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Scissors elevating work platforms

剪叉式升降工作平台

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces JB/T 9229.1-1999 “Scissors elevating platforms - Types and basic parameters”, JB/T 9229.2-1999 “Scissors elevating platforms - Specifications” and JB/T 9229.3-1999 “Scissors elevating platforms - Testing method”. Compared with JB/T 9229.1-1999, the main technical changes are as follows:

- Deleted the concept of elevating truck [Clause 2d) in JB/T 9229.1-1999];
- Modified terms and definitions as part references of GB 25849 (Clause 3 of this edition; Appendix A of JB/T 9229.1~9229.2-1999);
- Modified height parameter series of the maximum platform from 19 grades (0.8m~18m) to 23 grades (1m~36m) (4.2 of this edition; 3.2 of JB/T 9229.1-1999);
- Deleted model preparation (Clause 4 of JB/T 9229.1-1999);
- Deleted structure form of elevating power transfer used by steel wire rope and/or chain, screw nut (3.3.4 and 3.8.2 of JB/T 9229.2-1999);
- Modified stability requirements and test methods so as to comply with the provisions in GB 25849 (5.4 and 6.7 of this edition; 3.6 of JB/T 9229.2-1999 and Clause 13, Clause 19 of JB/T 9229.3-1999);
- Modified elevating speed which is not greater than 0.4 m/s (5.3.3 of this edition; 3.2.1 of JB/T 9229.2-1999);
- Added rotating speed which shall not be greater than 0.7 m/s (5.3.3 of this edition);
- Added walking speed at which it can walk under elevating state (5.3.3 of this edition);
- Modified carrying capacity from elevating 100 times at 1.25 times the rated load to elevating 30 times at 1.33 times the rated load (5.3.5 of this edition; 3.4.1 of JB/T 9229.2-1999);
- Modified descending volume from not greater than 10 mm in 20 min to 5 mm (5.3.8 of this edition; 3.8.8 of JB/T 9229.2-1999);
- Added emission requirements for internal combustion engine driven system (5.3.10 of this edition);

- Modified guardrail height of work platform from 0.9 m to 1.1 m (5.5.4 of this edition; 3.7.1 of JB/T 9229.2-1999);

- Added pollution requirements for hydraulic oil solid particles (5.9.6 of this edition);

- Added “Overload protection, level indicator, emergency stop and other safety devices shall be set” (5.11 of this edition);

- Modified reliability requirements be represented by mean time between failures and reliability (5.12 of this edition; 3.5 of JB/T 9229.2-1999);

- Added operation and use requirements (Clause 9 of this edition).

This Standard was proposed by China Machinery Industry Federation.

This Part shall be under the jurisdiction of Machinery Industry Standardization Technical Committee on Logistics and Warehousing Equipment (CMIF/TC10) and National Standardization Technical Committee on Elevating Platform (SAC/TC335).

Main drafting organization of this Standard: Beijing Hoisting and Conveying Machinery Design Institute.

Drafting organizations of this Standard: National Hoisting and Conveying Machinery Quality Supervision and Inspection Center, Suzhou Elevating Machinery Association, Shandong Jiyang Machinery Plant, Southworth (Shanghai) Lift Table Co., Ltd, Zhejiang Dingli Machinery Co., Ltd., Dongguan Hua Nan Junye Machinery Manufacturing Co., Ltd., and Beijing Jingcheng Heavy Industry Co., Ltd.

Main drafters of this Standard: Lu Jianhu, Wang Shunting, Xing Zengnan, Li Jikang, Tai Guozhu, Lu Fang, Xu Shugen, Liu Xuechun, Xin Hongyan, Ma Jianjie and Zhu Linxing.

This Standard replaces the following previous standards:

- ZB J83 001-1986, JB/T 9229.1-1999;

- ZB J83 003.1-1987, JB/T 9229.2-1999;

- ZB J83 003.2-1987, JB/T 9229.3-1999.

Scissors elevating work platforms

1 Scope

This Standard specifies the classification, technical requirements, test methods, inspection rules, marks, packaging, transport and storage, operation and use of scissors elevating work platforms.

