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Please be sure to refer to the Japanese test method if you need to be precisely correct.

Offset Frontal (MPDB) Collision Test Procedure

Created: May 2, 2024

1. Effective Dates:

This test procedure shall be put into force starting May 2, 2024.

2. Scope of Application

This test procedure applies exclusively to the "New Offset Frontal Collision Test Procedure" 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.

3. Definition of Terms

The terms in this test procedure are defined as follows:

(1) **Moving Deformable Barrier (hereinafter referred to as "MPDB"):** A progressive deformable barrier attached to the front of a trolley with which the test vehicle collides.

(2) **Dummy**: The anatomical models of adult men and women that ride in the test vehicle. In this test, this refers to the THOR (Test device for Human Occupant Restraint) Dummy Male 50^{th} Percentile (National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation,) and the Hybrid III Dummy Female 5th Percentile (CFR (U.S. Federal Regulations,))respectively: THOR" (https://www.nhtsa.gov/biomechanics-trauma/thor)) and Hybrid III dummy adult female 5% tile (CFR Title 49, Part 572, subpart O).

(3) **HIC (Head Injury Criterion):** An index showing the degree of injury to the dummy's head.

(4) DAMAGE (Diffuse Axonal Multi-Axis General Evaluation): A value indicating the degree of brain injury calculated using angular velocities around the front-back axis, left-right axis, and vertical axis of the center of gravity of the THOR dummy's head.

(5) Neck shear load: The shearing load on the upper neck loaded in the fore-aft direction

(6) Neck axial load: The tensile load on the upper neck loaded in the vertical direction.

(7) Neck extension bending moment: The moment on the upper neck around the lateral axis.

(8) Chest Displacement: Displacement measured on the THOR dummy chest in 4 places and on

hybrid Ⅲ dummy in 1 place

(9) Abdominal Displacement: Displacement measured on the THOR dummy abdomen in 2 places.

(10) Acetabular load: The load applied to left and right acetabular near the lumbar of THOR dummy

(11) Ilium load: The load applied to left and right pelvic ilium of dummy

(12) Femur Load: a load applied to parts of the dummy corresponding to the right and left femurs in the axial direction of the femurs at the time of collision.

(13) TCFC（Tibia Compressive Force Criterion）: Criterion for tibia compressive force

(14) TI（Tibia Index）: Tibia index

(15) Vehicle Width: The horizontal measurement between the right and left outer sides of the vehicle parallel to the longitudinal plane of the vehicle. However, side-view mirrors, side marker lamps, tire pressure indicators, turn signals, position lamps, flexible mud guards, and the distorted part of tire side-walls directly above the part contacting the ground surface are excluded.

(16) Overlap: The width of the vehicle in the area facing the surface of the barrier.

(17) Design Hip Point: The base point of each seat, which is determined in accordance with the method specified in Attachment 1.

(18) Hip Point: The vehicle manufacturer specifies where the dummy's hip points are in the test vehicle.

(19) Lap belt riding up from the ilium on the pelvis: The phenomenon in which the iliac spine on the pelvis is not properly restrained by the lap belt due to the belt riding up from the ilium on the dummy.

4. Test Environment

4.1 Condition of Test Vehicles

4.1.1 Provision of Data from Manufacturers

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

(1) Appendix 1

(2) Points to be specially checked during the preparations for the test. (Points to be checked for test preparations specific to the model concerned or, certain models including the model concerned.)

4.1.2 Test Automobile Mass

(1) The mass of the test automobile shall be adjusted to within the range of 100 to 101 percent of the mass when stored* without the dummies in the driver or passenger seats (referring to the seat next to the side of the automobile among those parallel to the driver seat, the same shall apply below), with the reduced mass of the measuring equipment (40kg) added.

However, this shall not apply to instances where the mass cannot be adjusted to within this range even by removing parts that have no chance of influencing test results. Furthermore, testing of automobiles equipped with spare tires and tools may be conducted with these items attached to the vehicle.

*Mass of the test vehicle when brought in: Upon receiving the test vehicle, the testing institute shall fill all fluid containers to the maximum level of the specified range, and fill the fuel tank (see Appendix 1-3) to 100% capacity (for gasoline cars: fuel tank capacity x 0.745g/ml, for diesel cars: fuel tank capacity x 0.840g/ml) and then measure the mass of the test vehicle. This mass shall be regarded as the mass of the test vehicle when brought in. Furthermore, presuming that the loaded weight will be positioned on the upper equivalent of the fuel tank, the vehicle manufacturer may designate the loading position. In such cases, instructions shall be in Appendix 1-3.

(2) In regard to parts among installed components that have no influence on test results, the parts in question may be removed.

[Examples of components that will not affect the test results]

Rear bumper, rear windshield, trunk door, muffler, lighting units, and other items installed to the rear where the driver seat shoulder harness is affixed.

4.1.3 Vehicle Posture

The test vehicle with the dummies placed in the driver seat and the passenger seat shall have an inclination of ±3° relative to the vehicle manufacturer and importer specified values on the horizontal plane in the fore-and-aft direction and an inclination of ±1° relative to the horizontal plane in the lateral direction.

4.1.4 Test Vehicle Fluids

(1) Fluids such as oils may be drained.

(2) Battery electrolytes shall be drained (this does not apply to cases where the battery electrolytes will not leak at the time of collision such as cases where the battery is installed in the rear trunk). This does not apply when there is an offer from a manufacturer because there is a possibility that it affects the action of restraint devices. In such a case, the automobile manufacturer shall indicate this in Appendix 1.

(3) The fuel tank must be filled with colored water equivalent to the fuel mass when the fuel tank is filled to over 90% capacity.

4.1.5 Seat Adjustments

4.1.5.1 Driver Seat

The driver seat shall be set to a position stipulated within (1) and (5) below. Details on each adjusting device, including compound type adjusting devices, shall be indicated in attachment 2-1.

(1) In cases where the driver seat can be adjusted in a front-back direction using seat rails, the

seat shall be adjusted to the midpoint in the front-back direction. However, if the seats cannot be adjusted to the middle position in the fore-and-aft direction or can't meet the requirements of the following ① to ③, they shall be adjusted behind the middle position in the fore-and-aft direction and the closest position from the middle position meet the requirements.

① The amount of depression of the accelerator pedal by the foot of the dummy is 20mm or less.

② The distance between the thigh and the steering wheel is 20mm or more, and the distance between the thigh and the seat's surface is 30mm or less.

③ The distance between the lower leg and the instrument panel or the steering column cover is 30mm or more.

(2) The front seats shall be adjusted to the lowest position if they can be adjusted in the vertical direction (excluding those whose seat lower, seat cushion surface, and seatback angle change at the same time).

(3) If the seatback angle can be adjusted, it shall be adjusted to the design standard angle. If the lumbar support of the seatback can be adjusted, it shall be adjusted to the rearmost (fully retracted) position.

(4) If the head restraints of the front seats can be adjusted in the vertical direction, they shall be adjusted to the highest locking position in the vertical direction.

(5) If the front seats have adjustment mechanisms other than the abovementioned (1) through (4), the adjustment position or adjustment angle shall be adjusted to the design standard position or the design standard angle, respectively. However, all adjustments to the seat angle shall be in the lowest position.

4.1.5.2 Passenger Seats

The driver seat shall be set to a position stipulated within (1) and (5) below. Details on each adjusting device, including compound type adjusting devices, shall be indicated in the attachment 2-2.

(1) The front passenger seat shall be adjusted at standard position as designed, which is frontward from the mid-point, if adjustable in front-back direction by the seat rail. However, when the design standard position is not specified, it is made as close as possible to the further intermediate position between the front most position and the intermediate position (within 25% from the front most position of the adjustable range). If it is not possible to adjust to the intermediate position further between the foremost position and the intermediate position, it is adjusted to an adjustable position that is rearward of this position and closest thereto. Also, the distance between the lower leg of the dummy and the instrument panel must be adjusted to a position where it can be secured by at least 10 mm.

(2) The front passenger seat shall be adjusted at standard position as designed if adjustable in up-down direction (excluding adjusters that also affect the angles of the seat lower, the seat surface and the seat back at the same time).

(3) In cases where seat back angle of the passenger seat can be adjusted, the seat shall be adjusted to the standard angle as designed. However, it shall be re-adjusted if the dummy's head angle cannot be adjusted within the range of ± 0.5 degrees in a horizontal direction.

(4) In cases where the headrest of the passenger seat can be adjusted in the up-down direction, the headrest shall be locked in at the lowest possible position in the up-down direction.

(5) In cases where the passenger seat has adjustment devices other than those mentioned in (1) to (4), such devices shall be adjusted to the standard position or standard angle as designed.

4.1.5.3 Seats other than the Driver and Passenger seats

Seats other than the driver seat and passenger seat (referred to hereafter as "front seats") shall be adjusted to the standard position and angle as designed.

4.1.6 Adjustment of the Steering System

(1) In cases where the steering system can be adjusted upwards or downwards, it should be in a position that is in the geometrical center of the adjustable range when driving. However, in cases where the steering system cannot be adjusted into a central position, it must be adjusted to the closest possible position lower than a central position.

(2) In cases where the steering system can be adjusted forwards or backwards, it should be in a position that is in the geometrical center of the adjustable range when driving. However, in cases where the steering system cannot be adjusted into a central position, it must be adjusted to the closest possible position to the rear of a central position.

4.1.7 Adjustment of the Seat Belt Shoulder Harness Mounting

If the position of the seat belt shoulder harness mounting is adjustable, it should be placed in the standard position as designed.

4.1.8 Other Vehicle Conditions

4.1.8.1 Ignition

The motor of the test automobile should be in a stopped state. However, the ignition switch should be in the ON position.

If the test automobile is equipped with electrical restraint devices such as airbags and seat belts with pre-tensioner structures, it should be confirmed that such devices will operate properly with warning lamps when the ignition switch is put in the ON position. Regarding vehicles equipped with electric motors, the motor power supply circuit may be quarantined if the structure is such that it will not influence these devices upon consultation with the automobile manufacturer.

4.1.8.2 Side Windows and Doors

All side windows of the test vehicle that can be opened should be opened (excluding those to the rear of the driver seat). Doors should be properly shut. However, they shall not be locked.

Furthermore, automobiles equipped with systems that lock doors in response to vehicle speed or increases in vehicle speed/engine rotations will have said systems disabled in cases where a means of setting/disabling the system is noted in the user' s manual, and if it is possible to easily perform such operations without the use of tools.

4.1.8.3 Roof

If the roof is removable, the roof shall be installed.

If the roof is a sunroof, the sunroof shall be closed.

If the vehicle is a convertible, the top shall be closed.

4.1.8.4 Drive Axle, Transmission, and Parking Brake

If the drive axle can be selected, the standard drive axle shall be selected.

The transmission shall be neutral.

The parking brake shall be released.

4.1.8.5 Tires

The air pressure of the tires shall meet the requirements of the specification sheet.

4.1.8.6 Other

(1) Installation of Stroboscope, etc.

The test vehicle shall be equipped with a stroboscope, etc. for identifying the moment of collision in photographs taken using a high-speed photography device. However, this provision shall not apply to cases where the stroboscope, etc. is installed in ground facilities within the visual field of the high-speed photography device.

(2) Remodeling the Test Vehicle

The structure and devices of the test vehicle forward from the driver seat shall not be remodeled. However, such prohibitions do not apply to remodeling necessary for towing the test vehicle, installation of the stroboscope used to identify the moment of collision, securing of space for fixing wiring, and attachment of instruments for measuring the speed of the test vehicle, insofar as the test results are not affected.

When remodeling is necessary for towing the test vehicle, the hook, lower suspension arms, stabilizers, tension rods, front cross member, and floor cross member may be remodeled.

(3) Attaching Target Marks

In order to grasp the state of deformation in the test, marks (hereafter referred to as "target marks") shall be attached to the test vehicle at points that are not deformed during the test.

When attaching the target marks, the positions of each target mark and intervals between the target marks shall be recorded in the data sheet (dimensions shall be recorded using the key holes and the side sill of the vehicle as a reference).

(4) Coloring of Compartment Interior Trim

The interior trim of the compartment shall be colored using colors other than liquid chalk colors, etc. applied to the dummy so that the position at which the dummy collides with the interior trim can be easily identified.

(5) Adjusting Vehicle Height

The test vehicle shall be in the normal running attitude prescribed in Paragraph 4.1.3. If the vehicle has a mechanism for adjusting the height depending on the vehicle speed, the height of the vehicle shall be adjusted to the height specified by the vehicle manufacturer when traveling at 50km/h.

(6) Collision position confirmation lines

The front portion of the test vehicle must have lines drawn on the portion indicating the center of the vehicle to confirm collision position with the edge of the barrier.

4.1.9 Dummy and Seatbelt

4.1.9.1 Driver Seat Dummy Placement

The driver seat dummies shall be in the test automobile in a state described in sections 4.1.5 to 4.1.7. However, in cases where it is necessary to place the dummies onboard as stipulated, the position of the seats may be adjusted and steering parts removed. After the dummies are loaded onboard as specified, the positions of the seats should be placed in the state described in sections 4.1.5 to 4.1.7, and any removed parts restored to their proper state.

Seat adjustments that can be performed as part of the above provision are up-down positioning of the seat, seat back angle, seat back hip support position, angle at which seat lower is attached, up-down and front-back positioning of the headrest, as well as axial direction and angle of the steering column. Parts that may be removed are the cover of the seat position and angle adjusting device (up-down positioning of the seat, seat back angle, seat back hip support position, angle at which seat lower is attached), the headrest, steering wheel, doors, tops for vehicles with convertible and removable roofs.

(1) Arm

The upper arm should be as close to the upper torso as possible.

(2) Torso and shoulder

The dummy shall be horizontally aligned with the center of the seat, and its upper torso shall be in contact with the seatback. The shoulders are pushed in at the extreme rear.

(3) Hip point

The driver seat dummy’s hip point on the external side of the vehicle is to match a position that is 20mm forward in terms of the front-back direction and 20mm over in terms of the up-down direction. When doing so, it is fine if the hip point is within a square of ±13 mm in both the front-back and vertical directions. However, in cases where this condition cannot be met, the hip point is to be made as close to this range as possible.

(4) Pelvic angle

The pelvic angle of the driver's seat dummy shall be adjusted to the values of the tilt sensor built into the lumbar region of the THOR dummy within the range of 33° ± 2.5° for the front-back angle (around the left-right axis (Y)) and 0° ± 1° for the left-right angle (around the front-back axis (X)).

(5) Upper torso angle

The upper torso angle of the driver's seat dummy shall be adjusted to the value of the tilt sensor built in the lower neck position (equivalent to T1) of the THOR dummy within the range of ±1° for the front-back angle (around the left-right axis (Y)) and 0° ±1° for the left-right angle (around the front-back axis (X)) designed by the automobile manufacturer.

(6) Hands

Set the thumbs on the steering wheel rim. The position of the palms should be on a line that passes through the center of the steering wheel, with the top of the hands facing towards the exterior of the vehicle. The left and right armpits are to be closed. Affix the thumbs on the steering wheel with tape. The tape should be drafting tape approximately 12mm in width.

(7) Head angle

If the head of the driver's seat dummy is not in contact with the headrest, the headrest shall remain in place. If there is contact with the headrest, the headrest shall be moved backward and, if necessary, backward along the vertical direction. If the headrest cannot be adjusted any further, the test shall be performed at that location. The left-right angle (around the front-back axis (X)) should be adjusted to a range of 0° ± 1°, and the front-back angle (around the left-right axis (Y)) should be as close to horizontal as possible.

(8) Legs

The legs of the driver's seat dummy are initially set so that the distance between the outer surface of the flange of both knees is 270mm±10mm. However, these dimensions are not meant to stipulate the final position of the knees. If the distance between the knees and the instrument panel is less than 30 mm, the seat and dummy should be moved backward until a distance of 30 mm or more is secured. However, in such cases, the seat shall be adjusted forward and backward to the rear position closest to the middle position where a spacing of at least 30 mm can be secured. The right foot is to be placed upon the acceleration pedal in an undepressed state, with the heel set upon the floor at the bottom end of the acceleration pedal. In cases where the plane formed by the femur and tibia of the right leg is not perpendicular, move and adjust the knee until it is as close to perpendicular as possible. In cases where there is a footrest, the foot is to be placed upon the footrest. If there is no footrest, place the heel on the floor as close as possible to the intersection of the toe board and floor pan, and place the foot on the toe board. If the foot does not reach the toe board, put the foot at right angles to the tibia and on the floor as close as possible to the toe board. In cases where the plane formed by the femur and tibia of the left leg is not perpendicular, move and adjust the knee until it is as close to perpendicular as possible. In cases where the left foot interferes with the brake pedal or clutch pedal, the left foot is to be rotated as little as needed to center it with the tibia. If the foot is still in the way even after this, the femur may be rotated so that there is as little interference as possible.

4.1.9.2 Passenger Seat Dummy

The passenger seat dummies shall be placed in the test vehicle under the conditions prescribed in Paragraphs 4.1.5 through 4.1.7. However, in cases where it is necessary to place the dummies onboard as stipulated, the position of the seats may be adjusted and steering parts removed. After the dummy has been placed in the specified position properly, the positions of the seats shall be returned to the condition prescribed in Paragraphs 4.1.5 through 4.1.7 and the removed parts shall be reinstalled in the original positions.

The seat positions that may be adjusted as prescribed in the above proviso are the seat position in the vertical direction, seatback angle, and lumbar support position of the seatback, installation angle of the lower seat, position of the head restraint in the vertical direction and in the fore-and-aft direction, and axial direction and angle of the steering column. The parts that may be removed are the covers of the devices for adjusting the positions and angles of the seats (seat positions in the vertical direction, angle of the seatback, lumbar support position of the seatback, and installation angle of the lower seat), head restraints, doors, tops of convertible vehicles, and removable roof.

(1) Torso

The dummy shall be horizontally aligned with the center of the seat, and its upper torso shall be in contact with the seatback.

(2) Legs

① Both knees are first set so that the distance between the outer surface of the flange of both knees is 229 mm ± 5 mm (114.5 mm ± 2.5 mm from dummy center to left and right). However, these dimensions are not meant to stipulate the final position of the knees. Furthermore, this shall not apply to cases where the space between the knees and the instrument panel is not over 10 mm, cases where the space between the knees cannot be set to the stipulated interval, and cases where the knees cannot be set perpendicular due to the shapes of the instrument panel, floor, and toe board.

② Adjust the right and left femur and tibia so the planes formed by each of them are perpendicular to each other.

③ Place the femurs in a state in contact with the surface of the seat cushion, in a position with the leg as for as possible from front end of the seat cushion.

④ Place the foot and the tibia at a right angle, then lower the leg until the foot reaches the floor without changing the angle of the femur.

⑤ Rotate the foot with the heel touching the floor so that the toes touch the floor as much as possible.

⑥ In cases where the foot does not touch the floor, either place the calf in contact with the front end of the seat cushion or lower the foot until the back of the foot comes into contact with the interior upholstery and the foot is as level as possible with the floor.

⑦ In cases where the feet interpose with protrusions in the body of the vehicle, rotate the direction of the toes as little as possible to the left or right while maintaining the interval between the knees in order to avoid interposition. If the feet are still in the way even after doing this, rotate the femurs to eliminate or minimize the obstruction and prevent the feet from being in the way as much as possible. Finally, in cases where the space between the lower legs and the instrument panel is under 10 mm, conduct seat rail adjustments forwards or backwards to adjust the space to at least 10 mm.

In cases where the legs moved out of position while setting the position of the upper body, it shall be re-adjusted again.

(3) Arms

Although the upper arms shall be in contact with the seatback and with the sides of the torso, ultimately, it should be in contact with the seat back as much as possible, but also in contact with the torso. The lower arms and hands shall be in contact with the upper legs, and the little fingers shall be positioned to slightly touch the seat cushion. However, if the hands and arms are in contact with the vehicle trim or other parts after performing procedures, the arm may be placed on the armrest of the trim side to avoid such contact.

(4) Hip point

The dummy's hip point on the external side of the vehicle is to match a position that is left as-is in terms of the front-back direction, from the designed hip point after seat position has been adjusted and under 6mm in terms of the up-down direction. The hip point should be within a square of ±13 mm in both the front-back and vertical directions. However, if this cannot be met, it should be as close to that range as possible.

(5) Pelvis angle

Set the pelvis angle to a range of 20.0°±2.5°.

(6) Head angle

Set the head angle to a range of ±0.5° horizontally. If when doing so the head angle cannot be set within the appropriate range, the position of the dummy's upper body is to be readjusted within the ranges stipulated in (4) and (5), in the order of hip point then pelvis. In cases where, even after these readjustments, the head angle cannot be set within the range stipulated in this section, the seat back angle is to be adjusted to get the head angle within the appropriate range.

However, in cases where the position of a dummy's upper body has been adjusted as stipulated in (4) to (6) and the pelvis angle is not within the range stipulated in (5), the dummy's upper body posture may be moved forward or backward within a range of ±2.5° to adjust the pelvis angle. In cases where, as a result of these adjustments, the head angle no longer falls within the range stipulated in (6), the neck bracket is to be moved to adjust the head angle so that it is as close to level as possible.

4.1.9.3 Fastening the Seatbelt

After placing the dummies in the seats of the test vehicle, the seat belts shall be fastened in their design standard position, and they shall be tightened thoroughly. However, if the seatbelt is equipped with a device for eliminating the feeling of compression when the wearer fastens the seatbelt, the design standard slack shall be provided at the webbing for the shoulder.

For AF 5 percentile dummies, the center of the belt shall be placed between the breasts. If the belt will not fit there, reset it to the design standard position and confirm with a witness.

4.1.9.4 Dummy Temperature Conditions

The dummy shall be left in a room at a temperature of 19-22°C for at least four hours just before conducting the test to stabilize the temperature of the dummy. Furthermore, operations such as placement of the dummy may be carried out during this time. If there are justifiable reasons such as for preparing for conducting the test, the dummy may be removed from the room maintained at the above temperature for a maximum cumulative duration of 10 minutes. If the dummies are placed in the test vehicle, the temperature measuring point shall be at the height of the shoulders of each dummy. In other cases, the temperature measuring point shall be at a height equivalent to that of the shoulders of the dummies.

4.1.9.5 The Dummy's Coloring

Paint such as liquid chalk shall be applied to the face, head and lower leg of the dummies at the driver seat and passenger seat. Areas not covered in the information above cannot be applied.

4.1.10 Installation of Electric Measuring Instruments

4.1.10.1 Installation of Accelerometers

Accelerometers shall be installed at the following points in the test vehicle to measure acceleration during the collision. However, if it is difficult to install accelerometers at the specified position, the test institute may change the installation position at its discretion.

(1) Tunnel: 3-axes (fore-and-aft direction, lateral direction, and vertical direction)

(2) Inside of side sill to the left of the vehicle: Single axis (fore-and-aft direction)

(3) Inside of side sill to the right of the vehicle: Single axis (fore-and-aft direction)

The positions of the accelerometers shall be recorded in Appendix 2.

4.1.10.2 Installation of the seat belt load indicator

A load indicator for the shoulder belt shall be installed near the shoulder area of the dummy in the driver's and front passenger's seat belt to measure the load during a collision. The position of the load indicator shall be specified by the automobile manufacturer. To maintain the natural mounting position of the load indicator on the shoulder belt, the load indicator may be supported from above using drafting tape or other means. The mounting positions are described in Appendix 1.

4.1.10.3 Installation of Measuring Equipment

(1) Measuring equipment is to be affixed securely in positions that will not be affected by deformations caused by collision tests on the test automobile. However, if loading space cannot be procured within the vehicle, equipment may be loaded on external portions of the vehicle recommended by the automobile manufacturer.

(2) Wiring connecting the measuring equipment affixed to the test automobile with the transducer (the equipment converting the measured physical quantities into electrical signals) shall be given enough slack that it does not affect behavior of dummies during collision tests.

4.2 Test Facilities

4.2.1 Trolley

The specifications of the trolley shall be as follows. The trolley may be equipped with an appropriate braking device to prevent secondary collision. However, the braking device shall be activated at least 300 ms after collision with the test vehicle.

(1) Total weight shall be 1,200 ± 20 kg including barrier face and braking device.

(2) The center of gravity shall be located within 10 mm from the left and right centers of the trolley,

1,000 ± 30 mm backward from the front axle, and 500 ± 30 mm from the ground.

(3) The front-to-back distance from the front of the barrier face to the center of gravity of the trolley shall be 2,290 ± 30 mm.

(4) The height of the barrier face shall be 150 ± 5 mm from the ground at the lowest point of the barrier face on the left and right sides when measured under stationary conditions before impact.

(5) The outer edge of the barrier face shall be 850 mm ± 10 mm from the left and right centers of the trolley.

(6) The width between the front and rear wheels of the trolley (the distance from the center of the left tire to the center of the right tire) shall be 1,500 ± 10 mm.

(7) The distance between the front and rear axles of the trolley shall be 3,000 ± 10 mm.

(8) The mounting surface (frame plate) of the barrier face shall be 1,700 mm wide and 645 mm high.

(9) Equipping the trolley with a braking device shall be optional.

(10) The tire pressure of the trolley shall be the same for all four wheels.

(11) The weight distribution on the left and right sides of the trolley shall be the same as far as possible.

(12) There shall be no structures on the upper side of the frame plate that vehicles may come in contact with.

4.2.2 Progressive deformable barrier

The specifications and verification methods for progressive deformable barrier shall be equivalent to those specified in Technical Bulletin TB022 (Euro NCAP Mobile Progressive Deformable Barrier Face Specification Draft Version 1.2.1 March 2023) in EuroNCAP. The manufacturer shall perform one dynamic test for every 100 units of the barrier face produced, in accordance with the method described in TB022 above.

4.2.3 The Runway

The runway must be an even, level, and dry road surface.

4.2.4 Towing Unit

The towing device shall be capable of causing a vehicle with a mass of 2.8 tons or less to collide in front of each other at a coasting speed of 50.0 ± 1km/h.

4.2.5 Lighting System

The lighting system must be capable of producing the amount of light needed for high-speed photography and must not cause halation.

4.2.6 High-speed Photographing Apparatus

The photographing speed of the high-speed photographing apparatus must be set to at least 500 frames/second. Furthermore, the time interval of the time base signal (timing pulse) must be under 10ms.

The camera may be equipped with polarizing filters to reduce unnecessary light.

4.2.7 Speed Measurement Device

The speed measuring device shall be capable of measuring the time required for the test vehicle and the trolley to pass through the speed measuring zone in units of 0.1ms or less.
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.
The speed-measuring device shall be installed so as to be able to measure the speed of the test vehicle and the trolley when it is traveling within 2m from the collision point.

4.2.8 Temperature and Humidity Measuring Equipment

The temperature of a dummy before testing as stipulated in section 4.1.9.4 and the dummy's temperature and humidity during inspection must be recorded at intervals of within 1 minute by an automatic logger. The minimum scale for the thermometer should be 0.1°C, while the minimum scale for the hydrometer (relative hydrometer) should be 1%.

4.2.9 Electrical Measuring Equipment

The connected state of measuring equipment, including all devices that compose them and output units (including analysis computers (measurement equipment in this state shall be referred to as "measurement channels")) must conform to ISO 6487:2002*1.
(1) The measurement channel shall measure acceleration, load, moment, and displacement according to the following channel classes.
① For collision tests, the channel classes are as follows:
(a) Head acceleration shall be 1,000.
(b) Head angular velocity (adult male 50% tile only) shall be 60.
(c) Head and neck spring cable load (adult male 50% tile only) shall be 1,000.
(d) The neck load shall be 1,000.
(e) Neck moment shall be 600.
(f) Clavicular load (adult male 50% tile only) shall be 600.
(g) Thoracic spine acceleration shall be 180.
(h) Thoracic spine load (adult male 50% tile only) shall be 600.
(i) Thoracic spine moment (adult male 50% tile only) shall be 600.
(j) Thoracic displacement shall be 180 for the adult male 50% tile and 600 for the adult female 5% tile.
(k) Chest angle (adult male 50% tile only) shall be 180.
(l) Sternal acceleration (adult male 50% tile only) shall be 1,000.
(m) Abdominal displacement (adult male 50% tile only) shall be 180.
(n) Abdominal angle (adult male 50% tile only) shall be 180.
(o) Abdominal acceleration (adult male 50% tile only) shall be 1,000.
(p) Lumbar acceleration shall be 1,000.
(q) Tibia load shall be 600 for adult male 50th percentile dummies and 180 for adult female 5th percentile dummies.
(r) Tibia momentum shall be 600 for adult male 50th percentile dummies and 1000 for adult female

5th percentile dummies.

(s) Acetabular loading (adult male 50% tile only) shall be 600.

(t) Femoral load shall be 600.

(u) Femoral momentum (adult male 50% tile only) shall be 600.

(v) Change in knee position (adult male 50% tile only) shall be180.

(w) Tibia load (adult male 50% tile only) shall be 600.

(x) Tibia momentum (adult male 50% tile only) shall be 600.

(y) Side sill acceleration shall be 60.

(z) Tunnel acceleration shall be 60.

(aa) The seat belt load shall be 60.

(ab) MPDB acceleration shall be 60.

② For dummy verification, channel classes shall be as follows in addition to the provisions of ① above.

(a) Acceleration of the head impactor (adult male 50% tile only) shall be 180.

(b) The acceleration of the neck pendulum shall be 1,000 for the adult male 50% tile and 180 for the adult female 5% tile.

(c) The angular velocity of the neck pendulum (adult male 50% tile only) shall be 60.

(d) Angular velocity of the neck (adult male 50% tile only) shall be 60.

(e) The rotation angle of the neck rotation detector shall be 60.

(f) Acceleration of the chest impactor shall be 180.

(g) Acceleration of the abdominal impactor (adult male 50% tile only) shall be 180.

(h) Acceleration of the knee impactor shall be 600.

(i) Acceleration of the lower leg impactor (adult male 50% tile only) shall be 600.

③ Acceleration used for calculating velocity shall be 180 even though regulated in ①.

(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. When verifying dummies, the number of samples shall be at least 8 times as many as the channel classes specified in ②.

(3) The HIC shall be calculated with the sampling time (time intervals of data sampling conducted according to the abovementioned provision) set to the minimum time interval. The range of this calculation shall be between the collision and 200ms 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, HIC, etc.

4.2.10 Accelerometer, Load Meter, Moment Meter and Dummy

4.2.10.1 Accelerometers, Load Meters, and Moment Meter Used in the Test

For the accelerometer, moment meter, and load meter used in collision tests, the measurement items and number of channels are listed in the table, and the measurement capacities are given for reference.

THOR dummy

Measuring Position	Item to be measured		Reference Meas. Capacity	No. of Meas. Channels
Head	Accelerometer	Ax・Ay・Az	250G	3
	Angular Velocity Meter	ωx・ωy・ωz	4000deg/s	3
Nead and Neck (Front・Back)	Load Meter	Fz	5kN	2
Neck (Upper)	Load Meter	Fx・Fy	9kN	2
		Fz	14kN	1
	Moment Meter	Mx・My・Mz	290Nm	3
Clavicle	Load Meter	Fx・Fz	10kN	8
Thoracic Vertebrae	Accelerometer	Ax・Ay・Az	200G	9
	Load Meter	Fx・Fy・Fz	5kN	3
	Moment Meter	Mx・My	300Nm	2
Chest (Right-upper・Left-upper・Right -lower・Left-lower)	3D Displacement Meter	Displacement	100mm	4
		Angle	50deg	8
Breastbone	Accelerometer	Ax	200G	1
Abdomen (Right・Left)	3D Displacement Meter	Displacement	100mm	2
		Angle	50deg	4
Abdomen	Accelerometer	Ax	200G	1
Lumber	Accelerometer	Ax・Ay・Az	200G	3
Ilium	Accelerometer	Fx	9kN	2
	Moment Meter	My	220Nm	2
Acetabulum	Load Meter	Fx・Fy・Fz	5kN	6
Knee (Right・Left)	Displacement Meter	Displacement	19mm	2
Femur	Load Meter	Fx・Fy・Fz	20kN	6
	Moment Meter	Mx・My・Mz	400Nm	6
Tibia (Right・Left)	Load Meter	Fx・Fz	12kN	8
	Moment Meter	Mx・My	400Nm	8
Dummy's total # of Channels				99

Hybrid Ⅲ dummy adult female 50% tile

Measuring Position	Item to be measured		Reference Meas. Capacity	No. of Meas. Channels
Head	Accelerometer	Ax・Ay・Az	200G	3

Neck (Upper)	Load Meter	Fx・Fy	9kN	2
		Fz	14kN	1
	Moment Meter	Mx・My・Mz	300Nm	3
Chest	Accelerometer	Ax・Ay・Az	200G	3
	Displacement Meter	Deflection	65mm	1
Lumber	Accelerometer	Ax・Ay・Az	200G	3
Ilium	Load Meter	Fx	9kN	2
	Moment Meter	My	220Nm	2
Femur	Load Meter	Fz	20kN	2
Dummy's total # of Channels				22

Test Vehicle

Measuring Position	Item to be measured		Reference Meas. Capacity	No. of Meas. Channels
Tunnel	Accelerometer	Ax・Ay・Az	200G	3
Collision Side Side Sill	Accelerometer	Ax	500G	1
Non-Collision Side Side Sill	Accelerometer	Ax	200G	1
Seat belt on Driver Seat	Load Meter	Force	15kN	1
Seat belt on Passenger Seat	Load Meter	Force	15kN	1
Test Vehicle’s Total # of Channels				7

MPDB

Measuring Position	Item to be measured		Reference Meas. Capacity	No. of Meas. Channels
Center of gravity of MPDB	Accelerometer	Ax・Ay・Az	200G	3
Near center of gravity of MPDB	Accelerometer	Ax・Ay・Az	200G	3
MPDB’s Total # of Channels				6

4.2.10.2 Dummy

(1) The driver's seat dummy is the THOR dummy developed by NHTSA (the National Highway Traffic Safety Administration) (https://www.nhtsa.gov/biomechanics-trauma/thor), which shall be the 50% tile of adult males. The driver's seat knee displacement gauge and lower leg shall be the Hybrid III dummy adult male 50% tile (CFR (Compendium of Federal Regulations) Title 49, Part 572, subpart E). The passenger seat dummy shall be a Hybrid III dummy as specified in CFR (Compendium of Federal Regulations), Title 49, Part 572 subpart O, 5% tile

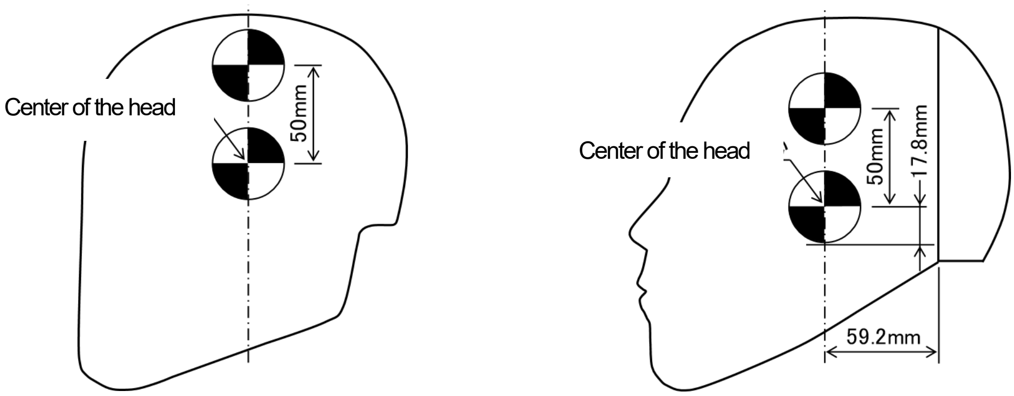
for adult females.

(2) The characteristics of each part of the driver's seat dummy shall conform to the certification in accordance with Technical Bulletin TB026 (THOR Specification and Certification Version 1.3 13th February 2023) in EuroNCAP, and the characteristics of the leg conform to the certification in accordance with Attachment 3-2. The spine box shall be adjusted to “slouched” position. The characteristics of each part of the dummy in the passenger seat shall conform to the verifications according to Attachment 3-2. If adjustment of the shoes is required in the verification of the shoed feet, innersoles may be used.

