

Mast climbing working platform STC200

Operating Instructions



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1 Purpose

STC mast climbing working platform is the specialized equipment for the construction of building exterior walls. It's suitable for the applications such as the painting, washing, face tiling, welding steel structure and erecting curtain wall and other outside building wall activities.

2 Performance and Technical Data

No.	Performance and Technical Data		Double mast installation mode
1	Model		STC200
2	Rated load (at largest platform length)		2000 kg (even load)
3	Highest people capacity		4 people
4	Rated lifting speed		6.4 m/min
5	Maximum operation height		150 m
6	Rail rack top biggest suspending arm height		3m
7	Maximum platform length		20.4 m
8	Basic platform width		1.5 m
9	Maximum extended platform width		2.5 m
10	The first mast tie height		3 ~ 4 m
11	Mast tie spacing	Working height (0-100m)	6 m
		Working height (100-150m)	3 m
12	Mast section specifications and sizes		1508×500×500 mm
13	Electromotor	Model	TYEJ permanent magnet synchronous
		Input power	4×2.8 kW
		Rated rotating speed	1500 r/min
		Rated voltage	6.8 A/pc
		Voltage	380 V
4	Brake	Braking torque	40 N.m
		Excitation voltage	DC99 V
15	Reducer	Model	CRLa87-84.5
		Transmission ratio/output torque	84.5 / 1550 N.m
16	Power		3P、380V、50Hz

Table 1 Working Platform Load Sheet

Working platforms Installation type	Working platform total length (m)	Working platform rated load
Double mast	12.9 (1.5+1.2+1.5×5+1.2+1.5)	2750
	14.4 (1.5×2+1.2+1.5×4+1.2+1.5×2)	2600
	17.4 (1.5×2+1.2+1.5×6+1.2+1.5×2)	2300
	20.4 (1.5×3+1.2+1.5×6+1.2+1.5×3)	2000

Note: (1) Drive platform length: 1.2m ; (2) Short platform length: 0.8m; (3) Long platform length: 1.5m.

(4) It's prohibited to keep the full load operation for a long time.

3 Basic Structure and Working Principle Briefing of Equipment

3.1 Basic mode

This equipment has two installation modes which are single mast and double mast installed mode. Single mast installed-type mast climbing working platform, hereinafter referred to as single mast platform; double mast installed-type mast climbing working platform, hereinafter referred to as double mast platform.

3.2 Single mast platform (see Figure 1)

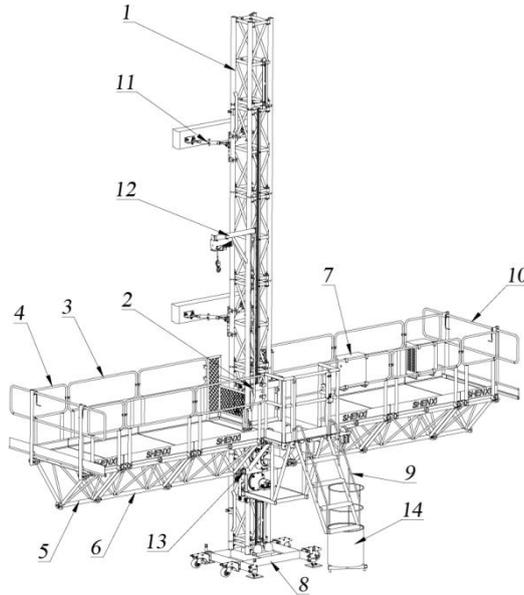
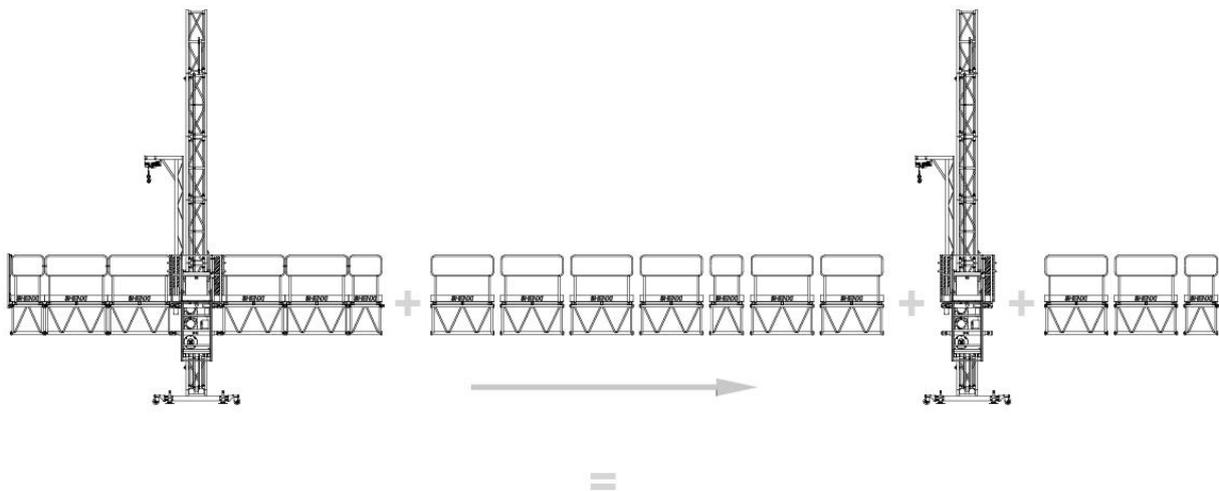


Figure 1 Single Mast Platform Structure Outline

Single mast platform is mainly composed of mast 1, Drive platform 2, Long guardrail 3, Short guardrail 4, Short platform 5, Long platform 6, Electronic control system 7 Base 8, boarding ladder 9, Side guardrail 10, Mast tie 11, Electric hanging pipe 12, Leveling device 13 And cable collar 14 Composition.

3.3 Double mast platform

Double mast platform C (see Figure 2) is mainly composed of platform A and single mast platform B.



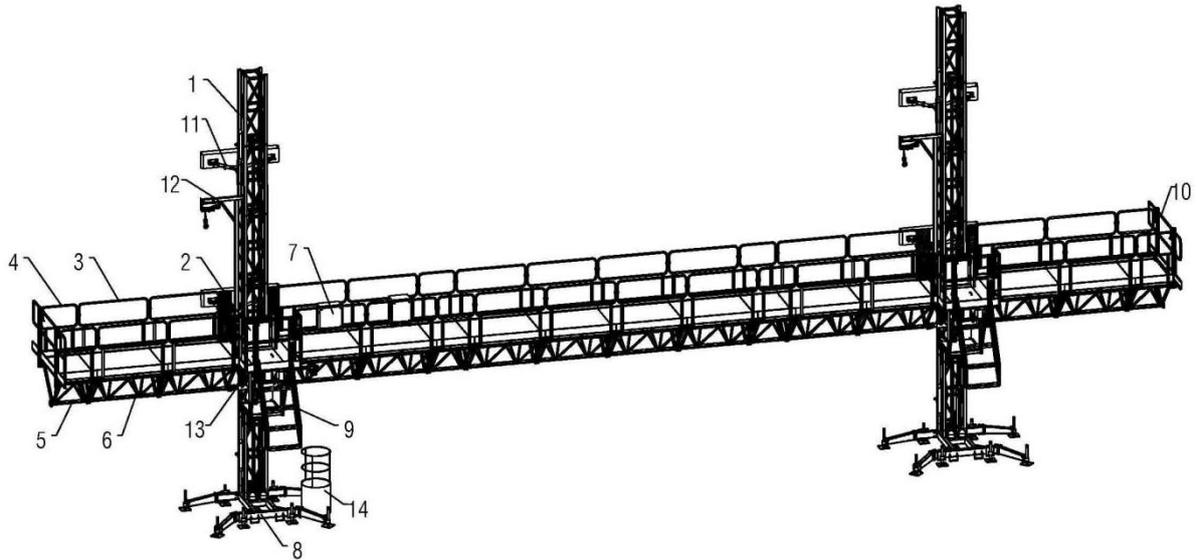


Figure 2 Double Mast Platform Structure Diagram

3.4 Equipment characteristics

This equipment can be configured and combined into working platform of different length, width to cater to the vertical surfaces of exterior wall of high buildings and super high skyscrapers. It is also retractable to make up the shape matching with the exterior wall convex and concave contours of the buildings. This will guarantee to meet all the construction needs.

This equipment is easy to manipulate, safe, reliable, and is one indispensable machinery for the exterior vertical wall construction of high and super high facilities.

4 Structure, Performance and Function of Main Parts

4.1 Mast

The mast (also called the rail rack) is made by multiple mast sections joining together; it is not only the guiding rail of the climbing platform, but also the supporting metal structure for the working platform. The mast section is one standard component with four square tubes (vertical column) in a square shape and three groups of square frames along with several tilted bracing bar welded together. At one side of the mast section is the fixed gear rack. The four columns are the rail for moving upward and downward of drive platform; the gear rack is the main force bearing parts of the platform, which will give anti-force for the driving gears on the platform. Amid them, the first section on the top is the gearless mast section and the second top is the terminating limit mast section to realize the climbing function of the platform.

The cross section of mast section is 500mm×500mm, the height is 1508mm. It's combined by many mast sections to meet the construction height of the building. As the rail for the working lift platform the mast section is also the major force bearing part, therefore the high-strength bolts are used for the intersection between the standard joints for connection purpose. Between the joints 4 groups of M16×240 (Grade 8.8) high-strength bolts are used for the connection. The bolt tightening torque cannot be smaller than 150 N•m.

Note: The mast sections (rolling section of the roller) and the gear rack mounted on it is acting as the rail for the lift platform, they shall be smeared with butter on the surface for lubrication.

4.2 Drive platform

The drive platform (see Figure 3) is made of front guide roller 2.1, guide frame 2.2, driving and transmission 2.3, anti-falling safety device 2.4, side guide wheel 2.5, hoisting frame 2.6, pin shaft 2.7, sensor pin 2.8, flange plate 2.9, limit socket 2.10, cable tray 2.11, mast section side guardrail, 2.12 cabin door assembly 2.13.

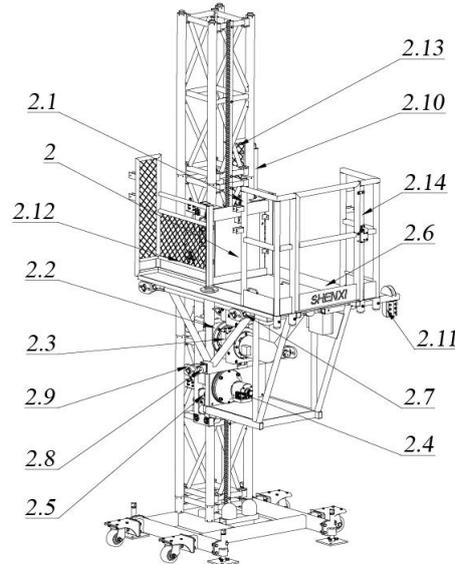


Figure 3 Drive platform

The guide frame is to fix the front guide roller and side guide roller each of which has 4 groups for supporting and directing. Both sides of the rack have 3 flange seats for the connection to the working platform. The upper flange seat uses pin shaft for articulated connection. The lower flange seat uses sensor pin for articulated connection. The sensor pin can detect the overturning moment after the loading of working platform. With the help of controller, it can limit the working platform from getting overload.

The guide frame and the climbing rack are welded together to be one integral body. Its function is to mount and support the driving motor and transmission unit and anti-falling safety device.

Each driving board has been installed with 2 groups of driving and transmission units. 2 groups of driving and transmission units will work together to drive the working platform as well as the payload thereon (or constructor) to move up and down.

The driving and transmission unit is the power source and power transmitting structure of the lift platform. It's composed of electromotor, disk electromagnetic brake, tilted gear reducer and drive gears, etc. The electromotor is TYEJ permanently magnetic synchronous motor. Its brake electromagnet can achieve the self-tracking and self-regulation along with attrition of the brake disk, the magnitude of its braking torque can be adjusted willingly. The reducer is the tilted gear reducer with advantages such as compact structure, heavy load capacity, high mechanical efficiency, longer service period, steady operation, etc. The driving power torque is increased after going through the reducer, and then exerted to the driving gears; the driving gear is

meshing perfectly with the gear rack mounted on the mast section of the mast, the drive platform frame and working platform will move up and down along the mast column vertically.

There is clutch on the guide frame. Its position is set behind the back of the driving gears and gear rack meshing point. This is for balancing the tangential force created during the meshing of the driving gear and the gear rack.

Disc motor electromagnetic brake is connected to the electromotor tail. When the electromotor is powered, the control loop will allow a 99VDC current to flow to the excitation coil of the brake, then the disk brake will be released under the working of electromagnetism. When the electromotor is cut off power, the brake excitation coil is also cut off power, under the effect of the brake spring, the brake produces braking torque, to hold the electromotor periphery tight, to stop the platform operation, and make the platform stop in certain position of the mast.

There is a hand-pull release ring equipped at the rear end of the disc type brake electromotor, this release ring is the power release device on the disc type brake electromotor, lift and pull this release ring, the motor spindle can be released, to make the platform slowly descend under the effect of the gravity. When pulling the release ring by hand, it shall make sure that both electromotors are released at the same time.

The anti-falling safety device is fixed on the guide frame. The type is SAJ30-0.5 type anti-falling safety device. The gear at the shaft end of the safety device meshes with the rack on the mast, when the working platform descends with over speed which is caused due to fault, the centrifugal weight inside the safety device overcomes the spring tension, and drives braking drum to rotate, the screw connected with it screws in at the same time, which makes the braking drum come in contact with the cone shell, and increases the force of friction to make the gear shaft stop rotating, so as to make the platform stop placidly on the mast. When the screw screws in, touches and breaks the chain microswitch, cuts the control power supply, making the electromotor stop, and ensuring the safety of personnel and equipment. The movement speed of the safety device is set when it's leaving factory. The user shall not open arbitrarily, or else the user will have to bear the risk. After the movement of the anti-falling safety device, it shall adjust and reset the safety device according to provisions in Chapter 10, and then starting the mast climbing working platform is allowed. The verification cycle of the safety device is one year. When the calibration period on the nameplate expires, it shall deliver the safety device to the manufacture factory or testing organization for re-verification.

There is also a set of clutch equipped on the driver board on the back of the meshing point of the drive gear and the rack, which is used to balance the tangential force of the drive gear meshing the rack.

The boarding ladder is set on the side of the guide frame, which is used for operating personnel to climb on or get off the platform. The guide frame at the entrance of the boarding ladder is equipped with a cabin door. This cabin door can only be opened inward. A mechanical latch hook is equipped on the upper part of the cabin door, to prevent the cabin door from non human opening. There is a limit switch equipped on the middle part of the cabin door, when the cabin door isn't fully closed, the

drive platform shall stop operation immediately or be unable to start. Only when the cabin door is fully closed, limit switch acts, and then elevation and descending of the platform can be started.

