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Building construction machinery and equipment — Portable, hand-held, internal combustion engine-driven abrasive cutting machines —

Part 1: Safety requirements for cut-off machines for centre-mounted rotating abrasive wheels

Machines et matériels pour la construction des bâtiments — Machines de coupe par abrasion, portatives, à moteur à combustion interne — Partie 1: Exigences de sécurité des tronçonneuses à disque abrasif monté au centre

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 151, *Construction equipment and building material machines - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 19432-1 cancels and replaces ISO 19432:2012, which has been technically revised.

The main changes compared to the previous edition are as follows:

— update of normative references;

— update/revision of terms and definitions;

— revision of handle requirements;

— update of figures;

— revision of requirements for fuel tanks, oil tanks and fuel lines;

— revision of Clause 5, information for use;

— revision of requirements for labels.

A list of all parts in the ISO 19432 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

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

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

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.

Building construction machinery and equipment — Portable, hand-held, internal combustion engine-driven abrasive cutting machines —

Part 1: Safety requirements for cut-off machines for centre-mounted rotating abrasive wheels

1 Scope

This document specifies safety requirements and measures for their verification for the design and construction of portable, hand-held, internal combustion engine-driven cut-off machines intended to be used by a single operator in the cutting of construction materials, such as asphalt, concrete, stone and metal. It is applicable only to those machines designed purposely for use with a rotating, bonded-abrasive and/or super-abrasive (for example diamond) cut-off wheel having a maximum outer diameter of 430 mm, centre-mounted on and driven by a spindle shaft where the top of the wheel rotates away from the operator (see Figure 1).

This document deals with all significant hazards, hazardous situations or hazardous events significant to these machines when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer. See Annex F for a list of significant hazards.

This document specifies methods for the elimination or reduction of hazards arising from their use, as well as the type of information on safe working practices to be provided with the machines.

Cut-off wheel specifications are not considered in this document. Cut-off wheels are deemed to comply to existing cut-off wheel standards.

NOTE For example see Bibliography.

All through the document, portable, hand-held, internal combustion engine-driven cut-off machines are called “cut-off machines”.

This document is not applicable to machines manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 5349-2:2001, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 2: Practical guidance for measurement at the workplace*

ISO 7293:1997, *Forestry machinery — Portable chain saws — Engine performance and fuel consumption*

ISO 8041-1:2017, *Human response to vibration — Measuring instrumentation — Part 1: General purpose vibration meters*

ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

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

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14982:1998, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

ISO 16063-1:1998, *Methods for the calibration of vibration and shock transducers — Part 1: Basic concepts*

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

IEC 60745-1:2006, *Hand-held motor-operated electric tools — Safety — Part 1: General requirements*

IEC 61672-1:2013, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 20643 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp;

— IEC Electropedia: available at http://www.electropedia.org/.

3.1
cut-off wheel
wheel designed to be fitted to a hand-held portable cut-off machine and whose peripheral edge cuts material such as asphalt, concrete, stone and metal

3.1.1
bonded-abrasive wheel
cut-off wheel (3.1) entirely made of abrasive particles bonded together with synthetic resin and reinforced with glass fibre matting

3.1.2
superabrasive wheel
cut-off wheel (3.1) with diamond grains set into segments secured around the circumference of a steel core disc (the wheel body)

3.2
arbor hole
centre hole of the *cut-off wheel* (3.1) used for mounting the cut-off wheel on the machine *spindle* (3.19)

3.3
blotter
washer made from compressible material (e.g. paper, card or similar), attached to each side of the *cut-off wheel* (3.1)

Note 1 to entry: The function of the blotter is to smooth imperfections in the cut-off wheel and to allow a limited degree of slip when the wheel stalls in use.

3.4
clutch
device for connecting and disconnecting the driven member to and from a rotating source of power

3.5
cut-off wheel guard
partial enclosure intended to deflect cutting debris as well as pieces of the *cut-off wheel* (3.1) in the event that the wheel is broken in operation and to reduce the risk of unintentional contact with the cut-off wheel

3.6
engine-stopping device
device by which the stopping of the engine is initiated

3.7
flange contact surface
area between the inner and outer circumference on the flange which forms the contact surface between the flange and the *cut-off wheel* (3.1)

3.8
flange assembly
device provided to clamp and drive the *cut-off wheel* (3.1)

3.9
handle
device designed to facilitate safe and easy control of the machine

3.9.1
front handle
handle (3.9) located at or towards the front of the engine housing

3.9.2
rear handle
handle (3.9) located at or towards the rear of the engine housing

3.10
idle speed
speed at which the engine runs with no load and *throttle trigger* (3.21) released and the *cut-off wheel* (3.1) does not rotate

3.11
reactive force
force generated in a direction opposite to that in which the wheel is moving at the point of contact when the spinning *cut-off wheel* (3.1) is slowed or stopped by frictional contact with any solid object, including the workpiece, or when it is pinched or bound in the cut

Note 1 to entry: 3.11.1, 3.11.2, and 3.11.3, which further describe these reactions, are based on an abrasive cut-off wheel rotation with the top of the wheel rotating away from the operator.

