


EASA	COMMENT RESPONSE DOCUMENT
	Proposed Special Condition D-xx on Airbag installation – Neck injury criteria (Applicable to Large Aeroplane category)

Commenter 1 : Boeing

Comment #[1] – Statement of Issue

There is no Appendix A located in the proposed SC

Comment :

The current wording :

“EASA consider now that these neck injury criteria, listed in Appendix A, ...”

is proposed to be corrected, to not reference Appendix A

EASA response: Agreed

The wrong reference has been corrected.

Comment #[2] – Statement of Issue

“EASA consider now that these neck injury criteria, [], are mature enough to be systematically added to the Special Conditions raised on any airbag design ...”

There have been few forward facing tests where NIC has been measured and are publically available. The conclusion that NIC is now mature enough for inclusion as a criterion for all airbag tests is premature.

Comment

Please provide reference to data demonstrating maturity of requirement.

EASA response:

Not agreed

Nij has been extensively used in the automotive industry to assess interaction between the occupant and airbags. The interaction between the occupant and the airbag may results in neck injuries also for the occupant of a forward-facing seat. It is understood that an aircraft seat equipped with an airbag having adequate size and performance may not cause any critical neck extension, flection or rotation. See also answer to comment #3.

Comment #[3] – Statement of issue

“However, for forward-facing seats, EASA finds acceptable that the assessment of neck injury be based on evidence coming from HIC tests conducted using the Hybrid II ATD, in which the ATD head is shown to adequately interact with the airbag ...”

As written, the proposed Special Conditions do not contain this wording and force the applicant to measure NIC using a HIII ATD.

Comment :

Incorporate this wording into the proposed Special Conditions.

EASA response:

Agreed

An Interpretative Material Section has been created to provide the clarification previously included in the statement of issue.

Comment #[4] – Statement of Issue

“... in which the ATD head is shown to adequately interact with the airbag, i.e. it is demonstrated that the ATD head would never hit the side edges of the airbag in testing conducted considering the entire range of yaw angles prescribed by CS 25.562.”

Clear definitions of these terms will enable the proposed Special Conditions to be appropriately applied and complied with. For instance, how close to the edge of the airbag is considered the “side”? This guidance is unclear.

Comment :

Please provide a clear definition of “adequate interaction” with the airbag.

Further, please provide a clear definition of “side edges of airbag.”

EASA response:

Not agreed

The special conditions clearly deliver the message that a structure mounted airbag installation should be substantiated in the entire range of yaw angles prescribed by CS 25.562. For forward-facing seats it must be shown that the Hybrid II ATD head interaction with the airbag is such that neck rotation, as well as neck extension and/or flexion, can be excluded.

Comment #[5] – Special Condition #a

“The installation of the airbag must protect the occupant from experiencing serious neck injury.”

As written, the proposed Special Condition does not specify a range of occupants.

The current practice to address occupant injury for emergency landing dynamic conditions separates front row installations and row-to-row installations. Front row installations are assessed by showing clearance using the 50th percentile head trajectory and by assessing the bulkhead, or partition, for protrusions that may potentially injure a 95th percentile occupant. Row-to-row installations are assessed for the complete range of occupants (5th percentile female to 95th percentile male) by adding 3 inches to the measured 50th percentile head trajectory and conducting appropriate analysis or testing.

The use of an airbag and the measurement of neck injury should not alter this process. The proposed Special Conditions should make this clear.

Comment :

Define the expected range of occupants for these proposed Special Conditions. State that for row-to-row installations, the range of occupants from 5th percentile female to 95th percentile male must be considered and for front row installations, only the 50th percentile occupant need be considered.

EASA response:

Not agreed

EASA special conditions on airbag installation have always required substantiation that the airbag provides adequate protection to the entire range of occupants.

Comment #[6] – Special Condition #c

“Available biomechanics texts, citing relevant research literature, indicate that there is a high risk of injury for head rotation over 114 degrees.”

Providing these references will enable the proposed Special Conditions to be evaluated in context.

Comment :

Please provide references to texts and research literature in a Special Condition introductory note.

EASA response:

Agreed

The Special Conditions have been revised to introduce a reference to “Accidental Injury, Biomechanics and Prevention”, Third Edition 2015, N. Yoganandan, A. Nahum, J. Melvin editors, Chapter 11 “Neck Injury Biomechanics”, R Nightingale, B. Myers, N. Yoganandan, Section 11.4.3 “Torsion”. In that section, 114 degrees is cited from a study by B. Myers as the “rotation required to produce injury in the cadaver”. The injury cited is “atlantoaxial dislocation” which is an AIS-3 (Serious) injury.

Comment #[7] – Special Condition #c

The lower limit prescribed is due to uncertainty of evaluation by visual means. Should the measurement be done using calibrated instrumentation, therefore eliminating the degree of uncertainty of a subjective review, it would seem reasonable to increase the limit.

Comment :

The current wording :

“Available biomechanics texts, citing relevant research literature, indicate that there is a high risk of injury for head rotation over 114 degrees. To account for the degree of uncertainty in determining the rotation angle from observation of test video, rotation of the head about its vertical axis relative to the torso is limited to 105 degrees in either direction from forward-facing.”

is proposed to be amended as followed :

“Available biomechanics texts, citing relevant research literature, indicate that there is a high risk of injury for head rotation over 114 degrees. ~~To account for the degree of uncertainty in determining the rotation angle from observation of test video, rotation of the head about its vertical axis relative to the torso is limited to 105 degrees in either direction from forward-facing.~~ Rotation of the head about its vertical axis relative to the torso in either direction from forward-facing, is limited to 105 degrees when evaluation is done by observation of test video. However, rotation of up to 114 degrees is acceptable if measurement is conducted by using calibrated instruments.”

EASA response:

Noted

EASA appreciates the intent of the comment. However, the text of the special conditions is fully harmonized with equivalent FAA Special Conditions. EASA will coordinate with the FAA and, if deemed necessary by both Aviation Authorities, the text of the special conditions may be revised in the future.

Comment #[8] – Special Condition #d

Our suggested text would clarify the expected behavior of the ATD during test and the types of contact that may be acceptable.

Comment :

The current wording :

“Impact of the neck with any surface could cause serious neck injury from concentrated loading and is not allowed.”

is proposed to be replaced as followed :

“Concentrated loading on the neck is unacceptable during any phase of the test. The intent is that the neck should not be a load path in any ATD contact with the seat system, never the initial point of contact and for neck movement to be in unison with the head and shoulders. In particular, the front of the neck should never be contacted, however incidental contact, such as a sliding motion against a flat surface, or a headrest, during rebound may be acceptable. [Visual evidence and loading data shall be collected during the test to show that neck contact is non-injurious.]”

EASA response:

Noted

EASA appreciates the intent of the comment. However, the text of the special conditions is fully harmonized with equivalent FAA Special Conditions. EASA will coordinate with the FAA and, if deemed necessary by both Aviation Authorities, the text of the special conditions may be revised in the future.