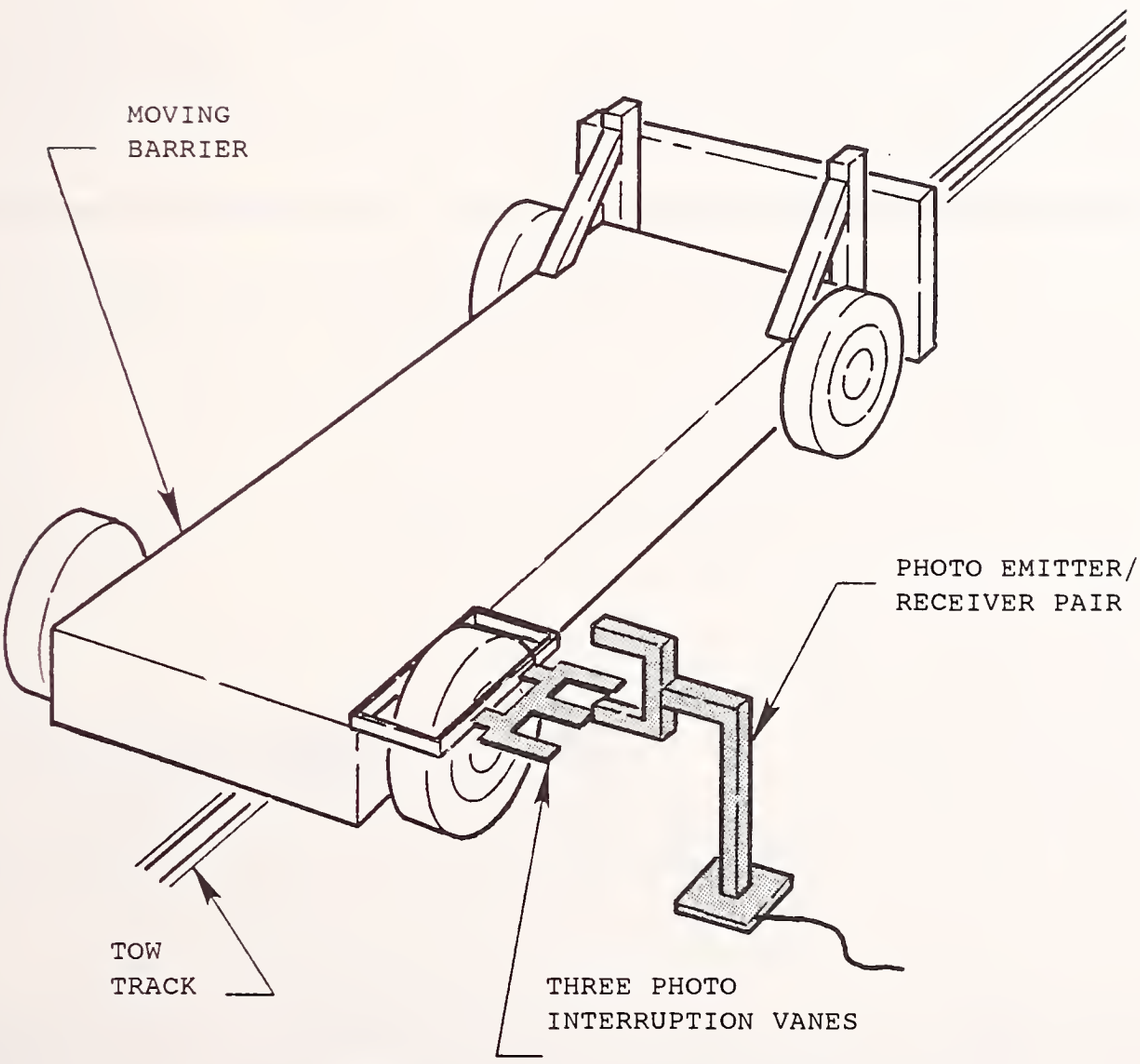
	DRIVER
TYPE:	Biosid
SERIAL NO.:	001
INSTRUMENTATION:	
HEAD ACCEL.:	3
SHOULDER ACCEL.:	1
SHOULDER DISPLACEMENT:	1
UPPER SPINE ACCEL.:	3
UPPER RIB ACCEL.:	2
CENTER RIB ACCEL.:	2
LOWER RIB ACCEL.:	2
RIB DISPLACEMENT:	3
LOWER SPINE ACCEL.:	4
UPPER ABDOMEN ACCEL.:	1
LOWER ABDOMEN ACCEL.:	1
ABDOMEN DISPLACEMENT:	2
PELVIS ACCEL.:	3
SHOULDER FORCE:	1
PELVIS FORCE:	3
RESTRAINT SYSTEM:	Unrestrained

REMARKS:

*AS MEASURED OVER FINAL 305 MM OF TRAVEL.

**FIRST CONTACT POINT OF MOVING DEFORMABLE BARRIER AND SUBJECT VEHICLE AS MEASURED FORWARD OF THE SUBJECT VEHICLE'S WHEELBASE MIDPOINT.

FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM

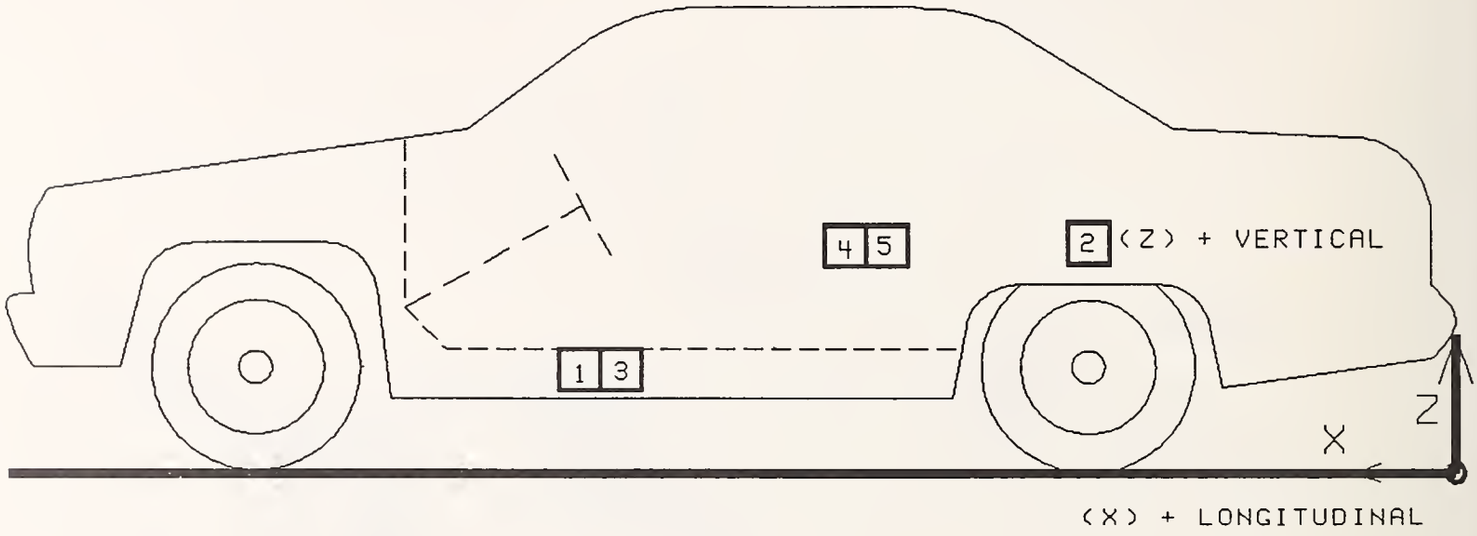


The final vane clears emitter/receiver 51 millimeters before impact.

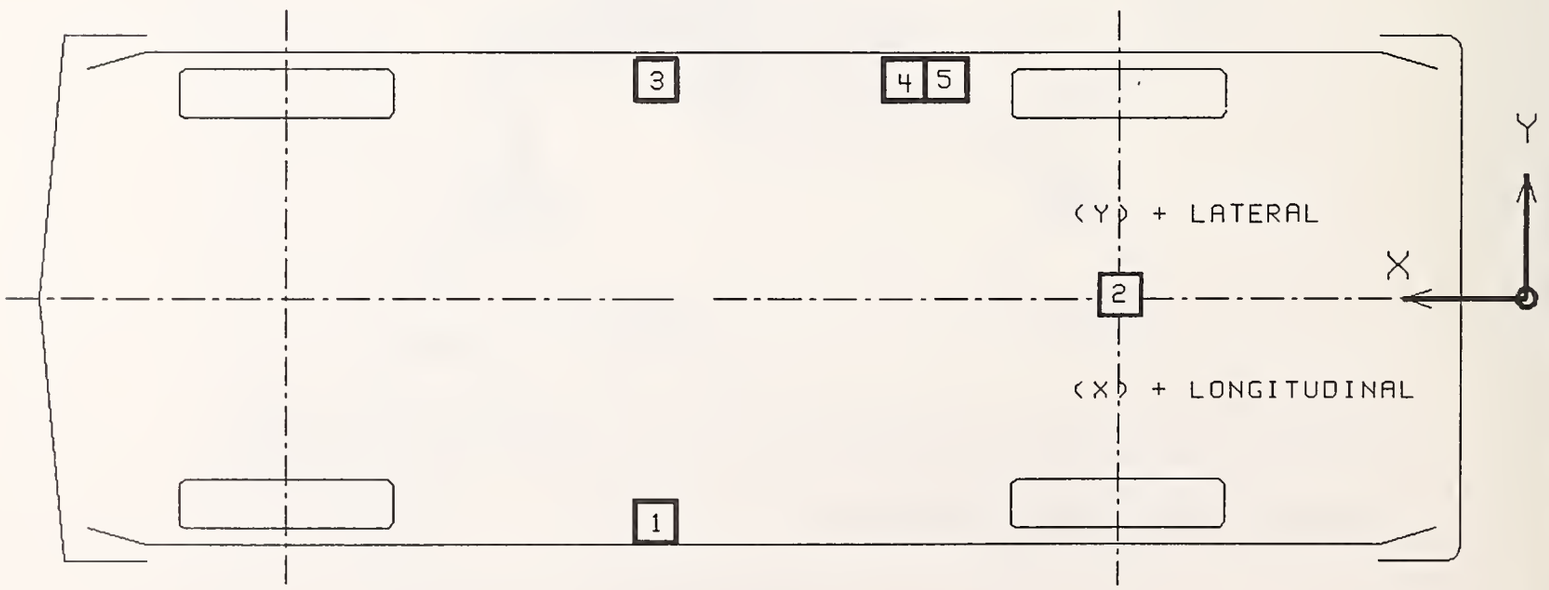
The vanes have 305-meter spacing.

FIGURE 2

VEHICLE INSTRUMENTATION PLACEMENT



SIDE VIEW



BOTTOM VIEW

VEHICLE INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 930112

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX	NEGATIVE DIRECTION MSEC
1	RIGHT FRONT DOOR SILL ACCELERATION (G)	228	-64	27				
	LONGITUDINAL				1.5	111.3	13.3	43.5
	LATERAL				4.2	164.4	18.3	32.9
	VERTICAL				5.2	117.9	6.2	49.9
	RESULTANT				19.7	32.8		
2	REAR FLOORPAN OVER AXLE ACCELERATION (G)	97	0	42				
	LONGITUDINAL				1.3	180.0	13.7	81.3
	LATERAL				1.9	157.9	13.5	59.9
	VERTICAL				4.4	78.9	5.3	72.0
	RESULTANT				16.5	81.3		
3	LEFT FRONT DOOR SILL ACCELERATION (G)	228	64	29				
	LONGITUDINAL				4.9	19.3	24.6	48.0
	LATERAL				96.3	58.9	59.8	47.6
	VERTICAL				44.6	38.5	21.7	52.6
	RESULTANT				101.6	59.0		
4	LEFT FRONT DOOR ACCELERATION (G)	163	69	62				
	LONGITUDINAL				15.5	17.1	22.3	66.3
	LATERAL				12.9	16.4	52.1	66.9
	VERTICAL				28.2	25.8	64.9	67.4
	RESULTANT				84.7	67.1		
5	LEFT B-PILLAR FORCE (N)**	177	65	67				
	Z-AXIS LONGITUDINAL FORWARD POSITIVE				671.0	170.4	14300.7	73.
	Y-AXIS LAT DOWN 45 DEG TO RIGHT POSITIVE				6090.4	81.9	3433.8	23.
	X-AXIS LATERAL UP 45 DEG TO RIGHT POSITIVE				749.2	96.8	4235.4	74.

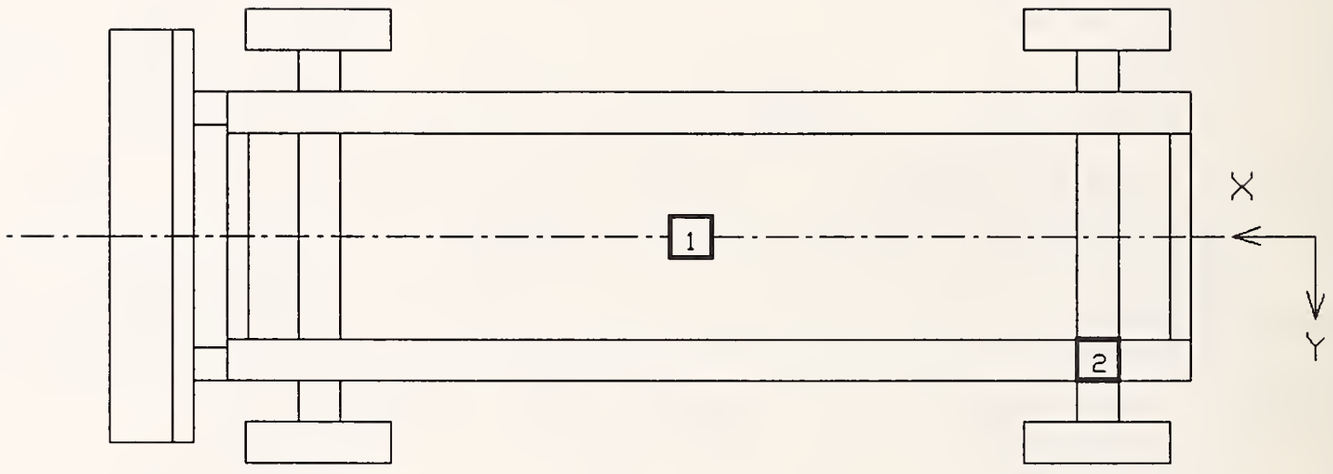
* ALL MEASUREMENTS OF INSTRUMENTATION LOCATIONS ARE IN CENTIMETERS.

**LOAD CELL'S X, Y, AND Z AXIS DO NOT CORRESPOND TO VEHICLE X, Y AND Z AXIS.

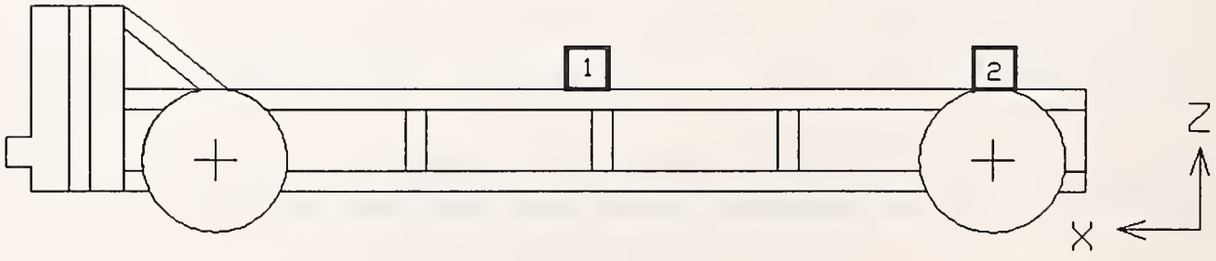
REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

FIGURE 3

MOVING BARRIER
ACCELEROMETER PLACEMENT



TOP VIEW



SIDE VIEW

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 930112

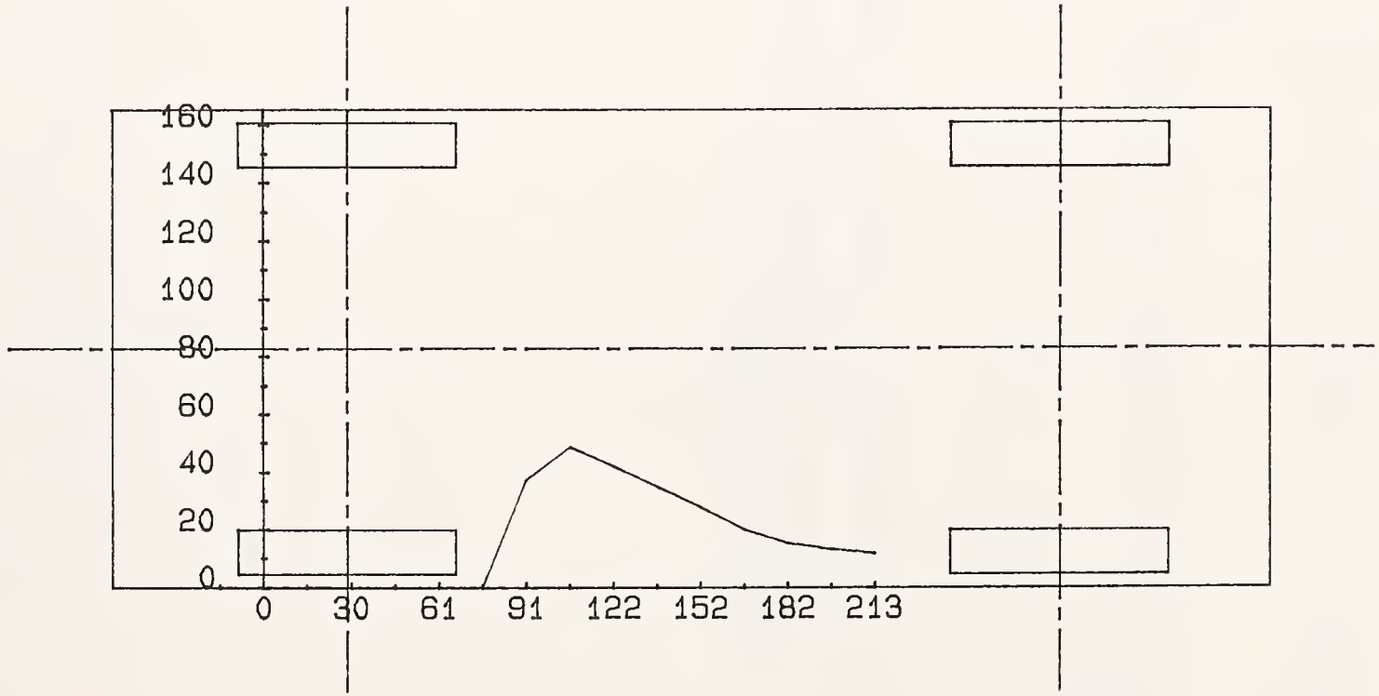
No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	CENTER OF GRAVITY	186	0	30				
	LONGITUDINAL				0.8	191.1	16.5	51.8
	LATERAL				3.1	58.8	8.2	32.9
	VERTICAL				9.9	45.9	3.7	38.1
	RESULTANT				16.9	45.6		
2	LEFT FRAME RAIL OVER REAR AXLE	38	64	63				
	LONGITUDINAL				1.9	193.5	18.7	30.5
	LATERAL				2.6	111.5	10.1	61.6

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN CENTIMETERS.

REFERENCE: X: + FORWARD FROM REARMOST POINT OF FRAME
Y: + LEFTWARD FROM BARRIER CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

FIGURE 4

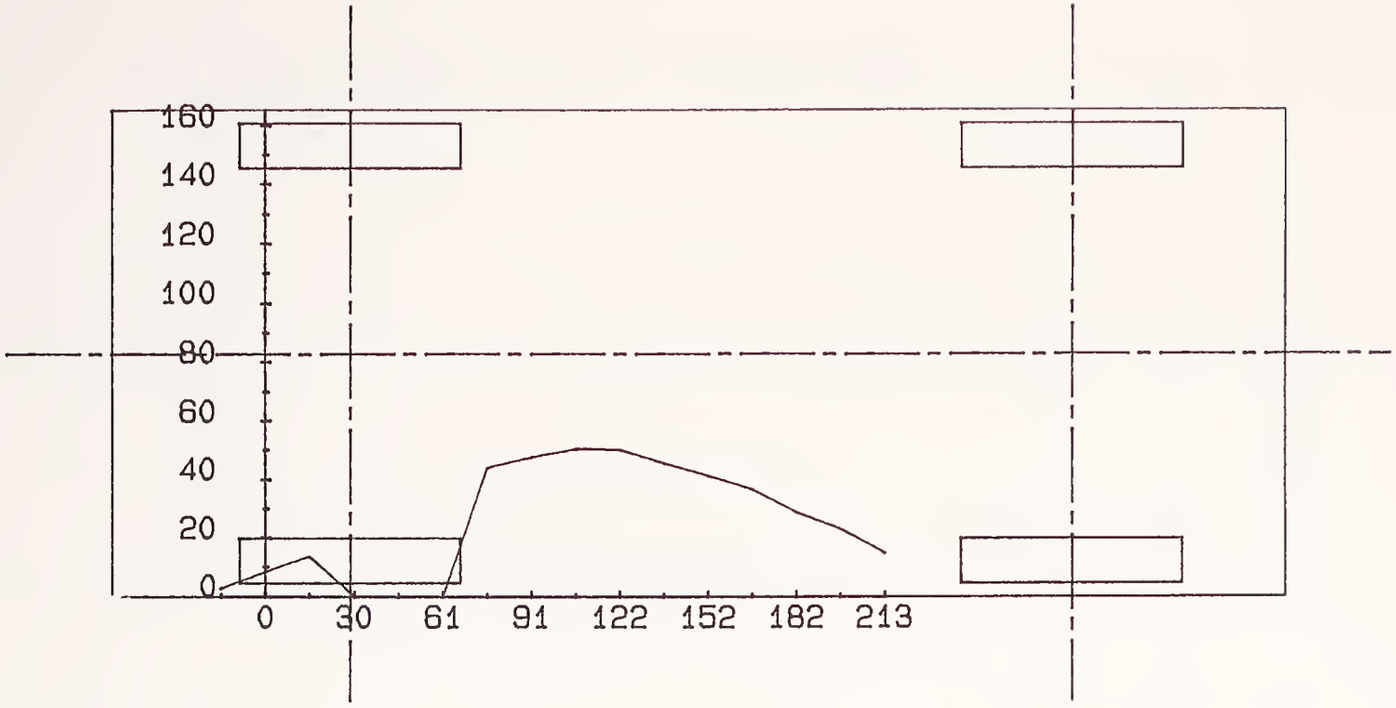
VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS AXLE HEIGHT WHICH IS 27.3 CM. ABOVE GROUND LEVEL

FIGURE 4, CONT'D.

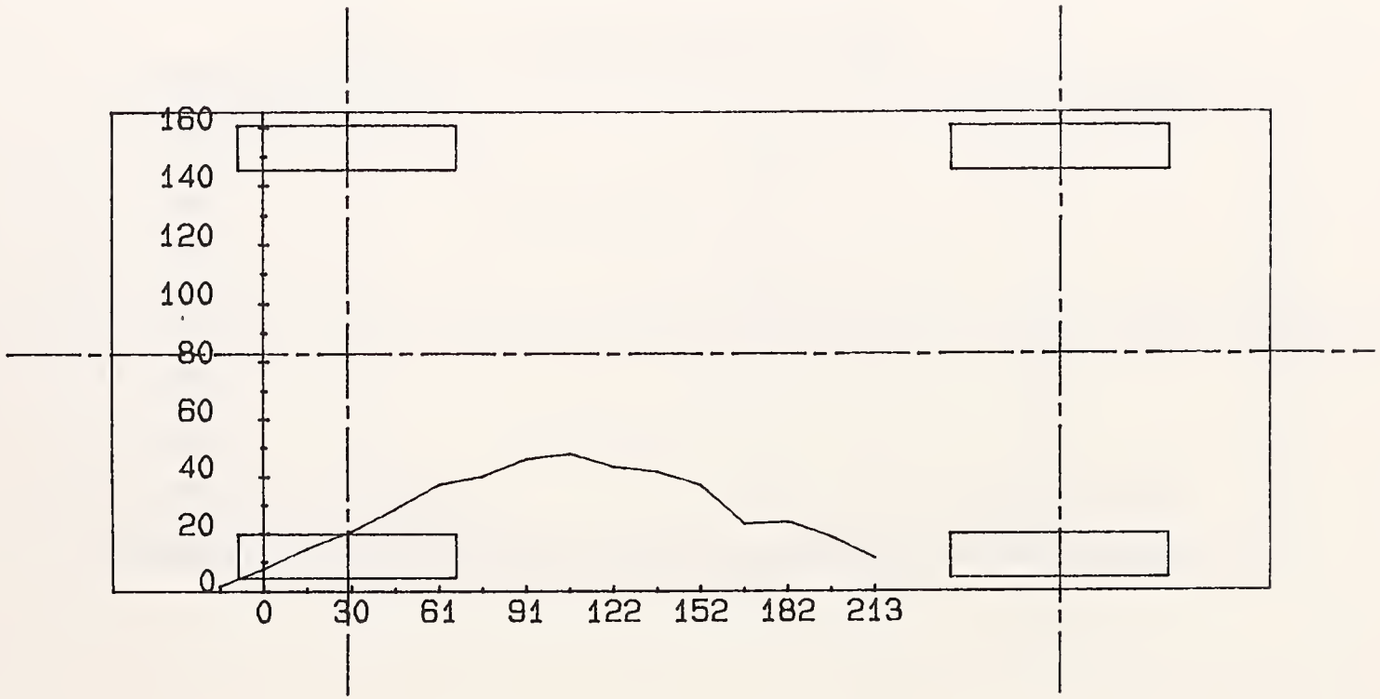
VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS H-POINT HEIGHT WHICH IS 53.7 CM. ABOVE GROUND LEVEL

FIGURE 4, CONT'D.

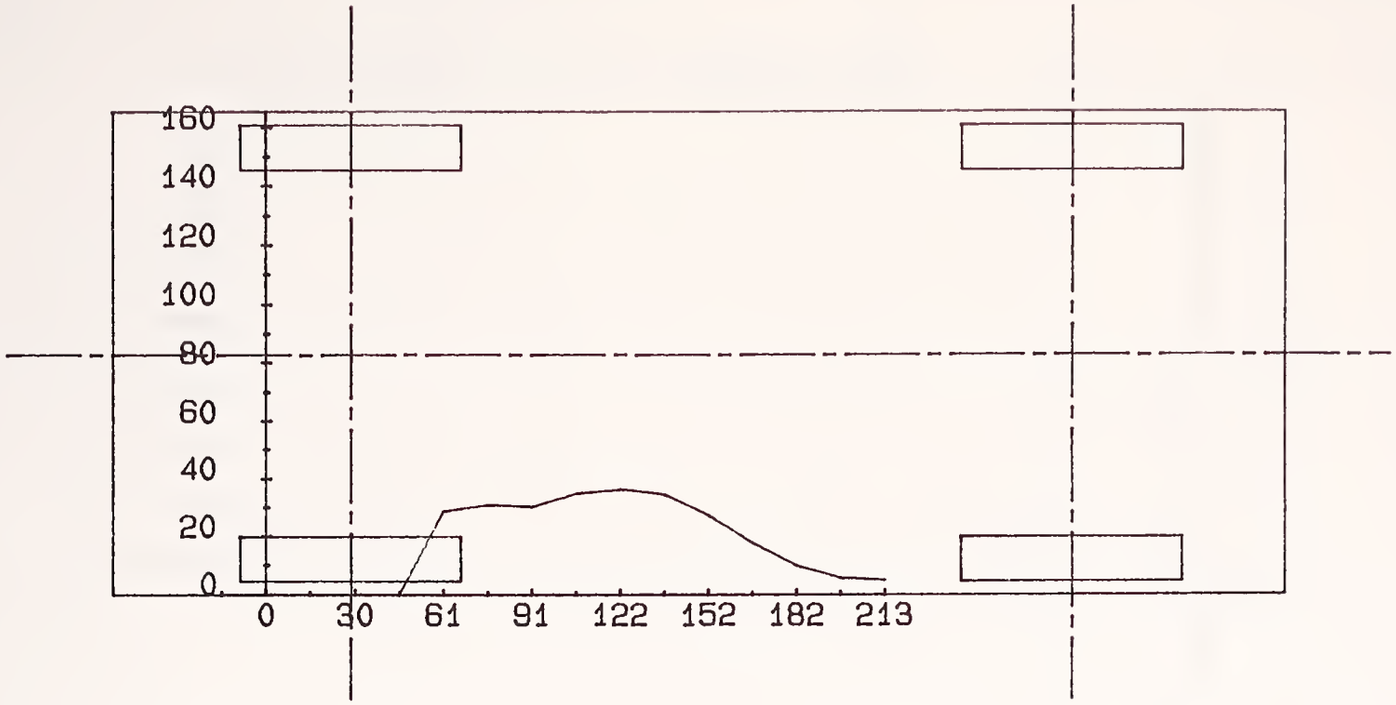
VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID DOOR HEIGHT WHICH IS 61.9 CM. ABOVE GROUND LEVEL

FIGURE 4, CONT'D.

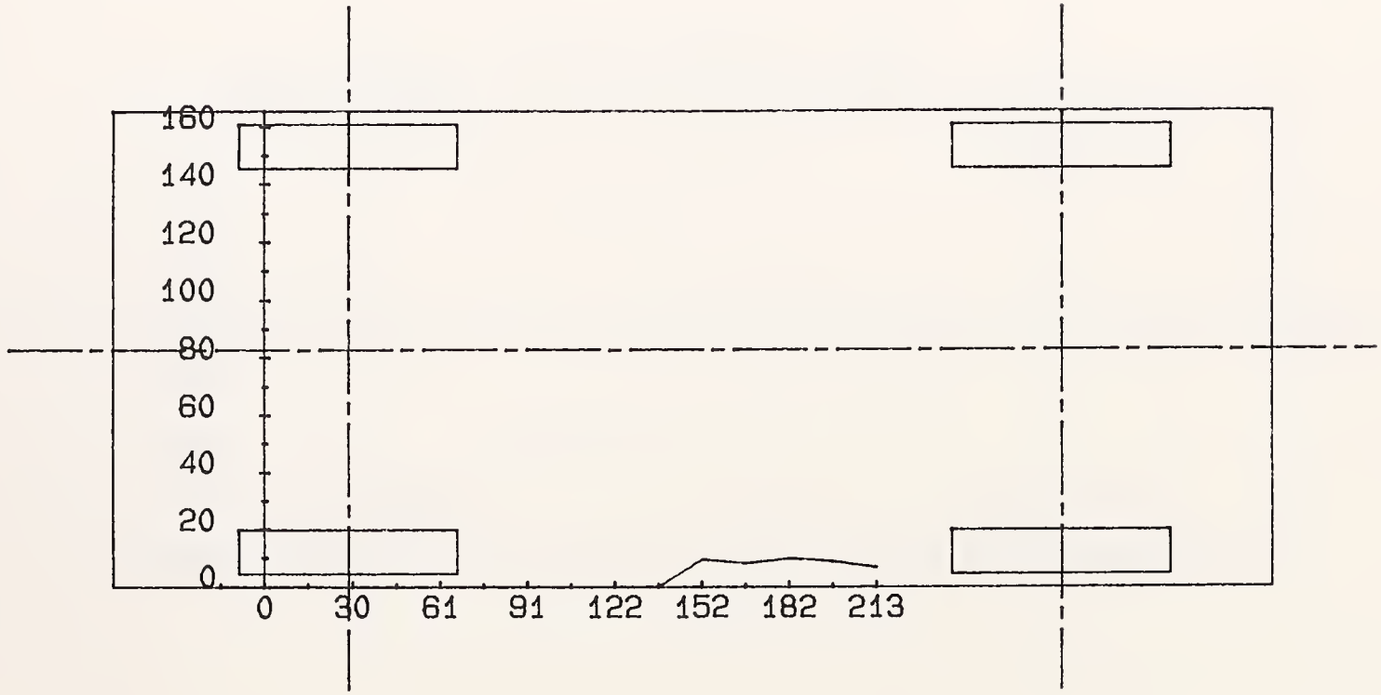
VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW SILL HEIGHT WHICH IS 87.3 CM. ABOVE GROUND LEVEL

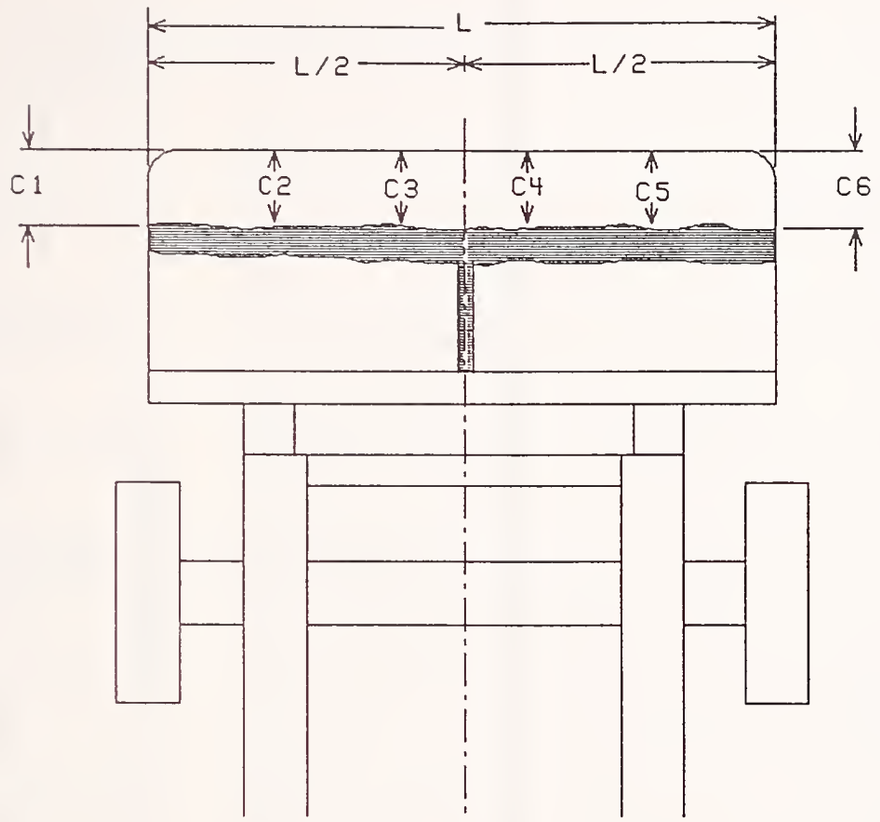
FIGURE 4, CONT'D.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW TOP HEIGHT WHICH IS 136.2 CM. ABOVE GROUND LEVEL

FIGURE 5 MOVING DEFORMABLE BARRIER FACE CRUSH



NOTES: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is vehicle centerline.
All measurements are in millimeters.
Reference plane is the rear surface of the deformable barrier face.

	PRE-TEST		POST-TEST		CRUSH
L	1524				
C1	481	C1	140	C1	341
C2	481	C2	276	C2	205
C3	478	C3	445	C3	33
C4	478	C4	476	C4	2
C5	476	C5	483	C5	-7
C6	473	C6	483	C6	-10
CL	476	CL	476	CL	0

TABLE 7 VEHICLE EXTERIOR PROFILES AND STATIC CRUSH*

LOCATION	HEIGHT (MM)	-152	0	152	305	457	610	762	914	1067	1219	1372	1524	1676	1829	1981	2134
PRE-TEST PROFILE (DISTANCE IN MILLIMETERS FROM REFERENCE PLANE**)																	
Axle Height	273	X	X	X	X	X	X	X	470	465	467	454	454	464	467	460	454
H-point	537	521	486	456	X	X	X	391	413	414	410	400	403	405	413	403	400
Mid Door	619	518	483	454	419	387	381	419	410	408	410	394	391	397	406	397	394
Window Sill	873	X	X	X	X	X	425	479	470	457	457	438	441	451	460	448	441
Window Top	1362	X	X	X	X	X	X	X	X	X	X	X	737	724	721	711	718
POST-TEST PROFILE (DISTANCE IN MILLIMETERS FROM REFERENCE PLANE**)																	
Axle Height	273	X	X	X	X	X	X	X	841	949	884	800	730	662	618	589	570
H-point	537	549	570	594	X	X	X	829	884	914	908	852	813	767	698	632	549
Mid Door	619	535	559	600	627	673	751	816	870	883	841	805	759	629	646	584	506
Window Sill	873	X	X	X	X	X	711	787	768	802	818	779	711	625	559	502	491
Window Top	1362	X	X	X	X	X	X	X	X	X	X	X	832	806	819	797	784
STATIC CRUSH (MM)																	
Axle Height	273	X	X	X	X	X	X	X	371	484	417	346	276	198	151	129	116
H-point	537	28	84	138	X	X	X	438	471	500	498	452	410	362	285	229	149
Mid Door	619	17	76	146	208	286	370	397	460	475	431	411	368	232	240	187	112
Window Sill	873	X	X	X	X	X	286	308	298	345	361	341	270	174	99	54	50
Window Top	68.0	X	X	X	X	X	X	X	X	X	X	X	95	82	98	86	66

*Zero distance is 1530 millimeters forward of the driver's side wheelbase midpoint.

Column readings are front to rear from left to right.

**Reference plane is parallel to and 1219 millimeters from the vehicle's longitudinal centerline.

TABLE 8 MOVING DEFORMABLE BARRIER FACE STATIC CRUSH

ZERO DISTANCE AT BARRIER CENTERLINE*

LOCATION	HEIGHT (MM)	813	711	610	508	406	305	203	102	0	102	203	305	406	508	610	711	813
PRE-TEST PROFILE (DISTANCE IN MILLIMETERS FROM REFERENCE PLANE**)																		
Top of Face	813	376	380	378	381	380	381	384	381	381	381	388	384	384	384	386	388	394
Mid-Face	559	372	373	375	375	375	376	378	378	378	378	378	381	380	384	384	381	384
Bumper	432	454	473	473	476	476	475	476	476	476	480	478	481	480	486	480	480	464
POST-TEST PROFILE (DISTANCE IN MILLIMETERS FROM REFERENCE PLANE**)																		
Top of Face	813	78	146	210	280	326	351	343	354	369	376	380	380	383	380	381	384	381
Mid-Face	559	124	169	205	265	318	362	362	375	376	381	381	381	383	381	381	384	378
Bumper	432	137	210	261	329	384	422	451	467	478	481	481	481	483	483	483	480	470
STATIC CRUSH (MM)																		
Top of Face	813	298	234	168	101	54	30	41	27	12	5	8	4	1	4	5	4	13
Mid-Face	559	248	204	170	110	57	14	16	3	2	-3	-3	0	-3	3	3	-3	6
Bumper	432	317	263	212	147	92	53	25	9	-2	-1	-3	0	-3	3	-3	0	-6

*COLUMN READINGS ARE LEFT TO RIGHT ACROSS BARRIER FACE FROM LEFT TO RIGHT.

**REFERENCE PLANE IS THE REAR SURFACE OF THE DEFORMABLE BARRIER FACE.

TABLE 9

DUMMY DATA SUMMARY

TEST NUMBER 930112

	DRIVER DUMMY SN: 001			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
HEAD ACCELERATION (g)				
LONGITUDINAL	11.2	68.0	106.5	103.4
LATERAL	24.9	63.4	49.6	77.9
VERTICAL	16.6	57.8	79.9	82.6
RESULTANT	113.1	103.4		
HIC	1233 FROM 74.4 TO 109.2			
LEFT SHOULDER				
LATERAL ACCEL	113.5	73.1	195.3	66.9
LATERAL FORCE	410.3	99.4	2688.6	75.0
LATERAL DISPL.	0.8	221.1	35.2	73.1
UPPER SPINE ACCELERATION (g)				
LONGITUDINAl	12.8	101.9	105.9	73.1
LATERAL	20.0	96.3	108.2	71.9
VERTICAL	15.1	57.5	11.6	98.7
RESULTANT	150.6	72.5		
LEFT UPPER THORAX RIB				
LATERAL ACCEL	89.8	72.5	194.8	66.9
LATERAL ACCEL	90.4	72.5	192.2	66.9
LATERAL DISPL.	1.1	242.9	28.4	72.8
LEFT CENTER THORAX RIB				
LATERAL ACCEL	60.3	71.9	177.5	66.3
LATERAL ACCEL	56.6	72.5	171.8	66.3
LATERAL DISPL.	0.6	232.3	26.9	71.9
LEFT LOWER THORAX RIB				
LATERAL ACCEL	55.3	71.3	171.7	65.6
LATERAL ACCEL	48.0	71.9	161.9	65.6
LATERAL DISPL.	0.2	333.8	24.3	71.8
TTI	143			
LOWER SPINE ACCELERATION (g)				
LONGITUDINAL	16.7	113.7	36.4	65.0
LATERAL (P)	9.5	119.4	90.6	61.2
LATERAL (R)	9.1	120.0	93.4	61.2
VERTICAL	80.5	61.9	30.4	72.5
RESULTANT	121.6	61.2		

TABLE 9

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 930112

	DRIVER DUMMY SN: 001			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
LEFT UPPER ABDOMEN RIB				
LATERAL ACCEL	24.6	68.8	151.6	63.8
LATERAL DISPL.	0.1	8.1	37.0	69.8
LEFT LOWER ABDOMEN RIB				
LATERAL ACCEL	12.7	69.4	130.7	63.8
LATERAL DISPL.	3.2	128.0	29.3	69.6
PELVIS ACCELERATION (g)				
LONGITUDINAL	9.7	125.0	74.8	56.3
LATERAL	6.6	135.0	151.9	56.3
VERTICAL	29.8	63.8	2.0	96.9
RESULTANT	171.0	56.3		
PELVIS PUBIC SYMPHYSIS FORCE (N)				
LATERAL	347.3	44.4	10250.4	56.3
PELVIS SACRUM FORCE (N)				
LATERAL	10175.5	58.8	631.2	280.6
PELVIS ILIAC FORCE (N)				
LATERAL	960.2	56.9	772.2	114.4

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD	LATERAL:	RIGHTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
LOAD CELLS:	TENSION	LOAD CELLS:	COMPRESSION

NOTES:

(P) Primary Sensor
(R) Redundant Sensor

TABLE 10 POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #001	PASSENGER #
HEAD	Driver's side door and passenger seat	NA
CHEST	None	NA
ABDOMEN	None	NA
LEFT KNEE	Driver's side door	NA
RIGHT KNEE	Driver's side door	NA

DOOR OPENING:

	LEFT	RIGHT
FRONT	Tools required	Easy
REAR	NA	NA

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	None	None
REAR	NA	NA

GLAZING DAMAGE:

The windshield cracked and retention failed along the driver's side vertical edge.

OTHER NOTABLE IMPACT EFFECTS:

The front left tire deflated.

DUMMY KINEMATIC SUMMARY

Upon impact, the driver dummy laterally translated and rotated toward the driver's side door. The dummy's head went through the door glass and struck the bottom edge of the window opening. The dummy then rebounded and translated toward the passenger side. While translating, the dummy rose and laterally rotated, causing the pelvis to reach an equal elevation as the head. The head struck the top of the window opening then the head liner while translating. Translation continued until the right side of the dummy's pelvis struck the windshield on the passenger side. The head struck the upper left corner of the passenger seat. The dummy then rebounded back toward the driver side and came to rest with its head against the driver's seat back, pelvis above the passenger seat at a higher elevation than the head, and feet in the driver's side footwell.

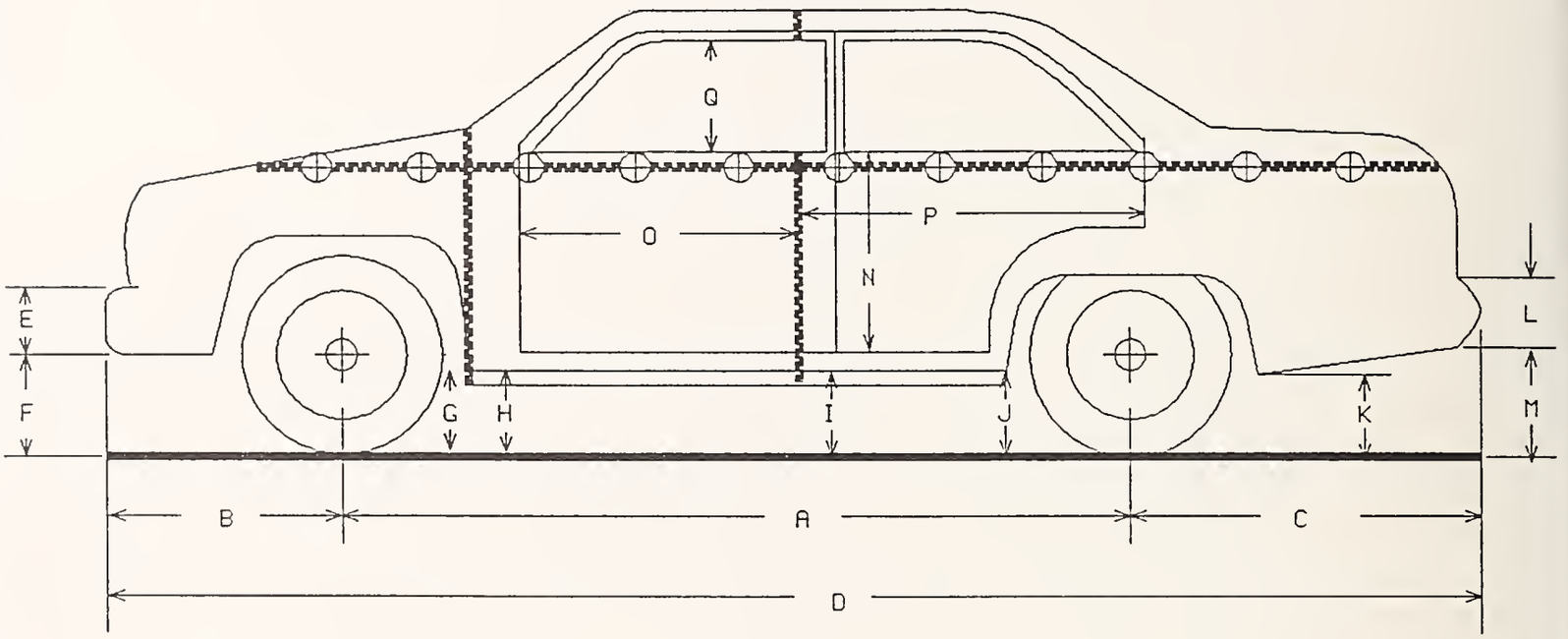
SECTION 3.0

VEHICLE, OCCUPANT, & CAMERA INFORMATION

FIGURE 6 PRE-TEST & POST-TEST VEHICLE MEASUREMENTS

VEHICLE YEAR/MAKE/MODEL/BODY 1986/Volkswagen/Golf/3-door hatchback

TEST DATE: 01/12/93 VIN: 1VWAG0175GV043853



LEFT SIDE VIEW

	PRE-TEST	POST-TEST	CHANGE		PRE-TEST	POST-TEST	CHANGE
A	2486	2375	111	J	230	214	16
B	819	762	57	K	254	281	-27
C	733	724	9	L	178	178	0
D	4032	3966	66	M	400	424	-24
E	149	149	0	N	NA	NA	NA
F	375	387	-12	O	NA	NA	NA
G	270	238	32	P	NA	NA	NA
H	246	340	-94	Q	416	437	-21
I	248	232	16				

ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

FIGURE 7 DUMMY AND SEAT POSITIONING DATA

MFR./MAKE/MODEL: Volkswagen/Golf/3-door hatchback

SEAT TYPE: ____Bench
X Bucket
____Split bench

ADJUSTER TYPE: X Manual
____Power
____Non-adjustable

BUCKET SEAT BACK TYPE: ____Non-adjustable
X Adjustable reclining

POSITIONING DATE: 01/12/93

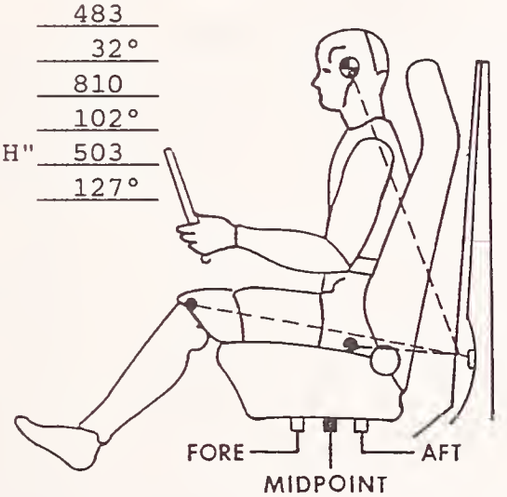
AMBIENT TEMP.: 20° C TIME: 1511

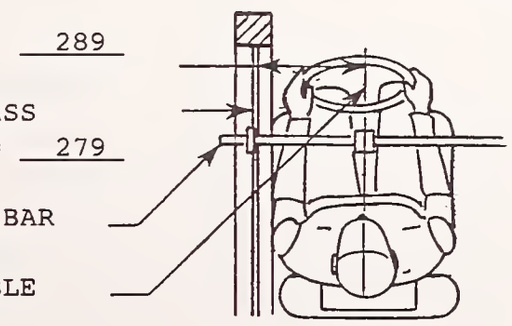
TECHNICIANS:

1. S. Ericksen
2. B. Crabtree
3. ____
4. ____

PASSENG DUMMY* # 001 TYPE: BIOSID

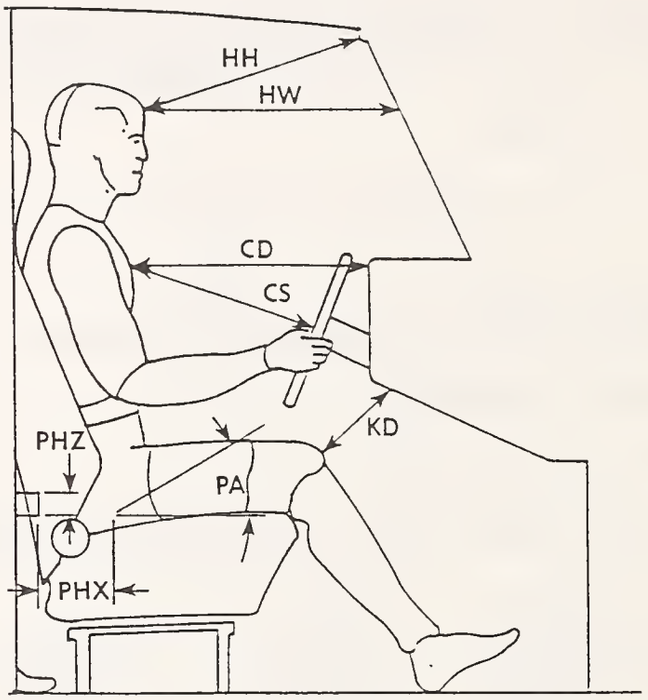
Head	483
Target	32°
Knee	810
Joint	102°
Approx. "H"	503
Point	127°





*Driver dummy measurements are referenced to top of front door striker.
ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.
ALL ANGLES ARE REFERENCED TO VERTICAL.

