B. TEXT OF THE REGULATION

1. PURPOSE

The purpose of this regulation is to reduce the risk of serious and fatal injury of vehicle occupants in side impact crashes by limiting the forces, accelerations and deflections measured by anthropomorphic test devices in pole side impact crash tests as well as by other specified means.

2. APPLICATION / SCOPE

This regulation shall apply to all Category 1-1 vehicles; Category 1-2 vehicles with a Gross Vehicle Mass of up to 4,500 kg; and Category 2 vehicles with a Gross Vehicle Mass of up to 4,500 kg[1].

3. DEFINITIONS

3.1 "Carrier Sled" is a mobile, horizontal, flat and smooth surface (otherwise known as a flying floor or floating floor) used to impact the side of a test vehicle with a stationary pole.

3.2 "Fully Latched Position" is the coupling condition of the latch that retains the door in a completely closed position.

3.3 "Hinge" is a device used to position the door relative to the body structure and control the path of the door swing for passenger ingress and egress.

3.4 "H-Point" means the mechanically hinged hip point of a manikin which simulates the actual pivot centre of the human torso and thigh, described in SAE Recommended Practice J826, "Manikin for Use in Defining Vehicle Seating Accommodations", May 1987 and determined in accordance with Annex 3.

3.5 "Impact Reference Line" is the line formed on the striking side of the test vehicle by the intersection of the exterior surface of the vehicle and a vertical plane passing through the centre of gravity of the head of the anthropomorphic test device positioned in accordance with Annex 3 or Annex 4 (as applicable) in the struck-side front row outboard designated seating position. The vertical plane forms an angle of [285 (or 75)] degrees with the vehicle's longitudinal centreline for a right (or left) side impact test. The angle is measured counter-clockwise from the vehicle's positive X-axis in the vehicle reference co-ordinate system.

[1] A contracting party may restrict application of the requirements in its domestic legislation if it decides that such restriction is appropriate.

3.6 "Latch" is a device employed to maintain the door in a closed position relative to the vehicle body with provisions for deliberate release (or operation).

3.7 "Pole" means a fixed rigid vertically oriented metal structure with a continuous outer cross section diameter of 254 ± [3/6] mm, beginning no more than 102 mm above the lowest point of the tyres on the struck side of the vehicle in its test reference mass condition, and extending at least 100 mm above the highest point of the roof of the vehicle in its test reference mass condition.

3.8 "Rated Cargo and Luggage Mass" (RCLM) means the cargo and luggage carrying capacity of the vehicle, which is the mass obtained by subtracting the vehicle delivery mass and the rated occupant mass from the gross vehicle mass.

3.9 "Rated Occupant Mass" is the mass obtained by multiplying the total number of designated seating positions in the vehicle by 68 kg.

3.10 "Secondary Latched Position" refers to the coupling condition of the latch that retains the door in a partially closed position.

3.11 "Striker" is a device with which the latch engages to maintain the door in the fully latched or secondary latched position.

3.12 "Three-dimensional H-point machine" (SAE H-point machine) means the device used for the determination of "H-points" and actual torso angles. This device is defined in Annex 5.

3.13 "Torso line" means the centreline of the probe of the H-point machine with the probe in the fully rearward position.

3.14 "Test Reference Mass" means the vehicle delivery mass, plus 136 kg or the rated cargo and luggage mass (whichever is less), plus the mass of the necessary anthropomorphic test devices as determined in accordance with Annex 8.

3.15 "Vehicle Delivery Mass" is the nominal mass of a complete vehicle filled to 100 percent of all fluid capacities, with bodywork, all tyres inflated to the manufacturer's specifications and all factory fitted equipment, electrical and auxiliary equipment for normal operation of the vehicle, including liquids, tools, fire extinguisher, standard spare parts, chocks and spare wheel (if fitted), but without cargo or occupants, as determined in accordance with Annex 8.

3.16 "Vehicle Reference Coordinate System" is an orthogonal coordinate system consisting of three axes, a longitudinal axis (X), a transverse axis (Y), and a vertical axis (Z). X and Y are in the same horizontal plane and Z passes through the intersection of X and Y. The X-axis is parallel to the longitudinal centreline of the vehicle and is positive to the vehicle front end and negative to the rear end.

The Y-axis is positive to the left side of the vehicle and negative to the right side. The Z-axis is positive above the X-Y plane and negative below it.

3.17 "Vehicle Reference Fuel" means the fuel recommended by the vehicle manufacturer for the normal operation of the vehicle.

4. REQUIREMENTS

4.1 A vehicle tested in accordance with Annex 1, using a WorldSID 50th percentile adult male dummy[2], must meet the requirements of paragraphs 4.3, 4.5, 4.6, 4.7 and 4.8.

4.2 Based on a determination by each Contracting Party or regional economic integration organization, a vehicle tested in accordance with Annex 1 using a WorldSID 5th percentile adult female dummy, may also be required to meet the requirements of paragraphs 4.4, 4.5, 4.6, 4.7 and 4.8.

