
Road vehicles — Injury risk curves for the THOR dummy

*Véhicules routiers — Courbe de risques de blessures pour mannequin
THOR*



This document is a preview generated by EUS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	1
4 Methodology	2
5 Injury risk curves	3
5.1 Head	3
5.1.1 HIC	3
5.1.2 Rotational criterion	6
5.2 Neck	14
5.2.1 N_{ij} – Eppinger	14
5.2.2 N_{te} – Mertz	16
5.3 Thorax	18
5.3.1 Maximum resultant deflexion	18
5.3.2 PC-Score	21
5.3.3 TIC	24
5.4 Abdomen	28
5.4.1 Penetration	28
5.5 Knee-thigh-hip	31
5.5.1 Femur z-force	31
5.5.2 Acetabulum force	33
5.5.3 Femur force versus acetabulum force	35
Annex A (informative) HIC data	36
Annex B (informative) Brain	39
Annex C (informative) Neck	73
Annex D (informative) Thorax	76
Annex E (informative) Abdomen	79
Annex F (informative) Knee-thigh-hip	80
Annex G (informative) HIII-THOR neck transfer function	98
Annex H (informative) Repeatability and reproducibility	100
Annex I (informative) Thorax repeatability and reproducibility	101
Bibliography	103

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 ISO documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 36, *Safety aspects and impact testing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The THOR-M 50 dummy is in its final development phase and can be used to evaluate the occupant protection in frontal impact. US-NCAP and Euro-NCAP are currently developing test procedures using this dummy to evaluate car performances. However, injury risk curves (IRCs) are proposed by these organizations without a large consensus. Rules were established to develop IRCs (ISO/TS 18506). These rules were applied to the available data to evaluate IRCs for THOR-M 50. In addition to the quality evaluation as recommended in ISO/TS 18506, considerations on the repeatability and reproducibility of the criteria, as well as their performance with regard to field investigations will be proposed.

Road vehicles — Injury risk curves for the THOR dummy

1 Scope

This document provides injury risk curves to assess occupant protection in frontal impact using the 50th percentile THOR metric dummy (THOR-M 50).

Injury risk curves developed specifically for the THOR dummy are chosen preferably, however, when not available, the applicability of the PMHS injury risk curve is evaluated with regard to the dummy biofidelity.

Finally, when possible, a field evaluation is provided.

2 Normative references

There are no normative references in this document.

3 Terms and definitions and abbreviated terms

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 Terms and definitions

3.1.1

THOR-M 50

50th percentile metric dummy as defined in Reference [61]

3.1.2

injury criterion

physical parameter which correlates well with the severity of a specific injury or injuries of a body region under consideration

3.1.3

injury risk curve

IRC

curve giving the probability, for a defined population and for a given input, to sustain a specified severity of injury

3.1.4

injury risk function

IRF

mathematical function that relates a value of an *injury criterion* (3.1.2) and possible additional factors (variables) to a risk of sustaining an injury of a certain level

3.2 Abbreviated terms

AIS abbreviate injury score