FIGURE 8 DUMMY LONGITUDINAL CLEARANCE MEASUREMENTS



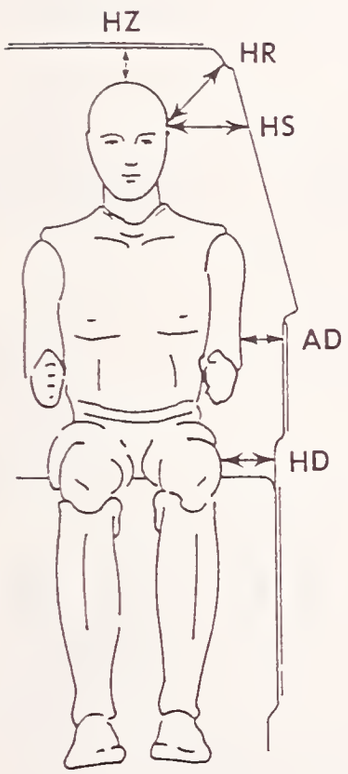
HH	414
HW	543
CD	523
CS	322
KDL	102
KDR	73
PA	22°
PHX	394
PHZ	159
HB	NA
NB	NA
CB	NA
KBL	NA
KBR	NA

ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

ALL ANGLES ARE REFERENCED TO HORIZONTAL.

NOTE: FOR TWO-DOOR VEHICLES, THE REAR PASSENGER'S PHX AND PHZ MEASUREMENTS ARE REFERENCED TO THE FRONT DOOR STRIKER.

FIGURE 9 DUMMY LATERAL CLEARANCE MEASUREMENTS



HR	124
HS	216
AD	100
HD	143
HZ	79

ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

FIGURE 10

CAMERA POSITIONS

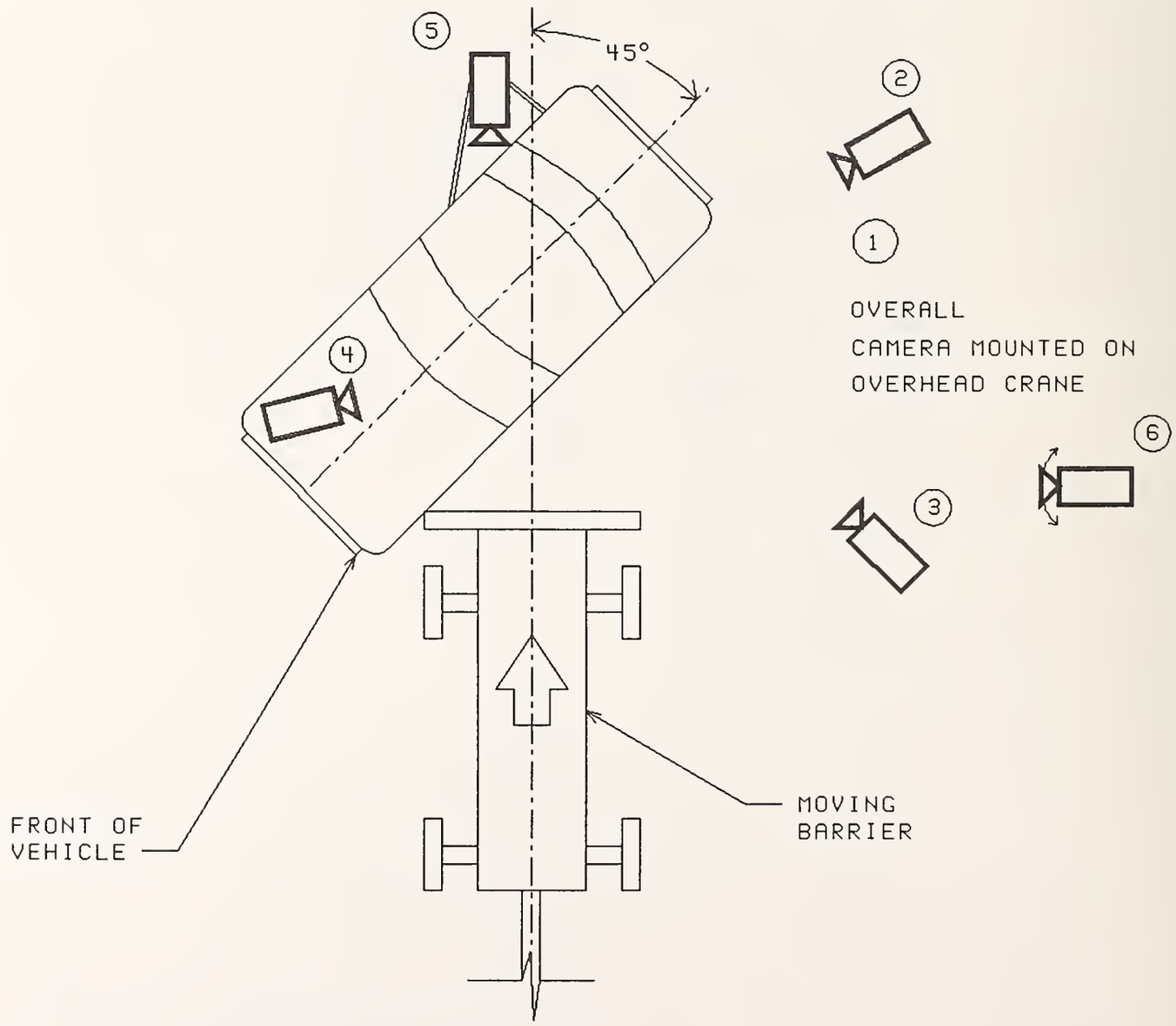


TABLE 11 CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Overhead wide	Photosonic	8	495	Vehicle dynamics
2	Right vehicle angle	Photosonic	13	502	Vehicle dynamics
3	Right vehicle perpendicular	Photosonic	13	500	Vehicle dynamics
4	Onboard vehicle front	Photosonic	8	502	Dummy kinematics
5	Onboard vehicle side - rear	Photosonic	13	505	Door latch movement
6	Panning	Beaulieu	12-120	24	Real-time panning

APPENDIX A

PHOTOGRAPHS

Figure A-1. PRE-TEST FRONT VIEW

Figure A-2. POST-TEST FRONT VIEW

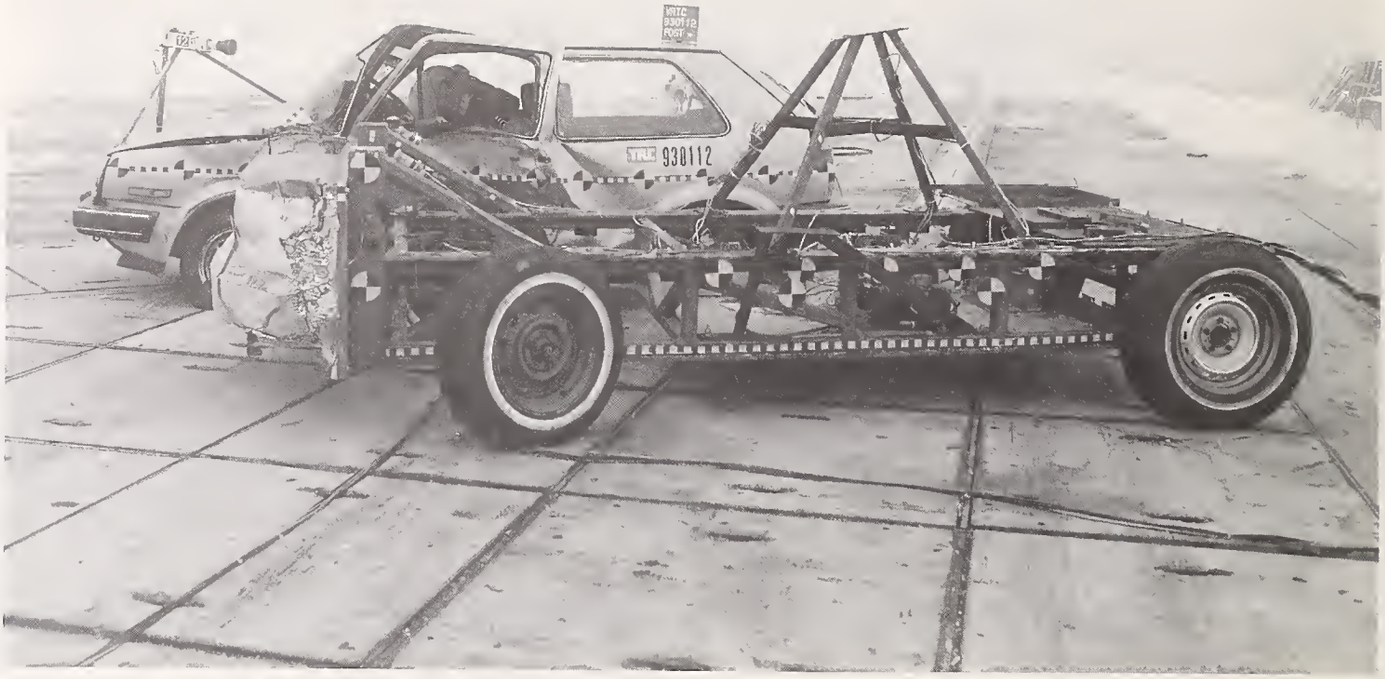


Figure A-3. POST-TEST LEFT SIDE - VIEW 1

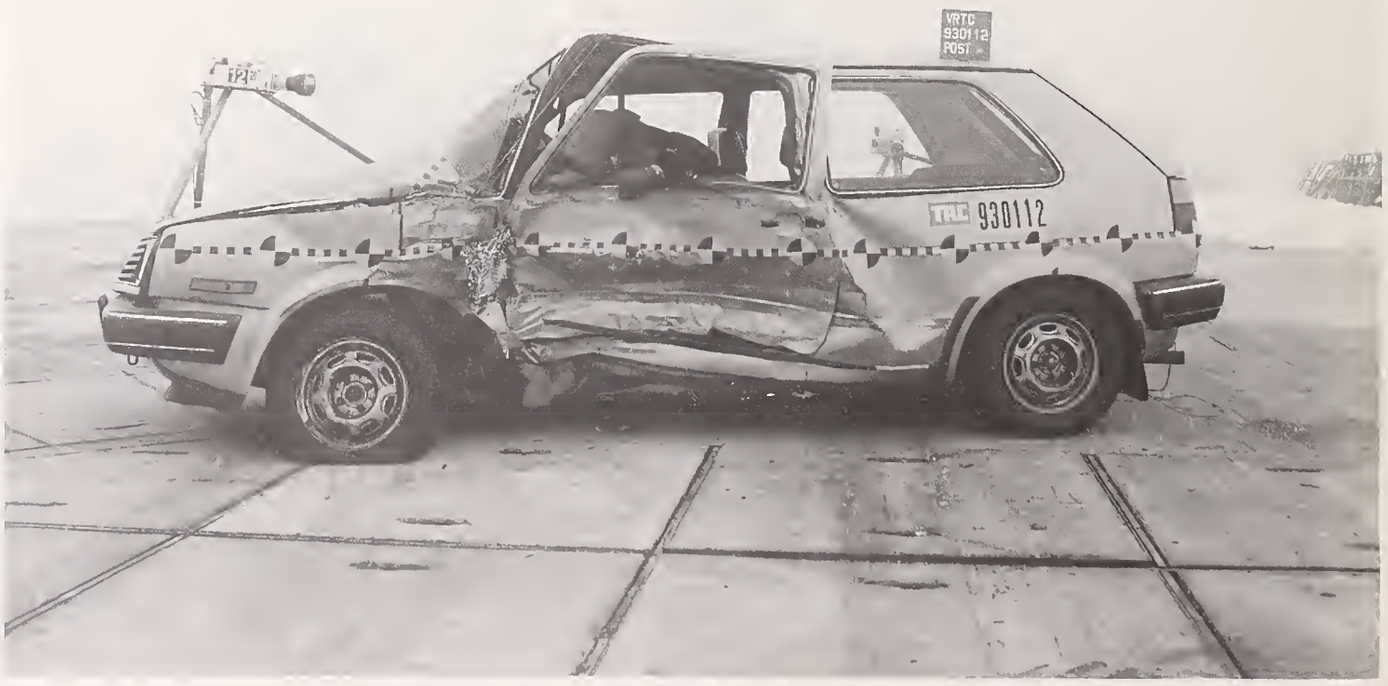


Figure A-4. POST-TEST LEFT SIDE - VIEW 2

Figure A-5. PRE-TEST REAR VIEW

Figure A-6. POST-TEST REAR VIEW

Figure A-7. PRE-TEST IMPACTOR FACE & VEHICLE ALIGNMENT - VIEW 1

Figure A-8. PRE-TEST IMPACTOR FACE & VEHICLE ALIGHMENT - VIEW 2

Figure A-9. PRE-TEST OVERHEAD VIEW

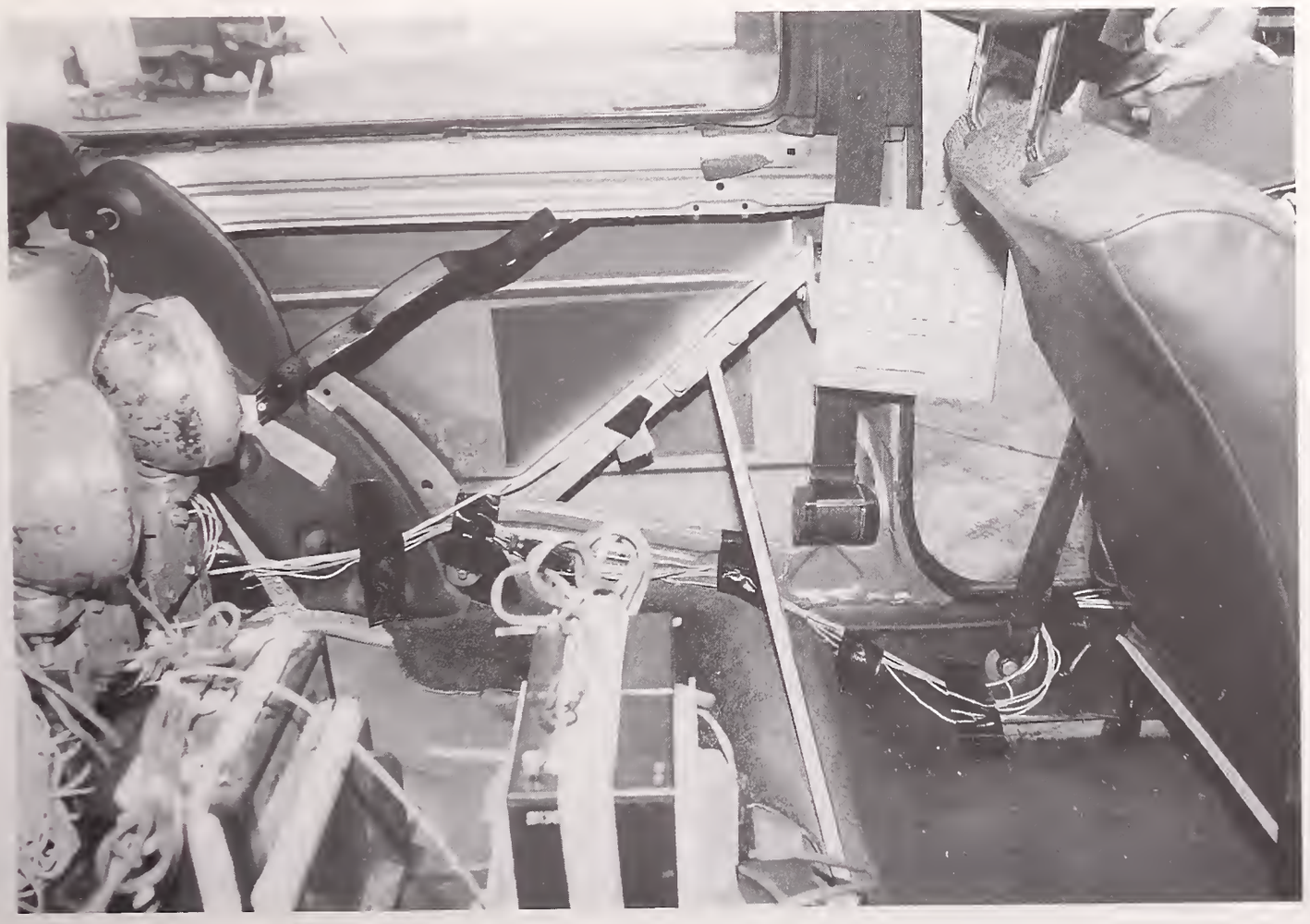


Figure A-10. PRE-TEST DOOR LATCH LOAD CELL - VIEW 1

Figure A-11. PRE-TEST DOOR LATCH LOAD CELL - VIEW 2

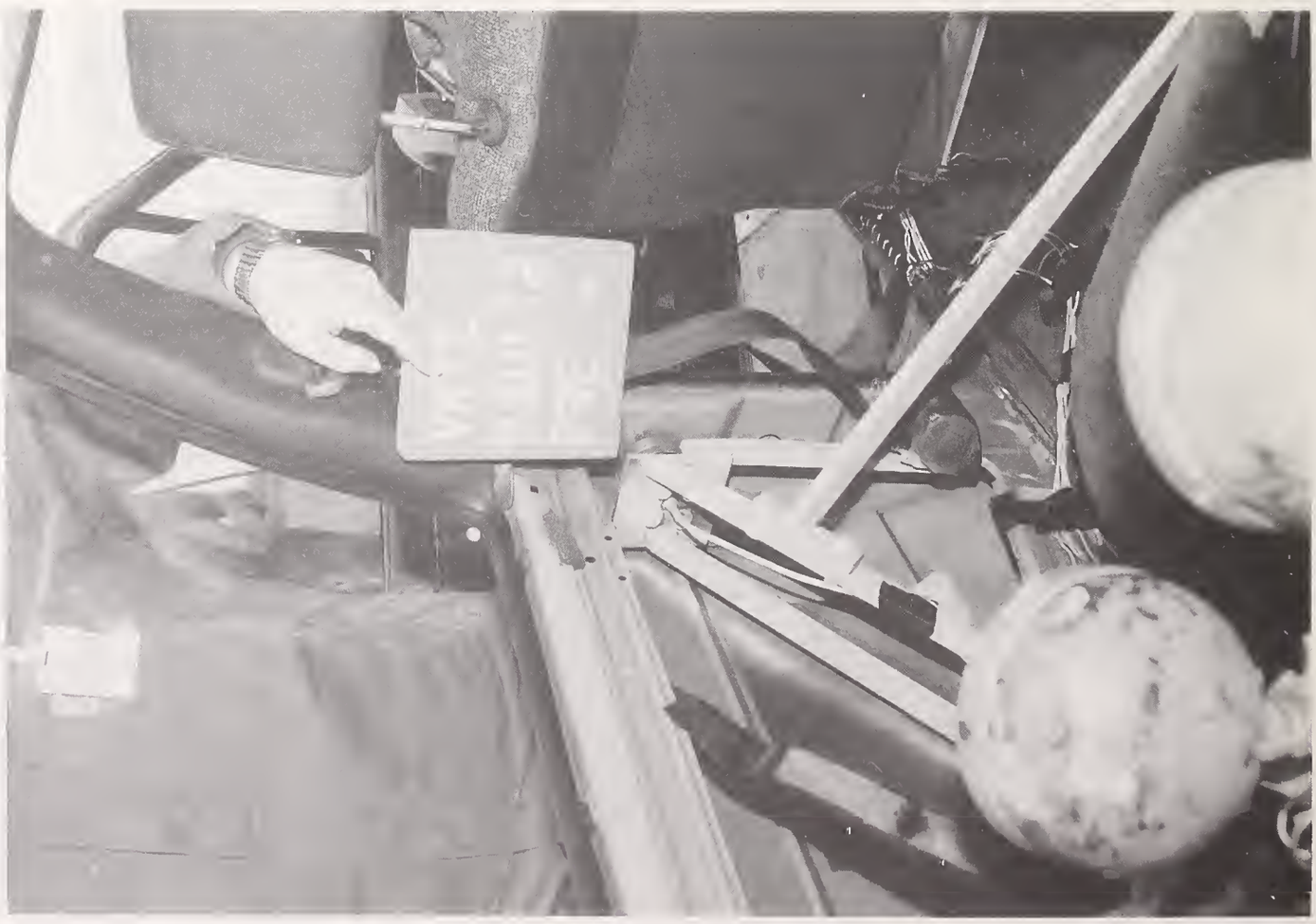


Figure A-12. PRE-TEST DOOR LATCH LOAD CELL - VIEW 3

Figure A-13. POST-TEST DOOR LATCH LOAD CELL - VIEW 1

Figure A-14. POST-TEST DOOR LATCH LOAD CELL - VIEW 2

Figure A-15. PRE-TEST DRIVER DUMMY POSITION - VIEW 1

Figure A-16. PRE-TEST DRIVER DUMMY POSITION - VIEW 2

Figure A-17. POST-TEST DRIVER DUMMY POSITION VIEW

Figure A-18. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

Figure A-19. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

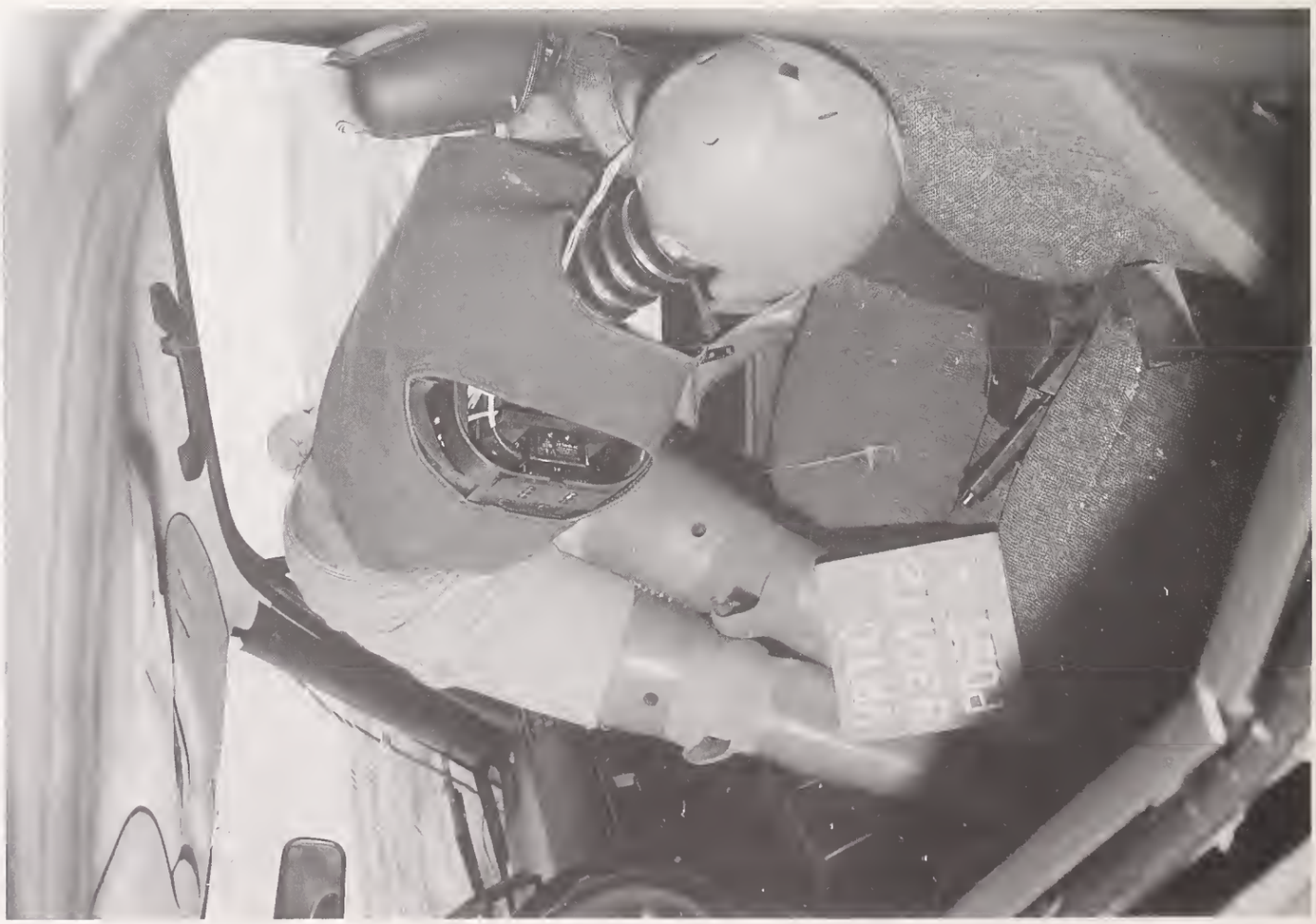


Figure A-20. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR VIEW

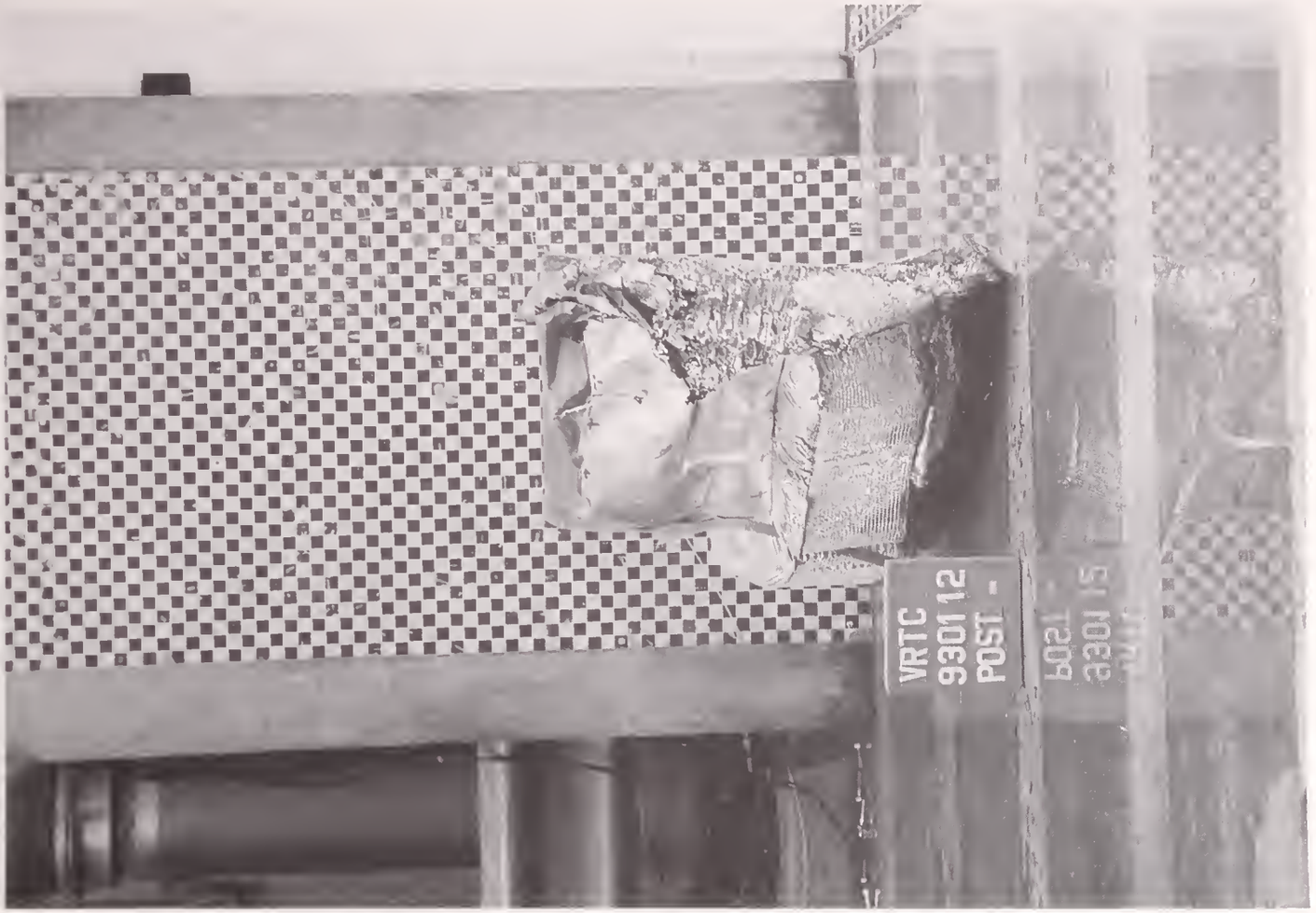


Figure A-21. POST-TEST IMPACTOR FACE - LEFT SIDE VIEW

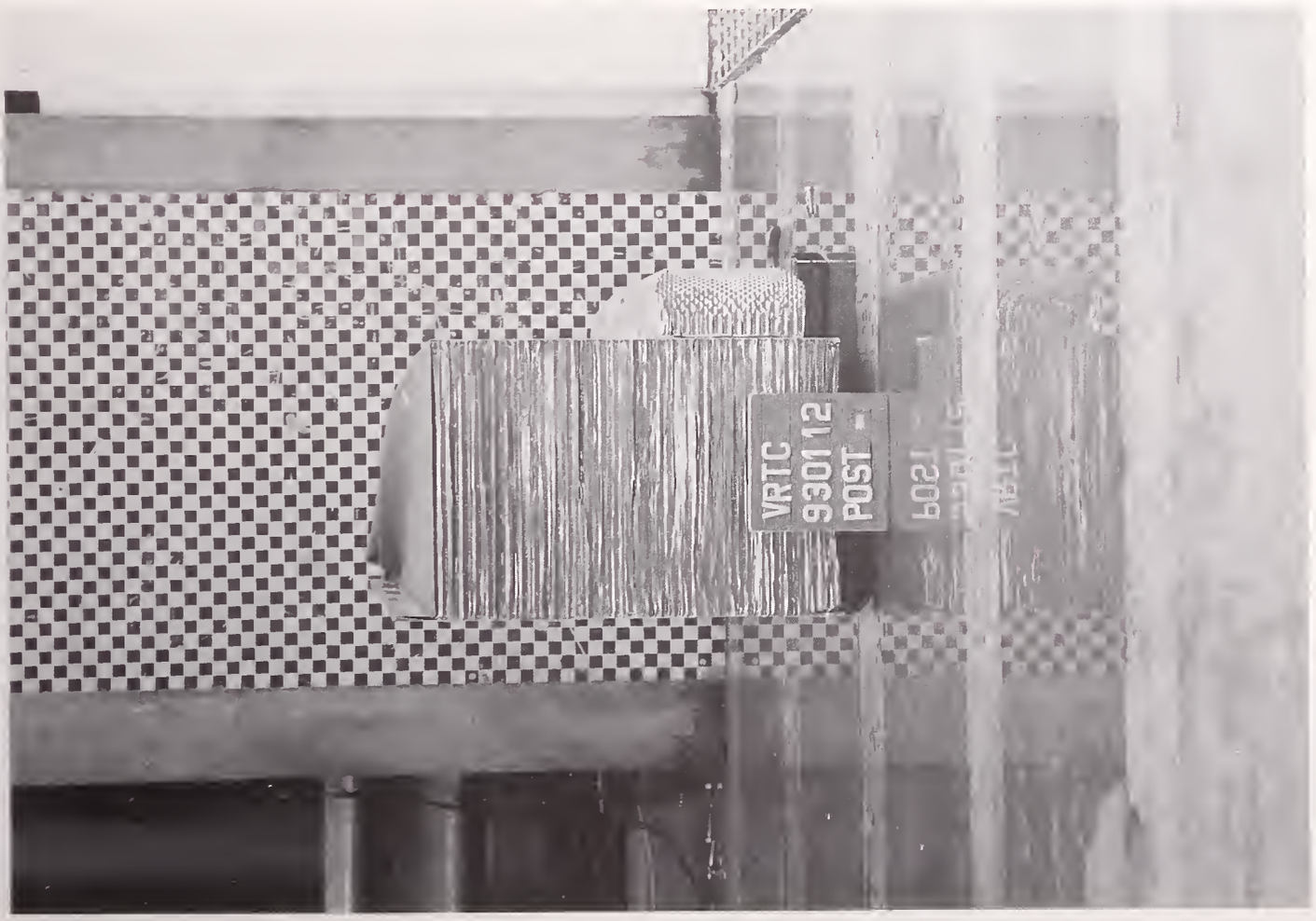


Figure A-22. POST-TEST IMPACTOR FACE - RIGHT SIDE VIEW

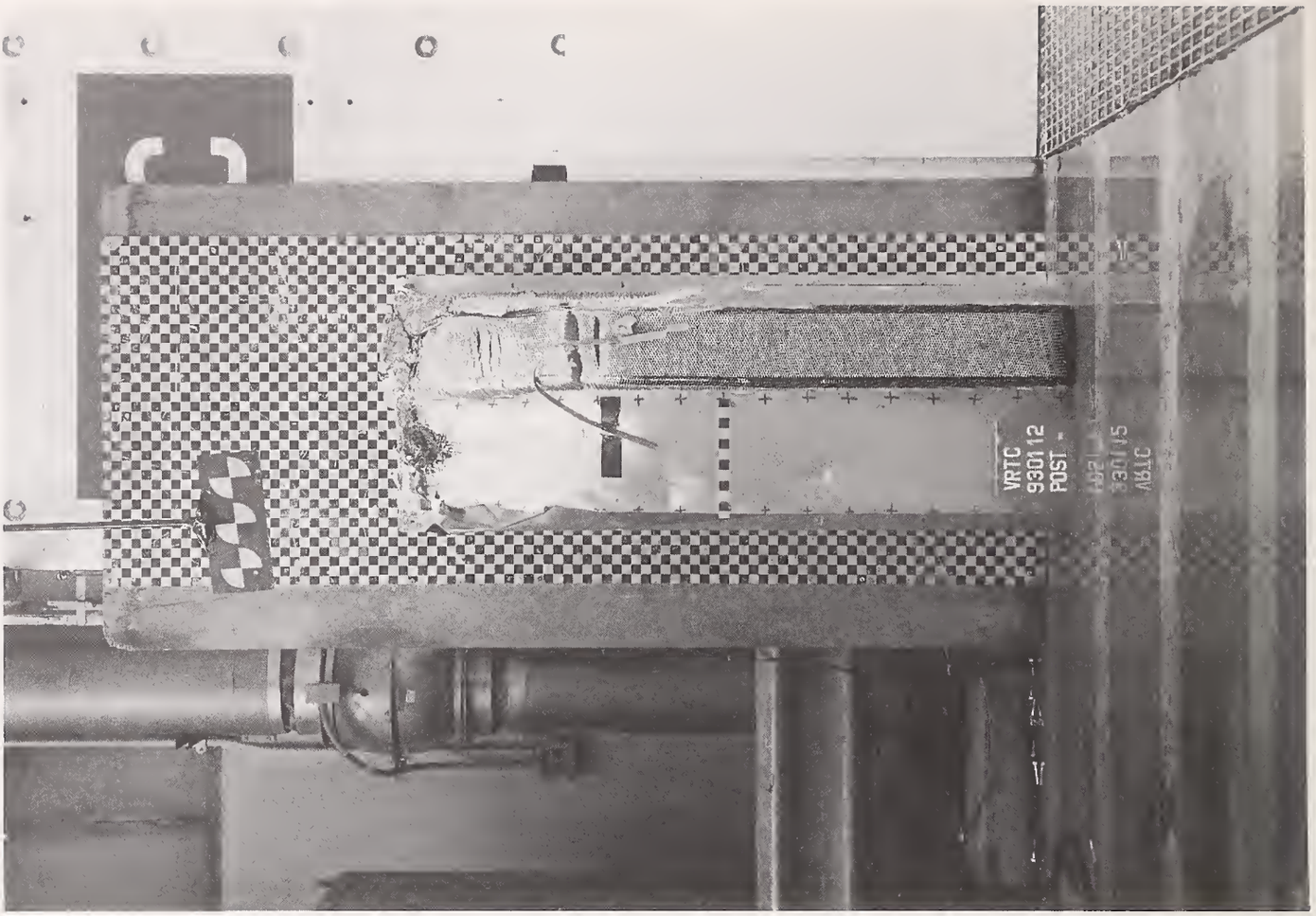


Figure A-23. POST-TEST IMPACTOR FACE - FRONT VIEW

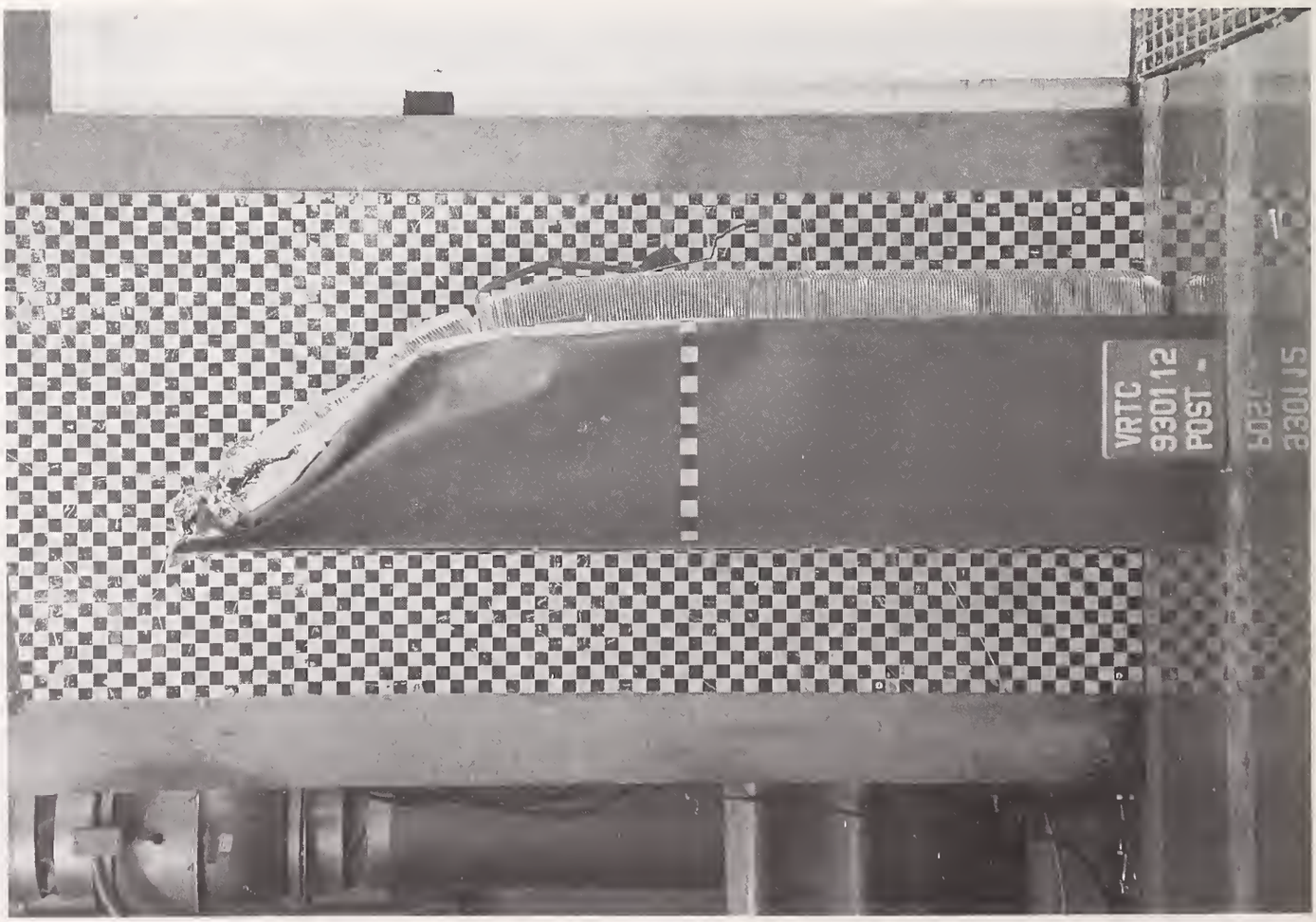


Figure A-24. POST-TEST IMPACTOR FACE - TOP VIEW

Figure A-25. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 1

Figure A-26. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 2

Figure A-27. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

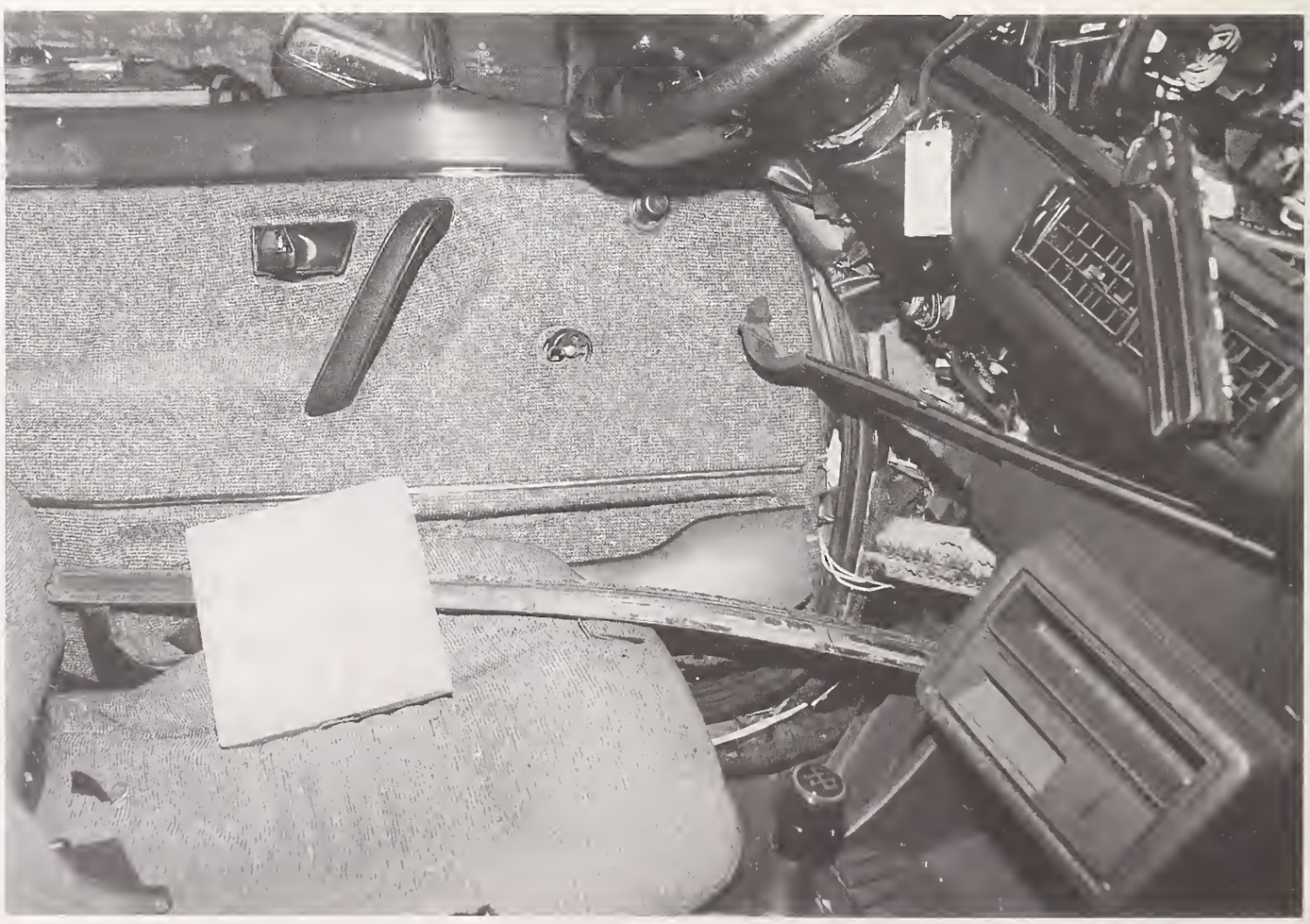
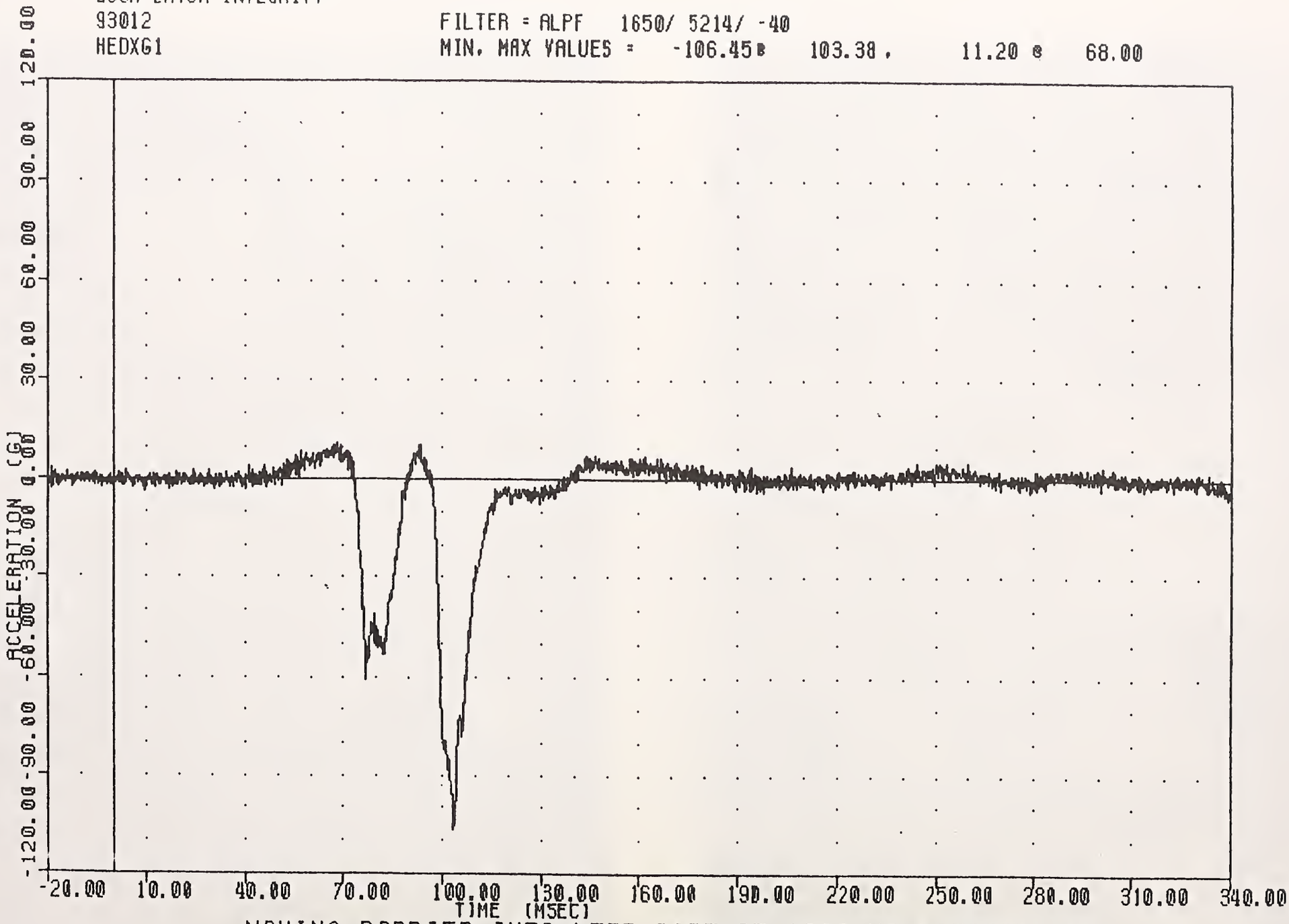


