
**Hand-held non-electric power tools —
Safety requirements —**

**Part 9:
Die grinders**

*Machines portatives à moteur non électrique — Exigences de
sécurité —*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 11148-9 was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 3, *Pneumatic tools and machines*.

ISO 11148 consists of the following parts, under the general title *Hand-held non-electric power tools — Safety requirements*:

— *Part 1: Assembly power tools for non-threaded mechanical fasteners*

— *Part 2: Cutting-off and crimping power tools*

— *Part 3: Drills and tappers*

— *Part 4: Non-rotary percussive power tools*

— *Part 5: Rotary percussive drills*

— *Part 6: Assembly power tools for threaded fasteners*

— *Part 7: Grinders*

— *Part 8: Sanders and polishers*

— *Part 9: Die grinders*

— *Part 10: Compression power tools*

— *Part 11: Nibblers and shears*

— *Part 12: Circular, oscillating and reciprocating saws*

A part 13, dealing with fastener driving tools, is under preparation.

Introduction

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

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are defined in the Scope of this part of ISO 11148.

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 other standards, for machines that have been designed and built according to the requirements of this type-C standard.

ISO 11148 consists of a number of independent parts for individual types of hand-held non-electric power tools.

Certain parts of ISO 11148 cover hand-held non-electric power tools driven by internal combustion engines powered by gaseous or liquid fuel. In these parts, the safety aspects relating to internal combustion engines are found in a normative annex.

The parts are type-C standards and refer to pertinent standards of type A and B where such standards are applicable.

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Hand-held non-electric power tools — Safety requirements —

Part 9: Die grinders

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1 Scope

This part of ISO 11148 specifies safety requirements for hand-held non-electric power tools fitted with collets (hereinafter “die grinders”) intended for grinding and surface finishing and chamfering using mounted points, burrs and files and small wire brushes and other accessories mounted on shanks. The die grinders can be powered by compressed air, hydraulic fluid or internal combustion engines and are intended to be used by one operator and supported by the operator's hand or hands, with or without a suspension, e.g. a balancer.

NOTE 1 At the time of publication, no die grinders driven by internal combustion engines are known. Once these are identified, it is intended to amend this part of ISO 11148 to include such power tools.

This part of ISO 11148 is applicable to:
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- angle die grinders;
- reciprocating files;
- rotary files;
- straight die grinders.

NOTE 2 For examples of die grinders, see Annex B.

NOTE 3 Grinders without collets, for use with cones and plugs with threaded inserts, are covered by ISO 11148-7.

This part of ISO 11148 deals with all significant hazards, hazardous situations or hazardous events relevant to die grinders when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer, with the exception of the use of die grinders in potentially explosive atmospheres.

NOTE 4 EN 13463-1 gives requirements for non-electrical equipment for potentially explosive atmospheres.

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 3857-3, *Compressors, pneumatic tools and machines — Vocabulary — Part 3: Pneumatic tools and machines*

ISO 5391, *Pneumatic tools and machines — Vocabulary*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13732-3, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 3: Cold surfaces*

ISO 15744, *Hand-held non-electric power tools — Noise measurement code — Engineering method (grade 2)*

ISO 17066, *Hydraulic tools — Vocabulary*

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

ISO 28927-12, *Hand-held portable power tools — Test methods for evaluation of vibration emission — Part 12: Die grinders*

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

3 Terms and definitions

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For the purposes of this document, the terms and definitions given in ISO 3857-3, ISO 5391, ISO 12100 and ISO 17066 (for hydraulic tools) and the following apply.

3.1 General terms and definitions

3.1.1

hand-held power tool

machine operated by one or two hands and driven by rotary or linear motors powered by compressed air, hydraulic fluid, gaseous or liquid fuel, electricity or stored energy (e.g. by a spring) to do mechanical work and so designed that the motor and the mechanism form an assembly that can easily be brought to its place of operation

NOTE Hand-held power tools driven by compressed air or gas are called pneumatic tools (or air tools). Hand-held power tools driven by hydraulic liquid are called hydraulic tools.

