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GB -

Electrolytic Machine Tools Technical Requirement for Safeguarding (For Approval)

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Inspection and Quarantine of the P.R.C.

Foreword

Chapters 5 & 7 of this Standard are mandatory and other parts are recommended. Please be informed that some contents in this Standard may involve patents. The institution issuing this Standard shall not be responsible for identifying such patents. Appendix A to this Standard is for information purposes.

This Standard is proposed by the China Machinery Industry Federation.

This Standard is managed by the National Technical Committee of Standardization for Special Machine Tools (SAC/TC161).

This Standard is drafted by (unit) the Special Processing Institute of Hefei University of Technology and the Suzhou Machine Tools Institute.

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Electrolytic Machine Tools

Technical Requirements for Safeguarding

1. Scope

This standard specifies the safeguarding requirements for electrolytic machine tools.

This Standard applies to the equipment used in the process of electrochemical machining (ECM), such as electrochemical sinking machines, electrochemical polishing machines, electrochemical deburring machines, electrochemical cutting machines, electrochemical lathe machines, electrochemical grinding machines, electrochemical etching machines and other ECM machines.

2. Normative Documents Quoted

Clauses of the following documents become clauses of this Standard once quoted herein. None of the revisions (excluding contents of the corrigenda) or revised versions of the quoted documents that are dated are applicable to this Standard. However, parties that agree to this Standard are encouraged to study whether the latest versions of the aforesaid documents are applicable. The latest versions of the quoted documents that are not dated are applicable to this Standard.

GB/T 2894 - 1996 Safety Signs

GB 5226.1 - 2002 Mechanical Safety Electromechanical Equipment Part 1 General Technical Conditions IEC60204 - 1:2000 IDT

GB/T 12265.1 Mechanical Safety - Safety Distance for Keeping Your Forearms away from Hazards

GB/T 14896.1 Special Machine Tools Terms Basic Terms

GB/T 14896.3 Special Machine Tools Terms Electrochemical Machine Tools

GB/T 15706.1 1995 Mechanical Safety Basic Concepts and Design Principles Part 1 Basic Terms and Methodology (eqv. ISO/TR12100 - 1:1992)

GB/T 15706.2 - 1995 Mechanical Safety Basic Concepts and Design Principles Part 2 Technical Principles and Specifications (eqv. ISO/TR 12100 - 2:1992)

GB/T 16769 - 1997 Metal Cutting Tools Measurement of Noise Pressure Levels

3. Terms and Definitions

Terms established in GB/T 14896.1 and 14896.3 and the following terms are applicable to this Standard.

3.1

Hazard

Source that is likely to injure or harm health.

Note: "Hazard" is usually used together with other terms to limit hazardous sources and predict the nature of personal injuries or health damages which are likely to result from those sources, such as electric shock, squeezing, cutting and poisoning (See Chapter 4 for various mechanical hazards).

[GB/T 15706.1 - 1995, Definition 3.5]

3.2

Risk

A combination of the probability and extent of personal injuries or health damages in hazardous

conditions.

[GB/T 15706.1 - 1995 Definition 3.7]

3.3

Danger zone

A zone inside the machine and/or around it where risk of personal injury or damage to health may occur.

Note: Hazards due to the supposed risks defined here may frequently occur in the preset commissioning period of the machine tool (caused by the movement of hazardous movable parts and electric arcs during welding), or may occur accidentally (e.g. accidental start-up).

[GB/T 15706.1 1995 Definition 3.10]

3.4

Machining area

The area between the cathode of the tool and the surface where the chemical reaction of the work piece takes place.

3.5

Safeguarding

Safety measures using special technical means called safeguarding devices (guards and safety devices) to protect people against risks that cannot adequately be avoided or restricted in the design.

[GB/T 15706.1 - 1995, Definition 3.19]

3.6

Operator

Person installing, using, adjusting, maintaining, repairing or transporting machine tools.

3.7

Guard

The part of the machine tool designed to provide protection by means of physical obstacles. The guard may be a shell, hood, screen, door, or closed guard.

Note 1: Guards may:

- function independently and be effective only when it is closed;
- function by means of an interlock device with or without a protection lock. In this case, the guard may provide protection in any position.

