

EEVC WG12 D3 Status

**“The use of thoracic deflection
criteria balanced with abdomen
pressure criteria for the Q-Series in
frontal impacts”**

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GRSP IG Paris - April 19, 2016

EEVC WG 12 & Q dummies

- Terms of Reference from EEVC Steering Committee (SC)
- D1: Q10 in frontal impact (incl. thorax and abdo). Approved SC. Doc 642. Online.
- D2: Q10 in side impact. Approved SC. Doc 646. Online
- D3: Thorax and abdomen injury assessment with Q dummies. Draft finalized. To be submitted to SC. Doc 661. 72 pages, 6 sections.
 - Aims and Terms of Reference
 - Summary accident data
 - Abdominal sensors for Q1.5 to Q6
 - Thoracic injury criteria
 - Interactions with shoulder and lap belt
 - Summary conclusions and recommendations

D3 summary of recommendations (abdomen & submarining)

- Finalize APTS & abdomen design keeping in mind the biofidelity requirements and, if needed, update the certification procedure to better control the variability
 - Current final version: lighter moulded abdomen
- Implement APTS in Q dummies for regulatory testing both for integral and non-integral CRS.
- Concerning injury thresholds: implement a threshold around 1 bar pressure to distinguish between acceptable and non-acceptable abdominal penetration
 - For Q1.5: level should be further evaluated as biomechanical evidence and number of test results is limited in comparison to Q3 and Q6 and to some extent the Q10.

D3 summary of recommendations (abdomen & submarining)

- Q6 hip liner (insert) provided by Humanetics is effective to avoid unrealistic belt entrapment that prevents submarining behaviour with this dummy and is recommended to use in regulatory tests.
 - Q3 and Q10: Equivalent production-ready versions available. As soon as these inserts are positively evaluated, it is recommended to use these parts in regulatory tests as well.
- An adequate installation procedure should be used to evaluate protection from submarining in frontal impact tests with non-integral child restraint systems. The UMTRI installation procedure is recommended as it was shown to be effective for Q3, Q6 and Q10 dummies.

D3 summary of recommendations (thorax and diagonal belt)

- For chest deflection, initial recommendations for injury thresholds are available taking the AIS ≥ 4 threshold values from Table 13.

| 50% risk AIS ≥ 4 | Q0* | Q1 | Q1.5 | Q3 | Q6 | Q10 | HIII 50th |
|-----------------------|------|------|------|------|------|------|-----------|
| Deflection (mm) | 23.5 | 30.5 | 31.6 | 34.1 | 37.7 | 43.1 | 64.3 |
| Compression (%) | | 28.0 | 28.0 | 28.0 | 27.9 | 27.8 | 29.1 |

Deflection based on Mertz et al. (2003). Compression use depth from CANDAT or HIII spec. *cannot be measured

- Considering assumptions made to select these values, they should be evaluated for the specific applications in which the dummies are to be used, **separating integral CRS – for which no significant issues with the dummy kinematic behaviour was put forward – from belted configurations.**

D3 summary of recommendations (thorax and diagonal belt)

- Belted configurations:
 - due to issues with diagonal belt interactions, value and feasibility of adopting such chest deflection values as the **only assessment** of the chest loading in R129 Phase 2 remains to be proven. Recommended to continue research to improve diagonal belt interactions for Q3 and Q6. In particular, belt slippage towards the neck should be reduced.
 - **In the meantime, until such issues are fixed**, assuming that chest acceleration is kept as an injury criteria in that configuration, **use chest deflection in addition** to prevent strategies where the deformable ribcage of the dummy would be excessively compressed to lower the acceleration or other injury metric.

- Thanks