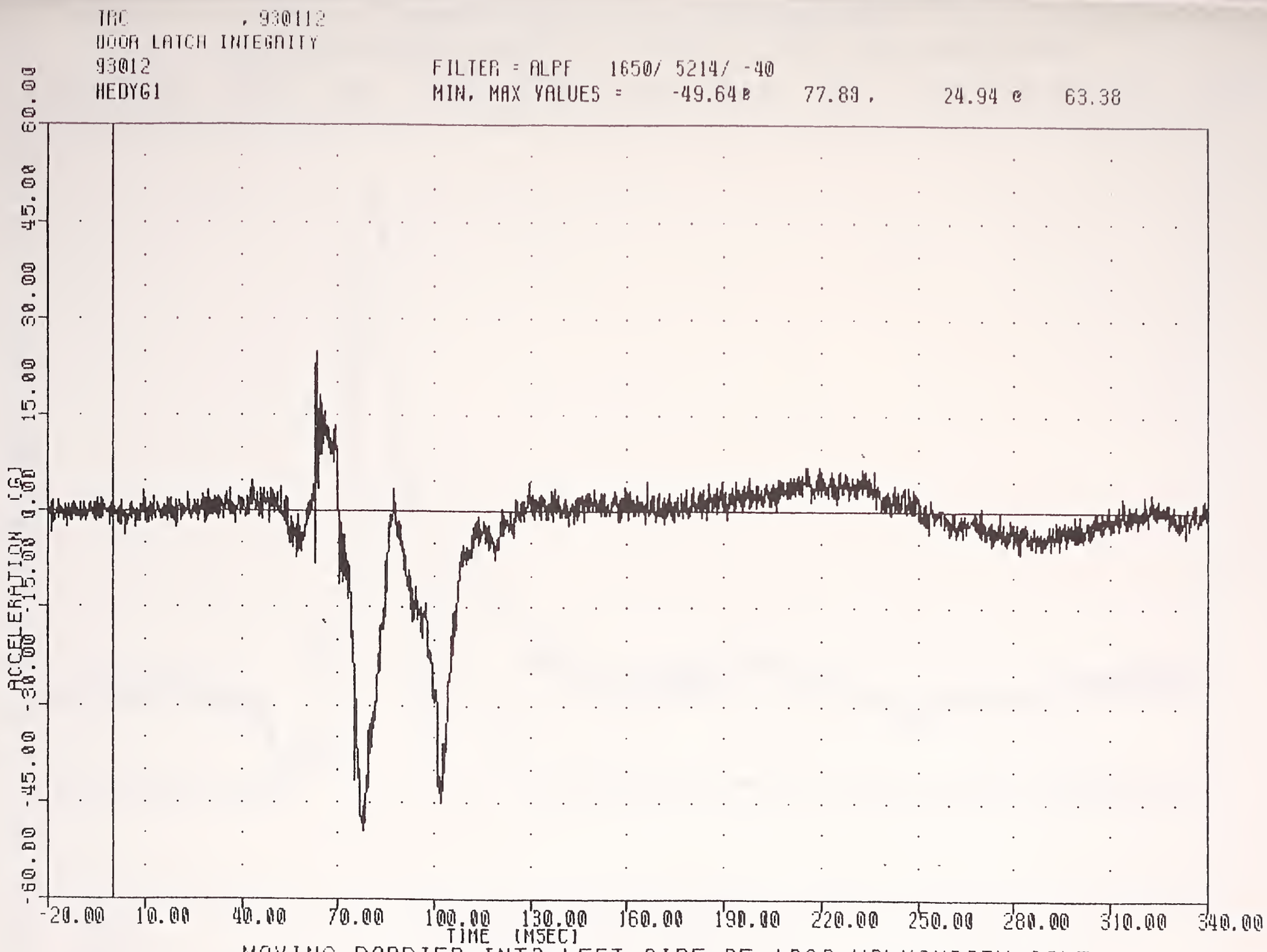
Figure A-28. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2

APPENDIX B

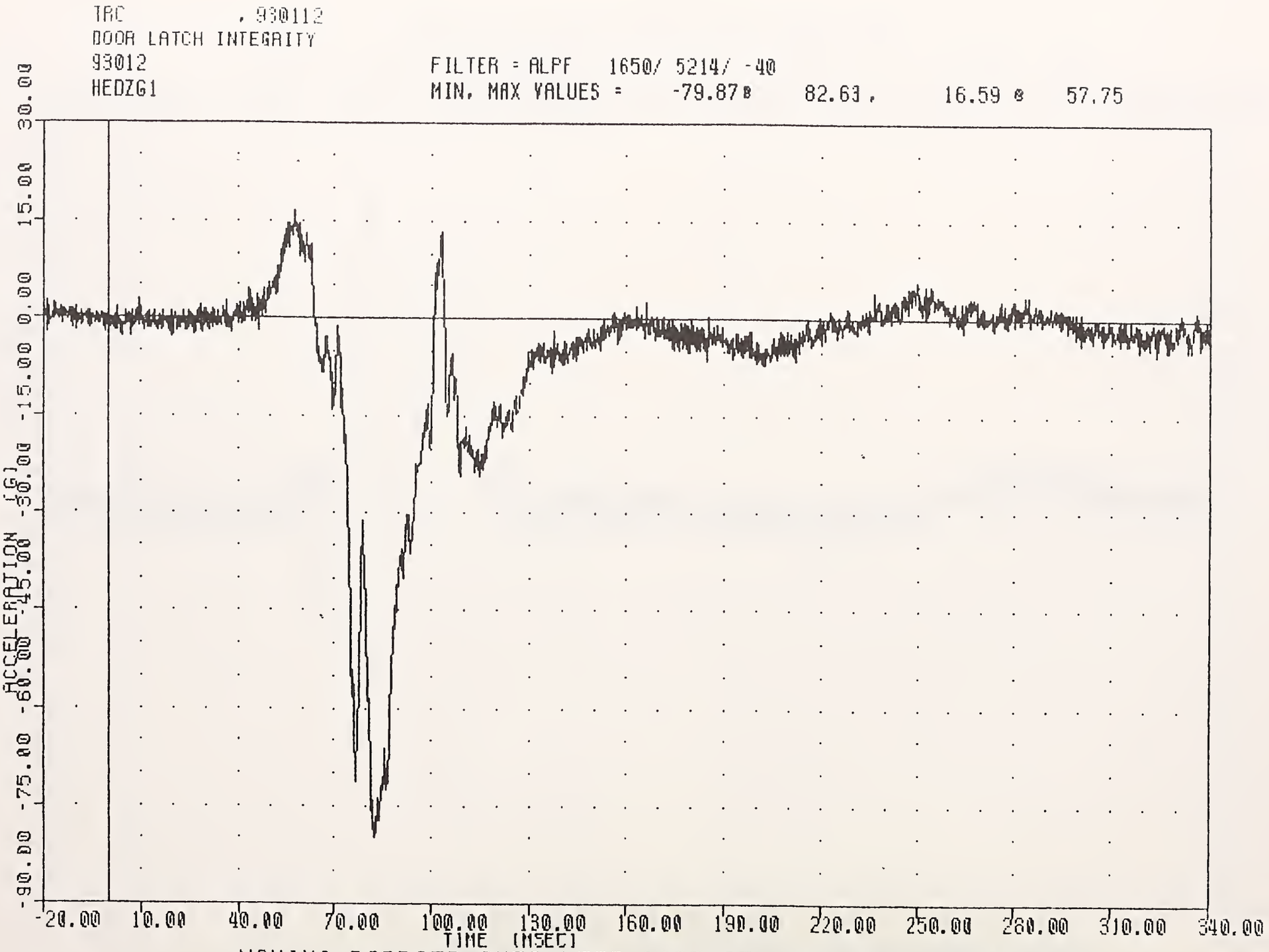
DATA PLOTS



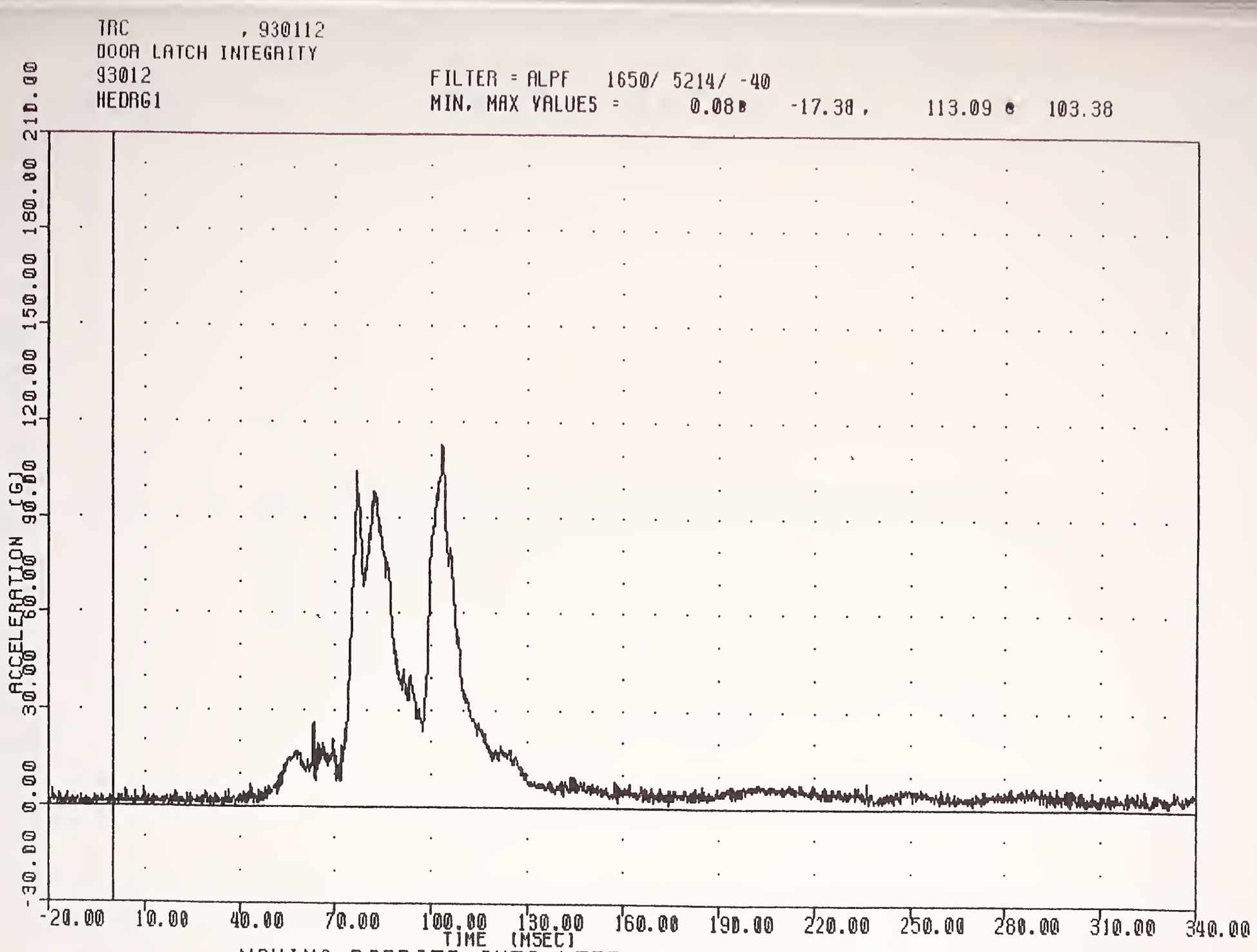
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER HEAD X-AXIS ACCELERATION



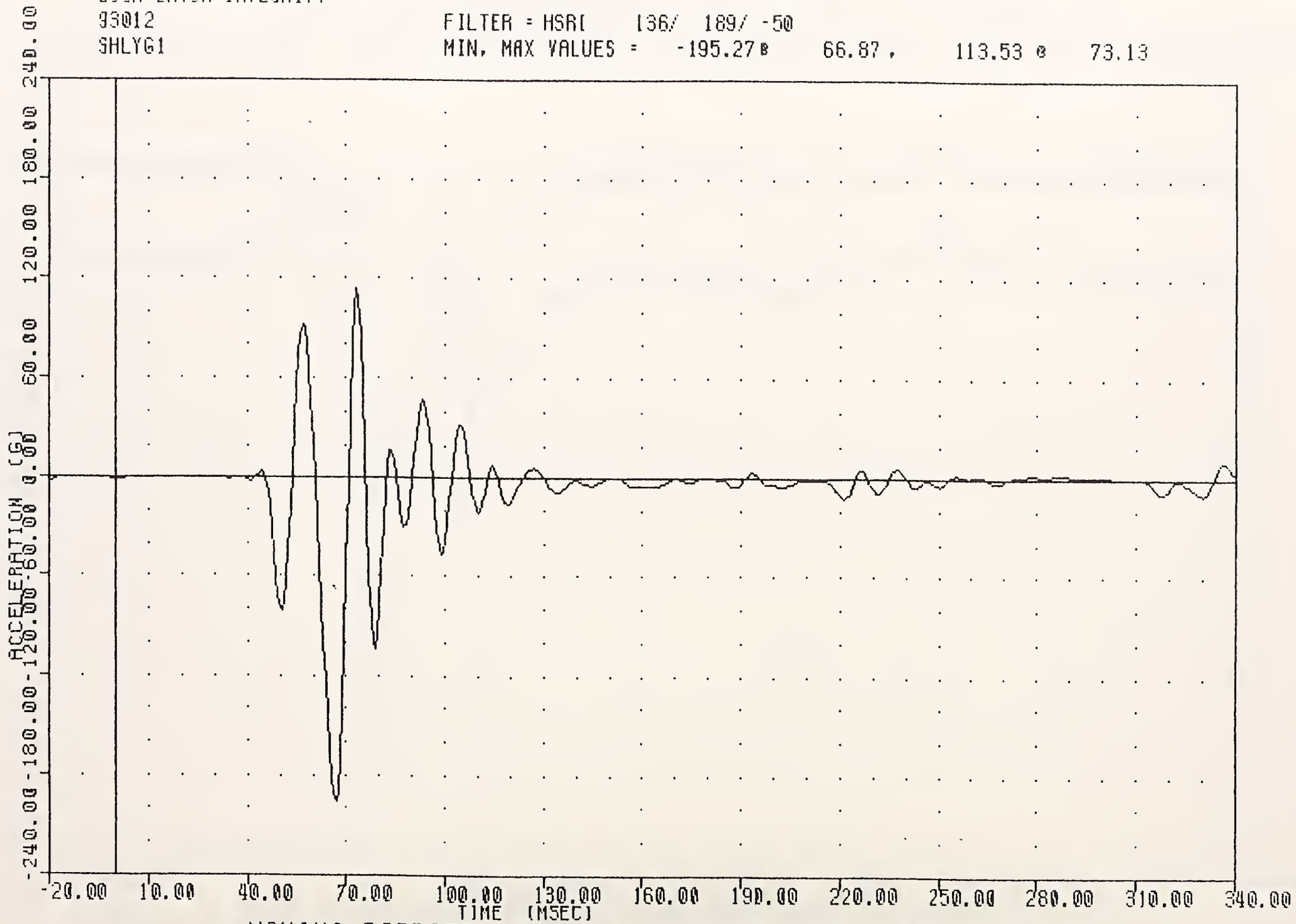
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER HEAD Y-AXIS ACCELERATION



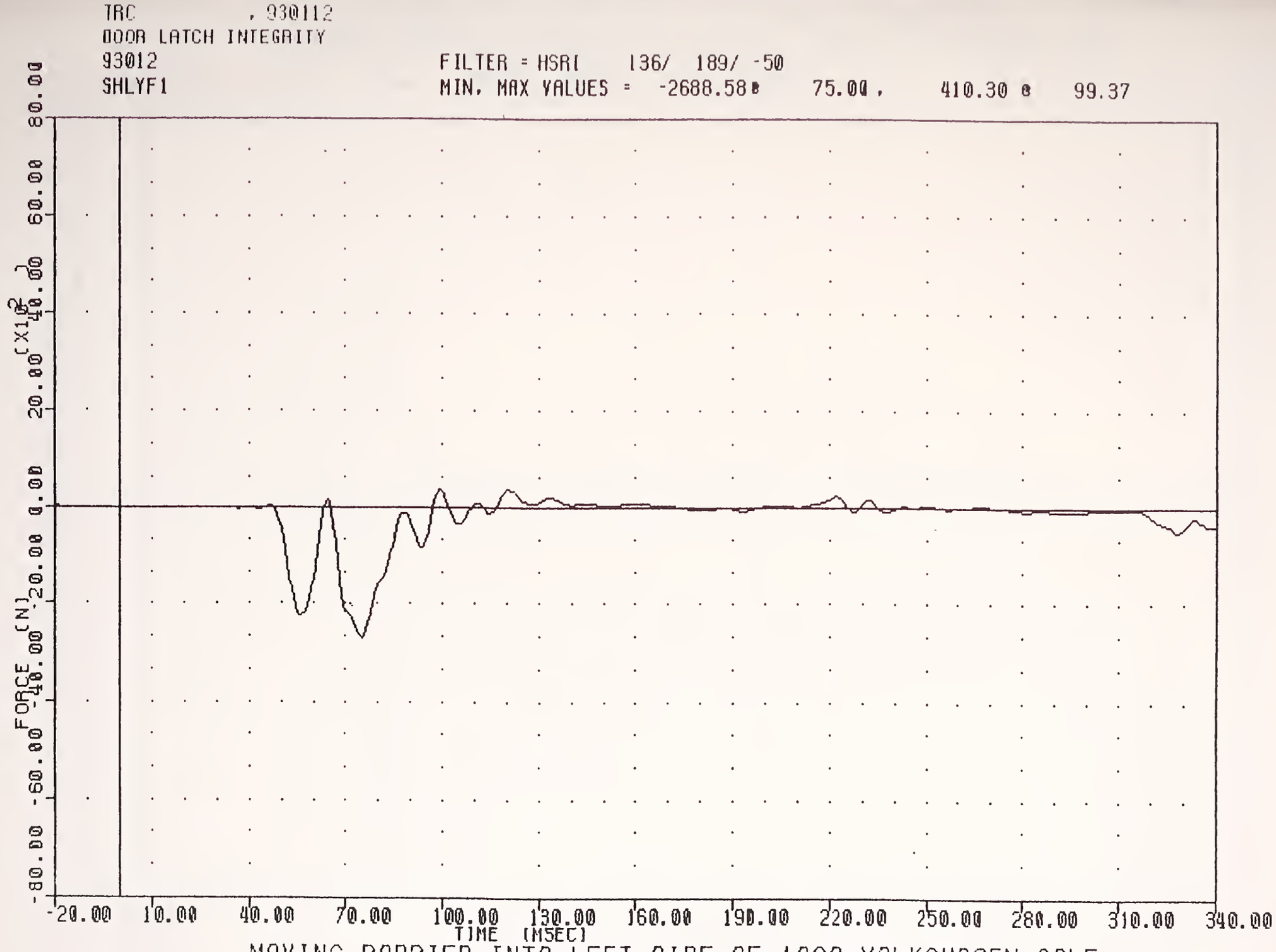
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER HEAD Z-AXIS ACCELERATION



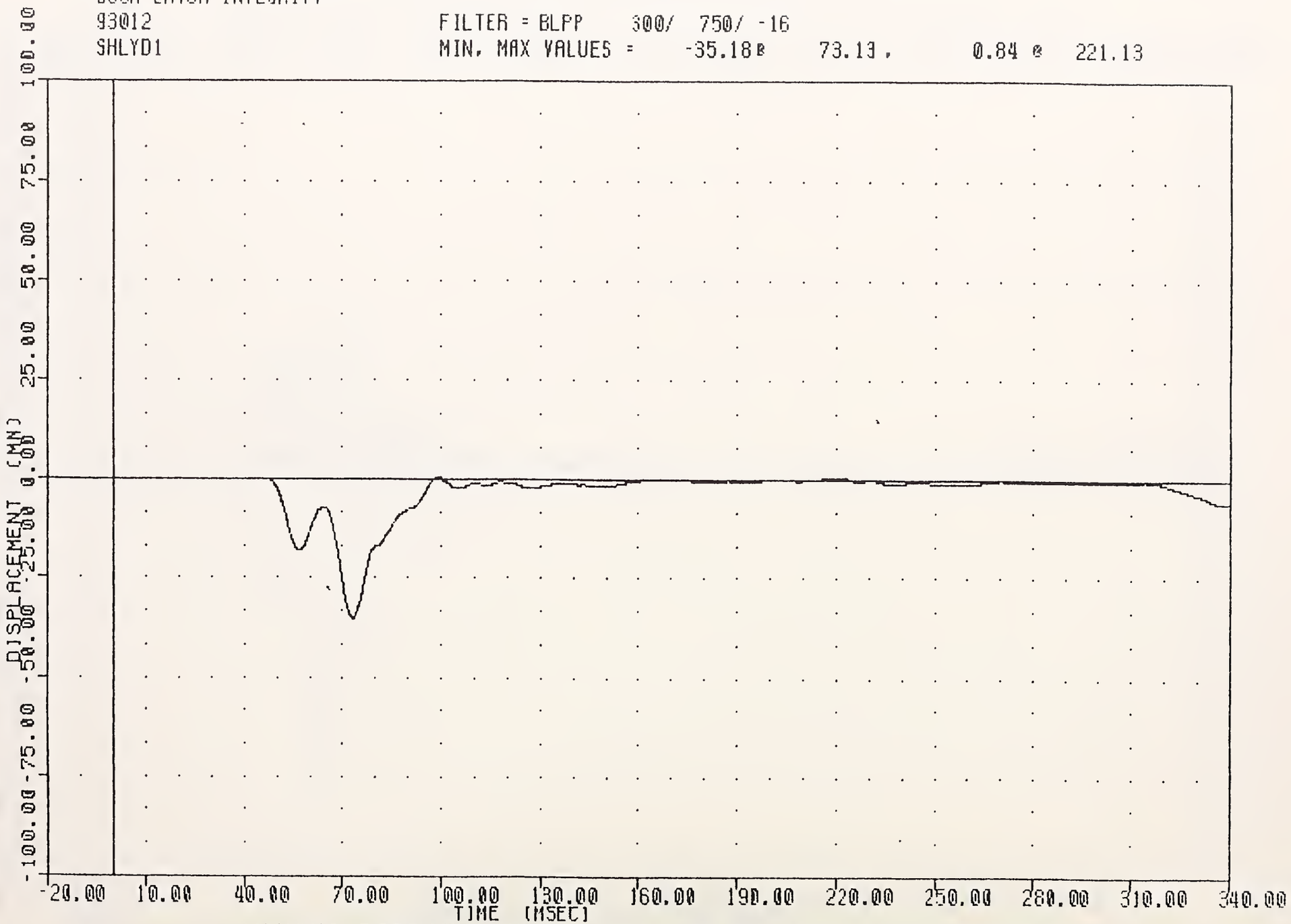
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER HEAD RESULTANT ACCELERATION



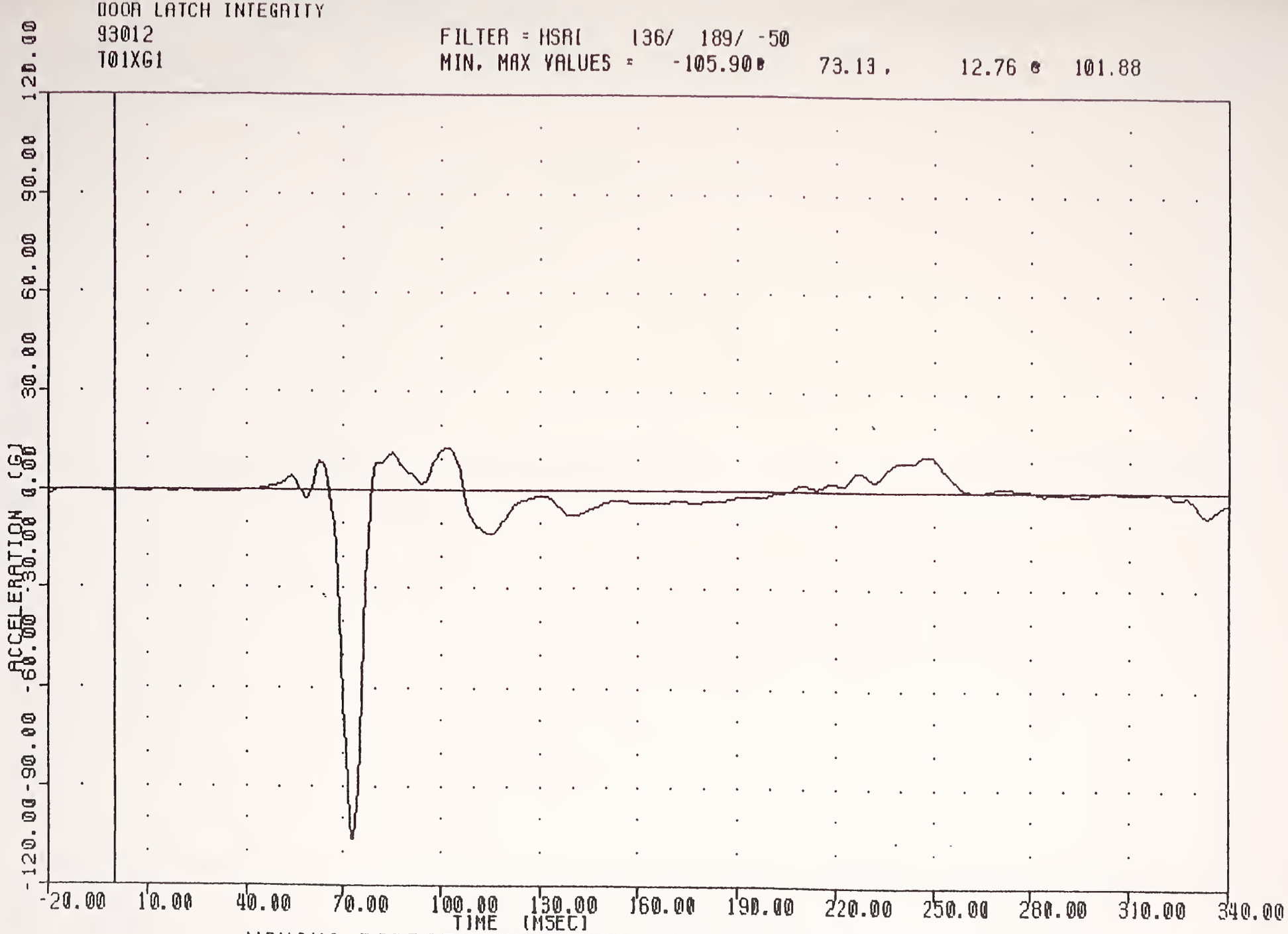
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT SHOULDER Y-AXIS ACCELERATION



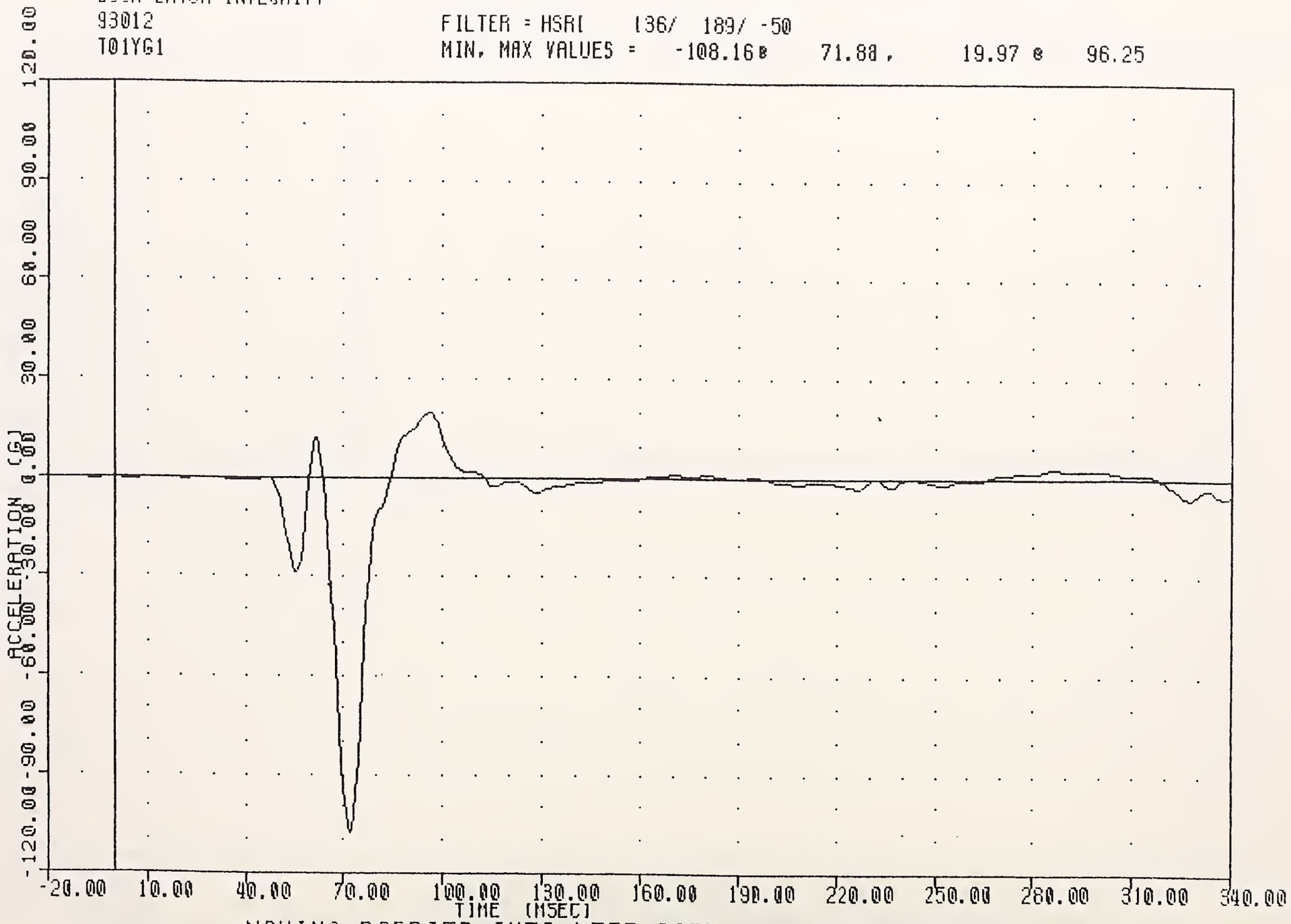
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT SHOULDER Y-AXIS FORCE



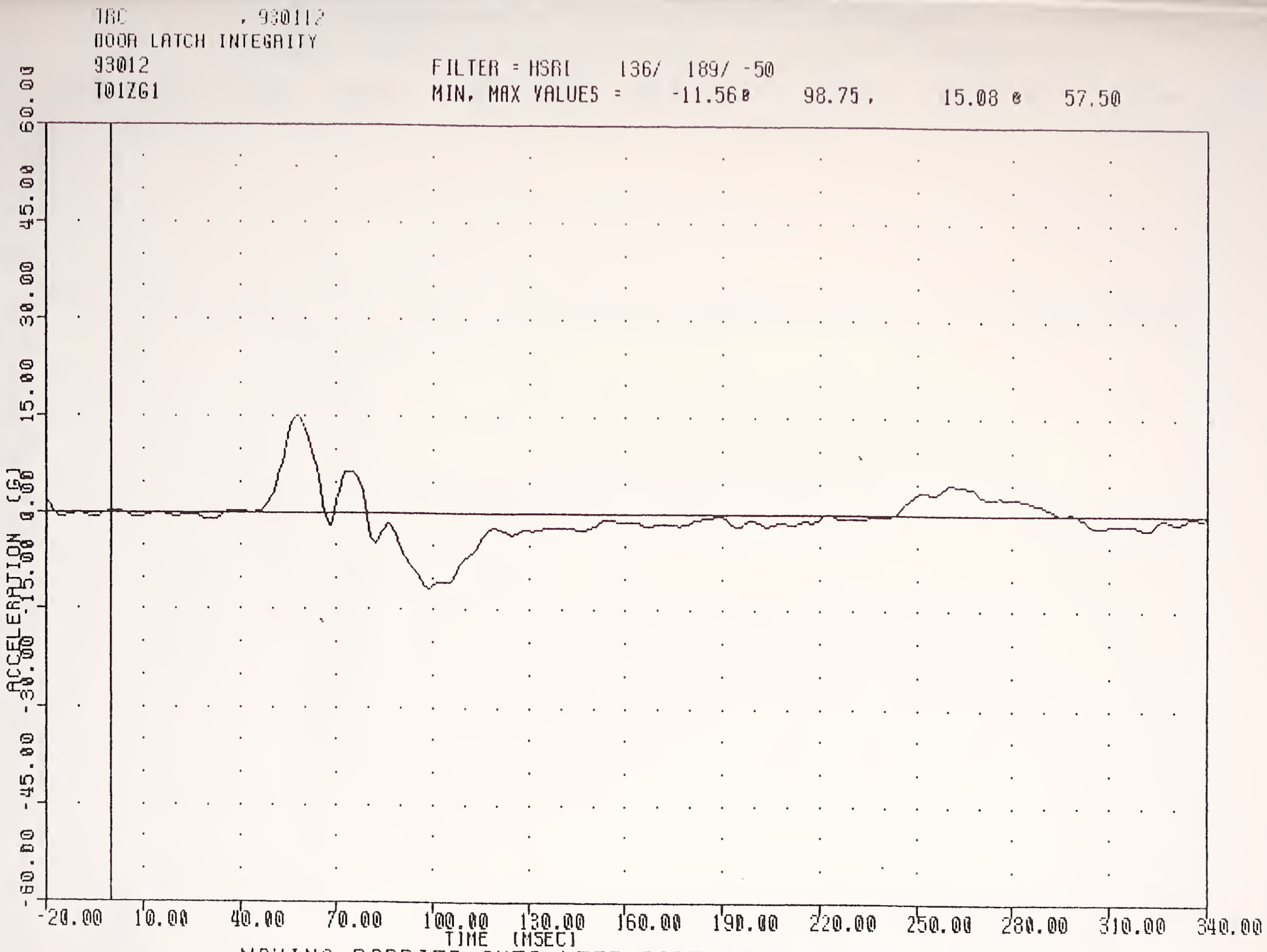
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT SHOULDER TO SPINE DISPLACEMENT



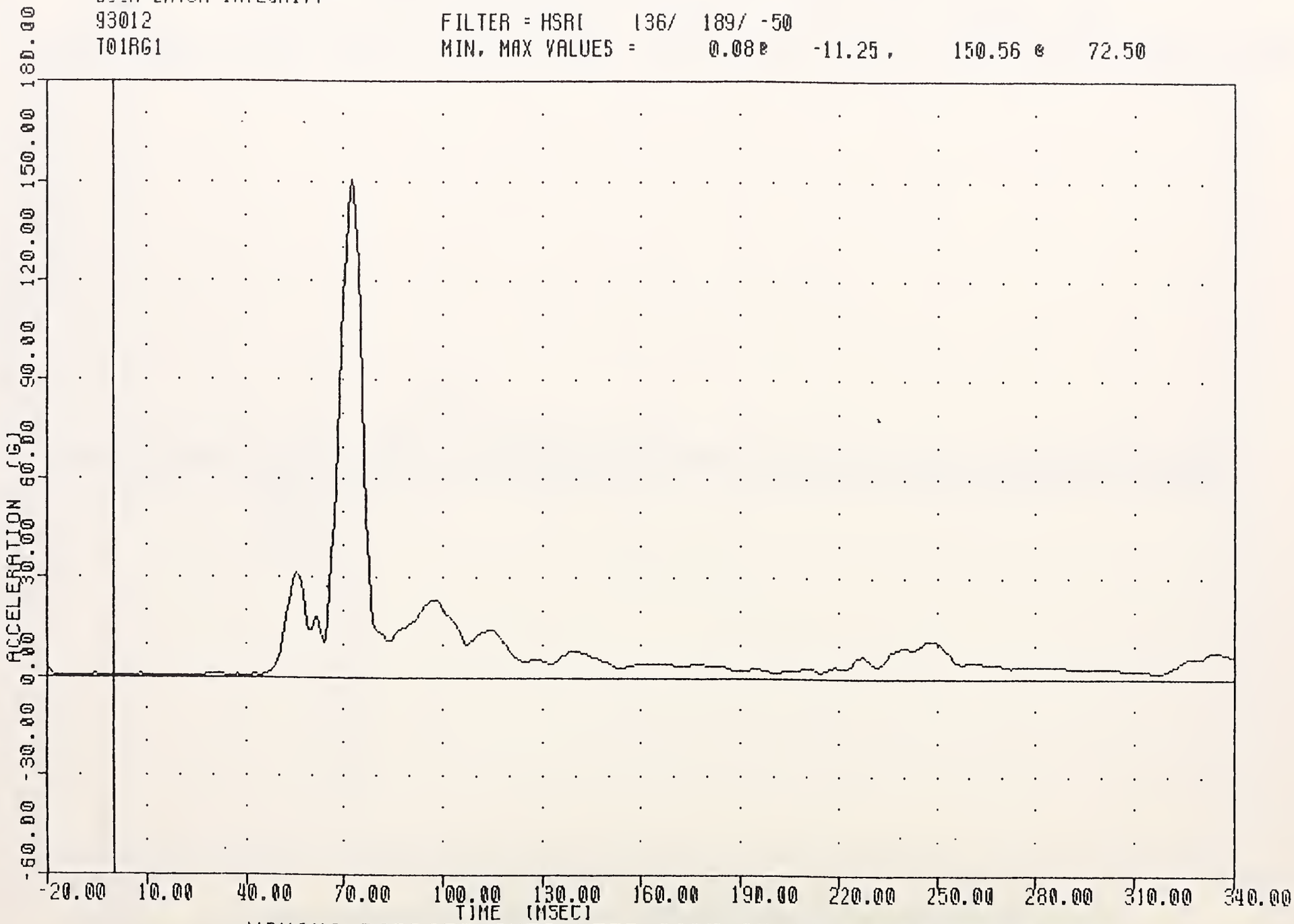
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER UPPER SPINE X-AXIS ACCELERATION



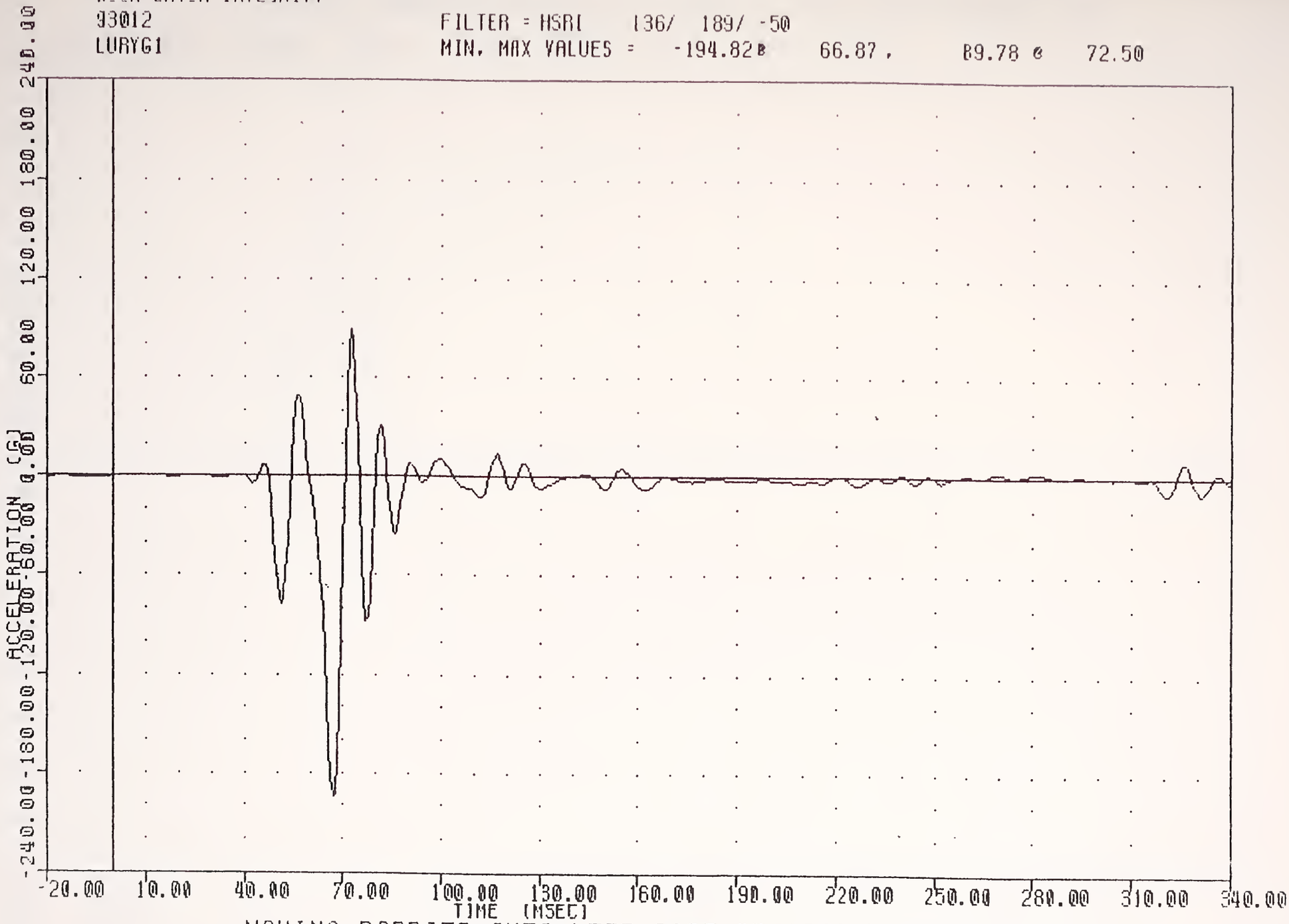
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER UPPER SPINE Y-AXIS ACCELERATION



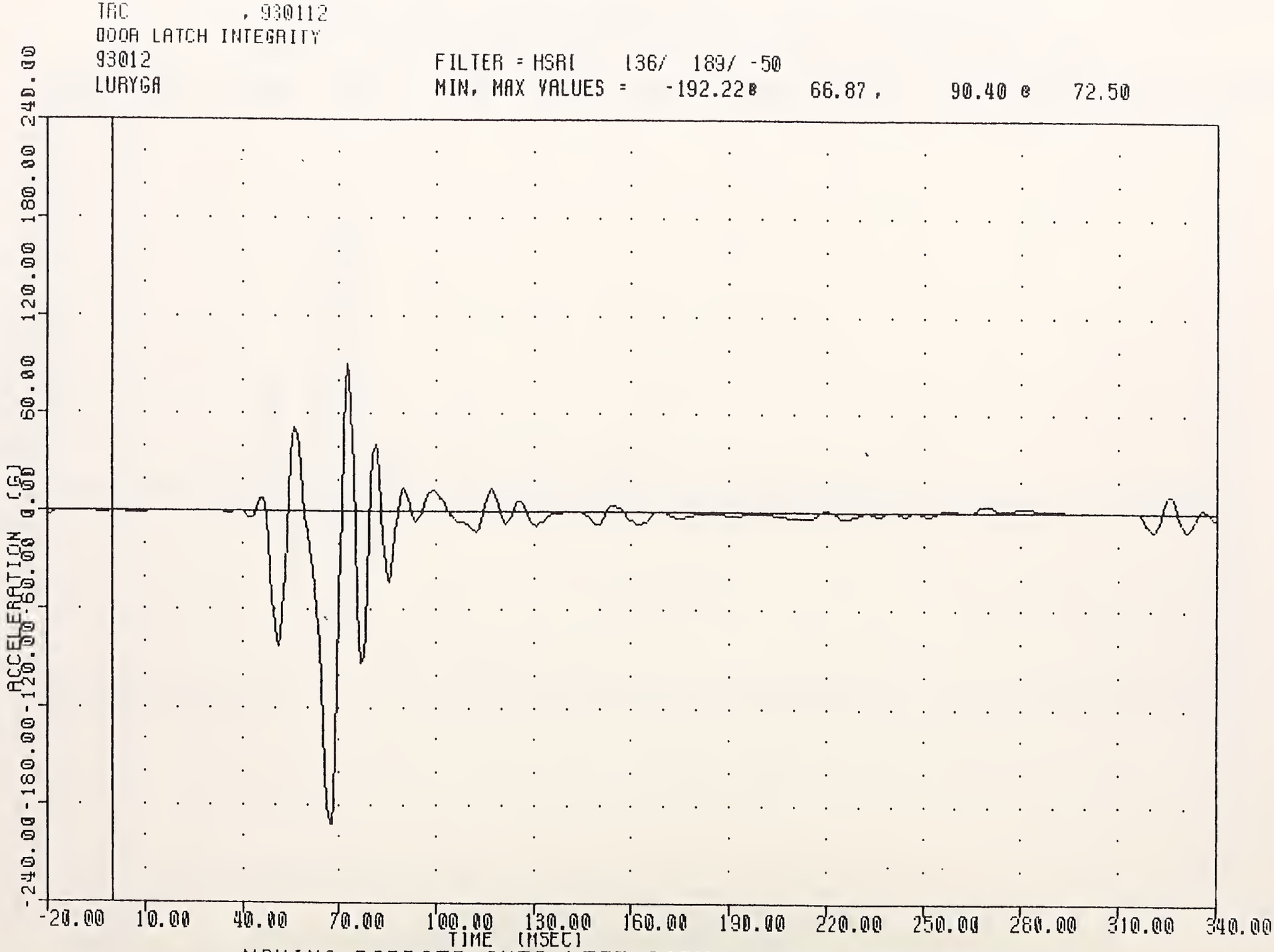
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER UPPER SPINE Z-AXIS ACCELERATION



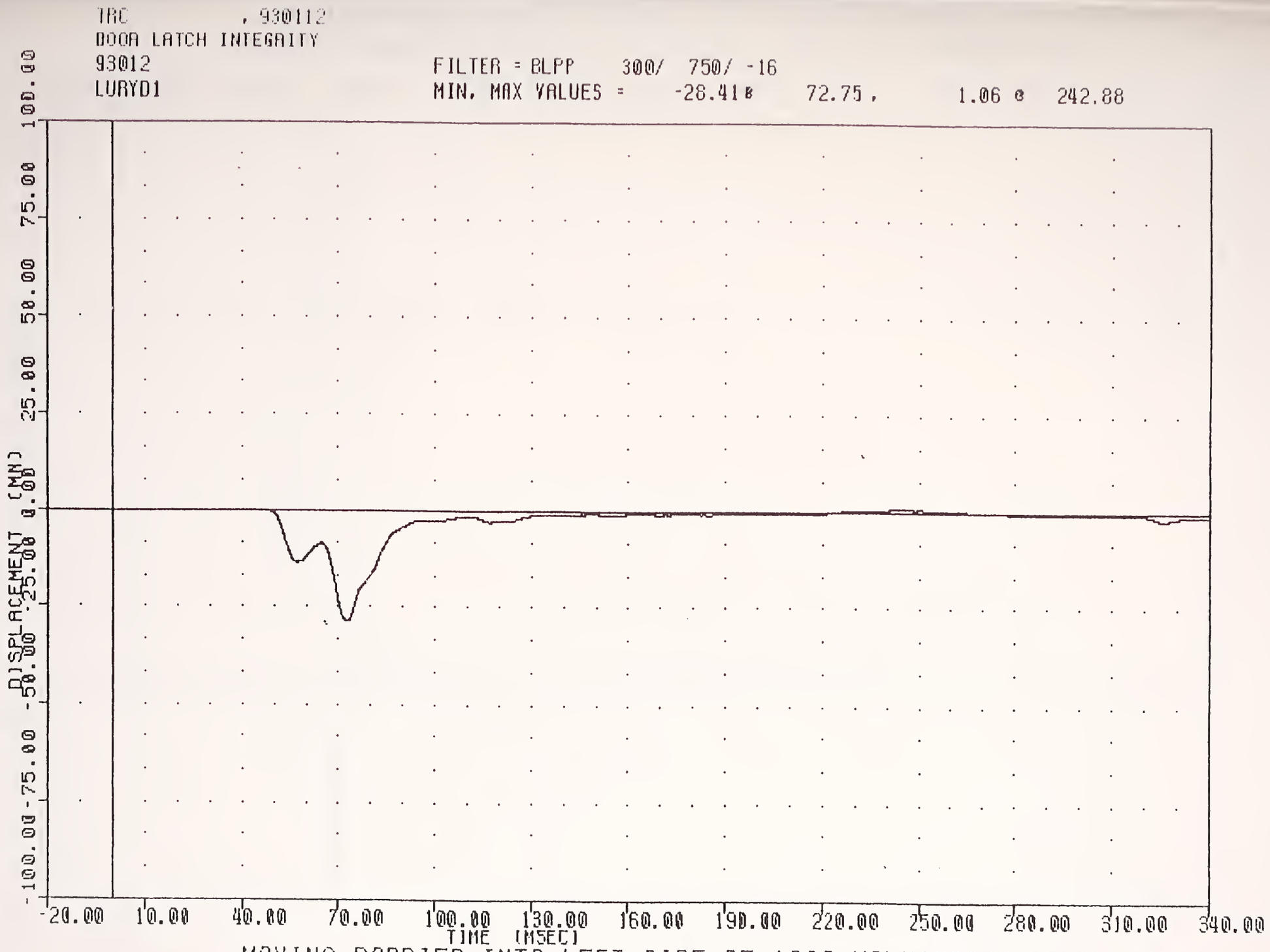
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER UPPER SPINE RESULTANT ACCELERATION



