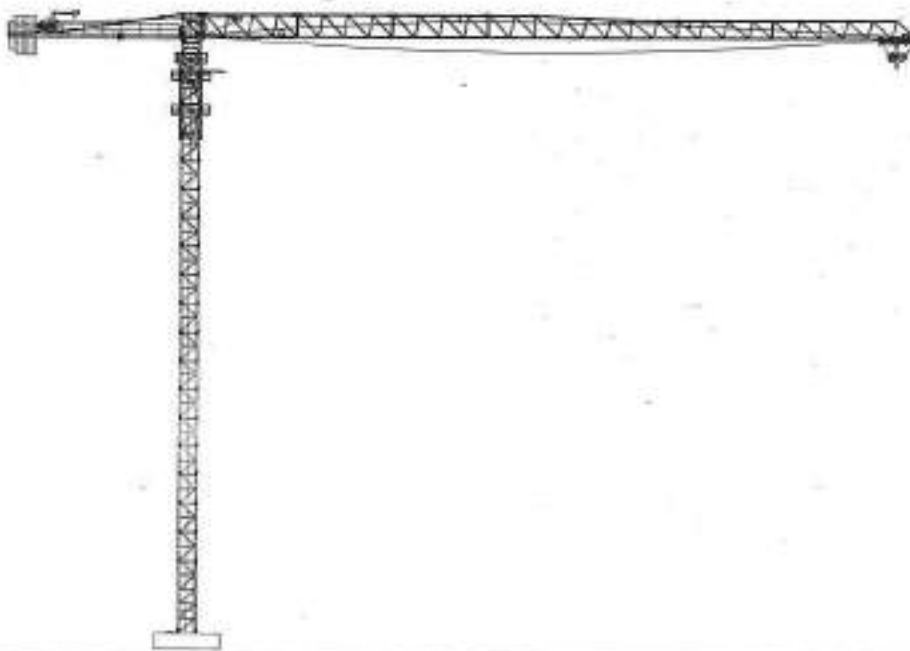


Quality changes the world



Tower Crane

**SFT250C (T7520-16)**



Operation Manual



## Foreword

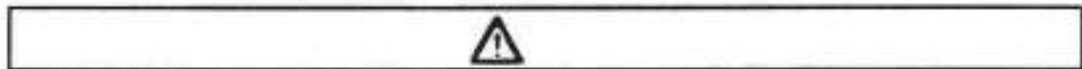
1. Thank you for choosing SANY tower crane (hereinafter referred to as the "tower crane"). We will provide you with high-quality products and star-rated after-sales services.
2. This Operation Manual describes in detail the technical performance of SF7250C tower crane, structural description of the main components, safety precautions for assembly and use of the tower crane, as well as the hydraulic and electrical working principle diagram and operation.
3. Before operating the tower crane, please carefully read and master the contents of this Operation Manual. You can operate the machine skillfully and safely only after you fully understand the contents of this Manual. It will:
  - 1) Avoid machine faults caused by improper operation;
  - 2) Enhance safety and reliability of the tower crane;
  - 3) Extend service life of the tower crane;
  - 4) Reduce repair costs and downtime.
4. Safety and operation are closely related. The safety precautions in this Manual are an important part of safe operation, operators shall strictly abide by them.
5. If the operator or the on-site operation personnel fail to use this machine as described in this Operation Manual, or operate the machine negligently and carelessly, it is likely to result in personal injury or death and will cause significant property damage. Therefore, the tower crane operators and owners shall attach great importance to safety problems.
6. Our company is committed to continuous improvement and perfection of the product, so the relevant contents of this Manual may change without prior notice, please understand.
7. If you have any questions about the machine or this Manual, please call the service hotline 4008878318 for SANY service support.
8. Please keep this Manual properly for easy reference.
9. Thank you for your trust in SANY. We sincerely wish you a bright future and brilliant achievements in your career.



## Guide to reading

1. This Operation Manual gives the guidelines for correct use of the tower crane, including the safety use guidelines, technical description, function introduction of all parts, installation introduction, precautions for operation of the tower crane and so on.
  - 1) Safety use guidelines of tower crane  
The safety requirements for installation and use of the tower crane and the safety operation procedures for operation of the tower crane are introduced.
  - 2) Technical description of tower crane  
The structure, working principle, main technical parameters and accessories of the tower crane are introduced.
  - 3) Function introduction of all parts of tower crane  
The structure and functions of steel structure components, control system, hydraulic drive system, electrical system and safety devices are introduced.
  - 4) Installation and operation introduction of tower crane  
The precautions for assembling of the tower crane, operation methods and precautions for installation of the tower crane, operation and maintenance methods of the tower crane, and installation and operation of accessories are introduced.
  - 5) Precautions for operation of tower crane  
The important tips for safe operation, precautions for general operation and use, precautions for normal use and extension of service life, safety precautions for tower crane lifting operation and so on are included.
2. Interpretation of symbols

1)



This is a sign of "Take Care".

When you see this mark on machine or in this Manual, you should be aware of the danger of personal injury or property damage accident. Follow the suggested precautions and safe operation methods.

On machine safety signs,  is used with "Danger", "Warning" or "Caution" which define the degree of hazard.

2)



An emergency hazard that is highly hazardous and, if not avoided, could result in death or serious injury.

3)



A potential hazard that is moderately hazardous and, if not avoided, could result in serious injury.

4)



A potential hazard that is mildly hazardous and, if not avoided, could result in mild or moderate injury.

The "Danger" or "Warning" safety signs are posted near specific hazards. The general precautions are listed on the "Caution" safety sign for your attention to safety instructions.

5)



Tip

"Tip" is used to give additional clarifications to specific information.

6)



Indicates that the operation that do not comply with safety specifications may easily cause serious casualties and should be prohibited.

7)



Indicates that the operation complies with safety specifications.

# SANY

## Introduction

1.1	Introduction .....	1-3
1.2	Overview .....	1-4

A large area of the page is filled with horizontal dashed lines, providing a space for handwritten notes or a table of contents.



## 1. Introduction

### 1.1 Introduction

1. SANY tower crane will provide you with high-quality operation performance and star-rated after-sales services.
2. SANY tower crane can be widely used in various kinds of construction in the industry.
3. SANY Group is an international leading construction machinery manufacturing company.

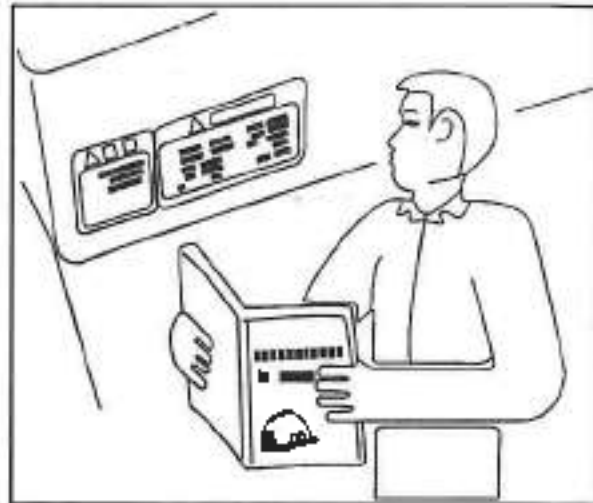


Fig.1-1

4. This Manual provides the contents of safety, technical parameters, operation, troubleshooting and maintenance. In order to use the tower crane correctly, read this Manual carefully before operation.
5. The information provided in this Manual is intended to help you to:
  - 1) Understand the structure and operation performance of the tower crane;
  - 2) Use the tower crane correctly.
  - 3) Improve operation efficiency of the tower crane.
  - 4) Extend service life of the tower crane.
  - 5) Reduce maintenance costs of the tower crane.
6.
  - 1) Please keep the Manual at a place in the cab that can be easily accessed. If it is damaged, replace it as soon as possible.
  - 2) If you want to sell this tower crane, please provide this Manual to new user of the tower crane.
  - 3) The detailed changes caused by continuous improvement of the design are not included in this Manual. If you have any questions about this machine or the contents of this Manual, please contact Hunan SANY Tower Crane Co., Ltd.

## 1.2 Overview

1. The SFT250C (T7520-16) tower crane is a horizontal jib high-level slewing self-raising tower crane developed in accordance with GB/T5031 "Tower Crane", GB/T3811 "Design Rules for Cranes", GB/T13752 "Design Rules for Tower Cranes" and related laws and regulations. It has the following advantages:
  - 1) The nominal lifting moment is 2,500 kN·m, and multiple working modes, including the bolt fixing, underframe fixing, attachment, walking and climbing, are available. The maximum working radius is 75 m, the maximum lifting weight at the maximum working radius is 2.0 t, and the maximum attachment height is 300 m.
  - 2) The basic safety devices are complete, and the tamper protection of the highest degree is adopted.
  - 3) The transfer mechanism adopts full frequency conversion control and SANY's unique near zero speed engagement technology, which makes the mechanism run smoothly, and the movement switching is soft when the tower crane speed changes, when braking is applied to stop, the structure pendulum momentum is very small and the brake noise is very low.
  - 4) Three-in-one display and control screen: Control intelligent operation of the whole tower crane, display working parameters in real time, and has GPS remote control, interaction and storage functions.
  - 5) The side-mounted cab has a wide field of vision; the handles are easy to operate, and the pedals can improve the operating comfort.
2. The SANY tower crane has excellent performance and is suitable for high-rise or super-high-rise civil buildings, bridges and water conservancy projects, and large-span industrial plants, as well as large-scale construction projects such as tall chimneys and silos constructed by sliding form construction method.

# SANY

## Safety

<b>2. Safety</b> .....	<b>2-1</b>
<b>2.1 Safety</b> .....	<b>2-3</b>
<b>2.2 Operator</b> .....	<b>2-3</b>
<b>2.2.1 Protective equipment for operator</b> .....	<b>2-3</b>
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<b>2.5 Requirements for assembling and disassembling operation of tower crane</b> .....	<b>2-8</b>
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Blank lined area for safety notes.

## 2. Safety

### 2.1 Safety



Fig.2-1

1. The safety information in this Manual provides the operator with basic guidance on safe operation. Please read the Operation Manual carefully before work.

**Local governments or agencies may issue stricter standards. If the provisions of this Manual conflict with local laws or regulations, stricter regulations should be followed.**

2. When using the tower crane, the relevant provisions in JG/T 100-1999 Specifications for Operation of Tower Crane and this Manual shall be strictly implemented.
3. The manufacturer shall not be liable under the following circumstances:
  - 1) Damage of the tower crane and safety accidents are caused by failure to operate and maintain in accordance with the requirements of this Manual.
  - 2) The components or accessories used are not the genuine parts of the manufacturer.
  - 3) Modifications are made without the manufacturer's permission.
  - 4) The installation of accessories is not approved by the manufacturer.
  - 5) The basic condition of the tower crane does not meet the requirements in this Manual.
  - 6) Components are damaged due to the fact that voltage of the power grid does not meet the requirements or natural disasters.

## 2.2 Operator

### 2.2.1 Protective equipment for operator

**Tower crane can only be operated by the following qualified persons:**

1. Having been trained and obtained relevant qualifications, must have knowledge of tower crane operation, regular maintenance skills and understand the control principle of tower crane;

2. The personnel being trained shall be supervised by experienced personnel on site.
3. Maintenance and testing personnel.

No person other than the above shall enter the cab, except with the consent of the competent management personnel.

All personnel shall meet the requirements stipulated in ISO 1100-1999, a national construction industry standard.

In order to reduce the risk of personal injury, the personnel working on the tower crane must wear safety protection equipment properly.



Fig.2-2 Safety helmet

1. Safety helmet

The safety helmet protects your head from falling objects.

2. Safety shoes

The safety shoes protect your feet from falling objects or protruding nails.



Fig.2-3 Safety shoes

3. Safety gloves

The safety gloves protect your hands from irritating substances or chemicals or from friction and cuts caused by operation of the tower crane.



Fig.2-4 Safety gloves

4. Safety rope

For the sake of safety, be sure to use the climbing auxiliary device and working platform or fasten the safety rope properly when working at height. Be sure to comply with relevant national regulations.



Fig.2-5 Safety rope

### 2.2.2 Signal commanding personnel



Fig.2-6

1. **Job responsibility:** Assist the driver to complete the lifting of heavy objects and avoid accidents by instructing lifting, lowering, juffing, slewing and other actions of the hook or lifted weight with the agreed (or specified) gestures.

### 2.3 Safe Distance

1. When installing the tower crane, the distance between the tower crane and the high voltage wire must be greater than the minimum safe spacing (see following table).

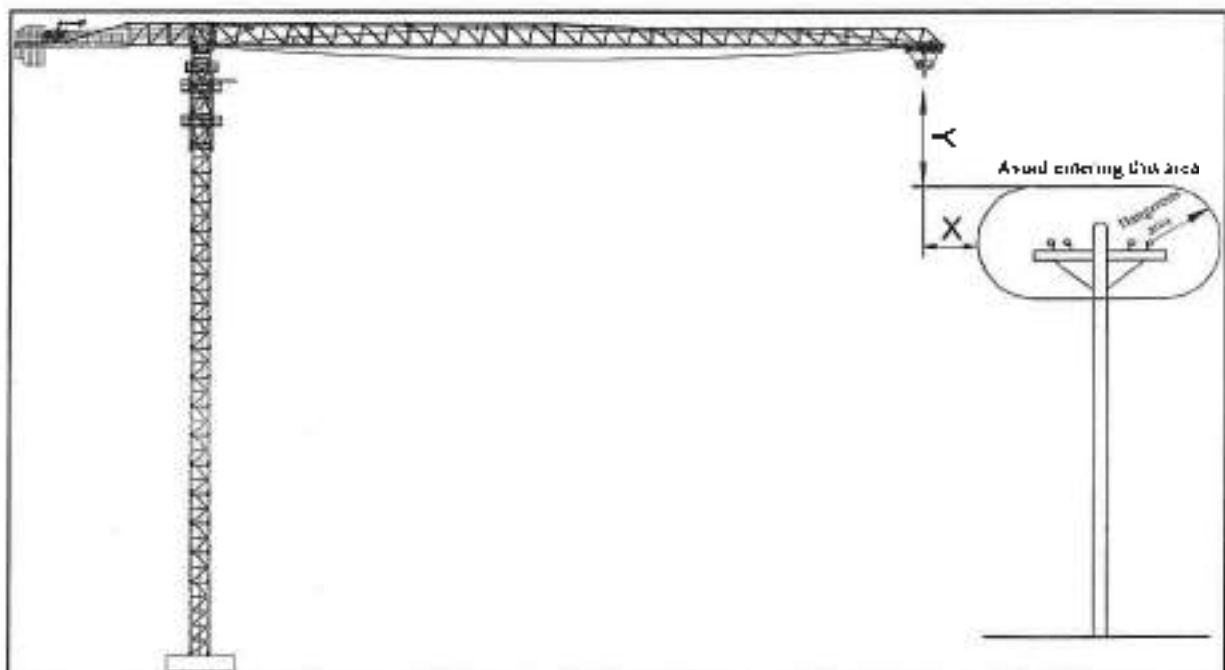


Fig 2-7

Tab 2-1 Minimum distance between tower crane and power line

Safe distance m/voltage Kv	< 1	1-15	20-40	60-110	200
Along the vertical direction (Y)	1.5	3.0	4.0	5.0	6.0
Along the horizontal direction (X)	1.0	1.5	2.0	4.0	6.0

## 2.4 Safety operation procedures

These procedures apply to all types of tower cranes produced by our company.

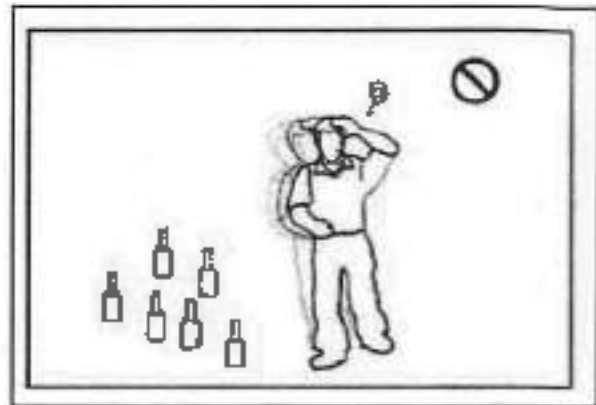


Fig.2-8

1. The driver, disassembling and assembling personnel, commanding personnel and commanding signals of the tower crane must meet the requirements of JG/T100-1999 Specifications for Operation of Tower Crane, and carry out all works strictly according to this standard.
2. It is strictly forbidden to work after drinking.

### Check the tower crane before operation:

1. The ambient temperature that is appropriate for working of the tower crane is  $-20^{\circ}$   $\sim$   $+40^{\circ}$ , and the wind strength at the highest place shall be less than 20 m/s;
2. When multiple tower cranes enter a job location at the same time, the plane layout of tower cranes must be reasonable, so that no interference or space interleaving occurs among each other;
3. All connectors shall be connected firmly, and the main welds shall be free from cracks and open welding;
4. Grounding and neutral protection measures of the tower crane shall be checked;
5. Each controller should be in zero position before switching on the power;
6. The operating system shall be flexible and accurate, all electrical components shall work normally, and all junction points shall be firm;
7. The power supply voltage should be  $380V \pm 10\%$ ;
8. The quantity and quality of lubricating oil of each reducer shall meet the requirements;
9. The braking action shall be flexible and reliable when braking situation of the tower crane is checked;
10. The hook, pulley and guide sleeve shall rotate flexibly; each wire rope shall be in good conditions and secured firmly;



- 11 Before operation, it is necessary to run an operation cycle without load and try to lift heavy objects for confirmation before operation can be started.

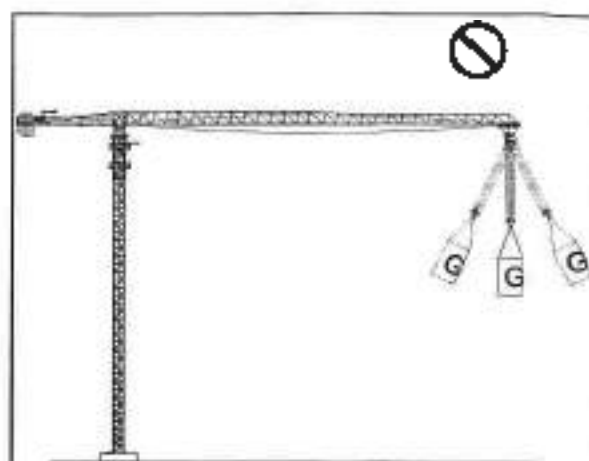


Fig.2-9

#### During operation:

1. Sound signals shall be sent out first.
2. The hanging of heavy objects must meet the following requirements:
  - 1) It is strictly prohibited to hang heavy objects directly with the hook;
  - 2) When lifting short and broken materials, they must be packed with nets and hags with sufficient strength, and not directly tied up for lifting;
  - 3) When lifting thin and long materials, the materials shall be tied at least two places and lifted with two lifting points, and the materials shall be kept in a horizontal state during the whole process;
  - 4) The heavy objects lifted shall not swing or rotate during the whole lifting process. The heavy objects that cannot be suspended stably shall not be lifted;
  - 5) It is not allowed to hang any heavy objects on the heavy objects lifted.
3. It is forbidden to start and stop suddenly.
4. The operator must concentrate on the operation. When the safety device gives an alarm, the operator must operate according to the relevant provisions in the Operation Manual.
5. Overload operation is prohibited; when the wind force is greater than 20 m/s, the operation shall be prohibited, the weather vane and brake device shall be started, and the boom shall be allowed to slew freely.
6. When the distance from the lower load block to the crane arm is less than 5 m during hoisting, hoisting shall be carried out at low speed.
7. It is strictly forbidden to lower the hook or heavy objects by free dropping method. When the heavy object is about 2 m away from the emplacement point, it is necessary to take the heavy object in place at slow speed.
8. When lifting heavy objects with translation motion, the height of the heavy objects above the obstacles to be crossed shall not be less than 1 m.
9. When the tower crane is working, the hook shall be avoided from touching the ground as far as possible, in order not to mess the hoisting wire rope. If the hook must be in contact with the ground, it shall be necessary to carefully observe the arrangement of the hoisting wire rope, and the hoisting wire rope must be arranged neatly again when necessary.
10. It is not allowed to lift heavy objects carrying people, and it is forbidden to lift people by tower crane.
11. The heavy objects must be unloaded, and the hook shall be raised before the tower crane stops running. Each operating handle shall be set to the "Zero" position.

12. When hoisting or lowering heavy objects, no one is allowed to pass or stay under them.

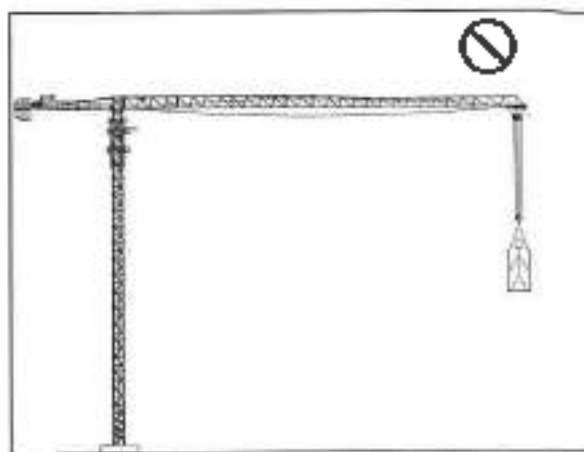


Fig.2-10

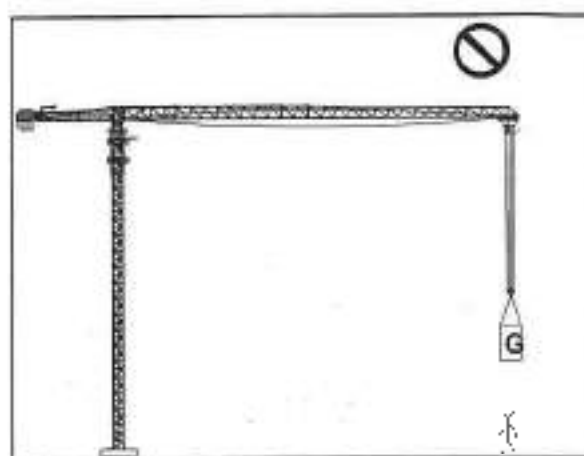


Fig.2-11

**After operation:**

1. Before leaving, the hook shall be hoisted to the high end, the load bearing hogie shall be retracted to the minimum radius, the control device shall be returned to zero, the slewing mechanism shall rotate freely, and the main power supply shall be cut off.
2. Records of use, maintenance and shift handover of the tower crane shall be made.

**2.5 Requirements for assembling and disassembling operation of tower crane**

1. When disassembling and assembling the tower crane, the disassembling and assembling personnel must comply with the following principles:
  - 1) Understand performance of the tower crane;
  - 2) Operate strictly according to the installation and removal procedures specified in the Manual;
  - 3) Understand the weight and lifting point position of each component to be disassembled and assembled.

2. The disassembling and assembling personnel must have a comprehensive understanding of the performance and operation procedures of the mechanical equipment and tools used during operation, and use them strictly in accordance with the provisions.
3. During installation of the tower crane, it shall be ensured that the connectors of each component are fully installed and fixed reliably.
4. When installing and disassembling the crane arm and counter jib, it is strictly prohibited to interrupt the operation when only one of them is assembled or disassembled. If the operation has to be interrupted, the tower crane must be in a moment balance state.
5. When fastening the tie bolts of the standard section, the torque wrench must be used to tighten them to the specified value.
6. When disassembling the electrical section of tower crane, it must be carried out by electricians with electrician operation certificate, and other personnel are strictly prohibited to disassemble and assemble.
7. During installation of tower crane, the safety devices and protective facilities in each part must be installed completely, and must be debugged before lifting operation.
8. During jacking of the tower crane, the tower crane must be kept in the best balance condition in accordance with the instructions as described in this Manual, and clearance of the guide wheel must be adjusted to the specified value (2-4 mm).
9. During jacking, the clearance of guide wheels and cables must be carefully checked by special personnel.
10. When it is necessary to install the attachment frame on the tower crane, the user shall contact our company and offer the following written materials:
  - 1) Horizontal attachment distance between tower crane and building;
  - 2) Condition of the place where the tower crane attaches with the building;
  - 3) Other requirements.
11. When installing the attachment device, a theodolite shall be used to check the perpendicularity of the axis of the tower body, and the deviation shall not be greater than 4/1000 of the full height of the tower body (under the attached state, the deviation above the highest attachment point shall be no more than 4/1000, and the deviation below the highest attachment point shall be no more than 2/1000. This can be achieved by adjusting the length of the attached brace.)
12. The connection between the building and the attachment frame must be firm.

## 2.6 Requirements for jacking operation

1. When the wind speed on top of the tower is greater than 12 m/s, jacking operation shall not be carried out.
2. The jacking shall not be carried out under severe and extreme weather such as rain, snow and heavy fog.
3. During jacking, it is necessary to ensure that the crane arm is in the same direction as the introduction of the standard section, and the crane arm shall be stopped by the slewing mechanism brake.
4. The position of the introduced platform on the step of the attached standard section must be correct, and must be aligned with the existing standard section.
5. During jacking, if the hydraulic jacking system works abnormally (for example, peculiar noise and heating, etc.), stop jacking immediately, retract the cylinder, set the lower seat on top of the tower body, connect the lower seat with the tower body firmly with high strength bolts, and then eliminate faults of the hydraulic system.
6. After attached sections of the tower crane have reached the desired height, rotate the crane arm to different angles, and ensure that the bolts at each connection point reach the required pre-tightening torque.

## 2.7 Precautions for maintenance

Before maintenance of tower crane, the maintenance personnel are required to pay attention to the following safety precautions:

1. Ensure that the tower crane is in a stationary state, no heavy object is hung on the hook, and all control levers should be in the shut-down position.
2. Use appropriate maintenance equipment.
3. If the tower crane is a walking tower crane, pay attention to prevent interference, and clamp the rail clamp.
4. During maintenance, arrange special personnel to guard or post the warning signs of "Maintenance Operation, Do Not Switch On".
5. Cool the hot parts down completely before maintenance.
6. Never remove the hydraulic system components before the pressure is released to prevent injury due to pressurized oil.
7. Use only the genuine spare parts and do not wait for accessories to be damaged before replacing them.
8. The basket fastened on the side of the load bearing bogie with a rated bearing capacity of 100 kg is for maintenance purpose. When the tower crane is working, never allow people to stand in the basket.

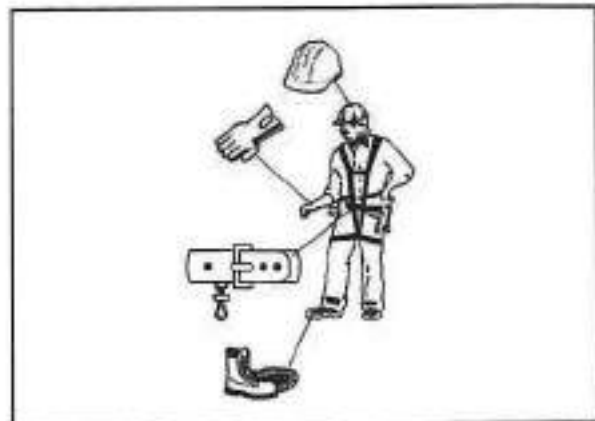


Fig.2-12

## 2.8 Labels of tower crane

1. Ensure that all safety, alert and warning labels are complete and in good conditions. Ensure that the operator and all relevant personnel understand the contents of the labels and their location on the equipment.
  - If some labels on the tower crane are damaged or missing, contact your SANY dealer to claim for new ones. The contents of the existing labels shall not be modified or altered without the permission of SANY selling dealer.
  - When replacing damaged or missing labels, make sure they are installed in the correct position.
2. Precautions label

Indicate the precautions for erection, climbing, operation and disassembling of tower crane.

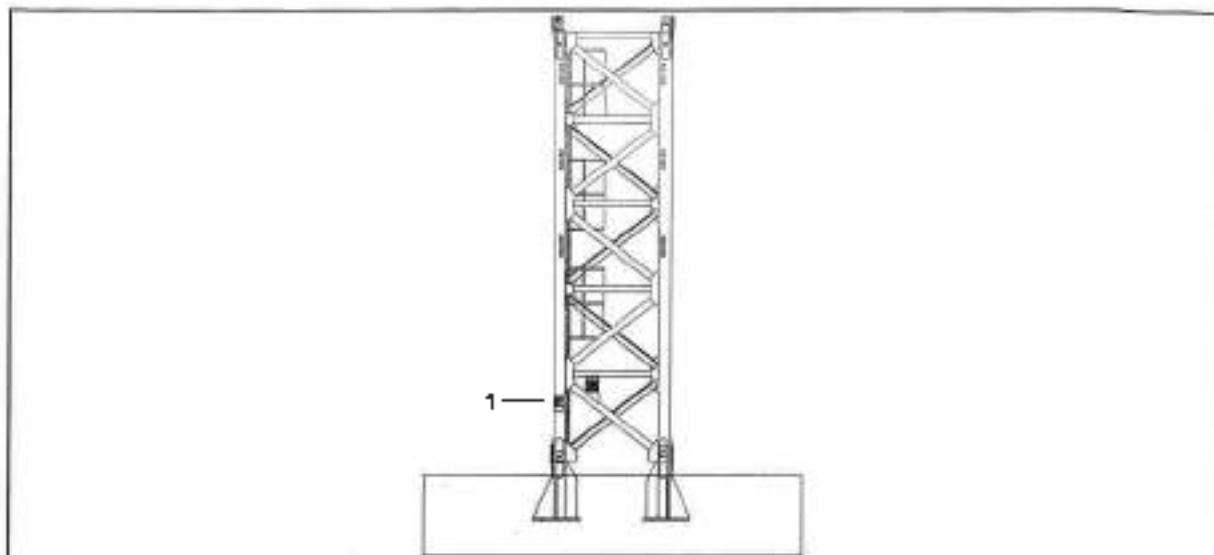


Fig.2-13

### SANY Precautions

- I. Before installing tower crane, be sure to carefully read the installation and removal procedures as described in the Operation Manual, and operate in strict accordance with these procedures; and, make sure that the connectors of each component are fully installed and fixed reliably. Before jacking, be sure to install the arm-release pin on the jacking beam. Before jacking, be sure to install the safety devices and safeguard facilities in all parts. During jacking, be sure to check the clearance of guide wheels and cables carefully.
- II. Before climbing the tower, please read the following precautions carefully:
  1. Be sure to wear the safety helmet.
  2. When climbing the stairs, please pay attention to grasp the pull rod, watch your step, and do not miss your step.
  3. Mind your head.
  4. After climbing the tower, pay attention to your step and do not fall or slip.
  5. Do not touch the control equipment in the cab.
  6. Do not touch the machinery or the wire rope.
  7. Do not enter the site without platform and guardrail.
- III. Before operating the machine, please read the Safety operating procedures of operator carefully, operate in strict accordance with the instructions, and confirm that all safety devices, instruments, and insures of the tower crane are complete and work normally before starting the machine.
- IV. When dismantling the tower, the dismantling and assembling workers must fully understand the performance and operation procedures of the mechanical equipment and tools used, and strictly use them in accordance with these procedures.

Fig 2-14 Precautions label

### 3. Nameplate

The basic technical parameters of tower crane are provided, including product model, nominal lifting moment, maximum hoisting weight, working radius, free hoisting height, working temperature, lifting speed, slewing speed and so on.

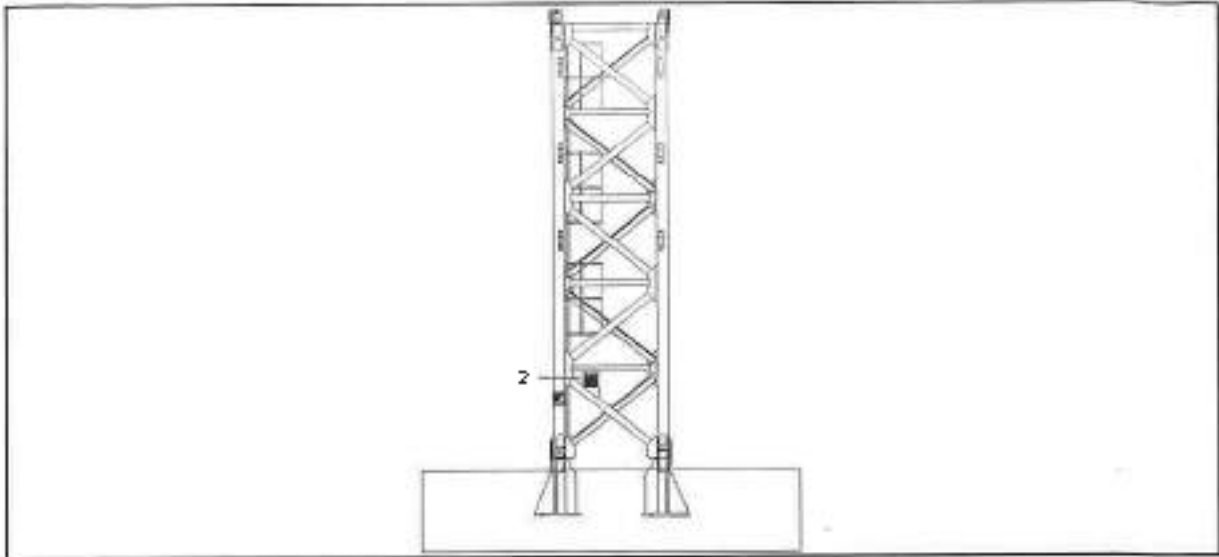


Fig.2-15

<b>SANY</b> 湖南三一塔式起重机械有限公司 Hunan SANY Tower Crane Co., Ltd.			
塔式起重机 Tower Crane			
产品型号 Product Type	<input type="text"/>	额定速度 Rating Speed	<input type="text"/> r/min
公称起重量 Rated Lifting Mass	<input type="text"/> t	回转速度 Rotating Sp. N	<input type="text"/> r/min
最大起升高度 Max. Lifting Height	<input type="text"/> m	个变幅速度 Luffing Speed	<input type="text"/> r/min
工作幅度 Turning Radius	<input type="text"/> m	行走速度 Travelling Speed	<input type="text"/> m/min
独立式起升高度 Max. Lifting Height	<input type="text"/> m	总功率 Total Power	<input type="text"/> kW
工作温度 Working Temperature	<input type="text"/>	电源 Main Supply	<input type="text"/> V/Hz
制造许可证号 License No.	<input type="text"/>	生产日期 Date of Production	<input type="text"/>
设备代码 Equipment No.	<input type="text"/>	出厂编号 Number	<input type="text"/>
///		厂家电话: 186 0830 2000	

Fig 2-16 Nameplate

4. Safety pin warning sign

When jacking and lowering the tower, the safety pin must be fastened properly after the jacking team is placed in the step.



Fig.2-17 Safety warning label

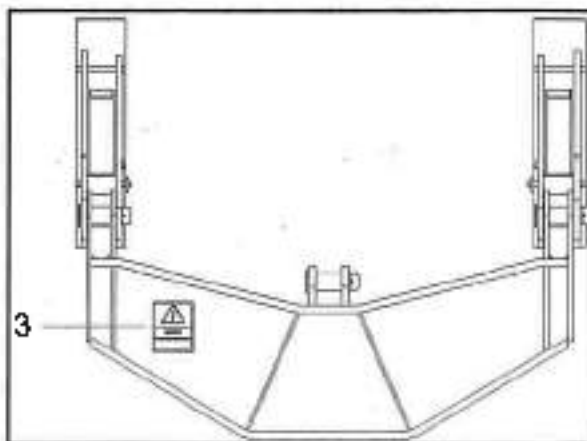
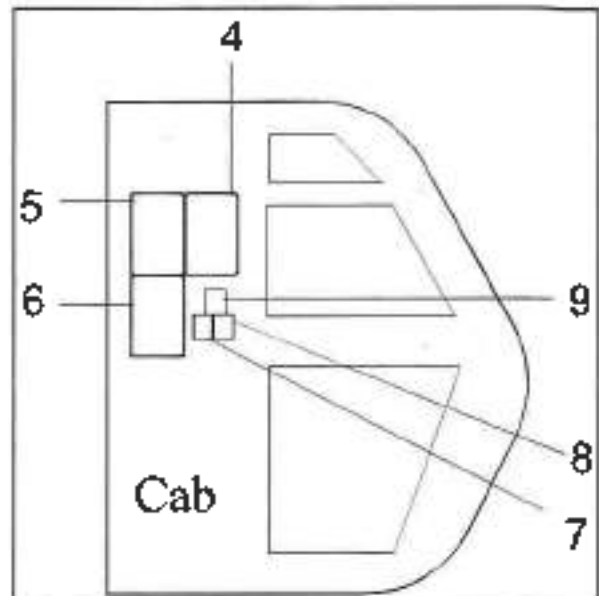


Fig.2-18 Jacking beam

4. Safety operating procedures of operator
5. Lifting performance table
6. Maintenance and repair of crane
7. Manual reading label
8. Conditions of off-working lower crane
9. Warning sign of safety protection device



5. Safety operating procedures of operator and maintenance and repair of crane

The matters that the operator shall pay attention to when operating the tower crane are indicated; the requirements for maintenance and repair of tower crane are put forward.







Fig. 2-19 Driver's operating procedures &amp; Crane repair and maintenance

6. Lifting performance table

The model, lifting performance, nominal moment, working radius and mechanism parameters of tower crane are described.



## SFT250C(T7520-16)塔式起重机 Tower crane

塔机型号 Crane Type	SFT250C(T7520-16)													制造许可证 License No.	T524431162104	
出厂编号 No.														出厂日期 Date		
幅度 Radius(m)	20	26	30	35	40	45	50	55	60	65	70	75	Max Capacity (t)(t)			
 双倍率 Two Fall	75	8.00	8.00	6.76	5.61	4.76	4.09	3.56	3.13	2.74	2.45	2.22	2.00	4.5-26.048.00		
	70	8.00	8.00	7.86	6.98	5.42	4.68	4.10	3.62	3.22	2.89	2.60		4.5-28.918.00		
	65	8.00	8.00	7.91	6.59	5.61	4.65	4.28	3.75	3.34	3.00			4.5-29.728.00		
	60	8.00	8.00	8.00	6.60	5.64	5.06	4.43	3.92	3.50				4.5-30.738.00		
	55	8.00	8.00	8.00	7.48	6.57	5.52	4.85	4.30					4.5-32.678.00		
	50	8.00	8.00	8.00	7.87	6.81	5.91	5.20						4.5-34.688.00		
	45	8.00	8.00	8.00	8.00	7.36	6.46							4.5-37.248.00		
	40	8.00	8.00	8.00	8.00	7.50								4.5-37.858.00		
	35	8.00	8.00	8.00	8.00									4.5-35.038.00		
	30	8.00	8.00	8.00										4.5-30.008.00		
 四倍率 Four Fall	75	10.25	7.71	6.26	5.11	4.25	3.58	3.06	2.63	2.28	1.98	1.72	1.50	3.5-31.75116.00		
	70	11.80	8.80	7.16	5.88	4.92	4.18	3.60	3.12	2.72	2.39	2.10		3.5-35.21116.00		
	65	11.80	8.10	7.41	6.09	5.11	4.35	3.74	3.25	2.84	2.50			3.5-35.81116.00		
	60	12.47	8.48	7.54	6.36	5.34	4.56	3.89	3.42	3.00				3.5-38.43116.00		
	55	13.51	10.30	8.30	6.96	5.87	5.02	4.35	3.80					3.5-37.27116.00		
	50	14.45	11.05	8.83	7.47	6.31	5.41	4.70						3.5-38.24116.00		
	45	15.58	11.85	9.57	7.90	6.66	5.68							3.5-39.44116.00		
	40	15.85	12.17	9.76	8.06	7.80								3.5-39.79116.00		
	35	14.88	11.33	9.86	7.80									3.5-38.98116.00		
	30	14.34	10.97	8.80										3.5-38.43116.00		

注意: 吊钩及其附属装置作为载荷的组成部分。Attachment,Slings and lifting attachments are parts of the load.

公称起重力矩 Rated lifting moment (kN.m)		2500											
工作幅度 Radius (m)		3.5-75											
独立工作高度 Free height of look (m)		固定式 Stationary(m)									80		
		附墙式 Anchorage(m)									300		
		行塔式 Mobile(m)											
功率速度 Power & Speed	机构 Mechanism	起升 Hoisting			变幅 Trolleying			回转 Slowing			行走 Travelling		
	功率 Power(kW)	55			7.5			2*7.5					
	速度 Speed (r/min)	0~100			0~13			0~0.7(r/min)					
平衡重 Counter-weight (t)	最大幅度 Max radius (m)	30	35	40	45	50	55	60	65	70	75		
	平衡重 Counter-weight (t)	12.00	13.70	15.40	17.75	17.70	20.00	21.10	21.70	23.40	25.10		
最大允许风速(6s时距平均附风速) Design wind speed at the top of the crane's (s) average instantaneous wind speed of 3 seconds interval)		安装状态 Erection/Climbing										12	
		工作状态 at service										20	
		非工作状态 out of service	高度 Height(m)	0~20									36
				29~100									42
≥109									48				

湖南三一塔式起重机械有限公司  
Hunan SANY Tower Crane Co.,Ltd.

Fig. 2-20 Lifting Performance

7. Manual reading label

You are prompted to read the manual and safety operation instructions before operation.

8. Conditions of off-working tower crane

The state of off-working tower crane is prompted.



Fig.2-21 Manual reading label

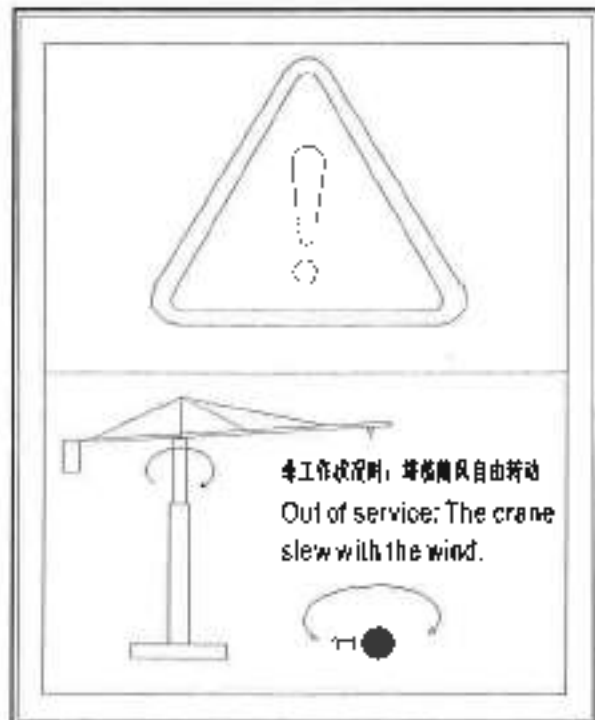


Fig.2-22 Conditions of off-working tower crane

### 9. Warning sign of safety protection device

It prompts you to turn on the safety protection devices when operating the tower crane.



Fig.2-23 Warning sign of safety protection device

### 10. Part code plate

The main structural components are managed by coding according to enterprise standard, including the year number, product model, component number and serial number information.

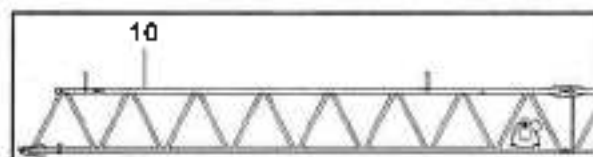


Fig.2-24 Crane arm section

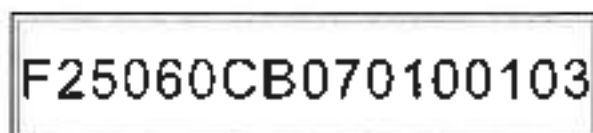


Fig.2-25 Schematic diagram of crane arm code plate

### 11. Caution label for electric shock

It is a warning sign reminding you not to touch the live part to prevent electric shock.



Fig.2-26 Caution Label for electric shock

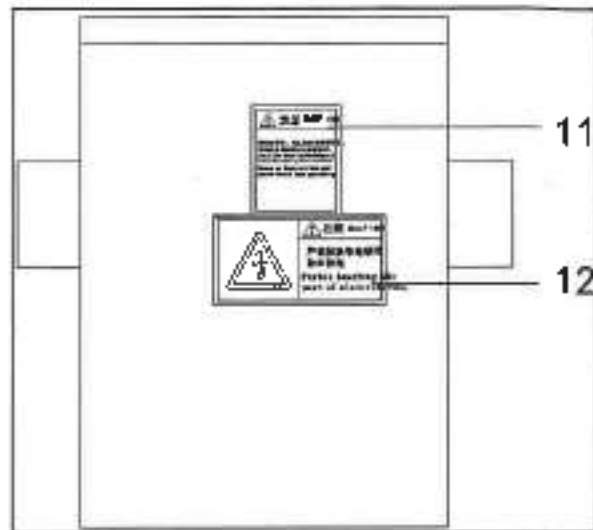


Fig.2-27 Braking resistor box

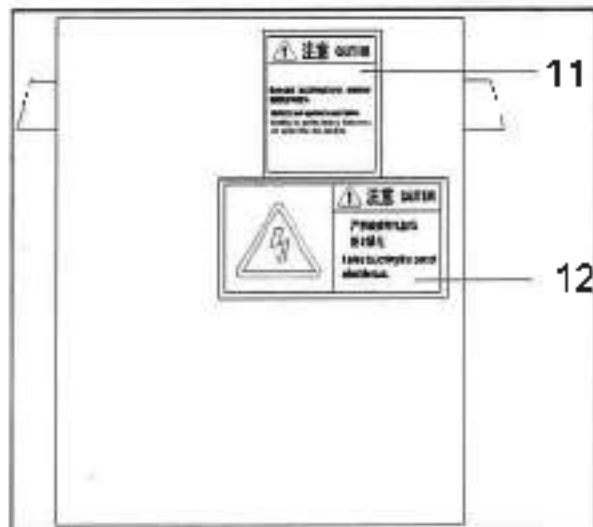


Fig.2-28 Power cabinet

12. Caution label for no touching

This prompts you not to touch the tower crane while it is running.



Fig.2-29 Caution label for no touching

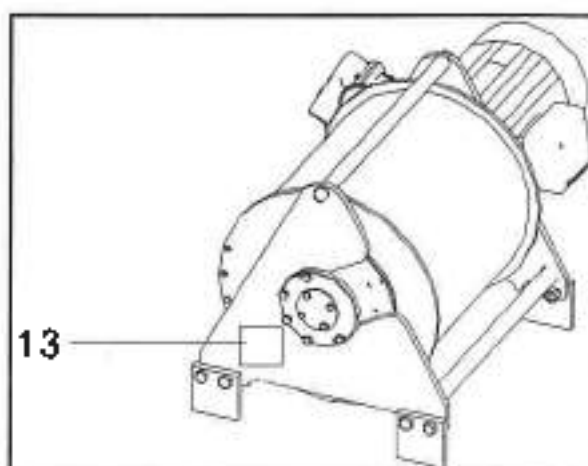


Fig.2-30 Luffing mechanism

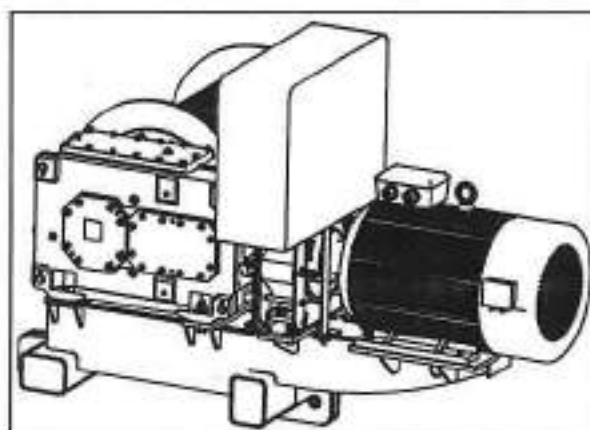


Fig.2-31 Hoisting mechanism

13. Hook point sign

The lifting point position of the crane arm assembly during lifting (for reference, please adjust it according to the actual balance condition during the test lifting)

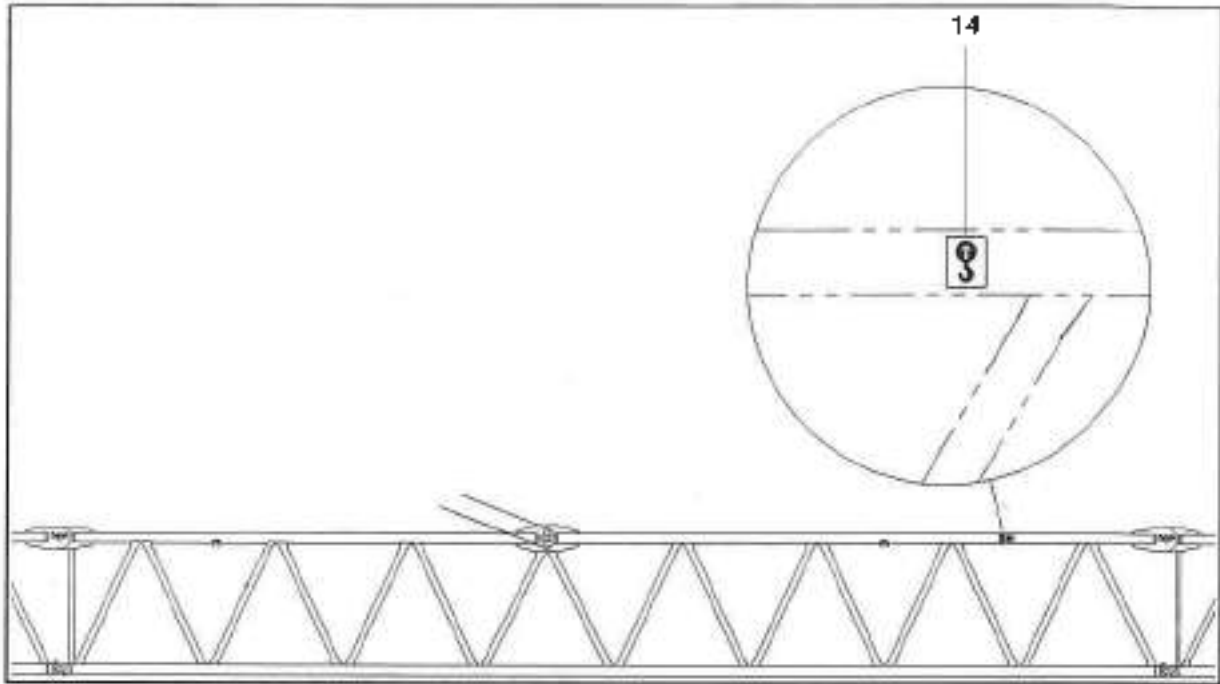


Fig. 2-32 Hook point sign



# SANY

## Technical description

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<b>3.6 Hydraulic system</b> .....	<b>3-11</b>
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A large area of the page is filled with horizontal dashed lines, providing a template for technical drawing or notes.

### 3. Technical description

#### 3.1 General schematic diagram

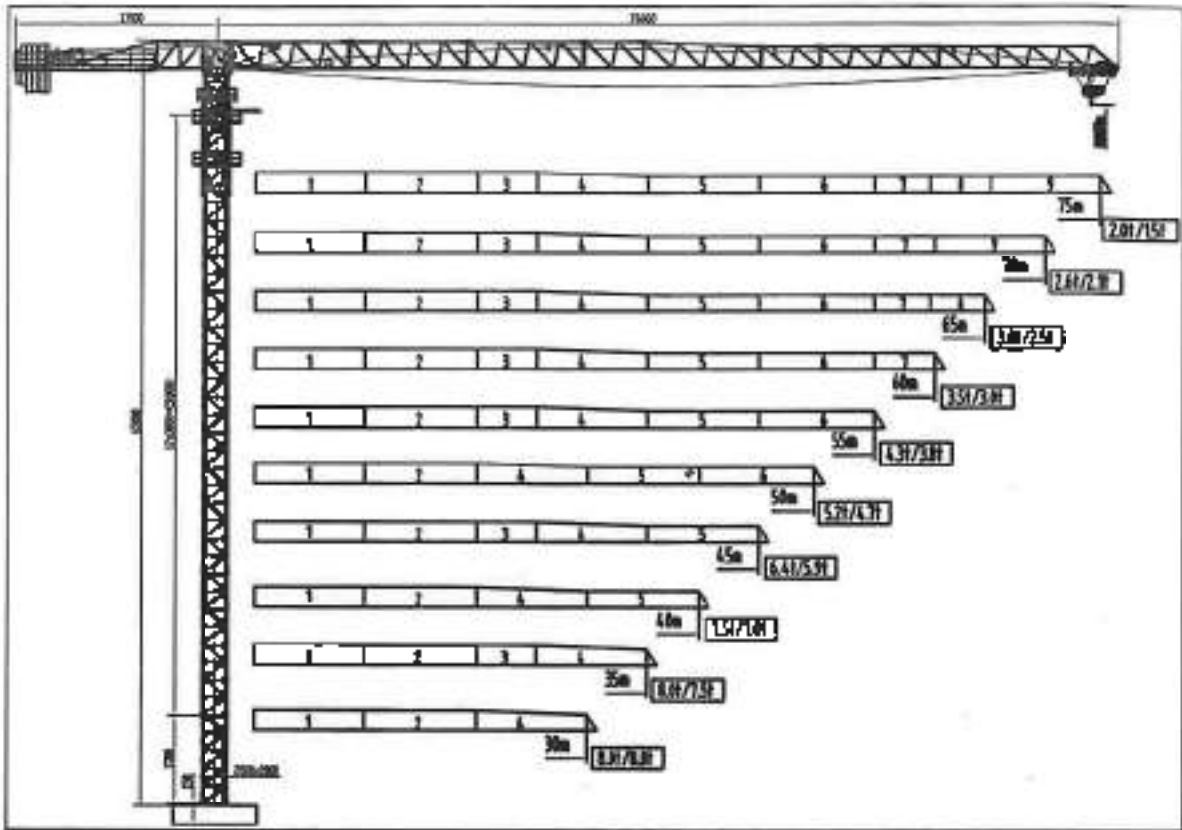


Fig 3-1 Overall dimension, arm length combination and boom tip lifting weight

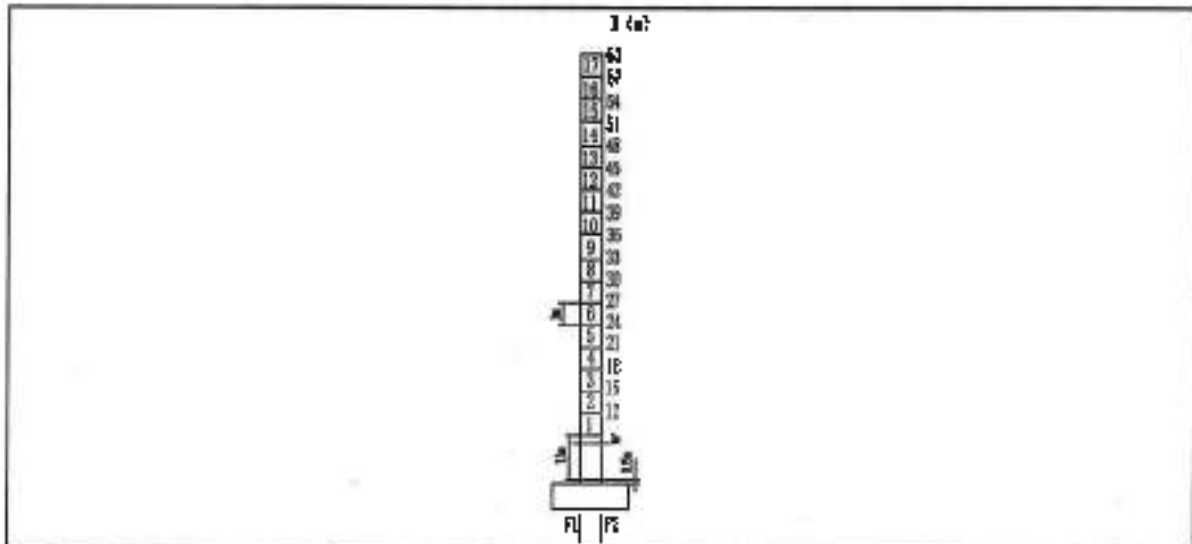


Fig.3-2 Bolted type

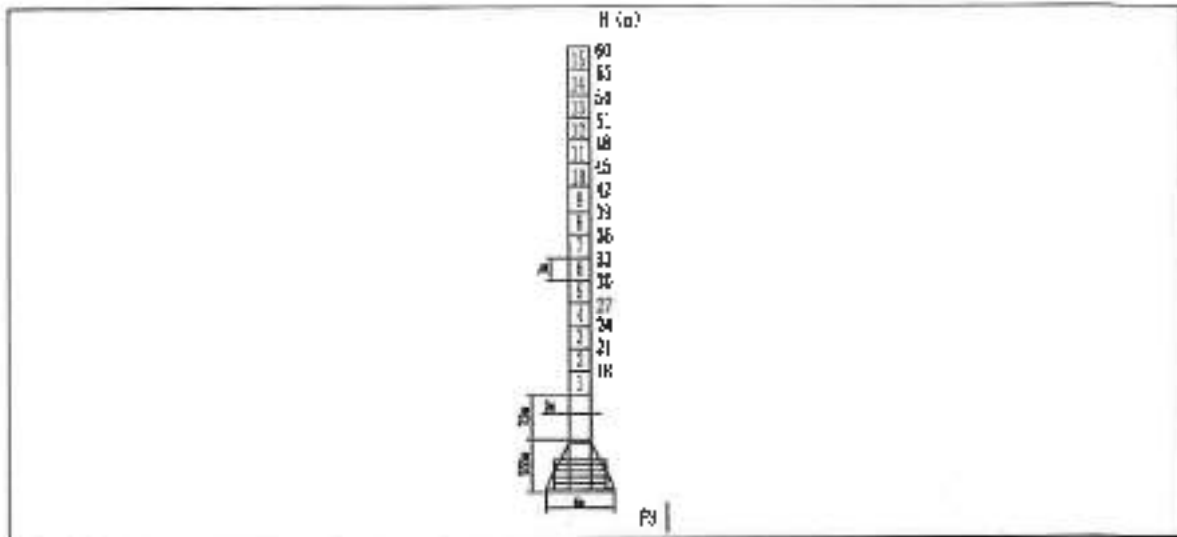


Fig.3-3 Underframe fixed type

Tab.3-1 Reaction force (bolted)

Bolted type	F1	Working state reaction force	175.1t
		Non-working state reaction force	217.2t
	F2	Working state reaction force	118.6t
		Non-working state reaction force	169.5t
Independent height and dead weight of the longest crane boom (excluding counterweight, lifting weight and ballast)			70.5t

Tab.3-2 Reaction force (underframe fixed type/walking type)

Underframe fixed type/walking type	F3	Working state reaction force	118.8t
		Non-working state reaction force	129.7t
	Independent height and dead weight of the longest crane boom (excluding counterweight, lifting weight and ballast)		

**Caution**

When installing the attachment frame, when the attachment height reaches the required height, the attachment frame must be installed, and the attachment times shall not be less than that required by the design.