Limit soleplate: set limit soleplate on the top of the guide frame, the soleplate is equipped with proximity limit switch, when installing mast section, it can prevent the drive platform from rushing out of the mast section during unsuitable operation, the knot switch shall be adjusted around 3-4mm from the main riser of the mast section.

Cable guide: cable guide is a device for fixing power cable, it can use bolt to fix power cable on the circular groove of splint and screw down them, then the cable guide can drive power cable to elevate and descend, it shall make sure the center of the cable drum is in accordance with the splint center.

Mast section lateral guardrail: install one mast section lateral guardrail on each side of the guide frame, at the same time fix the guard bar and the platform guardrail and the guide frame with bolt, which can ensure personnel's safety during the platform operation.

4.3 Working platform

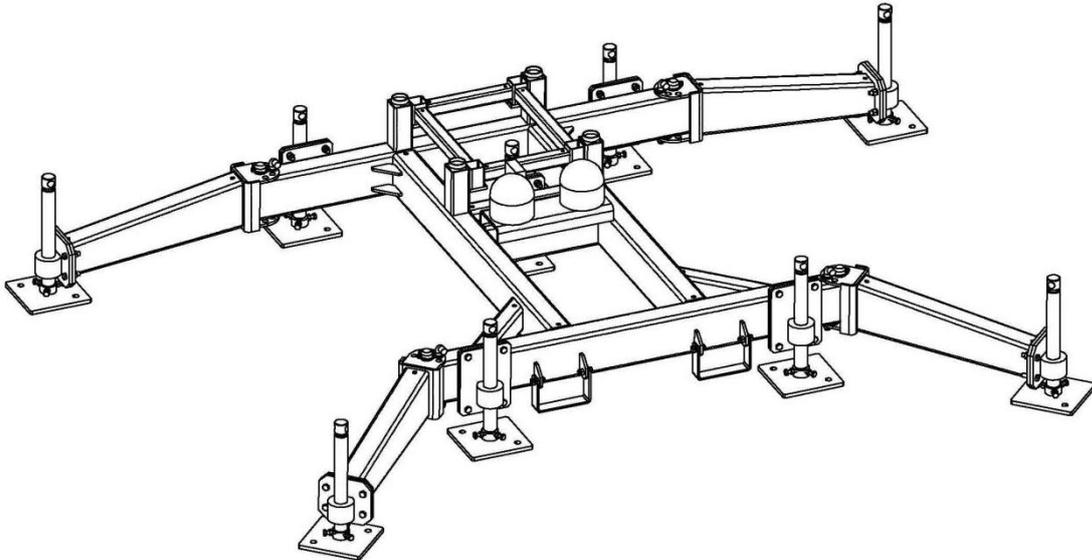
The working platform is made by docking several long platforms (1.5m) and short platforms (0.8m). The working platform is connected to both sides of the drive platform with 6 sets of flange. Different numbers of long and short platforms can be selected to assemble working platforms of various lengths at discretion, within a certain range of length, based on construction requirements of different lengths of construction plant.

There are fixed tubes for extending inserted bar on the inner side of long and short platforms. The basic width of the working platform is 1.5m, after inserting extending inserted bar, the maximum platform width can reach 2.5m. When the exterior facade of the building is in concave-convex shape, it can insert extending inserted bars on partial platform, and let the user lay scaffold boards on the extending inserted bars, so as to make the working platform form a concave-convex platform in accordance with the exterior facade of the building, to meet special operational requirements.

Note: extending inserted bar shall be separately custom-made according to practical requirements, in addition, the resulted extending inserted bars and scaffold boards self weight shall be included in the rated load of the platform.

Triangular cross section is adopted for both long and short platforms, which can effectively reduce structural self weight, and make stress reasonable. There are long and short guardrails installed on both sides of long and short platforms, and lateral guardrails installed on the end of the platform, to ensure operator's personal safety. After docking with current platform lengths and widths, the construction site requirements are still not satisfied, the user shall contact with our company, we will wholeheartedly design and manufacture applicative platforms of non-standard lengths or widths according to the actual conditions of the construction site, to satisfy the user's construction requirements.

4.4 Base



Base is the load bearing unit to bear the whole machine weight and working load of the mast climbing working platform. Hence, the base to place the pedestal on is required to be solid, flat and be able to bear the total weight and working load of the whole equipment without collapse.

The top central part of the base is for installing the mast section of the mast. There are adjustable fulcrum bearings set in the four corners of the base, to bear the whole machine weight and working load. The adjustable fulcrum bearings can adjust the base levelness and the mast section perpendicularity by rotating the screw. There are four universal casters set underneath the base, constructors can move the platform under the condition of flat foundation. Be aware that when the platform is moving, it shall be no-load; in addition, the tripods on both sides of the platform shall be symmetrical.

4.5 Mast tie

The mast tie is the connection part between the mast and buildings, to enhance the mast stiffness and increase the stability of the overall structure of the mast. The mast tie is composed of mast section supporting structure, sliding seat, fixed seat, regulating lever and regulating tube.

The mast tie can be adjusted within a certain range of dimensions. Along the mast height direction (height 0-100m) every 6m install a wall attaching frame, (height 100-150m) every 3m install a mast tie. The height of the lowest mast tie to the ground is 3 to 4m. The cantilever height of the mast at the top of mast tie shall not exceed 4.0m. The included angle between the plane and the horizontal plane of mast tie shall not be more than $\pm 8^\circ$.

4.6 Electric hanging pipe

Electric hanging pipe is composed of supporting frame, boom, mini electric hoist and lifting hook. Suspender is mounted on the drive platform through the support frame. In the installation or removal of the mast section, take an electric hoist as power driven to drive wire rope and lift the hook standard section of traction, dismantle it. In the drive and transmission system for maintenance or replacement, electric hanging pipe also can be used to carry out the lifting operation. The rated starting weight of the electric hanging pipe is 150kg.

Note 1: after removal, the suspender must be removed from the drive platform and placed separately.

Note 2: when the suspender is operated, the steel wire rope should be tightened to ensure that it is in order.

4.7 Electrical control system

All movements of the lift platform are controlled by electrical system. The electrical system is composed of electric cabinet, frequency conversion box, resistance box, power distribution box, travel limit, final limit, overload limit, leveling limit, electromechanical interlocking device and power cable, etc. Electric cabinet is installed on the drive platform, the main control element is equipped with a frequency conversion device, contactor, control transformer, overheat protector and phase sequence protection relay.

The electrical control system can touch the upper and lower limit switches (automatic reset type) through the travel block set at the upper and lower end of the mast to control the drive platform to drive up to the top of the table and fell to the bottom of the work schedule. Touch the upper and lower final limit switches (non automatic reset type) through travel block to respectively prevent the platform running up to the top, and running down to the bottom.

The electrical control system can prevent the operation of the overload of working platform by setting the pin shaft overload sensor hinged on the drive platform and the operating platform.

The electrical control system can automatically adjust the synchronous lifting operation of double mast platform two-set driving mechanism by setting the automatic leveling device of the electric cabinet, which can effectively control the excessive tilt of the working platform, so that the vertical tilt angle of automatic leveling of the operating platform can be controlled within 1°, when the tilt angle is 1.5°, the platform must stop running.

5 Installation of Mast Climbing Working Platform

5.1 Requirements for installation team and personnel

5.1.1 Installation team must have the appropriate qualifications and ability.

5.1.2 Installation team must definite security technology responsible person with unified command; before the construction, security technical disclosure must be carried out, each operation personnel must be familiar with installation scheme, and master the rules of safe operation.

5.1.3 Installation personnel must be at least 18 years old, with the level of culture of junior high school (including) or above.

5.1.4 The installation personnel must be in good health and be suitable for high altitude operation without heart disease, hypertension, acrophobia, epilepsy and other diseases.

5.1.5 Installation personnel must undergo professional security technical training, pass the examination and obtain the "operation certificate" before taking the job.

5.1.6 The installation personnel must be familiar with the main structure, performance and characteristics of the equipment, with good operating skills and fault troubleshooting skills.

5.1.7 Installation personnel must wear the necessary safety protection products, such as safety helmet, safety belt, tight clothing, non slip shoes, etc., and be prohibited from drinking or excessive fatigue status when carrying out operation.

5.1.8 Installation personnel should work in the designated position, should not leave or exchange positions with each other. If the work needs to change people during operation, the transfer of work must be done well.

5.1.9 During installation, the installation personnel shall not be less than 4, including 1 electrician.

5.2 Site preparation before installation

5.2.1 Familiar with the installation of technical documents: before installation, installation personnel must read the *Operation Instructions* first, master the characteristics of the equipment; familiar with *Installation and Construction Scheme*, master the installation process and key points.

5.2.2 Select installation location: make the mast climbing working platform as close as possible to the building in order to facilitate the stability of the whole machine; but the minimum safety distance between the moving parts of the mast climbing working platform and the building and the fixed construction facilities (such as scaffolding, etc.) is 200-300mm. The distance from the end of the adjacent platform is not less than 500mm.

5.2.3 Selection basis: consideration should be given to the ground with a certain carrying capacity, there shall be no pipe or hole in the ground; at the same time, we should fully consider the attachment of the building, which should be able to withstand the maximum adhesion of the device.

5.2.4 Pouring concrete foundation: The size and position of the foundation shall be in accordance with the relevant requirements of *Operation Instructions* (see Chapter 16); the upper plane of the ground should be 200mm higher than the surrounding ground, the bottom of the equipment shall not be in water.

Note: The precast concrete plate can be used to replace the cast-in-place concrete foundation, and can be used repeatedly.

5.2.5 Mast tie wall bolt and expansion bolt should be installed on the attachment point of the building.

5.2.6 Power supply on site: The power box must be equipped with a lift platform for construction purpose to ensure adequate power supply capacity.

5.2.7 Installation site: it must be flat, with sufficient space to accommodate the platform section, the mast section, the base, the temporary parking and installation of the relevant guardrails and position installation. Set the warning area and safety signs to eliminate loiterers entering.

5.2.8 Installation personnel: it must be clear with personal responsibility and unified command, division of labor in place, responsible and cooperative operation.

5.2.9 Check the parts to be installed: after the equipment arrived at the scene, it should be carefully checked whether there is any damage during transport, whether the components are lost or not, in good condition, complete accessories or not.

5.2.10 Check whether installation tools are in good condition, complete or not. During the installation process, the needed theodolite, impact drill, steel detector will be further purchased according to the actual situation of the customer.

5.3 Installation conditions

5.3.1 All the preparation work before the installation is completed, meeting the requirements.

5.3.2 Concrete foundation and pre - buried complete the maintenance period, the strength achieves the specified number of labeling requirements.

5.3.3 The voltage fluctuation of the power supply shall not exceed $\pm 5\%$ of the rated voltage; if the fluctuation is too large, it should increase the corresponding power of the voltage regulator.

5.3.4 Good weather, no rain, snow, fog, sandstorm and wind is greater than five grade and other adverse weather conditions, and the environmental temperature of -20°C to 60°C .

5.4 Installation order and technical requirements

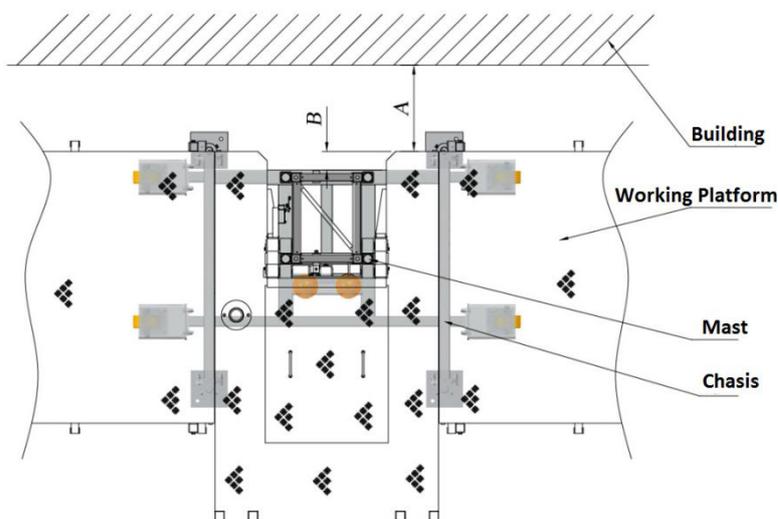


Figure 4 Base Installation Position

5.4.1 Base installation: the lift platform base is flatly placed in a predetermined installation position. Adjust the height of the 4 corners supporting seat so that the basic level of the base plane is flat. The buffer stopper is installed on the base.

The position of the base mounting distance from the building facade, see Figure 4.

$$A = 540 \sim 840 \text{ mm} ; B = 110 \text{ mm}$$

5.4.2 Installation of mast section: Install two mast sections on the base, through the M16×240 high-strength bolt, which is not less than 150 N•m tightening torque.

5.4.3 Drive platform installation: adjust all guide rollers of the drive platform to the maximum eccentricity, and pull open all the electric motor brake handle and mat it with cushion block (release brake), which is beneficial to install drive platform in place. Use the auxiliary hoisting equipment to lift the drive platform and set it on the standard mast section, making the drive gears and the gear and rack of the anti-falling safety device meshed. Put the drive platform gently on the base buffer stopper.

Note: after installing the drive platform, the brake should be restored immediately.

5.4.4 Detect and adjust the meshing clearance between the gear and the rack: detect that if the meshing clearances of the gear and the rack of the anti-falling safety device and the drive gears are within the range of the standard (the contact spots should be $\geq 40\%$ along the tooth depth, $\geq 50\%$ along the tooth length, and the backlash of the tooth surface should be between 0.2mm and 0.5mm). Change the direction of the eccentric shaft by spinning the multi-hole shaft-end positioning plate to adjust the interval between the gear and the rack.

5.4.5 Detect and adjust the interval of the guide roller: detect intervals between the mast guiding column and all front guide rollers, as well the column and all side guide rollers. By spinning the multi-hole shaft-end positioning plate of relevant guide roller, adjust the interval between the guide roller and the guiding column, which should be controlled within 1.0mm and 1.5mm.

5.4.6 Installation of platform section: Joint the platform sections to the sides of the drive platform by flange with the high-strength bolts of M20×100 (Grade 8.8), whose tightening torque should be not less than 275Nm. When installing the platform sections, they should be alternatively jointed in pairs till reaching the scheduled length of the working platform. Install the guardrail and the side guardrail around the working platform, note that: put the bolts into the bottom of the guardrail pole and fasten them, avoiding that guardrails are pulled out accidentally.

5.4.7 Retrofitting of mast section: Installing the mast sections of Section 3 to Section 5, and fasten the connecting bolts by the specified torque.

5.4.8 Measuring the perpendicularity of the mast: inspect the perpendicularity of the mast by theodolite and adjust it by the fulcrum bearing with quadrilateral base, making it be on the two orthogonal facades. For the error of the perpendicularity, please refer to Table 2.

5.4.9 Connect power: connect the power of the lift platform.

5.4.10 Test run: power on the working platform for test run. Ensure that all motions are accurate.

5.4.11 Adjusting the down stroke: Adjust the lower limit switch baffle and the lower final limit switch baffle to avoid the base collision of working platform.

