

Protection of the Occupants of the Cab of a Commercial Vehicle

1. Scope

This standard specifies the cab of an automobile with the gross weight of 1000 kg or over which carries goods only (hereinafter referred to as "truck"). The standard, however, shall not be applied to the canvas-top cab, one-side cab, center cab, wind shield cab, cowl cab, no door cab type trucks, etc.

Remarks 1: Shapes of a cab of a vehicle which are not applicable to this standard shall be pursuant to **JASO Z 216** (Glossary of Terms Relating to Body of Motor Trucks), except the canvas-top cab.

2: In this standard, units and numerical values are based on SI (International System of Units), while units and numerical values given in { } are customary units system, and are given for reference.

2. Purpose

This standard aims to reduce the damage of occupants caused by deformation of the cab in case of a head-on collision and overturn of a truck.

3. Definitions

Definition of main terms used in this standard are as follows:

(1) Canvas-top Cab Type Truck

A Truck with a cab which the roof is formed of canvas, or tarpaulin etc.

(2) Cab-over Engine Truck

A truck that more than half of the overall length of its engine is located behind the fore front end of the windshield base, and the center of the steering wheel is located within 1/4 front of the overall length of the vehicle.

(3) Panel Van

A van that satisfies the conditions of (2) cab-over engine truck and spaces for the driver and goods are united into one room.

(4) Crew-cab Type Truck

A truck which has a cab provided with 1 ~ 2 rows of seats behind the front seat (refer to **JASO Z 216**).

(5) Dummy

An object that simulates a human body regarding its size, shape, mass, and characteristics of joints [refer to **JASO Z 211** (Glossary of Terms Relating to Automobile Safety)].

(6) Manikin

An object that simplifies a human body in sitting position with regard to its size and shape.

(7) R-point

A reference point of design corresponding to the actually measured H-point. Then, adjustable mechanisms, if any, for seat height, seat back angle, seat cushion fitting angle, etc. shall be adjusted at the reference design positions specified by the manufacturer [refer to **JIS D 0024** (Road Vehicles—Procedure for H-point Determination)].

Here, a actually measured H-point means the H-point of a three-dimensional manikin seated on a normal driving or riding position at the aftermost end of the seat slide specified by the manufacturer.

(8) Gross Vehicle Mass

Mass of a vehicle under the maximum loaded condition [refer to **JIS D 0122** (Glossary of Terms Relating to Automobiles)].

Applicable Standards:	JIS D 0102-79 Glossary of Terms Relating to Automobiles — Dimensions, Masses, Weights and Performances of Automobiles
	JIS D 1060-82 Frontal and Rear Vehicle Collision Test Procedure
	JIS D 0024-85 Determination of H-point of Automobiles
	JASO B 201-76 Test Code of Side Door Lock Systems for Automobiles
	JASO Z 103-83 Frontal Collision Test Procedure for Passenger Cars
	JASO Z 211-83 Glossary of Terms Relating to Automobile Safety
	JASO Z 216-77 Glossary of Terms Relating to Body of Motor Trucks
Reference Standards:	ECE No. 29 (01) Uniform Provisions Concerning the Approval of Vehicles with Regard to the Protection of the Occupants of the Cab of a Commercial Vehicle
	JIS D 0101-82 Glossary of Terms Relating to Kinds of Automobiles

(9) Unloaded State

A state added following substances to the dry state: Cooling liquid, fuel (90% of its capacity or more), spare tyre ⁽¹⁾, fire extinguisher ⁽¹⁾, standard spare parts ⁽¹⁾, scotch ⁽¹⁾, accompanying tools ⁽¹⁾ (refer to JIS D 0102).

Here, air pressure of the tyre shall be the value specified for the vehicle.

Note: ⁽¹⁾ These may be excluded in the empty state.

(10) Door Locking Device

A device that makes a door unable to be opened by one or both handles in- and outside the door which is kept in completely closed position [refer to JASO B 201 (Test Code of Side Door Lock Systems for Automobiles)].

4. Performance

The cab of a truck shall satisfy the following performance under the condition after each test when the cab is tested as shown in 6.

