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**Security alarm equipment - Safety requirements and test
methods**

安全防范报警设备 安全要求和试验方法

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Security alarm equipment - Safety requirements and test methods

1 Scope

This document establishes the safety protection design principles for security alarm equipment, stipulates the requirements for protection from electric shock, requirements for protection from mechanical injury, requirements for thermal burn protection, requirements for fire prevention, requirements for radiation protection, indicative requirements for safety protection, requirements for markings and instructions, and describes the test methods for each corresponding requirement.

This document applies to the design, manufacture, inspection and application of various types of equipment in security systems.

Note: Various types of equipment include but are not limited to equipment in systems such as intrusion and emergency alarm, video surveillance, entrance and exit control, parking lot (warehouse) security management, explosion-proof safety inspection, electronic inspection, building intercom, physical protection and human biometric identification.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB 4943.1-2022, Audio/video, information and communication technology equipment - Part 1: Safety requirements

GB/T 5465.1-2009, Graphical symbols for use on electrical equipment - Part 1: Overview and classification

GB 7247.1-2012, Safety of laser products - Part 1: Equipment classification and requirements

GB 15208.1-2018, Micro-dose X-ray security inspection system - Part 1: General technical requirements

GB/T 37958-2019, Requirements of optical radiation safety for active lighting units of video surveillance systems

Note 3: Abnormal operating conditions may cause the failure of components, devices or safety protection.

[Source: GB 4943.1-2022, 3.3.7.1]

3.27

single fault condition

Under normal operation conditions of the equipment, a single safety protection (rather than an enhanced safety protection) or a single component or device fails.

Note: B.4 in GB 4943.1-2022 specifies single fault conditions.

[Source: GB 4943.1-2022, 3.3.7.9]

4 Safety protection design principles

The safety protection design principles are as follows.

- a) Prevent and reduce equipment safety risks under normal operation conditions, abnormal operating conditions and single fault conditions.
- b) Prevent and reduce safety risks of equipment in special use environments (such as strong electromagnetic interference, extreme climate, explosion-proof places), special working conditions (such as continuous long-term work) and specific installation conditions (such as hoisting, wall hanging). For outdoor equipment used in extremely cold and hot areas, when metal materials are used as the enclosure, appropriate protective measures should be taken in the design.
- c) Prevent and reduce safety risks caused by equipment components and parts, such as implosion or explosion, ultrasonic or infrasonic damage.
- d) Design or select a suitable protective enclosure that is provided with functions such as protection from electric shock, protection from mechanical injury and ignition prevention.
- e) Select materials that meet the relevant requirements for pollution control of electronic information products and are compatible with the requirements for flame retardant grade, aging performance and mechanical strength of the equipment.

5 Requirement for protection from electric shock

5.1 Accessible parts

5.1.1 Steady-state voltage or steady-state touch current limits

5.5 Lightning protection

Equipment intended to use coaxial cables to transmit data between different buildings or between outdoor antennas and buildings shall be able to meet the electrical strength requirements of 5.2.2 after undergoing the pulse test (without damp and hot pretreatment); the above-mentioned equipment with antenna terminals shall also undergo a voltage impact test, after which it shall be able to meet the electrical strength requirements of 5.2.2 (without damp and hot pretreatment).

5.6 Battery

For equipment equipped with batteries, the batteries shall comply with the requirements of 7.6 in GB 4943.1-2022.

6 Requirements for protection from mechanical injury

6.1 Protection of sharp edges/acute angles

When there are accessible sharp edges and/or acute angles on the equipment, protective measures shall be taken to prevent harm to the human body.

Special equipment whose basic functions are achieved by using accessible sharp edges/acute angles shall be provided with safety protection instructions.

6.2 Protection of moving parts

When there are accessible moving parts on the equipment, protective measures shall be taken to prevent harm to the human body.

Special equipment whose basic functions are achieved by using moving parts shall be provided with safety protection instructions.

