HS-806932

853

DOT#853

# MVMA SIDE IMPACT TESTING

## MDB-TO-CAR SIDE IMPACT TEST OF
## A 26° CRABBED MOVING DEFORMABLE BARRIER
## TO A 1985 FORD LTD
## AT 33.6 MPH

PREPARED BY:
TRANSPORTATION RESEARCH CENTER OF OHIO
ST. RT. 33 LOGAN COUNTY
EAST LIBERTY, OHIO 43319

TEST REPORT
TEST NO.: 850626
TEST DATE: JUNE 26, 1985
TEST CONDITIONS: BASELINE STRUCTURE, DUMMY
SEATED AGAINST PADDED DOOR PANEL

PREPARED FOR:
MGA RESEARCH CORPORATION
12790 MAIN ROAD
AKRON, NEW YORK 14001-0071

Prepared By: B. L. Wade

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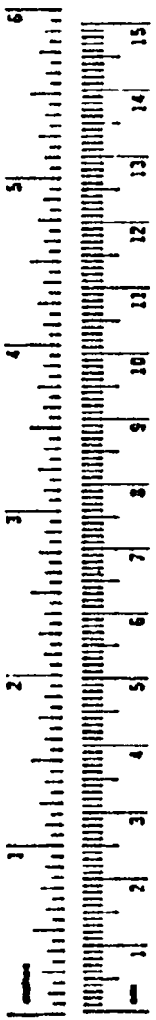
# METRIC CONVERSION FACTORS

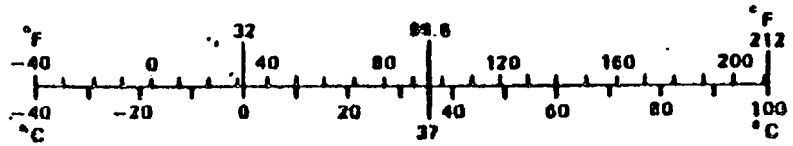
## Approximate Conversions to Metric Measures

| 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 | metric ton | t |
| **VOLUME** | | | | |
| tsp | teaspoons | 5 | milliliters | mL |
| Tbsp | tablespoons | 15 | milliliters | mL |
| $in^3$ | cubic inches | 16 | 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 | degrees Fahrenheit | 5 9 (after subtracting 32) | degrees Celsius | °C |



## 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 | metric ton (1000 kg) | 1.1 | short tons | |
| **VOLUME** | | | | |
| mL | milliliters | 0.03 | fluid ounces | fl oz |
| mL | milliliters | 0.06 | cubic inches | $in^3$ |
| 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 | degrees Celsius | 9/5 (then add 32) | degrees Fahrenheit | °F |



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SECTION 1.0

PURPOSE AND INTRODUCTION

PURPOSE

The main purpose of this test was to evaluate occupant responses to a padded door panel in a 90° side impact crash test.

INTRODUCTION

A stationary 1985 Ford LTD 4-door sedan was impacted on the right side by a Moving Deformable Barrier (MDB) on June 26, 1985. The test was to simulate an intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. The orientation angle of the striking vehicle was 90° clockwise with respect to the longitudinal axis of the struck vehicle. The leading edge of contact was to be 37 inches forward of the vehicle center of gravity which is defined by accident investigation to be the midpoint of the wheelbase.

To simulate this collision, the MDB was to be towed into the stationary Ford LTD at 33.5 mph with the MDB's wheels crabbed counterclockwise to 26°. The actual test speed was 33.6 mph and the actual leading edge of contact was 32.0 inches forward of the midpoint of the Ford LTD's wheelbase.

The vehicle was a baseline model with no structural modification. The front passenger inner door panel was replaced with a padded hardboard panel. The padding was five inches thick at dummy torso height and six inches thick at the pelvis and leg height. A side impact dummy (SID) was seated in the right front passenger seat with its shoulder just touching the door padding.

Section 2 contains test parameter data. Section 3 contains crash test data. Appendix A contains Data Plots. Appendix B contains Dummy Certification Data.

# SECTION 2.0

# TEST PARAMETER DATA

This section includes the following information:

1. General Test Vehicle Information
2. Dummy Temperature Control and Positioning Data
3. High Speed Camera Information
4. Transducer Information

## TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Ford Motor Company

MAKE/MODEL: Ford LTD VIN: 1FABP39A8FG214516

BODY STYLE: 4-Door Sedan MODEL YEAR: 1985

NHTSA NO.: DNA COLOR: Midnight Blue

ENGINE DATA: TYPE: Inline CYLINDERS: 4 DISPLACEMENT 140 CID

TRANSMISSION DATA: Automatic

DATE VEHICLE RECEIVED: 4/24/85 ODOMETER READING: 4

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

| | | | |
|---|---|---|---|
| POWER STEERING | Yes | AUTOMATIC TRANSMISSION | Yes |
| 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 | No | REAR WINDOW DEFROSTER | No |
| OTHER | | | |

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
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

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: Ford Motor Company

DATE OF MANUFACTURE: 4/85

GVWR: 4225 LBS.,

GAWR: FRONT 2103 LBS., REAR 2255 LBS.

## VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 30 psi; REAR 30 psi

TIRES ON VEHICLE (MFGR. & LINE, SIZE): General Ameri Way P195/75R14

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 3

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

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

| | | | | | |
|---|---|---|---|---|---|
| RIGHT FRONT | 805 | LBS. | RIGHT REAR | 665 | LBS. |
| LEFT FRONT | 796 | LBS. | LEFT REAR | 672 | LBS. |
| TOTAL FRONT WEIGHT | 1601 | LBS. (54.5 % OF TOTAL VEHICLE WEIGHT) | | | |
| TOTAL REAR WEIGHT | 1337 | LBS. (45.5 % OF TOTAL VEHICLE WEIGHT) | | | |
| TOTAL DELIVERED WEIGHT | 2938 | LBS. | | | |

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

| | | | | |
|---|---|---|---|---|
| DELIVERED ATTITUDE: | RF 26 5/8 | ;LF 26 1/4 | ;RR 25 | ;LR 24 3/4 |
| PRE-TEST ATTITUDE: | RF 25 3/4 | ;LF 25 3/4 | ;RR 23 1/4 | ;LR 23 1/2 |
| POST-TEST ATTITUDE: | RF 25 1/2 | ;LF 24 1/2 | ;RR 23 3/4 | ;LR 23 1/8 |

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 104 LBS. CARGO:

| | | | | | |
|---|---|---|---|---|---|
| RIGHT FRONT | 870 | LBS. | RIGHT REAR | 798 | LBS. |
| LEFT FRONT | 785 | LBS. | LEFT REAR | 763 | LBS. |
| TOTAL FRONT WEIGHT | 1655 | LBS. (51.5 % OF TOTAL VEHICLE WEIGHT) | | | |
| TOTAL REAR WEIGHT | 1561 | LBS. (48.5 % OF TOTAL VEHICLE WEIGHT) | | | |
| TOTAL TEST WEIGHT | 3216 | LBS. | | | |

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

## TEST FLUID DATA

TEST FLUID TYPE: RED STODDARD SOLVENT 2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: NA GALLONS ACTUAL

TEST VOLUME: 15.0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 16.0 GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: No FUEL INJECTION: No

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? DNA

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 30 psi; REAR 30 psi

RECOMMENDED TIRE SIZE: P195/75R14 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Bench

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 3 FRONT
3 REAR
6 TOTAL

CARGO LOAD 100 LBS.

TOTAL 1000 LBS.

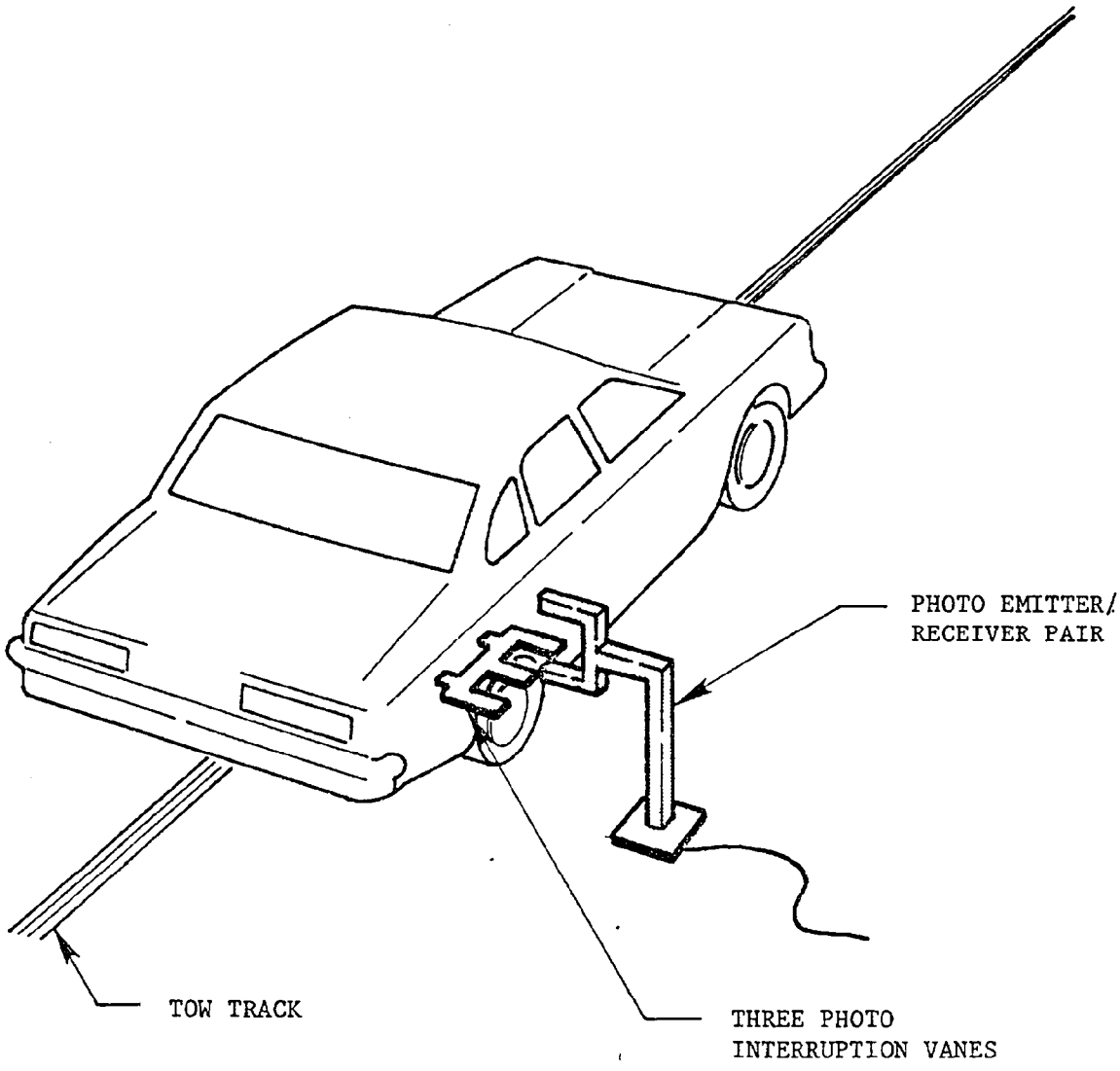
*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

## VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
Number of Dummies X 174 lbs. +
Cargo Weight
= 2938 + 1 X 174 + 100 lbs.
= 3212 lbs.

To achieve test weight, the exhaust systeme, battery, air pump and alternator were removed and 15.0 gallons of Stoddard Solvent were added in the fuel tank. The weight of the test vehicle was measured by placing each wheel on a Force Plate manufactured by K.J. Law Engineers, Inc., Detroit, Michigan.

IMPACT VELOCITY MEASUREMENT SYSTEM




The final vane clears emitter/receiver 24 inches before impact.

The vanes have one foot spacing.

## DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 2 hours prior to the test. Temperature inside the vehicle and ambient temperature at the crash area were recorded. Dummy temperature while outside the crash test building was maintained portably until approximately 1 minute prior to the test.

The following table summarizes the steps taken to position the instrumented, calibrated dummies in the test vehicle.

## SIDE IMPACT DUMMY SEATING PROCEDURE

The following is an outline of the Side Impact Dummy Seating Procedure which is currently being developed.

1. The seat is placed in the midpoint of the fore to aft adjustment.

2. The H-point location of the NHTSA Side Impact Dummy (SID) is located by using the SAE three-dimensional H-point machine (SAE J826 APR80 - 50TH Percentile Male Configuration). The H-point machine is positioned in the right front outboard designated seating position such that the midsaggital plane is vertical and longitudinal. The H-point is located and documented using Sections 4 through 6 of SAE Standard J826 APR80.

3. The H-point machine is removed and the SID is positioned in the right front passenger seat such that its right shoulder is either five inches from or against the hardboard or padded inner door panel. The knees are initially set 11 1/2 inches apart, measured between the outer surfaces of the knee pivot bolt heads, if possible. The H-point is then positioned to within 1/2 inch of the coordinates of the H-point machine H-point location found in Step 2 by applying force in the appropriate direction to the dummy's lower torso. If the dummy's upper torso does not rest against the seatback, position the torso without moving the H-point so the upper torso does rest against the seatback. The dummy's feet are then positioned such that the heels rest on the floorpan and the feet are on the toeboard. If the dummy's feet will not reach the toeboard, the feet are positioned such that the feet are at right angles to the lower legs. If wheelhouse projections interfere with the above positioning of the feet, the heel is placed on the floorpan with the foot perpendicular to the lower leg by twisting the foot about the ankle.

4. Prior to the crash test the dummy's longitudinal and lateral head locations are rechecked. The dummy is then visually checked.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: Ford LTD

FRONT SEAT TYPE: ___ BENCH
___ BUCKET
X SPLIT BENCH

ADJUSTER TYPE: X MANUAL
___ POWER

BUCKET SEAT BACK TYPE: X FIXED
___ ADJUSTABLE

TECHNICIANS:
1. G. Watters
2. B. Fishbaugh
3. D. Carpenter

POSITIONING DATE: 6/26/85

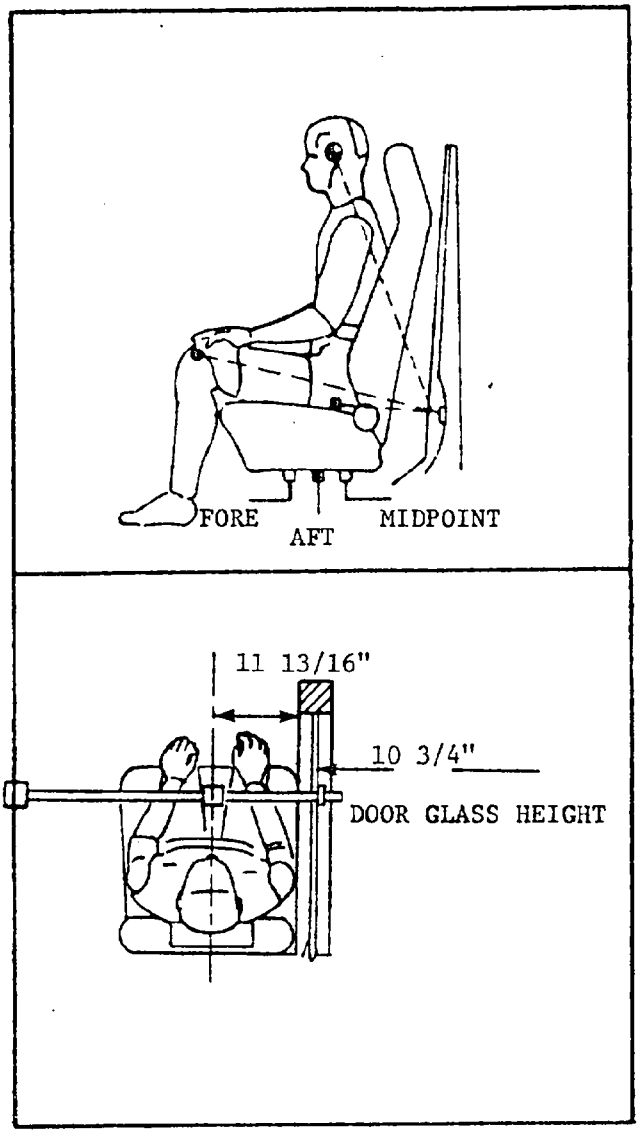
AMBIENT TEMP: 76 °F TIME: 10:30

FRONT PASSENGER DUMMY # 016

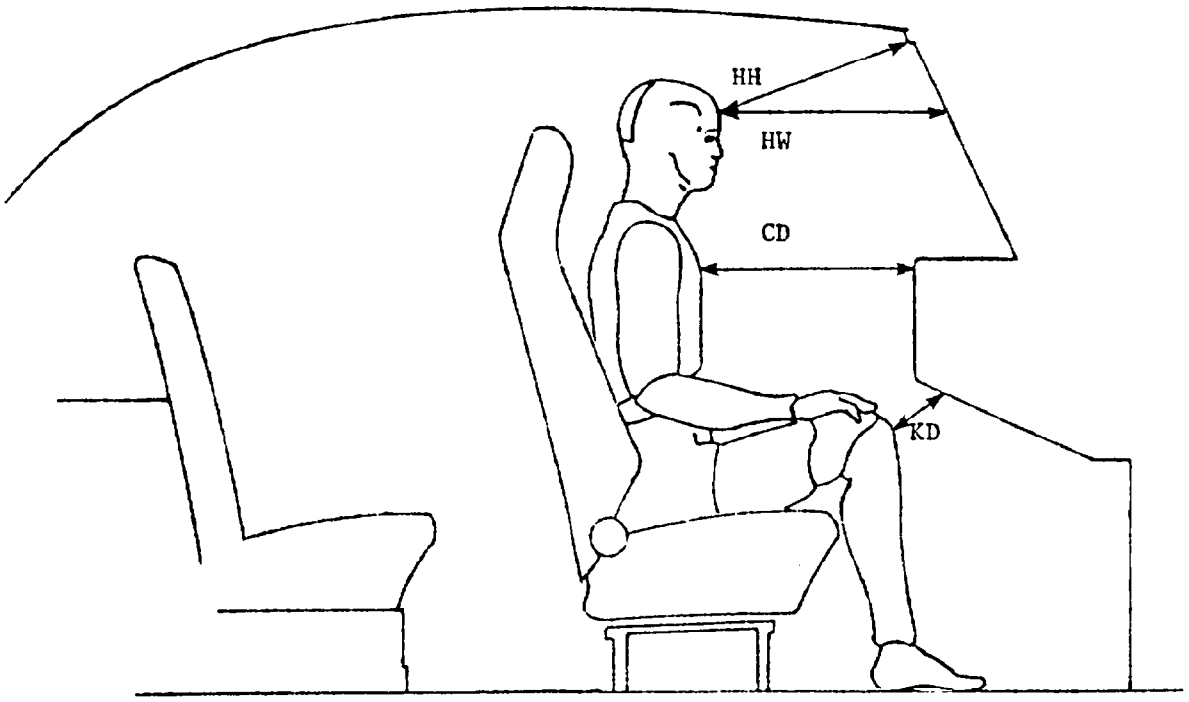
20 7/8" / 4° HEAD TARGET*

25 3/16" / 88° KNEE JOINT

11 7/8" / 110° APPROX. "H" POINT




*All passenger dummy dimensions referenced to top of front door striker bolt and all angles referenced to vertical.



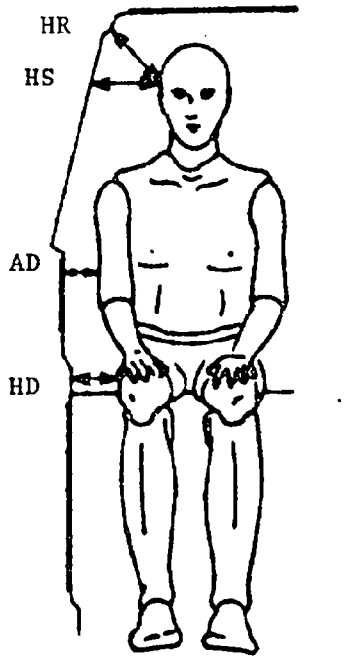

PASSENGER

016

| | |
|---|---|
| HH | 12 3/16 |
| HW | 18 3/8 |
| CD | 19 9/16 |
| KDL | 5 3/16 |
| KDR | 5 1/16 |

ALL MEASUREMENTS IN INCHES

DUMMY LONGITUDINAL CLEARANCE DIMENSION




PASSENGER
016

| | |
|---|---|
| HR | 6 3/4 |
| HS | 8 7/8 |
| AD | 0 |
| HD. | 1/8 |

ALL MEASUREMENTS IN INCHES

DUMMY LATERAL CLEARANCE DIMENSIONS

## LOCATIONS OF OFFBOARD HIGH SPEED CAMERAS

| CAMERA NO. | X | Y | Z |
|---|---|---|---|
| 1 | -6'11 1/2" | -25'10 1/2" | + 3'3" |
| 2 | -23'4 3/4" | +41'6 1/2" | + 3'1" |
| 5 | 0 | 0 | +40' |
| 6 | +1' | 0 | +40' |

Origin of Coordinate System is Point of Impact

+X = Forward with Respect to Striking Vehicle's Velocity Vector
+Y = Rightward with Respect to Striking Vehicle's Velocity Vector
+Z = Upward with Respect to Striking Vehicle's Velocity Vector

## CAMERA INFORMATION

| CAMERA NO. | LOCATION | TYPE | LENS (mm) | SPEED (fps) | PURPOSE OF CAMERA DATA |
|---|---|---|---|---|---|
| 1 | | Beaulieu | 18-86 | 24 | Documentary |
| 2 | Right Panning | Kodak | 16 | 24 | Real Time |
| 3 | MDB Wide | Photosonic 1B | 13 | 998 | View Impact |
| 4 | Overhead Tight | Photosonic 1B | 25 | 940 | View Impact |
| 5 | Overhead Wide | Photosonic 1B | 8 | ---* | Vehicle Crush |
| 6 | Right | Photosonic 1B | 25 | ---* | Vehicle Crush |
| 7 | Left | Photosonic 1B | 13 | 1035 | Vehicle Crush |
| 8 | Onboard Windshield | Photosonic 1B | 8 | 1000 | Dummy Kinematics |
| 9 | Onboard Roof | Photosonic 1B | 8 | 1003 | Dummy Kinematics |
| 10 | Onboard Door | Photosonic 1B | 8 | 990 | Dummy Kinematics |

*Camera Failure

TRANSDUCER INFORMATION

| PARAMETER BEING MEASURED | LOCATION | TYPE OF TRANSDUCER | MFGR | MODEL NUMBER | SERIAL NUMBER |
|---|---|---|---|---|---|
| HEDXG2 | HEAD CENTER OF GRAVITY | ACCEL. | ENDEVCO | 2264 | AY95 |
| HEDYG2 | HEAD CENTER OF GRAVITY | ACCEL. | ENDEVCO | 2264 | BA26 |
| HEDZG2 | HEAD CENTER OF GRAVITY | ACCEL. | ENDEVCO | 2264 | BA30 |
| T01XG2 | UPPER SPINE | ACCEL. | ENDEVCO | 2264 | AR93 |
| T01YG2 | UPPER SPINE | ACCEL. | ENDEVCO | 2264 | AN61 |
| T01YGB | UPPER SPINE | ACCEL. | ENDEVCO | 2264 | AZ77 |
| T01ZG2 | UPPER SPINE | ACCEL. | ENDEVCO | 2264 | AN37 |
| T12XG2 | LOWER SPINE | ACCEL. | ENDEVCO | 2264 | AZ55 |
| T12YG2 | LOWER SPINE | ACCEL. | ENDEVCO | 2264 | BA64 |
| T12YGB | LOWER SPINE | ACCEL. | ENDEVCO | 2264 | AZ74 |
| T12ZG2 | LOWER SPINE | ACCEL. | ENDEVCO | 2264 | AR86 |
| RURYG2 | RIGHT UPPER RIB | ACCEL. | ENDEVCO | 2264 | AR82 |
| RURYGB | RIGHT UPPER RIB | ACCEL. | ENDEVCO | 2264 | AZ24 |
| RLRYG2 | RIGHT LOWER RIB | ACCEL. | ENDEVCO | 2264 | AN60 |
| RLRYGB | RIGHT LOWER RIB | ACCEL. | ENDEVCO | 2264 | AY78 |
| PEVXG2 | PELVIS | ACCEL. | ENDEVCO | 2264 | AR78 |
| PEVYG2 | PELVIS | ACCEL. | ENDEVCO | 2264 | AN01 |
| PEVZG2 | PELVIS | ACCEL. | ENDEVCO | 2264 | AJ35 |
| RRTYD2 | RIGHT RIB TO SPINE DISPLACEMENT | LINEAR POT. | BOURNS | 5184 | 4081-191 |
| RFDYG1 | RIGHT FRONT DOOR-POSITION 1 | ACCEL. | ENDEVCO | 2264 | AJ42 |
| RFDYG2 | RIGHT FRONT DOOR-POSITION 2 | ACCEL. | ENDEVCO | 2264 | AP56 |
| RFDYG3 | RIGHT FRONT DOOR-POSITION 3 | ACCEL. | ENDEVCO | 2264 | BC29 |
| RFDYG4 | RIGHT FRONT DOOR-POSITION 4 | ACCEL. | ENDEVCO | 7264 | AN86 |
| LFSXG | LEFT FRONT SILL | ACCEL. | B & H* | 4-202-0001 | 18840 |
| LFSYG | LEFT FRONT SILL | ACCEL. | B & H | 4-202-0001 | 18236 |
| LFSZG | LEFT FRONT SILL | ACCEL. | B & H | 4-202-0001 | 18837 |
| BCGXG | BARRIER CENTER OF GRAVITY | ACCEL. | B & H | 4-202-0001 | 18851 |
| BCGYG | BARRIER CENTER OF GRAVITY | ACCEL. | B & H | 4-202-0001 | 18859 |
| BCGZG | BARRIER CENTER OF GRAVITY | ACCEL. | B & H | 4-202-0001 | 18847 |
| BRCXG | BARRIER REAR CROSS MEMBER | ACCEL. | B & H | 4-202-0001 | 19002 |
| BRCYG | BARRIER REAR CROSS MEMBER | ACCEL. | B & H | 4-202-0001 | 18237 |

*Bell & Howell

# SECTION 3.0
# CRASH TEST DATA

The following pages are included in this section:

1. Test conditions
2. Dummy accelerometer data summary
3. Dummy contact points and kinematic summary
4. Vehicle accelerometer locations and data summmary
5. Vehicle static crush table and profiles
6. Deformable moving barrier accelerometer locations and data summary
7. Test anomalies

## TEST CONDITIONS

TEST NUMBER: 850626

DATE OF TEST: June 26, 1985 TIME OF TEST: 13:45

WIND VELOCITY: 0-2 mph 126° E HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA: 77° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 78° F

DUMMY TEMPERATURE: 78° F

## SUBJECT VEHICLE DATA

| | ACTUAL | INTENDED |
|---|---|---|
| VEHICLE TEST WEIGHT (LBS.) | 3216 | 3212 |
| MDB TEST WEIGHT (LBS.) | 2991 | 2992 |
| MDB VELOCITY (MPH)* | 33.6 | 33.5 |
| IMPACT POINT (INCHES)** | 32.0 | 37.0 |

## DUMMIES

| | DRIVER | MIDDLE PASSENGER | RT. FRONT PASSENGER | LEFT REAR PASSENGER | RT. REAR PASSENGER |
|---|---|---|---|---|---|
| TYPE: | | | SID | | |
| SERIAL NO.: | | | 016 | | |
| INSTRUMENTATION: | | | | | |
| HEAD ACCEL.: | | | 3 | | |
| CHEST ACCEL.: | | | 12 | | |
| FEMUR L.C.'S: | | | 0 | | |
| OTHER: | | | 3 Pelvis<br>1 Rib Disp. | | |

RESTRAINT SYSTEM: Dummy was unrestrained

* As measured over final one foot of travel.

** As measured forward of the midpoint of the test vehicle's wheelbase

## SIDE IMPACT DUMMY DATA SUMMARY

| | PASSENGER DUMMY | | | |
|---|---|---|---|---|
| | POSITIVE DIRECTION* | | NEGATIVE DIRECTION** | |
| | MAX (g) | TIME (msec) | MAX (g) | TIME (msec) |
| HEAD ACCELERATION | | | | |
| LONGITUDINAL | 22.32 | 191.88 | 20.65 | 92.63 |
| LATERAL | 22.55 | 191.25 | 22.46 | 45.00 |
| VERTICAL | 40.97 | 61.00 | 5.17 | 274.75 |
| RESULTANT | | 43.95 @ 61.00 | | |
| HIC | 342.84 | from 36.38 to 198.88 | | |
| DELTA V (MPH) | | -20.8 @ 163.38 | | |
| CHEST ACCELERATION | | | | |
| UPPER SPINE | | | | |
| LONGITUDINAL | 8.05 | 33.75 | 5.31 | 61.88 |
| LATERAL (P)**** | 13.45 | 62.50 | 50.69 | 30.00 |
| LATERAL (R)**** | 15.88 | 62.50 | 47.93 | 30.00 |
| VERTICAL | 9.64 | 34.38 | 15.54 | 60.62 |
| RESULTANT (P) | | 51.07 @ 30.00 | | |
| RESULTANT (R) | | 48.32 @ 30.00 | | |
| DELTA V (MPH)*** | | -25.4 @ 58.63 (P) | | |
| | | -24.5 @ 58.00 (R) | | |
| LOWER SPINE | | | | |
| LONGITUDINAL | 15.42 | 51.88 | 13.94 | 63.13 |
| LATERAL (P) | 11.40 | 63.75 | 63.26 | 37.50 |
| LATERAL (R) | 11.00 | 63.75 | 75.33 | 37.50 |
| VERTICAL | 5.06 | 91.87 | 16.33 | 60.62 |
| RESULTANT (P) | | 63.69 @ 29.38 | | |
| RESULTANT (R) | | 76.18 @ 29.38 | | |
| DELTA V (MPH) | | -29.4 @ 56.63 (P) | | |
| | | -35.5 @ 62.75 (R) | | |
| RIGHT UPPER RIB | | | | |
| LATERAL (P) | 9.94 | 60.00 | 42.29 | 25.00 |
| LATERAL (R) | 9.39 | 60.62 | 44.68 | 25.00 |
| DELTA V (MPH) | | -23.3 @ 58.50 (P) | | |
| | | -23.7 @ 59.00 (R) | | |
| RIGHT LOWER RIB | | | | |
| LATERAL (P) | 7.92 | 202.50 | 39.22 | 36.88 |
| LATERAL (R) | 7.47 | 202.50 | 39.84 | 25.00 |
| DELTA V (MPH) | | -24.5 @ 58.50 (P) | | |
| | | -26.0 @ 59.88 (R) | | |
| PELVIS ACCELERATION | | | | |
| LONGITUDINAL | 13.84 | 77.00 | 19.32 | 38.25 |
| LATERAL | 23.19 | 73.13 | 52.31 | 36.38 |
| VERTICAL | 11.39 | 93.25 | 26.78 | 34.38 |
| RESULTANT | | 56.03 @ 34.50 | | |
| DELTA V (MPH) | | -27.5 @ 56.38 | | |

## SIDE IMPACT DUMMY DATA SUMMARY CONTD

| | PASSENGER DUMMY | | | |
|---|---|---|---|---|
| | POSITIVE DIRECTION* | | NEGATIVE DIRECTION** | |
| | MAX (in) | TIME (msec) | MAX (in) | TIME (msec) |
| RIB DEFLECTION † | 0.06 | 198.50 | 2.03 | 103.13 |

| | | | |
|---|---|---|---|
| * LONGITUDINAL: | FORWARD | **LONGITUDINAL: | REARWARD |
| LATERAL: | RIGHTWARD | LATERAL: | LEFTWARD |
| VERTICAL: | DOWNWARD | VERTICAL: | UPWARD |

*** For dummy channels, Delta V is the velocity change at the approximate time of separation from the contact area.

**** (P) = Primary Sensor, (R) = Redundant Sensor

† Compression: Negative

VISIBLE DUMMY CONTACT POINTS:

| | DRIVER DNA | PASSENGER 016 |
|---|---|---|
| Head | | Right Window Sill |
| Chest | | Door Padding |
| Abdomen | | Door Padding |
| Left Knee | | Right Knee |
| Right Knee | | Door Padding |

DOOR OPENING:

| | LEFT | RIGHT |
|---|---|---|
| Front | Normal | Tools Required |
| Rear | Normal | Tools Required |

SEAT MOVEMENT:

| | SEAT BACK FAILURE | SEAT SHIFT |
|---|---|---|
| Front | No | No |
| Rear | No | No |

GLAZING DAMAGE: All right side door glass was shattered. Front windshield was cracked.

OTHER NOTABLE IMPACT EFFECTS:

## DUMMY KINEMATIC SUMMARY

During impact, the dummy's right leg and right side of the torso contacted the inner door padding. The dummy's head rotated to the right about the neck until it contacted the right front door window sill. Upon rebound, the dummy became airborn as its head hit the ceiling. The dummy came to rest with its buttocks on the middle of the seat, leaning to the right with its head resting on the right front window sill.

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

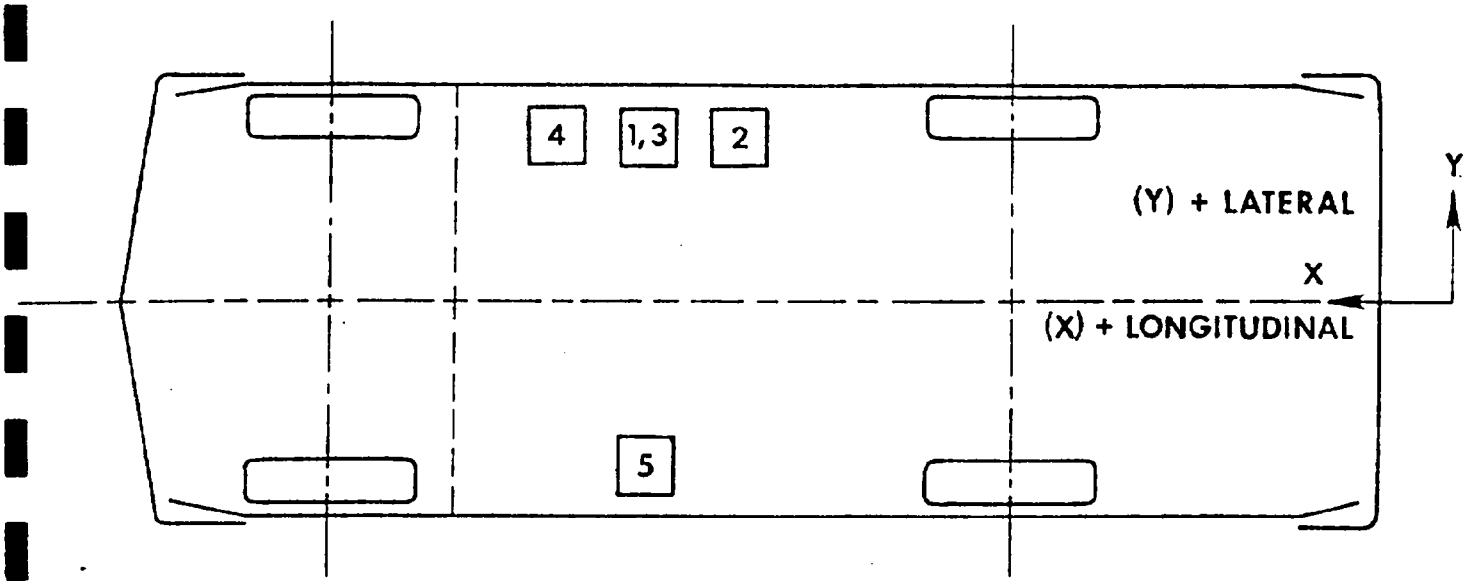
| NO. | LOCATION | X* | Y* | Z* | POSITIVE** DIRECTION MAX (g) | POSITIVE** DIRECTION TIME (msec) | NEGATIVE*** DIRECTION MAX (g) | NEGATIVE*** DIRECTION TIME (msec) |
|---|---|---|---|---|---|---|---|---|
| 1 | RIGHT FRONT DOOR CENTERLINE (LATERAL) | 112.2 | 28.9 | 23.1 | | | | |
| | Δ V = -17.5 mph @ 22.12 msec | | | | 17.92 | 42.75 | 136.19 | 12.50 |
| 2 | MIDREAR OF RIGHT FRONT DOOR (LATERAL) | 101.6 | 28.6 | 24.8 | | | | |
| | Δ V = -19.6 mph @ 17.75 msec | | | | 24.29 | 22.88 | 92.98 | 9.75 |
| 3 | UPPER RIGHT FRONT DOOR CENTERLINE (LATERAL) | 112.6 | 28.7 | 29.8 | | | | |
| | Δ V = -16.2 mph @ 21.25 msec | | | | 76.40 | 31.13 | 53.11 | 13.50 |
| 4 | MIDFRONT OF RIGHT FRONT DOOR (LATERAL) | 122.0 | 28.5 | 23.2 | | | | |
| | Δ V = -17.2 mph @ 20.38 msec | | | | 78.53 | 29.50 | 92.61 | 10.75 |
| 5 | LEFT SILL AT FRONT SEAT | 118.8 | -25.8 | 13.0 | | | | |
| | (LONGITUDINAL) | | | | 4.63 | 50.63 | 6.72 | 20.75 |
| | (LATERAL) Δ V = -13.4 mph @ 129.75 msec | | | | 1.87 | 184.38 | 22.44 | 39.63 |
| | (VERTICAL) | | | | 3.91 | 118.00 | 5.77 | 18.75 |
| | (RESULTANT) | | | | | 22.62 @ 39.75 | | |

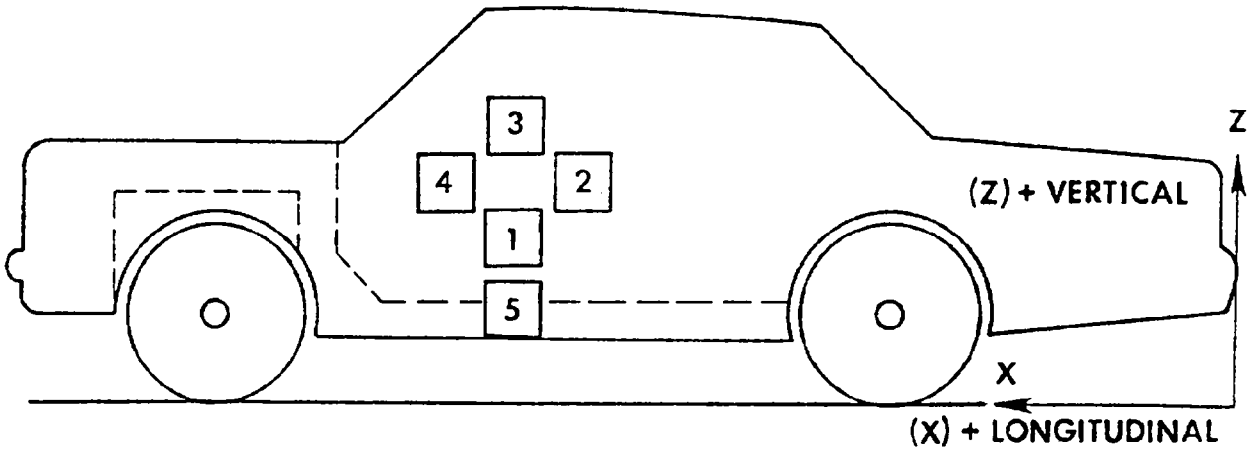
* Reference: X - Rear Bumper (+ Forward), Y - Vehicle Centerline (+ To Right), Z - Ground Level (+ Up)

| | | | |
|---|---|---|---|
| **LONGITUDINAL: | FORWARD | ***LONGITUDINAL: | REARWARD |
| LATERAL: | RIGHTWARD | LATERAL: | LEFTWARD |
| VERTICAL: | DOWNWARD | VERTICAL: | UPWARD |

All measurements of accelerometer locations in inches.

## VEHICLE ACCELEROMETER PLACEMENT



VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

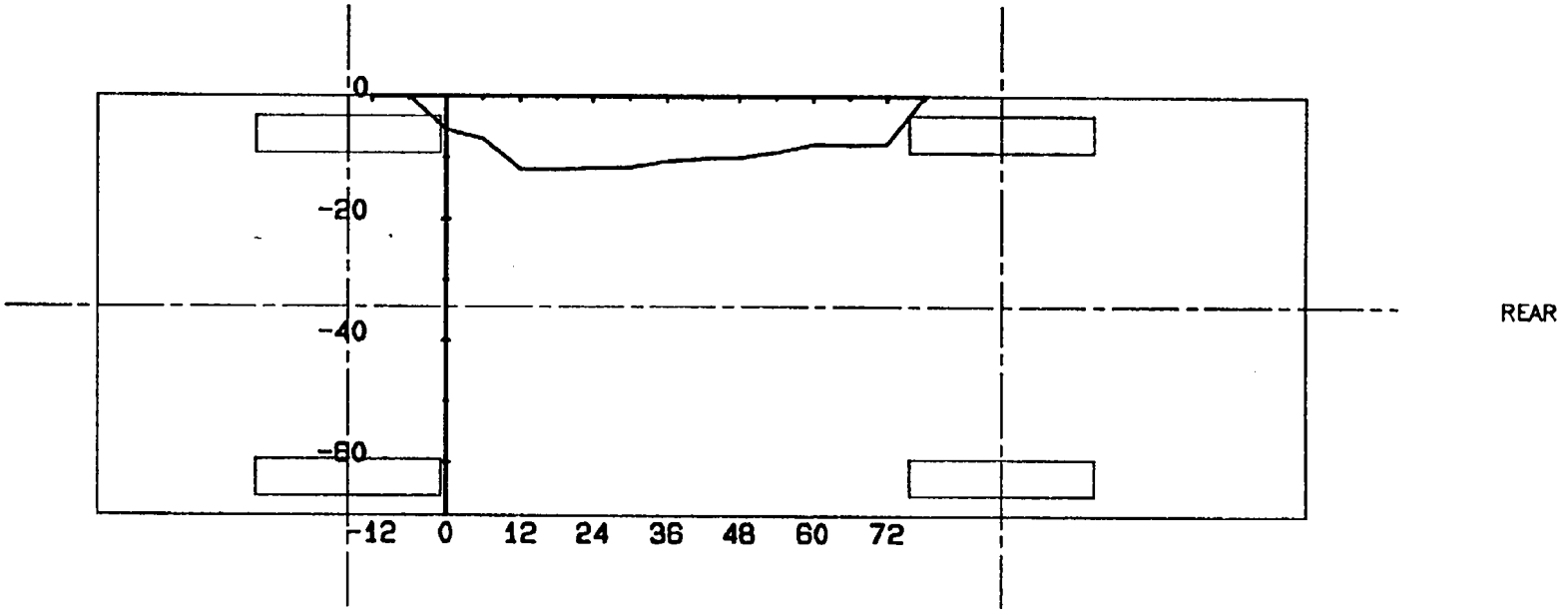
ZERO DISTANCE AT PROJECTED IMPACT POINT*

| LOCATION | HEIGHT (in) | 78 | 72 | 66 | 60 | 54 | 48 | 42 | 36 | 30 | 24 | 18 | 12 | 6 | 0 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**) | | | | | | | | | | | | | | | | |
| Axle Height | 12.0 | X | 17.7 | 17.5 | 17.4 | 17.2 | 17.2 | 17.1 | 17.1 | 17.0 | 16.9 | 16.9 | 16.9 | 16.8 | 16.7 | X |
| H-Point | 22.2 | 12.9 | 13.6 | 13.5 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.5 | 13.6 | 13.6 | 13.7 | 13.6 | X |
| Window Sill | 36.4 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 15.9 | 15.9 | 16.0 | 16.1 | 16.1 | 16.1 | 16.2 | 16.2 | 16.5 | 16.8 |
| Window Top | 53.6 | 24.2 | 24.1 | 24.1 | 24.0 | 24.0 | 24.0 | 24.1 | 24.1 | 24.4 | X | X | X | X | X | X |
| POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**) | | | | | | | | | | | | | | | | |
| Axle Height | 12.0 | X | 25.5 | 25.4 | 25.2 | 26.2 | 27.1 | 27.2 | 27.7 | 28.5 | 28.6 | 28.8 | 28.8 | 23.7 | 22.1 | X |
| H-Point | 22.2 | 22.5 | 29.4 | 30.4 | 30.7 | 30.9 | 31.1 | 29.6 | 29.2 | 29.2 | 28.9 | 28.6 | 27.9 | 22.5 | 20.5 | X |
| Window Sill | 36.4 | 21.5 | 24.4 | 27.8 | 27.9 | 28.2 | 27.4 | 26.6 | 26.5 | 26.5 | 26.2 | 26.0 | 24.2 | 20.6 | 20.4 | 20.2 |
| Window Top | 53.6 | 27.6 | 27.8 | 28.1 | 28.4 | 28.8 | 29.1 | 29.0 | 29.0 | 29.1 | X | X | X | X | X | X |
| STATIC CRUSH (IN) | | | | | | | | | | | | | | | | |
| Axle Height | 12.0 | X | 7.8 | 7.9 | 7.8 | 9.0 | 9.9 | 10.1 | 10.6 | 11.5 | 11.7 | 11.9 | 11.9 | 6.9 | 5.4 | X |
| H-Point | 22.2 | 9.6 | 15.8 | 16.9 | 17.3 | 17.5 | 17.7 | 16.2 | 15.8 | 15.8 | 15.4 | 15.0 | 14.3 | 8.8 | 6.9 | X |
| Window Sill | 36.4 | 5.5 | 8.4 | 11.8 | 11.9 | 12.2 | 11.5 | 10.7 | 10.5 | 10.4 | 10.1 | 9.9 | 8.0 | 4.4 | 3.9 | 3.4 |
| Window Top | 53.6 | 3.4 | 3.7 | 4.0 | 4.4 | 4.8 | 5.1 | 4.9 | 4.9 | 4.7 | X | X | X | X | X | X |

* Projected impact point is 37 inches forward of passenger side wheelbase midpoint. Column readings are rear to front from left to right.