For the installing site of the lower limit switch baffle, it should guarantee that when the working platform runs down with full load, the limit switch touches the lower limit switch baffle and automatically cuts off the control power resulting in the car stop, the car can stop at the base of the drive platform with a proper distance from the buffer stopper.

For the installing site of the limit final switch baffle, it should guarantee that the final limit switch acts after touching the final limit switch, and the drive platform should not collide with the buffer stopper.

5.4.12 Installation of the mast tie: install the first mast tie in about 3m to 4m above the ground. Fasten reliably all the bolts.

5.4.13 Height joining: continue the height joining of the lift platform till the needed working height is reached.

When it is under 100m, install a set of mast tie about every 6m on the mast, and about every 3m when it is above 100m. The maximum overhang height of the mast free end above the topside mast tie should be no more than 4.0m.

5.4.14 Measurement of the mast: measure the perpendicularity of the mast tie in the two directions by theodolite. If they exceed the requirements in Table 2, they should be rectified. They may be rectified by the method of adjusting the joint lever and the regulating lever of the mast tie.

Table 2 Perpendicularity Requirements of Mast

Mast erecting height h/m	$h \leq 70$	$70 < h \leq 150$
Perpendicularity deviation /mm	No more than 1/1000 of the mast erecting height	≤ 70

5.4.15 Adjustment of the upper limit: adjust the upper limit switch baffle and the upper final limit switch baffle to avoid the base collision of working platform.

When the height of the mast reaching the scheduled, install the upper limit switch baffle firstly, for whose installing site, it should guarantee that when the platform runs upward to the limit switch and touches the baffle and stops, the base plate of the working platform reaches the maximum working height, and the distance between the upper part of the working platform and the mast top should be not less than 0.5m. Then install the upper limit switch baffle. For its installing site, it should guarantee that the overrun distance between the final limit switch and the upper limit switch should be more than 50mm.

5.4.16 Calibration of running stroke: after installation and adjustment of the limit switch baffles, they should be examined for the accuracy and reliability of the action. They should be repeatedly examined for three times at least.

5.4.17 Inspection, adjustment and fastening: inspect and adjust the intervals between all part to make them meet with the criteria; inspect and fasten all the fasteners to make the tightening torque meet with the specification.

5.4.18 Running test: conduct the empty running test, negative-load running test and the leveling test of the working platform successively.

5.4.19 Adjust the electromechanical interlocking device of the cabin door, making the working platform cannot be started when the door is not tightly closed.

5.5 Operating essentials of the height joining of mast

5.5.1 Run the working platform to the lowest position allowed by the lower limit position.

5.5.2 Press on the Down button of the tiny electric hoist to put down the lifting hook and the special lifting device for mast sections.

5.5.3 Hang a mast section by the lifting device on the ground. Press on the Up button of the electric hoist to lift the mast section to the working platform and place it steadily.

5.5.4 Lifting of the working platform. When the working platform rises to the upper of the drive platform, and the distance between it and the seam allowance of the highest mast section is more than 500mm, stop the running immediately.

Note: In the lifting if the working platform, turn the lifting arm to the safe angle and fix it with bolts to ensure that the arm will not collide with and rub the mast and the surrounding buildings when the platform runs.

5.5.5 Lift the prepared mast section with the electric hanging pipe, making it 200mm higher than the mast section on the top of the mast; wipe the interfaces in the joint of the mast sections and smear the buffer; then turn the lifting arm slowly and align the interfaces of the mast section; put down the mast section slowly, making the four interfaces completely consistent.

5.5.6 Well put the connecting bolts and screw up with the tightening torque being not less than 150 N•m.

5.5.7 Take off the lifting device from the mast section and take back the lifting hook; descend the working platform and conduct the height joining of the next mast section only after turning the lifting arm to a safe direction.

Note: In each height joining, the interfaces and the racks of mast sections should be smeared with butter for rust protection.

5.6 Operational provision for mast tie installation

5.6.1 The first set of mast tie should be installed in the place that is 3 to 4m higher than the ground; the distance between the two adjacent mast ties should be within 6m (below 100m), and within 3m (above 100m); above the high mast tie, the maximum height of the free end on mast top should be not more than 4m.

5.6.2 Specific operation and installation (see Figure 5):

- 1) Connect the sliding seat and the supporting structure with the high-strength bolts of M12×85 (Grade 8.8);
- 2) At the height of mast where mast tie should be installed, connect the connected supporting structure of the sliding seat to the column of mast section with high-strength bolts of M12×100 (Grade 8.8);
- 3) Install and fasten the two fixed seats to the building respectively, whose center distance should be 1000 to 1200mm as showed in the picture. The fixed seats shall be fixed by the through-wall bolts M16 (two bolts for each seat). The wall for fixing

mast tie should be able to afford the 32kN static tension the seat imposes on it without damage. If the through-wall bolts can not be used, use expansion bolts. The effective anchorage depth should be not less than 100mm. And the strength grade of the concrete structure of the anchorage point should not be lower than C30.

When drilling holes on the wall with the percussion drilling, the operator should fasten the safety belt.

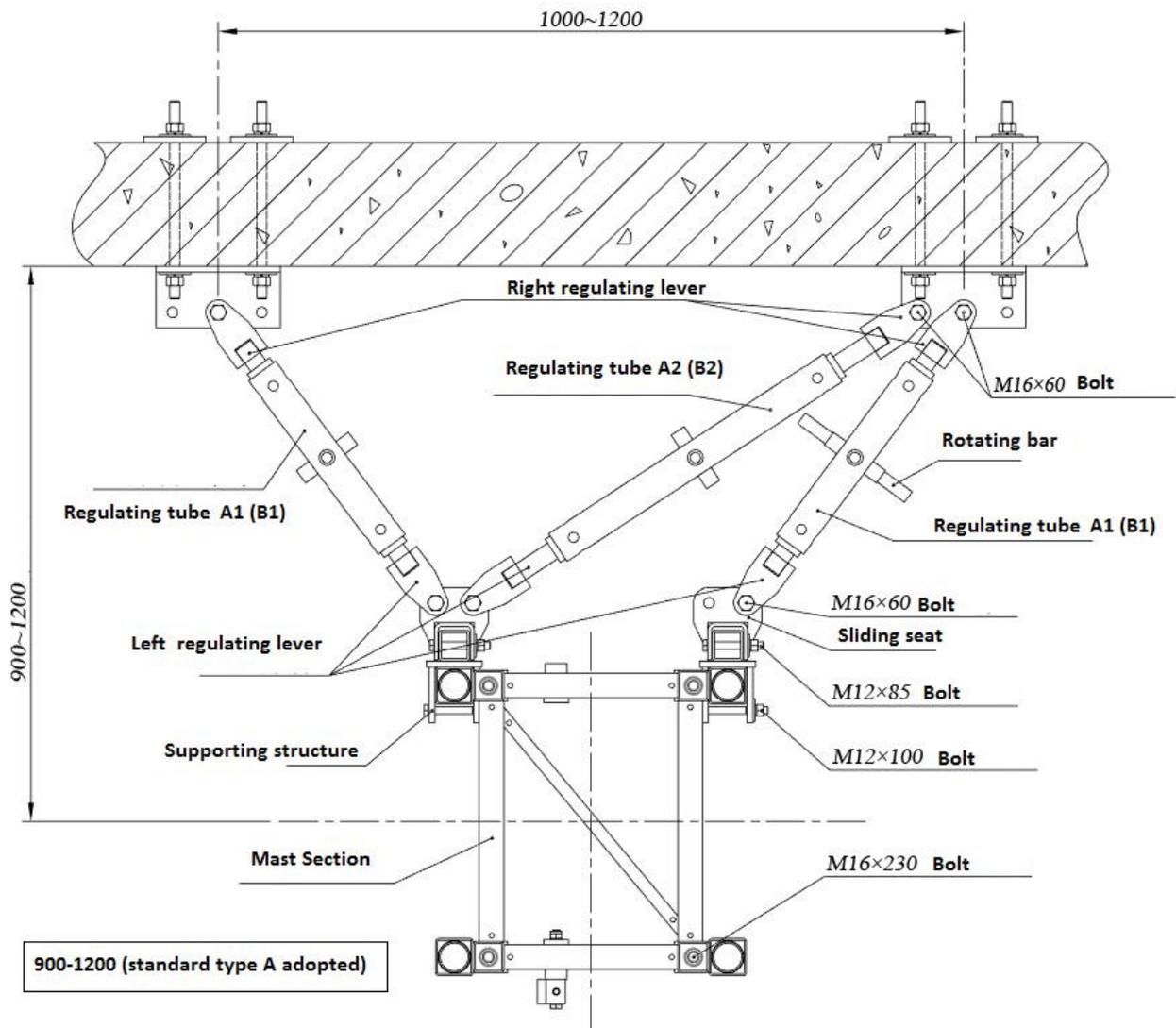


Figure 5 Installation Diagram of Mast Tie

4) Screw the left and the right adjustment lever respectively on the two ends of regulating tube A1 (B1) and A2 (B2). Use high-strength bolts of M16×60 (Grade 8.8) to connect one end of right adjustment lever with fixed seat and one end of left adjustment lever with sliding seat.

5) After installation, use the theodolite for measurement. After assuring that the error of verticality of the mast is within the specialized range, tighten all fasteners and connecting bolts. As showed in the picture, the verticality of the mast can be adjusted and rectified by the method of rotating the length of regulating tube A1 (B1) and regulating tube A2 (B2) with rotating bar.

Note: 1) The mast tie should be installed horizontally as far as possible. The included angle of the surface of the mast tie and the ground should be not more than $\pm 8^\circ$.

2) In installation, the length that the left and the right adjustment lever came out of the regulating tube should be not more than 160mm.

3) The installation dimension for the standard mast tie is that: The center of the mast section is 900 to 1200mm away from the wall. If there is special requirement for installation length, it should consult the technology department of the manufacturer for customization.

6 Inspection and Acceptance after Installing Lift Platform

6.1 After installing lift platform, the installation unit should first perform self-inspection according to the specified inspection items.

6.2 Inspect whether there is any loose bolt fastener, and tighten it, if any, immediately according to the specified torque.

6.3 Inspect whether the mast verticality meets with the criteria from the two vertical directions by theodolite.

6.4 Measure the ground resistance of the metal structure and the metal shell of the electrical equipment by ground resistance tester. The resistance should be not more than 4Ω . Measure the ground insulation resistance of the electromotor and the electrical elements (except the electronic parts and components) by the 500V megger, and the resistance should not be less than $0.5M\Omega$. In addition, the ground insulation resistance of the electric circuit should not be less than $1M\Omega$.

6.5 Inspect the joints of interface of guiding column of adjacent mast sections. The difference caused by mutual dislocation should be not more than 0.8mm.

6.6 Inspect whether the working condition of the phase sequence protective relay and hot protective relay in the electrical system of lift platform, the absorption of the all AC contactors and the cable jointing are normal.

6.7 Inspect whether the movement of all limit switches and final limit switches is sensitive and reliable and whether the position of all limit switch baffles is accurate.

6.8 Inspect whether there is protrusion in the running channels of lift platform and working platform, and ensure the safety of running channel of working platform; the outmost edge of working platform should be 200 to 300mm away from other fixtures.

6.9 Inspect the lubrication of all parts and fill lubricant in time (referring to the lubrication section in the specification for methods).

6.10 Inspect whether the opening of the cabin doors of the working platform is flexible and whether the movement of the electromechanical interlocking device is reliable.

6.11 Inspect whether the adjusting clearance of all guide rollers and clutches and the meshing clearance of gears and racks meet the requirements, and adjustment shall be made timely if the requirements are not met.

6.12 After all inspections, leveling test shall be performed for the working platform to inspect if the action for platform leveling is accurate and reliable.

6.13 Conduct empty load test, rated load test and overload test by rule. Inspect whether there is instant slip phenomenon during braking of working platform, whether the starting and braking are normal, whether it runs steadily and whether there is abnormal noise. The oil temperature rise of the helical gear reducer can not be over 60K; the noise can not be over 87dB (A).

6.14 After all the self-inspections performed by installation unit are passed, the user, project general contractor and project supervisor shall be invited to perform acceptance inspection. It may not be put into use until passing the inspection and provided with Acceptance Inspection Report on mast climbing working platform.

7 Operation of Lift Platform

7.1 Preparation before operation of lift platform

7.1.1 The latter driver must read the running record kept by the former driver, and timely settle any question found in it.

7.1.2 In winter when it is cold and in low temperature, running resistance of the lift platform is larger, therefore, it should be run without load for several times to make the oil temperature of reducer normal before official operation.

7.2 Safe operation regulations for lift platform

7.2.1 Operators must be at least 18 years old, with the level of culture of junior high school (including) or above.

7.2.2 The operators must be in good health, be suitable for high altitude operation without heart disease, hypertension, acrophobia, epilepsy and other diseases.

7.2.3 Operators must undergo professional security technical training, pass the examination and obtain the "operation certificate" before taking the job.

7.2.4 The single mast platform allows, at most, three people (six people in case of double mast platform) to operate safely in coordination. All operators on the platform must wear safety belts and helmets. Slippery shoes like slippers and shoes with plastic soles are not allowed on platform. No horseplay on platform.

7.2.5 Operators who are drunk or over fatigued are prohibited from making operation.

7.2.6 Overcrowding or overloading is strictly prohibited in operation.

7.2.7 Passengers or goods should be uniformly distributed to avoid unbalance-loading operation. All working personnel must stand on the main platform instead of the extending platform when it is in service.

7.2.8 In order to avoid danger in operation, goods should be placed on two sides of the drive platform as far as possible, and it is strictly prohibited that goods extend to any area beyond the working platform. Heavy goods should be placed on the middle drive platform. It is strictly prohibited to directly pile on the right or left platform, not alone directly place on the extending platform or inspection door of the drive platform.

7.2.9 When inflammable, explosive or overlength goods are loaded, safety and technology measures in written form examined and approved by the safety and technical supervisor must be provided with the monitoring of specially-assigned personnel. Moreover, any unrelated person should not accompany.

7.2.10 Equipment with fault is prohibited from operation; the equipment must be stopped and inspected if anything abnormality is found in operation.

7.2.11 It is strictly prohibited to use stool, foot-pat or ladder in the working platform.

7.2.12 It is strictly prohibited to use the mast climbing working platform as man-carrying or cargo-carrying lift.

7.2.13 During normal running, it is strictly forbidden to use manual releasing device of the brake for the working platform descending.

7.2.14 When the air speed on the top of the equipment is larger than the wind power in five-class, the lift platform can't be in service. When encountering adverse weather such as rain, snow, heavy fog and sand storm in operation, it's necessary to immediately suspend operation, place the working platform at the bottom, cut off the electricity by switching out, lock electric cabinet and wear devices with rain-proof coat or take other good rain-proof measures. Any failure in machinery or electrical equipment caused by poor rain-proof measures is beyond guarantee.