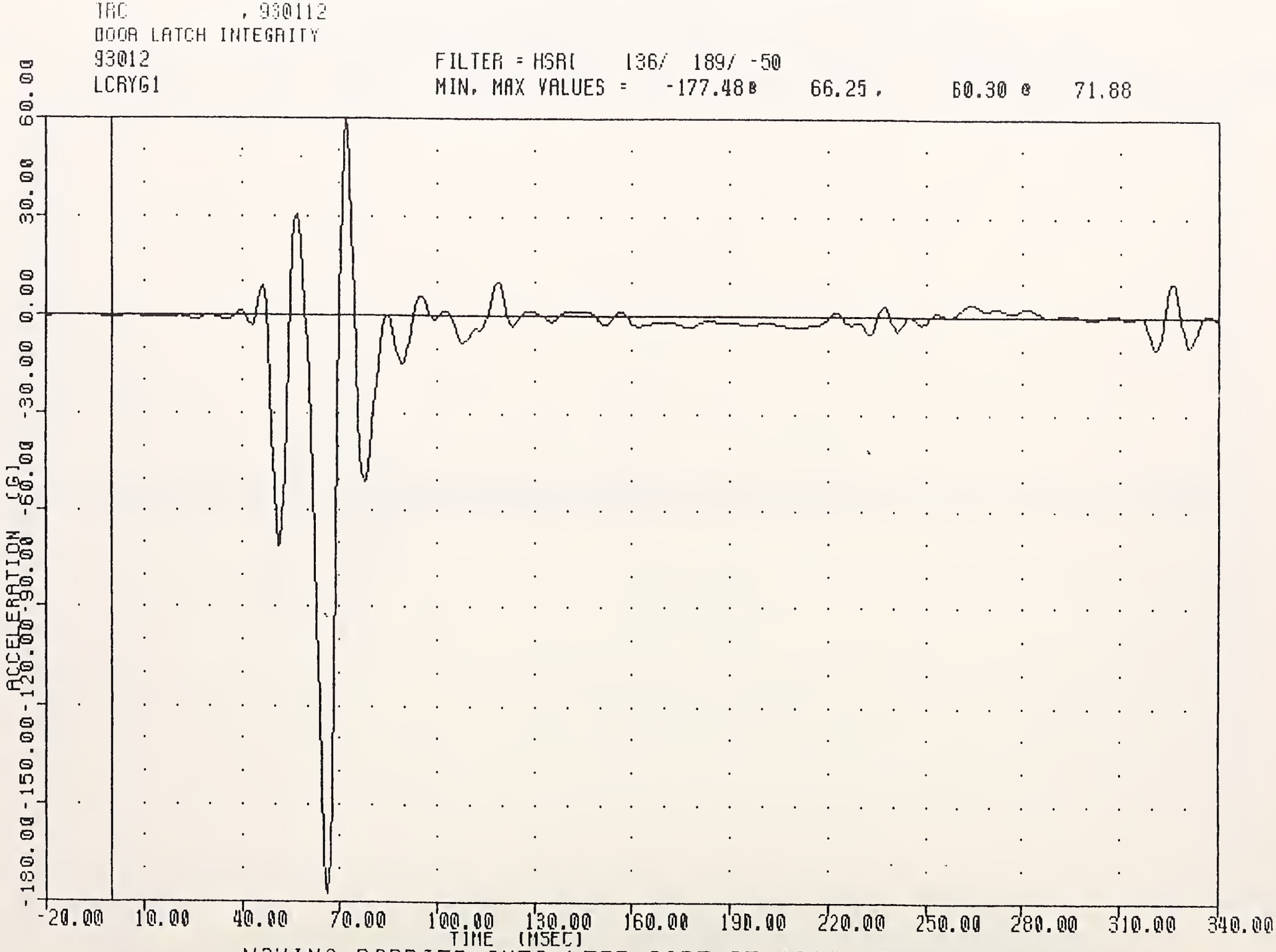
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT UPPER THORAX RIB Y-AXIS ACCELERATION



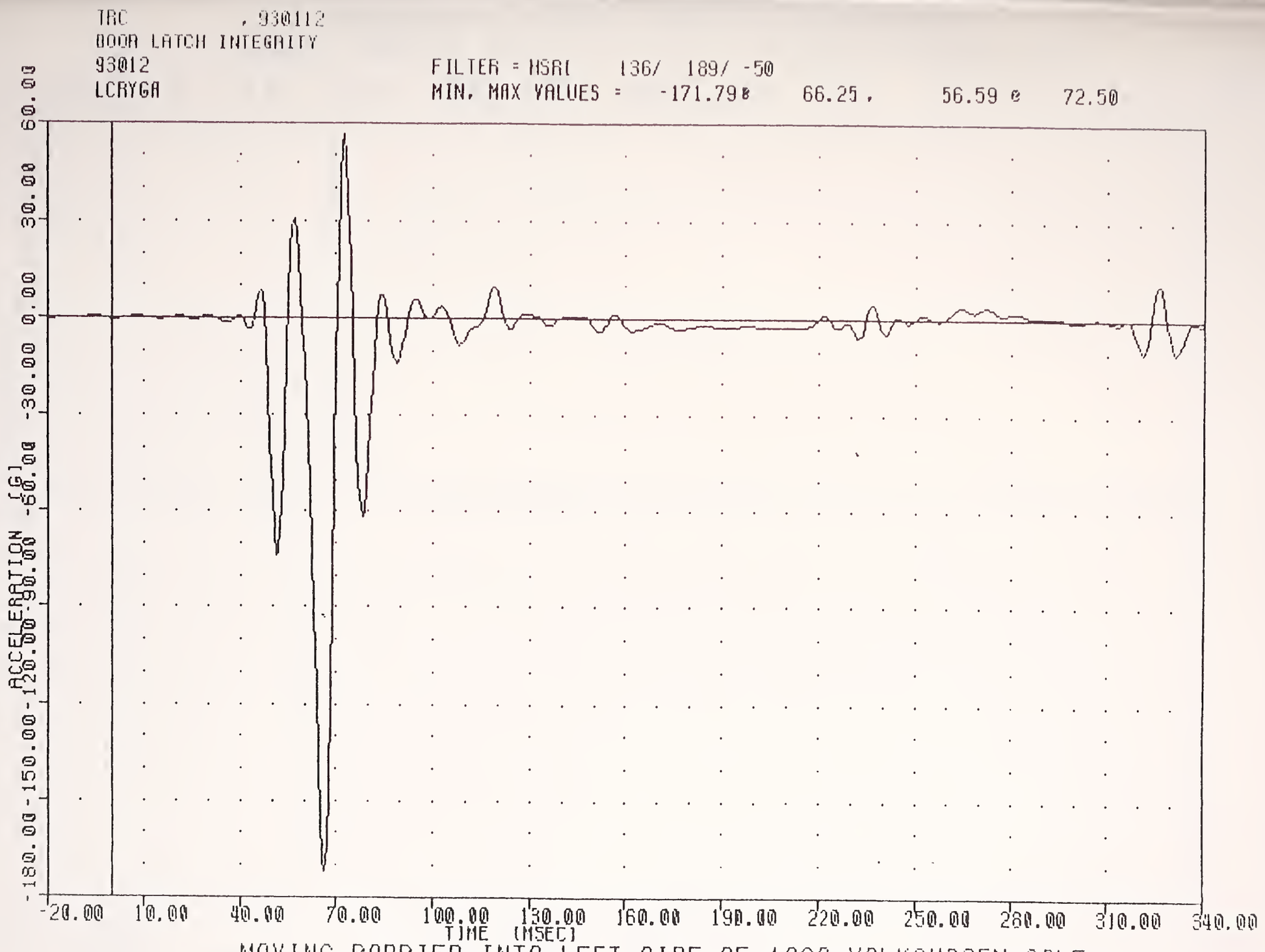
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT UPPER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



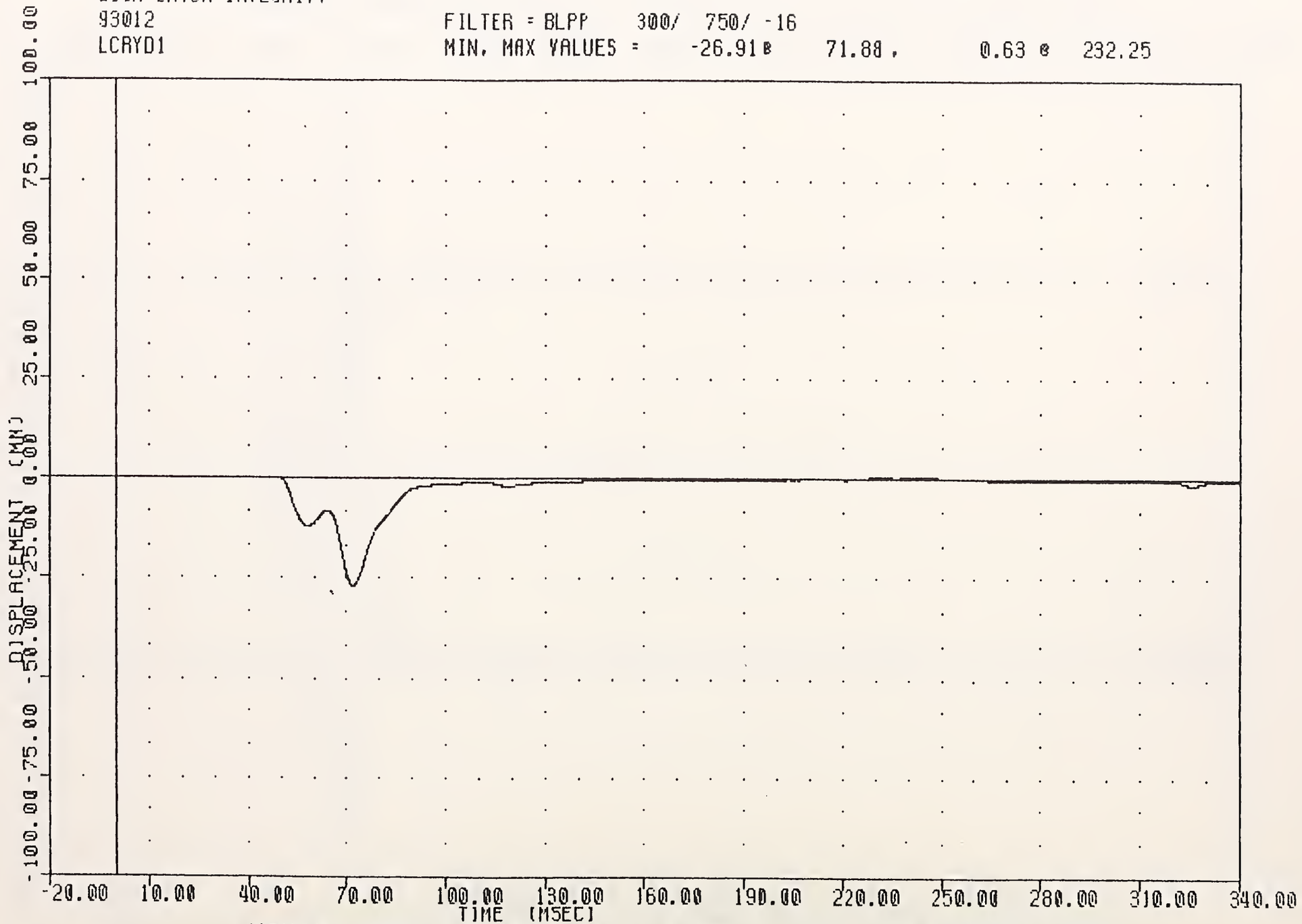
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT UPPER THORAX RIB DISPLACEMENT



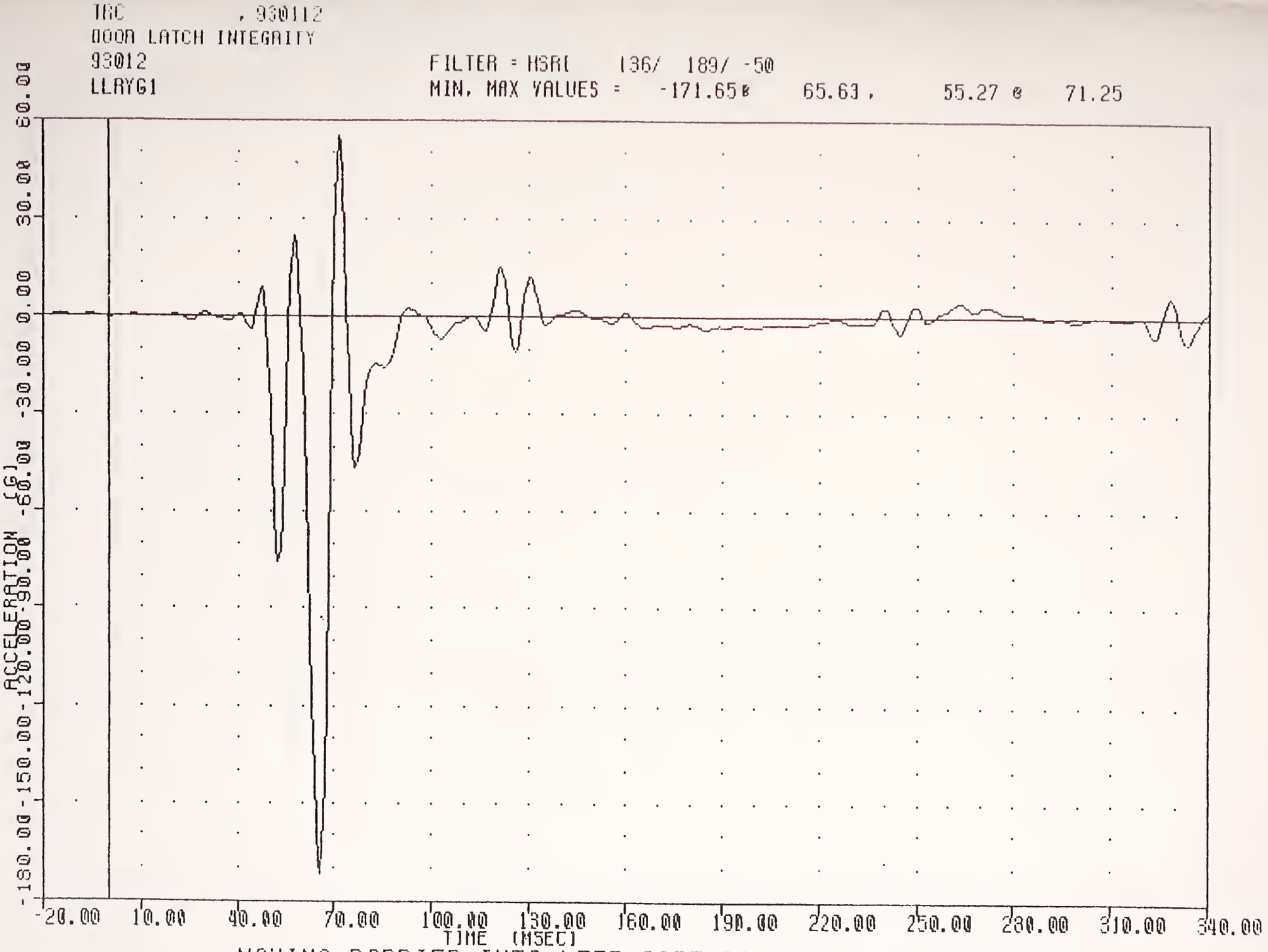
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT CENTER THORAX RIB Y-AXIS ACCELERATION



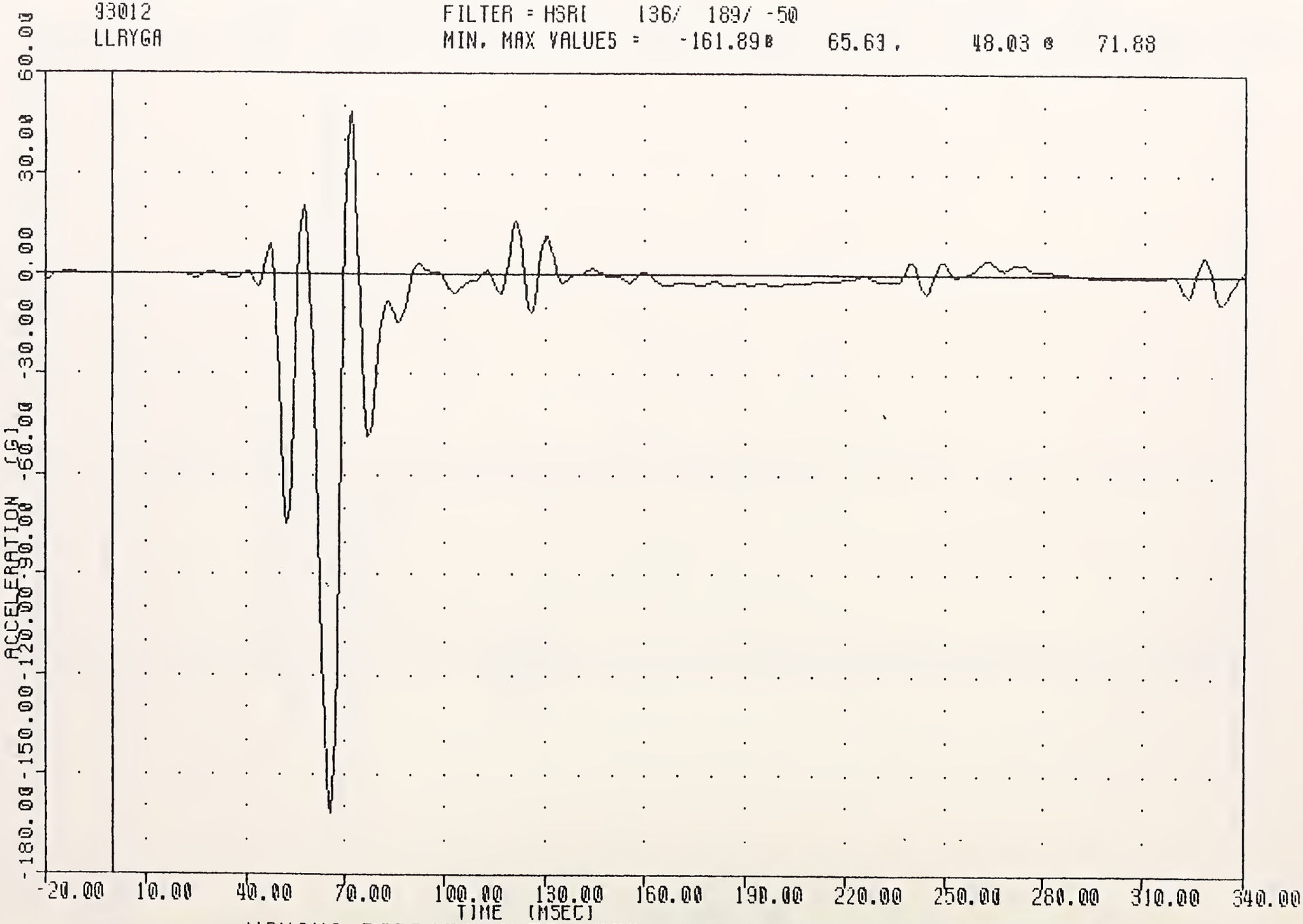
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



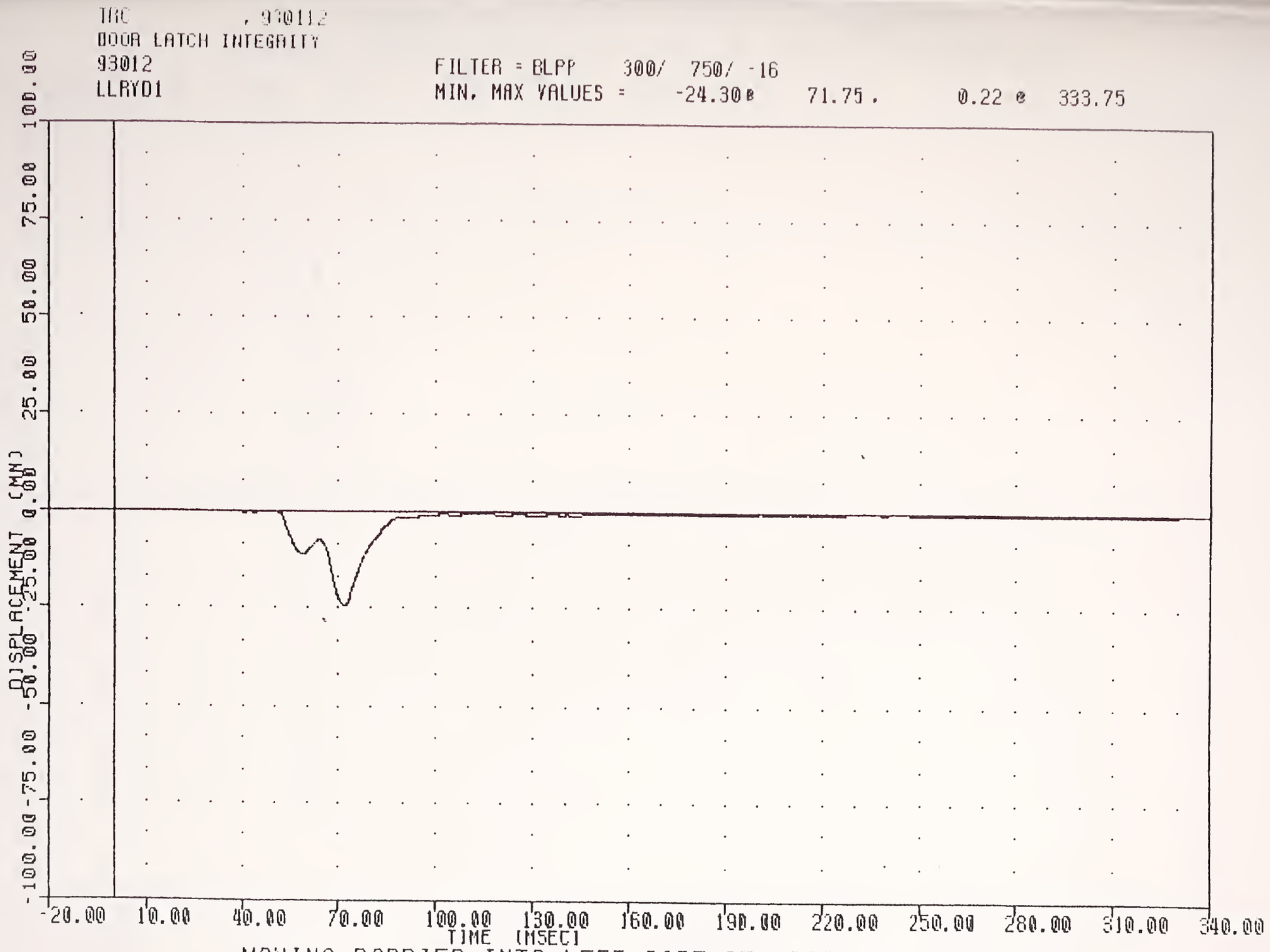
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT CENTER THORAX RIB DISPLACEMENT



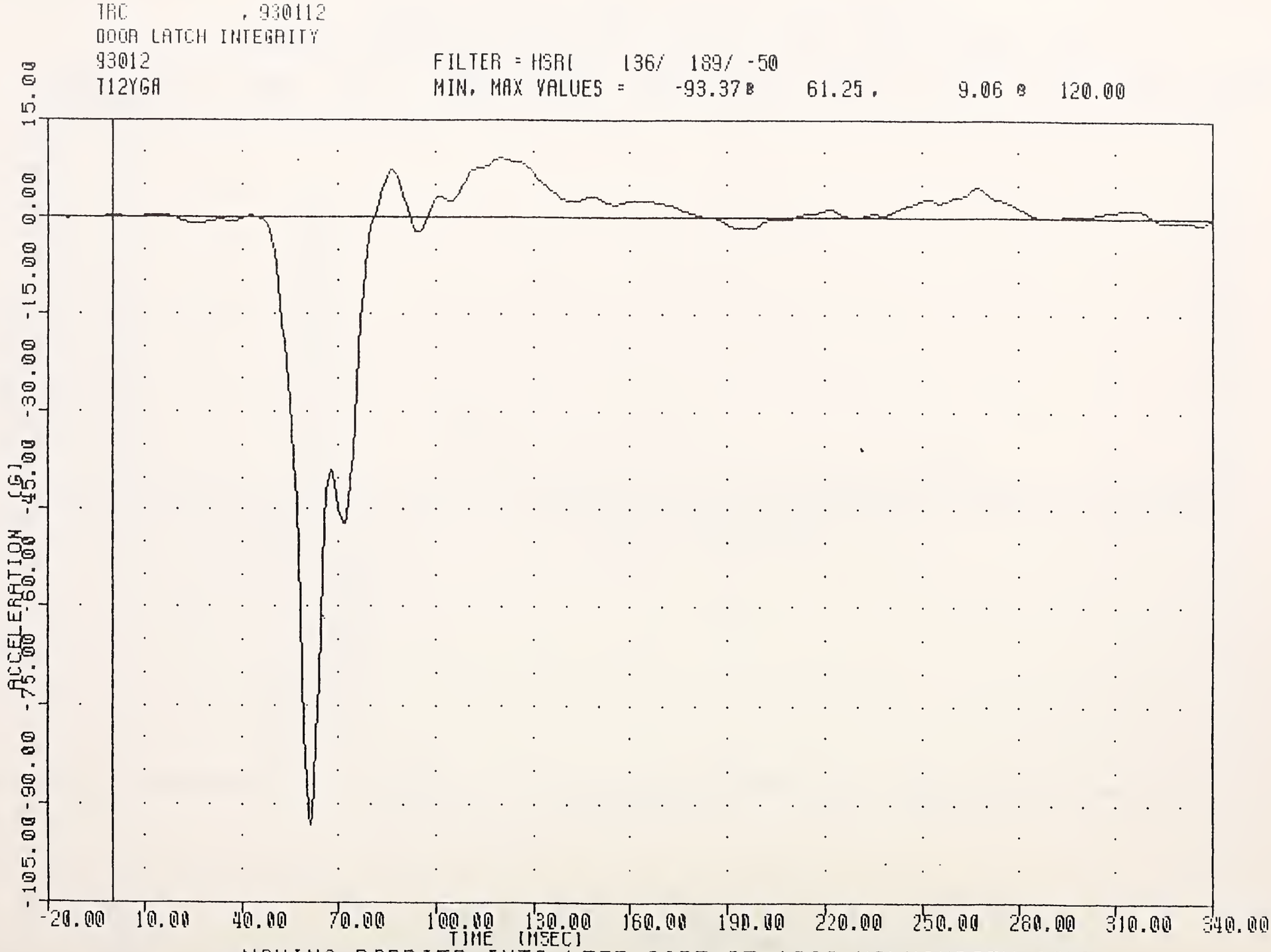
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT LOWER THORAX RIB Y-AXIS ACCELERATION



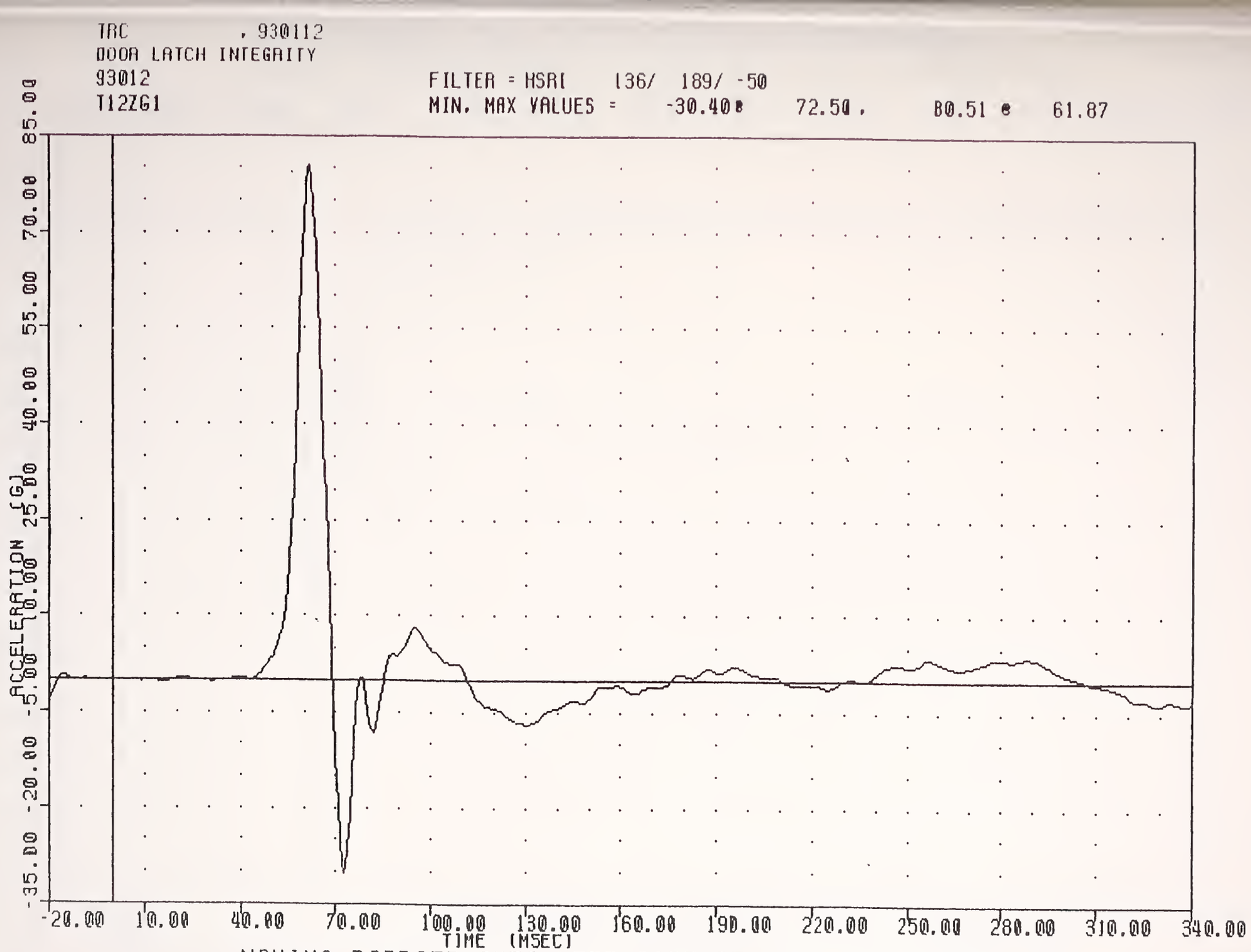
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



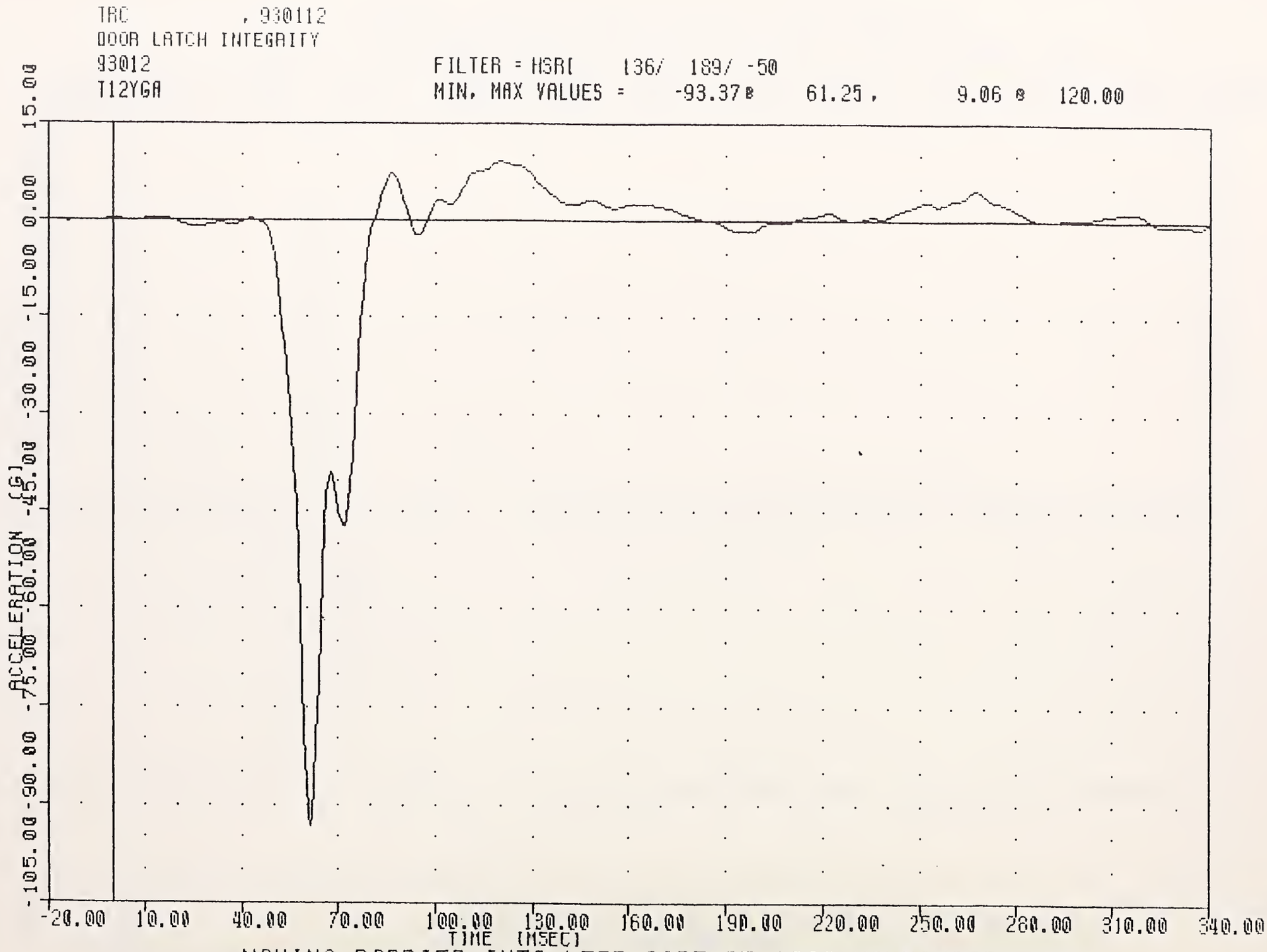
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT LOWER THORAX RIB DISPLACEMENT



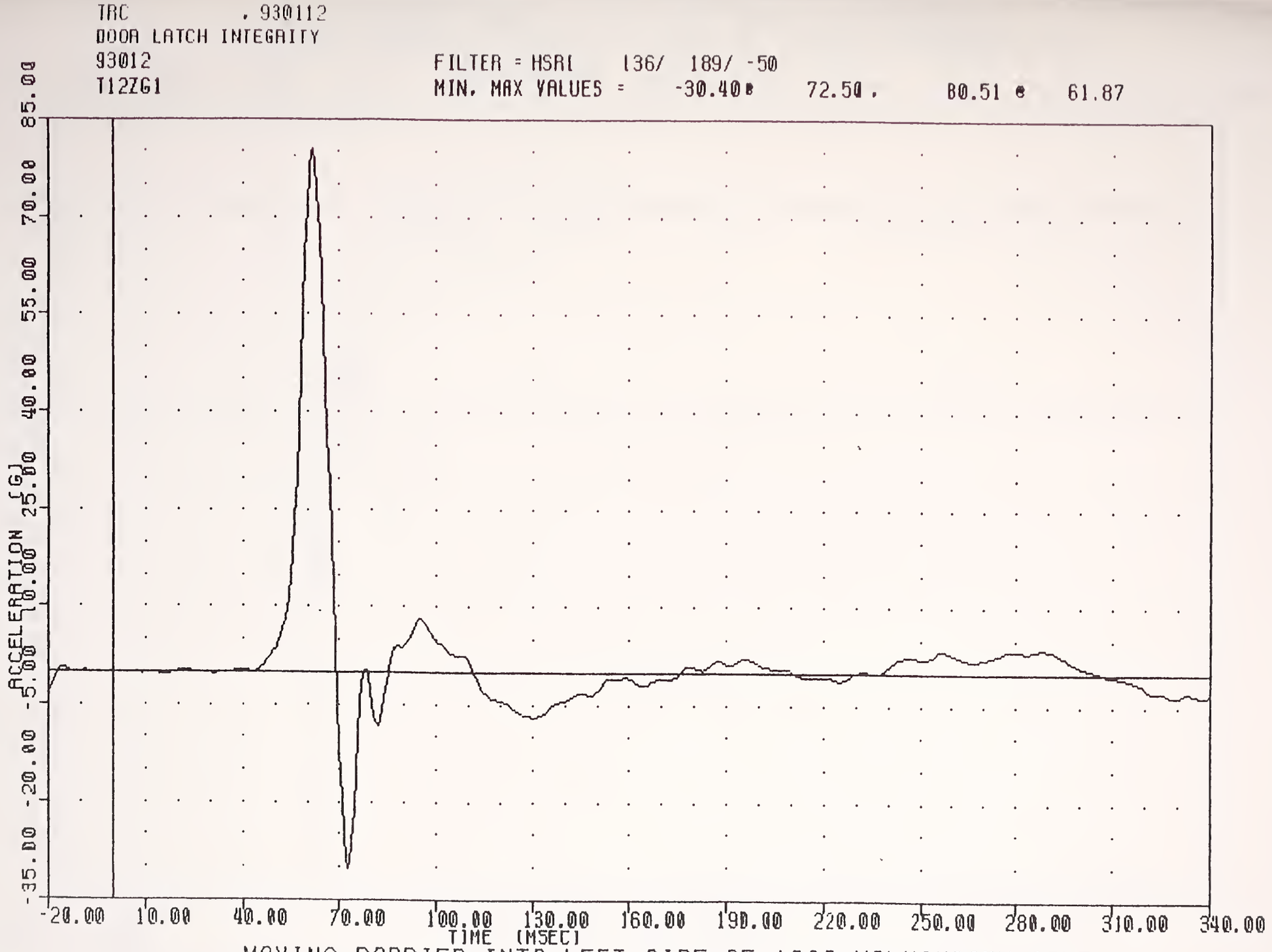
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LOWER SPINE Y-AXIS REDUNDANT ACCELERATION



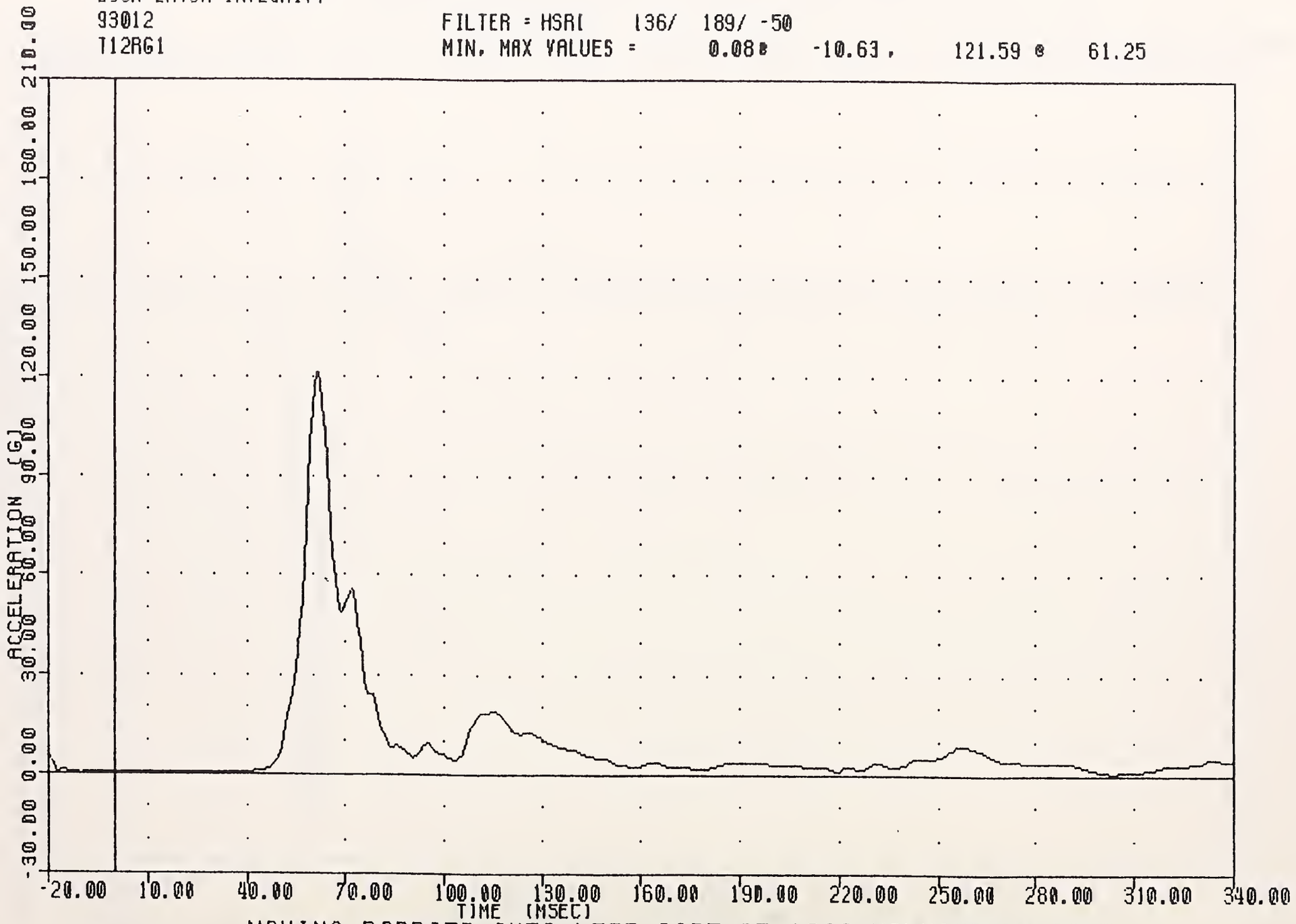
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LOWER SPINE Z-AXIS ACCELERATION



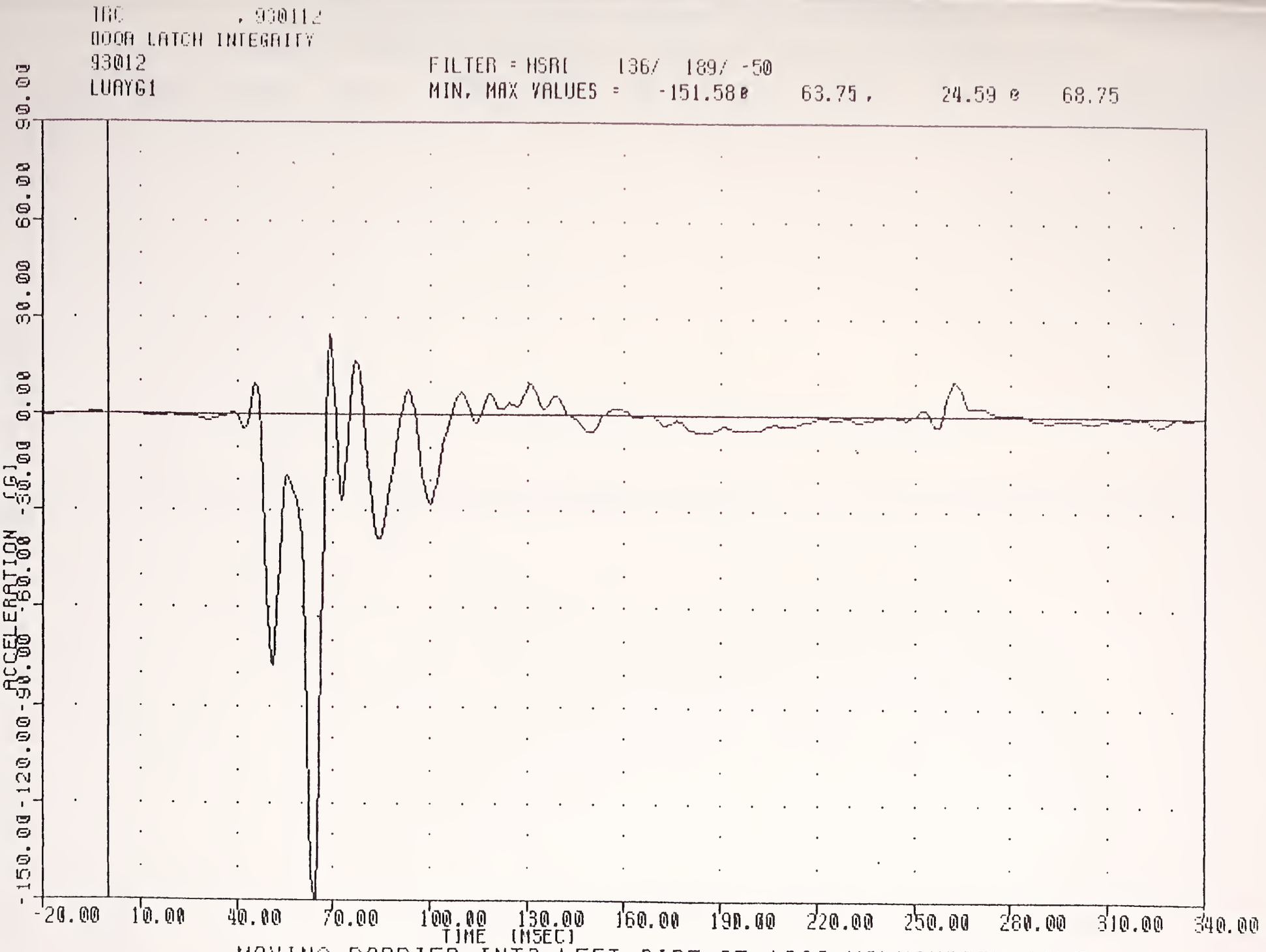
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LOWER SPINE Y-AXIS REDUNDANT ACCELERATION



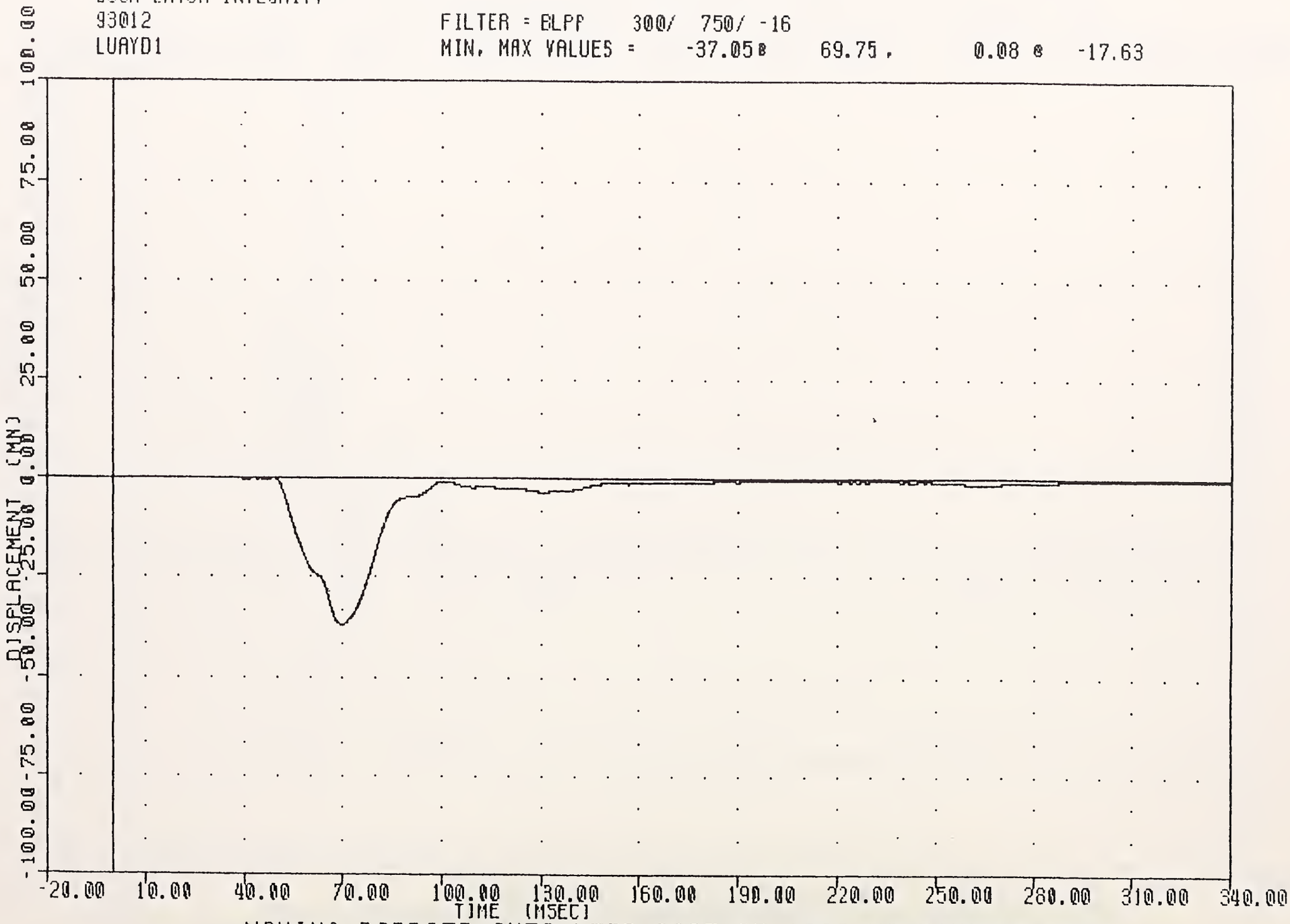
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LOWER SPINE Z-AXIS ACCELERATION



