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

PEDESTRIAN LEG PROTECTION PERFORMANCE TEST PROCEDURE

Created: April 1, 2011
Revised: May 2, 2024
March 20, 2018

1. Dates Effective

This testing procedure was first implemented on April 1, 2011. However, the changes made on May 2, 2024 went into effect on May 2, 2024.

2. Scope of Application

This test procedure applies to the “Pedestrian Leg Protection Performance Test” of passenger vehicles with 9 occupants or less and commercial vehicles with a gross vehicle mass of 2.8 tons or less, excluding a car for which the conducted by the National Agency for Automotive Safety and Victims’ Aid (NASVA) in the new car assessment program information supply project.

3. Definition of Terms

The terminology in this testing procedure is defined as follows:

(1) **Ground Reference Plane:** a horizontal plane, either real or imaginary, that passes through the lowest points of contact for all tires of a vehicle.

(2) **A Pillars**: The foremost and outermost roof supports extending from the chassis to the roof of the vehicle.

(3) **Leg form Impactor**: A test device which simulates human leg constructions, and it has flexible long bones as well as the human ones. (more details are described in ISO/TS 20458)

(4) **Tibia Bending Moment**: The measured bending moment at the tibia of the leg form impactor.

(5) **MCL Elongation**: The measured elongation at the medial collateral ligament (MCL) located at the knee of the leg form impactor.

(6) **ACL Elongation**: The measured elongation at the anterior cruciate ligament (ACL) located at the knee of the leg form impactor.

(7) **PCL Elongation**: The measured elongation at the posterior cruciate ligament (PCL) located at the knee of the leg form impactor.

(8) **Femur Bending Moment**: The measured bending moment at the femur of the leg form impactor.

4. Testing Requirements

4.1 Conditions of Test Vehicle

4.1.1 Data Submitted by the Vehicle Manufacturer

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

(1) Appendix 1

(2) Special verification items relating to preparation of the test.

4.1.2 Mass of Test Vehicle

The mass of the test vehicle shall be adjusted between 100% and 101% of the mass at vehicle delivery* without installing the mass on the driver's seat and the front passenger's seat (seat parallel to the driver's seat and situated adjacent to the side face of the vehicle; hereinafter the same).

However, this shall not apply if the mass of the vehicle cannot be adjusted to this range after removing parts that will not affect the test. When the vehicle is equipped with a spare tire and tools, it is permissible to test the vehicle as it is.

* Mass at vehicle delivery: The test institute shall measure the mass of the vehicle received after filling with every liquid except fuel to the maximum within a specified range and filling with the fuel to 100% of the fuel tank capacity. This mass is referred to as the mass at vehicle delivery.

4.1.3 Vehicle Posture

The vehicle posture is specified as follows:

(1) The vehicle posture of the test vehicle shall be the condition the vehicle when brought in, however, test vehicles equipped with a height adjusting device shall be adjusted to the position specified for a traveling speed of 40 km/h. And if the vehicle is equipped with a manual height adjusting device, the vehicle shall be set to the standard position.

(2) If the vehicle is equipped with an impact force reduction device for pedestrian protection which works upon car impact with a pedestrian, the vehicle manufacturer shall provide technical documents which explain the influence of the device regarding pedestrian leg injuries. NASVA will carefully verify the technical documents, then decide whether to conduct the test "the device activated," "the device deactivated," "the system needed to activate the device activated during the test."

(3) A mass the same as the Hybrid III dummy with the mass equivalent to 50 percentile adult male (75kg) shall be installed on the center surface of the driver's and front passenger's seats. The dummy shall comply with the stipulations provided in Title 49, Part 572, Subpart E of CFR (Code of Federal Regulations) as amended in the Federal Register No. 63 dated February 4, 1998.

(4) Front wheels are set to the straight-traveling state. The direction of the vertical cross section of the vehicle must be within ±2deg with respect to the direction of projection of the leg form impactor.

(5) Before conducting the test, the vehicle manufacturer shall provide NASVA with wheel arch design

height measurements after going through steps (1) to (4) of vehicle posturing (hereinafter referred to as, "Normal Riding Posture.") If the vehicle's wheel height is ±25mm from the design position, that design position shall be deemed the normal riding posture wheel height and the test will be conducted by either adjusting the vehicle's design position (within ±2mm) or by correcting the impact height of the leg form impactor.

(6) If the test is conducted after the side collision test, it is assumed to be impossible to conduct vehicle adjustment based on the protocol of (1) to (4). In this case, the following vehicle adjustments shall be made:

(a) Measure the vehicle posture (fore-and-aft, and lateral directions) before the side collision test, then adjust the test vehicle posture within the tolerance ±0.1deg in the fore-and-aft direction and lateral direction based on the measured values beforehand. The vehicle posture shall be adjusted by adjusting the tire pressure (standard tire pressure +25, -50kPa) or by using additional weights.

(b) The test may be evaluated by using vehicle height tolerance (vehicle height before the side collision test ±5mm; the point at which vehicle height is measured shall not be deformed by the side collision test). However, if it is difficult to adjust the car by using the vehicle height tolerance, it is permissible to adjust the vehicle height difference (before and after the side collision test) by adjusting the impact height of the leg form impactor to the car.

(7) If the seat is taken off the test vehicle to conduct the neck injury protection performance test in the rear-end collision, vehicle posture measurements taken when it was marked will be used in order to conduct the following test in the same posture. In this case, tolerance of longitudinal axis shall be within ±0.1°, tolerance of lateral axis shall be within ±0.1° and tolerance of vehicle height shall be within ±5mm. However, if it is difficult to adjust the car within the tolerance, it is possible to adjust the vehicle height difference before and after removing the seat by adjusting the impact height of the leg form impactor to the vehicle.

4.1.4 Test Vehicle Fluids

(1) Every liquid except fuel shall be provided to the maximum within the specified range.

(2) Fuel or an alternative fuel having a specific gravity similar to that of the fuel shall be provided to 100% of the fuel tank capacity.

(3) If liquid cannot be filled as specified in (1) and (2) above for a vehicle after the side collision test, filling of (1) and (2) shall be implemented as much as possible.

4.1.5 Seat Adjustments

(1) If the driver's seat and front passenger's seat are adjustable in the fore-aft direction, they shall be adjusted to the middle position. If adjustment to the middle position is not available, the seats shall be adjusted to a position behind the middle position but at the nearest adjustable position.

(2) If the driver's seat and front passenger's seat are adjustable only in the vertical direction, they shall be adjusted to the lowest position.

(3) If the driver's seat and front passenger's seat have other than the adjustable mechanisms in (1) and

(2), they shall be adjusted to the design standard positions and angles.

(4) Seats other than the driver's seat and front passenger's seat shall be adjusted to the design standard positions and angles.