4.3 WorldSID 50th Percentile Adult Male Performance Requirements

4.3.1 The injury criteria response values measured by a WorldSID 50th percentile adult male in any struck-side front row outboard seating position of a vehicle tested in accordance with Annex 1, must meet the requirements of paragraphs 4.3.2 to 4.3.6.

4.3.2 Head Injury Criteria

4.3.2.1 The HIC36 must not exceed 1000 when calculated in accordance with paragraph 1 of Annex 6.

4.3.3 Shoulder Performance Criteria

4.3.3.1 Shoulder rib deflection must not exceed [65] mm when calculated in accordance with paragraph 2.1 of Annex 6.

4.3.3.2 The peak resultant shoulder force must not exceed [2.56] kN when calculated in accordance with paragraph 2.2 of Annex 6.

[2] The technical specifications, detailed drawings and adjustment requirements of the WorldSID 50th percentile adult male dummy are specified in [insert reference standard / GTR here].

4.3.4 Thorax Performance Criteria

4.3.4.1 The maximum thorax rib deflection must not exceed [50/57] mm when calculated in accordance with paragraph 3.1 of Annex 6.

4.3.4.2 The peak thorax viscous criterion must not exceed [0.82] m/s when calculated in accordance with paragraph 3.2 of Annex 6.

4.3.5 Abdomen Performance Criteria

4.3.5.1 The maximum abdomen rib deflection must not exceed [57] mm when calculated in accordance with paragraph 4.1 of Annex 6.

4.3.5.2 The peak abdomen viscous criterion must not exceed [0.82] m/s when calculated in accordance with paragraph 4.2 of Annex 6.

4.3.5.3 The lower spine acceleration must not exceed [75g] (1g = the acceleration due to gravity = 9.81 m/s^2), except for intervals whose cumulative duration is not more than 3ms, when calculated in accordance with paragraph 4.3 of Annex 6.

4.3.6 Pelvis Performance Criteria

4.3.6.1 The pubic symphysis force must not exceed [3.12] kN when calculated in accordance with paragraph 5.1 of Annex 6.

4.3.6.2 The pelvis acceleration must not exceed [111] g (1g = the acceleration due to gravity = 9.81 m/s^2), except for intervals whose cumulative duration is not more than 3ms, when calculated in accordance with paragraph 5.2 of Annex 6.

4.4 <u>WorldSID 5th Percentile Adult Female Performance Requirements</u>

4.4.1 Reserved until WorldSID 5th Percentile Adult Female requirements are included in this regulation or adopted in the national regulation of a Contracting Party or regional economic integration organization.

4.4.1.1 The absence of any performance requirements for a 5th percentile adult female anthropomorphic test device in this paragraph 4.4 shall not serve to promote or require a Contracting Party to remove any pre-existing pole side impact performance requirements for any 5th percentile adult female side impact dummy (including the SID-IIs), from any national regulation.

4.5 <u>Door Opening Requirements</u>

4.5.1 Any side door that is struck by the pole shall not separate totally from the vehicle.

4.5.2 Any door (including a rear hatchback or tailgate) that is not struck by the pole shall meet the following requirements:

4.5.2.1 The door shall not disengage from the [fully/secondary] latched position;

4.5.2.2 The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle; and

4.5.2.3 Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

4.6 Fuel System Integrity Requirements?

4.6.1 In the case of a vehicle propelled by liquid fuel, continuous leakage of liquid from the fuel-feed installation after the collision shall not exceed 30 g/min.

4.6.2 If the liquid from the fuel-feed system mixes with liquids from the other systems and the various liquids cannot easily be separated and identified, all the liquids collected shall be taken into account in evaluating the continuous leakage.

4.7 Electrical Safety Requirements?

4.8 Requirements for the Post-crash Evacuation of Occupants?

- Door opening force and release of dummy from restraint system requirements etc.?

ANNEX 1

DYNAMIC POLE SIDE IMPACT TEST PROCEDURE

1. PURPOSE

1.1 Demonstration of compliance with the requirements of paragraph 4 of this regulation, using a WorldSID 50th percentile adult male or WorldSID 5th percentile adult female test dummy (as applicable).

2. TEST EQUIPMENT

2.1 Carrier Sled

2.1.1 A carrier sled with a level, smooth and uniformly constructed surface large enough to ensure all wheels of the test vehicle remain in the same horizontal level plane [± tolerance mm] for at least 100ms after first vehicle contact (impact) with the pole.

2.1.2 Two (2) Polytetrafluoroethylene (PTFE) sheets for each vehicle tyre [minimum dimension? Covering section width +? Length?].

2.2 Other Measurement Equipment

2.2.1 A system for measuring the final vehicle-to-pole impact velocity.

2.2.2 Equipment for measuring tyre pressure.

2.2.3 Equipment for measuring vehicle fluid volumes.

2.2.4 Equipment for measuring the mass of the test vehicle (at each axle).

2.2.5 A temperature sensing system for recording the vehicle laboratory preparation area temperature.

2.2.6 Equipment for recording the position of the test dummy H-point and head centre of gravity relative to vehicle fiducial marks in the vehicle reference coordinate system.