6.3 Mechanical stability

Non-fixed floor-standing equipment with a mass greater than or equal to 25 kg shall not tip over after the test specified in 12.3.3.

6.4 Mechanical strength

After the enclosure strength test in Table 4 and the drop test in Table 5, the equipment shall meet the following requirements:

- a) The enclosure shall not have cracks that may cause danger;
- b) The insulation of internal wires shall not be damaged;
- c) The internal baffle shall not be damaged or loose;

9.3 Protection against microwave radiation

For equipment containing microwave devices, the power density of stray microwave radiation at a distance of 50 mm from the outer surface of the equipment (frequency range 1 GHz ~ 40 GHz) shall be less than or equal to 10 W/m².

10 Indicative requirements for safety protection

10.1 General provisions

Safety protection instructions shall be completely marked on the equipment, or graphic symbols or warning text shall be marked on the equipment and complete instructions shall be provided in the instructions. If only warning text is used, the text shall begin with the words “WARNING”, “CAUTION” or similar text. Safety instructions marked on the equipment shall be close to hazardous parts.

10.2 Safety protection of sharp edges and acute angles

Indicative requirements for safety protection of sharp edges and acute angles shall include the following:

- Graphical symbol: the symbol  numbered 6043 in IEC 60417 (2011-01);
- Warning text: “Beware of sharp edges” or similar text.

10.3 Safety protection of moving parts

Indicative requirements for safety protection of moving parts shall include the following:

- Graphical symbol: the symbol  numbered 6057 in IEC 60417 (2011-05);
- Warning text: “Caution of moving parts” or similar text.

10.4 Safety protection of equipment containing light sources

Equipment containing laser light sources shall comply with the requirements marked in Chapter 5 of GB 7247.1-2012; video surveillance equipment containing active lighting components such as LEDs and xenon lamps with emission wavelengths 200 nm ~ 1 400 nm shall comply with the requirements of 6.3 in GB/T 37958-2019.

10.5 Safety protection of equipment of high voltage or high current

Indicative requirements for safety protection of equipment of high voltage or high current shall include the following:

- Graphical symbol: the symbol  numbered 5036 in GB/T 5465.1-2009;
- Warning text: “Beware of electric shock” or similar text.

11 Requirements for equipment marking and instruction manual

11.1 Marking

11.1.1 Marking contents

The equipment shall be marked with at least the following.

- a) Manufacturer’s name, responsible supplier’s name or registered trademark.
- b) Model and name of the equipment.
- c) Nature (AC, DC or both AC and DC) and polarity of the power source. For AC, the symbol ~ numbered 5032 in GB/T 5465.1-2009 shall be used, and for DC, the symbol  numbered 5031 in GB/T 5465.1-2009 shall be used.
- d) Rated value or rated voltage range of the supply voltage. For equipment powered by AC mains power grid, the rated voltage or rated voltage range shall be marked as 220 V or 380 V (applicable to three-phase equipment) or include the above values, and be set to 220 V or 380 V at the factory; if the equipment has multiple power connections and the connections have different rated voltages, each connection shall be marked with the rated voltage.
- e) AC rated frequency or rated frequency range. Equipment powered by AC mains power grid shall be marked as 50 Hz or including 50 Hz.
- f) Rated current or rated power. If the equipment is provided with a grid power output socket, the rated current or power marked shall include the current or power allocated to the output socket; if the equipment has multiple power connections, each connection shall be marked with a rated current or power.
- g) Rated current value, voltage value, fusing characteristics and model of the fuse (fuse wire/tube). If the fuse is replaceable, it shall be marked near the fuse holder.
- h) Protection category of the equipment against electric shock. The marking of protection category against electric shock for Class I equipment and Class II equipment shall meet the following requirements respectively:

-- Class I equipment:

The characteristics of the power supply used during the test (such as power supply impedance, output voltage waveform) shall not have a significant impact on the test results. For AC-DC dual-use products, the two power supplies must be supplied separately.