This Standard is applicable to scissors elevating work platforms (hereinafter referred as scissor platforms).

2 Normative references

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 3323-2005 Radiographic examination of fusion welded joints in metallic materials

GB/T 3766 Hydraulic fluid power - General rules and safety requirements for systems and their components

GB/T 7935 Hydraulic fluid power - General requirements for hydraulic components

GB/T 9286-1998 Paints and varnishes - Cross cut test for films

GB 12265.3 Safety of machinery - Minimum gaps to avoid crushing of parts of the human body

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

GB/T 20082 Hydraulic fluid power - Fluid contamination - Determination of particulate contamination by the counting method using an optical microscope

GB 20891 Limits and measurement methods for exhaust pollutants from diesel engines of non-road mobile machinery (CHINA I, II)

GB/T 22087-2008 Arc-welded Joints in Aluminium and its Alloys - Guidance on Quality Levels for Imperfection

GB 25849-2010 Mobile elevating work platforms - Design calculations, safety requirements and test methods

ISO 18893 Mobile elevating work platforms - Safety principles, inspection, maintenance and operation

3 Terms and definitions

Terms and definitions defined by GB 25849 and the following ones apply to this document.

3.1 Elevating work platforms

A device that is used to carry people, tools and materials to the working position; it is composed of working platform with control, extending structure and chassis.

3.2 Scissors elevating work platforms

A elevating work platform of which the extending structure is scissors mechanism.

3.3 Stationary scissors elevating work platforms

A scissors elevating work platform that is fixed mounted and without walking mechanism.

3.4 Mobile scissors elevating work platforms

A scissors elevating work platform of which the walking mechanism has no dynamic but can easily move at workplace with the aid of external force.

3.5 Self-propelled scissors elevating work platforms

A scissors elevating work platform of which the walking mechanism has dynamic and can drive by itself, running between workplace or site.

3.6 Scissors mechanism

An unit that elevates the platform. For example: it may consist of scissor rod, hydraulic cylinder, guide wheels, etc.

3.7 Scissors rod

A rod to form scissors mechanism.

5 Technical requirements

5.1 General requirements

5.1.1 The main raw material shall be used when it has material certificate. When using alternative material, its main technical performance shall not be lower than the original specified requirements.

5.1.2 Parts and components of same model product shall be interchangeable.

5.1.3 Scissors platform dynamic system shall be divided into manually driven, power driven or internal combustion engine driven.

5.1.4 Rated load value shall be prominently indicated on the platform.

5.1.5 For the platform with stretching function, the allowable load values and corresponding working conditions during stretching shall be clearly specified in the instructions for use.

5.1.6 Working conditions for scissors platforms are as follows:

a) Working ground shall be solid and flat; it shall not sink during operation;

b) Ambient temperature: -20°C~40°C;

c) Relative ambient humidity shall not be greater than 90% (at 20°C);

d) Altitude shall not exceed 1000 m;

e) Wind speed shall not exceed 12.5 m/s;

f) Allowable fluctuation of power voltage: ±10%.

5.1.7 The connection between each scissors rod of scissor mechanism, connection between hydraulic cylinder support beam and scissors rod, connection between vertical and horizontal beams of underframe, the weld of joints between lower hinge bearing and lower roller tracks, and steel material shall comply with the requirements regulated in Grade II of GB/T 3323-2005; aluminum alloy shall comply with the requirements regulated in Grade B of GB/T 22087-2008.

On the outer of weld, there shall be no burn-through, undercut, entrapped slag, weld bead or other defects. There shall be no cracks at vertical and horizontal direction of weld and on parent metal. Continuous weld shall have no interruption. Squamous corrugation shall be formed evenly. And the maximum height difference shall not be greater than 2 mm.

f_2 - Dynamic load factor.

The values of f_1 and f_2 shall be determined by experimental analysis on prototype, or taking f_1 ≥1.10, f_2 ≥1.25.

5.2.2 The plastic material used by bearing components of scissors platform shall be calculated according to the yield strength of the material. The structural safety factor shall not be less than 2.