**Caution**

When the independent tower machine with a height of 60 m encounters a strong wind above level XI, the climbing frame shall be lowered to the minimum position or by two standard sections of the tower.

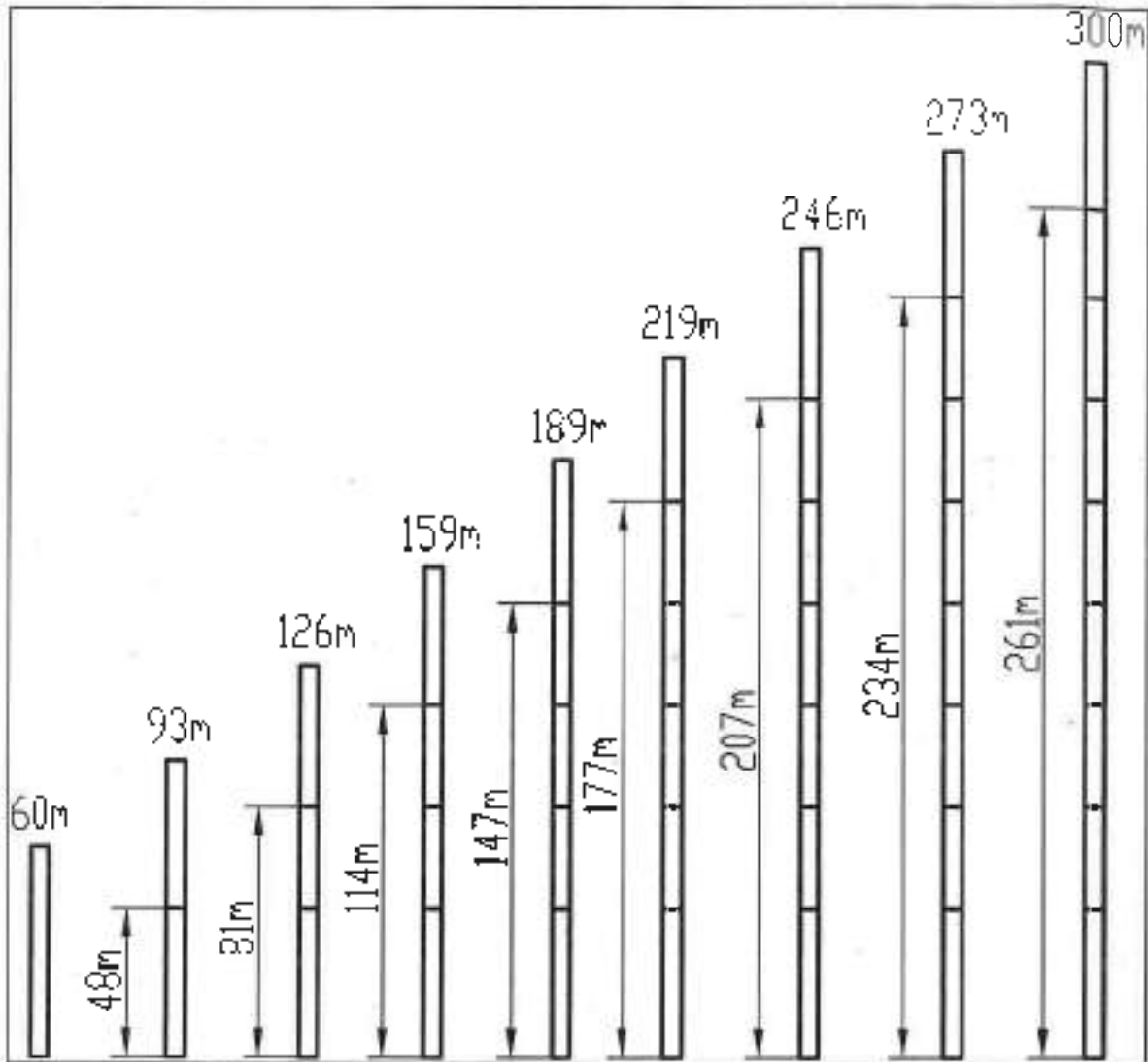


Fig.3-4 Schematic diagram of attachment size

### 3.2 Overall performance parameters

Tab.3-3 Main performance parameters table

Category	Name	Parameter
Basic performance	Working level	A4
	Nominal lifting moment (kN.m)	2,500
	Independent hoisting height (m)	60
	Max. attachment height (m)	300
	Maximum rated lifting capacity (t)	16
	Working radius (m)	3.5-75
	Rated lifting capacity at the maximum radius of crane boom(t)	2.0

Tab.3-3 Main performance parameters table (Continued)

	Maximum rated lifting capacity of full arm length (t)	2.5~3.75
Mechanism characteristics	Hoisting velocity (m/min)	0-110
	Hoisting mechanism power (kW)	5.5
	Luffing velocity of bogie (m/min)	0-7.5
	Luffing mechanism power (kW)	7.5
	Swinging speed (r/min)	0-0.7
	Swinging mechanism power (kW)	2~7.5
	Jacking velocity (m/min)	0.5
	Jacking motor power (kW)	11
	Total installed capacity excluding jacking motor (kW)	77.5
Working environment ①	Power supply voltage (V)	380±10%
	Frequency of power supply (Hz)	50
	Operating ambient temperature (°C)	-20~+40
	Suitable working area (m)	≤1.000
	Working state wind velocity (m/s)	≤20
	Installing or climbing state wind velocity (m/s)	≤12
	Non-working state wind velocity (m/s) (0-20 m)	≤36
	Non-working state wind velocity (m/s) (20-100 m)	≤42
	Non-working state wind velocity (m/s) (≥100 m)	≤46

Note ①: The wind velocity here refers to the "average instantaneous wind velocity VS in 3s interval" in table F.1 of GB/T3811-2008.

### 3.3 Mechanism performance parameters

Tab.3-4 Mechanism performance parameters

Category	Name		Parameter	
Hoisting mechanism	Maximum traction of a single rope (N)		40,000	
	Hoisting velocity (m/min)		0-110	
	Capacity of spiral type cartridge (t)		600	
	Braking torque (N·m)		1,250	
	Wire rope	Specification		18-1960-CJ-229-sZ-non-rotation GB8918
		Maximum linear velocity (m/min)		200
	Motor	Power (KW)		5.5
		Rated torque (N·m)		552
	Note: If the working capacity is more than 600t, please contact the manufacturer.			

Tab.3-4 Mechanism performance parameters (continued)

Luffing mechanism	Maximum traction (N)		7,000
	Wire rope	Specification	10-1770-L-58 4-SZ-rotation GB8918
		Maximum linear velocity (m/min)	75
		Length with 60 m arm (m)	L1-80, L2-120
	Motor	Power (KW)	7.5
		Rotation speed (r/min)	1,450
Braking torque (N·m)		75	
Slewing mechanism	Motor	Power (KW)	7.5
		Rotation speed (r/min)	1,440
	Reducer output torque (N·m)		15,000
	Braking torque (N·m)		80
	Output end gear parameters	Modulus m	12
		Number of gears z	15
		Displacement coefficient x	0.5
	Maximum slewing speed of base crane		0.7
	Slewing bearing	Modulus m	12
		Number of gears z	148
Displacement coefficient x		0.5	
Jacking mechanism	Electric motor power (kW)		11
	Rotation speed of electric motor (r/min)		1,440
	Working pressure (MPa)		31.5
	Jacking velocity (m/min)		0.55

### 3.4 Lifting performance characteristic curve

#### 60 m arm performance curve

Tab.3-5 75 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
75 m	Double parts of line	26.04	8.00				6.76	5.61	4.75
	Quadruple parts of line	13.75	16.00	14.55	10.23	7.71	6.26	5.11	4.25

Radius		Max. lifting weight	45	50	55	60	65	70
75 m	Double parts of line	26.04	4.09	3.56	3.13	2.78	2.48	2.22
	Quadruple parts of line	13.75	3.59	3.06	2.63	2.28	1.98	1.72

Radius		Max. lifting weight	75
75 m	Double parts of line	26.64	2.00
	Quadruple parts of line	13.75	1.50

Fig.3-5 75 m arm performance curve

**70 m arm performance curve**

Tab.3-6 70 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
70 m	Double parts of line	28.91	8.00				7.66	6.38	5.42
	Quadruple parts of line	15.21	16.00	11.60	8.80	7.16	5.88	4.92	

Radius		Max. lifting weight	45	50	55	60	65	70
70 m	Double parts of line	28.91	4.68	4.10	3.62	3.22	2.89	2.60
	Quadruple parts of line	15.21	4.18	3.60	2.12	2.72	2.39	2.10

Fig.3-6 70 m arm performance curve

**65 m arm performance table**

Tab.3-7 65 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
65 m	Double parts of line	29.72	8.00				7.91	6.59	5.61
	Quadruple parts of line	15.61	16.00	11.98	9.10	7.41	6.09	5.11	

Radius		Max. lifting weight	45	50	55	60	65
65 m	Double parts of line	29.72	4.85	4.24	3.75	3.34	3.00
	Quadruple parts of line	15.61	4.35	3.74	3.25	2.84	2.50

Fig.3-7 65 m arm performance curve



60 m arm performance table

Tab.3-8 60 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
60 m	Double parts of line	30.73	8.00					6.86	5.84
	Quadruple parts of line	16.13	16.00	12.35	9.39	7.45	6.08	5.06	

Radius		Max. lifting weight	45	50	55	60
60 m	Double parts of line	30.73	5.06	4.43	3.92	3.50
	Quadruple parts of line	16.13	4.28	3.95	3.42	3.00

Fig.3-8 60 m arm performance curve

55 m arm performance curve

Tab.3-9 55 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
55 m	Double parts of line	32.97	8.00					7.46	6.37
	Quadruple parts of line	17.27	16.00	13.51	10.30	8.20	6.96	5.87	

Radius		Max. lifting weight	45	50	55
55 m	Double parts of line	32.97	5.52	4.85	4.30
	Quadruple parts of line	17.27	5.02	4.35	3.80

Fig.3-9 55 m arm performance curve

50 m arm performance curve

Tab.3-10 50 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
50 m	Double parts of line	34.88	8.00					7.97	6.81
	Quadruple parts of line	18.24	16.00	14.15	11.05	8.83	7.47	6.31	

Radius		Max. lifting weight	45	50
50 m	Double parts of line	34.88	5.91	5.20
	Quadruple parts of line	18.24	5.41	4.70

Fig.3-10 50 m arm performance curve

**45 m arm performance curve**

Tab.3-11 45 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
45 m	Double parts of line	37.24	8.00						7.36
	Quadruple parts of line	19.44	16.00	15.58	11.95	9.57	7.90	6.86	

Radius		Max. lifting weight	45
45 m	Double parts of line	37.24	6.40
	Quadruple parts of line	19.44	5.90

Fig.3-11 45 m arm performance curve

**40 m arm performance curve**

Tab.3-12 40 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35	40
40 m	Double parts of line	37.85	8.00						7.50
	Quadruple parts of line	19.75	16.00	15.85	12.17	9.76	8.06	7.00	

Fig.3-12 40 m arm performance curve

**35 m arm performance curve**

Tab.3-13 35 m arm performance table

Radius		Max. lifting weight	10	15	20	25	30	35
35 m	Double parts of line	36.31	8.00					
	Quadruple parts of line	18.96	16.00	14.80	11.33	9.06	7.50	

Fig.3-13 35 m arm performance curve

30 m arm performance curve

Tab.3-14 30 m arm performance table

Radius		Max. lifting weight:	10	15	20	25	30
30 m	Double parts of line	35.27	8.00				
	Quadruple parts of line	18.43	16.00	14.34	10.97	8.80	

Fig.3-14 30 m arm performance curve

**Caution**

The lifting capacity in the performance curve is calculated based on an independent height of 60 m. When the hoisting height is greater than 60 m, the lifting weight must be reduced due to the increase of the length of the lifting wire rope. The calculation formula is: the lifting weight of the calculated height = the lifting weight in the performance table + the weight of the wire rope per meter × (calculated height - 60) × parts of line. (height unit: m, weight unit: t) the weight per meter of 18-1960U-229-5Z-non-rotation GB8918 wire rope is about 1.49 kg.

3.5 Foundation load

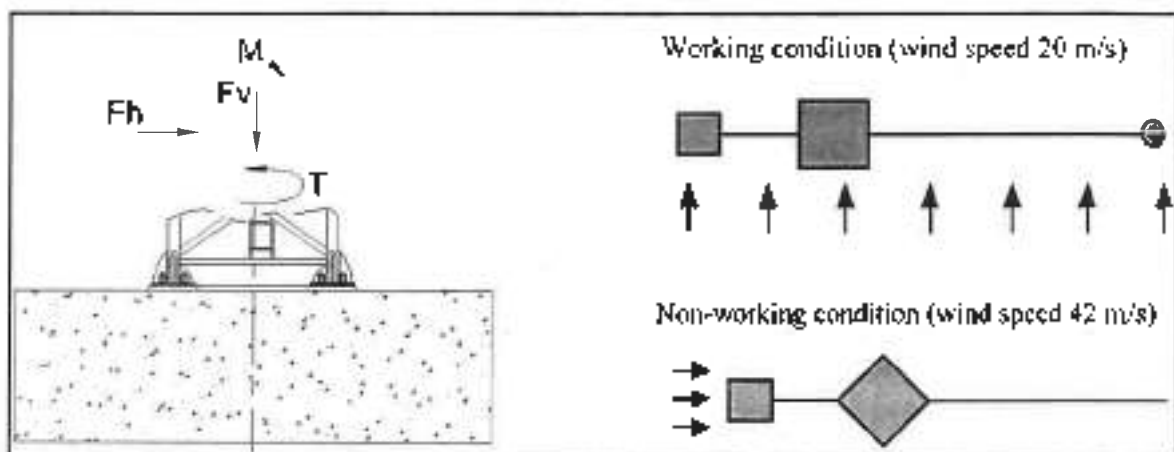


Fig 3-15

Tab.3-15 Foundation load data of 75 m boom

Boom length (m)	State	$F_v(t)$	$F_h(t)$	$M(t \cdot m)$	$T(t \cdot m)$
75 m	Working condition	113.05	4.34	371.23	65.66
	Non-working condition	95.44	16.00	489.76	0.0

3.6 Hydraulic system

1. The hydraulic system is a hydraulic lifting device that increases the standard section of the tower when the tower crane is raised and removes the standard section when it is lowered. It is composed of hydraulic pumping unit, hydraulic cylinder, valve and oil pipes.
2. During jacking, with the help of the support of the climbing frame, the pumping unit works, the hydraulic cylinder extends, and the upper structure of the tower crane will be jacked up to introduce or remove the standard section and realize the lifting or lowering of the tower crane. The assembly and disassembly of a standard section is completed through the two cycles of extending and retracting the piston rod of the hydraulic cylinder.

3. It can be seen from the hydraulic schematics that when the pump station works, the high-pressure oil enters the manual three-position four-way valve, and then enters the upper chamber of the oil cylinder through the balance valve to realize the expansion and contraction of the hydraulic cylinder. The function of the balance valve is to prevent the leakage of high-pressure oil due to failure during jacking to ensure that the hydraulic cylinder pressure will not drop sharply and cause safety accidents.

#### 4. Hydraulic system installation

Unscrew the air filter and add the hydraulic oil after being filtered through the oil filter (the filtering accuracy is  $\mu$ ) to the upper limit of the liquid level thermometer on the oil tank.

##### 1) Connection of system pipelines:

Connect the pipeline according to the hydraulic schematics, and the connector shall be tightened. Start the oil pump motor and pay attention to whether the motor can drive the oil pump to work normally. In case of wrong connection, check and adjust it to operate correctly.

##### 2) System venting:

1. Venting of the hydraulic station: Loosen the handle of the overflow valve, then loosen the high-pressure rubber hose joint connected with the oil supply port of the valve body on the tank, move the handle of the manual reversal valve to make it in the rising position, start the motor, and the air will overflow from the loosened high-pressure rubber hose joint until the sound of the oil pump is normal, and the oil is free of bubbles.

2. Cylinder venting: The cylinder must be vented before use, and the cylinder venting shall be carried out during idling.

##### 5. Use of hydraulic system

Before operation, it shall ensure that the connection between the hydraulic cylinder and the climbing frame is correct and firm before jacking operation.

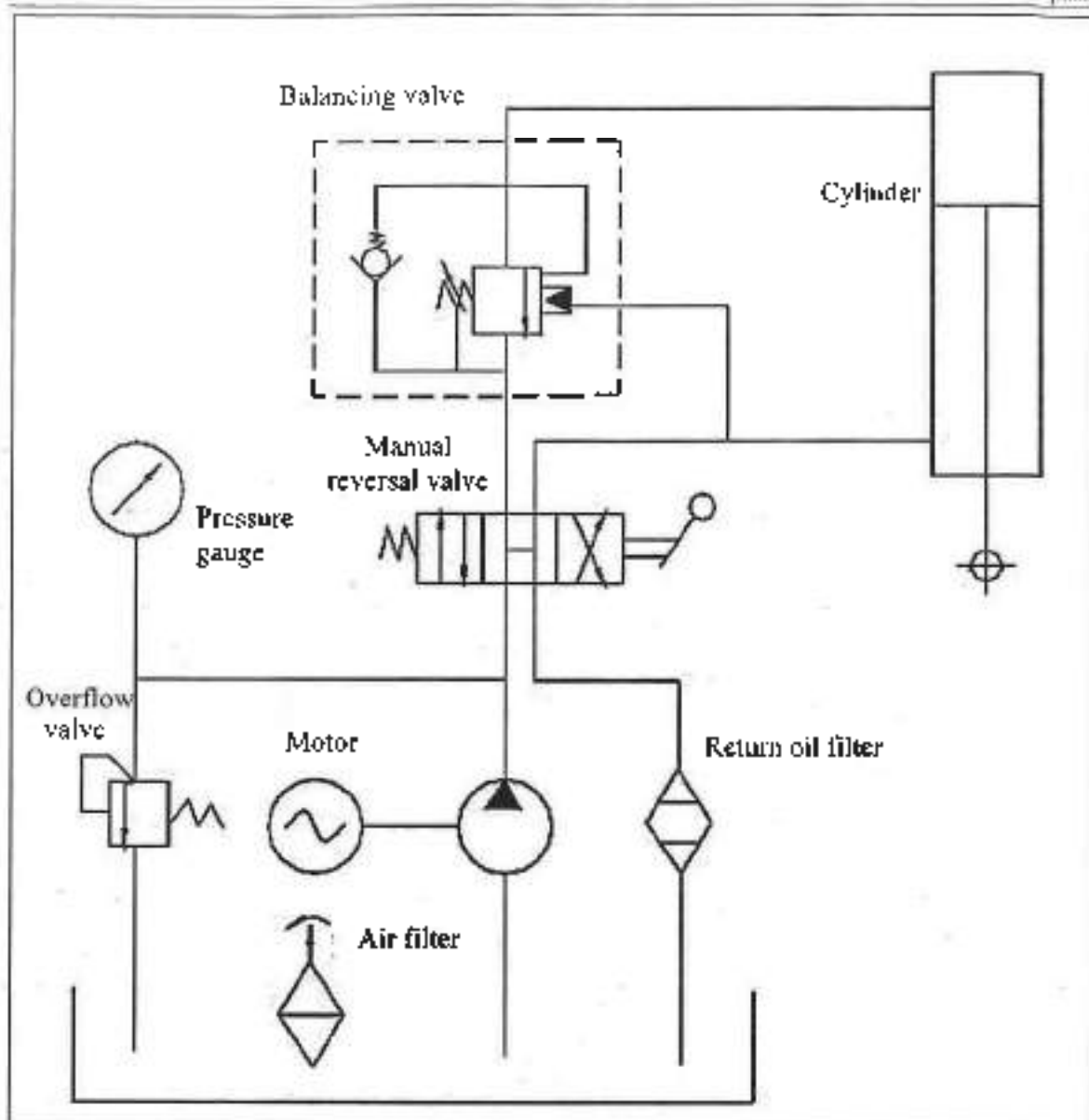


Fig.3-16 Hydraulic schematics

### *Caution*

Before the user uses the hydraulic system for jacking, the hydraulic system shall be pre-jacked, and the load test shall be required to ensure the correct and reliable connection.

#### 6. Maintenance of hydraulic system

- 1) The hydraulic oil must be cleaned (it can be filtered by portable filter for 4-6 hours), and the hydraulic oil can be started up for use only after the cleanliness index reaches grade 7-8 (NAS1638).
- 2) After the hydraulic system starts working for hours, the oil shall be completely replaced. After working for hours, some clean oil shall be added.

- 3) When the hydraulic system does not work, it must be closed in time to prevent excessive temperature rise.

**Prompt:**

Due to the low frequency of use of the hydraulic system, users shall check and maintain the system before each jacking operation to ensure that the system can be used safely.

### 3.7 Electrical control system

1. The installed capacity of the tower crane is 77.5 kW (excluding the jacking system). The incoming power supply is required to be TN-S system (five wire system), the zero line and protective ground wire are separated, and the grounding resistance is less than  $4 \Omega$ . It is recommended to use 120 kVA power supply, and the voltage at the distribution box at the bottom of the tower is required to be no less than 380 V.

The tower crane is manufactured in strict accordance with national standards, and the three major mechanism adopt frequency conversion drive. The intelligent control technology is adopted for control to improve the safety of tower crane operation. For the convenience of disassembly and assembly, many connectors are also used.

#### *Caution*

The distribution box at the bottom of the tower shall be equipped with leakage protector. It is recommended to use the high-frequency leakage current protection circuit breaker dedicated to the frequency converter. If the leakage current protector not dedicated to the frequency converter is used, the leakage circuit breaker with rated residual operating current  $\geq 300 \text{ mA}$  and operating time of 0.4-1 s shall be selected.

#### 2. Component description

The control components of the tower crane mainly include the cab distribution block, linkage work bench, power cabinet and external safety protection device.

The distribution block at the bottom of the tower shall be prepared by the user and can be fixed on the tower crane foundation section or the first standard section. The incoming line of external power supply is connected to the distribution block, and the line on the tower is also led out from the distribution block.

#### *Caution*

The rated current of the distribution switch needs to be greater than 250 A.

The cab distribution block and linkage work bench are located in the tower crane cab.

See the following figure for the main elements in the cab distribution box. Voltmeter 1 is used to display the voltage value of the incoming power supply, and selection switch 2 is used to select the voltage between which two phases measured by the voltmeter.

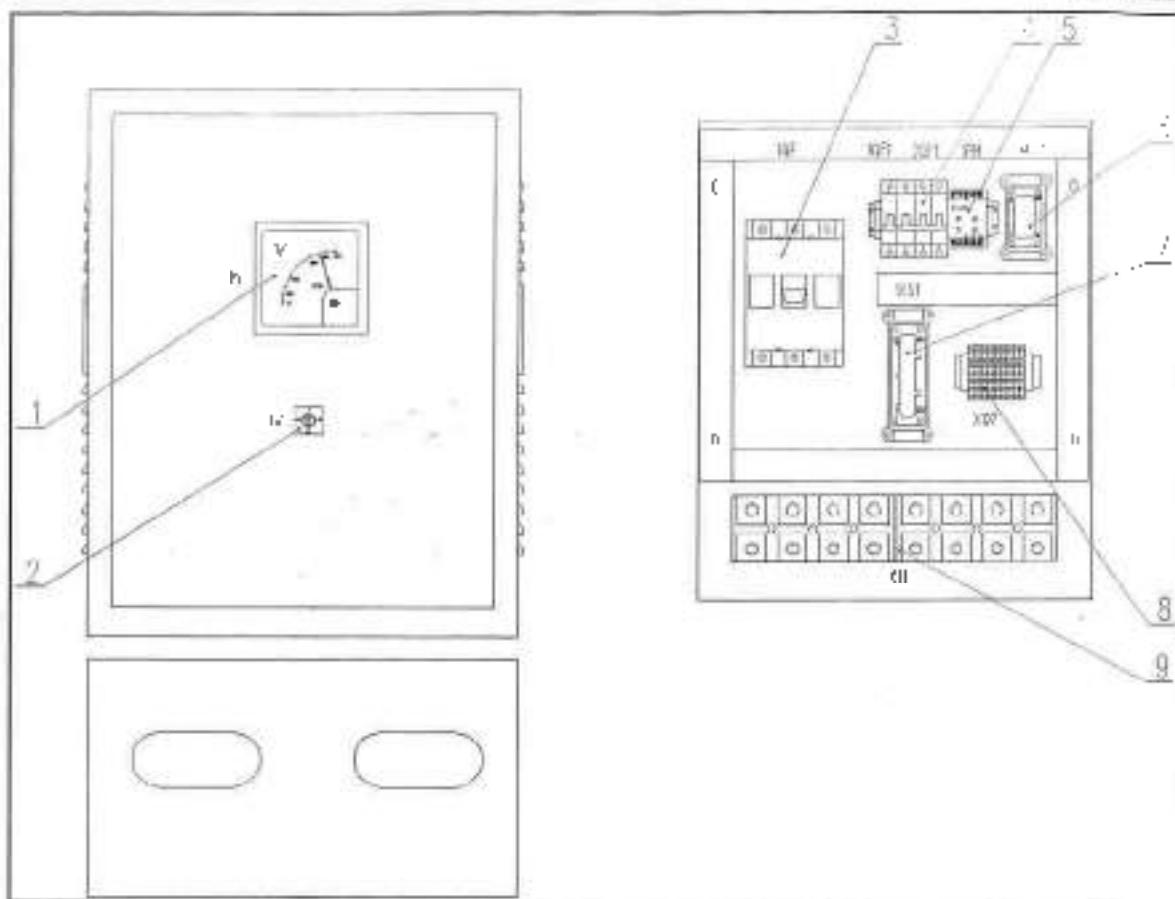


Fig.3-17 Control cabinet

Tab.3-16

1. Voltmeter	2. Selector switch	3. General circuit breaker	4. Control circuit breaker
5. Phase sequence	6. To work bench socket	7. To power cabinet socket	8. Incoming and outgoing terminal strip 2
9. Incoming and outgoing terminal block 1			

The linkage work bench is the operation and control mechanism of the tower crane, which is separated into two parts: the left linkage work bench and the right linkage work bench. There are control handles and various control command elements on the linkage platform, and there is a liquid crystal display (LCD) on the LH front of the linkage platform, which is used to realize good man-machine communication.

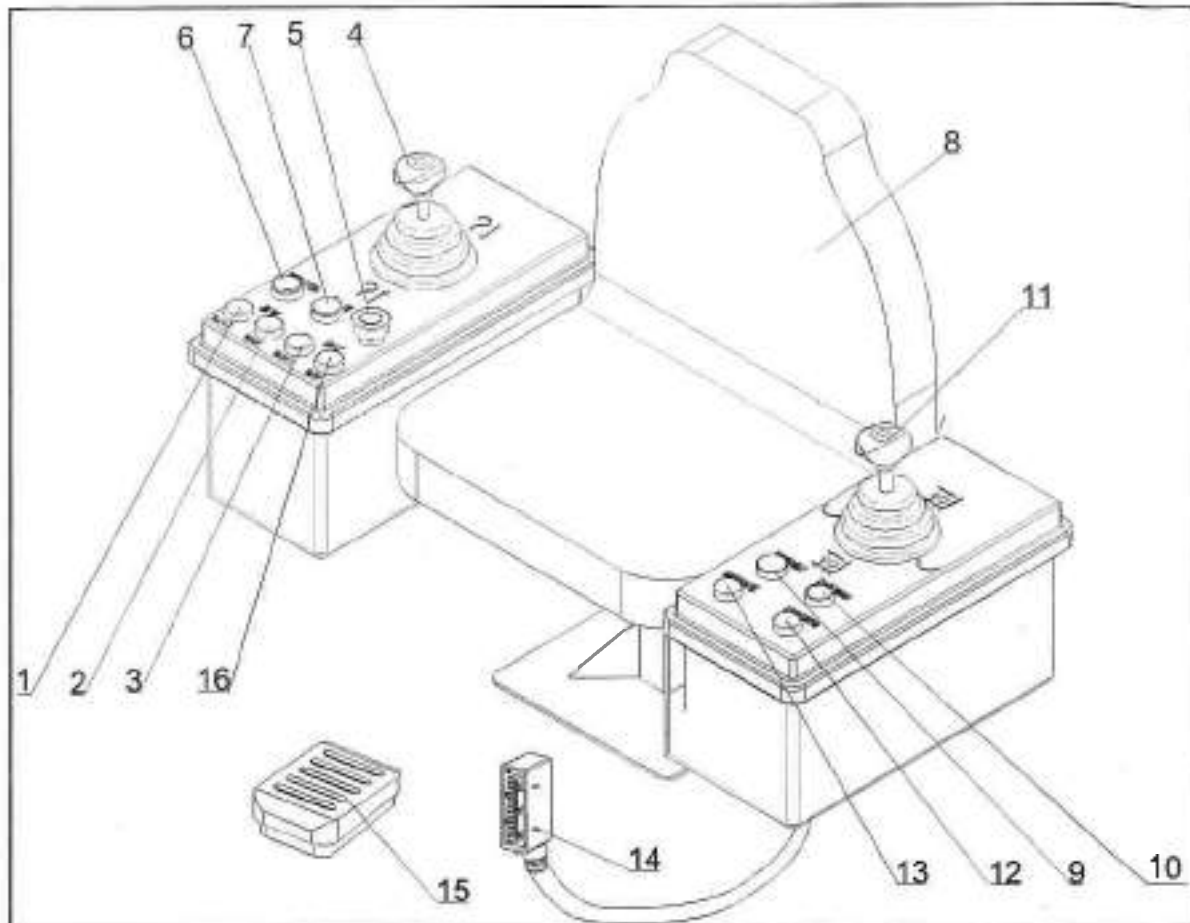


Fig.3-18 Linkage work bench

Tab.3-17

1. 110% weight alarm indicator	2. 90% weight alarm indicator	3. Torque 110% alarm indicator	4. Right control handle
5. Emergency stop	6. Power supply (bypass) rocker switch	7. Backup switch	8. Seat
9. Wind vane control button with lamp	10. Fault reset button	11. Left operating handle	12. Power up indicator
13. System fault indicator	14. Linkage console harness plug	15. Pedal electric siren switch	16. Torque 80% alarm indicator

The power cabinet is located on the slewing platform opposite the cab, and its internal main elements are shown in the figure below.



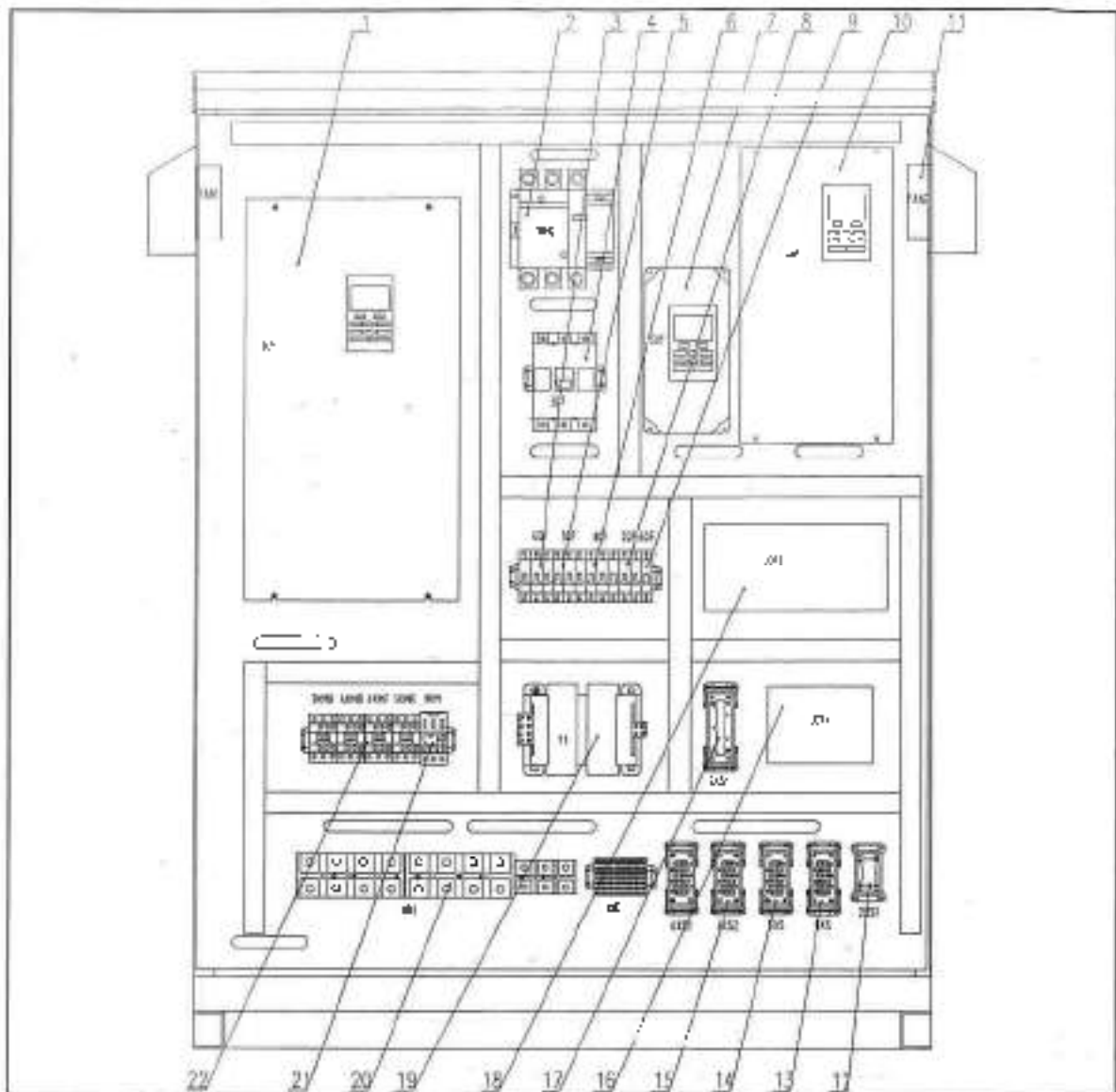


Fig 3-19 Layout of power cabinet

Tab 3-18 Layout of power cabinet

1. Hoisting converter	2. Main power supply contactor	3. Slewing power supply circuit breaker	8. Control power supply circuit breaker 1
5. Luffing power supply circuit breaker	6. Jacking power supply circuit breaker	7. Luffing converter	12. To slewing mechanism socket
9. Control power supply circuit breaker 2	10. Slewing converter	11. Ventilation fan	16. Integrated control and communication module
13. To jacking socket	14. To luffing motor socket	15. To slewing motor socket	20. Incoming and outgoing terminal strip
17. To distribution block socket	18. Integrated control module	19. Voltage converter	
21. Jacking contactor	22. Brake and fan contactor	4. Hoisting power supply circuit breaker	

### 3. Application of intelligent technology

In order to make the operation of the tower crane simpler and more effective, the tower crane adopts as many intelligent devices and technologies as possible, which provides more protection and convenience for the use and operation of the tower crane.

#### 1) Introduction of intelligent equipment

The tower crane mainly adopts the following intelligent equipment independently developed by SANY: SS-SCG-01 display screen: It controls the intelligent operation of the whole tower crane, with color display and GPS remote control, interaction and storage functions.

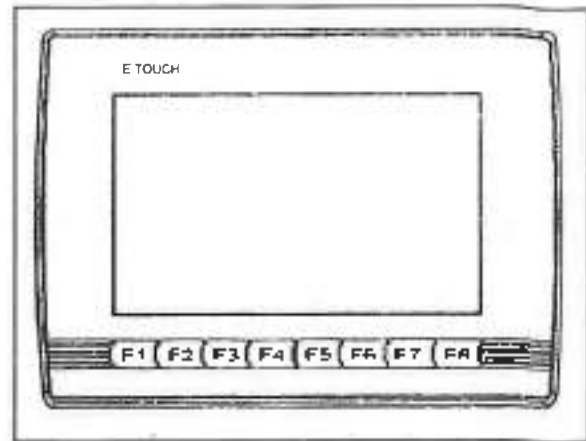


Fig.3-20

#### 2) Basic security protection intelligence

- ① Limit position restraint and speed limit of the three major mechanisms.
- ② Double torque limit: The common torque limit is combined with the torque calculated through the lifting weight and radius to give an alarm and limit the action of the mechanisms.
- ③ Double restraint and real-time display of weight: In addition to the ordinary weight limit function, the lifting weight is measured and displayed in real time through the weight sensor.
- ④ Wind velocity alarm and inclination alarm (inclination alarm is optional): The wind velocity and inclination sensor will display the wind velocity and inclination through wind velocity sensor and inclination sensor. When the limit value is exceeded, the alarm will be given and the mechanism will be controlled not to move in the dangerous direction.
- ⑤ Real time display of operating gear, height and radius of the three mechanisms.

#### 3) Advanced intelligence

- ① Fault diagnosis: When the tower crane fails, the controller analyzes the possible causes of the fault and suggests solutions on the display screen.
- ② Black box of tower crane: It can record and store the safe working conditions of tower crane in real time, and record the illegal operation of tower crane to provide basis for managers to effectively manage the equipment.

# SANY

## Installation

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## 4. Installation

### 4.1 Preparation before installation

#### 4.1.1 Work site preparation

##### Check tower crane installation area

- 1 There shall be enough space at the installation site of the tower crane to ensure that the tower crane can rotate freely without interference with surrounding objects.

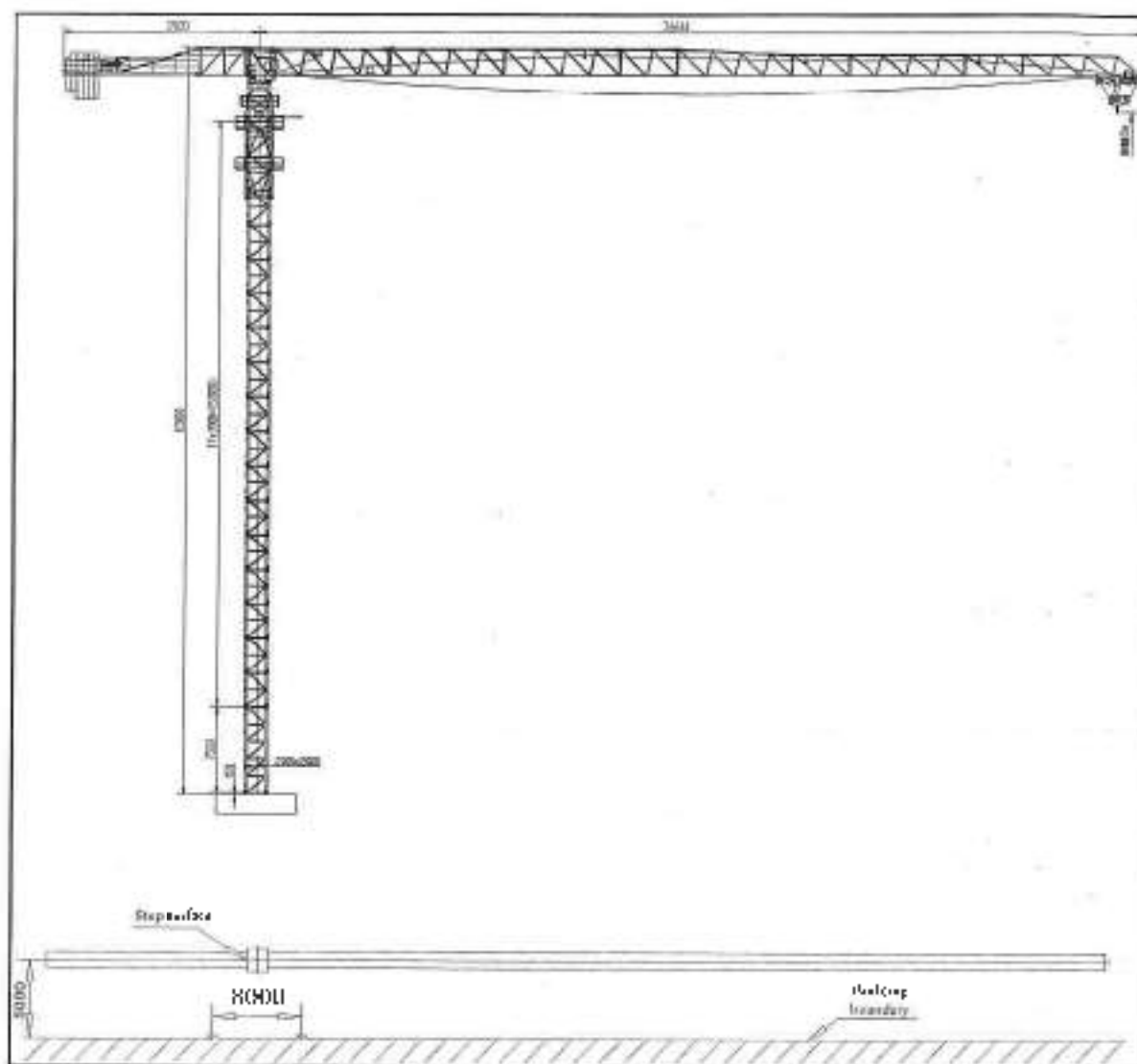


Fig 4-1

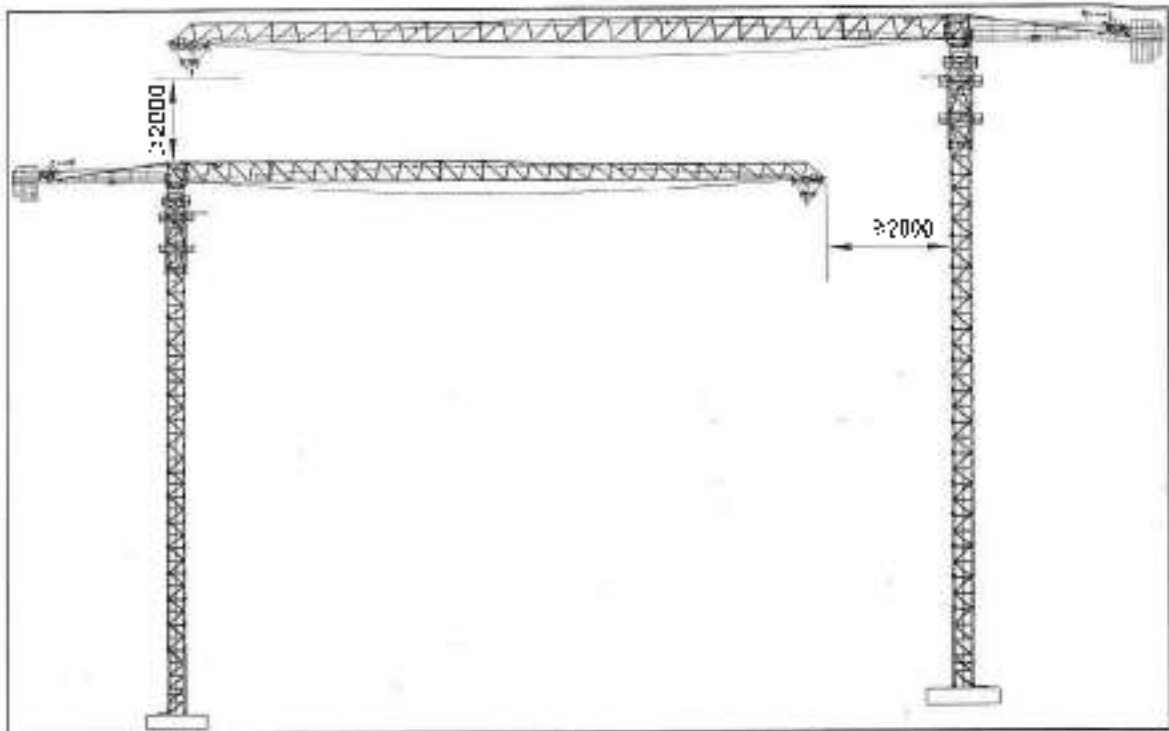


Fig.4-2

When two or more tower cranes are working in the same site, the minimum erection distance between the two tower cranes shall ensure that there is at least 2.0 m distance between the boom end of the low-level tower crane and the tower of the other, and the vertical distance between the lowest part of the high-level tower crane (the hook rises to the highest position or the lowest position of the counterweight) and the highest part of the low-level tower crane shall not be less than 2.0 m.

#### Preparation of power supply

1. For the requirements of power supply, please refer to the nameplate of tower crane and the relevant contents of Chapter III "Technical Description" in this manual.

#### Lightning protection

Lightning protection or grounding measures must be considered before tower crane operation. There are three grounding methods as follows:

1. Regular ground post and  $\phi 33 \times 4.5$  at 1.5 m long steel pipe, or  $L70 \times 70$  at 1.5 m long angle steel shall be used (see the figure below)

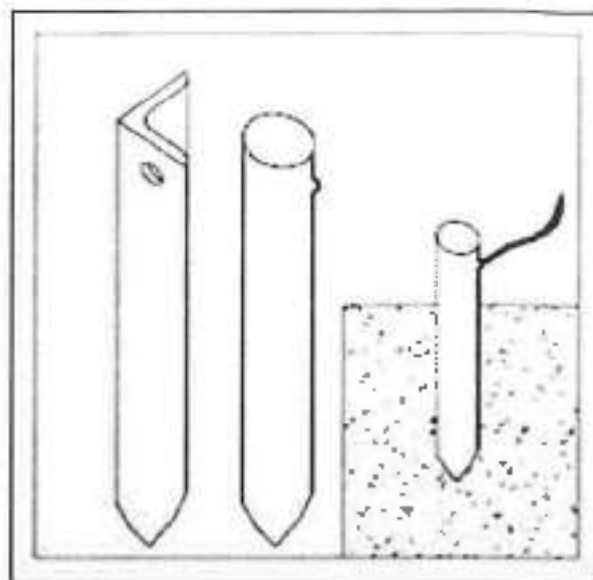


Fig. 4-3

2. The grounding plate is made of steel plate or other extendable sheet metal, with an area of  $1 \text{ m}^2$  and it is vertically buried at a depth of 1.5 m underground (see the figure below).

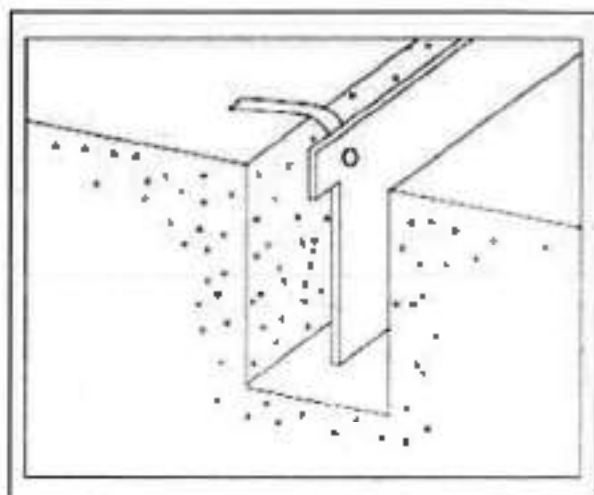


Fig. 4-4

3. Copper conductor with section  $\geq 28 \text{ mm}^2$  or iron conductor with section  $\geq 50 \text{ mm}^2$  shall be buried in the trunking 1.5 m deep from the ground surface, and its buried length shall be determined by the grounding resistance (see the figure below).

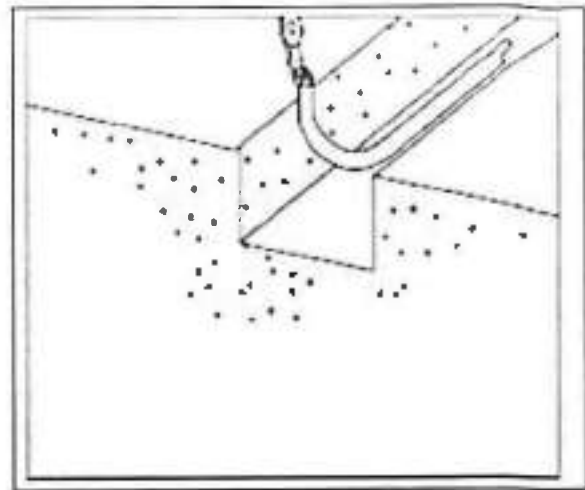


Fig 4-5

1. The copper cable with a section of no less than 25 mm or anti-rust metal strip with a section of no less than 100 mm shall be used for the connection between the grounding body and the foundation section or base of the tower crane. The metal strip can be directly welded. The cable can be connected to the tower crane by welding screws on the tower and pressing the cable lug. 2. The final grounding resistance is related to the contact area between the ground body and the soil and the conductivity of the soil. If the grounding resistance cannot meet the requirements of less than 4  $\Omega$ , the number of grounding bodies can be increased, or the soil conductivity can be increased by adding salt to the soil.

#### 4.1.2 Preparation of installation personnel

1. The construction unit shall obtain the qualification license of installation.
2. The installation personnel shall be familiar with the relevant chapters of the operation manual provided by the manufacturer; be familiar with all knowledge of personnel protective equipment and be able to use protective equipment correctly.
3. The installation personnel shall confirm that all parts shall belong to the installed tower crane and shall be in good condition without any defects.
4. The installation personnel shall confirm the lifting points of all components.
5. The installation supervisor shall have rich experience and various skills to manage and supervise the installation team.
6. Before installation, confirm that the weather conditions will not affect the stability of tower crane and its components; if the weather conditions may bring danger to the installation personnel, it is prohibited to carry out the installation work.
7. Pay attention to the following matters when erecting the tower:
  - 1) The wind velocity at the cat head shall not be greater than 12 m/s.
  - 2) Well know the tower erecting procedures.
  - 3) All connectors are specially made and cannot be replaced at will.
  - 4) The safety protection device must be installed.
  - 5) Installation sequence and weight of the counterweight.



6) It is strictly prohibited to lift when it is not installed properly.

#### 4.1.3 Ground foundation

1. A solid foundation that meets the requirements is a prerequisite for the safe use of fixed tower crane. An integral reinforced concrete foundation is required for S#T250C tower crane.
2. The size and construction method of foundation shall be determined by this company. The foundation is designed according to different ground endurance conditions, and the technical requirements are as follows.

##### Technical requirements

1. The soil under the concrete shall be firm and solid, and different foundations can be selected according to the soil conditions.

Tab-4-1

Ground endurance/Mpa	L/mm	Upper main reinforcement	Lower main reinforcement	Vertical bar	Concrete/m <sup>3</sup>
≥0.18	7,000	42-φ25 in both the vertical and horizontal direction	42-φ25 in both the vertical and horizontal direction	400-φ12	78.4
≥0.14	7,500	42-φ25 in both the vertical and horizontal direction	42-φ25 in both the vertical and horizontal direction	400-φ12	90.0

2. Pebble layer shall be backfilled at the ground base for about 100 mm, and reinforcement shall be made after compaction.
3. The upper and lower reinforcement and vertical bar of the concrete foundation adopt secondary reinforcement, and each layer of reinforcement is composed of two staggered layers. According to the convenience of construction, when the reinforcement is bound to a certain extent, grade I φ8 hoop shall be used to fix, and reinforcement measures shall be taken.

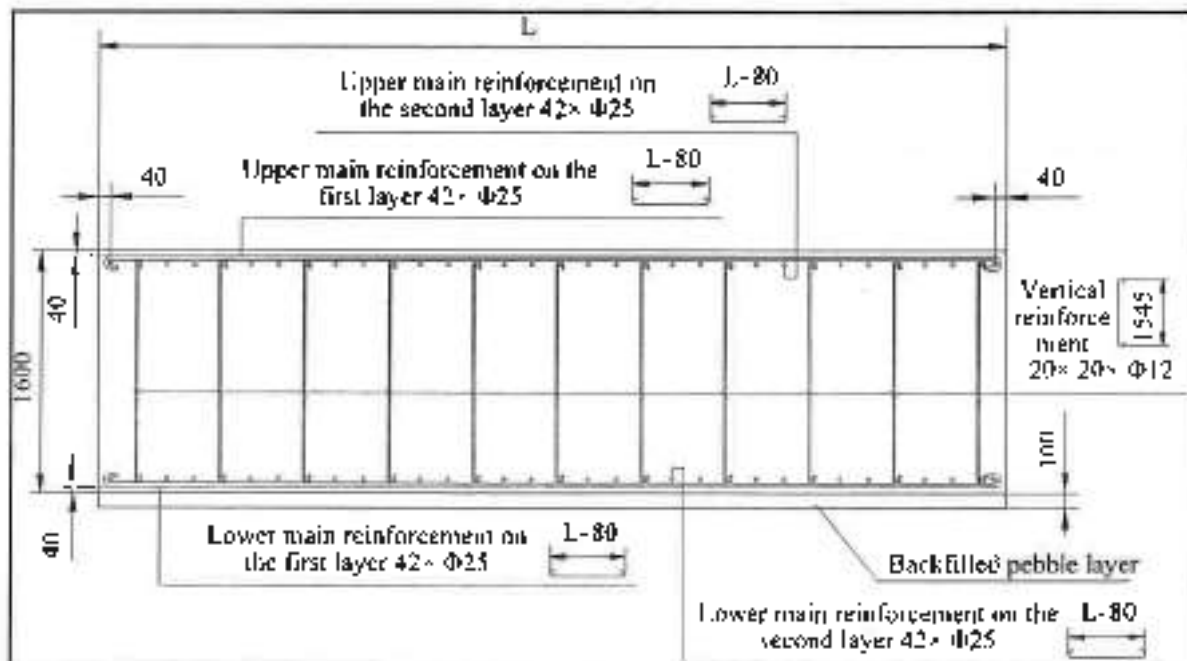


Fig 4-6 Schematic diagram of reinforcement layout of concrete foundation

4. When installing the embedded outrigger, use the outrigger installation manual or foundation section to assemble the four outriggers and put them into the reinforcement cage in the pit, and set an adjustable cushion block under the outrigger. Strictly ensure the dimension of 150 mm.

