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Vägfordon – Metod för utvärdering av interaktion mellan bilbarnstol och airbag (ISO/TR 14645:2015, IDT)

Road vehicles – Test procedures for evaluating child restraint system interactions with deploying air bags (ISO/TR 14645:2015, IDT)

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Dokumentet är framtaget av kommittén för Fordonssäkerhet, SIS/TK 237.

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 36, *Safety aspects and impact testing*.

This second edition cancels and replaces the first edition (ISO/TR 14645:1998), which has been technically revised.

This document is published as a Technical Report, rather than as an International Standard, because of the general inexperience in testing the interaction between child restraint systems (CRS) and deploying air bags, and the lack of real-world accident data. When statistically significant, real-word data are available, in which air bags have contacted a variety of child restraints, and there is more testing experience with this interaction, it may be appropriate to develop an International Standard.

Introduction

During its inflation process, an air bag generates a considerable amount of kinetic energy and, as a result, substantial forces can be developed between the deploying air bag and the child restraint system (CRS). (For background on air bag design and deployment, see References [1] and [2]. With passenger air bags, laboratory tests have indicated that these forces can be sufficient to produce serious injury to the CRS occupant. The National Highway Traffic Safety Administration has recommended that rear-facing child restraints of current design be used only in the rear seat of vehicles equipped with such air bags (see Reference [3]). Even so, many children can be restrained in either rear- or forward-facing CRSs in the front seat of such vehicles, and the child and/or the CRS can interact with the air bag. These guidelines were developed to improve the understanding of such interactions and to aid in the assessment of future designs.

A mild-severity crash pulse is described in this Technical Report. This pulse is not vehicle-specific, but represents general acceleration-time histories. This mild-severity pulse approximates a crash that would just deploy a typical air bag. This pulse is used to evaluate the effect of the energy of the deploying air bag when the CRS and dummy are exerting the least amount of inertial force in the forward direction, but the dummy and/or CRS is moved forward by that inertial force. This generic pulse or other vehicle-specific pulses can be used as appropriate. Differences in shape between the generic and the vehicle-specific pulses are expected with corresponding differences expected in dummy responses.

This Technical Report encourages the use of a wide range of test configurations and conditions, while recognizing that the range of possible interactions is essentially limitless and beyond testing capability. Furthermore, measurements of primary importance for the various configurations are given in Table 1, but performance limits are not specified. References [4] to [9] give some background on human impact tolerance and criteria, describe scaling techniques for different size occupants, and offer interpretations of dummy responses relative to human injury potential that can be helpful in the evaluation. These and additional background papers on air bag development and deployment can be found in References [10] and [11].

Road vehicles — Test procedures for evaluating child restraint system interactions with deploying air bags

1 Scope

This Technical Report describes dummies, procedures, and configurations that can be used to investigate the interactions that occur between a deploying air bag and a Child Restraint System (CRS) that would have been considered properly installed and used in the outer and centre front passenger positions. Static tests can be used to sort CRS/air bag interaction on a comparative basis in either an actual or a simulated vehicle environment. Systems that appear to warrant further testing can be subjected to an appropriate dynamic test at a speed near that needed to deploy an air bag or at a higher speed commonly used to evaluate CRS performance. No test matrix is specified at this time for evaluating either a CRS or an air bag during interaction with each other. Instead, engineering judgment based on prior experience with CRS and/or air bag testing should be used in selecting the tests to be conducted with each individual system. Such tests can be aimed not only at producing interactions with the most severe results but also at identifying those conditions that produce the least interaction and/or satisfactory CRS performance results. Baseline tests to indicate the performance of a CRS in the absence of air bag deployment are also recommended for comparison purposes.

2 Normative references

There are no normative references.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
rear-facing
R
child restraint that positions the child to face the rear of the vehicle

3.2
laterally-positioned
L
child restraint that positions a prone or supine child perpendicular to the direction of vehicle travel

3.3
forward-facing
F
child restraint that positions the child to face the front of the vehicle

3.4
booster
B
normally used to better position adult belt restraints on the child

3.5
ISOFIX/LATCH
“plug-in” system designed for fitting child safety seats in cars quickly and with ease per ISO 13216

4 Test device

4.1 General

Five sizes of child dummies, from six-month to age six, are available for CRS/air bag investigations. However, the recommended dummies for use in this testing are listed in Reference [19].