7.2.15 The user should install an additional safeguarding rope on the extending platform, using for working-load of the extending platform. When platform operation is stopped, before working personnel enter the extending platform, it must be first fixed on the safeguarding rope to assure construction safety. The safeguarding rope must be relieved before platform lifting when work is finished.

7.2.16 Each time after work, working personnel should switch off the power, carefully keep the operation record on duty and lock the electric cabinet before leaving.

7.3 Basic operation method for lift platform.

7.3.1 Operation of construction working platform with single mast (as shown in Figure 6)

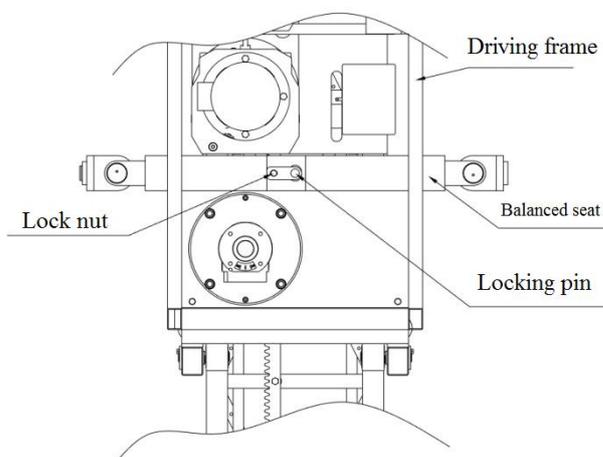


Figure 6 Installation Diagram of Locking Pin Shaft

7.3.1.1 Inspect and make sure that the locking pin shaft has been inserted into the central hole of the balance foundation of the driving frame, and the locking nuts have been fastened.

7.3.1.2 Close the cabin door after boarding the working platform; Insert the motor plug, limit switch plug and attaching plug into the corresponding sockets at the bottom of electric cabinet in order and tighten the nuts.

Note: The platform can't run normally if anyone is not plugged!

7.3.1.3 Close the leakage protection switch QF_1 of electric cabinet to provide electricity for 36V controlling circuit.

7.3.1.4 Press the SB_1 start button on the electric cabinet door, making the M_1 contactor closed, the main loop electrified and the M_2 lifting contactor of electromotor closed, then the green power light is on.

7.3.1.5 Lifting operation of the working platform: Press the SB_2 button on the electric cabinet door or the SB_0 button on the holding button box, and the controlling braking contactor M_3 will be closed. As the 99V direct-current power is supplied to the YB brake coil through rectification circuit, the brake of electromotor will be released, and it will start to rotate in positive direction to lift the working platform. When the working platform is lifted to the assigned height, release the SB_2 or SB_0 button, the M_2 will be powered off to stop the running of electromotor and the brake start to work to keep the working platform at the required position.

7.3.1.6 Descending operation of the working platform: Press the SB_3 button on the electric cabinet door or the SB_0 button on the holding button box, and the controlling braking contactor M_3 will be closed. As the 99V direct-current power is supplied to the YB brake coil through rectification circuit, the brake of electromotor will be released, and it will start to rotate reversely to descend the working platform. When the working platform is descended to the assigned floor, release the SB_3 or SB_0 button, the M_2 will be powered off to stop the running of electromotor and the brake start to work to keep the working platform at the required position.

7.3.2 Operation of construction and working platform with double masts.

7.3.2.1 Examine and confirm that the locking pin shaft has been pulled out.

Note: It must be pulled out when both masts are in service!

7.3.2.2 Close the cabin door after boarding the working platform; insert the motor plug, limit switch plug, frequency converter plug and the attaching plug of electric cabinet into the corresponding sockets at the bottom of electric cabinet in order and tighten the nuts. **Note: The platform can't run normally if anyone is not plugged.**

7.3.2.3 Close the leakage protection switch QF_1 of electric cabinet to provide electricity for 36V controlling circuit.

7.3.2.4 Press the SB_1 start button on the electric cabinet door, making the M_1 contactor closed and the main loop power on, thus the green power light is on.

7.3.2.5 Lifting operation of the working platform: Press the button SB_2 on the electric cabinet door or the lifting button SB_0 on the holding button box and the two contactors for lifting M_2 and M_4 of electromotor will be closed as well as braking contactor M_6 . As the 170V direct-current power is supplied to the YB brake coil through rectification circuit, the brake of motor will be released and it will start to rotate in positive direction to lift the working platform synchronously. When the working platform is lifted to the assigned height, release the SB_2 or SB_0 button, the M_2 and M_4 will be simultaneously powered off to stop the running of electromotor and the brake start to work to keep the working platform at the required position.

7.3.2.6 Descending operation of the working platform: Press the button SB_3 on the electric cabinet door or the lifting button SB_0 on the holding button box and the two contactors for descending M_3 and M_5 of electromotor will be closed as well as braking contactor M_6 . As the 99V direct-current power is supplied to the YB brake coil through rectification circuit, the brake of motor will be released and it will start to rotate reversely to descend the working platform synchronously. When the working platform is descended to the assigned height, release the SB_3 or SB_0 button, the M_3 and M_5 will be simultaneously powered off to stop the running of electromotor and the brake start to work to keep the working platform at the required position.

7.3.2.7 Automatic leveling operation of construction and working platform with double masts.

Calibrate the locating pins on the balancing seat of second drive platform by theodolite to keep them on the same level; turn the leveling to the manual gear; press the resetting key to default the angle to 0° ; in operation, turn the leveling to the automatic gear; when the vertical tilt angle of the working platform reach 1° in operation, the platform will automatically level (as shown in Figure 7);

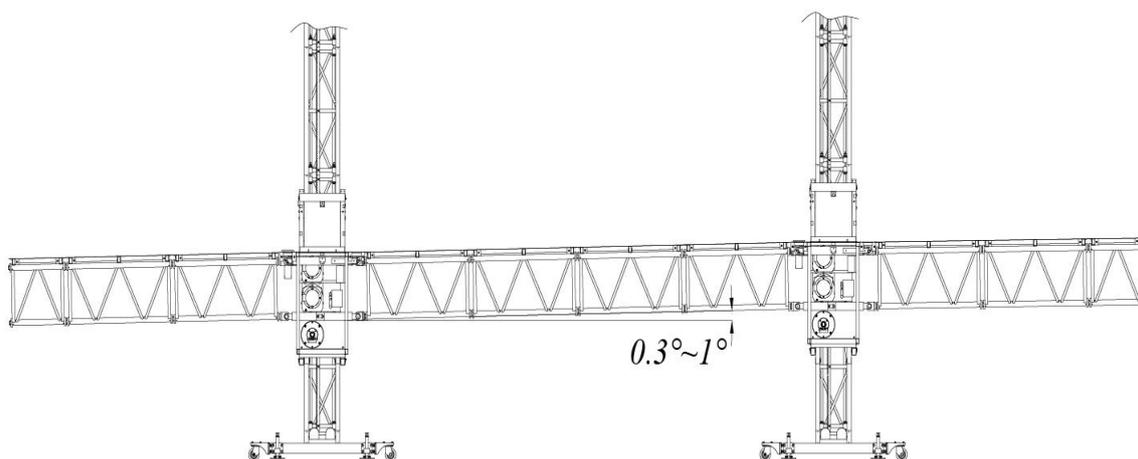


Figure 7 As Tilt Angle of Platform Is $0.3^\circ-1^\circ$.

If the tilt angle is over 1.5° owing to fault of platform leveling device, the platform will be powered off and suspended. At this time, it's necessary to release the driving unit brake of higher drive platform manually to make them at the same level for platform operation (as shown in Figure 8).

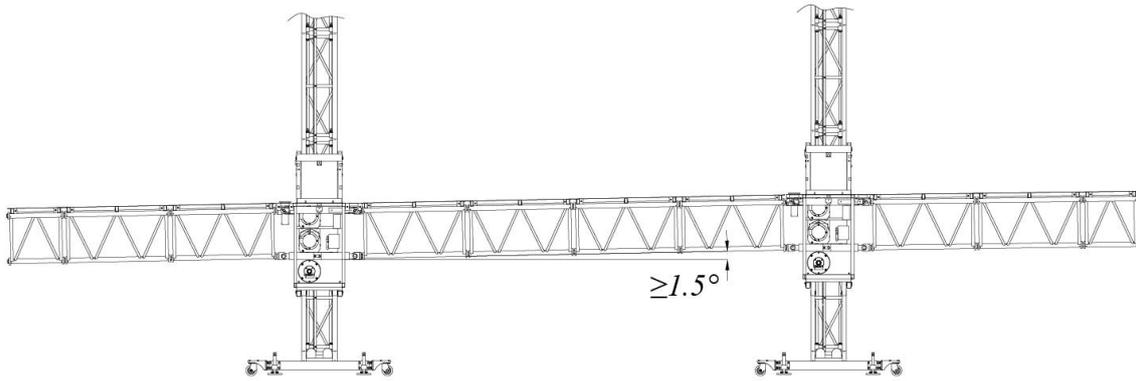


Figure 8 As Tilt Angle of Platform Is 1.5°

7.3.3 There is an emergency stop switch TA₁ for non-automatic resetting on the electric cabinet door, which can be used, in emergency, to cut off the general controlling power so as to stop operation of the working platform.

Note: Operator must give a warning by ringing the bell before running.

8 Lubrication of Lift Platform

8.1 The first lubrication

The lift platform must experience its first integrated lubrication after it has been run for 40 hours since leaving the factory. The reducer lubricant must be changed in the first lubrication. Prior to oil change, thorough cleaning of reducer interior is vital to extending the life span of reducer.

8.2 Periodic lubrication

Requirements for periodic lubrication of the whole machine is shown in Table 3:

Table 3 List of Lift Platform Lubrication

Lubrication interval	Lubrication parts	Lubricants	Consumption	Instructions
After 40 hours in service or once a month at least.	Reducer	220# Gear lubricant	Supplement oil level	Inspect oil level
	Gear and rack	2# lime grease	Evenly spread with proper amount	Clean it up before oil refueling
	Anti-falling safety device	2# lime grease	Squeeze out affluent oil	Refuel with oil gun
After 200 hours in service or 6 times every year at least	Guide roller	2# lime grease	Squeeze out affluent oil	Refuel with oil gun
	Clutch	2# lime grease	Squeeze out affluent oil	Refuel with oil gun
	Mast stand-pipe	2# lime grease	Evenly spread with proper amount	Brush
After 400 hours in service or 4 times every year at least	Hinge of electric box door	20# Gear oil	Evenly spread with proper amount	Instil
	Electric brake taper sleeve	20# Gear oil	Evenly spread with proper amount	Instill and be sure not to instill on the friction disk
After 1000 hours in service or once every year at least	Reducer	220# Gear lubricant	4 L	Clean and replace oil

Description: 1. Lubricant has been added to this product according to requirements in above table.

2. Details of lubrication for reducer, anti-falling safety device and electrical brake are in specifications of related components attached to the machine.

9 Maintenance and Repair of the Lift Platform

9.1 Daily maintenance of lift platform

It is important to extend equipment lifespan. The basic method of daily maintenance can be summarized as “cross working method”, i.e. lubrication, fastening, adjustment, cleaning and anti-corrosion.

Mechanical structure includes but is not limited to electrical machine, retarder, falling protector and crane and so on. All those must be properly maintained. Any mechanical fault caused by improper maintenance is beyond guarantee.

9.2 Regular maintenance of lift platform

In addition to necessary daily maintenance, periodic maintenance is also needed. The circle and content of regular maintenance should be in line with stipulations in Table 4.

Table 4 Regular Maintenance Period and Contents of Lift Platform

Maintenance period	Parts	Maintenance content
When accumulative working time exceeds 100 hours or at least once every month	Anti-falling safety device	Check whether there is abnormal sound or abnormal high temperature.
	Reducer	Check oil level and whether there is leakage of the lubricant. Replace oil seal, if necessary.
	Motor brake	Check the distance between the fixed plate and rotating plate, which should be 0.5-0.8mm; replace brake disc if necessary; Ensure braking distance not over 0.1m when the working platform descends in full load.
	Guide roller and clutch	Check the fastening situation of bolt; conduct fastening, if necessary.
	Driving frame	Check the fastening situation of the bolts and ensure that there is no looseness.
	Gear and rack	Check the meshing clearance; conduct adjustment, if necessary.
	Electrical system	Check whether the connection of binding post is loose and check the erosion of contacts of contactor.
	Cables	Check whether there is breakage or severe distortion of the cables.
	Plates	Ensure all plates clear and complete.
When accumulative working time exceeds 200 hours or at least 6 times every year	Connecting bolts of mast section	Check whether they are loose and fasten any loose one timely.
	Connecting bolts of mast tie	Check whether they are loose and fasten any loose one timely.
	Limit and final limit switches as well as their cams	Check whether the switch is flexible and the cam shifts
	Cables	Check the wear condition of cable rubber and replace it if necessary.
	Gear and rack	Check the amount of wear according to "limit of wear and adjustment" and replace it if necessary.
	Guide roller and clutch	Check running clearance; conduct adjustment, if necessary.

When cumulative working time exceeds 400 hours or at least 4 times every year	Anti-falling safety device	Make the reliability test according to standard requirements.
	Electromotor	Carry out maintenance according to requirements in operation instructions of electromotor.
	Guide roller	Check whether the wear of guide roller exceeds the limit;
When cumulative working time exceeds 1000 hours or at least once every year	Anti-falling safety device	Rework in the factory or recalibrate in qualified inspection institute
	Reducer	Overhaul gear and bearing; replace parts with wear exceeding the limit.
	Structural part	Check the structural parts of the whole equipment and make corresponding protective measures on erosive positions; replace erosive parts or those with wear exceeding the limit.

Description: Make regular maintenance on lubricant according to the requirements in "Lift Platform Lubricant List" of the instruction.

