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

Part 12: Die grinders

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

Partie 12: Meuleuses d'outillage

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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 28927-12 was prepared by Technical Committee ISO/TC 188, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 3, *Pneumatic tools and machines*.

This first edition of ISO 28927-12 cancels and replaces ISO 8662-13:1997, which has been technically revised. It also incorporates the Technical Corrigendum ISO 8662-13:1997/Corr.1:1998. The most important changes are

— vibration measurement in three axes and, where applicable, at both hand positions,

— new test method; a real grinding process is introduced, and

— new transducer positions, with an improved definition of the transducer positions and orientation.

ISO 29827 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*[1)]

— *Part 2: Wrenches, nutrunners and screwdrivers*[2)]

— *Part 3: Polishers and rotary, orbital and random orbital sanders*[3)]

— *Part 4: Straight grinders*[4)]

— *Part 5: Drills and impact drills*[5)]

— *Part 6: Rammers*[6)]

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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.*

4) Together with Part 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.*

— *Part 7: Nibblers and shears*[7)]

— *Part 8: Saws, polishing and filing machines with reciprocating action and small saws with oscillating or rotating action*[8)]

— *Part 9: Scaling hammers and needle scalers*[9)]

— *Part 10: Percussive drills, hammers and breakers*[10)]

— *Part 11: Stone hammers*[11)]

— *Part 12: Die grinders*[12)]

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 Part 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) Replaces ISO 8662-2 and its amendments, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 2: Chipping hammers and riveting hammers,* ISO 8662-3 and its amendments, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 3: Rock drills and rotary hammers*, and ISO 8662-5 and its amendments, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 5: Pavement breakers and hammers for construction work*. Chipping and riveting hammers, rock drills and rotary hammers all covered.

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

12) Replaces ISO 8662-13 *Hand-held portable power tools — Measurement of vibrations at the handle — Part 13: Die Grinders*.

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 die grinders vary considerably in typical use. This is largely due to variations in the unbalance of the inserted tool and from the contact between the inserted tool and the surface of the workpiece. The vibration value is also to a large extent dependent on the skill of the operator. This part of ISO 28927 uses a real working process for the test.

In order to provide a method that gives good measurement reproducibility, the procedure is described in detail and it is essential that the procedure be followed. The procedure is chosen to give vibration values which are, as far as possible, in accordance with ISO 20643.The values obtained according to this part of ISO 28927 are type-test values. The procedures of ISO 5349 are required whenever exposure at the workplace is to be assessed.

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 m/s^2 be used for estimating the vibration magnitude under real working conditions. In such cases, 2,5 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) in that work situation can 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 unbalanced inserted tools, bent shafts of burrs or worn-out collets.

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*, can be replaced by a future part of ISO 28927.

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

Part 12: Die grinders

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 portable die grinders. It is a type-test procedure for establishing the magnitude of vibration in the gripping areas of the machines where operating under type test conditions. It is intended that the results be used to compare different models of the same type of machine.

This part of ISO 28927 is applicable to hand-held machines (see Clause 5), driven pneumatically or by other means, equipped with a collet and intended for deburring operations using hard metal burrs or mounted points, on different materials ranging from hard steel to plastics. It is also applicable to low-speed die grinders using flap wheels or cylindrical sleeves.

NOTE 1 It is not applicable to straight grinders equipped with type 1 straight wheels, type 4 tapered wheels or different types of cylindrical plugs. For those machines, ISO 28927-4 is applicable.

NOTE 2 It is not applicable to die grinders used with wire brushes.

NOTE 3 To avoid confusion with the terms “power tool” and “inserted tool”, “machine” is used hereinafter for “power tool”.

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 630 (all parts), *Structural steels*

ISO 2421, *Coated abrasives — Cylindrical sleeves*

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, *Pneumatic tools and machines — Vocabulary*

ISO 15637-1, *Holding fixtures of cylindrical abrasive sleeves — Part 1: Holding fixtures with shank for hand-held grinding machines*

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*

DIN 8033-1, *Hardmetal burrs — Technical requirements*

DIN 8033-2, *Hardmetal burrs — Cylindrical burrs*

3 Terms, definitions and symbols

3.1 General

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

3.2 Terms and definitions

3.2.1
die grinder
machine for deburring and light cleaning operations, the output spindle normally being fitted with a collet, making it suitable for use with mounted points and hardmetal burrs

NOTE 1 A die grinder with a burr may also be called a file.