2.2.7 Equipment for recording the actual impact alignment accuracy relative to the impact reference line.

2.2.8 Equipment for measuring the test vehicle pitch and roll angles.

2.2.9 Equipment for measuring the test vehicle ride heights at each wheel.

2.2.10 Measurement equipment shall have been calibrated at least once within 12 months of use in any test conducted for the purpose of determining compliance with this regulation. Such calibration shall be traceable to national standards.

2.3 Test Vehicle Preparation Area

2.3.1 An enclosed temperature controlled area suitable for ensuring stabilization of the test dummy temperature for at least [4 hours] prior to testing.

2.4 Rigid Pole

2.4.1 The impact face of the rigid pole shall be a vertically oriented metal structure with a continuous outer cross section diameter of 254 ± [3/6] mm, beginning no more than 102 mm above the lowest point of the tyres on the struck side of the vehicle in its test reference mass condition and extending at least 100 mm above the highest point of the roof of the vehicle in its test reference mass condition.

2.4.2 The pole face shall be offset from any mounting surface, such as a barrier or other structure, so that the test vehicle will not contact such a mount or support at any time within 100 ms of the initiation of vehicle to pole contact.

2.4.3 [The pole shall be sufficiently rigid such that it does not deform in any dimension by more than [x mm or %?] either during or after any test.]

2.5 A WorldSID 50th percentile adult male dummy in accordance with [insert reference standard / GTR here] and fitted with (as a minimum) all instrumentation required to obtain the data channels necessary to determine the injury criteria response values listed in paragraph 4.3 of this regulation.

2.6 [Reserved: A WorldSID 5th percentile adult female dummy (where applicable).]

3. VEHICLE PREPARATION

3.1 Each tyre shall be inflated to the manufacturer's recommended pressure [± tolerance] as listed on the vehicle tyre placard or otherwise specified by the manufacturer.

3.2 The mass of the test vehicle shall be adjusted to ± 1 percent of the test reference mass as defined in paragraph 3.17 of this Regulation.

3.2.1 Fuel tank ballast: the fuel tank shall be filled with either water or Stoddard[1] solvent approximately equal in mass to the mass of the vehicle reference fuel required to fill 100 percent of the useable fuel tank capacity.

3.2.1.1 Where water is used as the fuel tank ballast, water shall be added to the test vehicle fuel tank in an amount that is equal to not less than 72 percent and not more than 74 percent of the useable fuel tank capacity.

3.2.1.2 Where Stoddard solvent is used as the fuel tank ballast, Stoddard solvent shall be added to the test vehicle fuel tank in an amount that is equal to not less than 92 percent and not more than 94 percent of the useable fuel tank capacity.

3.2.2 Either water or Stoddard solvent shall be used to fill the entire fuel system from the fuel tank through to the engine induction system.

3.2.3 The mass placed in the cargo/luggage carrying area, including any onboard test equipment, shall be centred over the longitudinal centreline of the vehicle.

[1] Stoddard solvent has the physical and chemical properties of Type 1 solvent or cleaning fluid, as defined in Table 1, ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents".

3.2.4 Transmission fluid, brake fluid, coolant, engine oil, and windshield washer fluid may be drained from the test vehicle prior to the test and replaced with the equivalent ballast mass.

3.2.5 The mass on each test vehicle axle shall be within 5% or 20 kg (whichever is less) of the respective axle reference load determined in accordance with paragraph 3.5 of Annex 8 of this regulation.

4. VEHICLE PASSENGER COMPARTMENT ADJUSTMENTS

4.1 Adjustable Front Row Seats

4.1.1 When testing with a WorldSID 50th percentile adult male dummy, any seat adjustment, including any seat cushion, seatback, armrest, lumbar support, and head restraint shall be placed in the position of adjustment specified in Annex 3.

4.1.2 When testing with a WorldSID 5th percentile adult female dummy, any seat adjustment, including any seat cushion, seatback, armrest, lumbar support, and head restraint shall be placed in the position of adjustment specified in Annex 4.

4.2 Adjustable Seat Belt Anchorages

4.2.1 When testing with a WorldSID 50th percentile adult male dummy, adjustable seat belt anchorages shall be placed in the position of adjustment specified in Annex 3.

4.2.2 When testing with a WorldSID 5th percentile adult female dummy, adjustable seat belt anchorages shall be placed in the position of adjustment specified in Annex 4.

4.3 Adjustable Steering Wheels

4.3.1 Adjustable steering wheels shall be placed in the position of adjustment specified in Annex 3 or Annex 4 (as applicable).

4.4 Convertible Tops

4.4.1 Convertibles and open-body type vehicles shall have the top, if any, in place in the closed passenger compartment configuration.

4.5 Doors

4.5.1 Doors, including any rear hatchback or tailgate, shall be fully closed and latched but not locked.

4.6 Parking Brake

4.6.1 The parking brake shall be engaged.

4.7 Ignition

4.7.1 The ignition shall be “on”.

4.8 Pedals

4.8.1 Any adjustable pedals shall be placed as specified in Annex 3 or Annex 4 (as applicable).

4.9 Transmission

4.9.1 For a vehicle equipped with a manual transmission, the transmission shall be placed in second gear.

4.9.2 For a vehicle equipped with an automatic transmission, the transmission shall be placed in neutral.

4.10 Windows, Vents and Sunroofs

4.10.1 Moveable vehicle windows and vents located on the struck side of the vehicle shall be placed in the fully closed position.

