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GB 15760-2004
Replacing GB 15760-1995

Metal-cutting Machine Tools – General Safeguarding Specification

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General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China （AQSIQ）and
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CONTENTS

INTRODUCTION

All stipulations laid down in this standard are binding except those in Section 4, f) under 5.3.6, and 5.5.1, 5.7, 5.9, 5.10, 5.11.1, 5.11.4, 5.12 (excluding 5.12.3.2), 5.17, 5.18, 5.19.1 and 5.19.2.

This standard replaces GB 15760 -1995 Metal-cutting Machine Tools – General Safeguarding Specification, which will become redundant once this standard becomes effective.

Key differences between this standard and GB 15760-1995 are as follows:

- The layout is different, the new layout follows that for GB/T 16755-1997 Safety of machinery – Rules on Drafting and Formulation of Safety Standards;
- The scope has been extended, covering machine tool accessories (Section 1, 1995 version; Section 1 in this version);
- A new section entitled Risks of Machine Tools (see Section 4) has been added;
- Information on abnormal temperature, vibration, radiation, substance and materials, ergonomics, assembly errors, measurement, adjustment, cleaning and maintenance have been added)see 5.7, 5.9, 5.10, 5.11, 5.12, 5.14, 5.20);
- Requirements regarding the functions and categories of safety-related components in the control system are added (see 5.4.2);
- Max installation height for button stations and displays have been added (see 5.12.2.3.2, 5.12.3.1.2);
- Storage requirements have been added (see 5.19.2);
- Verification requirements have been added (see Section 5);
- A new section entitled Information for Use is added (see Section 6);
- A Reference section has been added;
- Electrical System has been further expanded (Section 8.1 in 1995 version and 5.3 in this version);
- "when a machine stops, the stopping of the independent feed drive should not be slower than the movement of the main drive" has been removed (5.2.6 in 1995 version);
- Appendix A has been removed (Appendix A, 1995 version).

From 1st July 2005 the design and production of new products should follow this national standard. Previous products designed and manufactured before 1st July 2005 are given a 12 month transitional period. From 1st July 2006 the sale of products not meeting this national standard will cease.

This standard is proposed by the China Machine Industry Federation.
The Technical Committee (SAC/TC22) of National Metal-cutting Machine Tools Standardization is the relevant organisation of this standard.
This standard is drafted by Beijing Machine Tools Research Institute.
Key persons taken part in the drafting of this standard are Zhang Wei, Li Xiangwen, Xu Guangwu.
The standard replaced by this standard is GB15760 – 1995.

METAL-CUTTING MACHINE TOOLS– GENERAL SAFEGUARDING SPECIFICATION

1. Scope

This standard describes the basic safeguarding techniques and measures taken against the main risks associated with metal-cutting machine tools (hereinafter referred to as "machine tools") and their accessories as well as verification methods.
This standard is applicable to all types of machine tools and accessories.

2. Normative reference documents

The provisions in the following documents cited in this standard are construed as parts of its provisions. Albeit any amendments (excluding errors) or revisions made to such dated reference documents subsequently are not applicable to this standard, the adoption of the latest version of such documents is encouraged, subject to a study undertaken by the parties who entered an agreement on the basis of this standard. The latest version of an undated normative reference document shall apply to this standard.

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 verification (GB 1251.2-1996, eqv ISO/DIS 11428:1992)
GB 1251.3	Ergonomics – Auditory and visual system for dangerous and non-dangerous conditions (GB 1251.3-1996, eqv ISO/DIS 11429:1992)
GB 2893	Safety colours (GB 2893-2001)
GB 2894	Safety signs (GB 2894-1996, neq ISO 3864:1984)
GB/T 3167	Metal-cutting machine tools – indicative graphic symbols for operation (GB/T 3167-1993, neq ISO 7000:1984)
GB/T 3168	Numerical control machine tools - indicative graphic symbols for operation (GB/T 3168-1993, neq ISO 2972:1979)
GB 5226.1-2002	Safety of machinery – mechanical/electrical equipment Part 1: general specification (idt IEC 60204-1:2000)
GB/T 6576	Machine tools - lubrication system (GB/T 6576-2002, ISO 5170:1977, MOD)
GB 7247.1	Laser product safety Part 1: category of equipment, requirements and user guide (GB 7247.1-2001, idt IEC 60825:1993)
GB/T 7932	Pneumatic system – general specification (GB/T 7932-2003/ISO 4414:1998, ISO 4414:1998, IDT)
GB/T 8196	Safety of machinery – safeguarding devices – design and manufacture of fixed and movable guards – general requirements (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 for indoor working systems (GB/T 13379-1992, neq ISO 8995:1989)
GB/T 14775	General ergonomics requirements for controllers – (GB/T 14775-1993)
GB/T 14776	Ergonomics – principle for determining dimensions of work places in manufacturing areas and the dimensions (GB/T 14776-1993)
GB/T 15241.2	Principle of ergonomics 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 Concept, General Principles for Design - Part 2: Basic Terminology, Methodology (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 – noise level measurement methods (GB/T 16769-1997)
GB/T 16855.1 - 1997	Systems - Part 1: General Principles for Design Safety of Machinery - Safety Related Parts of Control (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 device - Part 1: General Principles for the Design and Testing of Pressure Sensing Mats and Pressure Sensing Floors (GB/T 17454 ???????????:1994)
GB 17888.1	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants - Part 1: Choice of a Fixed Means of Access between Two Levels (GB ???8.1-???, eqv ISO/DIS 14122-1:1996)
GB 17888.2	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants Part 2: Working Platforms and Gangways (GB 17888.2-199?, eqv ISO/DIS 14122-2:1996)
GB 17888.3	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants - Part 3: Stairways, Stepladders and Guard-Rail (GB 17888.3-??????????1996)
GB 17888.4	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants - 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 56???
GB 18209.1	Safety of Machinery - Indication, Marking and Actuation - Part 1: Requirements for Visual, Auditory and Tactile Signals (GB 18209.1-????, idt IEC???0-1:19??)
GB 18209.2	Safety of Machinery - Indication, Marking and Actuation - Part 2: Requirements for Marking (GB 18209.2-2000, idt IEC?????2:1995)
GB/T 18209.3	Safety of Machinery - Indication, Marking and Actuation - Part 3: Requirements for the Location and Operation of Actuators (GB 18209.??????????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	The Information Displays Device - General Requirement for Human Factors and Ergonomics (JB/T 5062-1991)
JB/T 8356.1	Machine Tools - Specification for Packing (JB/T 8356.1-199?)

JB/T 8356.2	Machine Tools - Parking Box (JB/T 8356.2-1996)
JB/T 8356.3	Inside Medium and Small Wood Box for Packing of Machine Tools (JB/T 8356.3-1996)
JB/T 9878	Metal-Cutting Machine Tool - Determination of Dust Concentration (JB/T 9878-1999)
JB/T 9879	Metal-Cutting Machine Tool - Measurement Method for Oil Fog Concentration (JB/T 9879-1999)
JB/T 10051	Metal-Cutting Machine Tool - General Specification for Hydraulics System (JB/T 10051-1999)

3. Technical terms and definitions

The following technical terms and definitions and those established by GB/T 15706.1 – 1995 are applicable to this standard.