5.2.3 The non-plastic material used by bearing components of scissors platform shall be calculated according to the tensile strength of the material. The structural safety factor shall not be less than 5.

5.3 Performance requirements

5.3.1 The platform shall be reliably stopped at any place within the elevating range.

5.3.2 Transmission system shall be steady. There shall be no abnormal noise caused by vibration and hydraulic pump evacuation.

5.3.3 Elevating and lowering speeds shall not exceed 0.4 m/s; rotating speed shall not exceed 0.7 m/s (horizontal speed at the outermost edge of the platform). For scissors platform that can walk under elevating condition, the walking speed shall not exceed 0.4 m/s; when it lowers to the initial altitude, the walking speed shall not exceed 0.7 m/s.

5.3.4 Place scissors platform on a solid horizontal plane. The scissors platform for carrying people shall withstand concentrated rated load at any place that is 300 mm away from the surrounding of the platform. The scissors platform for carrying objects shall withstand concentrated rated load at platform width that is 1/3 away from the platform center. After full-stroke elevating for 30 times, there shall be no permanent deformation or cracks to load-bearing components.

5.3.5 Place scissors platform on a solid horizontal plane. The platform shall withstand 1.33 times the rated load evenly. After full-stroke elevating for 30 times, there shall be no permanent deformation or cracks to load-bearing components.

5.3.6 When the platform elevates to the maximum height, the allowable maximum horizontal lateral force applied on the platform shall be calculated according to equation (2):

5.3.13 The width, length and height errors of scissors platform shall not be greater than 1% of the nominal value.

5.4 Stability

5.4.1 The calculation of stability shall comply with the provisions of 5.2.4 in GB 25849-2010.

5.4.2 A static stability test shall be conducted for scissors platforms. For the scissors platform that can walk in elevating condition, it shall also conduct a dynamic stability test. The whole platform shall be stable.

5.4.3 The platform shall withstand the rated load. After it elevates to the maximum height, when the maximum lateral force is applied at any point around it, the whole platform shall be stable.

5.5 Working platform

5.5.1 The levelness between working platform and horizontal plane or chassis plane or rotating plane shall not be greater than 5°.

5.5.2 The working platform's width shall not be less than 0.45 m. The working platform surface shall be anti-skidding and self-draining. Instead of chain, it shall use rope for guardrail or entrance door.

5.5.3 The working platform shall be made of fireproof material.

5.5.4 The height of working platform guardrail shall not be less than 1.1 m. There shall be intermediate crossbars of which the space between intermediate crossbars shall not be greater than 0.55 m, and the skirting board height shall not be less than 0.15 m. For the skirting board at the entrance of the platform, its height can be 0.10 m.

5.5.5 The guardrail structure shall withstand 500 N of the concentrated load applied the interval of 0.5 m at the most unfavorable position and the most unfavorable direction. All terminal vertical rods of guardrail can withstand 900 N of static concentrated load on rod's top end from each direction and it will not cause the guardrail deformed permanently.

5.5.6 For the platform used to carry people, there shall be places reserved for safety belts for working staff on the surface. For the platform used to carry objects, there shall be no guardrail, skirting board and guard pieces.

5.5.7 The guard pieces which can automatically close but cannot open freely at the entrance of the platform must not opened outward.

5.7.2.1 If stabilizer is required to use in the design of scissors platform, it shall be indicated in the instructions for use. The working platform shall be able to work only when stabilizer is accurately adjusted to normal operation. Meanwhile, interlock device shall be set.

5.7.2.2 Each leg shall be securely fixed in a predetermined position, and can be adjusted individually. For stretchable legs, mechanical locking device shall be set.

5.7.2.3 For stabilizer driven by hydraulic pressure, self-locking device shall be set to prevent it from retracting when hydraulic circuit fails.

5.8 Electrical system

5.8.1 The insulation resistance of main electrical components shall not be less than 1.0 MΩ and the insulation resistance of control circuit shall not be less than 2.0 MΩ.

5.8.2 The main structure and electrical equipment of scissors platform shall be reliably grounded. Ground resistance shall not exceed 4Ω. The electrical system shall have safety protection device.

