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Metal-cutting Machine Tools – General Protection Specification

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Jointly issued by: General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ); Standardization Administration (SAC) of the People's Republic of China.

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Foreword

Chapter 4, 5.3.6, f) of 5.5.1, 5.7, 5.9, 5.10, 5.11.1, 5.11.4, 5.12 (except 5.12.3.2), 5.17, 5.18, 5.19.1, and 5.19.2 of this Standard are recommendatory; the rest are compulsory.

This Standard replaces GB 15760-1995 "Metal-cutting machine tools-General protection specification". GB 15760-1995 shall be abolished simultaneously, from the implementation date of this Standard.

Compared with GB 15760-1995, the main changes of this Standard are as follows:

— The arrangement order is adjusted according to the modes specified in GB/T 16755-1997 "Safety of Machinery-Rules for Drafting and Presentation of Safety Standards";

— The application range is enlarged; and machine tool accessories are brought in (Chapter 1 of edition 1995; Chapter 1 of this edition);

— "Machine tools danger" is added (see Chapter 4);

— Abnormal temperature, vibration, radiation, substance and material, ergonomics, assembly error, measurement, adjustment, clean, as well as maintenance are added (See 5.7, 5.9, 5.10, 5.11, 5.12, 5.14 and 5.20);

— Functions and type requirements of safety-related part of control system are added (See 5.4.2);

— Installation height limit of push button station and display are added (See 5.12.2.3.2 and 5.12.3.1.2);

— Storage contents are added (See 5.19.2);

— Verification contents are added (See Chapter 5);

— The chapter "Information for use" is added (See Chapter 6);

— "Bibliography" is added;

— "Electrical system" is materialized (Section 8.1 of edition 1995; Section 5.3 of this edition);

— "When machine tool stops, independent feed transmission shall not stop later than main movement" is deleted (Article 5.2.6 of edition 1995);

— Annex A is deleted (Annex A of edition 1995).

Since July 1, 2005, manufacturers shall design and manufacture new products in accordance with this Standard. The transition period of old products designed and manufactured before July 1, 2005 shall be 12 months. Since July 1, 2006, products which do not comply with this Standard shall not be sold on the market.

This Standard was proposed by China Machinery Industry Federation.

This Standard shall be under the jurisdiction of National Technical Committee on Metal Cutting Machine Tools of Standardization Administration of China (SAC/TC 22).

Drafting organization of this Standard: Beijing Machine Tool Research Institute

Chief drafting staffs of this Standard: Zhang Wei, Li Xiangwen, and Xun Guangwu.

Historical edition replaced by this Standard is as follows:

GB 15760-1995.

Metal-cutting Machine Tools – General Protection Specification

1 Scope

This Standard specifies the basic protection technical requirements & measures and verification methods that are adopted for main dangers in metal-cutting machine tools (hereinafter referred to as machine tools) and the accessories.

This Standard is applicable to all machine tools and accessories.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For dated reference, subsequent amendments (excluding correction) or revisions of these publications do not apply. However, the parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards. For undated references, the latest edition of the normative document referred to applies.

GB/T 191 Packaging - Pictorial Marking for Handling of Goods (GB/T 191-2000, eqv ISO 780: 1997)

GB 1251.1 Danger signals for work places - Auditory danger signals (GB 1251.1-1989, eqv ISO 7731: 1986)

GB 1251.2 Ergonomics-Visual danger signals - General requirements, design and testing (GB 1251.2-1996, eqv ISO/DIS 11428: 1992)

GB 1251.3 Ergonomics - System of danger and non-danger signals with sound and light (GB 1251.3-1996, eqv ISO/DIS 11429: 1992)

GB 2893 Safety colors (GB 2893-2001)

GB 2894 Safety signs (GB 2894-1996, neq ISO 3864: 1984)

GB/T 3167 Symbols for indications appearing on machine tools (GB/T 3167-1993, neq ISO 7000: 1984)

GB/T 3168 Numerical control of machine - Symbols (GB/T 3168-1993, neq ISO 2972: 1979)

GB 5226.1-2002 Safety of machinery-Electrical equipment of machines - Part 1: General requirements (idt IEC 60204-1: 2000)

GB/T 6576 Machine tools - Lubrication systems (GB/T 6576-2002, ISO 5170: 1977, MOD)