3.1 Safety of machine tools

Refers to a situation where the operating of a machine tool under the anticipated operating conditions described in its manual, its transportation, installation, adjustment, maintenance, dismantling and disposal will not cause any injury to the personnel or threaten their health or damage the equipment.
Note: Anticipated operating ????[1] and consistent with ???? and foreseeable misuse should be considered as appropriate.

3.2 Machine tools danger

Refers to a situation where a stationary or running machine tool may injure the personnel, threaten their health and damage the equipment.

3.3 Risks

A combination of probability and degree of injury or health threat in a dangerous state.
[3.7 of GB/T 15706.1 – 1995]

3.4 Machine tools danger zone

An area where injury or health threat to personnel may exist while a machine tool is stationary or running.

3.5 Machining area

An area which the workpieces of a machine tool pass through.

3.6 Working areas

Areas that are involved in the marching process, including ?????[2] position, positions for loading and unloading materials and for operating, adjusting and maintaining a machine tool.

3.7 Guard

A physical barrier dedicated to protect parts of a machine tool. Types of such guards include shell, hull, screen, door and enclosure.
[3.22 in GB/T 15706.1 – 1995]

3.8 Safety device

A device used to eliminate or reduce risks or a device used in conjunction with a guard (but not a guard itself).
[3.23 in GB/T 15706.1 – 1995]

3.9 Information for use

Safety measures consisting of various communication means such as text, signs, signals or graphs and charts. These means can be used independently or in conjunction with other means to provide information to the users in order to guide professional and/or non-professional users.
[3.2 in GB/T 15706.1 – 1995]

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[1] ????? = characters illegible, concealed by the dark colour GB seal
[2] ????? = characters illegible, concealed by the dark colour GB seal

3.10 Operator
A person who installs, operates, makes adjustment to, maintains, cleans, repairs or transports a machine tool.
[3.21 in GB/T 15706.1 – 1995]

4. Machine tool risks

4.1 A risk analysis and assessment, identification and evaluation of potential risks in a machine tool should be conducted in accordance with the provisions in Section 5, GB/T 15706.1 – 1995 and Section 6, GB/T16856.
Note: safety measures against other risks not covered by this standard should be taken in accordance with GB/T 15706.2 – 1995.

4.2 In conducting a risk analysis, pay special attention to the risks that can be caused by foreseeable misuse by operators and other personnel (see 3.12 in GB/T 15706.1 – 1995), such as:

- during machine tool operating period;
- during machine tool adjustment, cleaning and maintenance period.

4.3 Main risks associated with machine tools are shown in Table 1.

Table 1 Risk Summary

S/N	RISK	THE RELEVANT PROVISIONS IN GB/T15706.1 -1995	THE RELEVANT PROVISIONS IN GB/T15706.2 -1995	RELEVANT STANDARD	SAFEY REQUIREMENTS & MEASURES & THE RELEVANT PROVISIONS
1	Mechanical risks (causes): - shape; - relative position; - quality & stability (potential energy); - quality & speed (kinetic energy); - inadequate mechanical strength; - build-up of potential energy: - elastic components; - fluid or gas under pressure; - vacuum	4.2			
1.1	Compression risk	4.2.1, 4.2.2	3.2	GB 12265.3	5.2.3.2, 5.2.4.5, 5.5.1
1.2	Shear risk	4.2.1, 4.2.2	3.2,4.1.1		5.2.3.2, 5.5.1
1.3	Cut off or incision risk	4.2.1, 4.2.2	3.2		5.2.2.1, 5.2.2.3, 5.2.7
1.4	Entwining risk	4.2.1, 4.2.2			5.2.3.1
1.5	Suck in or entangle risk	4.2.1	3.11, 4.1.1, 6.1.2		5.2.3.1
1.6	Impact risk	4.2.1			5.2.3.3, 5.2.3.4, 5.2.3.7
1.7	Prick or puncture risk	4.2.1			5.2.2.1, 5.2.2.3, 5.20
1.8	Friction or abrasion risk	4.2.1	3.3b		5.2.3.4, 5.19.3
1.9	Spray risk by high pressure liquid	4.2.1		GB/T 7932 JB/T 10051	5.4.10, 5.15, 5.16
1.10	Ejection risk by machine tool component/workpiece	4.2.2	???8		5.2.3.5, 5.2.4, 5.4.10, 5.5.1
1.11	Risk of loss of stability	illegible	illegible		5.2.1, 5.2.5, 5.19
1.12	Risk of slipping, tripping over and tumbling	??2.3	6.2.4	GB 17888.1~ 17888.4	5.2.2.2, 5.2.9.1, 5.11.5, 5.15, 5.18
2	Electrical risk				
2.1	Direct contact with electricity under normal operating voltage, direct contact with a charged article			GB 5226.1 - 2002	5.3.1
2.2	Indirect contact ???*[concealed*			GB 5226.1-2002	5.3.1, 5.3.5

	by the GB seal] insulator failure, indirect contact with a charged article				
2.3	inadequate insulation	???.3		GB 5226.1-2002	5.3.1
3	Thermal risk	???4.4	3.6.3		
3.1	Burn or scorch risk resulting from contact with heat or radiation of a heat source	???4		GB/T 1?153	5.7
3.2	Health risk from super heat or super cooling				5.7
4	Noise risk	4.5	3.6.3		
4.1	Loss of hearing or other physiological disorders	4.5		GB/T 16769	5.8
4.2	Signals that interfere with voice communication and sound signal	4.5			5.8
5	Vibration risk (causing various metal disorders)	4.6	3.6.3		5.9
6	Radiation risk	4.7			
6.1	Electrical arc	4.7		GB 5226.1-2002	5.10.1
6.2	Laser	4.7		GB 7247.1	5.10.2
6.3	Ionisation radiation source	4.7		GB 5226.1-2002	5.10.1
6.4	High frequency electro-magnetic field	4.7	3.4	GB 5226.1-2002	5.3.6
7	Risk posed by substances and materials	4.8	3.3b		
7.1	Contact with or inhalation of harmful liquid, gas, smoke, oil mist and dust	4.8		GB/T 18569.1 GB/T 18569.2 JB/T 9878 JB/T 9879	5.11.1, 5.11.2
7.2	Fire and explosion	4.8			5.11.3
7.3	Risk from organism and micro organism	4.8			5.11.4
8	Risk resulting from ignoring ergonomics during the design stage	4.9	3.6		
8.1	Unhealthy postures and physical straining	4.9	3.6.1, 3.6.4	GB/T 14775 GB/T 14776 GB/T 16251 GB/T 18717.1~ 18717.3 JB/T 5062	5.2.9.2 5.12.1 5.12.2 5.12.3
8.2	Inadequate consideration given to the structural requirements of arms and legs	4.9	3.6.9		5.12.2
8.3	Overlooking the use of personnel protection gear	5.5			5.10.2, 5.12.1
8.4	Inappropriate area lighting		3.6.5	GB 5226.1 - 2002 GB/T 13379	5.13
8.5	Mental tension or inadequate preparations	4.9	3.6.4	GB/T 15241.2	5.12.1
8.6	Human errors	4.9	3.6	GB/T 3167 GB/T 31678 GB 5226.1 - 2002 GB 18209.3 - 2002 GB/T 17161	5.4.3, 5.12.2.1
9	Risk resulting from energy supply interruption, damage and breakdown of mechanical components and other malfunctions	5.2.2	3		
9.1	Interruption of energy supply to machine tool or control system	3.16	3.7	GB 5226.1 - 2002 GB/T 16855.1 - 1997	5.3.2, 5.4.2
9.2	Accidentally throwing out of machine tool components/workpiece or spurting of pressurised liquid or gas		3.8.4		5.2.3.5, 5.2.4, 5.4.10, 5.5.1, 5.15, 5.16
9.3	Failure or	3.1.5, 3.1.6,	3.7	GB 5226.1 - 2002	5.2.3.7,