3.11.1
rotational force
kickback
attempt of the wheel to move back and up towards the operator when the spinning *cut-off wheel* (3.1) is slowed or stopped by frictional contact with any solid object in its upper quadrant, so that if it is abruptly slowed or stopped by a pinch or binding in the upper quadrant, the wheel can be thrown back and up towards the operator in a rotational kickback motion

3.11.2
climbing
attempt of the wheel to climb the object being cut when the spinning *cut-off wheel* (3.1) is slowed or stopped by frictional contact with any solid object or by a pinch or binding at the front of the wheel

3.11.3
pulling
pull-away
attempt of the wheel to pull away from the operator when the spinning *cut-off wheel* (3.1) is slowed or stopped by frictional contact with any solid object or by a pinch or binding at the bottom of the wheel

3.12
gyroscopic force
force caused by the rapid spinning of the *cut-off wheel* (3.1) that results in opposition to a directional change of the cut-off machine

3.13
reducing bushing
insert or device used to reduce the hole size in a grinding wheel so that it can be mounted on a smaller diameter *spindle* (3.19)

3.14
maximum depth of cut
t
distance to which *the cut-off wheel* (3.1) can enter the workpiece as measured from the outer diameter of the wheel to the outside diameter of the flange

3.15
maximum cut-off wheel speed
maximum permitted speed of a new *cut-off wheel* (3.1) marked on the cut-off wheel

3.16
maximum spindle speed
maximum speed at which the *spindle* (3.19) rotates with a fully open throttle and no load

3.17
muffler
device for reducing engine exhaust noise and directing the exhaust gases

3.18
rated engine speed
rated speed
engine speed at which maximum power occurs as determined by the manufacturer

3.19
spindle
shaft of the cut-off machine which supports, retains and drives the *cut-off wheel* (3.1) in connection with the flanges

3.20
spindle sleeve
device used to increase the *spindle* (3.19) shaft diameter at the contact area of the abrasive wheel for mounting an abrasive wheel with a larger diameter *arbor hole* (3.2)

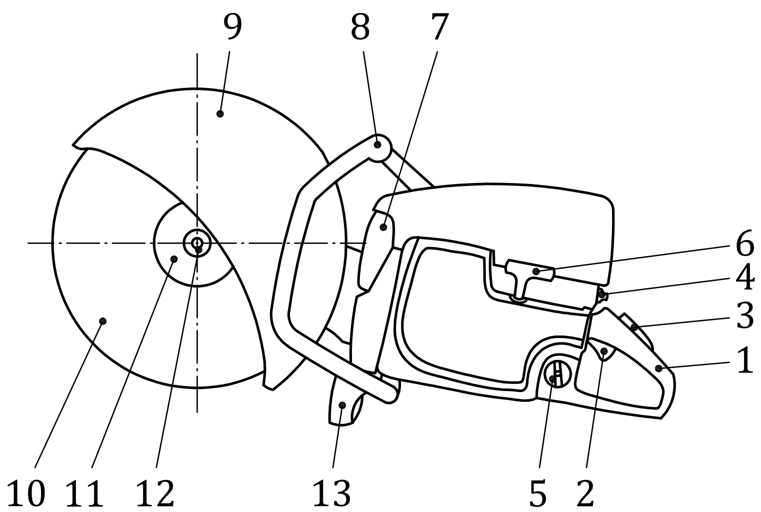
3.21
throttle trigger
device for controlling the engine speed

3.22
throttle lock
device for setting the throttle in a partially open position to aid starting

3.23
throttle trigger lock-out
device that prevents the unintentional operation of the *throttle trigger* (3.21) until manually released

3.24
throttle control linkage
mechanism which transmits motion from the *throttle trigger* (3.21) to the throttle control valve

3.25
transmission cover
device between the engine and the cutting equipment designed to prevent unintentional contact with the transmission



Key

1 *rear handle* (3.9.2)
2 throttle trigger (3.21)
3 throttle trigger lock-out (3.23)
4 engine stopping device
5 fuel tank/fuel tank cap
6 starter
7 *muffler* (3.17)
8 *front handle* (3.9.1)
9 *cut-off wheel guard* (3.5)
10 *cut-off wheel* (3.1)
11 *flange assembly* (3.8)
12 spindle
13 foot/standing base

Figure 1 — Example of a cut-off machine

4 Safety requirements and verification

4.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of ISO 12100 for relevant but not significant hazards which are not dealt with by this document.

