
**Methods for the calibration of vibration and
shock transducers —**

Part 13:
**Primary shock calibration using laser
interferometry**

Méthodes pour l'étalonnage des transducteurs de vibrations et de chocs —

Partie 13: Étalonnage primaire de chocs par interférométrie laser



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 16063 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 16063-13 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 3, *Use and calibration of vibration and shock measuring instruments*.

ISO 16063 consists of the following parts, under the general title *Methods for the calibration of vibration and shock transducers*:

- Part 1: *Basic concepts*
- Part 11: *Primary vibration calibration by laser interferometry*
- Part 12: *Primary vibration calibration by the reciprocity method*
- Part 13: *Primary shock calibration using laser interferometry*
- Part 21: *Secondary vibration calibration by comparison*

Annex A forms a normative part of this part of ISO 16063. Annexes B and C are for information only.

Introduction

The shock sensitivity S_{sh} is determined, according to definition, as the relationship between the peak values of the accelerometer output quantity and the acceleration. S_{sh} is not a unique quantity but may vary depending on the duration and shape of the shock pulse and the bandwidth over which the sensitivity of the transducer under test and the frequency response of the optional conditioning amplifier are sufficiently uniform.

A unique quantity applicable for linearity tests of accelerometers is the complex sensitivity at a frequency f_n , calculated in the frequency domain. This part of ISO 16063 makes use of data-processing procedures which allow the magnitude S_n and phase shift $\Delta\varphi_n$ of the complex sensitivity to be calculated, in addition or alternatively to the shock sensitivity S_{sh} (cf. informative annex C).

The method specified in this part of ISO 16063 is based on the absolute measurement of the time history of the motion. This method fundamentally deviates from another shock calibration method which is based on the principle of the change in velocity, described in ISO 16063-1. The shock sensitivity therefore differs fundamentally from the shock calibration factor obtained by the latter method, but is in compliance with the calibration factor stated in ISO 5347-4¹⁾.

1) To be revised as ISO 16063-22.

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Methods for the calibration of vibration and shock transducers —

Part 13:

Primary shock calibration using laser interferometry

1 Scope

This part of ISO 16063 specifies the instrumentation and procedure to be used for primary shock calibration of rectilinear accelerometers, using laser interferometry to sense the time-dependent displacement during the shock. The method is applicable in a shock pulse duration range 0,05 ms to 10 ms and a range of peak values of 10^2 m/s² to 10^5 m/s² (pulse-duration dependent). The method allows the shock sensitivity to be obtained.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 16063. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 16063 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 5347-22, *Methods for the calibration of vibration and shock pick-ups — Part 22: Accelerometer resonance testing — General methods*

ISO 16063-1, *Methods for the calibration of vibration and shock transducers — Part 1: Basic concepts*

ISO 16063-11, *Methods for the calibration of vibration and shock transducers — Part 11: Primary vibration calibration by laser interferometry*

3 Uncertainty of measurement

The limits of the uncertainty of shock sensitivity measurement shall be as follows:

- 1 % of the reading at a reference peak value of 1 000 m/s² and reference shock pulse duration of 2 ms and reference amplifier gain settings;
- ≤ 2 % for all values of peak acceleration and shock pulse duration.

The uncertainty specifications above are valid for the calibration of acceptable precision grade transducers (e.g. reference standard accelerometers) provided that great care is taken to keep all uncertainty components small enough to comply with the specifications (for uncertainty budgets, see annex A). In particular, the spectral energy produced by the excitation of any mode of resonance inherent in the transducer or shock machine structure during calibration must be small relative to the spectral energy contained in the frequency range of calibration. The transducer resonance testing shall be performed in accordance with ISO 5347-22. In general, this requirement might preclude the use of pulses with relatively short durations that are given in clauses 1 and 6.

All users of this part of ISO 16063 shall make uncertainty budgets according to annex A to document their level of uncertainty.

NOTE The uncertainty of measurement is expressed as the expanded measurement uncertainty in accordance with ISO 16063-1 (briefly referred to as “uncertainty”).