	malfunctioning of control system	3.1.7		GB/T 16855.1 - 1997	5.2.4.6, 5.4.10
9.4	Incorrect assembly				5.14
9.5	Toppling over or loss of machine tool stability	4.2.2	6.2.5	JB/T 8356.1 ~ 8356.3	5.2.1, 5.2.5, 5.19
10	Risk resulting from safety measure error, incorrect installation of safety device or inaccurate positioning		4		
10.1	Guard	3.22	4.2		5.5.1, 5.5.2
10.2	Safety (guard) device	3.23	4.2	GB 5226.1 - 2002 GB/T 17454.1 GB/T 18831	5.5.1, 5.5.3
10.3	Start-up and stopping device		3.7	GB 5226.1 - 2002	5.5.4, 5.4.5
10.4	Safety signal and signalling device		3.6.7, 5.2, 5.3, 5.4	GB 2893 GB 2894 GB 18209.2	5.6
10.5	Information and alarm devices		5.4	GB 1251.1 GB 1251.2 GB 1251.3 GB 5226.1 - 2002 GB 9969.1 GB/T 15706.2 - 1995 JB/T 5062	5.4.3, 5.12.3, Section 6
10.6	Energy supply cut-off device		6.2.2	GB/T 15706.2 - 1995 GB/T 7932 JB/T 10051	5.4.5, 5.15, 5.16
10.7	Emergency stopping device		6.1	GB 5226.1 - 2002 GB 16754	5.4.6
10.8	Loading and unloading device		3.11		5.2.6
10.9	Key equipment and accessories for safety adjustment and/or maintenance	3.3, 3.11	3.12, 6.2.1, 6.2.3, 6.2.6		5.20
10.10	Exhaust system				5.2.4.7

5. Safety requirements and measures and verification methods

5.1 General requirements

5.1.1 Endeavours should be made to eliminate or reduce all the potential risk factors through design.

5.1.2 The necessary safety guards (guards and safety devices) must be used to deal with risks that cannot be avoided or adequately confined through design.

5.1.3 Information and warnings should be provided to operators to guard against risks that cannot be eliminated or reduced through design and cannot be effectively or completely dealt with by safety guards.

5.2 Machine Tool Construction

5.2.1 Stability

The configuration of a machine tool should ensure that it is adequately stable. Risks of accidentally tipping over, drifting down or shifting should not happen during its operation (under the operation conditions described in its manual). If adequate stability cannot be achieved due to the shape of a machine tool, a stabilisation measure should be specified in its manual.

Verification: visual inspection and/or check information.

5.2.2 Contour

5.2.2.1 Its exposed parts should not have sharp edges, corners, and openings that may cause personal injuries.

Verification: visual inspection and/or check information.

5.2.2.2 The arrangement of pipes and wires should be reasonable, unobtrusive and should not cause any risk of obstruction or tripping over.
Verification: visual inspection and/or check information.

5.2.2.3 Safety measures should be taken against protrusions, moving parts and separate parts of a machine tool to avoid the risks of bumping, colliding, scuffing and cutting.
Verification: visual inspection or check information.

5.2.3 Moving parts

5.2.3.1 Parts and components (such as chains, sprockets, gears, racks, belt pulleys, belts, worm wheels, worm screws, spindles, levers and waste removal devices) that may entangle, suck or engulf should be enclosed or fitted with a safety guard or provided with information for use unless their location is safe.
Verification: visual inspection and/or check information.

5.2.3.2 Risks of extrusion and/or shearing should not occur between moving parts or ????? [3] otherwise safety measures should be taken in accordance with GB 12265 ???? [4]
Verification: check drawings, visual inspection and/or check information.

5.2.3.3 A reliable limiter should be fitted to a powered reciprocating part that has any inertia impact and reliable buffering measures should be taken if necessary. If the fitting of a limiter is a problem, the necessary safety measure should be adopted.
Verification: visual inspection and/or check information.

5.2.3.4 ??? [5] device should be fitted to a moving part that may be damaged by excess loading. If this cannot be fitted because of structural reasons, the limiting operating conditions should be stated on the machine tool (or its manual).
Verification: check drawings, visual inspection and/or check information.

5.2.3.5 A locking device should be fitted to a moving component or part that may come loose.
Verification: check drawings and/or visual inspection.

5.2.3.6 For an unidirectional moving part ??? clearly ??? [6]
Verification: visual inspection.

5.2.3.7 During an emergency stoppage or failure of the power system, a moving part should stop on the spot or return to a designated position; the lowering of a part that moves vertically or at an angle should not pose any risks.
Verification: visual inspection.

5.2.3.8 Any moving parts that are not expected to move simultaneously should be interlocked by their control mechanism. If interlocking can not be implemented, a warning sign should be fitted near the control mechanism and clearly stated in the manual.
Verification: visual inspection and/or check information.

5.2.4 Jig

5.2.4.1 A jig should ensure that the workpiece and tool will not fall off or be thrown out. If necessary, the maximum safety rotation speed of the jig supplied with a machine tool should be specified in the manual.
Verification: visual inspection and/or check information.

5.2.4.2 Manual jig

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[3] ????? = characters illegible, concealed by the dark colour GB seal
[4] ????? = characters illegible, concealed by the dark colour GB seal
[5] ????? = characters illegible, concealed by the dark colour GB seal
[6] ????? = characters illegible, concealed by the dark colour GB seal

Safety measures should be adopted to eliminate accidental risks such as a key or spanner remaining in the manual jig and rotates with a running machine tool.
Verification: function test and/or check information.

5.2.4.3 Powered jig

a) The starting up of a machine tool should interlock with the completion of the clamping process of its powered jig;
b) The release action of a powered jig should interlock with the completion of the running of a machine tool;
c) A machine tool equipped with an automatic loading and unloading system should allow the spindle to rotate without the risk of throwing out the workpiece.

