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PROPOSAL FOR A DRAFT CANDIDATE GLOBAL TECHNICAL REGULATION ON SAFETY-BELT ANCHORAGES

Transmitted by the Expert from the International Organization of Motor Vehicle Manufacturers (OICA)

Note: The text reproduced below was prepared by the expert from OICA. It is based on a document distributed without a symbol (informal document No. 3) during the twenty-seventh session (TRANS/WP.29/GRSP/27, para. 16).

Note: This document is distributed to the Experts on General Safety Provisions only.

A. EXPLANATION

1. Introduction

The proposal is based on ECE Regulation No. 14, 04 series of amendments.
All references to approvals and approval markings have been deleted.

The following is a brief summary of the differences between the European and United States legislation and the requirements that are proposed for use in the proposal. As the Japanese legislation has many elements comparable with FMVSS 210 or ECE Regulation No. 14 and accepts both standards parallel to the Japanese Standard, the Japanese requirements are not shown separately

2. Major Differences

2.1. Scope

The FMVSS 210 requirements apply to all passenger cars, MPV´s, buses and trucks. ECE Regulation No. 14 refers to categories M and N (strength requirements and minimum number of anchorages for the designated seating positions depending on the vehicle category). The draft Global Regulation will only refer to passenger cars of category M1.

2.2. Differences in Definitions

Safety-belt anchorage

Contrary to ECE Regulation No. 14, the FMVSS 210 definition for a seat belt anchorage includes the original attachment hardware as well as rigid parts of the seat belt.

Industry is however not yet in a position to suggest a firm proposal.

Effective anchorages

This definition of ECE Regulation No. 14 has no counterpart in FMVSS 210. All ECE Regulation No. 14 location requirements refer to the Effective Anchorages.
This definition will be included in the draft Global Regulation, considering the fact that the use of effective anchorages for the check of the belt geometry is more logic.

Folding seats

This kind of seat is only described in ECE Regulation No. 14, with special requirements relating to the minimum number of anchorages. Folding seats are also described in the draft Global Regulation, also considering that folding seats are rather rare so that no

degradation of safety is expected.

"R-point" or "seating reference point (SRP)"

The definitions for the „seating reference point" described in ECE Regulations and US Standards are different.

The "US-SRP", defined by the manufacturer, is established by using a two dimensional drafting template with 95% legs as described in SAE J826 (May 1987). The "ECE-SRP", defined by the manufacturer, has to be checked with the three-dimensional H-point machine. This 3-D machine corresponds to the one described in SAE J826.
Basically, it is possible to have one common SRP for a vehicle seat worldwide.
The Global Regulation includes the ECE definition for the SRP with the relevant annex.

2.3. Differences in Requirements

Strength test

Contrary to FMVSS 210, ECE Regulation No. 14 requires different load values on the safety-belt anchorages depending on the vehicle category and orientation (forward/rearward facing) of the seats. For forward facing seats of passenger cars and light trucks the anchorage load values of FMVSS 210 and ECE Regulation No. 14 are practical identical. Since the draft Global Regulation would only cover M1 passenger cars, no difficulties are expected.

The time durations of the loads to test the anchorages are extremely different : ECE Regulation No. 14 requires a reasonable 0.2 seconds while 10 seconds are required in FMVSS 210. ECE Regulation
No. 14 requirements are considered to reflect real world accidents while FMVSS 210 requires an unrealistic duration.

ECE Regulation No. 14 includes deformation requirements such that during the static strength test the spacing of the effective lower anchorages and the vertical distance between upper effective anchorage and R-point shall remain within the required limits. FMVSS 210 does not have such requirements.
The draft Global Regulation includes the ECE Regulation No. 14 deformation requirements.

For adjustable seats, the strength test according FMVSS 210 shall be performed with the seat in its rearmost position. According to ECE Regulation No. 14, the seats "shall be placed in a position to give the most adverse conditions with respect to the strength of the system".
As a compromise the Global Regulation requires that adjustable seats shall be adjusted to the same position as used to determine the H-point for checking the R-point.

Location requirements

While ECE Regulation No. 14 specifies location requirements for the Effective Anchorages (point where belt leaves the guide, bracket etc.), FMVSS 210 considers the Anchorage (bolt attaching point), where the seat-belt is fitted to the vehicle or seat-structure.

Upper anchorages:

The FMVSS 210 / ECE Regulation No. 14 location fields for the upper anchorage look similar but are quite different. Even the basis to build up these fields are different : R-point in ECE-Regulation No. 14, the H-point with the seat in its rearmost position according to FMVSS 210.

ECE Regulation No. 14 describes also upper anchorages for H-point belts, which are not mentioned in FMVSS 210.

ECE Regulation No. 14 is more stringent relating to the vertical minimum distance of 450 mm, measured between R-point and the upper effective anchorage.

The FMVSS 210 location field for the upper anchorage is more limited in forward direction.

For the upper anchorages, it is proposed that the draft Global Regulation includes the ECE Regulation No. 14 location requirements.

Lower anchorages:

For the lower anchorages the minimum lateral distance between the anchorages required in FMVSS 210 is only 165 mm in contrast to ECE Regulation No. 14, requiring at least 350 mm.

The angle requirements for the lower anchorages are also quite different between FMVSS 210 and ECE Regulation No. 14.
The angle requirements of ECE Regulation No. 14 are different for the inboard and outboard side. Moreover these angles shall be met for all normal seating adjustments
In FMVSS 210 the angle requirements are only determined with the seat in its rearmost position.

The draft Global Regulation includes the ECE Regulation No. 14 requirements for lower anchorages, except for the lateral distance on rear seating positions which would be reduced to 240 mm minimum.

Exemptions

FMVSS 210 : Anchorages at the outer front seating positions are exempt from the location requirements if the frontal crash protection requirements of FMVSS 208 are met.

With the upcoming of the ECE Frontal Impact Regulation No. 94, this should also be a possibility for ECE Regulation No. 14.
This exemption, referring to FMVSS208 and ECE Regulation No. 94, is part of the draft Global Regulation.

3. Minor differences

Supplemental load due to seat weight

For anchorages with at least one anchorage on the seat structure, FMVSS 210 requires that the seat is loaded with a force of 20 times the mass of the seat through the centre of gravity
In this case, ECE Regulation No. 14 requires a supplemental load on the belts with 20 times the mass of the seat.
The draft Global Regulation proposes both possibilities optionally.

Body blocks

The body blocks described in FMVSS 210 / ECE Regulation No. 14 vary slightly in the dimensions. To load the lower seat belt anchorages for a center seating position FMVSS 210 allows a special, narrow pelvic body block for optional use.
The draft Global Regulation takes over the body block dimensions of ECE Regulation No. 14.

Number of anchorages for designated seating positions

FMVSS 210 requires seat belt anchorages for 3-point belts at all outboard seating positions, at least lap belts at all other seating positions. ECE Regulation No. 14 requires the same number of anchorages as FMVSS 210 with one exemption: for rear outboard seating positions with a space between the seat and the sidewall considered as a passage, only two lower anchorages are required.
The draft Global Regulation takes over the provisions of ECE Regulation No. 14 for M1 category vehicles.

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B. PROPOSAL

1. SCOPE

This Regulation applies to anchorages for safety-belts for adult occupants of forward-facing or rearward-facing seats in passenger cars of category M1.

2. DEFINITIONS

For the purposes of this Regulation,

2.1. "Safety-belt", means an arrangement of straps with a securing buckle, adjusting device and attachments which is capable of being anchored to the interior of a power-driven vehicle and is designed to diminish the risk of injury to its wearer, in the event of collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer's body.

