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**General specifications for motion rehabilitation training robot**

运动康复训练机器人通用技术条件

*(English Translation)*

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Foreword

SAC/SWG13is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This standard is drafted in accordance with the rules given in GB/T 1.1-2009Directives for standardization—Part 1: Structure and drafting of standards.

This standard was proposed and prepared by SAC/SWG 13 (Standardization Working Group 13 on Special TaskRobots of Standardization Administration of China).

Introduction

With the intensification of the aging process in society, there is an increasing number of disabled and semi-disabled older people who require care. In addition, there is a large population of people with limb movement disabilities caused by conditions such as stroke and spinal cord injury in China. These groups exhibit a growing demand for daily care, mental comfort, rehabilitation, nursing, and other services. The development of robotics technology and its integration with clinical rehabilitation medicine provide a good opportunity for research on rehabilitation training robots. The use of robots and related technologies to objectively monitor and evaluate the rehabilitation training process can improve the targeted and scientific nature of rehabilitation training, enable the development of appropriate rehabilitation programs for trainees, and further improve the efficiency of rehabilitation training.

The purpose of developing this standard is to standardize and unify the performance indicators and testing methods of motion rehabilitation training robots, which will be beneficial for enterprises to improve their product and service quality, as well as improve the trainees' satisfaction with the use of such robots.

General specifications for motion rehabilitation training robot

1. Scope

This standard specifies the terms and definitions, classifications, compositions of product model, requirements, test methods, inspection rules,signs,instruction manual, packaging, transporting and storing of motion rehabilitation training robots.

This standard is applicable to robots for rehabilitation training through limb motion under the guidance of rehabilitation physicians, rehabilitation therapists, or professional nurses (hereinafter referred to as robots).

1. Normative Reference

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 191Packaging—Pictorial marking for handling of goods

GB 4343.1Electromagnetic compatibility requirements for household appliances, electric tools and similar apparatus—Part 1: Emission

GB/T 4343.2Electromagnetic compatibility requirements for household appliances, electric tools and similar apparatus—Part 2: Immunity

GB 4706.1-2005 Household and similar electrical appliances—Safety—Part 1:General requirements

GB/T 9969 General principles for preparation of instructions for use of industrial products

GB/T 13384 General specifications for packing of mechanical and electrical product

GB/T 16754 Safety of machinery - Emergency stop - Principles for design

GB 24436-2009 Rehabilitation training instrument—General safety requirements

GB/T 33265-2016 Education robot safety requirements

GB/T 36239-2018 Special robot—Terms

GB/T 36321-2018 Special robot—Classification,symbol,mark

1. Terms and Definitions

For the purposes of this document, the terms and definitions given in GB/T 36239-2018 and the following apply

3.1

limb

upper limbs and lower limbs of a person (excluding head, neck, and torso)

3.2

rehabilitation training robot

robot used in the field of healthcare and assistance for the elderly and disabled,to assist people with limb motion dysfunction or disability for rehabilitation training and the recovery, reconstruction, enhancement of limb function

NOTE: Rewrite GB/T 36239-2018, definition 3.6.

3.3

motion rehabilitation training robot

robot used for rehabilitation training through limb movements under the guidance of rehabilitation physicians,rehabilitation therapists, or professional nurses

3.4

passive training

one of the training modesin whichthe robot apply force on a certain part of the human body and drive the movement of limb joints. The driving force comes from the robot

3.5

active training

one of the training modesin whichthe limbs drive the robot to complete rehabilitation training. The driving force mainly comes from the myodynamia of trainees

3.6

assistive training

one of the active training modes (3.5) in whichthe robot provides auxiliary drivingforce to assistthe limbs to perform active training continuously

3.7

resistive training

oneof the active training modes (3.5) in whichthe robot provides resistance forceon the limbsto training the myodynamia and muscular endurance

3.8

protective belt

belt used for trainees to maintain the training pose and prevent the body from leaning

EXAMPLE: Such as waist protective belt, dice protective belt, etc.