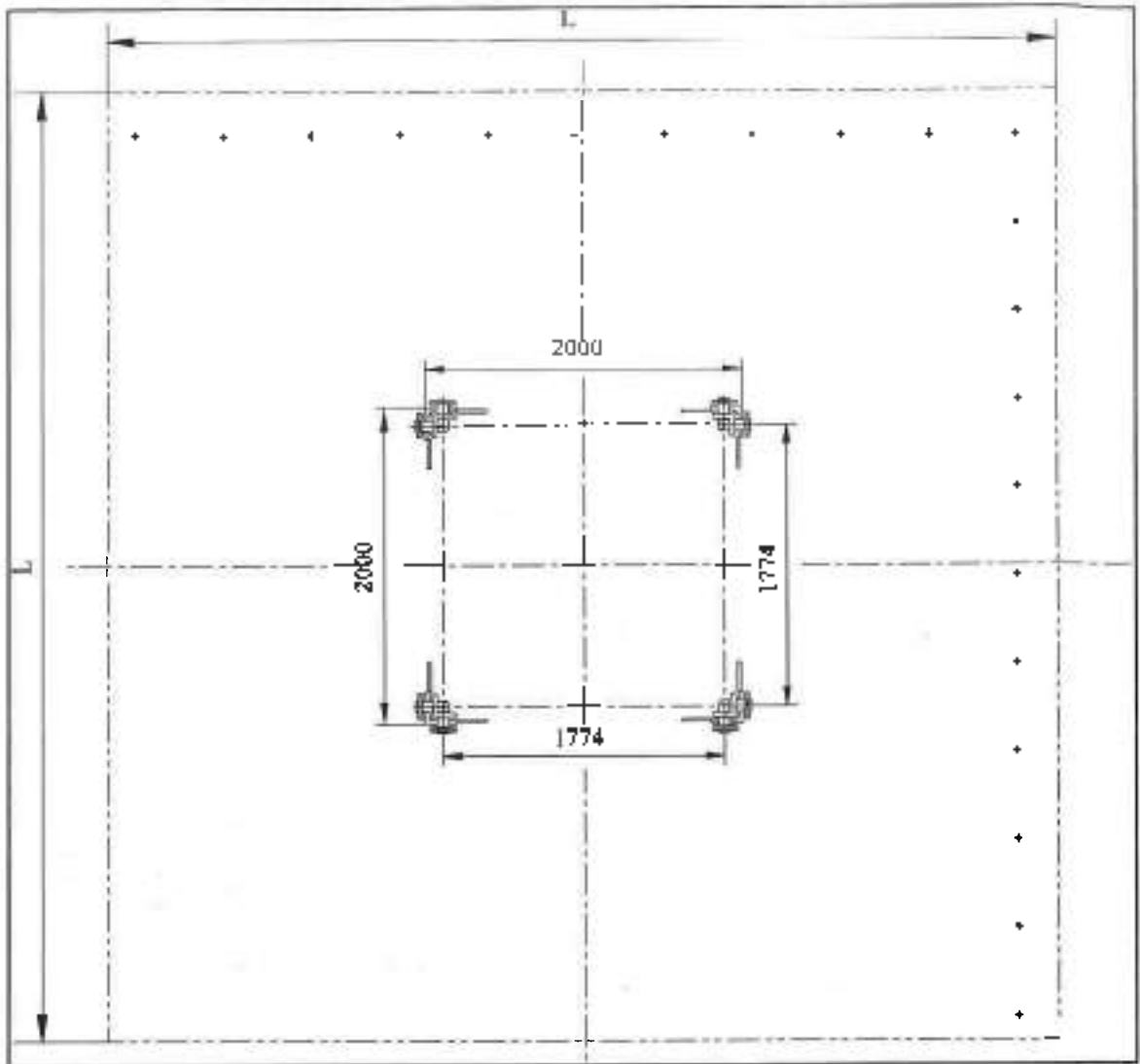


Fig.4-7 Layout of outrigger

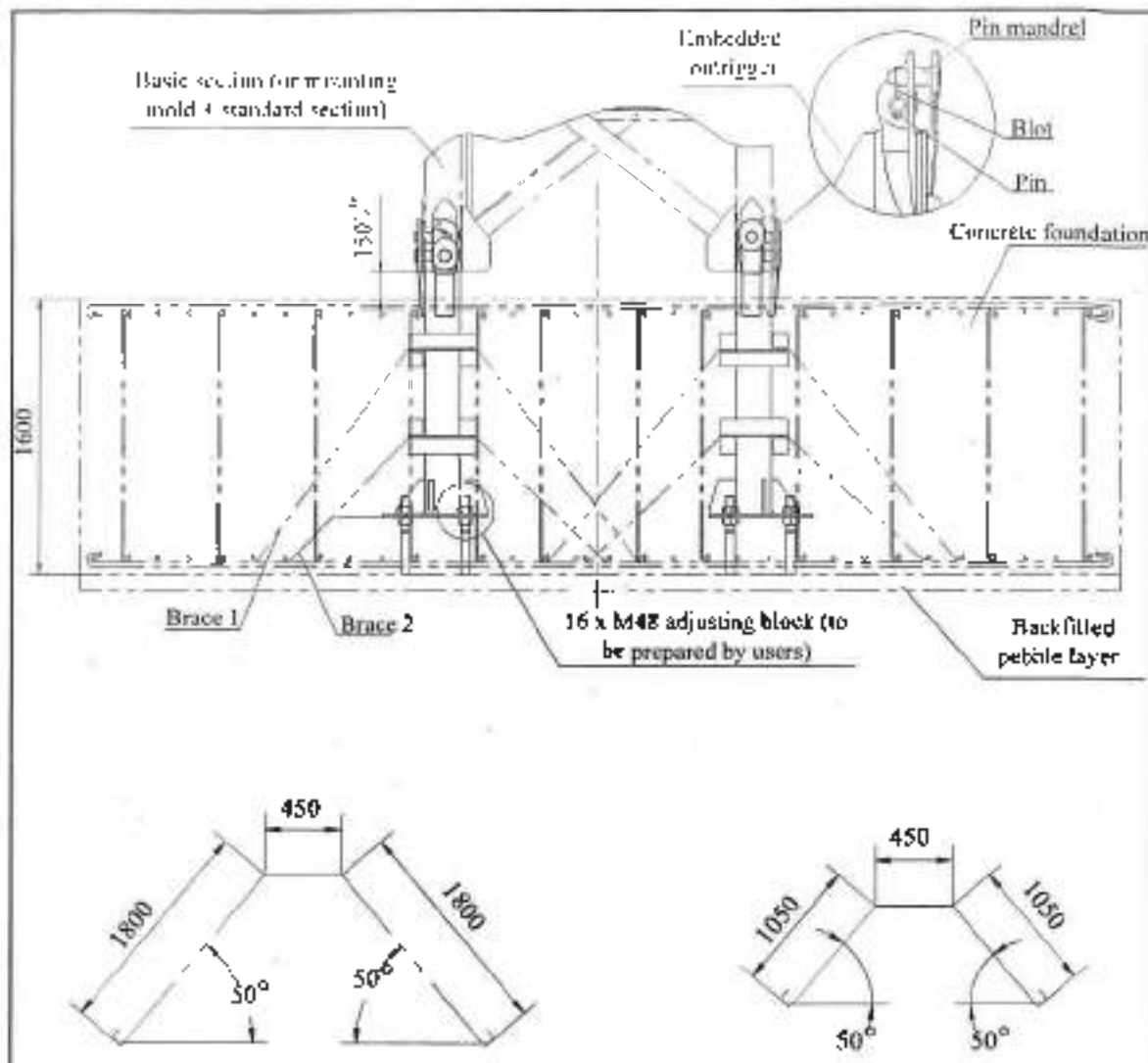


Fig.4-8 Schematic diagram of outrigger embedding

5. After the foundation reinforcement and embedded layout are completed, pour concrete and level the embedded outriggers at the same time to ensure that the flatness error on the four installation outriggers is not greater than 1/1000 (2 mm) of the standard section area.
6. When embedding outrigger accessories, do not cut reinforcing steel bars or reduce the given quantity.
7. The concrete filling rate around the embedded outrigger must reach 95% or more; the grade of concrete shall not be lower than C35, and its curing period shall be at least 15 days.
8. The depth of concrete foundation shall not be less than 1.6 m.
9. The concrete surface shall be about 100 mm higher than the ground around the foundation to facilitate drainage.
10. When the attachment installation is adopted, the distance between the center line of the tower (from the balance boom to the crane boom) and the edge line of the installation hole of the embedded support of the attachment frame is required to be 5 m.
11. The embedded outriggers required for installation shall be provided by this company, and the rest (such as various reinforcement, concrete, etc.) shall be made ready by the user.

**Warning!**

4 embedded outriggers must be provided by this company. The company will not be responsible for the consequences for any accident if not using the accessories provided by the company.

**Caution**

When connecting the embedded outrigger with the positioning frame or foundation section, please pay attention to the cleanliness of the connecting surface and pin mandrel and there shall be free of any dirt.

**4.1.4 Counterweight**

1 Schematic diagram of coating for counterweight

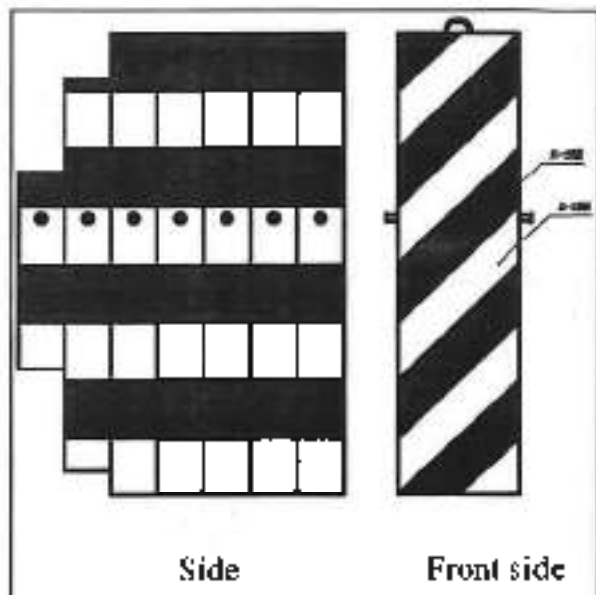


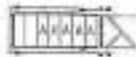
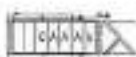
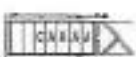


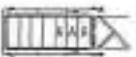
Fig.4-9 Schematic diagram of coating for counterweight

2 Configuration of counterweight

Tab.4-2 Configuration of counterweight

Counterbalance configuration (t) for 75 m crane boom Total weight: 25.10 t							
C	B	A	A	A	A	A	
1.70	3.40	4.00	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 70 m crane boom Total weight: 23.40 t							
	B	A	A	A	A	A	
	3.40	4.00	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 65 m crane boom Total weight: 21.70 t							
	C	A	A	A	A	A	
	1.70	4.00	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 60 m crane boom Total weight: 21.15 t							
	C	B	A	A	A	A	

Tab.4-2 Configuration of counterweight (continued)

	1.70	3.40	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 55 m crane boom Total weight: 20.00 t							
		A	A	A	A	A	
		4.00	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 50 m crane boom Total weight: 17.70 t							
		C	A	A	A	A	
		1.70	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 45 m crane boom Total weight: 17.70 t							
		C	A	A	A	A	
		1.70	4.00	4.00	4.00	4.00	
Counterbalance configuration (t) for 40 m crane boom Total weight: 15.40 t							
			B	A	A	A	
			3.40	4.00	4.00	4.00	
Counterbalance configuration (t) for 35 m crane boom Total weight: 13.70 t							
			C	A	A	A	
			1.70	4.00	4.00	4.00	
Counterbalance configuration (t) for 30 m crane boom Total weight: 12.00 t							
				A	A	A	
				4.00	4.00	4.00	

### 3. Fabrication of counterweight

The counterbalance has three specifications: 4.00t, 3.40t and 1.70t. It is formed by pouring reinforced concrete. Please make it in strict accordance with the drawings provided by this company.



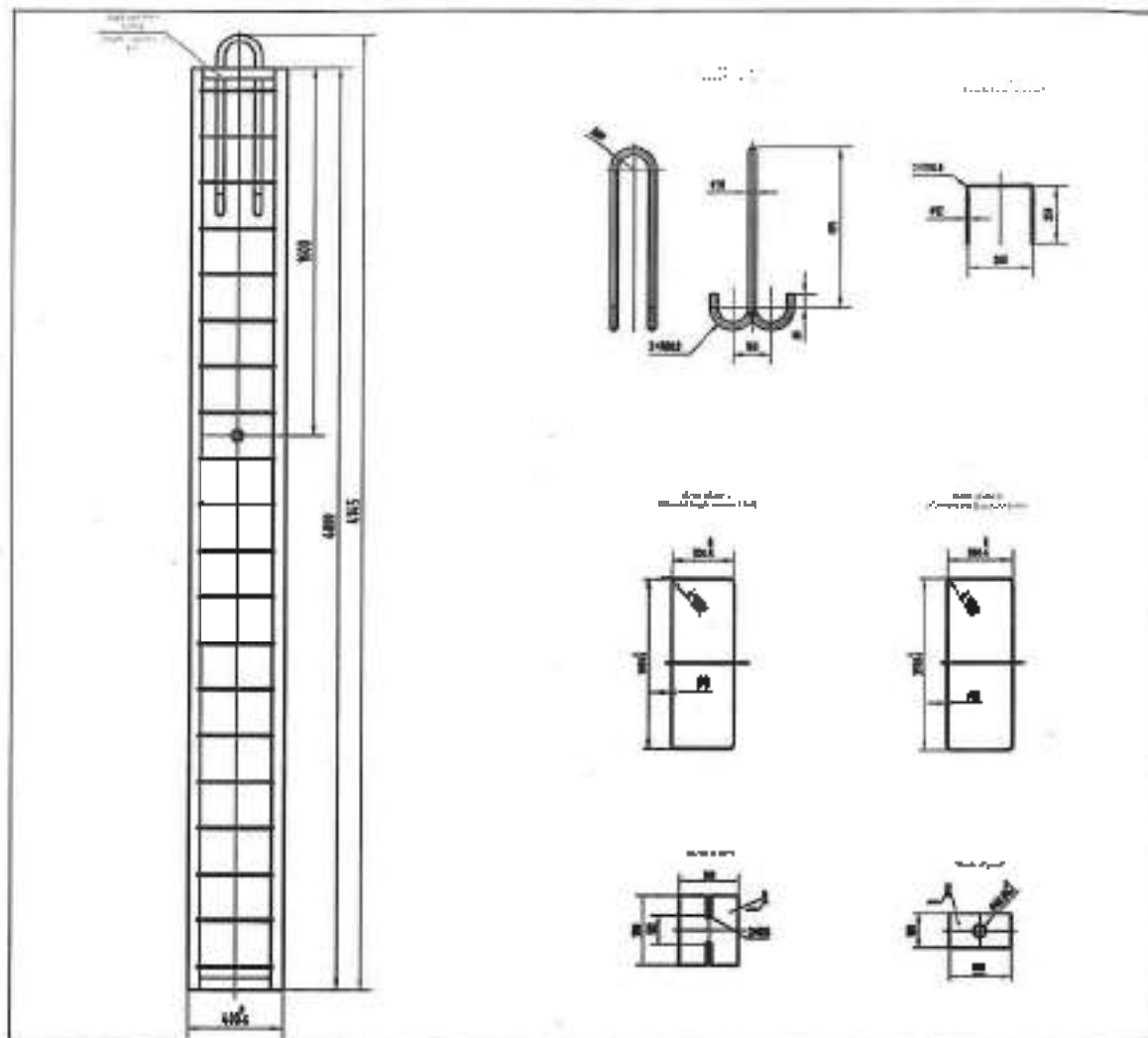


Fig.4-11 4.0t counterbalance

#### Technical requirements

- 1) The intersection of transverse reinforcement and longitudinal reinforcement shall be welded firmly, and the reinforcement mesh shall be welded and fixed to the outer frame with short reinforcement
- 2) The surface of the counterweight must be flat, and the concrete shall be controlled not to exceed the outer surface of the angle steel frame during pouring.
- 3) The allowed tolerance of counterweight shall be  $\pm 2\%$ .
- 4) The concrete grade shall not be lower than C20, and the density shall be  $2.35\text{t/m}^3$ .
- 5) Mark "4000 kg" on the surface of the counterweight hook.
- 6) The total weight of steel is about 170 kg.

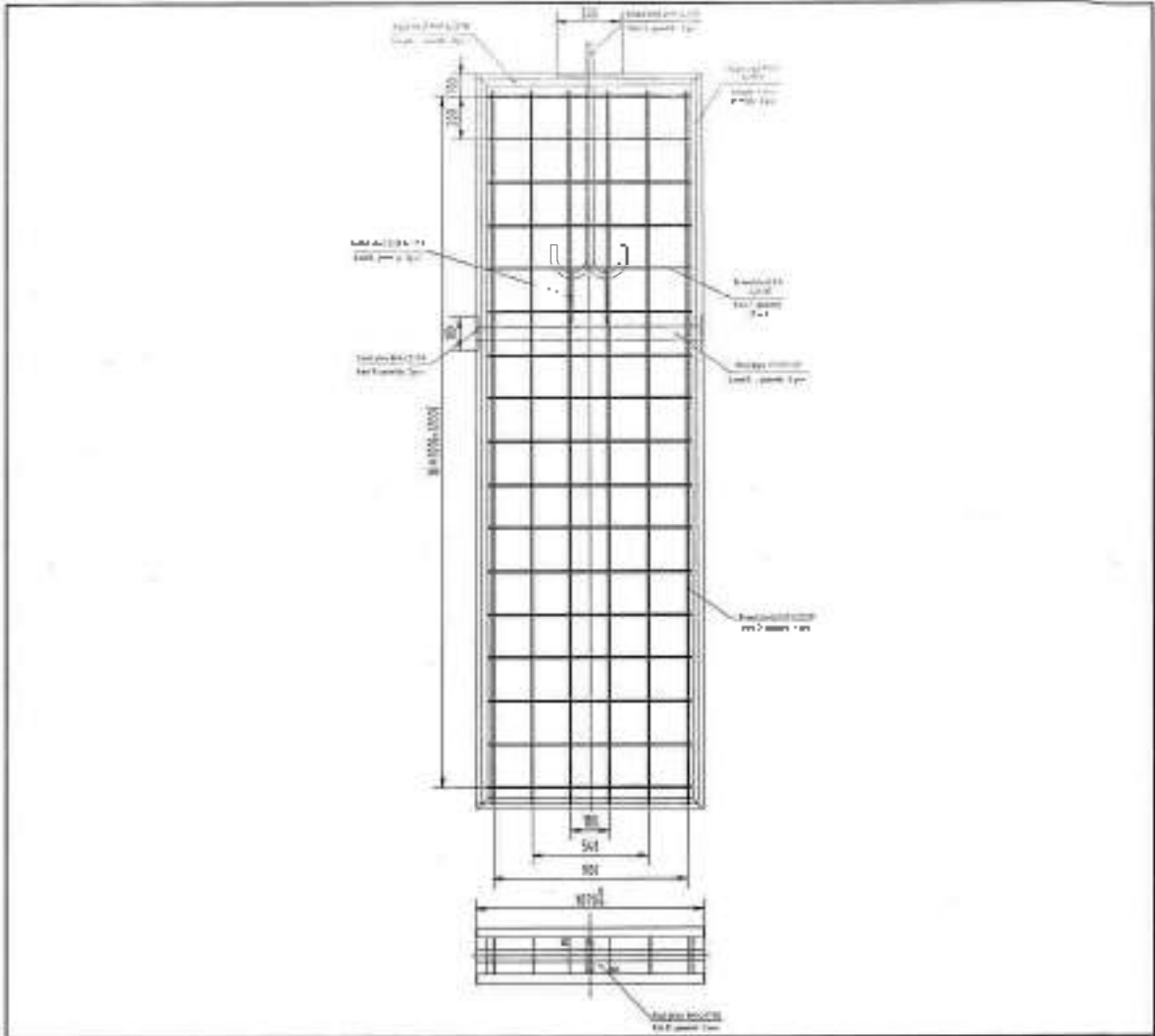


Fig.4-12 3.41 counterbalance







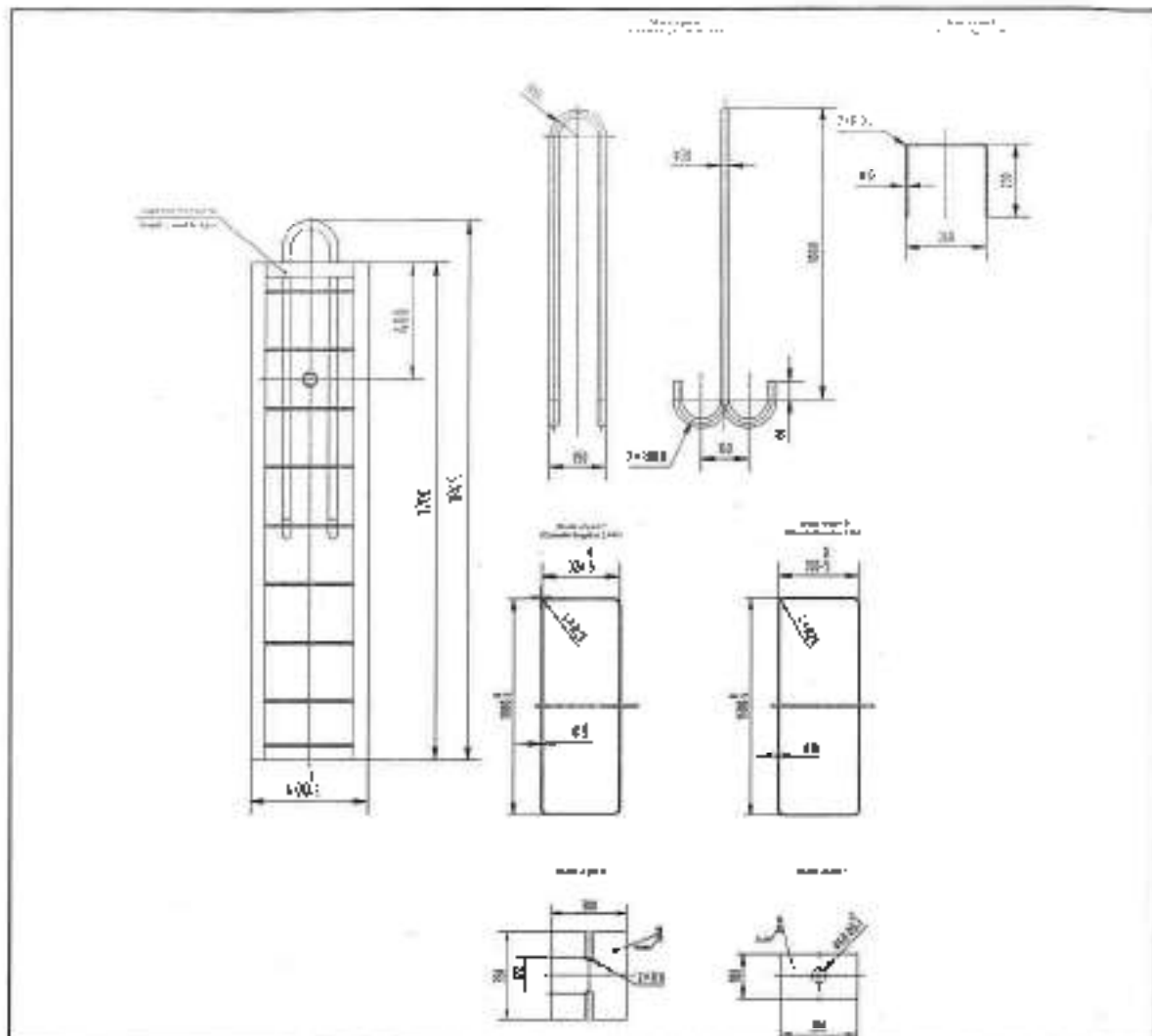


Fig.4-15 1.7t counterbalance

#### Technical requirements

1. The intersection of transverse reinforcement and longitudinal reinforcement shall be welded firmly, and the reinforcement mesh shall be welded and fixed to the outer frame with short reinforcement
2. The surface of the counterweight must be flat, and the concrete shall be controlled not to exceed the outer surface of the angle steel frame during pouring.
3. The allowed tolerance of counterweight shall be  $\pm 2\%$
4. The concrete grade shall not be lower than C20, and the density shall be  $2.35t/m^3$
5. Mark "1700 kg" on the surface of the counterweight hook.
6. The total weight of steel is about 119 kg.

## 4.2 Installation of tower crane

### 4.2.1 Precautions for tower crane installation

1. During installation, the connectors and locking elements (such as pin mandrel, bolt shaft, shaft end retaining plate, cotter pin, wire rope clamp, etc.) between various components shall be complete and connected reliably.
2. During installation, the high strength bolts shall be tightened according to the pre-tension and preload torque required in the operation manual. All bolt assemblies must be coated with a small amount of lubricating oil to reduce the friction coefficient and ensure the preload and torque value. The lubricating parts include all threaded surfaces and contact surfaces of parts imposed with preload.

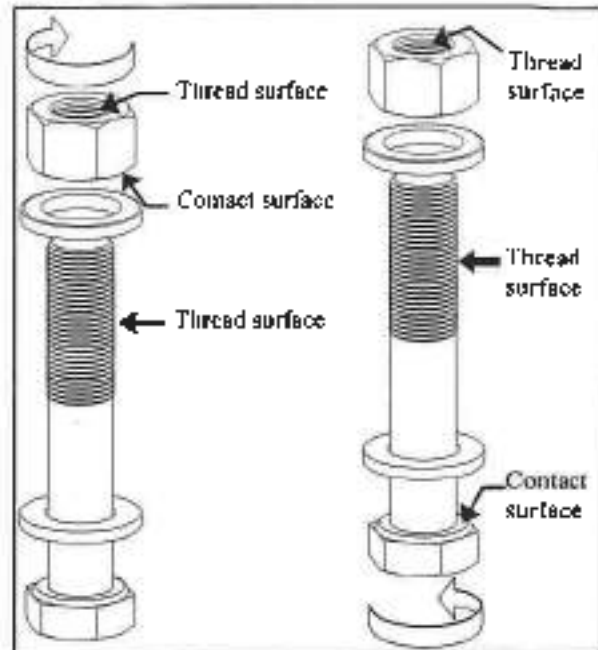


Fig.4-16

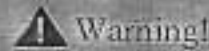
3. Ensure that the pin mandrels are connected effectively and fixed reliably. No following phenomena shall occur.
  - 1) The cotter pin is not installed;
  - 2) The end of the cotter pin is not bent separately as required;
  - 3) Small cotter pin is used;
  - 4) Replace the cotter pin with iron wire.
4. Check the wear condition of the pinhole in time. When the wear of the pinhole makes it impossible to fix the pin mandrel reliably which will affect the effectiveness of the pin connection, please repair it before continuing the installation.



Fig.4-17

5. Before hoisting the counter boom, the components installed on it shall be fastened and reliable, and the components to be hoisted shall be in balance.

6. During installation, the quantity, weight and position of counterweight and the installation process of boom shall strictly follow the provisions of this manual.



**Warning!**

It is strictly prohibited to use bolts and nuts that are damaged or have rusted screws and threads!

7. Please refer to the weight and lifting height data of the lifting unit, select the appropriate auxiliary hoisting equipment, such as wooden sleepers, supports, rigging, rope buckles, etc.

Tab 4-3 List of hoisting units

S. N.	Hoisting unit	Composition	Weight (kg)				Min. lifting height
1	Basic section assembly	Basic section+pin mandrels	4,180				8.5
2	Standard section assembly	Sheet structure-ladder+pin mandrels+platform	1,520				11.5
3	Climbing frame assembly	Frame and platform	4,750			5,500	19.5
		Hydraulic cylinder and pumping unit	750				
4	Transition section assembly	Transition section + platform + pin mandrel + introduced guide rail	2,540				14
5	Stewing assembly	Upper and lower seal + stewing mechanism + cab + electric control cabinet	6,400				15.5
6	Tower head assembly	Tower head + pull plate + pin mandrel	2,590				18
7	Square boom	Square boom	1,700				18
8	Counter boom assembly	Counter boom+hoisting mechanism+maintenance frame+platform guardrail-pull rod	8,500				18
9	Counterweight	First block of 4.0 counterweight	4,000				21
		Second block of 4.0 counterweight	4,000				21

Tab.4-3 List of hoisting units (continued)

10	Crane arm assembly (including luffing mechanism and hoist)	75 m boom	13,425			18	
		70 m boom	13,025			18	
		65 m boom	12,810			18	
		60 m boom	12,410			18	
		55 m boom	11,945			18	
		50 m boom	10,945			18	
		45 m boom	10,880			18	
		40 m boom	9,880			18	
		35 m boom	9,655			18	
		30 m boom	8,655			18	
11	Other counterweights	Boom length	4.0 t	3.4 t	1.7 t	Total balance weight (t)	21
		75 m boom	3	1	1	17.1	
		70 m boom	3	1	0	15.4	
		65 m boom	3	0	1	13.7	
		60 m boom	4	1	1	13.1	
		55 m boom	3	0	0	12	
		50 m boom	2	0	1	9.7	
		45 m boom	2	0	1	9.7	
		40 m boom	1	1	0	7.4	
		35 m boom	1	0	1	5.7	
		30 m boom	1	0	0	4	

### Caution

The minimum lifting height refers to the minimum lifting height required for each component when the tower is erected. When the tower is erected, the tower section includes 1 basic section and 1 standard section.

#### 4.2.2 Installation sequence of tower crane

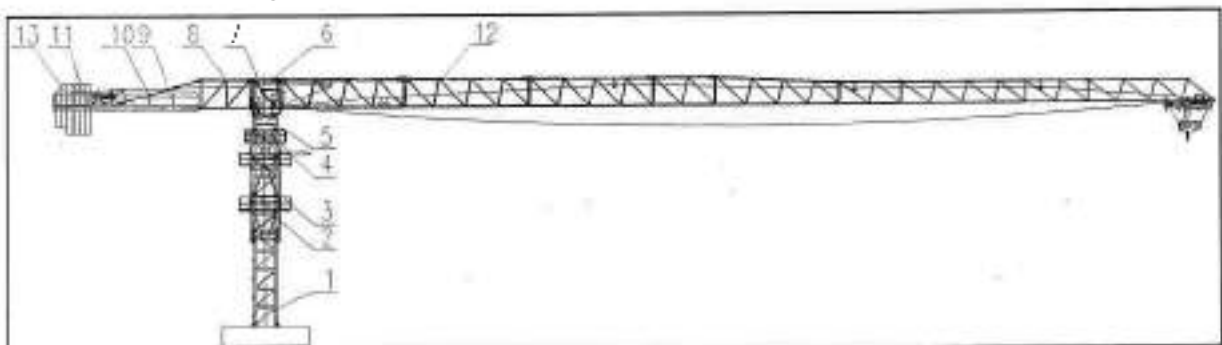


Fig.4-18 Installation sequence

Tab.4-4 Installation sequence

1. Installing basic sections	2. Installing standard sections	3. Installing climbing frame assembly	4. Installing the transition section assembly
5. Installing slewing assembly	6. Installing tower head assembly	7. Installing electric harness	8. Installing the square boom assembly
9. Hoisting the counter boom	10. Installing counter boom link	11. Hoist 2 blocks of 4t counterweight	12. Hoisting of crane boom
13. Hoist other counterweights			

#### 4.2.3 Installing basic sections

1. Select a suitable crane to lift the basic section, and slowly place it on the foundation outrigger (p65). Connect the pin mandrel.
2. Pay attention to the following items when installing the pin mandrel:
  - 1) Ensure that there is no burr or wear on the fishplate and side surface;
  - 2) Apply lubricating grease to the pin mandrel and inner hole;
  - 3) Knock the pin mandrel completely in.

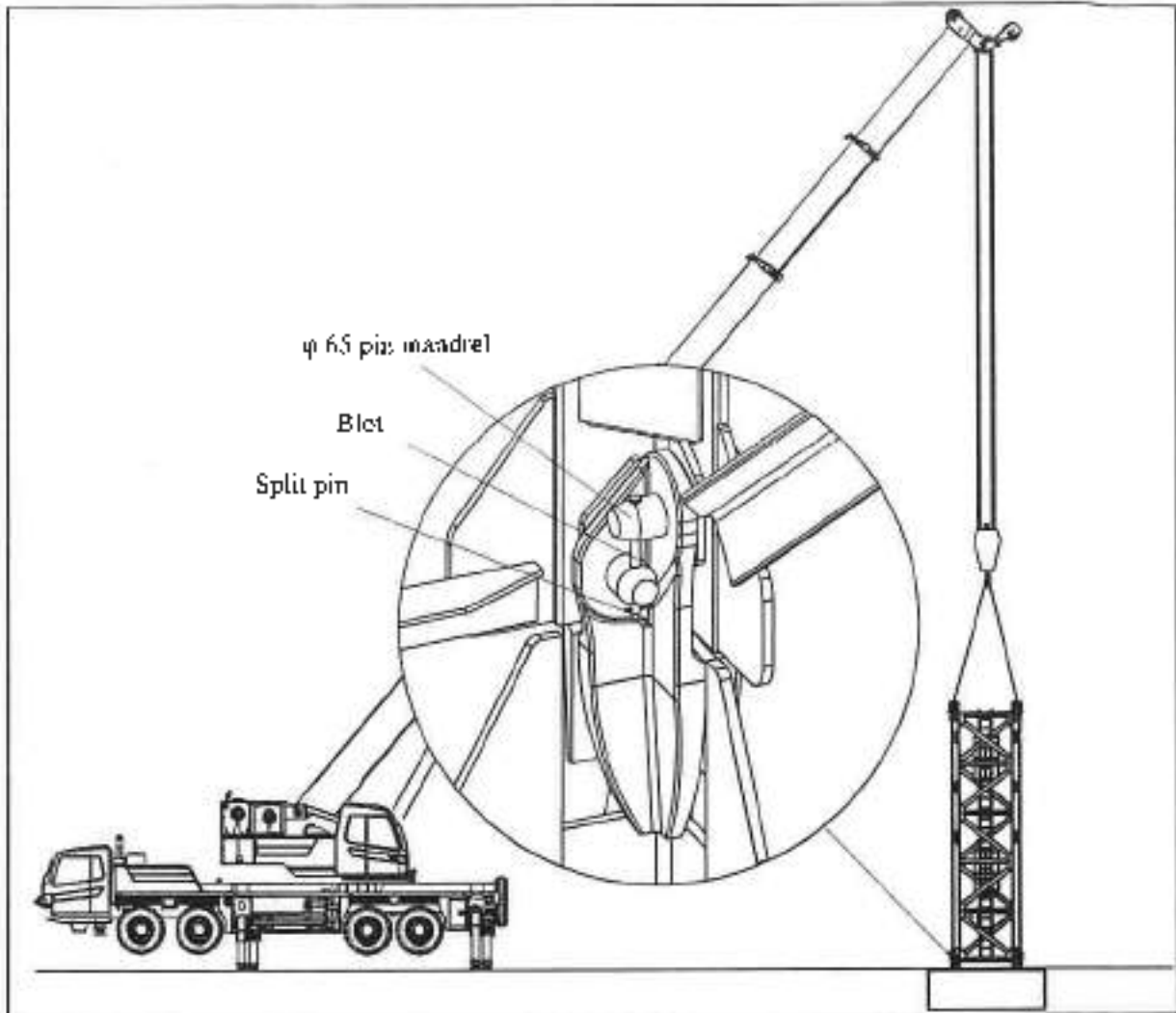


Fig.4-19 Hoisting base section

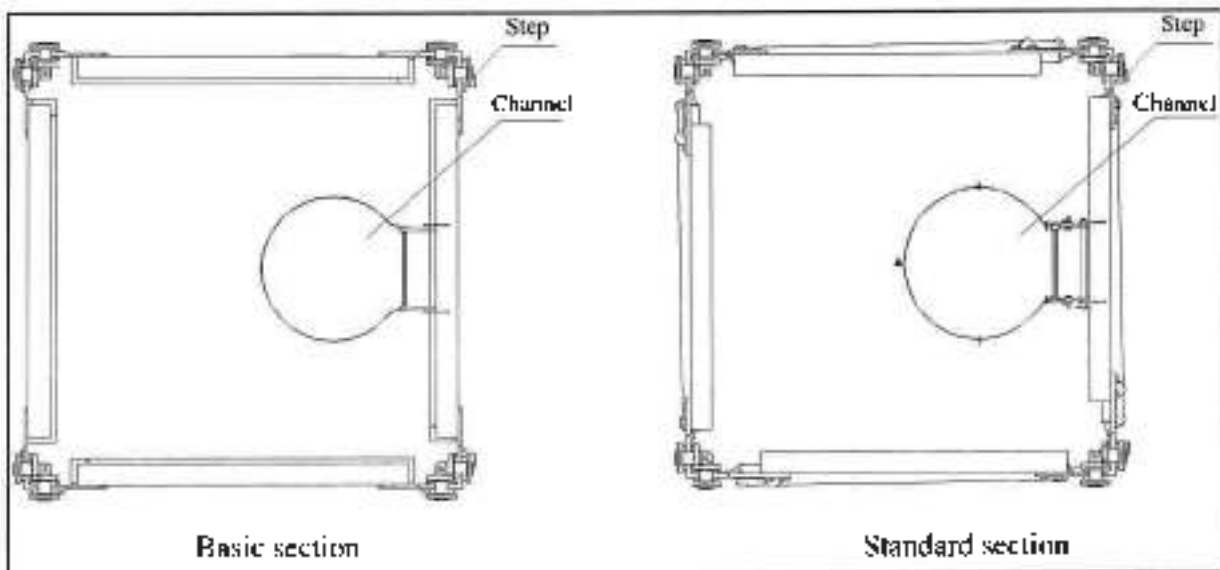


Fig.4-20 Orientation of lower section



### Caution

The orientation of the steps of the foundation section and the standard section determines the introduction direction of the standard section when jacking up and adding sections. When placing the foundation section, the needs of tower crane jacking and tower lowering (disassembly) must be considered.

#### 4.2.4 Installing the standard section assembly

1. The standard section can be divided into straight ladder standard section and inclined ladder standard section. For these two forms of standard section, only structure of ladder and platform are different, but functions are same, both of which can be used for SPT250C tower (can not be mixed). Since the two standard sections have the same frame form, only the standard straight ladder will be introduced in detail.
2. Installation procedures:
  - 1) As shown in the figure below, assemble the one-piece of standard section with M27 hexagon head reamed bolt (pre-tension torque 950 N·m), firmly connect the beam with bolt, and firmly connect the beam with M20 bolt (pre-tension torque 370 N·m).

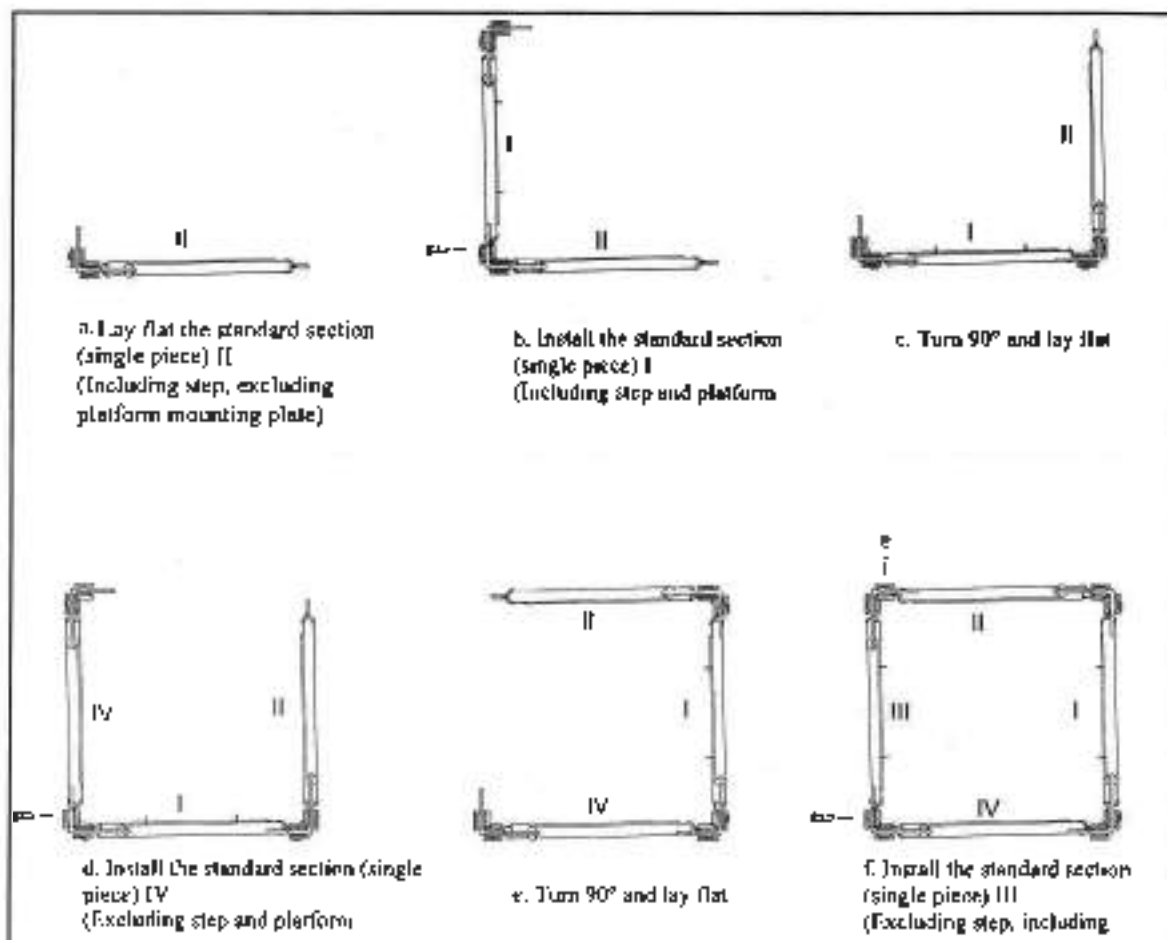


Fig.4-21 Assemble the one-piece of standard section

### Caution

Please carry out the assembly in strict accordance with the figure, and pay attention to distinguish one-piece standard sections: one-piece III does not include stair step, one-piece I and one-piece II both include stair step, and there is a platform mounting plate on the middle transverse web member of one-piece I.

Please pay attention to distinguish the beam. The beam connecting one-piece I and one-piece II must include the ladder mounting plate.

The standard diagonal web member is made of round steel, and the frame assembly is made by internal splicing (the gusset plate is on the inner side of the main chord); the selected standard diagonal web member is made of channel steel, and the frame assembly is made by external splicing (the gusset plate is outside the main chord). The two types of standard sections can be mixed.

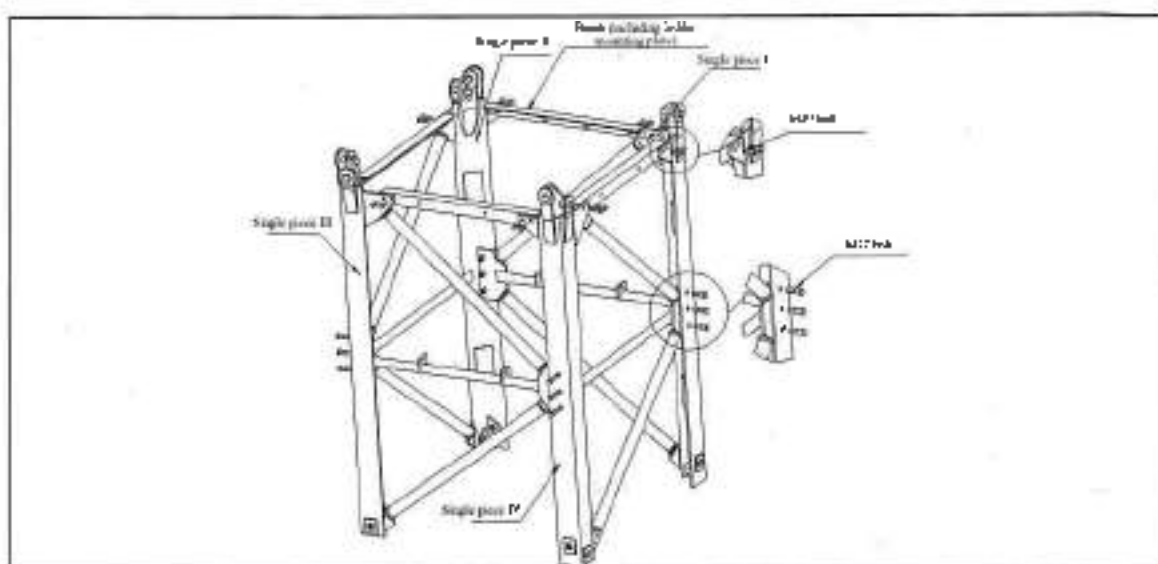


Fig. 4-22 Assembly diagram of standard sections

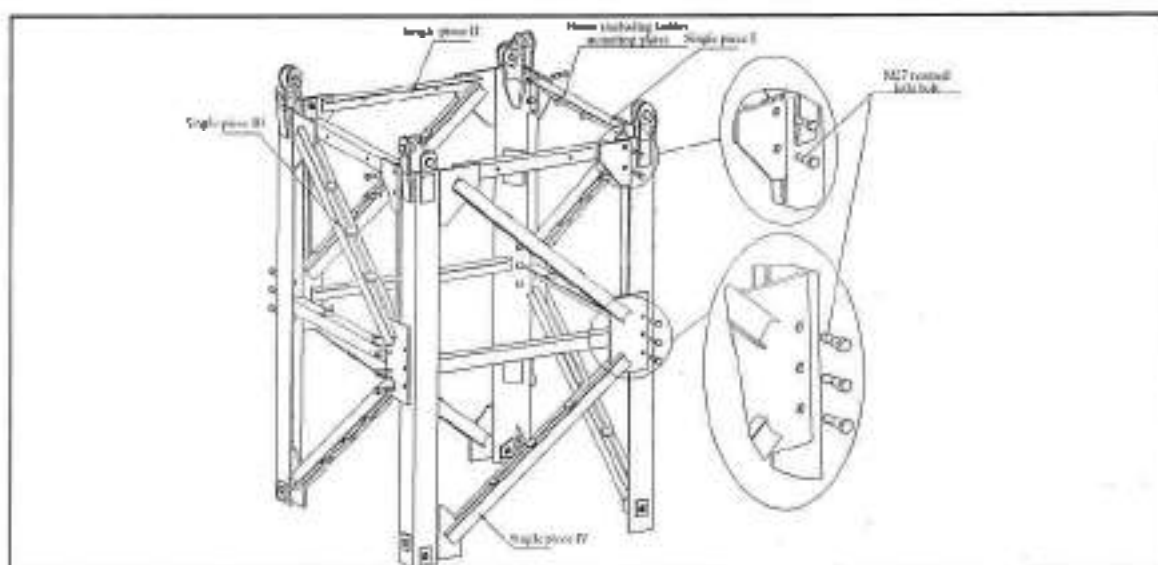


Fig. 4-23 Assembly diagram of standard sections (optional)

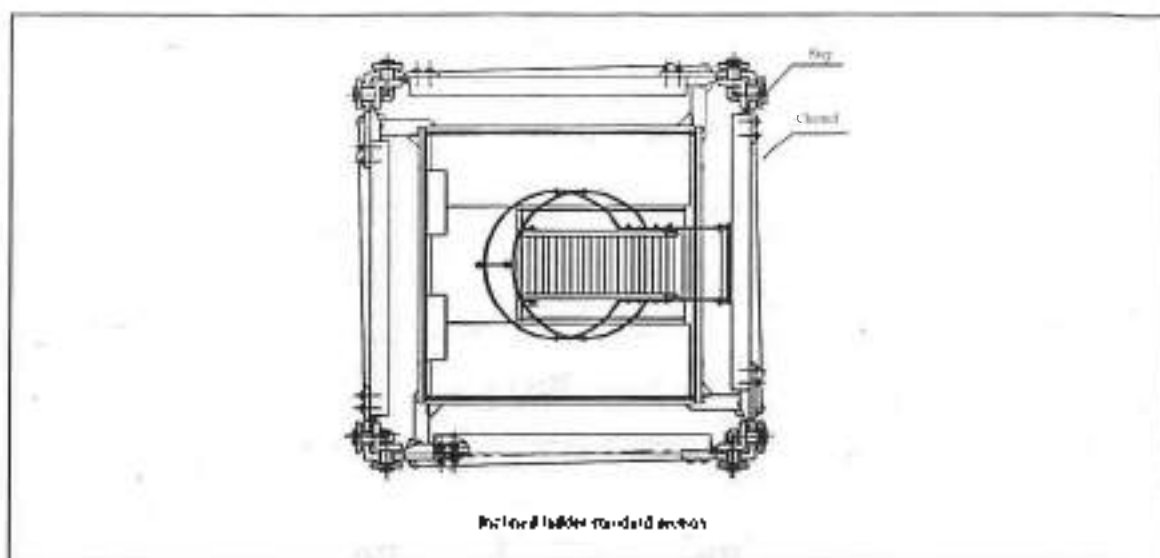


Fig.4-24 Standard sections of inclined ladders

**Caution**

When assembling the one-piece, first align the mounting hole on the assembly plate with the mounting hole on the angle steel through the guide pin, and then install the M27 bolt.

**Caution**

When installing various high strength bolts, the preload torque required in this manual must be followed to ensure the safe operation of the tower crane.

- 2) Fix the upper end of the ladder on the ladder mounting plate of the beam of the standard section with the mounting pin, and insert the cotter pin.

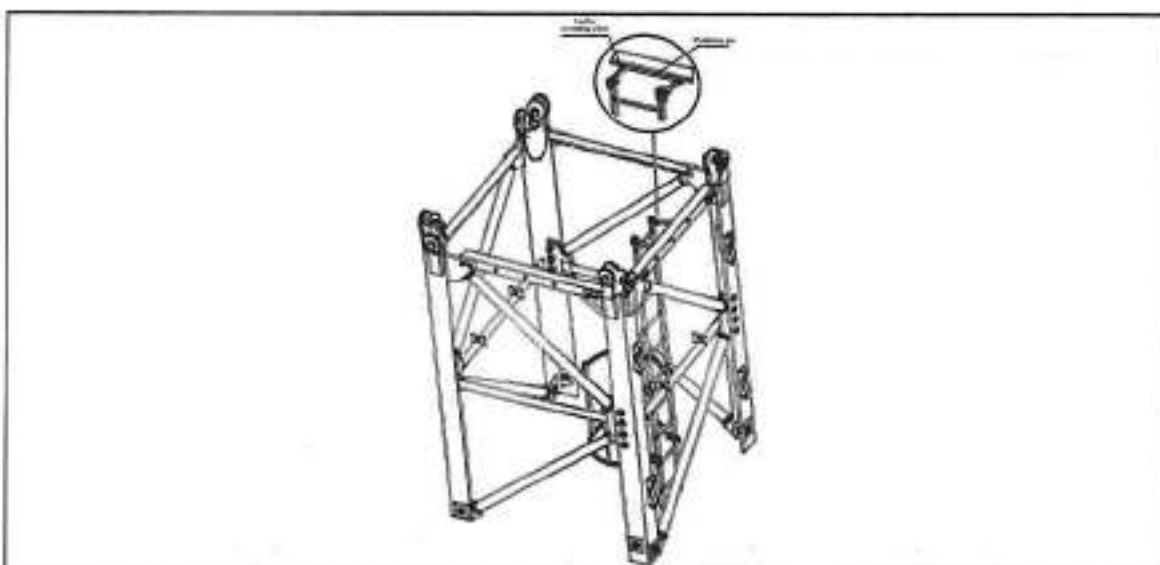


Fig.4-25 Installation of ladders

- 3) Install the platform assembly on the platform mounting plate of the middle transverse web member of the standard section with M12 bolt assembly

**Caution**

A platform shall be installed every 10 meters (or every 3 standard sections).

**Caution**

In order to prevent the ladder from shaking in the standard section, it can be fixed with iron wire.

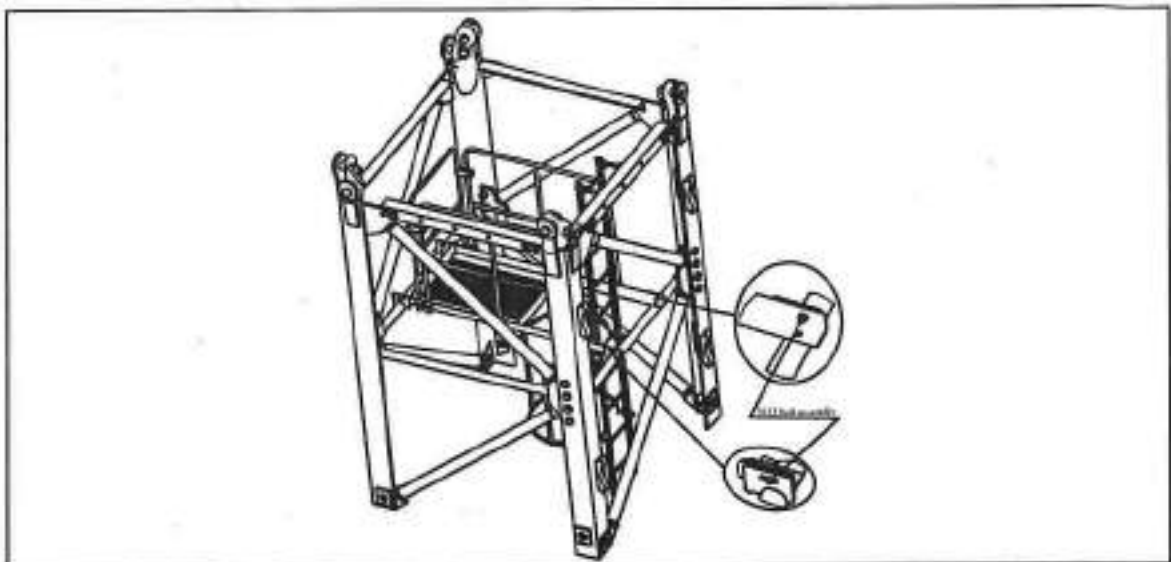


Fig.4-26 installation of platforms

- 4) After completing the assembly of the standard section assembly, lift the standard section, insert it slowly into the fishplate of the basic section, and connect with  $8 \times \phi 55$  pin mandrel,  $4 \times \phi 20$  bolts and 4 cotter pins. At the same time, insert the lower end of the standard section ladder into the upper end of the basic section ladder.
- 5) The verticality shall be checked by theodolite or suspension wire method. The verticality error of the four sides of the main chord shall not be greater than  $1.5/1000$ .

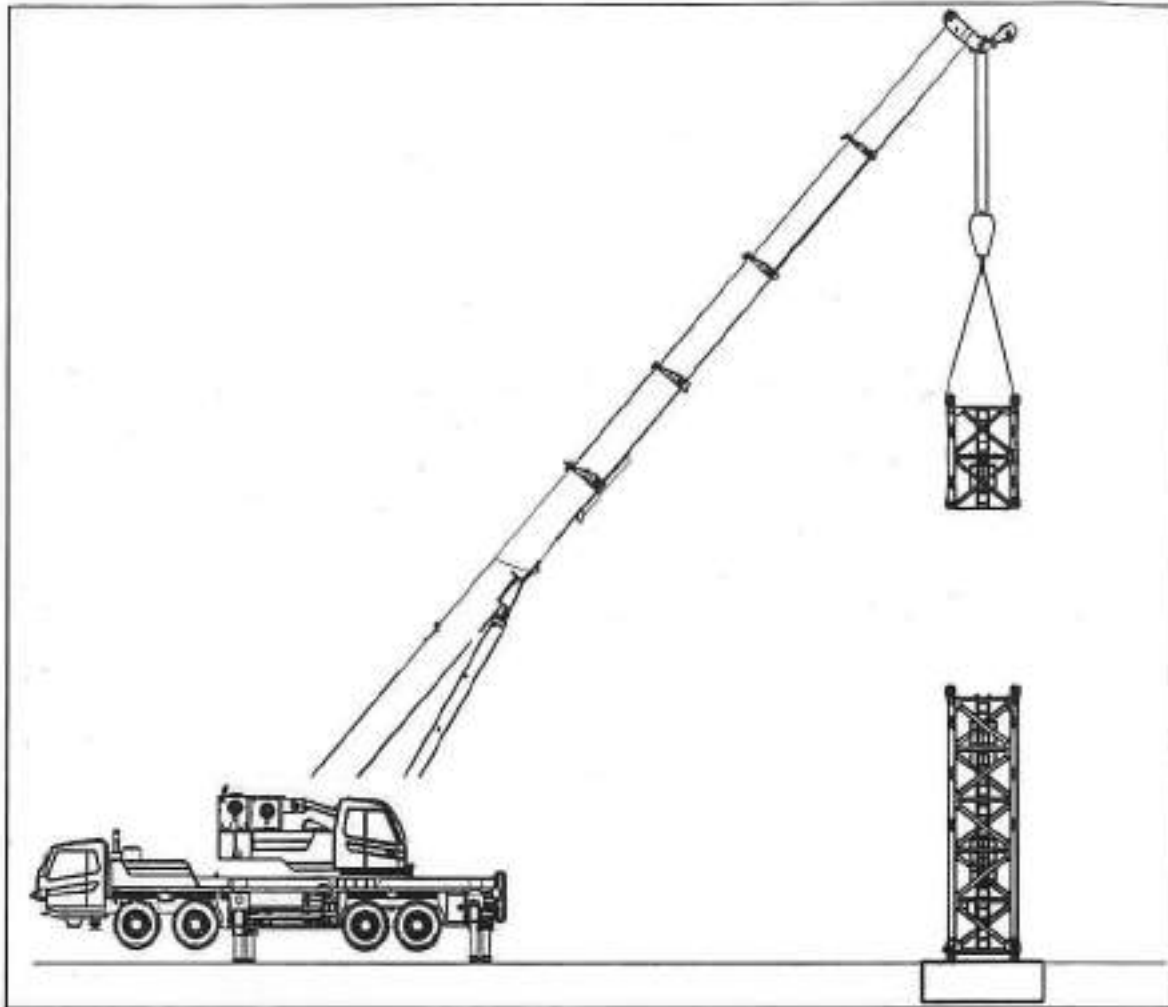


Fig 4-27 Hoisting of standard sections

#### 4.2.5 Installing climbing frame assembly

1. The climbing frame is mainly composed of steel structure of climbing frame, platform and hydraulic jacking device.
2. There are 16 rollers inside the climbing frame. During jacking, the rollers are supported on the outside of the main chord of the tower to guide. In order to meet the safety needs of jacking mechanism installation, working platforms are set at the lower, middle and upper parts of the climbing frame. The cross beam of the climbing frame will be hinged with the hydraulic cylinder to bear the jacking load of the hydraulic cylinder. The middle part of the climbing frame is equipped with a swinging claw controlled by the control rod. In the process of recovering the hydraulic cylinder and introducing the standard section, it can bear the weight of the superstructure by parking on the upper end face of the tower steps.