Verification: function test

5.2.4.4 Electromagnetic chuck

a) The category of hull protection should be at least IP54 and its earthing protection should meet the requirements specified in 8.2, GB 5226.1 – 2002;
b) It should meet the requirements specified in 5.2.4.3.

Verification: check electrical diagrams, visual inspection, function test and/or check information.

5.2.4.5 Safety measures should be taken if a workpiece or tool is manually loaded or unloaded to ensure that there is no risk to the fingers.
Verification: visual inspection and/or check information.

5.2.4.6 Safety measures should be adopted to prevent risk in the event of an emergency stoppage or power system failure ???[7] electromagnetic chuck
Verification: visual inspection or check information.

5.2.4.7 When a pneumatic jig is used measures should be taken to ensure that the loose bits from the tools and ???[8] do not blow in the direction of the operator.
Verification: visual inspection and/or check information.

5.2.5 Balancing device

5.2.5.1 ???[9] associated with a machine tool component and its movement ???? safety guard measures ?? placing it within the hull of the machine tool or a fixed guard ???????? risks caused by fracture.
Verification: visual inspection, check information.

5.2.5.2 When a dynamic balancing device is used one should ensure that parts and components of the machine tool will not fall out in the event of a power system failure.
Verification: visual inspection, check information.

5.2.6 Automatic loading and unloading system
When an automatic loading and unloading system is used ???[10] a guard or interlocking guard should be fitted or warning signs should be in place.
Verification: visual inspection and/or check information.

5.2.7 Tool magazine and tool changer
Unless its location does not pose any risks, if a tool magazine and tool changer is used, a fixed guard should be fitted or warning signs should be displayed .
Verification: visual inspection and/or check information.

5.2.8 Waste removal device

[7] ????? = characters illegible, concealed by the dark colour GB seal
[8] ????? = characters illegible, concealed by the dark colour GB seal
[9] ????? = characters illegible, concealed by the dark colour GB seal
[10] ????? = characters illegible, concealed by the dark colour GB seal

A waste removal device should not pose any risks to the operators; if necessary it can be interlocked with the opening up of the guard and the stopping of the machine tool.
Verification: visual inspection and/or check information.

5.2.9 Working platforms, gangways and openings

5.2.9.1 A steel ladder and working platform should be fitted to a machine tool that cannot be operated on the ground level. Anti-slip and fall-prevention devices should be fitted to the platforms and gangways and must ensure that the operator is not close to a danger zone. If necessary, gangplanks and fencing should be fitted. All steel ladder, fencing and platforms should meet the requirements specified in GB 17888.1 – 17888.4.
Verification: visual inspection and/or check information.

5.2.9.2 Depending on the operational needs, a machine tool can be installed at an opening for access. The dimensions of such an opening should meet the requirements specified in GB/T 18717.1 – 18717.3.
Verification: actual measurement.

5.3 Electrical system

5.3.1 Electric shocks

Safeguarding of electrical equipment should meet the following requirements in order to avoid the risks of electric shocks:

a) a charged guard should meet the requirements specified in Section 6, GB/ 5226.1 – 2002;
b) electrical insulation protection should meet the requirements specified in 6.2.3, 6.3.2.2 & 13.3 of GB/ 5226.1 – 2002;
c) earthing of electrical equipment should meet the requirements specified in 8.2, 14.1 & 14.2 of GB/ 5226.1 – 2002.

Verification: visual inspection, continuous earthing test, insulation resistance test and withstand voltage test.

5.3.2 Protection
In order to prevent accidental risks, the protection of electrical equipment should meet the following requirements:

a) overcurrent protection should meet the requirements specified in 7.2 of GB 5226.1 – 2002;
b) overload protection should meet the requirements specified in 7.3 of GB 5226.1 – 2002;
c) overspeed protection should meet the requirements specified in 7.6 of GB 5226.1 – 2002;
d) voltage fluctuation and power interruption protection should meet the requirements specified in 7.5 & 7.9 of GB 5226.1 – 2002;
e) earth-fault protection should meet the requirements specified in 7.7 of GB 5226.1 – 2002.

Verification: visual inspection, check technical documentation and survival voltage.

5.3.3 Conductors, cables and wiring
The conductors, cables and wiring of the electrical system should meet the following requirements:

a) conductors & cables should meet the requirements specified in Section 13, GB 5226.1 – 2002;
b) wiring should meet the requirements specified in Section 14, GB 5226.1 – 2002;

Verification: visual inspection.

5.3.4 Electric motor
An electric motor should meet the requirements specified in Section 15, GB 5226.1 – 2002;
Verification: visual inspection.

5.3.5 Static electricity
Electrical equipment should not discharge static or should have only a limited amount of static discharge; if necessary a discharging device should be fitted.
Verification: visual inspection.

5.3.6 Electromagnetic compatibility

Electromagnetic compatibility of electrical equipment should meet the requirements specified in 4.4.2 of GB 5226.1 – 2002;

Verification: supplier to provide relevant certification or testing results

5.4 Control system

5.4.1 General requirements

In addition to the requirements specified in 5.4.2 – 5.4.10 herein, it should also meet the requirements specified in Sections 5, 9, 10 & 12 of GB/T 15706.2 – 1995 and GB/T16855.1 - 1997.

Verification: check electrical diagrams, visual inspection, function test and/or check information.

5.4.2 Safety and reliability of control system

The parts of a control system that are relevant to safety refer to the whole system starting from the preliminary control devices or input points to the end actuators or components (electric motor for example).

A control system should be able ensure that its functions are safe and reliable and can withstand the anticipated work load and effects of external factors and logic errors (excluding the operating program).

The functions and classification of the parts of a control system that are relevant to safety should meet the requirements shown in Table 2 (see Section 7, GB/T 16855.1 – 1997).

Table 2 functions and classification of the parts of a control system

Function	GB/T 16855.1 – 1997 Classification
Start up and restarting	Class 1 or 2
Stopping	Class 1
Emergency stop	Class 1 or 3
Mode selection	Class 1
Maintain operation	Class 3
Interlocking	Class 1 or 3
Interlocking of guards	Class 3
Spindle rotation	Class 1 or 2
Workpiece clamping	Class 1
Max speed	Class 2 or 3

Verification: check drawings, visual inspection, check whether the components are consistent with the relevant certification and check information.

5.4.3 Location of the control system

The location of the control system should ensure no dangers will occur during machine operation as well as meeting the following requirements:

a) sited at a location outside danger zones (emergency stopping device and movement control device excepted);
b) clearly visible and easily distinguishable from other devices; if necessary, markings indicating its function and purpose should be installed. Such signs and symbols should meet the requirements specified in GB/T 3167 and GB/T 3168. The colour codes should conform with the specification laid down by 10.2 in GB 5226.1 – 2002;
c) with a control device that is multi-control (such as a keyboard), the action it is implementing should be clearly labelled;
d) should not cause any operation errors and additional dangers;
e) for a machine tool whose operating position does not offer a full view of the working area, visual or auditory start-up warning signalling devices should be installed or warning information should be available to ensure that the personnel in the working area can leave the area in time or quickly terminate the start up;
f) for a machine tool that has more than one operating position, a control interlocking device should be installed.

