

**BS ISO 16063-16:2014**

*Incorporating corrigendum September 2015*



**BSI Standards Publication**

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

Part 16: Calibration by Earth's gravitation

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### National foreword

This British Standard is the UK implementation of ISO 16063-16:2014. It supersedes BS 6955-5:1994 which is withdrawn.

The ISO corrected text 1 May 2015 incorporates the following editorial corrections:

- Table 1, last row, + sign added before 240°.
- Paragraph 2, after Formula (2),  $k = 1$  changed to  $k = 2$  and the uncertainty value adapted.
- Formula (5) has been corrected, and a degree sign has been added after 180 in the explanation.
- Formula (7) has been corrected, and in the explanation, the superfluous rows for  $a_{\alpha 0}$  and  $a_{\alpha 180}$  have been removed.
- In Figure 1, the equal sign has been removed.
- Keys have been added under Figures 2 and 3.
- In Formula (A.2), the 8 above the summation sign has been removed.
- In the explanation to Formula (A.2),  $u_i$  has been replaced by  $u(x_i)$ .
- In Formula (A.3) and in its explanation,  $u(e_g)$  has been replaced by  $u(a_g)$ .

The UK participation in its preparation was entrusted by Technical Committee GME/21, Mechanical vibration, shock and condition monitoring, to Subcommittee, GME/21/2, Mechanical vibration, shock and condition monitoring - Vibration and shock measuring instruments and testing equipment.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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2015-05-01

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

**Part 16:  
Calibration by Earth's gravitation**

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

*Partie 16: Étalonnage par gravitation tellurique*



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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.

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](http://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](http://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 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 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 3, *Use and calibration of vibration and shock measuring instruments*.

This first edition of ISO 16063-16 cancels and replaces the first edition of ISO 5347-5:1993, which has been technically revised.

This corrected version of ISO 16063-16:2014 incorporates the following corrections:

- Table 1, last row, + sign added before  $240^\circ$
- Paragraph 2, after Formula (2),  $k = 1$  changed to  $k = 2$  and the uncertainty value adapted.
- Formula (5) has been corrected, and a degree sign has been added after 180 in the explanation.
- Formula (7) has been corrected, and in the explanation, the superfluous rows for  $a_{\alpha 0}$  and  $a_{\alpha 180}$  have been removed.
- In Figure 1, the equal sign has been removed.
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- In the explanation to Formula (A.2),  $u_i$  has been replaced by  $u(x_i)$ .
- In Formula (A.3) and in its explanation,  $u(e_g)$  has been replaced by  $u(a_g)$ .
- In addition, the following list of parts has been updated:

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 15: Primary angular vibration calibration by laser interferometry*
- *Part 16: Calibration by Earth's gravitation*
- *Part 21: Vibration calibration by comparison to a reference transducer*
- *Part 22: Shock calibration by comparison to a reference transducer*
- *Part 31: Testing of transverse vibration sensitivity*
- *Part 32: Resonance testing — Testing the frequency and the phase response of accelerometers by means of shock excitation*
- *Part 41: Calibration of laser vibrometers*
- *Part 42: Calibration of seismometers with high accuracy using acceleration of gravity*
- *Part 43: Calibration of accelerometers by model-based parameter identification*

The following parts are under preparation:

- *Part 17: Primary calibration by centrifuge*
- *Part 33: Testing of magnetic field sensitivity*





# Methods for the calibration of vibration and shock transducers —

## Part 16: Calibration by Earth's gravitation

### 1 Scope

This part of ISO 16063 specifies the instrumentation and procedure to be used for performing primary calibration of accelerometers using Earth's gravitation. It is applicable to rectilinear accelerometers with DC (zero hertz frequency) response, such as strain gauge, piezoresistive, variable capacitance, and servo accelerometer types.

This part of ISO 16063 is applicable to the calibration of the magnitude of the sensitivity, referenced to the acceleration due to the local gravitation at 0 Hz.

With the use of appropriate calibration equipment, this part of ISO 16063 can be applied to the calibration of the magnitude of the sensitivity, referenced to fractional parts of the acceleration due to the local gravitation at 0 Hz. The specification of the instrumentation used contains requirements on environmental conditions, as well as specific requirements for the apparatus to be used.

The sensitivity obtained using this part of the ISO 16063 standard for accelerometers with a DC response can be used over the flat part of the low-frequency range of the accelerometer. The degree of flatness of the applicable frequency range is intended to be taken into account in the uncertainty of measurement (UoM).

This part of ISO 16063 is applicable to reference standard accelerometers and working standard accelerometers, as well as complete acceleration measurement chain (accelerometer complete with amplifier and readout unit).

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

### 3 Uncertainty of measurement

All users of this part of ISO 16063 are expected to make an uncertainty budget according to [Annex A](#) in order for them to document their UoM estimation. A calibration arrangement example is given in order to help set up systems that fulfil different uncertainty requirements.

When the local value of acceleration due to gravitation,  $g_l$ , is known and used, an UoM of 0,1 % can be obtained.

When the local value of acceleration due to gravitation,  $g_l$ , is not known and the standard acceleration due to gravitation,  $g_n$ , is used (ignoring the influence of latitude and altitude), an UoM of 0,5 % can be obtained. This estimation is assuming a value for the acceleration due to Earth's gravitation of  $9,806\ 65\ \text{m/s}^2 \pm 0,026\ \text{m/s}^2$ .

The uncertainty limits mentioned in this clause are applicable to devices with a maximum transverse sensitivity of 5 %.