GB 7247.1 Safety of laser products--Part 1: Equipment classification, requirements and users guide (GB 7247.1-2001, idt IEC 60825: 1993)

GB/T 7932 Pneumatic fluid power - General rules relating to systems (GB/T 7932-2003/ISO 4414: 1998, ISO 4414: 1998, IDT)

GB/T 8196 General Requirements for the Design and Construction of Fixed and Movable Guards (GB/T 8196-2003, ISO 14120: 2002, MOD)

GB 9969.1 General principles for preparation of instructions for use of industrial products (GB 9969.1-1998)

GB 12265.1 Safety of machinery - safety distances to prevent danger zones being reached by the upper limbs (GB 12265.1-1997, eqv EN 249: 1992)

GB 12265.2 Safety of machinery - Safety distances to prevent danger zones being reached by the lower limbs (GB 12265.2-2000, eqv EN 811: 1994)

GB 12265.3 Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (GB 12265.3-1997, eqv EN 349: 1993)

GB/T 13379 Principles of visual ergonomics - The lighting of indoor work systems (GB/T 13379-1992, neq ISO 8995: 1989)

GB/T 14775 General ergonomics requirements for controller (GB/T 14775-1993)

GB/T 14776 Ergonomics - Principles for determining dimensions of work places in manufacturing areas and the dimensions (GB/T 14776-1993)

GB/T 15241.2 Ergonomic principles related to mental workload - Part 2: Design principles (GB/T 15241.2-1999, idt ISO 10075-2: 1996)

GB/T 15706.1-1995 Safety of machinery - Basic concept, general principles for design - Part 1: Basic terminology, methodology (eqv ISO/TR 12100-1: 1992)

GB/T 15706.2-1995 Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications (eqv ISO/TR 12100-2: 1992)

GB/T 16251 Ergonomic principles in the design of work systems (GB/T 16251-1996, eqv ISO 6385: 1981)

GB 16754 Safety of machinery - Emergency stop - Principles for design (GB 16754-1997, eqv ISO/IEC 13850: 1995)

GB/T 16769 Metal-cutting machine tools - Measurement method of sound pressure level (GB/T 16769-1997)

GB/T 16855.1-1997 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (GB/T 16855.1-1997, eqv prEN 954-1: 1994)

GB/T 16856 Safety of machinery - Principles for risk assessment (GB/T 16856-1997, eqv prEN 1050-12: 1994)

GB/T 17161 Machine tools - Direction of operation of controls (GB/T 17161-1997, eqv ISO 447: 1984)

GB/T 17454.1 Safety of machinery - Pressure-sensitive protective devices - Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors (GB/T 17454.1-1998, neq prEN 1760-1: 1994)

GB 17888.1 Safety of machinery - Permanent means of access to machinery - Part 1: Choice of a fixed means of access between two levels (GB 17888.1-1999, eqv ISO/DIS 14122-1: 1996)

GB 17888.2 Safety of machinery - Permanent means of access to machinery - Part 2: Working platforms and walkways (GB 17888.2-1999, eqv ISO/DIS 14122-2: 1996)

GB 17888.3 Safety of machinery - Permanent means of access to machinery - Part 3: Stairs stepladders and guard-rails (GB 17888.3-1999, eqv ISO/DIS 14122-3: 1996)

GB 17888.4 Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders (GB 17888.4-1999, eqv ISO/DIS 14122-4: 1996)

GB/T 18153 Safety of machinery - Temperatures of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces (GB/T 18153-2000, eqv EN 563: 1994)

GB 18209.1 Safety of machinery - Indication, marking and actuation - Part 1: Requirements for visual, auditory and tactile signals (GB 18209.1-2000, idt IEC 61310-1: 1995)

GB 18209.2 Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (GB 18209.2-2000, idt IEC 61310-2: 1995)

GB 18209.3-2002 Safety of machinery - Indication, marking and actuation - Part 3: Requirements for the location and operation of actuators (GB 18209.3-2002, idt

IEC 61310-3: 1999)

GB/T 18569.1 Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufacturers (GB/T 18569.1-2001, eqv ISO 14123-1: 1998)

GB/T 18569.2 Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery - Part 2: Methodology leading to verification procedures (GB/T 18569.2-2001, eqv ISO 14123-2: 1998)

GB/T 18717.1 Ergonomic design for the safety of machinery - Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery (GB/T 18717.1-2002, neq ISO 15534-1: 2000)