- (1) A space able to contain the specified manikin or dummy shall remain. Then, the manikin or dummy shall not contact with any non-resilient parts which have Shore A hardness of 50 or more, except that only one place without contact with non-resilient parts may be obtained in a range of 0 ~ 25° of angle of each left or right thigh aperture of the manikin or the dummy.
- (2) The parts to install the cab to the chassis may be deformed or broken by the test as far as the cab is not separated from the chassis.
- (3) Doors shall not open during the tests. And, these doors may not be opened after the tests

5. Kinds and General Conditions of Tests

5.1 Kinds of Tests

Tests shall be classified into following two kinds:

- (1) Front Impact Test
- (2) Roof Strength Test

5.2 General Conditions

- 5.2.1 Either of the front impact test or roof strength test may be carried out earlier.
- 5.2.2 A single cab or different cabs may be used for the front impact test and the roof strength test.
- 5.2.3 As for the roof strength, the test of 6.2 may be omitted, if it will be proved that the space prescribed in 4.(1) may be obtained by means

of strength calculation of the component parts of the roof or other methods.

6. Tests

6.1. Front Impact Test

6.1.1 Object Vehicles

Object vehicles shall be cab-over engine trucks and panel vans.

6.1.2 Selection of Test Method

The front impact test shall, in principle, be carried out by the pendulum impact test method of 6.1.5. However, the fixed barrier test method of 6.1.6 may be adopted using the clash test facilities with the fixed barrier shown in 6.1.4 (2) may be adopted as substitute for the test of 6.1.5, if the pendulum impact test facilities of 6.1.4 (1) is absent.

6.1.3 Test Conditions

Test conditions shall be as follows:

- (1) Test vehicle shall be kept under the state of the chassis accompanied with cab or the state specified by the manufacturer.
- (2) Optional parts and accessories shall be attached, if necessary. But, the parts fitted on the roof (roof-carrier, air deflector, cab cooling unit, etc.) shall be removed.
The parts having no effect on the test may be removed.
- (3) The door shall be closed, but the door locking device shall not be locked.
- (4) The door window glass may be either opened or closed.
- (5) Adjusted position of the adjustable steering wheel shall be at the standard position of design according to the body dimensions of the manikin or dummy used for the evaluation of the test. Longitudinal position of the seat slide shall be free.
- (6) Manikins and dummies shall not be loaded.

6.1.4 Test Equipments

(1) Structure of Pendulum Impact Test Device

[refer to (a) and (b) of Attached Fig. 1]

- (a) The striking surface of the striking plate of the pendulum shall be flat; the striking plate shall be highly rigid, and its mass shall uniformly be distributed. The striking plate shall have 1500 ± 250 kg as mass, 2500 mm in width, 800 mm in height, and its edges shall be chamfered 1.5 ~ 5 mm.

- (c) Adjusting devices for seat height, inclination of the seatback, etc. shall be set at a standard position of design according to body dimensions of the manikin or dummy used for the evaluation.

- (d) The manikin or dummy shall be set in normal sitting posture so that the center of rotation of the body and femoral regions of the manikin or dummy coincides with the R-point.

And, make the longitudinal position of the seat slid to a standard position of design according to the manikin or dummy for the evaluation, and examine the contact between the manikin or dummy and non-resilient parts.

Then, keeping the angle of each thigh aperture of the manikin or dummy within the range of $0 \sim 25^\circ$ both left- and rightward from a vertical center plane rectangular to the frontal plane of the manikin or dummy, examine whether a position where the manikin or dummy does not contact with any non-resilient part (having Shore A hardness of 50 or more) remains or not.

Further, the manikin or dummy may be disassembled for its easy loading into the cab and be reassembled there.

(5.2) Separation of Cab from Chassis Frame

After the test, the cab shall be observed visually whether it is separated from the chassis or not.

(5.3) Release of Door

Doors shall be observed visually whether it is kept closed or not.

6.1.6 Test Method with Fixed Barrier

(1) Position and Direction of Clash

- (a) Height of the center of the impact surface of the projection shall be set identically with the relative positioning between the striking surface of the pendulum and the test vehicle prescribed in 6.1.5 (1) (a).
- (b) Transverse dislocation between the longitudinal center plane rectangular to the impact surface of the projection and the longitudinal center plane of the test vehicle shall be within ± 300 mm at the clash.
- (c) The angle between the impact surface of the projection and the longitudinal center axis shall be within $90 \pm 2^\circ$.
- (d) Direction of clash shall be set parallel to the horizontal ground surface and the longitudinal center plane of the test vehicle.