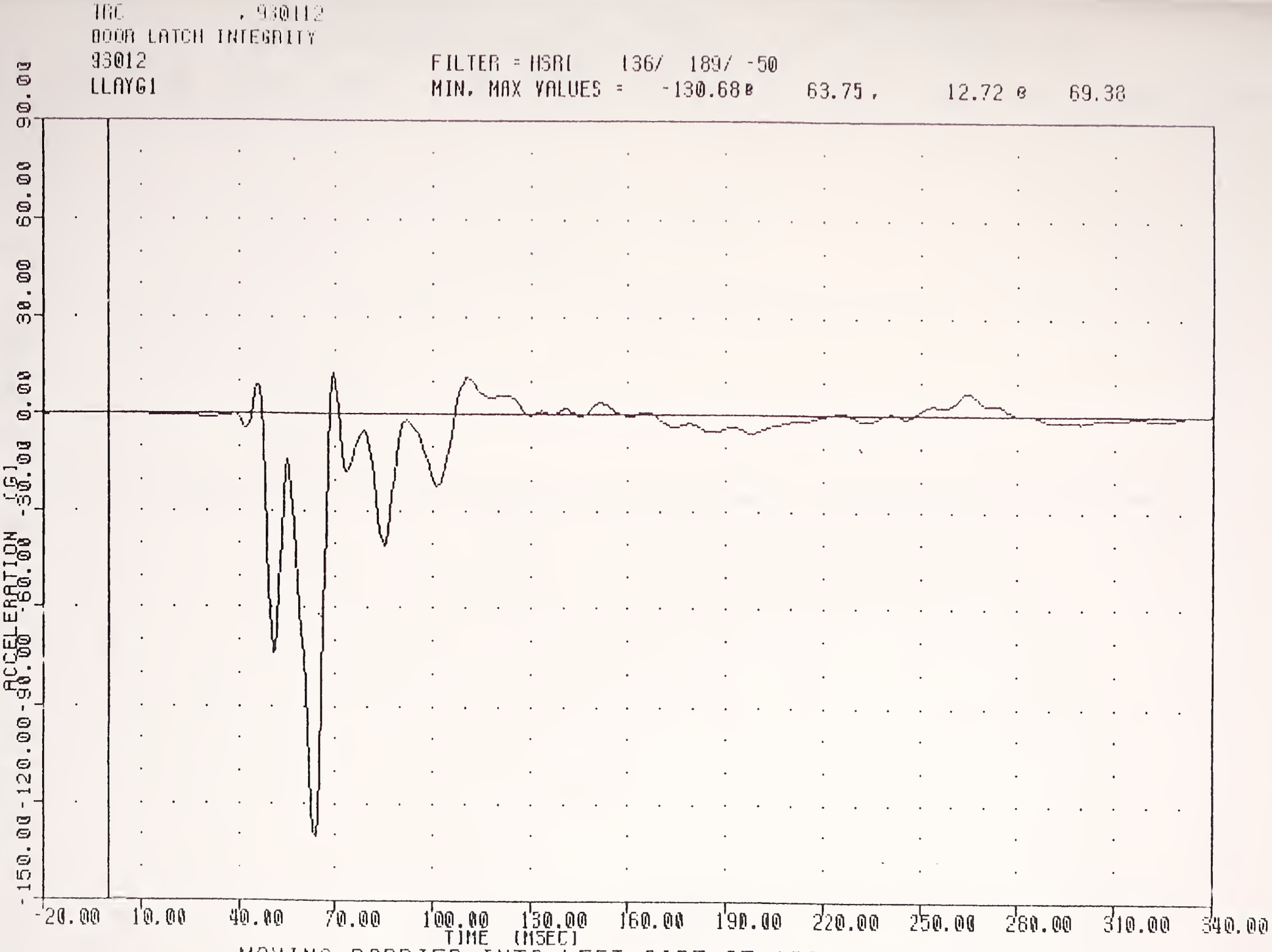
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LOWER SPINE RESULTANT ACCELERATION



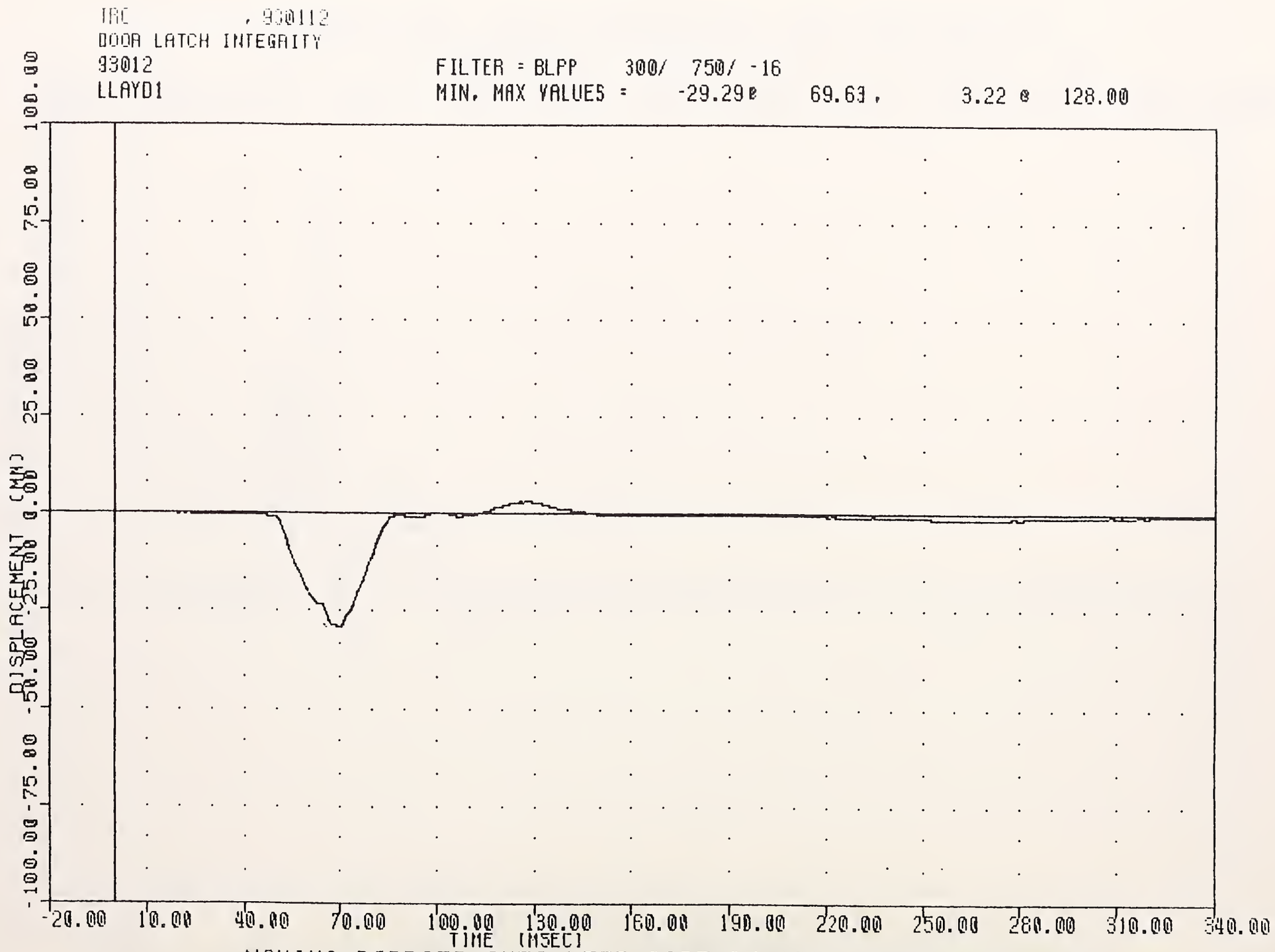
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT UPPER ABDOMEN RIB Y-AXIS ACCELERATION



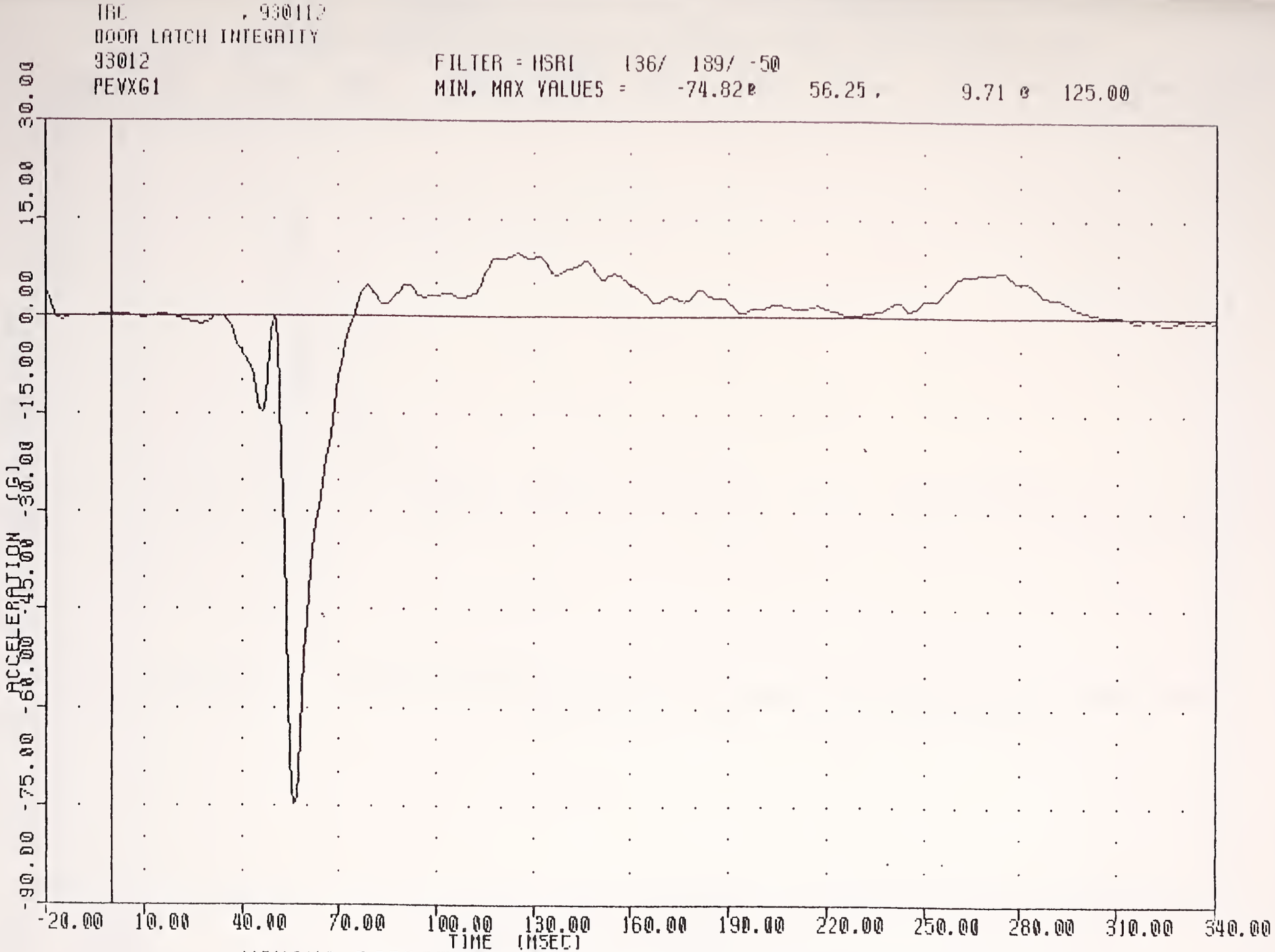
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT UPPER ABDOMEN RIB DISPLACEMENT



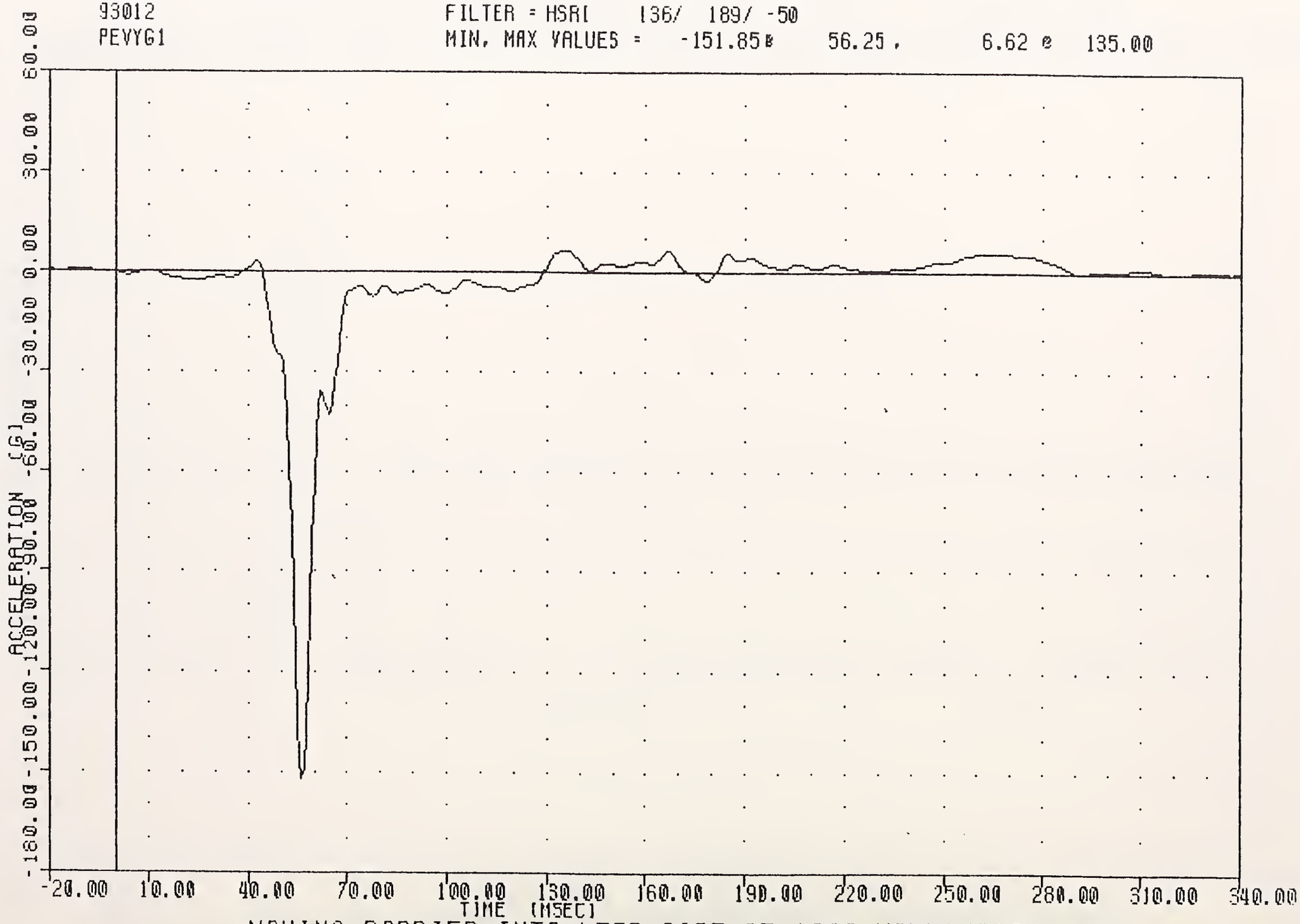
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT LOWER ABDOMEN RIB Y-AXIS ACCELERATION



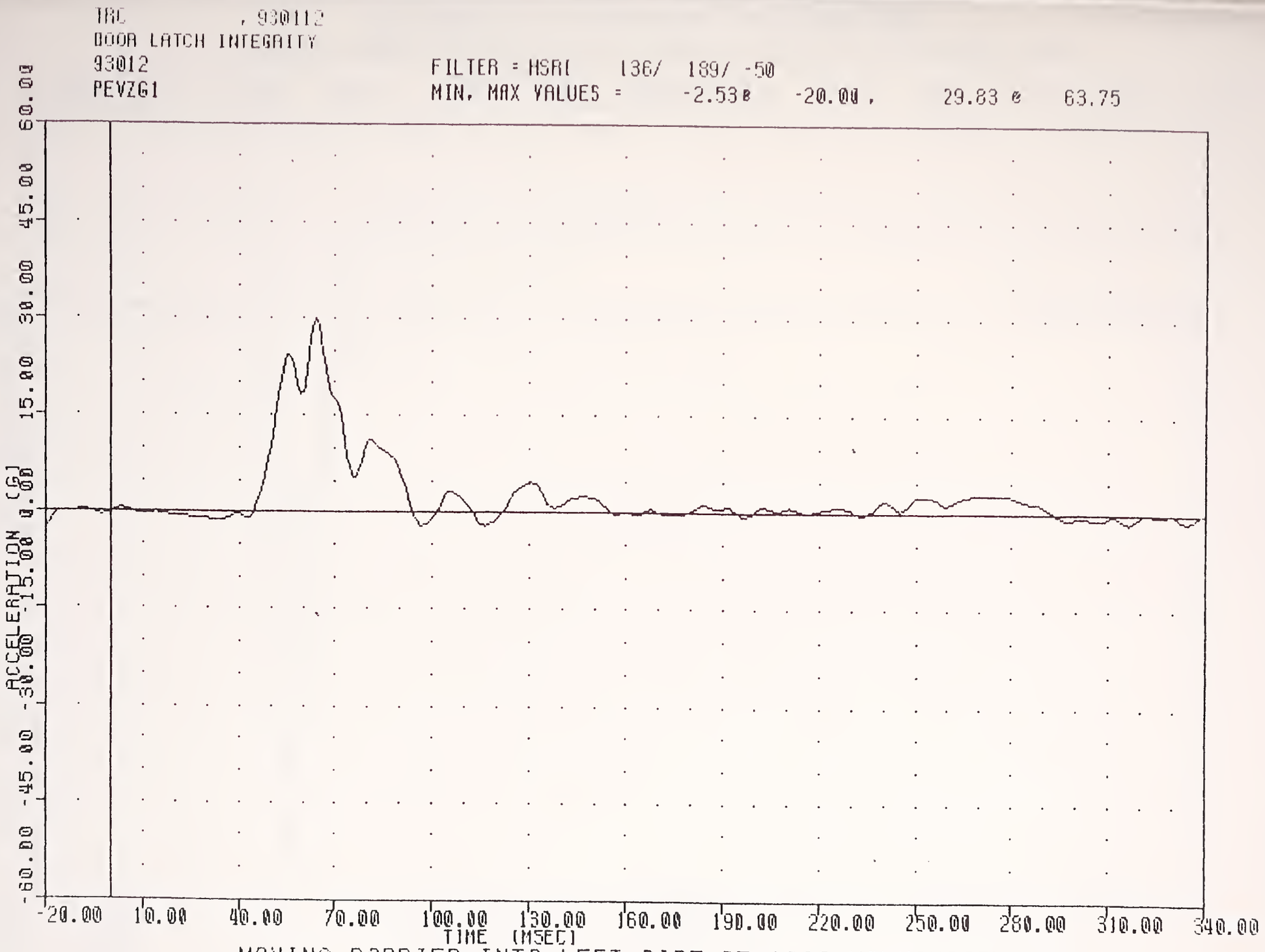
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER LEFT LOWER ABDOMEN RIB DISPLACEMENT



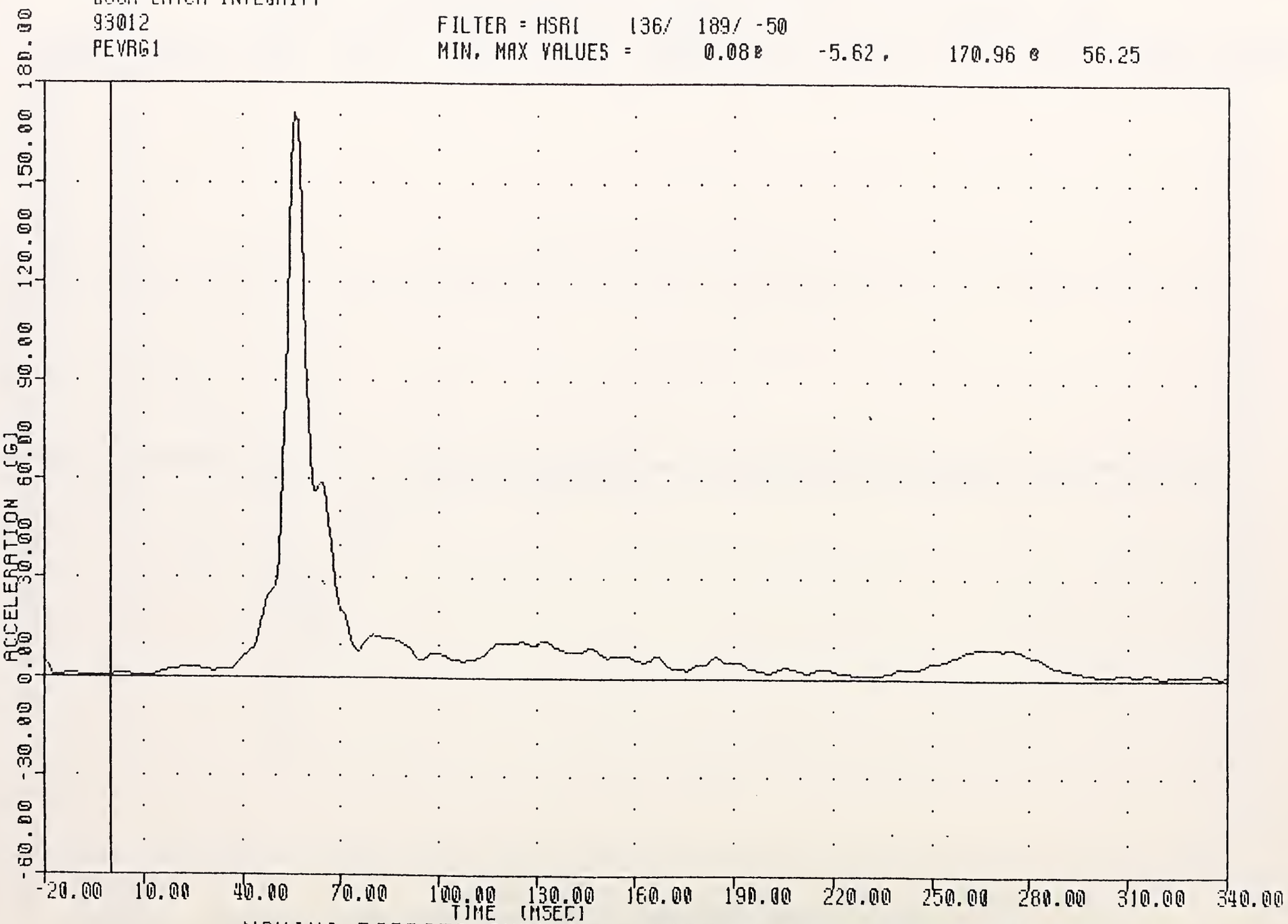
MOVING BARRIER INTO LEFT SIDE OF 1988 VOLKSWAGEN GOLF
DRIVER PELVIS X-AXIS ACCELERATION



MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER PELVIS Y-AXIS ACCELERATION

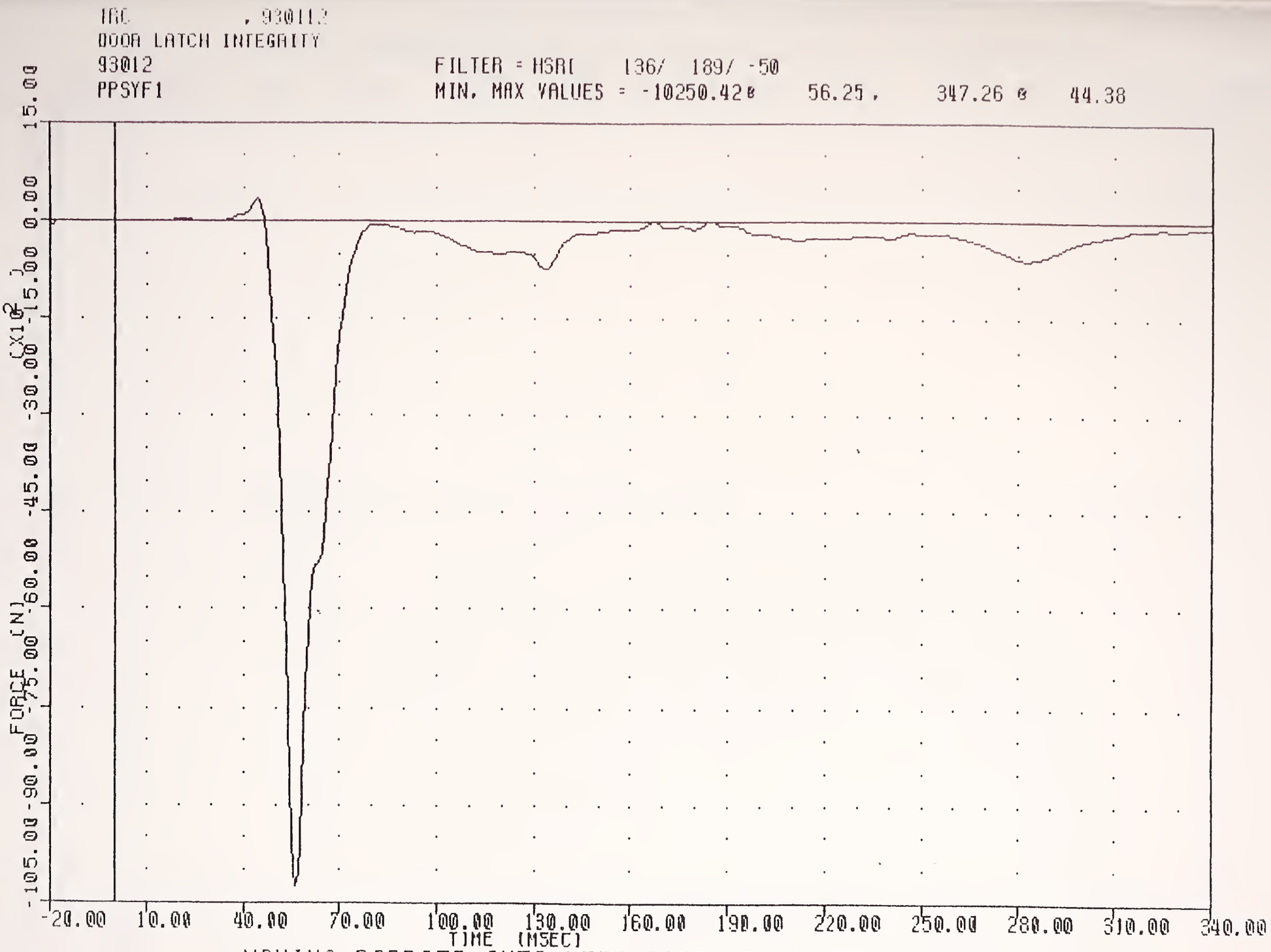


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
DRIVER PELVIS Z-AXIS ACCELERATION

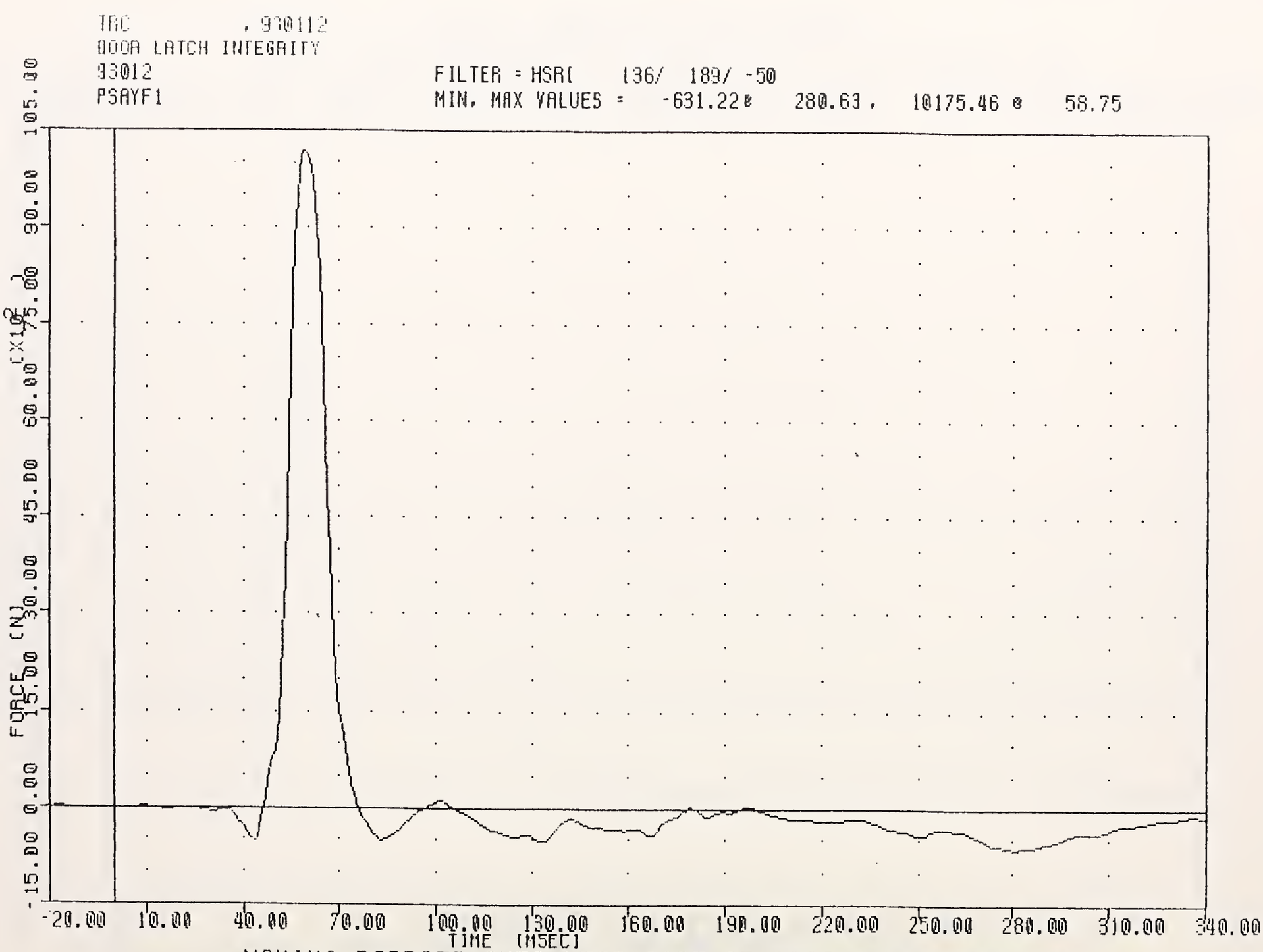


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF

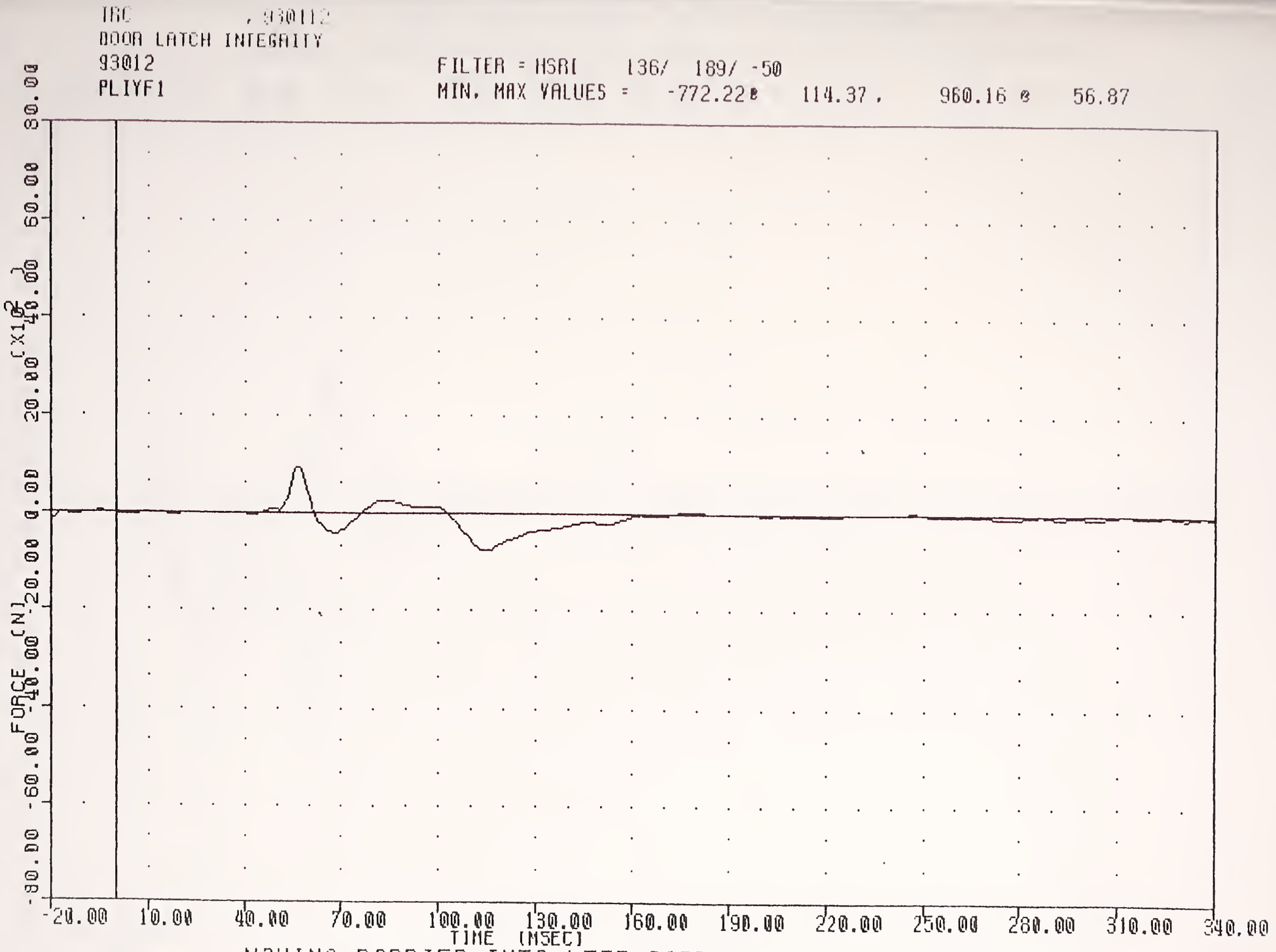
DRIVER PELVIS RESULTANT ACCELERATION



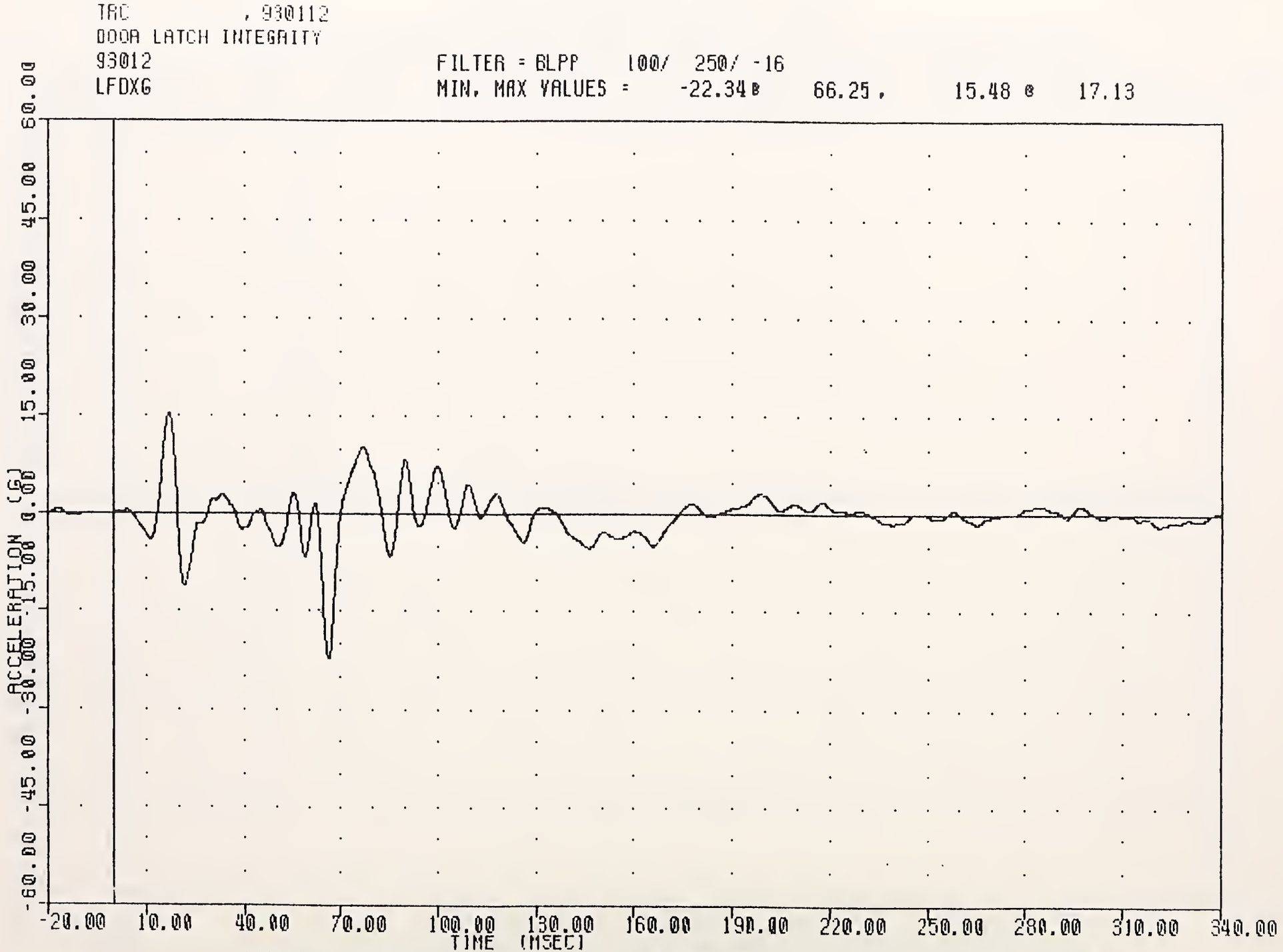
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
PUBIC SYMPHYSIS Y-AXIS FORCE



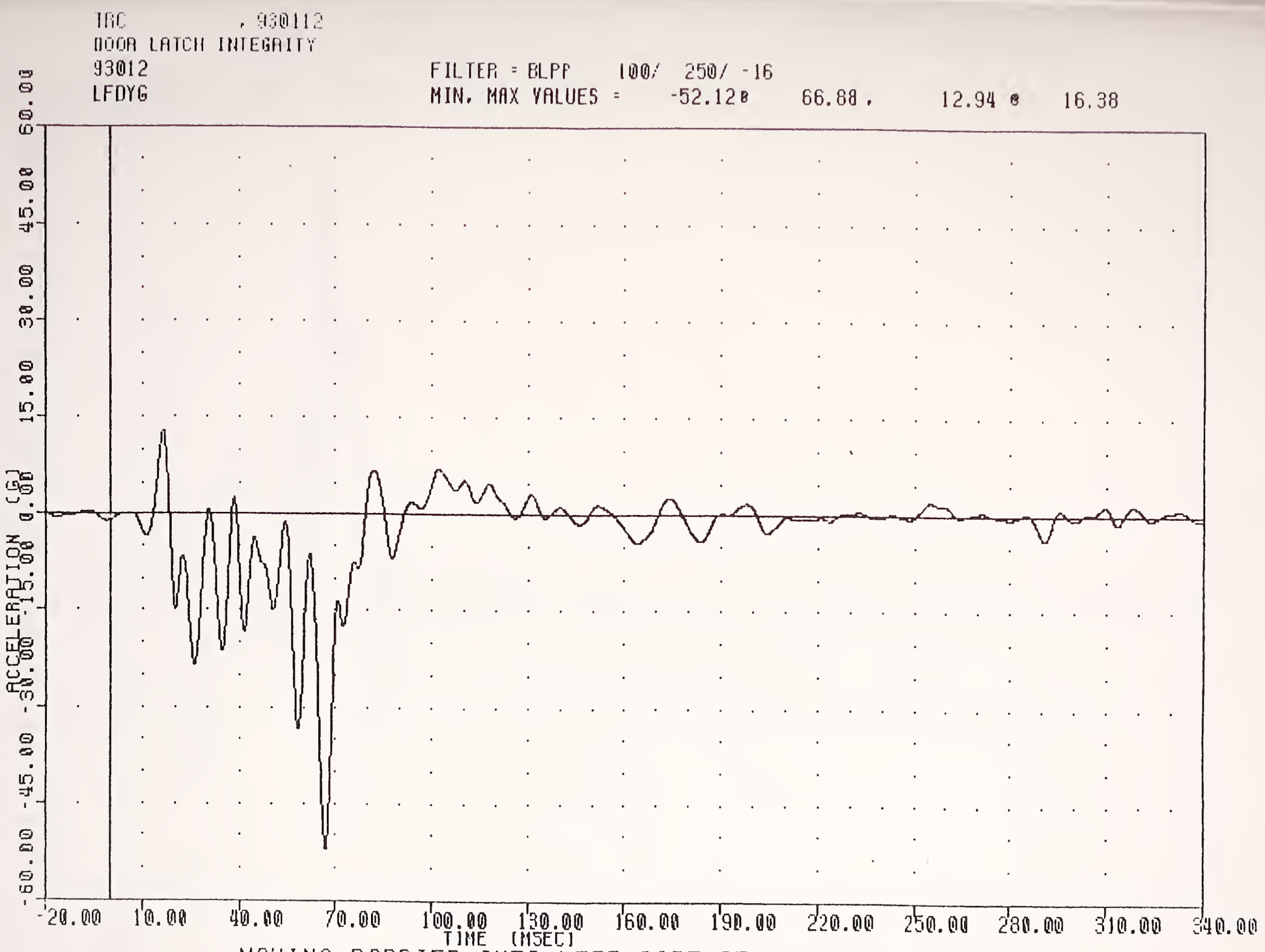
MOVING BARRIER INTO LEFT SIDE OF 1988 VOLKSWAGEN GOLF
PELVIS SACRUM Y-AXIS FORCE



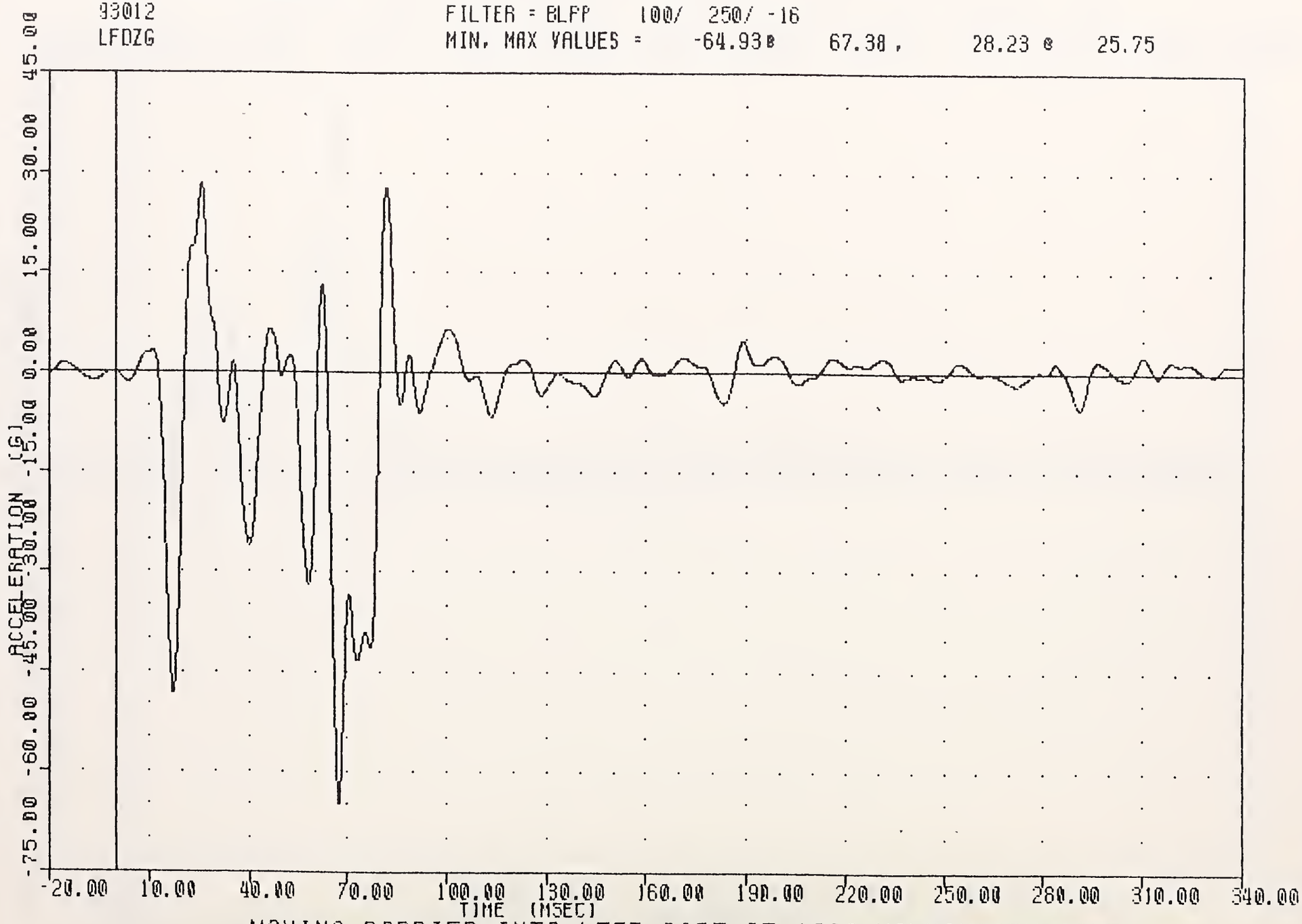
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
PELVIS ILIAC Y-AXIS FORCE



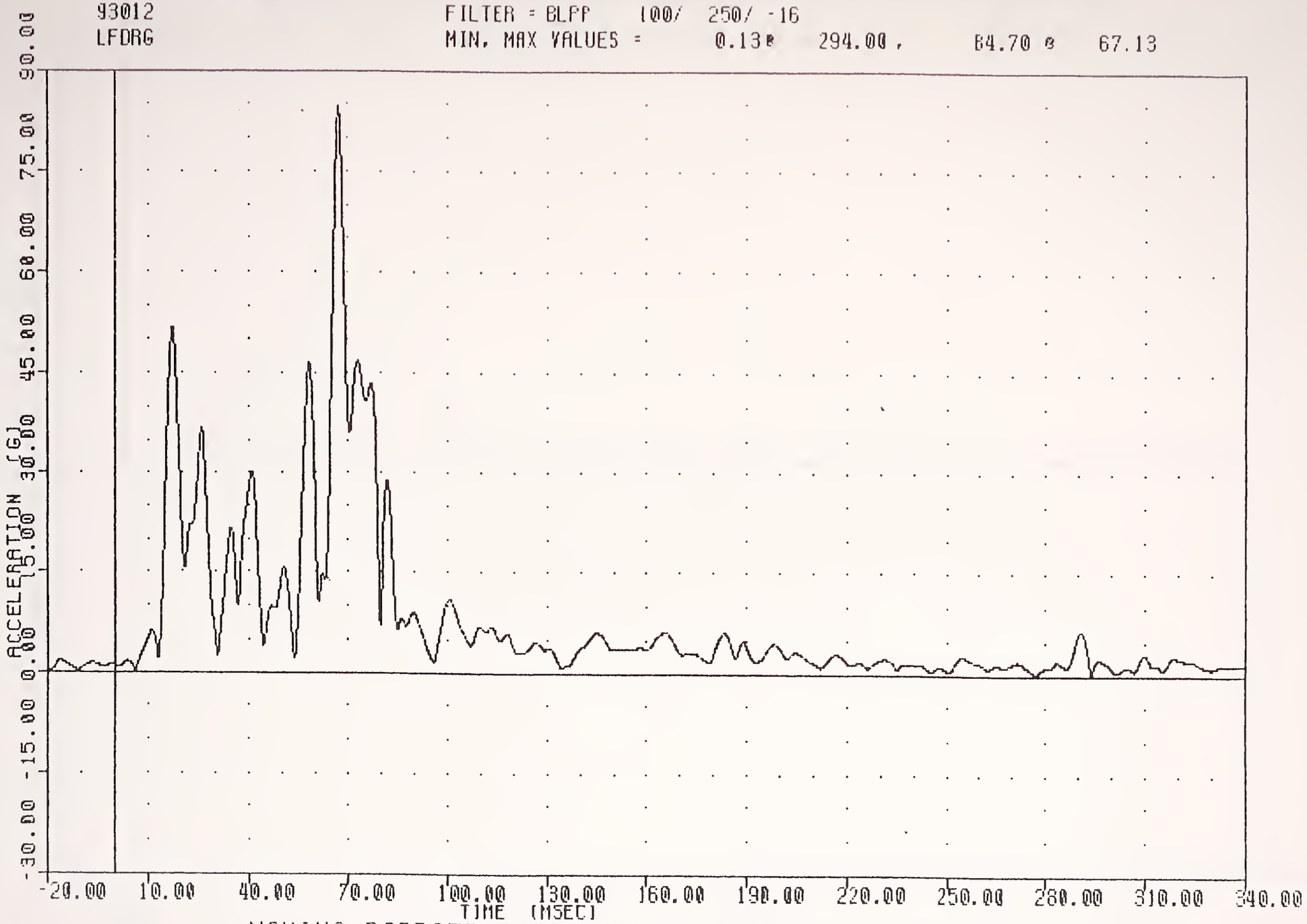
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT FRONT DOOR X-AXIS ACCELERATION