4.1.6 Other Vehicle Conditions

4.1.6.1 Ignition

The engine of the test vehicle shall be stopped, and the ignition switch shall be turned to the off position.

4.1.6.2 Side Doors

The doors of the test vehicle shall be closed securely. However, this shall not apply to doors of a vehicle after the side collision test that cannot be closed.

4.1.6.3 Roof

If the vehicle has a removable roof, the roof shall be installed.

If the vehicle has a sunroof, the sunroof shall be closed.

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

4.1.6.4 Tires

Air pressure of the tires shall be kept at the recommended level indicated in the specification table of the user's manual or label on the vehicle body. However, if the car conditions (posture, fore-aft wheel arch height, etc.) need to be adjusted by following procedures of Paragraph 4.1.3, (5) and (6), it is possible to ignore this requirement.

4.1.6.5 Securing the Vehicle

The tires of the test vehicle shall be secured by using appropriate holding means such as a parking brake or chocks.

Vehicles with automatic transmissions shall be held in place using a parking brake and keeping on P position or applying chocks.

4.1.6.6 Rearview Mirror, etc.

It is permissible to remove the rearview mirror and auxiliary mirror provided near the bonnet, wing, or A-pillar as long as this will not influence the test results.

4.1.6.7 Other

(1) If the secondary collision of the leg form impactor might affect certain areas on the vehicle, it is permissible to protect such areas with a cover or other means as long as the protective measures do not affect the test results.

(2) It is permissible to protect the driver's seat and front passenger's seat from flying pieces of broken glass from the windshield.

4.1.7 Marking the Test Range, etc

For vehicles whose wheel arch height is confirmed to be ±25mm from the design position, the wheel arch height shall be adjusted to the design value (within ±2mm) and the following markings shall be made on the vehicle.

4.1.7.1 Front Bumper Corner

(1) Mark the front bumper corner, which is the point of the vehicle where the vertical plane makes an angle of 60deg with the vertical longitudinal plane of the car and is tangential to the outer surface of the front bumper (see Figure 3.1). Mark both sides (left and right sides) of the front bumper.

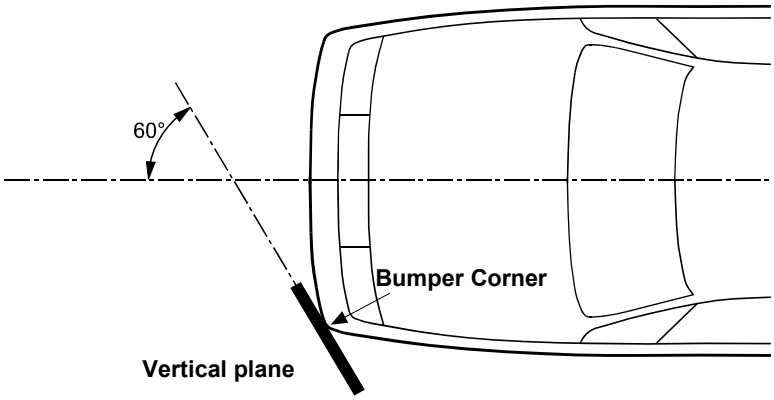


Figure 3.1: Front Bumper Corner

(2) Where multiple or continuous contacts occur, the most outboard contact shall form the bumper corner.

4.1.7.2 Test Area

The test area is the frontal surface of the bumper limited by two longitudinal vertical planes intersecting the bumper corners and inboard of the bumper corners.

4.1.7.3 Partitioning the Test Area

Draw an intersection line between the vertical longitudinal section that divides the test area into three equal sections in the direction of the vehicle's left-right axis and the front of the vehicle, and call them Area L1, Area L2, and Area L3, in descending order from the right side of the vehicle. In addition, a vertical longitudinal section dividing each area into three equal sections in the direction of the vehicle's right and left axes and intersecting the front of the vehicle is drawn, and these sections are designated as A and B, starting from the right side of the vehicle, and each area is designated as a subdivision area by adding A and B after the area name (see Figure 3.2).

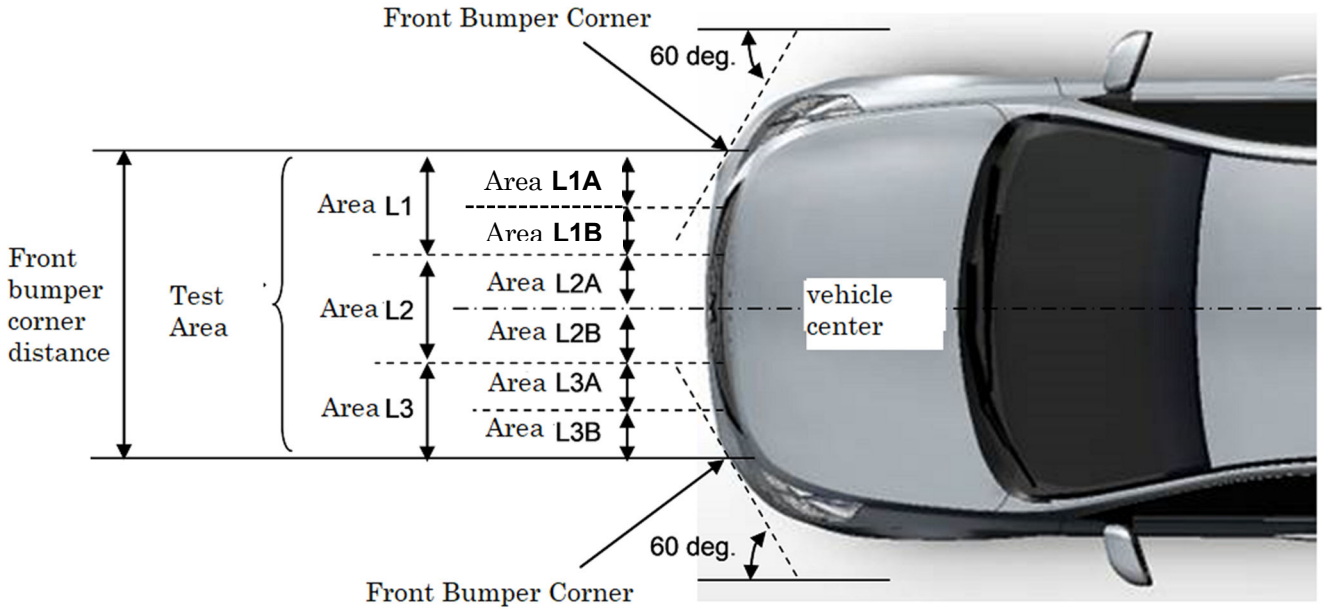


Figure 3.2: Determining and Labeling the Test Areas

4.1.8 Impact Points

4.1.8.1 Impact points for Assessment (First Candidate Impact Points)

(1) The impact area shall be identical to the test area as determined in Paragraph 4.1.7.4. NASVA selects three impact points from the L1, L2 and L3 areas, and selects a single impact point from each sub test area. The selected impact points are assumed by NASVA to be the most dangerous impact points for a pedestrian leg in each sub test area.