(3) A neck shield shall be attached to the neck of the dummy. The feet of the dummy in the driver’s seat shall be wearing shoes with size of 11EEE. The feet of the dummy in the front passenger’s seat shall be wearing shoes which shall be 0.41±0.09kg with size of 7 1/2E. The driver's seat dummy is required to wear special clothing and short cotton pants that do not cover the knees. The dummy in the front passenger’s seat shall be clothed in cotton shirts with short sleeves (or sleeveless) and short pants.

(4) The limb joints of the dummy shall be adjusted to be able to support the weight of the limbs extended horizontally.

(5) In order to confirm the movement of the dummy during the collision test, the target marks shall be attached to the dummy’s head at points where the movement of the dummy can be photographed using the camera during the test. Diagram 1 shows a reference example.



Driver seat dummy　　Passenger seat dummy

Diagram 1

4.2.10.3 Recording Electronic Results on a Recording Medium

The measurement results of acceleration and load shall be recorded on a recording medium with a channel class of 1,000 or more.

4.2.11 3-D Measuring Device

The accuracy of the three-dimensional measuring device used to measure the dimensions of the test vehicle, seating position of the dummy, routing of the seatbelts, and the progressive deformable barrier shall be 0.5mm/m or less

5. Testing Method

The front of the test vehicle and MPDB vehicle traveling at 50.0 ± 1km/h shall be caused to collide perpendicularly against the front face of the barrier in the area 50% ± 25mm of the vehicle width from the side of the driver's seat. The vertical impact position shall be ±25 mm above the target height. The traction acceleration of the device towing the test vehicle shall be 4.9m/s2 {0.5 G} or less.

6. Recording and Measuring Items

6.1 Recording Prior to Test

6.1.1 Check and Recording of Received Vehicle for Test

After receiving a vehicle for the test, the test institute shall check the following items and record the results in Appendix 3. At the same time, the test institute must make sure that the received vehicle complies with the vehicle specifications provided by NASVA.

(1) Name
(2) Model
(3) Classification
(4) Frame number
(5) Drive system
(6) Steering system type (wheel and steering column, existence of an adjustment system)
(7) Seatbelt, winder, and fastener type (driver and passenger seats)
(8) Existence of airbags (driver and passenger seats)
(9) Seat type (driver and passenger seats, existence of adjustment systems)
(10) Existence of vehicle speed sensitive door locks
(11) Existence of Crash sensitive door unlocking system
(12) Existence of precrash safety system
(13) Existence of a sunroof
(14) Existence of footrests

6.1.2 Recording the Verification Results for Dummy and Progressive Deformable Barrier

(1) The test institute shall record the verification results for the dummy and the progressive deformable barrier conducted before the test. The verification results for the progressive deformable barrier may be replaced by the performance certification issued by the manufacturer.

(2) The dummy shall be re-verified after conducting the test for driver's seat dummy four times or passenger's seat dummy three times. If the injury criterion reaches or exceeds the acceptable limit (ex. HIC15 700), 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.

6.1.3 Recording the Verification Results for seat shoulder belt load meter

(1) The results of the seat shoulder belt load meter verification conducted prior to the test shall be recorded. However, they may be replaced by the performance results of the manufacturer.

(2) The verification method shall be performed in accordance with the quasi-static calibration procedure for belt force transducers described in ISO/TS17242:2014 or equivalent. (See Technical Bulletin TB016 (Quasi-static Calibration Procedure of Seatbelt Loadcells Version 1.0 June 2014) in EuroNCAP.

6.1.4 Recording of Measuring Instrument Calibration Results

(1) The calibration results of the measuring instruments (each measurement channel including 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.

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

(2) To determine whether the injury criteria are calculated correctly, verifications shall be made using a calibration signal generation device (waveform generator).

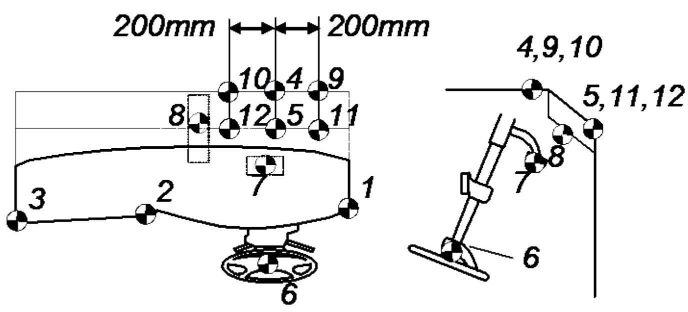
6.1.5 Recording of Measurement Results for Vehicle Dimensions Prior to the Test

Of the positions of the parts of the vehicle given below, compartment No. 6 and door and its surroundings No. 7 shall be measured and recorded using the three-dimensional measuring device before conducting the test. Parts that will not be affected by the collision shall be selected as reference points for measuring the vehicle dimensions. Other parts can be determined by the manufacturer.

(1) Measuring points in compartment (ex.)

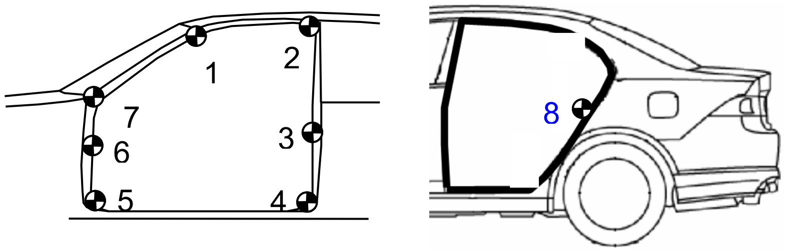
Note: The lateral position of locations No. 4 and 5 shall be the center of the brake pedal.

Part No.	Measuring Point	Part No.	Measuring Point
1	Instrument panel, right	7	Brake pedal
2	Instrument panel, center	8	Footrest
3	Instrument panel, left	9	Driver side toe board A
4	Driver side toe board	10	Driver side toe board B
5	Driver side floor	11	Driver side floor A
6	Steering column end	12	Driver side floor B



(2) Door vicinity measuring points (examples)

Part No.	Measuring Point
1	Pillar A , upper
2	Pillar B, upper
3	Striker bolt (fr. door)
4	Pillar B, lower
5	Pillar A, lower
6	Pillar A, mid.
7	Pillar A, root
8	Striker bolt (rr. door)



6.1.6 Recording the Measurement Results for Seating Position of Dummy

The seating position of the dummy placed in the vehicle according to Paragraph 4.1.9.1 and 4.1.9.2 and the routing position of the seatbelt fastened according to Paragraph 4.1.9.3 shall be measured and recorded according to Paragraph 15-1 of Appendix 1. Additionally, the positioning of the seatbelts shall be photographed.

6.1.7 Recording the Final Vehicle Conditions Prior to Test

After preparing the test vehicle according to the protocol described in Paragraph 4, the following items shall be checked and recorded:

(1) Test vehicle mass

(2) Names and masses of parts removed, and mass after adjustment

(3) Inclination of the test vehicle (fore-and-aft direction and lateral direction)

(4) Adjusted position of the seat (driver’s seat and passenger seat)

(5) Adjusted position of the steering system

(6) Adjusted position of the seatbelt anchorage

(7) Positions of accelerometers in each part of the vehicle body

(8) Positions of target marks attached to the vehicle body

(9) Reference positions for measurement of vehicle dimensions

(10) Position of the collision line (50% of vehicle width) of the test vehicle

6.1.8 Recording the Dummy's Temperature

(1) The start time and the finish time of the dummy soak and the temperatures at those times shall be recorded.

(2) The cumulative time during which the temperature conditions specified in Paragraph 4.1.9.4 could not be maintained shall be recorded.

6.2 Recording During the Test

6.2.1 Recording the Collision Speed and Deviation of Collision Position

Each speed of the test vehicle and MPDB just before the test vehicle collides against with MPDB shall be measured and recorded. The overlap amount of the test vehicle and the progressive

deformable barrier shall be measured and recorded.
Furthermore, the term "just before the test vehicle collides" shall mean within 2m of the collision location, and the test vehicle and MPDB shall be coasting.

6.2.2 Recording Electric Measurement Results for Each Part of Dummy, Vehicle Body, etc.

The electric measurement results for the accelerometers, load meters, displacement meters and moment meters, which are installed at each part of the dummy, vehicle body and MPDB and load meters in the structure to which the barrier is attached shall be recorded for the period from 20ms before the collision to 200ms or more after the collision.

(1) Acceleration of the head of the dummy in the driver’s seat in the fore-and-aft direction
(2) Acceleration of the head of the dummy in the driver’s seat in the lateral direction
(3) Acceleration of the head of the dummy in the driver’s seat in the vertical direction
(4) Driver seat dummy head angular velocity around front-back axis
(5) Driver seat dummy head angular velocity around left-right axis
(6) Driver seat dummy head angular velocity around up-down axis
(7) Driver seat dummy head and neck front side spring cable load
(8) Driver seat dummy head and neck back side spring cable load
(9) Driver seat dummy upper side of neck front-back direction load
(10) Driver seat dummy upper side of neck left-right direction load
(11) Driver seat dummy upper side of neck up-down direction load
(12) Driver seat dummy moment on upper side of neck around front-back axis
(13) Driver seat dummy moment on upper side of neck around left-right axis
(14) Driver seat dummy moment on upper side of neck around up-down axis
(15) Driver seat dummy right clavicle inside front-back direction load
(16) Driver seat dummy right clavicle inside up-down direction load
(17) Driver seat dummy right clavicle outside front-back direction load
(18) Driver seat dummy right clavicle outside up-down direction load
(19) Driver seat dummy left clavicle inside front-back direction load
(20) Driver seat dummy left clavicle inside up-down direction load
(21) Driver seat dummy left clavicle outside front-back direction load
(22) Driver seat dummy left clavicle outside up-down direction load
(23) Acceleration of the #1 thoracic vertebrae of the dummy in the driver’s seat in the fore-and-aft direction
(24) Acceleration of the #1 thoracic vertebrae of the dummy in the driver’s seat in the lateral direction
(25) Acceleration of the #1 thoracic vertebrae of the dummy in the driver’s seat in the vertical direction
(26) Acceleration of the #6 thoracic vertebrae of the dummy in the driver’s seat in the

fore-and-aft direction
(27) Acceleration of the #6 thoracic vertebrae of the dummy in the driver’s seat in the lateral direction
(28) Acceleration of the #6 thoracic vertebrae of the dummy in the driver’s seat in the vertical direction
(29) Acceleration of the #12 thoracic vertebrae of the dummy in the driver’s seat in the fore-and-aft direction
(30) Acceleration of the #12 thoracic vertebrae of the dummy in the driver’s seat in the lateral direction
(31) Acceleration of the #12 thoracic vertebrae of the dummy in the driver’s seat in the vertical direction
(32) Driver seat dummy the #12 thoracic vertebrae front-back direction load
(33) Driver seat dummy the #12 thoracic vertebrae left-right direction load
(34) Driver seat dummy the #12 thoracic vertebrae up-down direction load
(35) Driver seat dummy moment on the #12 thoracic vertebrae around front-back axis
(36) Driver seat dummy moment on the #12 thoracic vertebrae around left-right axis
(37) Driver seat dummy right upper chest displacement
(38) Driver seat dummy right upper chest angle around left-right axis
(39) Driver seat dummy right upper chest angle around up-down axis
(40) Driver seat dummy left upper chest displacement
(41) Driver seat dummy left upper chest angle around left-right axis
(42) Driver seat dummy left upper chest angle around up-down axis
(43) Driver seat dummy right upper chest displacement
(44) Driver seat dummy right lower chest angle around left-right axis
(45) Driver seat dummy right lower chest angle around up-down axis
(46) Driver seat dummy left lower chest displacement
(47) Driver seat dummy left lower chest angle around left-right axis
(48) Driver seat dummy left lower chest angle around up-down axis
(49) Acceleration of the breastbone of the driver seat dummy in the fore-aft direction
(50) Driver seat dummy right abdominal displacement
(51) Driver seat dummy right abdominal angle around left-right axis
(52) Driver seat dummy right abdominal angle around up-down axis
(53) Driver seat dummy left abdominal displacement
(54) Driver seat dummy left abdominal angle around left-right axis
(55) Driver seat dummy left abdominal angle around up-down axis
(56) Acceleration of the abdomen of the driver seat dummy in the fore-and-aft direction
(57) Acceleration of the lumbar of the driver seat dummy in the fore-aft direction

(58) Acceleration of the lumbar of the driver seat dummy in the lateral direction
(59) Acceleration of the lumbar of the driver seat dummy in the vertical direction
(60) Driver seat dummy right ilium front-back direction load
(61) Driver seat dummy moment on right ilium around left-right axis
(62) Driver seat dummy left ilium front-back direction load
(63) Driver seat dummy moment on left ilium around left-right axis
(64) Driver seat dummy right acetabulum front-back direction load
(65) Driver seat dummy right acetabulum left-right direction load
(66) Driver seat dummy right acetabulum up-down direction load
(67) Driver seat dummy left acetabulum front-back direction load
(68) Driver seat dummy left acetabulum left-right direction load
(69) Driver seat dummy left acetabulum up-down direction load
(70) Driver seat dummy right femur front-back direction load
(71) Driver seat dummy right femur left-right direction load
(72) Driver seat dummy right femur up-down direction load
(73) Driver seat dummy moment on right femur around front-back axis
(74) Driver seat dummy moment on right femur around left-right axis
(75) Driver seat dummy moment on right femur around up-down axis
(76) Driver seat dummy left femur front-back direction load
(77) Driver seat dummy left femur left-right direction load
(78) Driver seat dummy left femur up-down direction load
(79) Driver seat dummy moment on left femur around front-back axis
(80) Driver seat dummy moment on left femur around left-right axis
(81) Driver seat dummy moment on left femur around up-down axis
(82) Driver seat dummy right knee displacement
(83) Driver seat dummy left knee displacement
(84) Driver seat dummy upper right tibia front-back direction load
(85) Driver seat dummy upper right tibia up-down direction load
(86) Driver seat dummy moment on upper right tibia around front-back axis
(87) Driver seat dummy moment on upper right tibia around left-right axis
(88) Driver seat dummy lower right tibia front-back direction load
(89) Driver seat dummy lower right tibia up-down direction load
(90) Driver seat dummy moment on lower right tibia around front-back axis
(91) Driver seat dummy moment on lower right tibia around left-right axis
(92) Driver seat dummy upper left tibia front-back direction load
(93) Driver seat dummy upper left tibia up-down direction load
(94) Driver seat dummy moment on upper left tibia around front-back axis
(95) Driver seat dummy moment on upper left tibia around left-right axis

(96) Driver seat dummy lower left tibia front-back direction load
(97) Driver seat dummy lower left tibia up-down direction load
(98) Driver seat dummy moment on lower left tibia around front-back axis
(99) Driver seat dummy moment on lower left tibia around left-right axis
(100) Acceleration of the head of the dummy in the passenger seat in the fore-and-aft direction
(101) Acceleration of the head of the dummy in the passenger seat in the lateral direction
(102) Acceleration of the head of the dummy in the passenger seat in the vertical direction
(103) Passenger seat dummy upper side of neck front-back direction load
(104) Passenger seat dummy upper side of neck left-right direction load
(105) Passenger seat dummy upper side of neck up-down direction load
(106) Passenger seat dummy moment on upper side of neck around front-back axis
(107) Passenger seat dummy moment on upper side of neck around left-right axis
(108) Passenger seat dummy moment on upper side of neck around up-down axis
(109) Acceleration of the chest of the dummy in the passenger seat in the fore-and-aft direction
(110) Acceleration of the chest of the dummy in the passenger seat in the lateral direction
(111) Acceleration of the chest of the dummy in the passenger seat in the vertical direction
(112) Passenger seat dummy chest displacement
(113) Passenger seat dummy right femur load
(114) Passenger seat dummy left femur load
(115) Passenger seat dummy right ilium front-back direction load
(116) Passenger seat dummy moment on right ilium around left-right axis
(117) Passenger seat dummy left ilium front-back direction load
(118) Passenger seat dummy moment on left ilium around left-right axis
(119) Acceleration of the lumbar of the passenger seat dummy in the fore-aft direction
(120) Acceleration of the lumbar of the passenger seat dummy in the lateral direction
(121) Acceleration of the lumbar of the passenger seat dummy in the vertical direction
(122) Acceleration of the right-side sill in the fore-and-aft direction
(123) Acceleration of the left side sill in the fore-and-aft direction
(124) Acceleration of the tunnel in the fore-and-aft direction
(125) Acceleration of the tunnel in the lateral direction
(126) Acceleration of the tunnel in the vertical direction
(127) Seat belt load for driver seat

(128) Seat belt load for passenger seat
(129) Acceleration at the center of gravity of MPDB in the fore-and-aft direction
(130) Acceleration at the center of gravity of MPDB in the lateral direction
(131) Acceleration at the center of gravity of MPDB in the vertical direction

(132) Acceleration near the center of gravity of MPDB in the fore-and-aft direction
(133) Acceleration near the center of gravity of MPDB in the lateral direction
(134) Acceleration near the center of gravity of MPDB in the vertical direction

6.2.3 Recording the Injury Criteria

The injury criteria for the dummy shall be calculated from the waveform obtained in Paragraph 6.2.2 according to the following method and shall be recorded.

6.2.3.1 Recording Injury Criteria for the Driver Dummy

(1) HIC (Head Injury Criterion)

The maximum value among the values calculated by the following formula shall be determined using the head resultant acceleration of the dummy.

$$HIC = \left[\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} \frac{a_R}{9.80665}\,dt\right]^{2.5} (t_2 - t_1)$$

Where,

aR represents resultant acceleration (m/s2) of head accelerations in the fore-and-aft direction, in the lateral direction, and in the vertical direction (aX, aY, aZ)

$$a_R = \sqrt{a_X{}^2 + a_Y{}^2 + a_Z{}^2}$$

t1 and t2 represent arbitrary points in time during the collision (unit: s)

provided that |t2 - t1| ≤ 0.015s<

(2) DAMAGE：Diffuse Axonal Multi-Axis General Evaluation

The maximum value of the scalar amount of the composite vector calculated according to the following formula using the angular acceleration around the front-back axis, left-right axis, and up-down axis of the dummy head's center of gravity.

In this case, however, the angular acceleration calculated by differentiating the measured angular velocity in each direction is applied.

$$\begin{bmatrix} m_x & 0 & 0 \\ 0 & m_y & 0 \\ 0 & 0 & m_z \end{bmatrix} \begin{Bmatrix} \ddot{\delta}_x \\ \ddot{\delta}_y \\ \ddot{\delta}_z \end{Bmatrix} + \begin{bmatrix} c_{xx} + c_{xy} + c_{xz} & -c_{xy} & -c_{xz} \\ -c_{xy} & c_{xy} + c_{yy} + c_{yz} & -c_{yz} \\ -c_{xz} & -c_{yz} & c_{xz} + c_{yz} + c_{zz} \end{bmatrix} \begin{Bmatrix} \dot{\delta}_x \\ \dot{\delta}_y \\ \dot{\delta}_z \end{Bmatrix}$$

$$+ \begin{bmatrix} k_{xx} + k_{xy} + k_{xz} & -k_{xy} & -k_{xz} \\ -k_{xy} & k_{xy} + k_{yy} + k_{yz} & -k_{yz} \\ -k_{xz} & -k_{yz} & k_{xz} + k_{yz} + k_{zz} \end{bmatrix} \begin{Bmatrix} \delta_x \\ \delta_y \\ \delta_z \end{Bmatrix}$$

$$= \begin{bmatrix} m_x & 0 & 0 \\ 0 & m_y & 0 \\ 0 & 0 & m_z \end{bmatrix} \begin{Bmatrix} \ddot{u}_x \\ \ddot{u}_y \\ \ddot{u}_z \end{Bmatrix}$$

$$DAMAGE = \beta \cdot max_t\{|\vec{\delta}(t)|\}$$

$\vec{\delta}(t) = [\delta_x(t) \quad \delta_y(t) \quad \delta_z(t)]^T$, β: scale factor

m: Mass (kg)

c_ij: Viscous damping coefficient (Ns/m)

k_ij: stiffness (N/m)

(δ,) ̈δ ̇,δ: acceleration, velocity, displacement

u ̈: Applied angular acceleration

$m_x = 1$(kg), $m_y = 1$(kg), $m_z = 1$ (kg)

$k_{xx} = 32142$ (N/m), $k_{yy} = 23493$ (N/m), $k_{zz} = 16935$ (N/m)

$k_{xy} = 0$ (N/m), $k_{yz} = 0$ (N/m), $k_{xz} = 1636.3$ (N/m)

$\lambda = 5.9148$ (ms), $\beta = 2.9903$ (1/m)

$[c] = \lambda\,[k]$

In order to exclude secondary collisions between the head and the interior from the evaluation interval, the maximum calculation interval shall be from the loading phase of the collision and the time zero (T0), which corresponds to the loading phase and initial rebound phase, to 200 ms. However, if the external force acting on the head is less than -500 N (the absolute value of the negative value is greater than 500 N) due to the secondary collision of the head rebound behavior, the evaluation interval shall be up to the time immediately before that. The external force acting on the head shall be calculated according to the following formula using the acceleration of the head in the fore-and-aft direction and upper side of neck up-down direction load.

$$F_{external} = -m_{head} \times a_{head\ x} + F_{upper\ neck\ x}$$

$F_{external}$: External force acting on the head (N)

m_{head} : Head mass (kg)

a_{head} : head front-back direction acceleration (m/s^2)

$F_{upper\ neck\ x}$: Anterior – posterior load on upper neck (N)

(3) Neck injury criteria

・The maximum value of the anterior-posterior shear force and axial tensile force of the dummy neck.

・The maximum value of the flexural bending moment of the dummy neck.

(4) Chest Injury Criterion

・Maximum composite displacement of the upper right, upper left, lower right, and lower left at the dummy chest in the front-back, left-right, and vertical directions.

$$D_{thorax} = max\left(\sqrt{D_x(t)^2 + D_y(t)^2 + D_z(t)^2}\right)$$

In this case, the displacements in the front-back, left-right, right-right, and up-down directions are calculated according to the following formulas, using the length and angle of the instrument as measured by the respective 3D displacement measuring instruments on the upper right, upper left, lower right, and lower left sides of the dummy chest.

$$D_x(t) = \delta \cdot sin\left(\varphi_y(t)\right) + R(t) \cdot cos\big(\varphi_z(t)\big) \cdot cos\left(\varphi_y(t)\right) - D_x(0)$$

$$D_y(t) = R(t) \cdot sin\big(\varphi_z(t)\big) - D_y(0)$$

$$D_z(t) = \delta \cdot cos\left(\varphi_y(t)\right) - R(t) \cdot cos\big(\varphi_z(t)\big) \cdot sin\left(\varphi_y(t)\right) - D_z(0)$$

R(t): the length at the chest by 3D displacement measuring instrument

φ_y (t) : Angle at the chest around the left and right axes by the 3D displacement instrument (°)

φ_z (t) : Angle at the chest around the vertical axis by the 3D displacement instrument (°)

D_[x,y,z] (0) : Chest displacement in front-back, left-right, and up-down directions at t=0 (mm)

δ : Offset values at the chest by 3D displacement instrumentation

Upper chest＝+15.65mm, Lower chest＝-15.65mm

(5) Abdominal Injury Criterion

Maximum anteroposterior displacement of the right and left sides in the dummy abdomen

$$D_{abdomen} = max(D_x(t))$$

In this case, the displacement in the front-back direction is calculated according to the following formula, using the length and angle of the instrument as measured by each 3D displacement measuring instrument on the right and left sides of the dummy abdomen.

$$D_x(t) = R(t) \cdot cos\big(\varphi_z(t)\big) \cdot cos\left(\varphi_y(t)\right) - D_x(0)$$

R(t): the length at the abdomen by 3D displacement measuring instrument

φ_y (t) : Angle at the abdomen around the left and right axes by the 3D displacement instrument（°）

φ_z (t) : Angle at the abdomen around the vertical axis by the 3D displacement instrument（°）

D_x (0) : Abdomen displacement in front-back, left-right, and up-down directions at t=0（mm）

(6) Lumbar Injury Criterion

・The maximum composite load of the dummy's right and left acetabulum in the front-back, left-right, right-right, and up-down directions.

However, the composite load is calculated only for the time interval during which a compressive load in the front-back direction (right acetabulum: output in the - direction, left acetabulum: output in the + direction) occurs (the composite load for the time interval during which a tensile load occurs is set to zero).

(7) Thigh and lower leg injury values

① Femur Injury Criterion

The maximum value of the compressive load applied to the right and left thighs of the dummy.

② TCFC: Tibia Compressive Force Criterion

The maximum value of the compressive load (kN) transmitted in the direction of each tibia.

③ TI: Tibia Index

The maximum value calculated according to the flexion moment measured in the tibia and the axial load. Recorded examples of the electric measurement results measured and calculated in Paragraphs 6.2.2 and 6.2.3 are shown in Appendix 5.

6.2.3.2 Recording the injury value of the passenger dummy

(1) HIC (Head Injury Criterion)

The maximum value among the values calculated by the following formula shall be determined using the head resultant acceleration of the dummy.

$$HIC = \left[\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} \frac{\mathrm{a}_R}{9.80665} dt\right]^{2.5} (t_2 - t_1)$$

Where,

aR represents resultant acceleration (m/s2) of head accelerations in the fore-and-aft direction, in the lateral direction, and in the vertical direction (aX, aY, aZ)

$$a_R = \sqrt{a_X^{\ 2} + a_Y^{\ 2} + a_Z^{\ 2}}$$

t1 and t2 represent arbitrary points in time during the collision (unit: s)

provided that |t2 - t1| ≤ 0.015s

For a sharp waveform which can be perceived as having been generated by the occurrence of a secondary collision of the head with the knee in the dummy head resultant acceleration waveform diagram and which has a section in which the positive value of the change rate of the resultant acceleration is 196m/s2/ms or more and the negative value is -196m/s2/ms or less, this index shall be calculated by deleting the section exceeding the acceleration when the change rate first exceeds 196m/s2/ms at a point near the secondary collision start time or the acceleration when the change rate finally drops below -196m/s2/ms at a point near the secondary collision finish time in the waveform concerned, whichever is the greater. The specific deletion procedure is given below.

① Confirm that the secondary collision has taken place, either by adhesion to the knee of paint such as liquid chalk applied to the dummy before the test, or by the images produced by high-speed photography.

② In the dummy head resultant acceleration waveform diagram, confirm that those portions where the positive value of the change rate of the resultant acceleration is 196m/s2/ms or more and the negative value of the change rate of the resultant acceleration is -196m/s2/ms or less are included in the waveform which can be perceived as having been caused by the occurrence of the secondary collision.

③ The deletion of the resultant acceleration shall be carried out, using the deletion procedure described below, only when the secondary collision has been confirmed according to the provision of ① and the head resultant acceleration caused by the collision concerned has complied with the provision of ②.

(a) Using the data of the head resultant acceleration, produce numeric output values of the time, the resultant accelerations, and the change rate of the resultant accelerations from a point near the secondary collision start time to a point near the secondary collision finish time.

(b) Concerning the produced numeric output values, compare the acceleration in which the change rate of the resultant acceleration exceeds 196m/s2/ms at the earliest time against the acceleration in which the change rate of the resultant acceleration drops below -196m/s2/ms at the latest time. The greater acceleration shall be the "acceleration to be deleted."

(c) For those accelerations from when the change rate of the resultant acceleration first exceeds 196m/s2/ms to when the change rate of the resultant acceleration finally drops below -196m/s2/ms, determine whether there is any acceleration that is greater than the aforementioned "acceleration to be deleted." Only such accelerations shall be replaced by the value of the "acceleration to be deleted."

(2) Neck injury criteria

・The maximum value of the fore-and-aft shear strength and tension in the axial direction of the dummy neck.

・The maximum value of the flexural bending moment of the dummy neck.

(3) Chest Injury Criterion

・Maximum rib compression displacement in dummy chest.

(4) Femur damage value

The maximum value of a dummy’s right and left femoral compressive load.

(5) Ilium load (female 5 percentile dummies only)

As it pertains to the measured value of dummy ilium load, in cases where collapses of over 1,000N within duration of 1ms are seen, it shall be deemed that the waist belt slipped from the pelvis. However, in cases where multiple changes in ilium load become apparent, judgment shall be made based upon the load collapse following the final rise in load.

Furthermore, in cases where ilium load is greater than the leanings above during rebound and decreases, the waist belt shall be deemed to have not slipped from the pelvis if the ilium load directly before the value decreases is under 2,400N. The time of rebound beginning shall be time where the relative velocity with the vehicle is 0, with waist velocity calculated from the resultant acceleration of front-back direction and up-down direction waist acceleration.

6.2.4 High-speed Photography

The behavior of test vehicle, dummies, and MPDB during collision indicated in diagram 2 is to be photographed via high-speed VTR. Strobe lights indicating the moment of collision are to be inserted in the angle of view of each camera.

Camera No.	Camera Angle
1	Movement and collapse of vehicle (right side)
2	Movement and collapse of vehicle (left side)
3	Situation of Dummies
4	Movement of vehicle and collision position

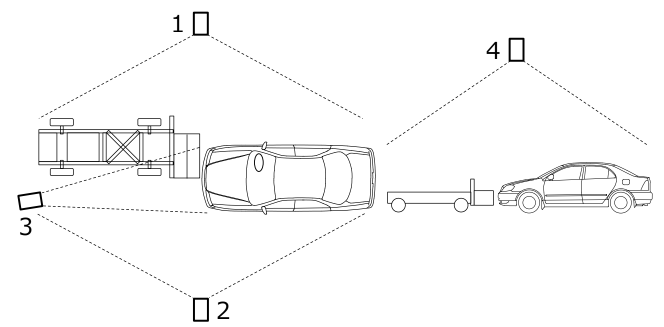


Diagram 2 Range of high-speed cameras

6.3 Post-test Records

6.3.1 Photograph the vehicle condition and barrier immediately after completion of the test

Distinctive sections shall be photographed both immediately after the test and after confirming the opening capability of the side doors as prescribed in Paragraph 6.3.2.

6.3.2 Confirmation and Recording of Opening Capability of Side Doors

The opening capability of all the side doors of the test vehicle shall be confirmed, and the results shall be recorded using any of the methods given below. To do so, proceed as follows: If the door latch could not be released by pulling the outer handle in (1), try the inner handle; if the latch has been released, repeat the action (1) to see if the door opens. If it opens, record that the inner handle was used to release the door latch. If the door latch could not be released even with the inner handle, move to the next step and repeat the sequence to check opening of the door.

(1) Openable with one hand.

(2) Openable with both hands.

(3) Openable by using tools.

6.3.3 Confirmation and Recording of the Extractability of Dummies

The removability of each dummy from the test vehicle shall be confirmed and recorded using any of the methods given below.

(1) No tool was used. No adjustment mechanism for the seat and the steering system, etc. was operated.

(2) No tool was used. An adjustment mechanism for the seat or the steering system, etc. was operated.

(3) Tools were used.

Furthermore, when operating the adjustment mechanism for the steering system, marks shall be made indicating the conditions before the operation. The adjustment mechanism shall then be returned to the original position before measuring the vehicle dimensions after the test as prescribed in Paragraph 6.3.4.

6.3.4 Recording the Measurement Results for Vehicle Dimensions after Test

After conducting the test, the dimensions of the test vehicle shall be measured and recorded as follows:

(1) After the test, the vehicle dimensions shall be measured and recorded at the same points as those before the test specified in Paragraph 6.1.5 using the three-dimensional measuring device.

(2) Record the positions of each point of the B-pillar after the collision on the side of the front passenger seat.

(3) Compare the ordinates (in the Z direction) of each point of the B-pillar sill before and after the test.

(4) Find the angle θ that satisfies the following equation for each point of the B-pillar sill.

$z = -x'\sin\theta + z'\cos\theta$

（where: z = the vertical measured value before collision, and x’ and z’ = measured values in the fore-and-aft direction and in the vertical direction after the collision.）

(5) Convert the measured values in the fore-and-aft and vertical directions (x’, z’) after the collision using the following equation:

$$\begin{pmatrix} X' \\ Z' \end{pmatrix} = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} \begin{pmatrix} x' \\ z' \end{pmatrix}$$

(6) If the coordinate systems of the vehicle before the test cannot be redefined by (1), the coordinate systems of the vehicle shall be determined as follows:

① Set coordinate axes for measurement by setting a basic frame at locations measured before the test or by using points taken in parallel with the axes before the test.

(7) If the steering system has a structure such as a shear capsule, whereby the steering column is removed from the steering system during the collision, the vehicle dimensions shall be measured and recorded after reinstalling the column in the steering system as precisely as possible.

(8) Brake pedals are to be measured and recorded without any load applied. However, in the event a brake pedal is designed so as to come completely free of its mount during collision and comes free of its mount during collision, it is to be recorded that "the pedal came loose during testing and there is no longer any significant resistance to its movement remaining". In such cases, measurements of the brake pedal in an unburdened state are to be conducted and recorded just to be sure. Furthermore, in instances where a brake pedal is designed to detach or fall away from its mount during collision and detaches or falls away from its mount during collision, no measurements will be conducted, and it will be noted that "the pedal detached or fell away from its mount during testing".

6.3.5 Recording Measurement Results for Fuel Leakage

The presence or absence of fuel flowing or dripping from each part of the vehicle after the collision shall be confirmed and recorded.

6.3.6 Calibration and Recording of Accelerometers

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

6. 3. 7 Recording of MPDB

(1) Record the OLC (Occupant Load Criterion: unit G) calculated according to the following formula using the acceleration at the center of gravity of MPDB in the fore-and-aft direction (CFC180). If any abnormality is found in the acceleration due to a malfunction of the accelerometer, etc., the acceleration near the center of gravity of MPDB in the fore-and-aft direction (CFC180) shall be used for the calculation.

$$V_t = \int A_X(t)\,dt + V_0$$

In this case

Ax is the acceleration at the center of gravity of MPDB (unit m/s2)

V0 is the MPDB velocity at the time of collision (t=0) (unit: m/s)

Vt is the MPDB velocity at time t (unit m/s)

$$OLC = OLC_{SI-unit}/9.80665$$

$$OLC_{SI-unit} = (V_0 - V(t_2))/(t_2 - t_1)$$

$$\int_{t=0}^{t=t_1} V_0\,dt - \int_{t=0}^{t=t_1} V(t)dt = 0.065$$

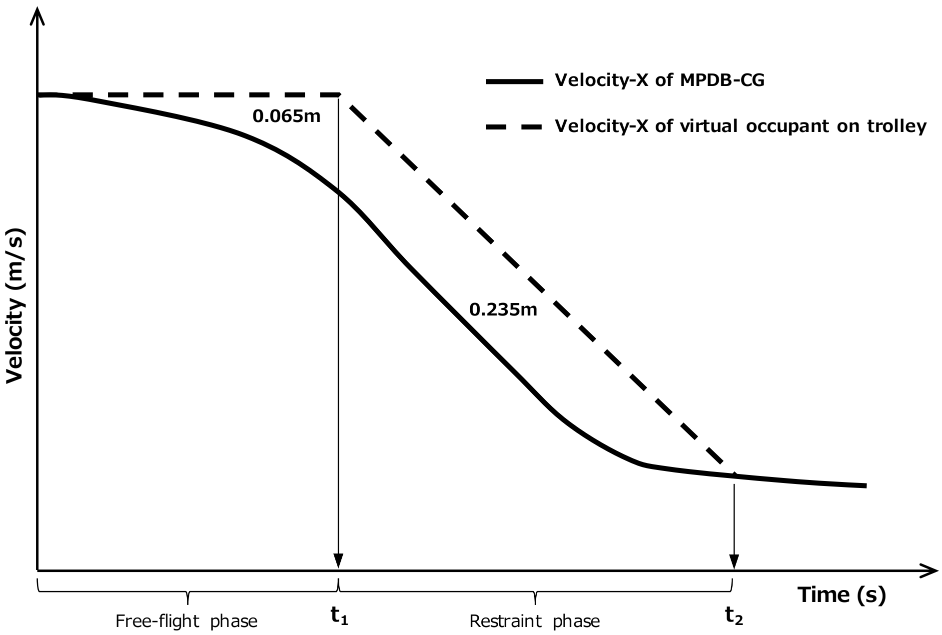
$$\int_{t=t_1}^{t=t_2} (V_0 - OLC_{SI-unit} \times (t - t_1))dt - \int_{t=t_1}^{t=t_2} V(t)dt = 0.235$$

In this case,

t1 is the end time (in s) of the free-flight phase of the virtual dummy on the barrier along the 0.065 m displacement

t2 is the end time of the constraint phase of the virtual dummy on the barrier along the 0.235 m displacement after the free-flight phase (i.e., total 0.3 m displacement of the virtual dummy) (unit s)

9.80665 is the conversion factor from OLCSI-unit (unit m/s^2) to OLC (unit G)



(2) Progressive deformable barriers shall be measured deformation and recorded after smoothing with adhesive tape, clay, etc. after the completion of the test, after consultation between NASVA and the automobile manufacturer.

