This is a translation to English for reference purpose of JNCAP test method which is originally prescribed in Japanese language.
Please be sure to refer to the Japanese test method if you need to be precisely correct.

NECK INJURY PROTECTION PERFORMANCE TEST FOR REAR-END COLLISION

Created: April 1, 2009
Revised: July 17, 2020
October 19, 2017

1. Effective Dates

This testing procedure went into effect April 1, 2009. The changes made on July 17, 2020 will go into effect starting July 17, 2020.

2. Scope of Application

This test procedure applies to the "Neck Injury Protection Performance Test for Rear-end Collision " of passenger vehicles with 9 occupants or less and commercial vehicles with a gross vehicle mass of 2.8 tons or less conducted by the National Agency for Automotive Safety and Victims' Aid (hereinafter referred to as the "NASVA") in the new car assessment program information supply project. Seats for the test are driver's seat and front passenger seat (same row of the driver seat and outer position in the vehicle).

3. Definition of Terms

The terms used in this test procedure are defined as follows:

(1) **Seat**: The seats for a driver and a front passenger in the vehicle.

(2) **Headrest**: A device designed to limit the rearward movement of an adult occupant's head in the event of a rear collision.

(3) **Dummy**: A model simulating the human body of adult male to be placed in the test vehicle seats. In this test, the BioRID II dummy is used.

(4) **Hip Point**: The base point measured by the specifications in Paragraph 5.5.1 to be included in every test seat.

(5) **HP (Hip Point) Manikin**: A device used to determine the hip point and actual torso angle (see SAE standard J826, 1999).

(6) **HRMD (Head Restraint Measuring Device)**: A device used with the hip point machine to measure the horizontal distance between the front surface of the head restraint and the rear of the dummy's head and the vertical distance between the top of the head restraint and the top of the dummy's head (see SAE paper 1999-01-0639).

(7) **Backset**: The horizontal distance between the front surface of the head restraint and the rear of the

dummy's head based on the procedure specified in Paragraph 5.5.2 using HRMD.

(8) **NIC**: The calculated Neck Injury Criterion combined with the head acceleration and acceleration on the first thoracic vertebra (T1 Acceleration) (see Figure 1.1). The calculation method is specified in Paragraph 8.2.3 (2).

(9) **Upper Neck Fx**: The shearing load on the upper neck loaded in the fore-aft direction (see Figure 1.2, (the same applies in (10) through (14)).

(10) **Upper Neck Fz**: The tensile load on the upper neck loaded in the vertical direction.

(11) **Upper Neck My**: The moment on the upper neck around the lateral axis.

(12) **Lower Neck Fx**: The shearing load on the lower neck loaded in the fore-aft direction.

(13) **Lower Neck Fz**: The tensile load on the lower neck loaded in the vertical direction.

(14) **Lower Neck My**: The moment on the lower neck around the lateral axis.

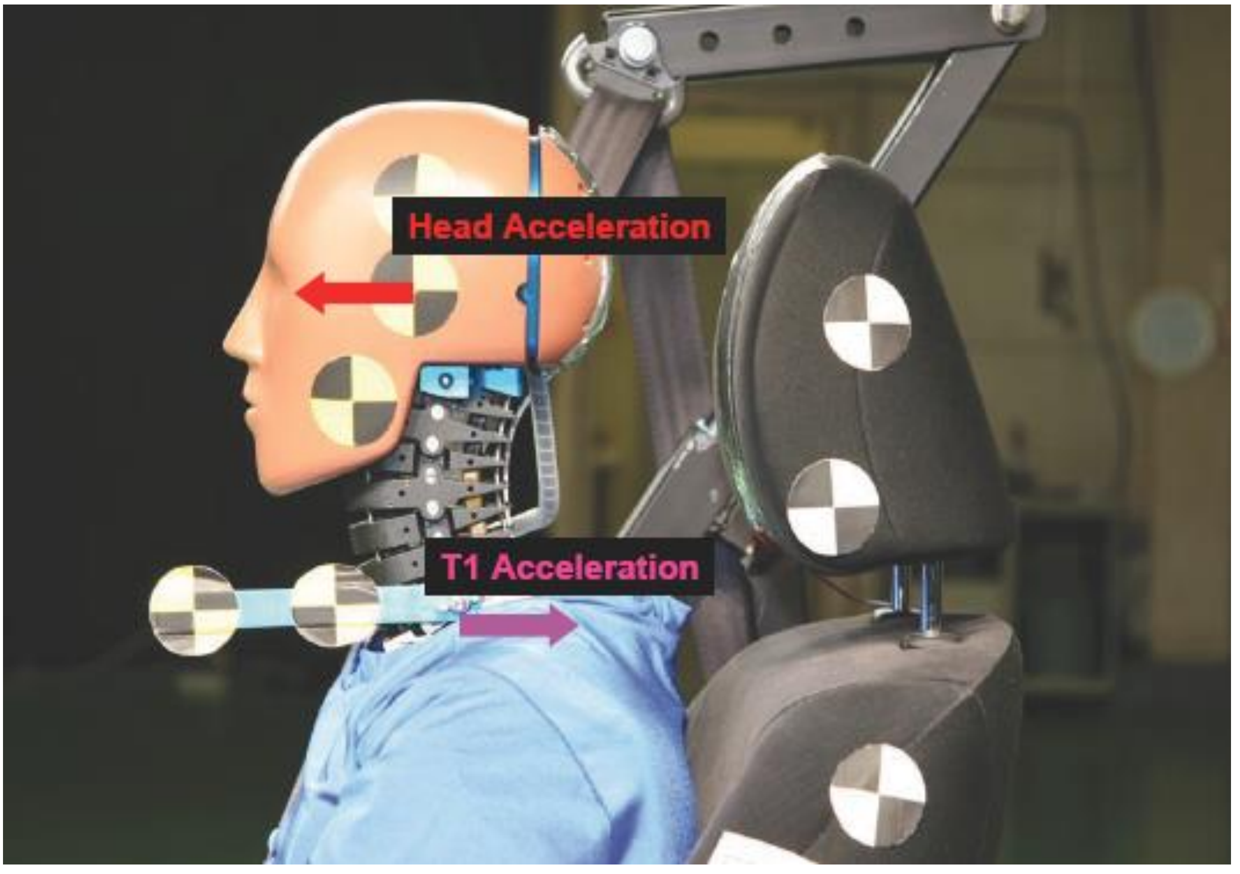


Figure 1.1: Dummy Acceleration

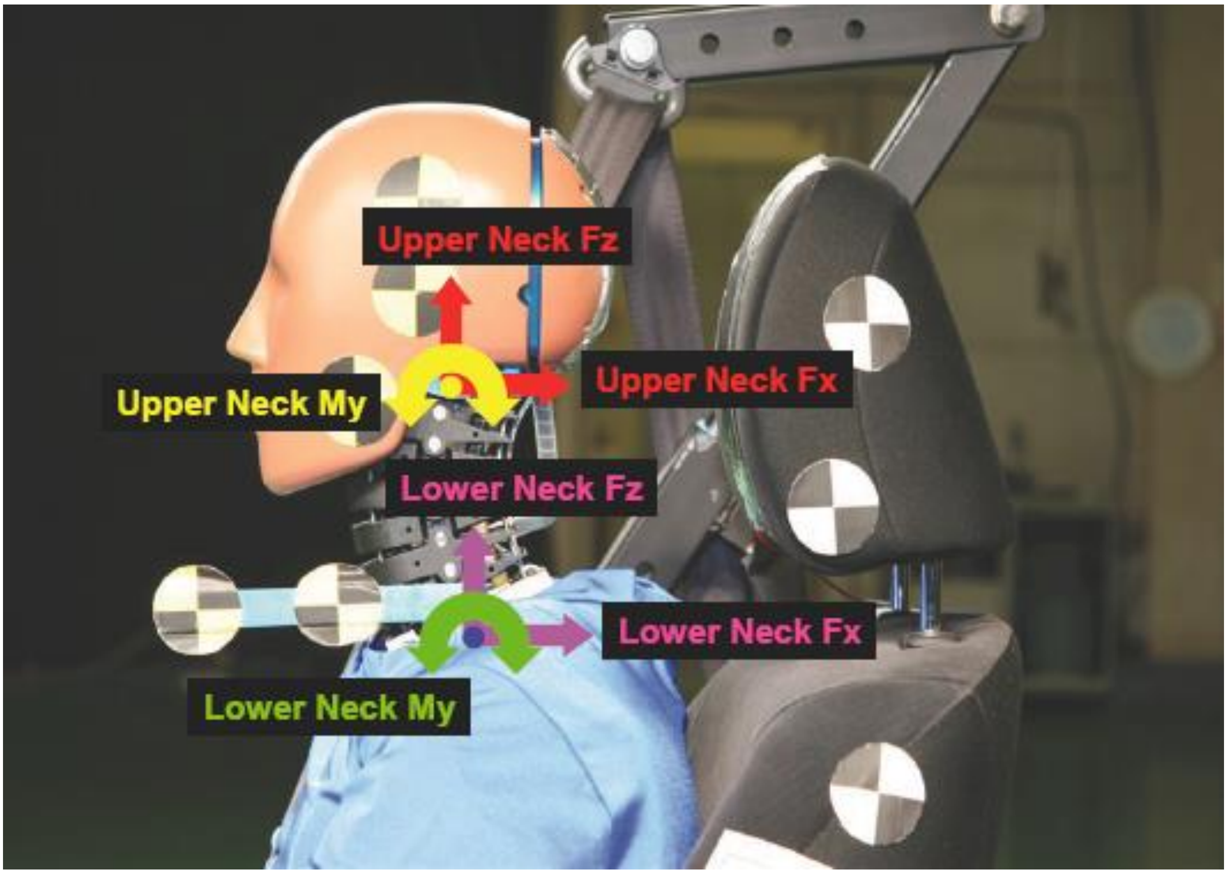


Figure 1.2: Dummy Neck Load and Moment

4. Test Preparations

4.1 Selecting the Test Seat

The vehicle manufacturer and importer shall submit information regarding the main structure of the driver's seat and front passenger seat specified in Appendix 2 immediately after the vehicles are selected.

NASVA will review the submitted information and make a decision on the test seat.

In principle, either the driver's seat or front passenger seat will be selected as the test seat. To determine which seat will be used, compare the principal parts in Appendix 2 and use the unfavorable seat specified in Attachment 2 as the test seat.

If both seats are identical and it cannot be determined which is the unfavorable seat, NASVA may select either the driver's seat or passenger's seat at their discretion. However, if test data is submitted at the time of testing along with Attachment 2, that data shall be used as a reference.

If the vehicle manufacturer and importer wishes the test to be conducted additionally on a seat that has not been selected, the test institute may conduct the test using that seat.

4.2 Procuring the Test Seat

NASVA shall consult with the vehicle manufacturer and importer for the method of procuring the test seat after the seat has been selected according to Paragraph 4.1, then procure the seat. The manufacturer shall not modify the test seat.

If the test seat is difficult to procure within the time period and the delay may affect subsequent tests, NASVA shall consult with the manufacturer, then the test seat may be removed from the vehicle for the lateral collision safety performance test and the test may be conducted using this seat.When the test seat is removed from the vehicle for the lateral collision test, it shall be after the manufacturer witnesses markings on the body for the pedestrian head protection performance test. After the test, in this case, the tested seat shall be re-installed in the test vehicle for the lateral collision test.

4.3 Submitting Data from the Manufacturer

The vehicle manufacturer shall provide NASVA with the following data necessary for preparing the test vehicle properly:

(1) Special confirmation items for test preparation (confirmation items for specific preparation of the said seat or specified series of the seat for test preparation)

(2) Appendix 1 "Seat Jig (fixture) Preparation" (only if NASVA is requested to produce it.)

(3) Appendix 2 "Seat Selection Information"

(4) Appendix 3-1 "Test Seat Specifications"

(5) Appendix 4-1 "H Point / Backset Measurements"

(6) Appendix 5-1 "Dummy Positioning"

4.4 Confirmation of Identicalness of Seats

The test institute shall check before and after the test that the test seat procured from the vehicle manufacturer is identical to the test vehicle seat. The confirmation before the test is done according to Appendix 6-1.

5. Test Conditions

The installation condition of the seat in the vehicle shall be confirmed without occupants or goods in the vehicle, with the fuel tank filled to 100% capacity, with the spare tire and tools installed, and with the tires adjusted to the vehicle manufacturer's recommended pressure so that the vehicle is on a flat plane. Additionally, if the vehicle is equipped with a height adjustment mechanism, it shall be set at the design standard position in the stopping condition.

5.1 Seat Jig

The seat jig, in principle, shall be supplied by the manufacturer. If the manufacturer cannot supply the seat jig, they shall submit information on the seat jig (Appendix 1) to NASVA. In this case, the manufacturing tolerance of the seat jig on the seat rail angle that will be produced by the test institute shall be kept within 0.2° in the fore-aft direction and lateral direction specified in the design values.The seat jig shall not be specially treated.

The test institute shall measure the main dimensions of the seat anchorage and seat jigs of the vehicle used for other assessment tests by JNCAP of the same model. If the results of comparing the main parts dimensions differ from the measurement results of the test vehicle seat, NASVA shall consult with the vehicle manufacturer, then make a final decision on the requirements for main parts dimensions, etc. of the seat jig.

5.2 Seat Adjustments

The seat shall be adjusted to the positions specified in the following (1) through (11) requirements. Including combination adjustment mechanisms, each mechanism's details are shown in Attachment 1.

(1) If the test seat is adjustable in the fore-aft direction by the seat rail, the test seat shall be adjusted to the middle position. If adjustment to the middle position is not available, the seat shall be adjusted to the nearest adjustable position lower from the middle position. If the seat has an electric adjustable mechanism in the fore-aft direction, the seat shall be adjusted to the middle position with a tolerance of ±2mm.

(2) If the test seat is adjustable vertically the seat shall be adjusted to the middle position. If the seat cannot be adjusted to the middle position, the seat shall be adjusted to the nearest adjustable position lower from the middle position.

(3) If the seatback angle of the test seat is adjustable in several steps, it shall be adjusted to the design standard steps, and in the case of an electric adjuster, it shall be adjusted to the design standard angle with a tolerance of ±1°.

(4) If the headrest of the seat can be adjusted in the vertical direction, it shall be adjusted to the middle position. However, if the head restraint cannot be adjusted to the middle position but has a lock position within 10mm above the middle position, it shall be used in this lock position. If the lock position is more than 10mm above the middle position, the nearest lock position below the middle position shall be used. In this case, the adjustment range is from the lowermost position to the uppermost lock position.

(5) If the headrest of the seat can be adjusted in the fore-aft direction, it shall be adjusted to the middle position. However, if the headrest cannot be adjusted to the middle position but has a lock position within 10mm above the middle position, it shall be used in this lock position. If the lock position is more than 10mm above the middle position, it shall be used in the lock position rearward and nearest to the middle position.

(6) If the test seat is equipped with a lumbar support device, it shall be adjusted to the rearmost position.

(7) If the test seat is equipped with a side support device, it shall be adjusted to the most spread position.

(8) If the test seat is equipped with a cushion extension device, it shall be adjusted to the rearmost position.

(9) If the test seat is equipped with an armrest, it shall be adjusted to the folded position.

