

# Harmonization of qualification data

Instructions to generate standardized ISO-MME data sets

Motivation

## Motivation



- › General problem
  - › Analysis (comparison of time-history curves) of qualification data coming from different sources is complicated
    - ISO TS 13499 (ISO-MME) describes the general format of the data only
    - Data sets may vary in detail (e.g., ISO codes,  $t_0$ , bias removal)
  - › Time-consuming data processing necessary
    - Harmonizing of the relevant parameters (**even if it is not required to calculate performance criteria**)
      - Headers
      - Descriptors
      - ISO codes
      - Sign convention
      - Definition of  $t_0$
      - Biasing removal
      - etc.
- › Vision
  - › Harmonizing/standardizing of all important parameters to enable plug & play data analysis without time consuming data processing

## Motivation

### Pilot applications



- › THOR 50<sup>th</sup> Percentile Male (THOR-50M)
  - › Reference
    - THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation
    - EuroNCAP TB 026 2020-11  
THOR Specification and Certification, Version 1.2, TB 026, November 2020, B. Been & J. Ellway
  - › Improvement compared to other protocols because some essential pre-definitions
    - Definition ISO codes of the measured signals
    - Bias removal procedures
    - Usage of a sign convention and its implementation in the post-processing routines
  
- › WorldSID 50<sup>th</sup> Percentile Male Side Impact Dummy
  - › References
    - ISO 15830-2:2013(E), Road vehicles – Design and performance specifications for the WorldSID 50<sup>th</sup> percentile male side impact dummy – Part 2: Mechanical subsystems, ISO/TC 22/SC 36/ WG 5, Working Draft
    - THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation
  - › Link to similar THOR procedures to get a dummy-wide harmonization

## Motivation Goal



- › Definition of instructions to generate standardized ISO-MME data sets
  - › Boundary conditions
    - **Based on and not in conflict with existing instructions (e.g., users manuals)**
    - If new items needed, then use of existing procedures (if possible)
  - › Deliverables
    - Instructions for every qualification test (pdf document) – harmonized for all qualification procedures
    - Sample data sets
  - › Copyrights
    - Available for the public without any restrictions

## Instructions

# Instructions General layout

- › Document of 4 pages
- › Same structure for all qualification tests
- › Instructions for
  - › Data organization (ISO MME version, storage of additional information etc.)
  - › Data preparation (channel codes, channel sorting, physical units, sign convention,  $t_0$ , bias removal etc.)
  - › ISO MME test descriptor file (general information, test objects etc.)

**Neck Qualification - Neck Torsion Left V1.0**

This document describes the requirements for the data set preparation for the Neck Qualification- Neck Torsion Left according to TB 026 Version 1.2 November 2020, Euro NCAP.

**1 Data Organization**

The data set has to be delivered in ISO MME 1.6 format given by ISO/TS 13499 (respectively ISO MME). The data set must contain the \*.mme file and a directory named "CHANNEL", which contains the \*.cha file and the channel files. Reports in common file formats (\*.pdf, \*.emf) may be included in a directory "REPORT" next to the directory "CHANNEL".

**2 Data Preparation**

**2.1 Channels**

**2.1.1 Required Measurement Channels**

The measurement channels shown in the following table must be included in the data set.

Channel Description / Proposed Longname	Channel Code
Neck Upper Angular Velocity Z	DNBCKUPRBT3AVZP
Neck Upper Moment Z	DNBCKUPRBT3MOP
Impactor Acceleration X	T02WPA000000ACXP <sup>1</sup>
Impactor Angle Z	T02WPA000000AZP <sup>2</sup>

**2.1.2 Optional Channels**

- All head and neck channels shall be included in the data set, if available.
- Calculated channels can be included in the data set.

**2.1.3 Further Channel Requirements**

- No filtering is applied to the channels.
- A time range of at least 200 ms before contact (expected  $T_0$ ) and 300 ms after contact (expected  $T_0$ ) has to be included in each channel.

**2.1.4 Physical Units**

All dynamic measurements have to be given in 'SI' units.

<sup>1</sup> In the NHTSA document THOR-50M Qualification Procedures Manual September 2018, the code used for the impactor is "NINMM". Here, the recommendation of the ISO MME working group is followed by using the code "T02WPA000000ACXP" → "T02WPA000000ACXP".