2.2. "Category M1", means vehicles used for the carriage of passengers and comprising no more than eight seats in addition to the driver´s seat.

2.3. "Belt anchorages", means [means any component other than the webbing or straps involved in transferring safety-belt loads to the vehicle structure, including, but not limited to the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure]

2.4. "Effective belt anchorage", means means the point used to determine conventionally, as specified in paragraph 3.3., the angle of each part of the safety belt in relation to the wearer, that is, the point to which a strap would need to be attached to provide the same lie as the intended lie of the belt when worn, and which may or may not be the actual belt anchorage depending on the configuration of the safety-belt hardware at its attachment to the belt anchorage.

For example, in the case

where a safety-belt incorporates a rigid part which is attached to a lower belt anchorage and which is either fixed or free to swivel, the effective belt anchorage for all positions of seat adjustment is the point where the strap is attached to that rigid part;

where a strap guide is used on the vehicle structure or on the seat structure, the middle point of the guide at the place where the strap leaves the guide on the belt wearer's side, shall be considered as the effective belt anchorage; and,

where the belt runs directly from the wearer to a retractor

attached to the vehicle structure or the seat structure without an intervening strap guide, the effective belt anchorage shall be considered as being the intersection of the axis of the reel for storing the strap with the plane passing through the centre line of the strap on the reel;

2.5. "Floor", means the lower part of the vehicle body-work connecting the vehicle side walls. In this context it includes ribs, swages and possibly other reinforcements, even if they are below the floor, such as longitudinal and transverse members;

2.6. "Seat", means a structure which may or may not be integral with the vehicle structure complete with trim, intended to seat one adult person. The term covers both an individual seat or part of a bench seat intended to seat one person;

2.6.1. "Front passenger seat", means any seat where the "foremost H-point" of the seat in question is in or in front of the vertical transverse plane through the driver's R-point;

2.7. "Group of seats",means either a bench-type seat, or seats which are separate but side by side (i.e. with the foremost anchorages of one seat in line with or forward of the rearmost anchorages and in line with or behind the foremost anchorages of another seat) and accommodate one or more seated adult person;

2.8. "Bench seat", means a structure complete with trim, intended to seat more than one adult person;

2.9. "Folding seat", means an auxiliary seat intended for occasional use which is normally folded;

2.10. "Adjustment system", means the device by which the seat or its parts can be adjusted to a position suited to the morphology of the seated occupant; this device may, in particular, permit of:

2.10.1. longitudinal displacement;

2.10.2. vertical displacement;

2.10.3. angular displacement;

2.11. "Displacement system", means a device enabling the seat or one of its parts to be displaced or rotated without a fixed intermediate position, to permit easy access to the space behind the seat concerned;

2.12. "Locking system", means any device ensuring that the seat and its parts are maintained in any position of use and includes devices to lock both the seat back relative to the seat and the seat relative to the vehicle.

2.13. "Reference zone", means the space between two vertical

longitudinal planes, 400 mm apart and symmetrical with respect to the H-point, and defined by rotation from vertical to horizontal of the head-form apparatus [as described in Regulation No. 21 annex 1]. The apparatus shall be positioned as described in [that annex to Regulation No. 21] and set to the maximum length of 840 mm .

2.14 . Definitions (see annex 1)

2.14.1. The H point is a reference point as defined in paragraph 2.3. of annex 2 of this Regulation, which must be determined in accordance with the procedure set out in that annex.

2.14.1.1. The R point is the seating reference point defined in paragraph 2.4. of annex 2 of this Regulation.

2.14.2. The three-dimensional reference system is defined in appendix 2 of annex 2 of this Regulation.

2.14.3. Points L_1 and L_2 are the lower effective belt anchorages.

2.14.4. Point C is a point situated 450 mm vertically above the R point. However, if the distance S as defined in paragraph 2.14.6. is not less than 280 mm and if the alternative formula BR = 260 mm + 0.8S specified in paragraph 3.3.3.3. is chosen by the manufacturer, the vertical distance between C and R shall be 500 mm.

2.14.5. The angles $á_1$ and $á_2$ are respectively the angles between a horizontal plane and planes perpendicular to the median longitudinal plane of the vehicle and passing through the point H and the points L_1 and L_2.

2.14.6. S is the distance in millimetres of the effective upper belt anchorages from a reference plane P parallel to the longitudinal median plane of the vehicle defined as follows:

2.14.6.1. If the seating position is well-defined by the shape of the seat, the plane P shall be the median plane of this seat.

2.14.6.2. In the absence of a well-defined position:

2.14.6.2.1. The plane P for the driver's seat is a vertical plane parallel to the median longitudinal plane of the vehicle which passes through the centre of the steering-wheel in the plane of the steering-wheel rim when the steering-wheel, if adjustable, is in its central position.

2.14.6.2.2. The plane P for the front outboard passenger shall be symmetrical with that of the driver.

2.14.6.2.3. The plane P for the rear outboard seating position shall be that specified by the manufacturer on condition the following limits

for distance A between the longitudinal median plane of the vehicle and plane P are respected:

A is equal or more than 200 mm if the bench seat has been designed to accommodate two passengers only,

A is equal or more than 300 mm if the bench seat has been designed to accommodate more than two passengers.

3. SPECIFICATIONS

3.1. General specifications

3.1.1. Anchorages for safety-belts shall be so designed, made and situated as to:

3.1.1.1. enable the installation of a suitable safety-belt. The belt anchorages of the front outboard positions shall be suitable for safety-belts incorporating a retractor and pulley, taking into consideration in particular the strength characteristics of the belt anchorages.

3.1.1.2. reduce to a minimum the risk of the belt's slipping when worn correctly;

3.1.1.3. reduce to a minimum the risk of strap damage due to contact with sharp rigid parts of the vehicle or seat structures;

3.1.1.4. enable the vehicle, in normal use, to comply with the provisions of this Regulation;

3.1.1.5. for anchorages which take up different positions to allow persons to enter the vehicle and to restrain the occupants, the specifications of this Regulation shall apply to the anchorages in the effective restraint position.

3.2. Minimum number of belt anchorages to be provided

3.2.1. Each forward outboard seating position has to be provided with two lower anchorages and one upper anchorage.

3.2.2. However, for outboard seating positions, other than front, two lower anchorages are allowed, where there exists a passage between a seat and the nearest side-wall of the vehicle intended to permit access of passengers to other parts of the vehicle.

A space between a seat and the side-wall is considered as a passage if the distance between that side-wall, with all doors closed, and a vertical longitudinal plane passing through the centre line of the seat concerned, measured at the R-point position and perpendicularly to the median longitudinal plane of the vehicle is more than 500 mm.

3.2.3. The front center seating position has to be provided with two lower anchorages and one upper anchorage.

3.2.4. However, for the front centre seating position two lower anchorages shall be considered adequate where the windscreen is located outside the reference zone defined in paragraph 2.13.; if located inside the reference zone, three anchorages are required.

As regards belt anchorages, the windscreen is considered as part of the reference zone when it is capable of entering into static contact with the test apparatus according to the method described in annex 1 to Regulation No. 21.

3.2.4. For center seating positions other than front, at least two lower anchorages shall be provided.

3.2.5. For all folding seats or seating intended solely for use when the vehicle is stationary as well as for all the seats of any vehicle which are not covered by paragraphs 3.2.1. to 3.2.3., no belt anchorages are required. However, if the vehicle is fitted with anchorages for such seats, these anchorages must comply with the provisions of this Regulation. In this case, two lower anchorages shall be sufficient.

