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

Part 5: Rotary percussive drills

Machines portatives à moteur non électrique — Exigences de sécurité —

Partie 5: Perceuses à percussion rotatives

Reference number
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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 11148-5 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.

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

Part 5:
Rotary percussive drills

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1 Scope

This part of ISO 11148 specifies safety requirements for hand-held non-electric power tools (hereinafter "rotary percussive drills") intended for making holes in hard materials, such as rock and concrete. The rotary percussive drills can be powered by compressed air, hydraulic fluid or internal combustion engines (ICEs) 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.

This part of ISO 11148 is applicable to:

— plug hole drills;

— rock drills;

— rotary hammers.

NOTE 1 For examples of rotary percussive drills, see Annex B.

This part of ISO 11148 is not applicable to special requirements and modifications of rotary percussive drills for the purpose of mounting them in a fixture.

This part of ISO 11148 deals with all significant hazards, hazardous situations or hazardous events relevant to rotary percussive drills 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 rotary percussive drills in potentially explosive atmospheres.

NOTE 2 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 9158, *Road vehicles — Nozzles spouts for unleaded gasoline*

ISO 9159, *Road vehicles — Nozzles spouts for leaded gasoline and diesel fuel*

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*

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

3 Terms and definitions

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 rotary percussive tool to perform the intended work

3.1.3
service tool
tool for performing maintenance or service on the rotary percussive tool

3.1.4
control device
device to start and stop the rotary percussive tool 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 rotary percussive tool 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 which 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 rotary percussive tool 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 rotary percussive tool

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 rotary percussive tool 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 The rated speed is expressed in revolutions per minute.

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 rotary percussive tool

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 rotary percussive power tools

3.2.1
rotary percussive drill
power tool with both rotary and percussive action for making holes in rock, concrete, etc.

3.2.2
plug hole drill
rotary percussive drill with spiral or straight drill and without air flushing, mainly intended for drilling in concrete, bricks, etc.

3.2.3
rock drill
rotary percussive drill with straight drill bit and with, for example, air or water flushing, mainly intended for drilling in rock, concrete, etc.

3.2.4
rotary hammer
rotary percussive drill with spiral drill bit and without air flushing

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 power tool 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 rotary percussive drills, 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

Rotary percussive drills shall be so designed that they can be laid aside and remain in a stable position on a plane surface.

4.2.3 Ejection of parts

Rotary percussive drills shall be equipped with a retainer or other device to prevent the ejection or falling out of the inserted tool.

4.2.4 Hydraulic fluid ejection

Hydraulic systems of the rotary percussive drill shall be enclosed so as to provide protection from high-pressure fluid ejection.

4.2.5 Guards

Guards covering the inserted tools are not required to be fitted to a rotary percussive drill.

4.2.6 Power tool construction

The rotary percussive drill 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 rotary percussive drill which are held during use or that can be inadvertently touched shall follow the provisions of ISO 13732-1 and ISO 13732-3.

Rotary percussive drills shall be designed to minimize the cooling effects of exhaust air on the handles and other gripping zones.

4.4 Noise reduction

The rotary percussive drill 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 rotary percussive drills with reduced noise emission are contained in ISO/TR 11688-1 and ISO/TR 11688-2.

The noise emission from using rotary percussive drills has three main sources:

— the rotary percussive drill 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 rotary percussive drill.

Typical sources of noise emitted by the rotary percussive drill itself are

a) the motor and drive mechanism,

b) the exhaust air or gases, and

c) the 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 rotary percussive drill 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 rotary percussive drills with reduced vibration emission are contained in CR 1030-1.

Typical sources of vibration emitted by a rotary percussive drill are

— impacts,

— poorly designed motors, and

— resonances in the structure of the machine, particularly the handles and their mounts.

The following design features have been found to be effective and should be considered by manufacturers when designing rotary percussive drills:

a) reaction masses and springs;

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

Rotary percussive drills driven with compressed air, gas or an internal combustion engine 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 rotary percussive drill 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.

4.6.3 Lubricants

When specifying lubricants, the manufacturer shall take environmental and occupational health aspects into account.

4.7 Ergonomics

4.7.1 Design of the handle

Gripping areas of the rotary percussive drills shall be designed to provide convenient, effective means for the operator to exercise full control over the rotary percussive drill.

Handles and other parts used for gripping the rotary percussive drill shall be designed to ensure that the operator is able to grip the rotary percussive tool correctly and to perform the expected work. Handles shall suit the functional anatomy of the hand and the dimensions of the hands of the operator population.

NOTE Further guidance on ergonomic design principles can be found in EN 614-1.

Rotary percussive drills having a mass greater than 2 kg (including the inserted tool) shall be capable of being supported by two hands whilst being lifted or operated.