<sup>2</sup> Here as in the NHTSA document THOR-50M Qualification Procedures Manual September 2018, the angle is assigned to the impactor. In the ISO MME working group it is discussed to use the main location "S00B" in order to assign the angle to the subject of investigation (D02B0M000000AZP → "T02WPA000000AZP" → D02B0M000000AZP).

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Static tilt: sensors should be given in the unit "deg" (degrees).

The SI units must be written as shown in the following table (from ISO/TS 13499 Database):

Physical Dimension	ISO Code	Unit
Acceleration	AC	m/s <sup>2</sup>
Angle	AN	rad
Angular Acceleration	AA	rad/s <sup>2</sup>
Angular Velocity	AV	rad/s
Distance	DC	m
Displacement	DS	m
Energy	EN	J
Dwell	EV	1
Force	FD	N
Humidity	HU	%
Lever Arm	LE	m
Mass	MA	kg
Moment	MO	Nm
Temperature	TE	K
Velocity	VE	m/s
Voltage	VO	V

**2.1.5 Channel Sorting**

The channels have to be sorted in the following order:

- Dummy channels
- Pendulum/test rig channels
- Other channels

The channel sorting given for dummy channels by the document ISO/TS 13499 – RED 6 - 2021 E has to be respected.

**2.1.6 Sign Convention**

All measurement channels should be delivered in their own local coordinate systems with respect to SAE J1773 November 2008. This reference system has to be specified as instrumentation standard in the channel information file (\*.cha).

The angular velocity of the pendulum should be positive as it falls towards the honeycomb.

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**2.1.7 Offset Correction and  $T_0$  (Time Zero) Definition**

The following sequence of steps has to be applied:

- Pre-Shift:** Set  $T_0$  to the time when the pendulum first contacts the honeycomb. Perform bias removal of the channel T02WPA000000ACXP by subtracting the average value of the data samples over the period between (0.05 s) to (0.01 s) prior to  $T_0$ .
- Shift:** Set  $T_0$  to the first data sample, where the bias removed channel T02WPA000000ACXP filtered by CF1000 exceeds the 5 g level (= 49.03325 m/s<sup>2</sup>).
- Offset Correction:** Perform bias removal of the remaining measured (unfiltered) channels by subtracting the average value of the data samples over the period between (0.05 s) to (0.01 s) prior to  $T_0$ . Do not perform bias removal for absolute channels (e. g. angle, voltage, constant channels) or MITRAC channels.

Subtype of the test	Filter Class	Search level	Final Shift
NETL	CF1000	5 g	0 ms

<sup>1</sup> A sampling rate of at least 10 kHz is assumed.

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**3 ISO MME Test Descriptor File (\*.mme)**

**3.1 General Information**

The following information must be included:

Type of the test	Dummy Certification T3
Subtype of the test	NETL
Regulation	Euro NCAP TB026-2020-11
Laboratory test ref. number	A unique test ref. number must be provided here.
Customer test ref. number	A unique test ref. number must be provided here (must comply to the test name).
Date of the test	The date of the test must be provided here in the format YYYY-MM-DD. Time information is not necessary.
Data format edition number	1.6
Reference temperature	The reference temperature in Kelvin must be provided here.
Relative air humidity	The relative air humidity must be provided here.

**3.2 Test Objects**

- The test objects must have the following order: Dummy, Pendulum/Test Rig
- For the dummy, the following information must be included:

Name of test object 1	Dummy
Driver position object 1	0
Impact side test object 1	LE
Type of test object 1	0
Ref. number of test object 1	The pure dummy ID must be provided here or 'NOVALUE' for a component test without dummy reference.
Code of test object 1	The part number must be provided here or 'NOVALUE' if unknown.

