

H.-J. von Martens  
Physikalisch-Technische Bundesanstalt (PTB)

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**Report of the ISO International Observer to the 4<sup>th</sup> Meeting of the CCAUV,  
BIPM, Sèvres, September 2004**  
(cf. Draft Agenda of 20/04/04, item 12.2)

**Advances of ISO TC 108/SC 3 towards key comparisons and traceability in the  
field of vibration and shock acceleration**

## **1 Introduction**

This report updates the information presented to the 2<sup>nd</sup> meeting and to the 3<sup>rd</sup> meeting of the CCAUV. In the documents CCAUV-99/12, CCAUV-01/05 and CCAUV-02/08, the International Organization for Standardization outlined the regulations for developing and adopting ISO standards, and presented the standards developed in ISO/TC 108/SC 3 (in Working Group WG 6: *Calibration* in particular). With the development of the new ISO 16063/XX series of standards, ISO/TC 108 responded to the need for upgraded standard calibration methods applicable to

- key comparisons on the CIPM and RMO levels in the field of vibration and shock acceleration measurements
- the reliable and uniform specification of the Calibration and Measurement Capabilities (CMCs) in the field of vibration/acceleration, published in the BIPM key comparison database (cf. Appendix C of the Mutual Recognition Arrangement MRA) - nearly all NMIs claim their CMCs in the field of vibration/acceleration to be in compliance with the relevant ISO standards
- the establishment of traceability chains in the field of vibration (measurands: acceleration and derived motion quantities).

Upgraded and new and ISO standards and standardization projects focusing on the specification of calibration methods needed at different levels of a traceability chain in the field of vibration and shock have been presented. In the following, the information will be updated outlining the progress achieved since the 3<sup>rd</sup> meeting of the CCAUV. The meeting of ISO/TC 108/SC 3 held in Adelaide/Australia in February 2004 marked a milestone in the ongoing process of developing standards significant for key comparisons and traceability.

## **2. The new standard series ISO 16063 “Methods for the calibration of vibration and shock transducers”**

Under the general title "Methods for the calibration of vibration and shock pick-ups", a standard series, ISO 5347, was issued in the period between 1987 and 1997. A

revision of the ISO 5347 series, re-numbered to ISO 16063, was started in 1995, focusing on the specification of upgraded and new calibration methods needed at different levels of a traceability chain: methods for primary vibration calibration, secondary vibration calibration, primary shock calibration and secondary shock calibration. The re-numbering applies to those standards only which are under revision or are being newly developed. Therefore, the former numbering system is still valid for the standards which have recently been reviewed and confirmed without revision. A survey of the state of the standards and standardization projects of the 16063 series is given in the following.

(1) **ISO 16063-1: Basic concepts**

Issued as international standard in 1998, reviewed and confirmed in 2004

(2) **ISO 16063-11: Primary vibration calibration by laser interferometry**

Issued as international standard in 1999, reviewed and confirmed in 2004

(3) **ISO 16063-12: Primary vibration calibration by the reciprocity method**

Issued as international standard in 2002

(4) **ISO 16063-13: Primary shock calibration by laser interferometry**

Issued as international standard in December 2001

(5) **ISO 16063-14: Primary calibration by high impact shocks**

Proposed Work Item PWI 16063-14 (zero stage project) deleted in 2004

(6) **ISO 16063-15: Primary angular vibration calibration by laser interferometry**

Approval as active work item in 2003, Committee draft in 2003, Circulation as a Draft International Standard in 2004

(7) **ISO 16063-21: Vibration calibration by comparison to a reference transducer**

Issued as international standard in 2003

(8) **ISO 16063-22 Shock calibration by comparison to a reference transducer**

Circulation as a Final Draft International Standard in 2004

(9) **ISO 16063-23: Angular vibration calibration by comparison to reference transducers**

Proposed Work Item (zero stage project) confirmed in 2004

(10) **ISO 16063-31: Testing of transverse vibration sensitivity**

Revision of ISO 5347-11:1993 approved in 2004, a working draft was discussed at the TC 108/SC 3/WG 6 meeting in Adelaide in 2004.