Verification: visual inspection, function test and/or check information.

5.4.4 Starting up

The starting up of a machine tool should meet the following conditions:

a) A machine tool can only start up under manual control, including:
    1) restarting after stopping;

2) when significant changes have occurred in the operating conditions (speed, and pressure for example)

Note: The above requirements can be ignored if it is by normal automatic control program or the restarting or change of conditions will not pose any risks to any personnel.

b) a machine tool should not start up immediately when a moveable guard is closed.
c) a machine tool should not accidentally start up when a moveable guard is disengaged.
d) If there is more than one starting devices, a selection system should be in place and there will only be one starting device functioning at any one time.

Verification: function test.

5.4.5 Stopping

A machine tool should be fitted be a stopping device. Such a device should be located near each starting device. The stopping of a machine tool should meet the following conditions:

a) when a stopping device is operated the motion of a machine tool should terminate completely safely;

Note: Since dangerous conditions vary, a stopping device should be able to stop the running of parts of or the whole machine tool.

b) when the motion of a machine tool has ceased, the energy supply to the actuators should be cut off to ensure that there will not be any potential energy and/or dynamic energy downstream from the disconnection point.

Note: Since some loops must maintain normal connection with their energy supply – to support the workpiece and to maintain information flow or internal lighting for example, some special measures must be taken (such as warning message or warning light) to ensure operator safety.

Verification: check drawings, visual inspection, function test and/or check information.

5.4.6 Emergency stop

5.4.6.1 An emergency stop should meet the requirements specified in 10.7, GB 5226.1 – 2002 and GB 16754 as well as the following conditions:

a) it should be clearly identified, clearly visible, easily accessed and its operation should not pose any dangers;
b) its action should not affect the functioning of any devices installed for protecting the operators or machine tools;
c) it is capable of stopping the running of the machine tool or the moving parts;
d) the action of its actuators should be able to lock the control device and continue to do so until machine reset (not locked);
e) reset should not start up the machine tool or any of the dangerous moving parts.

Verification: check drawings, visual inspection and function test.

5.4.6.2 A machine tool should be equipped with one or more emergency stop devices at locations such as:

a) main control console;
b) mobile control console;
c) loading & unloading point (far away from the operating position);
d) if the location of the tool magazine is separate from the working area, ??? ???[11] nearby (if ????[12] near).

Verification: visual inspection.

5.4.7 Mode selection

If a machine tool has more than one operating or working mode ???? ??????[13] , a mode selection control device should be fitted and each selected mode should only allow one ?????[14]. Under a certain working or operating mode, the machine tool can only operate when the safety guard is disengaged or inactive and a mode selection control should meet the following conditions:

a) automatic control mode should be inactive;

[11] ????? = characters illegible, concealed by the dark colour GB seal
[12] ????? = characters illegible, concealed by the dark colour GB seal
[13] ????? = characters illegible, concealed by the dark colour GB seal
[14] ????? = characters illegible, concealed by the dark colour GB seal

b) under further control command (?????machine tool ???[15];
c) the moving parts that can pose dangers can only rotate when special safety measures (measures such as deceleration or ???[16]);
d) ??? dangerous movement ???? machine tool rotating directly or indirectly through ???[17]).
Verification: visual inspection, function test and/or check information.

5.4.8 Maintain-run
Maintain-run should continue to activate until work is completed.
Verification: function test.

5.4.9 Numerical control system
A numerical control system should meet the requirements specified in Section 11 of GB 5226.1 – 2002 and the following conditions:
a) it should meet the anticipated operating and environmental conditions;
b) an access password or key switch should be added to protect intentional or accidental changes made to the program;
c) changes made to any safety-related software must be authorised.
Verification: visual inspection, function test and/or check information.

5.4.10 Control system failures
A control system failure should not pose any risks and special attention should be paid to the following:
a) a machine tool should not be able to start up accidentally;
b) the speed changes of moving parts should not be out of control;
c) a moving part should not stop running;
d) a moving part or a workpiece or tool on the machine tool should not fall off or spin off and fluid should not spurt out;
e) a safety device should not fail.
Verification: check drawings and/or check information.

5.5 Safety guard

5.5.1 General requirements
A safety guard should meet the requirements specified in Section 11 of GB/T 8196 and GB/T 18831 as well as the following conditions:
a) its performance should be reliable and can withstand bits of articles being spun off, dangerous substances and emissions;
b) it should not pose additional risks and restrict the functioning of the machine tool as well as unnecessarily restrict the operating, adjustment and maintenance of the machine tool;
c) the safe distance between a guard and the danger zone of a machine tool should meet the requirements specified by GB 12265.1, GB 12265.2 and GB12265.3;
d) the material of the safety enclosure, screen and fencing as well as the maximum size and minimum safe distance of the mesh or holes for a net structure, orifice plate and fencing should meet the relevant requirements;
e) the moveable parts of a guard should be easily manoeuvrable and usable;
f) a guard that is frequently dismantled for removal should be easy to dismantle and its mass should be greater than 16kg. Any guard that is not easily manoeuvred by hand should be fitted with lifting holes, lifting ears and hooks and its mass (kg) should be shown on its hull and indicated in the manual;
g) the transparent guard for observing the running of a machine tool should be useful for such observation.
Verification: visual inspection, actual measurement and/or check information.

5.5.2 Guard

5.5.2.1 Fixed guard

[15] ????? = characters illegible, concealed by the dark colour GB seal
[16] ????? = characters illegible, concealed by the dark colour GB seal
[17] ????? = characters illegible, concealed by the dark colour GB seal

It should be securely fixed or coupled. Dismountable parts can only be dismantled by tools.
Verification: visual inspection.

5.5.2.2 Movable guard

A movable guard should meet the following conditions:

a) secured by heavy force, fasteners, set nuts, hinges or guide rail;

b) when it is open it should maintain a relative stability with the machine tool;

c) some of its accessories can only be dismantled by tools;

d) if an interlocking movable guard is used, the machine tool should not be able to start up unless the guard is closed and the machine tool should stop as soon as the guard is open (unless the machine is in an adjustment status):

e) a safety lock should be fitted if necessary.

Verification: visual inspection, function test and/or check information.

5.5.2.3 Adjustable guards

During a specific operation period, the adjustable components of a fixed or movable guard which is adjustable or partly adjustable should be secure and can be easily adjusted without the aid of any tools.

Verification: visual inspection.

5.5.3 Safety devices

5.5.3.1 Interlock devices

The interlocking protection function of an interlocking device should meet the requirements specified in 9.3 of GB 5226.1 – 2002.

Verification: check drawings and function test.

5.5.3.2 Limiters

The limiters of a machine tool should be installed at a suitable location that is free of, and not affected by, vibration and should be to carry its function reliably.

