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Rock drilling machines and pneumatic tools - Safety requirements

凿岩机械与气动工具 安全要求

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Rock drilling machines and pneumatic tools - Safety requirements

1 Scope

This standard specifies the general safety requirements for rock drilling machines and pneumatic tools during design, manufacture, use, maintenance.

This standard applies to rock drilling machines powered by pneumatic, electric, hydraulic or internal combustion, tools and machines driven by compressed air, non-electrically driven power tools and auxiliary equipment (hereinafter referred to as products or machines).

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB 2894 Safety signs and guideline for the use

GB/T 3766 Hydraulic fluid power - General rules and safety requirements for systems and their components

GB 4351.1 Portable fire extinguishers - Part 1: Performance and construction

GB/T 5226.1-2019 Electrical safety of machinery - Electrical equipment of machines - Part 1: General requirements

GB/T 5898 Hand-held non-electric power tools - Noise measurement code - Engineering method (grade 2)

GB/T 6247 (all parts) Rock drilling machines and portable power tools - Terminology

GB/T 7932 Pneumatic fluid power - General rules and safety requirements for systems and their components

GB/T 8196 Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards

If the pressure may cause danger, the residual pressure in the pressure system shall be released.

Any component or element that can change the direction of hydraulic oil injection can be used as an effective protective device.

Rigid pipes and hoses shall be able to withstand the usage pressure. The hose shall be clearly marked with its rated working pressure and shall comply with the relevant requirements of GB/T 3766 and GB/T 7932.

4.1.12 Pipe joints

Various pipe joints, including the air intake (oil, water) joints and threaded joints of the machine itself, shall adopt reliable anti-loosening and anti-leakage (oil, water) structures; it shall ensure sufficient strength.

The joints used to connect impact machines shall also ensure that they have the characteristics of impact resistance and vibration resistance.

4.1.13 Valves

The valves shall be well sealed, open flexibly; there shall be no leakage (oil, water) after closing.

4.1.14 Risk of slipping, tripping or falling

For mechanical parts where people often walk or stand, their design and manufacture shall prevent people from slipping, tripping, falling, or falling from these parts.

If necessary, these parts shall be equipped with handrails that are relatively fixed to the user and maintain their stability.

4.1.15 Protection of moving parts

4.1.15.1 General

The design, manufacture, layout of moving parts of rock drilling machines and pneumatic tools shall be able to avoid the hazards described in GB/T 15706.

4.1.15.2 Transmission parts

All rotating or reciprocating parts, except the drill rod propulsion mechanism and the travel mechanism, as well as the portable power tools mentioned in the specific safety requirements, shall be equipped with protective devices to avoid contact. The protective devices shall comply with the requirements of GB/T 8196. The protective devices shall be firmly manufactured and reliably fixed. For transmission parts that are not often approached, fixed protective devices shall be installed. Fixed protective devices shall be fixed by welding or by using necessary tools or keys to open or move them.

4.1.15.3 Moving parts during operation

The design, manufacture, installation of rock drilling machines and pneumatic tools shall minimize manual operation in danger zones.

The product information shall remind users to set up warning signs in the restricted areas during the operation of rock drilling machines and pneumatic tools.

For handheld or outrigger-type rock drills, the product information shall remind users to always pay attention to the safety hazards caused by the drill clamp not being locked or the drill rod being broken.

4.1.16 Noise

The noise shall not exceed the provisions of GB 19872.

4.1.17 Fire prevention

4.1.17.1 Flame retardant

The manufacturing materials of rock drilling machines and pneumatic tools shall be as fire resistant as possible. The decorative materials in the cab shall be flame retardant materials. The maximum value shall not exceed 250 mm/min, when the material flame spread linear velocity test is carried out according to GB/T 20953.

4.1.17.2 Flame retardant

For machines driven by the driver, the inner walls, interior decoration and insulation layer of the cab and other parts of the machine using insulating materials shall be made of flame retardant materials. When tested according to GB/T 20953, the burning rate shall not exceed 200 mm/min.

4.1.17.3 Fire extinguisher

Machines with a working mass greater than 1500 kg shall have at least one space for storing fire extinguishers, which shall be easily accessible to the driver or operator. A passage shall be set up to allow the driver or operator to escape from the machine safely.

4.1.18 Dust and exhaust gas

4.1.18.1 Dust removal or dust prevention measures

Dry-type rock drilling machines shall have dust removal or dust prevention measures.

4.1.18.2 Emissions from machinery

Emissions from machinery and equipment shall comply with the relevant requirements of GB/T 15706.

- The laser devices installed on machinery shall be protected, so that their effective radiation or the radiation and secondary radiation generated by reflection or scattering will not harm human health;

- The optical devices used on the machinery to observe and adjust the laser devices shall not cause the risk of laser rays causing health hazards.

4.1.20 Safety requirements for special safety equipment used in products

Special equipment, such as pressure vessels, used in products shall be purchased from manufacturers with special equipment manufacturing licenses and certificates of qualified inspection by manufacturers.