4.10.2 Any sunroof(s) shall be placed in the fully closed position.

5. DUMMY PREPARATION AND POSITIONING

5.1 A properly clothed and calibrated WorldSID 50th percentile adult male or WorldSID 5th percentile adult female dummy (in accordance with reference standard/GTR) shall be positioned in the front outboard seat located on the impact side of the vehicle in accordance with either Annex 3 (WorldSID 50th percentile adult male seating procedure) or Annex 4 (WorldSID 5th percentile adult female seating procedure), as appropriate.

5.2 For a test in which the test vehicle is to be struck on its left side, each dummy shall be configured and instrumented to be struck on its left side, in accordance with [insert reference standard/GTR]. For a test in which the test vehicle is to be struck on its right side, each dummy shall be configured and instrumented to be struck on its right side, in accordance with [insert reference standard/GTR].

5.3 The stabilised temperature of the test dummy at the time of the test shall be between 20.6 degrees C and 22.2 degrees C.

5.4 A stabilised dummy temperature shall be obtained by soaking the dummy at controlled test laboratory environment temperatures within the range specified in paragraph 5.3 above for at least [4 hours] prior to the test.

5.5 The temperature of the dummy shall be recorded at intervals not exceeding [insert interval requirement in minutes here] by an internal non-impact side dummy chest cavity temperature sensor.

6. VEHICLE-TO-POLE SIDE IMPACT TEST

6.1 A carrier sled shall be used to impact a test vehicle prepared in accordance with paragraph 3, paragraph 4 and paragraph 5 of this Annex, at any velocity up to and including 32 km/h, with a stationary rigid pole[2].

6.2 The test vehicle shall be positioned on the carrier sled so that, when the vehicle-to-pole contact occurs, its longitudinal centreline is approximately at [75°] (for a left-side impact) or [285°] (for a right-side impact) relative to the direction of travel of the test vehicle/carrier sled.

6.3 To minimise friction between the tyres of the test vehicle and the surface of the carrier sled, two sheets of PTFE shall be placed between each vehicle tyre and the carrier sled.

[2] [Based on a determination by each Contracting Party or regional economic integration organisation, "any velocity up to and including 32 km/h" may be limited in domestic legislation to "31.5 ± 0.5 km/h".]

6.4 The impact reference line shall be aligned with the centreline of the rigid pole surface, as viewed in the direction of test vehicle/carrier sled travel, so that, when the vehicle-to-pole contact occurs, the centreline contacts the vehicle area bounded by two vertical planes parallel to and [20/38 mm] forward and aft of the impact reference line.

6.5 During the acceleration phase of the test, the acceleration of the carrier sled shall not exceed [1.5 m/s^2].

6.6 To avoid vehicle movement prior to the impact, the vehicle may be secured or attached to the carrier sled until 5 m before the vehicle first contacts (impacts) the pole.

6.7 To ensure the vehicle velocity is stabilized at impact, the attachment device used to propel the carrier sled along the test track and impact the test vehicle with the rigid pole shall be released from the carrier sled at least [0.5 m] before the vehicle first contacts (impacts) the pole.

6.8 The vehicle-to-pole impact velocity shall be measured after release of the attachment device used to propel the carrier sled along the test track and no more than [insert value here] m before the pole.

6.9 Crush tubes or comparable devices shall not decelerate the carrier sled until at least [insert value greater than 60ms] after the test vehicle first contacts (impacts) the pole.

ANNEX 2

THREE-DIMENSIONAL REFERENCE SYSTEM

1. The three dimensional reference system is defined by three orthogonal planes established by the vehicle manufacturer (see Figure 2-1) [1]/.

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 coordinates of the "R" point and the "H" point are established in relation to the fiducial marks defined by the vehicle manufacturer.