(2) If two of the selected impact points are symmetrical in the longitudinal vertical plane intersecting the vehicle center and are assumed to have the same internal structure, one side test result may be applied to the other side.

(3) Additionally, if there are structures outboard of the bumper corners which are deemed to be clearly more injurious to a pedestrian's legs, these areas shall be struck, and those test results may be used as the results for L1A or L3B. Such tests will be limited to locations between the two outermost ends of the bumper beam/lower rails/cross beam structures.

(4) The impact points shall be laid out at least 132 mm away from each other (in straight-line distance). If this spacing requirement prevents a test from being performed for a sub test area, the area can be assigned the score from the most appropriate adjacent sub test area located in the same sub test area or symmetrical sub test area in the longitudinal vertical planes intersecting the vehicle center.

(5) The selected impact points shall be entered into Appendix 2-1.

4.1.8.2 Second Candidate Impact Points (Impact Points of the Target Test)

(1) The test vehicle manufacturer can request to set second candidate impact points excluding the sub-sub test areas which include NASVA-selected impact points (first candidate impact points) as long as NASVA is informed immediately. If NASVA selected impact points at the boundary of the sub-sub test

area, i.e. boundary points "A" and "B", the vehicle manufacturer can select either sub-sub test area "A" or "B" to set the second candidate impact points as long as NASVA is informed immediately.

(2) The second candidate impact points shall be selected by NASVA as the points that are most dangerous for a pedestrian leg in the selected sub-sub test areas.

(3) The impact points shall be laid out at least 132mm away from each other (in straight-line distance). If this spacing requirement prevents a test from being performed for a sub test area, the area can be assigned the score from the most appropriate adjacent sub test area located in the same sub test area or symmetrical sub test area in the longitudinal vertical planes intersecting the vehicle center.

4.1.9 The Leg form impactor

(1) The leg form impactor must meet the specifications stipulated in ISO/TS 20458.

(2) The leg form impactor shall be fitted with four transducers to measure the tibia bending moment at the tibia (one transducer at each of four locations) and three transducers to measure the elongation of MCL, ACL and PCL (one transducer for each), three bending moments at the femur and one angular speed meter at the upper mass around hip axis (X axis) at the locations prescribed.

(3) The characteristics of the leg form impactor shall be stipulated in ISO/TS 20458 and must successfully pass the leg form impactor certification tests specified in ISO/TS 20458.

(4) Wires and such may be attached to the leg form impactor in order to protect it from damage as long as adverse effects to the test are minimized.

4.1.10 Temperature Conditions

Ambient temperatures of the test vehicle (exchanged parts), testing equipment, and leg form impactor during the test must be kept at 20 ± 4°C. And the leg form impactor used for the test must be kept in this temperature environment for four hours at least prior to the test.

5. The Testing Facility

5.1 The Impact Generator

The impact generator shall be capable of propelling the leg form impactor (weighing around 25kg) in free flight to the front surface of the test vehicle at a speed of 40.0 ± 0.7km/h.

5.2 Speed-Measuring Device

The speed measuring device shall be capable of measuring the leg form impactor speed just before impacting with the vehicle's front with an accuracy of 0.1km/h.

5.3 Angular Rate Sensor

The angular rate sensor shall be capable of measuring the angular rate with an accuracy of 0.1 deg./sec.

5.4 High-Speed Photography Device

The photographing frame speed of the high-speed photographing device must be set at least 1,000 frames per second and shutter speed must be set at 1/5,000 sec. or more.

5.5 Temperature-Measuring Device

The minimum scale value of the temperature indicator used shall be 0.1°C.

5.6 Electric Measuring Devices

5.6.1 Accuracy and Frequency Characteristics

(1) The measuring device used must meet the ISO6487:2002*[11] requirements for all the equipment including its components as well as the output devices (including the computer for analysis) being connected. (The measuring device in this state is called the "measuring channel").

(2) The channel class (an index that defines the frequency characteristics (the relationship between input frequency and input-output ratio) of all measuring instruments mounted on the leg impactor) shall be 180.

(3) When analog-to-digital conversion is conducted on the measuring channel, the number of samples per second shall be at least 10,000.

(4) Conversion factors for calculating bending moments from the strains measured at the femoral and tibial sections of the leg impactors shall be obtained from a quasi-static three-point bending test with a span length of 130 mm with the center of the strain gage as the loading position. The conversion coefficients obtained using the bone core calibration test fixture specified in ISO/TS 20458 (the center of rotation of the 3-point bend is offset from the bone core neutral axis by 20.7 mm for the femur and 20.6 mm for the tibia in the loading direction) shall be multiplied by 1.021 for both the femur and the tibia.

(5) The evaluation range using the measured data shall be from the moment of impact of the leg impactor (0 ms) to 60 ms. However, in accordance with the provisions of ISO/TS 20458, a sudden decrease in upper mass angular acceleration exceeding 1935 rad/s^2 shall be observed during the 1 ms period up to the time (hereinafter referred to as “time t”) of occurrence of the negative peak value of the angular acceleration of the upper mass around the hip axis (hereinafter referred to as “upper mass angular acceleration”), If a sudden increase in femoral bending moment exceeding 28 Nm is observed between time t and 1 ms, the injury evaluation interval is defined as the period up to 1 ms before time t. The negative femoral bending moment that occurs in the early stages of the crash shall not be included in the evaluation.

(6) Deletion of high-frequency components (filter processing) shall be performed prior to evaluation using measured data.

5.6.2 Range of the Measuring Devices

5.6.2.1 Bending Moment Transducer

The measurement range of the transducers for measuring bending moment at the femur and the tibia shall be from -300 Nm to +500 Nm.

5.6.2.2 Elongation Transducer

The measurement range of the transducers for measuring elongation at the knee points shall be from

*1 ISO6487:2000 is considered as the same requirement

0 mm to +35 mm.

5.6.3 Recording of Electric Measuring Results to Recording Media

The measuring results of the leg form impactor acceleration to the recording media shall be recorded with the channel class of 1,000 or above.

5.7 3-D Measuring Devices

The accuracy of 3-D measuring devices used in measurement of impact points on the test vehicle shall be 0.5mm/m at maximum.