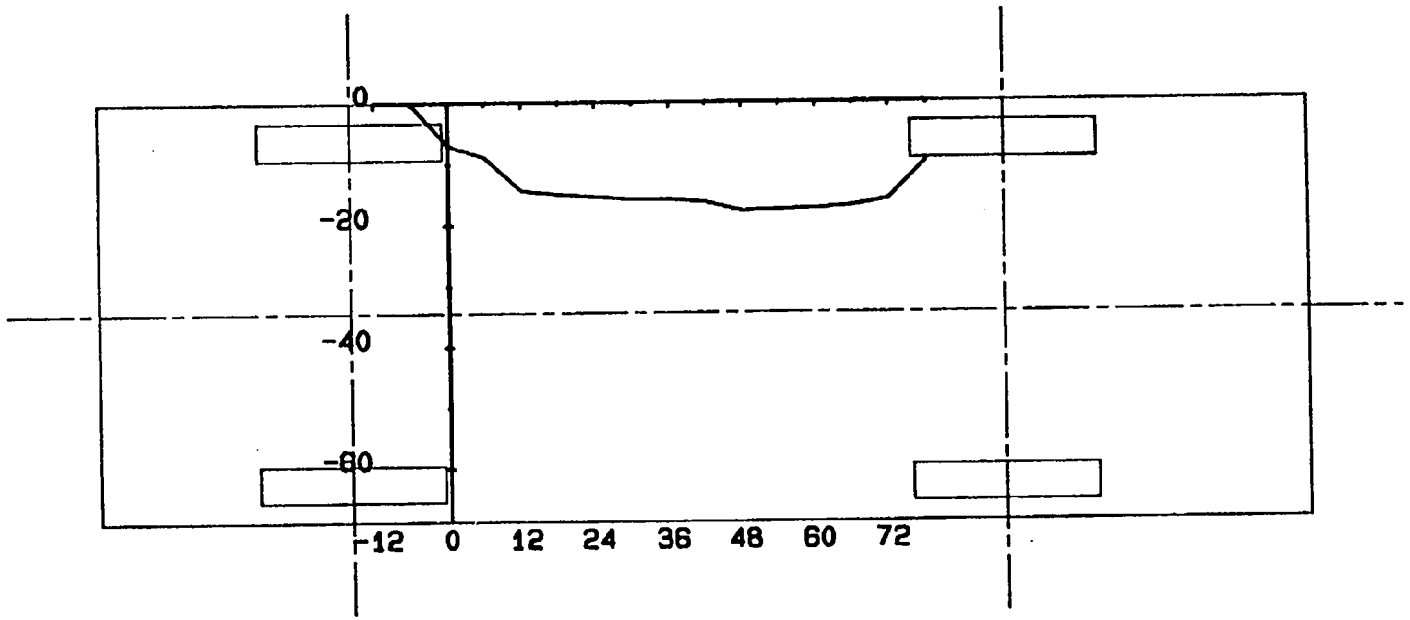
** Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

# VEHICLE EXTERIOR STATIC CRUSH PROFILE



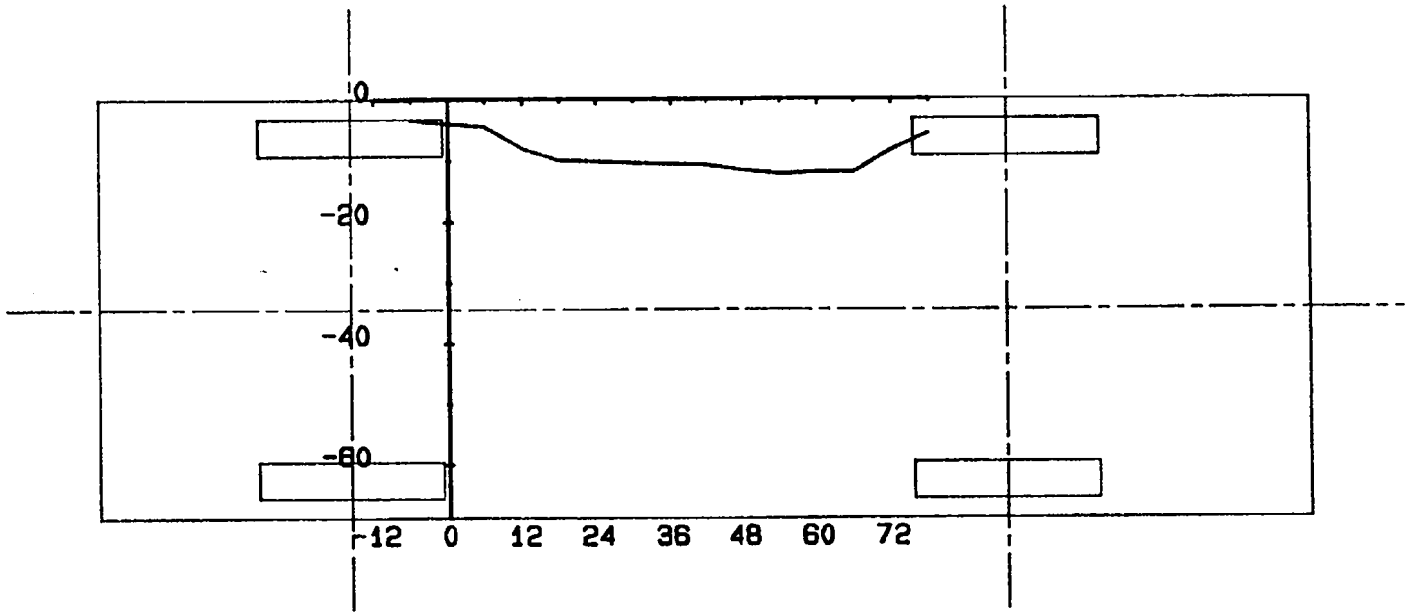

PROFILE LEVEL EQUALS AXLE HEIGHT WHICH IS 12.0 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.033

# VEHICLE EXTERIOR STATIC CRUSH PROFILE



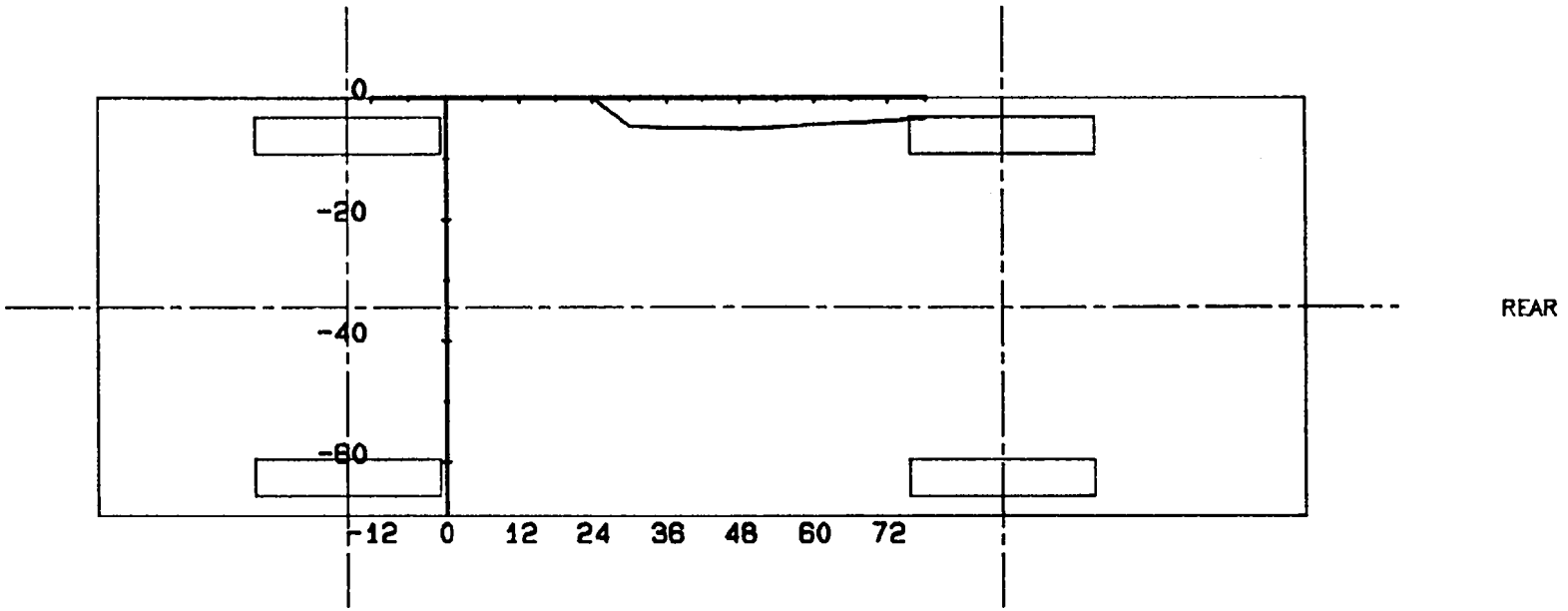

PROFILE LEVEL EQUALS H-POINT HEIGHT WHICH IS 22.2 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.033

# VEHICLE EXTERIOR STATIC CRUSH PROFILE



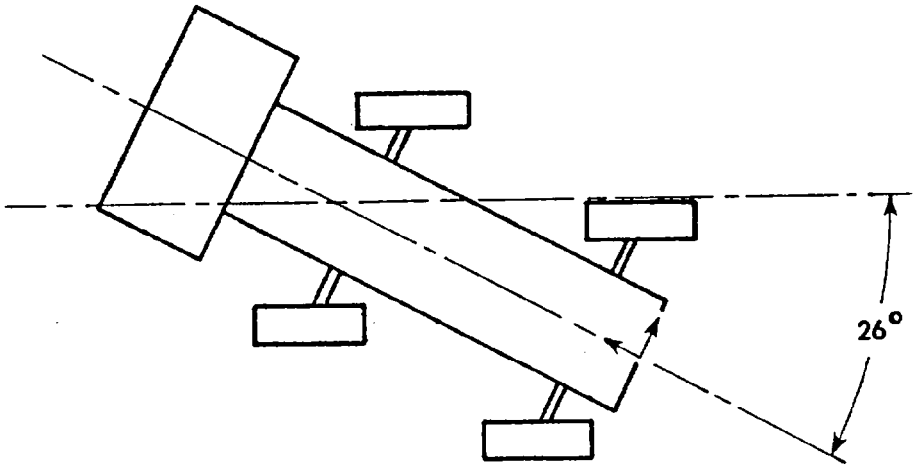

PROFILE LEVEL EQUALS WINDOW SILL HEIGHT WHICH IS 36.4 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.033

# VEHICLE EXTERIOR STATIC CRUSH PROFILE




PROFILE LEVEL EQUALS WINDOW TOP HEIGHT WHICH IS 53.6 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.033

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY




| NO. | LOCATION | X* | Y* | Z* | POSITIVE DIRECTION MAX (g) | POSITIVE DIRECTION TIME (msec) | NEGATIVE DIRECTION MAX (g) | NEGATIVE DIRECTION TIME (msec) |
|---|---|---|---|---|---|---|---|---|
| 1 | CENTER OF GRAVITY | 73.0 | 0.9 | 11.9 | | | | |
| | (LONGITUDINAL) | ΔV = -18.1 mph @ 120.75 msec | | | 0.92 | 174.75 | 15.37 | 33.63 |
| | (LATERAL) | ΔV = 3.5 mph @ 120.75 msec | | | 6.83 | 30.88 | 1.21 | 69.63 |
| | (VERTICAL) | | | | --- | ---γ | --- | ---γ |
| | (RESULTANT) | | | | | 16.13 @ 33.25σ | | |
| 2 | REAR FRAME MEMBER | 18.5 | -19.2 | 11.9 | | | | |
| | (LONGITUDINAL) | ΔV = -14.2 mph @ 120.75 msec | | | 1.46 | 145.50 | 11.24 | 42.75 |
| | (LATERAL) | ΔV = -0.9 mph @ 120.75 msec | | | 2.25 | 98.63 | 4.07 | 22.38 |

* Reference: X - Rear Most Point of Frame (+ To Forward), Y - Barrier Centerline (+ To Right), Z - Ground Level (+ To Up)

| | | | |
|---|---|---|---|
| **LONGITUDINAL: | FORWARD | ***LONGITUDINAL: | REARWARD |
| LATERAL: | RIGHTWARD | LATERAL: | LEFTWARD |
| VERTICAL: | DOWNWARD | VERTICAL: | UPWARD |

All measurements of accelerometer locations in inches.

γ See TEST ANOMALIES

σ The center of gravity resultant was calculated using X and Y axes.

## TEST ANOMALIES

Data was lost on the barrier center of gravity Z-axis accelerometer, BCGZG, after -50 msec due to transducer failure.

The actual impact point was 32.0 inches forward of the wheelbase midpoint rather than the intended 37.0 inches. The cause of anomaly is still under investigation at this time.

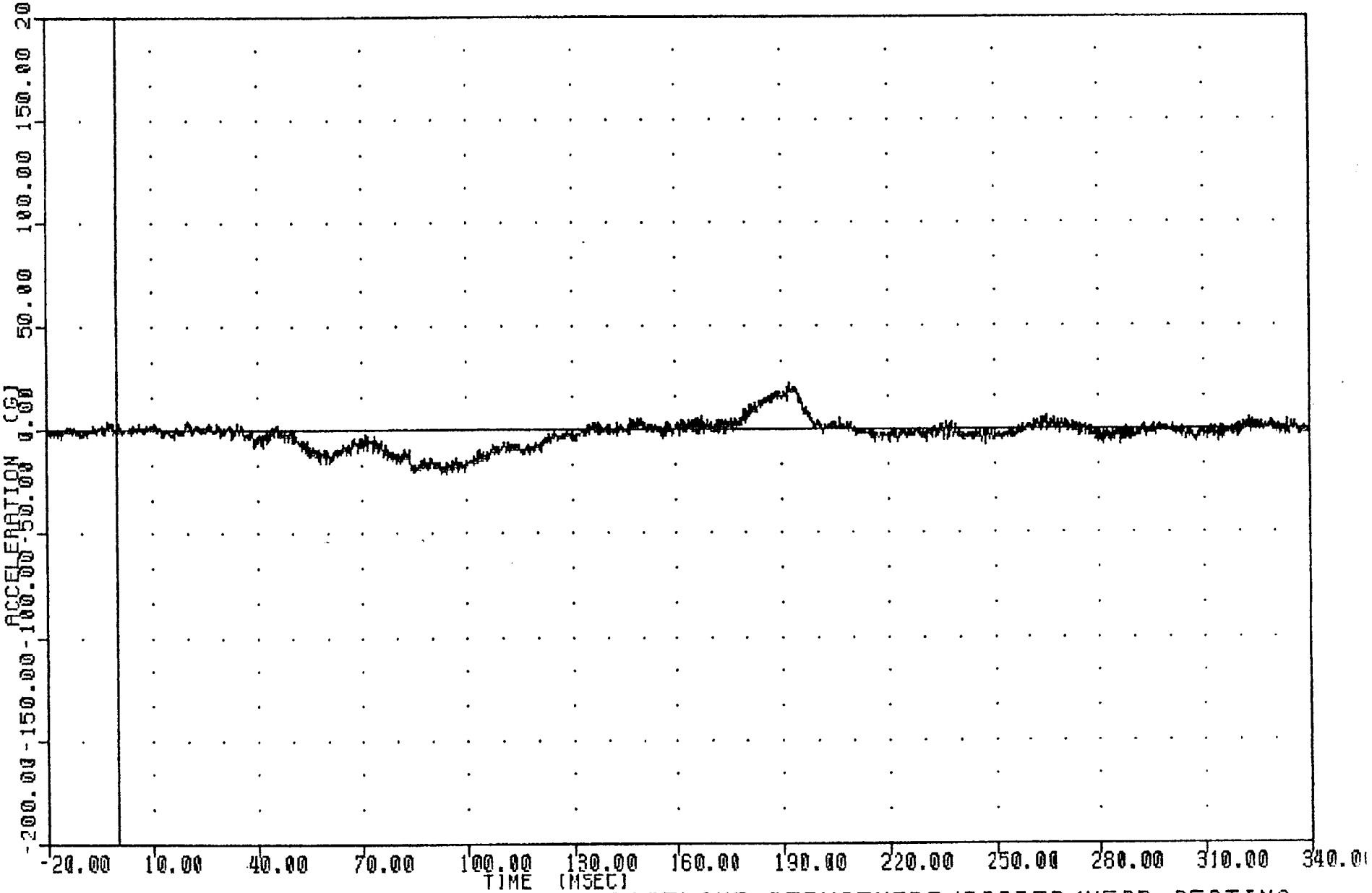
The ground level right side camera and the overhead wide camera both failed shortly after startup. The failures were caused by the film being broken in both cameras.

# APPENDIX A

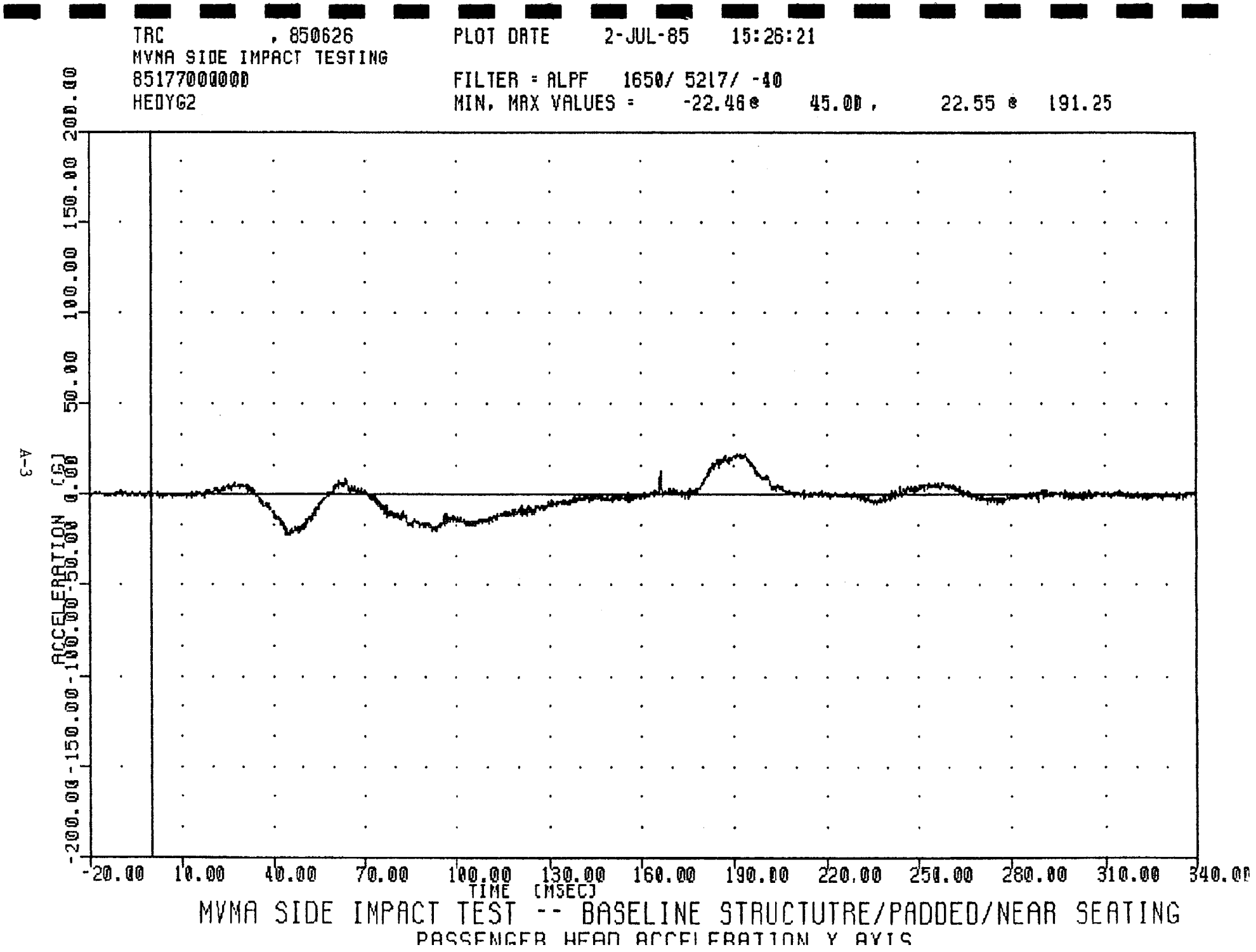
## DATA PLOTS

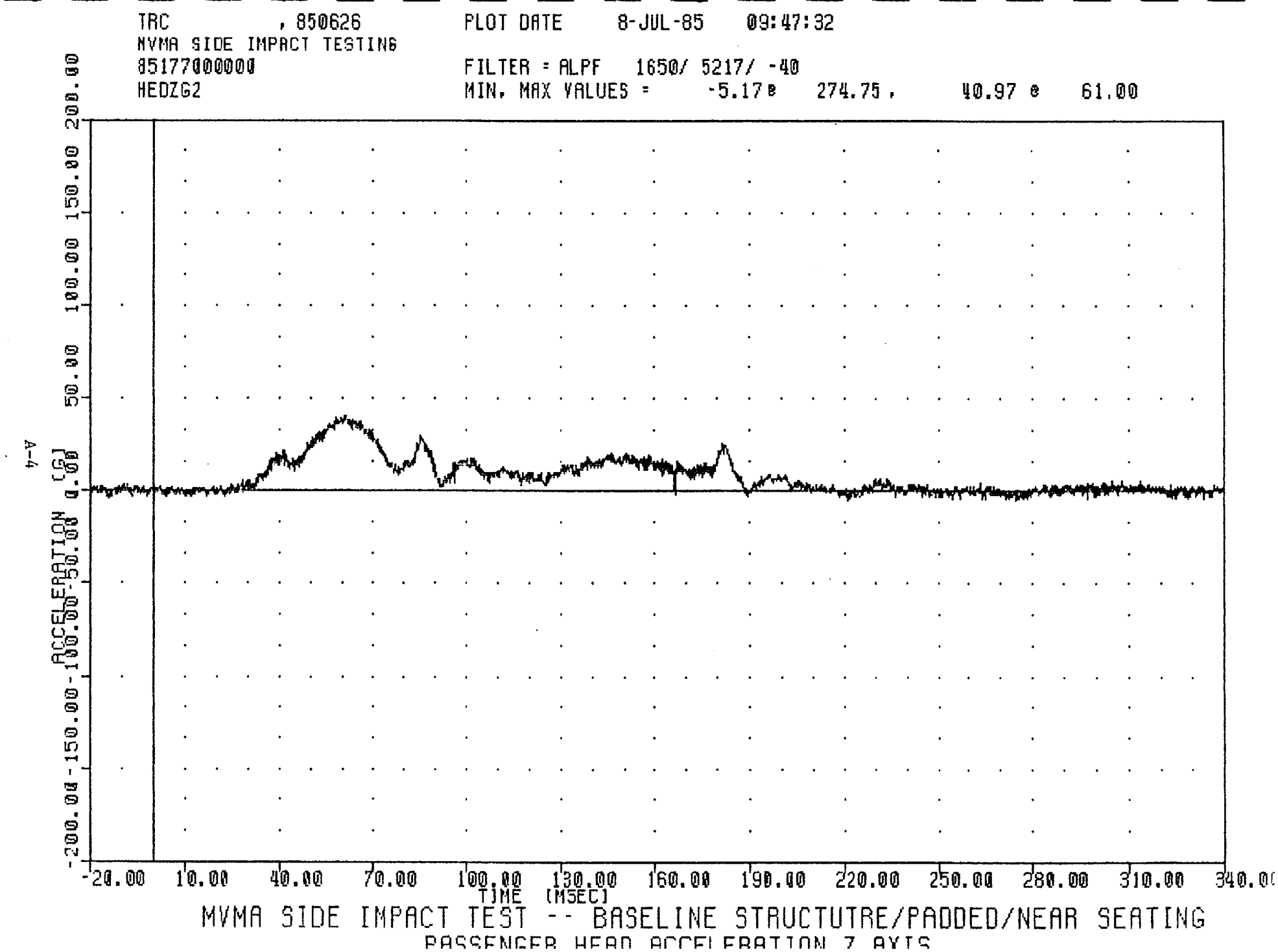
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211, except that dummy thorax data were filtered using the HSRI filter.

TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
85177000000 FILTER = ALPF 1650/ 5217/ -40
HEDXG2 MIN, MAX VALUES = -20.65 @ 92.63 , 22.32 @ 191.88

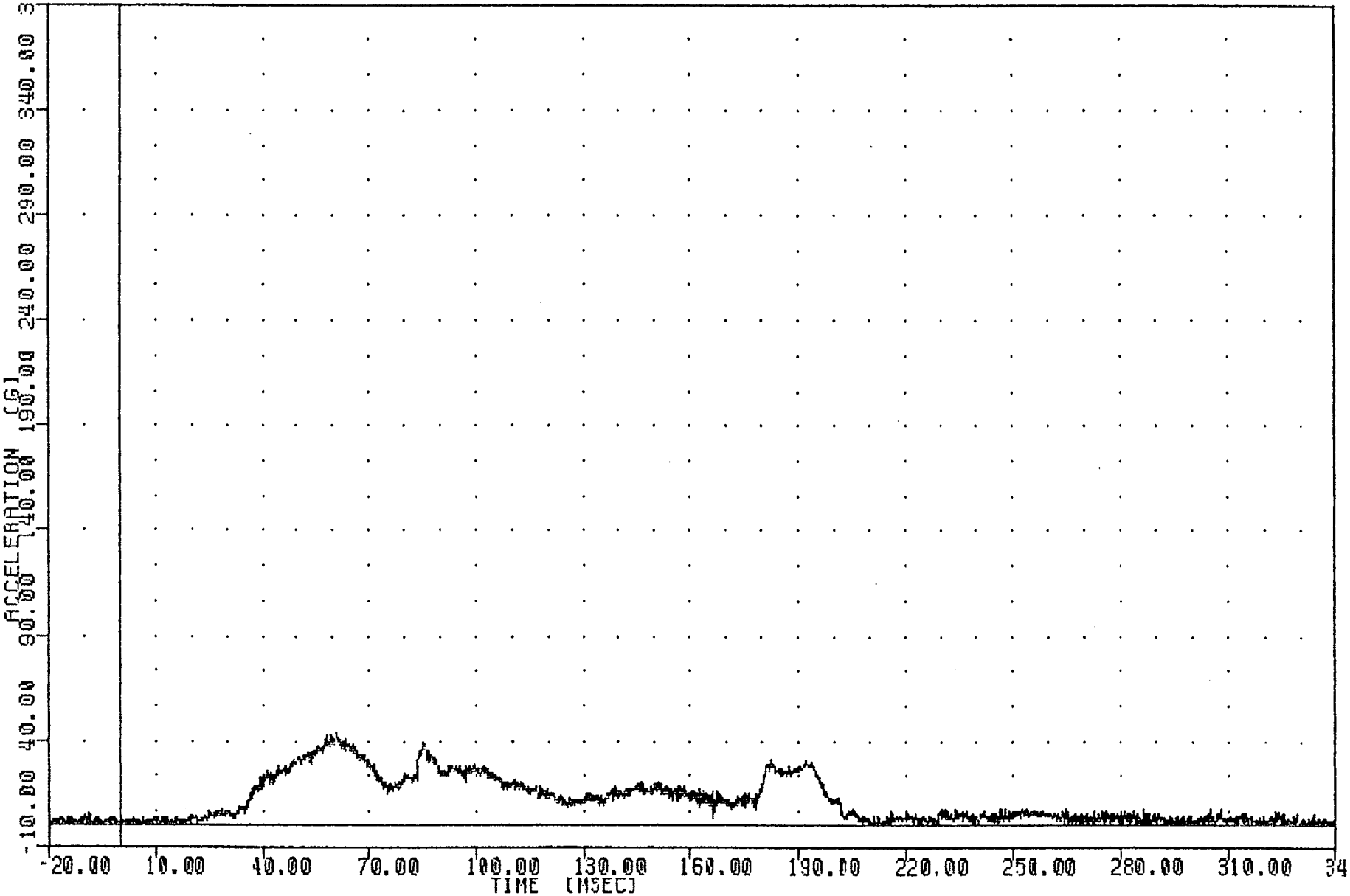



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER HEAD ACCELERATION X AXIS

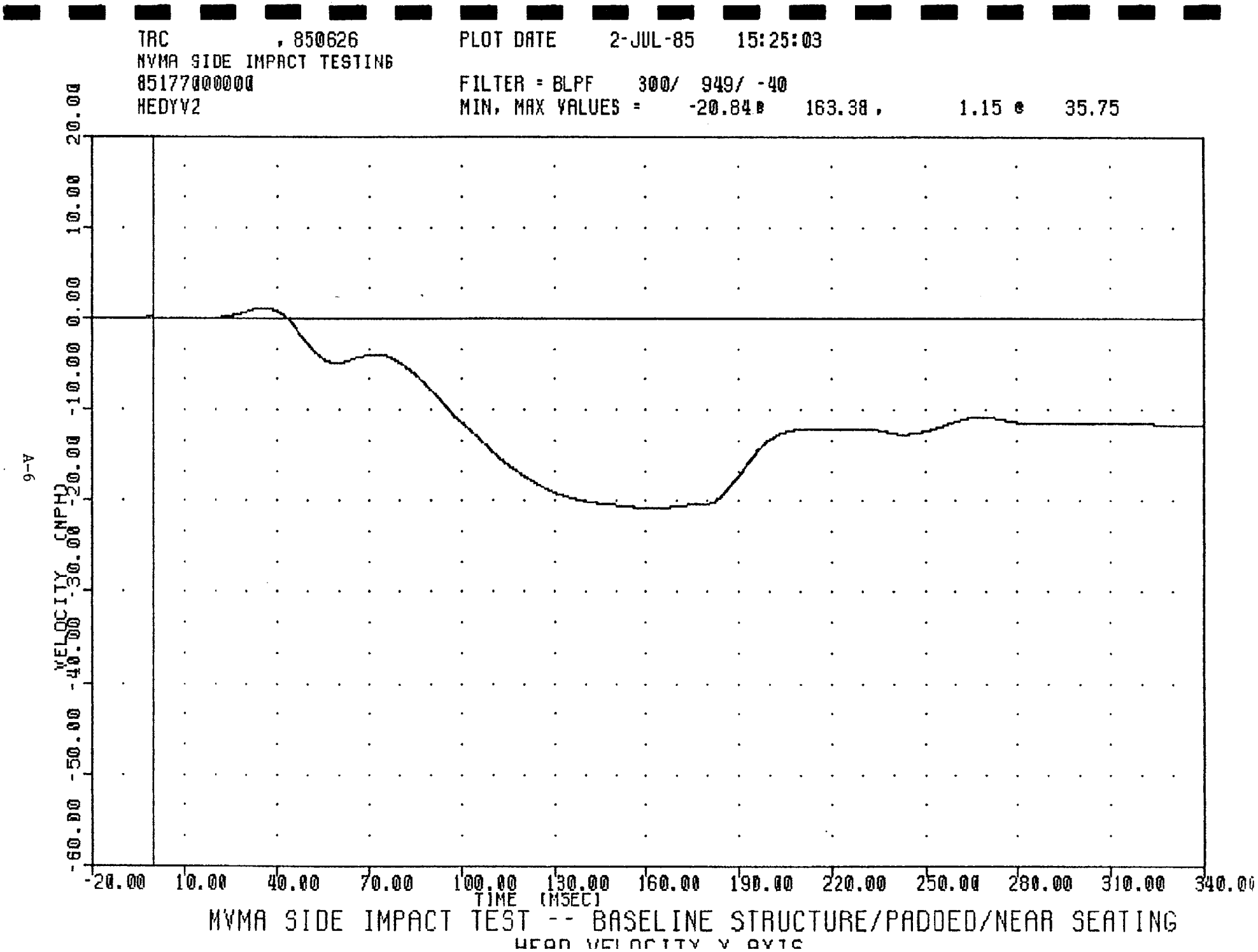

TRC , 850626
PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
8517700Q000D
FILTER = ALPF 1650/ 5217/ -40
HEDYG2
MIN, MAX VALUES = -22.46 @ 45.00 , 22.55 @ 191.25
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER HEAD ACCELERATION Y AXIS

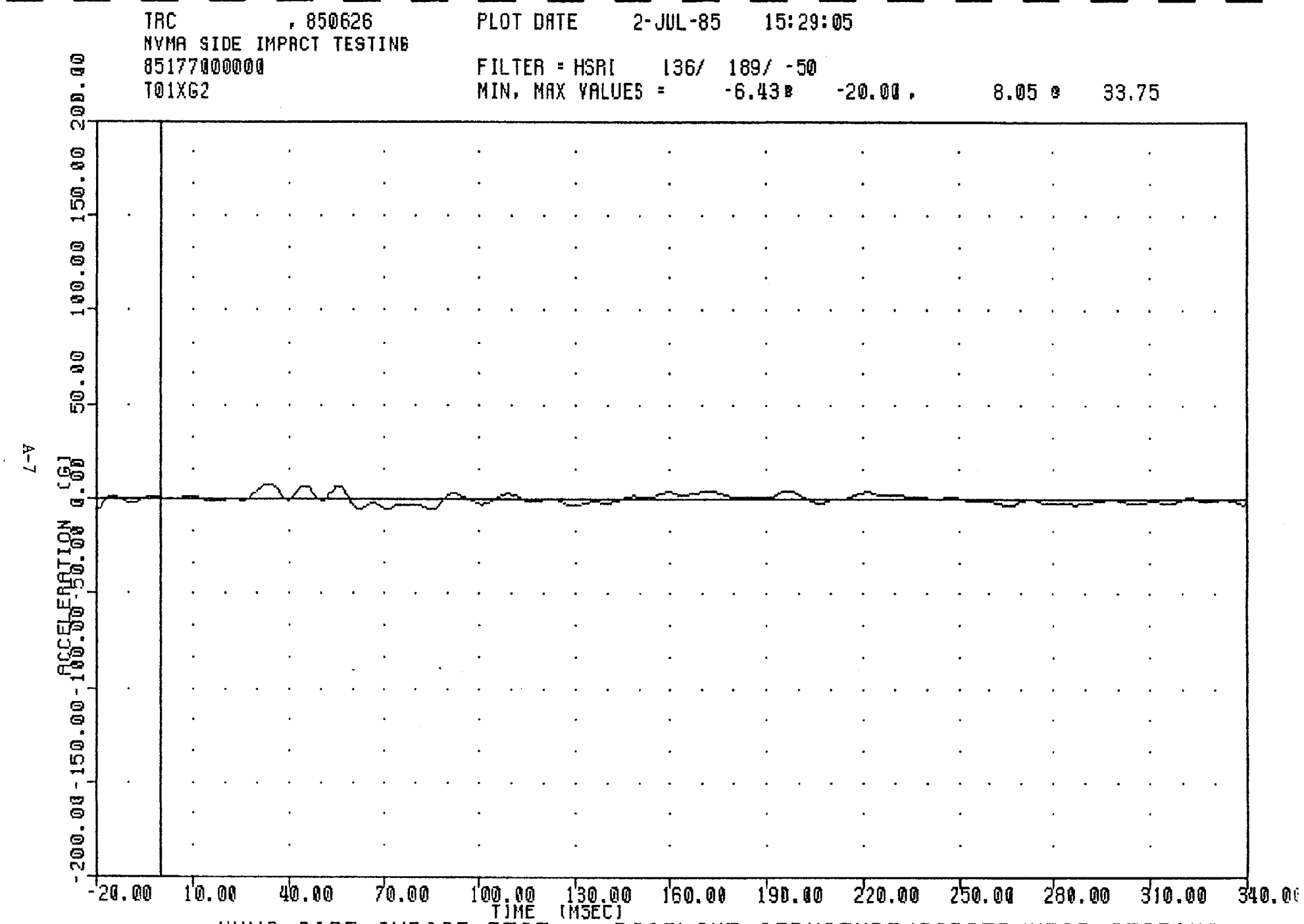

TRC , 850626
PLOT DATE 8-JUL-85 09:47:32
MVMA SIDE IMPACT TESTING
85177000000
FILTER = ALPF 1650/ 5217/ -40
HEDZG2
MIN, MAX VALUES = -5.17 @ 274.75 , 40.97 @ 61.00
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION [G]
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER HEAD ACCELERATION Z AXIS

TRC , 850626 PLOT DATE 8-JUL-85 09:10:58
MVMA SIDE IMPACT TESTING
85177000000 FILTER = ALPF 1650/ 5217/ -40
HEDRG2 MIN, MAX VALUES = 0.14@ -13.25 , 43.95 @ 61.00

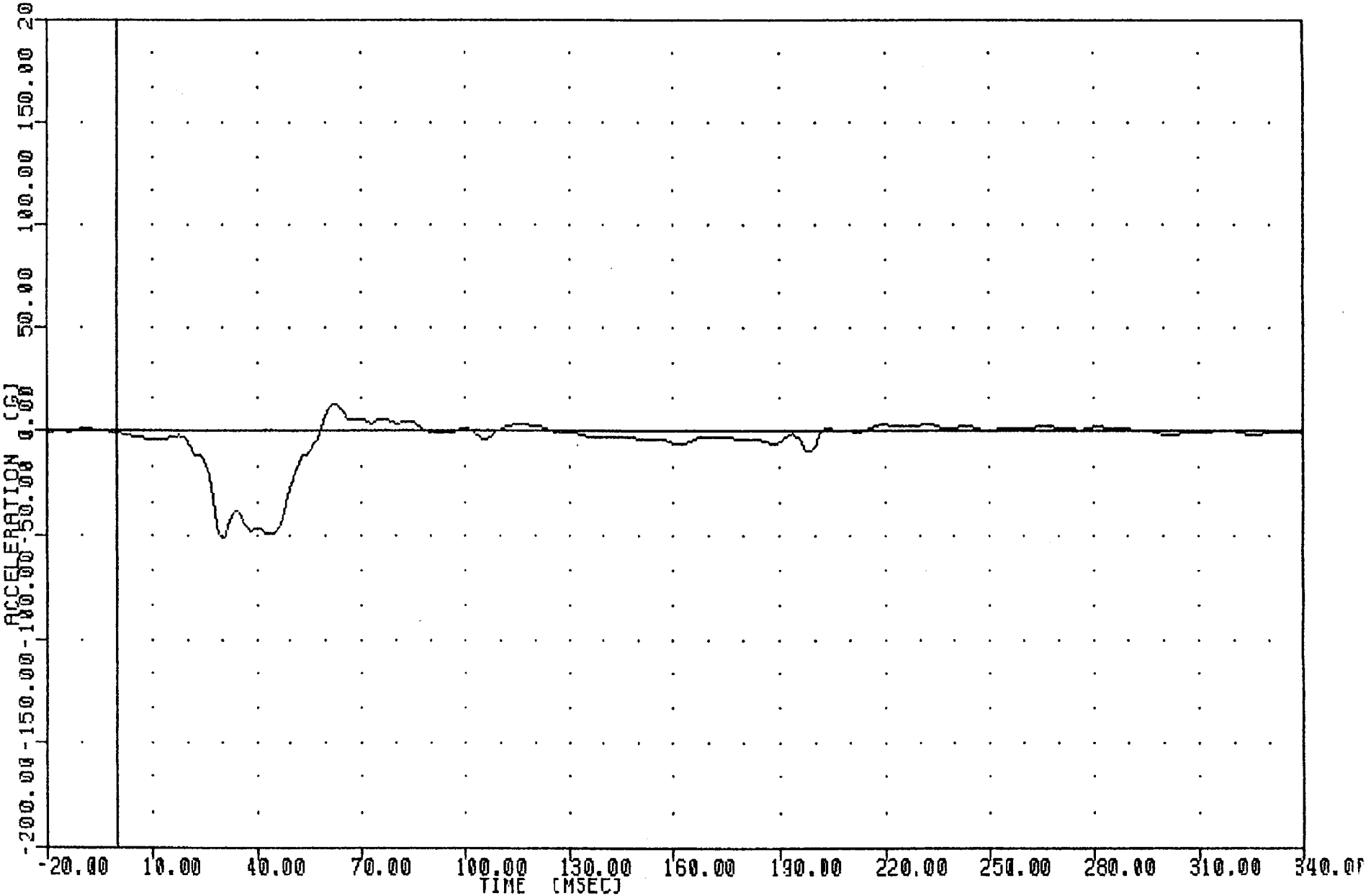



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER HEAD RESULTANT ACCELERATION

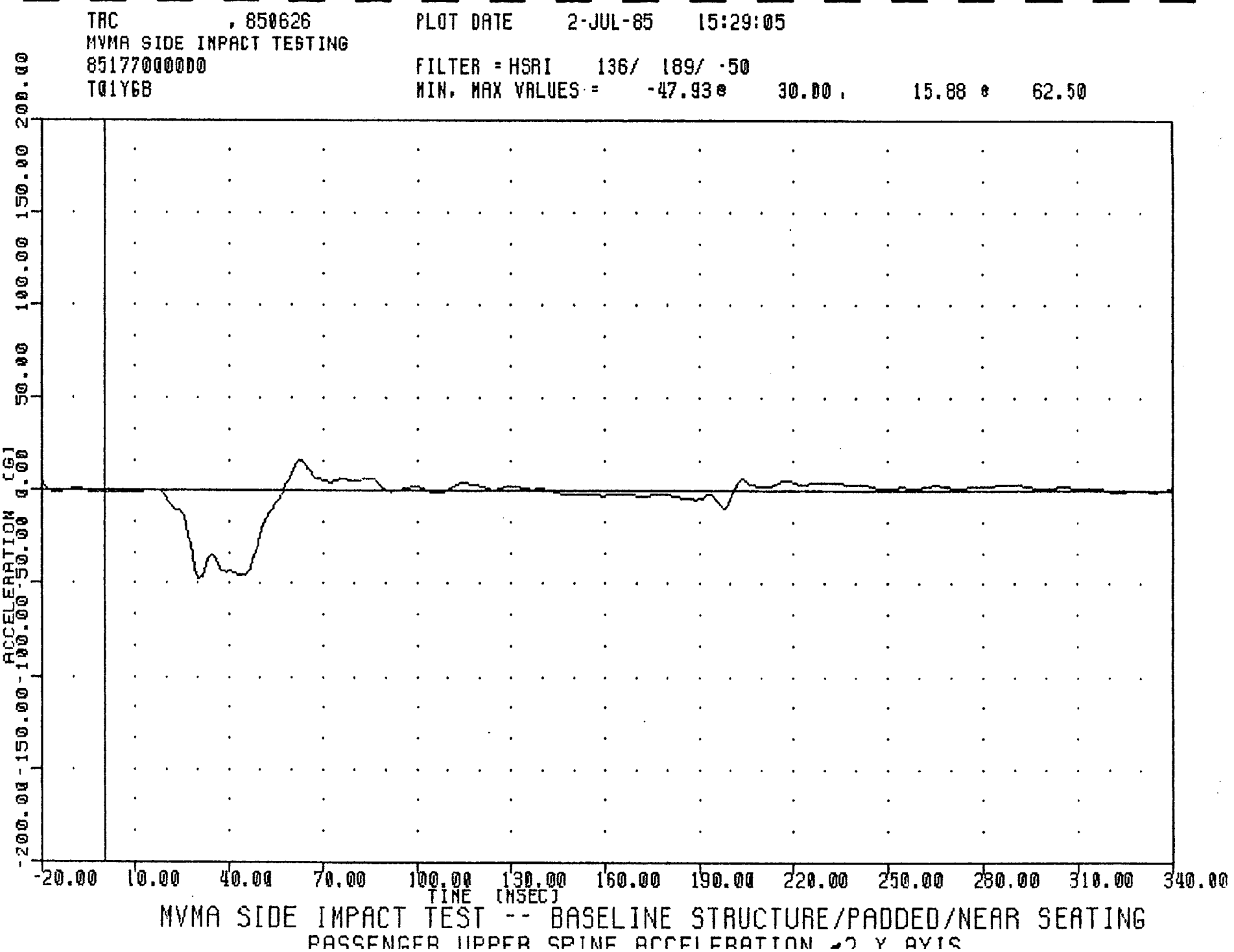

TRC , 850626
PLOT DATE 2-JUL-85 15:25:03
NVMA SIDE IMPACT TESTING
851770000000
FILTER = BLPF 300/ 949/ -40
HEDYV2
MIN, MAX VALUES = -20.84 @ 163.38 , 1.15 @ 35.75
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
VELOCITY (MPH)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
HEAD VELOCITY X AXIS