12.1.3 Test sequence

The tests shall be carried out in the following order.

- a) Tests carried out when the equipment is not powered on.
- b) Tests carried out when the equipment is powered on, the test sequence is:
 - 1) Tests under normal operation conditions;
 - 2) Tests under abnormal operating conditions;
 - 3) Tests under single fault conditions;
 - 4) Other tests that may cause destructive effects.

12.1.4 normal operation conditions

Unless otherwise specified, the tests shall be conducted under the most unfavorable conditions of the following factors.

- a) Supply voltage. The most unfavorable supply voltage for a certain test shall be determined based on the rated voltage of the equipment, the upper and lower limits of the rated voltage range, and the rated voltage tolerance specified by the manufacturer. Unless the manufacturer declares the use of wider tolerances, the minimum tolerances for AC mains power supplies shall be +10% and -10% and the minimum tolerances for DC mains power supplies shall be +20% and -15%.
- b) Power frequency. The most unfavorable power frequency for a certain test shall be determined based on different frequencies within the rated frequency range of the equipment (for example, 50 Hz and 60 Hz).
- c) Environmental conditions, such as the maximum ambient temperature specified by the manufacturer.
- d) Working mode, such as full load working conditions.
- e) Adjustment of control buttons, knobs, etc.

12.1.5 Abnormal operating conditions

Before introducing abnormal operating conditions, the equipment shall be in normal operation conditions. Each abnormal operating condition shall be imposed individually

12.2 Anti-shock test

12.2.1 Test of requirements for accessible parts

12.2.1.1 Steady-state voltage or steady-state touch current test

The steady-state voltage or steady-state touch current test shall be carried out according to the following method.

- a) Use the articulated test fixture specified in Figure A.1 in Appendix A to determine the accessible parts of the equipment. When there is an opening in the equipment that prevents the articulated test fixture from contacting the component, the non-articulated test fixture in Figure A.2 in Appendix A shall be used to apply a force of 30 N for testing. If a non-articulated test fixture can enter the opening, the articulated test fixture shall be used again to apply a force of less than 30 N to determine the accessible part of the equipment. Use the blunt test fixture specified in Figure A.3 in Appendix A to determine the accessible parts of the equipment plug, jack, and connector. (Accessible parts of the equipment include parts behind doors, panels, removable covers, etc. that can be opened without tools, and exclude floor-standing equipment with a mass exceeding 40 kg that becomes accessible only when tilted).
- b) The supply voltage is 1.1 times the rated voltage of the equipment.
- c) Put the equipment in normal operation conditions, abnormal operating conditions and single fault conditions respectively, use an oscilloscope (or a voltmeter with an observable waveform) with an internal resistance not less than 50 k Ω , and test the steady-state voltage of each accessible part (If the equipment or parts of the equipment need to be earthed during use, they shall be earthed before testing).
- d) Put the equipment in normal operation conditions, abnormal operating conditions and single fault conditions respectively (the single fault test of Class I equipment shall include the disconnection of the protective earthing conductor). The human body impedance measurement network used for Class I equipment and Class II equipment under single fault conditions shall comply with the requirements of Figure 2a); the human body impedance measurement network used for Class II equipment under other conditions shall comply with the requirements of Figure 2b). Test between the accessible parts of the equipment and between the accessible part and any pole of the power supply. The test circuit is shown in Figure 3 or Figure 4. For single-phase equipment, the L-N polarity is changed for a total of 2 tests; for three-phase equipment, the L1/L2/L3 polarity is changed for a total of 6 tests.
- e) For accessible non-conductive parts of the equipment, cover the parts with metal foil (the area of the metal foil is approximately 100 mm $\times$ 200 mm) for testing.
- f) Determine whether the inspection results meet the requirements of 5.1.1.

If the equipment is provided with a power switch, test with the power switch on and off.