3.2.6. In the case of seats capable of being turned to or placed in other orientations, for use when the vehicle is stationary, the requirements of paragraph 3.2. shall apply only to those orientations designated for normal use when the vehicle is travelling on a road, in accordance with this Regulation.

[3.3. Location of belt anchorages (see annex 1, fig.1.)

Anchorages for seat belt assemblies that meet the frontal crash protection requirements of ECE-Regulation 94, 01 series of amendments or subsequent series or US Standard FMVSS 208, section S 5.1, or Japanese Technical Standards relating to the Safety Regulations for Road Vehicles, Article 11.4.14, are exempted from the location requirements of this section.]

3.3.1. General

3.3.1.1. The belt anchorages for any one belt may be located either wholly in the vehicle structure or in the seat structure or any other part of the vehicle or dispersed between these locations.

3.3.1.2. Any one belt anchorage may be used for attaching the ends of two adjacent safety-belts provided that the test requirements are met.

3.3.2. Location of the effective lower belt anchorage

3.3.2.1. Front seats

The angle $á_1$ (other than buckle side) shall be within the range of 30° to 80° and the angle $á_2$ (buckle side) shall be within the range of 45° to 80°. Both angle requirements shall be valid for all normal travelling positions of the front seats. Where at least one of the angles $á_1$ and $á_2$ is constant (e.g. anchorage fixed at the seat) in all normal positions of use, its value shall be 60 ± 10E. In the case of adjustable seats with an adjusting device as described in paragraph 2.10. with a seatback angle of less than 20E (see annex 1, figure 1), the angle $á_1$ may be below the minimum value (30E) stipulated above, provided it is not less than 20E in any normal position of use.

3.3.2.2. Rear seats

The angles $á_1$ and $á_2$ shall be within the range of 30° to 80° for all rear seats. If rear seats are adjustable the above angles shall be valid for all normal travelling positions.

3.3.2.3. The distance between the two vertical planes parallel to the median longitudinal plane of the vehicle and each passing through a different one of the two effective lower belt anchorages L_1 and L_2 of the same seat-belt shall not be less than 350 mm. In case of central rear seating positions the above mentioned distance shall not be less than 240 mm. The median longitudinal plane of the seat shall pass between points L_1 and L_2 and shall be at

least 120 mm from these points.

3.3.3. Location of the effective upper belt anchorages (see annex 1)

3.3.3.1. If a strap guide or similar device is used which affects the location of the effective upper belt anchorage, this location shall be determined in a conventional way by considering the position of the anchorage when the longitudinal centre line of the strap passes through a point J_1 defined successively from the R point by the following three segments:

RZ: a segment of the torso line measured in an upward direction from R and 530 mm long;

ZX: a segment perpendicular to the median longitudinal plane of the vehicle, measured from point Z in the direction of the anchorage and 120 mm long;

XJ_1: a segment perpendicular to the plane defined by segments RZ and ZX, measured in a forward direction from point X and 60 mm long.

Point J_2 is determined by symmetry with point J_1 about the longitudinal vertical plane passing through the torso line described in paragraph 5.1.2. of the manikin positioned in the seat in question.

Where a two-door configuration is used to provide access to both the front and rear seats and the upper anchorage is fitted to the "B" post, the system must be designed so as not to impede access to or egress from the vehicle.

3.3.3.2. The effective upper anchorage shall lie below the plane FN, which runs perpendicular to the longitudinal median plane of the seat and makes an angle of 65E with the torso line. The angle may be reduced to 60E in the case of rear seats. The plane FN shall be so placed as to intersect the torso line at a point D such that DR = 315 mm + 1.8 S. However, when S # 200 mm, then DR = 675 mm.

3.3.3.3. The effective upper belt anchorage shall lie behind a plane FK running perpendicular to the longitudinal median plane of the seat and intersecting the torso line at an angle of 120E at a point B such that BR = 260 mm + S. Where S $ 280 mm, the manufacturer may use BR = 260 mm + 0.8S at his discretion.

3.3.3.4. The value of S shall not be less than 140 mm.

3.3.3.5. The effective upper belt anchorage shall be situated to the rear of a vertical plane perpendicular to the median longitudinal plane of the vehicle and passing through the R point as shown in annex 1.

3.3.3.6. The effective upper belt anchorage shall be situated above a horizontal plane passing through point C defined in

paragraph 2.14.4.

3.3.3.7. In addition to the upper anchorage specified in paragraph 5.4.3.1., other effective upper anchorages may be provided if one of the following conditions is satisfied:

3.3.3.7.1. The additional anchorages comply with the requirements of paragraphs 3.3.3.1. to 3.3.3.6.

3.3.3.7.2. The additional anchorages can be used without the aid of tools, comply with the requirements of paragraphs 3.3.3.5. and 3.3.3.6. and are located in one of the areas determined by shifting the area shown in figure 1 of annex 1 of this Regulation, 80 mm upwards or downwards in a vertical direction.

3.4. Dimensions of threaded anchorage holes

3.4.1. An anchorage shall have a threaded hole of 7/16 inch (20 UNF 2B).

3.4.2. If the vehicle is fitted by the manufacturer with safety-belts which are attached to all anchorages prescribed for the seat in question, these anchorages need not meet the requirement set out in paragraph 3.4.1., provided that they comply with the other provisions of this Regulation. In addition, the requirement set out in paragraph 3.4.1. shall not apply to additional anchorages which meet the requirement set out in paragraph 3.3.3.7.3.

3.4.3. It shall be possible to remove the safety-belt without damaging the anchorage.

4. TESTS

4.1. General

4.1.1. Subject to application of the provisions of paragraph 4.2., and at the request of the manufacturer;

4.1.1.1. the tests may be carried out either on a vehicle structure or on a completely finished vehicle;

4.1.1.2. The tests may be restricted to the anchorages relating to only one seat or one group of seats on the condition that:

(i) the anchorages concerned have the same structural characteristics as the anchorages relating to the other seats or group of seats; and

(ii) where such anchorages are fitted totally or partially on the seat or group of seats, the structural characteristics of the seat or group of seats are the same as those for the other seats or groups of seats.

4.1.1.3. windows and doors may be fitted or not and closed or not;

4.1.1.4. any fitting normally provided and likely to contribute to the rigidity of the vehicle structure may be fitted.

4.1.2. The seats shall be adjusted to the position corresponding to the seat adjustment used in annex 2 to determine the H-point and actual torso angle

4.2. Securing of the vehicle

4.2.1. The method used to secure the vehicle during the test shall not be such as to strengthen the anchorages or the anchorage areas or to lessen the normal deformation of the structure.

4.2.2. A securing device shall be regarded as satisfactory if it produces no effect on an area extending over the whole width of the structure and if the vehicle or the structure is blocked or fixed in front at a distance of not less than 500 mm from the anchorage to be tested and is held or fixed at the rear not less than 300 mm from that anchorage.

4.2.3. It is recommended that the structure should rest on supports arranged approximately in line with the axes of the wheels or, if that is not possible, in line with the points of attachment of the suspension.

4.2.4. If a securing method other than that prescribed in paragraphs 4.2.1. and 4.2.3. of this Regulation is used, evidence must be furnished that it is equivalent.

4.3. General test requirements

4.3.1. All the belt anchorages of the same group of seats shall be tested simultaneously.

However, if there is a risk that non-symmetrical loading of the seats and/or anchorages may lead to failures, an additional test may be carried out with non-symmetrical loading.

4.3.2. The tractive force shall be applied in a direction corresponding to the seating position at an angle of 10E ± 5E above the horizontal in a plane parallel to the median longitudinal plane of the vehicle.