GB/T 18717.2 Ergonomic design for the safety of machinery - Part 2: Principles for determining the dimensions required for openings for access of parts of the body into machinery (GB/T 18717.2-2002, neq ISO 15534-2: 2000)

GB/T 18717.3 Ergonomic design for the safety of machinery - Part 3: Anthropometric data (GB/T 18717.3-2002, neq ISO 15534-1: 2000)

GB/T 18831 Safety of machinery-Interlocking devices associated with guards - Principles for design and selection (GB/T 18831-2002, ISO 14119: 1998, MOD)

JB/T 5062 Information display equipment - The general require of man-machine engineering (JB/T 5062-1991)

JB/T 8356.1 Machine tool - Specification for products packaging (JB/T 8356.1-1996)

JB/T 8356.2 Machine tool - Packing box (JB/T 8356.2-1996)

JB/T 8356.3 Medium and small wooden boxes for packing machine tools (JB/T 8356.3-1996)

JB/T 9878 Metal-cutting machine tools - Determination method of dust concentration (JB/T 9878-1999)

JB/T 9879 Metal cutting machine tools - Determination method of oil mist concentration (JB/T 9879-1999)

JB/T 10051 Hydraulic system general specifications for metal-cutting machine tools (JB/T 10051-1999)

3 Terms and Definitions

The following terms and definitions as well as those defined in GB/T 15706.1-1995

are applicable to this Standard.

3.1

Safety of machine tools

It refers to that the machine tools do not cause personnel injury or health hazard and equipment damage during operation, transportation, installation, adjustment, maintenance, disassembly and treatment, under the predetermined usage conditions (or given period) specified in the instructions.

Note: Predetermined usage refers to the reasonable usage of the machine tool according to the information supplied by the manufacturer. Predetermined usage shall be consistent with the instructions, and foreseeable misuses shall be taken into proper consideration.

3.2

Machine tools danger

It refers to the conditions that cause personnel injury or health hazard and equipment damage, under the still or operating state of machine tools.

3.3

Risk

It is the combination of probability and degree of damage or health hazard under the danger state.

[Section 3.7 of GB/T 15706.1-1995]

3.4

Machine tools danger zone

It refers to the area that may cause personnel injury and equipment damage under the still or operating state of machine tools.

3.5

Machining area

It refers to the area where is passed by the cut-workpiece on the machine tool.

3.6

Working area

It refers to the area where may appear in the working process, including the positions

relevant requirements of Chapter 5 and Chapter 6 of GB/T 15706.1-1995 and GB/T 16856.

Note: For the dangers not referred to in this Standard, safety measures shall be adopted according to the relevant requirements of GB/T 15706.2-1995.

4.2 During the danger analysis, special attention shall be paid to the dangers caused by the foreseeable misuses (see Article 3.12 of GB/T 15706.1-1995) of operators and other personnel, including:

— Machine tool usage period;

— Machine adjustment, clean and maintenance period.

4.3 Main potential dangers of machine tools are detailed in Table 1.

pulley, belt, worm wheel, worm, shaft, screw rod, chip removal device) that may cause winding, inhaling or involving dangers shall be sealed or set with protection or information for use, unless their locations are safe.

Verification: visual inspection and/or inspecting information.

5.2.3.2 Extrusion danger and/or shearing danger shall not exist between moving parts or between moving part and stationary part, otherwise safety measures shall be adopted according to the relevant requirements of GB 12265.3.

Verification: inspecting drawings, visual inspection and/or inspecting information.

5.2.3.3 Reliable stop blocks shall be arranged for the engine-driven reciprocating parts with inertia impact; if necessary, reliable buffering measures may be adopted. If it is difficult to set stop blocks, necessary safety measures shall be adopted.

Verification: visual inspection and/or inspecting information.

5.2.3.4 Overload safety devices shall be set for the moving parts that may be damaged due to overload. When the safety devices can not be set due to structure reasons, extreme usage conditions of machine tools shall be marked on the machine tools (or instructions).

Verification: inspecting drawings, visual inspection or inspecting information.

5.2.3.5 Locking devices shall be set for the parts and components that may loose during the movement.

Verification: inspecting drawings and/or visual inspection.

5.2.3.6 Rotation direction shall be marked in prominent positions for the components in unidirectional rotation.

Verification: visual inspection.

