

ICS25.120.30
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National Standard of the People's Republic of China

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Safety requirements for Foundry Machinery

(Draft for approval)

(Completion date of this draft: January 2004)

××××-××-×× Issue date

××××-××-×× Implementation date

**Issued by the General Administration of Quality Supervision, Inspection and Quarantine
of the People's Republic of China**

Foreword

This standard is compulsory in its entirety.

This standard is put forward by the China Machinery Industry Federation.

This standard is under the jurisdiction of the National Foundry Machinery Standardisation Technical Committee (SAC/TC186).

This standard is drafted by Qinhuangdao Chunguang Foundry Machine Company Limited, Jinan Foundry and Metalforming Machinery Research Institute and Tianshui Foundry Machinery Factory.

Main drafters of this standard: Jiang Yonglu, Lu Jun and Li Jianping.

This standard is issued for the first time on_____.

Safety requirements for Foundry Machinery

1 Scope

This standard specifies the safety requirements with which the design and manufacturing of foundry machinery must comply.

This standard is applicable to foundry machinery (hereinafter referred to as “the machine”).

2 Normative references

The clauses in the following documents become clauses of this standard after being referenced. In relation to dated reference documents, all subsequent amendments (excluding corrections) and revised versions do not apply to this standard; however, any parties that come to an agreement in accordance with the Standard are encouraged to study whether the latest versions of these documents are applicable. Where the references are not dated, their latest versions are applicable to the Standard.

GB2893—1982 safety colour

GB/T3766 General specification of hydraulic system (GB/T3766-2001, eqv ISO4413:1998)

GB4053.1 Safety requirements for fixed steel vertical ladders

GB4053.2 Safety requirements for fixed steel oblique ladders

GB4053.3 Safety requirements for fixed industrial protective railings

GB4053.4 Fixed industrial steel platform

GB5083 General rules for designing the production facilities in accordance with safety and health standards

GB5226.1-2002 Safety of machinery – Electrical equipment of machines – part 1: General requirements (IEC60204-1:2000, IDT)

GB 6222 Safety code for gas for industrial enterprises

GB/T7932 General technical specifications of pneumatic systems (GB/T7932-2003, ISO4414-82, REF)

GB9969.1 General principles for preparation of instructions for use of industrial products

GB/T13306 Nameplate

GB/T15706.1 Safety of machinery – Basic concept, general principles for design – Part 1: Basic terminology, methodology

GB/T15706.2-1995 Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles and specifications

3 General requirements

3.1 The design structure of the machine and its component parts should meet the GB5083, GB/T15706.1 and GB/T15706.2 standards and the requirements specified in this standard.

3.2 Exposed components and parts of the machine including ancillary devices installed on the machine should meet safety requirements.

3.3 During machine operation, dangerous conditions can arise whilst materials are being processed, such as the breaking of a mould or material which could cause loose fragments, loose bullets or spilt liquid, etc. In this case it is necessary to take the corresponding suggested protective measures, or to use the transparent protective cover, baffle, etc, bearing in mind the predicted load.

3.4 The machine should be set up with the corresponding devices for safety protection and prevention appropriate to its structural features, technological function and operating mode.

3.5 If necessary, a check for faults should be carried out on important components and parts of the machine.

3.6 The pneumatic system of the machine should meet the requirements relating to safety in GB/T7932.

3.7 The hydraulic system of the machine should meet the requirements relating to safety in GB/T3766.

3.8 The electrical system of the machine should meet the stipulations of GB5226.1.

3.9 The structure and all components and parts of the machine should have the required strength, resistance and stability. When produced, installed, transported and used under the specified conditions, they should not pose any danger to personnel.

3.10 When the power or control signal is interrupted, any braking, clamping, hoisting or falling, etc should be carried out as safely as possible.

4 Requirements for safety devices

4.1 General assembly principle

According to its structural features and operating mode, the machine should be equipped with at least one kind of suitable safety device in dangerous working areas, except in the following conditions:

- Oscillating parts of the machine move less than 6 mm;
- The machine is equipped with an exclusive feeding device;
- Installing a safety device would not reduce any risks.