6. Testing Method

6.1 Impact Conditions

The leg form impactor is mounted on the impact generator, then impact is applied to the specified impact point on the test vehicle with the following impact conditions:

(1) The permissible range of the impact velocity shall be 40.0 ± 0.7km/h (if possible, ± 0.5km/h is preferable). However, even if the impact velocity has exceeded this range, the test data is acceptable as long as the results can obtain the best performance points of this assessment.

(2) The direction of the impact velocity vector shall be in the horizontal plane and parallel to the longitudinal vertical plane of the vehicle. The tolerance for the direction of the velocity vector in the horizontal plane and in the longitudinal plane shall be 0 ± 2deg at the time of first contact. The axis of the leg form impactor shall be perpendicular to the horizontal plane, with a roll and pitch angle tolerance of ± 2deg in the lateral and longitudinal plane (if possible, 0 ± 1deg is preferable). The horizontal, longitudinal and lateral planes are orthogonal to each other (see Figure 5.2).

(3) The bottom of the leg form impactor shall be at 25 mm above the ground reference plane at the time of first contact with the bumper (see Figure 5.1), with a ±10mm tolerance (if possible, a ±5mm tolerance is preferable).

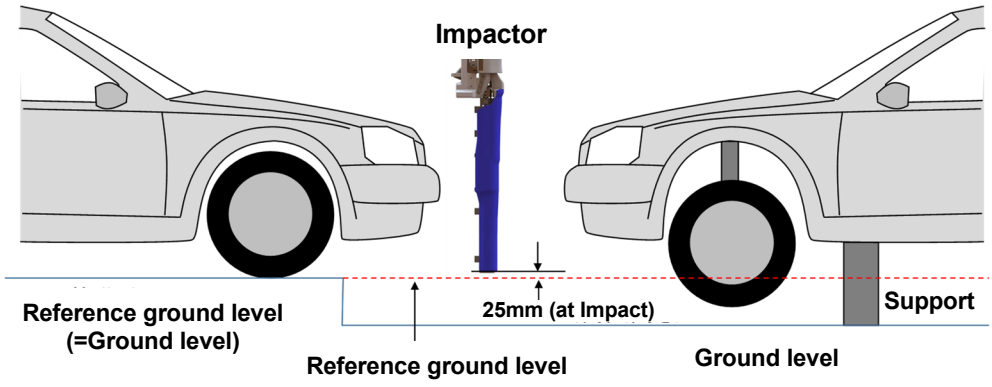


Figure 5.1: Impact Height of Leg form impactor
(Complete vehicle in normal riding posture (left)
and or cut-body mounted on supports (right))

(4) The leg form impactor for the bumper tests shall be in 'free flight' at the moment of impact. The leg

form impactor shall be released to free flight at such a distance from the vehicle that the test results are not influenced by contact of the leg form impactor with the propulsion system during rebound of the leg form impactor.

(5) The leg form impactor may be propelled by any means that can be shown to meet the requirements.

(6) At the time of first contact, the leg form impactor shall have the intended orientation about its vertical axis, for the correct operation of its knee joint, with a yaw angle tolerance of ±5deg (see Figure 5.2).

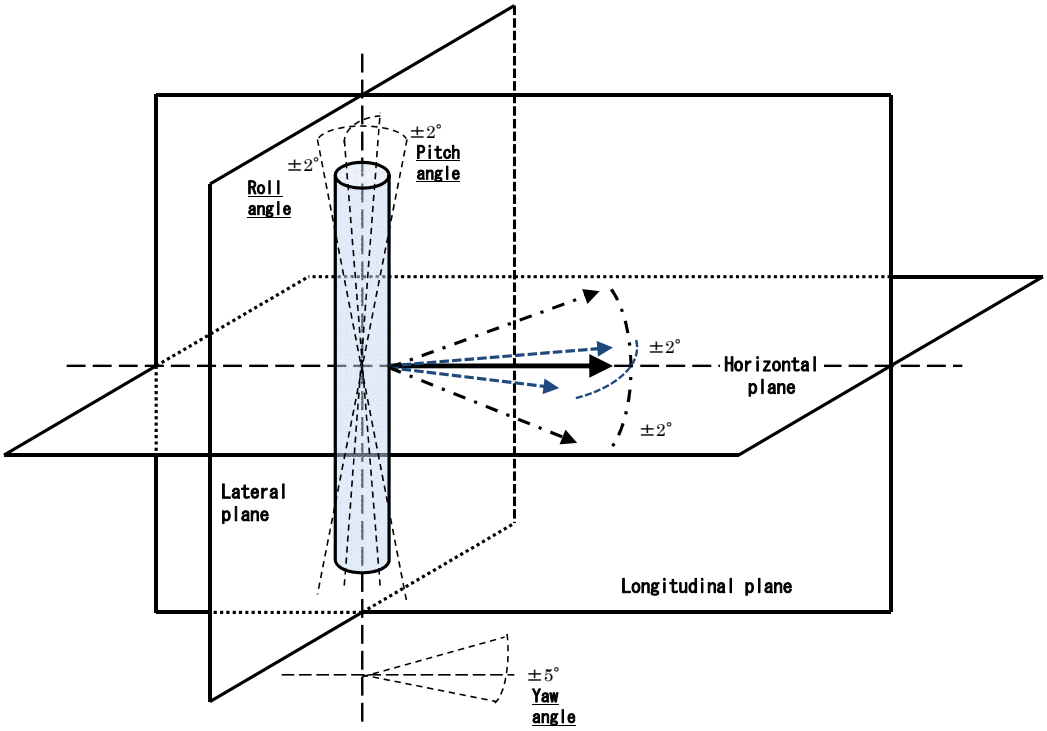


Figure 5.2: Tolerances of Angles for the Leg form impactor at the time of the First Impact

(7) At the time of first contact, the centerline of the leg form impactor shall be within a ±10mm tolerance of the selected impact location.

(8) During contact between the leg form impactor and the vehicle, the impactor shall not contact the ground or any object which is not part of the vehicle.

(9) The effect of gravity shall be taken into account when the impact velocity is obtained from measurements taken before the time of first contact.

(10) The bending moment generated at the tibia and femur before the vehicle impact shall be ± 10Nm which is judged by using absolute maximum values within just before the impact with the vehicle (if possible, 0 ± 5Nm is preferable). The load level of the elongation measuring devices at the knee portions shall be up to ± 1mm. To determine the points for the bending moment in this case, use the maximum value (absolute value) taken before the collision, and determine the points of elongation at

the moment of impact.

6.2 Test Omissions

If the selected collision points are symmetrical about the longitudinal vertical plane intersecting the vehicle center and are assumed to have the same internal structure, it is possible to apply the test results for one side to the other side.

6.3 Testing After the Side Collision Test

Collision points that might affect the results of the side collision test may be tested after the side collision test. However, to be allowed to use this protocol, the vehicle manufacturer shall submit technical documents to NASVA to explain the collision points that affect the side collision test results if the points were tested before the side collision test.