Note 2: For a fixed guard, "closed" means "in the required position".

[GB/T 15706.1 - 1995, Definition 3.22]

3.8

Safety device

An independent device for eliminating or reducing risk, or a device used together with guards (not guards by themselves)

[GB/T 15706.1 - 1995, Definition 3.23]

3.9

Protective structure

A tangible obstacle, like a baffle, forming part of the machine and serving to restrict the movement of the human body and/or a certain part of it.

[GB 12265.1 - 1997, Definition 3.1]

3.10

Safety distance

The minimum distance between the protective structure and the danger zone.

[GB 12265.1 – 1997, Definition 3.2]

3.11

Electrolyte

The liquid medium filling the area between the cathode and the work piece and, together with the work piece, forming the electrochemical reaction system during machining.

3.12

Electrolytic grinding-wheel

The rotating cathode of the electrolytic grinding tool.

3.13

Busbar

The copper or aluminium bar connecting the rectifier and the cathode of the tool or work piece in order to conduct electricity.

4. Hazard List

For the hazardous factors of the machine tool, see Appendix A (Informative)

5. Safety Requirements and Measures

5.1 General requirements (See 7.1)

5.1.1 Safeguarding measures should be considered in designing the designated functions and uses and expected service life of the machine tool. No hazard shall occur in manufacturing, installing, debugging, maintaining, repairing, storing, transporting or using the machine tool under the specified conditions.

5.1.2 Risks shall be removed or reduced as much as possible during the design period, including the following measures (separately or combined)

- avoiding or reducing risks with appropriate structures; and
- reducing the need for the operator to enter the danger zone.

5.1.3 Hazards that cannot be avoided or adequately restricted through design shall be prevented through guards and safety devices.

5.1.4 The operator shall be made aware of any risks beyond the guards and any hazards that cannot be conveniently prevented in the product instructions, or if necessary through warnings or signs at the hazardous areas.

5.2 Mechanical hazards and protection (See 7.2)

5.2.1 Parts of the machine tool within easy reach shall not have sharp edges, protrusions or openings that may result in personal injury.

5.2.2 Under the designated working conditions, the machine tool or any part thereof shall not overturn, fall or move accidentally. Measures shall be taken to prevent open guide rails (if any) from overturning.

5.2.3 The reciprocating parts of the machine tool shall be restricted and reliably spaced. The respective moving shafts shall be provided with reliable limiting devices to prevent falling or squeezing.

5.2.4 In the case of the machine tool stopping due to an emergency stop, or power and/or control signal interruption, impact hazards shall be prevented. The braking action shall not be stopped for the parts that may move naturally should an emergency stop or power and/or control signal interruption occur; the parts moving vertically (like the main shaft of the electrochemical sinking machine) shall not fall, or if it does fall, it can return to the designed safe position.

5.2.5 The cathode clamp of the tool shall be safe and reliable, to ensure no hazards occur should the

cathode fall or swing off at high speed.

5.2.6 The door of the toolkit shall be locked to prevent it opening accidentally during the machining process. The door/cover of the machine tool shall be interlocked with the electrolyte supply system, where electrolyte splashing in the machining area occurs.

5.2.7 The machining process shall be stopped or cannot be started when the interlock of the safeguarding device is open, and the machine tool shall not start before the guard is closed.

5.2.8 Two or more types of guard shall be provided for dangerous parts (such as the dual-limiting device of the moving shaft (except the manual shaft) of the machine tool in case any guard fails.

5.3 Guards (See 7.3)

5.3.1 Guards are designed for mechanical or other hazards, and shall:

- have the desired mechanical strength, rigidity and reliable performance;
- not lead to any additional hazard (e.g. nipping, cutting, etc.); and
- be fixed firmly and reliably.

5.3.2 The safety distance of the guards shall comply with GB 12265.1.

5.3.3 Dismountable guards shall be easy to mount and dismount and not heavier than 6kg. The opening push force of guards should not be greater than 40N.

5.4 Control system and devices (See 7.4)

5.4.1 The control system of the moving parts of the machine tool shall be reliable, and no functions shall interfere with each other. The control system shall be able to sustain the expected workload and external influences and prevent the information carrier from being interrupted or damaged, and prevent any hazard from occurring.