Verification: visual inspection and function test.

5.5.3.3 Pressure sensitive devices

The performance of a pressure sensitive device should be reliable and conform to the GB/T 17454.1.

Verification: function test.

5.6 Safety signs and safety colours

If necessary, safety signs or safety colours should be applied on or nearby a dangerous part of a machine tool to remind the personnel who carry out the operation, adjustment and maintenance of the existence of risks. The safety signs used should conform to the requirements specified in GB 2894 and GB 18209.2 and the safety colours used should conform to the requirements specified in GB 2893.

Verification: visual inspection.

5.7 Abnormal temperature

The temperature of the parts of a machine tool that come into contact with people should meet the requirements specified in GB/T 18153.

In the event that the temperature of a machine tool component (electrical components, lights and etc) and material (cuttings & etc) becomes abnormal, safety measures should be taken to prevent injury to personnel through contact.

Verification: visual inspection and/or check information.

5.8 Noise

Measures should be taken to reduce machine tool noise level.

The noise level of an idling machine tool should meet the requirements specified in Table 3.

Table 3 Sound level limit values for an idling machine tool

Type of machine tool/??[18]	??	?? -10-30	>=30
General purpose machine tool / dB?A	?85	85	90
NC machine tool / dB?A	?83		

Noise measurement should comply with the requirements specified in GB/T 16769.
Verification: actual measurement.

5.9 Vibration

Measures should be taken to reduce health threat posed by machine tool vibration.
Verification: visual inspection and/or by touch.

5.10 Radiation

5.10.1 Electric arc, ionisation chemical radiation

Safety measures against the danger of electric arc and ionisation chemical radiation during a short-circuit condition should be taken in accordance with the requirements specified in 4.4.7 ??[19] GB 5226.1 – 2002.
Verification: visual inspection and/or check information.

5.10.2 Laser

The laser used by a machine tool should comply with the requirements specified in GB ??[20] as well as the following conditions:

a) a guard should be installed to protect the personnel from laser radiation (including reflection and secondary radiation):
b) use a movable or dismountable guard ????????[21];
c) an operator should be given training;
d) if necessary, the operator should wear personal protection gear.

Verification: visual inspection and/or check information.

5.11 Substances and materials

5.11.1 General requirements

The substances and materials used and emitted by a machine tool should comply with the requirements specified in GB/T 18569.1 and GB/T 18569.2.
Verification: visual inspection and/or check information.

5.11.2 Harmful substances

5.11.2.1 Liquids

Liquids used by a machine tool should comply with the following requirements:

a) the coolant used should ensure that the machine tool can operate normally and human health is not affected;
b) the oil used should comply with the requirements specified by the applicable standard(s);
c) coatings and paints used on the machine tool should not adversely affect human health.

Note: hardened coatings and paint ???[22]
Verification: provide the relevant proof or check information.

5.11.2.2 Gas, smoke and oil mist

Effective enclosure measures should be taken against, and/or effective exhaust system and mist arrester should be installed on, a machine tool that generates harmful gases, a large amount of smoke and oil mist.
The determination of oil mist concentration should meet the requirements specified in JB/T 9879.
Verification: visual inspection and/or actual measurement.

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[18] Illegible
[19] ????? = characters illegible, concealed by the dark colour GB seal
[20] ????? = characters illegible, concealed by the dark colour GB seal
[21] ????? = characters illegible, concealed by the dark colour GB seal
[22] Sentence incomplete

5.11.2.3 Dust

Effective enclosure measures should be taken against, and/or an effective dust extractor should be installed on, a machine tool that generates a large amount of smoke and oil mist. The determination of dust concentration should meet the requirements specified in JB/T 9878.
Verification: visual inspection and/or actual measurement.

5.11.3 Fire and explosion

Measures against the risk of fire and explosion caused by substances such as gas, liquid and dust should be taken, and special attention should be paid to the following:

a) The users should be encouraged to use not easily inflammable coolants and oils whenever possible; if inflammable coolants, oils or materials are used, fire and explosion prevention measures such as the following should be taken:
    1) fire extinguishers;
    2) anti-explosive devices;
    3) flammability retardant devices.
b) The location of lights should avoid the risk of explosion in contact with coolant spray, otherwise a guard should be fitted.
c) Flammability retardant devices for electrical equipment should conform with the requirements specified in ??3.3 of GB 5226?7 – 2002.

Verification: visual inspection and/or check information.

5.11.4 Organisms and micro organisms

The maintenance of the oil and coolant tanks of a machine tool should be easy. The coolant tank ??????[23] to prevent the entering of foreign matter. The users should be reminded to change coolants and oils regularly.
Verification: visual inspection and/or check information.

5.11.5 Splashing

Threats of skidding and injury by coolant and cutting splash should be avoided. If the anti-splash protection in a working area is not effective in protecting the operators, a splash guard should be added, or remind the user to add a splash guard that is appropriate to the shape and dimensions of the workpieces.
Verification: visual inspection and/or check information.

5.12 Ergonomics

5.12.1 General requirements

The ergonomic design of a machine tool should meet the following requirements:

a) appropriate to the suitability of human ability and limit adaptation to working strength, motion amplitude, visibility and posture as well as conforming to the requirements specified in GB/T 16251;
b) the working position should suit the physical size, nature of the work, and posture of the operator as well as meeting the requirements specified in GB/T 14776;
c) endeavours should be made to ensure that the operator is not subject to threats such as interference, tension, physiological and psychological risks during machine operation and should meet the requirements specified in 10.1 of GB/T 15241.2;
d) if a machine tool may cause injuries, the users should be reminded to use personal protection gear.

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

5.12.2 Controllers

5.12.2.1 General requirements

A controller should meet the requirements specified in 10.1 of GB 5226.1 – 2002 and GB 18209.3 – 2002 as well as the following conditions:

a) an operator should be able to judge whether the end effect(s) has been achieved (directly or through a feedback/answer and question system);

[23] ????? = characters illegible, concealed by the dark colour GB seal

Note: the end effect(s) refers to the result(s) anticipated by an operator when he/she takes an action (see 3.3, GB 18209.3 – 2002).

b) the operating direction of a controller should be consistent with the end effect and meet the requirements specified in GB/T 17161.

Note: The operation direction of controllers of some machine tools (grinder) and their end effect(s) can be specified as per convention.

c) the relative position of an operator to the machine's can be changed (using a remote control, a portable and suspended operating device) and the direction of the motion of a machine tool can also change. Whenever it is not clear, signs that correspond to the operating symbols and/or colours use on a controller should be added on the moving part(s) of a machine tool or in its surrounding area;

d) both powered and manual controllers can be used; when the peripheral speed is greater than 20 m/min, it should automatically disengage itself from the rotating spindle; spokeless and handleless controllers can also be used;

Note: due to the effects of inertia, the controller should be allowed to sway temporarily on disengagement.

e) symmetric mirror image layout should be avoided;

f) the positioning of a controller should allow the operator to see the target of control during operation;

g) the operator should conduct a process of logical combination based on the operating relationship or the functional relationship of the target under control;

h) The following measures can be taken to reduce risks associated with controller operation:

1) set it in a recess or under a cover;
2) increase the control force;
3) fit a safety device (such as a locking device);
4) place it in a location which can avoid accidental contact;
5) operate it following a sequence;
6) use a controller that requires both hands to deploy;
7) use an enabling device.

