



R17 (Seat Strength) R25 (Head Restraints) Test Procedure

National Traffic Safety and Environment Laboratory

Feb.05. 2020



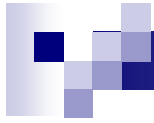
Test procedure for seats and seat anchorages (R17)

1. Passenger cars (for less than 10 persons)

- ① General requirements
- ② Seatback impact absorption test
- ③ Radii of curvature provisions for components
- ④ Seatback moment test
- ⑤ Head restraint moment test
- ⑥ Strength test (test of resistance to inertia effects or barrier test
- ⑦ Test for devices intended to protect the occupants against displacement of luggage

2. Bus, truck

- ① Installation method, confirmation of secure anchorage



Test procedure for head restraints (R17&R25)

Test items

- ① General requirements
- ② Head restraint impact absorption test
- ③ Radii of curvature provisions for components
- ④ Head restraint moment test
- ⑤ Dimension test





Test procedure for seats and seat anchorages (R17)

1. Passenger cars (for less than 10 persons)

① **General requirements**

- ② Seatback impact absorption test
- ③ Radii of curvature provisions for components
- ④ Seatback moment test
- ⑤ Head restraint moment test
- ⑥ Strength test (test of resistance to inertia effects or barrier test)
- ⑦ Test for devices intended to protect the occupants against displacement of luggage

2. Bus, truck

- ① Installation method, confirmation of secure anchorage



① General Requirements

1. Passenger cars (for less than 10 persons)

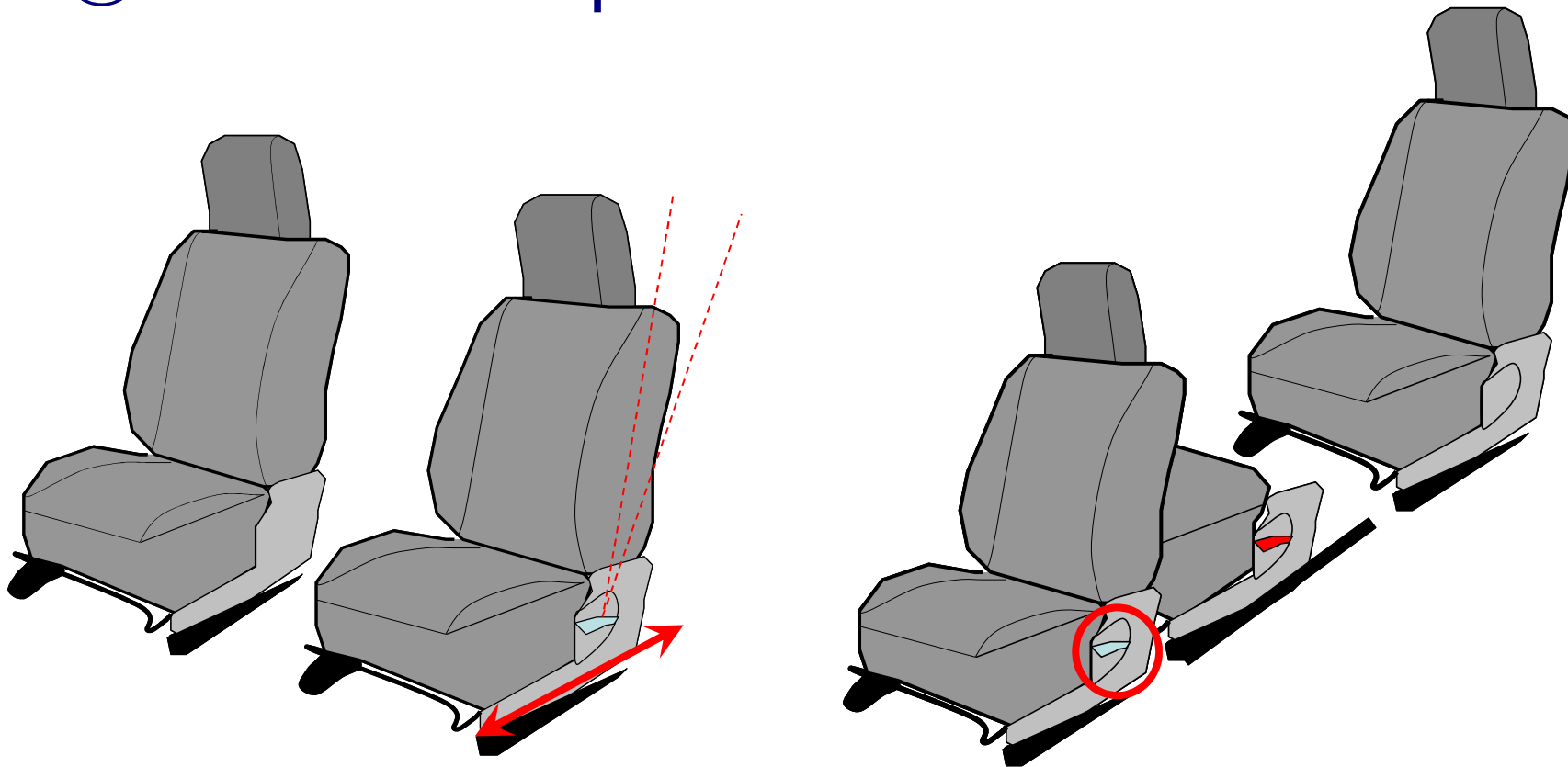
a. Requirement for locking mechanism

All adjustment and displacement systems provided shall incorporate a locking system which shall operate automatically.

b. Lock cancellation device of displacement system

- The device shall be placed on the outside of the seat close to the door.
- The device shall be easily accessible to the occupant of the seat immediately behind the seat concerned.

① General Requirements





① General Requirements

▪5.2.4

No sharp or rough edges likely to increase the danger of injuries of the occupants shall be present in all positions of use.

▪5.5.4

The head restraint shall be secured to the seat or to the vehicle structure in such a way that no rigid and dangerous parts project from the padding of the head restraint or from its attachment to the seatback as a result of the pressure exerted by the headform during the test.



Test procedure for seats and seat anchorages (R17)

1. Passenger cars (for less than 10 persons)

- ① General requirements
- ② **Seatback impact absorption test**
- ③ Radii of curvature provisions for components
- ④ Seatback moment test
- ⑤ Head restraint moment test
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- ⑦ Test for devices intended to protect the occupants against displacement of luggage

2. Bus, truck

- ① Installation method, confirmation of secure anchorage



Test procedure for head restraints (R17&R25)

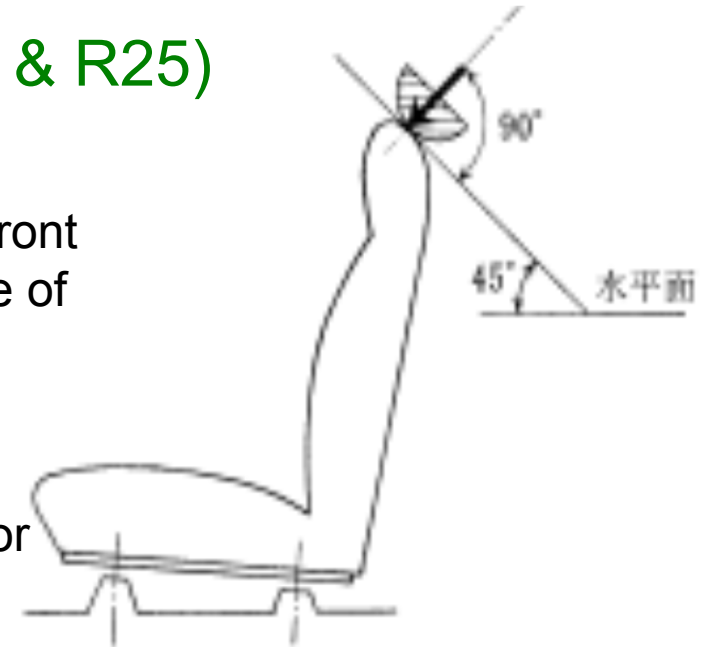
Test items

- ① General requirements
- ② **Head restraint impact absorption test**
- ③ Radii of curvature provisions for components
- ④ Head restraint moment test
- ⑤ Dimension test

② Impact absorption test (R17 & R25)

● Test Procedure for Seatbacks

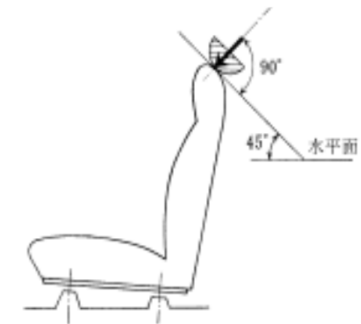
- The direction of impact from the rear towards the front shall be situated in a longitudinal plane at an angle of 45 degrees from the vertical using the pendulum method or longitudinal method
- The headform shall strike at a speed of 24.1km/h or more.
- The impact point shall be in area 1 or, if necessary in area 2, on surfaces exhibiting a radii of curvature less than 5mm.
- The surfaces of the rear parts of the seats to be checked are those situated in the defined areas which can be contacted by a 165mm diameter sphere when the seat is mounted in the vehicle.
- For area 1, the head restraint shall be placed in the most unfavorable position.



② Impact absorption test (R17 & R25)

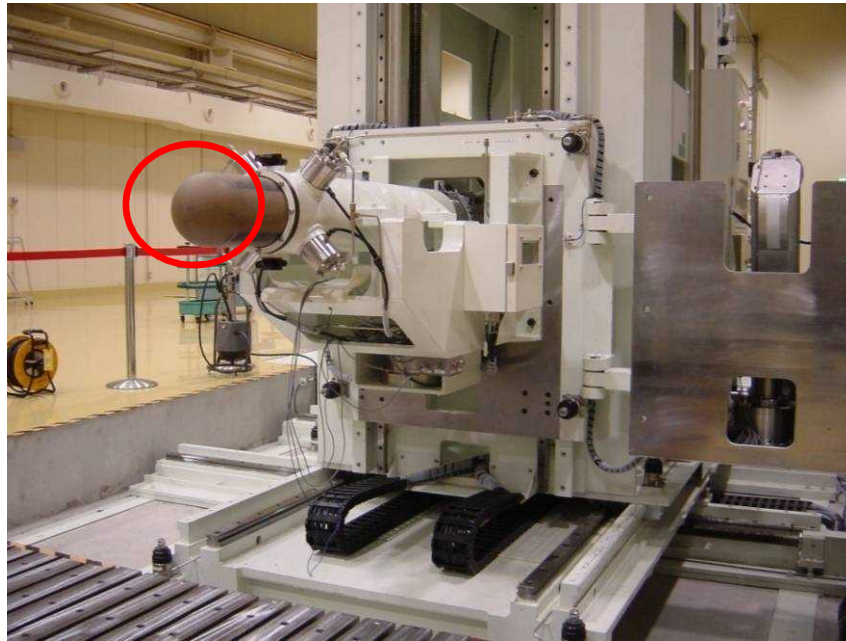
● Test Procedure for Head Restraint

- Impact point of the rear face: the direction of impact from the rear towards the front shall be in a longitudinal plane at an angle of 45° from the vertical using the pendulum method or longitudinal method.
- Impact point of the front face: the direction of impact from the front towards the rear shall be **horizontal in a longitudinal plane**.
- Apply impact at a speed over 24.1km/h using a headform.
- Impact area: between the longitudinal vertical planes, on either side of and 70mm from the longitudinal median plane.
- Test area: the head restraint situated above the plane perpendicular to the reference line 635mm from the R point.