5.4.2 In designing the control devices, it shall be necessary to consider additional hazards resulting from misoperations, and error tolerance shall be designed for control parts prone to misoperations in the case of any unexpected start-up resulting from the control parts being touched accidentally or unintentionally.

5.4.3 A “stop” button shall be provided near every “Start” button. Every operation position of the machine tool shall be designed with an emergency stop device complying with 10.7 of GB 5226.1 2002.

5.4.4 Every control function of a digital control machine tool shall be designed with a work mode selection switch, with each position corresponding to only one control method or work mode (e.g. auto control or adjustment, check). Other methods (like code control) can also be used to select work mode.

5.4.5 The operating force of the operation hand wheel or handle shall be consistent and not exceed the values provided in Table 1 within the stroke of the machine tool.

Table 1 Operating Force of Operation Hand Wheel/Handle

Host weight, t	≤ 2	> 2 ~ 5	> 5 ~ 10	>10
Operating force of hand wheels and handles often used, N	40	60	80	120
Operating force of hand wheels and handles seldom used, N	60	100	120	160

The operating forces of hand wheels and handles used to clamp, lock, press against or add impedance shall meet the design requirements.

The operating forces of adjustment or maintenance hand wheels and handles seldom used shall meet the design requirements.

The operating forces of hand wheels and handles of a remodelling machine tool shall meet the requirements for base machines.

Note: Hand wheels and handles used more than 25 times in each shift are regarded as often used.

5.4.6 The installation heights (from the ground surface, operation table or pedal to the middle of the hand wheel or handle) shall meet the specifications in Table 2. A machine tool whose hand wheel or handle is higher than 2m shall be supplied with an operation table or pedal.

Table 2 Installation Height of Hand Wheel/Handle

Use Conditions	Height of Hand Wheel/Handle Above the Ground, m
Often used	0.5 ~ 1.7
Seldom used	0.30 ~ 1.85
Used only for adjustment	≤ 2

5.4.7 Meters to be read very often shall be 0.7m ~ 1.7m high, while meters not to be read often may be 0.3m ~ 2.5m high.

5.5 Electrical hazards and protection (See 7.5 & 7.14)

5.5.1 Cables on the machine tool, cathode of the tool and work piece shall be reliably connected. The conduction sectional area at the joints shall match the current to be carried.

5.5.2 Busbars for a large current shall be reliable. Busbars connecting the cathode of the tool and work piece shall be spaced at the proper safety distance depending on the size of the current.

5.5.3 Dual over-current protection devices shall be supplied for electrochemical sinking machines.

5.5.4 Anticorrosion measures shall be taken for an exposed conductor outside of an electrical cabinet.

5.5.5 Insulation between the machine and the work piece shall be reliable. Insulating resistance shall be in accordance with 19.3 of GB 5226.1-2002.

5.5.6 The protection grade provided by the electrical cabinet shall be in accordance with 12.3 of GB 5226.1-2002. The power supply system for machining shall be provided with an independent cabinet or separated from other equipment in the cabinet, and its protection grade shall be IP22. The protection grades of other cabinets shall not be lower than IP54.

5.5.7 Other requirements for the electric devices of the machine tool shall comply with Chapters 4 ~ 19 of GB 5226.1 2002.

5.6 Hydraulic System (See 7. 6)

5.6.1 The materials for pipes and pipe joints shall be safe and corrosion-proof, the joints and exposed connections shall not leak and shall be able to sustain 1.5 times the maximum working pressure of the system.

5.6.2 The pipes shall be set safely and properly spaced to avoid vibrations and collisions.

5.6.3 The liquid level during the working period shall be maintained at a safe height, with enough space for expansion and air separation.

5.6.4 An interlock safety device shall be provided to ensure action sequence of the moving parts. If a static pressure device is used, make sure not to drive the hydraulic system or other machines before the static pressure is established. Interlock safety devices shall be provided if possible.

5.6.5 Guards shall be provided if the joint between the oil pump and the motor is exposed.

5.6.6 If loss of normal pressure of the hydraulic system of the machine tool results in a hazard, an alarm device or indication signal shall be provided in the system.