Verification: visual inspection, function test and/or check information.

5.12.2.2 Dimensions and control force

5.12.2.2.1 The design of a controller should conform to the requirements specified in GB/T 14775.

5.12.2.2.2 The control force applied to a hand wheel and handle throughout should be even and meet the requirements shown in Table 4.

Table 4 Control force applied to a hand wheel and handle

Machine tool mass/I	≤ 2	> 2-5	> 5-10	> 10
Frequently used/N	≤ 40	≤ 60	≤ 80	≤ 120
Infrequently used/N	≤ 60	≤ 100	≤ 120	≤ 160
Note 1: hand wheels and handles used more than 26 times per shift is classified as frequently used hand wheels & handles. Note 2: the control force for hand wheels and handles used for special purposes such as changing direction, clamping, propping and increasing damping are based on their design. Note 3: The control force for infrequently used hand wheels and handles are based on their design.				

Verification: visual inspection and actual measurement.

5.12.2.2.3 For foot-operated controller, safe guarding measures should be taken against operating errors. The travel stress for a foot-operated controller is 45 mm -70mm and displacement is 20 N – 200 N.

Verification: visual inspection and actual measurement.

5.12.2.3 Operating height

5.12.2.3.1 The installation height (from ground or control console to the middle of a hand wheel or handle) for hand wheels and handles should meet the requirements shown in Table 5.

Table 5 Installation height for hand wheels and handles unit = m

Situation of use	Installation height
Frequently used	0.5 – 1.7
Infrequently used	0.3 – 1.9
Only used for adjustment	≤ 2
Note: not applicable to machine tools whose operation requires standing on the workpiece or using a dedicated console.	

Verification: actual measurement.

5.12.2.3.2 The installation height for a button station (from ground or the floor of the operating platform to the middle of the button station) should be 0.6 m – 1.9 m.

Verification: actual measurement.

5.12.3 Information display devices

An information display device should be durable, clear and its meaning without any ambiguities as well as meeting the requirements specified in JB/T 5062.

Verification: visual inspection.

5.12.3.1 Indicators and displays

5.12.3.1.1 Position

Indicators and displays should be located in a position that can be seen and identified easily.

Verification: visual inspection.

5.12.3.1.2 Installation height

a) The installation height for an indicator (from the ground or the floor of the operating platform to the middle of the indicator) should meet the requirements shown in Table 6.

Table 6 Installation height for indicators unit = m

Viewing situation	Installation height
Frequently viewed	0.7 – 1.7
Infrequently viewed	0.3 – 2.5

b) The minimum viewing distance for an indicator is 0.3 m and its installation position should be 1.3 m – 2 m from the ground or the floor of the operating platform.

Verification: actual measurement.

5.12.3.2 Alarm devices

Visual, auditory and tactile alarm signals used by a machine tool should meet the requirements specified in GB 1251.1, GB 1251.2, GB 1252.3 and GB18209.2 as well as the following conditions:

a) the messages and meanings displayed are clear and easy to understand;
b) they should be easy to identify within the signal reception area;
c) the effectiveness of the signals should be periodically checked.

Verification: function test and/or check information.

5.13 Lighting

5.13.1 Inadequate lighting poses threats to operators during machine operation. Localised lighting should be provided to ensure safe machine operation.

Verification: visual inspection.

5.13.2 The design and installation of lighting devices should meet the requirements specified in Section 16 of GB 5226.1 – 2002 and GB/T 13379 as well as the following requirements:

a) lighting in a working area should be reliable;
b) avoid strobe effect, glaring effect and shadowed area;
c) lighting and light pollution should be minimum;
d) easy maintenance;
e) minimum illumination is 500 lux (1x).

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

5.14 Assembly errors

Avoid risks associated with assembly errors or reassembly errors otherwise observe the following precautions:

a) show the direction of operation on the moving parts or at a nearby location;
b) make clear markings on conduits, conductors, cables, fluid and gas pipes and/or connectors.

Verification: visual inspection and/or check information.

5.15 Hydraulic system

A hydraulic system should meet the requirements specified in JB/T 10051 and the following requirements:

a) safety valves that can prevent over pressure or overflow valves that can adjust pressure changes should be fitted to a hydraulic system;

b) a hydraulic system should be able to cope with the maximum operating pressure specified in the design;

c) the pressure safe device should be set to the value indicated in the specifications;

d) hydraulic system leakage should not pose any risks;

e) the accumulator should be able to discharge the pressure or lock down safely during a power interruption (not applicable to special situations where pressure is still required after power cut). If the accumulator needs to maintain the pressure after power cut, a safety message including "Careful of (or please beware of) the pressure vessel" should be displayed on the accumulator or a nearby noticeable location.

The following are minimum markings to be displayed on an accumulator:

1) manufacture date;
2) capacity (l);
3) nominal pressure;
4) allowable temperature (°C).

Verification: check drawings, visual inspection, function test and/or check information.

5.16 Pneumatic system

A pneumatic system should meet the requirements specified in GB/T 7938 and the following conditions:

a) a pneumatic system should be fitted with safety valves that can prevent over pressure or pressure-limiting valves that can adjust the pressure changes;

b) a pneumatic system should be able to cope with the maximum operating pressure specified in the design;

c) the pressure safe device should be set to the value indicated in the specifications;

d) the leakage of a hydraulic system should not pose any risks;

e) when a machine tool is connected to the air supply, the machine tool should have a pressure-limiting valve and pressure gauge and the maximum allowable cut-in pressure should be stated.

Verification: check drawings, visual inspection, function test and check information.

5.17 Lubrication system

A lubrication system should meet the requirements specified in GB/T 6576 and the following conditions:

a) an oil level indicator should be installed at a easily viewable and safe location;

b) the manual lubrication points on a machine tool and its accessories should have signs for identification;

c) mixing oils is only allowed if the hydraulic system and lubrication system use the same oil; however special attention must be paid to the removal of impurities.

Verification: visual inspection.

5.18 Coolant system for cutting

The coolant for cutting should meet the requirements specified under 5.11 herein and the following conditions:

a) a machine tool should be able to accommodate and effectively recover coolants;

b) the fastening device for coolant nozzles should be able to fix the nozzles conveniently and securely to their intended positions;

c) the location of coolant switches and flow controllers should ensure that the operators are safe when adjustments are being carried out.

Verification: visual inspection.

5.19 Packing, storage and transportation

5.19.1 Packing

The packing of a machine tool should meet the following requirements:

a) packing, storage and transportation graphics and markings should meet the requirements specified in GB/T 191;

b) the packing and packing case should meet the requirements specified in JB/T 8356.1 – 8356.3.