(2) Speed of Clash

Speed of clash shall be calculated from the shock energy (E) prescribed in the Table of 6.1.5 (3) by following formula:

$$V = \sqrt{\frac{2E}{M}} \times 3.6$$

Where, V : Speed of clash km/h

E : Shock energy J

M : Mass of a test vehicle kg

Note: Speed of clash shall be $\pm 2\%$ km/h against the calculated speed. But; the higher speed is available if the performance of 4. has been satisfied.

(3) Test Procedure

- (a) Put the test vehicle under the condition prescribed in 6.1.3.
- (b) Adjust the mounting portion of the projection and set the test vehicle so that the position and direction of the clash prescribed in (1) may be obtained for the test vehicle.
- (c) Make the test vehicle clashed to the projection at a speed prescribed in (2).
- (d) Detection of the speed of clash shall be pursuant to the method prescribed in JASO Z 103 (Frontal Collision Test Procedure for Passenger Cars).

(4) Evaluating Method

Evaluating method shall be pursuant to 6.1.5 (5).

6.2 Roof Strength Test

6.2.1 Object Vehciels

Object vehicles shall be cab-over engine trucks and cab-behind engine trucks except panel vans and crew-cab type trucks.

6.2.2 Test Conditions

Test conditions shall be in accordance with 6.1.3 (2) ~ (6).

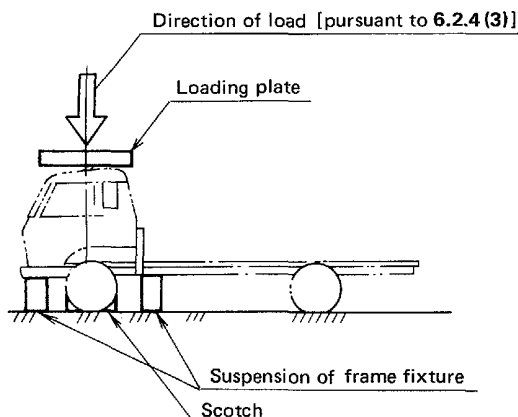
And, the test vehicle shall be set in accordance with either 6.1.3 (1) or the condition that a cab is mounted on the frame.

6.2.3 Test Equipments

Test devices shall be as follows (refer to the Fig.).

- (1) The loading plate and its fitting portion shall have high rigidity, and the contact surface of the loading plate shall have a shape conformed to the roof or a flat shape.
- (2) The size of the contact surface of the loading plate shall cover whole of the roof.

Fig. Test Device and Direction of Load
(an example under the state of the chassis accompanied with a cab)



6.2.4 Test Method

Test method shall be as follows:

(1) Position and Direction of Loading

The test vehicle shall be fixed and loaded so that relative positioning of the contact surface of the loading plate and the roof during the loading may be equivalent to following conditions:

- (a) Position of the roof shall be equivalent to the posture of the vacant vehicle.
- (b) Direction of loading shall be vertical to the horizontal ground surface. But, allowable error of the load shall be within $\pm 5^\circ$ to the vertical line.
- (c) When the contact surface of the loading plate is flat, the contact surface shall be set parallel to the horizontal ground surface.

(2) Fixing Method of Test Vehicle

The test vehicle shall be fixed by one of the following methods so that the direction of loading against the cab will not change during the test:

(a) When the Test Vehicle is in the State of 6.1.3 (1)

The test vehicle shall be fixed so as not to be remarkably moved during the test by means of parking brakes, transmission gears engaged each other, scotches applied to the front wheels, and removal of the movement of various elements of the suspension (springs, tyres, etc.) by the use of appropriate materials.

(b) In Case of the Cab Mounted on the Frame

The frame shall be fixed so as not to be remarkably moved during the test.

(3) Load

The load to be applied shall be the load on the front axle when the test vehicle is loaded to its maximum loading capacity, and its allowable error shall be $\pm 2\%$. When the front axle load exceeds 98.0 kN {10000 kgf}, the load shall be 98.0 kN $\pm 2\%$ {10000 kgf $\pm 2\%$ }.

But, the allowable error may be exceeded 2%, if the performance of 4. is satisfied.