4.3.3. Full application of the load shall be achieved as rapidly as possible. The belt anchorages must withstand the specified load for not less than 0.2 second.

4.3.4. Traction devices to be used in the tests described in paragraph 4.4. below are shown in annex 3.

4.3.5. The belt anchorages for seats for which upper belt anchorages are provided shall be tested under the following conditions:

4.3.5.1. Front Outboard Seats:

The belt anchorages shall be submitted to the test prescribed in paragraph 4.4.1. in which the loads are transmitted to them by means of a device reproducing the geometry of a three-point belt equipped with a retractor having a pulley or strap guide at the upper belt anchorage. In addition, if the number of anchorages is more than that prescribed in paragraph 3.2. these anchorages shall be subjected to the test specified in paragraph 4.4.5., in which the loads shall be transmitted to the anchorages by means of a device reproducing the geometry of the type of safety-belt intended to be attached to them.

4.3.5.1.1. In the above case the tests prescribed in paragraphs 4.4.1. and 4.4.3. can be performed on two different structures if the manufacturer so requests.

4.3.5.2. Rear outboard seats and all centre seats:

The belt anchorages shall be subjected to the test prescribed in paragraph 4.4.2. in which the loads are transmitted to them by means of a device reproducing the geometry of a three-point safety-belt without a retractor, and to the test prescribed in paragraph 4.4.3. in which the loads are transmitted to the two lower belt anchorages by means of a device reproducing the geometry of a lap belt. The two tests can be performed on two different structures if the manufacturer so requests.

4.3.5.3. When a manufacturer supplies his vehicle with safety-belts, the corresponding belt anchorages may be submitted only to a test in which the loads are transmitted to them by means of a device reproducing the geometry of the type of belts to be attached to these anchorages.

4.3.6. If no upper belt anchorages are provided for the outboard seats and the centre seats, the lower belt anchorages shall be submitted to the test prescribed in paragraph 4.4.3. in which the loads are transmitted to these anchorages by means of a device reproducing the geometry of a lap belt.

4.3.7. If the vehicle is designed to accept other devices which do not enable the straps to be directly attached to belt anchorages without intervening sheaves, etc. or which require belt anchorages supplementary to those mentioned in paragraph 3.2., the safety-belt or an arrangement of wires, sheaves, etc. representing the equipment of the safety-belt, shall be attached by such a device to the belt anchorages in the vehicle and the belt anchorages shall be subjected to the tests prescribed in paragraph 4.4. as appropriate.

4.3.8. A test method other than those prescribed in paragraph 4.3. may be used, but evidence must be furnished that it is equivalent.

4.4. Particular test requirements

4.4.1. Test in configuration of a three point belt incorporating a retractor having a pulley or strap guide at the upper belt anchorage

4.4.1.1. A special pulley or guide for the wire or strap appropriate to transmit the load from the traction device, or the pulley or strap guide supplied by the manufacturer shall be fitted to the upper belt anchorage.

4.4.1.2. A test load of 13.5 kN ± 0.2 kN shall be applied to a traction device (see annex 3, figure 2) attached to the belt anchorages of the same belt, by means of a device reproducing the geometry of the upper torso strap of such a safety-belt.

4.4.1.3. At the same time a tractive force of 13.5 kN ± 0.2 kN shall be applied to a traction device (see annex 3, figure 1) attached to the two lower belt anchorages.

4.4.2. Test in configuration of a three-point belt without retractor or with a retractor at the upper belt anchorage

4.4.2.1. A test load of 13.5 kN ± 0.2 kN shall be applied to a traction device (see annex 3, figure 2) attached to the upper belt anchorage and to the opposite lower belt anchorage of the same belt, using, if supplied by the manufacturer, a retractor fixed at the upper belt anchorage.

4.4.2.2. At the same time a tractive force of 13.5 kN ± 0.2 kN shall be applied to a traction device (see annex 3, figure 1) attached to the lower belt anchorages.

4.4.3. Test in configuration of a lap belt

A test load of 22.25 kN ± 0.2 kN shall be applied to a traction device (see annex 3, figure 1) attached to the two lower belt anchorages.

4.4.4. Test for belt anchorages located wholly within the seat structure or dispersed between the vehicle structure and the seat structure

4.4.4.1. The test specified in paragraphs 4.4.1., 4.4.2. and 4.4.3. above shall be performed, as appropriate, at the same time superimposing for each seat and for each group of seats a force as stated below.

4.4.4.2. A force equal to 20 times the mass of the complete seat is applied in addition to the loads indicated in paras 4.4.1, 4.4.2. and 4.4.3, either as a supplement to those loads or, at the manufacturers option, through the centre of gravity of the seat.

4.4.5. Test in the case of rearward-facing seats

4.4.5.1. The anchorage points shall be tested according to the forces prescribed in paragraphs 4.4.1., 4.4.2. or 4.4.3. as appropriate.

4.4.5.2. The test load shall be directed forward in relation to the seating position in question, corresponding to the procedure prescribed in paragraph 4.3.

[4.5. The attachment hardware of a seat belt assembly, which is subject to the requirements of S.5.1. of US Standard FMVSS 208 or paragraph 5.2. of Regulation No. 94, or Japanese Technical Standards relating to the Safety Regulations for Road Vehicles, Article 11-4-14, does not have to meet the requirements of paragraph 4.4. of this regulation.]

5. INSPECTION AFTER TESTING

5.1. All the anchorages shall be capable of withstanding the test prescribed in paragraphs 4.3. and 4.4. Permanent deformation, including partial rupture or breakage of any anchorage or surrounding area, shall not constitute failure if the required force is sustained for the specified time. During the test, the minimum spacings for the effective lower belt anchorages specified in paragraph 3.3.2.3. and the requirements of paragraphs 3.3.3.6. for effective upper belt anchorages shall be respected.

5.2. In vehicles where such devices are used, the displacement and locking devices enabling the occupants of all seats to leave the vehicle must still be operable by hand after the tractive force was removed.

