XGT8040-25
塔式起重机使用说明书
TOWER CRANE OPERATING MANUAL

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说明书版本号： Version code:	XCMG-TC-20180810
产品说明书是产品的一部分，应始终放在手边以备查阅。 安装、验收、操作、维护保养产品前请仔细阅读该说明书。 This instruction introduces each part of the tower crane, as well as the information users require, such as installation, operation, maintenance information and so on. Before you use the tower crane , please read the instructions carefully.	

前言 Preface

首先感谢您对徐工品牌的信赖和认可，选用徐工集团徐州建机工程机械有限公司生产的塔式起重机。

Thank you for your trust and acceptance of the XCMG product and using the tower crane made by Xuzhou Construction Machinery CO., Ltd.

本说明书叙述了塔式起重机（简称塔机）的零部件组装、立塔安装过程、安全保护装置的调试和塔机具体的操作等内容。塔机作业是一种涉及危险的工作，为了保证您使用的安全，发挥塔机的最佳性能，保证其长期可靠而高效的工作，请您在安装操作塔机之前，务必仔细阅读本操作手册，熟练掌握和运用手册所载的内容，并严格按照手册要求操作。操作者要特别注意手册中标注“危险”、“警告”、“注意”、“小心”、“提示”的内容。

The manual gives a detailed description for parts assembly, installation procedures of vertical tower, debugging of safety protection device, specific operations of tower cranes, etc. Since tower crane operation is full of dangers, the workers must carefully read the manual, become familiar with it and make use of the information contained in the manual, and operate strictly in accordance with the manual before tower crane installation and operation, so as to ensure operational safety, optimum performance, and long-term reliable and efficient operation of the crane. Operators are required to pay special attention to the parts marked with “**Danger**”, “**Warning**”, “**Caution**”, and “**Check**”.

⚠ 警告

只有经过培训并经考试合格取得资质证书的人员方能操作该塔机！否则将容易造成产品损坏及人身伤害安全事故，给您造成不必要的损失。

⚠Warning

This tower crane can only be operated by trained and qualified personnel with a qualification certificate. Otherwise it will easily bring damage and personal injury accidents, causing you unnecessary losses.

请您特别注意对塔机安全装置进行定期检查和维护，安全装置存在任何故障或工作异常都不能勉强使用，您必须遵守的最高准则是：安全第一。

Please pay special attention to the regular inspection & maintenance of tower crane safety devices, and do not use the safety devices when any faults are detected. In other words, you must comply with the highest standard: **Safety First**.

本手册适用于塔机安装人员、操作人员及相关人员，对特殊的作业情况或对手册中不明白的内容，操作前请与我公司联系。

The manual is applicable for installation personnel, operating personnel as well as related personnel. If you have any questions about the special working conditions or the manual, please contact our company.

在本产品的保修期内，如果塔机出现任何故障或者异常，须将保修单送至厂家，保修内容和保修后的状态将记录在保修单中。

If any faults or failures are found within the warranty period of the product, the warranty bill must be delivered to the manufacturer, describing the warranty items and conditions after warranty.

本操作手册是产品的组成部分，在产品的寿命期内应妥善保存。本手册作为您安装、操作使用该塔机必要的依据。特殊情况时，为确保起重机安全工作，请与我公司联系，我们将为您提供及时有效的技术支持。

The manual shall be properly kept during the service life of the product because it is the composition of this product. The manual provides an essential basis for the installation and operation of this tower crane, and our company will not be responsible for any consequences resulted from the operations that violate the manual. Under special circumstance, please contact our company so as to ensure safe operation of the tower crane, and we will provide timely effective technical support for you.

⚠ 注意

在维修保养过程中，用户更换主要配套零部件时，必须采用原产品配置的同厂家同型号零部件，否则可能造成产品损坏及人身伤害安全事故，给您造成不必要的损失。

⚠ Caution When the main supporting parts are subject to replacement during maintenance, the user must use the parts and components of the same model from the original manufacturer; otherwise, our company will not undertake the relevant responsibility.

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安全说明 Safety Instruction

1 规范性引用文件

本产品的使用（安装、验收、拆卸、操作、维护保养等）应遵守如下标准（标准以颁布的最新有效版本为准）：

- GB 5144-2006 《塔式起重机安全规程》
- GB/T 5031-2008 《塔式起重机》
- GB/T 23720.3-2010 《起重机 司机培训 第 3 部分：塔式起重机》
- GB/T 23723.3-2010 《起重机 安全使用 第 3 部分：塔式起重机》
- GB/T 23724.3-2010 《起重机 检查 第 3 部分：塔式起重机》
- GB/T 31052.3-2016 《起重机械 检查与维护规程 第 3 部分：塔式起重机》
- GB/T 33080-2016 《塔式起重机安全评估规程》
- GB/T 26471-2011 《塔式起重机安装与拆卸规程 》
- GB/T 28758-2012 《起重机 检查人员的资格要求》
- GB/T 5082-1985 《起重吊运指挥信号》
- GB/T 5972-2016 《起重机 钢丝绳 保养、维护、检验和报废》
- JG/T 100-1999 《塔式起重机操作使用规程》
- JGJ 33-2012 《建筑机械使用安全技术规程》
- JGJ 196-2010 《建筑施工塔式起重机安装、使用、拆卸安全技术规程》
- JGJ/T 187-2009 《塔式起重机混凝土基础工程技术规程》
- JGJ/T 301-2013 《大型塔式起重机混凝土基础工程技术规程》
- 建设部第 166 号令 《建筑起重机械安全监督管理规定》
- 其他相关国家、地方标准，技术规范，法律法规。

⚠ 注意

上述标准、规范、法律、法规均引用为本产品说明书内容的一部分，用户必须寻求上述的所有标准、规范、法律、法规颁布的最新有效版本。用户除了遵守本产品说明书中所提及的内容，还必须严格遵守但不局限于上述所有标准、规范、法律、法规的相关规定。

本产品说明书中的内容和以上标准、规范、法律、法规不一致时，以较为严格的为准。

1 normative citation

The use of this product (installation, acceptance, disassembly, operation, maintenance, etc.)

should comply with the following standards (standards to promulgate the latest version of the effective prevailing):

GB 5144-2006 "safety regulations for tower cranes"

GB/T 5031-2008 "tower crane"

GB/T 23720.3-2010 "crane driver training third parts: Tower Crane"

GB/T 23723.3-2010 "third parts of safe operation of cranes: Tower cranes"

GB/T 23724.3-2010 "crane inspection third part: Tower Crane"

GB/T 31052.3-2016 "crane inspection and maintenance regulation third part: Tower Crane"

GB/T 33080-2016 "safety assessment rules for tower cranes"

GB/T 26471-2011 "Specification for installation and dismantling of tower cranes"

GB/T 28758-2012 "qualification requirements for crane inspectors"

GB/T 5082-1985 "hoisting and hoisting command signals"

GB/T 5972-2016 "crane wire rope maintenance, maintenance, inspection and scrapping"

JG/T 100-1999 "Specification for operation and operation of tower cranes"

JGJ 33-2012 "technical regulations for the safe use of construction machinery"

JGJ 196-2010 "safety technical specification for installation, use and demolition of tower cranes for construction"

JGJ/T 187-2009 "technical specification for tower crane concrete foundation"

JGJ/T 301-2013 "technical specification for large scale tower crane concrete foundation"

The provisions of the 166th order of the Ministry of construction on safety supervision and management of construction cranes.

Other relevant national and local standards, technical specifications, laws and regulations.

Caution

The above-mentioned standards, specifications, laws and regulations are quoted as part of this product specification. The user must seek the latest and effective version of all the above-mentioned standards, specifications, laws and regulations. In addition to abiding by the contents mentioned in this product specification, the user must strictly abide by but not be limited to all the standards, specifications, laws and regulations mentioned above.

If the contents of this product specification are inconsistent with the above standards, specifications, laws and regulations, the more stringent standards shall prevail.

2 塔式起重机一般安全规则

2 General safety rules of tower crane

2.1 警告标识及含义

2.1 Warning signs and implications

在使用规则中，下述符号均为非常重要的标识：

During the use of rules, the following symbols are very important:

危险 ——警告词“危险”表示即将发生的危险状况。如果不能避免，将导致产品报废，及重大安全事故。

警告 ——警告词“警告”表示潜在的危险状况。如果不能避免，可能会导致产品损伤，及重大安全事故。

注意 ——警告词“注意”表示一种能够对设备、私人财产和/或环境带来损害，或使设备运行不当的情况。如果不严格地遵守，可能造成财产损失、机器部件的损坏或降低机械性能，及一般安全事故。

提示 ——“提示”用来对个别信息进行指示或附加说明。

Danger ——“Danger” indicates a hazardous condition that is about to happen. In the case of failure to avoid, death or severe injuries will be caused.

Warning ——“Warning” indicates a potential dangerous condition. In the case of failure to avoid, death or severe injuries may be caused.

Caution ——“Caution” indicates a potential dangerous condition. In the case of failure to avoid, minor or moderate injuries may be caused.

Prompt ——“Prompt” Used to indicate or add to individual information.

2.2 正确使用原则

2.2 Principles of proper use

2.2.1 基本工作条件

2.2.1 Working conditions

2.2.1.1 风速/风压条件

2.2.1.1 Wind speed/wind pressure conditions

1）工作状态时塔机顶部风速≤20m/s，相当于风压 250Pa，6 级风速。

1）In working state, when the wind speed at the top of the crane is below 20 m / s, it correspond to the wind pressure 250Pa and 6 grades wind speed.

2）安装和顶升时塔机顶部风速≤12m/s，相当于风压 90Pa，4 级风速。

2）During the erection and jacking, when the wind speed at the top of the crane is below 12m/s, it correspond to the wind pressure 90Pa and 4 grades wind speed.

3）非工作状态的风速设计值是按离地面高度来进行取值。

3）The design value of the wind speed of non-working state is to be evaluated according to the height of the ground.

a.当高度为 0～20m 时，风速取 36m/s，相当于风压 810Pa，10 级风速；

a. During 0～20m, the 36m/s wind speed is equal to wind pressure 810Pa and 10 grades wind speed;

b.当高度为 20m～100m 时，风速取 42m/s，相当于风压 1100Pa，11 级风速；

b. During 20m～100m, the 42m/s wind speed is equal to wind pressure 1100Pa and 11grades wind speed.

c.当高度为 > 100m 时，风速取 46m/s，相当于风压 1320Pa，12 级风速。

c. When the height is greater than 100m, the 46m/s wind speed is equal to wind pressure 1320Pa and 12 grades wind speed.

当非工作状态的风速大于以上数据，应采取必要可行的防风措施（可向我公司咨询）。

When the wind speed of non-working condition is greater than the above data, it is necessary to take some measures for wind protection (You can consult my company).

⚠ 警告

塔机在安装、顶升和工作时必须根据当时的风速，按照规定来开展工作，否则将造成重大财产损失及人身伤害安全事故。

⚠Warning

The installation, lifting and operation of the tower machine must be carried out according to the prevailing wind speed. Otherwise, it will cause serious property loss and personal injury.

2.2.1.2 环境温度条件

2.2.1.2 Ambient temperature condition

1) 工作工况环境温度：-20^{0}C ～ 40^{0}C；

1) Tower crane in working condition: -20°C ~ 40°C;

2) 非工作工况环境温度：-20^{0}C ～ 40^{0}C；

2) Tower crane in non-working condition: -20°C ~ 40°C;

3) 存放环境温度：-25^{0}C ～ 55^{0}C；

3) Storage environment: -25^{0}C ～55^{0}C

4) 运输环境温度：-25^{0}C ～ 55^{0}C。

4) Transportation environment: -25^{0}C ～ 55^{0}C。

⚠ 注意

在上述环境温度外工作会影响塔机元器件的寿命及起重作业安全。如果需在此温度范围外使用，应在订货时额外注明特殊使用环境，进行非标定制。当环境温度超过正常工作环境温度时，操作者有权利在不会产生二次危险的情况下停止起重机作业。否则可能造成产品损坏及人身伤害安全事故。

⚠ Caution Working beyond environment temperature will affect the life span of tower components and the safety of lifting operations. If you need to use it beyond the temperature range, you should specify a special use environment for non-standard customization when you place an order. When the ambient temperature exceeds the normal working environment temperature, the operator has the right to stop the crane operation without a secondary hazard. Otherwise, it may cause damage for product and personal injury.

2.2.1.3 海拔高度条件

2.2.1.3 Altitude condition

海拔高度条件：≤2000 m。

Altitude condition:≤2000 m.

2.2.1.4 工作湿度条件

2.2.1.4 Moisture

工作湿度条件：30～95%。

Moisture: 30～95%.

2.2.1.5 工作电压/频率条件

2.2.1.5 Working voltage/Frequency

1）中国国内工作电压/频率条件

1) Domestic working voltage/ Frequency

工作电压：AC380V（±10%）

working voltage：AC380V（±10%）

电源频率： 50Hz。

Power frequency: 50Hz

2）其他地区

2) Other regions

工作电压及电源频率根据当地实际情况进行非标设计。

The working voltage and power frequency are designed according to local actual conditions.

2.2.2 禁用

2.2.2Prohibition

1) 不能在打雷、爆炸性的工作条件下使用；

1) It cannot be used in thundering and explosive working conditions;

2) 不能在能见度低、风速大于规定风速的条件下使用。

2) It cannot be used low visibility and high wind speed.

2.3 单位、人员和资格的选择

2.3 The selection of units, personnel and qualifications

2.3.1 安装单位要求

2.3.1 The requirements of installation unit

1) 安装单位必须具有塔机安装资质证书。

1) The installation unit must have the installation qualification certificate of the tower machine.

2) 安装单位必须在安装过程中指定一个安装人员作为“安装负责人”。

2) The installation unit must appoint a “installation supervisor” during the process of installation.

2.3.2 安装人员要求

2.3.2 Requirements for installation personnel

1）安装人员必须符合以下条件：

1) The installation personnel must satisfy the following conditions:

a. 具有资格证书。

a. Holding qualification certificates.

b. 年龄大于 18 周岁。

b. Over 18 years old.

c. 适应该项工作，特别是视力、听力、灵活性和反应能力。

c. Suitable for this work, especially in terms of the eyesight, hearing, flexibility and reaction.

d. 具备安全搬运重物，包括安装塔机的体力。

d. Having the physical strength to carry heavy weight and install the tower machine safely.

e. 能够登高作业。

e. Being able to work aloft.

f. 具有估计载荷质量、平衡载荷及判断距离、高度和静空的能力。

f. Having the capability of estimating load quality, balancing load and judgment judging distance, height and static space.

g. 经过吊装及信号技术的培训。

g. Having received trainings in hoisting operation and signaling technology.

h. 具有根据载荷的情况选择吊具和附件的能力。

h. Being able to select lifting equipment and accessories according to the loading capacity.

i. 在塔机安装、拆卸以及所安装类型塔机的操作方面经过全面培训。

i. Having received complete training on the installation and disassembly of the tower machine and the operation of the type tower.

j. 在所安装类型塔机安全装置的安装和调试方面经过全面培训。

j. Having received complete training on the installation and commission of safety devices of the type tower.

k. 完全熟悉并掌握安装操作手册中相关章节的要求。

k. Being completely familiar with the manual and master the requirements described in related chapters and sections of the manual.

l. 能熟练并正确使用所有个人安全防护装备。

l. Being able to skillfully and correctly us e all the personal safety protective equipments.

⚠ 注意

安装人员的职责：依据本产品说明书要求进行安装塔机，否则可能造成产品损坏及人身伤害的安全事故。

⚠ Caution

Responsibility of installation personnel: install tower cranes according to the installation and operation manual.

2）安装负责人除满足安装人员的条件外还应满足以下条件：

2) In addition to meeting the requirements for installation personnel, the installation supervisor shall also satisfy the following requirements:

a. 有塔机或类似设备的安装与拆卸工作经验并接受过相关安拆方面的培训。

a. Having working experience in mounting and dismounting tower cranes or similar equipments, and having received relevant trainings on being an installation supervisor.

b. 熟悉并拥有该塔机的安装操作手册。

b. Having the manual and knowing well about it.

c. 接受过对塔机安装拆卸人员进行管理的培训。

c. Having received training on how to manage the personnel.

d. 能证实安装过程中使用设备的适用性。

d. Being capable of verifying the applicability of equipment to be used during installation.

3）安装负责人的职责如下：

3) Responsibilities of installation supervisor:

a. 安装负责人在塔机的整个安装、拆卸、爬升过程中不能离开现场。

a. Being present throughout the entire process of the installation, disassembly and lifting of the tower crane.

b. 管理所有安装人员和安装、拆卸、爬升过程中可能用到的相关辅助起重设备的操作人员。

b. Managing all the installation personnel and personnel who can use the auxiliary lifting equipment to help the installation, disassembly and lifting of the tower crane of relevant auxiliary lifting equipment which may be used during the installation, disassembly and lifting of the tower crane.

c. 提供保证塔机按塔机安装工作计划运行的技术措施(即安装方案)。

c. Providing technical plan to ensure the installation of tower machine.

d. 保证塔机的附属设施与安装报告完全一致。

d. Ensuring that the ancillary facilities are exactly consistent with the installation report.

e. 查证所有安装人员都配备有必要的工具和个人安全保护设备。

e. Checking that all installation personnel are provided with necessary tools and personal safety protective devices.

f. 保证通道设备随安装进程的进度而逐步正确安装，以便安装人员使用。

f. Ensuring the proper installation of the channel devices in accordance with the progress of installation, so as to service for the installation personnel.

g. 安装负责人在认为场地条件、气候、障碍物或其它原因不能保证安全时，有权终止安装作业。

g. The installation supervisor has the right to terminate the installation when he/she believes that the safety cannot be guaranteed under the consideration of site conditions, climate, obstacles or other reasons.

⚠ 危险

操作者应掌握充分的信息，以便顺利完成工作。准备不足强行工作，意外事故随时可能发生，将造成产品损坏及人身伤害安全事故。

⚠ Danger The operators shall have sufficient information to complete the work successfully. Accidents may happen at any time if preparation is inadequate.

2.3.3 塔机司机和起重工的要求

2.3.3 Requirements for Tower Crane Driver and Lifting Worker

2.3.3.1 塔机司机的要求

2.3.3.1 Requirements for tower crane driver

1）对塔机的操作，只能由下述人员进行：

1) Tower crane can only be operated by the following personnel:

a. 经过考试，并取得塔机操作合格证的人员。

a. Personnel who have passed the examination and obtained tower crane operation certificate.

b. 为了执行任务需要进行操作的维修、检测人员。

b. Maintenance and inspection personnel required to finish specific operational task.

c. 经上级任命的劳动安全监察员。

c. Labor and safety supervisors appointed by higher authorities.

2）塔机司机必须具备的条件：

2) Tower crane driver must satisfy the following requirements:

a. 具有资格证书。

a. Holding qualification certificates.

b. 年龄大于 18 周岁。

b. Over 18 years old.

c. 视力(包括矫正视力)在 0.7 以上，无色盲。

c. Eyesight (including corrected vision) above 0.7, without color blindness.

d. 听力能满足具体工作条件的要求。

d. Hearing satisfies the requirements for specific working conditions.

e. 熟悉所操作塔机各机构的构造和技术性能。

e. Being familiar with the structure and technical performance of each mechanism of the

crane being operated.

f. 掌握塔机操作规则和有关法令。

f. Knowing well about the operation rules and relevant directions of the tower crane.

g. 掌握起重指挥信号，操作准确。

g. Knowing well about the commanding signal for lifting and being capable of operating properly.

h. 熟悉塔机保养和基本的维修知识。

h. Being familiar with the basic knowledge of maintenance and repair.

2.3.3.2 塔机起重工的要求

2.3.3.2 Requirements for tower crane lifting worker

a. 具有资格证书。

a. Holding qualification certificates.

b. 年龄大于 18 周岁。

b. Over 18 years old.

c. 掌握起重指挥信号，指挥准确并符合标准规定。

c. Knowing well about the commanding signal for lifting, being capable of correctly directing and satisfying the standard provisions.

警告

酗酒者、吸毒者及服用抑制反应药物的人员不得参与起重机的安装、操作、维修、指挥等相关工作，否则可能造成产品损坏及人身伤害安全事故。

Warning **Alcoholics and drug addicts and the reaction drugs personnel shall not participate in installation, operation, maintenance, command and other related work, otherwise may cause product damage and personal injury accidents.**

2.3.4 人员安全装备

2.3.4 Personnel safety equipment

1) 在操作机器时，你必须使用安全装备。

1）when operating the machine, you must use safety equipment.

2) 根据工作现场状况选择合适的安全装备，如安全帽、安全手套、安全防护眼镜、安

全带、安全靴和听力保护装置等；

2) Select suitable safety equipments according to the working conditions, such as safety helmet, safety gloves, safety goggles, safety belts, safety boots and listening protection devices;

3) 在工作前后检查安全装备，按规定程序进行维护或在必要时进行更换；

3) Check safety equipments before and after work, maintain or replace when necessary;

4) 在需要时应保存检查和维修记录；

4) Keep the inspection and maintenance records;

5) 某些安全装备（例如安全帽和安全带）使用一段时间可能会损坏，因而应定期检查并更换。

5) Some safety equipments (such as safety hats and safety belts) may be damaged for a period of time and should be checked and replaced regularly.

⚠ 注意

所有的个人防护装置都不能提供 100%的保护，安全装备应定期检查，如果发现损坏应立即更换，否则将容易造成人身伤害安全事故。

⚠ Caution All personal protective equipments can not provide 100% protection. Safety equipments should be checked regularly. Any damage should be replaced immediately, otherwise it will be easy to cause personal injury.

2.4 塔机安装前现场准备

保证现场能满足塔机技术特性和使用的需要。

2.4 site preparation before tower crane installation

Ensure that the site can meet the tower crane technical characteristics and use needs.

2.4.1 塔机安装现场

在开始安装前，对现场进行仔细研究，例如：

1) 当地法规中对有关公共建筑或其他，如道路、铁路、运河等要求。

2) 接近其他起重机、机场、电线、电磁波发射站等。

3) 考虑地面状况，地面障碍、坑道、斜坡、地下建筑物等。

4) 在安装或拆除时塔机零部件存放场地，汽车吊的定位等。

5) 塔机安装或拆除时与建筑物是否存在干涉。

2.4.1 tower crane installation site

Before starting the installation, we should carefully study the scene, for example:

1) local laws and regulations concerning public buildings or other requirements such as roads, railways, canals and so on.

2) close to other cranes, airports, wires, electromagnetic wave transmitting stations, etc.

3) consider ground conditions, ground obstacles, tunnels, slopes, underground structures, etc.

4) when installing or dismantling, the location of tower crane parts, location of truck crane and so on.

5) whether there is interference with the building when tower crane is installed or dismantled.

2.5 塔机安装与拆卸的安全规则

2.5 Safety rules for tower mounting and disassembly

塔机安装场地禁止一切与工作无关的人员进入。

The installation site prohibits all personnel who are not involved in the work.

6) 根据装箱单检查货物是否齐全，检查各部件是否有运输变形或损坏。

1) Check whether the goods are complete and whether each component is deformed or damaged during transportation according to the packing list.

7) 确定塔机的顶升爬耳方向，以方便顶升和拆塔。

2) Determine the direction of Jack-up climbing ears to facilitate the lifting and dismantling of the tower

8) 安装架设时塔机顶部风速不大于 12m/s。

3) The wind speed at the top of the tower crane during installation and erection should not

be greater than 12m/s.

9) 固定式混凝土基础具有 80%以上强度时才能进行立塔工作。

4) It is not allowed to erect the tower crane unless the strength of the fixed concrete base is more than 80%.

10) 安装塔机需要一辆辅助汽车吊，它的起重性能要与所吊部件的重量和需要吊装的高度相适应。

5) An auxiliary truck crane shall be provided for tower crane installation, and its lifting performance shall be suitable for the weight of parts to be lifted and the required lifting height.

11) 在现场最大限度的节约辅助汽车吊的使用时间，需要在安装和装配程序、安装队、道路与地面之间有很好的配合。

6) The operating time of auxiliary truck crane shall be saved on site as applicable as possible. Sound coordination shall be realized between installation and assembling processes as well as installation team, road and ground service.

12) 立塔安装必须按照立塔说明顺序进行安装。

7) Vertical towers must be installed in accordance with the orders of vertical tower instruction.

13) 使用汽车吊吊装塔机零部件必须注意安全，必须保证汽车吊支撑稳固、幅度与吊重适合、不超载使用、吊点位置准确。

8) Be careful when hoisting the crane parts by truck crane, make sure that truck crane is reliably supported; the range and lifting weights are matched; no overloading and lifting point is accurate.

14) 对所吊物品的重心和重量不清楚时必须进行试吊。

9) Lifting test must be made if the center of gravity and weight of the lifting objects are unknown.

15) 在未安装完成前，不能用塔机吊运物品。

10) Do not lift articles with the crane before installation is finished.

16) 必须安装和使用安全保护设施，如爬梯、平台、护栏、安全帽和安全带等。

11) Safety protection facilities must be installed and applied, such as, ladder stand, platform, guard bars, safety helmet and safety belts.

17) 开口销的安装必须正确，要求使用新的或状态良好的开口销。

12) Cotter pins must be correctly installed. New and qualified cotter pins are required.

18) 如果销轴的安装位置为上下穿插形式，在无特殊要求的情况下带肩销轴必须从上往下插入，即销轴带肩部分在上方，以防止开口销断后销轴掉落。

13) If the pin position is designed for top-bottom installation, shouldered pins must be inserted from top to bottom (that is, shouldered section of the pin is at upper position) when no special requirements is specified, so as to prevent the pins from falling after the cotter pins are broken.

19) 所需工具：大锤、扳手、撬棍、电工工具、吊绳、吊具、卡具、卷尺、经纬仪、绝缘电阻表和接地电阻仪器等。

14) Tools required: sledge hammer, wrench, crowbar, electric tools, lifting rope, lifting devices, fixture, tape, theodolite, insulation resistance meter, grounding resistance meter, etc.

20) 安装过程中需要导向绳，防止起吊货物旋转引发事故。

15) During installation, guide rope is required to prevent accidents caused by the rotation of lifting weights.

2.6 工作阶段的安全规则

2.6 Safety Rules for Working Stages of Tower Crane

2.6.1 塔机操作者要做到“十不吊”

2.6.1) “Ten impermissibilities for hoisting work” should be followed by tower crane operators

1) 指挥信号不明确或违章指挥不吊。

1) Unclear commanding signals or command against rules

2) 超载不吊。

2) Overload.

3) 工件或吊物捆绑不牢不吊。

3) Loose binding of workpiece or lifting objects.

4) 吊物上面有人不吊。

4) There are people on the lifting objects.

5) 安全装置不齐全或动作不灵敏、失效不吊。

5) Incomplete safety devices or inflexible and ineffective lifting.

6) 吊物埋在地下、与地面建筑物或设备有钩挂不吊。

6) Lifting objects are buried underground, or are hooked with buildings or equipment on the ground.

7) 光线阴暗视线不佳不吊。

7) Poor light and poor vision.

8) 棱角物件无防切割措施不吊。

8) No anti-cutting measures for objects with edges and corners.

9) 斜拉歪拽工件不吊。

9) Workpiece to be improperly pulled or dragged.

10) **遇到大雷雨、暴雨和塔机最高处风速超过 20m/s 时不吊。**

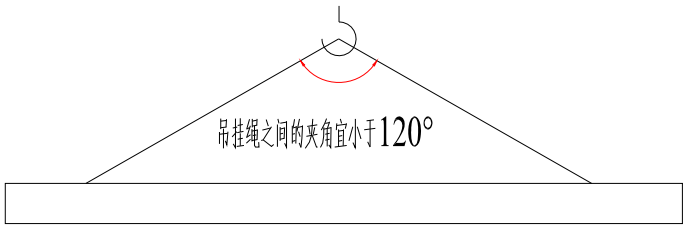
10) Thunderstorm, heavy rain, or wind speed at the tower crane peak exceeding 20m/s.

2.6.2 **起重工操作安全规则**

2.6.2 Safety operation rules for lifting worker

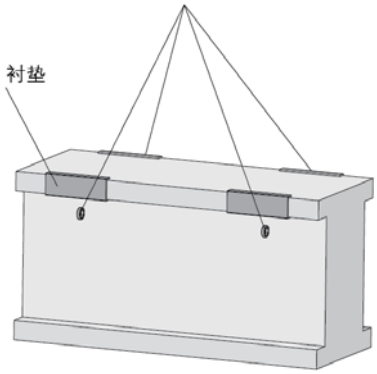
1) 吊装绳的选择必须能满足安全起吊载荷的要求。吊挂时，吊挂绳之间的夹角宜小于120°，以免吊挂绳受力过大，建议采用 90° 或 60° 夹角。

1) The hoisting rope must meet the requirements for safe lifting. The angle between hanging ropes shall be less than 120° during hoisting in order to prevent the hanging ropes from being excessively pressed.



2) 绳、链所经过的棱角处应加衬垫，防止绳、链被棱角割断。

2) The edges where ropes and chains pass shall be padded to prevent the ropes and chains being cut off.



3) 指挥物体翻转时，必须使其重心平衡变化，不应产生指挥意图之外的动作。

3) Balanced center of gravity for the object must be changed when the object is rotated according to the direction, and operation against the specified direction is not allowed.

4) 进入悬吊物体下方时，必须先与塔机操作者联系并设置支撑装置以免发生事故。

4) Please firstly contact the crane operator and arrange support devices to avoid accidents when the workers need to operate under the suspended objects.

5) 多人绑挂时，必须由一人负责指挥。

5) When more than one people are tying up, one person must be in charge.

2.6.3 在塔机使用前的安全规则

2.6.3 Safety rules to be followed before operating of tower crane

1) 听取工地负责人的指令。

1) Follow the instructions of the person in charge of job location.

2) 认真阅读塔机的工作日志，了解前一班塔机的运行情况。

2) Carefully read the operation records and know about the operating condition of the prior shift.

3) 检查塔机钢结构各杆件有无变形，检查连接螺栓有无松动。

3) Carefully read the operation records and know about the operating condition of the prior shift.

4) 检查钢丝绳端头固定情况、查看钢丝绳有无磨损。

4) Check whether the wire ropes are battered and their ends are fixed.

5) 检查塔机金属结构部分有无漏电现象。

5) Check metal structural parts of the tower crane for electric leakage.

6) 检查各传动部位及润滑点的润滑油量。

6) Check each transmission part and lubricating point to make sure that they are properly lubricated.

7) 检查各机构的固定情况，制动器各铰点是否灵活、闸瓦松紧是否合适。

7) Check each mechanism for fixing, each hinge point of the brake for flexibility and brake shoe for appropriate tightness.

8) 检查所有保护和安全装置是否处于正常状态。

8) Check to make sure that all the protection and safety devices are in normal conditions.

2.6.4 在塔机使用过程中的安全规则

2.6.4 Safety rules to be followed during using

1) 用空载低速度试验塔机各机构的动作是否正常。

1) Inspect the operating condition of each mechanism by running it at low speed under no load.

2) 塔机动作时，不要将起吊载荷从人员上方经过。

2) Do not hoist the lifting load to pass over people when the crane is operating.

3) 起吊载荷进入视线之外区域时，必须有人导向。

3) Someone must be present for guidance when the lifting load comes into the area out of sight.

4) 不要在规定的幅度以外吊起超重的载荷。

4) Do not lift overweight loads beyond the specified radius.

5) 不要使用急停按钮停止正常的动作。急停按钮只能用于整机停止运行，或在紧急特殊情况或在威胁安全的情况下使用。

5) Do not use the emergency stop button to stop normal operation. The emergency stop button can only be used for stopping the whole machine or be used under emergency, special conditions or conditions where safety is threatened.

6) 不要将限制器和限位器当作正常停车的装置使用。

6) The limiter and the stopper can not be used as the common devices to stop the crane.

7) 禁止将安全保护装置短接、改动其调整的安全工作状态。

7) It is forbidden to short-circuit or change the adjusted safe working condition of the safety protection devices.

8) 确保塔机与空中电线之间有足够安全距离。

8) Make sure there is sufficient safe distance between the tower crane and the overhead wires.

9) 塔机出现运转不良时，必须立即停车并派人修理，不允许塔机带病工作。

9) Immediately stop operating the crane and send someone for repairing when the crane is not operating properly, and it is not allowed to operate the faulty crane.

10) 不要在有载荷的情况下调整起升、变幅机构的制动器。

10) Do not adjust the brakes of the lifting mechanism and luffing mechanism under loading conditions.

11) 塔机工作时，不能进行检查和维修。

11) Inspection and maintenance is not allowed when the crane is operating.

12) 所吊重物接近或达到额定起重能力时，用小高度、短行程试吊后再平稳地吊运。

12) Try to lift at small height and short stroke and then smoothly lift when the lifting weights are close to or reach the rated lifting capacity.

13) 多台塔机在同一工程进行施工时，应注意保持各自活动范围，以免发生事故。

13) Make sure that each crane is operating within specified range when multiple tower cranes are applied in project construction, so as to avoid unexpected accidents.

14) 在工作班中，操作者必须离开司机室时，离开前必须切断电源。

14) During each work shift, the operator must cut off the power before leaving the cab.

15) 按使用说明书规定和标明的周期对塔机进行检查和巡视！

15)Check and inspect the tower machine according to the specified period!

2.6.5 在塔机使用完成后的安全规则

2.6.5 Safety rules to be followed after using

1) 吊钩必须升高至上限位置。

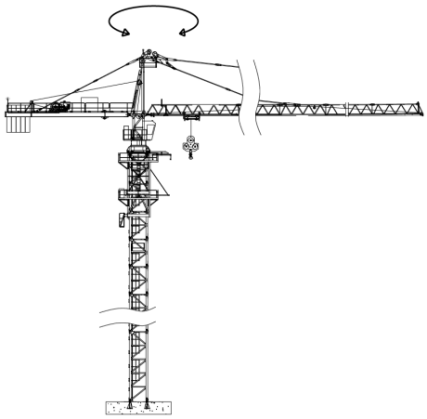
1) The hook must be lifted to the upper limit position.

2) 将小车收放在最小幅度处。

2) Retract the trolley at the maximum radius.

3) 回转制动器必须处于松开状态。

3) Slewing brake must be maintained in a release state.



⚠ 注意

以上位置及状态为理论情况，根据工地实际工况，必须保证吊钩、小车在自由回转时必须避开相应障碍物，如有特殊情况不允许塔机自由旋转时，可酌情对塔机进行锚固，但当遭遇大风情况时，需按照 3.11 章节中的相关预案进行处理，否则将会造成产品损伤及人身伤害安全事故。

⚠ Caution The above position and condition are the theoretical conditions. According to the actual working conditions of the construction site, the hook and the trolley must be guaranteed to avoid the obstacles during the free rotation. If there is a special case, the tower crane can not be rotated freely, the tower crane can be anchored. However, in the event of a strong wind, it is necessary to handle it in accordance with the relevant plans in Section 3.11.Otherwise,it will cause product damage and personal injury.

4) 认真填写塔机的工作日志。

4) Carefully keep record of the tower crane conditions.

5) 切断塔机司机室电源，关闭门窗并上锁，同时根据工地实际情况，切断塔机下方控制柜总电源。对于障碍灯需要供电的情况，必须保留障碍灯的电源，保证障碍灯能够正常工作。

5) Cut off the tower crane power supply and lock it. For obstacle lights need power, you must retain the power of obstruction lights to ensure that the obstruction lights to work properly.

2.6.6 **安全上下起重机**

2.6.6 Climbing safety

由于塔式起重机械结构的特殊性，司机室位置高度较高，在您上下起重机时应当注意安全以免发生意外伤害。

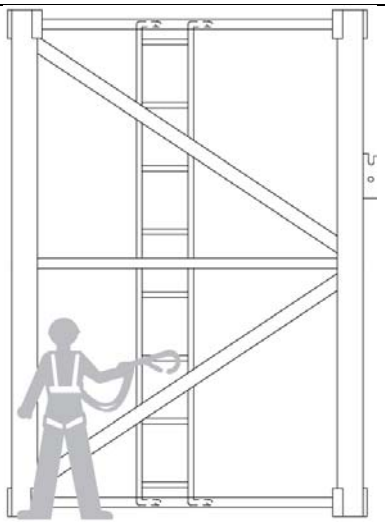
Due to the special structure of the tower crane, the height of the driver's cab is very high, and you should be careful when climbing the crane so as to avoid accidental injury.

1）上下起重机过程中必须佩戴安全带、安全帽、防护鞋、防护手套等安全防护措施。

1) Climbing the crane process must wear safety belts, helmets, protective shoes, protective gloves and other safety precautions.

2）应当借助梯子扶手等固有通道设施进出司机室或工作平台。

2) Access to the cab or working platform should be made with the aid of an inherent access facility such as a ladder handrail.



3）当爬梯上覆盖有霜、冰和雪时应尽量避免使用起重机。

3) When the ladder covered with frost, ice and snow, it should be avoided using the tower cranes.

4）未经允许不得擅自改动起重机固有的通道装置。

4) Do not modify the crane's access device without permission.

⚠ 注意

⚠ Caution

1) 小心踩空或滑倒！

1) Caution! Slippery surface!

2) 在作业之前必须清除附着的油污、泥浆、水或雪，并且保持鞋和司机室底板清洁。

2) Remove dirt, mud, water or snow that has adhered to the unit before operation and keep the shoe and cab floor clean.

3) 在通道上不要放置任何妨碍安全操纵和通行的物品或工具，否则将威胁通过者人身安全。

3) Do not place any objects or tools on the corridor that will prevent safe operation .Otherwise, it will threaten the personal safety of the passer.

2.7 关于特殊危险的说明

2.7 Description of specific dangers

2.7.1 电气

2.7.1 Electricity

1) 更换各种保险和开关，应使用与原件同类型的并适合电流规定的保险和开关。电气设备发生故障，应立即停止塔机工作。

1) Replace all kinds of fuses and switches, and use the fuses and switch with the original type. If the electrical equipment fails, stop the tower machine immediately.

2) 塔机与架空线应保持足够的距离。在架空线附近施工时，注意不要使塔机靠近架空线，以免造成生命危险！

2) Tower crane and transmission lines should be maintained a sufficient distance. Working near the transmission lines, please be careful not to make tower crane close overhead lines, so as to avoid danger!

3) 一旦触到架空线：

3) If it happened:

a. 不要离开塔机。

a. . The operator shall not leave the cab

b. 将塔机开除危险区。

b. Drive the tower crane immediately out of the dangerous zone.

c. 告知周围的人不要靠近塔机和触摸塔机。

c. Immediately inform the people around to keep away from the crane.

d. 切断这条电线的电源。

d. Cut off the power supply as soon as possible.

e. 在确认这条被碰撞的电线断电之前不要离开塔机。

e. Do not leave the cab before making sure that the contact wire is de-energized.

4) 对电气设备的维修只能由有资格的电工进行，或由经过培训的人员在一名有资格的电工指导并监督下按电气规定进行，如有规定，塔机的检查、保养和修理部位应断电。

4) For electrical equipment maintenance, it can only be carried out by a qualified electrician or by trained personnel according to provisions of electricity. And if there are any rules, inspection and maintenance of the tower crane should be cut off electricity.

5) 首先检查该断电部位是否确已无电，然后将其接地和短路，并使之与附近其它带电部位绝缘。

5) First check if the power cut-off is indeed dead, then ground and short-circuit it, and insulate it from other live parts nearby.

6) 塔机电气设备应定期检查，发现隐患，如接头松动或电线老化，应及时排除。

6) Tower crane electrical equipment should be regularly checked to find hidden dangers, such as loose joints or wire aging, which should be promptly excluded.

7) 如需对某些部位进行带电作业，应有另一人在场，以便在出现紧急情况时切断总

电源。用红白安全链将带电作业区隔离开并竖立警告牌。应使用绝缘工具。

7）If live parts work is required, another person should be present to cut off the main power supply in case of emergency. Separate the live working area with red and white safety chains and erect a warning sign. And insulation tools should be used.

2.7.2 液压、气动

2.7.2 Hydraulic pressure and pneumatic

1) 对液压装置进行作业，只能由专业人员和有液压经验的人进行定期检查各种导管，软管和接头，以便检查有无漏油和外部故障。有故障应及时排 除。漏油会造成伤害并引发火灾。

1) For the hydraulic unit, it can only be operated by professional personnel to check for oil spills and external faults, which should be promptly excluded. Oil leak can cause accident and fire.

2) 进行修理工作之前，应按有关部件的规定对带有压力的零件去除压力（液压、压缩 空气）。

2) Prior to the repair work, pressure (hydraulic pressure, compressed air) shall be removed according to the provisions of the relevant parts.

3) 正确安放和安装液压及压缩空气管路。不要把接头接反。软管的接头、长度和质量应符合规定。

3) Correct installation and installation of hydraulic and compressed air lines. Do not reverse the connector. Hose joints, length and quality should be consistent with the provisions.

4) 保持油质（工作前去除冷凝水）。

4) Keep oil quality (remove condensate before work).

2.7.3 声音

2.7.3 Sound

塔机工作时，隔声装置应安装好。

During working, the sound insulation device should be installed.

2.7.4 安装、拆卸

2.7.4 Erection and dismantling

塔机特殊安装或拆卸，特殊工地出现的故障不在本说明书范围内，请与当地代理商或者服务人员接洽。

Special installation or dismantlement of the tower machine and the failure of the special construction site is not within the scope of this manual, please contact the local agent or service staff.

2.7.5 风力

2.7.5Wind strength

塔机工作和非工作状态下的倾覆稳定性根据现行标准和规定允许的风速进行计算。但在特殊情况下，如：塔机上部转动部分的风速超过标准规定时，请向我方咨询。

The overturning stability of tower crane in working and non-working conditions is calculated according to the current standard and the allowable wind speed. However, under special circumstances, such as: the upper part of the tower crane wind speed exceeds the standard requirements, please consult us.

塔机安装现场的地形较为特殊，如：风标起动后，起重臂不稳定；局部风速增加，请向我方咨询。

The terrain of the installation site of the tower is special, such as: after the wind buoy starts, the boom is unstable; local wind speed is stronger, please consult us.

2.8 预防、防护和应急措施

2.8 Prevention and emergency measures

⚠ 注意

为了您和他人的利益，请正确操作起重机，并且熟悉工作时可能发生的各种危险，否则可能造成产品损坏及人身伤害的安全事故。

For your and others safety, please operate the crane correctly and be familiar with the various dangers that may occur during the work. Otherwise, the accidents that may result in product damage and personal injury may occur.

⚠ Caution

2.8.1 触电事故的应急措施

2.8.1 Emergency measures for electric shock accidents

触电：塔机在架空线附近施工时，尽管采取了必要的预防措施，当发生触电事故，可参考下面的程序处理：

Electric shock: In addition to necessary precautions, the following procedures still can be taken for reference to deal with electric shock accidents when the tower crane is operating near the overhead lines:

1) 操作者应保持冷静，不要惊慌。

1) Keep clam and do not panic.

2) 操作者不要离开驾驶室，并且不要触碰金属物件，以防触电。

2) The operator shall not leave the cab, or touch any metal objects so as to prevent electric

shock.

3) 将塔机立即开出危险区。

3) Drive the tower crane immediately out of the dangerous zone.

4) 立即告知周围的人远离塔机;

4) Immediately inform the people around to keep away from the crane;

5) 立即报告主管人员，并与附近的电力部门取得联系，报告情况，尽快切断电源。

5) Immediately report to the supervisor, contact the electric power department nearby and report the conditions, in addition, cut off the power supply as soon as possible.

6) 在确认接触电线断电前不要离开驾驶室。

6) Do not leave the cab before making sure that the contact wire is de-energized.

2.8.2 雷击和地震的安全预防措施

2.8.2 Safety precautions for lightning and earthquake

自然灾害的发生是不确定的，当我们在施工中发生自然灾害时，一定要冷静处理。

Natural disasters may occur at any time. We must keep calm when natural disasters occur during construction.

1) 停止作业，将吊重物体放置地面。

1) Stop operating, and lower the lifting weights down to the ground.

2) 切断所有电路。

2) Cut off all circuit.

3) 撤离到安全地方。

3) Evacuate to a safe place.

2.8.3 火灾防护措施及自救逃生方法

2.8.3 Fire prevention and self-rescue

火灾：灭火器和急救箱作为火灾或人身伤害的必要预防措施，您要始终保持将其放置在机器的指定位置。同时，应当遵循以下内容：

Fire: Fire extinguishers and first-aid kit are necessary stuff for fire or personal injury, you must always keep it in the designated position of the machine. At the same time, the following contents should be followed:

1) 确保灭火器功能正常可靠。

1) Ensure the fire extinguisher function is normal and reliable.

2) 操作和维护人员应熟悉提供的灭火器的使用和维护方法。

2) Operators and maintenance personnel should be familiar with the use and maintenance

methods of fire extinguishers.

