REPORT NO. TRC-85-NO1

# NEW CAR ASSESSMENT PROGRAM (NCAP)
# FRONTAL BARRIER IMPACT TEST

FUJI HEAVY IND. LTD JAPAN

1985 SUBARU DL

4-DOOR SEDAN

NHTSA NO. CF5501

TRCO TEST NO. 850116

THE TRANSPORTATION RESEARCH CENTER OF OHIO

ST. RT. 33, LOGAN COUNTY

EAST LIBERTY, OHIO 43319


FEBRUARY 1985

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

OFFICE OF MARKET INCENTIVES

400 SEVENTH STREET, S.W.

ROOM NO. 5313 (NRM-22)

WASHINGTON, DC 20590

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-84-D-11149. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

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MAR 5 1985

Date of Report Acceptance

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| TRC-85-N01 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| NHTSA NEW CAR ASSESSMENT PROGRAM (NCAP) FRONTAL BARRIER IMPACT TEST ON 1985 SUBARU DL 4-DOOR SEDAN TO INDICANT REQUIREMENTS OF FMVSS NOS. 208, 212, 219 (PARTIAL), AND 301-75 | FEBRUARY 1985 |
| | 6. Performing Organization Code: TRC |
| | 8. Performing Organization Report No.: TRC-OMI-01 |
| 7. Author(s): M.S. Beebe, Project Engineer, TRCO | |
| 9. Performing Organization Name and Address: Transportation Research Center of Ohio, St. Rt. 33, Logan County, East Liberty, Ohio 43319 | 10. Work Unit No. (TRAIS): TRC-85-DOT-1 |
| | 11. Contract or Grant No.: DTNH22-84-D11149 |
| 12. Sponsoring Agency Name and Address: U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Market Incentives (NRM-20), 400 Seventh St., S.W., Washington, DC 20590 | 13. Type of Report and Period Covered: FINAL REPORT, January-February 1985 |
| | 14. Sponsoring Agency Code: DOT/NHTSA/RM/OMI |

15. Supplementary Notes

16. Abstract

A 35 mph frontal barrier impact test using a load cell barrier was conducted on a 1985 Subaru DL 4-door Sedan at the Transportation Research Center of Ohio in East Liberty, Ohio on January 16, 1985.

The barrier impact velocity was 35.1 mph, and the ambient temperature at the barrier face at the time of impact was 72°F. The post-test vehicle crush maximum was 24.8 inches and intrusion of the firewall into the compartment was 1.6 inches.

The test vehicle appeared to comply with the indicant requirements of the following Federal Motor Vehicle Safety Standards:

1. FMVSS No. 212, "Windshield Mounting"
2. FMVSS No. 219 (Partial), "Windshield Zone Intrusion"
3. FMVSS No. 301-75, "Fuel System Integrity"

Driver HIC: 1360.77
Passenger HIC: 791.57

| 17. Key Words | 18. Distribution Statement |
|---|---|
| 35 mph Frontal Barrier Impact Test<br>New Car Assessment Program (NCAP)<br>FMVSS 212 Indicant Testing<br>FMVSS 219 (Partial) Indicant Testing<br>FMVSS 301-75 Indicant Testing | Available from:<br>Technical Reference Division, National Highway Traffic Safety Administration<br>Nassif Building, Room 5108<br>400 Seventh Street, S.W.<br>Washington, DC 20590 |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | 168 | |

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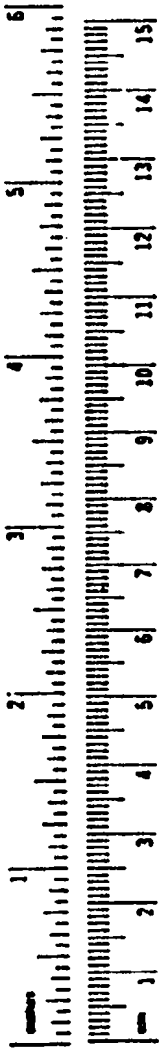
# METRIC CONVERSION FACTORS

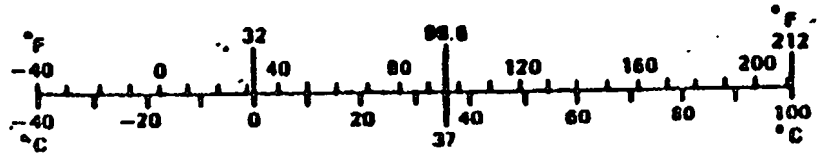
## Approximate Conversions to Metric Measures

| 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 TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY'85 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-84-D-11149. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph FMVSS 212/219/301-75 requirements.

The 35 mph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test. Standards Enforcement Indicant Test Program data for FMVSS No. 212, "Windshield Mounting", FMVSS No. 219 (Partial), "Windshield Zone Intrusion", FMVSS No. 301-75, "Fuel System Integrity", as well as occupant performance data are provided herein.

## SECTION 2.0

## SUMMARY OF TEST NUMBER CF5501

A load cell barrier consisting of 36 load cells was impacted by a 1985 Subaru DL 4-door Sedan at a velocity of 35.1 mph. The test was performed at the Transportation Research Center of Ohio on January 16, 1985. Pre- and post-test photographs of the vehicle and occupants can be found in Appendix A.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions, according to dummy placement procedures specified in Laboratory Procedure for Vehicle Assessment IP-212-02.

Both ATDs were instrumented with head and chest triaxial accelerometers and right/left femur load cells. In addition, load cells were placed on the driver's and passenger's lap and shoulder belts to measure dummy upper torso and pelvic section loading. A summary of dummy calibration test data can be found in Appendix C.

The crash event was recorded by one real-time camera and 16 high-speed cameras. Camera locations and other pertinent camera information are found in Section 4 of this report.

The 67 channels of data were recorded on two 14 track tape drives. Appendix B contains the vehicle, load cell barrier and dummy response data plots.

# CRASH TEST SUMMARY

TEST NO. 850116 PROJECT: CF5501

DATE: January 16, 1985 TIME: 1500 TEMP: 72°F

VEHICLE: Subaru DL 4-door Sedan

TEST WEIGHT (LBS): 2687

IMPACT ANGLE (DEG)*: 0

IMPACT VELOCITY (MPH)**: 35.1

MAX CRUSH (IN) STATIC: 24.8

DUMMIES

| | | |
|---|---|---|
| TYPE: | Part 572 | Part 572 |
| LOCATION: | Front Left | Front Right |
| RESTRAINT: | 3-pt. Production Seat Belt | 3-pt. Production Seat Belt |

NUMBER OF DATA CHANNELS: 67

NUMBER OF HIGH SPEED CAMERAS: 16 and 1 real-time camera

*With respect to tow track centerline.
**Speed trap measurement (± .05% accuracy).

## GENERAL COMMENTS

The 1985 Subaru DL 4-door sedan was equipped with a 1800 cubic centimeter, 4-cylinder transverse engine and five-speed manual transmission. The total test weight with two 50th percentile male dummies, instrumentation and two on-board cameras was 2687 pounds.

The test vehicle was involved in a frontal load cell barrier crash at a velocity of 35.1 mph and appeared to comply with FMVSS Nos. 212, "Windshield Mounting" and 301-75, "Fuel System Integrity". There was 100 percent windshield retention and no fuel leakage after impact or any phase of the rollover test.

The vehicle sustained 24.8 inches of static crush. Maximum load cell barrier force measured by the 36 load cells was 112,920 pounds at 30.75 milliseconds.

The driver's head struck the steering wheel rim and center hub. "Head Injury Criteria" was 1360.77. The maximum chest deceleration over 3 milliseconds was 56.4 g's, and right and left femur loads were 276 and 717 pounds respectively.

The right-front passenger's HIC was 791.57, the maximum chest deceleration over 3 milliseconds was 38.6 g's, and the right and left femur loads were 408 and 622 pounds respectively.

The belt-related data for each occupant are presented in Section 4.0 of this report.

## TEST ANOMALIES

A wire to the accelerometer mounted on the top of the engine block, ENGXG1, was cut during the test.

## TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Fuji Heavy Ind. LTD Japan

MAKE/MODEL: Subaru Sedan DL VIN: JF1AC42B7FB206890

BODY STYLE: 4-door MODEL YEAR: 1985

NHTSA NO.: CF5501 COLOR: Red

ENGINE DATA: TYPE: Transverse CYLINDERS: 4 DISPLACEMENT: 1800 cc

__X__ GAS, ____ DIESEL, ____ TURBOCHARGE

TRANSMISSION DATA: __5__ SPEED, __X__ MANUAL, ____ AUTOMATIC

DATE VEHICLE RECEIVED: 11/16/84 ODOMETER READING: 228.6

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

| | | | |
|---|---|---|---|
| POWER STEERING | No | AUTOMATIC TRANSMISSION | No |
| POWER BRAKES | No | AUTOMATIC SPEED CONTROL | No |
| POWER SEATS | No | TILTING STEERING WHEEL | No |
| POWER WINDOWS | No | TELESCOPING STEERING WHEEL | No |
| TINTED GLASS | Yes | AIR CONDITIONING | No |
| RADIO | Yes | ANTI-SKID BRAKE | No |
| CLOCK | Yes | REAR WINDOW DEFROSTER | Yes |
| OTHER | | | |

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

VEHICLE MANUFACTURED BY: Fuji Heavy Ind. LTD Japan

DATE OF MANUFACTURE: 10/84

GVWR: 3430 LBS.,

GAWR: FRONT 1860 LBS., REAR 1570 LBS.

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

VEHICLE LOAD (UP TO CAPACITY): FRONT 28 psi; REAR 28 psi

RECOMMENDED TIRE SIZE: 155SR13 LOAD RANGE X B, C, D

TIRES ON VEHICLE (MFGR., LINE, SIZE): Bridgestone, 155SR13

IS SPARE TIRE A "SPACE SAVER": Yes

IS SPARE TIRE STANDARD EQUIPMENT: Yes

VEHICLE CAPACITY: TYPES OF SEATS Front - Bucket
Rear - Bench

TYPE OF FRONT SEAT BACKS Adjustable reclining

NUMBER OF OCCUPANTS 2 FRONT 3 REAR 5 TOTAL

CARGO LOAD 60 LBS. TOTAL 810 LBS.

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

| | | | | | |
|---|---|---|---|---|---|
| RIGHT FRONT | 655 | LBS. | RIGHT REAR | 418 | LBS. |
| LEFT FRONT | 645 | LBS. | LEFT REAR | 453 | LBS. |

TOTAL FRONT WEIGHT 1300 LBS. (59.9 % OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 871 LBS. (40.1 % OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 2171 LBS.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2171 LBS)

VCW = VEHICLE CAPACITY WEIGHT (810 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

RCLW = VCW - 150 (DCS) = 60 LBS

TARGET TEST WEIGHT = UDW + RCLW + (2 DUMMIES X 164 LBS/DUMMY)

TARGET TEST WEIGHT = 2559 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 60 LBS. CARGO:

| | | | | | |
|---|---|---|---|---|---|
| RIGHT FRONT | 726 | LBS. | RIGHT REAR | 607 | LBS. |
| LEFT FRONT | 766 | LBS. | LEFT REAR | 588 | LBS. |

TOTAL FRONT WEIGHT 1492 LBS. (55.5 % OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 1195 LBS. (44.5 % OF TOTAL VEHICLE WEIGHT)

TOTAL TEST WEIGHT 2687 LBS.

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

COMPONENTS REMOVED TO MEET TARGET WEIGHT: Rear bumper, hub caps and side mirror. Total of 37 pounds.

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

| | | | | |
|---|---|---|---|---|
| DELIVERED ATTITUDE: | RF 25 5/16 | ;LF 25 | ;RR 23 15/16 | ;LR 23 9/16 |
| PRE-TEST ATTITUDE: | RF 23 7/8 | ;LF 23 5/8 | ;RR 21 11/16 | ;LR 21 3/4 |
| POST-TEST ATTITUDE: | RF 27 3/4 | ;LF 26 1/2 | ;RR 21 7/8 | ;LR 21 1/2 |

WHEELBASE: 97.5 INCHES

CG = 44.1 INCHES REARWARD OF FRONT WHEEL CENTERLINE

## TEST CONDITIONS

TEST NUMBER: 850116

DATE OF TEST: January 16, 1985 TIME OF TEST: 1500

TYPE OF TEST: Frontal Load Cell Barrier Impact IMPACT ANGLE: 0 °

AMBIENT TEMPERATURE AT IMPACT AREA: 72°F

TEMPERATURE IN OCCUPANT COMPARTMENT: 72°F

IMPACT VELOCITY: PRIMARY = 35.1 MPH

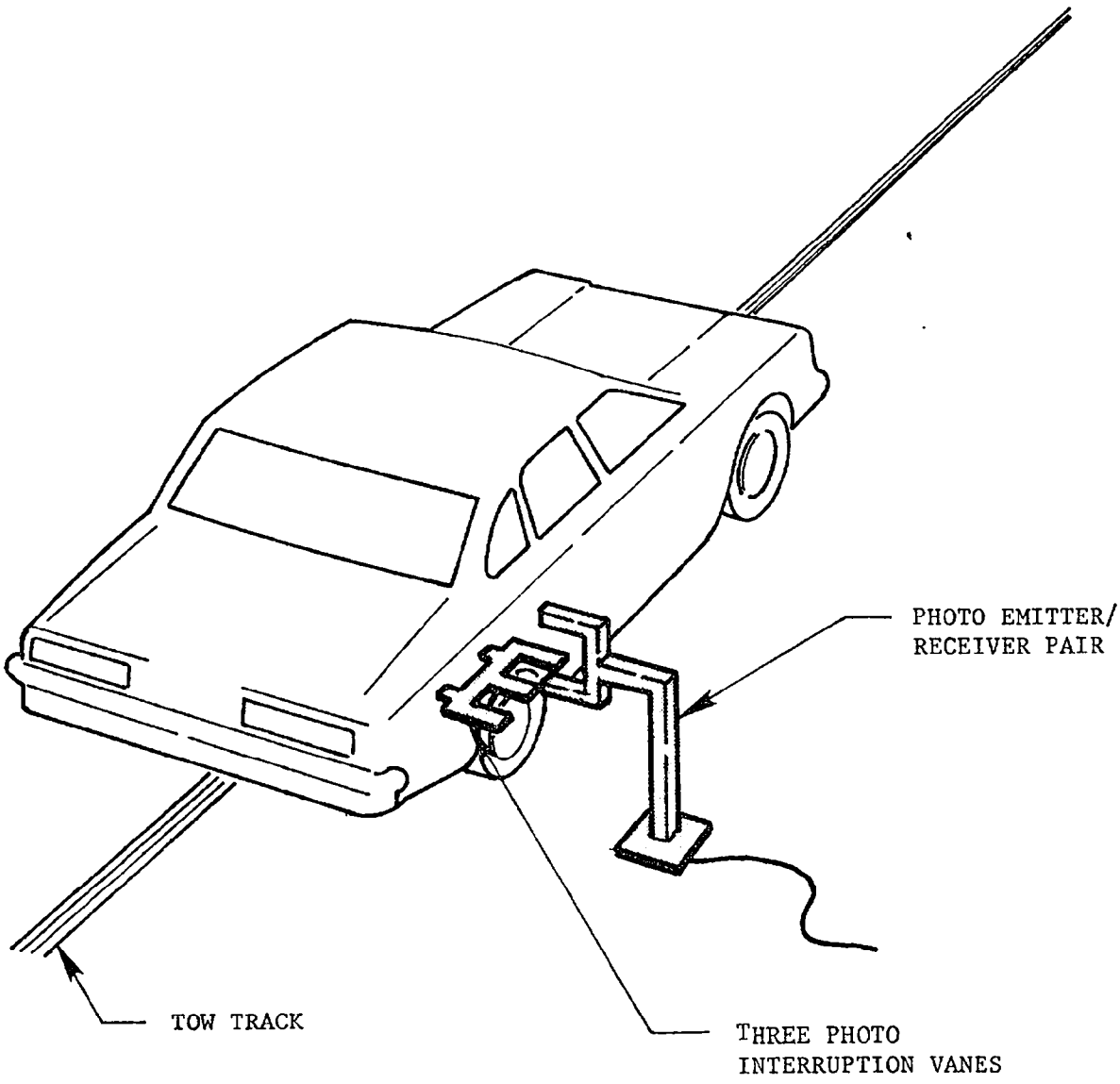
(SPECIFIED RANGE = 34.5 TO 35.5 MPH)

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES)

| | | | | |
|---|---|---|---|---|
| OVERALL LENGTH OF TEST VEHICLE: | PRE-TEST: | R 171 1/8 | ;C 172 1/8 | ;L 171 1/8 |
| | POST-TEST: | R 147 1/2 | ;C 149 1/4 | ;L 148 |
| | TOTAL CRUSH: | R 23 5/8 | ;C 22 7/8 | ;L 23 1/8 |

FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER IMPACT: R: 13 11/16 ;C: 14 5/8 ;L: 16 1/4

IMPACT VELOCITY MEASUREMENT SYSTEM




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

The vanes have one foot spacing.

VISIBLE DUMMY CONTACT POINTS:

| | DRIVER 830 | PASSENGER 411 |
|---|---|---|
| Head | Steering Wheel | Right Knee |
| Chest | None | None |
| Abdomen | None | None |
| Left Knee | Lower Dash | Glove Box |
| Right Knee | Lower Dash | Glove Box, Head |

DOOR OPENING:

| | LEFT | RIGHT |
|---|---|---|
| Front | Tools Required | Hard |
| Rear | Tools Required | Easy |

SEAT MOVEMENT:

| | SEAT BACK FAILURE | SEAT SHIFT |
|---|---|---|
| Front | No | Forward One Position |
| Rear | No | Forward One Position |

GLAZING DAMAGE: Windshield cracked, dash went into windshield.

OTHER NOTABLE IMPACT EFFECTS:

No leakage after impact.

Hood went into the lower windshield.

# SECTION 3.0

SUMMARY OF RESULTS FOR - - -

FMVSS 212, "Windshield Mounting"

FMVSS 219 (Partial), "Windshield Zone Intrusion"

FMVSS 301-75, "Fuel System Integrity"

SUMMARY OF FMVSS 212 AND 301 DATA

PRE-IMPACT DATA

MAKE/MODEL: Subaru DL

BODY STYLE: 4-door Sedan MODEL YEAR: 1985

NHTSA NO.: CF5501 COLOR: Red

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: Fuji Heavy Industries LTD, Japan

DATE OF MANUFACTURE: 10/84 VIN: JF1AC42B7FB206890

GVWR: 3430 LBS., GAWR: FRONT 1860 LBS., REAR 1570 LBS.

POST-IMPACT DATA

TYPE OF TEST: Frontal Load Cell Barrier Impact

DATE OF TEST: 1/16/85 TIME: 1500 TEMP: 72°F

REQUIRED IMPACT VELOCITY RANGE: 34.5 MPH TO 35.5 MPH

IMPACT VELOCITY: PRIMARY = 35.1 MPH

TEST WEIGHT = 2687 LBS., STATIC CRUSH MAX. = 24.8 IN., REBOUND = 14.6 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: 15.9 GALLONS (FURNISHED BY CTM)

TEST VOLUME: 14.8 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 15.9 GALLONS

DETAILS OF FUEL SYSTEM: _____

_____

_____

ELECTRIC FUEL PUMP: Yes FUEL INJECTION: No

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

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

FMVSS NO. 212, "WINDSHIELD MOUNTING", DATA SHEET

Details of windshield mounting such as retention method, trim type, etc.:

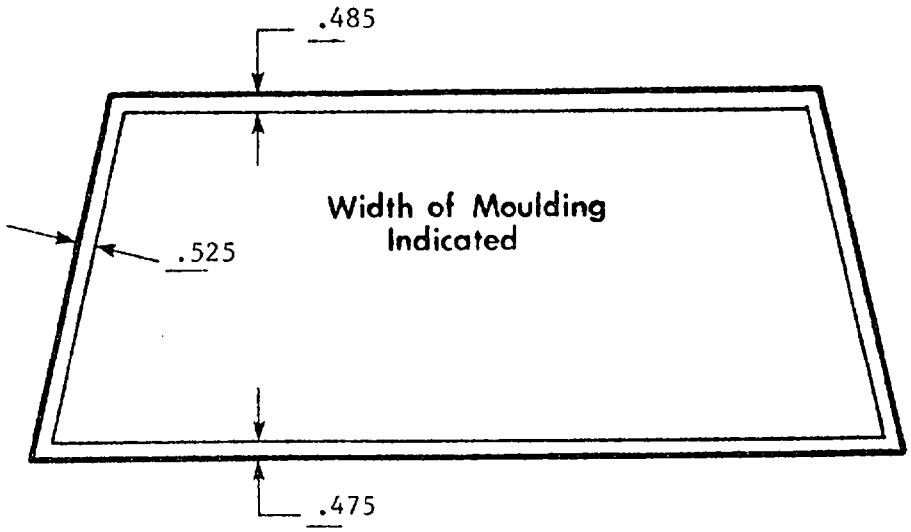
FMVSS 212 REQUIREMENTS: The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

WINDSHIELD PERIPHERY

| | PRE-TEST (in.) | POST-TEST (in.) | PERCENT RETENTION |
|---|---|---|---|
| RIGHT SIDE | 76.0 | 76.0 | 100% |
| LEFT SIDE | 76.0 | 76.0 | 100% |
| TOTAL | 152.0 | 152.0 | 100% |

AREA OF RETENTION FAILURE:



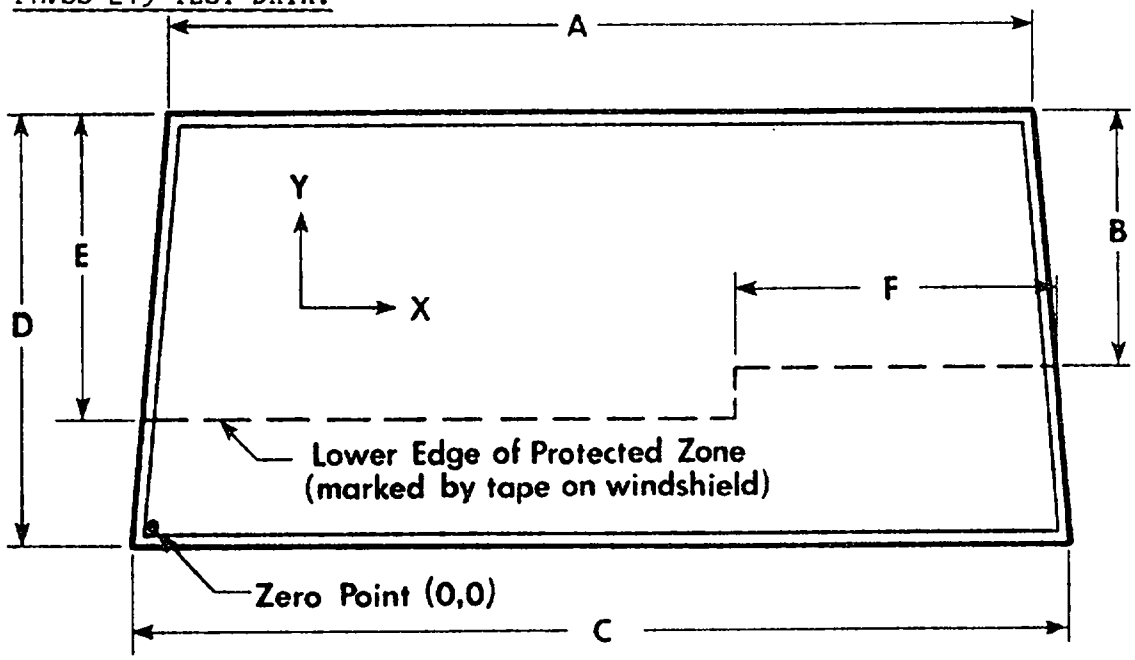

FAILURE DETAILS:

FMVSS NO. 219, "WINDSHIELD ZONE INTRUSION", DATA SHEET

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" dia. rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection onto the outer surface of the windshield of this line.

FMVSS 219 TEST DATA:




FRONT VIEW

A = 42"  C = 57 1/2"  E = 19"

B = 14"  D = 26 1/2"  F = 21 3/4"

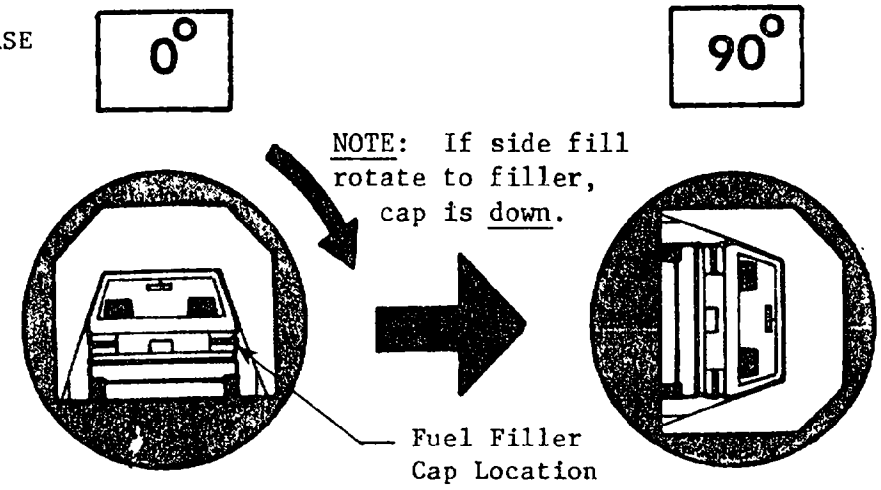
DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":
(Show location of penetration on above sketch)

| | COORDINATES X | Y |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

850116

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE




STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1 to 3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301-75 Position Hold Time = 5 minutes, 00 seconds

TOTAL - - - - - - - - = 7 minutes, 00 seconds

Next Whole Minute Interval - - - - - = 7 minutes

FMVSS 301-75 REQUIREMENTS

| | First 5 Minutes FROM ONSET OF ROTATION | 6th Minute | 7th Minute |
|---|---|---|---|
| Maximum Allowable Solvent Spillage - - | 5 oz. | 1 oz. | 1 oz. |
| 0 to 90° (filler cap down) - - - - - | 0 | 0 | 0 |

SOLVENT SPILLAGE LOCATION(S)

_____

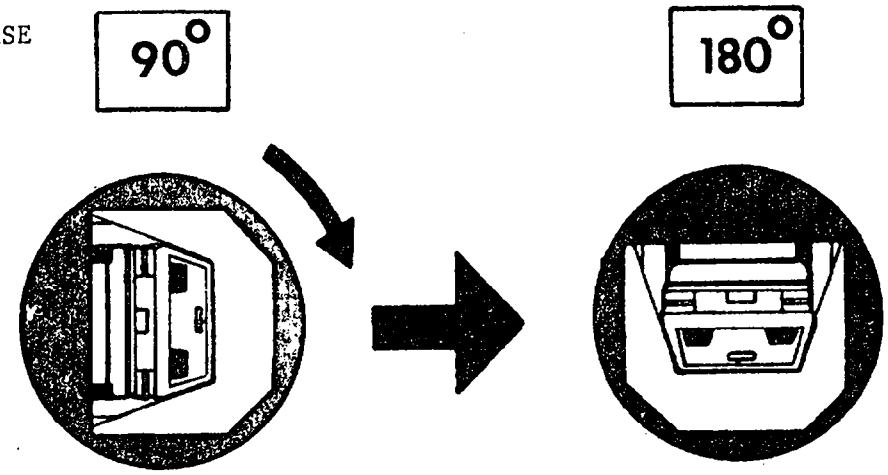
_____

_____

_____

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE




STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1 to 3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301-75 Position Hold Time = 5 minutes, 00 seconds

TOTAL - - - - - - - = 7 minutes, 00 seconds

Next Whole Minute Interval - - - - = 14 minutes

FMVSS 301-75 REQUIREMENTS

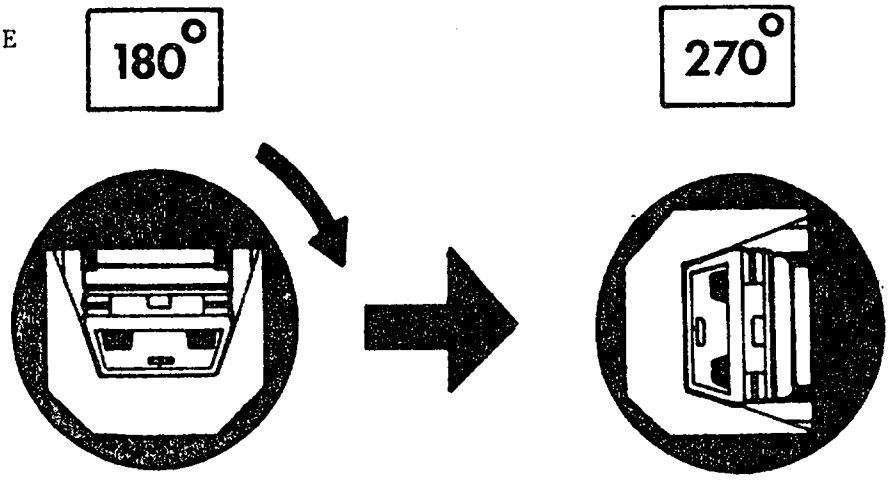
| | First 5 Minutes FROM ONSET OF ROTATION | 6th Minute | 7th Minute |
|---|---|---|---|
| Maximum Allowable Solvent Spillage - | 5 oz. | 1 oz. | 1 oz. |
| 90° to 180° (filler cap down) - - - | 0 | 0 | 0 |

SOLVENT SPILLAGE LOCATION(S)

850116

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE




STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1 to 3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301-75 Position Hold Time = 5 minutes, 00 seconds

TOTAL - - - - - - - - = 7 minutes, 00 seconds

Next Whole Minute Interval - - - - = 21 minutes

FMVSS 301-75 REQUIREMENTS

| | First 5 Minutes FROM ONSET OF ROTATION | 6th Minute | 7th Minute |
|---|---|---|---|
| Maximum Allowable Solvent Spillage - - | 5 oz. | 1 oz. | 1 oz. |
| 180° to 270° (filler cap down) - - - - | 0 | 0 | 0 |

SOLVENT SPILLAGE LOCATION(S)

_____

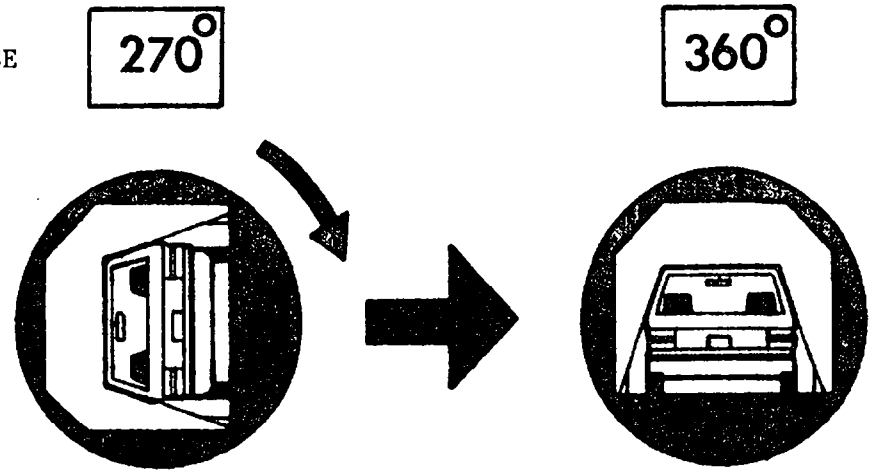
_____

_____

_____

850116

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE 


STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1 to 3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301-75 Position Hold Time = 5 minutes, 00 seconds

TOTAL - - - - - - - - = 7 minutes, 00 seconds

Next Whole Minute Interval - - - - = 28 minutes

FMVSS 301-75 REQUIREMENTS

| | First 5 Minutes FROM ONSET OF ROTATION | 6th Minute | 7th Minute |
|---|---|---|---|
| Maximum Allowable Solvent Spillage - - | 5 oz. | 1 oz. | 1 oz. |
| 270° to 360° (filler cap down) - - - - | 0 | 0 | 0 |

SOLVENT SPILLAGE LOCATION(S)

_____

_____

_____

_____

VEHICLE STATIC ROLLOVER DATA SUMMARY:

| MAXIMUM ALLOWABLE SOLVENT SPILLAGE | FIRST 5 MINUTES FROM ONSET OF ROTATION 5 OZ | 6TH MIN. 1 OZ | 7TH MIN. 1 OZ |
|---|---|---|---|
| 0 TO 90° (FILLER CAP DOWN) - - - - - - | 0 | 0 | 0 |
| 90 TO 180° - - - - - - - - - - - - - - - | 0 | 0 | 0 |
| 180 to 270° - - - - - - - - - - - - - - | 0 | 0 | 0 |
| 270 to 360° - - - - - - - - - - - - - - | 0 | 0 | 0 |

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# SECTION 4.0
# OCCUPANT, VEHICLE AND LOAD CELL BARRIER INFORMATION

DUMMY INJURY CRITERIA

| | MAXIMUM ACCELERATION ('G') | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HEAD | | | | CHEST | | | |
| | X | Y | Z | R | X | Y | Z | R* |
| DRIVER | -209.9 | -28.5 | -104.9 | 236.4 | -59.6 | -15.6 | 9.15 | 56.4 |
| PASSENGER | -39.1 | 20.4 | -65.3 | 67.4 | -38.6 | 20.6 | -9.4 | 38.6 |

| | MAXIMUM FORCE-FEMUR LOAD (LBS) | |
|---|---|---|
| | RIGHT FEMUR | LEFT FEMUR |
| DRIVER | 275.7 | 716.5 |
| PASSENGER | 408.6 | 621.6 |

| | MAXIMUM FORCE-SEAT BELT LOADS (LBS) | | |
|---|---|---|---|
| | SHOULDER STRAP UPPER BELT LOAD | LAP STRAP RIGHT BELT LOAD | LAP STRAP LEFT BELT LOAD |
| DRIVER | 1956.5 | --- | 1173 |
| PASSENGER | 1585.8 | 1196.5 | --- |

| | HEAD INJURY CRITERIA** | | |
|---|---|---|---|
| | HIC | $t_1$ (SEC) | $t_2$ (SEC) |
| DRIVER | 1360.77 | .06700 | .08212 |
| PASSENGER | 791.57 | .05962 | .12262 |

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

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DRIVER

During impact, the driver leaned forward in the seat, striking the steering wheel with the face. The forehead contacted the upper rim of the wheel while the mouth and chin area hit the hub of the steering wheel. As the driver continued forward movement the steering wheel rim bent and both knees contacted the dash. Rebounding from the wheel, the dummy rotated back into the seat, striking the back of the head on the headrest. Rotating forward once again, the driver finally came to rest in an upright position.

PASSENGER

During impact the passenger rotated forward in the seat barely missing the dash panel, but striking the head on the right knee. The dummy then rotated back into the seat, hitting the right side of the head on the headrest. Final resting position showed the dummy seated upright with both knees in contact with the glove box.

DUMMY IN-VEHICLE POSITION

RECORDING SHEET

VEHICLE NHTSA NO. CF5501 MFR./MAKE/MODEL: Fuji, Subaru DL Sedan

SEAT TYPE: ___ Bench
X Bucket
___ Split Bench

ADJUSTER TYPE: X Manual
___ Power

BUCKET SEAT BACK TYPE: ___ Fixed
X Adjustable Reclining

TECHNICIANS:
1. N. Echeverria
2. B. Fishbaugh
3. D. Carpenter
4.

POSITIONING DATE: 1/16/85

AMBIENT TEMP.: 72° F. TIME: 8:00

DRIVER DUMMY # 830 TYPE P572

Head 22 1/8"

Target 2 °

Knee 21 7/8"

Joint 92 °

Approx."H" 7 1/4"

Point 139 °

PASSENGER DUMMY # 411 TYPE P572

Head 21 1/2"

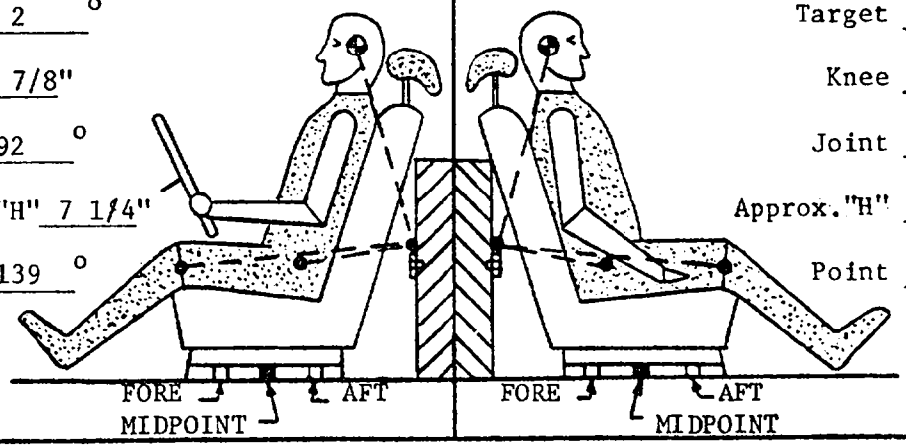
Target 4 1/2 °

Knee 21 3/4"

Joint 92 °

Approx."H" 7 5/8"

Point 130 °

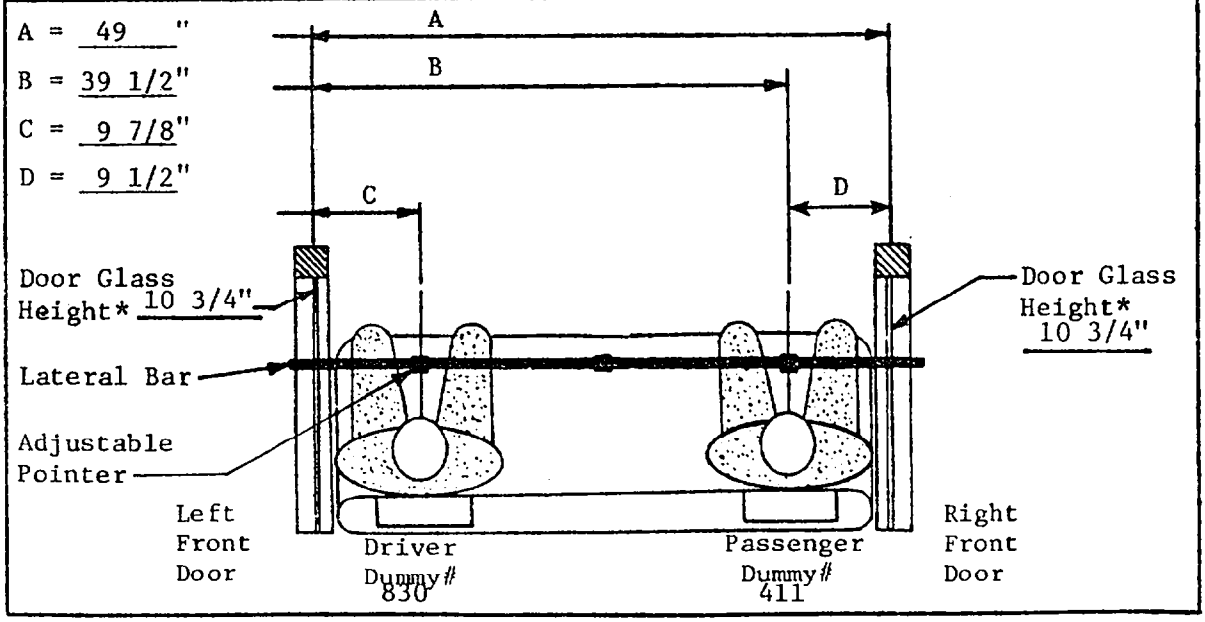



A = 49 "

B = 39 1/2"

C = 9 7/8"

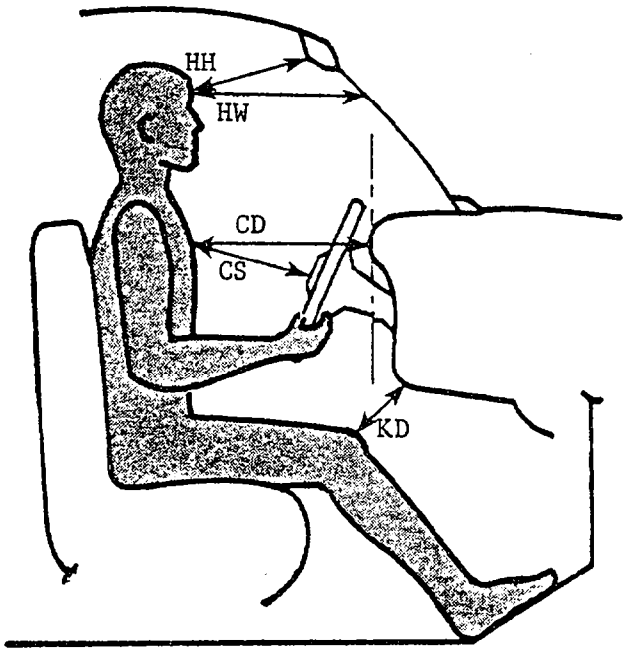
D = 9 1/2"




* Door glass height is equal on the right and left side of vehicle.

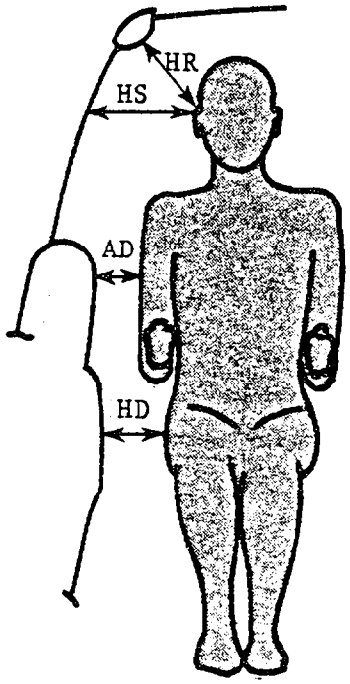
DUMMY IN-VEHICLE POSITION RECORDING SHEET

| | DRIVER 830 | PASSENGER 411 |
|---|---|---|
| HH | 13 | 15 1/4 |
| HW | 17 | 20 |
| CD | 22 | 23 3/8 |
| CS | 14 1/4 | DNA |
| KDL | 4 | 4 9/16 |
| KDR | 4 | 4 7/8 |




| | DRIVER 830 | PASSENGER 411 |
|---|---|---|
| HR | 4 3/8 | 4 5/8 |
| HS | 6 1/2 | 6 1/2 |
| AD | 3 | 3 1/2 |
| HD | 6 3/4 | 6 5/8 |

ALL MEASUREMENTS IN INCHES

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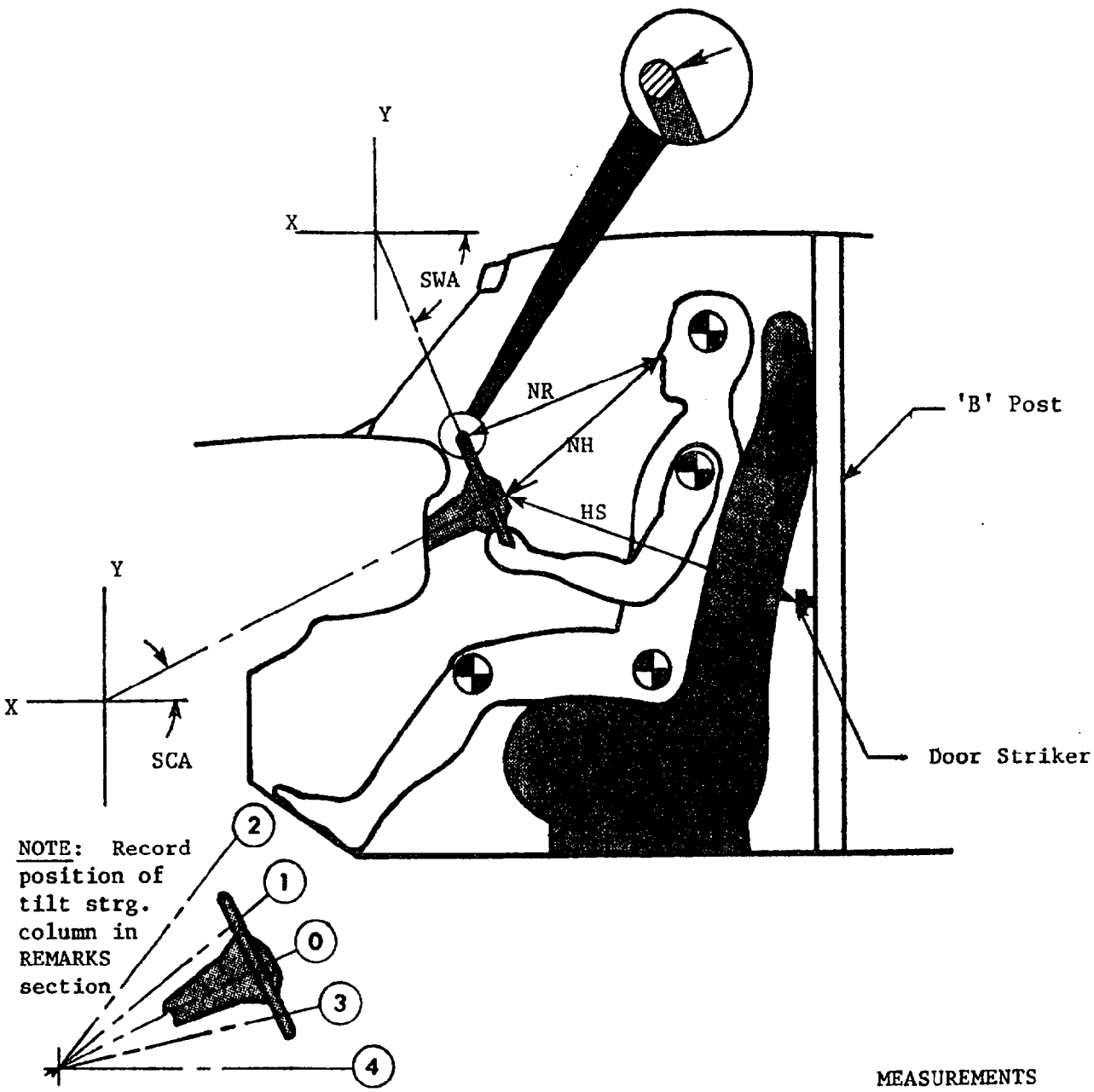
DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS




| | MEASUREMENTS |
|---|---|
| NR - Distance from tip of dummy's nose to top rear surface of steering wheel rim. | 17" |
| NH - Distance from tip of dummy's nose to center of steering column hub. | 17 7/16" |
| HS - Distance from center of steering column hub to the forward surface of the door lock striker pin. | 18 3/8" |
| SCA - Angle of steering column relative to the horizontal X axis. | 22° |
| SWA - Angle of steering wheel relative to the horizontal X axis. | -66° |

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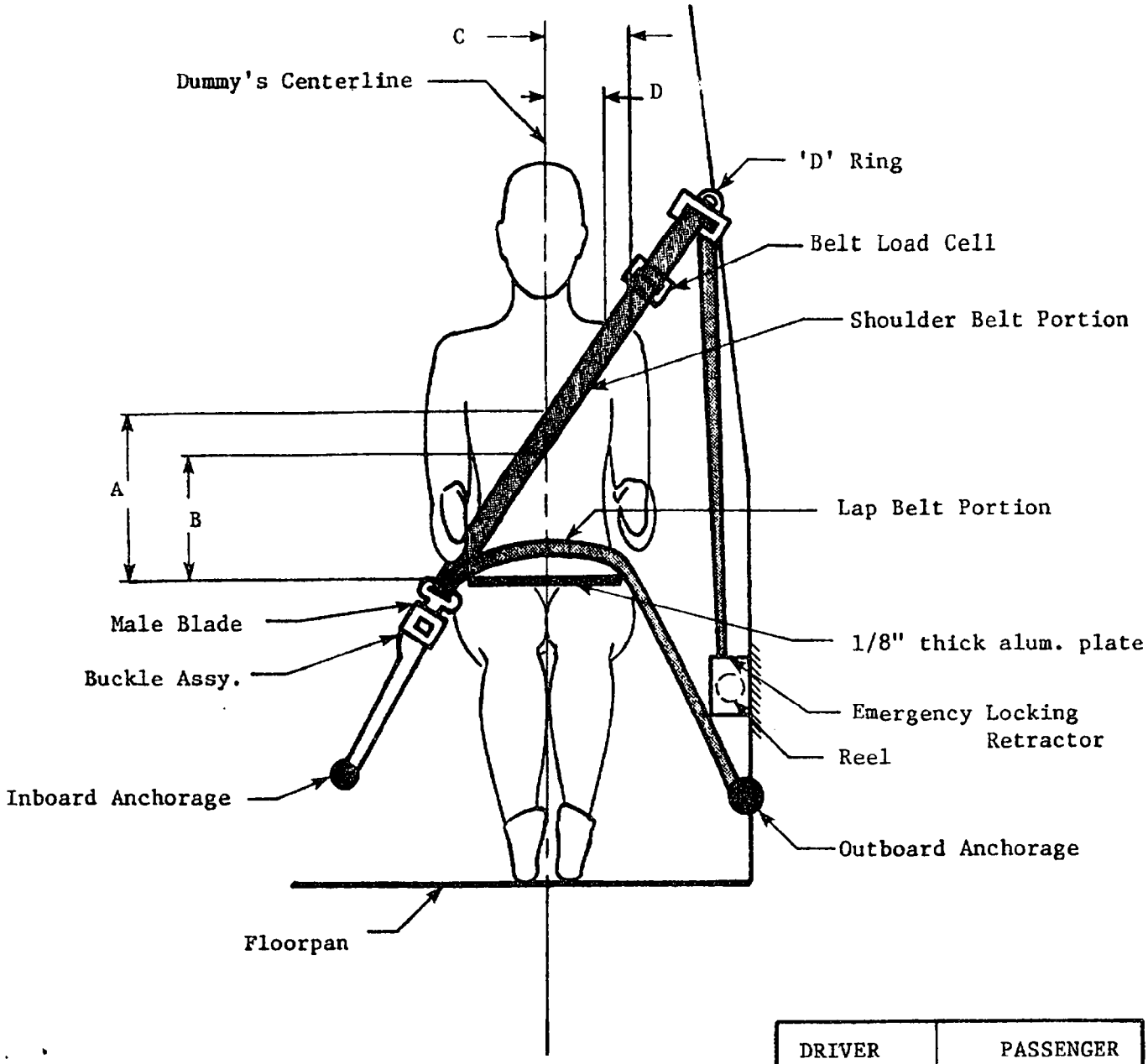
SEAT BELT POSITIONING DATA

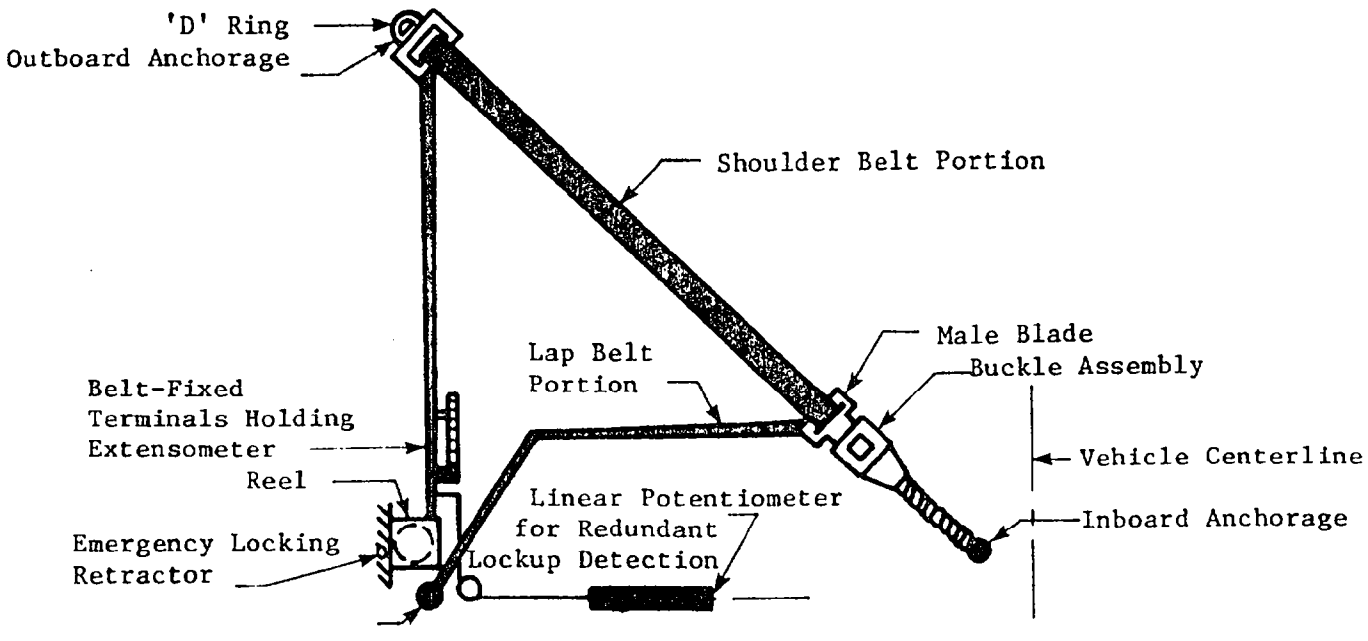



| | DRIVER DUMMY | PASSENGER DUMMY |
|---|---|---|
| A - Top surface of alum. plate to belt upper edge (in) | 13" | 12 1/8" |
| B - Top surface of alum. plate to belt lower edge (in) | 9 3/8" | 9" |
| C - Dummy centerline to outer edge of belt at chest flesh top (in) | 5 5/8" | 6 3/8" |
| D - Dummy centerline to inner edge of belt at chest flest top (in) | 3 1/4" | 4" |
| LAP BELT TENSION (lbs) | 3" | 4" |
| SHOULDER BELT TENSION (lbs) | 1 1/2" | 1" |

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

BELT LENGTH DATA:

| | DRIVER SIDE | | PASSENGER SIDE | |
|---|---|---|---|---|
| | PRE-TEST | POST-TEST | PRE-TEST | POST-TEST |
| Total belt length from retractor reel to bolt hole anchor point for continous webbing systems. | | | | |
| Retractor reel to 'D' ring as measured on Part 572 dummy. | | | | |
| Shoulder belt length as measured on Part 572 dummy. | | | | |
| Lap belt length as measured on Part 572 dummy. | | | | |
| Remainder of belt webbing left on retractor reel. | | | | |
| BELT SPOOL-OFF DATA: As determined by film analysis | | .93 | | .77 |
| As determined electronically | | .62 | | .21 |
| BELT STRAIN DATA: Measured between retractor reel and 'D' ring. | | | | |

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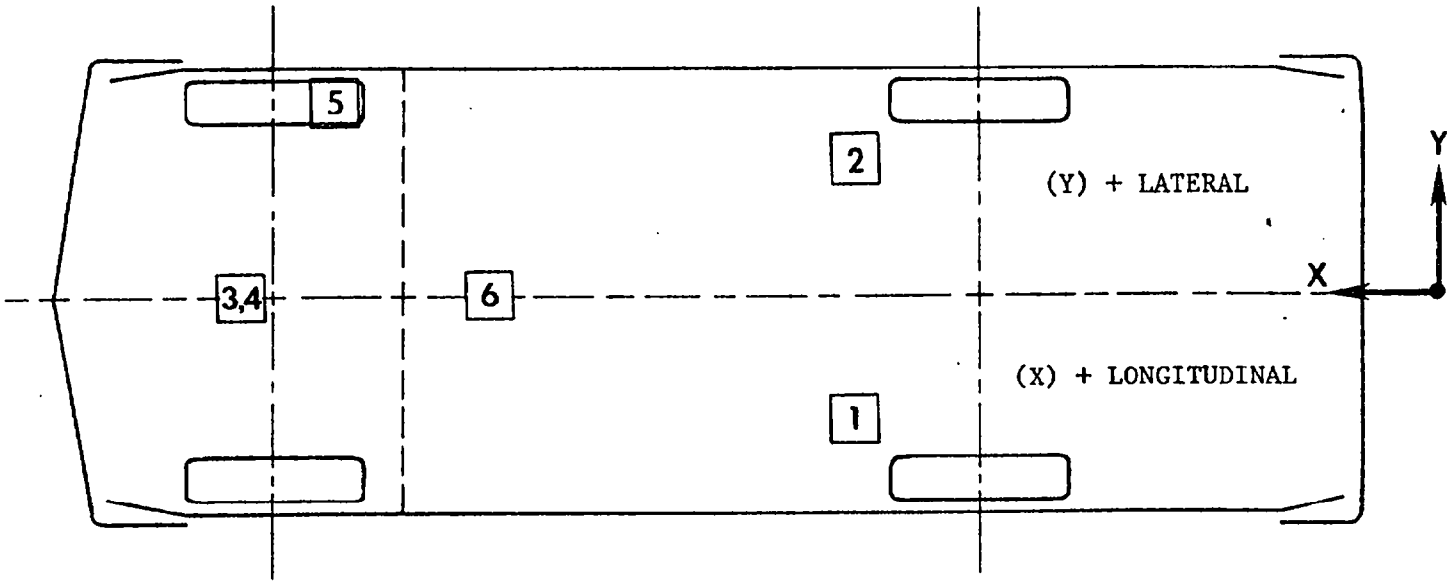
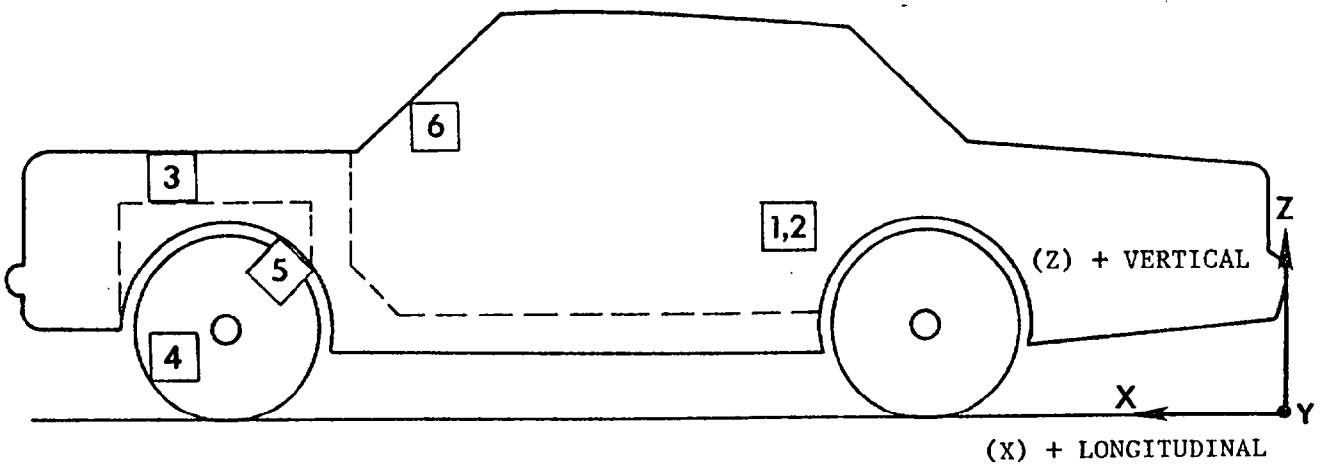
VEHICLE ACCELEROMETER LOCATIONS

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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 | REAR SEAT X-MEMBER AT LEFT SIDE LONGITUDINAL | 65.4 | 19.8 | 12.9 | 3.39 | 153.13 | 33.76 | 46.13 |
| 2 | REAR SEAT X-MEMBER AT RIGHT SIDE LONGITUDINAL | 65.7 | -19.8 | 12.9 | 4.34 | 152.75 | 29.50 | 46.25 |
| 3 | TOP OF ENGINE BLOCK LONGITUDINAL | 153.1 | 0.0 | 23.8 | 32.83 | 39.75 | 181.80 | 29.63 |
| 4 | BOTTOM OF ENGINE BLOCK LONGITUDINAL | 151.6 | 0.0 | 7.9 | --- | --- Y | --- | --- Y |
| 5 | BRAKE CALIPER AT RIGHT SIDE LONGITUDINAL | 132.0 | -24.8 | 9.9 | 33.28 | 74.38 | 87.92 | 55.00 |
| 6 | DASH PANEL LONGITUDINAL | 113.9 | 0.0 | 33.2 | 58.95 | 92.25 | 77.78 | 46.38 |

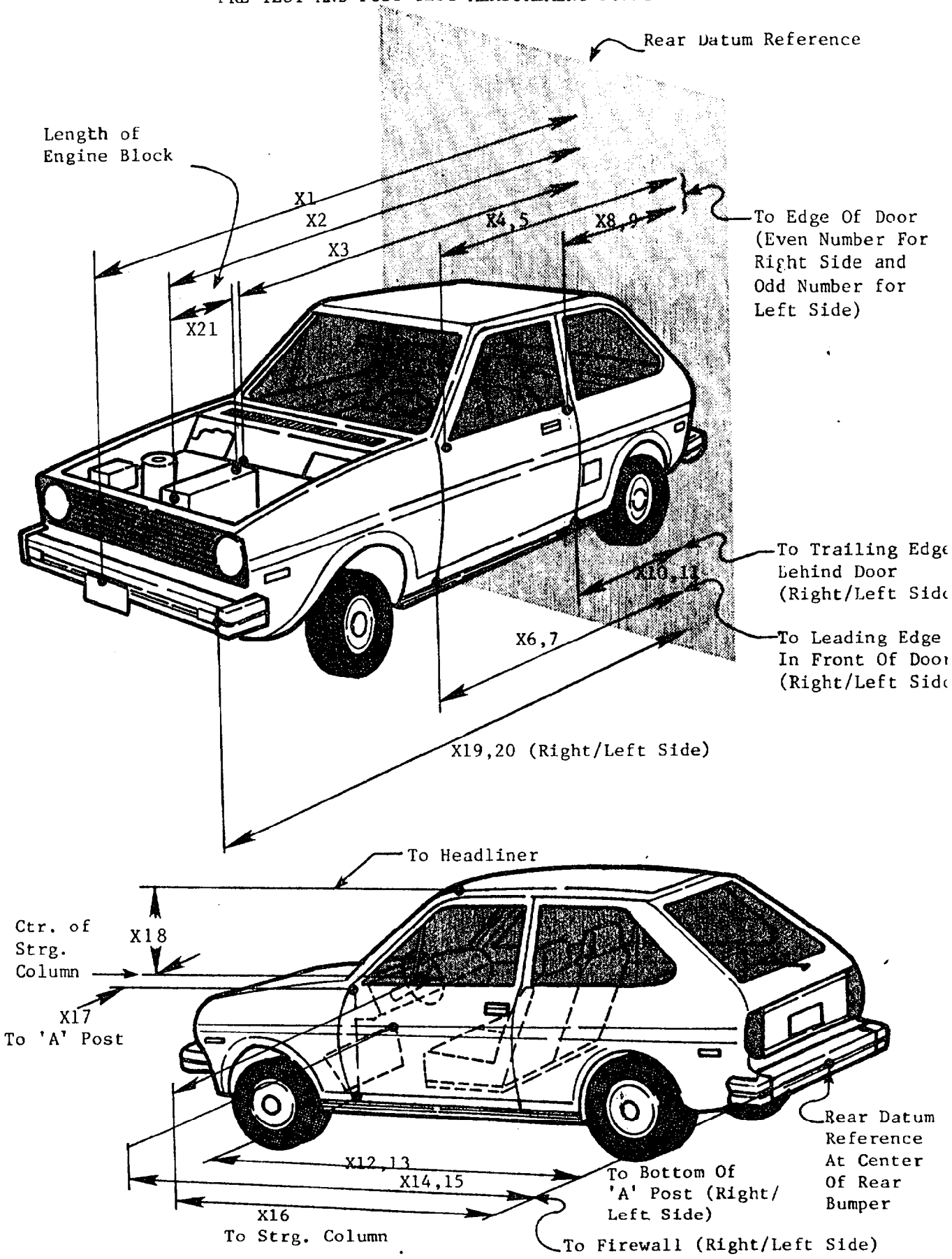
* X + Forward from rear bumper
Y + Left vehicle centerline
Z + Up from ground level

** LONGITUDINAL: FORWARD
LATERAL: LEFTWARD
VERTICAL: UPWARD

MEASUREMENTS IN INCHES

Y See TEST ANOMALIES

PRE-TEST AND POST-TEST MEASUREMENT POINTS



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## IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL Subaru DL Sedan TEST NUMBER 850116

DIMENSIONS IN INCHES

| NO. | TYPE OF MEASUREMENT | PRE-TEST | POST-TEST | DIFF. |
|---|---|---|---|---|
| X 1 | TOTAL LENGTH OF VEHICLE AT CENTERLINE | 172.1 | 147.3 | 24.8 |
| X 2 | REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK | 154.1 | NA | -- |
| X 3 | REAR SURFACE OF VEHICLE TO FIREWALL | 122.8 | NA | -- |
| X 4 | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR | 116.9 | 116.0 | 0.9 |
| X 5 | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR | 117.1 | 116.3 | 0.8 |
| X 6 | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR | 119.6 | 118.8 | 0.8 |
| X 7 | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR | 119.7 | 118.9 | 0.8 |
| X 8 | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR | 80.1 | 79.6 | 0.5 |
| X 9 | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR | 80.1 | 79.5 | 0.6 |
| X10 | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR | 81.4 | 80.5 | 0.9 |
| X11 | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE ON LEFT DOOR | 81.3 | 80.4 | 0.9 |
| X12 | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE | 118.5 | 117.6 | 0.9 |
| X13 | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE | 118.4 | 117.6 | 0.8 |
| X14 | REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE | 127.4 | 125.8 | 1.6 |
| X15 | REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE | 126.3 | 125.8 | 0.5 |
| X16 | REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER | 101.8 | 98.2 | 3.6 |
| X17 | CENTER OF STEERING COLUMN TO "A" POST | 16.0 | NA | -- |

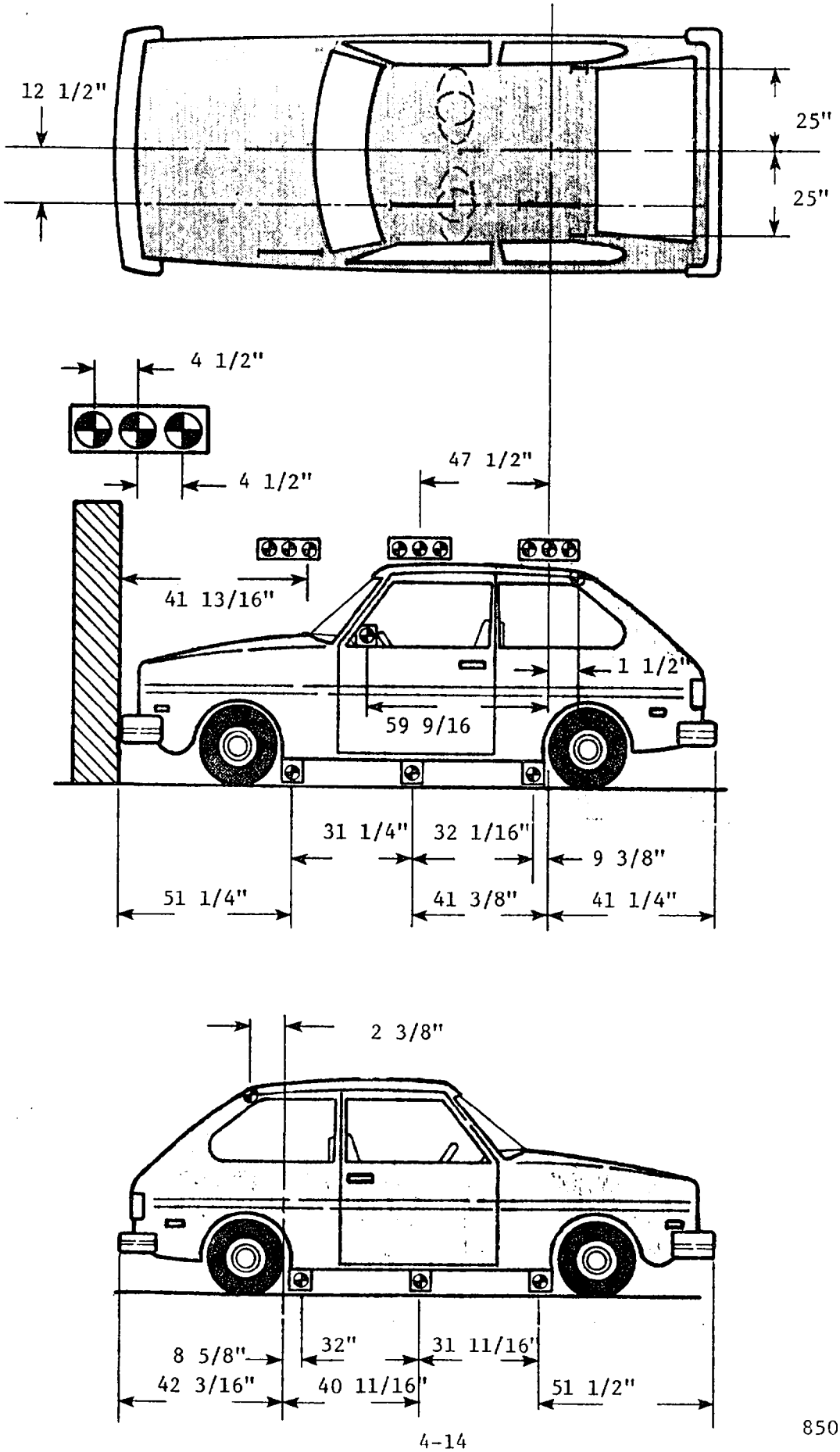
IMPACTED VEHICLE MEASUREMENTS CONTD

VEHICLE MAKE/MODEL Subaru DL Sedan TEST NUMBER 840116

DIMENSIONS IN INCHES

| NO. | TYPE OF MEASUREMENT | PRE-TEST | POST-TEST | DIFF. |
|---|---|---|---|---|
| X18 | CENTER OF STEERING COLUMN TO HEADLINING | 15.8 | 13.3 | 2.5 |
| X19 | REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER | 171.1 | 147.5 | 23.6 |
| X20 | REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER | 171.1 | 148.0 | 23.1 |

VEHICLE TARGET LOCATIONS




850116

ACCIDENT INVESTIGATION DIVISION DATA
FOR 35 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: Subaru DL 4-Door Sedan

VEH. NHTSA NO.: CF5501 ; VIN: JF1AC42B7FB206890

MODEL YEAR: 1985 ; BUILD DATE: 10/84 ; TEST DATE 1/16/85

VEH. SIZE CATEGORY: Mid-size ; TEST WEIGHT: 2687 lbs.