5.3. After testing any damage to the anchorages and structures supporting load during tests shall be noted.

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Annex 1

LOCATION OF EFFECTIVE BELT ANCHORAGES

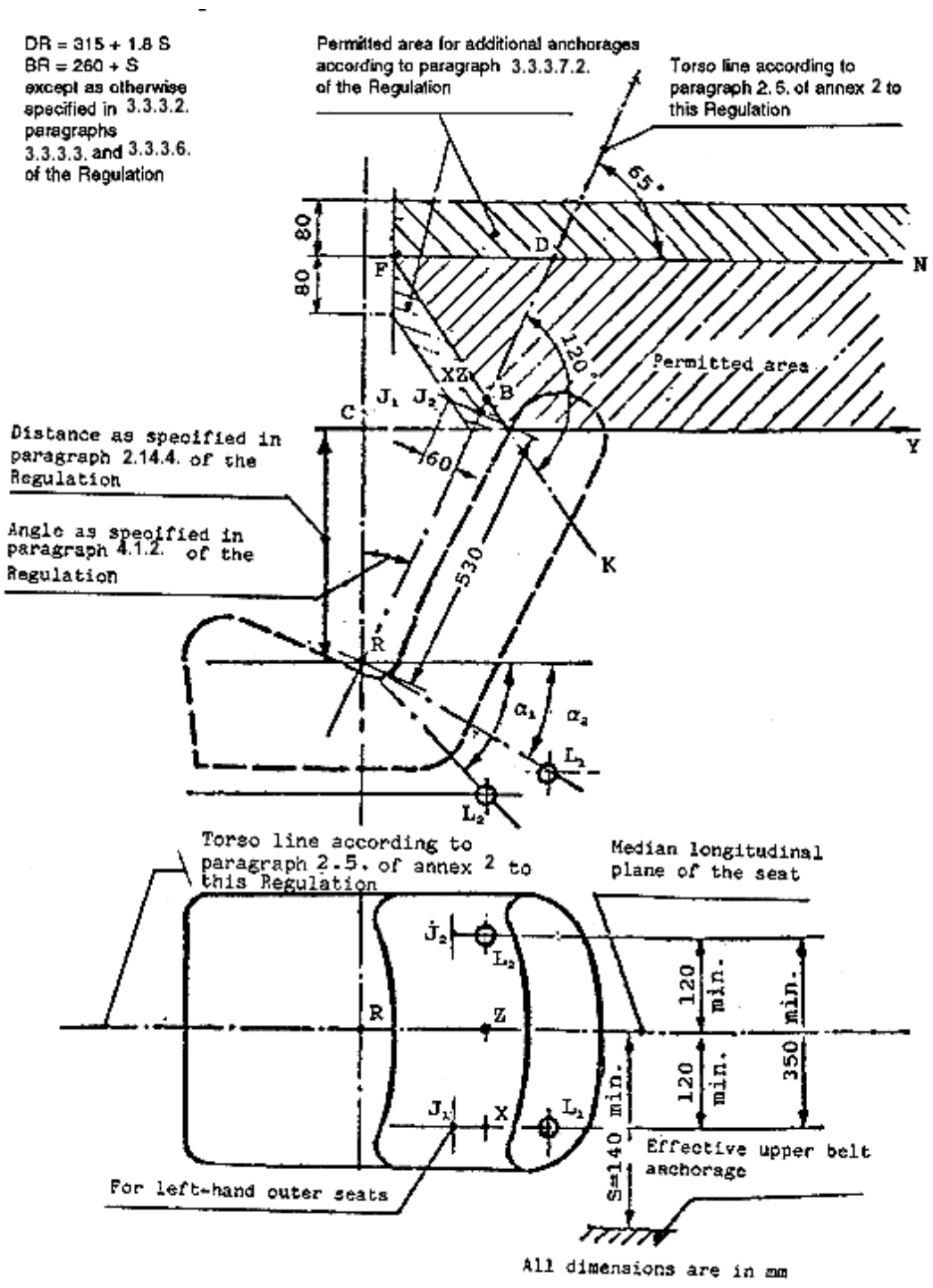

Figure 1: Areas of location of effective belt anchorages

Annex 2

PROCEDURE FOR DETERMINING THE "H" POINT AND THE ACTUAL TORSO ANGLE FOR SEATING POSITIONS IN MOTOR VEHICLES

1. PURPOSE

The procedure described in this annex is used to establish the "H" point location and the actual torso angle for one or several seating positions in a motor vehicle and to verify the relationship of measured data to design specifications given by the vehicle manufacturer.

2. DEFINITIONS

For the purposes of this annex:

2.1. "Reference data", means one or several of the following characteristics of a seating position:

2.1.1. the "H" point and the "R" point and their relationship,

2.1.2. the actual torso angle and the design torso angle and their relationship.

2.2. "Three-dimensional 'H' point machine" (3-D H machine), means the device used for the determination of "H" points and actual torso angles. This device is described in appendix 1 to this annex;

2.3. "'H' point", means the pivot centre of the torso and the thigh of the 3-D H machine installed in the vehicle seat in accordance with paragraph 4. below. The "H" point is located in the centre of the centreline of the device which is between the "H" point sight buttons on either side of the 3-D H machine. The "H" point corresponds theoretically to the "R" point (for tolerances see paragraph 3.2.2. below). Once determined in accordance with the procedure described in paragraph 4., the "H" point is considered fixed in relation to the seat-cushion structure and to move with it when the seat is adjusted;

2.4. "'R' point" or "seating reference point", means a design point defined by the vehicle manufacturer for each seating position and established with respect to the three-dimensional reference system;

2.5. "Torso-line", means the centreline of the probe of the 3-D H machine with the probe in the fully rearward position;

2.6. "Actual torso angle", means the angle measured between a vertical line through the "H" point and the torso line using the back angle quadrant on the 3-D H machine. The actual torso angle

corresponds theoretically to the design torso angle (for tolerances see paragraph 3.2.2. below):

2.7. "Design torso angle", means the angle measures between a vertical line through the "R" point and the torso line in a position which corresponds to the design position of the seat-back established by the vehicle manufacturer;

2.8. "Centreplane of occupant" (C/LO), means the median plane of the 3-D H machine positioned in each designated seating position; it is represented by the co-ordinate of the "H" point on the "Y" axis. For individual seats, the centreplane of the seat coincides with the centreplane of the occupant. For other seats, the centreplane of the occupant is specified by the manufacturer;

2.9. "Three-dimensional reference system", means a system as described in appendix 2 to this annex;

2.10. "Fiducial marks", are physical points (holes, surfaces, marks or indentations) on the vehicle body as defined by the manufacturer;

2.11. "Vehicle measuring attitude", means the position of the vehicle as defined by the co-ordinates of fiducial marks in the three-dimensional reference system.

3. REQUIREMENTS

3.1. Data presentation

For each seating position where reference data are required in order to demonstrate compliance with the provisions of the present regulation, all or an appropriate selection of the following data shall be presented in the form indicated in appendix 3 to this annex:

3.1.1. the co-ordinates of the "R" point relative to the three-dimensional reference system;

3.1.2. the design torso angle;

3.1.3. all indications necessary to adjust the seat (if it is adjustable) to the measuring position set out in paragraph 4.3. below.

3.2. Relationship between measured data and design specifications

3.2.1. The co-ordinates of the "H" point and the value of the actual torso angle obtained by the procedure set out in paragraph 4. below shall be compared, respectively, with the co-ordinates of the "R" point and the value of the design torso angle indicated by the vehicle manufacturer.

3.2.2. The relative positions of the "R" point and the "H" point and the

relationship between the design torso angle and the actual torso angle shall be considered satisfactory for the seating position in question if the "H" point, as defined by its co-ordinates, lies within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the "R" point, and if the actual torso angle is within 5E of the design torso angle.

3.2.3. If these conditions are met, the "R" point and the design torso angle, shall be used to demonstrate compliance with the provisions of this regulation.

3.2.4. If the "H" point or the actual torso angle does not satisfy the requirements of paragraph 3.2.2. above, the "H" point and the actual torso angle shall be determined twice more (three times in all). If the results of two of these three operations satisfy the requirements, the conditions of paragraph 3.2.3. above shall apply.

3.2.5. If the results of at least two of the three operations described in paragraph 3.2.4. above do not satisfy the requirements of paragraph 3.2.2. above, or if the verification cannot take place because the vehicle manufacturer has failed to supply information regarding the position of the "R" point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the "R" point or the design torso angle is referred to in this Regulation.

4. PROCEDURE FOR "H" POINT AND ACTUAL TORSO ANGLE DETERMINATION

4.1. The vehicle shall be preconditioned at the manufacturer's discretion, at a temperature of 20 ± 10EC to ensure that the seat material reached room temperature. If the seat to be checked has never been sat upon, a 70 to 80 kg person or device shall sit on the seat twice for one minute to flex the cushion and back. At the manufacturer's request, all seat assemblies shall remain unloaded for a minimum period of 30 min prior to installation of the 3-D H machine.