(3) SD (standard deviation) shall be calculated and recorded from the amount of deformation (deformation at intervals of 20 mm vertically and horizontally) of the barrier within the evaluation range (Diagram 3). (Refer to Technical Bulletin TB027 (Compatibility Assessment Version 1.1.1 June 2020) in EuroNCAP.)

(4) Record the BO (whether or not the barrier has bottomed out) within the evaluation range (Diagram 3).

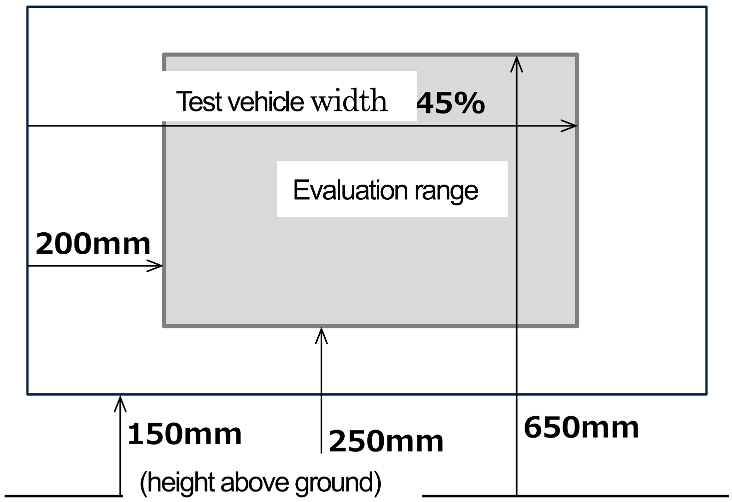


Diagram 3: evaluation range of progressive deformable barrier

6.4 Handling of measured value

The measured values, etc. shall be handled as follows.

(1) Measurements of speed (km/h) are to up 1 decimal place, with the next place rounded up.

(2) Measurements of distance (mm) are to be to the integer position, with the next place rounded up.

(3) Measurements of acceleration (m/s) are to be to 2 decimal places, with the next place rounded up.

(4) Measurements of load (kN) are to be to 2 decimal places, with the next place rounded up.

(5) Measurements of moment (Nm) are to be to 2 decimal places, with the next place rounded up.

(6) Measurements of chest displacement are to be to 2 decimal places, with the next place rounded up.

(7) Calculation of HIC is to be to 1 decimal place, with the next place rounded up.

(8) Calculation of tibia index is to be to 2 decimal places, with the next place rounded up.

(9) Calculation of DAMAGE is to be 2 decimal places, with the next place rounded up.

(10) Calculation of trolley OLC is to be 1 decimal place, with the next place rounded up.

(11) Calculation of SD is to be to the integer position, with the next place rounded up.

Attachment 1

Procedure for Measuring the Hip Point and Actual Torso Angle for Seating Positions in Motor Vehicles

1. Objectives

This Attachment describes how to establish the hip point location and actual torso angle for one or several seating positions in a motor vehicle.

2. Definitions

2.1 "Three-dimensional manikin": A device used for measuring hip points and actual torso angles. The device is described in Appendix 1 to this Attachment. The thigh length and lower leg length of the 3-D manikin shall be adjusted to 401mm and 414mm in this measurement process.

2.2 "Hip Point": The pivot center of the torso and the thigh of the 3-D manikin installed in the motor vehicle in accordance with Paragraph 3 below. The hip point is located between the hip point sight buttons on either side of the 3-D manikin. Once determined in accordance with Paragraph 3, the hip point is considered fixed in relation to the seat-cushion structure and to move with it when the seat is adjusted.

2.3 “AM 50 Hip Point": The hip point as specified in Paragraph 2.2 of the Hybrid III male 50% dummy.

2.4 "AF 05 Hip Point": The hip point as specified in Paragraph 2.2 and revised as specified in Paragraph 4 of the Hybrid III female 5% dummy.

2.5 "Torso Line": The centerline of the probe of the 3-D manikin with the probe in the fully rearward position.

2.6 "Actual Torso Angle": The angle measured between the vertical line through the hip point and the torso line using the back angle quadrant on the 3-D manikin.

2.7 "Center Plane of Occupant": The median plane of the 3-D manikin positioned in each designated seating position, represented by the coordinate of the hip point on the “Y” axis. For individual seats, the center plane of the seat coincides with the center plane of the occupant. For other seats, the center plane of the seat coincides with the center plane of the occupant specified by the vehicle manufacturer and importer.

2.8 "Three-Dimensional Reference System": The system as described in Appendix 2 to this Attachment.

2.9 "Fiducial Marks": Physical points (holes, surfaces, marks or indentations) on the vehicle body as defined by the vehicle manufacturer.

2.10 "Vehicle Measuring Posture": The position of the vehicle as defined by the coordinates of fiducial marks in the three-dimensional reference system.

3. Procedure for Determining Hip Point and Actual Torso Angle

3.1 The test vehicle shall be preconditioned at the discretion of the vehicle manufacturer, at a temperature of 20 ± 10ºC to ensure that the seat material reaches the room temperature. If the seat to be checked has never been sat upon, a 70–80kg person or device shall sit on the seat twice for one minute each to flex the cushion and back. All seat assemblies shall remain unloaded for a minimum period of 30 minutes prior to installation of the 3-D manikin.

3.2 The test vehicle shall be at the measuring posture defined in Paragraph 2.10 above.

3.3 The seat, if it is adjustable, shall be adjusted first to the rearmost normal driving or riding position, as specified by the vehicle manufacturer, taking into consideration only the longitudinal adjustment of the seat, excluding seat travel used for purposes other than normal driving or riding positions. Where other modes of seat adjustment exist (vertical, angular, seatback, etc.), these will then be adjusted to the position specified by the vehicle manufacturer. For suspension seats, the vertical position shall be rigidly fixed corresponding to a normal driving position as specified by the vehicle manufacturer.

3.4 The area of the seating position contacted by the 3-D manikin shall be covered by muslin cotton of sufficient size and appropriate texture (18.9 threads/cm^2 and weighing 0.228 km/m^2) or knitted or non-woven fabric having equivalent characteristics.

3.5 Place the seat and back assembly of the 3-D manikin so that the center plane of the occupant coincides with the center plane of the 3-D manikin. The 3-D manikin may be moved inboard with respect to the center plane of the occupant if the 3-D manikin is located so far outboard that the seat edge will not permit leveling of the 3-D manikin.

3.6 Attach the foot and lower leg assemblies, either individually or by using the T-bar and lower leg assembly. A line through the hip point sight buttons shall be parallel to the ground and perpendicular to the longitudinal center plane of the seat.

3.7 Adjust the feet and leg positions of the 3-D manikin as follows:

3.7.1 Both feet and leg assemblies shall be moved forward in such a way that the feet take up natural positions on the floor, between the operation pedals if necessary. Where possible, the left foot shall be located approximately the same distance to the left of the center plane of the 3-D manikin as the right foot is to the right. The spirit level verifying the transverse orientation of the 3-D manikin is brought to the horizontal by readjusting the seat pan if necessary, or by adjusting the leg and foot assemblies towards the rear. The line passing through the hip point sight buttons shall be maintained perpendicular to the longitudinal vertical center plane of the seat.

ssemblies towards the rear. The line passing through the hip point sight buttons shall be maintained perpendicular to the longitudinal vertical center plane of the seat.

lies towards the rear. The line passing through the hip point sight buttons shall be maintained perpendicular to the longitudinal vertical center plane of the seat.

3.7.2 If the left leg cannot be kept parallel to the right leg and the left leg cannot be supported by the structure, move the left leg until it is supported. The sight button shall be horizontal and perpendicular to the longitudinal vertical center plane of the seat and this state shall be maintained.

3.8 Apply lower leg and thigh weights and level the 3-D manikin.

3.9 Tilt the back pan forward against the forward stop and draw the 3-D manikin away from the seatback using the T-bar. Reposition the 3-D manikin by one of the following methods:

3.9.1 If the 3-D manikin tends to slide rearward, allow it to do so until a forward load on the T-bar is no longer required (i.e. until the seat pan contacts the seatback). If necessary, reposition the lower leg.

3.9.2 If the 3-D manikin does not tend to slide rearward, slide it rearwards by applying a horizontal rearward load to the T-bar until the seat pan contacts the seatback (see Diagram 2 of Appendix 1 to this Attachment).

3.10 Apply a 100 ± 10N load to the back pan assembly of the 3-D manikin at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application shall be maintained along a line passing through the above intersection to a point just above the thigh bar housing (see Diagram 2 of Appendix 1). Then carefully return the back pan to the seatback. Care must be taken throughout the remainder of the procedure to prevent the 3-D manikin from sliding forward.

3.11 Attach buttock weights to the right and left hip point pivots, then alternately attach the 8 torso weights to the torso weight hangers. Maintain the 3-D manikin level.

3.12 Tilt the back pan forward to release the tension on the seatback. Rock the 3-D manikin from side to side through a 10° arc (5° to each side of the vertical center plane) for three complete cycles to release any accumulated friction between the 3-D manikin and seat.

During the rocking action, the T-bar of the 3-D manikin may tend to diverge from the specified horizontal and vertical alignment. The T-bar must therefore be restrained by applying an appropriate lateral load during the rocking motions. Care shall be taken in holding the T-bar and rocking the 3-D manikin to ensure that no inadvertent exterior loads are applied in a vertical or fore-and-aft direction.

ll be taken in holding the T-bar and rocking the 3-D manikin to ensure that no inadvertent exterior loads are applied in a vertical or fore-and-aft direction.

The feet of the 3-D manikin are not to be restrained or held during this step. If the feet change position, they should be allowed to remain in that attitude for the moment.

Carefully return the back pan to the seatback and check the two spirit levels for zero position. If the feet have moved during the rocking operation of the 3-D manikin, they must be repositioned as follows.

Alternately lift each foot off the floor until no additional foot movement occurs. During this lifting, the feet are free to rotate, and no forward or lateral loads are applied. When each foot is placed back in the down position, the heel shall be in contact with the structure designed for this.

Check the spirit level for zero position; if necessary, apply a lateral load to the top of the back pan sufficient to level the 3-D manikin's seat pan on the seat.

3.13 Holding the T-bar to prevent the 3-D manikin from sliding forward on the seat cushion, proceed as follows:

(a) Return the back pan to the seatback.

(b) Alternately apply and release a horizontal rearward load, not exceeding 25N, to the back angle bar at the height approximately at the center of the torso weights until the hip angle quadrant indicates that a stable position has been reached after the load is released. Care shall be taken to ensure that no exterior downward or lateral loads are applied to the 3-D manikin. If another level adjustment of the 3-D manikin is necessary, rotate the back pan forward, re-level, and repeat the procedure from Paragraph 3.12.

level, and repeat the procedure from Paragraph 3.12.

graph 3.12.

3.14 Take all of the following measurements:

3.14.1 Measure the coordinates of the hip point with respect to the three-dimensional reference system.

3.14.2 Read the actual torso angle at the back angle quadrant of the 3-D manikin with the probe in its fully rearward position.

3.15 If the 3-D manikin needs to be installed again for a re-run, the seat assembly should remain unloaded for at least 30 minutes prior to the re-run. The 3-D manikin should not be left loaded on the seat assembly for longer than the time required to perform the test.

3.16 If the driver’s seat and front passenger seat can be regarded as similar (bench seat, identical seat, etc.), only one hip point and one "actual torso angle" shall be determined. The 3-D manikin described in Appendix 1 is seated on the driver’s seat as the representative seat.

4. Determining the Hip Point for the AF05

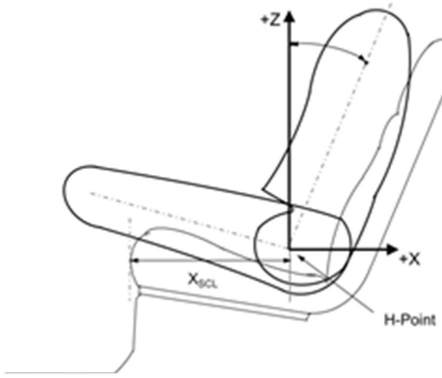
Let the positioning procedure of AM 50% dummy hip point fore-aft and vertical be (X_{AM50}, Z_{AM50}) and the positioning procedure of the AF 05% dummy hip point fore-aft and vertical be (X_{AF0}, Z_{AF05}). XSCL is defined as the horizontal distance between the AM50 dummy's hip point and the seat cushion top's foremost position (see Diagram 1). Use the formula below to calculate the AF05 dummy's hip point.

$X_{AF05}=X_{AM50}+（93－0.323×SCL）$

$Z_{AF05}=Z_{AM50}$

Where X represents the car's rearward direction and Z represents the car's upward direction.

Diagram 1



+Z
+X
X_{SCL}
H-Point

Attachment 2 - Appendix 1: 3-D Manikin Description (*note1)

1. Back and Seat Pans

The back and seat pans are constructed of reinforced plastic and metal. They simulate the human torso and thigh and are mechanically hinged at the hip point. A quadrant is fastened to the probe hinged at the hip point to measure the actual torso angle. An adjustable thigh bar, attached to the seat pan, establishes the thigh centerline and serves as a baseline for the hip angle quadrant.

2. Body and Leg Elements

Lower leg segments are connected to the seat pan assembly at the T-bar joining the knees, which is a lateral extension of the adjustable thigh bar. Quadrants are incorporated in the lower leg segments to measure knee angles. Shoe and foot assemblies are calibrated to measure the foot angle. Two spirit levels determine the position of the manikin in the vertical and horizontal directions. Body element weights are placed at the corresponding centers of gravity to provide seat penetration equivalent to a 76kg male. All joints of the 3-D manikin should be checked for free movement without encountering noticeable friction.

equivalent to a 76kg male. All joints of the 3-D manikin should be checked for free movement without encountering noticeable friction.

male. All joints of the 3-D manikin should be checked for free movement without encountering noticeable friction.

Diagram 1 3-D Manikin Elements Designation

[*note1] For details of the construction of the 3-D manikin refer to SAE, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096. The machine corresponds to that described in ISO Standard 6549-1999 and SAEJ826.

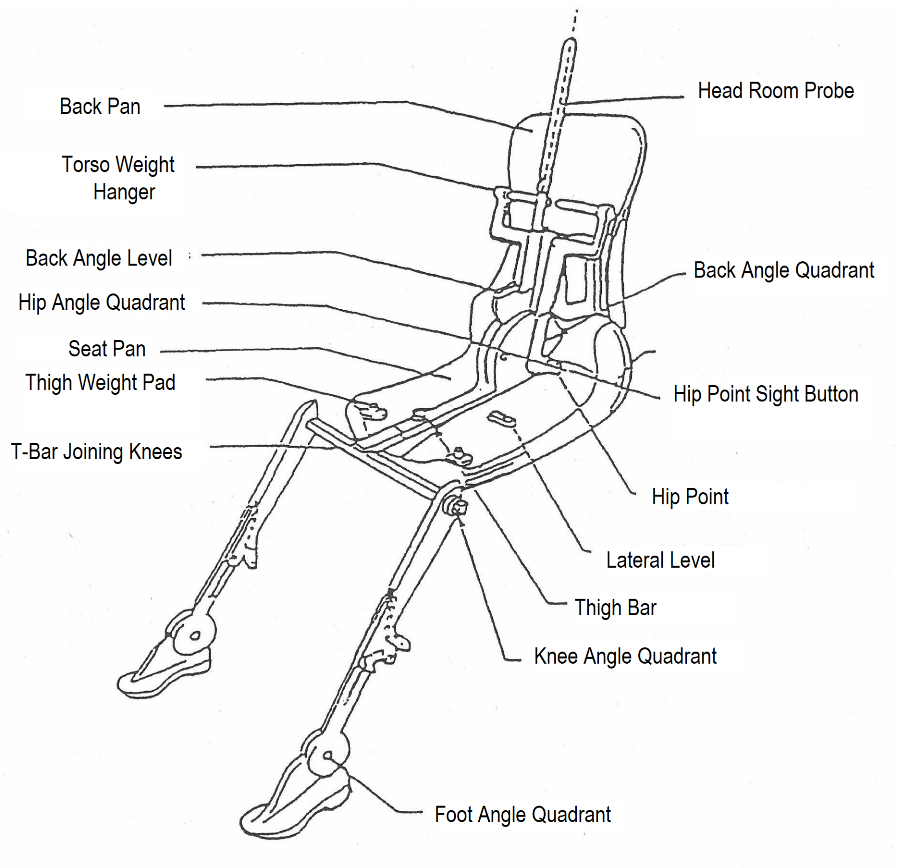
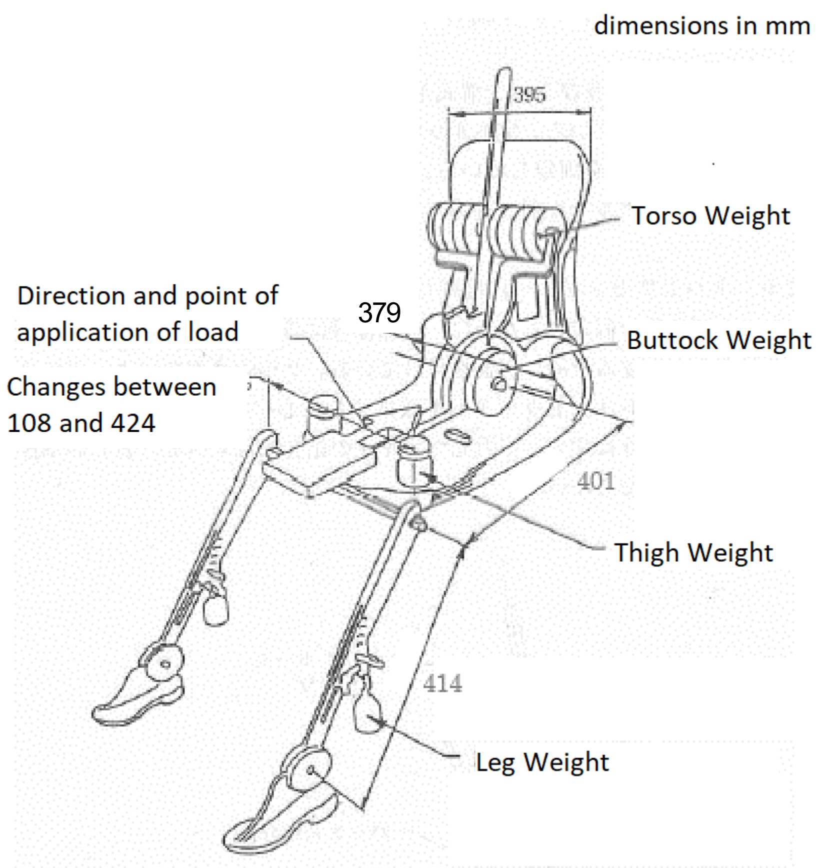


Diagram 2 Dimensions of the 3 D H Measuring Device Elements and Load Distribution

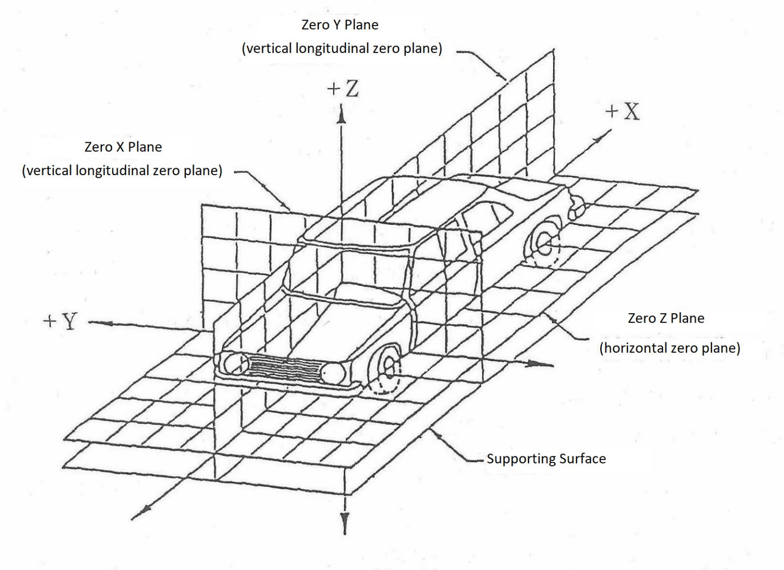


Attachment 1 - Appendix 2: 3-D Reference System

1. The three-dimensional reference system is defined by three orthogonal planes established by the motor vehicle manufacturer and importer. (See Diagram). (*note2)

2. The vehicle-measuring posture is established by positioning the vehicle on the supporting surface such that the coordinates of the fiducial marks correspond to the values indicated by the motor vehicle manufacturer.
3. The coordinates of the hip point are established in relation to the fiducial marks defined by the motor vehicle manufacturer.

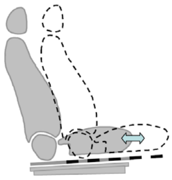
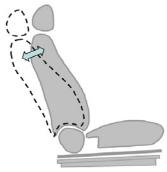
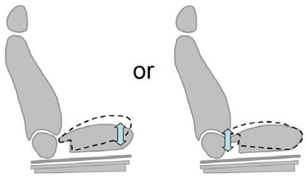
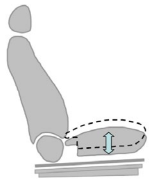
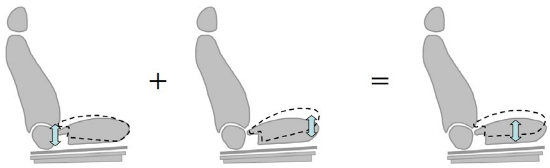
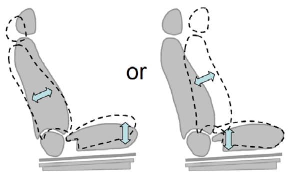
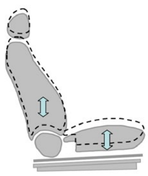
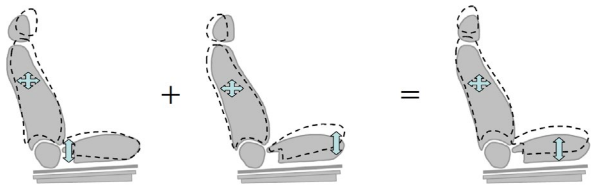
Diagram: 3-D Reference System

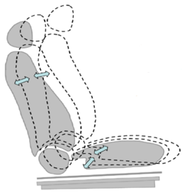
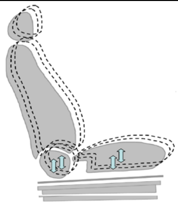


note2 The reference system corresponds to ISO standard 4130-1978

<u>**Attachment 2-1**</u>

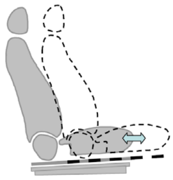
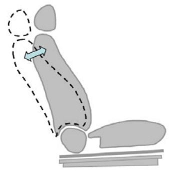
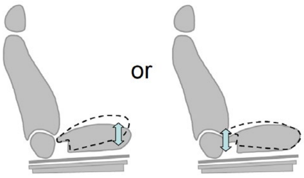
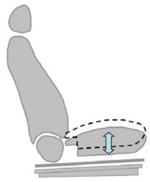
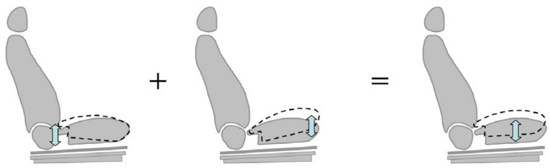
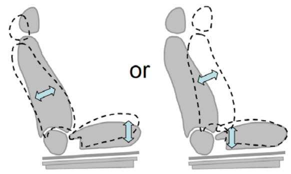
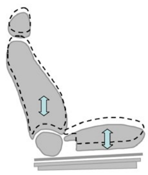
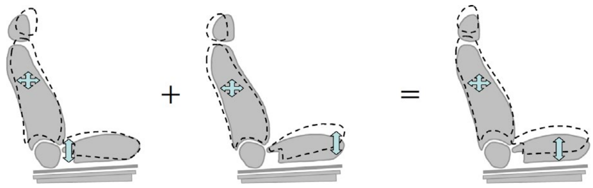
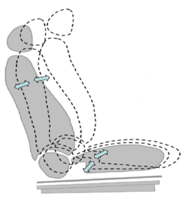
Adjusting Position of Test Seat Adjustment Mechanism

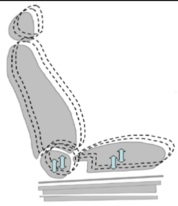
Fore -aft direction adjustment device (ref. 4.1.5.(1))  Middle position in fore -aft direction	Seatback angle adjustment device (ref. 4.1.5.(3))  Design standard angle
Seat cushion surface angle adjustment device (tilt or lifter) (ref. 4.1.5.(5))  Lowest position	Seat cushion surface vertical adjustment device (lifter) (ref. 4.1.5.(2))  Lowest position
Seat cushion surface angle/vertical adjustment device (others) (ref. 4.1.5.(5))  Lowest position	Seat lower-seatback angle adjustment device (ref. 4.1.5.(5))  Lowest position, Design standard angle for seatback angle
Seat lower-seatback vertical adjustment device (lifter) (ref. 4.1.5.(2))  Lowest position	Seat lower (angle/vertical)-seatback angle adjustment device (ref. 4.1.5.(5))  Lowest position, Design standard angle for seatback angle
Fore-and-aft/vertical angle all linked adjustment device (ref. 4.1.5.(5))	Fore-and-aft/vertical all linked adjustment device (lifter) (ref. 4.1.5.(2))

 Lowest position	 Lowest position

Attachment 2-2

Adjusting Position of Test Seat Adjustment Mechanism at passengers' seat

Fore -aft direction adjustment device (ref. 4.1.5.(1))  Design standard position	Seatback angle adjustment device (ref. 4.1.5.(3))  Design standard position
Seat cushion surface angle adjustment device (tilt or lifter) (ref. 4.1.5.(5))  Design standard position	Seat cushion surface vertical adjustment device (lifter) (ref. 4.1.5.(2))  Design standard position
Seat cushion surface angle/vertical adjustment device (others) (ref. 4.1.5.(5))  Design standard position	Seat lower-seatback angle adjustment device (ref. 4.1.5.(5))  Design standard position
Seat lower-seatback vertical adjustment device (lifter) (ref. 4.1.5.(2))  Design standard position	Seat lower (angle/vertical)-seatback angle adjustment device (ref. 4.1.5.(5))  Design standard position
Fore-and-aft/vertical angle all linked adjustment device (ref. 4.1.5.(5)) 	Fore-and-aft/vertical all linked adjustment device (lifter) (ref. 4.1.5.(2))

Design standard position	 Design standard position

Attachment 3-1

Hybrid III 50% Dummy Lower leg Verification Procedure

1. Verification Procedure and Requirements

Dummies may be disassembled or mounted when necessary to test the characteristics of the dummy's lower leg and foot sections in accordance with the following provisions.

1.1 Lower Leg and Foot Characteristics

1.1.1 Upper Foot Impact Test

1.1.1.1 Test Procedure

1.1.1.1.1 Each leg assembly shall be maintained (soaked) for four hours prior to the test at a temperature of 22 ± 3ºC and a relative humidity of 40 ± 30%. The soak period shall not include the time required to reach steady state conditions.

1.1.1.1.2 Clean the impact surface of the upper foot section and the impactor surface with isopropyl alcohol or equivalent prior to the test. Dust with talc.

1.1.1.1.3 Align the impactor accelerometer with its sensitive axis parallel to the direction of impact at the contact with the foot.

1.1.1.1.4 Mount the leg assembly to the test fixture (see Diagram 1). The test fixture shall be rigidly secured to prevent movement during impact. The centerline of the femur load cell simulator shall be vertical with a tolerance of ±0.5°. Adjust the mount such that the line joining the U-link knee clevis joint and the ankle attachment bolt is horizontal with a tolerance of ±3°, with the heel resting on two sheets of a flat low-friction (PTFE sheet) surface. Ensure that the tibia flesh is located fully towards the knee end of the tibia. Adjust the ankle such that the plane of the underside of the foot is vertical and perpendicular to the direction of impact with a tolerance of ±3° and such that the mid sagittal plane of the foot is aligned with the pendulum arm. Adjust the knee joint to 1.5 ± 0.5 g before each test. Adjust the ankle joint so that it is free and then tighten just sufficiently to keep the foot stable on the PTFE sheet.

sagittal plane of the foot is aligned with the pendulum arm. Adjust the knee joint to 1.5 ± 0.5 g before each test. Adjust the ankle joint so that it is free and then tighten just sufficiently to keep the foot stable on the PTFE sheet.

agittal plane of the foot is aligned with the pendulum arm. Adjust the knee joint to 1.5 ± 0.5 g before each test. Adjust the ankle joint so that it is free and then tighten just sufficiently to keep the foot stable on the PTFE sheet.

1.1.1.1.5 The rigid impactor comprises a horizontal cylinder of diameter 50 ± 2mm and a pendulum support arm of diameter 19 ± 1mm (see Diagram 4). The cylinder has a mass of 1.25 ± 0.02kg including instrumentation and any part of the support arm within the cylinder. The pendulum arm has a mass of 285 ± 5G. The length between the central horizontal axis of the impactor cylinder and the axis of rotation of the whole pendulum shall be 1,250 ± 1mm. The mass of the rotating part of the axis to which the support arm is attached should not be greater than 100G.

The impactor cylinder is mounted with its longitudinal axis horizontal and perpendicular to the direction of impact. The pendulum shall impact the underside of the foot, at a distance of 185 ± 2mm from the PTFE sheet of the heel resting on the rigid horizontal platform, so that the longitudinal centerline of the pendulum arm falls within 1° of a vertical line at impact. The impactor shall be guided to exclude significant lateral, vertical or rotational movement.

1.1.1.1.6 Allow at least 30 minutes between successive tests on the same leg.

1.1.1.1.7 The data acquisition system, including transducers, shall conform to the specifications for CFC 600.

1.1.1.2 Performance specifications

When each ball of the foot is impacted at 6.7 ± 0.1m/s in accordance with Paragraph 1.1.1.1, the maximum lower tibia bending moment of the y-axis (My) shall be 120 ± 25Nm.

1.1.2 Lower Foot Impact Test without Shoe

1.1.2.1 Test Procedure

1.1.2.1.1 Each leg assembly shall be maintained (soaked) for four hours prior to the test at a temperature of 22 ± 3ºC and a relative humidity of 40 ± 30%. The soak period shall not include the time required to reach steady state conditions.

1.1.2.1.2 Clean the impact surface of the lower foot section and the impactor face with isopropyl alcohol or equivalent prior to the test. Dust with talc. Check that there is no visible damage to the energy-absorbing insert in the heel.

1.1.2.1.3 Align the impactor accelerometer with its sensitive axis parallel to the impactor longitudinal centerline.

1.1.2.1.4 Mount the leg assembly to the test fixture (see Diagram 11). The test fixture shall be rigidly secured to prevent movement during impact. The leg assembly shall be mounted in accordance with Paragraph 1.1.1.1.4.

1.1.2.1.5 The rigid impactor shall be as specified in Paragraph 1.1.1.1.5. The impactor cylinder is mounted with its longitudinal axis horizontal and perpendicular to the direction of impact. The pendulum shall impact the underside of the foot, at a distance of 62 ± 2mm from the PTFE sheet of the heel resting on the rigid horizontal platform, so that the longitudinal centerline of the pendulum arm falls within 1° of a vertical line at impact. The impactor shall be guided to exclude significant lateral, vertical or rotational movement.

otational movement.

1.1.2.1.6 Allow at least 30 minutes between successive tests on the same leg.

1.1.2.1.7 The data acquisition system, including transducers, shall conform to the specifications for CFC 600.

1.1.2.2 Performance Specifications

When each heel of the foot is impacted at 44 ± 0.1m/s in accordance with Paragraph 1.1.2.1, the maximum impactor acceleration shall be 2,894 ± 491m/s^2 (295 ± 50g).

1.1.3 Lower-Foot Impact Test (with shoes)

1.1.3.1 Test Procedure

1.1.3.1.1 Each leg assembly shall be maintained (soaked) for four hours prior to the test at a temperature of 22 ± 3ºC and a relative humidity of 40 ± 30%. The soak period shall not include the time required to reach steady state conditions.

1.1.3.1.2 Clean the impact surface of the underside of the shoe with a clean cloth and impactor face with isopropyl alcohol or equivalent prior to the test. Check that there is no visual damage to the energy-absorbing insert to the heel.

1.1.3.1.3 Align the impactor accelerometer with its sensitive axis parallel to the impactor longitudinal centerline.

1.1.3.1.4 Mount the leg assembly to the test fixture (see Diagram 12). The test fixture shall be rigidly secured to prevent movement during impact. The leg assembly shall be mounted in accordance with Paragraph 1.1.1.1.4.

1.1.3.1.5 The rigid impactor shall be as specified in Paragraph 1.1.1.1.5. The impact cylinder is mounted with its longitudinal axis horizontal and perpendicular to the direction of impact. The pendulum shall impact the heel of the shoe in a horizontal plane at a distance of 62 ± 2mm above the PTFE sheet of the dummy heel when the shoe is resting on the rigid horizontal platform, so that the longitudinal centerline of the pendulum arm falls within 1° of a vertical line at impact. The impactor shall be guided to exclude significant lateral, vertical or rotational movement.

d to exclude significant lateral, vertical or rotational movement.

ude significant lateral, vertical or rotational movement.

1.1.3.1.6 Allow at least 30 minutes between successive tests on the same leg.

1.1.3.1.7 The data acquisition system, including transducers, shall conform to the specifications for CFC 600.

1.1.3.2 Performance Specifications

When the heel of the shoe is impacted at 6.7 ± 0.1m/s in accordance with Paragraph 1.1.3.1, the maximum tibia compressive force (Fz) shall be 3.3 ± 0.5kN.