- For the pendulum/test rig, the following information must be included:

Name of test object 2	Pendulum/Test Rig
Velocity test object 2	The pendulum/test rig velocity in m/s must be provided here.
Mass test object 2	The pendulum/test rig mass in kg must be provided here.
Driver position object 2	0
Impact side test object 2	FR
Type of test object 2	T

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## Instructions

### General requirements



- › Filtering
  - › Pre-filtered signals only
- › Recording time
  - › At least 200 ms before the expected  $t_0$  to make use of the algorithms of finding  $t_0$ , required for bias removal
  - › At least 300 ms after the expected  $t_0$  to allow the  $t_0$  finding algorithms a time shift



## Instructions

### Naming convention of the qualification tests – THOR-50M



Subtype of test	Acronym	Comment
Head qualification	HEIP	<b>Head impact</b>
Face qualification	FAIP	<b>Face impact</b>
Neck qualification, neck frontal flexion	NEFX	<b>Neck flexion</b>
Neck qualification, neck extension	NEEX	<b>Neck extension</b>
Neck qualification, neck flexion left	NEFL	<b>Neck flexion left</b>
Neck qualification, neck flexion right	NEFR	<b>Neck flexion right</b>
Neck qualification, neck torsion left	NETL	<b>Neck torsion left</b>
Neck qualification, neck torsion right	NETR	<b>Neck torsion right</b>
Upper thorax qualification	THHS	<b>Thorax high speed</b>
Upper thorax low speed qualification	THLS	<b>Thorax low speed</b>
Lower left thorax qualification	THLL	<b>Thorax lower left</b>
Lower right thorax qualification	THLR	<b>Thorax lower right</b>
Abdomen qualification	ABIP	<b>Abdomen impact</b>

Subtype of test	Acronym	Comment
Left upper leg qualification	ULIL	<b>Upper leg impact left</b>
Right upper leg qualification	ULIR	<b>Upper leg impact right</b>
Left knee qualification	KNSL	<b>Knee slider left</b>
Right knee qualification	KNSR	<b>Knee slider right</b>
Left ankle qualification, inversion	ANIL	<b>Ankle inversion left</b>
Left ankle qualification, eversion	ANEL	<b>Ankle eversion left</b>
Right ankle qualification, inversion	ANIR	<b>Ankle inversion right</b>
Right ankle qualification, eversion	ANER	<b>Ankle eversion right</b>
Left heel qualification	HEIL	<b>Heel impact left</b>
Right heel qualification	HEIR	<b>Heel impact right</b>
Left ball of foot qualification	BAIL	<b>Ball of foot impact left</b>
Right ball of foot qualification	BAIR	<b>Ball of foot impact right</b>

## Instructions

### Naming convention of the qualification tests – WorldSID 50<sup>th</sup>



Subtype of test	Acronym	Comment
Head qualification, head drop frontal	HEDF	<b>Head drop frontal</b>
Head qualification, head drop left	HEDL	<b>Head drop left</b>
Head qualification, head drop right	HEDR	<b>Head drop right</b>
Neck qualification, neck flexion left	NEFL	<b>Neck flexion left</b>
Neck qualification, neck flexion right	NEFR	<b>Neck flexion right</b>
Neck qualification, neck torsion left	NETL	<b>Neck torsion left</b>
Neck qualification, neck torsion right	NETR	<b>Neck torsion right</b>
Shoulder qualification, shoulder impact left	SHIL	<b>Shoulder impact left</b>
Shoulder qualification, shoulder impact right	SHIR	<b>Shoulder impact right</b>
Thorax qualification, thorax impact left	THIL	<b>Thorax impact left</b>
Thorax qualification, thorax impact right	THIR	<b>Thorax impact right</b>

Subtype of test	Acronym	Comment
Abdomen qualification, abdomen impact left	ABIL	<b>Abdomen impact left</b>
Abdomen qualification, abdomen impact right	ABIR	<b>Abdomen impact right</b>
Pelvis qualification, pelvis impact left	PEIL	<b>Pelvis impact left</b>
Pelvis qualification, pelvis impact right	PEIR	<b>Pelvis impact right</b>