3) 保持急救箱在存放处且定期检查。

3) Keep the first aid box in storage place and check regularly.

4) 准备一份急救电话清单在手边以备事故急用。

4) Prepare a list of emergency telephones for emergencies.

5) 当塔机发生火灾时，操作人员应立即停止起重作业，迅速撤离现场。同时拨打所在地的火警电话，在救援人员到来之前并且不危及操作人员生命安全的前提下，可采用塔机自带灭火器先行实施自救。事故之后，再次使用塔机前，应仔细检查所有部件、仪器仪表、安全装置等是否工作正常。

5) In the event of a crane fire, the operator shall stop the lifting operation immediately and quickly evacuate from the site and call the local fire department at the same time. Before the arrival of the rescue personnel and there is no life threats for operator, it is possible to use the fire extinguisher of the tower machine to carry out the self-rescue first. After the accident, the operator shall carefully check whether all the components, instruments and safety devices are working normally before operating the tower crane again.

2.8.4 **其他伤害**

2.8.4Other danger

1）工具使用误伤

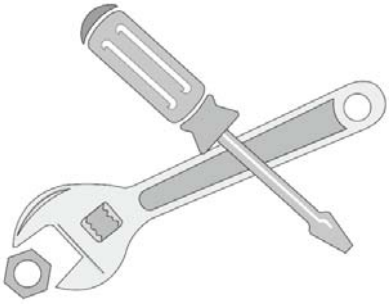
1)The accidental injury of tool

a. 在进行维修或安装调试工作时，操作人员应确保选用合适的工具，否则可能导致人员伤害。尤其在狭小空间工作，避免伤害。

a. During maintenance or installation, the operator should make sure that the right tool is selected .Otherwise, this may result in personal injury. In particular, work in tight spaces.

b. 保持工具整洁，使用完毕后收存整齐，避免遗漏在机器上。

b. Keep tools neat and tidy after use to avoid leaving on the machine



2）旋转部件的伤害

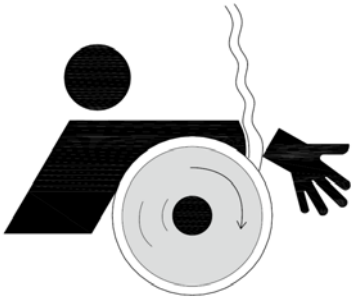
2) The injury of rotating parts

维护起重机时应停止运行设备，如果维修工作必须在起重机运转下进行，请严格遵守以下基本安全规则：

When maintaining the crane, the equipment should be stopped. If the maintenance work must be carried out under the crane operation, please strictly observe the following basic safety rules:

a. 当心旋转中的部件。起重机运转时禁止将手及身体其它部位或衣物伸入车辆运部位。

a. Beware of the rotating parts. When the crane operates, it is forbidden to extend the hand and other parts of the body or clothing into the vehicle parts.



b. 制动必须起动，操纵装置处于中位或锁止状态。

b. The brake must be started with the control unit in the neutral position or locked.

c. 禁止触碰控制装置。若必须操作控制杆，你应确保维修人员在你的视力范围内，且在操作控制杆前给他们发信号。

c. Do not touch the control device. If the lever must be operated, you should ensure that the service personnel are within your eyesight and signal them before operating the lever.

3）高压油管路

3) High pressure oil pipeline

操作人员在检修或更换液压管路时，特别注意以避免高压管路泄露可能导致的伤害。

When servicing or replacing the hydraulic piping, the operator should pay special attention to avoid the possible damage caused by the leakage of the high-pressure piping.

a. 检查液压管路及软管是否有破裂或变形，可以通过周围区域有渗出油渍来判断。

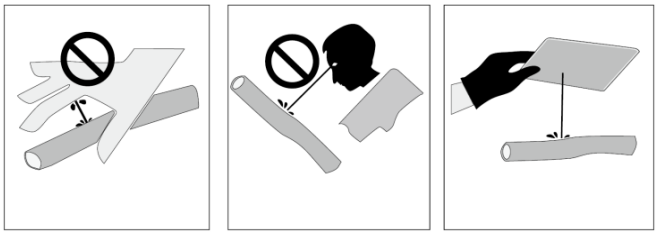
a. Check whether the hydraulic piping and hose are ruptured or deformed, which can be judged by the surrounding area.

b. 当液压系统存在压力时，禁止检测或更换管路。否则，可能导致严重的伤害。

b. When the hydraulic system is under pressure, it is forbidden to detect or replace the pipeline. Otherwise, it can cause serious injury.

c. 禁止用身体的任何部位去检测或感知管路泄露情况，必须穿戴防护眼镜和皮手套用木板或硬纸板检查小孔的泄露。

c. It is forbidden to use any part of the body to detect the leakage of the pipe. It is necessary to wear protective glasses and leather gloves to inspect the leakage of the hole with wood or cardboard.



c. 一旦高压液体刺伤你的皮肤或眼睛，请立即就医。

c. Once high-pressure fluid has burned your skin or eyes, please seek medical attention immediately.

2.8.5 塔机的清洁防护

2.8.5 Cleaning and protection of tower cranes

塔机的平台和通道应保持清洁，以免导致操作者及相关人员在通过平台和通道时发生滑倒、跌落。

The tower crane platforms and walkways shall be kept clean and dry to protect the operators and related personnel from slipping and falling down while passing.

人身防护设备：对塔机进行安装、使用的操作者以及管理员必须在上塔到下塔的全过

程中配戴安全帽、安全带和穿防滑鞋。

The installation personnel and operator must wear helmets, safety belts and antiskid shoes during the whole process of getting on and off the machine.

2.9 安全资料

2.9 Safety Data

2.9.1 安全距离

2.9.1 Safe Distance

1）有架空输电线的场合，塔机任何部位与输电线的安全距离应符合下表规定：

In the case of overhead transmission lines, the safe distance between any parts of the tower crane and the transmission line shall be satisfied with the provisions of Table.

塔机任何部位与架空输电线安全距离

Safe Distance between Any Parts of the Tower Crane and Overhead Transmission Line

安全距离/m Safe Distance/m	电压/kV Voltage/kV				
	＜1	1～15	20～40	60～110	220
沿垂直方向 Vertical Direction	1.5	3.0	4.0	5.0	6.0
沿水平方向 Horizontal Direction	1.0	1.5	2.0	4.0	6.0

2）如果因为条件限制不能保证表中的安全距离，应与有关部门协商，并采取安全保护措施后方可架设塔机。

If safe distance described in the above table cannot be guaranteed due to some restrictions, the tower crane should not be erected before negotiating with related departments and taking some safety precautions.

⚠ 危险

塔机在高压输电线附近作业时，其任何部位与架空输电线的安全距离，应符合表 1-1 的要求，否则会造成触电伤亡事故，另外还可能引发二次事故，如：民用停电、医院停电危及病人、工厂停产等。

⚠ Danger If the tower crane operates near the high voltage transmission lines, the safe distance between any parts of the crane and overhead transmission lines shall comply with the provisions of Table 1-1, otherwise, casualties resulting from electric shock as well as secondary accidents (such as, civil power failure, hospital power failure that endangers the lives of patients, plant shutdown, etc.) may be caused.

3）塔机的尾部与周围建筑物及外围施工设施之间的安全距离不小于 0.6m。

3) Safe distance between the rear of tower crane and surrounding buildings or peripheral construction facilities shall not be less than 0.6m.

4） 两台塔机之间的最小架设距离应保证处于低位塔机的起重臂端部与处于高位塔机的塔身之间至少有 2m 的距离；处于高位塔机的最低位置的部件（吊钩升至最高点或平衡重的最低部位）与低位塔机中处于最高位置部件之间的垂直距离不小于 2m。

4) The minimum erection distance between two tower cranes shall contribute to a distance of at least 2m between boom end for the lower crane and tower body for the upper crane; vertical distance between the parts at the lowest position of the upper crane and the parts at the highest position of the lower crane shall not be less than 2m.

2.10.2 物象风速

2.10.2 Wind speed of images

起重作业时应以作业高度的瞬时风速为准。离空旷地面 10m 高度处 10min 时距的平均风速乘以“工作风速换算系数 1.5”后换算得到时距为 3s 的短时距平均风速即瞬时风速。

During lifting operation, the instantaneous wind speed at operating height shall prevail. Instantaneous wind speed is the average wind speed within 3s calculated by fall the average wind speed (within 10min) at 10m above the open field by “conversion coefficient of working wind speed - 1.5”.

物象风速表

平均风速 m/s	瞬时风速 m/s	名称	级数	说明（陆地）
0.0～0.2	0.0～0.3	无风	0	静，炊烟直升
0.3～1.5	0.5～2.3	轻风	1	炊烟能表示风向，但风向标不能转动
1.6～3.3	2.4～5.0	柔风	2	面部感觉有风，树叶微响，寻常的风向标
3.4～5.4	5.1～8.1	微风	3	树叶及微枝摇动不息，旗帜随风飘扬
5.5～7.9	8.3～11.9	和风	4	地面扬尘、纸张飞跃，枝条摇动
8.0～10.7	12～16.1	疾风	5	小树摇摆
10.8～13.8	16.2～20.7	强风	6	大树枝摇动，电线摇摆，撑伞困难
13.9～17.1	20.9～25.7	中强	7	大树摇动，迎风步行困难
17.2～20.7	25.8～31.1	劲风	8	树枝折断，迎风行走阻力很大
20.8～24.4	31.2～36.6	烈风	9	烟囱及平房屋顶受损（烟囱顶部及平顶摇
24.5～28.4	36.8～42.6	狂风	10	陆上少见，可拔树毁屋
28.5～32.6	42.8～48.9	暴风	11	陆地很少见，有则必受重大损毁
>32.7	>49.1	飓风	12	陆上绝少，其摧毁力极大

Image Anemometers

Average wind speed (m/s)	Instantaneous wind speed (m/s)	Name	Scale	Description (land)
0.0～0.2	0.0～0.3	calm	0	Calm, smoke rises straight up.
0.3～1.5	0.5～2.3	Slight breeze	1	Smoke shows wind direction, but the wind vane does not rotate.
1.6～3.3	2.4～5.0	Soft breeze	2	Sensation of wind on face, leaves flutter, ordinary wind vane rotation.
3.4～5.4	5.1～8.1	Gentle breeze	3	Leaves and small branches shake, flags unfurl.
5.5～7.9	8.3～11.9	Moderate breeze	4	Stirs up ground dust and paper, larger branches shake.
8.0～10.7	12～16.1	Moderate gale	5	Small leaves sway.
10.8～13.8	16.2～20.7	Fresh gale	6	Large tree branches sway and power lines make whining sound, umbrellas hard to hold.
13.9～17.1	20.9～25.7	Moderately strong gale	7	Total swaying of trees, hard to walk against the wind.
17.2～20.7	25.8～31.1	Strong breeze	8	Twigs break off trees, people face wind barrier in front.
20.8～24.4	31.2～36.6	Strong gale	9	Chimney and cottage roofs are damaged (chimney tops and flattop sway)
24.5～28.4	36.8～42.6	Whole gale	10	Seldom seen inland, trees are uprooted and houses are destroyed.
28.5～32.6	42.8～48.9	Storm	11	Really rare inland, major damages.
>32.7	>49.1	Hurricane	12	Extremely rare inland, massive destructive force.

⚠ 警告

作业前操作人员必须从气象部门获得风速、风力信息，如果风速超过规定值，禁止作业，避免发生危险，造成不必要的损失。

⚠Warning

Before operation, the operator must obtain the wind speed and wind information from the meteorological department. If the wind speed exceeds the specified value, operation is forbidden to avoid danger and cause unnecessary loss.

2.10 设备的修改

2.10 Equipment modification

非经我公司同意，不得对建筑物，塔机安装和使用条件进行修改，尤其是：

Without the permission of our company, it shall not modify the installation and using conditions for buildings and tower crane, in particular:

1) 在塔机上安装带有迎风面的挡板。

1) Install baffle with windward side on tower crane.

2) 在结构件上进行焊接。

2) Welding on the structure.

⚠ 危险

如果改变塔机工作状态（起重臂加长，起重臂扬高），必须重新调整过载限制或力矩限制，否则将造成产品损坏及人身伤害的安全事故。

⚠ Danger If you change the working status of the tower crane (the boom is longer and the boom is raised), you must readjust the overload limit or torque limit, otherwise it will cause the safety accident of product damage and personal injury.

2.11 非工作状态说明

2.11 Non-working status instructions

已安装架设完毕的塔机，不吊载，所有机构停止运动，切断动力电源，并采取防风保护措施的状态。

The installed tower machine doesn't load anything, all the mechanisms stop moving;cut off power supply, and take wind protection measures.

2.11.1 抗强台风安全措施及预案

2.11.1 Safety measures for strong typhoon

本塔机按 GB/T13752-2017《塔式起重机设计规范》设计，对沿海地区，几乎每年都有强热带风暴、甚至较强的台风侵袭，有时风载将会超出规范的设计范围，威胁到塔机的安全。为避免自然灾害造成的损失，应根据实际情况制定出防强台风的措施或应急预案。在此提出以下要求：

According to GB / T13752-2017 "Tower Crane Design Code", the tower crane is designed. For coastal areas, almost every year, there is a strong tropical storm and even strong typhoon to invade, and sometimes wind load will exceed the scope of the design of the standard, which threat to Tower crane safety. In order to avoid losses caused by natural disasters, measures to prevent typhoon or contingency plans should be formulated according to the actual situation. Here are the following requirements:

1) 塔机用户应密切注意天气、风力动向，当预报风力大于 6 级小于 11 级时，塔机

应停止工作，检查塔身、附墙杆、机构、广告牌、电气箱、灯具等是否连接牢固，有问题应及时处理，吊钩升到最高处，吊臂应能随风转动，回转范围内不得有障碍。

1) Users should pay close attention to the weather, and wind direction. When the forecast wind strength is between 6 grades and 11grades, the tower crane should stop working and check the tower for whether tower body, wall bars, institutions, billboards, electrical cabinet and lighting are connected stably. There are problems should be promptly handled; the hook rose to the highest position; the boom should be able to rotate freely with the wind.

2) 当预报风力大于 11 级时，独立高度的塔机应至少降下 1/3 的高度，或者在塔身上部安装一道附墙，并适当降低高度到不碰建筑物顶部为止，必要时应拆除楼顶的钢管、脚手架等设施，让塔身尽量降低，当塔机独立固定高度满足缆风绳方案时，可以使用缆风绳防护。塔机在独立高度时候，应将回转机构拆下。

2) When the forecast wind power is greater than 11, the independent height of tower crane shall be lowered at least 1/3 of the height, or a attached-wall shall be installed on the upper part of the tower body and the height shall be lowered to below the roof of building. And if necessary, the steel pipe, scaffolding and other facilities on building can be dismantled. When the tower crane independent fixed height satisfies the cable rope program, you can use cable rope protection. For tower crane with an independent height, the rotary mechanism should be removed.

3) 对于超过独立高度并安装有附着的塔机，且四周空旷，风力不受阻碍的高层建筑塔机用户，当预报风力大于 11 级时，应将塔机降低至建筑物高度以下，并将吊臂和平衡臂与建筑物主体结构连接牢固（不得仅连接在建筑物外的钢管架等物体上），如下图所示。并且平时就应准备好固定塔机的工具，以免临时没办法加固。

3) For this tower crane, it exceeds the independent height and has attachment, staying in open field, which should be lowered to below the height of the building when the wind speed is greater than 11.And the boom and counter-jib are firmly connected with the main structure of the building (not only connected to the steel pipe rack and other objects outside the building), as shown in the following figure. And it usually should be ready to fix the tower crane tools.

4) 严格按照塔机使用说明书安装和使用，塔身高度和附墙以上的塔机悬出高度不得超过说明书规定的范围，附墙装置（框架及支撑杆）也应由专业厂家设计制作，不可贪图便宜，在没有计算依据的情况下随意制作，且附着点强度必须满足设计要求。

4) Erection and using strictly according with the manual, and the height of tower crane and overhang height shall not exceed the height specified in the manual. Devices attached the wall (frame and support rod) should also be designed by a professional manufacturer, which cannot be manufactured optionally for cheap. And the strength of the attachment point must meet the design requirements.

5) 严格按设计要求制作塔机基础，不得心存侥幸、降低要求。

5) Design the tower crane foundation in accordance with the requirements in manual.

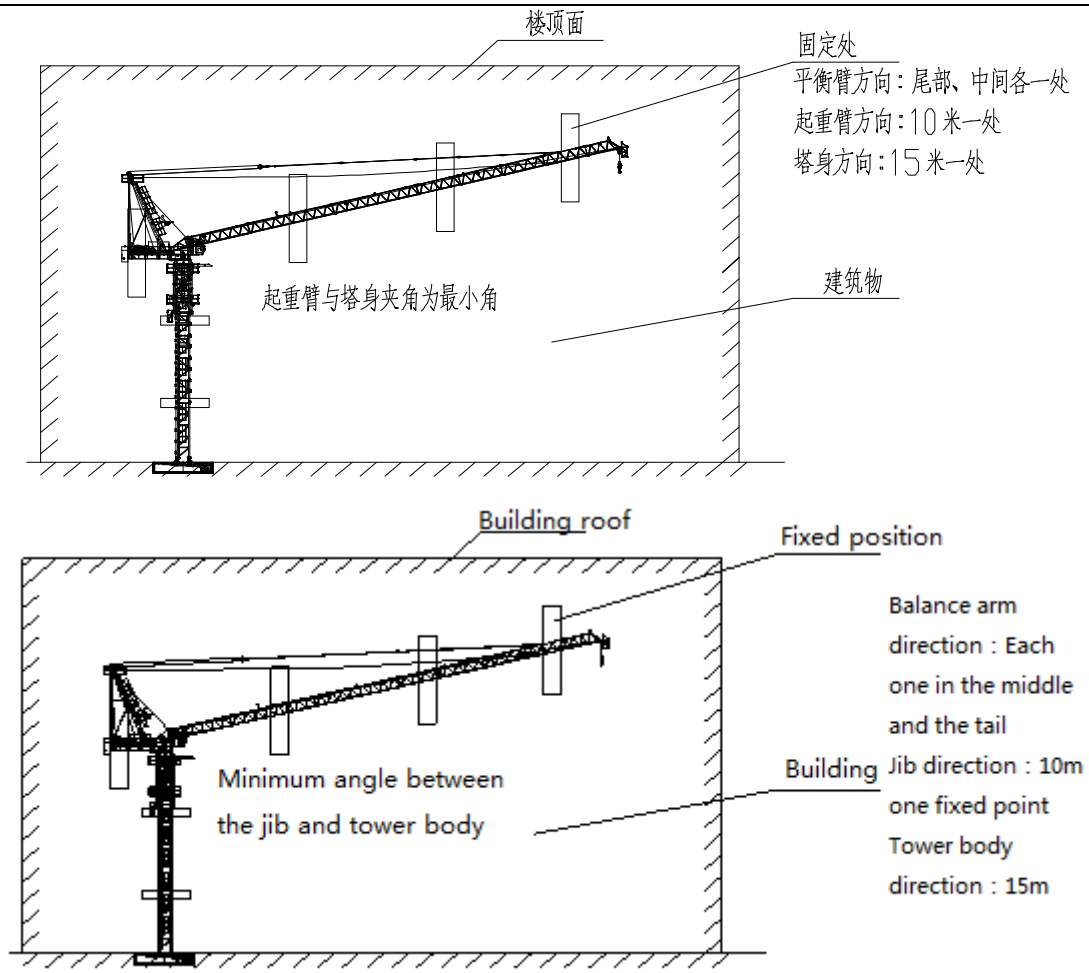
6) 因为台风来袭时的方向还是有规律可循，塔机安装时尽量安装在建筑物能挡风的背风面。

6) Because the direction of the typhoon struck is regular, the tower crane should be installed as far as possible on the leeward side of the building that can be wind-protected.

⚠ 警告

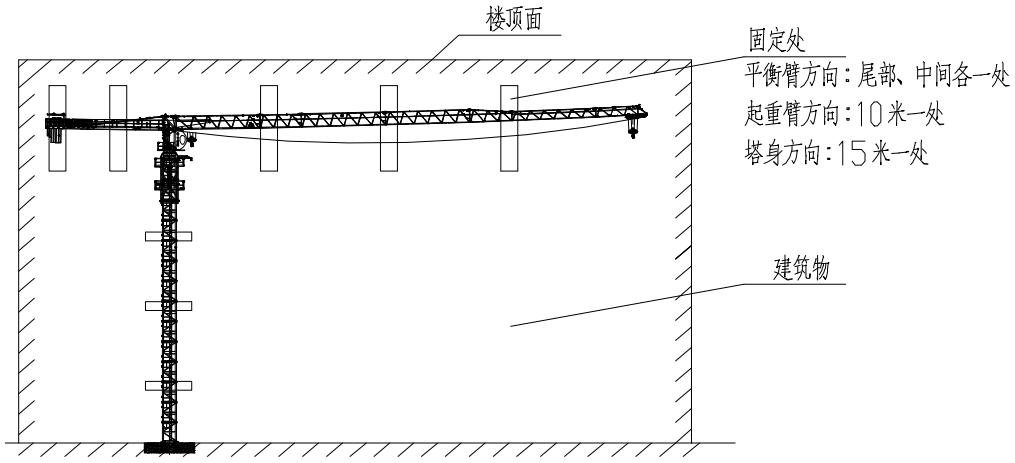
塔机安装与顶升加节时应该在四级风以下进行作业。塔机禁止作回转和变幅操作。请严格按照以上要求操作，否则将会导致折臂或整机倾覆现象发生，造成财产损失及人身伤害的安全事故。

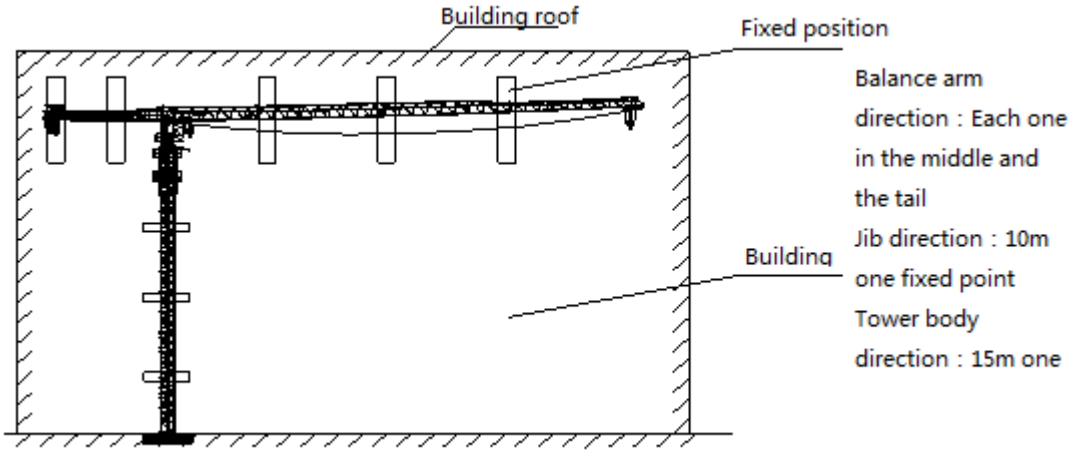
⚠Warning The installation and adding masts should be operated below the four wind strength.During the process, the slewing and luffing operation is prohibited. Please strictly follow the above requirements, otherwise it will make the boom break and the whole machine overturn, resulting in property damage and personal injury



动臂式塔机固定示意图

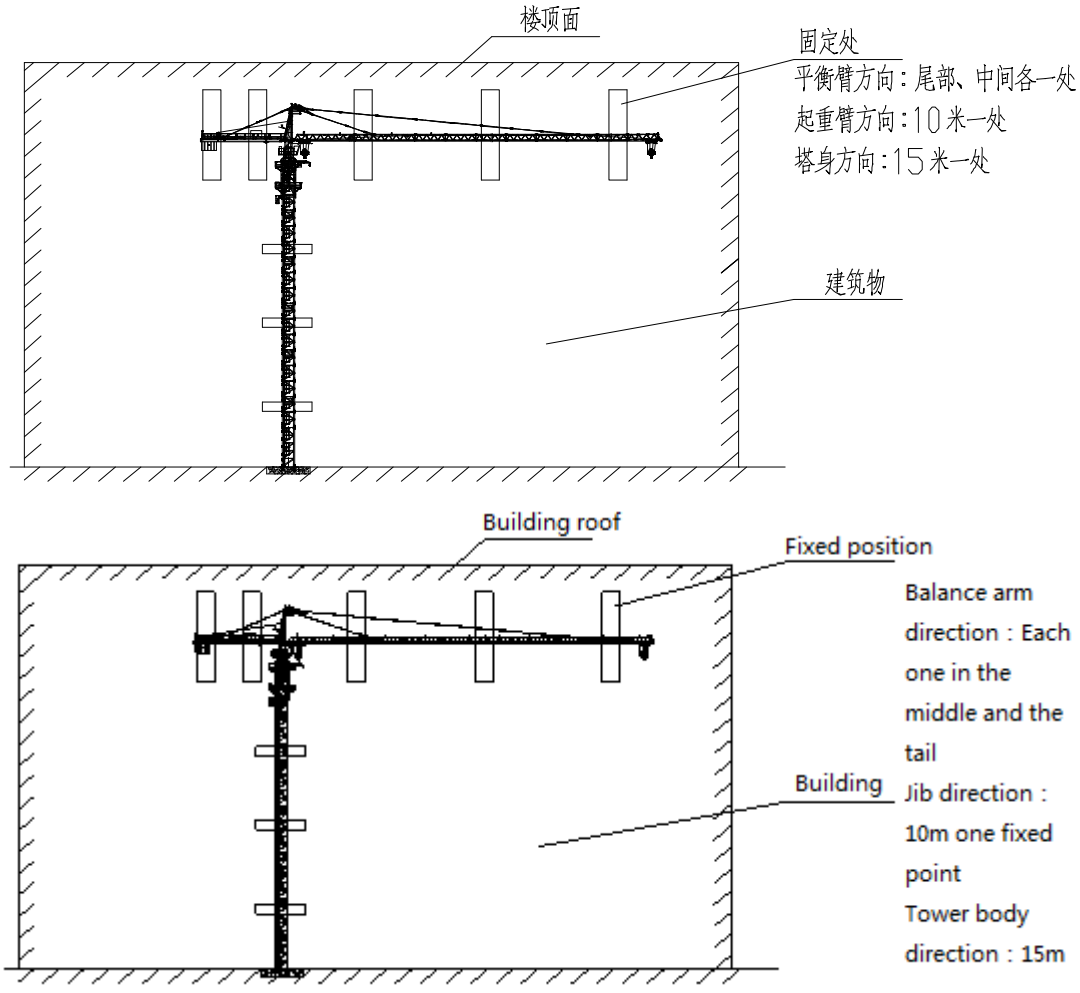
Luffing tower crane stationary schematic





平头式塔机固定示意图

Topless tower crane stationary schematic



塔顶式塔机固定示意图

Hammer-head tower crane stationary schematic

3 安全信号

3 Safety signal

3.1 说明

3.1Instruction

安全或危险健康信号，是针对某一物体某一特定环境，所提供的与安全或健康有关的知识或规定。根据情况不同，该信号可以是一块板、一种颜色、一个灯光或声响信号。

Safe or dangerous signals are intended for a particular environment of an object and provide knowledge or regulations related safety or health. Depending on the situation, the signal can be a board, a color, a light or an audible signal.

3.2 安全标识

3.2 Safety signs

3.2.1 安全标识说明

3.2.1 Safety signs instructions

安全标识相关说明

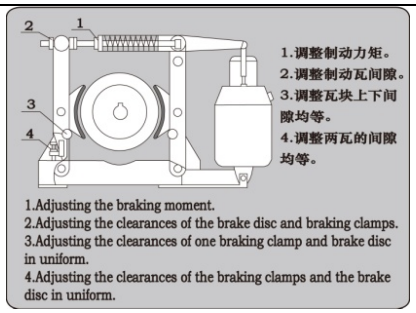
Safety signs instructions

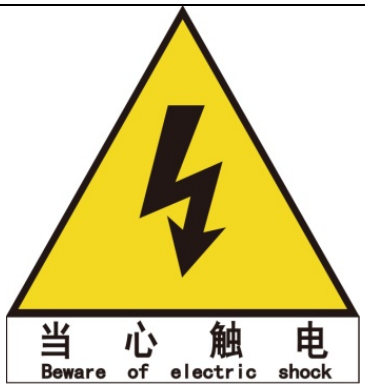
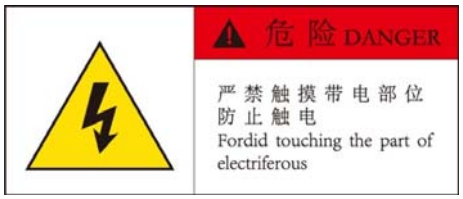
序号 No	代码 Code	图形标志 Graphical signs	安装位置 Installing position	说明 Instruction	备注 Remark
1	AQBZ1		基础节起重臂第一节 Base section, first jib section	必须系好安全带 You must fasten your safety belt	

2	AQBZ2		基础节 Base section	必须戴安全帽 You must wear a helmet	
3	AQBZ3		基础节 起重臂第一节 Base section, first jib section	当心坠落 Be careful to fall	
4	AQBZ4		基础节 Base section	当心落物 Beware of falling objects	
5	AQBZ5		基础节 Base section 塔帽 Tower cap	检查安全装置是否处于良好工作状态 Check whether the safety device is in good	

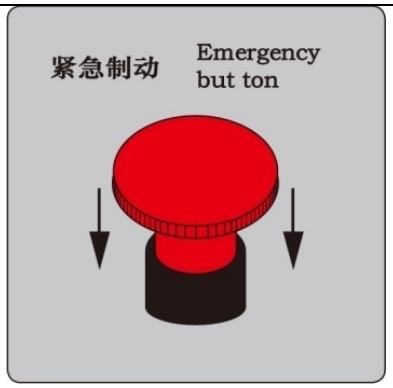
				working condition	
6	AQBZ6		基础节 Base section	塔机工作中未经允许严禁攀爬！ No unauthorized ascent 攀爬时须告知塔机操作者 Authorized personnel must warn crane driver	
7	AQBZ7		基础节 Base section	必须穿防护鞋 You must wear protective footwear	
8	AQBZ8		基础节 Base section	必须戴防护手套 You must wear protective gloves	

9	AQBZ9		塔帽 Tower cap	检查钢丝绳的磨损情况 每三个工作日一次 Check the worn condition of the wire ropes every 3 days working.	
10	AQBZ10		起升机构 Hoisting mechanism	检查制动块的间隙! Check the brakes for performance	
11	AQBZ11		塔帽 Tower cap	检查主要金属结构件的变形、焊缝等情况 每周一次 Check the condition of main metal structure's deformation and weld joint weekly	

12	AQBZ12		塔帽 Tower cap	保持对减速机及各润滑点加油 Add oil to the reducers and lubricant location in time	
13	AQBZ13		起升机构 Hoisting mechanism	更换钢丝绳后必须重新调整高度限位器 It is necessary to adjust the height limiter again after changing wire rope.	
14	AQBZ14		起升机构 Hoisting mechanism	调节制动器 Adjust brake	

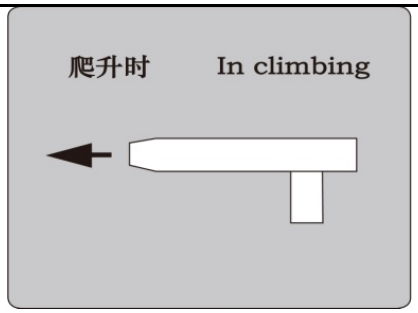
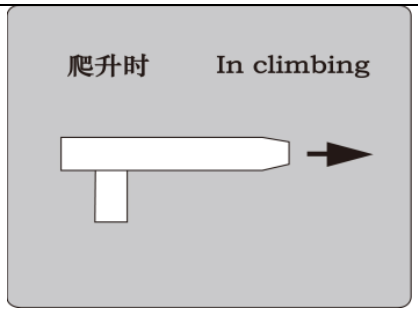
15	AQBZ15		起升机构 Hoisting mechanism	当心机械伤人 Beware mechanical hand injury	
16	AQBZ16		主电控柜 Main electric control cabinet	当心触电 Beware of electric shock	
17	AQBZ17		主电控柜 Main electric control cabinet	严禁触摸带点部位防止触电 Prohibit touching the electriferous part	
18	AQBZ18		主电控柜 Main electric control cabinet	操作前请阅读使用手册定期维护保养 Read the manual before operation and	

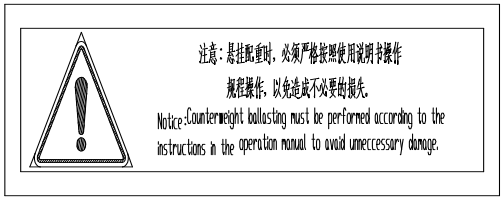
				maintain on time	
19	AQBZ19		主电控柜 Main electric control cabinet	开门前请关闭电源 Close the supply power before opening the door	
20	AQBZ20		主电控柜 Main electric control cabinet	非专业人员勿动 Don't touch Except specialized person	
21	AQBZ21		司机室内左侧 Left side in operator cabin	使用机器前，请认真阅读使用手册，按照使用手册和安全章程操作 Carefully read operator's manual before handling the machine. Observe instructions and safety	

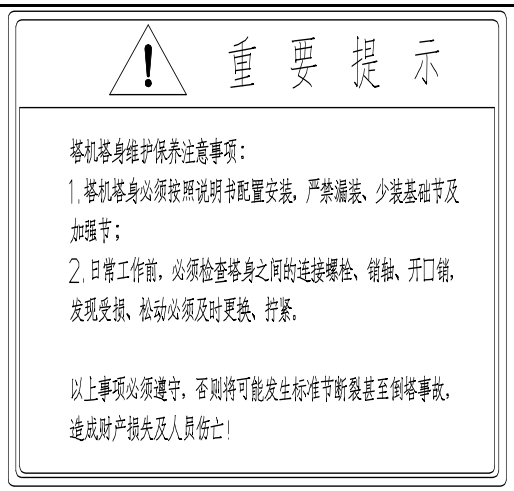
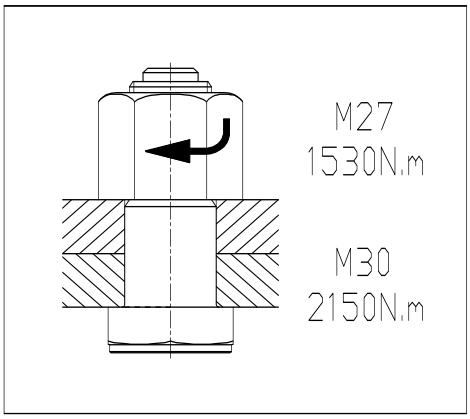
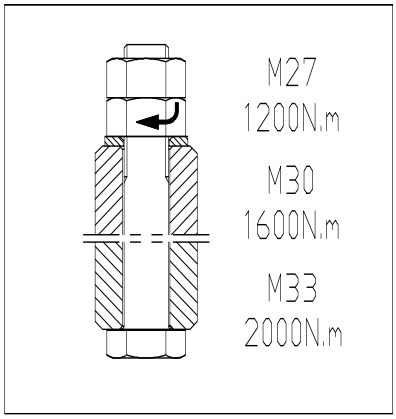
				rules when operating.	
22	AQBZ22		司机室内左侧 Left side in operator cabin	紧急制动 Emergency button	
23	AQBZ23		司机室内左侧 Left side in operator cabin	非工作工况时回转自由 rotating freely in non-working conditions	适用于塔顶式机型 Apply to Hammer-head Tower crane
24	AQBZ23A		司机室内左侧 Left side in operator cabin	非工作工况时回转自由 rotating freely in non-working conditions	适用于平头式机型 Apply to topless tower crane

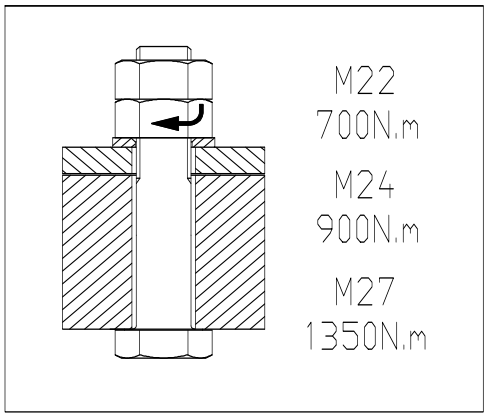
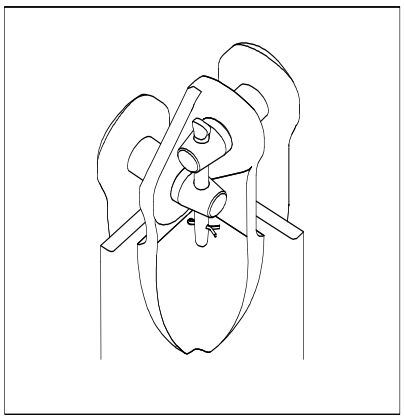
25	AQBZ23B		司机室内左侧 Left side in operator cabin	非工作工况时回转自由 rotating freely in non-working conditions	适用于动臂式机型 Apply to luffing tower crane
26	AQBZ24		基础节 Base section	大臂下方禁止站人 People cannot stand below the boom.	适用于塔顶式机型 Apply to Hammer-head tower crane
27	AQBZ24A		基础节 Base section	大臂下方禁止站人 People cannot stand below the boom.	适用于平头式机型 Apply to topless tower crane

28	AQBZ24B		基础节 Base section	大臂下方禁止站人 People cannot stand below the boom.	适用于动臂式机型 Apply to luffing tower crane
29	AQBZ25		基础节 Base section	当心吊物 Beware of hanging things	
30	AQBZ26		基础节 Base section	当心电缆 Beware of cable	
31	AQBZ27		顶升横梁 Jacking beam	当心冒顶 Beware of roof-falling	

32	AQBZ28		顶升横梁 Jacking beam	顶升时必须将安全销插入 Safety pin must be inserted when lifting	
33	AQBZ28A		顶升横梁 Jacking beam	顶升时必须将安全销插入 Safety pin must be inserted when lifting	
34	AQBZ30		基础节 Base section	仔细观察 Observe carefully	
35	AQBZ31		基础节 Base section	注意安全 Caution danger	
36	AQBZ32		台车外侧司机室内左侧 Outside the trolley and Left side in operator cabin	塔机行走注意事项 Tower crane walking precautions	行走式塔机专用 Use for moving tower crane

37	AQBZ33		爬升架 Climbing frame	下支座未于标准节相连时禁止拆下爬升架 It is prohibited to remove the climbing frame when lower support has not connected with tower standard section.	
38	AQBZ34		平衡臂 Counter-jib	请按照说明书要求悬挂配重 Please hang the weights according to the instructions	

39	AQBZ35		基础节 Base section	塔机塔身维保相关注意事项 Tower body maintenance related note	
40	AQBZ36		标准节 Mast section	片式标准节连接螺栓拧紧力矩说明 Tightening torque description of joint bolt of plate mast	片式标准节专用 Use for plate mast
41	AQBZ37		标准节 Mast section	螺栓连接型式塔身连接螺栓拧紧力矩说明 Bolt-connection tightening torque description of bolt-connection type tower body	塔身为螺栓连接型式塔机专用 Tower body for Bolt-connection tower crane

42	AQBZ38		上下支座总成 Upper and lower support assembly	回转支撑连接螺栓拧紧力矩说明 Tightening torque description of connecting bolt of slewing support	
43	AQBZ39		标准节 Mast section	片式标准节连接销轴示意图 Connection pin diagram of piece standard section	L 系列片式标准节专用 Use for L piece Standard section

3.2.2 安全标识在塔机上的位置

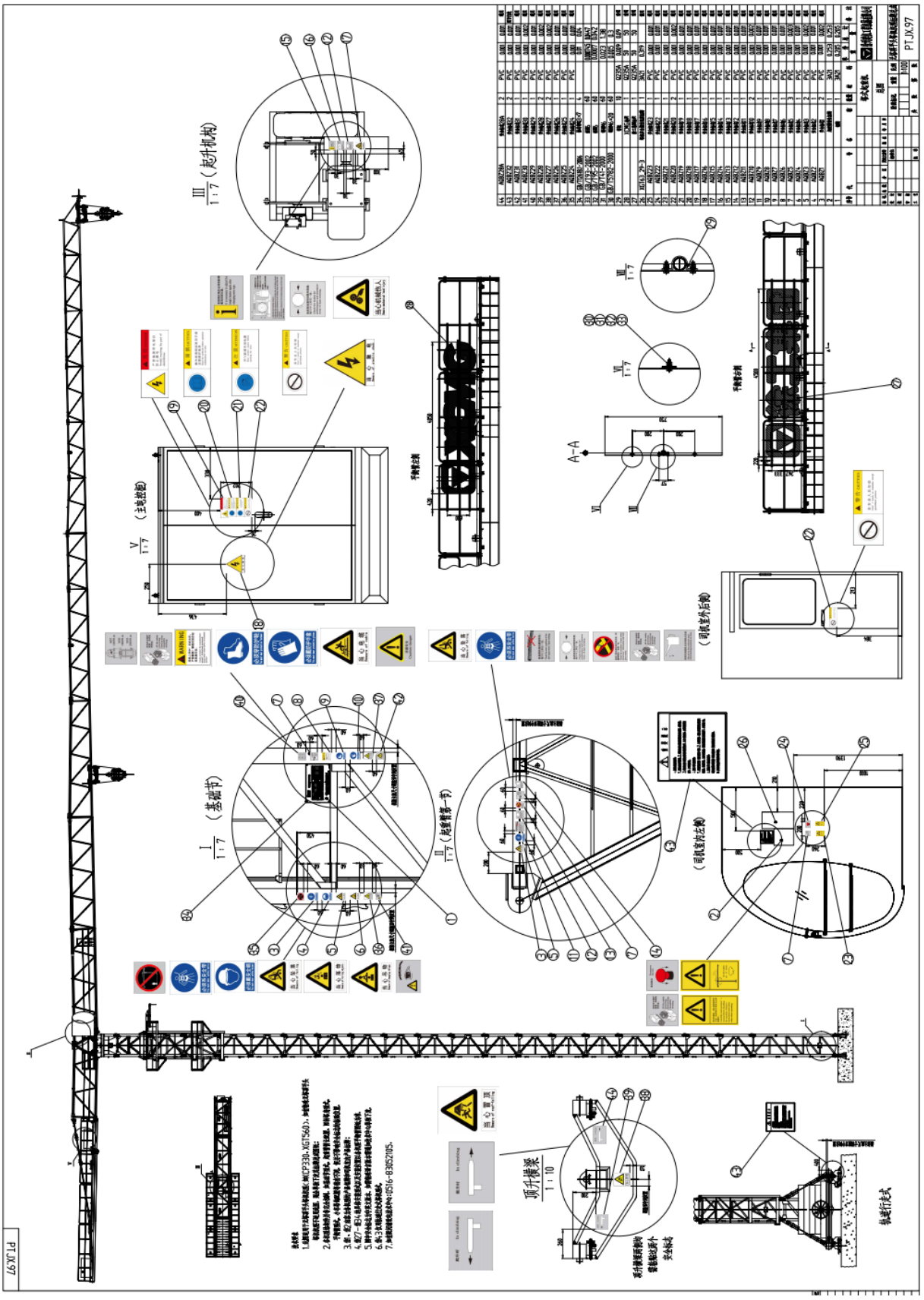
3.2.2 The location of the safety signs on the tower

在塔身节、平衡臂、起重臂、塔顶、司机室等重要部位，有各种安全警示标志，指导操作者安全使用，避免造成伤害，车辆的安全标识必须位置准确，完整无损，无外物遮挡。

On the tower section, counter jib, boom, tower top, operator cabin and other important parts, there are all kinds of safety warning signs to guide the safe use of the operator to avoid injury. The safety signs of vehicle must be accurately located, intact and clear.

塔机安全标识粘贴位置

The location of the safety signs on the tower



提示

Caution

1) 如需更换标志，您的徐工经销商会提供新的安全标识。除经我公司或经销商授权，禁止擅自篡改或更换现有标志。

1) If you need to change the logo, Xugong dealer will provide a new safety label. Except authorized by our company or distributor, it is forbidden to tamper with or replace the existing mark without authorization.

2) 更换新标志时，请粘贴在正确的位置。

2) When replacing the new logo, please paste in the correct position.

4 术语

4 Terms

4.1 起重名词说明

4.1 Description of hoisting

1)最大起重量 Q

1) Maximum Lifting Capacity (Q)

塔机在各种安全作业的情况下，所容许的起吊重物的最大质量。最大质量是吊钩以下质量的总和（不含吊钩质量，包括吊具质量）。

It refers to the maximum quality of lifting weights allowed by the crane in the case of various safety operations. The maximum mass is the sum of the weight of any parts lower than the hook (excluding the weight of hook).