5.8.3 A master switch shall be set to easily cut off the platform power.

5.8.4 Control circuit voltage of electrical system shall be safe or it shall use reliable protection against electric shock.

5.8.5 Electrical equipment shall be waterproof, shockproof, and dust-resistant. The protection class shall not be less than IP54. Elements shall be arranged in order and firmly connected.

5.8.6 Non-metal wire shall be grounded. When wires go through metal holes, there shall be insulating protective sleeve.

5.9 Hydraulic system

5.9.1 Hydraulic system shall comply with the provisions of GB/T 3766. Hydraulic components shall comply with the provisions of GB/T 7935.

5.9.2 For connectors and hoses of hydraulic system's key components, the minimum bursting strength shall not be less than 4 times the designed pressure. For connectors and hoses of hydraulic system's non-critical components, the minimum bursting strength shall not be less than 3 times the designed pressure.

5.9.3 In hydraulic system, there shall be devices to prevent overload and

5.11 Safety protection devices

5.11.1 Scissors platform shall be set with overload protection device.

5.11.2 Scissors platform shall be set with level indicating device. It shall be able to work only after the chassis is adjusted to the level.

5.11.3 Scissors platform shall be set with emergency stop button that is installed in a easily reachable place to allow easy power cut off in emergency. The emergency stop button shall be red and non-automatic reset.

5.11.4 Limit device shall be set at the end position of each movement of scissors platform.

5.11.5 If scissors platform is allowed to use on slope, anti-tipping warning device shall be set. When the angle between chassis and level at any direction is greater than the maximum allowable inclination stipulated by manufacturer, this device shall automatically send out alarm.

5.11.6 When the distance between lower surface of working platform of stationary scissors platform and upper surface of underframe is less than 100 mm, it shall take safety measure along the peripheral of platform's lower surface.

5.11.7 For rotating working platform, when it rotates to some angle and stops, there shall be locking device to lock it. When scissor platform is driving, the working platform must not rotate.

5.11.8 When dynamic or parking fails, there shall be safety device to prevent the working platform from descending due to control failure.

5.11.9 After the stretching platform stretches, when stretching mechanism fails, there shall be a device to make it retract.

5.11.10 For insulation platform, the insulation voltage shall be indicated on the platform.

5.11.11 Moving parts that may cause danger to human body shall be set with protection devices. At the place where protection devices cannot be installed, the safety distance shall comply with the provision of GB 12265.3, so as to prevent fingers, hands and feet pinched.

5.11.12 Scissors platform of which the maximum platform height is greater than 20 m shall be set with intercom system.

5.11.13 For scissors platform that is operated on working platform, there shall be a device sending out alarm to work site during operation.

d) Allowable fluctuation of power voltage is ±10%.

6.1.3 There shall be no obstacles around scissors platform to affect its rotation. During noise measurement, the distance from reflecting object such as wall shall exceed 10 m. Keep it far way other noise sources.

6.1.4 Test instrument and apparatus shall have verification or calibration certificate issued by measurement organization and it shall be within the validity period.

6.1.5 Test load deviation is ±1%.

6.1.6 Scissor platform with special requirements shall be tested according to requirements of order contract.

6.2 Structure parameter measurement

Measure the geometrical parameters of the maximum platform height, vertical and horizontal distance between legs, and dimensions when scissors platform carries nothing.

6.3 No-load test

6.3.1 Make scissors platform lift, descend, rotate (if any), levelly stretch (if any), retract legs and walk (if any).

6.3.2 Lifing speed measurement: adjust scissors platform to working condition. The platform shall elevate to the highest position. Record the required time and distance. Repeat the test twice.

6.3.3 Descending speed measurement: adjust scissors platform to working condition. The platform shall descend from the highest position to the lowest. Record the required time and distance. Repeat the test twice.

6.3.4 Rotating speed measurement: adjust scissors platform to working condition. Measure the required time and angle when the platform rotates to the maximum angle. Repeat the test twice.