TRC , 850626
PLOT DATE 2-JUL-85 15:29:05
NVMA SIDE IMPACT TESTING
851770000000
FILTER = HSRI 136/ 189/ -50
T01XG2
MIN, MAX VALUES = -6.43 @ -20.00 , 8.05 @ 33.75
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER UPPER SPINE ACCELERATION Y AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000 FILTER : HSRI 136/ 189/ -50
T01YG2 MIN, MAX VALUES = -50.69 @ 30.00 , 13.45 @ 62.50



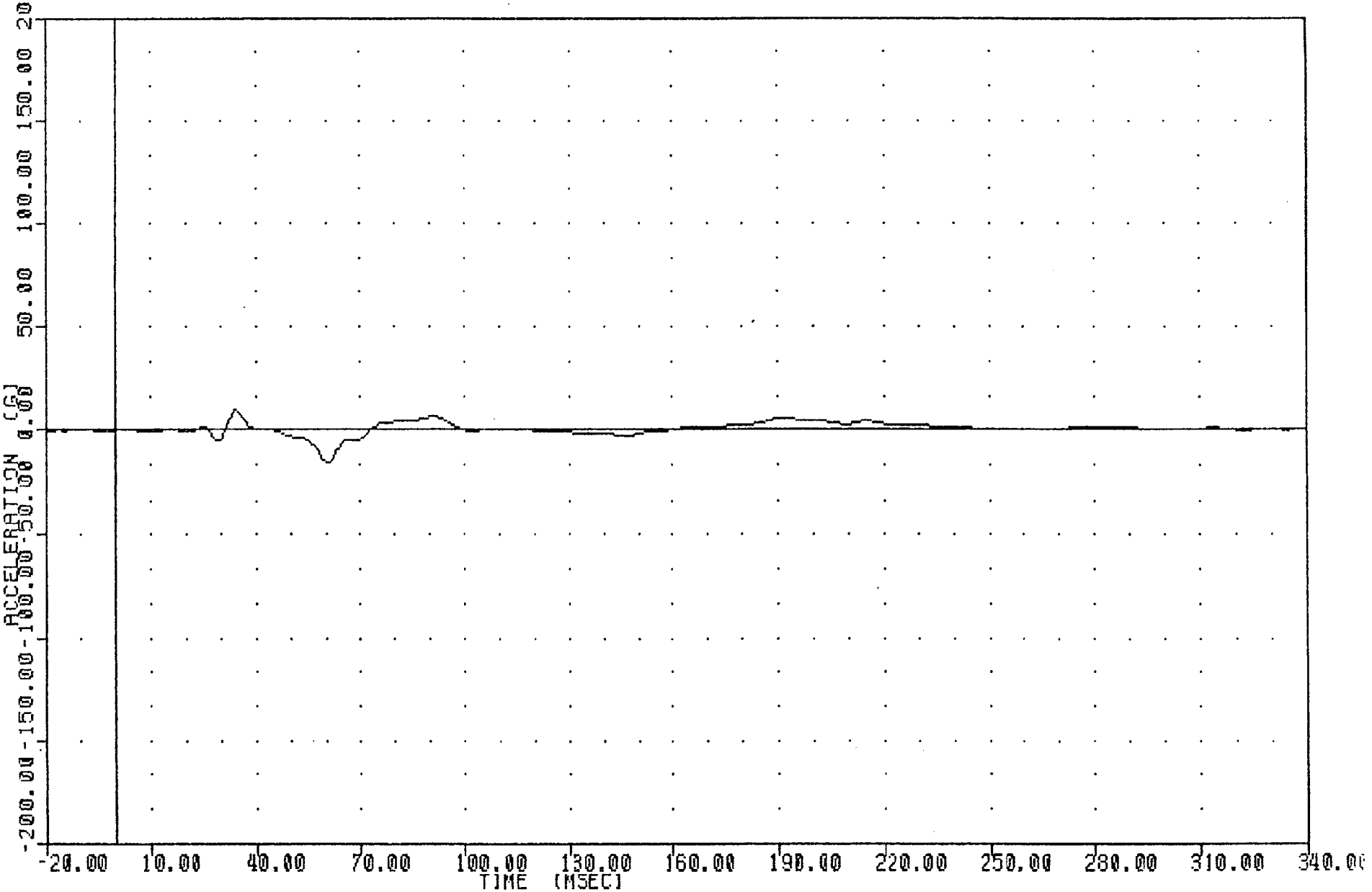

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER UPPER SPINE ACCELERATION X AXIS




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

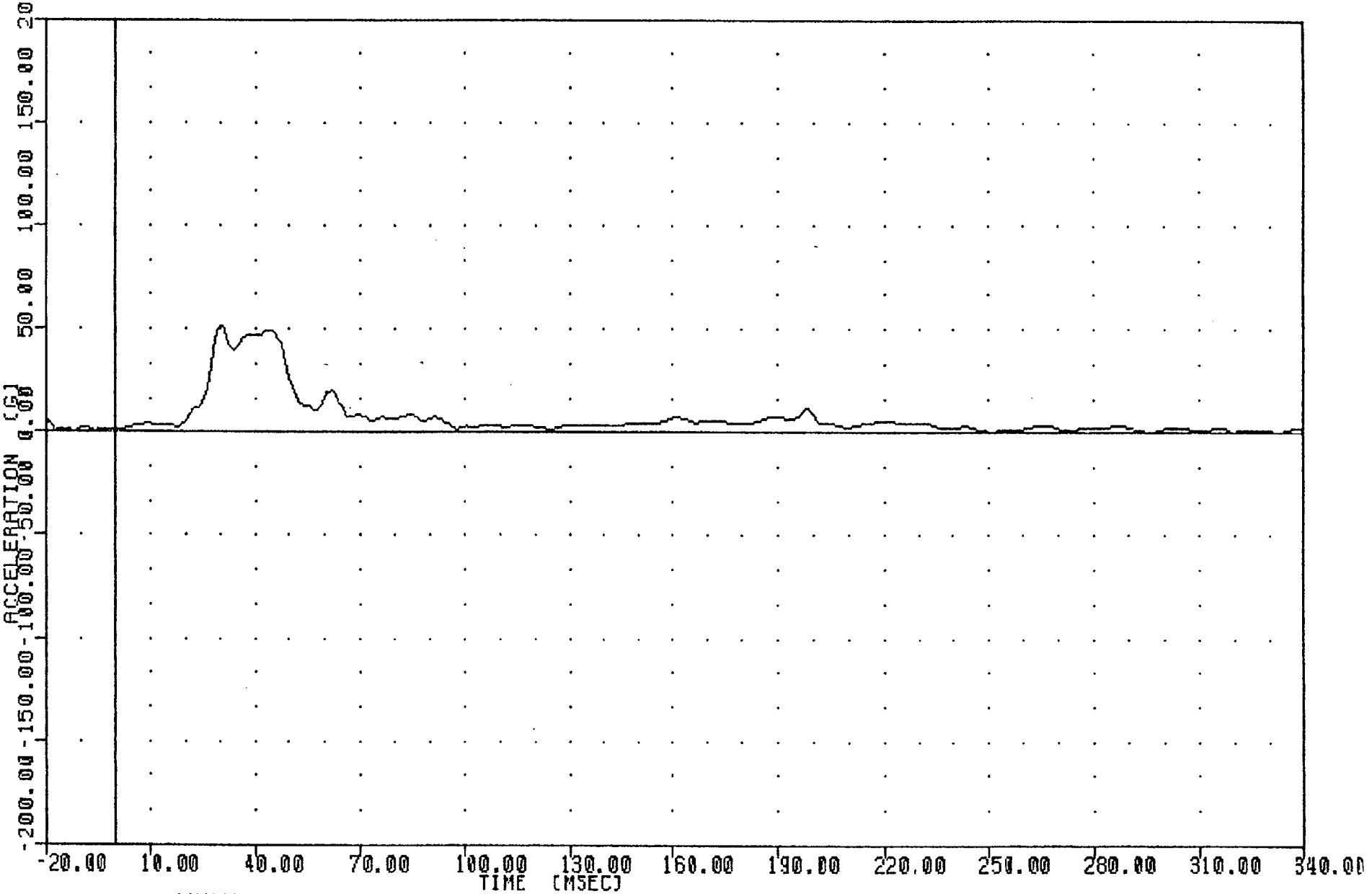
PASSENGER UPPER SPINE ACCELERATION -2 Y AXIS

TRC , 850626 PLOT DATE 8-JUL-85 09:10:25
NVMA SIDE IMPACT TESTING
85177000000 FILTER = HSRI 136/ 189/ -50
T01ZG2 MIN, MAX VALUES = -15.54 @ 60.62 , 9.64 @ 34.36

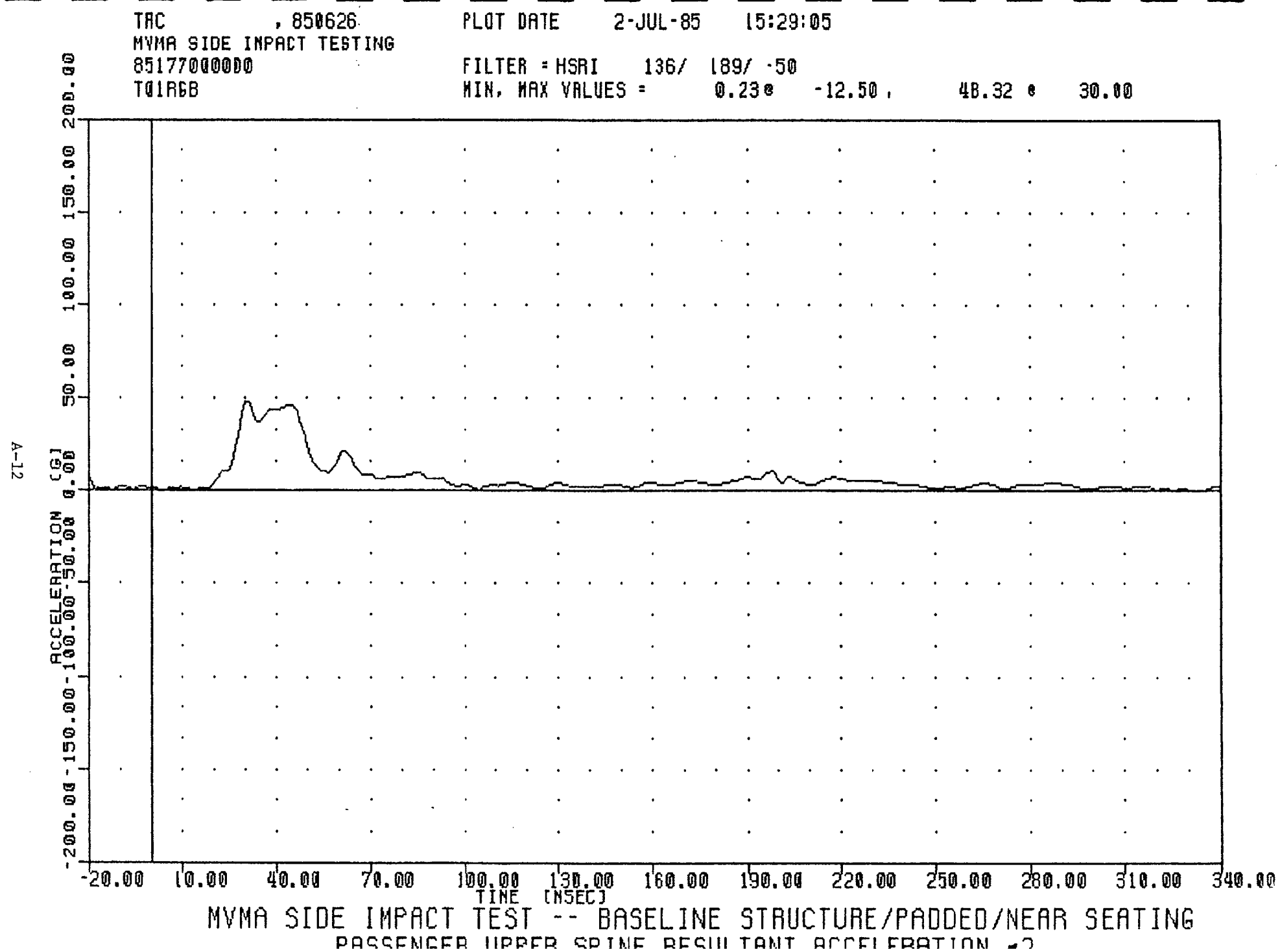



MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER UPPER SPINE ACCELERATION Z AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000 FILTER = HSRI 136/ 189/ -50
T01RG2 MIN, MAX VALUES = 0.25 @ -12.50 , 51.07 @ 30.00




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER UPPER SPINE RESULTANT ACCELERATION




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

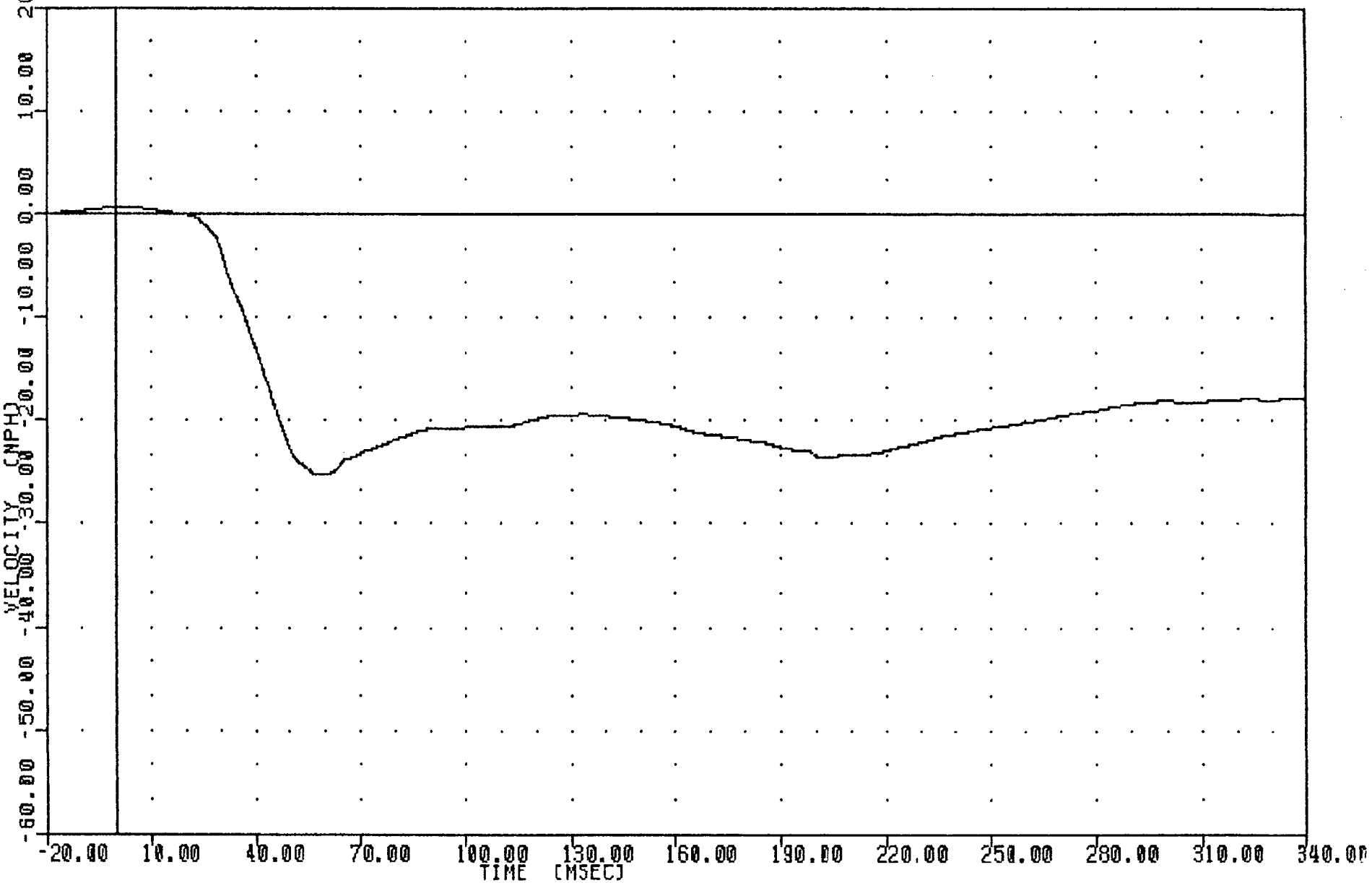
PASSENGER UPPER SPINE RESULTANT ACCELERATION #2

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03

MVMA SIDE IMPACT TESTING

8517700000D FILTER = BLPF 300/ 949/ -40

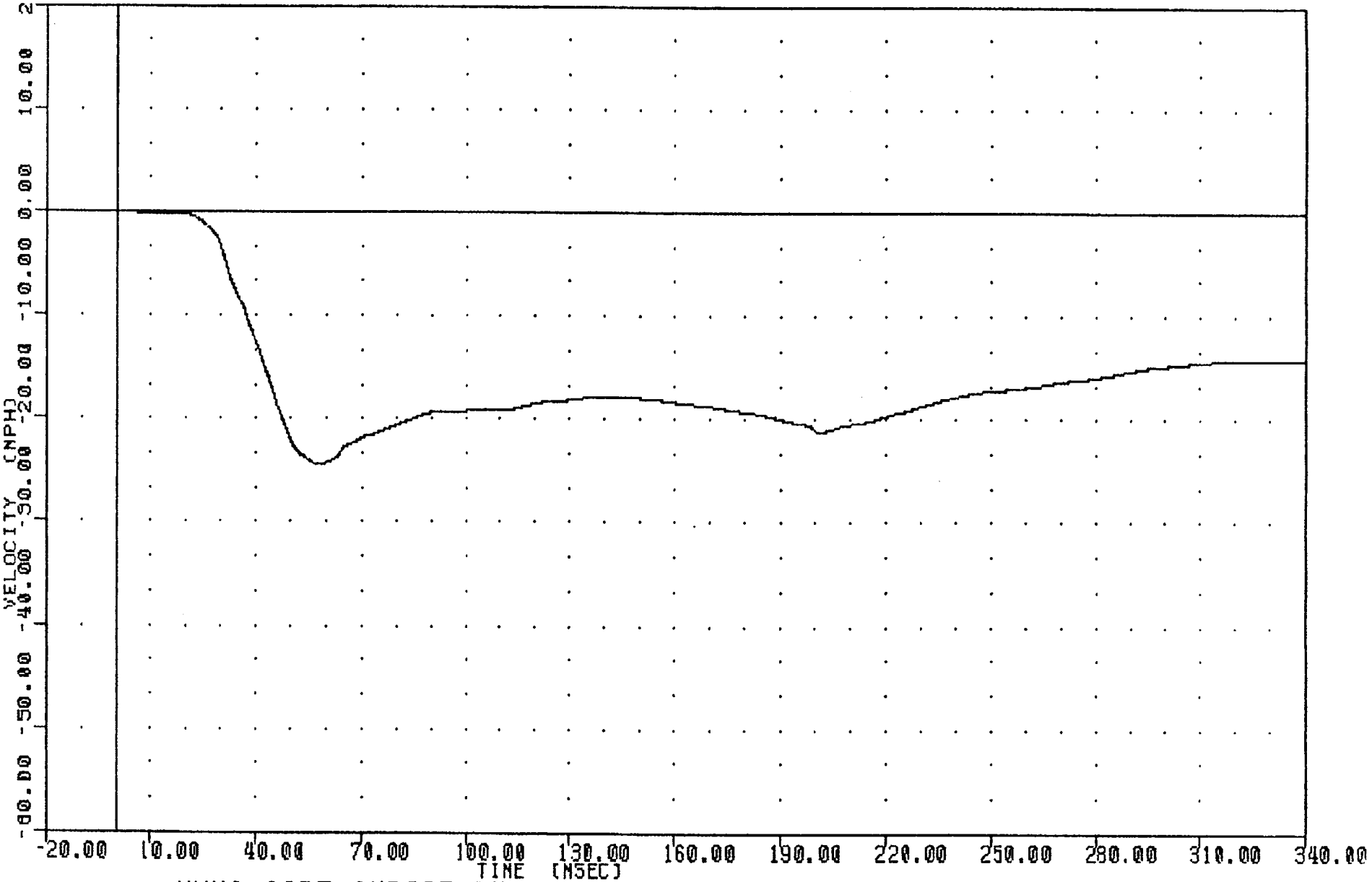
T01YV2 MIN, MRX VALUES = -25.35 @ 58.63 , 0.63 @ 2.25



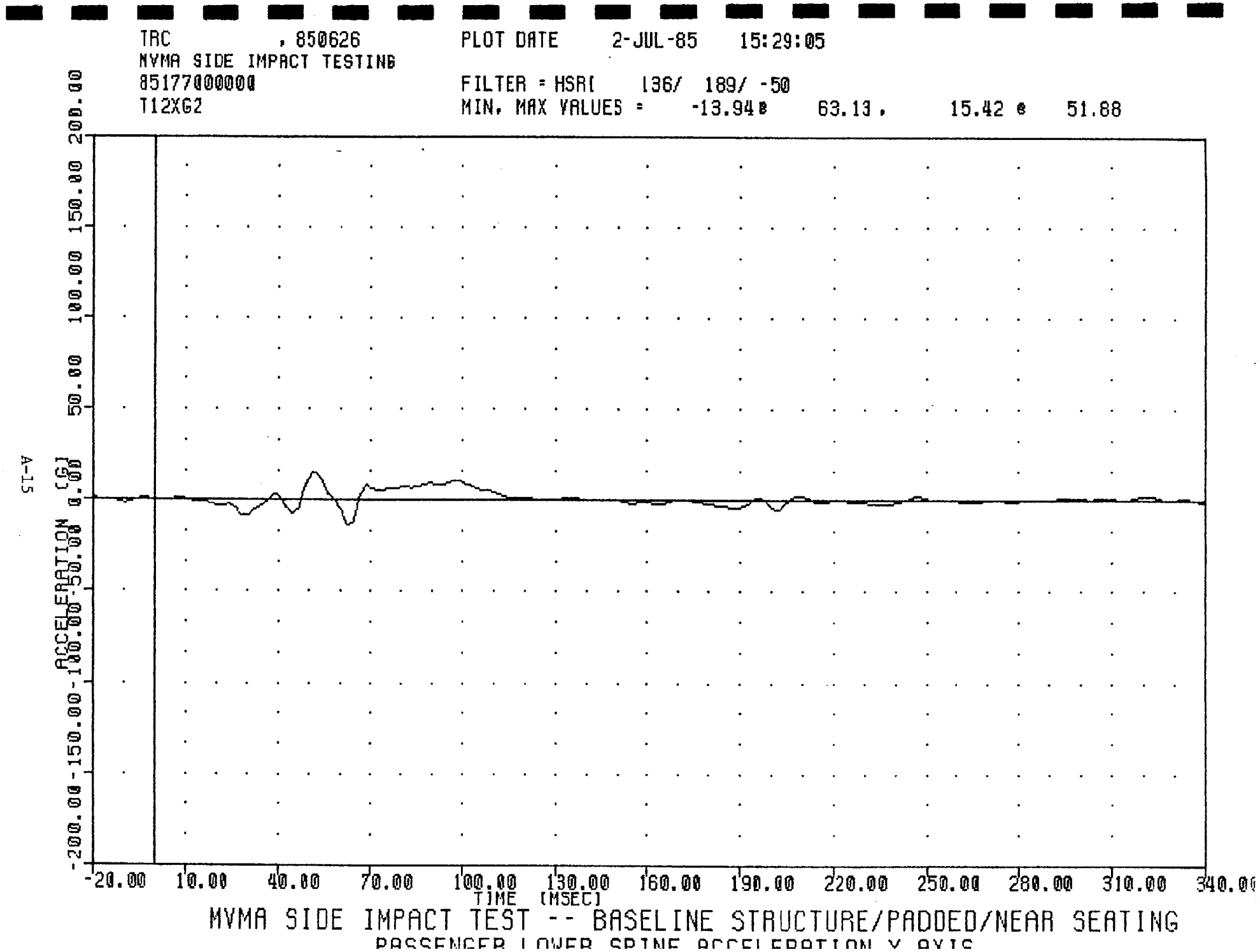

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

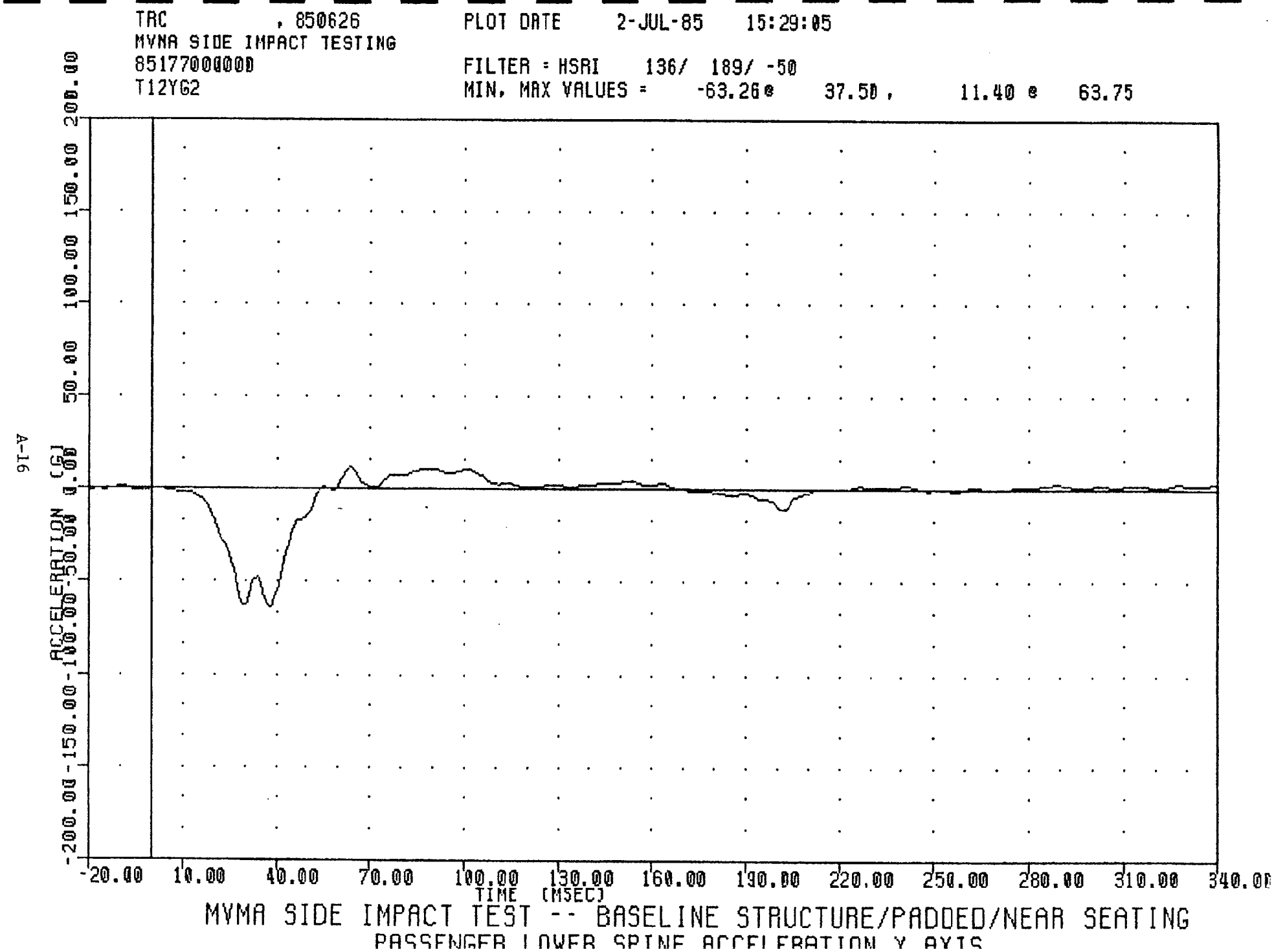
UPPER SPINE VELOCITY X AXIS

TAC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
T01YVB MIN, MAX VALUES = -24.46 @ 58.00 , 0.07 @ -4.63



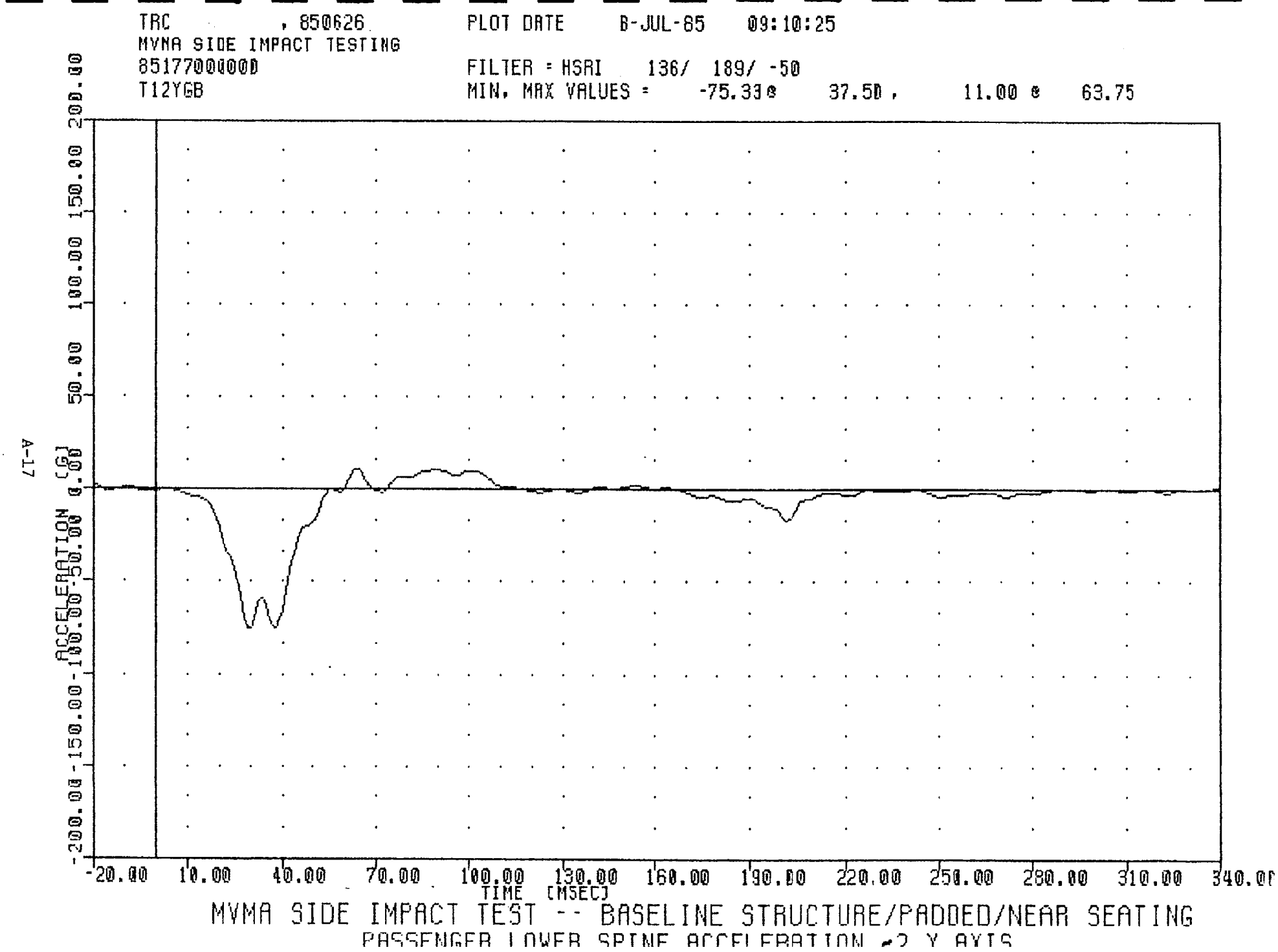

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
UPPER SPINE VELOCITY -2 Y AXIS

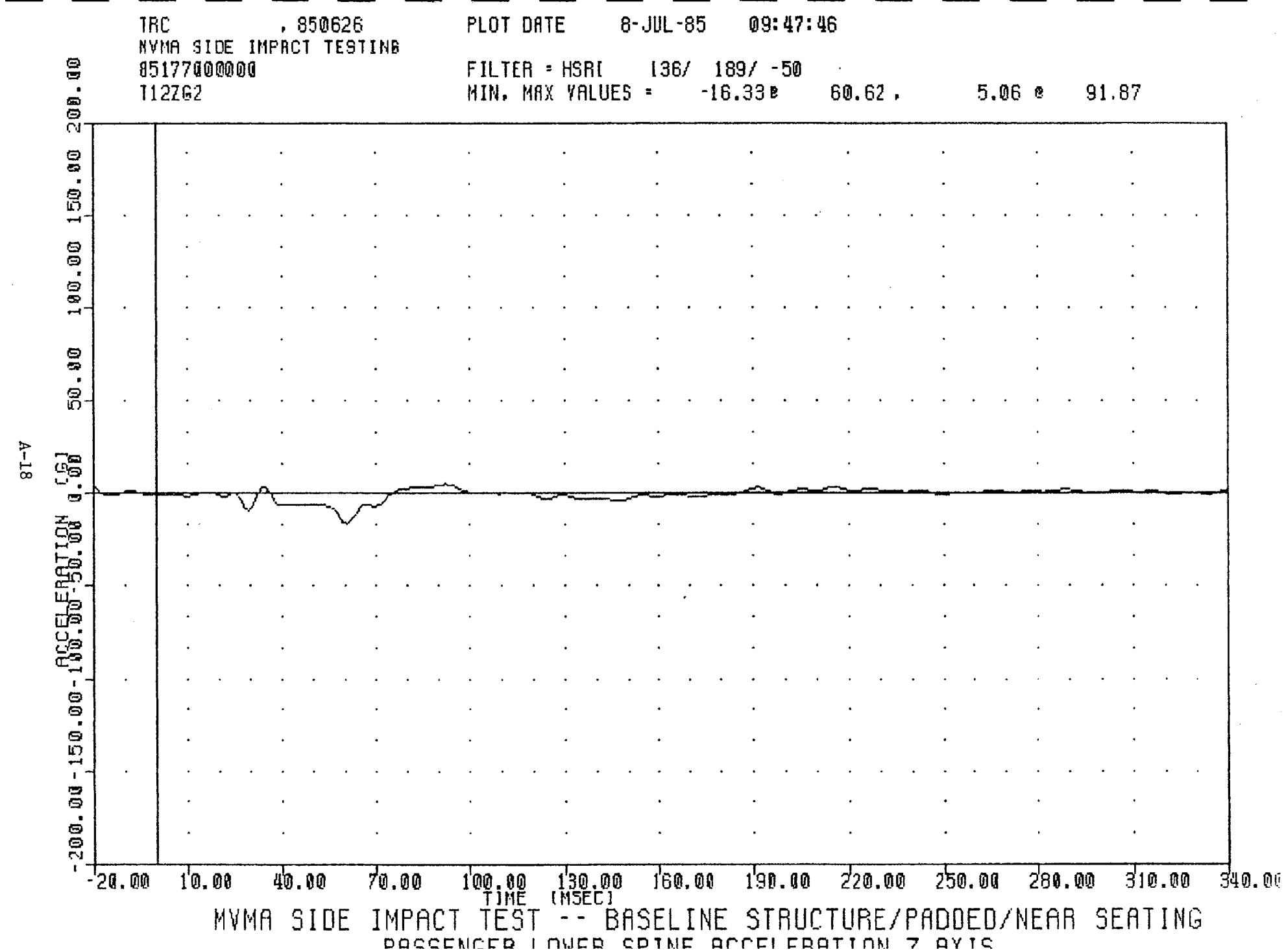

TRC , 850626
PLOT DATE 2-JUL-85 15:29:05
NVMA SIDE IMPACT TESTING
85177000000
FILTER = HSR( 136/ 189/ -50
T12XG2
MIN, MAX VALUES = -13.94 @ 63.13 , 15.42 @ 51.88
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER LOWER SPINE ACCELERATION X AXIS

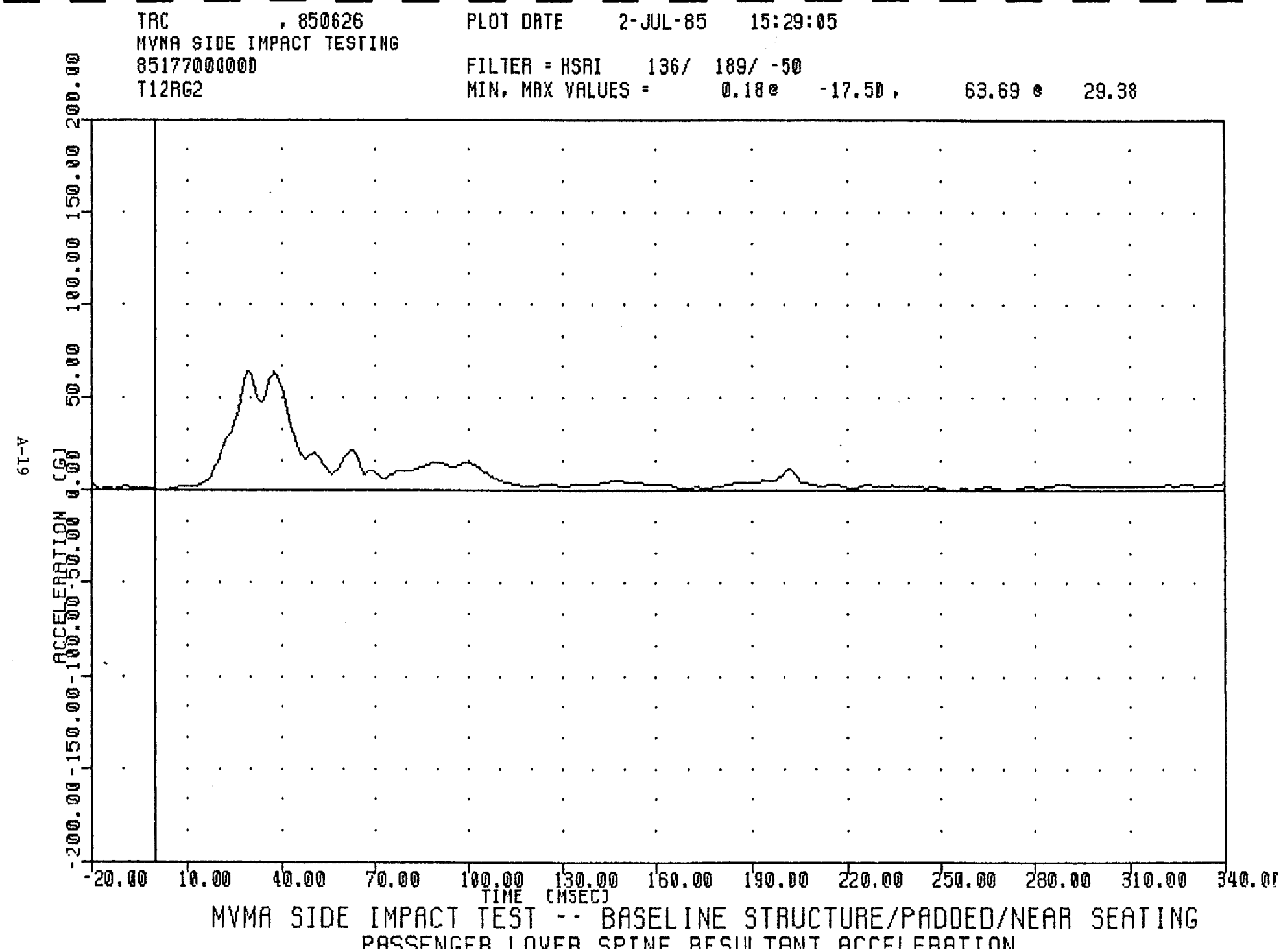


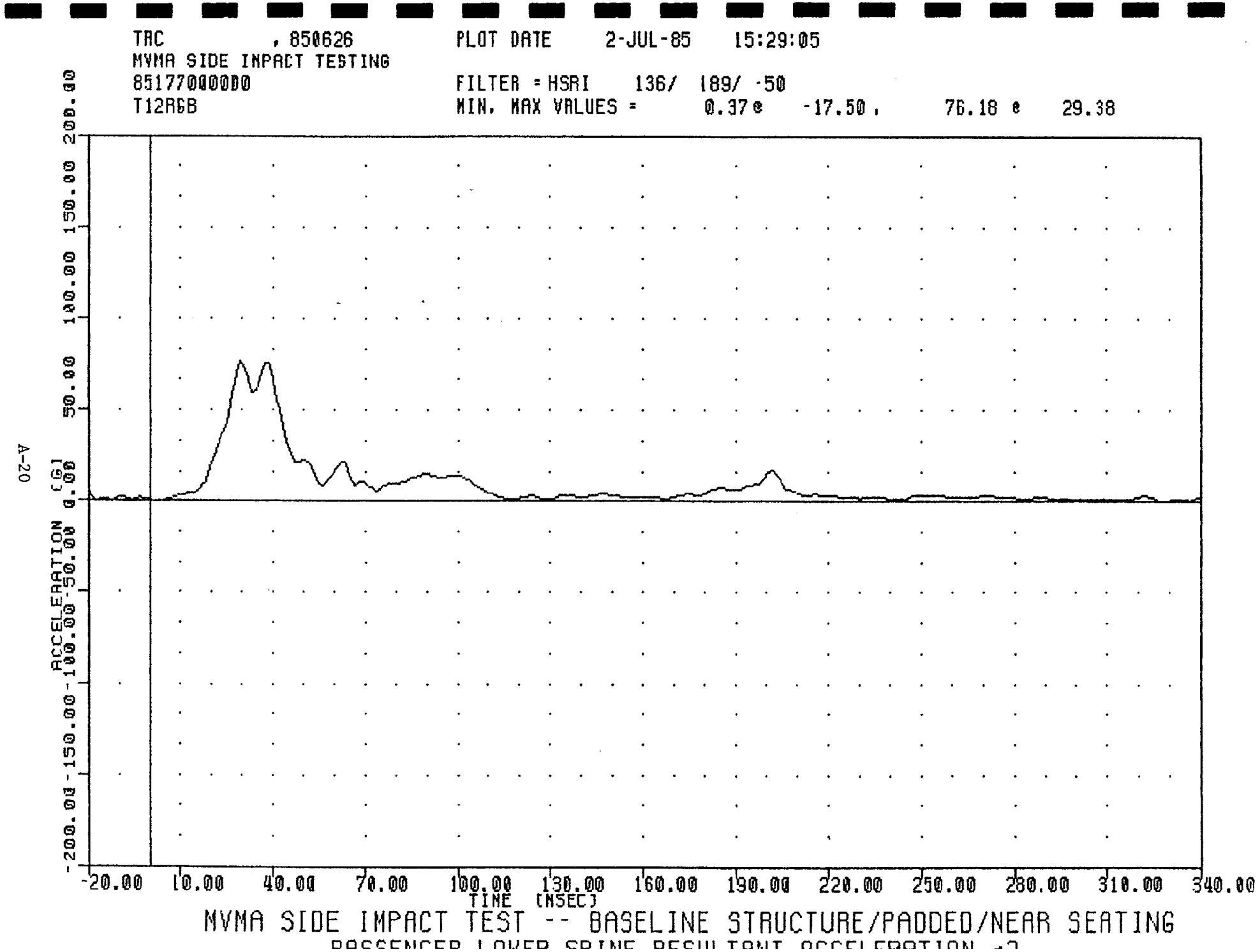

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

PASSENGER LOWER SPINE ACCELERATION Y AXIS

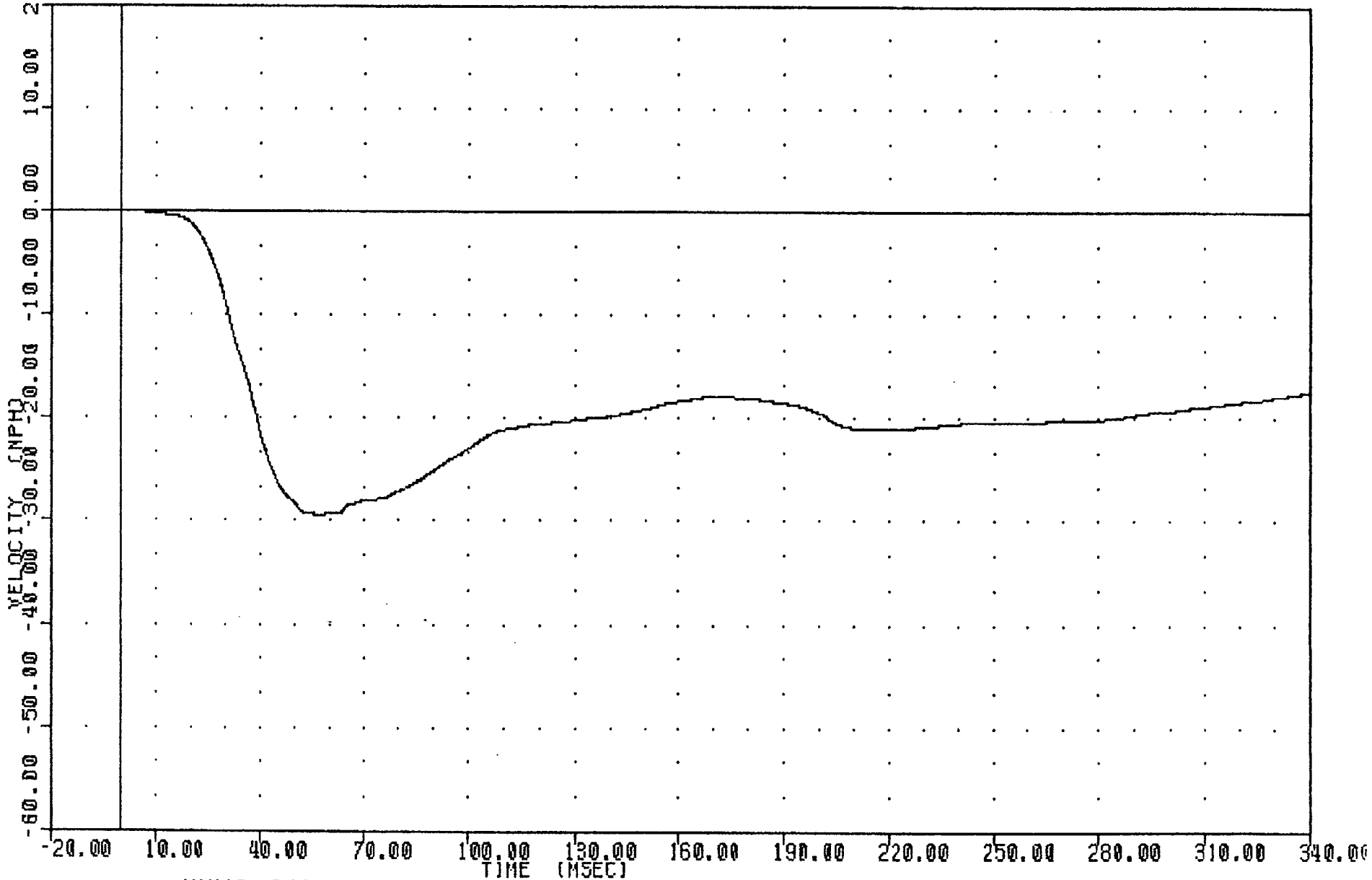

TRC , 850626
PLOT DATE 8-JUL-85 09:10:25
MVMA SIDE IMPACT TESTING
85177000000
FILTER = HSRI 136/ 189/ -50
T12YGB
MIN, MAX VALUES = -75.33 @ 37.50 , 11.00 @ 63.75
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER LOWER SPINE ACCELERATION -2 Y AXIS