9.3 Adjustment of main parts of the lift platform

9.3.1 Adjustment of guide roller (Figure 9)

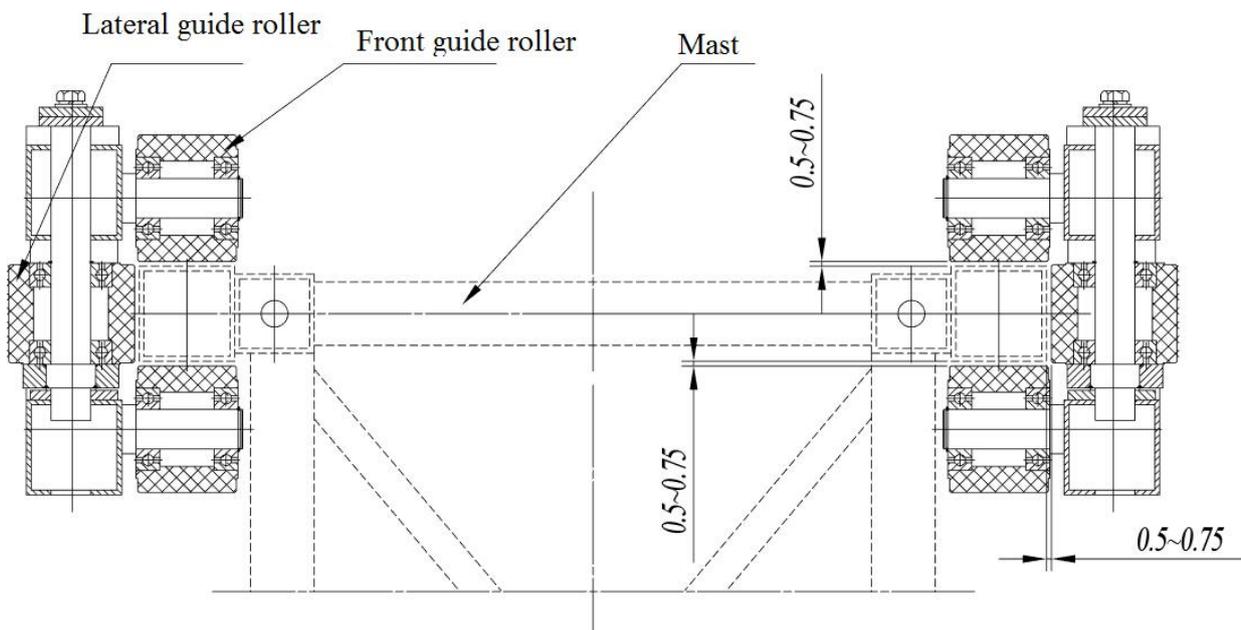


Figure 9 Adjustment of guide roller

Adjust the side guide rollers beside mast guide pillar in pair. Turn the eccentric shaft to make the single side distance between side guide roller and mast guide pillar as 0.5~0.75mm (total distance of the two sides should not exceed 1.5mm). Fix the shaft end locating plates with bolts afterwards.

Adjust the front guide rollers beside mast guide pillar in pair. Turn the eccentric shaft to make the single side distance between front guide roller and mast guide pillar as 0.5~0.75mm (total distance of the two sides should not exceed 1.5mm). Fix the shaft end locating plates with bolts afterwards.

Adjustment should make upper and lower guide rollers in even stress, and make the direction of speed reducer gear and breaker gear with rack joint along tooth width not less than 50%.

9.3.3 Adjustment of clutch (Figure 10)

Adjust the clearance between the clutch and rack back behind the guide frame to make clearance between the clutch and rack back; loosen the fastening bolt, turn the eccentric shaft to adjust clearance, and make the meshing backlash between driving gear and rack 0.2~ 0.5mm.

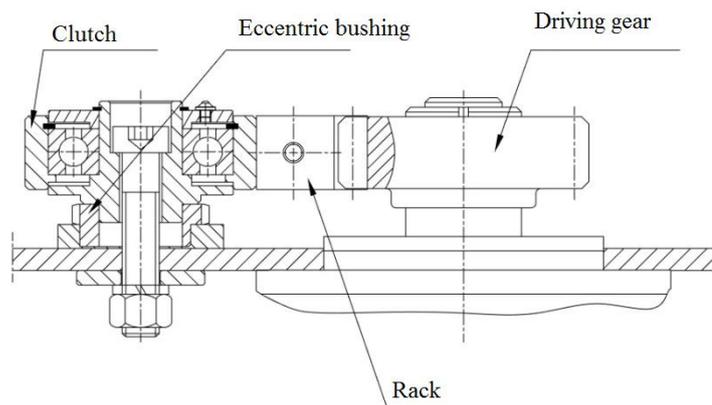


Figure 10 Adjustment of clutch

9.3.4 Adjustment of the longitudinal angle for the synchronized operation of double mast construction working platform (Figure 7 and Figure 8)

The longitudinal angle for the synchronized operation of double mast construction working platform should not exceed 1°.

Adjustment method of longitudinal angle is:

1. Calibrate the locating pins on the balancing seat of second drive platform by theodolite to keep them on the same level;
2. Turn the leveling to the manual gear; press the resetting key to default the angle to 0°;
3. Turn the leveling to auto mode during working. When the longitudinal angle inclines to 1° during the operation of working platform, the platform will automatically level itself. When the longitudinal angle exceeds 1.5° due to the failure of platform leveling device, the platform will turn off and stop working. At this time, it's necessary to release the driving unit brake of higher drive platform manually to make them at the same level for platform operation.

9.3.5 Adjustment of moment limiter

9.3.4.1 Adjustment of moment limiter of the single mast construction working platform (Figure 11)

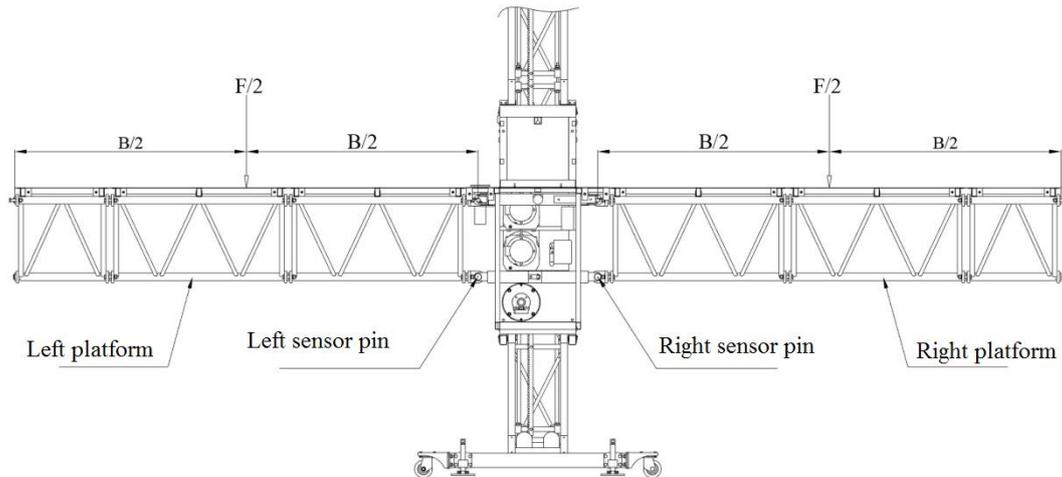


Figure 11 Adjustment of moment limiter of the single mast construction working platform

- Start "no-load study" according to methods in Operation Instructions of IN318 Type Capacity Limiter when the left and right platform is in no load separately.
- Start "rated load study" according to methods in Operation Instructions of IN318 Type Capacity Limiter when $F/2$ (F is rated weight) is loaded on the left and right platform $B/2$ (B is the length of the right and left platform) separately;
- User should set up other parameters according to specifications in Operation Instructions of IN318 Type Capacity Limiter.

9.3.4.2 Adjustment of moment limiter of double single mast construction working platform (Figure 12)

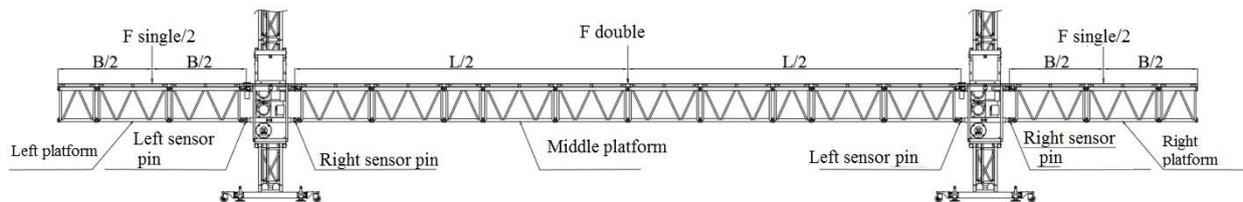


Figure 12 Adjustment of moment limiter of double single mast construction working platform

- The moment limiter of double single mast construction working platform shall maintain the adjustment results of moment limiter of the single mast construction working platform and may not be adjusted any more;
- Note: load $F_{\text{single frontal}}/2$ ($F_{\text{single frontal}}$ is rated weight) on $B/2$ (B is the length of the right and left platforms) of the right and left platforms, and load $F_{\text{double frontal}}$ ($F_{\text{double frontal}}$ is the difference between double mast frontal load and single mast frontal load) on $L/2$ (L is the length of middle platform) of the middle platform.

9.3.5 Adjustment of limit mounting seat (Figure 13) :

Adjust nuts near the switch on the mounting seat to make the distance from limit switch to guide frame column as 3-5mm, so that the limit switch is on power during journey and off power when disconnects from the column.

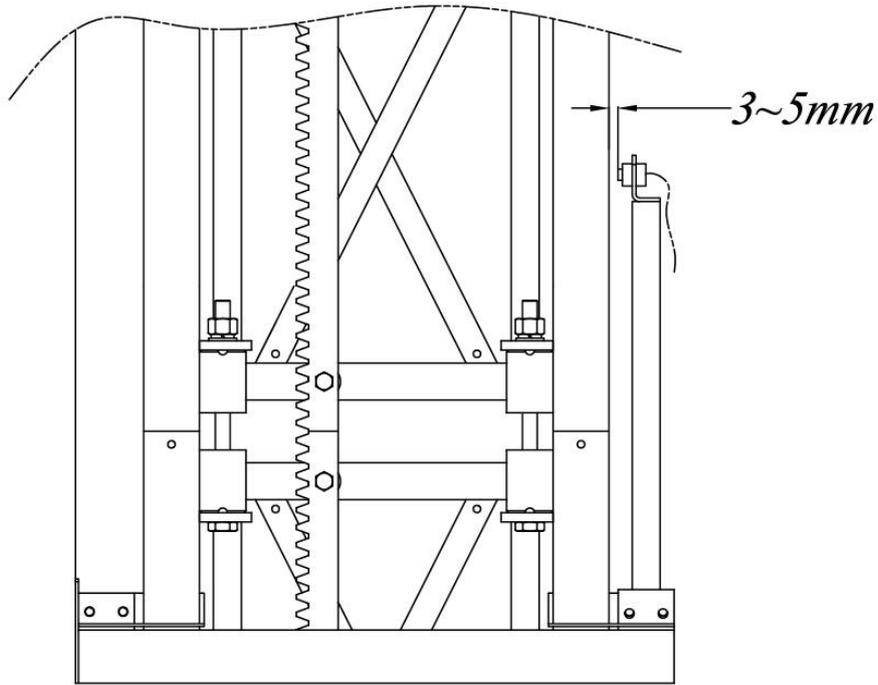


Figure 13 Adjustment of limit mounting seat

9.4 Wear limit of main components of lift platform

9.4.1 Wear limit of driving gear and breaker gear (see Figure 14 and Table 5)

Measurement mode: Measure across 3 teeth. Measure length L with gear tooth micrometer or vernier caliper.

Table 5 Table of Wear Limit of Driving Gear and Breaker Gear

Base tangent length of new gear L	45.8mm
Base tangent length of wear limit L	Minimum size 44.5mm

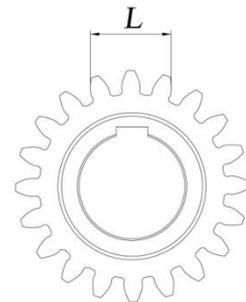


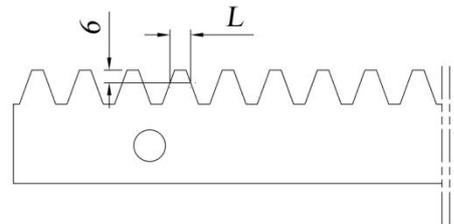
Figure 14 Figure of Base Tangent Length of Gear

9.4.2 Wear limit of rack (see Figure 15and Table 6)

Measurement mode: Measure gear thickness L with gear tooth vernier calipers.

Table 6 Table of Wear Limit of Rack

Gear thickness of new rack L	9.4mm
Gear thickness of wear limit L	Minimum size 8.5mm



15 Figure of Gear Thickness of Rack

9.4.3 Wear limit of clutch

Measurement mode: Measure with vernier caliper (see Table 7)

Table 7 Table of Wear Limit of Clutch

Outside diameter of new clutch	Φ80mm
Outside diameter of wear limit	Minimum size Φ77mm

9.4.4 Wear limit of electromotor brake disc (see Figure 16)

Measurement mode: Measure with feeler gauge

Clearance of the brake should be 0.5-0.8mm

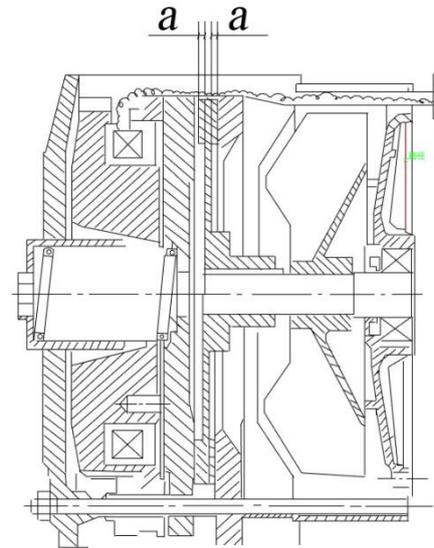


Figure 16 Figure of Wear Limit of Brake Disc

The brake disc must be replaced when the wear-thickness *a* of single face of friction materials by rotary brake disc reaches nearly 1mm.

9.4.5 Adjustment of braking distance of brake

When the working platform descends in full load, braking distance should not be over 100mm; otherwise, the braking torque will not be sufficient and the retarding spring in back of the motor should be adjusted.

9.4.6 Wall thickness wear limit of mast section vertical pipe

When the wear limit of wall thickness of mast section vertical pipe is over 10%, it should be scrapped.

9.5 Maintenance and replacement of lift platform

9.5.1 Replacement of guide roller

Guide roller must be replaced when its bearing (Model 6205 RS) is broken or the wear is out of tolerance to reach the wear limit. Method of replacement is as follows:

- a) Descend the working platform to the ground and fix it stable with wood brick;
- b) Remove the old guide roller with the wrench to remove the connecting bolts of guide roller;
- c) Install new guide roller, adjust the clearance between guide roller and mast guide column, then fasten bolts fixed of locating plate on fixed shaft.

9.5.2 Replacement of clutch

Clutch must be replaced when its bearing (Model 6205 RS) is broken or the wear of outer ring is out of tolerance to reach the wear limit. Method of replacement is as follows:

- a) Descend the working platform to the ground and fix it stable with wood brick;
- b) Loosen the fixed bolts at the shaft end of clutch and remove the old clutch;
- c) Install new clutch and adjust the meshing clearance between rack and gear before fastening the bolts to fix the locating plate on fixed shaft.

9.5.3 Replacement of reducer drive gear

Reducer must be replaced when the wear of drive gear tooth reaches the limit. Method of replacement is as follows:

- a) Descend the working platform to the ground and fix it stable with wood brick;
- b) Disconnect the power supply;
- c) Remove round nut and locking plate on outer side of reducer drive gear, and remove the drive gear;
- d) Clean the surface of the gear and coat butter;
- e) Install new gear to the bearing and fix the locking plate and round nut;
- f) Adjust the meshing clearance of gears;
- g) Connect the wiring of electromotor and brake.