2)幅度 R

2) Range (R)

塔机回转中心线至吊钩中心线的距离，也称工作幅度。

It refers to the distance between the slewing centerline and centerline of the hook, also known as the working range.

3) 起升高度 H

3) Lifting Height (H)

塔机固定独立状态时，空载、塔身处于最大高度、吊钩处于最小幅度处，吊钩支承面对塔机基础上平面的最大垂直距离。 以上说明是针对固定式或附着式塔机的。

It refers to the maximum vertical distance between the hook bearing surface and the upper plane of the tower crane base when the tower body reaches the maximum height and the hook

is at the minimum amplitude under no-load and fixed independent conditions. These instructions are applicable to fixed or attached tower cranes.

4) 最大起重力矩 M

4) Maximum Hoisting Moment (M)

最大额定起重量与其在设计确定的各种组合臂长中所能达到的最大工作幅度的乘积。

It is the product of the maximum rated lifting capacity and the maximum working range that can be reached under any combination boom length determined by the design.

5) 安全距离

5) Safe Distance

塔机运动部分与周围障碍物之间的最小距离。

It refers to the minimum distance between the moving parts of the tower crane and the surrounding obstacles.

6) 工作状态

6) Working State

塔机处于司机控制之下进行作业的状态。

It refers to the operating state of the tower crane under the control of the driver.

7) 非工作状态

7) Non-working State

已经安装架设完毕的塔机，小车处于臂根位置，吊钩处于最上部，不吊载，所有机构停止运动，切断动力电源，并采取防风保护措施的状态。

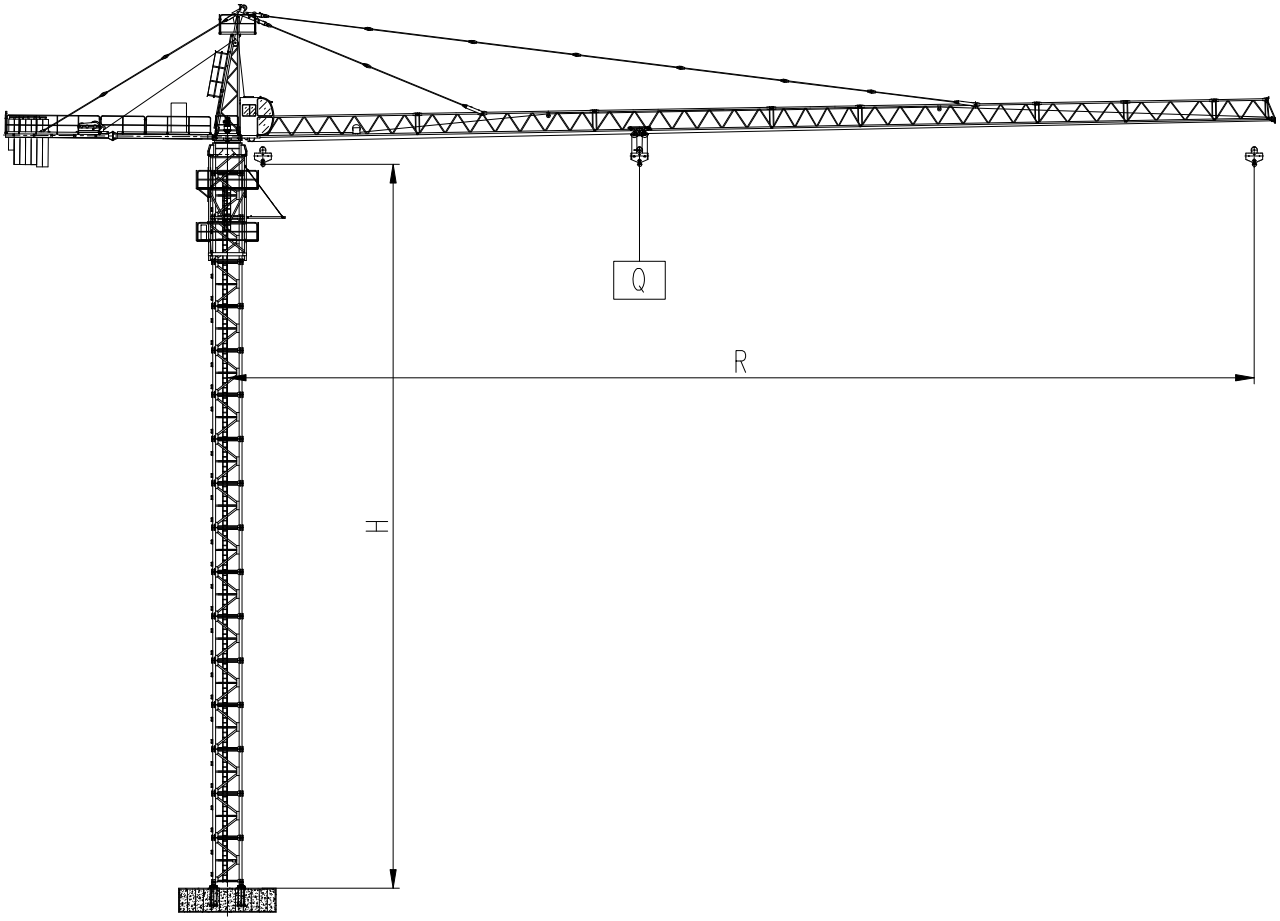
It refers to the conditions that there is no loading during the installation process, all the mechanisms stop working, power supply is cut off and wind protection measures are taken.

8) 最大工作压力

8) Maximum Working Pressure

正常操作状态下，液压回路或元件中的最大压力。

It refers to the maximum pressure in hydraulic circuits or elements under normal operating state.



起重名词示意图

Hoisting noun diagram

4.2 相关数据单位说明

4.2 Description of data unit

说明书用数据单位表

Data unit table

类别 Type	单位 Unit
长度单位 length	mm
重量单位 weight	kg
风压单位 wind pressure	Pa
风速单位 wind speed	m/s
温度单位 temperature	℃

提示

本说明书中未提到单位的数据所采用的单位按照上表中单位为准，若文中数据规定了单位，以具体规定的单位为准，请悉知。

Caution

The units that are not mentioned in this manual are based on the units in the above table. If the data in this document specifies units, please refer to the specific units.

4.3 起重吊运指令

4.3 Hoisting instructions

当执行塔机各种动作时，司机必须时刻关注塔机周围的空间情况。在带载动作时，司机必须注视载荷；在空钩动作时，司机应注意吊钩。为确保起重安全，起重工和司机应熟练掌握各种指挥信号。由于塔机高度较高，一般都采用对讲机进行指挥。

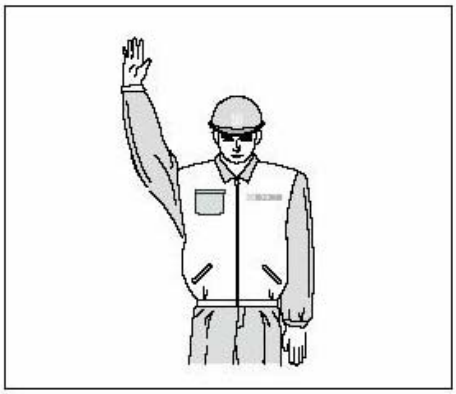
While practicing various actions of the tower crane, the driver must always be aware of the space around the tower crane. The driver must keep an eye out on the load for loaded operation; and pay attention to the hook during empty-hook actions. To ensure lifting safety, the crane operator and driver shall have a good knowledge of various commanding signals. As the tower crane is high, usually walkie-talkie is used to conduct the operation.

推荐指挥手势如下：

Recommended command gestures are as follows:

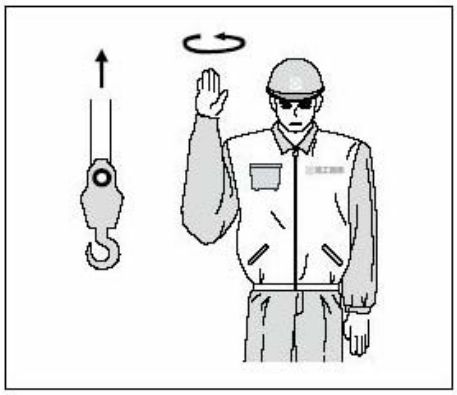
1.“预备”（注意）

手臂伸直，置于头上方，五指自然分开，手心朝前保持不动。



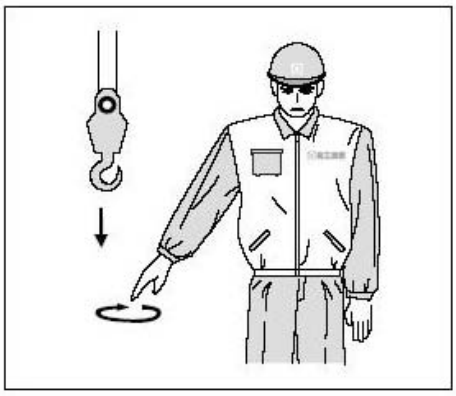
2.“吊钩上升”

小臂向侧上方伸直，五指自然伸开，高于肩部，以腕部为轴转动。



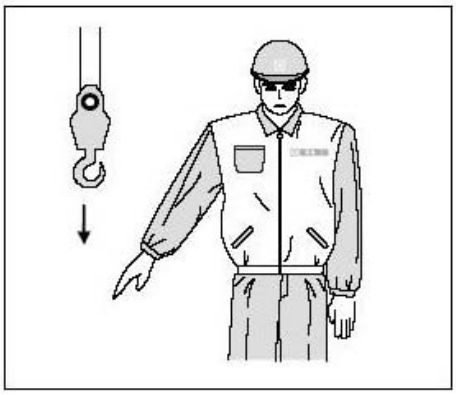
3.“吊钩下降”

手臂伸向侧前下方与身体夹角约30°，五指自然分开，以腕部为轴转动。



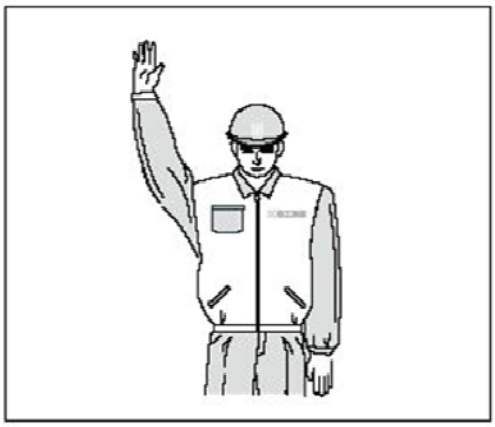
4“指示降落方位”

五指伸直，指出负载应降落的位置。



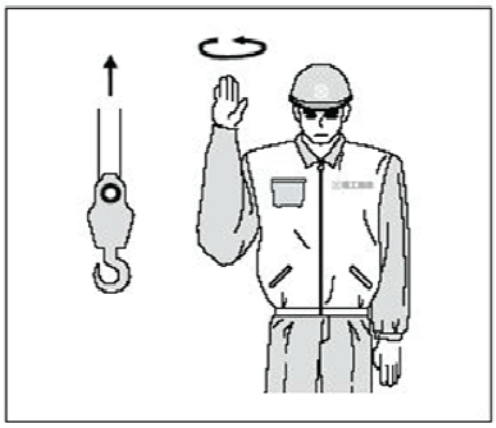
1. "Ready" (attention)

Stretch out straight the arm up to the head, with the five fingers naturally separated and palm kept forward.



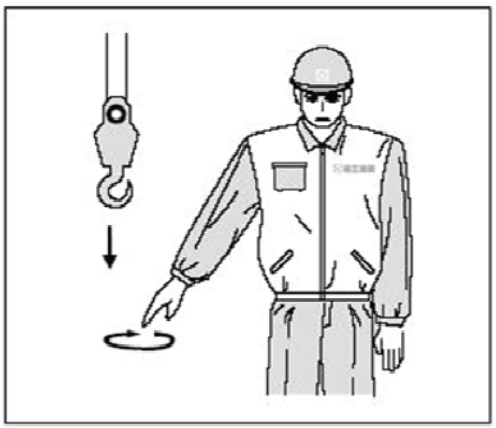
2. "Hook ascending"

Put up the forearm straight to the lateral side with five fingers naturally separated and the palm higher than the shoulder, turn the hand with wrist as the axis.



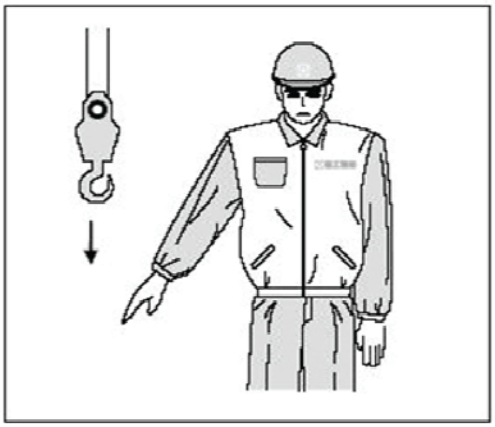
3. "Descend hook"

Stretch out the arm to the lower lateral front side in an intersection angle of 30° to the body with five fingers be separated naturally, and turn the palm with wrist as the axis.



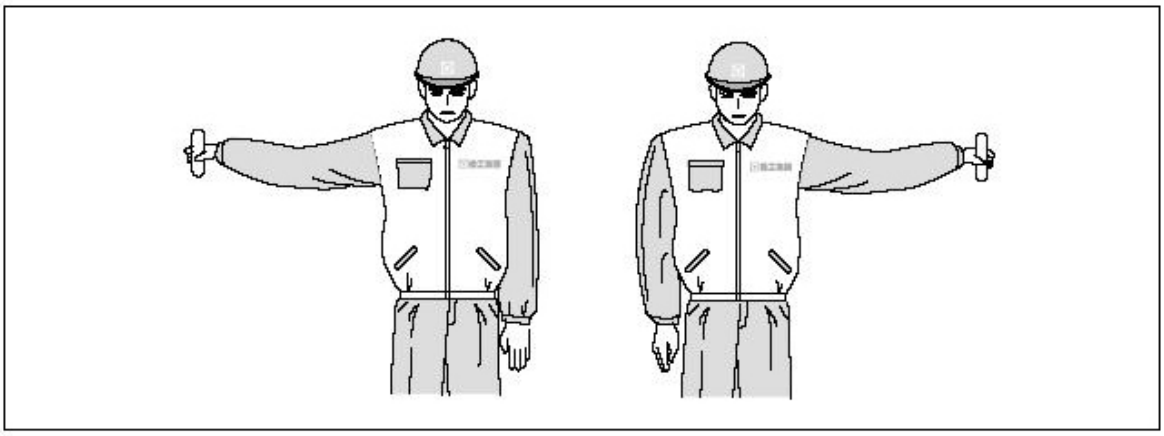
4. "Indicate descending orientation"

Stretch out five fingers naturally, and point to the position that the load is to be landed.



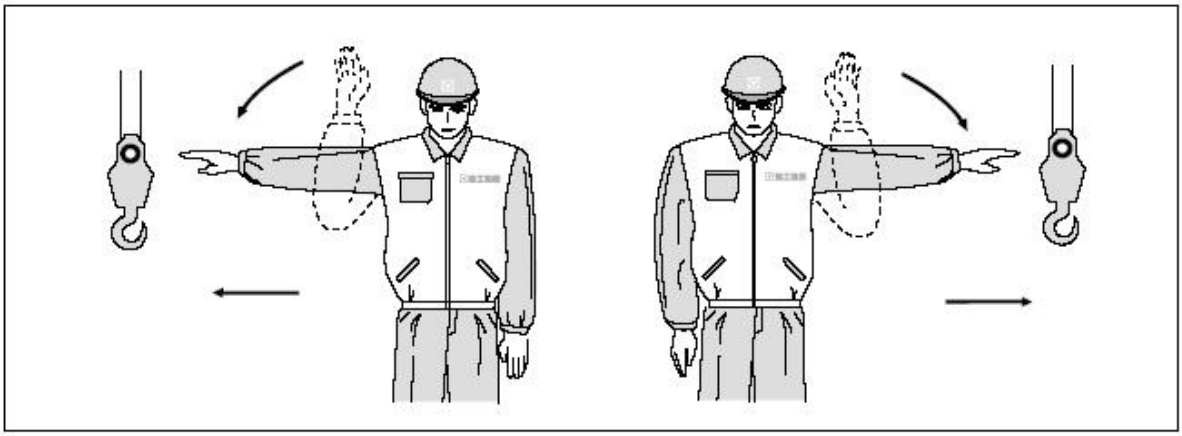
5. “转臂”

手臂水平伸直，指向应转臂的方向，拇指伸出，余指握拢，以腕部为轴转动。



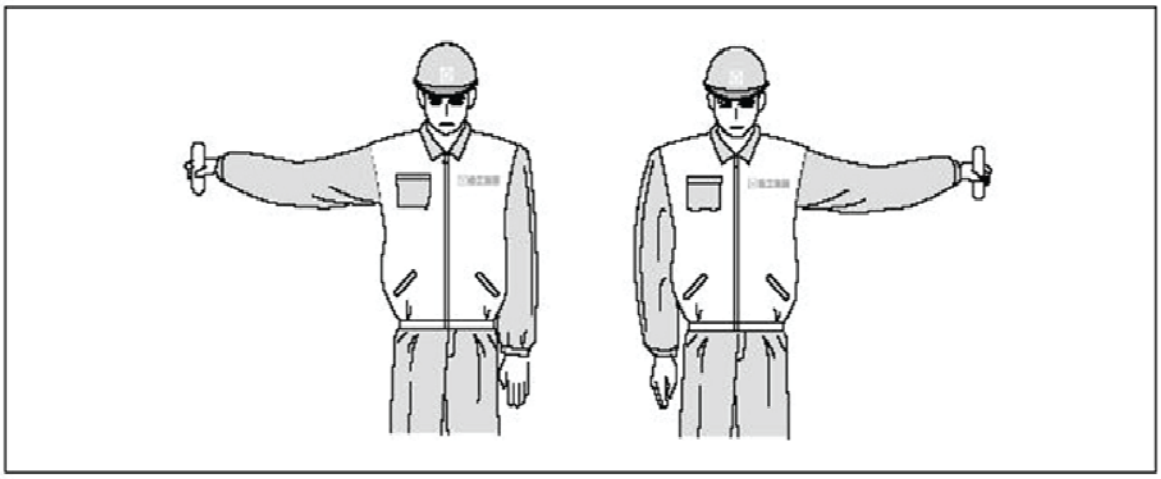
6.“吊钩水平移动”

小臂向侧上方伸直，五指并拢手心朝外，朝负载运行的方向，向下挥动到与肩相平的位置。



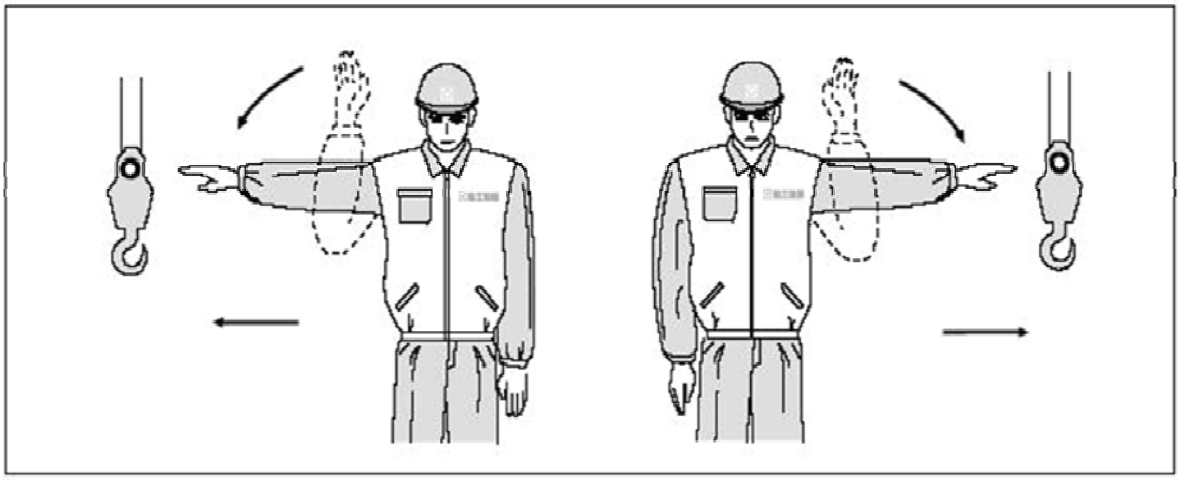
5. "Slew the jib"

Stretch out the arm straight horizontally to the direction that the jib is to be slewed with thumb stretched out and rest of the fingers retracted, and turn the handle with wrist as the axis.



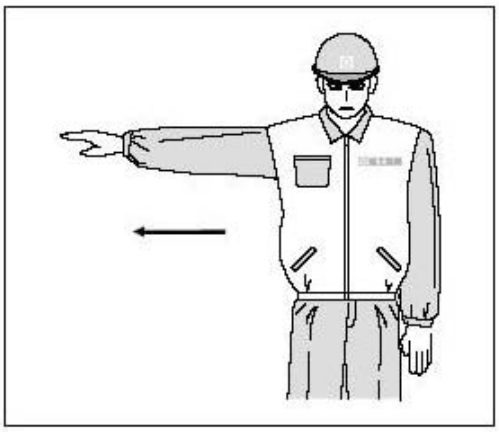
6. "horizontal movement of hook"

Stretch out the forearm to the lateral upper side with five fingers retracted and the palm facing the direction that the load is to be moved, swing the forearm to the position parallel to the shoulder.



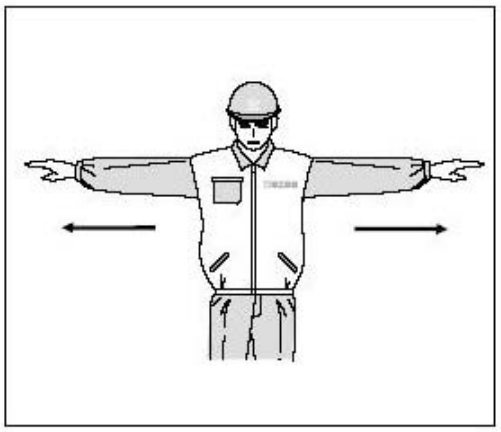
7.“停止”

小臂水平置于胸前，五指伸开，手心朝下，水平挥向一侧。



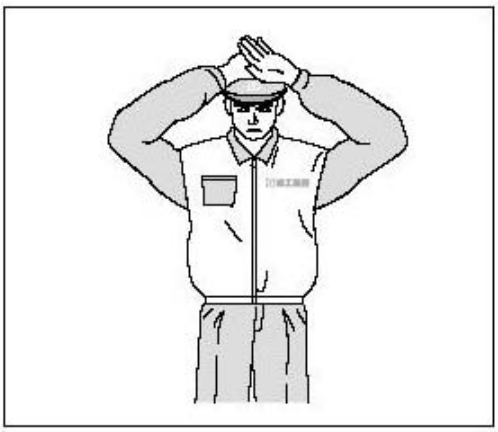
8.“紧急停止”

两小臂水平置于胸前，五指伸开，手心朝下，同时水平挥向两侧。



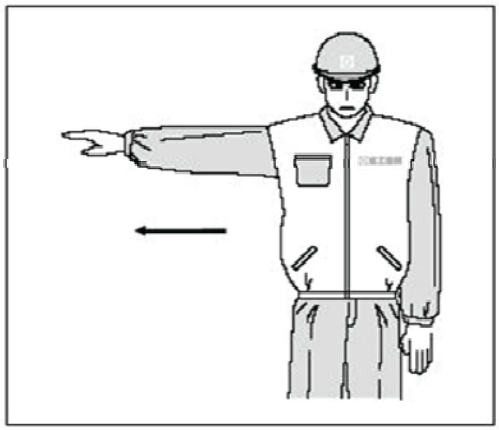
9.“工作结束”

双手五指伸开，在额前交叉。



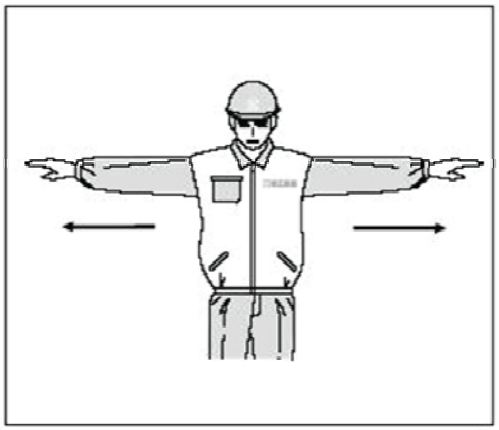
7. " stop"

Put the forearm in front of the chest with five fingers stretched and palm facing the ground, swing the forearm horizontally to the one side.



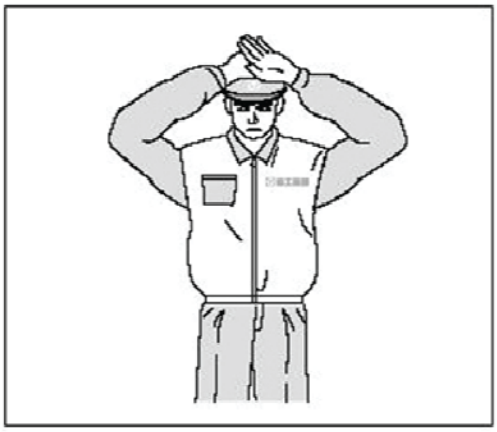
8. "Emergency stop"

Put both forearms in front of the chest with five fingers stretched and palms facing the ground, swing the forearms horizontally to the both sides.



9. "Task finished"

Intersect both hands with singers stretched.



⚠ 注 意

本产品说明书所给的指挥语言只作为推荐，是基本的指挥语言。如果不能满足，使用单位可根据使用情况增加，指挥信号可参考标准 GB5082-1985《起重吊运指挥信号》。

⚠ Caution **The command language provided is only for recommendation, it is the basic command language. If insufficient, the user may increase the command language according to needs. The command signals may take reference from Standard GB5082-1985 *The Commanding Signal for Lifting and Moving*.**

⚠ 警告

对本章中所提到的要点疏忽检查或不遵守，可能会导致产品损坏及人身伤害安全事故。

⚠Warning

Inadvertent inspections or non-compliance with the points mentioned in this chapter may result in product damage and personal injury.

概 述
Overview

XGT8040-25 塔式起重机是由徐工集团徐州建机工程机械有限公司按照国家和行业标准，参照相应的国际标准设计、制造的新一代自升式塔式起重机。

XGT8040-25 is a new generation self-elevating tower crane made by XCMG Xuzhou Construction Machinery Co., Ltd., in accordance with corresponding national and industry standards.

XGT8040-25 塔机为水平起重臂、小车变幅、上回转自升式多用途塔机，该机的特色有：

XGT8040-25 is a multi-purpose tower crane with horizontal jib, trolley, and upper-slewing and self-climbing structure. The features of the crane include:

1.最大工作幅度 80m，最大起升高度 277m。

1. The max working radius is 80m and max lifting height is 277m.

2.该机有独立固定式、附着式、等工作方式，适用各种不同的施工对象。

2. The crane’s working type includes stationary type, under-frame loading type, attached typed, rail-mounted type and inner climbing type and so on, in order to meet different construction requirements.

提 示

独立固定式基本型起升高度为 68.8m，附着式的起升高度为 277m。本说明书中关于塔机独立固定式起升高度的技术参数均以基本起升高度 68.8m 依据进行计算的。

Caution

The standard independent height of stationary tower crane is 68.8m, and the attached tower crane’s is 277m. all the technical parameters of stationary independent tower crane lifting height is calculated based on the standard lifting height of 68.8m.

3.整机外形为国际流行式，美观，深受国内外用户喜爱。

3. The whole shape of the machine is internationally popular and is beloved by domestic and international customers.

4.工作速度高，调速性能好，工作平稳可靠。

4. The crane has high working speed and good performance, so it is smooth and reliable.

5.电气控制系统采用国内外知名品牌元器件，寿命长，故障率低，维修简单，工作稳定可靠。

5. The main components of electrical control system are domestic and foreign well-known brand components. It features long operating life, less breakdown and easy maintenance. It also has reliable performance during operation.

6.大量采用了国内外成熟可靠的先进技术，以提高整机的技术水平，采用先进技术有：

6. The design absorb advanced technology at home and abroad as much as possible to improve the overall technology. The advanced technologies are:

1）回转机构采用行星减速机，配置变频电机，采用变频器驱动，实现无级调速，起动、制动平稳，无冲击，安全可靠；

1) A slewing mechanism adopts a planetary reducer, is equipped with converter motors, and is driven using an inverter, realizing stepless speed adjusting, starting, balance braking, shock-free, safe, and reliable.

2）引进国外先进技术并国产化的起重量限制器、力矩限制器、高度限位器、幅度限位器、回转限位器、起升、回转、变幅机构的制动器等安全装置；

2) The safety devices are locally manufactured based on foreign advanced technology, such as load limiter, torque limiter, height stopper, amplitude stopper, slewing stopper, brakes of lifting mechanism, slewing mechanism, trolleying mechanism and other devices;

3）小车防断绳装置（防溜车）和防断轴装置；

3) Anti-broken rope device of trolley (anti-slip) and anti-off-axis device;

4）起升机构排绳系统；

4) Hoisting mechanism is equipped with a rope-winding system;

5）变幅绳张紧系统；

5) Tensioning system of traction rope;

6）刚性双拉杆悬挂大幅度起重臂，起重臂刚度好，自重轻，断面小，风阻小，外形美观，长度有几种变化，满足不同施工要求；

6) Rigid double drag rod suspends the wide-range jib. The jib has excellent stiffness and light weight. Small profile contributes to low wind resistance. The tower crane has beautiful appearance. There are several changes in length, to meet the different requirements of construction;

7）司机室采用工业化设计，美观舒适，视野好，内部空间大，给操作者创造良好的工作环境；司机用工业化设计的联动台操纵各机构动作，操作简单，维修方便。

7) The cab is an industrial design and installed at one side so the driver will have wide visual field. Driver's seat can be adjusted according to personal needs. It creates a better working environment for operator; cab is using the industrial design linkage units for each action, and it is

easy to operate and maintain.

8.设计完全符合或优于相关国家标准。

8. The design is fully compliant with or superior to national standards.

适用于高层或超高层民用建筑、桥梁水利工程，大跨度工业厂房以及采用滑模法施工的高大烟囱及筒仓等高塔形建筑工程。

The tower crane is suitable for senior or super tall buildings, bridges engineering, large-span industrial plants, and high tower construction projects using sliding construction method, such as tall chimneys and silos.

9.塔机适用的条件

9. Applicable conditions

（1）最大工作风压（起重机全高）：　　≤250Pa

(1) Maximum working wind pressure (overall height of a crane)　　≤250 Pa

（2）最大非工作风压（起重机全高）：　　≤1200Pa

(2) Maximum non-working wind pressure (overall height of a crane)　　≤1200 Pa

（3）最大安装或顶升风压（起重机全高）：　　≤100Pa

(3) Maximum installation or lifting wind pressure (overall height of a crane)　　≤100 Pa

（4）工作环境温度：　　-20℃～+40℃

(4) Working temperature:　　-20℃-+40℃

（5）海拔高度：　　≤2000m

(5) Altitude:　　≤ 2000m

（6）工作电压：　　AC380V±10% 50Hz

(6) Working voltage:　　AC380V±10% 50Hz

（7）工地电源供电箱：工地电源开关 I_e≥350A，安装位置在塔机底部电源进线一侧距塔身标准节 3 米范围内。

(7) Site power supply box: site power switch I_e ≥350A, and the installation location is in the range of three meters away from the standard section, at the introducing power line side of tower crane bottom.

10. 起重机的参数
10. Parameters
10.1 起重机整体技术参数
10.1 Parameters of whole machine

<table>
<tr><td colspan="2" rowspan="3">机构工作级别
Working level of mechanism</td><td colspan="2">起升机构
Hoisting mechanism</td><td colspan="10">M5</td></tr>
<tr><td colspan="2">回转机构
Slewing mechanism</td><td colspan="10">M5</td></tr>
<tr><td colspan="2">变幅机构
Trolleying mechanism</td><td colspan="10">M4</td></tr>
<tr><td colspan="2" rowspan="3">起升高度 m
Hoisting height</td><td>倍率
Fall</td><td colspan="2">独立固定
Independent fixing</td><td colspan="8">附着
Attached</td></tr>
<tr><td>α=2</td><td colspan="2">68.8</td><td colspan="8">277</td></tr>
<tr><td>α=4</td><td colspan="2">68.8</td><td colspan="8">158</td></tr>
<tr><td colspan="4">额定起重力矩 (t·m)
Rated load moment (t·m)</td><td colspan="8">525</td></tr>
<tr><td colspan="4">最大起重量 t
Max. load</td><td colspan="8">25</td></tr>
<tr><td colspan="2" rowspan="2">幅度 m
Radius</td><td colspan="2">最大幅度 (m)
Minimum radius (m)</td><td colspan="8">80</td></tr>
<tr><td colspan="2">最小幅度 (m)
Minimum radius (m)</td><td colspan="8">3.5</td></tr>
<tr><td rowspan="6">起升机构
Hoisting mechanism</td><td></td><td colspan="2">一档
1-shift</td><td colspan="2">二档
2-shift</td><td colspan="2">三档
3-shift</td><td colspan="2">四档
4-shift</td><td colspan="2">五档
5-shift</td></tr>
<tr><td>倍 率
Fall</td><td>2</td><td>4</td><td>2</td><td>4</td><td>2</td><td>4</td><td>2</td><td>4</td><td>2</td><td>4</td></tr>
<tr><td>速度
(m/min)
Speed</td><td>4</td><td>2</td><td>18</td><td>9</td><td>35</td><td>17.5</td><td>50</td><td>25</td><td>70</td><td>35</td></tr>
<tr><td>起重量(t)
Lifting weight</td><td>12.5</td><td>25</td><td>12.5</td><td>25</td><td>12.5</td><td>25</td><td>9.37</td><td>18.75</td><td>4.37</td><td>8.75</td></tr>
<tr><td>容绳量
(m)
Rope capacity</td><td colspan="10">654</td></tr>
<tr><td colspan="11">电机型号： YZP2-315S2-6 90kW
Motor Model： YZP2-315S2-6 90kW</td></tr>
<tr><td colspan="2" rowspan="2">回转机构
Slewing mechanism</td><td>转速
Rotating speed</td><td colspan="4">电机型号
Motor type</td><td colspan="5">功率
Power</td></tr>
<tr><td>0～0.6
(r /min)</td><td colspan="4">YTRVFW132M3-4F1 9kW、
YTRVFW132M3-4F2 9kW</td><td colspan="5">3×9 (kW)</td></tr>
<tr><td colspan="2">变幅机构
Trolleying</td><td>速度
Speed</td><td colspan="4">电机型号
Motor type</td><td colspan="5">功率
Power</td></tr>
</table>

mechanism	0～60 (m/min)	YE3-160L-4B5			15 (kW)			
顶升机构 Jacking mechanism	0.45 (m/min)	Y2-160L-4	15 (kW)		1460 (r/min)			
	额定工作压力 Rated working pressure	37 (MPa)						
总功率 Total power	132kW（不包括顶升） 132kW (excluding jacking)							
工作温度 Working temperature	-20℃ ～＋40℃							
平衡重 Counterweight	臂长 Arm length (m)	80/ 75	70	65	60	55	50	45
	重量 Wight (t)	35	33	32.5	30.5	38.5	36	32.5

10.2 起重性能
10.2 Lifting performance

起重性能（t） Lifting performance (t)								
臂长（m） Boom length (m)	80		75		70		65	
最大吊重（kg） Max weight (kg)	25000	12500	25000	12500	25000	12500	25000	12500
最大吊重对应最大幅度（m） Max extent corresponding to max weight (m)	16.53	31.60	18.29	34.96	19.68	37.61	20.94	40.01
幅度（m） Radius (m)	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall
3.5 - 16	25000	12500	25000	12500	25000	12500	25000	12500
17	24267	12500	25000	12500	25000	12500	25000	12500
18	22816	12500	25000	12500	25000	12500	25000	12500
19	21518	12500	24005	12500	25000	12500	25000	12500
20	20349	12500	22712	12500	24574	12500	25000	12500
21	19292	12500	21542	12500	23316	12500	24923	12500
22	18331	12500	20479	12500	22172	12500	23706	12500
23	17454	12500	19508	12500	21128	12500	22595	12500
24	16649	12500	18618	12500	20170	12500	21577	12500
25	15909	12500	17799	12500	19289	12500	20639	12500
26	15226	12500	17044	12500	18476	12500	19774	12500
27	14594	12500	16344	12500	17724	12500	18974	12500
28	14007	12500	15694	12500	17024	12500	18230	12500
29	13460	12500	15089	12500	16374	12500	17537	12500
30	12949	12500	14524	12500	15766	12500	16891	12500
31	12472	12500	13996	12500	15198	12500	16287	12500
32	12024	12324	13501	12500	14665	12500	15720	12500
33	11604	11904	13036	12500	14165	12500	15187	12500
34	11208	11508	12598	12500	13694	12500	14686	12500
35	10835	11135	12185	12485	13249	12500	14214	12500
36	10483	10783	11795	12095	12830	12500	13768	12500
37	10149	10449	11427	11727	12433	12500	13345	12500
38	9834	10134	11077	11377	12057	12357	12946	12500
39	9534	9834	10746	11046	11701	12001	12566	12500
40	9249	9549	10431	10731	11362	11662	12206	12500
41	8979	9279	10131	10431	11040	11340	11863	12163
42	8721	9021	9846	10146	10733	11033	11536	11836
43	8475	8775	9574	9874	10440	10740	11225	11525
44	8240	8540	9314	9614	10161	10461	10928	11228
45	8016	8316	9066	9366	9894	10194	10644	10944
46	7802	8102	8829	9129	9639	9939	10372	10672
47	7596	7896	8602	8902	9394	9694	10112	10412
48	7399	7699	8384	8684	9160	9460	9863	10163

臂长（m） Boom length (m)	80		75		70		65	
幅度（m） Radius (m)	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall
49	7211	7511	8175	8475	8935	9235	9624	9924
50	7029	7329	7974	8274	8719	9019	9394	9694
51	6855	7155	7782	8082	8512	8812	9174	9474
52	6688	6988	7597	7897	8313	8613	8962	9262
53	6527	6827	7418	7718	8121	8421	8758	9058
54	6372	6672	7247	7547	7937	8237	8562	8862
55	6222	6522	7081	7381	7759	8059	8372	8672
56	6078	6378	6922	7222	7587	7887	8190	8490
57	5939	6239	6768	7068	7421	7721	8014	8314
58	5805	6105	6619	6919	7262	7562	7843	8143
59	5675	5975	6476	6776	7107	7407	7679	7979
60	5549	5849	6337	6637	6958	7258	7520	7820
61	5428	5728	6203	6503	6813	7113	7367	7667
62	5311	5611	6073	6373	6674	6974	7218	7518
63	5197	5497	5947	6247	6538	6838	7074	7374
64	5087	5387	5825	6125	6407	6707	6935	7235
65	4980	5280	5707	6007	6280	6580	6800	7100
66	4877	5177	5593	5893	6157	6457	——	——
67	4776	5076	5482	5782	6038	6338	——	——
68	4679	4979	5374	5674	5922	6222	——	——
69	4584	4884	5269	5569	5809	6109	——	——
70	4492	4792	5167	5467	5700	6000	——	——
71	4403	4703	5069	5369	——	——	——	——
72	4316	4616	4972	5272	——	——	——	——
73	4232	4532	4879	5179	——	——	——	——
74	4149	4449	4788	5088	——	——	——	——
75	4069	4369	4700	5000	——	——	——	——
76	3992	4292	——	——	——	——	——	——
77	3916	4216	——	——	——	——	——	——
78	3842	4142	——	——	——	——	——	——
79	3770	4070	——	——	——	——	——	——
80	3700	4000	——	——	——	——	——	——

起重性能（t） Lifting performance (t)								
臂长（m） Boom length (m)	60		55		50		45	
最大吊重（kg） Max weight (kg)	25000	12500	25000	12500	25000	12500	25000	12500
最大吊重对应最大幅度（m） Max extent corresponding to max weight (m)	21.56	41.20	21.81	41.69	22.56	42.88	23.21	44.35
幅度（m） Radius (m)	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall
3.5 to 16	25000	12500	25000	12500	25000	12500	25000	12500
17	25000	12500	25000	12500	25000	12500	25000	12500
18	25000	12500	25000	12500	25000	12500	25000	12500
19	25000	12500	25000	12500	25000	12500	25000	12500
20	25000	12500	25000	12500	25000	12500	25000	12500
21	25000	12500	25000	12500	25000	12500	25000	12500
22	24468	12500	24774	12500	25000	12500	25000	12500
23	23323	12500	23617	12500	24345	12500	25000	12500
24	22274	12500	22556	12500	23254	12500	24118	12500
25	21309	12500	21579	12500	22249	12500	23079	12500
26	20419	12500	20678	12500	21323	12500	22121	12500
27	19594	12500	19844	12500	20464	12500	21233	12500
28	18828	12500	19069	12500	19667	12500	20408	12500
29	18115	12500	18348	12500	18925	12500	19641	12500
30	17449	12500	17674	12500	18233	12500	18924	12500
31	16827	12500	17045	12500	17585	12500	18254	12500
32	16243	12500	16454	12500	16978	12500	17626	12500
33	15695	12500	15899	12500	16407	12500	17036	12500
34	15179	12500	15377	12500	15870	12500	16480	12500
35	14692	12500	14885	12500	15364	12500	15957	12500
36	14233	12500	14420	12500	14886	12500	15462	12500
37	13798	12500	13981	12500	14433	12500	14994	12500
38	13386	12500	13564	12500	14005	12500	14551	12500
39	12996	12500	13169	12500	13598	12500	14130	12500
40	12624	12500	12793	12500	13212	12500	13731	12500
41	12271	12500	12436	12500	12845	12500	13351	12500
42	11935	12235	12096	12396	12495	12500	12989	12500
43	11615	11915	11772	12072	12161	12461	12644	12500
44	11309	11609	11462	11762	11843	12143	12314	12500
45	11016	11316	11166	11466	11538	11838	12000	12300
46	10736	11036	10883	11183	11247	11547	——	——
47	10469	10769	10612	10912	10969	11269	——	——
48	10212	10512	10353	10653	10702	11002	——	——

臂长（m）Boom length (m)	60		55		50		45	
幅度（m）Radius (m)	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall	4Fall	2Fall
49	9966	10266	10104	10404	10445	10745	——	——
50	9729	10029	9864	10164	10200	10500	——	——
51	9502	9802	9635	9935	——	——	——	——
52	9284	9584	9414	9714	——	——	——	——
53	9074	9374	9201	9501	——	——	——	——
54	8872	9172	8997	9297	——	——	——	——
55	8677	8977	8800	9100	——	——	——	——
56	8489	8789	——	——	——	——	——	——
57	8307	8607	——	——	——	——	——	——
58	8132	8432	——	——	——	——	——	——
59	7963	8263	——	——	——	——	——	——
60	7800	8100	——	——	——	——	——	——

注：二倍率时从吊勾上取下四块配重，共 160kg。
Note: Fetch 4 counterweights of 160 kg in total during 2-magnification mode.

⚠ 注意 上述载荷性能表是根据 XGT8040-25 塔机独立高度（68.8m）计算而得出的，当起升高度大于 68.8m 时，起升性能中的起重量必须降低。计算方法为:计算高度的起重量＝性能表中的起重量－每米钢丝绳的重量×（计算高度－68.8）×倍率。（单位:高度：m；重量：kg）起升钢丝绳为 22 35W×7 1870 U ZS，钢丝绳重量为 223kg/100m。

⚠ Caution The above load parameters are calculated based on the independent fixed height (68.8m) of XGT8040-25. When the lifting height is greater than 68.8m, the lifting load must be reduced. Calculated as follows: load of calculated height = the load in the table - the weight of per meter wire rope × (calculated height - 68.8) × fall. Hoisting rope is 22 35W×7 1870 U ZS, and the rope weighs 223kg/100m.