VEH. WHEELBASE: 97.5"

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

F (Frontal)

CRUSH DEPTH DIMENSIONS:

C1 = 23.1 inches

C2 = 24.2 inches

C3 = 24.5 inches

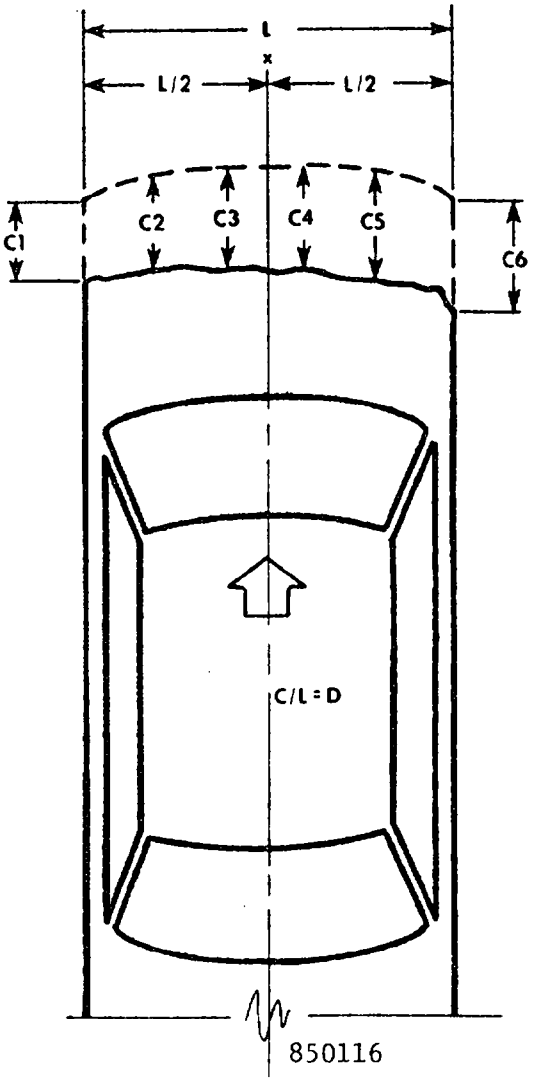
C4 = 22.9 inches

C5 = 24.4 inches

C6 = 23.6 inches

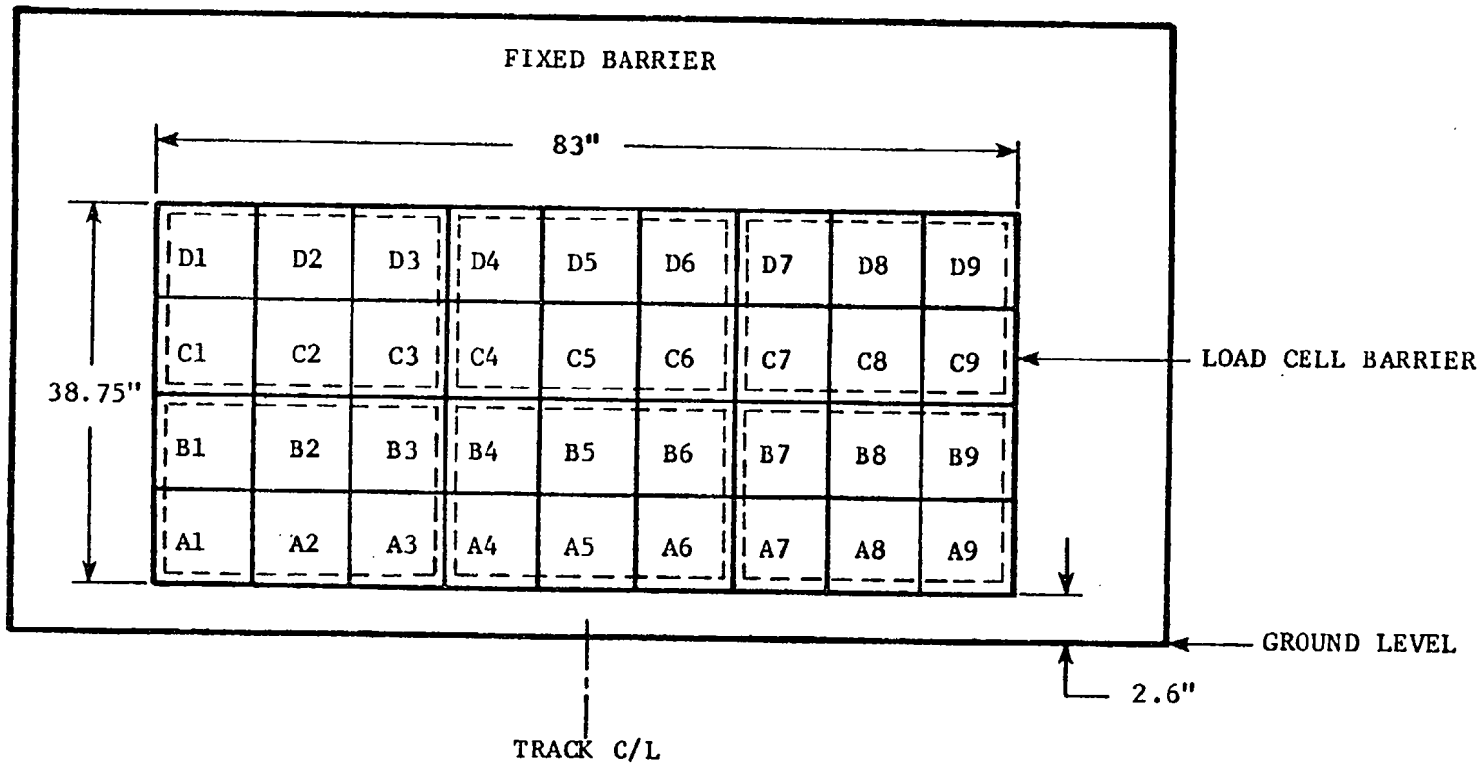
MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitudinal)

LENGTH OF DAMAGED REGION: L = 60.1 inches



36 LOAD CELLS
4 ROWS
9 COLUMNS

FRONT VIEW




**BARRIER LOAD CELL CONFIGURATION**

GROUP 1: D1 thru C3
GROUP 2: D4 thru C6
GROUP 3: D7 thru C9
GROUP 4: B1 thru A3
GROUP 5: B4 thru A6
GROUP 6: B7 thru A9

LOAD CELL BARRIER SUMMARY

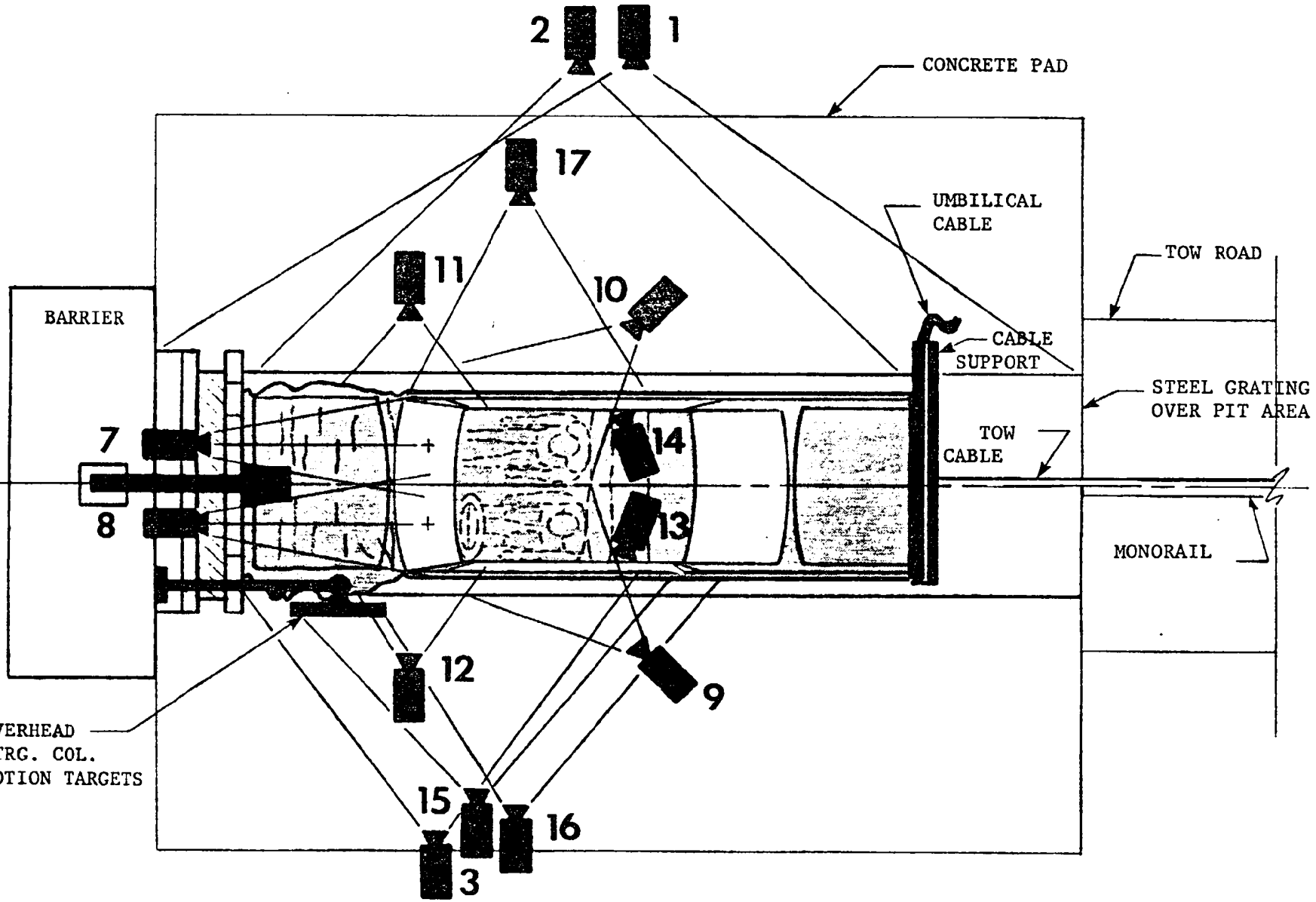
| POSITION | POSITIVE DIRECTION* MAX (lb) | TIME (msec) | NEGATIVE DIRECTION* MIN (lb) | TIME (msec) |
|---|---|---|---|---|
| D1 | 424.68 | 41.00 | 419.25 | 46.25 |
| D2 | 1772.84 | 50.00 | 134.93 | 21.88 |
| D3 | 476.48 | 33.00 | 153.21 | 22.25 |
| C1 | 222.99 | 40.75 | 273.21 | 46.25 |
| C2 | 5211.11 | 29.38 | 25.60 | 97.50 |
| C3 | 3882.70 | 29.50 | 17.77 | 109.13 |
| TOTAL GROUP 1 | 9223.67 | 29.50 | 159.10 | 107.25 |
| D4 | 1415.29 | 34.38 | 284.88 | 22.50 |
| D5 | 627.07 | 35.00 | 214.37 | 22.75 |
| D6 | 358.71 | 39.63 | 320.55 | 35.75 |
| C4 | 2312.44 | 31.38 | 61.90 | 5.13 |
| C5 | 5220.02 | 31.00 | 47.98 | 4.88 |
| C6 | 2010.34 | 31.50 | 73.31 | 39.00 |
| TOTAL GROUP 2 | 10897.86 | 31.88 | 13.95 | 125.13 |
| D7 | 379.38 | 32.50 | 126.58 | 22.13 |
| D8 | 1397.67 | 49.75 | 104.62 | 21.63 |
| D9 | 1358.93 | 34.00 | 196.13 | 22.38 |
| C7 | 2435.69 | 28.63 | 49.12 | 5.00 |
| C8 | 4188.07 | 31.88 | 10.14 | 106.63 |
| C9 | 362.04 | 39.38 | 174.24 | 20.00 |
| TOTAL GROUP 3 | 8473.76 | 32.13 | 60.78 | 107.75 |
| B1 | 153.66 | 19.88 | 217.75 | 40.13 |
| B2 | 3694.36 | 15.50 | 56.13 | 191.00 |
| B3 | 10326.88 | 17.00 | 2.38 | 138.75 |
| A1 | 221.69 | 20.75 | 276.67 | 24.88 |
| A2 | 752.55 | 91.88 | 120.25 | 13.25 |
| A3 | 796.97 | 34.25 | 145.76 | 13.13 |
| TOTAL GROUP 4 | 13864.51 | 16.88 | 154.52 | 138.75 |

LOAD CELL BARRIER SUMMARY CONTD

| POSITION | POSITIVE DIRECTION* MAX (lb) | TIME (msec) | NEGATIVE DIRECTION* MIN (lb) | TIME (msec) |
|---|---|---|---|---|
| B4 | 16404.82 | 31.25 | 3.28 | 140.13 |
| B5 | 22372.35 | 31.25 | 50.22 | 148.88 |
| B6 | 20232.65 | 30.50 | --- | --- ε |
| A4 | 312.11 | 46.50 | 317.90 | 39.63 |
| A5 | 4253.97 | 29.25 | 506.02 | 36.75 |
| A6 | 1019.56 | 31.50 | 229.75 | 13.25 |
| TOTAL GROUP 5 | 63428.70 | 30.75 | 125.84 | 287.00 |
| B7 | 10345.01 | 16.63 | 64.67 | 141.13 |
| B8 | 5216.28 | 16.00 | 1.53 | 147.13 |
| B9 | 126.62 | 23.88 | 118.33 | 19.75 |
| A7 | 1234.44 | 48.00 | 157.24 | 13.25 |
| A8 | 347.09 | 58.63 | 108.40 | 40.38 |
| A9 | 117.41 | 16.25 | 168.88 | 19.88 |
| TOTAL GROUP 6 | 15879.19 | 16.50 | 196.52 | 139.25 |
| TOTAL LOAD CELL FORCE | 112920.14 | 30.75 | 458.90 | 139.50 |

*REFERENCE: COMPRESSION IS POSITIVE
TENSION IS NEGATIVE

ε There were no negative values in the time interval of interest.




CAMERA POSITIONS



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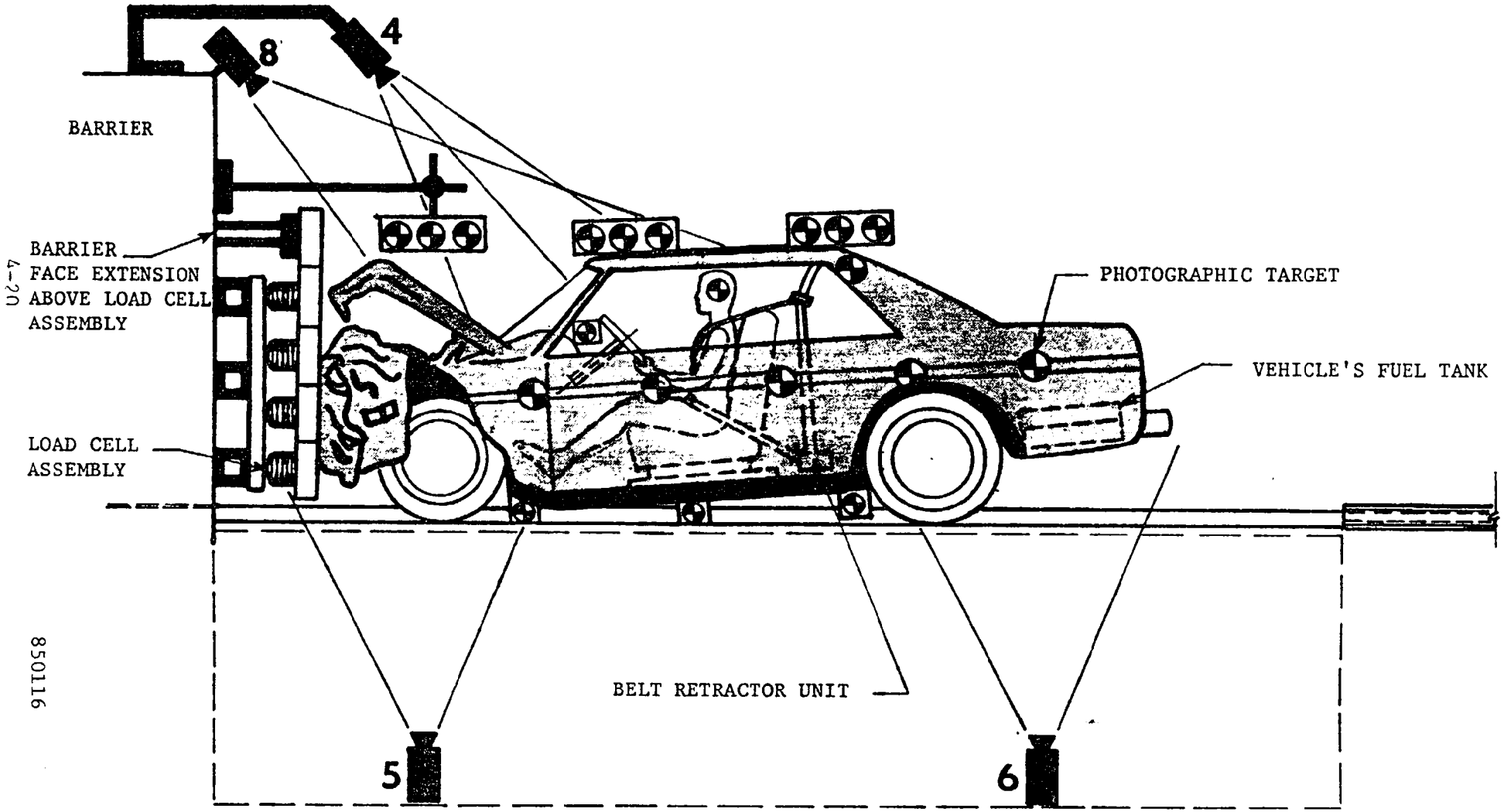
CAMERA POSITIONS






850116

## HIGH SPEED CAMERA LOCATIONS

TEST NO.: 850116 VEHICLE: Subaru DL Sedan

| CAMERA NO. | VIEW | CAMERA POSITIONS (IN)* X | Y | Z | ANGLE ** (DEG) | FILM PLANE TO HEAD TARGET | LENS (MM) | SPEED (FPS) |
|---|---|---|---|---|---|---|---|---|
| 1 | Real-time Panning | -142 | 504 | 61 | NA | NA | 16 | 24 |
| 2 | Vehicle Crush | -81.3 | 266.4 | 37.1 | -2 | NA | 13 | 503 |
| 3 | Dummy Kinematics | -41.5 | -295 | 44 | -12 | 282 1/4" | 25 | 505 |
| 4 | Windshield Damage | -36.4 | 0 | 120 | -80 | NA | 13 | 545 |
| 5 | Crush & Fluid Spillage | -50.5 | 0 | -92.4 | 90 | NA | 13 | 500 |
| 6 | Fluid Spillage | -99.3 | 0 | -99 | 90 | NA | 13 | 498 |
| 7 | Passenger Kinematics | 4.5 | 13.8 | 115 | -50 | NA | 17 | 587 |
| 8 | Driver Kinematics | 6.8 | -14.5 | 113.3 | -50 | NA | 17 | 503 |
| 9 | Driver Kinematics | -157.3 | -166.9 | 74.1 | -14 | 151 7/16" | 25 | 483 |
| 10 | Passenger Kinematics | -152.1 | 167.9 | 76 | -15 | 148 1/4" | 25 | 503 |
| 11 | Windshield Intrusion | -53.9 | 306.1 | 44 | 0 | NA | 50 | 500 |
| 12 | Windshield Intrusion | -53 | -309.4 | 42.3 | 0 | NA | 50 | 502 |
| 13 | Driver Seatbelt Movement | NA | NA | NA | NA | NA | 13 | 501 |
| 14 | Passenger Seatbelt Movement | NA | NA | NA | NA | NA | 13 | 505 |
| 15 | Column Movement | -98 | -286 | 99.5 | -15 | NA | 25 | 500 |
| 16 | Column Movement | -98 | -286 | 70.6 | -10 | NA | 25 | 495 |
| 17 | Passenger Kinematics | -38.8 | 210.8 | 45.3 | 7 | 198" | 13 | 503 |

* X = Film plane to monorail centerline
Y = Film plane to impact location
Z = Film plane to ground
** Referenced to horizontal plane

APPENDIX A

PHOTOGRAPHS

1. PRE-TEST FRONT VIEW
2. POST-TEST FRONT VIEW
3. PRE-TEST LEFT SIDE VIEW
4. POST-TEST LEFT SIDE VIEW
5. PRE-TEST RIGHT SIDE VIEW
6. POST-TEST RIGHT SIDE VIEW
7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW
8. POST-TEST RIGHT FRONT THREE-QUARTER VIEW
9. PRE-TEST LEFT REAR THREE-QUARTER VIEW
10. POST-TEST LEFT REAR THREE-QUARTER VIEW
11. POST-TEST TOP VIEW (VEHICLE ON ROLLOVER MACHINE)
12. PRE-TEST ENGINE COMPARTMENT VIEW
13. POST-TEST ENGINE COMPARTMENT VIEW
14. PRE-TEST FUEL FILLER CAP VIEW
15. POST-TEST FUEL FILLER CAP VIEW
16. PRE-TEST FRONT UNDERBODY VIEW
17. POST-TEST FRONT UNDERBODY VIEW
18. PRE-TEST REAR UNDERBODY VIEW
19. POST-TEST REAR UNDERBODY VIEW
20. PRE-TEST DRIVER DUMMY POSITION VIEW
21. POST-TEST DRIVER DUMMY POSITION VIEW
22. PRE-TEST PASSENGER DUMMY POSITION VIEW
23. POST-TEST PASSENGER DUMMY POSITION VIEW
24. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR VIEW (DOOR OPEN)
25. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR VIEW (DOOR OPEN)
26. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR VIEW (DOOR OPEN)
27. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR VIEW (DOOR OPEN)

PHOTOGRAPHS . . . . Continued:

28. POST-TEST DRIVER DUMMY HEAD CONTACT AREA

29. POST-TEST STEERING COLUMN HUB/RIM CONTACT BY DRIVER DUMMY

30. POST-TEST PASSENGER DUMMY HEAD/KNEE CONTACT


Figure 1. PRE-TEST FRONT VIEW

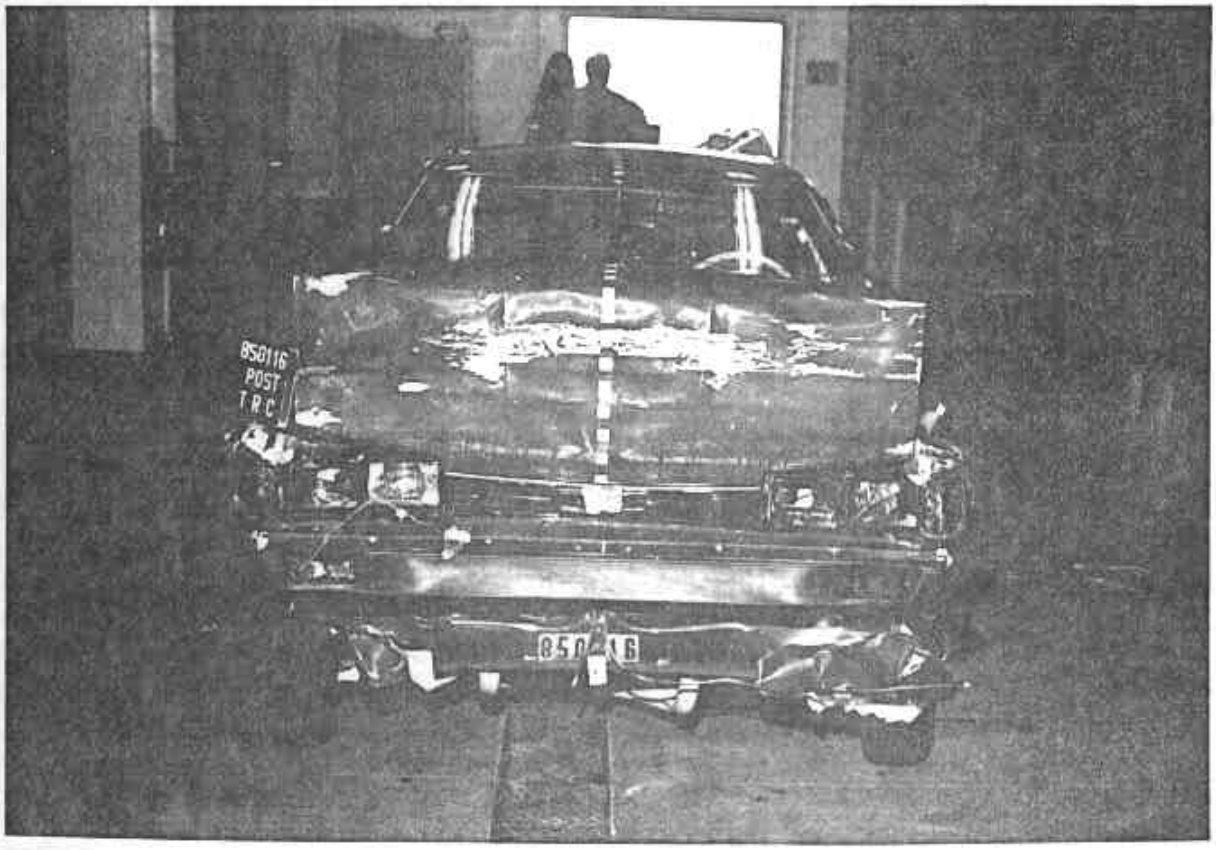



Figure 2. POST-TEST FRONT VIEW

Figure 3. PRE-TEST LEFT SIDE VIEW

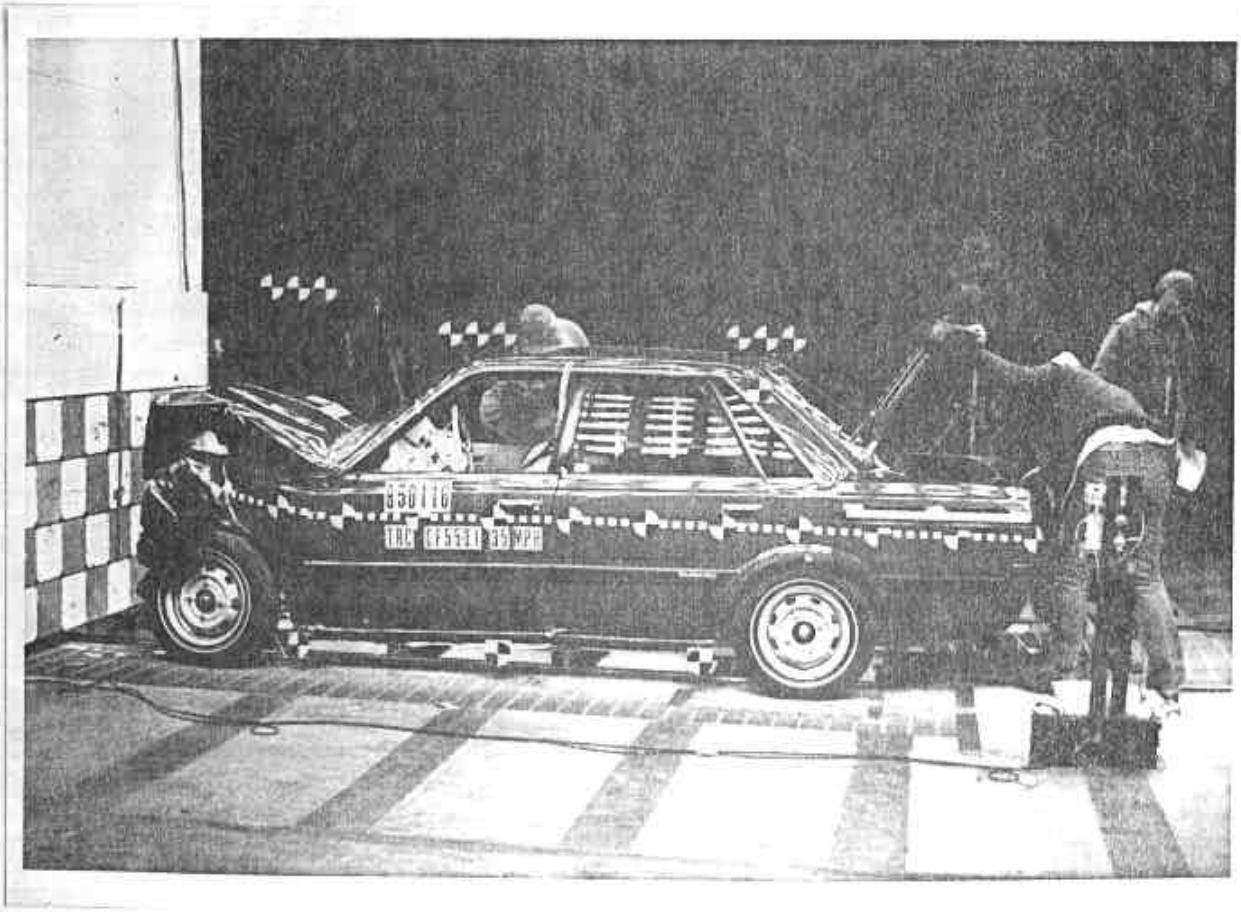


Figure 4. POST-TEST LEFT SIDE VIEW

Figure 5. PRE-TEST RIGHT SIDE VIEW

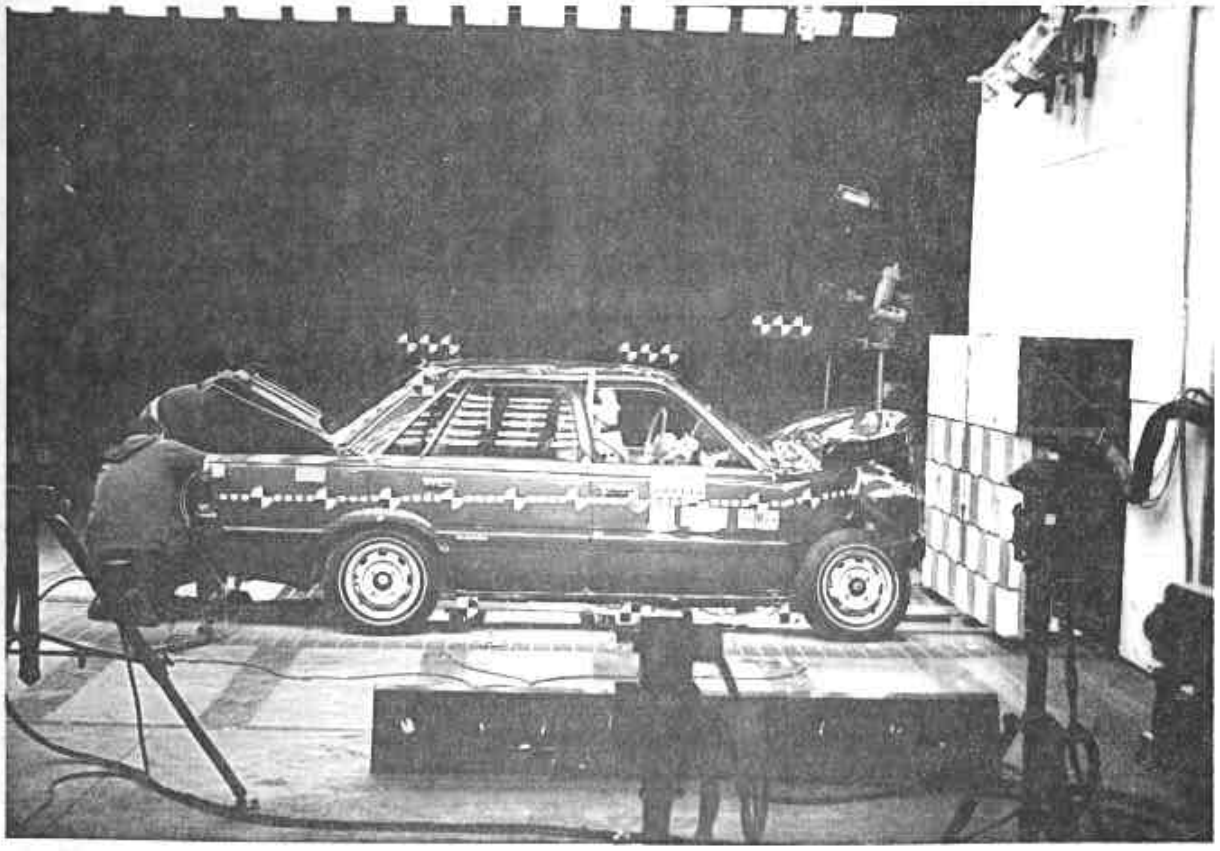


Figure 6. POST-TEST RIGHT SIDE VIEW



850116

Figure 7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

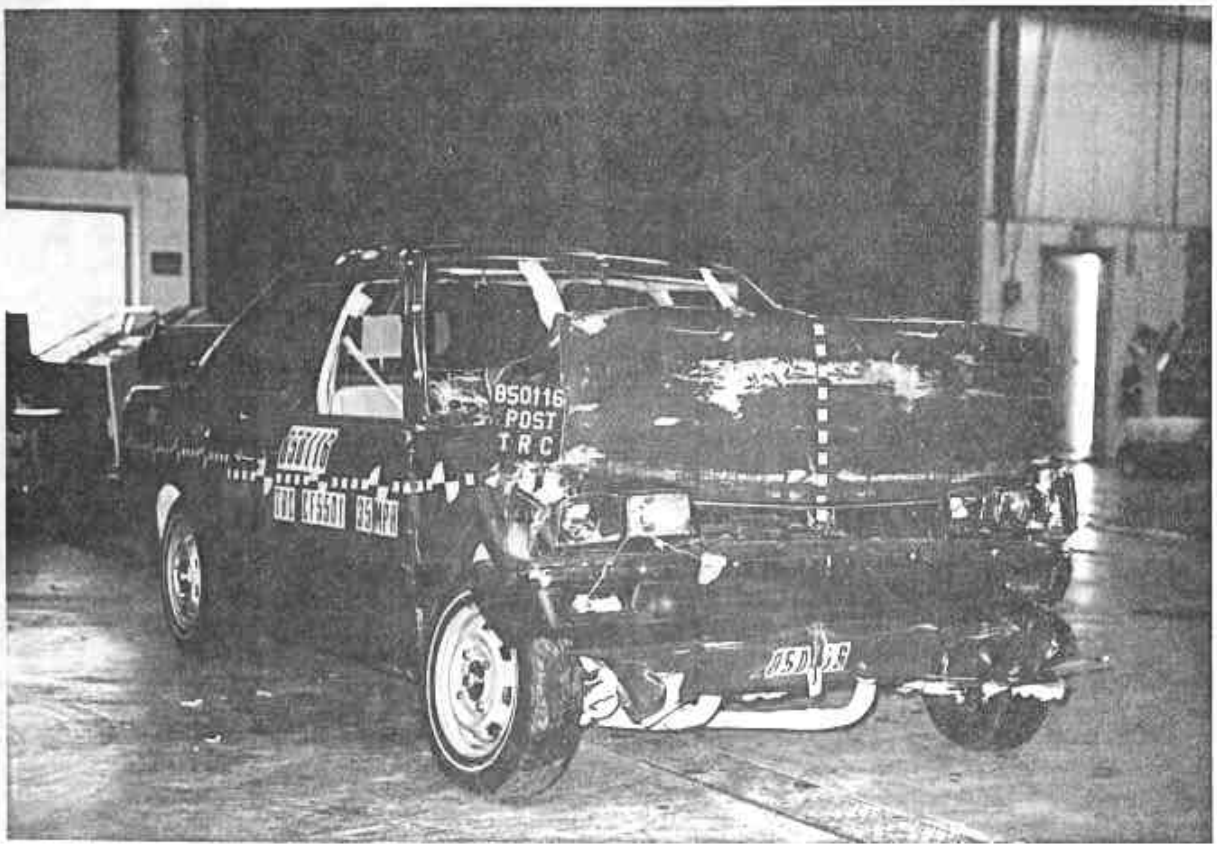



Figure 8. POST-TEST RIGHT FRONT THREE-QUARTER VIEW

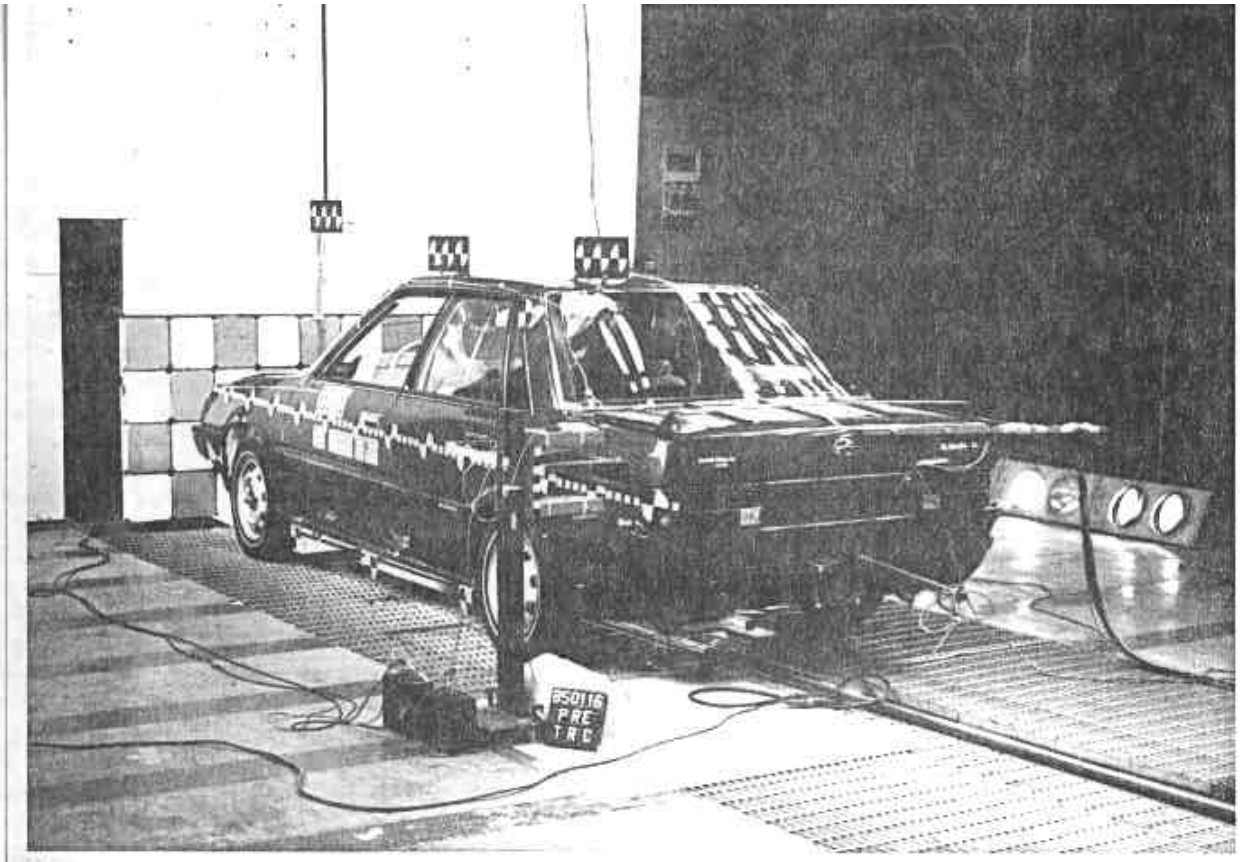



Figure 9. PRE-TEST LEFT REAR THREE-QUARTER VIEW


Figure 10. POST-TEST LEFT REAR THREE-QUARTER VIEW

Figure 11. POST-TEST TOP VIEW (VEHICLE ON ROLLOVER MACHINE)