4.2. The vehicle shall be at the measuring attitude defined in paragraph 2.11. above.

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

4.4. The area of the seating position contacted by the 3-D H machine shall be covered by a muslin cotton, of sufficient size and appropriate texture, described as a plain cotton fabric having 18.9 threads per cm^2 and weighing 0.228 kg/m^2 or knitted or non-woven fabric having equivalent characteristics. If test is run on a seat outside the vehicle, the floor on which the seat is placed shall have the same essential characteristics 2-9 as the floor of the vehicle in which the seat is intended to be used.

4.5. Place the seat and back assembly of the 3-D H machine so that the centreplane of the occupant (C/LO) coincides with the centreplane of the 3-D H machine. At the manufacturer's request, the 3-D H machine may be moved inboard with respect to the C/LO if the 3-D H machine is located so far outboard that the seat edge will not permit levelling of the 3-D H machine.

4.6. Attach the foot and lower leg assemblies to the seat pan assembly, either individually or by using the T-bar and lower leg assembly. A line through the "H" point sight buttons shall be parallel to the ground and perpendicular to the longitudinal centreplane of the seat.

4.7. Adjust the feet and leg positions of the 3-D H machine as follows:

4.7.1. Designated seating position: driver and outside front passenger

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

4.7.1.2. If the left leg cannot be kept parallel to the right leg and the left foot cannot be supported by the structure, move the left foot until it is supported. The alignment of the sight buttons shall be maintained.

4.7.2. Designated seating position: outboard rear

For rear seats or auxiliary seats, the legs are located as specified by the manufacturer. If the feet then rest on parts of the floor which are at different levels, the foot which first comes into contact with the front seat shall serve as a reference and the other foot shall be so arranged that the spirit level giving the transverse orientation of the seat of the device indicates the horizontal.

4.7.3. Other designated seating positions:

The general procedure indicated in paragraph 4.7.1. above shall be followed except that the feet shall be placed as specified by the vehicle manufacturer.

4.8. Apply lower leg and thigh weights and level the 3-D H machine.

4.9. Tilt the back pan forward against the forward stop and draw the 3-D H machine away from the seat-back using the T-bar. Reposition the 3-D H machine on the seat by one of the following methods:

4.9.1. If the 3-D H machine tends to slide rearward, use the following procedure. Allow the 3-D H machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required i.e. until the seat pan contacts the seat-back. If necessary, reposition the lower leg.

4.9.2. If the 3-D H machine does not tend to slide rearward, use the following procedure. Slide the 3-D H machine rearwards by applying a horizontal rearward load to the T-bar until the seat pan contacts the seat-back (see figure 2 of appendix 1 to this annex).

4.10. Apply a 100 ± 10 N load to the back and pan assembly of the 3-D H machine at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application shall be maintained along a line passing by the above intersection to a point just above the thigh bar housing (see figure 2 of appendix 1 to this annex). Then carefully return the back pan to the seat-back. Care must be exercised throughout the remainder of the procedure to prevent the 3-D H machine from sliding forward.

4.11. Install the right and left buttock weights and then, alternately, the eight torso weights. Maintain the 3-D H machine level.

4.12. Tilt the back pan forward to release the tension on the seat-back. Rock the 3-D H machine from side to side through 10E arc (5E to each side of the vertical centreplane) for three complete cycles to release any accumulated friction between the 3-D H machine and the seat.

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

The feet of the 3-D H machine are not to be restrained or held during this step. If the feet change position, they should be

allowed to remain in that attitude for the moment.

Carefully return the back pan to the seat-back and check the two spirits levels for zero position. If any movement of the feet has occurred during the rocking operation of the 3-D H machine, they must be repositioned as follows:

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

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

4.13. Holding the T-bar to prevent the 3-D H machine from sliding forward on the seat cushion, proceed as follows:

(a) return the back pan to the seat-back;

(b) alternately apply and release a horizontal rearward load, not to exceed 25 N, to the back angle bar at a height approximately at the centre of the torso weights until the hip angle quadrant indicates that a stable position has been reached after load release. Care shall be exercised to ensure that no exterior downward or lateral loads are applied

to the 3-D H machine. If another level adjustment of the 3-D H machine is necessary, rotate the back pan forward, re-level, and repeat the procedure from paragraph 4.12.

4.14. Take all measurements:

4.14.1. The co-ordinates of the "H" point are measured with respect to the three-dimensional reference system.

4.14.2. The actual torso angle is read at the back angle quadrant of the 3-D H machine with the probe in its fully rearward position.

4.15. If a re-run of the installation of the 3-D H machine is desired, the seat assembly should remain unloaded for a minimum period of 30 min prior to the re-run. The 3-D H machine should not be left loaded on the seat assembly longer than the time required to perform the test.

4.16. If the seats in the same row can be regarded as similar (bench seat, identical seats, etc.) only one "H" point and one "actual torso angle" shall be determined for each row of seats, the 3-D H machine described in appendix 1 to this annex being seated in a place regarded as representative for the row. This place shall be:

4.16.1. in the case of the front row, the driver's seat;

4.16.2. in the case of the rear row or rows, an outer seat.

Annex 2 - Appendix 1

DESCRIPTION OF THE THREE DIMENSIONAL "H" POINT MACHINE
(3-D H machine)

1. Back and seat pans

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

2. Body and leg elements

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

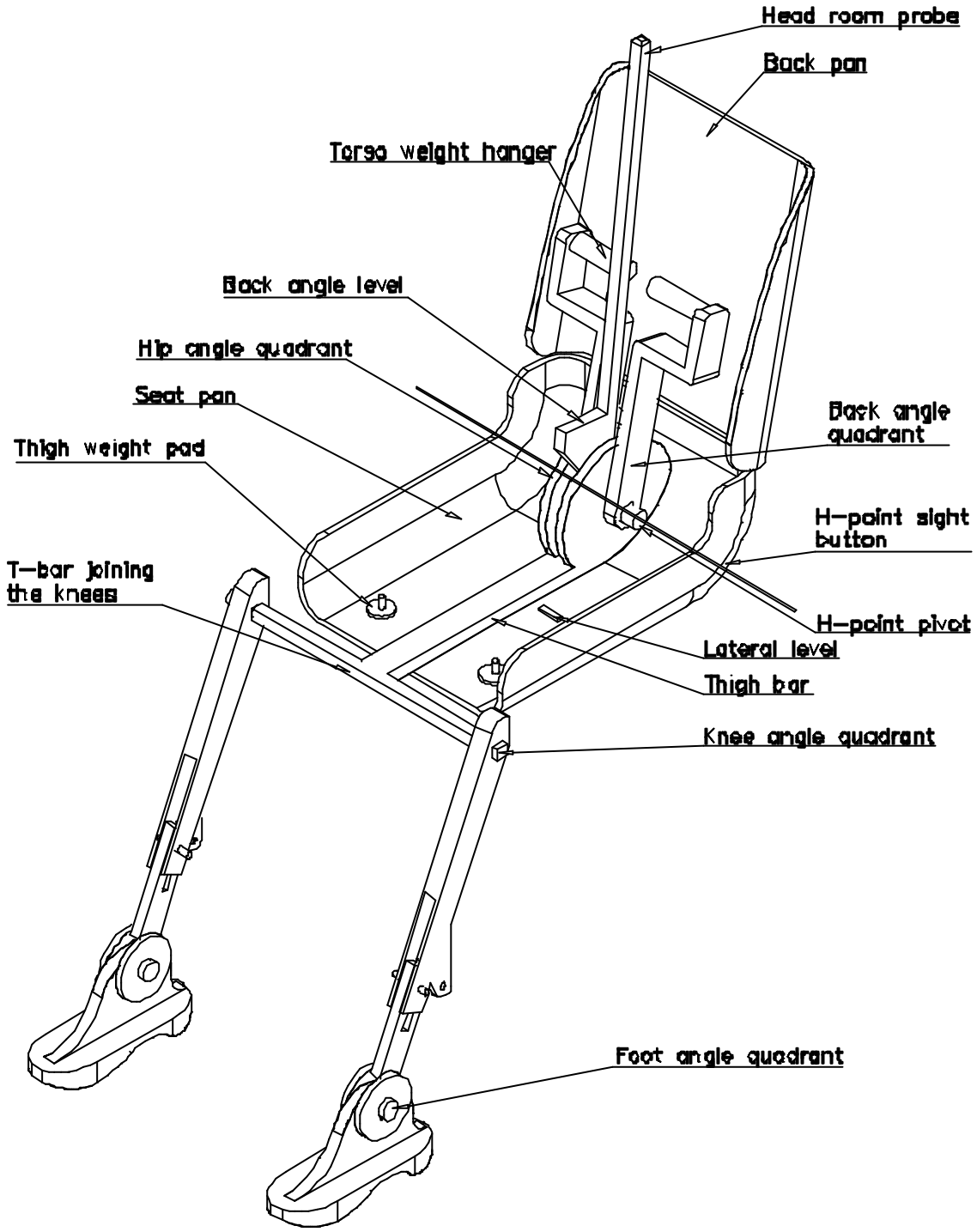
Head room probe
Back pan
Torso weight hanger
Back angle level
Hip angle quadrant
Seat pan
Thigh weight pad
Back angle quadrant
H-point sight button
T-bar joining the knees
H-point pivot
Lateral level
Thigh bar
Knee angle quadrant
Foot angle quadrant