The safe operation of cut-off machines depends on both complying with the safety requirements of this clause and using safe working practices. The use of appropriate personal protection equipment (PPE), such as gloves, leg protection, boots, eye, hearing, dust protection mask and head protection equipment, are an integral part of safe working practices (see 5.1).

Cut-off machines shall be marked in accordance with 5.2. Cut-off machines shall carry warnings in accordance with 5.3.

An instruction handbook shall be provided with the machine and shall comply with the requirements of 5.1.

For protection from contact with moving parts, except the cut-off wheel, any opening shall have a safety distance to the moving part that meets the requirements of ISO 13857:2008, 4.2.4.1 and 4.2.4.3.

When the machine is placed in its normal resting position (see Figure 2) on a flat horizontal surface, the cut-off wheel or the guard shall not touch the horizontal surface and the machine shall remain stable.

The requirements for the normal resting position shall be verified by inspection.

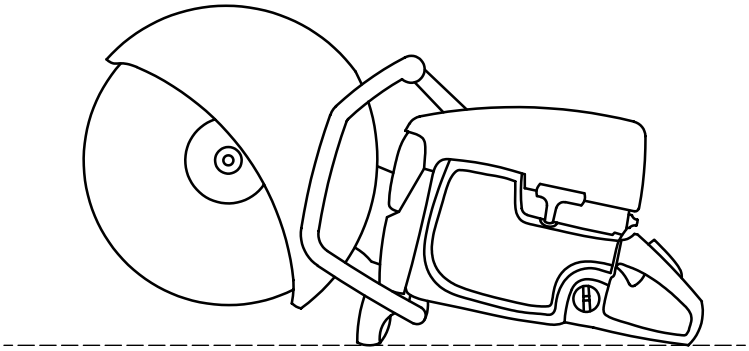


Figure 2 — Example of cut-off machine placed in a normal position on a flat surface

A method of verification is established for each requirement in the following clauses.

WARNING — Some of the tests specified in this document involve processes that could lead to a hazardous situation. Any person performing tests in accordance with this document should be appropriately trained in the type of work to be carried out. All national regulatory conditions and health and safety requirements shall be taken into consideration.

4.2 Handles

4.2.1 Requirements

Cut-off machines shall have a handle for each hand. These handles shall be designed so that they

— can be fully gripped by an operator when wearing protective gloves;

— provide the necessary sureness of grip by their shape and surface; and

— conform to the dimensions and clearances according to Table 1.

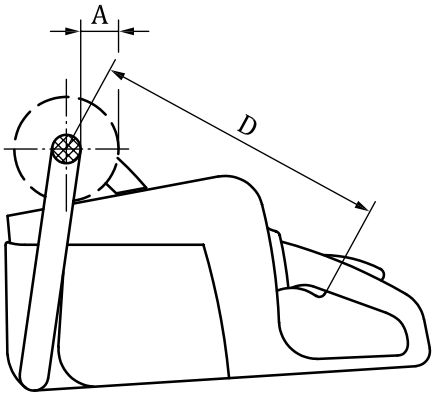
Cut-off machines with a system to isolate the machine vibration from the handles shall be designed so that the operator is able to stop the engine in a controlled manner with the engine-stopping device, even in the event of partial or full failure of the vibration isolators.

Table 1 — Handle requirements

Handles	Description	Dimension	Figure	Minimum size
Front	Finger clearance in the grip area	A	3	35 mm
Front and rear	Perimeter of the cross-section of the handle	H	4	65 mm
	Distance from the rear side of the throttle trigger to the centre of the front handle at the top	D	3	225 mm
Rear[a]	Finger clearance at the released throttle trigger	E	5	30 mm
	Clearance below the released throttle trigger	F	6	25 mm
	Clearance behind the released throttle trigger	G	7	25 mm × 3[b]

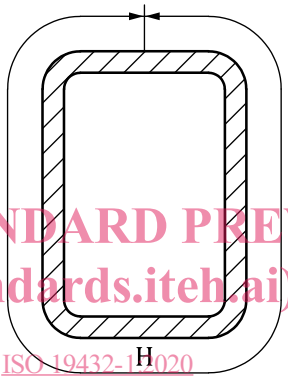
[a] The dimensions shall be gauged free of play, i.e. with a slight initial pressure on the throttle trigger.

