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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 47494-2026

Logistics robots - Requirements for electrical safety

物流机器人 电气安全要求

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5.1 Drive System

5.1.1 Motor The robot motor should meet the electrical safety requirements of GB/T 39553. The motor should be suitable for the application and capable of operating without causing electrical hazards. In the event of fire, electric shock, or personal injury, provide its maximum normal load.

5.1.2 Driver Robot actuators shall comply with the electrical safety provisions in GB/T 12668.501 and shall have protection functions against overcurrent, overload, and short circuit.

5.1.3 Integrated Unit The integrated robot drive unit should meet the relevant requirements of the corresponding electrical safety standards to ensure that it does not fail to operate under normal or abnormal conditions. This poses an electrical safety risk.

5.2 Control System

5.2.1 Controller The robot controller should comply with the requirements of

7.5.4 in GB/T 30029-2023 and have wide voltage operating characteristics. Furthermore, it should possess high reliability. In the specific application scenarios required, the controller has a dual power supply redundancy design to prevent system failure due to a single point of failure, and to provide backup power in case of a power failure. Automatically switch to backup power.

5.2.2 Navigation Sensor/Obstacle Avoidance Sensor Robot navigation sensors/obstacle avoidance sensors should meet the following requirements.

a) The enclosure protection rating conforms to GB/T 4208, and the protection rating for indoor navigation sensors/obstacle avoidance sensors is not lower than [specific standard]. IP65, outdoor protection rating not lower than IP67;

b) The laser navigation sensor complies with the radiation limits and labeling requirements

for Class 1 laser products in GB 7247.1.

5.2.3 Control Loop The external control loop should meet the following requirements.

a) The power supply and voltage of the power supply circuit comply with the requirements of

9.1 in GB/T 5226.7-2020;

b) The control circuit provides overvoltage and overcurrent protection. In the event of a short circuit, the control circuit can automatically disconnect the circuit within 5 seconds. Power supply to the equipment.

5.3 Battery System

5.3.1 Battery (pack) The battery pack performance should ensure the robot operates normally under its specified usage conditions. If used in hazardous production environments, it should also meet certain requirements. According to GB/T 37669, all types of batteries should meet the following requirements.

a) Lead-acid batteries meet the requirements of GB/T 7403.1;

b) Nickel-cadmium batteries and nickel-metal hydride batteries meet the requirements of GB/T 22084.2;

c) The lithium-ion battery meets the requirements of GB 40165, and the battery cells have measures to prevent heat diffusion, and there is no thermal runaway between the battery cells. Heat generation and diffusion.

5.3.2 Battery Box The battery or battery pack should be supported and protected by a housing or outer shell structure and should be secured to the robot's chassis. Battery box or... The casing meets the following requirements.

a) For batteries weighing more than 25 kg, the battery case or casing should be designed with a convenient lifting device to prevent damage during assembly/disassembly. The process may pose safety risks.

b) The battery compartment should have sufficient ventilation to prevent the accumulation of hazardous gases. For lead-acid batteries, it should comply with GB/T 7403.1. Ventilation requirements; for other types of batteries, appropriate ventilation measures should be designed according to battery characteristics. Ventilation openings should prevent foreign objects from entering. Enter and keep it open.

c) The battery case cover or separate housing (such as a cover or lid) should be securely fastened to prevent the battery pack from falling when tilted at 90°, and the inner surface should be securely fastened. It should be able to resist the chemical effects of the electrolyte and prevent the electrolyte from leaking onto the ground.

d) The battery box cover shall meet the following requirements. 1) For metal case covers, they should have sufficient strength and rigidity. The metal cover or any live parts of the battery must be effectively insulated. Adequate space should be left between the battery and the terminal block. 2) For non-metallic box covers, the flammability rating should meet V0 or V1 and be able to withstand an impact test of 136J (from a diameter of...). (This is caused by a 100mm thick steel ball weighing 4.11kg falling from a height of 3.3m). If the battery is located under the overhead support frame... The impact can be reduced to 68J (from a steel ball with a diameter of 100mm and a mass of 4.11kg falling from a height of 1.65m). (Born). At this time, there should be no exposed live parts or impacts that could cause physical damage to the battery.

5.3.3 Battery Management System The battery management system should ensure that the battery and battery pack operate within their specified working range. Battery management for robots using lithium-ion batteries. The system should at least meet the following requirements.

- a) It has the function of real-time monitoring or obtaining battery parameters such as voltage, current, and temperature through other means. It also has the function of equalizing and insulating the battery. The battery management system with resistance detection function enables equalization and insulation resistance monitoring.
- b) It has the function of real-time estimation of battery state of charge.
- c) It has alarm and protection functions when the battery is in an abnormal state, including over-discharge, overcharge, overcurrent, and over-temperature.
- d) It has fault diagnosis and handling functions, such as fault code reporting, real-time warning, fault protection, and charge/discharge control.

6 Labeling Requirements

6.1 Marking Requirements The robot's labeling should include at least the following requirements.

- a) There are clear warning signs related to electrical safety;
- b) The design of electrical safety warning signs complies with the requirements of GB/T 26560;
- c) Mark the rated voltage, number of phases, and frequency, as well as the full-load current of the input power supply, near the casing of the input power supply;
- d) All safety signs and markings are durable and can withstand the effects of their use (such as friction, washing, oil) throughout the product's expected lifespan. Despite the effects of dirt, temperature, humidity, etc., it remains clear, legible, and firmly attached.

6.2 Warning signs

6.2.1 Electric Shock Hazard Enclosures that do not clearly indicate that they contain electrical equipment that poses a risk of electric shock should be marked with WO12 from ISO 7010:2019. Graphic symbols and warning signs should be clearly visible on the exterior doors or covers. Warning signs may be omitted in the following cases.

- a) A housing equipped with a power cut-off switch;
- b) Human-machine interface or control station;
- c) Single devices with their own housing (such as position sensors).

6.2.2 Hot Surface Hazards The graphic symbol WO17 from ISO 7010:2019 should be used to warn of the danger of surface temperature on electrical equipment.