(10) If the test seat has other adjustment mechanisms other than (1) through (9) mentioned above, the adjustment position or the adjustment angle shall be adjusted to the design standard position or the design standard angle, respectively.

(11) If the test seat is equipped with an active headrest, etc. which is activated by electric signal, it shall be activated at the specified timing of the electric signal, assuming the vehicle manufacturer has provided information showing that they proved the timing of the signal.

5.3 Use of the Seatbelt

A generic three-point lap-shoulder seatbelt should be used during the test and the seatbelt shall be belted from the left side on the dummy. However, when the vehicle manufacturer requests and can demonstrate good reasons for doing so to NASVA, vehicle-specific seatbelt and geometry may be considered. The seatbelt geometry and restraint equipment that approximates that of the test vehicle should be used. The manufacturer shall provide or lend the test institute an attachment frame or fixture.

If the seat is equipped with an integrated seatbelt, the vehicle's own seatbelt hardware (retractor and buckle) may be used.

5.4 Other Test Trolley and Seat Conditions

(1) Installing the Stroboscope

A stroboscope shall be installed on the trolley synchronized with the high-speed photo images and electric measurements when images are photographed using a high-speed camera.

(2) Installing the Target Marks

The "target marks" shall be put on dummy and test seat where deformation during the test crash does not occur, to confirm dummy movement and seat deformation. Figure 2 shows the locations of the target marks. However, if the test is conducted under the proviso of Paragraph 5.3, this requirement shall not apply.

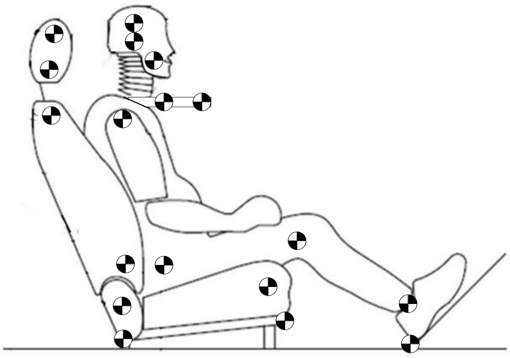


Figure 2: Target Mark Placement

When target marks are put on the dummy and the test seat, the coordinate locations of the target marks shall be recorded in Appendix 5-2. (The measurement results should be expressed relative to the installation bolt of the seat, etc.)

(3) Toe Board

When conducting the test, the dummy's feet shall be placed on the simulated toe board. The toe board shall be connected to a section oriented 45° from the horizontal plane and the surface shall be covered with short-piled carpet. The horizontal plane of the toe board shall be installed to simulate the vehicle floor height and seat location and shall be rigidly constructed so that it is not transformed by the weight of the dummy's feet.

5.5 Measuring the Hip Point and Backset

In this operation, the measurement time shall be kept to within 15 minutes for each, and after three repetitions, if the tolerance is exceeded, the seat shall be left unloaded for 15 minutes before the fourth measurement. However, if the total measurement time is less than 45 minutes after the three measurements are finished, the fourth measurement may be conducted, but the total time of the four measurements shall not exceed 45 minutes.

5.5.1 Installing the HP Manikin

5.5.1.1 The seat shall be covered entirely by a cotton cloth. The cloth shall be tucked into the seat joint by an amount sufficient to prevent loosening of the material or fastened by adhesive tape, etc. In this case, the cotton cloth shall not be hammock-like. The cotton cloth shall be as specified in "JIS D4607-1994 Three-dimensional manikins for use in defining automobile seating accommodations: kanekin 2003 or stable fiber muslin No. 9" or an equivalent material.

5.5.1.2 The HP Manikin shall be placed in the seat.

5.5.1.3 The lower legs shall be adjusted to the 50 percentile leg length setting, and the upper legs shall be adjusted to the 10 percentile leg length setting. Furthermore, the ankles shall be fixed at a 90° angle to the shin.

5.5.1.4 The legs shall be attached to the HP Manikin set to the 5th position (No. 5) on the knee joint T-bar, which places the knees 250mm apart.

5.5.1.5 With the legs attached and the back pan tilted forward, a horizontal rearward load of 100N shall be applied once to the T-bar and the HP Manikin shall be positioned in the seat such that its mid sagittal plane coincides with the longitudinal design standard centerline of the seat.

5.5.1.6 The feet shall be placed as far forward as possible and the heels shall be on the toe board floor. The lower leg and thigh weights shall be attached to the HP Manikin, the assembly shall be leveled to the right and left, then the lateral center of the HP Manikin shall be adjusted to the design center of the seat.

5.5.1.7 The back pan shall be tilted forward from the seatback and the HP Manikin pushed rearward until the seat pan contacts the vehicle seatback. A horizontal rearward force of 100N shall be applied on the push point rearward of the T-bar using a force gauge. The load application shall be repeated twice and, while keeping the 100N applied, the back pan shall be returned to the vehicle seat back and then the load shall be released. Pay attention not to move the HP Manikin until the following processes have been finished.

5.5.1.8 A check shall be made to determine that the HP Manikin is level to the right and left, facing directly forward, and located in the centerline of the seat.

5.5.1.9 The right and left buttock weights shall be installed. The four chest weights shall be installed alternately on the left and right. The two large HRMD chest weights shall be attached last, flat side down.

5.5.1.10 Tilting the back pan forward to the vertical position, the assembly shall be rocked from side to side over a 10° arc (5° in each direction). This rocking shall be repeated twice while preventing movement of the seat pan of the HP Manikin in the horizontal direction to the right and left and fore-aft and lifting up lightly so as not to influence the legs of the HP Manikin. If the shape of the seat cushion prevents movement of up to 5°, it should be rocked as far as possible.

5.5.1.11 The back pan shall be returned to the seatback, the feet shall be in contact with the floor, and the HP Manikin shall be leveled to the right and left again.

5.5.1.12 After the back pan is returned to the seat, and while preventing horizontal movement of the seat pan of the HP Manikin, the torso angle shall be stabilized to apply 10 N load in the rearward and horizontal direction to the right and left at the same height as the hanger bar.

5.5.2 Installing and Measuring the HRMD (Head Restraint Measuring Device)

5.5.2.1 The backset probe shall be installed and pushed at the same height against the HRMD.

5.5.2.2 The HRMD shall be lowered into position on the HP Manikin torso weight hangers and on the top edge of the channel between the hangers.

5.5.2.3 Loosening the leveling knob at the rear of the device and repositioning the head using the HRMD water level and maintaining the HRMD level laterally, the leveling knob shall then be retightened by hand. If the HRMD cannot be leveled laterally because it contacts the head and the headrest, it shall be leveled as much as possible. If it is confirmed from documents such as drawings submitted by the vehicle manufacturer for NASVA that the structure does not allow the HRMD to be level, the HRMD may be corrected to become level by calculations after NASVA has consulted the vehicle manufacturer.

5.5.2.4 The HP Manikin shall be confirmed to be level to the right and left.

5.5.2.5 Measure the height difference of the backset, head restraint and the HRMD.

5.5.2.6 Measure both sides of the hip point location of the HP Manikin. Both sides of the hip location of the HP Manikin shall be maintained within 5mm of the X and Z-axis. If the result is not maintained in this range, repeat the process starting from tilting the back pan forward and pushing the HP Manikin rearward.

5.5.2.7 Measure the torso angle.

5.5.2.8 Locate the screw on the center of the rear surface of the HRMD backset probe. Mark an identifiable point on the head restraint along its vertical centerline that is defined by the first contact point between the backset probe and head restraint. The reference backset is the horizontal distance between the rearmost point on the HRMD skull and the identifiable point on the head restraint.

5.5.2.9 The measurement shall be repeated three times and it shall be confirmed for all three measurements that the difference of measured torso angle is within 1°, the hip point stays within 5mm on the X- and Z-axis, and the backset stays within 5mm.

5.5.2.10 The torso angle, hip point coordinate (X, Z), backset and height difference of the head restraint and the HRMD shall be measured three times and the average calculated after meeting the above-mentioned tolerances, then recorded in Appendix 4-2.

5.6 Installing the Dummy and Seatbelt

5.6.1 Installing the Dummy

5.6.1.1 The seat shall be left empty for 15 minutes before placing the dummy on it.

5.6.1.2 The dummy shall be horizontally aligned with the center of the seat, and its upper body shall be pushed against the seatback. The torso angle of the dummy shall be adjusted to +1.5° (±2.5°), with the torso angle as described in Paragraph 5.5.2.10.

5.6.1.3 The hip point of the dummy shall be positioned at +20mm (±5mm) in the fore-aft direction and unchanged height (±5mm) in the vertical direction relative to the hip point as described in Paragraph 5.5.2.10, while keeping the torso angle at +1.5°(±2.5°), and the pelvis angle as described in Paragraph 5.5.2.10. However, if the vertical direction of the hip point cannot be adjusted within ±5mm, the matter shall be determined after NASVA has consulted the vehicle manufacturer.

5.6.1.4 Both legs shall be adjusted such that the space between the centerlines of the knees and ankles is 200mm (±10mm).

5.6.1.5 By adjusting both legs of the dummy and the adjustable toe board, the top of the shoes shall be placed on the toe pan at the position of 230–270mm from the intersection of the heel surface and the toe board by measuring alongside the toe board surface when the heels of the shoes on the dummy are placed on the heel surface.

5.6.1.6 Both arms of the dummy shall be positioned such that both of the upper arms of the dummy contact the seat back, the pinky finger of both hands contacts the upper portion of the seat cushion, and the palms of the hands face the thighs of the dummy. However, if the upper arm cannot be directly placed on the seat back due to the seat shape, the upper arm shall be placed close to the seat back as much as possible.

5.6.1.7 The head angle shall be leveled within 0° ± 0.5°.

5.6.1.8 The amount of the dummy's backset shall be measured. This is the horizontal distance at the same position as the HRMD measurement. The rear of the dummy's head shall be measured at the point which is 95mm from the upper end of the skullcap alongside the centerline. The point marked during the backset measurement shall be used for the headrest measurement point. A check shall be made to confirm that the dummy backset is at the standard backset +15mm (±2mm). If the dummy backset does not match this, the head angle, hip point coordinate, etc. shall be adjusted within the range of tolerance. Placing the highest priority on the dummy backset, the hip point X-axis coordinate, head angle, and lumbar angle shall be adjusted in that order. If there is no matching even after this procedure, a decision shall be made based on consultation between NASVA and the vehicle manufacturer. The measurements shall be recorded in Appendix 5-2.

5.6.2 Fastening the Seatbelt

After installing the dummy in the test seat, the seat belt shall be fitted on the dummy without hindering its movement.

5.6.3 Dummy Temperature Conditions

The dummy shall be left untouched in a room in which temperature is maintained at 22.5 ± 3° for four hours or longer until immediately before testing to stabilize temperature. During this state of being left untouched, work to install the dummy, etc. may be conducted. In addition, in case of any compelling reason such as preparations to conduct testing, the dummy may not have to be left untouched in the room maintained at the applicable temperature condition for a maximum cumulative period of ten minutes. The temperature gauge shall be positioned at the height of the dummy shoulder.

5.7 Measurement of Head/Headrest Contact Time

In order to measure the timing between the start and end of the contact of the head and the headrest, conductive foil (aluminum tape, etc.) shall be attached by a contact method to the rear of the dummy's head (skullcap) and the face of the head restraint for confirmation.

6. Testing Facility, etc.

6.1 The Test Trolley (Vehicle Target)

The test trolley shall travel along rails installed on a level and straight line, and shall create impact by acceleration or deceleration.

6.2 Illumination Device

The illumination device shall be capable of emitting light sufficient for high-speed photography and cause no halation.

6.3 High-Speed Photography Device

The photographing speed of the high-speed photography device shall be set at 1,000 frames/second or faster and the shutter speed shall be set at 1/5,000 second or faster.

The cameras may be equipped with polarized filters to reduce unnecessary light.

6.4 Speed Measuring Device

The test speed shall be the maximum speed of the trolley. The speed shall be calculated by integrating the trolley acceleration. The sampling time (time interval of sample data) of the acceleration shall be 0.1ms.

Furthermore, when converting the time into the speed (km/h) of the test vehicle, the speed-measuring device shall indicate the speed to the first decimal place.

6.5 Electric Measuring Device

The measuring device shall comply with the requirements of ISO 6487:2002*1 under the condition in which all the devices between the constituent devices and the output devices (including a computer for analytical use) are connected (measuring device under this condition is referred to as "measurement channel".).

(1) The measurement channel shall measure acceleration, load and moment based on the channel classes listed below:

For collision tests, channel classes are as follows:

(a) Head acceleration shall be 1,000.

(b) Neck load shall be 1,000.

(c) Neck moment shall be 600.

(d) First thoracic vertebra acceleration shall be 60.

(e) Eighth thoracic vertebra acceleration shall be 60.

(f) First lumbar vertebra acceleration shall be 60.

(g) Lumbar acceleration shall be 1,000.

(h) Head acceleration in case of calculating NIC shall be 60.

(i) Trolley acceleration shall be 60.

(j) Trolley acceleration in case of calculating trolley speed shall be 180.

(2) When converting analog values into digital values in the measurement channel, the number of samples per second shall be 8,000 or more in the collision test. In the case of dummy verification, the

*1 ISO 6487:2000 is considered as the same requirement number of samples shall be specified by the dummy manufacturer.

(3) The NIC shall be calculated with the sampling line (time interval of data samples to be conducted according to the above-described provision) set to the minimum time interval. The range of this calculation shall be between the collision and the end of contact of the rear of the dummy's head and the head restraint after the collision.

(4) Deletion (filtering) of the high-frequency components in accordance with the channel classes shall be performed before calculating the head resultant acceleration, chest resultant acceleration, NIC, and the like.

6.6 Accelerometer, Load Meter, and Dummy

6.6.1 Speed, Load, and Moment Measurements in the Test

Measurement ranges of the accelerometers, load meter, and moment meter used in the collision test shall be in principle within the following ranges:

(1) The measurement range of the accelerometer to be installed in the head of the dummy shall be -1,960m/s^2 (-200G) to +1,960m/s^2 (+200G).

(2) The measurement range of the load meter to be installed in the neck of the dummy shall be -5,000N (-509kgf) to +5,000N (+509kgf).

(3) The measurement range of the moment meter to be installed in the neck of the dummy shall be -200Nm (-20.4kgfm) to +200Nm (+20.4kgfm).

(4) The measurement range of the accelerometer to be installed in the vertebrae of the dummy shall be -1,960m/s^2 (-200G) to +1,960m/s^2 (+200G).

(5) The measurement range of the accelerometer to be installed in the trolley shall be -490m/s^2 (-50G) to +490m/s^2 (+50G).

6.6.2 Installing Electric Measuring Devices

6.6.2.1 Installing the Accelerometer

The accelerometer shall be installed at a position in the trolley without any external impact or impact from seat deformation.

6.6.2.2 Installing the Measuring Device

The measuring device shall be securely fixed in a position without any influence from seat deformation during the trolley collision test.

The cable connecting the transducer and the measuring device fixed in the trolley shall have sufficient room so that it does not influence the movement on the dummy during the collision test.