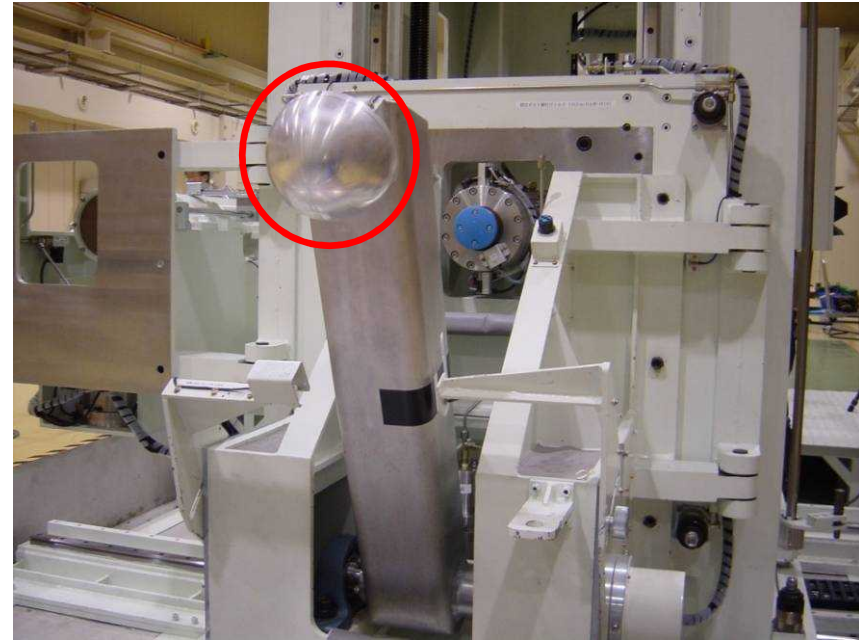


② Impact absorption test (R17 & R25)

● Impact Device



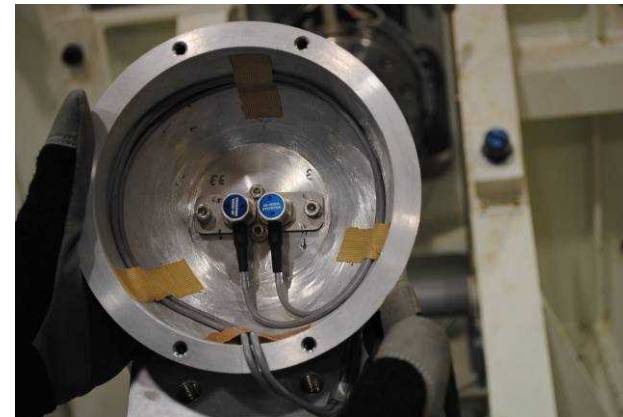
Longitudinal type



Pendulum type

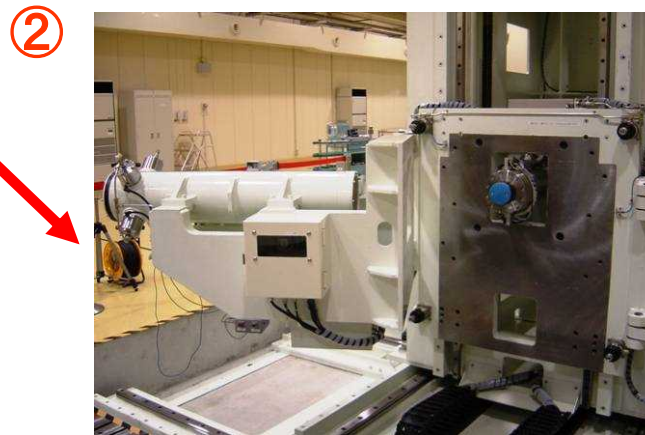
② Impact absorption test (R17 & R25)

- The position of accelerometers



② Impact absorption test (R17 & R25)

- Longitudinal Type & Pendulum Type Combined



② Impact absorption test (R17 & R25)

● Impact Absorption Test for Rear Face

(Pendulum type)

The performance when the back seat passenger's head strikes the front seat is evaluated.

Impact speed:

24.1km/h or more

Direction:

45° inclination

Front seat

165mm diameter
headform



② Impact absorption test (R17 & R25)

● Impact Absorption Test for Rear Face (Pendulum type)

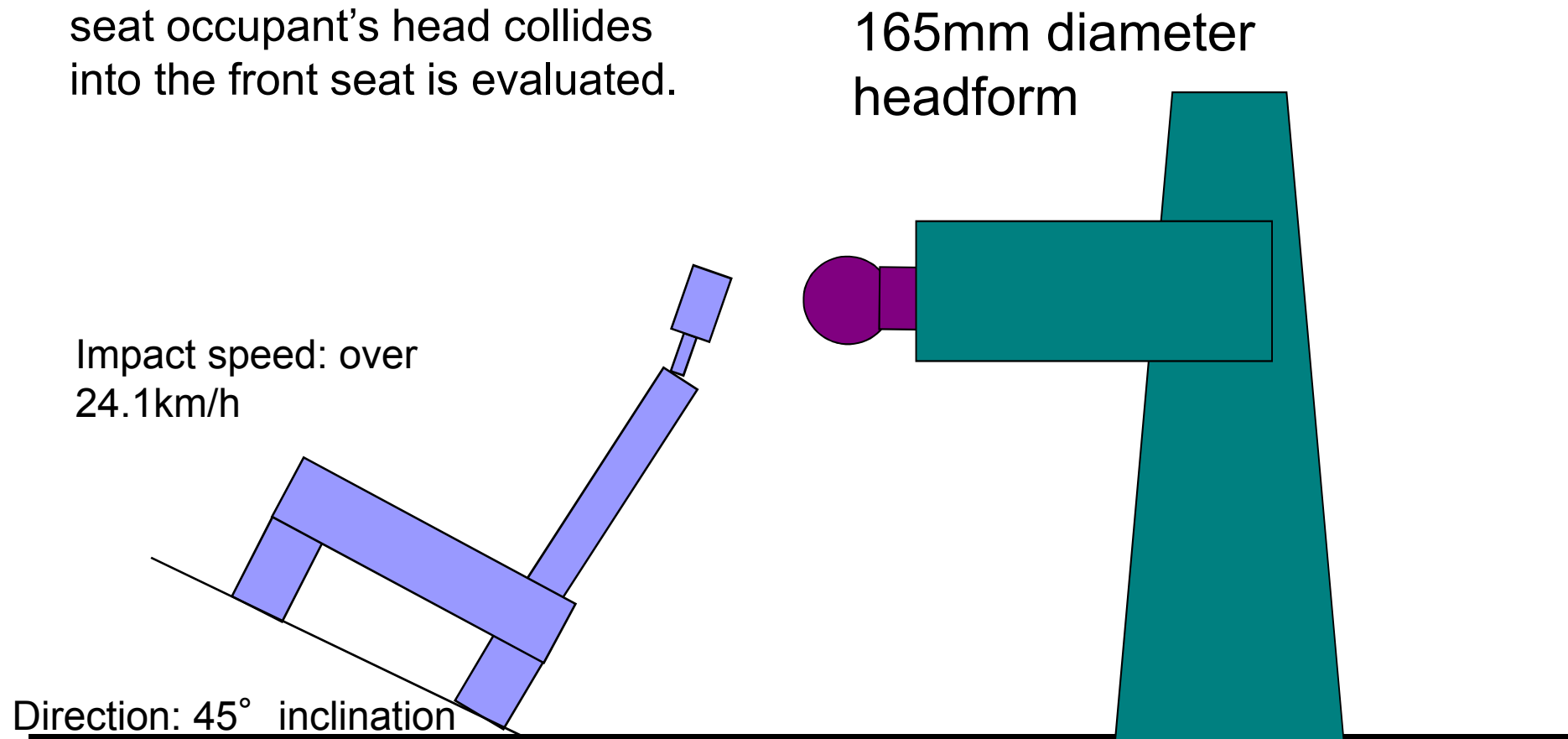


Pendulum type test

② Impact absorption test (R17 & R25)

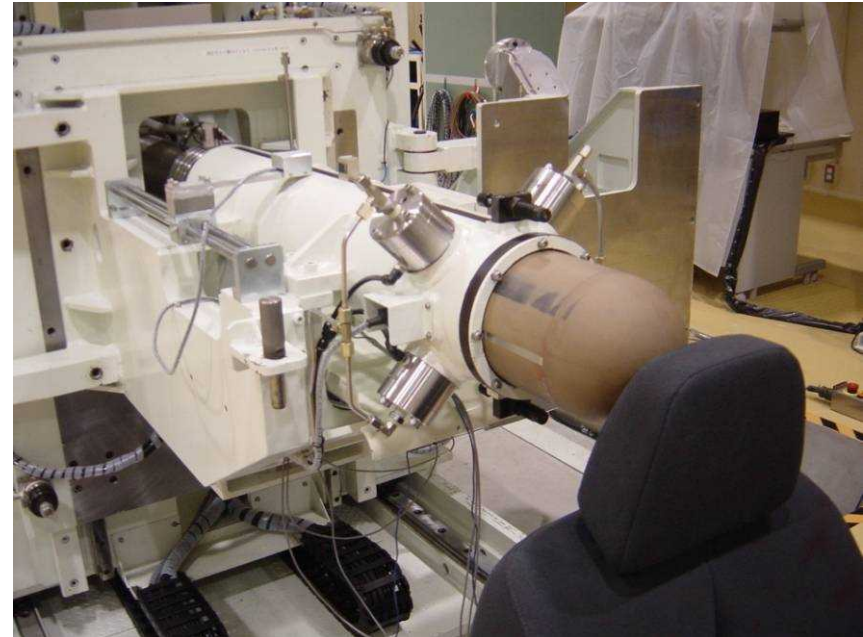
● Impact Absorption Test for Rear Face (longitudinal type)

The performance when the rear seat occupant's head collides into the front seat is evaluated.



② Impact absorption test (R17 & R25)

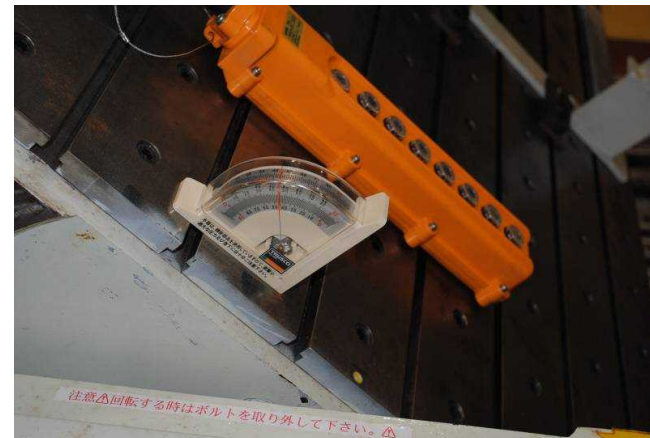
● Impact Absorption Test for Rear Face (longitudinal type)



Longitudinal type test

② Impact absorption test (R17 & R25)

● Impact Absorption Test for Rear Face (longitudinal type)