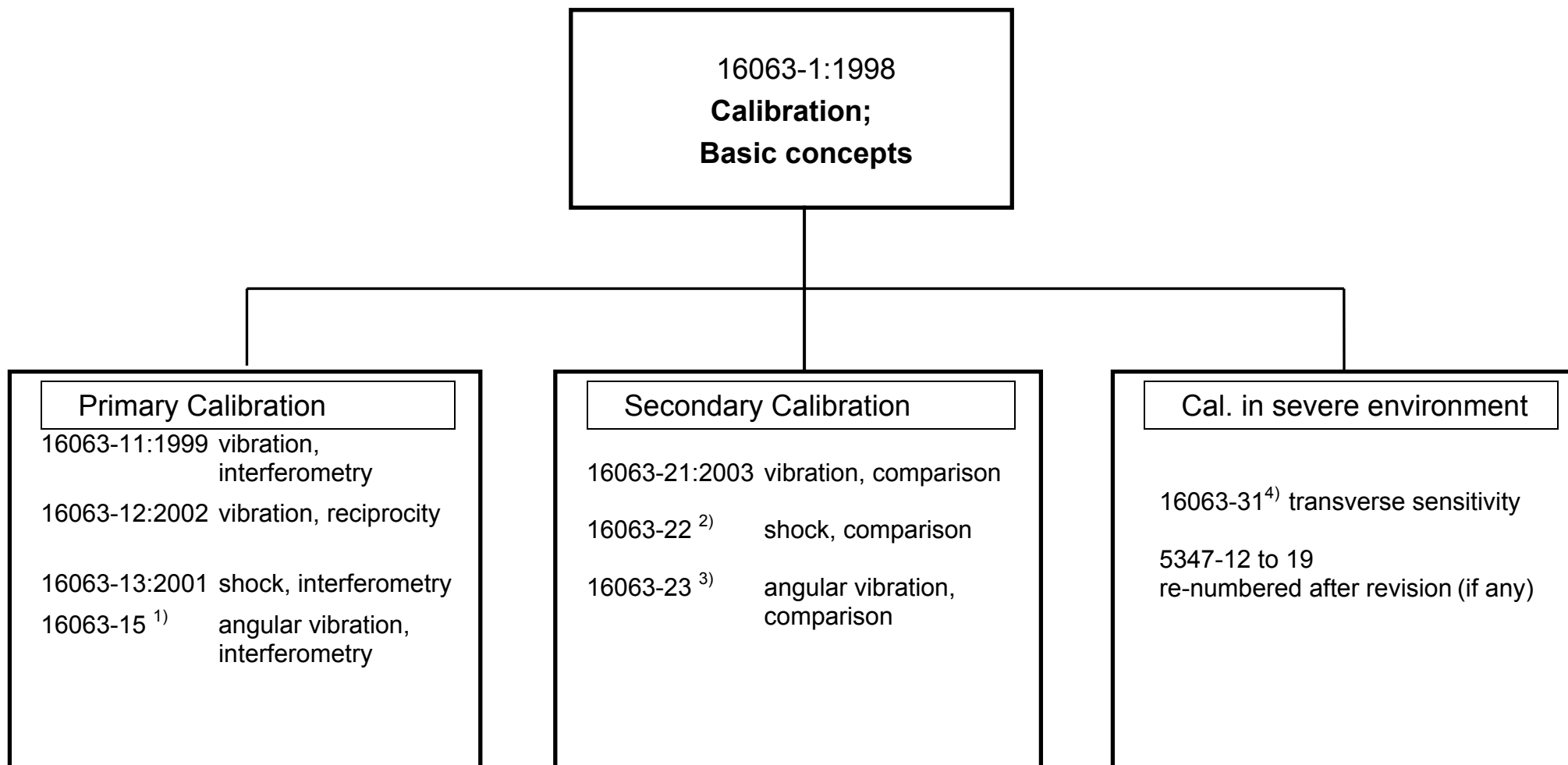
(11) **ISO 16063-32: Resonance testing**

New Proposed Work Item of revision of ISO 5347-14:1993, preliminary work item in the programme of work, 2004

Figure 1: State of the standard series ISO 16063 “Methods for the calibration of vibration and shock transducers” (July 2004)

New proposed work items see sect. 2, items (11) 16063-32 Resonance testing, (12) 16063-41 Cal. of laser vibrometers, (13) ISO 16063-42 Cal. of seismometers

Footnotes: <sup>1)</sup> DIS, <sup>2)</sup> FDIS, <sup>3)</sup> zero stage project, <sup>4)</sup> WD



**(12) 16063-41: Calibration of laser vibrometers**

New Proposed Work Item ISO/TC 108/SC 3  
preliminary work item in the programme of work, 2004