6.6.3 The Dummy

(1) A BioRID II Ver.G dummy shall be used for the test. The dummy has the following characteristics: the physical constitution is equivalent to the 50 percentile American adult male as with the Hybrid-III, with a weight of 78kg and the vertebrae structure composed of seven cervical vertebrae, twelve thoracic vertebrae and five lumber vertebrae. For details, see "BIORID II USERS MANUAL" (July 29, 2008).

In order to avoid interaction with the seatbelt, the cables shall come out from the front or side of the lumbar area.

(2) Each dummy section shall be probed. For specifications on the dummy's jacket and waist areas, consult "BioRID II Dummy Certification Manual (ARA-9901 [Rev. E])," and for all other areas, consult "BIORID II USERS MANUAL" (July 29, 2008). The probe results shall be recorded in writing and submitted to NASVA before testing.

6.6.4 Recording Electronic Measurement Results

Measurement results of acceleration and load shall be recorded for the channel class of 1000 or more.

6.7 3-D Measuring Device

Accuracy of the three-dimensional measuring device used to measure the dimensions of seat position of the dummy and target mark position, etc. shall be 0.5mm/m or less.

7. Testing Procedure

7.1 The Test Speed and Impact Waveform

The maximum speed as of the end of impact generated onto the trolley shall be 20.0km/h ±1.0km/h. The test unit shall be set up so that the impact waveform is within the permissible range described the Diagram of Figure 3 and as close to the typical impact waveform as much as possible.

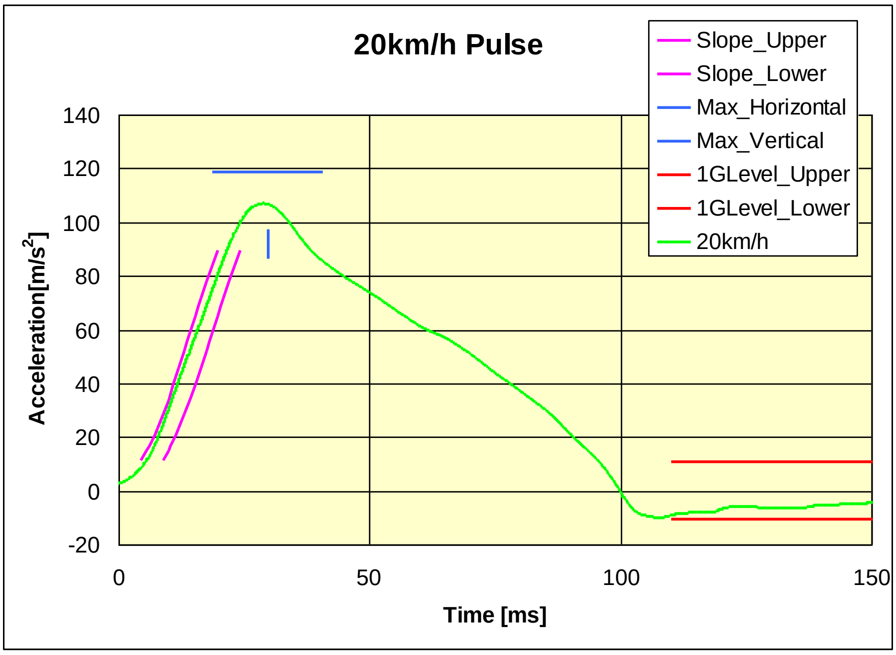


Figure 3 Impact Waveform and Waveform Permissible Range

Table: Scope of Corridors

Time	Slope_Upper	Time	Slope_Lower
4.4	11.4	8.8	11.4
5.5	14.8	9.9	14.8
6.6	18.8	11.0	18.8
7.7	23.3	12.1	23.3
8.8	28.3	13.2	28.3
9.9	33.7	14.3	33.7
11.0	39.6	15.4	39.6
12.1	45.7	16.5	45.7
13.2	52.1	17.6	52.1
14.3	58.7	18.7	58.7
15.4	65.2	19.8	65.2
16.5	71.6	20.9	71.6
17.6	77.9	22.0	77.9
18.7	83.8	23.1	83.8
19.8	89.2	24.2	89.2

Time	Max_Horizontal	Time	Max_Vertical
18.7	118.7	29.7	86.3
40.7	118.7	29.7	97.1

Time	1GLevel_Upper	Time	1GLevel_Lower
110.0	10.8	110.0	-10.8
154.0	10.8	154.0	-10.8

Units: Time[ms], Acc[m/s^2]

Table: Test Waveform Tolerance

		Definition	Tolerance Range	Unit
Velocity change	ΔV	20.0	±1.0	km/h
Duration	ΔT	100.0	±5.0	ms
Average Acceleration	Mean Acceleration	55.5	±5.0	m/s^2
T=0 Acceleration	AT0	0.0	±3.0	m/s^2

7.2 Number of Tests

The test shall be conducted once.

8. Recording and Measurement Items

8.1 Recording Prior to the Test

8.1.1 Confirming and Recording the Received Seat

After receiving a seat for test, the test institute shall check the following items and record the results in Appendix 3-2. At the same time, the test institute must make sure that the seat for test complies with specifications of the seat for test provided in Appendix 3-1 from vehicle manufacturers, etc.

(1) Name, nickname, model, and classification of the vehicle

(2) Driver's seat, or front passenger's seat

8.1.2 Recording the Dummy Verification Results

(1) The test institute shall record the verification results for the dummy.

(2) The dummy shall be re-verified after conducting the test the recommended number of times by the dummy manufacturer, and five times on all other areas.

If the injury criterion reaches or exceeds the acceptable limit, the part of the dummy concerned shall be re-verified.

If a component of the dummy is damaged, the component concerned shall be replaced by a verified component.

8.1.3 Recording the Measurement Instrument Calibration Results

(1) The calibration results of the measuring instruments (each measurement channel including the transducer) conducted before the test shall be recorded. The valid period for the measuring instrument calibration shall be one year. The measuring instruments may be used during that period.

If any abnormalities, etc. are found in the measuring instruments, the measuring instruments shall be re-calibrated at that time.

(2) To determine whether or not the injury criteria are calculated correctly, verification shall be made using a calibration signal generation device (waveform generator).

8.1.4 Recording Measurement Results for Dummy Seating Position

The seating position of the dummy placed in the vehicle according to Paragraph 5.6.1 shall be measured and recorded according to Appendix 5-2.

8.1.5 Recording the Final Vehicle Condition Prior to the Test

The following items shall be confirmed and recorded after preparing the test seat in accordance with Paragraph 4:

(1) Test seat adjustment position (driver's seat and front passenger's seat)

(2) Adjustment position of seatbelt installation device

8.1.6 Recording the Dummy's Temperature

(1) The dummy soak start time and end time, as well as the temperature during that period, shall be recorded.

(2) The cumulative period of time during which the temperature condition prescribed in Paragraph 5.6.3 was not maintained shall be recorded.

8.2 Recording During the Test

8.2.1 Speed and Acceleration of the Test Trolley

The maximum speed immediately after the trolley impact shall be measured and recorded. This maximum speed shall be calculated by integrating the acceleration measured by the accelerometer installed in the trolley.

In addition, the trolley acceleration during the collision shall be measured and recorded.

8.2.2 Recording the Electric Measurement Results for the Test Trolley and Dummy Parts

The electrical measurement results for the accelerometer and load meter which are installed at each of the dummy and the trolley shall be recorded for a period of time from 20ms before the collision to 300ms or more after the collision.

(1) Trolley fore-aft direction acceleration

(2) Dummy head fore-aft direction acceleration

(3) Dummy head lateral direction acceleration

(4) Dummy head vertical direction acceleration

(5) Dummy upper neck fore-aft direction load

(6) Dummy upper neck lateral direction load

(7) Dummy upper neck vertical direction load

(8) Dummy upper neck fore-aft direction moment

(9) Dummy upper neck lateral direction moment

(10) Dummy upper neck vertical direction moment

(11) Dummy lower neck fore-aft direction load

(12) Dummy lower neck vertical direction load

(13) Dummy lower neck lateral direction moment

(14) Dummy first thoracic vertebra right-side fore-and-aft direction acceleration

(15) Dummy first thoracic vertebra right-side vertical direction acceleration

(16) Dummy first thoracic vertebra left-side fore-aft direction acceleration

(17) Dummy first thoracic vertebra left-side vertical direction acceleration

(18) Dummy eighth thoracic vertebra fore-aft direction acceleration

(19) Dummy eighth thoracic vertebra vertical direction acceleration

(20) Dummy first lumbar vertebra fore-aft direction acceleration

(21) Dummy first lumbar vertebra vertical direction acceleration

(22) Dummy lumbar area fore-aft direction acceleration

(23) Dummy lumbar area lateral direction acceleration

(24) Dummy lumbar area vertical direction acceleration

(25) Rear of dummy head and headrest contact signal

8.2.3 Recording the Injury Criterion

The injury criteria for the dummy shall be calculated from the waveform obtained as described in Paragraph 8.2.2 according to the following method and shall be recorded.

(1) Head and Headrest Contact Time ($T\text{-}HRC_{start}$, $T\text{-}HRC_{end}$)

The start of the headrest contact time, $T\text{-}HRC_{Start}$, shall be when the contact continues for 40ms or longer after the rear of the dummy's head comes in contact with the headrest (calculated from T=0). $T\text{-}HRC_{Start}$ shall be rounded to the first decimal point in ms (e.g. 70.34ms → 70.3ms). If it is found that these figures are due to insufficient electric contact, the contact time (within 1ms) after the second decimal point shall be tolerated. In such a case, however, it must be checked, by confirming the film, that the halt of the contact is not caused by any biomechanical phenomenon including jumping of the dummy, falling down of the head restraint/seatback, or bouncing of the head during non-structural contact with the headrest. As a subsequent criterion, the end of the head restraint, i.e. $T\text{-}HRC_{end}$, must be determined. It shall be defined as the time at which the head separates from the contact condition for the first time when the subsequent period of uninterrupted non-contact exceeds 40ms.

(2) Neck Injury Criterion: NIC

This shall be obtained from the relative speed and horizontal acceleration of the head against the first thoracic vertebra. Acceleration shall be calculated in units of meters per square second, with the head in the fore-aft direction acceleration filtered by CFC60. The first thoracic vertebra acceleration shall be calculated for the right and left; however, in calculating NIC, the average figure of the right and left shall be used, with each filtered by CFC60. This average acceleration shall be obtained by:

$$T1(t) = \frac{T1_{left}(t) + T1_{right}(t)}{2}$$

$T1_{left}(t)$ ＝ acceleration obtained from the left-side first thoracic vertebra acceleration

$T1_{right}(t)$ ＝ Acceleration obtained from the right-side first thoracic vertebra acceleration

The "relative fore-aft direction acceleration" between the head and first thoracic vertebra (γ_x^{rel}) shall be obtained by subtracting the head fore-aft direction acceleration (γ_x^{Head}) from the right/left average first thoracic vertebra fore-and-aft direction acceleration (γ_x^{T1}).

The acceleration shall be calculated by:

$$\gamma_x^{\mathrm{rel}} = \gamma_x^{\mathrm{T1}} - \gamma_x^{\mathrm{Head}}$$

The "relative fore-aft direction velocity" between the head and first thoracic vertebra (V_x^{rel}) shall be calculated by integrating acceleration relative to time:

$$V_x^{\mathrm{rel}}(t) = \int_0^t \gamma_x^{rel}(\tau) d\tau$$

Next, NIC shall be calculated by multiplying the combination of relative acceleration by 0.2 and adding the result to the square of relative speed:

$$NIC(t) = 0.2 * \gamma_x^{\mathrm{rel}}(t) + [V_x^{\mathrm{rel}}(t)]^2$$

The overall maximum NIC value ($NIC_{\max}$) shall be obtained as follows while considering the data from T=0 (test start) to $T\text{-}HRC_{(end)}$ (end of contact of the head and head restraint):

$$NIC_{\max} = \underset{T-HRC_{(end)}}{Max} [NIC(t)]$$

The maximum value and its time of occurrence shall be recorded.

(3) Upper-Neck Shearing Load (Upper Neck Fx)

Lower-Neck Shearing Load (Lower Neck Fx)

These refer to the shearing load measured by the load cell of the upper neck and lower neck of the dummy. When the equipment is set up in accordance with the SAE J211, the positive-side shearing load shall be that with the head pulled backward. The data shall be filtered by CFC1000, while considering the maximum value from T=0 until $T\text{-}HRC_{(End)}$, and the load shall be determined as described below. Note that data shall be considered only for the positive side.

$$Fx_{\max} = \underset{T-HRC(_{end})}{Max}[Fx(t)]$$

(4) Upper-Neck Axial Force Load (Upper Neck Fz)

Lower-Neck Axial Force Load (Lower Neck Fz)

These refer to the axial force (tensile load, compressive load) measured by the load cell of the upper neck and lower neck of the dummy. When the equipment is set up in accordance with the SAE J211, the positive-side axial load shall be that of a case of pulling the head upward. The data shall be filtered by CFC1000, while considering the maximum value for T=0 until T-$HRC_{(End)}$, and the load shall be determined as described below. Note that data shall be considered only for the positive side.

$$Fz_{\max} = \underset{T-HRC(_{end})}{Max}[Fz(t)]$$

(5) Upper-Neck Lateral Direction Axis Moment (Upper Neck My)

This refers to the moment about the lateral direction axis measured by the load cell of the upper neck of the dummy. When the equipment is set up in accordance with the SAEJ211, the positive-side moment about the lateral direction axis shall be that when the head is bent (anterior inclination). The data shall be filtered by CFC600. Here, the moment actually measured by the load cell of the upper neck due to structural problems with the dummy shall be corrected as described below in order to convert it into the moment centered on the occipital condyle (OC) of the head.

$$My^{OC}(t) = My^{Upper}(t) - DFx^{Upper}(t)$$
$$D = 0.01778$$

For the maximum value of the above calculation, My^{OC}, data from T=0 until T-$HRC_{(End)}$ shall be considered, and the moment shall be determined as described below. Note that the data shall be considered for both the positive side and negative side.

$$My^{OC}{}_{\max} = \underset{T-HRC(_{end})}{Max}[My^{OC}(t)]$$

(6) Lower-Neck Lateral Direction Axis Moment (Lower Neck My)

This refers to the moment about the lateral direction axis measured by the load cell of the lower neck of the dummy. When the equipment is set up in accordance with the SAE J211, the positive-side moment about the lateral direction axis shall be that when the head is bent (anterior inclination). The data shall be filtered by CFC600, while considering the data from T=0 until T-$HRC_{(End)}$, and the moment shall be determined as described below. Note that the data shall be considered for both the positive side and negative side.

$$My_{\max} = \underset{T-HRC(_{end})}{Max}[My(t)]$$

Examples of electric measurement results measured and calculated under Paragraphs 8.2.2 and 8.2.3 are shown in Appendix 7.

8.2.4 High-Speed Photography

The movements of the test seat and dummy illustrated below during the collision shall be photographed using a high-speed VTR. As shown below, the field angle shall be an overall image of the dummy and zoom-in of the dummy neck (as much as possible). Filming period must be all angles of the test from T=0 until 300ms. Note that stroboscopic light, etc. shall be inserted in angles of each camera to indicate the moment of collision.

However, when the test is conducted based on the proviso of Paragraph 5.3, a location where high-speed photographing of dummy movement is not disturbed by the seatbelt, etc. may be selected.