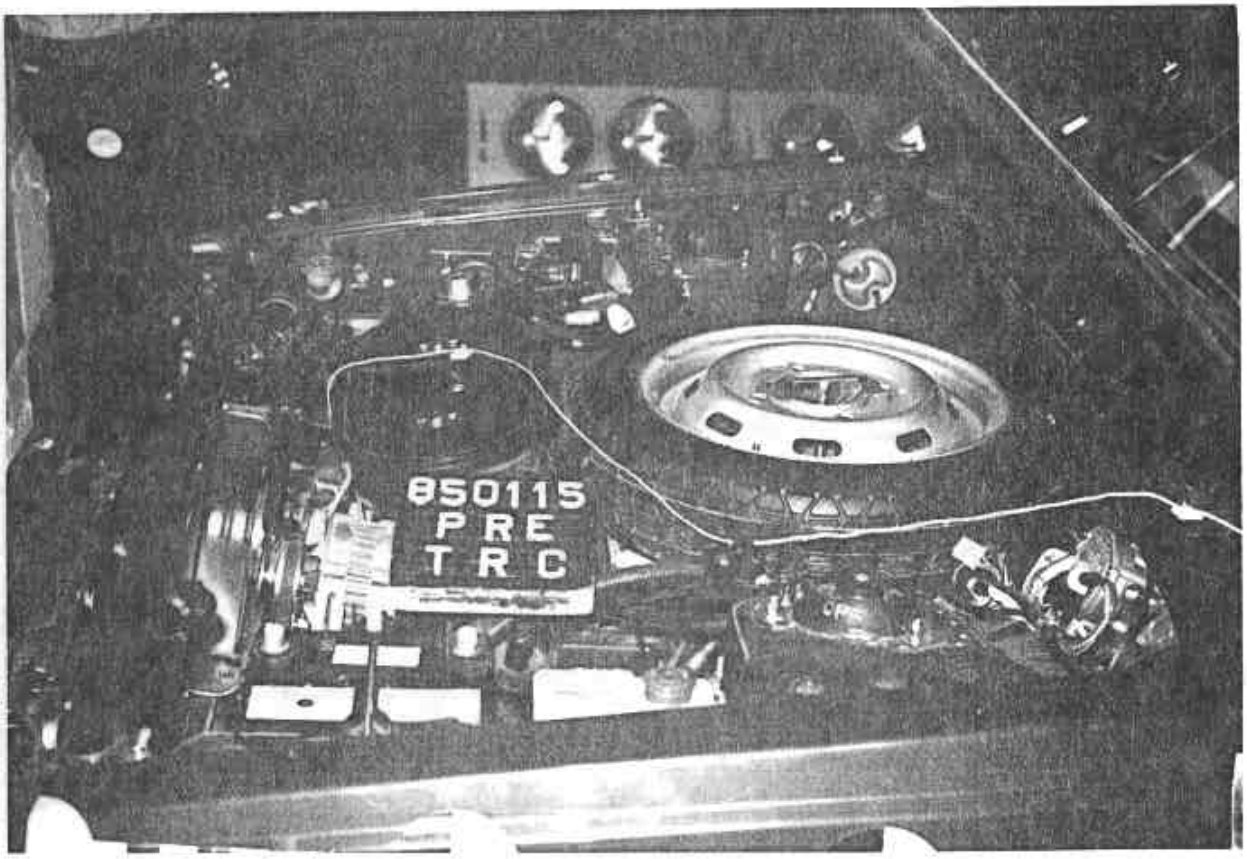



Figure 12. PRE-TEST ENGINE COMPARTMENT VIEW

850116

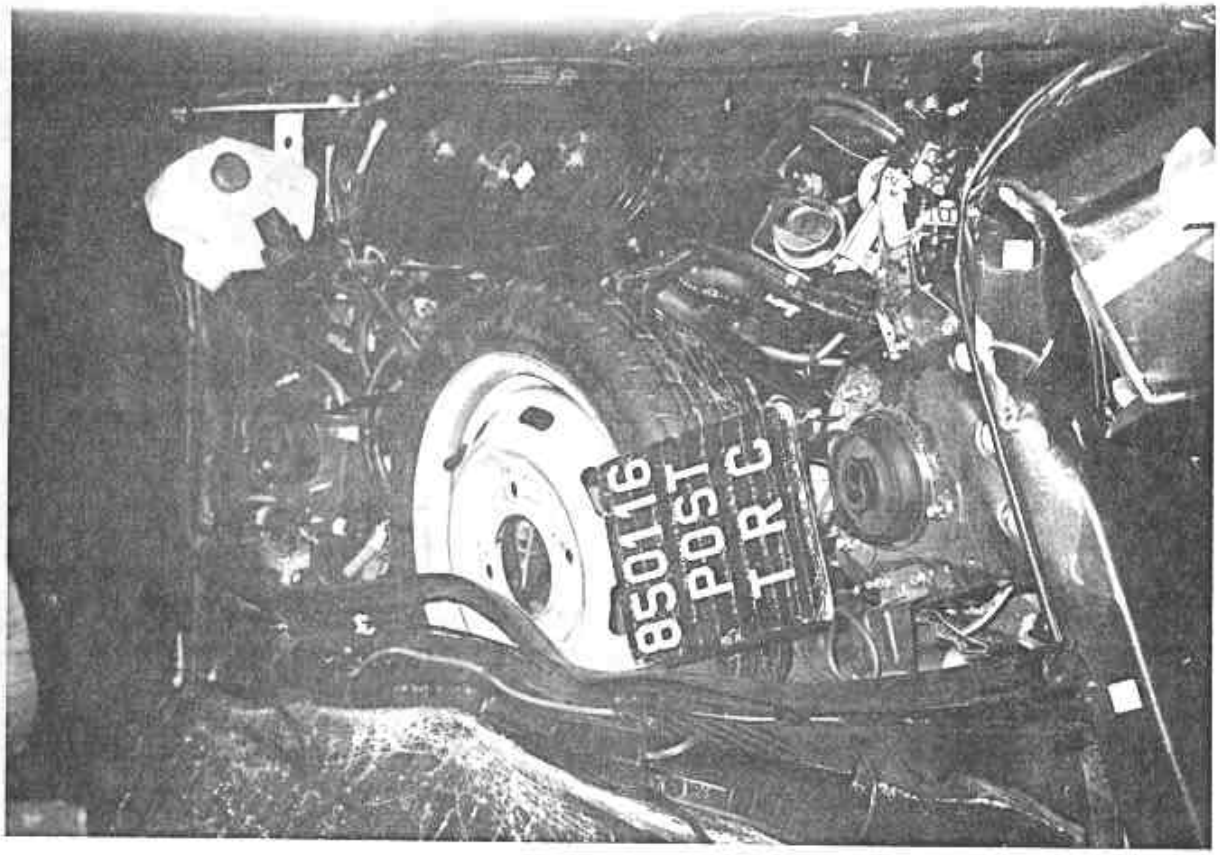



Figure 13. POST-TEST ENGINE COMPARTMENT VIEW

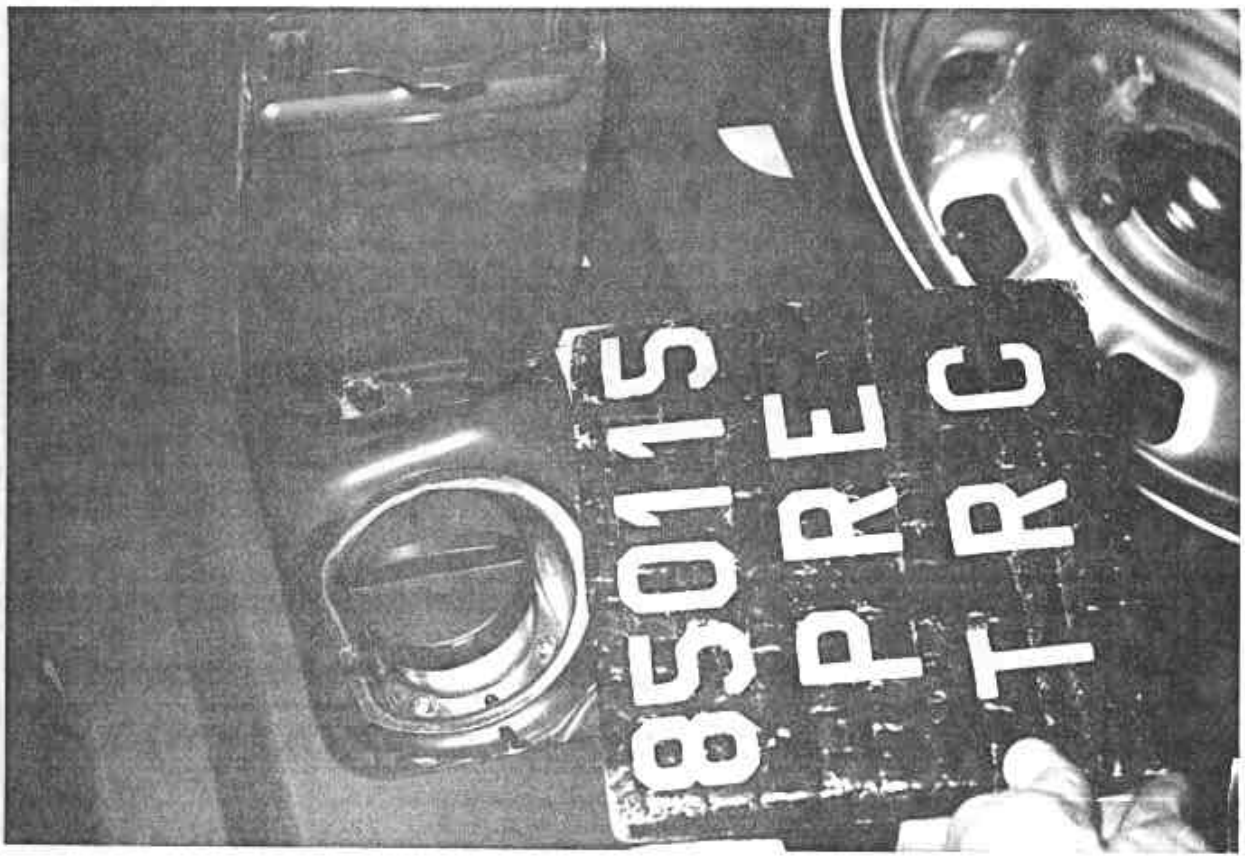



Figure 14. PRE-TEST FUEL FILLER CAP VIEW

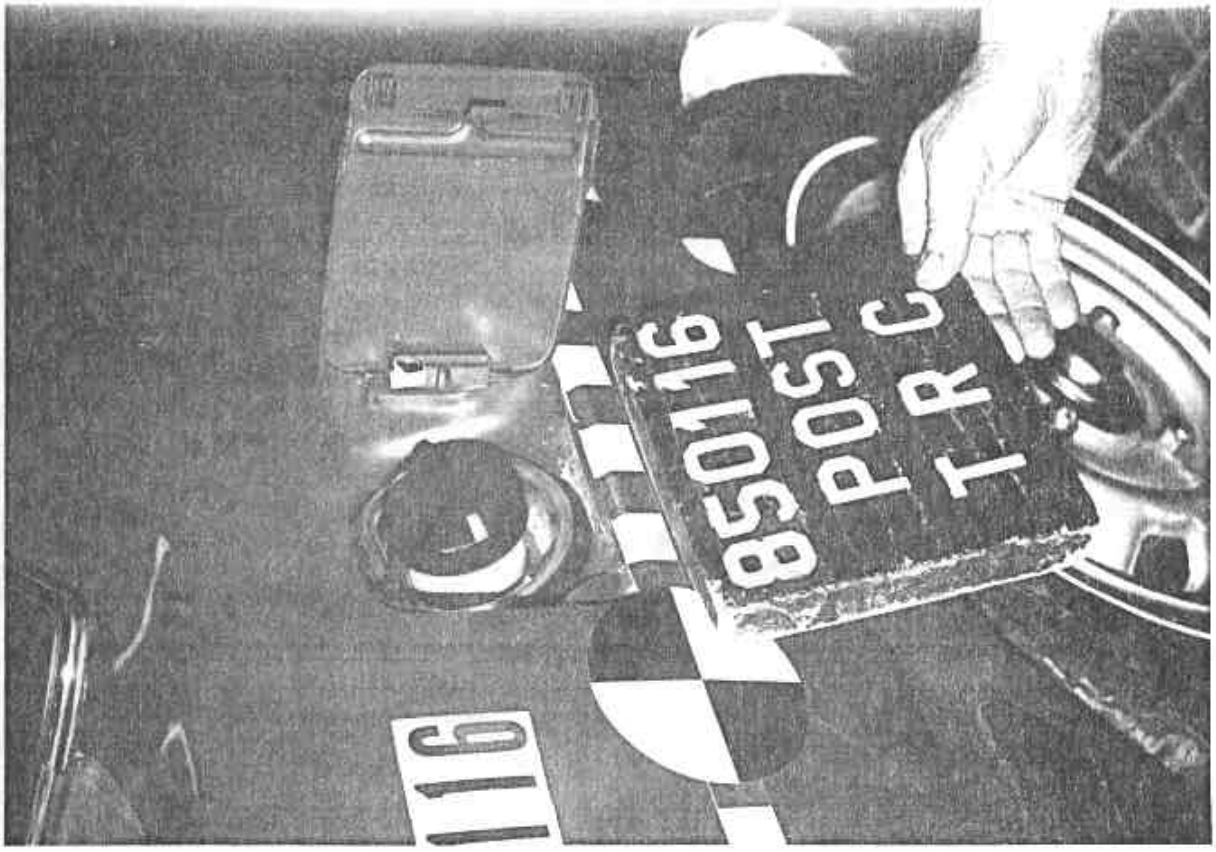



Figure 15. POST-TEST FUEL FILLER CAP VIEW

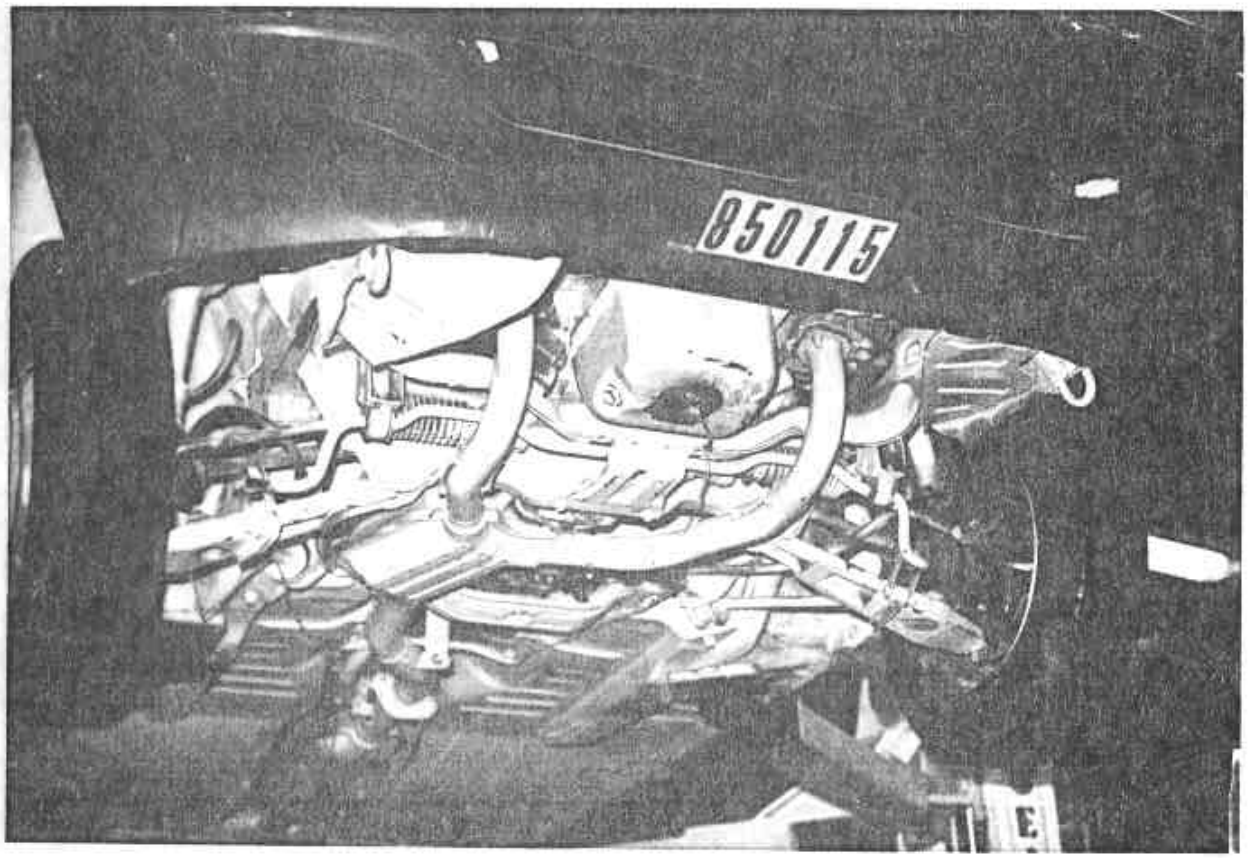



Figure 16. PRE-TEST FRONT UNDERBODY VIEW

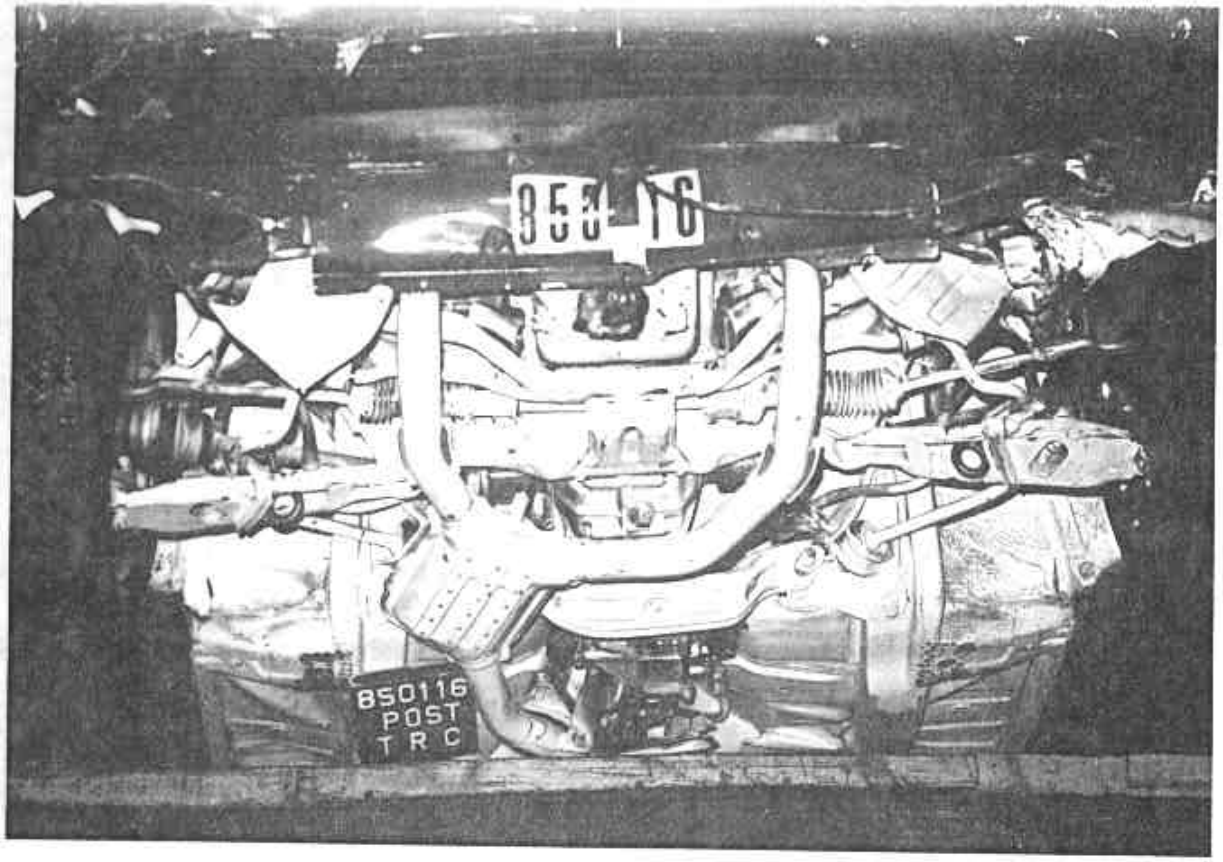



Figure 17. POST-TEST FRONT UNDERBODY VIEW

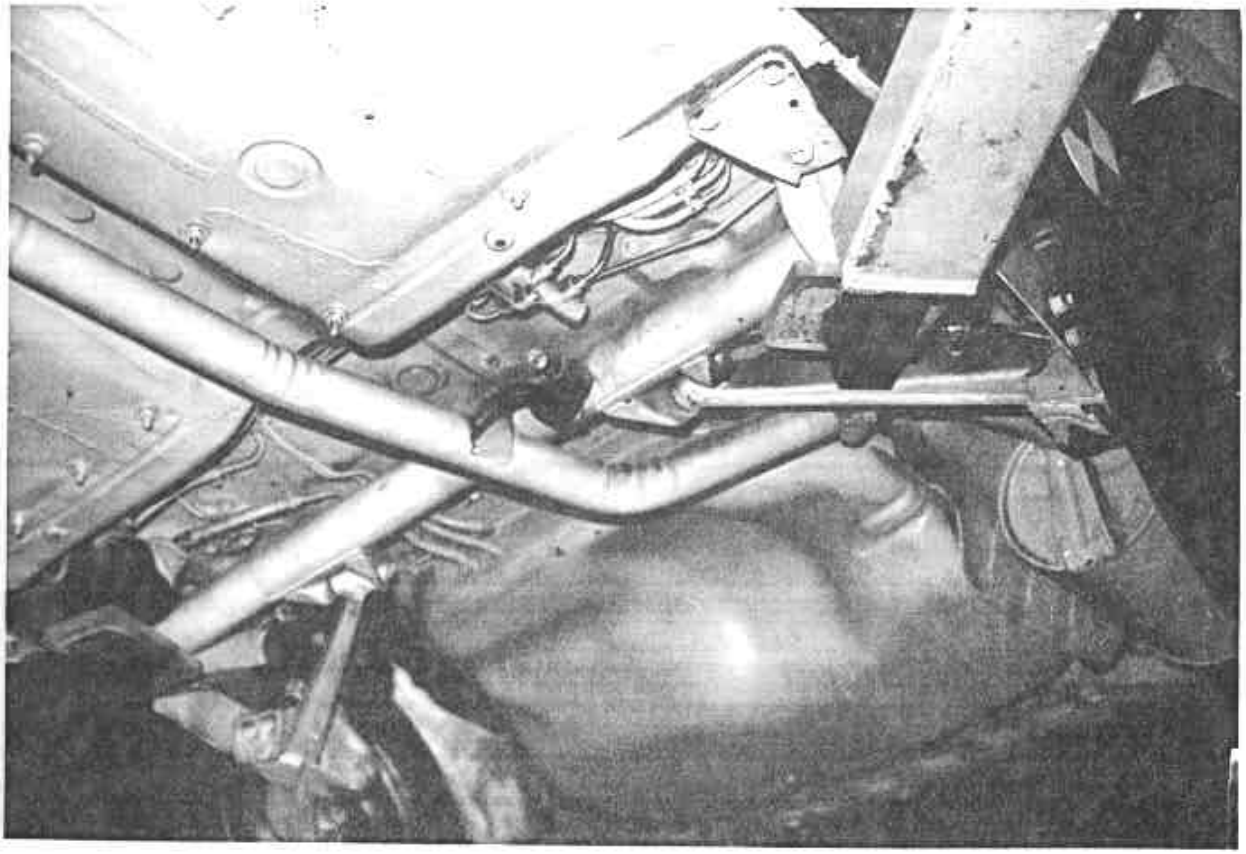


Figure 18. PRE-TEST REAR UNDERBODY VIEW

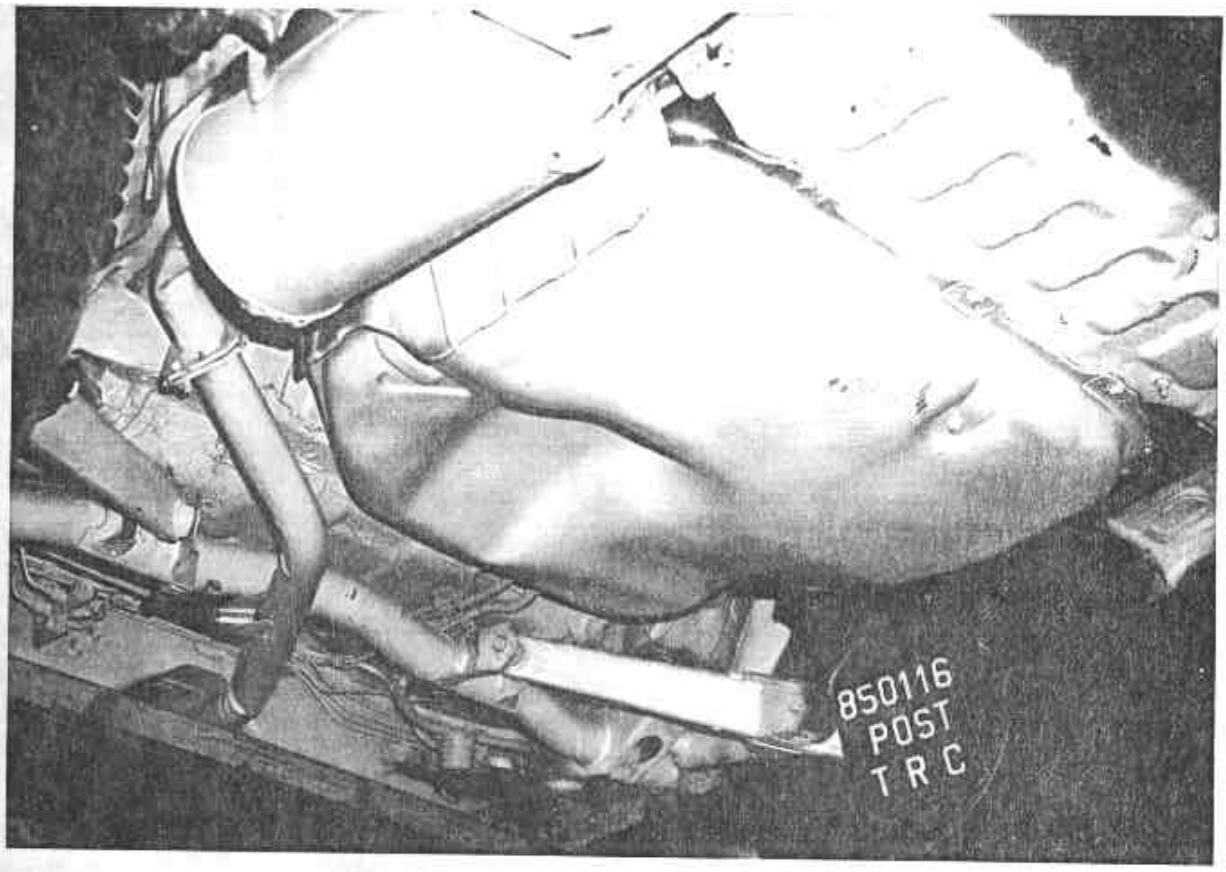



Figure 19. POST-TEST REAR UNDERBODY VIEW


Figure 20. PRE-TEST DRIVER DUMMY POSITION VIEW


Figure 21. POST-TEST DRIVER DUMMY POSITION VIEW

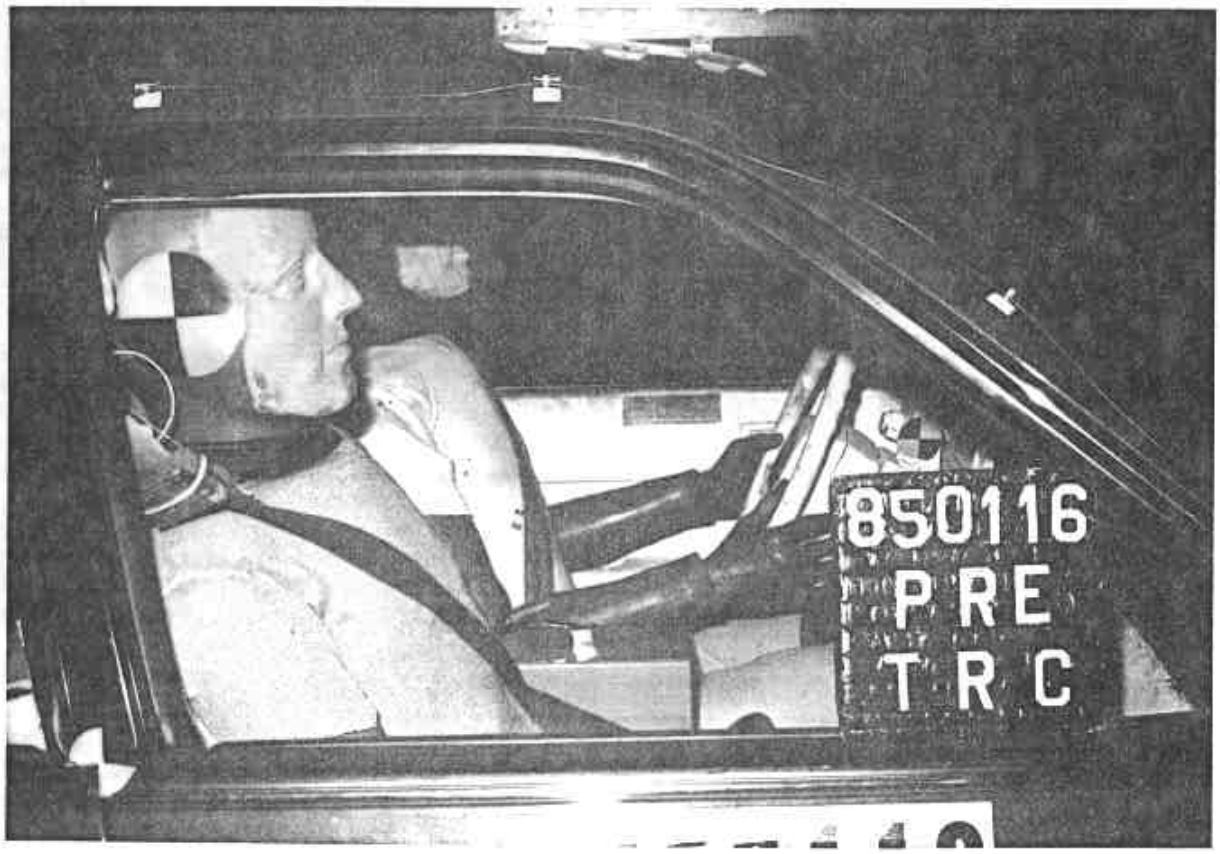



Figure 22. PRE-TEST PASSENGER DUMMY POSITION VIEW


Figure 23. POST-TEST PASSENGER DUMMY POSITION VIEW

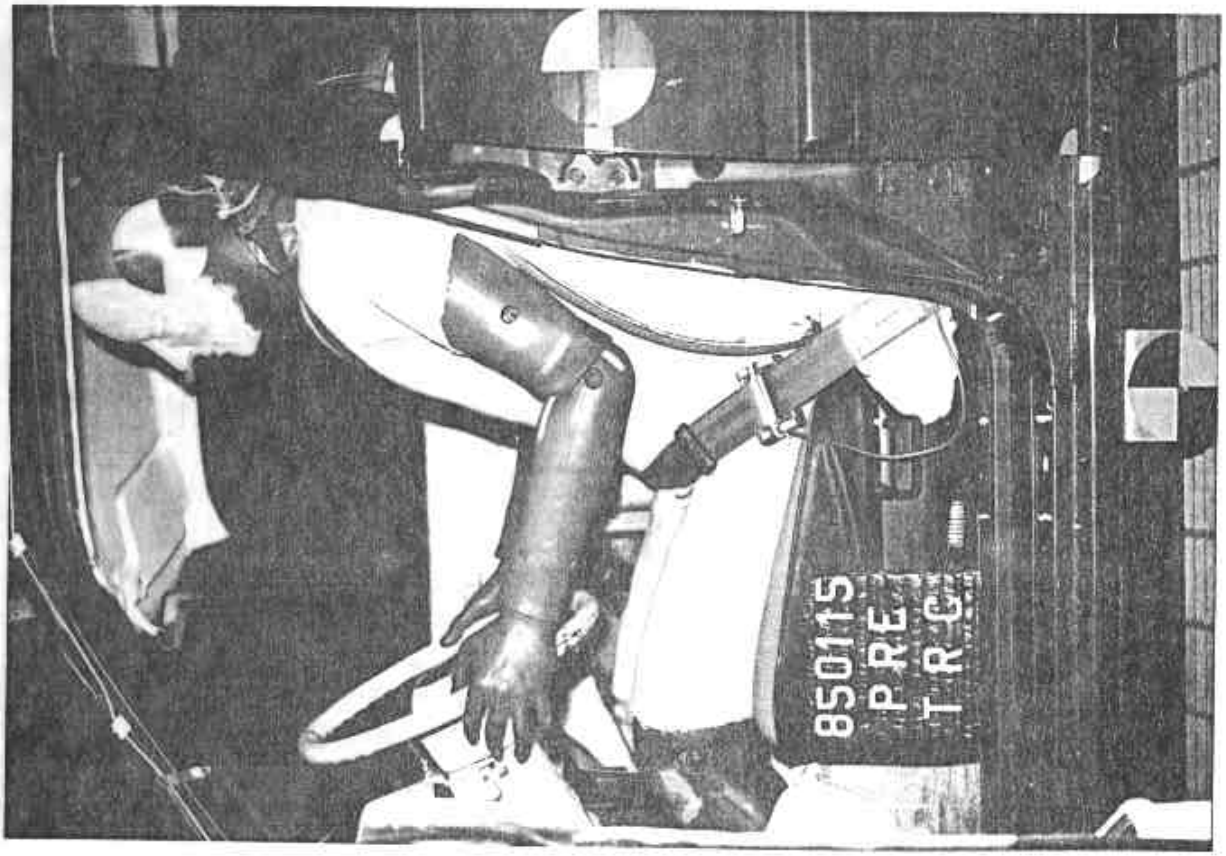



Figure 24. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR (DOOR OPEN)

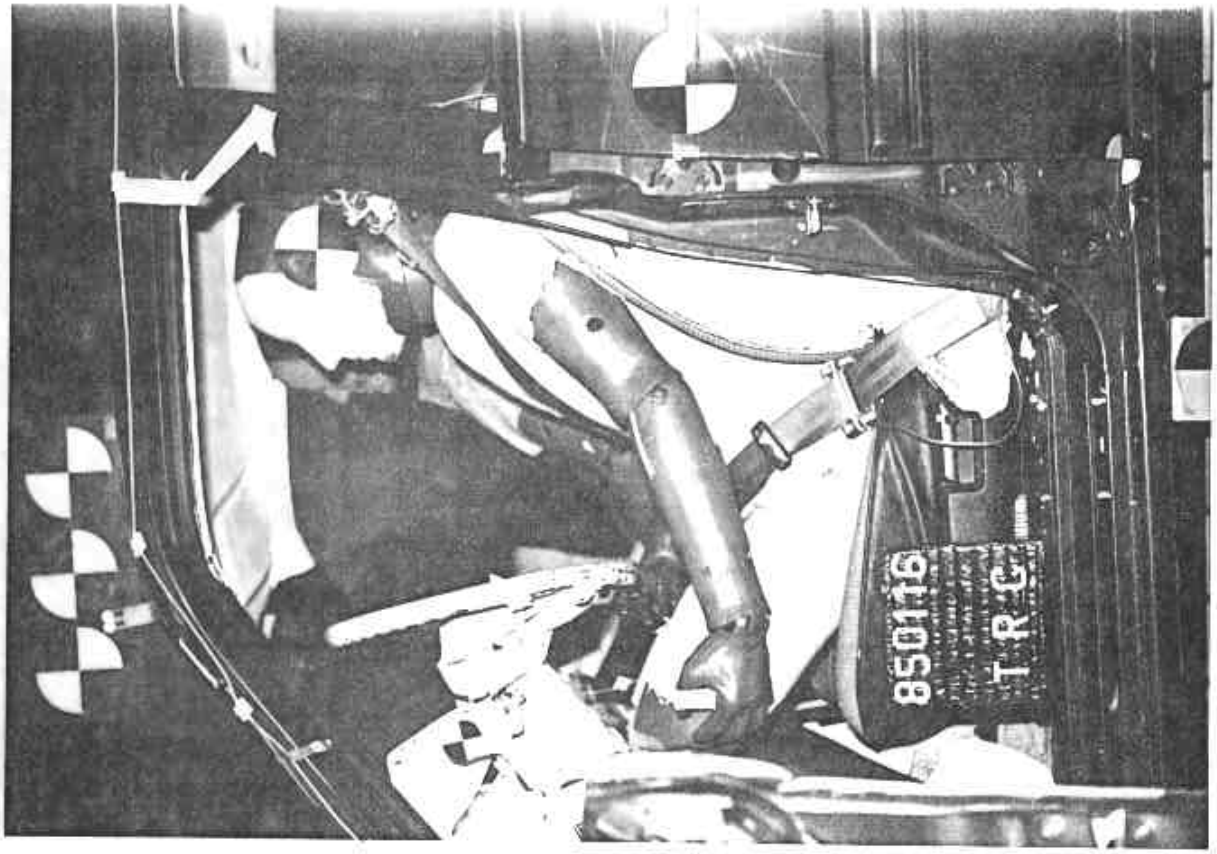



Figure 25. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR (DOOR OPEN)

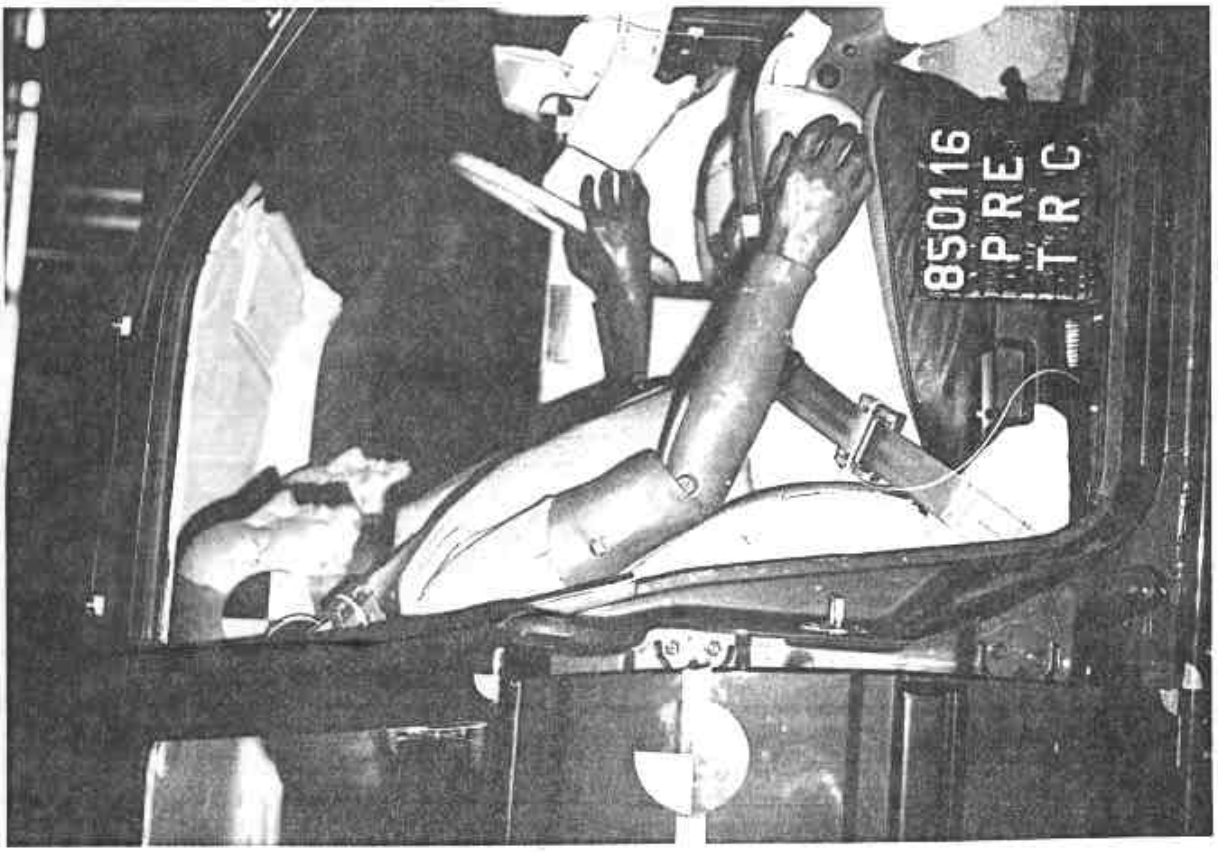



Figure 26. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR (DOOR OPEN)

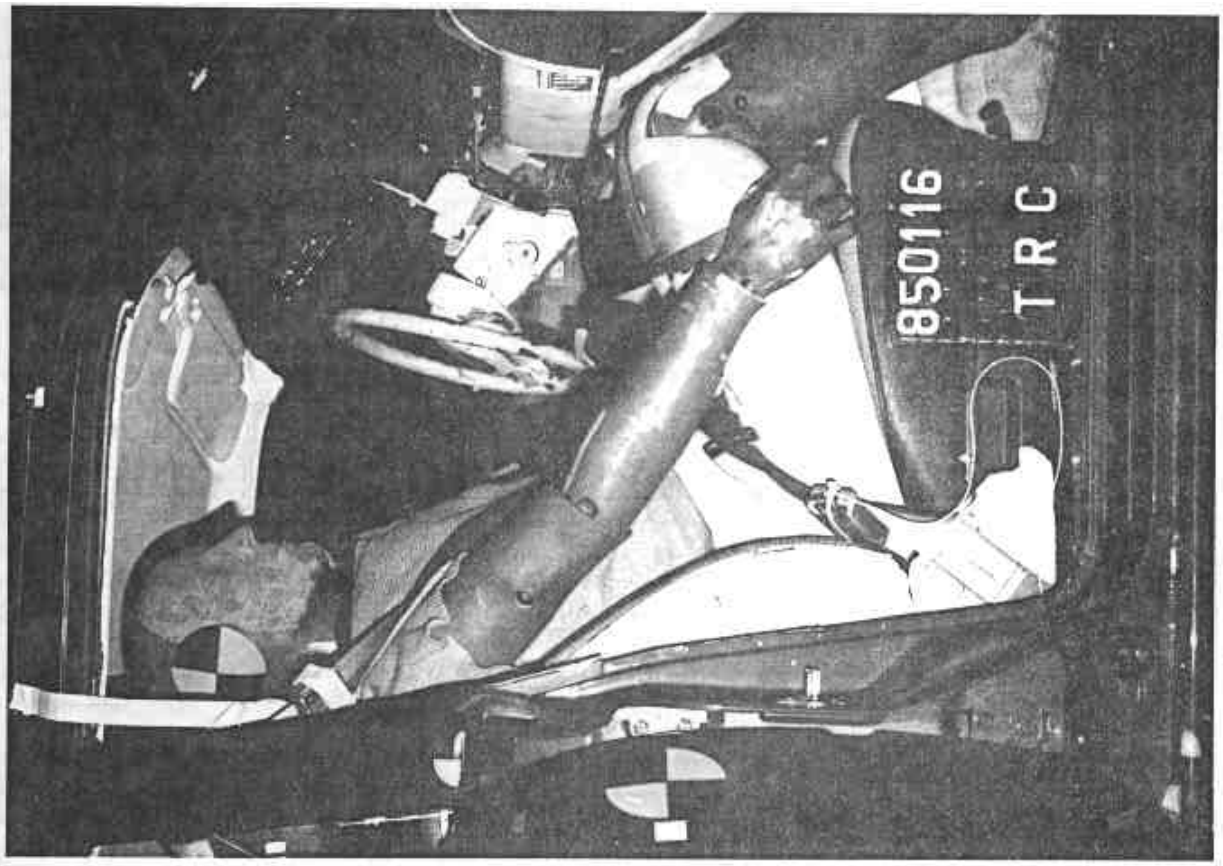



Figure 27. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR VIEW (DOOR OPEN)

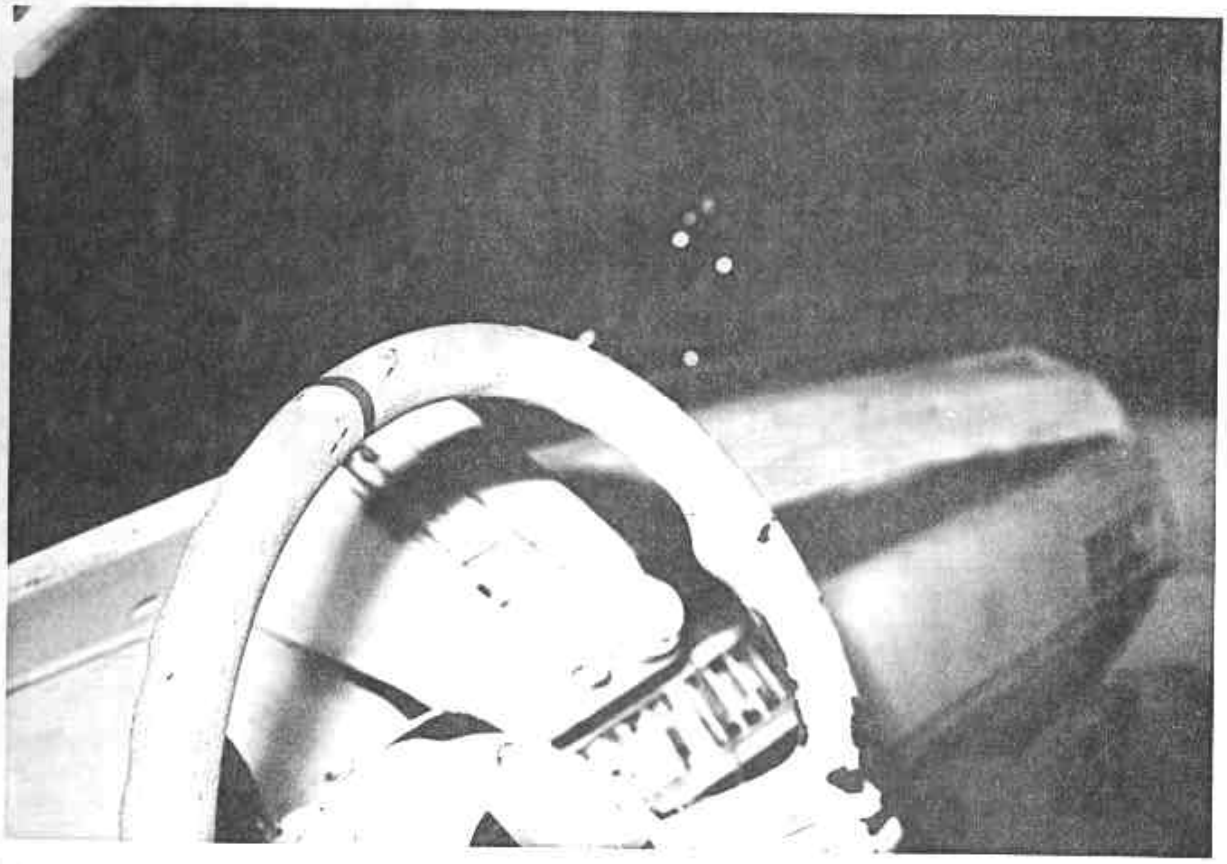


Figure 28. POST-TEST DRIVER DUMMY HEAD CONTACT AREA

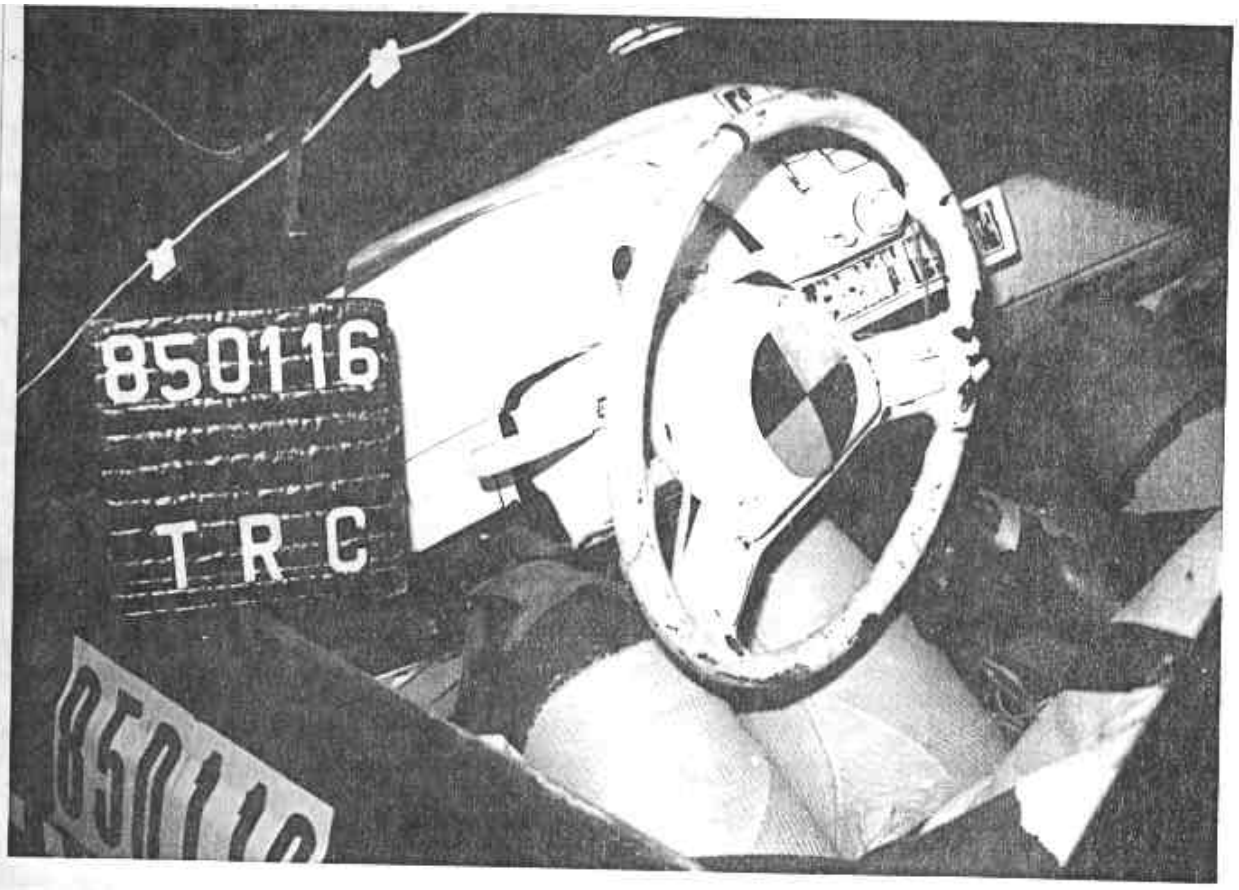



Figure 29. POST-TEST STEERING COLUMN HUB/RIM CONTACT BY DRIVER DUMMY

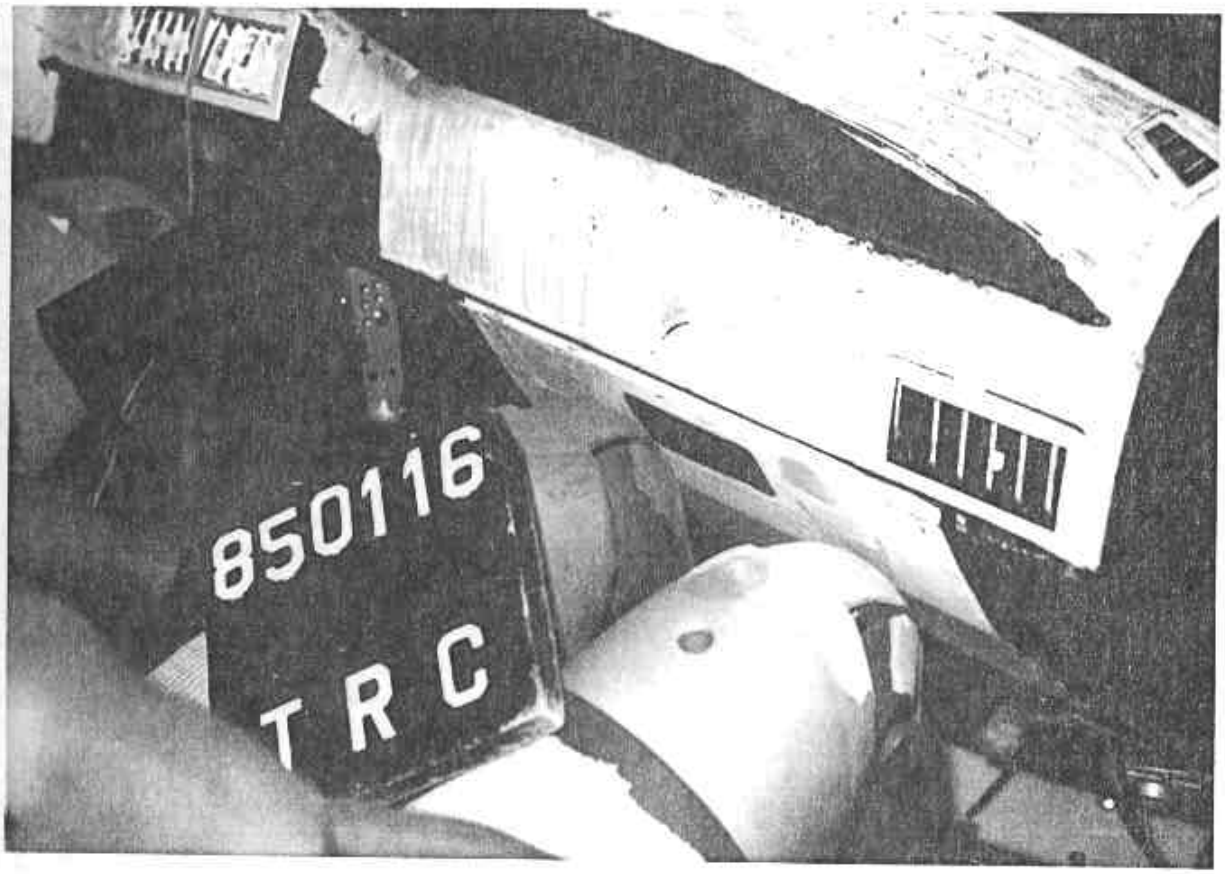
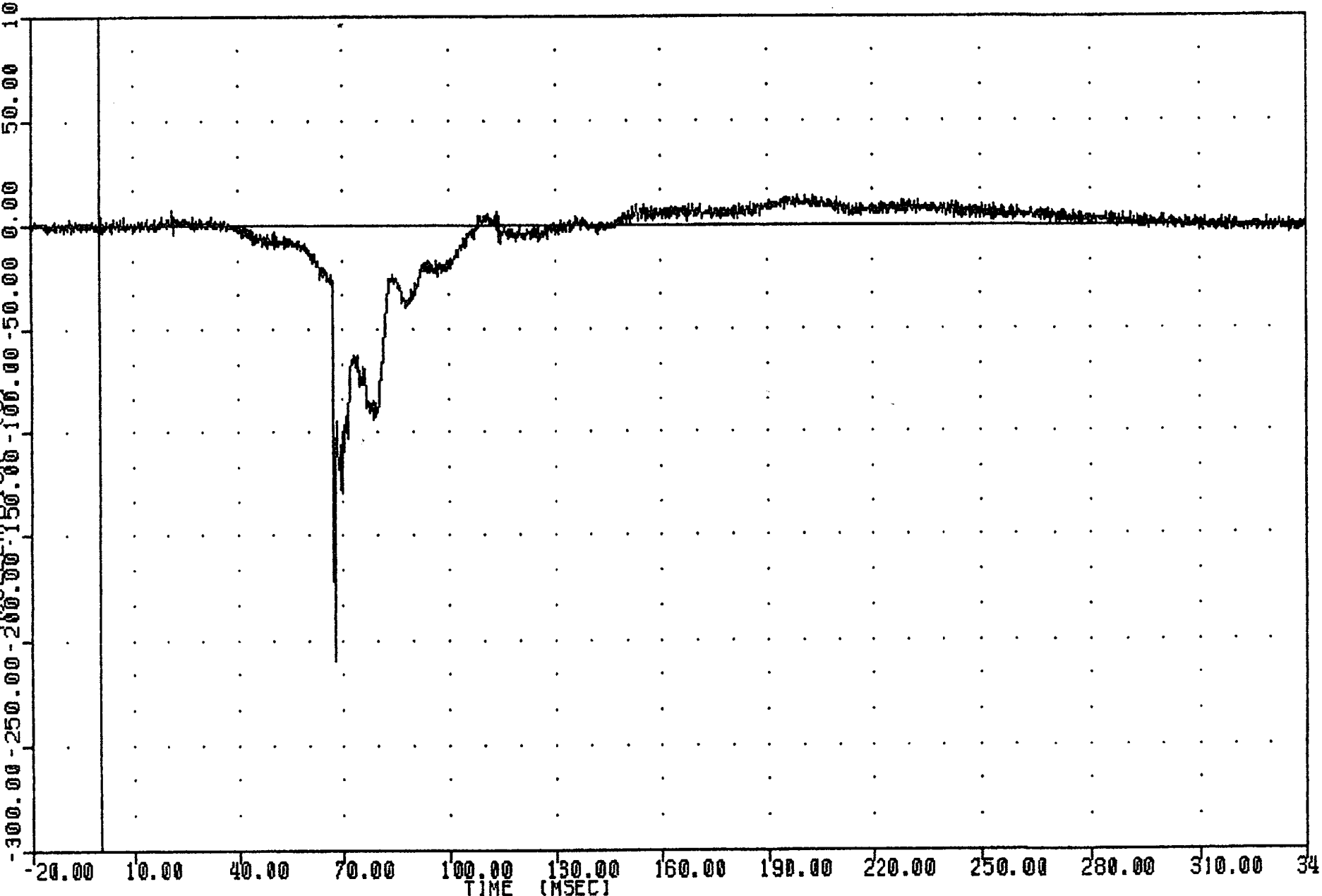



Figure 30. POST-TEST PASSENGER DUMMY HEAD/KNEE CONTACT

# APPENDIX B

# DATA PLOTS

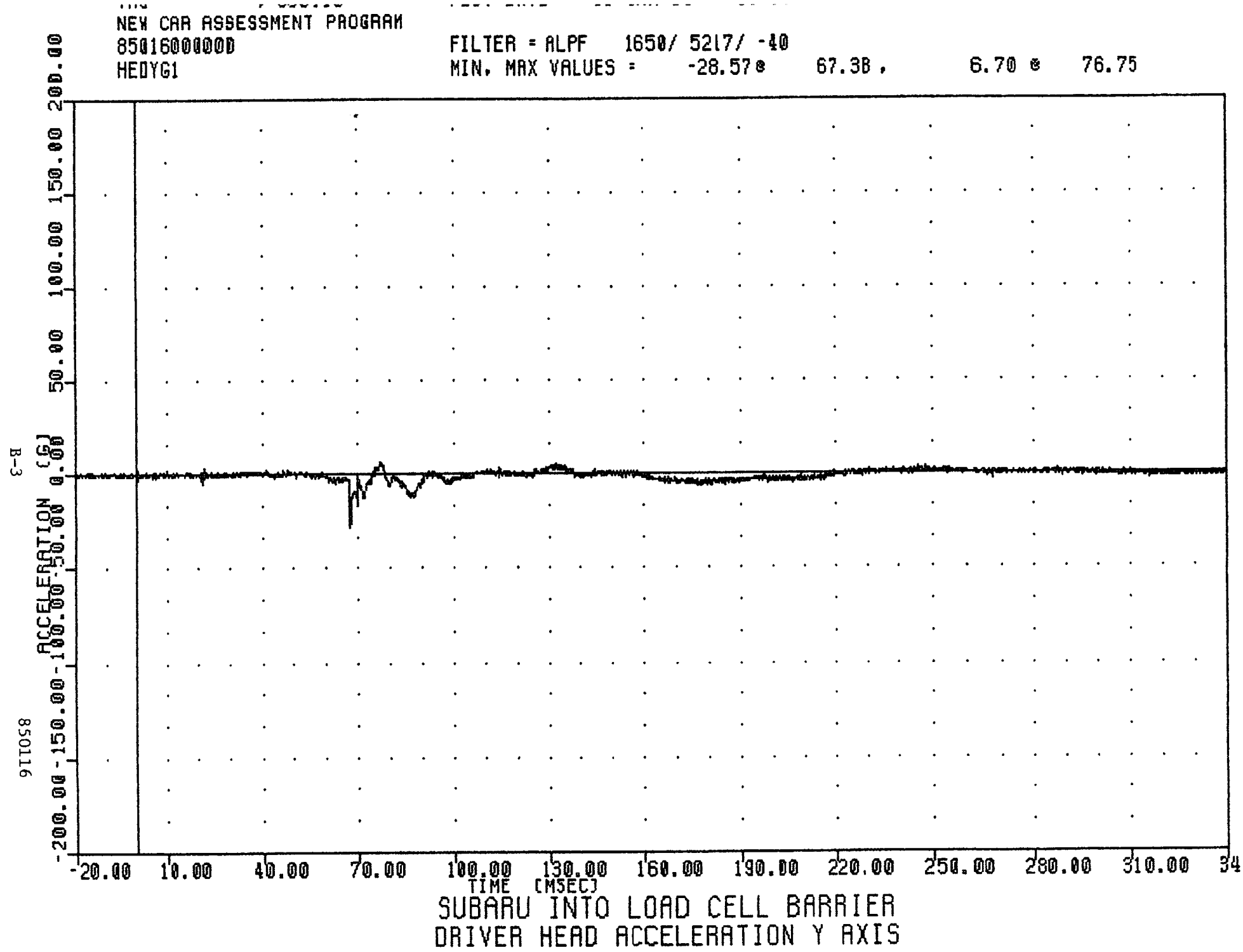
INC # 850116 PLOT DATE 30 JAN 85 15:30:00
NEW CAR ASSESSMENT PROGRAM
850160000000
HEDXG1
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -209.92 @ 67.38 , 13.98 @ 198.25




B-2

850116

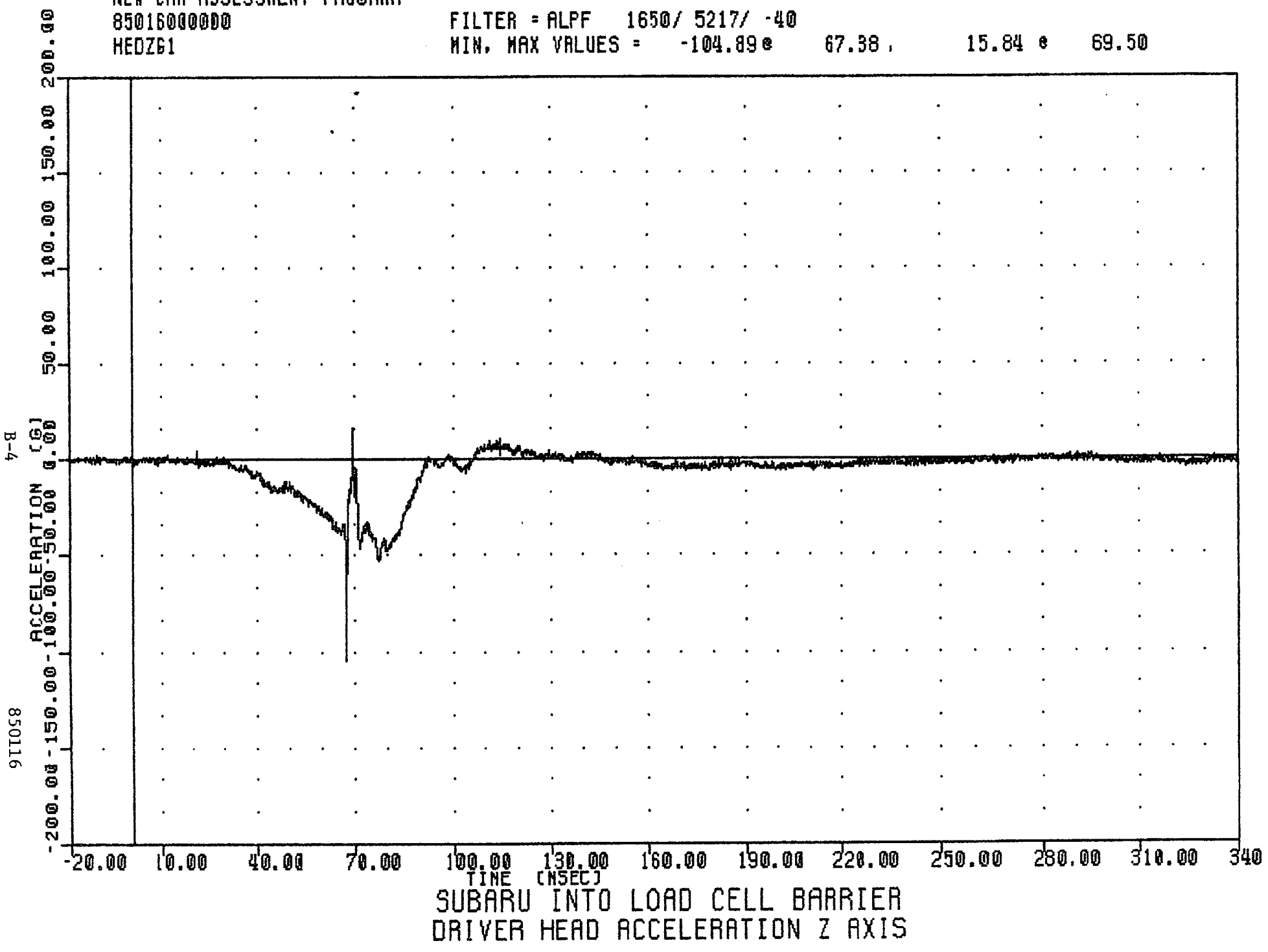
SUBARU INTO LOAD CELL BARRIER
DRIVER HEAD ACCELERATION X AXIS




SUBARU INTO LOAD CELL BARRIER
DRIVER HEAD ACCELERATION Y AXIS



850116



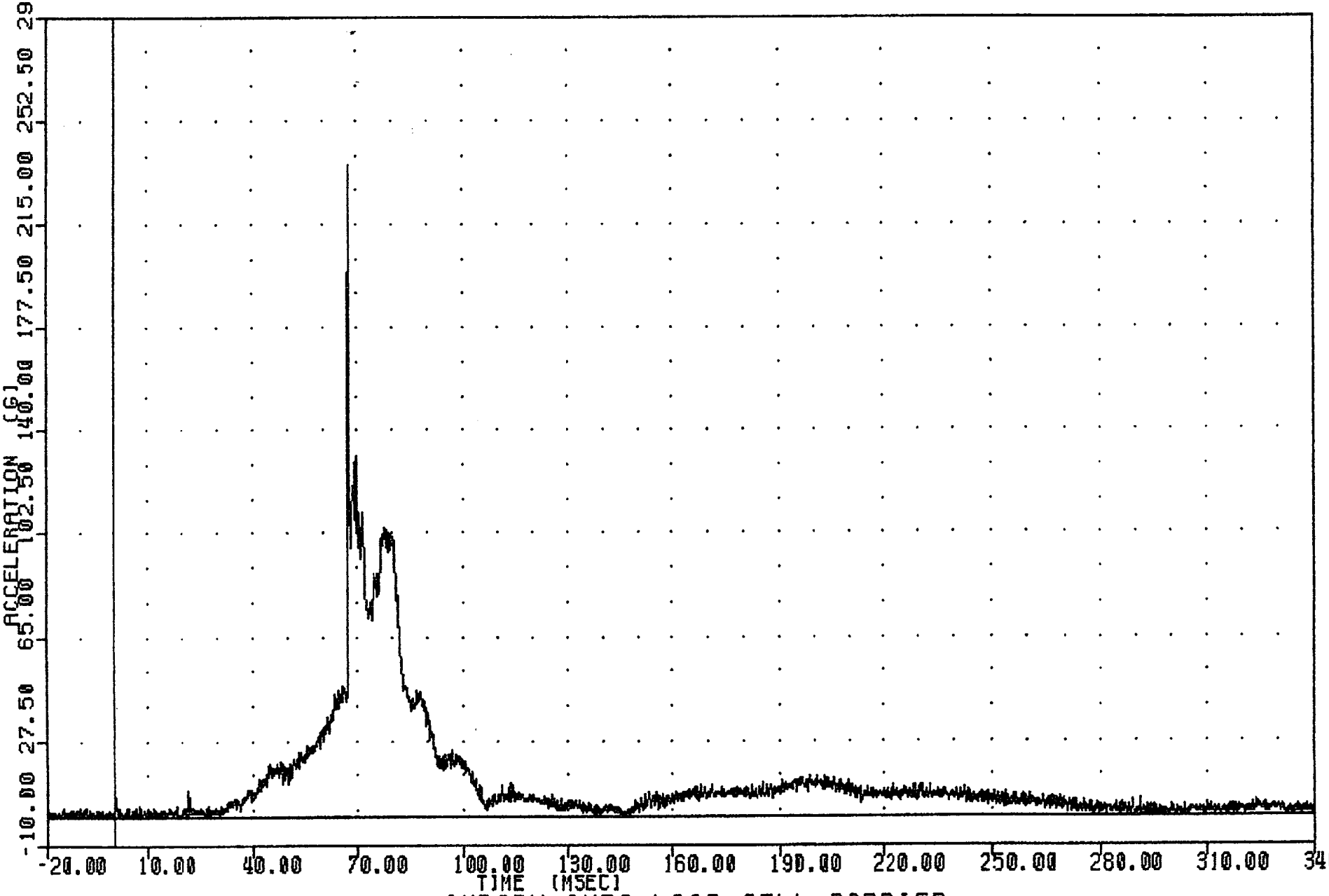

SUBARU INTO LOAD CELL BARRIER
DRIVER HEAD ACCELERATION Z AXIS



850116

NEW CAR ASSESSMENT PROGRAM
850160000000
HEDRG1

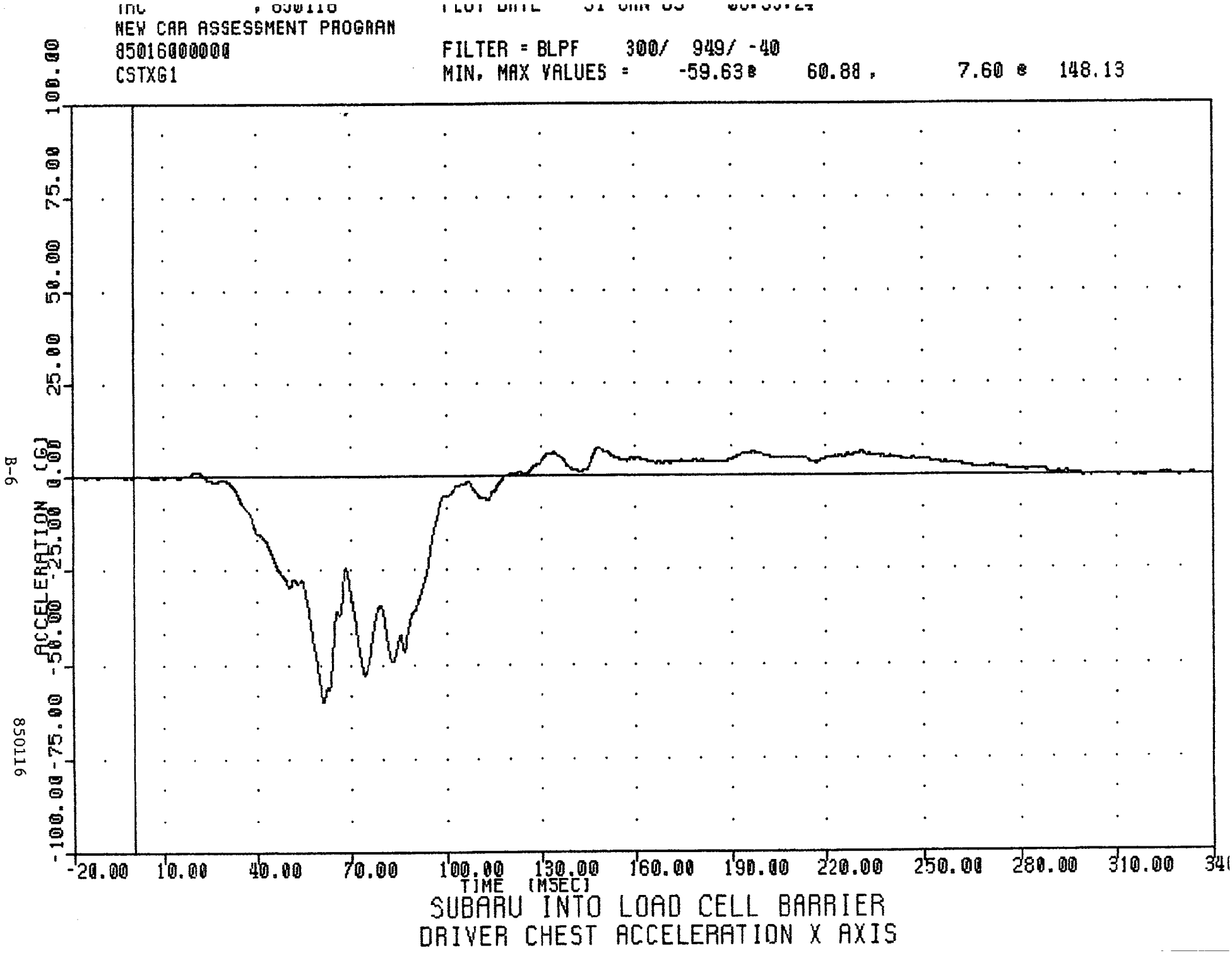
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = 0.21 @ -5.88 , 236.40 @ 67.38

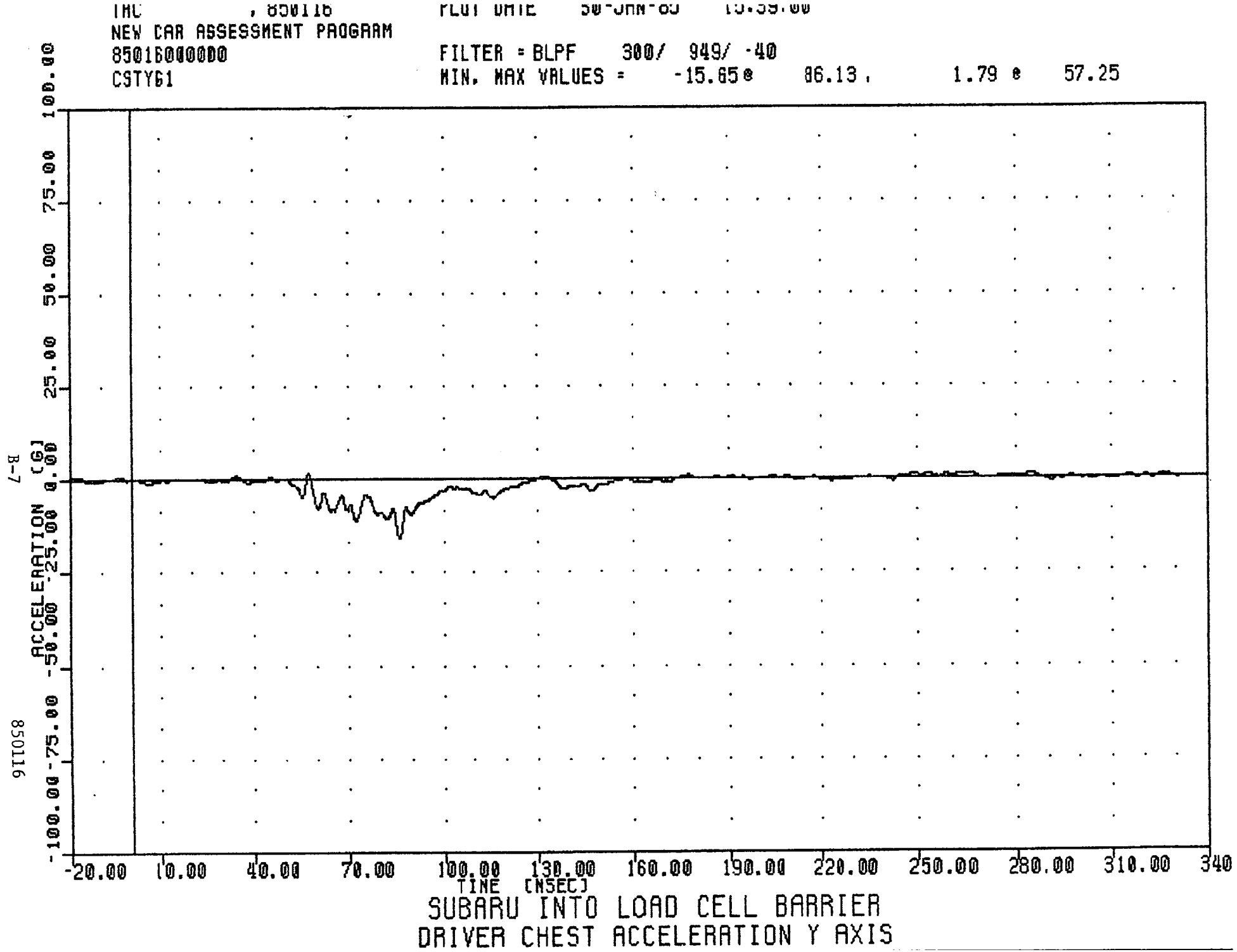



SUBARU INTO LOAD CELL BARRIER
DRIVER HEAD RESULTANT

B-5

850116


NEW CAR ASSESSMENT PROGRAM
850160000000
CSTXG1
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -59.63 @ 60.88 , 7.60 @ 148.13
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
DRIVER CHEST ACCELERATION X AXIS