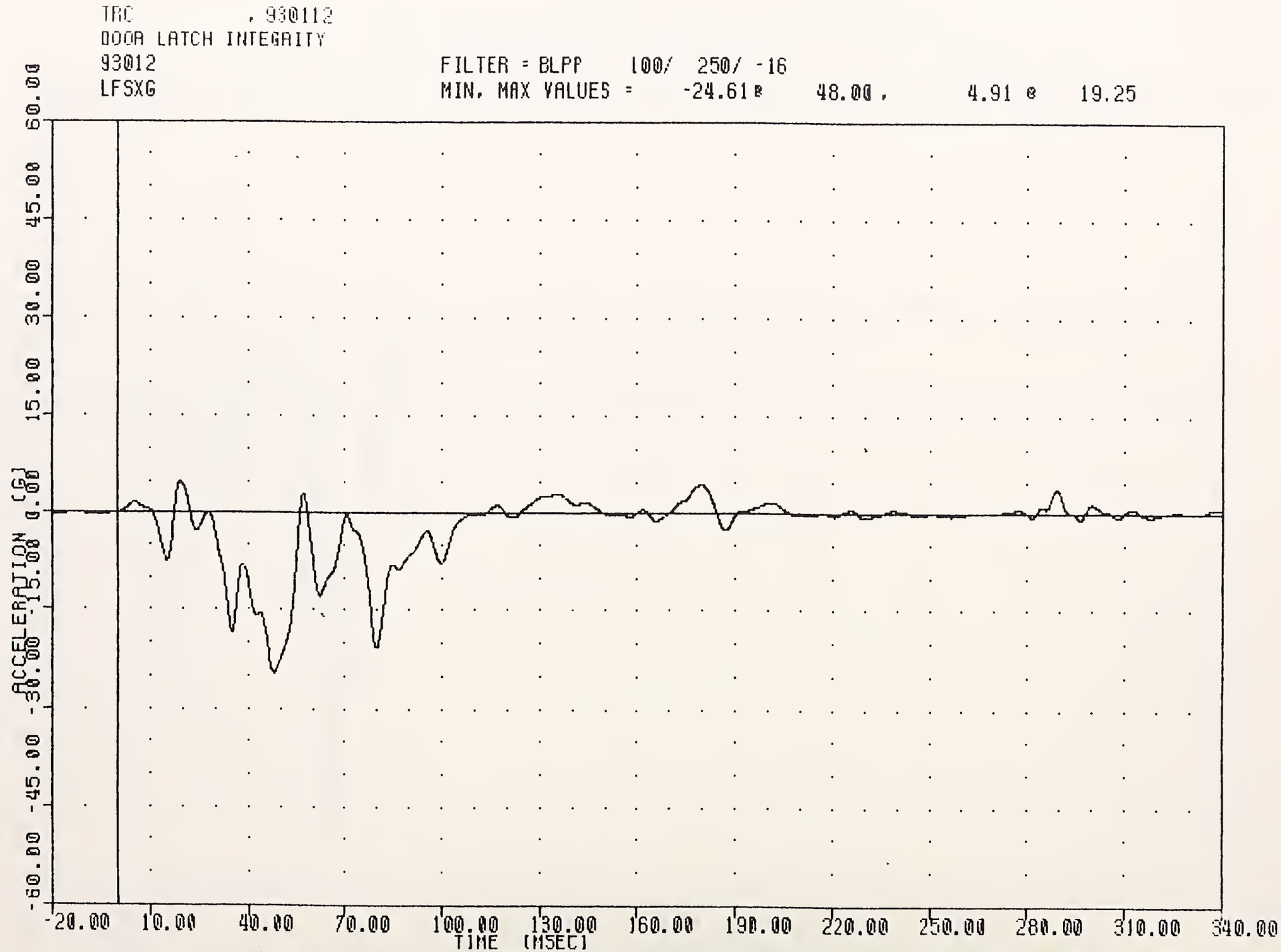
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT FRONT DOOR Y-AXIS ACCELERATION



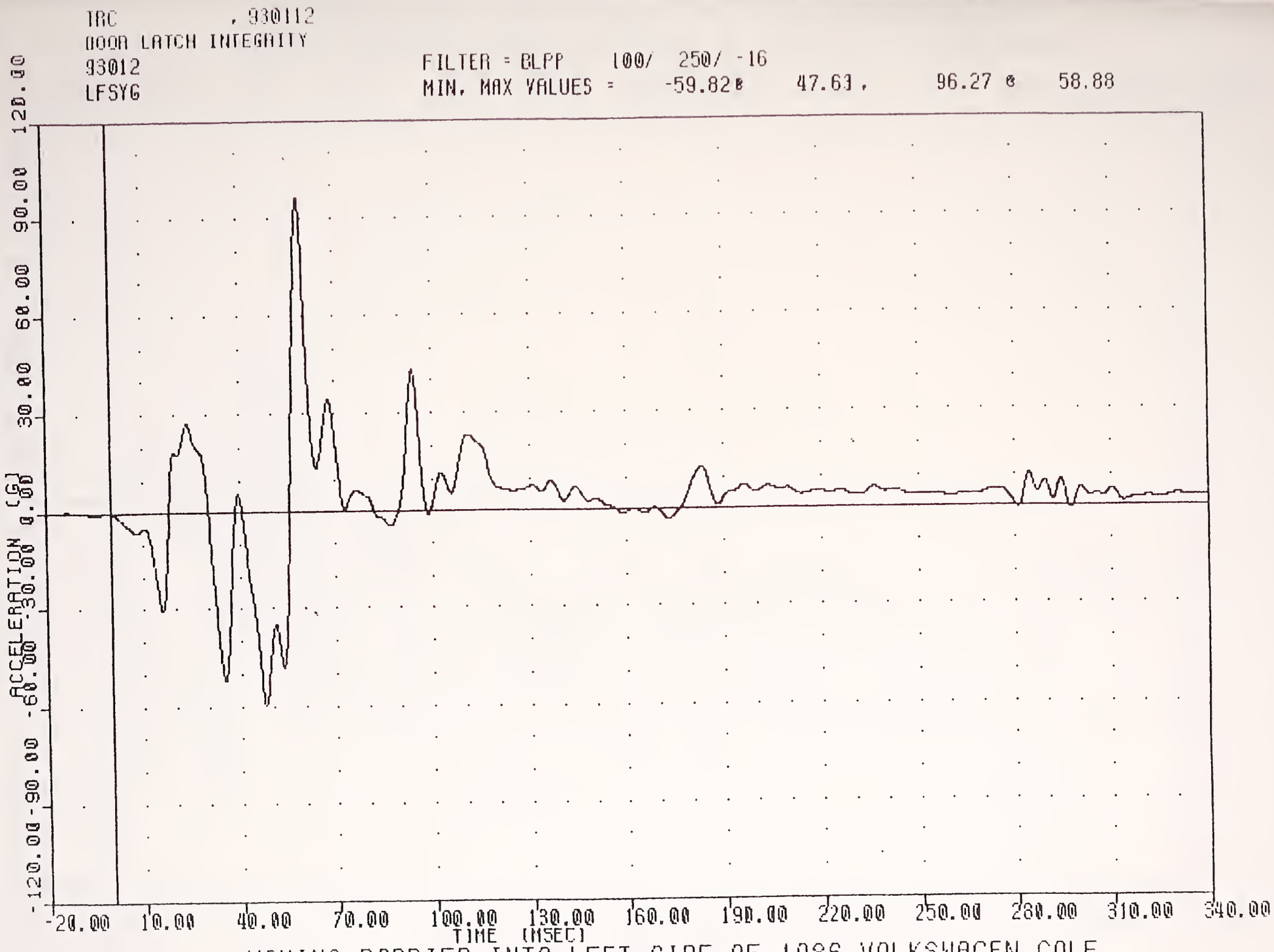
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT FRONT DOOR Z-AXIS ACCELERATION



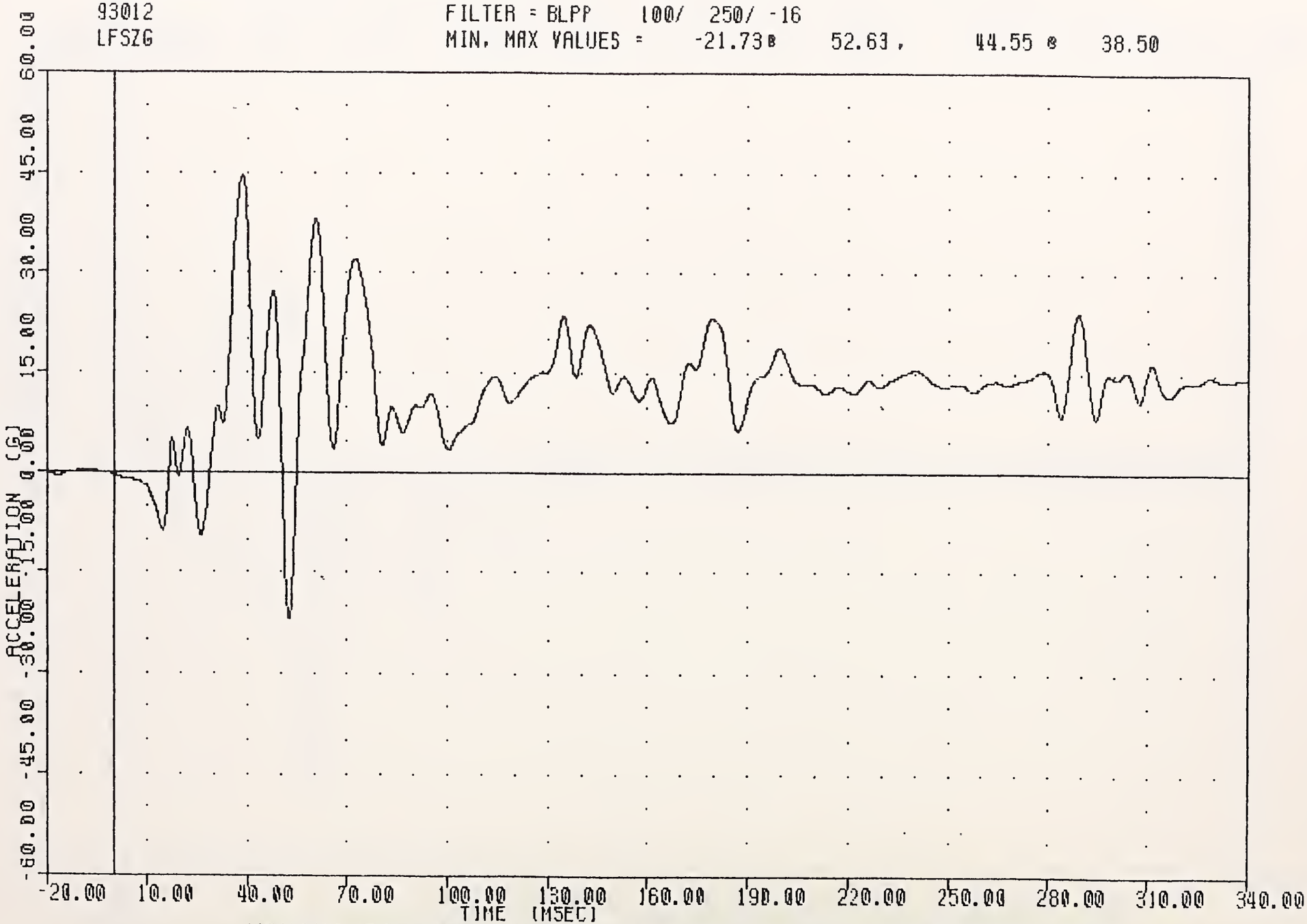
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT FRONT DOOR RESULTANT ACCELERATION



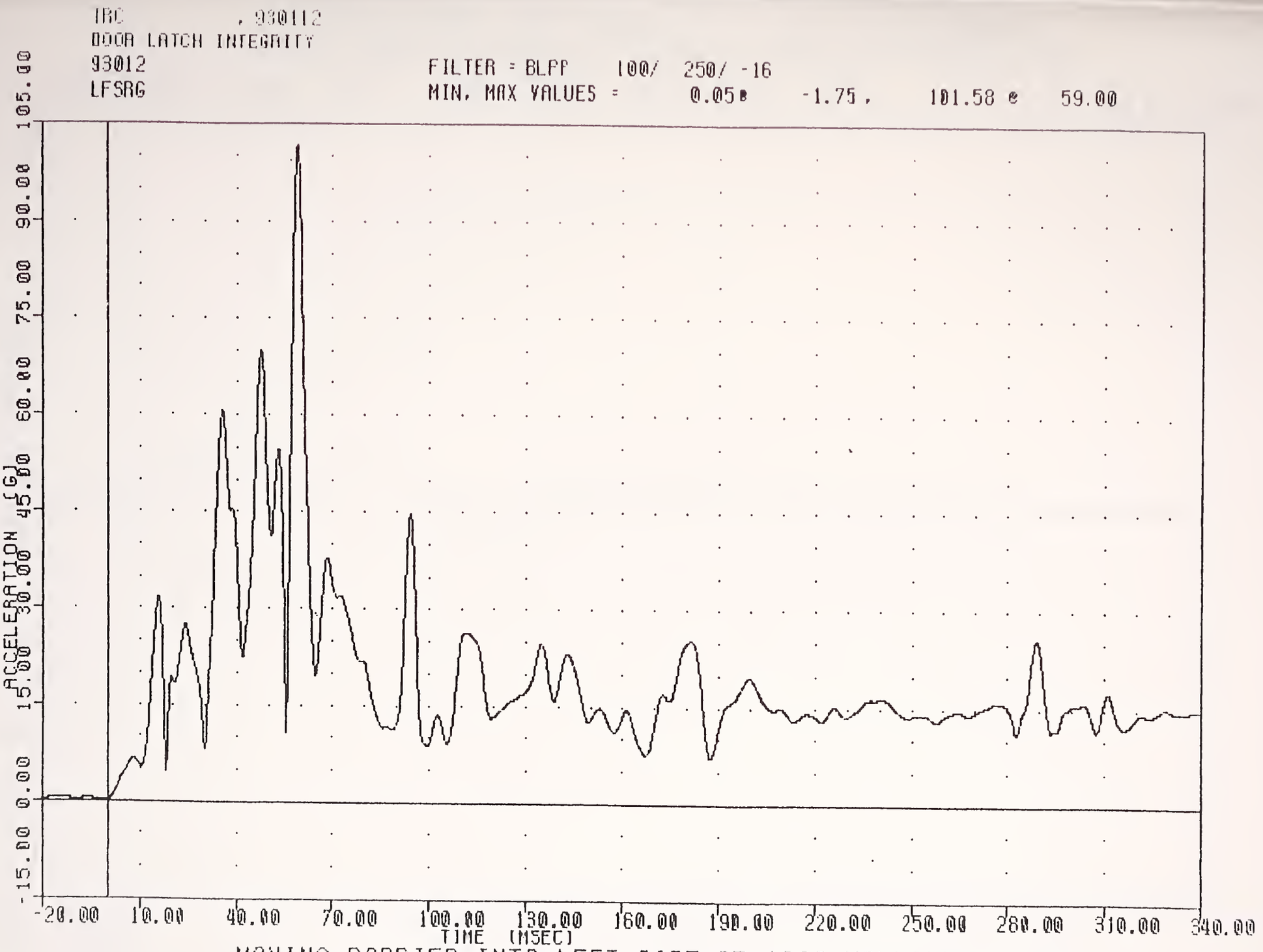
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE LEFT FRONT DOOR SILL X-AXIS ACCELERATION



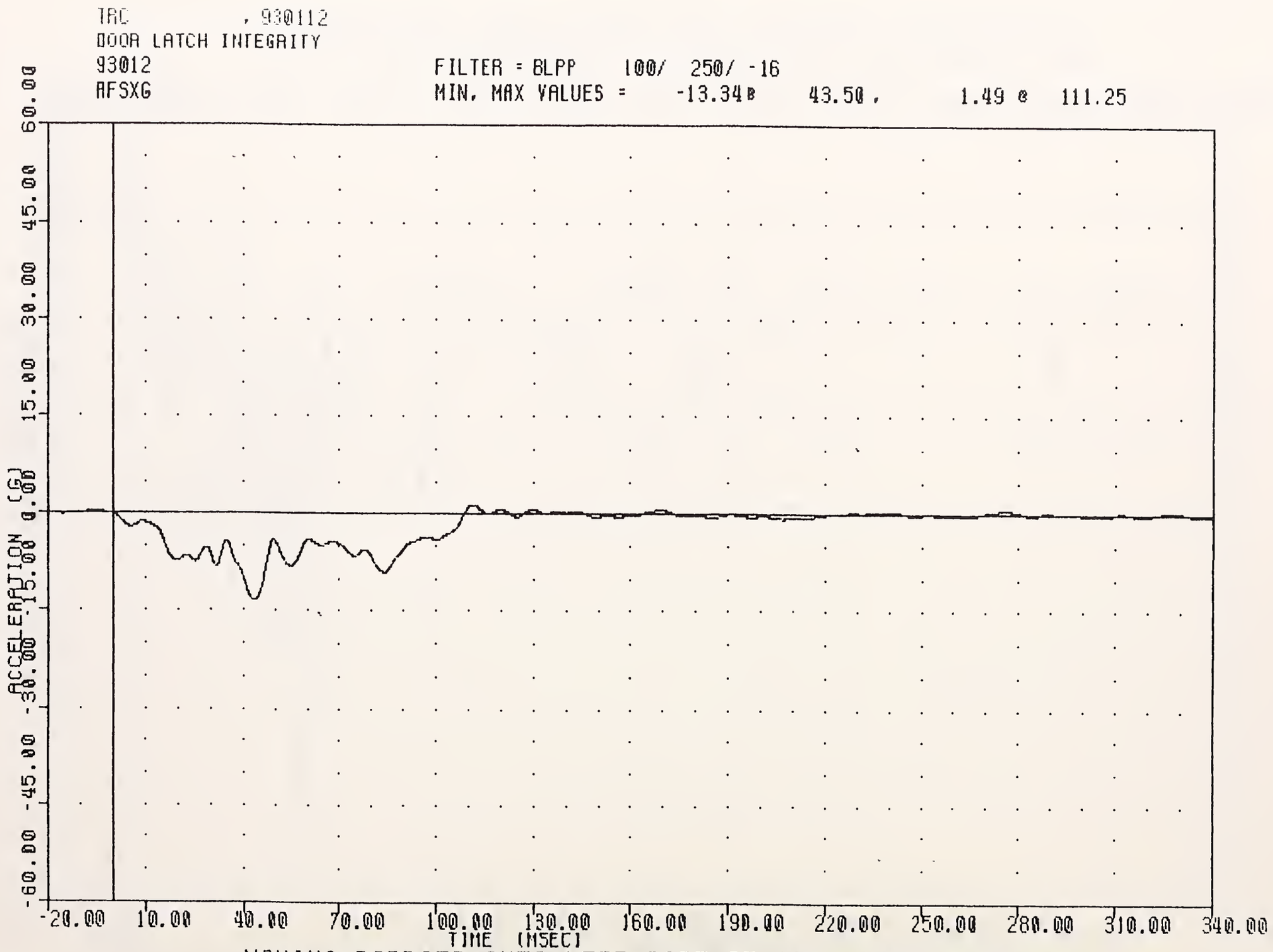
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE LEFT FRONT DOOOR SILL Y-AXIS ACCELERATION



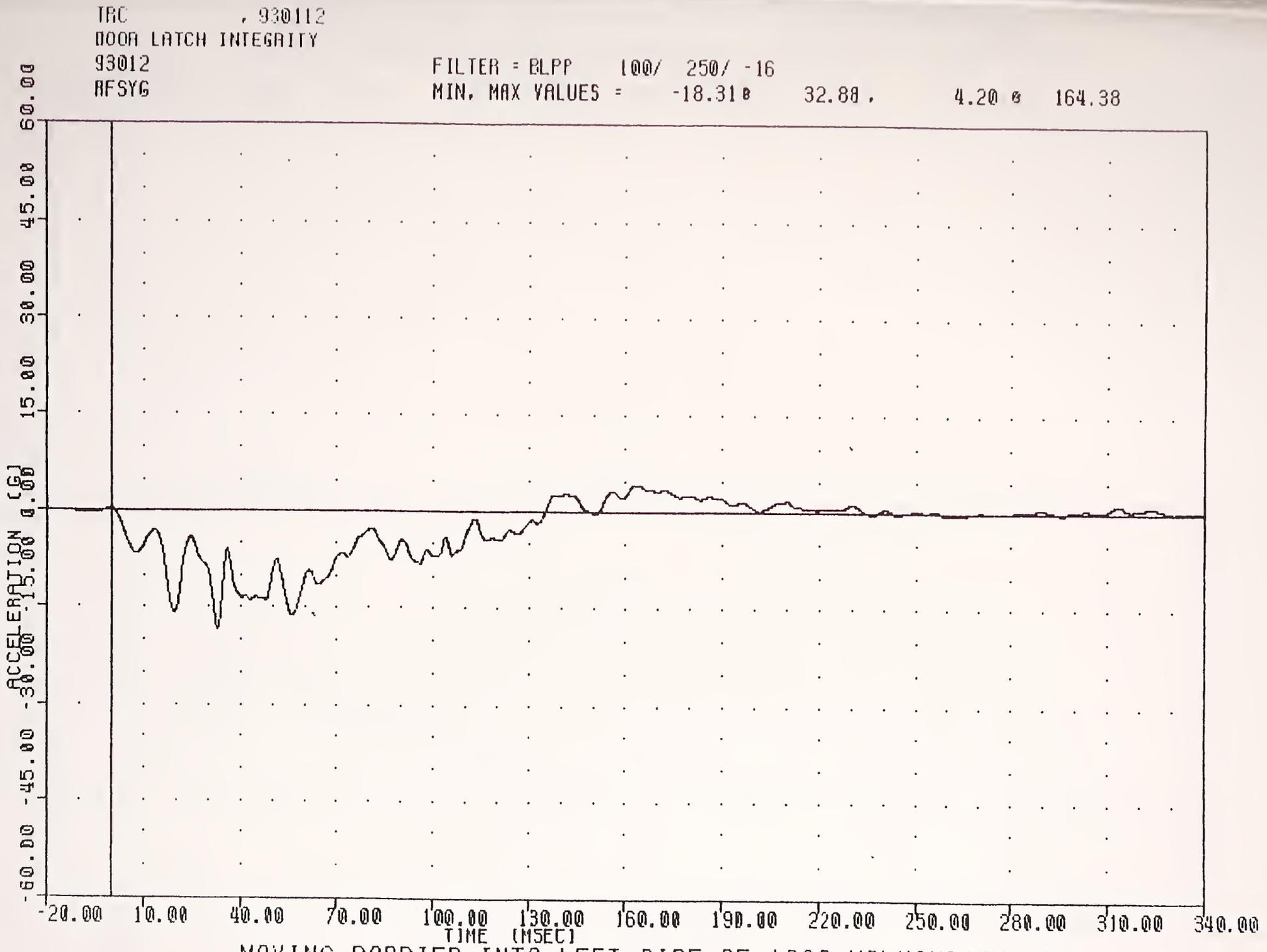
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE LEFT FRONT DOOR SILL Z-AXIS ACCELERATION



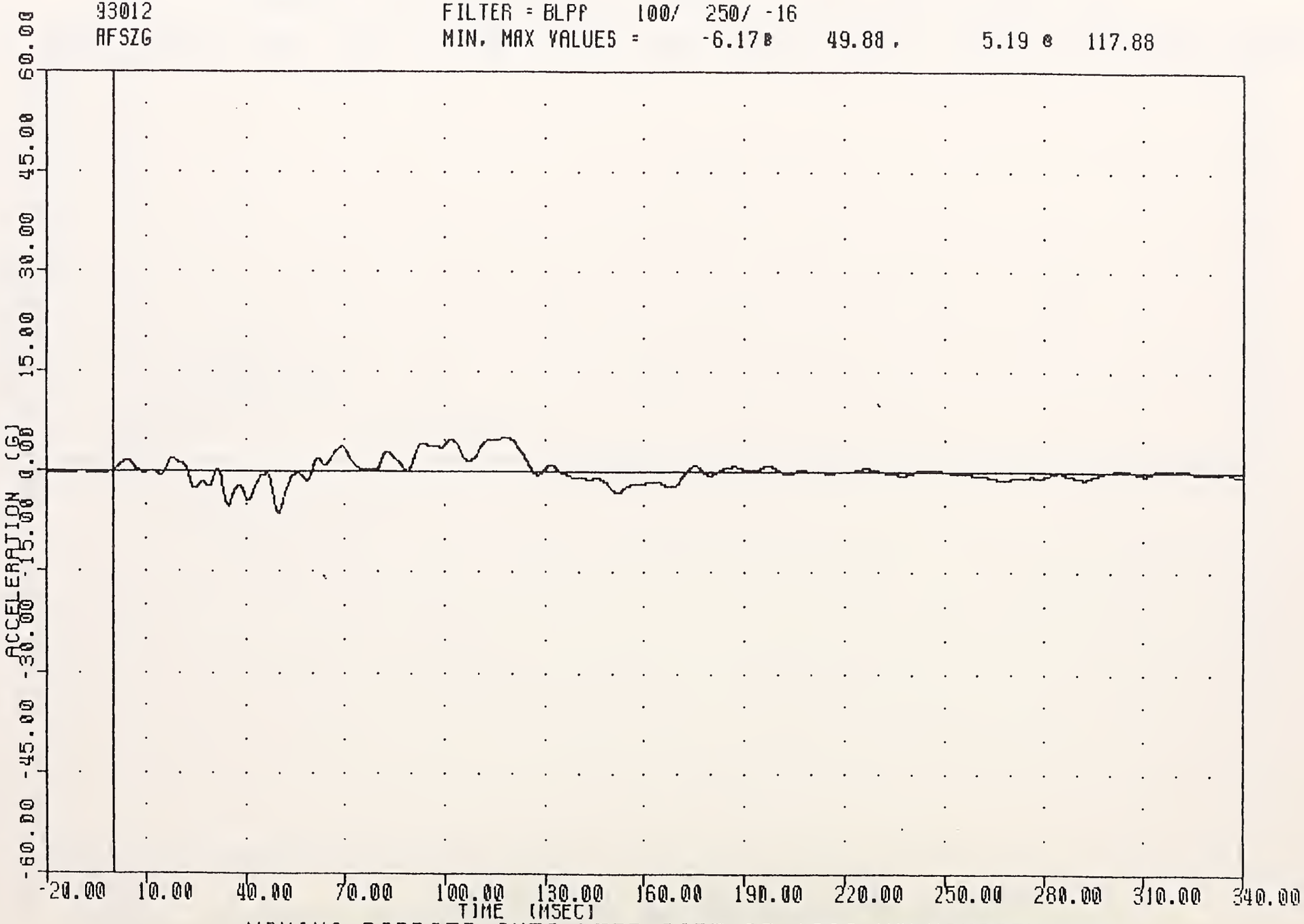
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE LEFT FRONT DOOR SILL RESULTANT ACCELERATION



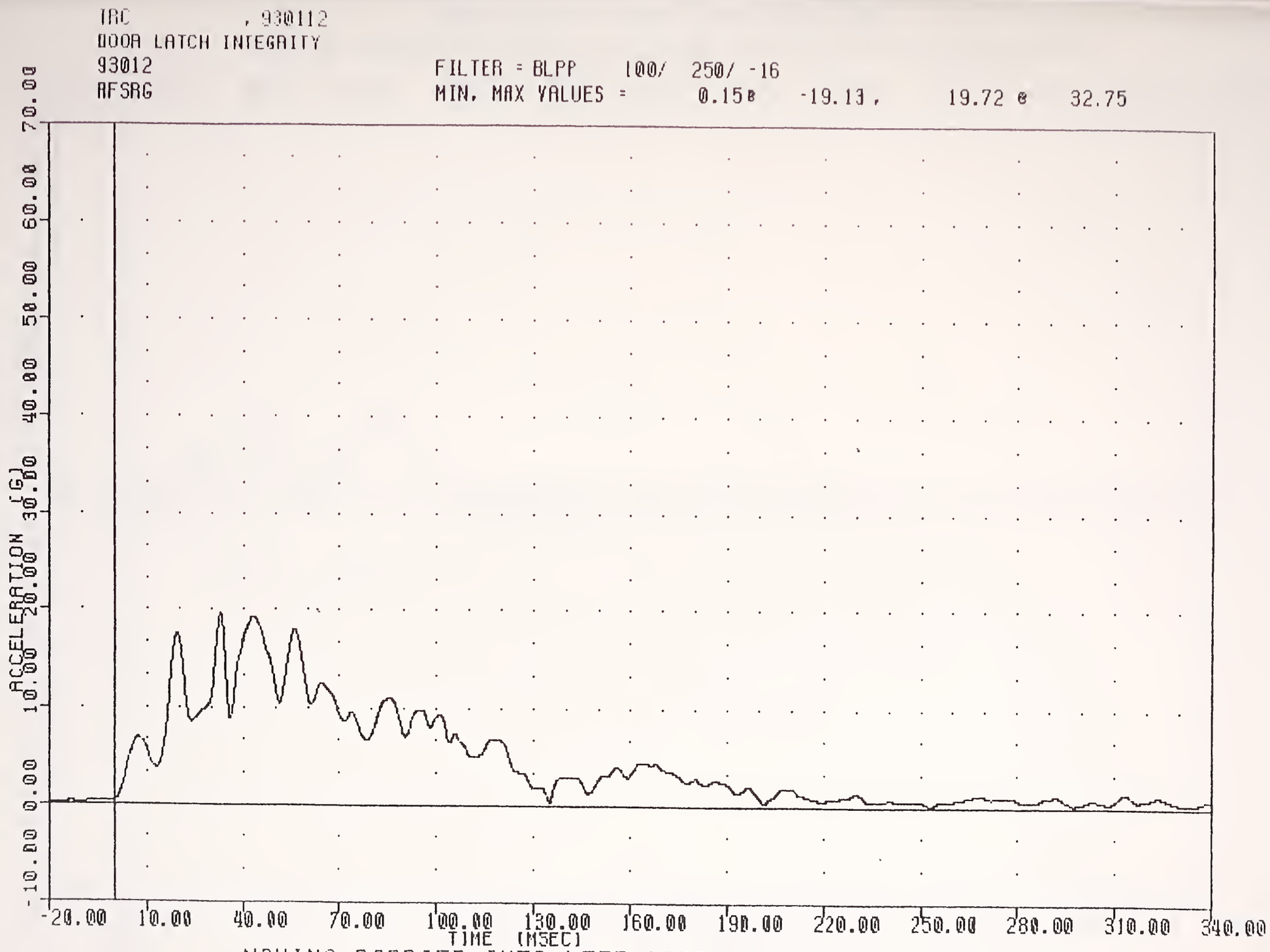
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE RIGHT FRONT DOOR SILL X-AXIS ACCELERATION



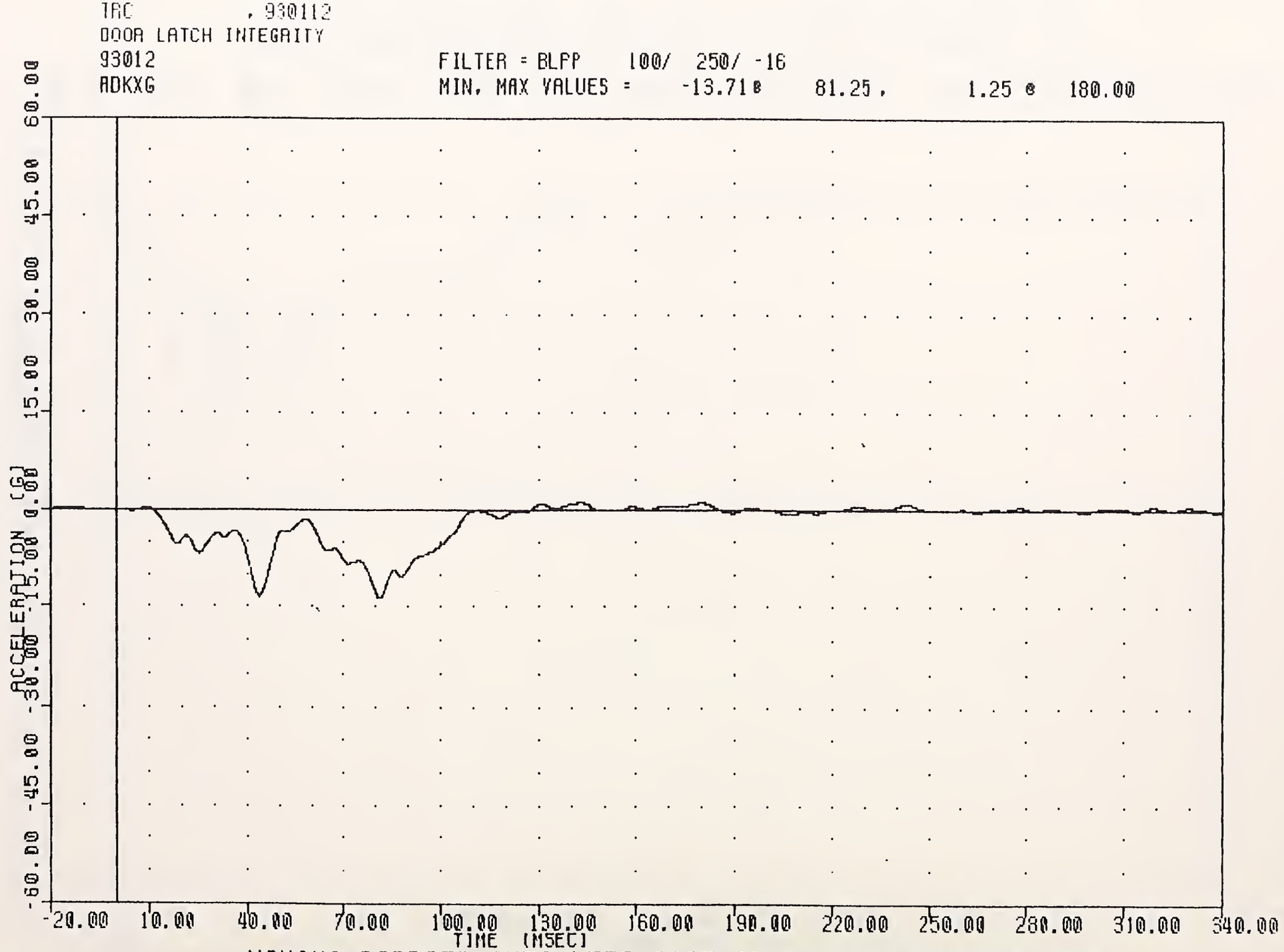
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE RIGHT FRONT DOOR SILL Y-AXIS ACCELERATION



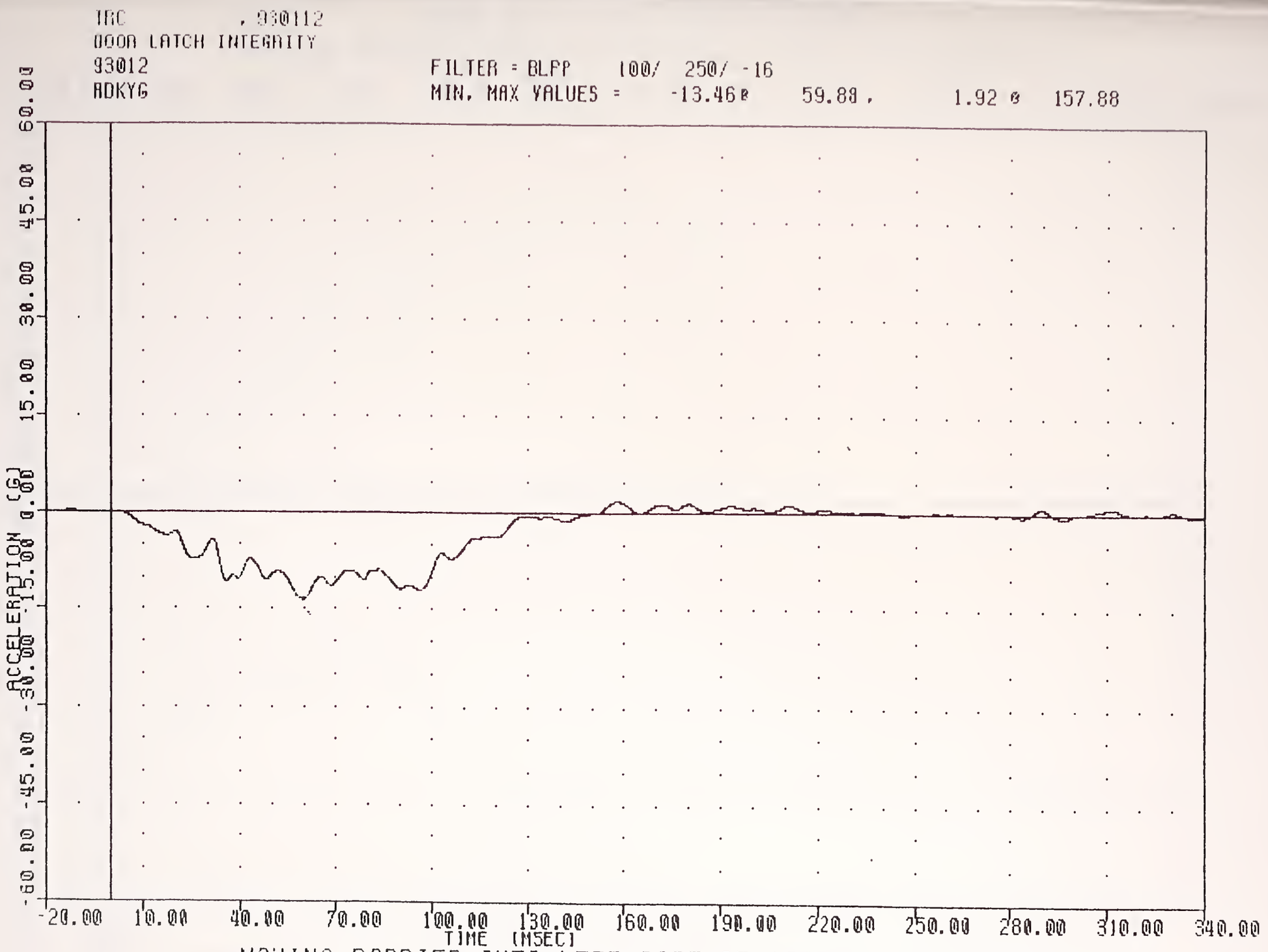
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE RIGHT FRONT DOOR SILL Z-AXIS ACCELERATION



MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
VEHICLE RIGHT FRONT DOOR SILL RESULTANT ACCELERATION

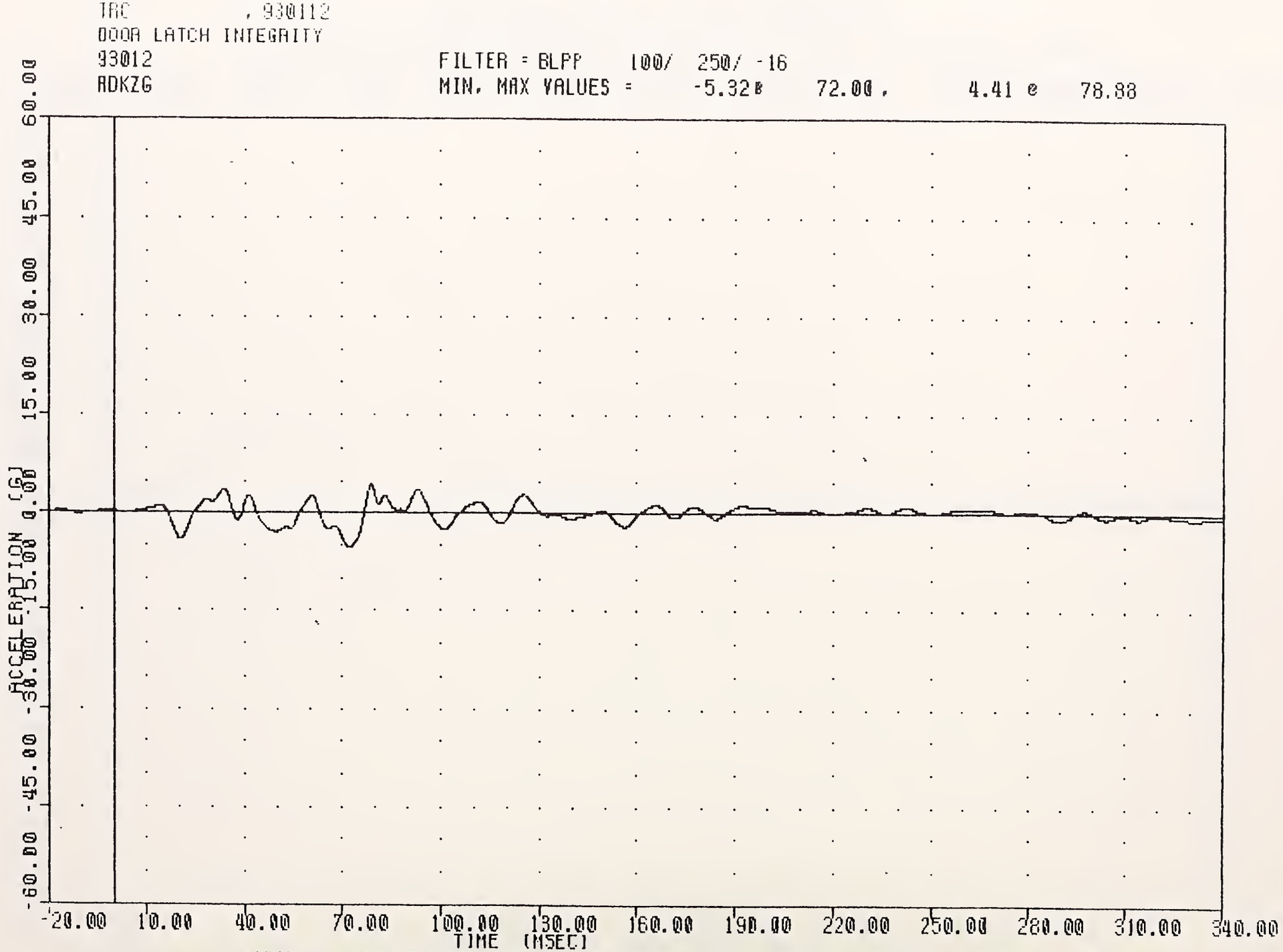


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
REAR DECK X-AXIS ACCELERATION

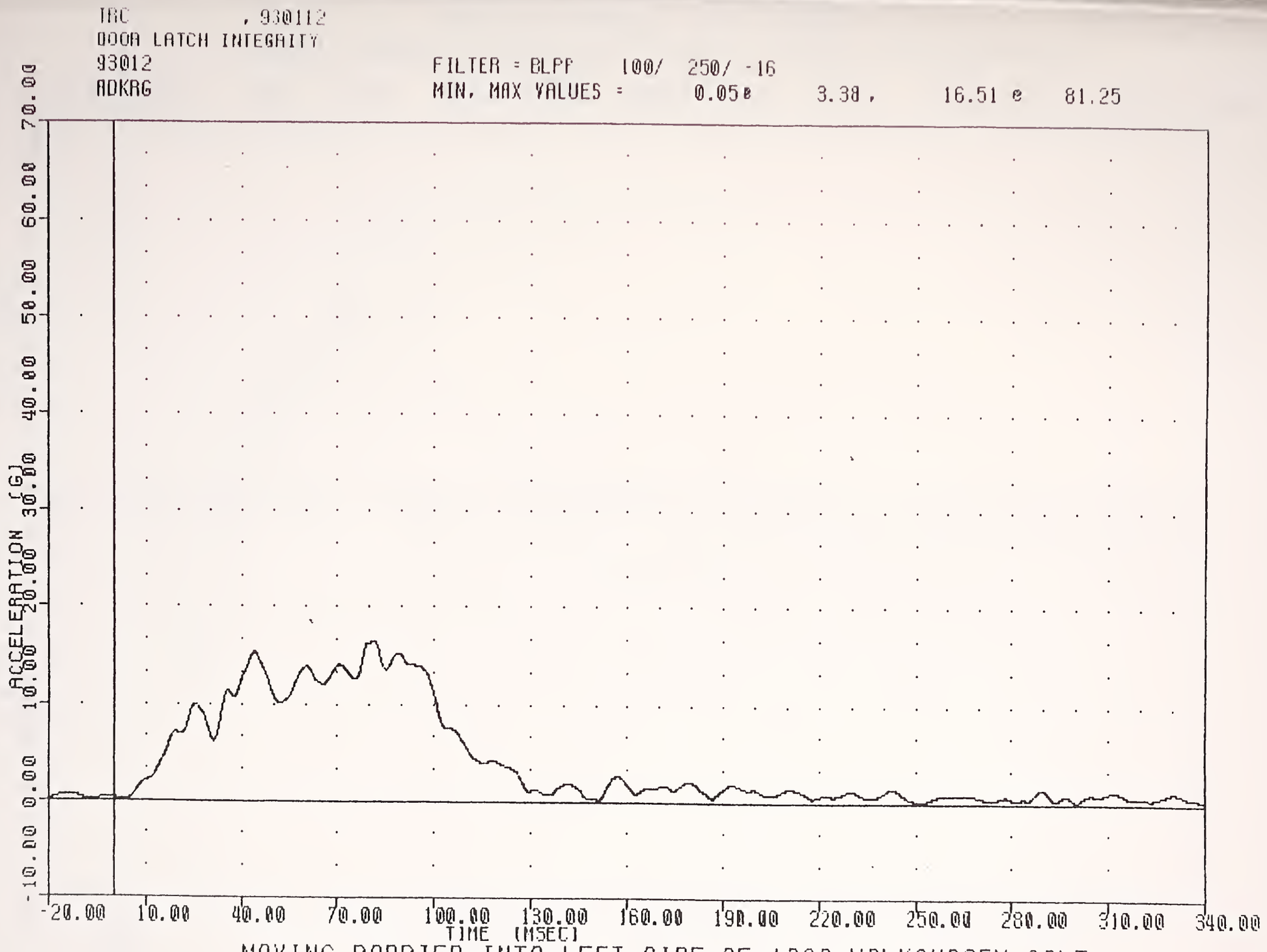


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF

REAR DECK Y-AXIS ACCELERATION

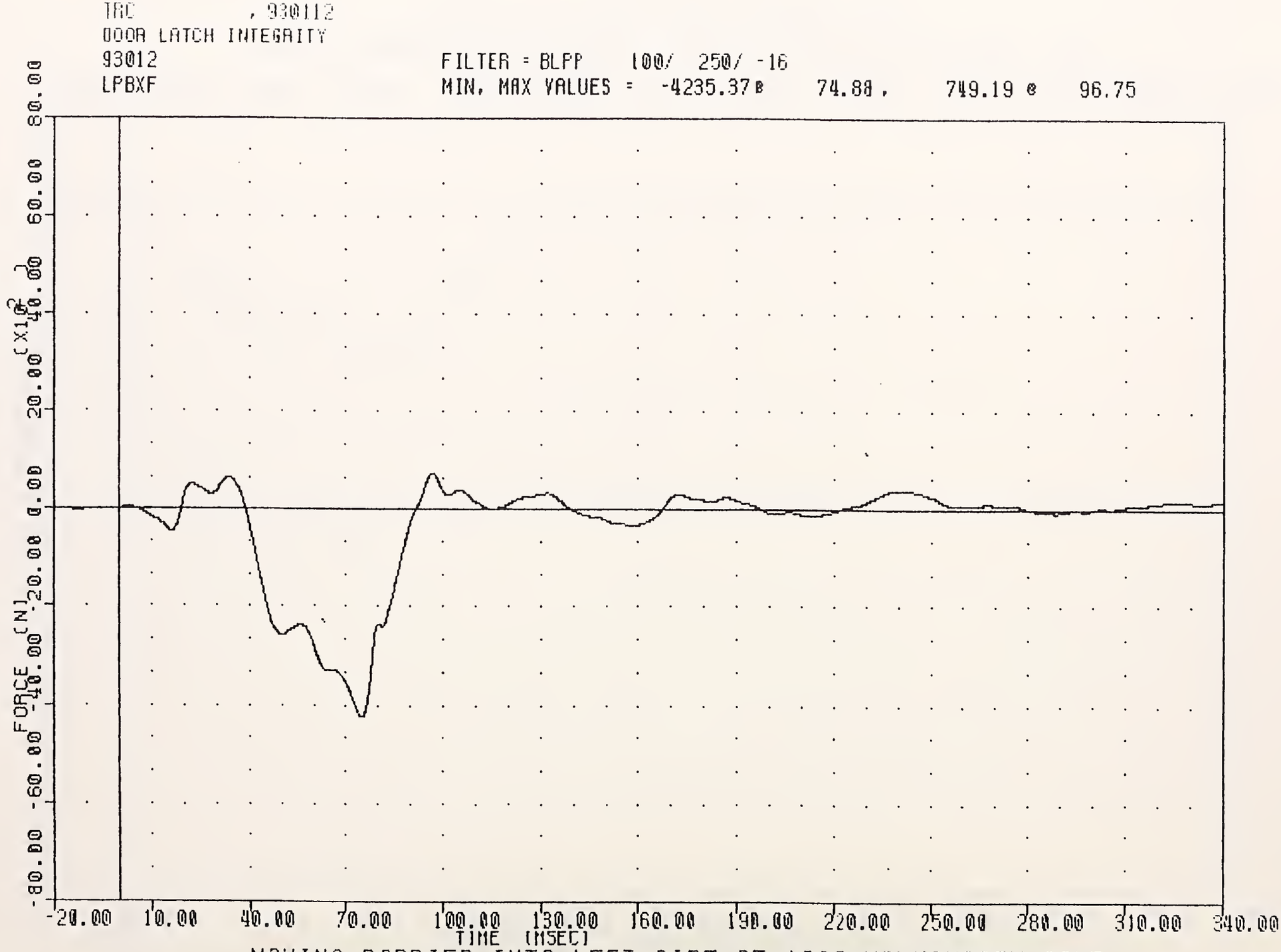


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
REAR DECK Z-AXIS ACCELERATION