Disassembly of the gear shall be performed in pulling method as following figure. (Figure 17 a)

Assembly of the gear shall be performed in screw pressing method as following figure. (Figure 17 b)

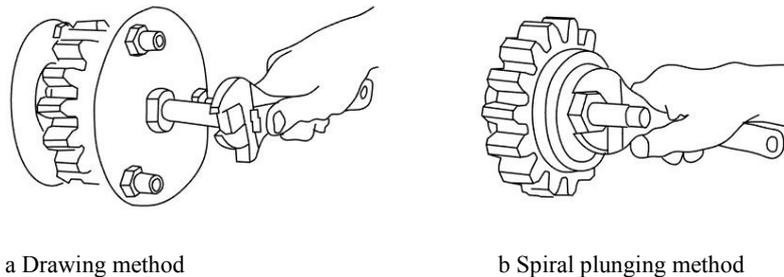


Figure 17 Gear Disassembling Method

9.5.4 Replacement of rack (see Figure 18)

The rack should be replaced when it is broken or reaches wear limit. Method of replacement is as follows:

- a) Loosen the rack connecting bolts and remove the worn or damaged rack; if necessary, rack can be heated partially (temperature shall be not more than 200°C) to clean connecting piece of the rack;
- b) Measuring graphic dimension L1 and L2 and make the value of L1 and L2 close to each other;
- c) Install new rack according to dimension in the figure. Bolt tightening torque should be 150 N•m.

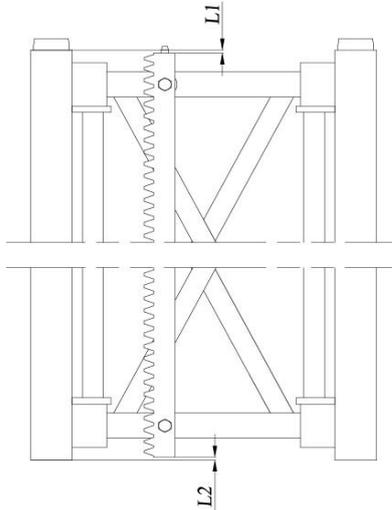


Figure18 Rack Installation Figure

9.5.5 Replacement of reducer

During the operation of working platform, if the occurrence of overheat or oil leakage of reducer makes the equipment vibrate strongly or lead to distortion of the gear shaft, reducer or its relative components should be replaced. Method of replacement is as follows:

- a) Descend the working platform to the ground and fix it stable with wood brick;
- b) Remove the connecting bolts between reducer and driving frame, take down the driving unit;
- c) Remove the flange connecting bolts between electromotor and reducer and separate the reducer from the electromotor;
- d) Judge the fault location; oil leaked, replace the oil seal; gear worn excessively, replace the gear;
- e) If the above methods cannot deracinate the faults, replace the reducer;
- f) Scrub the input shaft of reducer and grease.
- g) Connect the replaced reducer and electromotor, tighten the connecting bolts, the tightening torque is 100 Nm;
- h) Install the driving unit on the driving frame, tighten the connecting bolts, the tightening torque is 150 Nm;
- i) Adjust meshing clearance of rack in gear;
- j) Electromotor wiring.
- k) Switch on the current and test run.

9.5.6 Replacement of anti-falling safety device

For the disabled, or beyond the calibration date, or expired in service life, the anti-falling safety device should be replaced.

Method of replacement is as follows:

- a) Remove the cover under the safety device and dismantle the cable of microswitch;
- b) Loosen the connecting bolts between safety device and the driving plate, remove the safety device;
- c) Install a new safety device, tighten the connecting bolts with torque 150 Nm, adjust the meshing clearance between gear of safety device and rack;
- d) Connect cable to microswitch and install;
- e) Grease the safety device;

f) Make a drop test, check the brake result;

g) Reset the safety device;

9.5.7 Replacement of electromotor

The method of replacing motor is as follows:

a) Judge the fault location;

b) The dismantling method of electromotor is the same as reducer's when replacing the whole motor.

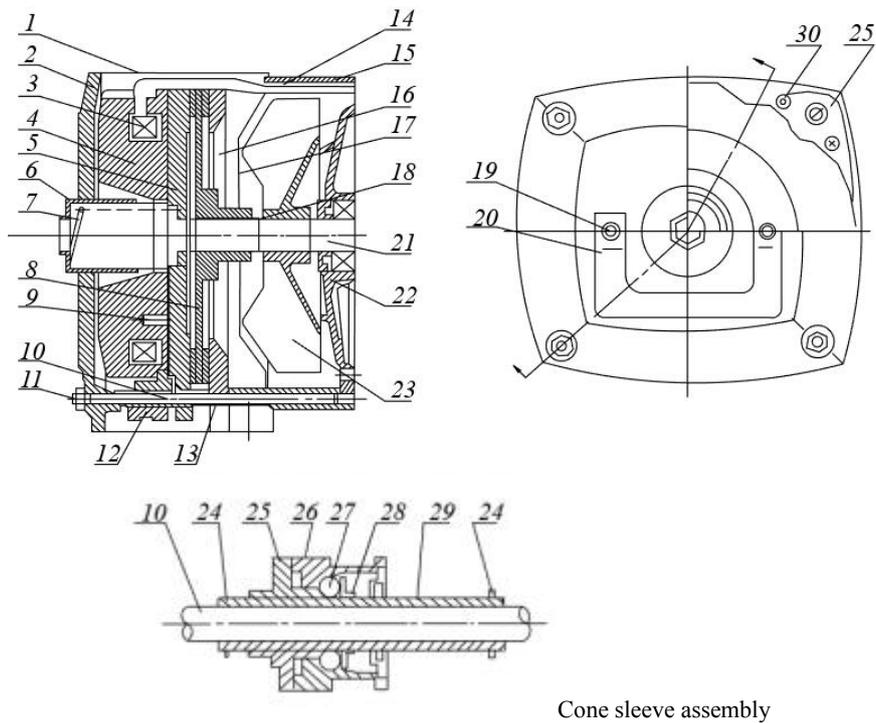


Figure 19 Structure Figure of Motor Brake

1 Protective cover	2 End cap	3 Electromagnetic coil	4 Electromagnet iron seat	5 Electromagnet armature
6 Adjusting sleeve	7 Retarding spring	8 Rotary brake disc	9 Compression spring	10 Fixed bolt
11 Nut	12 Cone sleeve assembly	13 Spacer bush	14 Coil cable	15 Cable clamp
16 Fixed brake disc	17 Fan housing	18 Button	19 Braking bolt	20 Release handle
21 Main spindle	22 Back cover	23 Fan	24 Washer on shaft	25 Bracket
26 Conical bushing	27 Ball	28 Spacer bush	29 Casing pipe	30 Screw

9.5.8 Replacement of motor brake

Judge the fault position and confirm the spare parts that should be replaced(As reference to Figure 19)

9.5.8.1 Replacement of brake disc

Rotary brake disc (8) is the easy-damage part, when the thickness of friction material on single side is close to 1mm, the whole set of brake disc should be replaced. Method of replacement is as follows:

a) Remove the protective cover (1) and mechanical release handle (20); measure and make a clear mark for the position of adjusting sleeve (6) in order to reset after the replacement of brake disc;

b) Remove the adjusting sleeve (6), take down the retarding spring (7), loosen the nut (11) and take off the end cap (2);

c) Remove the electromagnet iron seat (4) and armature (5), notice that the friction surface shall be placed upward. Remove the old brake disc, and replace the new one;

d) Reinstall the electromagnet iron seat (4) and the armature (5), get the armature near the new rotary brake disc (8);

e) Install the electromagnet iron seat (4) and the armature (5) on the mounting bolt (10), the cable groove is to be opposite to the groove on the fixed brake disc (16); slowly tighten the nut (11) , preventing the warpage of the electromagnet seat and the armature on the mounting bolt;

f) Install the end cap (2), tighten the nut (11), reinstall the spring (7) and the adjusting sleeve (6), tighten the sleeve (6) at the position marked in the procedure a, and reset it;

g) Get the brake device work several times, to inspect whether the work is normal.

h) Install the protective cover (1) at last. Release handle (20). Note the braking bolt (19) should not be too tight.

Note: Carry out a number of tests before the normal use of the brake.

If the brake cannot be released, the following spare parts should be checked:

a) Whether the rectifier bridge is normal;

b) Whether the contactor is normal;

c) Measure the voltage value of the coil (Rated voltage is 99V) If any problem, replace the electromagnet iron seat with coil.

9.5.8.2 Replacement of the electromagnet iron seat

a) Remove the protective cover (1) and mechanical release handle (20); Dismantle the cable (14) and cable cleat (15);

Measure and make a mark for the position of adjusting sleeve (6) in convenience for resetting when reinstalling;

b) Dismantle the adjusting sleeve (6) and the retarding spring (7) with hexagon spanner, remove the nut (11), take down the end cap (2) and electromagnet iron seat (4);

c) Hold the electromagnet seat vertically, dismantle the screws (30);

d) With the working surface of the electromagnet iron seat up, dismantle the four washers on shaft (24), take out the armature (5), and remove the spring (9);

e) Get out the backside stopper from the electromagnet iron seat [including the spare parts (25), (26), (27), (28), (29)]; install the new electromagnet iron seat; **Note: Be sure not to pull the casing pipe (29) from the conical bushing (26)!**

- f) Install the spring (9);
- g) Get the armature (5) through the sleeve, with its groove opposite to the coil cable (14);
- h) Install the washer on shaft (24);
- i) Press the electromagnet seat (5) on the armature, install the spacer bush (28) and screws (30);
- j) Adjust the clearance of brake device and insure the clearance is 0.5-0.8mm;
- k) Install the electromagnet iron seat and the armature on the mounting bolt (10), the cable groove is to be opposite to the groove on the fixed brake disc (16);
- l) Fix the end cap (2) on the mounting bolt (10), tighten the nut (11) slowly, preventing the warpage of the electromagnet iron seat and the armature on the mounting bolt;
- m) Install the retarding spring (7) and the adjusting sleeve (6), tighten the adjusting sleeve (6) at the location marked in the procedure a and reset it;
- n) Connect the coil cable (14), give power to the brake device and brake for several times to check whether it is working normal;
- o) Install the protective cover (1) and release handle (20). Note the braking bolt (19) should not be too tight.

9.5.8.3 Replacement of the backside stopper

- a) According to the method of the replacement of the electromagnet seat in Section 8.5.8.1, dismantle the brake;
- b) Remove the screws from the discs on the adjusting structure that need be replaced;
- c) Dismantle the washer on shaft (24);
- d) Press the bracket (25) to the conical bushing (26); release the casing pipe (29);
- e) Take down the armature, note that do not pull out the conical bushing from the casing pipe; take out the backup stopper vertically.
- f) Install the new backup stopper on the electromagnet seat, and also the armature;
- g) Install the electromagnet and other parts according to the method of replacement of eletromagnet seat 10.5.8.2.

Note: The main force support element, driving, transmission and safety spare parts must be supplied by our company; the spare parts from other source are strictly forbidden to use without our written confirmation!

10 Drop Test of S Anti-falling Safety Device

The drop test or calibration of anti-falling safety device should be done on the special experimental equipment and up to standard before installation.

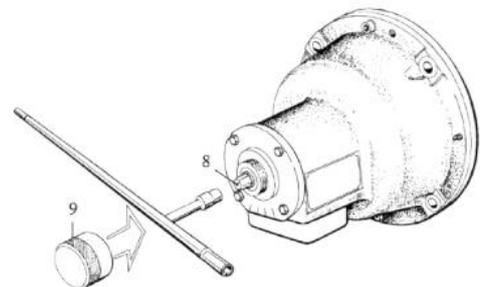
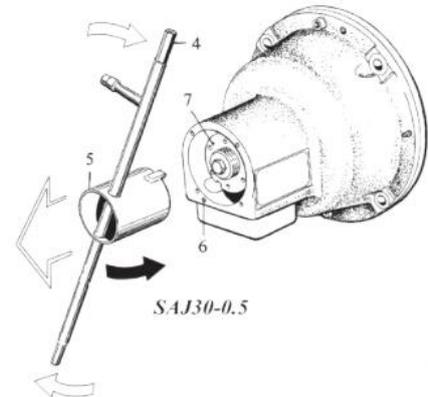
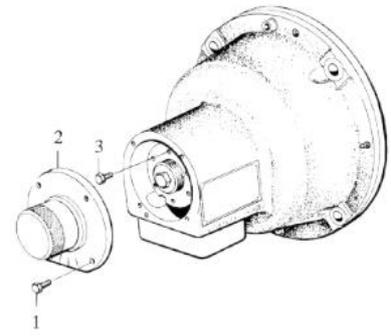
It is required to reset the safety device after drop test. The resetting method is as follows (Figure 20):

10.1 Spin out the screw (1), remove the end cap (2) and take down the screw (3)

10.2 Rotate the handle (4) of special tools (5), spin out the nut (7) until the pin (6) end is at the same level with the shell end surface

10.3 Install the screw (3) and end cap (2) Take down the cover (9), tighten the bolt (8), then tighten the bolt (8) by 30° with toll, reinstall the cover (9).

10.4 Connected to main power supply, ***travel the working platform upwards at least 200mm*** in convenience for separating the centrifugal swing block and friction drum from the tapered shell.



11 Dismantling of Lift Platform

11.1 Safety requirement of dismantling

11.1.1 The dismantling space should be cleaned out, and only for personnel with circled by marker posts, in case for falling objects above.

11.1.2 Non-staff persons are forbidden to operate the lift platform during the dismantling process.

11.1.3 In the bad weather such as when the wind force is above Grade 5, thunderstorm days or snowy days, the dismantling work cannot be done.

11.1.4 It cannot be overloaded when dismantling by suspender, suspender can only be used for dismantling the spare parts on the lift platform, cannot be used for other lifting use.

11.1.5 People are forbidden to stand below the suspender.

11.1.6 When there are suspenders on the lifting device, cannot start the working platform.

11.1.7 The workers' heads, hands and things loaded should not be exposed outside the guardrail when the lift platform is operating.

11.1.8 If somebody works on the derrick post or attachment frame, lift platform cannot be started; no one shall be allowed to enter the bottom guardrail when the working platform is lifting.

11.1.9 Full inspection should be done to eliminate all the unsafe hidden trouble before starting the working platform.

11.1.10 Must be loaded according to the rated load of the lift platform when the dismantling is operating, and overloaded is not allowed.

11.1.11 Dismantling operation during the night is forbidden.

11.2 Dismantling method

The dismantling process is opposite to the installing process of the lift platform, and following the principle of spare parts installed at a later time should be dismantled firstly. The specific procedures is as follows:

11.2.1 Remove the up limit and upper limit block

11.2.2 If there is a tower crane at the construction site, hang up the top mast sections, remove each 6 mast sections as a whole in one time, and remove the derrick post and the mast tie.