The grip shall be such that normal feed force and reaction torque can be transmitted in an ergonomic way from the hand of the operator to the rotary percussive drill.

The strength of a removable handle and the method of fixing it shall be appropriate to the intended principal use.

4.7.2 Suspension device

Provision shall be made, where appropriate, to enable the attachment of a suspension device to the rotary percussive drill in order to reduce, where practicable, the physical strain placed on the operator by the weight of the rotary percussive drill. The fitting of a suspension device shall not introduce an additional hazard.

4.7.3 Reaction torque

Rotary percussive drills shall be designed so that the effect of reaction torque is reduced as much as possible. This can be done by mounting a support handle or through other suitable means.

Rotary percussive drills that can be foreseen to be used in such operations where a harmful reaction torque has to be absorbed by the operator shall have provisions for the attachment of absorbing devices, such as support handles or other suitable means. Pistol grip and D-handle tools shall have a provision for mounting a second handle if the reaction torque absorbed by the operator can exceed 10 N·m.

NOTE 1 Provisions for mounting second handles or other suitable means can be required at lower values of reaction torque than indicated above, depending upon factors such as the expected frequency and daily duration of operation, the physique and posture of the operator, the type of joint and the use of accessories.

NOTE 2 Recommended force limits for machinery operation are given in EN 1005-3.

4.8 Controls

4.8.1 Start-and-stop device

Rotary percussive drills shall be equipped with a single control device to start and/or stop them. It shall be arranged near the handle so that the operator can activate it without releasing the grip on the handles.

The start-and-stop device shall be so designed that the inserted tool ceases to be powered when the start-and-stop device is released. Without manual effort and when completely released, the device shall move to the stop position, i.e. shall be of the hold-to-run type.

Start-and-stop devices shall be in the stop position or immediately move to the stop position when the rotary percussive drill is connected to the energy supply.

It shall not be possible to lock the start-and-stop device in the running position, with the following exception: rock drills may have a lock-on start-and-stop device.

NOTE The lock-on control offers collaring with less exposure to noise, vibration and dust.

4.8.2 Unintentional start

The start-and-stop device shall be so designed, positioned or guarded that the risk of unintentional start is minimized. Verification shall be carried out in accordance with 5.4.

4.8.3 Actuating forces

For rotary percussive drills that are intended for frequent starts or for use with precision work, the actuating force shall be small.

For rotary percussive drills that are normally used in operations of long duration, the force to keep the start device in the run position should be small.

NOTE For further information on trigger forces for control devices, see EN 894-3.

5 Verification

5.1 General conditions for tests

Tests according to this part of ISO 11148 are type tests.

5.2 Noise

The noise-emission values shall be measured and declared in accordance with ISO 15744.

Compliance with 4.4 may be verified through the comparison of the noise-emission values with those for other machines of the same family or with machines of similar size and performance characteristics.

5.3 Vibration

The vibration total value shall be measured and reported in accordance with ISO 28927-10.

The vibration-emission value and its uncertainty shall be declared in accordance with EN 12096.

Compliance with 4.5 may be verified through the comparison of the vibration-emission values with those for other machines of the same family or with machines of similar size and performance characteristics.

5.4 Unintentional start

Compliance with 4.8.2 shall be verified for rotary percussive drills up to 15 kg as follows.

The retainer shall be mounted and not removed.

Connect the rotary percussive drill to the energy supply and place and maintain it in any possible position on a horizontal plane. Establish that the start-and-stop device cannot initiate running in any of those positions.

Operation of the start-and-stop device shall not occur when the rotary percussive drill is pulled across a horizontal plane by its hose.

5.5 Power tool construction

Compliance with 4.2.6 shall be verified by dropping a sample rotary percussive drill three times on to a concrete surface from a height of 1 m without affecting its operational and safety functions. The sample shall be positioned so as to vary the point of impact.

5.6 Structure of verification

The verification shall be carried out in conformity with Table 1.

Table 1 — Structure of verification

Safety requirement	Visual check	Functional check	Measurement	Reference [to the subclause(s) of this part of ISO 11148 or other International Standard]
4.2.1 Surfaces, edges and corners	X	—	—	—
4.2.2 Supporting surface and stability	—	X	—	—
4.2.3 Ejection of parts	X	—	—	—
4.2.4 Hydraulic fluid ejection	X	—	—	—
4.2.6 Power tool construction	—	X	—	5.5
4.3 Thermal safety	—	X	X	ISO 13732-1, ISO 13732-3
4.4 Noise reduction	—	—	X	ISO 15744 5.2
4.5 Vibration	—	—	X	ISO 28927-10 5.3
4.6.1 Exhaust air or gas	—	X	—	—
4.6.2 Dust and fumes	X	X	—	—
4.7.1 Design of the handle	X	—	—	—
4.7.2 Suspension device	X	X	—	—
4.7.3 Reaction torque	X	X	X	—
4.8.1 Start-and-stop device	—	X	—	—
4.8.2 Unintentional start	—	X	—	5.4
4.8.3 Actuating forces	X	X	—	—

6 Information for use

6.1 Marking, signs and written warnings

Rotary percussive drills shall be marked visibly, legibly and indelibly with the following information:

— name and full address of the manufacturer and, where applicable, his/her authorized representative;

NOTE 1 The address can be simplified if there is not really enough room on small machines, as long as the manufacturer (and, where applicable, his/her authorized representative) can always be identified so that mail is able to reach the company.

