

SVENSK STANDARD

SS-ISO 6487:2016



Fastställt/Approved: 2016-04-20
Publicerad/Published: 2016-04-26
Utgåva/Edition: 6
Språk/Language: engelska/English
ICS: 43.020

Vägfordon – Kollisionsprovning – Icke-optisk instrumentering (ISO 6487:2015, IDT)

Road vehicles – Measurement techniques in impact tests – Instrumentation (ISO 6487:2015, IDT)

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Denna standard ersätter SS-ISO 6487:2012, utgåva 5.

The International Standard ISO 6487:2015 has the status of a Swedish Standard. This document contains the official English version of ISO 6487:2015.

This standard supersedes the Swedish Standard SS-ISO 6487:2012, edition 5.

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Denna standard är framtagen av kommittén för Fordonssäkerhet, SIS/TK 237.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

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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 sixth edition cancels and replaces the fifth edition (ISO 6487:2012), which has been technically revised.

Introduction

This International Standard is the result of a willingness to harmonize the previous edition, ISO 6487:2012, and SAE International's Recommended Practice, SAE J211-1.

It presents a series of performance requirements concerning the whole measurement sequence of impact shocks.

These requirements may not be altered by the user and all are obligatory for any agency conducting tests to this International Standard. However, the method of demonstrating compliance with them is flexible and can be adapted to suit the needs of the particular equipment used by a testing agency.

This approach affects the interpretation of requirements. For example, there is a requirement to calibrate within the working range of the channel, i.e. between F_L and $F_H/2,5$. This cannot be interpreted literally, as low-frequency calibration of accelerometers requires large displacement inputs beyond the capacity of virtually any laboratory.

It is not intended that each requirement be taken as necessitating proof by a single test. Rather, it is intended that any agency proposing to conduct tests to this International Standard guarantee that if a particular test could be and were to be carried out, then their equipment would meet the requirements. This proof would be based on reasonable deductions from existing data such as the results of partial tests.

On the basis of studies carried out by technical experts, no significant difference has been identified between the characteristics of the load transducer when using static as opposed to dynamic calibration methods. This new edition helps to define the dynamic calibration method for force and moment data channels in accordance with the current knowledge base and studies available.

The temperature of the anthropomorphic test device (ATD) used in a collision test needs to be monitored to confirm that it has been used within the acceptable temperature range prescribed for the whole ATD or body segment. The objective is to prevent temperature from being a variable that will influence the ATD response. The actual ATD temperature can be influenced by various factors including ambient air, high-speed photography lighting, sunshine, heat dissipation from transducers, and ATD in-board data acquisition systems. In order to respond to these objectives, the new edition specifies the performance requirements for the ATD temperature measurement.

This International Standard defines the requirements of an impact test for which the measurement uncertainties can only be partially calculated.

To summarize, this International Standard enables users of impact test results to call up a set of relevant instrumentation requirements by merely specifying this International Standard. Their test agency then has the primary responsibility for ensuring that the requirements of this International Standard are met by their instrumentation system. The evidence on which they have based this proof assessment will be available to the user upon request. In this way, fixed requirements guaranteeing the suitability of the instrumentation for impact testing can be combined with flexible methods of demonstrating compliance with those requirements.

Road vehicles — Measurement techniques in impact tests — Instrumentation

1 Scope

This International Standard gives requirements and recommendations for measurement techniques involving the instrumentation used in impact tests carried out on road vehicles. Its requirements are aimed at facilitating comparisons between results obtained by different testing laboratories, while its recommendations will assist such laboratories in meeting those requirements. It is applicable to instrumentation including that used in the impact testing of vehicle subassemblies. It does not include optical methods which are the subject of ISO 8721.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2041, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 3784, *Road vehicles — Measurement of impact velocity in collision tests*

ISO 4130, *Road vehicles — Three-dimensional reference system and fiducial marks — Definitions*

ISO/TR 27957, *Road vehicles — Temperature measurement in anthropomorphic test devices — Definition of the temperature sensor locations*

SAE J211-1, *Instrumentation for impact test — Part 1: Electronic instrumentation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions given in ISO 2041 and the following apply.

