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Methods for the calibration of vibration and shock pick-ups —

Part 15:
Testing of acoustic sensitivity

Méthodes pour l'étalonnage de capteurs de vibrations et de chocs — Partie 15: Essai de sensibilité acoustique

Reference number
ISO 5347-15:1993(E)

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.

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.

International Standard ISO 5347-15 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Sub-Committee SC 3, *Use and calibration of vibration and shock measuring instruments*.

ISO 5347 consists of the following parts, under the general title *Methods for the calibration of vibration and shock pick-ups*:

— *Part 0: Basic concepts*

— *Part 1: Primary vibration calibration by laser interferometry*

— *Part 2: Primary shock calibration by light cutting*

— *Part 3: Secondary vibration calibration*

— *Part 4: Secondary shock calibration*

— *Part 5: Calibration by Earth's gravitation*

— *Part 6: Primary vibration calibration at low frequencies*

— *Part 7: Primary calibration by centrifuge*

— *Part 8: Primary calibration by dual centrifuge*

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— *Part 9: Secondary vibration calibration by comparison of phase angles*

— *Part 10: Primary calibration by high-impact shocks*

— *Part 11: Testing of transverse vibration sensitivity*

— *Part 12: Testing of transverse shock sensitivity*

— *Part 13: Testing of base strain sensitivity*

— *Part 14: Resonance frequency testing of undamped accelerometers on a steel block*

— *Part 15: Testing of acoustic sensitivity*

— *Part 16: Testing of mounting torque sensitivity*

— *Part 17: Testing of fixed temperature sensitivity*

— *Part 18: Testing of transient temperature sensitivity*

— *Part 19: Testing of magnetic field sensitivity*

— *Part 20: Primary vibration calibration by the reciprocity method*

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Methods for the calibration of vibration and shock pick-ups —

Part 15:
Testing of acoustic sensitivity

1 Scope

ISO 5347 comprises a series of documents dealing with methods for the calibration of vibration and shock pick-ups.

This part of ISO 5347 lays down detailed specifications for the instrumentation and procedure to be used for acoustic sensitivity testing. It applies to accelerometers.

This part of ISO 5347 is applicable for a frequency range of random noise from 125 Hz to 8 000 Hz and a sound pressure level of 130 dB (reference value: 2×10^{-5} Pa).

2 Apparatus

2.1 Equipment capable of maintaining room temperature at 23 °C ± 3 °C.

2.2 Room, having a volume of at least 75 m^3 so as to obtain approximate free-field conditions.

2.3 Random noise generator, low-pass filter or **equalizer, amplifier** and **loudspeaker**, which can produce a free-field random noise with a total sound pressure level of 130 dB ± 5 dB (reference value: 2×10^{-5} Pa) with the following spectrum shape per frequency octave band:

— 125 Hz: 115 dB ± 6 dB;

— 250 Hz to 2 000 Hz: 120 dB ± 5 dB;

— 4 000 Hz: 115 dB ± 6 dB;

— 8 000 Hz: 105 dB ± 10 dB.

NOTE 1 A 0,5 mH and 1 μF low-pass filter, a commercial 30 W power amplifier and an 8 in, 50 W broadband loudspeaker in a 1 m × 1 m baffle is recommended. Distance from the loudspeaker to the accelerometer: 50 mm to 100 mm.

2.4 Sound level measuring equipment with octave band filtering, covering the range from 80 dB to 140 dB (reference value: 2×10^{-5} Pa) and with uncertainty maximum ± 3 dB.

3 Method

3.1 Test procedure

Place the loudspeaker in the middle of the room with no hard reflecting surfaces in front of it.

Suspend the accelerometer in a rubber harness in front of and close to the loudspeaker. The suspension resonance frequency shall be lower than 20 Hz. Rotate the accelerometer in order to find maximum sensitivity.

Replace the accelerometer by a microphone and shape the noise spectrum.

After the accelerometer has been suspended in its rubber harness and then rotated, measure the maximum output, in metres per second squared, for the specified sound pressure level. If it is suspected that whole accelerometer rigid body vibrations are induced and that this affects the accelerometer output, special test procedures, outlined in 3.3, shall be carried out and reported.

3.2 Expression of results

The acoustic sensitivity shall be reported as the equivalent accelerometer output, in metres per second squared, for the applied level sound pressure (reference value: 2×10^{-5} Pa).

3.3 Special test procedures

Acoustic sensitivity measurements of piezoelectric accelerometers can be difficult to make because whole rigid body vibratory motion effects can be induced into the accelerometer. If these effects are suspected, the following methods for minimizing motion effects shall be applied:

a) Mount the accelerometer on a very heavy but small fixture; this generally distorts the acoustic field so the sound pressure level has to be measured with the microphone in an accelerometer dummy mounted on the fixture.

b) Measure the induced motion with an accelerometer that is protected and mounted inside the fixture and subtract the induced motion components from the pick-up output.

c) Mount the accelerometer on the smallest possible rod fixture clamped to a heavy base and isolate this fixture and the base from the sound field; a high density material, e.g. tungsten, is recommended.