— designation of series or type;

NOTE 2 The designation of the tool can be achieved by using a combination of letters and numbers.

— serial number or batch number;

— year of construction, that is the year in which the manufacturing process is completed;

— for pneumatic rotary percussive drills:

  — the rated air pressure marked as (max.);

— for hydraulic rotary percussive drills:

  — the nominal pressure and flow;

  — the maximum allowable setting for the pressure relief valve.

Rotary percussive drills shall be permanently marked with a graphical symbol in accordance with Annex C showing that the operator's instructions shall be read before work starts.

Other graphical symbols that may be used are shown in Annex C.

6.2 Instruction handbook

6.2.1 General

For the information to be provided to the user, the content of Clause 6 together with ISO 12100:2010, 6.4.5.2 and 6.4.5.3, apply.

The information provided by the manufacturer is an important, but not exclusive, basis for safe use of the tool. It shall provide sufficient information for the end user to perform an initial risk assessment.

The hazards identified in 6.2.2.4 to 6.2.2.13 are foreseeable in the general use of hand-held rotary percussive drills. The information provided with the tool shall state that the user or the user's employer shall assess the specific risks that can be present as a result of each use.

The instruction handbook shall contain information relating to at least the following:

— name and address of the manufacturer or supplier or any other agent responsible for placing the rotary percussive drill on the market;

— designation of the series or type;

— operating instructions; see 6.3;

— information on noise emission; see 6.4.2;

— information on vibration transmitted to the hands of the operator; see 6.4.3;

— maintenance instructions; see 6.5;

— explanations of any symbols marked on the rotary percussive drill; see Annex C;

— information about residual risks and how to control them.

NOTE Mandatory symbols for ICE tools are given in Annex C. See Annex D.

6.2.2 Operator's instructions

6.2.2.1 General

The instructions and warnings stated in 6.2.2 to 6.2.4 shall be given with all rotary percussive drills unless the risk assessment shows that they are not relevant to a particular rotary percussive drill. Words of equivalent meaning may be used.

6.2.2.2 Statement of use

The operator's instructions shall include a description of the correct use of the rotary percussive drill and shall make reference to the appropriate inserted tools. The operator's instructions shall state that any other use is forbidden. Foreseeable misuse of the rotary percussive drill, which experience has shown can occur, shall be warned against.

6.2.2.3 Allowance for user

The operator's instructions shall be written primarily for professional users. Where a tool may be used by non-professional users, additional information for use shall be provided.

6.2.2.4 General safety rules

— For multiple hazards, read and understand the safety instructions before installing, operating, repairing, maintaining, changing accessories on, or working near the rotary percussive drill. Failure to do so can result in serious bodily injury.

— Only qualified and trained operators should install, adjust or use the rotary percussive drill.

— Do not modify this rotary percussive drill. Modifications can reduce the effectiveness of safety measures and increase the risks to the operator.

— Do not discard the safety instructions; give them to the operator.

— Do not use the rotary percussive tool if it has been damaged.

— Tools shall be inspected periodically to verify that the ratings and markings required by this part of ISO 11148 are legibly marked on the tool. The employer/user shall contact the manufacturer to obtain replacement marking labels when necessary.

6.2.2.5 Projectile hazards

— Be aware that failure of the workpiece or accessories, or even of the inserted tool itself can generate high-velocity projectiles.

— Always wear impact-resistant eye protection during operation, repair or maintenance of the tool or when changing accessories on the tool. The grade of protection required should be assessed for each use.

— Ensure that the workpiece is securely fixed.

— Disconnect the rotary percussive drill from the energy source when changing inserted tool or accessories.

— For overhead work, wear a safety helmet.

— The risks to others should also be assessed at this time.

— Never operate a tool unless the inserted tool is retained in the tool with a proper retainer.

— To avoid injury, retainer parts shall be replaced when they become worn, cracked or distorted.

— Hold the inserted tool firmly against the work surface before starting the tool.

6.2.2.6 Entanglement hazards

Choking, scalping and/or laceration can occur if loose clothing, personal jewellery, neck wear, hair or gloves are not kept away from the tool and its accessories.