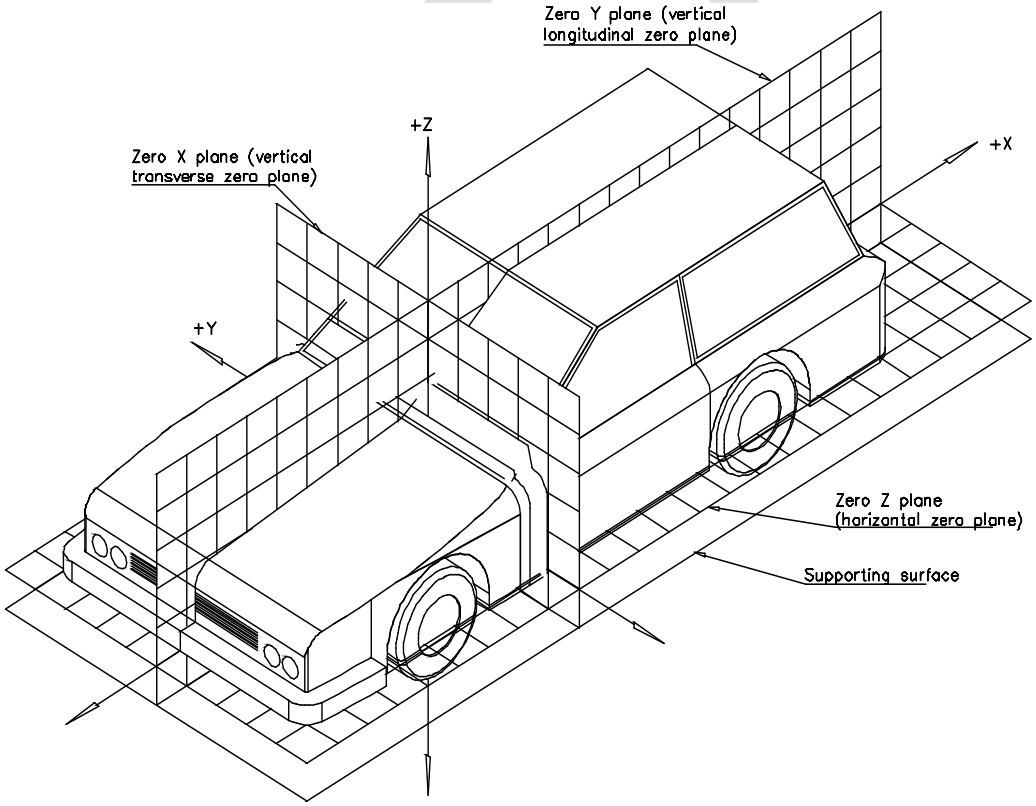

Figure 2-1 - Three-dimensional reference system

[1]/ The reference system corresponds to ISO standard 4130: 1978.

ANNEX 3

WORLDSID 50TH PERCENTILE ADULT MALE SEATING PROCEDURE

[RESERVED]

ANNEX 4

WORLDSID 5TH PERCENTILE ADULT FEMALE SEATING PROCEDURE

[RESERVED]

ANNEX 5

DESCRIPTION OF THE THREE-DIMENSIONAL H-POINT MACHINE [1]/

(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.

[1]/ For details of the construction of the 3-D H machine refer to Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, Pennsylvania 15096, United States of America (SAE J826 1995 version). The machine corresponds to that described in ISO Standard 6549: 1999.