4.2 General safety requirements for non-portable machines

4.2.1 Instructions for use

Graphic symbols or signs shall be used to remind operators to read the operating instructions before starting work; sufficient information to remind operators to use safety shall be stated in the product usage information.

4.2.2 Pipeline layout

During the design stage of the product, the layout of various gas, hydraulic, water pressure pipelines shall minimize the risk of causing safety hazards.

4.2.3 Control system

The safety design of the control system shall comply with the provisions of GB/T 16855.1.

4.2.4 Drill rod connection and removal mechanism

The drill rod connection and removal mechanism shall be safe and reliable. If the drill rod is connected and removed manually, targeted safety operation requirements shall be put forward in the instructions.

4.2.5 Signage

The operating mechanism of non-portable machines shall be equipped with signs indicating actions. Signage shall not use graphic symbols and signs that may cause the operator to misunderstand.

4.2.6 Field of view

The driving, shifting, working position of non-portable machines shall have good visibility; it shall ensure that the driver or operator will not bring danger to himself or other people when operating the equipment. If necessary, optical auxiliary devices shall

be installed or other measures shall be taken.

4.2.7 Materials

The materials selected for non-portable machines shall be harmless to the safety and health of exposed personnel; they shall be suitable for the predetermined ambient temperature. The manufacturer shall indicate the design operating temperature range of the equipment in the operating manual.

4.2.8 Hoses and cables

The layout of hoses and cables shall avoid being blocked by rocks and other objects when the non-portable machine is driving or shifting. The manufacturer shall remind the user in the operating manual to prevent the hoses and cables from being blocked when the non-portable machine is driving or shifting, so as to avoid the risk of pulling off and injuring people.

4.2.9 Driving speed

The maximum driving speed of tire-type self-propelled machines shall not exceed 25 km/h; the maximum driving speed of crawler-type self-propelled machines shall not exceed 8 km/h.

The maximum driving speed of machines with accompanying control shall not exceed 3.5 km/h. If the control device is located at the rear of the machine, the reverse speed of the machine shall not exceed 3.5 km/h.

4.2.10 Braking performance

When the self-propelled machine is traveling, operating, stopping on the slope of specified angle, it shall ensure reliable braking and flexible turning, meanwhile there shall be no shaking, slipping or loss of control.

4.2.11 Stability

The design and manufacture of non-portable machines shall ensure their stability under normal use conditions, such as transportation, shifting, operation (running), parking, etc., to ensure that there is no danger of tipping over or falling.

The design of non-portable machines shall ensure that they have sufficient stability and can be used safely under the specified conditions of use. Factors to be considered include:

- The geometry of the base;

- The weight distribution including the load;

- Dynamic forces that can generate overturning moments due to the movement of

system, that covers the engine compartment and equipment and meets the following requirements:

- Manned machines shall be equipped with a manual trigger device;

- Remotely controlled unmanned or semi-manually operated machines shall be equipped with an automatic trigger device;

- Machines equipped with a fixed fire extinguishing system shall also be equipped with at least one portable fire extinguisher.

4.2.15 Placement of fire extinguishers

Fire extinguishers shall be placed where they are easily accessible to the operator. If it is a remote-controlled machine, it shall be placed in a position that is easy to see and touch.

Fire extinguishers shall be installed so that they can be removed from the bracket without tools.

If there is more than one fire extinguisher, they shall be placed on different sides of the machine.

Fire extinguishers shall not be placed near fire-prone areas such as power supplies and fuel tanks, but shall be placed between the operator and fire-prone areas.

4.2.16 Noise

Technical means and feasible methods shall be considered in design and manufacturing, to reduce airborne noise, especially the noise of noise sources.

4.2.17 Vibration

Technical means shall be considered in design and manufacture, to reduce the vibration to which the operator is exposed.

4.2.18 Hazard information

The product use information shall include hazard information on the relationship between the machine operating conditions and hazards.

4.2.19 Symbols and signs

Graphic symbols and signs shall comply with the provisions of the special safety requirements document for specific machines in Chapter 5.

4.2.20 Ventilation holes

Ventilation holes for machines with driver's cabs shall comply with the provisions of the special safety requirements document for specific machines in Chapter 5.

4.2.21 Engine exhaust emissions

The exhaust location of the engine exhaust shall be away from the driver or operator.

4.2.22 Lifting safety of non-portable machines and their parts

The product shall be designed and manufactured so that the machine and its parts can be lifted safely.

4.2.23 Driving, shifting, operating positions

4.2.23.1 General

The design and construction of the operating position shall avoid risks caused by exhaust gases and (or) lack of oxygen.

If the machine is intended to be used in a hazardous environment that poses a risk to the health and safety of the driver or operator, or the machine itself can also cause a hazardous environment, THEN, sufficient means shall be provided to ensure that the operator has good working conditions and can be protected from foreseeable dangers.

4.2.23.2 Driver's operating position

4.2.23.2.1 Basic entrance and exit

A basic entrance and exit shall be provided; its dimensions shall comply with the provisions of GB/T 17300.

