INTERNATIONAL STANDARD

**ISO 19432**

Second edition
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# Building construction machinery and equipment — Portable, hand-held, internal combustion engine driven cut-off machines — Safety requirements

*Machines et matériels pour la construction des bâtiments — Tronçonneuses à disque, portatives, à moteur à combustion interne — Exigences de sécurité*



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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 19432 was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*.



This second edition cancels and replaces the first edition (ISO 19432:2006), which has been technically revised, primarily concerning:



- additional requirement for starting device (4.4);
- throttle trigger (4.6);
- unintentional movement (4.6.2);
- throttle lock (4.6.3);
- additional requirements for tank strength (4.10);
- additional requirements for transmission cover (4.12);
- clarification of the parts to be recognized as hot parts, including temperature limits (4.13.1);
- additional requirement for electromagnetic immunity;
- added requirement for declaration of uncertainties to noise and vibration values (5.1.1, B.8 and C.10);
- modifications in required markings (5.2) and warnings (5.3) including durability requirements for labels;
- modified calculation of values for equivalent sound power, sound pressure and hand vibration (Annexes B and C);
- stricter specification for accelerometer mounting (C.4.3) and position (C.5);
- inclusion of a simulated feeding force to the vibration test procedure (C.8);
- definition of machine positions (Annex D);
- additional information on reproducibility for noise and vibration measurements (Annex E);
- a new informative Annex F covering a list of significant hazards.

## Introduction

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

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

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 cut-off machines — Safety requirements

## 1 Scope

This International Standard 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 (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 International Standard 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 International Standard 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 International Standard; for such specifications, see, for example, ISO 603-7[1], ISO 13942[12] and ISO 22917[15].



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

## 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 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, *Forestry machinery — Portable chain-saws — Engine performance and fuel consumption*

ISO 7914:2002, *Forestry machinery — Portable chain-saws — Minimum handle clearance and sizes*

ISO 8041, *Human response to vibration — Measuring instrumentation*

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/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

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, *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 61672-1:2002, *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 and the following apply.



**3.1**
**cut-off wheel**
wheel composed of abrasive particles bonded together by an appropriate binder and incorporating, if necessary, some appropriate form of reinforcement, or made of metal or other materials of similar properties and having diamond, CBN particles or other suitable abrasive particles bonded to its rim

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

**3.3**
**blotter**
washers made from some compressible material (e.g. paper, card or similar), attached to each side of the cut-off wheel, the function of which is to smooth imperfections in the cut-off wheel and allow a limited degree of slip when the wheel stalls in use

**3.4**
**choke**
device for enriching the fuel air mixture in the carburettor, to aid starting

**3.5**
**clutch**
device for connecting and disconnecting the driven member to and from a rotating source of power

**3.6**
**cut-off wheel guard**
partial enclosure intended to deflect cutting debris, as well as pieces of the cut-off wheel in the event that the wheel is broken in operation

**3.7**
**engine-stopping device**
device by which the stopping of the engine is initiated

**3.8**
**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

**3.9**
**flange assembly**
device provided to clamp and drive the cut-off wheel

**3.10**
**handle**
device designed to facilitate safe and easy control of the machine

**3.10.1**
**front handle**
handle located at or towards the front of the engine housing

**3.10.2**
**rear handle**
handle located at or towards the rear of the engine housing



**3.11**
**idle speed**
speed at which the engine runs with no load and throttle trigger released and the cut-off wheel does not rotate



**3.12**
**reactive movement**
sudden and unexpected motion of the machine, which can occur when the rotating cut-off wheel contacts a foreign object during cutting or because of pinching

**3.13**
**maximum depth of cut**
*t*
distance to which the cut-off wheel can enter the work-piece, as measured from the outer diameter of the wheel to the outside diameter of the flange

**3.14**
**maximum cut-off wheel speed**
maximum permitted speed of a new cut-off wheel marked on the cut-off wheel

**3.15**
**maximum spindle speed**
maximum speed at which the spindle rotates with a fully open throttle and no load

**3.16**
**muffler**
device for reducing engine exhaust noise and directing the exhaust gases

**3.17**
**rated speed**
engine speed at which maximum power occurs

**3.18**
**spindle**
shaft of the cut-off machine, which supports, retains and drives the cut-off wheel in connection with the flanges

**3.19**
**throttle trigger**
device for controlling the engine speed

**3.20**
**throttle lock**
device for setting the throttle in a partially open position, to aid starting

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

**3.22**
**throttle control linkage**
mechanism which transmits motion from the throttle trigger to the throttle control valve

**3.23**
**transmission cover**
device between the engine and the cutting equipment designed to prevent unintentional contact with the transmission

## 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 International Standard.



The safe running of cut-off machines depends on both the safety requirements according to this clause and the safe working conditions associated with the use of adequate personal protection equipment (PPE), such as gloves, leg protection, boots, eye, hearing and head protection equipment, and safe working procedures (see 5.1).