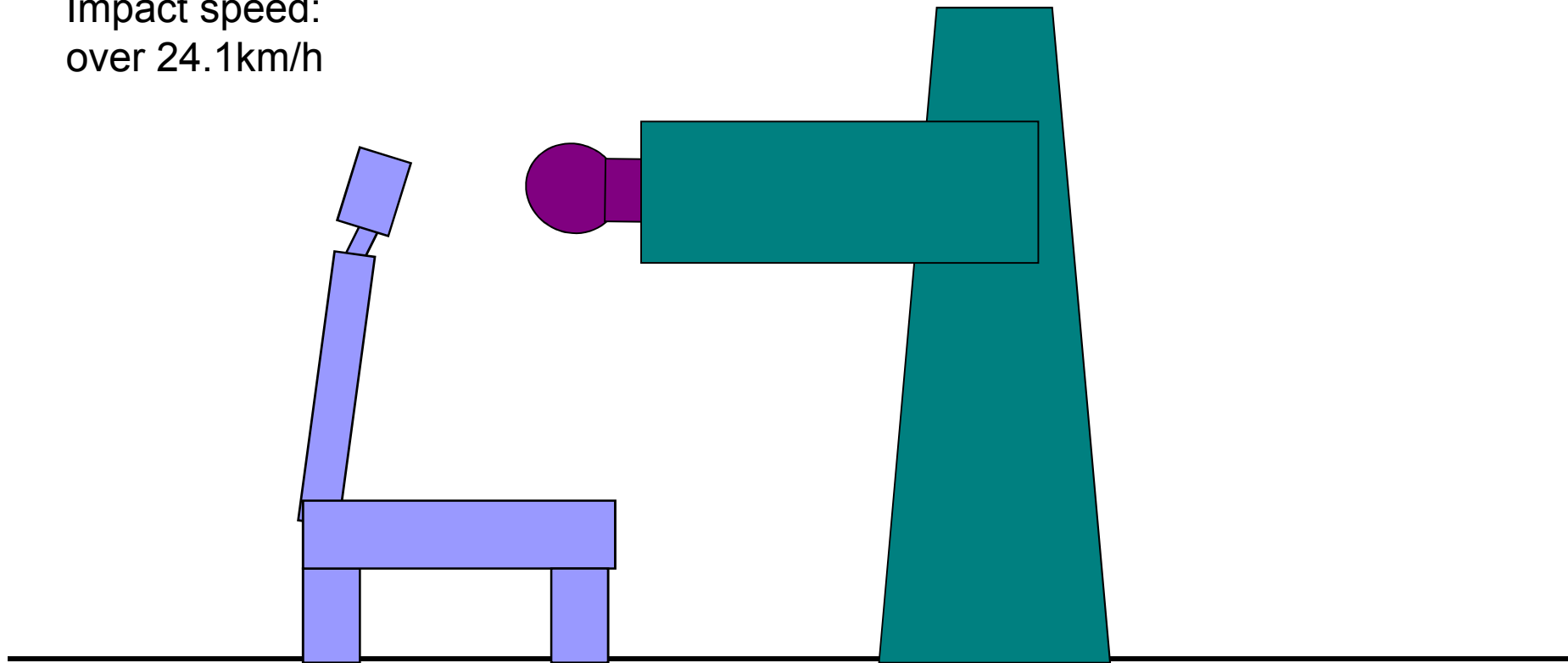


② Impact absorption test (R17 & R25)

● Head Restraint Impact Absorption Test for front face (Longitudinal type)

165mm diameter headform

Impact speed:
over 24.1km/h



② Impact absorption test (R17 & R25)

● Test setting conditions

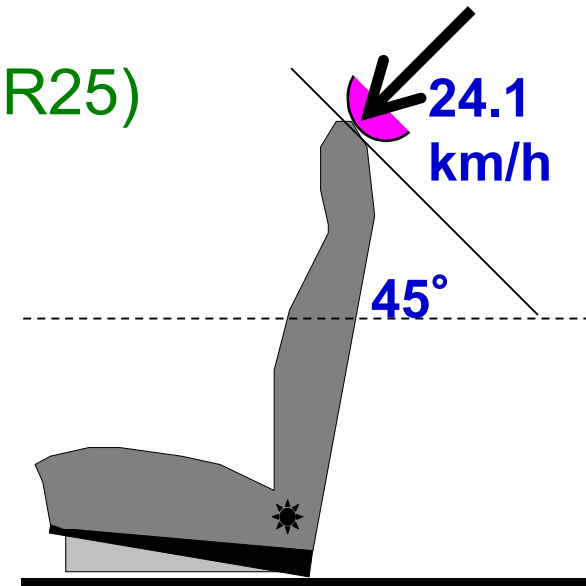
Common requirements

- The seatbacks, if adjustable, shall be set in a position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- The seatbacks, if adjustable, shall be locked in a position as close to 25 degrees backward from the vertical line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- Tests for seats with adjustable head restraints shall be conducted with the head restraints placed in the most unfavorable position (generally, the highest position) .
- The seats shall be secured to the test bench.
Seats with head restraints shall be mounted on the seatback.

② Impact absorption test (R17 & R25)

● Judgment Criteria

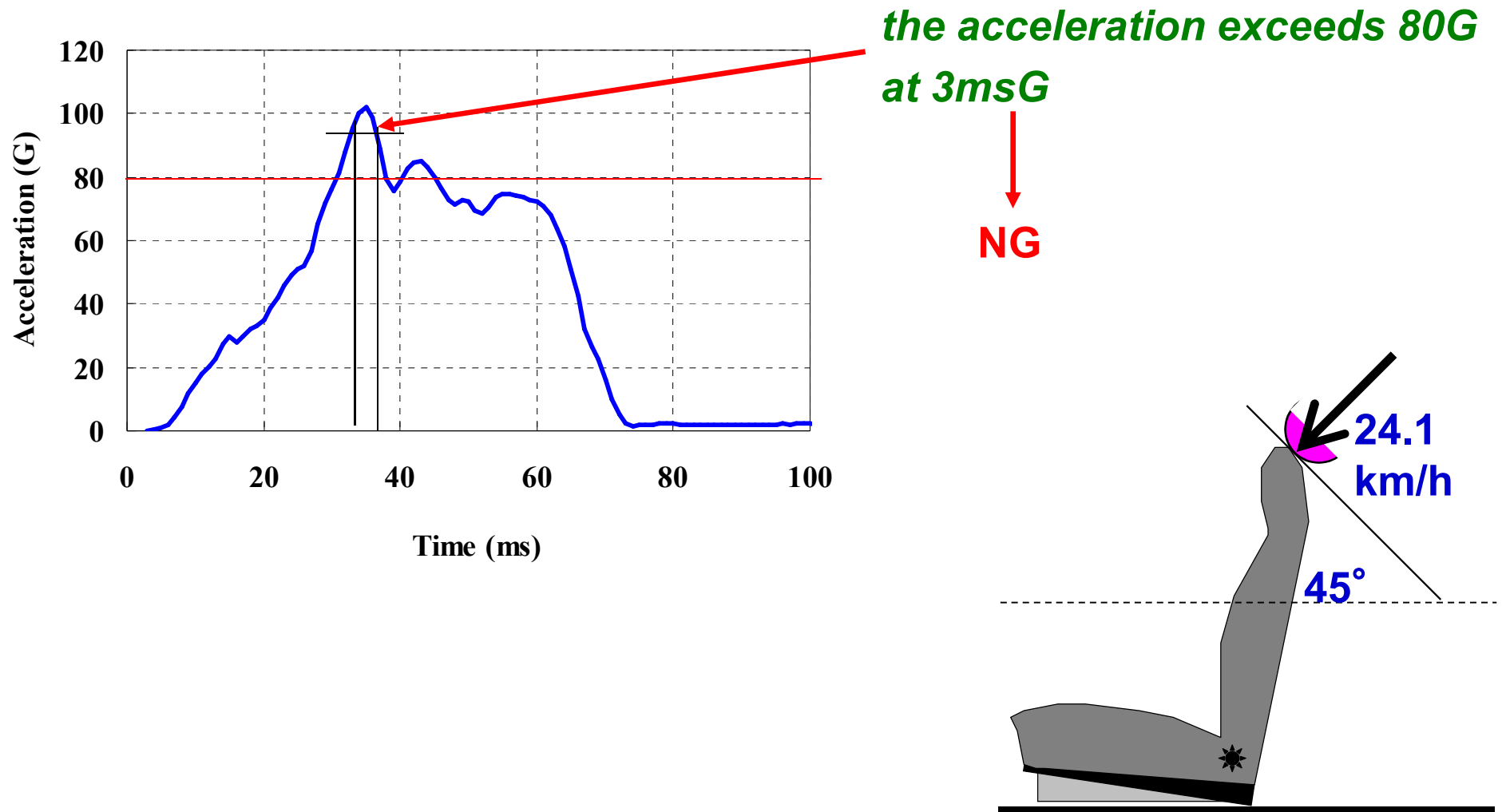
- The deceleration of the headform does not exceed 80G(=784m/s²) continuously for more than 3ms.
- No dangerous edge shall occur during or remain after the test.
- The deceleration rate shall be taken as the average of the readings on the two decelerometers.



Common requirements

- After the tests, the displacement systems intended for permitting the access of occupants must be in working order.
- The system must be capable of being unlocked at least once.
- The displacement of the seat or the part of the seat for which they are intended must be permitted.
- Other displacement systems, including adjustment systems and the locking mechanism are not required to be in working order.

② Impact absorption test (R17 & R25)





Test procedure for seats and seat anchorages (R17)

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2. Bus, truck

- ① Installation method, confirmation of secure anchorage



Test procedure for head restraints (R17&R25)

Test items

- ① General requirements
- ② Head restraint impact absorption test
- ③ Radii of curvature provisions for components**
- ④ Head restraint moment test
- ⑤ Dimension test

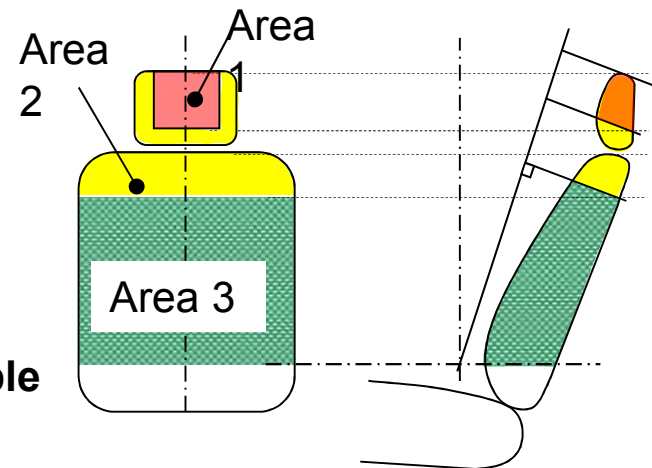
③ Radii of Curvature Provisions for Components

● Test setting conditions

- When there are parts covered with material softer than 50 Shore A hardness in the respective areas, the R requirement shall apply only to the rigid parts.

Common requirements

- The seatbacks, if adjustable, shall be set to the position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraints placed in the most unfavorable position (generally, the highest position) .



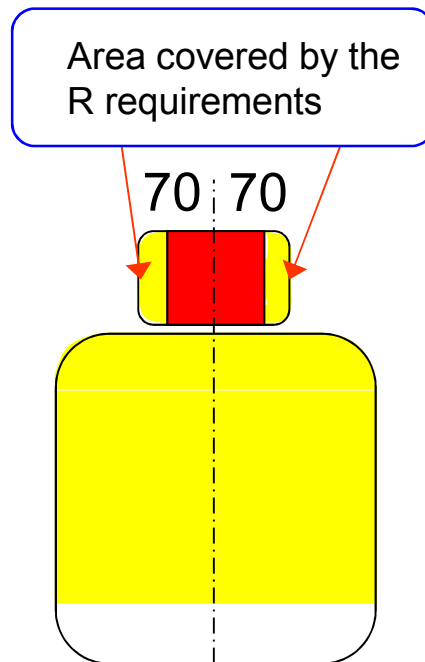
③ Radii of Curvature Provisions for Components

	With HR	HR integral seatback
Separate	<p>Outer side 70 70</p> <p>635</p> <p>100</p> <p>SRP</p> <p>Torso line</p>	<p>Outer side 100 100</p> <p>100</p> <p>635</p> <p>SRP</p> <p>Torso line</p>
Bench	<p>Outer side 70 70</p> <p>635</p> <p>100</p> <p>SRP</p> <p>Torso line</p>	<p>Outer side 100 100</p> <p>100</p> <p>635</p> <p>SRP</p> <p>Torso line</p>

③ Radii of Curvature Provisions for Components

- If the areas contain parts covered with material softer than 50 Shore A hardness, the R requirement applies to the rigid parts.