6.3.5 Walking speed measurement: self-propelled scissors platform is under no-loading operation. Make gearbox at the gear for test. Conduct straight running. Record the required time when it drives on 50 m of test road at the maximum walking speed of each gear. The auxiliary driving distance shall make sure the self-propelled scissors platform reach to the maximum walking speed. Repeat the test four times for the round driving, i.e., twice for each one-way driving.

platform shall horizontally and vertically displace at the place where working platform center is equivalent to the starting position. Repeat the test twice for each.

6.6.3 The maximum deflection amount

When scissors platform is under no-loading state or withstands the rated load, apply the maximum horizontal lateral force based on the provisions in 5.3.6. Use theodolite to measure the maximum horizontal displacement of working platform center at the place where it is equivalent to the horizontal lateral force. Repeat the test twice for each.

6.7 Stability test

6.7.1 General requirements

6.7.1.1 Conduct stability test. Observe whether there is instability. It shall add protective ropes when necessary.

6.7.1.2 When conducting the test in 6.6.3, observe the stability of scissors platform.

6.7.2 Static stability test

Set chassis of scissors platform at the maximum allowable inclination stipulated by manufacturer and plus with 0.5°. Use the stabilizer stipulated by manufacturer.

Test load shall be the combination of the most unfavorable load and force specified in 5.4.1.

If the test load has been calculated according to the maximum allowable inclination of chassis stipulated by manufacturer plus with 0.5°, the test shall be allowed to conduct on the level ground.

If necessary, the test load can be placed at position with appropriate strength so as to prevent any part or component of scissors platform over-loaded. Repeat the test at all the most unfavorable lifting and descending states of scissors platform.

When withstanding the test load, if it is stable and shall not tip over, then this scissors platform shall be regarded as stable.

In addition, the test shall indicate that at any position of working platform, it uses the manual operation force stipulated in 5.2.3.4 of GB 25849-2010. And there shall be no permanent deformation for the working platform.

6.9 Emission measurement

The emission measurement of scissors platform driven by internal combustion engine shall be conducted in the measurement methods in GB 20891.

6.10 Driving test

6.10.1 Self-propelled scissors platform that is under no-loading operation state is driving on level pavement at medium speed. The driving distance shall not be less than 10 km (fuel supplementary is allowed).

6.10.2 When self-propelled scissors platform is driving on asphalt or concrete pavement with the maximum slope stipulated by manufacturer. Transmission mechanism of walking mechanism is at neutral position. Observe if it can reliably brake when it drives forward and backward.

6.10.3 Cut off the power of walking mechanism of scissors platform and observe if it can move.

6.11 Measurements of working platform, guardrail size and guardrail carrying capacity

6.11.1 Place working platform on a flat ground. Guardrail shall be fixed and reliable.

6.11.2 Measure the size of working platform, guardrail and skirting board.

6.11.3 Apply 500 N of vertical load on the upper part of the guardrail armrest (upper rail) at every 0.5 space. Maintain it for 3 min and remove the load. Observe if there is residual deformation on the whole guardrail.

6.11.4 Apply 500 N of horizontal load on the upper part of the guardrail armrest (upper rail) at every 0.5 space. Maintain it for 3 min and remove the load. Observe if there is residual deformation on the whole guardrail.

6.11.5 Apply 900 N of concentrated load on the top of guardrail terminal vertical rod. Maintain it for 3 min and remove the load. Observe if there is residual deformation on the whole guardrail. The concentrated load shall be applied once at up, down, left and right in each direction.

6.12 Measurement of hydraulic oil solid particle pollution

The hydraulic oil solid particle pollution shall be measured according to the

method stipulated in GB/T 20082.

6.13 Structural stress test

6.13.1 Conduct structural stress test for two working conditions: when scissors platform withstands the rated load and 1.33 times the rated load.

6.13.2 Prepare and make the distribution of stress measurement points based on calculations and structural stress analysis.

6.13.3 Rated load test and overload test shall be gradually loaded. In the test, as long as any of the test results show plastic deformation or other damage during the test, it shall stop the test and conduct a thorough examination.