Diagram 1: Upper Foot Impact Test (Test set-up specification)

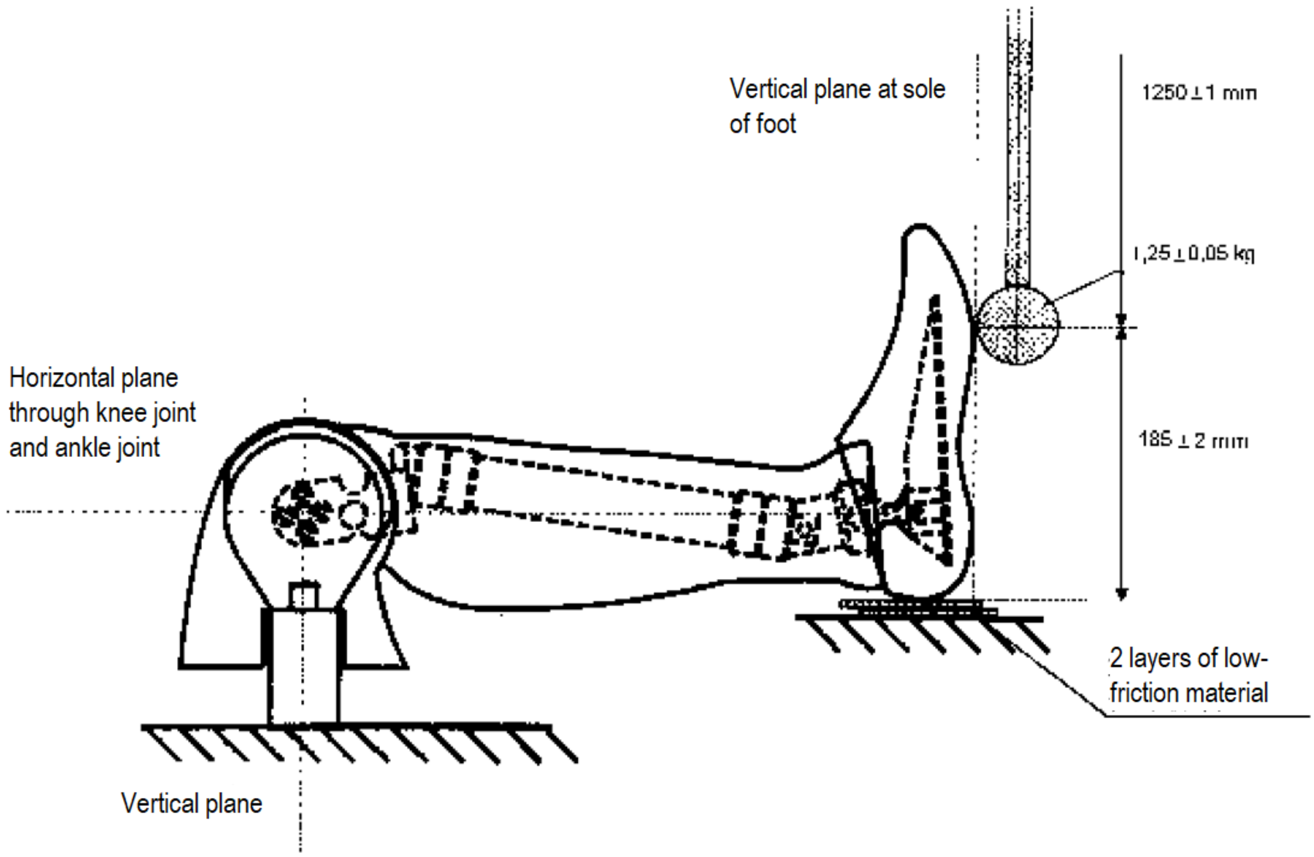


Diagram 2: Lower Foot Impact Test (without shoe) (test set-up specifications)

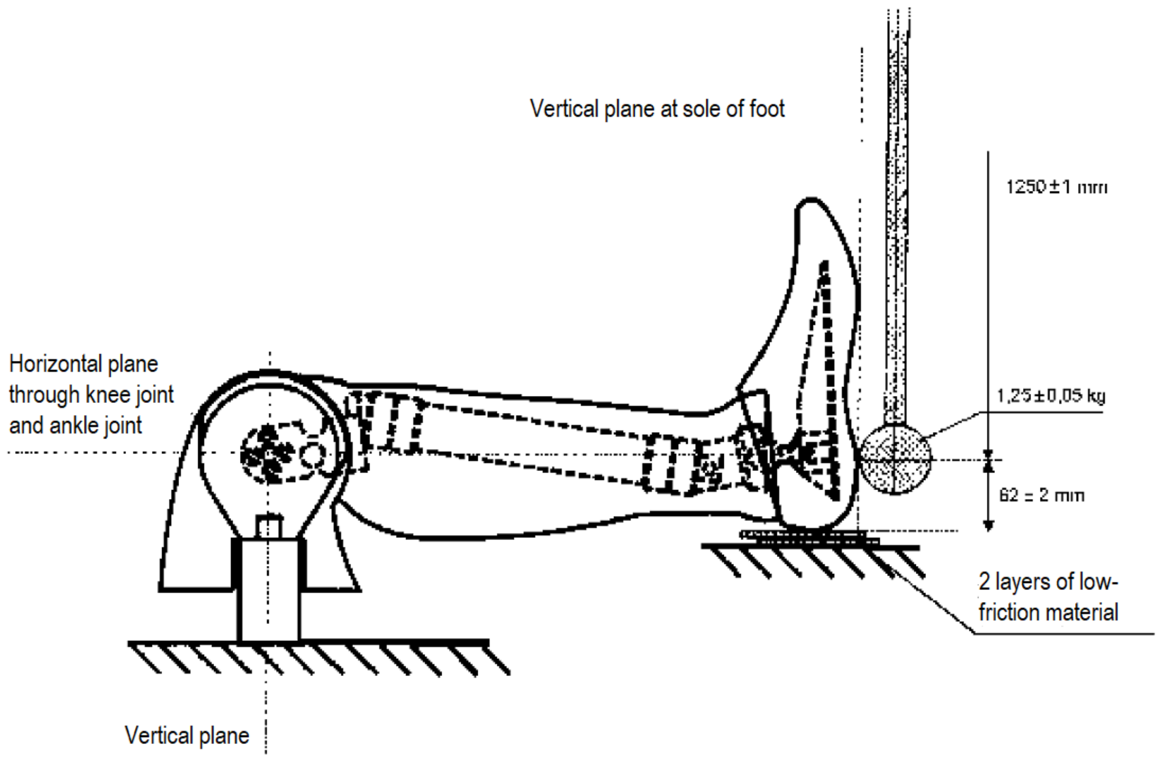


Diagram 3 Lower Foot Impact Test (with shoe) (Test set-up specifications)

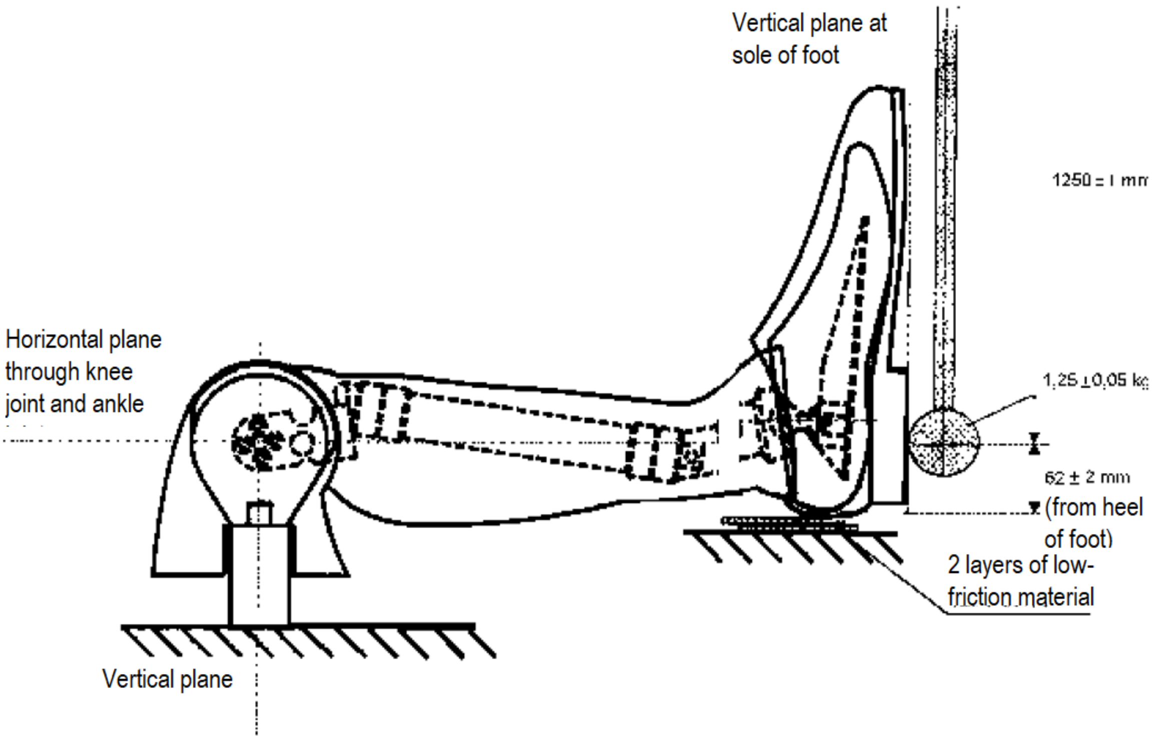
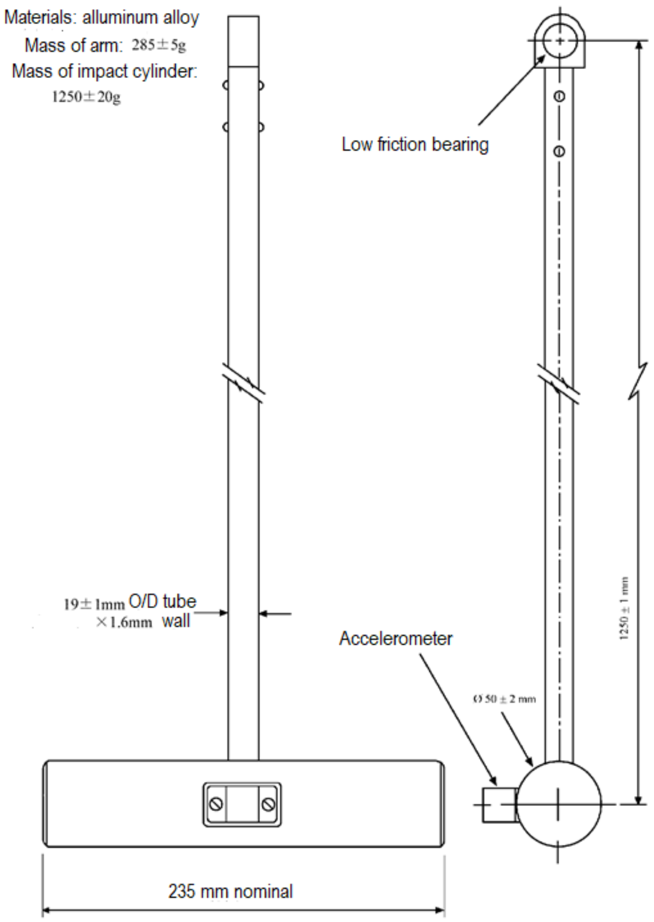


Diagram 4: Pendulum Impactor



Hybrid III 5% Dummy Verification Procedure

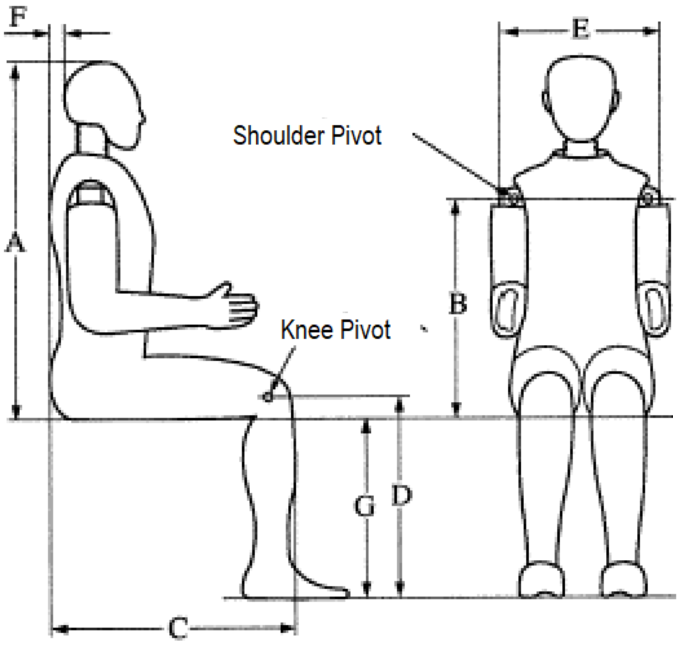
1. Verification Procedure and Requirements

It is permissible to disassemble or assemble the dummy if necessary to verify the characteristics of each part of the dummy in accordance with the provisions of Paragraphs 1.2 through 1.6. Furthermore, the measurement of the constructional dimensions provided for in Paragraph 1.1 shall be conducted after all verifications in Paragraphs 1.2 through 1.6 have been completed and the dummy has been assembled in the normal condition. Tape, etc. may be used to maintain the dummy posture during the measurement of dummy dimensions and verification of characteristics.

1.1 Constructional Dimensions

The measurements of each part of the dummy shall be as shown in Diagram 1.

Diagram 1: Constructional Dimensions of Hybrid III



A	774	~	800	mm
B	431	~	457	mm
C	520	~	546	mm
D	393	~	419	mm
E	350	~	366	mm
F	43	~	48	mm
G	355	~	376	mm

1.2 Head Characteristics

When the verification test is conducted as described below, the maximum resultant acceleration at the time of dropping shall be 2,450m/s^2–2,940m/s^2. Furthermore, in a curve indicating the relationship between the resultant acceleration occurring at the head and the lapsed time, the maximum value of the waveform that occurs after the main waveform (the maximum waveform) shall be 10% or less of the maximum value of the main waveform. Moreover, the maximum acceleration in the lateral direction shall be 147m/s^2 or less.

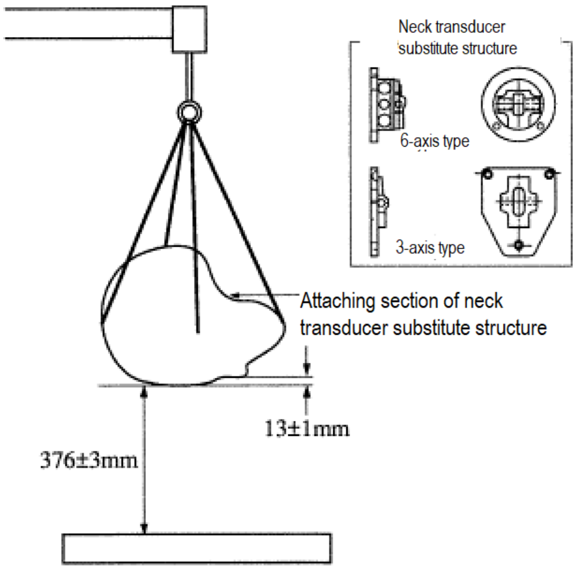
(1) Condition the head to be verified in an environment with temperature of 18.9 ºC

−25.6°C and relative humidity of 10%–70% for at least four hours.

(2) Suspend the head as shown in Diagram 2 so that the lowest point of the forehead is 13 ± 1mm below the lowest point of the dummy nose. Drop the head from a height of 376 ± 3mm onto steel plate which measures 50mm or more in thickness with a surface roughness of 0.0002mm (ms) to 0.002mm (ms). Measure the accelerations in the three axes (fore-and-aft direction, lateral direction and vertical direction) and calculate the maximum value of the resultant acceleration. It is permissible to attach a neck transducer on the head to attain the actual attaching conditions.

(3) When the verification is conducted on the same head consecutively, allow at least three hours between successive tests, under the environmental conditions given in (1).
the environmental conditions given in (1).

Diagram 2: Head Characteristics Test



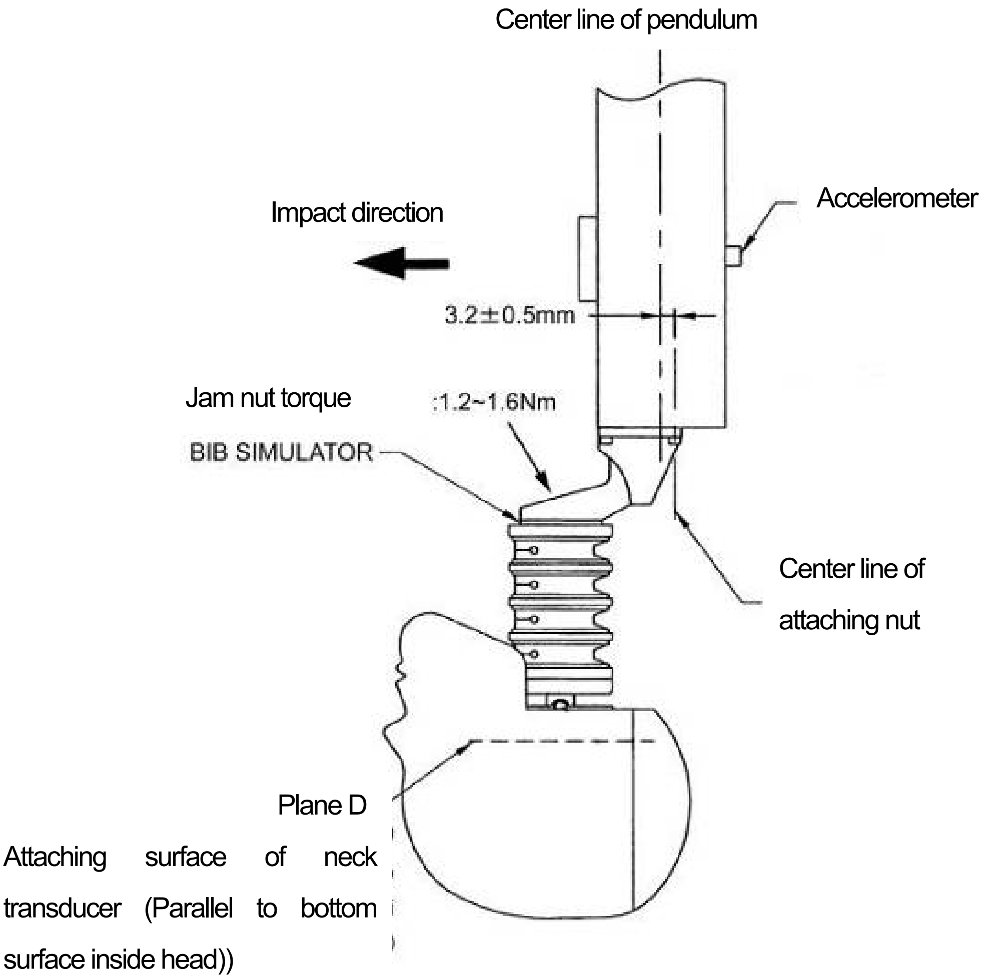
1.3 Neck Characteristics

When conducting the verification test as follows, the characteristics at the flexion side (the side where the neck is contracted) and the characteristics at the extension side (the side where the neck is extended) shall comply with the requirements given in the following table.

Characteristics at flexion side	① The moment measured by the neck measuring equipment shall reach a maximum of 69–83 N·m after the impact, and Plane D in Diagram 3 shall be within 77°–91° relative to the pendulum. ② The positive moment (the moment in the same direction as the rotation direction of the pendulum) shall decay for the first time to 10Nm between 80ms and 100ms after the impact.

Characteristics at extension side	① The moment measured by the neck measuring equipment shall reach a maximum of –65 to –53 N·m after the impact, and Plane D in Diagram 4 shall be within 99°–114° relative to the pendulum. ② The negative moment (the moment in the reverse direction of the rotating direction of the pendulum) shall decay for the first time to -10Nm between 94ms and 114ms after the impact.

Diagram 3.　Neck Flexion Side Characteristics Test

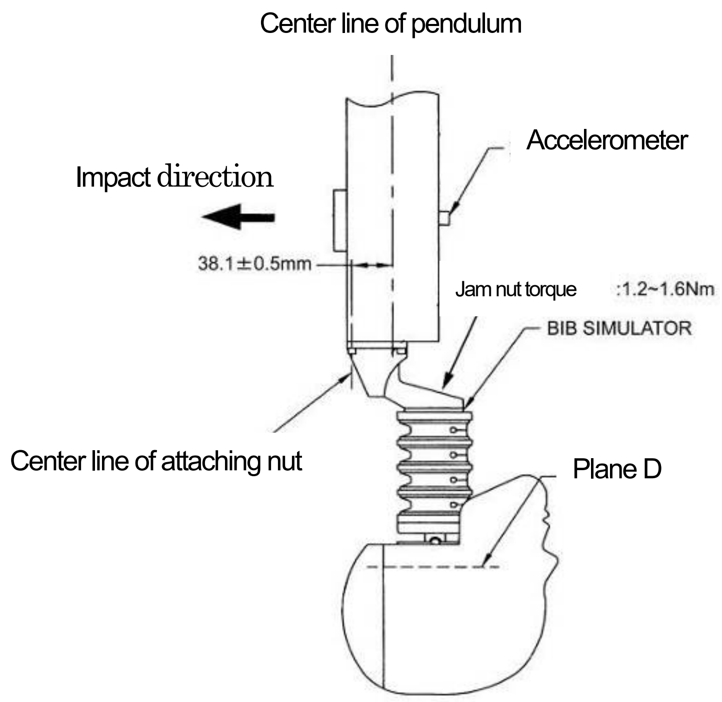


Example: rotation angle measurement methods

・Measure with mounted a displacement meter, and calculate

・Film analysis to use high speed photos

Diagram 4 Neck Extension Side Characteristics Test



(1) Condition the neck to be verified in an environment with temperature of 20.6 ºC –22.2ºC and relative humidity of 10%–70% for at least four hours.

(2) Prior to the verification, tighten the jam nut of the neck cable to a torque of 1.2Nm –1.6Nm.

(3) Mount the neck and head on a pendulum as shown in Diagram 5. The face section shall face toward the collision direction for verification at the flexion side, and the reversed direction for verification at the extension side. A bib simulator (see Diagrams 3 and 4) shall be mounted to attain actual matching. Furthermore, Plane D shall be virtually perpendicular to the centerline of the pendulum. However, it is permissible to employ a head used exclusively for verification, on which a displacement meter for verification is mounted.

(4) Apply an impact by releasing the pendulum and allow it to fall freely from a height such that the velocity at impact becomes 6.89m/s–7.13m/s for verification at the flexion side, and 5.95m/s–6.19m/sec for verification at the extension side. Measure and calculate the rotational angle and moment of the neck at this moment. The neck moment is calculated by:

e flexion side, and 5.95m/s–6.19m/sec for verification at the extension side. Measure and calculate the rotational angle and moment of the neck at this moment. The neck moment is calculated by:

$M = M_y - 0.01778\ (M) \times F_x$

Where,

M : Moment of neck (unit: N・m)

M_y: Moment of neck measuring equipment (unit: N・m)

F_x: X axis force of neck measuring equipment (unit: N)

(5) For verification at the flexion side, the deceleration of the pendulum occurring at the time of impact shall be within the range specified in the right column of table A in accordance with the lapse time after the impact specified in the left column of table A. For verification at the extension side, the said deceleration shall be within the range specified in the right column of table B in accordance with the lapse time after the impact specified in the left column of table B.

Diagram 5: Neck Characteristics Test

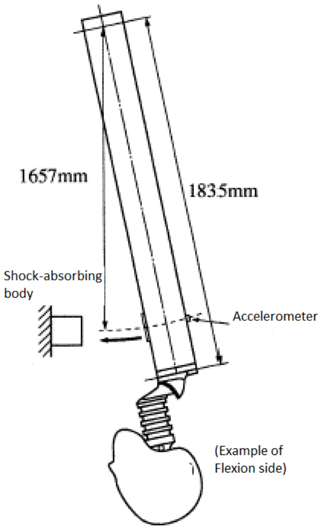


Table A

Time (ms)	Speed Range (m/s)
10	2.1～2.5
20	4.0～5.0
30	5.8～7.0

Table B

Time (ms)	Speed Range (m/s)
10	1.5～1.9
20	3.1～3.9
30	4.6～5.6

(6) When verification is conducted on the same neck, etc. consecutively, allow at least 30 minutes between successive tests, under the environmental conditions given in (1).

1.4 Chest Characteristics

The potentiometer for the chest shall be in accordance with SAEJ2517.

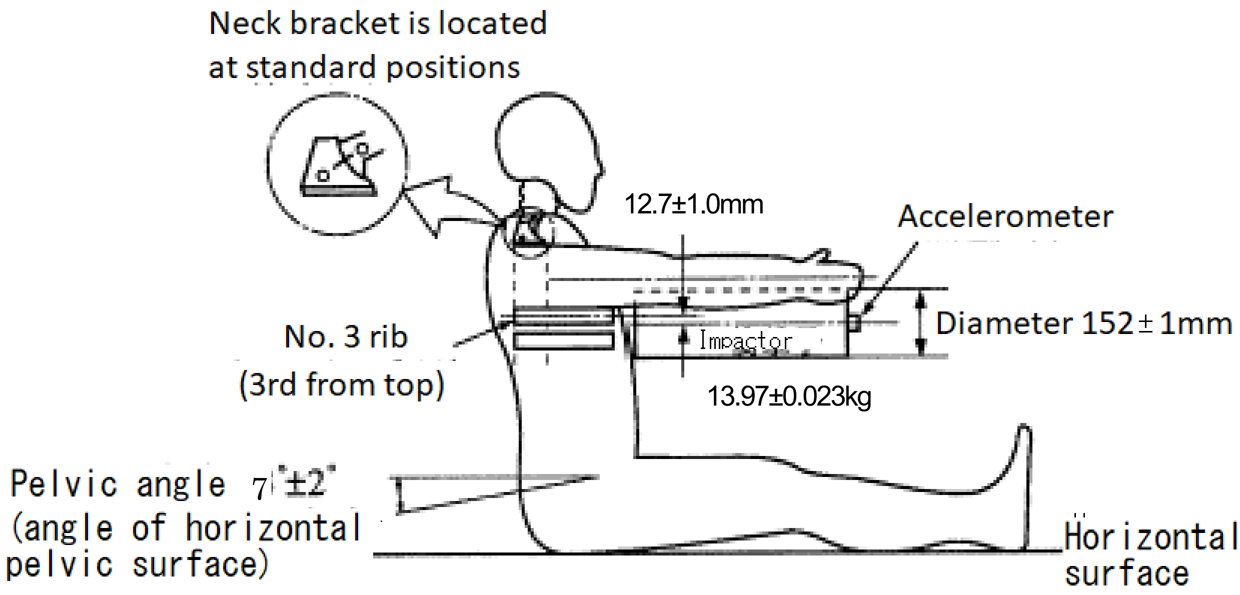
1.4.1 High-Speed Characteristics

When an impact is applied to the dummy chest with an impactor as shown below, the impact force occurring at the impactor shall reach its maximum between 390daN and 440daN and the displacement of the dummy sternum relative to the spine shall be between 50mm and 58mm. Furthermore, the impact force occurring at the impactor shall not exceed 460daN while the displacement of the dummy sternum relative to the spine is between 18mm and 50mm. The internal hysteresis at the moment of impact shall be 69% to 85%.

(1) Condition the chest to be verified in an environment with a temperature of 20.6 °C –22.2°C and relative humidity of 10%–70% for at least four hours.

(2) Seat the dummy on a flat surface, without a back support or armrest, as shown in Diagram 6. At this time, the joint of the shoulder and elbow shall be tightened securely so that the upper limbs may be extended forward. Adjust the pelvic angle to 7° ± 2°. The dummy may be clothed in a shirt and pants as provided in Paragraph 3.2.9.2 (3) of this Technical Standard.

Diagram 6: Chest Characteristics Test

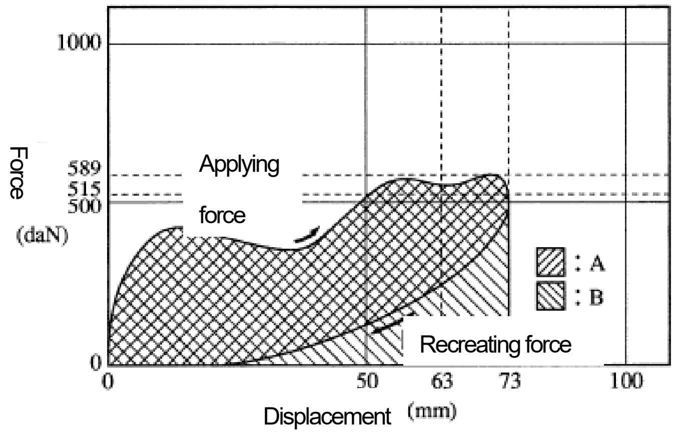


(3) Adjust the positional relationship between the impactor and the No. 3 rib in such a way that the longitudinal centerline extended from the impactor is 12.7 ± 1.0mm below the horizontal centerline of the No. 3 rib on the median plane of the dummy.

(4) Impact the chest with the impactor at a speed of 6.59m/s –6.83m/s. Measure the deceleration occurring at the rear end of the impactor, the displacement of the sternum relative to the dummy spine (measured by a potentiometer mounted inside the sternum), and calculate the impactor force occurring at the impactor (the product of the impactor mass and the deceleration) and the hysteresis (the ratio of Area A between the loading and unloading portions of the force-displacement curve to area B under the loading position of the curve (A/B) (see Diagram 7).

(5) When the verification is conducted on the same chest, etc. consecutively, allow at least 30 minutes between successive tests under the environmental conditions given in (1).

Diagram 7: Chest Characteristics Test, Force-Displacement Curve



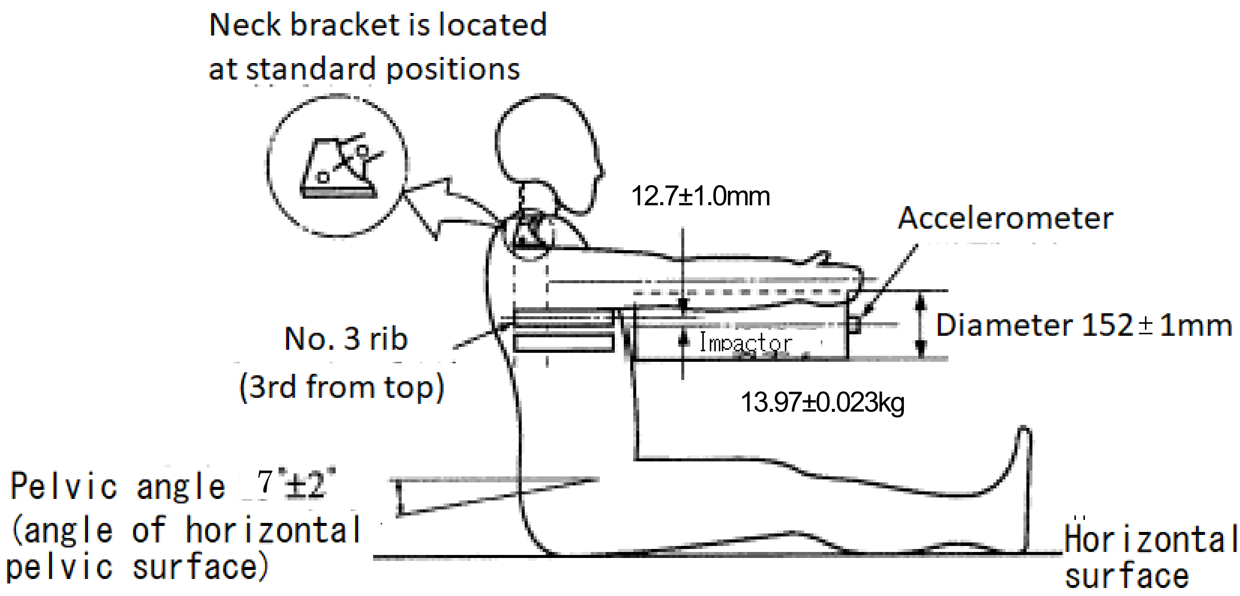
1.4.2 Low-Speed Characteristics

When an impact is applied to the dummy chest with an impactor as shown below, the impact force occurring at the impactor shall reach its maximum between 178daN and 207daN and the displacement of the dummy sternum relative to the spine shall be between 17.4mm and 21.8mm. The internal hysteresis at the moment of impact shall be 65% to 79%.

(1) Condition the chest to be verified in an environment with a temperature of 20.6 °C –22.2°C and relative humidity of 10%–70% for at least four hours.

(2) Seat the dummy on a flat surface, without a back support or armrest, as shown in Diagram 8. At this time, the joint of the shoulder and elbow shall be tightened securely so that the upper limbs may be extended forward. Adjust the pelvic angle to 7° ± 2°. The dummy may be clothed in a shirt and pants as provided in Paragraph 4.2.9.2 (3) of this Technical Standard.

Diagram 8: Chest Characteristics Test

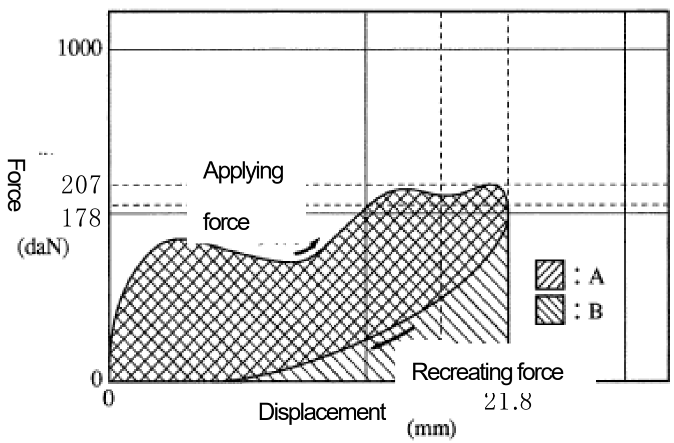


(3) Adjust the positional relationship between the impactor and the No. 3 rib in such a way that the longitudinal centerline extended from the impactor is 12.7 ± 1.0mm below the horizontal centerline of the No. 3 rib on the median plane of the dummy.

(4) Impact the chest with the impactor at a speed of 2.95m/s –3.05m/s. Measure the deceleration occurring at the rear end of the impactor, the displacement of the sternum relative to the dummy spine (measured by a potentiometer mounted inside the sternum), and calculate the impactor force occurring at the impactor (the product of the impactor mass and the deceleration) and the hysteresis (the ratio of Area A between the loading and unloading portions of the force-displacement curve to area B under the loading position of the curve (A/B) (see Diagram 9).

(5) When the verification is conducted on the same chest, etc. consecutively, allow at least 30 minutes between successive tests under the environmental conditions given in (1).

Diagram 9: Chest Characteristics Test, Force-Displacement Curve



1.5 Flexion Characteristics of the Lumbar Vertebrae

As shown in Diagram 10, when the lumbar vertebrae are rotated downward as follows, the upper torso pulling load shall be 320N –390N when the angle between the upper torso and the legs becomes 44.5°–45.5°. Additionally, when the load is removed, the upper torso shall return to keep the angle within 8° from the original position.

(1) The dummy for verification shall be preconditioned in an environment with temperature of 18.9 ºC –25.6ºC and relative humidity of 10%–70% for at least four hours.

(2) The dummy shall be installed on the pedestal and keeping the connecting surface of the pelvis and lumbar vertebra horizontal, the pelvis shall be fixed by using a pelvis-fixing jig. Additionally, the loading jig shall be installed at the vertebra.

(3) Bend the dummy's upper torso forward at an angle of 30° from the vertical plane.

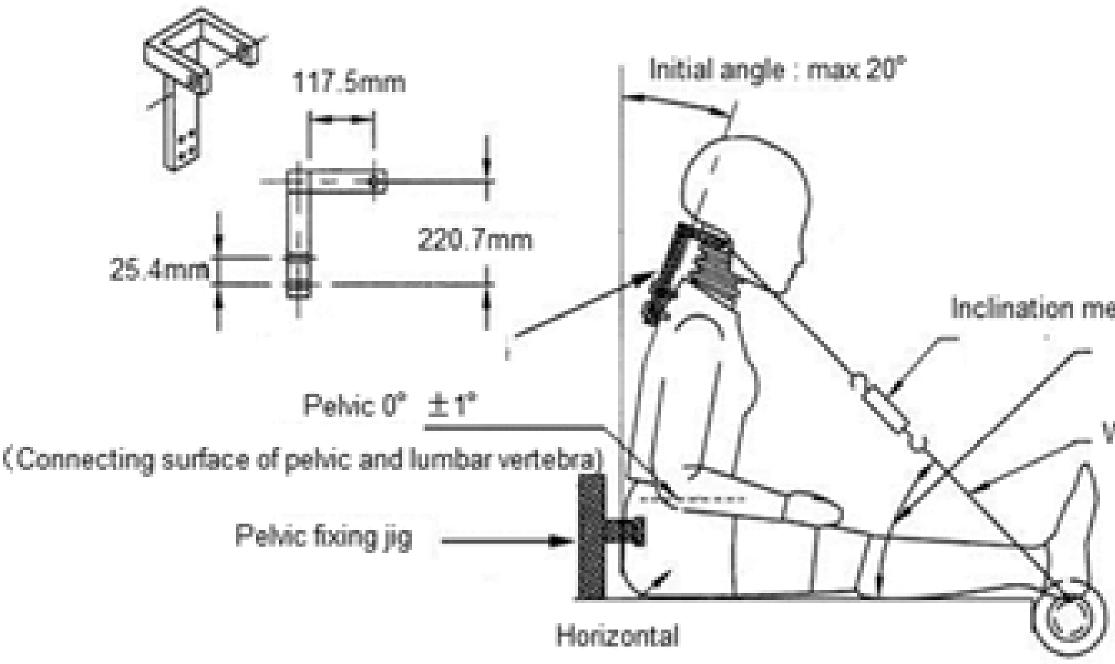
Repeat this three times and then leave the dummy for 30 minutes before conducting the test. Meanwhile, support the dummy's torso by external means so that it is maintained in the vertical position.