● Test setting condition

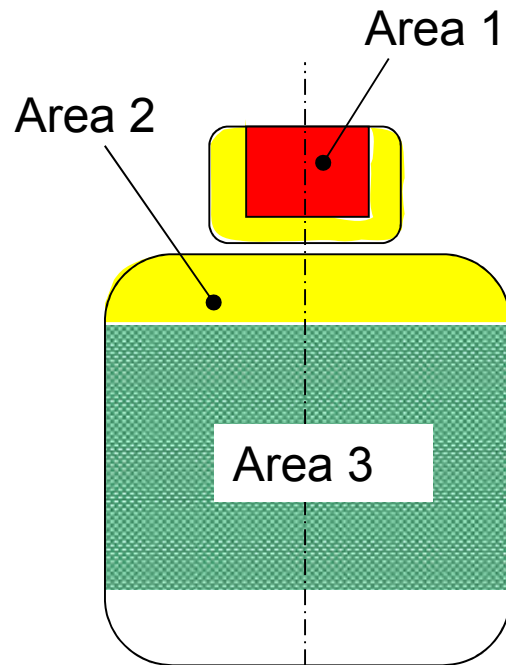


- The impact area shall be on the outer side of the vertical planes, on either side of and 70mm from the longitudinal median plane.
- The seatbacks, if adjustable, shall be locked in a position as close to 25 degrees backward from the vertical line of the manikin.

③ Radii of Curvature Provisions for Components

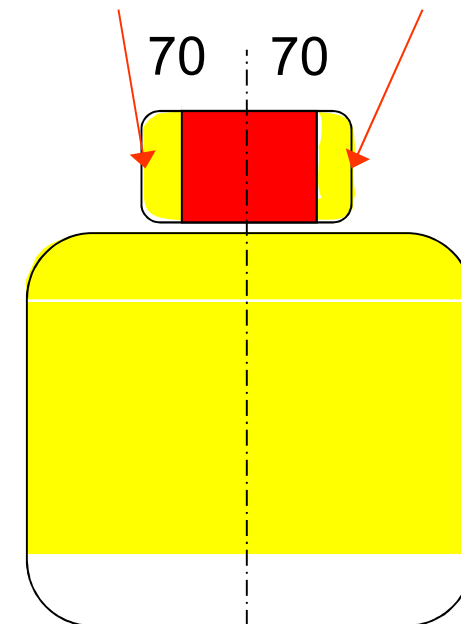
● Test Method

Area covered by R requirements



R17

Area covered by R requirements

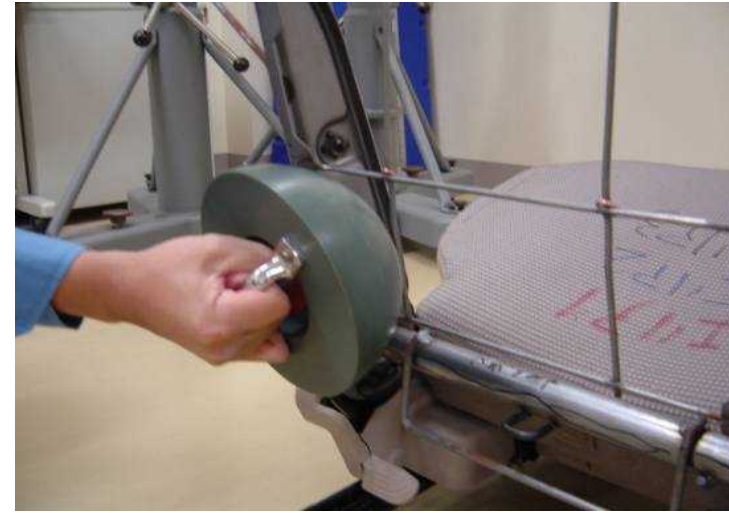


R25

③ Radii of Curvature Provisions for Components



③ Radii of Curvature Provisions for Components





③ Radii of Curvature Provisions for Components

● Judgment criteria (R17)

Specified value of radii of curvature

The surface of the rear parts of seats shall exhibit the following radii of curvature: Area 1: not less than 2.5mm

Area 2: not less than 5.0mm

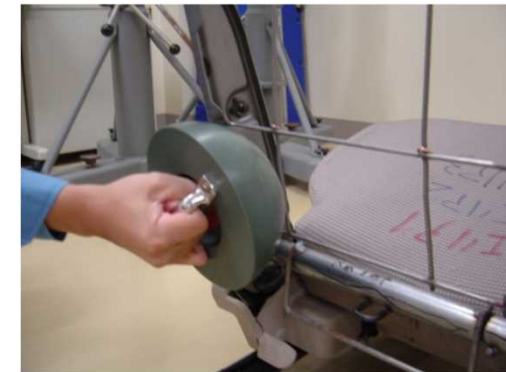
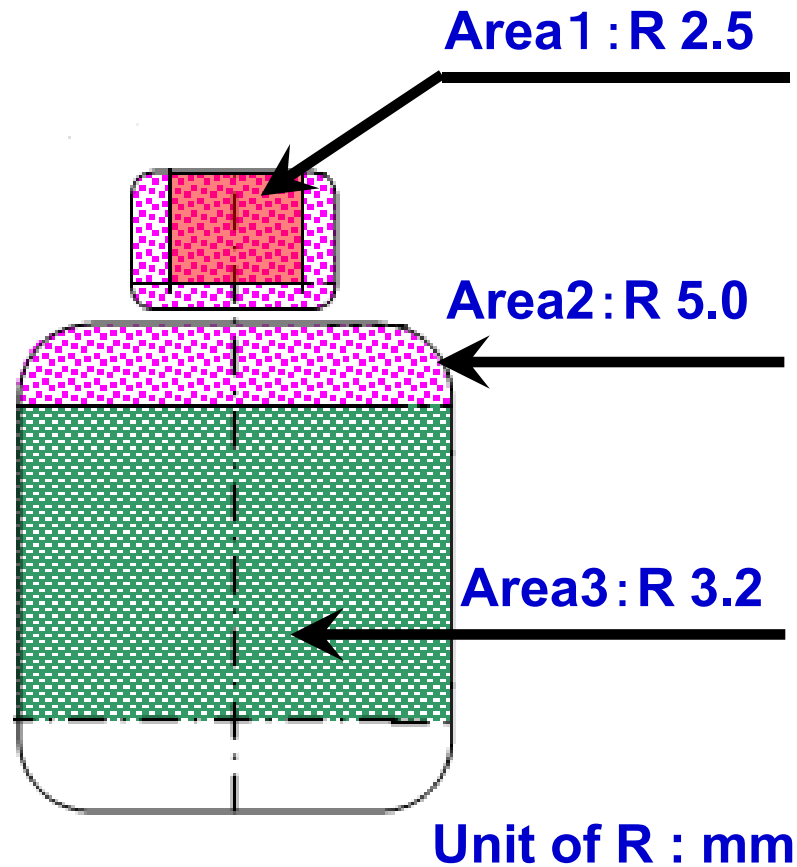
(If the radii of curvature is more than 2.5mm and less than 5.0mm, the requirements are deemed to be met when conforming to the impact absorption test)

Area 3: not less than 3.2mm

● Judgment criteria (R25)

- It shall exhibit radii of curvature not less than 5.0mm within an area contacted by a 165mm diameter sphere.

③ Radii of Curvature Provisions for Components





Test procedure for seats and seat anchorages (R17)

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- ⑦ Test for devices intended to protect the occupants against displacement of luggage

2. Bus, truck

- ① Installation method, confirmation of secure anchorage

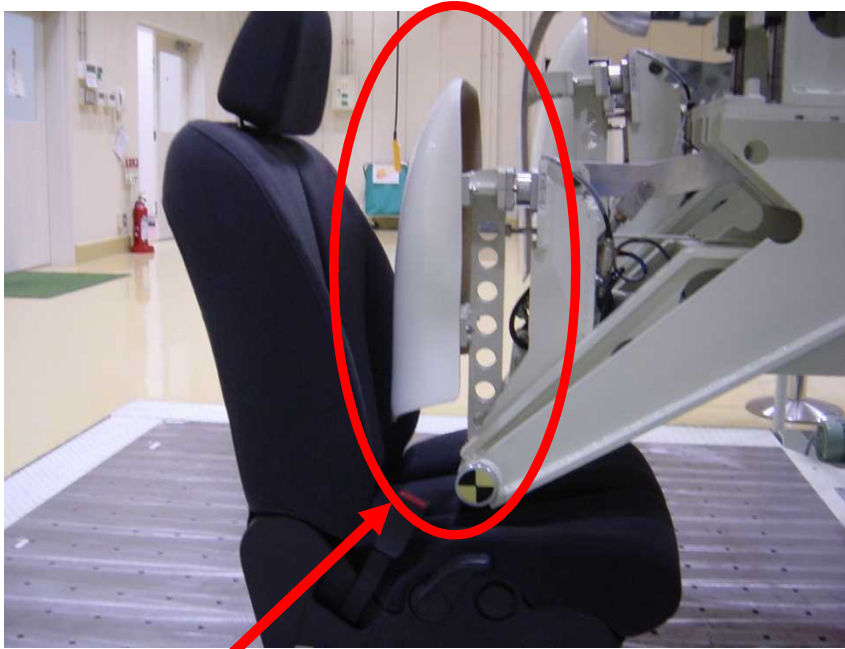


④ Seatback moment test

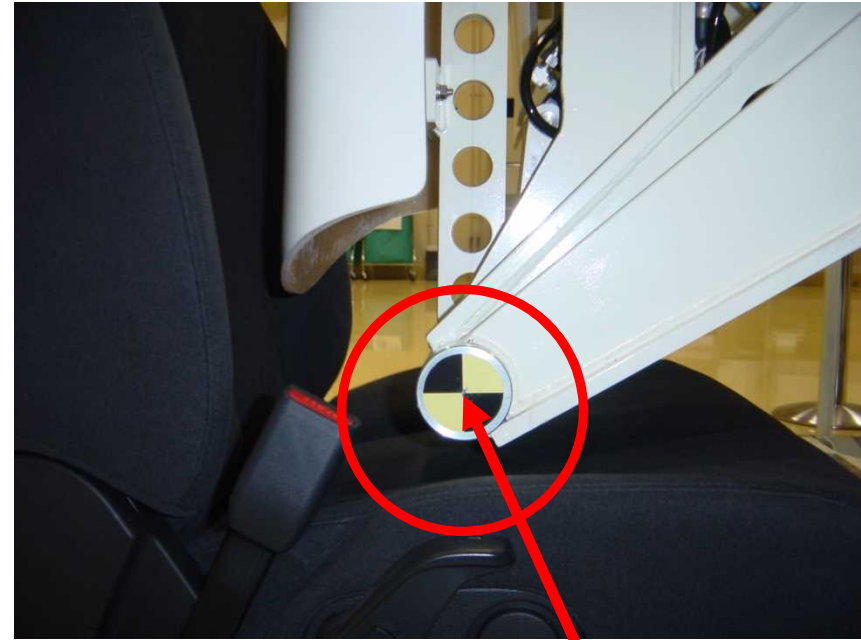
● Test Method

- Apply a force producing a moment of 530Nm in relation to the R point longitudinally and rearwards to the upper part of the seatback frame through a component simulating the back of the manikin (back pan).
- If the supporting frame is common to more than one seating position (bench seat), apply the test load simultaneously for all those seating positions.