NOTE 2 Adapted from ISO 5391:2003, definition 2.1.5.

3.2.2
straight die grinder
die grinder having the output spindle coaxial with the motor axis

[ISO 5391:2003, definition 2.1.5.1]

3.2.3
angle die grinder
die grinder where the output spindle is at an angle to the motor axis of the tool

[ISO 5391:2003, definition 2.1.5.2]

3.3 Symbols

For the purposes of this document, the following symbols apply.

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
σ_R	standard deviation of reproducibility (for a population, σ)	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 28297 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 and Annex B the means for determining the uncertainty, K.

5 Description of the family of machines

This part of ISO 28927 is applicable to hand-held machines, driven pneumatically or by other means, equipped with a collet and intended for deburring operations using hard metal burrs or mounted points, on different materials ranging from hard steel to plastics. It is also applicable to low-speed die grinders using flap wheels or cylindrical sleeves.

Figures 1 to 4 show examples of typical grinders covered by this part of ISO 28927.

Figure 1 — Straight die grinder — Short version

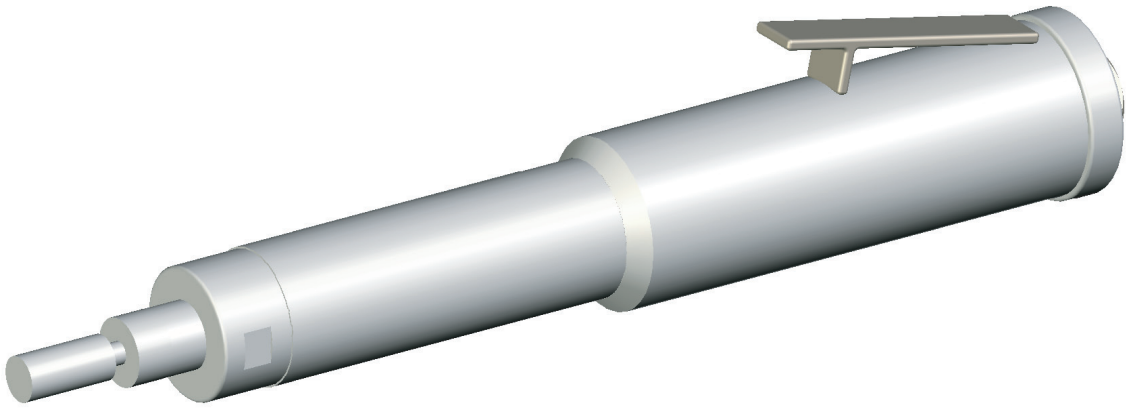


Figure 2 — Straight die grinder — Long version

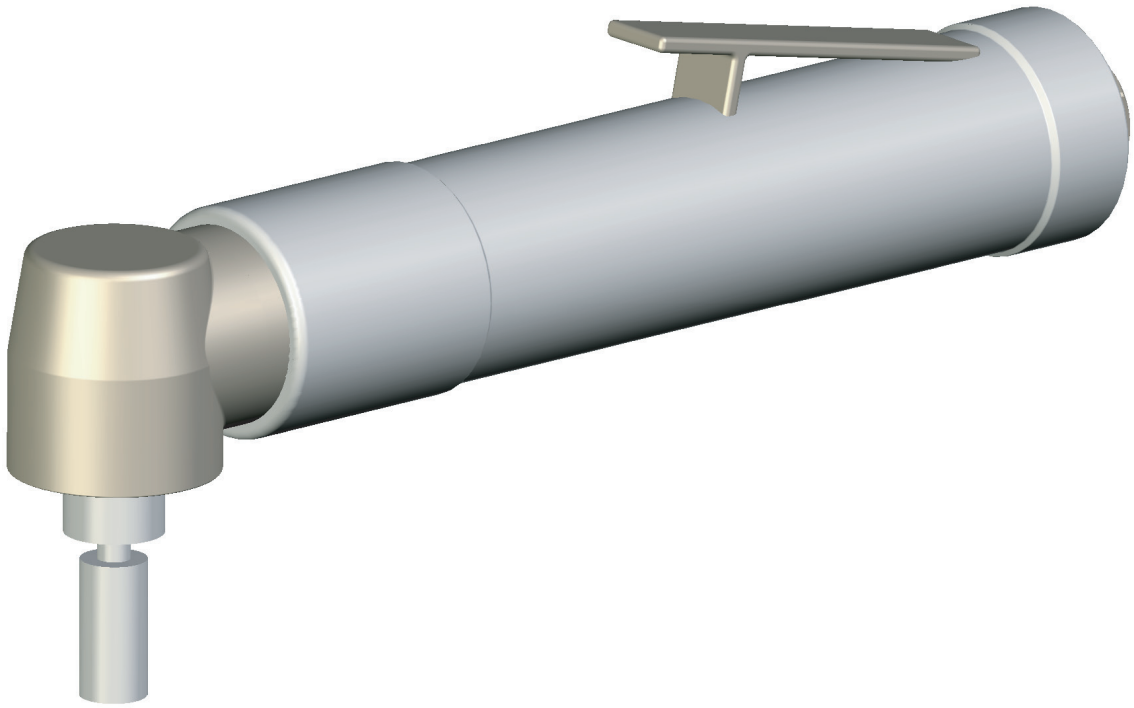


Figure 3 — Angle die grinder

Figure 4 — Pencil die grinder

6 Characterization of vibration

6.1 Direction of measurement

