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Standards

Irish Standard  
I.S. EN ISO 28927-10:2011

# Hand-held portable power tools - Test methods for evaluation of vibration emission - Part 10: Percussive drills, hammers and breakers (ISO 28927-10:2011)

## I.S. EN ISO 28927-10:2011

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**Hand-held portable power tools - Test methods for evaluation of  
vibration emission - Part 10: Percussive drills, hammers and  
breakers (ISO 28927-10:2011)**

Machines à moteur portatives - Méthodes d'essai pour  
l'évaluation de l'émission de vibrations - Partie 10:  
Marteaux à percussion, perforateurs et brise-béton (ISO  
28927-10:2011)

Handgehaltene motorbetriebene Maschinen -  
Messverfahren zur Ermittlung der Schwingungsemission -  
Teil 10: Bohrhämmer, Schlaghämmer und  
Aufbruchhämmer (ISO 28927-10:2011)

This European Standard was approved by CEN on 14 April 2011.

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## **Foreword**

This document (EN ISO 28927-10:2011) has been prepared by Technical Committee ISO/TC 118 "Compressors and pneumatic tools, machines and equipment" in collaboration with Technical Committee CEN/TC 231 "Mechanical vibration and shock" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2011, and conflicting national standards shall be withdrawn at the latest by October 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

### **Endorsement notice**

The text of ISO 28927-10:2011 has been approved by CEN as a EN ISO 28927-10:2011 without any modification.

## **Annex ZA** (informative)

### **Relationship between this International Standard and the Essential Requirements of EU Directive 2006/42/EC**

This International Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive excerpt ER 2.2.1.1 and associated EFTA regulations.

**WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.**

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STANDARD**

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**Hand-held portable power tools — Test  
methods for evaluation of vibration  
emission —**

Part 10:  
**Percussive drills, hammers and breakers**

*Machines à moteur portatives — Méthodes d'essai pour l'évaluation de  
l'émission de vibrations —*

*Partie 10: Marteaux à percussion, perforateurs et brise-béton*



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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 28927-10 was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 3, *Pneumatic tools and machines*.

ISO 28927-10 cancels and replaces ISO 8662-2:1992, ISO 8662-3:1992 and ISO 8662-5:1992, which have been technically revised. It also incorporates the Amendments ISO 8662-2:1992/Amd.1:1999, ISO 8662-3:1992/Amd.1:1999 and ISO 8662-5:1992/Amd.1:1999. The most important changes are

- vibration measurement in three axes and at both hand positions,
- new transducer positions,
- improved definition of the transducer positions and orientation,
- rock drills from ISO 8662-3, chipping hammers and riveting hammers from ISO 8662-2 are included, and
- amended description of the energy absorber.

ISO 28927 consists of the following parts, under the general title *Hand-held portable power tools — Test methods for evaluation of vibration emission*:

- *Part 1: Angle and vertical grinders*<sup>1)</sup>
- *Part 2: Wrenches, nutrunners and screwdrivers*<sup>2)</sup>
- *Part 3: Polishers and rotary, orbital and random orbital sanders*<sup>3)</sup>

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1) Together with ISO 28927-4, replaces ISO 8662-4, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 4: Grinders*.

2) Replaces ISO 8662-7, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 7: Wrenches, screwdrivers and nut runners with impact, impulse or ratchet action*. All screwdrivers and nutrunners except for one-shot tools now covered.

3) Replaces ISO 8662-8, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 8: Polishers and rotary, orbital and random orbital sanders*.

- Part 4: Straight grinders<sup>4)</sup>
- Part 5: Drills and impact drills<sup>5)</sup>
- Part 6: Rammers<sup>6)</sup>
- Part 7: Nibblers and shears<sup>7)</sup>
- Part 8: Saws, polishing and filing machines with reciprocating action and small saws with oscillating or rotating action<sup>8)</sup>
- Part 9: Scaling hammers and needle scalers<sup>9)</sup>
- Part 10: Percussive drills, hammers and breakers
- Part 11: Stone hammers<sup>10)</sup>
- Part 12: Die grinders<sup>11)</sup>

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4) Together with ISO 28927-1, replaces ISO 8662-4, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 4: Grinders*.

5) Replaces ISO 8662-6, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 6: Impact drills*. Non-impacting drills now covered.