1. Classification

4.1Classification by training part

According to the training part, the robot may be divided into:

1. Upper limb training robot: a robot usedfor motion training of the shoulder, elbow, wrist, and finger joints;
2. Lower limb training robot: a robot used for motion training of the hip, knee, ankle, and toejoints;

c）Upper and lower limbs training robot: a robot used to trainthe upper andlower limbs.

4.2Classification by training mode

According to the training mode, the robot may be divided into:

1. Active training robot: a robot that provides active training mode for trainees;
2. Passive training robot: a robot that provides passive training mode for trainees;

c) Active and passive training robot: a robot that provides active and passive training modes for trainees.

4.3Classificationby control mode

According to the control mode, the robot may be divided into:

1. Fully autonomous control robot: the control signals are all derived from the robot system;
2. Semi-autonomous control robot: the control signal is partially derived from the robot system;
3. Manual control robot: the control signals are all derived from the user;

d) Other control robot: robots with other control mode in addition to the above.

1. Compositions of Product Model

5.1 Encoding rules

1. The product model codes shall be as simple as possible, and some code numbers maybe omitted if the encoding is clear. The codes of the company, name, industry, space, movement mode and function shall comply with the requirements specified in GB/T 36321—2018. The format is as follows:



1. The design code is composed of product feature code and design sequence code. The product feature code is composed of control mode code, training part code and training mode code. The format is as follows:



1. The code of control mode is represented by the two-representative capital of Chinese characters in Chinese Pinyin, seeTable 1.

Table 1 Control mode codes

|  |  |  |
| --- | --- | --- |
| Control method | Chinese Pinyin | Code |
| Full autonomy | Quan Zi Zhu | QZ |
| Semi-autonomous | Ban Zi Zhu | BZ |
| Manual | Ren Gong | RG |
| Other | Qi Ta | QT |

5.1.4 The code of training part is represented by the two-representative capital of Chinese characters in Chinese Pinyin, see Table 2.

Table 2 Training part codes

|  |  |  |
| --- | --- | --- |
| Training part | Chinese Pinyin | Code |
| Upper limb | Shang Zhi | SZ |
| Lower limb | Xia Zhi | XZ |
| Upper and lower limbs | Shang Xia Zhi | SX |

5.1.5 The code of training mode is represented by the two-representative capital of Chinese characters in Chinese Pinyin, see Table 3.

Table 3 Training mode codes

|  |  |  |
| --- | --- | --- |
| Training mode | Chinese Pinyin | Code |
| Active | ZhuDong | ZD |
| Passive | BeiDong | BD |
| Active and passive | ZhuBeiDong | ZB |

* + 1. The code of produce design sequenceis the last two digits represented by Arabic numerals 01, 02, …

5.2 Example of product model

For a semi-autonomous upper limb robot with active and passive training mode, its manufacturer's name is represented by "XX", and the product model may be represented by XXTZKF-BZSZZB01.

1. Requirements

6.1 Basic structure

* + 1. General requirements

6.1.1.1 The robot shall include a body, sensors, control system and related application software, and should be equipped with physiological parameter monitoring devices.

6.1.1.2 The exposed part of the hard component longer than 8mm shall be chamfered in the tail or taken other protection measures.

6.1.1.3 The length of exposed part of a screw shall not exceed 2 times of its screw pitch. The protruding part is not permissibleto have sharp corners or burrs, and its end shall be covered by a smooth device.

6.1.1.4 The exposed edges and sharp corners of the hard surface that supports the human body shallhave a smooth transition or be protected by a guard. The smooth transition radius *R* shall meet the following requirements:

—Substrate thickness ≥ 6mm：*R* ≥ 3.0mm；

—Substrate thickness < 6mm：*R* = 1/2 Substrate thickness.

6.1.1.5 The filling of the soft bag shall be full, the seam edge shall be firm and regular, and the outer surface shall not have defects such as wrinkles, fading, jumpers or damage, etc.