11.2.3 If there is no tower crane, install the electric hanging pipe on the working platform, then loose and remove each mast section's connecting bolts one by one. Remove the mast sections one by one from the top of the derrick post by the electronic suspender until the top mast tie. Transport the removed mast sections to the bottom with working platform, then to the ground with the suspender.

11.2.5 Remove the top mast tie and send to the ground.

11.2.6 Repeat the procedure of 11.2.2-11.2.5, dismantle the rest mast sections (except the last two at the bottom) and mast tie one by one, and then deliver the dismantled elements to the ground.

11.2.7 Remove the connecting wires of power cables and electric cabinet.

11.2.8 Remove the shorter (longer) platform section symmetrically from outside. Until only the base, 2 mast sections and drive platforms left.

11.2.9 Classify, check and arrange all the spare parts, transport them to the warehouse or the next installation site.

During the dismantling process, people should not:

a) When dismantling, the number of mast section hanged by the suspender each time should be only one, the number should not be beyond six when the mast sections are lifted by the cranes;

b) The max adhering distance from the dismantling place to the top undetached cannot exceed 4m;

c) The loaded weight when dismantling cannot exceed the rated load of the lift platform;

d) The cable must be noted at any time when dismantling, in case the cable is pulled off due to be hanged on other spare parts.

12 Maintenance and Repair of the Electrical System

12.1 Basic requirement

12.1.1 The maintenance and repair of the electrical system in lift platform should be charged by professional electrician with *Certificates for Special Operations*.

12.1.2 The professional electrician must be familiar with the electric system and circuit structure of the lift platform. He should be equipped with electrotechnical instruments such as the universal meter, megger and clip-on ammeter.

12.2 The common inspection method

12.2.1 First check the principle chart, when there is fault on the electrical system.

12.2.2 Check whether the voltage of the power supply is normal.

12.2.3 After the disconnecting switch and the final limit switch is turned on, check whether the incoming voltage of electric box cable is normal. If the broken phase and the phase sequence protection light does not shine, it indicates the wrong connection sequence or shortage of power phase; if the power phase is shorted, resolve the phase shortage problem; if connection sequence is wrong, replace any two phase of the cables in the electric cabinet; resupply the power until the light of the phase sequence protection shines.

12.2.4 Inspect each item and confirm the urgent stop button and thermal relay have been reset when the electromotor cannot be started. Microswitch of the safety device, all the limit switches, air switch of control circuit are all closed. Limit switch and final limit switch of upper and lower stroke are not be cut off; the main contactor, operation contactor, and the electromagnet contactor are all closed; generally, the fault can be excluded.

12.2.5 For the common electrical faults of the lift platform, referring to the *Common Faults and Analysis of the Lift Platform* in Chapter XIII.

12.3 Characteristics and special requirements of the electrical system in lift platform

12.3.1 For the convenience of conducting the leveling test and improving the security of the test, there is control wiring for the leveling test set specially in the lift platform.

12.3.2 In order to cut off the power of the electromotor and the electromagnetic braking coil immediately when the anti-falling safety device runs to make the electromotor stop running and the brake start braking, there is a microswitch set in the tail end of the anti-falling safety device.

Note: After the running, the safety device should be restored and the microswitch should be released from the normal operation.

12.3.3 To ensure the correct directional control of the lifting button in the working platform and the effective control of upper and lower limit switches to avoid the accident, there is a phase sequence protection relay set on the lift platform.

12.3.4 To stop the running of the working platform in time when there is equipment fault or immediate danger, there is an emergency stop set on the lift platform; the emergency stop button and the contactor coil of the master control circuit are concatenated. Once the emergency stop button is pressed, the power supply for the main contactor will be cut off; the operation will be continued only after the red emergency stop button is restored manually.

12.3.5 To ensure that the working platform runs safely within the limited range, there are upper and dual protectors of lower limit switch and final limit switch set in the lift platform.

Note: If the working platform runs over the range, there will be an accident of clashing the top or colliding the bottom, which will damage the machine or cause fatal crash!

Its safety and reliability depend on the quality of the components and parts, the accurate positioning and the stable installation, as well as the correct wire connection and orientation.

12.3.7 To prevent the working platform squeezing or colliding the bottom personnel in its descending, there is sound-light alarm apparatus specially set for the descending of the platform.

12.3.8 To protect the body of the operator in the working platform from coming out of the cage, there is a series of electric interlocking line specially set in the lift platform--there are interlocking switches set in the single and double door of the import and export and the outing door on the top of the cage of the platform. To ensure the safe running, the interlocking switch should not be out of order in any time.

12.3.9 For the voltages of all parts in the electric circuit are different (380V 3-phase AV in the main circuit, 36V single phase AC in the circuit controlled by the electric cabinet, 99V single phase AC in the electromagnet coil of the electromagnetic brake), it should note that the joints of different circuits cannot be interconnected.

12.3.10 The lift platform is jointly driven by two driving units, so the two electromotors should be specially requested to run synchronously. The electrical characteristics and the mechanical characteristics should be the same. The rotating speed and the torque of all electromotors should be the same even in the running. Otherwise, there will be load unevenness and circulation. And the electromotor may be damaged if they are serious. So pay special attention to the changing of the single electromotor.

12.3.11. If the resistor is overheat with a temperature being over 200°, the equipment may be temporarily closed and reused when the temperature drops to be below 100°. The overheat of the resistor and the related equipment faults caused by continuous use is out of the warranty.

13 Common Faults of Lift Platform and Analysis

See Table 7 for the common faults of lift platform and the cause analysis

Table 7 Common Faults of Lift Platform and Cause Analysis

No.	Common fault	Cause analysis
1	Switch strip of the main power	<ol style="list-style-type: none"> 1. Short circuit existing in the circuit 2. Ground connection existing in the phase line
2	Power source is normal, main contactor doesn't get absorbed	<ol style="list-style-type: none"> 1. The cabin door is not fully closed, causing the limit switch being failed in the closure 2. The emergency stop button or the microswitch or the thermorelay is not restored 3. The phase sequence is wrongly connected or there is default phase 4. There is disconnection or open circuit 5. The start button or the contactor is damaged
3	The contactor cannot be closed in operation of lifting.	<ol style="list-style-type: none"> 1. The normally-closed contact of the upper or lower limit switch is off 2. The circuit of the operation button is opened or damaged 3. The contactor coil is damaged
4	It is difficult to start the electromotor and there is abnormal noise	<ol style="list-style-type: none"> 1. The brake is not started 2. Motor suffers from phase shortage 4. Overload or serious unbalance loading.
5	The electromotor blocks and stops.	<ol style="list-style-type: none"> 1. The brake is not started 2. Low supply voltage 3. There is foreign matter jammed between the drive gear and rack 4. Serious overweight
6	Stop automatically in the running of the working platform.	<ol style="list-style-type: none"> 1. The thermal relay operation caused by long-time overload operation. 2. The cabin door is not well closed, causing the bad connection in the door limit switch 3. The circuit is not well contacted
7	The limit switch is not effective when the working platform runs out-of-limit.	<ol style="list-style-type: none"> 1. Limit switch is damaged. 2. Limit switch baffle is displaced. 3. Contact of contactor is spliced.

		4. The contacts of the operating handle bond.
8	There is bottom colliding when the working platform runs up out-of-limit.	<ol style="list-style-type: none"> 1. The upper limit switch fails 2. Upper limit switch baffle is displaced 3. The final limit switch fails or is damaged
9	There is bottom colliding when the working platform runs down out-of-limit.	<ol style="list-style-type: none"> 1. The lower limit switch fails 2. Lower limit switch baffle is displaced 3. The final limit switch fails or is damaged
10	There is chattering in the running of the working platform.	<ol style="list-style-type: none"> 1. The backlash of the gear engagement is too large 2. The interval between the guide rollers is too large or uneven 3. The difference in the joints of the mast section and the rack is too big 4. The brake is not fully separated, and the brake clearance is uniform
11	The electromotor brake cannot be taken off	<ol style="list-style-type: none"> 1. The brake coil is damaged 2. The rectifier bridge is damaged 3. The brake contactor is damaged
12	The temperature rise of the transmission mechanism is too large	<ol style="list-style-type: none"> 1. Shortage or metamorphism of lubricant 2. The rolling bearing is damaged 3. There is abnormal resistance in the working platform 4. Long-time full-load work
13	The safety device operates in the running with normal speed	<ol style="list-style-type: none"> 1. The calibrated speed is too low 2. The spring of the centrifugal flail block is loose
14	The circuit is normal, but it moves at times during running	<ol style="list-style-type: none"> 1. The circuit is not well contacted 2. There is a false junction in the joints
15	The movement lags in stop operation	<ol style="list-style-type: none"> 1. There is residual magnetism in the iron core of the contactor, causing the delayed release 2. It is too dirty within the contactor, causing the restoration of the iron core blocking

14 List of the Main Purchased Part (calculating on the single mast constructed lift platform)

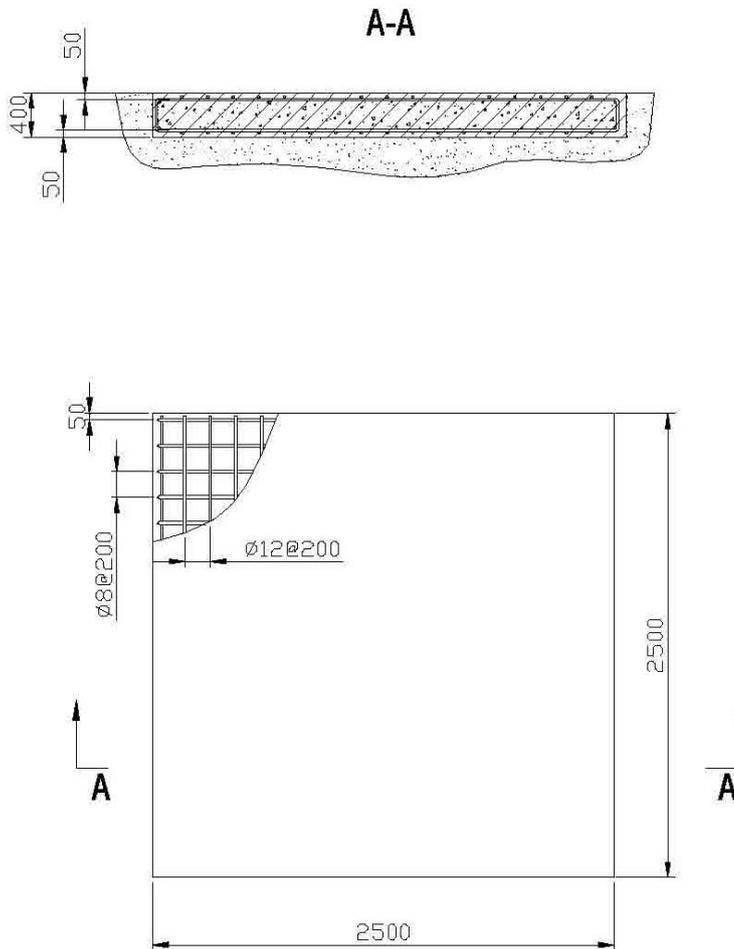
No.	Name	Quantity(Piece/Set)	Specifications or models
1	Electromotor	2	TYEJ permanent magnet synchronous (2.8kW)
2	Reducer	2	CRLa87-84.5
3	Anti-falling safety device	1	SAJ40-0.5 (20 gears)
4	Capacity limiter	2	IN318
5	Tiny electric hoist	1	PA500
6	Main cable (Single mast)	1	YCW 3×4+2×2.5
7	Main cable (Double mast)	1	YCW 3×6+2×2.5

15 List of the Main Vulnerable Part (calculating on the single mast constructed lift platform)

No.	Name	Quantity(Piece/Set)	Specifications or models
1	Driving gear	2	Module 6 and gear number 20
2	Clutch	3	Outside diameter Φ73mm
3	Clutch bearing	6	GB/T276 Bearing 6205 RS
4	Guide roller	16	Outside diameter Φ80mm
5	Bearing of the guide roller	32	GB/T276 Bearing 6205 RS
6	Grease seal in the input end of the	2	Dedicated
7	Friction disk of the electromotor brake	2	Dedicated
8	Buttons	4	Start and scram
9	Stroke switch	1	YBLX-K1/111
10	Stroke switch	3	BLX-K3/20S/T
11	photoelectrical limit switch	1	LJG1A-8/Z2DN2
12	Limit switch of the safety device	1	LXW5-11M

16 The Basic Requirements for the Foundation of the Lift Platform

16.1 The prefabricated concrete foundation should conform to the following requirements

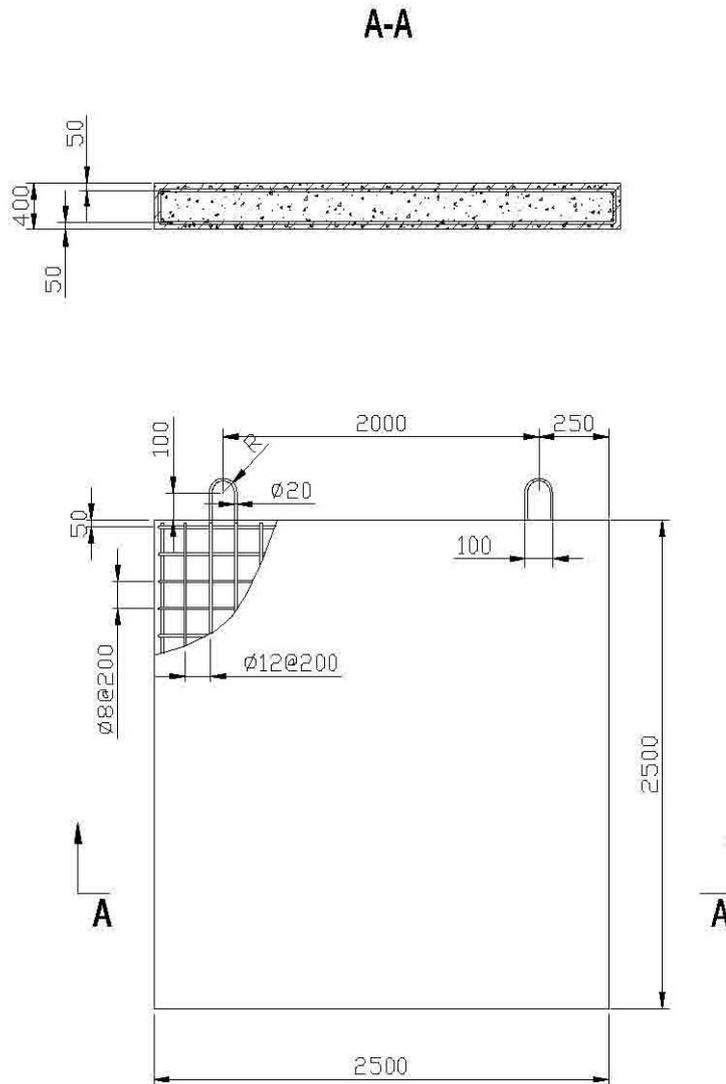


Foundation Drawing of STC200 mast climbing working platform

Note: With rammed earth in the basement of foundation, the soil bearing capacity should not be less than 100KPa;

2. The concrete mark should be not less than C30;
3. Levelness of the upper surface of the foundation is $\pm 5\text{mm}$;
4. The foundation should be 200mm higher than the surrounding ground.