3.1.2

inserted tool

tool inserted in the die grinder to perform the intended work

3.1.3

service tool

tool for performing maintenance or service on the die grinder

3.1.4

control device

device to start and stop the die grinder or to change the direction of the rotation or to control the functional characteristics, such as speed and power

3.1.5**start-and-stop device
throttle**

manually operated control on the die grinder by which the energy supply to the motor can be turned on and off

3.1.6**hold-to-run start-and-stop device
constant pressure throttle**

start-and-stop device that automatically returns to the OFF position when force on the start-and-stop device actuator is released

3.1.7**lock-on start-and-stop device
constant pressure throttle with instant release lock**

hold-to-run start-and-stop device that can be locked in the ON position and which is designed so that it permits the die grinder to be turned off by a single motion of the same finger or fingers used to turn it on

3.1.8**lock-off start-and-stop device
lock-off throttle**

start-and-stop device that automatically latches in the OFF position when the actuator is released and where two motions are required to energize the die grinder

3.1.9**positive on-off start-and-stop device
positive on-off throttle**

start-and-stop device that remains in the ON position until it is manually changed

3.1.10**maximum operating pressure**

maximum pressure at which a die grinder may be operated

3.1.11**whip hose**

air hose connecting the main air hose with an air tool for the purpose of providing more flexibility

3.1.12**rated air pressure**

air pressure, required at an air tool inlet port to ensure rated performance of the tool, also considered the maximum pressure at which the tool may be operated

3.1.13 Rated speed**3.1.13.1****rated speed**

⟨pneumatic tool⟩ speed of an air tool at no load and rated air pressure at the tool inlet port

NOTE The rated speed is expressed in revolutions per minute.

3.1.13.2**rated speed**

⟨hydraulic tool⟩ nominal speed of a hydraulic tool at no load and rated flow at the tool inlet port

NOTE 1 The rated speed is expressed in revolutions per minute.

NOTE 2 Also considered the maximum speed at which an abrasive tool, such as a die grinder, shall be operated.

3.1.14

maximum attainable speed

maximum speed which the tool can achieve under the most adverse condition of possible maladjustment or malfunction of its speed control devices, when supplied with compressed air at the pressure marked on the die grinder or when supplied with hydraulic fluid at the maximum flow rate marked on the die grinder

3.1.15

suspension device

device, which is attached to the tool, whose primary purpose is to reduce the strain on the operator caused by the weight of the tool

NOTE The device can also have a secondary purpose of transmitting a reaction torque.

3.2 Terms and definitions related to die grinders

3.2.1

die grinder
rotary file

rotary power tool intended for chamfering, deburring and light cleaning operations and fitted with inserted tools mounted in collet chucks

NOTE A die grinder with a burr is often called a rotary file.

3.2.2

reciprocating file

power tool with a rotary or reciprocating motor driving a file in a reciprocating motion

3.2.3

collet chuck

device for attaching the inserted tool by clamping the shank

3.2.4

machine spindle

rotating part of a die grinder, driving the collet chuck and consequently the inserted tool

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4 Safety requirements and/or protective measures

4.1 General

The machine shall comply with the following safety requirements and/or protective measures and be verified in accordance with Clause 5. In addition, the machine shall be designed in accordance with the principles of ISO 12100 for relevant, but not necessarily significant, hazards which are not dealt with by this part of ISO 11148.

The measures adopted to comply with the requirements of Clause 4 shall take account of the state-of-the-art.

It is recognized that optimizing the design with respect to some safety measures can result in a degradation of performance against other safety requirements. In such cases, it is required to strike a balance between the various requirements in order to achieve a die grinder design that satisfies each requirement, so far as is reasonably practicable, and remains fit for purpose.