6.4 Exchanging of Parts

A deformed or damaged part (e.g. bonnet, bumper, spoiler, headlight, etc.) must be replaced before the next test, except those conducted at the locations specified below. Additionally, for exchanging parts at the front of the vehicle, refer to Attachment 3.

(1) The collision point of the next test is more than 400mm from the collision point of the preceding test. However, if a part is so damaged that it is considered to affect the progress of the next test, the part may be replaced by mutual agreement between NASVA and the automobile manufacturer, etc.

(2) The deformed or damaged parts are unlikely to affect the next test result.

7. Recording and Measuring Items

7.1 Recording Prior to the Test

7.1.1 Confirming and Recording Received Vehicle for Test

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

(1) Name, model, and classification number or symbol of the vehicle

(2) Frame number

(3) Shape of body

(4) Engine model

(5) Drive system

(6) Type of transmission

(7) Size of tires

7.1.2 Recording the Impactor Certification Results

(1) Characteristics of the leg form impactor shall successfully pass the certification test specified in ISO/TS 20458.

(2) The testing institute must record details of the leg form impactor certification test in Appendix 5.

(3) If the main body of the leg form impactor is damaged during the test and those parts are then

repaired, a dynamic full assembly verification test (below-knee impact, knee impact) as specified in ISO/TS 20458 shall be performed and the leg impactor shall conform to the requirements. On the other hand, if it is clear that only the meat part attached around the body part is damaged and only the meat part is replaced, the dynamic full assembly verification test may be omitted.

7.1.3 Recording of Calibration Results of Measuring Instruments

(1) Results of the calibration conducted prior to the test, on the measuring instruments (measuring channels used by the evaluation) shall be recorded. The calibration remains effective for one year irrespective of how many times the instruments may be used during this period. However, if abnormalities are observed, they must be recalibrated.

(2) Correctness of computation of the injury value shall be verified by using the calibration signal generator, unless the calibration described in (1) was conducted not only for each channel including transducers but also for the data acquisition system.

7.1.4 Recording of Final Vehicle Condition Prior to Test

After preparing the test vehicle according to the protocol described in Paragraph 3, the following items shall be checked and recorded:

(1) Mass of the test vehicle

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

(3) Heights of the vehicle (the points for measuring vehicle height shall be specified by the vehicle manufacturer)

(4) Collision points

(5) Reference impact-measuring points

7.1.5 Recording of Test Room Temperature, etc.

Regarding the temperature conditions specified in 4.1.10, the following shall be recorded into Appendix 6:

(1) The test room temperature

(2) The duration during which the leg form impactor was kept at the environment specified in Paragraph 4.1.10.

7.2 Recording During the Test

7.2.1 Recording Impact Velocity, Free Flight Posture of Leg form Impactor, and Deviations from the Target and Impact Points

(1) The velocity of the leg form impactor just before the impact with the test vehicle shall be measured using a velocity indicator, and the measured velocity shall be recorded.

(2) If the velocity indicator has any trouble in (1), the time differential of the moving distance of the leg form impactor just before impact in the high-speed photographing shall be adopted and recorded as an equivalent to impact velocity.

(3) The leg form impactor posture data during the free flight (from launch to the impact with the vehicle) shall be recorded.

(4) The flight attitude in the case of angular rate indicator failure in the measurement in (3) shall be determined from the high-speed images and the crash position deviation in (5), etc., and NASVA shall consult with the vehicle manufacturer, etc., to determine whether or not to adopt the results of said test.

(5) Collision point deviation shall be determined and recorded by checking the positions of marks such as paint left on the leg form impactor prior to the test.

7.2.2 Recording of Electric Measurements

Electric measurements for injury assessment shall be recorded from -50ms to 100ms or longer. Additionally, for monitoring purposes, the acceleration of the upper mass (X, Y, Z axes) and the acceleration of the knee (Y axis) shall be measured.

7.2.3 Recording the Maximum Values

By using the measured waveform data recorded as specified in Paragraph 7.2.2, the maximum values of all measurement items shall be calculated and recorded.

7.2.4 High-Speed Photography

A high-speed VTR or the like shall be used as an auxiliary recording system in order to record the free flight and impact posture of the leg form impactor during the test.

7.3 Recording After the Test

7.3.1 Filming the Vehicle Condition Immediately After the Test

The test vehicle's following conditions shall be photographed:

(1) Damaged locations near the collision point

(2) Damaged internal parts within the collision point

7.3.2 Confirming and Recording the Damaged Parts

Check damages on the following parts of the test vehicle and record the damages.

(1) The bonnet

(2) The front bumper (bumper face, grill, internal parts, etc.)

(3) The front body (the radiator support, etc.)

7.4 Management of Measured Values

The following rules apply to management of measured values:

(1) Measurement on the impact velocity (km/h) shall be recorded up to the first decimal place.

(2) Measurement on the posture angles (deg) of the leg form impactor shall be recorded up to the first decimal place.

(3) Measurement values shall be rounded at the first decimal place and recorded up to the next whole number.

ATTACHMENT 1

Detailed Protocols for Replacing Vehicle Parts

1. Repair of vehicle parts

Part	Repair
Frame/Body	These parts cannot be replaced even if they are deformed by the impact test. Therefore, deformed parts shall be repaired to the original shape by using several repair tools where possible.
Fender Bonnet hinge	These parts take too long to replace. Therefore, deformed parts shall be repaired to the original shape by using several repair tools where possible.
Other parts	If other deformed parts would affect the subsequent test results, they shall be repaired to the original shape by using several repair tools where possible.

2. Replacement of vehicle parts

Part	Change	Do Not Change
1. Bumper 2. Bonnet 3. Energy Absorber	If these parts were deformed or broken by the preceding test, they shall be changed to new parts before the next test.	If the collision point of the next test is located 400 mm or more from the collision point of the preceding test.
1. Headlights	If these parts were deformed or broken by the preceding test, they shall be changed to new parts before the next test.	If the collision point of the next test is located in a symmetrical sub test area (e.g. L1 → L3, L3 → L1) and the collision point of the next test is located 400 mm or more from the collision point of the preceding test.
1. Bumper Beam 2. Striker 3. Grill 4. Radiator Support	If these parts were deformed or broken by the preceding test, they shall be changed to new parts before the next test.	If the collision point of the next test is located 400 mm or more from the collision point of the preceding test. However, if a part is so damaged that it is considered to affect the progress of the next test, the part may be replaced upon mutual agreement between NASVA and the automobile manufacturer, etc.
Other parts	If the damaged or deformed parts would affect the results of the next test.	