Cut-off machines shall also be marked according to 5.2 and carry warnings according to 5.3.

The instruction handbook to be provided with the machines shall comply with 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 1) on a flat horizontal surface, the cut-off wheel or the guard shall not touch the horizontal plane and the machine shall remain stable.

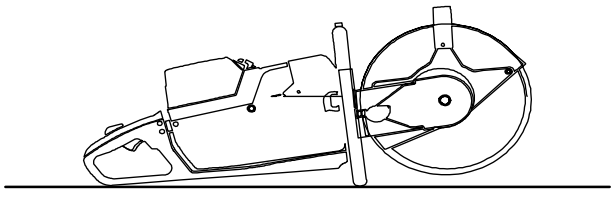


**Figure 1 — Example of cut-off machine placed in a normal position on a flat surface**

A method of verification is established for each requirement.

**SAFETY PRECAUTIONS — Some of the tests specified in this International Standard involve processes that could lead to a hazardous situation. Any person performing tests in accordance with this International Standard should be appropriately trained in the type of work to be carried out. All national regulatory conditions and health and safety requirements must be followed.**

## 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 shaping and surface, and

— conform to the dimensions and clearances, except distances *B* and *C*, given in ISO 7914:2002, Table 1, for tree work service.

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.

### 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.



## 4.3 Spindle speed



### 4.3.1 Requirement

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

### 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.

NOTE 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.

To activate the electrical starting device, two or more separate and dissimilar actions shall be required. This also applies to manual starting devices with stored energy.

#### 4.4.2 Verification

The means to start the cut-off machine shall be verified by inspection and a functional test.

### 4.5 Engine-stopping device

#### 4.5.1 Requirements

The machine shall be fitted with an engine-stopping device by which the engine can be brought to a final stop and which does not depend on sustained manual effort for its operation. The control for this device shall be so positioned that it can be operated by the operator's hand while holding the rear handle and wearing protective gloves.

The colour of the control shall contrast clearly with the background of the engine-stopping device.

#### 4.5.2 Verification

The function of the engine-stopping device shall be verified by inspection while the machine is being operated. The control location and colour shall be verified by inspection.

### 4.6 Throttle control system

#### 4.6.1 Dimensions



##### 4.6.1.1 Requirements

The throttle trigger shall be positioned so that it can be pressed and released with a gloved hand while holding the rear handle by fulfilling the dimensional requirements for clearance around and behind the throttle trigger, as shown in ISO 7914:2002, Figures 3 and 4.



##### 4.6.1.2 Verification

The dimensions shall be verified by measurement.

#### 4.6.2 Operation

##### 4.6.2.1 Requirements

The cut-off machine shall be provided with a throttle trigger that, when released, automatically reverts to the idling position unless a throttle lock to aid starting is engaged (see 4.6.3). The throttle trigger shall be retained in the idling position by the automatic engagement of a throttle trigger lock-out.

After the starting procedure has finished, activation of the throttle trigger, to increase the engine speed to a point where the cut-off wheel starts to move, shall only be possible after the throttle trigger lock-out has been disengaged.

The starting procedure is finished when the operator disengages the throttle lock and the engine returns to idling speed.

Unintentional movement of the cut-off wheel shall be minimized by a throttle control linkage, so designed that a force applied to the rear handle with the throttle trigger lock-out engaged will not increase the engine speed to a point where the clutch engages and cut-off wheel movement begins.

#### 4.6.2.2 Verification

The function of the throttle trigger and throttle trigger lock-out shall be verified by inspection while operating the machine. The throttle control linkage design shall be verified by applying a force in any direction related to the plane of the cut-off wheel, on the centre of the rear handle grip and with the machine body secured. The force shall be equal to three times the weight of the cut-off machine unit with empty tanks, without accessories and without the cut-off wheel.

### 4.6.3 Throttle lock

#### 4.6.3.1 Requirement

If a throttle lock is provided to aid starting and its engagement will result in a movement of the cut-off wheel during starting, it shall be such that it has to be engaged manually and shall be automatically released when the throttle trigger is operated. Releasing the throttle lock, both with and without operation of the throttle trigger lock-out, is acceptable.