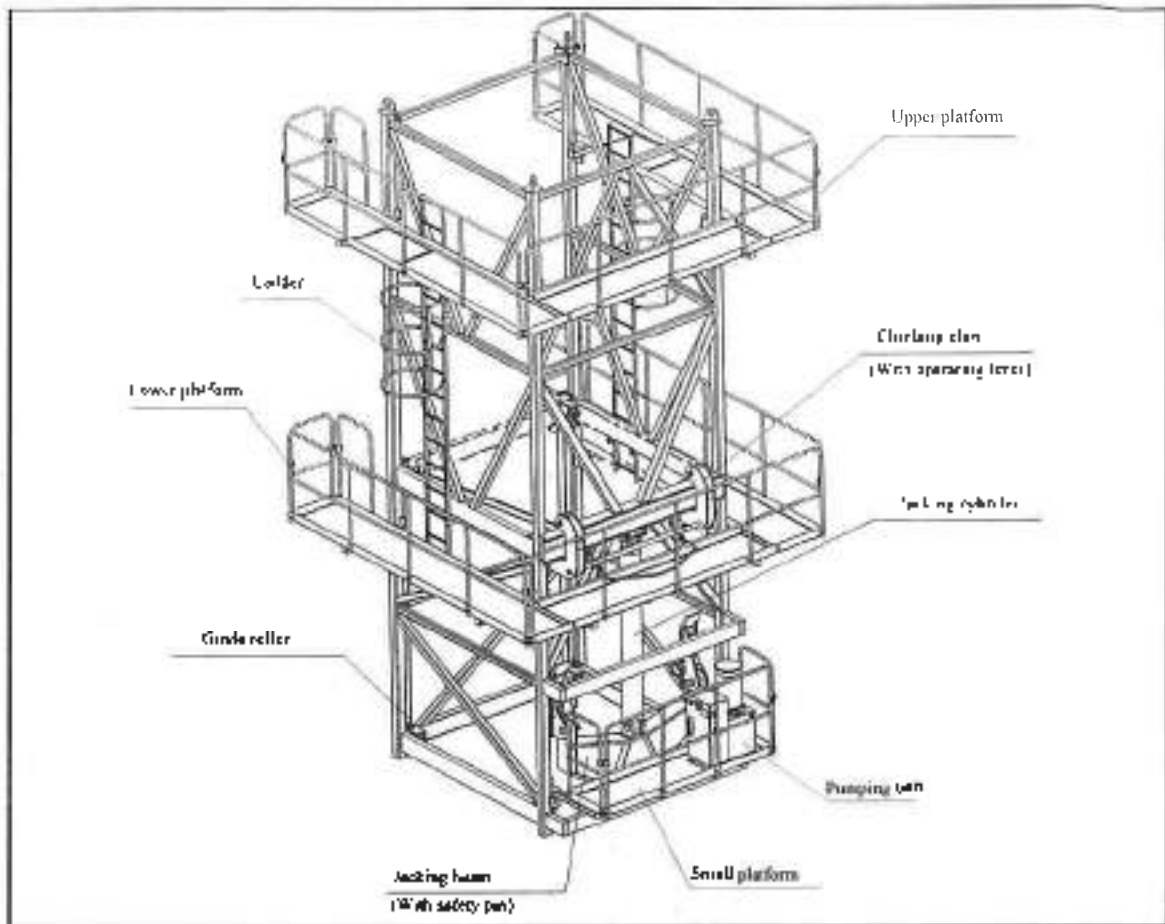


Fig.4-28 Composition of climbing frame

### Caution

Please pay attention to protect the jacking pumping unit and jacking hydraulic cylinder during installation.

### Hoisting process:

1. After assembling the climbing frame, hang the spreader on the climbing frame and lift it with steel wire rope. The position of installing the jacking hydraulic cylinder must be on the same side as the step of the tower.
2. Slowly put the climbing frame on the outside of the tower section.
3. Park the climbing claw on the climbing frame on the second pair of steps of the foundation section, press the control lever and lock it.
4. Install the jacking hydraulic cylinder, lift the hydraulic pumping unit to a corner of the platform, connect the oil pipe, and check the operation of the hydraulic system (see Chapter 3.6 of this manual for the hydraulic system).

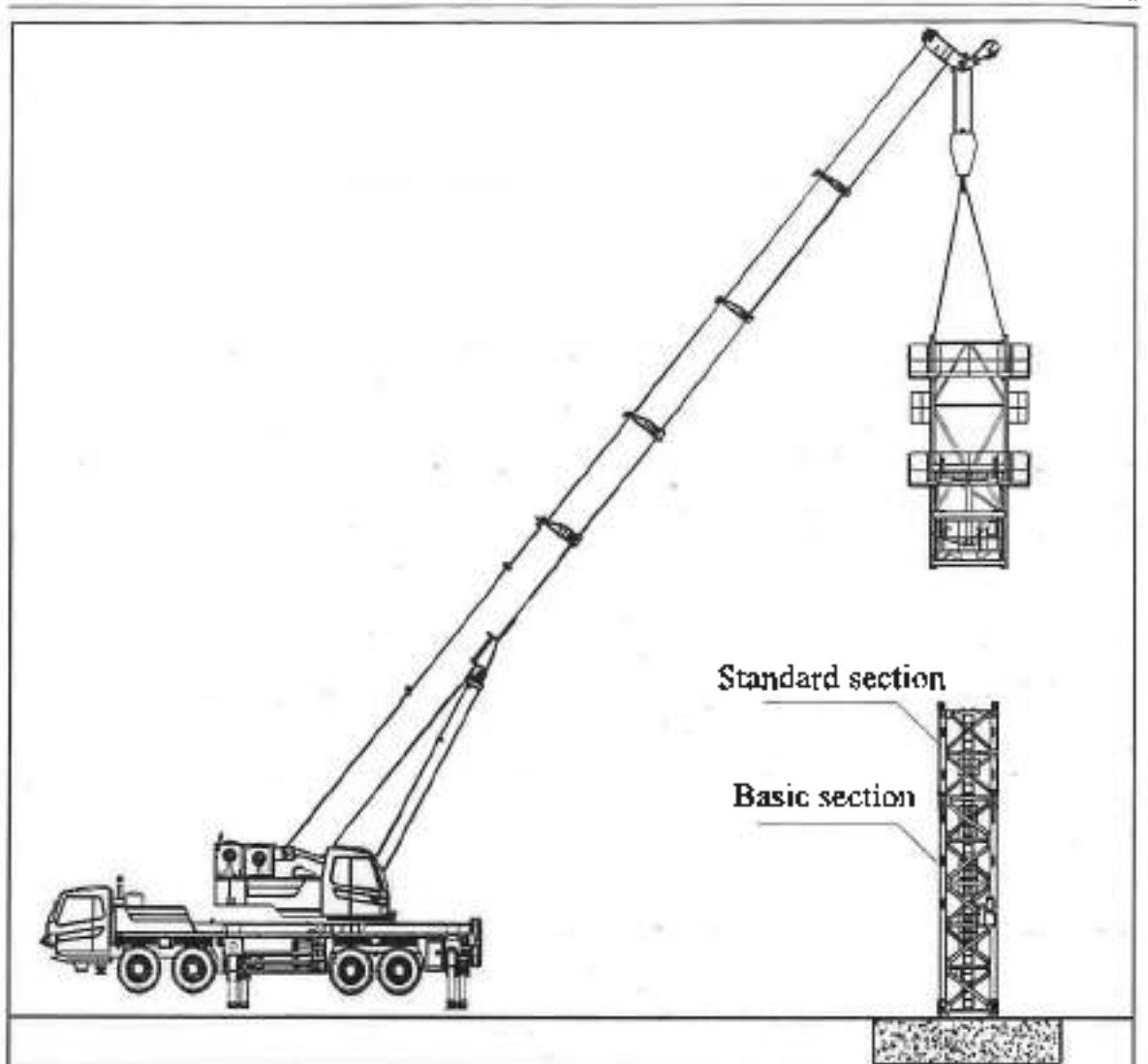


Fig.4-29 Hoisting diagram of climbing frame

#### 4.2.6 Installing the transition sections

1. The transition section is made of integral welded angle steel structure. The transition section assembly includes transition section structure, two side platforms, two lead-in guide rails and one lead-in platform assembly.
2. Installation procedures:
  - 1) Install the side platform and fasten it with four sets of M12 bolts.

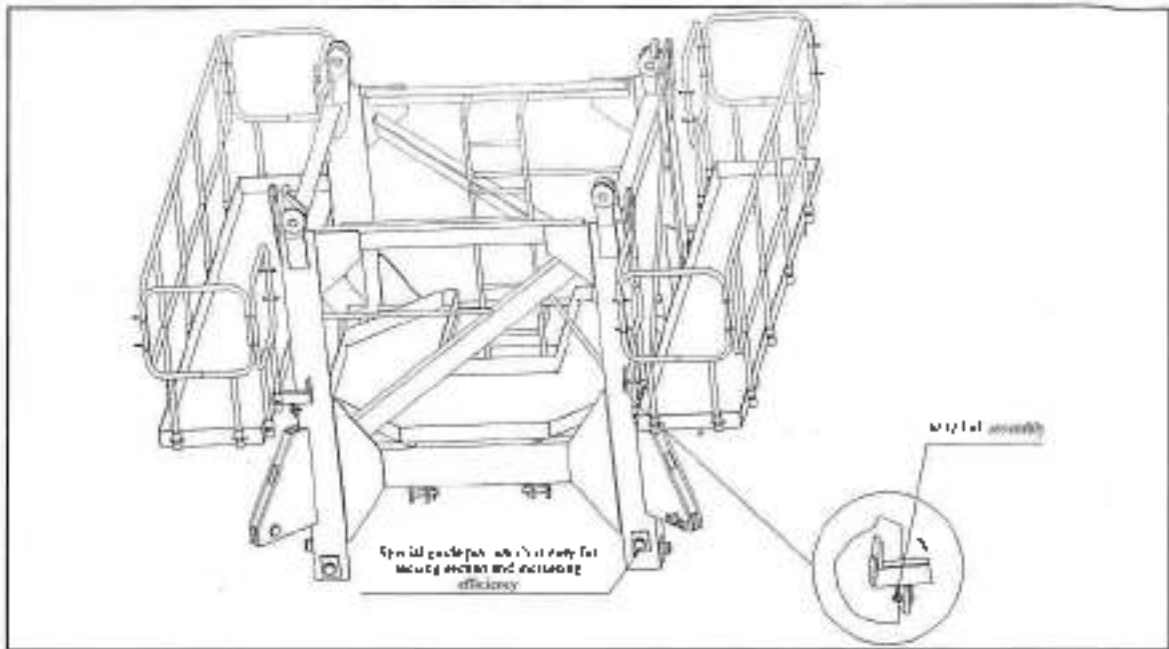


Fig.4-30 Installation diagram of platform on the side of transition sections

- 2) Install the lead-in guide rail and firmly connected with the transition section through 4×φ30 pin mandrels and 4 center pins, and the lead-in platform assembly is firmly connected through 4 sets of M24 bolt assemblies.

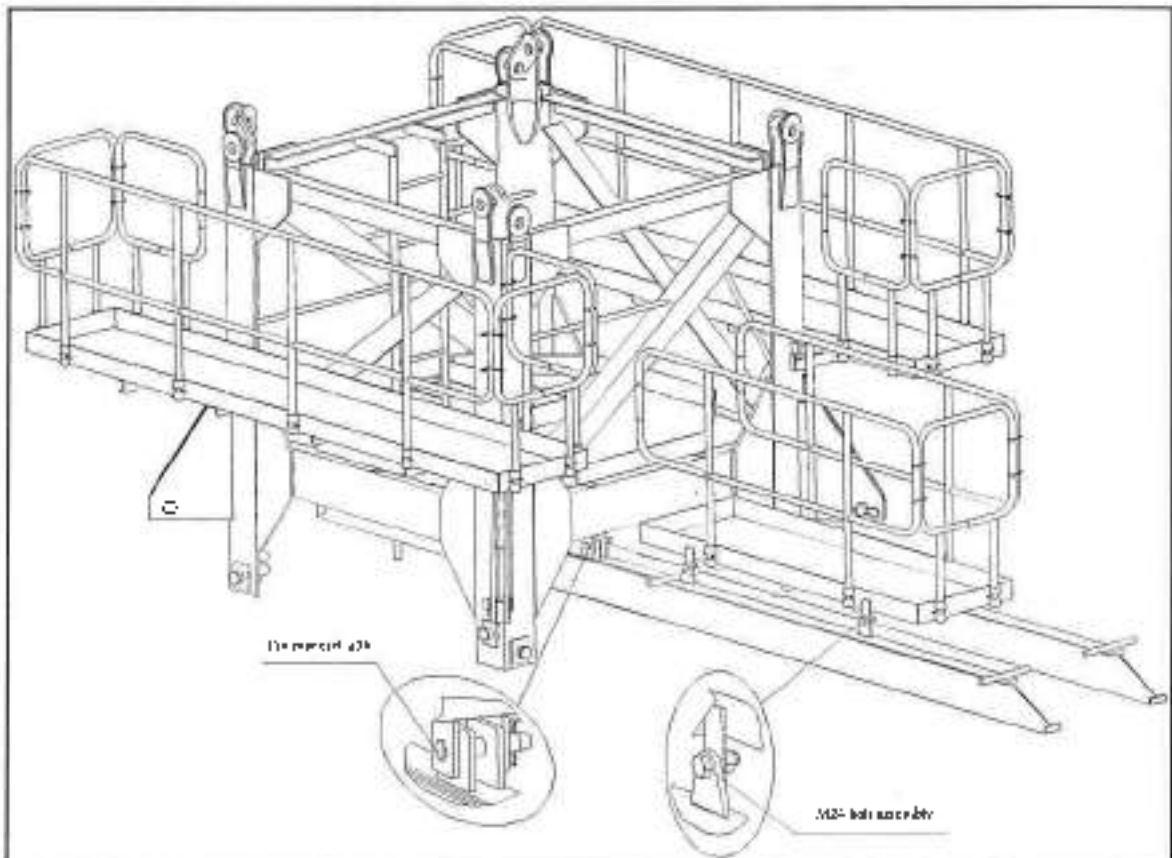


Fig.4-31 Schematic diagram of transition insert assembly



- 3) Hoist the assembled transition section assembly and firmly connect it with standard section with  $\phi 55$  pin mandrel (the same as the connection mode between the basic section and the standard section).

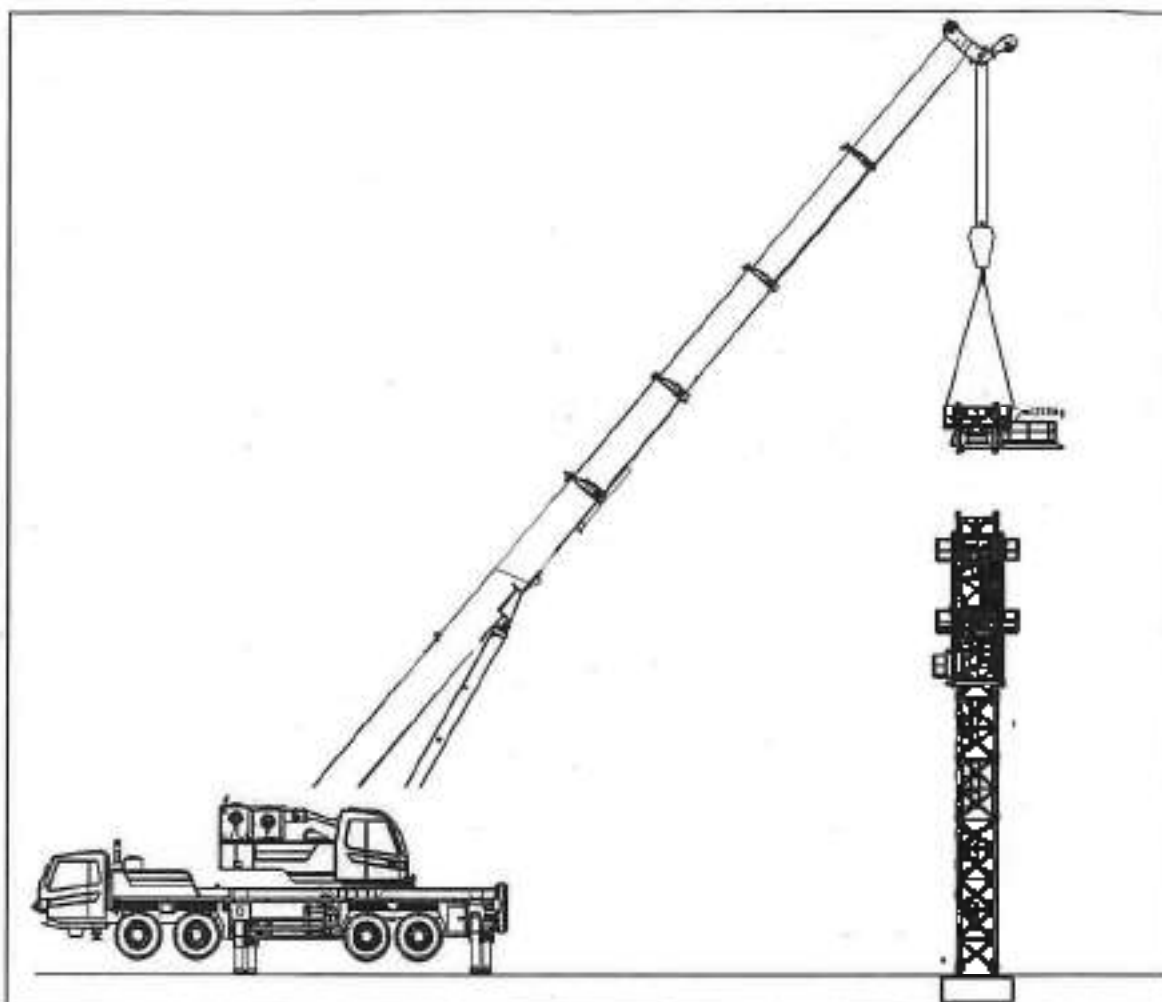


Fig.4-32 Hoisting of transition sections and standard sections

- 4) After confirming that the transition section assembly is reliably connected with the standard section, operate the hydraulic cylinder, hang the hanging shoes at both ends of the jacking beam on the step of the third standard section, and insert the safety pin. Lift the claw operating lever to release the claw and lock it with the lock ring.
- 5) Jack the climbing frame to contact with the connecting support of the transition section, and connect with four  $\phi 55$  pin mandrels and insert the lock pin.
- 6) Pull out the safety pin and retract the hydraulic cylinder.

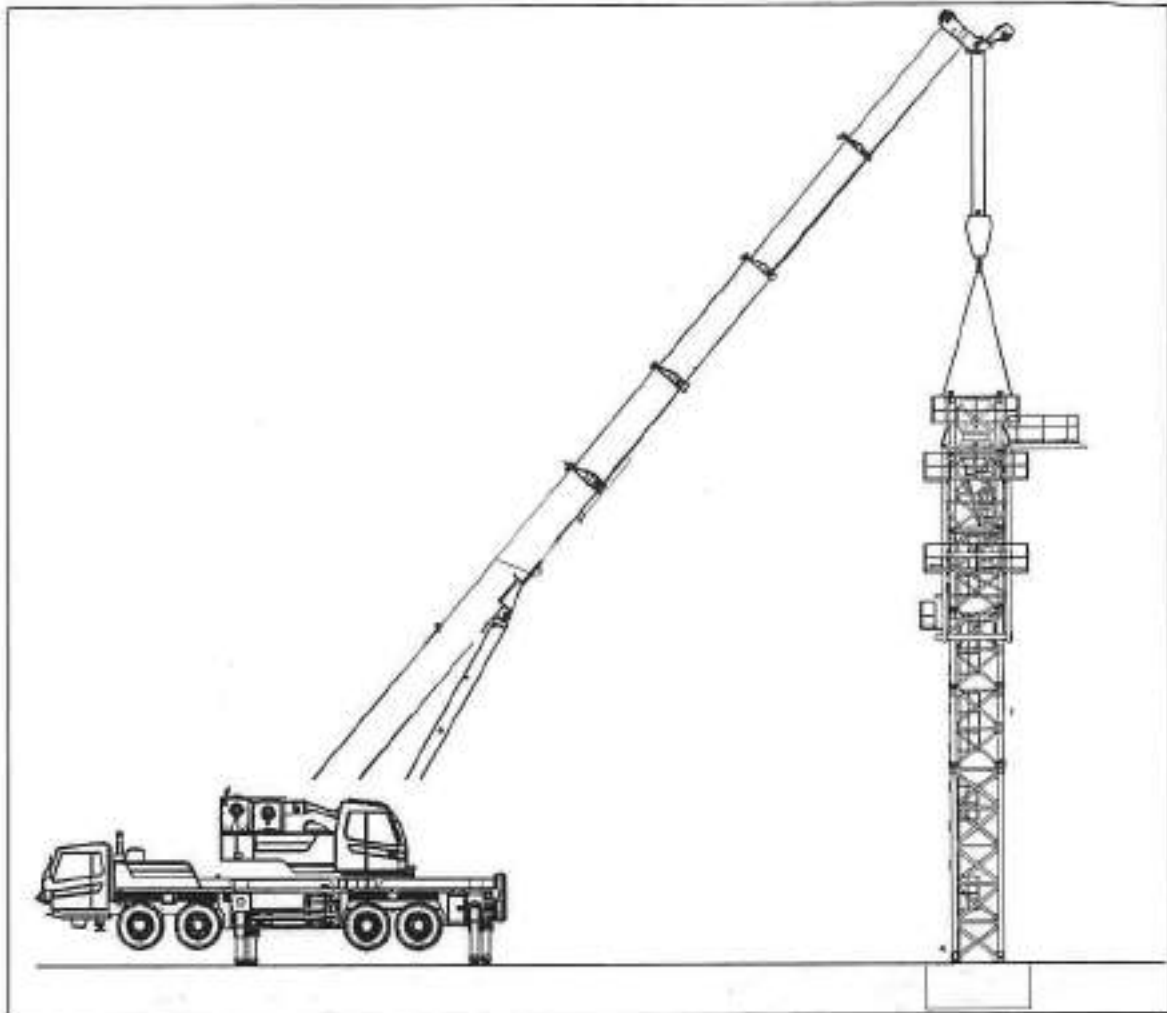


Fig.4-33 Hoisting of transition sections and climbing frame

#### 4.2.7 Installing slewing assembly

##### Assembling of slewing assembly:

1. Installation of slewing support: Connect the lower support, slewing support and upper support with 120 pieces M27 high strength bolts of grade 10.9. The preload torque of each bolt shall reach 1,350 N·m, and it shall be tightened and loosened with double nuts. Fix the 2 slewing mechanisms on the upper support with 12 pieces M16 bolts of grade 8.8 respectively, and the preload torque of each bolt shall reach 190 N·m.

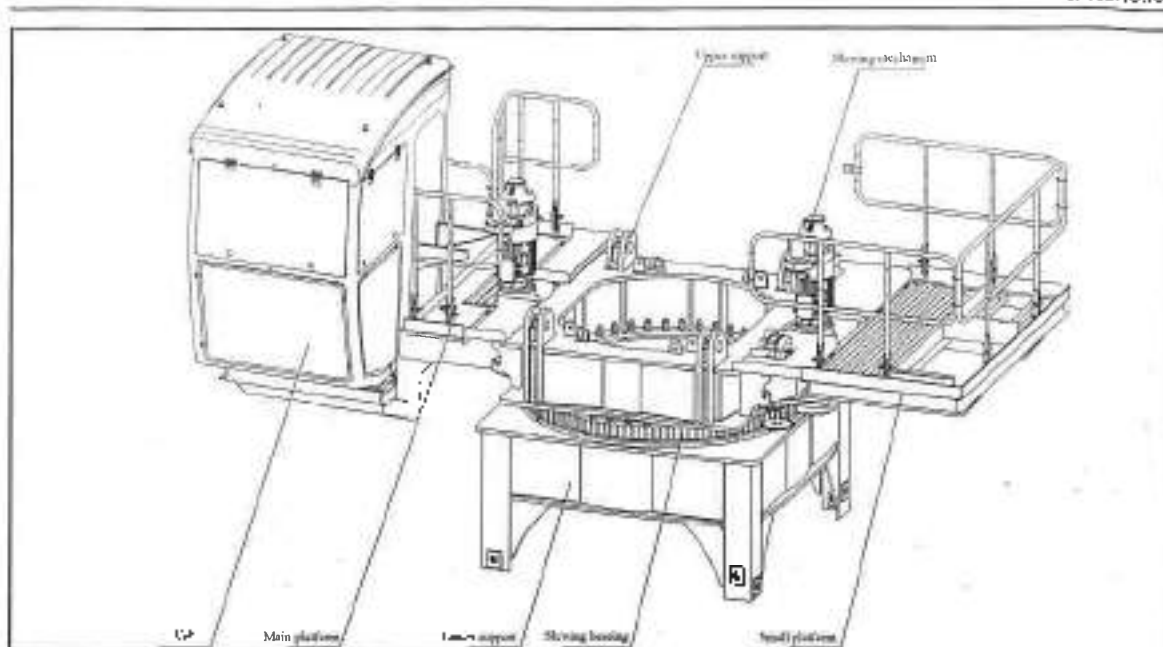


Fig.4-34 Installation of slewing support

2. Platform installation: Hang the installation pin on the platform into the hook of the platform hanging plate of the upper support, lock the upper part with a fixed pin, and insert the cotter pin to complete the assembly of the platform. Then install the guardrail at the opposite position of the platform, and fix the adjacent guardrail with bolt assembly. Finally, install the cab on the main platform with 4 sets of pin mandrels and cotter pins.

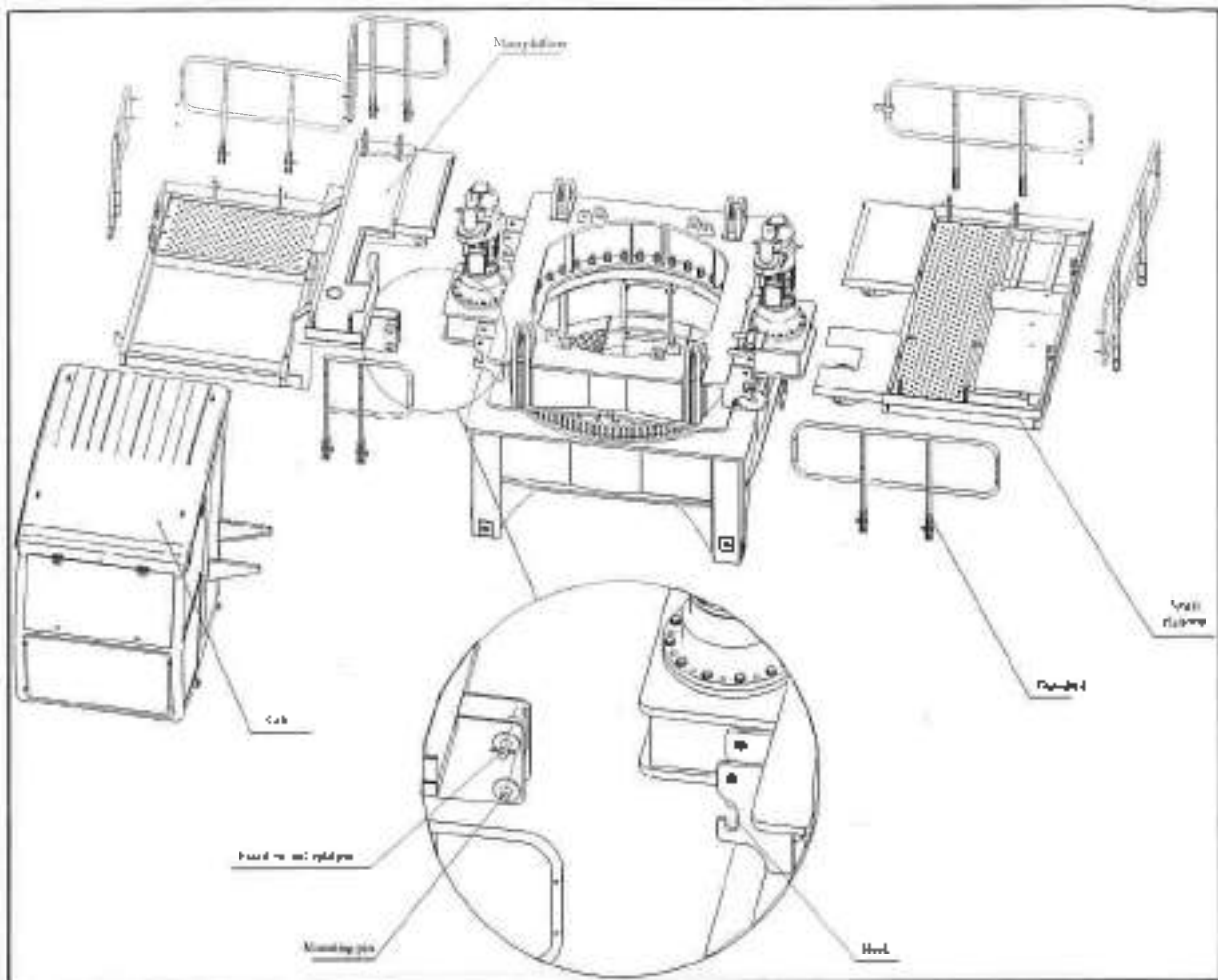


Fig.4-35 Platform installation

### Hoisting process

1. Lift the slewing assembly through the four lifting lugs of the upper support, align the connecting plate of the lower support with the fishplate of the transition section, and slowly put it down. Place the slewing assembly on the top of the tower and connect it  $\phi 55$  pin mandrel assembly.

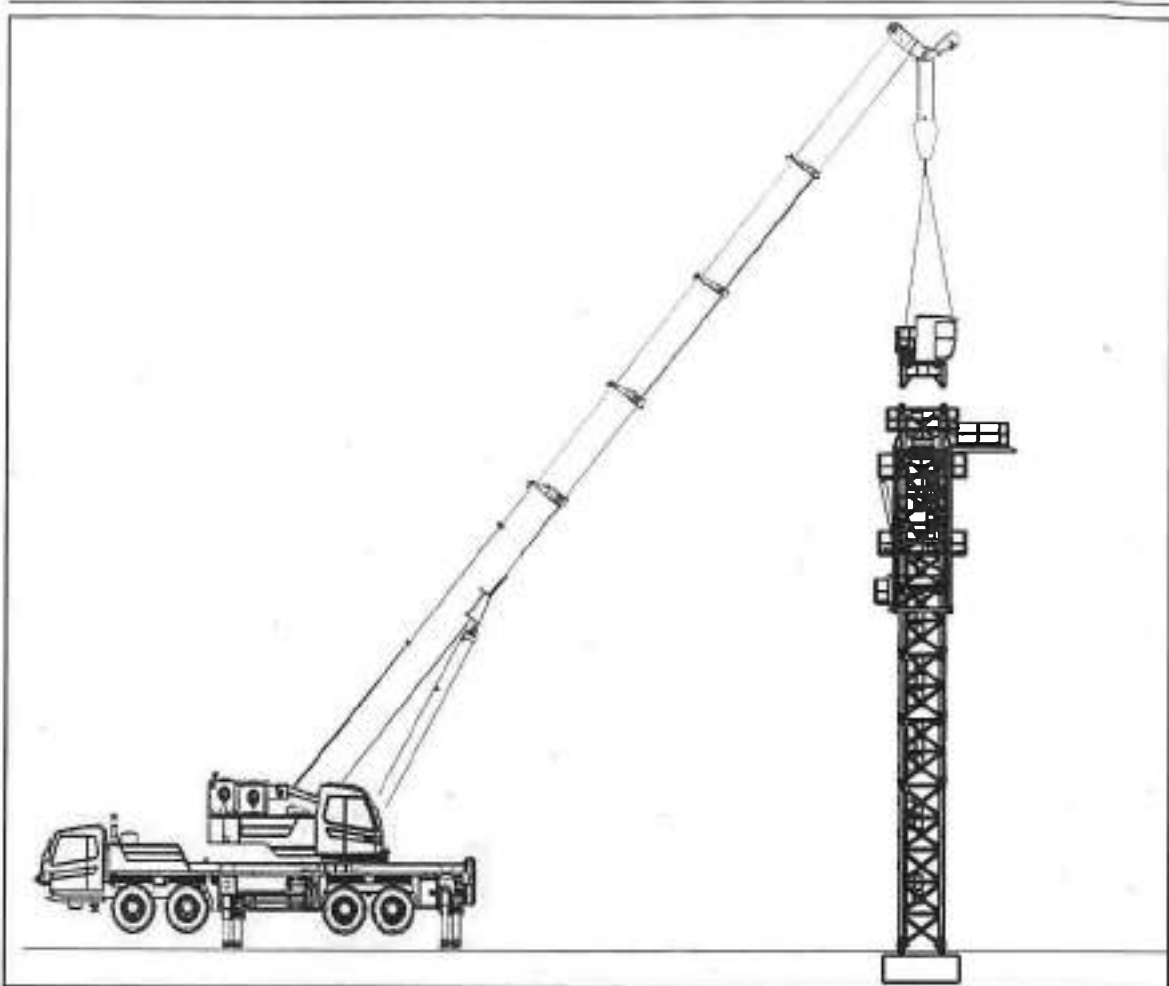


Fig.4-36 Connection between slewing assembly and transition sections

2. The channel direction of the lower support shall be consistent with that of each section of the tower.

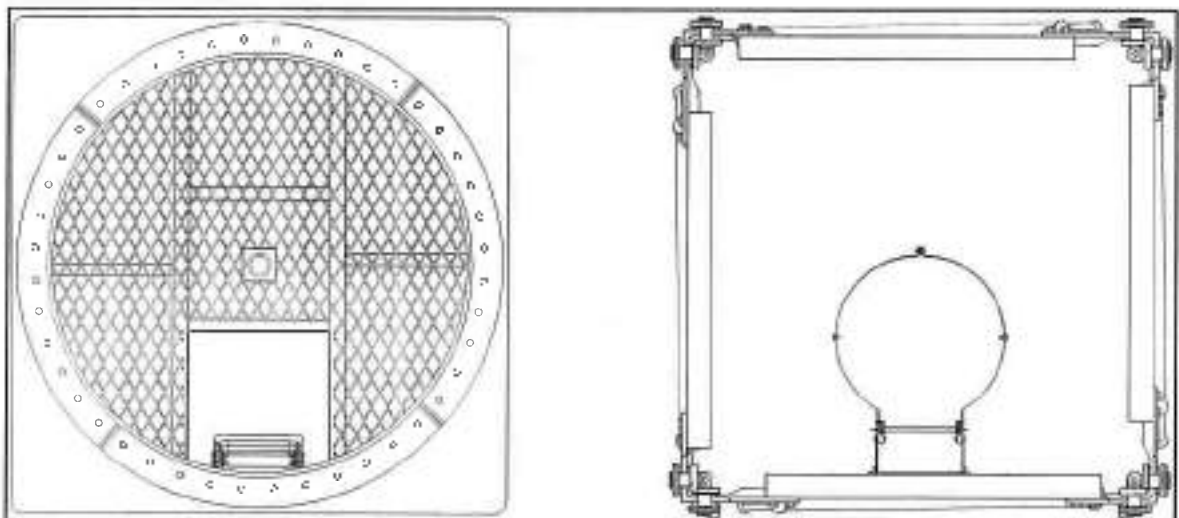


Fig.4-37 Channel between lower bearing and lower section

#### 4.2.8 Installing tower head assembly

1. The tower head assembly is composed of tower head structure, load moment indicator and support roller.
2. Installing load moment indicator
  - 1) Tighten the three lock bolts (M6×20) on the side of the load moment indicator, remove the front cover of the load moment indicator, unscrew the M8 nuts of the module on one side equipped with microswitch, and connect the module with the 2 holes in the middle of the right bow plate through M8 bolts, similarly, connect one side module with M8 bolt to the left bow plate. After installation, it shall ensure that the microswitch and M12 bolt match with other on the same plane; close the front cover and tighten the lock bolts on the three sides to complete the installation (the front cover can be closed after the calibration is completed).

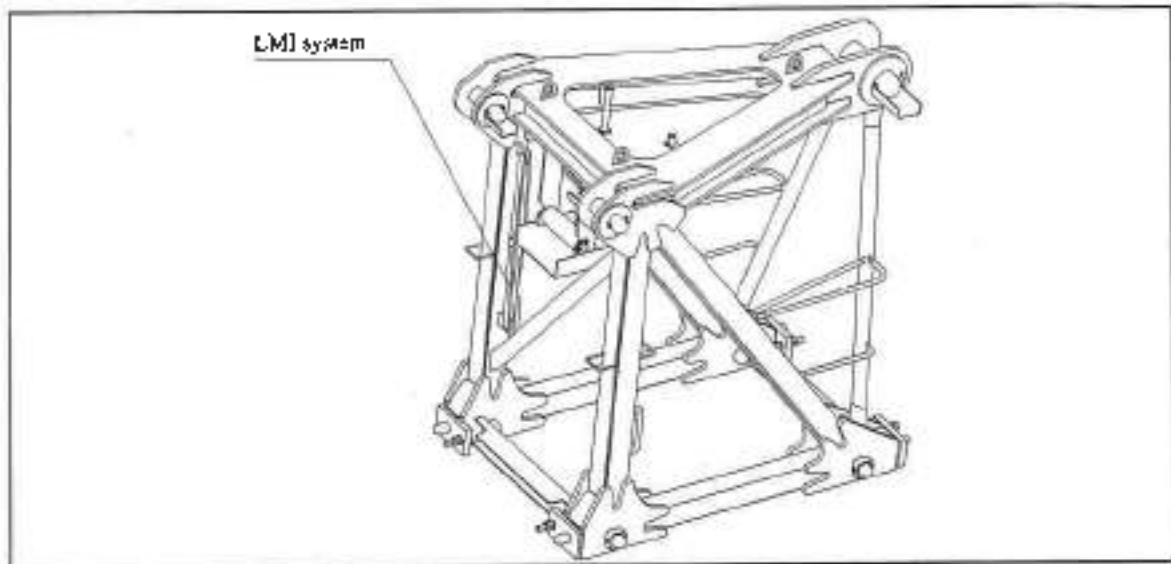


Fig.4-38 Installation schematic diagram of torque limiter

- 2) The torque limiter and anemometer harness shall be coiled and tied to the bow plate at the tower head, as shown in the figure:

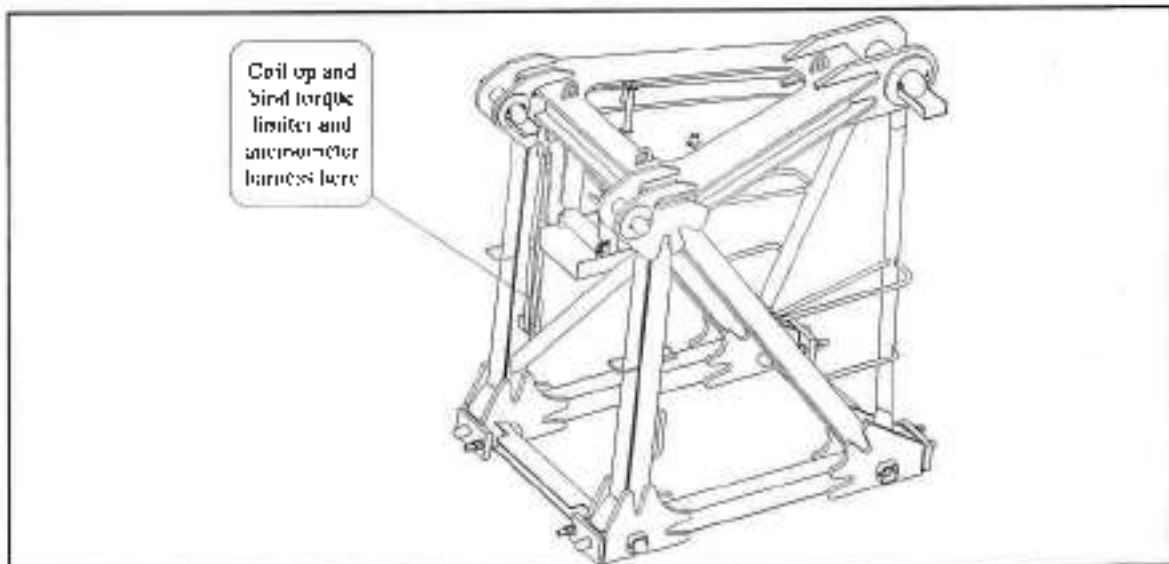


Fig.4-39 Harness binding diagram

### Hoisting process

1. Hang the lifting tool on the lifting lug of the tower head assembly. Lift it up and slowly lower it onto the upper support. It shall be noted that one side of the connecting end of the square arm is aligned with the direction of the counter boom.

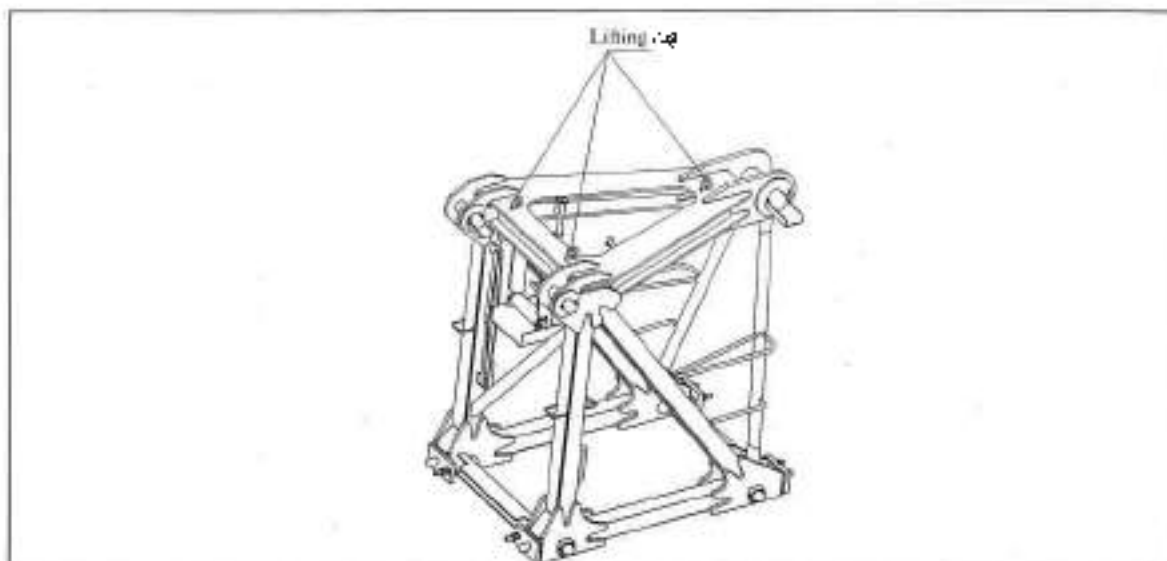


Fig.4-40 Hoisting tower head assembly

2. Use  $\phi 75$  pin mandrel, centering pin and cotter pin to connect the tower head assembly with the upper support.

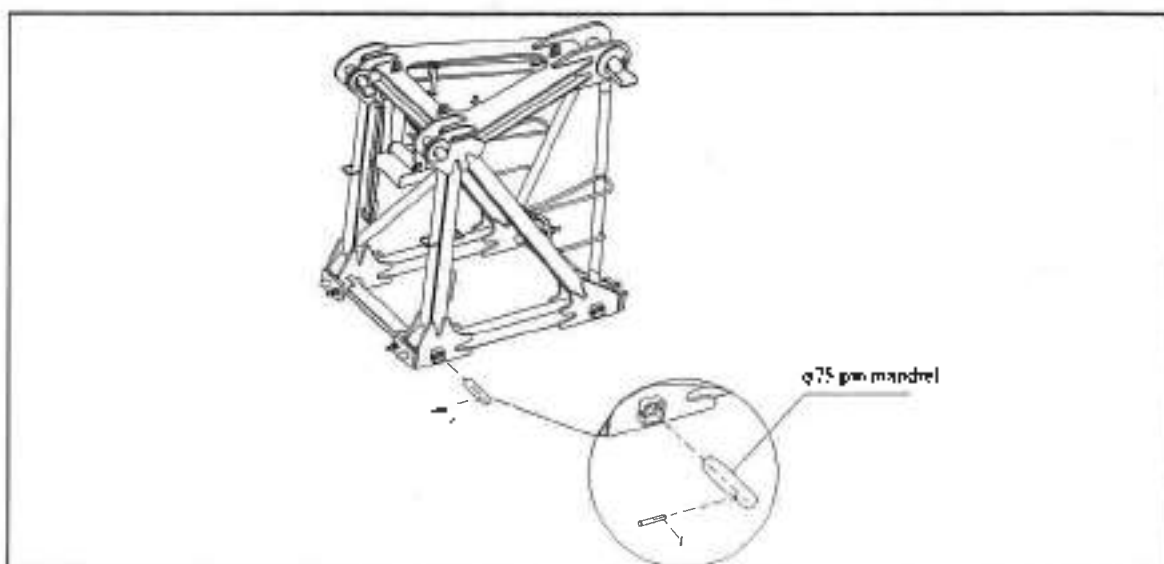


Fig 4-41 Connection between tower head assembly and upper bearing

### 4.2.9 Installing the counter boom

#### Composition of counter boom

1. The counter boom includes counter boom I, counter boom II, platform, guardrail, hoisting mechanism, maintenance rack and some counter boom links. The crane maintenance frame is used for the lifting motor during maintenance of the mechanism, and its maximum load capacity is 1.2 t.

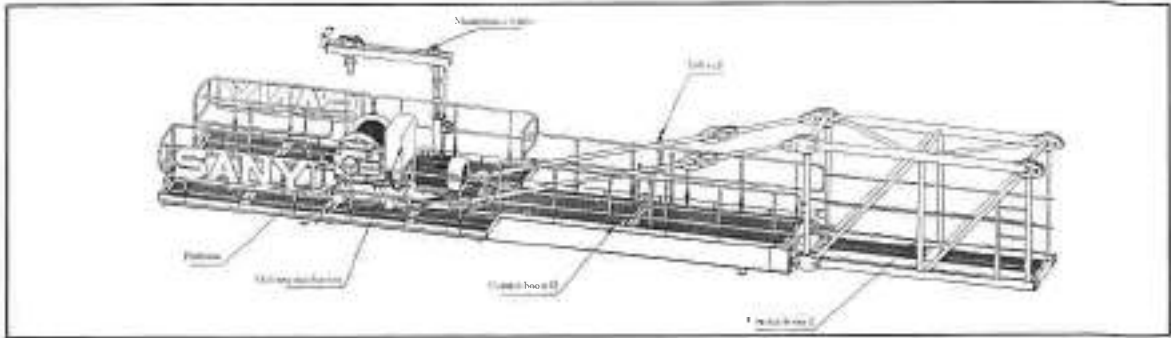


Fig.4-42 Composition of counter boom

Complete the assembly of the counter boom on the ground, and divide the 2 boom sections into 2 groups for assembly:

1. Assemble the counter boom I with the corresponding checker plate, chute and link into a square boom assembly, as shown in the figure.

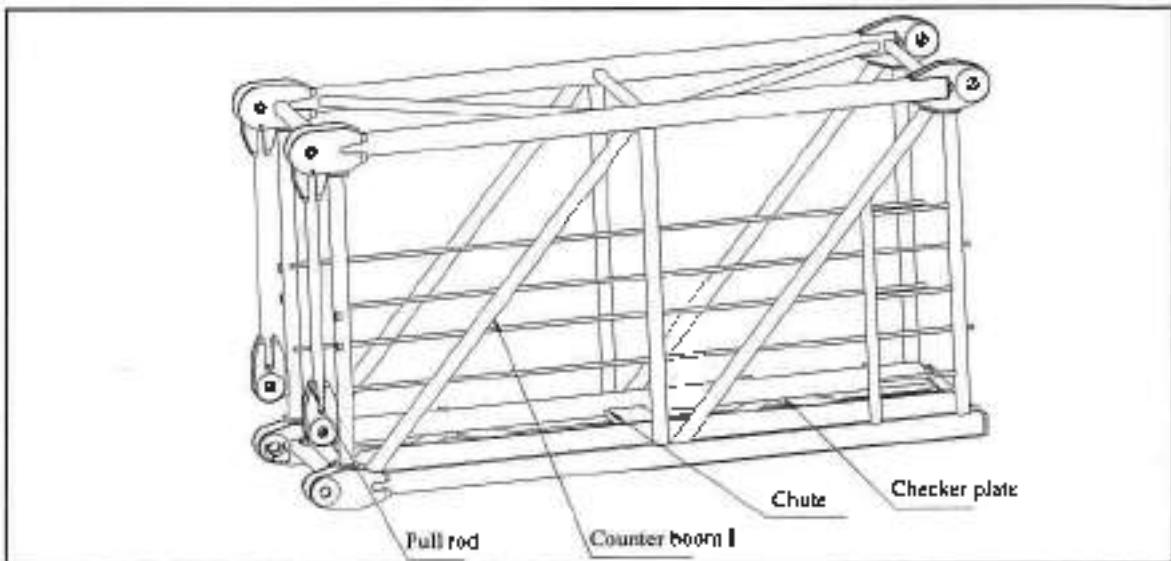


Fig.4-43 Square boom assembly

2. Use  $\phi 16$  pin and cotter pin to assemble the four platforms on the left and right sides of the counter boom II

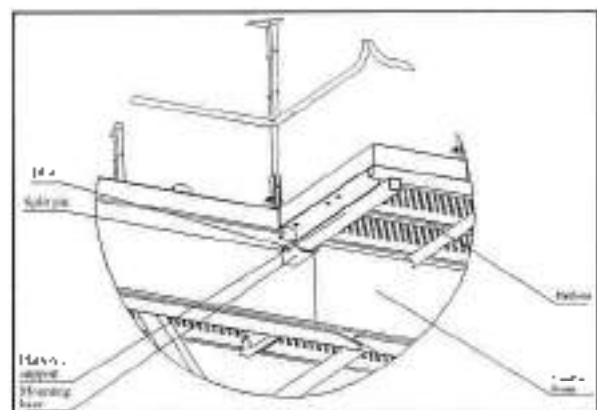


Fig.4-44 Installation of platforms



3. Fix the hoisting mechanism and maintenance rack on the counter boom II.
4. Install the guardrail in the corresponding mounting plate of the counter boom II and the platform, and fix it with M16 bolts. The guardrail is firmly connected with M8 bolts.
5. Install the 2 pieces of counter boom link II on the counter boom II link lug.

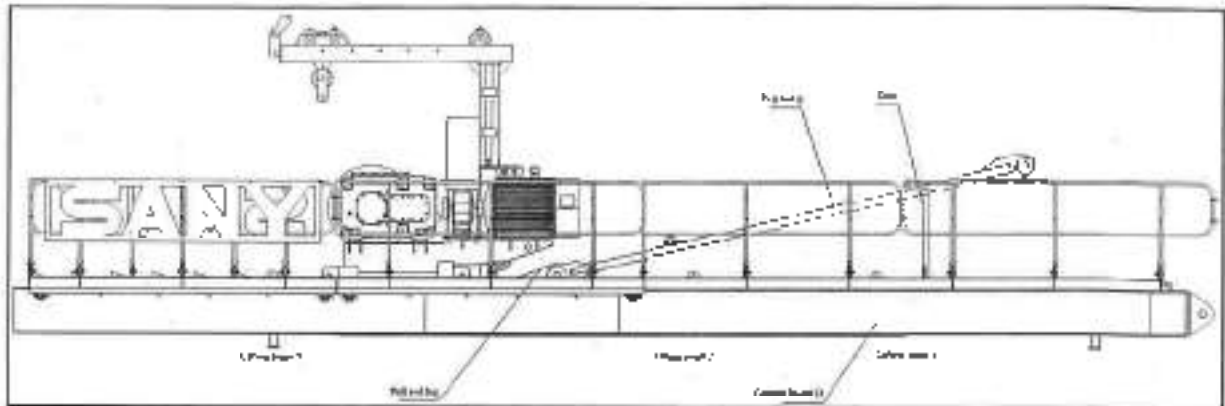


Fig.4-45 Schematic Diagram of link installation and lifting point

#### Hoisting counter boom assembly:

1. Use the temporary power supply of the slewing mechanism to rotate the upper structure of the tower crane to the position convenient for the installation of the crane boom.
2. Lift the square boom assembly to the installation height. Upper end is connected with the ear plate of the tower head by  $\varphi 80$  pin mandrel assembly (pin mandrel, bolts and cotter pin); the lower end is connected with the tower head with M30 bolt assembly (bolt, washer and nut) after being positioned with guide pin on the tower head.
3. Take lifting point 2 and 3 to lift the counter boom II. Put and align the pinhole on the main beam of the counter boom into the pinhole on the square boom matched with it and fix its axial movement by  $\varphi 70$  pin mandrel assembly (pin mandrel, bolts and cotter pin). Raise the tail of the counter boom gradually and connect the counter boom link II with the link I on the square boom with  $\varphi 70$  pin mandrel assembly (pin mandrel, bolts and cotter pin).

