

Harmonization of qualification data

Instructions to generate standardized ISO-MME data sets

Update – version 1.3.1

Updates

Updates



- › Version 1.3.1 (Mar 2024)
 - › THOR-50M (TH, T3)
 - ISO code of pendulum updated
 - Only neck tests and only instructions affected
 - Examples ok but version number set to 1.3.1
 - › WorldSID-50M
 - ISO code of pendulum updated
 - Only neck tests and only instructions affected
 - Examples ok but version number set to 1.3.1
- › Version 1.3 (Jan 2024)
 - › THOR-50M
 - Update to be compliant with “THOR-50M Qualification Procedures and Requirements, April 2023”, NHTSA
 - › WorldSID-50M
 - Update to be compliant with ISO 15830:2022
 - › General
 - Examples
 - Raw and processed data to verify the process of t_0 definition and bias removal

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 50th Percentile Male (THOR-50M)
 - › Reference
 - THOR 50th Percentile Male (THOR-50M), Qualification Procedures and Requirements, April 2023, National Highway Traffic Safety Administration, U. S. Department of Transportation
 - EuroNCAP TB 026
THOR Specification and Certification, Version 1.3, TB 026, 13th February 2023, B. Been & J. Ellway
 - › Improvement compared to other protocols because of 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 50th Percentile Male Side Impact Dummy
 - › References
 - ISO 15830-2:2022(E), Road vehicles – Design and performance specifications for the WorldSID 50th percentile male side impact dummy – Part 2: Mechanical subsystems
 - THOR 50th 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

Instructions

Instructions

Availability and terms of use



- › Information is available on PDB's website
 - › <https://pdb-org.com/en/information/36-qualification-procedures-en.html>
- › Terms of use
 - › Download without registration
 - Blocking of some countries because of restrictions of the German government
 - › Usage free of charge and without any registration
 - › License agreement
 - Is included in the downloaded packages
 - Is accepted automatically by using the instructions
 - Agreement limits the liability of PDB
 - Requests to use the instructions not against general laws (e.g., human rights etc.)
 - › The user is responsible to check PDB's website for updates
- › Packages
 - › General information
 - › WorldSID 50% instructions incl. examples (ISO-MME data)
 - › THOR-50M instructions incl. examples (ISO-MME data)

The screenshot shows the PDB website's 'Qualification procedures' page. The page has a navigation bar with 'Home', 'Objectives', 'Areas', 'Information' (highlighted), and 'Contact'. The main content area is titled 'Qualification procedures' and contains the following text:

The comparison of dummy qualification data sets coming from different sources is complicated even if the ISO-MME (ISO/TS 13499) format is used. This standard describes the general data format but some essential information such as coding of the channels, definition of t0 is not standardized.

PDB made a proposal to standardize the missing information to get data sets that can be used for analyzes without any additional data processing.

The proposals are made for the use with THOR-50M and WorldSID 50%. They are based on the information that is provided with existing qualification procedures.

The revised version 1.2 of the instructions including example data sets is now available.

Follow the link to download some general information.

The use of the qualification procedures is free of charge and there is no registration needed. However, there is license agreement enclosed to limit PDB's liability. The agreement is automatically accepted when using the procedures.

On the right side, there is an image of a dummy head and neck assembly. Below the image, the contact information for PDB is provided:

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At the bottom of the page, there is a footer with the text: 'Sprache deutsch english | Legal notice | Privacy'.

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 13489 (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	DNBCKUPRBT3M0ZP
Impactor Acceleration X	T01PFA000000ACXP ¹
Impactor Angle Z	T01PFA000000AZP ²

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.

¹ In the NHTSA document THOR-50M Qualification Procedures Manual September 2018, the code used for the impactor is 'T01PFA'. Here, the recommendation of the ISO MME working group is followed by using the code 'T01PFA000000ACXP' → 'T01PFA000000ACXP'.
² 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 (D08B0M000000AZP → 'T01PFA000000AZP' → D08B0M000000AZP).

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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 13489 Database):

Physical Dimension	ISO Code	Unit
Acceleration	AC	m/s ²
Angle	AN	rad
Angular Acceleration	AA	rad/s ²
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	MD	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 13489 – RED 5 - 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 T01PFA000000ACXP 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 T01PFA000000ACXP filtered by CF1000 exceeds the 5 g level (= 49.03325 m/s²).
- 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

¹ 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 information



- › 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
- › Definitions
 - › Acronym for every sub type of test
 - E.g., Head impact – HEIP, Neck torsion left – NETL
 - › Naming of the channels
 - According to an expert group of DIN NA 052-00-36-03 AK
- › Data processing
 - › Definition of t_0
 - › Bias removal

Instructions

Supporting information and general workflow



- › Naming convention of the qualification tests
 - › THOR-50M: THOR_Abbreviations.pdf
 - › WorldSID-50M: WorldSID_Abbreviations.pdf
- › Summary of information required to define t_0 and to remove bias
 - › THOR-50M: THOR_Subtypes.pdf
 - › WorldSID-50M: WorldSID_Subtype.pdf
- › General workflow
(see test-specific instructions for all details or THOR_Subtypes.pdf/WorldSID_Subtypes.pdf for a brief overview)
 1. Identify the **reference channel**
 2. Filter the **reference channel**
 3. Identify the time of the first contact ($t_{0 \text{ preliminary}}$)
 4. Apply a bias removal of the **reference channel**
 5. Time zero t_0 is defined as the time when the first data sample of the **reference channel** exceeds the search level
 6. Apply a test specific final time shift to **all** measured **channels**
 7. Apply a test specific bias removal of **all** signals **except the reference channel**

Examples

Examples



- › Examples for every qualification test provided
- › Raw data
 - › Correct naming of the channels (ISO code)
 - › Correct signs of the channels
 - › t_0 not corrected
 - › No bias removal
- › Processed data (=final data according to described instructions)
 - › Raw data but fully processed (definition of t_0 and bias removal)
- › The data shall help to verify the user's routines to process qualification data

End