10.3 整机外形尺寸

10.3 Dimensions

10.3.1 基础固定式整机外形尺寸

10.3.1 Dimensions of fixed-foundation type

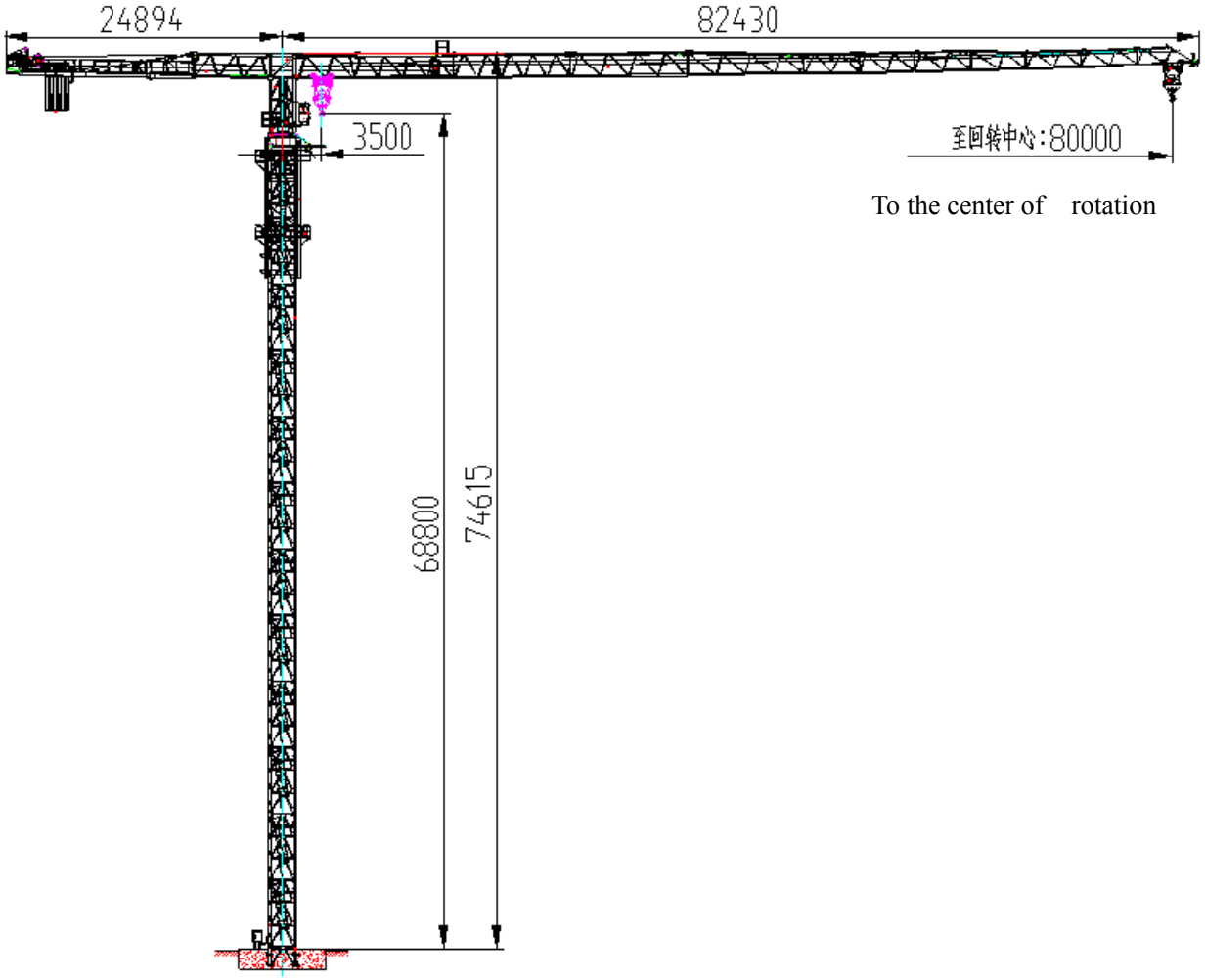


图 10.3-1 XGT8040-25 塔机基础固定式外形尺寸

Fig 10.3-1 Dimensions of fixed-foundation type of XGT8040-25

10.3.2 支腿固定附着式
10.3.2 Fixed-angle attached type

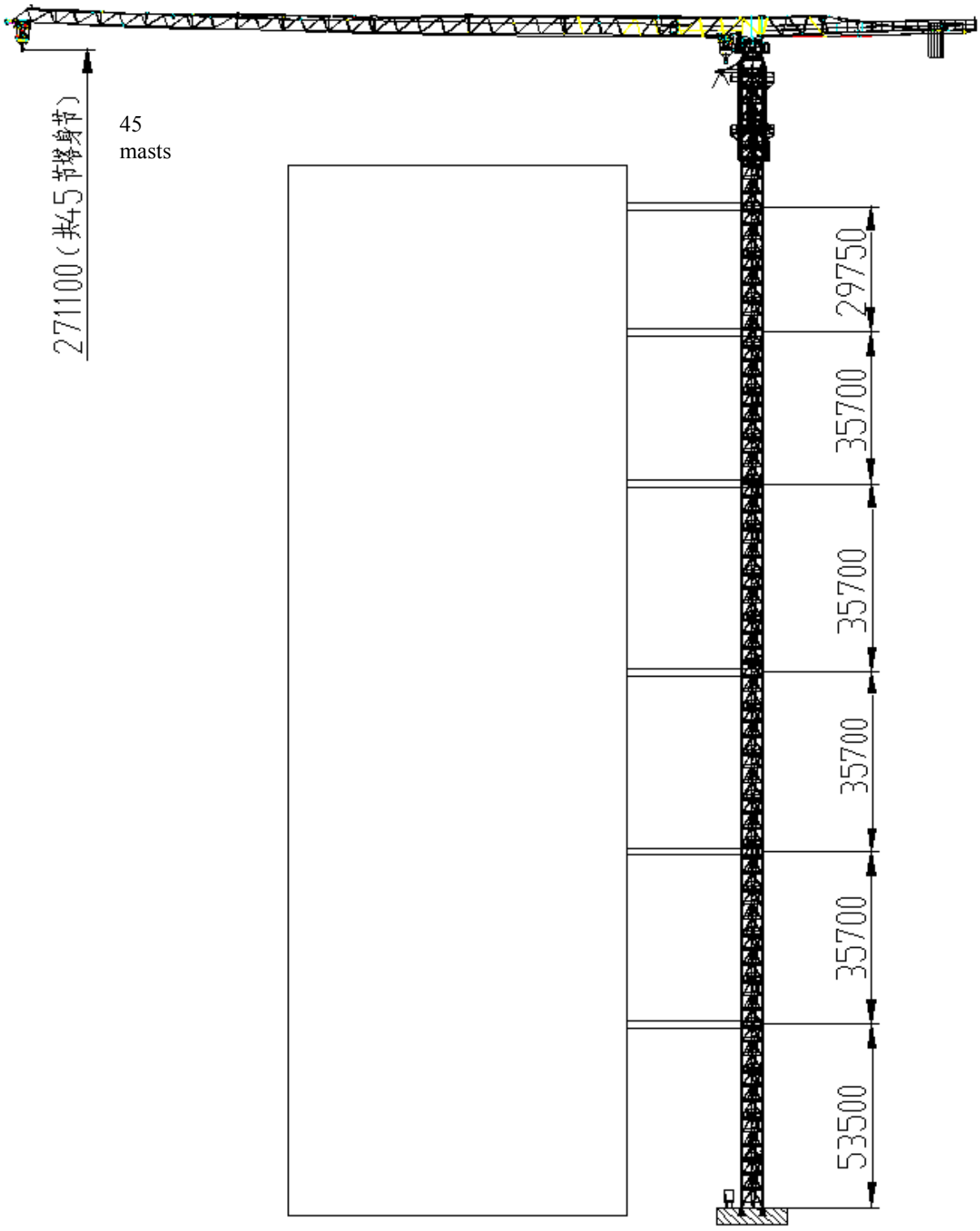
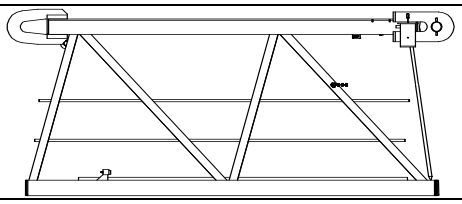
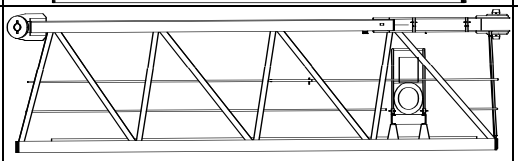
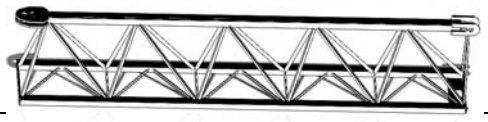
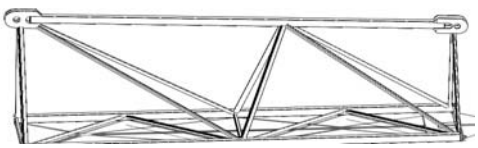
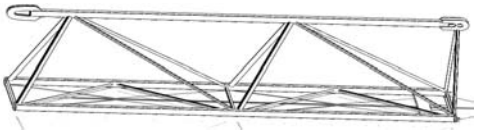
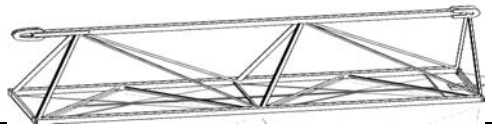
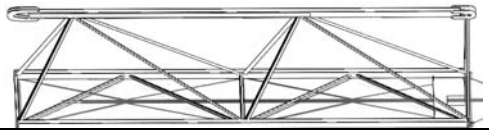
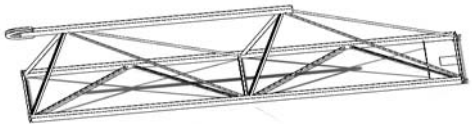
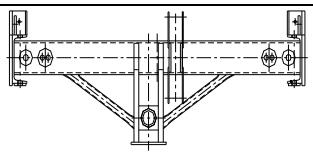
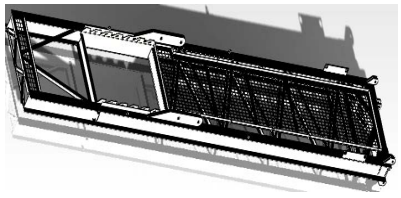
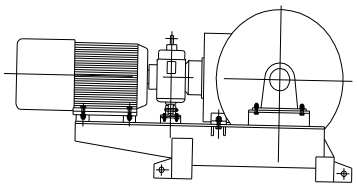


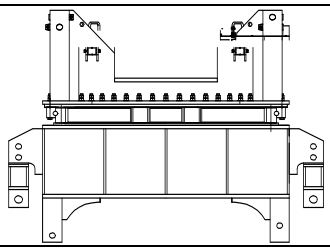
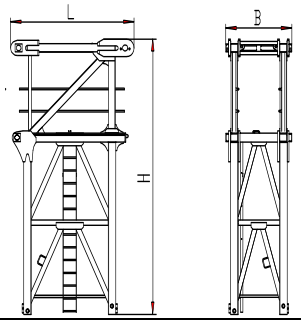
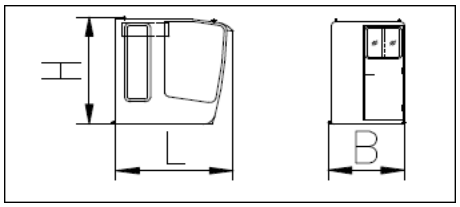
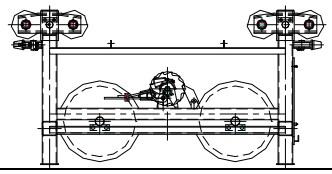
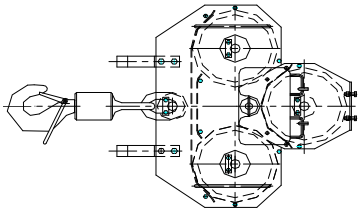
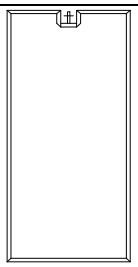
图 10.3-2　XGT8040-25 塔机支腿固定式外形尺寸及附着示意图
Fig 10.3-2 Dimensions and attached figure of XGT8040-25 fixed-angle attached type
（最大附着高度 277m，实际附着时采用 6 道时附着最高可达 271.1m）
The maximum adhesion height is 277 m, and the adhesion height can reach 271.1m with 6 lanes adopted in actual use.

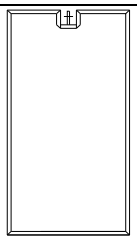
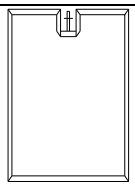
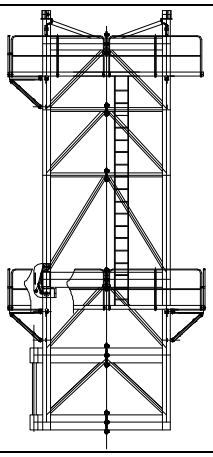
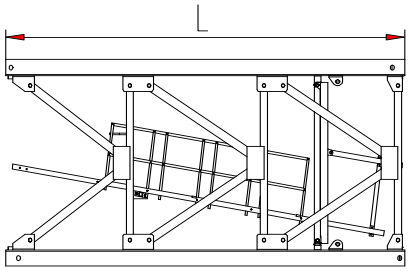
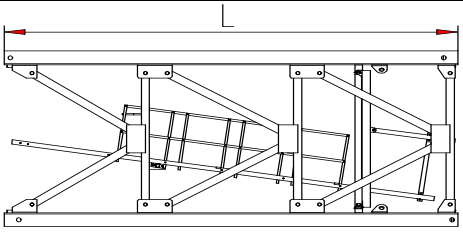
10.4　部件运输、吊装单元

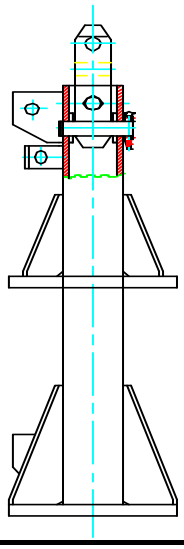
10.4 Part transportation and hoisting unit

部件 Component	件数 Piece	名称 Name	简图 Diagram	长(m) Length (m)	宽(m) Width (m)	高(m) Height (m)	重量（Kg） Weight (kg)
上部结构 superstructure	1	起重臂 M1 Jib M1		5	1.548	2.31	3744
	1	起重臂 M2+变幅机构 Jib M2 + trolleying mechanism		9	1.495	2.35	5571
	1	起重臂 M3 Jib M3		10	1.45	2.3	3618
	1	起重臂 M4 Jib M4		10	1.45	2.3	2847
	1	起重臂 M5 Jib M5		10	1.45	2.3	2505
	1	起重臂 M6 Jib M6		5	1.45	1.9	1119
	1	起重臂 M7 Jib M7		5	1.45	1.83	976
	1	起重臂 M8 Jib M8		5	1.45	1.845	800
	1	起重臂 M9 Jib M9		5	1.45	I.56	687

部件 Component	件数 Piece	名称 Name	简图 Diagram	长(m) Length (m)	宽(m) Width (m)	高(m) Height (m)	重量（Kg） Weight (kg)
	1	起重臂 M10 Jib M10		5	1.45	I.56	572
	1	起重臂 M11 Jib M11		5	1.45	1.56	496
	1	起重臂 M12 Jib M12		5	1.45	1.535	382
	1	起重臂端部 Jib end		0.55	1.51	0.55	160
	1	第 1 节平衡臂 Balance arm section 1		6.78	1.43	2.198	3509
	1	第 2 节平衡臂 Balance arm section 2		4.03	1.98	0.71	1776
	1	第 3 节平衡臂 Balance arm section 3		11.69	1.98	0.71	4913
	1	起升机构+钢丝绳 Hoisting mechanism + wire rope		3.90	2.16	1.31	4800

部件 Component	件数 Piece	名称 Name	简图 Diagram	长(m) Length (m)	宽(m) Width (m)	高(m) Height (m)	重量（Kg） Weight (kg)
	1	回转总承+回转机构 Sewing assembly + slewing mechanism		3.19	2.99	2.56	15803
	1	塔顶 Tower head		3.16	1.69	6.23	6785
	1	驾驶室 Cab		3.70	2.15	2.25	450
	1	变幅小车 Trolley car		2.117	1.05	1.57	603
	1	吊钩 Hook		2.15	0.54	1.47	930
	7	配重 A Counter weight A		1.55	0.35	4.29	5500

部件 Component	件数 Piece	名称 Name	简图 Diagram	长(m) Length (m)	宽(m) Width (m)	高(m) Height (m)	重量（Kg） Weight (kg)
	1	配重 B Counter weight B		1.55	0.35	2.35	3000
	1	配重 C Counter weight C		1.55	0.35	1.56	2000
	1	套架 Climbing frame		3.28	3.58	11.96	14820
	2	加强节 Strengthening mast		2.5	2.5	5.95	6324
	9	标准节 Standard mast		2.5	2.5	5.95	5729

部件 Component	件数 Piece	名称 Name	简图 Diagram	长(m) Length (m)	宽(m) Width (m)	高(m) Height (m)	重量（Kg） Weight (kg)
	4	固定支脚 Fixing support arm		0.6	0.6	2.14	668

注：重量/件

Note: Weight/piece

第一篇　塔机的安装
Part I Tower Crane Installation

第一章　立塔
Chapter I Tower Erection

1.1 引言

1.1 Introduction

用户应熟读本章说明，以便正确迅速地安装塔机。

Users are required to go through this chapter to ensure proper and smooth installation of tower crane.

1.2 安装拆卸前的准备

1.2 Preparation before Installation and Disassembly

1.2.1 技术与人员准备

1.2.1 Technology and personnel preparation

1.2.1.1 施工方案应符合 GB/T23723.3-2010/ISO12480-3:2005，IDT 中 9.1 条的规定：

1.2.1.1 Construction scheme shall meet the requirements of paragraph 9.1 in ISO12480-3:2005 and GB/T23723.3-2010.

在制定塔机的安装、变更高度，尤其是拆卸方案时应考虑周密。大多数塔机安装单位，无论是为谁安装，都采用某种形式的表格或核查列表来确保在计划阶段不捕过任何细节。

Careful consideration shall be made during the determination of installation and length change of the tower crane, especially for the development of disassembly scheme. Most of the tower crane installation units (no matter who is the client) may use sheet of a certain form or checklist to ensure that all the details are considered during planning stage.

塔机安装/拆卸方案应由具有实际经验的一人或多人起草。安装/拆卸方案宜在作业前予以公布，以便相关人员熟悉其内容。建议召开相关人员参加作业前准备会，以评估作业程序并且分配任务。该方案应包含下列内容：

Tower crane installation/disassembly scheme shall be prepared by one or more people with practical experience. The installation/disassembly scheme shall be published before operation so as to ensure relevant personnel can be familiar with its contents. It is recommended that relevant personnel shall be convened to participate in the preparation meeting before operation, which is designed to evaluate operating procedures and assign tasks. The scheme shall include the followings:

a) 塔机运往工地或从工地运出的方式。

a) Means to transport the tower crane to or from the construction site.

b)安装/拆卸过程中需要使用的辅助起重机的选型问题，尤其应考虑到从高处拆除某些塔机部件，例如：当辅助起重机从一台竖立着的塔机上移除某一部件(如一节臂架)，一旦拆除连接插销，辅助起重机将承受整个部件的载荷，从而不可能安全地将该部件拆除。在这种情况下，辅助起重机最好具有一定的额外性能，允许失误导致部件突然分离。任何情况下用于拆卸作业的起重机都不应使负载自由脱落。在起重机承受初始张力后，必要时，可用千斤顶或其他方法撬动载荷。

b) Model selection of auxiliary crane to be used during installation/disassembly shall be considered, in particular, consideration shall be taken to the removal of some tower crane parts from a high position, for example, if the connecting pins are removed when the auxiliary crane removes a component (such as a boom frame) from the tower crane that is vertically erected, the auxiliary crane will support the load of entire component, therefore, it is impossible to disassemble this component in a safe manner. In this case, certain additional performance shall be available for the auxiliary crane to allow sudden separation of parts as a result of any mal-operation. In any circumstance, the crane used for disassembly shall not allow the load to drop freely. After the crane withstands the initial tension, move the load with a jack or other tools if necessary.

c)运输用车辆及安装用辅助起重机与工地间的通道。

c) Access connecting the transport vehicles & auxiliary crane for installation to the construction site.

d)被安装塔机的地基情况。

d) Foundation conditions of the tower crane to be installed.

e)被安装塔机将要到达的独立高度以及臂架的长度。

e) The expected unattached height of the crane (to be installed) and the length of boom frame.

f)塔机周边的危险因素，见GB/T 23723.1—2009中的8.3。

f) See 8.3 under GB/T 23723.1-2009 for risk factors surrounding the tower crane.

g)安装期间用到的专用吊装设备。

g) Special lifting equipment to be used during installation.

h) 与邻近财产所有人的联系。

h) Contact the owner of the neighboring property.

i) 与要求法定通告的地方政府或其他机构的联系。

i) Contact with local government or other institutions to be informed as specified.

j)必要的道路封闭的安排。

j) Arrangement of necessary road closure.

k)必要时，向政府有关部门申请无线电使用许可证。

k) If necessary, apply the relevant government departments for the Permit to use radio equipment.

l)工地上准备好的全套制造商提供的使用说明书，说明书的语言应是安装人员能看懂的。

l) A complete set of Operation Manual provided by the manufacturer shall be available in the construction site in a language understandable to the installation personnel.

1.2.1.2 作业人员组织分工

1.2.1.2 Operating personnel arrangement

序号 No.	作业人员工种 Work type	数量 Qty	备注 Remark
1	安装主管 Installation supervisor	1	
2	技术支持 Technical support	1	
3	质检员 Quality inspector	1	
4	安全员 Safety officer	1	特殊工种作业人员必须经过当地相关部门特殊工种培训，并取得合格证，作业时持证上岗；100%的作业人员经过相关部门主办的“大型机械拆除、安装”培训，并取得资格证书 Workers involved in special type of work shall be trained and possess required work permits. All workers shall participate the training for installation and dismantling large machinery by related Department and acquire the certificate.
5	电工 Wireman	1	
6	安装工 Installation worker	4	
7	起重工 Lifting worker	2	
8	塔机司机 Tower crane operator	1	
9	现场警戒人员 Safety guard at site	1	

1.2.2 安装机具和检测器具等的准备

1.2.2 Preparations of installing equipment and testing tools

1.2.2.1 用于安装拆卸作业的起重设备应满足起升高度、幅度、最大起重量要求并安全可靠。

1.2.2.1 The performance of crane machine used for installing tower crane should meet the requirements of the lifted articles, including the lifting height, working radius and max load. Make sure the installing process is safe.

1.2.2.2 吊装作业用的钢丝绳、卸扣等吊具的安全系数不小于 6。

1.2.2.2 The security coefficient of hook block, such as steel wire and shackles, should not be less than 6.

1.2.3 配备塔机安装拆卸计划规定的器械、安全防护用品和指挥联络工具。

1.2.3 Prepare the equipment and tools for installing, protection and contact, needed in the installation process.

1.2.4 配备塔机安装拆卸计划规定的检测器具，所使用的检测器具应在检定有效期内。

1.2.4 Prepare the testing tools, which should be of validity.

1.3 安装前的检查

1.3 Inspection before installation

1.3.1安装前的检查应符合GB/T23723.3-2010/ISO12480-3:2005，IDT中9.6条的规定：

1.3.1 The inspection before installing should be according to the Article 9.6 of IDT in Standards GB/T23723.3-2010/ISO12480-3:2005.

a)安装前应检查确认所有零件属于被安装塔机，并处于良好状况，无任何缺陷。

a) Check all parts before installation should belong to be installed and tower crane is in good condition without any defects.

b)应确认所有部件的吊装点。

b) All parts for confirmation of hoisting points.

1.3.1 塔机基础的强度和安装面的平面度应符合使用说明书的规定。

1.3.2 All mark plates and nameplate on working mechanisms and cab operation platform should be completed and clear.

1.3.2 塔机的工作机构和司机室操作平台的有关标牌和指示牌应齐全清晰。

1.3.3 All mark plates on working mechanisms and cab and platform should be clear and complete.

1.4 立塔注意事项

1.4 Announcements of erecting

1.4.1 需安装的塔机应具有我公司出具的产品合格证；

1.4.1 The tower crane which is going to be erected should be qualified with the production

certificate by our company.

1.4.2 必须遵循本说明书所要求的立塔程序；

1.4.2 Follow the erecting process.

1.4.3 遇有大风、大雾、雷、雨天等恶劣天气，**禁止安装拆卸塔机**；

1.4.3 Erecting are forbidden when there is a strong wind, heavy fog, thunder or rain.

1.4.4 塔机安装拆卸作业时，塔机最大安装高度处的风速不大于 12m/s；

1.4.4 The wind speed at the highest erecting point during mounting and dismounting should be less than 12m/s.

1.4.5 夜间进行塔机安装拆卸，现场应配备足够亮度的照明；

1.4.5 Sufficient illumination is needed when mounting and dismounting tower crane at night.

1.4.6 达到可顶升加节的位置前，需根据（表 1.4-1）选用一台合适的汽车吊。

1.4.6 A suitable truck crane is needed before the tower crane is erected to the position where adding mast is possible. Select the truck crane according to Table 1.4-1.

表 1.4-1 吊装单元重量
Table 1.4-1 Lifting Unit Weight

序号 No.	部 件 名 称 Name	重 量 kg Weight	备 注 Remark
1	标准节 Mast	5730	塔身节 Tower masts
2	加强节 Strengthening mast	6325	
3	套架 Climbing frame	15620	包括油缸、泵站、平台、护栏 Including oil cylinder, pump station, platform and guardrail
5	起 重 臂 Jib	9315	包括起重臂臂节 1 和 2、变幅机构、起重量限制器 Including 1st and 2nd boom sections, load limiter and trolleying mechanism of a jib
6	平 衡 臂 Counter jib	14357	包括平衡臂、起升机构、配电柜、部分平衡臂拉杆 Including counter jib, hoisting mechanism, electrical distribution cabin, moment limiter, load limiter and part counter jib drag rods
7	上、下支座 Upper and lower support	17080	包括上支座（含平台、护栏）、下支座、回转支承、回转机构 Including upper support (including platform and guardrail), lower

序号 No.	部 件 名 称 Name	重 量 kg Weight	备 注 Remark
			support, slewing bearing and slewing mechanism
8	吊 钩 Hook	930	
9	塔顶 Tower top	5972	包括力矩限制器 Including moment limiter

1.4.7 塔机各部件所有可拆的销轴、塔身标准节、回转支承的连接螺栓、螺母均是专用特制零件，用户不得随意代换；

1.4.7 The removable components of tower crane, including pins, masts, connecting bolts of slewing bearing, and nuts, all are special made-to-order by our company, so they can't be replaced optionally.

1.4.8 必须安装并使用保护和安全措施，如扶梯、平台、护栏等；

1.4.8 Safety protections are needed, such as ladders, platforms, and guardrails.

1.4.9 必须根据起重臂臂长，正确确定平衡重块数量（见有关章节），安装好起重臂第一节后，再安装其余起重臂之前必须在平衡臂上安装重量为 5.5t×1 的平衡重，**注意严禁超过此数量；**

1.4.9 Decide the right counterweight quantity depending Installed crane boom after the first quarter before installing the rest of the lifting beam, must be installed on the balance arm balance arm balance weight of 5.5t×1tons. No more counterweight is allowed.

1.4.10 装好起重臂后，平衡臂上未装够规定的平衡重前，**严禁起重臂吊载**；

1.4.10 After completion of installing jib, no lifting actions are allowed if there is no sufficient counterweight on counter jib.

1.4.11 塔机在施工现场的安装位置，应确保其最大旋转部分与周围建筑物之间的距离不小于 1.5m，塔机任何部位与架空输电线的安全距离应符合表 1.4-2 的规定；

1.4.11 The erected tower crane should be placed less than 1.5m away from other buildings around. Each part of tower crane should be at the safety distance from the aired electrical wires, according to Table 1.4-2.

表 1.4-2 塔机与周围建筑物之间的距离

Table 1.4-2 Distance between tower crane and surrounding buildings

电压 kV Voltage / 安全距离 m Safety distance	<1	1～15	20～40	60～110	200
沿垂直方向 Vertical direction	1.5	3.0	4.0	5.0	6.0

沿水平方向 Horizontal direction	1.0	1.5	2.0	4.0	6.0

1.4.12 准备辅助吊装设备、枕木、索具、绳扣等常用工具；

1.4.12 Prepare the auxiliary lifting equipment, sleeper wood, cables and rope buckles etc.

1.4.13 塔机安装场地的参考尺寸（见图 1.4-1）

1.4.13 Preference size of tower crane mounting site (see Fig 1.4-1)

1.4.14 顶升前，应将小车开到规定的顶升平衡位置，起重臂转到引进横梁的正前方，然后用回转制动器将塔机的回转锁紧；

1.4.14 before jacking, move trolley to specified balance position and jib to the right ahead of introduction crossbeam. And then lock the tower crane by using slewing brake.

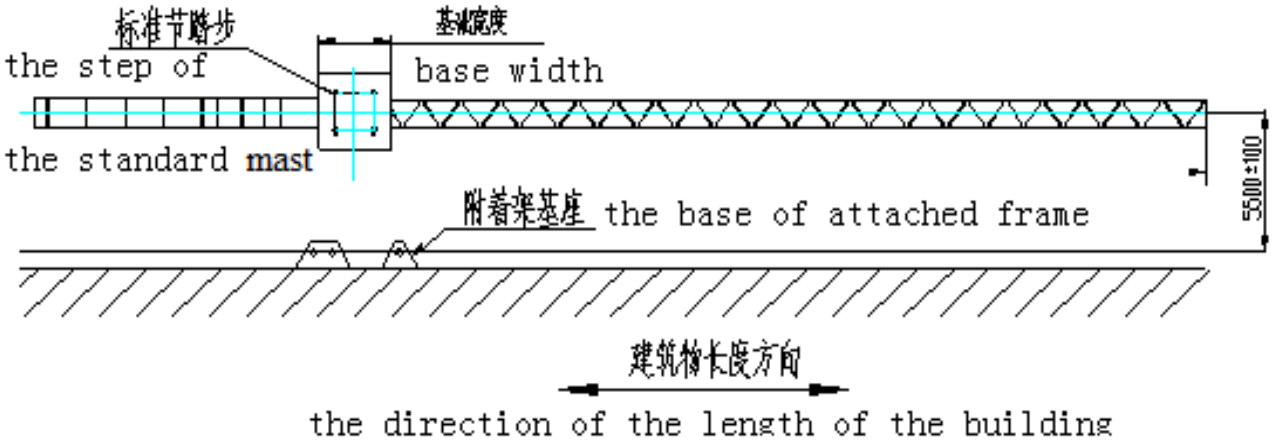


图 1.4-1 塔机安装场地的参考尺寸

Figure 1.4-1 Reference dimensions at installation site

1.4.15 顶升过程中，严禁旋转起重臂或开动小车以及使吊钩起升或放下！

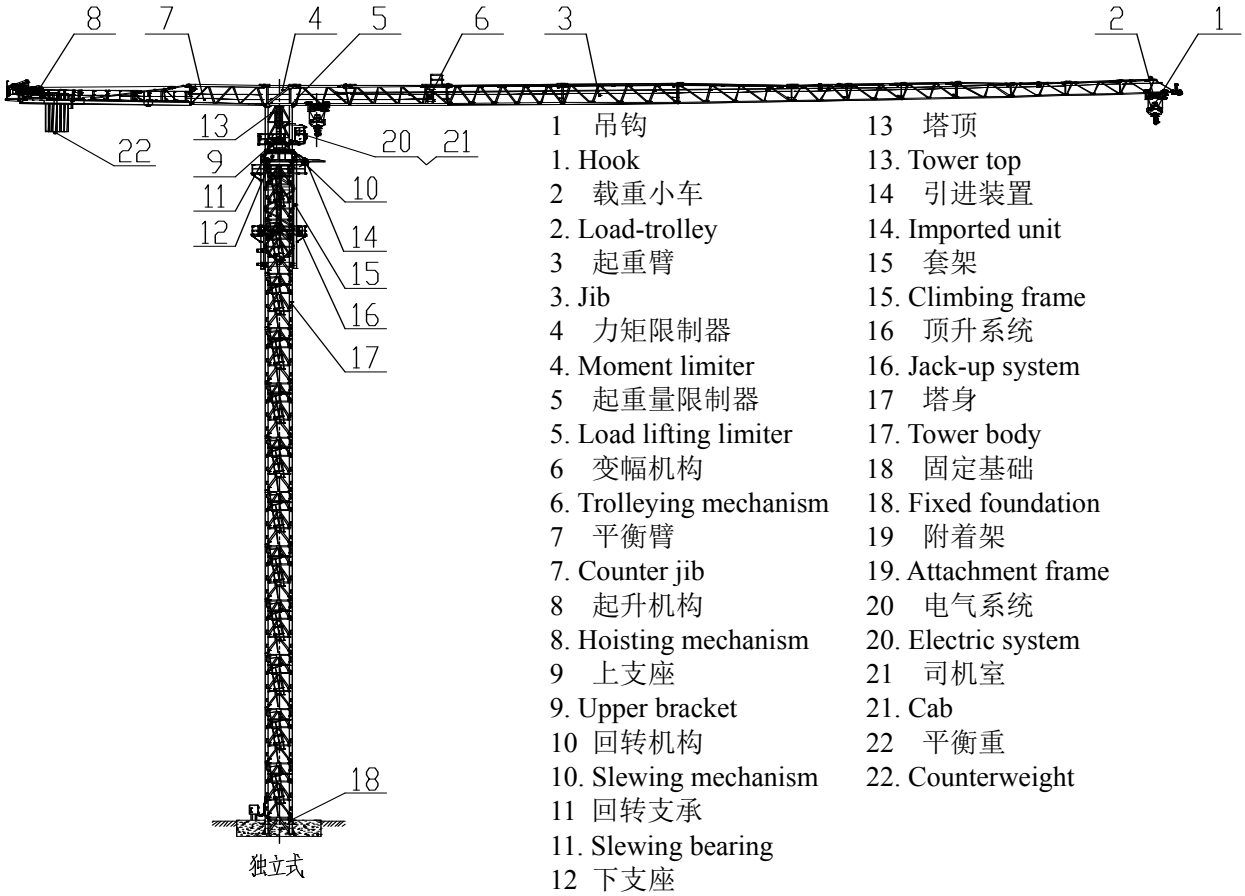
1.4.15 Don’t move the jib or trolley and hook, during the process of hoisting.

1.5 塔机的总体布置

1.5 General layout of tower crane

1.5.1 独立式主要组件装配关系（见图 1.5-1）

1.5.1 Assembling relations of main parts of Stationary tower crane (see Fig 1.5-1)



1 吊钩
1. Hook
2 载重小车
2. Load-trolley
3 起重臂
3. Jib
4 力矩限制器
4. Moment limiter
5 起重量限制器
5. Load lifting limiter
6 变幅机构
6. Trolleying mechanism
7 平衡臂
7. Counter jib
8 起升机构
8. Hoisting mechanism
9 上支座
9. Upper bracket
10 回转机构
10. Slewing mechanism
11 回转支承
11. Slewing bearing
12 下支座
12. Lower bracket
13 塔顶
13. Tower top
14 引进装置
14. Imported unit
15 套架
15. Climbing frame
16 顶升系统
16. Jack-up system
17 塔身
17. Tower body
18 固定基础
18. Fixed foundation
19 附着架
19. Attachment frame
20 电气系统
20. Electric system
21 司机室
21. Cab
22 平衡重
22. Counterweight

图 1.5- 1 主要组件装配图示意

Figure 1.5-1 Main parts assembly

独立固定独立式塔机最大起升高度 68.8m，可采用二倍率或四倍率钢丝绳起吊重物，塔身标准节主肢由两角钢拼焊而成，塔身（或底架）下部与基础相连。

The max lifting height of independent stationary tower crane is 68.8m. It can use 2-fall or 4-fall rope to lift objects. The main limb of tower crane mast is welded by two angle steels, and the bottom of tower body is attached to foundation.

特殊节下端是套架，环绕在塔身四周，顶升机构可顶起塔身上部结构和套架，引进标准节，升高塔机的高度。

Under lower support is climbing frame, surrounding the tower body. The jacking mechanism can be used to jack upper tower body and climbing frame, to introduce masts and increase the tower height.

1.5.2 附着式（参见图 1.5-2、图 1.5-3）

1.5.2 Attached tower crane (see Figure 1.5-2 and Figure 1.5-3)

本塔机独立固定式的最大起升高度为 68.8m。若起升高度要超过 68.8m，必须增加塔身节并用附着装置加固塔身。增加 6 道附着装置后最大起升高度可达 271.1m（6 道以上附着可达 277m）。在工作高度≤158m 时，可采用二倍率或四倍率起升，当工作高度＞158m 时，只能采用二倍率起升。附着时，要求塔身中心距建筑物 5.5m，如实际工程有变化请与本公司联系设计非标附着装置。

The max lifting height of fixed-angle stationary tower crane is 68.8m. If the lifting height is more than 68.8m, adding masts and adhesions to enhance tower body are needed. 增加 6 道附着装置后最大起升高度可达 271.1m（6 道以上附着可达 277m）。A maximum lifting height can reach 271.1m with 6 adhesive devices added and 277 m with more than 6 adhesive devices added.

With 6 attachments, a maximum lifting height can reach 271.1m (more than 6 channels attached to 277m). When the working height ≤158m, adopt 2-fall or 4-fall for lifting; and adopt 2-fall when the working height ＞158m. In adhesion process, the distance from tower center to building is 5.5m. If there is any change, please contact our company for designing non-standard adhesion devices.

1.5.2.1 第一道附着（见图 1.5-2）

1.5.2.1 First adhesion (see Fig 1.5-2)

（1）附着架以下的塔身高度 h_1（支腿固定式含标准节高度、底架固定式含底架基础节、标准节高度）

(1) The tower height beneath the frame h_1 (the fixed-angle stationary type includes the height of mast, while under-frame stationary includes the height of basic mast and mast):

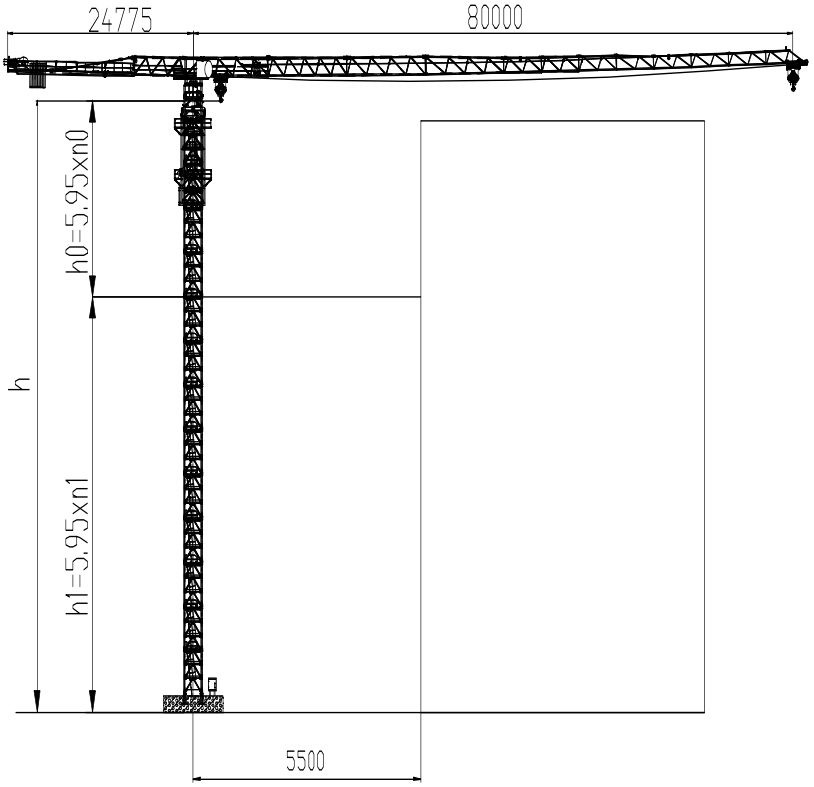


图 1.5-2　第一道附着图

Fig 1.5-2 First adhesion

36（m）≤h_1≤59.5（m）

即第一道附着架以下的塔身节数 n_1 为：

6≤n_1≤10

36 (m) ≤h1≤ 59.5 (m)

(i.e. the number of mast under tie frame n_1: 6≤n_1≤10).

（2）附着架以上塔身最大悬高 h_0：

h_0≤46.25（m）

(2) The max suspension height of tower body above tie frame h_0: h_0≤46.25 (m)

即附着架以上塔身节数：

n_0≤7.8

(i.e. mast number above tie frame: n_0≤7.8)

1.5.2.2 第二道或第二道以上附着（见图 1.5-3）

1.5.2.2 Second Adhesion or above second Adhesion (see Fig 1.5-3)

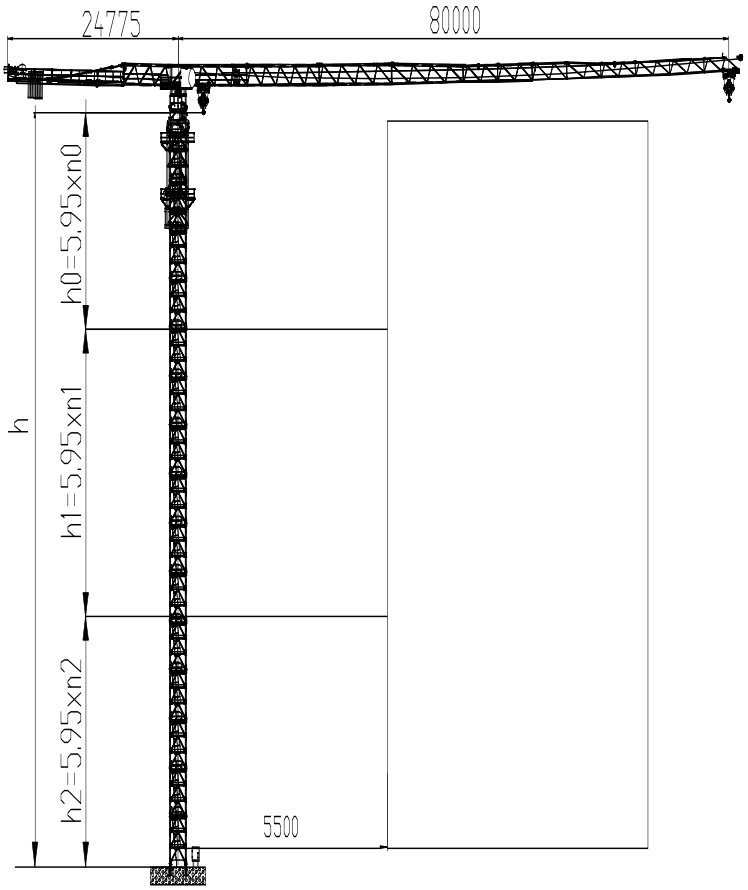


图 1.5-3　第二道或第二道以上附着图

Fig 1.5-3 Second Adhesion or above second Adhesion

（1）两道附着架之间的距离 h_1：

$$29.75（m）\leq h_1 \leq 35.7（m）$$

The distance between each two adhesions h_1: 29.75 (m) ≤ h_1 ≤ 35.7 (m)

即两道附着架之间的塔身节数 n_2 为：

$$5 \leq n2 \leq 6$$

(i.e. mast number between each two adhesions n_2: $5 \leq n_2 \leq 6$).

（2）不同附着高度附着架以上塔身悬高 h_0（见 1.8 附着式安装）

(2) After the second adhesion, the suspension height of tower body above tie frame with different height: h_0 (see 1.8 Adhesion Installation)

1.6 固定基础及平衡重

表 1.6-1
Table 1.6-1

80m 起重臂 68.8m 高度 80 m jib Height: 68.8 m	垂直载荷 F_{hv}（kN） Horizontal load	水平载荷 F_h(kN) Vertical load	弯矩 M(kN·m) Bending moment	扭矩 T（kN·m） Torque
工作工况 Working condition	1800	71	8140	1498
非工作工况 Non-working condition	1693	262	9090	0

1.6 Fixed foundation and counterweight

1.6.1 固定式基础载荷（表 1.6-1、图 1.6-1）

1.6.1 Foundation load of stationary tower crane (Table 1.6-1, Fig 1.6-1)

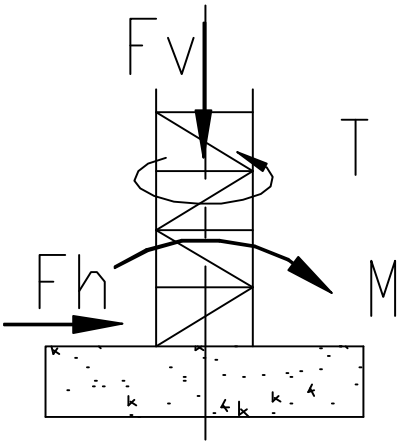


图 1.6-1 固定基础载荷示意图

Fig 1.6-1 Fixed Foundation load

1.6.2 预埋支腿固定基础（图 1.6-2）

1.6.2 Pre-embedded outrigger fixed foundation (Fig 1.6-2)

采用整体钢筋混凝土基础，对基础的基本要求如下：

It equips with integral steel-bar concrete foundation, and the requirement on foundation is following:

a）混凝土强度等级不小于 C35。基础土质要求坚固牢实，且承载压力不小于表 1.6-2 的规定；

a) Concrete strength is not smaller than C35. The earth of foundation shall be solid and bearing pressure shall not smaller than the requirements in Table 1.6-2.