12.2.2 Insulation test

12.2.2.1 Clearance and creepage distance tests

Carry out the test according to the requirements of 5.4.2 and 5.4.3 in GB 4943.1-2022, and determine whether the test results meet the requirements of 5.2.1.

12.2.2.2 Electric strength test

The electric strength test is carried out according to the following method.

- a) Carry out the damp heat test when the equipment is not powered on. The test temperature is (40 ± 2) °C and the relative humidity is (93 ± 3) %. For equipment used in tropical climate conditions, the test time is 120 h; for equipment used in non-tropical climate conditions, the test time is 48 h.
- b) After the damp heat test, determine the type of insulation between the equipment's power plug or power input/output terminal and the accessible part of the enclosure; then, with the equipment's power switch turned on, apply the test voltage specified in Table 2 between the power plug or power input/output terminal of the equipment and the accessible part of the equipment enclosure (different values of voltage are applied according to the rated voltage and insulation type of the equipment). Determine whether the inspection results meet the requirements of 5.2.2.

If the equipment enclosure is free of exposed metal parts, cover the surface of the enclosure with metal foil (the metal foil area is 100 mm × 200 mm) for testing.

For equipment in which reinforced insulation and lower-level insulation are used together, care shall be taken that the voltage applied to the reinforced insulation shall not cause the basic insulation or supplementary insulation to withstand voltage stresses exceeding the specified voltage stress.

12.2.2.3 Insulation resistance test

The insulation resistance test is carried out according to the following method.

- a) Carry out the damp heat test when the equipment is not powered on. The test temperature is (40 ± 2) °C and the relative humidity is (93 ± 3) %. For equipment used in tropical climate conditions, the test time is 120 h; for equipment used in non-tropical climate conditions, the test time is 48 h.
- b) After the damp heat test, determine the type of insulation between the equipment power plug or power input/output terminal (if the output terminal is hazardous voltage) and the accessible part of the enclosure. When the power switch of the equipment is turned on, apply a 500 V DC voltage between the equipment power

plug or power input/output terminal (if the output terminal is dangerous voltage) and the accessible part of the equipment enclosure. The test time is 60 s. Test the insulation resistance and judge whether the inspection result meets the requirements of 5.2.3.

If the equipment enclosure is free of exposed metal parts, cover the surface of the enclosure with metal foil (the metal foil area is 100 mm × 200 mm) for testing.

12.2.3 Protective conductor test

12.2.3.1 Test of basic requirements

Make a visual inspection to determine whether the results meet the requirements of 5.3.1.

12.2.3.2 Protective earthing conductor size test

Use a standard measuring tool to test the diameter of the protective earthing conductor and calculate the cross-sectional area to determine whether the inspection results meet the requirements of 5.3.2.

12.2.3.3 Earthing continuity test

Apply a 25 A DC or an effective 25 A AC current between the protective earthing terminal of the equipment and the farthest component or terminal within the equipment that requires protective earthing, and test the voltage at both ends to determine the resistance value. The test time is 1 minute. For equipment with a detachable power cord, the resistance value of the protective earthing conductor of the power cord shall not be included in the test. Determine whether the inspection results meet the requirements of 5.3.3.

12.2.4 Fuse

Check the fuse parameters and manually disconnect the fuse for testing to determine whether the test results meet the requirements of 5.4.

12.2.5 Lightning protection

Carry out the pulse test between the point where the equipment supply circuit terminals and the power supply protective earth terminal (if any) are connected together and the external connection point of the equipment coaxial cable (other than any earthing conductor). All components connected to the external connection point of the equipment's coaxial cable and between the protective earth terminals of the power supply shall be disconnected before testing. If there is an on/off switch, it shall be in the "on" position.

Apply 10 conditioning pulses of alternating polarity using the pulse test generator of Figure 5. The time interval between consecutive pulses is 60 s, and U_c is:

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