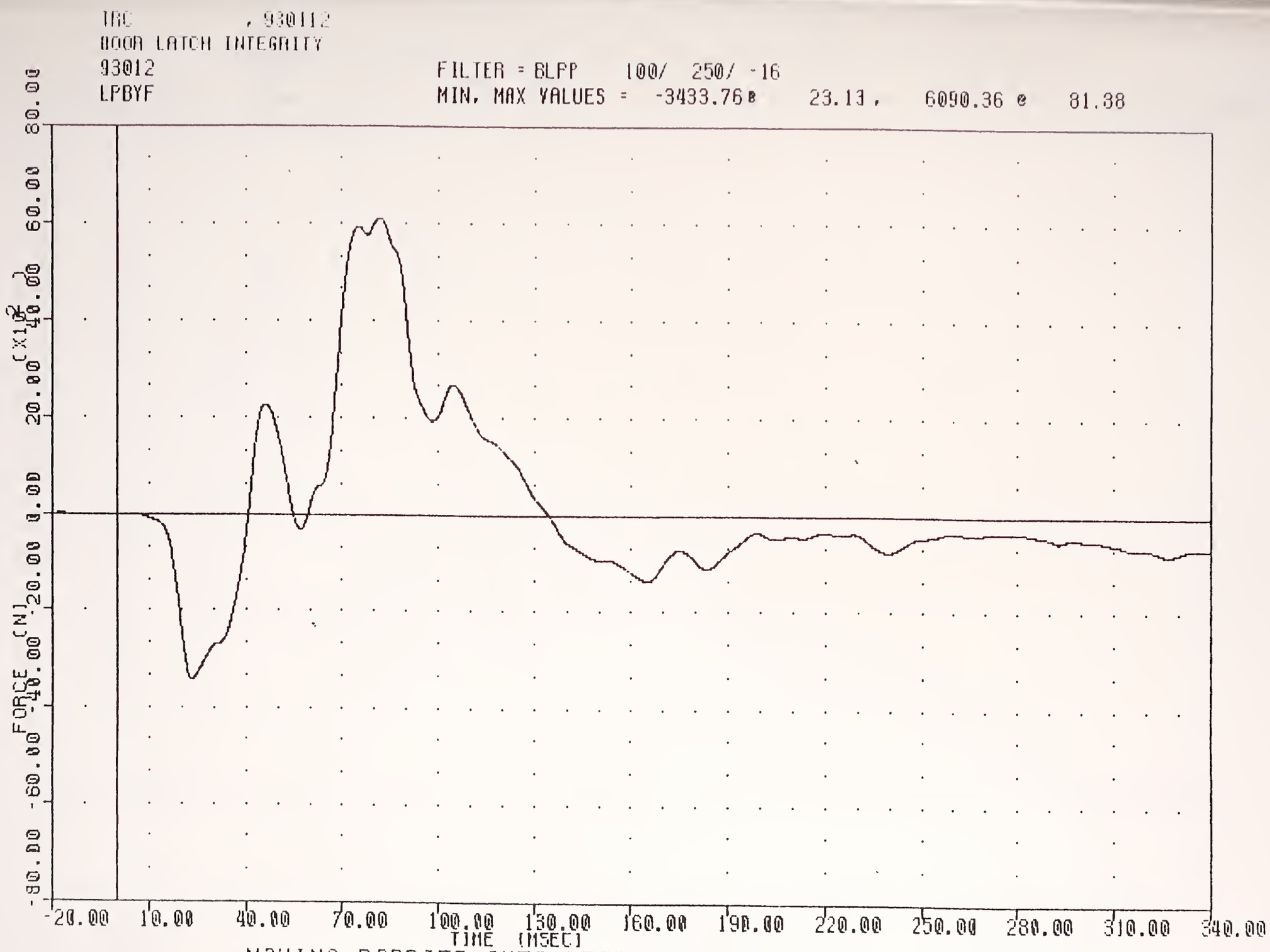


MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF

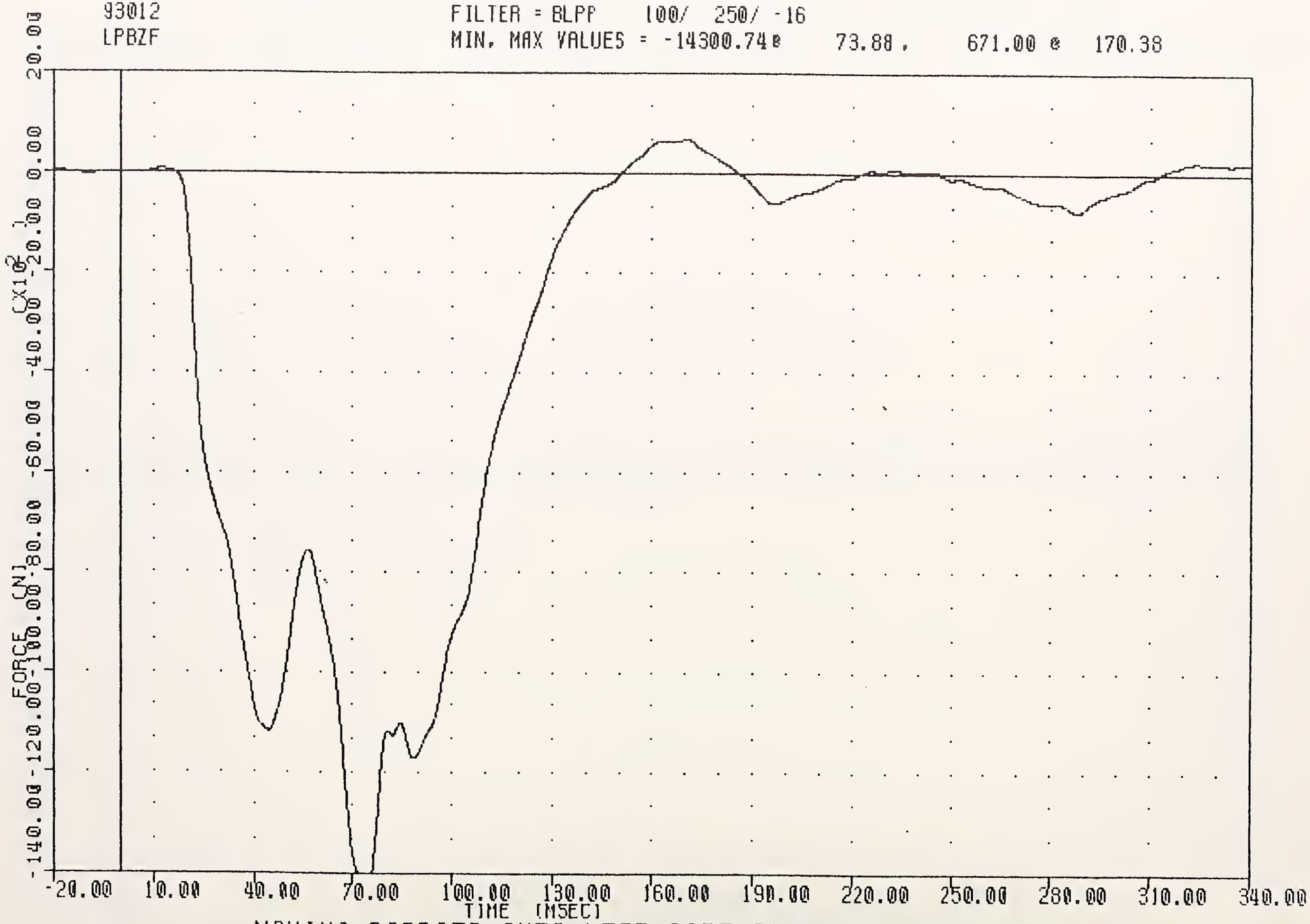
REAR DECK RESULTANT ACCELERATION



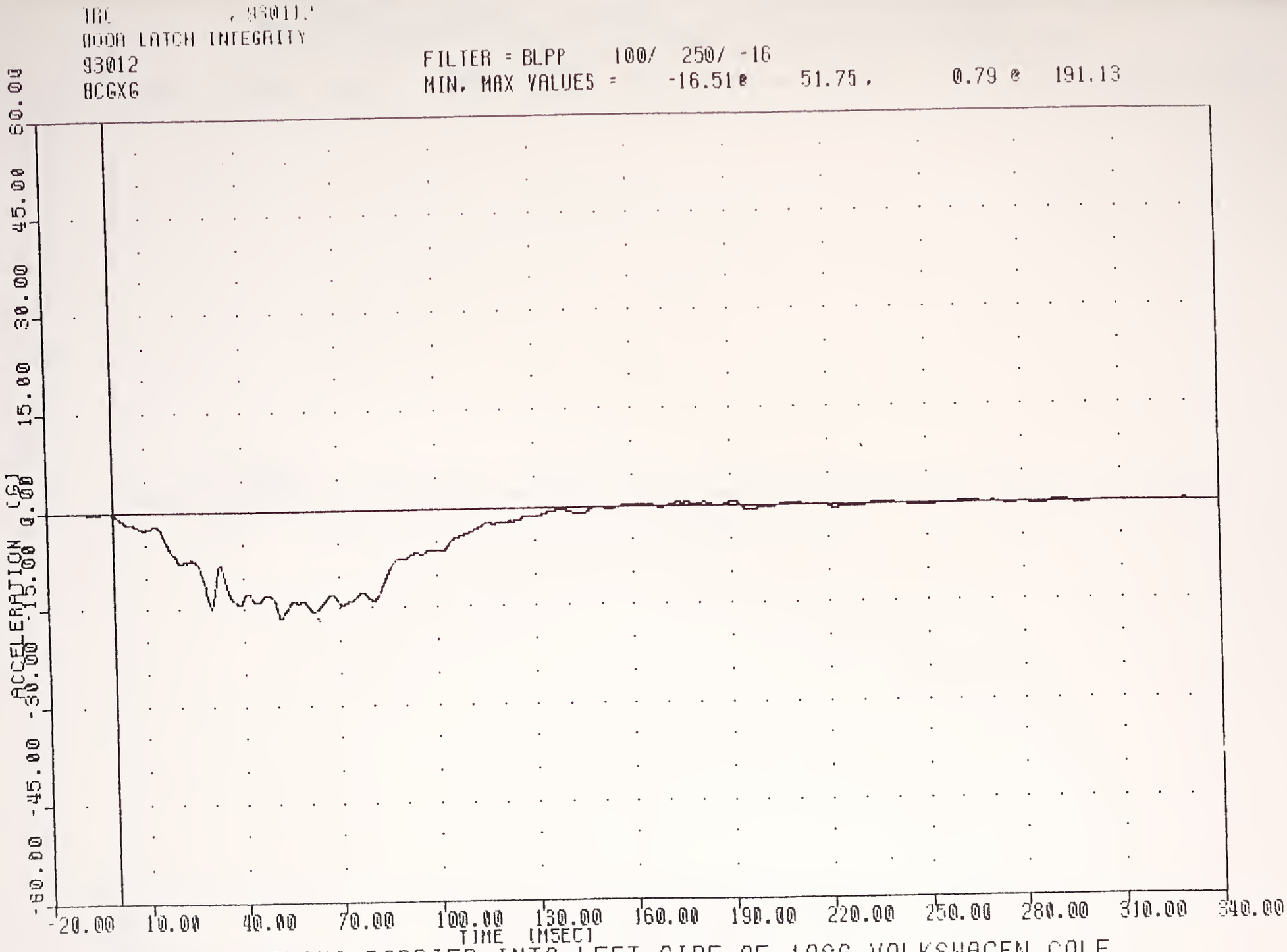
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT B-PILLAR X-AXIS FORCE



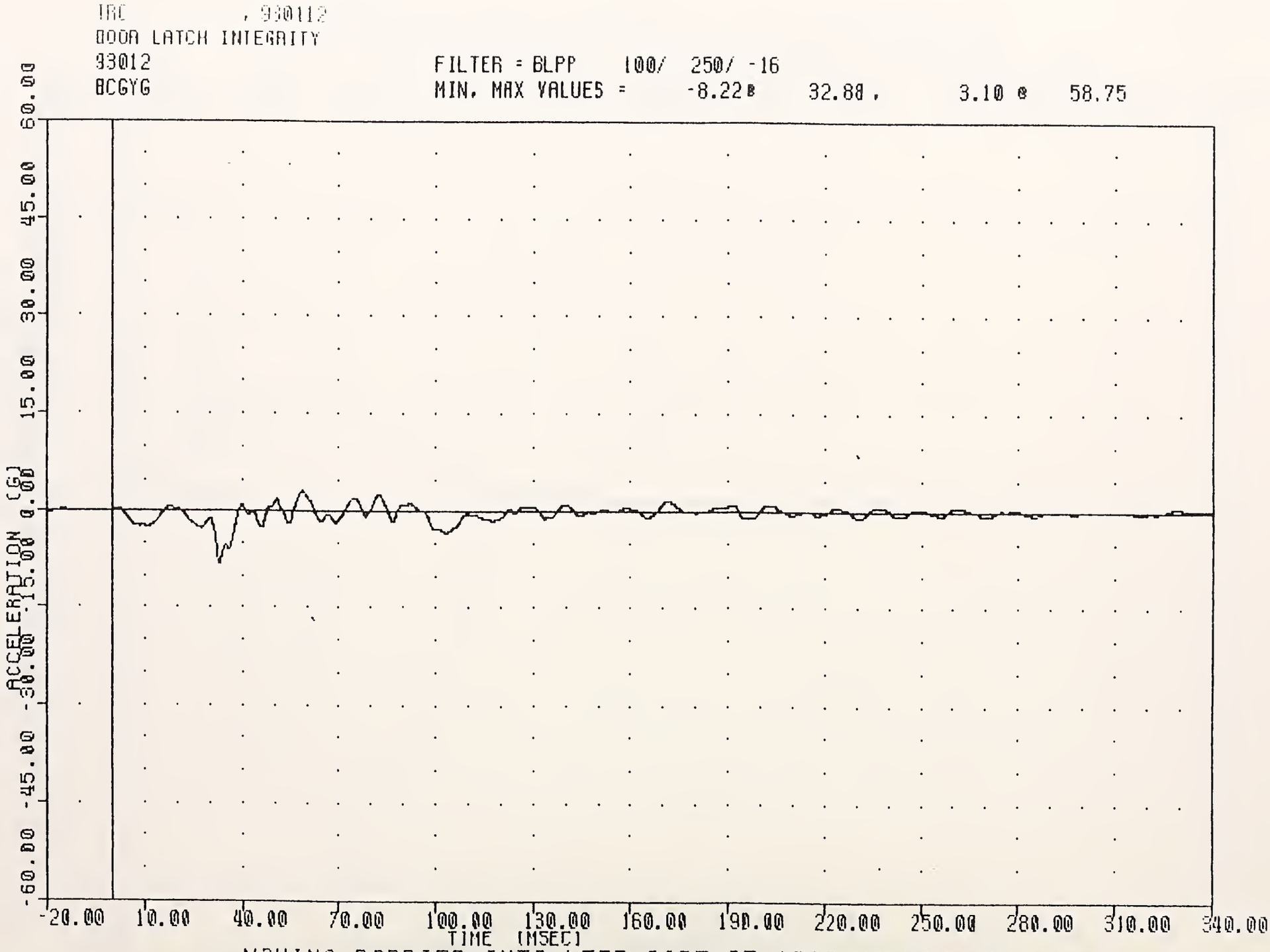
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
LEFT B-PILLAR Y-AXIS FORCE



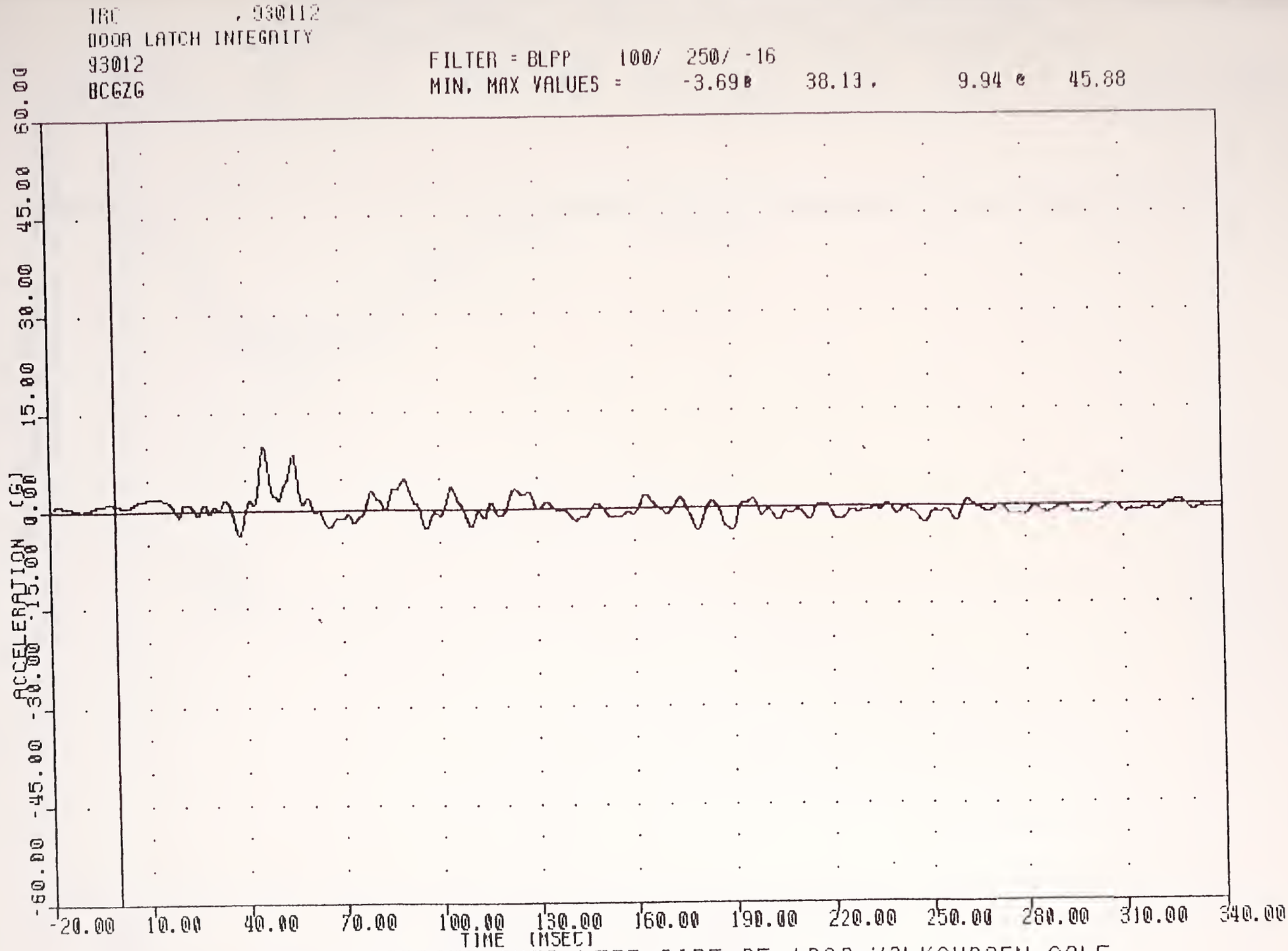
MOVING BARRIER INTO LEFT SIDE OF 1988 VOLKSWAGEN GOLF
LEFT B-PILLAR Z-AXIS FORCE



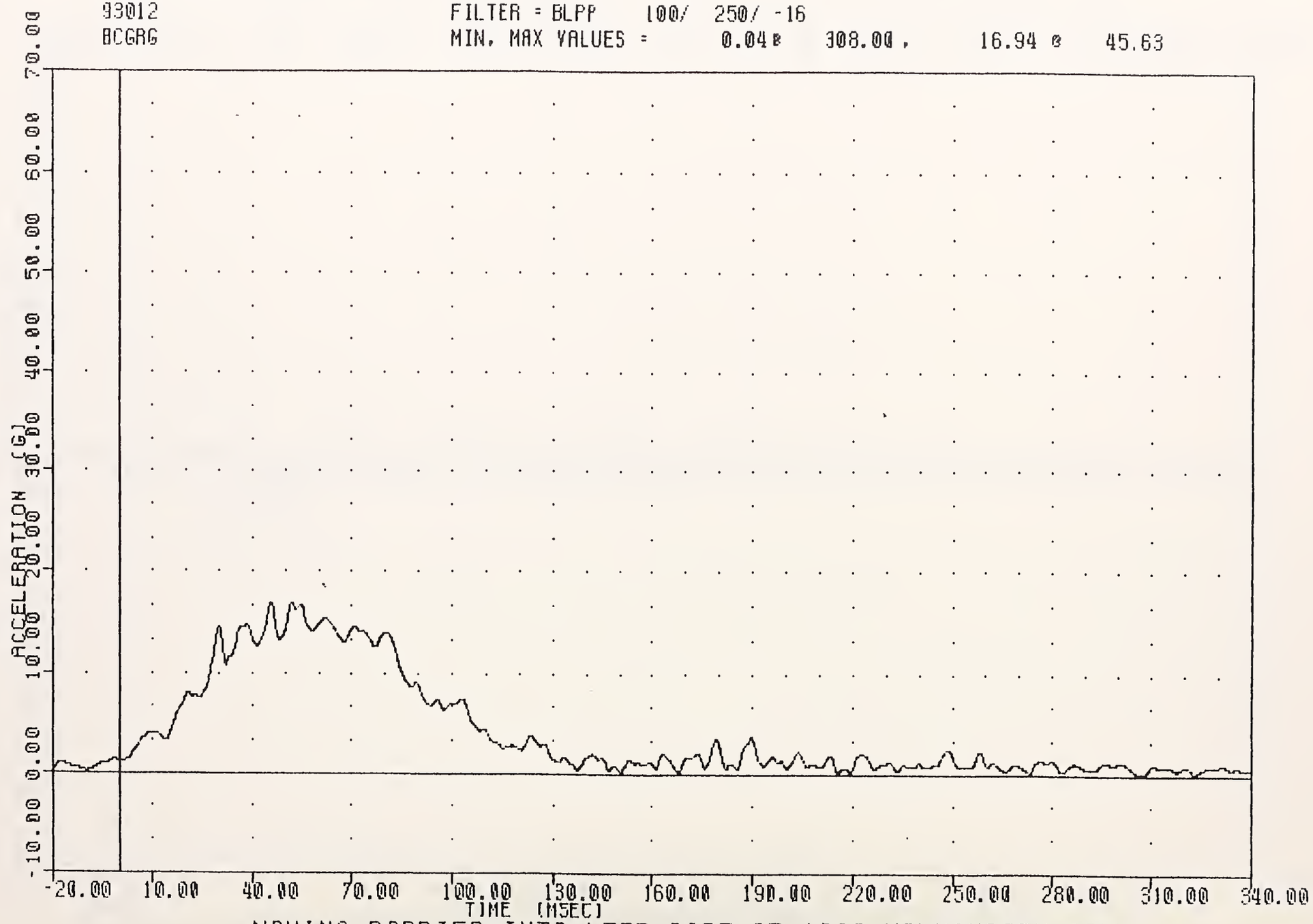
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER CENTER OF GRAVITY X-AXIS ACCELERATION



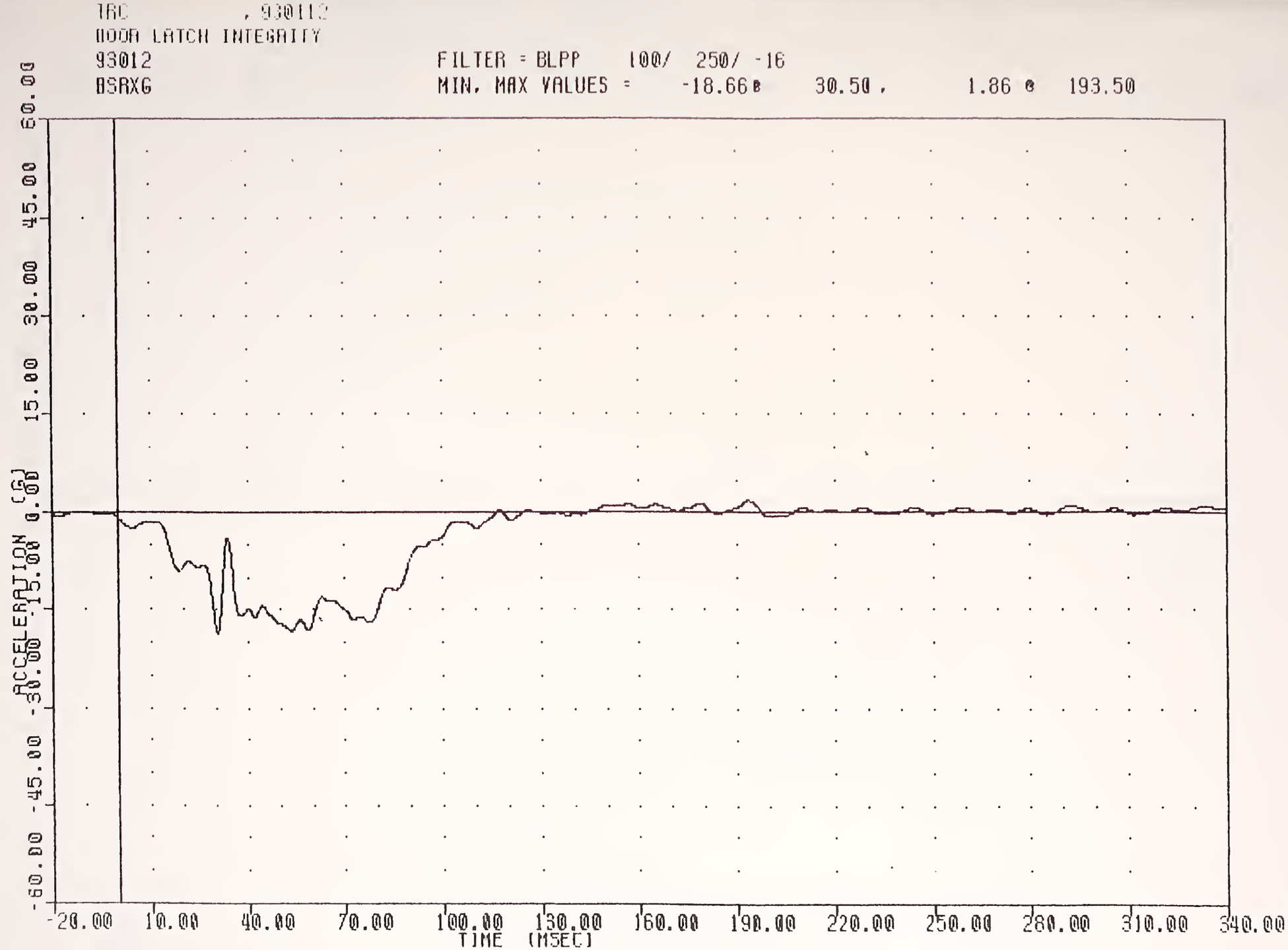
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER CENTER OF GRAVITY Y-AXIS ACCELERATION



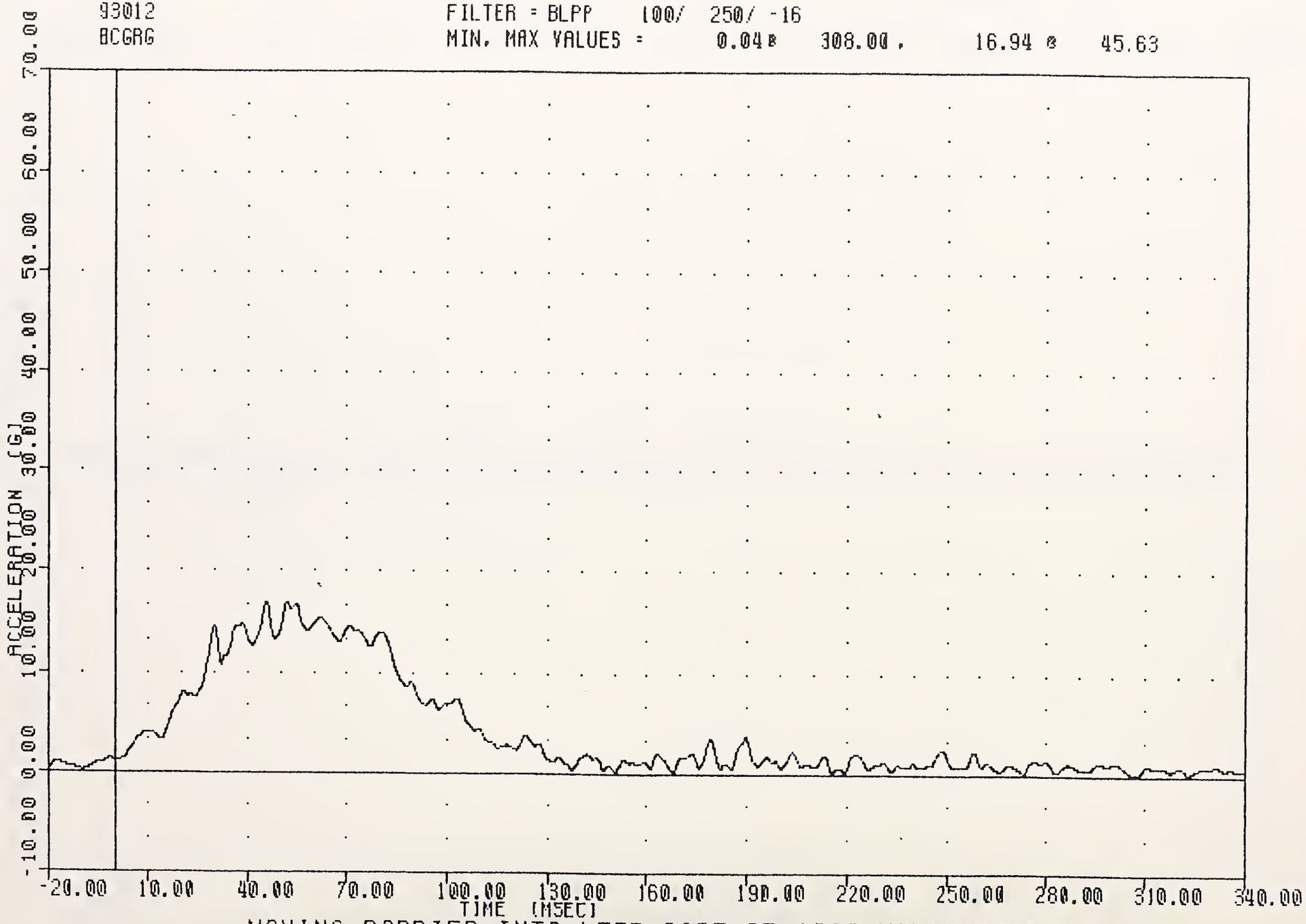
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER CENTER OF GRAVITY Z-AXIS ACCELERATION



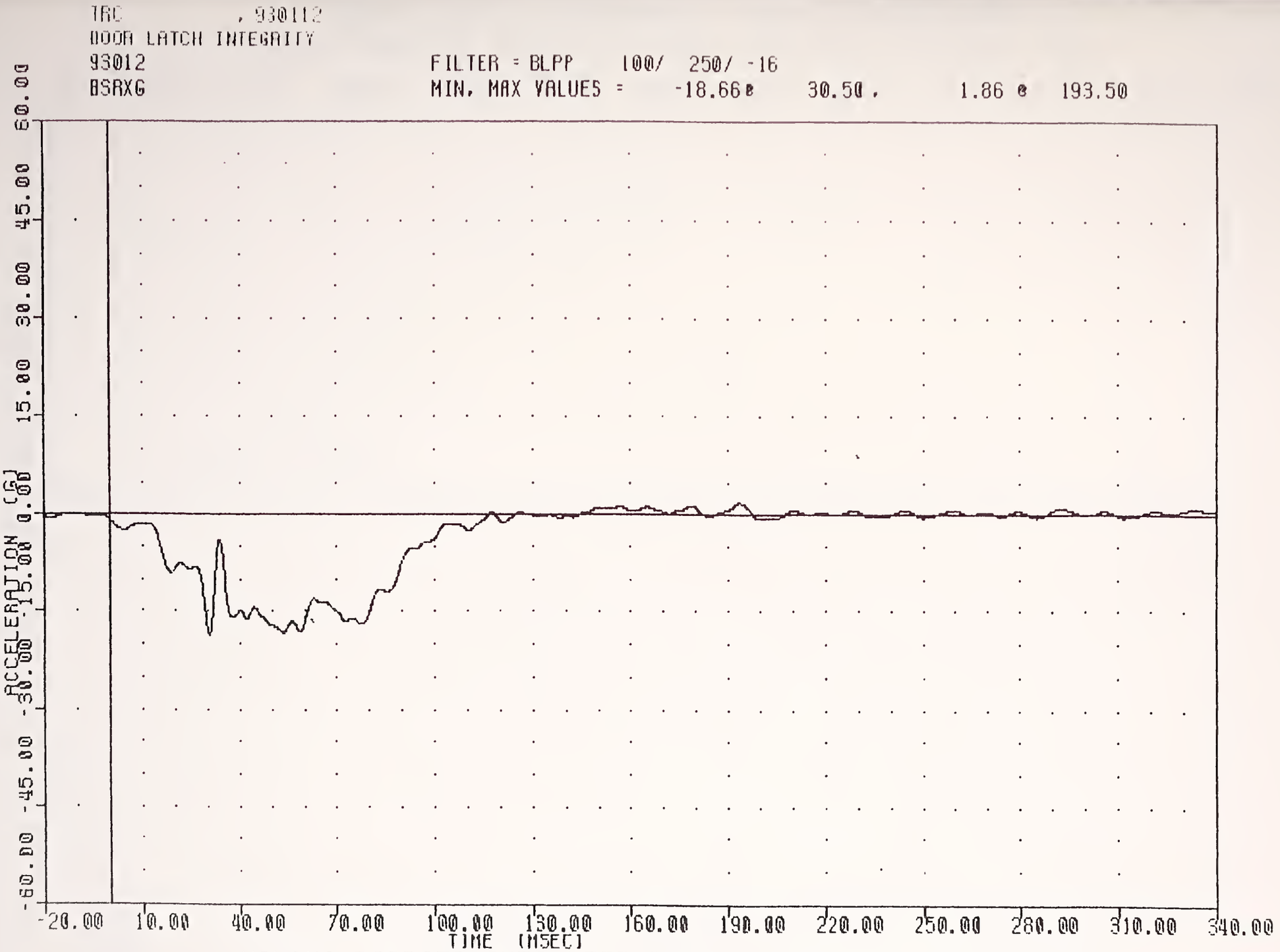
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER CENTER OF GRAVITY RESULTANT ACCELERATION



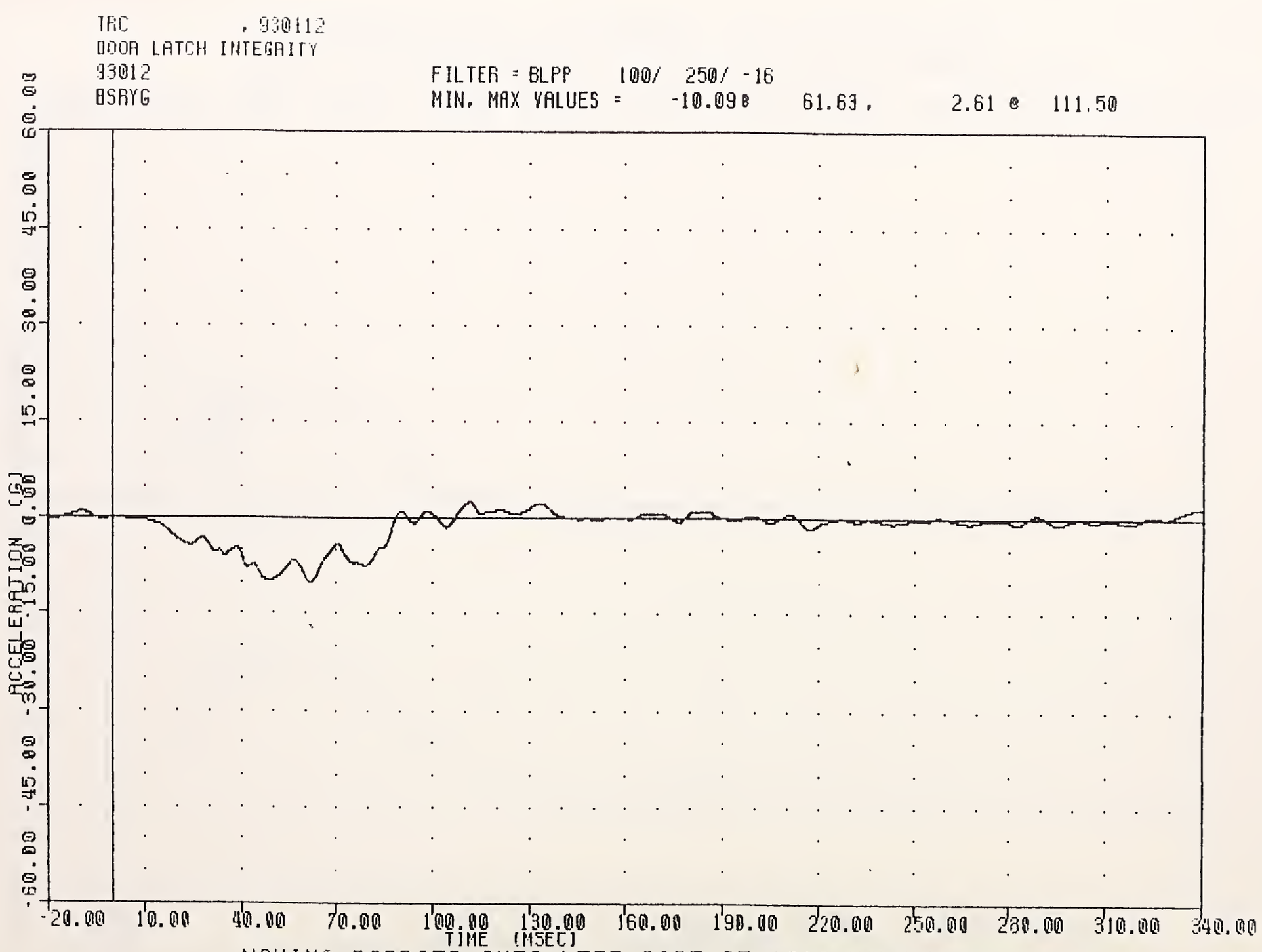
MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER REAR CROSSMEMBER X-AXIS ACCELERATION



MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER CENTER OF GRAVITY RESULTANT ACCELERATION



MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER REAR CROSSMEMBER X-AXIS ACCELERATION



MOVING BARRIER INTO LEFT SIDE OF 1986 VOLKSWAGEN GOLF
BARRIER REAR CROSSMEMBER Y-AXIS ACCELERATION

APPENDIX C

DUMMY CALIBRATION

PRE-TEST CALIBRATION

DRIVER DUMMY S/N 001

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT WITH ARMS - PENDULUM TEST

BIOSID DUMMY 05-Jan-93

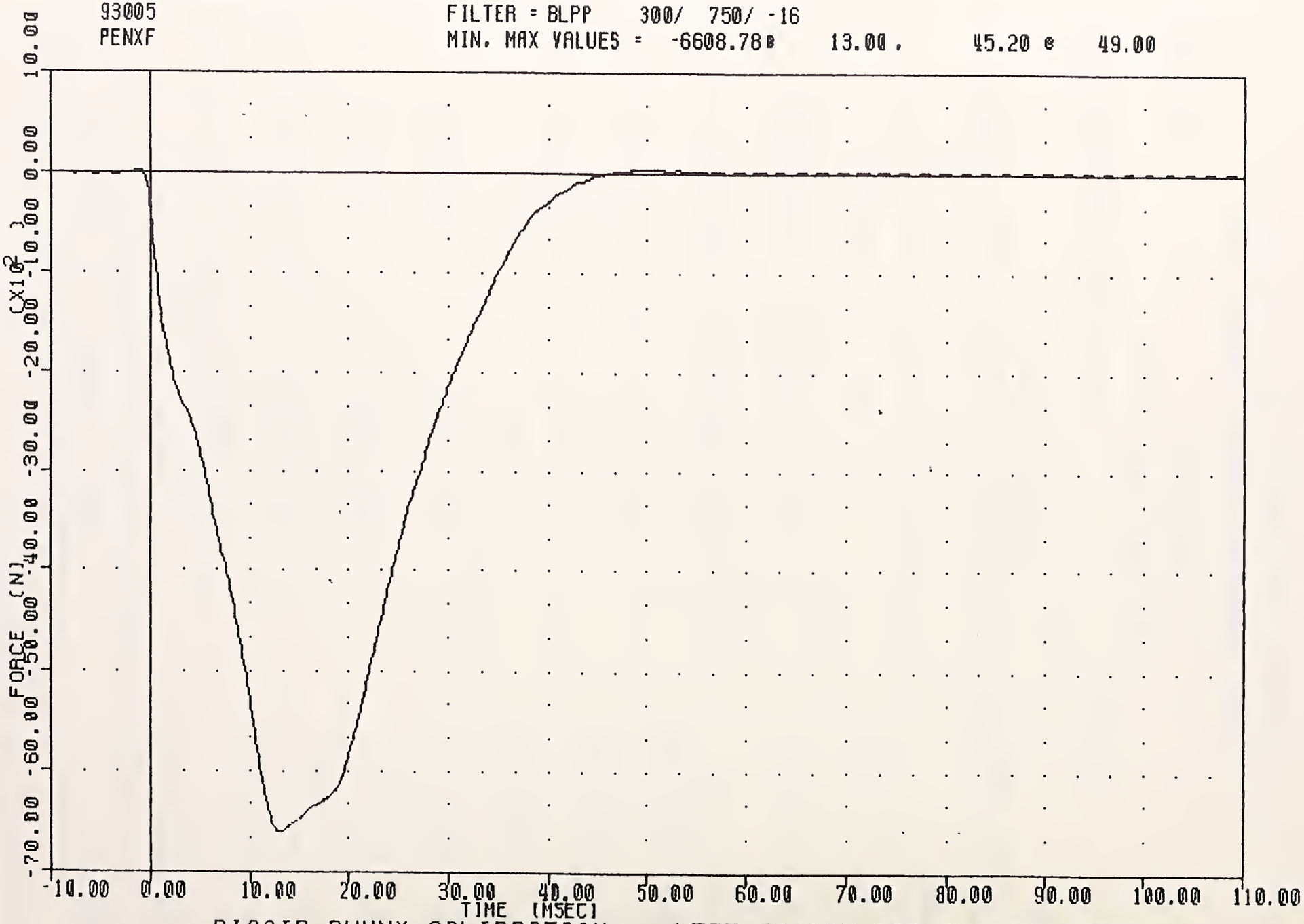
LEFT SIDE CONFIGURATION

TRC B01C13TA1 BIOSID SN001 THORAX-ARM CAL13

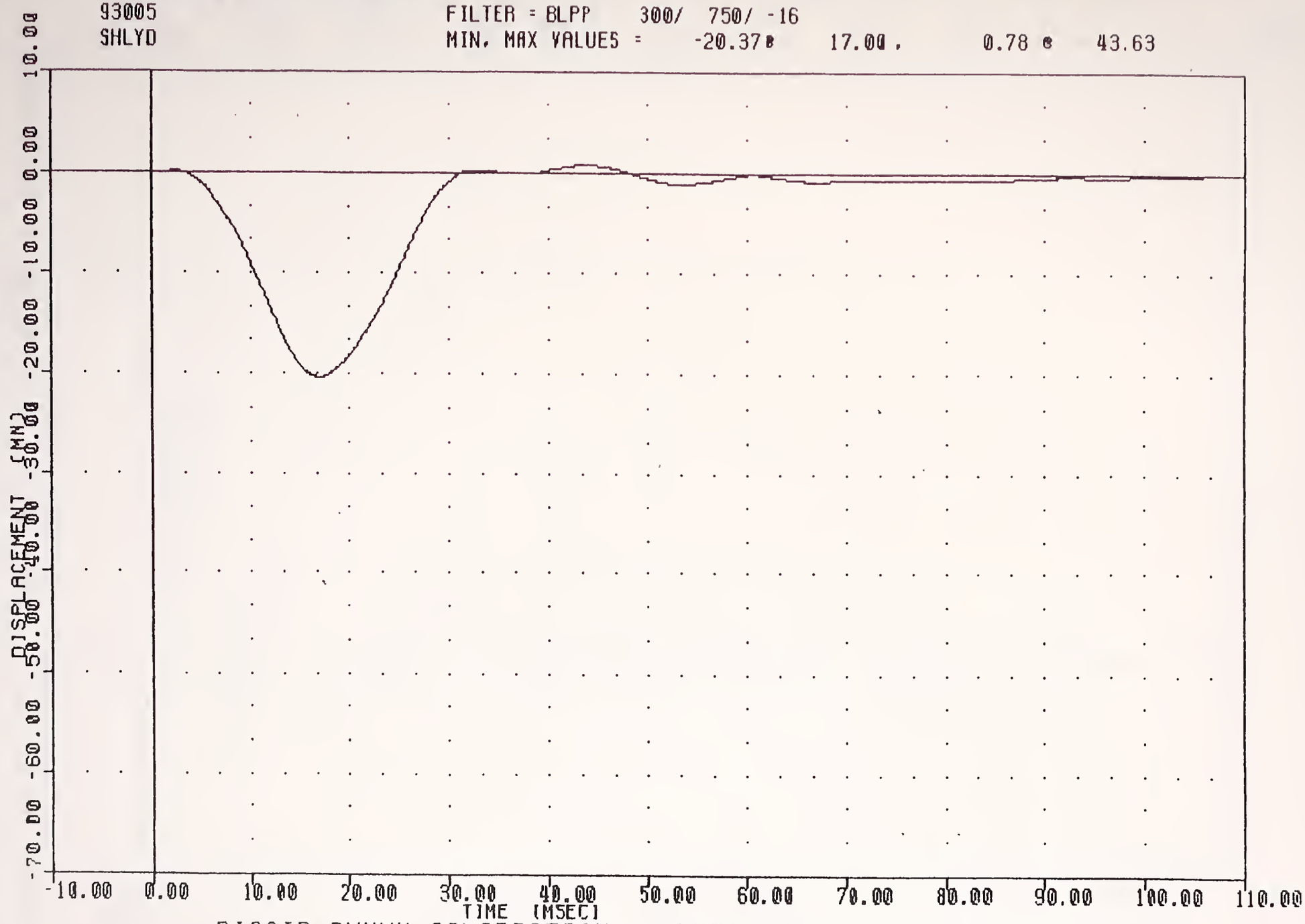
TEST PARAMETER	SPECIFICATION (ABSOLUTE VALUE)	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.11 DEG. C
RELATIVE HUMIDITY	10% - 70%	44.00 %
PENDULUM VELOCITY	6.58 - 6.84 M/SEC	6.68 M/SEC
IMPACTOR FORCE	6200 - 7600 N	-6609. N
PEAK ACCELERATION UPPER THORACIC RIB	55 - 80 G	-78.9 G
PEAK ACCELERATION MID THORACIC RIB	70 - 100 G	-98.1 G
PEAK ACCELERATION LOWER THORACIC RIB	85 - 128 G	-127.2 G
PEAK DISPLACEMENT UPPER THORACIC RIB	21 - 29 MM	-27.2 MM
PEAK DISPLACEMENT MID THORACIC RIB	32 - 42 MM	-36.7 MM
PEAK DISPLACEMENT LOWER THORACIC RIB	42 - 53 MM	-45.5 MM
PEAK ACCELERATION UPPER SPINE	34 - 43 G	-34.0 G
PEAK ACCELERATION LOWER SPINE	14 - 21 G	-16.3 G
PEAK DISPLACEMENT SHOULDER	0.59 - 1.06 IN	-20.4 MM