6.1.2 Body

6.1.2.1 The body may be driven by electricity, pneumatics, hydraulics, etc.

6.1.2.2 In normal workingcondition, cutting, entanglement, squeezing, or collisionshall not existin the user accessible area.

6.1.2.3 The motion of body mechanism shall be flexible, stable and reliable, and its motion shall always be controlled when training.

* + 1. Sensor

6.1.3.1 The joint motion unit of the body shall be equipped with pose sensors.

6.1.3.2 Sensors or devices with force or torque measurement function shall be set on the training-related joint motion unit of the body.

6.1.4 Control system

6.1.4.1 The control system shall include a power switch and an emergency stop device, separately,the emergency stop device shallcomply with the requirements specifiedin GB/T 16754.

6.1.4.2 The control system shall include a normal operation indicatorlight and a fault operation indicator light.

6.1.4.3 The control system shall include one or more communication interfaces.

6.1.4.4 The control software shall comply with the requirements specified in GB/T 33265-2016,4.6.

6.1.5 Physiological parameter monitoring device

The physiological parameter monitoring device is used for monitoring physiological parameters including,but not limited to pulse,blood oxygen saturation, blood pressure, body temperature, and breathing frequency, etc. The physiological parameter monitoring device shall be convenient to wear, and wireless communication should be adopted.

* + 1. Application software

6.1.6.1 The robot should include audio and video monitoring interface, data display interface, back-end database, scenario games that simulate rehabilitation training, etc.

6.1.6.2 The audio and video monitoring interface may monitor and record the audio and video information of the trainee, the robot and the surrounding environment in real time.

6.1.6.3 The visual interface may display the monitoring information specified in 6.2.2 in real time.

6.1.6.4 The back-end database may record and save the monitoring information specified in 6.2.2 in real time, and has functions of querying, marking, storing, etc.

6.1.6.5 The robot should be equipped with more than two sets of scenario games that simulate rehabilitation training. The game level may be settable.

6.2 Functions

6.2.1 Rehabilitation training function

6.2.1.1 The robot shall have one or more of the following training modes:

a) Passive training;

1. Active training (including assistive training and resistive training);

c) Active and passive training.

6.2.1.2 Training mode shall be settable (except single training mode)

6.2.2 Information monitoring function

6.2.2.1 The robot shall have the function of monitoring the motion information between the robot and the trainee. The monitoring information including, but not limited to motion pose, motion velocity, and interaction force.

6.2.2.2 The robot should have the function of real-time audio and video monitoring, and may record the audio and video information of the trainee, the robot, and the surrounding environment.

6.2.2.3 The robot should have the function of real-time physiological parameter monitoring. The monitoring parameters may include, but not limited to pulse,blood oxygen saturation, blood pressure, body temperature, and breathing frequency.

6.2.3 Data analysis function

6.2.3.1 Analysis function of robot parameters shall determine the operating state of the robot in real time.

6.2.3.2 Analysis function of physiological parameters shall reflect abnormalities of the trainee in real time.

6.2.3.3 Analysis function of the interaction force between the robot and the trainee shall reflect the training state in real time.

6.2.4 Security protection function

6.2.4.1 The robot shall have the function of self-checking and error reporting when it starts or resets.

6.2.4.2 Even if the operation is improper, the robot shall still be used safely.

EXAMPLE: Improper operation refers to situations such as incorrect setting of operation parameters, etc.

6.2.4.3 When passive training, motion parts with limited running range shall provide the final stroke limit measures such as terminal limit or other limiting methods to prevent motion parts from overshooting.

6.2.4.4 The robot shall have an emergency stop function. Once the emergency stop device is activated, the robot shall remain in an unusable state.

6.2.4.5 The robot shall have a sound-light alarm function, and the visual alarm shall not be stopped when mute orreset. For the robot equipped with a physiological parameter monitoring module, it shall also have a physiological alarm function, and the physiological alarm signal may be delayed.