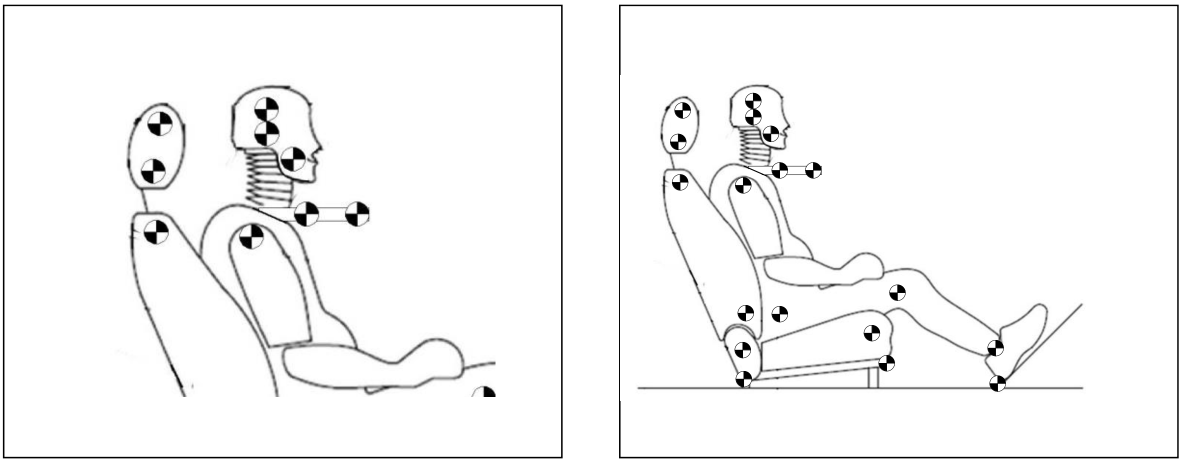


Figure 4: High-Speed Image Angles (examples)

8.3 Recording After the Test

8.3.1 Filming the Seat's Condition Just After the Test

Distinctive sections shall be photographed immediately after the completion of the test.

8.3.2 Calibration and Recording of Accelerometers

The accelerometer used in the test shall be calibrated after collision, and the calibration results shall be recorded.

8.4 Handling the Measured Values

The measured values shall be handled as below:

(1) The measured values for speed (km/h) shall be rounded off to the first decimal place.

(2) The measured values for distance (mm) shall be rounded off to the first decimal place.

(3) The measured values for angle (°) shall be rounded off to the first decimal place.

(4) The measured values for acceleration (m/s^2) shall be rounded off to the first decimal place.

(5) The measured values for load (N) shall be rounded off to the first decimal place.

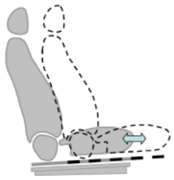
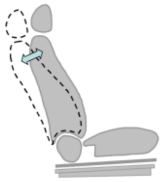
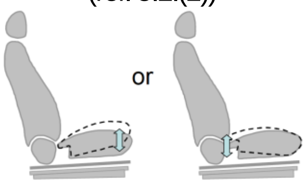
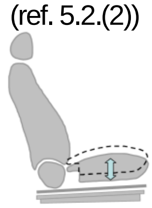
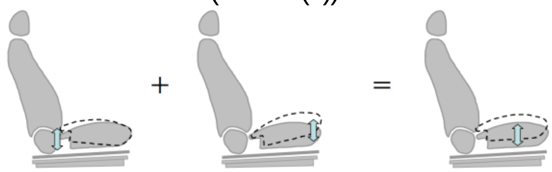
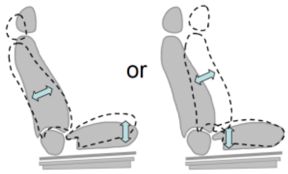
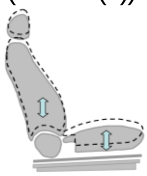
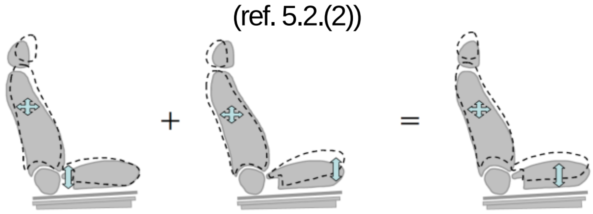
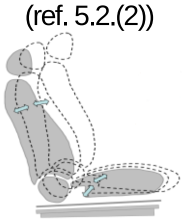
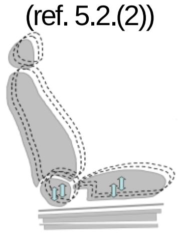
(6) The measured values for moment (Nm) shall be rounded off to the first decimal place.

(7) The measured values for NIC (m^2/s^2) shall be rounded off to the first decimal place.

(8) The measured values for headrest contact time (ms) shall be rounded off to the first decimal place.

ATTACHMENT 1

Adjusting Position of Test Seat Adjustment Mechanism

Fore-aft adjustment device by seat-rail (ref. 5.2.(1))  Middle position in fore-aft direction	Seatback angle adjustment device (ref. 5.2.(3))  Design standard angle
Seat cushion surface angle adjustment device (tilt or lifter) (ref. 5.2.(2))  Middle position in vertical direction	Seat cushion surface vertical adjustment device (lifter) (ref. 5.2.(2))  Middle position in vertical direction
Seat cushion surface angle vertical adjustment device (others) (ref. 5.2.(2))  Middle position in vertical direction	Seat lower / Seatback angle adjustment device (ref. 5.2.(2))  Middle position in vertical direction
Seat lower / Seatback vertical adjustment device (lifter) (ref. 5.2.(2))  Middle position in vertical direction	Seat cushion (angle / vertical) / Seatback angle adjustment device (ref. 5.2.(2))  Middle position in vertical direction
Fore-aft / Vertical / Angle - all linked adjustment device (ref. 5.2.(2))  Middle position in vertical direction	Fore-aft / Vertical all linked adjustment device (lifter) (ref. 5.2.(2))  Middle position in vertical direction

ATTACHMENT 2

Regarding Seat Selection for Neck Injury Protection (Rear Collision) Performance Test Procedure

When there is a disparity among the following items, select the less adequate seat. When the lesser of the seats cannot be determined, select either the driver's seat or the front passenger's seat.

Select the less adequate seat from the following list, ranked in order of priority.

Selection Items

① The strength of the seatback or the shape of the hinges (if it's single or double-hinged, choose the single-hinge or the weaker hinge. If the ideal hinge cannot be determined by shape, refer to the data provided by the vehicle manufacturer or to in house testing data.)

② The horizontal distance between the back of the dummy's head and the headrest. (If the distance difference is less than 5mm, it's considered equivalent. If more than 5mm, it shall be determined as inferior.)

③ The vertical distance between the top of the dummy's head and the headrest's upper-edge. (If the vertical distance difference is within 5mm, they're considered equivalent. If the difference is over 5mm, the lower seat shall be selected as inferior.)

④ The seatback mass (If the seatback mass difference is within 0.5kg, they're considered equivalent. If the difference is over 0.5kg, the heavier seat shall be considered inferior.)

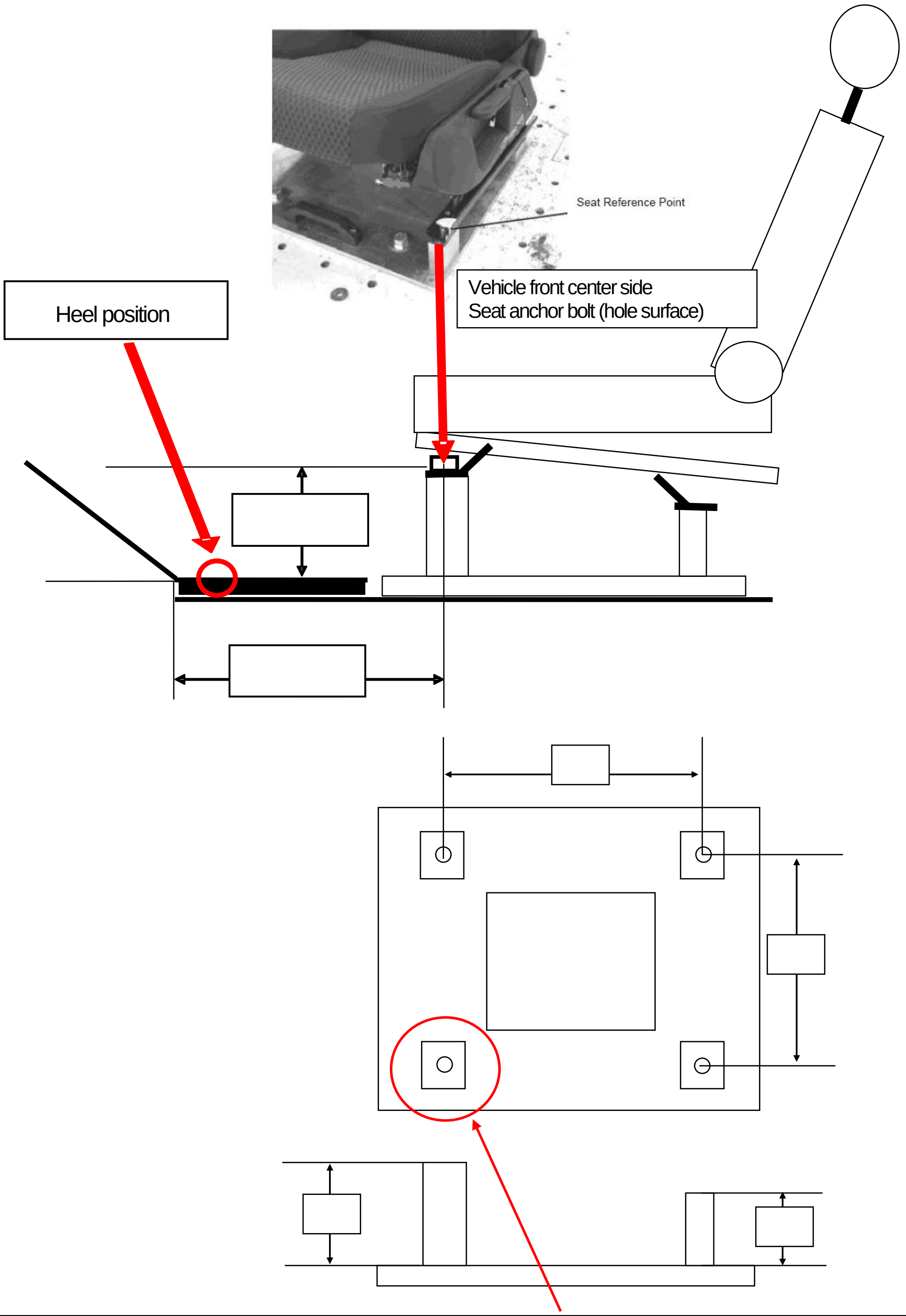
⑤ The seat mass (If the seat mass difference is within 1.0kg, they're considered equivalent. If the difference is over 1.0kg, the heavier seta shall be considered inferior.)

ATTACHMENT 3

Regarding the Permissible Range of the Assessment Vehicle's Equipped Seat with the Test Seat

		Test Seat (Permissible difference from the vehicle seat)
Headrest Measurements	Height	± 5 mm
	Width	± 5 mm
Seatback Measurements	Length	± 10 mm
	Width	± 10 mm
Seat Slide	Total Adjustment Amount	± 5 mm
	All Stages	± 0 stage
Seatback Angle Adjustments	Hinge Type	Single-hinged, Double-hinged, no difference in type
Angle between the Seat Rail and Headrest's Mounting Stay (Test Standard Position)		±2°

Appendix 1: SEAT JIG (FIXTURE) PREPARATION [For use by vehicle manufacturer]



Items	Direction	Measuring Point	Design Value
Installation angle of seat slide rail (against horizontal plane)	Fore-aft		°
	Left-right		°

※ The vehicle manufacturer shall submit detailed information (bolt diameter, angle of mounting plane, etc.) on each of the (4) blocks around the seat anchor bolt holes as an additional attachment.

※ As seat jig information, the vehicle manufacturer shall show that the relative position of the front seat anchor bolt center on the hole surface on the vehicle center side and heel height of the dummy is the same as it would be in its vehicle.

※ The above seat jig information is only one example; the vehicle manufacturer is expected to submit all other necessary data.

Appendix 2: SEAT SELECTION INFORMATION [For vehicle manufacturer use]

All necessary information to judge identicalness shall be provided by using this attachment.

<table>
<tr><td>Model / Type</td><td>/</td></tr>
<tr><td>Model Name / (Grade name)</td><td>/ ( )</td></tr>
</table>

<table>
<tr><th colspan="3">Item</th><th>Driver's Seat</th><th>Front Passenger's Seat</th></tr>
<tr><td rowspan="4">① Seatback and hinge strength/shape</td><td rowspan="2">Seatback</td><td>Shape</td><td></td><td></td></tr>
<tr><td>Strength</td><td></td><td></td></tr>
<tr><td rowspan="2">Hinge</td><td>Shape</td><td></td><td></td></tr>
<tr><td>Strength</td><td></td><td></td></tr>
<tr><td colspan="3">② Horizontal distance between back of head and headrest</td><td>mm</td><td>mm</td></tr>
<tr><td colspan="3">③ Vertical distance between top of head and top edge of headrest</td><td>mm</td><td>mm</td></tr>
<tr><td colspan="3">④ Seatback weight</td><td>kg</td><td>kg</td></tr>
<tr><td colspan="3">⑤ Seat weight</td><td>kg</td><td>kg</td></tr>
</table>

Seat Frame Photo (Driver's Seat)	Seat Frame Photo (Passenger's Seat)

Seat Hinge Photo (Driver's Seat) (One each, right and left. If hinges are identical, one photo is sufficient)	Seat Hinge Photo (Passenger's Seat) (One each, right and left. If hinges are identical, one photo is sufficient)

Headrest Connection Photo (Driver's Seat)	Headrest Connection Photo (Passenger's Seat)

Other, important notes to determine sameness

Appendix 3-1: TEST SEAT SPECIFICATIONS

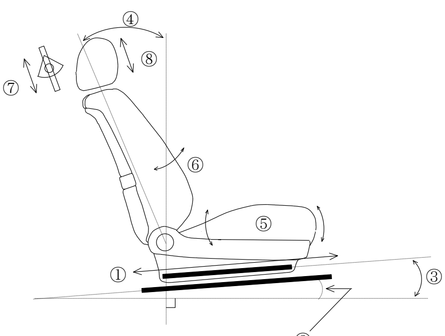
[For use by vehicle manufacturer]

Name / Model name	
Type /Type Classification No. or Class Symbol	

Front Seats				Either Front Seat
Seats	Fore-aft adjustments	Adjustment amount per stage		mm
		Full adjust. amount (stages)		mm (stage)
		Mid pos.	From front edge (st. 0)	mm (stage)
			From rear edge (st. 0)	mm (stage)
	Vertical adjustments	Mid pos.	Seat tilt	Lowest stage ~
			Seat lifter	Lowest stage ~
			Other	Lowest stage ~
Seat lower / Seatback linked adjustment		Mid-vertical position		
		Adjustment method		
Seat slide rail attaching angle		°		
Seatback		Design standard stage: most forward reclining angle (0 stage) Head restraint hole surface center vehicle inner (X coordinate, Z coordinate)		stage (,)
Headrest		All height adjustments (mm)		mm
		Mid. pos.	# of stages from top	stages
			Adj. Amt. from top st	mm
		Fore-aft total adjust. (mm)		mm
		Mid. pos.	# of stages from bottom	stages
			Adj. Amt. from btm. st	mm
		Headrest stay angle		°
Other ( )		Design standard location		
Seat Center		Y coordinate (lateral dir.)		Y=
Seat Anchor Bolt		Clamp torque		Nm