5.6.7 When the machine tool stops, the hydraulic loop with an accumulator shall be able to automatically release the pressure in the accumulator or the loop and accumulator can be reliably isolated. If the machine tool stops and the hydraulic loop still requires the pressure oil in the accumulator to work, safety instructions (including such words as “Precautions” and “Pressure Container”) shall be provided on the accumulator or at an obvious place it. The product instructions shall also include corresponding contents.

5.7 Pneumatic System (See 7. 7)

5.7.1 The system shall have overpressure, no-pressure or exhaust protection devices. The pipes shall not leak.

5.7.2 The control valve shall have a failure protection device. The mechanical control valve shall ensure no hazard will occur in the case of overload or stroke excess. The electric control valve shall support manual operations, but the manual operation mechanism shall be protected from accidental operations.

5.7.3 The air tank and pressure-equalizing tank shall meet the design specifications and their designed working pressure shall be 115% of the working pressure of the pipes. Both the air tank and pressure-equalizing tank shall be provided with a manual evacuation valve and annexed with permanent signs such as “Pressure Container, Be Careful”.

5.8 Electrolyte system (see 7.8)

5.8.1 The electrolyte circulation and filtration system shall not leak or splash or drip from the machine. The pipe system shall be able to sustain 1.5 times the nominal pressure of the electrolyte.

5.8.2 Except for the heat-conducting component, the electrolyte heating device shall be isolated from the electrolyte to prevent the electrolyte from infiltrating. The electrolyte heating device and the heating measure taken shall not produce an additional hazard.

5.8.3 The drainage of the electrolyte and its dregs shall be in accordance with relevant national rules for environmental protection, and shall be specified in the instructions for the machine tool.

5.9 Baneful gas prevention (see 7.9)

5.9.1 The working box or machining area of the machine tools with a working current not less than 100A shall be provided with vents at the top to ensure that the baneful gas and electrolyte fog produced during the processing shall escape effectively, in accordance with relevant national rules for environmental protection.

5.9.2 Checking and protecting devices for missing ventilation shall be provided for machines in which a mechanical ventilation measure is adopted.

5.10 Anti-corrosion protection (see 7.10)

5.10.1 Anti-rust and anti-corrosion protection measures shall be taken for the body of the machine tool, the guide rail conjugation of the operation table, the guide rail conjugation of the main gudgeon and other guide rail conjugations, other sliding (rolling) guide rail conjugations, the main shaft, lead screw conjugation, worm gear conjugation, high-speed heavy-duty gears, and electrolyte container.

5.10.2 The surface of the operation table of the machine tool and the busbar shall be corrosion proofed.

5.10.3 Parts directly contacting the electrolyte, such as the working box, operation table, cathode installation plate, gas-liquid mixing chamber, electrolyte pump, pipes, valves, pipe connectors, fittings (T-shaped block, pressure plate, and fasteners) shall be made of corrosion-proof material.

5.10.4 The ventilation pipeline, fan and pipe connection shall be made of corrosion-proof material.

5.11 Noise (see 7.11)

5.11.1 Running the machine tools shall not produce sharp noises or percussion sounds.

5.11.2 The noise pressure level of the machine tool shall not exceed 83 dB (A).

5.12 Lighting (see 7.12)

5.12.1 Lighting facilities shall be provided for the safe operation of the machine tool or an interface shall be reserved on the machine tool for installing lighting facilities.

5.12.2 The electric safety of the lighting facilities of the machine tool shall comply with 16.2 of GB 5226.1 - 2002.

5.12.3 The lighting facilities installed in the working box shall be corrosion-proof and explosion-proof.

6 Operation Information (see 7.13)

6.1 Signal and alarm devices

The signal and alarm devices shall be designed and configured in order to facilitate checks. The operation instructions shall contain specifications for how to check the alarm devices.

6.2 Signs and symbols

6.2.1 The machine tool shall have the product sign (nameplate), displaying the following information:

- Name of manufacturer
- Product name
- Product model
- Date of production or delivery
- Product No.

6.2.2 The oiling positions and lubricating points of the machine tool and accessories shall have red signs. The colour of the work pieces shall be different to the machine tool.