6.2.4.6 Whenthe power is interrupted or restored, Limb fixation frame shall remain in the state when it stopped or only be compliant with limbs movement of the trainee.

6.3 Operation parameters

6.3.1 Motion resistance

Motion resistance shall be settable or adjustable during resistive training.

6.3.2 Motion velocity

Motion velocity shall be settable during passive training.

6.3.3 Driving torque

In order to avoid safety risks, driving torque shall not exceed the value specified by the manufacturer.

* + 1. Joint motionangle

6.3.4.1When active training, the joint motionangleof the robot shall not be less than the range of motion of the correspondinghuman joint.

6.3.4.2 When passive training, the joint motion angle shall be set or adjusted within the range of motion of the correspondinghuman joint. The tolerance of the actual joint motion angle relative to the set or adjusted value shall not exceed ±5°, and shall not exceed the allowable limits of the start and end positions of the maximum motion range.

6.3.5Training time

Training time shall be set and displayed within the range specified by the manufacturer, and the indication error of timing should not exceed ±10% of the set value.

6.4Tipping stability

Tipping stability shallcomply with the requirements specified in GB 4706.1—2005,20.1.

6.5 Static load strength

6.5.1 Static load strength of main supporting components

The main supporting components that carry the entire weight of the trainee shall be tested according to 7.5.1. The maximum deformation *f* of the bearing surface in the two-end support type shall not exceed L/100. The maximum deformation *f* of the bearing surface in the one-end support typeshall not exceed L/150. After test, there shall not be any permanent deformation at the bearingsurface, and all parts shallnot have cracks, breakages, etc.

6.5.2 Static load strength of handles orgripping rods

The handles or gripping rods shall be capable of carrying 1000 N vertical load and 500 N horizontal load, andshall be tested according to 7.5.2. There shall not be any breakage, looseness, etc. after unloading, and the permanent deformation shall not exceed 3%.

6.5.3 Static load strength of protective belt

The protective belt shall be ableto carry 1000 N load, andshall be tested according to 7.5.3. It shall be firmly connected without any damage after unloading.

6.6Fatigue strength

After fatigue strength test according to 7.6, the motion parts shall not have any cracks, breaks, etc., and may still be operated and used normallyaccording to the instructions.

When the robot is composed of more than two (including two) independent functional units, each unit shall withstand the fatigue strength test.

6.7 Working noise

Working noise generated by the robot shall not be greater than 60dB (A).

6.8 Electrical safety

Electrical safety shall comply with the requirements specified in GB 4706.1—2005.

6.9 Electromagnetic compatibility

Electromagnetic compatibility shall comply with the requirements specified in GB 4343.1 and GB/T 4343.2.

1. Test Method

7.1Basic structure inspection

* + 1. Overall requirements inspection

7.1.1.1 Check whether the product composition of the robot contains the body, sensors, control system, application software, and physiological parameter monitoring modulein combination with the instruction manual.

7.1.1.2 The structure dimensions should be measured by measuring tools which meet the accuracy requirements, and the other structure and appearance could be inspected visually.

EXAMPLE 1: The linear dimensions should be measured by calipers, rulers, band tapes, etc.

EXAMPLE2: The angle dimensions should be measured by angle rulers, protractors, etc.

7.1.2 Body inspection

7.1.2.1 Connect the robot system and power it on without load. For different driving modes, simulate the operation according to the instruction manual to check whether the robot motion can be driven.

EXAMPLE1: For electric driven type, power on starting motor or other drive systems to check whether the robot motion can be driven.

EXAMPLE2: For pneumatic driven type, start the pneumatic pump, gasbag or other drive systems to check whether the robot motion can be driven.

EXAMPLE3: For hydraulic driven type, start the hydraulic drive system to check whether the robot motion can be driven.

7.1.2.2 In the area accessible to the user, using a simulated trial method, check for the possibility of cutting, entanglement, squeezing, or collision.