TRC , 850626
PLOT DATE 8-JUL-85 09:47:46
NVMA SIDE IMPACT TESTING
851770000000
FILTER = HSRI 136/ 189/ -50
T12ZG2
MIN, MAX VALUES = -16.33 @ 60.62 , 5.06 @ 91.87
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION [G]
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER LOWER SPINE ACCELERATION Z AXIS


TRC , 850626
PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000
FILTER = HSRI 136/ 189/ -50
T12RG2
MIN, MAX VALUES = 0.18 @ -17.50 , 63.69 @ 29.38
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER LOWER SPINE RESULTANT ACCELERATION

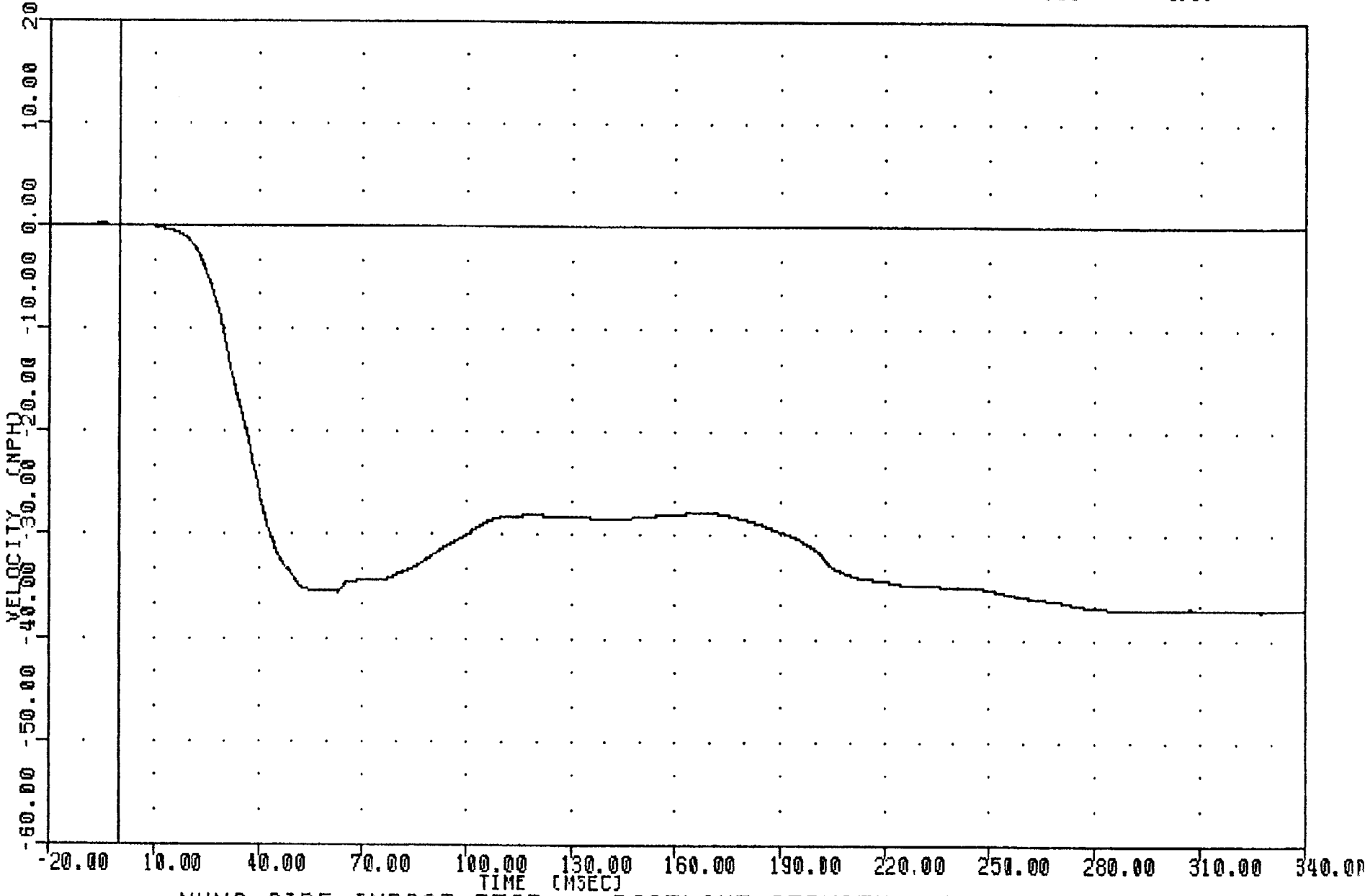

TRC , 850626
PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000
FILTER = HSRI 136/ 189/ -50
T12R6B
MIN, MAX VALUES = 0.37 @ -17.50 , 76.18 @ 29.38
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER LOWER SPINE RESULTANT ACCELERATION

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
NVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
T12YV2 MIN, MAX VALUES = -29.43 @ 56.63 , 0.03 @ -6.25

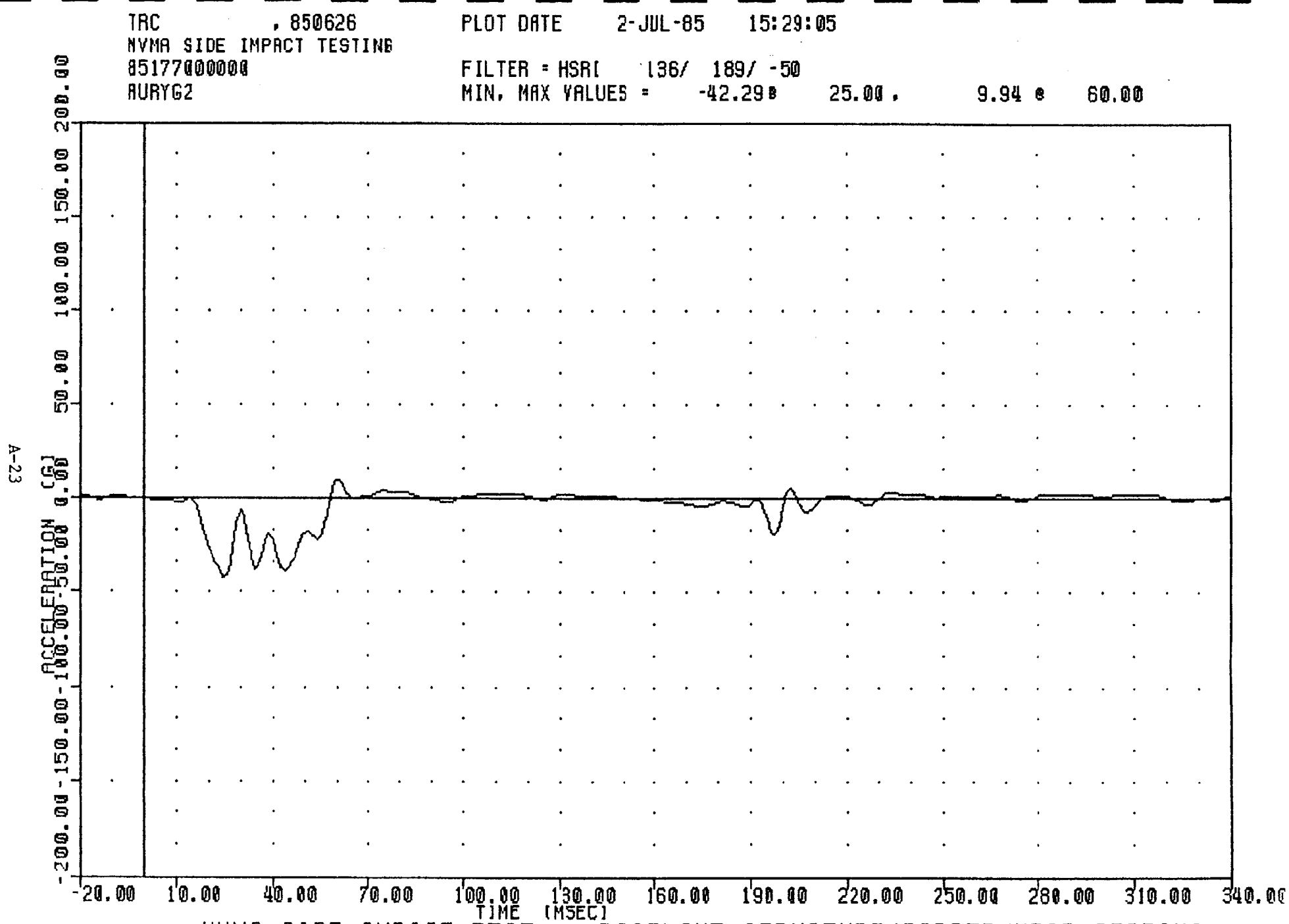



MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
LOWER SPINE VELOCITY Y AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177004000 FILTER = BLPF 300/ 949/ -40
T12YVB MIN, MAX VALUES = -37.23@ 327.25 , 0.11 @ -4.88



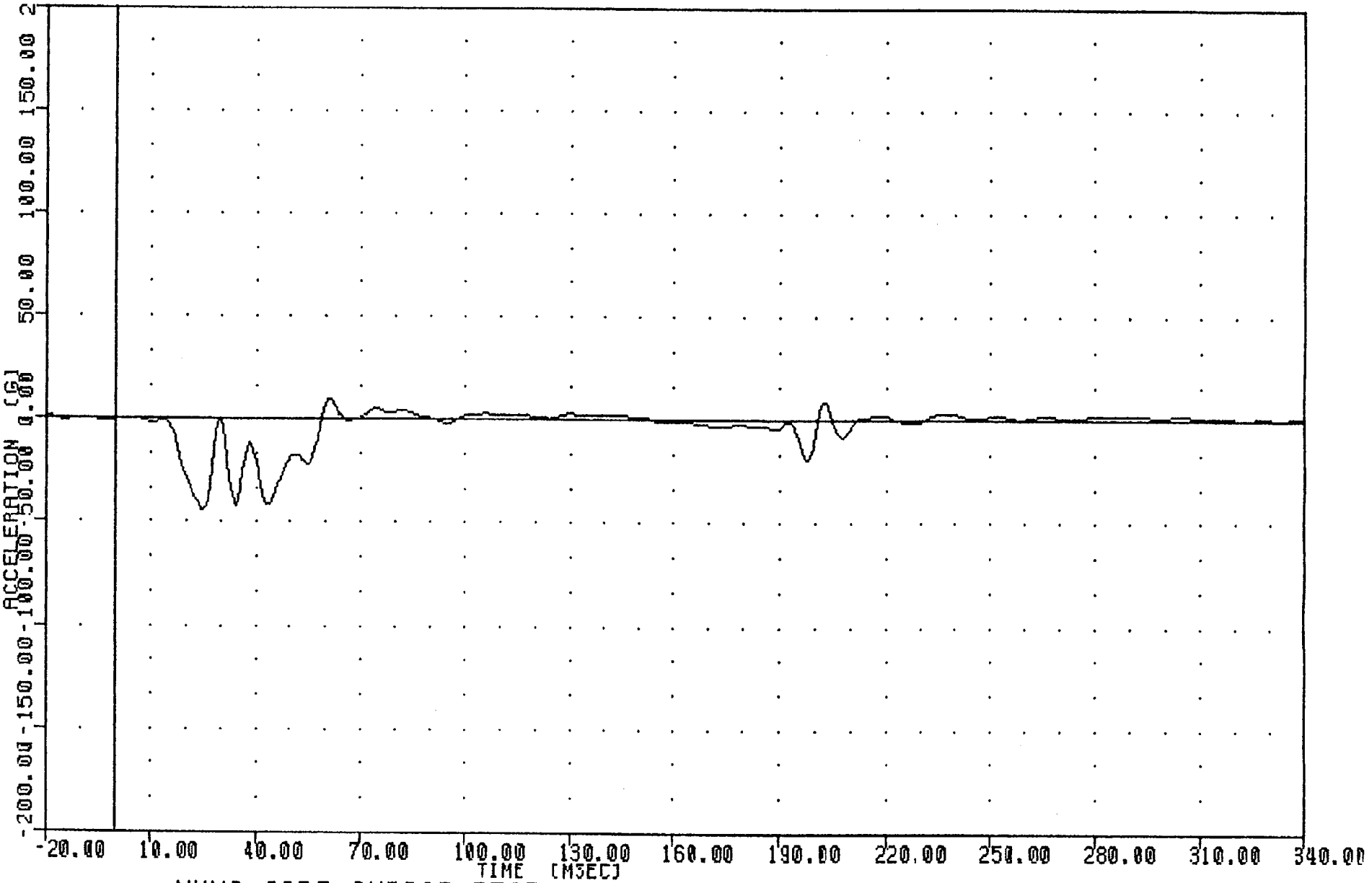

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
LOWER SPINE VELOCITY -12 X AXIS




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

PASSENGER RIGHT UPPER RIB ACCELERATION X AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000 FILTER = HSRI 136/ 189/ -50
RURYGB MIN. MAX VALUES = -44.68 @ 25.00 , 9.39 @ 60.62



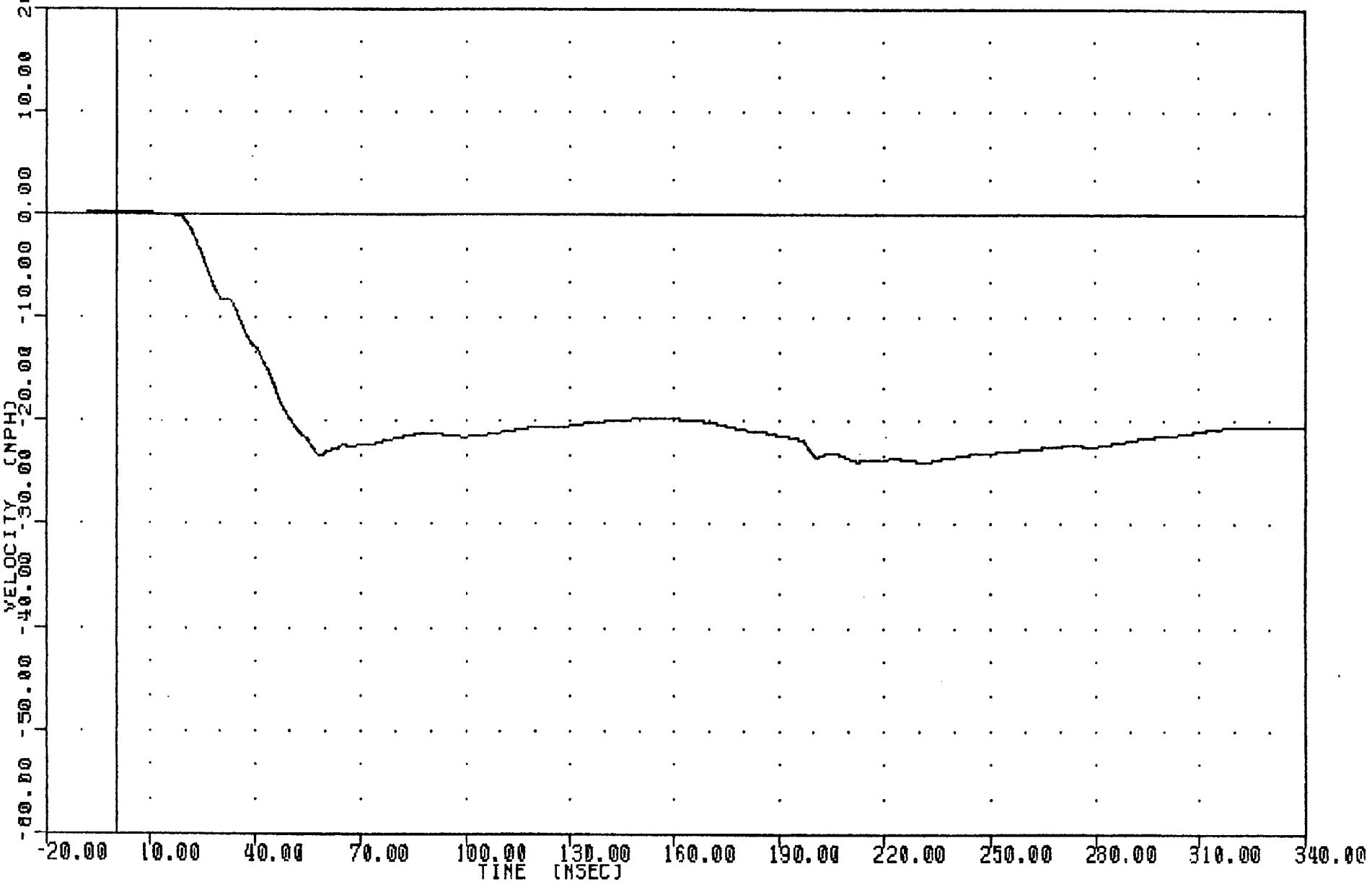

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER RIGHT UPPER RIB ACCELERATION -2 Y AXIS

TAC , 850626 PLOT DATE 2-JUL-85 15:25:03

MVMA SIDE IMPACT TESTING

851770000D0 FILTER = BLPF 300/ 949/ -40

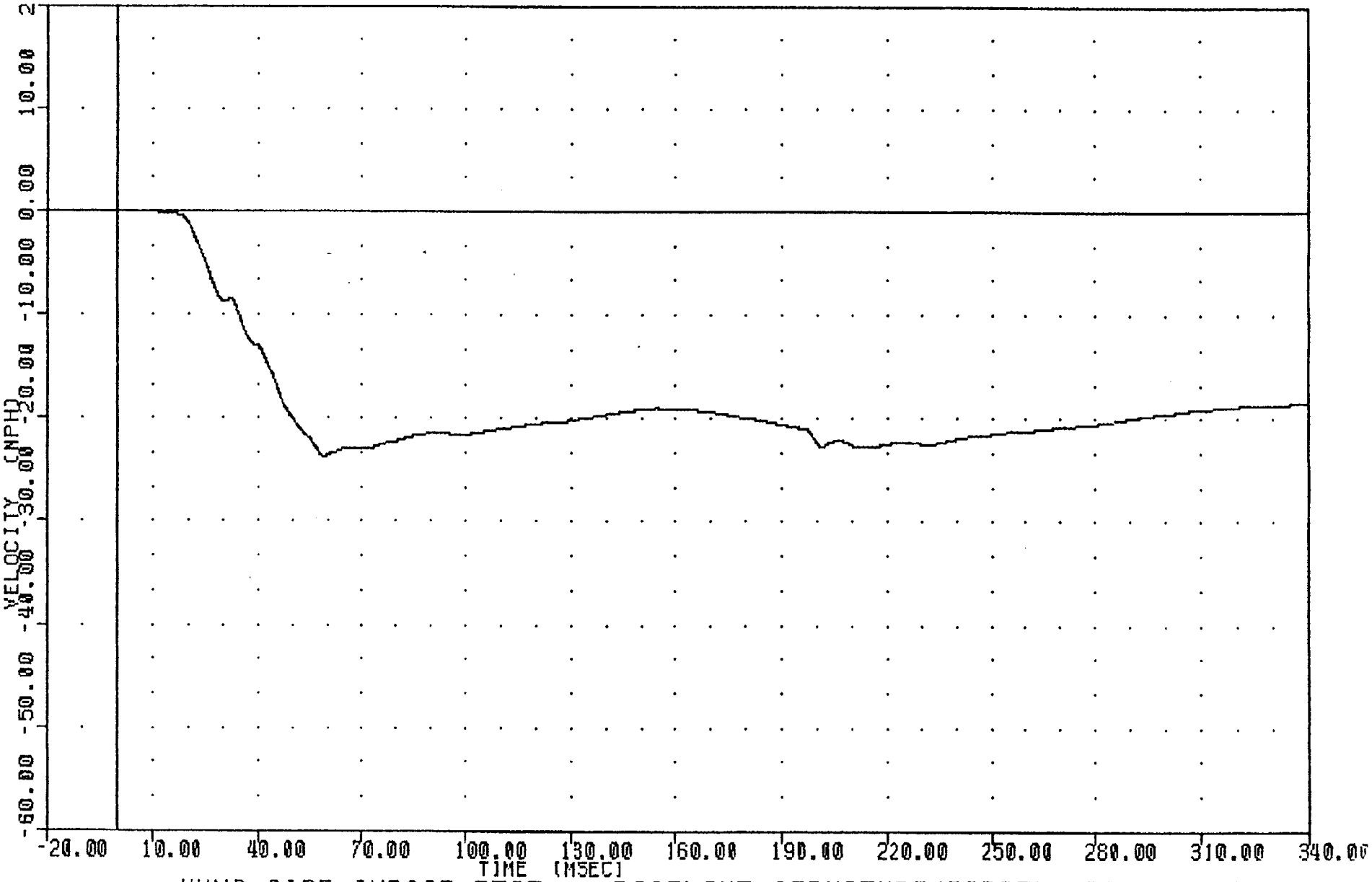
RURYY2 MIN, MAX VALUES = -23.96 @ 231.13 , 0.23 @ -1.25



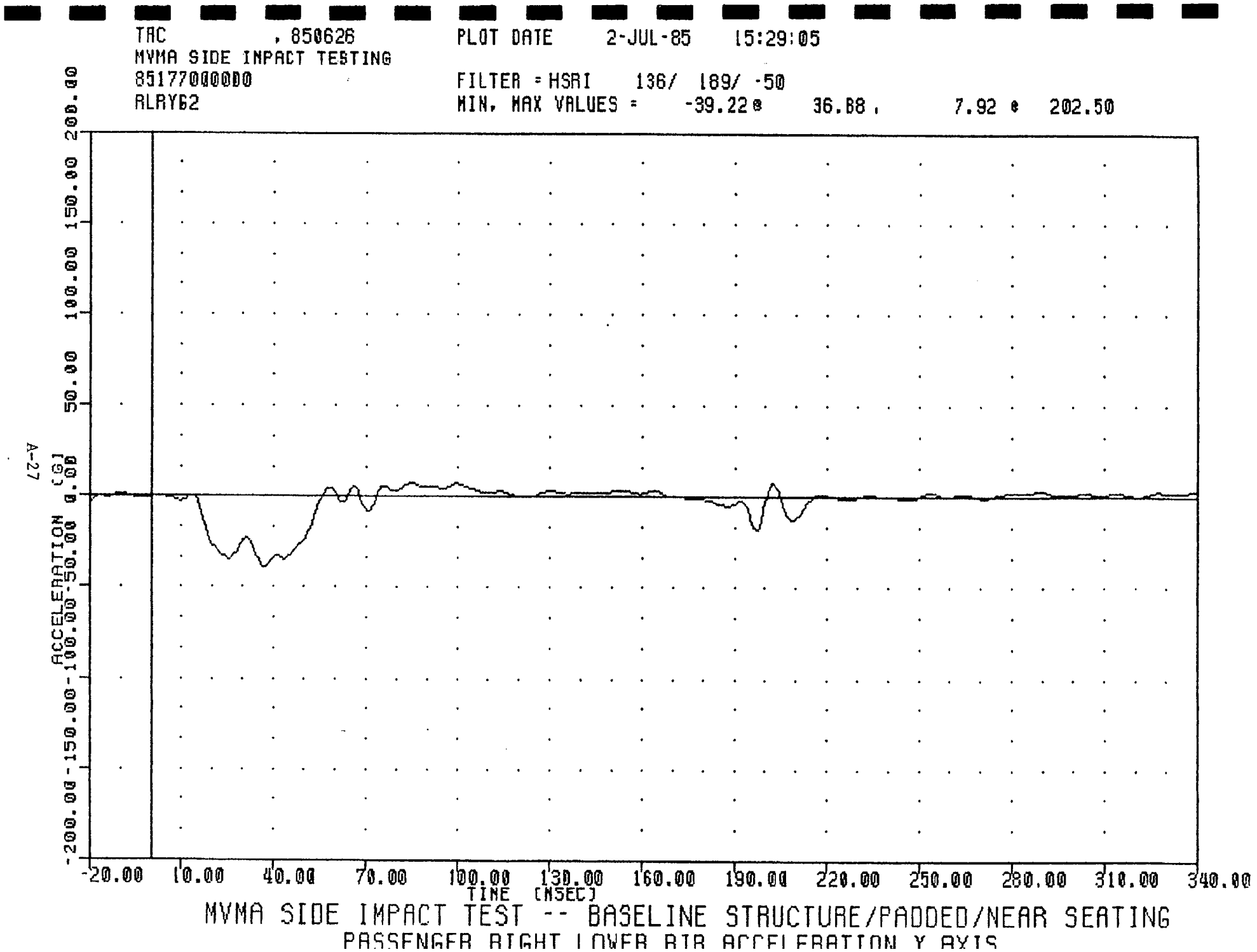

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

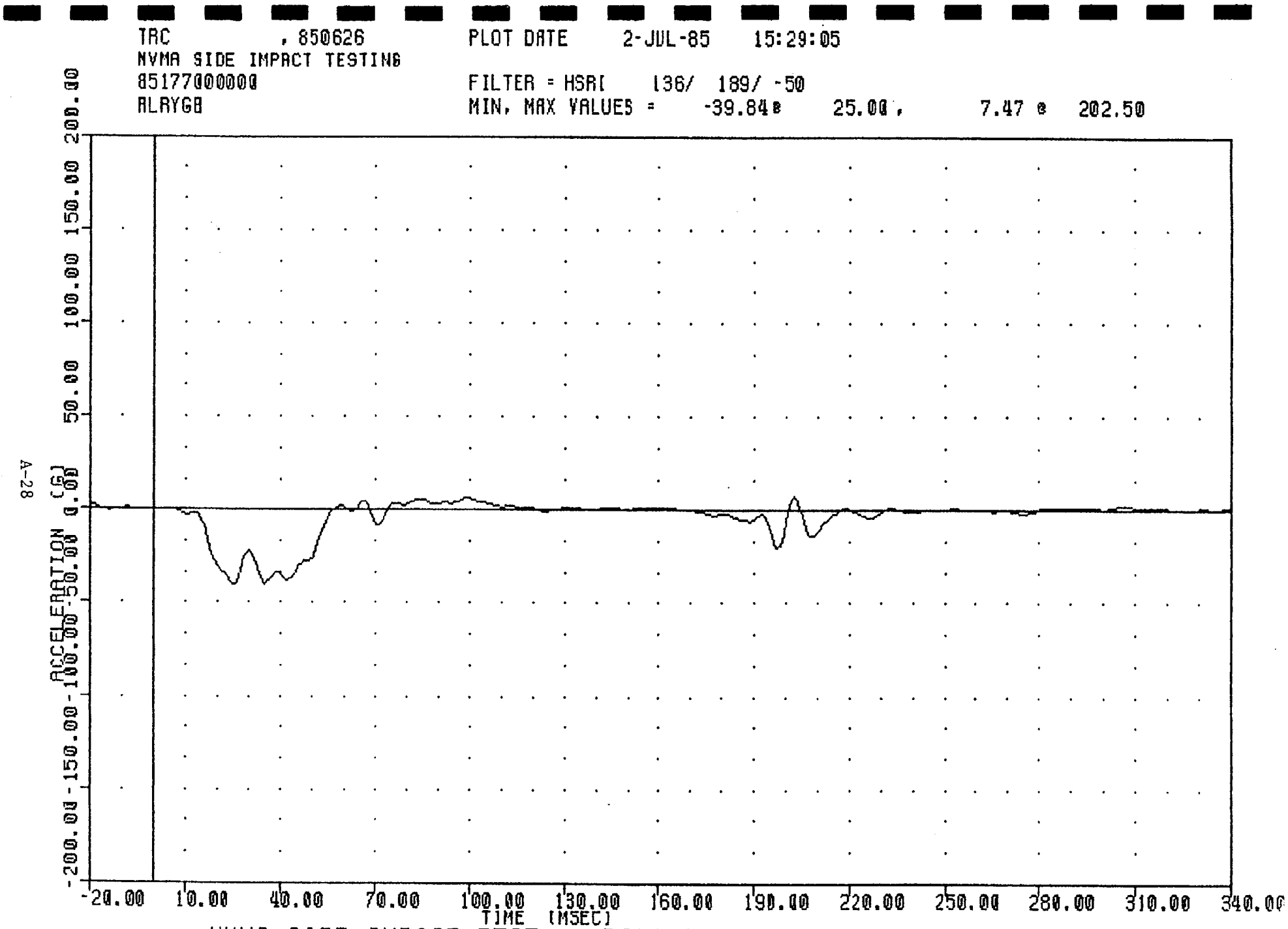
RIGHT UPPER RIB VELOCITY Y AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
NVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
RURYVB MIN. MAX VALUES = -23.71 @ 59.00 , 0.05 @ -4.63




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT UPPER RIB VELOCITY #2 Y AXIS

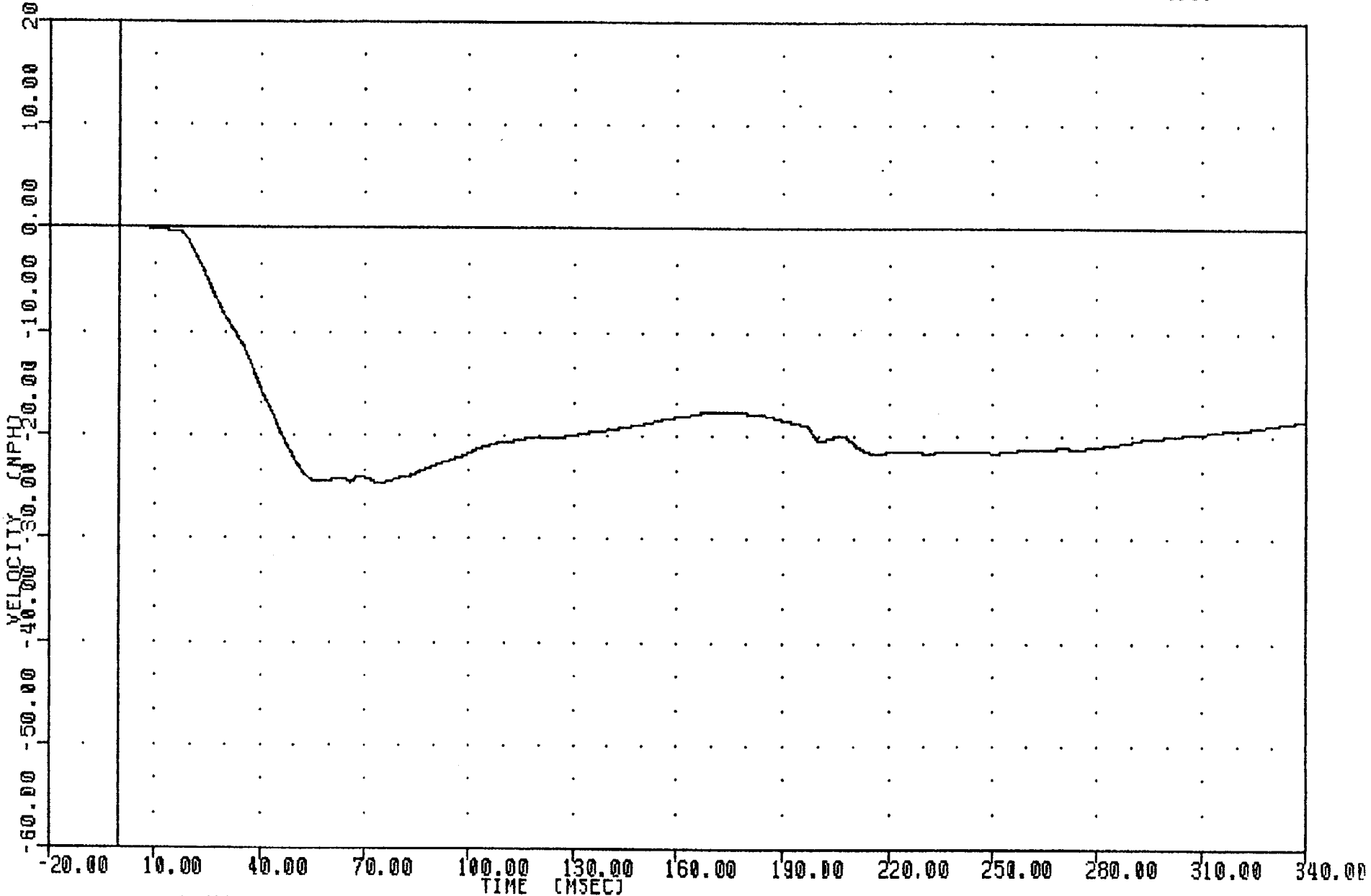

TRC , 850626
PLOT DATE 2-JUL-85 15:29:05
MVMA SIDE IMPACT TESTING
85177000000
FILTER = HSRI 136/ 189/ -50
RLRYB2
MIN, MAX VALUES = -39.22 @ 36.88 , 7.92 @ 202.50
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PASSENGER RIGHT LOWER RIB ACCELERATION Y AXIS




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING

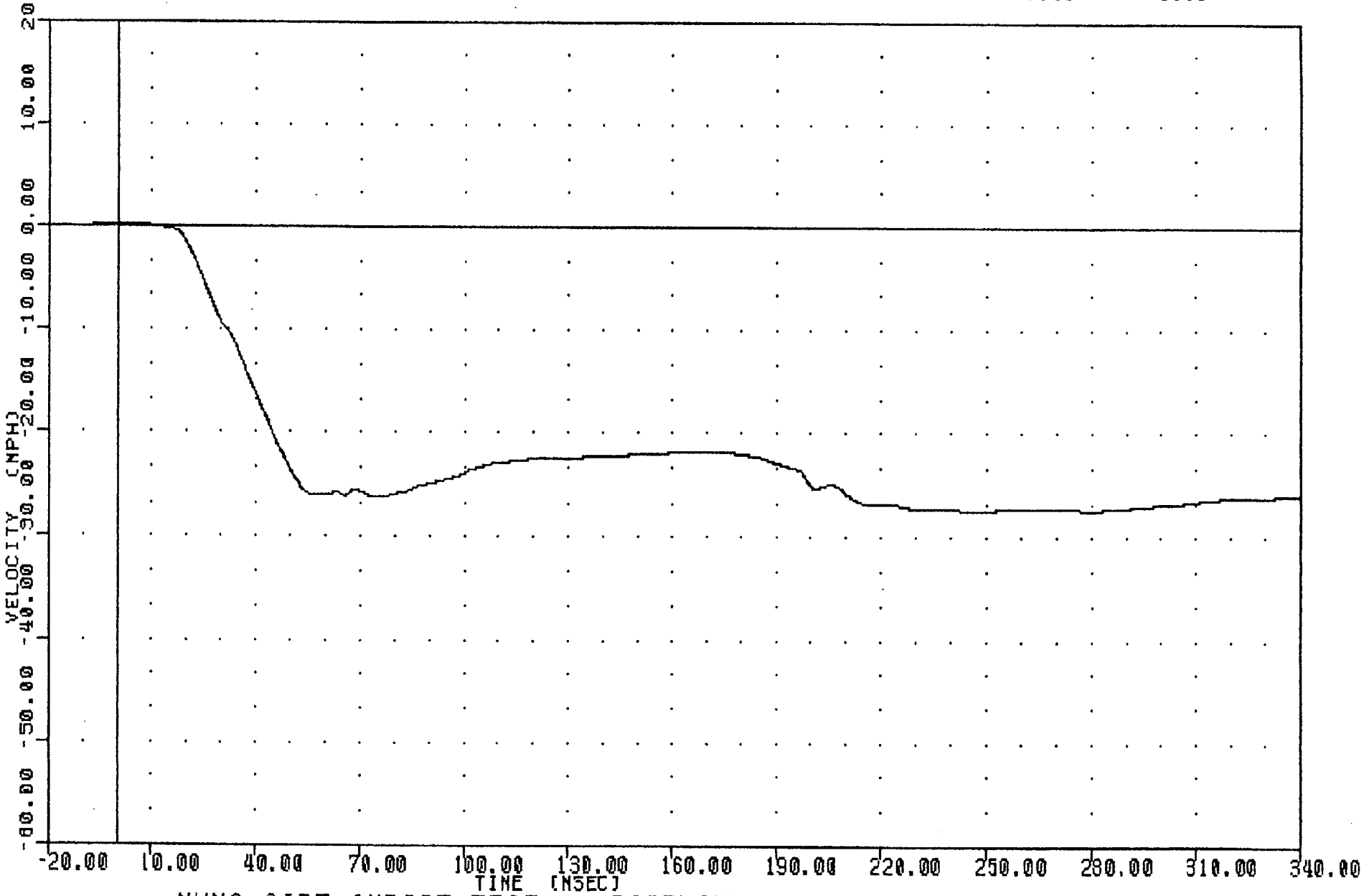
PASSENGER RIGHT LOWER RIB ACCELERATION #2 Y AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
RLAYV2 MIN, MAX VALUES = -24.64 @ 73.88 , 0.05 @ -5.50

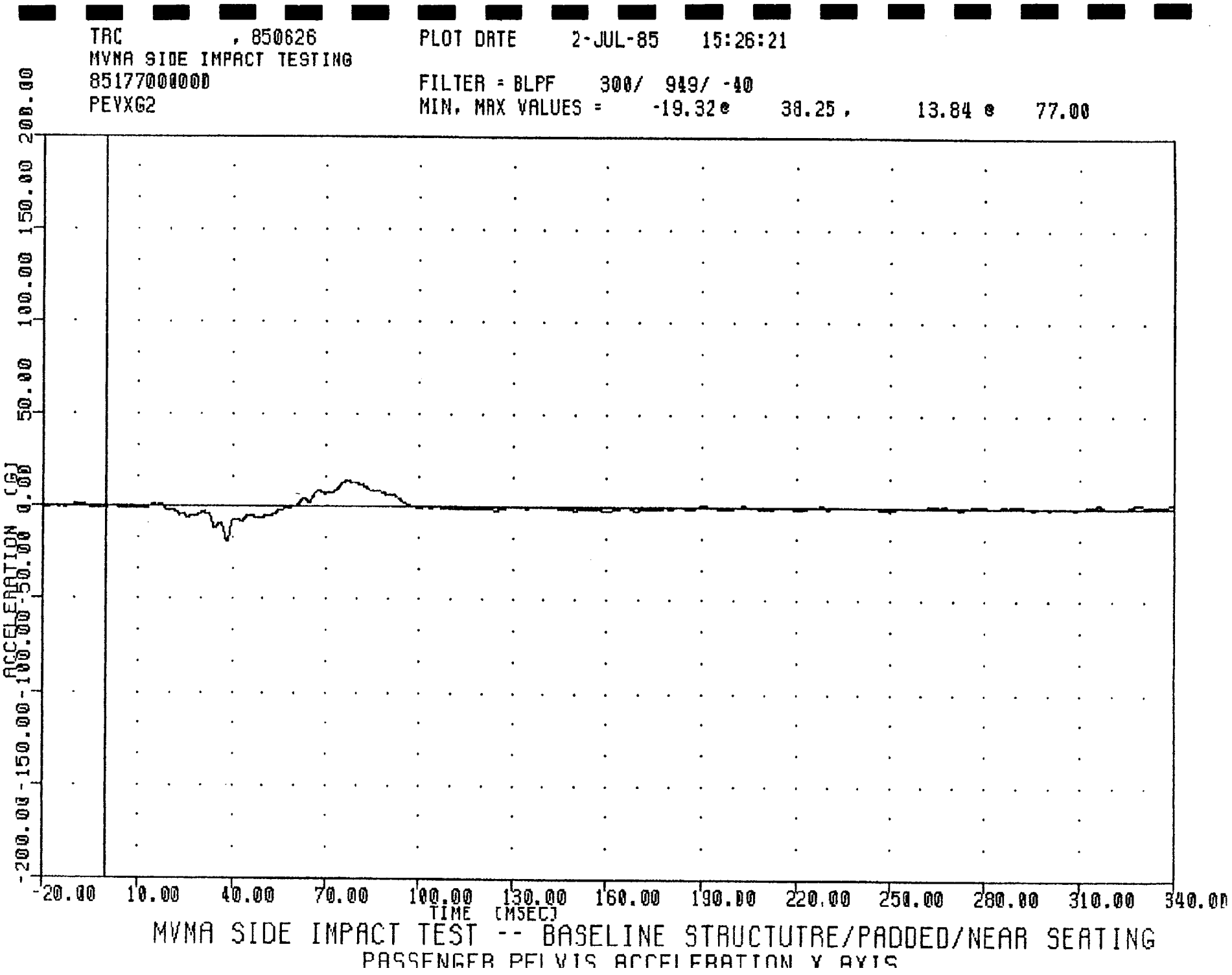



MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT LOWER B1R VELOCITY

TAC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE INPACT TESTING
85177000000
RLRYYB
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -27.34 @ 280.50 , 0.16 @ -1.63