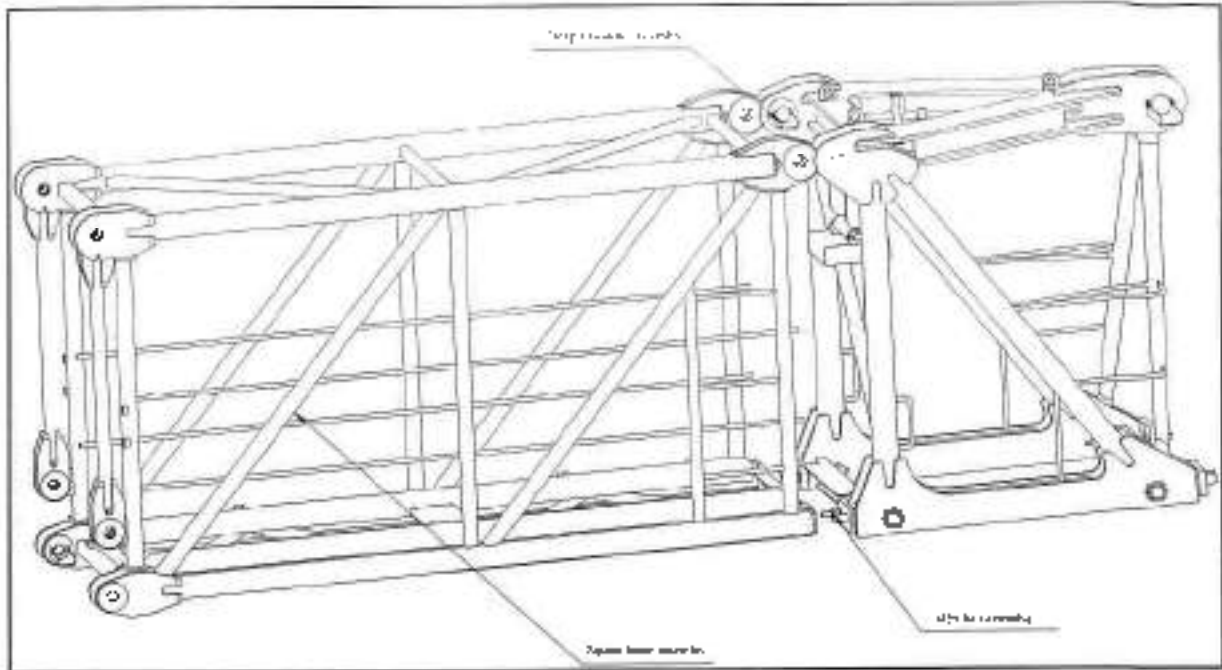


Fig.4-46

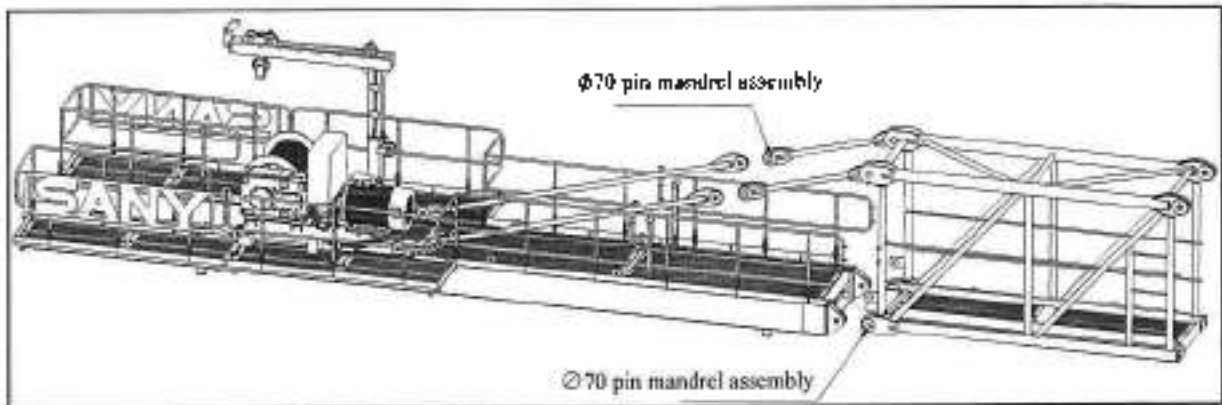


Fig.4-47 Hoisting of counter boom assembly

4. Slowly lower the counter boom to make the link under tension.
5. Hoist another 2 blocks of 4.0 t counterweight.

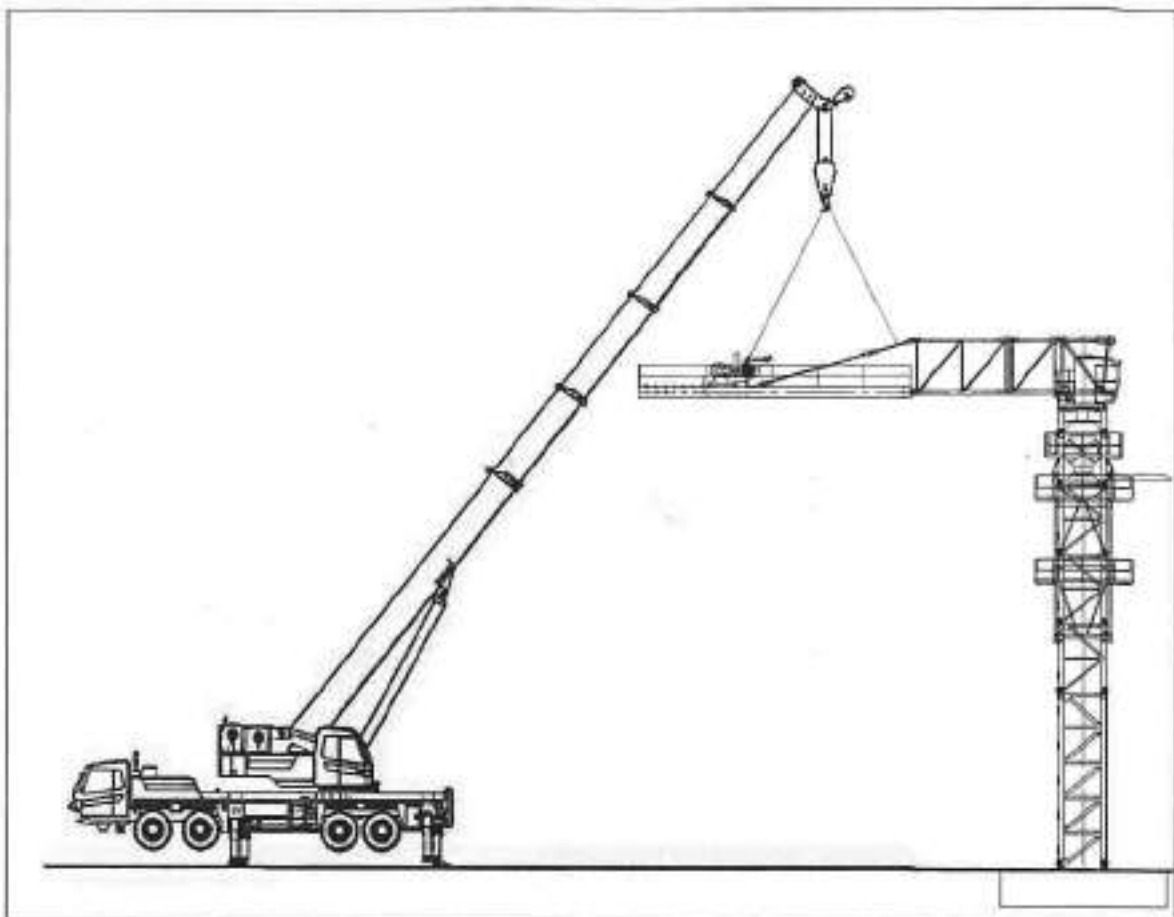


Fig.4-48 Hoisting of counter boom

### *Caution*

The installation sequence of counterweight block must be from near (tower) to far (tower).

### *Caution*

1. The stopper of the mounting pin must be close to the counterweight; 2. The counterweight shaft must exceed the counterweight hanging plate on which the counterweight is installed on the counter boom; 3. The first 4.0 t counterweight is close to the transverse web of the counter boom, and the counterweights shall be close to each other.

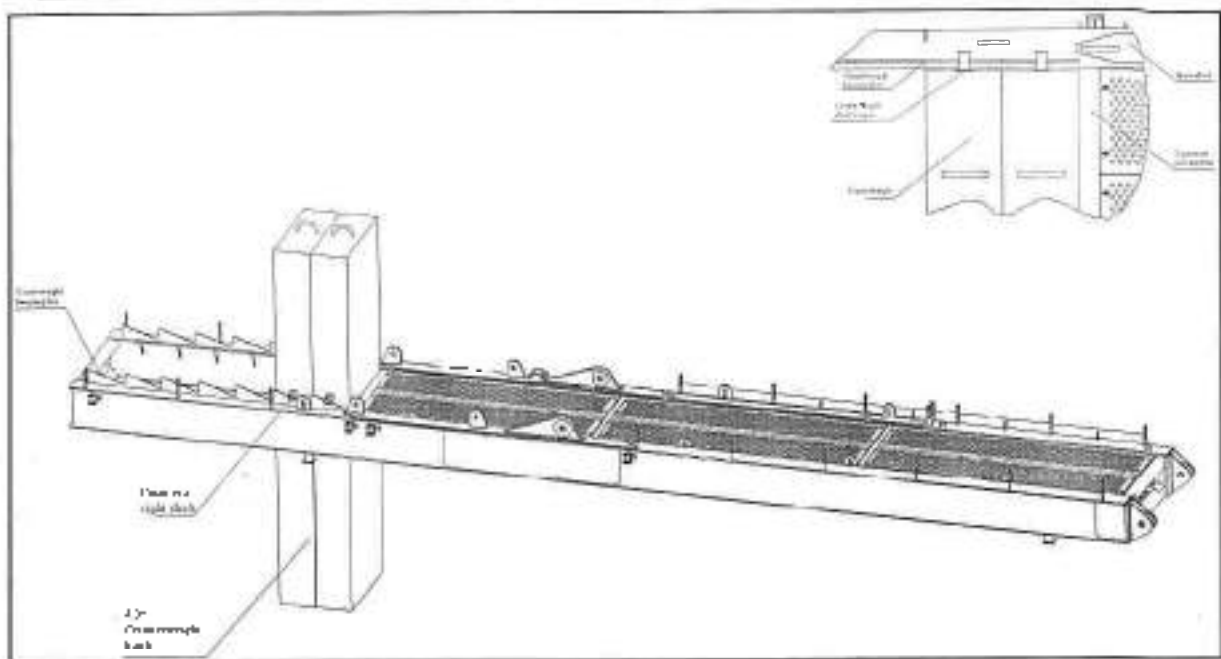


Fig.4-49 Schematic diagram of balance weight

#### 4.2.10 Installing the crane boom assembly

1. The crane arm assembly includes crane arm, load bearing bogie and luffing mechanism. The crane arm length combination is shown in the figure below.

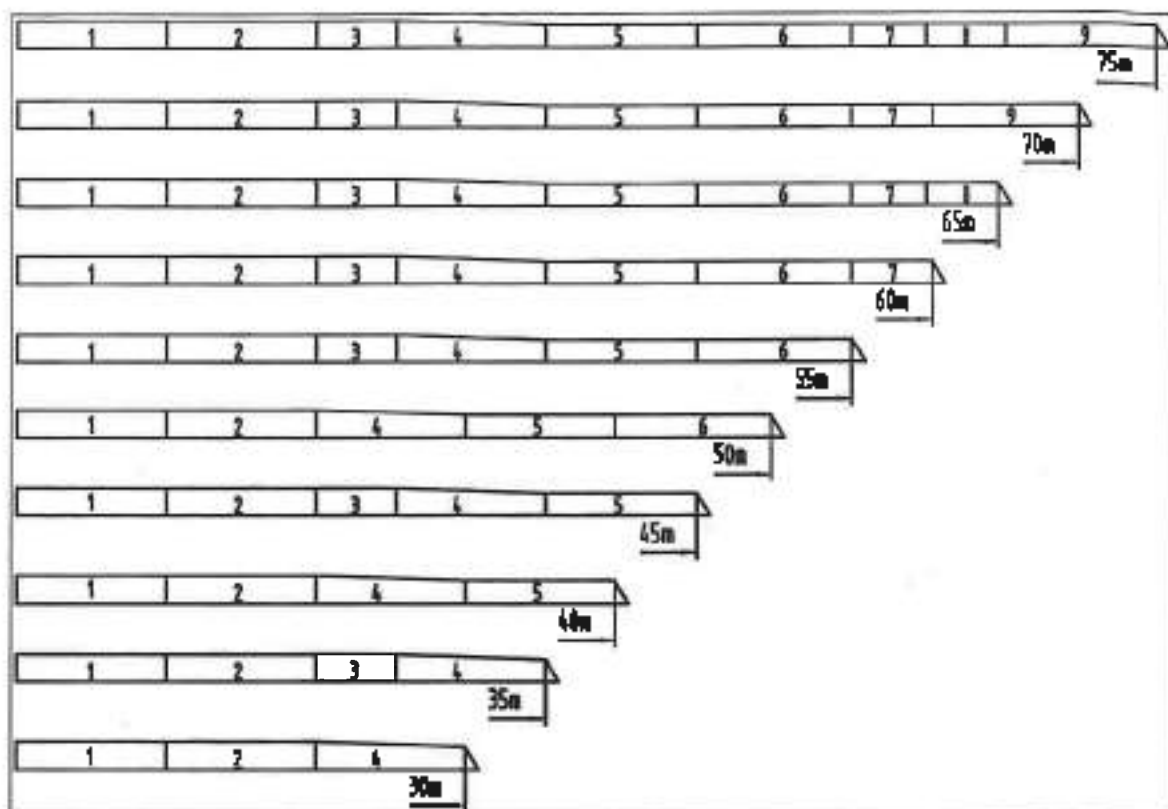


Fig.4-50 Crane arm length combination

1. When the boom is installed with a boom length of 40 m or less, in order to increase the windward area on the boom side, two shades shall be installed near the boom tip.

2. The shade shall be prepared by the user. It is recommended to use u-shape bolts for the connection between the shade and the boom (each set of bolts includes one u-shape bolt M16, two flat washers, two elastic washers and two M16 nuts). At each web member, the shade needs to be drilled to connect with the crane boom. Users can also adopt other connection methods according to the actual situation of the construction site, but they must ensure that the shade is firmly fixed and will not damage the crane boom.

3. The shade is installed on the boom tip side of the crane arm, as shown in the figure below. The u-bolt installation hole on the shade needs to be drilled to ensure the smooth installation of the shade.

4. The connecting hole of the u-shape bolt on the shade needs to be drilled after the shade is matched with the crane boom. The shade shall be connected with each diagonal web member of the boom, and the connecting hole shall be drilled on the upper and lower profiled pipes.

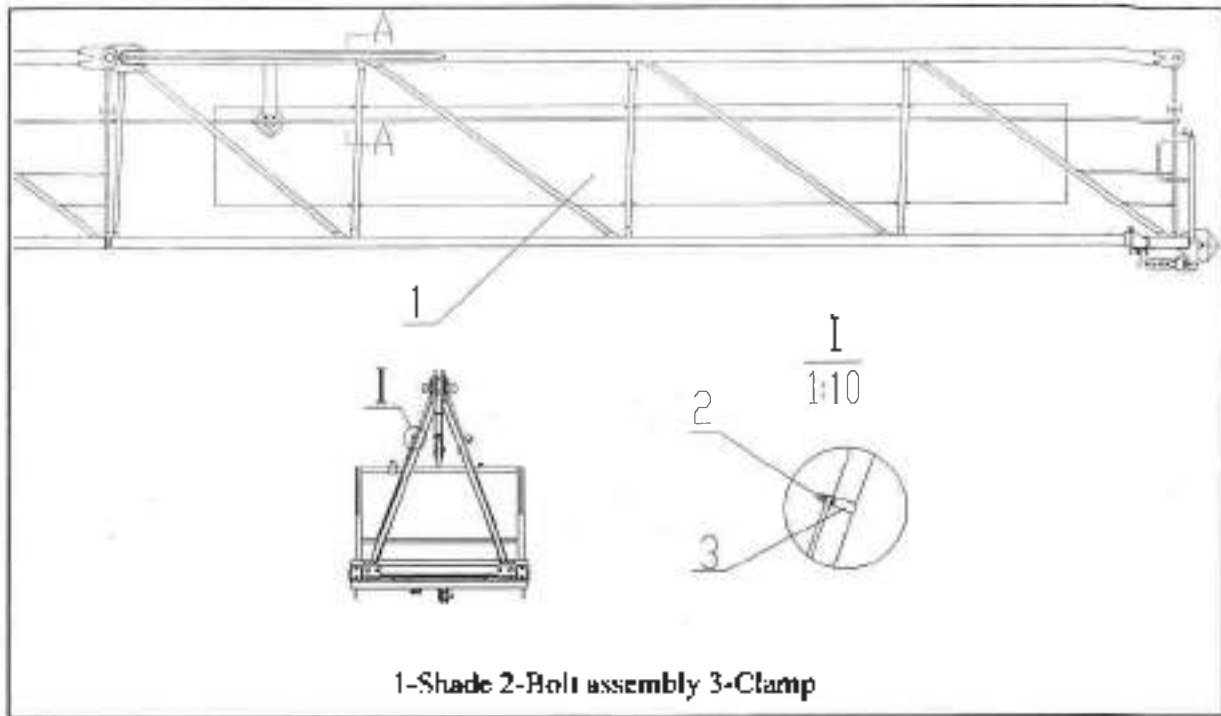


Fig.4-51 Shade

**Assembly process of crane boom assembly:**

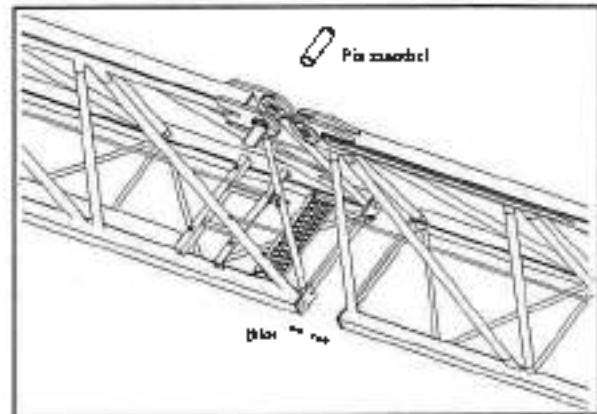


Fig.4-52

1. Assemble the crane boom on the flat sleeper (or support, about 0.6 m high) near the tower crane. Please refer to the following table for the use of pin mandrels.

Tab 4-5 Specification of connecting pin

Boom sections connection	①-②	②-③ ③	③-④	④-⑤	⑤-⑥	⑥-⑦	⑦-⑧	⑧-⑨	⑨-⑩
Upper chord pin mandrel	$\phi 105 \times 285$	$\phi 90 \times 260$		$\phi 75 \times 225$		$\phi 50 \times 170$		$\phi 50 \times 155$	-
Lower chord bolt	M27 × 120								

- Fasten the maintenance basket on the load bearing bogie, and install the bogie near the minimum radius of the root of arm section I.

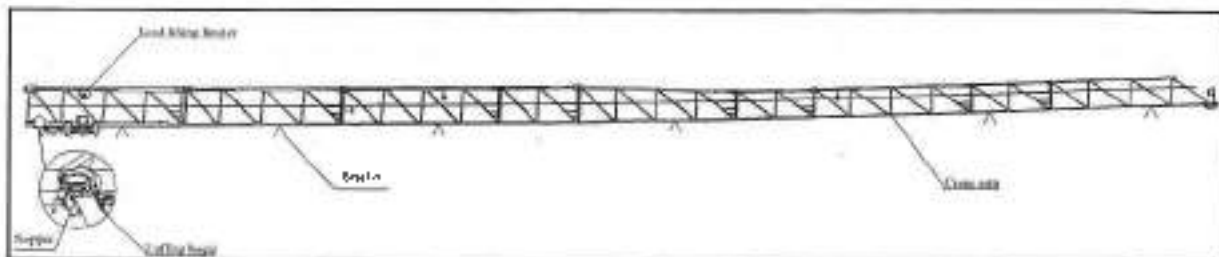


Fig 4-53 Schematic diagram of crane arm assembly

Install the load lifting limiter (Install the load lifting limiter on the boom section I with  $\phi 25$  pin mandrel. The steps are as follows: 1. The indicating arrow is posted on the tension ring, and the indicating direction is pointed by the  $\phi 25$  pin mandrel weight sensor; 2. Remove  $\phi 25$  pin mandrel at one end of the connecting plate assembly, take out the spacer bushing hanging on the pin mandrel, and install the tension ring with correct pointing on  $\phi 25$  pin mandrel end of the tension ring, place spacer bushing on both sides, and connect with  $\phi 25$  pin mandrel, and insert the cotter pin; 3. The other end of the tension ring is connected with pin mandrel type weight sensor, clamped with a clamping plate, and fixed with M10 mounting bolts (the indicating direction of the pin mandrel weight sensor is consistent with that of the tension ring).

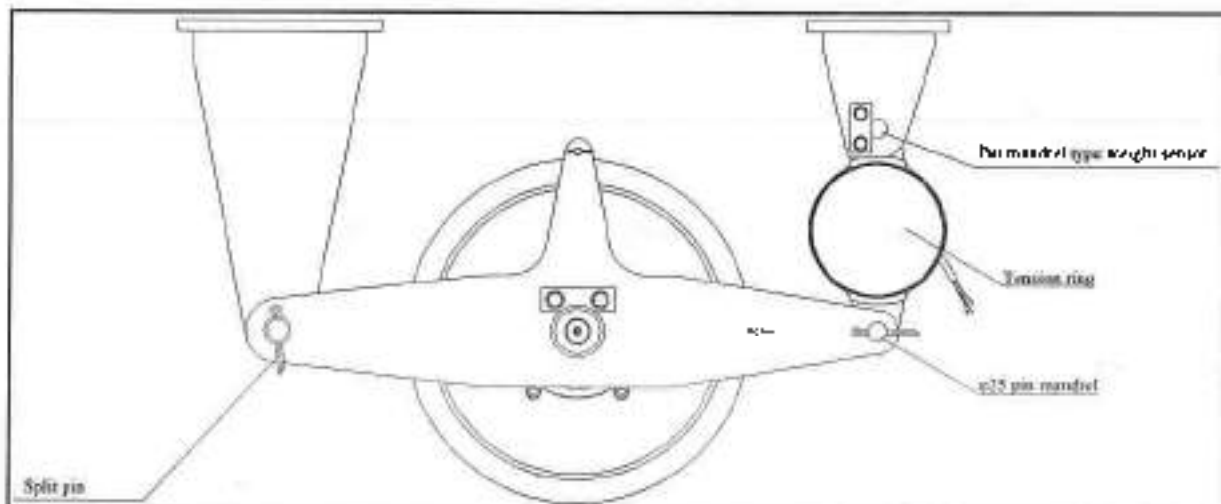


Fig.4-54 Load lifting limiter

When hoisting the crane boom, the wire rope shall not be wound in the middle of the inclined web member, and inclined hoisting is strictly prohibited.

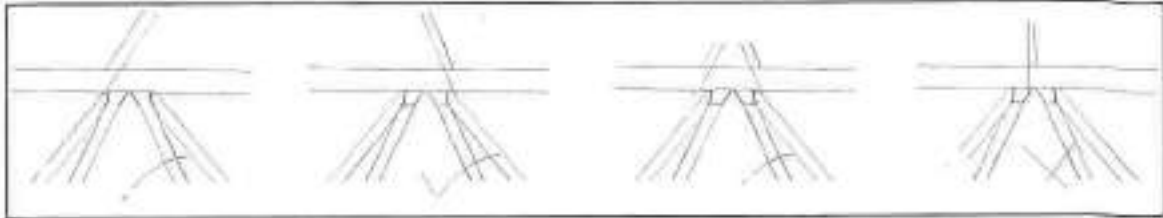


Fig.4-55

### Installation and tensioning of boom hoist rope

1. The bogie stops at the root of the crane arm and is fixed to the crane arm through a pin mandrel.
2. The rear boom hoist rope (short rope) is fixed on the ratchet (tension device) through the rope threading hole (broken rope protection device) at the rear of the luffing bogie through the arm root guide pulley; the front rope (long rope) passes through the guide pulley in the middle and head of the crane arm and is fixed on the wedge sleeve with rope clamp through the rope threading hole (broken rope protection device) in the front of the trolley.
3. Start the luffing mechanism and tension the front rope (long rope).
4. Adjust the ratchet with a wrench to tension the boom hoist rope.
5. Actuate the bogie and travel back and forth several times over the full length of the crane arm to make the tension evenly distributed on the front and rear wire ropes. Use a wrench to loosen and remove the wire rope during disassembly.

#### ⚠ Attention

When fixing the wire rope with rope clamp, be sure to follow the use specification of rope clamp in subsection 4.2.11.

#### ⚠ Attention

Three circles of safety rope must be reserved on the spool type cartridge for boom hoist rope, and one circle of isolation rope must be reserved on the spool type cartridge. When changing the arm length of the crane arm, the excess luffing wire rope shall be holed and fixed on the bogie.

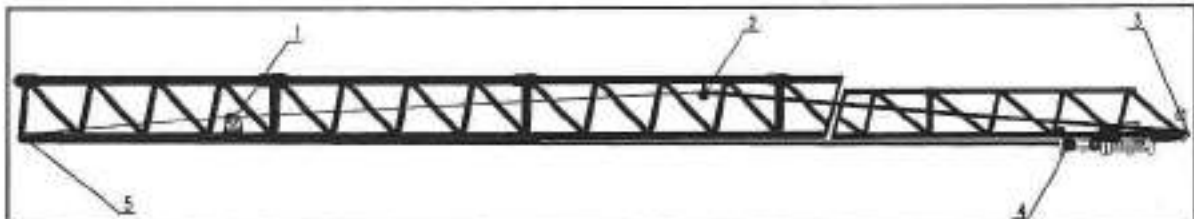


Fig.4-56



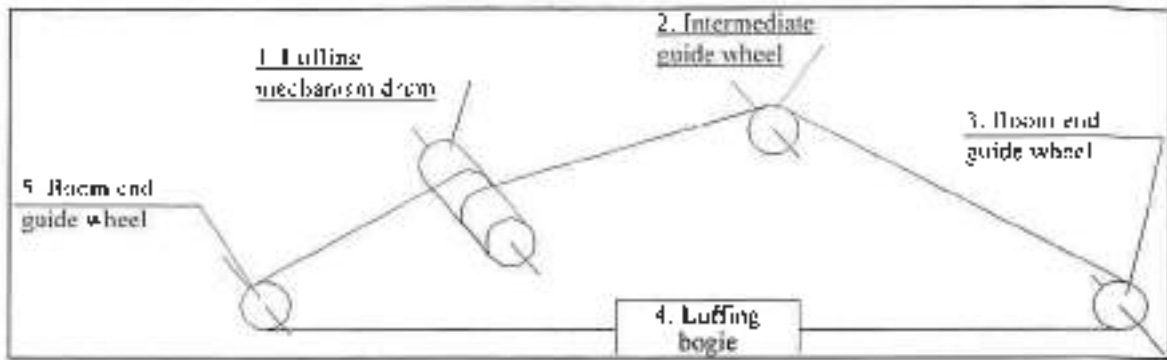


Fig.4-57

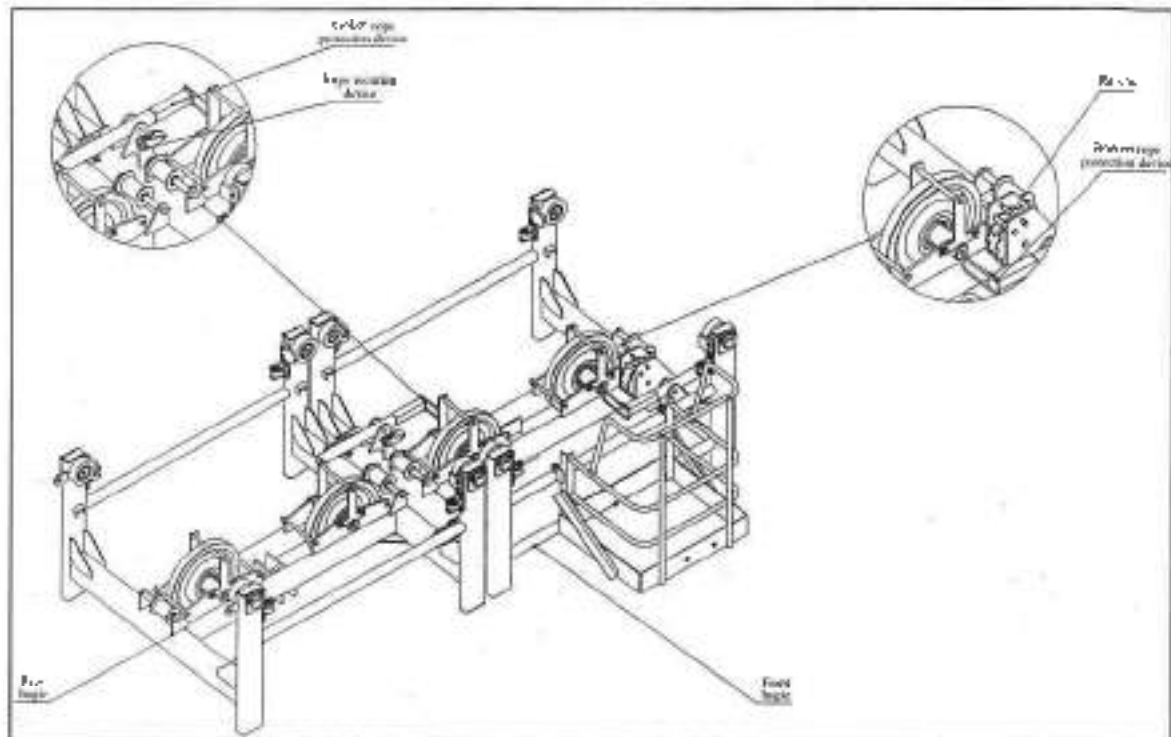


Fig.4-58

### Huisting of crane boom assembly

1. Use the temporary power supply of the slewing mechanism to rotate the upper structure of the tower crane to the position convenient for the installation of the crane boom.
2. Hang the rope according to the figure below, and the hoisting center is shown in the table below; check whether the lifting is balanced. Otherwise, move the hanging rope properly and lift the crane arm assembly to the installation height.

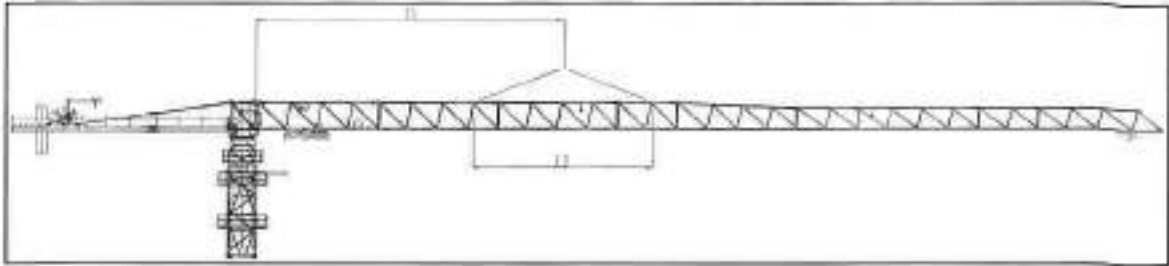


Fig.4-59 Hoisting of the crane arm

Length of crane boom (m)	75	70	65	60	55	50	45	40	35	30
Center of gravity distance L <sub>1</sub> (m)	25.3	23.8	23.0	21.7	20.6	17.9	16.9	14.8	13.8	11.8
Span L <sub>2</sub> (m)	$8 \leq L_2 \leq 20$									

**⚠ Attention**

When hoisting the crane boom, the position of the lifting point shall be recorded and marked for use when dismantling the tower.

3. Connect the boom assembly and the tower head assembly. Top chord is connected through  $\phi 120$  pin mandrel assembly, and the lower chord is connected with M30 bolt assembly after being positioned through the guide pin of the transition section.

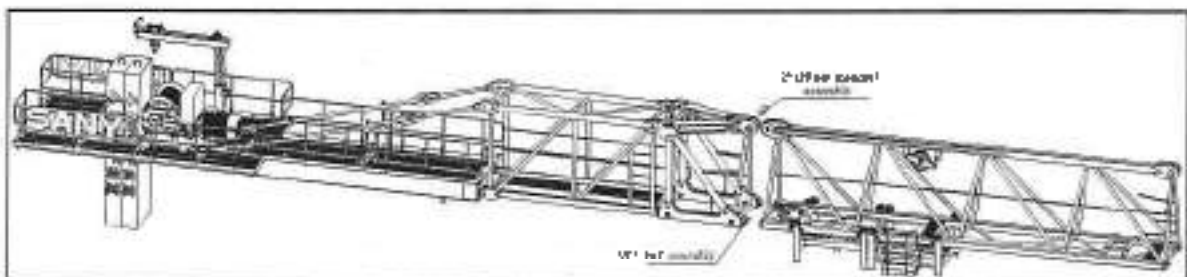


Fig 4-60 Installation of crane arm

#### 4.2.11 Installing other counterweights

1. Hoist the remaining counterbalance according to the length of the installed crane arm (the 75 m arm is shown in the figure, and refer to the counterbalance configuration table in Chapter 4.1.4 for other lengths).

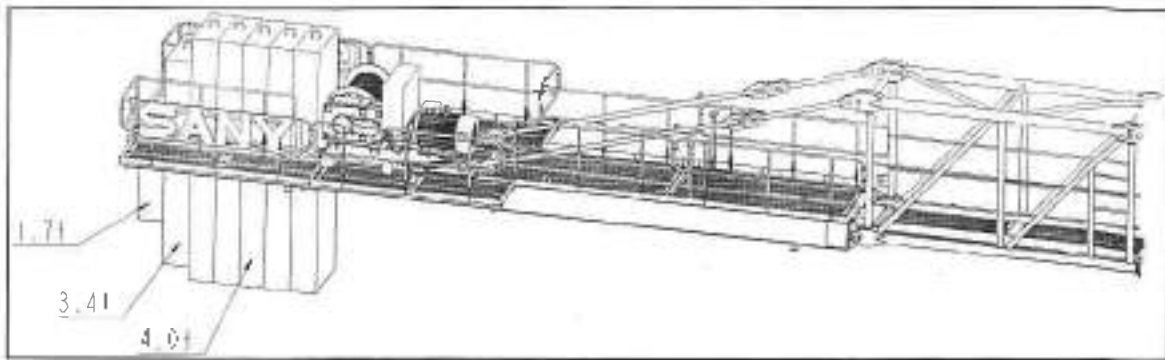


Fig.4-61 Hoisting of other counterbalance (75 m arm)

#### 4.2.12 Threading and winding hoisting wire rope

1. After the counterweight is hoisted and installed, the hoisting wire rope shall be wound.

The hoisting wire rope is released from the spool type cartridge of the hoisting mechanism, passes through the lifting weight limiter pulley of arm section I through the tower head guide supporting pulley, winds downward to the arm root pulley of arm section I, and then winds forward to the luffing bogie and hook pulley block. Finally, the rope end is fixed on the anti-torsion device of the boom head with a pin mandrel through the rope clamp and wedge sleeve.

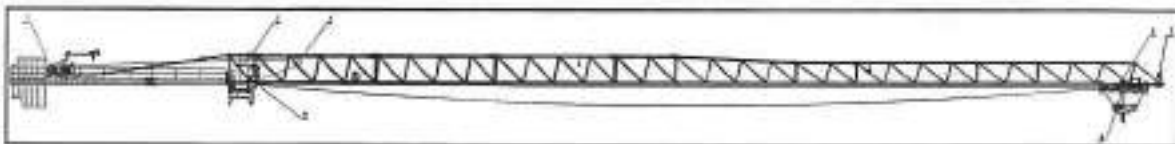


Fig.4-62 Threading and winding sequence of hoisting wire rope

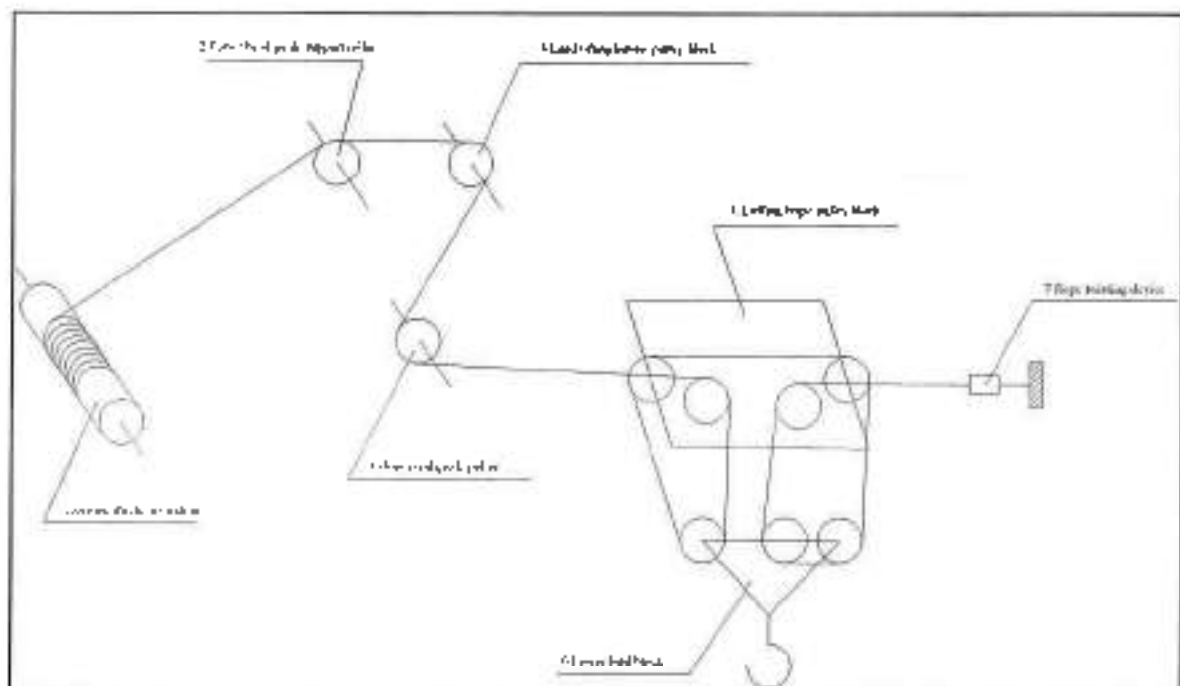


Fig.4-63 Schematic diagram of threading and winding

**Caution**

The lifting wire rope must pass through the wedge sleeve as shown in the figure below, and it is strictly prohibited to pass through it backwards.

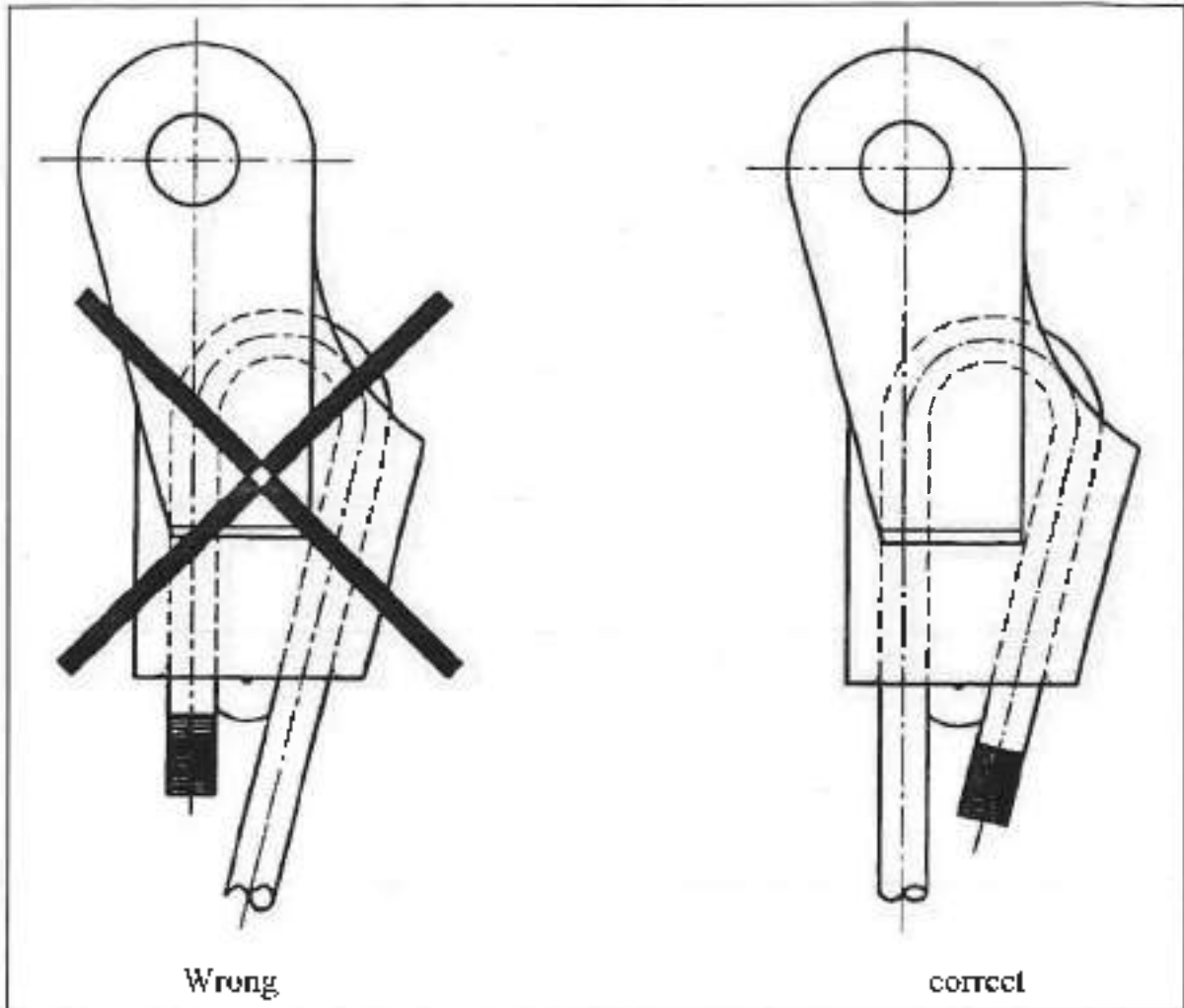


Fig. 4-64

### Caution

The rope clamp shall be used according to the specifications shown in the figure below: 1. The spacing  $A$  of rope clamp shall be equal to 6-7 times of the diameter of steel wire rope. The rope clamp closest to the collar shall be close to the collar as much as possible, but the correct tightening of the rope clamp must still be ensured, and the outer steel wire of the wire rope shall not be damaged. 2. The clamp holder shall be fastened on the working section of the wire rope, and the u-shape bolt shall be fastened on the tail section of the wire rope. It shall not be arranged alternately. 3. It is not allowed to reduce the quantity of rope clamp (3 pieces) at will. 4. When fastening the rope clamp, its reasonable stress must be considered. The rope clamp furthest from the collar shall not be fastened separately in advance. 5. In actual use, the rope clamp shall be checked after being loaded for one or two times. In most cases, the nut needs to be further tightened.

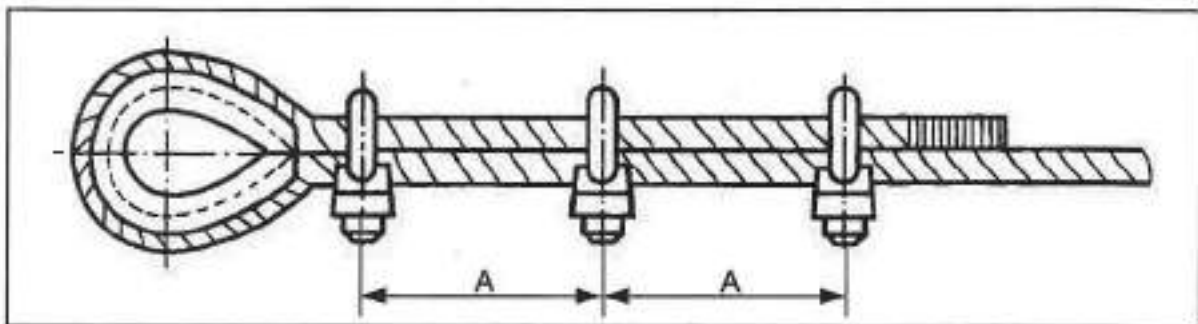


Fig.4-65

### Caution

When walking on the boom for inspection or maintenance, it is mandatory to buckle the safety belt on the handrail and take safety protection measures.

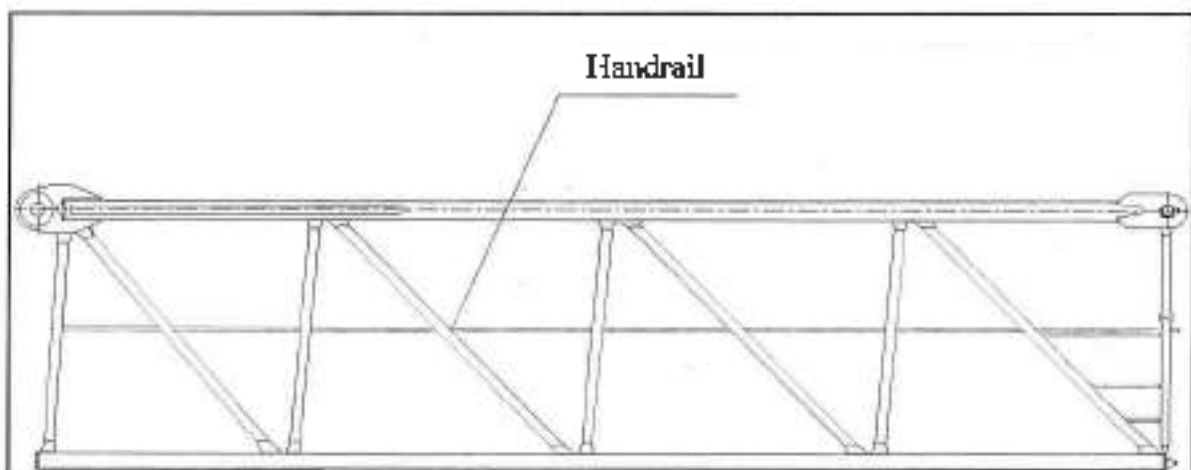


Fig.4-66 Schematic diagram of handrail

2. The luffing bogie is a double bogie structure, which is mainly composed of front bogie, rear bogie, working platform and connectors.

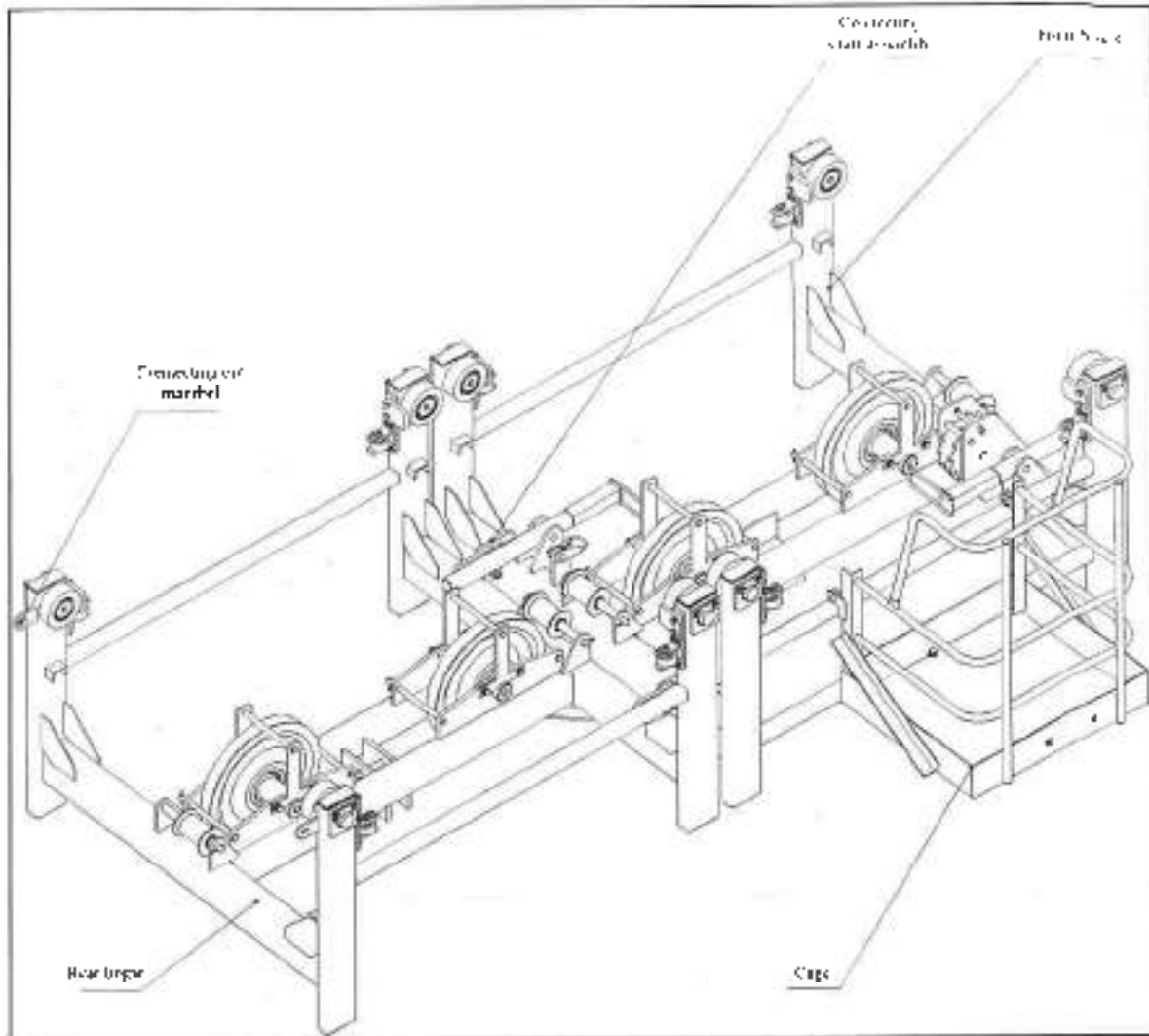


Fig.4-67 Twin bogie structure

3. The hook is mainly composed of hook block, pulley block 1, pulley block 2 and connecting plate.
4. Please follow the following operation procedure when switching from quadruple parts of line to double parts of line:
  - Park the trolley to the root of the boom and lower the hook to the ground and keep it vertical;
  - Remove the connecting pin rod connecting the main pulley and the auxiliary pulley block and hang it on the auxiliary pulley block;
  - Remove the pin mandrel firmly connected between the auxiliary pulley block and the connecting frame, and reinstall the above pin mandrel in the auxiliary pulley block after the auxiliary pulley block is separated from the connecting frame;
  - Lock the rear bogie at the root of the crane arm through the connecting pin mandrel, and remove the connecting shaft between the front and rear trolley to complete the switching of parts of line.
5. Please follow the following operation procedure when switching from double parts of line to quadruple parts of line:
  - Park the front bogie to the rear bogie at the root of the boom, install the connecting shafts of the two bogies, and remove the connecting pin between the rear bogie and the crane boom,
  - Lower pulley block 2 to the ground, and then continue to lower pulley block 1 to the ground,
  - Fasten the connecting pin rod between the pulley blocks, remove the pin mandrel 1 on the pulley block 1, and connect the connecting plate with the pulley block 1 with the pin mandrel 1;

- Lifting the hook to complete the switching for parts of line

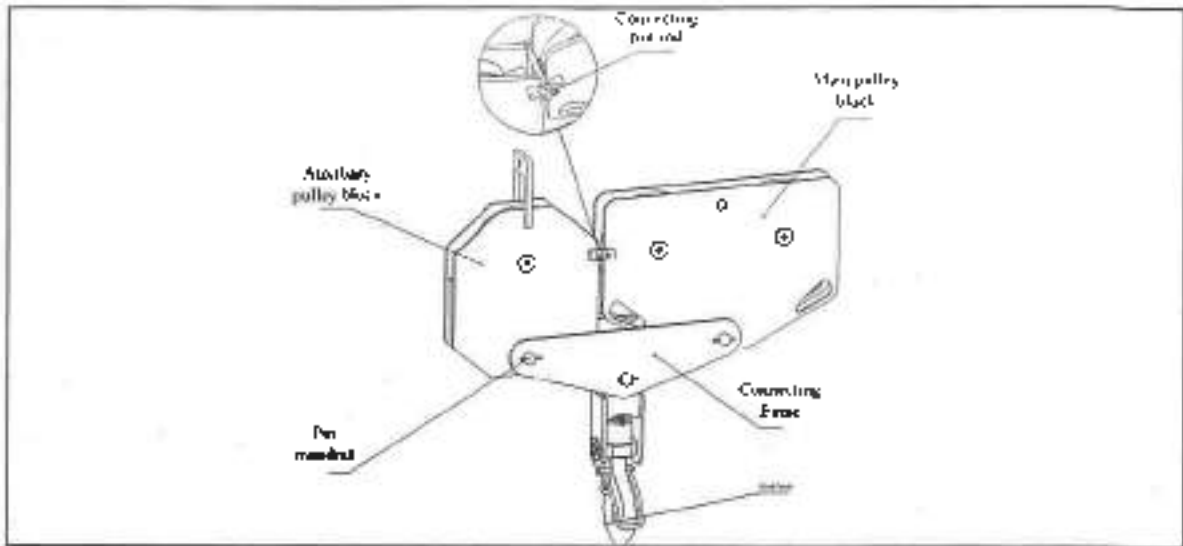


Fig.4-68 Hook group

6. The working state at each magnification is shown as follows:

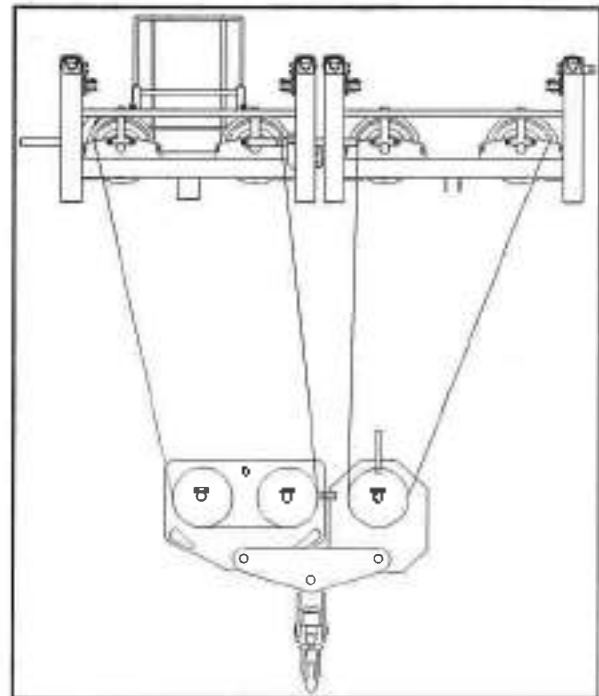


Fig.4-69 Schematic diagram of quadruple parts of line working state

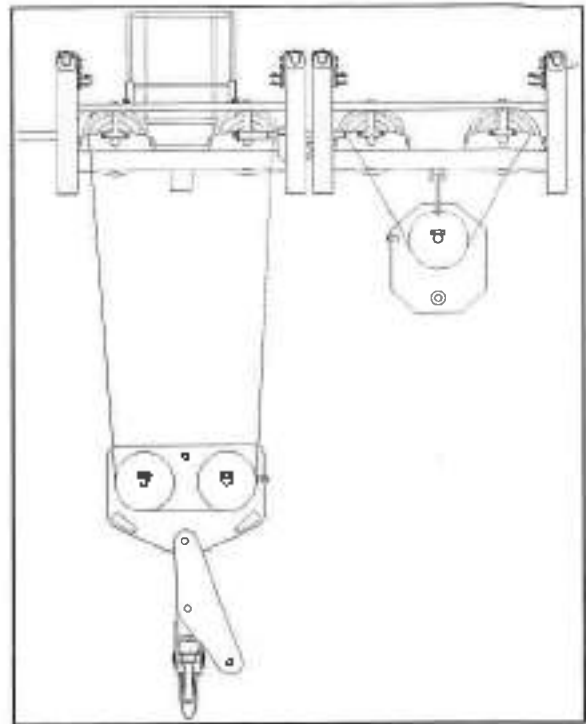


Fig.4-70 Schematic diagram of double parts of line working state



# SANY

## Electrical installation and commissioning

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## 5. Electrical installation and commissioning

### 5.1. Checkout and standby

1. See the right table for general steps of electrical installation and commissioning

Tab 5-1

Checkout and standby
Mount the distribution block at the tower bottom
Counter boom wire splicing
Connect the main incoming cable
Tower connection
Power on commissioning
Cooperate with hoisting crane arm
Component commissioning
Test run
Jacking motor commissioning

2. For the initial installation of the equipment, sort out all the installation materials and place them neatly; check all the materials against the electrical list, supplement it for lost or damaged item. Especially the cable shall be supplemented, the cable and plug and socket lost or damaged shall be recovered; replacement and re-fabrication shall be made for those that can't be recovered.
3. Prepare all necessary tools: multimeter, screwdriver, hexagonal socket, wrench, electric iron and welding material, tie, scissors and other tools.
  - 1). Prepare the necessary installation data such as manual and drawing.
  - 2). Electrical installation requires the cooperation of two personnels, or one person can be temporarily assigned to cooperate with professional electrical installation personnel.

### Caution

In order to improve installation efficiency, all the mounting steps and orders shall be arranged reasonably! Electrical installation and commissioning shall be done alternately and cooperated mutually with the installation of other components. If the devices such as obstruction light and anemometer are not mounted, they shall be installed on the ground as far as possible. Multiple work operations can be done at the same time!

### 5.2. Distribution block at the tower bottom

1. The distribution block at the tower bottom shall be provided by the user, which is installed near the bottom of the tower and also can be mounted on the base section

### 5.3. Counter boom wire splicing

1. After the counter boom is assembled, the electrical cabinet and braking resistance box shall be mounted at the opposite of driver's cab
2. Connect all the cables from lifting mechanism to power cabinet according to the system connection diagram in appendix, including 1 main motor cable, 1 band-type brake can and 1 fan motor cable, and 1 encoder cable. Wherein the motor cable is in the control cabinet, other cables are fixed on the mechanism with one end connected. Connect the lifting limiter cluster JCTX-GP to the power supply cabinet, insert the plug into the socket of the lifting limiter marked on the JCTX module in the cabinet. Connect one end of 1 hoisting braking resistance cable to the power supply cabinet, connect another end to the connection terminal of corresponding lifting resistance of three-in-one resistance box.

3. All the cables and clusters shall be sorted out and put in the crane span structure which shall be covered.

**Warning!**

In connecting the brake resistor or speed regulation resistance, the copper connectors of the external cable and the resistance outgoing line in the resistance box shall be directly pressed together on the terminal board, or the connector will be burnt out!