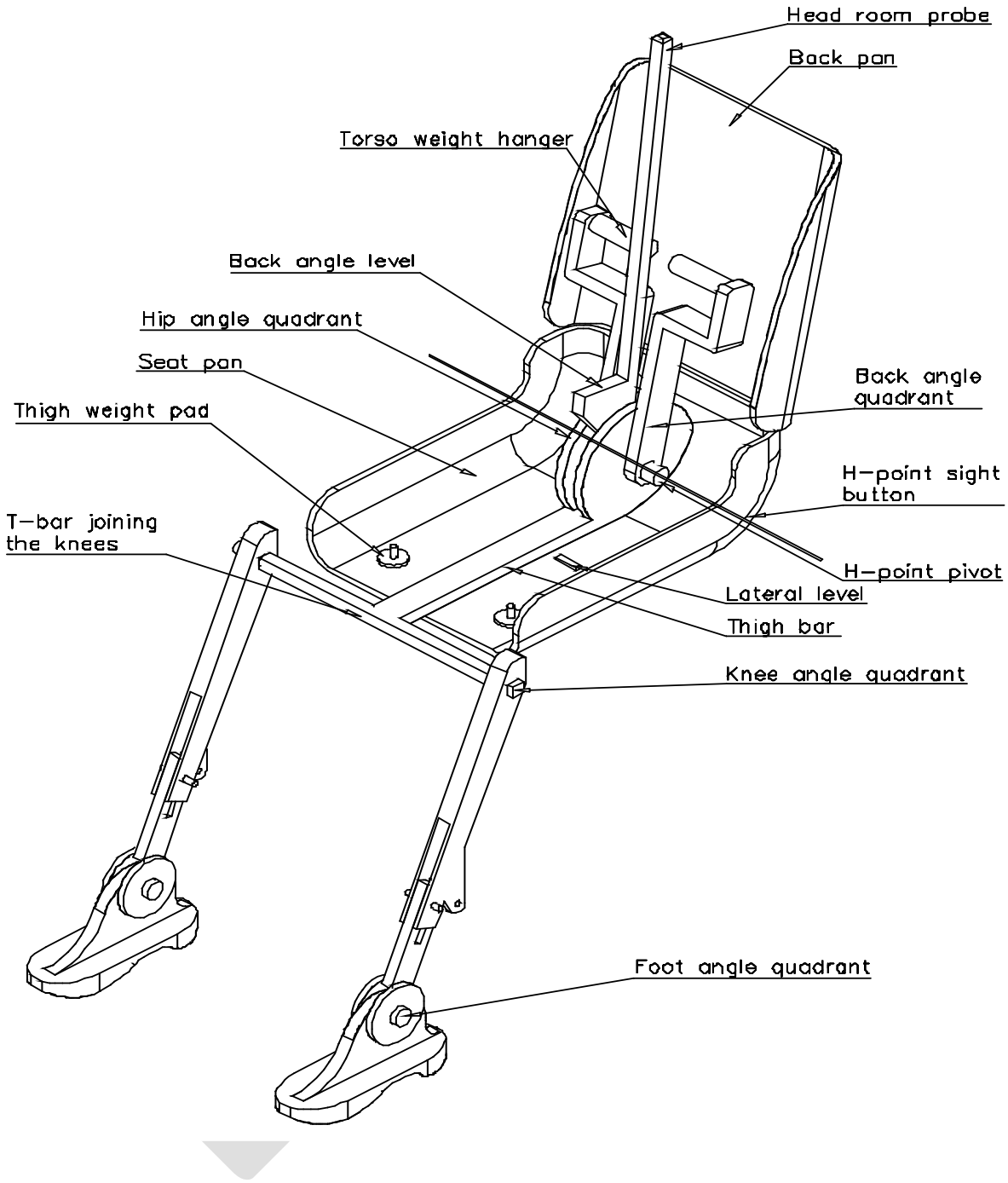

Figure 5-1 - 3-D H machine elements designation

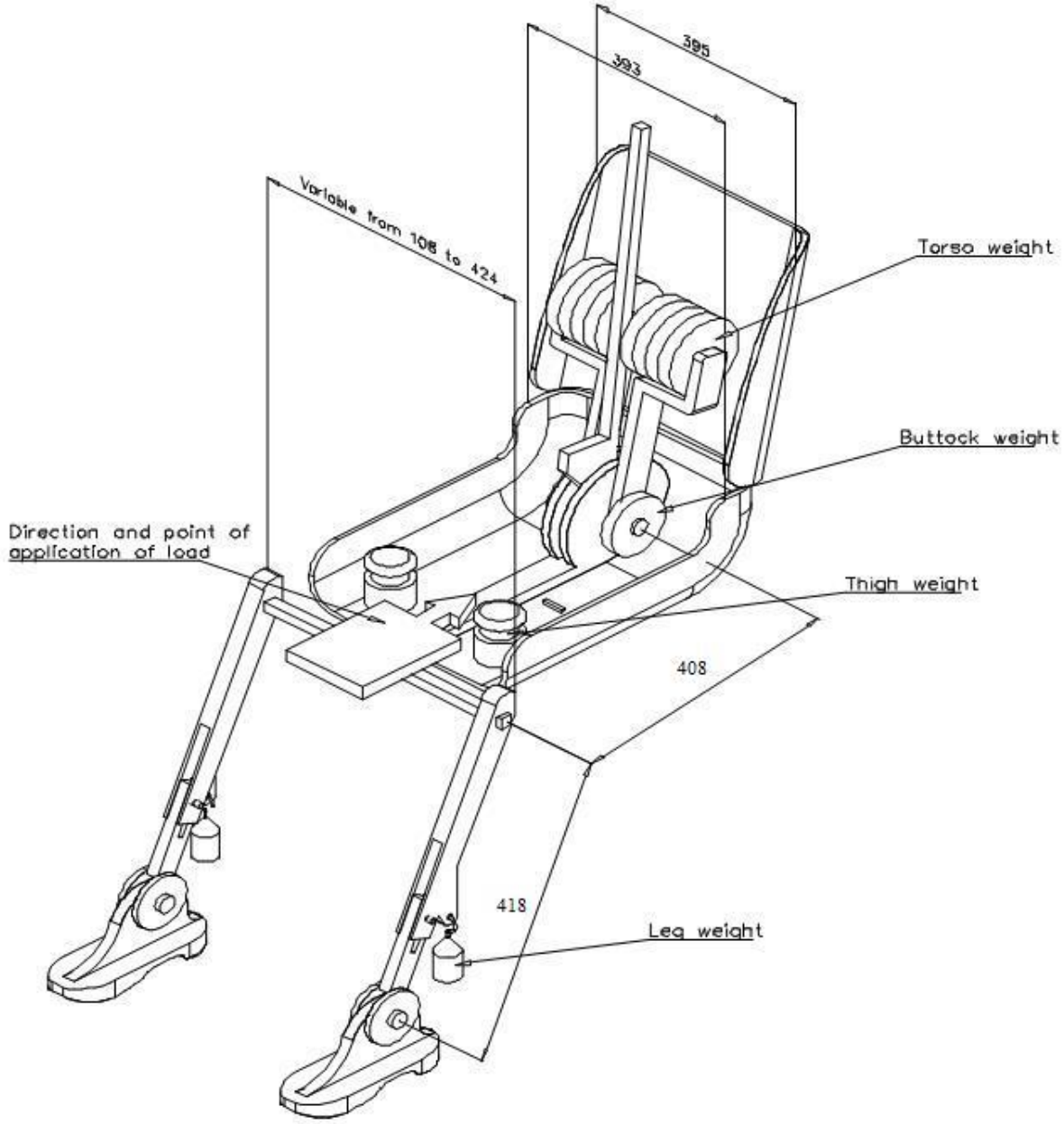

Figure 5-2 - Dimensions of the 3-D H machine elements and load distribution

(Dimensions in millimeters)

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ANNEX 6

DETERMINATION OF WORLDSID 50TH PERCENTILE ADULT MALE PERFORMANCE CRITERIA

1. HEAD INJURY CRITERION (HIC36)

1.1 The Head Injury Criterion is the maximum value calculated from the expression:

$$\text{HIC36} = \left[\frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a_R \, dt\right]^{2.5} (t_2 - t_1)$$

Where:

a_R = the resultant acceleration at the centre of gravity of the dummy head recorded versus time in units of gravity, g (1 g = 9.81 m/s^2); and

t_1 and t_2 are any two points in time during the impact which are separated by not more than a 36 millisecond time interval and where t_1 is less than t_2.