表 1.6-2 80m 起重臂 68.8m 高度
Table 1.6-2 80 jib with height of 68.8 m

L(mm)	h(mm)	上层筋 Upper steel-bar	下层筋 Lower steel-bar	地耐力 10^5Pa Ground endurance	混凝土 m^3 Concrete	重量 t Weight	架立筋(件) Vertical bar (piece)
7600	1800	纵横向各 51 -φ25 Vertically and horizontally 51 -φ25	纵横向各 51-φ30 Vertically and horizontally 51-φ30	2.5	103.97	250	324
7800	1800	纵横向各 52 -φ25 Vertically and horizontally 52 -φ25	纵横向各 52-φ30 Vertically and horizontally 52-φ30	2.2	109.51	263	324
8000	1800	纵横向各 53 -φ25 Vertically and horizontally 53 -φ25	纵横向各 53-φ30 Vertically and horizontally 53-φ30	2.0	115.2	277	361
8500	2000	纵横向各 57 -φ25 Vertically and horizontally 57 -φ25	纵横向各 57-φ30 Vertically and horizontally 57-φ30	1.7	144.5	347	400
9000	2000	纵横向各 60 -φ25 Vertically and horizontally 60 -φ25	纵横向各 60-φ30 Vertically and horizontally 60-φ30	1.5	162	350	441

b） 固定支腿上表面应校水平，平面度误差为 1/1000。

b) The surface of fixed outriggers shall be leveled and planeness error is 1/1000.

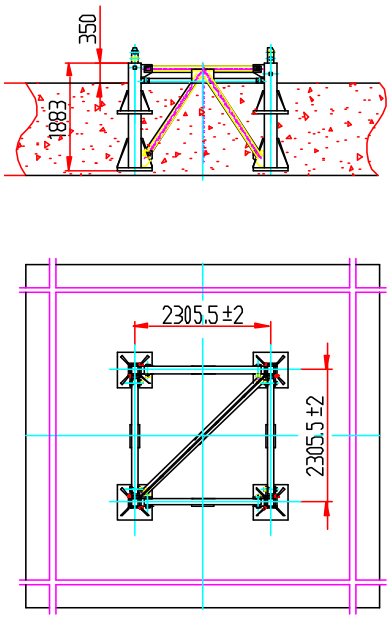


图 1.6-2 预埋支腿固定基础

Fig 1.6-2 Fix foundation of pre-embedded angle

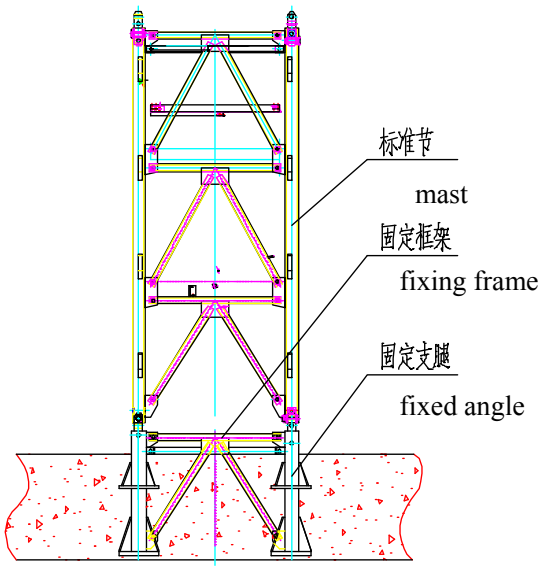


图 1.6-3 固定支腿的浇注示意图

Fig 1.6-3 Pouring the fixed angles

1.6.2.2　固定支腿的安装

1.6.2.2 Installation of fixed angle

固定支腿的安装十分重要，请参考以下程序施工：

Installation of fix angle is very important. Install fix angle as follows:

a) 将 4 个三角片与 4 个固定支腿用 16 个 φ45×170 的销轴连接，并将 1 个连杆（作为斜撑）与 2 个固定支腿用 2 个 φ45×53 的销轴连接，用 φ15×70 的锁销和 φ4×30 开口销固定，开口销充分打开；

a) Connect the four triangle pieces with four fix angles by sixteen φ45×170 pin shafts, and link one connecting rod (as diagonal strut) with two fix angles by two φ45×53 pin shafts, fixing by φ15×70 lock pins and fully-open φ4×30 cotter pins;

b) 为了便于施工，当钢筋捆扎到一定程度时，将装配好的固定支腿、固定框架和标准节整体吊入钢筋网内；

b) For the convenience of construction, when steel bar is seized to certain degree put the mounted unit of fix angle, fixing frame and mast in steel mesh;

c) 固定支腿周围的钢筋数量不得减少和切断；

c) The steel-bar quantity around the fix angles shall not be reduced or cut off;

d) 主筋通过支腿有困难时，允许主筋避让；

d) If there is difficulties for main steel bar to cross the angles, it is allowed to give it way;

e) 吊起装配好的固定支腿、固定框架和标准节整体，在预埋支腿连接的标准节的两个方向中心线上挂铅垂线，保证预埋支腿固定的标准节中心线与水平面的垂直度≤1/1000；浇注砼，待其完全干硬后，拆下固定框架和标准节。要求同一水平上的销轴孔的垂直误差小于 2mm。

e) Lifting up the unit of fix angles, fixing frame, and mast, using lead wire or gradienter from two directions to make sure that the verticality of mast center line based on pre-embedded angles and the level surface ≤1/1000. Pour the concrete block. After it is completely dry, remove the fixing frame and mast. The vertical error is smaller than 2mm for pin holes at the same level;

f) 固定支腿周围混凝土充填率必须达到 95%以上；

f) The fill-in ration of concrete around the fix angles needs to be more than 95%;

g) 安装示意图见图 1.6-3。

g) Fig 1.6-3 is shown for installation of fix angle.

⚠ 注意

1.固定支腿受力最大，应由塔机制造商生产，否则一切责任自负；

⚠ Caution

1. Fixed angle is the most stressed part, so it ought to be made by professional manufacturers. Otherwise, customers are responsible for any consequence.

2.固定支腿只能使用一次，决不允许从基础中挖出来重新使用。

2. Fix angles can only be used once and it is forbidden to dig out it and reuse.

3.固定框架仅做埋设固定支腿用，在任何情况下，都不能在工作时用于支撑塔身。

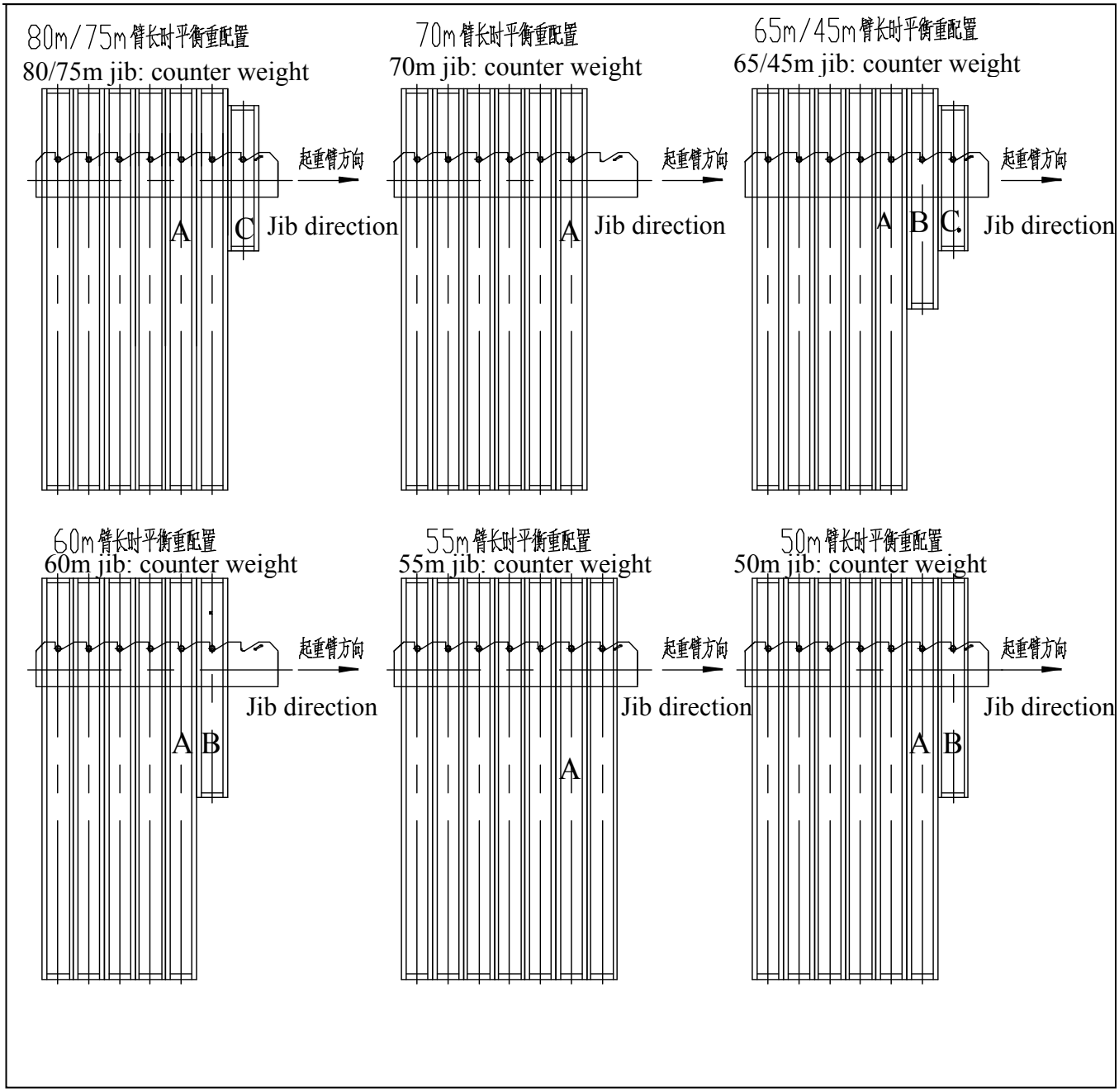
3. Fix frame is only used for pre-embedding fix angle, and not allowed to used for supporting tower body in any case.

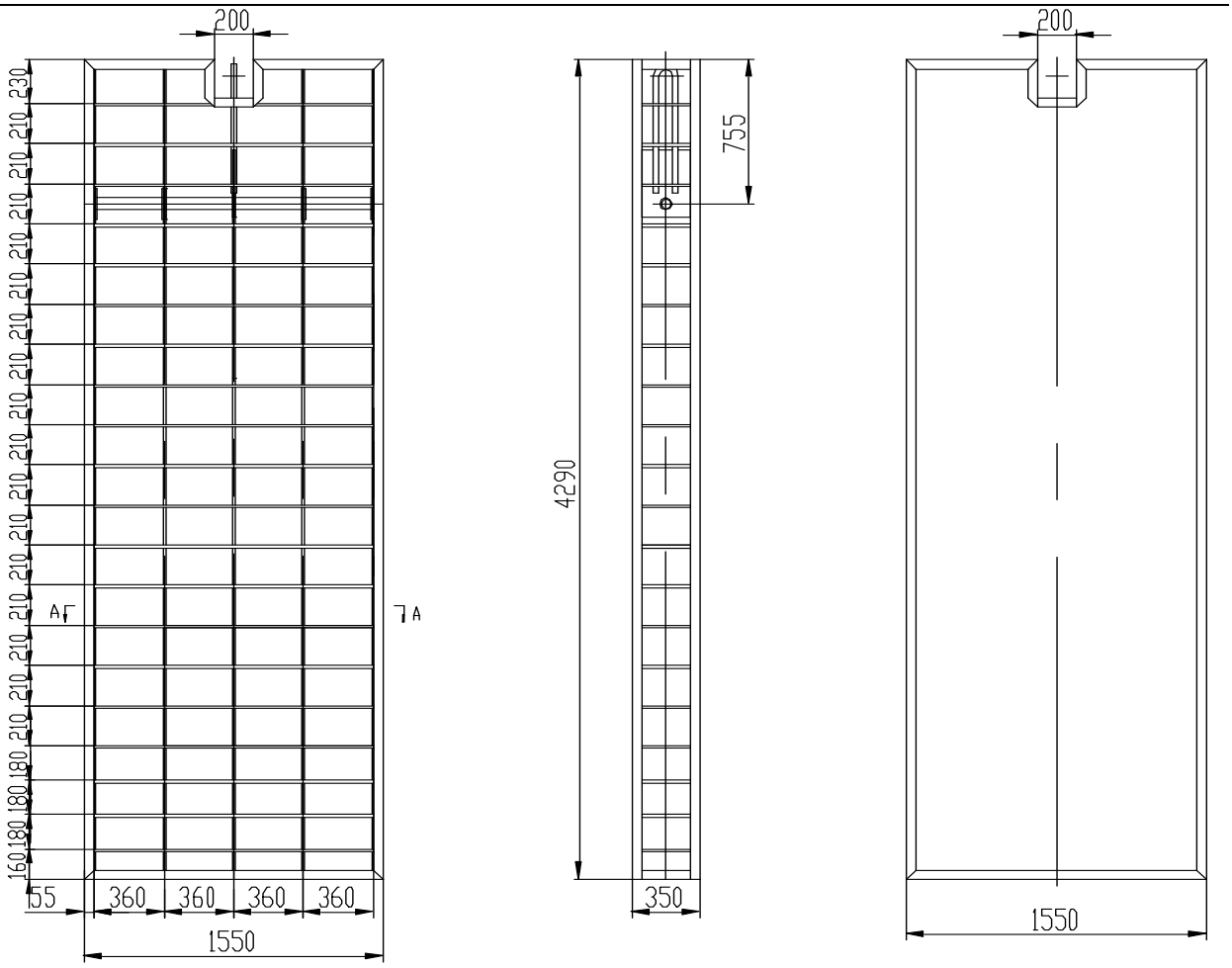
1.6.3 平衡重

1.6.3 Counterweight

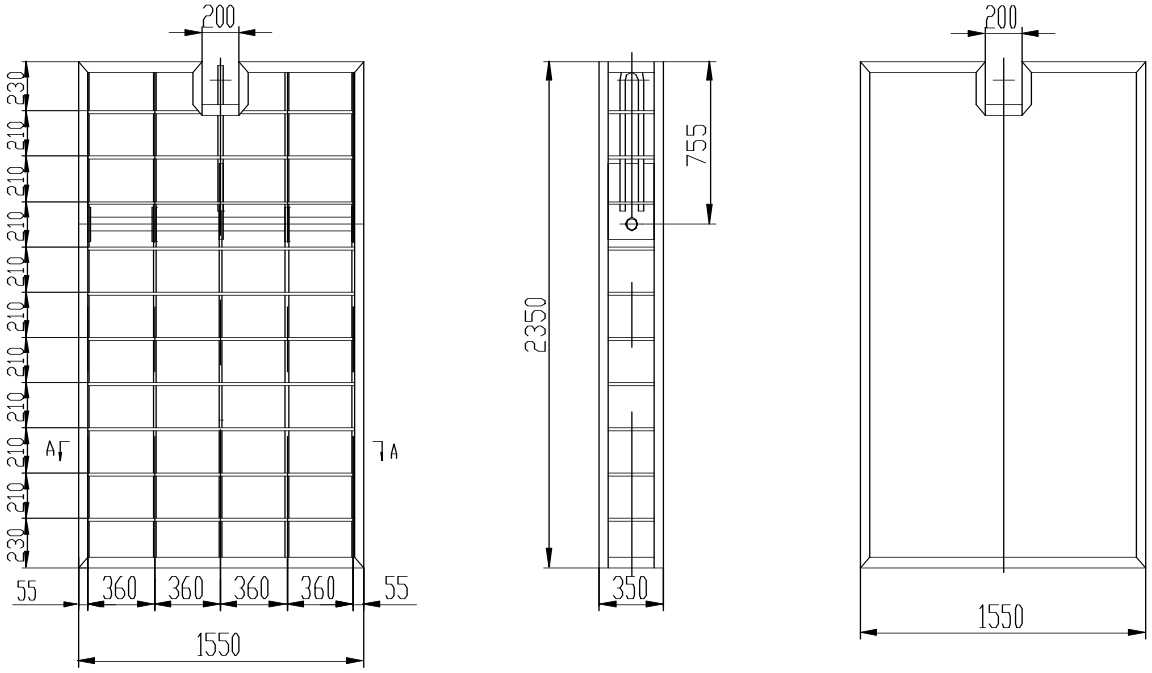
平衡重共有三种规格，均采用钢筋混凝土浇注成形，具体外形尺寸参见图 1.6-4

There are three kinds of counterweight, which all are poured from steel-bar and concrete. The detailed dimensions are following, see Fig 1.6-4.

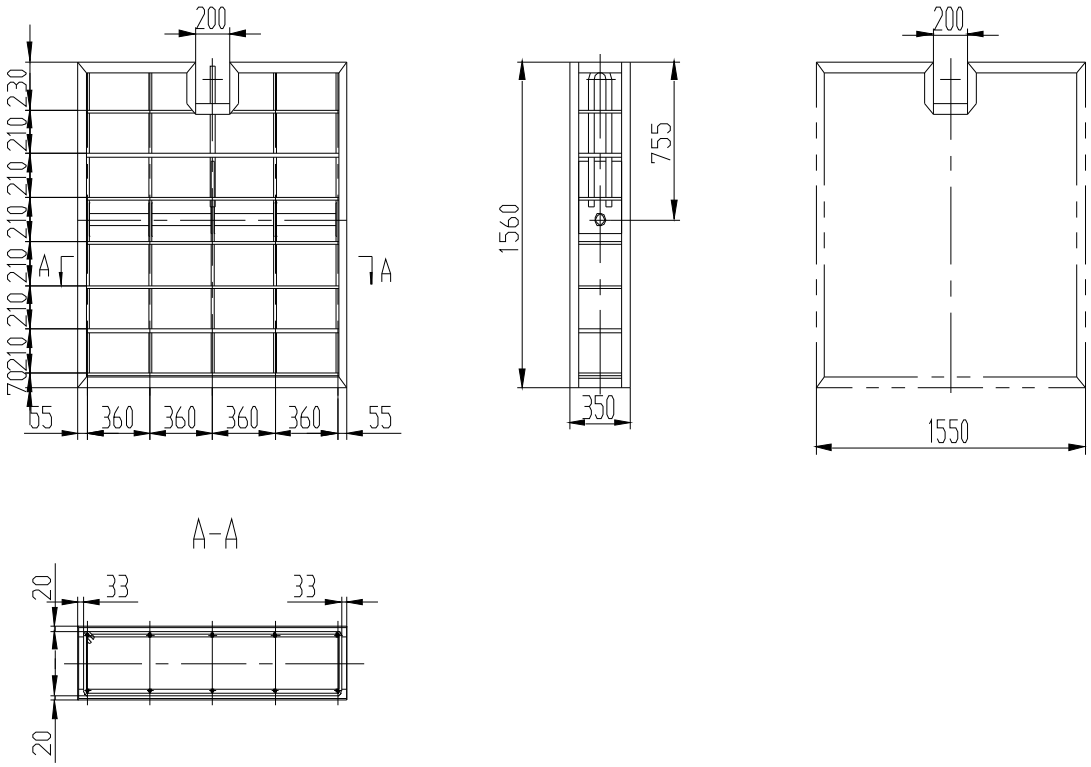

80m/75m臂长时平衡重配置
80/75m jib: counter weight
起重臂方向
A
C
Jib direction
70m臂长时平衡重配置
70m jib: counter weight
起重臂方向
A
Jib direction
65m/45m臂长时平衡重配置
65/45m jib: counter weight
起重臂方向
A
B
C
Jib direction
60m臂长时平衡重配置
60m jib: counter weight
起重臂方向
Jib direction
A
B
55m臂长时平衡重配置
55m jib: counter weight
起重臂方向
Jib direction
A
50m臂长时平衡重配置
50m jib: counter weight
起重臂方向
Jib direction
A
B



平衡重 A=5500　　Counterweight A=5500



平衡重 B=3000　　Counterweight B=3000



平衡重 C=2000　　Counterweight C=2000

图 1.6-4　平衡重外形尺寸

Table 1.6-4 Overall dimension of counterweight

对平衡重的基本要求如下：

Basic requirements of balance weight are as follows:

a) 用混凝土浇注成形后称重，重量允许误差 1%，混凝土强度等级不低于 C35；

a) Because the weight of counterweight should reach the specified value, weigh the counterweight after it is completed. The weight error is 1%, the concrete strength rating is no less than C35.

b) 平衡重的配置随起重臂长度的改变而变化。见表 1.6-3 中的数值；

b) The counterweight is needed to be adjusted with the change of arm length. See in Table 1.6-3.

c) 允许通过改变平衡重长度尺寸来改变其重量，满足 1%的重量精度要求。

c) Changing the dimension of counterweight in order to change its weight is acceptable, as long as the weight accuracy is ±1%.

表 1.6-3

Table 1.6-3

臂长 Jib length	平衡重 A（块）5.5T Counterweight A 5.5t (block)	平衡重 B（块）3T Counterweight B 3t (block)	平衡重 C（块）2T Counterweight C 2t (block)	总重（T） Total weight
80m	6	0	1	35
75m	6	0	1	35
70m	6	0	0	33
65m	5	1	1	32.5
60m	5	1	0	30.5
55m	7	0	0	38.5
50m	6	1	0	36
45m	5	1	1	32.5

1.7 独立固定式塔机安装

1.7 Independent-stationary tower crane installation

⚠ 注意

塔机安装必须在固定基础的混凝土强度达到设计值的 90%以上后才能进行。

⚠ Caution

Tower crane installation begins only when the strength of concrete foundation reach to 90% of the designed value.

塔机安装是一项技术性很强的工作，尤其是塔身节、平衡重、平衡臂、起重臂等部件的安装，稍有疏忽，便会导致机毁人亡。因此用户在安装这些部件时需严格按照本说明书的规定，严禁违反操作程序。上塔操作人员，必须是经过培训并经考试合格取得相关资质上岗证书的人员。

Installation of tower crane has high demands to operators' skill, especially for mounting tower mast, counterweight, counter jib and jib and so on. Any negligence can result at serious consequence. So when installing, users should do the process strictly as the instruction. Any violation of the process is not allowed. And operators are needed to be trained and qualified.

1.7.1 独立固定式塔机的安装

1.7.1 Installation of stationary tower crane

独立固定式塔机组装顺序以下顺序进行：

The assembling order is shown in the following:

a) 安装加强节；

a) Installing strengthening masts

b) 吊装套架；

b) Installing climbing frame

c) 安装标准节 tower masts

b) Installing tower masts

d) 安装回转总成

d) Installing slewing assembly

e) 安装司机室

e) Installing cab

f) 安装塔顶

f) Installing a tower top

g) 安装起重臂臂根节

g) Installing job arm section

h) 安装平衡臂总成

h) Installing counter jib assembly

i) 安装平衡臂拉杆

i) Installing counter jib drag rods

j) 吊装重 5.5t×1 的平衡重

j) Installing counterweight of 5.5t×1

k) 安装剩余起重臂

k) Installing the remaining jib

l) 配装平衡重（余下的配重）

l) Assembling the counterweights (the rest counterweights)

1.7.2 塔身节的安装

1.7.2 Installation of mast

1.7.2.1 结构简述

1.7.2.1 Structure introduction

塔机在最大起升高度 68.8m 的独立状态下共有 11 节塔身节，从下向上为：2 节加强节、9 节标准节。塔身节内有供人上下的爬梯及休息平台。

The tower crane with independent height of 68.8m consists of 11 tower masts from bottom to top: 2 strengthening masts, 9 masts. Inside the tower mast there are climbing ladders and resting platforms.

加强节与标准节的区别：加强节与标准节的结构型式基本一样，所用的材料及规格也

相同，主要区别在于加强节主肢内部有加强板。加强节的长度为 5.95m，其结构如图 1.7-1。标准节的长度为 5.95m，其结构如图 1.7-2。

The difference between strengthening mast and mast lies in there are strengthening plates in main limb of strengthening masts. Except that, the structure type, materials and specifications are same. The length of strengthening mast is 5.95m (its structure is shown in Figure 1.7-1), the mast length is also 5.95m, shown in Figure 1.7-2.

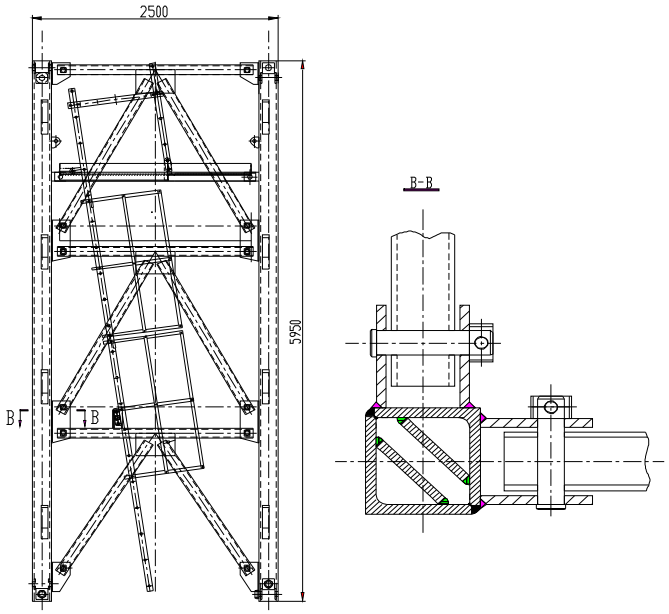


图 1.7-1　加强节
Figure 1.7-1 Strengthening mast

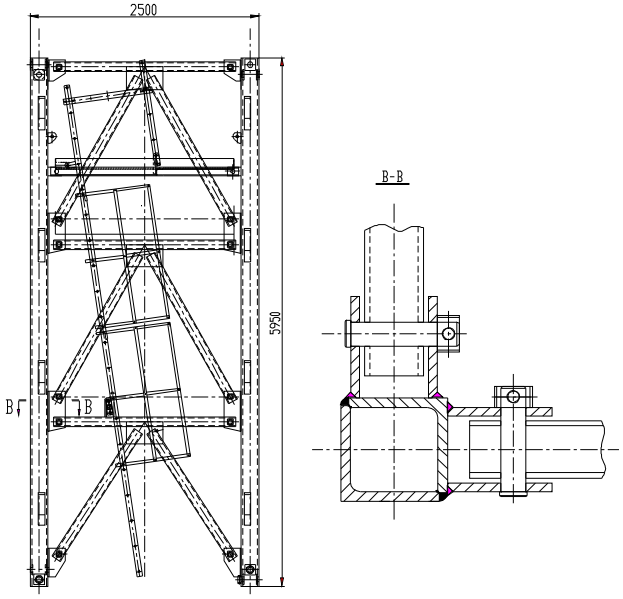


图 1.7 -2　标准节
Figure 1.7-2 Mast

1.7.2.2 塔身节的组装

1.7.2.2 Assembly of masts

塔机塔身节为片式结构，由主弦杆、“K”形片、斜连杆、平台、爬梯等组成，相互之间采用专用的销轴连接。在塔身节地面拼装时，塔身节之间连接用的方形接头须在地面上安装在主弦杆上，然后在拼装 K 形片。

The mast of this tower crane is split-type structure, which is composed of main chords, “K” piece, diagonal web member, platform and ladder, and which is connected with each other by special pin shafts. When the mast is assembled on the ground, the square joint used for connecting the masts must be installed on the main chord on the ground. Then the “K” pieces are assembled.

1.7.2.3 吊装塔身节

1.7.2.3 Installing tower mast

1）将加强节吊起放置在砼基础上，与固定支腿通过连接接头用 8 个 φ60×247 的带肩锥头销轴连接，并用 φ20×150 的插销和 φ5×30 开口销固定，开口销充分打开，如图 1.7-3；

1) Place strengthening mast on concrete foundation and connect it with fixed angles through connection joint by eight φ60×247 shoulder pin shafts, fixing with φ20×150 cross-pin and fully open φ5×30 cotter pin, as Figure 1.7-3.

2）用经纬仪或吊线法检查其垂直度，主弦杆四个侧面的垂直度误差应不大于 1.5/1000。

2) Check the verticality of mast by theodolite or lead wire to make sure that the verticality error of four sides of main chords is not more than 1.5/1000.

3）装时注意塔身加强节、标准节有踏步的侧面要垂直于建筑物。

3) Pay attention that the step sides of tower strengthening mast and mast are vertical to building during installing.

注意 **所有连接孔及连接销应确保干净，不应带有任何污垢。**

Caution All connection holes and pins should be clean without any dirt.

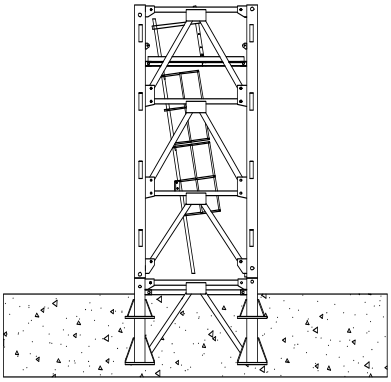


图 1.7-3　塔身节安装

Table 1.7-3 Tower body mast installation

1.7.3 顶升横梁的安装
1.7.3 Installing jacking beam

将顶升横梁吊起至加强节有顶升踏步一侧，用顶升横梁的止动靴将顶升横梁与加强节左、右踏步连接在一起（见图 1.7-4）。

Lift jacking crossbeam on the step side of strengthening mast. Connect jacking beam with the right and left step of strengthening mast by using crossbeam brake shoes (see Fig 1.7-4).

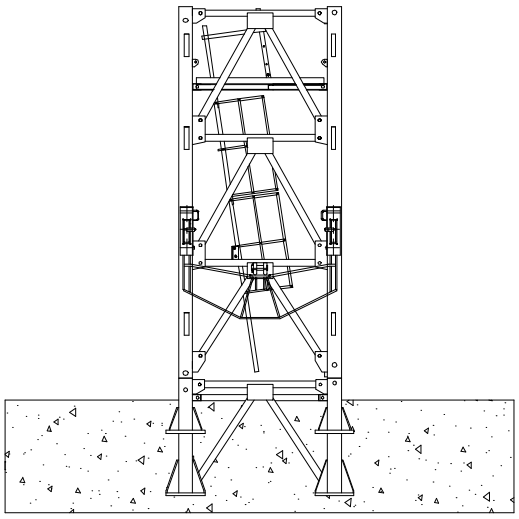


图 1.7-4　顶升横梁的安装

Figure 1.7-4 Installing jacking beam

1.7.4 吊装套架
1.7.4 Installing climbing frame
1. 7.4.1 结构简述（见图 1.7-5）

1.7.4.1 Structure overview (See Figure 1.7-5)

套架由主结构、平台、爬梯及液压顶升系统等组成，塔机的顶升运动主要靠此部件完成。

Climbing frame consists of frame structure, platform, ladder, hydraulic system and mast introduction device. The hoisting installation of tower crane is mainly relying on this part.

顶升油缸安装在套架后侧的横梁上(即预装平衡臂的一侧)，液压泵站放在液压缸一侧的平台上，套架内侧有 16 个滚轮，顶升时滚轮支于塔身主弦杆外侧，起导向支承作用。为了便于顶升安装和安全需要，在顶升挂板上设有防脱装置。在套架上部、中部及下部位置设有平台及栏杆，顶升时，工作人员站在平台上，操纵液压系统，完成顶升、引入标准节和打入连接销轴的工作。

Jacking cylinder is mounted on rear crossbeam of climbing frame (the side for mounting counter jib). The hydraulic pump station is on cylinder side platform. In climbing frame, there are sixteen rolling wheels for supporting outside main chords of tower body to guide direction. For the convenience of jacking installation and safety consideration, there are anti-release device on jacking hanging plate. On the upper and medium part of climbing frame is equipped with

platform for operators to stand on when operating hydraulic system to introduce mast and fix tower body.

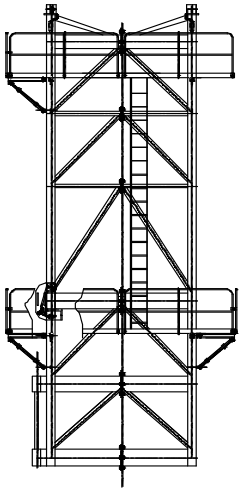


图 1.7-5 套架结构

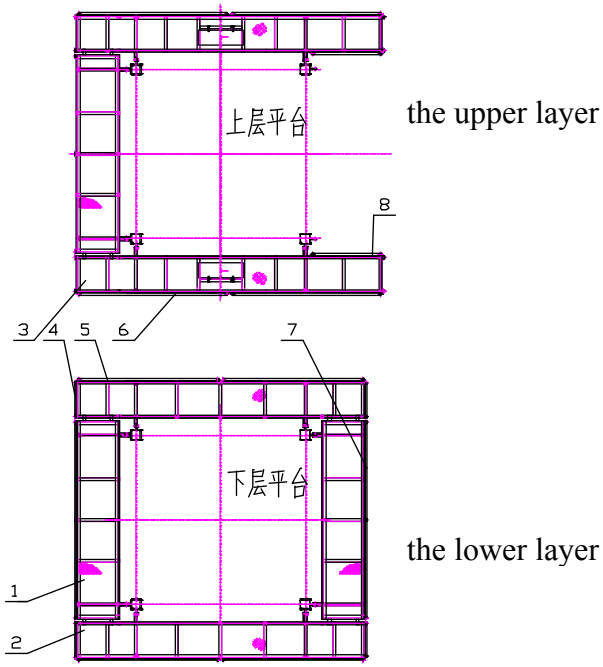
Figure 1.7-5 Climbing frame structure

1. 7.4.2 安装套架平台

1.7.4.2 Installation of climbing frame platform

套架平台共分上、下两层，具体安装位置，如图 1.7-6 所示。

The climbing frame platform consists of two parts, the upper layer and the lower layer, and the specific installation location shown in Figure 1.7-6. The installation sequence is:



注：1 下前后、上后平台 2 下左右平台 3 上左右平台 4 栏杆 590m 5 栏杆 2395m 6 栏杆 2555m 7 栏杆 3450m 8 栏杆 1200

Note: 1. Lower front rear platform and upper rear platform 2. Lower left and right platform 3. Upper left and right platform 4. 590m railing 5. 2395m railing 6. 2555m railing 7. 3450m railing 8. 1200m railing

图 1.7-6 套架平台

Figure 1.7-6 Climbing frame platform

安装顺序如下：

The installation sequence is:

a) 下层左、右平台;

a) Left and right lower platform;

b) 下层后平台;

b) Rear lower platform;

c) 下层前平台;

c) Front lower platform;

d) 上层左平台;

d) Left upper platform;

e) 上层右平台;

e) Right upper platform;

f) 上层后平台。

f) Rear upper platform.

在地面上将平台支撑杆用 φ25×70 普通销轴装在平台上、并用弹簧销 φ3 固定，装上平台栏杆。吊起平台使平台上安装孔对准套架上平台安装耳板，并用 φ25×70 销轴和弹簧销 φ3 固定。旋转平台支撑杆使之与套架上安装孔对正，并用 φ25×70 销轴和弹簧销 φ3 固定。(见图 1.7-7)

Install the supporting rod onto the platform with φ25×70 common pin shafts on the ground, fix it with φ3 spring pins, and then install the handrails. Lift the platform to make its mounting hole align with the installation ear plate on the climbing frame, and then fix it with φ25×70 common pin shafts and φ3 spring pins. Rotate the platform strut to make it align with the mounting hole on the climbing frame, then fix it with φ25×70 common pin shafts and φ3 spring pins. (See Figure 1.7-7)

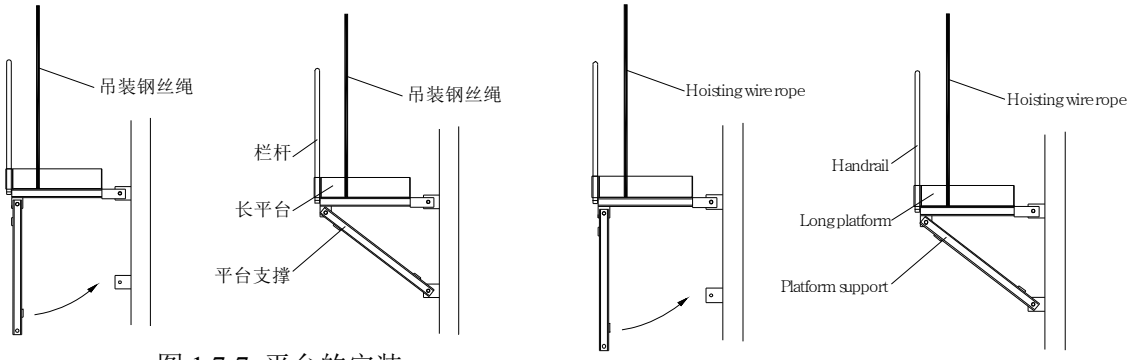


图 1.7-7 平台的安装

Figure 1.7-7 Installing platform

在安装前、后平台时要注意下层后平台应安装顶升油缸一侧，下层前后台与上层后平台规格相同，可以互换使用。下层左、右平台通用，上层左、右平台通用，待平台安装好后，再安装栏杆。并用栏杆夹板和 M14×70 螺栓固定。(见图 1.7-8)。

When installing the front and rear platforms, please note that the rear lower platform shall be installed at the jacking cylinder side, and the front lower platform and rear upper platform are of the same specification, so they can be used interchangeably. The left and right lower platforms are interchangeable as well. Install the front and rear platforms and then the front and rear handrails. Then fix them with splints and M14×70 bolts (see Figure 1.7-8).

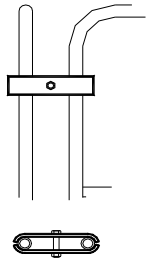


图 1.7-8 平台的安装

Figure 1.7-8 Installing platform

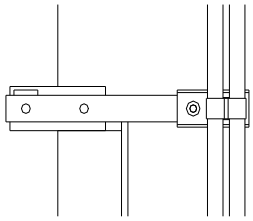


图 1.7-9 套架爬梯的安装

Figure 1.7-9 Installing ladder of climbing frame

1.7.4.3 安装套架爬梯

1.7.4.3 Installing climbing frame ladder

将套架爬梯立于下层平台上，用梯子联接件按所示位置安装在套架上。具体安装方法见安装加强节节部分。(见图 1.7-9)。

Erect climbing frame ladder on lower platform and install it. The installation method is shown in Strengthening Mast Installation Part (Figure 1.7-9).

1. 7.4.4 安装顶升油缸

1.7.4.4 Installing jacking cylinder

将顶升油缸吊至安装位置，用 φ80×190（200）带肩锥头销轴和 φ10×100 开口销固定，开口销充分打开，然后让油缸处于自然垂直状态。

Lift up the oil cylinder to installation position and fix it by φ80×190 (200) shoulder pin and φ10×100 cotter pin, with cotter pin fully open. After that, keep oil cylinder at natural state.

1. 7.4.5 吊装套架

1.7.4.5 Install climbing frame unit

a) 将套架组装完毕后，将吊具挂在套架上，拉紧钢丝绳吊起（如图 1.7-10 所示）。

a) Assemble the climbing frame and then hang hook block on it and fasten the steel wire to lift (shown in Fig 1.7-10).

b) 将套架缓慢套装在标准节外侧。

b) Cover climbing frame outside the mast.

c) 将套架上的挂靴放在塔身节的第三个（从下往上数）踏步上。

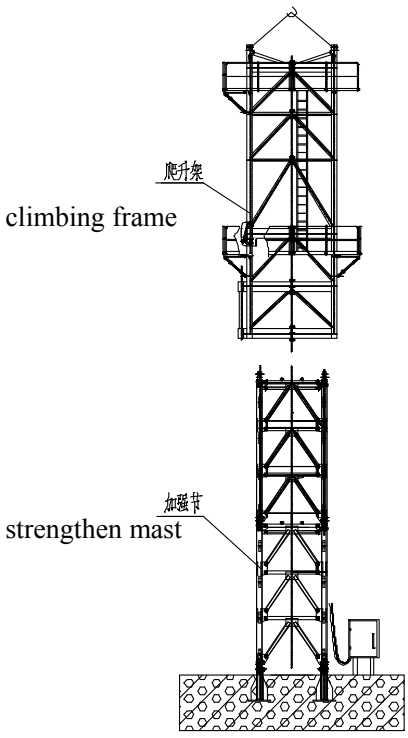
c) Place the movable claw of climbing frame on the third step of basic mast.

d) 安装顶升油缸，将液压泵站吊装到平台一角，接油管，检查液压系统的运转情况。

d) Install the jacking cylinder and lift the hydraulic pump station to one corner of platform. Connect the oil pipe, checking the running of hydraulic system.

注意 **切记安装顶升油缸的位置必须与塔身踏步同侧。**

Caution Jacking cylinder should be at the same side of step of tower body.



1、套架　　2、塔身节
1. Climbing frame 2. Tower mast
图 1.7-10　吊装套架示意图

Figure 1.7-10 Installing climbing frame

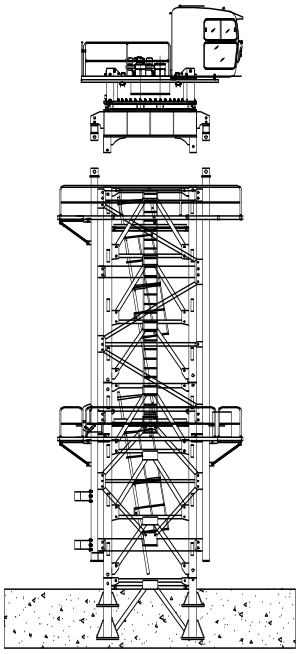
1. 7.4.6 安装回转总成(图 1.7-11)

1. 7.4.6 installing rotary complement (table 1.7-11)

1）检查回转支承上 10.9 级 M30 的高强螺栓的预紧力矩是否达 1300N·m，且防松螺母的预紧力矩稍大于或等于 1300N·m。

1) Check whether the pretension moment of 10.9 grade high-strength M30 bolt reaches to 1300N•m or not, at the meantime the pretension moment of anti-loose nut is more than or equal to 1300N•m.

2）如图 1.7-11 所示，在地面上将走台、栏杆及司机室安装在回转总成上，将吊具挂在上支座 Φ60 的销轴孔上，将回转总成吊起。



2) As shown in Fig. 1.7-11, a walking platform, railing, and a driver's cab are installed on the rotary assembly, and lifting appliance is hung on the pin hole of the upper bracket Φ60. The slewing assembly is hoisted.

图 1.7-11　吊装回转示意图

Fig 1.7-11 Installation of slewing unit

3）将下支座四条支脚插入套架连接接头上，缓慢落下，将回转总成放在套架顶部。下支座与套架连接时，应对好四角的标记。

3) Insert four supporting feet of the lower bracket into the joint of the climbing frame, and slow down and place the rotary assembly on the top of the climbing frame. When the lower bracket is connected with the climbing frame, four corners should be well marked.

4）用 8 个 φ60(φ60×225/270)双锥销和 16 个 φ20×150 的插销将下支座与套架连接牢固，装上 φ5×30 开口销，并将开口销充分打开 90°。

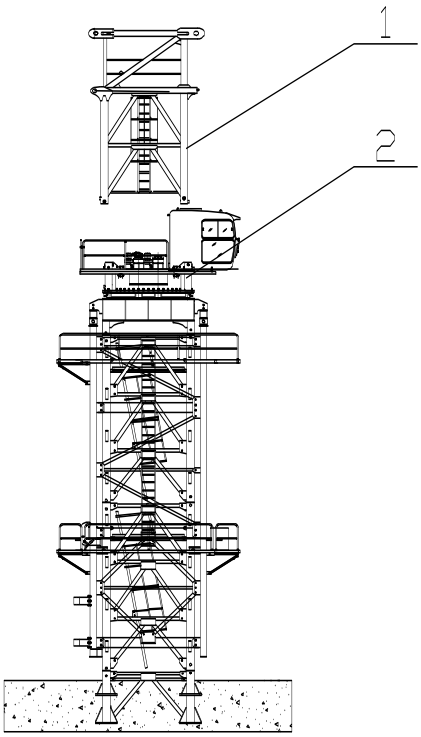
4) A lower support frame is firmly connected with the climbing frame using 8 x φ60 (60 x 225/270) double taper pins and 16 φ20 x 150 pins. Install a φ5×30 cotter pin and open it with an angle of 90°.

5）操作顶升系统，将油缸伸长，使顶升横梁销轴落入到最上面一个塔身节的踏步圆弧槽内，再将套架顶升至与下支座连接耳板接触，用 4 根 φ80(φ80×215/260)销轴将套架与下支座连接牢固。

5) Operate the hoisting system and extend cylinder, and drop manually the pins of jacking

crossbeam into holes of lower step. And then lift climbing frame to aim at the positioning pins of connecting ear plates, and fix climbing frame with lower support by four φ80 (φ80×215/260) pins.