**Encoder wire splicing** The encoder is fixed above the interior lifting frequency mixer, which will not be seen until the mixer panel is opened. The display screen shall be removed firstly before disassembly of the panel. If the cable marking is fell off, please connect it as per the colors. If the encoder cable has shielding layer, please connect it on FE, the remaining part of the shielding layer shall be properly handled to prevent failure from touching with other cable or device.

Straight screw-driver in a width of 2.5 mm shall be used for connecting. After the wire splicing is completed, the outgoing line shall be bound inside the mixer or near the outer mixer to prevent external force from breaking the wiring.

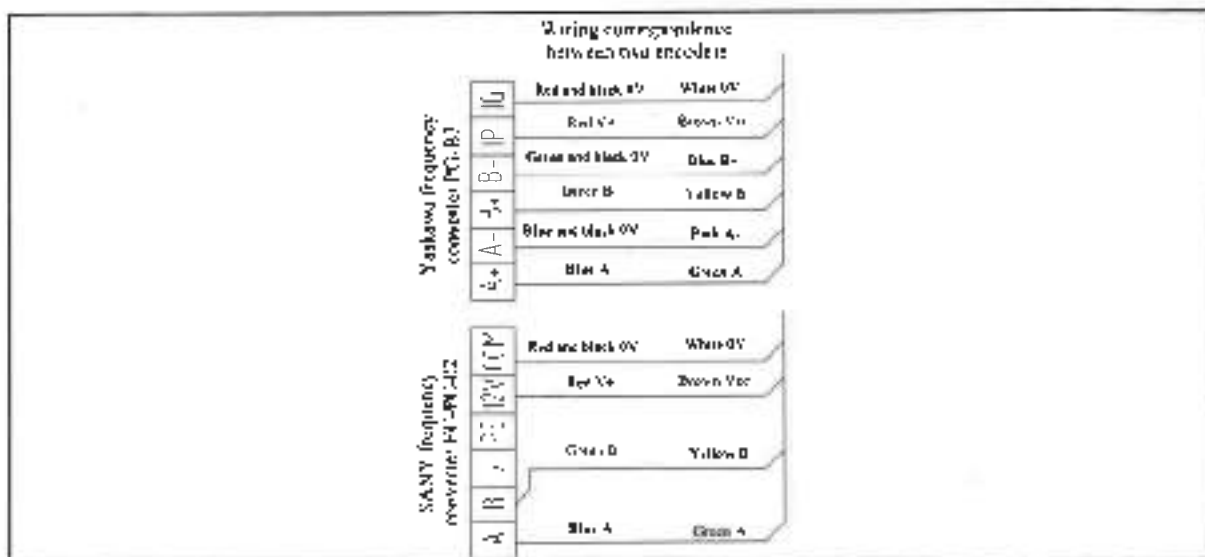


Fig.5-1 Connection diagram

**5.4. Connect the main incoming cable**

1. After the tower cap and the control cabinet are finished (at assembling the crane arm), the following works shall be started:
  - 1) Connect the cable from the distribution block at the tower bottom to the electric control cabinet.
  - 2) Connect the external power source to the distribution block at the tower bottom

**Caution**

1. The protective ground wire of external power source shall be split with zero line, its grounding resistance must be less than 4 Ω. 2. The main incoming cable shall bypass all standard sections, it shall climb up the tower from the fixing hole in the middle of the slewing and then go into the electric control cabinet, see the following drawing. 3. After the cable at one end of the electric control cabinet is fixed, sort out the external cable to leave a certain margin between the cable and the fixing hole in the middle of the lower slewing, then fix it at the fixing hole by filling rubber. 4. The cable margin between the fixing hole and lower seat fixture shall not affect the jacking section mounting; compress the cable of fixture after the margin is adjusted properly. 4. In connecting, confirm the breaker inside the electric control cabinet is opened.

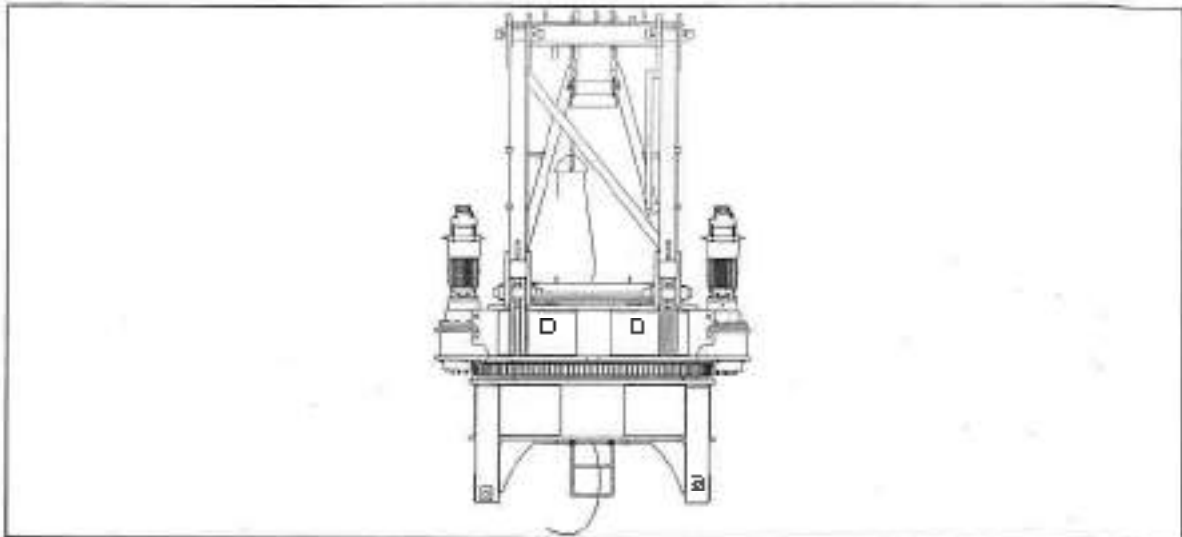


Fig.5-2 Connect the main incoming cable

### 5.5. Tower connection

1. Connect one 24-core control harness (1XP1-2XP1) and one power cable between the power distribution cabinet of driver's cab and the power supply cabinet.
2. Connect the motor cluster of the slewing mechanism (4XP1,4XP2) to the 4XS1 of the power supply cabinet, connect the fan cluster to terminal X02.
3. Connect the cables of slewing and derricking brake resistors (one end is connected with the power supply cabinet) to the slewing and derricking connection terminals of the three-in-one resistance box.
4. Connect the slewing mechanism limiter cluster (JCTX-IP), clusters of slewing band-type brake and eddy current (2XP7), torque limiter cluster (JCTX-AP) and wind speed cluster (JCTXBP) to the power supply cabinet.
5. Connect the electric whistle. The cable of the electric whistle shall be connected from the distribution cabinet of the driver's cab to the connection terminal block X2.

#### *Caution*

The clusters 4XP, JCTX-IP, JCTX-AP, 2XP7, JCTX-AP and JCTX-BP have been mounted on the components before tower installation; the clusters from the balance arm, crane arm to the power supply cabinet shall be set along the slot and nearby transition section notch.

#### **Warning!**

In wire splicing, it shall ensure that the distribution switch in the distribution block at the tower bottom and the main power switch in the electric control cabinet are powered off; otherwise there will be danger of accidents caused by electric shock and short circuit.

### 5.6. Power on commissioning

**Before power on, do the following checkouts:**

1. Check that the insulation of all phase lines (including motor) to zero and ground shall be more than 0.5 MΩ;
2. Check that there is no short circuit between all power supplies, zero lines and the positive and negative poles of DC power supply;
3. Check that voltage between phases of external incoming power supply voltage shall not be less than 380 V.

- 4 Check all the wire splicing, especially whether each connection terminal of the power circuit is loose or not; tighten it to appropriate level with screwdriver if any.
- 5 Confirm all the mechanisms are maintained before starting up, and can be operated normally.

Refer to the drawing to close the breaker at all levels step by step, verify the connection relationship between circuits at all levels, and measure the voltage of each return circuit with multimeter, detailed steps are as followings:

- 1 Ensure all the breakers are opened before power on, all the commanding apparatuses are the release and opening positions.
- 2 Close the breaker of the distribution block at the lower bottom 1QK, and the breakers of the control cabinet 1QF and 2QF1 in turn; if the light is turned on which is caused by the phase sequence protector is out of phase, adjust the two-phase phase sequence of the incoming power supply in the driver's cab.
- 3 Turn the 'selector switch' on the cabinet door, the voltage of each phase of the voltage meter shall be no less than 380 V.

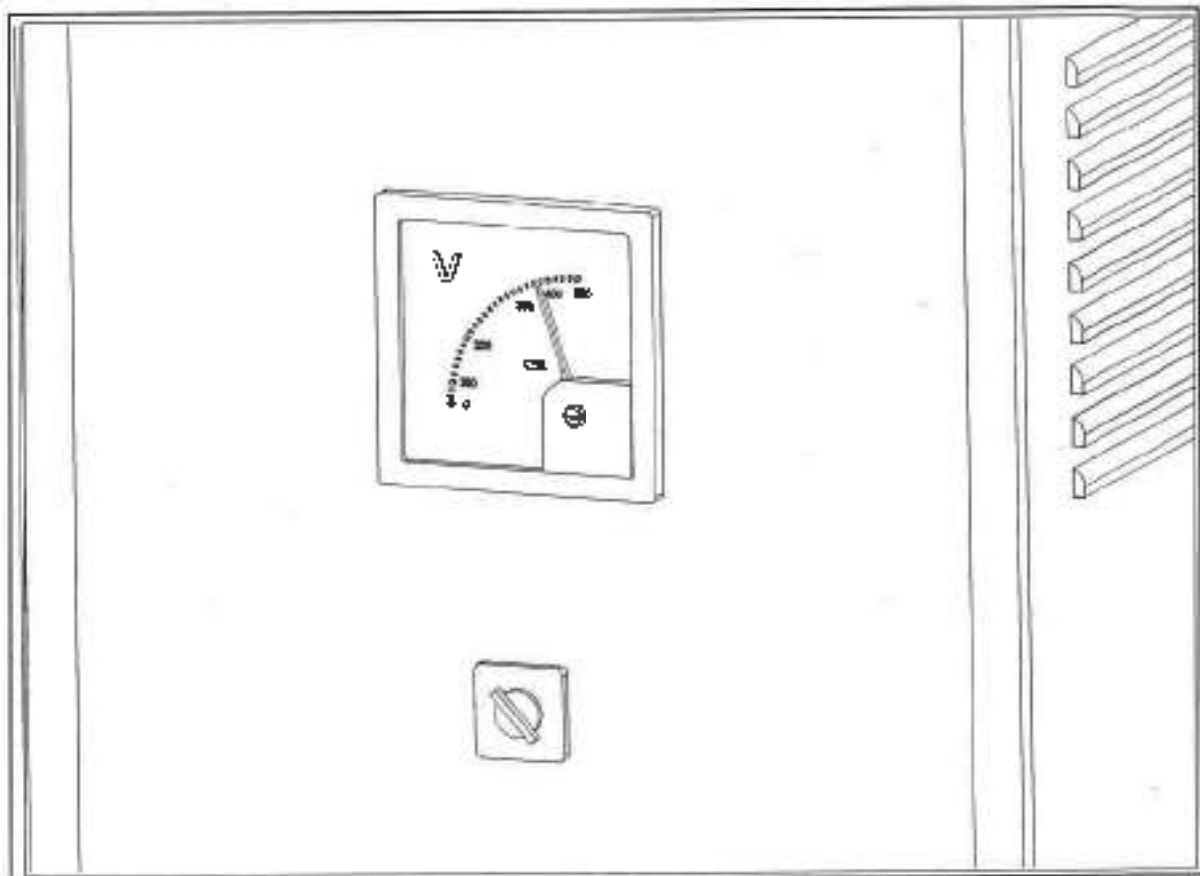


Fig.5-1

4. Close 1QF1, check whether the driver cab's light and fan is normal; whether the output voltage of socket is normal; step on the 'foot switch', the electric whistle shall blow.

Close 4QF, the integrated control module shall power on, the display screen and linkage platform shall be activated normally; press the button 'power supply' on the right console, the main contactor 1KM2 in the power cabinet I shall be closed, the indicator of 'power on' is turned on at the same time, after pressing the mushroom button 'emergency stop', the contactor 1KM2 is opened, release the mushroom button 'emergency stop', the contactor 1KM2 can't be closed again.

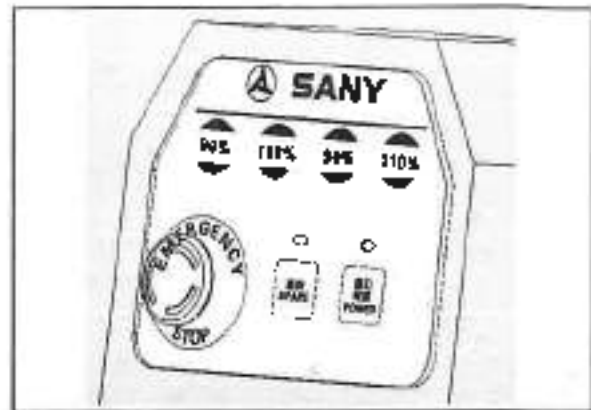


Fig. 5-4

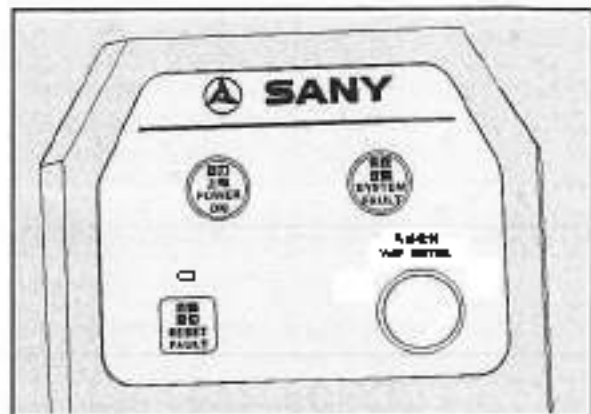


Fig. 5-5

### Motion commissioning of hoisting mechanism

1. Confirm the breaker of hoisting mechanism in the electric control cabinet 3QF is opened.
2. Click the key 'F3' on the main interface of the display screen, enter into the password verification interface firstly, if the password is entered rightly, it will go into the installation mode interface. Click the key 'F3', 'normal mode' will be changed into 'installation mode'; the words 'installation mode, please operate prudently!' will appear on the top of the interface at this time; the prompt beside the key 'F3' is changed at the same time; click the key to return to the main interface, the words 'installation mode!' will be shown at the top of the main interface.



Fig. 5-6

**Caution**

Due to commissioning of each limiter has not been done, the installation mode can make the system release the limitation to the limiter. However, the lifting, slewing and derricking is limited within 2-gear. After all limiter commissioning is completed, click the key 'F3' on the main interface again if it is required to return to normal model: go into the password verification interface firstly, enter into the interface of the installation mode if the password is entered rightly; click the key 'F3' at this time to change the 'installation mode' into 'normal mode'; return to the main interface by clicking the backspace key.

3. Close the breaker 3QF, jog up a gear, and check whether the brake can be opened normally; if it can't be opened smoothly, check the brake outlet and adjust the relevant devices of the brake.
4. Jog up a gear, check whether the turning direction is right.

**Caution**

Due to anti-disassembly protection limitation, the weight limiter plug must be plugged into the mechanism before it can act. As the commissioning of each mechanism's turning direction has been performed properly, and stored in phase sequence relay. If no alarm is sent by the phase sequence relay, the turning direction of each mechanism will not be out of order.

5. Verify whether the actions of raising and lowering 2-gear are right by inching. Whether the coordination between the brake sticking and actuation is appropriate. Please adjust in time if there is any question.

**Motion commissioning of slewing mechanism**

1. Close the breaker of the slewing mechanism in the electric control cabinet 4QF to power on the mixer.
2. Jog the rotary handle, check whether the rotational direction of the motor is consistent with the handle direction; adjust the phase sequence at the motor side if it is inconsistent.
3. Rotate the handle to test whether the actions of each gear and acceleration and deceleration are normal.
4. Turn the knob switch 'slewing brake sticking' on the left console right to the vicinity of the two rotary motor, listen there is sound of brake sticking action; if there is no sound, check the circuit and find out the reason. If the band-type brake mechanism is normal, the slewing shall not be turned after locking.



Fig.5-7

**Caution**

If the slewing band-type brake has been locked when activating the slewing mechanism, the slewing mechanism can't be activated. The mechanism can be activated only after unlocking the slewing band-type brake.



### 5.7. Cooperate with hoisting crane arm

- 1) Control the lifting and slewing mechanisms, cooperate with hoisting process of the crane arm
- 2) After the crane arm hoisting is completed, connect the derricking mechanism cluster (SXP, JCTX-GP) and weight limiter cluster (JCTX-IP) to the power cabinet 1.

#### ▲ Warning!

The clusters SXP and JCTX-GP have been mounted on the components before tower installation, which are fixed near the motor.

### 3. Steps for commissioning of derricking mechanism are as following:

- 1) Confirm the SQF breaker of the derricking mechanism in the electrical cabinet is closed and the derricking mechanism is allowed to carry out commissioning.
- 2) Push the inching motor of the derricking handle, listen whether there is sound of brake sticking action at the motor; confirm the opening and closing actions of the derricking brake sticking are normal.
- 3) Set the inching derricking mechanism at low speed gear, check whether the turning direction is right.
- 4) Shift from low speed gear to high speed gear, check whether the mechanism is operated normally.

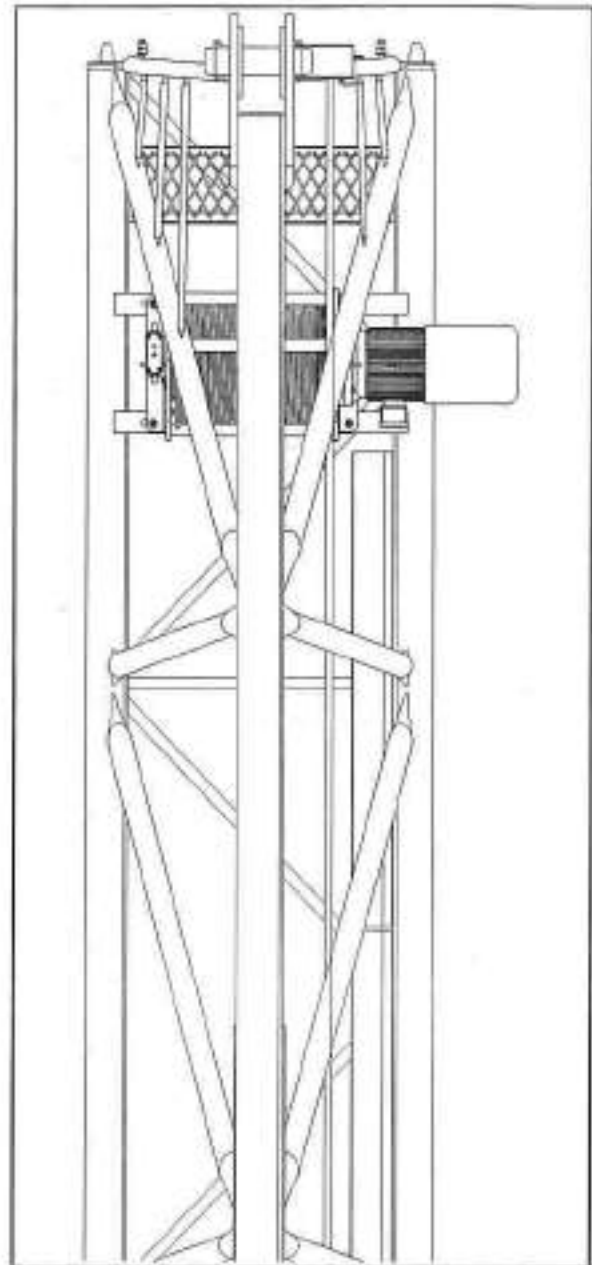


Fig.5-8

4. Cooperate with the pulling and winding of the steel wire rope of the derricking and hoisting mechanisms.

## 5.8. Component commissioning

### 5.8.1 Commissioning of mechanism limiter and position sensor

#### Commissioning of mechanism limiter

##### 1. Limiter commissioning

The structure of the limiter is shown as the following drawing. Each limiter has 4 sets of memory contactors (1WK-4WK), each set of contactors can be connected into normally open or normally closed, respectively corresponding to the memory positions of the 4 cams of the mechanism (1T-4T). For example, the functions of the slewing limiter are: left limit position, left deceleration position, right deceleration position and right limit position. The adjusting devices of the 4 memory contactor are the 4 adjusting screws surrounding the M5 nut (1Z-4Z).

In reviewing the positions, one limit position at one end must be reviewed first; then find its corresponding cam is 1T or 4T as per subsequent turning.

In setting each limit position, the basic steps are as following.

- 1) Open the mechanism to this limit position;
- 2) Loosen the nut M5;
- 3) Adjust corresponding screw to make corresponding cam press on corresponding microswitch until the microswitch is acted;
- 4) Lock the nut M5;
- 5) Operate the mechanism for several times repeatedly to verify whether the memory position is right; if there is error, do adjustment as per steps 1-4 again;
- 6) Confirm the position meet the requirements, tighten the nut M5.

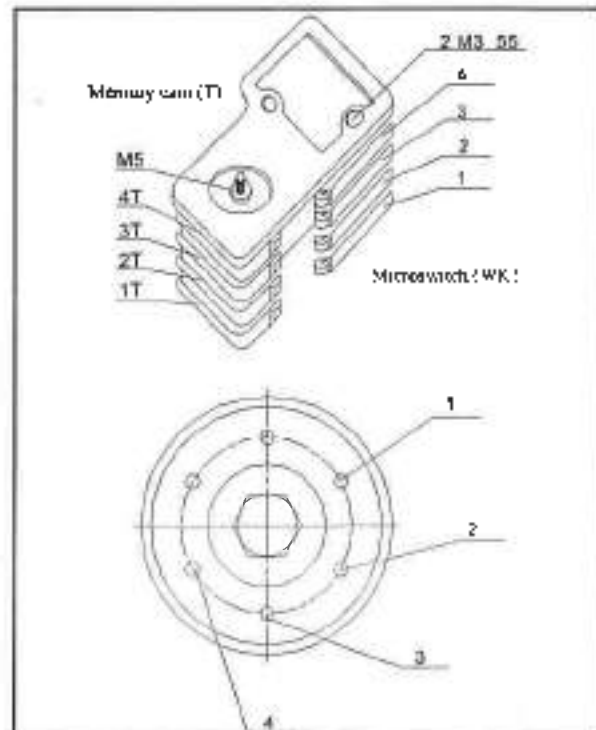


Fig.5-9

## Commissioning of position sensor



Fig.5.10

### 1. Hoisting potentiometer

The potentiometer is located in the limiter, the method for its commissioning is as following (the following figure is the interface of 'commissioning and calibration' which can be entered from the display screen main interface by clicking the key F1):

- 1) Move the hook to the high limit point and adjust the hoisting potentiometer to show the channel sampling value as  $200 \pm 50$ .
- 2) Move the hook close to the ground, click the key 'F3', the height will show 0.0 m; during the hoisting, the channel sampling value is decreased, and the height value is increased, the calibration is completed.
- 3) Repeat the step 2 if the height is required to be recalibrated due to the reasons such as addition of standard section.

### 2. Derricking encoder (calibration-free)

The encoder is located in the limiter, the method for its commissioning is as following:

- 1) Check whether the calibration-free proximity switch cluster is connected to the terminal block of the electric control cabinet X03
- 2) Detect whether the derricking calibration-free option on the device information page of the display screen is 'Yes'.
- 3) The bogie moves from the derricking baffle position to the arm tip; when pass the position of about 6.8 m, the derricking on the display screen will automatically calibrate 6.8 m, the commissioning is completed.
- 4) Or move the bogie to the position where the angle steel of the column is just below the proximity switch, and press F4 on the display screen for one key calibration.

## *Caution*

The hoisting mechanism shall lift certain weight during the calibration; otherwise, since the wire rope can't be straightened, the real lifting situation can't be reflected by the position.

### 5.8.2. Commissioning of load lifting limiter

1. After the proving ring and the clevis pin sensor is installed and the cluster (JPXP, APXP) is inserted into the left of the electric control cabinet, the display screen may show the weight which is the default before delivery, if it is inaccurate, check and calibrate it on the site.
2. Press 'F7' on the 'commissioning and calibration' interface to enter into the weight sensor calibration interface, see the following figure.
  - 1) Zero calibration: keep the empty hook stationary, press F5, the zero weight value will be cleared or close to zero;

- 2) First point calibration: select a weight or load with known minor weight, input the weight value after lifting it; press F6, the weight value of calibration point 1 after pressing the key is the same as the input value.
- 3) Second point calibration: select a weight or load with known larger weight, input the weight value after lifting it; press F7, the weight value of calibration point 2 after pressing the key is the same as the input value.
- 4) After calibration, verify the weight or load with other known weights, all the errors shall be less than 2%, otherwise, eliminate the cause and recalibrate it.

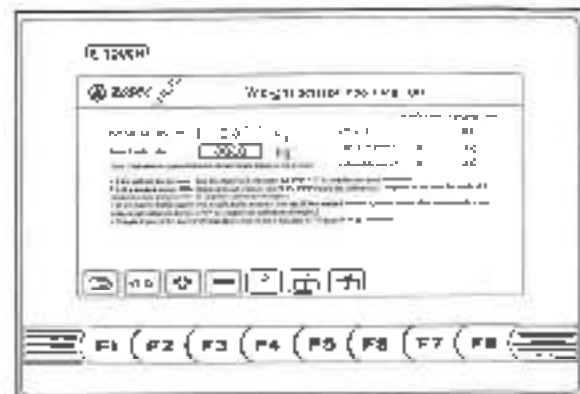


Fig 5-11

See the following drawing for the load lifting limiter, it typically has 4 adjusting screws, 3 adjusting screws are applied here, the adjustment method is as following

1. 25% weight adjustment:
  - 1) Lift a weight of  $Q_{max}/4$ , raise the hook to a safe distance; the bogie do derricking outward at the speed of five gears, it is not allowed for the phenomenon of speed limit.
  - 2) Add additional weight of 50 kg, raise the hook to a safe distance; adjust the load lifting limiter switch 1 at the same time to turn on the point location light at the weight of 25% on the IO input page. The actual gear can only reach fourth gear for above five-gear derricking.
  - 3) The results shall be consistent after repeating b for two or three times.
2. 90% weight adjustment (the derricking can't be more than 10 m):
  - 1) Lift a weight of 90% $Q_{max}$ , lift up and down the hook for one time at a low gear, failure of lifting up and down is not allowed.
  - 2) Add additional weight of 50 kg, adjust the load lifting limiter switch 2; hoist the weight at a low gear to make the alarm indicator at 90% is on.
  - 3) The results shall be consistent after repeating b for two or three times.
3. 110% weight adjustment (the derricking can't be more than 10 m)
  - 1) Lift a weight of 110% $Q_{max}$ , lift up and down the hook for one time at a low gear, failure of lifting up and down is not allowed.
  - 2) Add additional weight of 50 kg, adjust the load lifting limiter switch 3; hoist the weight at a low gear to make the alarm indicator at 110% is on, stop the hoisting.
  - 3) The results shall be consistent after repeating b for two or three times.

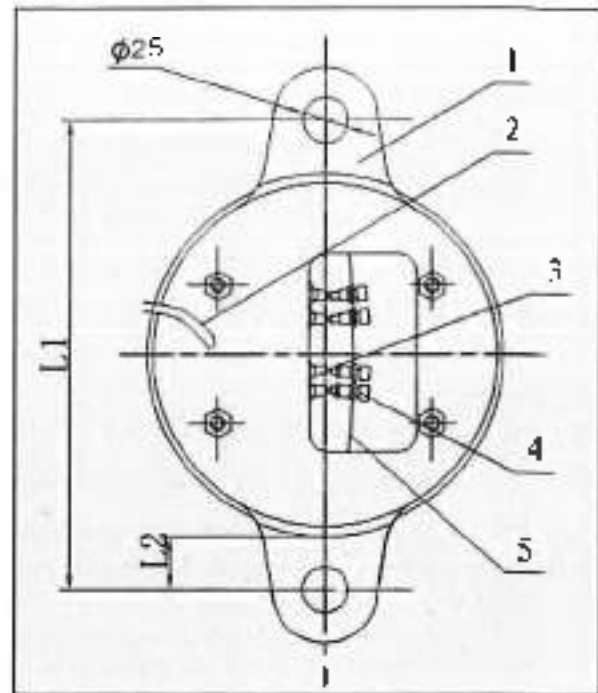


Fig.5-12

Tab.5-2

1. Proving ring	2. Cable	3. Microswitch
4. Adjusting screw	5. Strapnel	

### ▲ Attention

In order to prevent random adjustment by other personnel, the torque limiter and weight limiter is equipped with individual adjusting internal hex wrench. The special wrench is provided to the customer with its operation manual, and shall be changed by specially-assigned person

#### 5.8.3. Commissioning of torque limiter

1. The torque limiter (see the following figure) is composed of two arched plates, several microswitches and adjusting bolt set. It is fixed on the torque limiter cylinder through the arched plates to drive the adjusting bolts to move; when the adjusting bolts touch the microswitches, the corresponding torque can alarm and open the circuit of tower crane upward and bogie outward derricking to limit the torque.

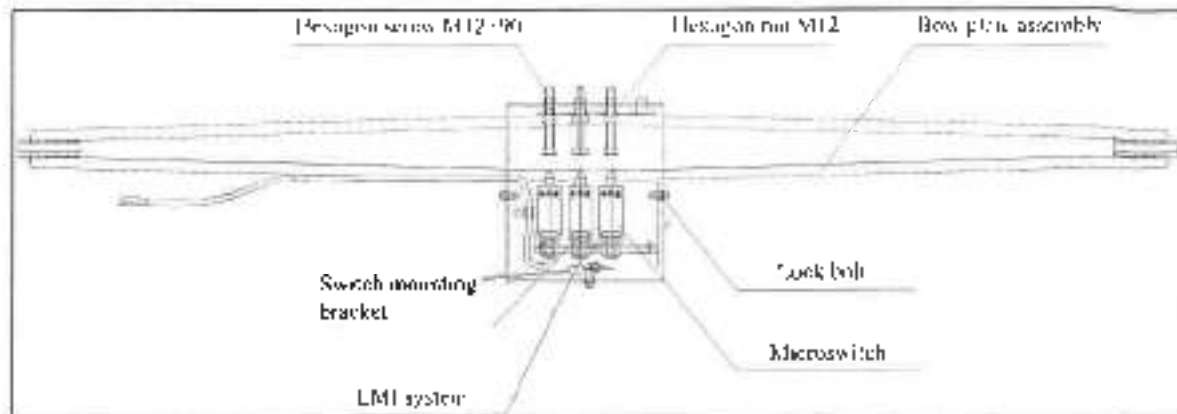


Fig 5-13 Torque limiter

## 1 Adjustment of the torque limiter

### 1) Adjustment of fixed code and derricking

- 1) According to the current parts of line of the tower crane and maximum crane arm derricking, check the jack up performance table in the driver's cab; when a certain working range is recorded in the middle section as L1, the rated weight is Q1.
- 2) Lift a weight with a weight of Q1 at low amplitude, change the derricking to 0.8L1 position at a normal speed; adjust the corresponding contact I of 80% torque alarm to turn on the alarm lamp; then move the lifting weight to 1.05L1 position, adjust the contact II to turn on the limit alarm lamp of 110% torque alarm.
- 3) Move the lifting weight to previous position of 0.8L1, the alarm lamp is off; then move the lifting weight to derricking increasing direction at a fast gear. When it arrives at 0.8L1 position, 80% torque alarm lamp is on, the travel speed automatically changes low speed operation. When it arrives at 1.05L1 position, 110% torque alarm lamp is on, the travel process is automatically stopped.

Repeat the verification action once till the function is stable.

### 2) Adjustment of constant derricking and variant code

- 1) According to the current parts of line of the tower crane and maximum crane arm derricking, check the jack up performance table in the driver's cab; when a certain working range is recorded in the middle section as L2, the rated weight is Q2.
- 2) Lift a weight with a weight of Q2 at a working amplitude of L2, the torque limiter shall not act, but can hoist normally. When the load is landed, lift it at lowest speed after loading to 105%Q2, adjust corresponding contact III to turn on the limit alarm lamp of 110% torque alarm, the hoisting process will automatically be stopped.

Repeat the verification action once till the function is stable.

## 2 Verification of torque limiter

### 1) Verification of maximum amplitude.

At the maximum amplitude of the arm end, lift the weight with rated weight at a low speed. Increase weight by 10%, and lift at a low speed, 110% torque alarm lamp is on, it is not allowed to lift. Verify the above process once, just till the action is correct.

If the above process is failed, adjust 110% torque alarm limit until the re-verification is succeeded.

### 2) Verification of maximum weight:

When calculating the maximum weight as per jacking performance table, the amplitude positions that the 80% and 105% responded are 0.8L and 1.05L respectively. Change the derricking from inside to outside, and verify whether the derricking at about 0.8L and 1.05L can alarm, slow down automatically and stop automatically, just basically correct is ok. If the error is large, it is necessary to find out the cause and recalibrate after eliminating the abnormality.

### 5.9. Test run

#### 1. No load test

Movement shall be separately done to each mechanism for more than three times, then comprehensive movement shall be done for more than three times, any abnormal situation shall not be occurred on all control, safety and moving parts and tower crane block. If the abnormal situation is occurred, it shall be eliminated timely, and then do movement for more than three times.

#### 2. Load test

Lift 25%, 50%, 75% and 100% rated weight separately at maximum derricking; repeat all the steps of no load test; any abnormal situation shall not be occurred on all control, safety and moving parts and tower crane block. If the abnormal situation is occurred, it shall be eliminated timely, and then do movement for more than three times.

### 5.10. Jacking motor commissioning

1. Bypass the cluster (8XP) at the jacking pump station around the standard section and jacket, pass it through the middle of the slewing support and temporarily plug it into the socket (8XS).
2. Check whether the action pressure of the upper limit pointer of pressure gauge (see the following drawing) in the pumping unit is 31.5 MPa, and adjust it if it is not right.
3. Close the breaker in the power cabinet 8QP, turn the start knob switch in the pumping unit to the right, the contactor in the power cabinet 8KM is closed, the motor in the pumping unit will activate.
4. Check the running direction of the motor, adjust it if it is not right.
5. Repeat the start and stop for several times; if there is no abnormality, the jacking motor commissioning is complete.
6. The jacking cluster is a temporary line; sort out the cluster after the jacking is completed, roll up and place it near the pumping unit, and cover the plug cap. Otherwise, the cluster may be damaged to cause failure.

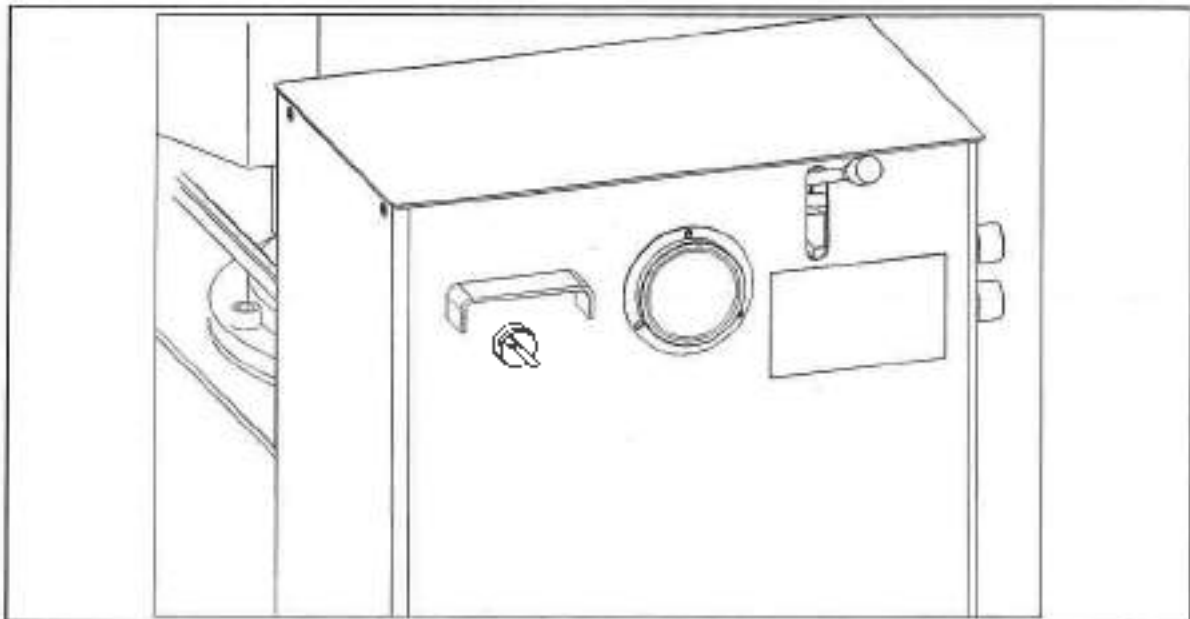


Fig.5-14

Lined area for notes or technical drawings, consisting of numerous horizontal dashed lines.



# SANY

## Jacking operation

<b>6. Jacking operation</b> .....	<b>6-1</b>
<b>6.1 Precautions</b> .....	<b>6-3</b>
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<b>6.5 Attachment of tower crane</b> .....	<b>6-8</b>

A series of horizontal dashed lines for writing notes.

## 6. Jacking operation

### 6.1 Precautions

1. When the wind speed on top of the tower is greater than 12 m/s, jacking operation shall not be carried out.
2. During the jacking operation of tower crane, ensure that the pin shafts at both ends of the jacking beam are reliably connected with the steps.
3. During the balancing and jacking, it is forbidden to rotate the crane arm, move the bogie, perform lifting up or down operation.
4. It is forbidden to operate the tower crane before the lower seat is not properly connected with the tower.
5. After attached sections of the tower crane have reached the desired height for working, rotate the crane arm to different angles, and ensure that the bolts at each connection point of the tower have been tightened.

### 6.2 Preparations before jacking

#### 6.2.1 Check the installation of the lead-in guide rail

1. Check the installation of the lead-in guide rail carefully, confirm it has been properly installed, and the clevis pin and cotter pin have been fixed.

#### 6.2.2 Installation of lead-in bogie subassembly

1. Install the lead-in bogie subassembly on the standard section assembly to be hoisted: the guide plate on the assembly must face the side with steps on the standard section. Change the hook body into jacking hook, lift the standard section through the round bar in the middle of the bogie assembly as shown in the drawing.

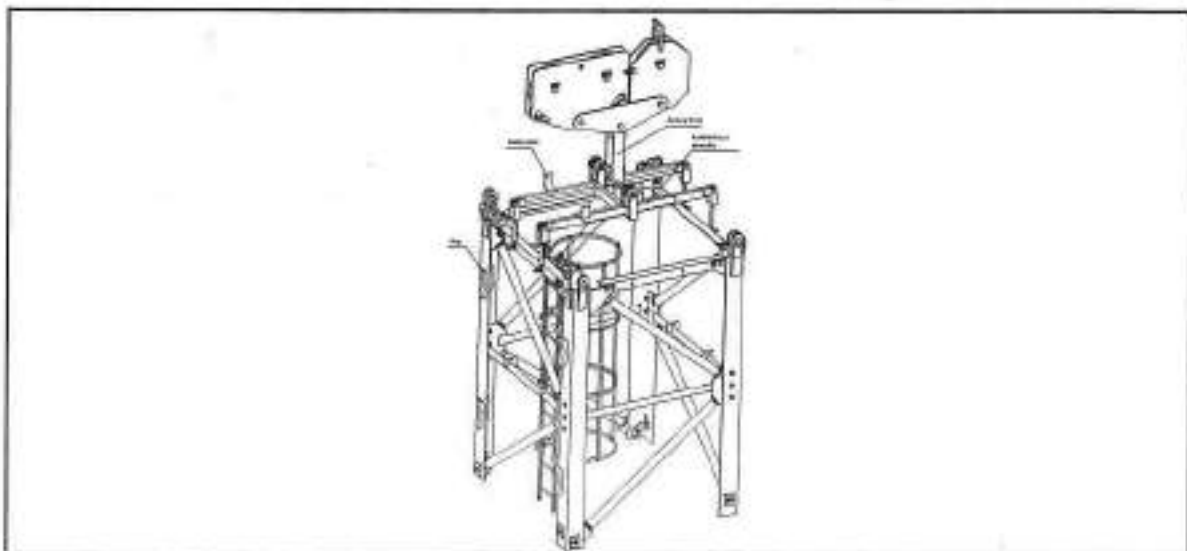


Fig.6-1 Installation of lead-in bogie assembly

### **Caution**

The jacking hook is only provided for lifting tower section or balancing load during the jacking, and can't be used for other purpose.

### 6.3 Jack up balancing

1. Lift the standard section through the bogie subassembly, and hang on the lead-in guide rail of the lower seat

**▲ Attention**

When hanging the lead-in standard sections, the step orientation shall be consistent with the tower section.

2. When lifting the counterweight (the standard section is often used as the counterweight as shown in the drawing), drive the bogie to theoretical balance position first by referring to the following table.
3. Remove the connecting clevis pin between the lower seat and the transition section.
4. Confirm the climbing claw is raised and locked firmly
5. Start the hydraulic system to extend the cylinder rod; hang the hanging boots at both ends of the jacking beam onto the tower section step nearest to the jacking beam, and insert the safety pin into the pin hole

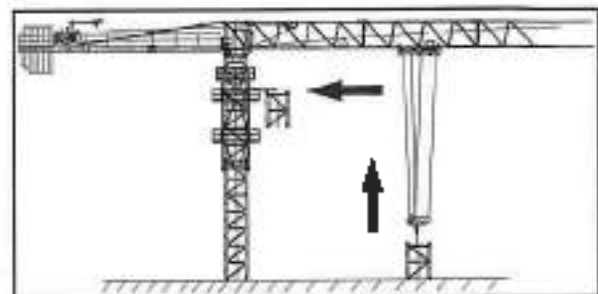


Fig.6-2 Hanging the standard section

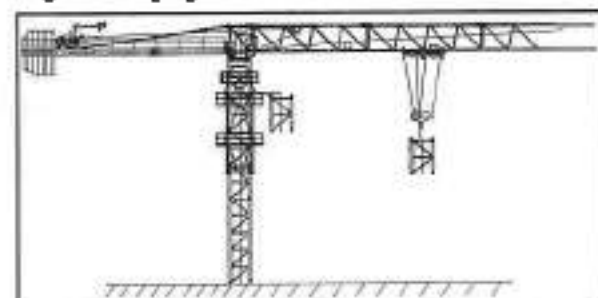


Fig.6-3 Hanging the counterweight

6. Jack up to the position that the connecting plate of the transition section is just separated from the standard fishtail plate
7. Check whether the connecting plate of the lower seat is at the same vertical line with the standard section main chord, and observe the clearance between the 8 guide wheels on the frame and the tower body main chord is basically consistent to check whether the tower crane is balanced; after it is balance, the center of the upper tower crane shall fall on the position of the jacking oil cylinder beam.

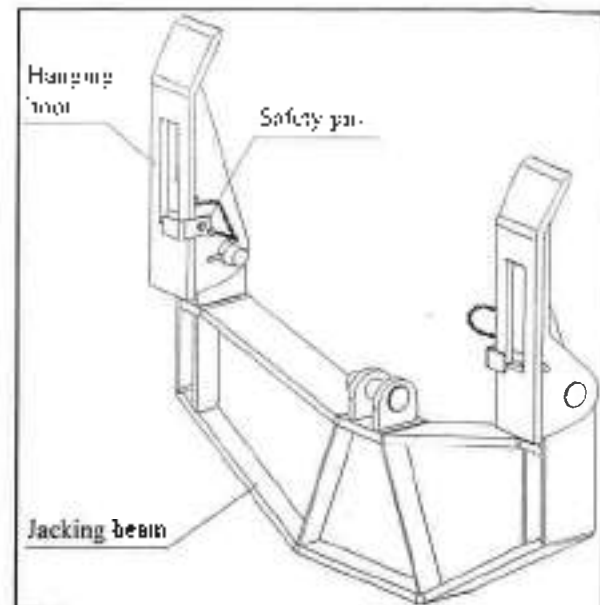


Fig 6-4 Jacking beam

### ▲ Attention

The climbing ring must be fitted when raising the climbing claw with operating lever before jacking to prevent the operating lever from falling and causing danger.

8. Record the balancing position of load-bogie.

Tab.6-1 Jack up balancing position

S. N.	Boom length (m)	Distance from the hook to tower slewing center (m)	Remarks
1	75	15.1	One standard section (1.52t)
2	70	16.7	
3	65	19.7	
4	60	20.2	
5	55	24.4	
6	50	28.2	
7	45	21	Two standard sections (3.04t)
8	40	22.4	
9	35	20	
10	30	22.1	

### ▲ Attention

The jacking balancing positions vary with the length of the crane arm, see the table for the detailed data. The data is for reference only, please take the actual situation as the standard.

#### 6.4 Jacking section

1. Cut on the jacking after confirming the balancing until the climbing claw just hangs on the step c; depress the operating lever and lock it.

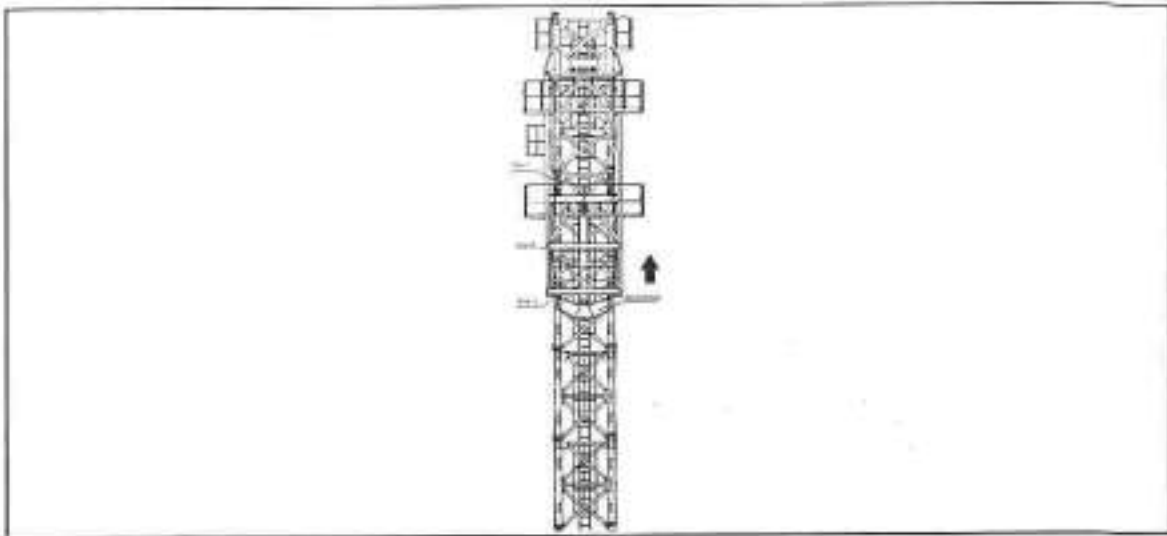


Fig.6-5

2. Pull out the safety pin, place it on the step b, insert the safety pin again; raise the climbing claw, jack up it about half of standard section again, hang it on the step d and lock it.

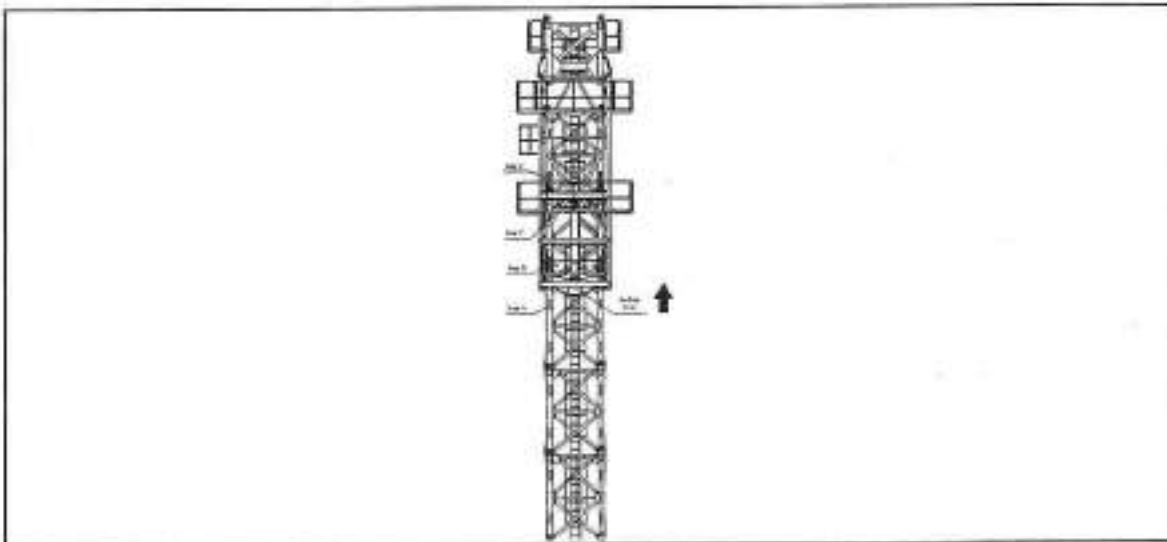


Fig.6-6

3. Pull out the pin, retract the cylinder again, place the jacking beam on step c; insert the pin, raise the climbing claw, and go on jacking until the sufficient section mounting space L is left between the transition and the tower.

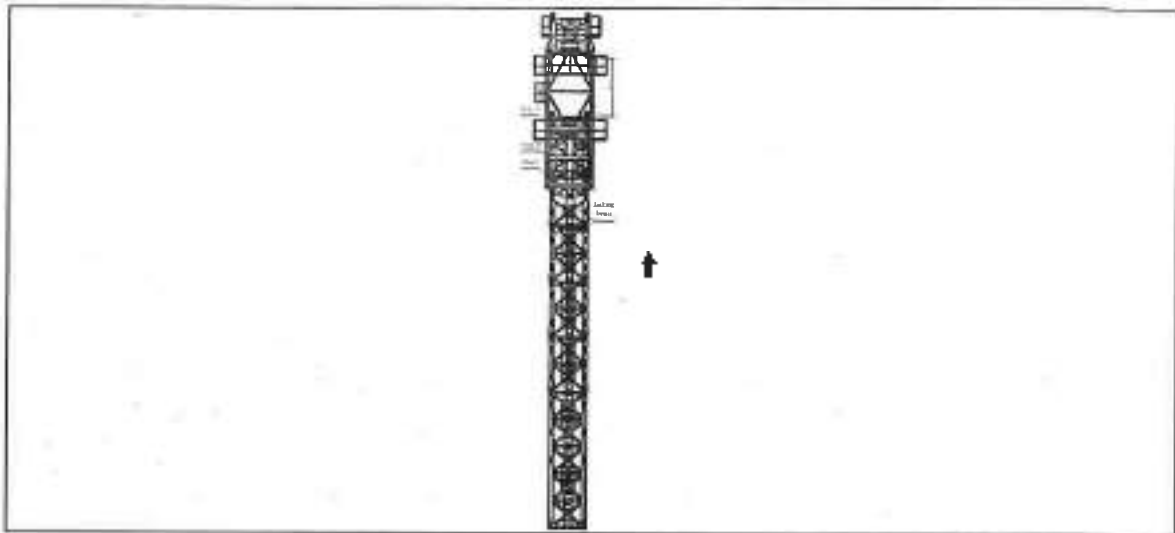


Fig.6-7

4. Pull the standard section on the lead-in guide rail right above the tower.

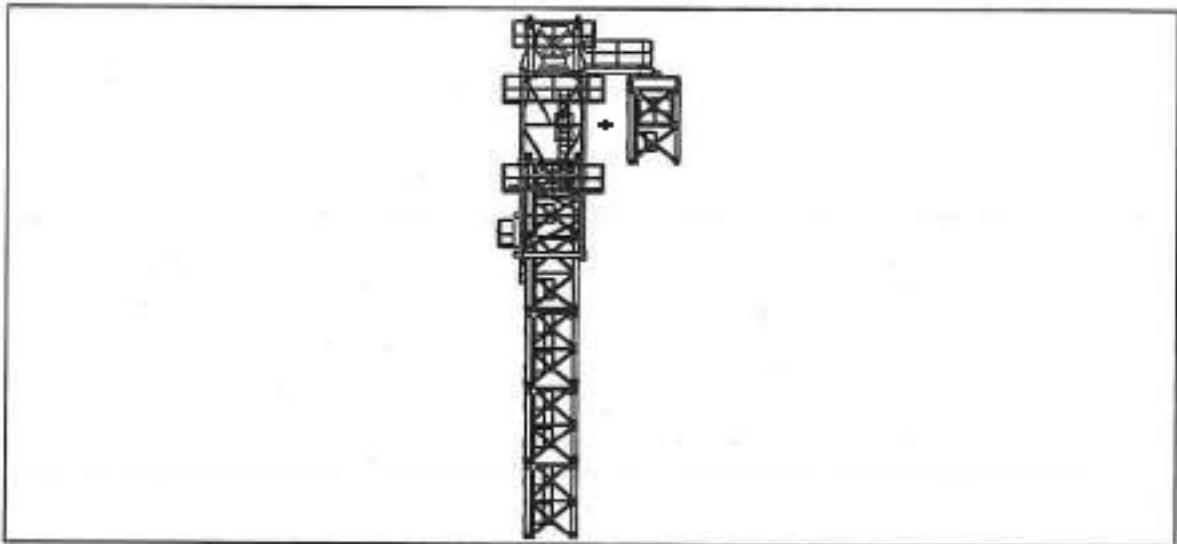


Fig 6-8

5. Retract the cylinder slowly until the lead-in section is accurately inserted into the tower fishtail plate, and firmly connect them with  $\phi 55$  clevis pin,  $\phi 15$  pin and cotter pin.
6. Remove the lead-in bogie subassembly, and extend it from lead-in guide rail. Continue to retract the cylinder to make the transition section connecting plate insert into the standard section fishtail plate, and fix them with four  $\phi 55$  clevis pins.
7. Lower the counterweight to release the lifting hook. Lift down the bogie assembly on the lead-in guide rail so that it can be fixed on other standard sections to be added if necessary.
8. Section mounting work of one standard section is completed till now, repeat above steps for repeating section-adding.

The jacking can be done only after the safety pins are inserted into the connection point between the two sides of the jacking beam and the steps. Please pull out the safety pins timely before retracting the cylinder. During the whole jacking process, special person must be arranged for monitoring the operations of all components to ensure no abnormalities such as deformation and peculiar noise are occurred so that the jacking can be done.

### 6.5 Attachment of tower crane

1. If the user requires the working height of the tower crane is more than independent height, the tower must be attached. The user shall provide the installation dimensions to the manufacturer when ordering the attachment frame to the manufacturer according to the construction requirements. Before installing the attachment frame, the pedestal of the attachment frame shall be embedded (the embedded pedestal and its bolts, nuts and gaskets shall be prepared by the user himself).

