ANNEX 10

CRITERIA FOR TESTING AND EVALUATION OF REVENUE AND CREW SEATS

These criteria have been amended from the 1994 HSC Code in order to clarify and eliminate inconsistencies.

1 Purpose and scope

The purpose of these criteria is to provide requirements for revenue and crew seats, seat anchorage and seat accessories and their installation to minimize occupant injury and/or disruption of egress/ingress if the craft suffers a collision.

2 Static seat tests

2.1 The requirements of this section are applicable to all crew and revenue seats.

Note that static tests now apply to ALL seats. This is a change from the 1994 HSC Code, in which static tests are only applied to seats in craft with a collision design acceleration, g_{coll}, less than 3.

2.2 All seats to which this paragraph applies, along with their supports and deck attachments, shall be designed to withstand at least the following static forces applied in the direction of the craft:

.1 forward direction: a force of 2.25 kN;

.2 after direction: a force of 1.5 kN;

.3 transverse direction: a force of 1.5 kN;

.4 vertically downward: a force of 2.25 kN; and

.5 vertically upward: a force of 1.5 kN.

A seat shall comprise a frame, bottom and back. Forces applied in the fore or aft direction of the seat shall be applied horizontally to the seat back 350 mm above the seat bottom. Forces applied in the transverse seat direction shall be applied horizontally to the seat bottom. Vertical upward forces shall be evenly distributed to the corners of the seat bottom frame. Vertical downward forces shall be uniformly distributed over the seat bottom.

If a seating unit consists of more than one seating position, these forces shall be applied at each seating position concurrently during the tests.

2.3 When the forces are applied to a seat, consideration shall be given to the direction in which the seat is to face in the craft. For example, if the seat faces sideways, the transverse craft force would be applied fore and aft on the seat and the forward craft force would be applied transversely on the seat.

Where the same seating unit is used in a variety of orientations within the craft, it should be separately tested for each orientation.

2.4 Each seating unit to be tested shall be attached to the support structure similar to the manner in which it will be attached to the deck structure in the craft. Although a rigid support structure can be used for these tests, a support structure, having the same strength and stiffness as the support structure in the craft, is preferred.

2.5 The forces described in 2.2.1 to 2.2.3 shall be applied to the seat through a cylindrical surface having a radius of 80 mm and a width at least equal to the width of the seat. The surface shall be equipped with at least one force transducer able to measure the forces applied.

2.6 The seat shall be considered acceptable if:

.1 under the influence of the forces referred to in 2.2.1 to 2.2.3, the permanent displacement measured at the point of application of the force is not more than 400 mm;

.2 no part of the seat, the seat mountings or the accessories become completely detached during the tests;

.3 the seat remains firmly held, even if one or more of the anchorages is partly detached;

.4 all of the locking systems remain locked during the entire test but the adjustment and locking systems need not be operational after the tests; and

.5 rigid parts of the seat with which the occupant may come into contact shall present a curved surface with a radius of at least 5 mm.

2.7 The requirements of section 3 may be used in lieu of the requirements of this section provided that the accelerations used for the tests are at least 3g.

Note that since section 3 only requires tests under the collision design acceleration, g_{coll}, static tests in the other directions will always be required.

3 Dynamic seat tests

3.1 The requirements of this section are applicable in addition to those in 2.1 for crew and revenue seats in craft having a design collision load of 3g or greater.

3.2 All seats for which this section applies, the seat supporting structure, the attachment to the deck structure, the lap belt, if installed, and shoulder harness, if installed, shall be designed to withstand the maximum acceleration force that can be imposed upon them during a design collision. Consideration shall be given to the orientation of the seat relative to the acceleration force (i.e. whether the seat is forward-, aft-, or side-facing).

Where the same seating unit is used in a variety of orientations within the craft, it should be separately tested for each orientation.

3.3 The acceleration pulse to which the seat is subjected shall be representative of the collision time-history of the craft. If the collision time-history is not known, or cannot be simulated, the acceleration time-history envelope shown in the figure can be used.

The acceleration time-history used in the test should lie in the area between the two solid lines in the figure below.

3.4 In the test frame, each seat unit and its accessories (e.g., lap belts and shoulder harnesses) shall be attached to the support structure similar to the manner in which it will be attached in the craft. The support structure can be a rigid surface; however, a support structure having the same strength and stiffness as the support structure in the craft is preferred. Other seats and/or tables with which an occupant may come in contact during a collision shall be included in the test frame in an orientation and with a method of attachment typical of that in the craft.

"Same strength and stiffness" to be interpreted as "equivalent strength and stiffness".