APPENDIX 1: SPECIFICATION DATA SHEET OF TEST VEHICLE

[For entry by the vehicle manufacturer and importer]

1. Specifications of test vehicle

Name, model, classification number or symbol of the vehicle	
Frame number	
Body shape	
Engine model	
Drive system	
Type of transmission	
Tire air pressure	Front: kPa, Rear: kPa
Fuel tank capacity	L

2. Seat Adjustments

				Driver's seat	Front passenger's seat	Second row	Third row
Seat	Fore-aft adjustment	Adjustment distance per stage		mm	mm	mm	mm
		Total adjusted distance		mm	mm	mm	mm
		Designed position	From front edge	mm (stages)	mm (stages)	mm (stages)	mm (stages)
			From rear edge	mm (stages)	mm (stages)	mm (stages)	mm (stages)
	Vertical adjustment	Designed position	Lifter				
			Tilt				
			Other				
Adjustment of seatback angle		Designed standard position		° (stages)	° (stages)	° (stages)	° (stages)
Lumbar support		From the release position					
Other adjustment device ( )		Designed standard position					

Note) Enter the number of position adjusting stages counting the first locking position as 0

3. Reference Measuring Points of Vehicle Posture

(Enter the vehicle height after installing a mass of 75 kg to the driver and front passenger seat, respectively, in addition to the mass of the test vehicle when brought in.)

(1) Height of left and right of front wheel: Reference point (*) : Left mm Right mm

(2) Height of left and right of rear wheel: Reference point (*) : Left mm Right mm

* Describe name of reference point. Submit drawings, if necessary to understand the point.

4. Coordinates of the front bumper corner (Coordinates of the point of contact between the vertical plane shown in Figure 3.1 and the vehicle. If there is more than one contact point, the point located most to the side of the vehicle)

Front bumper corner (X,±Y,Z) : (, ,)

APPENDIX 2: SPECIFICATION DATA SHEET OF TEST VEHICLE

[For entry by the testing institute]

1. Specifications of test vehicle

Vehicle name, Model type	
Model name	
Grade	
Model type	
Tire size	
Mass at vehicle delivery	

2. Seat Adjustments

				Driver's seat	Front passenger's seat	Second row	Third row
Seat	Fore-aft adjustment	Adjustment distance per stage		mm	mm	mm	mm
		Total adjusted distance		mm	mm	mm	mm
		Designed position	From front edge	mm (stages)	mm (stages)	mm (stages)	mm (stages)
			From rear edge	mm (stages)	mm (stages)	mm (stages)	mm (stages)
	Vertical adjustment	Designed position	Lifter				
			Tilt				
			Other				
Adjustment of seatback angle		Designed standard position		° (stages)	° (stages)	° (stages)	° (stages)
Lumbar support		From the release position					
Other adjustment device ( )		Designed standard position					

Note) Enter the number of position adjusting stages counting the first locking position as 0

3. Others

Reference Measuring Points of Vehicle Posture

(1) Height of left and right of front wheel: Reference point (*) : Left mm Right mm

(2) Height of left and right of rear wheel: Reference point (*) : Left mm Right mm

* Describe name of reference point.

Appendix 2-1: Collision Points for Assessment (vehicle name:)

First candidate of collision point [NASVA]

		Area L1		Area L2		Area L3	
		L1A	L1B	L2A	L2B	L3A	L3B
Request							
Distinction between 1st and 2nd candidates							
Collision point	x						
	y						
	z						
Collision order							
Remarks	Parts						
	Replacement of bumper and other						

Note 1. “〇” in the Area Classification column indicates the second candidate area. Those without “〇” indicate the first candidate area.

2. Reference impact point (x=0, y=0, z=0): Bonnet rear end on the vehicles centerline.

Appendix 2-2: Bird's Eye Photo of Test Vehicle

Reference

- Test vehicle attached with marking
- Angle: 30 degrees in front of the test vehicle
- Photo taken using a digital camera
  (use this photo for lower leg impactor test as well as for head impactor test)

Appendix 2-3: Collision Points for Assessment (vehicle name:)

Second candidate of collision point

		Area L1		Area L2		Area L3	
		L1A	L1B	L2A	L2B	L3A	L3B
Request							
Distinction between 1st and 2nd candidates							
Collision point	x						
	y						
	z						
Collision order							
Remarks	Parts						
	Replacement of bumper and other						

Note 1. "○" in the Area Classification column indicates the second candidate area. Those without "○" indicate the first candidate area.

2. Reference impact point (x=0, y=0, z=0): Bonnet rear end on the vehicles centerline.

Appendix 2-4: Collision Points for Assessment (vehicle name:)

		Area L1		Area L2		Area L3	
		L1A	L1B	L2A	L2B	L3A	L3B
Request							
Distinction between 1st and 2nd candidates							
Collision point	x						
	y						
	z						
Collision order							
Remarks	Parts						
	Replacement of bumper and other						

Note 1. "○" in the Area Classification column indicates the second candidate area. Those without "○" indicate the first candidate area.

2. Reference impact point (x=0, y=0, z=0): Bonnet rear end on the vehicles centerline.

APPENDIX 3-1: SPECIFICATION DATA SHEET OF TEST VEHICLE

[For entry by the test institute]

1. Specifications of test vehicle

Name, model, classification number	
Frame number	
Body shape	
Engine model	
Drive system	
Type of transmission	
Tire size	
Tire air pressure	Front: kPa, Rear: kPa

2. Seat Adjustments

Seat	Fore-aft Adjustment	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
	Seatback Adjustment	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
	Height Adjustment （Lifter）	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
	Height Adjustment （Tilt）	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
	Other Adjustment Devices （ ）	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
	Lumbar support Adjustment	Driver Seat	Absent / Present (Electric / Manual)
		Front Passenger Seat	Absent / Present (Electric / Manual)
		Rear Seat	Absent / Present (Electric / Manual)
Fuel Tank Capacity		L	