6) Replaces ISO 8662-9, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 9: Rammers*.

7) Replaces ISO 8662-10, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 10: Nibblers and shears*.

8) Replaces ISO 8662-12, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 12: Saws and files with reciprocating action and saws with oscillating or rotating action*.

9) Together with ISO 28927-11, replaces ISO 8662-14, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 14: Stone-working tools and needle scalers*.

10) Together with ISO 28927-9, replaces ISO 8662-14, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 14: Stone-working tools and needle scalers*.

11) Under preparation. Replaces ISO 8662-13, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 13: Die grinders*. It also incorporates the Technical Corrigendum ISO 8662-13:1997/Cor.1:1998.

## Introduction

This document is a type-C standard as stated in ISO 12100.

When requirements of this type-C standard are different from those which are stated in type-A or -B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The vibration test codes for portable hand-held machines given in ISO 28927 (all parts) are based on ISO 20643, which gives general specifications for the measurement of the vibration emission of hand-held and hand-guided machinery. ISO 28927 (all parts) specifies the operation of the machines under type-test conditions and other requirements for the performance of type tests. The structure/numbering of its clauses follows that of ISO 20643.

The basic principle for transducer positioning first introduced in the IEC 60745 series of European standards is followed, representing a deviation from ISO 20643 for reasons of consistency. The transducers are primarily positioned next to the hand in the area between the thumb and the index finger, where they give the least disturbance to the operator gripping the machine.

It has been found that vibrations generated by percussive machines vary considerably in typical use. For percussive machines, the impacting action is the dominating source of vibration and the variation in the result is affected by the quality of the working/inserted tool, the worked material and the skill of the operator.

The values obtained are type-test values intended to be representative of the average of the upper quartile of typical vibration magnitudes in real-world use of the machines. However, the actual magnitudes vary considerably from time to time and depend on many factors, including the operator, the task and the inserted tool or consumable. The state of maintenance of the machine itself might also be of importance. Under real working conditions the influences of the operator and process can be particularly important at low magnitudes. It is therefore not recommended that emission values below  $2,5 \text{ m/s}^2$  be used for estimating the vibration magnitude under real working conditions. In such cases,  $2,5 \text{ m/s}^2$  is the recommended vibration magnitude for estimating the machine vibration.

If accurate values for a specific work place are required, then measurements [according to ISO 5349 (all parts)] in that work situation could be necessary. Vibration values measured in real working conditions can be either higher or lower than the values obtained using this part of ISO 28927.

Higher vibration magnitudes can easily occur in real work situations, caused by the use of excessively worn or bent inserted tools.

The vibration test codes given in ISO 28927 (all parts) supersede those given in ISO 8662 (all parts) , which has been replaced by the corresponding parts of ISO 28927 (see Foreword).

NOTE ISO 8662-11, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 11: Fastener driving tools*, could be replaced by a future part of ISO 28927.

# Hand-held portable power tools — Test methods for evaluation of vibration emission —

## Part 10:

## Percussive drills, hammers and breakers

### 1 Scope

This part of ISO 28927 specifies a laboratory method for measuring hand-transmitted vibration emission at the handles of hand-held power driven percussive machines with and without rotary action [portable rock drills, plug hole drills, rotary hammers, breakers (e.g. pavement breakers, concrete breakers or road breakers), riveting hammers, chipping hammers, pick hammers or similar]. It is a type-test procedure for establishing the magnitude of vibration in the gripping areas of a machine fitted with an inserted tool bit.

This part of ISO 28927 is applicable to hand-held machines (see Clause 5), driven pneumatically or by other means, intended for making holes in hard materials, such as rock and concrete. It is also applicable to breakers intended to work downwards to break hard materials (concrete, rock, pavement, asphalt, etc.) and for hammers intended to work in any direction to perform riveting or chiselling work. It is not applicable to impact drills with direct mechanical impact mechanisms. This part of ISO 28927 is not applicable to jack leg type rock drills and push feed rock drills, which are hand guided (the feed force is not applied by hand, but by an additional device).

It is intended that the results be used to compare different models of the same type of machine.