5.2.3.7 During the emergency stop or dynamical system malfunction, moving part shall stop on the spot or return to the design-specified position; sinkage of vertically or obliquely moving parts shall not cause danger.

Verification: visual inspection.

5.2.3.8 When the moving parts are not allowed to move simultaneously, the control mechanism shall be interlocked. For those that can not be interlocked, warning sign shall be set nearby the control mechanism and stated in the instructions.

Verification: visual inspection and/or inspecting information.

5.2.4 Holding device

Verification: visual inspection or inspecting information.

5.2.4.7 When pneumatic holding devices adopted, chip and dust shall be avoided from blown toward the operator.

Verification: visual inspection and/or inspecting information.

5.2.5 Balancing device

5.2.5.1 Complete protection measures (e.g. placing the balance weight in the machine tool or in the fixed guard) shall be adopted for the dangerous balance weight related to machine tool components and their movement, to prevent danger caused by fracture of balance weight system elements.

Verification: visual inspection, inspecting information.

5.2.5.2 Dynamic balance device shall be adopted to prevent the machine tool components from falling when the dynamical system malfunctions.

Verification: visual inspection, inspecting information.

5.2.6 Automatic loading and unloading device

When the automatic loading and unloading devices are adopted, fixed guard, interlocked movable guard or warning sign shall be set.

Verification: visual inspection and/or inspecting information.

5.2.7 Tool changer and tool changing device

When tool changers and tool changing devices are adopted, fixed guard, interlocked movable guard or warning sign shall be set, unless their locations are safe.

Verification: visual inspection and/or inspecting information.

5.2.8 Chip removal device

Chip removal devices shall not be dangerous to the operator; if necessary, it may be interlocked with the open of guard and stop of machine tool operation.

Verification: visual inspection and/or inspecting information.

5.2.9 Working platform, passage and opening

5.2.9.1 Machine tools can not be operated on the ground; it shall be equipped with steel ladder and working platform. Platform and passage shall be anti-skidding and anti-falling. The operators shall try not to approach the machine tools danger zone. If necessary, pedal and handrail may be set. Steel ladder, handrail and platform shall

Verification: visual inspection, inspecting technical documents, residual voltage test.

5.3.3 Conducting wire, cable and wiring

Conducting wire, cable and wiring of electrical system shall meet the following requirements:

a) Conducting wire and cable shall meet the relevant requirements of Chapter 13 of GB 5226.1-2002;

b) Wiring shall meet the relevant requirements of Chapter 14 of GB 5226.1-2002;

Verification: visual inspection.

5.3.4 Motor

Motor shall meet the relevant requirements of Chapter 15 of GB 5226.1-2002;

Verification: visual inspection.

5.3.5 Static electricity

Electrical equipment shall be prevented or limited from electrostatic discharge; if necessary, it may be equipped with discharge devices.

Verification: visual inspection.

5.3.6 Electromagnetic compatibility

Electromagnetic compatibility of electrical equipment should meet the relevant requirements of Article 4.4.2 of GB 5226.1-2002.

Verification: the supplier providing corresponding certification or test.

5.4 Control system

5.4.1 General requirements

Besides the requirements of Articles 5.4.2 ~5.4.10 of this Standard, it shall comply with the relevant requirements of Chapter 5, Chapter 9, Chapter 10 and Chapter 12 of GB 5226.1-2002, Section 3.7 and Section 3.10 of GB/T 15706.2-1995, as well as GB/T 16855.1-1997.

Verification: inspecting electrical drawing, visual inspection, functional inspection, and/or inspecting information.

5.4.2 Safety and reliability of control system

e) For machine tools in all working areas can not be observed in the operating position, visual or auditory start warning signal device or warning message shall be set, so that the personnel in the working area can timely evacuate or rapidly prevent starting;

f) The machine tool with more than one operating positions shall be equipped with control interlocking device.

Verification: visual inspection, functional inspection and/or inspecting information.

5.4.4 Start

Machine tool starting shall meet the following requirements:

a) Machine tool can start under the factitious start-up control, including:

1) Re-start after stopping;

2) Operation conditions (such as speed and pressure) have significant changes.