6.2.3 Parts (including guards) of the machine tool prone to hazards shall have safety warnings or be painted with safety colours. The warning signs shall comply with 4.2 of GB 2894 - 1996.

6.2.4 The signs for electrical equipment shall comply with Chapter 18 of GB 5226.1 - 2002.

6.2.5 The signs on the machine tool shall be made of corrosion-proof materials and firmly fixed, and the contents of the signs shall be legible.

6.3 Operation Instructions

The safety requirements in the operation instructions shall be comprehensive and detailed, clearly reminding the operators of the possible hazards during operation, and providing preventive measures and methods. For the contents of the operations instructions, see 6.3.1~6.3.7.

6.3.1 Information about the transportation, handling and storage of machine tools

- Conditions for the safe storage of machine tools;
- Dimensions, weight and gravity centres of machine tools;
- Instructions for handling machine tools (such as points of force application); and
- Safety requirements and illustrations for packing machine tools

6.3.2 Information on the delivery and commissioning of machine tools

- Requirements for the fixing and foundations of machine tools;
- Requirements for assembly and installation: installation space, drainage of flushing machines, etc.
- Instructions for power supply connections (including the requirements for groundings); and
- Permitted environment conditions: ambient temperatures, relative humidity, and vibrations

6.3.3 Information about the machine tools themselves

- Data on the noises produced by the machine tools; and
- Instructions and charts/tables for safety functions;

6.3.4 Information about how to use machine tools

- Preparations and checks before use;
- Safety whilst using machine tools, safety warnings, and instructions;
- Operation procedures, methods and precautions for starting and using machine tools, and common misoperations and preventive measures;
- Possible hazards during operation; and

—— Safety monitoring and records during operation.

6.3.5 Information on how to maintain machine tools

Safety technical requirements for the maintenance staff.

6.3.6 Information on electrolyte disposal

Instructions on electrolyte recycling, disposal of waste electrolytes, and electrolyte drainage compliant with government requirements for environment protection.

6.3.7 Information on the discharge of baneful gases

Instructions on how to install and use baneful gas discharge pipes and related accessories. The discharge of baneful gases shall meet relevant national regulations for environment protection.

6.3.8 The Operation Instructions for the machine tools shall be durable.

7. Checks on safety requirements

Safety requirements for machine tools may be inspected through checks and tests. Checks may be made by eye, by hand or by measurement, and tests may be conducted with instruments in order to get related indices and drawing qualitative and quantitative conclusions (checks may also be made during tests).

7.1 General Checks (See 5.1 for safety requirements)

Through safety evaluation and design safety analysis, check whether the machine tools meet the safety designs and whether the safety measures are proper.

7.2 Checks on mechanical hazards and protective measures (see 5.2 for safety requirements)

7.2.1 Whether the parts within easy reach are smooth or have any sharp edge.

7.2.2 Whether the machine tools are fixed firmly and the gravity centres are rational; whether machine tools with open guide rails are designed with measures to prevent overturn.

7.2.3 Whether the reciprocating parts are restricted and spaced reliably; whether reliable mechanical spacing measures are available for the moving shafts (electric) beside electrical spacing measures.

7.2.4 Whether there are undesired natural movements in the case of the machine tool stopping due to an emergency stop or power and control signal interruption; whether no-pressure protection devices are available for main hydraulic gudgeon.

7.2.5 Whether the cathode holders are reliable.

7.2.6 Whether the toolkit doors are closed reliably, and whether the splash hood (door) is interlocked with the liquid supply system.

7.2.7 Whether the interlock guards can be interlocked effectively and reliably.

7.2.8 Whether multiple types of protective measures have been provided for parts prone to major hazards.

7.3 Checks on guards (See 5.3 for Safety Requirements)

7.3.1 Whether the guards are set properly, whether their rigidity, strength and installation capability meet the requirements, and whether they may lead to any additional hazards.

7.3.2 Whether the safety distances of the guards comply with GB 12265.1.

7.3.3 Whether the dismantlable guards are heavier than 6kg, and whether the opening push force for the guards is greater than 40N.

7.4 Checks on the control systems (see 5.4 for safety requirements)

7.4.1 Whether the control systems function reliably or interfere with each other; whether the interruption of the information carrier leads to hazards.