(4) Test Procedure

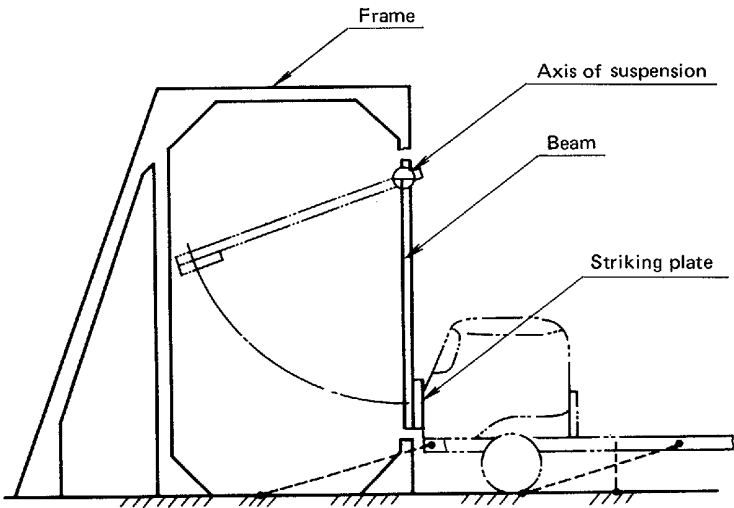
- (a) Put the test vehicle under the condition prescribed in 6.2.2.
- (b) Fix the test vehicle according to (2) so that the position and direction of loading prescribed in (1) may be obtained.
- (c) Apply the load prescribed in (3).
- (d) Remove the load quickly after the load has reached to the prescribed value.

(5) Evaluating Method

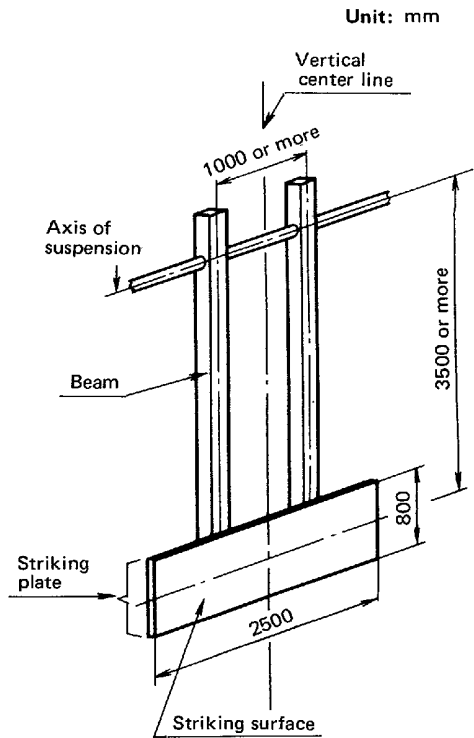
Evaluating method shall be pursuant to 6.1.5 (5).