[b] 3 represents the number of circles.



NOTE Refer to Table 1 for the A and D dimensions.

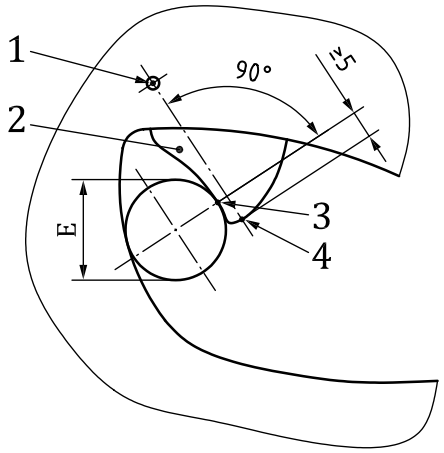
Figure 3 — Clearance and distance between front and rear handles for rear handle machines



NOTE Refer to Table 1 for the H dimension.

Figure 4 — Perimeter of handles cross section

Dimensions in millimetres



Key

1	pivot point	3	contact point
2	throttle trigger	4	intersection point

NOTE Refer to Table 1 for the E dimension.

Figure 5 — Finger clearance at released throttle trigger

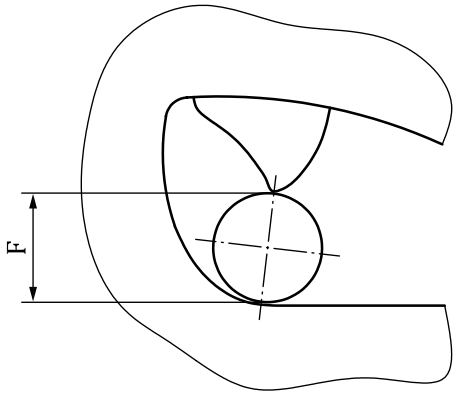
The conformity of the E dimension shall be verified as follows:

— step 1: put gauge E to the uppermost position between housing and throttle trigger;

— step 2: define contact point with throttle trigger;

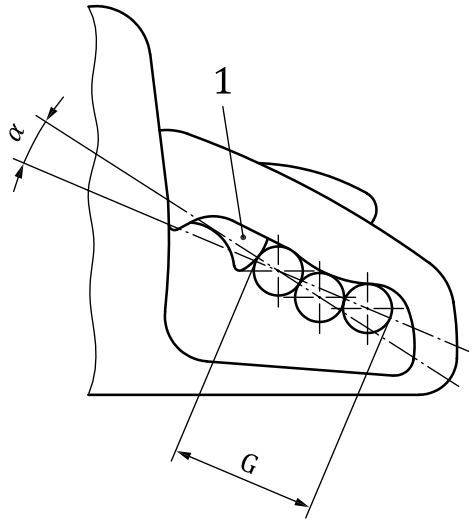
— step 3: connect a line between the centre of the gauge and the contact point and extend into the direction of the throttle trigger;

— step 4: add a perpendicular line to this line which intersects the pivot point of the throttle trigger.



NOTE Refer to Table 1 for the F dimension.

Figure 6 — Finger clearance below the released throttle trigger



Key

1 throttle trigger

α = ±15°

NOTE 1 Angle α shows the maximum allowed deviation of the lower outline of the handle grip.

NOTE 2 Refer to Table 1 for the G dimension.

Figure 7 — Finger clearance at released throttle trigger

4.2.2 Verification

Dimensions shall be verified by measurements. The ability to control the machine if a failure occurs in the vibration isolators shall be verified by inspection of the design and function test with a simulated failure.

4.3 Spindle speed

4.3.1 Requirement

Engine speed shall be limited so that it is not possible to accelerate the engine beyond the specified maximum spindle speed (see 5.1).

4.3.2 Verification

The spindle speed shall be measured at the spindle with fully open throttle and no load. The maximum allowed inaccuracy is 5 r/min.

Simple calculations using the engine speed and the transmission ratio cannot be permitted due to the potential for slippage in the energy transmission from the engine to the shaft.

4.4 Engine-starting device

4.4.1 Requirements

The engine-starting device shall be an electric starter or a manual starter. The actuator for the manual starter shall be permanently attached to the machine.

The cut-off machine with a manual starter shall have a recoil device for the rope.