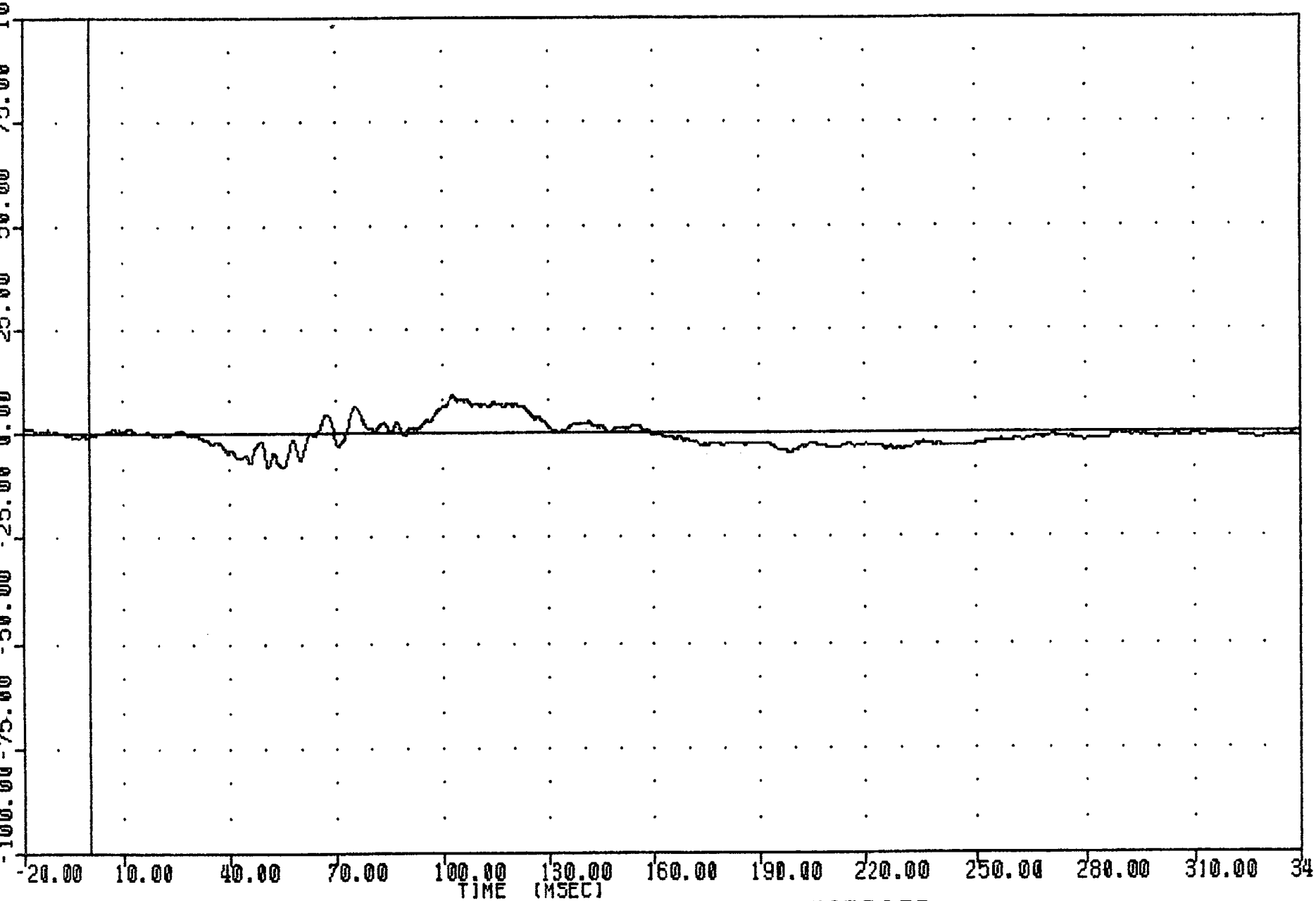

SUBARU INTO LOAD CELL BARRIER
DRIVER CHEST ACCELERATION Y AXIS



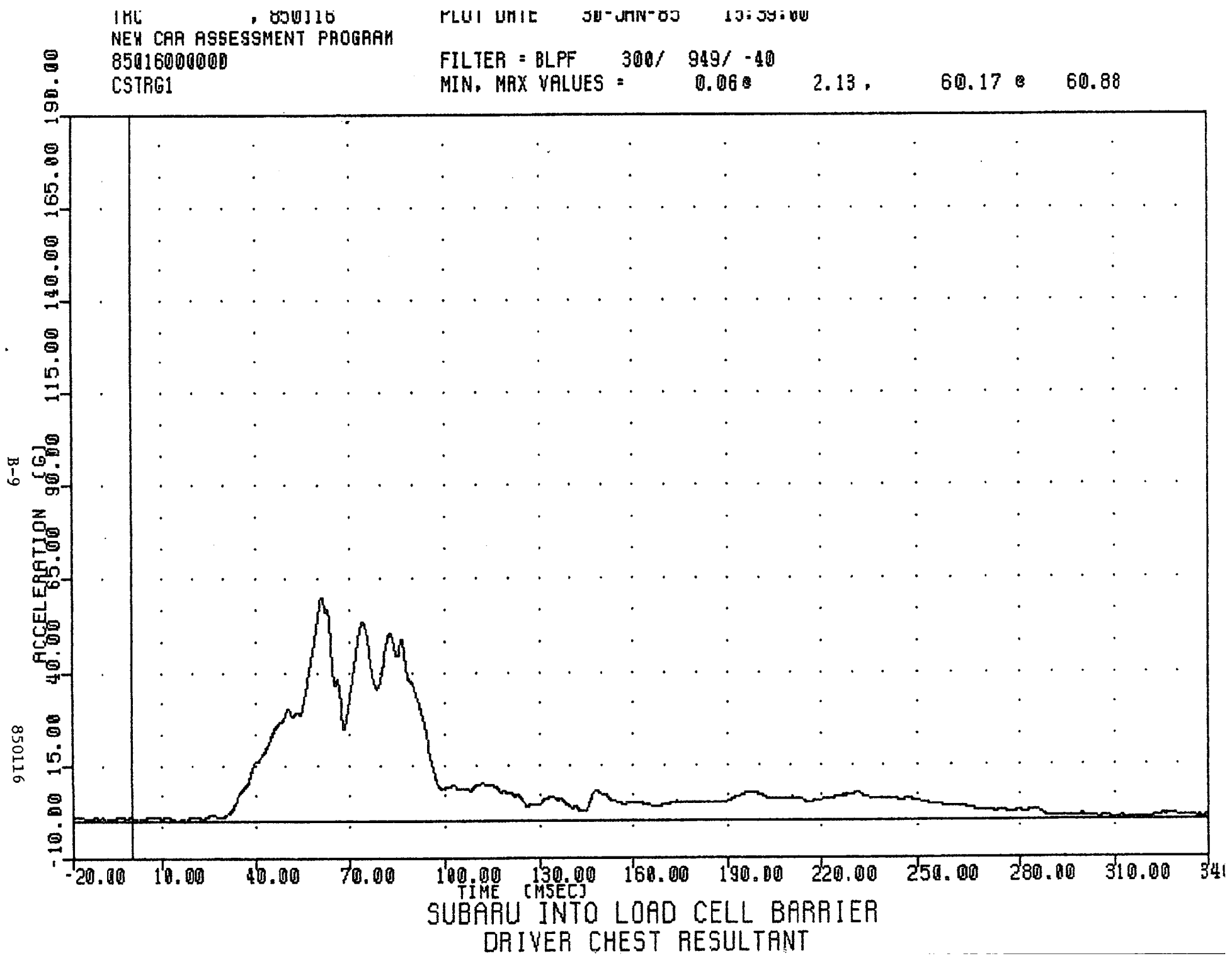
850116

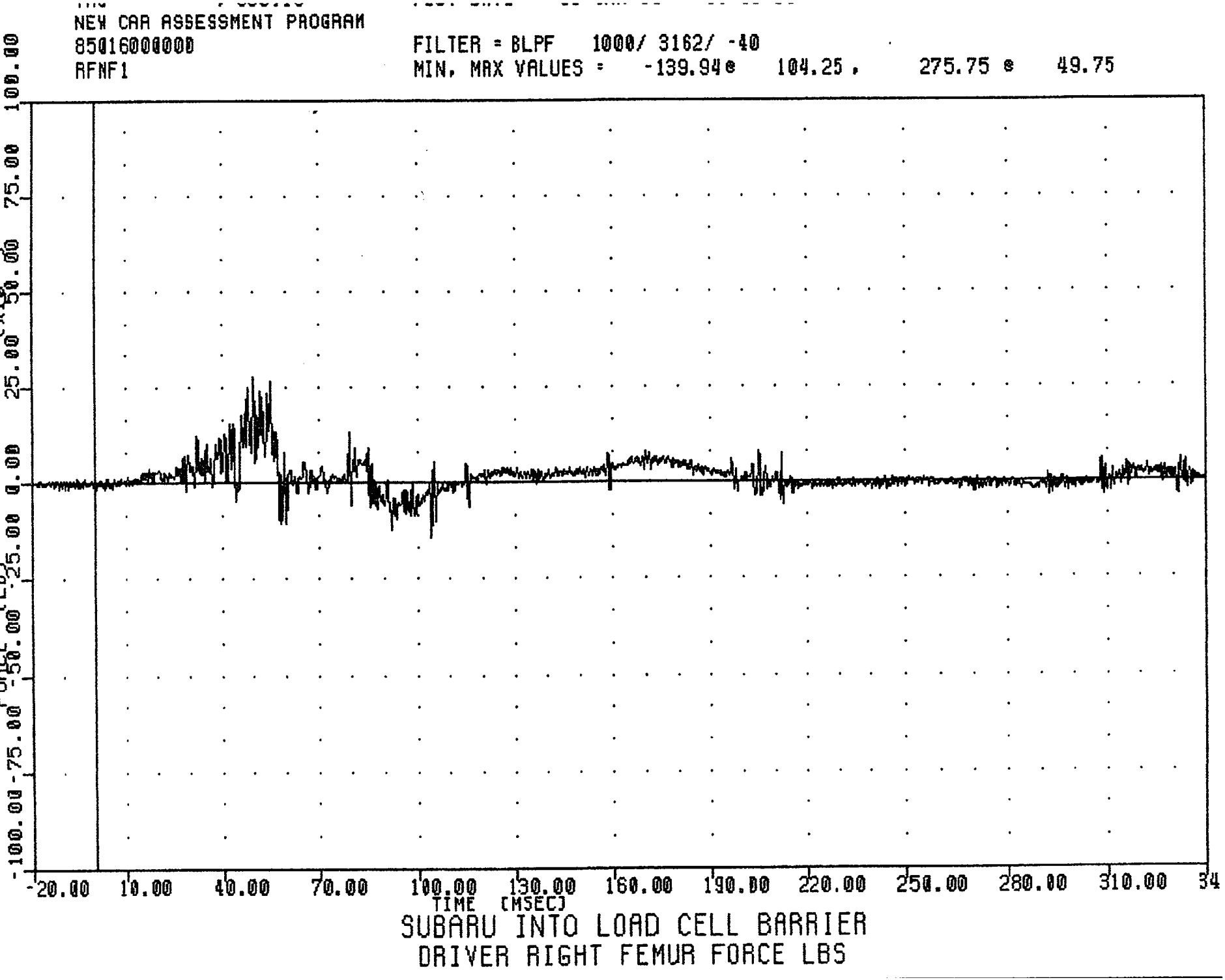
NEW CAR ASSESSMENT PROGRAM
850160000000
CSTZG1

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -8.07 @ 51.13 , 9.15 @ 102.75



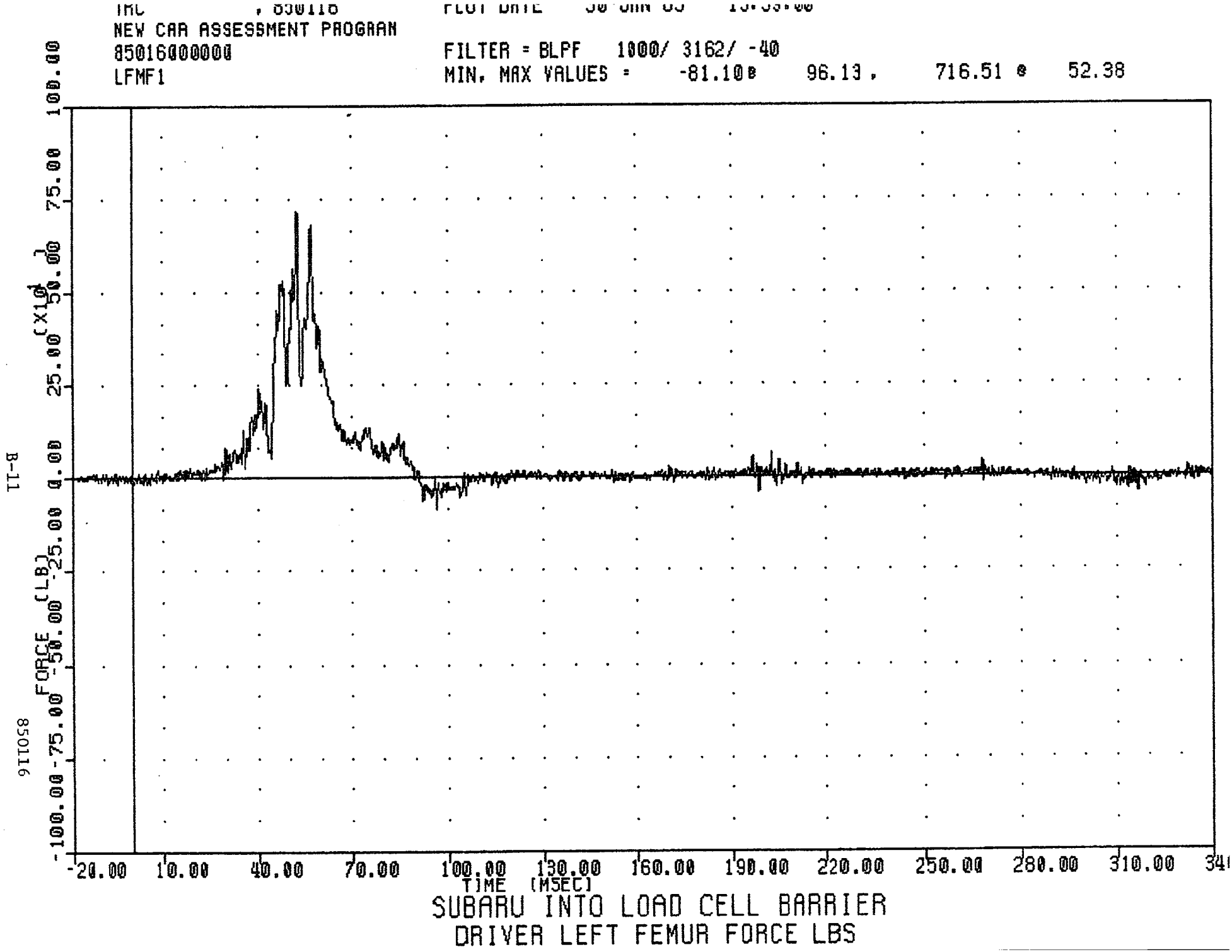

SUBARU INTO LOAD CELL BARRIER
DRIVER CHEST ACCELERATION Z AXIS


IHC , 850116 PLOT DATE 30-JAN-85 13:39:00
NEW CAR ASSESSMENT PROGRAM
85016000000
CSTRG1
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = 0.06 @ 2.13 , 60.17 @ 60.88
190.00
165.00
140.00
115.00
90.00
65.00
40.00
15.00
-10.00
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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
DRIVER CHEST RESULTANT
B-9
850116


NEW CAR ASSESSMENT PROGRAM
850160000000
RFNF1
FILTER = BLPF 1000/ 3162/ -40
MIN, MAX VALUES = -139.94 @ 104.25 , 275.75 @ 49.75
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
FORCE (LB) (X10)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
34
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
DRIVER RIGHT FEMUR FORCE LBS

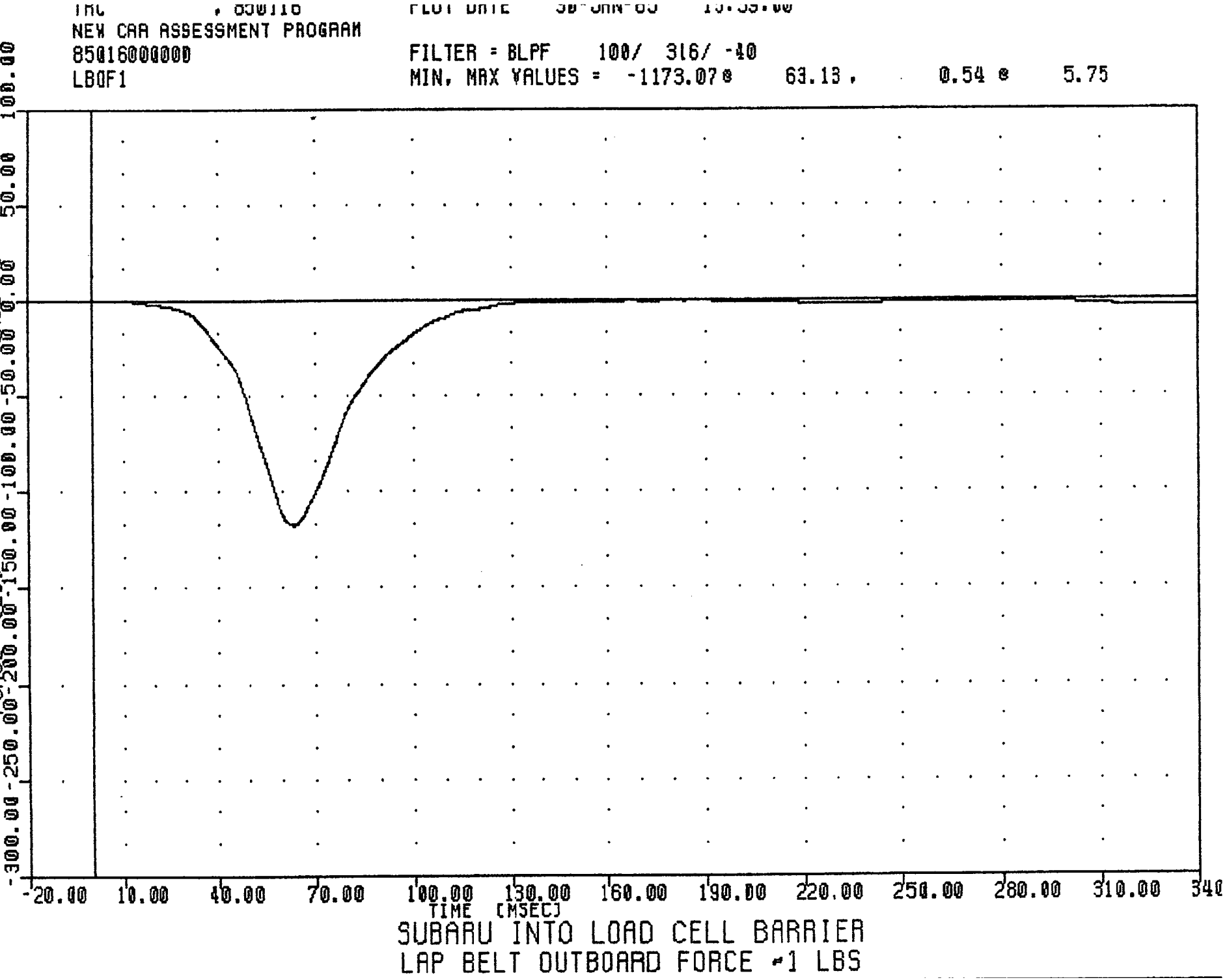


850116


NEW CAR ASSESSMENT PROGRAM
850160000000
LFMF1
FILTER = BLPF 1000/ 3162/ -40
MIN, MAX VALUES = -81.10 @ 96.13 , 716.51 @ 52.38
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
FORCE (LB) (X10)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
DRIVER LEFT FEMUR FORCE LBS



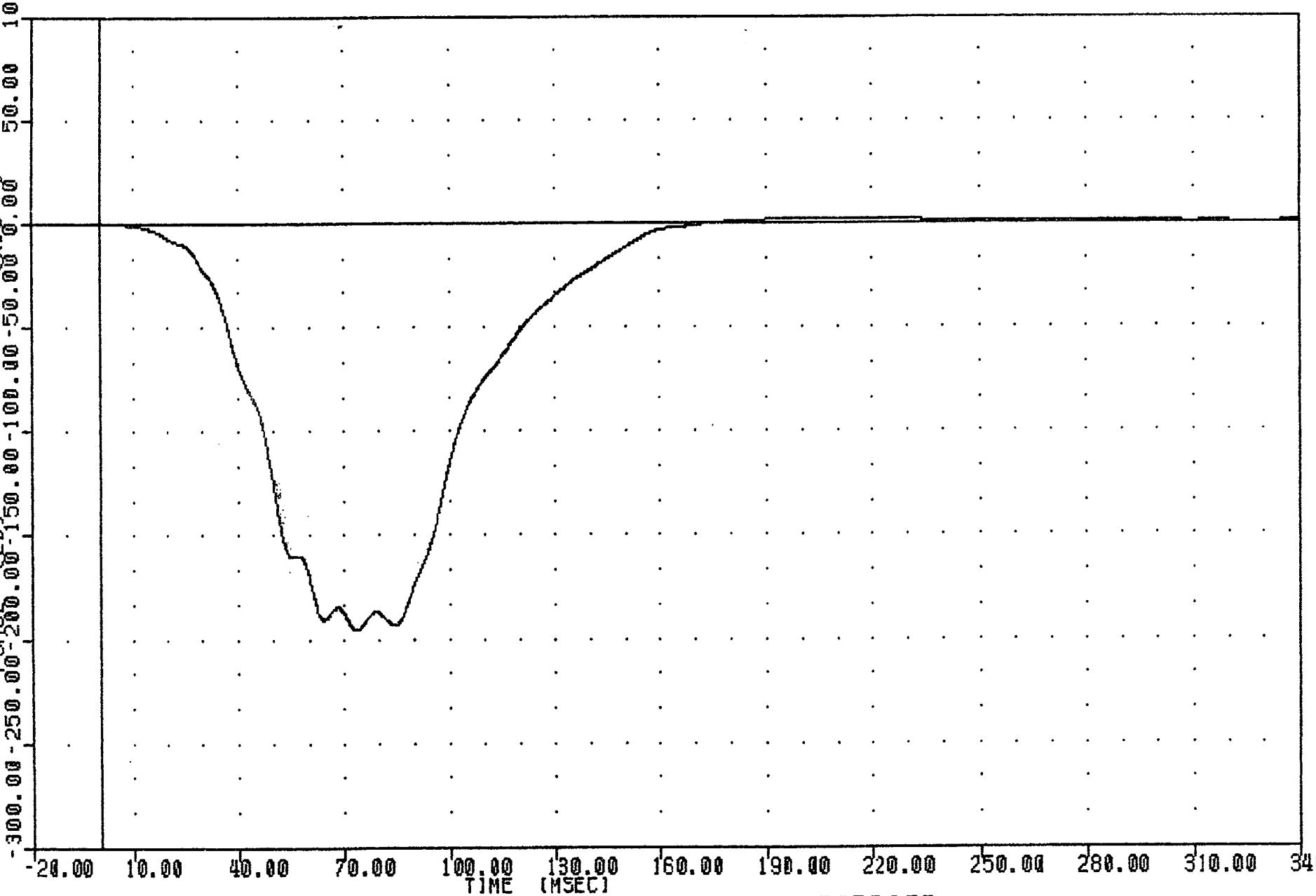
850116


TRC # 850116 PLOT DATE 30-JAN-85 15:55:00
NEW CAR ASSESSMENT PROGRAM
850160000000
LBOF1
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -1173.07 @ 63.13 , 0.54 @ 5.75
FORCE (LB) (X10^1)
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
-300.00
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LAP BELT OUTBOARD FORCE #1 LBS



850116

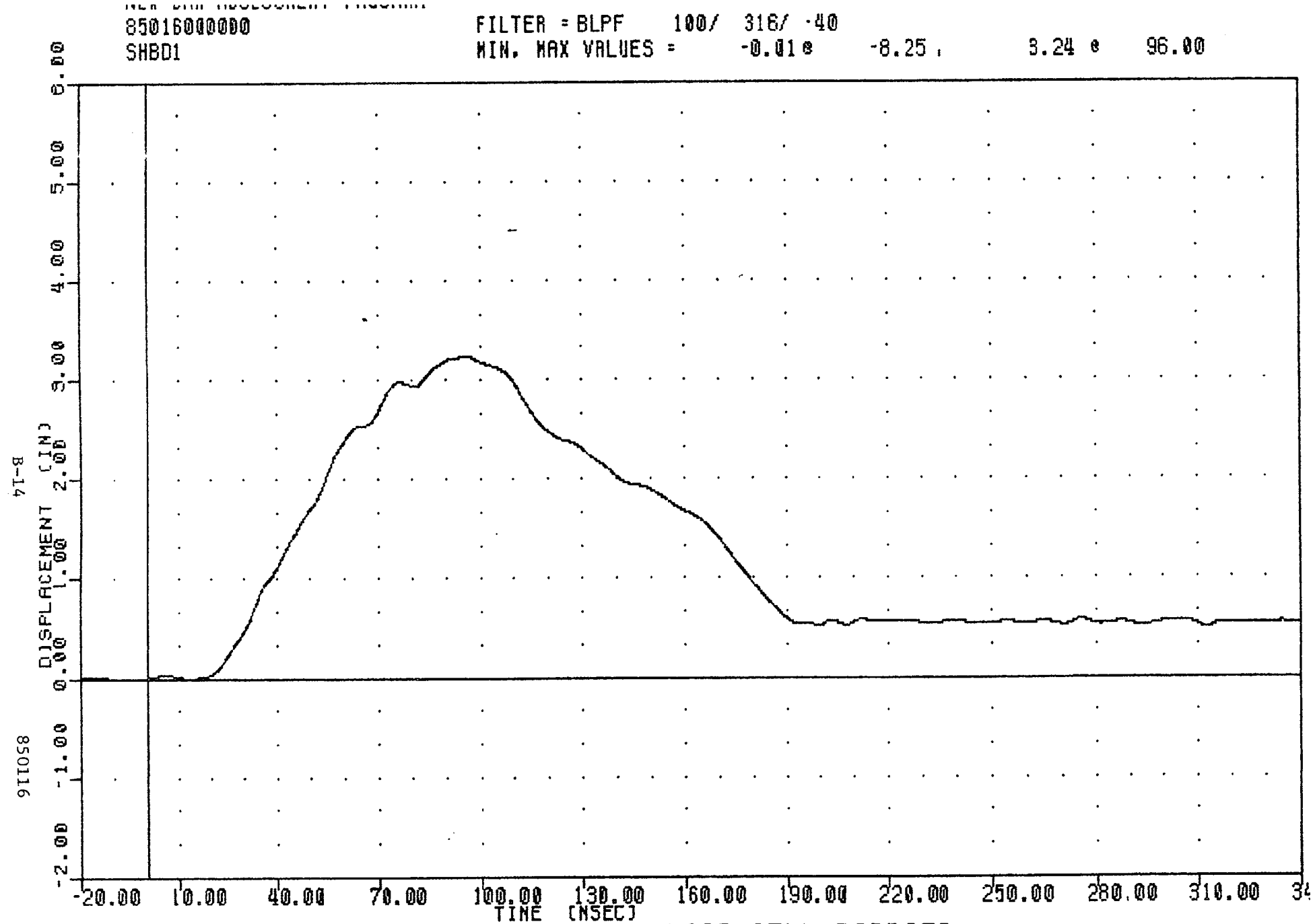
TRC , 850116 PLOT DATE 30-JAN-85 15:39:00
NEW CAR ASSESSMENT PROGRAM
850160000000 FILTER = BLPF 100/ 316/ -40
SHBF1 MIN, MAX VALUES = -1956.50 @ 73.38 , 18.35 @ 195.25




SUBARU INTO LOAD CELL BARRIER
SHOULDER BELT FORCE #1 LBS

B-13

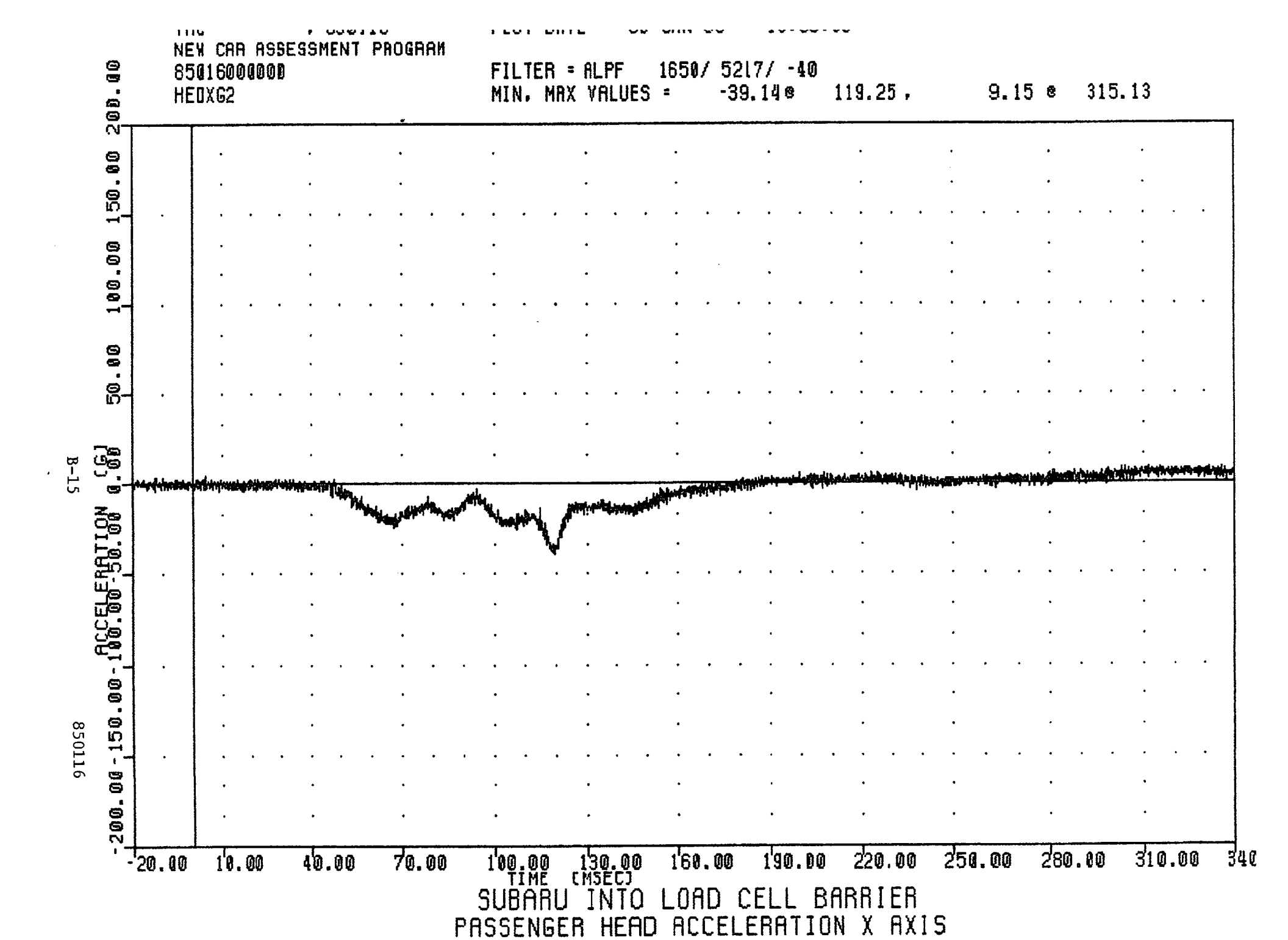
850116




SUBARU INTO LOAD CELL BARRIER
SHOULDER BELT -1 DISPLACEMENT INCHES



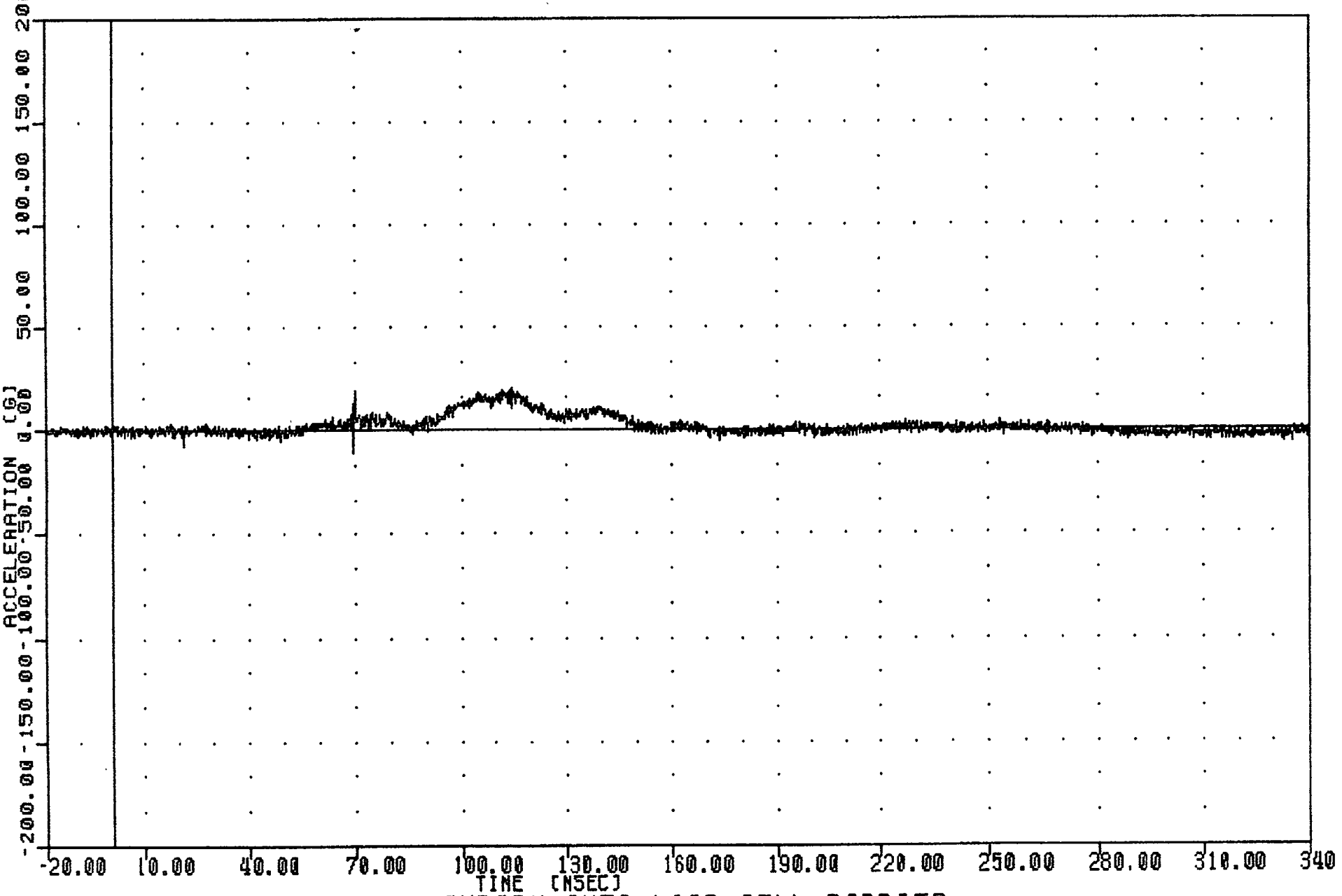
850116


NEW CAR ASSESSMENT PROGRAM
8501600000D
HEDXG2
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -39.14@ 119.25, 9.15 @ 315.13
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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
PASSENGER HEAD ACCELERATION X AXIS

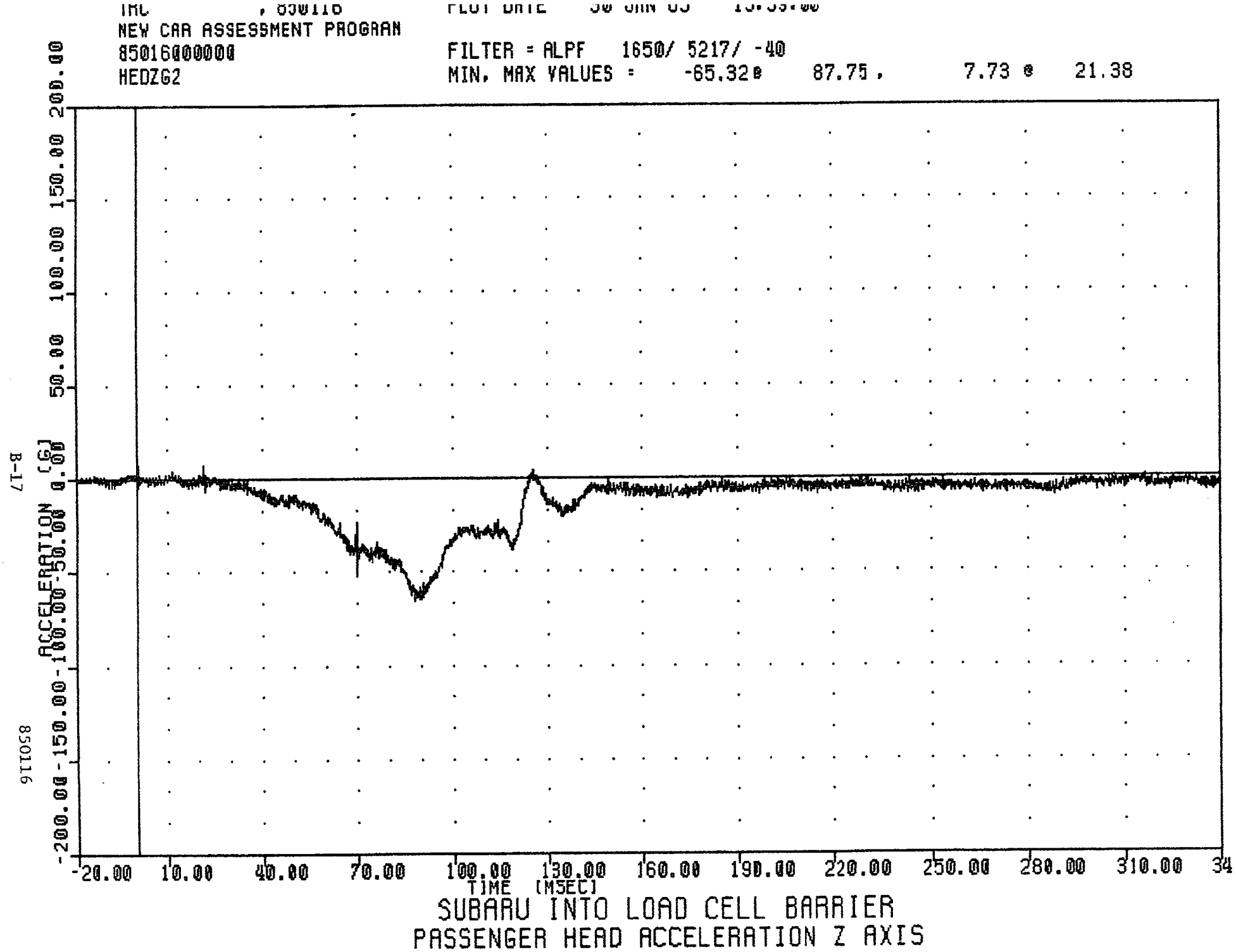


850116

INC # 030110 TEST DATE 30 JAN 03 13:33:00
NEW CAR ASSESSMENT PROGRAM
85016000000
HEDYG2
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -10.78 @ 69.50 , 20.38 @ 114.38

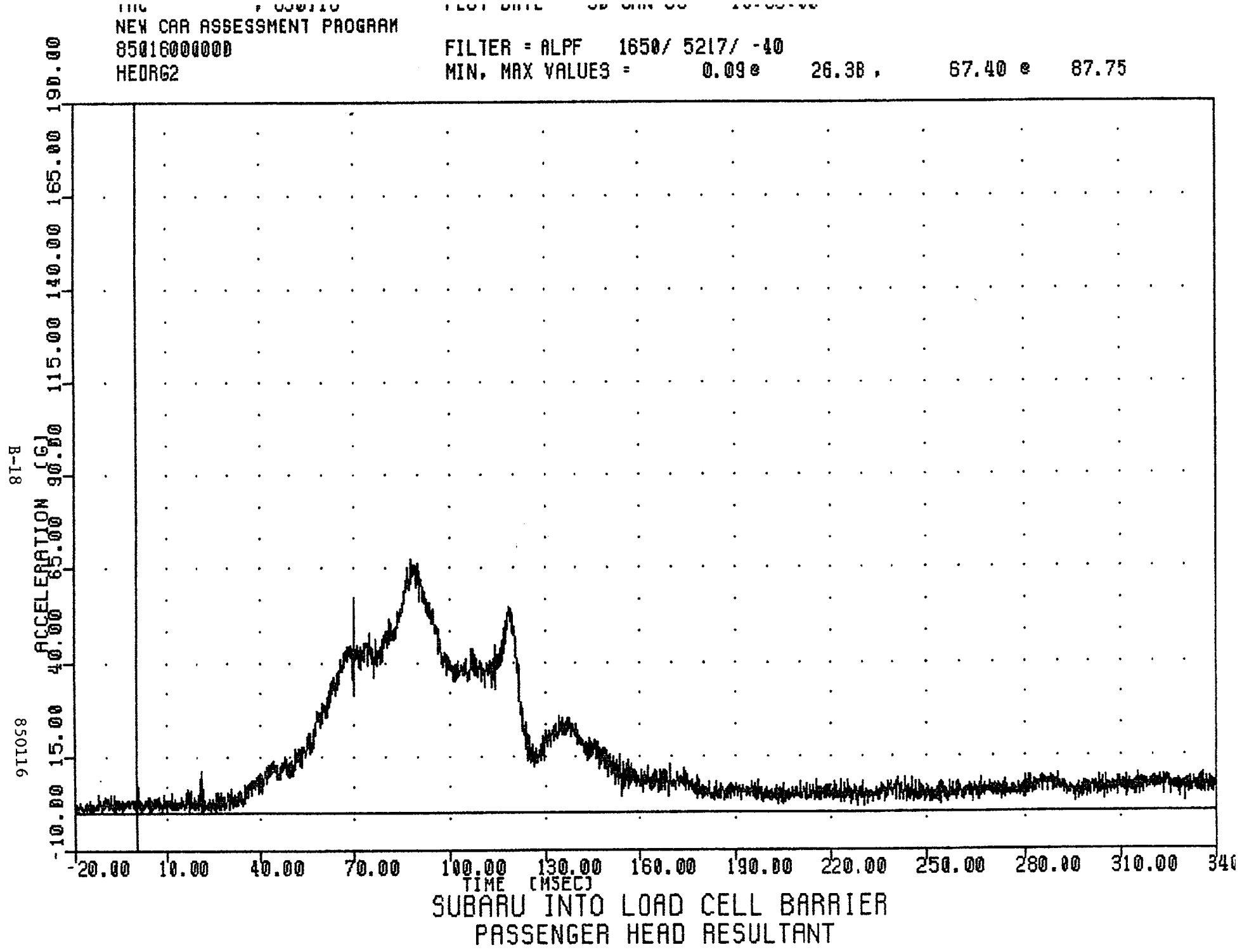



SUBARU INTO LOAD CELL BARRIER
PASSENGER HEAD ACCELERATION Y AXIS


NEW CAR ASSESSMENT PROGRAM
850160000000
HEDZG2
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -65.32 @ 87.75 , 7.73 @ 21.38
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
34
TIME [MSEC]
SUBARU INTO LOAD CELL BARRIER
PASSENGER HEAD ACCELERATION Z AXIS

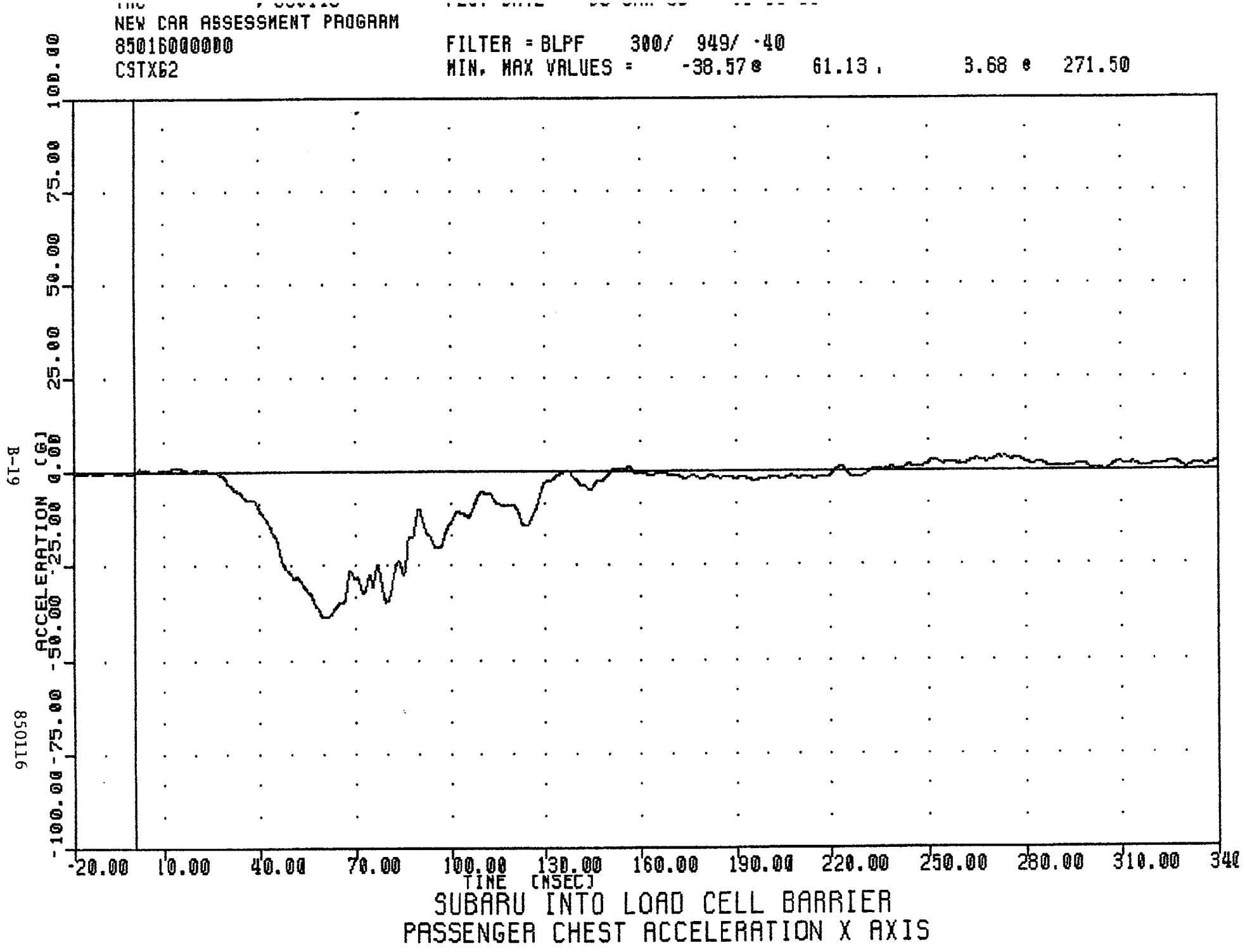


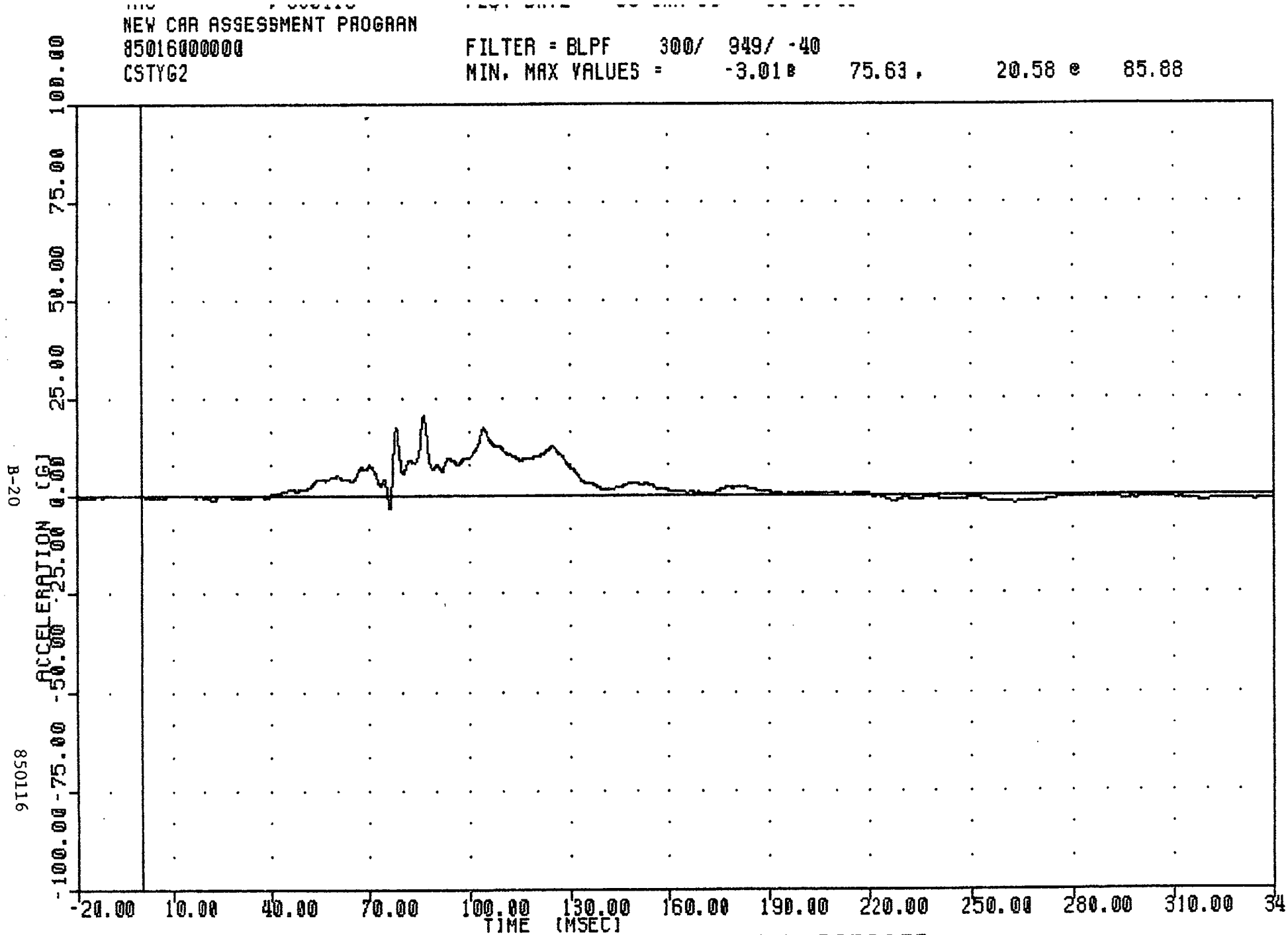
850116


NEW CAR ASSESSMENT PROGRAM
85016000000
HEORG2
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = 0.09 @ 26.38 , 67.40 @ 87.75
ACCELERATION (G)
-10.00 15.00 40.00 65.00 90.00 115.00 140.00 165.00 190.00
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
PASSENGER HEAD RESULTANT



850116


NEW CAR ASSESSMENT PROGRAM
85016000000
CSTX62
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -38.57 @ 61.13 , 3.68 @ 271.50
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
PASSENGER CHEST ACCELERATION X AXIS

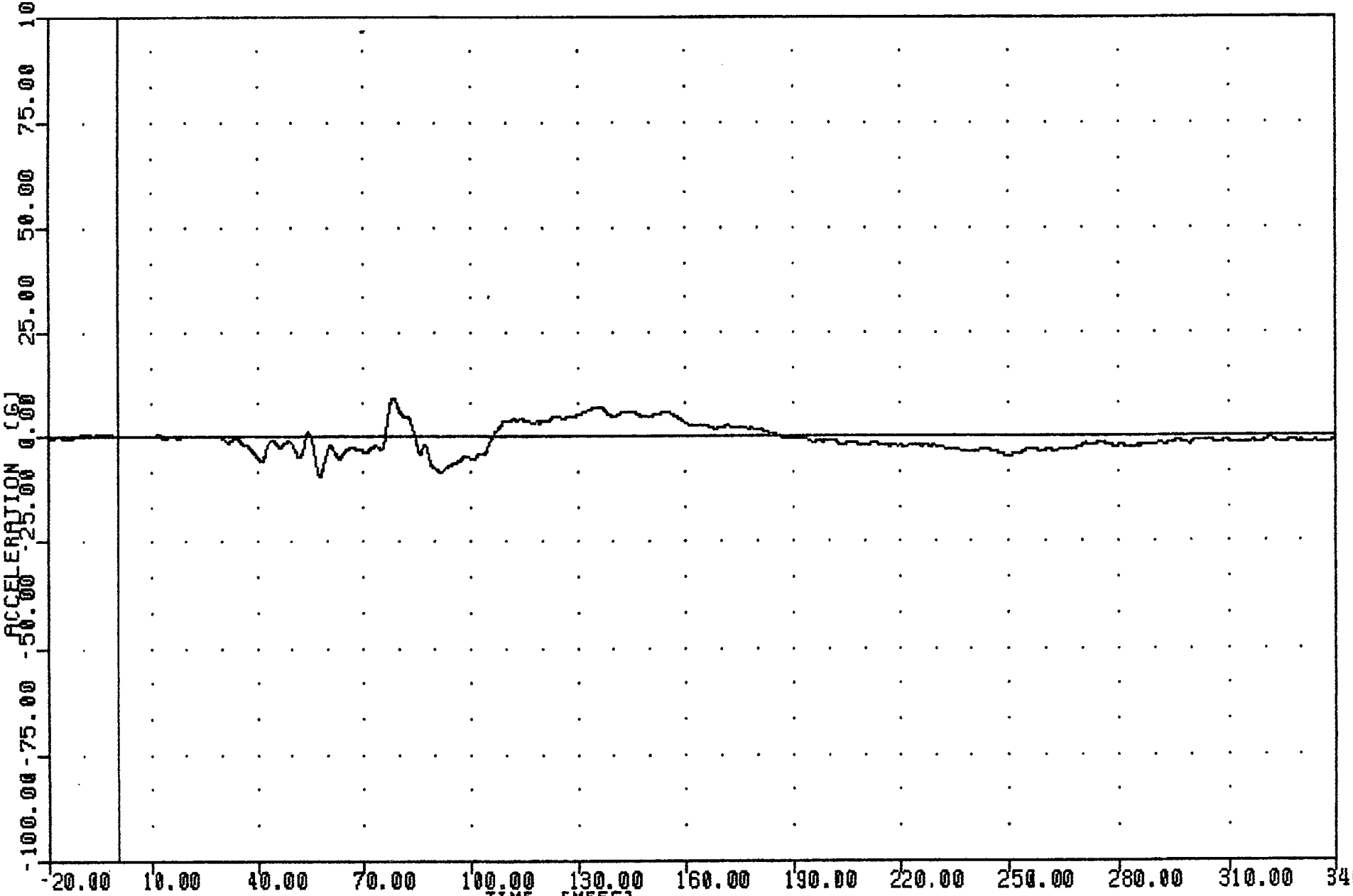



SUBARU INTO LOAD CELL BARRIER
PASSENGER CHEST ACCELERATION Y AXIS



850116

NEW CAR ASSESSMENT PROGRAM
850160000000
CSTZG2
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -9.43 @ 57.63 , 9.37 @ 78.25



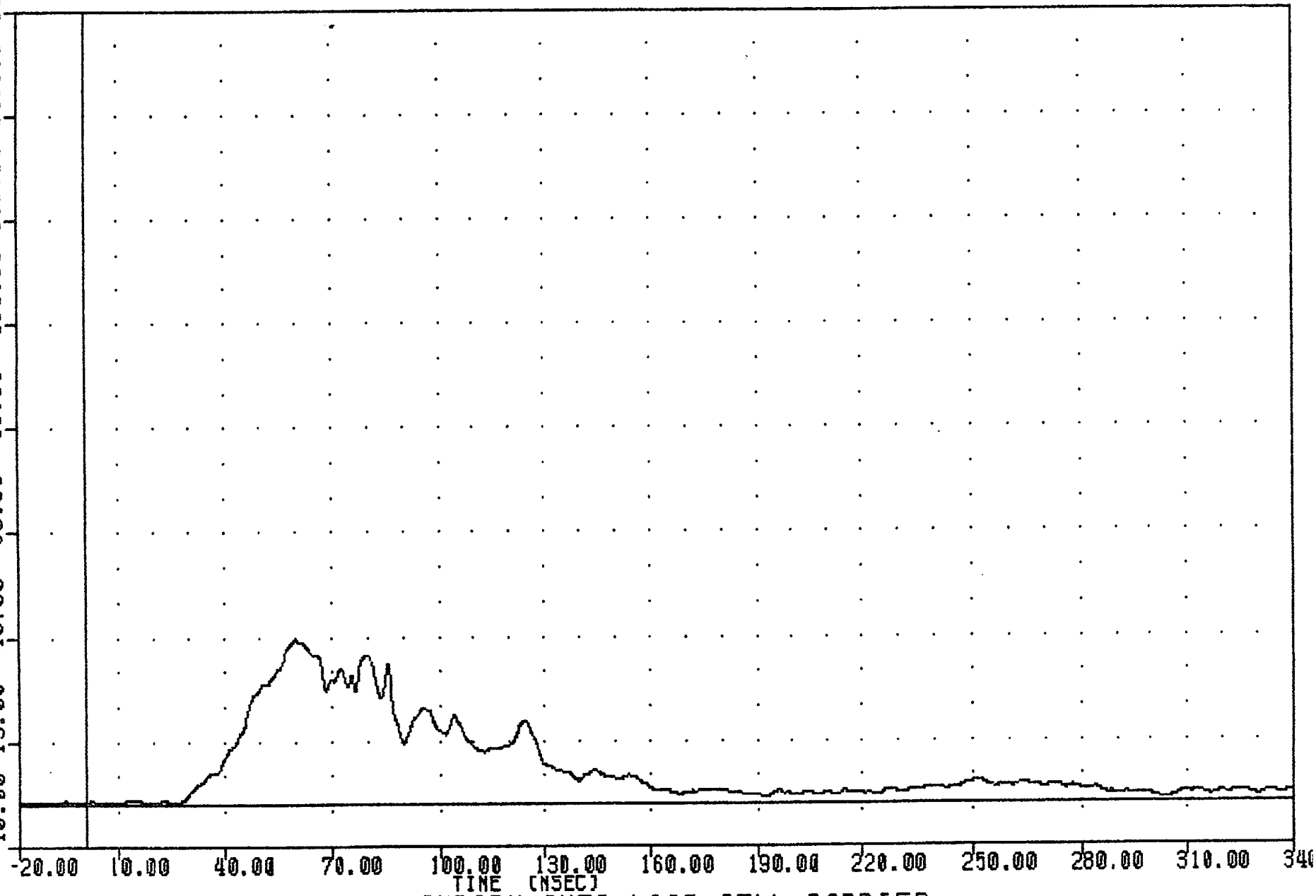

SUBARU INTO LOAD CELL BARRIER
PASSENGER CHEST ACCELERATION Z AXIS



850116

NEW CAR ASSESSMENT PROGRAM
85016000000
CSTR62

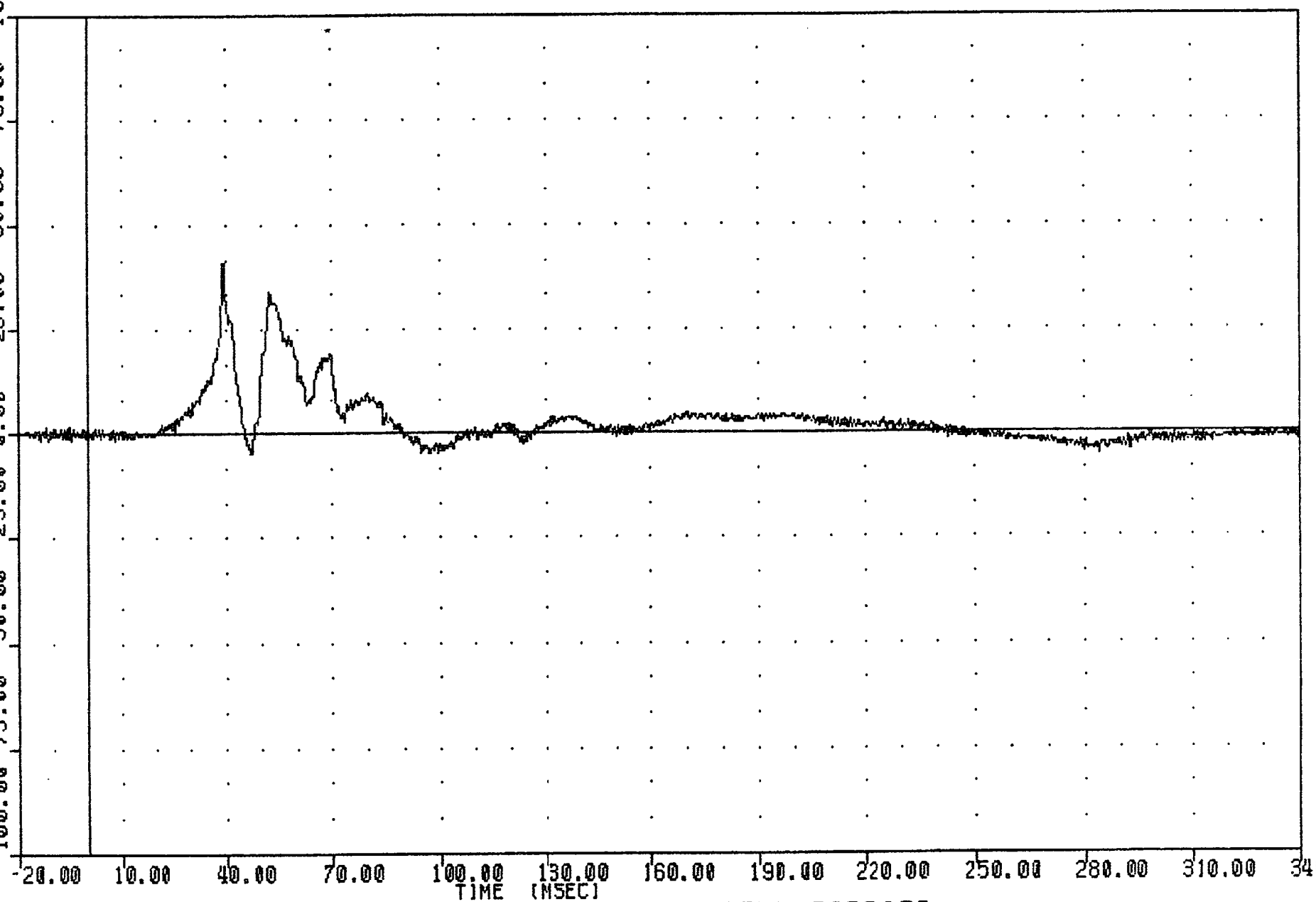
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = 0.18 @ -7.25 , 39.02 @ 59.88