1.7.4.7 安装塔顶



1.7.4.7 Installing a tower top

图 1.7-12

Figure 1.7-12

将塔顶（件 1）缓慢吊起，安装在回转总成上支座（件 2）上，用 8 根 φ60×164 的带肩锥头销轴将塔顶与上支座连接在一起，并用 φ20×252 的锁销和 φ5×36 开口销固定，开口销充分打开。

Slowly lift the tower top (component 1), install it on the upper bracket of the rotary complement (component 2), use eight φ60×247 shoulder pin shafts to connect the tower roof with the upper bracket, use lock pins of φ20×252 and cotter pins of φ5×36 to fix the connection, and the cotter pins are fully opened.

1) Place strengthening mast on concrete foundation and connect it with fixed angles through connection joint by eight φ60×247 shoulder pin shafts, fixing with φ20×150 cross-pin and fully open φ5×30 cotter pin, as Figure 1.7-3.

1. 7.4.8 安装起重臂根部节

1.7.4.8 Installing jib end

在地面上将起重臂第一节与第二节安装好（含变幅机构、走台及栏杆）平稳起吊，用两个φ130 销轴与塔顶相连并穿上开口销，开口销充分打开。这是很重要并且是必不可少的，见图 1.7-13。从回转中心往起重臂臂头方向看，变幅机构的电机头在起重臂的左侧处。

Install 1st and 2nd boom sections (including trolleying mechanism, walking board, and handrail) on the floor, stably lift them, use two φ130 pin shafts to connect them with the tower top and inserting to pin shafts, and cotter pins are fully opened. This is important and essential, as shown in figure 1.7-13.The motor of the trolleying mechanism is on the side of the jib from the rotation center to the direction of the jib head.

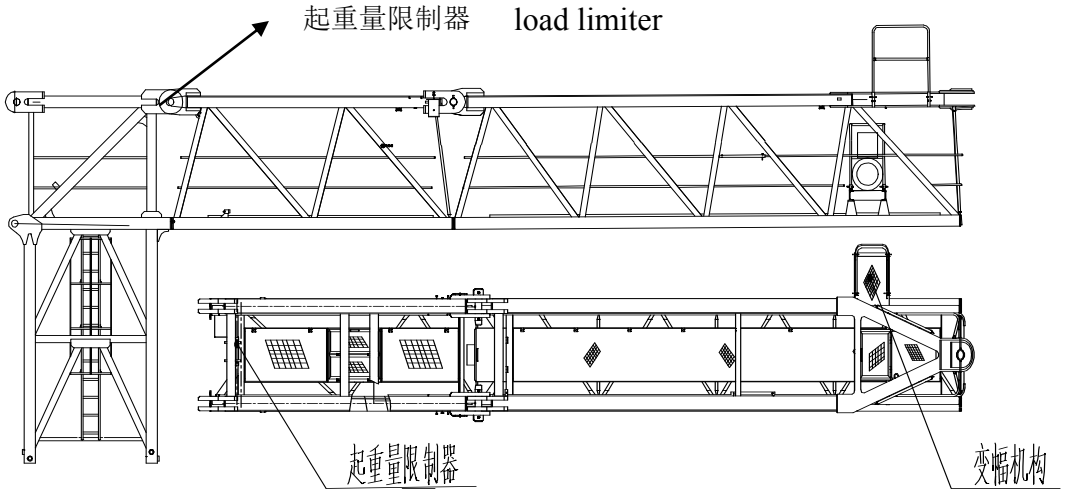


图 1.7-13

Figure 1.7-13

1. 7.4.9 安装平衡臂、平衡臂拉杆

1.7.4.9 Installation of balance arm and its lever

组装平衡臂，在平地上拼装好平衡臂，并将起升机构、配电箱、电阻箱等装在平衡臂上，接好各部分所需的电线。

Assemble the balance arm on the ground, install the hoisting mechanism, electrical cabinet and resistance box on the balance arm, and connect the wires required by each part.

根据不同的臂长，平衡臂组装如下：

Balance arm are assembled as follows by length:

1. 7.4.9.1 起重臂长度（60m、65m、70m、75m、80m），平衡臂由三节组成，图 1.7-14。

1.7.4.9.1 Jib length is (60m, 65m, 70m, 75m, 80m), the counter jib is composed of three parts, as Fig 1.7-14.

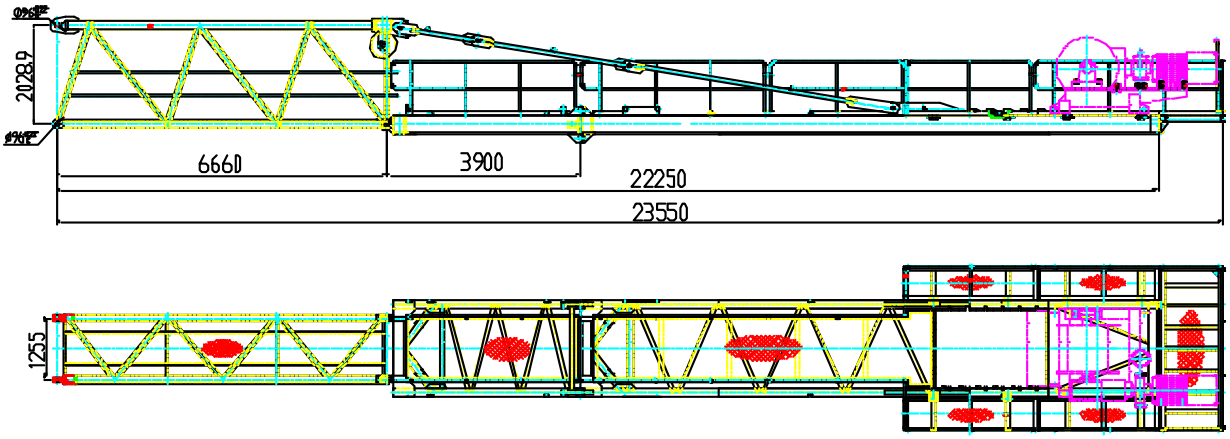


图 1.7-14

Fig 1.7-14

对应的平衡臂拉杆组成如图 1.7-15：

The correspondent counter jib drag rod composition is shown in Fig 1.7-15:

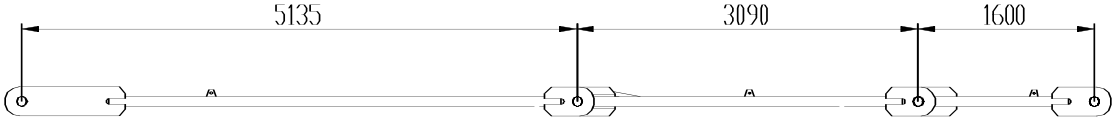


图 1.7-15

Fig 1.7-15

1. 7.4.9.2 起重臂长度（45m、50m、55m），平衡臂由臂节 1 和臂节 3 组成，见图 1.7-16；

1.7.4.9.2 Jib length is (45m, 50m, 55m), and counter jib is composed of counter jib 1 and counter jib 3. See in Fig 1.7-16.

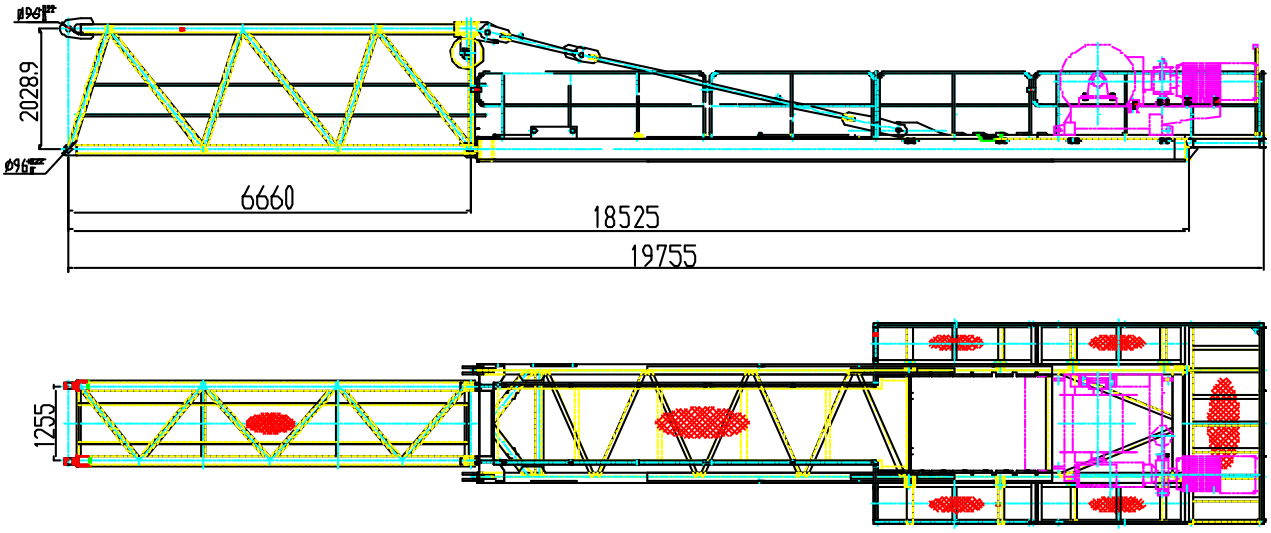


图 1.7-16

Fig 1.7-16

对应的平衡臂拉杆组成如图 1.7-17：

The correspondent counter jib drag rod composition is shown in Fig1.7-17:

图 1.7-17
Fig 1.7-17

1. 7.4.9.3 安装一个平衡重块

1.7.4.9.3 Mount one counterweight block

将一块配重块从平衡臂第三节端部开口处平稳起吊，装入平衡臂第三节，位置靠近起升机构旁边，用配重销紧固在平衡臂第三节上，即完成平衡臂安装，图 1.7-18。

Lift up one counterweight block from counter jib 3 opening and insert it into jib counter 3, near to hoisting mechanism and locked on counter jib 3 by counterweight pin. After this, the installation of counter jib is completed.

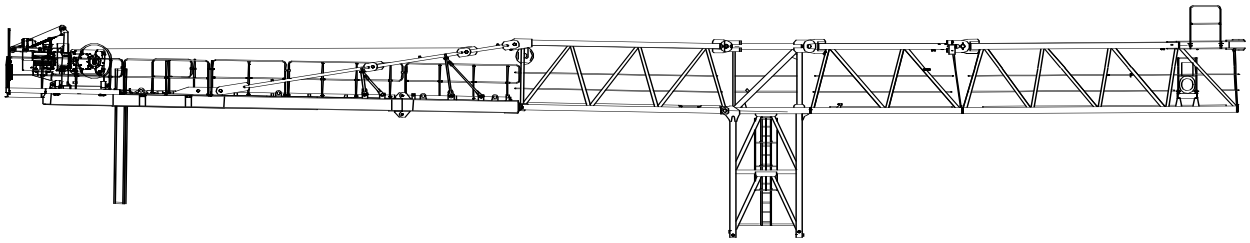


图 1.7-18
Fig 1.7-18

1. 7.4.10 安装起重臂

1.7.4.10 Installing jib

1. 7.4.10.1 按照不同吊臂长度，用相应销轴把它们装配在一起（臂节一除外），装上小车和吊篮，并把小车和吊篮固定在臂节二上，把吊臂搁置在 1 米高左右的支架上，使小车和吊篮离开地面，装上小车变幅机构。所有销轴都要装上开口销，并将开口销充分打开，见图 1.7-19。

1.7.4.10.1 Assemble the boom according to different jib length. Assemble them together with proper pins (Except jib 1), then install the trolley and its cage on jib 2, put the boom on the 1m support and lift the trolley from the ground. All pins shall be mounted with cotter pins which shall be kept fully open. (See Fig 1.7-19)

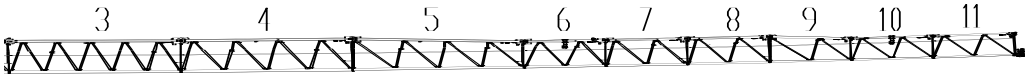
起重臂各种臂长配置如下（臂节 1、2 除外）：

The jib configuration is as follows (except Jib 1、2):

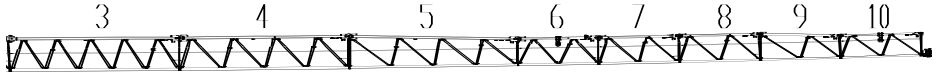
起重臂长度 80m

Jib length: 80m

起重臂长度 75m
Jib length: 75m

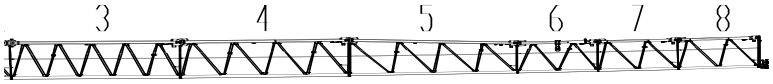


起重臂长度 70m
Jib length: 70m

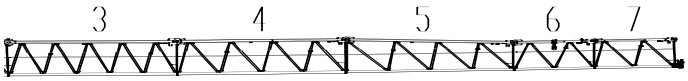


起重臂长度 65m
Jib length: 65m

起重臂长度 60m
Jib length: 60m



起重臂长度 55m
Jib length: 55m



起重臂长度 50m
Jib length: 50m

起重臂长度 45m
Jib length: 45m

图 1.7-19

Fig 1.7-19

1. 7.4.10.2 检查吊臂上的电路是否完整，并穿绕上小车牵引钢丝绳

1.7.4.10.2 Check the circuit on jib and wind the trolley traction rope.

1. 7.4.10.3 用汽车起重机将吊臂总成平稳提升，提升中必须保持吊臂处于水平位置，使吊臂能够顺利安装到平衡臂和上支座的铰点上。

1.7.4.10.3 Lift up jib assembly by truck crane, keeping jib in level position, so that the jib can be successfully mounted on the hinge of jib and upper support.

1. 7.4.11 安装平衡重，详见各种臂长的平衡重

1.7.4.11 Mount counterweight and the counterweight for each jib length is shown in 3.1.4.

1. 7.4.12 穿绕牵引钢丝绳(图 1.7-20)

1.7.4.12 Wind traction rope (Fig 1.7-20)

图 1.7-20

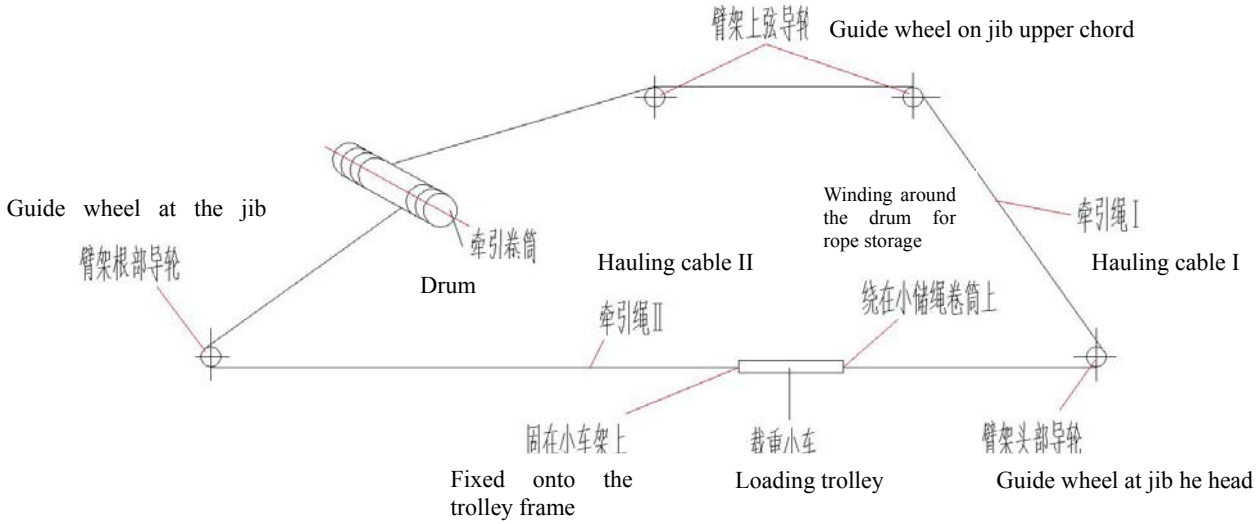


Fig 1.7-20

1. 7.4.13 穿绕起升钢丝绳(图 1.7-21)

1.7.4.13 Wind the Lifting Steel Rope (Fig 1.7-21)

将起升钢丝绳引经平衡臂过绳轮、起重臂导向滑轮后，绕过在起重臂根部的起重量限制器滑轮，再引向小车滑轮与吊钩滑轮穿绕，最后，将绳端固定在臂头上。

After directing the lifting steel rope through the counter jib rope wheel, jib guide pulley, and round the load lifting limiter pulley at jib root, then direct it to the trolley pulley to wind with the lifting hook pulley. In the end, fix the rope end to the jib head.

起升钢丝绳绕绳示意图

Winding Diagram of Hoisting Steel Wire

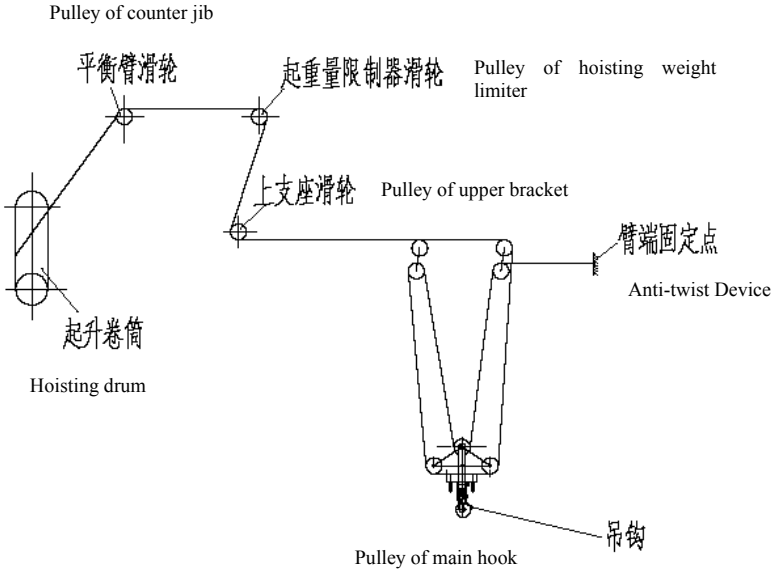


图 1.7-21

Fig 1.7-21

图示吊钩倍率为四倍率，在四倍率基础上拿掉吊钩上滑轮销轴，吊钩滑轮由四倍率变成两倍率，并拆掉吊钩上的所有配重块。

The hook ratio shown in figure Fig 1.7-21 is four magnifications, the pulley pin on the hook is removed on the basis of four magnifications, the hook pulley is changed from four magnifications to two magnifications, and all the counterweight blocks on the hook are removed.

注意：在使用四倍率或者两倍率时，不用的配重块必须拆除！

Note: when using the 4-fall or 2-fall, you must remove the useless counterweight!

1.7.5 顶升加节

1.7.5 Jacking operation

1.7.5.1 顶升前的准备工作

1.7.5.1 Preparations before jacking

a) 按液压泵站说明书要求加注液压油，将顶升横梁通过销轴与套架上的油缸连好；

a) Fill oil into oil tank as the requirements of hydraulic pump station. And link the jacking crossbeam with oil cylinder on climbing frame by pin shafts;

b) 清理好各个标准节，在标准节连 接销孔内涂上黄油，将待顶升加高用的标准节在

顶升位置时的起重臂下排成一排，这样能使塔机在整个顶升加节过程中不用回转机构，能使顶升加节过程所用时间最短；

b) Clean each mast and oil the connection pin holes on masts. Arrange the masts ready to be added into a line under jib so that there is no need to slew the mechanism during adding masts, contributing to save time;

c) 放松电缆长度略大于总的顶升高度，并紧固好电缆；

c) Relax the cable until its length is slightly more than jacking height and then fix the cable;

d) 将起重臂旋转至套架前方，平衡臂处于套架的后方（**顶升油缸必须位于平衡臂下方**）；

d) Rotate jib to the front of climbing frame, counter jib at rear (Jacking cylinder should be beneath counter jib);

e) 在套架上层平台上准备好 4 根塔身与下支座安装用临时销轴，在套架中层平台上准备好 8 根塔身标准节连接销轴。

e) Set the four temporary pin shafts on upper platform of climbing frame for connection of tower body and lower support, and eight mast connection pins on middle platform of climbing frame;

f) 检查、调试并确认顶升机构工作正确、可靠，保证套架能按塔机爬升规定的程序上升、下降、可靠停止；运行过程中应平稳，无爬行、振动现象；

f) Examine and debug to confirm that the jacking mechanism is correct and reliable and stable in operation, without shaking, besides, whether the climbing frame can work up and down as required;

g) 检查套架支承系统，确保各部分运动灵活，承重可靠；

g) Check the climbing frame bearing system which should be flexible and reliable;

h) 液压顶升机构应保证安全，溢流阀的调整压力不得大于系统额定工作压力的 110%。

h) Hydraulic jacking system shall be safe and the adjusting pressure of overflow valve shall not be over 110% rated working pressure.

1.7.5.2 顶升一般规则

1.7.5.2 Jacking operation announcements

1）顶升前塔机旋转部分必须进行配平。

1) Before jacking, balance the slewing part of tower crane.

2）塔机最高处风速大于 12m/s 时，不得进行顶升作业。

2) Wind speed at the highest point of tower crane ≤12m/s, you can start mounting tower crane.

3）严禁在顶升系统正在顶起或已顶起时进行吊重（上升或下降）。

3) No lifting load during jacking operation.

4）严禁在顶升系统正在顶起或已顶起时进行小车移动。

4) No trolley movement during jacking operation.

5）顶升过程中必须保证起重臂与引入标准节方向一致，并利用回转机构制动器将起重臂制动住，载重小车必须停在顶升配平位置。

5) During jacking, the jib is at the same direction with the introduced mast, and stop jib using slewing mechanism brake. Meanwhile the load trolley should be at the balanced position.

6）塔身与下支座安装用临时销轴其直径比标准销轴 φ60 稍小，以便容易就位。该销轴仅 用于标准节引进过程中，每节标准节引进完进行下一节标准节引进前，必须用标准销轴取代。在标准销轴安装前，绝对禁止进行吊重操作。

6) The temporary pin for mast and lower support is smaller in diameter than standard φ60 pin, so it is easier to be positioned. However, this kind of pins are just used in the process of introducing mast, so after the finish of one mast introduction and before the other one introduction, the temporary pins ought to be replaced. Don’t conduct the loading operation until the standard pins are mounted well.

7）若要连续加高几节标准节，则每加完一节后，塔机起吊下一节标准节前，塔身各主弦杆和下支座必须有 4 根 φ60 销轴连接，唯有在这种情况下，允许用 4 根 φ60 销轴。

7) If you want to increase several masts continuously, after completed increasing one mast and before hang up another mast, the main chords of tower body and lower support must be connected by four φ60 pins which are used at this case only.

8）所加标准节上的踏步，必须与已有标准节对正。

8) The added mast steps are supposed to match to tower mast.

9）在下支座与塔身没有用 8 根 φ60 销轴连接好之前，严禁回转、变幅和吊装作业。

9) It is forbidden to operate jib and trolley before lower support and tower body are not connected well by pins.

10）在顶升过程中，若液压顶升系统出现异常，应立即停止顶升，收回油缸，将下支座落在塔身顶部，并用 8 根 φ60 销轴将下支座与塔身连接牢靠后，再排除液压系统的故障。

10) In jacking operation, if there is any abnormal condition stop jacking instantly, recovering oil cylinder and lowering lower support on tower top. Fix lower support and tower body together using eight φ60 pin shafts. And then clear up the breakdown.

11）顶升结束后，所有标准节之间均是用 8 根 φ60 的标准销轴连接，最顶部标准节与

下支座之间是用 8 根 φ60 销轴连接。

11) Having completed the jacking operation, confirm that both all masts are connected with each other and the top mast is with lower support by eight φ60 pin shafts.

1.7.5.3 顶升前塔机的配平

1.7.5.3 Jacking balance position

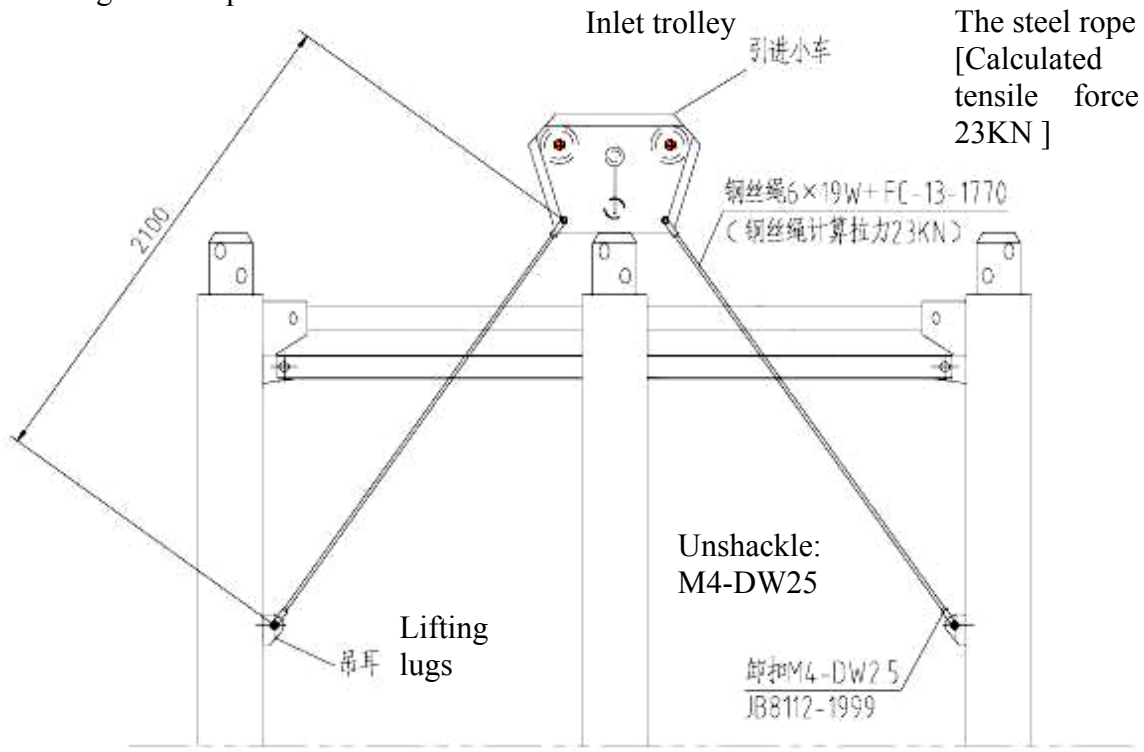


图 1.7-22

Fig 1.7-22

a) 塔机配平前，必须先吊一节标准节放在下支座的引进横梁上（标准节的平台、平台栏杆和爬梯要固定好），标准节的吊装见图 1.7-22，钢丝绳挂在标准节的对角吊耳上，再将载重小车吊一节标准节运行到配平参考位置，如图 1.7-23，然后拆除下支座 4 个支腿与标准节连接的 8 个销轴；

a) Before balancing, place one mast section on introduction beam of lower support (fixing well the platform, rails and ladders of mast), as Figure 1.7-22. Hang up the steel rope on two diagonal lifting lugs of mast and move trolley to reference position shown in Fig 1.7-23 and hoist one mast(when jacking adjust according to actual demands). And then remove the pins connecting four outriggers and masts.

b) 将液压顶升系统操纵杆推至“顶升”方向，使套架顶升至下支座支腿刚刚脱离塔身的主弦杆的位置；

b) Push the joystick of hydraulic jacking system to “Jacking” direction, and jack the climbing frame to the position where outrigger of lower support just apart from main chord of tower crane.

c) 通过检验下支座支腿与塔身主弦杆是否在一条垂直线上，并观察套架 8 个导轮与塔身主弦杆间隙是否基本相同来检查塔机是否平衡。略微调整载重小车的配平位置，直至平衡。记录实际配平位置，以后顶升或降节时使用。**必须使得塔机上部重心落在顶升油缸梁的位置上；**

c) Check tower crane is balanced or not: whether outrigger of lower support is at the same vertical line with main chord of tower crane; the distance between eight guiding pulleys of climbing frame and main chord are same or not. Reach to balance through adjusting slightly the balance position of trolley. The upper gravity center must be on jacking cylinder.

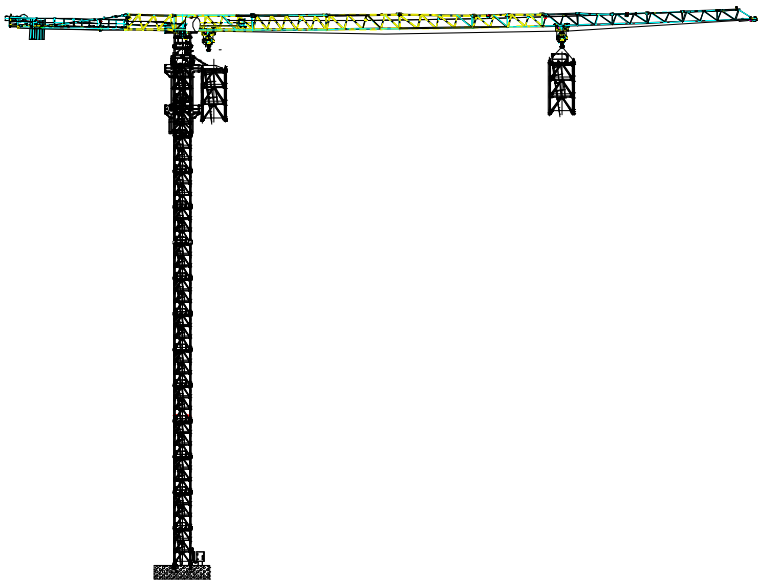


图 1.7-23 顶升前的平衡

Figure 1.7-23 Balancing before jacking operation

表 1.7-2
Table 1.7-2

臂长（m） Arm length	平衡重量（kg） Counterweight	理论平衡位置 L（m） Theoretical balance position L
80m	5730（1 个标节） 5730 (1 standard section)	32.9
75m	5730（1 个标节） 5730 (1 standard section)	36.9
70m	5730（1 个标节） 5730 (1 standard section)	38.2

65m	5730（1 个标节） 5730 (1 standard section)	43.2
臂长（m） Arm length	平衡重量（kg） Counterweight	理论平衡位置 L（m） Theoretical balance position L
60m	5730（1 个标节） 5730 (1 standard section)	44.7
55m	5730（1 个标节） 5730 (1 standard section)	44
50m	5730（1 个标节） 5730 (1 standard section)	46.5
45m	5730（1 个标节） 5730 (1 standard section)	45

记录下载重小车的配平位置。但要注意该位置随起重臂长度不同而改变；
Record the balance position of trolley, but notably, this position will be different along with the change of jib length.

d) 操纵液压系统使套架下降，连接好下支座和塔身节间顶升用临时销轴。

d) Operate the hydraulic system to drop climbing frame and connect lower support with tower mast by temporary jacking pin shafts.

1. 7.5.4 顶升作业

1.7.5.4 Jacking operation

顶升作业为多人配合作业，专人负责操作泵站、其余人负责操作标准节及销轴。

Jacking operation needs many people operating. Special person is for controlling pump station and the rest person for operating anti-out pins and pins.

a) 按在引进梁上吊挂标准节的方法将一节标准节吊挂在引进梁上，并保证标准节上端面与引进小车下端面的距离在 100～250mm 之间。

a) Before hoisting each time, hang mast on introduction beam, keeping the distance from top surface of mast to bottom of introduction car is at the range of 100-250mm.

b) 再吊配平标准节，将载重小车开至顶升平衡位置，塔机处于配平状态。

b) Lift up mast and make it in balance, moving trolley to jacking balance position.

c) 使用回转机构上的回转制动器，将塔机上部机构处于制动状态；

c) Move the slewing brake on slewing mechanism to stay upper tower crane in braking state.

d) 卸下塔身顶部与下支座连接的顶升用临时销轴。

d) Remove the temporary jacking pin shafts connecting tower top and lower support.

e) 开动液压顶升系统，使油缸活塞杆伸出，将顶升横梁两端的止动靴挂在距顶升横梁最近的塔身节踏步上（**要设专人负责观察顶升横梁两端止动靴都必须落入踏步圆弧槽内**）；

e) Start hydraulic jacking system to extend oil cylinder piston rod. Hang the brake boot at two ends of jacking beam on the nearest step to jacking beam **(someone needs to observe that the brake boot at the two ends of crossbeam ought to be set in arc groove of step)**.

f) 打开套架上止动靴操纵杆，使套架止动靴与塔身分开，继续顶升，将套架及以上部分顶起 0.1~0.5m 时停止。

f) Operate the braking boot joystick on climbing frame to apart the boot from tower body. Continue jacking until the upper parts have been jacked up 0.1-0.5m.

g) 当液压油缸活塞接近下止点位置时，推动套架止动靴操纵杆使上止动靴挂入踏步上的圆弧槽内，使塔机套架以上部分临时固定在顶升踏步上。

g) When hydraulic cylinder piston is close to the bottom dead center, push the control lever of supporting climbing claw on climbing frame so that the supporting climbing claw is inserted into the arc groove of step to fix tower crane parts above climbing frame temporarily on jacking step.

h) 将顶升横梁上的止动靴从塔身节踏步上脱开。

h) Take off the brake plate within the jacking beam boot.

i) 液压泵站操纵杆搬向“向下”位置，使顶升横梁收回。在收回的过程中，注意不要使顶升梁与塔身上螺栓或鱼尾板卡住，防止造成事故。

i) Push the control lever of hydraulic pump station to “down” position and retract the jacking beam. During retracting, be careful not to stick the jacking beam by bolt or fish plate on the tower body so as to avoid accident.

j) 当顶升横梁止动靴开口与上一级顶升踏步对齐时，搬动顶升横梁止动靴使其挂入顶升踏步上。

j) When jacking beam boot aligns with the higher stage of the climbing steps, move the beam towards the tower body to hang the boot on the climbing step.

k) 打开套架上止动靴操纵杆，使套架止动靴与塔身分开，液压泵站操纵杆搬向“向上”位置，继续顶升。

k) Move the brake shoes lever on climbing frame to apart brake shoes from tower body. Push the control lever of hydraulic pump station to “up” position and continue the jacking operation.

l) 该过程要重复三次方能形成可将一节标准节放进套架内的空间。

l) The procedure needs to be repeated for three times to form the space used for accommodating one mast in the climbing frame.

1. 7.5.5 引进标准节

1.7.5.5 Introduction of the mast

a) 当顶升第三循环接近完成、套架内空间可以容纳标准节时，将挂在引进梁上的标准节轻轻推向塔身、引入套架内；

a) When the third cycle of jacking operation is about to end and the space within the climbing frame can accommodate the mast, push the mast hanging on the introduction beam toward the tower body and import it into the climbing frame.

b) 液压泵站操纵杆搬向“向下”位置，引进的标准节下端与塔身原标准节上端鱼尾板对齐相联，打入 8 个标准节联接销轴，并用锁销固定。在联接标准节时注意使两标准节上爬梯对正，上下插接在一起。

b) Push the control lever of hydraulic pump station to “down” position, the lower end of the imported mast shall align with and be connected with the upper fish plate of the original mast on tower body; plug 8 mast connecting pins and fix the shafts with lock pin. When connecting the masts, note that the ladder of two sections shall be aligned and upper and lower parts shall be connected.

c) 拆下引进小车上 4 根固定标准节的螺栓，将螺栓装在引进小车吊环内。向外推出引进小车至标准节以外位置；

c) Remove the 4 bolts which fix the mast to the inlet trolley and mount the bolts to the hoisting rings of the trolley. Push the inlet trolley outward to the position outside the mast.

d) 继续下降套架使下支座 4 个支腿落在新安装好的标准节上。用套架上附带的四个临时固定销轴将下支座与标准节联接起来；

d) Continue to descend the climbing frame and let the 4 outriggers of the lower support drop into the newly installed mast. Connect the lower support with the mast by using the 4 temporary fixing pins attached on the climbing frame.

e) 重复上述顶升程序，直到塔机顶升作业完成为止。

e) Repeat above procedures until the jacking operation is completed.

注意：在 4 个临时销轴没有安装以前，塔机不能做任何动作（包括小车、起升和回转）。否则有可能造成塔机倾翻的事故。

Note: No action (including trolley, lifting and swinging) is allowed for the tower crane before the 4 temporary pins are installed. Otherwise severe damages and casualties may be caused.

关于顶升用临时销轴的说明：

Instruction about the temporary pins used for jacking:

为方便顶升作业，配有 4 个临时销轴，此销轴直径比标准节销轴小 2mm 。此销轴只做顶升时联接下支座与塔身用，**塔机正式作业时不允许用此销轴替代标准节销轴。**

For convenience of jacking operation, 4 temporary chain pins are welded on the 4 upper corners of jacking frame. The diameter of the pin is 2mm shorter than the one for mast. This pin is only used for connecting the lower support with tower body during jacking, and i**t is not allowed to replace the mast pin with this pin during normal operation.**

1. 7.5.6 顶升过程的注意事项

1.7.5.6 Notes for jacking operation

a) 塔机最高处风速大于 12m/s 时，不得进行顶升作业；

a) When the wind speed of the highest point is less than 12m/s, you can start mounting tower crane.

b) 塔机的爬升机构，其爬升作业时应确保套架上支承在塔身上的受力部位与塔身顶升支承部位应可靠定位和结合。并应及时查看顶升支承部位焊缝情况，若有异常情况应排除后才能继续进行爬升作业。

b) In climbing operation, the stressed part of climbing frame on tower body should be wise position and united with the bearing part of tower body. Check the welds at bearing part, if there is any abnormal condition, remove it instantly and then continue to climb.

c) 顶升过程中必须保证起重臂与引入标准节方向一致，并利用回转机构制动器将起重臂制动住，载重小车必须停靠在顶升配平位置；

c) In jacking operation, jib and introduction direction of mast ought to be same. Taking advantage of slewing brake to stop jib, trolley should stop at jacking counter position.

d) 所加标准节上的踏步，必须与已有塔身节对正；

d) The added mast steps are supposed to match to tower mast.

e) 在下支座与塔身没有用销轴连接好之前，严禁起重臂回转、载重小车变幅和吊装作业；

e) It is forbidden to operate jib and trolley before lower support and tower body are not connected well by pins.

f) 在顶升过程中，若液压顶升系统出现异常，应立即停止顶升，收回油缸，将下支座落在塔身顶部，并用 8 个销轴将下支座与塔身连接牢靠后，再排除液压系统的故障；

f) In jacking operation, if there is any abnormal condition stop jacking instantly, recovering oil cylinder and lowering lower support on tower top. Fix lower support and tower body together using eight pin shafts. And then clear up the breakdown.

1. 7.5.7 顶升作业完成后注意事项

1.7.5.7 End the jacking operation

a) 最后一节标准节要带有休息平台；

a) The last mast shall have a rest platform.

b) 引进小车不要放在塔身内；

b) Do not put the inlet trolley in tower body.

c) 必要时可以放下引进梁；

c) The introduction beam may be put down where necessary.

d) 下支座与塔身必须用 8 个标准节销轴联接好并用锁销固定；

d) The lower support and tower body should be connected well by eight mast pins and fixed with lock pins.

e) 顶升梁必须轻挂在最后一级顶升踏步上，注意要使液压油缸卸荷；

e) Jacking beam must be hitched lightly on the last stage of climbing step. Please note that the hydraulic cylinder shall be unloaded.

f) 拆掉液压泵站的电源线，整理好塔机电源随线；

f) Remove the power supply lines from hydraulic pump station. Put the power supply lines of tower crane in order.

g) 整个塔机安装完毕后，将套架降到塔身最底部，固定牢固，以降低风载；

g) After the installation of the whole tower crane, descend the climbing frame to the bottom of tower body and fix it firmly to reduce the wind load.

1.8 附着塔机的安装

1.8 Installation of attached tower crane

XGT8040-25 塔式起重机附着工作时，塔机的起升高度增加。附着工作时将塔身直接紧固在专用混凝土基础上，基础中心距建筑物不小于 5.5 米，爬升时应使得吊臂方向与建筑物平行。

When attaching, XGT8040-25 tower crane increases in hoisting height of tower crane. When attaching, fix tower body directly on special concrete foundation whose center is 5.5m away from building. The jib direction should be parallel to building when climbing.

1.8.1 安装前准备工作

1.8.1 Preparations before installation

1.8.1.1 混凝土基础的施工

1.8.1.1 Construction of concrete foundation

用户和安装单位根据给出的压重固定式基础附图进行混凝土基础的施工，同时保证其

所提技术要求。

Users and installing company manufacture concrete foundation according to the supplied loading stationary foundation figure, making sure to meet the technical requirements.

1.8.1.2 建筑物附着处强度

1.8.1.2 Adhesion strength of building

用户和安装单位在安装 XGT8040-25 独立固定附着式塔机之前，应对建筑物附着点的确定和附着点的强度预先计算和确定。

Before installing XGT8040-25 independent stationary attached tower crane, users and installing company have to calculate and confirm the adhesion point position and its strength.

1.8.2 附着的安装

1.8.2 Mounting steps

塔机附着前的安装程序与独立固定式塔机基本相同，其安装程序请参照 1.7 的独立固定式塔机安装程序。加标准节的方法同独立固定式塔机一样，附着式塔机塔身自下而上的组成为（起升高度 271.1 米时）：砼基础，固定支腿，2 节加强节，43 节标准节，下支座和上部回转部分。

Attached Crane is basically identical with the fixed crane in terms of mounting steps. Mounting steps can refer to Chapter 1.7 for independent crane installation. The way of adding up the stand rode is also the same, when the independent crane is formed from lower to the top as: (lifting height of 271.1m: Concrete basement, the fixed angles, 2 strengthening masts, 43 masts, lower support and upper slewing system.

1.8.2.1　XGT8040-25 固定附着式标准节 68.8—271.1 米附着安排（表 1.8-2）

1.8.2.1 The adhesion arrangement of XGT8040-25 tower crane in attachment from 68.8-271.1m (Table 1.8-2)

表 1.8-2

Table 1.8-2

高度 Height	附着次数 Adhesion number	各次附着高度(米) Adhesion height	标准节数量（节） Mast quantity (section)	加强节数量（节） Strengthening mast quantity (section)
271.1	6	53.5、35.7、35.7、35.7、35.7、29.75 53.5, 35.7, 35.7, 35.7, 35.7, 29.75	43	2

1.8.2.2 附着式塔身的最大悬高 h_0（表 1.8-3）

1.8.2.2 The max. suspension height h_0 of tower crane in attachment (Table 1.8-3)

表 1.8-3

Table 1.8-3

序号 No.	附着架的道数 Adhesion bracket number	附着架距固定基础或下面附着架的高度（m） Height of the attachment frame to a fixed base or a lower attachment frame (m)	附着架以上塔身最大悬高 h_0（m） Max. suspension height h_0 above adhesion bracket (m)	附着后最大起升高度（m） Max. lifting height after attachment (m)	塔身节数量（节） Number of tower masts
1	第一道 First	53.5	47.6	104.5	17
2	第二道 Second	35.7	47.6	140.2	23
3	第三道 Third	35.7	47.6	175.9	29
4	第四道 Fourth	35.7	47.6	211.6	35
5	第五道 Fifth	35.7	41.7	241.4	40
6	第六道 Sixth	29.75	41.7	271.1	45

1.8.2.3 附着位置（见图 1.8-1）

1.8.2.3 Adhesion position (Fig 1.8-1)

XGT8040-25 附着式起重机的最大起升高度为 277 米（实际附着时采用 6 道附着最高可达 271.1m），为了保证塔机工作的稳定性和整机刚性，减少上部塔身的自由长度，在塔机全高设置 6 套附着架，6 套附着架相对位置见图 1.8-1。

A maximum lifting height of XGT8040-25 attached tower crane is 277 m (a maximum height of 271.1 m is used in actual use). To ensure the stability and rigidity of tower crane, the upper tower free length has been reduced. The tower crane has six sets of adhesion bracket in full height. The position of all adhesions is shown in Fig 1.8-1.