※ Y = distance from the seat anchor bolt's hole center (front side of vehicle center side)

※ # of adjustment stages shall start from the first locking position ("stage 0")



Appendix 3-2: Test Seat Specifications

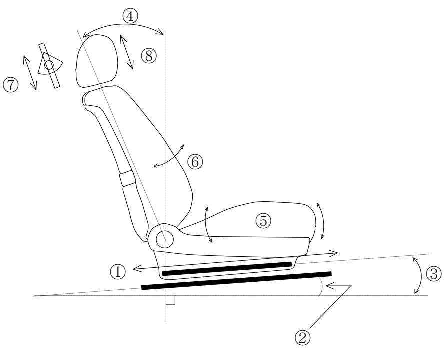
[For use by testing institute]

Name / Model name	
Type /Type Classification No. or Class Symbol	

Front Seats				Either Front Seat
Seats	Fore-aft adjustments	Adjustment amount per stage		mm
		Full adjust. amount (stages)		mm (stage)
		Mid pos.	From front edge (st. 0)	mm (stage)
			From rear edge (st. 0)	mm (stage)
	Vertical adjustments	Mid pos.	Seat tilt	Lowest stage～
			Seat lifter	Lowest stage～
			Other	Lowest stage～
Seat lower / Seatback linked adjustment		Mid-vertical position		
		Adjustment method		
Seat slide rail attaching angle		°		
Seatback		Design standard stage: most forward reclining angle (0 stage) Head restraint hole surface center vehicle inner (X coordinate, Z coordinate)		stage (,)
Headrest		All height adjustments (mm)		mm
		Mid. pos.	# of stages from top	stages
			Adj. Amt. from top st	mm
		Fore-aft total adjust. (mm)		mm
		Mid. pos.	# of stages from bottom	stages
			Adj. Amt. from btm. st	mm
		Headrest stay angle		°
Other ( )		Design standard location		
Seat Center		Y coordinate (lateral dir.)		Y=
Seat Anchor Bolt		Clamp torque		Nm

※ Y = distance from the seat anchor bolt's hole center (front side of vehicle center side)

※ # of adjustment stages shall start from the first locking position ("stage 0")



Appendix 4-1: H Point / Backset Measurements

[For use by vehicle manufacturer]

(Measurement) Date:

Name					
Model name					
Test Seat	Driver's Seat / Front Passenger's Seat				
Seat fore-aft adjustment mid-position (mm)	(forwardmost	mm or	rearmost	mm)	
	full adj. amt.	mm			
Seat fore-aft adjustment mid-position (stage)	(forwardmost	stage or	rearmost	stage)	
	full adj. amt.	stage			
Vertical adjustment mid-position	Tilt	From lowest			
	Lifter	From lowest			
	Other	From lowest			
Seat lower / Seatback adj. (mid-vertical)					
Seatback stage (angle) (X, Z coordinates)	stage (°)	(,)			
Headrest (height) mid-position	(from highest stage)	stage	(from highest stage)	mm	
Headrest (fore-aft) mid-position	(from rearmost)	stage	(from rearmost)	mm	
Headrest stay angle	°				
Other ( ) Design standard pos.					
Seat Center (coordinate Y)	(From seat anchor bolt center on the hole surface)	Y=			

H Point	Measuring time	X (left side) (fore-aft) mm	Z (left side) (vertical) mm	X (right side) (fore-aft) mm	Z (right side) (vertical) mm
Target val.					
1st time					
2nd time					
3rd time					
Average					

Back pan angle Backset	Back pan angle ° (deg)	Backset mm	Height mm
Target value			
1st time			
2nd time			
3rd time			
Average			

※ Y = distance from the seat anchor bolt's hole center (front side of vehicle center side)

※ # of adjustment stages shall start from the first locking position ("stage 0")

Appendix 4-2: H Point / Backset Measurements

[For use by testing institute]

(Measurement) Date:

Name					
Model name					
Test Seat	Driver's Seat / Front Passenger's Seat				
Seat fore-aft adjustment mid-position (mm)	(forwardmost	mm or	rearmost	mm)	
	full adj. amt.		mm		
Seat fore-aft adjustment mid-position (stage)	(forwardmost	stage or	rearmost	stage)	
	full adj. amt.		stage		
Vertical adjustment mid-position	Tilt	From lowest			
	Lifter	From lowest			
	Other	From lowest			
Seat lower / Seatback adj. (mid-vertical)					
Seatback stage (angle)	stage	(	°)		
(X, Z coordinates)	(	,	)		
Headrest (height) mid-position	(from highest stage)	stage	(from highest stage)	mm	
Headrest (fore-aft) mid-position	(from rearmost)	stage	(from rearmost)	mm	
Headrest stay angle	°				
Other ( ) Design standard pos.					
Seat Center (coordinate Y)	(From seat anchor bolt center on the hole surface)	Y=			

H Point	Measuring time	X (left side) (fore-aft) mm	Z (left side) (vertical) mm	X (right side) (fore-aft) mm	Z (right side) (vertical) mm
Target val.					
1st time					
2nd time					
3rd time					
Average					

Back pan angle Backset	Back pan angle ° (deg)	Backset mm	Height mm
Target value			
1st time			
2nd time			
3rd time			
Average			

※ Y = distance from the seat anchor bolt's hole center (front side of vehicle center side)

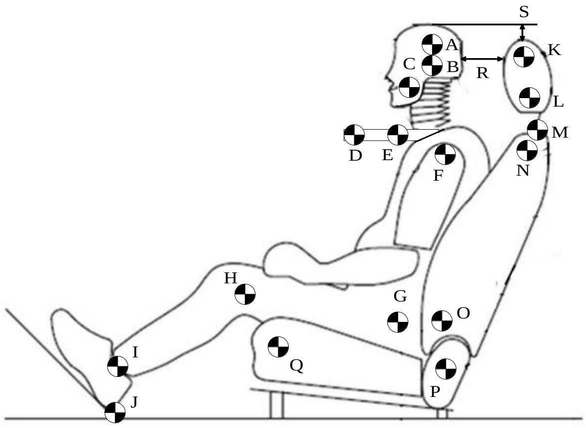
※ # of adjustment stages shall start from the first locking position ("stage 0")

Appendix 5-1: Dummy Positioning

[For vehicle manufacturer use]

Test #:

Test Date: (dd/mm/yyyy)   /   /



	Measurement Point	X (fore-aft)	Y (lateral)	Z (vertical)
B	Head center of gravity			
	Head angle			°
G	Hip point			
	Pelvis angle			°
J	Right heel			
J	Left heel			
M	Headrest inner hole center			
R	Backset			
S	Top of head - headrest height			
	Dummy center	—		—

Unit: mm

※Headrest inner hole center and base point are defined as a center of hole surface.

Appendix 5-2: Dummy Positioning Record Sheet

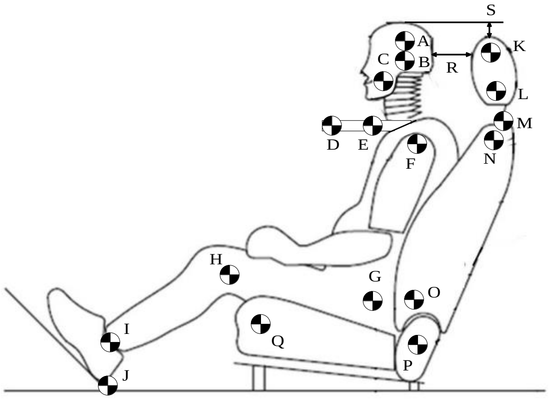
[For use by testing institute]

Test #:

Test Date (dd/mm/yyyy):

Assessment overseer:

Test Assistant:



	Measurement Point	X (fore-aft)	Y (lateral)	Z (vertical)
A	Head (upper)			
B	Head center of gravity (lower)			
C	Chin			
	Head angle			°
D	T1 Locator (front)			
E	T1 Locator (rear)			
F	Shoulder			
G	Hip point			
	Pelvis angle			°
H	Knee			
I	Ankle			
J	Right heel			
J	Left heel			
K	Headrest (upper)			
L	Headrest (lower)			
M	Headrest inner hole center			
N	Seatback (upper)			
O	Seatback (lower)			
P	Seat hinge			
Q	Seat cushion			
	Trolley floor height	—	—	
R	Backset			
S	Head top - headrest height			
	Base point (front inner seat anchor bolt)			
	Dummy center	—		—

Unit: mm

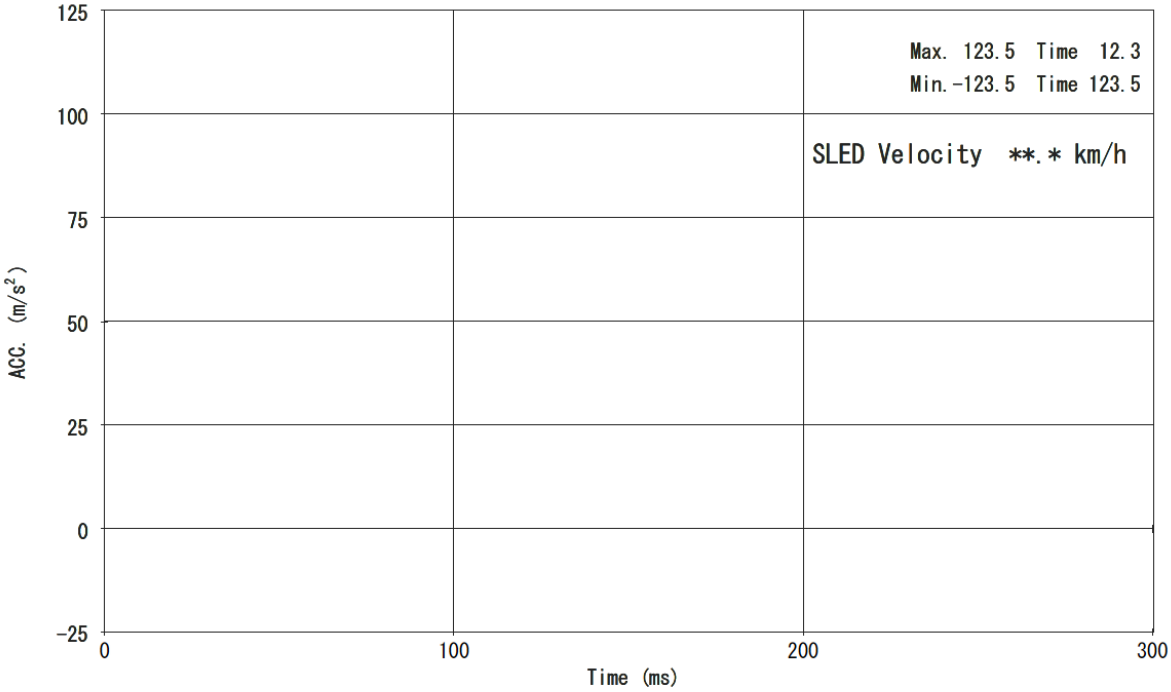
※ Headrest inner hole center and base point shall be the center of hole surface.

Appendix 6-1: Items to Check Seat Identicalness

To confirm the identicalness of the assessment test vehicle seat and the test seat, the following items shall be confirmed, then the measurement results and other necessary items shall be recorded before the test.

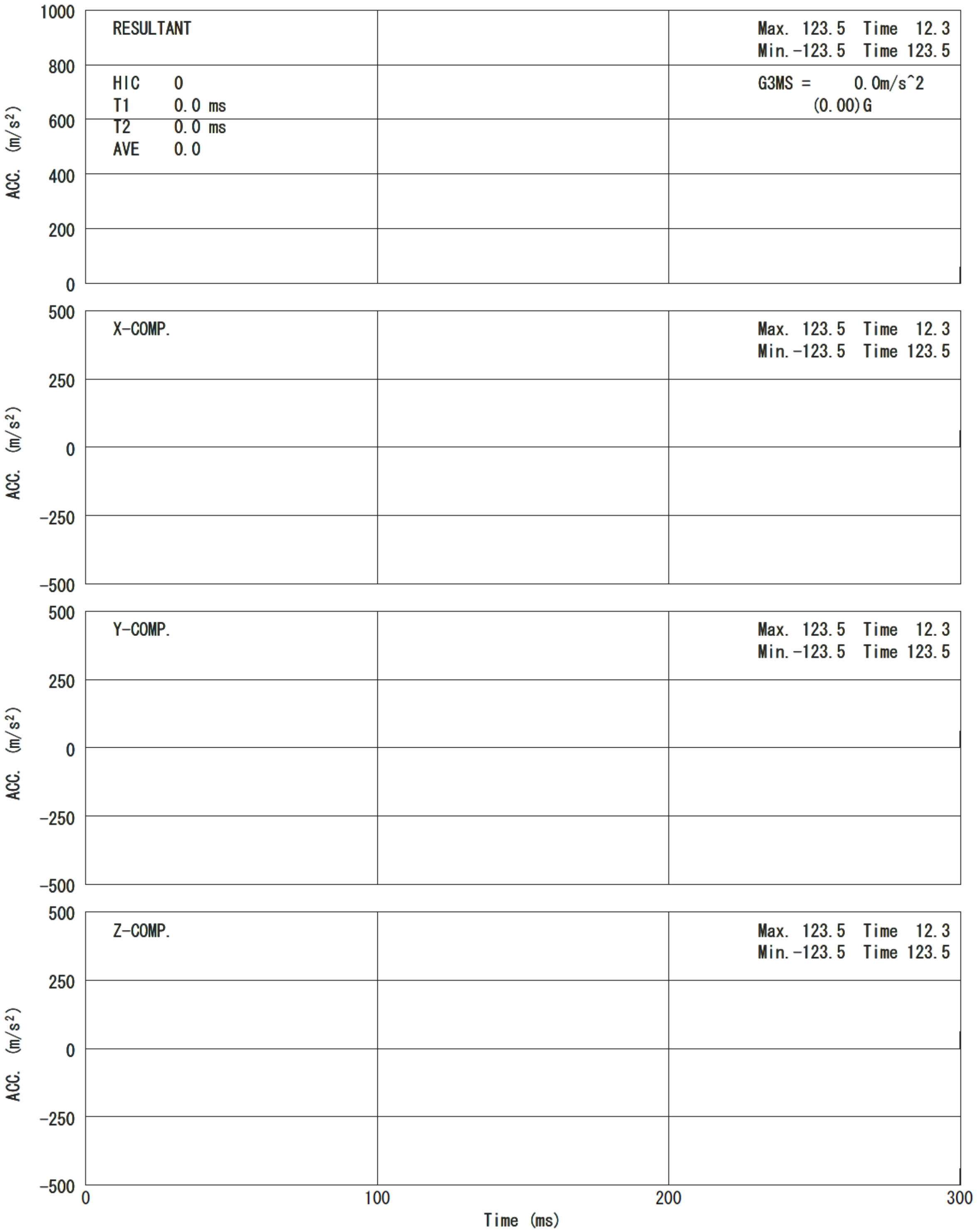
<table>
<tr><th colspan="2"></th><th>Test Seat</th><th>Test Vehicle Seat</th></tr>
<tr><td rowspan="2">Headrest Measurement</td><td>Length</td><td>mm</td><td>mm</td></tr>
<tr><td>Width</td><td>mm</td><td>mm</td></tr>
<tr><td rowspan="2">Seatback Measurement</td><td>Length</td><td>mm</td><td>mm</td></tr>
<tr><td>Width</td><td>mm</td><td>mm</td></tr>
<tr><td rowspan="2">Seat Slide</td><td>Full adjustment amount</td><td>mm</td><td>mm</td></tr>
<tr><td>Total # of stages</td><td>stages</td><td>stages</td></tr>
<tr><td>Seatback Angle Adjustment</td><td>Hinge Type</td><td>Single / double / electric</td><td>Single / double / electric</td></tr>
<tr><td colspan="2">Angle between seat rail and headrest stay (design standard position)</td><td>°</td><td>°</td></tr>
</table>