7.1.2.3 Simulate the operation according to the instruction manual, observe whether the output of sensors which are set on each joint motion unit for pose information measurement is continuous, stable and reliable; Set the velocityaccording to the instruction manual, and observe whether the motion velocity changes in the passive training mode.

7.1.3 Sensor inspection

7.1.3.1 Observe whether there are sensors for pose measurement in combination with the instruction manual, and check whether it can output the pose of joint motion units after start.

7.1.3.2 Observe whether there are sensors or devices for force or moment measurement in combination with the instruction manual, and check whether it can output the force or moment of joint motion units after start.

7.1.4 Control system inspection

7.1.4.1 Observe whether the control system is equipped with power switch and emergency stop device separately in combination with the instruction manual. Simulate the emergency stop device according to the method specified in the instruction manual, and check whether it comply with the requirements specified in 6.1.4.4.

7.1.4.2 Observe whether the control system is equipped with normal operation indicator light and fault indicator light in combination with the instruction manual.

7.1.4.3 Simulate the operation according to the instruction manual, and check whether the control system can receive the detection information of sensors and whether it can send control commands through the communication interface.

7.1.4.4 Simulate and operate the control software according to the instruction manual, and check whether it comply with the requirements specified in 6.1.4.4.

7.1.5 Physiological parameter monitoring device inspection

Simulate the operation of physiological parameters monitoring according to the instruction manual, and check whether it is convenient to wear and whether it can monitor physiological parameters including, but not limited to pulse, blood oxygen saturation, blood pressure, body temperature, and breathing frequency.

7.1.6 Application software inspection

7.1.6.1 Simulate the operation according to the instruction manual, and observe whether there are audio and video monitoring interface, data display interface, back-end database, and simulation rehabilitation training scenario games.

7.1.6.2 Simulate the operation according to the instruction manual, and observe whether there is a function of monitor and record the audio and video information of trainees, robots and surrounding environment in real time.

7.1.6.3 Simulate the operation according to the instruction manual, and observe whether the monitoring information specified in 6.2.2 can be displayed in real time.

7.1.6.4 Simulate the operation according to the instruction manual, and observe whether the back-end database can record and save the monitoring information specified in 6.2.2 in real time, and whether it has functions of querying, marking, storing, etc.

7.1.6.5 Simulate the operation according to the instruction manual, and observe whether there is a game interface and whether the game level can be set.

7.2Function test

7.2.1 Rehabilitation training function test

7.2.1.1 Simulate the operation according to the instruction manual, and check whether the type of training mode comply with the requirements specified in6.2.1.1.

7.2.1.2For robot with non-single training modes, simulate operation according to the instruction manual and check the setting function of the training modes.

7.2.2 Information monitoring function test

7.2.2.1 Simulate the operation according to the instruction manual, and check whether it has a function of motion information monitoring between the robot and the trainee and whether the monitoring information includes, but not limited to motion pose, motion velocity, and interaction force.

7.2.2.2 Simulate the operation according to the instruction manual, and check whether it has a function ofreal-time audio and video monitoring and whether the audio and video information between the trainee and the robot as well as the surrounding environment can be recorded.

7.2.2.3 Simulate the operation according to the instruction manual, and check whether it has afunction of real-time physiological parameters monitoring and whether the monitoring parameters include, but not limited to pulse, blood oxygen saturation, blood pressure, body temperature, and breathing frequency.

7.2.3 Data analysis function test

7.2.3.1 Simulate the operation according to the instruction manual, and check whetherit has a function of parameter analysis to monitor the robot's running status in real time.

7.2.3.2 Simulate the operation according to the instruction manual, and check whether it has a function of physiological parameter analysis to reflect the abnormal physical condition of the trainee in real time.

7.2.3.3 Simulate the operation according to the instruction manual, and check whether it has a function of interaction force analysis to reflect the training status of the robot and the trainee in real time.