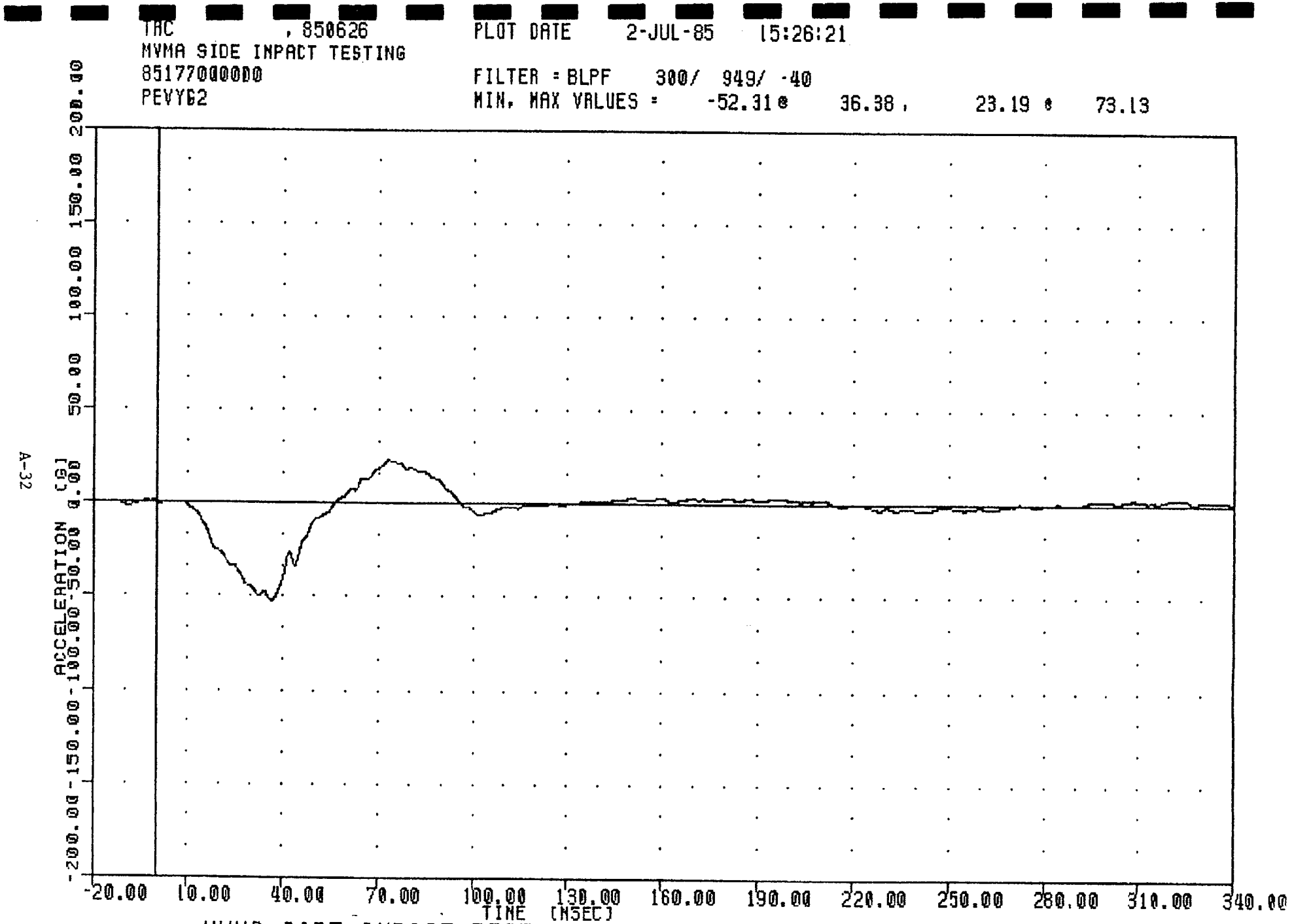



MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT LOWER RIR VELOCITY #2 Y AXIS

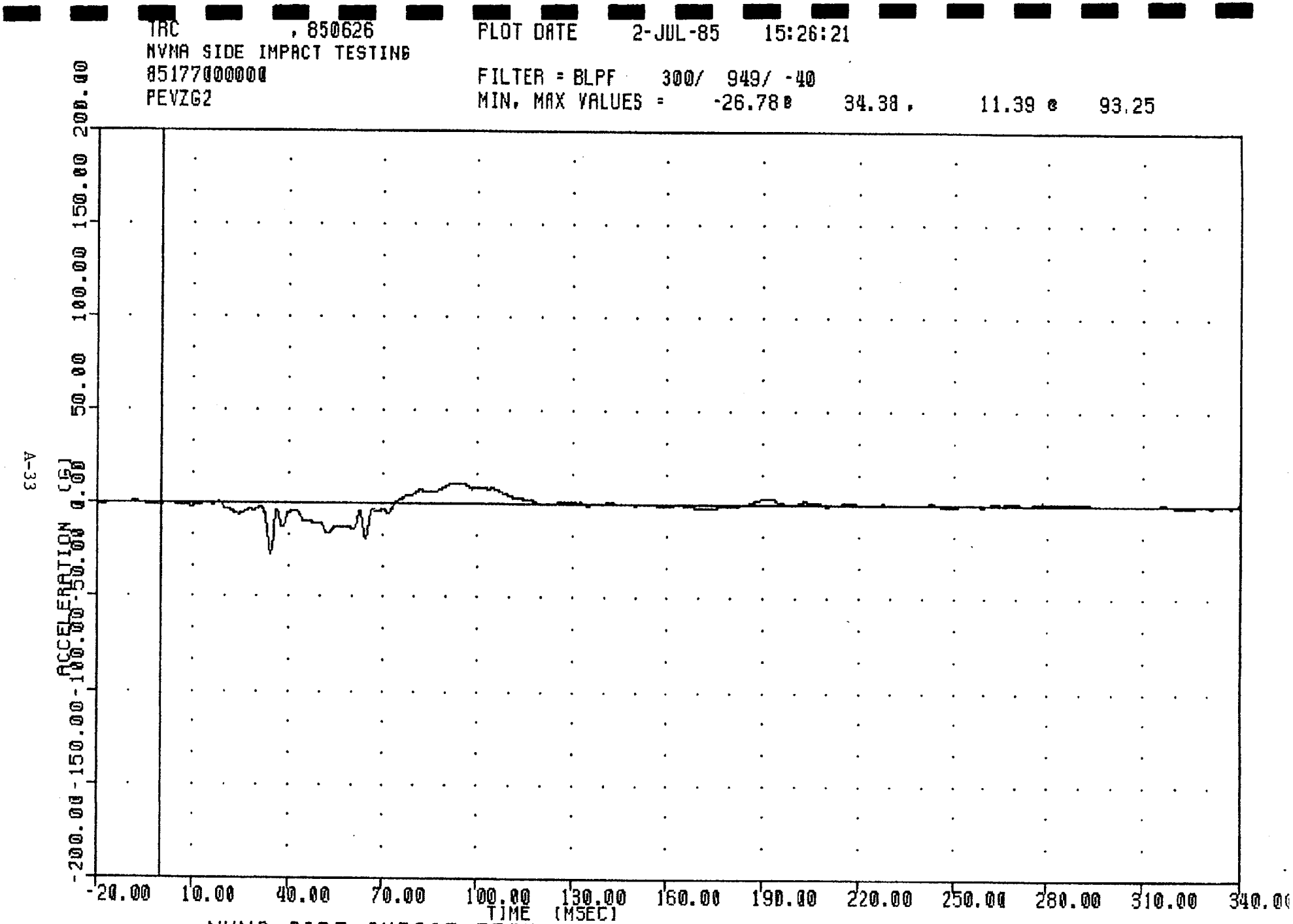



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING

PASSENGER PELVIS ACCELERATION X AXIS

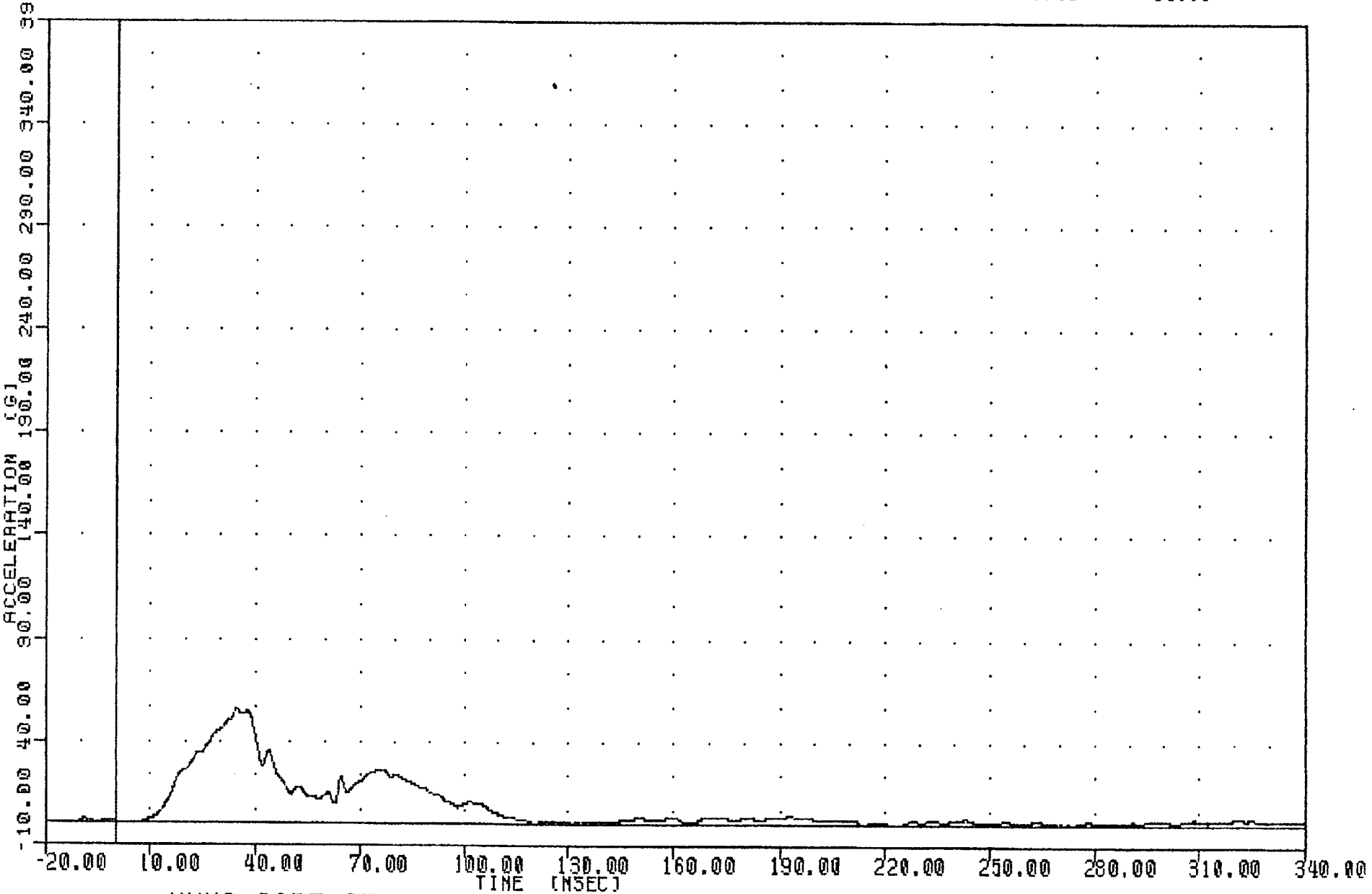



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER PELVIS ACCELERATION Y AXIS

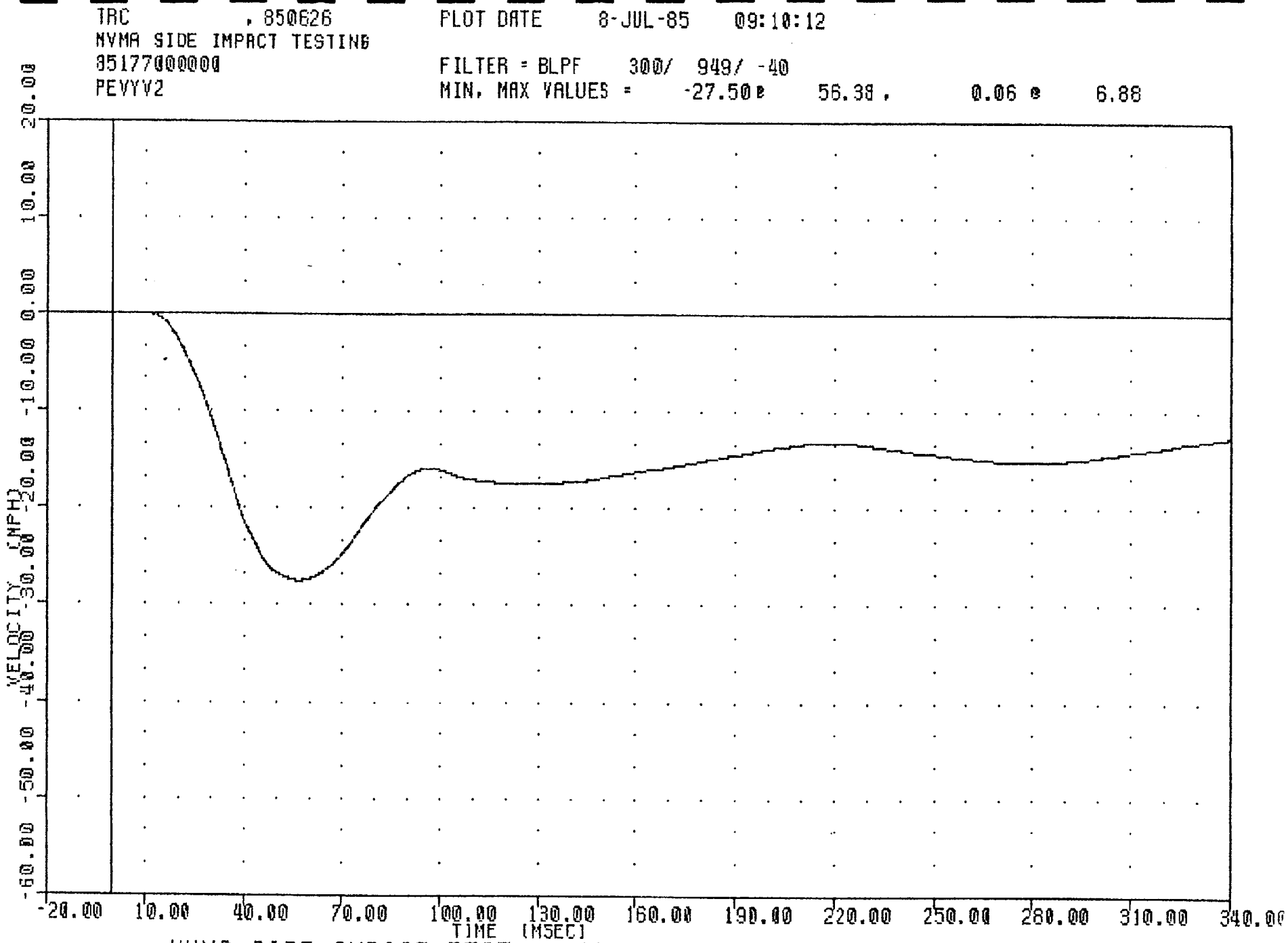



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER PELVIS ACCELERATION Z AXIS

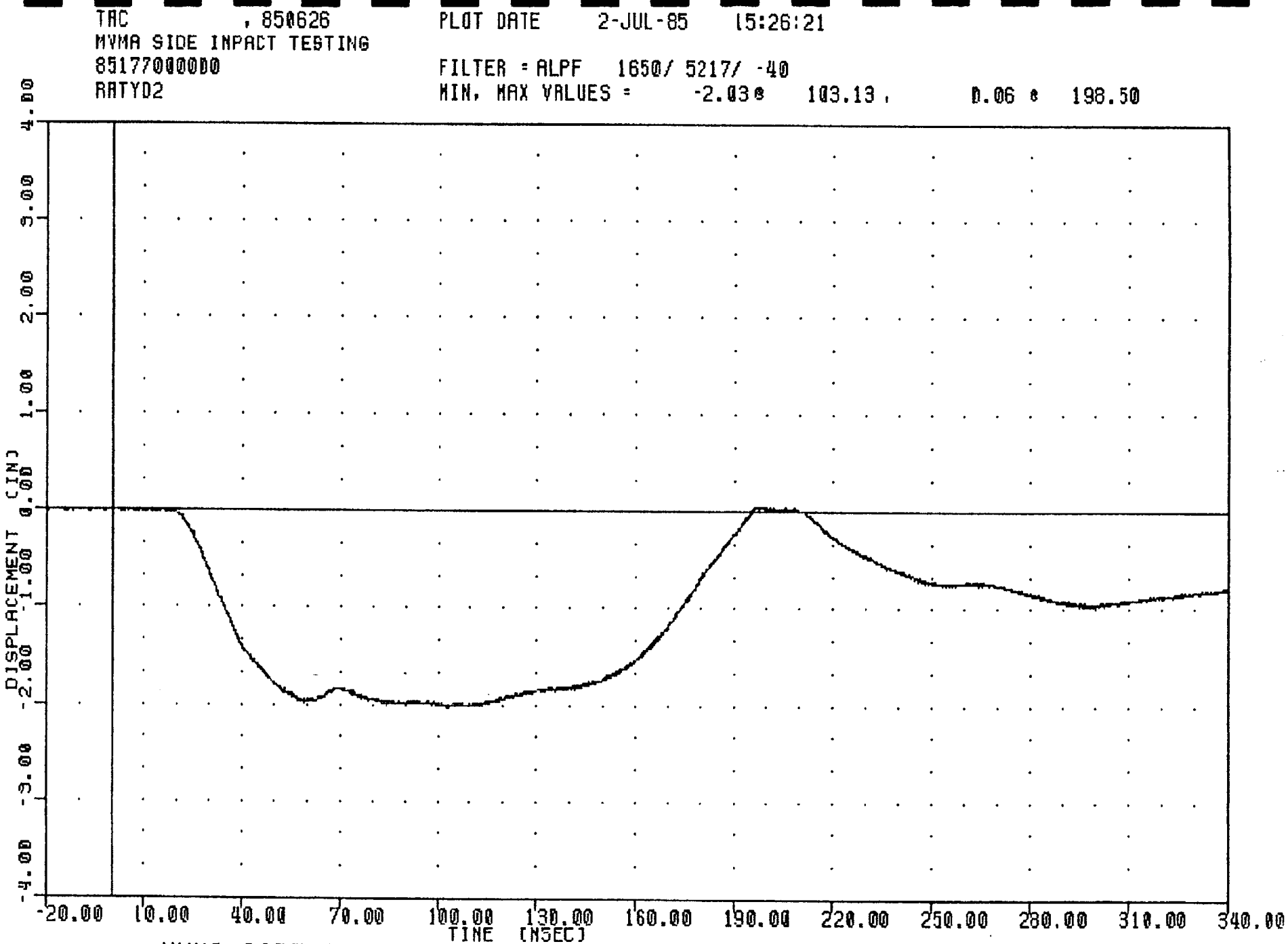
TRC , 850626 PLOT DATE 8-JUL-85 09:10:58
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
PEVRB2 MIN, MAX VALUES = 0.05 @ -11.75 , 56.03 @ 34.50



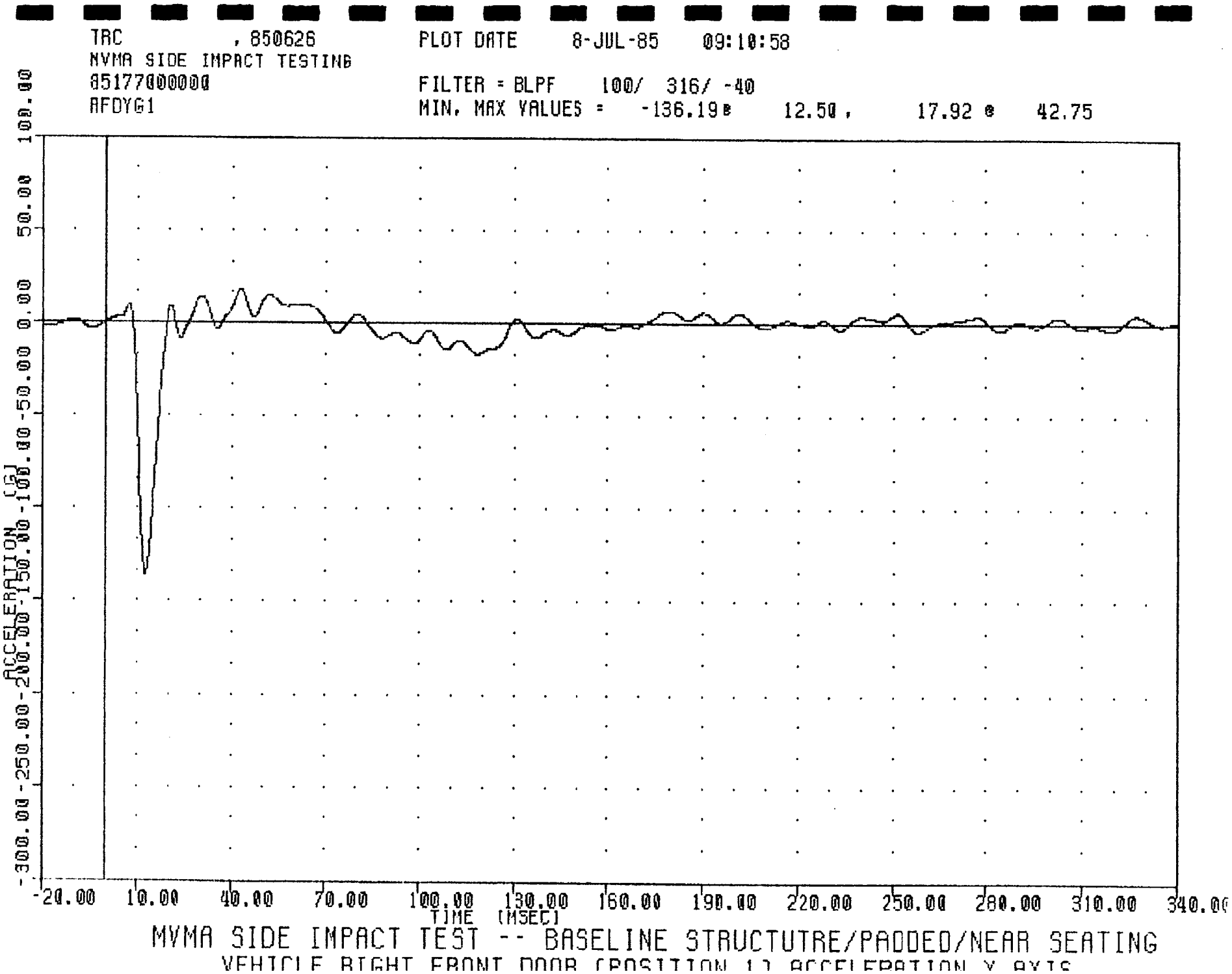

MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER PELVIS RESULTANT ACCELERATION




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
PELVIS VELOCITY Y AXIS

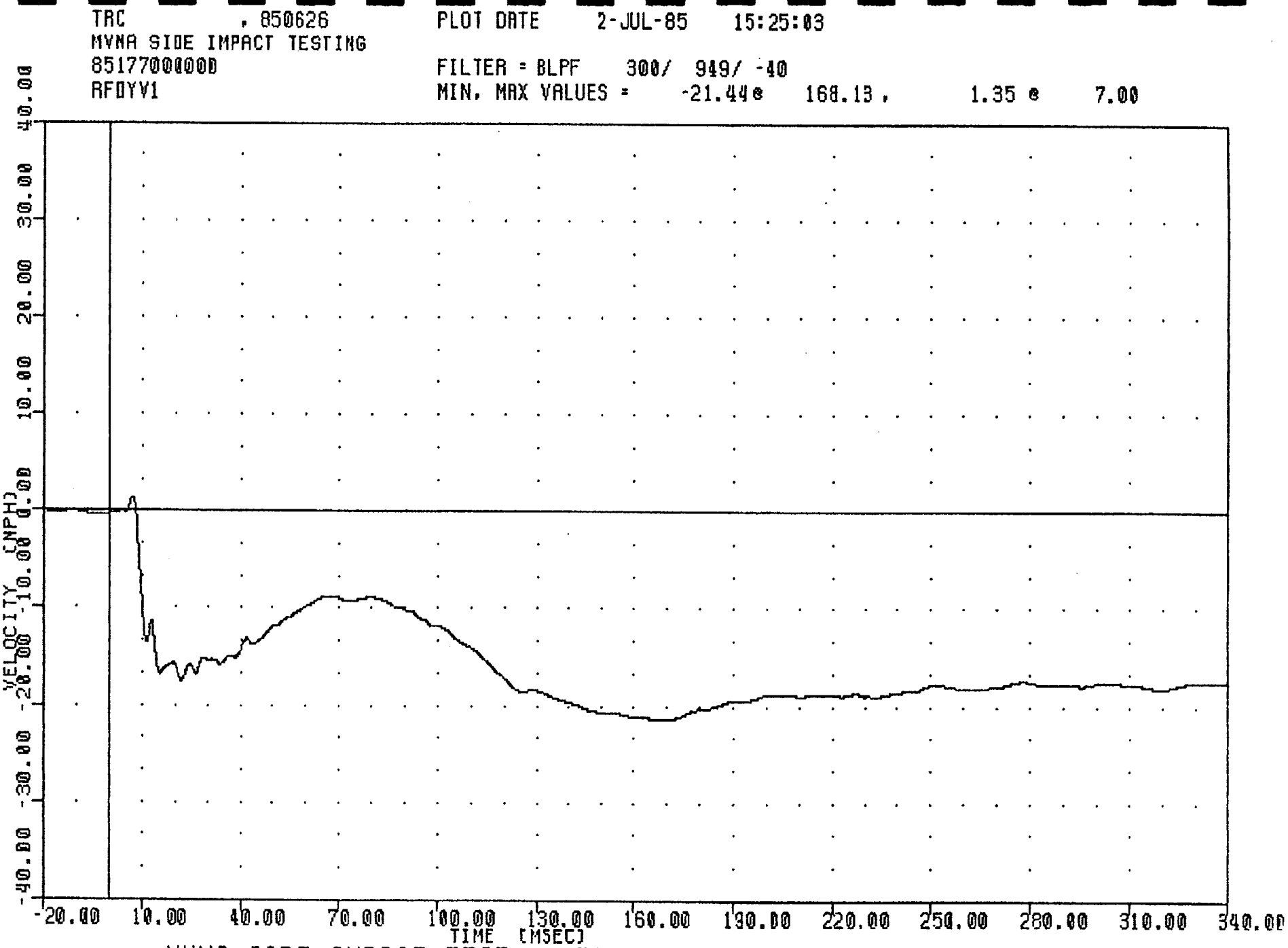



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
PASSENGER RIGHT RIB TO SPINE DISPLACEMENT INCHES

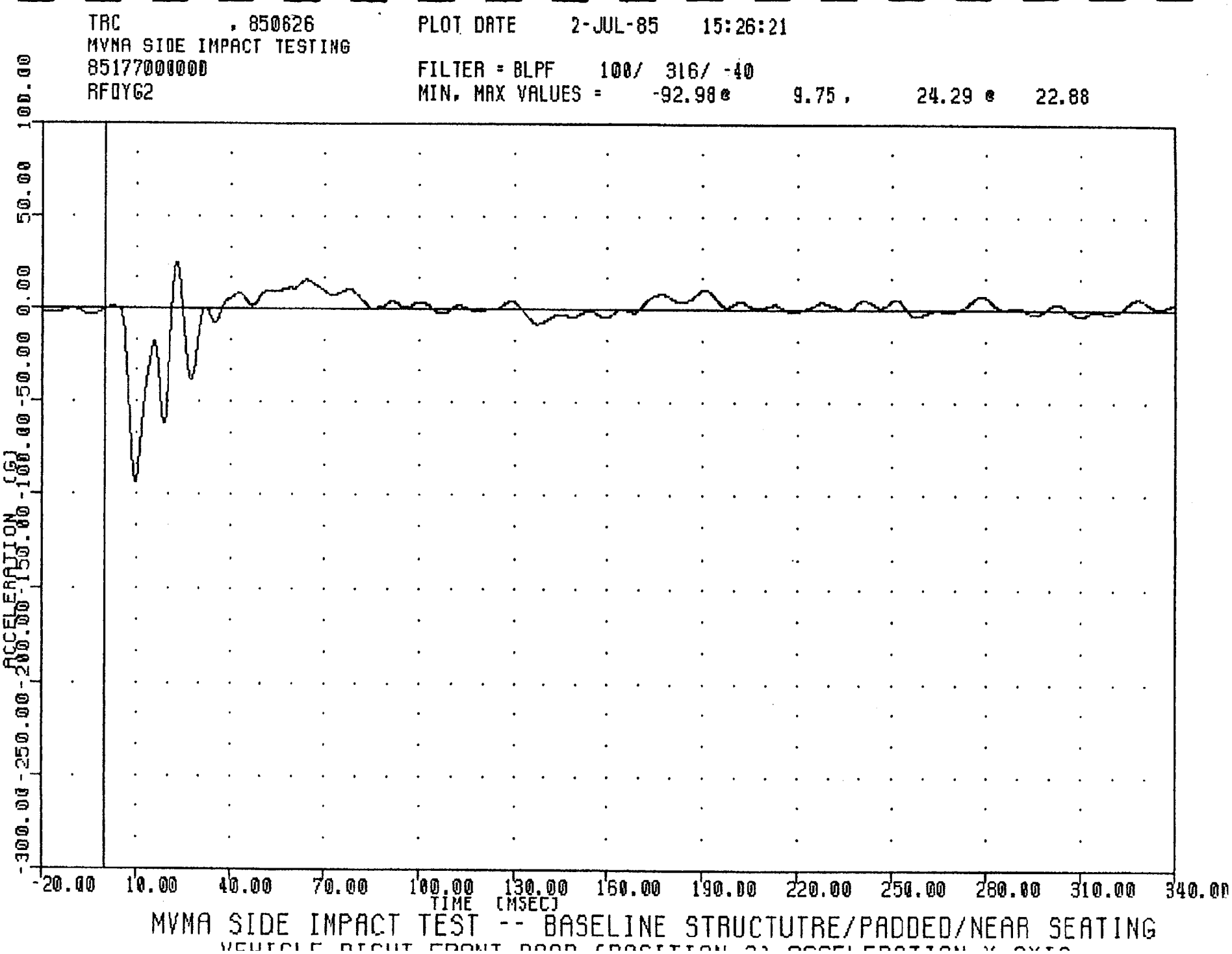



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING

VEHICLE RIGHT FRONT DOOR (POSITION 1) ACCELERATION Y AXIS



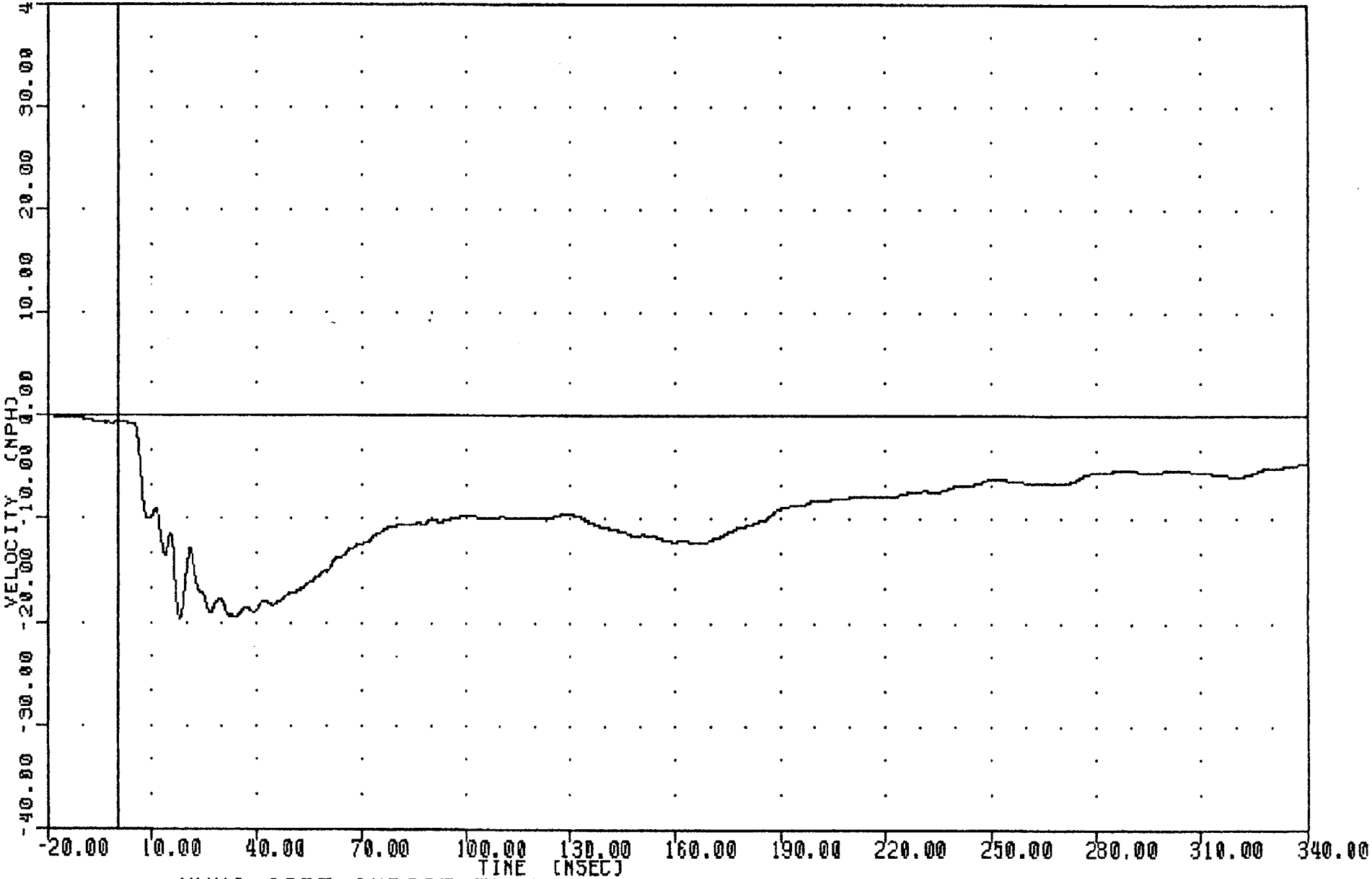

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT FRONT DOOR (POSITION 1) VELOCITY Y AXIS



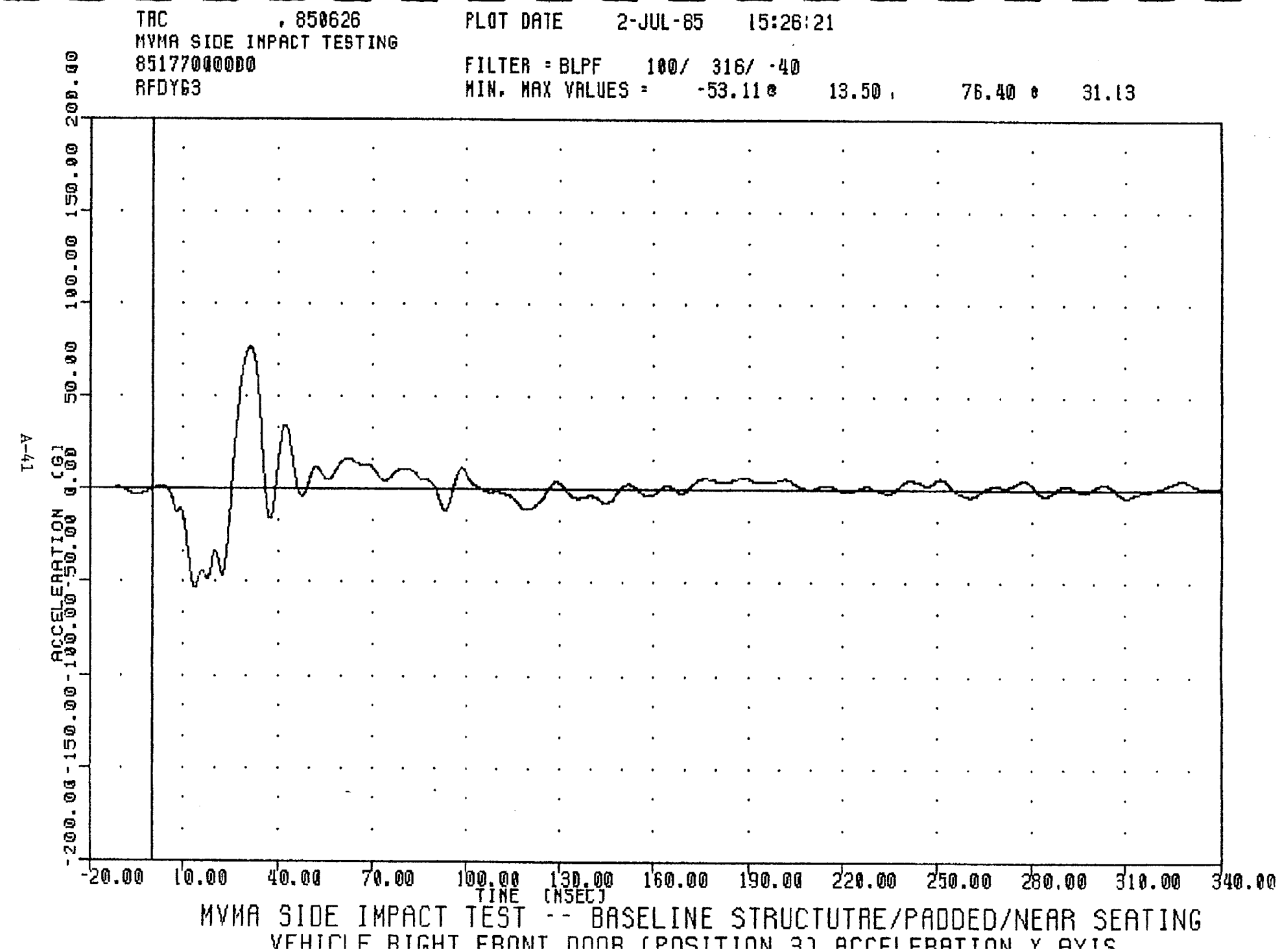

MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING

VEHICLE RIGHT FRONT DOOR (POSITION 2) ACCELERATION X AXIS

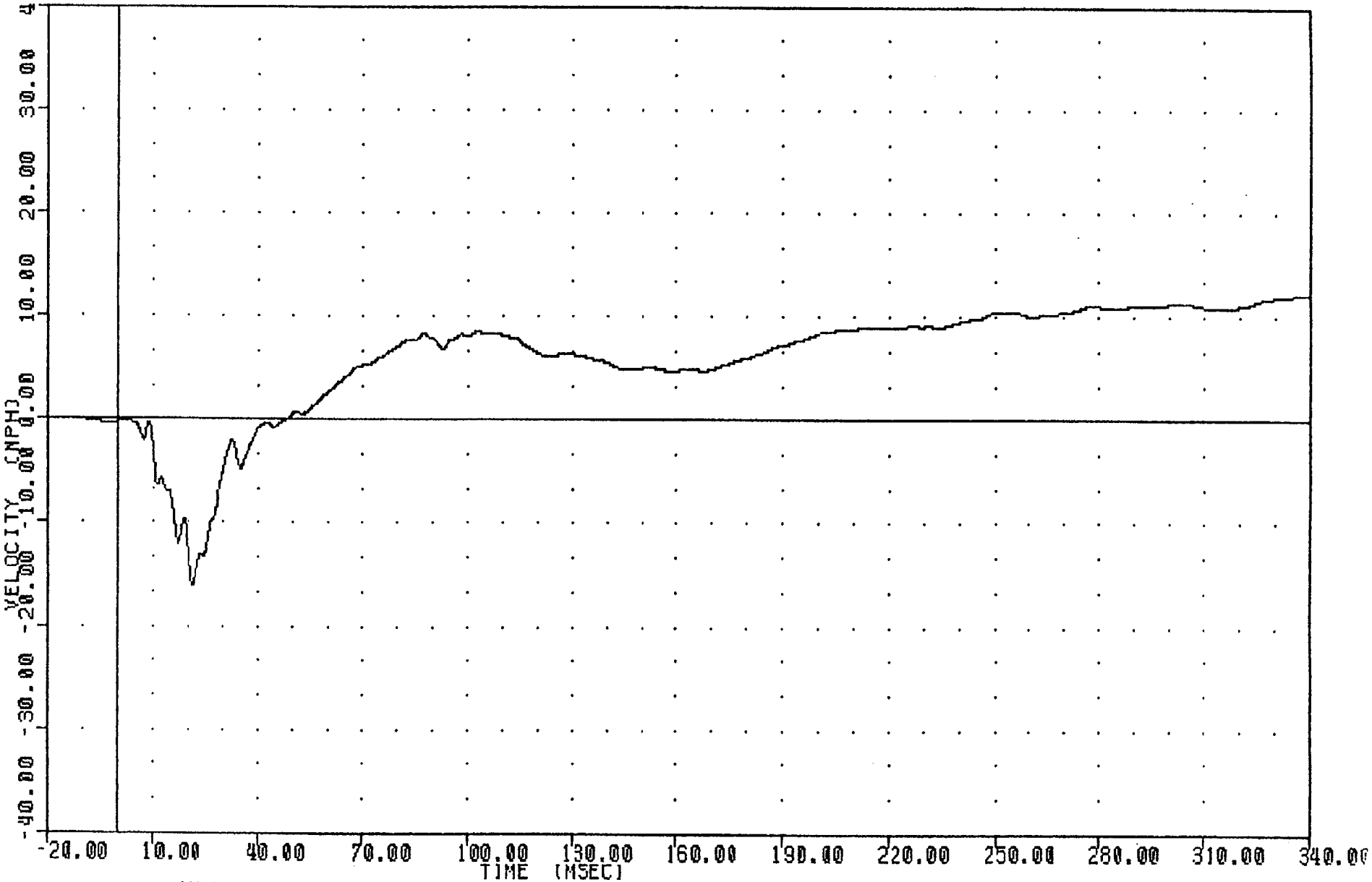
TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
RFDYV2 MIN, MAX VALUES = -19.62@ 17.75, 0.00 @ -20.00