Appendix 7: Electric Measurement Result Recording Examples



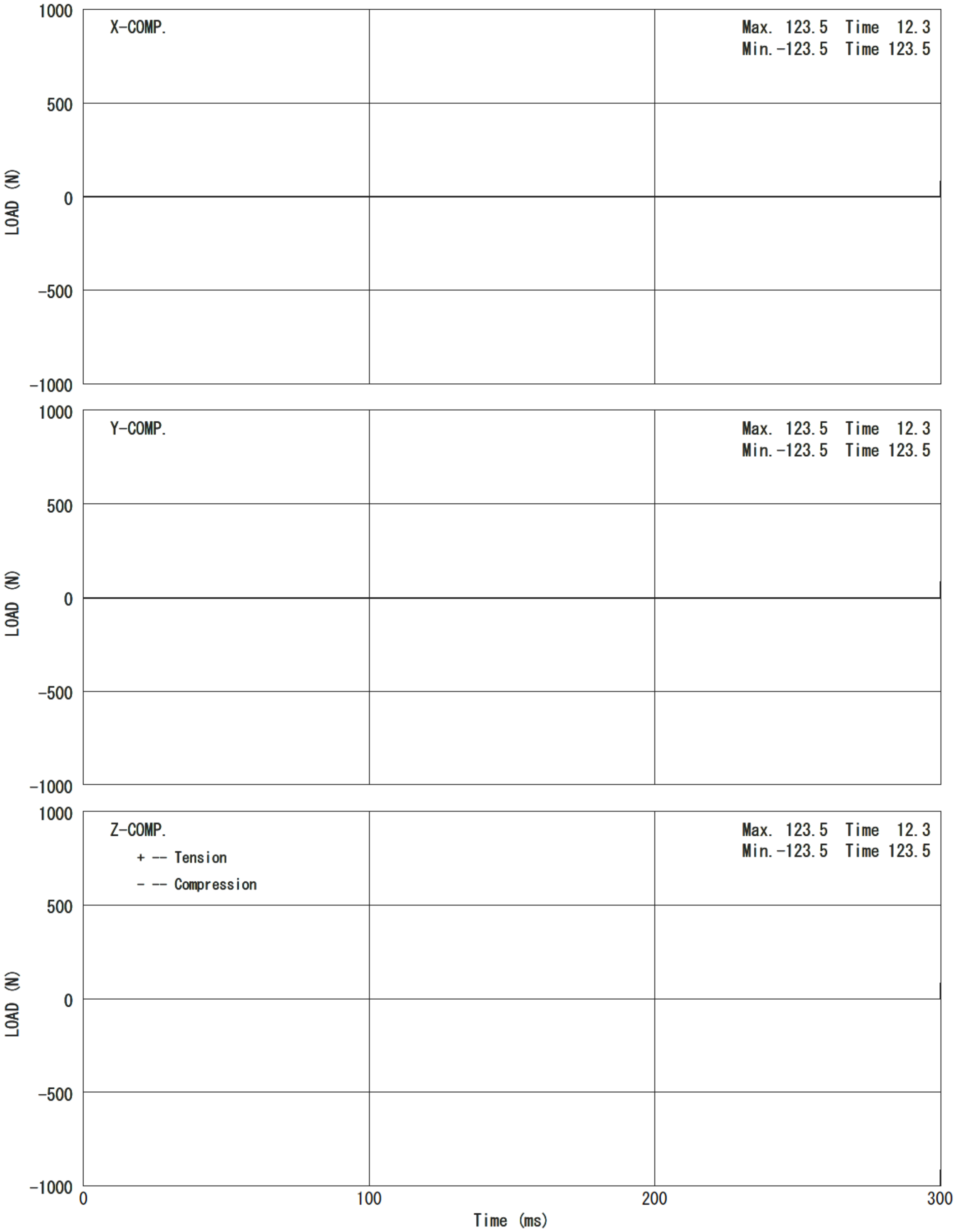
SLED FLOOR Acceleration & Velocity

No. NASVA



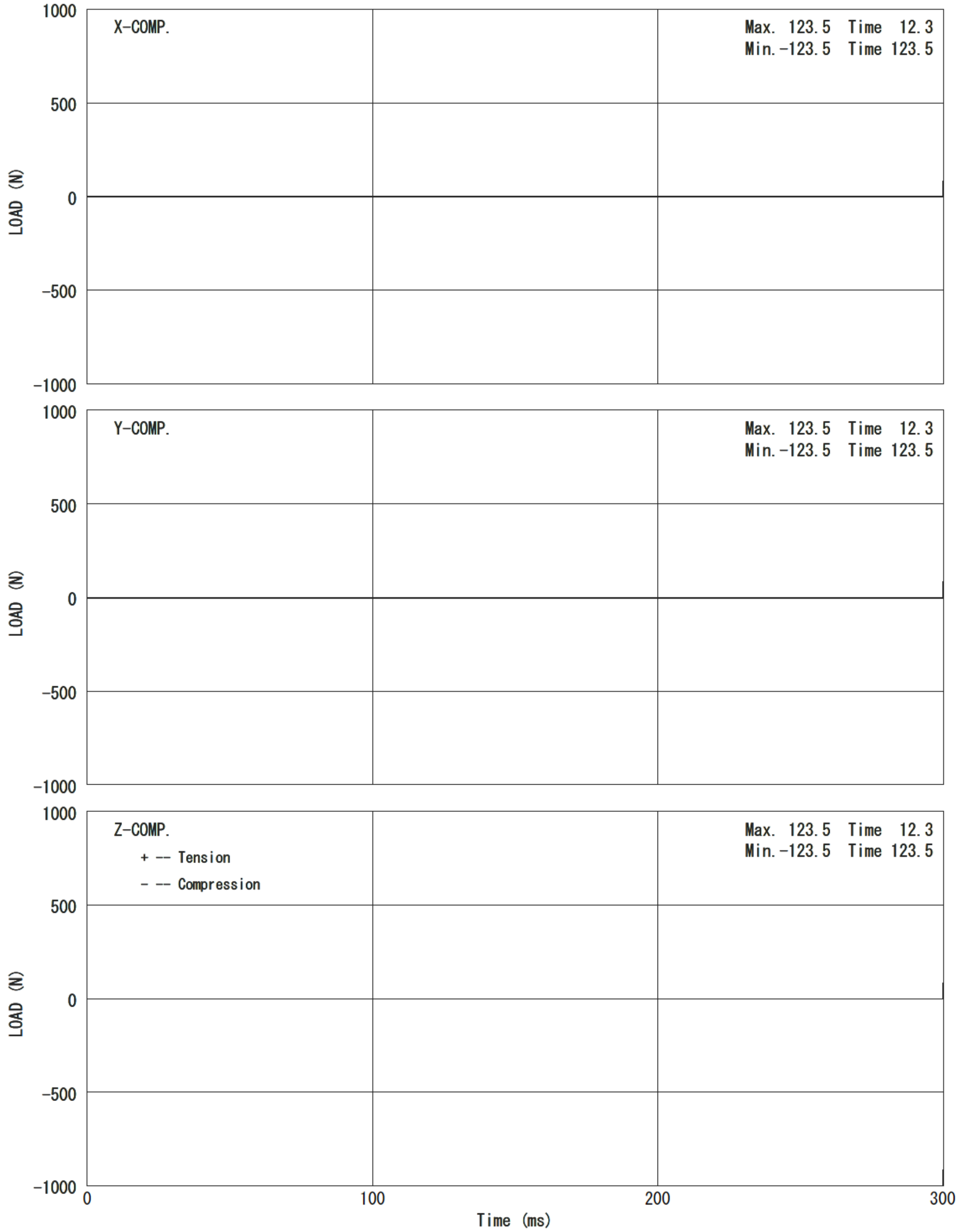
BioRID Dummy Head Acc.