Attached Fig. 1

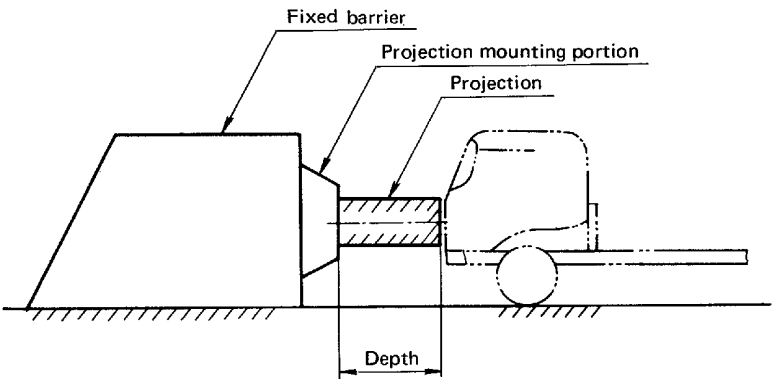
(a) Pendulum Shock Test Equipment



(b) Structure of Pendulum

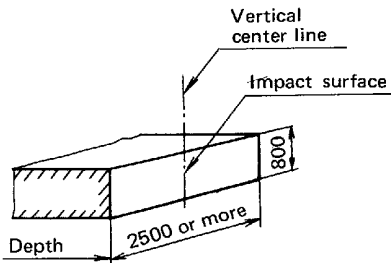


(c) Clash Test Equipment with Fixed Barrier

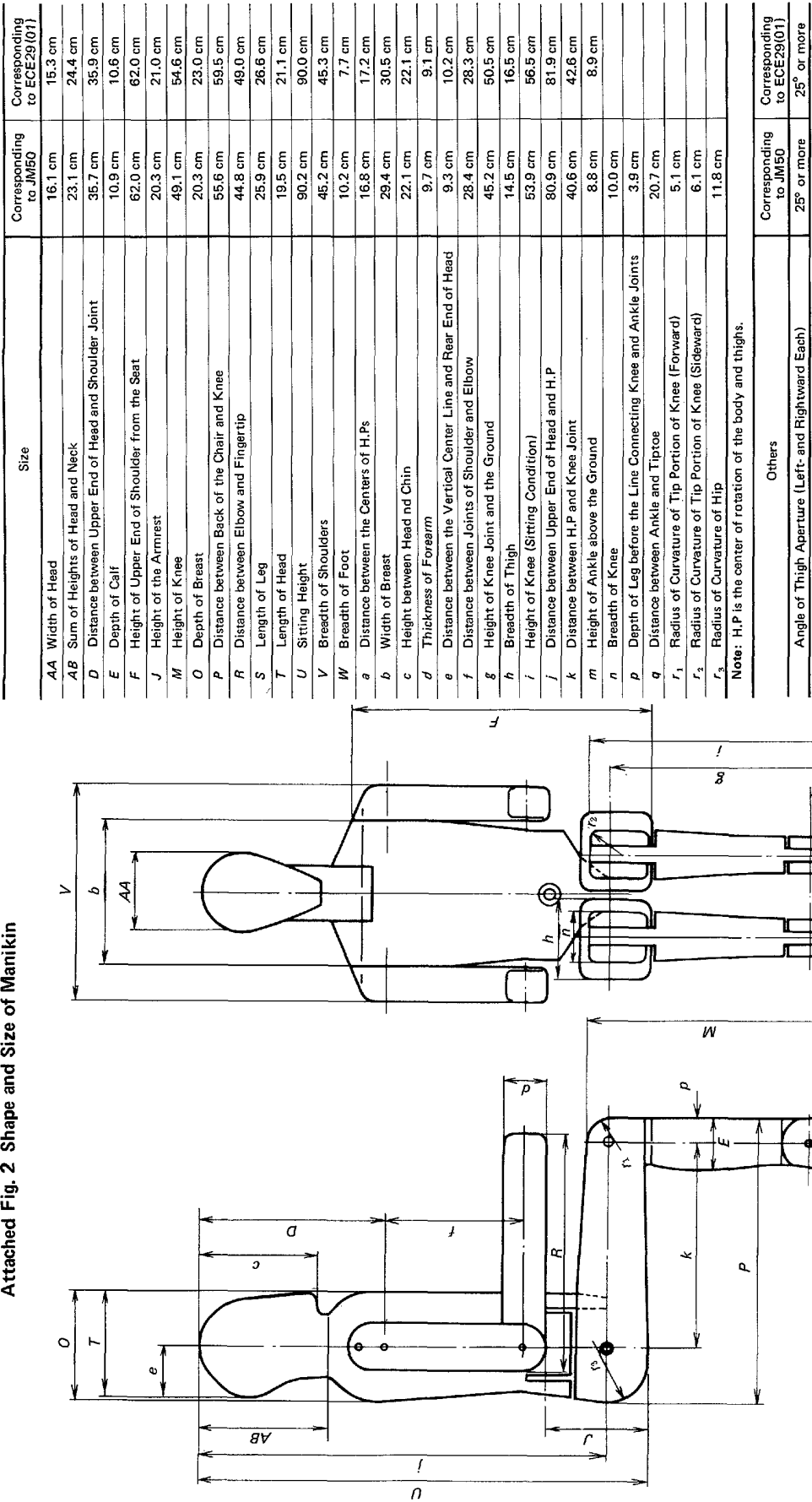


Unit: mm

Shape of Front End of Projection



Attached Fig. 2 Shape and Size of Manikin



Appendix: Fixing Method of the Test Vehicle in Pendulum Shock Test

1. Scope

This appendix specifies the fixing method of the test vehicle in the pendulum shock test for cab-over engine trucks and panel vans. However, when the test vehicle is difficult to be fixed by this method, the vehicle may be fixed by other method, as far as the vehicle is not remarkably moved.

2. Fixing Device of Test Vehicle

Fixing device shall be pursuant to **Appendix Fig.** and chains or ropes (hereafter referred to as "ropes") and their fitting portions shall be as follows:

(1) Strength of the Rope

The rope shall be of steel and have the tensile strength prescribed in **Appendix Table 1**.