4.2 Protective devices

4.2.1 Types of protective device

The following types of protective device exist: fixed protective device, movable protective device, adjustable protective device, interlocking protective device, interlocking protective device with protection locking, and controllable protective device, etc.

4.2.2 Requirements for protective devices

Protective devices should comply with the stipulations in clause 4.2, GB/T15706.2-1995.

4.3 Safety devices

4.3.1 Safety devices can be either devices operated by both hands (such as button devices operated by both hands) or automatic stop devices (such as light-type safety devices).

4.3.2 Button devices operated by both hands should comply with the stipulations of clause 5.5 of this standard.

4.3.3 Light-type safety devices should comply with the stipulations of the related standards.

5 Requirements for operating mechanisms

5.1 Manual operating mechanisms should be flexible and convenient to use and have a reliable positioning device.

5.2 For machines with several operating modes, the operating mode with key locking should be selected with the option switch. An alternation switch may also be used with key locking for all operating modes.

5.3 When the machine is completing a single operation the working parts should stop at the cutting off point specified in the design. Even if the start button is continuously pressed, the working parts should still not operate when the machine is in use.

5.4 The structure and installation position of the operating mechanism and button should

prevent the accumulation of sand, liquid, etc.

5.5 Buttons operated by both hands

5.5.1 For machines that may cause danger if they are operated with one hand (such as when using the core box, the sand head and the core-shooting machine for compaction), or for machines that must be operated by two or more operators jointly, it is necessary to provide buttons operated by both hands for each operator.

5.5.2 When using both hands it is necessary to press two start buttons simultaneously so that the control system can start up the working parts. If one button is locked in advance, the working parts should not be started.

5.5.3 When machines with oscillating working parts use buttons operated using both hands, both hands should continue to press the start button until it is impossible for both hands in the course of operation to enter the work danger area. If one or both buttons are released too early then the movement of the working parts should stop immediately.

5.5.4 The arrangement position of the button operated by both hands should ensure that it is impossible to operate it with one hand or with one hand and an elbow or knee, etc.

5.6 Foot operating device

5.6.1 The foot-operated device and the manual operating button should be connected.

5.6.2 The upper parts and both sides of the pedal parts of the foot operating device should have a protective cover.

5.6.3 There should be an anti-slip plate or non-slip mat in the pedal area.

5.6.4 The return spring of the pedal parts should use a compression spring with a guide bar or guide sleeve.

5.7 A single machine with an automatic line and automatic control is equipped with a controller (such as a handle and hand wheel, etc) that can manually move moving parts if required when there is sudden power failure or a fault.

5.8 Moving elements that may cause danger when simultaneously in use should have control mechanisms that are connected

5.9 Operating force

5.9.1 The operating force for frequently used handle and foot switches (including the operating mode for single direction of travel) should be no more than 40N.

5.9.2 The force for less frequently used handles, control bars and hand wheels, with an operation time of no more than 10 minutes for every shift, should be no more than 150N; with an operation time of no more than 25 minutes, the force should be no more than 80N.

5.9.3 The operating force of the machine's hydraulic systems should meet the stipulations of GB/T3766.

5.10 Emergency stop mechanism

5.10.1 Emergency stop mechanisms (such as button, handle, etc) should be installed on the machine, with the exception of emergency stop mechanisms that do not reduce risk.

5.10.2 Emergency stop mechanisms should be set in a position where it is easy for operators or staff that need to operate the machine to approach it without any risk.

5.10.3 If the machine is operated by many persons at once, every operating point should be equipped with an emergency stop mechanism.

5.10.4 Emergency stop mechanisms should stop the machine working under any operating condition, but should not cut off or interrupt clamping, braking or other devices whose operation could prevent an accident.

5.10.5 Emergency stop mechanisms should be self-locking. The colour of their operating parts should be red. If there is a colour behind the operating parts, this colour should be yellow. The operating parts of a button console switch should be of the palm or mushroom head type.