No. NASVA



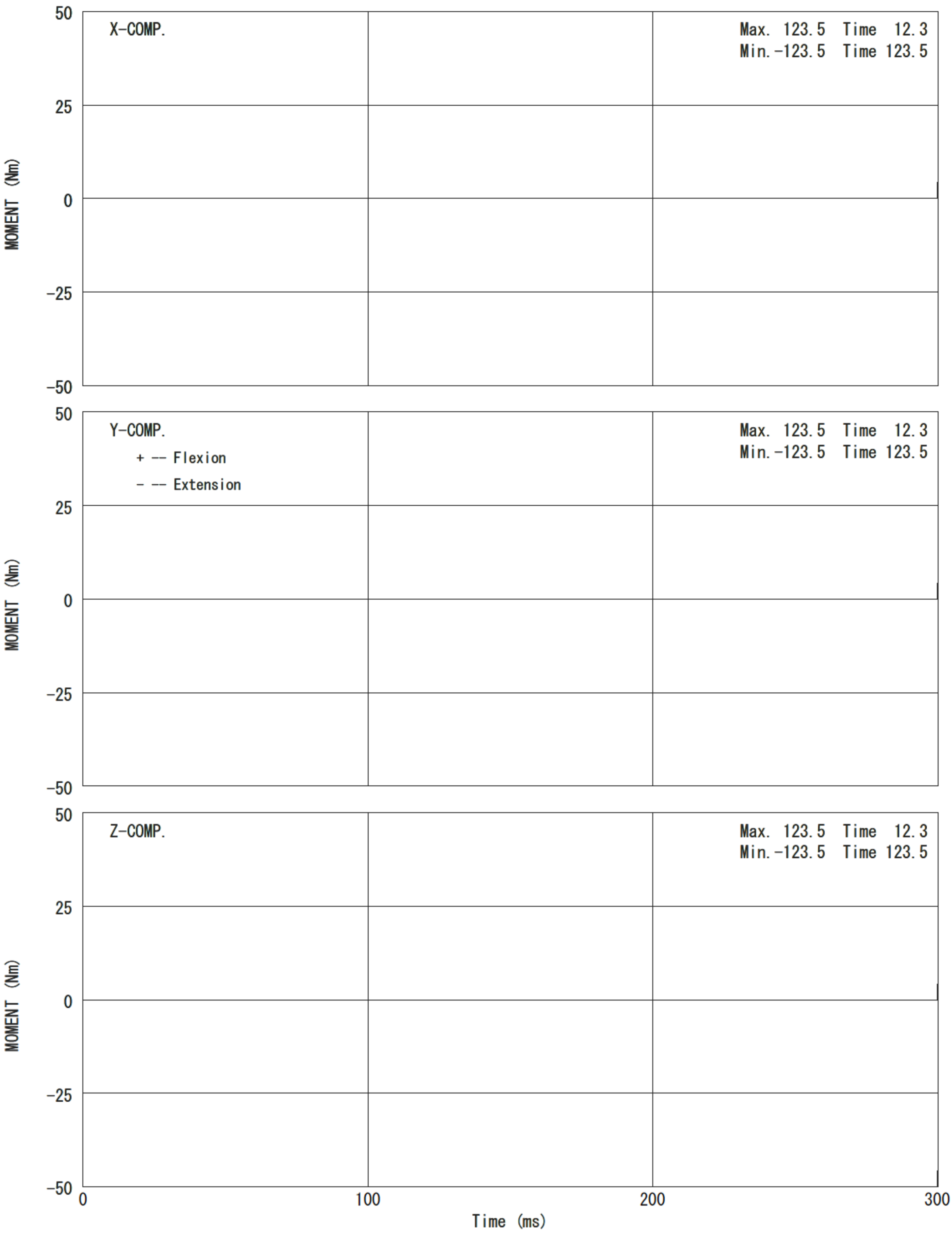
BioRID Dummy Skull Force

No. NASVA



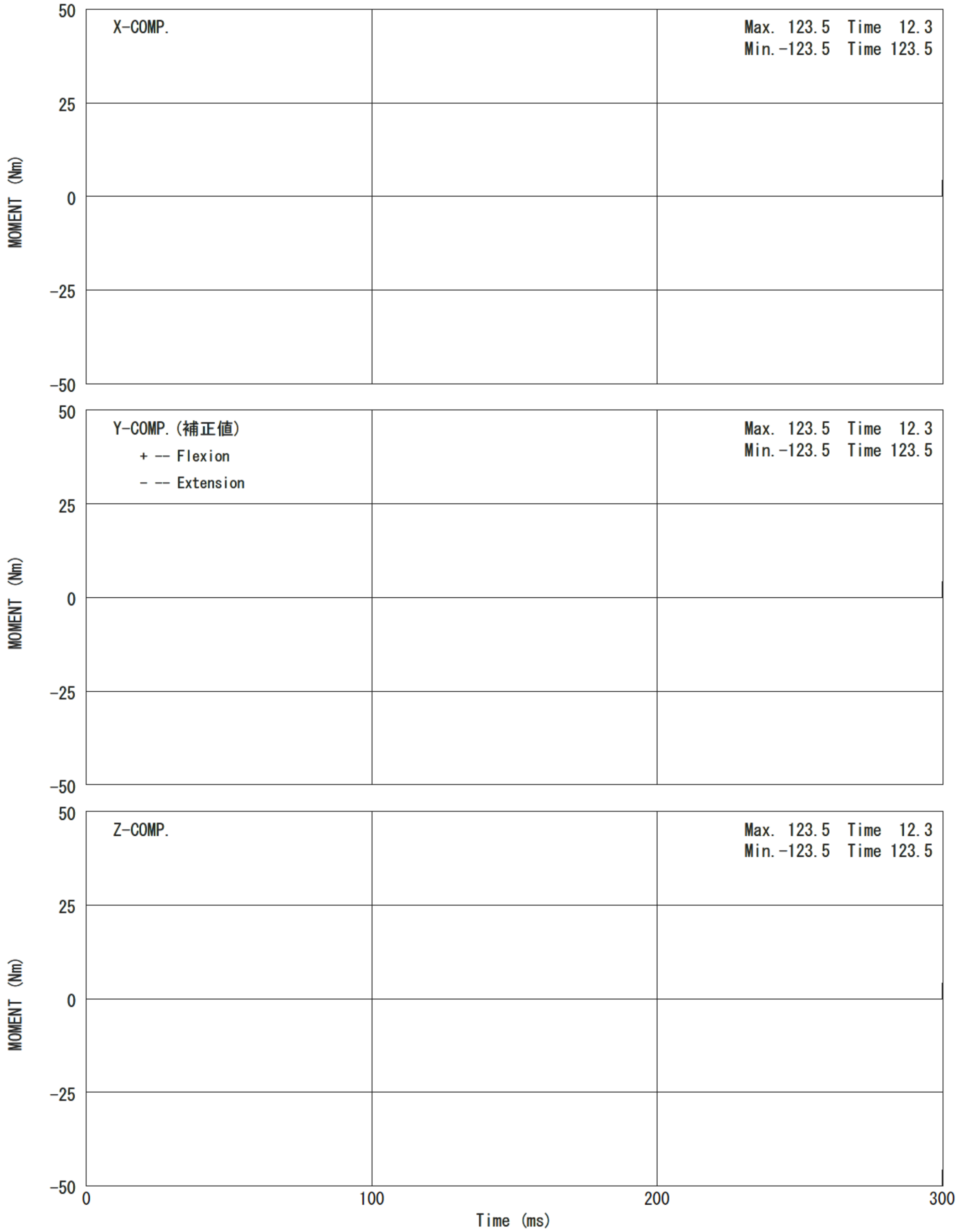
BioRID Dummy Upper Neck Force

No. NASVA



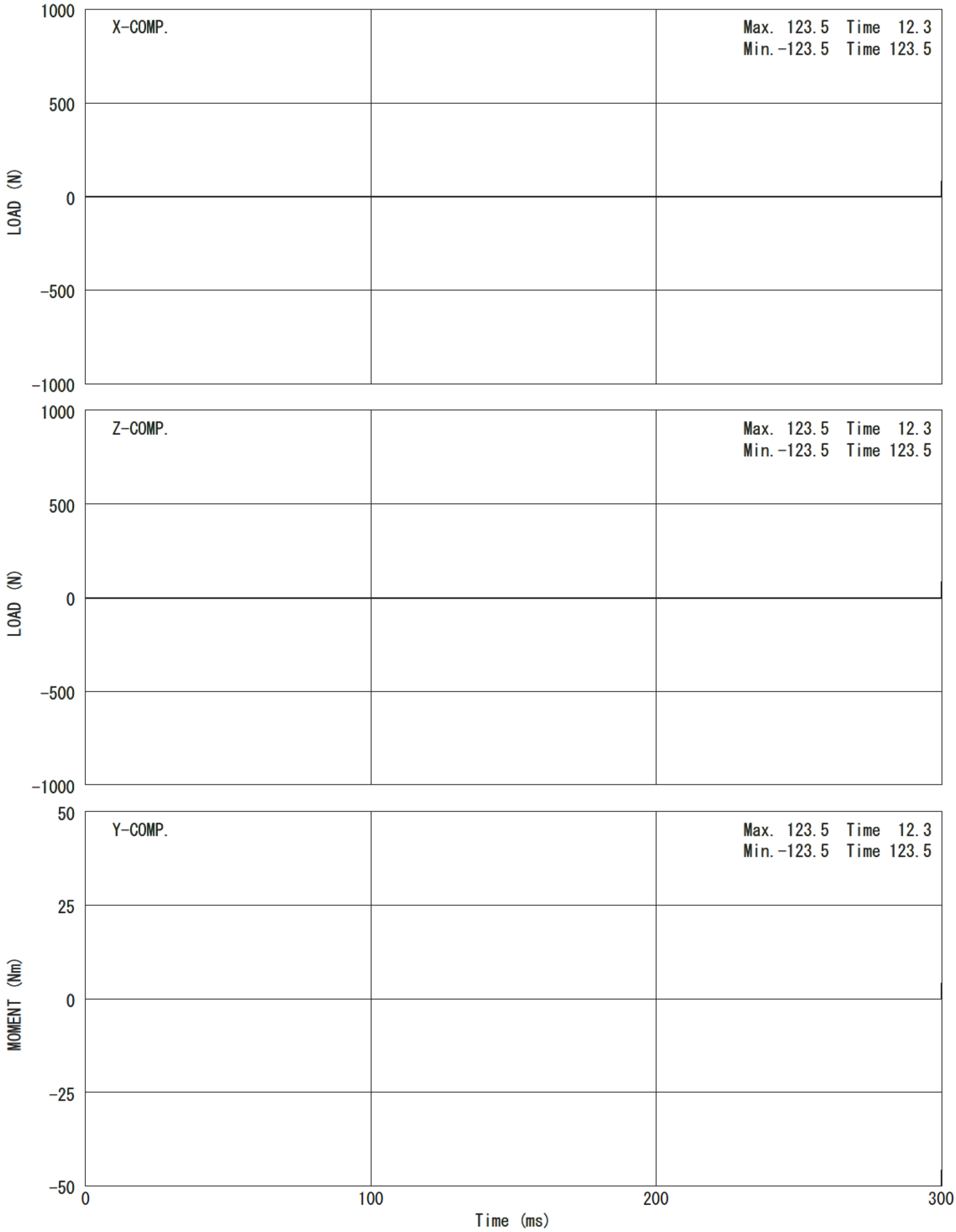
BioRID Dummy Upper Neck Moment

No. NASVA



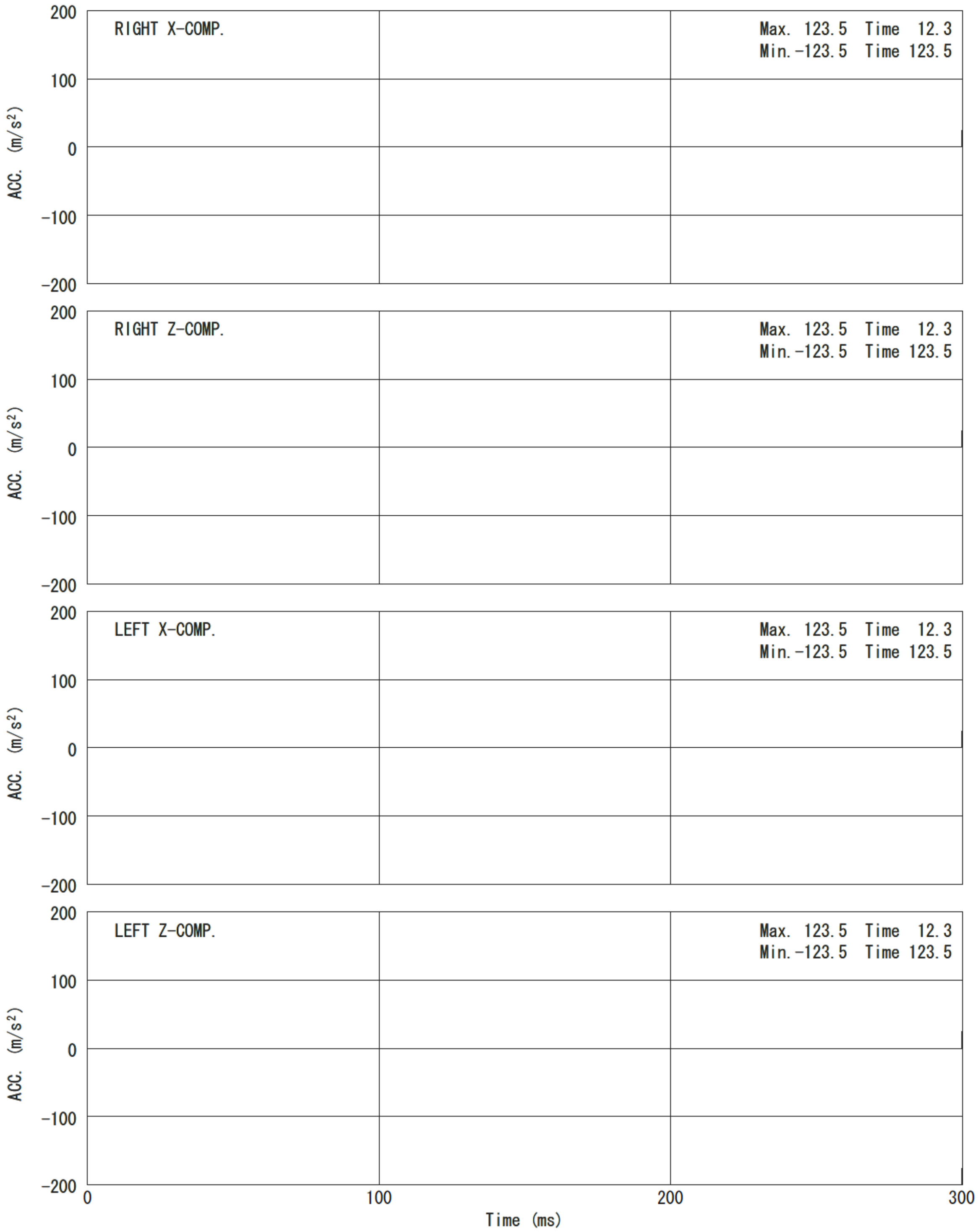
BioRID Dummy Upper Neck Moment

No. NASVA



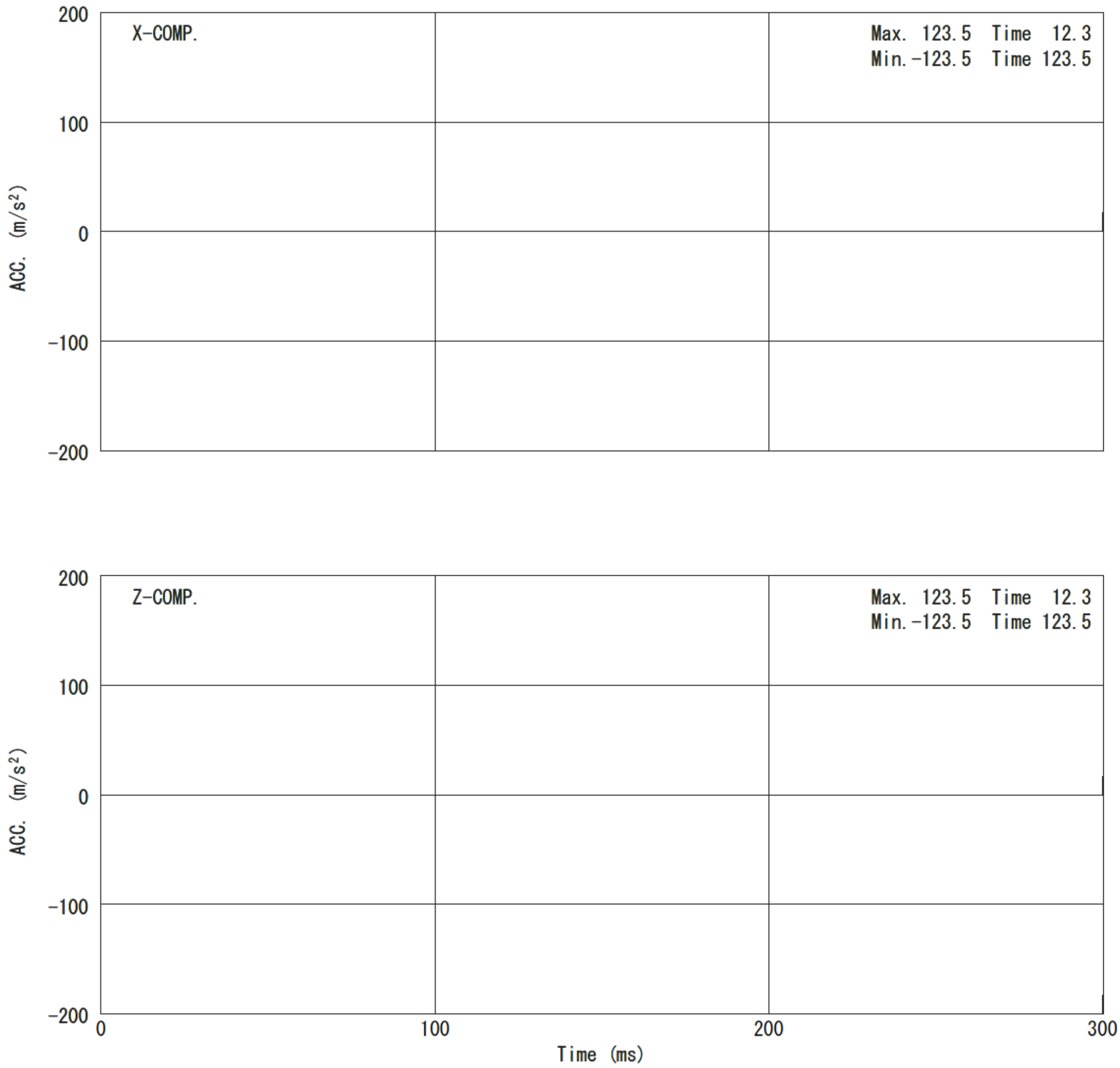
BioRID Dummy Lower Neck Force & Moment

No. NASVA



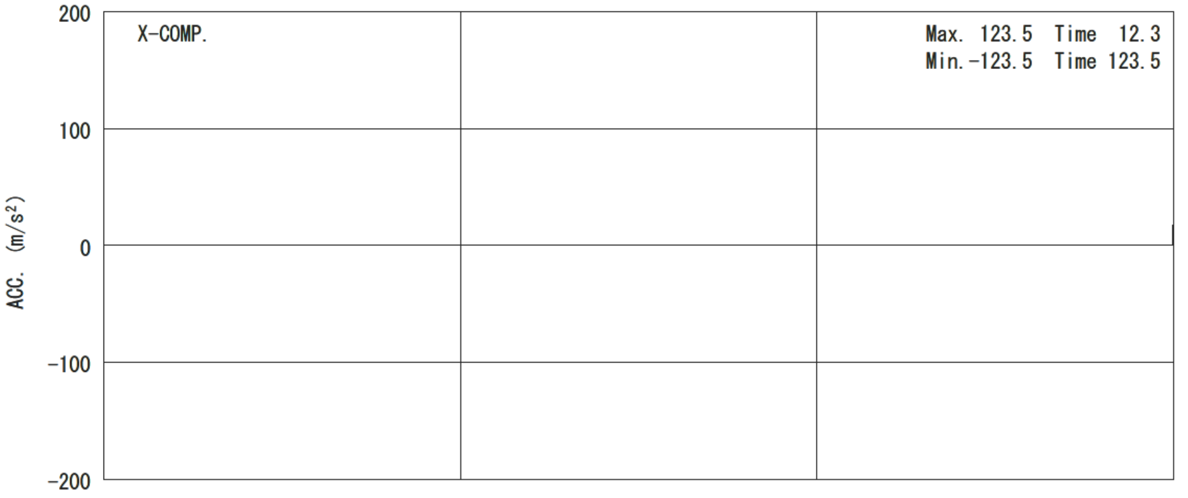
BioRID Dummy T1 Acc.