6.2.2.7 Operating hazards

— Use of the tool can expose the operator's hands to hazards, including impacts, cuts and abrasions and heat. Wear suitable gloves to protect hands.

— Operators and maintenance personnel shall be physically able to handle the bulk, weight and power of the tool.

— Hold the tool correctly; be ready to counteract normal or sudden movements and have both hands available.

— Maintain a balanced body position and secure footing.

— High reaction torque can be developed in the case of stalling.

— Keep hands away from the rotating chuck and drill bit.

— Release the start-and-stop device in the case of an interruption of the energy supply.

— Use only lubricants recommended by the manufacturer.

— Personal protective safety glasses shall be used; suitable gloves and protective clothing are recommended.

— Avoid direct contact with the inserted tool during and after use as it can become hot.

— Sharp tools should always be used.

— Unexpected tool movement or breakage of inserted tools can cause injuries.

— Avoid unsuitable postures as it is likely for these positions not to allow counteracting of normal or unexpected movement of the rotary percussive drill, such as a sudden break of the inserted tool.

— If the application for which the rotary percussive drill is being used can result in the reaction torque upon the operator exceeding the appropriate value according to 4.7.1, a second handle shall be used.

— Beware of the risk of being drawn into or trapped by the rotating inserted tool.

— Beware of the risks due to whipping of the compressed air hose.

— Collaring the drill should be avoided where possible; however, if necessary, exposure should be kept to a minimum.

— In cases where the means to absorb the reaction torque are requested, it is recommended to use side handles for pistol grip and D-handle tools whenever possible. In any case, it is recommended to use a means to absorb the reaction torque above 10 N·m.

— Warnings shall be given regarding the risk of explosion or fire due to the material being processed.

6.2.2.8 Repetitive motions hazards

— When using a rotary percussive drill to perform work-related activities, the operator can experience discomfort in the hands, arms, shoulders, neck or other parts of the body.

— While using a rotary percussive drill, the operator should adopt a comfortable posture whilst maintaining secure footing and avoiding awkward or off-balance postures. The operator should change posture during extended tasks; this can help avoid discomfort and fatigue.

— If the operator experiences symptoms such as persistent or recurring discomfort, pain, throbbing, aching, tingling, numbness, burning sensations or stiffness, these warning signs should not be ignored. The operator should tell the employer and consult a qualified health professional.

6.2.2.9 Accessory hazards

— Disconnect the rotary percussive drill from the energy supply before changing the inserted tool or accessory.

— Use only sizes and types of accessories and consumables that are recommended by the manufacturer of rotary percussive drills; do not use other types or sizes of accessories or consumables.

6.2.2.10 Workplace hazards

— Slips, trips and falls are major causes of workplace injury. Be aware of slippery surfaces caused by use of the tool and also of trip hazards caused by the air line or hydraulic hose.

— Proceed with care in unfamiliar surroundings. There can be hidden hazards, such as electricity or other utility lines.

— Rotary percussive drills shall not be used in explosive atmospheres unless specially designed for that purpose.

— Rotary percussive drills are not generally insulated against contact with electric power.

— Ensure that there are no electrical cables, gas pipes, etc., which can cause a hazard if damaged by use of the tool.

— Working in a potentially explosive atmosphere requires special attention.

6.2.2.11 Dust and fume hazards

— Dust and fumes generated when using rotary percussive drills can cause ill health (for example cancer, birth defects, asthma and/or dermatitis); risk assessment and implementation of appropriate controls of these hazards are essential.

— Risk assessment should include dust created by the use of the tool and the potential for disturbing existing dust.

— Operate and maintain the rotary percussive drill as recommended in the instruction handbook, in order to minimize dust or fume emissions.

— Direct the exhaust so as to minimize the disturbance of dust in a dust-filled environment.

— Where dust or fumes are created, the priority shall be to control them at the point of emission.

— All integral features or accessories for the collection, extraction or suppression of airborne dust or fumes should be correctly used and maintained in accordance with the manufacturer's instructions.

— Select, maintain and replace the consumable/inserted tool as recommended in the instruction handbook, in order to prevent an unnecessary increase in dust or fumes.

— Use respiratory protection in accordance with employer's instructions or as required by occupational health and safety regulations.

6.2.2.12 Noise hazards

— Exposure to high noise levels can cause permanent, disabling hearing loss and other problems, such as tinnitus (ringing, buzzing, whistling or humming in the ears). Therefore, risk assessment and the implementation of appropriate controls for these hazards are essential.

— Appropriate controls to reduce the risk can include actions such as damping materials to prevent workpieces from “ringing”.

— Use hearing protection in accordance with employer's instructions and as required by occupational health and safety regulations.

— Operate and maintain the rotary percussive drill as recommended in the instruction handbook, to prevent an unnecessary increase in the noise level.

