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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 12349-1 was prepared by Technical Committee ISO/TC 22, *Road Vehicles*, Subcommittee SC 12, *Passive Safety Crash Protection Systems*.

This second edition cancels and replaces the first edition (ISO/TR 12349-1:1999), which has been technically revised.

ISO/TR 12349 consists of the following parts, under the general title *Road vehicles — Dummies for restraint system testing*:

— *Part 1: Adult dummies*

— *Part 2: Child dummies*

Road vehicles — Dummies for restraint system testing — Part 1: Adult dummies

1 Scope

This Technical Report describes the adult crash test dummies which are recommended by ISO for use in evaluating the occupant protection potential of restraint systems in frontal, rear and side impact test procedures and out-of-position airbag test procedures. This Technical Report represents the best recommendation of widely available adult crash test dummies at the time of publication.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references only the edition cited applies. For undated references, the latest edition of the referenced document (including amendments) applies.

SAE J2862, *User's manual for the small adult female Hybrid III test dummy*, Warrendale, PA, USA.

SAE J2856, *User's manual for the 50th percentile Hybrid III dummy*, Warrendale, PA, USA.

SAE J2860, *User's manual for the Hybrid III large male test dummy*, Warrendale,PA, USA.

ISO 15830 (all parts), *Road vehicles – Anthropomorphic side impact dummy – Design and performance specifications for the WorldSID 50th percentile male side impact dummy*

SAE J2915, *H-III5F spine box update to eliminate electrical signal noise*, Warrendale, PA, USA.

SAE J2949, *H-III 50M ankle update to eliminate electrical signal noise*, Warrendale, PA, USA.

SAE J2779, *Low speed thorax impact test procedure for the HIII 50th male dummy*, Warrendale, PA, USA.

SAE J2878, *Low speed thorax impact test procedure for the HIII5F dummy*, Warrendale, PA, USA.

ISO TR 24997, *Road vehicles – Hybrid 3 chest potentiometer calibration procedure*

SAE J2517, *Hybrid III family chest potentiometer calibration procedure*, Warrendale, PA, USA.

SAE J2876, *Low speed knee slider test procedure for Hybrid III 50th male dummy*, Warrendale, PA, USA.

SAE J2570, *Performance specifications for anthropomorphic test device transducers*, Warrendale, PA, USA.

ISO 6487, *Road vehicles – Measurement techniques in impact - Instrumentation*

SAE J211-1, *Instrumentation for impact test – Part 1 – Electronic instrumentation*, Warrendale, PA, USA.

SAE J733, *Sign convention for vehicle crash testing*, Warrendale, PA, USA.

ISO TR 27957, *Road vehicles – Temperature measurment in anthropomorphic test devices – Definition of temperature sensor locations*

ISO 13330, Road vehicles – Calculation processes for neck injury criteria in rear impact

SAE J1727, *Calculation guidelines for impact testing*, Warrendale, PA, USA.

ISO/TR 7861, *Road vehicles – Injury risk curves to evaluate occupant protection in frontal impact*

ISO/TR 12350, *Road vehicles – Injury risk curves to evaluate occupant protection in side impact*

3 Symbols and abbreviated terms

3.1 Symbols

For the purposes of this Technical Report, the following symbols apply:

— A_x, A_y, A_z – linear acceleration along the positive x, y and z axes of the dummy

— F_x, F_y, F_z – force along the positive x, y and z axes of the dummy

— M_x, M_y, M_z – moment about the positive x, y and z axes of the dummy

— δ_x, δ_y, δ_z – deflection along the positive x, y and z axes of the dummy

3.2 Abbreviated terms

For the purposes of this Technical Report, the following abbreviations apply:

— ASIS – anterior superior iliac spine

— OOP – out-of-position

4 Recommended Dummies

A review of the widely available adult crash test dummies was carried out by the experts of ISO/TC 22/ SC 12/ Working Group 5, *Anthropomorphic Test Devices*. Adult dumies whose designs were protected intellectual property at the time of review were not considered.

4.1 Adult dummies recommended for frontal impact crash tests

The following dummies are recommended for use in frontal impact crash and sled tests [2,3,5]:

— Hybrid III small adult female[1)]

— Hybrid III midsize adult male

— Hybrid III large adult male

4.2 Adult dummies recommended for side impact crash tests

The following dummies are recommended for use in side impact crash and sled tests [1,4]:

— SID-IIs small adult female (recommended on an interim basis)

1) Do not use a neck shield, unless specified by the test procedure

— WorldSID midsize adult male

4.3 Adult dummy recommended for rear impact crash tests

The following dummy is recommended for use in high-severity rear impact crash and sled tests [11,9]:

— Hybrid III midsize adult male

4.4 Adult dummies recommended for out-of-position airbag tests

The following dummies are recommended for use in OOP airbag tests [6,7,8]:

— Hybrid III small adult female (for OOP tests with frontal airbags)

— SID-IIs small adult female (for OOP tests with side torso or curtain airbags)

Neck shield ABA-211 is recommended, but shall be used only if the test procedure specfies the use of a neck shield [10]. Instrumented arm(s) shall be used, but at the time of publication, no specific instrumented arm is recommended.

5 Dummy Instrumentation

5.1 Instrumentation for adult frontal impact dummies

Table 1 lists the instrumentation that is used with the recommended frontal impact dummies.