5.10.6 Before re-setting the emergency stop mechanism, make sure that the machine fails to operate and start.

5.11 The colour of the operating button should meet the stipulation in clause 10.2.1, GB5226.1-2002.

6 Requirements for moving parts

6.1 Moving parts and components that are often handled by personnel and that may cause harm should have a safety device installed. If it is impractical to install a safety device due to technical requirements, yellow and black alternate diagonal lines all with a width of 20mm~50mm must be painted on the end of moving parts and components and may only be painted yellow as required.

6.2 Electric motors that rotate in a single direction should be marked with an arrow showing the direction of motion in an obvious position.

6.3 The eccentric block of the electromotive vibration exciter should be firmly installed on the shaft and have a cover cap.

6.4 If the machine has an inverting or swinging mechanism, the operating space of this mechanism should be enclosed. If, in exceptional circumstances, enclosing fails, the surface of

the end of the inverting or swinging mechanism should be painted according to clause 6.1 in the stipulation, and equipped with a nameplate that clearly marks the actuation range of the mechanism.

6.5 The revolving platform should have a revolving localiser and an obviously placed caution notice.

7 Requirements for brake safety devices

7.1 When the machine actuating mechanism needs adjustment and this could be dangerous, a reliable safety device should be installed on the machine.

7.2 Machines or mechanisms that need a specific pressure, temperature, current, etc should have an indicating instrument installed, which should be easily visible to the operators.

7.3 Parts that are moved by hand should be installed using protective measures to prevent falling, and this should be written clearly in the operating instructions for the machine.

7.4 Moving parts with a cover should have a self-locking device (such as the sand throwing wheels of throwing machines, shot blasting mechanisms, etc) that makes the open cover stop moving, or should be installed with a plate indicating the danger of the cover opening or the instruction that opening is permitted after the actuating device is cut off.

8 Requirements for clamping devices

8.1 Devices for clamping or matched mould locking should be equipped with a self-locking device or control device that ensures the clamped tool can carry out the next operation (such as shooting sand or casting) after complete closing, and also that it will not open during operation, so as to prevent sand from blasting and molten metal from spraying and overflowing.

8.2 Clamping devices should be equipped with a self-lock or control device that ensures clamped tools cannot be opened when the pressure in the capacity chamber (including the pressure chamber connecting to it) of clamped tools (core box, metal mould, etc) fails to fall completely or reach the specified time limit.

8.3 In the case of sudden power failure or if the pressure of the pneumatic and hydraulic systems falls during operation, the clamping device should be kept gripped, or a safety device should be installed.

9 Requirements for hydraulic and pneumatic devices and pipeline and pressure vessels

9.1 The pressure gauges of pneumatic and hydraulic systems should be installed where they can be easily seen by operators. Protective measures must be taken and there must be a signal display for sudden decompression or interruption of air and hydraulic pressure.

9.2 A safety device that prevents hydraulic pressure from overloading should be equipped in the hydraulic system.

9.3 After the hydraulic pump starts, it is necessary to ensure that working parts will not move if the work button is not operated.

9.4 The design and production of pressure vessels, including all kinds of accumulators, should comply with the stipulations of safety standards relating to pressure vessels.

10 Requirements for lubricating, water cooling and other systems

10.1 The lubricating channel should run smoothly. The pipeline and connection should not leak. It is necessary to ensure that the lubrication system will not allow oil droplets to splash out of the machine.

10.2 The cooling system should ensure that cooling fluid does not drip into the pouring basin or the container with metallic solution or metal intracavity.

10.3 The cooling fluid, lubricant and treatment fluid must not cause pollution or slippery surfaces in working areas. A dead volume of cooling fluid should not accumulate on the machine.

10.4 During work, machines such as water-cooling and other systems may not be interrupted in the event of power failure of the machine. Ancillary devices that maintain water-cooling and other systems must continue to work normally.

10.5 The centralised lubricating system should be sealed to prevent lubricating fluid from leaking onto the ground.

11 Requirements for working platforms, ladders and railings

11.1 If it is necessary to carry out any operations, repairs or other maintenance at over 3 m above the ground, a platform and ladder should be installed. The floor planks of the platform should be non-slip and it should be surrounded by railings with a height of no less than 1050 mm. The steps of the ladder should be non-slip.