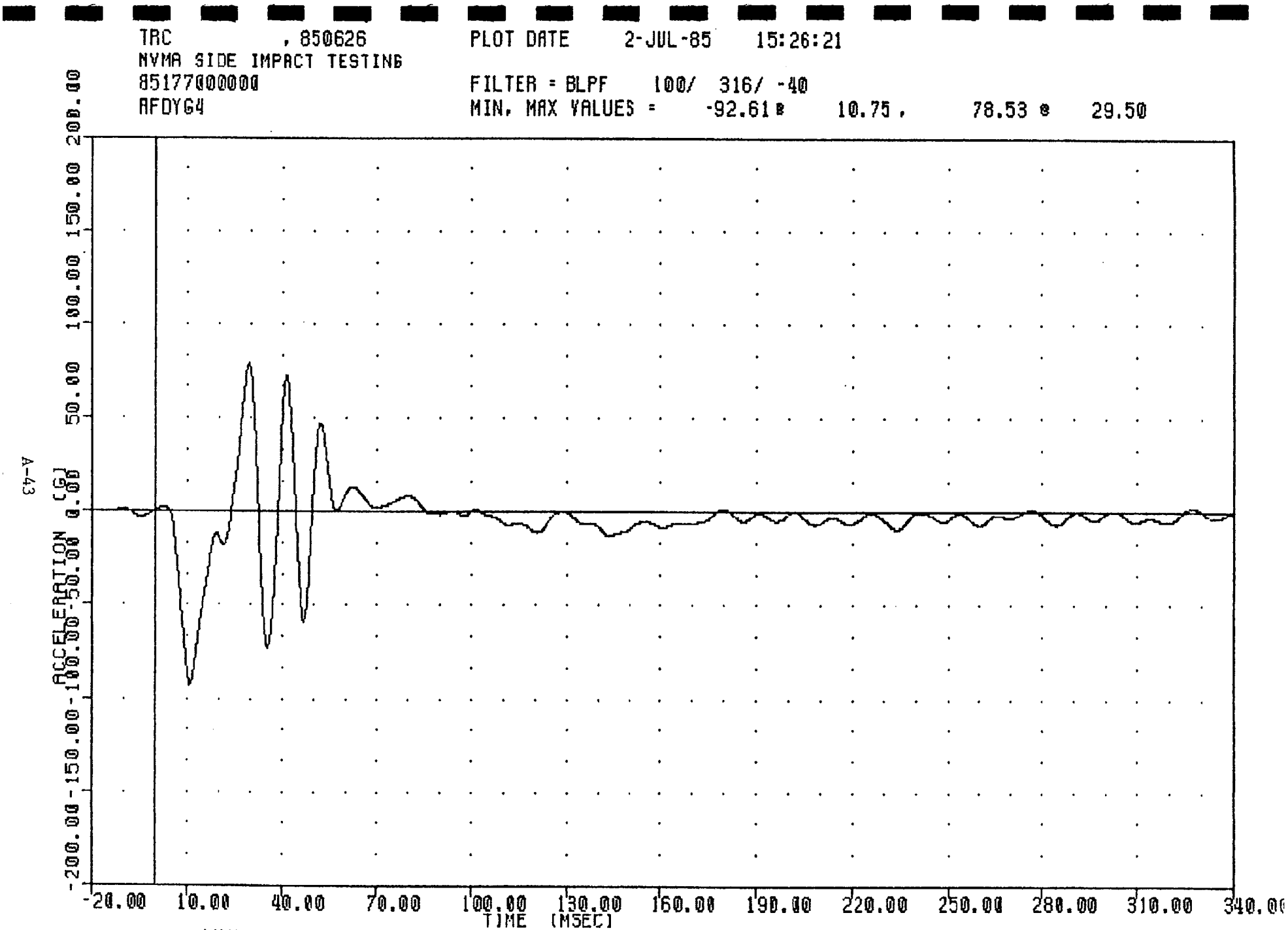

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT FRONT DOOR (POSITION 2) VELOCITY Y AXIS


TRC , 850626
PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
851770Q00D0
FILTER = BLPF 100/ 316/ -40
RFDY63
MIN, MAX VALUES = -53.11 @ 13.50 , 76.40 @ 31.13
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
VEHICLE RIGHT FRONT DOOR (POSITION 3) ACCELERATION X AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
NVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
AFDYV3 MIN, MAX VALUES = -16.15 @ 21.25 , 12.13 @ 338.88



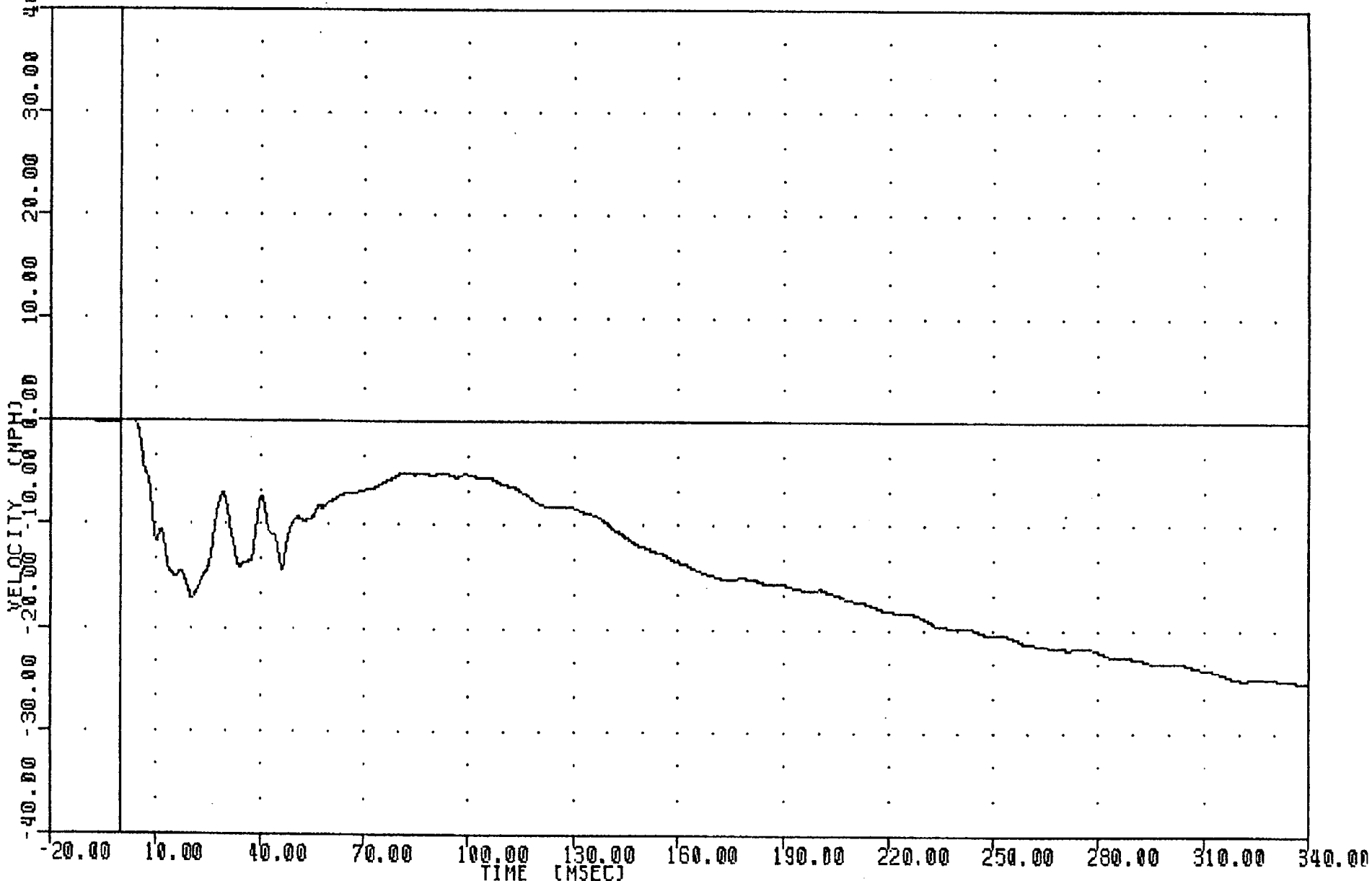

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT FRONT DOOR (POSITION 3) VELOCITY Y AXIS




MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING

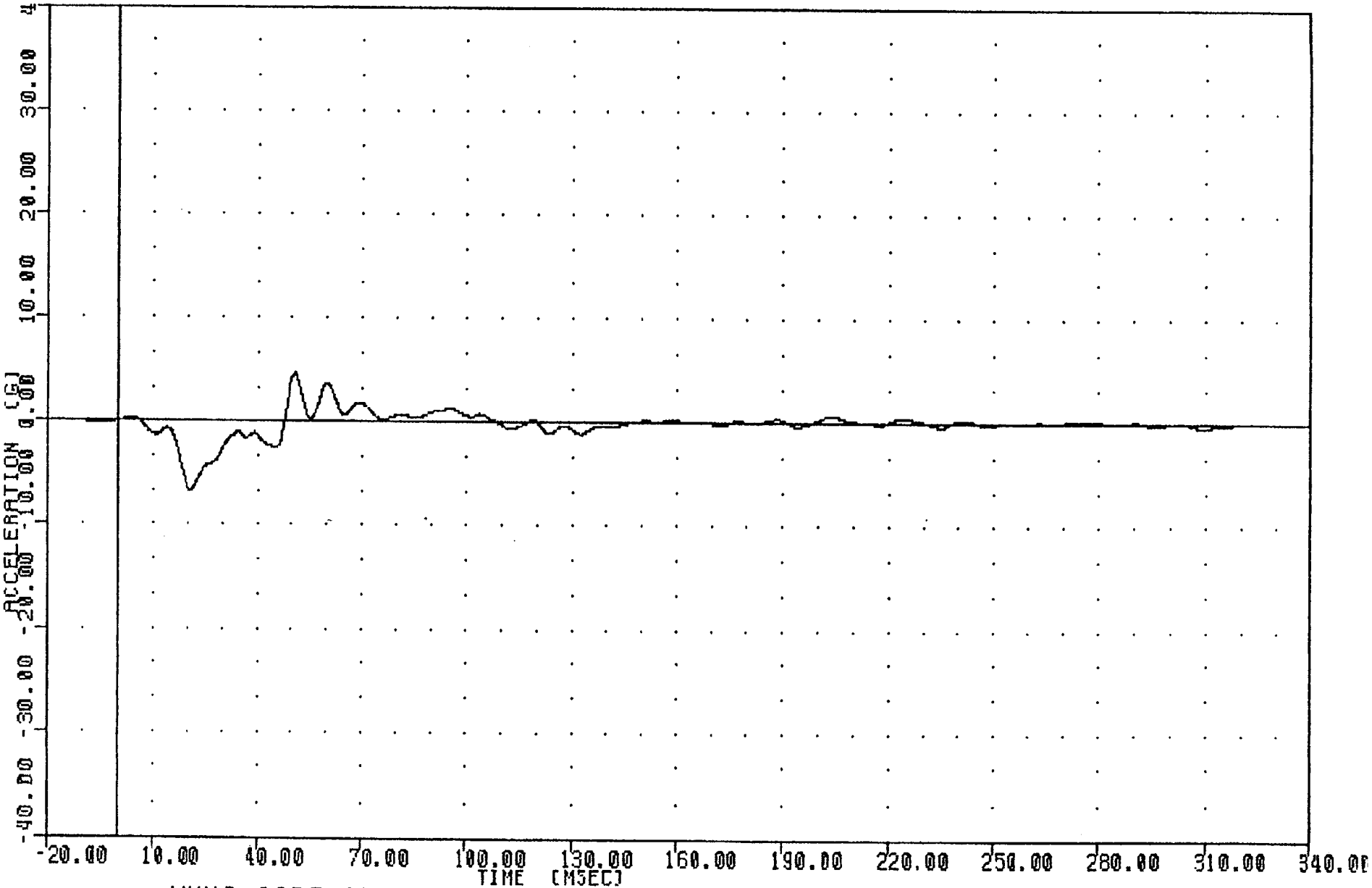
VEHICLE RIGHT FRONT DOOR (POSITION 4) ACCELERATION Y AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
RFOYV4 MIN, MAX VALUES = -25.24@ 340.00 , 0.14 @ -11.00

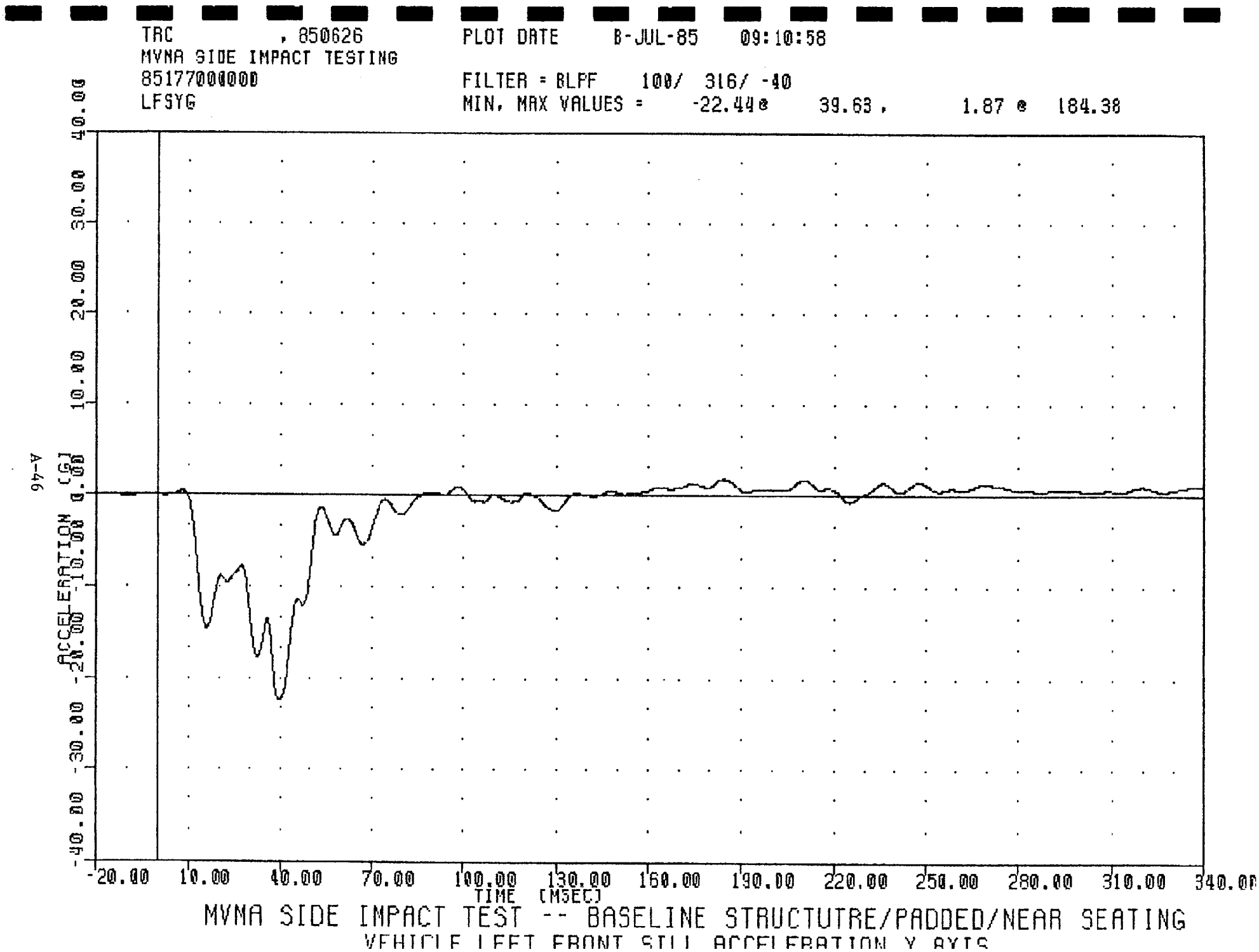


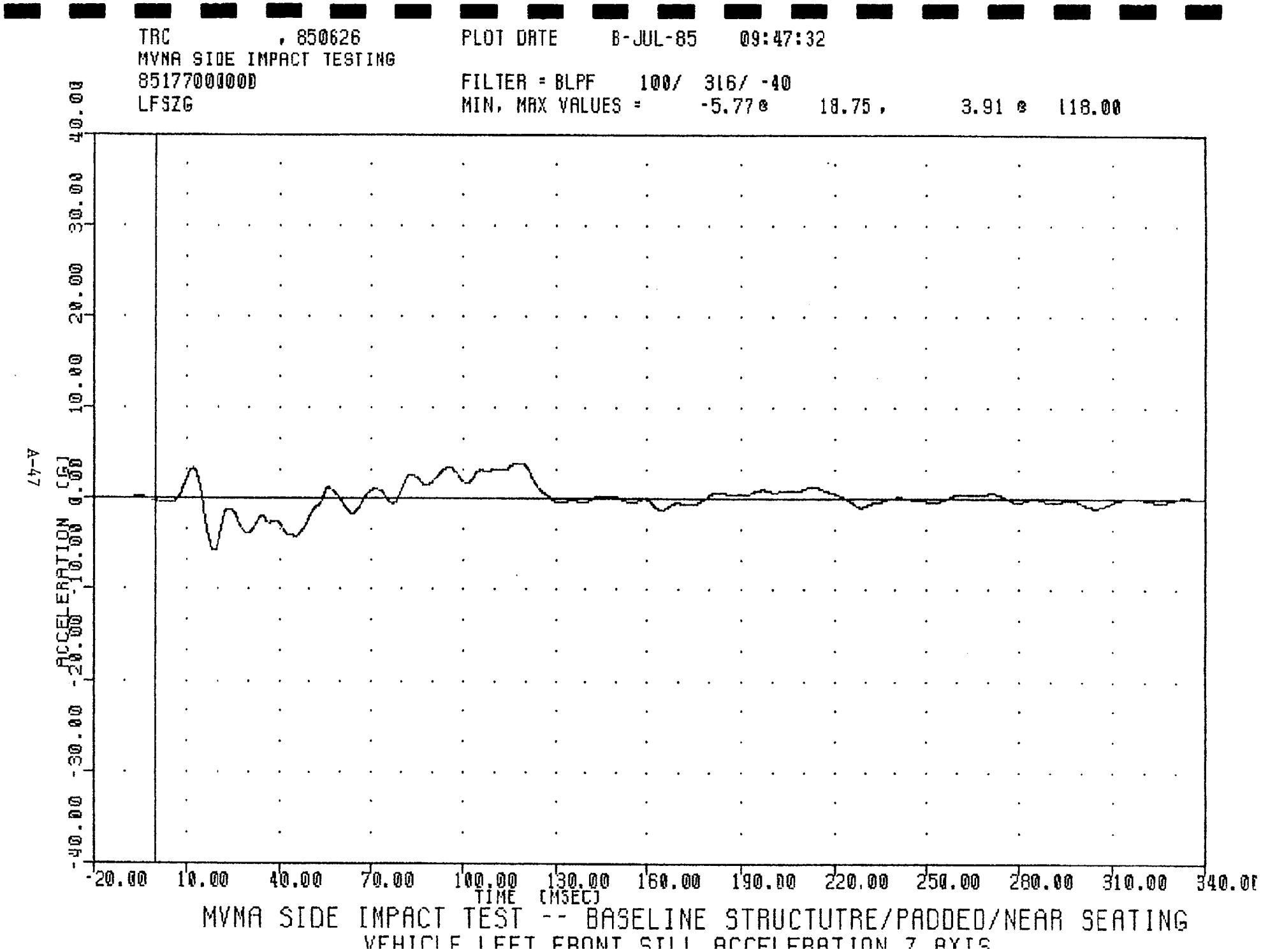

MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
RIGHT FRONT DOOR (POSITION 4) VELOCITY X AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
8517700000D FILTER = BLPF 100/ 316/ -40
LFSXG MIN, MAX VALUES = -6.72 @ 20.75 , 4.63 @ 50.63

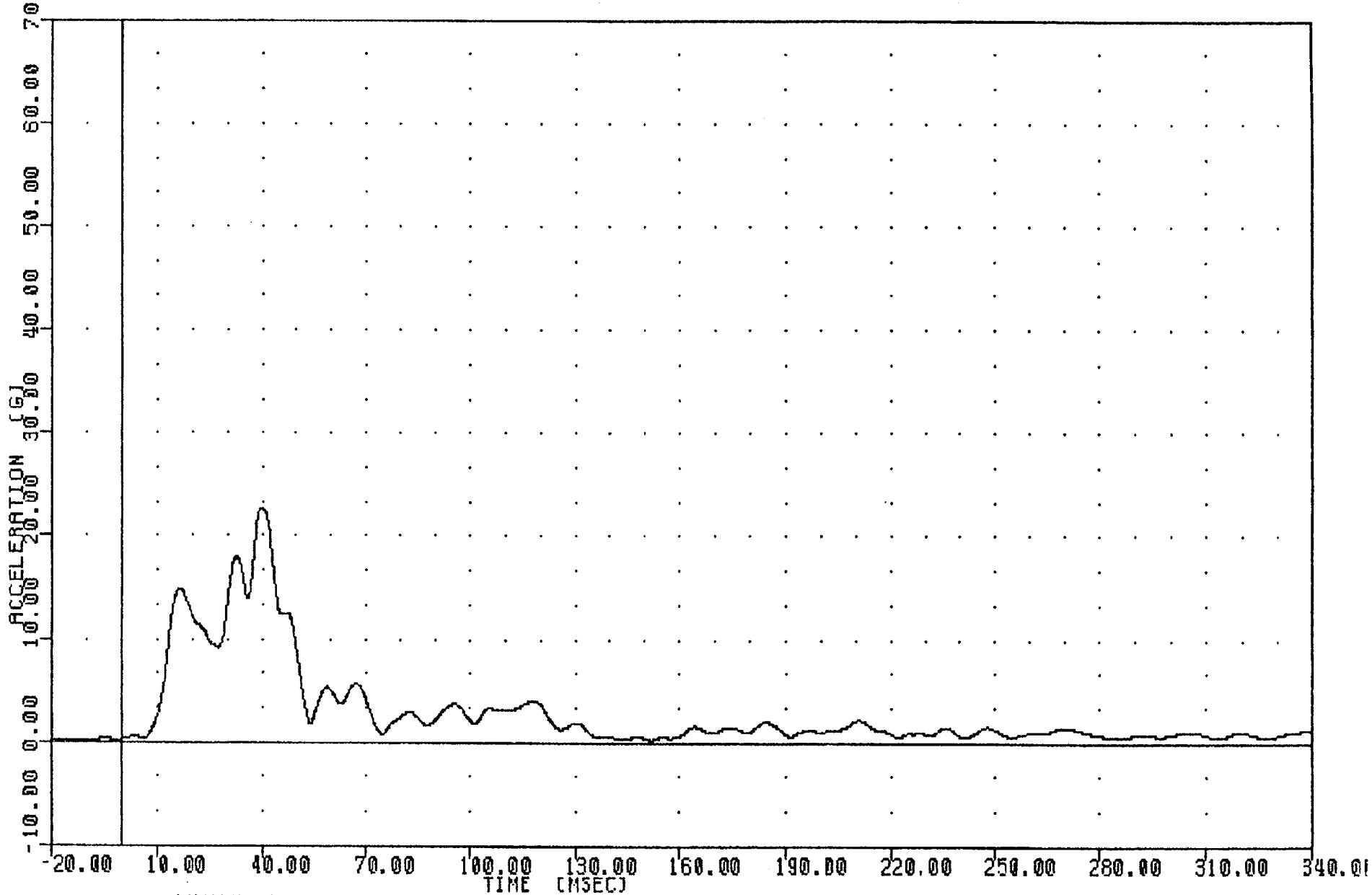



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
VEHICLE LEFT FRONT SILL ACCELERATION X AXIS

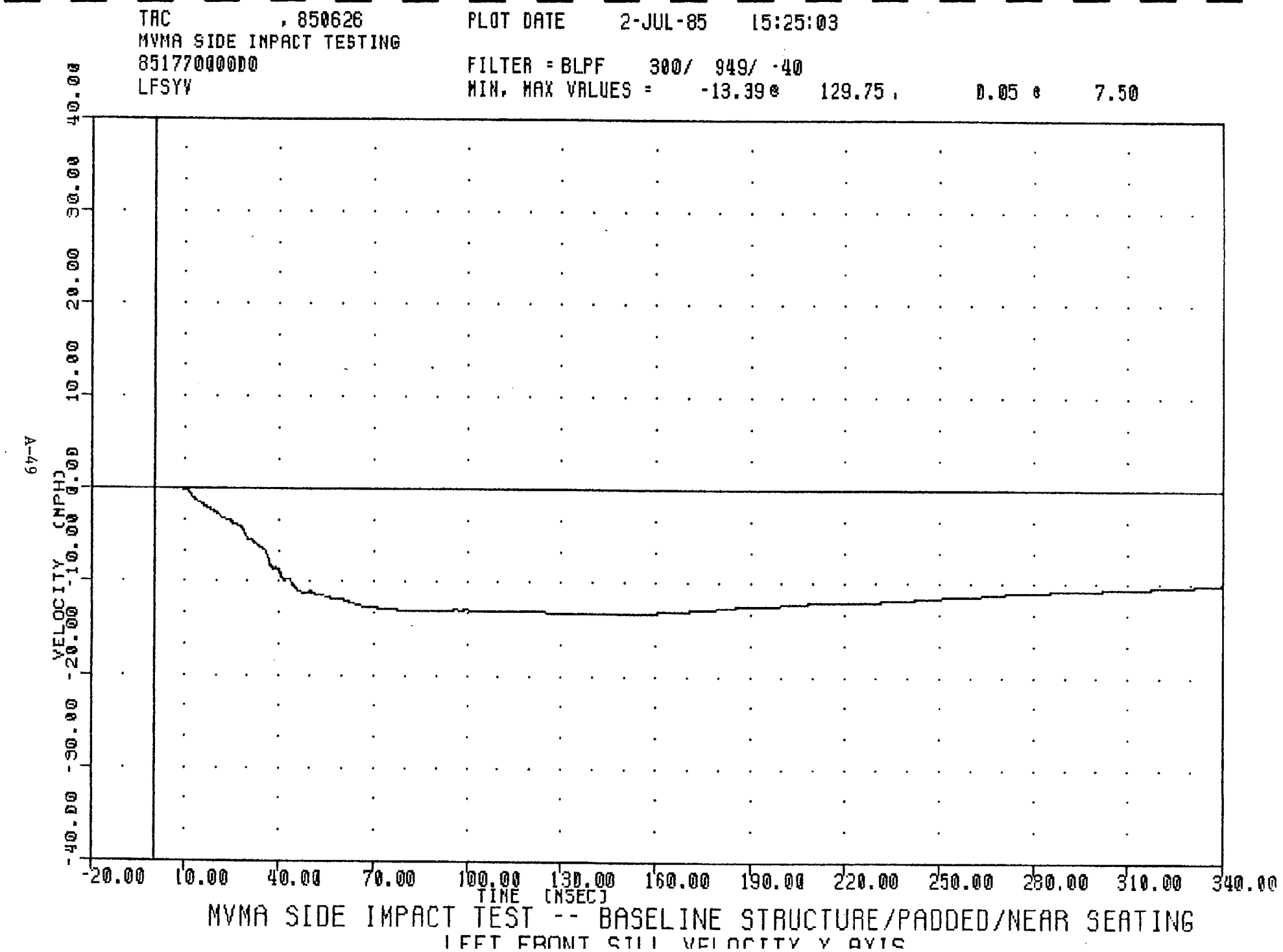

TRC , 850626
PLOT DATE 8-JUL-85 09:10:58
MVMA SIDE IMPACT TESTING
85177004000
FILTER = BLPF 100/ 316/ -40
LFSYG
MIN, MAX VALUES = -22.44@ 39.63 , 1.87 @ 184.38
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
VEHICLE LEFT FRONT SILL ACCELERATION Y AXIS

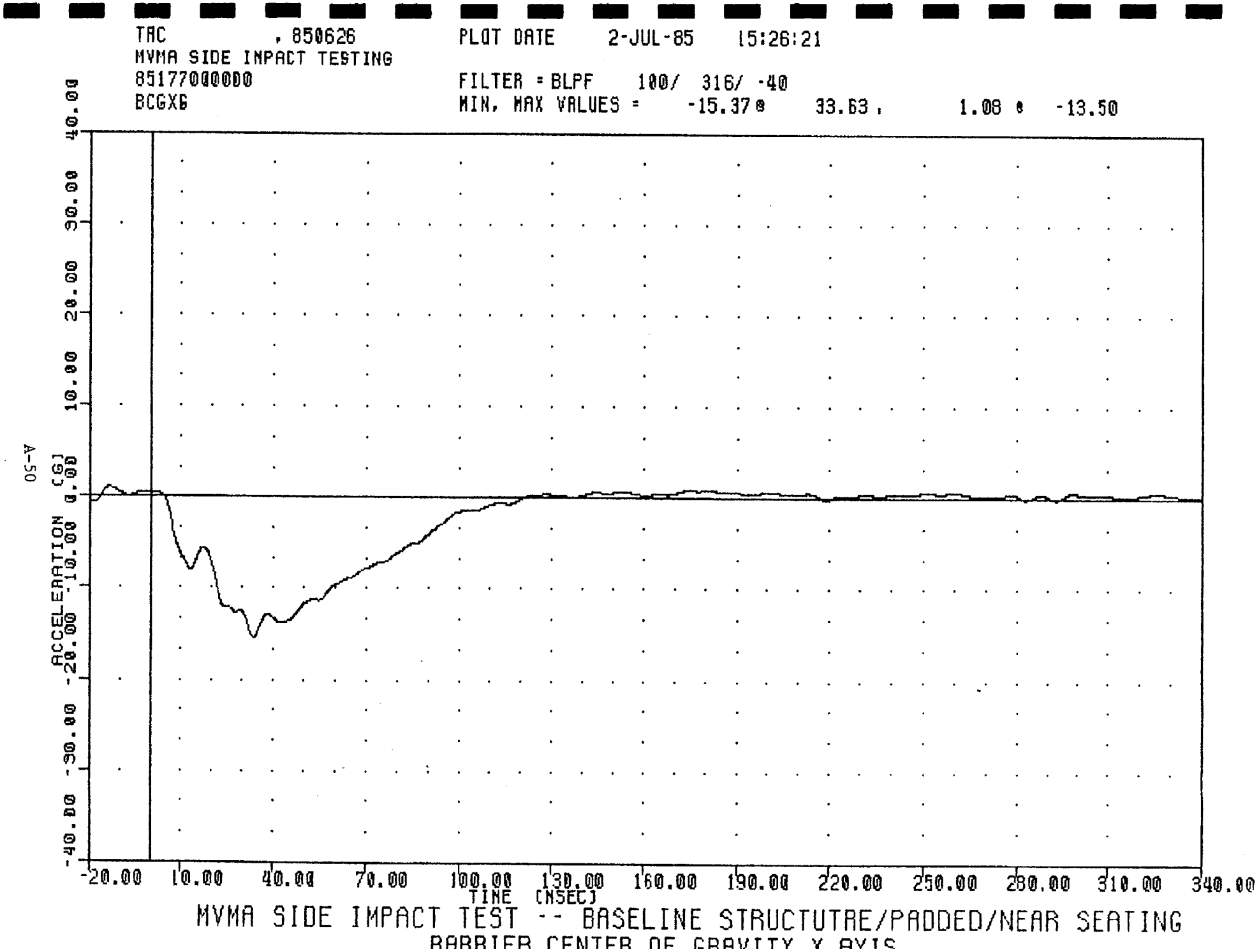

TRC , 850626
PLOT DATE 8-JUL-85 09:47:32
MVMA SIDE IMPACT TESTING
8517700000D
FILTER = BLPF 100/ 316/ -40
LFSZG
MIN, MAX VALUES = -5.77 @ 18.75 , 3.91 @ 118.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
ACCELERATION [G]
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
VEHICLE LEFT FRONT SILL ACCELERATION Z AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
85177004000 FILTER = BLPF 100/ 316/ -40
LFSRG MIN, MAX VALUES = 0.11@ -11.25 , 22.62 @ 39.75

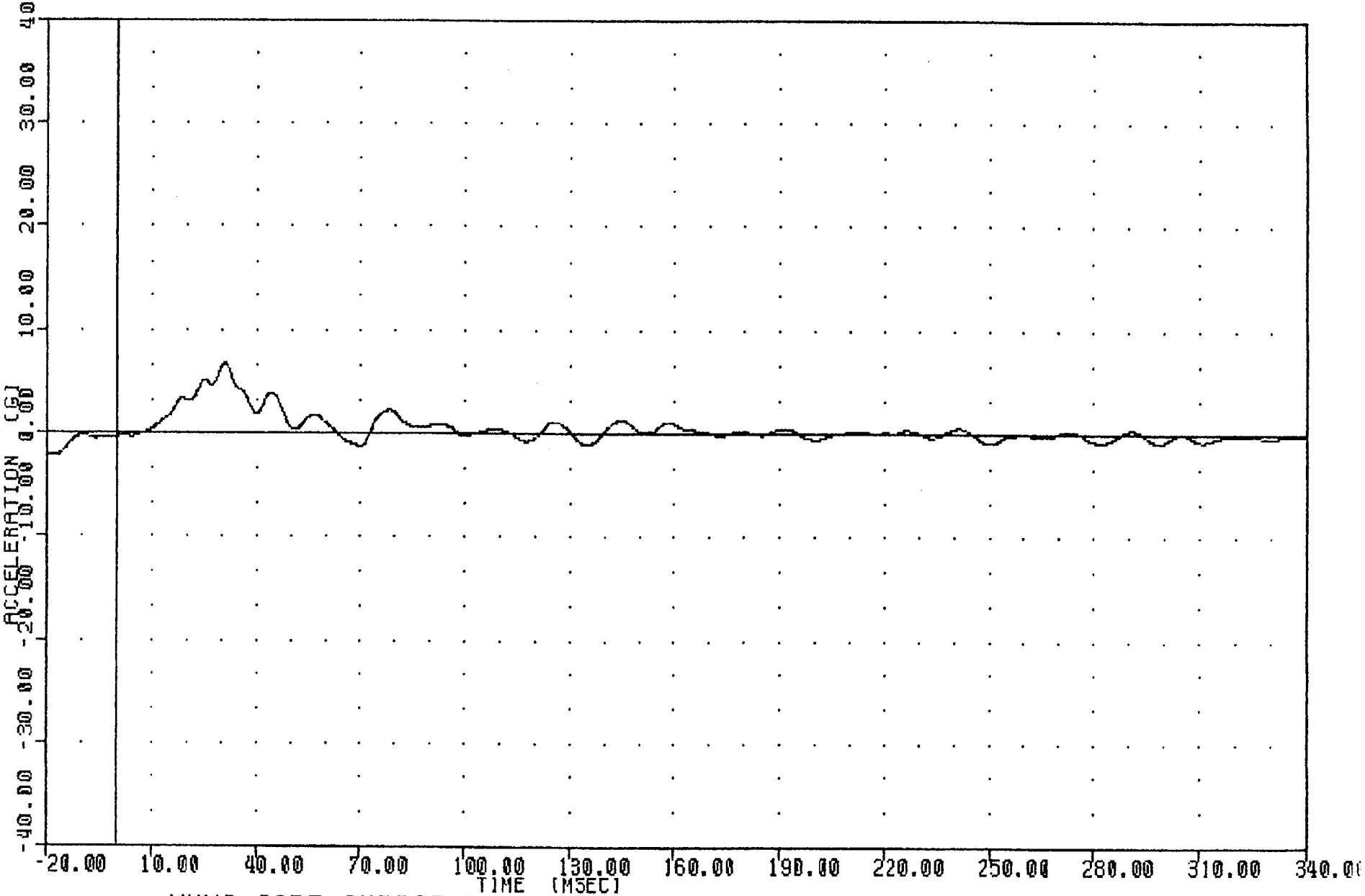



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
VEHICLE LEFT FRONT SILL RESULTANT

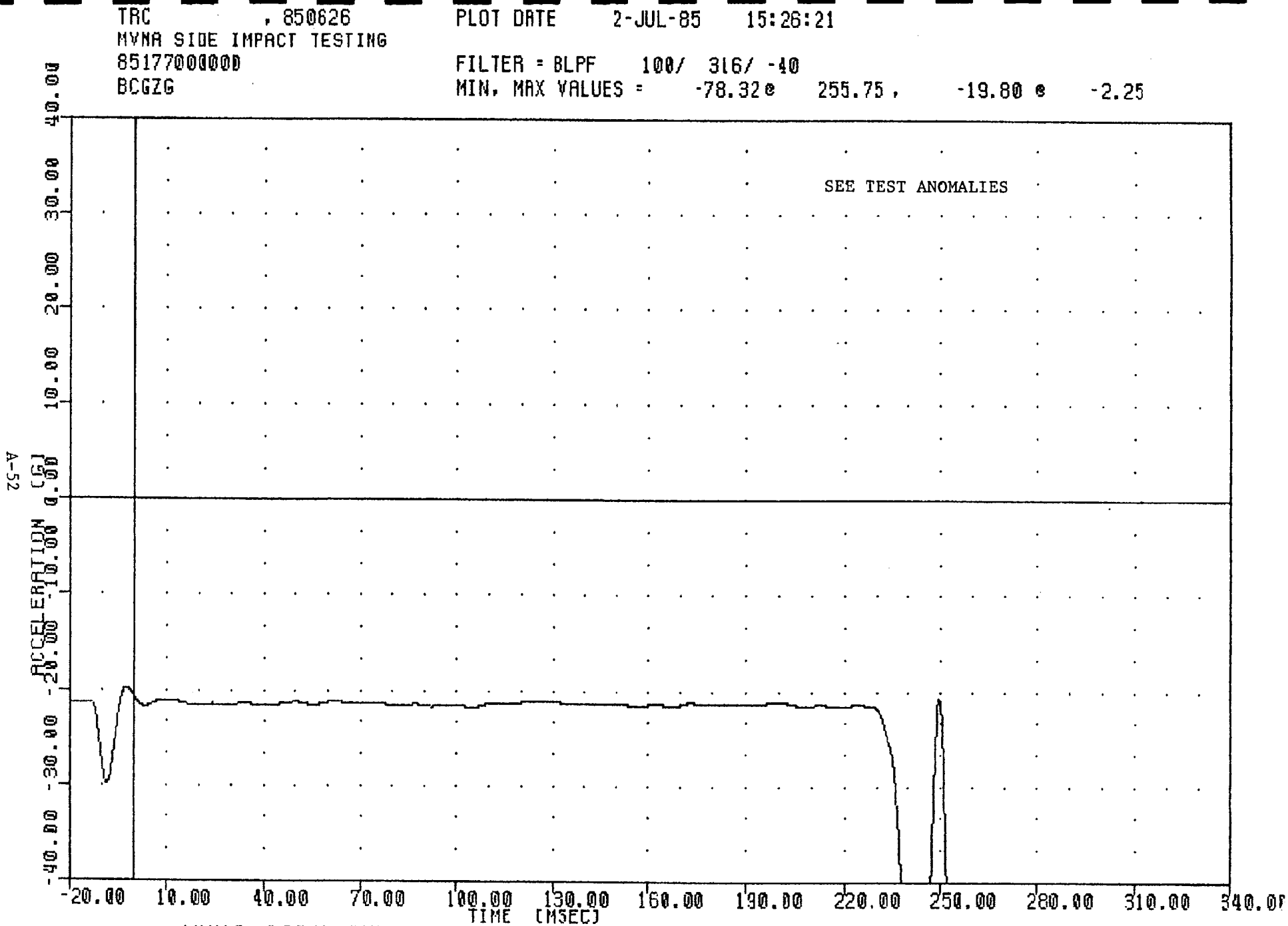

TRC , 850626
PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000
FILTER = BLPF 300/ 949/ -40
LFSYV
MIN, MAX VALUES = -13.39 @ 129.75 , 0.05 @ 7.50
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
VELOCITY (MPH)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
LEFT FRONT SILL VELOCITY X AXIS


TRC , 850626
PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
851770000D0
FILTER = BLPF 100/ 316/ -40
BCGXB
MIN, MAX VALUES = -15.37 @ 33.63 , 1.08 @ -13.50
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY X AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
NVMA SIDE IMPACT TESTING
85177000000
BCGYG
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -2.11 @ -17.50 , 6.83 @ 30.88

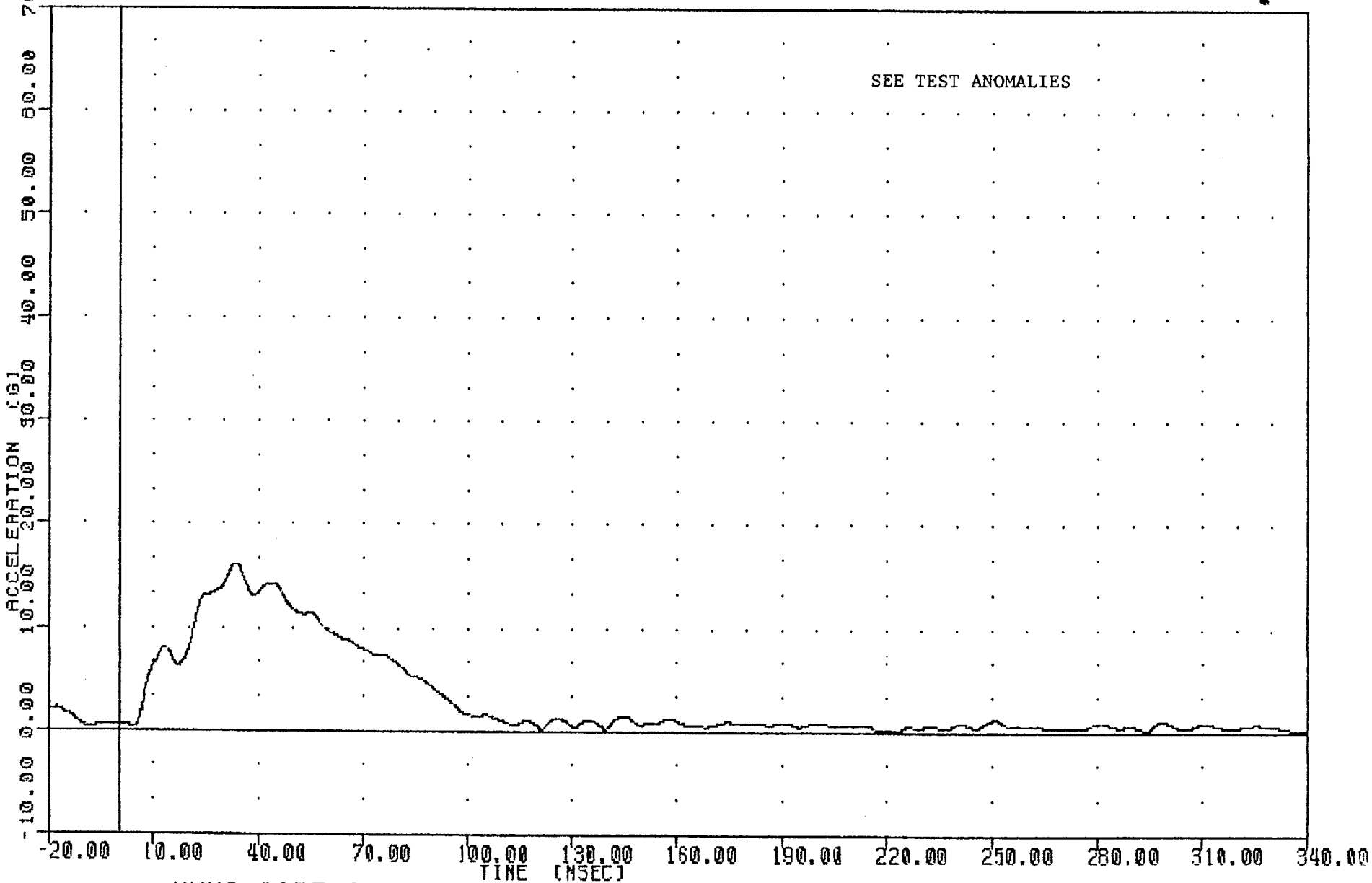



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY Y AXIS

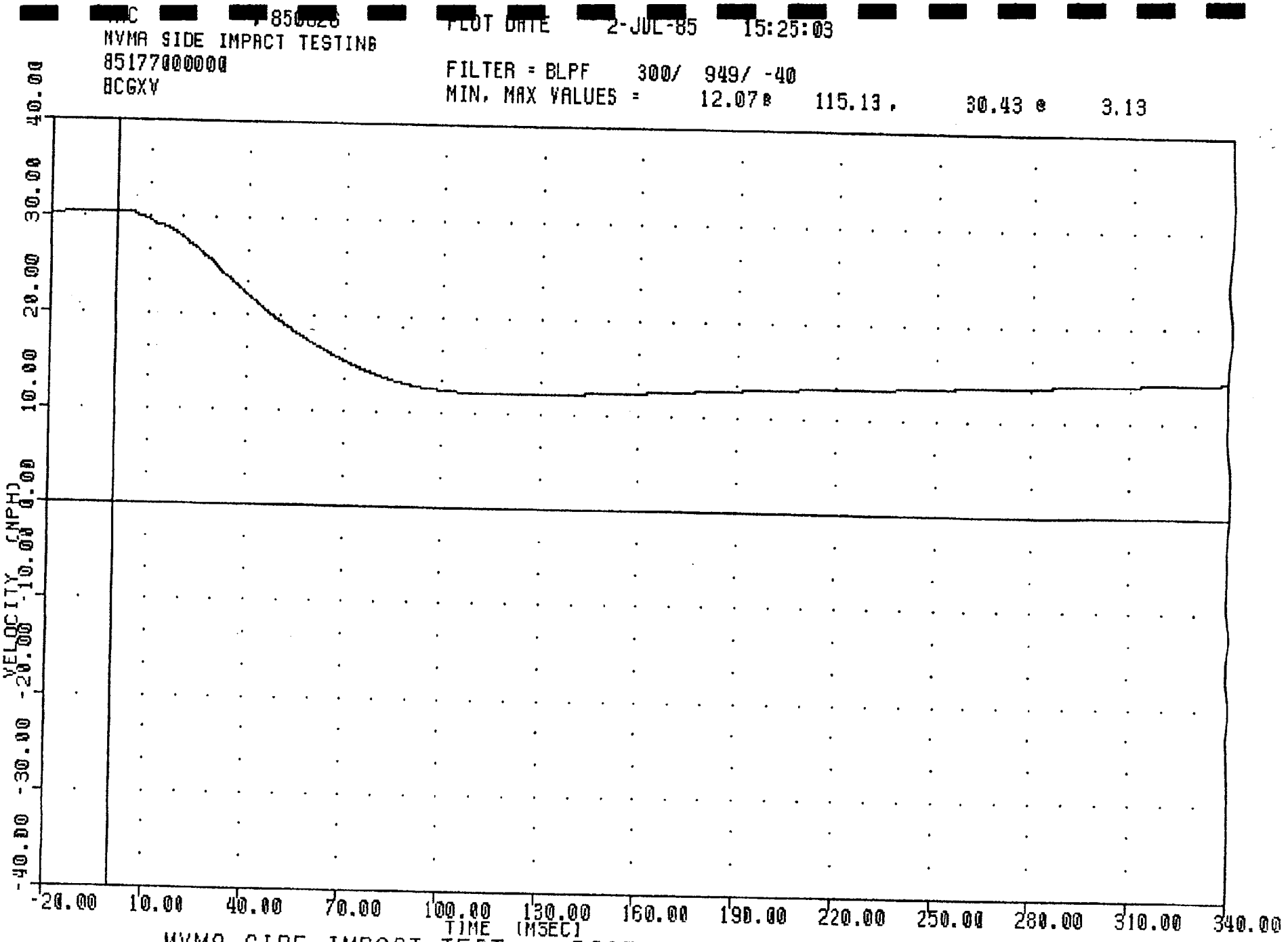



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY Z AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 100/ 316/ -40
BCGRG MIN, MAX VALUES = 0.03 @ 217.63 , 16.13 @ 33.25