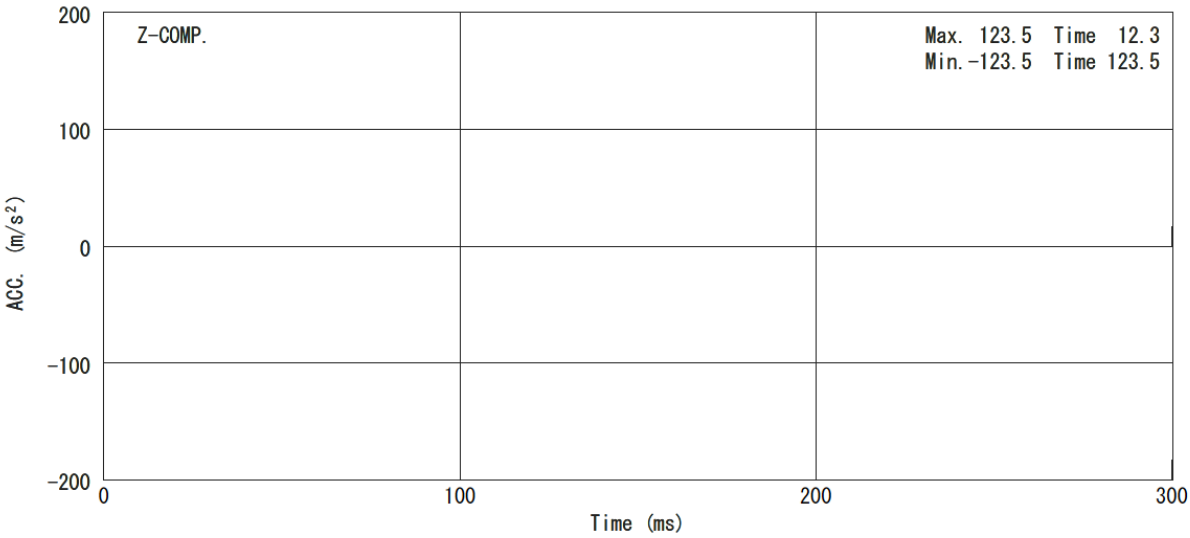
No. NASVA



BioRID Dummy T1 Average

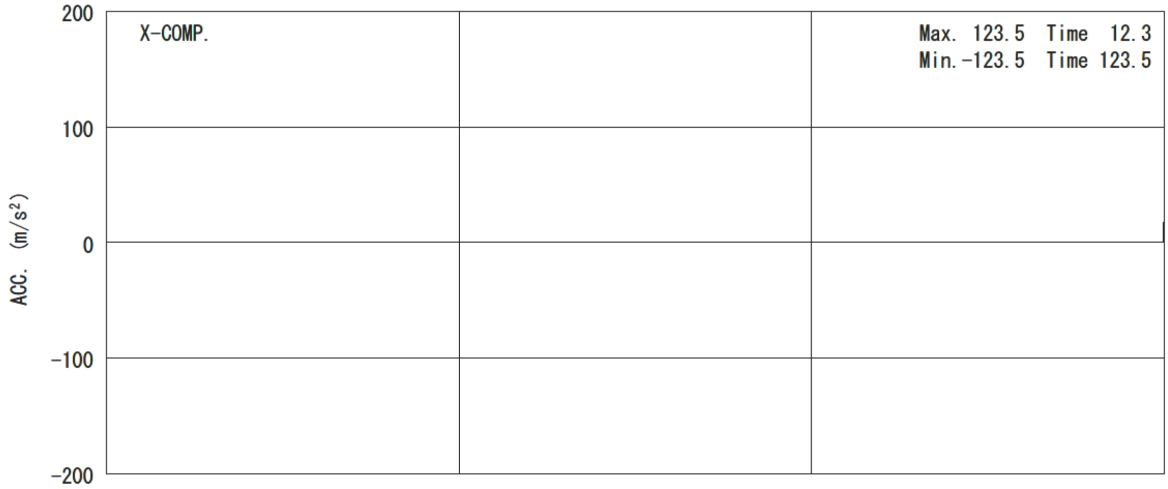
No. NASVA

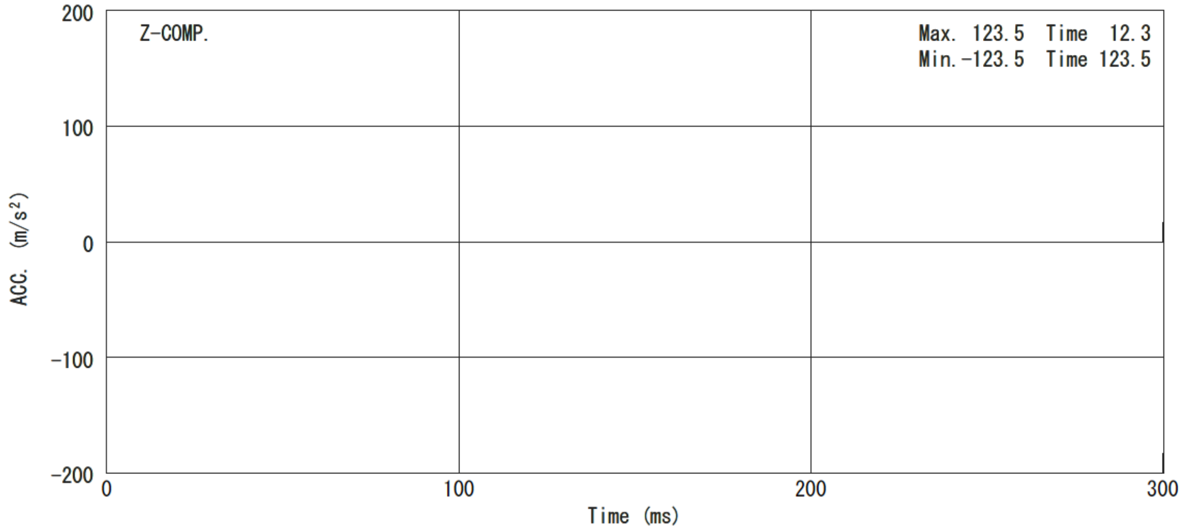




BioRID Dummy T8 Acc.

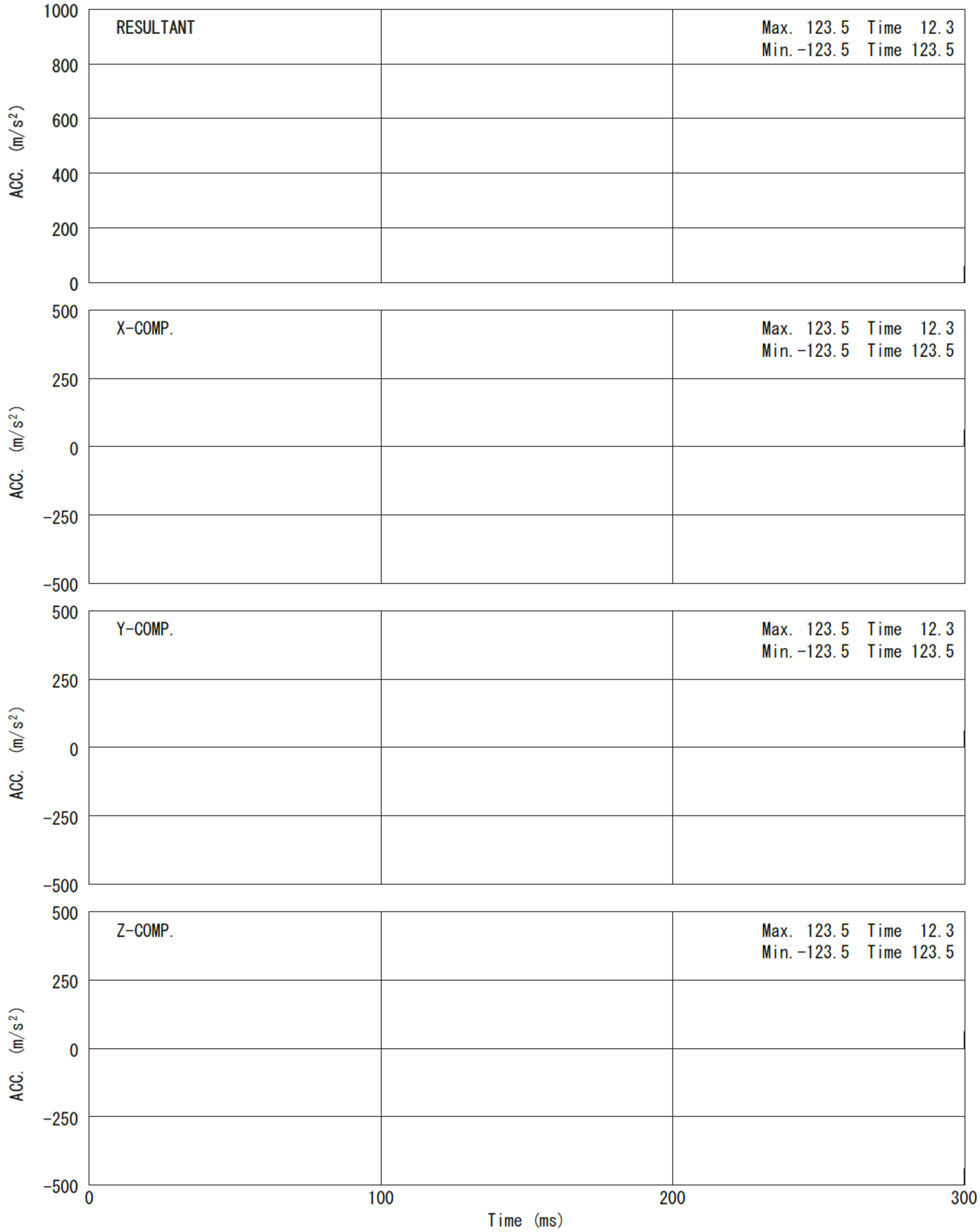
No. NASVA





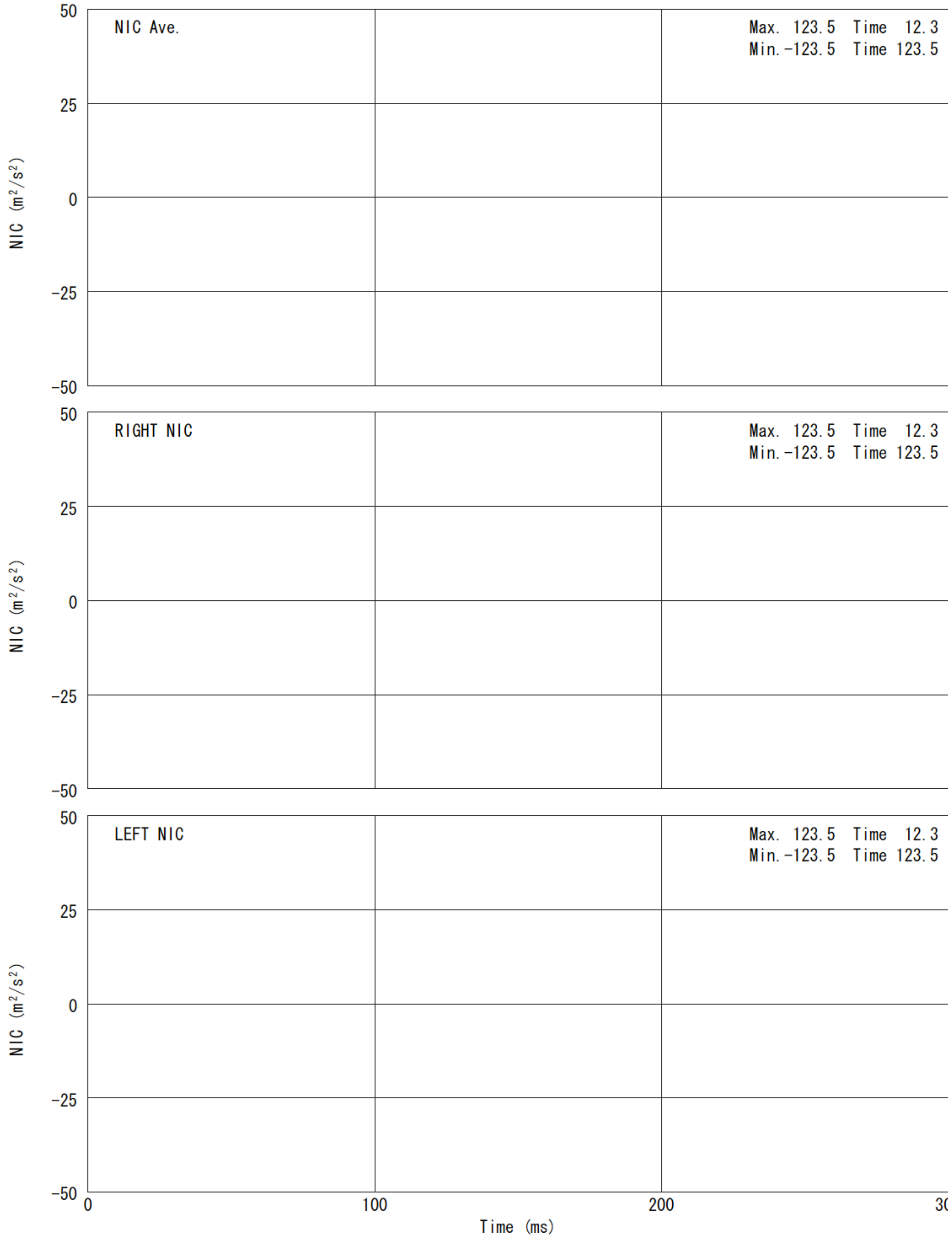
BioRID Dummy L1 Acc.

No. NASVA



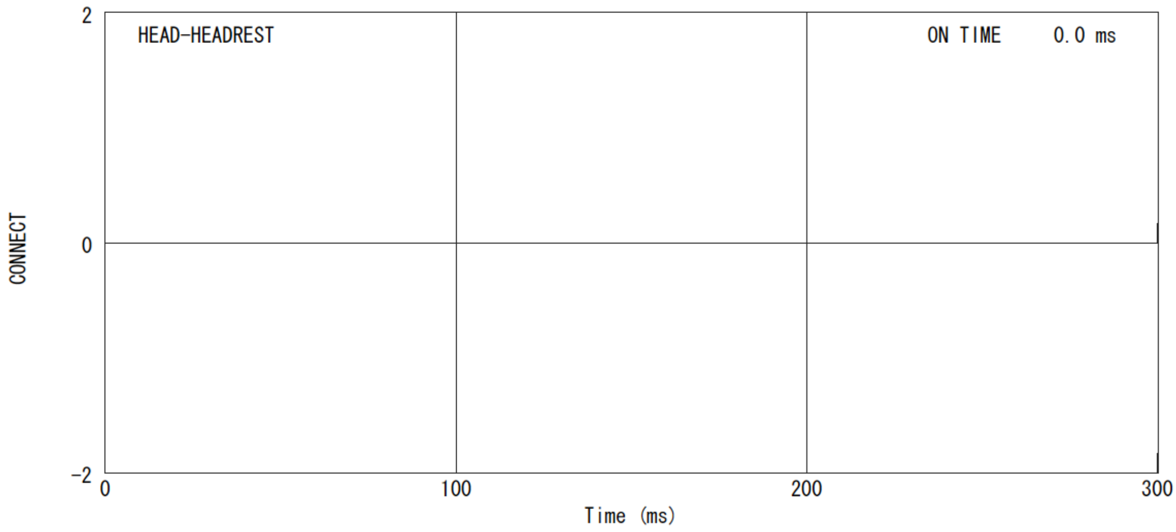
BioRID Dummy Pelvis Acc.

No. NASVA



BioRID Dummy NIC & Average

No. NASVA



BioRID Dummy Head - Head Restraint Contact Time

No. NASVA