And, when the gross mass of the vehicle is 1000 kg or more and less than 4000 kg, the rope shall have a sufficient tensile strength in consideration of the gross mass of the vehicle.

Appendix Table 1 Tensile Strength of Rope

Gross vehicle mass	Tensile strength of rope
8000 kg or more	98.0 kN { 10 000 kgf } or more
4000 kg or more and less than 8000 kg	

(2) Fitting Portion of the Rope

Fitting portions of the ropes A and B may be deformed but shall not be broken during the test. And, the ropes may be reinforced, if necessary.

3. Fixing of Test Vehicle (refer to **Appendix Fig.**)

3.1 Fixing from the Front (Ropes A)

- (1) Ropes A shall be attached at the front portions symmetrically about the longitudinal center plane of the vehicle.
Afterward movement of the test vehicle by the pendulum shock shall be prevented with them.
- (2) When the ropes A are stretched without looseness, their downward angles to the horizontal plane shall be 25° or less.
- (3) The angles between the projected lines of ropes A to the horizontal plane and the longitudinal center plane of the vehicle shall be 10° or less.
- (4) Those ropes may cross each other.

3.2 Fixing from the Sides (Ropes B)

- (1) Ropes B shall be attached between front and rear axles of the test vehicle symmetrically about the longitudinal center plane of the vehicle.
Lateral movement of the test vehicle by the pendulum shock shall be prevented with them.
- (2) When the ropes B are stretched without looseness, their downward angles to the horizontal plane shall be 20° or less.
- (3) The angles between the projected lines of ropes B to the horizontal plane and the longitudinal center plane of the vehicle shall be 25° or more and 45° or less.

3.3 Fixing from the Rear (Rope C)

- (1) Rope C shall be attached to the rear of the test vehicle.
- (2) When the rope C are stretched without looseness, their downward angles to the horizontal plane shall be 15° or less.

3.4 Downward Fixing (Rope D)

- (1) The test vehicle shall be fixed with rope D through the aid of a fixing block suitable to the structure of the test vehicle.
- (2) Fixing block shall be placed between the front and rear axles of the test vehicle.
- (3) Fitting position of rope D shall be in the front of rope B.

3.5 Fastening of Ropes

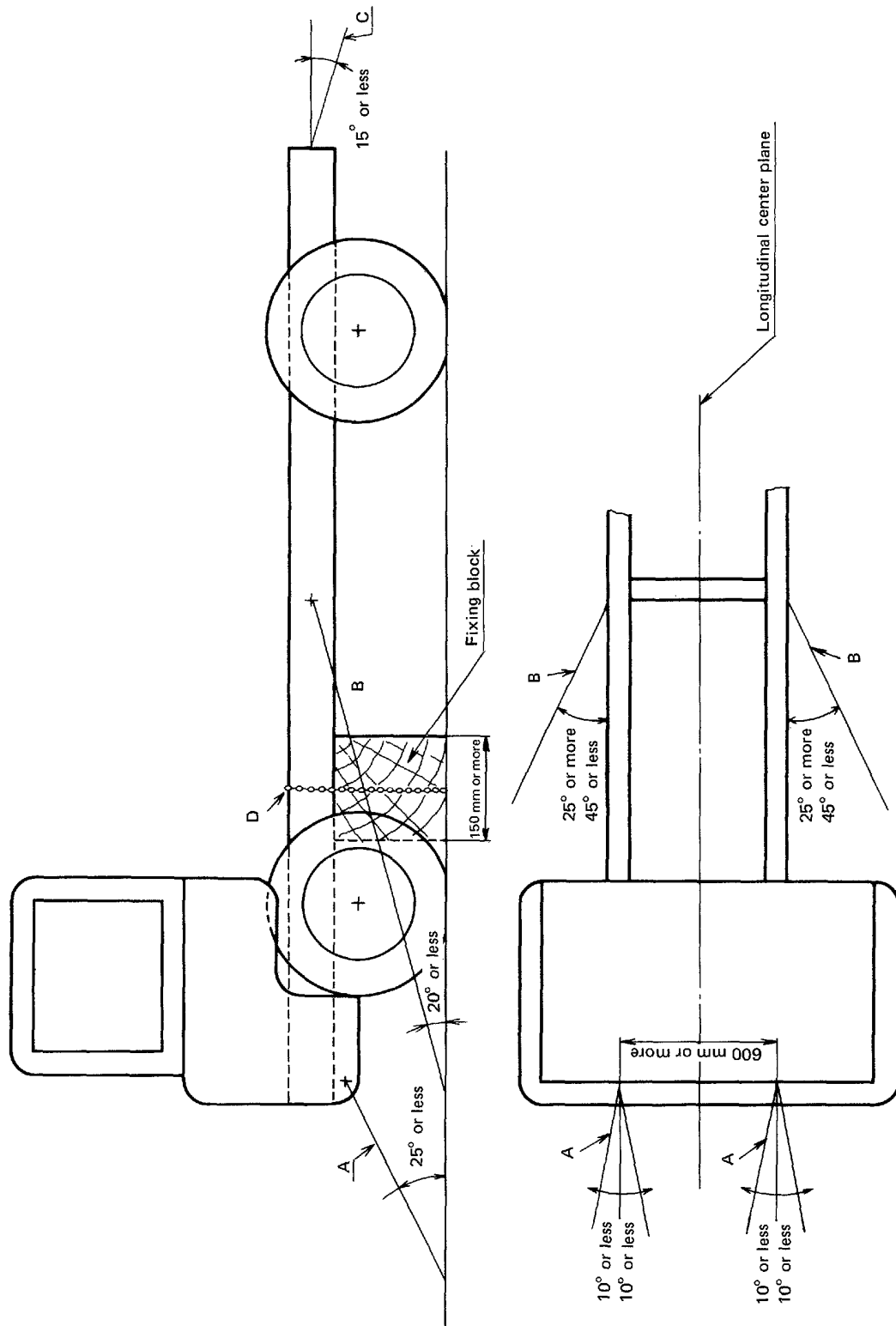
- (1) Put the fixing block and fix the vehicle with rope D on trial.
- (2) Add an arbitrary initial load to rope C.
- (3) Controlling ropes A and B, remove their looseness.
- (4) Adjust rope C so that its load becomes as shown in **Appendix Table 2**.
And, when the gross mass of the vehicle is 1000 kg or more and less than 4000 kg, the load shall be decided in consideration of the gross mass of the vehicle.