## Instructions

### Naming convention of the rib qualification tests – WorldSID 50<sup>th</sup>



Subtype of test	Acronym	Comment
Rib qualification, shoulder rib inner band	SR0I	<b>S</b> houlder rib inner band
Rib qualification, shoulder rib outer band	SR0O	<b>S</b> houlder rib <b>o</b> uter band
Rib qualification, thoracic rib 1 inner band	TR1I	<b>T</b> horacic rib <b>1</b> inner band
Rib qualification, thoracic rib 1 outer band	TR1O	<b>T</b> horacic rib <b>1</b> <b>o</b> uter band
Rib qualification, thoracic rib 2 inner band	TR2I	<b>T</b> horacic rib <b>2</b> inner band
Rib qualification, thoracic rib 2 outer band	TR2O	<b>T</b> horacic rib <b>2</b> <b>o</b> uter band
Rib qualification, thoracic rib 3 inner band	TR3I	<b>T</b> horacic rib <b>3</b> inner band
Rib qualification, thoracic rib 3 outer band	TR3O	<b>T</b> horacic rib <b>3</b> <b>o</b> uter band

Subtype of test	Acronym	Comment
Rib qualification, abdominal rib 1 inner band	AR1I	<b>A</b> bdominal rib <b>1</b> inner band
Rib qualification, abdominal rib 1 outer band	AR1O	<b>A</b> bdominal rib <b>1</b> <b>o</b> uter band
Rib qualification, abdominal rib 2 inner band	AR2I	<b>A</b> bdominal rib <b>2</b> inner band
Rib qualification, abdominal rib 2 outer band	AR2O	<b>A</b> bdominal rib <b>2</b> <b>o</b> uter band

## Instructions

### Coordinate systems , naming convention of channels



- › General philosophy
  - › Test object describes the coordinate system
    - “D”: coordinate system of the dummy
    - “T”: coordinate system of the test rig (e.g., pendulum)
- › Naming of channels
  - › (Standard) dummy signals
    - ISO channel code of the dummy
  - › Additional (non-standard) dummy signals
    - Use of existing definitions (e.g., THOR manual), if available
  - › Test rig
    - Use of existing definitions (e.g., THOR manual), if available
- › Remark
  - › An expert group of DIN AK3 (German ISO WG 3) started the work on a proposal for a standardized naming of additional dummy signals and test rig signals
  - › PDB will adopt the results of this expert group when available

## Instructions

### Definition of $t_0$ and bias removal – general procedure



1. Identify the **reference channel** (see table)
2. Filter the **reference channel** (see table)
3. Identify the time of the first contact ( $t_{0 \text{ preliminary}}$ )
4. Apply a bias removal of the **reference channel** between  $t_{0 \text{ preliminary}} - 50 \text{ ms}$  and  $t_{0 \text{ preliminary}} - 10 \text{ ms}$  (excluding WorldSID head drop test)
5. Time zero  $t_0$  is defined as the time when the first data sample of the **reference channel** exceeds the search level (see table)
6. Apply a test specific final time shift to **all** measured **channels** (see table)
7. Apply a test specific bias removal of **all** signals **except the reference channel** (see table)

# Instructions

## Definition of $t_0$ and bias removal – THOR TH (NHTSA)



Dummy	Body region	General information			Data processing						Reference
		Subtype of test	Acronym	Impact side	Reference channel	Filter	Search level	Final time shift	Type of first contact	Bias removal interval	
					Step 1	Step 2	Step 5	Step 6		Step 7	
TH	Head	Head Qualification	HEIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	3 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Head	Face Qualification	FAIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Frontal Flexion	NEFX	FR	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Extension	NEEX	RE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Flexion Left	NEFL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Flexion Right	NEFR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Torsion Left	NETL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Neck	Neck Qualification - Neck Torsion Right	NETR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	NHTSA 2018-09
TH	Thorax	Upper Thorax Qualification	THHS	FR	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	3 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Thorax	Upper Thorax Low Speed Qualification	THLS	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	see T3 THLS
TH	Thorax	Lower Left Thorax Qualification	THLL	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Thorax	Lower Right Thorax Qualification	THLR	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Thorax	Abdomen Qualification	ABIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	20 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Upper Leg Qualification	ULIL	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Upper Leg Qualification	ULIR	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Knee Qualification	KNSL	FR	DOFEMRLE00THFOZP	CFC180	1500 N	11 ms	load distribution bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Knee Qualification	KNSR	FR	DOFEMRRI00THFOZP	CFC180	1500 N	11 ms	load distribution bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Ankle Qualification - Inversion	ANIL	FR	DOTIBILELOTHFOZP	CFC600	90 N	3 ms	bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Ankle Qualification - Eversion	ANEL	FR	DOTIBILELOTHFOZP	CFC600	90 N	3 ms	bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Ankle Qualification - Inversion	ANIR	FR	DOTIBIRILOTHFOZP	CFC600	90 N	3 ms	bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Ankle Qualification - Eversion	ANER	FR	DOTIBIRILOTHFOZP	CFC600	90 N	3 ms	bracket	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Ball Of Foot Qualification	BAIL	FR	DOTIBILELOTHFOZP	CFC600	90 N	2 ms	ball/shoe	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Ball Of Foot Qualification	BAIR	FR	DOTIBIRILOTHFOZP	CFC600	90 N	2 ms	ball/shoe	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Left Heel Qualification	HEIL	FR	DOTIBILELOTHFOZP	CFC600	90 N	1 ms	heel/shoe	-50 ms to -10 ms	NHTSA 2018-09
TH	Extremities	Right Heel Qualification	HEIR	FR	DOTIBIRILOTHFOZP	CFC600	90 N	1 ms	heel/shoe	-50 ms to -10 ms	NHTSA 2018-09