(4) Remove the fixing jig from the dummy, keep this condition for 2 minutes, then measure the upper torso angle (initial angle). The measured angle (initial angle) shall be within 20°.

(5) Connect the wire and load meter to the loading jig, pull the upper torso down to 45 ± 0.5° at the speed of 0.5°/sec –1.5°/sec, then measure the load 10 minutes later.

(6) Quickly remove all loads from the load jig, then after 3 minutes, measure the change of upper torso angle from the initial angle.

Diagram 10 : Flexion Characteristic test for the Lumbar Vertebra



1.6 Leg Characteristics

Apply impact to each knee on the right and left side with the impactor as follows. The maximum impact force occurring at the impactor shall be 345daN –406daN. (The impactor is a cylinder whose impact applying section has a diameter of 76 ± 1mm. To measure the impactor acceleration that occurs in the longitudinal centerline of the cylinder, the accelerometer shall be mounted on the impactor surface opposite the impactor surface in a way superposed onto the aforesaid line. The impactor mass shall be 2.99 ± 0.023kg including the accelerometer.) (See Diagram 9.)

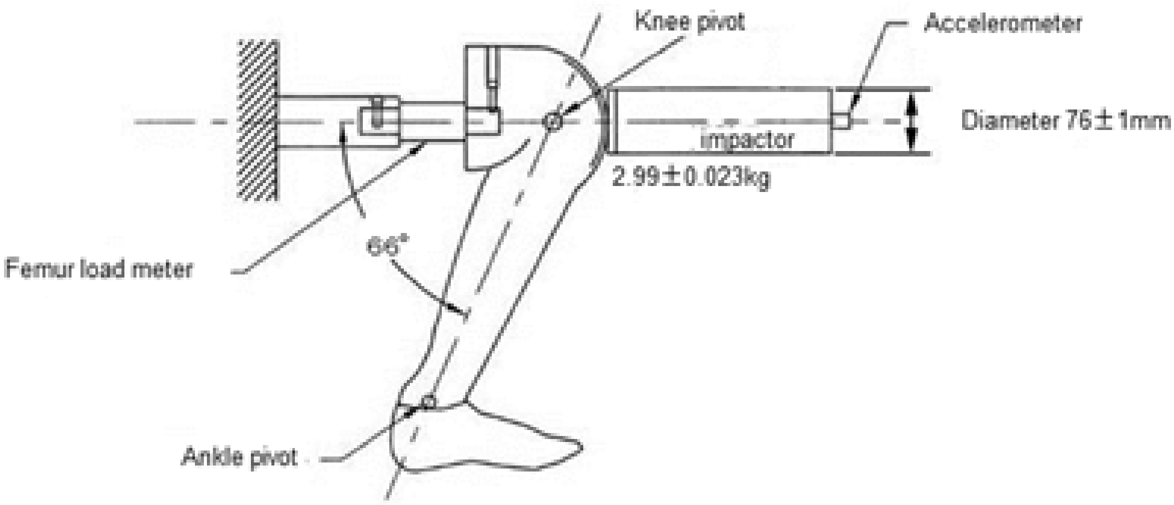
(1) Condition the leg to be verified in an environment with temperature of 18.9 ºC –25.6ºC and relative humidity of 10%–70% for at least four hours.

(2) Adjust the impactor position so that the height of the longitudinal centerline of the impactor is the same as the height of the centerline of the knee pivot bolt on the vertical plane that passes through the centerline of the upper leg at the time when the impactor comes in contact with the knee in a horizontal state.

(3) Impact the leg with the impactor at a speed of 2.07m/s –2.13m/s. Measure the deceleration occurring at the rear end of the impactor and calculate the impact force occurring at the impactor (the product of the impactor mass and the deceleration).

(4) When the verification is conducted on the same leg, etc. consecutively, allow at least 30 minutes between successive tests under the environmental conditions given in (1).

Diagram 11: Leg Characteristics Test



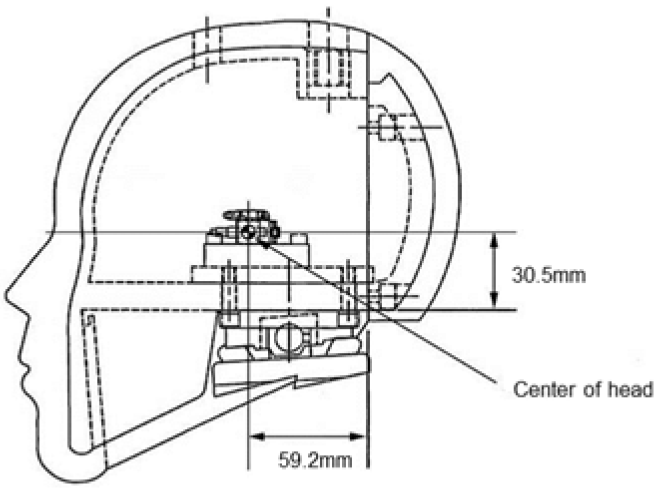
1.7 Measuring Equipment

(1) Center of Sensitivity of Head Accelerometer

The center of sensitivity of the head accelerometer shall be in the range specified in the table below with the head center as the zero-point. (The head center means the point that is on the dummy center plane, 30.5mm above the head inner bottom surface and 59.2mm forward from the vertical plane where the brainpan joins with the brain pan cover.) (See Diagram 12.)

	Range of head accelerometer center of sensitivity (mm)		
	Fore-aft direction	Lateral direction	Vertical direction
Fore-aft axis range	Backward within 33	±5	±5
Lateral axis range	±5	±33	±5
Vertical axis range	±5	±5	±8

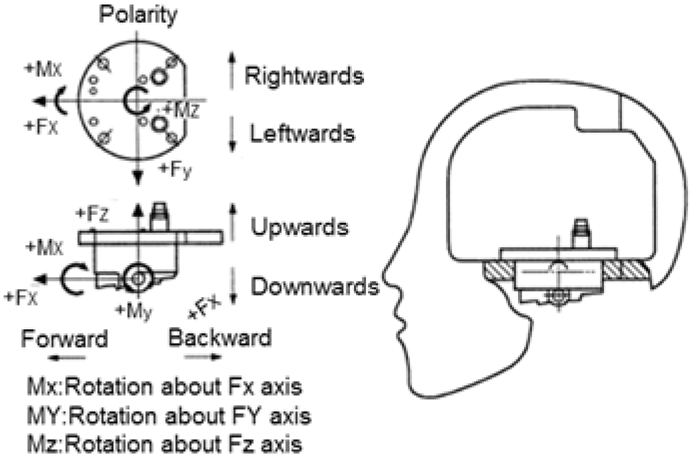
Diagram 12: Head Accelerometer Sensitivity Center



(2) Installation of Neck Load Meter

The neck load meter shall be installed as shown in Diagram 13.

Diagram 13: Installation of 6-axis Type Head Load Meter



(3) Center of Sensitivity of Chest Accelerometer

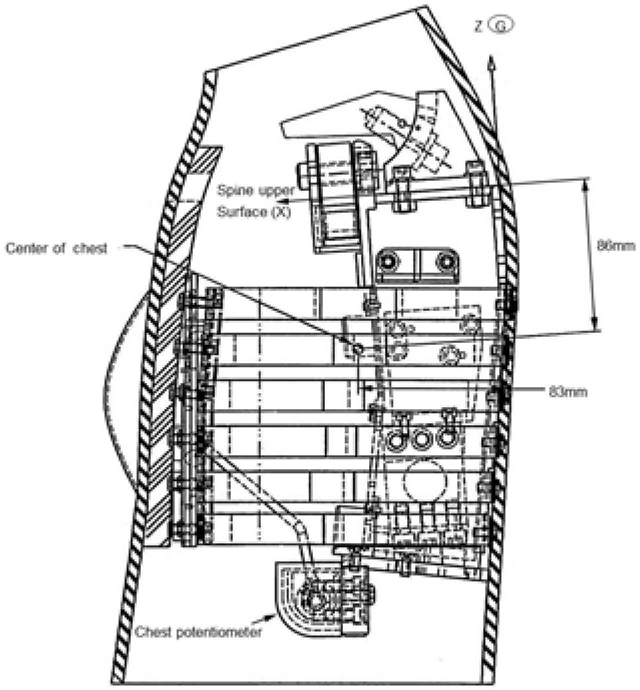
The center of sensitivity of the chest accelerometer shall be within the range specified in the table below from the chest center (which means the point on the dummy's center plane located 86mm below the spine upper face and 83mm forward of the rearmost thoracic plane). (See Diagram 14.)

	Range of chest accelerometer center of sensitivity (mm)		
	Fore-aft direction	Lateral direction	Vertical direction
Fore-aft axis range	Backward, within 40	±10	Downward, within 20
Lateral axis range	Backward, within± 50	±5	Downward, within 20
Vertical axis range	Backward, within 25	±10	Downward, within 45

(4) Installation of Chest Potentiometer

A potentiometer shall be installed as shown in Diagram 14.

Diagram 14: Center of Chest and Installation of Chest Potentiometer


Z G
Spine upper
Surface (X)
Center of chest
86mm
83mm
Chest potentiometer

Attachment 4

Sample Test Result Sheets（Example）

New Offset Frontal Collision
Test No. NASVA 2024-*****
Test Vehicle Name：**NASVA　1234**

Test Date　　：2024 / ** / **（*）

Test Site　　：Japan Automobile Research Institute

1. Test Vehicle

Vehicle Name / Model　　：NASVA　1234(DAA-ABCD)

Test Vehicle Mass　　　　：1000kg (F:600 / R:400)

Frame Number　　　　　：ABCD-123456

Occupant Crash Protection：Driver Seat - seatbelt (w/ double pretensioner)

＋ airbag（Front, Side, Knee, Curtain）

Rear Seat - seatbelt (w/ pretensioner)

＋ airbag（Front, Side, Curtain）

2. Dummy

Driver's Seat　　　　：THOR 50M ＋Lower leg H-Ⅲ 50M　No.　THOR-01（N-01）

Passengers' Seat　　：Hybrid-Ⅲ 05%tile　　　No.　DT01-1

3. Deformable Barrier

Maker　　　　　：

Serial No.　　　　：

Lot No.　　　　　：

Inspection Year　：dd / mm / 2024

4. Test Details

① Collision Speed : 50.0km/h（Test Vehicle） / 50.0km/h（MPDB）

② Deviation : L/ R 0mm（Lap rate 50.0%） Up-down 0mm

③ Injuries :

		Driver Seat		Passenger Seat
Head Injury Valur (HIC15)		123.4		123.4
Head Injury Value (DAMAGE)		0.12		
Neck	Tensile load (kN)	1.23		1.23
Neck	Shear load (kN)	1.23		1.23
Neck	Extension Moment (Nm)	-12.34		-12.34
Amount of Chest Displacement	Right upper (mm)	12.34		
Amount of Chest Displacement	Right down (mm)	12.34		
Amount of Chest Displacement	Left upper (mm)	12.34		
Amount of Chest Displacement	Left down (mm)	12.34		
Amount of Chest Displacement (mm)				-12.34
Shoulder belt load (kN)		1.23		1.23
Acetabular load	Right (kN)	1.23		
Acetabular load	Left (kN)	1.23		
Abdomen displacement	Right (mm)	-12.34		
Abdomen displacement	Left (mm)	-12.34		
Riding up of wrap belt from pelvis	Right			None
Riding up of wrap belt from pelvis	Left			None
Femur load	Right (kN)	-1.23		-1.23
Femur load	Left (kN)	-1.23		-1.23
Right Upper Tibia Index	Compression load (kN)	1.23	-1.23	
Right Lower Tibia Index	Compression load (kN)	1.23	-1.23	
Left Upper Tibia Index	Compression load (kN)	1.23	-1.23	
Left Lower Tibia Index	Compression load (kN)	1.23	-1.23	

④ Vehicle Body Deformation :

Steering Displacement (mm)	Backward Displacement	Forward 0
	Upward Displacement	Down 0
Brake Pedal Displacement (mm)	Backward Displacement	Forward 0
	Upward Displacement	Down 0

⑤ Dummy Constraint Condition During or After Testing :

- Driver Seat ……… Acceptable
- Passenger Seat ……… Acceptable

⑥ Waveform Remove in Secondary Collision :

- Driver Seat ……… None
- Passenger Seat ……… None

⑦ Fuel Leakage During or After Collision : None

⑧ Side Door Openability :

		Left Side	Right Side
Front Seat	Openability	Open Hand	Open Hand
	Door Lock	None	None
Rear Seat	Openability	Open Hand	Open Hand
	Door Lock	None	None

⑨ Ability to pull dummy out of vehicle :

- Driver Seat ……… Manpower
- Passenger Seat ………Manpower

⑩ Partner protection performance :

OLC (G)	12.3

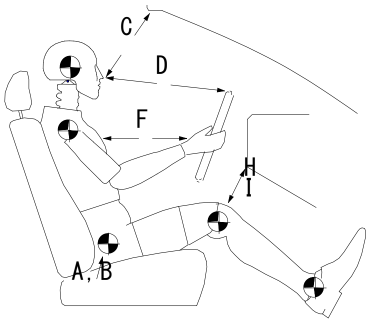
SD (mm)	12
BO（Barrier bottoming out or not）	None

Notes

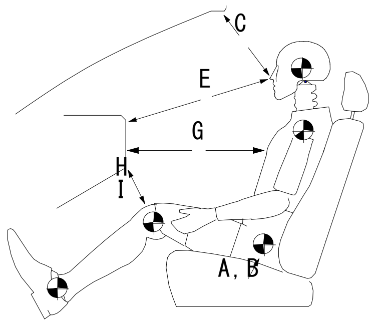
5. Dummy Seated Positions

(1) Point to Point Measurement Results

Driver Seat



Passenger Seat



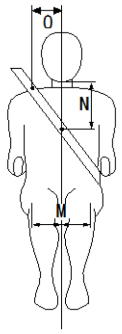
Units：mm

Measured Position	Driver Seat	Passenger Seat
A　Reference point　～　hip point front-back	123	123
B　Reference point　～　hip point up-down	123	123
C　Forehead / Nose tip　～　windshield header	123	123
D　Forehead　～　steering wheel rim top center	123	
E　Nose tip　～　dashboard		123
F　Chest　～　Steering horn pad (horizontal)	123	
G　Chest　～　dashboard（horizontal）		123
H　Right knee　～　dashboard bottom（Shortest）	123	123
I　Left knee　～　dashboard bottom（Shortest）	123	123
J　Head angle	0°	0°
K　Angle of lower neck (equivalent to T1)	0°	
L　Pelvis angle	33.0°	20.0°

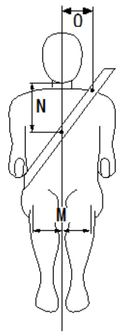
Note: C is the distance from the forehead (head center height) for the driver's seat and from the tip of the nose for the front passenger's seat.

Seatbelt Settings

Driver Seat



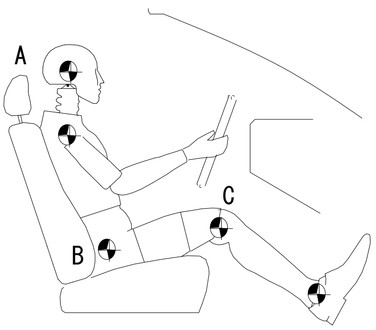
Passenger Seat



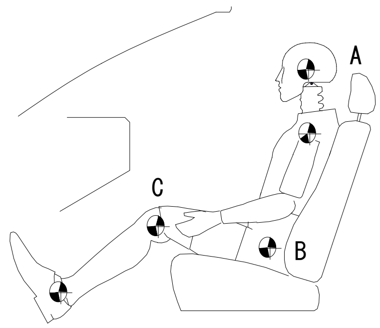
Measured Position	Driver Seat	Passenger Seat
M Knee interval（dummy center ～ left, right）	123 / 123	123 / 123
N Dummy under jaw ～ belt center（vertical, with dummy centerline）	123	123
O Dummy center ～ belt center（lateral, from the height of the root of the neck）	12	12

(2) 3-D measurement results

Driver Seat



Passenger Seat



Reference Points（Example）: Driver Seat – Fr door checked bolt head（X;1234.5 Y;123.4 Z;123.4）

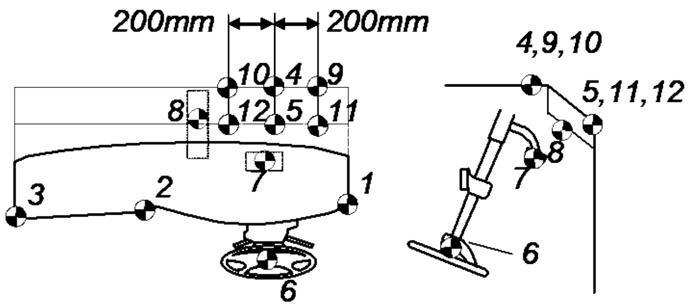
Passenger Seat - Fr door checked bolt head（X;1234.5 Y;-123.4 Z;123.4）

Unit：mm

Measured Part	Driver Seat			Passenger Seat		
	X	Y	Z	X	Y	Z
A: Head（Outside）	1234	123	1234	1234	123	1234
B: Waist（Outside）	1234	123	1234	1234	123	1234
C: Knee（Outside）	1234	123	1234	1234	123	1234

6. **Vehicle Body Part Deformation Amounts**

(1) Cabin Interior Part Deformation Amounts



1 : Instrument panel right end

2: Instrument panel center

3: Instrument panel left end

4 : Driver seat toe board

5 : Driver seat floor

6 : Steering shaft tip

7 : Brake pedal

8 : Footrest

9 : Driver seat toe board A

10 : Driver seat toe board B

11 : Driver seat floor A

12 : Driver seat floor B

Reference Points（Example）: door checked bolt head（X : 1234.5, Y : 123.4, Z : 123.4）

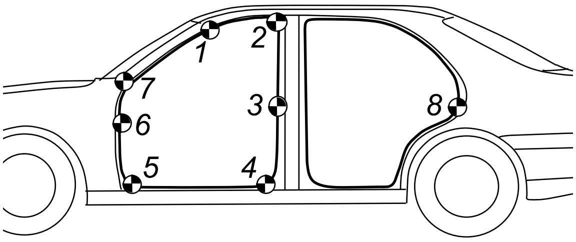
Unit : mm

Car interior

Part		Before test	After test	Deformation
1	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
2	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
3	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
4	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
5	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
6	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0

Part		Before test	After test	Deformation
7	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
8	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
9	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
10	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
11	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
12	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0

(2) Door vicinity Deformation



1：A pillar top

2：B pillar top

3：Striker bolt (front door)

4：B pillar bottom

5：A pillar bottom

6：A pillar center

7：A pillar fitting

8：Striker bolt (back door)

Reference Points（Example）: Fr door checked bolt head（X：1234.5, Y：123.4, Z：123.4）

Unit：mm

Right door

Part		Before test	After test	Deformation
1	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
2	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
3	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
4	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
5	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
6	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
7	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
8	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0

Left door

Part		Before test	After test	Deformation
1	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
2	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
3	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
4	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
5	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
6	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
7	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0
8	X	1234	1234	0
	Y	123	123	0
	Z	1234	1234	0

Electrical Measurement Data

Dummy test results and sensor transcripts

Progressive Deformable Barrier Transcript

Photo of the situation at the time of the test

Appendix 1: Test Vehicle Specification Data Sheet

[To be completed by vehicle manufacturer]

1. Adjusting Seats and Seatbelts

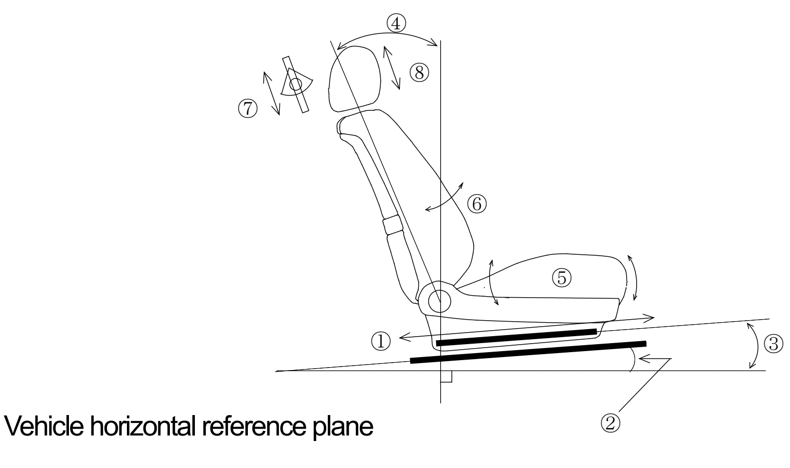
[Row 1]

			Driver Seat	Front Passenger Seat
①Adjustment of seat in fore-and-aft direction	Adjustment amount per stage		mm	mm
	Entire adjustment amount		mm	mm
	Mid. Position	From front edge	mm (stage)	mm (stage)
		From rear edge	mm (stage)	mm (stage)
② Adjustment of seat-slide-rail in attaching angle			°	°
③ Adjustment of seat lower and seatback at once	Design standard position			
	Attachment method			
④ Adjustment of seatback angle	Design standard angle		° (stage)	° (stage)
⑤ Adjustment of seat in vertical direction	Tilt	From the lowest position	mm	mm
	Lifter		mm	mm
	Other		mm	mm
⑥ Adjustment of lumbar support	From the release position			
⑦ Adjustment of anchorage for seatbelt shoulder webbing	Adjustment range		mm (stage)	mm (stage)
	Design standard position		[From top position] mm (stage)	[From top position] mm (stage)
⑧ Adjustment of head-rest height	Adjustment range		mm (stage)	mm (stage)
⑨Other adjustment mechanisms ( )	Design standard position			

[Rows 2, 3]

<table>
<tr><td colspan="3"></td><td>3rd (sic) Row</td><td>3rd Row</td></tr>
<tr><td rowspan="4">① Adjustment of seat in fore-and-aft direction</td><td colspan="2">Adjustment length per stage</td><td>mm</td><td>mm</td></tr>
<tr><td colspan="2">Total adjustment length</td><td>mm</td><td>mm</td></tr>
<tr><td rowspan="2">Standard</td><td>From front edge</td><td>mm
(stage)</td><td>mm
(stage)</td></tr>
<tr><td>From rear edge</td><td>mm
(stage)</td><td>mm
(stage)</td></tr>
<tr><td>④ Adjustment of seatback angle</td><td colspan="2">Design standard angle</td><td>°
(stage)</td><td>°
(stage)</td></tr>
<tr><td rowspan="2">⑦ Adjustment of anchorage for seatbelt shoulder webbing</td><td colspan="2">Adjustment range</td><td>mm(stage)</td><td>mm(stage)</td></tr>
<tr><td colspan="2">Design standard position</td><td>[From top position]
mm (stage)</td><td>[From top position]
mm (stage)</td></tr>
<tr><td rowspan="2">⑧ Adjustment of headrest height</td><td colspan="2">Adjustment range</td><td>mm (stage)</td><td>mm (stage)</td></tr>
<tr><td colspan="2">Design standard position</td><td>[From top position]
mm (stage)</td><td>[From top position]
mm (stage)</td></tr>
<tr><td>⑨Other adjustment mechanisms
( )</td><td colspan="2">Design standard position</td><td></td><td></td></tr>
</table>

(Note) The number of stages for adjustment position shall start from the first locking position ("stage 0").



(Note) position of ⑨ other adjustable mechanism shall be shown on the above drawing.

2. Adjustment of Steering System

(1) Vertical direction: (present/absent)

Adjustment range: ______° ~ ________° (________stage)

Vertical adjustment position: From highest position______° (________stage)

(2) Fore-aft direction

Adjustment range: ______________mm (________stage)

Fore-aft adjustment position: From foremost position ________mm (________stage)

(Note) The number of stages for position adjustment in the vertical direction and the fore-and-aft direction shall start from the uppermost position and foremost position ("stage 0"), respectively.

(3) Distance between steering pad center and forward end of steering shaft: _______mm

3. Fuel Tank Capacity: __________L

When specification is needed of the vehicle's mounting position when its mass at vehicle delivery was recorded, diagram it below.

Diagrams or photographs may be used.

4. Vehicle Width: _________mm

5. Reference Points of Measurement of Vehicle Inclination (Enter the inclination of the unloaded vehicle with two dummies placed in their assigned positions.)

(1) Fore-aft Direction

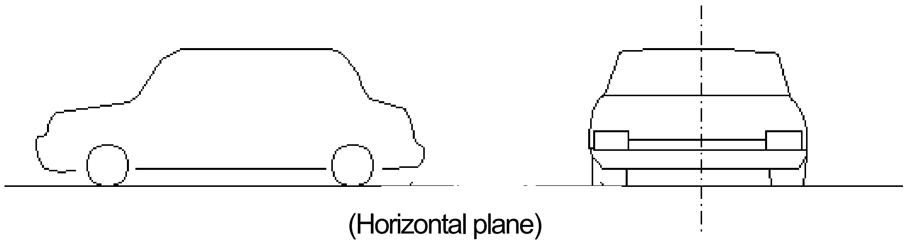
Reference Points (locations):___________________________(indicated below)

Angle to Horizontal Plane: □Forward Tilt □Backward Tilt_______°

(2) Lateral Direction (in relation to driving direction)

Reference Points (locations):___________________________(indicated below)

Angle to Horizontal Plane: □Leftward Tilt □Rightward Tilt_______°



(Horizontal plane)

6. Location and Method for Installing Vehicle Accelerometers

The details shall be entered using Appendix 2.

7. Removable Parts

8. Automatic Door-Locking Systems, etc.

Vehicle-speed-sensitive door-locking system: Available (sensitive type) / Not Available

Crash-sensitive door-unlocking system: Available / Not Available

9. Installation of Towing Hook

The towing hook shall be installed at the center of the test vehicle.

Diagrams or photographs may be used.

10. belt load cell mounting position

Indicates the installation position of the load cell on the driver's and front passenger's seat belt (shoulder area).

Diagrams or photographs may be used.

11. Handling of measurement cable for dummy

Handling such as position of measurement cable of dummy at driver's seat and passenger's seat shall be indicated below.

Diagrams or photographs may be used.

12. Vehicle Body Measuring Reference Points

The vehicle manufacturer shall indicate 3 to 5 reference points that do not deform during the collision test.

Diagrams or photographs may be used.

13. Clamping Torque of Bolts

Driver side airbag module :________________ N

Driver seat anchor bolts :________________ N

Front passenger seat anchor bolts :________________ N

Other

:________________ N

:________________ N

:________________ N

14, Battery liquid

To maintain functions such as operation of restraining device, only when battery liquid must not be eliminated, it is indicated below. (However, battery here indicates only one mounted at vehicle front (engine room)

Battery Fluid Required: Yes (circle)

For New Offset Frontal Collision Test

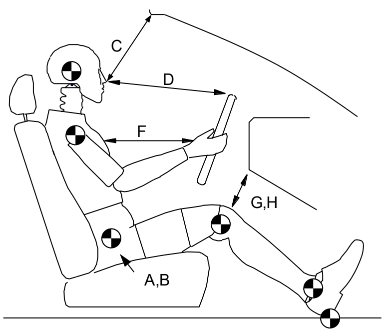
15. Dummy Seating Position Measurement Recordings

For entry by vehicle manufacturer

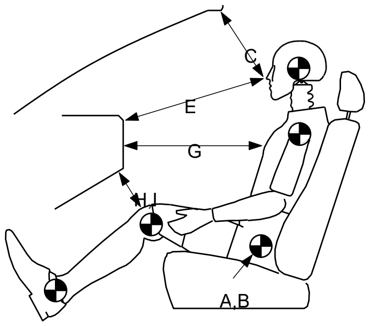
① Recording Sheet for Simple Measurements

Test vehicle name/model:		Test Date:	
Frame Number:		Test Location:	
Dummy Type:		Overseer:	
Dummy Number:		Notes:	

Driver's Seat



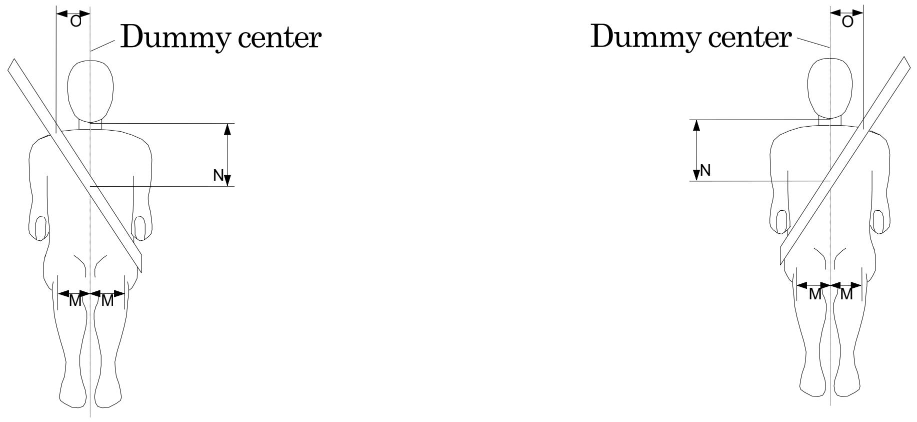
Passenger Seat



Measurement Items		Driver's Seat	Passenger Seat
A	Reference Point ( )～ Hip Point, fore-aft direction		
B	Reference Point ( )～ Hip Point, vertical direction		
C	Forehead / Top of nose ～ Windshield Header		
D	Forehead ～ Steering Wheel Rim, upper-center		
E	Top of nose ～ dashboard		
F	Chest ～ Steering, horn, pad surface (horizontal)		
G	Chest ～ dashboard (horizontal)		
H	Right Knee ～ Under the dashboard (shortest)		
I	Left Knee ～ Under the dashboard (shortest)		
J	Head Angle		
K	Angle of Lower neck (T1 equivalent)		
L	Pelvis Angle		

Driver's Seat

Passenger Seat



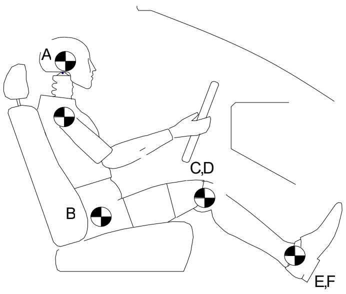
Measurement Items		Driver Seat	Passenger Seat
M	Knee Gap (dummy center～right, left)	R: L:	R: L:
	Reason why the dummy can't be loaded with a knee gap		
N	Dummy Lower Jaw～Belt Center (vertical line down the dummy's center)		
O	Dummy Center～Belt Center (lateral direction at height of root of neck)		
P			

(Note) For items A and B, the parts which constitute the reference of the vehicle body shall be entered in parentheses ( ) for the reference point. Then, dimensions of fore-and-aft and vertical components shall be measured. It is not necessary that the same reference points be employed. C shall be the distance from the forehead (head center height) for the driver's seat and from the nose tip end for the passenger seat.

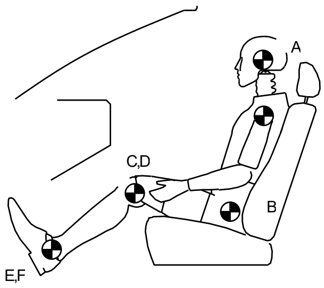
② 3-D Measuring Device Recording Sheet

Test vehicle name/model:		Test Date:	
Frame Number:		Test Location:	
Dummy Type:		Overseer:	
Dummy Number:		Notes:	

Driver's Seat



Passenger Seat



Measurement Items (target value)		Driver Seat			Passenger Seat		
		X	Y	Z	X	Y	Z
A	Head Center						
B	Hip Point						
C	Knee Joint Center: Right Side (vehicle outer-side)						
D	Knee Joint Center: Left Side (vehicle outer-side)						
E	Heel center: Right side						
F	Heel center: Left side						
G	Head Angle						
H	Lower neck (T1 equivalent)						
I	Pelvis Angle						
J	Neck Bracket Step (if recommended steps are provided)						

Hip Point Design Value

	Driver Seat			Passenger Seat		
	X	Y	Z	X	Y	Z
Design Hip Point (Y is the dummy center value)						
Hip Point (Y is the dummy center value)						
Vehicle Reference Points ( )						

Vehicle reference point

Diagrams or photographs may be used.

For New Offset Frontal Collision Test

15-1. Dummy seating position measurement results record

for entry by testing institute

① Recording Sheet for Simple Measurements

Test vehicle name/model: ____________________

Frame Number: ____________________

Dummy Type: ____________________

Dummy Number: ____________________

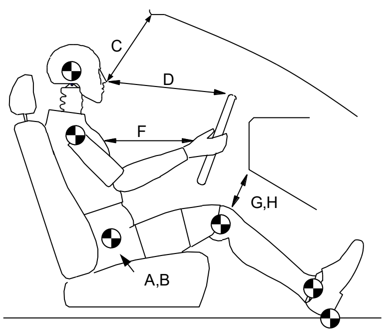
Test Date: ____________________

Test Location: ____________________

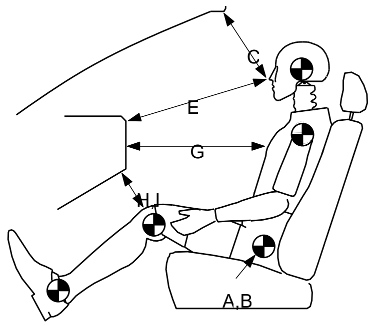
Overseer: ____________________

Notes: ____________________

Driver's Seat



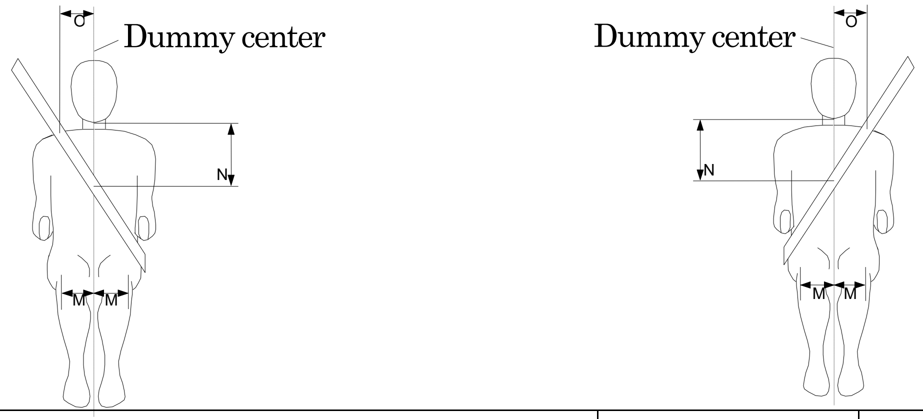
Passenger Seat



Measurement Items		Driver's Seat	Passenger Seat
A	Reference Point ( )～ Hip Point, fore-aft direction		
B	Reference Point ( )～ Hip Point, vertical direction		
C	Forehead / Top of nose ～ Windshield Header		
D	Forehead ～ Steering Wheel Rim, upper-center		
E	Top of nose ～ dashboard		
F	Chest ～ Steering, horn, pad surface (horizontal)		
G	Chest ～ dashboard (horizontal)		
H	Right Knee ～ Under the dashboard (shortest)		
I	Left Knee ～ Under the dashboard (shortest)		
J	Head Angle		
K	Lower neck (T1 equivalent)		
L	Pelvis Angle		

Driver's Seat

Passenger Seat



Measurement Items		Driver Seat	Passenger Seat
M	Knee Gap (dummy center～right, left)	R: L:	R: L:
N	Dummy Lower Jaw～Belt Center (vertical line down the dummy's center)		
O	Dummy Center～Belt Center (lateral direction at height of root of neck)		
Q			

(Note) For items A and B, the parts which constitute the reference of the vehicle body shall be entered in parentheses ( ) for the reference point. Then, dimensions of fore-and-aft and vertical components shall be measured. It is not necessary that the same reference points be employed. C shall be the distance from the forehead (head center height) for the driver's seat and from the nose tip end for the passenger seat.