SUBARU INTO LOAD CELL BARRIER
PASSENGER CHEST RESULTANT

NEW CAR ASSESSMENT PROGRAM
850160000000
RFMF2

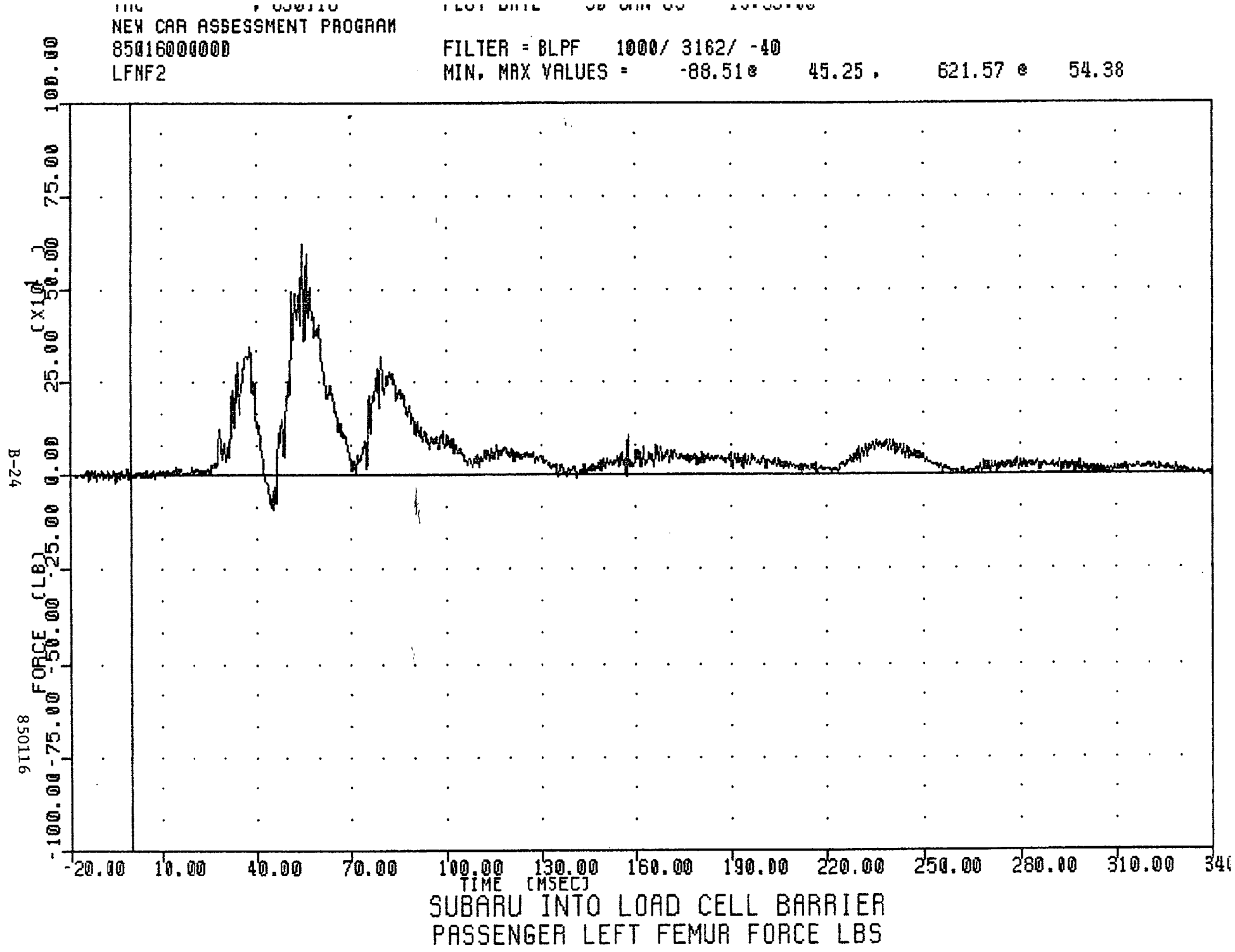
FILTER = BLPF 1000/ 3162/ -40
MIN, MAX VALUES = -49.77 @ 283.88 , 408.62 @ 39.13




SUBARU INTO LOAD CELL BARRIER
PASSENGER RIGHT FEMUR FORCE LBS

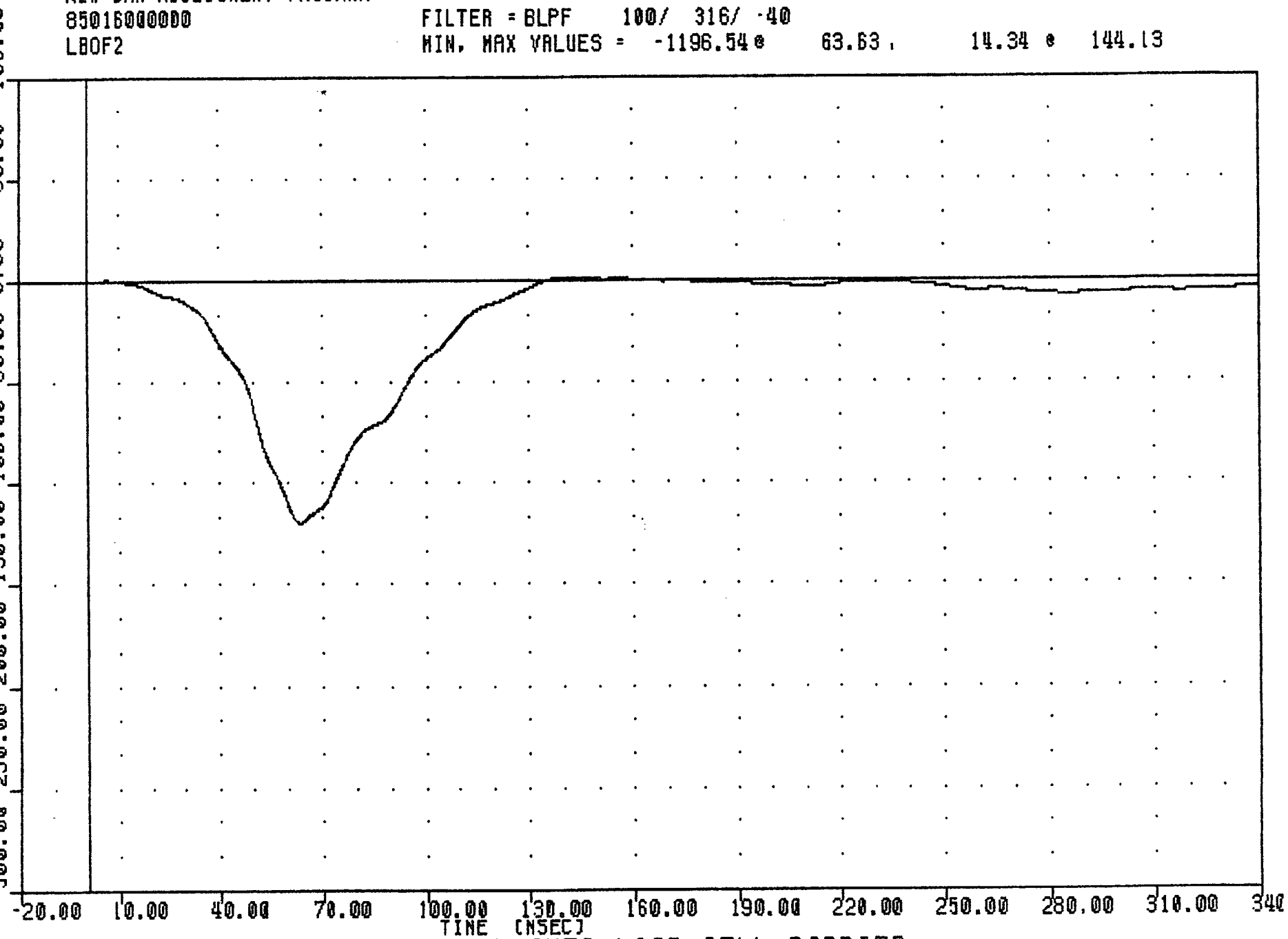


850116


NEW CAR ASSESSMENT PROGRAM
85016000000
LFNF2
FILTER = BLPF 1000/ 3162/ -40
MIN, MAX VALUES = -88.51 @ 45.25 , 621.57 @ 54.38
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
FORCE [LB] [X10]
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME [MSEC]
SUBARU INTO LOAD CELL BARRIER
PASSENGER LEFT FEMUR FORCE LBS



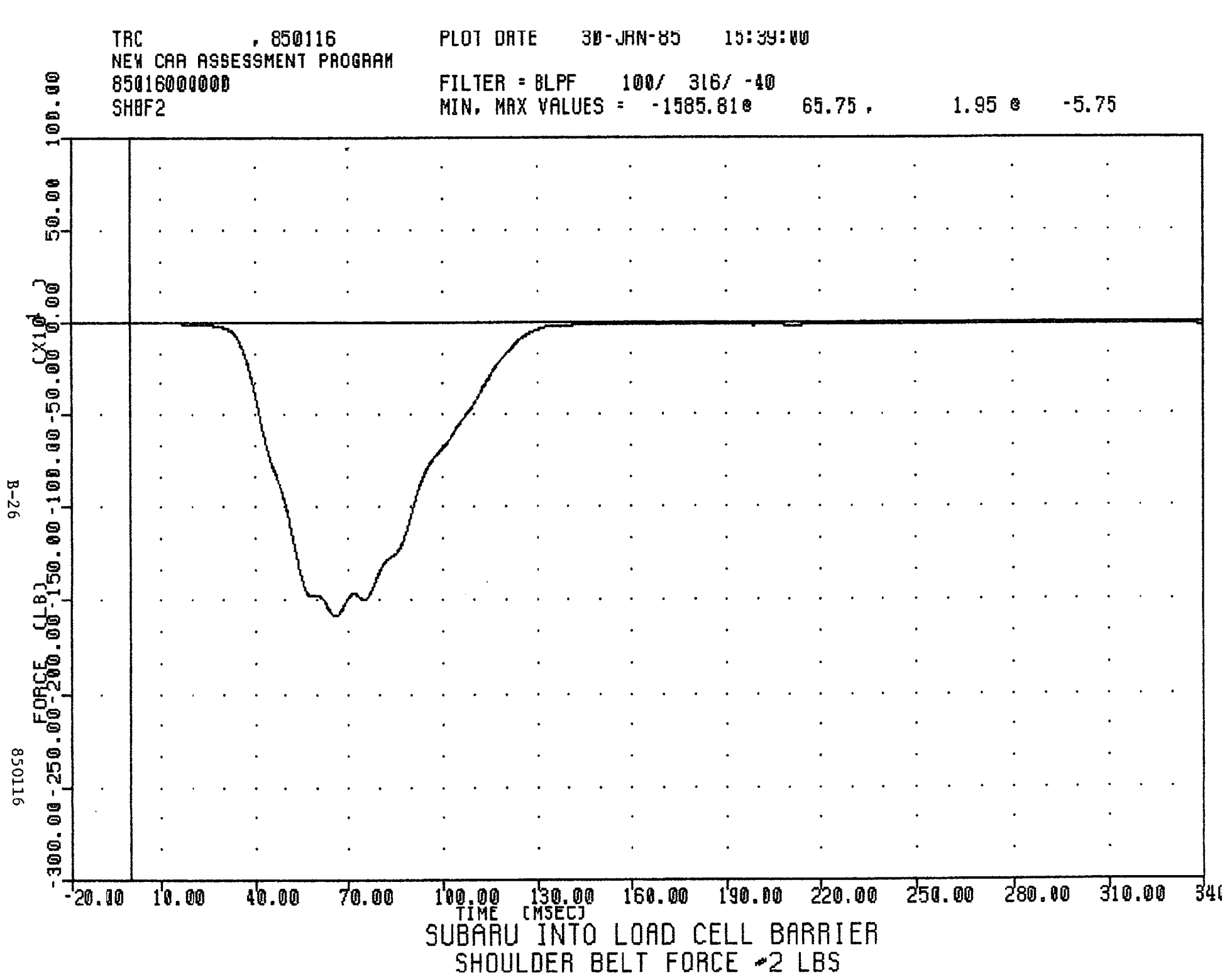
850116




SUBARU INTO LOAD CELL BARRIER
LAP BELT OUTBOARD FORCE -2 LBS



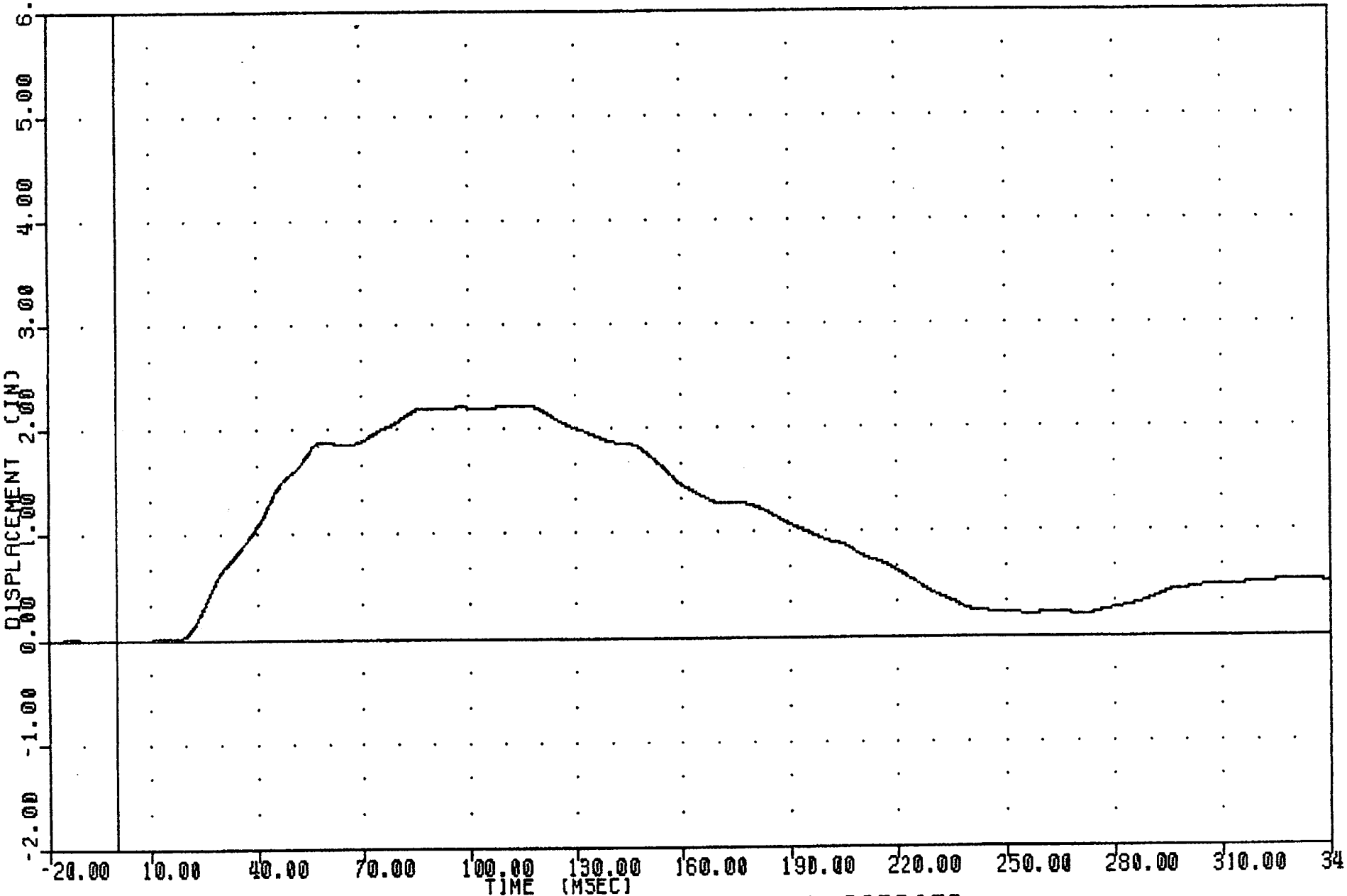
850116


TRC , 850116
PLOT DATE 30-JAN-85 15:39:00
NEW CAR ASSESSMENT PROGRAM
85016000000
FILTER = BLPF 100/ 316/ -40
SH0F2
MIN, MAX VALUES = -1585.81@ 65.75 , 1.95 @ -5.75
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
-300.00
FORCE (LB) (X10^1)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
SHOULDER BELT FORCE #2 LBS



850116

INC , 850116 PLOT DATE 30 JAN 85 10:00:00
NEW CAR ASSESSMENT PROGRAM
850160000000
SHBD2
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.01 @ 0.25 , 2.23 @ 113.38



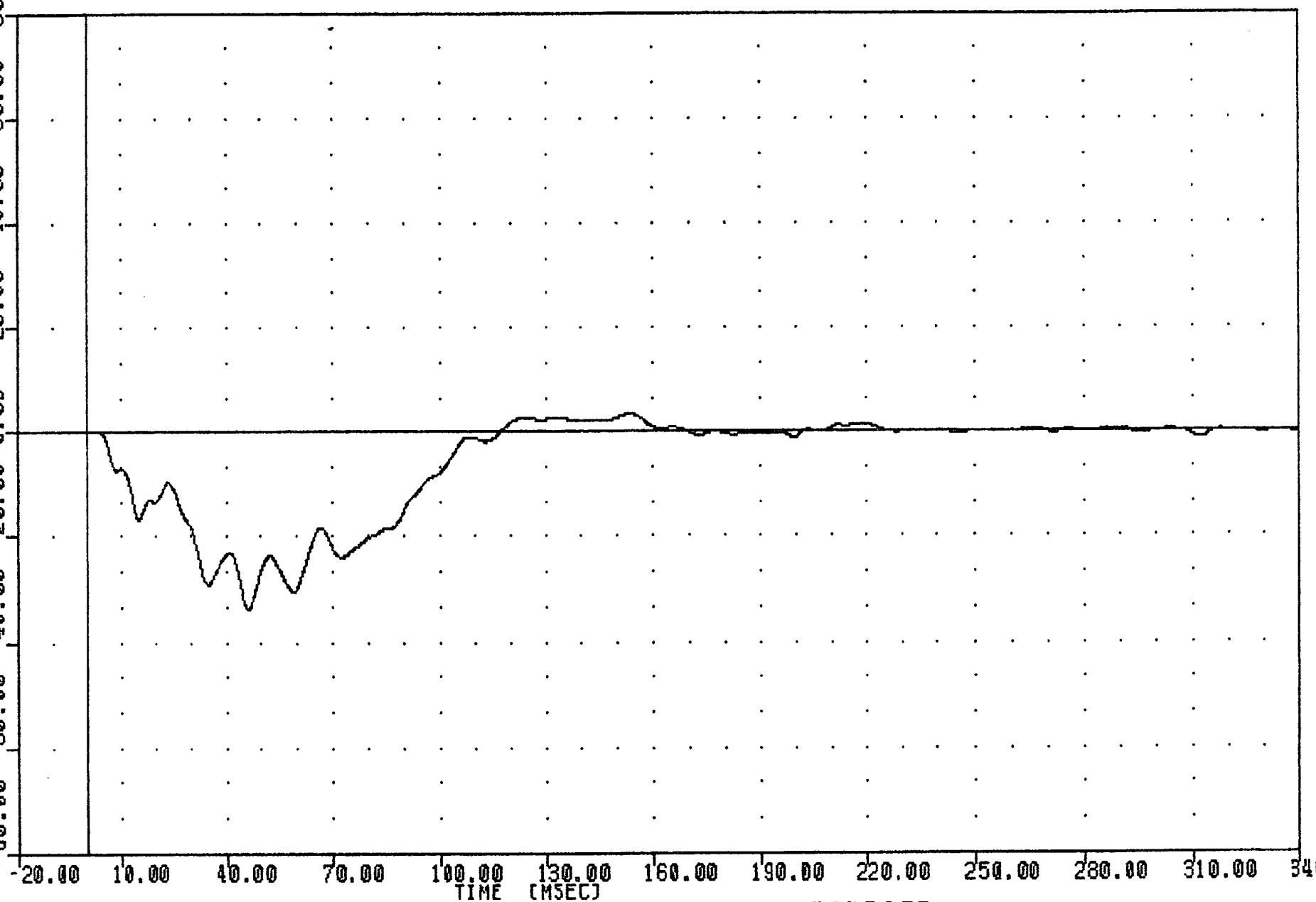

SUBARU INTO LOAD CELL BARRIER
SHOULDER BELT DISPLACEMENT INCHES

B-27

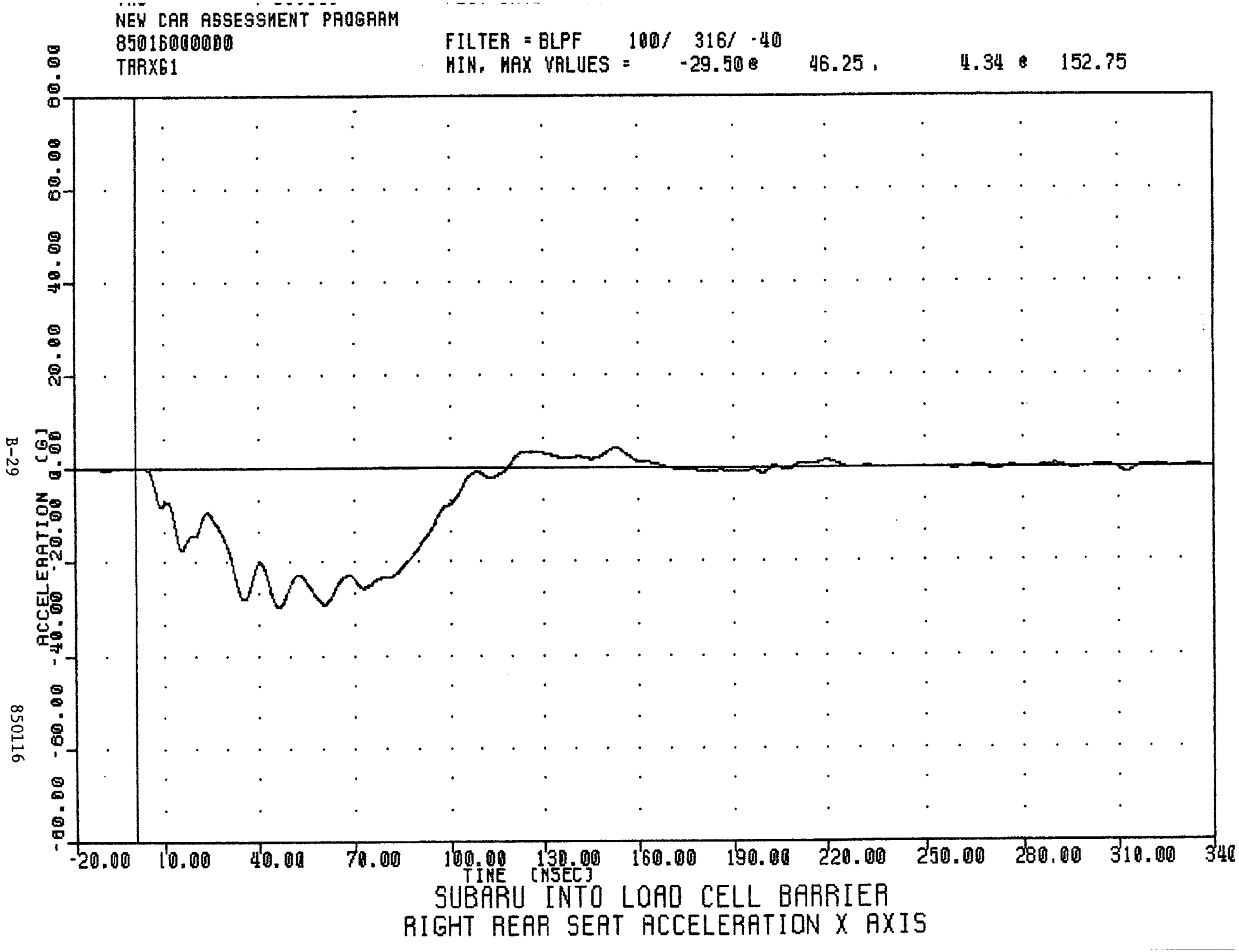
850116

NEW CAR ASSESSMENT PROGRAM
850160000D
TLRXG1

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -33.76 @ 46.13 , 3.39 @ 153.13



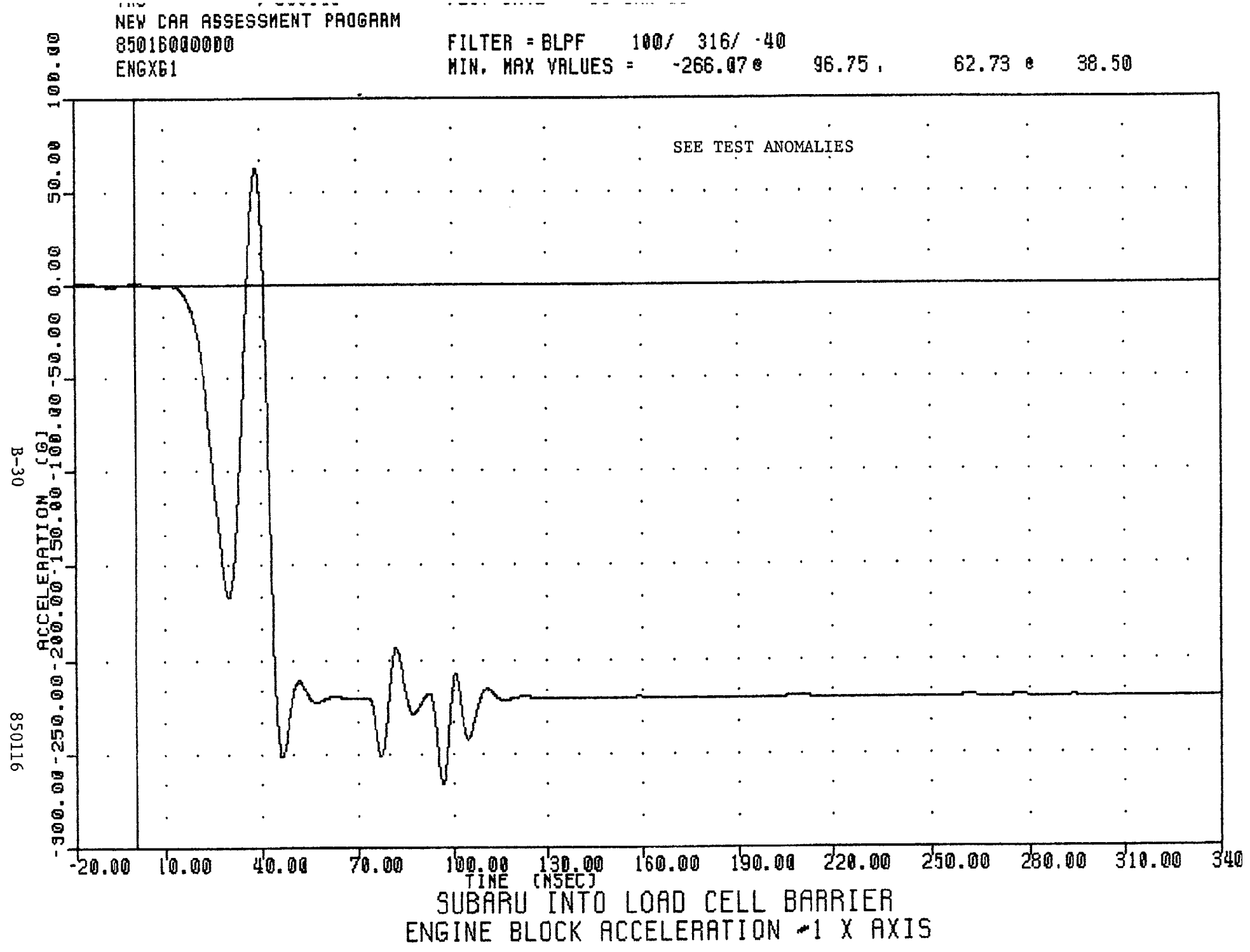

SUBARU INTO LOAD CELL BARRIER
LEFT REAR SEAT ACCELERATION X AXIS




SUBARU INTO LOAD CELL BARRIER
RIGHT REAR SEAT ACCELERATION X AXIS



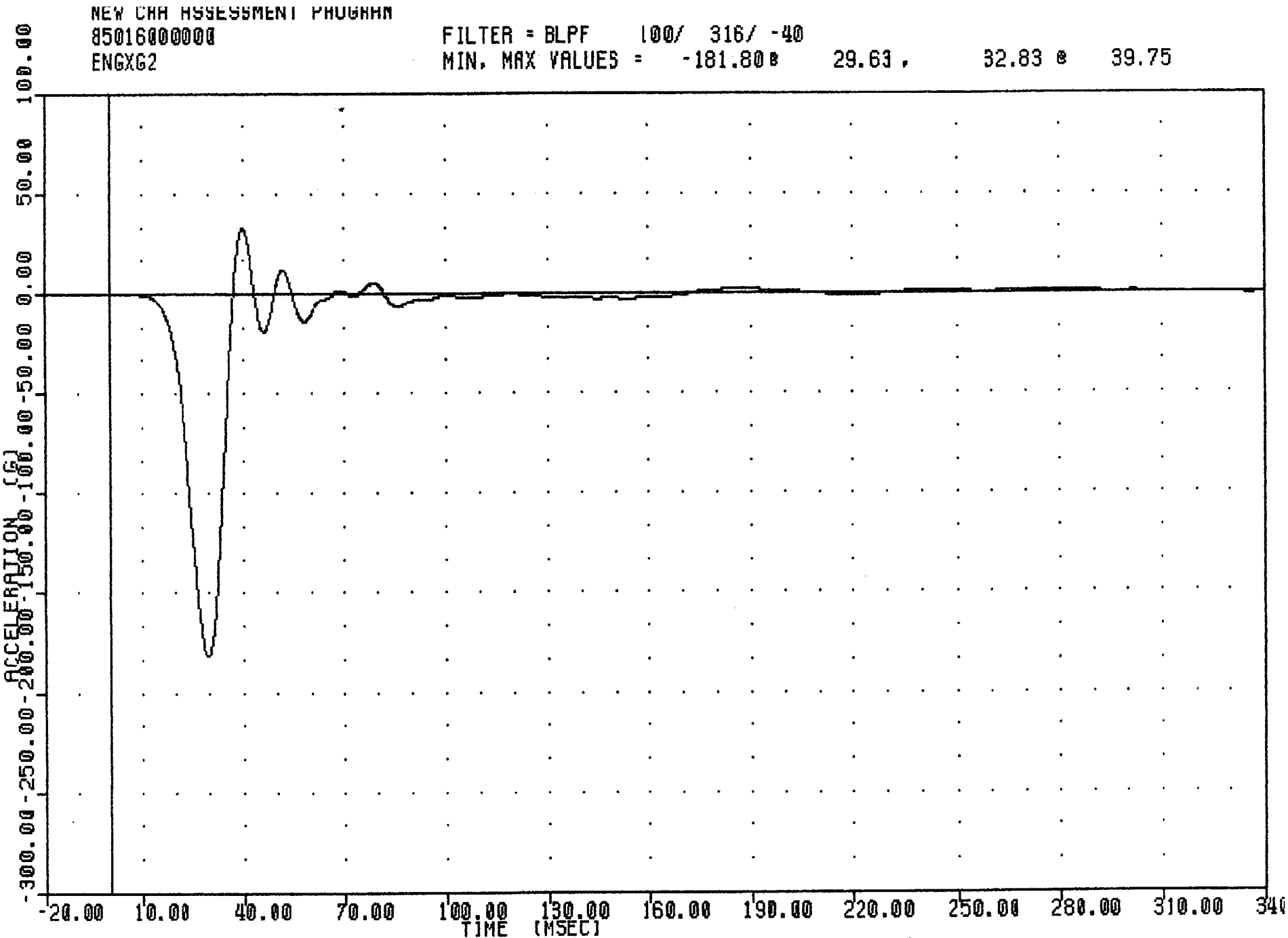
850116




SUBARU INTO LOAD CELL BARRIER
ENGINE BLOCK ACCELERATION -1 X AXIS



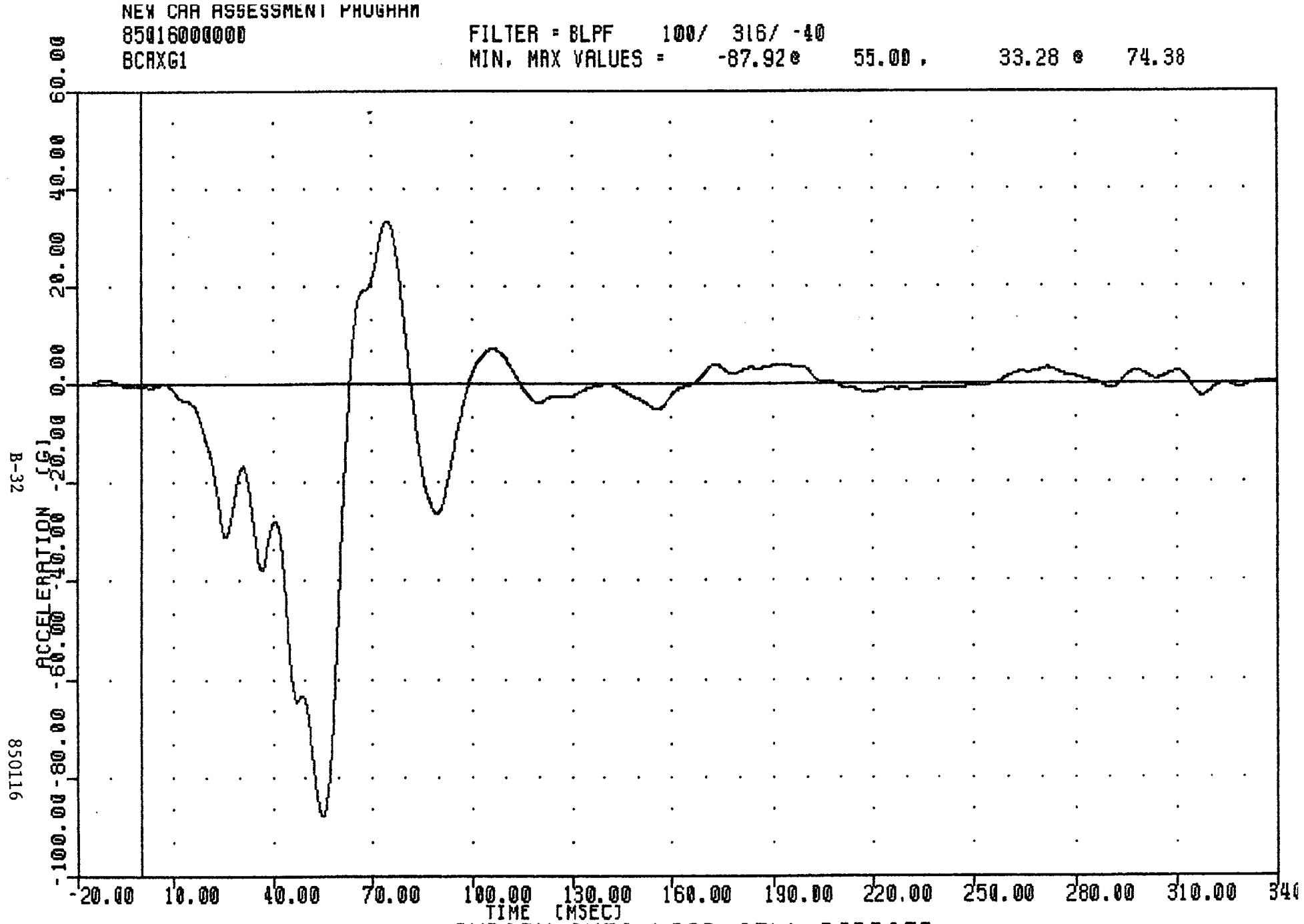
850116




SUBARU INTO LOAD CELL BARRIER
ENGINE BLOCK ACCELERATION -2 X AXIS



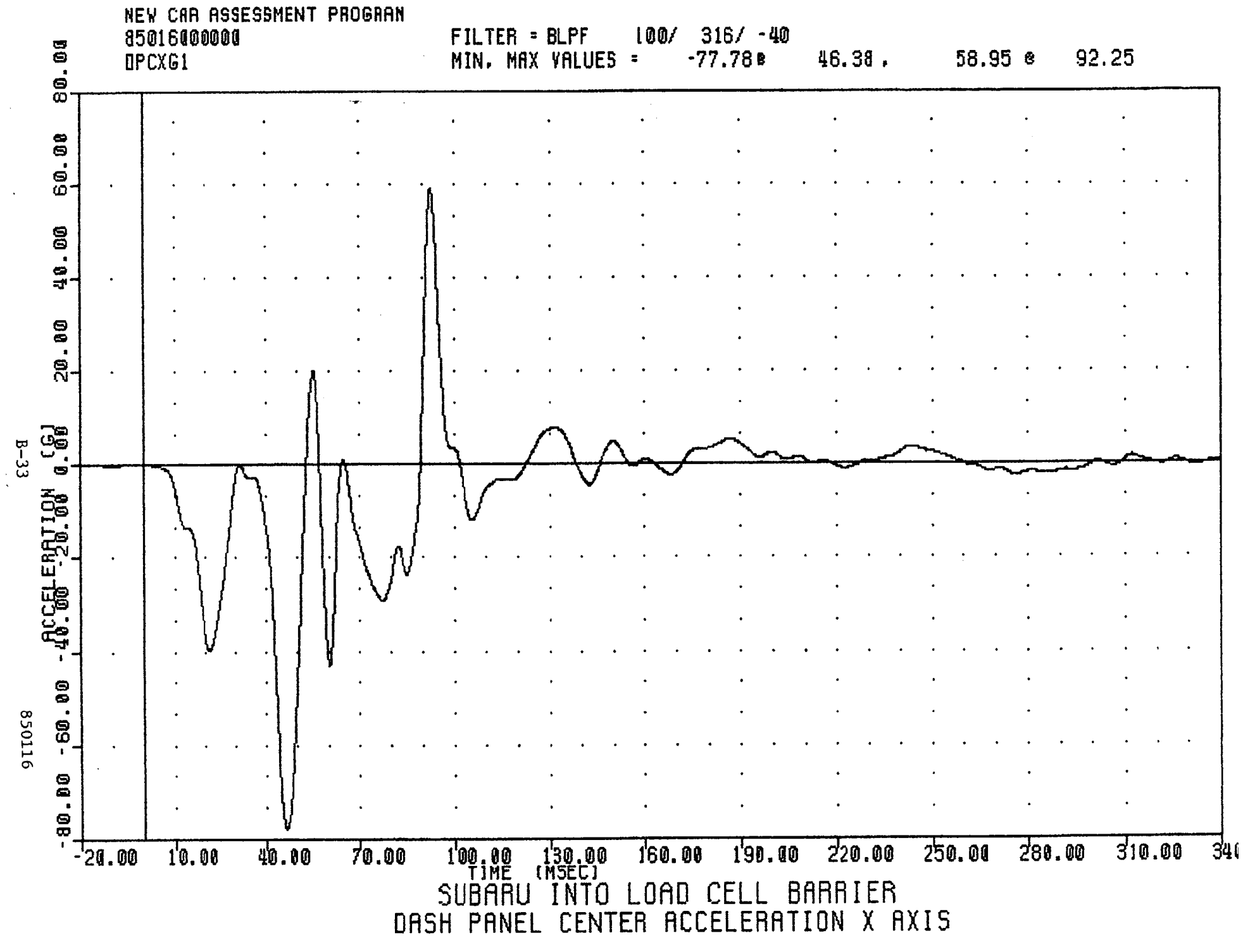
850116




SUBARU INTO LOAD CELL BARRIER
RIGHT BRAKE CALIPER ACCELERATION X AXIS

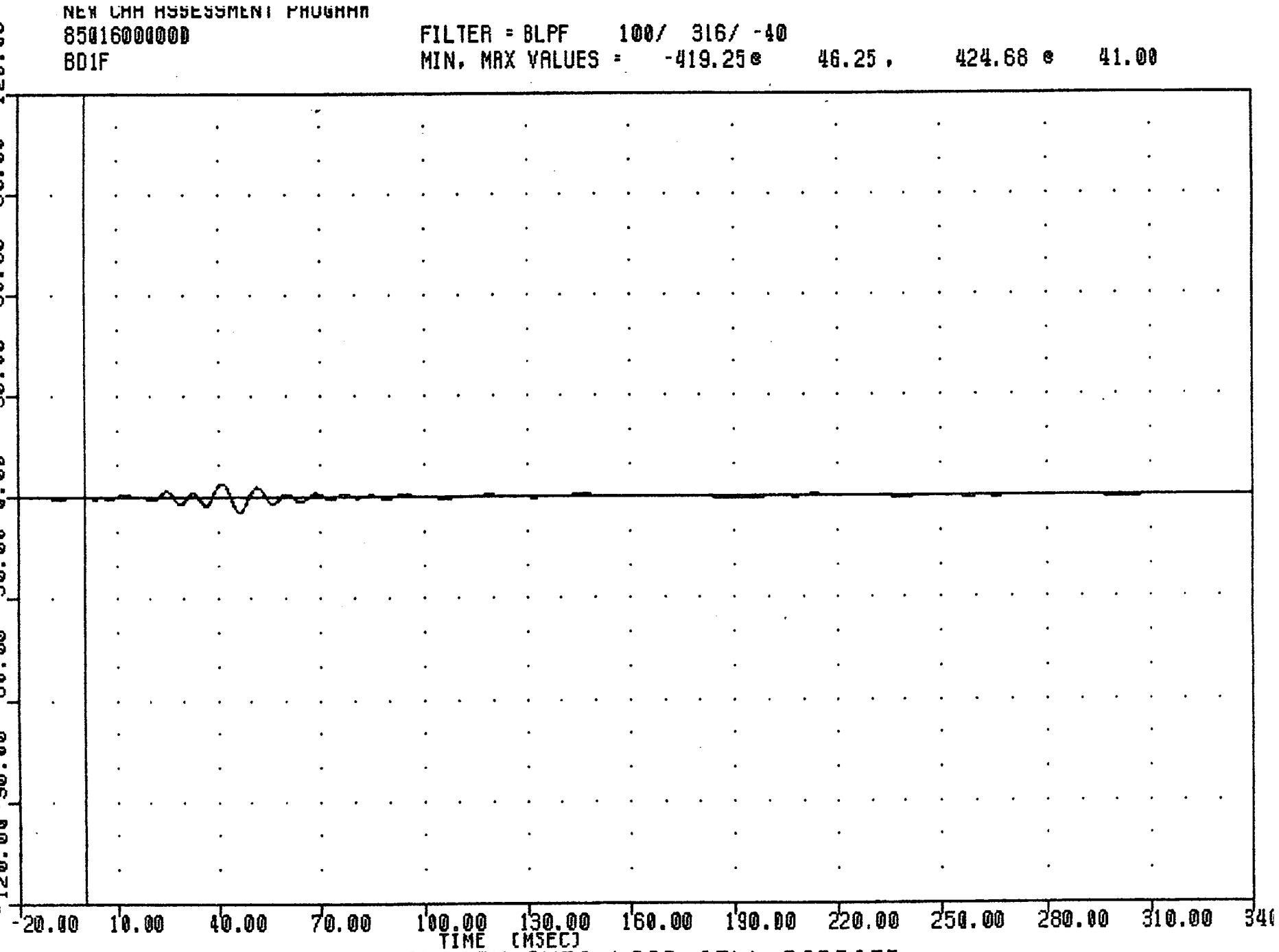


850116


NEW CAR ASSESSMENT PROGRAM
850160000001
DPCXG1
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -77.78 @ 46.38 , 58.95 @ 92.25
80.00
60.00
40.00
20.00
0.00
-20.00
-40.00
-60.00
-80.00
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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
DASH PANEL CENTER ACCELERATION X AXIS



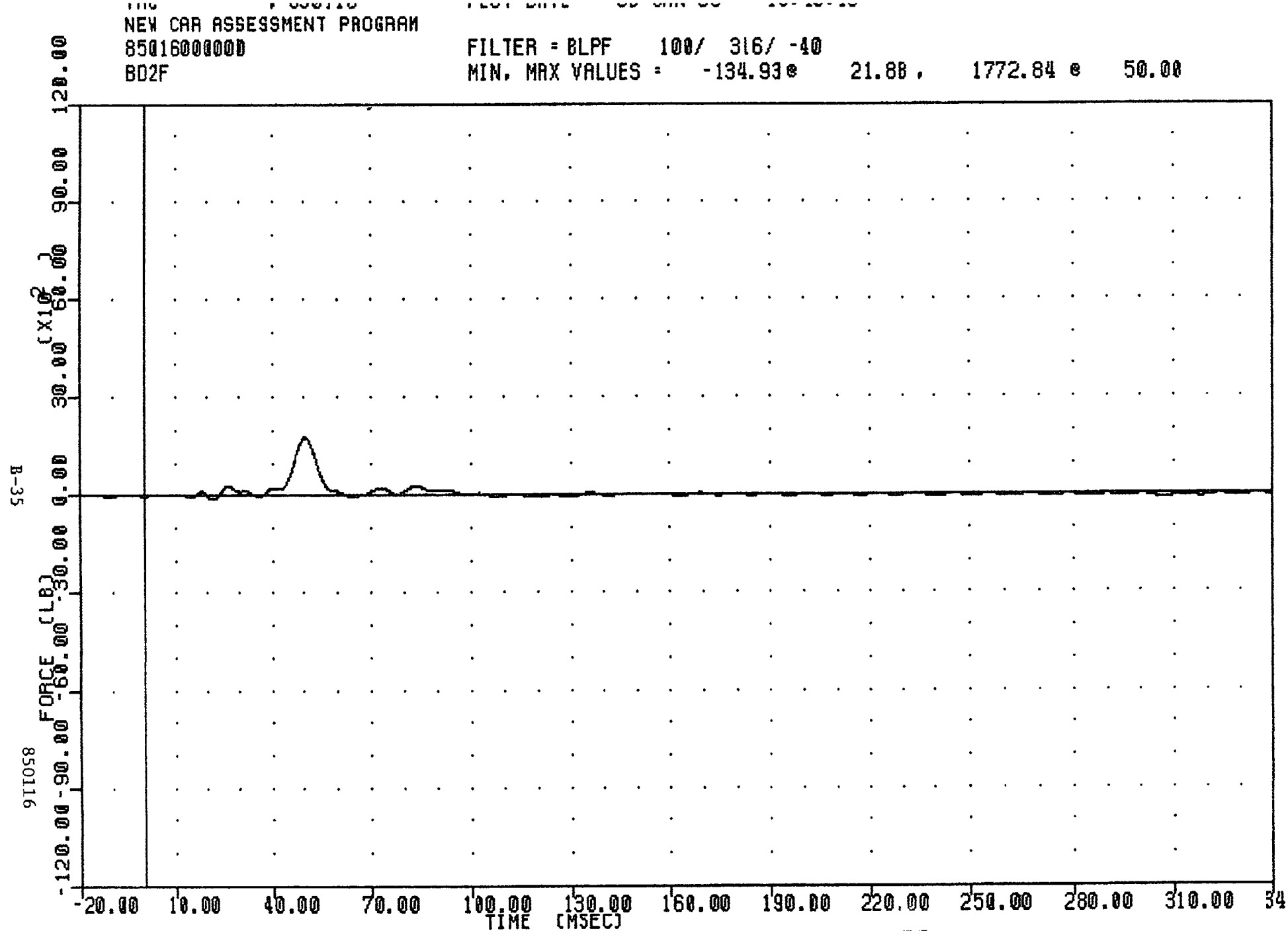
850116




SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D1 LBS



850116



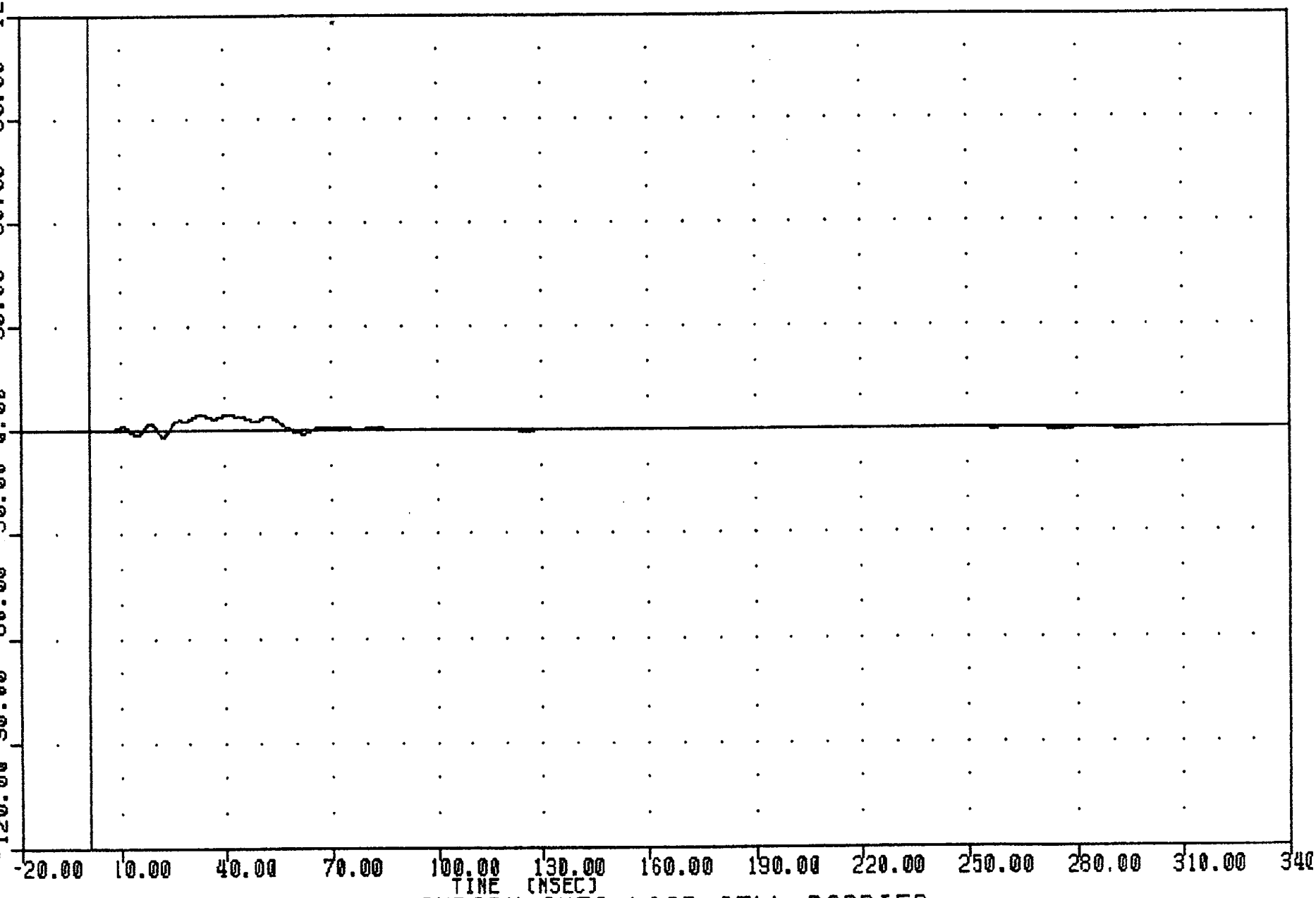

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D2 LBS



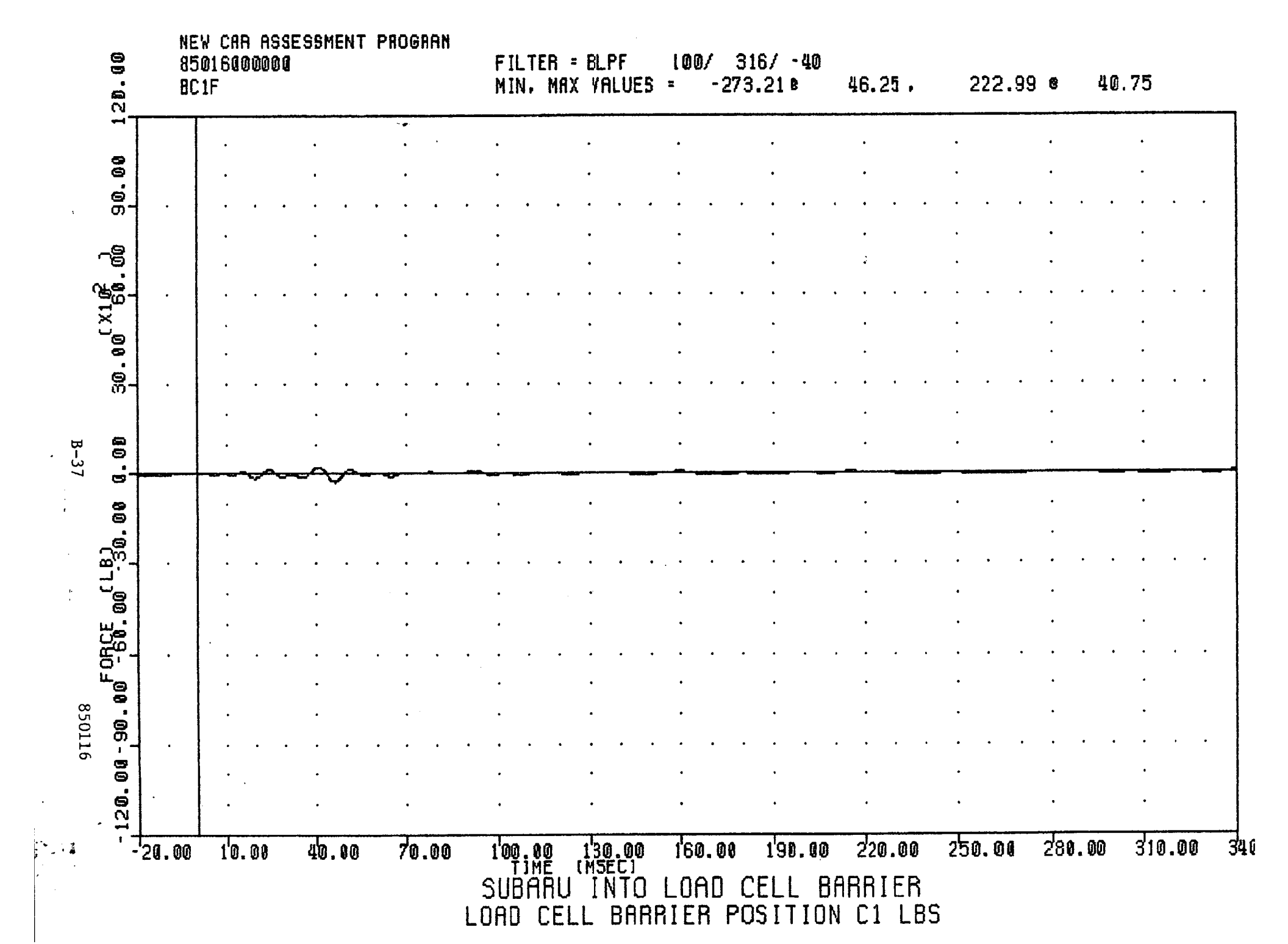
850116

NEW CAR ASSESSMENT PROGRAM
850160400D0
B03F

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -153.21 @ 22.25 , 476.48 @ 33.00

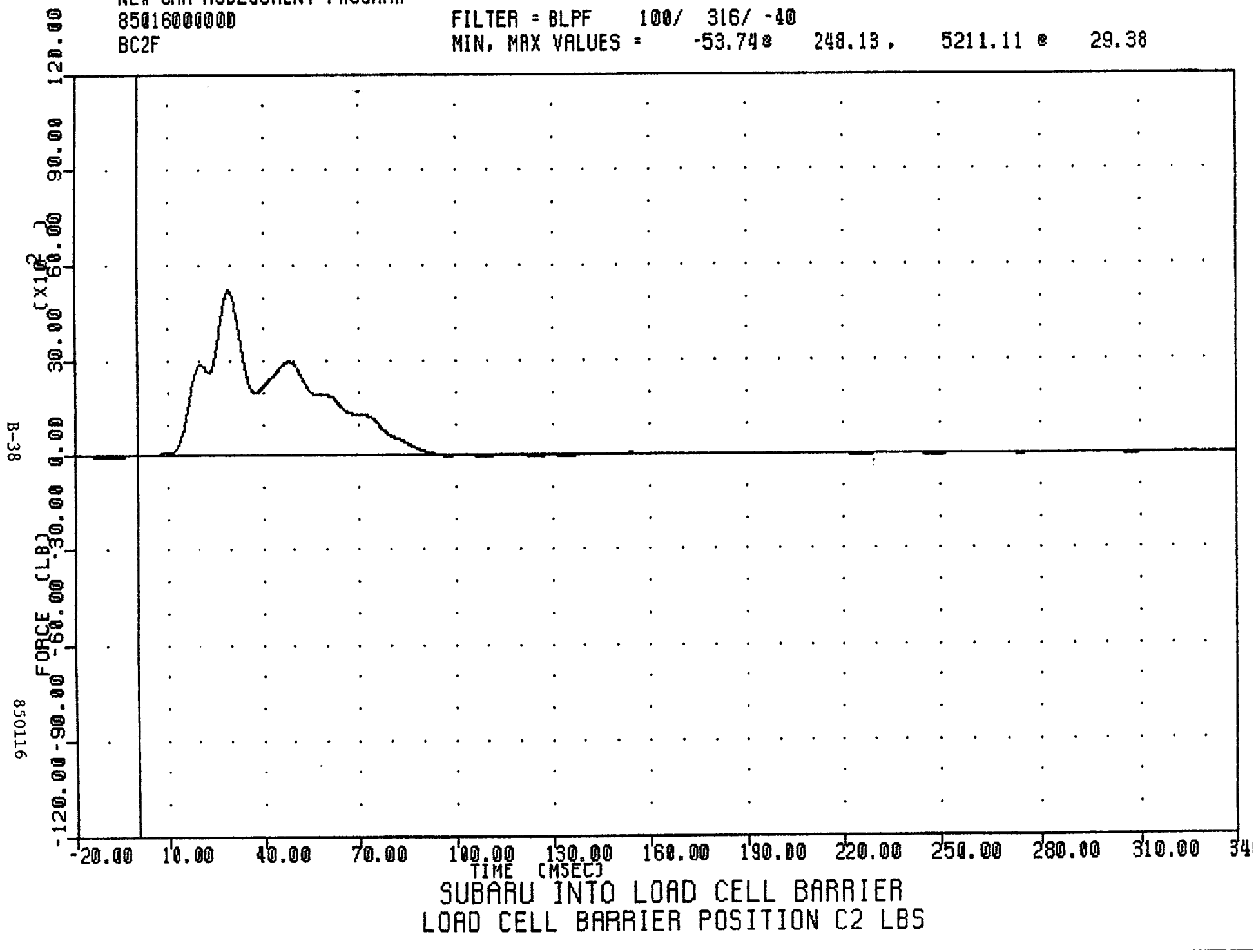



SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D3 LBS


NEW CAR ASSESSMENT PROGRAM
850160000000
8C1F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -273.21 @ 46.25 , 222.99 @ 40.75
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C1 LBS