④ Seatback moment test



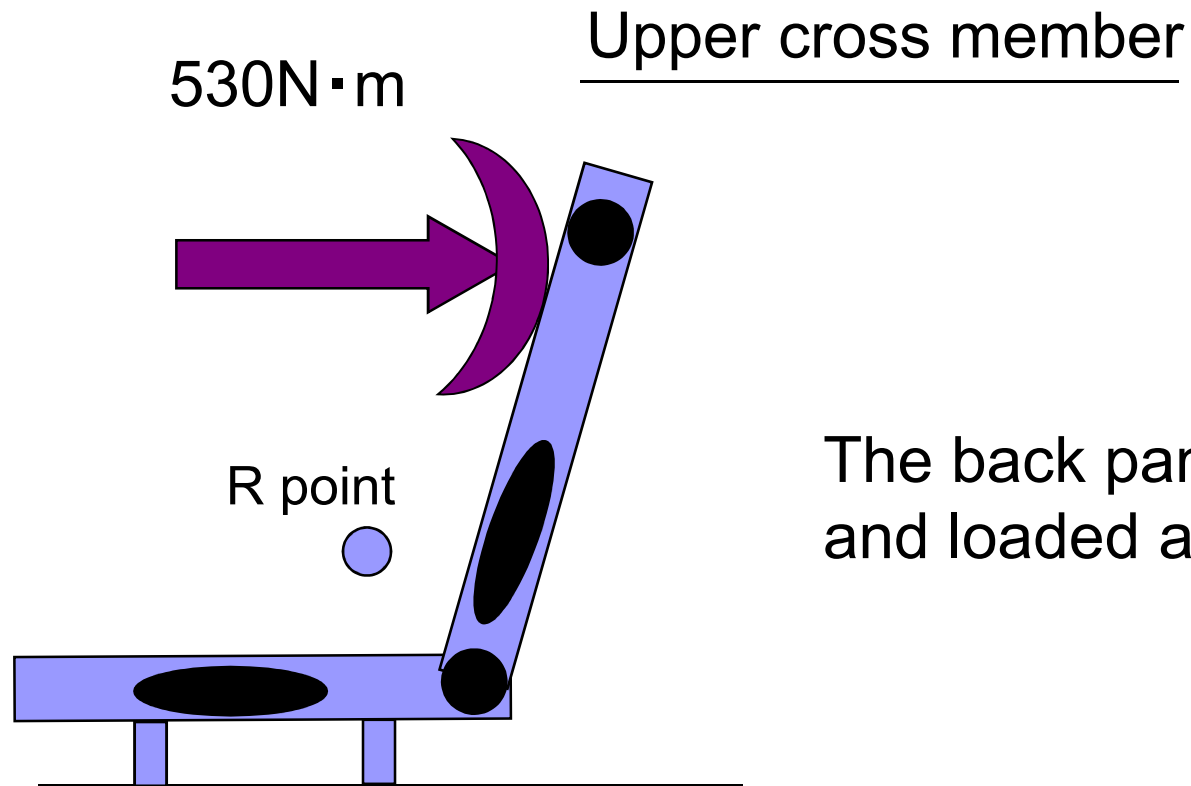
Back pan



The point of R

Load applied by back pan

④ Seatback moment test



The back pan may be rotated and loaded around the R point.

④ Seatback moment test

1. Passenger cars (for less than 10 persons)

● Test setting condition

- The supporting point of the back pan is adjusted to the R point.

Common requirements

- The seatbacks, if adjustable, shall be set to the position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraints placed in the most unfavorable position (generally, the highest position)



④ Seatback moment test

● Judgment Criteria

- No failure shall be shown in the seat frame or in the seat anchorage, the adjustment and displacement systems or their locking devices.
- A test shall be carried out in the case of seats with more places to sit than head restraints,
- The requirements are deemed to be met when conforming to the head restraint moment test.

Common requirements

- After the tests, the displacement systems intended for permitting the access of occupants must be in working order.
- The system must be capable of being unlocked at least once.
- The displacement of the seat or the part of the seat for which they are intended must be permitted.
- Other displacement systems, including adjustment systems and the locking mechanism are not required to be in working order.

④ Seatback moment test





Test procedure for seats and seat anchorages (R17)

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2. Bus, truck

- ① Installation method, confirmation of secure anchorage



Test procedure for head restraints (R17&R25)

Test items

- ① General requirements
- ② Head restraint impact absorption test
- ③ Radii of curvature provisions for components
- ④ Head restraint moment test**
- ⑤ Dimension test

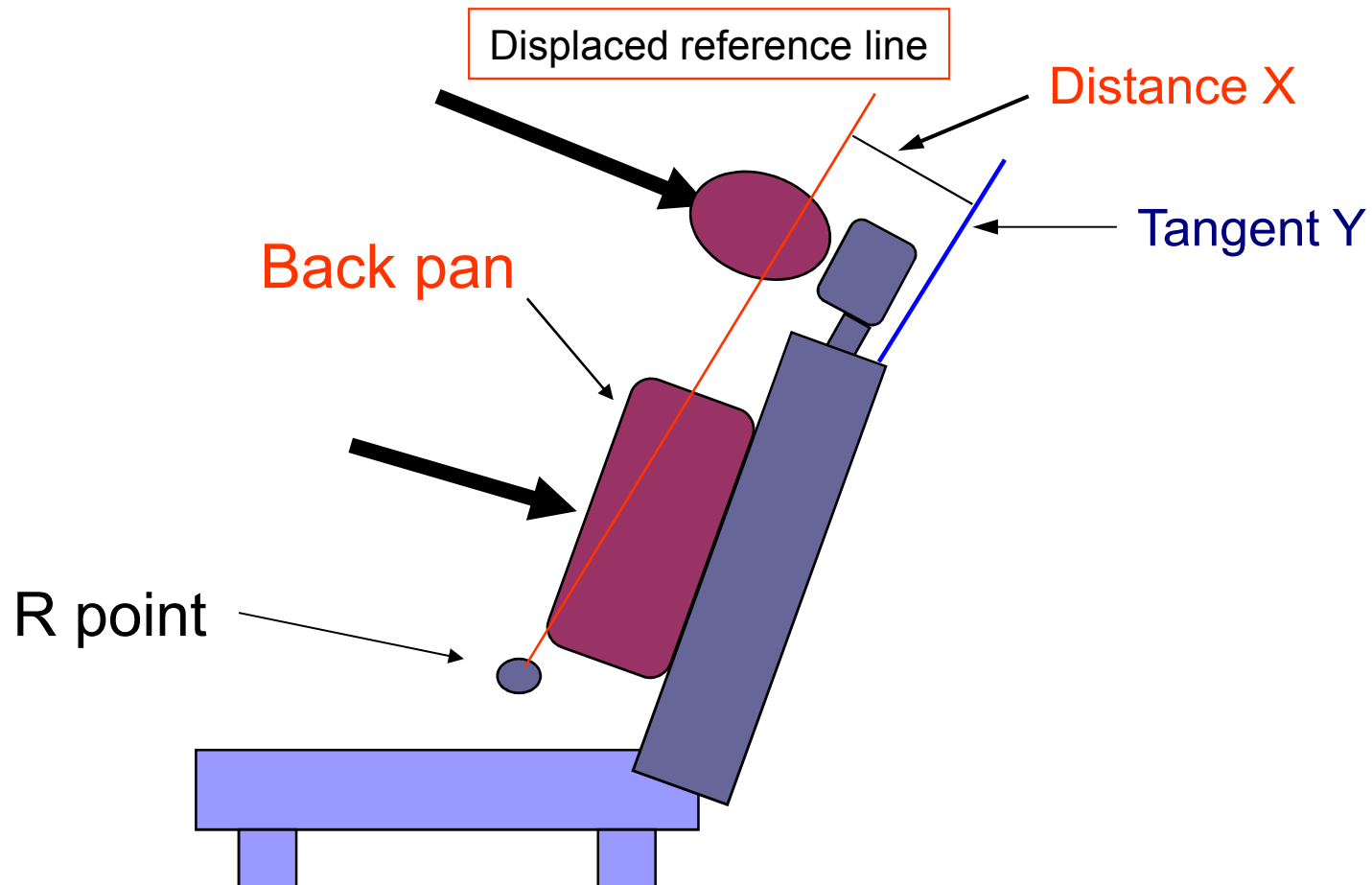


⑤ Head restraint moment test

● Test method (R17&25)

- ① Apply a force producing a moment of 373Nm in relation to the R point rearwards through a component simulating the back of a manikin (back pan), and determine the displaced torso line.
- ② Apply a force producing a moment of 373Nm in relation to the R point by means of a 165mm diameter sphere at right angles to the displaced torso reference line at a distance of 65mm below the top of the head restraint.
- ③ Determine The tangent Y to the spherical headform, parallel to the corrected torso reference line.
- ④ Determine The distance X between tangent Y and the displaced reference line.
- ⑤ If there is no breakage of seats or seatbacks, increase the force applied to the headform to 890N.

⑤ Head restraint moment test



⑤ Head restraint moment test

①



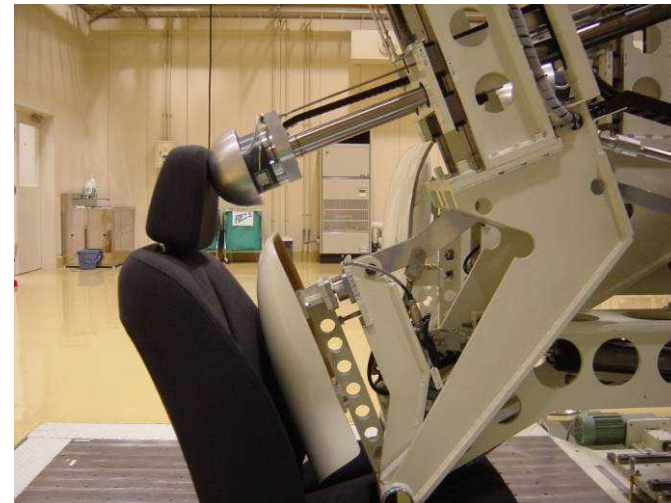
③



②



④



⑤ Head restraint moment test

⑤





⑤ Head restraint moment test

1. Passenger cars (for less than 10 persons)

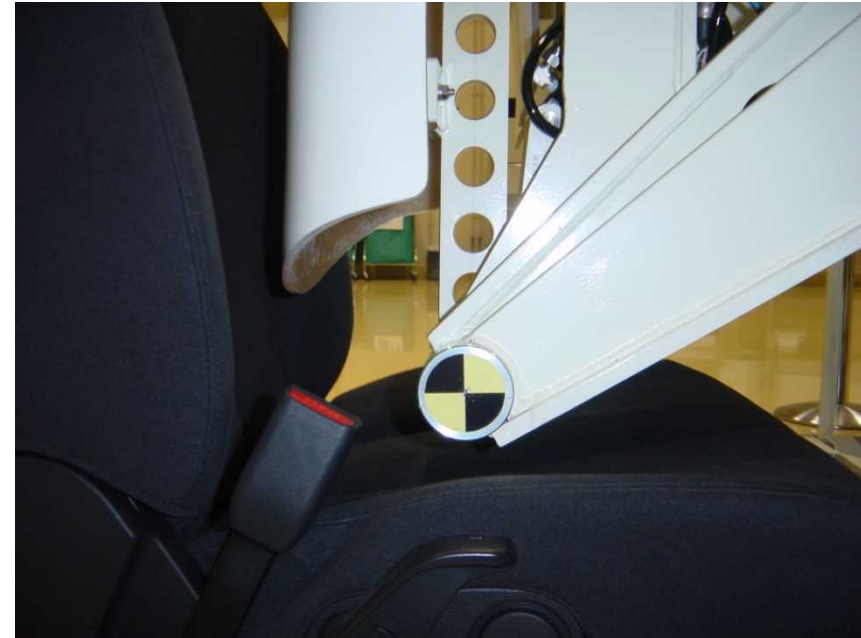
● Test setting conditions

- The supporting point of the back pan is adjusted to the R point.