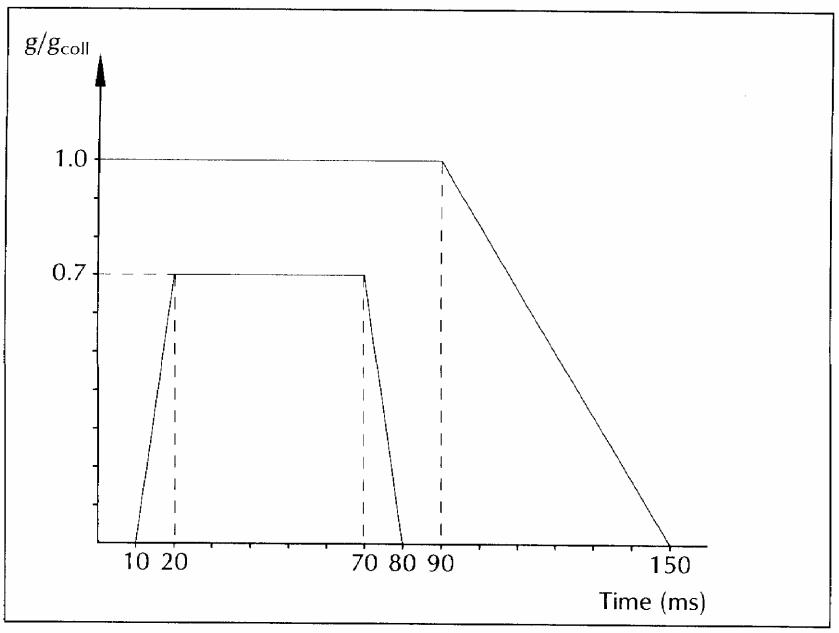

Figure – Acceleration time-history envelope

3.5 During the dynamic seat test, a fiftieth percentile anthropomorphic test dummy, suitable for the test being conducted, shall be placed in the seat in an upright seating position. If a typical seating unit is composed of more than one occupant seat, a test dummy shall be placed in each occupant seat in the unit. The dummy, or dummies, shall be secured in the seat unit in accordance with procedures of recognized national standards* and be secured using only the lap belt and shoulder harness if they are installed. Tray tables and other such devices shall be placed in the position that would cause the greatest potential for an occupant to become injured.

** Refer to ECE 80 with addendum 79. Other national standards may be acceptable.*

3.6 The test dummy shall be instrumented and calibrated, in accordance with the requirements of a recognized national standard, so as to permit, as a minimum, calculation of the head injury criterion, calculation of the thoracic trauma index, measurement of force in the femur, and measurement, if possible, of extension and flexion of the neck.

3.7 If more than one dummy is used in the tests, the dummy located in the seat having the highest potential for an occupant to be injured shall be the one instrumented. The other dummy or dummies need not be instrumented.

3.8 The tests shall be conducted and the instrumentation shall be sampled at a rate sufficient to reliably show response of the dummy in accordance with the requirements of a recognized national standard*.

** Refer to the specifications of International Standard ISO 6487 – Road vehicles – Measurement techniques in impact tests – Instrumentation (1987) or SAE J211 – Instrumentation.*

3.9 The seat unit tested in accordance with the requirements of this section shall be considered acceptable if:

.1 the seat unit and tables installed in the seat unit or area do not become dislodged from the supporting deck structure and do not deform in a manner that would cause the occupant to become trapped or injured;

.2 the lap belt, if installed, remains attached and on the test dummy's pelvis during the impact. The shoulder harness, if installed, remains attached and in the immediate vicinity of the test dummy's shoulder during the impact. After the impact, the release mechanisms of any installed lap belt and shoulder harness shall be operative;

.3 the following acceptability criteria are met:

.3.1 the head injury criterion (HIC), calculated in accordance with the formula, does not exceed 500

$$\mathrm{HIC} = (t_2 - t_1)\left[\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} a(t)\,\mathrm{d}t\right]^{2.5}$$

where:

t_1 and t_2 are the beginning and ending times (in seconds) of the interval in which the HIC is a maximum. The term a(t) is the resultant measured acceleration in the head of the dummy in g;

.3.2 the thoracic trauma index (TTI), calculated in accordance with the formula, does not exceed 30g except for periods totalling less than 3 ms

$$\mathrm{TTI} = \frac{g_R + g_{LS}}{2}$$ or acceleration at the centre of gravity

where:

g_R is the acceleration in g of either the upper or lower rib;

g_{LS} is the acceleration in g of the lower spine; and

.3.3 the force in the femur does not exceed 10 kN except that it cannot exceed 8 kN for periods totalling more than 20 ms; and

.4 loads on the upper torso harness straps do not exceed 7.8 kN or a total of 8.9 kN if dual straps are used.