1.2 The resultant acceleration at the centre of gravity of the dummy head is calculated from the expression:

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

Where:

a_X = the longitudinal (x-axis) acceleration at the centre of gravity of the dummy head recorded versus time and filtered at a channel frequency class (CFC)[1] of 1000 Hz;
a_Y = the lateral (y-axis) acceleration at the centre of gravity of the dummy head recorded versus time and filtered at a CFC of 1000 Hz; and
a_Z = the vertical (z-axis) acceleration at the centre of gravity of the dummy head recorded versus time and filtered at a CFC of 1000 Hz.

2 SHOULDER PERFORMANCE CRITERIA

2.1 The shoulder rib deflection is determined in accordance with [insert reference standard / GTR here] from the voltage output measurements recorded by the

[1] For details of each Channel Frequency Class (CFC) refer to SAE Recommended Practice J211/1 (revision December 2003).

IR-TRACC mounted between the struck side shoulder rib mounting bracket and central spine box ball joint assembly, and filtered at a CFC of 600 Hz.

2.2 The longitudinal (x-axis), lateral (y-axis) and vertical (z-axis) shoulder forces are measured by the load cell mounted between the shoulder clevis assembly and the shoulder rib doubler. The peak resultant shoulder force is calculated from the expression:

$$F_R = \sqrt{F_X^2 + F_Y^2 + F_Z^2}$$

Where:

F_X = the longitudinal (x-axis) shoulder force recorded versus time and filtered at a CFC of 600 Hz;
F_Y = the lateral (y-axis) shoulder force recorded versus time and filtered at a CFC of 600 Hz; and
F_Z = the vertical (z-axis) shoulder force recorded versus time and filtered at a CFC of 600 Hz.

3 THORAX PERFORMANCE CRITERIA

3.1 The maximum thorax rib deflection is the maximum deflection of any (upper, middle or lower) thorax rib, as determined in accordance with [insert reference standard / GTR here] from the voltage output measurements recorded by the IR-TRACC mounted between the accelerometer mounting bracket and central spine box ball joint assembly inside each struck side thorax rib, and filtered at a CFC of 600 Hz.

3.2 The peak thorax viscous criterion response is the maximum value of VC on any (upper, middle or lower) thorax rib which is calculated from the instantaneous product of the thorax rib deflection as a proportion of the half thorax width, and the velocity of thorax rib deflection derived by differentiation of the deflection with respect to time:

$$VC = Max\left[\frac{D}{0.17}.\frac{dD}{dt}\right]$$

Where:

D = thorax rib deflection (metres) filtered at a CFC of 600 Hz

$$\frac{dD}{dt} = \frac{8[D_{(t+1)} - D_{(t-1)}] - [D_{(t+2)} - D_{(t-2)}]}{12dt}$$

t = time (s)

For the purposes of this calculation the standard width of the half thorax rib cage is 170 mm (0.17 m).

4 ABDOMEN PERFORMANCE CRITERIA

4.1 The maximum abdomen rib deflection is the maximum deflection of any (upper or lower) abdomen rib, as determined in accordance with [insert reference standard / GTR here] from the voltage output measurements recorded by the IR-TRACC mounted between the accelerometer mounting bracket and central spine box ball joint assembly inside each struck side abdomen rib, and filtered at a CFC of 600 Hz.

4.2 The peak abdomen viscous criterion response is the maximum value of VC on any (upper or lower) abdomen rib which is calculated from the instantaneous product of the abdomen rib deflection as a proportion of the half thorax width, and the velocity of abdomen rib deflection derived by differentiation of the deflection with respect to time:

$$VC = Max\left[\frac{D}{0.17}.\frac{dD}{dt}\right]$$

Where:

D = abdomen rib deflection (metres) filtered at a CFC of 600 Hz

$$\frac{dD}{dt} = \frac{8[D_{(t+1)} - D_{(t-1)}] - [D_{(t+2)} - D_{(t-2)}]}{12dt}$$

t = time (s)

For the purposes of this calculation the standard width of the half thorax rib cage is 170 mm (0.17 m).

4.3 The value of the resultant lower spine (T12) acceleration (a_R) which is exceeded for 3 milliseconds cumulatively (i.e. across one or more peaks) is calculated from the expression:

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

Where:

a_X = the longitudinal (x-axis) acceleration of the dummy lower spine recorded versus time and filtered at a CFC of 180 Hz;
a_Y = the lateral (y-axis) acceleration of the dummy lower spine recorded versus time and filtered at a CFC of 180 Hz; and
a_Z = the vertical (z-axis) acceleration of the dummy lower spine recorded versus time and filtered at a CFC of 180 Hz.