4.2 Mechanical safety

4.2.1 Surfaces, edges and corners

Accessible parts of die grinders, except the inserted tool, shall not have sharp edges or angles or rough or abrasive surfaces; see ISO 12100:2010, 6.2.2.1.

4.2.2 Supporting surface and stability

Die grinders shall be so designed that they can be laid aside and remain in a stable position on a plane surface.

4.2.3 Run-down time

The run-down time, after the stop command has been given, shall be as short as possible.

4.2.4 Hydraulic fluid ejection

Hydraulic systems of the die grinder shall be enclosed so as to provide protection from high-pressure fluid ejection.

4.2.5 Speed control

The rated speed of the die grinder shall not be exceeded under the conditions marked on the die grinder. It shall be possible to measure rotational speed using a tachometer.

The speed control device of a die grinder shall be so designed as to prevent incorrect assembly. The speed control device shall be manufactured using non-corrodible material.

4.2.6 Guards

Guards covering the inserted tool are not required, with the following exception: die grinders intended for use with accessories larger than 50 mm in diameter shall have a wheel guard.

4.2.7 Power tool construction

The die grinder shall be so designed and constructed as to prevent the loosening or loss of components during expected use, including rough handling and occasional dropping, which can compromise its safety functions. Verification shall be carried out in accordance with 5.5.

4.3 Thermal safety

Surface temperatures of parts of the die grinder which are held during use or which can be inadvertently touched shall follow the provisions of ISO 13732-1 and ISO 13732-3.

Pneumatic tools shall be designed to minimize the cooling effects of exhaust air on the handles and other gripping zones.

4.4 Noise reduction

The die grinder shall be designed and constructed so that the emission of noise is reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source. Principles for designing die grinders with reduced noise emission are contained in ISO/TR 11688-1 and ISO/TR 11688-2.

The noise emission from using die grinders has three main sources:

- the die grinder itself;
- the inserted tool;
- the workpiece.

NOTE Generally, the noise emitted due to the characteristics of the workpiece cannot be controlled directly by the manufacturer of the die grinder.

Typical sources of noise emitted by the die grinder itself are

- a) the motor and drive mechanism,
- b) the exhaust air or gases, and
- c) vibration or impact-induced noise.

Where the exhaust air or gases are the major contributor to the noise, means to reduce the noise, for example a silencer or equivalent means, shall be included in the design.

Alternatively, where practicable, the exhaust air or gases may be piped away from the operator in a hose.

Vibration-induced noise can often be reduced by vibration isolation and damping.

This list is not exhaustive; where alternative technical measures for noise reduction, with greater efficiency, are available, they should be used by the manufacturer.

4.5 Vibration

The die grinder shall be designed and constructed so that the vibration is reduced to the lowest level at the handles and at any other parts of the tool in contact with the operator's hands, taking account of technical progress and the availability of means of reducing vibration, in particular at source. Principles for designing die grinders with reduced vibration emission are contained in CR 1030-1.

Typical sources of vibration emitted by a die grinder are

- imbalance of rotating parts,
- poorly designed motors and gears, and
- resonances in the structure of the machine, particularly the handles and their mounts.

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The following design features have been found to be effective and should be considered by manufacturers when designing die grinders:

- a) autobalancers;
- b) increasing inertia;
- c) isolated casing or handles.

This list is not exhaustive; where alternative technical measures for vibration reduction, with greater efficiency, are available, they should be used by the manufacturer.

4.6 Materials and substances processed, used or exhausted

4.6.1 Exhaust air or gas

Pneumatic die grinders driven with compressed air or gas shall be designed in such a way that exhaust air or gases are directed so as not to cause a hazard to the operator and so that any other effects, such as blowing dust and reflected air or gas from the workpiece on to the operator, are minimized.

4.6.2 Dust and fumes

So far as is reasonably practicable, the die grinder shall be designed to facilitate the collection and removal or suppression of airborne dust particles and fumes generated by the work process. The instruction handbook shall include sufficient information to enable adequate control of the risks from dust and fumes.