INTERNATIONAL STANDARD

ISO 8662-1
First edition
1988-08-01

Reprinted
1988-09-01

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Hand-held portable power tools — Measurement of vibrations at the handle —

Part 1 : General

Machines à moteur portatives — Mesurage des vibrations au niveau des poignées —

Partie 1 : Généralités

Reference number
ISO 8662-1 : 1988 (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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8662-1 was prepared by Technical Committee ISO/TC 118, *Compressors, pneumatic tools and pneumatic machines*, in collaboration with Technical Committee IEC/TC 61, *Safety of household and similar electrical appliances*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Hand-held portable power tools — Measurement of vibrations at the handle —

Part 1 : General

0 Introduction

This International Standard specifies type test methods for the measurement of vibrations in the handles of hand-held power-driven tools.

It defines a laboratory measuring procedure which provides accurate and reproducible results as well as results which are as far as possible in agreement with results measured under real working conditions.

These type tests serve to establish type values, enabling comparison of the same type or of different types of tools.

This part of ISO 8662 contains general requirements for the measurement of vibrations in all types of hand-held power tools. The other parts of ISO 8662 specify type test procedures for the measurement of vibrations in handles of hand-held power-driven tools. The type test is designed to give information on the vibration performance of a given power tool, making it possible to compare various tools. As far as possible, the operating conditions of the tool will represent a typical work situation. The operating procedure is specified in sufficient detail to ensure satisfactory reproducibility of measurements.

NOTE — A number of test methods have been specified, covering a range from a real work situation to a completely artificial situation, to achieve the desired reproducibility.

The vibrations generated in a tool depend on the work situation in which it is used. The operator's exposure to vibration depends on factors additional to those specified in the type test given, e.g. the operator's experience, the condition of the tool and its accessories, the process and the duration of exposure. This International Standard does not give any guidelines or recommendations for assessing the risk of damage due to the vibration exposure. However, the magnitude of the vibrations measured is, as far as possible, a realistic measure of the vibration intensity to be expected in a normal working situation.

Vibrations in a hand-held power tool in a working situation comprise components generated in the machine itself and in the inserted tool, e.g. the grinding wheel or chisel. The workpiece and the process have an important influence on the vibration levels encountered. It is not the purpose of this International Standard to separate the influences of these various factors.

At present, the deviation observed between measurements carried out in different laboratories is not as low as desired. However, development of the measurement technique and more precise specification of the operating conditions in conjunction with experience should lead to a greater degree of reproducibility in the future.

NOTE — When further experience and more information have been gained, a revision to this International Standard may become justified.

1 Scope and field of application

This part of ISO 8662 describes the basic requirements for evaluating vibrations in the handles of hand-held power-driven tools.

It is not intended for assessment of human exposure to vibrations. The measurement and assessment of human exposure to hand-transmitted vibration in the workplace is given in ISO 5349.

2 References

ISO 1683, *Acoustics — Preferred reference quantities for acoustic levels.*

ISO 5347, *Methods for the calibration of vibration and shock pick-ups.* [1)]

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers.*

ISO 5349, *Mechanical vibration — Guidelines for the measurement and the assessment of human exposure to hand-transmitted vibration.*

1) At present at the stage of draft.

ISO 5805, *Mechanical vibration and shock affecting man — Vocabulary.*

ISO 8041, *Human response to vibration — Measuring instrumentation.* [1)]

IEC Publication 225, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.*

3 Quantities to be measured

3.1 Physical quantity

Vibrations are measured as the acceleration of the handles of the power tool under test and shall be expressed as the root-mean-square (r.m.s.) acceleration, a_h, in metres per second squared.

The magnitude of the vibration may also be expressed in terms of an acceleration level, L_{a_h}, in decibels, determined according to the formula

$$L_{a_h} = 20 \lg\left(\frac{a_h}{a_0}\right)$$

where

a_h is the r.m.s. acceleration, in metres per second squared;

a_0 is the reference acceleration equal to 10^{-6} m/s^2, as specified in ISO 1683.