Reference Measuring Points of Vehicle Posture

Height of right and left front wheels (*): left mm, right mm

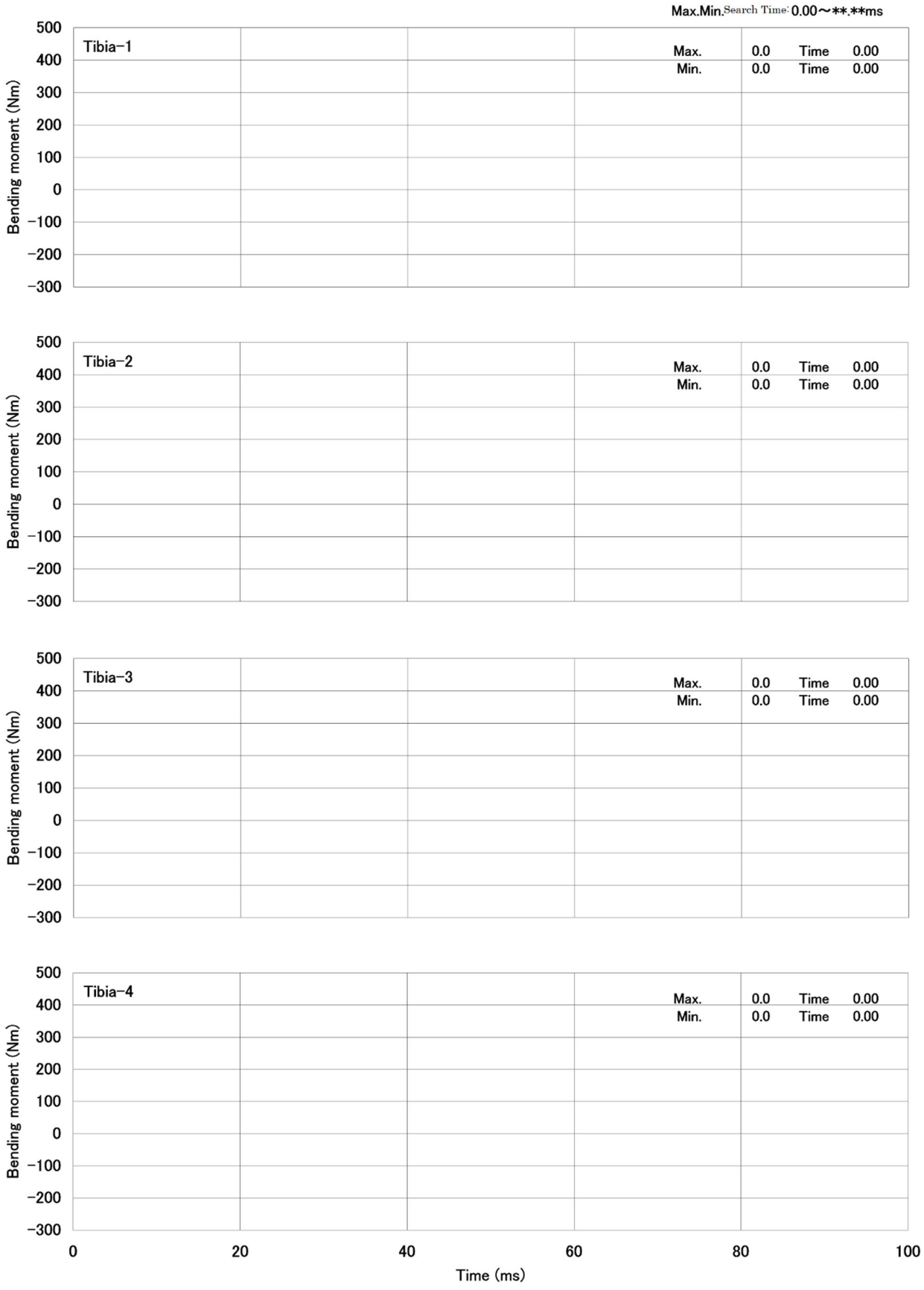
Height of right and left rear wheels (*): left mm, right mm

*Note: The part of the reference point is shown in parentheses ( ).

Appendix 3-2: List of Test Results

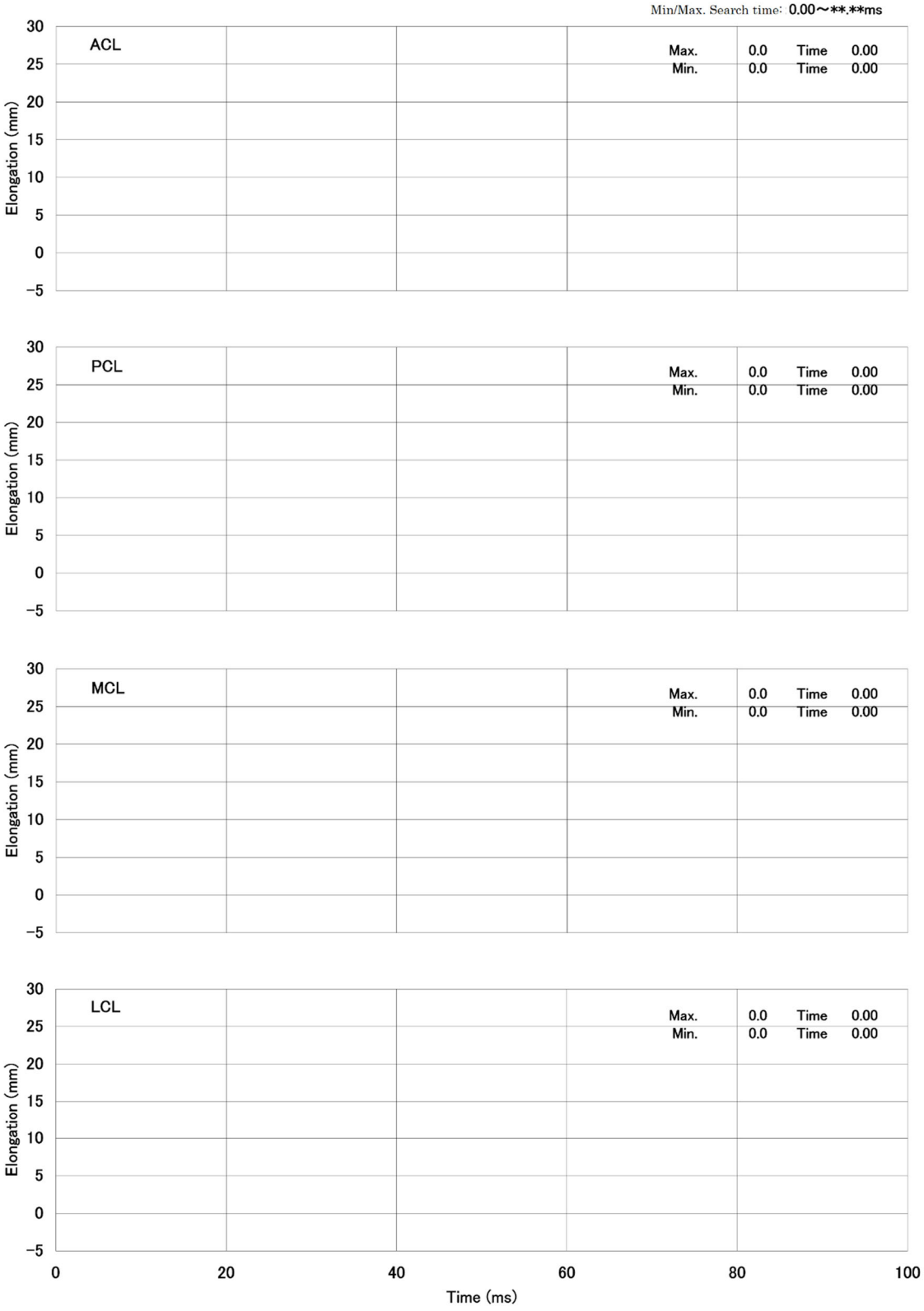
	Area L1		Area L2		Area L3	
	L1A	L1B	L2A	L2B	L3A	L3B
Distinction between 1st and 2nd candidates						
Impact order						
Collision Speed						
Flight Posture Roll angle (°) Yaw angle (°) Pitch angle (°)						
Deviation						
Femur-3 (Upr) (Nm)						
Femur-2 (Mid) (Nm)						
Femur-1 (Lwr) (Nm)						
MCL (Nm)						
ACL (Nm)						
PCL (Nm)						
Tibia-1 (Upr) (Nm)						
Tibia-2 (Upr) (Nm)						
Tibia-3 (Upr) (Nm)						
Tibia-4 (Upr) (Nm)						
Remarks						