NOTE To avoid confusion with the terms “power tool” and “inserted tool”, “machine” is used hereinafter for the former.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2787, *Rotary and percussive pneumatic tools — Performance tests*

ISO 5349 (all parts), *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration*

ISO 5391:2003, *Pneumatic tools and machines — Vocabulary*

ISO 17066, *Hydraulic tools — Vocabulary*

ISO 20643:2005, *Mechanical vibration — Hand-held and hand-guided machinery — Principles for evaluation of vibration emission*

EN 12096, *Mechanical vibration — Declaration and verification of vibration emission values*

### 3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 5391, ISO 17066 and ISO 20643, and the following apply.

#### 3.1 Terms and definitions

##### 3.1.1

##### **rock drill**

percussive power rotating machine with flushing for drilling holes in rock, concrete, etc.

NOTE 1 Adapted from ISO 5391:2003, definition 2.3.1.

NOTE 2 Light rock drills have a mass of  $\leq 15$  kg (inserted tool excluded when measured). Rock drills  $> 15$  kg are defined as heavy rock drills.

##### 3.1.2

##### **rotary hammer**

rotary percussive drill with spiral drill bit and without air flushing

[ISO 5391:2003, definition 2.3.2]

##### 3.1.3

##### **breaker**

percussive machine for breaking up concrete, rock, brickwork and asphalt, etc.

NOTE 1 Adapted from ISO 5391:2003, definition 2.2.12.

NOTE 2 This type of machine is generally used in a vertical position and is characterized by a "T-handle" with the body of the machine.

##### 3.1.4

##### **plug hole drill**

rotating percussive machine with spiral or straight drill mainly intended for drilling in concrete, rock, bricks, etc.

NOTE Adapted from ISO 5391:2003, definition 2.3.3.

##### 3.1.5

##### **chipping hammer**

##### **chiselling hammer**

percussive machine for chipping, caulking, trimming or fettling castings, welds, etc., normally using chisels or inserted cutting/shaped tools

NOTE Adapted from ISO 5391:2003, definition 2.2.1.

##### 3.1.6

##### **riveting hammer**

percussive machine for forming rivet heads

NOTE Adapted from ISO 5391:2003, definition 3.4.1.

##### 3.1.7

##### **pick hammer**

percussive machine for light demolition or mine work

NOTE Adapted from ISO 5391:2003, definition 2.2.10.

### 3.2 Symbols

| Symbol              | Description   | Unit    |
|---------------------|---|---------|
| $a_{hw}$            | root-mean-square (r.m.s.) single-axis acceleration value of the frequency-weighted hand-transmitted vibration   | $m/s^2$ |
| $a_{hv}$            | vibration total value of frequency-weighted r.m.s. acceleration; is the root sum of squares of the $a_{hw}$ values for the three measured axes of vibration | $m/s^2$ |
| $\overline{a_{hv}}$ | arithmetic mean value of $a_{hv}$ values of runs for one operator for one hand position   | $m/s^2$ |
| $a_h$               | arithmetic mean value of $\overline{a_{hv}}$ values for all operators for one hand position   | $m/s^2$ |
| $\overline{a_h}$    | arithmetic mean value of $a_h$ values for one hand position on several machines   | $m/s^2$ |
| $a_{hd}$            | declared vibration emission value   | $m/s^2$ |
| $s_{n-1}$           | standard deviation for a test series (for a sample, $s$ )   | $m/s^2$ |
| $\sigma_R$          | standard deviation of reproducibility (for a population, $\sigma$ )   | $m/s^2$ |
| $C_v$               | coefficient of variation for a test series  | —       |
| $K$                 | uncertainty   | $m/s^2$ |

## 4 Basic standards and vibration test codes

This part of ISO 28927 is based on the requirements of ISO 20643 and corresponds to its structure in respect of clause subjects and numbering, except for the annexes.

Annex A presents a model test report, Annex B the means for determining the uncertainty,  $K$ , and Annex C presents the design of a steel ball absorber.

## 5 Description of the family of machines

This part of ISO 28927 applies to hand-held machines for rotary percussive tools intended for making holes in hard materials, such as rock and concrete. It also applies to breakers intended to work downwards to break hard materials (concrete, rock, pavement, asphalt, etc.) and to hammers intended to work in any direction to perform riveting or chiselling work.

Typical examples of breakers, hammers and drills covered by this part of ISO 28927 are shown in Figures 1 to 7.

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