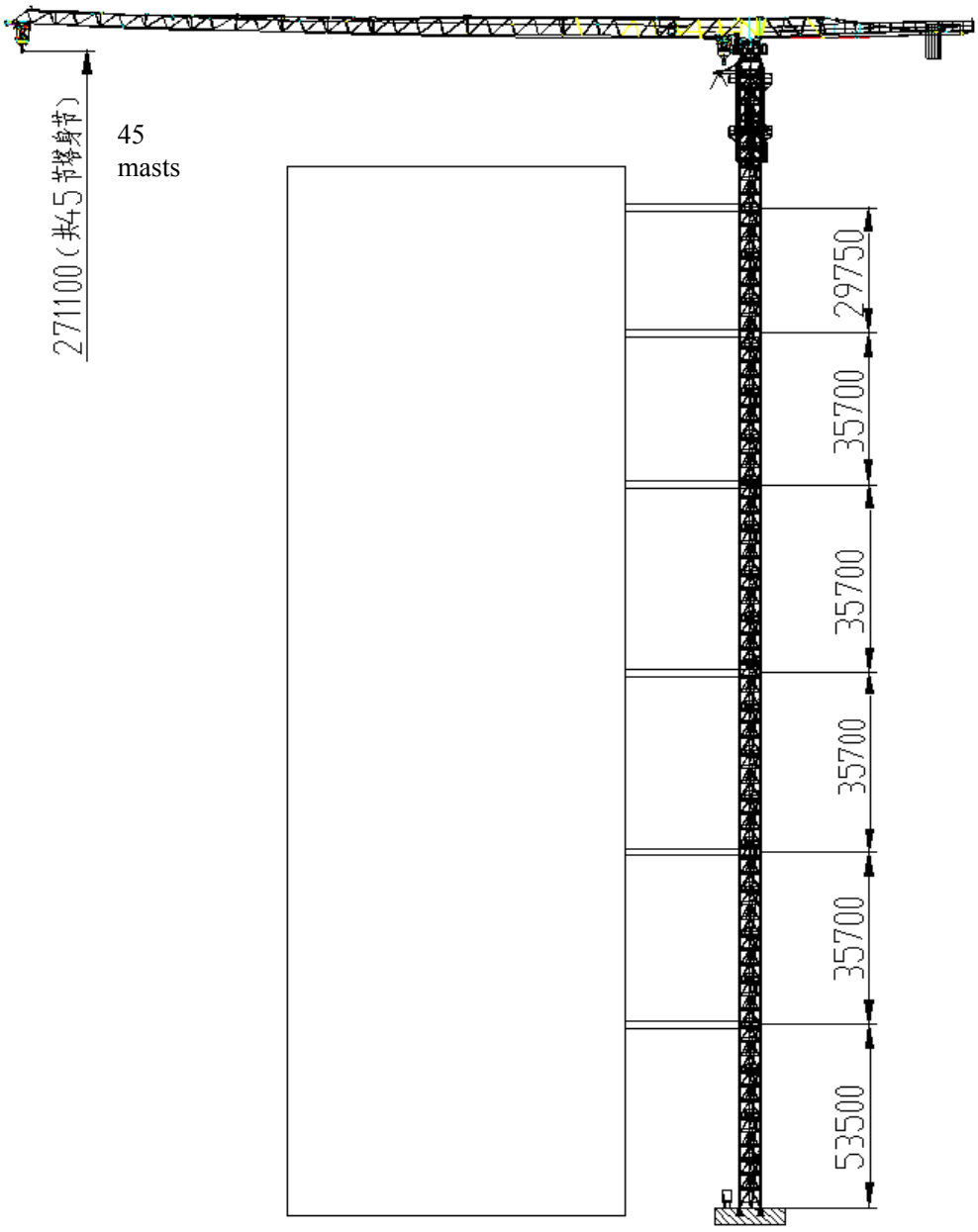


图 1.8-1　附着位置图

Fig 1.8-1 Adhesion position

1.8.2.4 附着点布置

1.8.2.4 Adhesion allocation

塔机附着点的确定可分为在垂直方向上附着点的确定和在水平方向上附着点的确定。

The adhesion allocation includes the adhesion point confirmation vertically and horizontally.

1.8.2.4.1 垂直方向上的附着点

1.8.2.4.1 Vertical adhesion point

当塔机计划使用总高度确定以后，可按照表 1.8-3 确定垂直方向上的附着点。

When the planned height of tower crane is certain, identify the vertical adhesion point based on Table 1.8-3.

1.8.2.4.2 水平方向上的附着点

1.8.2.4.2 Horizontal adhesion point

在水平方向上布置附着点没有定式，可根据建筑物具体情况灵活变化。但要遵循以下原则：

There is no certain allocation of horizontal adhesion, so it is subject to the changes of building situation, with following below principles:

⑴ 最外侧两根撑杆与附着框架前梁垂线之间的夹角应在 40°～60°之间（四杆形式）或 15°～45°之间（三杆形式）。

(1) The angle between the two outboard stay-bars and the front-beam vertical of the attached frame is from 40° to 60° (four poles), or else 15° to 45° (three poles)

⑵ 最外侧两根撑杆最好对称安装，尽量避免相差太大。

(2) The two outboard stay-bars had better be assembled symmetrically, and mostly avoid difference.

⑶ 附着点最好选取建筑物的拐角、或成 T 字的部位，以加大建筑物对撑杆的承载能力。

(3) The attached points had better laid at the building corner or T part, to increase the bearing force of the building.

⑷ 最好多作几种附着方案进行比较，选取附着点受力最小的方案。

(4) You'd better make several attaching plans to compare, and choose the plan which the attaching point bears least force.

⑸ 如果撑杆支座在建筑物上能作两个方向的安装（如拐角处，立柱上）时，应将其安装在固定螺栓受剪切力较小的方向上。

(5) If the supporting-seat of the stay-bar could be fixed in 2 directions (e.g. at the corner, on the upright post); it should be fixed on the direction when the standing bolt bears the least shearing force.

⑹ 在选定附着的位置上，建筑物应根据附着撑杆所受的拉、压力进行适当的加强。

(6) At the chosen attached position, reinforce the building according to the pulling force and pressure born by the stay-bar.

⑺ 对附着点的受力情况应作计算，不要盲目作出决定。

(7) Calculate the force of the attaching points, and don't make a decision aimlessly.

附着撑杆安装形式较多，下面给出两种最常用的形式，如图 1.8-2、1.8-3 所示。

There are many ways of installing stay-bar, and here are 2 normal ways (Fig 1.8-2, 1.8-3).

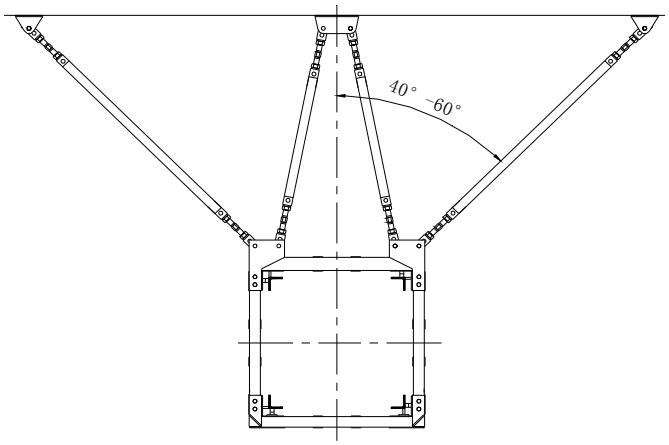


图 1.8-2

Fig 1.8-2

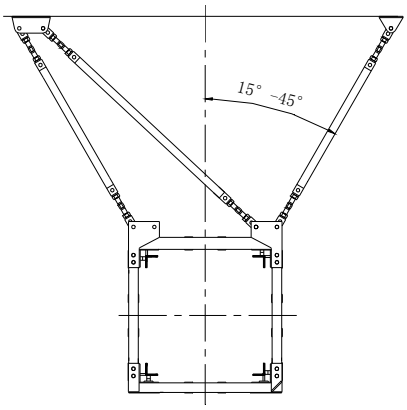


图 1.8-3

Fig 1.8-3

1.8.2.5 附着撑杆

1.8.2.5 The attached strut

由于塔机在每次附着时位置都可能不相同，所以附着撑杆的长度是不确定的。用户可根据实际距离设计撑杆。有关撑杆的设计要注意如下问题：

The attached strut should be designed according to the real distance, for the length of the attached strut couldn't be fixed because the crane's position may change every time when it is attached. NOTES of the design of the attached strut:

a) 首先要计算每根撑杆所受的轴向力，选取受力最大的一根作为撑杆设计依据；

a) Firstly, calculate the axial-force bearing by each attached strut, and then choose the attached strut which bears the biggest force as the model.

b) 如果附着撑杆长度较长时，应考虑由于撑杆自重产生的附加弯矩对撑杆的影响；

b) If the attached strut is too long, it is necessary to take the extra-bending moment caused by the stay-bar's weight itself into count.

c) 如果附着撑杆长度较长时，可采取将撑杆分成几段制作、到现场组装的形式，这时对撑杆的联接形式、联接强度要考虑周全。

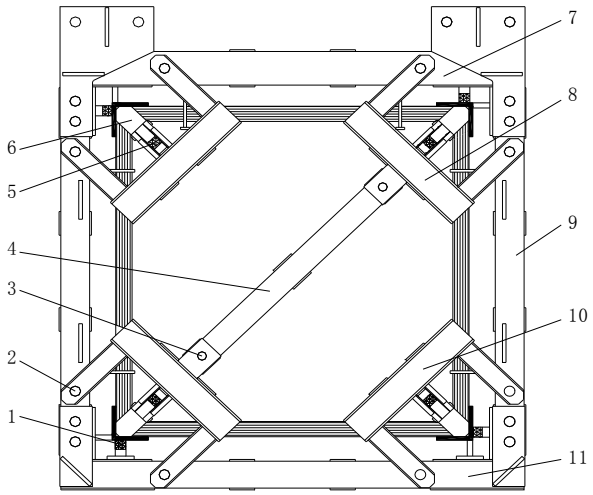
c) If the attached strut is too long, you can make it in several parts, and then assemble them at the worksite. At this time, you'd better to consider fully about the connecting-pattern and connecting-strength.

1.8.2.6 附着框（如图 1.8-4 所示）

1.8.2.6 Tie frame (Fig 1.8-4)

附着框在塔机附着时固定在塔身上，由下列部件组成，其结构见图 1.8-4。

The tie frame is fixed on the tower crane, when the crane is attached. And it is made up of the following parts:



1-外框楔块 2-双锥头销轴 3-双锥头销轴 4-斜撑杆 5-卡箍楔块 6-垫板 7-前梁 8-卡箍 9-侧梁 10-卡箍 11-后梁

1. Outside wedge 2. Double cone-head pin 3. Double cone-head pin 4. Angling strut 5. Hoop wedge 6. Backing plate 7. Front beam 8. Hoop 9. Side beam 10. Hoop 11. Rear beam

图 1.8-4 附着框

Figure 1.8-4 Attached frame

1.8.2.7 附着架的安装与使用

1.8.2.7 Mounting and use of the anchoring frame

a) 首先在准备安装附着框的标准节上搭建一临时平台；

a) First, build a temporary platform on the standard section where the anchoring frame will be mounted.

b)吊起前梁 7 至安装高度使朝向建筑物一侧，使前梁上两块支承板卡在标准节横腹杆上。用一手拉葫芦将前梁临时固定在塔身上，如图 1.8-5、1.8-6 所示。

b) Hoist a front beam to the mounting height and make it toward the building, stick the two support plates of front beam at the horizontal web rod of standard section. Fix the front beam at the tower body temporarily with a chain block, which is shown in Figure 1.8-5 and Figure 1.8-6.

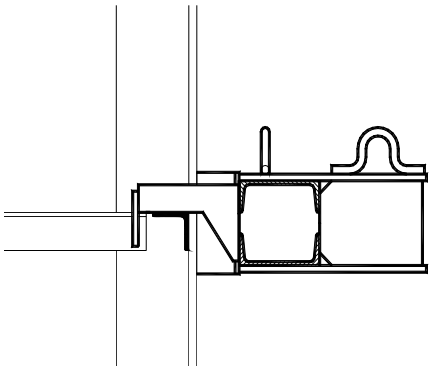


图 1.8-5

Figure 1.8-5

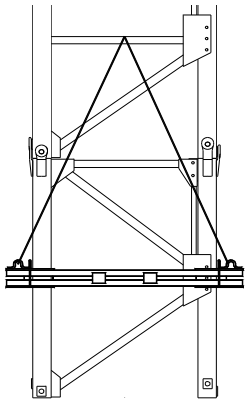


图 1.8-6

Figure 1.8-6

c) 吊起一侧梁 9 至塔身侧面，用两根双锥头销轴将侧梁与前梁相联接, 吊起另一侧梁安装到塔身另一侧。

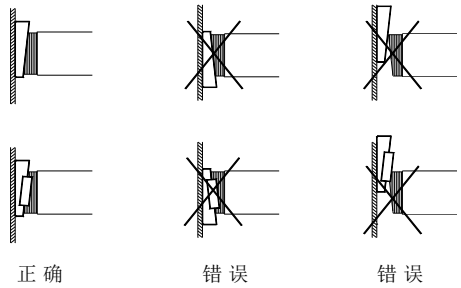
c) Hoist a side beam 9 to the side of the tower body and connect the side beam with the front beam by two double-cone pins; hoist another side beam to the another side of the tower body.

d) 吊起后梁 11 至塔身与前梁相对一面，用 4 根双锥头销轴将后梁与两侧梁相联接。

d) Hoist a back beam 11 to the side where the tower body is opposite to the front beam and connect the two side beams with the back beam by four double cone pins.

e) 将垫板 6 插入卡箍 8 内，用铅丝临时固定好。此时要注意楔块安装时的方向，不要装反， 如图 1.8-7 所示；吊起卡箍 8 至塔身内侧，用两根双锥头销轴将其与框架相联接；用相同方法安装其它卡箍，注意要使有斜撑杆安装耳板的两卡箍安装在塔身对角上。吊起斜撑杆至塔身内，用两根双锥头销轴将其安装在两卡箍上，如图 1.8-4 所示。

e) Insert the base plate 6 into the clamp 8 and fix temporarily with lead wires. At this time, pay attention to the mounting direction of the wedge shown in Figure 1.8-7 and no inverted installation is allowed; hoist a clamp 8 to the inner side of the tower body and connect it with the frame by two double cone pins; use the same method to mount other clamps, note that the two clamps with slanting strut rod mounting ear-plate shall be mounted to opposite angles of the tower body. Hoist a slanting strut rod into the tower body and mount it to two clamps with two double cone pins, see Figure 1.8-4.



Right Wrong Wrong

图 1.8-7

Figure 1.8-7

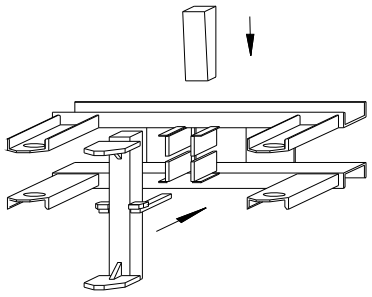


图 1.8-8

Figure 1.8-8

f) 调整好附着框架水平位置，在附着框架与塔身主角钢之间放入外框楔块，轻轻敲紧，在卡箍内垫板与塔身主角钢之间放入卡箍楔块，轻轻敲紧。楔块的安装方向见图 1.8-8 所示。

f) Adjust the horizontal position of the anchoring frame and put the frame wedge between the frame and the main angle steel of tower body, knock lightly to tighten it; put the clamp wedge between the inner base plate of clamp and the main angle steel of tower body and knock lightly to tighten it. See Figure 1.8-8 for mounting direction of the wedge.

g) 检查框架与塔身之间是否贴合紧密，将所有楔块打紧、打实。

g) Check whether the frame is attached closely to the tower body and knock all wedges tightly and solidly.

1.8.2.8 安装附着撑杆

1.8.2.8 Mount the anchoring strut rod

a) 在地面按计算长度调整好撑杆的长度，分别吊装至各自的位置，两端用双锥头销轴固定好。

a) Adjust the length of strut rods on ground according to the calculated length and hoist to corresponding positions respectively. Fix both ends of each rod with double cone pins.

b) 用经纬仪检查塔身垂直度，如果不符合要求可用撑杆上调整丝杠来调整，直到塔身侧向垂直度在千分之四以内。

b) Use the theodolite to check the tower body for verticality and adjust with the adjusting screw on strut rod if it fails to meet the requirements, until the lateral verticality for tower body is within 4‰.

c) 锁紧撑杆两端螺母。此项工作必须仔细认真，不能马虎从事。

c) Lock the nuts on both sides of the strut rod. This work must be done carefully.

附着后的塔机在正常工作中应经常检查附着撑杆两端锁紧螺母和建筑物上撑杆支座

固定螺栓的锁紧情况，如发现有松动现象要及时锁紧，以免事故发生。

After the tower crane is anchored, locking nuts on both sides of the anchoring strut rod and fixing bolts of the strut rod bearing on the building shall be regularly examined for locking during normal operation.

1.8.2.9 附着时安装应注意以下几点：

1.8.2.9 For the mounting during tower crane anchoring, pay attention to the following points:

a) 每道附着架的三根附着撑杆应尽量处于同一水平面上。但在安装附着框架和内撑杆时，若与标准节的某些部位干涉，可适当升高或降低内撑杆的安装高度；

a) The three anchoring strut rods of each frame shall be kept at the same horizontal plane. However, if they are interfered with some positions of the tower body during mounting of anchoring frames and inner strut rods, the height of rods may properly be raised or lowered.

b) 附着撑杆上允许搭设供人从建筑物通向塔机的跳板，但必须要做好防护措施，且严禁在跳板上堆放重物；

b) The walkway for personnel passage from the building to tower crane can be placed on the anchoring strut rod, but protective measures must be applied and no stockpiling of heavy objects on it.

c) 安装附着装置时，应当用经纬仪检查塔身轴线的垂直度。空载，风速不大于 3m/s 状态下，最高附着点以上轴心线侧向垂直度允差为 4/1000，最高附着点以下轴心线侧向垂直度允差为 2/1000，允许用调节附着撑杆的长度来达到；

c) During the mount of anchoring device, use the theodolite to check the axis of tower body for verticality. If the wind speed is not greater than 3m/s and the tower crane is without load, the tolerance for lateral verticality of the axis line above highest anchoring point is 4/1000; the tolerance for lateral verticality of the axis line below highest anchoring point is 2/1000. It is allowable to reach the tolerance by adjusting the length of anchoring strut rod.

d) 附着撑杆与附着框架，连接基座，以及附着框架与塔身、内撑杆的连接必须可靠。内撑杆应可靠地将塔身主弦杆预紧，各连接螺栓应紧固好。各调节螺栓调整好后，应将螺母可靠的拧紧。开口销应按规定充分张开，运行后应经常检查有否发生松动，并及时进行调整。

d) The connection of strut rods to anchoring frames, connecting base and anchoring frames to the tower body and inner strut rods shall be reliable. The inner strut rods shall be reliably pressed against the main chord rod of the tower body and all connection bolts shall be fastened. Adjusting bolts, when properly adjusted, shall be tightened by nut. Cotter pins shall be opened as specified. After operation they shall be frequently checked for looseness and

timely adjusted.

注意 **不论附着几次，只在最上面的一个附着框架内安装内撑杆，即新附着一次，内撑杆就要移到最新附着的框架内。**

Caution Regardless of the number of times of attached, at the last Tie frame, the four main axes should be firmly tied by the inner supporting bars.

1.9 投入使用前的工作

1.9 Needs before using

为了保证塔机能正确操纵，并在安全条件下运行。塔机投入使用前的工作主要是：对塔机部件的检查及调试各安全装置。

What needs before using tower crane are inspection to crane parts and testing safety device, which ensure the normal and safe function of tower crane.

1.9.1 部件检查

1.9.1 Parts inspection

为了检查架设的正确性和保证安全运转，应对塔机各部件进行系列试运转和检查。

To check the validity of erection and make sure safe function, conduct serial experimental work and test for parts of tower crane.

1.9.1.1 各部件之间的紧固联接状况检查；

1.9.1.1 Check for connection condition between parts.

1.9.1.2 检查支承平台及栏杆的安装情况；

1.9.1.2 Check the installation of bearing platform and rails.

1.9.1.3 检查钢丝绳穿绕是否正确，不能与塔机机构和结构件相摩擦；

1.9.1.3 Check whether steel rope is correctly rolled. No rub between rope and mechanism and structural parts is allowed.

1.9.1.4 检查电缆通行状况；

1.9.1.4 Check for the cable condition.

1.9.1.5 检查平衡臂配重的固定情况；

1.9.1.5 Check for the settlement of counterweight.

1.9.1.6 检查平台上有无杂物，防止塔机运转时杂物下坠伤人；

1.9.1.6 Check whether there are sundries on platform, avoiding hurting people by dropping sundries when tower crane is working.

1.9.1.7 检查各润滑面和润滑点。

1.9.1.7 Check lubrication surface and point.

1.9.2 安全装置调试

1.9.2 Debugging of safety device

塔机安全装置主要包括：行程限位器和载荷限制器。

Safety device of tower crane includes: distance stopper and load limiter.

行程限位器有：起升高度限位器、回转限位器、幅度限位器、行走限位器。

Distance stopper includes: lifting height stopper, slewing stopper and radius stopper and travelling stopper.

载荷限制器有：起重力矩限制器、起重量限制器。此外还包括风速仪。调试方法见第二篇第三章。塔机安全保护装置的安装位置如图 1.9-1 所示。

Load limiter includes: lifting moment limiter, load limiter, as well as anemograph. The debugging method is referring to chapter 2 and chapter 3. The installing positions of safety devices are shown in Figure 1.9-1.

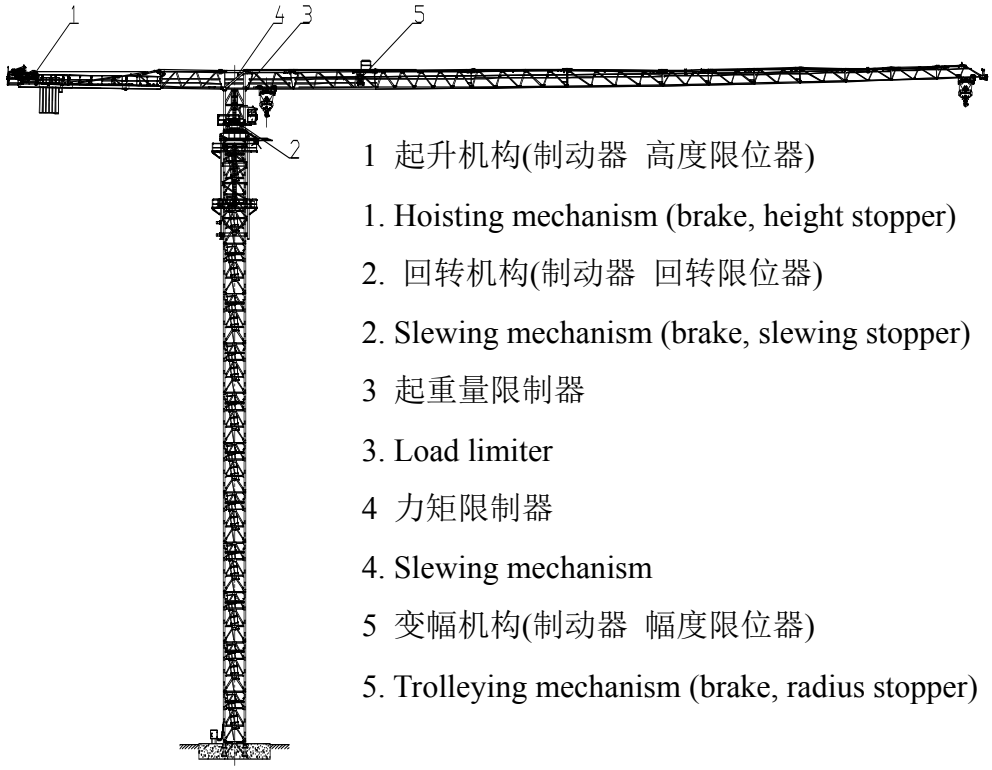


图 1.9-1 整机安全保护装置的安装位置

Figure 1.9-1 Installing positions of safety devices

1.9.3 立塔后检查项目（见表 1.9-2）

1.9.3 Inspection items after erection (see Table 1.9-2)

表 1.9-2

Table 1.9-2

检查项目 Item	检　查　内　容 Contents
基　础 Foundation	1.检查支腿和基础节连接销轴的情况 1. Check the connection pin connecting the jack with the basic mast. 2.检查输电线距塔机最大旋转部分的安全距离并检查电缆通过情况，以防损坏； 2. Check the safe distance of electricity wire from the max rotating range of tower crane, as well as the cable condition. Make sure no damage to cable;
塔　身 Tower body	检查塔身节连接销轴的情况 Check the connection pin of the tower mast.
套架 Climbing frame	1.检查与下支座的连接情况 1. Check the connection with lower support 2.检查各滚轮、活动爬爪、销轴连接各部件的转动或摆动是否灵活 2. Check whether pulleys, claws and parts connected by pins, run flexibly 3.检查走道，栏杆的紧固情况 3. Check whether aisle and rails are firm
上、下支座 司机室 Upper & lower support Cab	1.检查与回转支承连接的螺栓紧固情况 1. Check whether bolts connecting slewing bearing are firm 2.检查电缆的通行情况 2. Check the cable condition 3.检查平台、栏杆的紧固情况 3. Check whether platforms and rails are firm 4.检查与司机室的连接情况 4. Check connection with cab 5.司机室内严禁存放润滑油、油棉纱及其它易燃物品。 5. No inflammable article is allowed to be put in cab, such as lubrication oil, oil gauze and others.
起重臂 Jib	1.检查各处的连接销轴、垫圈、开口销安装的正确性 1. Check whether connecting pins, washers and cotter pins are mounted correctly 2.检查载重小车的安装运行情况，载人吊篮的紧固情况

	2. Check the installation and function of trolley, as well as whether the cage is firm 3.检查起升、变幅钢丝绳的缠绕及紧固情况 3. Check the rolling and firm condition of lifting and trolleying steel rope
平衡臂 Counter jib	1.检查平衡臂的固定情况 1. Check whether jib is mounted 2.检查平衡臂栏杆及走道的安装情况，保证走道无杂物 2. Check the installation of jib rails and aisle, ensuring there is no sundries in aisle
吊　具 Hook block	1.检查换倍率装置，吊钩的防脱绳装置是否安全、可靠 1. Check the fall-alteration device and whether anti-out rope device of hook is safe and reliable 2.检查吊钩有无影响使用的缺陷 2.Check whether hook has any defects influencing operation 3.检查起升、变幅钢丝绳的规格、型号应符合要求 3. Check whether the type and specification of lifting and trolleying rope meet the related requirements 4.检查钢丝绳的磨损情况及绳端固定情况 4. Check the attrition and fix condition of rope
机　构 Mechanism	1.检查各机构安装、运行情况 1. Check installation and function of each mechanism 2.各机构的制动器间隙调整合适 2. Adjust the distance between brakes appropriately 3.检查变幅机构，当载重小车分别运行到最小和最大幅度处，卷筒上钢丝绳至少应有 3 圈安全圈 3. Check the condition of trolleying mechanism. When trolley reaches at the max and mini radius, the rope on drum is at least 3 circles for safety 4.检查各钢丝绳绳头的压紧有无松动 4. Check whether there is any loose phenomenon of rope end
安全装置 Safety device	1.检查各安全保护装置是否按说明书的要求调整合格 1. Check each safety device is adjusted appropriately as requirements of Operation Instruction 2.检查塔机上所有扶梯、栏杆、休息平台的安装紧固情况 2. Check firm condition of all ladders, rails and platforms
润　滑	根据使用说明书检查润滑情况

Lubrication	Check the lubrication condition depending on the Operation Instruction.

1.9.4 塔机组装好后，先对机构及制动器、安全保护装置进行调整合适后（见有关章节）应一次进行下列实验（每转移一个工地都必须进行）

1.9.4 After finished assembling tower crane, firstly adjust mechanisms, brakes and safety device and then continue the next experiment (which is needed after moving to a new site).

1.9.4.1 空载试验

1.9.4.1 Empty-load test

各机构应分别进行数次全程范围内的运行，然后再做三次组合动作运行，运行过程不得发生任何异常现象，各机构制动器、操作系统、控制系统、联锁装置及各限位器应动作准确、可靠，否则应及时排除故障。

Each mechanism should be operated separately at all range and together three times later. No abnormal situation should be allowed to the tower crane during operating. All mechanisms should function well and precisely, including its brakes, operation and control system, interlock device as well as stoppers. If there is any breakdown, clear it instantly.

1.9.4.2 负荷试验

1.9.4.2 Load test

在最大幅度处分别吊对应额定起重量的 25%，50%，75%，100%进行试验。运行过程中不得发生任何异常现象，各机构制动器、力矩限制器、起重量限制器应动作准确、可靠，否则应及时排除故障。

Lift the weight of 25%, 50%, 75%, 100% of the rated load at the max radius, experimenting. All mechanisms should function well and precisely, including brakes, moment limiter and load limiter. If there is any breakdown, clear it instantly.

1.10 缆风绳的使用

1.10 Use of cable wind rope

塔机工作时，风力不得大于 6 级，如遇到大暴雨、雷电、浓雾等恶劣天气时，起重机应停止工作，如果天气预报有 12 级及以上的大风时，塔机要用缆风绳加固，并保证起重臂能够随风自由转动。

When tower crane is working, the wind speed should not be over 6-level. And tower crane should be stopped working when there is heavy rain, thunder and light, as well as heavy fog. And if weather forecast says there is going to have strong wind over 12-level, tower crane should be reinforced by cable wind rope.

第二章 拆　塔

Chapter II Tower Removal

2.1 拆卸注意事项：

2.1 Announcements:

2.1.1 塔机拆塔之前，顶升机构由于长期停止使用，应对各机构特别是顶升机构进行保养和试运转；

2.1.1 Before demounting, all mechanisms should be maintained and experimental run, especially jacking mechanism, because the jacking mechanism is out of use for a long time.

2.1.2 在试运转过程中，应有目的地对限位器、回转机构的制动器等进行可靠性检查；

2.1.2 During experimental running, check the reliability of position stoppers and brake of slewing mechanism on purpose.

2.1.3 **在塔机标准节已拆出，但下支座与塔身还没有用销轴连接好之前，严禁使用回转机构、变幅机构和起升机构；**

2.1.3 After masts of tower crane is removed, but before lower support and tower body has been connected by high-strength bolt, don’t use slewing mechanism, trolleying mechanism and hoisting mechanism.

2.1.4 塔机拆卸对顶升机构来说是重载连续作业，所以应对顶升机构的主要受力件经常检查；

2.1.4 Check the main stressed parts of jacking mechanism constantly, on account of that demounting tower crane equals to continuous loaded work for jacking mechanism.

2.1.5 顶升机构工作时，所有操作人员应集中精力观察各相对运动件的相对位置是否正常（如滚轮与主弦杆之间，套架与塔身之间），是否有阻碍套架运动（特别是下降运动时）的物件；

2.1.5 When jacking mechanism is working, all operators should pay high attention to whether the relative position of each moving part is right (such as, between pulley and main chord, between climbing frame and tower body), and whether there is article prevent the climbing frame action (especially when falling).

2.1.6 拆卸时最高处风速应低于 12m/s。由于拆卸塔机时，建筑物已建完，工作场地受限制，应注意工作程序和吊装堆放位置，不可马虎大意，否则容易发生人身安全事故。

2.1.6 When the wind speed of the highest point is less than 12m/s, you can start mounting tower crane. Since building construction is finished the demounting will be limited at space. Care for the demounting process and place to put the demounted parts, in case of any carelessness resulting in any accidents.

2.2 拆塔的具体程序

2.2 The detailed procedure of demounting

⚠ 警告

塔机拆卸是一项技术性很强的工作，尤其是塔身节、平衡重、平衡臂、起重臂等部件的拆卸，稍有疏忽，便会导致机毁人亡。因此用户在拆除这些部件时需严格按照本说明书的规定，严禁违反操作程序。上塔操作人员，必须是经过严格培训并经考试合格取得相关资质证书的专业操作人员。

⚠Warning

Demounting of tower crane has high demands to operators' skill, especially for demounting tower mast, counterweight, counter jib and jib and so on. Any negligence can result at serious consequence. So when demounting, users should do the process strictly as the Instruction. Any violation of the process is not allowed. And operators are needed to be trained and qualified.

将塔机旋转至拆卸区域，保证该区域无影响拆卸作业的任何障碍。如图 2.2-1 所示顺序，进行塔机拆卸。其步骤与立塔组装的步骤相反。拆塔具体程序如下：

Move tower crane to demounting area and make sure on obstacles in this area. The demounting order which is contrary to the mounting order is shown in Fig 2.2-1. The details are:

1) 降塔身标准节（如有附着装置，相应地也拆卸）；
1) Drop masts (drop adhesion device also, if it has);
2) 拆下平衡臂配重（保留 5.5t×1 的配重）；
2) Demount counterweight (leave one block of 5.5t×1);
3) 起重臂的拆卸（保留臂根节）；
3) Demount jib (Keep arms root section);
4) 拆卸 5.5t×1 的配重；
4) Demount one counterweight block of 5.5t×1;
5) 平衡臂的拆卸；
5) Demount counter jib;
6) 拆卸起重臂臂根节；

6) Remove the root section jib arm;

7) 拆卸塔顶；

7) Remove the tower top;

8) 拆卸司机室；（亦可待至与回转总成一起拆卸）

7) Demount cab; (or demount it together with slewing unit)

9) 拆卸回转总成；

8) Demount slewing unit;

10) 拆卸套架及塔身。

10) Demount climbing frame and tower body.

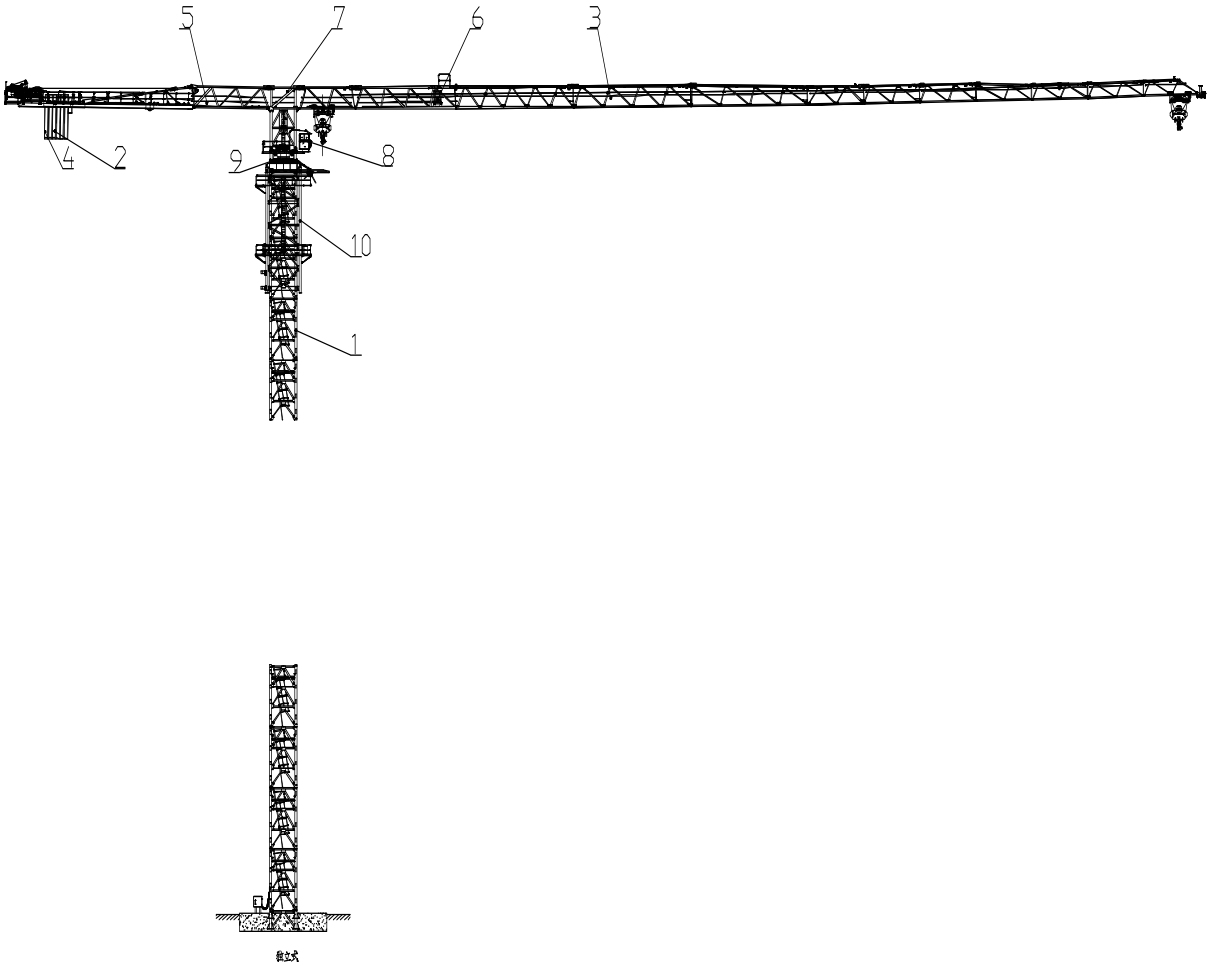


图 2.2-1 塔式起重机的拆卸
Fig 2.2-1 Tower crane dismantling

2.2.1 拆卸塔身

2.2.1 Dismantling tower body

2.2.1.1 将起重臂回转到引进方向（套架中有开口的一侧），使回转制动器处于制动状态，载重小车停在配平位置（与立塔顶升加节时载重小车的配平位置一致）；

2.2.1.1 Rotate jib to introduction direction (open side of climbing frame) to make slewing brake

at braking state. Trolley stops at balance position (same with the balance position when adding masts);

2.2.1.2 将套架的四个角用销轴锁定，拆掉最上面塔身标准节与特殊节的连接销轴，稍稍向上顶升，将单轨小车吊链安装固定在标准节吊装位置处，并保证安全可靠；然后拆掉最上面的塔身标准节与下一节标准节的连接销轴；

2.2.1.2 Lock four pin shafts for the corners of climbing frame and remove the connection pins of top mast and lower support. Jacking a little and set single-rail trolley chain at mast installing position and make sure it is safe and reliable. And then remove the connection pins of top mast and its next mast.

2.2.1.3 伸长顶升油缸，将顶升横梁顶在从上往下数第三个踏步的圆弧槽内，将上部结构顶起；

2.2.1.3 Stretch out jacking oil cylinder to the third step arc groove of jacking crossbeam numbered from top, supporting upper structure.

2.2.1.4 移动单轨小车， 将最上一节标准节沿引进梁移出；

2.2.1.4 Start the single-rail trolley to move the top mast out along with introduction beam.

2.2.1.5 扳开挂靴，回缩油缸，**继续下降至挂靴支承在套架横梁上并支承住上部结构后，再回缩油缸，**至下一标准节与特殊节相接触时为止；；

2.2.1.5 Open the suspending boot and get back the oil cylinder. Continue lowering the boot until the boot is on climbing frame beam and can bear the upper structure. Withdraw oil cylinder again so that the next mast is link to lower support.

2.2.1.6 特殊节与塔身标准节之间用销轴连接好后，用小车吊钩将标准节吊至地面。

2.2.1.6 Connect lower support with masts well. After that, suspend mast to the ground by trolley hook.

2.2.1.7 重复上述动作，将塔身标准节依次拆下。

2.2.1.7 Repeat above operations and demount tower masts in order.

塔身拆卸至安装高度后，若要继续拆塔，必须先拆卸平衡臂上的平衡重。

Demount tower mast to the installing height and if you want to continue demounting, demount counterweights on counter jib first.

⚠ 警告

套架的下落过程中，需用人工翻转挂靴，同时派专人看管顶升横梁和导轮，观察套架下降时有无被障碍物卡住的现象。以便套架能顺利下降。

Warning

During climbing frame falling, it is required to overturn claw manually. Meanwhile to make sure the successful falling of climbing frame, someone are specially needed to take care the jacking crossbeam and guiding pulley observing whether is blocked or not.

2.2.2 拆卸平衡臂配重

2.2.2 Dismantling of counterweight

2.2.2.1 将载重小车固定在起重臂根部，借助辅助吊车拆卸配重；

2.2.2.1 Fasten trolley at the root of jib and dismantle counterweight with the help of auxiliary crane.

2.2.2.2 按装配重的相反顺序，将各块配重依次卸下。仅留下 4.9t×1 的配重块。

2.2.2.2 Dismantle counterweight in the reverse order of assembling. Just leave one block of 4.9t×1.

2.2.3 起重臂的拆卸

2.2.3 Dismantling of jib

2.2.3.1 放下吊钩至地面，拆除起重钢丝绳与起重臂前端上的防扭装置连接，开动起升机构，回收全部钢丝绳；

2.2.3.1 Drop hook to the ground and disconnect the lifting rope and anti-twist device at the front of jib. Start hoisting mechanism and move back steel rope.

2.2.3.2 根据安装时的吊点位置挂绳；

2.2.3.2 Hang rope depending on the lifting point.

2.2.3.3 轻轻提起起重臂，慢慢启动起升机构，拆掉起重臂与臂根的连接销；

2.2.3.3 Lightly lift the jib, slowly start the hoisting mechanism, and remove a connection pin between the job and root.

2.2.3.4 放下起重臂，并搁在垫有枕木的支座上。

2.2.3.4 Drop jib and place it on bracket with sleeper under it.

2.2.4 平衡臂的拆卸

2.2.4 Dismantling of counter jib

将 4.9t×1 配重块全部吊下，然后通过平衡臂上的四个安装吊耳吊起平衡臂，使平衡臂拉杆处于放松状态，拆下拉杆连接销轴。然后拆掉平衡臂与上支座的连接销，将平衡臂平稳放至地面上。

Drop all blocks of counterweight. Suspend up the counter jib through four installing lugs on

counter jib to make counter jib drag rods at natural state. And then remove the connection pin shafts of drag rods. Remove connection pins of counter jib and upper support and place counter jib firmly on the ground.

2.2.5 起重臂臂根的拆卸

2.2.5 Remove the root section jib arm

轻轻提起起重臂，拆掉起重臂与塔顶的连接螺栓；

Lightly lift the jib and remove a connecting bolt between a job and a tower top.

2.2.6 拆卸塔顶

2.2.6 Remove the tower top.

2.2.7 拆卸司机室

2.2.7 Demount cab

2.2.8 拆卸回转总成

2.2.8 Dismantling of slewing unit

拆掉下支座与塔身的连接销轴，伸长顶升油缸，将顶升横梁轴销落入踏步的圆弧槽内，拆掉下支座与套架的连接销轴，回缩顶升油缸，将套架的爬爪支承在塔身上，再用吊索将回转总成吊起卸下。

Dismantle connecting bolts of lower support and tower body and extend jacking cylinder. Drop crossbeam pins in arc groove of step. Demount connecting bolts of lower support and climbing frame and move back cylinder. Support claws of climbing frame on tower body and then lift slewing unit by hanging cable and put it down.

2.2.9 拆走套架及塔身标准节

2.2.9 Dismantling of climbing frame and tower mast

2.2.9.1 吊起套架，缓缓地沿标准节主弦杆吊出，放至地面。

2.2.9.1 Lift climbing frame and get out mast main chord slowly and put it on the ground.

2.2.9.2 依次吊下各节标准节。

2.2.9.2 Lift down each mast in order.

2.2.10 附着式塔机的拆卸

2.2.10 Demounting attached tower crane

⚠ 警告

拆卸附着装置前必须先降低塔身，只有当塔身下降至套架下端与最高附着装置之间为最小安全距离时，并保证在此道附着装置之下的附着装置处于夹紧有效状态，才能拆卸该

道附着装置。

Warning

Before demounting adhesion device lower tower body first. Only when tower body is lowered until the distance between bottom of climbing frame and the highest adhesion device is safe and at this point the adhesion device is effective, is demounting operation allowed.

2.3 塔机拆散后的注意事项

2.3 Announcements

2.3.1 塔机拆散后由工程技术人员和专业维修人员进行检查。

2.3.1 After demounted, the tower crane should be checked by technology person and professional serviceman.

2.3.2 对主要受力的结构件应检查金属疲劳，焊缝裂纹，结构变形等情况，检查塔机各零部件是否有损坏或碰伤等。

2.3.2 Check the condition of the main stressed parts, such as fatigue of mental, flaws of welding joint, or deformation. Check whether each part of tower crane is damaged or not.

2.3.3 检查完毕后，对缺陷、隐患进行修复后，再进行防锈、刷漆处理。

2.3.3 After inspection, recover the defects and then do the treatment of rust prevention and painting.

第三章 包装、运输、贮存

Chapter III Packaging, Transportation and Storage

3.1 包装

3.1 Packaging

3.1.1 塔机及其零部件的包装应符合 JG/T 5012 的规定。

3.1.1 The tower crane and its components shall be packed in accordance with JG/T 5012.

3.1.2 装箱单应与实物相符，装箱单内容应包括产品制造编号、箱号、箱内零部件名称与数量、重量、连接件使用部位、发货日期、检验员签字等。

3.1.2 The packing list shall shows the item identical with the physical object, indicating the product manufacturing series number, packing box number as well as description, quantity, and weight of the components in the box. Also, the packing list shall indicate the installing position of the intermediate parts, date of shipment, signature of inspector, etc.