② 3-D Measuring Device Recording Sheet

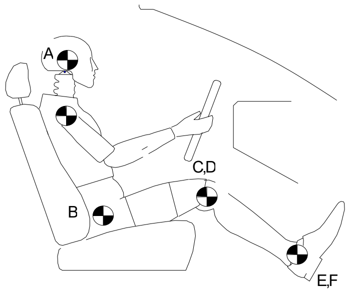
Test vehicle name/model: ____________________ Test Date: ____________________

Frame Number: ____________________ Test Location: ____________________

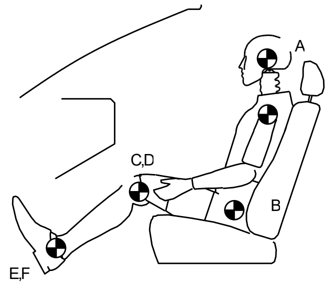
Dummy Type: ____________________ Overseer: ____________________

Dummy Number: ____________________ Notes: ____________________

Driver's Seat



Passenger Seat

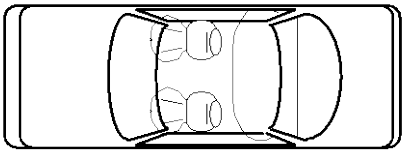


Measurement Items (target value)		Driver Seat			Passenger Seat		
		X	Y	Z	X	Y	Z
A	Head Center						
B	Hip Point						
C	Knee Joint Center: Right Side (vehicle outer-side)						
D	Knee Joint Center: Left Side (vehicle outer-side)						
E	Heel center: Right side						
F	Heel center: Left side						
G	Head Angle						
H	Lower neck (T1 equivalent)						
I	Pelvis Angle						
J	Neck Bracket Step (if recommended steps are provided)						
J							

15－2 Removed Parts and their Weights

Removed Parts	
Mass of Loaded Weight	

Location of Loaded Weight

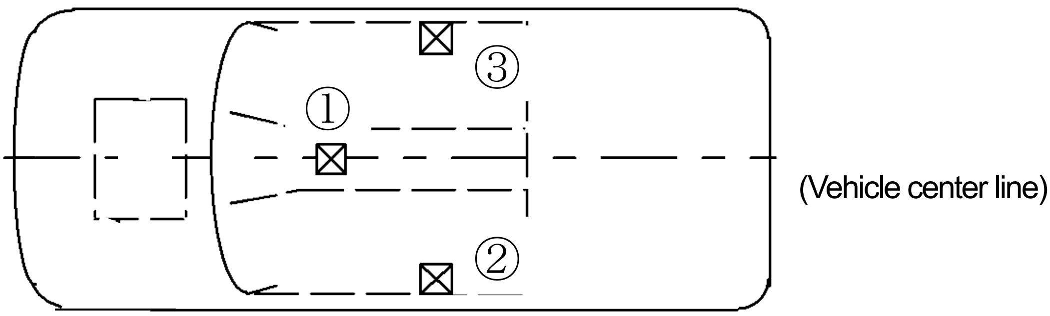


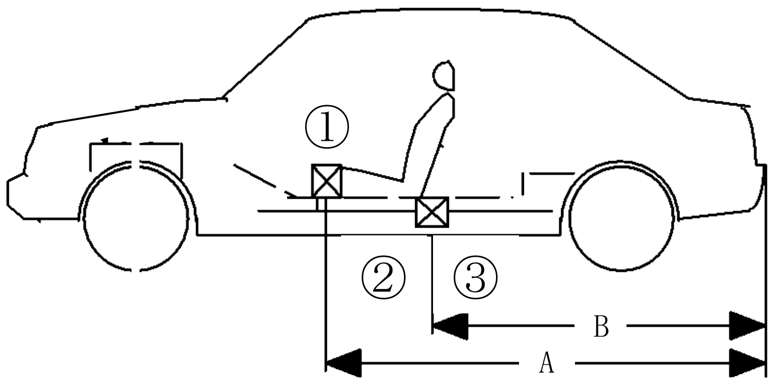
16. Results of Tests by Vehicle Manufacturer

The vehicle manufacturer shall provide the results of their tests in the format specified in Appendix 4.

Appendix2: Position of Accelerometers in Test Vehicle

［To be filled in by test institute］





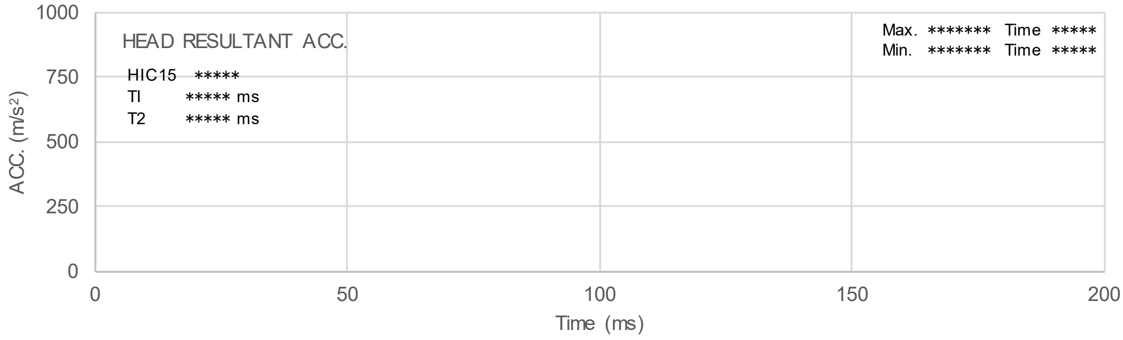
Measuring Points	Distance from reference measuring position of vehicle dimensions (mm)
① Tunnel	A:
② Left Side Sill	B:
③ Right Side Sill	B:

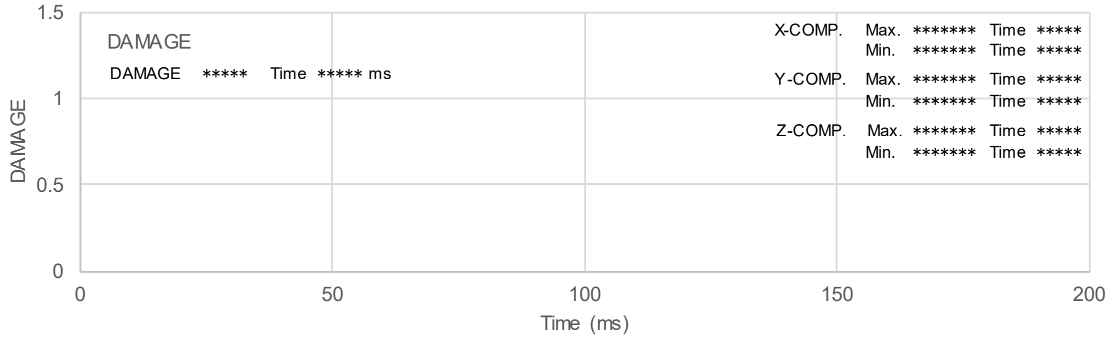
Appendix 3: Test Vehicle Specifications Data Sheet

[To be filled in by the test institute]

Model name		
Model type		
Classification		
Frame number		
Drive type		
Steering system	Steering wheel type	
	Air bag	Absent / Present
	Adjustment in the vertical direction	Absent / Present (Electric / Manual)
	Adjustment in the fore-and-aft direction	Absent / Present (Electric / Manual)
Seat	Adjustment in the fore-and-aft direction	Absent / Present (Electric / Manual)
	Adjustment of seat back	Absent / Present (Electric / Manual)
	Adjustment of lumbar support	Absent / Present (Electric / Manual)
	Adjustment of height	Absent / Present (Electric / Manual)
Seat belt	Pre-tensioner	Absent / Present (Shoulder / Inside of waist)
	Adjustment of shoulder webbing	Absent / Present (Electric / Manual)
Others (Circle around items present)		vehicle speed sensitive door locks / energy sensitive type door unlock system / precrash safety system / Sunroof /Footrest

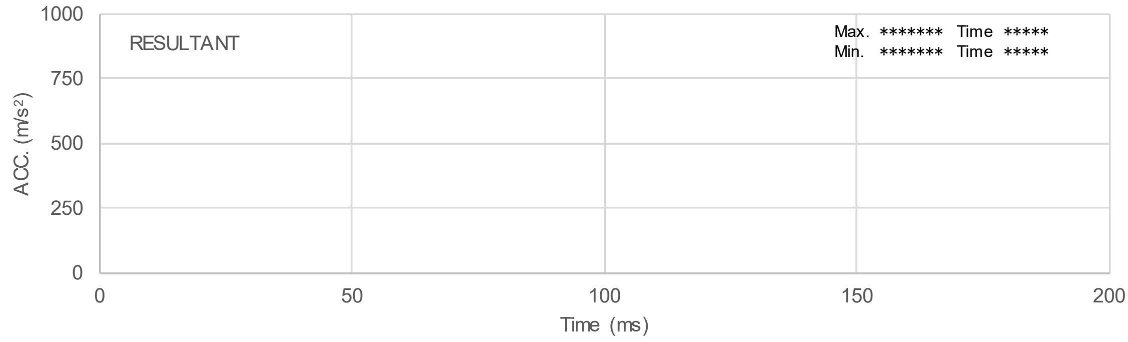
APPENDIX 4: RECORDED EXAMPLES OF ELECTRICAL MEASUREMENT RESULTS

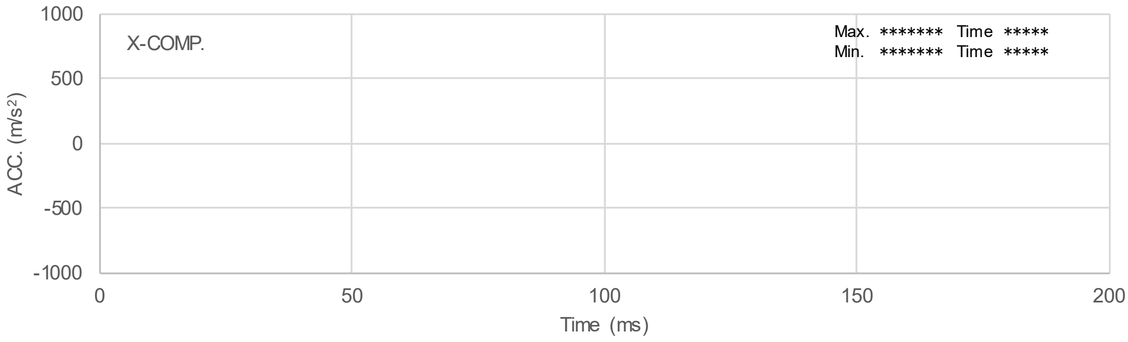


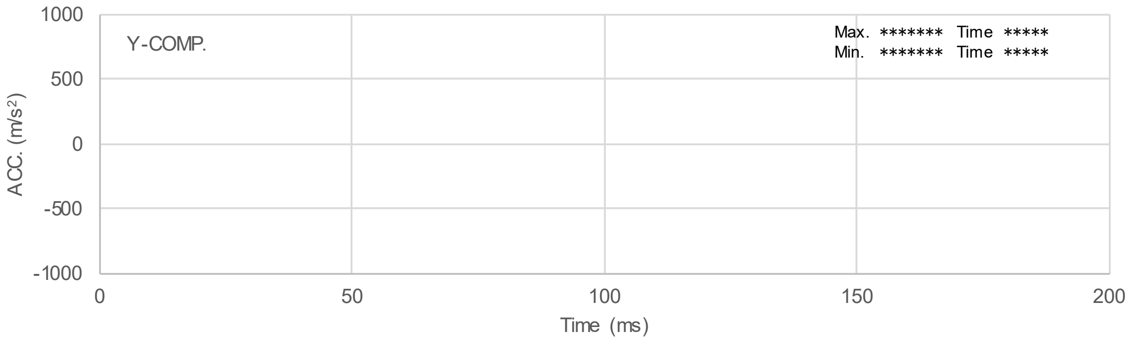


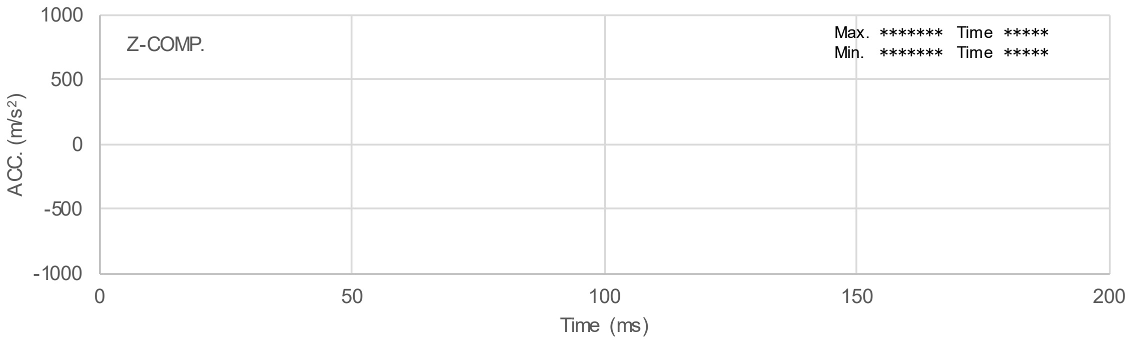
Driver Dummy HIC & DAMAGE

No. NASVA****−*****



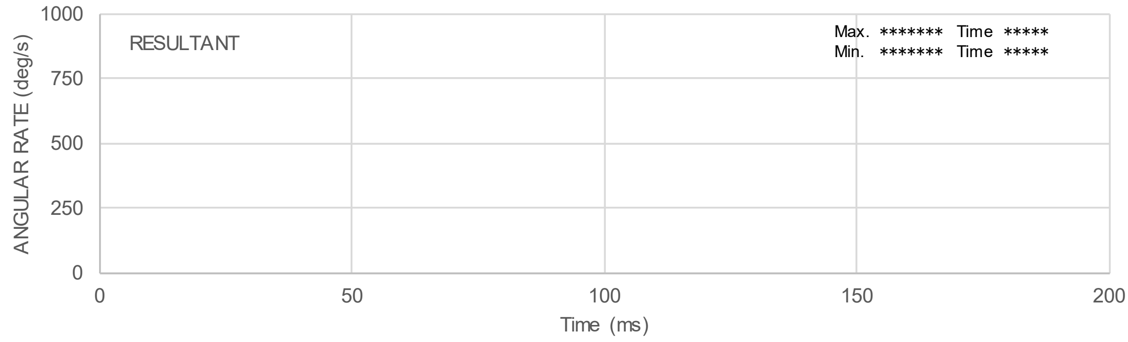


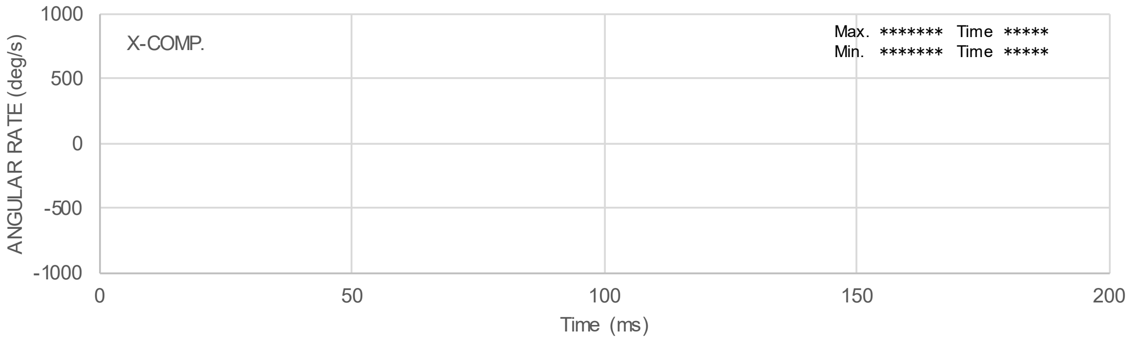


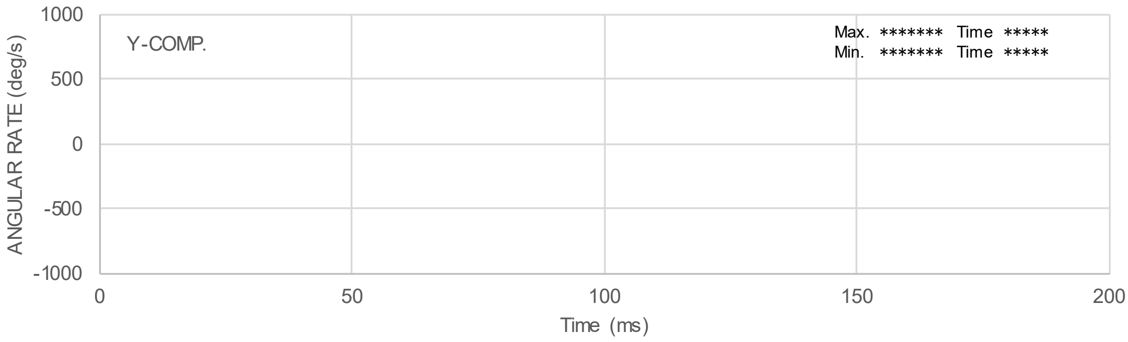


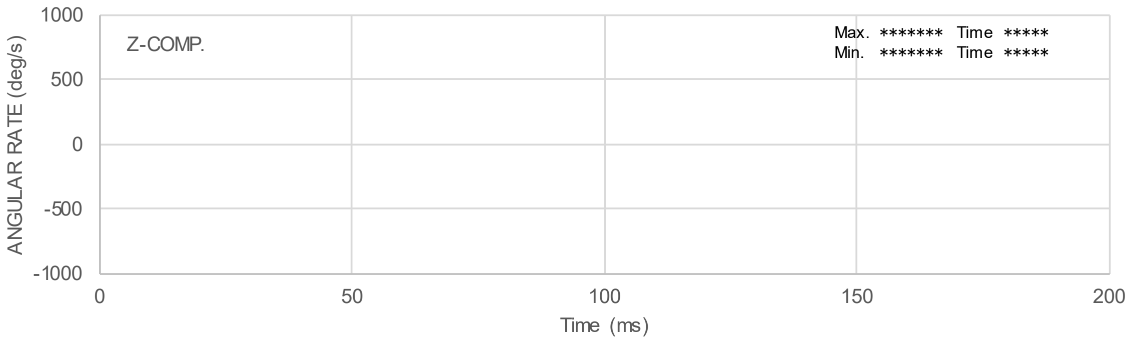
Driver Dummy Head Acc.

No. NASVA****−*****



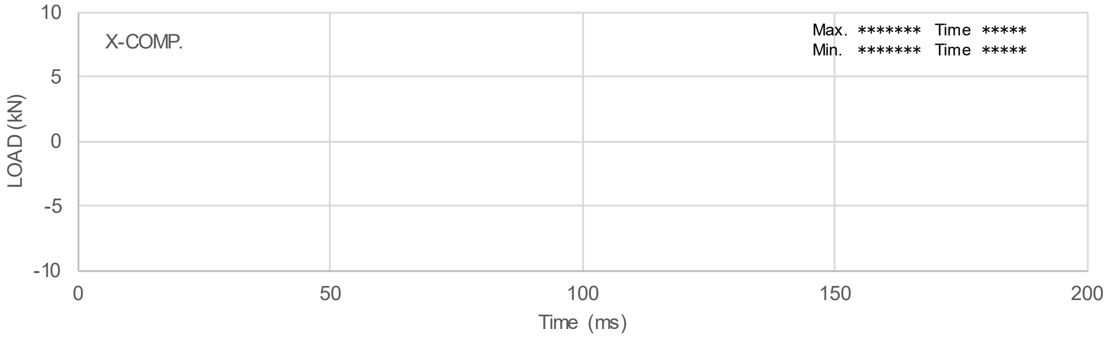


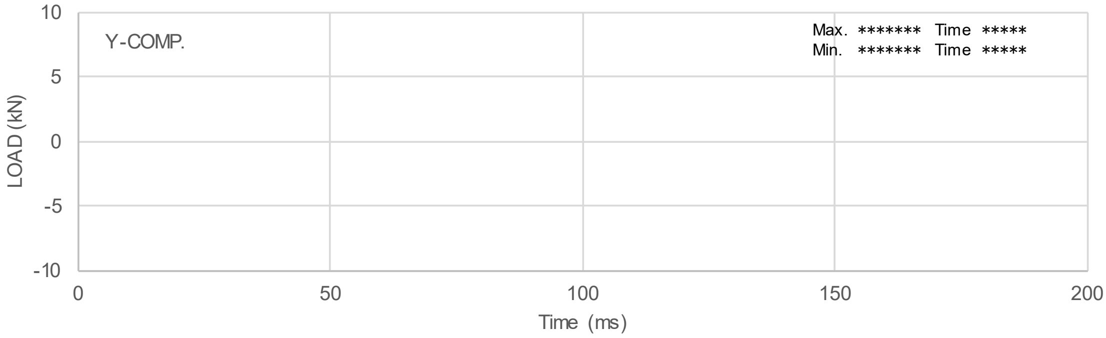


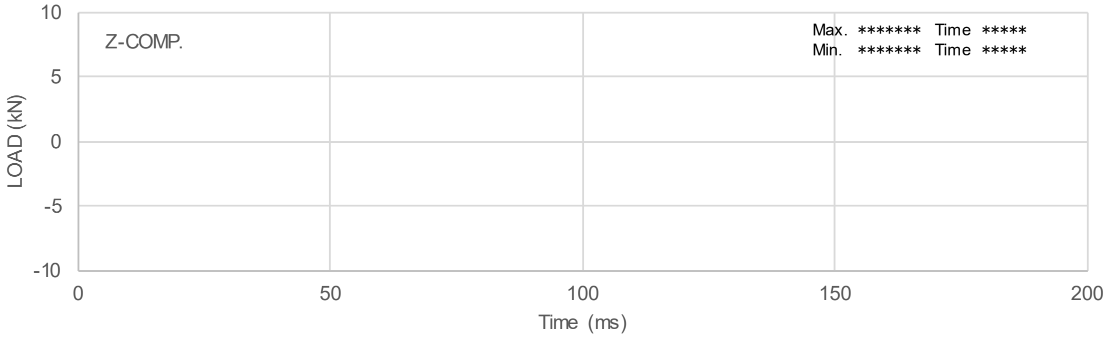


Driver Dummy Head Angular Rate

No. NASVA****−*****

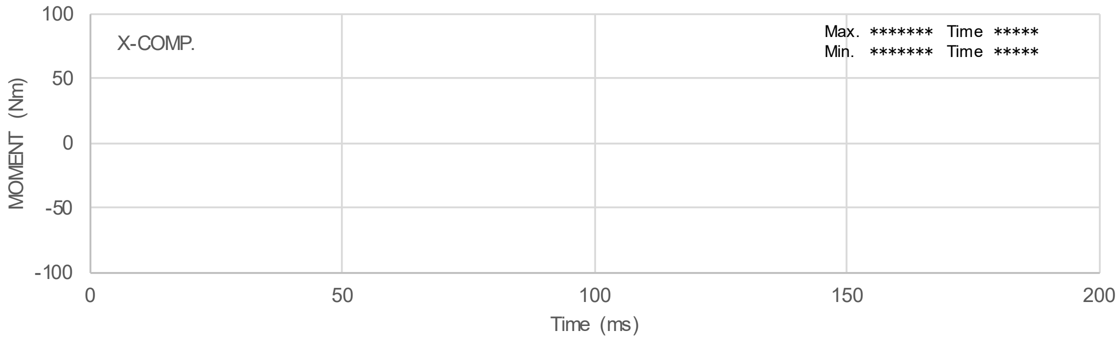


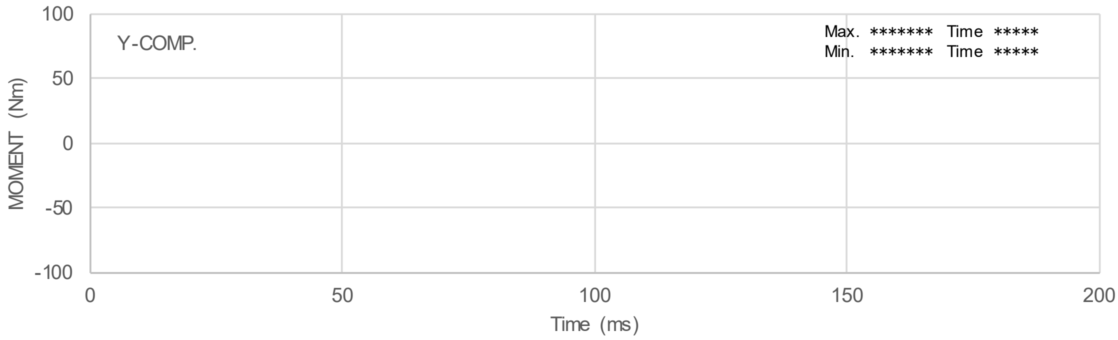


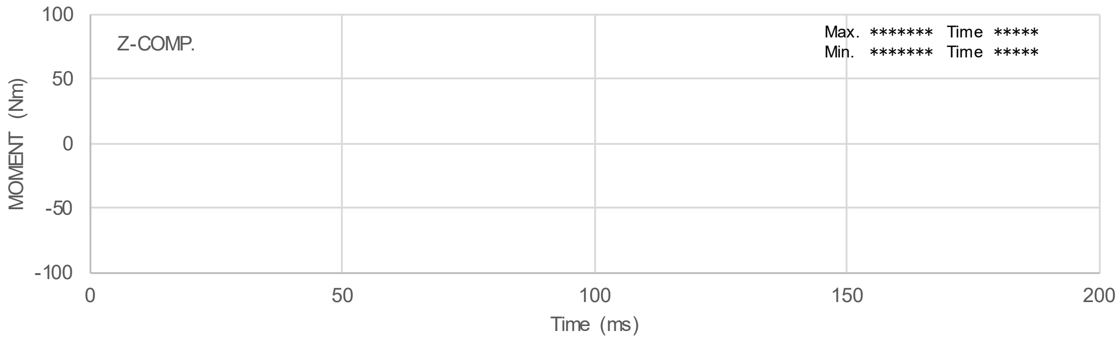


Driver Dummy Neck Force

No. NASVA****−*****

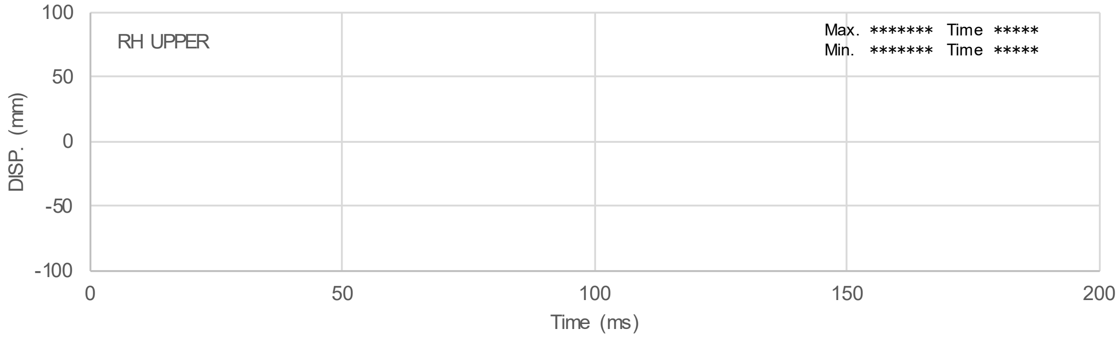


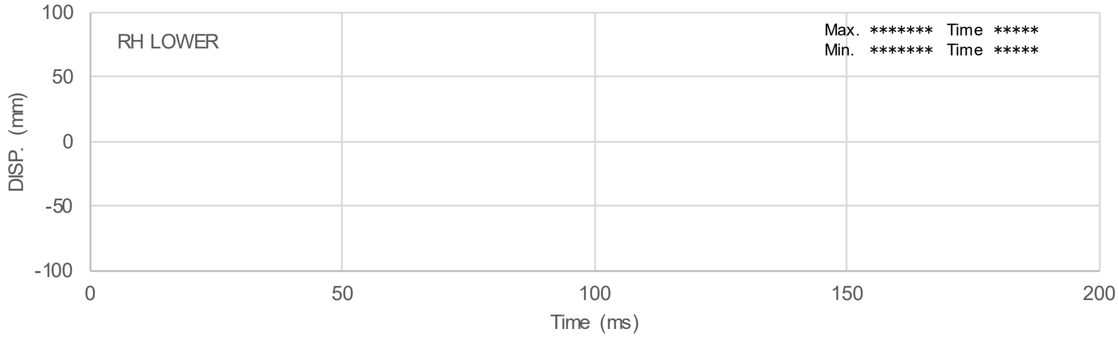


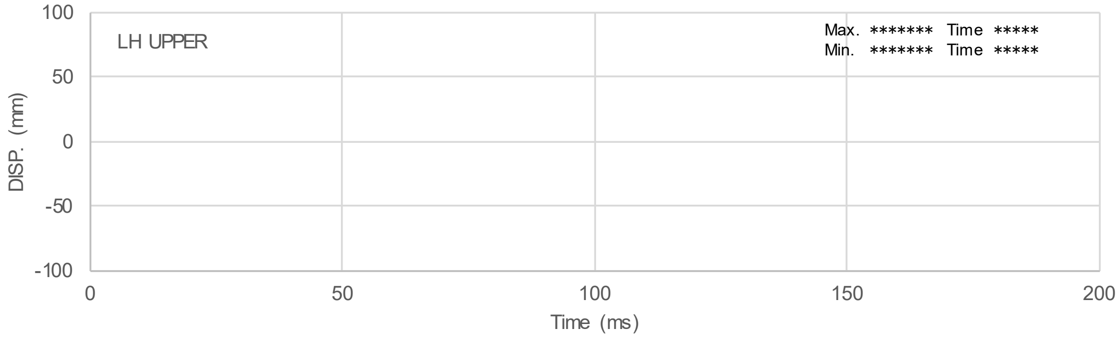


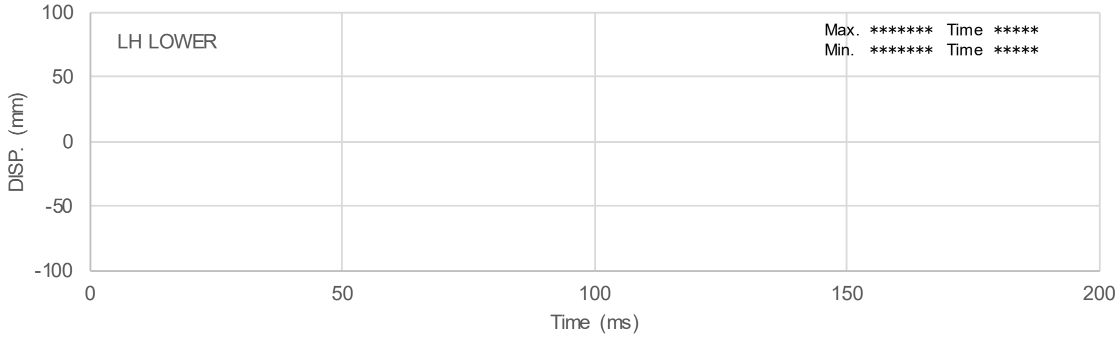
Driver Dummy Neck Moment

No. NASVA****−*****



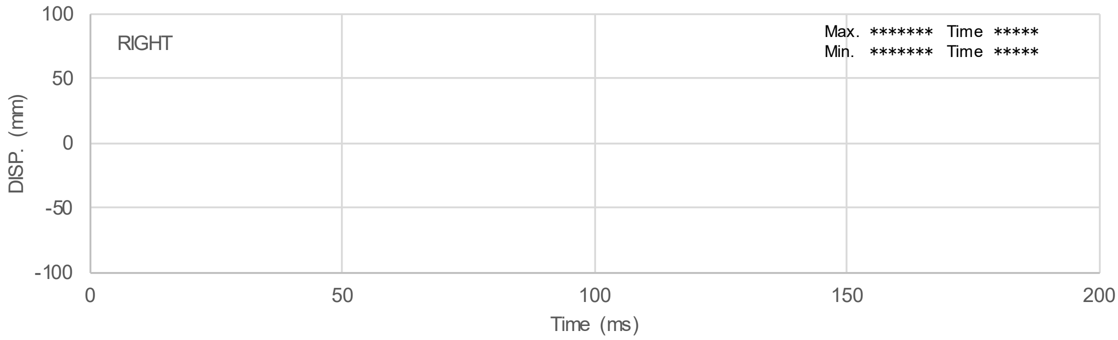


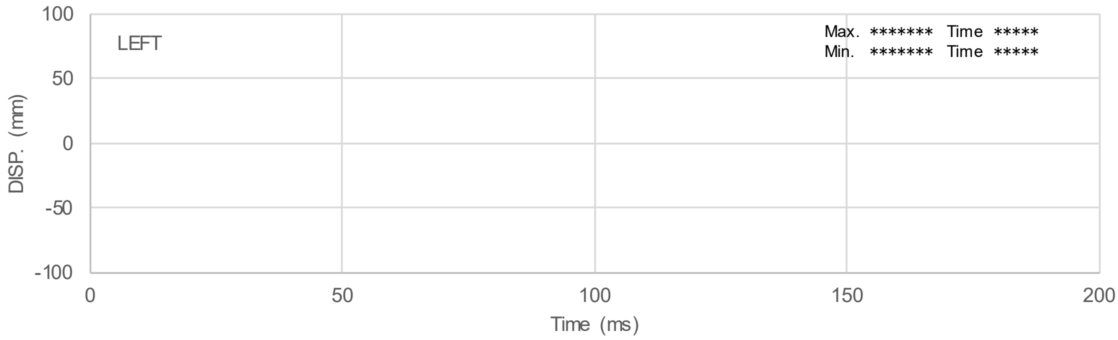




Driver Dummy Chest Disp.