Note: When normal automatic control program, re-start or operation condition changes will not cause danger to personnel, the above requirements may not need to be complied with.

b) When movable guard is closed, machine tool shall not start immediately.

c) When movable guard is disconnected, machine tool shall not start accidentally.

d) When there are several starting devices, selection devices shall be set to ensure that only one starting device functions at any time.

Verification: functional inspection.

5.4.5 Stop

Machine tools shall be equipped with stopping devices which shall be located nearby each starting device. Machine tool stopping shall meet the following requirements:

a) When the stopping device is pressed down, the movement of machine tools shall be able to stop entirely and safely;

Note: Stopping device may stop part or entire of machine tool operation, due to different danger conditions of various machine tools.

b) When the machine tool movement stops, the energy supply of actuating mechanism shall be cut off and there shall be no potential energy and/or kinetic energy on the "downstream" of cutoff point.

device shall be set, and each selected mode shall be corresponding to only one operation or control mode.

Under some working or operating mode, operation may be carried out when protection is disconnected or invalid; and mode selection controls shall meet the following requirements:

a) Invalid automatic control mode;

b) Machine tools can actuate under further control command (with command sequence);

c) Under the special safety measures (such as speed reduction, power reduction or other measures), machine tools danger moving parts can operate;

d) Machine tools operation, directly or indirectly through sensor control, shall be able to avoid any dangerous movement.

Verification: visual inspection, functional inspection and/or inspecting information.

5.4.8 Maintenance-operation

Maintenance-operation shall be able to continuously motivate until operation completion.

Verification: functional inspection.

5.4.9 Numerical control system

Numerical control system shall meet the relevant requirements of Chapter 11 of GB 5226.1-2002 and the following requirements:

a) Meeting the expected operating conditions and environmental impacts;

b) Setting access password or key switch to prevent the procedures from being modified on purpose or accidentally;

c) Safety-related software is not allowed unauthorized changes.

Verification: visual inspection, functional inspection and/or inspecting information.

5.4.10 Control system fault

Control system faults shall not result in dangers, especially:

a) Machine tools shall not start accidentally;

b) Moving parts shall not change speed out of control;

It shall be fixed or linked firmly; removable parts can only be disassembled with instruments.

Verification: visual inspection.

5.5.2.2 Movable guard

Movable guard shall meet the following requirements:

a) Fixed by gravity, clip, bolt, hinge or guide rail;

b) Shall try to keep relatively fixed with the machine tools when opened;

c) Some auxiliary devices can only be disassembled with instruments;

d) When interlocked movable guard is adopted, machine tools can not start before guard is closed; machine tools shall stop (except the adjustment state) once guard is started;

e) If necessary, protection lock may be set.

Verification: visual inspection, functional inspection and/or inspecting information.

5.5.2.3 Adjustable guard

For the entirely or partly adjustable fixed or movable guard, during the specified operating period, adjustable parts shall be able to keep fixed, and can be adjusted conveniently without instruments.

Verification: visual inspection.

5.5.3 Safety device

5.5.3.1 Interlocking device

Interlock protection of interlocking device shall meet the relevant requirements of Section 9.3 of GB 5226.1-2002.

Verification: inspecting drawings, functional inspection.

5.5.3.2 Stop block

Stop block of machine tools shall try to be installed to the proper position free from vibration and influence, and the actuation shall be reliable.

Verification: visual inspection, functional inspection.

5.5.3.3 Pressure-sensitive device

health.

Verification: visual inspection and/or feeling by hands.

5.10 Radiation

5.10.1 Electric arc and ion chemical radiation

Safety measures shall be adopted according to the requirements of Article 4.4.7 of GB 5226.1-2002 to avoid danger caused by ion chemical radiation during electric arc and short circuit.

Verification: visual inspection and/or inspecting information.

5.10.2 Laser

Laser facility used in machine tools shall meet the relevant requirements of GB 7247.1 and the following requirements:

a) Guard shall be set to prevent personnel from contacting the laser radiation (including reflect, diffusion and secondary radiation);

b) When movable or removable guard is adopted, interlocking guard shall be adopted;

c) Operators shall be trained;

d) If necessary, the operators are suggested to wear personal protection devices.

Verification: visual inspection and/or inspecting information.

5.11 Substance and material

5.11.1 General requirements

Substance and material used and discharged by machine tools shall meet the relevant requirements of GB/T 18569.1 and GB/T 18569.2.

Verification: visual inspection and/or inspecting information.