7.2.4 Security protection function test

7.2.4.1 Observe whether it has a function of self-checking and error reporting when starts or resets.

7.2.4.2 Deliberately set wrong operation parameters, and observe whether it is safe to use when starts.

7.2.4.3 Simulate the operation according to the instruction manual, and observe whether terminal limit or other limit methods are provided for motion parts with limited running range as the final stroke limit measures and check whether the measures can be implemented properly.

7.2.4.4 The test of emergency stop function is the same as 7.1.4.1.

7.2.4.5 Simulate the operationof the sound-light alarm function according to the instruction manual, and observe whether the visual alarm stops when mute or reset. For the robot equipped with physiological parameter monitoring module, simulate the function of physiological alarm according to the instruction manual, and observe whether it can work properly.

EXAMPLE1: Turn off the communication of sensor information and there is no signal output. Observe whether the fault indicator light indicates and whether the sound-light alarm works.

EXAMPLE2: Cut off the motor control powerto simulate motor failure. Observe whether the fault indicator light and the sound-light alarm work.

7.2.4.6 Cut off the power in the normal working state, and observe whether the limb fixation frame remain in the state when it stopped or can only be compliant with limb movement of the trainee.Then restore the power, and repeat the test.

7.3 Operating parameter test

7.3.1 Motion resistance test

Simulate the operation according to the instruction manual, and check whether the motion resistance is settable or adjustable during resistive training.

7.3.2 Motion velocity test

Simulate the operation according to the instruction manual, and check whether the motion velocity is settable during passive training.

7.3.3 Driving torque test

Set the maximum driving torque according to the instruction manual, and measure it with a torque tester. Compare the result with the value specified by the manufacturer.

7.3.4Joint motion angle test

7.3.4.1 For the angle of joint motion in active training, simulate and measure the angle of the beginning and ending positions with a goniometer according to the instruction manual.

7.3.4.2 For the angle of joint motion in passive training, use a goniometer to select three points (100%, 50%, and 20% of the maximum set value respectively) without load, and calculate the deviation between the result and the set value.

7.3.5 Training time test

Simulate the operation according to the instruction manual, and check whether the training time can be set and displayed properly. Select the maximum time that can be set or 1h (whichever is smaller) and time with an electronic stopwatch after running, and calculate deviation between the display time and measured time.

7.4 Overturning stability test

The tipping stability test should be conducted as specified in GB 4706.1—2005,20.1.

7.5 Static load strength test

7.5.1 Static load strength test of main supporting components

The bearing form of the main support components which bear the entire weight of the trainee can be simplified as two-end support type [see Figure 1a)] or one-end support type [see Figure 1b)]. For the two-end support type, a 2000N test load is applied to the surface in position of maximum stress (normally in the middle) during normal use; For the one-end support type, a 2000N test load is applied to surface of the cantilever end during normal use. If the bearing surface is separated, the test load should be applied to the entire area of the bearing surface at the same time and be kept for 5 minutes. Measure the amount of deformation during loading. After unloading, check whether there is any permanent deformation and whether there are any cracks, breakages, etc.



1. Two-end Support Type b) One-end Support Type

Description:

1 —— Supporting component;

2 —— Supporting point

L —— Bearing distance;

F —— Loading force (test load);

f —— Amount of deformation.

Figure 1 Diagram of Deformation Measurement

7.5.2 Handles or Gripping rods static load strength test

Apply the vertical load specified in 6.5.2 to the most unfavorable position of handles or gripping rods through a belt with a width of (80$\pm 5$) mm and keep it for 5 minutes. Then, apply the horizontal load specified in 6.5.2 through the strap at the same position in the vertical load test and in the direction of the horizontal maximum force of gripping rods and keep it for 5 minutes. Check its breakage, and measure the amount of permanent deformation after unloading.

7.5.3 Static load strength test of protective belt

After connected and fixed according to the instruction manual, the protective belt should be suspended a load specified in 6.5.3 and keep it for 5 minutes. After unloading, check whether the connection is firm and whether there is any other breakage.