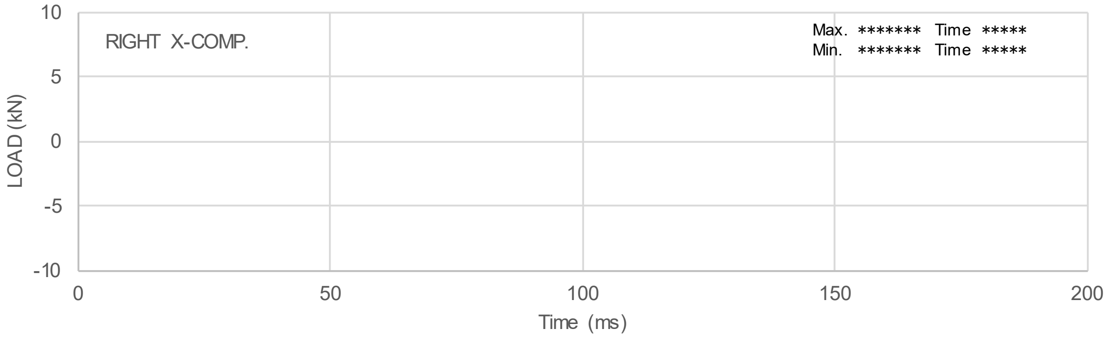
No. NASVA****−*****

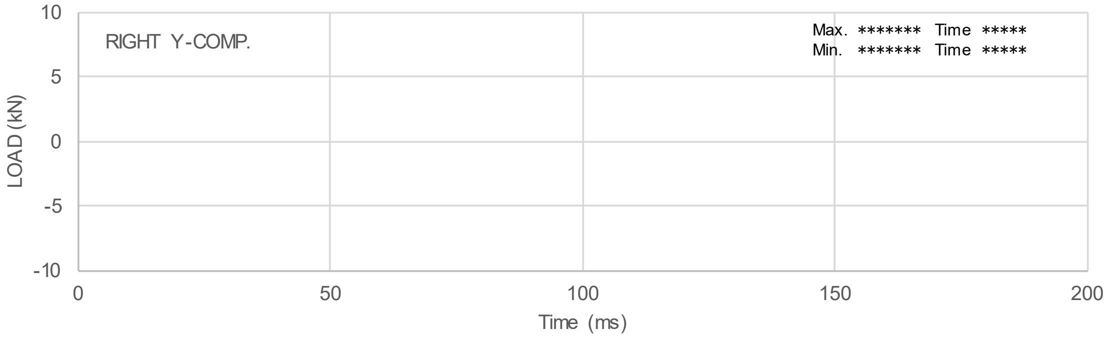


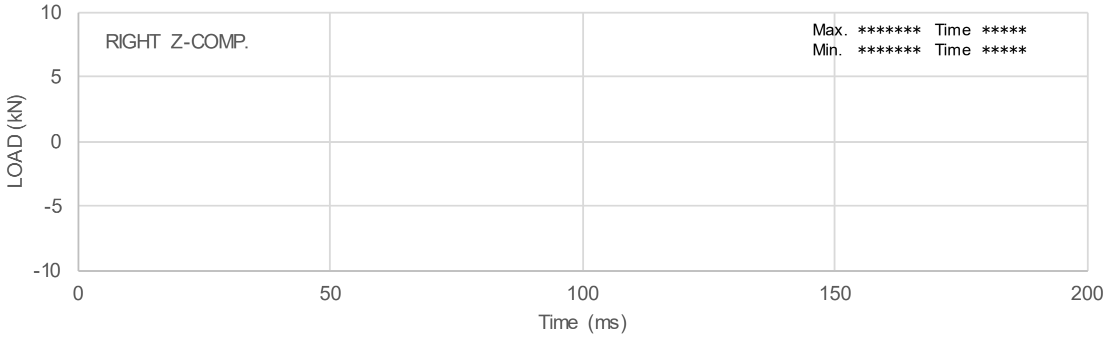


Driver Dummy Abdomen Disp.

No. NASVA****−*****

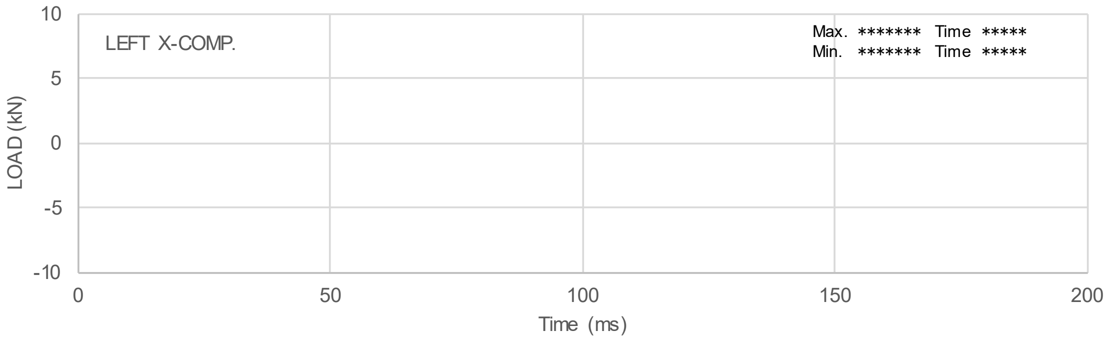


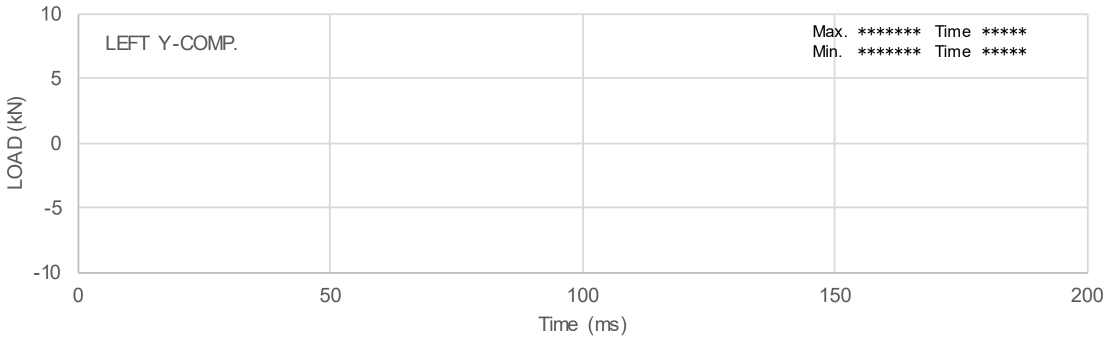


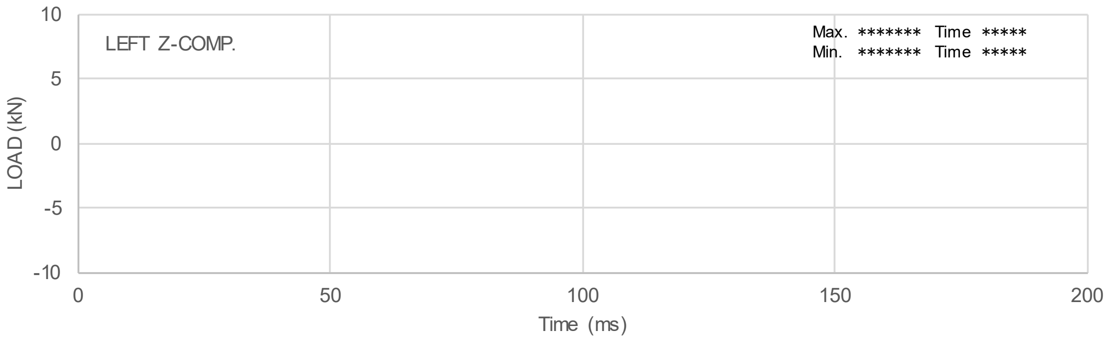


Driver Dummy Acetabulum Force

No. NASVA****−*****

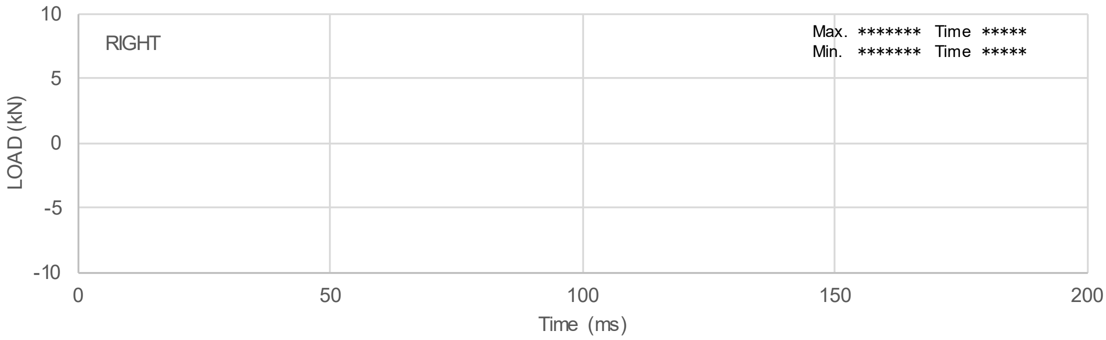


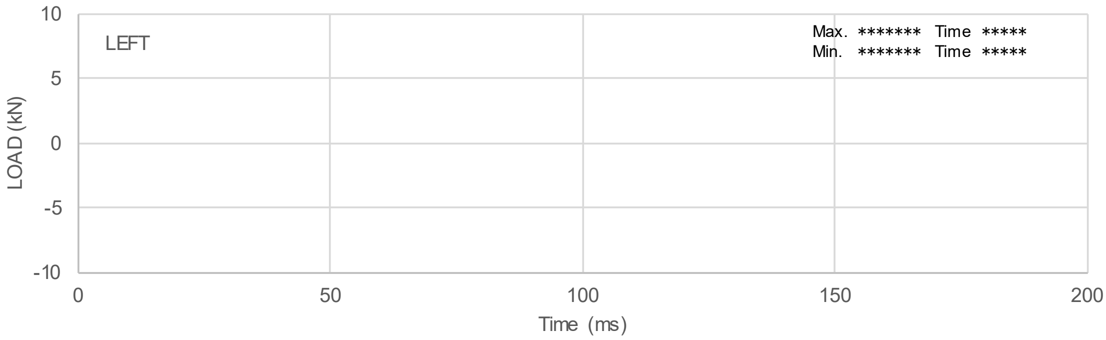




Driver Dummy Acetabulum Force

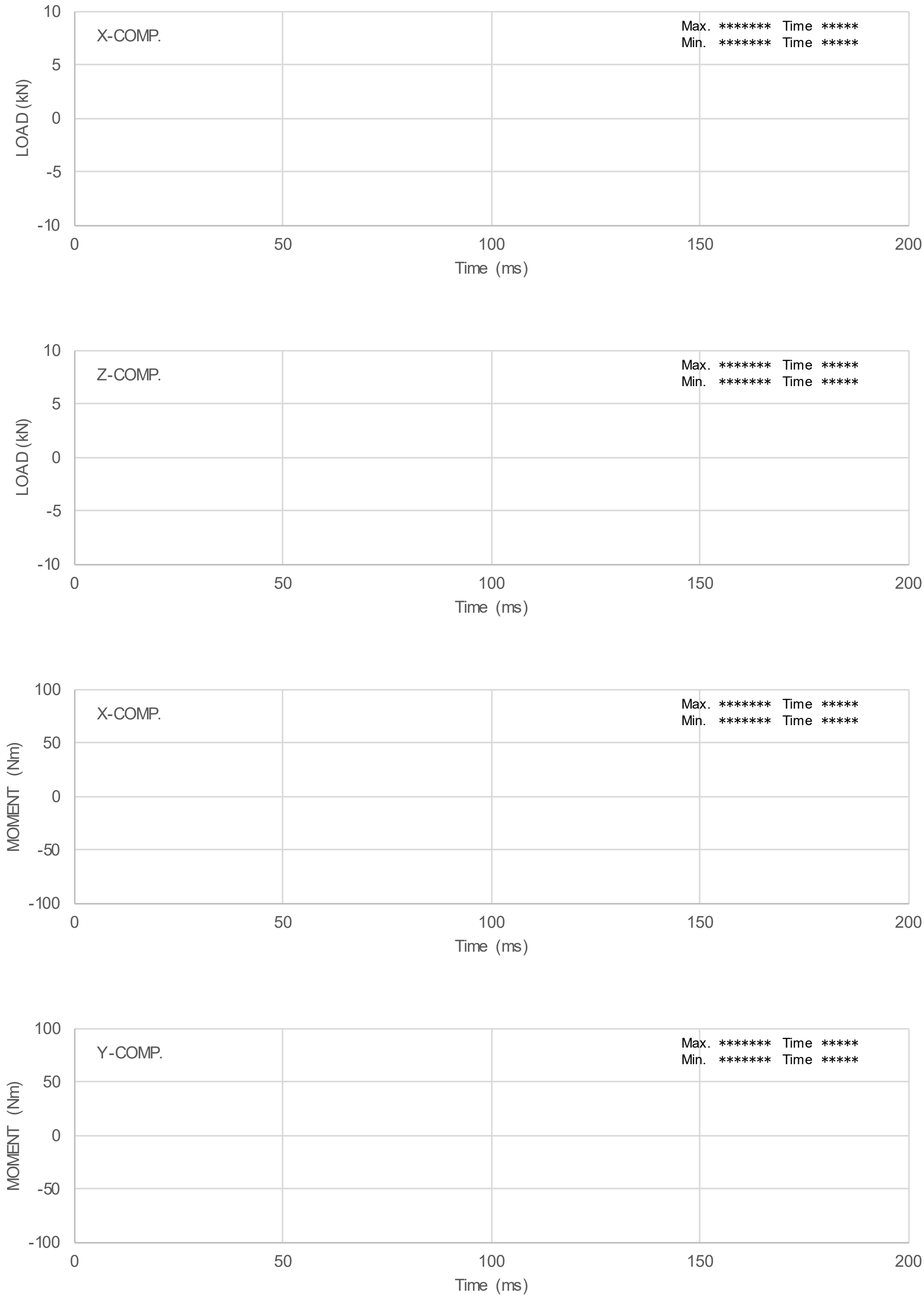
No. NASVA****−*****





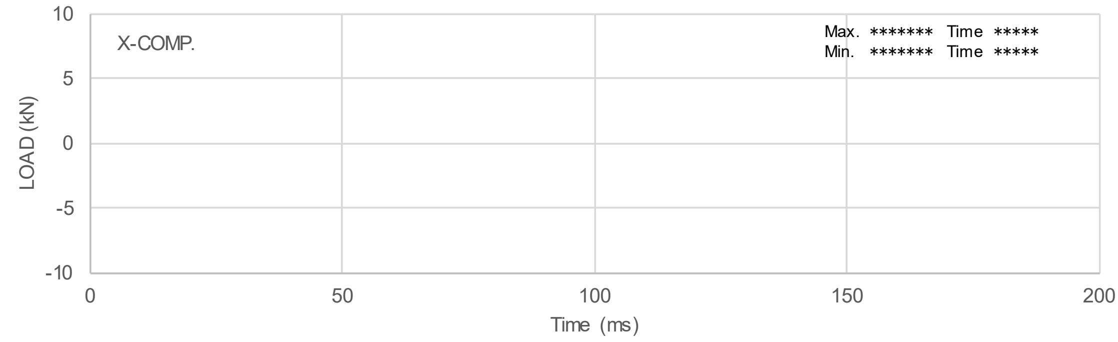
Driver Dummy Femur Force

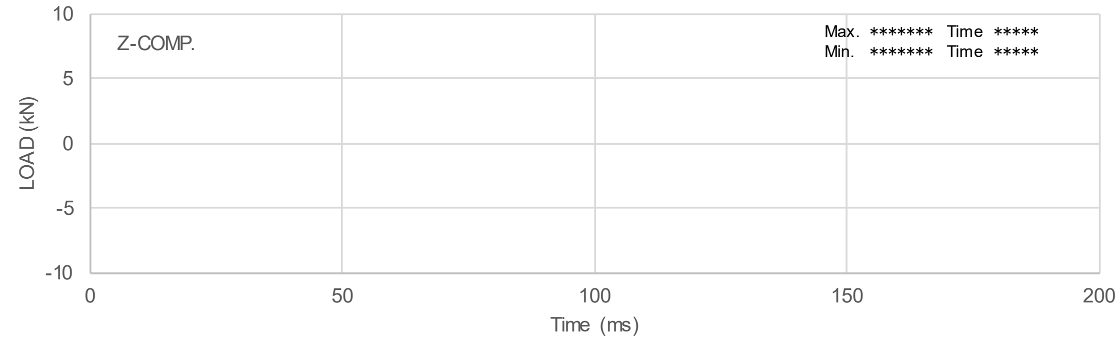
No. NASVA****−*****

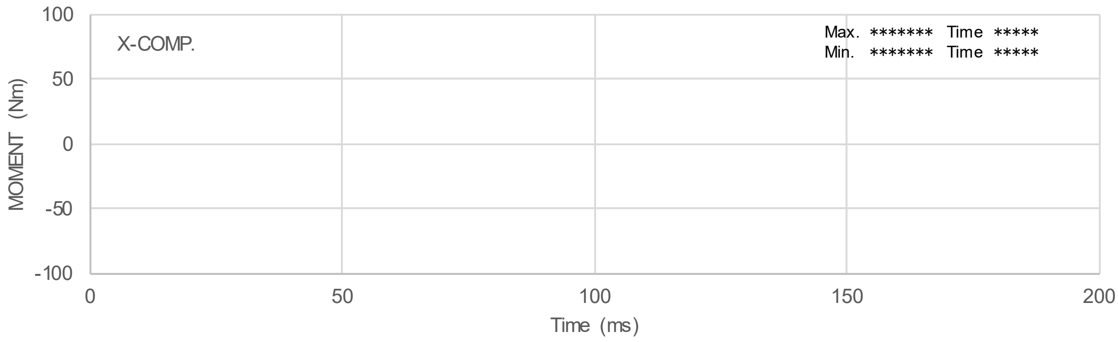


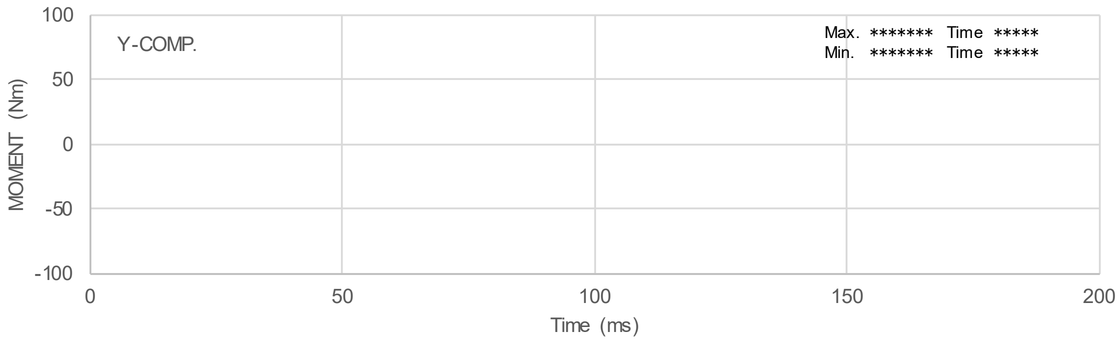
Driver Dummy Right Tibia Upper Force & Moment

No. NASVA****-*****



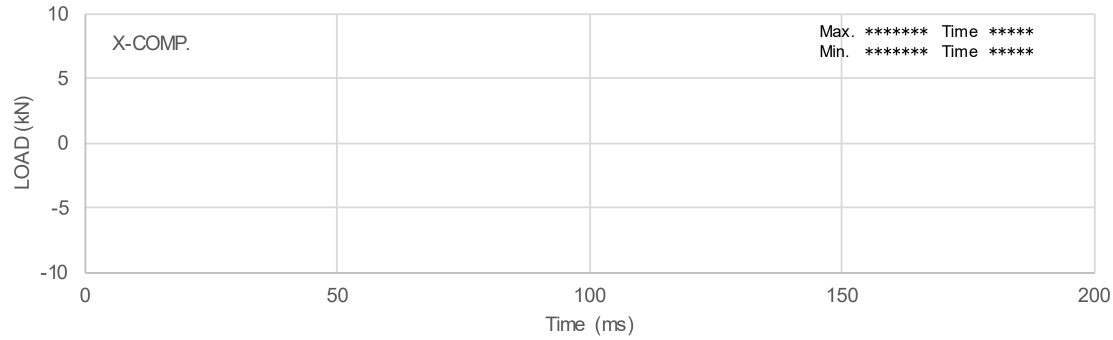


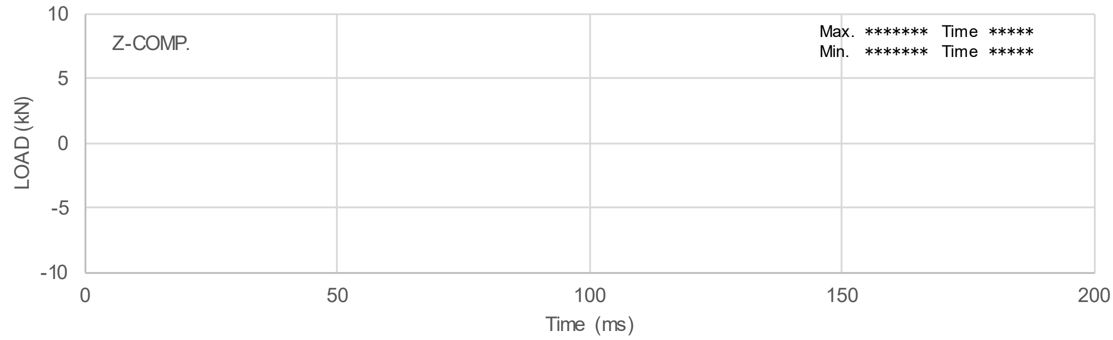


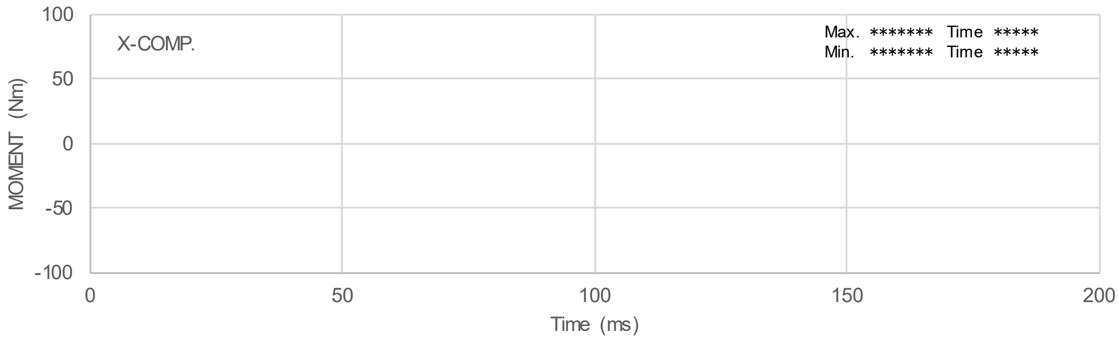


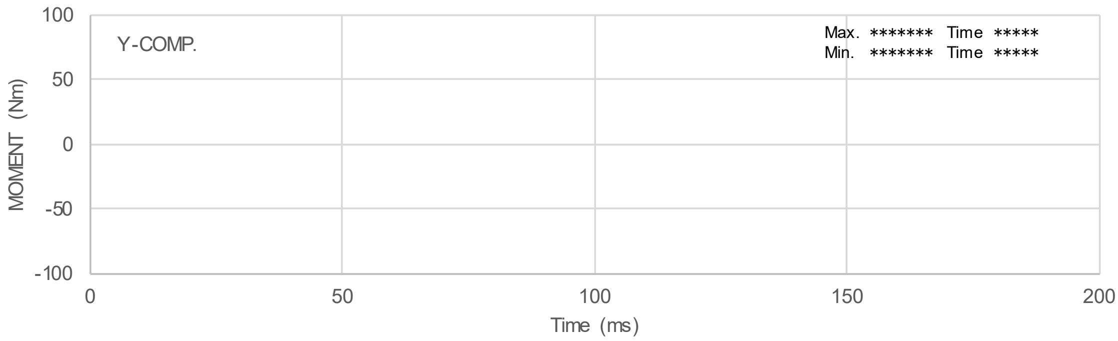
Driver Dummy Right Tibia Lower Force & Moment

No. NASVA****−*****



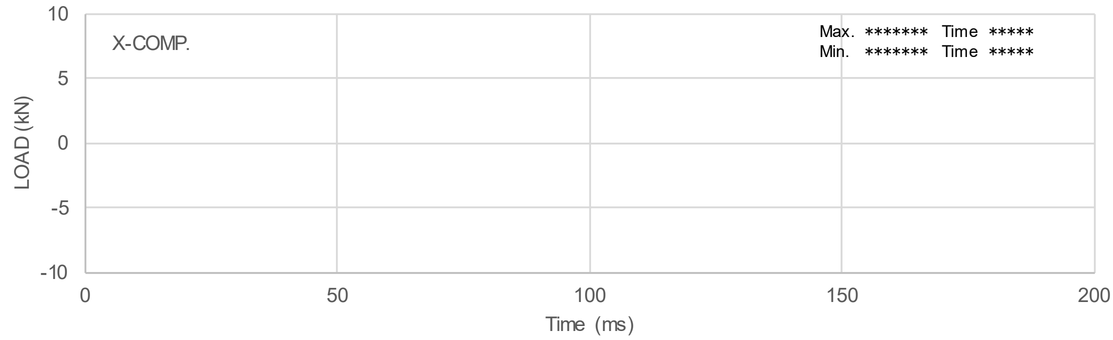


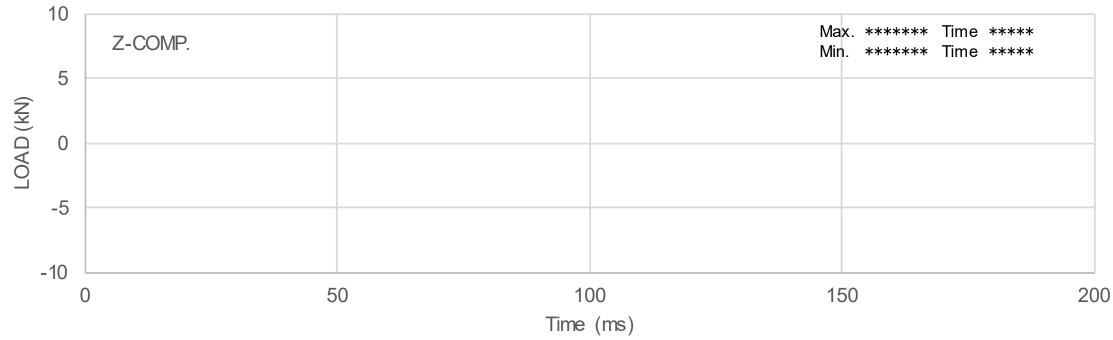


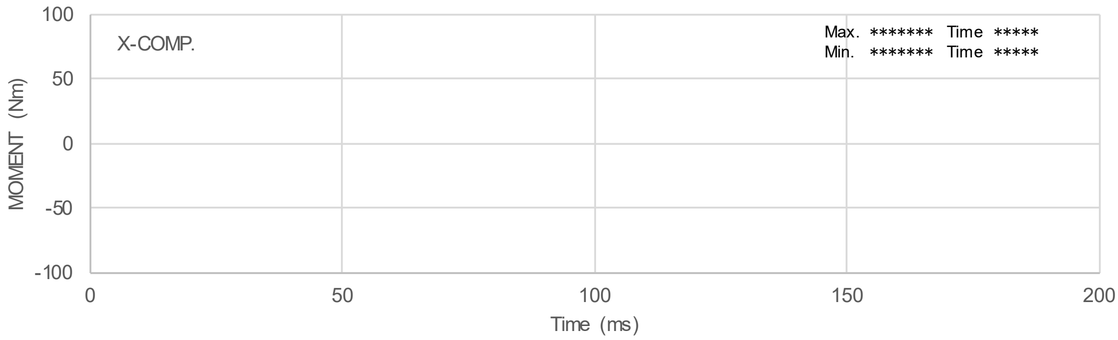


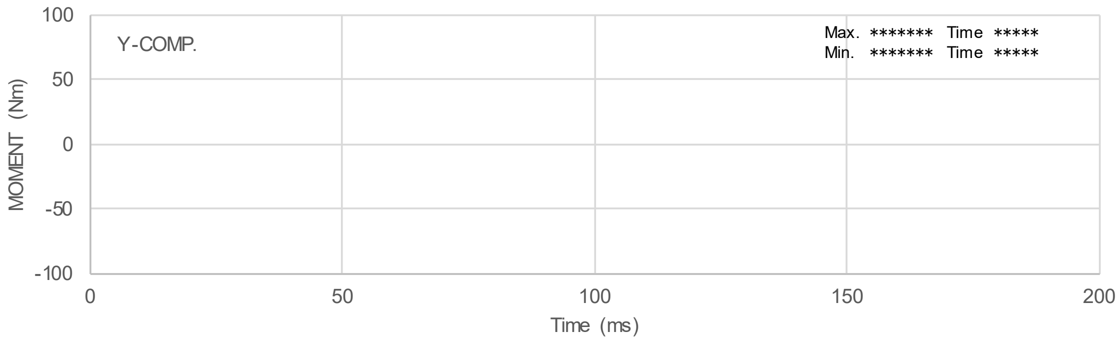
Driver Dummy Left Tibia Upper Force & Moment

No. NASVA****−*****



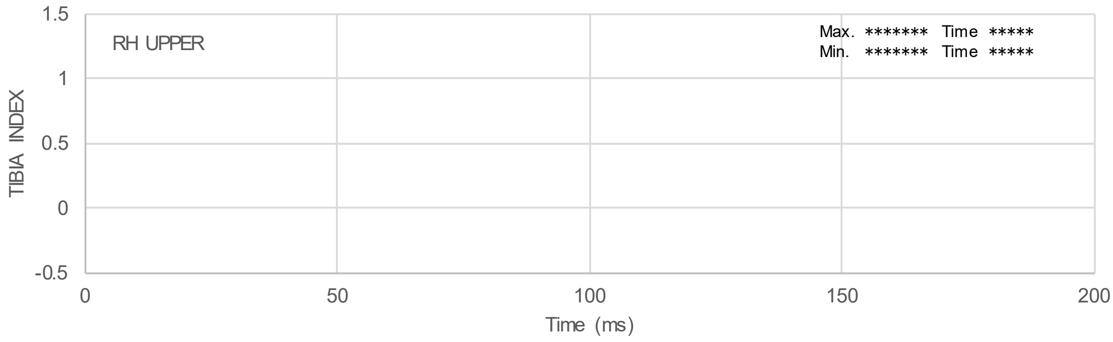


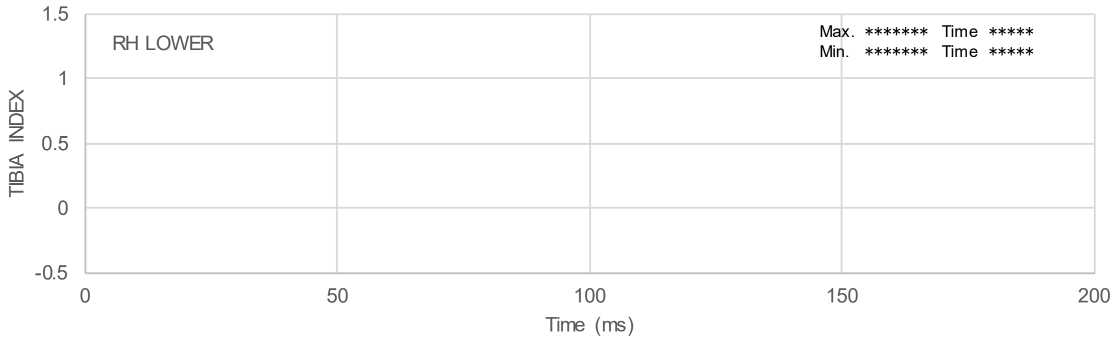


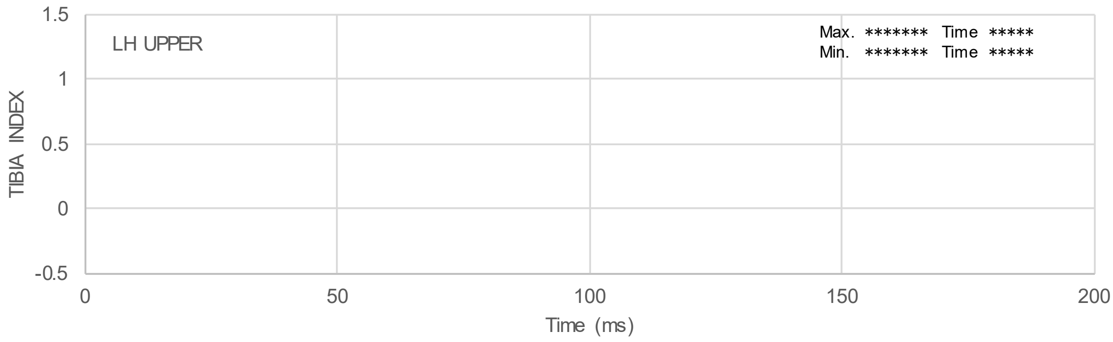


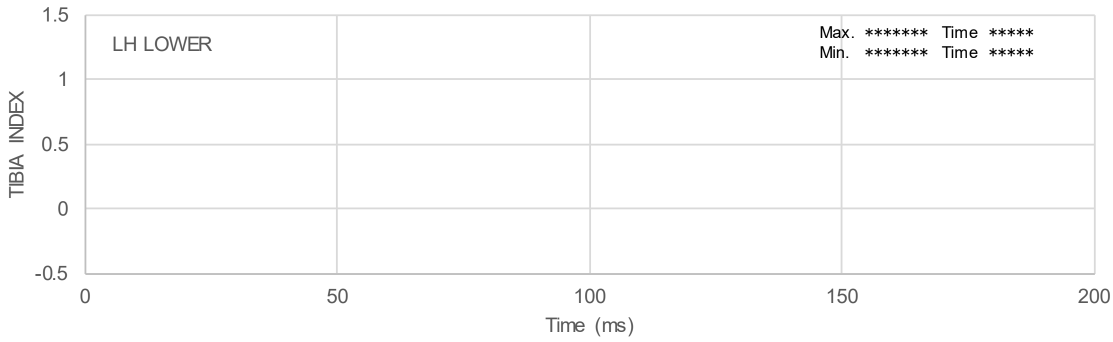
Driver Dummy Left Tibia Lower Force & Moment

No. NASVA****−*****



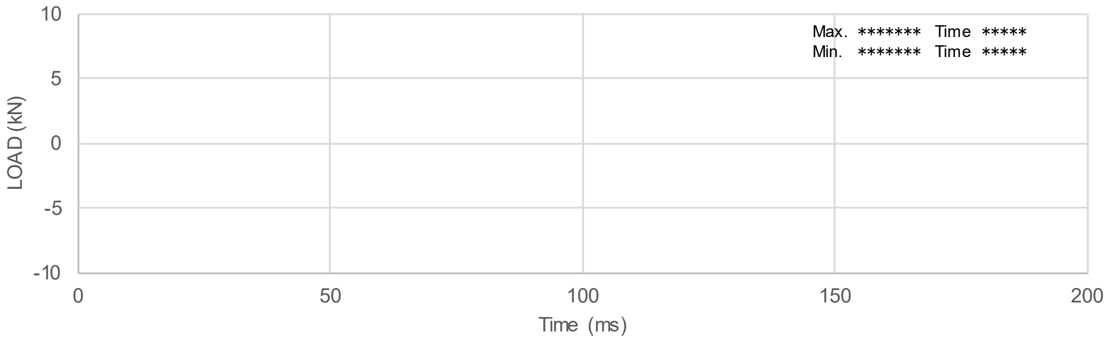






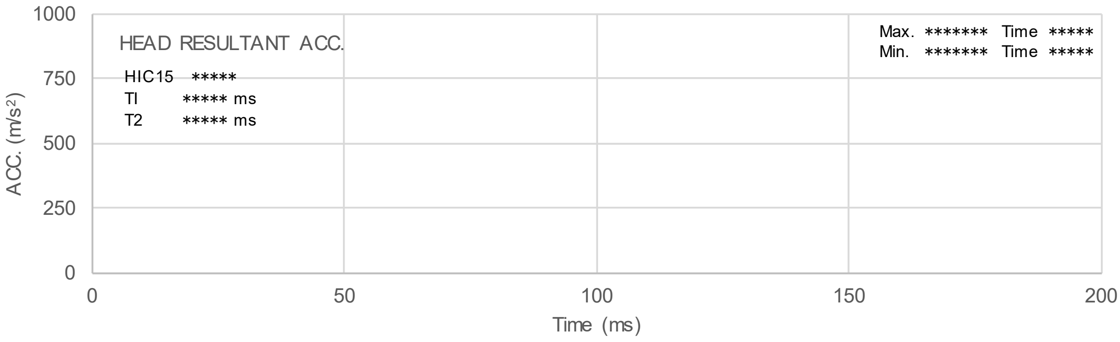
Driver Dummy Tibia Index

No. NASVA****−*****



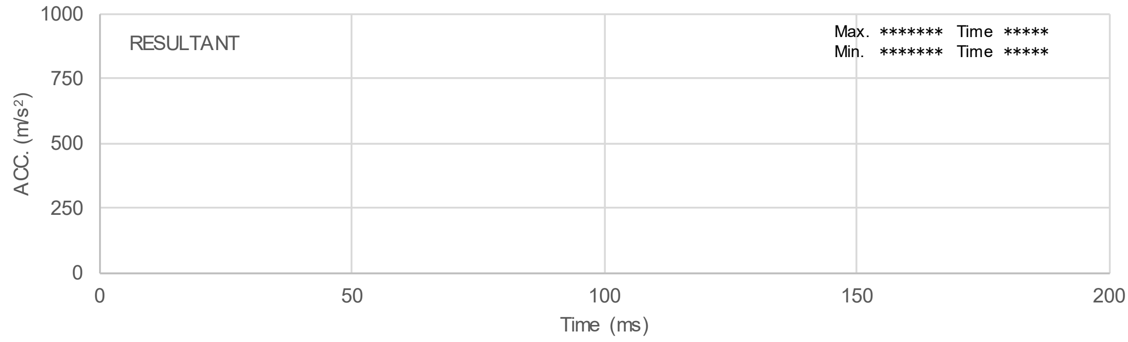
Driver Dummy Seatbelt - Shoulder Section Force