### References

- NHTSA 2018-09  
THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation
- EuroNCAP TB 026 2020-11  
THOR Specification and Certification, Version 1.2, TB 026, November 2020, B. Been & J. Ellway

# Instructions

## Definition of $t_0$ and bias removal – THOR T3 (EuroNCAP)



General information					Data processing						
Dummy	Body region	Subtype of test	Acronym	Impact side	Reference channel	Filter	Search level	Final time shift	Type of first contact	Bias removal interval	Reference
					Step 1	Step 2	Step 5	Step 6		Step 7	
T3	Head	Head Qualification	HEIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	3 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Head	Face Qualification	FAIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	see TH FAIP
T3	Thorax	Upper Thorax Low Speed Qualification	THLS	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	see T3 THHS
T3	Neck	Neck Qualification - Neck Frontal Flexion	NEFX	FR	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Neck	Neck Qualification - Neck Extension	NEEX	RE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Neck	Neck Qualification - Neck Flexion Left	NEFL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Neck	Neck Qualification - Neck Flexion Right	NEFR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Neck	Neck Qualification - Neck Torsion Left	NETL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Neck	Neck Qualification - Neck Torsion Right	NETR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Thorax	Upper Thorax Qualification	THHS	FR	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	3 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Thorax	Lower Left Thorax Qualification	THLL	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Thorax	Lower Right Thorax Qualification	THLR	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	7 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Thorax	Abdomen Qualification	ABIP	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	20 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Extremities	Left Upper Leg Qualification	ULIL	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11
T3	Extremities	Right Upper Leg Qualification	ULIR	FR	TOIMPA000000ACXP	CFC180	3 g (= 29.41995 m/s <sup>2</sup> )	1 ms	dummy	-50 ms to -10 ms	EuroNCAP TB 026 2020-11

### References

- NHTSA 2018-09  
THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation
- EuroNCAP TB 026 2020-11  
THOR Specification and Certification, Version 1.2, TB 026, November 2020, B. Been & J. Ellway

# Instructions

## Definition of $t_0$ and bias removal (excluding: head drop tests) – WorldSID 50<sup>th</sup>



General information					Data processing						Reference
Dummy	Body region	Subtype of test	Acronym	Impact side	Reference channel	Filter	Search level	Final time shift	Typ of first contact	Bias removal interval	
					Step 1	Step 2	Step 5	Step 6		Step 7	
WS	Neck	Neck Qualification - Neck Flexion Left	NEFL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Neck	Neck Qualification - Neck Flexion Right	NEFR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Neck	Neck Qualification - Neck Torsion Left	NETL	LE	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Neck	Neck Qualification - Neck Torsion Right	NETR	RI	TOIMPA000000ACXP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	0 ms	honeycomb	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Shoulder Qualification - Shoulder Impact Left	SHIL	LE	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Shoulder Qualification - Shoulder Impact Right	SHIR	RI	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Thorax Qualification - Thorax Impact Left	THIL	LE	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Thorax Qualification - Thorax Impact Right	THIR	RI	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Abdomen Qualification - Abdomen Impact Left	ABIL	LE	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Thorax	Abdomen Qualification - Abdomen Impact Right	ABIR	RI	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	5 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Pelvis	Pelvis Qualification - Pelvis Impact Left	PEIL	LE	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	2 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021
WS	Pelvis	Pelvis Qualification - Pelvis Impact Right	PEIR	RI	TOIMPA000000ACXP	CFC180	5 g (= 49.03325 m/s <sup>2</sup> )	2 ms	dummy	-50 ms to -10 ms	ISO 15830:2, Draft 2021