Figure 1 - 3-D H machine elements designation

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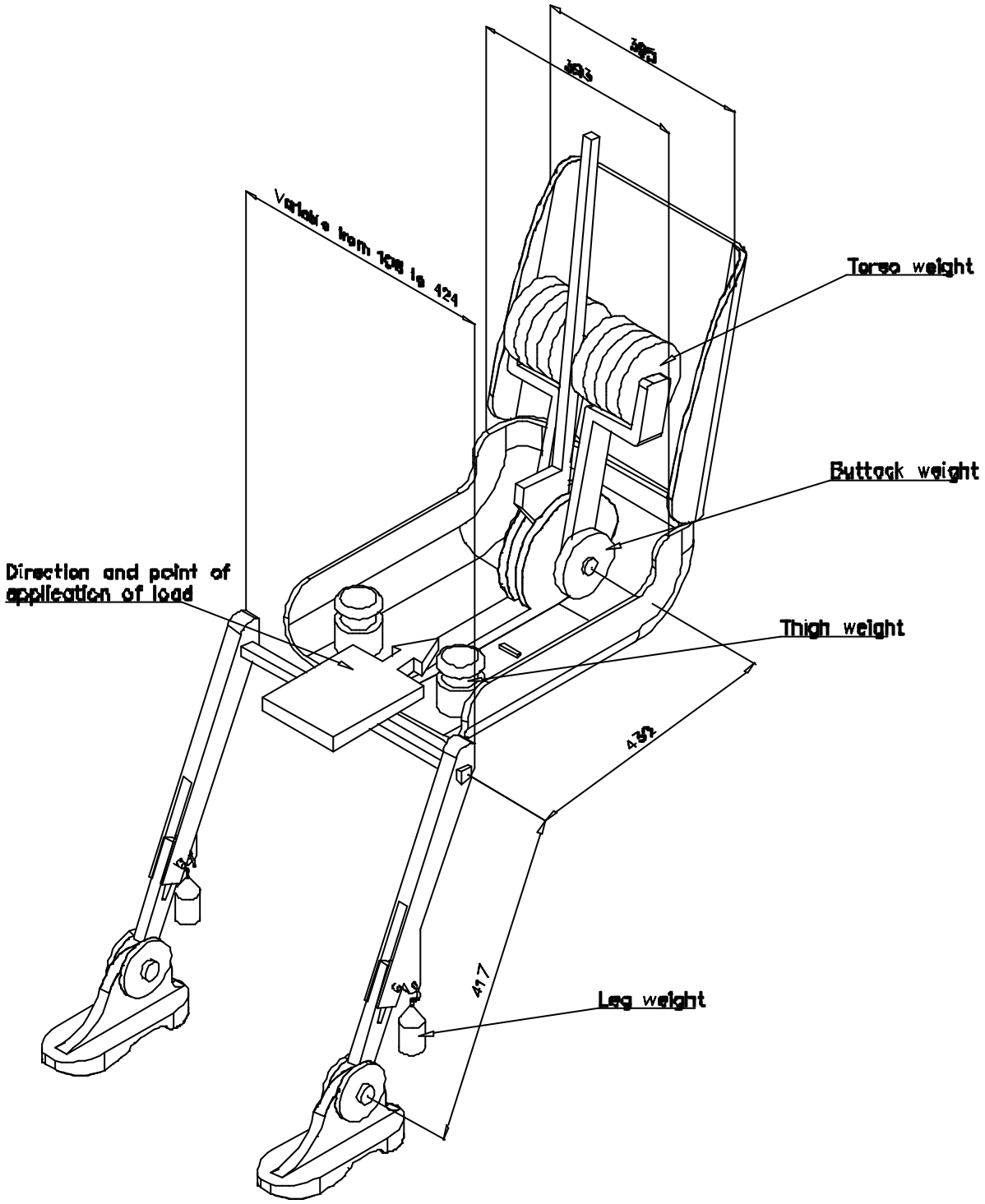
Variable from 106 to 424
Torso weight
Buttock weight
Direction and point of application of load
Thigh weight
430
417
Leg weight

Figure 2 - dimensions of the 3-D H machine elements and load distribution

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Annex 2 - Appendix 2

THREE-DIMENSIONAL REFERENCE SYSTEM

1. The three-dimensional reference system is defined by three orthogonal planes established by the vehicle manufacturer (see figure).

2. The vehicle measuring attitude is established by positioning the vehicle on the supporting surface such that the co-ordinates of the fiducial marks correspond to the values indicated by the manufacturer.

3. The co-ordinates of the "R" point and the "H" point are established in relation to the fiducial marks defined by the vehicle manufacturer.