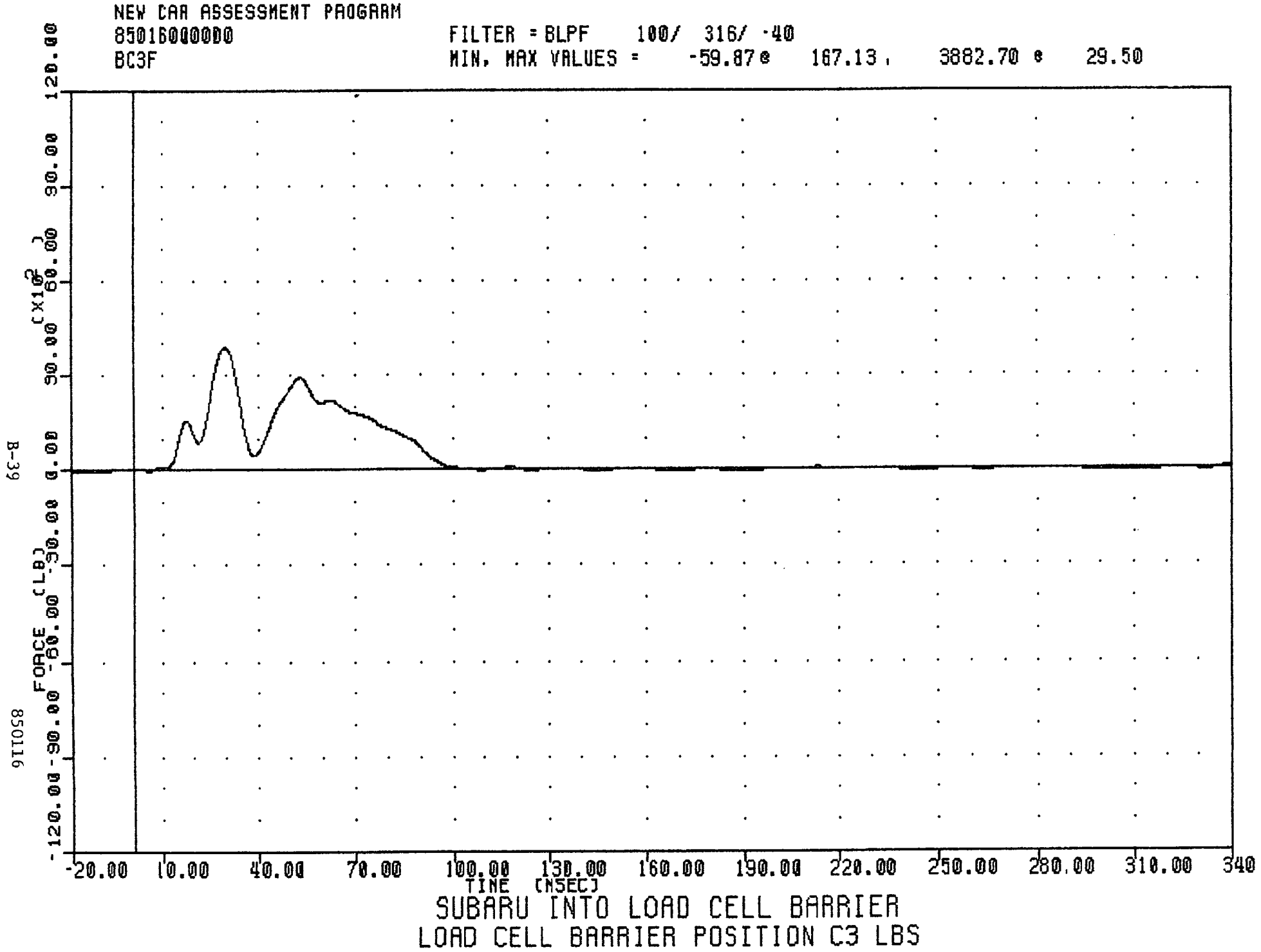


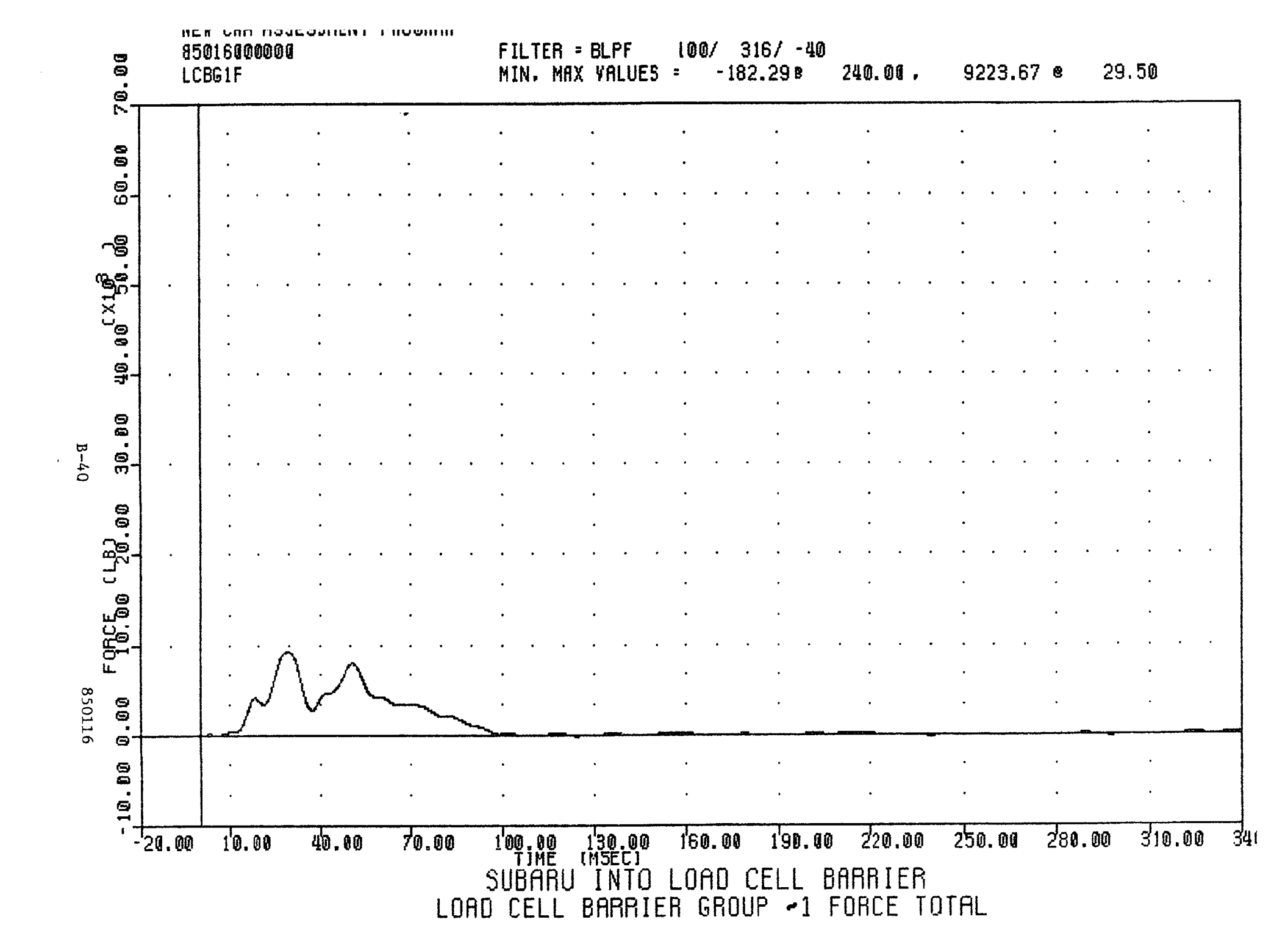
850116


NEW CAR ASSESSMENT PROGRAM
850160000D0
BC2F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -53.74 @ 248.13 , 5211.11 @ 29.38
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C2 LBS



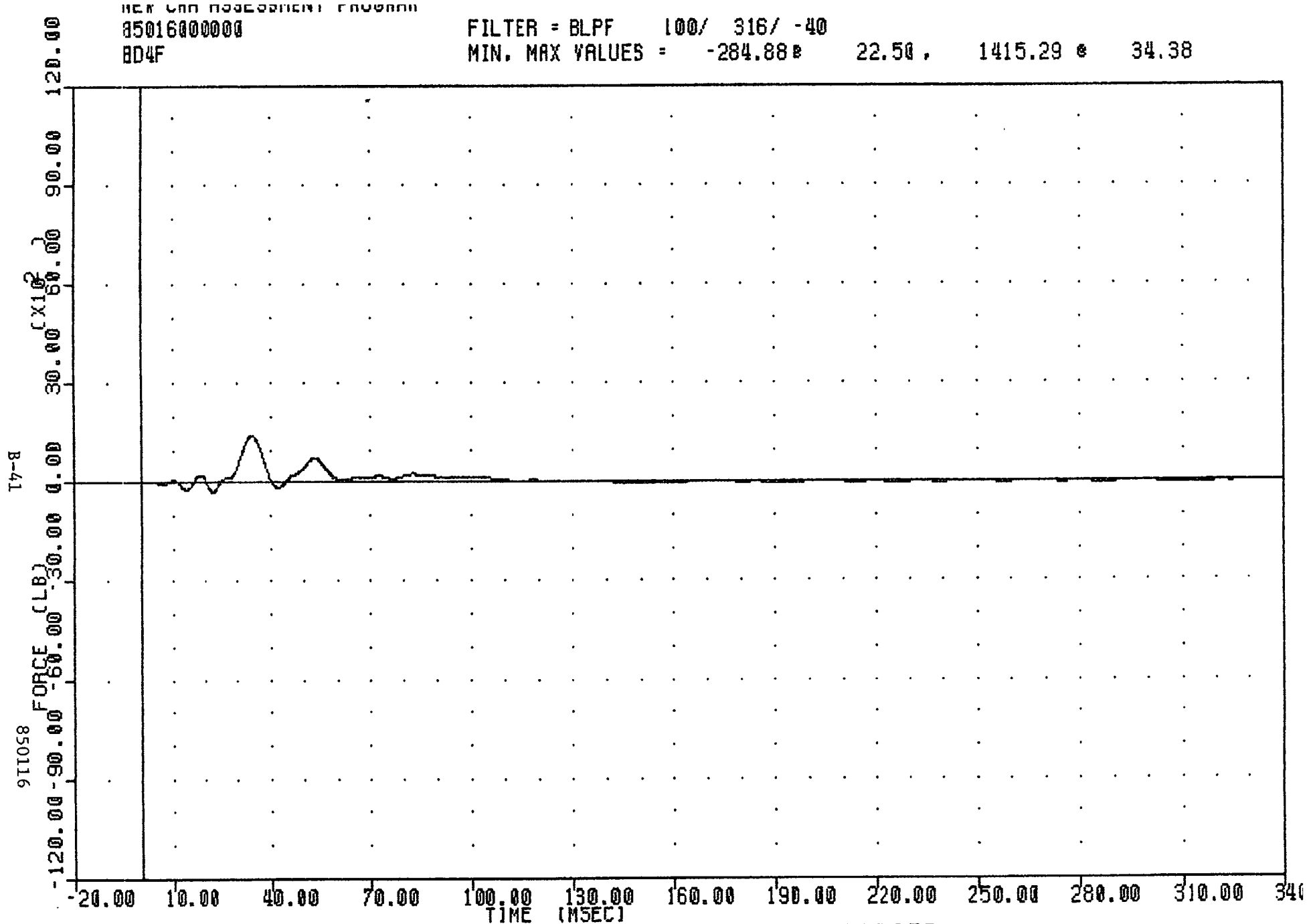
850116


NEW CAR ASSESSMENT PROGRAM
850160000D0
BC3F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -59.87 @ 167.13 , 3882.70 @ 29.50
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C3 LBS


NEW CAR ASSESSMENT PROGRAM
850160000000
LCBG1F
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -182.29 @ 240.00 , 9223.67 @ 29.50
FORCE (LB) (X10^3)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP -1 FORCE TOTAL

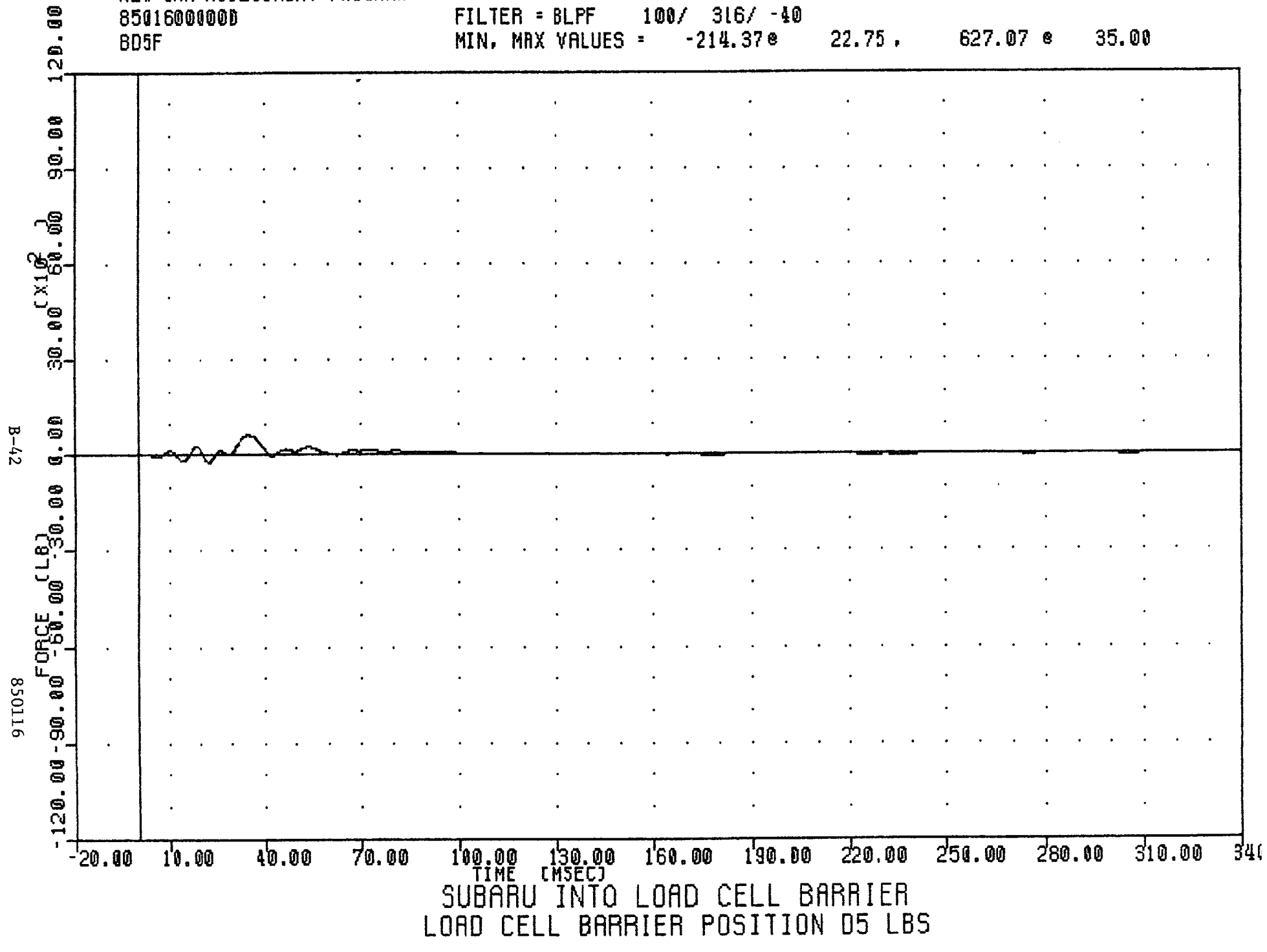


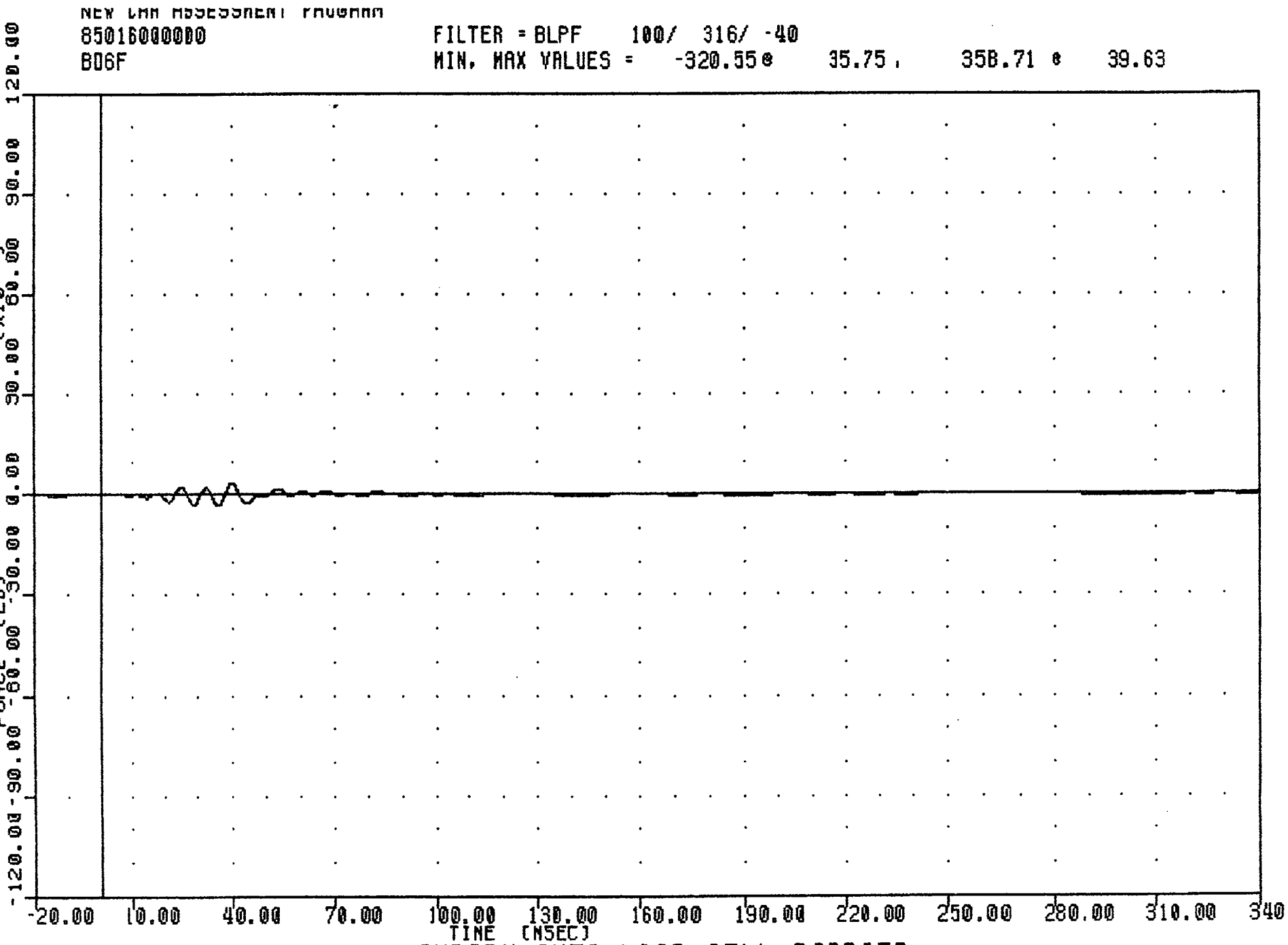
850116


NEW CAR ASSESSMENT PROGRAM
850160000000
8D4F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -284.88 @ 22.50 , 1415.29 @ 34.38
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D4 LBS

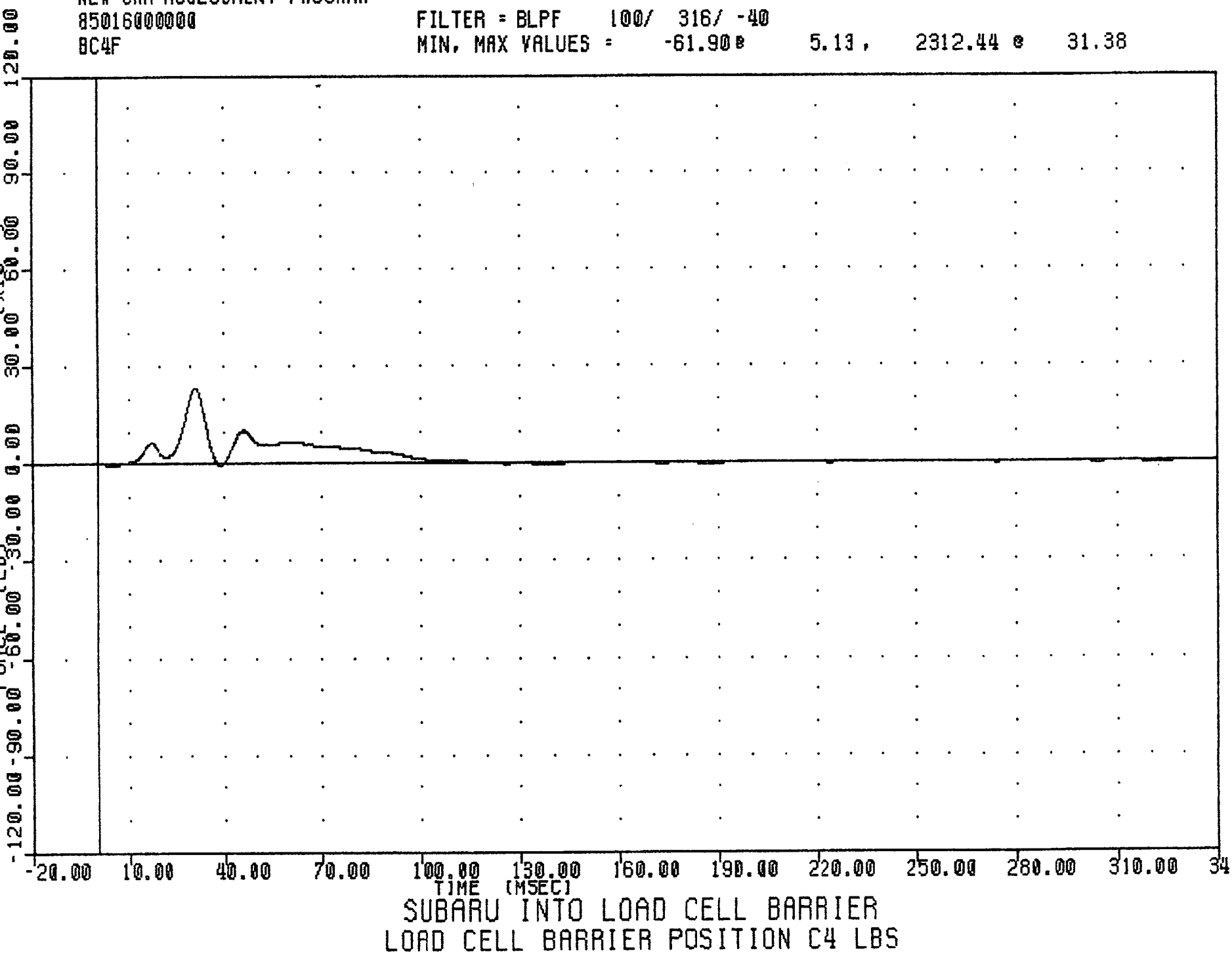


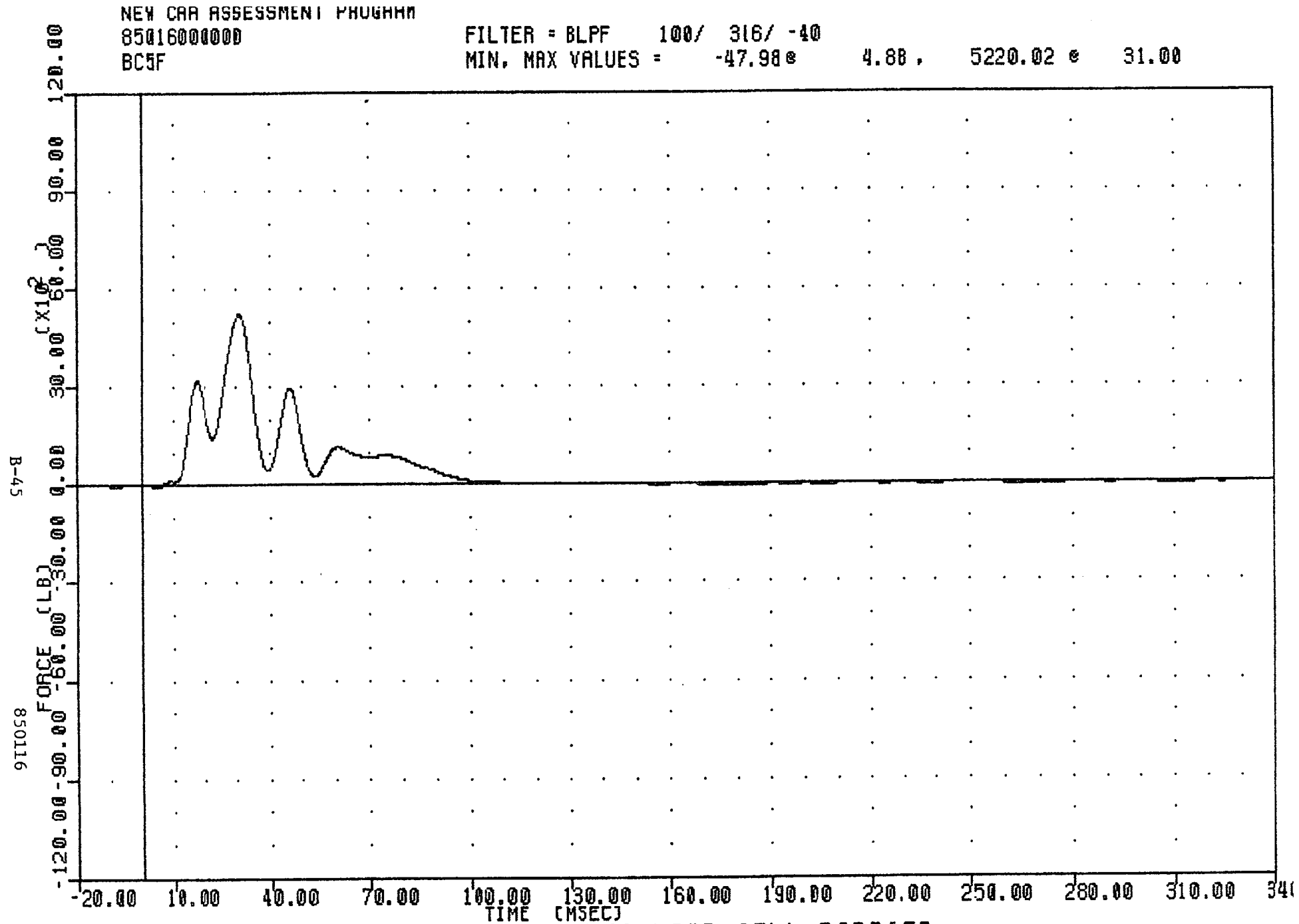
850116


NEW CAR ASSESSMENT PROGRAM
85016000000
BD5F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -214.37 @ 22.75 , 627.07 @ 35.00
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION 05 LBS




SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D6 LBS

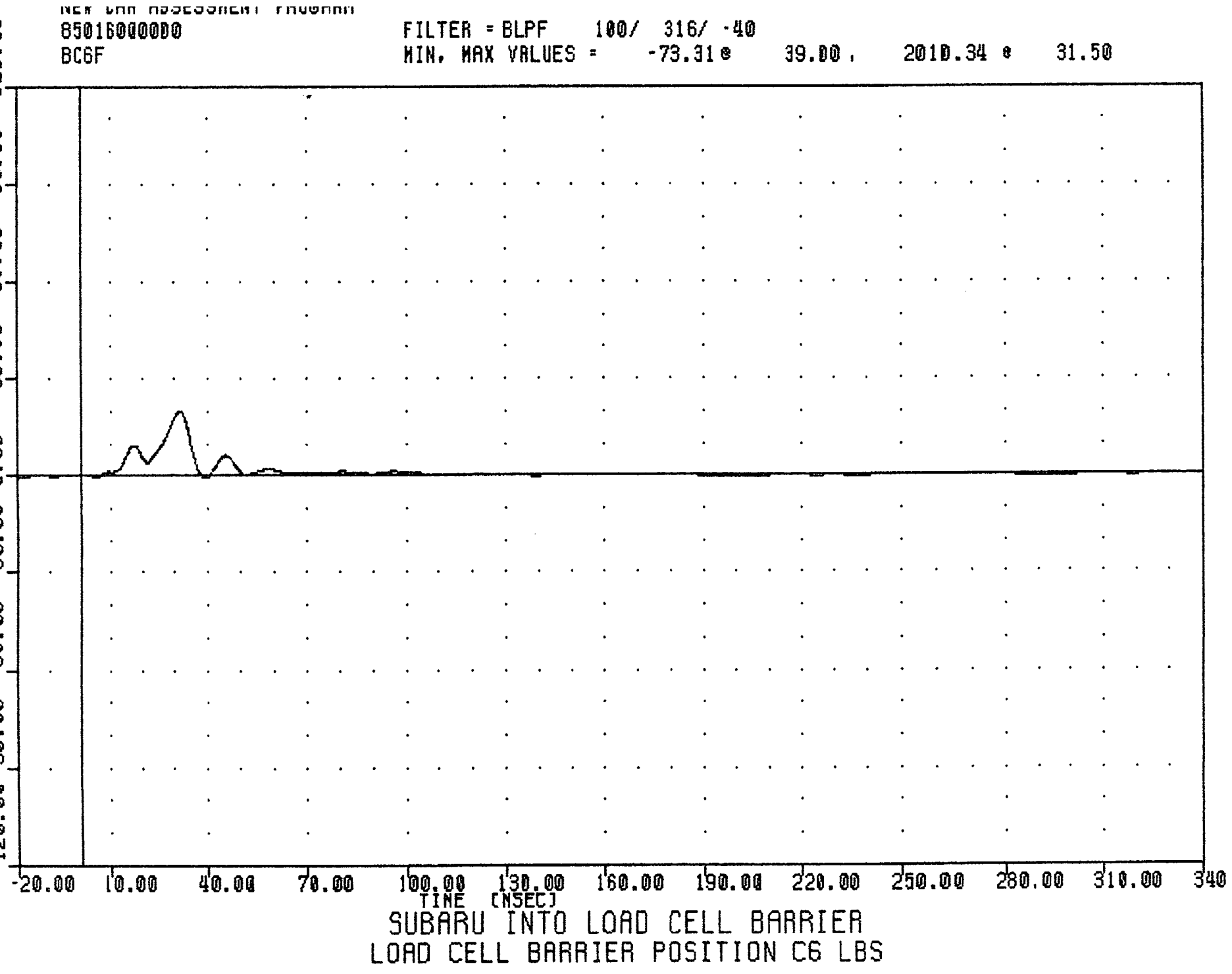

NEW CAR ASSESSMENT PROGRAM
85016000000
BC4F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -61.90 @ 5.13 , 2312.44 @ 31.38
FORCE [LB] [X10^2 ]
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C4 LBS

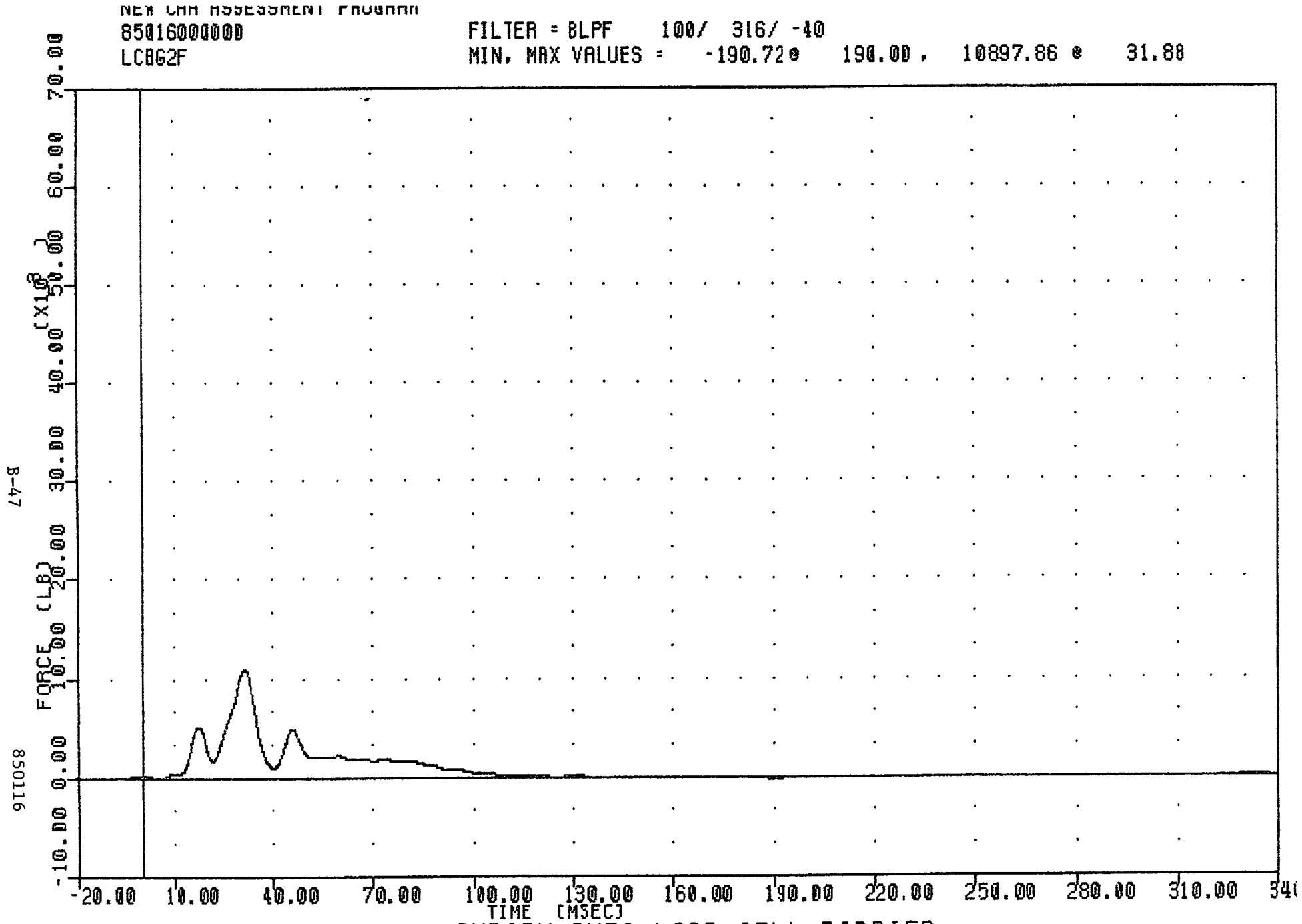



SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C5 LBS

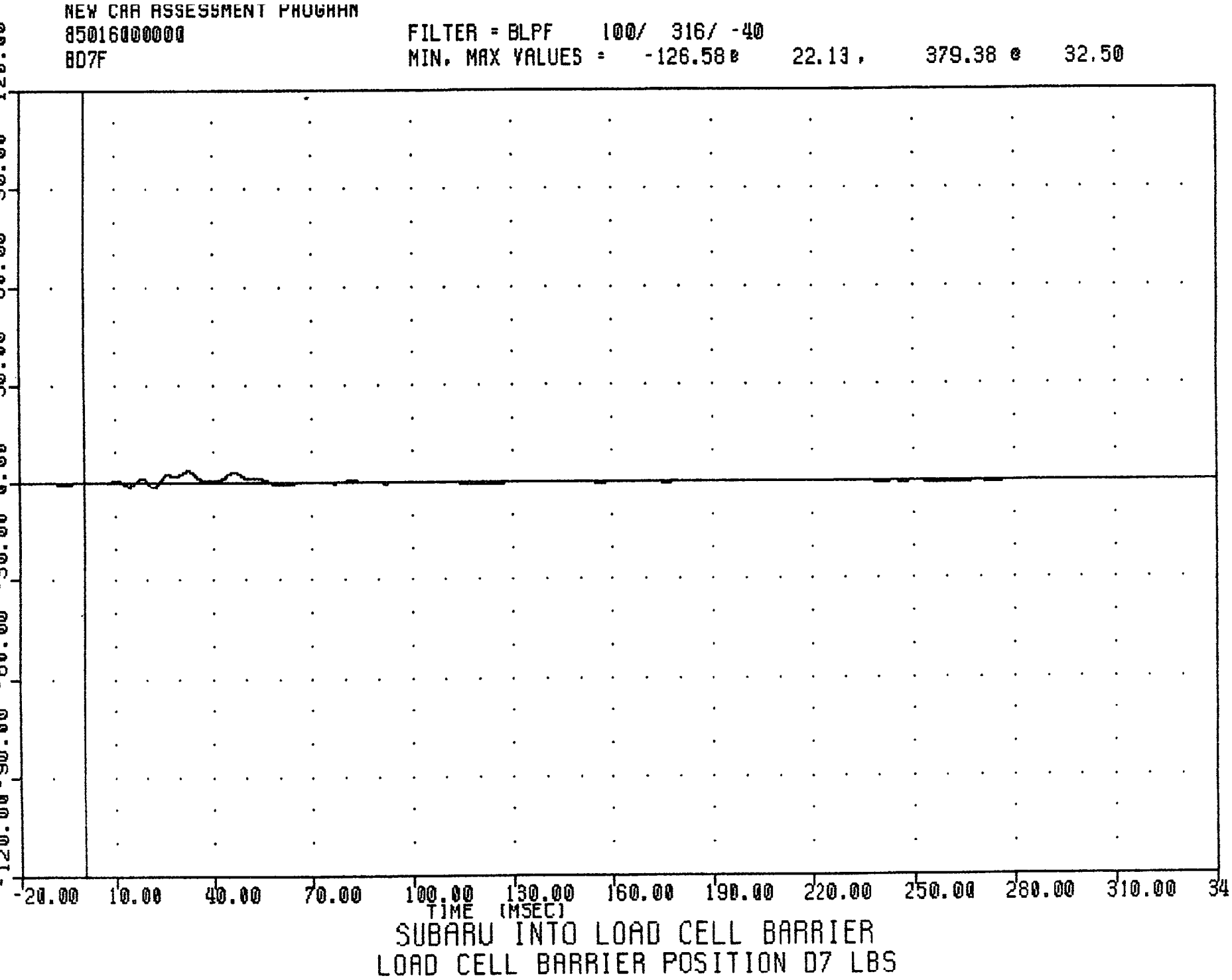


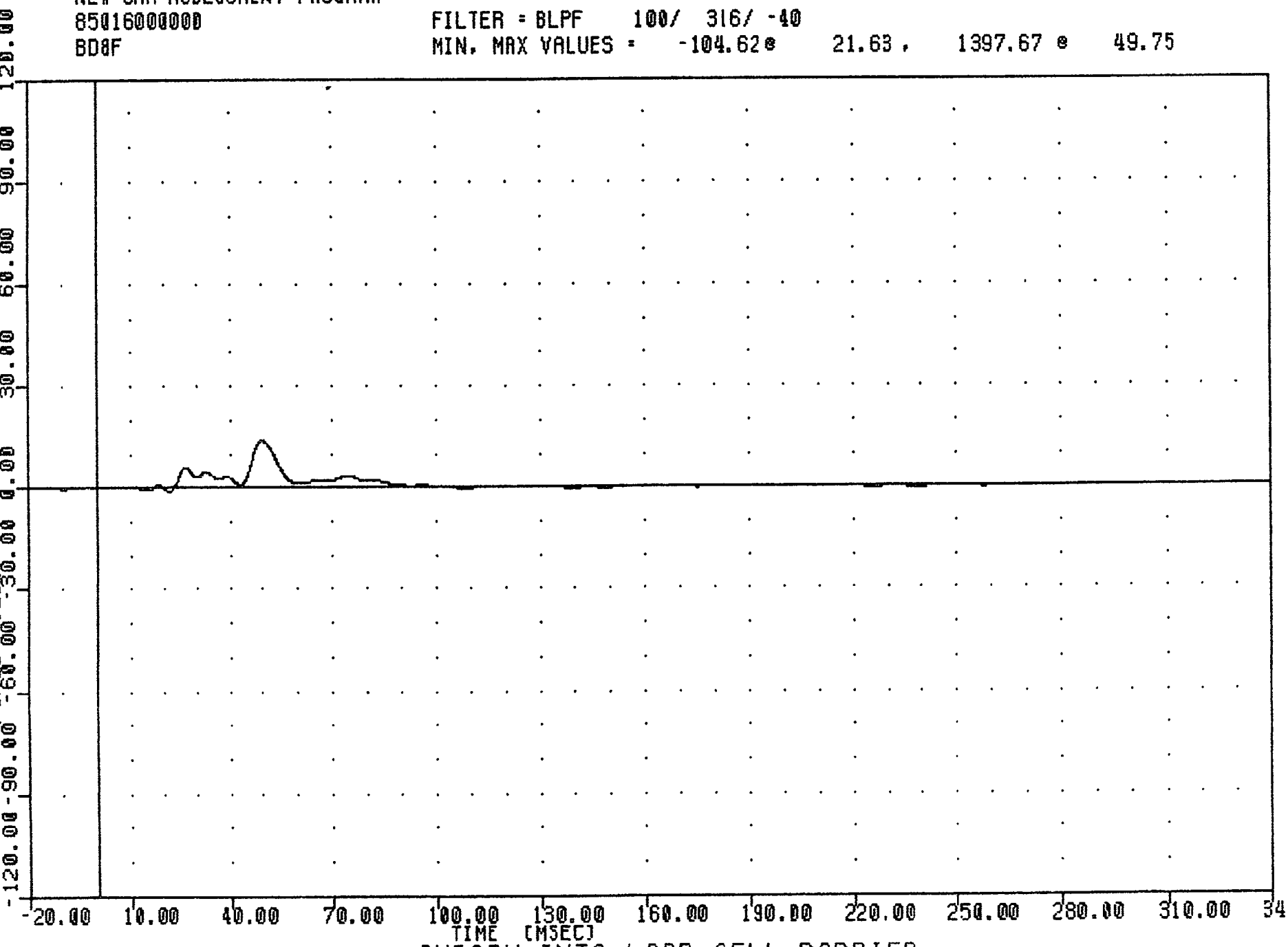
85016


NEW CAR ASSESSMENT PROGRAM
850160000D0
BC6F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -73.31 @ 39.00 , 2010.34 @ 31.50
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C6 LBS

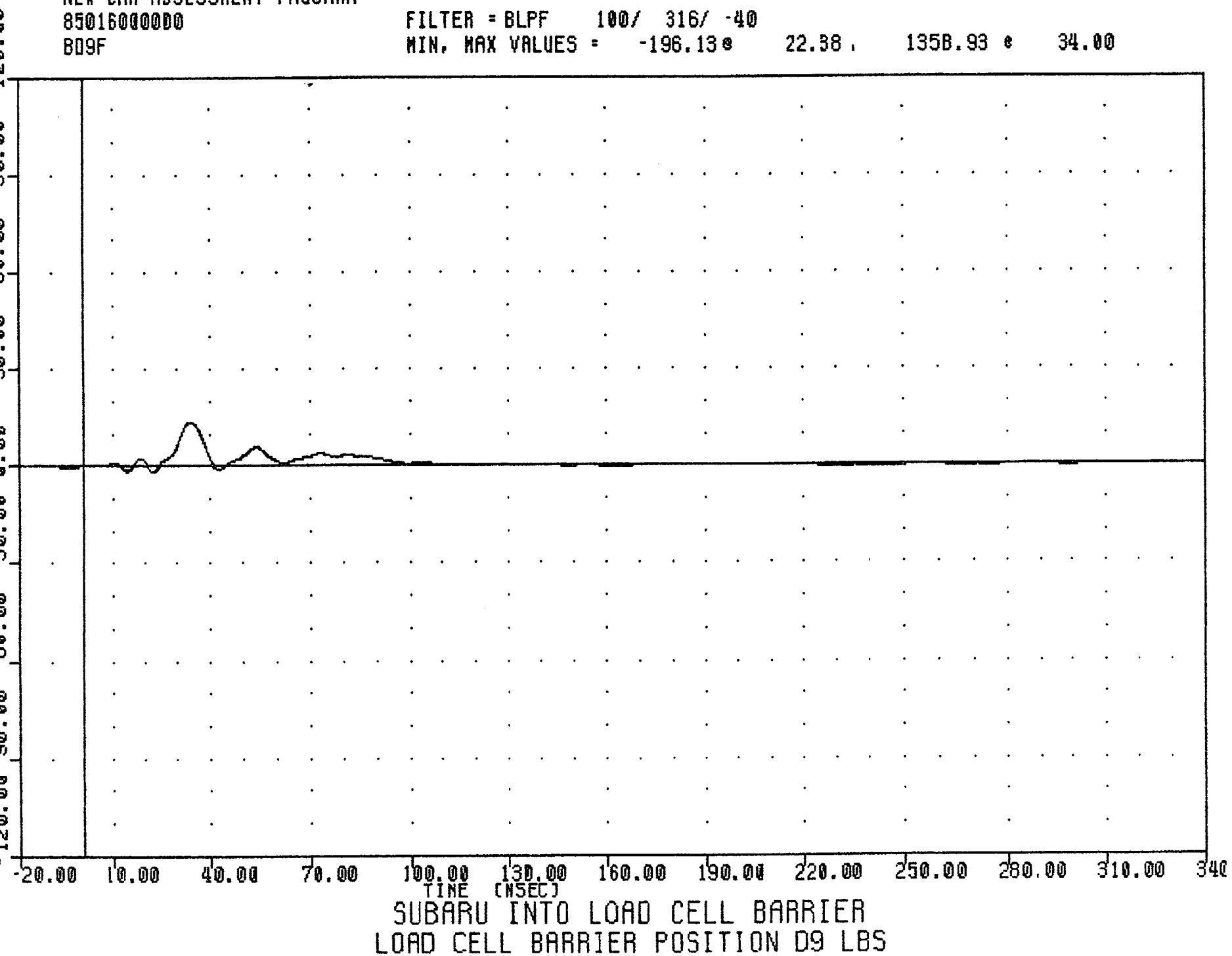



SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP #2 FORCE TOTAL


NEW CAR ASSESSMENT PROGRAM
85016000000
8D7F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -126.58 @ 22.13 , 379.38 @ 32.50
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D7 LBS



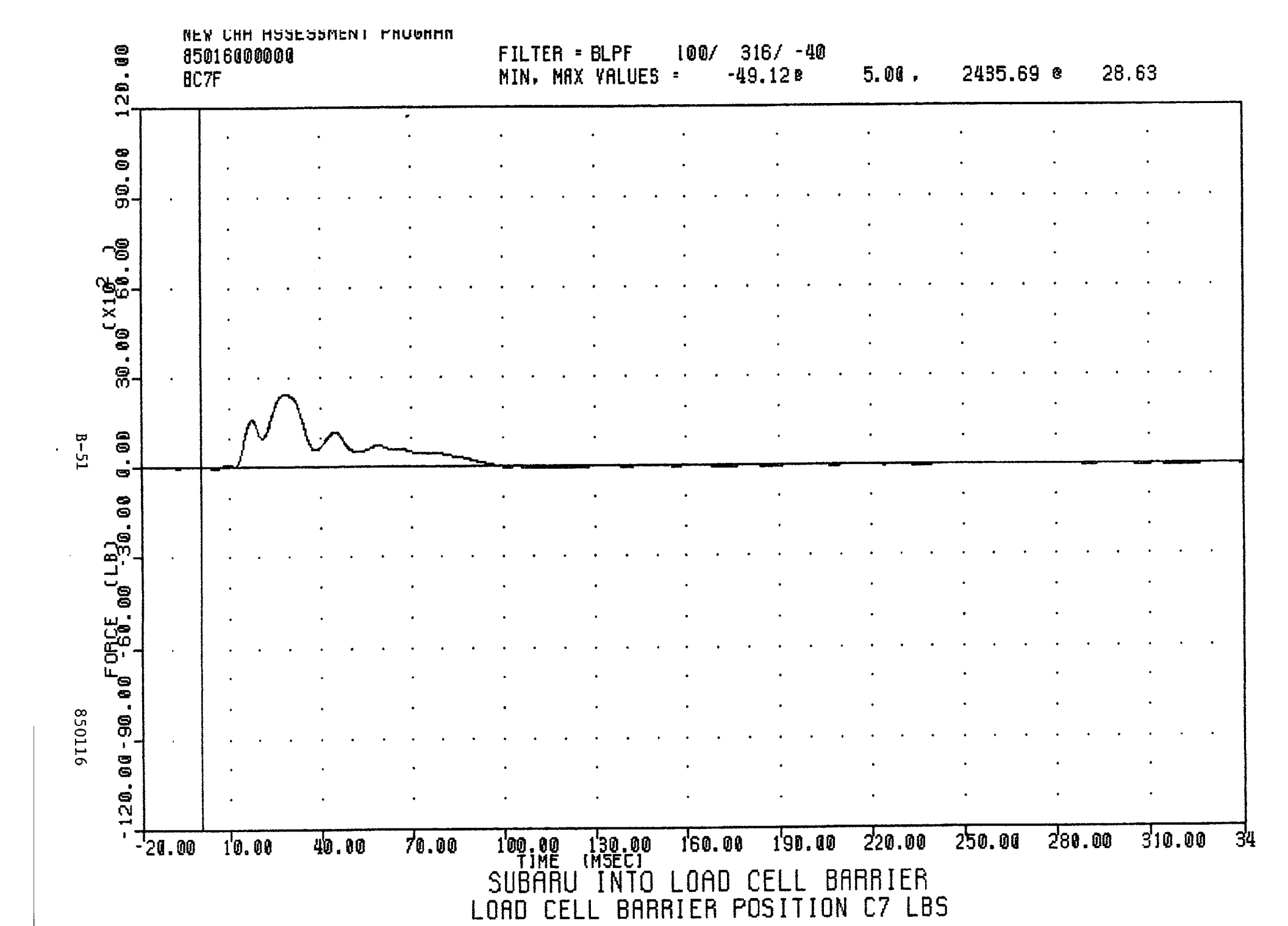

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D8 LBS

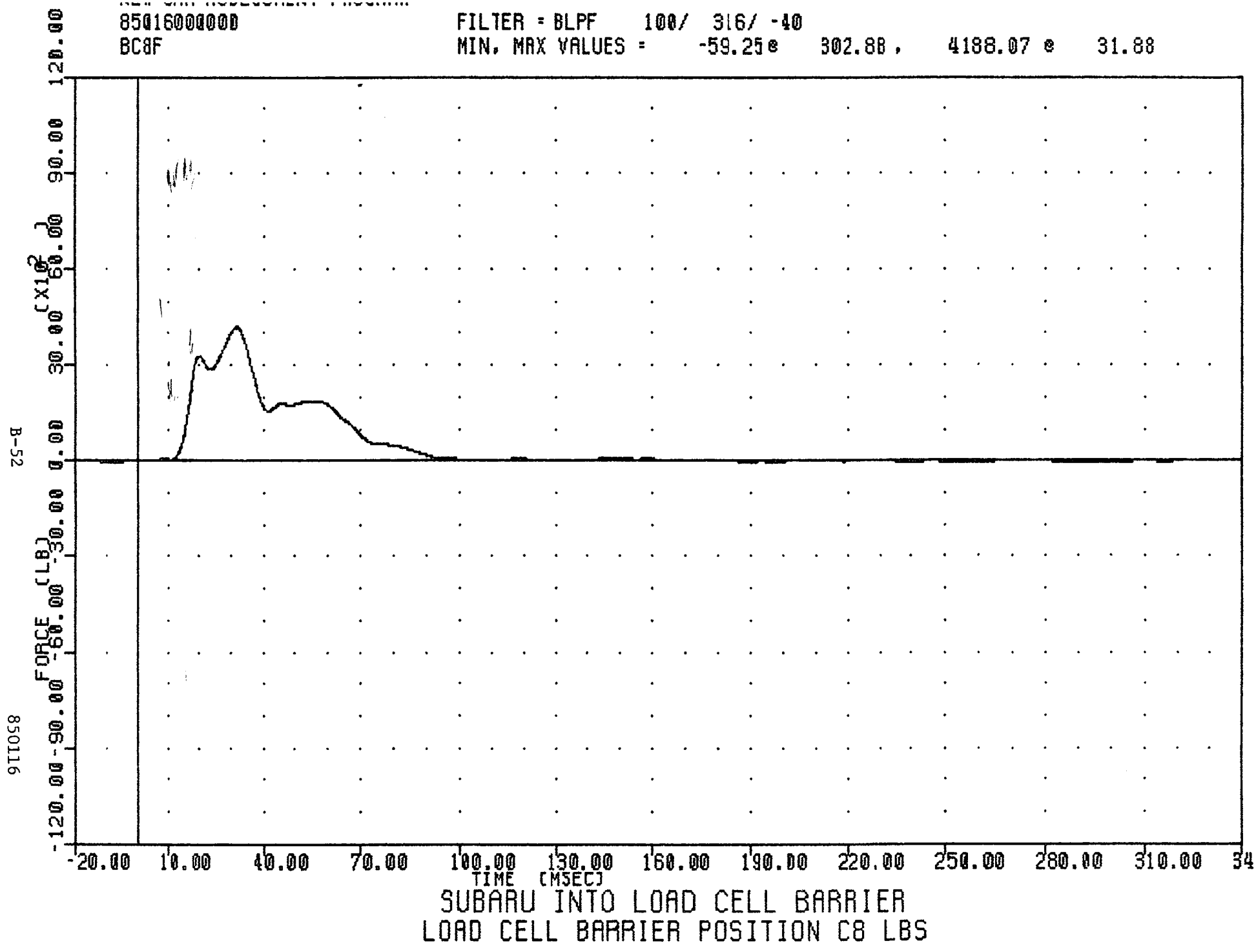



SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION D9 LBS



850116

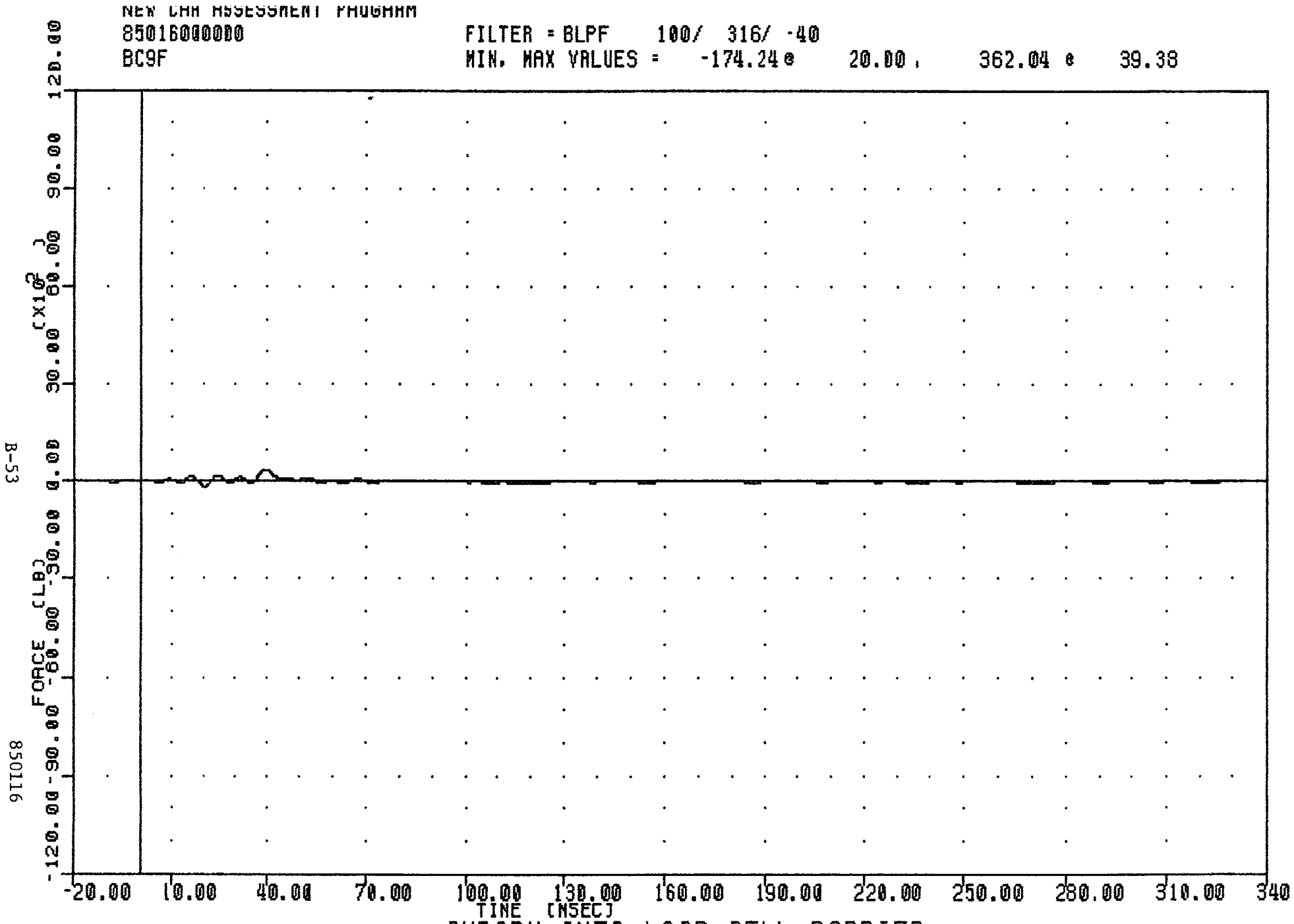

NEW CRM ASSESSMENT PROGRAM
85016000000
BC7F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -49.12 @ 5.00 , 2435.69 @ 28.63
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
(X10^2)
FORCE (LB)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C7 LBS




SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C8 LBS



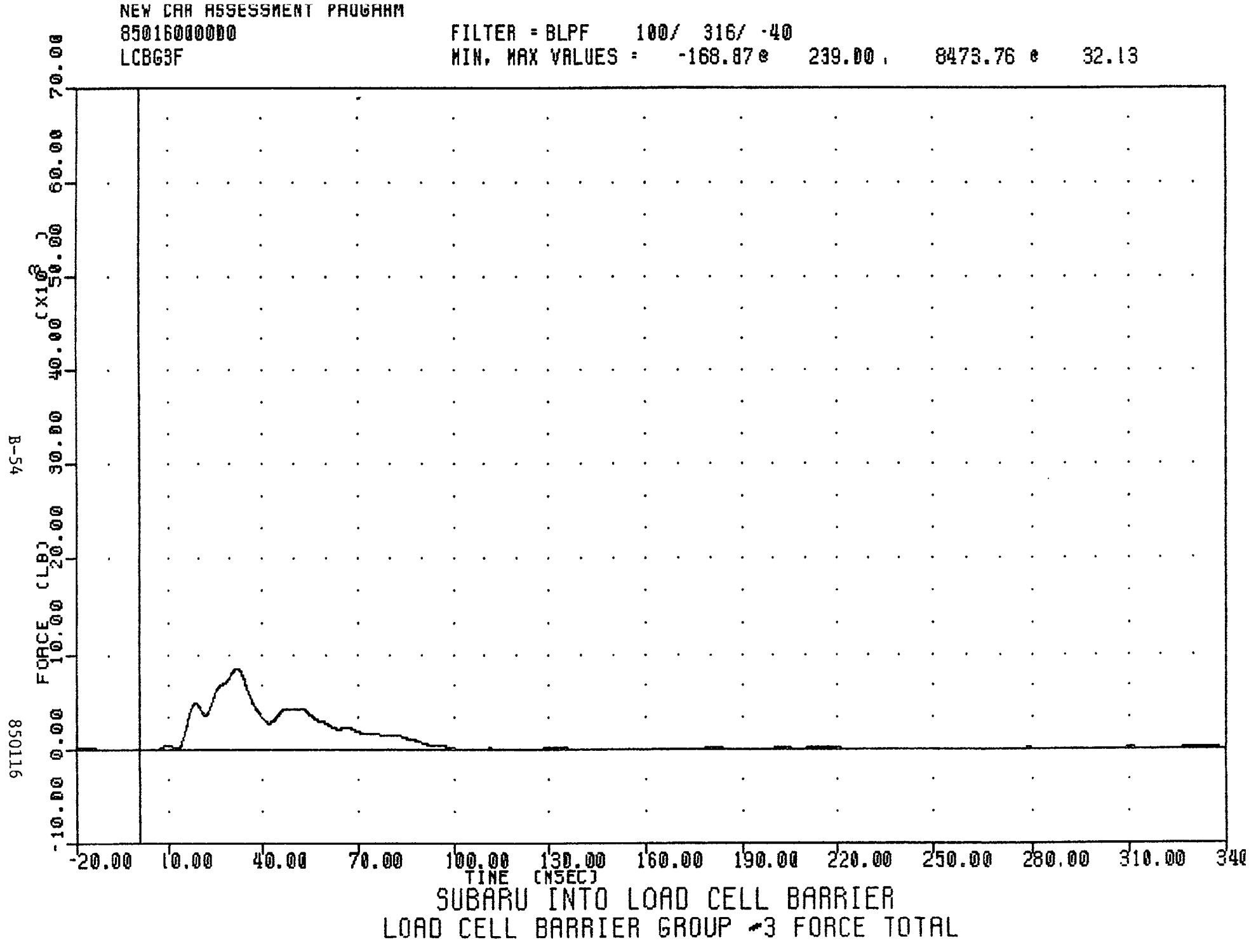
850116

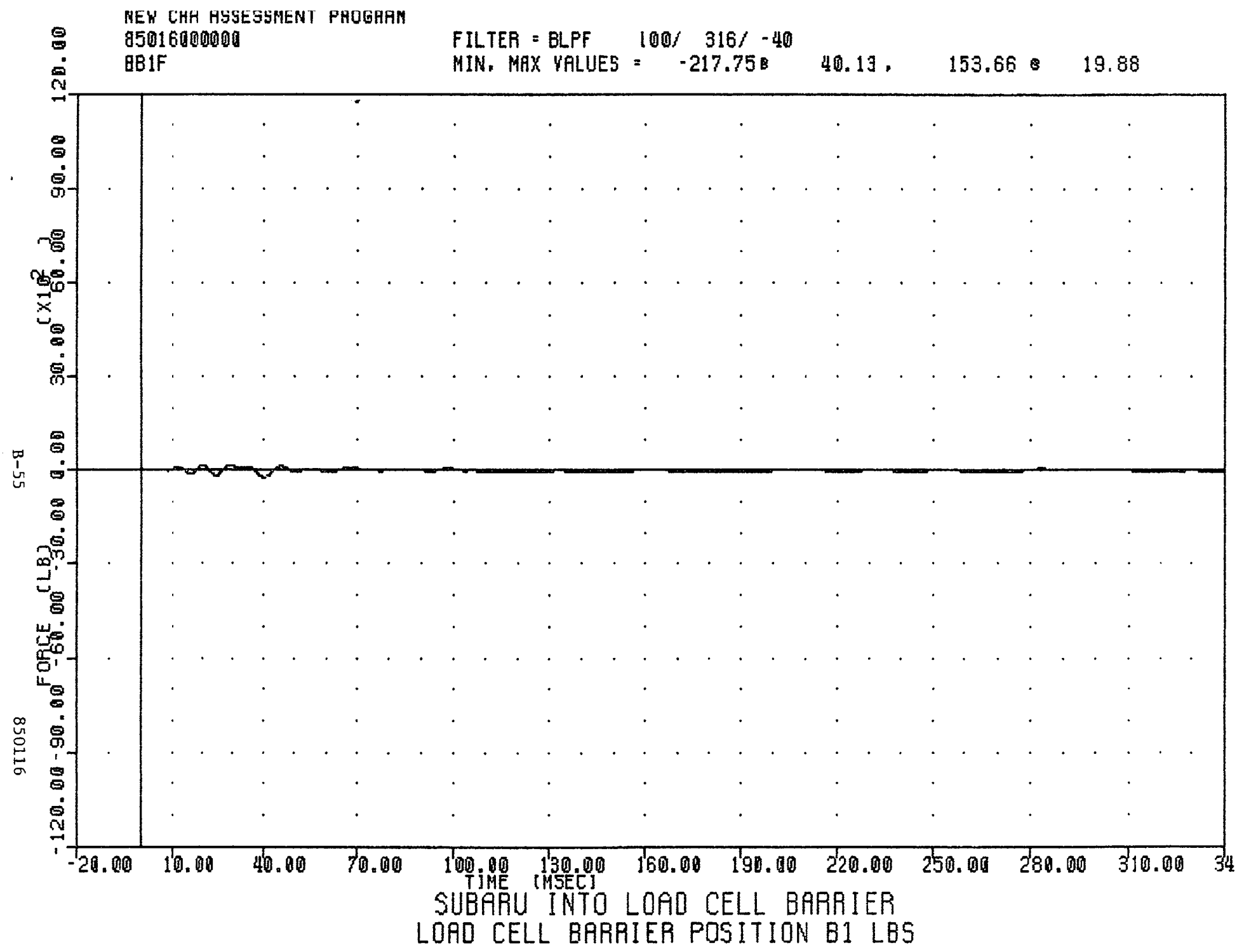


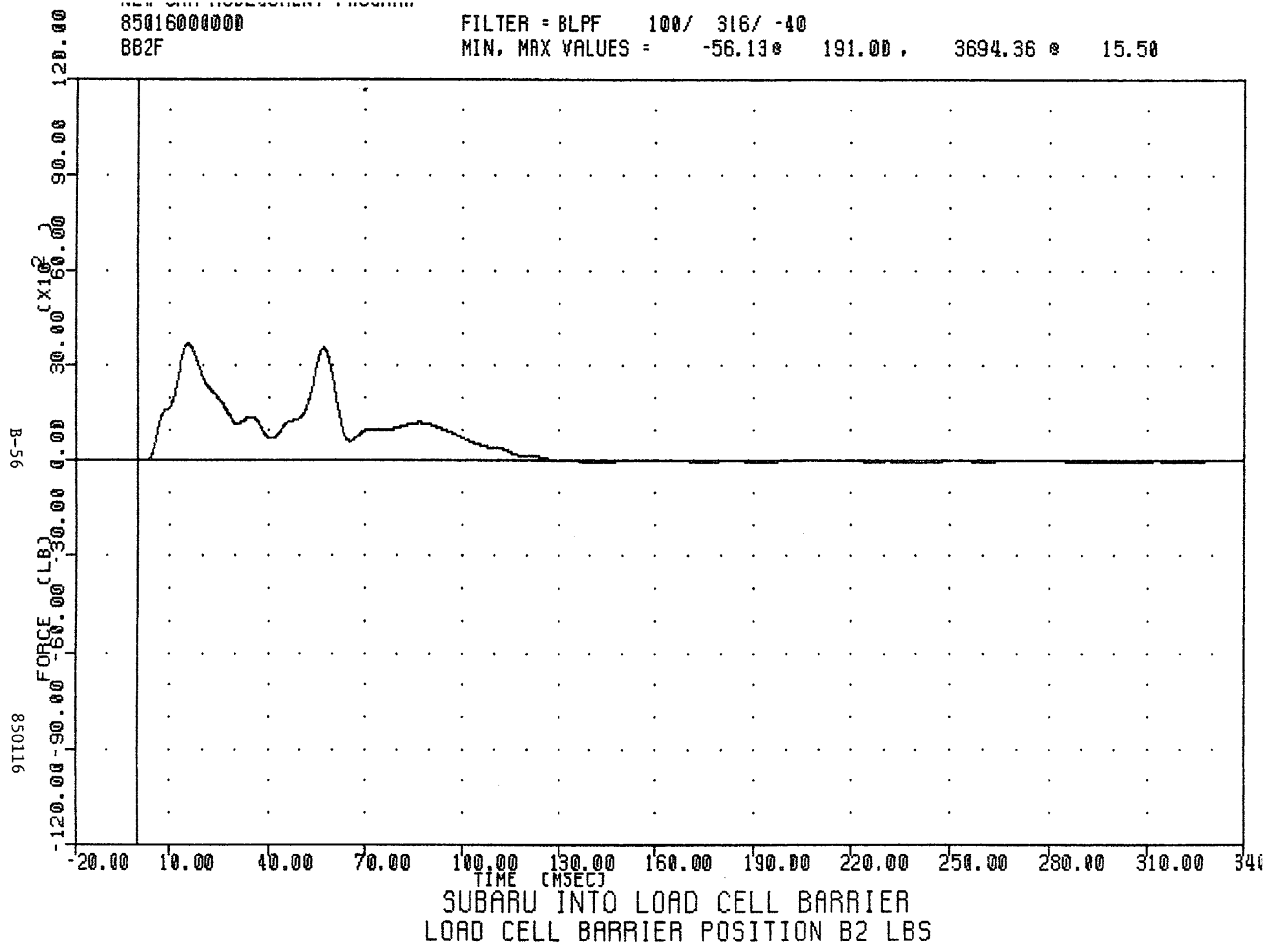

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION C9 LBS



850116

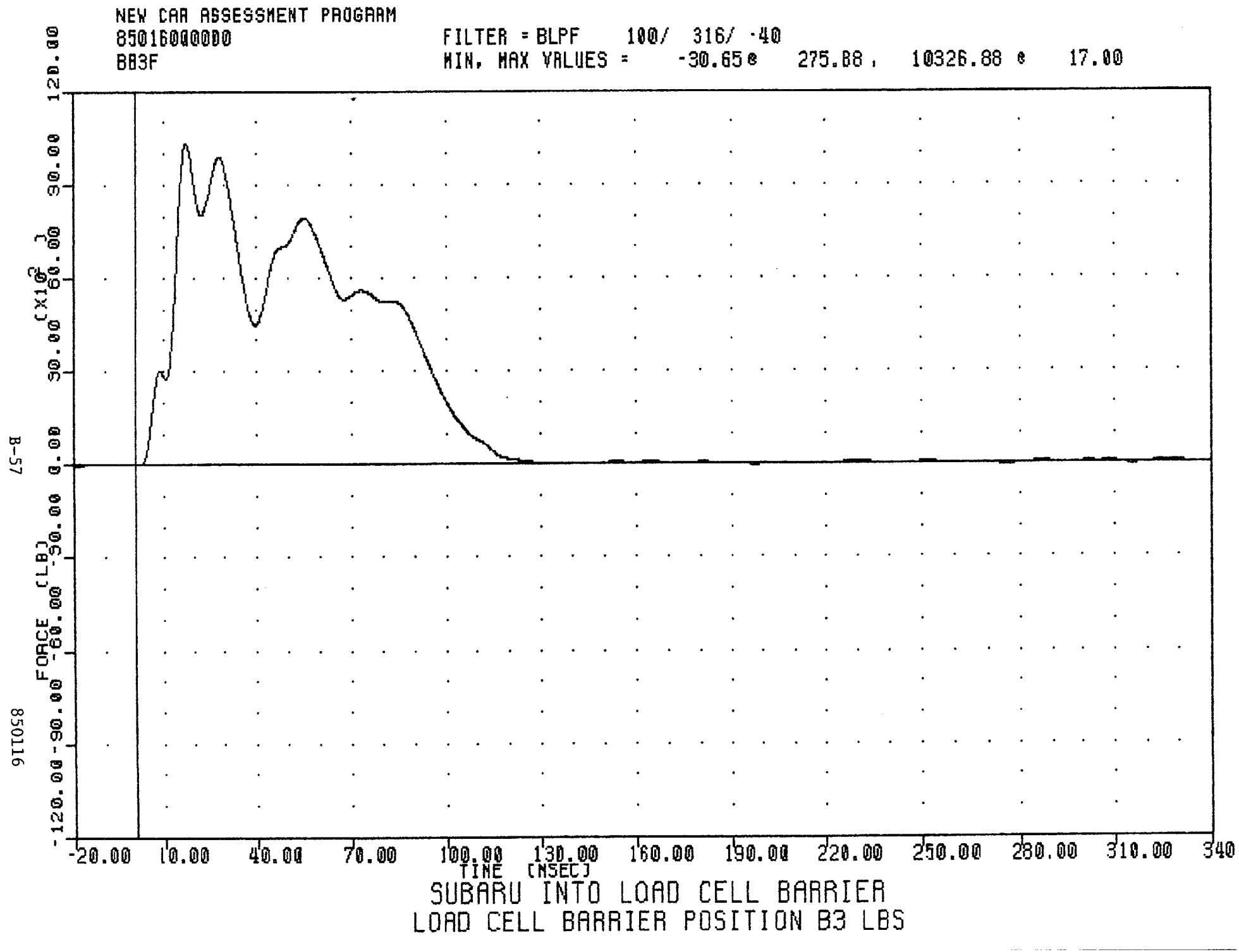

NEW CAR ASSESSMENT PROGRAM
85016000000
LCBG3F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -168.87 @ 239.00 , 8473.76 @ 32.13
FORCE (LB) (X10^3)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP #3 FORCE TOTAL

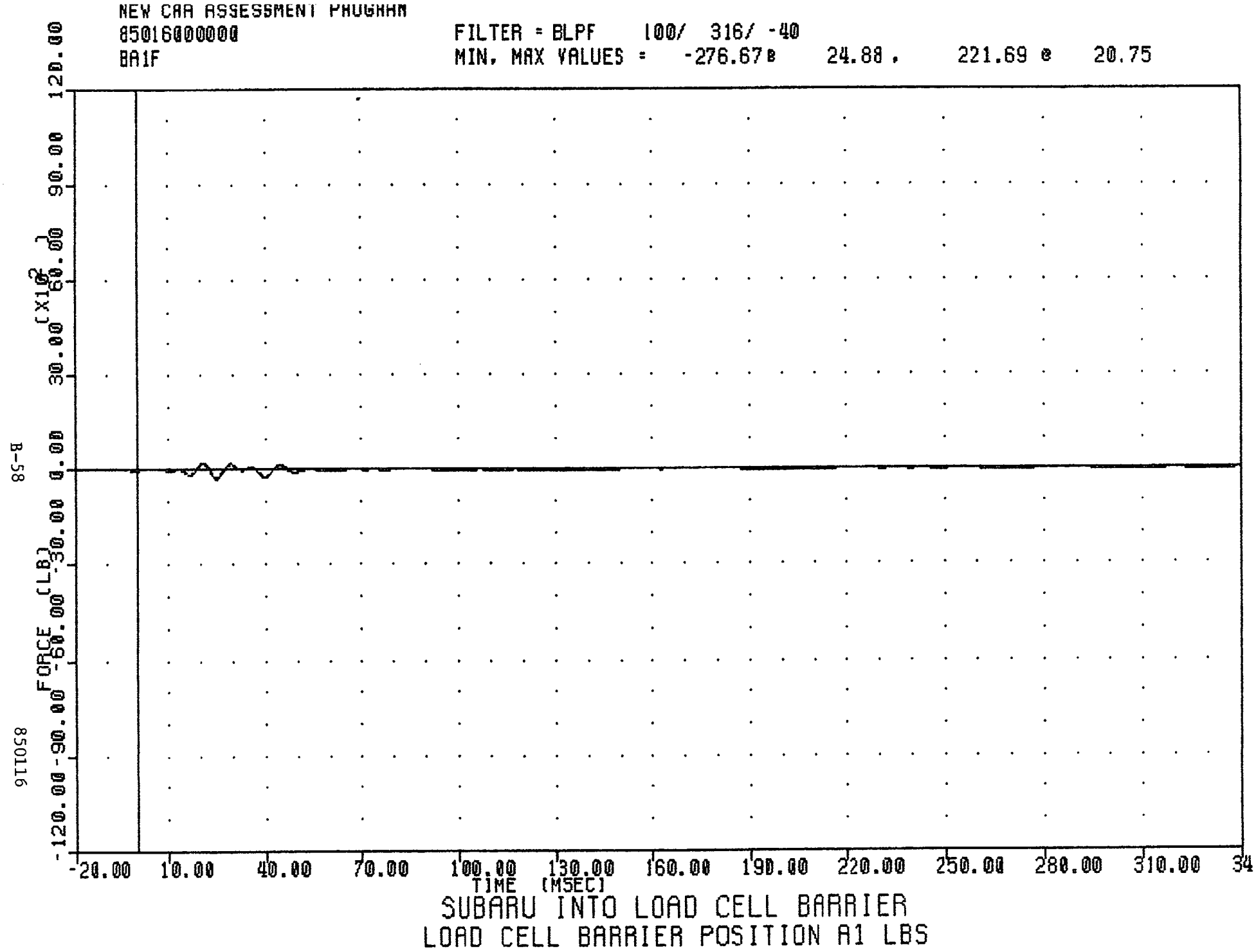

NEW CHR ASSESSMENT PROGRAM
850160000000
BB1F
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -217.75 @ 40.13 , 153.66 @ 19.88
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
34
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B1 LBS


850160000000
BB2F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -56.13 @ 191.00 , 3694.36 @ 15.50
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B2 LBS



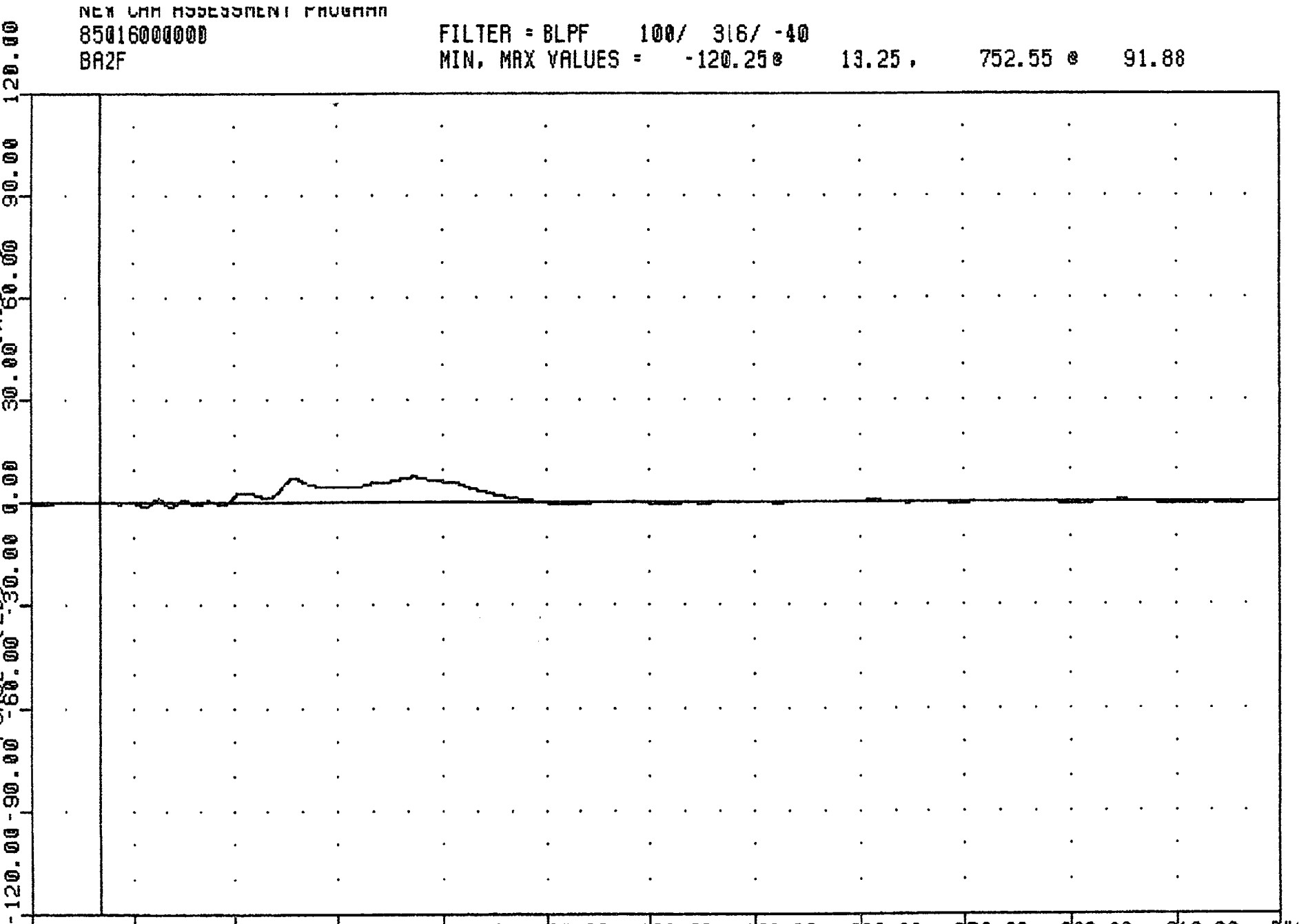
850116


NEW CAR ASSESSMENT PROGRAM
850160000000
B83F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -30.65 @ 275.88 , 10326.88 @ 17.00
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B3 LBS

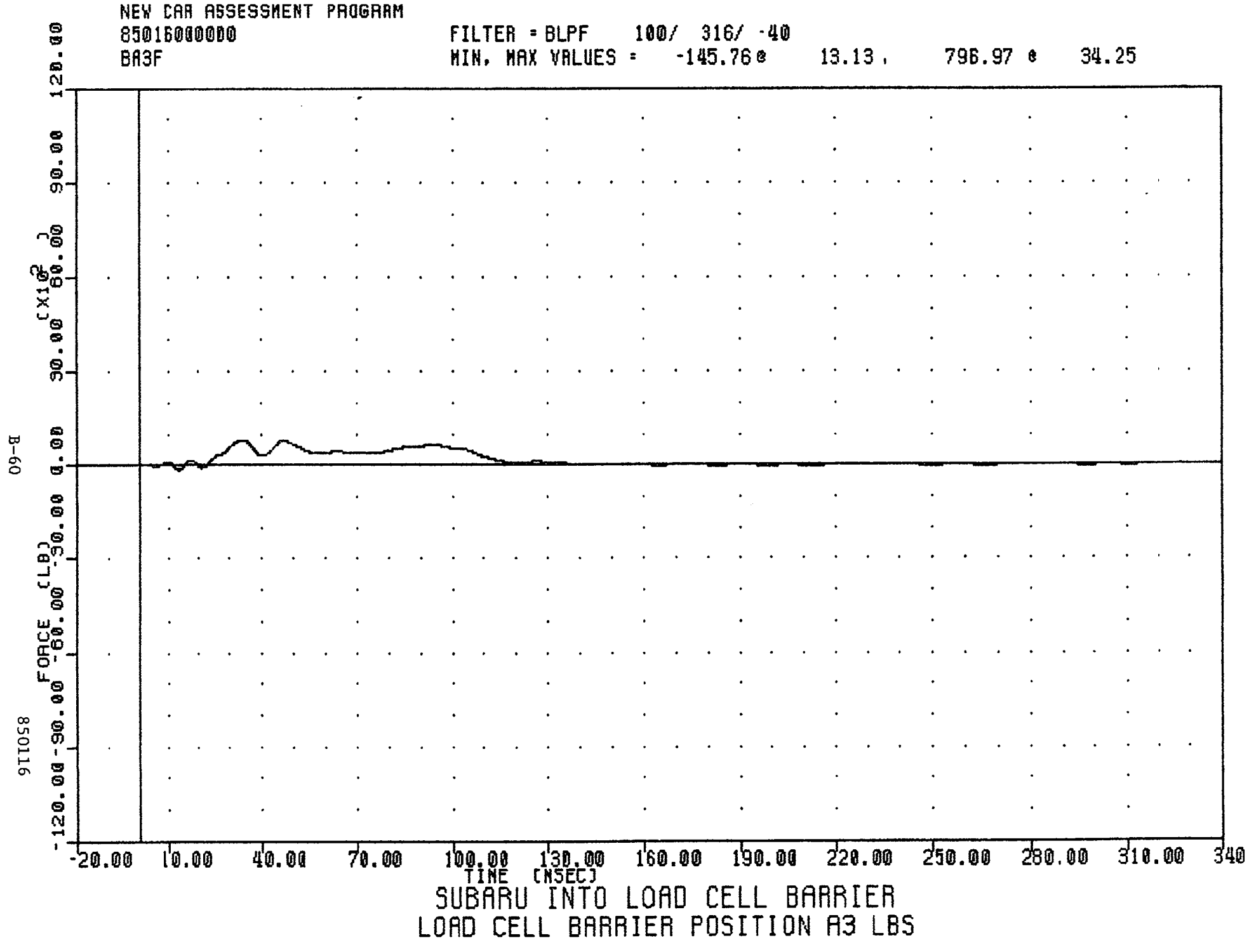

NEW CAR ASSESSMENT PROGRAM
850160000000
BA1F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -276.67 @ 24.88 , 221.69 @ 20.75
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
34
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A1 LBS



850116

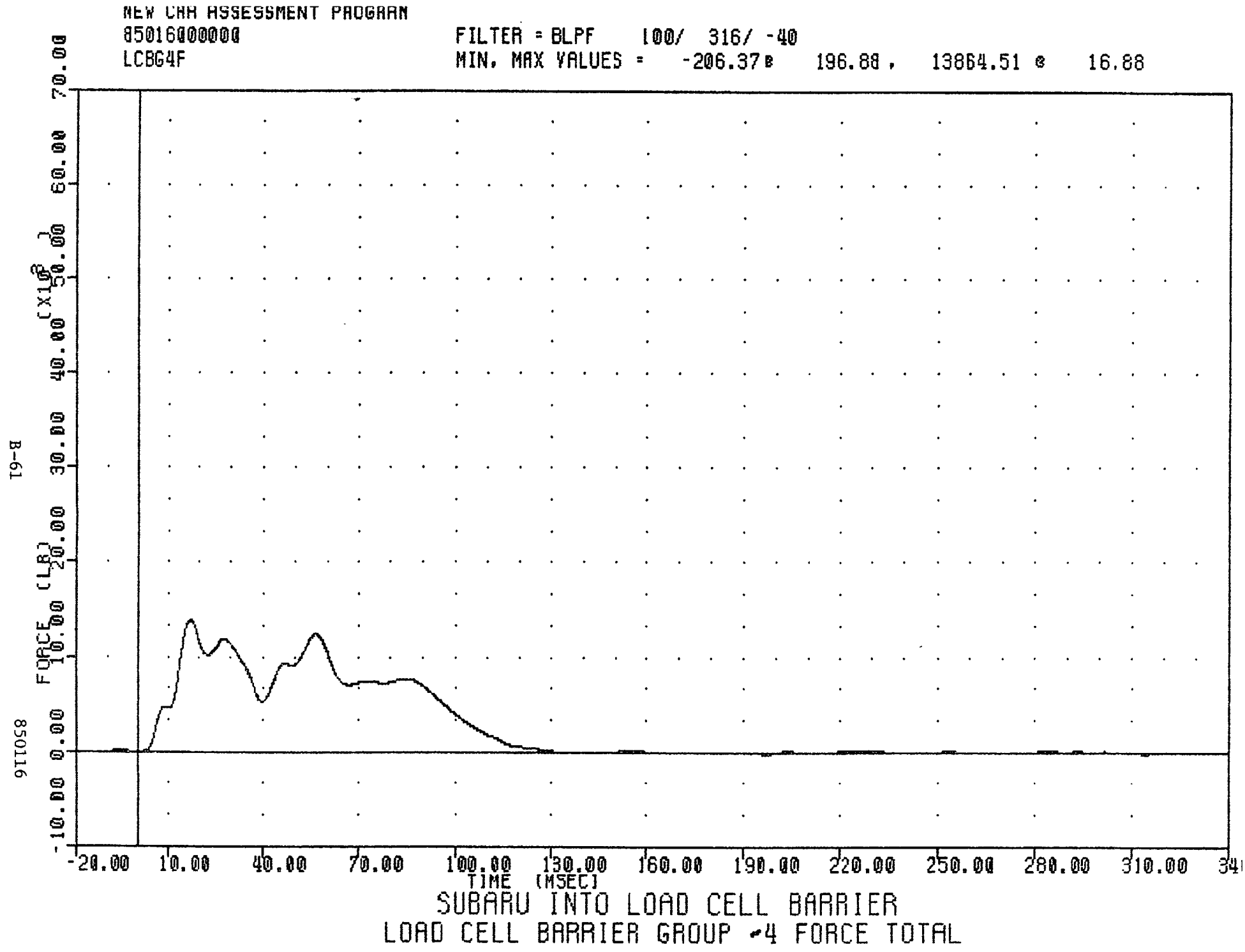


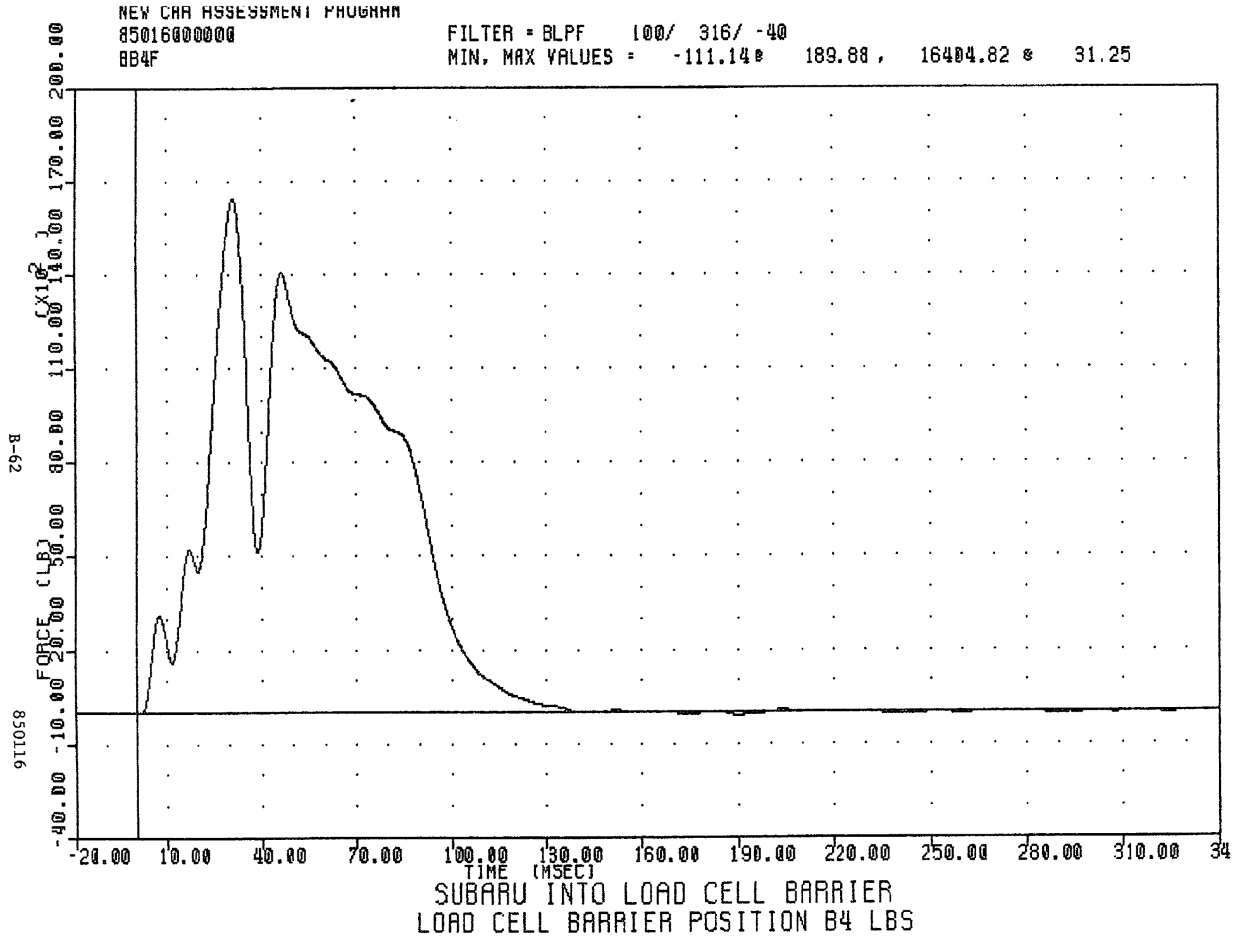

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A2 LBS


NEW CAR ASSESSMENT PROGRAM
850160000000
BA3F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -145.76 @ 13.13 , 796.97 @ 34.25
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A3 LBS



850116

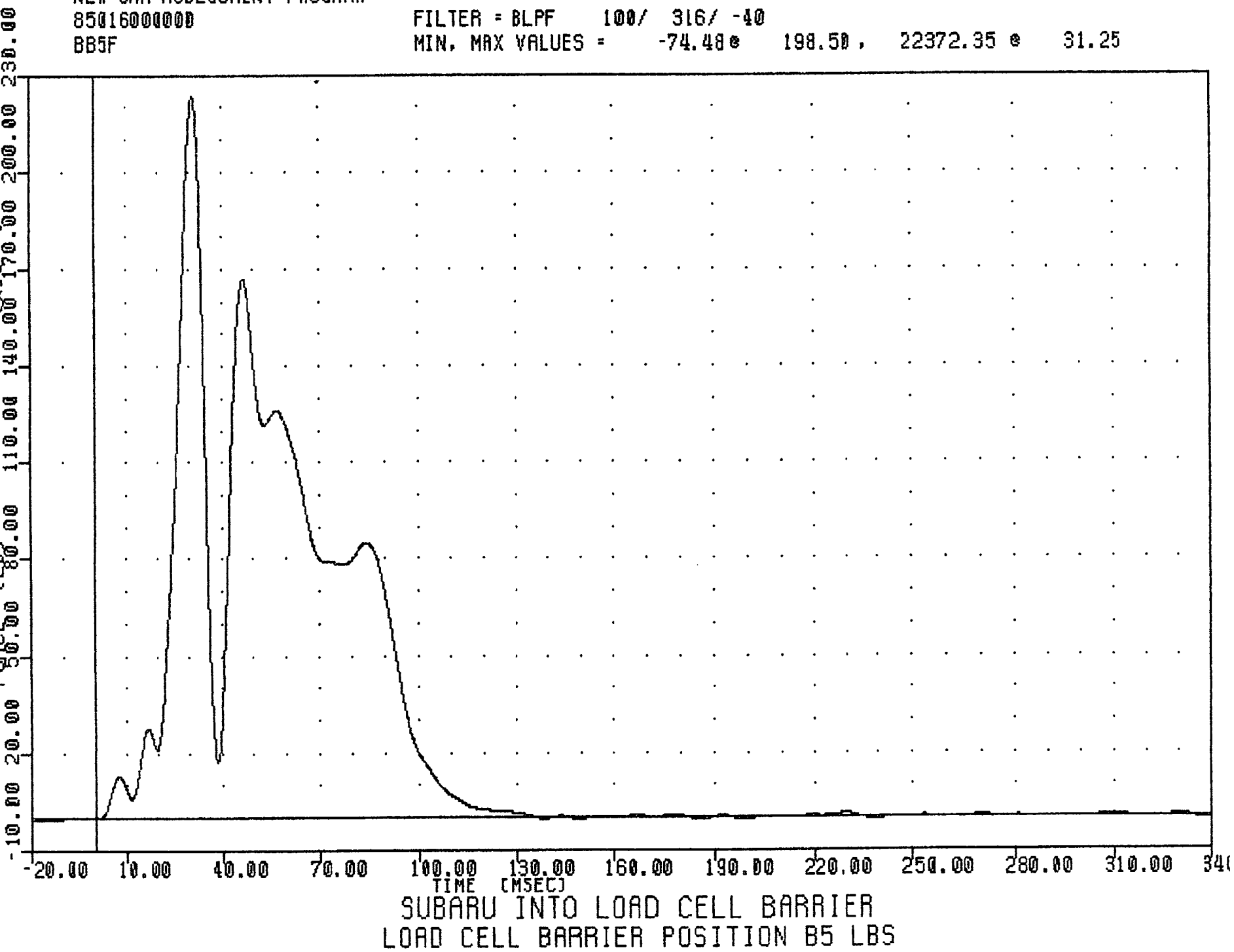

NEW CAR ASSESSMENT PROGRAM
850160000000
LCBG4F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -206.37 @ 196.88 , 13864.51 @ 16.88
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
FORCE (LB) (X10^3)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP -4 FORCE TOTAL

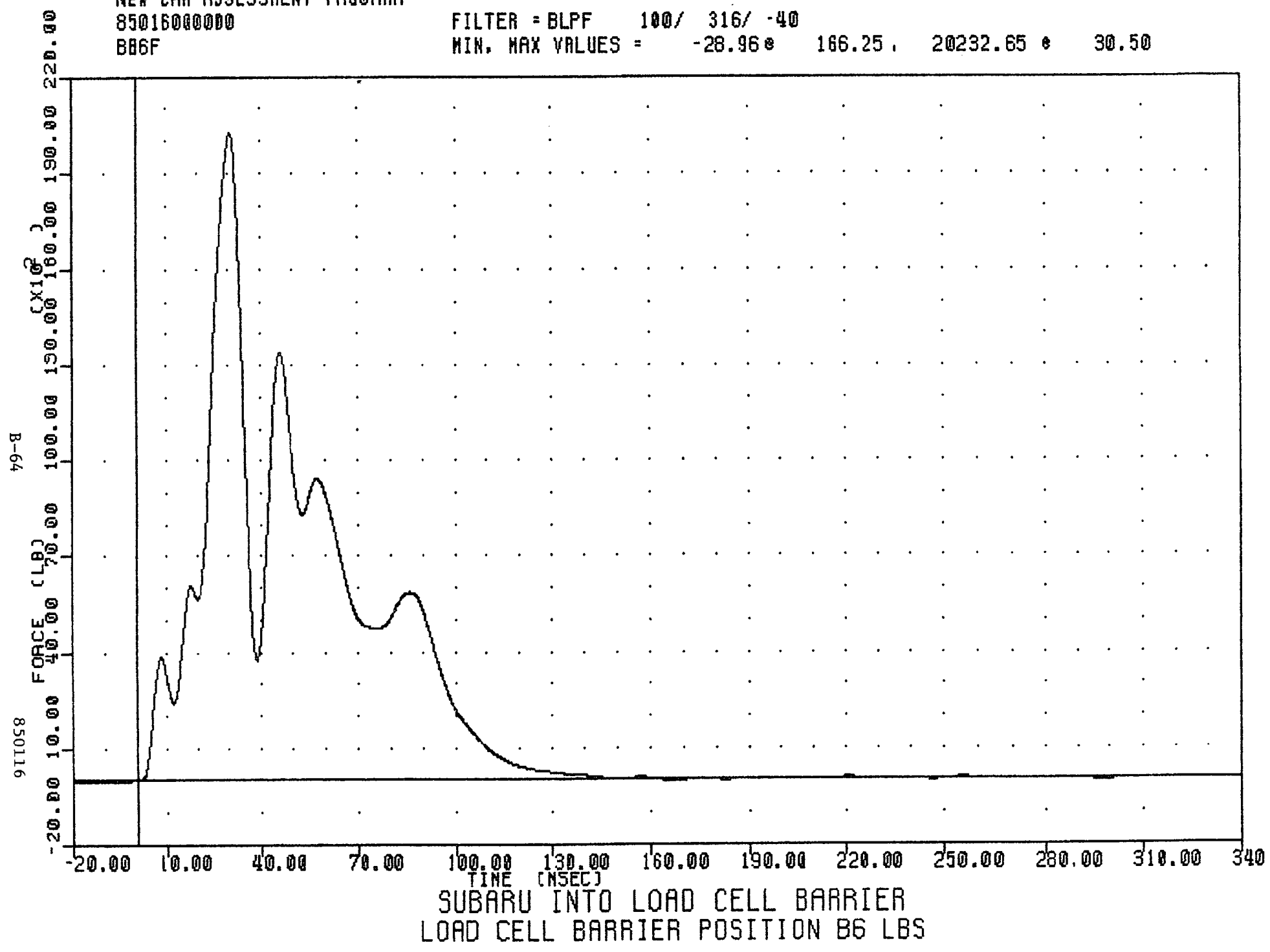


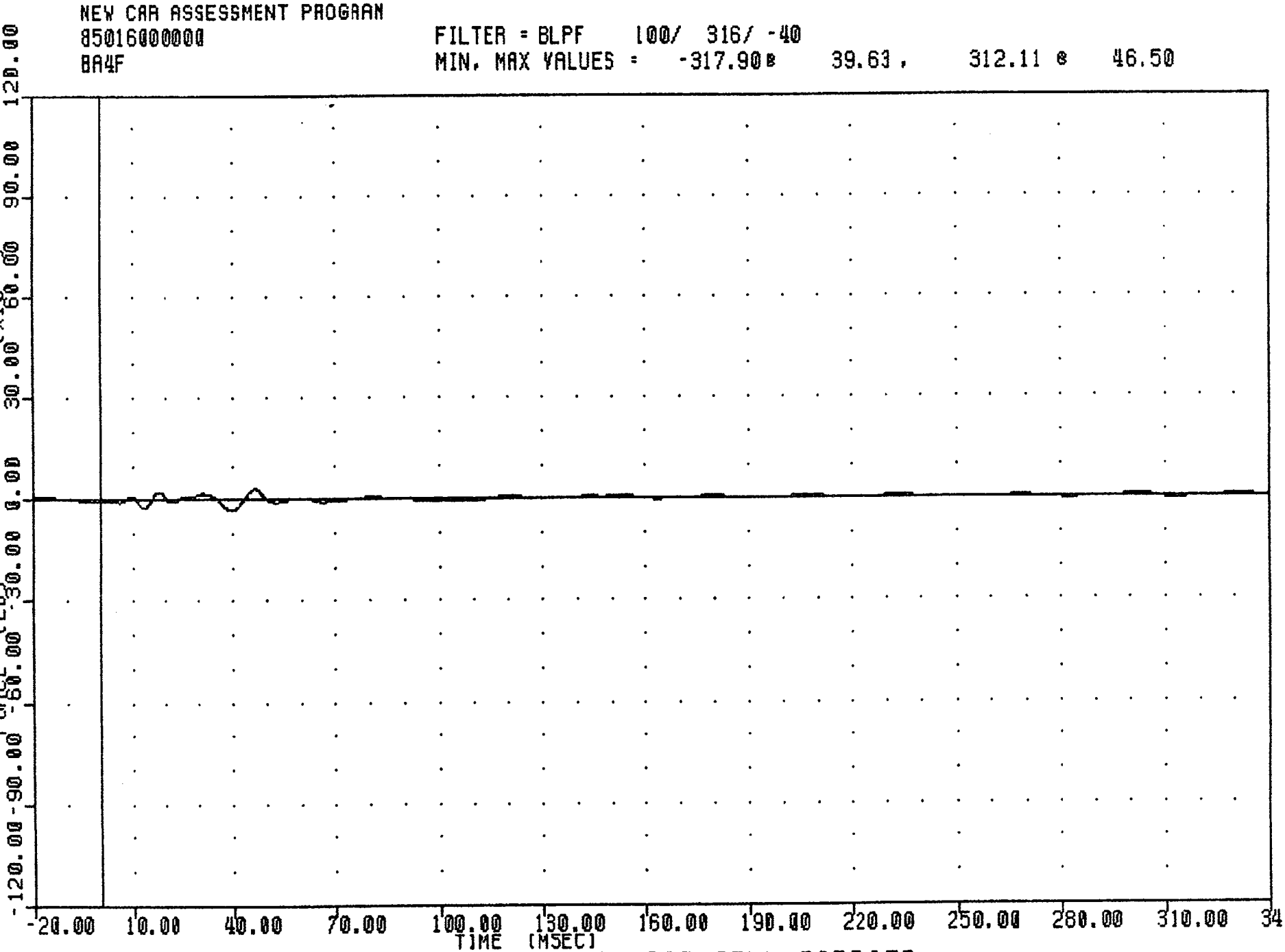

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B4 LBS



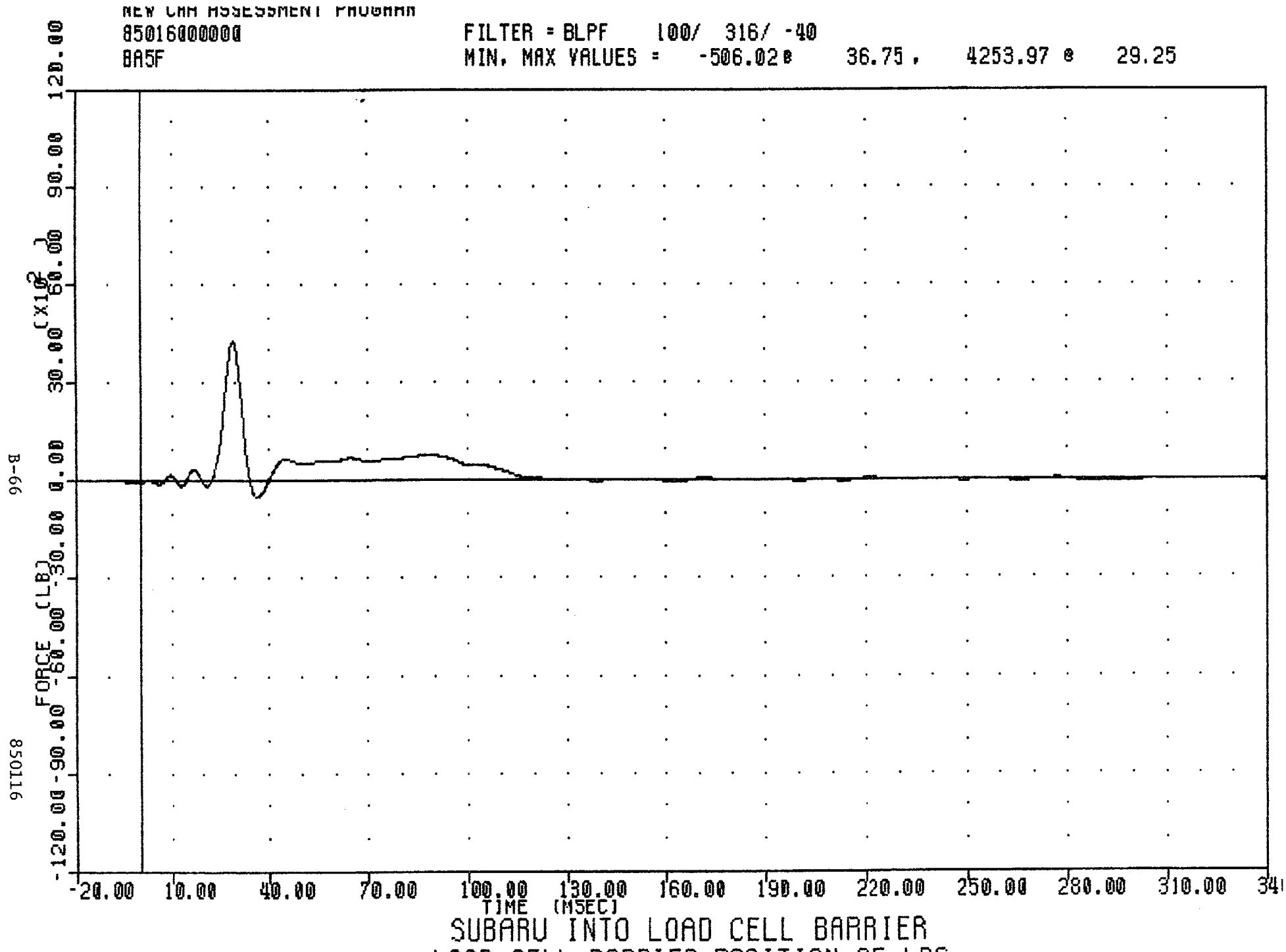
850116


NEW CAR ASSESSMENT PROGRAM
850160000D
BB5F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -74.48 @ 198.50 , 22372.35 @ 31.25
FORCE (LB) (X10^2)
-10.00 20.00 50.00 80.00 110.00 140.00 170.00 200.00 230.00
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B5 LBS


NEW CAR ASSESSMENT PROGRAM
850160000000
B86F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -28.96 @ 166.25 , 20232.65 @ 30.50
FORCE (LB) (X10^2)
-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
TIME (MSEC)
B-64
850116
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B6 LBS

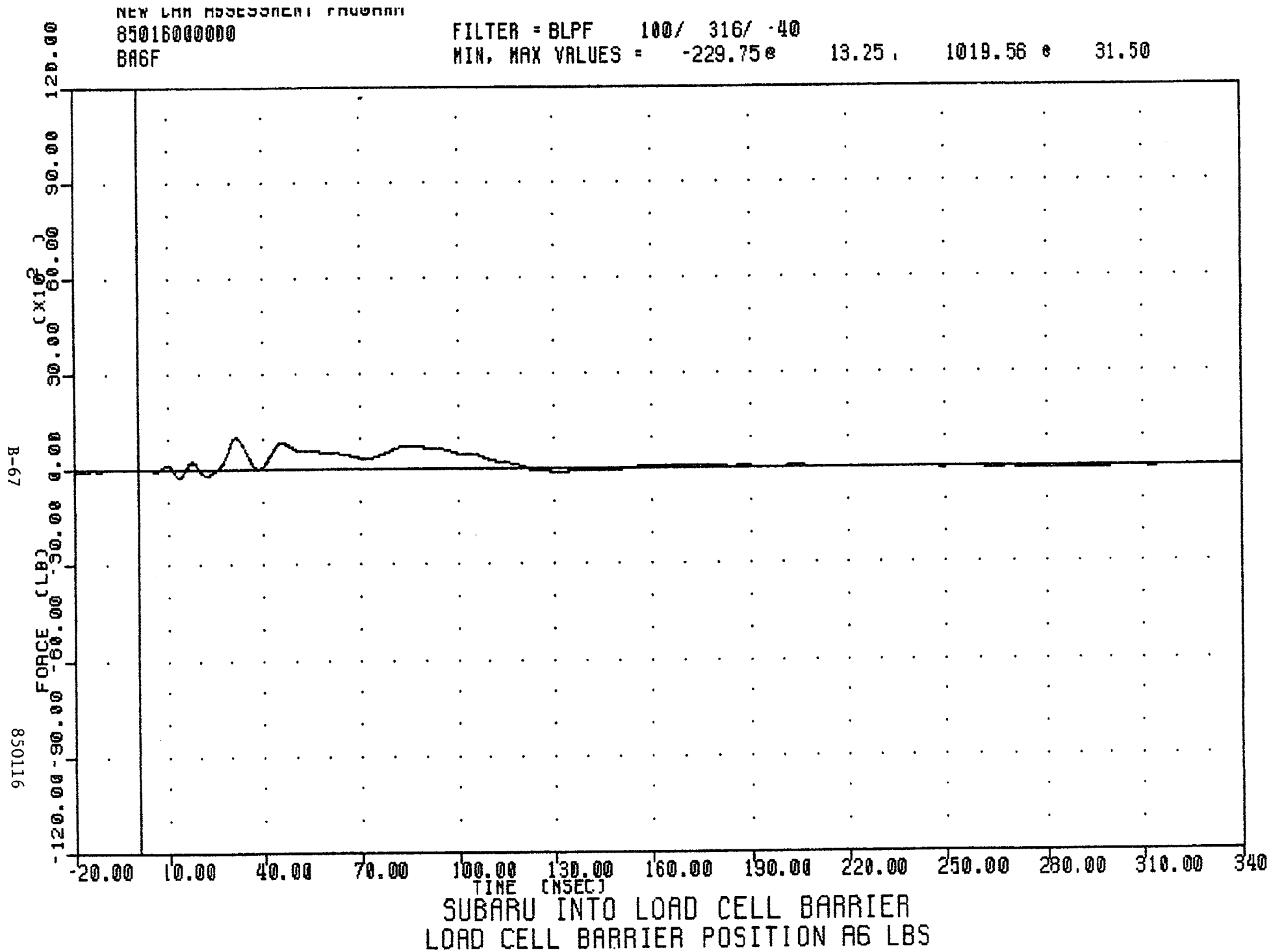



SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A4 LBS


NEW CAR ASSESSMENT PROGRAM
85016000000
BA5F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -506.02 @ 36.75 , 4253.97 @ 29.25
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A5 LBS



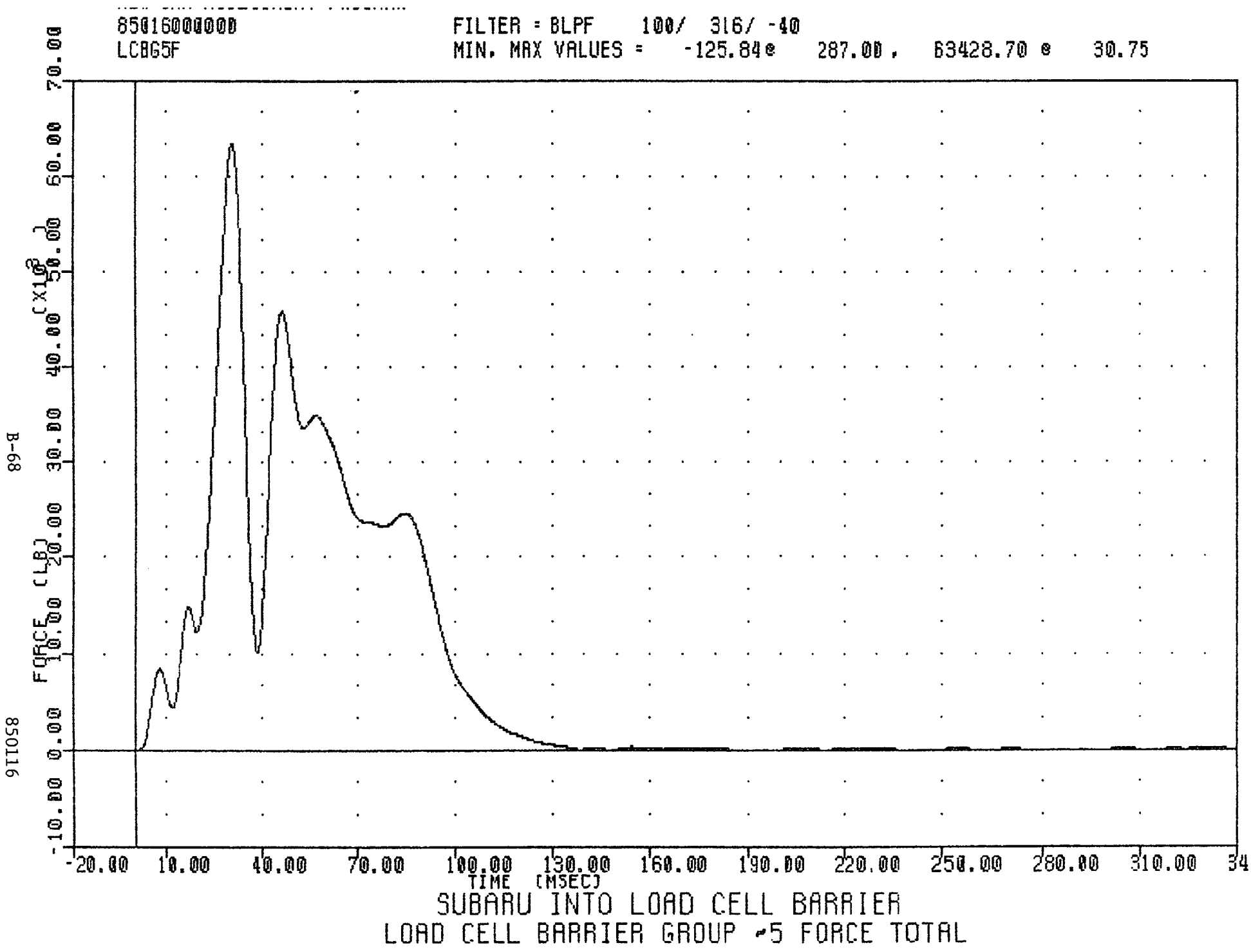
850116

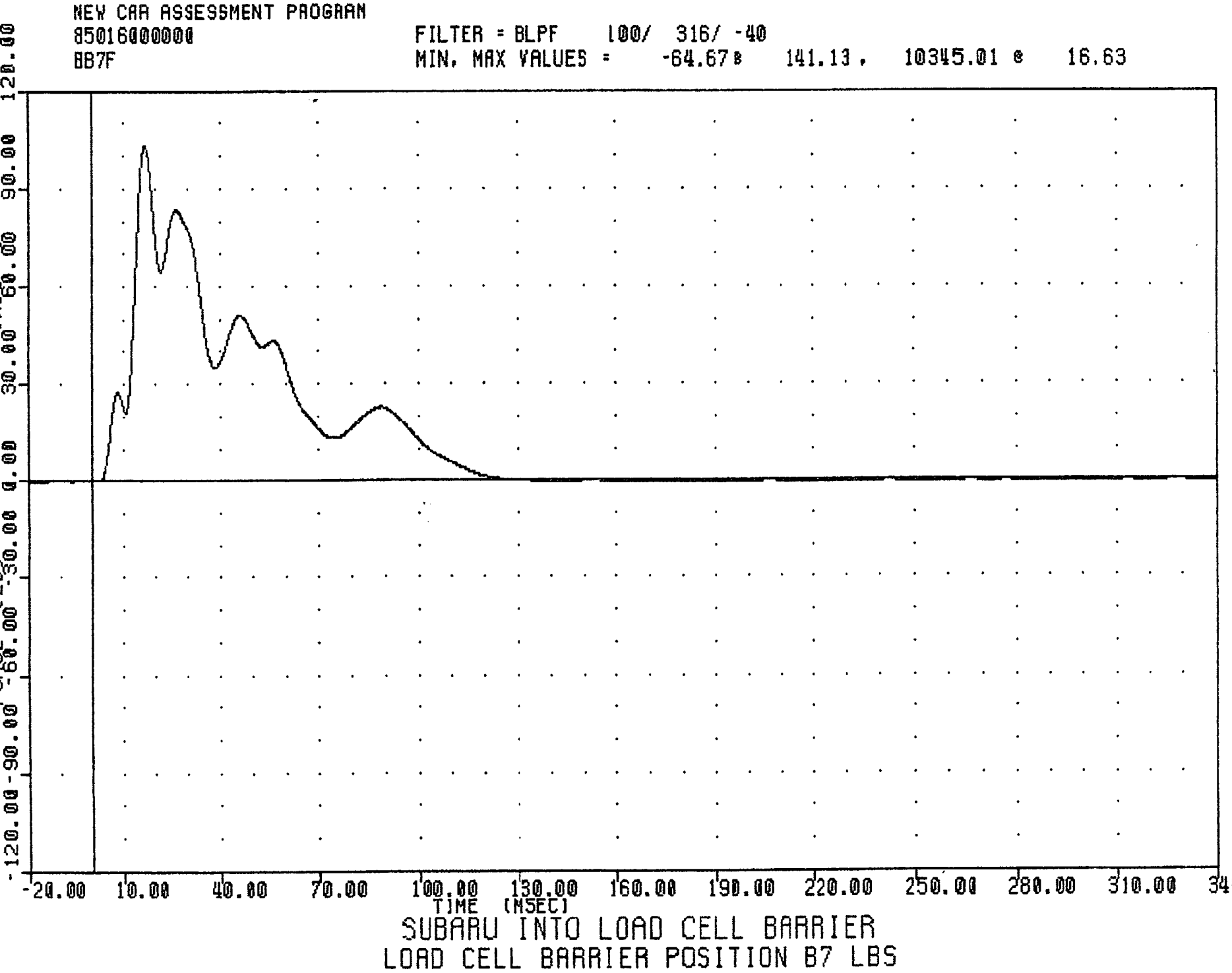


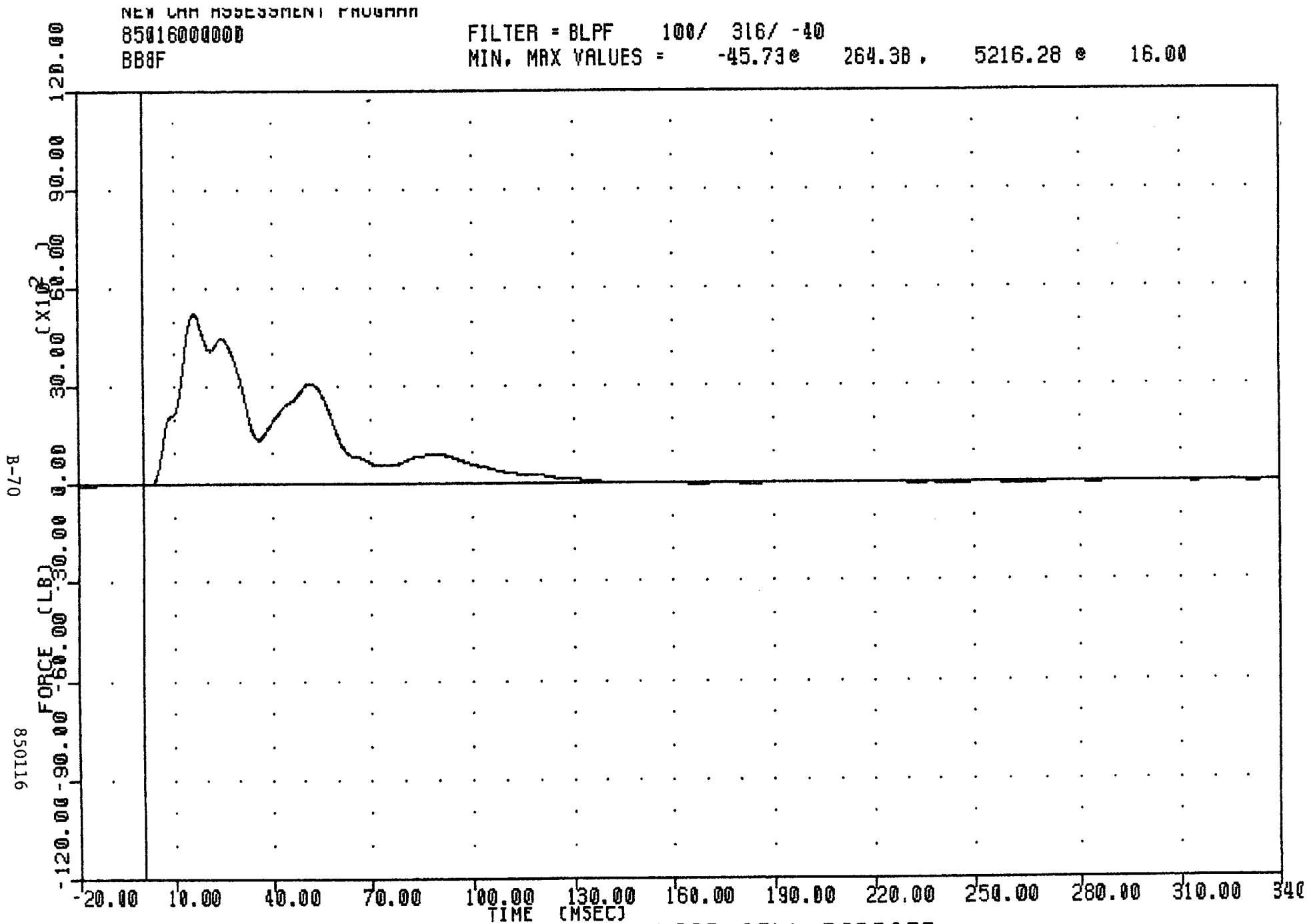

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A6 LBS



850116


85016000000
LCBG5F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -125.84 @ 287.00 , 63428.70 @ 30.75
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP #5 FORCE TOTAL


NEW CAR ASSESSMENT PROGRAM
850160000000
BB7F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -64.67 @ 141.13 , 10345.01 @ 16.63
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B7 LBS