3.2 Frequency analysis

Measurement shall be made in octave bands with centre frequencies of 8 to 1 000 Hz or in one-third octave bands with centre frequencies of 6,3 to 1 250 Hz.

NOTES

1 A frequency analysis in octave bands is regarded to be necessary in order to judge the validity of the measurement of the weighted value (see 3.3 and 4.3), e.g. high values in bands below the repetition frequency of the tool may indicate the presence of non-linear effects.

2 Octave band values can be directly measured or calculated from one-third octave band values.

3.3 Weighted acceleration

Weighted acceleration values, $a_{h,W}$, can be obtained either by measurement using the weighting filter for hand-arm vibration measurements defined in ISO 8041 or by calculation from one-third octave band data, using the weighting factors specified in ISO 5349.

NOTE — These two methods may produce different results owing to differences in the curves, the tolerances, and the filter characteristics in the electronic filtering networks.

1) At present at the stage of draft.

4 Instrumentation

4.1 Specification of transducer

A transducer for measuring acceleration, such as a piezoelectric device, shall be used in conjunction with a suitable preamplifier. ISO 8041 shall be consulted for the specification of the measuring equipment.

The total mass of the vibration transducer and its mounting shall be small in relation to that of the handle; it shall preferably be less than 50 g and not more than 5 % of the mass of the tool complete with accessories.

Specifications such as the transverse sensitivity (less than 10 %), the ambient temperature range and the maximum shock acceleration shall be considered in the selection of accelerometers.

NOTE — Under certain conditions, particularly when mounting a transducer on a handle made of a non-metallic material, e.g. plastic or rubber, or on a very light handle (approximately less than 3 % of the total mass of the tool complete with accessories), the above-stated mass of 50 g may lead to measurement errors. In this case it is necessary to use a transducer as small and light as possible.

4.2 Fastening of transducer

The transducer and the mechanical filter, if used, shall be mounted firmly, for example by using a threaded stud or clamp. Further details are given for individual tools in the relevant parts of ISO 8662. In all cases the mounting shall be in accordance with the transducer manufacturer's instructions. For accelerometers, the mounting shall be in accordance with ISO 5348.

NOTE — The measurement of vibration on handles with resilient covers can be accomplished by using a special adaptor between the hand and the handle. The adaptor may consist of a suitably formed light rigid plate with a suitable mounting arrangement for the accelerometer used. Care should be taken that the mass, size and shape of the adaptor do not significantly influence the signal from the transducer in the frequency range of interest.

4.3 Mechanical filter

For percussive tools, particularly those with an all-metal housing, the use of a mechanical filter together with the accelerometer is recommended. However, if it is known that no measurement errors are introduced when the mechanical filter is not used, it need not be used. The measurement errors may be, for example, periodic d.c. shifts which contribute to the vibration signal in the frequency range of interest.

NOTE — High acceleration in the high-frequency components of the vibration may cause the accelerometer to generate false signals in the frequency range of interest because of excitation of the resonance of the transducer itself.

Mechanical filters may be used to reduce the high-frequency components of the vibration input into the accelerometer.

The mechanical filter, if used, shall be adapted to the mass of the accelerometer to produce a response from 6,3 Hz up to 1,5 kHz. The cut-off frequency of the mechanical filter shall be at least a factor of five below the resonance frequency of the accelerometer.

4.4 Frequency filters

If octave band and one-third octave band filters are used they shall be as specified in IEC Publication 225.

4.5 Weighting filter and r.m.s. detector

If a weighting filter and r.m.s. detector for hand-arm vibration measurements are used they shall be as specified in ISO 8041.

The suggested methods for obtaining the individual r.m.s. values are as follows.

If the signal for analysis is of short duration, or if its magnitude varies substantially with time, a simple analysis cannot be made.

In order to obtain r.m.s. values under these circumstances, it is necessary to use an integrating meter or analyser which is equipped with "linear integration" facilities. It is recommended that "linear integration" analysis be adopted as the preferred method. The type of analyser normally used for noise analysis can be used only when the signal is relatively steady with time or is of sufficient duration. In such circumstances, the time constant chosen shall be appropriate for the signal duration.