5.11.2 Harmful substance

5.11.2.1 Liquid

Liquid used by machine tools shall meet the following requirements:

a) Selection of cooling fluid shall ensure the normal work of machine tools and shall not influence human health;

c) Flame resistance protection of electrical equipment shall meet the relevant requirements of Section 7.4 and Article 13.3 of GB 5226.1-2002.

Verification: visual inspection and/or inspecting information.

5.11.4 Organism and microorganism

Oil tank and cooling box of machine tools shall be convenient for cleaning. Oil tank and cooling box should be covered to prevent the extraneous matter from entering. The users shall be reminded to replace cooling fluid and oil fluid regularly.

Verification: visual inspection and/or inspecting information.

5.11.5 Splash

Slipping and injury danger caused by cooling fluid and chip splash shall be avoided. If the protection in the machining area is insufficient to prevent splashing to the operators, additional apron shall be set, or the users shall be reminded to set additional apron according to the shape and dimension characteristics of the machined work-pieces.

Verification: visual inspection and/or inspecting information.

5.12 Ergonomics

5.12.1 General requirements

Ergonomics design of machine tools shall meet the following requirements:

a) Working strength, movement amplitude, visibility and posture shall be appropriate to human ability and limit, and shall meet the relevant requirements of GB/T 16251;

b) Working position shall be appropriate to the body dimension, work category and posture of operators, and shall meet the relevant requirements of GB/T 14776;

c) Interference, tension, physiology or mentality danger shall be avoided during operation, and the relevant requirements of GB/T 15241.2 shall be met;

d) When the machine tools operation may cause injury, the users shall be reminded to adopt personal protection devices.

Verification: visual inspection, actual measurement and/or inspecting information.

5.12.2 Operation pieces

5.12.2.1 General requirements

Operation pieces shall meet the relevant requirements of Section 10.1 of GB 5226.1-2002 and GB 18209.3-2002 as well as the following requirements:

a) Operators shall be able to judge if the final effect is realized (direct or through feedback / answering device);

Note: Final effect refers to the expected results (see Section 3.3 of GB 18209.3-2002) required to be reached by the operators during operation.

b) The operation direction of operation pieces shall be consistent with the final effect and shall meet the relevant requirements of GB/T 17161.

Note: For the operation pieces of some machine tools (such as grinding machine), the operation direction and final effect may be in accordance with the general specification.

c) The relative position of operators and machine tools may be changed (such as remote control, portable and suspended operating devices). When the movement direction changes of machine tools are clear, the marks (correspondent to the operation symbols and/or colors on operation pieces) shall be stuck on or nearby the moving parts of machine tools;

d) When the peripheral speed is greater than 20m/min, both engine-driven and manually-operated operation pieces shall be automatically disconnected with the rotating shaft, or the operation pieces without spokes and handles shall be adopted;

Note: disconnected operation pieces may generate temporary swing due to inertial effect.

e) Mirror symmetry arrangement shall be avoided;

f) Positions starting operation pieces shall make the operators see the controlled objects during manipulation;

g) Operation pieces shall be combined logically according to the operation relationship or functional relationship of controlled objects;

h) Operation pieces shall try to avoid the danger of unexpected operation, and the following measures may be adopted:

1) Indenting or covering;

2) Increasing operating force;

3) Setting safety device (such as locking device);

4) Placing in the place free from accidental crash;

c) Efficiency of signals shall be inspected regularly.

Verification: functional inspection and/or inspecting information.

5.13 Lighting

5.13.1 The operators are endangered due to insufficient light during the operation of machine tools, local lighting devices ensuring the safe working of machine tools shall be provided.

Verification: visual inspection.

5.13.2 Design and installation of lighting devices shall meet the relevant requirements of Chapter 16 of GB 5226.1-2002 and GB/T 13379 as well as the following requirements:

a) Lightening in the working area shall be reliable;

b) Stroboscopic effect, blinding phenomenon and shadow area shall be avoided;

c) Lamp and light pollution shall be as little as possible;

d) Convenient maintenance;

e) Illumination shall be at least 500 lx.

Verification: visual inspection, actual measurement and/or inspecting information.

5.14 Assembly error

Dangers caused by assembly errors or re-assembly errors shall be avoided, or:

a) Operation direction shall be marked on or nearby the moving parts;

b) Marks shall be marked on conduit, conducting wire, cable, liquid or gas pipe fittings, and/or connecting pieces.