5 PELVIS PERFORMANCE CRITERIA

5.1 The pubic symphysis peak force (PSPF) is the maximum force measured by the load cell at the pubic symphysis of the pelvis and filtered at a CFC of 600 Hz.

5.2 The value of the resultant pelvis acceleration (a_R) which is exceeded for 3 milliseconds cumulatively (i.e. across one or more peaks) is calculated from the expression:

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

Where:

a_X = the longitudinal (x-axis) acceleration of the dummy pelvis recorded versus time and filtered at a CFC of 1000 Hz;
a_Y = the lateral (y-axis) acceleration of the dummy pelvis recorded versus time and filtered at a CFC of 1000 Hz; and
a_Z = the vertical (z-axis) acceleration of the dummy pelvis recorded versus time and filtered at a CFC of 1000 Hz.

ANNEX 7

DETERMINATION OF WORLDSID 5TH PERCENTILE ADULT FEMALE PERFORMANCE CRITERIA

[RESERVED]

ANNEX 8

PROCEDURE FOR DETERMINING VEHICLE DELIVERY AND TEST REFERENCE MASS CONDTITIONS AND VALUES

1. Vehicle Delivery Mass Condition

1.1 Place the test vehicle on a flat, level surface.

1.2 Drain/siphon the fuel from the vehicle fuel tank and/or operate the engine until the fuel tank and delivery system are empty.

1.3 Re-fill the tank with fuel, Stoddard Solvent[1], water or other ballast to a mass equivalent to the mass of the vehicle reference fuel required to fill 100% of the useable fuel tank capacity.

1.4 Record the volume, type and mass of the ballast fluid used to fill the fuel tank in accordance with paragraph 1.3 of this annex.

1.5 Ensure all other vehicle fluid reservoirs, including engine oil, transmission fluid, coolant, brake fluid and windshield washer fluid are filled to capacity as recommended by the vehicle manufacturer.

1.6 Ensure all the vehicle tyres are inflated in accordance with the vehicle tyre placard / manufacturer's instructions.

1.7 Ensure the vehicle is fitted with all standard factory fitted equipment, electrical and auxiliary equipment for normal operation of the vehicle, including tools, fire extinguisher, standard spare parts, chocks and spare wheel (if fitted).

1.8 Record the vehicle mass at each axle.

1.9 Calculate and record the vehicle delivery mass by determining the sum of the mass on each axle.

2 Vehicle Delivery Ride Height and Attitude Measurement

2.1 Place the test vehicle loaded to the vehicle delivery mass condition on a flat, level surface.

2.2 Record the distance between this flat, level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, to determine the vehicle ride height at each wheel.

2.3 Vehicle Delivery Pitch Angle Measurement: Mark a reference point on the driver and front passenger side door sills. Measure and record the angle of the door sills at that point.

2.4 Vehicle Delivery Roll Angle Measurement: Mark a reference point at the front and rear of the vehicle along a vertical plane that passes through the longitudinal centreline of the vehicle. Mark reference planes that are perpendicular to the vertical plane that passes through the longitudinal centreline of the vehicle and coincide with the reference points. Measure and record the left to right (roll) angles at the front and rear of the vehicle.

[1] Stoddard solvent has the physical and chemical properties of Type 1 solvent or cleaning fluid, as defined in Table 1, ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents".

3 Test Reference Mass Condition

3.1 Place the test vehicle loaded to the vehicle delivery mass condition on a flat, level surface.

3.2 Place weight(s) with a mass of 136 kg or the rated cargo and luggage mass (whichever is less), in the luggage compartment of the vehicle. Ensure this mass is centred over the longitudinal centreline of the vehicle.

3.3 Place the front row seats of the test vehicle in the position of adjustment required by Annex 3 or Annex 4 (as appropriate) of this regulation.

3.4 As appropriate, place weight(s) equivalent to a WorldSID 50^{th} percentile adult male test dummy (77.3 kg) or a WorldSID 5^{th} percentile adult female test dummy in the front outboard seating position on the impact side of the test vehicle.

3.5 Record the vehicle mass at each axle (the axle reference load).

3.6 Calculate and record the test reference mass by determining the sum of the mass on each axle.

4 Vehicle Test Reference Ride Height and Attitude Measurement

4.1 Place the test vehicle loaded to the vehicle test reference mass condition on a flat, level surface.

4.2 Record the distance between this flat, level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, to determine the vehicle ride height at each wheel.

4.3 Test Reference Pitch Angle Measurement: Mark a reference point on the driver and front passenger side door sills. Measure and record the angle of the door sills at that point.

4.4 Test Reference Roll Angle Measurement: Mark a reference point at the front and rear of the vehicle along a vertical plane that passes through the longitudinal centreline of the vehicle. Mark reference planes that are perpendicular to the vertical plane that passes through the longitudinal centreline of the vehicle and coincide with the reference points. Measure and record the left to right (roll) angles at the front and rear of the vehicle.