4.6 Signal recording

The vibration signal may be stored for later evaluation using a suitable high quality instrumentation recorder.

The vibration spectrum shall be corrected for any deviation from a flat frequency response of the recorder. The corrections to the octave band centre frequencies or the one-third octave band frequencies shall be recorded in the test report.

4.7 Auxiliary equipment

The auxiliary equipment for monitoring the running condition (electrical conditions, power, air pressure, rotational speed, etc.) and the working conditions of specific tools will be specified in subsequent parts of ISO 8662.

4.8 Calibration

The measuring chain including the transducer shall be calibrated (see ISO 8041 and ISO 5347).

5 Measurement direction and location

5.1 Measurement direction

A basicentric coordinate system[1] shall be used. When appropriate, measurements shall be made in the dominant axis. This axis is defined for specific tools in subsequent parts of ISO 8662. If no dominant axis exists, then measurements shall be made in all three axes.

1) See ISO 5805 for the definition.

5.2 Measurement location

Measurements shall be carried out at a point half-way along the length of the handles or at such places where an operator normally holds the tool during a typical operation. The specification of measurement positions on individual tools is given in subsequent parts of ISO 8662.

6 Determination of working procedure

6.1 General

The working procedure shall be specified in as much detail as necessary to achieve appropriate reproducibility.

A working procedure similar to that of a typical real working situation is preferred.

The number of runs and the length of each run shall be sufficient to obtain an appropriate accuracy. These data are specified for individual tools in the relevant parts of ISO 8662.

If for reasons of better reproducibility an artificial procedure is defined, the vibration source should produce approximately the same intensity of vibration as that in a real work situation.

6.2 Operating conditions

Measurements shall be carried out using a properly serviced and lubricated machine under stable running conditions. The machine shall be operated at the rated power supply, e.g. rated voltage or pressure, and this shall be maintained for the duration of the test.

The speed or blow rate shall be controlled and measured during the test. Specifications for the speed of individual tools are given in the relevant parts of ISO 8662.

6.3 Inserted tool, workpiece and task

The inserted tool (e.g. chisel, grinding wheel, chain or drill) to be used with the machine, the workpiece and the task will be specified in subsequent parts of ISO 8662. It should be noted that even small differences in size, shape, material, wear, unbalance etc. of the inserted tool can alter the vibration intensity considerably.

If a complete test rig is used, its design shall be reported in detail.

6.4 Operator

The vibrations of the tool can be influenced by the operator. The operator shall therefore be skilled and able to operate the tool properly.

7 Report on measurements

7.1 References

The report shall contain a reference to this part of ISO 8662 and to any relevant subsequent parts.

7.2 List of instrumentation

The manufacturer, type and relevant specifications of the instruments used shall be stated.

7.3 Transducer fastening

The measurement location and the kind of fastening of the transducer and (if applicable) of the mechanical filter shall be described. A statement of the measurement directions shall be given.

7.4 Description of the power tool and the inserted tool

A description of the power tool and the inserted tool shall be given.

The description of the power tool shall include the following details :

a) manufacturer;

b) type;

c) model number;

d) serial number;

e) running conditions;

f) mass.

The description of the inserted tool shall include the following details :

a) manufacturer;

b) type;

c) model number;

d) serial number;

e) size;

f) mass.

A description of the handle covering shall be given.

7.5 Working conditions

A detailed description of the working conditions as specified in the relevant part of ISO 8662 shall be given.

7.6 Signal processing

The type of signal integration in the spectrum analyser and the method of determining the weighted acceleration shall be stated.

7.7 Additional specifications

All relevant details on the measurement set-up such as the size, type and mounting of the workpiece shall be stated.

7.8 Result

The result shall be presented as a weighted value. For certain types of tools, octave band values shall also be reported when this is specified in the applicable part of ISO 8662.

This page intentionally left blank

UDC 534.1.08 : 621.9-182.4

Descriptors : vibration, tools, power-operated tools, portable equipment, portable electric machine tools, pneumatic equipment, tests, vibration tests.

Price based on 4 pages