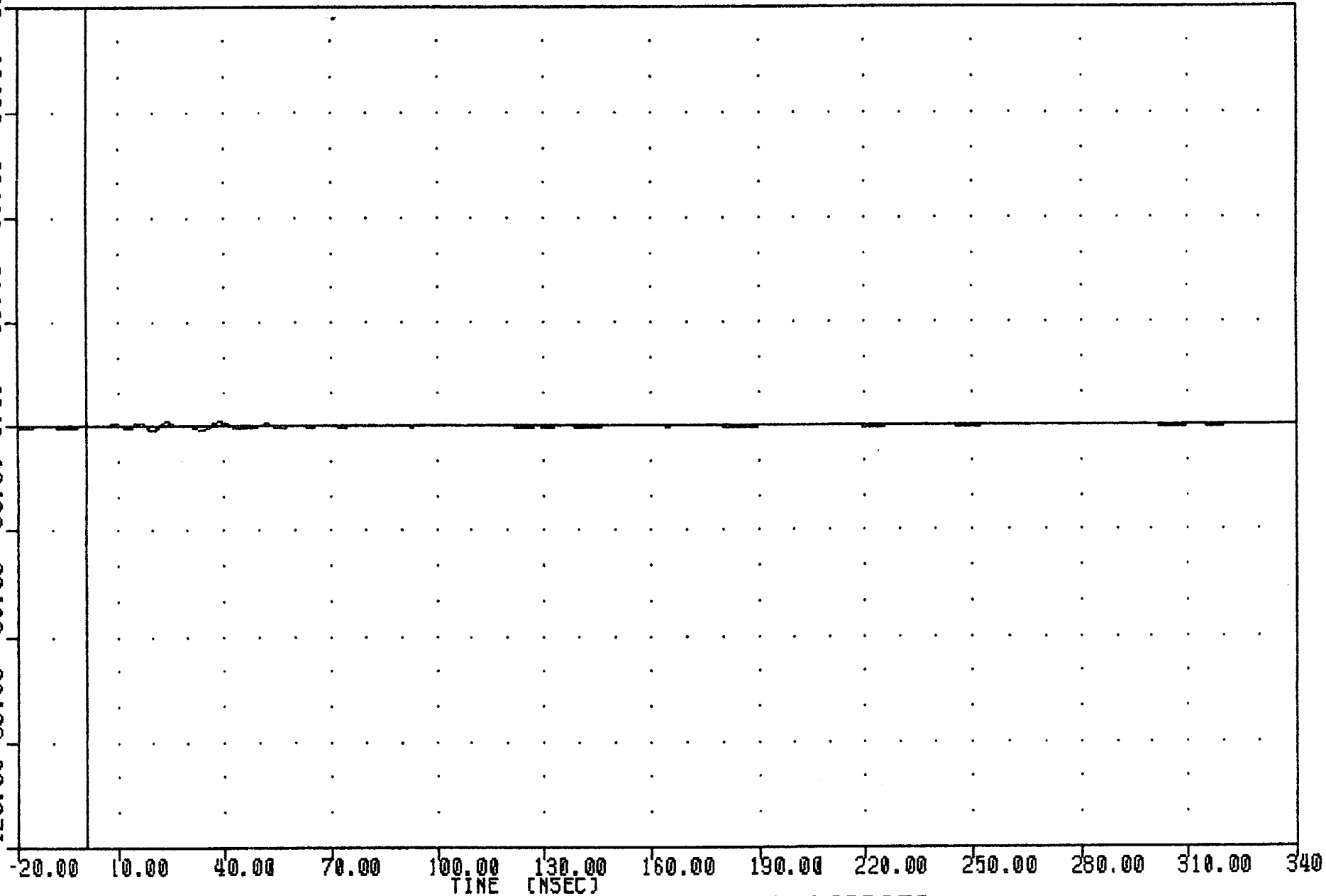

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B8 LBS



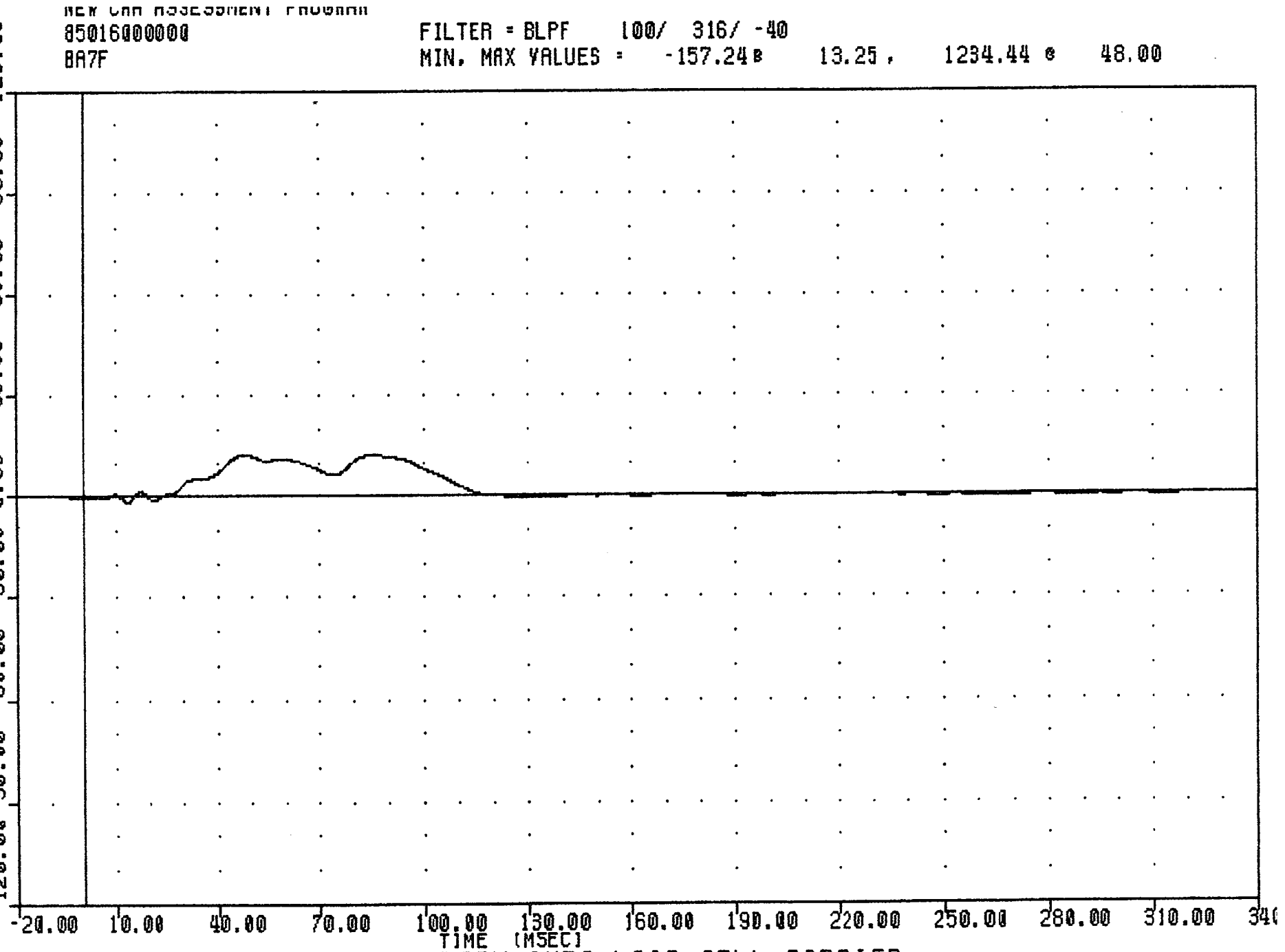
850116

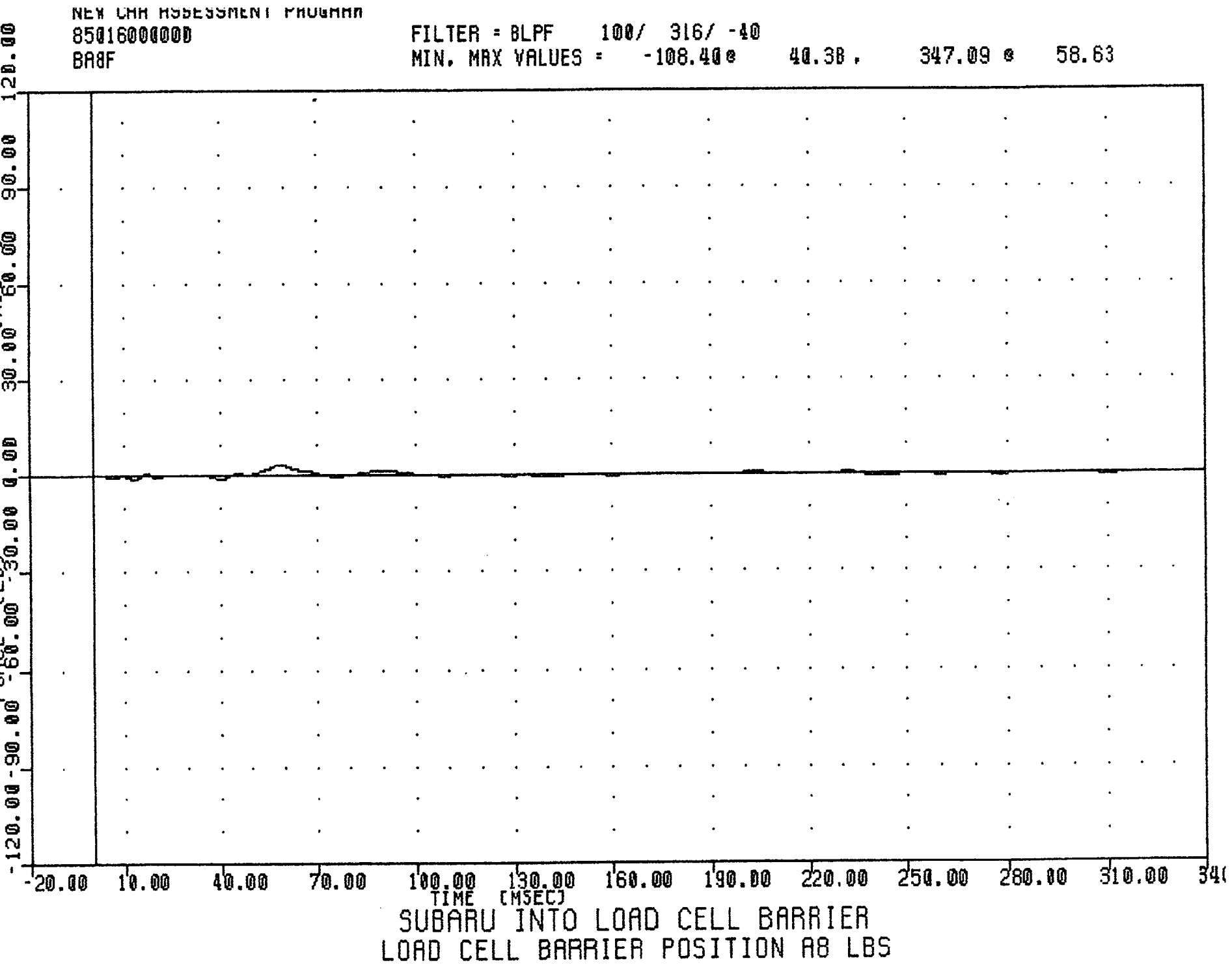
NEW CAR ASSESSMENT PROGRAM
850160000000
B89F

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -118.33 @ 19.75 , 126.62 @ 23.88



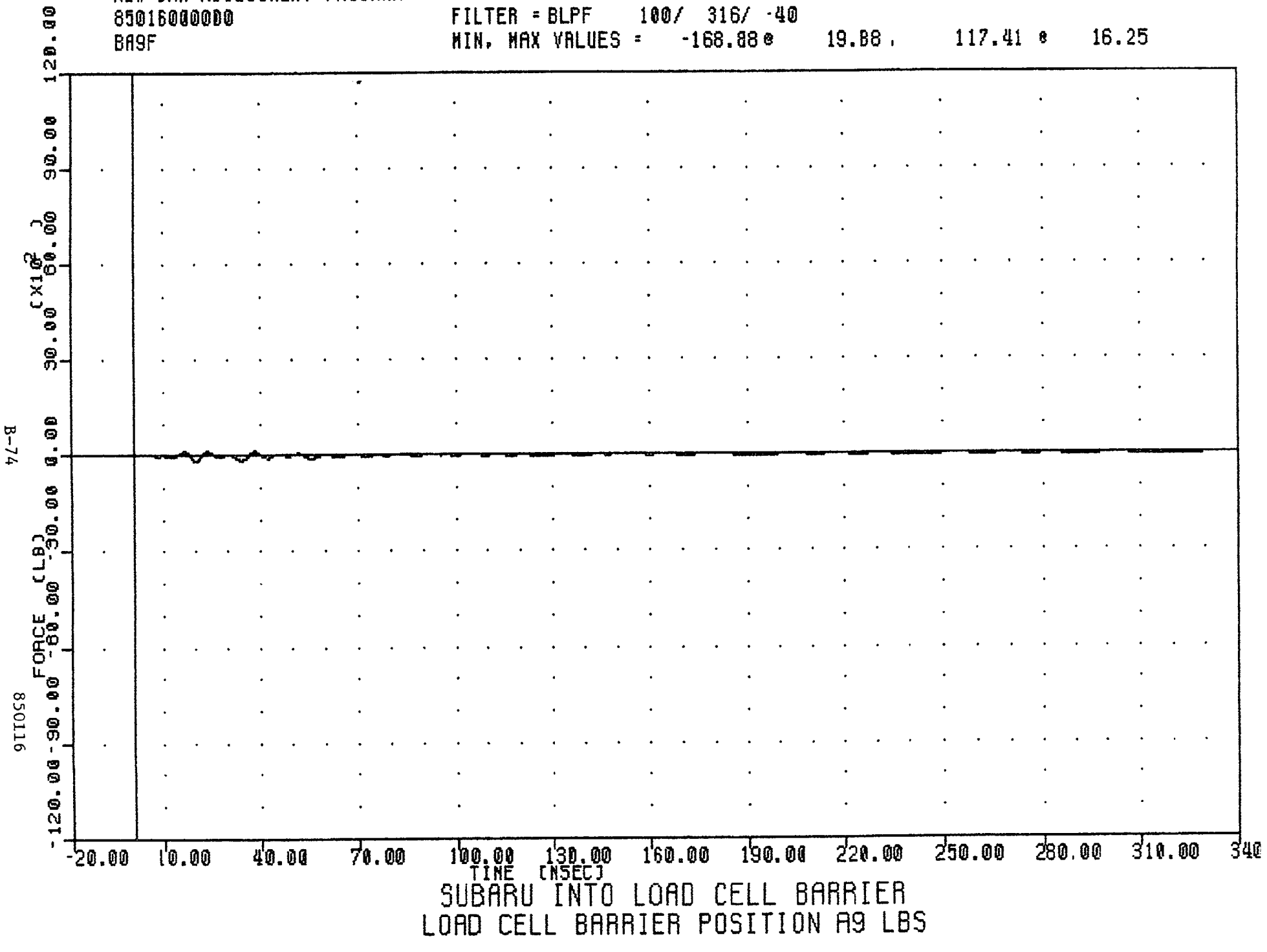

SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION B9 LBS

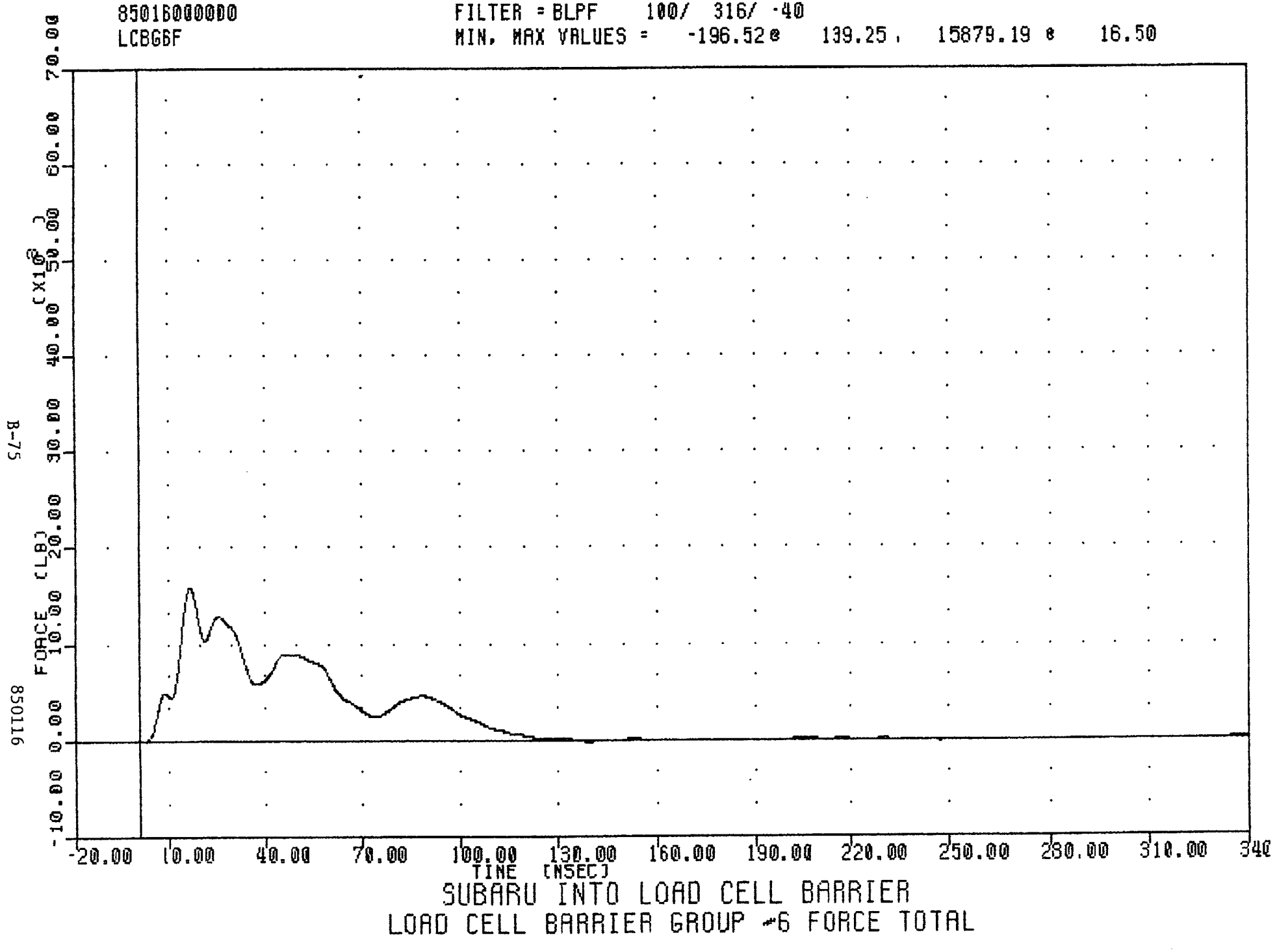

NEW CAR ASSESSMENT PROGRAM
850160000000
BA7F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -157.24 B 13.25 , 1234.44 @ 48.00
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE [LB] [X10^2]
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME [MSEC]
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A7 LBS

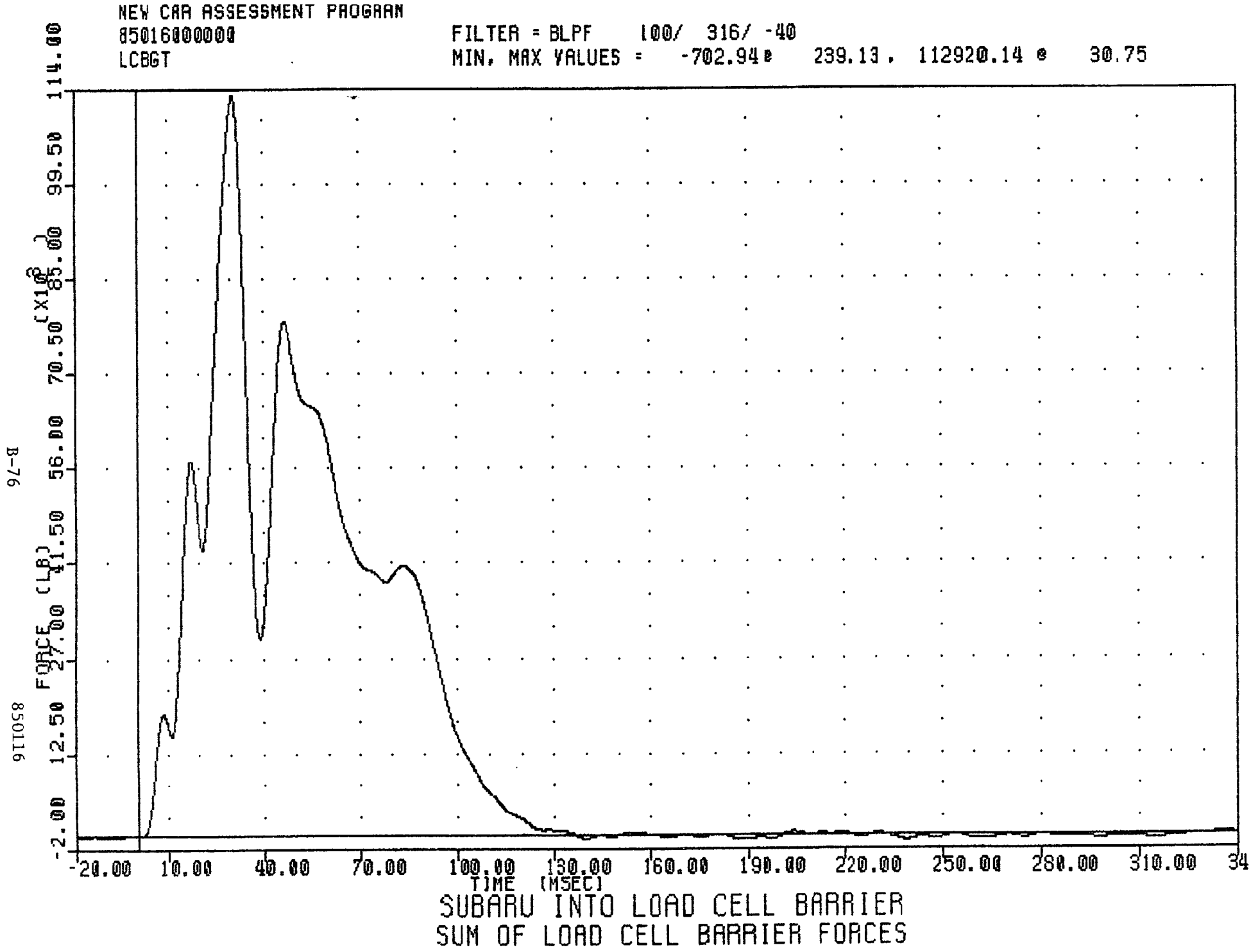

NEW CMH ASSESSMENT PROGRAM
85016000000
BA8F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -108.40 @ 40.38 , 347.09 @ 58.63
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A8 LBS



850116


NEW CAR ASSESSMENT PROGRAM
850160000D0
BA9F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -168.88 @ 19.88 , 117.41 @ 16.25
120.00
90.00
60.00
30.00
0.00
-30.00
-60.00
-90.00
-120.00
FORCE (LB) (X10^2)
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER POSITION A9 LBS


NEW CAR ASSESSMENT PROGRAM
850116000000
LCBG6F
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -196.52 @ 139.25 , 15879.19 @ 16.50
FORCE (LB) (X10^0)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
0.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
LOAD CELL BARRIER GROUP -6 FORCE TOTAL


NEW CAR ASSESSMENT PROGRAM
850160000000
LCBGT
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -702.94 @ 239.13 , 112920.14 @ 30.75
FORCE (LB) (X10^3)
-2.00
12.50
27.00
41.50
56.00
70.50
85.00
99.50
114.00
-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
TIME (MSEC)
SUBARU INTO LOAD CELL BARRIER
SUM OF LOAD CELL BARRIER FORCES

# APPENDIX C

## DUMMY CERTIFICATION

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

PART 572

TEMPERATURE 69.00 F
NHTSA NCA ED83003

RELATIVE HUMIDITY 37.00 %
572 SN 830 EXT. DIMENSIONS 03

| DESCRIPTION<br>SN ALDERSON RESEARCH LAB 830 | SPECIFICATION | TEST RESULTS |
|---|---|---|
| Sitting Height | 35.6 - 35.8IN | 35.6 INS |
| Shoulder Pivot Height | 21.8 - 22.4IN | 22.2 INS |
| Hip Pivot Height | 3.9 IN (ref.) | 3.9 INS |
| Hip Pivot From Backline | 4.8 IN (ref.) | 4.8 INS |
| Knee Pivot From Backline | 20.1 - 20.7IN | 20.5 INS |
| Rear of Head From Backline | 1.7 IN (ref) | 1.7 INS |
| Chest Depth | 9.1 - 9.6IN | 9.5 INS |
| Shoulder Width | 17.8 - 18.4IN | 18.1 INS |
| Chest Circumference Over Nipples | 36.8 - 40.0IN | 37.5 INS |
| Waist Circumference at Min. Girth | 31.4 - 32.6IN | 32.3 INS |
| Hip Width | 14.0 - 15.4IN | 14.6 INS |
| Knee Pivot From Floor | 19.3 - 19.9IN | 19.4 INS |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K. L. Walters

TEST SUPERVISOR R. E. LeVan

850116

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572

TEMPERATURE 70.00 F
NHTSA NCA LF83003

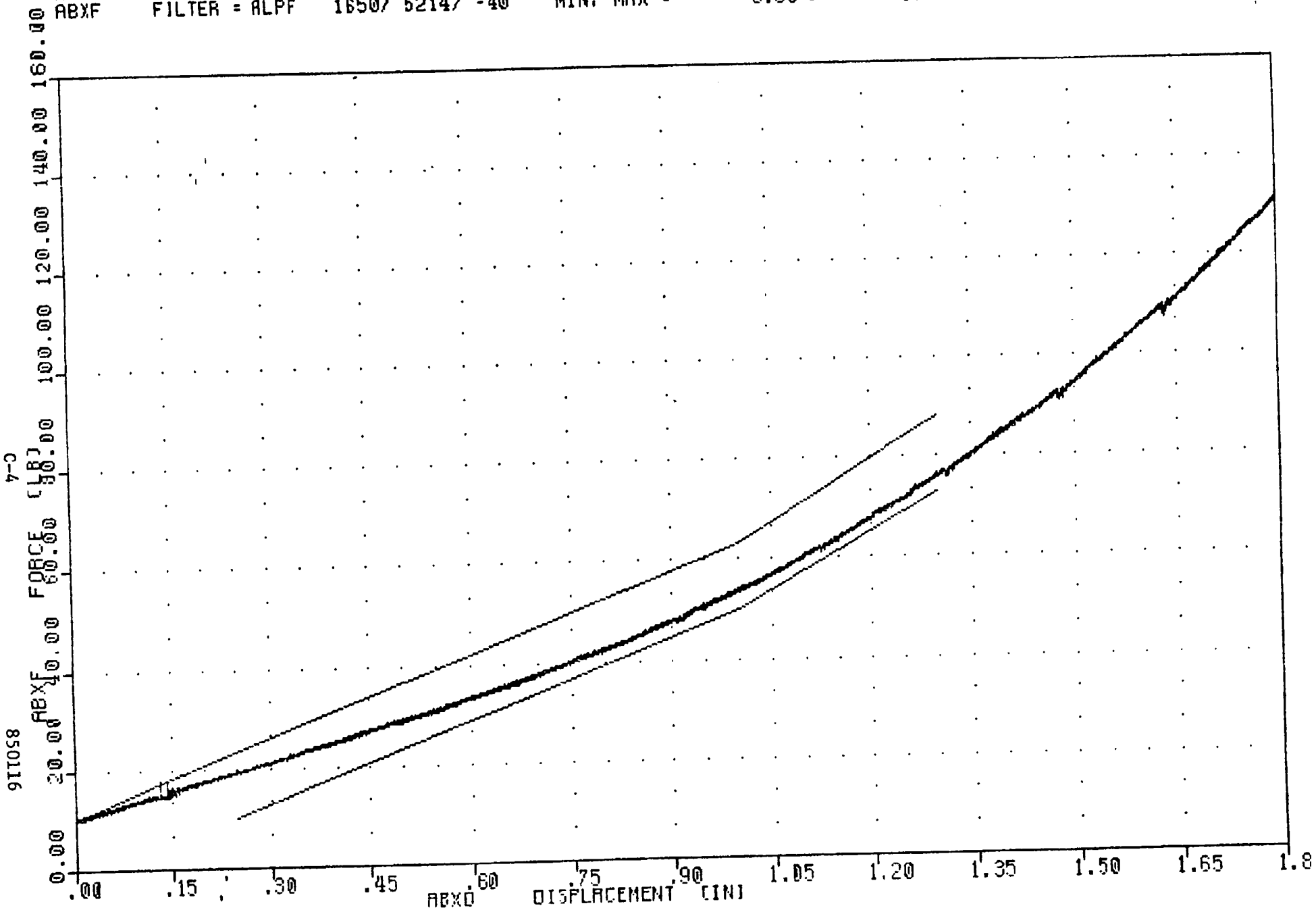
RELATIVE HUMIDITY 29.00 %
572 SN 830 LUMBAR FLEX CAL03

| DEFLECTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| 0 Deg. | 0 LBS | 0.00 LBS |
| 20 Deg | 22.00 - 34.00 LBS | 26.00 LBS |
| 30 Deg | 34.00 - 46.00 LBS | 40.00 LBS |
| 40 Deg | 46.00 - 58.00 LBS | 50.00 LBS |
| NET RETURN ANGLE | < 12 DEG | 9.30 DEG |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K. L. Walters
TEST SUPERVISOR R. E. LeVan

NHTSA NCA ,AB83003 572 SN 830 ABDOM COMPR CAL 03 84355 PLOT DATE 11-FEB-85 09:43:08
ABXD FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 0.00 0.00 1.80 130.43
ABXF FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 0.96 0.00 130.87 1.80




C-4

850116

FRONTAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572

TEMPERATURE 70.00 F
NHTSA NCA AB83003

RELATIVE HUMIDITY 29.00 %
572 SN 830 ABDOM COMPR CAL 03

| TEST CORRIDORS DISPLACEMENT | FORCE | TEST RESULTS |
|---|---|---|
| 0 IN. | 10 LBS | 10 LBS |
| .50 IN. | 23.00 - 36.00 LBS | 29.51 LBS |
| .75 IN. | 36.00 - 50.00 LBS | 40.15 LBS |
| 1.00 IN. | 50.00 - 63.00 LBS | 54.15 LBS |
| 1.30 IN. | 73.00 - 88.00 LBS | 76.18 LBS |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L Phelps

TEST SUPERVISOR V.L. Walters

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572

TEMPERATURE 70 F
NHTSA NCA HD83003

RELATIVE HUMIDITY 31 %
572 SN 830 HEAD DROP CAL 03

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PEAK RESULTANT ACCELERATION | 210 - 260 G | 226.56 G |
| TIME ABOVE 100 G LEVEL | 0.9 - 1.5 MS | 1.26 MS |
| PEAK LATERAL ACCELERATION | 10 G MAX | 8.28 G |
| IS ACCELERATION CURVE UNIMODAL? | | YES |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K. L. Watters
TEST SUPERVISOR R. E. LaVan

850116

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572

TEMPERATURE 70.00 F — RELATIVE HUMIDITY 26.00 %
NHTSA NCA HN83003 — 572 SN 830 HEAD/NECK CAL 03

| Test Parameter | Specification | Test Results |
|---|---|---|
| Pendulum velocity | 21.5 to 25.5 fps | 23.53 fps |
| Pendulum Deceleration: | | |
| T1 - T2: 5 - 20 G | 3 ms. max | 1.79 ms. |
| T2 - T3: 20 - 20 G | 25 - 30 ms. | 28.48 ms. |
| T3 - T4: 20 - 5 G | 10 ms. max | 4.83 ms. |
| Avg. G level T2 - T3 | 20 - 24 G | 23.58 G |
| Maximum Rotation Angle | 63 - 73 deg. | 68.21 deg. |
| Peak Head Resultant Accel | 26 G max | 24.29 G |

| Test Parameter | Specification | | Test Results | |
|---|---|---|---|---|
| Rotation Angle (degrees) | Time (ms.) | Chordal Disp. (in.) | Time (ms.) | Chordal Disp. (in.) |
| 0 | -2.0 - +2.0 | -0.5 - +0.5 | 1.13 | 0.01 |
| 30 | 25.6 - 34.4 | 2.1 - 3.1 | 30.14 | 2.28 |
| 60 | 40.3 - 51.7 | 4.3 - 5.3 | 45.15 | 4.31 |
| max | 53.2 - 66.8 | 5.0 - 6.0 | 57.13 | 5.10 |
| 60 | 67.0 - 83.0 | 4.3 - 5.3 | 70.43 | 4.46 |
| 30 | 85.4 - 104.6 | 2.1 - 3.1 | 88.37 | 2.23 |
| 0 | 101.0 - 123.0 | -0.5 - +0.5 | 102.21 | 0.12 |

* DUMMY MEETS SPECIFICATIONS

TECHNICAN Gary L. Phelps

TEST SUPERVISOR V. L. Walters



850116

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 71 F
NHTSA NCA TL83003

RELATIVE HUMIDITY 29 %
572 SN 830 L.S.THORAX CAL 03

| TEST PARAMETER | LOW SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 13.86-14.14 FT/SEC | 14.06 FT/SEC |
| PEAK DEFLECTION | 1.1 INCHES MAX. | 0.85 INCHES |
| PEAK RESISTIVE FORCE | 1,450. POUNDS MAX. | 1379. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 58.5% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K.L. Walters

TEST SUPERVISOR R.E. Lee

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 71 F
NHTSA NCA TH83003

RELATIVE HUMIDITY 28 %
572 SN 830 H.S.THORAX CAL 03

| TEST PARAMETER | HIGH SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 21.78-22.22 FT/SEC | 22.22 FT/SEC |
| PEAK DEFLECTION | 1.7 INCHES MAX. | 1.41 INCHES |
| PEAK RESISTIVE FORCE | 2,250. POUNDS MAX. | 2090. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 61.4% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K. L. Walters

TEST SUPERVISOR R. E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 71 F
LEFT KNEE
NHTSA NCA LK83003

RELATIVE HUMIDITY 34 %

572 SN 830 L.KNEE IMP CAL 03

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.96 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 2345.78 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.71 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L. Phelps

TEST SUPERVISOR K. L. Watters

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 71 F
RIGHT KNEE
NHTSA NCA RK83003

RELATIVE HUMIDITY 36 %

572 SN 830 R.KNEE IMP CAL 03

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.96 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 1856.02 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.89 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L. Phelps

TEST SUPERVISOR K.L. Watters

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

PART 572

TEMPERATURE 70.00 F
NHTSA NCA ED41101

RELATIVE HUMIDITY 39.00 %
572 SN 411 EXT. DIMENSIONS 01

| DESCRIPTION<br>SN HUMANOID 411 | SPECIFICATION | TEST RESULTS |
|---|---|---|
| Sitting Height | 35.6 - 35.8IN | 35.7 INS |
| Shoulder Pivot Height | 21.8 - 22.4IN | 22.3 INS |
| Hip Pivot Height | 3.9 IN (ref.) | 3.9 INS |
| Hip Pivot From Backline | 4.8 IN (ref.) | 4.8 INS |
| Knee Pivot From Backline | 20.1 - 20.7IN | 20.5 INS |
| Rear of Head From Backline | 1.7 IN (ref) | 1.7 INS |
| Chest Depth | 9.1 - 9.6IN | 9.5 INS |
| Shoulder Width | 17.8 - 18.4IN | 17.9 INS |
| Chest Circumference Over Nipples | 36.8 - 40.0IN | 37.2 INS |
| Waist Circumference at Min. Girth | 31.4 - 32.6IN | 32.6 INS |
| Hip Width | 14.0 - 15.4IN | 14.3 INS |
| Knee Pivot From Floor | 19.3 - 19.9IN | 19.5 INS |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN J. J. Walters

TEST SUPERVISOR R. E. LeVan

850116

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572

TEMPERATURE 70.00 F
NHTSA NCA LF41101

RELATIVE HUMIDITY 36.00 %
572 SN 411 LUMBAR FLEX CAL01

| DEFLECTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| 0 Deg. | 0 LBS | 0.00 LBS |
| 20 Deg | 22.00 - 34.00 LBS | 30.00 LBS |
| 30 Deg | 34.00 - 46.00 LBS | 43.00 LBS |
| 40 Deg | 46.00 - 58.00 LBS | 51.00 LBS |
| NET RETURN ANGLE | < 12 DEG | 11.60 DEG |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.J. Watters

TEST SUPERVISOR R.E. LeVan

# ABDOMINAL COMPRESSION TEST

## PART 572

TEMPERATURE 70.00 F
NHTSA NCA AB41101

RELATIVE HUMIDITY 29.00 %
572 SN 411 ABDOM COMPR CAL 01

| TEST CORRIDORS DISPLACEMENT | FORCE | TEST RESULTS |
|---|---|---|
| 0 IN. | 10 LBS | 10 LBS |
| .50 IN. | 23.00 - 36.00 LBS | 27.64 LBS |
| .75 IN. | 36.00 - 50.00 LBS | 40.04 LBS |
| 1.00 IN. | 50.00 - 63.00 LBS | 56.83 LBS |
| 1.30 IN. | 73.00 - 88.00 LBS | 83.53 LBS |

DUMMY MEETS SPECIFICATIONS

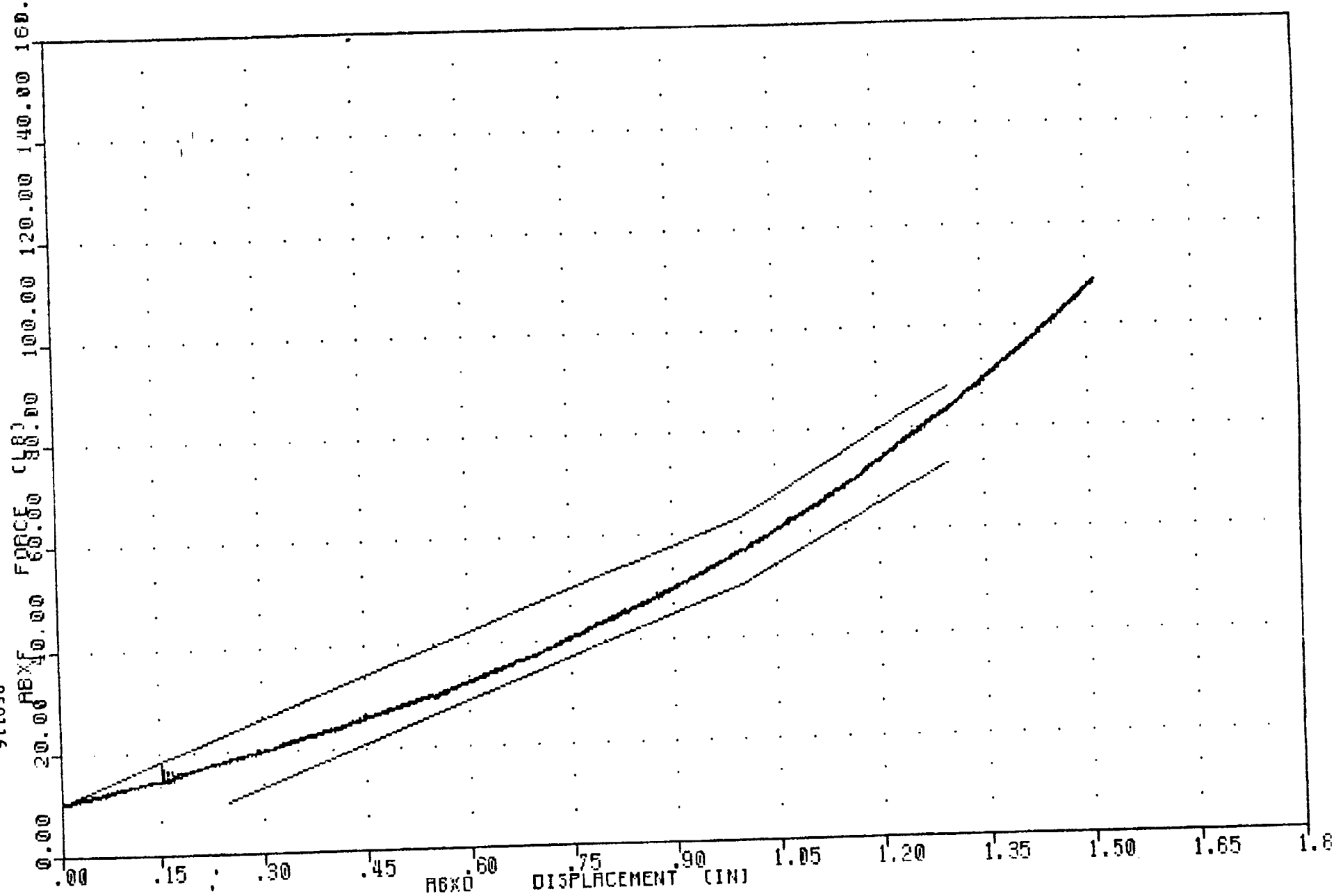
TECHNICIAN Mary L. Phelps

TEST SUPERVISOR V. L. Watters

NHTSA NCA ,AB41101 572 SN 411 ABDOM COMPR CAL 01 84355 PLOT DATE 11-FEB-85 09:36:04

ABXD FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 0.00 @ 0.00 , 1.51 @ 108.78

ABXF FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 0.98 @ 0.00 , 108.78 @ 1.51




ABDOMINAL COMPRESSION VS DISPLACEMENT

C-15

850116

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572

TEMPERATURE 70 F
NHTSA NCA HD41101

RELATIVE HUMIDITY 24 %
572 SN 411 HEAD DROP CAL 01

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PEAK RESULTANT ACCELERATION | 210 - 260 G | 254.75 G |
| TIME ABOVE 100 G LEVEL | 0.9 - 1.5 MS | 1.25 MS |
| PEAK LATERAL ACCELERATION | 10 G MAX | 5.03 G |
| IS ACCELERATION CURVE UNIMODAL? | | YES |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K.J. Watters

TEST SUPERVISOR R.E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572

TEMPERATURE 70.00 F — RELATIVE HUMIDITY 25.00 %
NHTSA NCA HN41101 — 572 SN 411 HEAD/NECK CAL 01

| Test Parameter | Specification | Test Results |
|---|---|---|
| Pendulum velocity | 21.5 to 25.5 fps | 22.22 fps |
| Pendulum Deceleration: | | |
| T1 - T2: 5 - 20 G | 3 ms. max | 1.97 ms. |
| T2 - T3: 20 - 20 G | 25 - 30 ms. | 25.49 ms. |
| T3 - T4: 20 - 5 G | 10 ms. max | 9.91 ms. |
| Avs. G level T2 - T3 | 20 - 24 G | 21.46 G |
| Maximum Rotation Angle | 63 - 73 deg. | 68.57 deg. |
| Peak Head Resultant Accel | 26 G max | 21.39 G |

| Test Parameter | Specification | | Test Results | |
|---|---|---|---|---|
| Rotation Angle (degrees) | Time (ms.) | Chordal Disp. (in.) | Time (ms.) | Chordal Disp. (in.) |
| 0 | -2.0 - +2.0 | -0.5 - +0.5 | 0.13 | 0.02 |
| 30 | 25.6 - 34.4 | 2.1 - 3.1 | 30.28 | 2.44 |
| 60 | 40.3 - 51.7 | 4.3 - 5.3 | 47.03 | 4.55 |
| max | 53.2 - 66.8 | 5.0 - 6.0 | 61.63 | 5.38 |
| 60 | 67.0 - 83.0 | 4.3 - 5.3 | 76.67 | 4.65 |
| 30 | 85.4 - 104.6 | 2.1 - 3.1 | 96.99 | 2.23 |
| 0 | 101.0 - 123.0 | -0.5 - +0.5 | 110.86 | 0.16 |

* DUMMY MEETS SPECIFICATIONS

TECHNICAN Gary L Phelps

TEST SUPERVISOR V. L. Watters

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 71 F
NHTSA NCA TL41101

RELATIVE HUMIDITY 25 %
572 SN 411 L.S. THORAX CAL 01

| TEST PARAMETER | LOW SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 13.86-14.14 FT/SEC | 14.04 FT/SEC |
| PEAK DEFLECTION | 1.1 INCHES MAX. | 0.93 INCHES |
| PEAK RESISTIVE FORCE | 1,450. POUNDS MAX. | 1293. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 55.9% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.J. Watters

TEST SUPERVISOR R.E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 71 F
NHTSA NCA TH41101

RELATIVE HUMIDITY 27 %
572 SN 411 H.S THORAX CAL 01

| TEST PARANETER | HIGH SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 21.78-22.22 FT/SEC | 22.22 FT/SEC |
| PEAK DEFLECTION | 1.7 INCHES MAX. | 1.39 INCHES |
| PEAK RESISTIVE FORCE | 2,250. POUNDS MAX. | 2036. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 58.8% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K.L. Walters

TEST SUPERVISOR R. E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 71 F
LEFT KNEE
NHTSA NCA LK41101

RELATIVE HUMIDITY 38 %

572 SN 411 L.KNEE IMP CAL 01

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.96 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 1947.49 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.75 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L. Phelps

TEST SUPERVISOR V. L. Watters

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 70 F
RIGHT KNEE
NHTSA NCA RK41101

RELATIVE HUMIDITY 38 %

572 SN 411 R.KNEE IMP CAL 01

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.96 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 1852.93 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.81 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L. Phelps

TEST SUPERVISOR K.L. Watters

POST-TEST CALIBRATION

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

PART 572

TEMPERATURE 73.00 F
NHTSA NCA ED83004

RELATIVE HUMIDITY 40.00 %
572 SN830 EXT.DIMENSIONS CAL04

| DESCRIPTION<br>SN ALDERSON RESEARCH LAB 830 | SPECIFICATION | TEST RESULTS |
|---|---|---|
| Sitting Height | 35.6 - 35.8IN | 35.6 INS |
| Shoulder Pivot Height | 21.8 - 22.4IN | 22.2 INS |
| Hip Pivot Height | 3.9 IN (ref.) | 3.9 INS |
| Hip Pivot From Backline | 4.8 IN (ref.) | 4.8 INS |
| Knee Pivot From Backline | 20.1 - 20.7IN | 20.3 INS |
| Rear of Head From Backline | 1.7 IN (ref) | 1.7 INS |
| Chest Depth | 9.1 - 9.6IN | 9.4 INS |
| Shoulder Width | 17.8 - 18.4IN | 17.9 INS |
| Chest Circumference Over Nipples | 36.8 - 40.0IN | 37.9 INS |
| Waist Circumference at Min. Girth | 31.4 - 32.6IN | 32.5 INS |
| Hip Width | 14.0 - 15.4IN | 14.8 INS |
| Knee Pivot From Floor | 19.3 - 19.9IN | 19.5 INS -- |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.L. Watters

TEST SUPERVISOR R.E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572

TEMPERATURE 73.00 F
NHTSA NCA LFB3004

RELATIVE HUMIDITY 40.00 %
572 SN 830 LUMBAR FLEX CAL

| DEFLECTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| 0 Deg. | 0 LBS | 0.00 LBS |
| 20 Deg | 22.00 - 34.00 LBS | 26.00 LBS |
| 30 Deg | 34.00 - 46.00 LBS | 35.00 LBS |
| 40 Deg | 46.00 - 58.00 LBS | 46.00 LBS |
| NET RETURN ANGLE | - 12 DEG | 9.00 DEG |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.L. Watters

TEST SUPERVISOR R.E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572

TEMPERATURE 74.00 F
NHTSA NCA AB83004

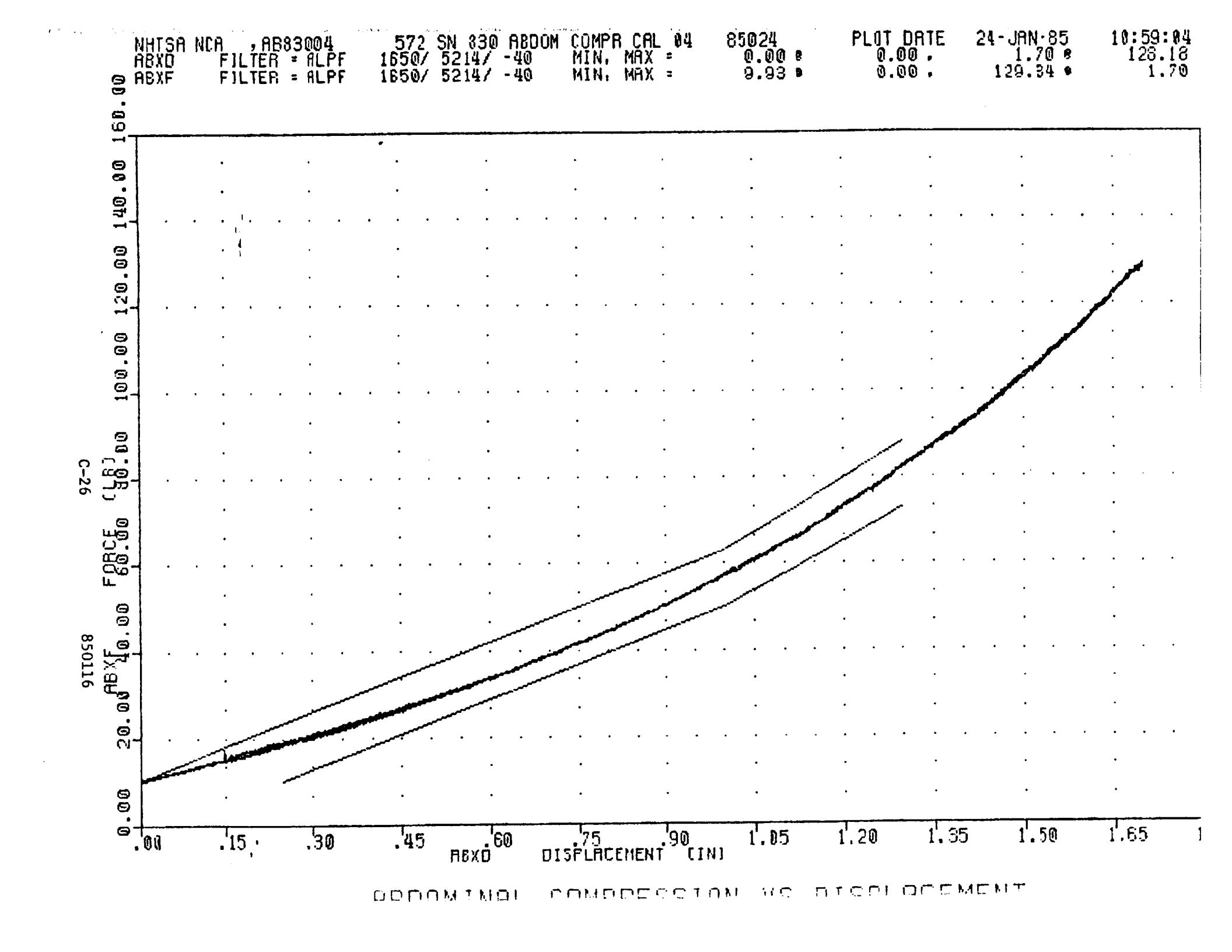
RELATIVE HUMIDITY 40.00 %
572 SN 830 ABDOM COMPR CAL 04

| TEST CORRIDORS DISPLACEMENT | FORCE | TEST RESULTS |
|---|---|---|
| 0 IN. | 10 LBS | 10 LBS |
| .50 IN. | 23.00 - 36.00 LBS | 28.76 LBS |
| .75 IN. | 36.00 - 50.00 LBS | 41.61 LBS |
| 1.00 IN. | 50.00 - 63.00 LBS | 57.52 LBS |
| 1.30 IN. | 73.00 - 88.00 LBS | 82.19 LBS |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L Phelps

TEST SUPERVISOR V.J. Wattes


NHTSA NCA ,AB83004 572 SN 330 ABDOM COMPR CAL 04 85024 PLOT DATE 24-JAN-85 10:59:04
ABXD FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 0.00 @ 0.00 . 1.70 @ 128.18
ABXF FILTER = ALPF 1650/ 5214/ -40 MIN, MAX = 9.93 @ 0.00 . 129.34 @ 1.70
ABXF FORCE (LB)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
.00
.15
.30
.45
.60
.75
.90
1.05
1.20
1.35
1.50
1.65
ABXD DISPLACEMENT (IN)
ABDOMINAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572

TEMPERATURE 73 F
NHTSA NCA HD83004

RELATIVE HUMIDITY 40 %
572 SN 830 HEAD DROP CAL 04

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PEAK RESULTANT ACCELERATION | 210 - 260 G | 224.40 G |
| TIME ABOVE 100 G LEVEL | 0.9 - 1.5 MS | 1.26 MS |
| PEAK LATERAL ACCELERATION | 10 G MAX | 7.60 G |
| IS ACCELERATION CURVE UNIMODAL? | | YES |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V. L. Watters

TEST SUPERVISOR R. E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572

TEMPERATURE 74.00 F
NHTSA NCA HN83004

RELATIVE HUMIDITY 41.00 %
572 SN 830 HEAD/NECK CAL 04

| Test Parameter | Specification | Test Results |
|---|---|---|
| Pendulum velocity | 21.5 to 25.5 fps | 23.53 fps |
| Pendulum Deceleration: | | |
| T1 - T2: 5 - 20 G | 3 ms. max | 1.76 ms. |
| T2 - T3: 20 - 20 G | 25 - 30 ms. | 29.20 ms. |
| T3 - T4: 20 - 5 G | 10 ms. max | 4.21 ms. |
| Avg. G level T2 - T3 | 20 - 24 G | 23.96 G |
| Maximum Rotation Angle | 63 - 73 deg. | 67.18 deg. |
| Peak Head Resultant Accel | 26 G max | 24.50 G |

| Test Parameter | Specification | | Test Results | |
|---|---|---|---|---|
| Rotation Angle (degrees) | Time (ms.) | Chordal Disp. (in.) | Time (ms.) | Chordal Disp. (in.) |
| 0 | -2.0 - +2.0 | -0.5 - +0.5 | 0.13 | 0.00 |
| 30 | 25.6 - 34.4 | 2.1 - 3.1 | 28.70 | 2.44 |
| 60 | 40.3 - 51.7 | 4.3 - 5.3 | 44.70 | 4.42 |
| max | 53.2 - 66.8 | 5.0 - 6.0 | 56.63 | 5.09 |
| 60 | 67.0 - 83.0 | 4.3 - 5.3 | 69.42 | 4.49 |
| 30 | 85.4 - 104.6 | 2.1 - 3.1 | 88.36 | 2.23 |
| 0 | 101.0 - 123.0 | -0.5 - +0.5 | 102.37 | 0.12 |

* DUMMY MEETS SPECIFICATIONS

TECHNICAN Gary L. Phelps

TEST SUPERVISOR

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 73 F
NHTSA NCA TL83004

RELATIVE HUMIDITY 41 %
572 SN 830 L.S.THORAX CAL 04

| TEST PARAMETER | LOW SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 13.86-14.14 FT/SEC | 14.04 FT/SEC |
| PEAK DEFLECTION | 1.1 INCHES MAX. | 0.93 INCHES |
| PEAK RESISTIVE FORCE | 1,450. POUNDS MAX. | 1371. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 60.0% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN K. L. Winters

TEST SUPERVISOR R. E. Snow

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

TEMPERATURE 73 F
NHTSA NCA TH83004

RELATIVE HUMIDITY 41 %
572 SN 830 H.S.THORAX CAL 04

| TEST PARAMETER | HIGH SPEED TEST SPECIFICATION | TEST RESULTS |
|---|---|---|
| PENDULUM VELOCITY | 21.78-22.22 FT/SEC | 22.22 FT/SEC |
| PEAK DEFLECTION | 1.7 INCHES MAX. | 1.43 INCHES |
| PEAK RESISTIVE FORCE | 2,250. POUNDS MAX. | 2083. POUNDS |
| INTERNAL HYSTERESIS | 50% - 70% | 59.7% |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.L. Witters

TEST SUPERVISOR R.E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 73 F
RIGHT KNEE
NHTSA NCA RK83004

RELATIVE HUMIDITY 41 %

572 SN 830 R.KNEE IMP CAL 14

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.96 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 2001.59 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.77 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Mary L. Helges

TEST SUPERVISOR V. J. Walters

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

TEMPERATURE 73 F RELATIVE HUMIDITY 11 %
LEFT KNEE
NHTSA NCA LK83004 572 SN 830 L.KNEE IMP CAL 04

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| PROBE VELOCITY | 6.76 - 7.04 FT/SEC | 6.94 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1850 - 2500 LBS. | 2327.40 LBS. |
| DURATION ABOVE 1000 LBS. | >=1.7 MS. | 1.75 MS. |

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gary L. Phelps

TEST SUPERVISOR K. J. Watters

# APPENDIX D

## RESTRAINT INSTRUCTION FROM OWNER'S MANUAL

## Front seat belts

The front seat belts equipped are the three-point type with an emergency locking retractor.

During sharp deceleration as when the vehicle suddenly stops, turns sharply, or strikes another object in an accident, the seat belt retractor automatically locks the belts. The belt is not locked if it is suddenly pulled out of the retrator by hand, but this is not a break down.

To fasten the front seat belt, pull the belt out of the retractor, then insert the tongue into the buckle until it snaps.

To unfasten the belt, push the button on the buckle.

**CAUTION:**

- **Never use a belt while twisted or reversed.**
- **Never wear the shoulder belt under the arm. If an accident occurs, it increases the risk or severity of injury.**

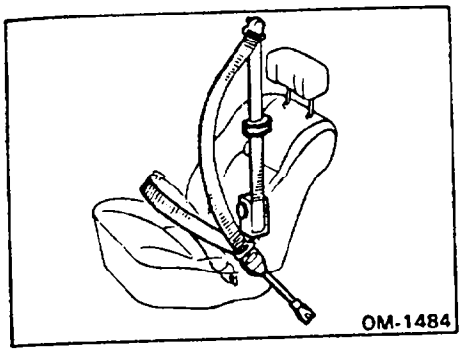
The three rear seat belts equipped are a two-point type.

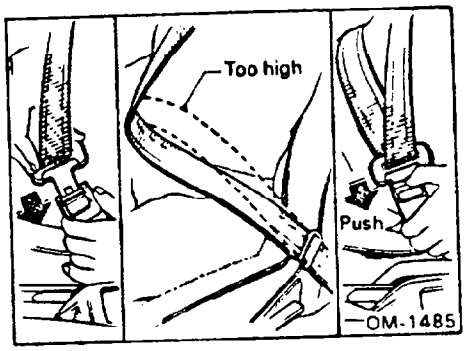
The belts for the two outside passengers have automatic locking retractors. The center belt is a manually adjusted type and belt length is adjusted at the tongue plate.

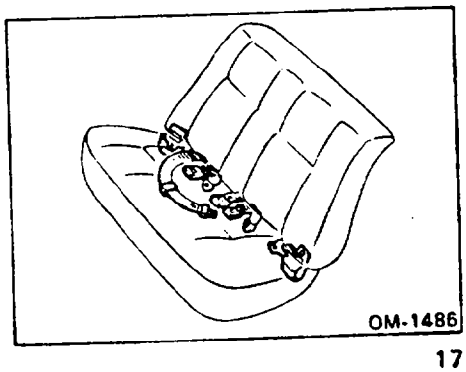
To fasten the rear seat belt, pull it out continuously from the retractor, then insert the tongue into the buckle until it snaps.

To unfasten the belt, push the button on the buckle.

Once pulling the belt stops and it is returned slightly, the belt will lock. If this happens and further adjustment is required, first return the belt to its original position, then pull it out again.



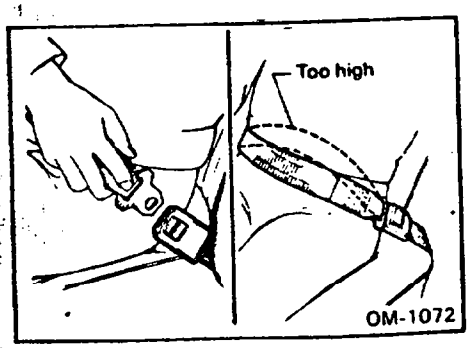






To unfasten the belt, push the button of the buckle.

**CAUTION:**

**Never use a belt while twisted or reversed.**





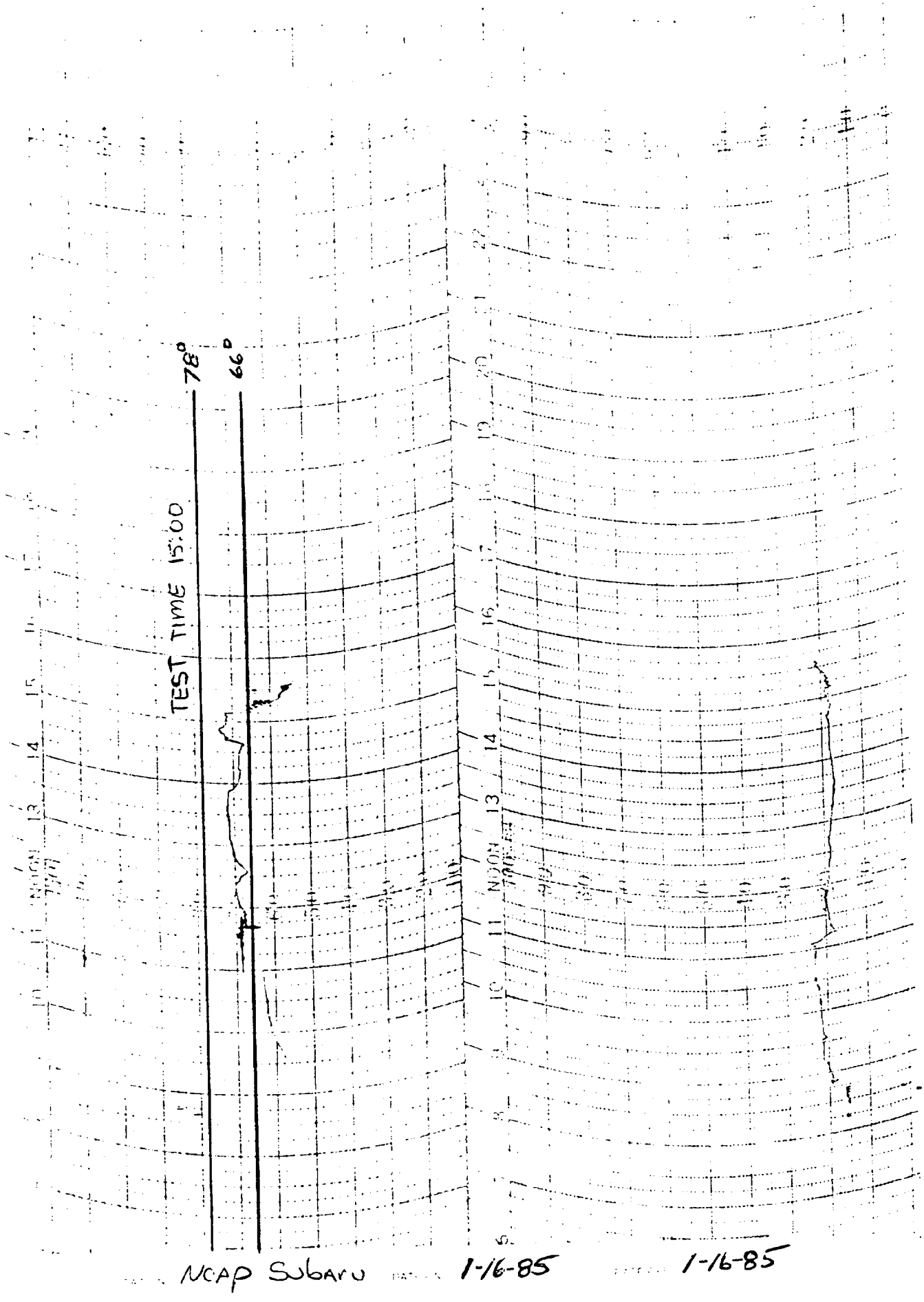

## Tips for seat belt

- To help reduce the risk or severity of injury in accidents or sudden stops, all persons riding in the vehicle should always protect themselves by using the seat belts provided.
- Make it a rule to have everyone, including the driver, fasten their seat belts before starting the vehicle.
- Always use one belt only for one person at a time.
- Position the lap belt across your lap as low as possible on your hips.

This is necessary to help reduce the risk or severity of injury in an accident. This spreads the force of the lap belt over the strong hip bones instead of across the soft abdomen.

- Never let any object enters the buckle or retractor. Anything inside will prevent them working properly.
- When fastening the front seat belt, take up the slack in the belt, pull the shoulder strap through tongue until the belt fits snugly. Then return the shoulder belt to its retractor until the shoulder strap also fits snugly.

- **Children.** It is recommended tha they sit in the rear seat and be restraine with the seat belts. If sitting in front, neve allow a child to stand up or kneel on th seat. Children especially should be re strained by seat belts at all times.
- **Baby or small child.** Using a chil safety seating system which fits your vehi cle is recommended. Before fitting always read the manufacturer's instruc tions carefully.
- **Expectant mother.** It is recommend ed to use a seat belt. Ask your doctor fo his recommendations. The lap belt shoulc be worn securely and as low as possible over the hips and not on the waist.


78°
66°
TEST TIME 15:00
NCAP Subaru
1-16-85
1-16-85