— Select, maintain and replace the consumable/inserted tool as recommended in the instruction handbook, to prevent an unnecessary increase in noise.

— If the rotary percussive drill has a silencer, always ensure that it is in place and in good working order when the rotary percussive drill is being operated.

6.2.2.13 Vibration hazards

The information for use shall draw attention to vibration hazards that have not been eliminated by design and construction and remain as residual vibration risks. It shall enable employers to identify the circumstances in which the operator is likely to be at risk from vibration exposure. If the vibration-emission value obtained using ISO 28927-10 does not adequately represent the vibration emission in the intended uses (and foreseeable misuses) of the machine, additional information and/or warnings shall be supplied to enable the risks arising from vibration to be assessed and managed.

— Exposure to vibration can cause disabling damage to the nerves and blood supply of the hands and arms.

— Wear warm clothing when working in cold conditions and keep your hands warm and dry.

— If you experience numbness, tingling, pain or whitening of the skin in your fingers or hands, stop using the rotary percussive drill, tell your employer and consult a physician.

— Operate and maintain the rotary percussive drill as recommended in the instruction handbook, to prevent an unnecessary increase in vibration levels.

— Select, maintain and replace the consumable/inserted tool as recommended in the instruction handbook, to prevent an unnecessary increase in vibration levels.

— Support the weight of the tool in a stand, pusher leg or balancer, if possible.

— Hold the tool with a light but safe grip, taking account of the required hand reaction forces, because the risk from vibration is generally greater when the grip force is higher.

— Keep suspended handles in a central position and avoid pushing handles into the end stops.

6.2.3 Additional safety instructions for pneumatic power tools

— Air under pressure can cause severe injury:

  — always shut off air supply, drain hose of air pressure and disconnect tool from air supply when not in use, before changing accessories or when making repairs;

  — never direct air at yourself or anyone else.

— Whipping hoses can cause severe injury. Always check for damaged or loose hoses and fittings.

— Do not use quick-disconnect couplings at the tool inlet. Use hardened steel (or material with comparable shock resistance) threaded hose fittings.

— Whenever universal twist couplings (claw couplings) are used, lock pins shall be installed and whipcheck safety cables shall be used to safeguard against possible hose-to-tool or hose-to-hose connection failure.

— Do not exceed the maximum air pressure stated on the tool.

— Never carry an air tool by the hose.

6.2.4 Additional safety instructions for hydraulic power tools

— Do not exceed the maximum relief-valve setting stated on the tool.

— Carry out a daily check for damaged or worn hoses or hydraulic connections and replace if necessary.

— Use only clean oil and filling equipment.

— Power units require a free flow of air for cooling purposes and should therefore be positioned in a well-ventilated area free from hazardous fumes.

— Ensure that couplings are clean and correctly engaged before operation.

— Do not inspect or clean the tool while the hydraulic power source is connected. Accidental engagement of the tool can cause serious injury.

— Do not install or remove the tool while the hydraulic power source is connected. Accidental engagement of the tool can cause serious injury.

— Be sure all hose connections are tight.

— Wipe all couplers clean before connecting. Failure to do so can result in damage to the quick couplers and cause overheating.

Instructions shall be given that only hydraulic fluid recommended by the manufacturer shall be used.

NOTE It is advisable to enquire of the manufacturer whether or not non-flammable fluids can be used.

6.2.5 Specific safety instructions

Warnings shall be given about any specific or unusual hazards associated with the use of the rotary percussive drill. Such warnings shall indicate the nature of the hazard, the risk of injury and the avoidance action to take.

6.3 Operating instructions

The instructions shall include, where appropriate:

— instructions for setting up or fixing the rotary percussive drill in a stable position as appropriate for rotary percussive drills which can be mounted in a support;

— assembly instructions, including recommended guards, accessories and inserted tools;

— an illustrated description of functions;

— limitations on tool use due to environmental conditions;

— instructions for setting and testing;

— general instructions for use, including changing inserted tools and limits on the size and type of workpiece.

6.4 Data

6.4.1 General

The instructions shall include the information on the data plate and the following:

— mass of the rotary percussive drill;

— for hydraulic rotary percussive drills:

  — specification of the coupling;

  — specification of hoses with regard to pressure and flow;

  — maximum inlet temperature of the inlet fluid.

6.4.2 Noise

6.4.2.1 Declaration of emission

The instructions shall include a noise-emission declaration in accordance with ISO 15744.

6.4.2.2 Additional information

If the values for noise emissions obtained using the appropriate tests defined in 5.2 do not adequately represent the emissions during the intended uses of the machine, additional information and/or warnings shall be supplied to enable an assessment and the management of the associated risks.

Information about noise emission should also be provided in the sales literature.