4.2.23.2.2 Alternative entrance and exit (emergency exit)

An alternative entrance and exit that is different from the main entrance and exit direction shall be provided. A window or another door that can be opened or moved without a key or tool can be used. If the entrance and exit can be opened from the inside without a key or tool, a latch can be used. Breakable door and window glass surfaces of appropriate size can also be considered as suitable alternative entrances and exits. In this case, the necessary escape hammer shall be provided in the driver's cab; the escape hammer shall be within the driver's reach.

When the window is used as an emergency exit, it shall be marked accordingly.

4.2.23.2.3 Storage of driver's manual

For machines with a cab and a shed, a space for safely storing driver's manuals or other instruction manuals shall be provided next to the driver's position.

There shall be safety protection devices to prevent abnormal starting, such as a lockable cab, a lockable starting switch or a lockable circuit switch.

If the machine has multiple starting devices, these devices shall be interlocked to ensure that only one device can control the start.

Starting the internal power source or connecting the external energy supply shall not lead to a dangerous state. For example, starting an internal combustion engine shall not cause the movement of a mobile machine, connecting the main power supply shall not cause the starting of the working parts of the machine.

Machines with electric, pneumatic or hydraulic engine/motor starters shall have a neutral starting function, to ensure that they can only be started under non-hazardous conditions.

The neutral starting procedure shall be described in the instruction manual.

The engine/motor starting device shall be reasonably arranged and designed, to prevent the driver from getting into danger when starting.

4.2.23.6 Shutdown

4.2.23.6.1 Normal shutdown

The machine shall be equipped with a shutdown device, to ensure that it can be safely and completely shut down.

The shutdown control of the machine shall take precedence over the starting control.

4.2.23.6.2 Emergency shutdown

The emergency shutdown device shall be installed in the comfortable operating area specified in GB/T 21935 and shall be able to stop all dangerous functions of the machine. The emergency shutdown device shall meet the requirements of GB/T 16754.

4.2.23.6.3 Restart after power interruption

If the spontaneous restart of the machine may be dangerous when the power is restored after interruption, such restart shall be prevented (such as using self-sustaining relays, contactors or valves).

4.2.23.6.4 Power source interruption

The design of the machine shall prevent dangerous conditions caused by power source interruption or excessive fluctuations. At least the following requirements shall be met:

- The machine can only be restarted manually by the operator;

- If a stop command is issued, the machine must shutdown;

- The parts or tools of the machine will not fall off or be thrown out;

- The function of automatically or manually shutting down the moving parts shall be effective;

- The protective devices and protective measures shall be effective.

The power interruption or the loss of pressure in the hydraulic and pneumatic systems shall ensure that there is no danger and shall not affect the function of the emergency shutdown device.

4.2.23.6.5 Control circuit failure

The control circuit failure or logic control failure shall not cause danger and meet the relevant safety requirements.

4.2.23.6.6 Remote control

The remote control of the machine shall comply with the provisions of GB/T 25686.

The operating function of the remote control device shall be consistent with the function of the control device on the machine.

4.2.23.6.7 Manual control

It shall follow the principles below:

a) The design and positioning of manual control devices shall comply with the principles of ergonomics;

b) The positioning of control devices and control positions shall enable the operator to observe the working area or danger zone as much as possible;

c) The design or protection of control actuators shall make them work only through active operation in risky situations;

d) For machine functions that rely on the operator's continuous and direct control to operate safely, measures shall be taken to ensure that the operator is in the control position (such as through the design and position of the control device).

For wireless control devices, the automatic shutdown function shall be executed when the correct control signal is not received, including loss of communication.

4.2.23.6.8 Selection of control and operating modes

If the design and construction of the machine allows for several control or operating

4.2.24 Hydraulic system

4.2.24.1 General

When designing and manufacturing hydraulic systems, they shall be able to withstand the load of the specified pressure and be designed in accordance with the provisions of GB/T 3766.

4.2.24.2 Hydraulic pipelines

Hard pipes and hoses shall be located in a position that minimizes damage and prevents contact with overheated surfaces, sharp edges and other sources of danger. Hoses and devices shall be able to be visually inspected. This requirement does not include hard pipes and hoses located in the frame.

4.2.25 Pneumatic system

The configuration of the pneumatic system shall comply with the safety requirements of GB/T 7932.

4.2.26 Warning devices

Warning devices such as signals shall be clear and easy to understand; operators shall be able to check all major warning devices at any time and conveniently.

4.2.27 Operating room

4.2.27.1 Dust

The amount of dust in the operating room shall not exceed 2 mg/m^3.

4.2.27.2 Noise

The noise in the operating room shall not exceed 85 dB(A).

The measurement method of noise in the operating room shall comply with the provisions of Appendix A.

4.3 General safety requirements for portable machines

4.3.1 Surfaces and edges

The accessible parts of the machine shall not have sharp edges, rough or abrasive surfaces.

4.3.2 Support surfaces and their stability

The machine shall be designed to be able to rest on any flat surface and remain stable.

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