Common requirements

- The seatbacks, if adjustable, shall be set to the position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraint placed in the most unfavorable position (generally, the highest position)

⑤ Head restraint moment test





⑤ Head restraint moment test

● Test setting conditions

- The seatbacks, if adjustable, shall be locked in a position as close to 25 degrees backward from the vertical line of the manikin.
- The measurement line shall be drawn in the vertical median plane of the seat concerned.
- The projection of the reference line shall be within the plane drawn in the vertical median plane of the seat.
- Force shall be applied around the R point and a position situated 65mm below the top.

⑤ Head restraint moment test

● Judgment Criteria

- After the 890N load test, no breakage of the seats or seatbacks shall occur.
- No failure shall be shown in the seat frame or in the seat anchorage, the adjustment and displacement systems or their locking devices.
- In the case of bench seats with more places to sit than head restraints, a seatback moment test shall be carried out.

Common requirements

- After the tests, the displacement systems intended for permitting the access of occupants must be in working order.
- The system must be capable of being unlocked at least once.
- The displacement of the seat or the part of the seat for which they are intended must be permitted.
- Other displacement systems, including adjustment systems and the locking mechanism are not required to be in working order.



⑤ Head restraint moment test

● Judgment Criteria

- After the test, the maximum backward displacement of the head permitted by the head restraint shall be less than 102mm.
- No breakage shall occur when a force of 890N is applied to a position 65mm below the top.
- The requirement is deemed to be met if the distance X is less than 102mm.



Test procedure for seats and seat anchorages (R17)

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2. Bus, truck

- ① Installation method, confirmation of secure anchorage

⑥ Strength test

(test of resistance to inertia effects or barrier test)

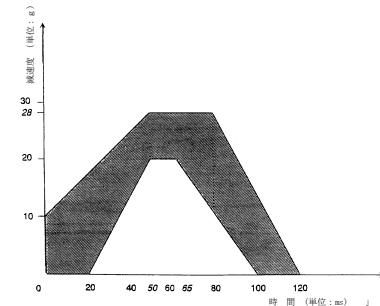
1. Passenger cars (for less than 10 persons)

● Test method

1, Test of resistance to inertia effects

1-1, A longitudinal horizontal deceleration of over 20G shall be applied for 30 ms in the forward and rearward direction to the whole vehicle.

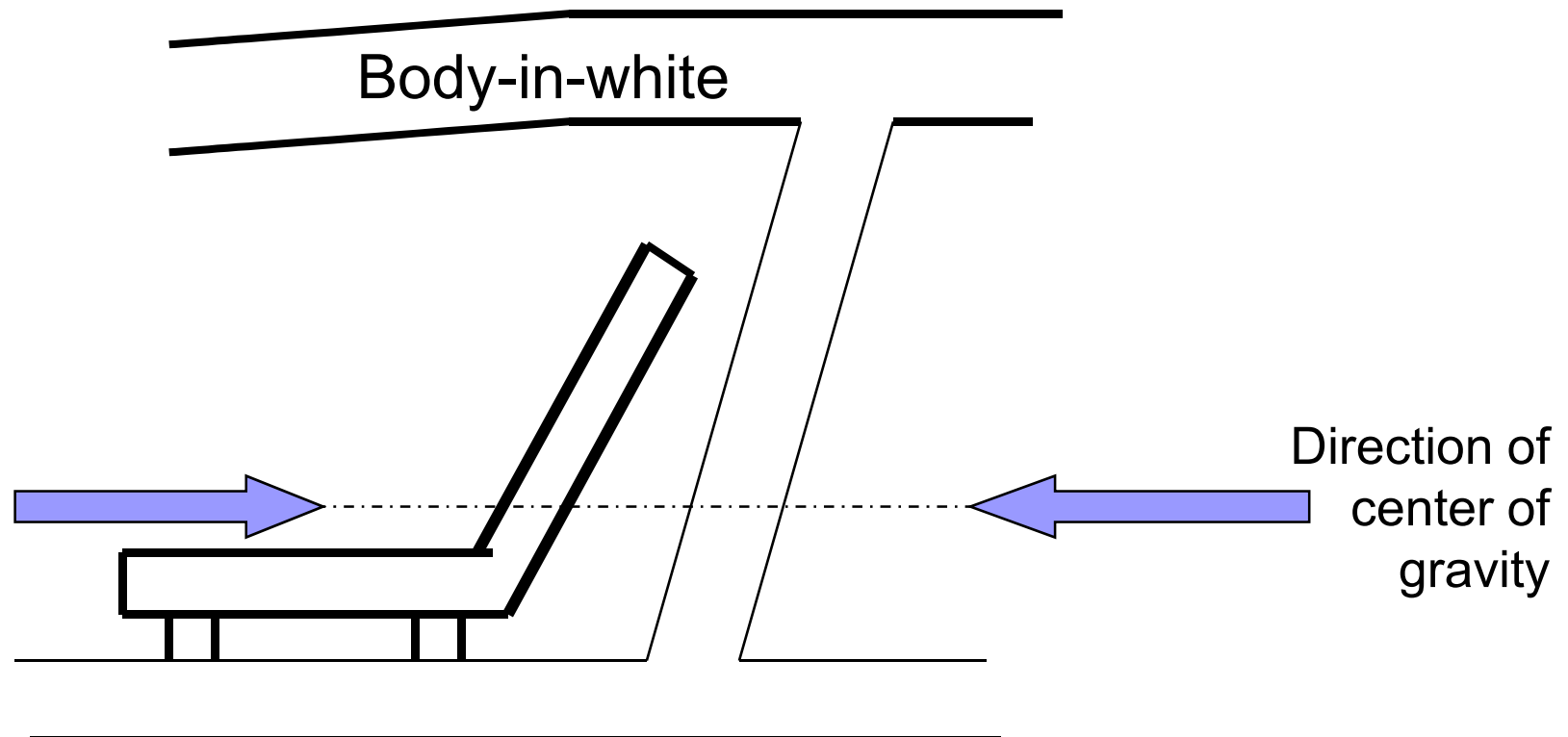
1-2, This can be substituted by a temporal waveform.



2, Barrier collision test

- The barrier shall consist of a reinforced concrete block not less than 3m width, not less than 1.5m high and not less than 0.6m thick
- It shall be covered with plywood boards 19 ± 1 mm thick.
- Speed on impact: between 48.3 km/h and 53.1 km/h
- Misalignment from collision: ± 30 cm

⑥ Strength test (test of resistance to inertia effects or barrier test)



Accelerate the vehicle in the longitudinal direction using a sled
“for 30 milliseconds at 20G” or “along the corridor.”
It can also be a collision test using an actual vehicle.

⑥ Strength test (test of resistance to inertia effects or barrier test)



Test seat mounted on the vehicle structure

⑥ Strength test (test of resistance to inertia effects or barrier test)



Launching piston

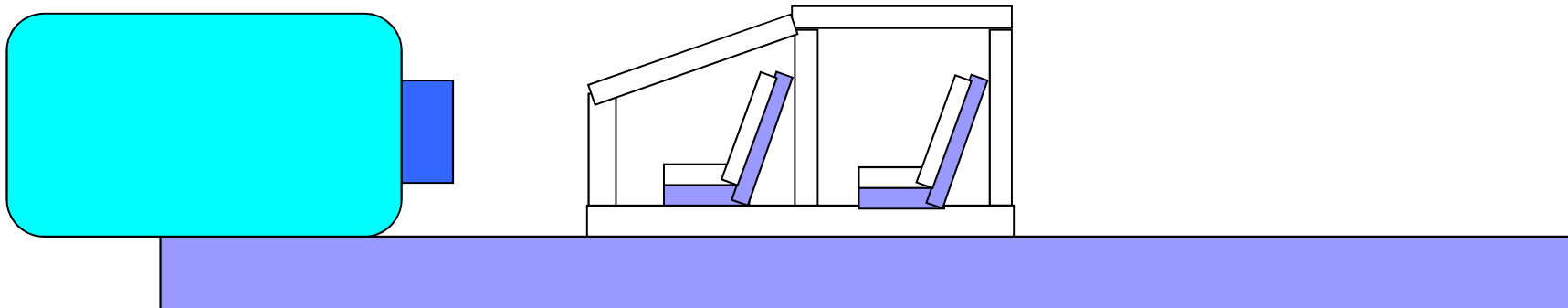
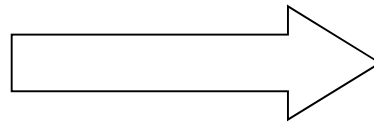


trolley



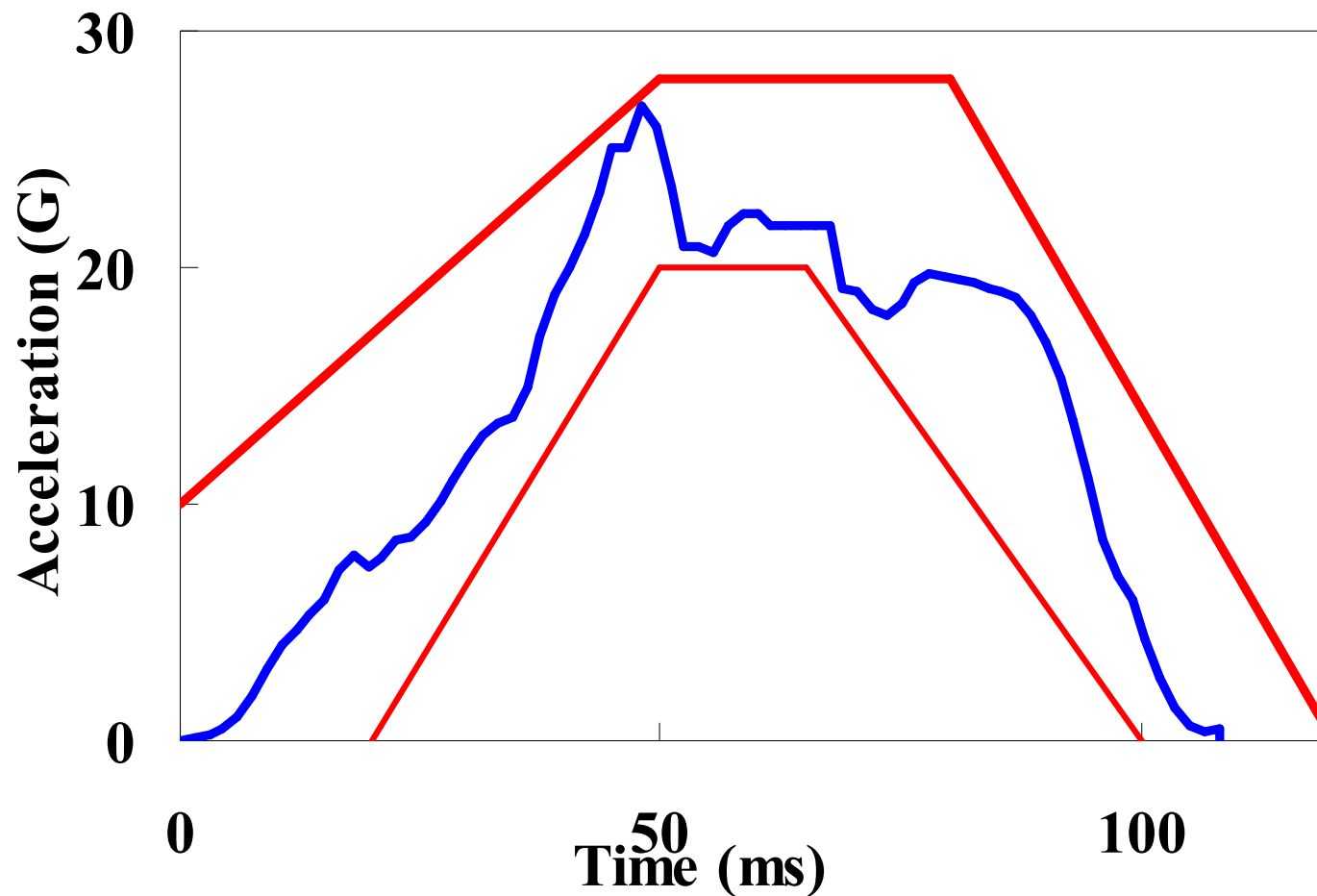
⑥ Strength test (test of resistance to inertia effects or barrier test)

Over 20G for
30 milliseconds



Sled

⑥ Strength test (test of resistance to inertia effects or barrier test)





⑥ Strength test

(test of resistance to inertia effects or barrier test)

1. Passenger vehicle car (for less than 10 persons)

● Test setting conditions

Adjustment position: The test shall be conducted in the below adjustment position or in the most unfavorable position.