TEST MEETS SPECIFICATIONS

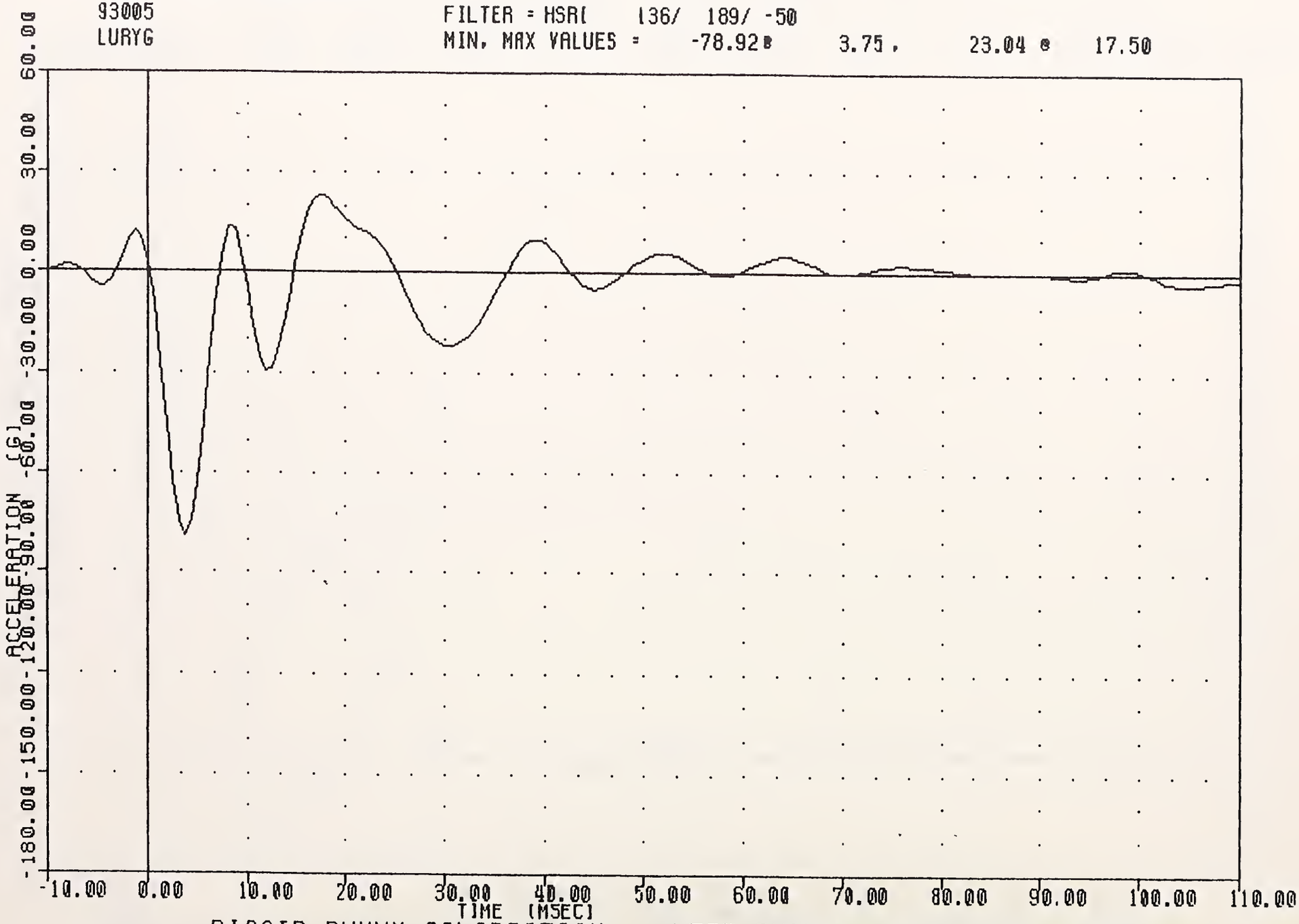
TECHNICIAN V. L. Watters



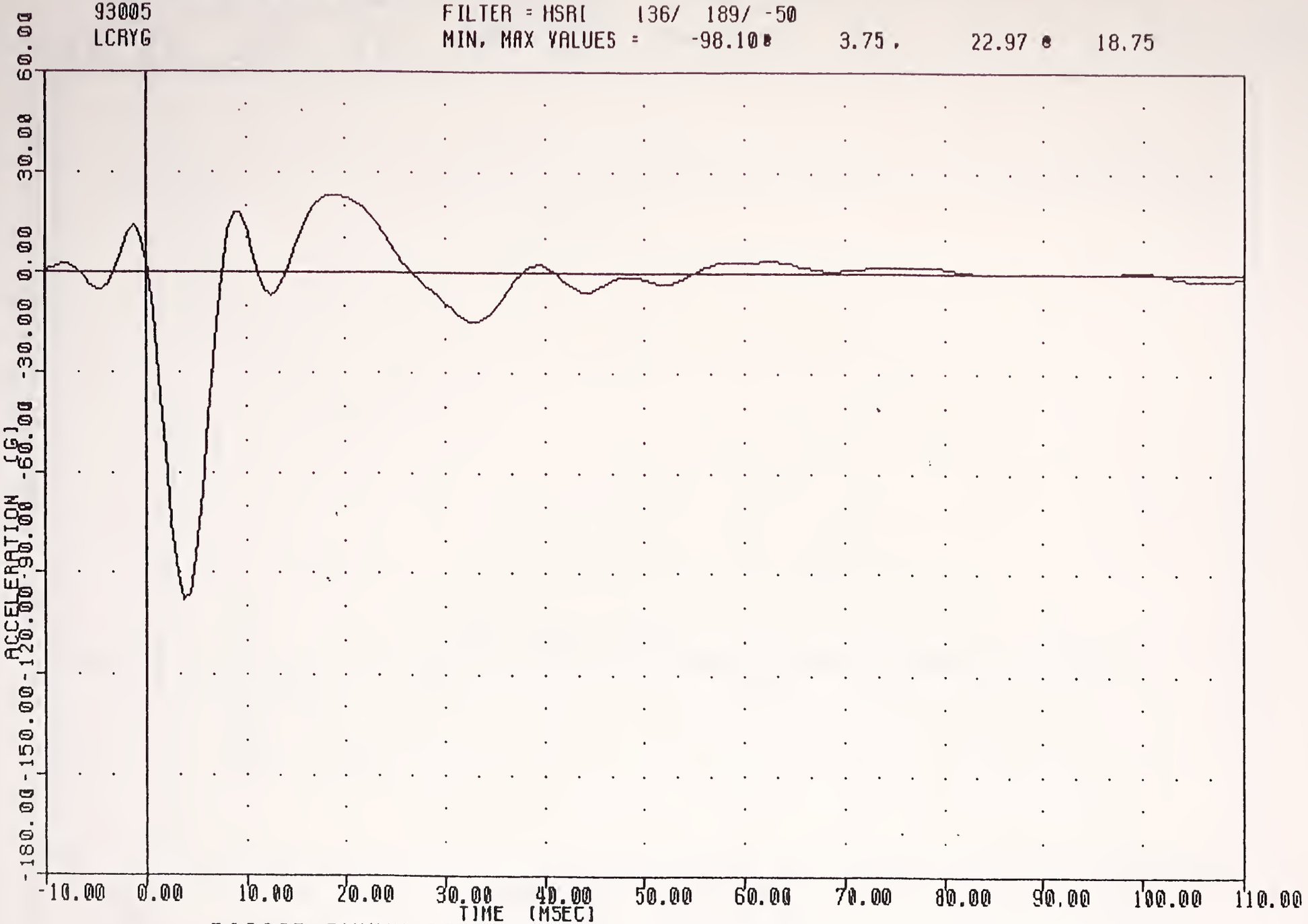
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
PENDULUM FORCE



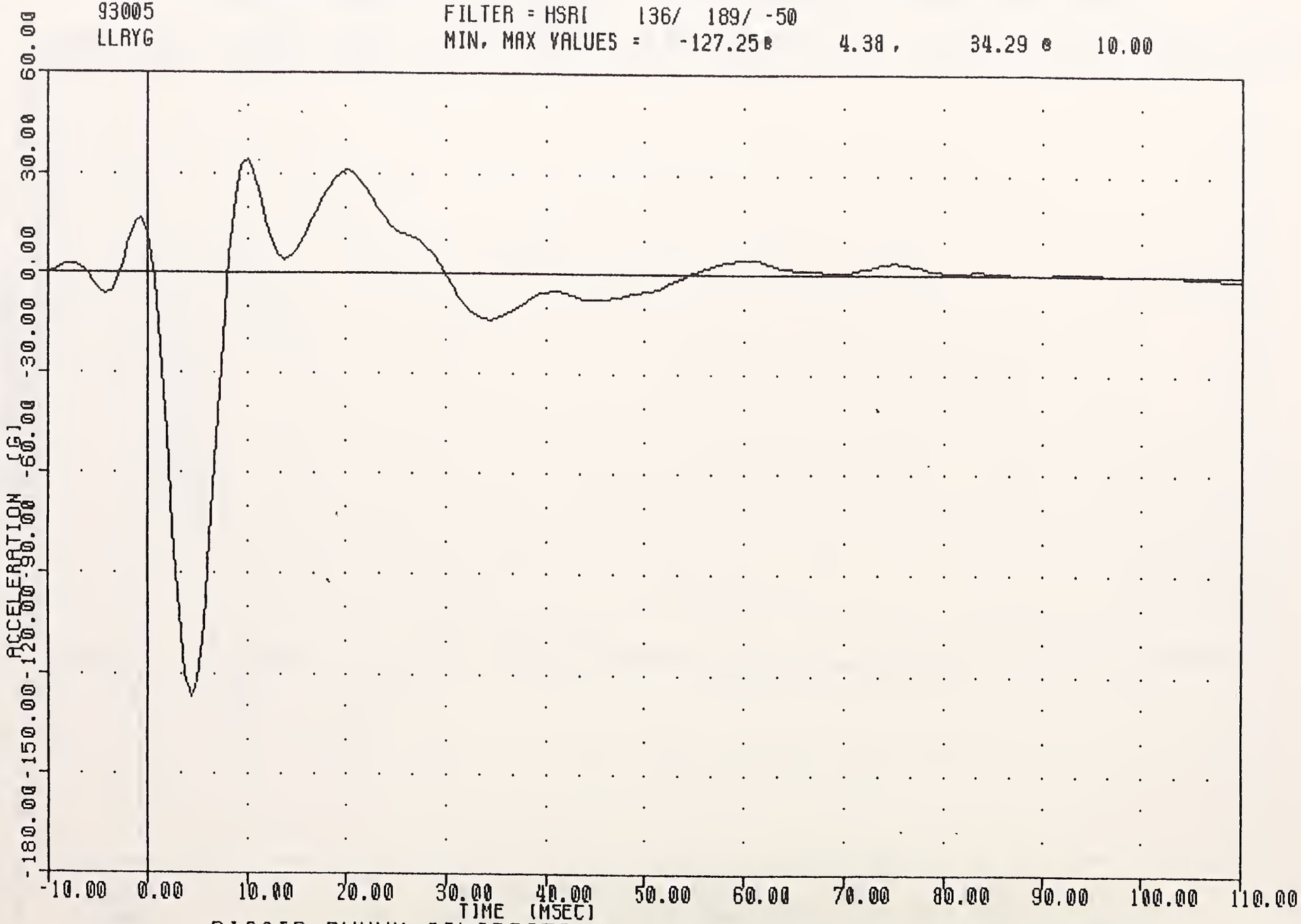
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT SHOULDER DISPLACEMENT Y AXIS



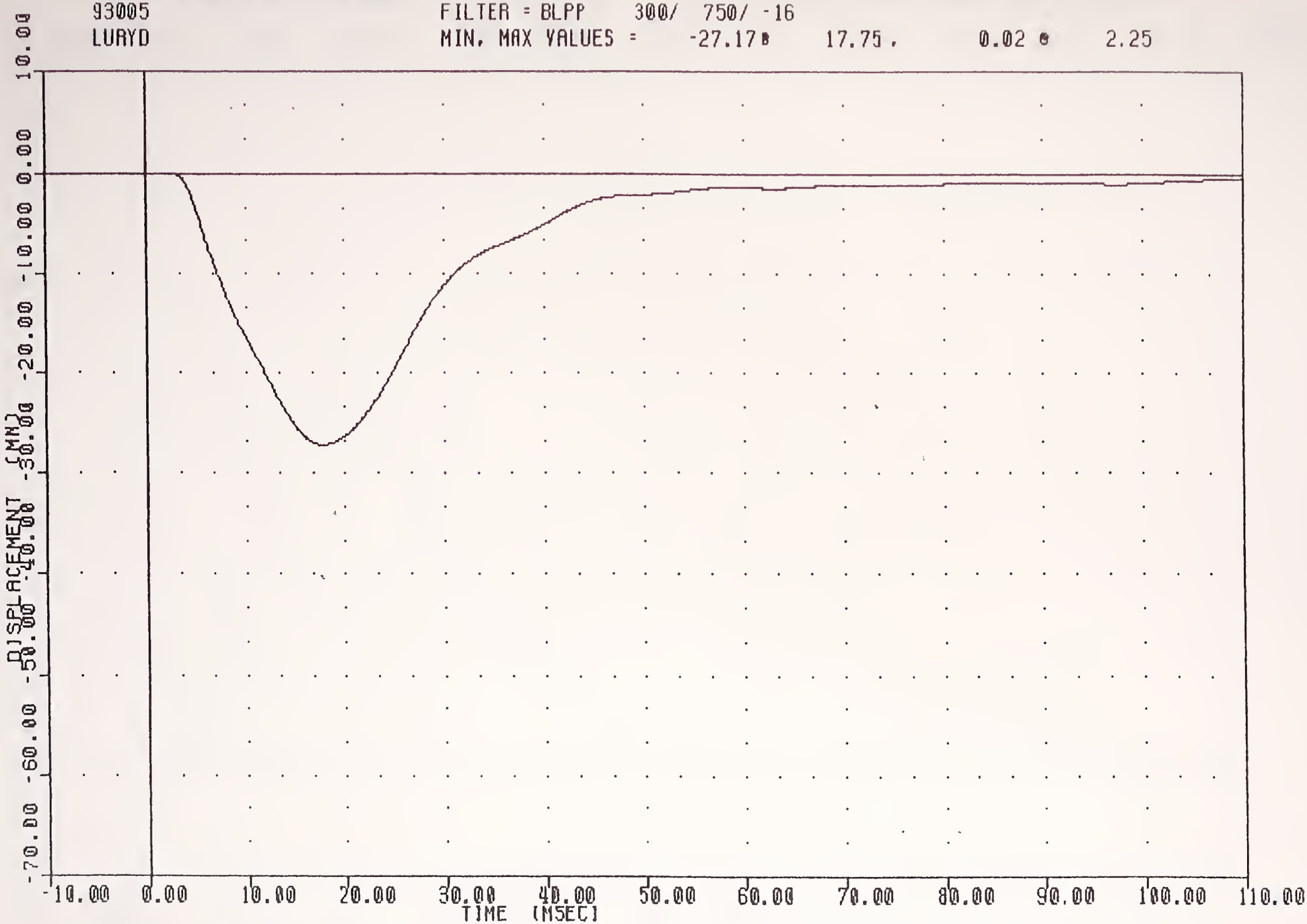
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT UPPER RIB ACCELERATION Y AXIS



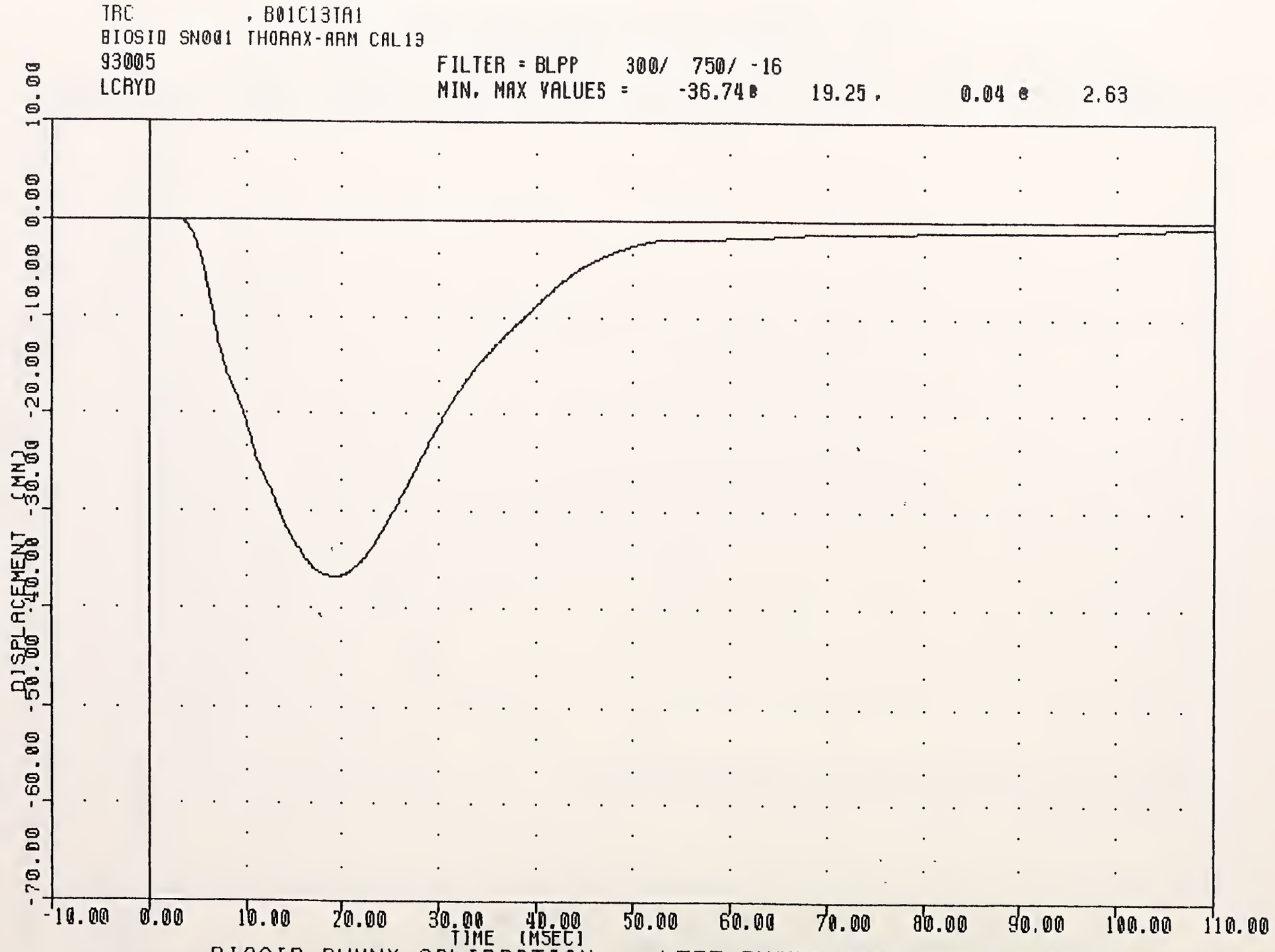
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT CENTER RIB ACCELERATION Y AXIS



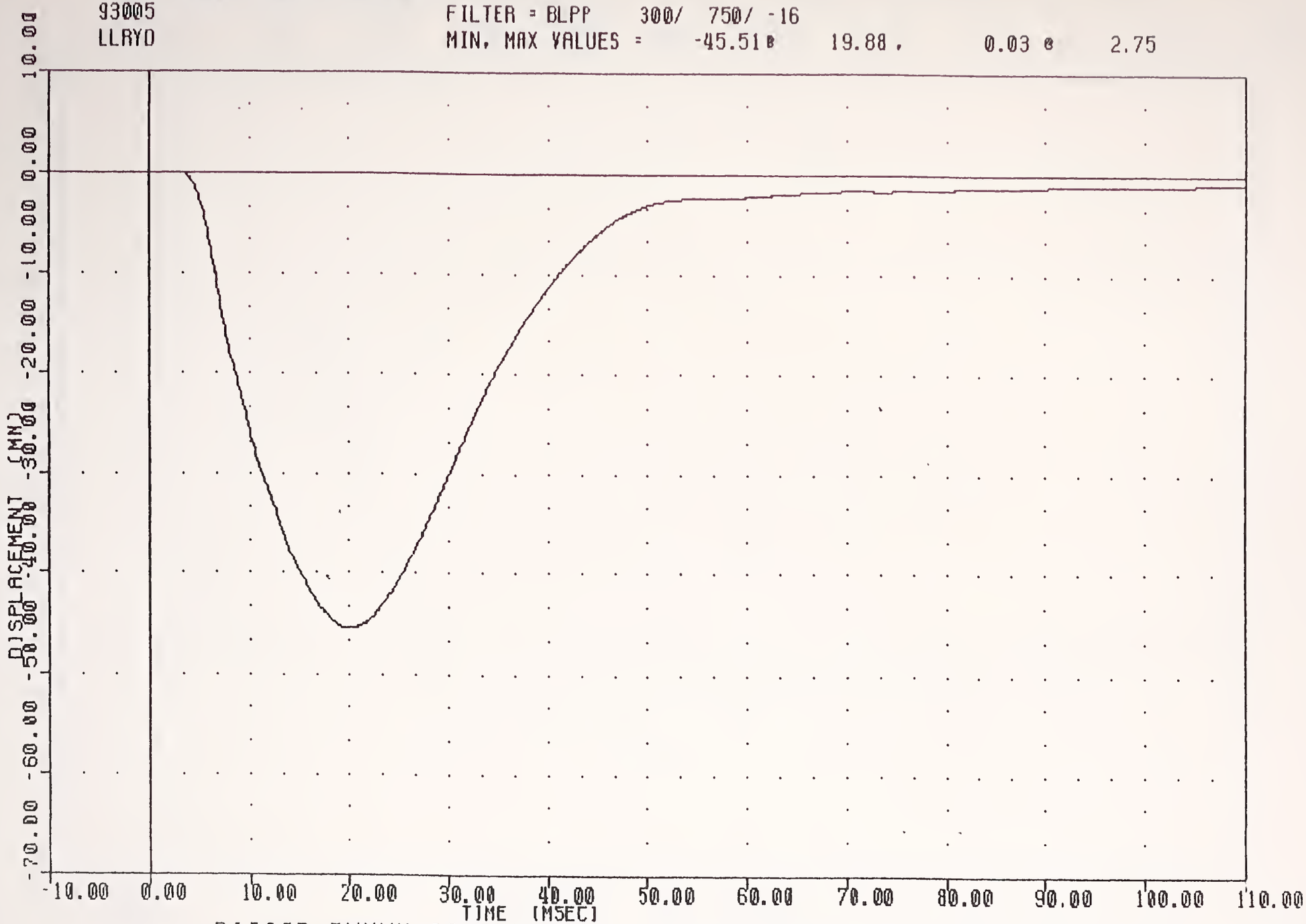
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT LOWER RIB ACCELERATION Y AXIS



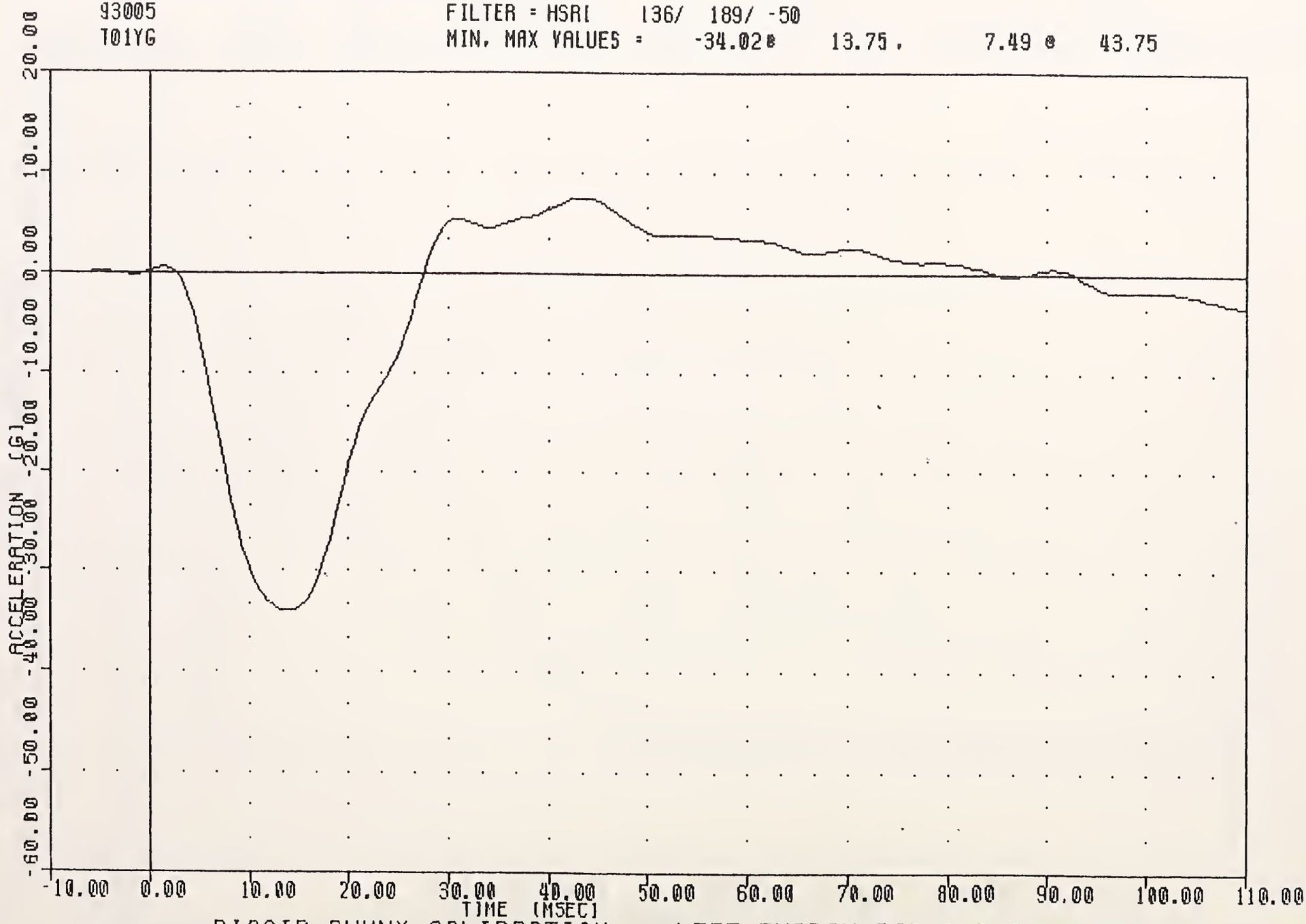
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT UPPER RIB DISPLACEMENT Y AXIS



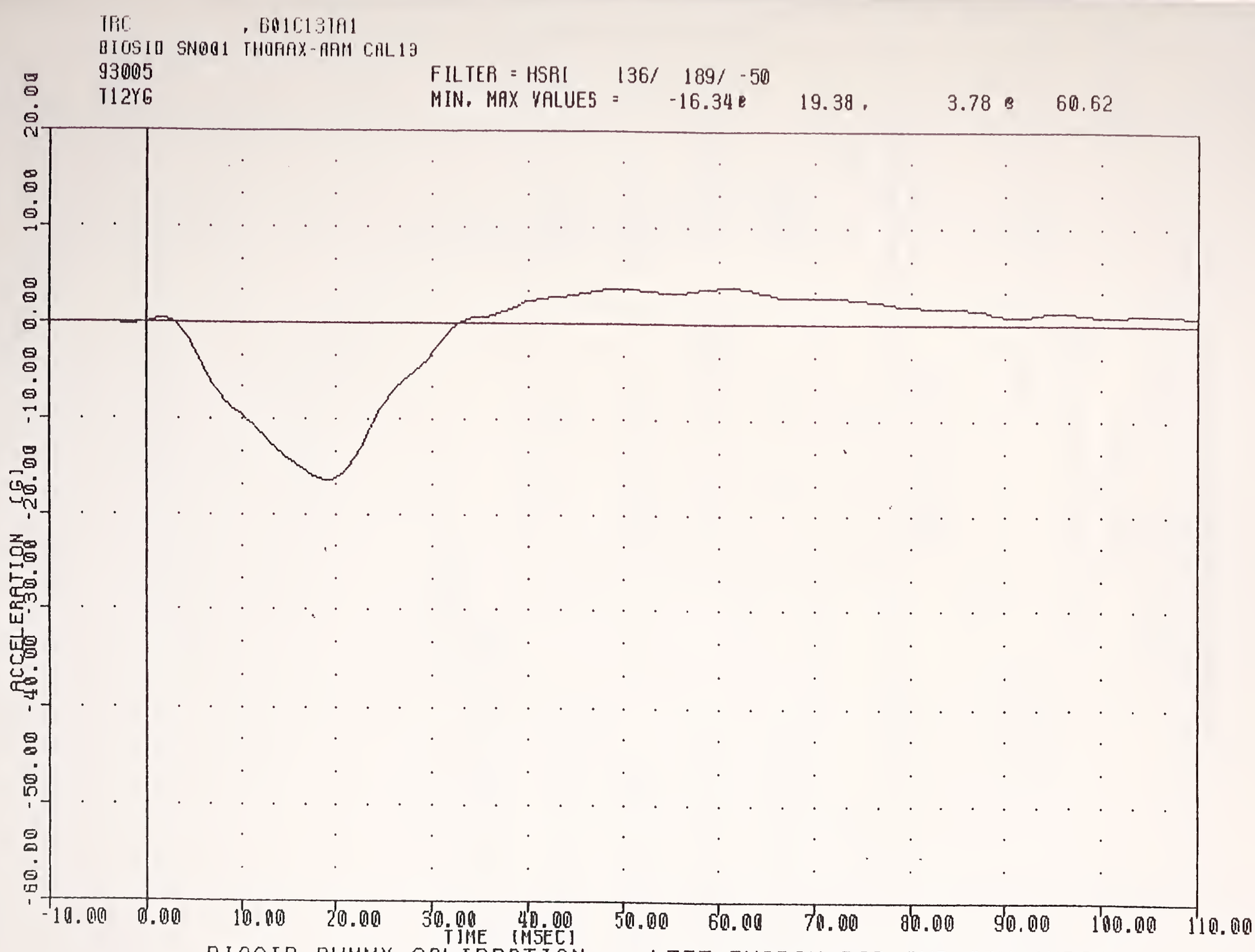
BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT CENTER RIB DISPLACEMENT Y AXIS



BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LEFT LOWER RIB DISPLACEMENT Y AXIS



BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
UPPER SPINE ACCELERATION Y AXIS



BIOSID DUMMY CALIBRATION - LEFT THORAX RIB AND ARM IMPACT
LOWER SPINE ACCELERATION Y AXIS

TRANSPORTATION RESEARCH CENTER OF OHIO

PELVIS IMPACT - PENDULUM TEST

BIOSID DUMMY 05-Jan-93

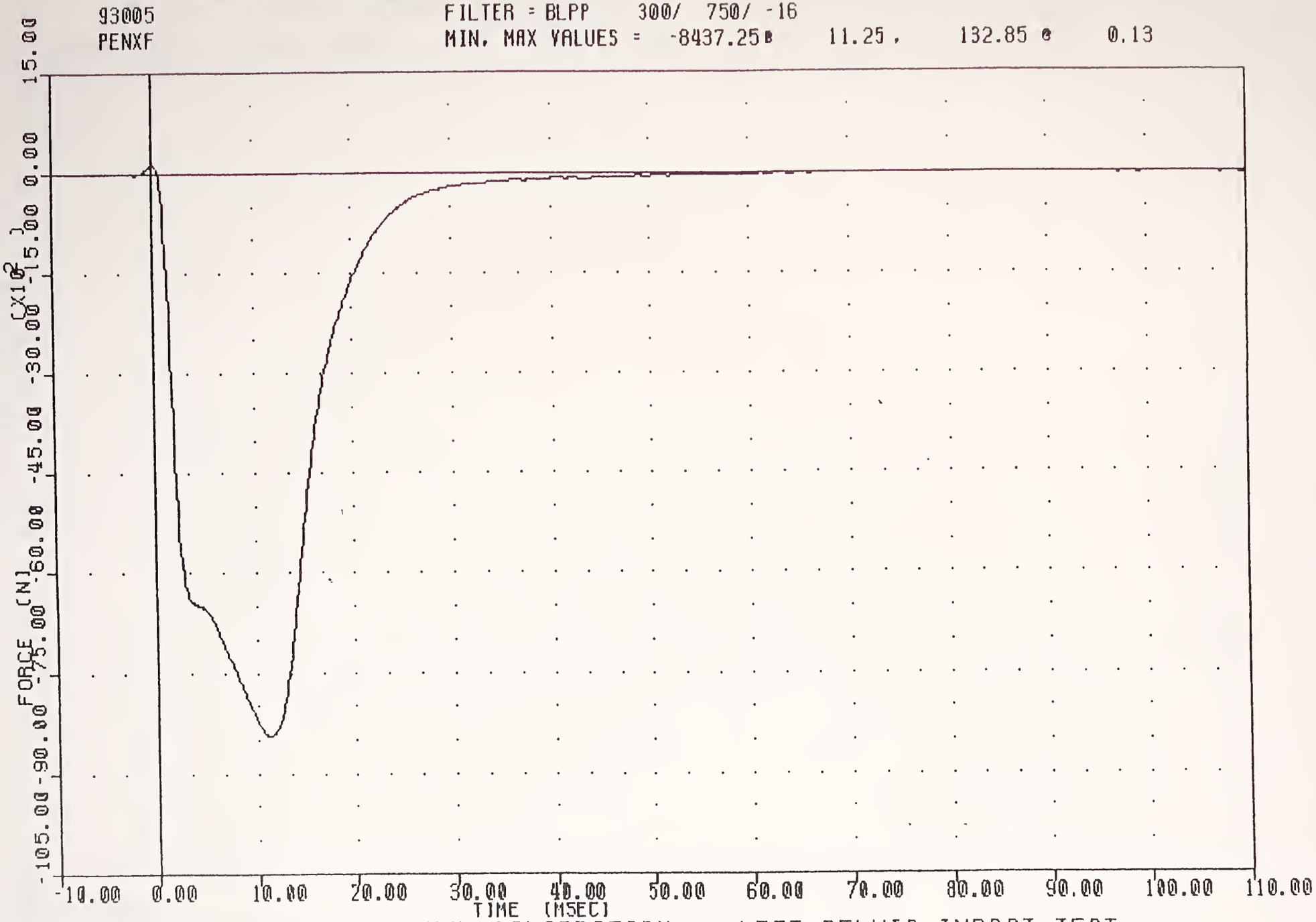
LEFT SIDE CONFIGURATION

TRC B01C13PV1 BIOSID SN001 PELVIS IMP CAL13

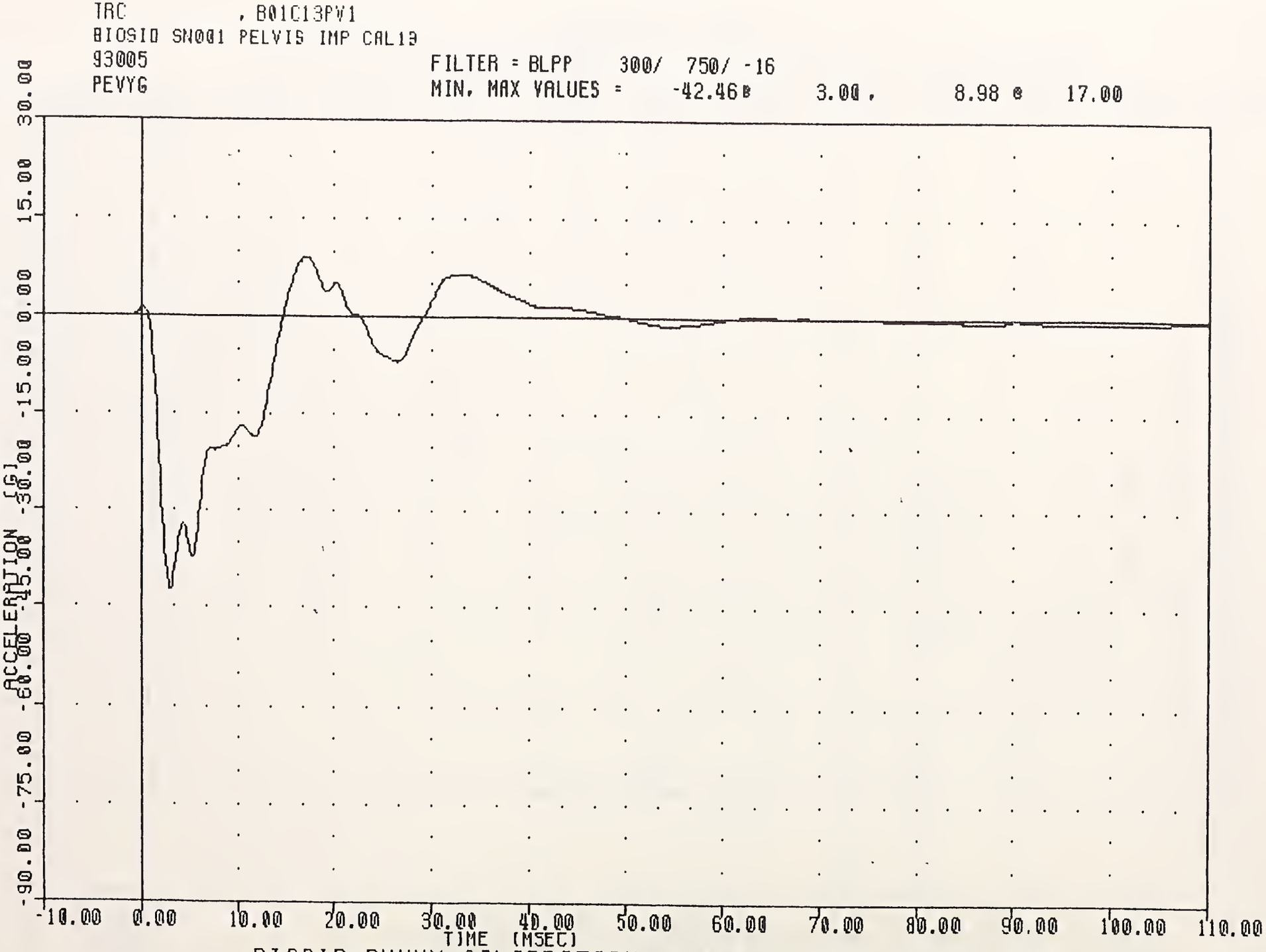
TEST PARAMETER	SPECIFICATION (ABSOLUTE VALUE)	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.11 DEG. C
RELATIVE HUMIDITY	10% - 70%	54.00 %
PENDULUM VELOCITY	6.58 - 6.84 M/SEC	6.68 M/SEC
IMPACTOR FORCE	7700 - 9700 N	-8437. N
PEAK ACCELERATION PELVIS	42 - 66 G	-42.5 G

TEST MEETS SPECIFICATIONS

TECHNICIAN K. L. Watters



BIOSID DUMMY CALIBRATION -- LEFT PELVIS IMPACT TEST
PENDULUM FORCE



BIOSID DUMMY CALIBRATION -- LEFT PELVIS IMPACT TEST
LEFT PELVIS ACCELERATION Y AXIS

APPENDIX D

MISCELLANEOUS TEST INFORMATION

DUMMY INSTRUMENTATION PLACEMENT

DUMMY MANUFACTURER & S/N: FIRST TECHNOLOGY SAFETY SYSTEMS/001

SEATING POSITION: DRIVER

MNEMONIC	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
HEAD ACCELERATION		X	ENDEVCO	7264	CC92H	REAR
HEAD ACCELERATION		Y	ENDEVCO	7264	DP87J	LEFT
HEAD ACCELERATION		Z	ENDEVCO	7264	BH91J	UP
LEFT SHOULDER ACCELERATION		Y	ENDEVCO	7264	BD88J	RIGHT
LEFT SHOULDER FORCE		Y	DENTON	2255	076	LEFT
LEFT SHOULDER DISPLACEMENT		Y	SPACE AGE TECHNOLOGY	160-321H	108	LEFT
UPPER SPINE ACCELERATION		X	ENDEVCO	7264	BF19J	REAR
UPPER SPINE ACCELERATION		Y	ENDEVCO	7264	DP46J	LEFT
UPPER SPINE ACCELERATION		Y	ENDEVCO	7264	BF04	UP
LEFT UPPER THORAX RIB ACCELERATION		Y	ENDEVCO	7264	BE95J	RIGHT
LEFT UPPER THORAX RIB REDUNDANT		Y	ENDEVCO	7264	BP55J	RIGHT
LEFT UPPER THORAX RIB DISPLACEMENT		Y	SPACE AGE TECHNOLOGY	160-321H	50	LEFT
LEFT CENTER THORAX RIB ACCELERATION		Y	ENDEVCO	7264	BD15J	RIGHT
LEFT CENTER THORAX RIB ACCELERATION REDUNDANT		Y	ENDEVCO	7264	BF26J	RIGHT
LEFT CENTER THORAX RIB DISPLACEMENT		Y	SPACE AGE CONTROL	160-321H	34	LEFT
LEFT LOWER THORAX RIB ACCELERATION		Y	ENDEVCO	7264	EH88J	RIGHT
LEFT LOWER THORAX RIB ACCELERATION REDUNDANT		Y	ENDEVCO	7264	EC41J	RIGHT
LEFT LOWER THORAX RIB DISPLACEMENT		Y	SPACE AGE CONTROL	160-321H	63	LEFT

DUMMY INSTRUMENTATION PLACEMENT, CONT'D.

DUMMY MANUFACTURER & S/N: FIRST TECHNOLOGY SAFETY SYSTEMS/001

SEATING POSITION: DRIVER

MNEMONIC	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
LOWER SPINE ACCELERATION		X	ENDEVCO	7264	EJ97J	REAR
LOWER SPINE ACCELERATION		Y	ENDEVCO	7264	DJ61J	LEFT
LOWER SPINE ACCELERATION REDUNDANT		Y	ENDEVCO	7264	BF99J	LEFT
LOWER SPINE ACCELERATION		Z	ENDEVCO	7264	FC01J	DOWN
LEFT UPPER ABDOMEN RIB ACCELERATION		Y	ENDEVCO	7264	DW83J	RIGHT
LEFT UPPER ABDOMEN RIB DISPLACEMENT		Y	SPACE AGE CONTROL	160-321H	70	LEFT
LEFT LOWER ABDOMEN RIB ACCELERATION		Y	ENDEVCO	7264	BG37J	RIGHT
LEFT LOWER ABDOMEN		Y	SPACE AGE CONTROL	160-321H	79	LEFT
PELVIS ACCELERATION		X	ENDEVCO	7264	DF41J	
PELVIS ACCELERATION		Y	ENDEVCO	7264	AP96	
PELVIS ACCELERATION		Z	ENDEVCO	7264	BE27J	
PUBIC SYMPHYSIS FORCE		Y	DENTON	2257	076	LEFT
PELVIS SACRUM FORCE		Y	DENTON	2256	076	LEFT
PELVIS ILIAC FORCE		Y	DENTON	2258	076	LEFT

VEHICLE INSTRUMENTATION PLACEMENT

NUMBER	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
1	RIGHT FRONT SILL	Y	ENDEVCO	2264	AP45	RIGHT
1	RIGHT FRONT SILL	Y	ENDEVCO	2264	AA05	RIGHT
1	RIGHT FRONT SILL	Y	ENDEVCO	2264	BF18J	RIGHT
2	REAR FLOORPAN OVER AXLE	X	ENDEVCO	7264	BR37J	REAR
2	REAR FLOORPAN OVER AXLE	X	ENDEVCO	7264	AH78	REAR
2	REAR FLOORPAN OVER AXLE	X	ENDEVCO	7264	AC44	REAR
3	LEFT FRONT SILL	Y	ENDEVCO	2264	AH88	RIGHT
3	LEFT FRONT SILL	Y	ENDEVCO	2264	AS34	RIGHT
3	LEFT FRONT SILL	Y	ENDEVCO	2264	AL42	RIGHT
4	LEFT FRONT DOOR REAR SURFACE	X	ENDEVCO	7264	AD97	FRONT
4	LEFT FRONT DOOR REAR SURFACE	Y	ENDEVCO	7264	AK87	RIGHT
4	LEFT FRONT DOOR REAR SURFACE	Z	ENDEVCO	7264	AM74	UP
5	LEFT B-PILLAR FORCE	X	DENTON	2655	075-FZ	FORWARD
5	LEFT B-PILLAR FORCE	45° below Y negative	DENTON	2655	075-FY	DOWN TOWARD RIGHT
5	LEFT B-PILLAR FORCE	45° above Y negative	DENTON	2655	075-FX	UP TOWARD RIGHT

MOVING BARRIER INSTRUMENTATION PLACEMENT

NUMBER	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
1	CENTER OF GRAVITY	X	ENDEVCO	2264	AS06	REAR
1	CENTER OF GRAVITY	Y	ENDEVCO	2264	AR49	RIGHT
1	CENTER OF GRAVITY	Z	ENDEVCO	2264	BB60	UP
2	LEFT FRAME RAIL OVER REAR AXLE	X	ENDEVCO	2264	AZ67	REAR
2	LEFT FRAME RAIL OVER REAR AXLE	Y	ENDEVCO	2264	AR38	RIGHT

SIGN CONVENTION

NHTSA DATA TAPE REFERENCE GUIDE

ACCELEROMETERS:	+X:	FORWARD
	+Y:	LEFTWARD
	+Z:	UPWARD

POTENTIOMETERS:	+SHOULDER DISPLACEMENT:	LEFTWARD
	+RIB DISPLACEMENT:	LEFTWARD

LOAD CELLS:	+SHOULDER FORCE:	LEFTWARD
	+PUBIC SYMPHYSIS FORCE:	LEFTWARD
	+PELVIS FORCE:	LEFTWARD

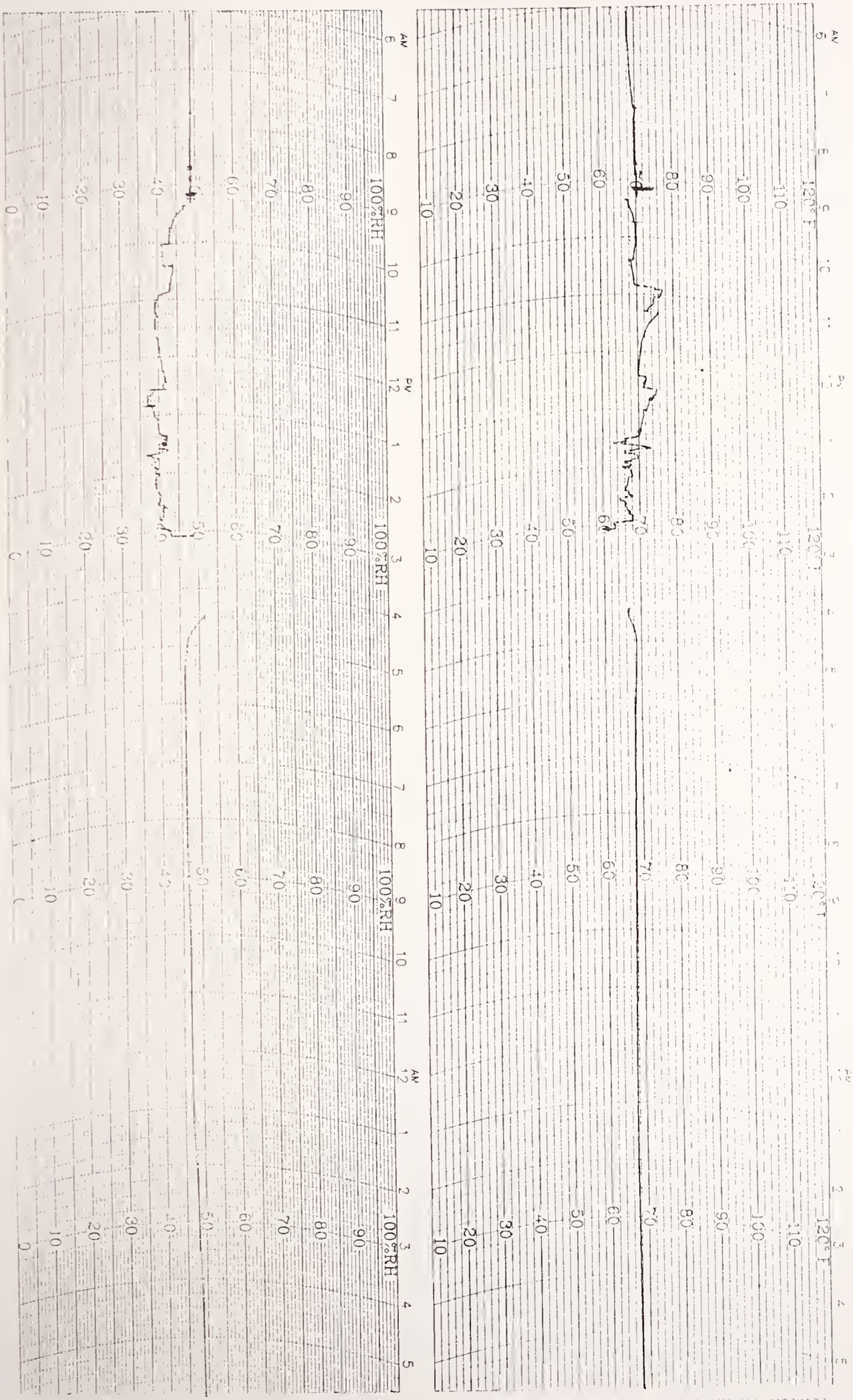
LATCH/STRIKER LOAD CELLS:	+X:	45° ABOVE HORIZONTAL TOWARD RIGHT
	+Y:	45° BELOW HORIZONTAL TOWARD RIGHT
	+Z:	FORWARD

FREQUENCY RESPONSE CLASSES

NHTSA LABORATORY PROCEDURE TP-214D-01

TYPICAL TEST MEASUREMENTS	CHANNEL CLASS
Vehicle Structural Accelerations for use in:	
Total vehicle comparison	60
Collision simulation input	60
Component analysis	600
Integration for velocity or displacement	180
Anthropomorphic Test Device	
Head accelerations (linear and angular)	1000
Thorax	
Spine accelerations	FIR100*
Rib accelerations	FIR100*
Deflections	180
Pelvis	
Accelerations	FIR100*

*Per the NHTSA FIR100 filtering routine, the data are processed by filtering to Channel Class 180, subsampling to a 1600 Hz sample rate, removing bias, and filtering with the Finite Impulse Response filter.



* U.S. G.P.O. 1993-343-273:80093