4.2 Six-month-old infant dummies

4.2.1 CRABI 6-month

With specifications from the SAE Infant dummy task group, a six-month size dummy has been developed that allows measurement of head, chest, and pelvic accelerations, as well as upper and lower neck and lumbar spine forces and moments. A special six-channel transducer has also been developed for use in any of the spinal locations.

4.3 Nine-month-old infant dummy

4.3.1 P-3/4

This dummy is specified in UN-ECE Regulation 44, annex 8, and has been incorporated without instrumentation in 49 CFR, Part 572, subpart J. It has main-joint articulation and has provision for head and chest accelerometers and for modeling clay in the abdomen to detect penetration. A three-channel neck transducer has been developed for use with this dummy.

4.4 Twelve-month-old infant dummy

4.4.1 CRABI 12-month

With specifications from the SAE Infant dummy task group, a twelve-month size dummy has been developed that allows measurement of head, chest, and pelvic accelerations, as well as upper and lower neck and lumbar spine forces and moments.

4.5 Three-year-old child dummies

The standard child dummy for FMVSS and CMVSS 213 testing is specified in 49 CFR Part 572, subpart C. This dummy has provision for head and chest accelerometers. Use of the “new” vinyl-covered fiberglass head, specified in part 572.16(a) (1), is recommended over the old head.

4.5.1 Three-year-old child Hybrid III

This dummy was developed for passenger air bag testing (see Reference [16]) by a task force of the SAE Human Biomechanics and Simulation Standards Committee and is commercially available.

4.5.2 P-3

This dummy is specified in UN-ECE Regulation 44, annex 8. It has main-joint articulation and provisions for head and chest accelerometers and for modelling clay in the abdomen to detect penetration.

4.5.3 Q-3

In 1993, the International Child Dummy Working Group started the development of a new series of child dummies as a successor to the P-series. This new series was called the Q-series. The development of the Q-series, directed by the International Child Dummy Working Group, resulted in a Q3 dummy in 1998, followed by the addition of the Q6 dummy in 1999, and the Q1 in 2000.

Part of the development of the Q-dummies has taken place within the European Research programs CREST (see Reference [1]) and CHILD (see Reference [2]), both aimed at improving child safety in cars.

4.6 Six-year-old child dummies

4.6.1 P-6

This dummy is specified in UN-ECE Regulation 44, annex 8. It has main-joint articulation and has provision for head and chest accelerometers and for modelling clay in the abdomen to detect penetration.

4.6.2 Hybrid-III six-year

This dummy was developed under a grant from the Centers for Disease Control (CDC), with input from SAE committees, and allows measurement of head, chest, and pelvic accelerations; neck, lumbar, and femur forces and moments; and chest displacement.

4.6.3 Q-6

The development of the Q-series, directed by the International Child Dummy Working Group, resulted in a Q3 dummy in 1998, followed by the addition of the Q6 dummy in 1999, and the Q1 in 2000.

Part of the development of the Q-dummies has taken place within the European Research programs CREST (see Reference [1]) and CHILD (see Reference [2]), both aimed at improving child safety in cars.

5 Instrumentation

5.1 Measurements

Measurements that can be made or calculated using the anthropomorphic test device for each age group as listed in 5.2 to 5.9. All measurements should be recorded and filtered according to ISO 6487 and SAE J 211 for body regions. These measurements should be continuous functions of time, so that other quantities referred to in the references may be derived.

5.2 CRABI 6-month and 12-month

— Head triaxial acceleration

— Head angular acceleration (one channel)

— Upper neck forces and moments (six channels)

— Lower neck forces and moments (six channels)

— Chest triaxial acceleration

— Lumbar spine forces and moments (six channels)

— Pelvic triaxial acceleration

5.3 P-3/4 nine-month

— Head triaxial acceleration (three channels)

— Upper neck forces (Fx, Fz) and moment (Fy)

— Chest triaxial acceleration

5.4 Hybrid III three-year