The vibration transmitted to the hand shall be measured and reported for three directions of an orthogonal coordinate system. At each hand position, the vibration shall be measured simultaneously in the three directions shown in Figures 5 to 8.

6.2 Location of measurements

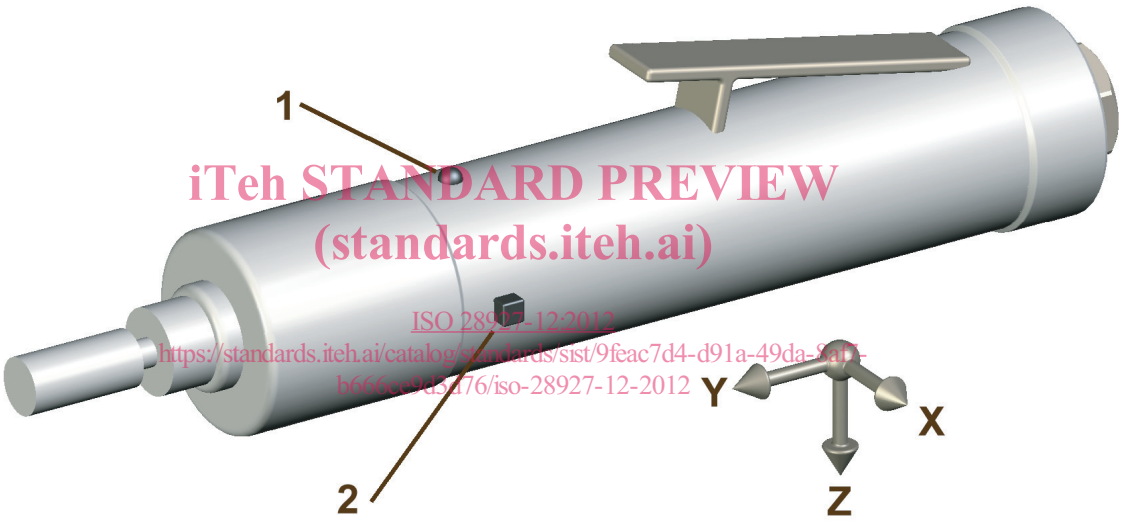
Measurement shall be carried out at the gripping zones, where the operator normally holds the machine and applies the feed force. For machines intended for one-hand operation, it is necessary to measure at only a single point.

The prescribed transducer location shall be as close as possible to the hand between the thumb and index finger. This shall apply to both hand positions, with the machine held as in normal operation. Whenever possible, measurements shall be made at the prescribed locations.

A secondary location is defined as being on the side of, and as close as possible to, the inner end of the handle where the prescribed location is found. If the prescribed location of the transducer cannot be used, this secondary location shall be used instead.

The prescribed or secondary locations on the support handle shall also be used on anti-vibration handles.

Figures 5 to 8 show the prescribed and secondary locations and measurement directions for the hand positions normally used for the different types of machines in this family.



Key

1 prescribed location
2 secondary location

Figure 5 — Measurements locations — Straight die grinder — Short version