6.4.3 Vibration

6.4.3.1 Declaration of emission

The instructions shall include the vibration-emission value and uncertainty as specified in 5.3 and the reference number of the test code in accordance with ISO 28927-10.

6.4.3.2 Additional information

If the vibration-emission values obtained using the appropriate tests defined in 5.3 do not adequately represent the emissions during the intended uses of the machine, additional information and/or warnings shall be supplied to enable an assessment and the management of the associated risks.

Information on vibration emission should also be provided in the sales literature.

6.5 Maintenance instructions

The maintenance instructions shall contain

— instructions to keep the rotary percussive drills safe by regular preventative maintenance,

— information on when the regular preventative maintenance shall be carried out, for instance after a specified time of operation, a specified number of cycles/operations or a stated number of times per year,

— instructions for disposal so as not to expose personnel and the environment to hazards,

— a list of the service operations that the user should carry out,

— instructions for lubrication, if required, and

— instructions to make a simple check of the vibration level after each service.

Maintenance instructions shall also include precautions to take in order to avoid exposure to hazardous substances deposited (due to work processes) on the tool.

NOTE Skin exposure to hazardous dusts can cause severe dermatitis. If dust is generated or disturbed during the maintenance procedure, it can be inhaled.

Annex A
(informative)

List of significant hazards

This annex contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this part of ISO 11148, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk. The following significant hazards can occur in the use of rotary percussive drills. For additional hazards that can occur with rotary percussive drills driven by an internal combustion engine, see Annex D.

Table A.1 — List of significant hazards

Hazard type	Reference to safety requirement	
	By design or guarding	Information for use
1 Mechanical hazards:		
— cutting	4.2.1	6.2.2.7
— crushing	4.2.2	6.2.2.7
— friction or abrasion hazard	4.2.1	
— ejection of parts	4.2.3, 4.2.6	
— loss of stability	4.2.2	
— whipping hose		
— ejection from high-pressure hydraulic systems	4.2.4	
— hose and hose coupling specifications		
2 Electrical hazards		6.2.2.9
3 Thermal hazards:		
— explosions		6.2.2.10
— health damage due to hot or cold surfaces	4.3	6.2.2.7
4 Hazards caused by noise	4.4	6.2.2.12
5 Hazards generated by vibration	4.5	6.2.2.13
6 Hazards generated by materials and substances processed, used or exhausted:		
— inhalation of harmful dust and fumes	4.6.2	6.2.2.11
— exhaust air and gases	4.6.1	6.2.2.11
— lubricants	4.6.3	6.2.2.7
— hydraulic fluid		6.2.4
— parts from working pieces		6.2.2.5
7 Hazards caused by neglecting ergonomic principles:		
— repetitive strain injuries		6.2.2.8
— unsuitable postures		6.2.2.7
— inadequate grip design and tool balance	4.7.1	
— effects of reaction forces upon operator	4.7.3	6.2.2.7
— neglected use of personal protection equipment		6.2.2.5, 6.2.2.12
8 Hazards caused by failure of energy supply:		
— unexpected return of energy supply after a breakdown		6.2.2.10
— incorrect hydraulic fluid flow and outlet pressure		6.2.4
9 Hazards caused by missing and/or incorrectly positioned safety-related means:		
— start-and-stop device	4.8.1	6.2.2.7
— unintentional start	4.8.2	

Annex B
(informative)

