
**Reciprocating internal combustion
engines — Test code for the measurement
of structure-borne noise emitted from
high-speed and medium-speed
reciprocating internal combustion engines
measured at the engine feet**

*Moteurs alternatifs à combustion interne — Code d'essai pour le mesurage
du bruit solidien émis par les moteurs alternatifs à combustion interne à
vitesse élevée et moyenne, mesuré aux pieds du moteur*

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Reference number
ISO 13332:2000(E)

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Printed in Switzerland

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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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13332 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

Annex A of this International Standard is for information only.

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Introduction

Noise in buildings, structures, ships, aircraft and land vehicles often arises from the use of internal combustion engines, particularly reciprocating engines, and there may be situations where these are the dominant noise source. Even where it is not dominant, it may form an unwelcome background noise. These noises, arising within the building, etc., can be transmitted in at least two ways as given below.

- a) Directly into the surrounding air. This is called airborne sound and ISO 6798 specifies methods for determining the airborne noise output of internal combustion engines.
- b) Through excitation or vibration in the supporting structure, pipes and shafts. These vibrations then pass through the structure as structural vibration, exciting in turn the walls and panels of the structure, resulting in the radiation of so-called secondary sound or structure-borne noise.

The ability of the source of vibration (the engine) to generate vibration in the structure in which it is mounted depends on the amount of motion of the engine at its mounting points, the properties of the engine mounting system and the mobility of the receiving structure. Vibration from the engine feet may be in the vertical sense, which is the one most easily visualised, but may also be longitudinal or transverse with respect to the crankshaft axis. The vibration source may also cause rotational input, resolved about each of the three orthogonal axes.

The passage through the structure of any vibration which has been caused in it can be very difficult to control, particularly at low frequencies. There are many possible modes of vibration of the structure which could be responsible for the transmission (compression, torsional or flexural modes). Only breaks in the continuity of the structure are likely to be completely effective, and this is not usually possible. Damping of the structure may be effective for some propagation modes, particularly at high frequencies/short wavelengths, but will not be sufficiently effective at low frequencies.

In spite of the difficulties in controlling the propagation of vibration within the structure, there are obvious benefits in knowing the characteristics of the engine as a potential vibration source so that a choice may be made amongst various competing mounting engines, or the structure and engine mounts can be designed to comply with the properties of the engine selected.

Reciprocating internal combustion engines — Test code for the measurement of structure-borne noise emitted from high-speed and medium-speed reciprocating internal combustion engines measured at the engine feet

1 Scope

This International Standard defines the procedure for measuring the capacity of a high-speed or medium-speed engine to generate vibration and the determination of the frequency limits of validity of the information quoted. The method described in this International Standard is not suitable for low-speed engines. This International Standard describes an engineering and not a precision method. Whether the tests are carried out on the test bed or on site shall be agreed between the user and the manufacturer.

This International Standard applies to high-speed and medium-speed reciprocating internal combustion engines for land, rail traction and marine use, excluding engines used to propel agricultural tractors, road vehicles and aircraft. This International Standard may be applied to engines used to propel road-construction and earth-moving machines, industrial trucks and for other applications where no suitable International Standard for these engines exists.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 1503:1977, *Geometrical orientation and direction of movements*.

ISO 2954:1975, *Mechanical vibration of rotating and reciprocating machinery — Requirements for instruments for measuring vibration severity*.

ISO 3046-1:—¹⁾, *Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods — Additional requirements*.

ISO 3046-3:1989, *Reciprocating internal combustion engines — Performance — Part 3: Test measurements*.

ISO 3046-7:1995, *Reciprocating internal combustion engines — Performance — Part 7: Codes for engine power*.

ISO 9611:1996, *Acoustics — Characterization of sources of structure-borne sound with respect to sound radiation from connected structures — Measurement of velocity at the contact points of machinery when resiliently mounted*.

1) To be published. (Revision of ISO 3046-1:1995)