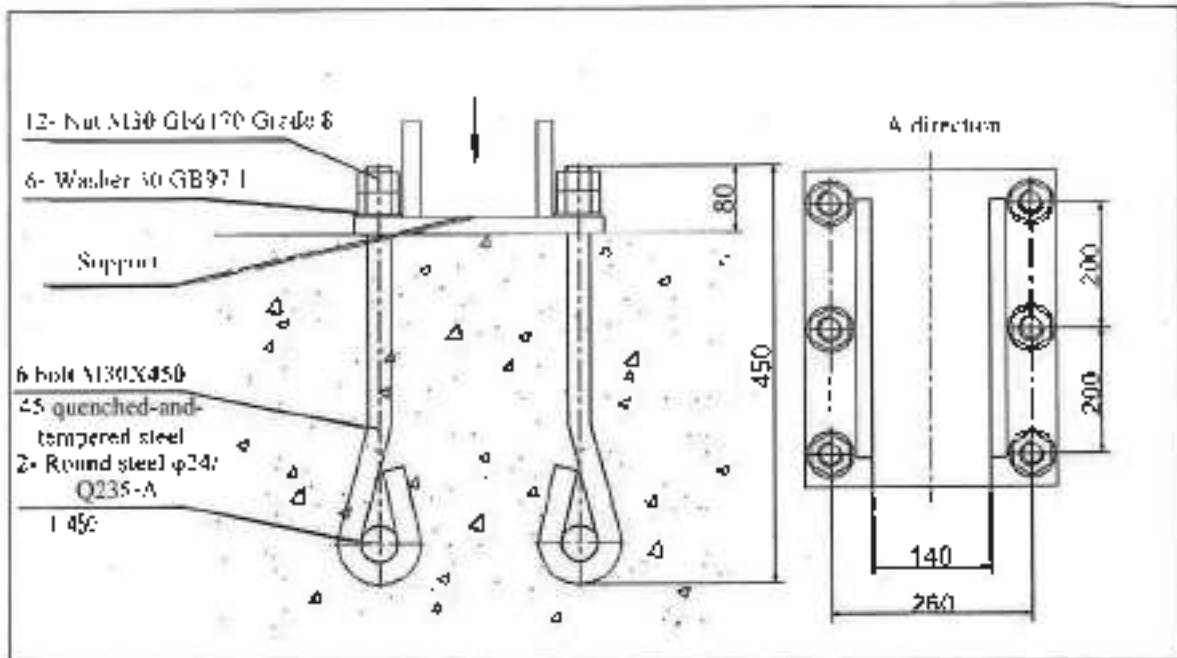


Fig.6-9

2. The attachment frame shall be erected at a distance of 5 m from the tower center line to the building, if it is different with the design value during the actual usage, you shall contact with us. The connection method between the brace rod and the building shall be determined according to actual situation.
3. Fit the attachment frame on the tower, the four screw stems fasten the four main chords of the standard section. One end of the four brace rods is connected with the attachment frame by pins, another end is connected with the embedded pedestal fixed on the building by pins (see the following drawing); the pedestal of the attachment frame shall be prepared by the user himself.
4. All the attachment frames shall be in the same horizontal plane; the maximum height difference between the attachment frame and the embedded pedestal shall be no more than 160 mm.
5. It is allowed to establish walkway from the building to the tower crane for person on the brace rod of the attachment frame, but piling up weight is forbidden.
6. Bearing capacity of the attached point. The user and installation unit shall consider the bearing capacity of the building's attached points (at the embedded pedestal) and the factors affecting the strength of the attached point, such as the construction date of the reinforced concrete skeleton, the position of the tower crane, the angle between the brace rod and the building prior to erecting of the tower crane, and work out the plan previously. We provide the following recommended attachment scheme and other typical attachment scheme for reference.
7. In erecting the attachment frame, theodolite shall be used to check the vertical level of the tower axis which discrepancy shall be no more than 4/1,000 of the tower height.

#### ⚠ Attention

When the installation dimension of the attachment frame is changed, the user must inform the manufacturer, and provide the changed installation dimension so that the manufacturer can design new attachment frame

#### ⚠ Attention

It is prohibited to use expansion screw instead of embedded bolt to attach embedded parts.



**⚠ Attention**

The bending moment of each section of the tower under different attachment heights and different working conditions shall be calculated according to the multi-span continuous beam on the elastic pedestal for attachment installation usage status. The installation dimension of attached erecting of the tower crane is shown as the following table

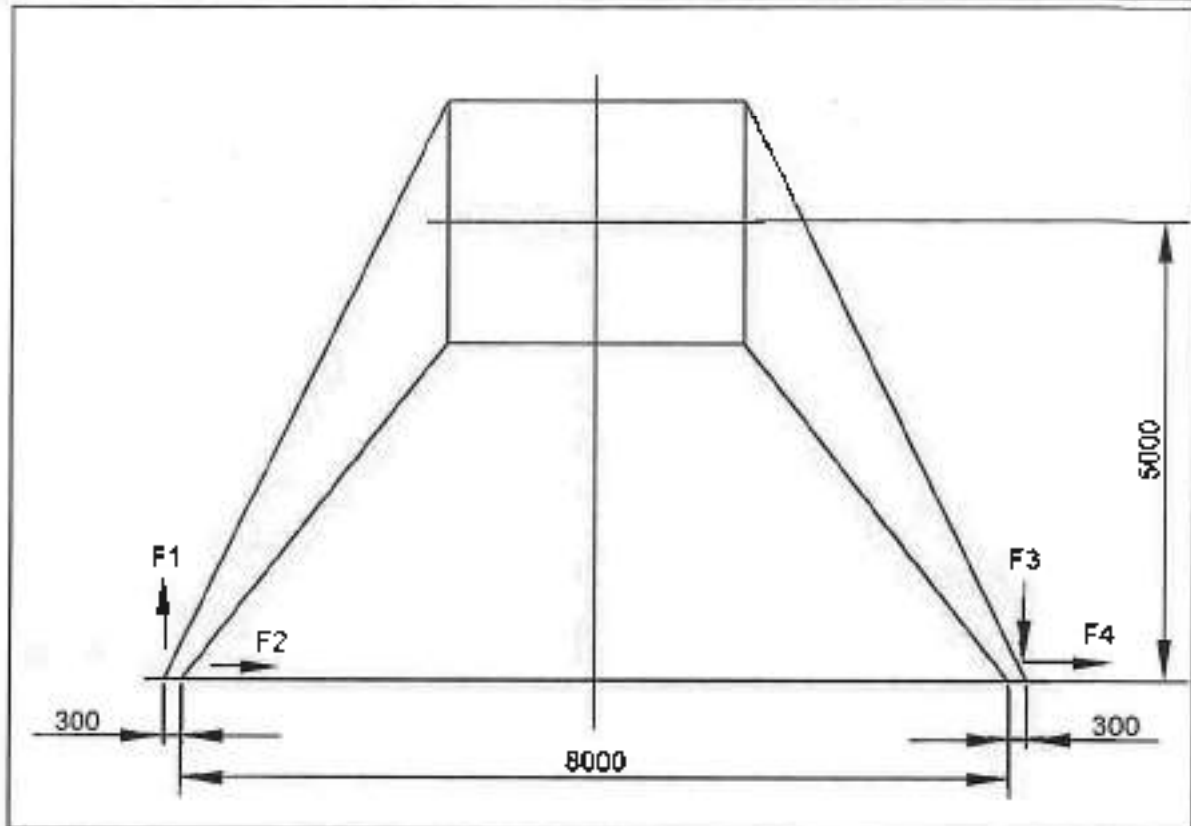


Fig.6-10 Attachment frame

Tab.6-2 Attached installation dimension table

Attachment quantity	Haisting height	Mounting height of the attachment frame	Height of tower cantilevered arm
0	60	0	58.5
1	93	48	43.5
2	126	81	43.5
3	159	114	43.5
4	189	147	40.5
5	219	177	40.5
6	246	207	37.5
7	273	234	37.5
8	300	261	37.5

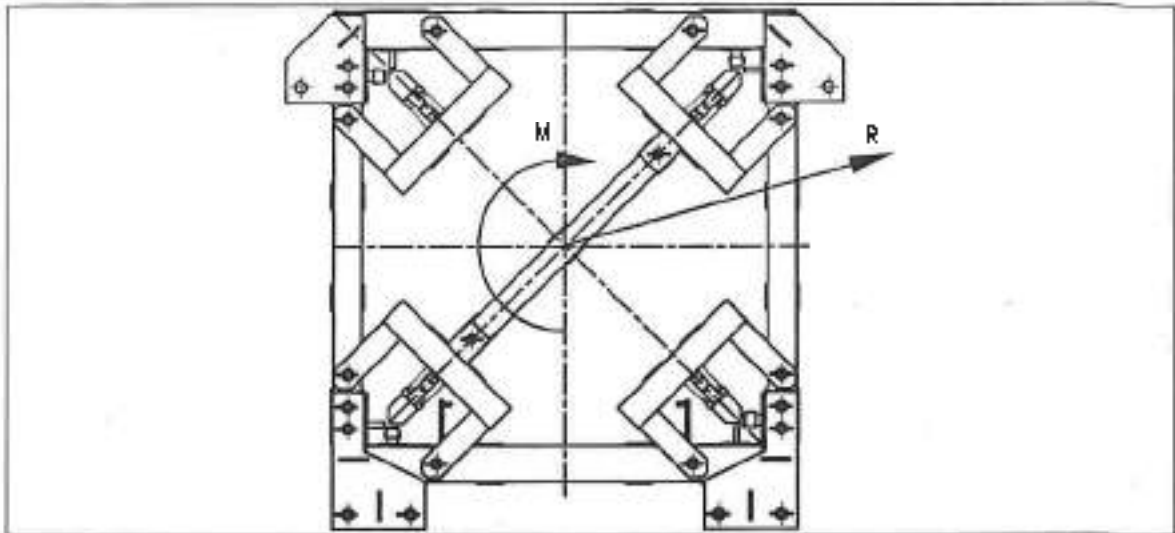


Fig 6-11 Maximum attachment force

Tab.6-3 Maximum load of the lower crane attachment frame

Working state		Non-working state	
Horizontal force $R$ (kN) $\theta=0^\circ-360^\circ$	Torque $M$ (kN·m)	Horizontal force $R$ (kN) $\theta=0^\circ-360^\circ$	Torque $M$ (kN·m)
275.68	$\approx 654.6$	475.89	0

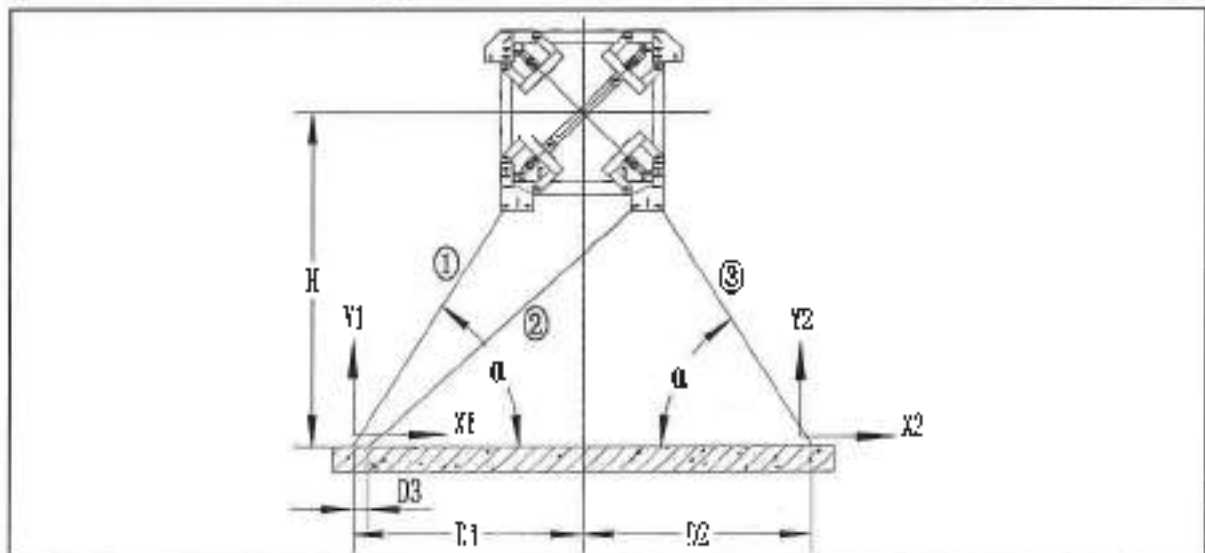


Fig 6-12 Scheme I: three-bar attachment

Tab.6-4 Scheme I Calculation table of reaction force load between attached rod and building support

S. N.	D (mm)	$\alpha^\circ$	L1-L3 (mm)	L2 (mm)	D1-D2 (mm)	D3(mm)	F1 (kN)	F2 (kN)	F3 (kN)
1	4,000	50	3,280	4,620	3,315	300	665	392	479
2		60	2,900	4,680	2,657	300	577	370	493

Tab.6-4 Scheme J Calculation table of reaction force load between attached rod and building support  
(continued)

3		70	2,680	3,670	7,170	300	519	377	545
4	6,000	50	5,890	7,150	4,994	300	672	396	478
5		60	5,210	6,280	5,812	300	583	389	508
6		70	4,810	5,650	2,848	300	522	422	594
7	8,000	50	8,510	9,730	6,672	300	675	399	477
8		60	7,520	8,540	4,966	300	586	401	516
9		70	6,930	7,710	3,576	300	524	453	623
10	10,000	50	11,120	12,320	8,350	300	677	402	477
11		60	9,830	10,820	6,121	300	588	409	521
12		70	9,060	9,800	4,304	300	525	474	641
S. N.	D (mm)	$\alpha^\circ$	$F_{x1}$ (kN)	$F_{y1}$ (kN)	$F_{x2}$ (kN)	$F_{y2}$ (kN)			
1	4,000	50	304	367	308	367			
2		60	295	427	247	427			
3		70	314	512	186	512			
4	6,000	50	304	366	107	366			
5		60	287	440	254	440			
6		70	296	558	203	558			
7	8,000	50	305	365	307	365			
8		60	283	447	258	447			
9		70	286	585	213	585			
10	10,000	50	305	365	306	365			
11		60	281	451	260	451			
12		70	280	602	219	602			

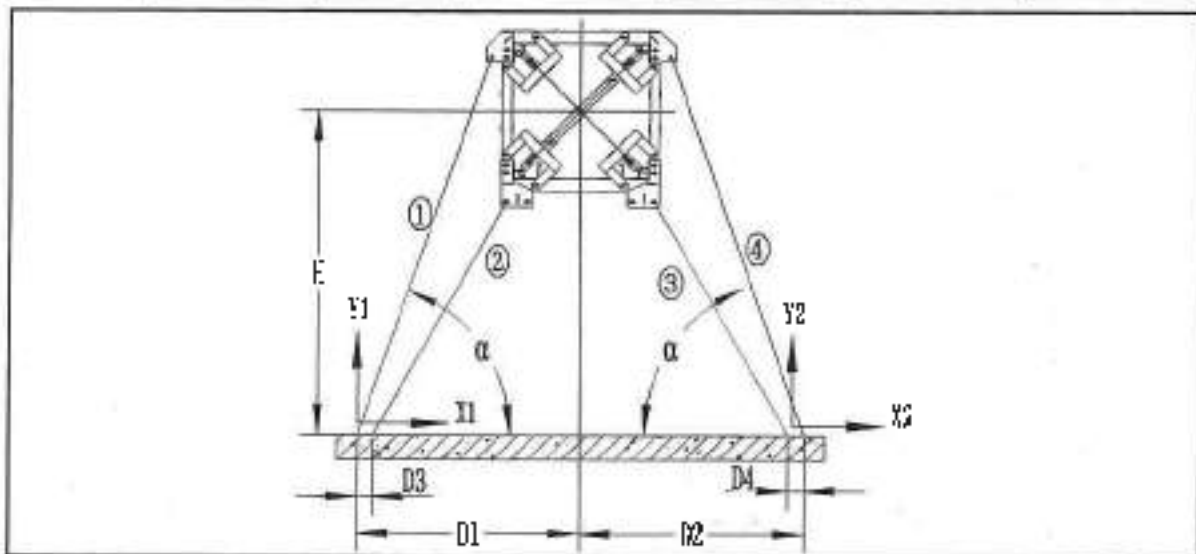


Fig 6-13 Scheme I: four-bar attachment

Tab 6-1 Scheme II Calculation table of reaction force load between attached rod and building support

S. N.	D (mm)	$\alpha$	L1=L4 (mm)	L2=L3 (mm)	D1=D2 (mm)	D3=D4 (mm)	F1 (kN)	F2 (kN)	F3 (kN)	F4 (kN)
1	4,000	40°	7,608	6,311	7,293	300	288	260	260	288
2		50°	6,383	4,779	5,468	300	264	275	275	264
3		60°	5,647	3,751	4,288	300	254	328	328	254
4		70°	5,204	3,058	3,245	300	267	463	463	267
5	6,000	40°	10,719	9,336	9,676	300	278	280	280	278
6		50°	8,994	7,304	7,246	300	260	300	300	260
7		60°	7,936	5,991	5,443	300	259	379	379	259
8		70°	7,332	5,145	3,973	300	316	591	591	316
9	8,000	40°	13,870	12,400	12,060	300	274	291	291	274
10		50°	11,610	9,870	8,925	300	261	319	319	261
11		60°	10,265	8,269	6,598	300	267	415	415	267
12		70°	9,461	7,257	4,701	300	354	678	678	354
13	1,000	40°	16,940	15,490	14,443	300	272	299	299	272
14		50°	14,220	12,460	10,603	300	262	333	333	262
15		60°	12,580	10,561	7,752	300	273	440	440	273
16		70°	11,590	9,380	5,430	300	382	739	739	382
S. N.	D (mm)	$\alpha$	Fx1 (kN)		Fy1 (kN)	Fx2 (kN)		Fy2 (kN)		
1	4,000	40°	431		269	431		269		
2		50°	355		292	355		292		
3		60°	304		329	304		329		
4		70°	267		398	267		398		
5	6,000	40°	410		277	410		277		
6		50°	336		308	336		308		
7		60°	289		359	289		359		
8		70°	258		456	258		456		
9	8,000	40°	398		281	398		281		
10		50°	328		318	328		318		
11		60°	283		376	283		376		
12		70°	255		495	255		495		
13	1,000	40°	391		286	391		286		
14		50°	323		326	323		326		
15		60°	280		393	280		393		
16		70°	254		523	254		523		

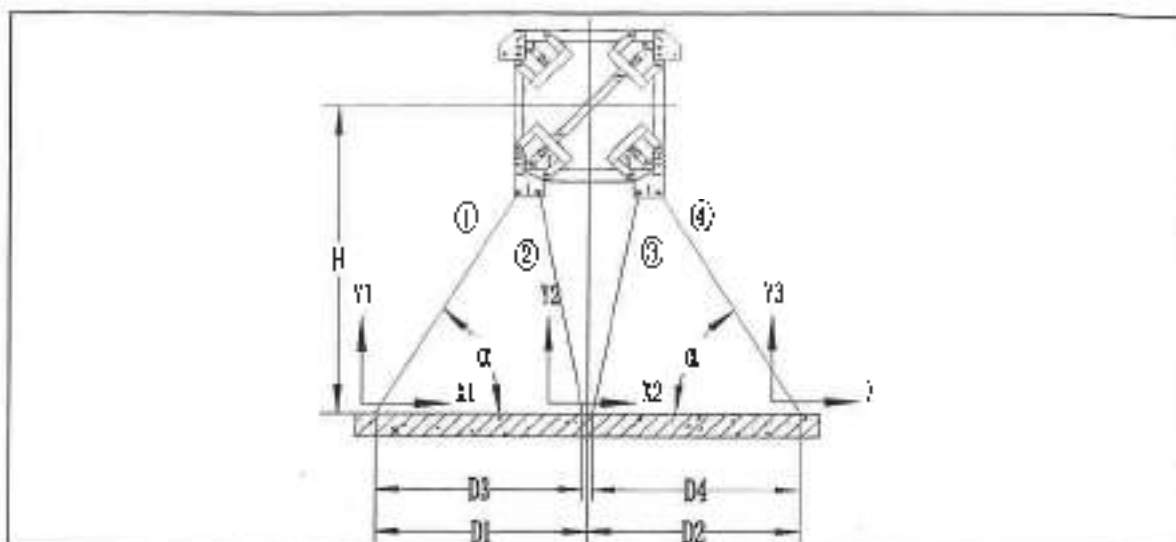


Fig.6-14 Scheme III: four-bar attachment

Tab.6-6 Scheme III Calculation table of reaction force load between attached rod and building support

S. N.	D (mm)	$\alpha$	L1=L4 (mm)	L2-L3 (m)	D1-D2 (mm)	D3-D4 (mm)	F1 (kN)	F2 (kN)	F3 (kN)	F4 (kN)
1	4,000	40°	3,913	2,612	4,202	4,052	351	414	414	351
2		50°	3,283		3,315	3,165	382	358	358	382
3		60°	2,904		2,657	2,507	429	331	331	429
4		70°	2,676		2,120	1,970	503	346	346	503
5	6,000	40°	7,024	4,570	6,586	6,436	337	444	444	337
6		50°	5,894		4,994	4,844	380	393	393	380
7		60°	5,214		3,812	3,662	445	381	381	445
8		70°	4,805		2,848	2,698	555	431	431	555
9	8,000	40°	10,136	6,553	8,969	8,819	331	460	460	331
10		50°	8,505		6,672	6,522	379	412	412	379
11		60°	7,523		4,966	4,816	453	409	409	453
12		70°	6,933		3,576	3,426	584	481	481	584
13	10,000	40°	13,247	8,544	11,353	11,203	328	469	469	328
14		50°	11,116		8,350	8,200	378	423	423	378
15		60°	9,852		6,121	5,971	458	426	426	458
16		70°	9,062		4,304	4,154	604	514	514	604
S. N.	D (mm)	$\alpha$	Fx1 (kN)	Fy1 (kN)	Fx2 (kN)	Fy2 (kN)	Fx3 (kN)	Fy3 (kN)		
1	4,000	40°	269	226	269	226	189	361		
2		50°	246	293	246	293	146	312		
3		60°	214	371	214	371	156	271		
4		70°	172	473	172	473	178	243		
5	6,000	40°	258	217	258	217	118	367		

Tab 6-6 Scheme III Calculation table of reaction force load between attached rod and building support (continued)

6		50°	114	291	244	291	95	319
7		60°	222	585	222	385	106	280
8		70°	190	521	190	521	129	252
9	8,000	40°	254	213	254	213	68	369
10		50°	243	290	243	290	70	321
11		60°	227	392	227	392	80	282
12		70°	200	549	200	549	101	254
13	10,000	40°	251	211	251	211	68	369
14		50°	243	290	243	290	76	322
15		60°	229	397	229	397	65	283
16		70°	207	567	207	567	83	255

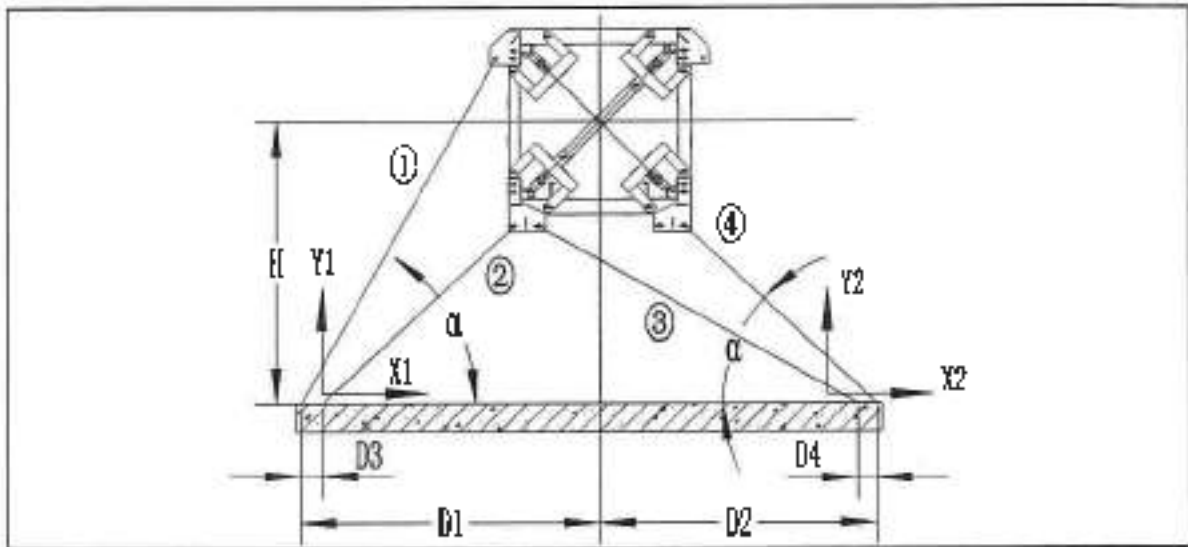


Fig.6-15 Scheme IV four-bar attachment equipment

Tab 6-7 Scheme IV Calculation table of reaction force load between attached rod and building support

S. N.	D (mm)	$\alpha$	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	D1 (mm)	D2 (mm)	D3=D4 (mm)
1	4,000	40°	7,608	6,311	5,381	3,913	7,293	4,702	300
2		50°	6,383	4,779	4,616	3,283	5,568	3,315	300
3		60°	5,647	3,751	4,080	2,904	4,288	2,657	300
4		70°	5,204	3,058	3,672	2,676	3,245	2,120	300
5	6,000	40°	10,719	9,336	8,448	7,024	9,676	6,586	300
6		50°	8,994	7,304	7,153	5,894	7,246	4,994	300
7		60°	7,956	5,991	6,281	5,214	5,443	3,812	300
8		70°	7,332	5,145	5,654	4,805	3,973	2,848	300
9	8,000	40°	13,830	12,400	11,539	10,136	12,060	8,569	300
10		50°	11,610	9,870	9,730	8,505	8,925	6,672	300

Tab. 6-7 Scheme IV Calculation table of reaction force load between attached rod and building support (continued)

S. N.	D (mm)	$\alpha$	F1 (kN)	F2 (kN)	F3 (kN)	F4 (kN)	Fx1 (kN)	Fy1 (kN)	Fx2 (kN)	Fy2 (kN)
11		60°	10,265	8,269	8,540	7,523	6,598	4,966	310	
12		70°	9,464	7,257	7,714	6,923	4,701	3,576	310	
13	10,000	40°	16,940	15,490	14,639	13,247	14,443	11,353	300	
14		50°	14,220	12,460	12,321	11,116	10,603	8,350	300	
15		60°	12,580	10,561	10,820	9,832	7,752	6,121	300	
16		70°	11,590	9,380	9,804	9,062	5,430	4,304	300	
1	4,000	40°	296	356	207	499	334	192	324	261
2		50°	276	289	227	447	271	225	260	282
3		60°	252	293	258	434	228	273	226	317
4		70°	221	338	304	436	185	348	221	379
5	6,000	40°	303	392	208	453	321	207	314	254
6		50°	280	322	243	427	261	243	255	282
7		60°	255	314	290	426	220	299	224	329
8		70°	232	367	361	432	182	394	218	415
9	8,000	40°	310	409	211	430	313	214	308	250
10		50°	284	342	252	417	256	253	252	282
11		60°	260	327	311	422	217	314	221	336
12		70°	240	390	399	429	183	422	214	438
13	10,000	40°	314	418	213	417	308	219	304	248
14		50°	288	354	258	410	253	259	250	283
15		60°	263	336	324	419	215	323	220	341
16		70°	245	406	426	428	184	441	211	454

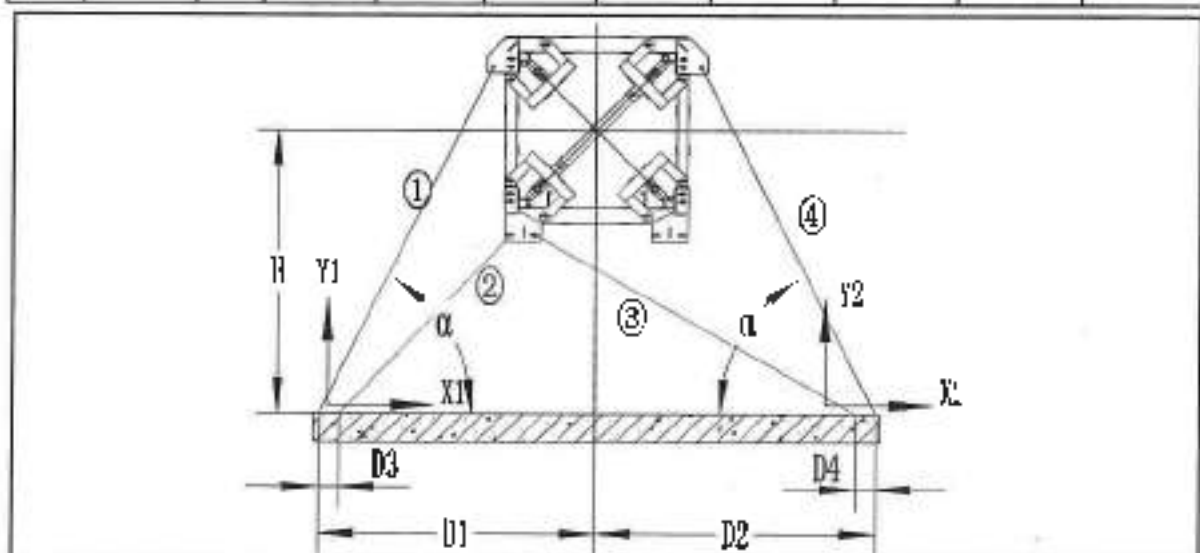


Fig. 6-16 Scheme V: four-bar attachment equipment

Tab.6-8 Scheme V Calculation table of reaction force load between attached rail and building support

S. N.	D (mm)	$\alpha$	L1-L4 (mm)	L2 (mm)	L3 (mm)	D1-D2 (mm)	D3-D4 (mm)			
1	4,000	40°	7,608	8,311	8,740	7,293	700			
2		50°	6,383	4,779	6,070	5,568	300			
3		60°	5,647	3,751	5,460	4,288	300			
4		70°	5,204	3,058	4,560	3,245	300			
5	6,000	40°	10,719	9,336	11,180	9,676	360			
6		50°	8,954	7,304	9,010	7,346	340			
7		60°	7,956	5,991	7,510	5,443	340			
8		70°	7,332	5,145	6,390	3,973	310			
9	8,000	40°	13,830	12,400	14,200	12,060	300			
10		50°	11,610	9,870	11,500	8,923	300			
11		60°	10,265	8,269	9,680	6,598	300			
12		70°	9,461	7,257	8,370	4,701	300			
13	10,000	40°	16,940	15,490	17,250	14,443	300			
14		50°	14,330	12,460	14,040	10,603	300			
15		60°	12,580	10,561	11,900	7,752	300			
16		70°	11,590	9,380	10,410	5,430	300			
S. N.	D (mm)	$\alpha$	F1 (kN)	F2 (kN)	F3 (kN)	F4 (kN)	Fx1 (kN)	Fy1 (kN)	Fx2 (kN)	Fy2 (kN)
1	4,000	40°	273	243	227	327	426	269	433	268
2		50°	237	253	230	289	347	292	365	290
3		60°	210	277	245	291	287	328	328	324
4		70°	186	313	292	311	276	388	319	382
5	6,000	40°	244	259	244	303	407	277	419	276
6		50°	214	262	251	287	328	308	351	306
7		60°	195	284	275	291	269	356	318	351
8		70°	189	328	345	309	213	442	310	457
9	8,000	40°	230	265	252	296	396	283	408	287
1-0		50°	205	267	267	286	320	318	343	316
1-1		60°	191	290	291	291	264	376	310	373
1-2		70°	193	343	386	308	214	479	302	476
1-3	10,000	40°	223	268	256	295	389	286	400	285
1-4		50°	200	270	269	286	315	325	337	324



Tab 6-8 Scheme V Calculation table of reaction force load between attached rod and building support  
(continued)

1-5		60°	190	296	303	291	262	389	304	387
1-6		70°	197	357	415	308	216	507	295	505

Area with horizontal dashed lines for handwritten notes.

# SANY

## Tower crane operation

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Lined area for notes or observations, consisting of multiple horizontal dashed lines.

## 7. Tower crane operation

### 7.1 Operation precautions

1. Each mechanism has zero position protection function, so each joystick cannot move away from the zero position when powering on the power circuit, otherwise power-on cannot be achieved.
2. In order to prevent damage to the tower crane due to improper operation, all related operation steps are provided with delay protection, which prevents the tower crane from being suddenly accelerated, decelerated or reversed.
3. In case of emergency, you may lock up each movement mechanism using the "emergency stop" button.
4. Weight sensor must be calibrated accurately, and regularly calibrated thereafter. Re-calibration shall be performed when more sections are added, otherwise the normal production may be affected.
5. If a battery is equipped, the following matters must be paid attention to when using and maintaining:
  - 1) The battery auxiliary brake system plays the role of preventing danger caused by the sudden lift of the slewing brake during the operation (especially when lifting the tower crane) in case of a sudden power failure. When getting off duty, do not put the "slewing brake" knob at the braking position, otherwise the battery may be damaged due to over-discharge. Please always keep the 9QF circuit breaker in the battery module closed, otherwise the battery will lose its function.
  - 2) The method of judging the battery to be full charge or undercharge is as follows:
    - Observe the 'hydrometer', a round indicator on the top of the battery, and 'green' indicates good charging condition, 'black' indicates the need to be charged; 'white' indicates the battery needs to be replaced.
    - Measure the battery output voltage. 24-26V of battery output voltage indicates the battery is fully charged and 21-23V of battery output voltage indicates undercharge and needs to be charged.
6. In the event of thunderstorm, heavy rain, dense fog or the wind speed at the top of the tower crane exceeds 20m/s, stop all lifting operations.
7. When installing, disassembly, adding or reducing sections, the wind speed at the maximum installation height of the tower crane should not be greater than 13m/s. Implement the agreement between the user and manufacturer if there are special requirements.
8. In case of encountering windsstorm and other extreme working conditions, please lower the climbing frame and tower height as much as possible while lifting the slewing lock, which keeps the upper part of the tower crane rotating with the wind (ensure that the rotation of the crane arm does not interfere with the surrounding objects).

### 7.2 Startup

1. Generally, the general distribution switch in the distribution box at the bottom of the tower crane should be in a closed state. Please confirm it is closed before the tower crane.
2. Main circuit breaker of the circuit is located in the control cabinet in the control room. Please confirm that knob switch and handle, etc. are in the release or closed position before closing the main circuit breaker.
3. Close the main circuit breaker, confirm that other circuit breakers (circuit breakers to be closed) are closed, confirm that the power indicator on the left console is on, rotate the knob on the control cabinet door and confirm that the three-phase voltage is normal.
4. Confirm that there is no fault indication on the display, turn on the power supply to power on the power circuit.
5. Sound the horn, prompting other site personnel to be aware that the tower crane will start up. Perform preliminary trial run to the three major mechanisms, and start to work only after confirming no abnormalities.

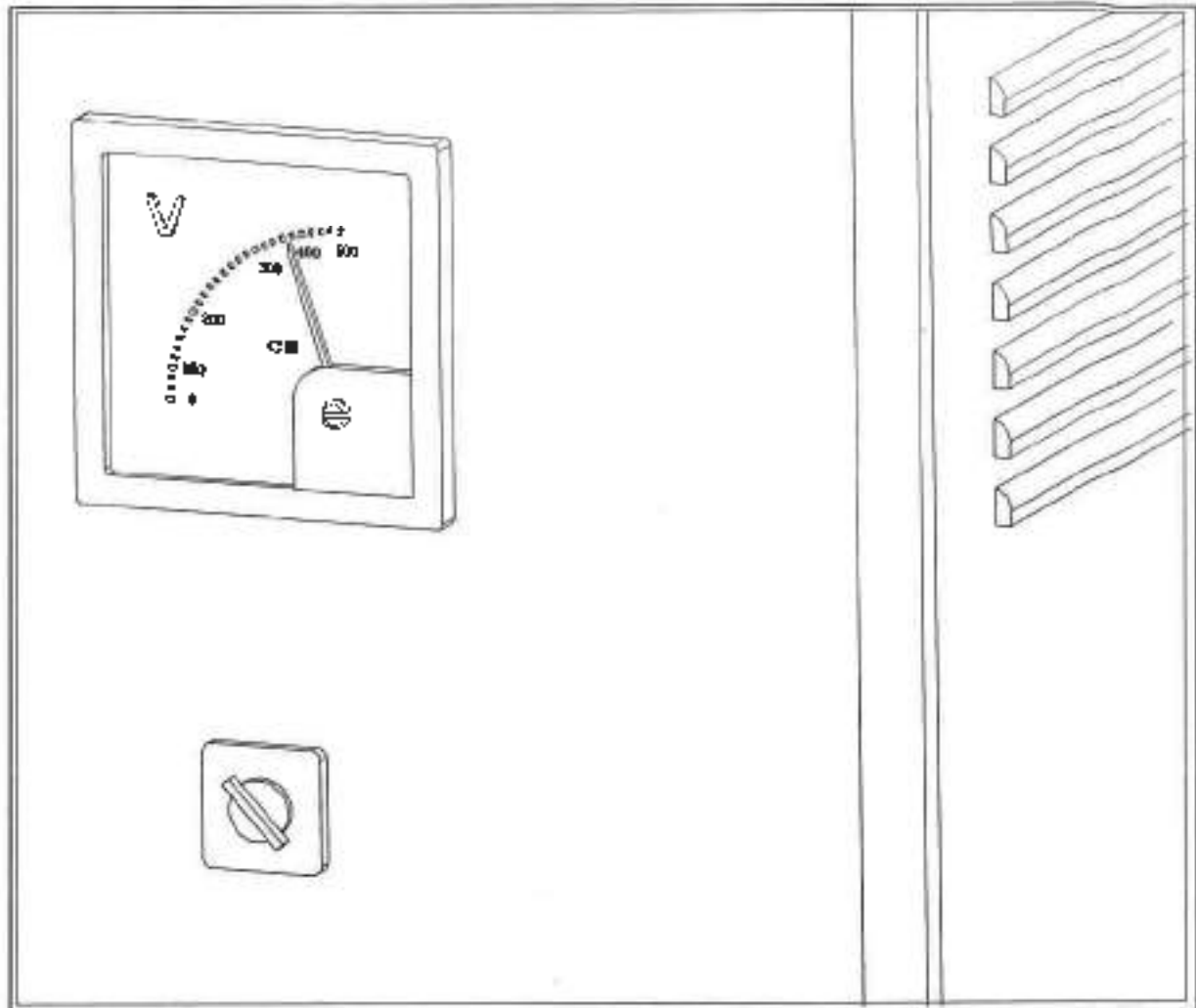


Fig 7-1

### 7.3 Shutdown

1. Withdraw the hook to the highest and nearest position (or the middle of the crane arm to prevent the hoisting wire rope from sagging too much).
2. Turn off the power supply.
3. Disconnect the main circuit breaker in the control room.
4. If the tower crane is in an environment where it can rotate freely, confirm that the slewing mechanism is in a free rotating state after powering off.
5. If the tower crane is located in a position where it cannot rotate freely, confirm the slewing mechanism in the effective braking state after powering off. At which time please be noted that the main circuit breaker 1QF in the driver's cab, the control power circuit in the power cabinet, power circuit breaker 2QF and 6QF of the display, and the circuit breaker at the tower bottom distribution box cannot be disconnected.
6. Battery auxiliary braking system can only maintain 6-8 hours of effective braking when fully charged. In order to prevent braking failure, please consider other safety measures.

#### ⚠ Attention

Under the circumstances that the tower crane cannot rotate freely, once the power supply is interrupted, the free slewing of the tower crane will lead to dangerous conditions.

The main circuit breaker on the tower and disconnecter under the tower must be closed in lightning weather, otherwise the control devices may be damaged.

7. Lock the door and leave the tower crane.

#### 7.4 Jacking

1. Jacking pumping unit startup knob switch is located on the front panel of the pumping unit, or in the form of knob box located near the pumping unit, as shown in the figure below. After the jacking pumping unit knob switch is turned on, pumping unit motor rotates and the three major mechanisms of the tower crane are prohibited to act.
2. In case of needing the three major mechanisms to act, you must first turn off the jacking pumping unit knob switch.
3. The action pressure of the overflow valve of the pumping unit is 31.5MPa, the upper pressure limit pointer on the pressure gauge is set to 34MPa. Please pay attention to the pressure change when operating, and shut it down for inspection when the upper limit is reached or exceed.

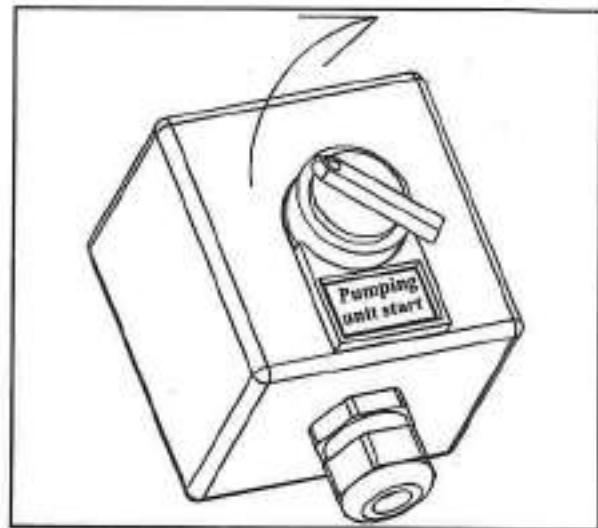


Fig.7-2

The jacking harness is a temporary harness.

Before jacking up, put the harness (8XP) around the standard section and sleeve frame, pass it through the middle of the slewing support, open the power cabinet door upward, and plug it into the socket (8XS) temporarily.

Be sure to wind this harness after jacking, coil it up near the pumping unit and cover the plugs. Otherwise, the cluster may be damaged to cause failure.

#### 7.5 Other operations

##### 7.5.1 Main operation interface

1. The main interface is shown in the following figure:

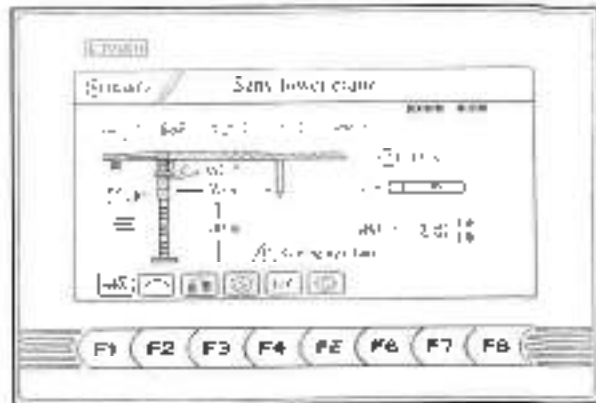


Fig.7-3

- 1) There are 8 function keys "F1-F8" under the display, and the functions of the keys are prompted by the corresponding menu at the bottom of the screen.
- 2) The main interface should provide the following information from top to bottom and from left to right:
  - 1) Current date and time: the basis for system data recording;
  - 2) Wind speed: display the current wind speed level;
  - 3) Torque: bar animation simulation, "N×M" indicates the product of lifting weight and amplitude, simulating the ratio of current torque and rated torque of the tower crane;
  - 4) Slewing gear: display the current slewing gear value;
  - 5) Hoisting gear: display the current hoisting gear value;
  - 6) Derricking gear: display the current derricking gear value;
  - 7) Working time: the accumulated working time of the tower crane after startup;
  - 8) Slewing angle (optional): the slewing position of the boom, the corresponding value from the right limit to the left limit is -540°-540°;
  - 9) Inclination (optional): the inclination angle of the tower crane in the direction of the crane arm;
  - 10) Bogie amplitude: the current amplitude value, i.e. the distance from the hook to the center of slewing;
  - 11) Multiplier: the current multiplier number;
  - 12) Equipment service prompt: prompt sign will flash on equipment every 360 hours, and you can press "Check" to eliminate the sign after service is done;
  - 13) Hook height: the height from the hook to the ground;
  - 14) Actual weight: the current actual weight of the load;
  - 15) Rated weight: the allowable lifting weight at the current amplitude;



- 16) Alarm and operation information prompt guidance and prompt for the operator on current problems.

### 7.5.2 IO query

1. Press F5 in the main interface to jump to the "IO status" interface (see the figure below).

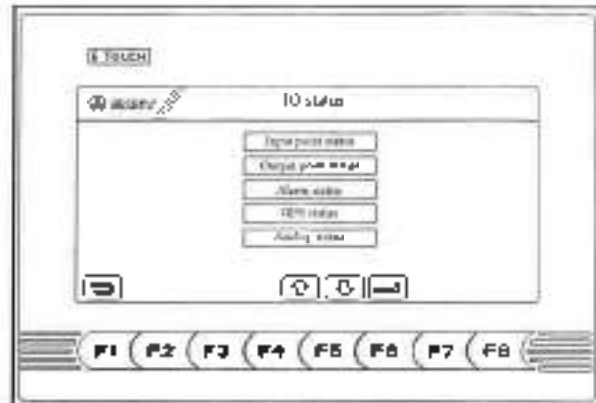


Fig.7-4

1. The "IO Status" interface is mainly used to query the status of input points, output points and alarms, which is used to provide some auxiliary reference information during the installation and commissioning, fault judgment and processing.
2. By selecting and confirming in this interface, you can enter the relevant interface, and return to the main interface using the return key.
3. The following figure shows the input point status inquiry interface, and the pie in front turns green when the relevant point position is triggered.

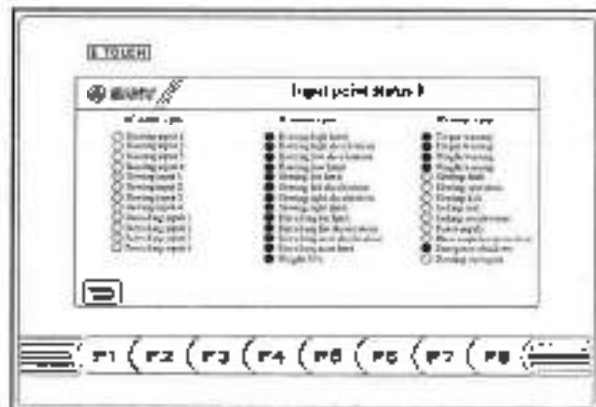


Fig.7-5

4. The following figure shows the alarm status query interface where you can query the status of all simultaneous alarm devices.

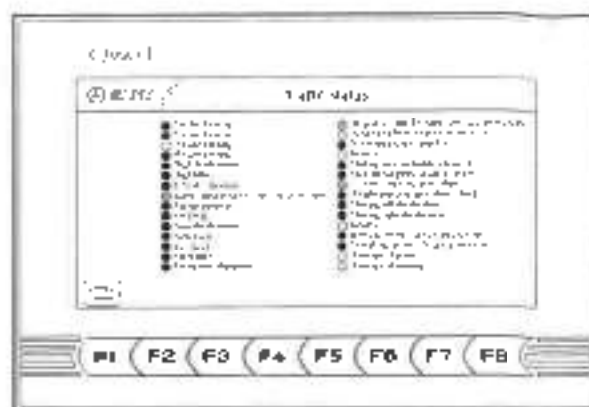


Fig.7-6

### 7.5.3 Setting change

1. Press F6 "Device" button on the main interface to call out the device information query interface (see the figure below).

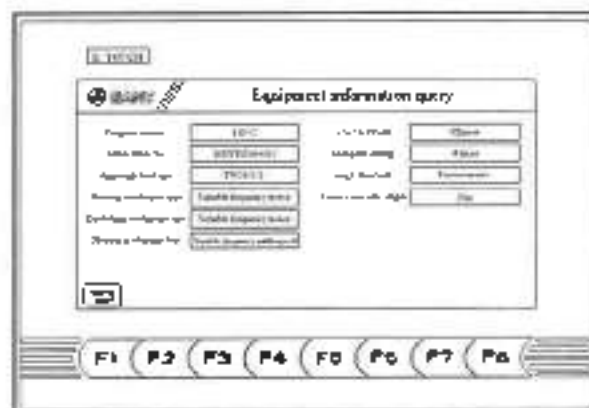


Fig.7-7

2. To modify the information and settings before the 'Derricking Drums Diameter' in the interface, a dynamic verification password is required. Other items that can be changed are as follows:
  - 1) Derricking drum diameter: this parameter concerns the accuracy of derricking measurement, and needs to be adjusted appropriately by Sany service personnel according to the measurement data.
  - 2) Multiplier change: the multiplier setting concerns the measurement and display of height and lifting load, and the setting here must match with the actual.
  - 3) After the multiplier is changed, select 'multiplier setting' using up and down keys, and select multiplier '1' or '2' or '4' using left and right keys. press enter key to complete setting.
  - 4) Angle detection device: it concerns the group tower anti-collision system, and the anti-collision system for tower crane is optional. When this option is selected, slewing angle detection device is an electronic compass, while the ordinary tower crane uses the slewing potentiometer.
  - 5) Tower arm length. when the tower crane configuration is less than the maximum arm length, for instance, 6012 tower crane configured with 55m arm, its amplitude load relationship differs from 60m arm. The setting here should correspond to the actual application of the arm length.

- 6) Select "tower crane's arm length" using up and down keys, change the setting using the left and right keys, and press enter key to complete the setting.
- 7) Language selection: Press "Page Down" key to turn to the next page. There are two options in language selection, Chinese and English. After English is selected, the whole interface will be in English.

#### 7.5.4 Slewing gear setting

1. The slewing gear setting function is to meet the individual needs of different customers for slewing speed and vortex braking performance of each gear. This feature is password protected for prudence purposes. In the main interface, press the F2 key "Slewing Setting" button to enter the password verification interface (see the figure below). Press the Enter key to start entering the password, press the left and right keys to select the number of digits, press the  $\leftarrow$   $\rightarrow$  keys to increase or decrease the number, after the six-digit password is entered, press the Enter key to confirm.

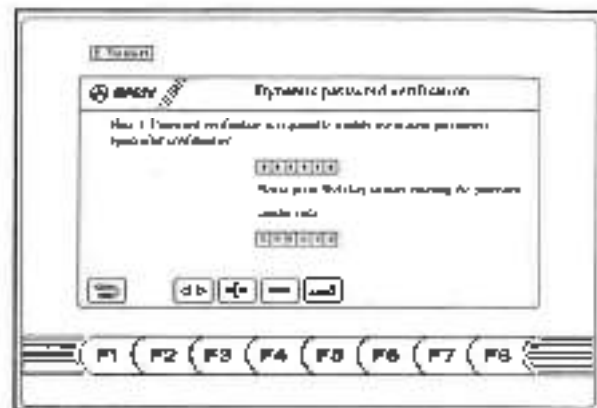


Fig.7-8

1. If the password entered is correct, it will enter the slewing gear setting interface. (See the following figure)

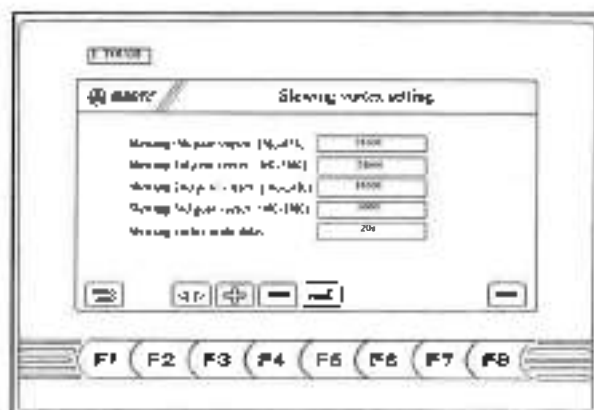


Fig.7-9

2. The slewing gear frequency setting function corresponds to the early tower cranes whose speeds were controlled with analog quantity, not applicable to the current tower with multi-speed control mode.
3. Vortex is used to smooth the movement of the tower crane during startup and shutdown, especially when decelerating to stop. The higher the value of vortex is set, the higher the corresponding braking resistance. Under the premise of stable slewing, the smaller the value of the vortex setting, the more favorable it is for energy saving, and the less damage to the motor. The specific settings and modifications should be based on the specific situation.
4. The slewing curve setting function corresponds to the early tower cranes whose speeds were controlled with analog quantity, not applicable to the current tower with multi-step speed control mode. Its three options represent three control modes respectively.

- Press up and down keys to select item, press left and right keys to change frequency, value or curve, press Enter key to complete the setting.
- After "Reset" key is pressed, all parameters in this interface will be restored to factory settings.

### 7.5.5 Safety monitoring

- Press the F4 button "Safety Monitor" on the main interface to enter the "Safety Monitor Menu" interface (see the figure below).

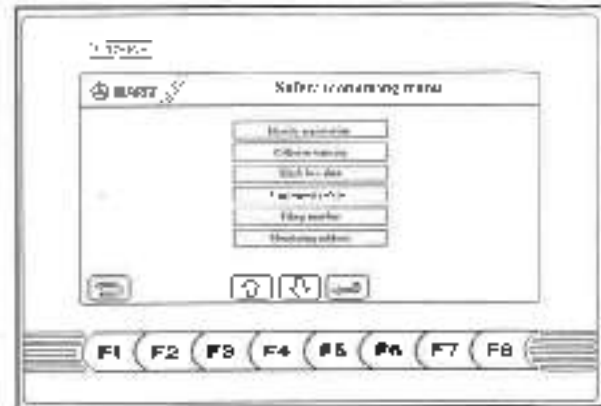


Fig.7-10

- The "Identity Registration" and "Anti-Collision" modules are optional functions, please refer to the relevant manual for the specific operation.
- After selecting the corresponding module, press the Enter key to enter.
- The "Equipment Service Information" interface is shown in the figure below. Every 360 hours, there will be an icon flashing in the middle left of the main interface. After maintenance and service, press F6 in the "Equipment Service Information" interface, and the flashing icon will disappear.



Fig.7-11

- "Filing Number" and "Monitoring Address" are related to the work of safety supervision station and third-party monitoring of tower data, and are optional. Please refer to the relevant instructions for the specific operation.

### 7.5.6 Bypass

- The "Power Supply" button on the right console has the function of "bypass" at the same time. Press and hold the button to remove the hoisting high limit and the derricking rear limit.

# SANY

## Disassemble

<b>8. Disassembly</b> .....	<b>8-1</b>
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<b>8.3.10 Work after disassembly</b> .....	<b>8-12</b>

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## 8. Disassembly

### 8.1 Preparation before disassembly

1. Make sure there are no obstacles to obstruct the operation.
2. Ensure that the jacking mechanism is working properly and main stress members are free from defects that affect safety.
3. Suitable crane.

### 8.2 Precautions

1. Before disassembly the tower crane out of site, perform service and trial run in the jacking system as it has not been used for a long time.
2. When the jacking mechanism is working, all operators should concentrate on observing whether the relative position of the relative moving parts is normal (such as between the roller and the main chord member, between the climbing frame and the tower crane body). If there is a deviation between the climbing frame and the tower body when the frame is rising, stop jacking up and immediately lower it.
3. Wind speed at the top of the tower crane should be not greater than 12m/s when disassembling.

### 8.3 Disassembly sequence

#### 8.3.1 Disassemble standard section

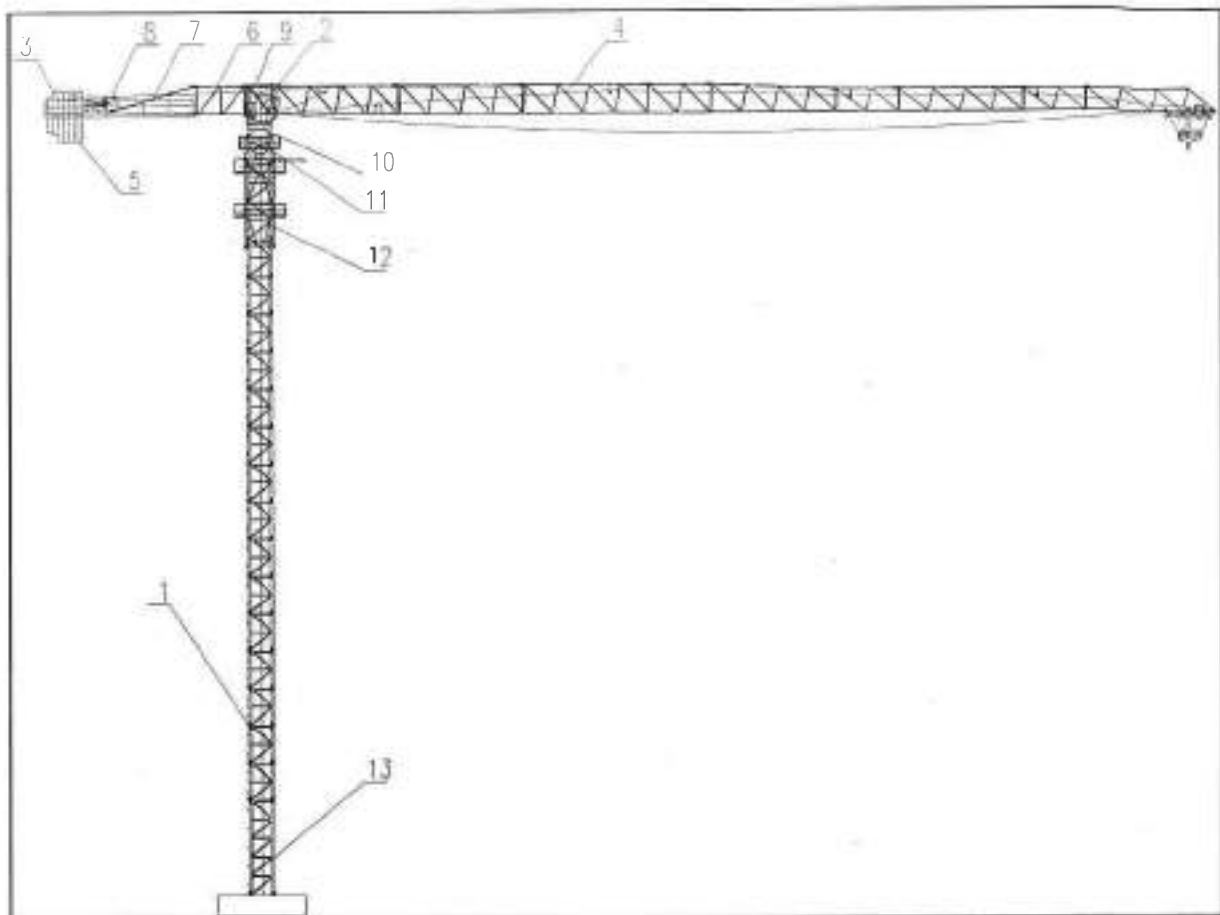


Fig.8-1 disassembly sequence

Tab.8-1 disassembly sequence

1. Disassembly of standard section (remaining one standard section)	2. Disassemble the electric control system	3. Disassemble the balance weight, leaving two 4t counterweight blocks	4. Disassemble the crane arm assembly.
5. Disassemble the remaining two 4t counterweight blocks	6. Disassemble the counter boom pull rod	7. Disassemble the counter boom	8. Disassemble the square boom assembly
9. Disassemble the tower crane head assembly	10. Disassemble the slewing assembly	11. Disassemble the transition section assembly	12. Disassemble the climbing frame assembly
13. Disassemble the remaining parts			

1. Install the guide rail and hang the bogie assembly on the rail. Make the slewing brake in the braking state, and remove the pin connection between the transition section seat and the uppermost standard section. Extend the jacking cylinder, slightly jack up the climbing frame, and balance through bogie derailing.
2. Jack up again for a small distance and put the hook on the bogie assembly on the standard section to be disassembled.
3. Remove the pin connecting this standard section to the standard section below and pull out the ladder. Open the jacking, pull out the lower end of the standard section from the fishplate, and then drop the crawling claw of the sleeve frame on the standard section tread, press down the lever and lock it.