7.4.2 Whether error tolerance is designed for control parts prone to misoperations; whether measures

have been taken to prevent accidental start-up.

7.4.3 Whether the “Start” and “Stop” buttons and the emergency stop button are set properly and correctly.

7.4.4 Whether one position of the work mode selection switch of the digital control machine tool corresponds to only one control mode or work mode.

7.4.5 Whether the operating force and installation height of the operation hand wheel or handle meet the requirements, and whether the installation heights of meters etc meet the requirements.

7.5 Checks on electrical safety (see 5.5 for safety requirements)

7.5.1 Whether the cables on the machine tools, cathodes and work pieces are connected reliably, whether the conduction sectional areas at the joints match the current to be carried.

7.5.2 Whether the busbars are installed as required.

7.5.3 Whether a dual over-current protection device is provided for the electrochemical sinking machine.

7.5.4 Whether the exposed conductors on the electrical cabinet are corrosion proofed.

7.5.5 Whether the insulating resistance between the cathode of the tool and the work piece comply with 19.3 of GB 5226.1 – 2002.

7.5.6 Whether the protection grades of the electric cabinet and operation table meets the requirements.

7.5.7 Whether other electrical equipment of machine tools comply with the requirements of Chapters 4 ~ 19 of GB 5226.1 – 2002.

7.6 Checks on the hydraulic system (see 5.6 for safety requirements)

7.6.1 Whether the hydraulic system of the machine tool leaks; whether the system works normally when it sustains 1.5 times the maximum working pressure.

7.6.2 Whether the pipes are set as required.

7.6.3 Whether the liquid level meets the requirements.

7.6.4 Whether the interlocks are set properly and function reliably.

7.6.5 Whether the hydraulic system is provided with no-pressure protection devices or warning devices.

7.6.6 Whether the hydraulic system is designed with hydraulic loop protection measures after shutdown.

7.7 Checks on the pneumatic system (see 5.7 for safety requirements)

7.7.1 Whether the loops are designed with overpressure, no-pressure or exhaust protection devices; whether the pipes leak.

7.7.2 Whether the failure protection measures for the control valves are effective.

7.7.3 Whether the gas tanks and pressure-equalizing tanks meet the requirements.

7.8 Checks on the electrolyte system (see 5.8 6.3.6 for safety requirements)

7.8.1 Whether the liquid of the electrolyte system splashes or drips out of the machine; whether the pipe system works normally when it sustains 1.5 times the nominal working pressure.

7.8.2 Whether the electrolyte heating devices are installed and set properly; whether the heating devices and heating methods lead to additional hazards.

7.8.3 Whether the Operation Instructions of the machine tool provide information on the disposal and drainage of electrolytes and on the national regulations on environment protection (see 6.3.6 for safety requirements).

7.9 Checks on baneful gas prevention (see 5.9 & 6.3.7 for safety requirements)

7.9.1 Whether the working box or machining area of the machine tool with the working current being not less than 100A is provided with vents or accessories at the top.

7.9.2 Whether the protection devices for machines which have adopted mechanical ventilation measures are effective.

7.9.3 Whether the Operation Instructions for the machine tool describe the discharge measures for baneful gases (see 6.3.7 for safety requirement)

7.10 Checks on corrosion prevention (see 5.10 for safety requirements)

7.10.1 Whether the important parts of the machine tool, the surface of the operation table of the machine tool and the busbar are corrosion proofed.

7.10.2 Whether parts directly contacting the electrolyte, such as the working box, operation table, cathode installation plate, gas-liquid mixing chamber, electrolyte pump, pipes, valves, pipe connectors, fittings (T-shaped block, pressure plate, and fasteners), as well the ventilation systems, are made of corrosion-proof material.

7.11 Checks on noises (see 5.11 for safety requirements)

Whether the machine tool produces sharp noises or percussion sounds (Check the noise of the machine tool as a whole in accordance with GB/T 16769 - 1997, whether the noise pressure level is $\leq 83\text{dB (A)}$).