11.2 The design of the ladder, platform and protective railings should meet the related stipulations of GB4053.1~4.

12 Requirements for maintenance of structure

12.1 Positions that need frequent lubricating, cleaning, adjusting and maintaining should be easy to operate.

12.2 The structure of the machine should meet the requirements for safe loading and unloading when replacing faulty components and parts.

12.3 The liquid storing vessel, hydraulic cylinder, etc in the hydraulic system of the machine should discharge treatment fluid completely.

12.4 If a dangerous area must be entered to carry out repair, maintenance or adjustment, a self-locking device that cuts off the power supply must be provided. If the safety protection device of the original device fails to take effect at this moment other safety protection measures must be taken.

12.5 For easy maintenance of parts of the machine below ground level, the width and depth of the pit must be sufficient, and the same should be indicated in the operating instructions of the machine accordingly.

13 Environmental, safety at work and area lighting requirements

13.1 For machines that release harmful substances (dust, smog, harmful gas, etc), shields to aid discharge or a reliable connection to centralised ventilation and an absorption system in the workshop must be installed. Site ventilation or absorption shields for all kinds of foundry machinery should meet the stipulations of the appropriate technical specifications, and should be written clearly with necessary information such as the necessary wind speed, air quantity or dust removal efficiency, etc. When the machine is in operation, the ventilation and dust removal devices should be put into operation immediately and the self-locking device of the

machine should be turned on if the ventilation and absorption devices close.

13.2 Machine noise should meet the stipulations of the corresponding technical specifications. Methods of noise measurement should also meet the stipulations of corresponding standards.

13.3 Effective vibration reducing measures should be taken in the working area of the machine.

13.4 The working area of the machine should have a site lighting device that meets requirement 16.2 in GB5226.1-2002.

14 Requirements for when the machine uses combustible, explosive and corrosive substances

14.1 Devices transporting harmful substances should be made of anti-corrosive material and must not leak.

14.2 Devices that mix or store combustible materials should be separately installed in an area that meets the requirements of anti-explosion and anti-fire regulations. All electric motors and electrical equipment used on these machines must be of the anti-explosion type.

14.3 Mixing devices that use corrosive solutions should be installed with a closing cap and indicating gauge for liquid volume that ensures the safety of supervisors and should have an emergency alarm.

14.4 Devices that require gas heating should meet the related safety specifications of GB6222. Devices that use gas heating should have enough space for free circulation of air.

15 Other requirements

15.1 The appearance and colour of the machine should meet the requirements of structural aesthetics.

15.2 Factors such as safety, convenience and durability should be taken into consideration for the working site.

15.3 All attachments should be fixed firmly and should not loosen when the machine operates; effective safety measures must be taken for components and parts that could loosen when they move, and to prevent any loosening or danger caused by starting, braking, reversing or impacts, etc.

15.4 Any machine requiring sampling during operations must be safe for sampling.

16 Safety mark and indication

16.1 General requirements

Any kind of safety and alarm indication on the machine should be marked clearly in an appropriate position on the machine. Warning signs, nameplates, tags and identification plates should be durable and should withstand different environments.

16.2 Indicator on operation panel

There should be indicators that display the safe running, operating state, any fault, and any other related information on the operation panel of the machine.

16.3 Warning signs

Any parts of the machine which pose a risk of electrocution should have warning signs. Warning signs should meet the stipulations of chapter 17 in GB5226.1-2002.

16.4 Safety colour

Any working parts of the machine and positions that could easily cause collisions or the clamping or crushing of operators should be painted with a safety colour line of alternating black and yellow according to stipulation 2.5 in GB2893-1982, and may also be painted yellow if required.

16.5 Colour of indicator signal

The colour of the indicator signal should meet the stipulation 10.3.2 in GB5226.1-2002.

16.6 Nameplate

The nameplate of the machine should meet the stipulation of GB/T13306 and should display clearly at least the following information:

- Model and basic parameters;
- Name and address of manufacturer;
- Ex-factory year and number

17 Operating instructions

The machine should have operating instructions compiled according to the stipulations of GB9969.1.

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