Appendix Table 2 Specified Load of Rope C

Gross vehicle mass	Load of rope C
8000 kg or more	9.8 kN { 10000 kgf } or more
4000 kg or more and less than 8000 kg	

- (5) Add a vertical preventive force to the test vehicle through the aid of the fixing block.

Appendix Fig.



Explanatory Note on JASO B 106-85 Protection of the Occupants of the Cab of a Commercial Vehicle

Explanations will be given to the items which particularly seem to require supplemental descriptions concerning to the contents of this standard. (The numbers of the items are the same with those of the Text.)

1. Scope

This standard is not intended to be applied to a vehicle accompanied with peculiar shape of the cab, but the standard is desirable to be applied correspondingly to such vehicle.

4. Performance

- (2) "Is not separated" means the state that the cab is compound with the chassis frame at one portion or more.

5. Kinds and General Conditions of Tests

5.2 General Conditions

- 5.2.3 The strength test of the roofs of the trucks that have some structures at least upward or backward adjoining to the cabs (car carrying trucks, trucks with simplified cranes, trucks loaded rear body with guard frame, etc.) may be replaced by strength test or calculation of the structures.

6. Tests

6.1 Front Impact Test

6.1.3 Test Conditions

- (1) Trucks that have the cabs united with the rear bodies, trucks which will lose their strength of cabs when the guard frames have been taken off, etc. may be tested under the state with rear bodies (the state specified by manufacturers).
- (2) "The parts which have no influence on the test" means outside rear view mirrors, fuel tanks, batteries, etc.

6.1.4 Test Equipments

- (2) As for the structure of the clash test facilities with fixed barrier may be in accordance with the test devices prescribed in JIS D 1060 except the projection prescribed in this standard.

6.1.5 Pendulum Impact Test Method

(4) Test Procedure

- (d) "Striking energy of a pendulum" means a kinetic energy of the whole body of a pendulum which consists of a striking plate, beam, etc. just before a strike.

(5) Evaluating Method

- (b) If the center of rotation of the body and thighs of a manikin is difficult to coincide with the R-point because the manikin is too light, the manikin may be modified by scraping off the portion of the manikin which contacts with the seat.
- (c) "Reference position of design" means the position specified by the manufacturer of the vehicle; and if no position has been specified, it shall be the central position of adjustable region; and when the manikin cannot be fixed at the central position, it shall be the position which is the nearest to the center and is in the direction where the space with the manikin or the dummy becomes less.