7.12 Checks on lighting (see 5.12 for safety requirements)

7.12.1 Whether the machine tool is provided with necessary lighting facilities or corresponding interfaces.

7.12.2 Whether the electrical safety of the lighting facilities of the machine tool meet relevant standards.

7.12.3 Whether the lighting facilities in the working box are corrosion-proof and explosion-proof.

7.13 Checks on information used (see Chapter 6 for safety requirements)

7.13.1 Whether the signal and warning signs and symbols of the machine tool are comprehensive and meet the safety requirements.

7.13.2 Whether the signs and symbols on the machine tool are firm and legible.

7.13.3 Whether the Operation Instructions provide clear information about the hazards and preventive measures for the machine tool and about the environmental protection requirements.

7.13.4 Whether the Operation Instructions are comprehensive and practical.

7.13.5 Whether the Operation Instructions are durable.

7.14 Tests on electrical safety (see 5.5 for safety requirements)

The following tests shall be conducted on the machine tool in accordance with Chapter 19 of GB 5226.1 - 2002)

a) Continuity of the protection grounding circuit

The test on the continuity of the protection grounding circuit shall be conducted in accordance with 19.2 of GB 5226.1 - 2002.

b) Insulating resistance test

Insulating resistance test shall be conducted in accordance with 19.3 of GB 5226.1 - 2002.

c) Pressure test

Pressure test shall be conducted in accordance with 19.4 of GB 5226.1 - 2002.

d) Test on dual over-current protection of the electrochemical sinking machine

1 - Conduct machining test, adjust the machining current to 30% of the maximum working current as the working current for the test.

2 - Adjust one over-current protection circuit; the machining power supply shall be switched off automatically when the working current is exceeded by 5%. Repeat the test three times.

3 - Conduct the same test on the other over-current protection circuit.

**Appendix A
(Informative)**

Hazards Related to This Standard

This table follows the principles given in GB/T 15706.1~15706.2 and based on actual conditions of electrochemical machine tools

Table A1 Hazards

Hazards		Corresponding Section
1	Mechanical hazards	5.1, 5.2
1.1	Hazards from sharp edges	5.2.1
1.2	Hazards from overturn, fall or movement of machine tools and their parts	5.2.2
1.3	Hazards from overturn and sliding of operation table	5.2.3
1.4	Hazards from squeezing	5.2.3
1.5	Hazards from gravity falling and impact due to an emergency stop or signal interruption	5.2.4
1.6	Hazards from electrode fall-off or casting	5.2.5
1.7	Hazards from ejection of pressure liquid	5.2.6
2	Electrical hazards	5.5
2.1	Hazards from short circuit between the anode and cathode of the busbar and cable	5.5.2, 5.5.3, 5.5.5
2.2	Hazards from electrical equipment	5.5.4, 5.5.6, 5.5.7
3	Hazards from electrical vibration and noise	5.11
3.1	Loss of hearing (becoming deaf), interfering communications and audio signals, etc.	5.11.1, 5.11.2
4	Hazards from chemical corrosion	5.8, 5.9, 5.10
4.1	Corrosion from electrolyte and baneful gases, discharge of electrolyte	5.8, 5.9, 5.10
5	Hazards from ignoring human ergonomics	5.4, 5.12
5.1	Improper setting of the positions of the control parts	5.4.3
5.2	Improper setting of control status	5.4.4
5.3	Excessive force in operating the hand wheel and handle	5.4.5
5.4	Improper installation height of the control parts	5.4.6, 5.4.7
5.5	Improper lighting of work surface	5.12
6	Hazards from power failure and mechanical damages	5.2, 5.4
6.1	Interruption of control information carrier	5.4.1
6.2	Failure and malfunction (accidental start-up) of the control system	5.4.2
6.3	Accidental projection of control parts or liquid	5.2.5, 5.2.6
7	Hazards from incorrect positioning of safety measures	5.2, 5.3, 5.4, 6
7.1	Hazards from unreliable interlocking of guards	5.2.7
7.2	Various related safety devices	5.3
7.3	Various guards	5.3
7.4	Start and Stop devices	5.4.3
7.5	Safety signals and devices	6.1
7.6	Various information or warning devices	6.1, 6.2, 6.3
7.7	Major equipment and parts for safety adjustment and/or maintenance	6.3