Longitudinal direction -one notch or 10mm rearward of the most forward position

-one notch or 10mm forward of the most rearward position

Common requirements

- The seatbacks, if adjustable, shall be set to the position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraints placed in the most unfavorable position (generally, the highest position).



⑥ Strength test

(test of resistance to inertia effects or barrier test)

● Judgment Criteria

- No failure shall be shown in the seat frame or in the seat anchorage, the adjustment and displacement systems or their locking devices. Permanent deformations or ruptures may be accepted if they do not increase the risk of injury in the event of collision and the prescribed loads were sustained.
- The locking mechanism must not be unlocked.
- All seat positions shall meet the requirements.

requirements

Common

- After the tests, the displacement systems intended for permitting the access of occupants must be in working order.
- The systems must be capable of being unlocked at least once.
- The displacement of the seat or the part of the seat for which they are intended must be permitted.
- Other displacement systems, including adjustment systems and the locking mechanism are not required to be in working order.



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2. Bus, truck

- ① Installation method, confirmation of secure anchorage



⑦ Test for devices intended to protect the occupants against displacement of luggage

● Test Method

Acceleration in the waveform in Annex 5 - Appendix is applied from the forward to rearward direction.

Speed: 50+0, -2km/h

(a) Seatback test

Test block: Type 1

Place the test block on the floor on both sides, 200mm rearward from the seatback, at a distance 25mm from the vehicle center.

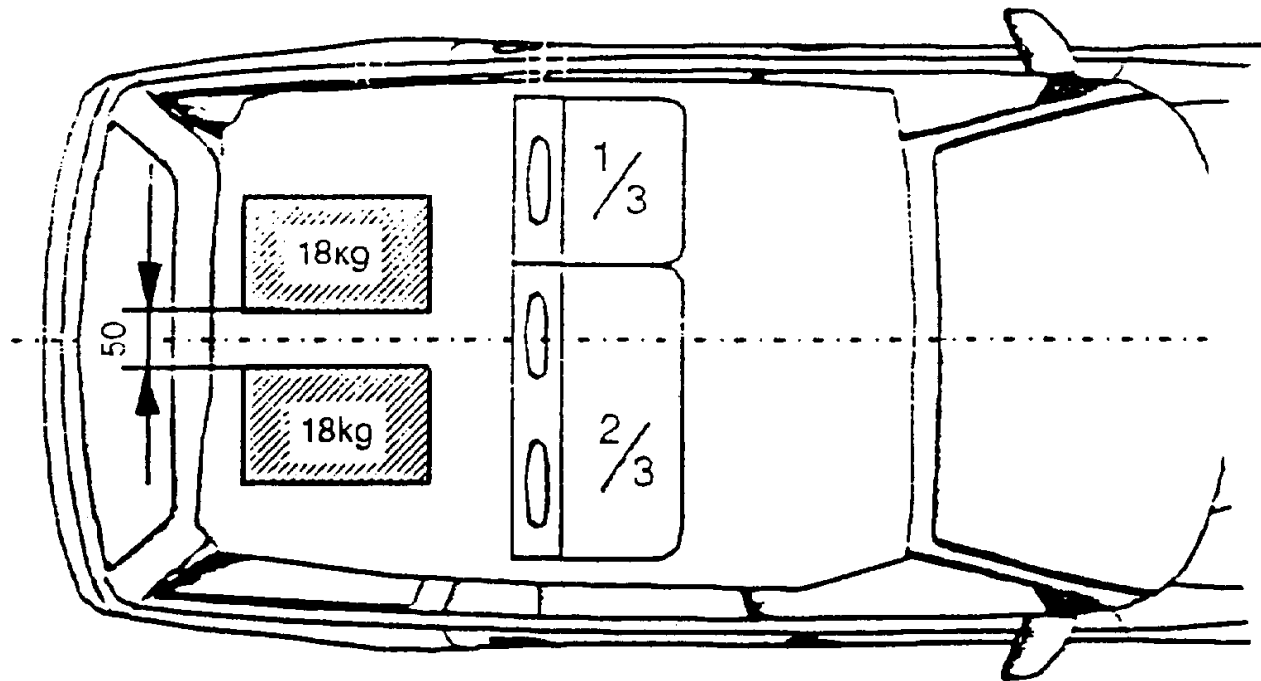
If it passes between the gap between the seats, place it behind the seat.

When it cannot be mounted, adjust the seat and place as far as possible from the seatback.

If the rearmost row of seats is removable, or can be folded down in vehicles with more than 2 rows of seats, the seat row immediately in front of this rearmost row shall also be tested.

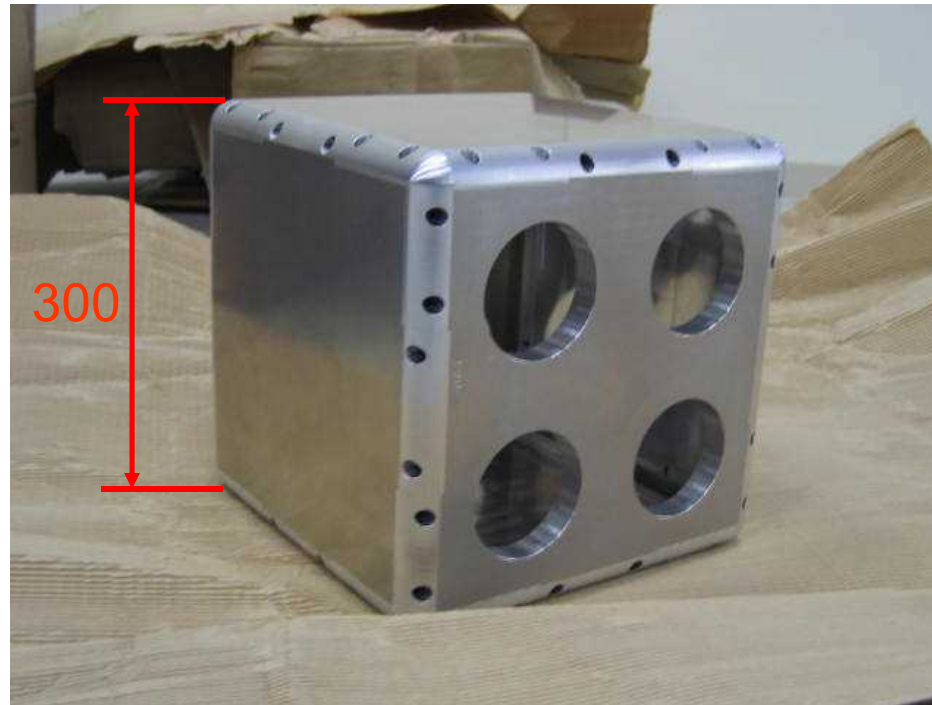
If the design is similar to the rearmost row, and the test block can be kept at a distance of 200mm when testing the rearmost row, the test can be omitted.

⑦ Test for devices intended to protect the occupants against displacement of luggage



Position of test block prior to the rear seatback test

⑦ Test for devices intended to protect the occupants against displacement of luggage



Test Block Type 1

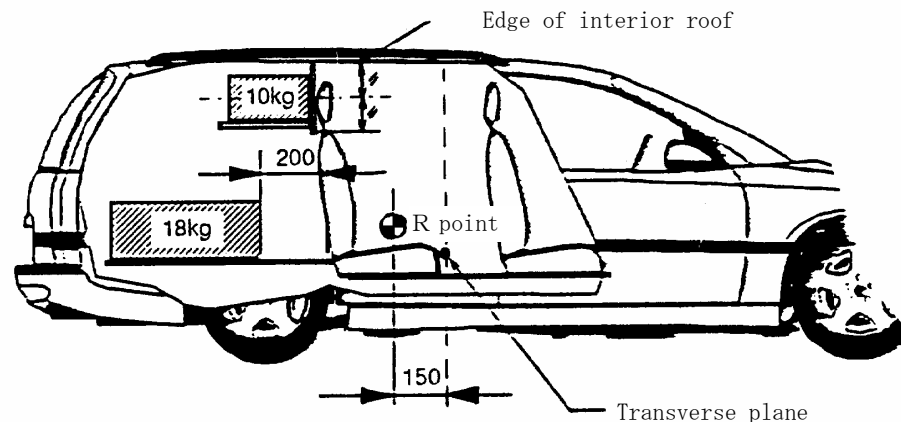
⑦ Test for devices intended to protect the occupants against displacement of luggage