7.6 Fatigue strength test

For the motion parts, the fatigue strength test should be checked at a frequency as close to the normal situation or less than 1Hz as possible withoutimpact. Common parts which have been used for more than one function test could be replaced before individual test. The following test conditions should be used:

a) Inspection load: the maximum load allowed during normal work;

1. Motion range: more than 80% of the allowed moving range;
2. Load direction: the same as the load direction during normal work, or consistent with the motion rule determined by 50% of trainees;

d) Number of cycles: suitable for the expected lifespan for safe use of the product, and it should be no less than 100,000 times (one reciprocating motion is completed once).

EXAMPLE: Common parts include ropes, pulleys, bearings, etc.

7.7 Working noise test

The working noise testshall be conducted as specified in GB 24436—2009, 6.7.

7.8 Electrical safety test

The electrical safety test shall be conducted as specified in GB 4706.1—2005.

7.9 Electromagnetic compatibility test

The electromagnetic compatibility test shall be conducted as specified in GB 4343.1 and GB/T 4343.2.

1. Inspection Rules

8.1 Inspection classification

Inspection includes factory inspection and type test.

8.2 Factory inspection

8.2.1 Every robot shall be inspected before leaving the factory. The items for the factory inspectionshall includeat least6.1.1.2~6.1.1.5, 6.2, 6.3.4, 6.3.5, 6.7, and leakage current and electric strengthin 6.8.

8.2.2 The department of quality inspection shall carry out the inspection item according to the technical documents and this standard, and issue the quality certificate documents to users after it passing the inspection.

8.3 Type test

8.3.1 Type test shall be taken for robots in any of the following situations:

a) When newly designed or old robots are trial produced in the interplant transfer procedure;

1. When robots’ performance may be affected after formal production;
2. When production is resumed after 3 years of suspension;
3. When the factory inspection result is quite different from the last type test;
4. When the State Administration for Market Regulation requests the type test.

EXAMPLE: It affects robots’ performance when some factors change greatly, such as structure, material, etc.

8.3.2 All requirements specified in this standard are the items for the type test.

1. Signs and Instruction Manual

9.1 Signs

9.1.1 There shall be permanent signs on the body and the signs shall be placed in an obvious position.

9.1.2 Signs shall include at least the following:

1. Product name;
2. Product model;
3. Name and address of the manufacturer;
4. Manufacturing date and manufacturing code;
5. Rated voltage and rated power;
6. Lifespan for safe use.

9.1.3 The following permanent warning marks shall be placed on the obvious parts of robots:

a)Warning marks that robots are not allowed to be used in unsupervised situations;

1. Warning marks for older people, children, and retarded people;
2. Warning marks that improper operation may cause safety hazard.

9.2 Instruction manual

The instruction manual shall comply with the requirements specified in GB/T 9969.

1. Packaging, transporting and storing

10.1 Packaging

10.1.1 The packaging box shall comply with the requirements specified in GB/T 13384.

10.1.2 The packaging sign shall comply with the requirements specified in GB/T 191.

10.1.3 The packaging box shall be accompanied with a packing list, product certificate, user manual, spare parts, and special tools.

10.2 Transporting

Robots should be handled with care during transportation and loading/unloading, strictly prohibiting throwing and collisionto prevent severe impacts and vibrations. Avoid direct exposure to rain and snow and contact with corrosive gases.

10.3 Storing

Robots should be stored indoors or in a dry place that can avoid rain, snow, windand sand, and should not be stored with corrosive materials. The storage temperature should be between -10℃ to +45℃, and the relative humidity should be less than 80%.

Bibliography

[1] GB 17498.2-2008 Stationary training equipment Part 2: Strength training equipment- Additional special safety requirements and test methods

[2]GB 17498.8-2008 Stationary training equipment Part 8: Steppers, stairclimbers and climbers -Additional special safety requirements and test methods

[3] GB/T 25295—2010 Guidelines on safety designs for electric equipments

[4] YY/T 0997—2015 Elbow, knee joints passive motion equipment