Verification: visual inspection and/or inspecting information.

5.15 Hydraulic system

Hydraulic system shall meet the relevant requirements of JB/T 10051 and the following requirements:

a) Hydraulic system shall be equipped with safety valves preventing overpressure or relief valves adjusting pressure changes;

b) Hydraulic system shall be able to bear the maximum working pressure

5.17 Lubrication system

Lubrication system shall meet the relevant requirements of GB/T 6576 and the following requirements:

a) Oil level indicator shall be set in the place convenient for observation;

b) Manual lubrication points on the machine tools and accessories shall be marked and convenient for operation;

c) Only when the hydraulic system and lubrication system use the same oil, they can be mixed, but the impurities must be removed.

Verification: visual inspection.

5.18 Cutting cooling system

Cutting cooling system shall meet the requirements of Article 5.11 of this Standard and the following requirements:

a) Machine tools shall contain and effectively recover the cooling fluid as possible;

b) Devices for fixing the nozzle of cooling fluid shall be conveniently, safely and reliably fixed on the required position;

c) Position of cooling fluid or flow controller shall ensure the safety of operator during adjustment.

Verification: visual inspection.

5.19 Package, storage and transportation

5.19.1 Package

Package of machine tools shall meet the following requirements:

a) Pictorial marking for handling and packaging of goods shall meet the relevant requirements of GB/T 191;

b) Package and packing box of machine tools shall meet the relevant requirements of JB/T 8356.1 ~ 8356.3.

Verification: visual inspection and/or inspecting information.

5.19.2 Storage and transportation

Storage of machine tools shall meet the following requirements:

Verification: visual inspection and/or inspecting information.

6 Information for Use

6.1 General requirements

6.1.1 Information for use shall inform and warn the operators the relevant residual risks.

6.1.2 Information for use (such as various signals, characters and warning signs) may be provided by the machine tools, accompanying documents and other modes.

6.1.3 Accompanying documents shall meet the relevant requirements of Chapter 18 of GB 5226.1-2002, GB 9969.1 and Section 5.5 of GB/T 15706.2-1995.

6.1.4 Information for use and accompanying documents shall be written in normal simplified Chinese.

6.1.5 Information for use and attachment paper shall be compiled in accurate, popular and easy-to-understand language.

6.1.6 Marks of electrical equipment of machine tools shall meet the relevant requirements of Chapter 17 of GB 5226.1-2002. The following distinct and durable marks shall be provided at least on the machine tools:

a) Manufacturer's name;

b) Machine tool name and machine tool type;

c) Date of production and/or factory number;

d) Various certification marks (if any).

6.2 Safety instructions

6.2.1 Manufacturer shall provide safety instructions for each machine tool.

6.2.2 Safety instructions may be compiled independently, or as part of usage and maintenance instructions.

6.2.3 Warning contents in the safety instructions shall be expressed in larger font size or different font, or emphasized in special symbol or color.

6.2.4 Safety instructions shall at least include the following contents:

a) Predetermined purposes, safety performances, safety precautions, requirements and responsibilities of machine tools, including:

e) Describing safety in preference to health.

f) Avoid frequent repeat and false warning to weaken the warning efficacy.

6.3.3 Medium and high danger warning sign shall be reliably fixed on the corresponding prominent positions of machine tools.

6.3.4 Positions of safety warning signs shall be indicated in the safety instructions to attract the attention of operators.

7 Responsibility

7.1 Manufacturer

7.1.1 Manufacturers shall be responsible for the eliminated and/or controlled dangers in design and structure of supplied machine tools and accompanying auxiliary equipment.

7.1.2 Manufacturer shall be responsible for the supplied machine tools and accompanying auxiliary equipment.

7.1.3 Manufacturers shall be responsible for the information for use and suggestion to the users.

7.2 User

7.2.1 Users shall pass the safety operation machine tool training, as well as be familiar with and grasp safety operation machine tool contents.

7.2.2 Users shall be responsible for the safety and danger of the clamp, frock and auxiliary equipment they added, as well for the safety and danger after they changed or revised the original machine tools, frock and auxiliary equipment.

7.2.3 Users shall be responsible for the dangers caused by operation, adjustment, maintenance, installation, storage and transportation of machine tools not conforming to the requirements of the instructions.

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