3.1

data channel

all the instrumentation from, and including a single transducer (or multiple transducers, the outputs of which are combined in some specified way), to, and including any analysis procedures that may alter the frequency content or the amplitude content of data

3.2

transducer

first device in a *data channel* (3.1) used to convert a physical quantity to be measured into a second quantity (such as an electrical voltage) which can be processed by the remainder of the channel

3.3

channel amplitude class

CAC

designation for a *data channel* (3.1) that meets certain amplitude characteristics as specified by this International Standard

Note 1 to entry: The CAC number is numerically equal to the upper limit of the measurement range which is equivalent to data channel full scale.

3.4 channel frequency class CFC

frequency class designated by a number indicating that the channel frequency response lies within certain limits

Note 1 to entry: CFC XXX defines the frequency class with XXX = Frequency, F_H , in hertz.

3.5 calibration value

mean value measured and read during calibration of a *data channel* (3.1)

3.6 sensitivity

ratio of the output signal (in equivalent physical units) to the input signal (physical excitation) when an excitation is applied to the *transducer* (3.2)

EXAMPLE 10,24 mV/g/V for a strain gauge accelerometer.

3.7 sensitivity coefficient

slope of the straight line representing the best fit to the *calibration values* (3.5) determined by the method of least squares within the *channel amplitude class* (CAC) (3.3)

Note 1 to entry: Specific sensors such as seat belt sensors, torque sensors, and multi-axial force sensors may require a specific calibration procedure.

3.8 calibration factor of a data channel

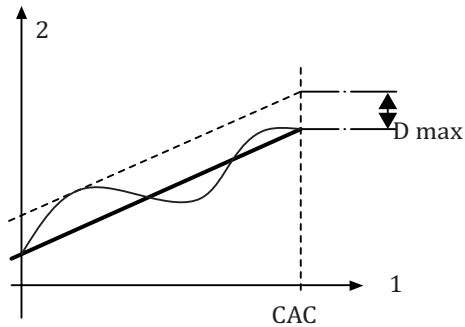
arithmetic mean of the *sensitivity coefficients* (3.7) evaluated over frequencies evenly spaced on a logarithmic scale between F_L and $F_H/2,5$

Note 1 to entry: See [Figure 2](#) and [Figure 3](#).

3.9 non-linearity

ratio of the maximum difference (D_{\max}) between the *calibration value* (3.5) and the value read from the best approximation of *calibration values* (3.5) expressed as a percentage of the *channel amplitude class* (CAC) (3.3)

Note 1 to entry: See [Figure 1](#) and [4.5.4](#).



Key

- 1 input signal
- 2 output signal

NOTE Non-linearity = $D_{max}/CAC * 100$.

Figure 1 — Non-linearity

3.10 transverse sensitivity of a rectilinear transducer

sensitivity (3.6) to excitation in a nominal direction perpendicular to its sensitive axis

Note 1 to entry: The transverse sensitivity of a rectilinear transducer is usually a function of the nominal direction of the axis chosen.

Note 2 to entry: The cross sensitivity of force and bending moment transducers is complicated by the complexity of loading cases. At time of publication, this situation had yet to be resolved.

3.11 transverse sensitivity ratio of a rectilinear transducer

ratio of the *transverse sensitivity of a rectilinear transducer* (3.10) to its sensitivity along its sensitive axis

Note 1 to entry: The cross-sensitivity of force and bending moment transducers is complicated by the complexity of loading cases. At time of publication, this situation had yet to be resolved.

3.12 phase delay time of a data channel

time equal to the phase delay, expressed in radians, of a sinusoidal signal divided by the angular frequency of that signal and expressed in radians per second

3.13 environment

aggregate at a given moment of all external conditions and influences to which the *data channel* (3.1) is subject

4 Performance requirements

4.1 CFC specifications and performance requirements

The absolute value of the non-linearity of a data channel at any frequency (except if data channel is calibrated against only one point) in the channel frequency class (CFC) shall be less than or equal to 2,5 % of the value of the CAC over the whole measurement range.

The frequency response of a data channel shall lie within the limiting curves given in [Table 1](#) and [Figure 2](#) for CFC 1 000 and CFC 600. For CFC 60 and CFC 180, the frequency response of a data channel