6.2 Roof Strength Test

6.2.4 Test Method

(4) Test Procedure

- (d) Holding time of the load which has reached to the specified value shall aim to be 0.2 sec.

In the event of any doubt, the original standards in Japanese should be referred.

 : SECOND PHASED STANDARD

(The standard where customary units and converted values are given in brackets after specified values of SI units.)

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- (b) The beams of the pendulum shall have highly rigid structure. One ends of the beams shall rigidly be fitted to the striking plate symmetrically to the longitudinal center plane perpendicular to the front plane of the pendulum with a distance of 1000 mm or more, and the other ends shall be fitted to the axis of suspension so as to be able to rotate freely.

The distance between the axis of suspension and the center of the striking surface shall be 3500 mm or more.

- (c) The frame and axis of suspension to suspend the pendulum shall have rigid structure.

(2) Structure of Clash Test Facilities with Fixed Barrier

[refer to (c) of Attached Fig. 1]

- (a) The impact surface of the projection to be attached to the fixed barrier prescribed in JIS D 1060 (Frontal and Rear Vehicle Collision Test Procedure) shall be flat and highly rigid, and have the dimensions; 2500 mm or more in width, 800 mm in height; and be chamfered 1.5 ~ 5 mm at its edges.
- (b) The projection shall have sufficient depth from its impact surface so that a test vehicle will not hit against the barrier and the projection mounting portion on the occasion of the crash. However, a fixed barrier prescribed in JIS D 1060 may be available when the test vehicle has no contact with any portion outside the area prescribed in (a).
- (c) The impact surface and the under surface of the projection shall be set vertical and parallel individually to the horizontal ground surface.

6.1.5 Pendulum Impact Test Method

(1) Position and Direction of Striking

- (a) Relative vertical positioning of the striking surface of the pendulum and a test vehicle shall be equal to following conditions: The height of the center of striking surface shall be set so as to be 150 ± 10 mm below the R-point of the driving seat under unloaded state. When this set value exceeds 1400 mm above the ground, it shall be in the range of 1400 ± 90 mm. The inclination of the test vehicle in the longitudinal direction shall be equivalent to unloaded state.

- (b) As for the longitudinal location, the test vehicle shall be fixed at a position where the most front end of the test vehicle in the range of contact touches the striking surface of the pendulum, when the longitudinal center line of the striking surface of the pendulum is vertical. Then, longitudinal dislocation of the striking surface to perpendicularity shall be within ± 50 mm at the most front end of the test vehicle inside the range of contact.

- (c) Transverse dislocation between the longitudinal center plane of the test vehicle and the vertical center plane rectangular to the striking surface shall be within ± 50 mm.

- (d) Direction of impact shall be horizontal and parallel to the longitudinal center plane of the test vehicle.

(2) Fixing Method of Test Vehicle

Fixing method of test vehicles shall be pursuant to the Appendix.

(3) Striking Energy

Striking energy shall be classified by gross vehicle masses as shown in following Table.

As for a truck having gross mass 1000 kg or more and less than 4000 kg, the striking energy shall be decided in consideration of 29.4 kJ {3000 kgf·m}, the energy for the gross vehicle mass 4000 kg or more and less than 8000 kg.

Table Striking Energy

Gross Vehicle Mass	Striking energy (E)
8000 kg or more	44.1 kJ {4500 kgf·m}
4000 kg or more and less than 8000 kg	29.4 kJ {3000 kgf·m}

Note: Allowable error of the striking energy shall be $\pm 5\%$. But the allowable error may exceed $\pm 5\%$, if the performance shown in 4. is satisfied.

(4) Test Procedure

- (a) Put the test vehicle under the condition prescribed in 6.1.3.
- (b) Adjust the test vehicle so that the striking position and direction is kept as prescribed in (1).
- (c) Fix the test vehicle according to (2).
- (d) Let swing the pendulum so that the striking energy prescribed in (3) will be added to the test vehicle.

(5) Evaluating Method

(5.1) Containable Space of Cab for Manikin or Dummy

- (a) The driver's seat and its side-by-side seats shall be evaluated.
- (b) The manikin to be used for evaluation shall be selected among the manikin shown in Attached Fig. 2, and dummies of JM 50 and AM 50 percentile.