Table 1 — Instrumentation for adult frontal impact dummies

Dummy Instrumentation	Hybrid III small female	Hybrid III midsize male	Hybrid III large male
Head			
Linear acceleration	A_x, A_y, A_z	A_x, A_y, A_z	A_x, A_y, A_z
Neck			
Head/C1 loads ad moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
C7/T1 loads and moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Thorax			
Spine acceleration	A_x, A_y, A_z	A_x, A_y, A_z	A_x, A_y, A_z
Sternum acceleration	A_x	-	-
Sternum deflection	δ_x	δ_x	δ_x
Lumbar			
Loads and moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Pelvis			
Acceleration	A_x, A_y, A_z	A_x, A_y, A_z	A_x, A_y, A_z
ASIS loads and moments	F_x, M_y	F_x (upper & lower)	F_x (upper & lower)
Lower extremities (left & right)			
Femur load	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Tibia/femur displacement	δ_x	δ_x	δ_x
Medial clevis load	F_z	F_z	F_z
Lateral clevis load	F_z	F_z	F_z
Upper tibia loads and moments	F_x, F_y, F_z, M_x, M_y	F_x, F_y, F_z, M_x, M_y	F_x, F_y, F_z, M_x, M_y
Lower tibia loads and moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z

5.2 Instrumentation for adult side impact dummies

Table 2 lists the instrumentation that is used with the recommended side impact dummies.

Table 2 — Instrumentation for adult side impact dummies

Dummy Instrumentation	SID-IIs small female	WorldSID midsize male
Head		
Linear acceleration	A_x, A_y, A_z	A_x, A_y, A_z
Neck		
Head/C1 loads ad moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
C7/T1 loads and moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Shoulder		
Loads	F_x, F_y, F_z	F_x, F_y, F_z (left & right)
Deflection	δ_y	δ_y
Thorax		
Spine acceleration (T1, T4, T12)	A_x, A_y, A_z	A_x, A_y, A_z (left & right)
Rib acceleration (upper, mid, lower)	A_y	A_x, A_y, A_z (left & right)
Rib deflection (upper, mid, lower)	δ_y	δ_y (left & right)
Abdomen		
Rib acceleration (upper & lower)	A_y	A_x, A_y, A_z (left & right)
Rib deflection (upper & lower)	δ_y	δ_y (left & right)
Lumbar		
Loads and moments	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Pelvis		
Acceleration	A_x, A_y, A_z	A_x, A_y, A_z
Iliac wing load (left & right)	F_y	F_y
Sacrum load (left & right)	-	F_x, F_y, F_z, M_x, M_y, M_z
Acetabulum load (left & right)	F_y	-
Pubic load (left & right)	F_y	F_y
Lower extremities (left & right)		
Femur neck load	-	F_x, F_y, F_z
Femur shaft load	F_x, F_y, F_z, M_x, M_y, M_z	F_x, F_y, F_z, M_x, M_y, M_z
Knee contact load (left & right)	-	F_y (inner & outer)
Upper tibia loads and moments	F_x, F_y, F_z, M_x, M_y	F_x, F_y, F_z, M_x, M_y, M_z
Lower tibia loads and moments	F_x, F_y, F_z, M_x, M_y	F_x, F_y, F_z, M_x, M_y, M_z

5.3 Instrumentation for adult rear impact dummy

Table 3 lists the instrumentation that is used with the dummy recommended for high-severity rear impact tests.

Table 3 — Instrumentation for adult rear impact dummy

Dummy Instrumentation	Hybrid III midsize male
Head	
Linear acceleration	A_x, A_y, A_z
Neck	
Head/C1 loads ad moments	F_x, F_y, F_z, M_x, M_y, M_z
C7/T1 loads and moments	F_x, F_y, F_z, M_x, M_y, M_z
Thorax	
Spine acceleration	A_x, A_y, A_z
T1 loads and moments	F_x, F_z, M_y
Lumbar	
Loads and moments	F_x, F_y, F_z, M_x, M_y, M_z
Pelvis	
Acceleration	A_x, A_y, A_z

Bibliography

1. **ISO 10997.** *Passenger vehicles - Side impact with deformable moving barrier - Full scale test.*

2. **ISO 3560.** *Road vehicles - Frontal fixed barrier or pole impact test procedure.*

3. **ISO 15828.** *Road vehicles - Offset frontal impact test procedure.*

4. **ISO 15829.** *Road vehicles - Side impact test procedures for evaluation of occupant interactions with side airbags by pole simulation.*

5. **ISO 7862.** *Road vehicles - Sled test procedure for evaluation of retraint systems by simulation of frontal collisions.*

6. **ISO/TS 15827.** *Road vehicles - Test procedures - Evaluating small female dummy arm and forearm interactions with driver frontal airbags and side airbags.*

7. **ISO/TR 14933.** *Road vehicles - Test procedures for evaluating occupant interactions with deploying side impact airbags.*

8. **ISO/TR 10982.** *Road vehicles - Test procedures for evaluating out-of-position vehicle occupant interactions with deploying air bags.*

9. **ISO 17373.** *Road vehicles - Sled test procedure for evaluating occupant head and neck interactions with seat/head restraint designs in low-speed rear-end impact.*

10. **R.F. Banglmaier, K.M. Pecoraro, J.R. Feustel, R.D. Scherer and S.W. Rouhana.** *Development and evaluation of a proposed neck shield for the 5th percentile Hybrid III female dummy.* Stapp Car Crash Journal, vol. 49, 2005. pp. 509-531.

11. **ISO 3984.** *Road vehicles - Rear moving barrier impact test procedure.*