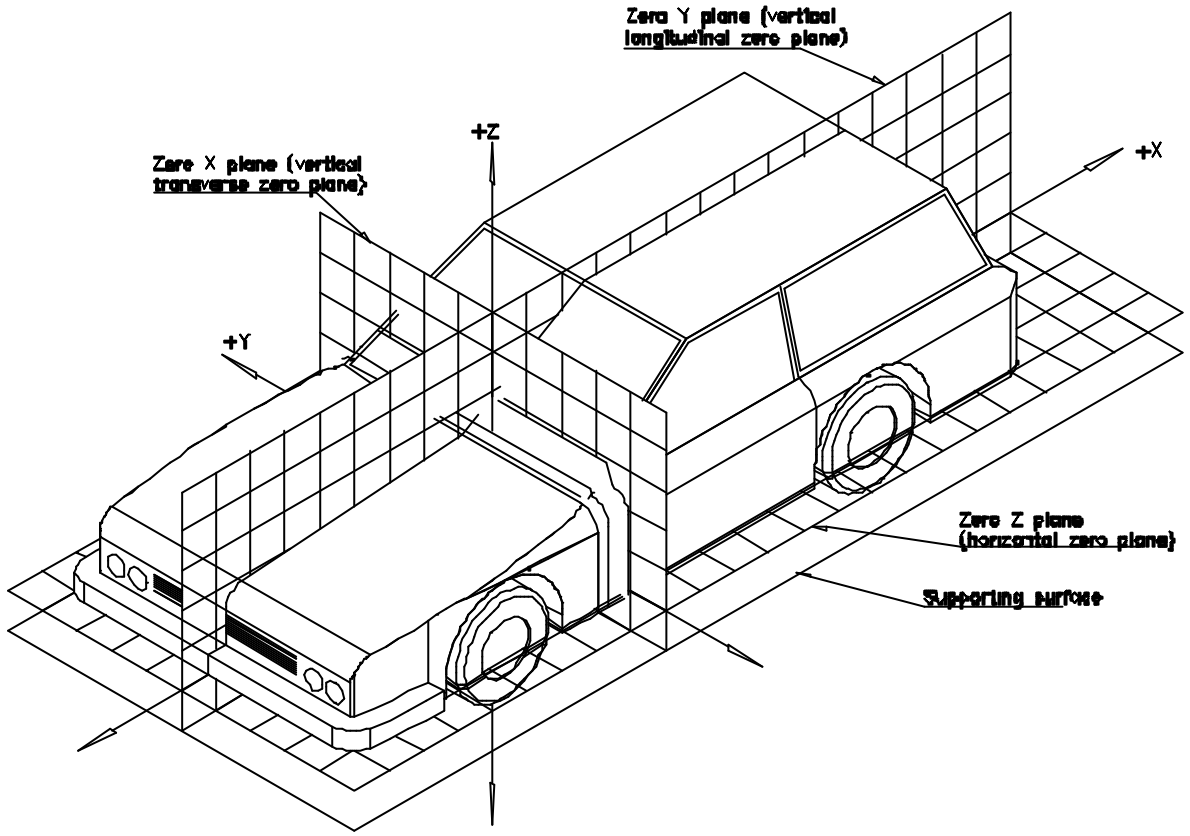

Figure – Three dimensional reference system

Annex 2 - Appendix 3

REFERENCE DATA CONCERNING SEATING POSITIONS

1. Coding of reference data

Reference data are listed consecutively for each seating position. Seating positions are identified by a two-digit code. The first digit is an Arabic numeral and designates the row of seats, counting from the front to the rear of the vehicle. The second digit is a capital letter which designates the location of the seating position in a row, as viewed in the direction of forward motion of the vehicle; the following letters shall be used:

L = left

C = centre

R = right

2. Description of vehicle measuring attitude

2.1. Co-ordinates of fiducial marks

X .....

Y .....

Z .....

3. List of reference data

3.1. Seating position: .....

3.1.1. Co-ordinates of "R" point

X .....

Y .....

Z .....

3.1.2. Design torso angle: .....

3.1.3. Specifications for seat adjustment

horizontal :.....

vertical :.....

angular :.....

torso angle:.....

Note: List reference data for further seating positions under

items 3.2., 3.3., etc.

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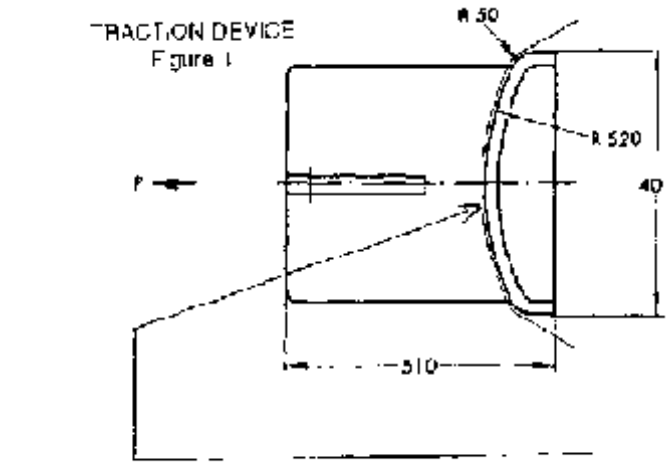
Annex 3



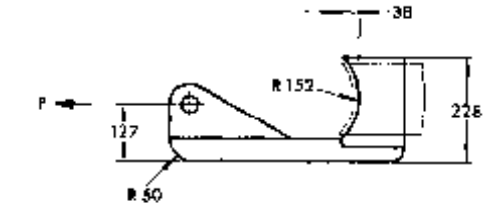


Figure 2

Figure 1

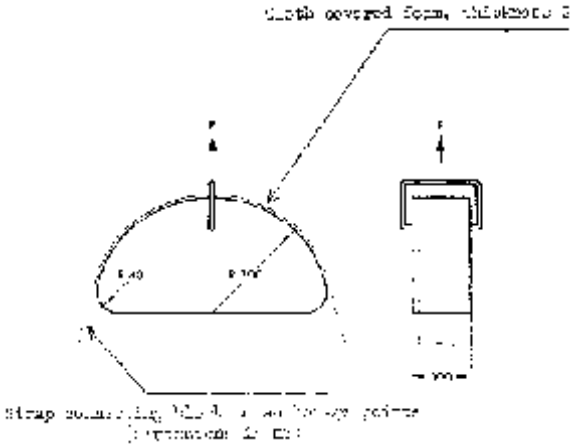


Figure 2

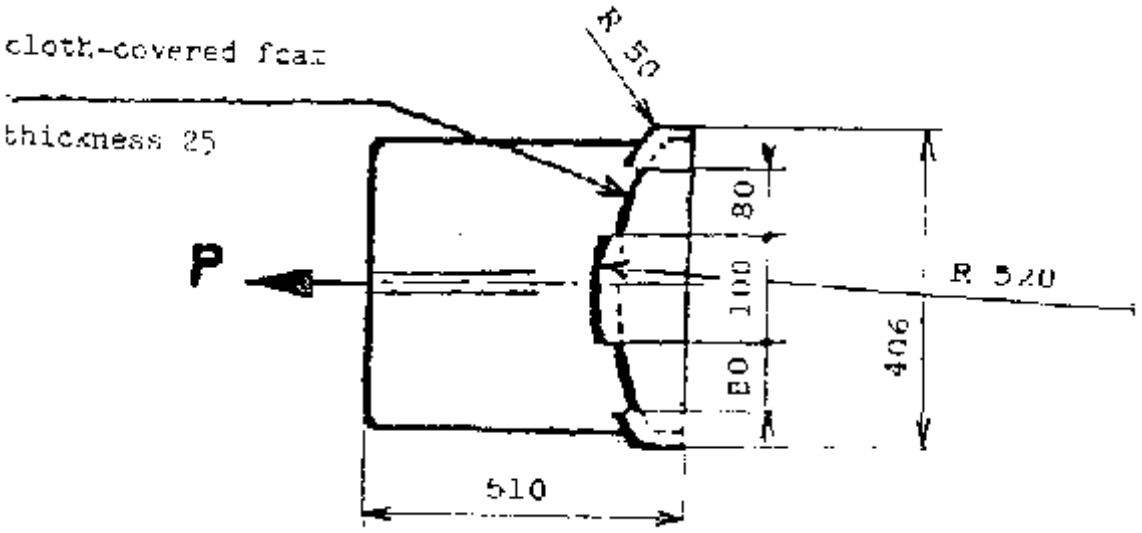


Figure 3

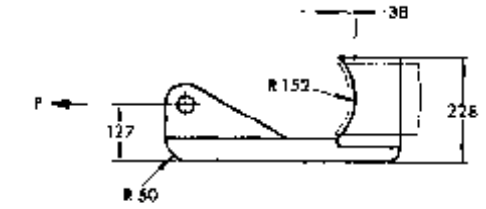


Figure 2

All dimensions are in mm