6.14 Reliability test

6.14.1 General requirements

Requirements for reliability test are as follows:

a) During reliability test, wearing parts are allowed to replaced according to the provisions on normal maintenance. It shall record in details the maintenance and repair during the test. However, it must not adjust the whole machine. And it must not conduct the test when the machine has failures.

b) When scissor platform is elevating at rated load, the interval between each two cycles shall not exceed 10 min and the reliability test time shall be 200 h. One cycle means it lifts to the maximum height and descends to the initial position.

6.14.2 Failure classification

The extent of damage of scissor platform to human safety, to parts and components, the degree of difficulties of function and repair shall be divided into mild failure, general failure, serious failure and fatal failure.

a) Fatal failure: severely deformed parts, body fracture and severely degraded insulation performance in normal working conditions that shall result in human injury or death. This kind of failure is not allowed;

b) Serious failure: distorted structure, safety protection device failure, and failure of which repair requires more than 3 h in normal working conditions;

c) General failure: failures that do not happen frequently but have affected platform's performance which require maintenance and repair by

attaching tools in not greater than 2 h in normal working conditions;

d) Mild failure: loosen fasteners, failures caused by improper adjustment and insufficient maintenance of which repair time shall not exceed 30 min.

6.14.3 Hazard coefficient of failure

According to failure type, use hazard coefficient of failure to count the number of failures. The hazard coefficients are shown in Table 4.

Table 4 Hazard coefficient of working platform failure

Failure type	Failure name	Hazard coefficient of failure ε
1	Fatal failure	∞
2	Serious failure	3.0
3	General failure	1.0
4	Mild failure	0.2

6.14.4 Reliability evaluation

6.14.4.1 Mean time between failures shall be calculated according to equation (4):

$$MTBF = \frac{t_0}{r_b} \quad \cdots\cdots (4)$$

Where,

MTBF - Mean time between failures, in hour (h);

t_0 - Accumulated working time of scissors platform, in hour (h);

r_b - Equivalent number of failures occurred during the specified reliability test of scissors platform ; its value shall be calculated according to equation (5):

$$r_b = \sum_{i=1}^{4} n_i \varepsilon_i \quad \cdots\cdots (5)$$

Where,

n_i - Number of i^{th} type of failures;

ε_i - Hazard coefficient of i^{th} type of failures.

When $r_b<1$, make $r_b=1$.

7.2.2 Type inspection items are shown in Table 5.

7.2.3 Type test sampling uses one-time random sampling method. Sample number is 2. Sampling base number is not limited.

7.2.4 During type inspection, if one of item 2, items 6~9, item 12 and items 14~15 fails, then this product shall be determined as unqualified. If the items mentioned above are qualified but two items in the rest fail, then this product shall be determined as unqualified. If only one item fails, it shall make re-sampling to this item; the product shall be determined as unqualified if this item fails.

Table 5 Inspection items

No.	Inspection item	Inspection method	Reference for determination	Exit-factory inspection	Type inspection
1	Appearance inspection	Visual inspection	5.1.4, 5.1.7~5.1.11	√	√
2	Safety protection device	Visual inspection	5.11	√	√
3	Structural parameter measurement	6.2	5.3.11~5.3.13	√	√
4	No-load test (including speed measurement)	6.3	5.3.2, 5.3.3	√	√
5	Rated load test (including speed measurement and measurement of the amount of declining)	6.4	5.3.3, 5.3.8	√	√
6	Bearing capability test	6.5	5.3.4, 5.3.5	√	√
7	Measurement of the amount of deflection	6.6	5.3.6, 5.3.7	-	√
8	Stability test	6.7	5.4	-	√
9	Noise measurement	6.8	5.3.9	-	√
10	Emission measurement	6.9	5.3.10	-	√
11	Driving test	6.10	5.7.1	-	√
12	Measurements of working platform, guardrail size and guardrail carrying capacity	6.11	5.5.2, 5.5.4, 5.5.5	-	√
13	Measurement of hydraulic oil solid particle pollution	6.12	5.9.6	-	√

and maintain it according to the instructions for use before reuse it.

9 Operation and use

The operation, examination and maintenance of scissors platform shall comply with the provisions of ISO 18893.

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