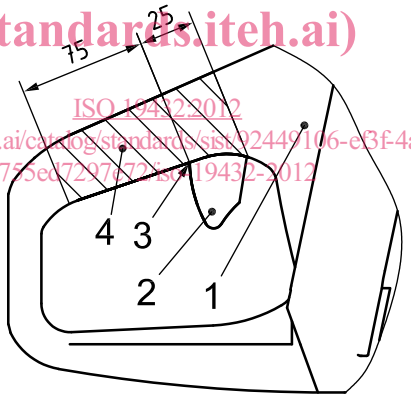
To prevent risk from unintentional operation, the throttle lock shall be located outside the gripping area of the handle and require at least two independent motions to engage the throttle lock.

The gripping area of the handle is defined to extend from 25 mm in front of the rear part of the throttle trigger to 75 mm behind the rear part of the throttle trigger (see Figure 2).

The operational force on the throttle trigger for releasing the throttle lock shall not exceed 25 N.



Dimensions in millimetres






**Key**

1 rear handle
2 throttle trigger
3 intersection between rear handle and throttle trigger
4 gripping area

**Figure 2 — Handle gripping area**

#### 4.6.3.2 Verification

The function of the throttle lock shall be verified by inspection and measurement. The force to release the throttle lock shall be applied within 1 s and measured (5 ± 1) mm in front of the rear part of the throttle trigger and in the direction of the trigger movement (perpendicular to the rotation radius of the trigger).

## 4.7 Clutch

### 4.7.1 Requirements

The cut-off machine shall have a clutch so designed that the cut-off wheel does not move when the engine rotates at any speed less than 1,25 times the idling speed.

### 4.7.2 Verification

The function of the clutch shall be verified by running the engine with any speed up to 1,25 times the idling speed. If a range is specified in the instruction handbook, the verification shall be done based on the highest idling speed.

## 4.8 Exhaust gases

### 4.8.1 Requirements

The exhaust outlet shall be designed so that the exhaust gases are directed away from the operator when the machine is held in a typical cutting position, as shown in Figure 3.



**Figure 3 — Example of cut-off machine held in typical cutting position**

### 4.8.2 Verification

The location and direction of the exhaust outlet shall be verified by inspection.

## 4.9 Cutting-debris discharge

### 4.9.1 Requirements

The cut-off machine shall be designed so that the main stream of cutting debris from the cut-off wheel is directed away from the operator's face or upper body when holding the machine in a typical cutting position, as shown in Figure 3. (See also 4.13.1.)

See 5.1 for required information about instructions for the wheel guard.

### 4.9.2 Verification

The direction of the cutting debris shall be verified by inspection.

## 4.10 Fuel and oil system

### 4.10.1 Requirements

The fuel tank cap and, if provided, the oil tank cap shall have a retainer to prevent the cap from being lost.

The fuel tank opening shall be at least 20 mm in diameter.

The design of the cap shall be such that no leakage occurs while the machine is at the normal operating temperature, in all working positions and while being transported.

The fuel tank and, if provided, oil tank filler opening shall be so located that the filling of the tank is not obstructed by other machine components. It shall be possible to use a funnel.

Tanks and fuel lines shall be integrated in the cut-off saw so that they withstand, without any visible leakage, the shock that occurs when the complete cut-off machine is impacted onto the ground in accordance with 4.10.2.2.

### 4.10.2 Verification

#### 4.10.2.1 General

The fuel cap retainer, opening dimensions and the possibility of using a funnel shall be verified by inspection and measurement. The tightness of the caps shall be verified by inspection while turning the cut-off machine in any direction. Seepage from fuel tank ventilation systems is not regarded as leakage.



#### 4.10.2.2 Drop test

The cut-off machine shall be impacted onto a concrete surface by dropping it twice, once with the largest diameter cut-off wheel, as specified in the instruction handbook, and once without the cut-off wheel, at (−5 ± 2) °C.



Before the drop test, install the cut-off wheel and fill the fuel tank and oil tank half full with a mixture of 50 % glycol and 50 % water (by volume) and condition the cut-off machine at the test temperature for at least 6 h.

Within 60 s of coming out from the conditioning environment, the cut-off machine shall be dropped onto a concrete surface.

The drop shall be done with the cut-off machine suspended by means of a string attached to the front handle so that the cut-off wheel plane is vertical and the lowest point of the front handle where it is suspended is 775 mm ± 5 mm above the concrete surface.

Repeat the test without the cut-off wheel after reconditioning at (−5 ± 2) °C for a minimum of 1 h.

Inspect for visible leakage while holding the machine for (30 ± 2) s in each of the positions a) to f) specified in Figure D.1.

## 4.11 Protection against contact with parts under high voltage

### 4.11.1 Requirements

All high-voltage parts of the circuit, including spark-plug terminals, shall be located, insulated or guarded so that the operator cannot make unintentional contact with them.

Ignition interruption or short-circuiting shall be provided and shall be fitted on the low-voltage side.