16.2 The concrete base plate should conform to the following requirements



Concrete Base Plate Drawing of STC200 mast climbing working platform

Technical requirements

1. The concrete mark should be not less than C30;
2. Levelness of the upper surface of the foundation is $\pm 5\text{mm}$;

17 Packing and Transportation

The whole structure of the equipment is large, which consists of many steel structures. So it should be packed by boxes and groups in transportation. The method to disassemble the whole machine:

17.1 The drive platform and the parts of the base (as shown in Figure 21)

Remove the platform and the guardrail on the two sides of the drive platform, as well as the door pillar, cabin steps, cabin door, lower limit switch and lower final limit switch around the drive platform. Leave two mast sections on the base. Leave the transmission mechanism within the drive platform, but unscrew the manual release lever in the tail of the driving motor. Lay the electric cabinet on the main platform and fix it. Put the driving frame gently on the bumper of the base, forming a packaging group.

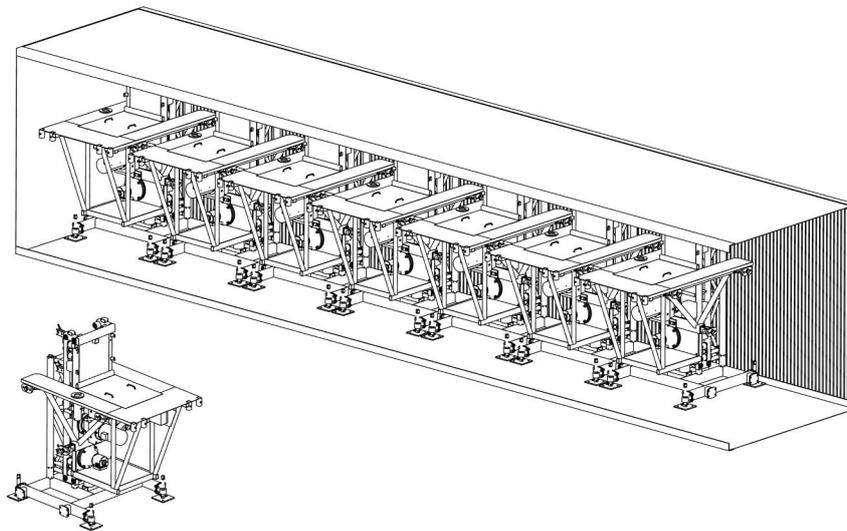


Figure 21 Diagram of the Packaging and Transportation of the Drive Platform and the Base Parts

17.2 The working platform and the guardrail (as shown in the Figure 22)

Put the long platform (1.5m) as shown in the Figure, and bind and tighten the vertexes of the triangular component of the four long platform with No. 8 galvanized wire ($\phi 4$), then bind and tighten the four corners with the same kind of wire, forming a stable frame structure.

Put the decomposed guardrail on the two sides of the frame respectively. Put a short platform (0.8m) on the top of the frame, and pack and fasten it with the steel belt, forming a packaging group.

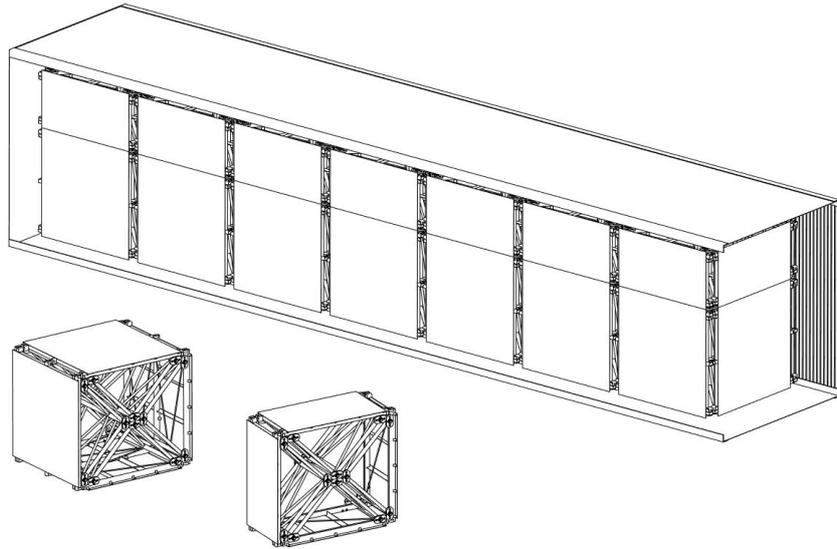
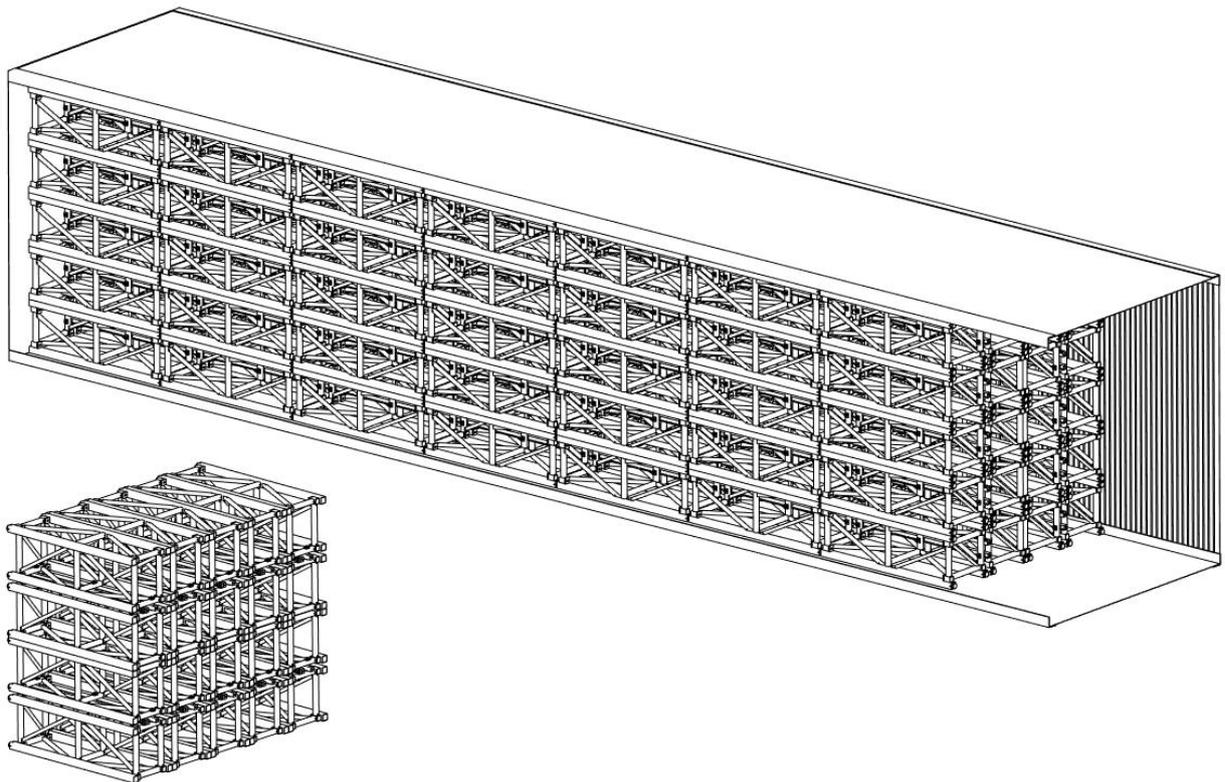


Figure 22 Diagram of the Packaging and Transportation of the Long Platform and the Guardrail

17.3 Mast section (as shown in the Figure 23)

Separate the mast section into the groups with 20 in each, and bind and tighten it with the No.8 galvanized wire, forming a packaging group.



17.4 Container Load Plan

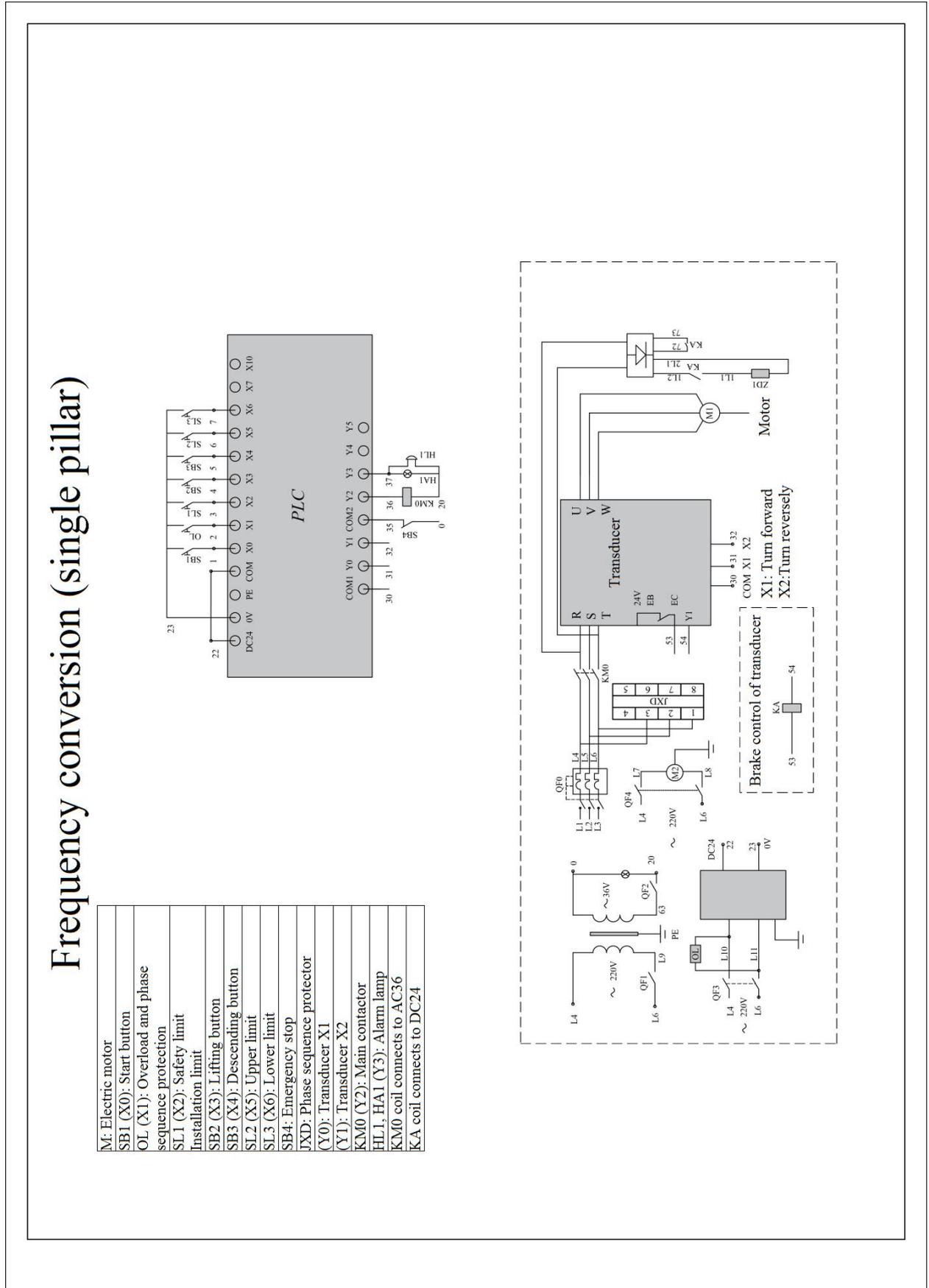
17.4.1 Packing List of the Standard Parts for the 35m Double Mast

No.	Installation position	Code	Name and specification	Quantity	Remark
1	Mast section	GB1228-2006	Bolt M16×240	200	Grade 8.8
		GB1229-2006	Nut M16	200	Grade 10
		GB97.1-2002	Flat gasket 16	200	
		GB93-2002	Spring washer 16	200	
			Pin A10×40	50	
2	Platform	GB5782-2000	Bolt M20×100	86	Grade 8.8
		GB6170-2000	Nut M20	86	Grade 10
		GB97.1-2002	Flat gasket 20	86	
		GB93-2002	Spring washer 20	86	
		GB5782-2000	Bolt M12×90	4	For suspender
		GB6170-2000	Nut M12	4	
		GB97.1-2002	Flat gasket 12	4	
		GB93-2002	Spring washer 12	4	
		GB5782-2000	Bolt M10×35	92	For tightening the
		GB6170-2000	Nut M10	92	
		GB5782-2000	Bolt M8×80	8	For guardrail
		GB5782-2000	Bolt M8×60	42	For corner
		GB6170-2000	Nut M8	76	
		GB97.1-2002	Flat gasket 8	24	
		GB93-2002	Spring washer 8	24	
3	Mast tie		Expansion bolt M16×150	24	
			Through-wall bolt M16×320	24	Customization
		GB5782-2000	Bolt M16×60	72	Grade 8.8
		GB6170-2000	Nut M16	72	Grade 10
		GB97.1-2002	Flat gasket 16	72	
		GB93-2002	Spring washer 16	72	
		GB5782-2000	Bolt M12×100	48	Grade 8.8
		GB5782-2000	Bolt M12×85	48	Grade 8.8
		GB6170-2000	Nut M12	96	Grade 10
		GB97.1-2002	Flat gasket 12	96	
		GB93-2002	Spring washer 12	96	
4	One Operation Manual				
5	1 set of auxiliary tools				

Note: The through-wall bolts made in the Table is adapted to the wall whose thickness is under 250mm. They should be made separately if the wall of the project is thicker than this.

18 Electrical Schematic Diagram

18.1 Schematic diagram of the electric box of the single mast



18.2 Schematic diagram of the electric box of the double mast

Frequency Conversion (Double Pillar)

PLC

M1:	Left motor
M2:	Right motor
SB1 (X0):	Start button
OL (X1):	Overload and phase sequence protection
SL1 (X2):	Safety limit
SL2 (X3):	Installation limit
SB3 (X4):	Lifting button
SB4 (X5):	Descending button
SL3 (X6):	Upper limit
SB4 (X7):	Lower limit
SB5 (X8):	Manual button
SBS (X10):	Automatic button
SB6 (X11):	Manual left control
SB7 (X12):	Manual right control
SBS (X13):	Automatic left control
SB9 (X14):	Automatic right control
SB10 (X15):	Inclined protection
IXD:	Emergency stop
IXD:	Phase sequence protector
KA KM0-4:	coil connects to AC36
KA1 and KA2:	coils connect to DC24

PLC

(Y0):	Transducer X1
(Y1):	Transducer X2
(Y2):	Transducer X3
(Y3):	Transducer X4
(Y4):	Transducer X6
KM0(Y10):	Main contactor
HL1, HA1(Y11):	Alarm lamp