### References

- ISO 15830-2:2013(E), Road vehicles – Design and performance specifications for the WorldSID 50<sup>th</sup> percentile male side impact dummy – Part 2: Mechanical subsystems, ISO/TC 22/SC 36/ WG 5, Working Draft
- NHTSA 2018-09  
THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation



# Instructions

## Definition of $t_0$ and bias removal (excluding: head drop tests) – WorldSID 50<sup>th</sup>



Dummy	Body region	General information			Data processing						Reference
		Subtype of test	Acronym	Impact side	Reference channel	Filter	Search level	Final time shift	Typ of first contact	Bias removal interval	
					Step 1	Step 2	Step 5	Step 6		Step 7	
WS	n/a	Rib Qualification - Single Rib Test		00	TOIMPA010000ACXP	prefiltered	1 g (= 9.80665 m/s <sup>2</sup> )	0 ms	rib	-50 ms to -10 ms	ISO 15830:2, Draft 2021
		Rib qualification, shoulder rib inner band	SR0I								
		Rib qualification, shoulder rib outer band	SR0O								
		Rib qualification, thoracic rib 1 inner band	TR1I								
		Rib qualification, thoracic rib 1 outer band	TR1O								
		Rib qualification, thoracic rib 2 inner band	TR2I								
		Rib qualification, thoracic rib 2 outer band	TR2O								
		Rib qualification, thoracic rib 3 inner band	TR3I								
		Rib qualification, thoracic rib 3 outer band	TR3O								
		Rib qualification, abdominal rib 1 inner band	AR1I								
		Rib qualification, abdominal rib 1 outer band	AR1O								
		Rib qualification, abdominal rib 2 inner band	AR2I								
		Rib qualification, abdominal rib 2 outer band	AR2O								

### References

- ISO 15830-2:2013(E), Road vehicles – Design and performance specifications for the WorldSID 50th percentile male side impact dummy – Part 2: Mechanical subsystems, ISO/TC 22/SC 36/ WG 5, Working Draft 2021 (DIS stage)
- NHTSA 2018-09  
THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation

# Instructions

## Definition of $t_0$ and bias removal (head drop tests only) – WorldSID 50<sup>th</sup>



General information					Data processing						
Dummy	Body region	Subtype of test	Acronym	Impact side	Reference channel	Filter	Search level	Final time shift	Typ of first contact	Bias removal interval	Reference
					Step 1	Step 4	Step 5	Step 6		Step 7	
WS	Head	Head Qualification - Head Drop Frontal	HEDF	FR	DOHEAD0000WSACZP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	2 ms	rigid plate	0 ms (single value)	ISO 15830:2, Draft 2021
WS	Head	Head Qualification - Head Drop Left	HEDL	LE	DOHEAD0000WSACZP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	2 ms	rigid plate	0 ms (single value)	ISO 15830:2, Draft 2021
WS	Head	Head Qualification - Head Drop Right	HEDR	RI	DOHEAD0000WSACZP	CFC1000	5 g (= 49.03325 m/s <sup>2</sup> )	2 ms	rigid plate	0 ms (single value)	ISO 15830:2, Draft 2021

### References

- ISO 15830-2:2013(E), Road vehicles – Design and performance specifications for the WorldSID 50th percentile male side impact dummy – Part 2: Mechanical subsystems, ISO/TC 22/SC 36/ WG 5, Working Draft 2021 (DIS stage) – including comments of DIN, 2022
- NHTSA 2018-09  
THOR 50<sup>th</sup> Percentile Male (THOR-50M) Qualification Procedures Manual, September 2018, National Highway Traffic Safety Administration, U. S. Department of Transportation



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