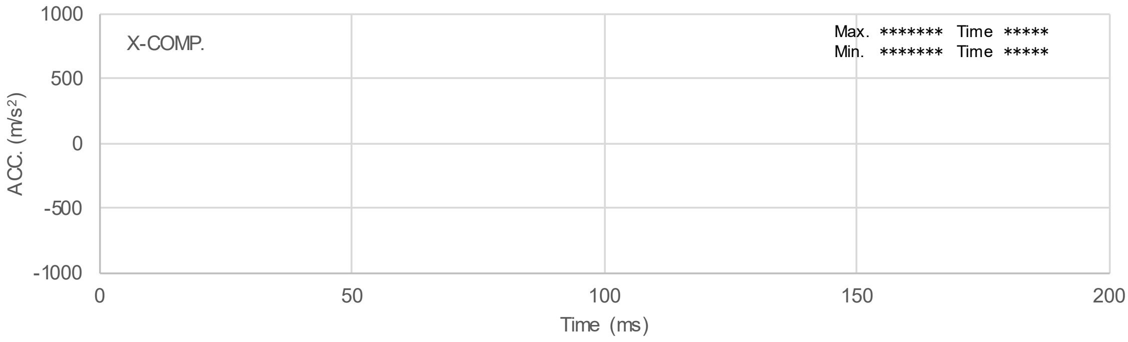
No. NASVA****−*****

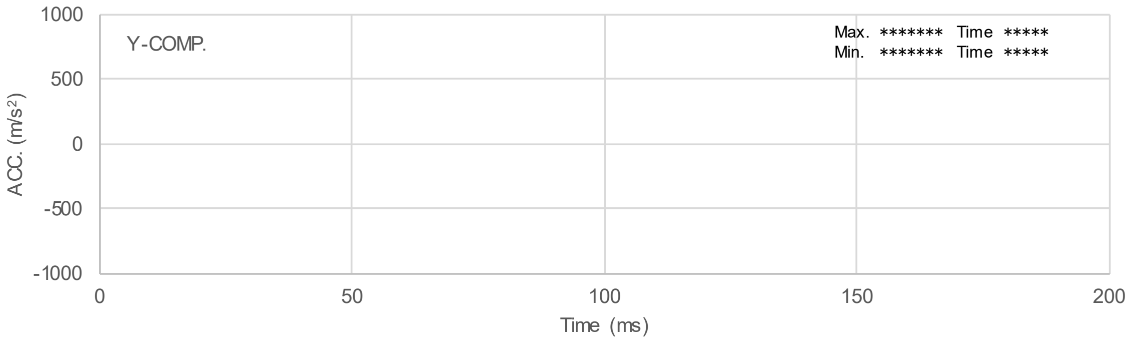


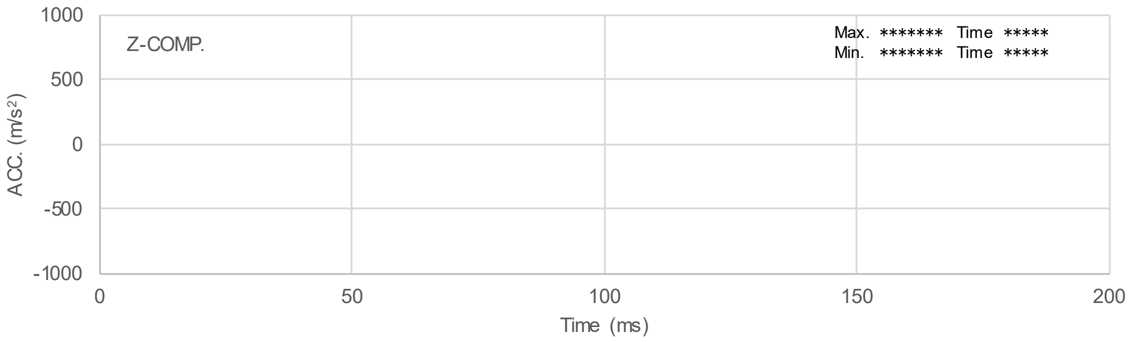
Passenger Dummy HIC

No. NASVA****−*****



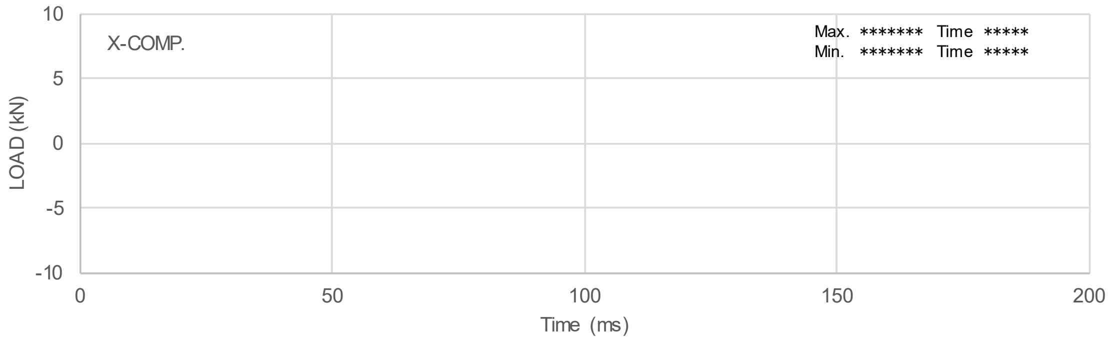


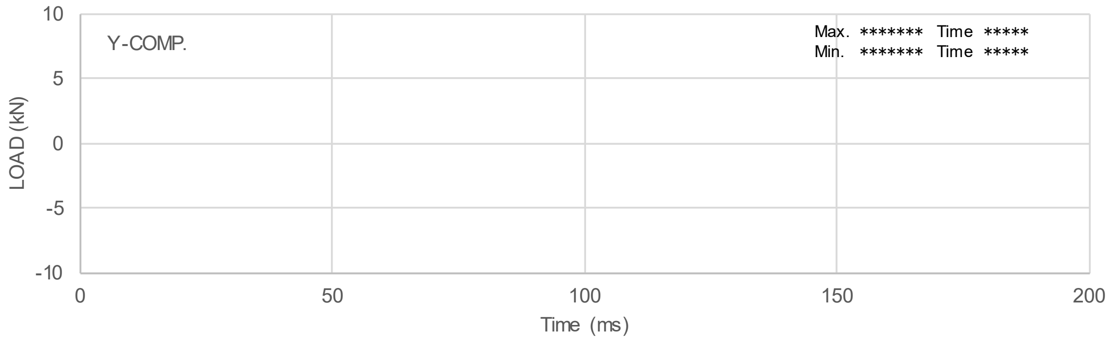


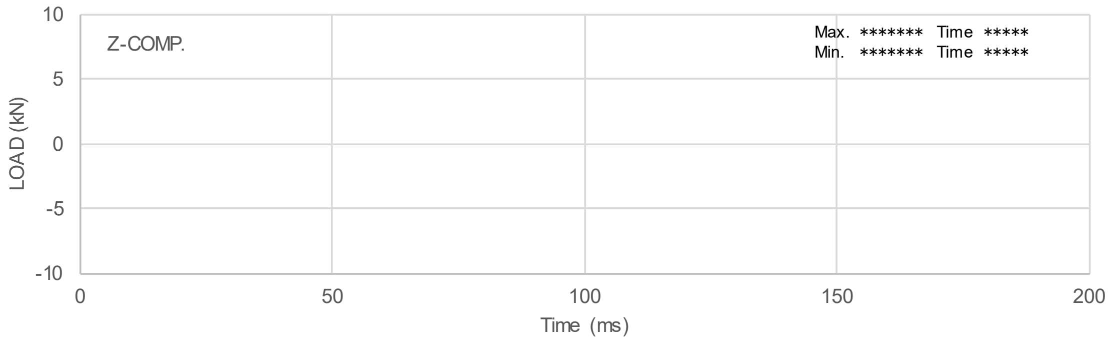


Passenger Dummy Head Acc.

No. NASVA****−*****

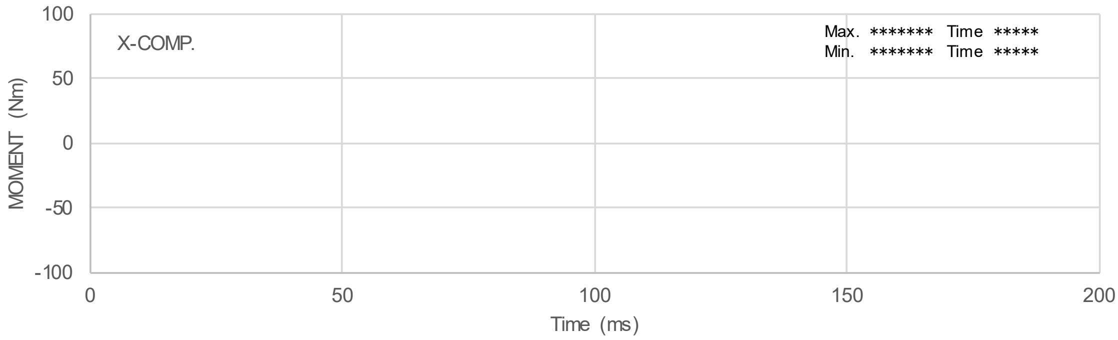


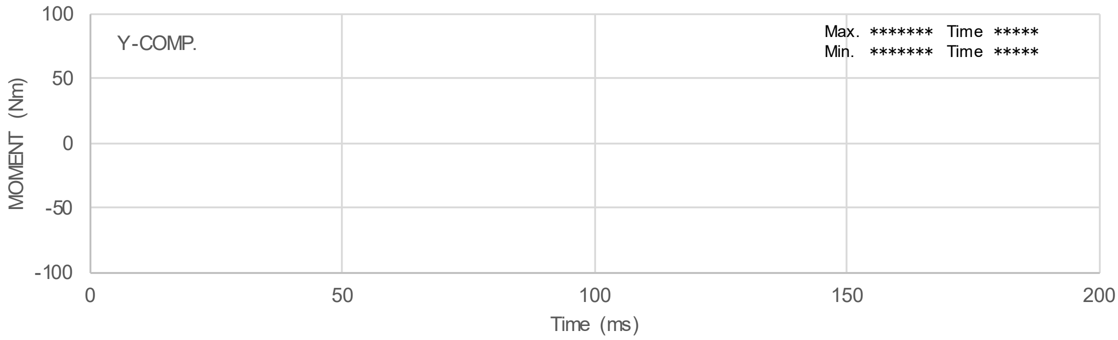


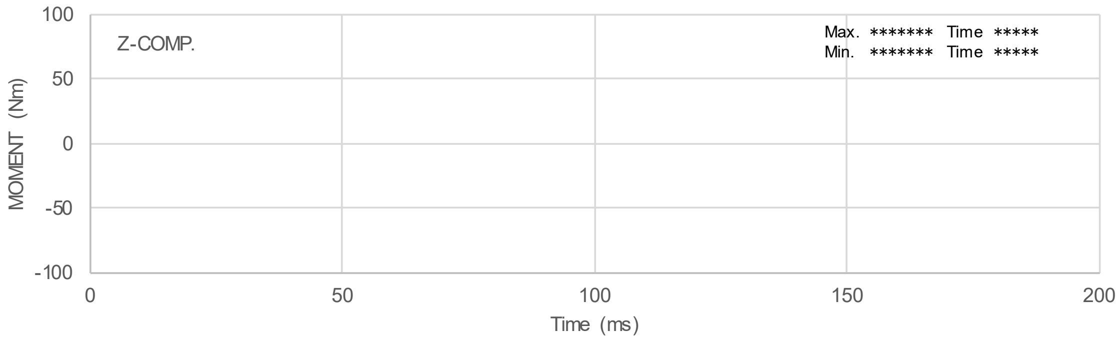


Passenger Dummy Neck Force

No. NASVA****−*****

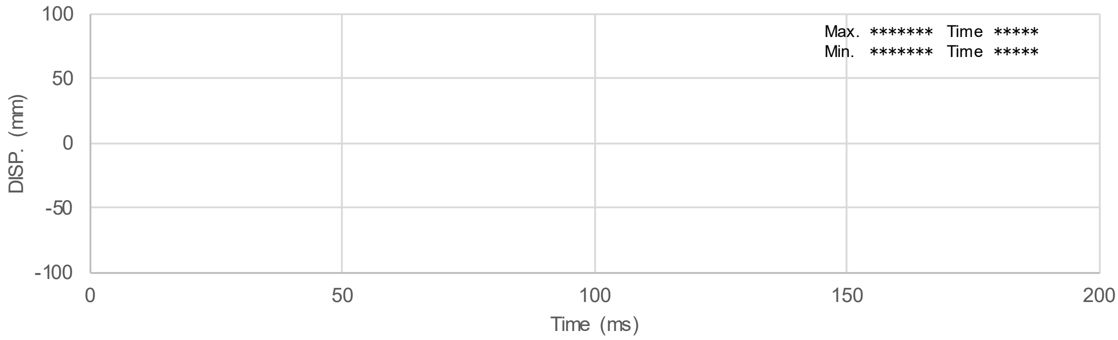






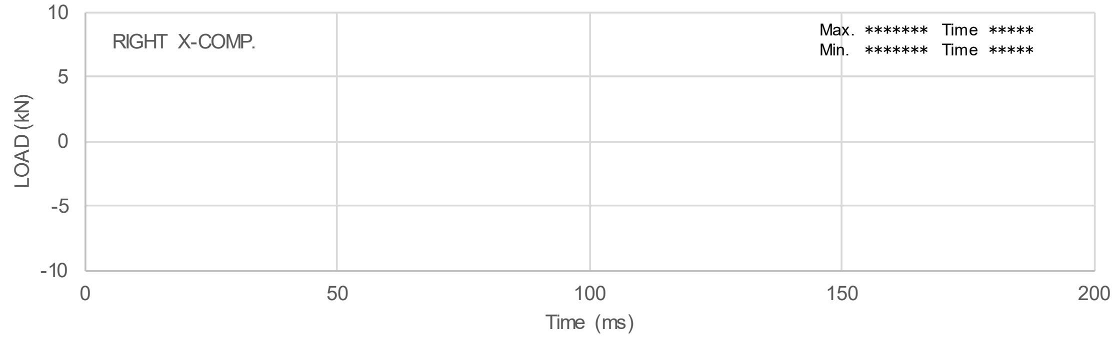
Passenger Dummy Neck Moment

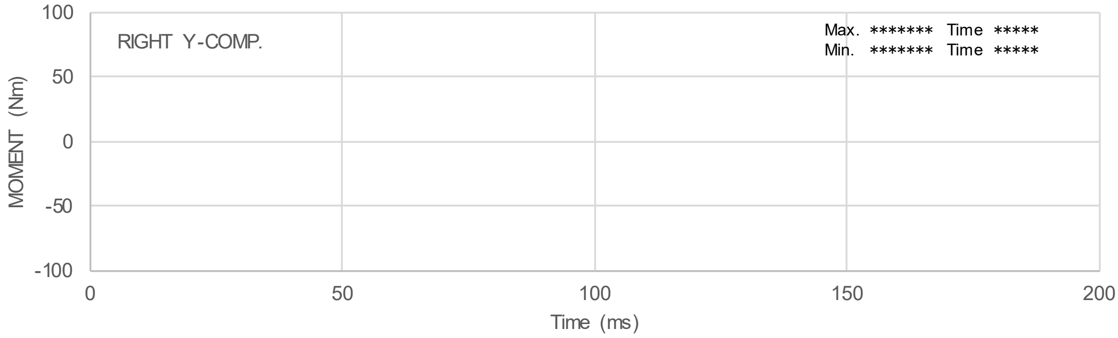
No. NASVA****−*****

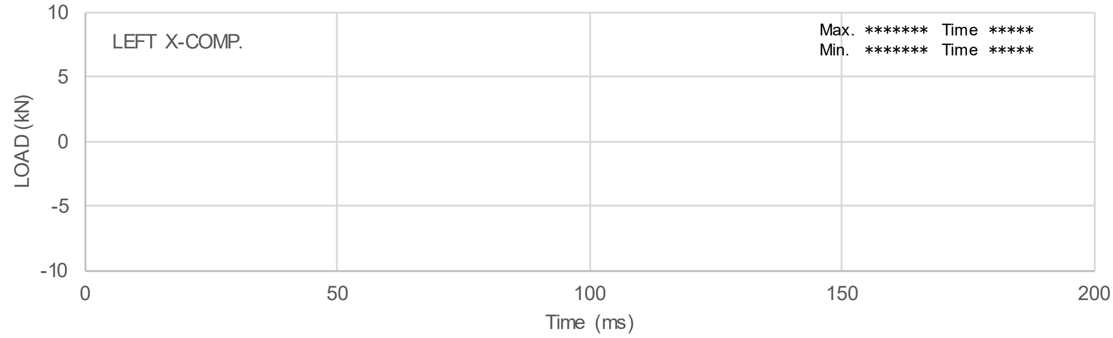


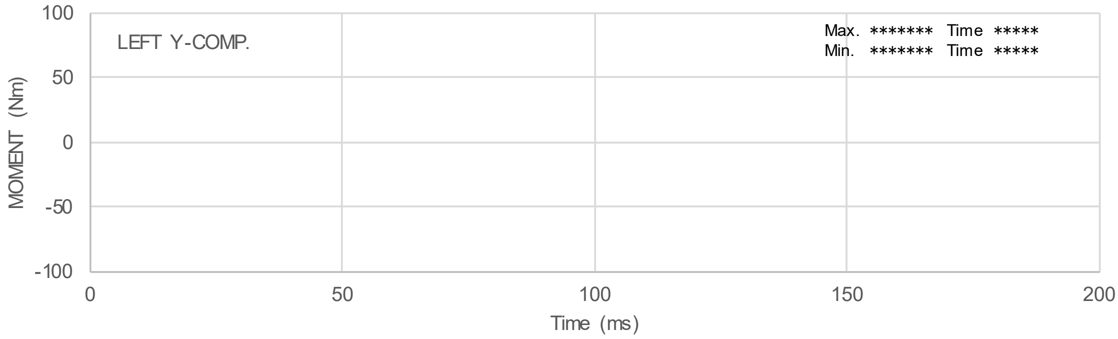
Passenger Dummy Chest Disp.

No. NASVA****−*****



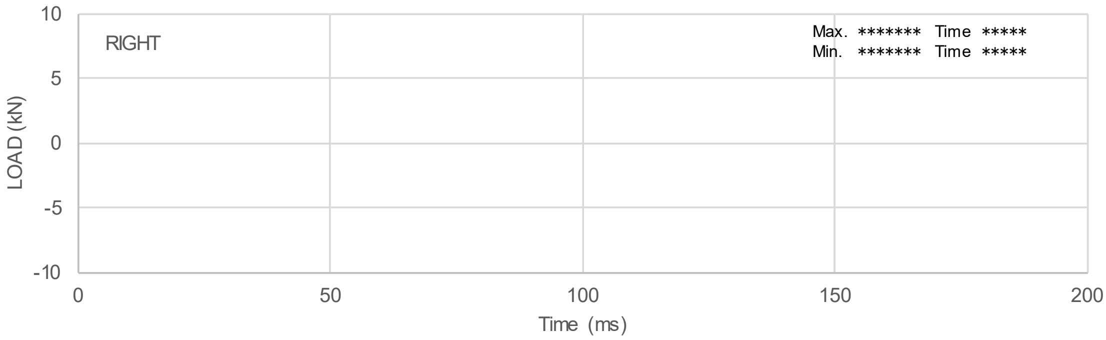


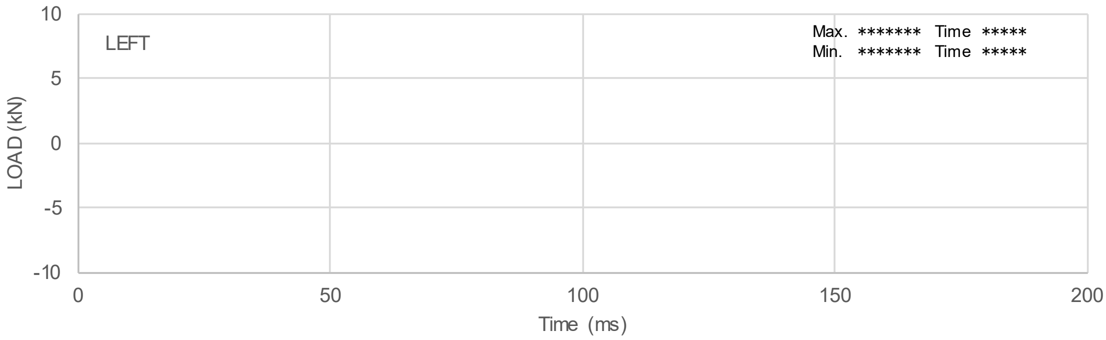




Passenger Dummy Iliac Force & Moment

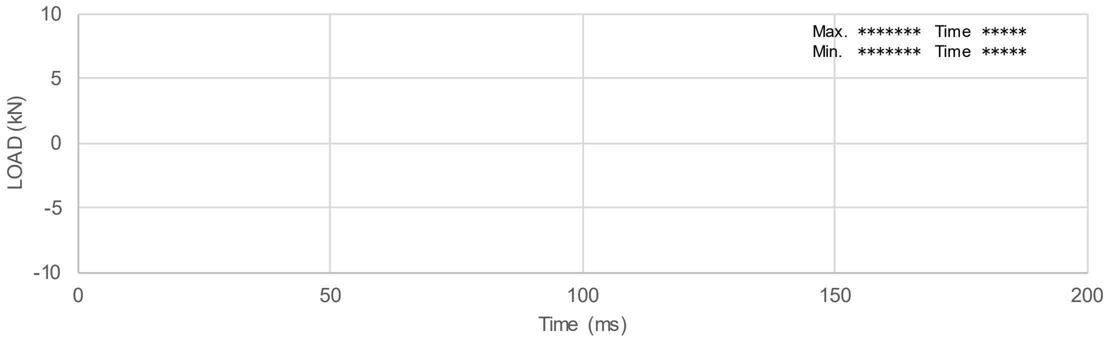
No. NASVA****−*****





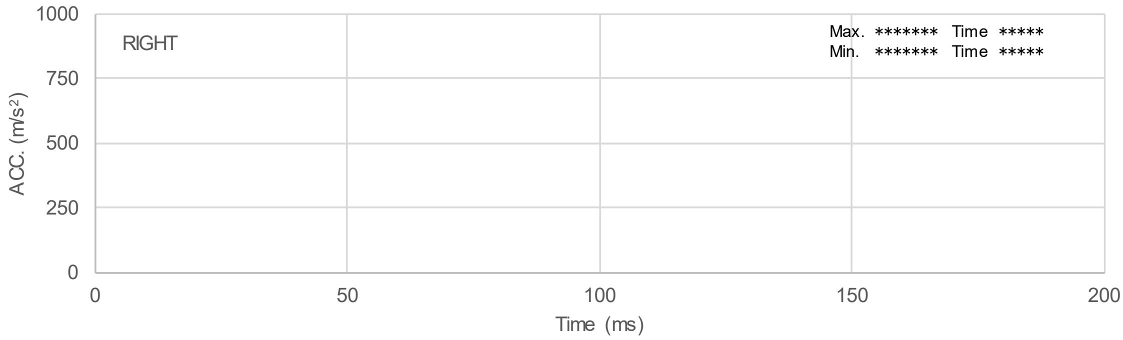
Passenger Dummy Femur Force

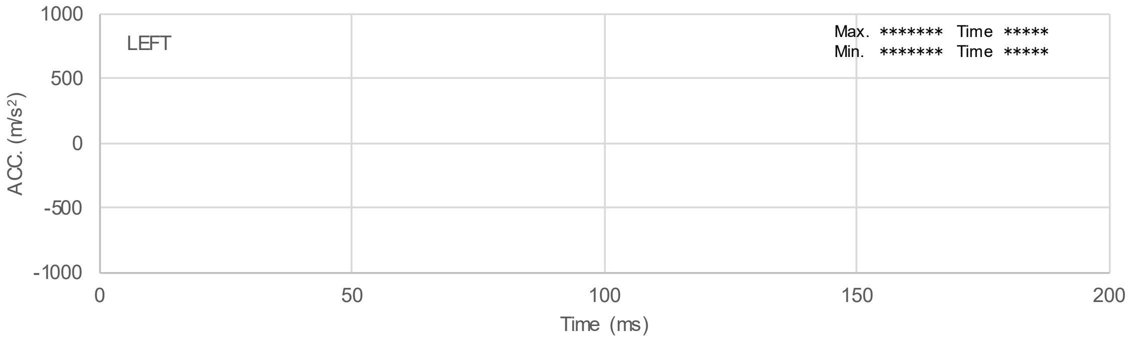
No. NASVA****−*****



Passenger Dummy Seatbelt - Shoulder Section Force

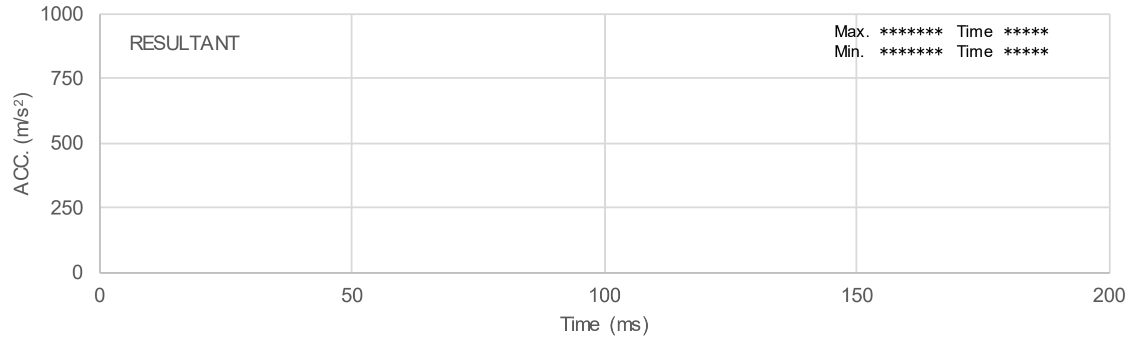
No. NASVA****−*****

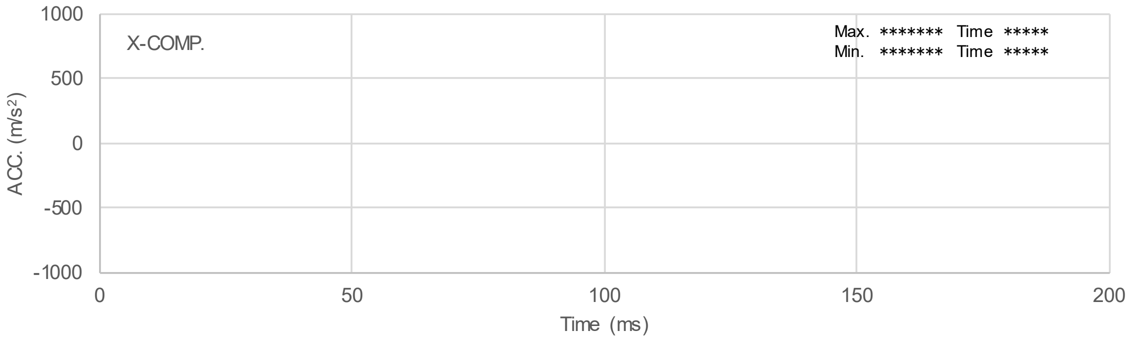


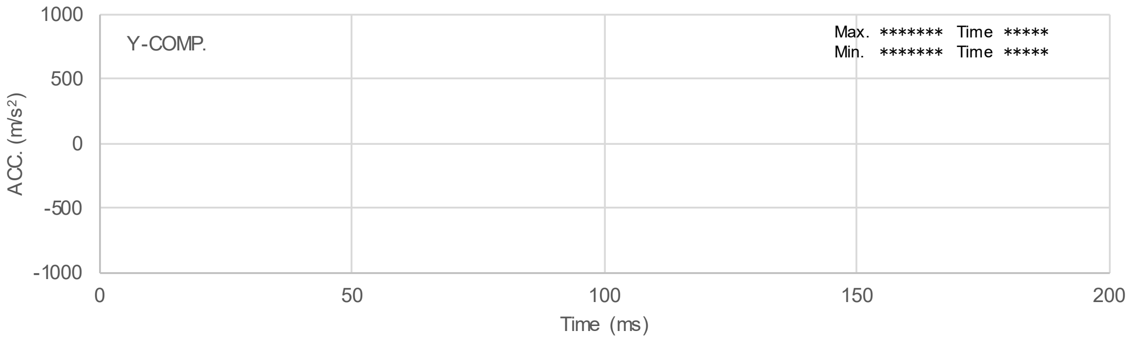


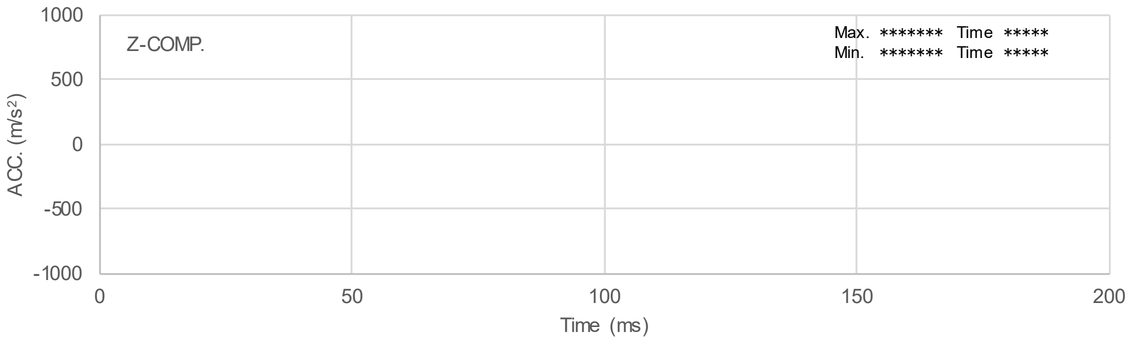
Vehicle Side Sill Acc.

No. NASVA****−*****



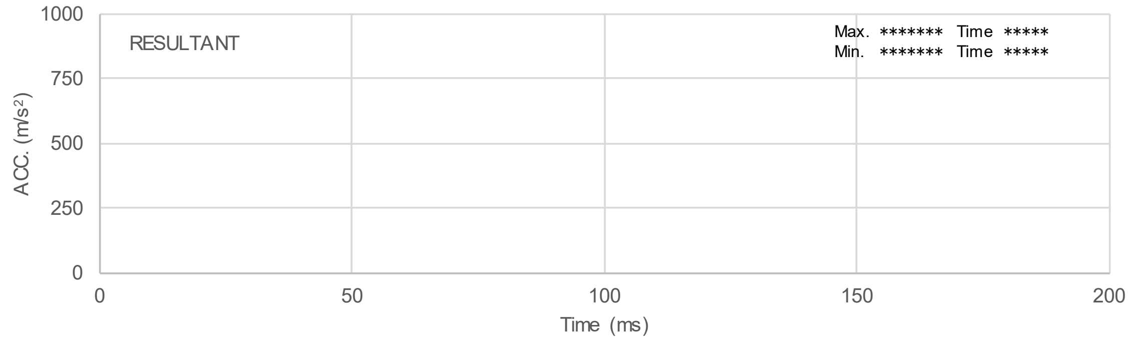


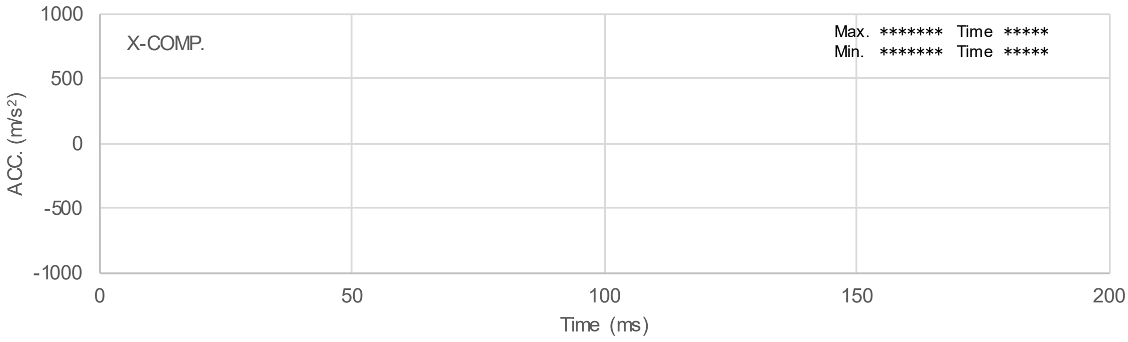


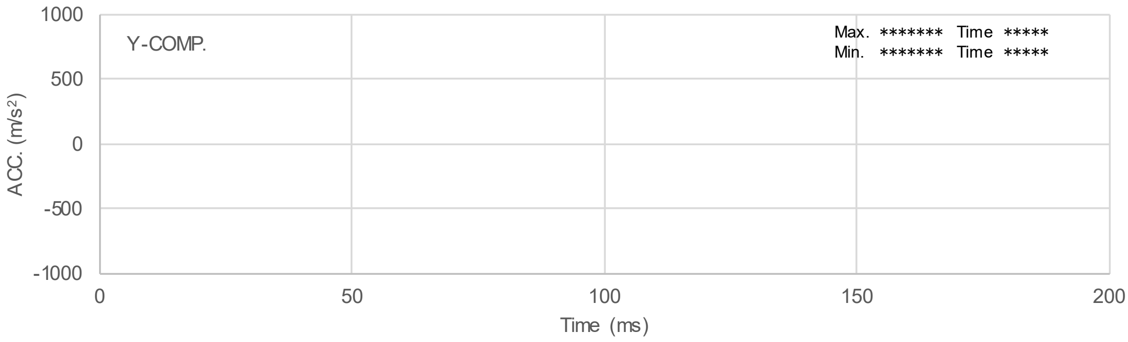


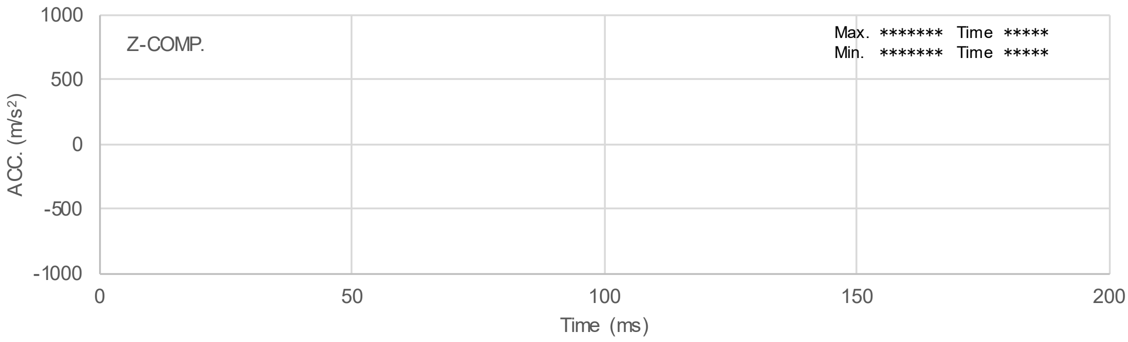
Vehicle Tunnel Acc.

No. NASVA****−*****









MPDB CG Acc.

No. NASVA****−*****