Examples of rotary percussive drills covered by this part of ISO 11148

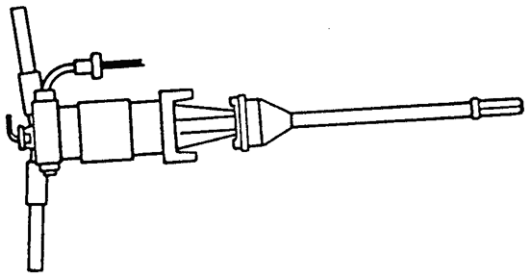


Figure B.1 — Rock drill

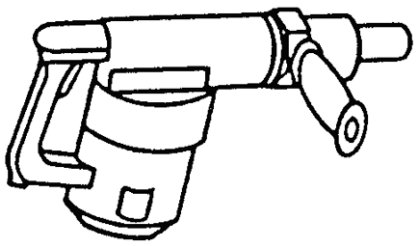


Figure B.2 — Rotary hammer

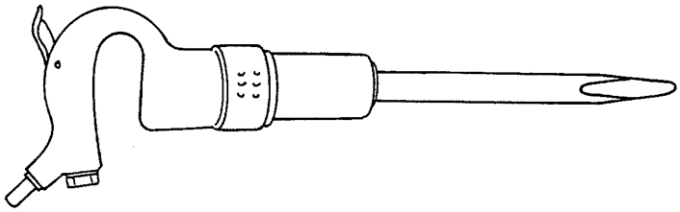


Figure B.3 — Plug hole drill

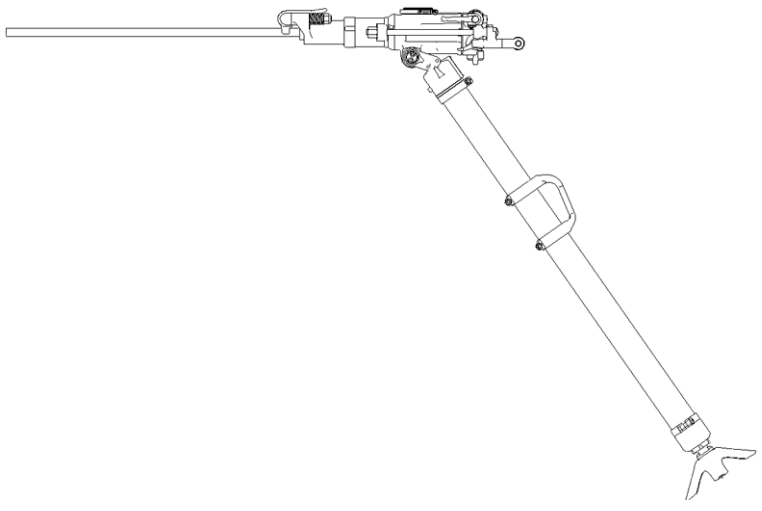
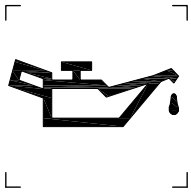


Figure B.4 — Underground rock drill with pusher leg

Annex C
(normative)

Symbols for labels and signs

Table C.1 — Symbols for labels and signs

No.	Symbol	Significance	Colours	Symbol registration number or source
C.1.1		Warning Minimum requirement. This symbol is normative. Additional symbols and/or text are informative.	Background in the circle: blue Symbol: white Background for warning: orange	ISO 3864-2 Application of ISO 7010-M002
C.1.2		Engine oil	Background: optional Symbol: black	ISO 7000-0248
C.1.3		Fuel	Background: optional Symbol: black	Application of ISO 7000-0245

Annex D
(normative)

Additional safety requirements related to internal combustion engine power tools

D.1 General

This annex covers the additional safety requirements related to internal combustion engines (ICE) of rotary percussive drills powered by liquid or gaseous fuel.

D.2 List of hazards

Table D.1 lists the hazards that are specific to cases where the energy source is an internal combustion engine.

Table D.1 — List of hazards for tools with an internal combustion engine as energy source

Hazard type	Reference to safety requirement	
	By design or guarding	Information for use
D.2.1 Mechanical hazards: — incorrect carburettor adjustment	D.3.1	—
D.2.2 Electrical hazards: — electric hazards	D.3.2	—
D.2.3 Thermal hazards: — radiation of heat sources	D.3.3	—
D.2.4 Hazards generated by materials and substances processed, used or exhausted: — resulting from contact with or inhalation of harmful fluids, gases, mists and fumes — fires or explosion hazards — incorrect fuel	—	D.4
D.2.5 Hazards caused by functional disorders: — resulting from unexpected ejection of fluid — breakdown of pressurized gas container	 D.3.4 D.3.6	—
D.2.6 Hazards caused by missing or incorrectly positioned safety-related measures and means	—	—

D.3 Safety requirements and measures

D.3.1 Mechanical safety

If carburettors or other fuel-management-system devices are adjustable, it shall be possible to adjust them from the outside without the removal of casing parts; control devices shall be easily and safely accessible.

D.3.2 Electrical safety

The electrical equipment in the internal combustion engine shall be insulated and covered so that the risk of electric shock or arcing is removed.

D.3.3 Thermal safety

Radiation of heat from hot surfaces and exhaust gases shall not cause a hazard to the operator under normal working conditions.

D.3.4 Materials and substances processed, used or exhausted

Refillable tanks for fuel and oil shall fulfil the following requirements.

— The openings for both fuel and oil shall be placed so that filling can be performed without obstacles and spillage is avoided.

— The openings shall be so positioned that no spilling falls on hot surfaces.

— The tank caps shall have retainers to prevent them from being lost.

— The opening of the fuel tank shall be large enough to enable filling with a standard canister with a nozzle spout in accordance with ISO 9158 or ISO 9159.

No apparent leakage of fuel from the fuel tank is allowed under normal operating conditions. Leakage from the venting hole in the cap is accepted.

D.3.5 Missing or incorrectly positioned safety-related measures and means

When releasing the start-and-stop device, the movement of the inserted tool is allowed to continue at idling speed, if it cannot cause any hazard.

D.3.6 Pressurized gas container

Containers for liquid petroleum gas (LPG) shall fulfil national regulations.