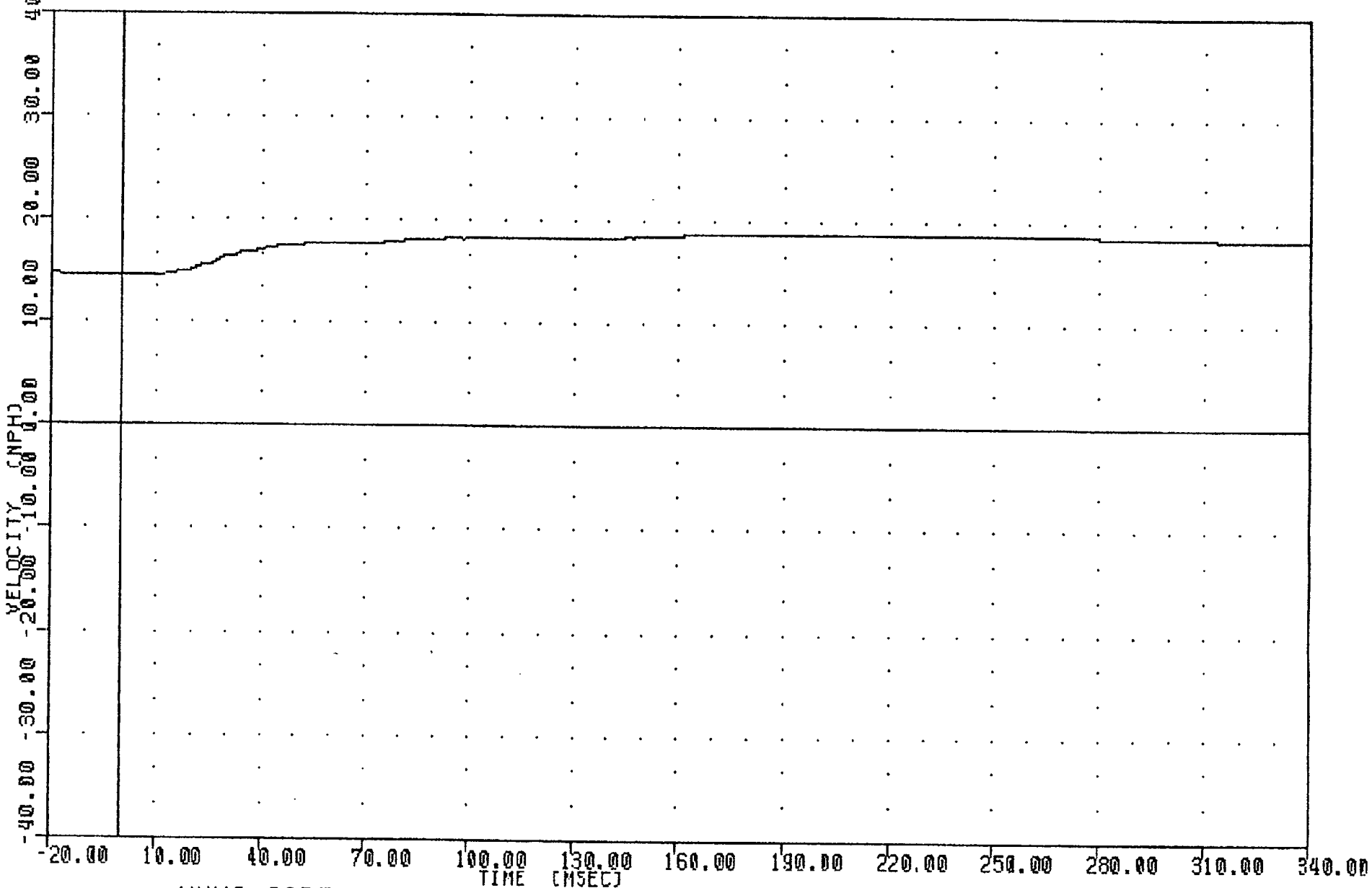



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY RESULTANT ACCELERATION USING X AND Y AXES

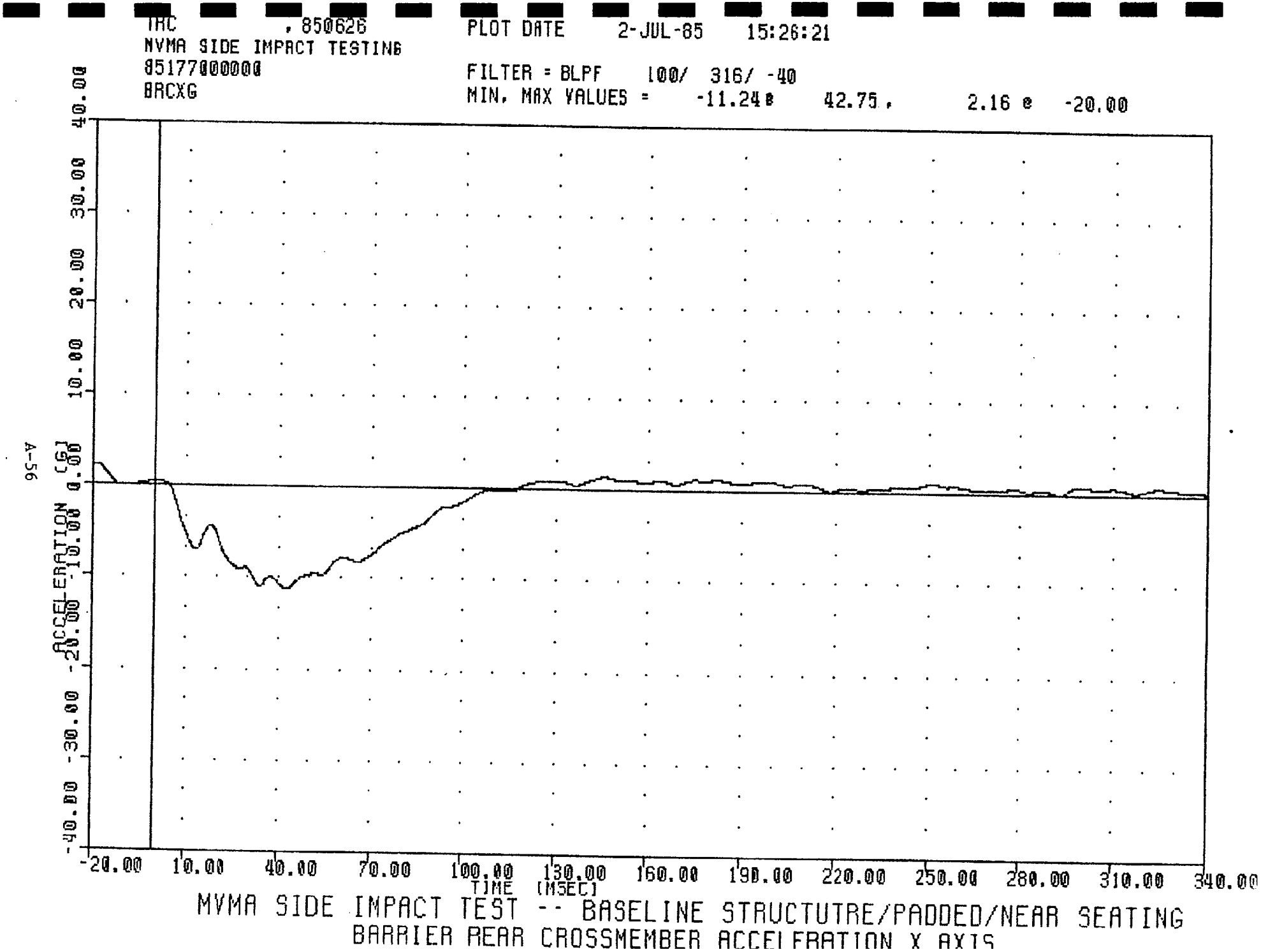



NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY VELOCITY X AXIS

TRC , 850626 PLOT DATE 2-JUL-85 15:25:03
MVMA SIDE IMPACT TESTING
85177000000 FILTER = BLPF 300/ 949/ -40
BCGYV MIN, MAX VALUES = 14.42 @ 4.00 , 18.81 @ 242.75

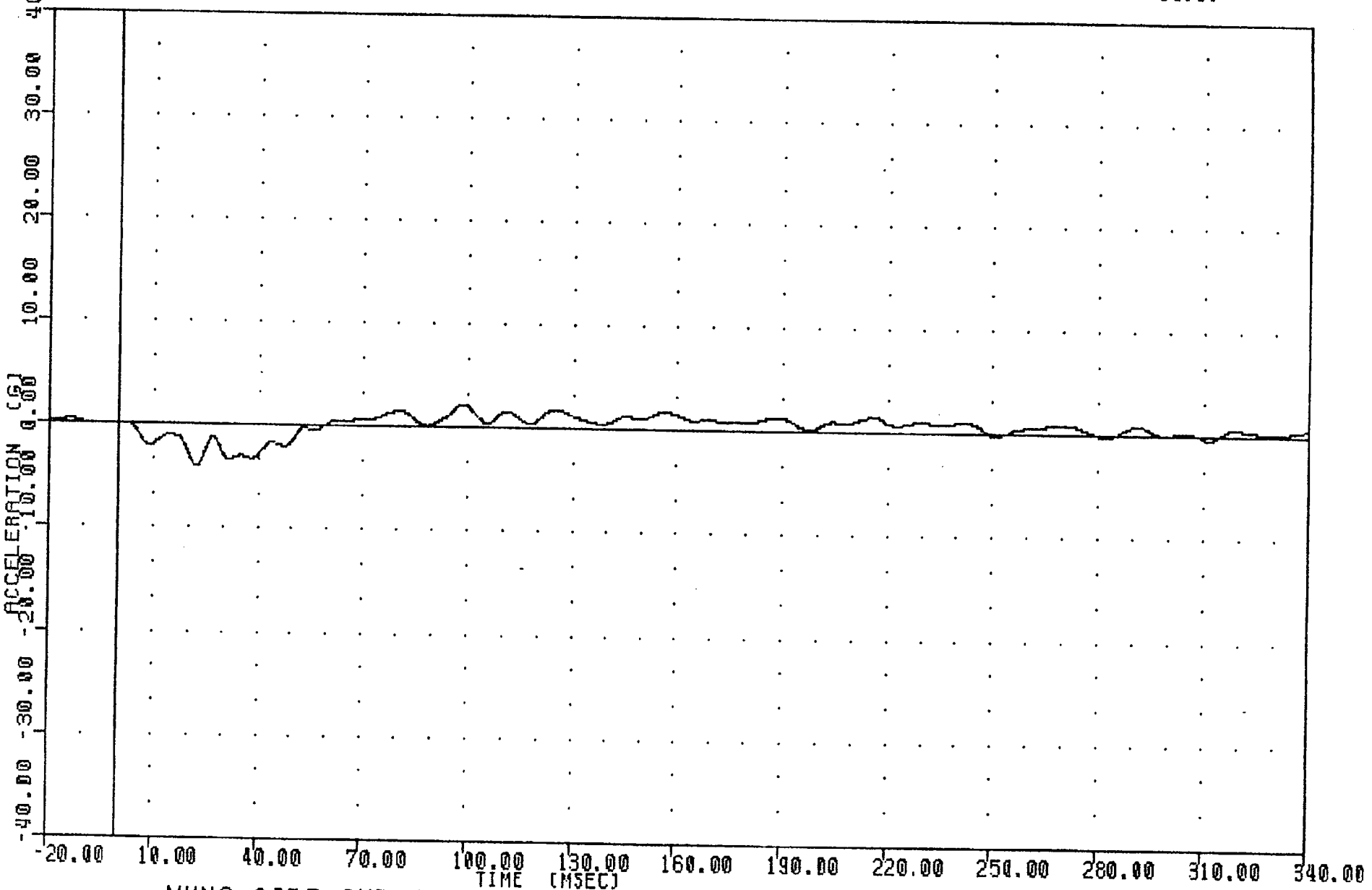



MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
BARRIER CENTER OF GRAVITY VELOCITY Y AXIS

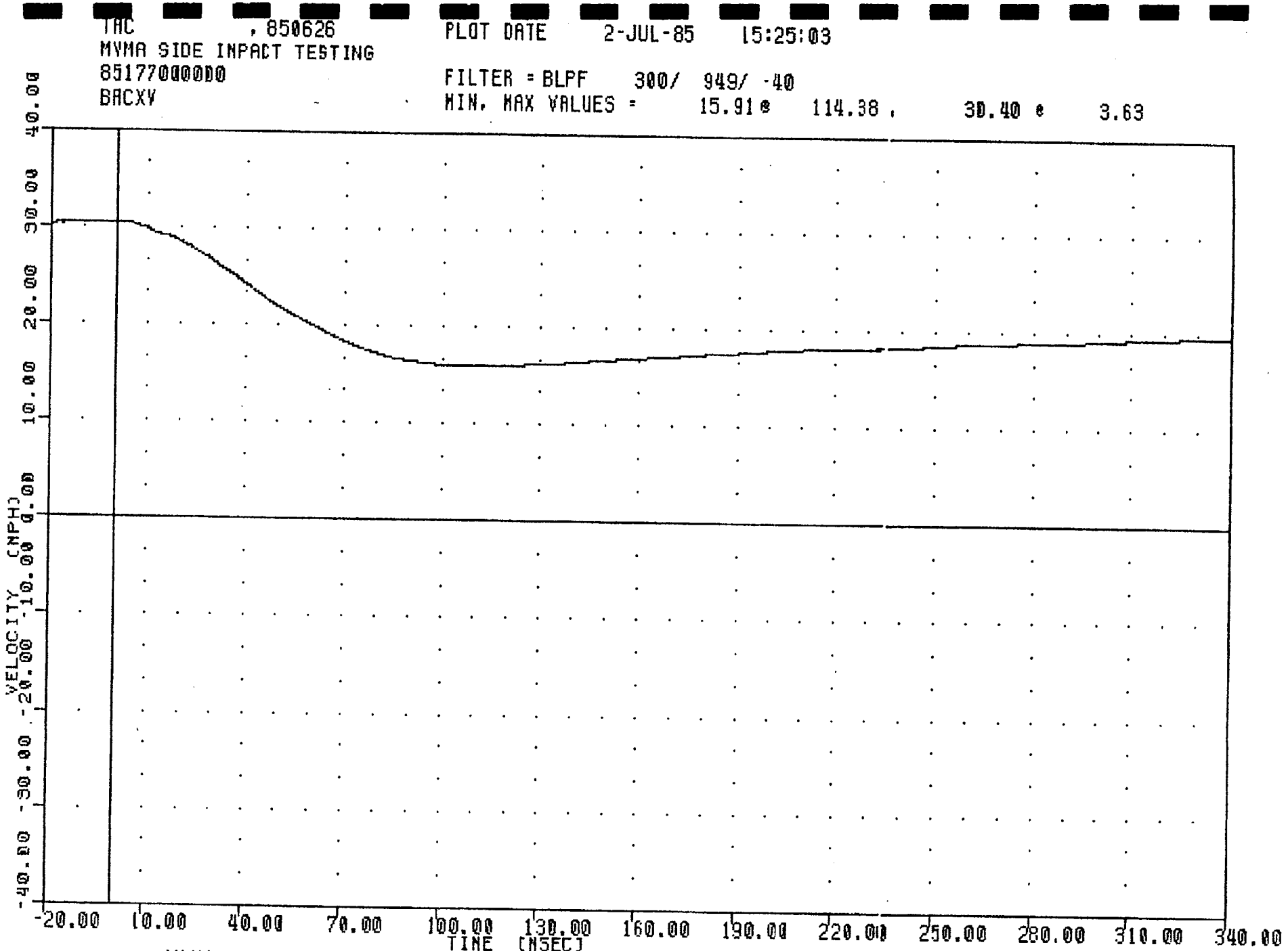



MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER REAR CROSSMEMBER ACCELERATION X AXIS

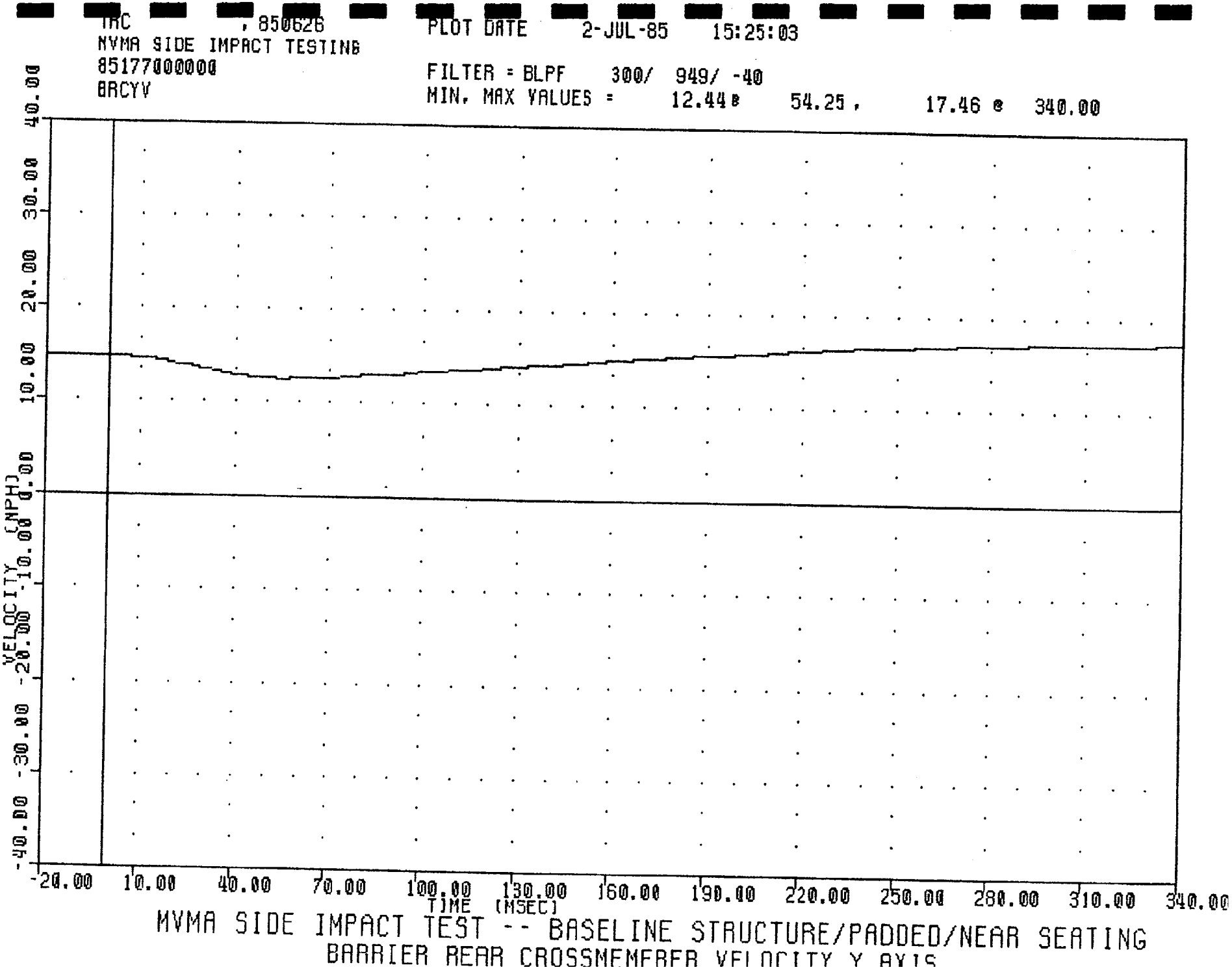
TRC , 850626 PLOT DATE 2-JUL-85 15:26:21
MVMA SIDE IMPACT TESTING
8517700@@@D FILTER = BLPF 100/ 316/ -40
BRCYG MIN. MAX VALUES = -4.07@ 22.3B , 2.25 @ 98.63




MVMA SIDE IMPACT TEST -- BASELINE STRUCTUTRE/PADDED/NEAR SEATING
BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS




MVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
BARRIER REAR CROSSMEMBER VELOCITY X AXIS




NVMA SIDE IMPACT TEST -- BASELINE STRUCTURE/PADDED/NEAR SEATING
BARRIER REAR CROSSMEMBER VELOCITY Y AXIS

# APPENDIX B

## DUMMY CERTIFICATION

SIDE IMPACT DUMMY CALIBRATION

"SID" Dummy Damage Checklist 816

| OK | Damaged | |
|---|---|---|
| ___ | ___ | Outer skin on entire dummy (gashes, rips, etc.) |
| ___ | ___ | Head - Gashes, rips, general appearance, etc. |
| ___ | ___ | Neck - broken or cracks in rubber |
| ___ | ___ | Spine - broken or cracks in rubber |
| ___ | ___ | Ribs - check all ribs for damage (bent or broken), damping material separation. |
| ___ | ___ | Rib Attach Leather - breaks in leather at ribs |
| ___ | ___ | Bourns Pot. - bent shaft - electrical discontinuity |
| ___ | ___ | Accelerometer Leads - torn cables |
| ___ | ___ | Accelerometer Mountings (Head, Thorax, Pelvis) - check for secure mounting |
| ___ | ___ | Retrofit Kit (Calspan) - check for bent brackets, sagging rib cage |
| ___ | ___ | Thorax support wire and springs - check for damage |
| ___ | ___ | Overall smooth stroking of thorax left to right (no interference) |
| ___ | ___ | Other |

If upon visual examination, damage is apparent in any of these areas, a VRTC representative is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement Approved By:

_____ _____

Signature Date

Comments on repair or replacement of parts:

VISUAL OK.

TRC Personnel
Checked By:

Doug Wills 17 JUN 85

Signature Date

VRTC Personnel
Checked and Approved for Testing BY:

_____ _____

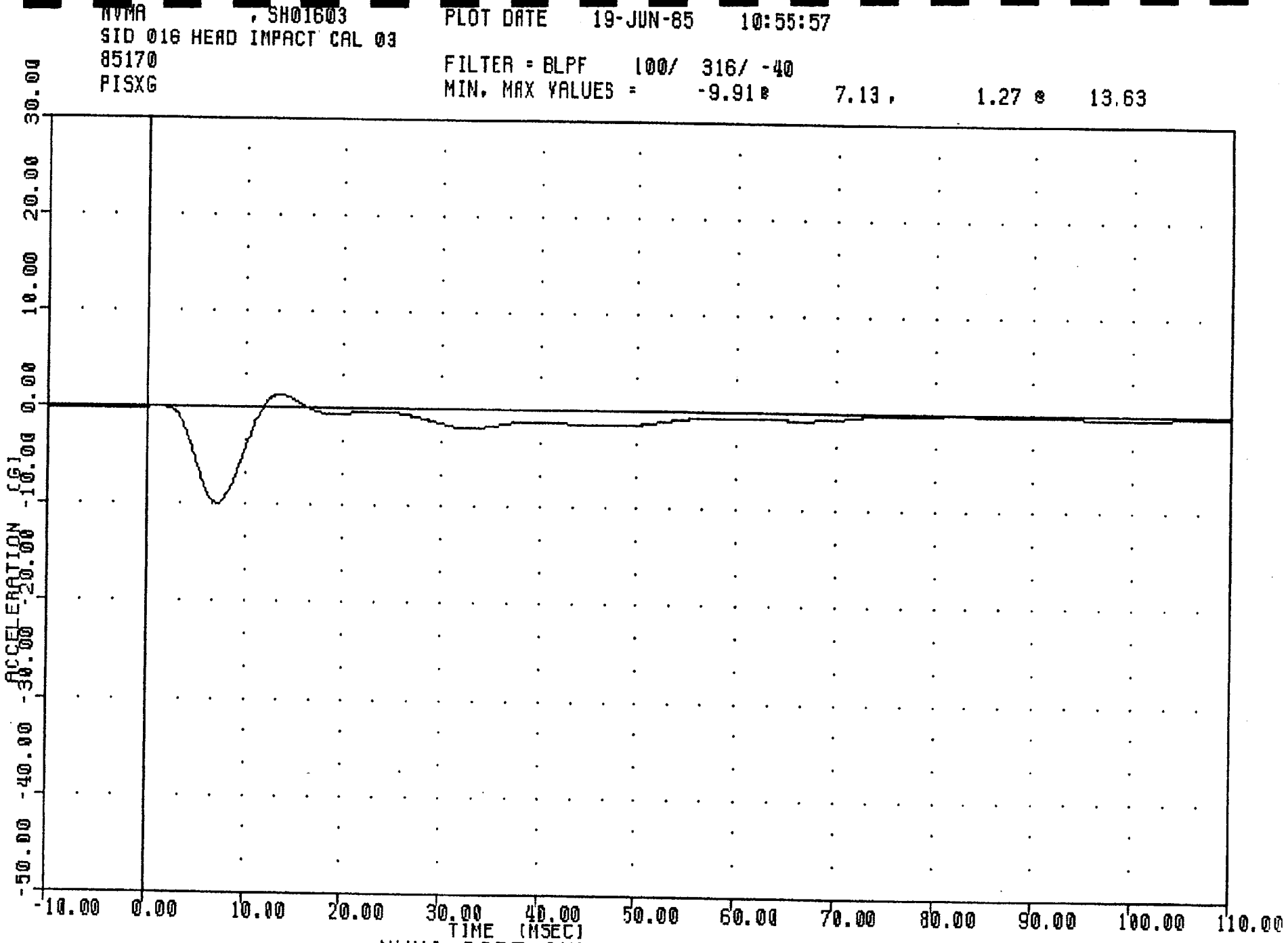
Signature Date

SIDE IMPACT DUMMY CALIBRATION
DUMMY SERIAL NUMBER 016
CALIBRATION 03

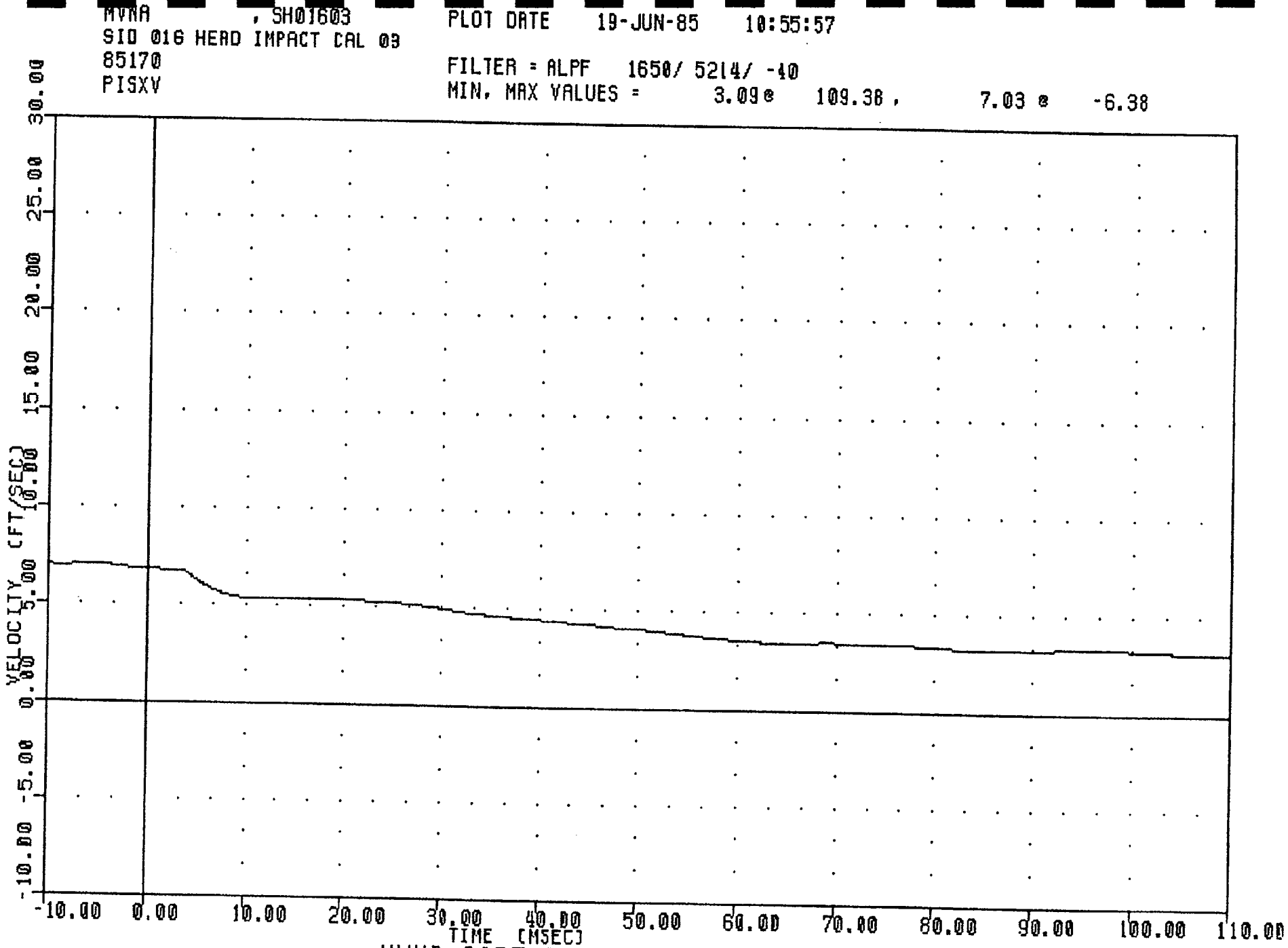
| TEST/ DATE | CHANNEL | FILTER CLASS | PEAK ACCELERATION (g) SPECIFICATION* | TEST RESULT |
|---|---|---|---|---|
| HEAD 6/19/85 | HEAD Y-AXIS | 1000 | 150-175 | 165.92 |
| THORAX 6/19/85 | UPPER SPINE Y-AXIS | | | |
| | PRIMARY | 180 | 16-24.6 | 22.35 |
| | REDUNDANT | 180 | 16-24.6 | 21.98 |
| | LOWER SPINE Y-AXIS | | | |
| | PRIMARY | 180 | 17.6-26.4 | 19.63 |
| | REDUNDANT | 180 | 17.6-26.4 | 19.80 |
| | RIGHT UPPER RIB Y-AXIS | | | |
| | PRIMARY | 180 | 36-50 | 37.05 |
| | REDUNDANT | 180 | 36-50 | 36.76 |
| | RIGHT LOWER RIB Y-AXIS | | | |
| | PRIMARY | 180 | 36-50 | 39.81 |
| | REDUNDANT | 180 | 36-50 | 39.66 |
| PELVIS 6/19/85 | PELVIS Y-AXIS | 180 | 50-65 | 49.00 |

*Side impact test specifications currently in use by VRTC-NHTSA.