**(13) ISO 16063-42 Calibration of seismometers**

preliminary work item in the programme of work, 2004

**3. The standard series ISO 5347**

ISO Part	Title	State
5347-0:1987	Basic concepts	revised, 16063-1
5347-1:1993	Primary vibration calibration by laser interferometry	revised, 16063-11
5347-2:1993	Primary shock calibration by light cutting	withdrawn
5347-3:1993	Secondary vibration calibration	revised, 16063-21
5347-4:1993	Secondary shock calibration	revision, FDIS 16063-22
ISO 5347-5:1993	Calibration by Earth's gravitation	confirmed 2004
ISO 5347-6:1993	Primary vibration calibration at low frequencies	withdrawn 2004
ISO 5347-7:1993	Primary calibration by centrifuge	confirmed 2004
ISO 5347-8:1993	Primary calibration by dual centrifuge	confirmed 2004
ISO 5347-9:1993	Secondary vibration calibration by comparison of phase angles	withdrawn
ISO 5347-10:1993	Primary calibration by high impact shocks	confirmed 2004
ISO 5347-11:1993	Testing of transverse vibration sensitivity	revision, WD 16063-31
ISO 5347-12:1993	Testing of transverse shock sensitivity	confirmed 2004
ISO 5347-13:1993	Testing of base strain sensitivity	confirmed 2004
ISO 5347-14:1993	Resonance frequency testing of undamped accelerometers on a steel block	confirmed 2004
ISO 5347-15:1993	Testing of acoustic sensitivity	confirmed 2004
ISO 5347-16:1993	Testing of torque sensitivity	confirmed 2004
ISO 5347-17:1993	Testing of fixed temperature sensitivity	confirmed 2004
ISO 5347-18:1993	Testing of transient temperature sensitivity	confirmed 2004
ISO 5347-19:1993	Testing of magnetic field sensitivity	confirmed 2004
ISO 5347-20:1997	Primary vibration calibration by the reciprocity method	revised, 16063-12
ISO 5347-22:1997	Accelerometer resonance testing - General methods	confirmed 2002

### 3 Conclusions

ISO TC 108/SC 3 “Use and calibration of vibration and shock measuring instruments” - WG 6 “Calibration” - in particular) has efficiently continued the great activities to specify upgraded and new standard methods for the calibration of vibration and shock transducers required to ensure international traceability to the SI units in the field of measurements of accelerations and derived motion quantities. The remarkable progress achieved since the 3<sup>rd</sup> CCAUV meeting is reflected in the Sections 2 and 3 of this report. A significant example of the progress is represented by the first international standard for angular vibration calibration, ISO 16063-15 (*Primary angular vibration calibration by laser interferometer*), which was only a new work item proposal at the time of the 3<sup>rd</sup> CCAUV meeting (in October 2002) and is at present (since June 2004) already circulating for voting as a Draft International Standard (DIS).

For primary vibration calibration by laser interferometry at NMI level, ISO 16063-11:1999 has extended the frequency range (0.4 Hz to 10 kHz) and included absolute phase shift measurement. ISO 16063-13:2001 provides interferometric primary shock calibration (100 m/s<sup>2</sup> to 100 km/s<sup>2</sup>). ISO 16063-15 specifies primary angular vibration calibrations (magnitude and phase shift) in the frequency range from 0.4 Hz to 1.6 kHz. For rectilinear vibration and shock calibration at lower levels of the traceability chain, parts 21 and 22 of ISO 16063 provide upgraded comparison methods, and ISO 16063-23 is the corresponding project for angular vibration calibration by comparison to a reference transducer.

With the registered new work item proposal for the specification of methods for the calibration of laser vibrometers (to become ISO 16063-41), a normative basis will be established to ensure traceability for vibration measurements by laser interferometry.

Using the ISO methods specified, hierarchies of measurement standards (traceability chains) have been established and are operated by national metrology institutes (NMIs) as well as accredited and non-accredited calibration laboratories in compliance with the upgraded and new ISO standards.

For key comparisons at the CIPM and RMO levels and supplementary comparisons in the field of vibration and shock measurements (quantity of acceleration), the methods specified in the relevant ISO standards are used - preferably primary vibration calibration by laser interferometry as specified in ISO 16063-11 and calibration by comparison to a reference transducer as specified in ISO 16063-21.

The calibration and measurement capabilities (CMCs) offered in Appendix C of the Mutual Recognition Arrangement MRA (see. <http://www.bipm.org>, Key Comparison Database) for the branch vibration are based on the up-to-date ISO standard methods.