Verification: visual inspection and/or checking information.

5.19.2 Storage

The storage of machine tools should meet the following requirements:

a) ensure that its stability is adequate;
b) ensure that it is safe from rain, moisture, damage by rats and ventilation is good;
c) for long-term storage – periodic inspection should be carried out to the conditions of the storage site and the packing;
d) if necessary, describe the environmental conditions of the machine storage site.

Verification: visual inspection and/or checking information.

5.19.3 Transportation

The transportation and handling of a machine tool should meet the following requirements:

a) it is safe and secure and accidental shifting, tilting and turning over should not happen;
b) for machine tool part and components whose mass is greater than 16 kg, lifting holes, lifting ears and lifting devices should be fitted as necessary.
c) If lifting or hoisting devices are provided with the machine tool, detailed information on safe working loads should be provided in the manual. The lifting and hoisting devices should be able to support the load in the event that the power system fails.
d) Machine tool parts and components handled manually should be easy to move and handles (or handholds) should be provided if necessary.
e) Special handling measures should be taken if the nature of the material or shape of a machine tool part or component may be dangerous.

Verification: visual inspection and/or checking information.

5.20 Measurement, adjustment and maintenance

Machine tool measurement, adjustment and maintenance should meet the following requirements:

a) Measurement, adjustment and maintenance should be carried out while the machine tool is stationary. If access to a danger area is necessary while the machine tool is running, the user should be reminded to take safeguarding measures.
b) The required special tools should be provided to ensure that the measurement, adjustment and maintenance are safely carried out.

Verification: visual inspection and/or checking information.

6 Information for Use

6.1 General requirements

6.1.1 Information for Use should inform the operators of the associated risks and provide them with warning.

6.1.2 Information for Use (including various types of signals, text and warning signs) can be provided by the machine tool itself, as a document that accompanied the machine or by any other means.

6.1.3 The documentation that accompanied the machine should meet the requirements specified in Section 18, GB 5226.1 – 2002, ?????????[24] and 5.5 in GB/T 15706.2 – 1995.

6.1.4 Information for Use and the documentation accompanying the machine should be written in ???[25].

6.1.5 The writing of Information for Use and the documentation accompanying the machine should be straightforward and easy to understand.

[24] ????? = characters illegible, concealed by the dark colour GB seal
[25] ????? = characters illegible, concealed by the dark colour GB seal

6.1.6 Markings for electrical equipment should meet the requirements specified in Section 17, GB ????[26] , and on the machine tool at least the following information in clear and permanent markings should be provided:

a) name of the manufacturer;
b) description and model of the machine tool;
c) manufacture date and/or identification number;
d) various certification markings (if any).

6.2 Safety instructions

6.2.1 The manufacturer should provide safety instructions with each machine tool.

6.2.2 Safety instructions can be prepared as a standalone document or as a part of the user manual and maintenance manual.

6.2.3 Warning messages in the safety instructions should be in a larger typeface or a different typeface or emphasised with special symbol or colour.

6.2.4 The safety instructions should at least contain the following:

a) Intended purpose of the machine tool, safety performance, safety precautions and responsibilities, including those relevant to:
    1) prior to machine tool operation;
    2) during machine tool operation;
    3) installation, storage and transportation;
    4) assembly and dismantling;
    5) adjustment;
    6) measurement;
    7) cleaning;
    8) maintenance (lubrication and maintenance).

b) Safety warnings.

c) Provide the following as necessary:
    1) information on non-permissible use;
    2) illustrations;
    3) training requirements.

6.3 Warnings

6.3.1 Warnings (such as warning signs, symbols, graphics and text) should meet the requirements specified in GB 2893, GB 2894, 5.4 of GB/T 15706.2 – 1995, 10.3 and 17.2 of GB 5226.1 – 2002 and GB 18209.2.

6.3.2 The preparation of warnings should take the following into consideration:

a) the contents and illustrations should be concise and to the point;
b) warnings should be classified in accordance with the severity of the injury, and if necessary reasons should be given:
    1) “Danger” indicates high risks (death), vigilance necessary;
    2) “Warning” indicates medium risks (normally refers to irreversible injuries), vigilance necessary;
    3) “Attention” indicates low risks, need to take notice.
c) clear instruction should be given to correct operation.
d) clear instruction should be given to avoid dangers.
e) priority should be given to safety if both safety and health are the focus at the same time.
f) avoid unnecessary repetitions and incorrect messages that can weaken the effectiveness of warnings.

[26] ????? = characters illegible, concealed by the dark colour GB seal

6.3.3 Medium and high risk warning signs should be securely fixed at an eye-catching position on the relevant parts of the machine tool.

6.3.4 In order to draw the attention of the operators, the locations of the safety warning signs should be stated in the safety instruction.

7 Responsibilities

7.1 Manufacturer

7.1.1 The manufacturer is responsible for the risks associated with the design and structure of the supplied machine tool and accompanied accessories that should have been eliminated and/or under control.

7.1.2 The manufacturer is responsible for the safety of the supplied machine tool and accompanied accessories.

7.1.3 The manufacturer is responsible for the Information for Use and suggestions it provided to the users.

7.2 User

7.2.1 Through training on the safe operation of machine tool, the user should understand and be familiar with matters relating to the safe operation of the machine tool.

7.2.2 The user is responsible for the safety of, and the risks associated with any associated jigs, tooling and accessories that it added to the machine tool. The user is also responsible for the safety of, and the risks associated with any changes and modifications made to the original machine tool.

7.2.3 The user is responsible for risks resulted from operating, adjusting, maintaining, installing, storing and transporting the machine tool not in accordance with the procedures set out in the manual.

Reference

[1] ISO 1760—1: 1977	Safety of Machinery - Pressure Sensitive Protective device - Part 1: General Principles for the Design and Testing of Pressure Sensing Mats and Pressure Sensing Floors
[2] ISO 3864—1: 2002	Graphic symbols – Safety Colours and Safety Signs – Part 1: Principles for the Design of Safety Signs for Work Places and Public Areas
[3] ISO 7731: 2003	Danger Signals for Work Places - Auditory Danger Signals
[4] ISO /IEC 8995: 2002	Principles of Visual Ergonomics - The Lighting of Indoor Work Systems
[5] ISO 11428—1996	Ergonomics - Visual Danger Signals - General Requirements – Design and Testing
[6] ISO 11429—1998	Ergonomics – Danger and Non-danger Acousto-optic Signal System
[7] ISO 14122—1: 2001	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants - Part 1: Choice of a Fixed Means of Access between Two Levels
[8] ISO 14122—2: 2001	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants Part 2: Working Platforms and Gangways
[9] ISO 14122—3: 2001	Safety of Machinery - Permanent Means of Access to Machines and Industrial Plants - Part 3: Stairways, Stepladders and Guard-Rails
[10] EN 982: 1996	Safety of Machinery – Safety Requirements for Hydraulic Equipment and Components: Hydraulic System