Appendix 4: Results of Electric Measurements (area: sub area, sub-sub area)



TestNo. NASVA20**-****-***

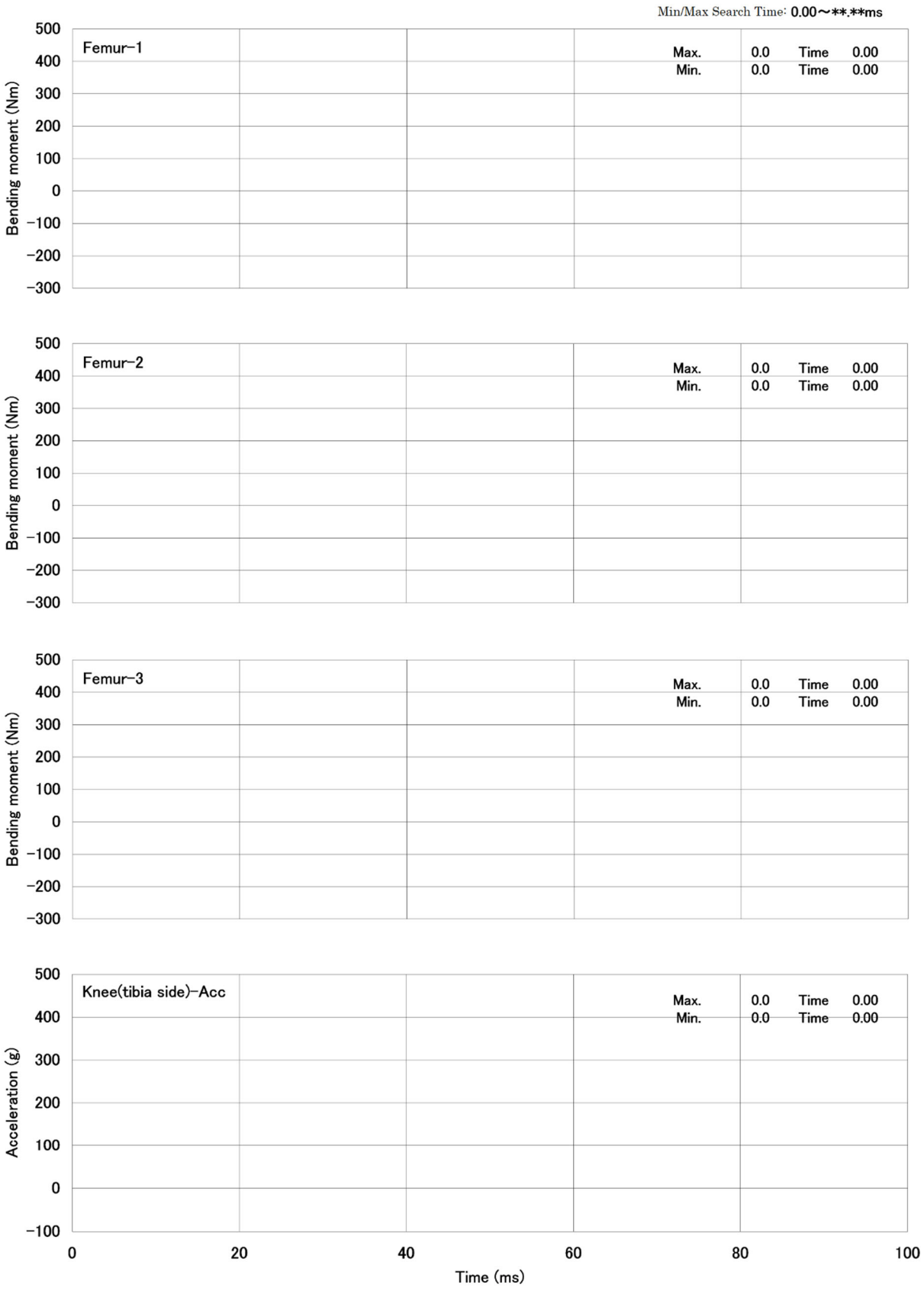
Leg Impactor Measurement Items: (Tibia-1, Tibia-2, Tibia-3, Tibia-4)



TestNo. NASVA20**-****-***

Leg Impactor Measurement Items: (ACL, PCL, MCL, LCL*)

*Reference Measurements



TestNo. NASVA20**-****-***

Leg Impactor Measurement Items: (Femur-3*, Femur-2*, Femur-1*, Knee(tibia side)-Acc*)

*Reference Measurements

Appendix 5: Results of Leg Impactor Certification Test

Test Number	Date/ Temperature	Calibration Methods	Leg Impactor No.	Measurement Items	Maximum Value
***		Dynamic full assembly (below-the-knee hit)		Tibia-1	Nm
				Tibia-2	Nm
				Tibia-3	Nm
				Tibia-4	Nm
				Femur-1	Nm
				Femur-2	Nm
				Femur-3	Nm
				ACL	mm
				PCL	mm
				MCL	mm
	Test Result Pass Fail				
		Dynamic full assembly (knee hit)		Tibia-1	Nm
				Tibia-2	Nm
				Tibia-3	Nm
				Tibia-4	Nm
				Femur-1	Nm
				Femur-2	Nm
				Femur-3	Nm
				ACL	mm
				PCL	mm
				MCL	mm
	Test Result Pass Fail				

Note: Attach wave forms during the calibration test.

Appendix 6: Temperature Records

Leg impactors soak start date and time: ___day____month_____year _____hr. _____min.

Temperature at the start of soak: Temperature: °C

Temperature when using leg impactor

Test No.	Temperature (°C)	Test Date/Time