4. Move the bogie assembly and remove the standard section from the sleeve frame.
5. Raise the climbing claw, perform the jacking and lowering operation, insert the transition section into the topflange of the standard section below and lock it with the pin.
6. Lift the standard section to the ground by hanging on the bogie assembly with the jacking hook.
7. Repeat the above operation to remove the other standard sections.

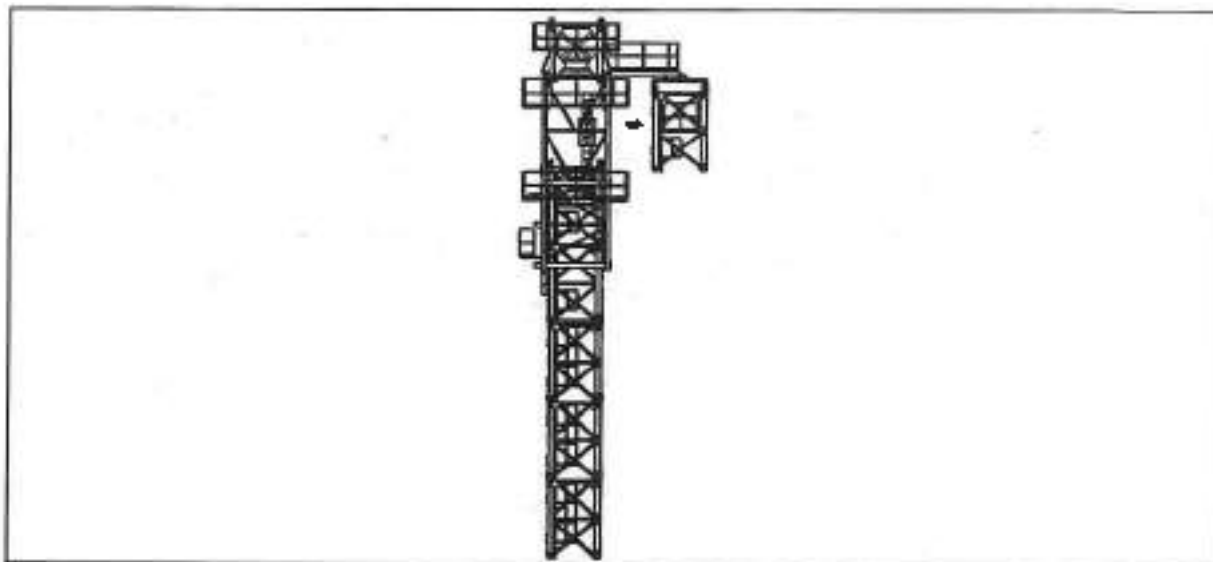


Fig.8-2 Remove the standard section

### 8.3.2 Disassemble the electric control system

1. Contrary to the installation of wiring, first disassemble in cooperation with machinery and wind wire rope to the reel, and then remove all harnesses one by one. Specific steps are as follows:
  - 1) Wind the bogie traction wire rope.
  - 2) Cooperate to disassemble the crane arm, and wind the main wire rope.
  - 3) Remove the main incoming cable.
  - 4) Remove the control cabinet to the power cabinet cable and coil it up. Fasten the protective cover at both ends of the control harness and then place it inside the driver's cab.
  - 5) Remove the wiring inside the control cabinet of the electric horn, wrap the connector, coil it up and tie it to the electric horn; unplug the inclination sensor (optional), wind the line and tie it near the terminals inside the control cabinet; remove the brake resistor cable (one end of the power cabinet), wind it above or near the resistor cabinet.
  - 6) Remove the hoisting mechanism cable (one end of the power cabinet), properly protect the motor (including the braking motor) cable connector and cable marker, coil up and hang in the safe position on the hoisting mechanism.
  - 7) Unplug the torque limiter and anemometer, wrap the connector, coil it up and fix it in at a safety position near the tower crane head torque limiter.
  - 8) Remove the jacking plug, slewing plug, derricking plug, cover with the protective cover, coil them up with respective cables, and fix them at the safety position near the corresponding mechanisms.

- 9) Remove the three major mechanisms limiter and potentiometer harness plug, weight sensor plug, wrap the connector, coil them up with respective cables, and fix them at the safety position near the corresponding mechanisms.
- 10) Remove the power cabinet and brake resistor box (if it needs to be removed), and leave the bolts on the base and tighten them, packaged and protected so as not to be damaged during transportation.
- 11) In order to avoid possible damage during transportation, the anemometer and barrier light should be removed for transportation.

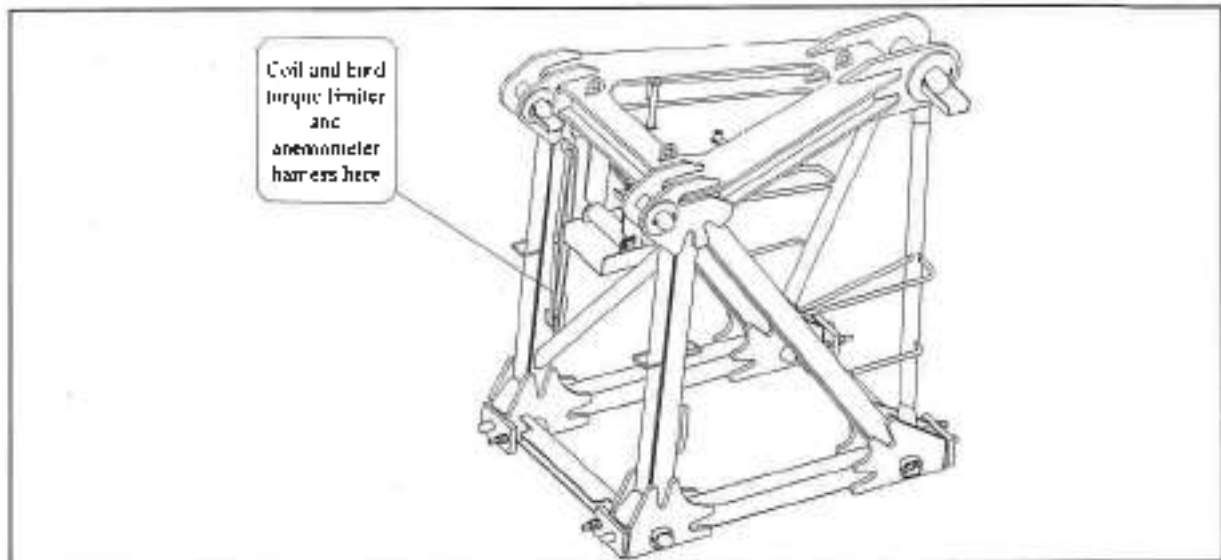


Fig. 8-3

After all harnesses are removed and coiled, focus on checking whether there is any obstruction to lifting and transportation, and ensure that the connectors and cable markers (wrapped with paper tape, etc.) are protected tightly to avoid damage during lifting, transportation and storage.

### 8.3.3 Disassemble counterweight

1. Following the sequence contrary to the counterweight installation, remove the counterweights in turn with the truck crane, leaving 2 pieces of 4.0t counterweights.

### 8.3.4 Disassemble the crane arm assembly

1. Remove the hoisting wire rope and check the wire rope carefully.
2. Lift the tip of the crane arm upward slightly with a truck crane according to the location of the lifting point at the time of installation. Please refer to section 4.2.9 for the table of the center of gravity of the crane arm.
3. Remove the connecting pin and connecting bolt between the crane arm and the tower crane head, making the crane arm detach from the tower crane.
4. Put the crane arm on the support with sleepers.

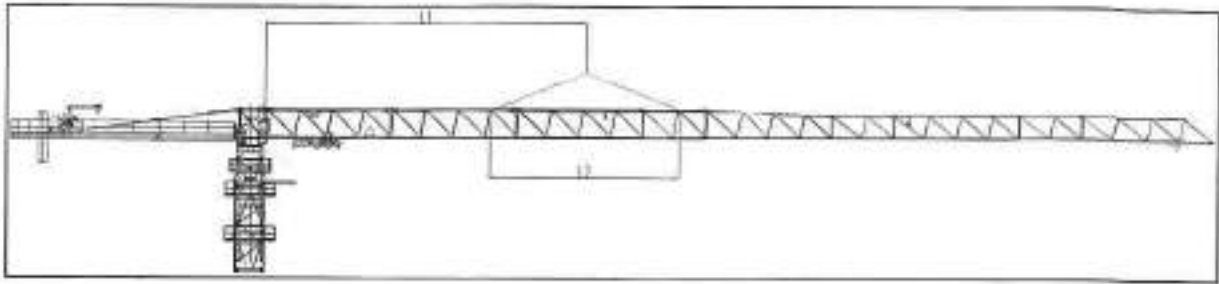


Fig.8-4 Disassemble the crane arm assembly

### 8.3.5 Disassemble the counter boom assembly

1. Lift off the remaining 2 pieces of 4.0t counterweight.
2. Lift the counter boom 11 to make the counter boom pull rod in an unstressed state and remove the connecting pin in the middle of the counter boom pull rod.

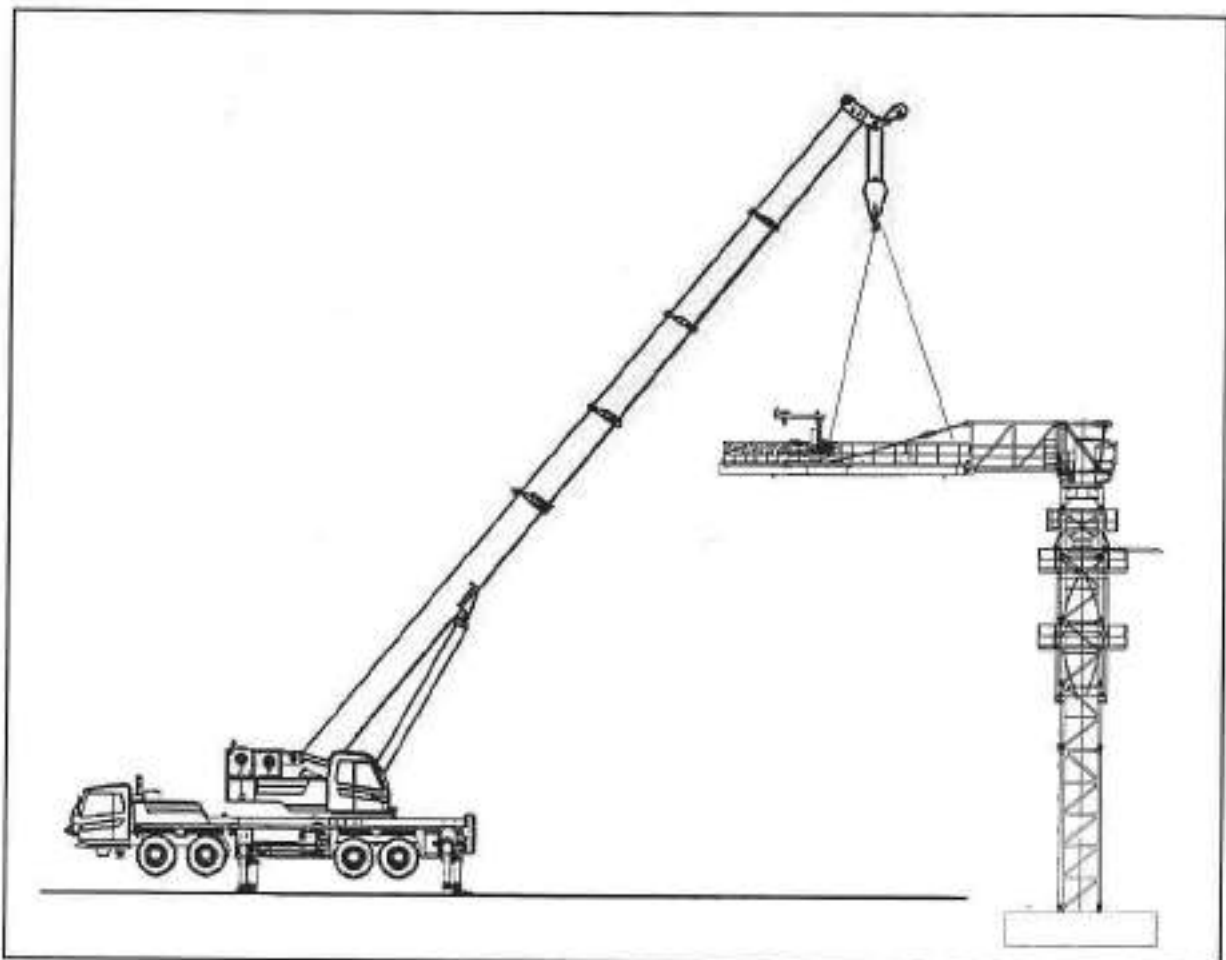


Fig.8-5 Disassemble the counter boom

3. Remove the connecting pin between the counter boom 11 and the square boom assembly, and lift it up and put it flat on the ground.
4. Remove the connecting pin between the square boom assembly and the tower crane head and lift it on the ground.

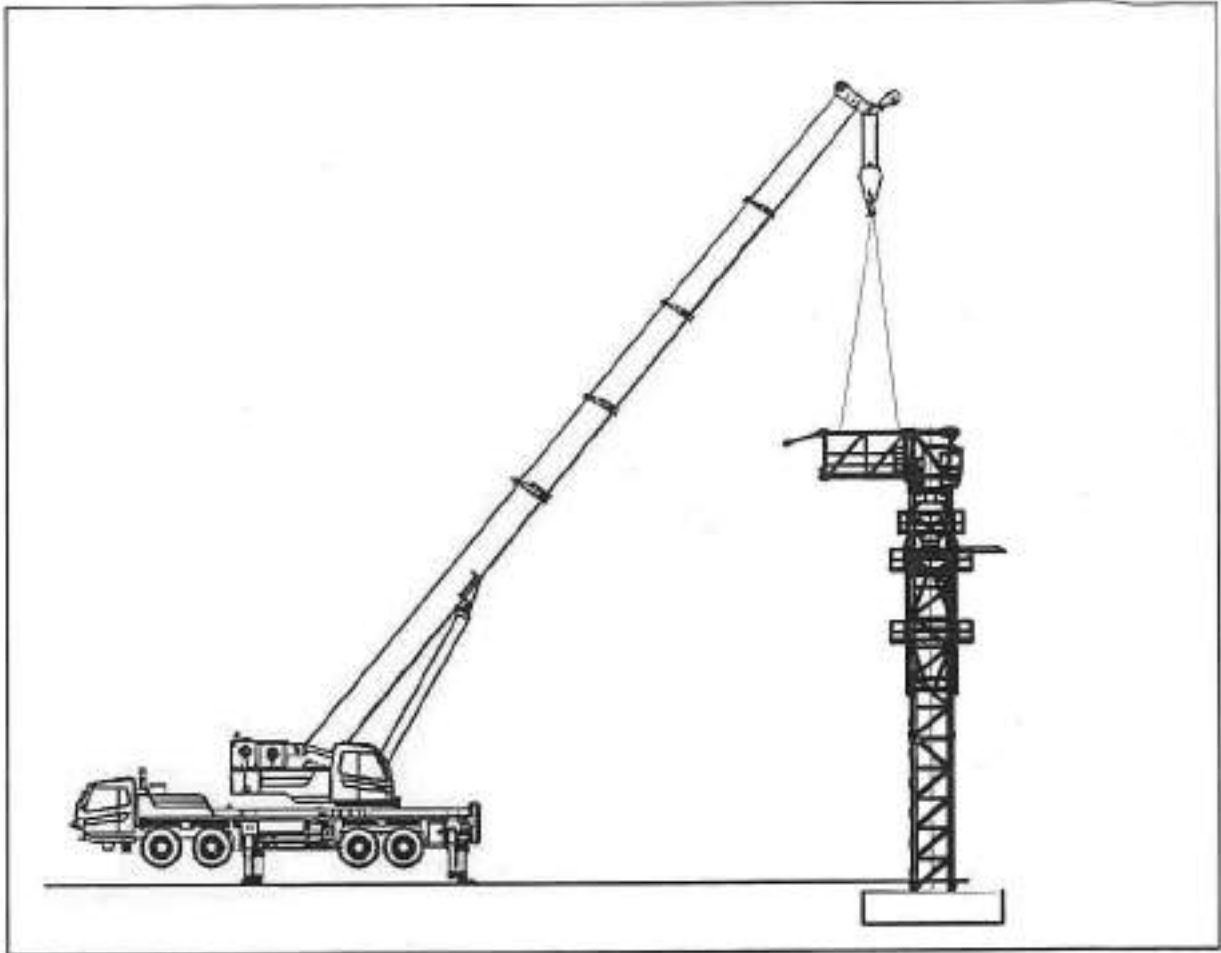


Fig.8-6 Disassemble the square boom

### 8.3.6 Disassemble the tower crane head assembly

1. Fix the rope on the lifting lug at the top end of the tower crane head and remove the connecting pin between the tower crane head and the slewing assembly.
2. Lift up the tower crane head assembly and place it on the ground.

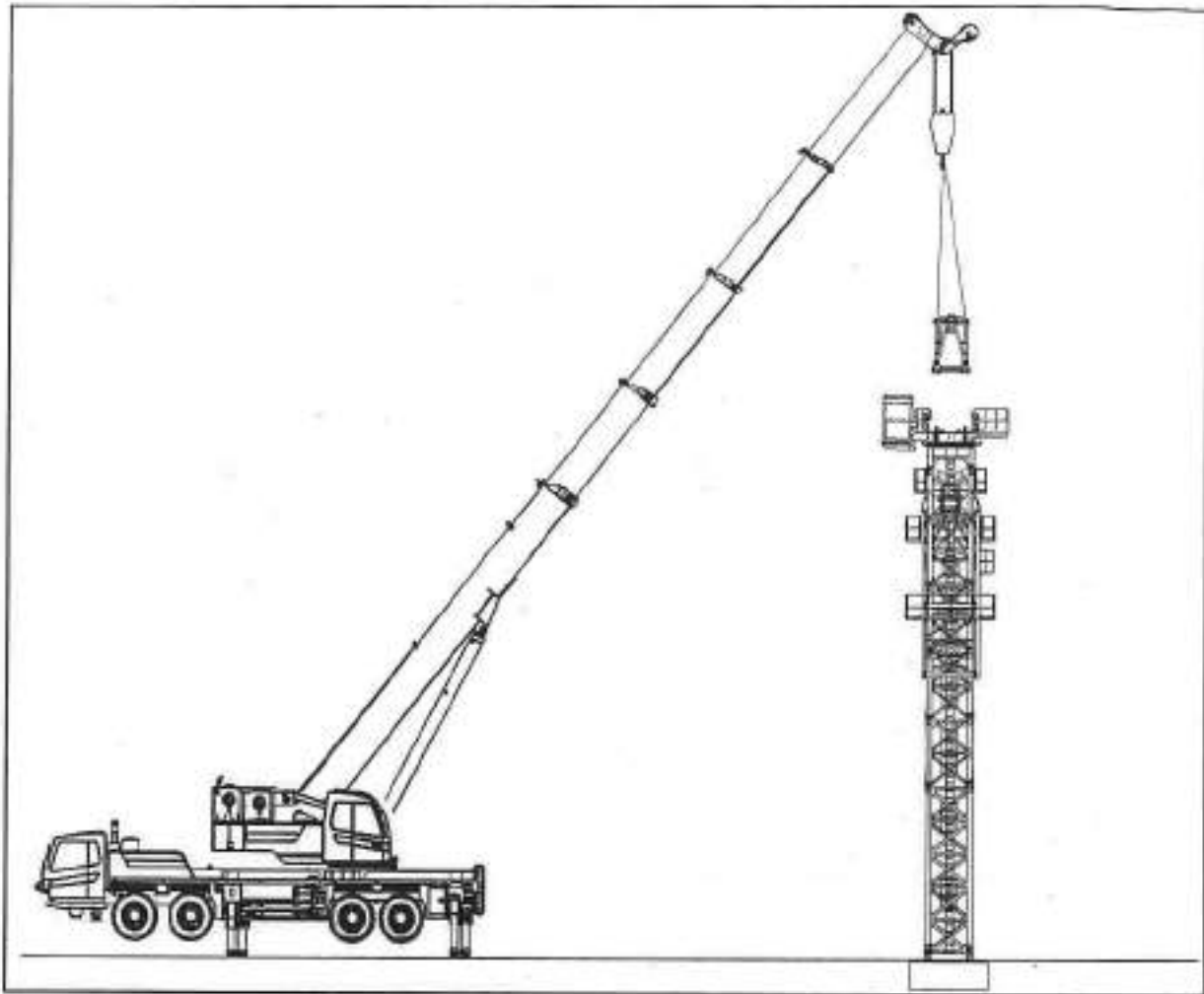
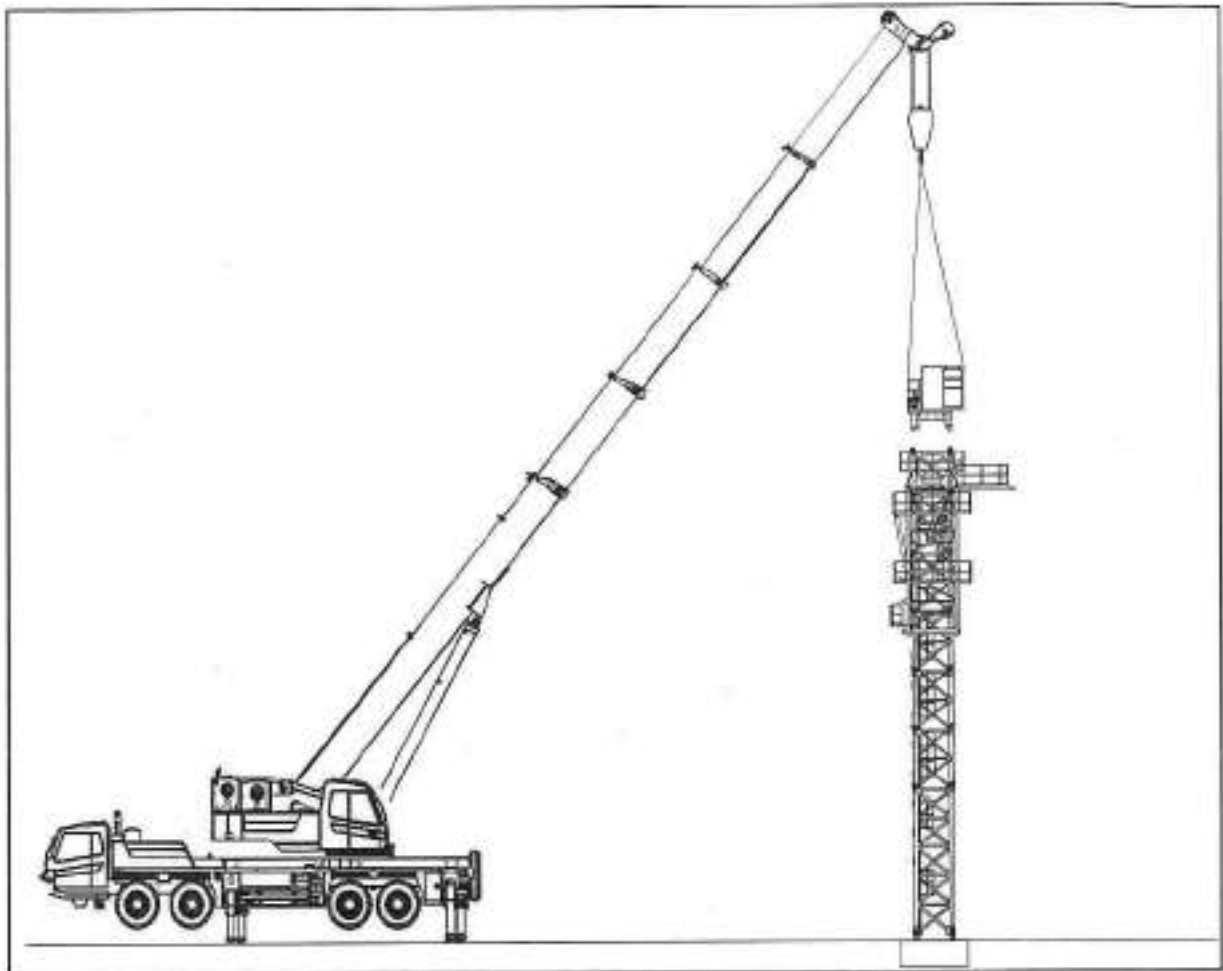


Fig.8-7

### 8.3.7 Disassemble the slewing assembly

1. Remove the lower support and transition section connecting pins.
2. Fix the rope on the top of the upper support lugs, lift the slewing assembly, and lift the slewing assembly to the ground.



**Fig.8-8 Disassemble the slewing assembly**

**8.3.8 Disassemble the transition section assembly**

1. Fix the rope on the four chord members at the top of the transition section and lift it out of the tower crane.

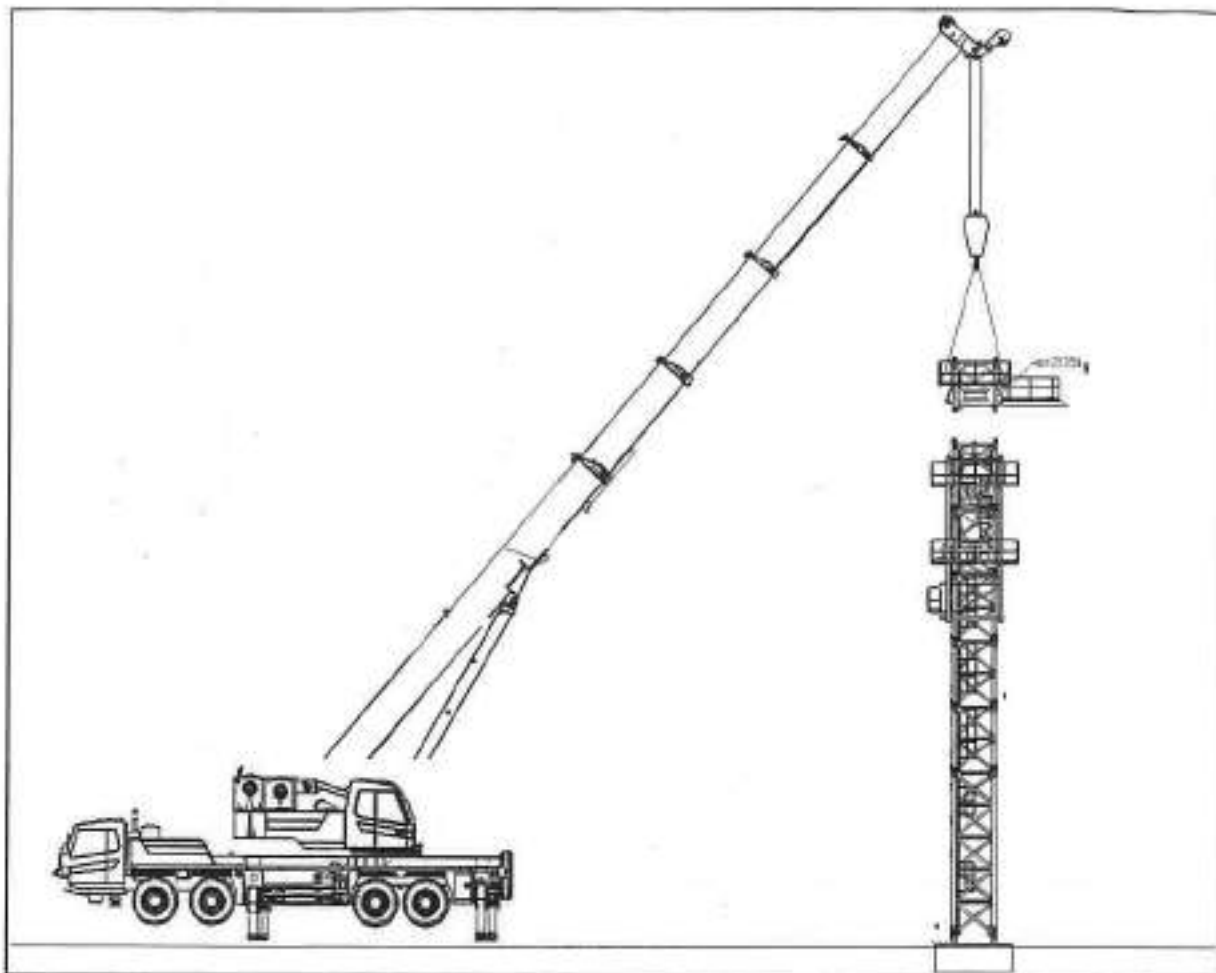


Fig 8-9

### 8.3.9 Disassemble the climbing frame assembly

1. Fix the rope on the four chord members at the top of the climbing frame and lift it out of the tower crane.

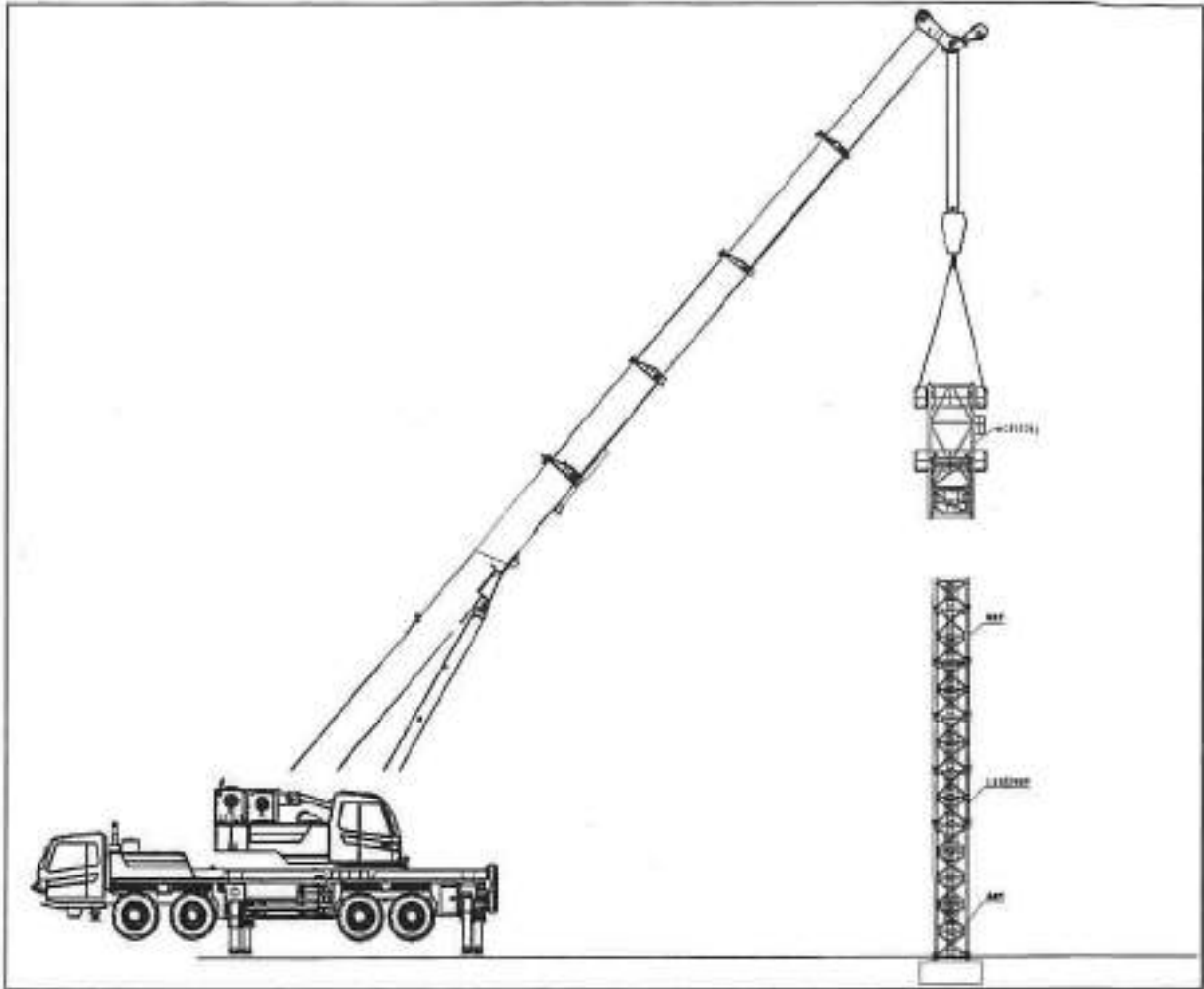


Fig 8-10 Disassemble climbing frame assembly

### 8.3.10 Work after disassembly

1. After the tower crane disassembly is completed, inspect and maintain the tower crane, and inspection and maintenance items includes:
  - 1) Clean the surface of the tower crane parts, and clean the oil, dirt and other debris off the surface of the tower crane parts.
  - 2) Check whether the parts have bruises and other defects.
  - 3) Repair the defects, then carry out rust removal and painting work.
  - 4) Protect the vulnerable parts.



# SANY

## Transport

<b>9. Transport</b> .....	<b>9-1</b>
<b>9.1 Transport precautions</b> .....	<b>9-3</b>
<b>9.2 Transport unit</b> .....	<b>9-3</b>

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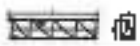
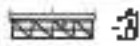

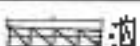
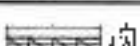
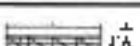

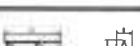
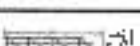
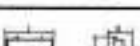
## 9. Transport

### 9.1 Transport precautions

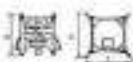
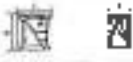
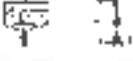
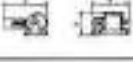
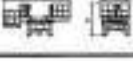
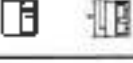
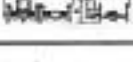



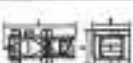




1. All parts and related accessories must be tied firmly when loading to ensure that they do not move horizontally. The overall bundling process should be isolated with blue film at the place of contact with the tower crane parts.
2. For all the parts placed directly on the truck and the parts placed on the upper layer of the parts, their contact surface should be provided with keepers for positioning. All bundled crane arm parts should be isolated with isolator to avoid mutual collision and friction.
3. When fixing the tower crane driver's cab and power cabinet, only hemp rope is allowed to be used for bundling, wire rope and other steel chain rope are not allowed. When bundling, through the retaining rings on the top of the driver's cab and power cabinet, while isolating parts in contact with corner angles with blue films.
4. After the loading is finished, the loaded parts must be counted to ensure that all parts have been loaded.
5. When passing through underground passages, bridges and tunnels, please ensure that sufficient clearance is reserved.
6. In the unloading stage ensure that the parts are not in direct contact with the ground to prevent sand, gravel and soil from entering the holes of the structural parts.

### 9.2 Transport unit

Tab.9-1 Transport unit

S. N.	Name	Shape	L (m)	B (m)	H (m)	Weight of single piece (t)	Quantity
1	Arm section I		10.35	1.64	2.65	3.15	1
2	Arm section II		10.30	1.46	2.48	2.27	1
3	Arm section III		5.27	1.46	2.44	1.00	1
4	Arm section IV		10.25	1.46	2.42	1.60	1
5	Arm section V		10.22	1.46	1.94	1.23	1
6	Arm section VI		10.17	1.46	1.93	1.06	1
7	Arm section VII		5.15	1.46	1.89	0.46	1
8	Arm section VIII		5.14	1.46	1.88	0.40	1
9	Arm section IX		10.12	1.46	1.87	0.61	1
10	Arm end section		1.68	0.85	1.36	0.17	1

Tab.9-1 Transport unit (continued)

11	Transition section assembly		2.62	2.62	2.48	2.54	1
12	Tower head		2.45	1.70	2.55	2.21	1
13	Hook		1.85	0.32	1.86	0.55	1
14	Hoisting mechanism		2.53	2.26	1.66	3.65	1
15	Slewing assembly		5.50	2.29	2.54	6.20	1
16	Cab		2.25	1.80	2.28	0.75	1
17	Bogie assembly		3.76	2.37	1.33	0.73	1
18	Counter boom rack I		4.62	1.65	2.50	1.72	1
19	Counterweight arm rack II		11.64	3.35	0.95	3.90	1
20	Basic section		7.81	2.09	2.09	4.38	1
21	Standard section		3.31	2.13	2.13	1.46	1
22	Climbing frame		7.67	2.61	2.91	4.75	1
23	Counter boom pull rod I		4.87	0.26	0.22	0.21	2
24	Counter boom pull rod II		2.04	0.26	0.22	0.11	2
25	Luffing mechanism		3.31	2.13	2.13	1.46	1

# SANY

## Service and maintenance

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Lined area for service and maintenance notes, consisting of multiple horizontal dashed lines.

## 10. Service and maintenance

### 10.1 Maintenance parts classification

1. Main service and maintenance work of the tower crane is inspection and repair:
  - 1) Inspection includes identifying and confirming all operations that affect the safety and function of the tower crane,
  - 2) Maintenance is to solve the defects found based on the inspection structure, restoring the tower crane back to normal operable condition.
2. Parts needing maintenance for the tower crane: structural parts, transmission system, steel wire rope, slewing support, pulley, electric control system, oil cylinder, pumping unit, etc.

#### ⚠ Attention

In order to ensure the normal operation of the tower crane, to avoid the occurrence of failure that affects the construction, all inspection, service and maintenance work must be strictly enforced. At the same time, regular service and maintenance can extend the life of the tower crane, reduce maintenance costs and obtain higher returns. Please fill out the inspection table when maintaining, so that you can check the information about the tower crane.

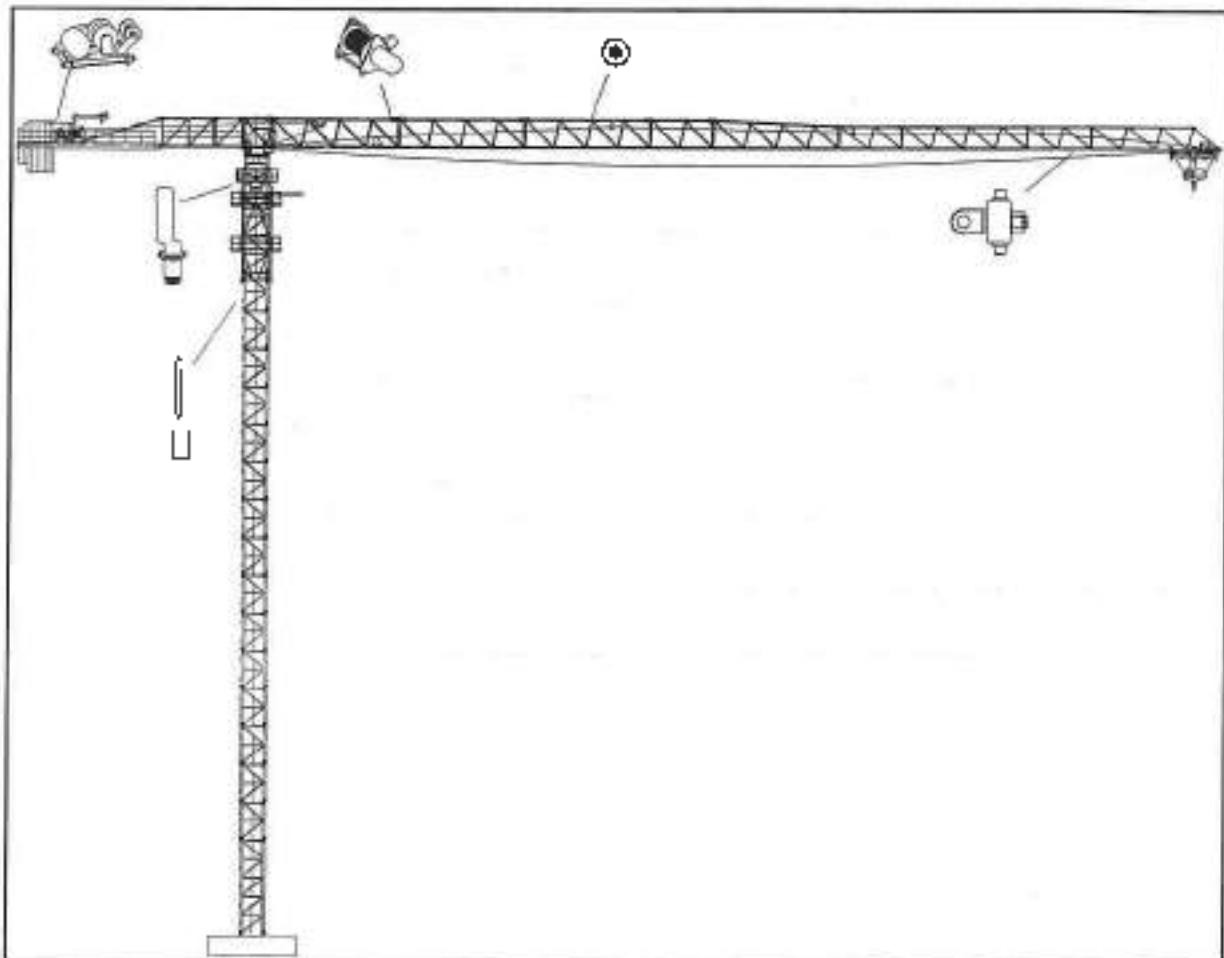


Fig.10-1

## 10.2 Regular maintenance

### 10.2.1 Daily inspection

1. Regular maintenance is divided into: daily, weekly, monthly, quarterly, semi-annual and annual inspection.

#### ⚠ Attention

1. In case of occurrence of special event such as severe weather (long-time heavy rain and accompanied by lightning), severe environment (tower crane works in the corrosive environment or particularly dirty area work for a long time), etc., check the electrical equipment more frequently and more carefully for whether there is obvious wear and tear and whether there is water leakage from the electric control cabinet. 2. Scrapping of wire rope, reel, pulley and hook must strictly in line with the provisions of GB5144 and GB/T5031. 3. Perform rust removal and painting treatment to the structural parts after each use of a project; damaged parts should be replaced in time.

Tab.10-1 Daily Inspection Item Table

Parts	Inspection content	Remarks
Complete machine	General condition of the tower crane (operation)	
Foundation	Safety of foundation	
Safety devices and accessories	Whether ladder, platform, guardrail, general safety device and operation safety device are safe and reliable	
Safe work record	The driver should read the last tower operation record carefully before starting the machine	The driver should do a good job of work record when operating the tower crane

### 10.2.2 Weekly inspection

Tab.10-2 Weekly Inspection Item Table

Parts	Inspection content	Remarks
Structural components	Whether the connection between the structural components is secure	
	Driver's cab condition	
	Whether the wire rope clamps and clamp sleeves are loose and fasten them in time	
Transmission system	Lubrication of mechanical parts	
	Lubrication of large gear ring and pinion at slewing	
	Lubrication of pulley	
	Whether safety protection device is complete	Ensure the working reliability and sensitivity
	Whether the installation and pin connection between parts are secure	
	Winch: visual inspection, operation test and brake pad wear inspection	
	Hoisting mechanism: visual inspection for defects, operation test and brake pad wear inspection, whether the limiter transmission connection is normal	The effective contact area of the limiter coupling bump is more than one-half



Tab.10-2 Weekly inspection item table (continued)

Electric Control System	Check whether the power supply cable is complete and whether the connections are correct	including whether cable and other wires are broken
	Visually check whether the electrical elements and electronic control system are complete	Including, whether the electrical elements are fastened
	Check whether the electrical elements and electronic control system work normally by operation test.	Including: limit switches and buttons shall not fail, etc
	Whether the current minimum and maximum boom inclination (optional) is consistent with the display of the driver's cab.	
	Whether the current arm amplitude value is consistent with the display in the driver's cab	
	Whether the current load value is consistent with the display of the driver's cab	

## 10.1.3 Monthly inspection

Tab.10-3 Monthly Inspection Item Table

Parts	Inspection content	Remarks
Structural components	Carefully check the welds of the base plate, underframe, tower body, slewing support, crane arm cable and jumbo (only for walking tower crane)	Check whether there is any crack on the bar, web and weld of each metal component, and pay attention to the peeling parts of the paint. If cracks or peeling parts of the paint are found, especially the peeling parts of the paint with 45° oblique stripes, quickly find out the reasons and deal with them in time.
	Check whether all nameplates are correctly installed and complete	
	Lubricate all coupling pins	
	Check the thread pre-tightening torque of each bolt connection	After a certain period of use, it must be re-tightened
	Check the brake disc for visible wear and its components for damage.	
Transmission system	Check whether the coupling bolts of the slewing ring are properly tightened	Check whether the tightening torque of the coupling bolts of the slewing bearing is correct.
	Check the connection between motor and flange	
	Check the oil level in the gearbox and refill oil in time	
	Check the pulley and bearing	
	Check the hoisting and pitching wire ropes for elongation and deformation	Replace the defective wire rope

Tab.10-3 Monthly inspection item table (continued)

	Check and lubricate all wire rope	
	Correctly lubricate the anti-twist device at the rope tail	
	Winch, check whether the brake disc act normally, the wear of the parts, adjust the brake shoe	
Electric Control System	Clean the electrical box and the inside of the console	Remove dust with low pressure air
	Clean the cooling fan and motor	Clean the fan screen with compressed air or water and soap
	Check the general condition of the electrical box and measuring system	
	Check the motor for damage and power	
	Check whether the motor wire connection is correct and secure, and whether there is any damage.	
	Check whether the connection between the motor, reducer and the base frame is normal.	
	Check whether it is normal for the connection between the underframe and the tower crane	
	Check the insulation of the electrical switch and switchboard	Its insulation resistance should not be less than 0.5M $\Omega$

**10.2.4 Quarterly inspection**

Tab.10-4 Quarterly Inspection Item Table

Parts	Inspection content	Remarks
Structural	Carefully visually inspect the welds of crane arm and counter boom.	
Transmission system	Check whether the tightening torque of the bolts of the slewing gear ring is correct	
Electric Control System	Check the grounding connection	

**10.2.5 Semi-annual inspection**

Tab.10-5 Semi-annual Inspection Item Table

Parts	Inspection content	Remarks
Structural components	Carefully check the welds of the ladder, platform and guardrail	
Transmission system	Check the wear of pulley and bearing	
Electric Control System	Check the wear of cab wiper	

## 10.2.6 Annual inspection

Tab.10-6 Annual Inspection Item Table

Parts	Inspection content	Remarks
Structural components	Perform non-destructive testing on the welds of the base plate, the arm, the slewing support and the stay rope of the lifting arm/balance arm	
	Check the wear of the connecting pin of the crane arm	
	Clean the dirt and rust off the connecting bolts between the base plate and the bottom tower section	
	Remove rust from structural parts and repaint	
	Perform anti-corrosion treatment on the exterior of the tower crane, spray paint	
	Check whether the pressure weight (counterweight) signage is clear	
	Check the tower crane fixing system	
Transmission system	Check the wear and tear of the ball and pinion of the slewing gear ring	
	Check the wear and lubrication of the rail and rollers	If installed
	Check external structural parts for corrosion	
	Check the wear of the main bearings, clean up the parts rust	
	Perform non-destructive testing on brake discs and pull rods of the winch	
	Perform non-destructive testing on brake disc of hoisting mechanism	
	Clear the rod rust and lubricate it	
	Replace damaged fixtures	
Electric Control System	Check whether the electric control system is installed correctly and carry out special maintenance if needed.	
	Clear rod corrosion on corroded parts and lubricate them	Repaint if necessary

## 10.3 Lubrication of all components

Tab 10-7 Lubrication chart of components

Names of components	Lubrication part designation	Type of lubricant	Lubrication method and cycle
Wire rope	a. Hoisting wire rope	Graphite calcium base grease	Lubricate once every six months

Tab.10-7 Lubrication chart of components (continued)

	b. Luffing wire rope	Industrial closed gear oil N220 (GB5903-2011)	After the reducer is installed for the first time, change new oil after 100 hours of operation and change new oil once every six months after continuous work.
Reducer	a. Hoisting mechanism reducer		
	b. Trailing mechanism reducer		
	c. Slewing mechanism reducer		
Rolling bearing	a. Rolling bearings in the reducer	Lithium base grease 6 (GB7323)	Refill appropriate oil every 160 hours of work, empty it and refill once every six months
	b. Drum bearing		
	c. Slewing bearing		
	d. Hook thrust bearing		
Motor bearing	All motors		Change oil once every 1,500 hours of work
Fixed and movable pulley block	a. Fixed and movable pulley of hoisting mechanism	Summer: Calcium-based grease No.4 (GB491-87); Winter: Calcium-based grease No.1 (GB491-87)	Change the grease once every 240 hours
	b. Guide wheels		
Hinge points of brake	Each hinge point	Engine oil	Refill oil with oil pot once every 60 hours of work
Crane arm, counter jib, upper support, standard section	Each hinge point, standard section connecting bolts, slewing bearing connecting bolts		Before installation and disassembly

#### 10.4 Common faults and troubleshooting

Tab.10-8 Common faults and troubleshooting of mechanical part

S. N.	Symptom	Cause	Troubleshooting
1	The wire rope is worn	Lubrication is insufficient	Lubricate once every six months
2	The connecting bolts become loose	The pre-tightening force of the bolts does not meet the design requirements	Tighten the bolts with a torque wrench
3	The steel structures are damaged	Damaged during handling or installation	Repair it if it does not affect the use; replace it if it is seriously damaged
4	The paint is damaged	The paint is damaged	Touch up the paint

Tab.10-9 Common faults and troubleshooting of hydraulic part

S. N.	Symptom	Cause	Troubleshooting
1	The cylinder retracts and vibrates greatly when it lowers down	The throttle valve of oil return circuit is not adjusted properly	Adjust throttle valve to the optimum condition
2	The connector clamp sleeve is damaged	The manufacturing process of the clamp sleeve is not guaranteed	Replace the connector with a new one
3	The cylinder cannot be stopped or slides down during lowering	Air in two cavities of the cylinder is not bled completely; the sealing is not good, or the hydraulic oil is not clean	Evacuate the air in the cylinder, ensure the seal of the control piston and one-way valve; frequently check the cleanliness of the oil to ensure the seal of the oil tank; adjustment of hydraulic pumping unit in the control valve should be accurate

Tab.10-10 Common faults and troubleshooting of transmission part

S. N.	Symptom	Cause	Troubleshooting
1	The mechanism makes abnormal noise or vibrates greatly	a. Mechanical wear	a. Refill grease to the bearings or replace them
		b. The bearings are less lubricated or damaged	b. Improve lubrication conditions. If the gear is severely worn, replace it
		c. The gear is less lubricated or severely worn	
2	The motor is overheating or even smoking	a. The load is too heavy	a. Measure the current, reduce the load if greater than the rated value
		b. The load continues and work does not meet the specified requirements	b. Operate according to regulations
		c. The power supply voltage is too low or too high	c. Check the input voltage and correct it
		d. Motor winding grounding or turn-to-turn, phase to phase short circuit	d. Find out the cause and eliminate the fault
		e. The clearance of the friction plate is inappropriate	e. Adjust the clearance to a proper value
		f. The braking and release time is incorrect	f. Adjust the braking and release time
3	The brake fails	g. The motor is not ventilated well	g. Check and maintain the ventilation
4	The mechanism is electrically charged	The brake fails	
		a. The power cable and grounding cable are incorrectly connected	a. Check and correct
		b. The grounding is bad	b. Keep it well grounded
		c. The wire is broken	c. Check and repair

### ⚠ Attention

In case of any electrical fault, please first look at the fault prompt in the lower left corner of the display screen and eliminate the fault according to the principle, which will speed up troubleshooting.

Tab.10-11 Common faults and troubleshooting of electrical part

S. N.	Symptom	Cause	Troubleshooting
1	The power circuit cannot be powered on	a. The control circuit is not powered on	a. Check whether the control circuit is powered on
		b. The emergency stop button is locked	b. Release the emergency stop button

Tab. 10-11 Common faults and troubleshooting of electrical part (continued)

		c. The handle is not returned to zero position	c. Check the cause for not zeroing and troubleshoot
2	The hoisting mechanism cannot be started	a. The circuit breaker trips for protection	a. Check the cause of trip protection
		b. The brake is not released	b. Check the cause and eliminate the line and mechanical failure
		c. The main contactor is burned out	c. Replace the contactor and commission the matching action with the brake, ensuring correct action
		d. The limiter is not connected or damaged	d. Check, repair and debug the limiter
		e. The wiring is faulty or damaged	e. Check and repair the wiring
		f. The voltage is too low	f. Check the causes of the low voltage and handle them
		g. The machine is blocked	g. Check the causes of the blockage and remove them
3	The heavy object slides down after stopping during hoisting	a. Clearance of the brake increases due to wearing	a. Adjust the clearance
		b. The brake mechanism is damaged	b. Repair the brake mechanism
4	The luffing motor does not start	a. The circuit breaker trips for protection	a. Check the cause of trip protection
		b. The motor is damaged	b. Find out the cause of damage and replace it
		c. Torque or weight limiter restriction or misoperation	c. Check the cause of the limit or misoperation and adjust it to be normal
5	The slewing motor does not work	a. The slewing brake is applied	a. Release the brake knob
		b. The motor is damaged	b. Find out the cause of damage and replace it
		c. The wiring is damaged	c. Check and repair the wiring
		d. The inverter reports a fault or abnormal parameters	d. Check the cause of the inverter and its parameters, adjust and correct the parameters.
6	The jacking motor starts abnormally	a. Loose assembly or loose wiring of start knob switch	a. Check the switch assembly and wiring condition and repair
		b. The safety pin is not inserted properly during jacking	b. Due to program limitations, the safety pin needs to be inserted into the needle pin hole during jacking


## 10.5 Wearing part

Tab. 10-12 List of wearing part

S. N.	Name and specification	Unit	Quantity	Remarks
1	Rolling bearing 6314-Z_GB276	Set	18	Hoisting pulley
2	Rolling bearing 6208-Z_GB276	Set	8	Luffing pulley
3	Rolling bearing 51308_GB301	Set	1	Anti-twist device

Tab. 10-13 List of wearing part (continued)

4	Rolling bearing 6012 2_GB276	Set	16	Roller
5	Rolling bearing 51313_GB301	Set	1	Hook
6	Rolling bearing 6304-Z_GB276	Set	8	Guide wheel
7	Pulley	Set	9	Bogie, hook, boom
8	Roller	Set	8	Bogie
9	Guide wheel	Set	4	Bogie
10	Warning lamp 0 234-24	Set	1	
11	Electric horn DL224G-24-B	Set	1	
12	AC contactor LCI-D12M7C	Set	1	
13	Coil suppressor module LAD-4RCU	Set	1	
14	AC contactor LCI-D205M7C	Set	1	
15	Contact auxiliary contact LAD-N11C	Set	1	
16	Frequency converter bus card EC-CM-C1	Set	1	
17	AC contactor LCI-D32M7C	Set	1	
18	Tower crane signal receiving module S19T-SR-01	Set	1	
19	Wind speed and direction sensor S-50-1	Set	1	
20	Stroke limiter DXZ(A1)-W-46	Set	1	
21	Push button PB1M-10/g	Set	1	
22	Emergency stop switch ZB2-BS14C-ZB2-105C	Set	1	
23	Pin sensor BWL-D8-ZX-2.5T	Set	1	
24	Stroke limiter DXZ(A1)-W-360	Set	1	
25	Stroke limiter DXZ(A1)-W-210	Set	1	
26	Limit switch YBLT-EKW-5A-B	Set	1	
27	N.c. contact piece ZB2-BE102C	Set	2	
28	N.o. contact piece ZB2-BE101C	Set	1	

 **Attention**

Some parts in the list may be slightly different from the actual configuration. Please refer to the parts manual for more accurate information.

Lined area for service and maintenance notes, consisting of multiple horizontal dashed lines.