D.4 Information for use

D.4.1 Markings, signs and warnings

The openings for fuel and oil shall be clearly and indelibly marked. Marking on the fuel tank and lubrication tank openings shall be a symbol in accordance with Annex C.

Devices for adjustment of the carburettor or other fuel metering devices shall be clearly and indelibly marked and indicated on the ICE-driven rotary percussive drill.

Symbols used shall be clear and unambiguous and shall be explained in the instruction handbook.

D.4.2 Instruction handbook

D.4.2.1 Additional safety instructions for ICE power tools

The following warnings (or equivalent) shall be given with all ICE rotary percussive drills, in addition to those specified in Clause 6.

D.4.2.1.1 Fuel hazards

The following are fuel hazards.

— Fuel is highly flammable:

  — never smoke near the machine;

  — never smoke when filling fuel.

— Spillage of fuel can cause fire:

  — operate the machine with the fuel cap securely in place;

  — when opening the fuel cap, always loosen the cap slowly to relieve any pressure in the tank;

  — never remove the fuel cap or add fuel when the engine is hot; stop the engine and allow it to cool before adding fuel;

  — do not overfill the tank;

  — do not use a machine that is leaking fuel;

  — ensure that the machine is upright during transportation.

— Include instructions on how to transport the rotary percussive drill so as to minimize the risk of fuel leakage.

— Include instructions on how to adjust the carburettor or other fuel-metering device.

— Specify that empty LPG containers shall be handled with care and sent back to the retailer.

D.4.2.1.2 Inhalation hazards

Inhalation of exhaust fumes can cause death by asphyxiation. Do not operate the machine in an unventilated environment or in closed pits where the surroundings hinder or prevent air circulation.

D.4.2.1.3 High-temperature hazards

The following are high-temperature hazards.

— The exhaust pipe and other machine parts can get very hot during operation, and can remain hot during a period of time after the machine has been shut off:

  — never touch the exhaust pipe or any other part of the machine before it has cooled down;

  — wait until the inserted tool has cooled down before performing maintenance on the machine.

— Hot parts and hot exhaust gases can cause materials in contact or nearby to burn or explode. Do not use or leave the machine near flammable material, gases or dust particles.

D.4.2.1.4 Consumable hazards

The following are consumable hazards.

— Fuel and oil can penetrate the skin and cause permanent damage:

  — wear safety gloves resistant to fluids used;

  — do not use your fingers to check for fluid leaks;

  — consult a physician if fuel or oil has penetrated the skin.

D.4.2.2 Operating instructions

The operating instructions for ICE rotary percussive drills shall, in addition to the information listed in Clause 6, also:

— include instructions on how to transport the rotary percussive drill so as to minimise the risk of fuel leakage;

— instruct how to adjust the carburettor or other fuel metering device;

— specify that empty LPG containers shall be taken care of and sent back to the retailer.

D.4.2.3 Data

In addition to the information specified in 6.4, the following data shall be included:

— the fuel quality, i.e.

  — for petrol, the lead content and octane number, and

  — for LPG, the specified class.

D.4.2.4 Maintenance instructions

The maintenance instructions shall contain instructions for checking electrical cables and electric insulation.

Bibliography

NOTE The documents listed are not referred to as normative in the text of this part of ISO 11148; however, they have a bearing on the specifications and are listed for information. This is not an exhaustive list.

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

[2] ISO 3857-1, *Compressors, pneumatic tools and machines — Vocabulary — Part 1: General*

[3] ISO 3864-2, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

[4] ISO 3864-4, *Graphical symbols — Safety colours and safety signs — Part 4: Colorimetric and photometric properties of safety sign materials*

[5] ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

[6] ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

[7] ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

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

[9] ISO/TR 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design*

[10] ISO 11690 (all parts), *Acoustics — Recommended practice for the design of low-noise workplaces containing machinery*

[11] ISO 14163, *Acoustics — Guidelines for noise control by silencers*

[12] EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

[13] EN 626 (all parts), *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery*

[14] EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

[15] EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

[16] EN 983, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

[17] EN 1005-3, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

[18] EN 13463-1, *Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements*

[19] EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals*

[20] EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

[21] 79/113/EEC, *Council Directive on the approximation of the laws of the Member States relating to the determination of the noise emission of construction plant and equipment*

[22] 84/537/EEC, *Council Directive on the approximation of the laws of the Member States relating to the permissible sound power level of powered hand-held concrete-breakers and picks*

[23] CR 1030-1, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

[24] EHTMA, *Recommendations for the correct use of hand-held or portable hydraulic tools and associated portable power sources*, June 1991[1)]

1) European Hydraulic Tool Manufacturers' Association (EHTMA) publications can be obtained from: www.ehtma.com or secretary@ehtma.org.

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