(b) Testing of partitioning system

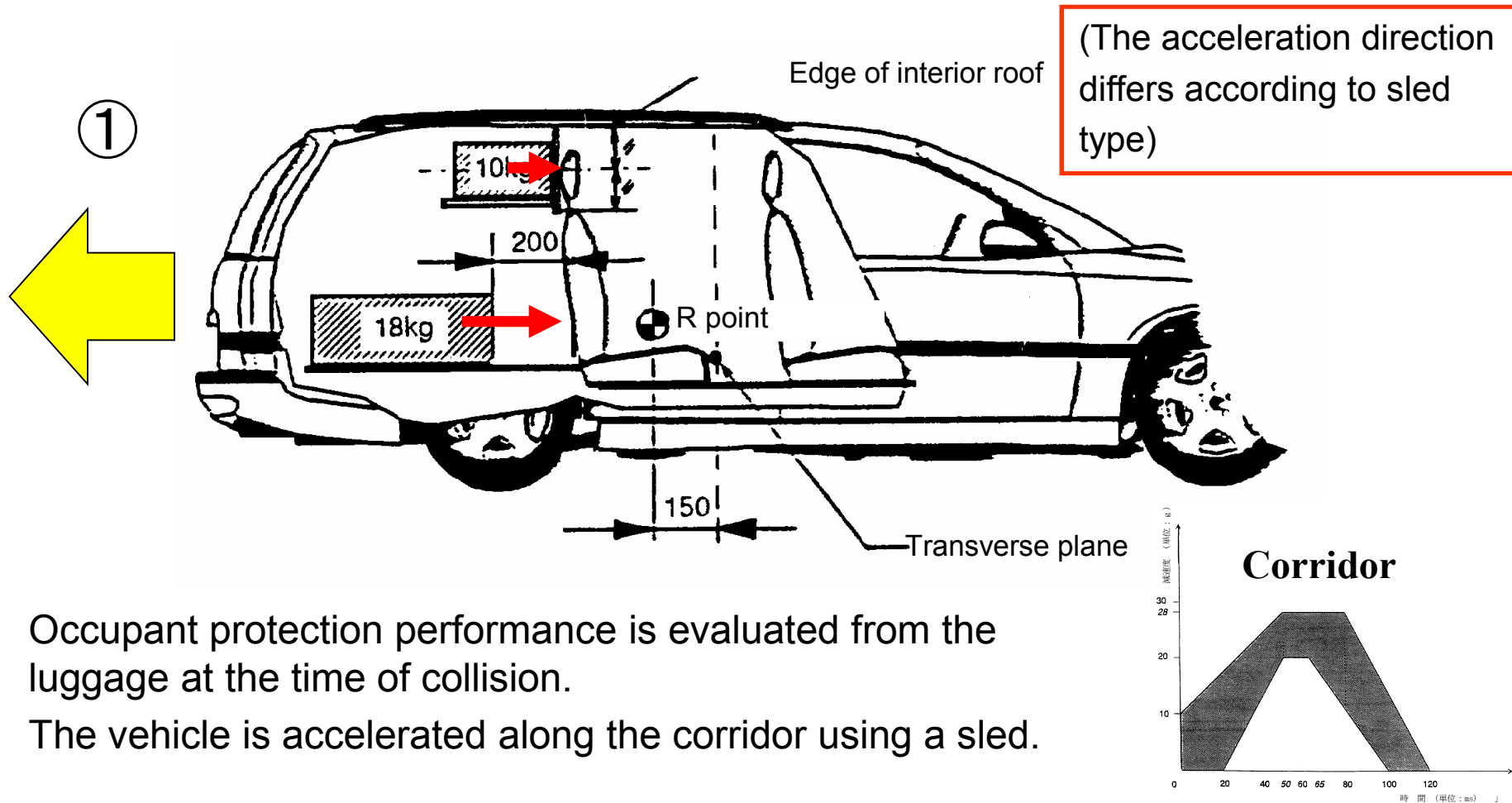
▪ Test block: Type 2

Fit the vehicle with a fixed raised test floor that locates the test block between the top edge of the bordering seatback and the bottom edge of the roof lining.

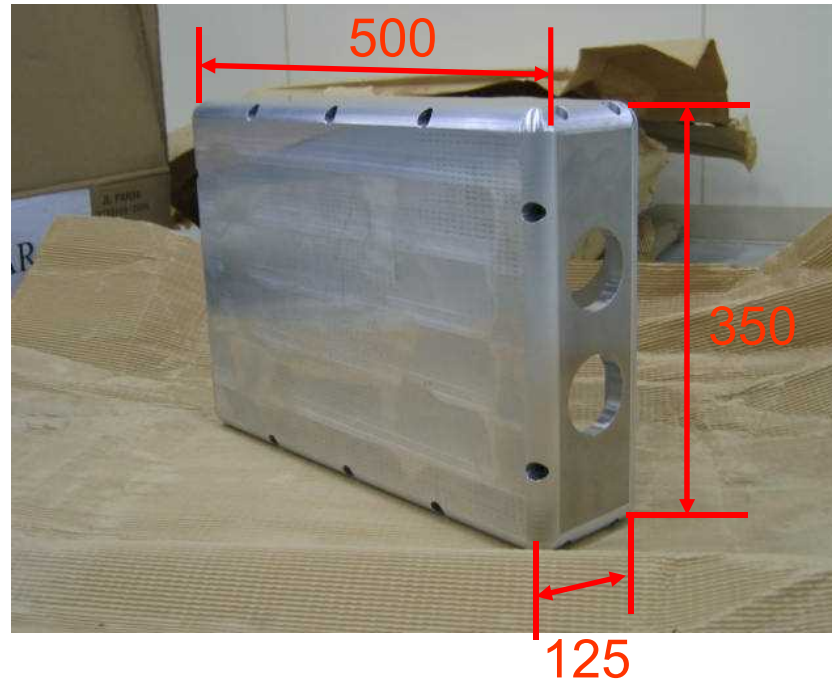
- Conduct the test simultaneously with the seatback test.
- Place the test block centrally in relation to the longitudinal axis of the vehicle and with the surface $500 \times 125\text{mm}$ to the front.
- Place the test block directly in contact with the partitioning system.



⑦ Test for devices intended to protect the occupants against displacement of luggage



⑦ Test for devices intended to protect the occupants against displacement of luggage



Test Block Type 2



⑦ Test for devices intended to protect the occupants against displacement of luggage

1. Passenger cars (for less than 10 persons)

● Test setting conditions

- Longitudinal direction: 1 notch or 10mm forward of most rearward position
Independent vertical adjustment (cushion only): cushion in lowest position
Seatback: in normal position of use
- Folding of rear seat
 - in normal position by locking mechanism

The part whose hardness is lower than 50 Shore A can be removed to conduct the test.

Common requirements

- The seatbacks, if adjustable, shall be set to the position as close to 25 degrees backward from the vertical line specified by the vehicle manufacturer or the torso line of the manikin.
- When a seat and its locking mechanism are identical or symmetrical with respect to another seat on the vehicle, only one such seat may be tested.
- In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraints placed in the most unfavorable position (generally, the highest position).



⑦ Test for devices intended to protect the occupants against displacement of luggage

● Judgment Criteria

(a) Seatback test

- The locking mechanism shall not be released during the test.
- The requirement is deemed to be met if the seatbacks remain in position and the locking mechanisms remain in place during and after the test.
- The test block shall remain behind the seatback concerned.
- The front contour parts of the test block that are harder than 50 Shore A should not move forward of the below points:
 - Deformation of head restraint: a point 150mm forward of the R point
 - Deformation of seatback: a point 100mm forward of the R point
- No sharp or rough edges likely to increase the danger of injuries of the occupants shall be present after the test.



⑦ Test for devices intended to protect the occupants against displacement of luggage

● Judgment Criteria

(b) Partitioning system test

- The requirement is deemed to be met if the partitioning system remains in place during the test.
- The test block shall remain behind the seat concerned.
- The front contour parts of the test block that are harder than 50 Shore A should not move forward of the below points:
 - Deformation of head restraint: a point 150mm forward of the R point
 - Deformation of seatback: a point 100mm forward of the R point
- No sharp or rough edges likely to increase the danger of injuries of the occupants shall be present after the test.



Test procedure for head restraints (R17&R25)

Test items

- ① General requirements
- ② Head restraint impact absorption test
- ③ Radii of curvature provisions for components
- ④ Head restraint moment test
- ⑤ **Dimension test**



⑤ Dimension Test

● Test setting conditions

- The seatbacks shall be set to the position with an inclination close to 25 degrees unless otherwise specified by the vehicle manufacturer.
- The measurement line shall be drawn in the vertical median plane of the seat concerned.
- All measurement lines shall be drawn in the center plane of the seat.

Determination of R point

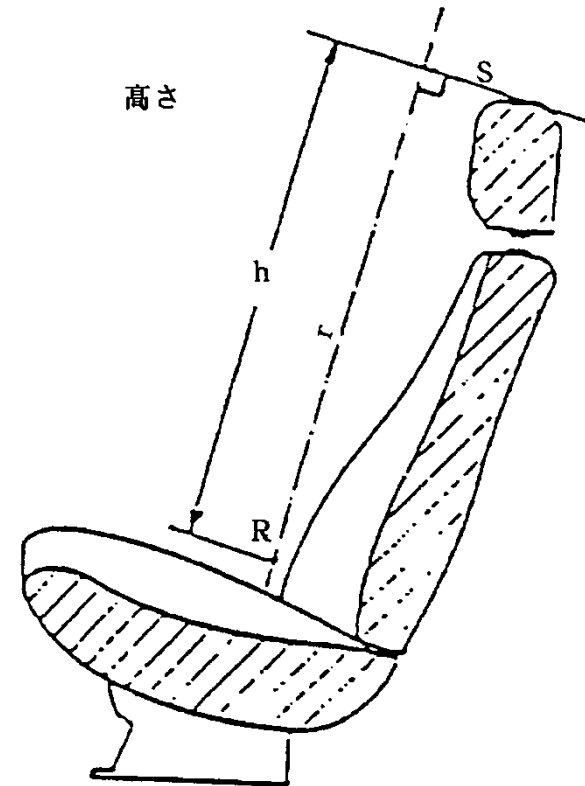
- The seat shall be adjusted to the rearmost driving or riding position specified by the manufacturer, taking into consideration only the longitudinal adjustment.
- Other adjustment modes shall be adjusted to the position specified by the manufacturer.

⑤ Dimension Test

● Test Method

Height

- ① Draw the projection of the reference line of the manikin on the seat.
- ② Draw the tangent S to the top of the head restraint perpendicular to the reference line.
- ③ The height is the distance “h” from the hip point to the tangent S.



⑤ Dimension Test

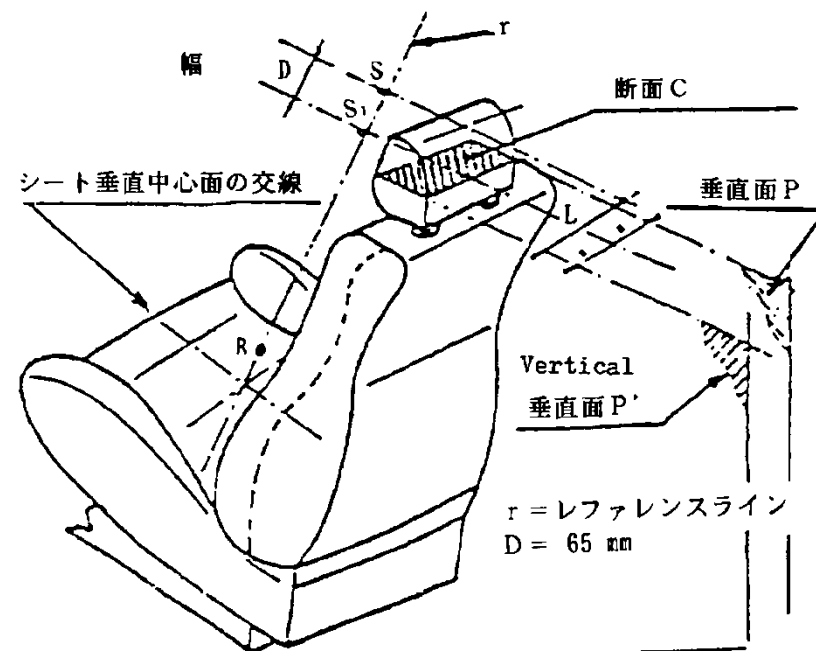
● Test Method

Width

① Plane S1: 65mm below the tangent S drawn perpendicular to the reference line

② L: Distance measured between the plane projected on plane S1

※ The width may be measured 635mm above the reference line on the R point if necessary.





⑤ Dimension Test

Judgment Criteria

Height (Separate type)

	Front seat D seat, P seat	Other seats
▪ Without HR adjusting system	800mm or more	750mm or more
▪ With HR adjusting system	800mm or more	750mm or more

Width (The height of the part of the device on which the head rests)
100mm or more



Test procedure for seats and seat anchorages (R17)

1. Passenger cars (for less than 10 persons)

- ① General requirements
- ② Seatback impact absorption test
- ③ Radii of curvature provisions for components
- ④ Seatback moment test
- ⑤ Head restraint moment test
- ⑥ Strength test (test of resistance to inertia effects or barrier test)
- ⑦ Test for devices intended to protect the occupants against displacement of luggage

2. Bus, truck

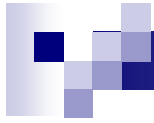
- ① **Installation method, confirmation of secure anchorage**



2. Bus, Truck

① Installation method, confirmation of secure anchorage

- Seats and bench seats must be firmly attached to the vehicle.
- Slide seats and bench seats must be automatically lockable in all the positions provided.
- Adjustable seatbacks must be lockable in all the positions provided.
- All seats which can be tipped forward or have fold-on backs must lock automatically in the normal position.



Thank you for your attention.