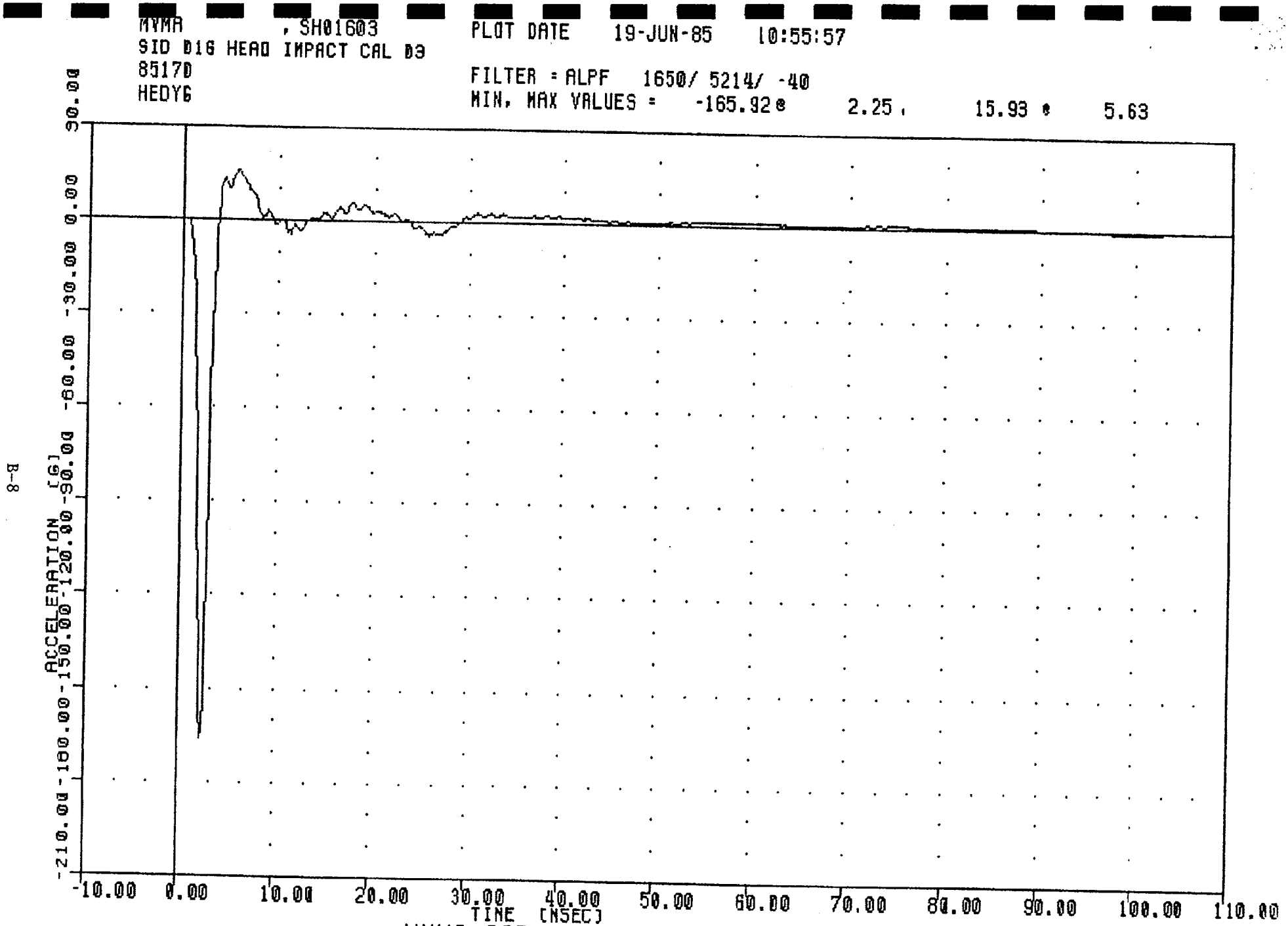
PART 572 CALIBRATION



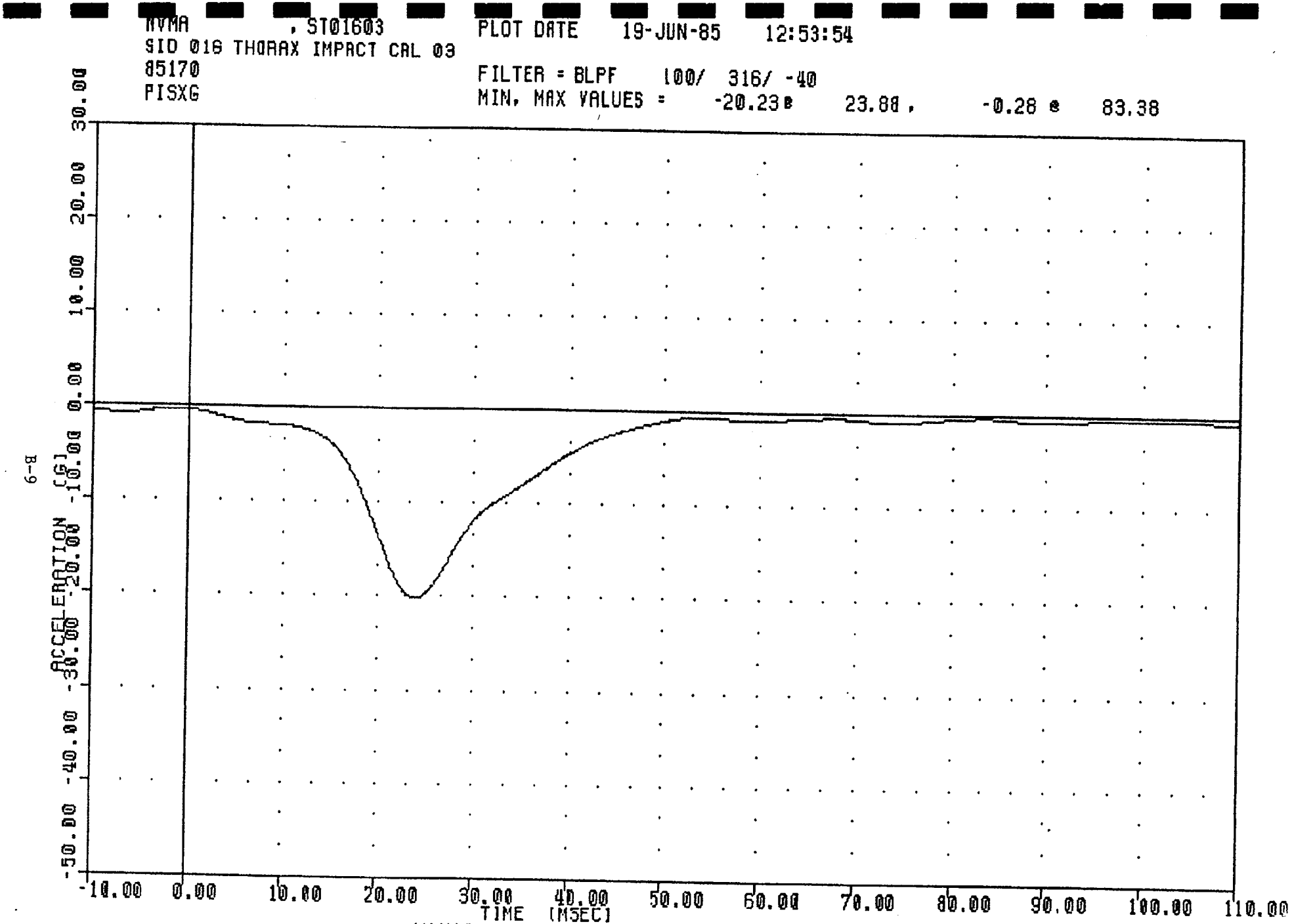

MVMA SIDE IMPACT DUMMY CALIBRATION
PISTON ACCELERATION



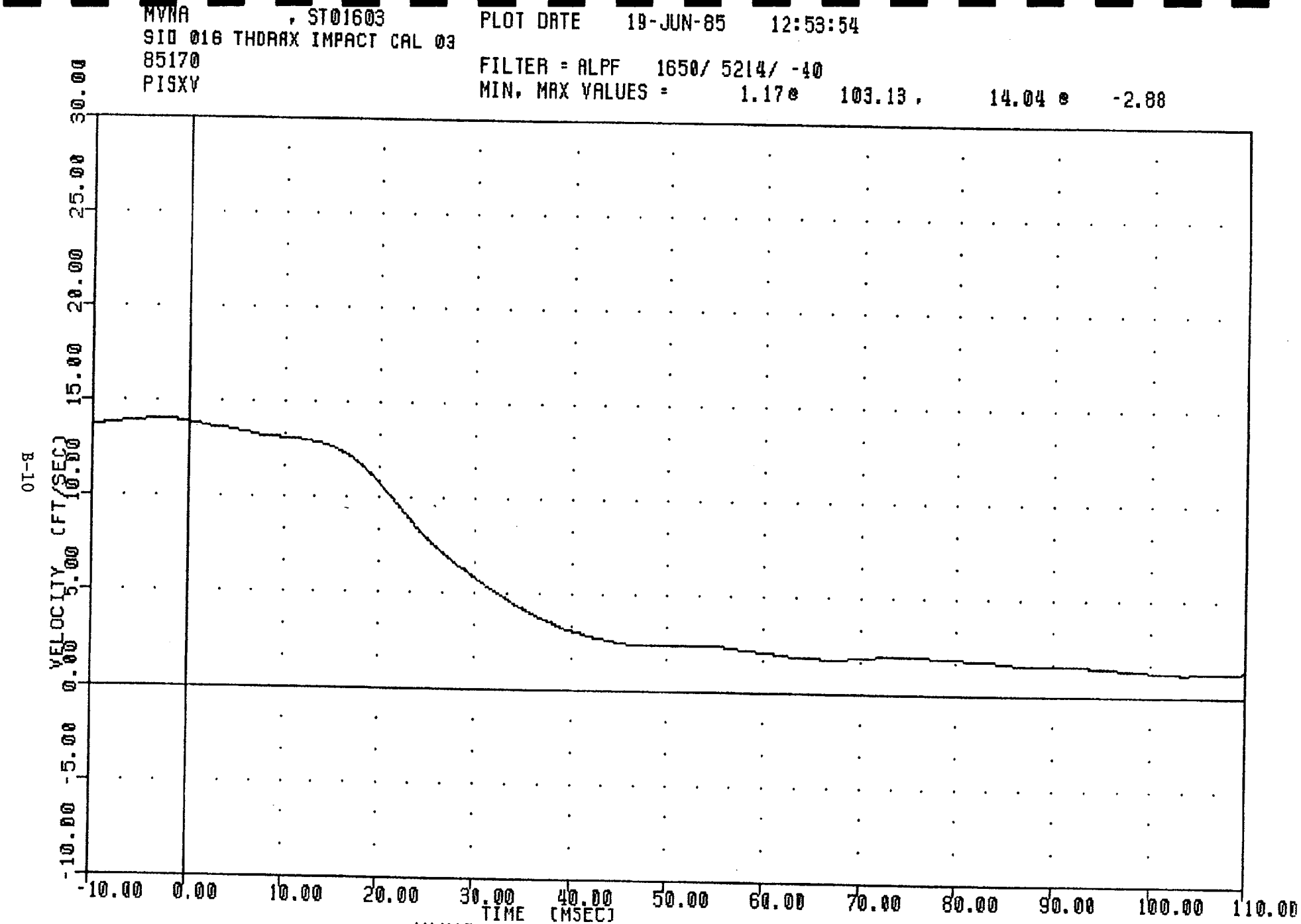

MVMA SIDE IMPACT DUMMY CALIBRATION
PISTON VELOCITY



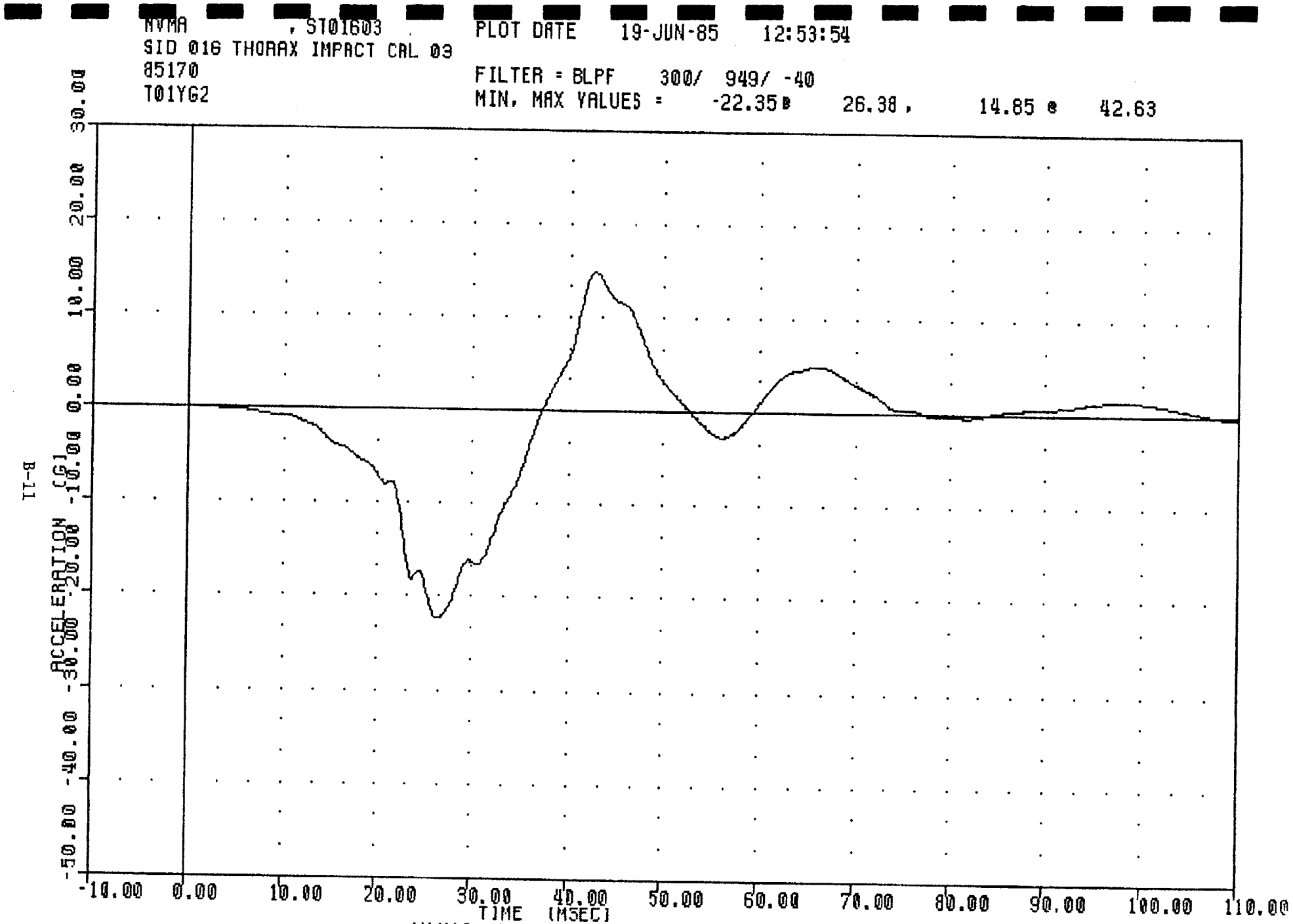

MVMA SIDE IMPACT DUMMY CALIBRATION
HEAD ACCELERATION Y AXIS



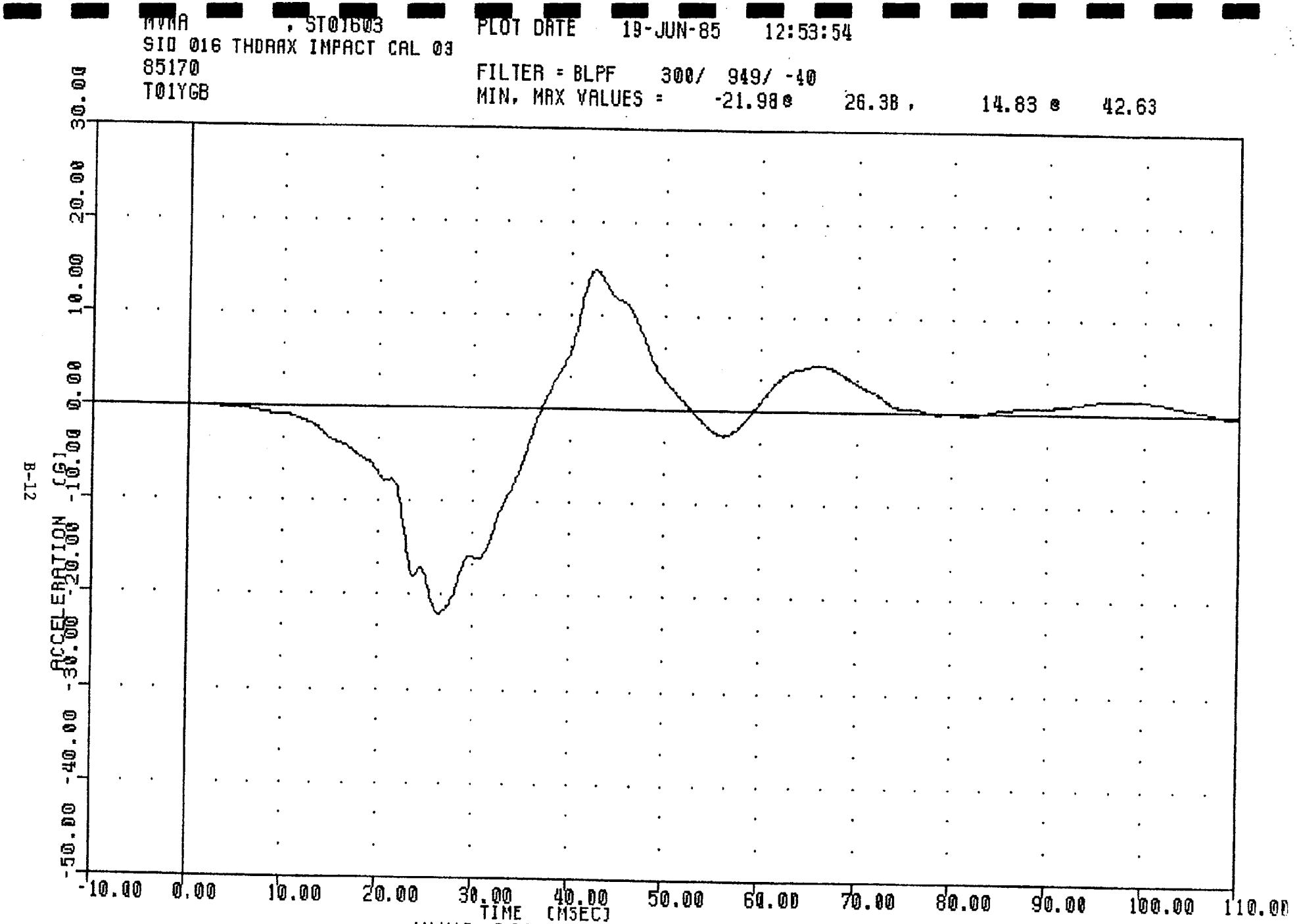

MVMA SIDE IMPACT DUMMY CALIBRATION
PISTON ACCELERATION



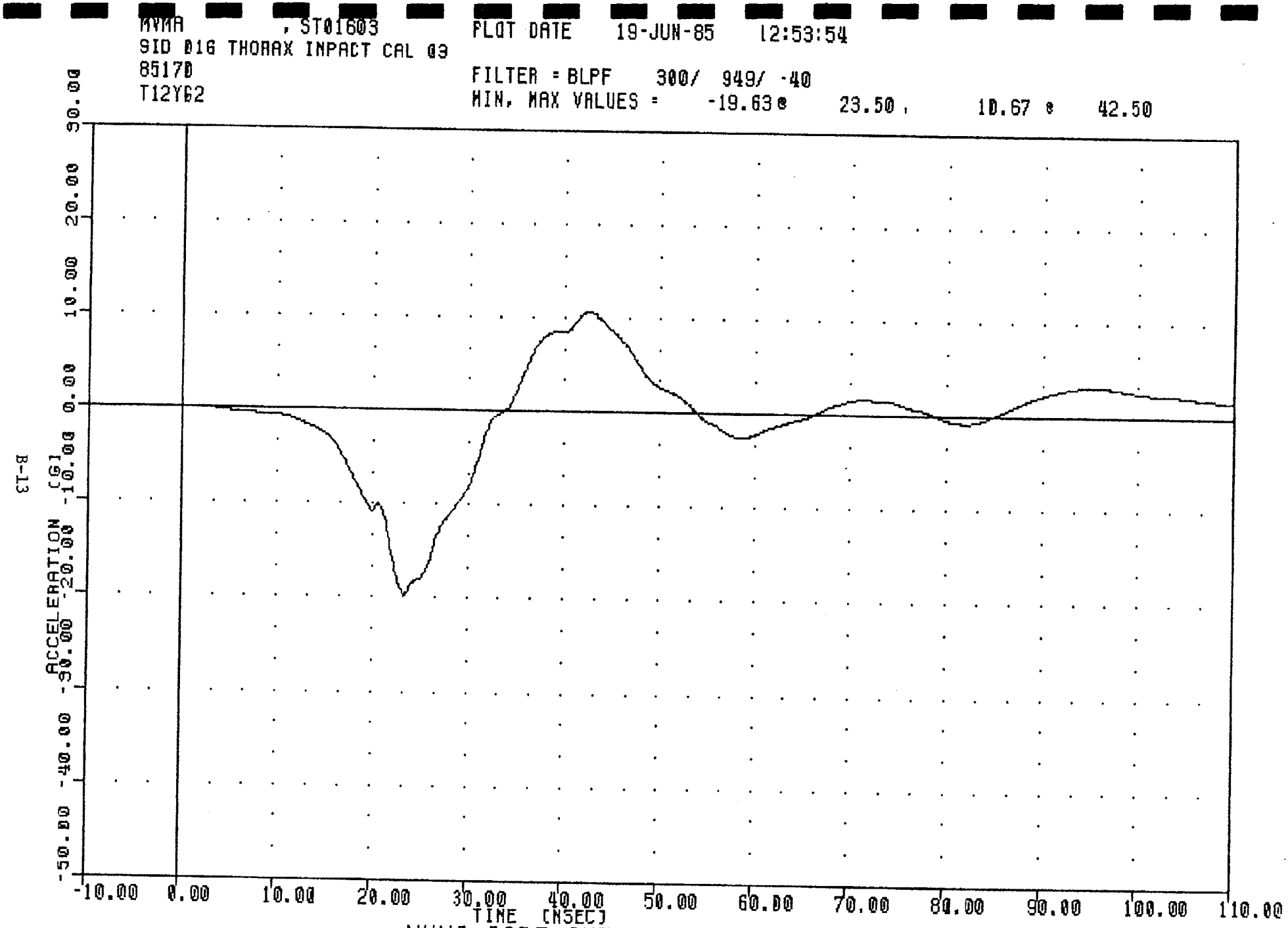

MVMA SIDE IMPACT DUMMY CALIBRATION
PISTON VELOCITY



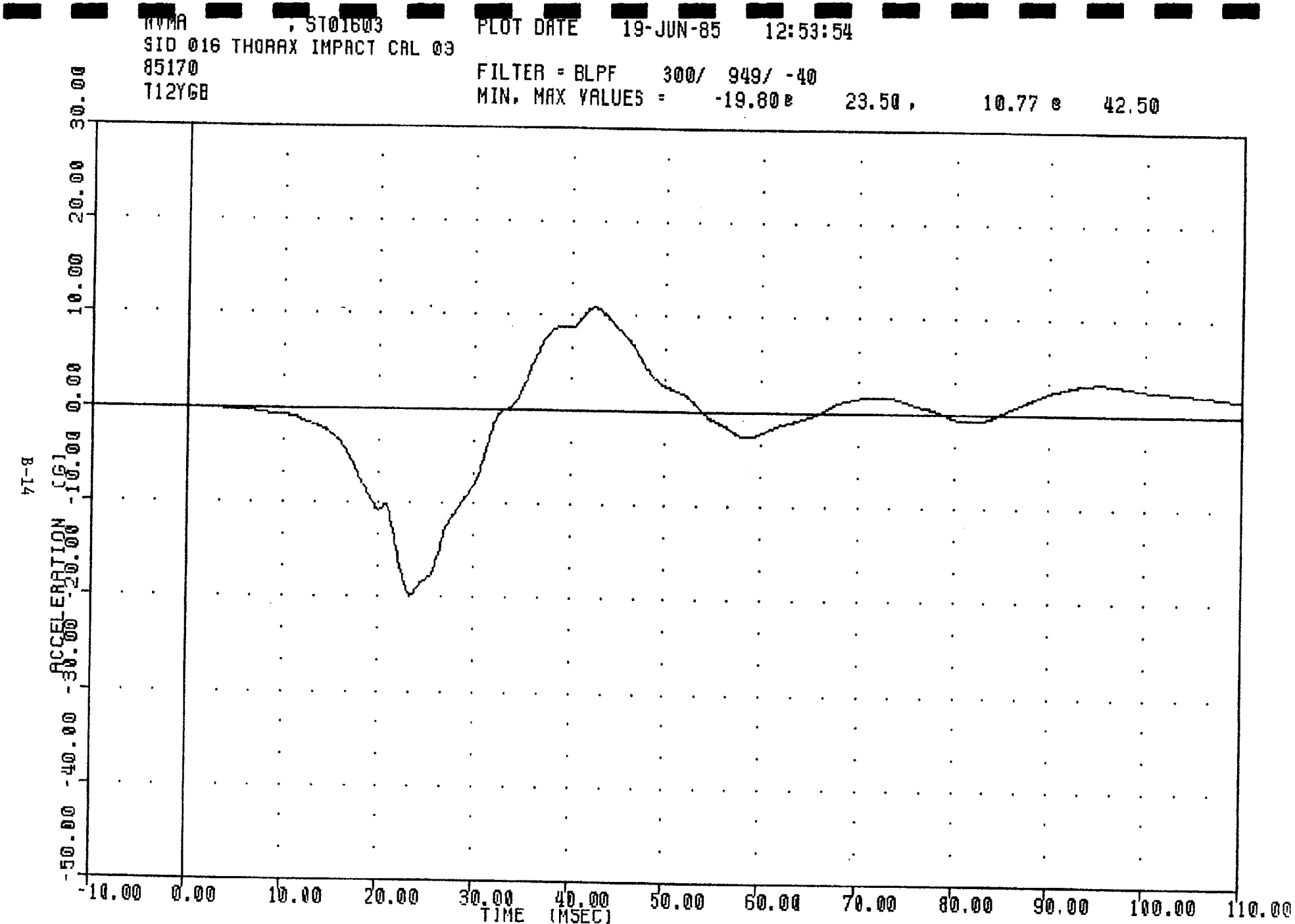

MVMA SIDE IMPACT DUMMY CALIBRATION
UPPER SPINE ACCELERATION Y AXIS -PRIMARY



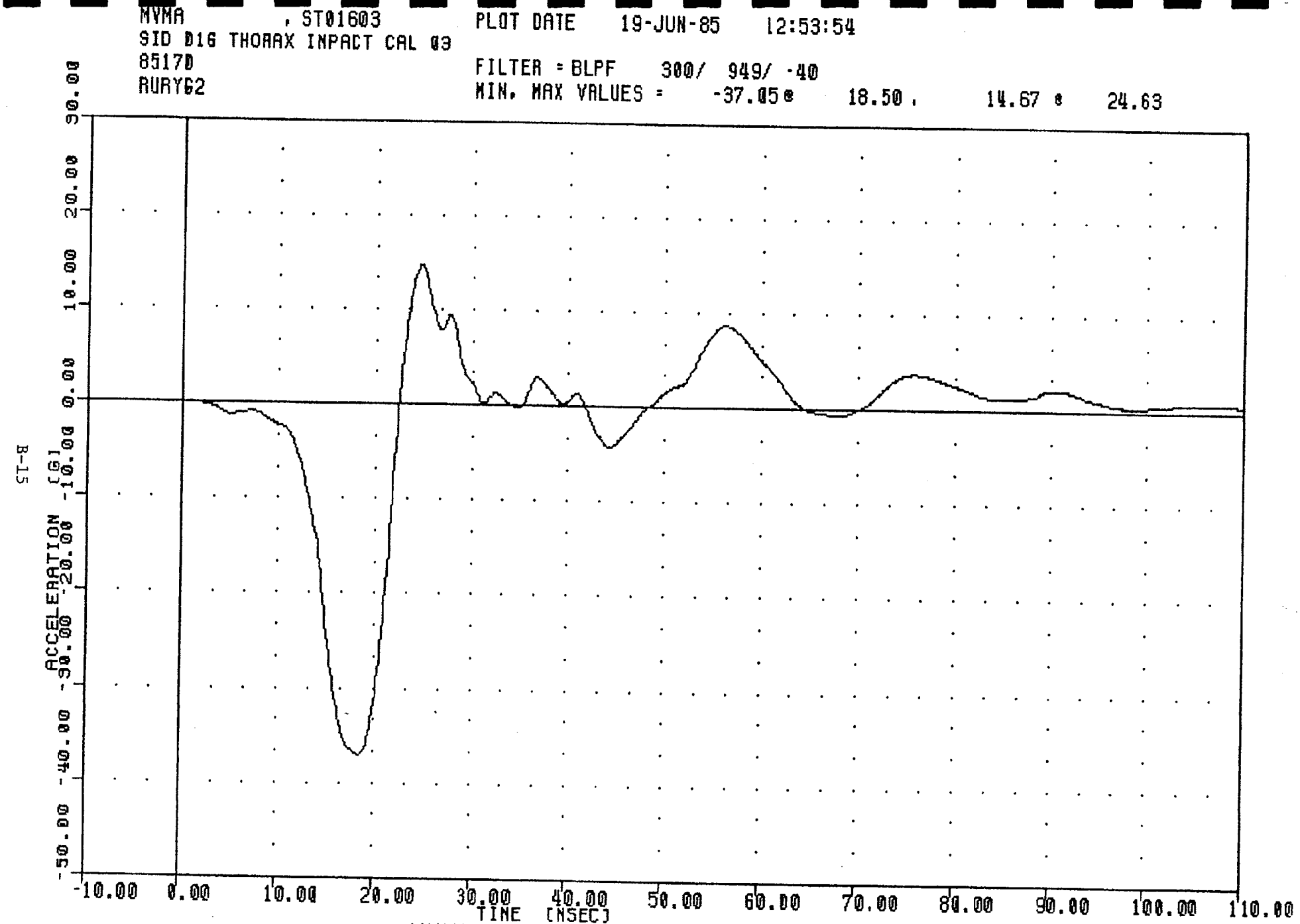

MVMA SIDE IMPACT DUMMY CALIBRATION
UPPER SPINE ACCELERATION Y AXIS -REDUNDANT




MVMA SIDE IMPACT DUMMY CALIBRATION
LOWER SPINE ACCELERATION Y AXIS -PRIMARY

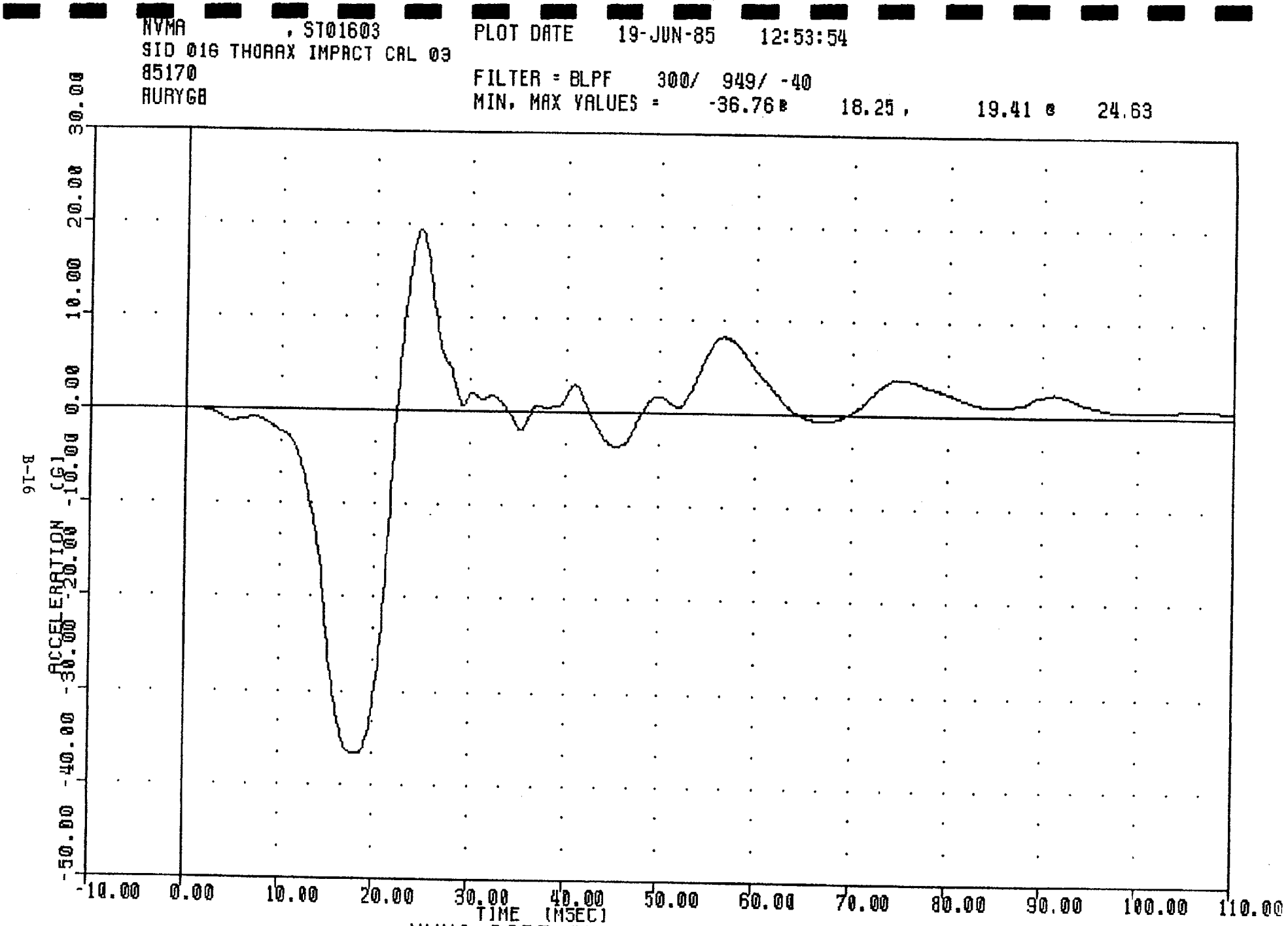



MVMA SIDE IMPACT DUMMY CALIBRATION
LOWER SPINE ACCELERATION Y AXIS -REDUNDANT



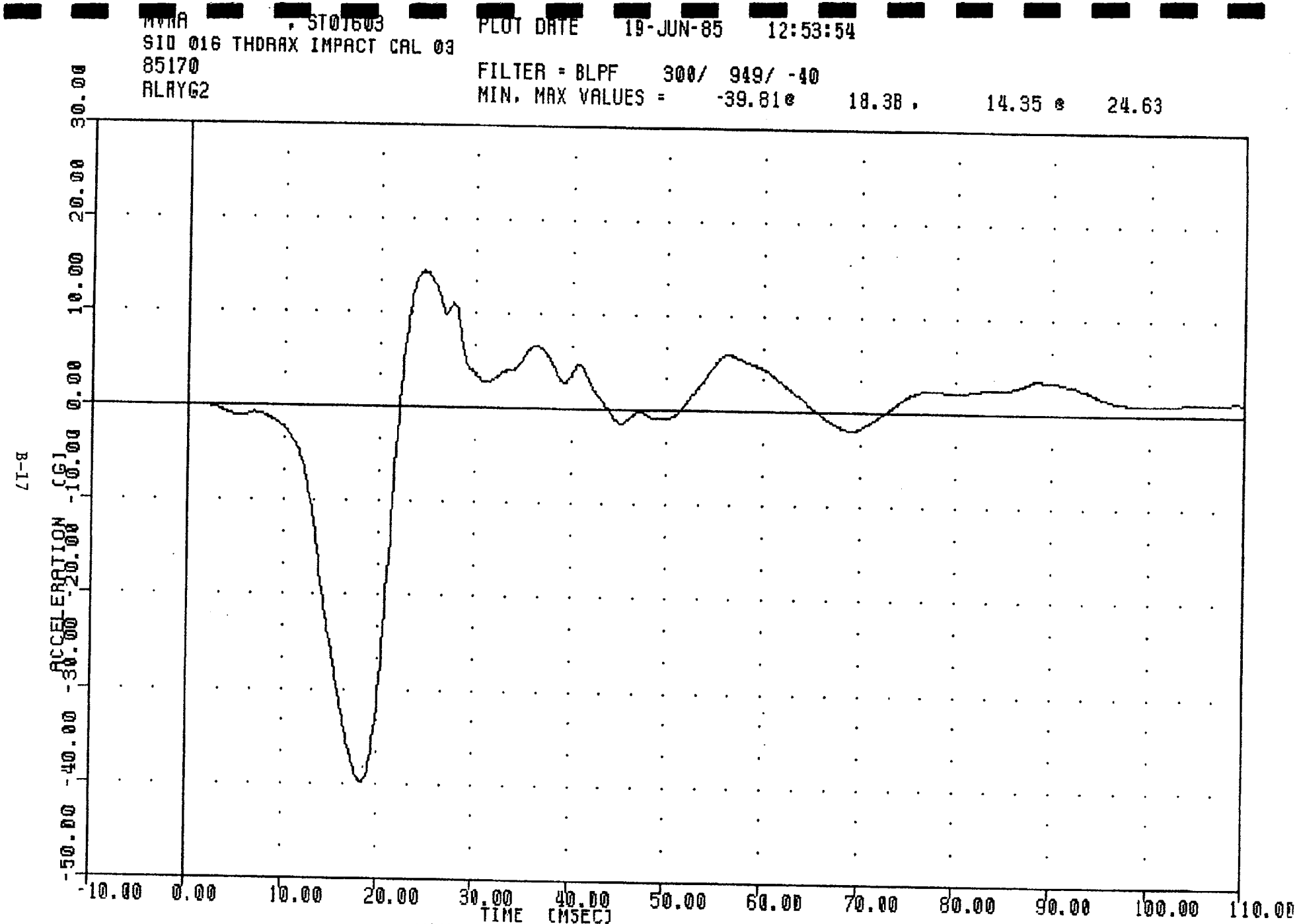

MVMA SIDE IMPACT DUMMY CALIBRATION

RIGHT UPPER RIB ACCELERATION Y AXIS -PRIMARY

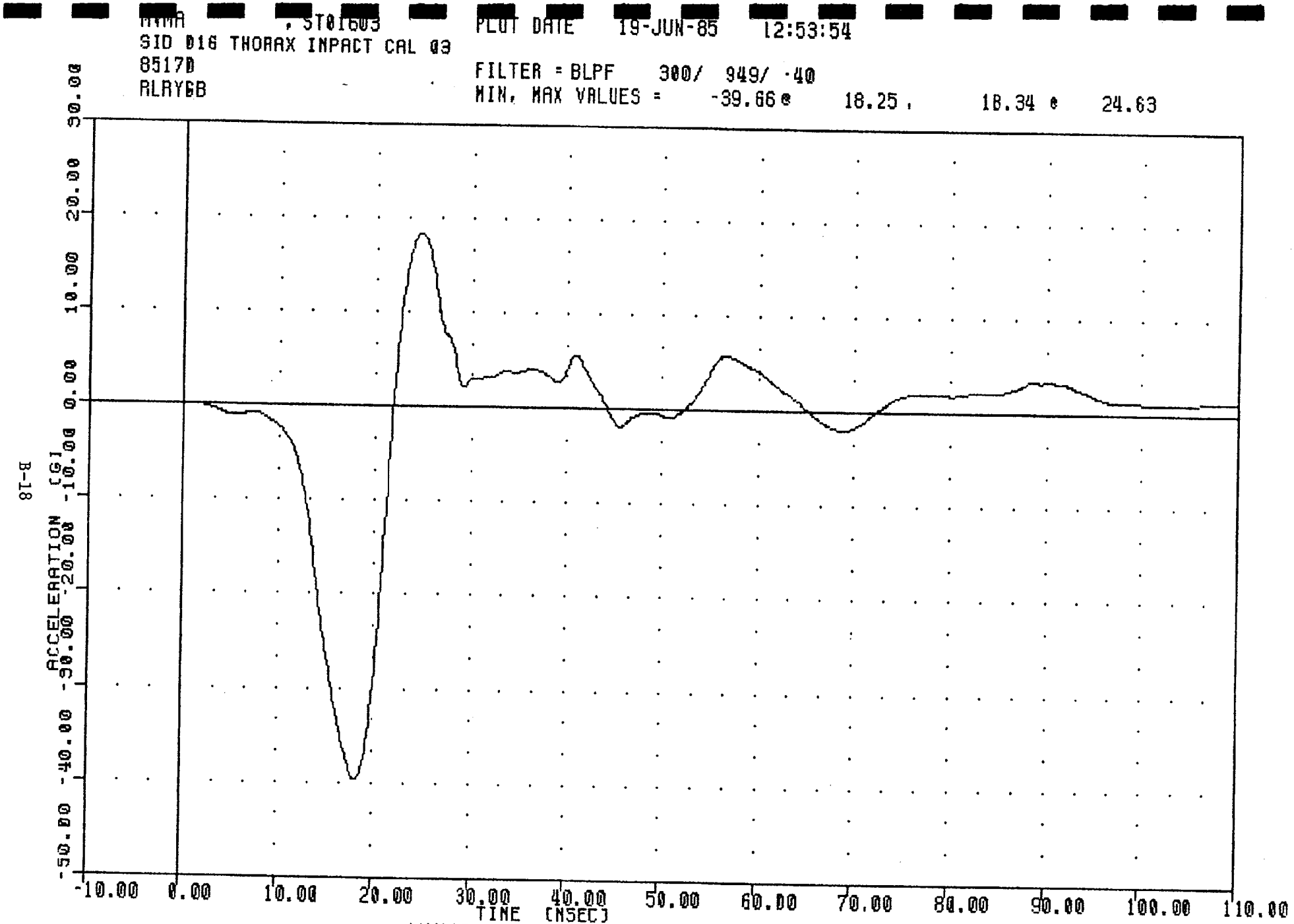



MVMA SIDE IMPACT DUMMY CALIBRATION

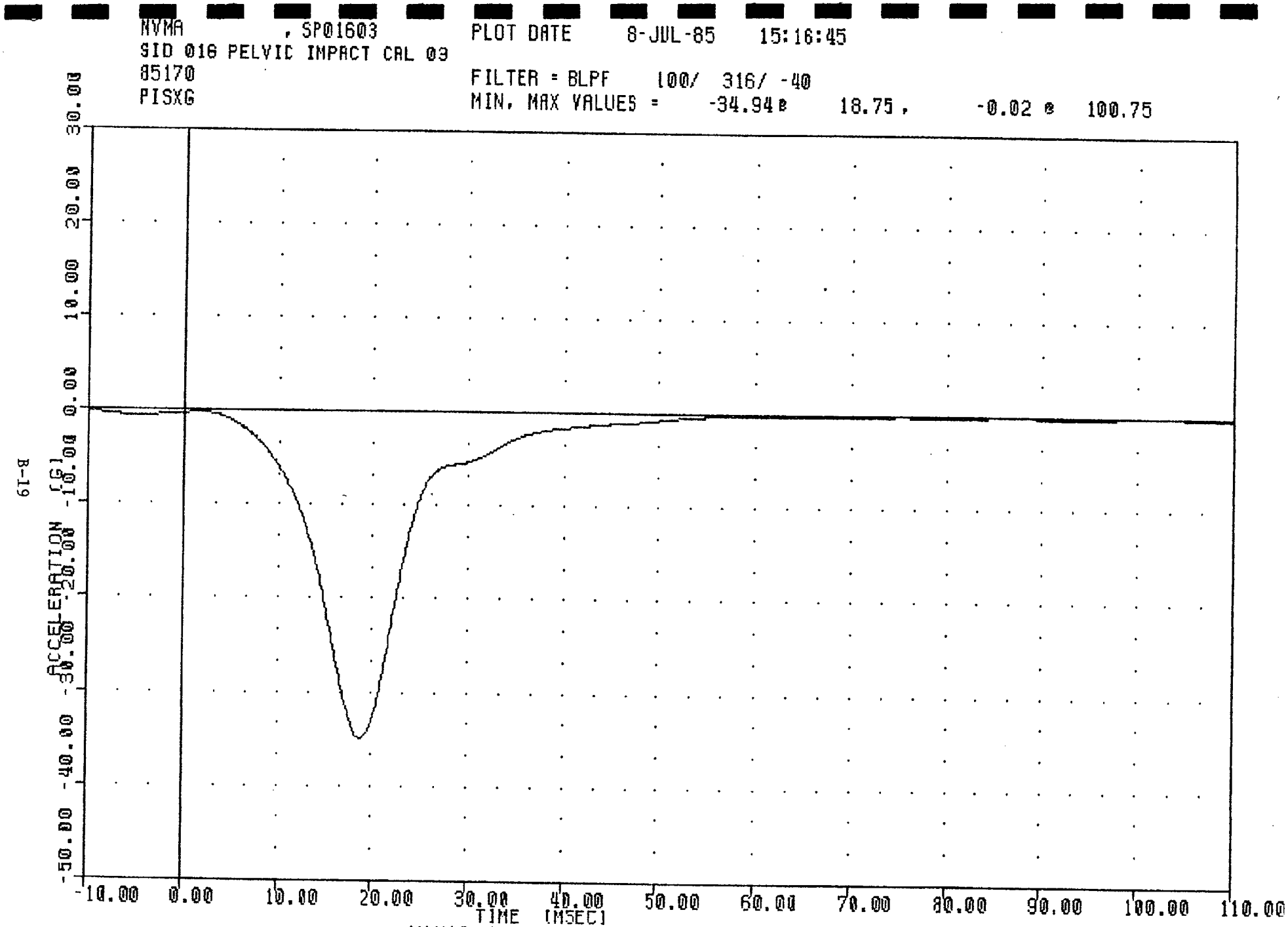
RIGHT UPPER RIB ACCELERATION Y AXIS -REDUNDANT



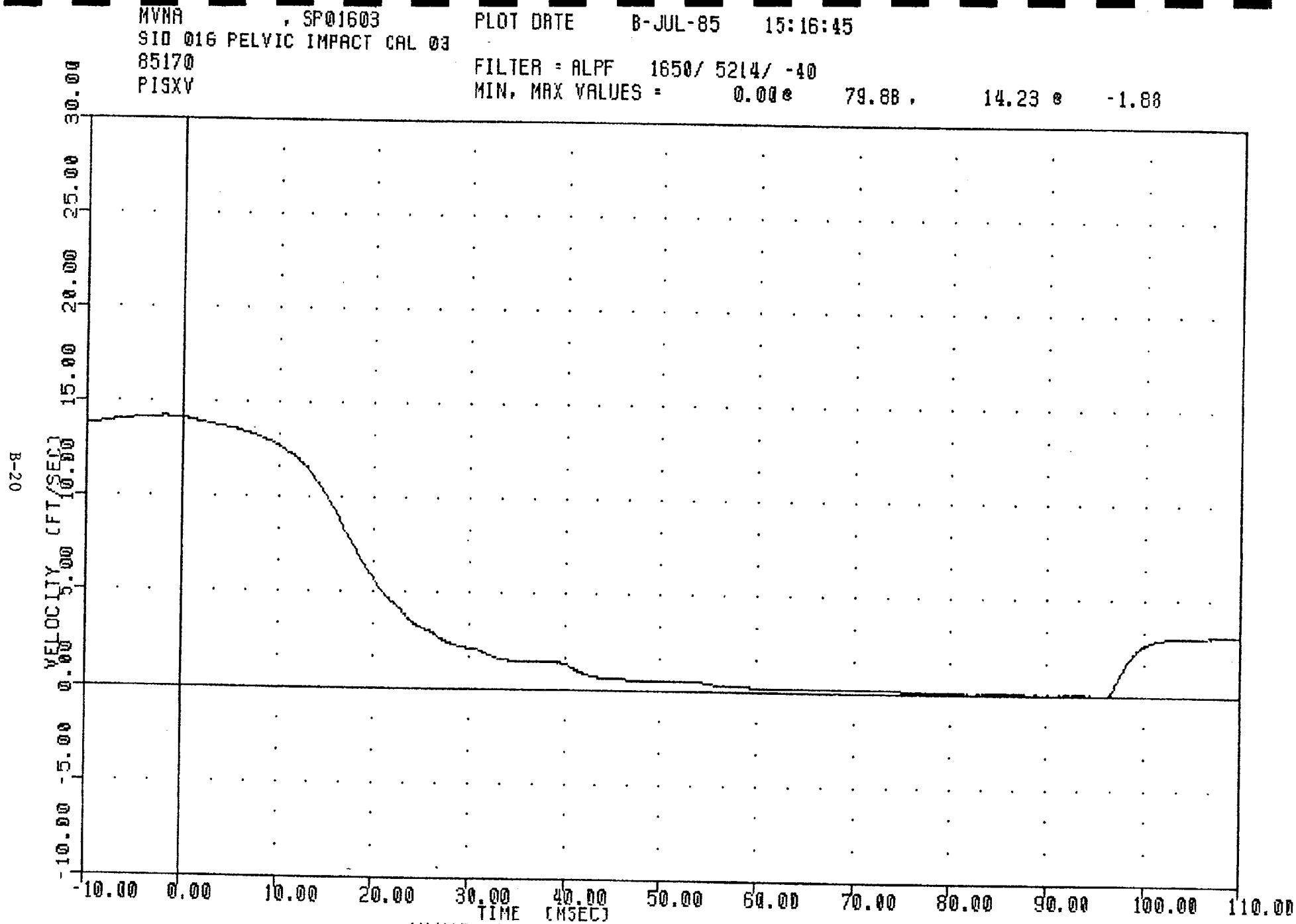

MVMA SIDE IMPACT DUMMY CALIBRATION
RIGHT LOWER RIB ACCELERATION Y AXIS -PRIMARY



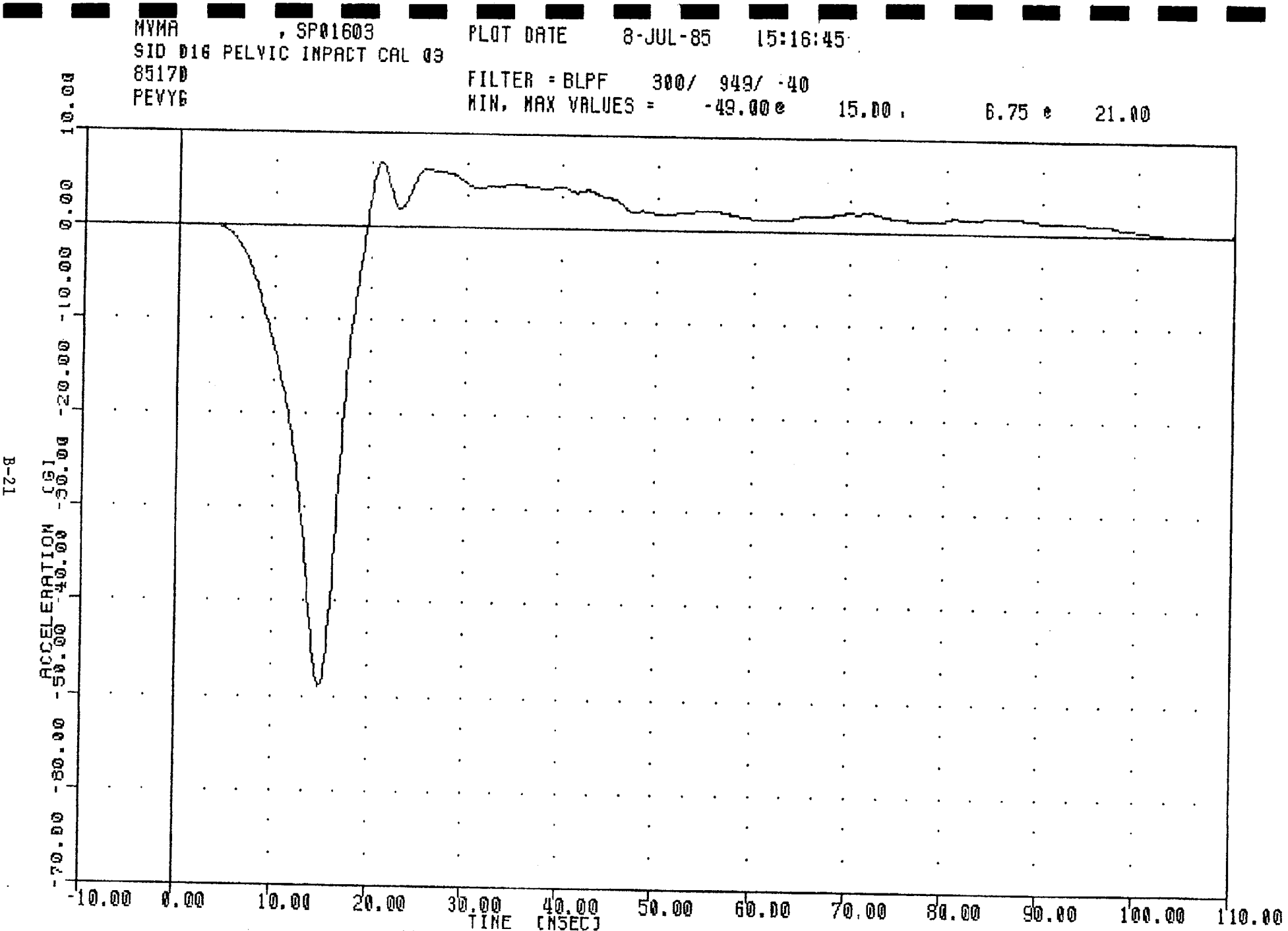

MVMA SIDE IMPACT DUMMY CALIBRATION
RIGHT LOWER RIB ACCELERATION Y AXIS -REDUNDANT




NVMA SIDE IMPACT DUMMY CALIBRATION
PISTON ACCELERATION




MVMA SIDE IMPACT DUMMY CALIBRATION
PISTON VELOCITY




MVMA SIDE IMPACT DUMMY CALIBRATION

PELVIS ACCELERATION Y AXIS