3.1.3 零部件应有识别标志，如标牌、标签等。标牌、标签应牢固清晰。

3.1.3 The components and parts shall be attached with identification mark such as caution plate, label, etc. The caution plates and labels shall be secure and legible.

3.2 运输

3.2 Transportation

3.2.1 塔机的运输应符合当地铁路、公路的规定；

3.2.1 The tower crane shall be transported in compliance with local regulations on transportation by railway and road.

3.2.2 整体拖运还应满足：

3.2.2 The one-piece tower crane shall be transported in accordance with the following requirements:

a）拖运装置应设有制动、转向装置，并符合通用牵引车辆的要求；

a) The carrier shall be provided with braking and steering device, meeting the requirements of general towing vehicles.

b）塔机回转部分应锁止，防止机构损坏；

b) The slewing parts of the tower crane shall be locked to prevent damage to the mechanism.

c）最大轴荷应符合道路桥梁限载要求；

c) The maximum axle load shall meet the requirements of the limit load on the roads and bridges involved.

3.3 贮存

3.3 Storage

3.3.1 塔机贮存时应采取措施防止结构变形；长期贮存时弹簧、油缸等均要卸去载荷；

3.3.1 For storage of the tower crane, measures shall be taken to prevent the structures from being deformed. The spring and oil cylinder will be unloaded for long-term storage.

3.3.2 长期贮存时，应定期清理、涂漆；裸露的装配面应采取有效的防腐措施，电气系统、塑料零件、橡胶制品应避免日光直晒和油污以防止过早老化。

3.3.2 For storage for a long time, the tower crane shall be periodically cleaned out and painted. The exposed assembling face shall be effectively protected from corrosion. The electrical system, plastic parts and rubber products shall be kept away from the direct sunlight and from oil and dirt, preventing them from being aged too early.

3.3.3 长期贮存后，启用时应进行全面检查；

3.3.3 The tower crane shall be thoroughly inspected immediately before it is re-put into service after stored for a long time.

3.3.4 塔机贮存时应保存有详细档案，贮存期间的所有变动情况均应详细记入档案；

3.3.4 The tower crane shall have detailed archive for storage. All the changes during storage shall be recorded and filed.

第二篇　　塔机的使用与维护
Part 2 Tower crane operation and maintenance

第一章　　塔机安全操纵规程

Chapter Ⅰ Tower crane safety operation regulation

1.1 司机与起重工

1.1 Cab driver and operator

1.1.1 必须严格执行 ISO 12480-3:2005《起重机 安全使用》的有关规定，司机与起重工必须是按当地劳动人事部门有关规定并经过严格培训并经考试合格取得相关资质证书的专业操作人员；

1.1.1 Operate tower crane strictly according to the regulation of ISO 12480-3:2005 *Safe Operation of Tower Crane*, besides, the drivers and operators should take the exam and get the certificate of related Labor and ministry of personnel.

1.1.2 司机必须了解所操作塔机的工作原理，熟悉该塔机的构造及安全装置的功用及其调整方法，掌握该起重机各项性能的操作方法以及该起重机的维修保养技术；

1.1.2 Drivers should be familiar with the working principles, structure, operation and maintenance methods of tower crane, as well as functions and adjustment methods of safety

1.1.3 严格按照本说明书提供的起重特性表操作，严禁超载运行；

1.1.3 Operate tower crane strictly in accordance with the lifting operation characteristics table provided in the instructions. Overloading operation is forbidden;

1.1.4 起升机构、回转机构、变幅机构的操作动作要柔和，应严格按档位间隔逐档操作，不得将操作手柄从静止（或低速）猛地向中速或高速位置推进；

1.1.4 hoisting mechanism, slewing mechanism, trolleying mechanism operating actions should be moved softly, and gradually converted from low to high speed, not from the motionless (or slow) advance directly to the medium or high speed position;

1.1.5 不准斜拉斜吊物品，不准抽吊交错挤压的物品，不准起吊埋在土里或冻粘在地上的物品；

1.1.5 Obliquely hanging items is not allowed, and not allowed to hanging staggered squeezing,

as well as items buried in the earth or frozen items stuck on the ground;

1.1.6 有物品悬挂在空中时，司机与起重工不得离开工作岗位；

1.1.6 When there are items hanging in the air, driver and rigger cannot leave their operating post;

1.1.7 指挥的信号、手势、旗号应符合 GB/T5082-1985 规定；

1.1.7 Command signals, gestures, flag shall comply with the provisions of GB5082-1985;

1.1.8 司机必须认真做好起重机的使用、维修、保养和交接班的记录工作；

1.1.8 Drivers must earnestly record crane use, repair, maintenance and shift work;

1.1.9 严禁司机疲劳、酒后上塔操作，

1.1.9 No driver fatigue, operation after drinking on the tower.

1.2 塔机安装人员

1.2 Tower crane installation personnel

1.2.1 塔机安装人员负责根据制造商提供的使用说明书安装塔机。

1.2.1 Responsibility of installation personnel: install tower cranes according to the installation and operation manual.

1.2.2 塔机安装人员应符合以下条件:

1.2.2 The installation personnel must satisfy the following conditions:

a) 具有资格证书;

a) Holing qualification certificates.

b) 年龄大于 18 周岁;

b) Over 18 years old.

c) 适应该项工作，特别是视力、听力、灵活性和反应能力;

c) Suitable for this work, especially in terms of the eyesight, hearing, flexibility and reaction.

d) 具备安全搬运重物，包括安装塔机的体力;

d) Physical strength to safely transport heavy objects, including the physical strength to install tower cranes.

e) 能够登高作业;

e) Being able to work at height.

f) 具有估计载荷质量、平衡载荷及判断距离、高度和净空的能力;

f) Being capable of estimating the load mass, balancing the load and determining the distance, height and clearance.

g) 经过吊装及信号技术的培训;

g) Having received trainings on hoisting operation and signaling technology.

h) 具有根据载荷的情况选择吊具和附件的能力;

h) Being able to select lifting equipment and accessories according to the loading capacity.

i) 在塔机安装、拆卸以及所安装类型塔机的操作方面经过全面培训;

i) Having received comprehensive trainings on tower crane installation, disassembly and operation of installed cranes.

j) 在所安装类型塔机的安全装置的安装和调试方面经过全面培训;

j) Having received comprehensive trainings on the installation and commission of safety devices for installed cranes.

k) 完全熟悉并掌握制造商使用说明书中相关章节的要求;

k) Being completely familiar with and mastering the requirements described in related chapters and sections of the installation and operation manual.

l) 能熟练并正确使用所有个人安全防护装备。

l) Being able to skillfully and correctly use all the personal safety protective equipment.

1.3 塔机安装主管

1.3 Installation supervisor:

1.3.1 塔机安装主管在塔机的整个安装/拆卸、爬升过程中不应离开现场。塔机安装主管除具有塔机安装人员的职责外还具有以下职责:

1.3.1 The installation supervisor needs to be present throughout the entire process of the installation, disassembly and lifting of the tower crane. Besides the responsibilities as an installation person, the responsibilities of supervisor are:

a) 管理所有安装人员和在安装/拆卸过程中可能用到的相关辅助起重设备的操作人员。

a) Managing all the installation personnel and operating personnel of relevant auxiliary lifting equipment which may be used during the installation, disassembly and lifting of the tower crane.

b) 提供保证塔机按塔机安装工作计划运行的技术措施。

b) Providing technical measures (i.e., installation scheme) to ensure that the crane can work according to the installation plan.

c) 保证塔机的附属设施与安装报告完全一致。

c) Make sure that the ancillary facilities are exactly consistent with the installation report.

d) 查证所有安装人员都配备有必要的工具和个人安全保护设备。

d) Checking to make sure that all installation personnel are provided with necessary tools and personal safety protective devices.

e) 保证通道设备随安装过程的正确安装，以便于安装人员使用。尤其要注意:

e) Ensuring the proper installation of the channel devices in accordance with the progress of installation, so as to meet the requirements of the installation personnel. Especially pay attention to:

——梯子连接螺栓;

---Connection bolt of ladder

——扶手，尤其是休息平台和检查平台的扶手;

---Handrail, especially on resting and maintenance platforms

——从地面到最低的梯子的下端或塔机底架的通道;

---From the ground to the bottom of the lowest ladder or passage of base frame

——从建筑物到塔机的通道。

---Passage from building to tower crane

1.3.2 塔机安装主管除满足塔机安装人员的要求外还应满足以下条件:

1.3.2 In addition to meeting the requirements for installation personnel, the installation supervisor shall also satisfy the following requirements:

a) 有 5 年以上塔机或类似设备的安装与拆卸工作经验并接受过安装主管方面的培训;

a) Having over 5 years of working experience in mounting and dismounting tower cranes and equivalent equipment, and having received relevant trainings on being an installation supervisor.

b) 熟悉并拥有该塔机的用户手册;

b) Knowing well about and having the installation and operation manual of this tower crane.

c) 接受过对塔机安装拆卸人员进行管理的培训;

c) Having received trainings on how to manage the personnel responsible for mounting and dismounting tower cranes.

d) 能证实安装过程中使用设备的适用性。

d) Being capable of verifying the applicability of equipment to be used during installation.

1.4 机械部分及其它

1.4 Mechanical parts and others

1.4.1 起重机的工作环境温度为-20℃~+40℃，最高处工作风力应小于 20m/s；

1.4.1 The normal temperature range of crane working is –20℃~+40℃, and wind velocity is below 20m/s.

1.4.2 所有安全保护装置，必须随时保养、严禁任意扳动和拆卸，严禁超负荷使用；

1.4.2 All safety devices must be maintained at all times, and disassembly and arbitrary flip is prohibited. No overload;

1.4.3 夜间作业，施工现场必须备有充分的照明设施；

1.4.3 The substantial lighting equipments are required at construction site besides the lighting facilities of crane itself when it is working at night.

1.4.4 塔机经过大修或转移后重新安装前注意事项：

1.4.4 Announcements for reinstalling tower after overhaul or transferred:

1.4.4.1 严格认真检查各联接处各铰接头，销轴有无裂纹、锈蚀、损伤；

1.4.4.1 Carefully exam each joint of the hinge, and whether there is cracks, corrosion, damage of pin;

1.4.4.2 检查拉杆、钢丝绳、滑轮、吊钩及换倍率器等重要零件是否符合使用条件；

1.4.4.2 Check the rod, wire rope, pulleys, hooks fall-alteration device and other important parts for conditions of use;

1.4.4.3 检查金属结构有无变形，焊缝有无开裂等情况；

1.4.4.3 Check the metal structural deformation, welds which shall comply with the commissioning to normal;

1.4.4.4 对起升、顶升、回转、变幅应进行试运转至正常；

1.4.4.4 Commissioning mechanisms of hoisting, lifting, slewing, luffing, which should be carried out until it is normal;

1.4.5 停机修理或维护保养时，必须切断总电源，指派专人看护，或挂上“正在维修，禁止合闸”的指示牌；

1.4.5 You must cut off the power at downtime when repairs or maintenance, and not working with electricity;

1.4.6 地面、楼台、施工面要设专人指挥塔机作业，与司机联络，必须规定严格的信号或手势，旗号等，最好采用步话机联络；

1.4.6 It needs to have special person responsible for ground, tower, tower construction surface, and for contacting with the driver. Strict signals or gestures must be set, as well as flags, etc., preferably using a walkie-talkie contact;

1.4.7 应保证塔机的使用电压在 380V±10%的范围时，否则塔机的电气设施容易损坏；

1.4.7 The use voltage of tower crane shall be ensured at the range of 380 ± 10%, otherwise the tower crane electrical facilities are easily damaged;

1.4.8 在遇大雷雨，暴雨，浓雾或塔机最高处风速超过 20m/s 时一律停止起重作业；

1.4.8 In the case of a thunderstorm, heavy rain, fog or wind speed of tower crane highest point exceeds 20m / s, stop all lifting operations;

1.4.9 多台塔机同时进行一个施工现场时，塔机的平面布置要合理，相互之间不得空间交错和发生干涉；

1.4.9 When multiple tower cranes are simultaneously working in one construction site, the layout should be reasonable, so that tower cranes may not be interleaved with each other and interfere in space;

1.4.10 司机在接通地面电源后，登上塔机进入司机室内应首先全面检查按钮操作手柄等是否处于非工作状态，确认无误后方可启动总按钮；

1.4.10 Drivers should switch on the ground power, and after boarding into cab should fully check handles and buttons whether in working state or not. Make sure the total are confirmed before start button and correct;

1.4.11 司机必须严格按照本塔机技术性能表或起重特性曲线图的规定作业，不得超载或强行作业；

1.4.11 Drivers must be strictly in accordance with the technical performance table and operating lifting characteristic curve of tower crane. Don’t overload or force to work tower crane;

1.4.12 操作时避免起重吊钩着地，以免引起卷筒钢丝绳排列不齐而遭损坏，如果吊钩必须着地，则吊钩着地后再次起升时，必须注意监视卷筒钢丝绳排列情况，必要时须重新将钢丝绳排列整齐；

1.4.12 Avoid putting lifting hook on the ground when operating, preventing it from damaging for roll rope mal-alignment. In case the lifting hook have to be grounded, thus when the hook is hoisted, pay attention to the arrangement of rope reel. When necessary, re-arrange the rope;

1.4.13 紧固在载重小车侧面的吊篮是供维修使用的，当需要维修起重臂上的某一些零件时，维修人员可站在吊篮内随载重小车一起执行维修任务，吊篮的额定承载重量为 100kg，当起吊重物时，吊篮内严禁站人。在每次立塔时，地面安装起重臂时，要仔细检查吊篮与载重小车的连接是否完善可靠；

1.4.13 The cage beside trolley is used for maintenance. When repairing some parts on jib, maintenance personnel can take trolley to perform maintenance tasks. The rated load capacity of cage is 100 kg. When lifting objects, no person is allowed standing in cage. At each erection,

when assembling jib on the ground, carefully check whether cage and trolley connections are perfect and reliable;

1.4.14 司机室限载 260kg，禁止存放润滑油、油棉纱及其它易燃、易爆物。

1.4.14 Cab load limit is 260kg. Prohibit the storage of oil, oil cotton yarn and other flammable and explosive materials.

1.4.15 各机构需要反向运行时，必须待电机正转停止后，再启动反转，反之也一样；

1.4.15 mechanisms need to reverse running, must wait until the motor is stopped after the turn, and then start reversing, and vice versa;

1.4.16 发现塔机有异常现象时，应停机切断电源，待查清并排除故障后再使用；

1.4.16 When the tower crane has abnormality, cut off the power supply and shut down the machine, and identify and troubleshoot before use;

1.4.17 塔机司机在每班作业完毕后，必须将起重臂转到与建筑物平行的方向，载重小车应停在起重臂根部位置，吊钩升高至距离小车约 2 米的高度，回转制动器处于松开状态，切断总电源后方可离去；

1.4.17 After each work shift completes, the boom must be parallel to the direction of the building. The trolley should be stopped at jib root. Hook rises to exceed trolley about 2m. Make brake at post-release state and cut off the mains before leaving;

1.4.18 每班作业前，司机必须对塔身、起重臂、回转支承、起重臂拉杆，平衡臂拉杆、卷筒联接螺栓，刹车制动器及换倍率等主要关键部位的销轴、螺栓等进行日常检查、紧固，确定无松动或脱离现象才允许开机作业；

1.4.18 Before crane starts working, the driver is required to check whether all components and parts are in good condition or not, especially the steel ropes, joint bolts and connecting pins, of tower body, jib, slewing bearing, rigid drag rod of jib, drag rod of counter jib and drum, as well as brakes and fall-alteration device. Make sure there is no loose or divorce.

1.4.19 司机对减速机、滑轮、轴承座等处要按规定日常保养加油，如发现有漏油现象，要及时处理；

1.4.19 Drivers is required to do the routine fueling and maintenance for reducer, pulley, bearing seat and fall-alteration device, etc. according to the provisions. If there is leakage, deal with it

1.4.20 司机在正式作业前，必须逐项检查各安全装置的可靠性，绝不允许在安全装置不可靠失灵的情况下勉强作业；

Warning

1.4.20 Before the formal job, driver must check the reliability of each safety devices. It is not allowed to operate in the case of the safety devices are failed or not reliable;

1.4.21 司机操作起升机构时，对于不同档位速度，有最大起重量的限制，具体参照表 1.2-1。如用 4 倍率以高速 5 档提升大于 8.75t 的载荷时，起重量限制器限高速微动开关动作，高速 5 档将不能运行，其将自动切换到高速 4 档档位上；用 4 倍率以高速 4 档提升大于 18.75t 的载荷时，起重量限制器限高速微动开关动作，高速 4 档将不能运行，其将自动切换到中速 3 档档位上

1.4.21 When the driver operates the hoisting mechanism, there are limitations of maximum weight for speeds at different gear. For details, see table 1.2-1. If a load of more than 8.75 t is born with 4-magnification at gear 5, the micro switch of the lifting weight limiter acts. Then high speed at gear 5 cannot be operated and is automatically lifted to gear 4. If a load of more than 18.75 t is born with 4-magnification at gear 4, the micro switch of the lifting weight limiter acts. Then high speed at gear 4 cannot be operated and is automatically lifted to gear 3.

表 1.2-1

Table 1.2-1

速　度 Speed / 倍　率 Magnification	低中速 1-3 档 Low and medium gears 1-3	高速 4 档 High speed gear 4	高 速 5 档 High speed gear 5
4 倍率 4 magnification	25 t	18.75 t	8.75 t
2 倍率 2 magnification	12.5 t	9.37 t	4.37 t

注意

Caution

关于塔机的操作：

About the operation of tower cranes:

在 4 倍率时，中速 3 档为最大起重量 25t 的额定运行速度，高速 4 档为最大起重量 18.75t 的额定运行速度，高速 5 档为起重量 8.75t 以内载荷的最高运行速度。塔机司机在操作塔机时，1 档和 2 档用于慢就位，3 档为最大起重量的最大速度运行档位，4 档用于重负载（小于 18.75t）的额定运行，5 档用于轻负载（小于 8.75t）的额定运行。

At 4-magnification, the medium speed at gear 3 is a rated running speed with a maximum lifting weight of 25 t, the high speed at gear 4 is a rated running speed with a maximum lifting weight of 18.75 t. When a tower crane is operated by a driver, gears 1 and 2 are used for slow place taking, gear 3 is an operating gear of a maximum running speed for a maximum weight, gear 4 is used for rated operating for heavy load, and gear 5 is used for rated running for light load (less than 8.75 t).

当 2 倍率时以上载荷减半运行。

The above loads will be halved for operation when 2-fall is adopted.

1.4.22 每月须对塔顶与回转塔身进行检查，特别需对其连接耳板及附近的母材进行检查。

1.4.22 Check tower top and slewing mast and its connection lug plate and parent material nearby each month.

1.4.23 每三个月须对起重臂上弦杆的连接耳板及附近的母材、焊缝和下弦杆的接头及附近的母材、焊缝进行检查。

1.4.23 Each three months check connection lug plate of upper boom and parent material nearby, as well as joint of lower boom and its parent material.

1.4.24 每次顶升加节或降塔减节时，须对塔身节的踏步及液压顶升系统的顶升横梁进行检查。

1.4.24 Check steps of tower body mast and jacking crossbeams of hydraulic jacking system each time when adding or decreasing a tower mast.

1.4.25 未安装附着框的塔机特别需要对基础以上三节塔身进行检查，安装附着框的塔机特别需要对最上一道附着框附近的上两节和下一节塔身进行检查；

1.4.25 For the tower crane without attached frame, check the three tower sections beyond foundation, while for the one with attached frame, and it especially needs to check the upper two masts and one lower mast of last attached frame.

1.5 高强度螺栓的使用和检查

1.5 Use and inspection of high-strength bolts

1.5.1 高强度螺栓安装前的准备

1.5.1 Preparation before installation of high strength bolts

回转总成的高强度连接螺栓使用前必须检查，检查时须用煤油等清洗剂对螺栓、螺母

和垫圈清洗干净。破损和任何可疑的破损（包括螺杆和螺纹部分锈蚀）都不能使用。

Before using, the high-strength bolts of slewing unit must be checked. Clean bolts, nuts and washers with kerosene and other cleaning agents. If there is any breakage or suspicious damage (including the threaded portion of the screw and corrosion), it cannot be used.

每次安装前螺栓、螺母和垫圈必须用 MoS_2 润滑脂涂裹，特别是结合面，以达到均衡摩擦的目的。

Bolts, nuts and washers must be wrapped with MoS2 grease paint before installation each time, especially the conjunction surface, in order to achieve a balanced friction.

1.5.2 高强度螺栓的拧紧

1.5.2 Tightening high strength bolts

高强度螺栓的双螺母须达到预紧力矩，其中防松螺母力矩应稍大于预紧力矩。

Double nut of high strength bolt is required to achieve tightening torque, and locknut torque should be slightly larger than the tightening torque.

1.5.3 安装后的检查

1.5.3 Inspection after installation

塔机立塔后应按下列规定对螺栓进行检查，先一周二次，再一周一次，两周一次然后一月一次；每年内拆下 2～3 组螺栓检查其变形、腐蚀等情况。

After erection of tower crane, bolts shall be checked, as following provisions. Firstly do the inspection twice one week and then once a week, once every two weeks and then once a month. Remove 2 to 3 groups of bolts in a year to check its deformation, corrosion and so on.

1.5.4 重复使用

1.5.4 Reuse

高强度螺栓不应重复使用，即重新立塔时，应更换新螺栓。若旧高强度螺栓重复使用，使用前须经有资质单位检测并出具合格证明。

High strength bolts should not be reused. When re-erecting the tower, they should be replaced with new bolts. If the old high strength bolts is reused, a qualified certificate by qualified unit is required.

1.6 钢丝绳的检查

1.6 Rope inspection

1.6.1 起重机械中的钢丝绳是易损件，缺乏维护是钢丝绳寿命短的主要原因之一。

1.6.1 Lifting rope is wear-prone parts. Lack of maintenance is one of the main reasons for short life.

1.6.2 对钢丝绳应进行适时地清洗并涂润滑油或润滑脂。

1.6.2 Rope should be cleaned and coated with oil or grease timely.

1.6.3 每个工作日都要尽可能对钢丝绳的任何可见部位进行观察，以便发现损坏与变形情况。应特别留心钢丝绳在机械上的固定部位，发现有任何明显变化时，应予报告并由主管人员按照《起重机 钢丝绳 保养、维护、安装、检验和报废》（ISO 4309:2004）中 2.4.2 款进行检验。

1.6.3 Check any visible part of the rope every working day for damage and deformation. Be careful about the fix position of rope on the mechanical parts. If there are significant changes found, you should report to the officer, and test in accordance with the *"Cranes-wire Rope care, Maintenance, Installation, Examination and Discard"* (ISO 4309:2004) in paragraph 2.4.2.

1.6.4 保证每周至少检验一次。

1.6.4 At least check once a week.

每日工作前和塔机工作时司机和地面工作人员应注意载重小车和吊钩的钢丝绳是否有跳绳现象，发现跳绳现象应立即停止工作，穿好钢丝绳再工作。

Drivers and ground staff should be aware of whether there is skipping rope phenomenon of trolley and hook before daily work, if there is, immediately stop working, and adjust rope, after that continue to work

1.7 紧急情况处理

1.7 Emergency Measures

1.7.1 司机操作位置处设置紧急停止按钮，在紧急情况下能方便切断塔机控制系统电源。紧急停止按钮应为红色非自动复位式。

1.7.1 There is an Emergency button at operation place, so the operator of tower crane is able to cut off the control power supply of tower crane at any emergency cases. And the emergency

button shall e the red non-automatic reset type.

1.7.2 遇到暴风侵袭时， 应停止工作，对塔机采取加固措施，如用缆绳加固塔身等；

1.7.2 When there is a storm, the operator should stop working and do some strengthening measures to tower crane, such as adding cables to tower crane.

1.7.3 触电事故的应急措施

1.7.3 Emergency measures for electric shock accident

塔机在架空线附近施工时，尽管采取了必要的预防措施，当发生触碰架空线时，可参考下面的程序处理：

Electric shock: despite necessary precautions taken, the following procedures still can be taken for reference to deal with electric shock accidents when the tower crane is operating near the overhead lines:

1) 操作者应保持冷静，不要惊慌。

1. Keep clam and do not panic.

2)操作者不要离开驾驶室，并且不要触碰金属物件，以防触电。

2. The operator shall not leave the cab, or touch any metal objects so as to prevent electric shock.

3)将塔机立即开出危险区。

3. Drive the tower crane immediately out of the dangerous zone.

4)立即告知周围的人远离塔机。

4. Immediately inform the people around to keep away from the crane;

5)立即报告主管人员，并与附近的电力部门取得联系，报告情况，尽快切断电源。

5. Immediately report to the supervisor, contact the electric power department nearby and report the conditions, in addition, cut off the power supply as soon as possible.

6)在确认接触电线断电前不要离开驾驶室。

6. Do not leave the cab before making sure that the contact wire is de-energized.

1.7.4 雷击和地震的安全预防措施

1.7.4 Safety precautions for lightning and thunder and earthquake

自然灾害的发生是不确定的，当我们在施工中发生自然灾害时，一定要冷静处理。

Natural disasters may occur at any time. We must keep calm when natural disasters occur during construction.

1)停止作业，将吊重物体放置地面。

1. Stop operating, and lower the lifting weights down to the ground.

2)切断所有电路。

2. De-energize all the circuits.

3)撤离到安全地方。

3. Evacuate to a safe place.

1.7.5 灾害防护措施及自救逃生方法

1.7.5 Protective measures as well as self-help and escape means

当塔机发生火灾时，操作人员应立即停止起重作业，迅速撤离现场。同时拨打所在地的火警电话，在救援人员到来之前并且不危及操作人员生命安全的前提下，可采用塔机自带灭火器先行实施自救。事故之后，再次使用塔机前，应仔细检查所有部件、仪器仪表、安全装置等是否工作正常。

Fire: in the event of a crane fire, the operator shall stop the lifting operation immediately and quickly evacuate from the site and at the same time call the local fire department. The operator can also use the fire extinguisher provided with the tower crane first for fire extinction before the arrival of rescue personnel and under the premise of not endangering the safety of the operator. The operator shall carefully check whether all the components, instruments and safety devices are working normally before operating the tower crane again after the accident.

第二章 机构及电气操作

Chapter Ⅱ Mechanisms and electrical operation

2.1 电气安装与使用

2.1 Electrical Installation and Use

2.1.1 电控系统准备工作

2.1.1 Preparation for an electronic control system

2.1.1.1 工地电源要求

2.1.1.1 Site power requirements

电控系统电源要求为 380V，50Hz。**注：**此处电源的电压要求是指塔机工作时的稳定电压为 380V。

The power of control system is required to be 380V and 50 Hz.

Note: The required voltage of power here refers to the stable voltage of 380V for tower crane working.

2.1.1.2 电气控制系统的组成

2.1.1.2 Composition of an electrical control system

电气控制系统是整个塔机的控制中心，它包含以下设备：

An electrical control system is the control center of the whole tower crane and it contains the following:

a) 左、右联动台；

a) Left and right linkage tables

b) 驾配箱、主控柜、行走柜（选配）；

b) Driving box, main control cabinet, and walking cabinet (optional);

c) 起升机构、回转机构、变幅机构、行走机构（选配）；

c) Hoisting mechanism, slewing mechanism, trolleying mechanism, and walking mechanism (optional);

d) 重量限制器、力矩限制器、起升限位器、回转限位器、变幅限位器、行走限位器（选配）等保护装置。

d) Weight limiter, moment limiter, lifting limit device, slewing limiter, elevating limiter, walking limiter (optional) and other protective devices.

2.1.1.3 电气控制系统的连接

2.1.1.3 Connections in an electrical control system

电控系统的连接示意图如下（具体详情请参照电气原理图电气连接图部分）

Connections in an electrical control system are shown in the following figure. For details, see the connections in an Electrical schematic diagram.

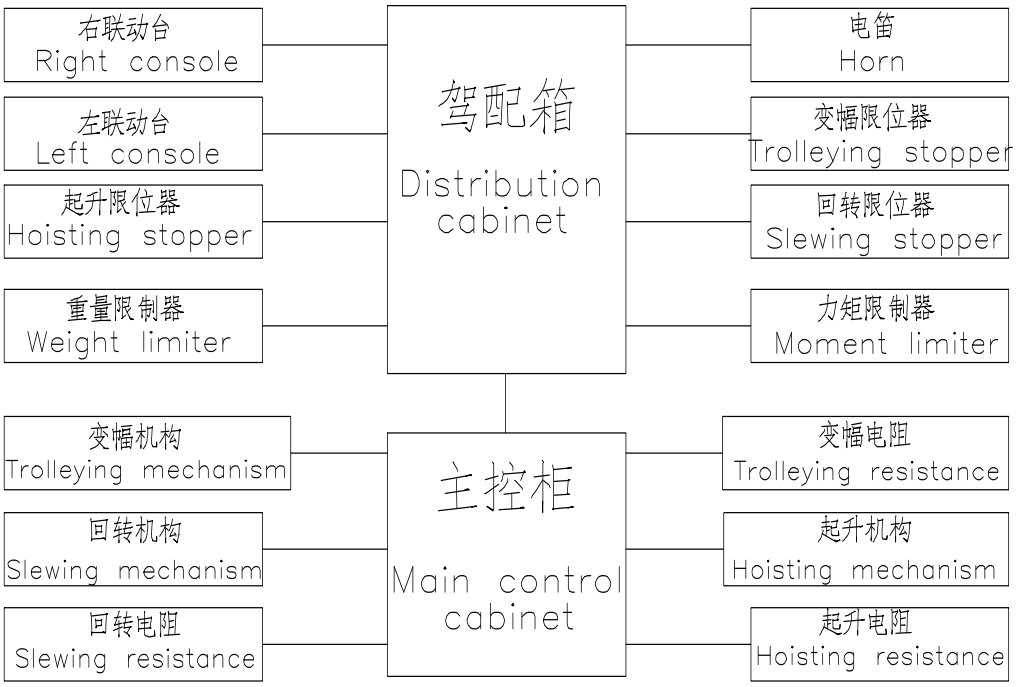


图 2.1-1 电控系统连接框图

Figure 2.1-1 Connection boxes in an electrical control system

2.1.2 电控系统使用方法

2.1.2 Using methods of an electrical control system

2.1.2.1 系统提示与报警信号

2.1.2.1 System prompt and alarm signal

驾驶员在操作本电控系统时应熟悉系统提供的以下各种报警信号：

A driver should be familiar with the following alarm signals provided by the system when operating the electronic control system:

1） 超力矩信号

1) Torque exceeding signals

当起重力矩超过最大允许值时，电控系统会作如下反应：

When the lifting torque exceeds the maximum allowable value, the electronic control system will react as follows:

a. 联动台上的红色“超力矩”报警灯闪烁。

a. A red "super torque" alarm light flashes on the linkage platform.

b. 联动台上的蜂鸣器发出连续的“嘀嘀嘀嘀”连续报警声。

b. A buzzer on a linkage platform sends a continuous "beep" alarm.

c. 主钩的上升运动被禁止。

c. The upward movement of the main hook is prohibited.

d. 小车的向外运动被禁止。

d. The outward movement of a car is prohibited.

解除方法：向内变幅。

Relieving method: elevating inwards

2） **超重量信号**

2) Excess weight signal

当起重量超过最大允许值时，电控系统会作如下反应：

When lifting weight exceeds the maximum allowable value, the electronic control system will react as follows:

a. 联动台上的红色“超重量”报警灯闪烁。

a. A red "super torque" alarm light flashes on the linkage platform.

b. 联动台上的蜂鸣器发出连续的“嘀嘀嘀”连续报警声。

b. A buzzer on a linkage platform sends a continuous "beep" alarm.

c. 主钩的上升运动被禁止。

c. The upward movement of the main hook is prohibited.

解除方法：起升下降操作，减轻吊重。

Relieving method: A lifting and descending operation reduces crane weight.

3） **力矩预警信号**

3) Torque warning signal

当起重力矩超过最大允许值的 80％时，电控系统会作如下反应：

When the lifting torque exceeds 80% of the maximum allowable value, the electronic control system will react as follows:

a. 联动台上的黄色“超力矩”预警灯闪烁。

b. 联动台上的蜂鸣器发出连续的“嘀嘀”连续报警声。

c. 向外变幅时没有高速，如正在以高速向外变幅时会自动减至最低速。

a. A yellow "super torque" alarm light flashes on the linkage platform.

b. A buzzer on a linkage platform sends a continuous "beep" alarm.

c. Trolleying outwards does not have a high speed. If it is moving outwards at a high speed, it will automatically reduce to the lowest speed.

4） **超 75%重量换速信号**

4) Over 75% of speed changing signals

当起重量超过最大允许值的 75％时，电控系统会作如下反应：

a. 联动台上的黄色“超重量”预警灯闪烁。

b. 联动台上的蜂鸣器发出连续的“嘀”连续报警声。

c. 升降操作时没有第四、五档，如正在以高速档升降运行中时，会自动减至第三档速度。

When lifting weight is greater than 75% of the maximum allowable value, the electronic control system will react as follows:

a. A yellow "super torque" alarm light flashes on the linkage platform.

b. A buzzer on a linkage platform sends a continuous "beep" alarm.

c. There are no gears 4 and 5 during lifting and falling operations. A machine will automatically runs at a lower speed of gear when running at a high speed originally.

超 75%重量换速信号为起升变频控制系统才具有，而起升非变频控制系统不具有。

More than 75% of weight speed changing signals are only equipped on a lifting frequency conversion controlling system, and not on a non-frequency conversion control system.

5） 超 50%或 35%重量换速信号

Over 50% or 35% of speed changing signals

当起重量超过最大允许值的 50%或 35%时，电控系统会作如下反应：

a. 联动台上的黄色“超重量”预警灯闪烁。

b. 升降操作时没有第五档，如正在以第五档升降运行中时，会自动减至第四档速度。

When lifting weight is greater than 50% or 35% of the maximum allowable value, the electronic control system will react as follows:

a. A yellow "super weight" alarm light flashes on the linkage platform.

b. There is no gear 4 during lifting and falling operations. A machine will automatically runs at a lower speed of gear when running at a high speed originally.

起升变频控制系统具有超 35%重量换速信号，而不具有超 50%重量换速信号；起升非变频控制系统具有超 50%重量换速信号，而不具有超 35%重量换速信号。

The lifting frequency control system has more than 35% of speed signals and does not have more than 50% of weight signals. The lifting frequency control system has more than 50% of speed signals and does not have more than 35% of weight signals.

6） 超高限位信号

6) Ultrahigh limit signals

当吊钩高度已达最大允许值时，电控系统会作如下反应：

When the hook height reaches the maximum allowable value, the electric control system will react as follows:

a. 吊钩的上升运动被禁止。

a. Hook lifting is prohibited.

7）超高减速信号

7) Ultrahigh restriction signals

当吊钩高度距超高限位只有几米远时，电控系统会作如下反应：

When the hook height is only a few meters away from ultra-high limit, the electric control system will react as follows:

a. 吊钩上升运动自动减速至第一档速度。

a. Hook lifting automatically runs at a speed at a lower gear.

8）超低限位信号

8) Ultralow limit signals

当吊钩下降高度已达最大允许值时，电控系统会作如下反应：

When the hook height reaches the maximum allowable value, the electric control system will react as follows:

a. 吊钩的下降运动被禁止。

a. Hook descending is prohibited.

9）超低减速信号

9) Ultralow restriction signals

当吊钩高度距超低限位只有几米远时，电控系统会作如下反应：

When the hook height is only a few meters away from ultralow limit, the electric control system will react as follows:

a. 吊钩下降运动自动减速至第一档速度。

a. Hook descending automatically runs at a speed at gear 1.

10）变幅外限位信号

10) Trolleying outward limit signals

当变幅小车运行到臂头时，电控系统会作如下反应：

When trolleying car runs to the arm head, the electronic control system will react as

follows:

a. 变幅小车的向外运动被禁止，如正在向外变幅会突然停车。

a. Outward operation of a trolleying car is prohibited. For example, outward trolleying will suddenly stop.

11）变幅外减速信号

11) Trolleying outward restriction signals

当变幅小车向外运行到距臂头只有几米远时，电控系统会作如下反应：

When a trolleying car runs outwards to a few meters away from the arm head, the electric control system will react as follows:

a. 变幅小车的向外运动没有高速，如正在以高速向外变幅会自动减至最低速。

a. A trolleying car cannot run at a high speed when running outwards, and will automatically runs at a low speed when running outwards.

12）变幅内限位信号

12) Trolleying inward limit signals

当变幅小车已开至臂根部时，电控系统会作如下反应：

When a trolleying car runs to the arm root, the electric control system will react as follows:

a. 变幅小车的向内运动被禁止，如正在向内变幅会突然停车。

a. Outward operation of a trolleying car is prohibited. For example, inward trolleying will suddenly stop.

13）变幅内减速信号

13) Trolleying inward restriction signals

当变幅小车内行到距臂根部只有几米远时，电控系统会作如下反应：

When a trolleying car runs inwards to a few meters away from the arm root, the electric control system will react as follows:

a. 变幅向内运动没有高速，如正在以高速向内变幅会自动减至最低速。

a. A trolleying car cannot run at a high speed when running inwards, and will automatically runs at a low speed when running inwards.

14）回转左减速信号

14）**Left reduction signal for slewing**

当吊臂向左回转快超过一圈半时，电控系统会作如下反应：

吊臂的向左回转运动没有高速，如正以高速向左回转会自动减至最低速。

The electrical control system shall act as follows when the crane jib slews leftwards for

faster than a lap and a half:

a. The leftward slewing of the jib is no high speed; the slewing motor at high speed will automatically decelerated to the lowest speed.

15）回转左限位信号

15) Slewing left limit signals

当吊臂向左回转超过一圈半时，电控系统会作如下反应：

When a suspension arm rotates for more than 1 and a half circles leftwards, the electrical control system will react as follows:

a. 吊臂的向左回转运动被禁止，如正在向左回转则回转电机会自动失电。

a. Leftward rotational motion of a suspension is prohibited. A rotation motor will automatically lose power when rotating leftwards.

16）回转右减速信号

16）**Right reduction signal for slewing**

当吊臂向右回转快超过一圈半时，电控系统会作如下反应：

吊臂的向右回转运动没有高速，如正以高速向右回转会自动减至最低速。

The electrical control system shall act as follows when the crane jib slews rightwards for faster than a lap and a half:

a. The rightward slewing of the jib is no high speed; the slewing motor at high speed will automatically decelerated to the lowest speed.

17）回转右限位信号

17) Slewing right limit signals

当吊臂向右回转超过一圈半时，电控系统会作如下反应；

When a suspension arm rotates for more than 1 and a half circles rightwards, the electrical control system will react as follows:

a. 吊臂的右回转运动被禁止，如正在向右回转则回转电机会自动失电。

a. Rightward rotational motion of a suspension is prohibited. A rotation motor will automatically lose power when rotating rightwards.

18）向前行走减速停止限位信号（选配）

18) Forward deceleration stop limit signals (Option)

当塔机向前行走到距轨道尽头只有几米远时，会触发减速停止限位，电控系统会作如下反应：

When a tower crane runs forwards to only a few meters away from the end of the track, it

will trigger deceleration stop limit, and the electric control system will react as follows:

塔机向前行走经几秒减速后停止。

A tower crane moves forwards and stops after a few seconds of deceleration.

19）向前行走紧急停止限位信号（选配）

19) Forward emergency stop limit signals (Option)

当塔机向前行走到距轨道尽头时，会触发紧急停止限位，电控系统会作如下反应：

When a tower crane runs forwards to the end of the track, it will trigger emergency stop limit, and the electric control system will react as follows:

立即切断行走总电源，塔机立即停止向前行走。

Immediately cut off the total power supply and the tower crane immediately stops.

20）向后行走减速停止限位信号（选配）

20) Backward deceleration stop limit signals (Option)

当塔机向后行走到距轨道尽头只有几米远时，会触发减速停止限位，电控系统会作如下反应：

When a tower crane runs backwards to only a few meters away from the end of the track, it will trigger deceleration stop limit, and the electric control system will react as follows:

塔机向后行走经几秒减速后停止。

A tower crane moves backwards and stops after a few seconds of deceleration.

21）向后行走紧急停止限位信号（选配）

21) Backward emergency stop limit signals (Option)

当塔机向后行走到距轨道尽头时，会触发紧急停止限位，电控系统会作如下反应：

When a tower crane runs backwards to the end of the track, it will trigger emergency stop limit, and the electric control system will react as follows:

立即切断行走总电源，塔机立即停止向后行走。

Immediately cut off the total power supply and the tower crane immediately stops.

22）过欠压保护信号

22) Overvoltage and under-voltage protection signals

当供电电压大于 110％额定电压或低于 85％额定电压时，电控系统会切断主电源，塔机停止工作。

When the supply voltage is greater than 110% of the rated voltage or less than 85% of the rated voltage, the electronic control system will cut off the main power supply, and the tower crane will stop.

a. 如果长期过欠，请不要启动和工作以免损坏电机和电器件。

a. If an overvoltage is remained for a long time, please don't start the system or make it to work to prevent damages to motor and electrical parts.

b. 变频器上有过欠警告提示，变频器具有过欠压自动停机保护功能。

b. If under-voltage alarms are reported on a frequency convertor, the convertor has an automatic overvoltage and under-voltage stop protection function.

1）起重机驾驶员在每次对起重机进行有载操作工作之前都必须检查行程限位器的功能。

2）在解除力矩、载荷或速度紧急行程缓冲的情况下，在起重机再次使用前技术人员必须重新对安全装置进行检查。

1）The crane driver must check the function of the stroke limiter every time before carrying out the loading operation on the crane。

2）In the case of lifting the torque、load or speed emergency travel buffer，the technician must recheck the safety device before the crane is used。

2.1.2.2 电控系统的操作

2.1.2.2 Electronic control system operations

电控系统的操作步骤如下：

Operations of the electronic control system are as follows:

1) **准备工作：**包括刀开关操作、总断路器的操作、司机室电源断路器的操作、启动与急停按钮的操作。

1) **Preparation:** Including operations of a knife switch, main circuit breaker, power circuit breaker in a cab, and starting and emergency stop button

2) **各机构的操作：**包括升降操作、回转操作、变幅操作、行走操作。

2) Operation of each mechanism: including operations of lifting, slewing, trolleying, and walking

下面分别加以说明。

For details, see the following:

2.1.2.2.1 准备工作

2.1.2.2.1 Preparation

1）刀开关的操作

1) Knife switch operation

刀开关装在塔身底部第一节标准节的刀开关箱内，作电源隔离用。将手柄往上推时刀开关闭合，三相五线制电源通过上行电缆送入塔上配电箱；将手柄往下拉时，刀开关断开，塔机上部失电。刀开关闭合后，配电箱箱上的电压表将指示输入线电压值。如果电压表无显示或电压不符要求，则必须查清原因方能进一步操作。司机下班后，须断开刀开关。

The knife switch is installed in the knife switch box of the first standard section at the bottom of the tower body, so as to be used for power isolation. The knife switch is disconnected when the handle is pushed upwards. A three-phase five-wire power supply is introduced into a distribution box through uplink cables. When the knife switch is disconnected, power loss occurs in the upper tower. After the knife switch is turned, the voltmeter on the distribution box will indicate the input wire voltage. If the voltmeter does not show a value or the voltage does not meet requirements, you must find out the reason for further operation. The driver must turn off the switch after work.

注：标配产品没有配刀开关箱，若非标需求配有刀开关箱时，请按上述进行操作。

Note: A standard product does not have a knife switch box. If a knife switch box is required for a non-standard product, refer to operations above.

2）关于漏电保护断路器的说明

2）Explanation of leakage protection circuit breaker

为了更好的使用变频塔机，建议使用变频器专用的 75mA 及以上漏电保护断路器。

For better use the frequency converter tower, best used the special leakage protection circuit breaker of protection current 75mA and above for frequency converter special-purpose.

3）总断路器的操作

3) Main circuit breaker operation

只有在现场准备就绪，司机就位，需要作业时，才能合上总断路器。合开关前先应检查电压表的读数看是否正常。总断路器位于司机室内的配电箱上，其操作手柄暴露在箱门外，便于司机操作。塔机除司机室电源外所有机构、控制箱柜等的电源均由此断路器控制。

Only when preparations at site are ready, the driver is in position, and the operation is required, can the main circuit breaker be switched on. Check whether the value on the voltmeter is normal before switching on circuit breaker. The main circuit breaker is installed on the distribution box in the cab and the operating handle is outside the door for convenient driver

operations. The circuit breaker is controls all mechanisms and control boxes and cabinets excepting power supplies in the cab.

当地面刀开关合闸后，即使总电源断路器处于断开状态，总电源断路器之前的线路也是有电的，请在操作、检修、维修、维护保养过程中注意安全，避免触电。

If a knife switch on the ground is connected and the total power circuit breaker is disconnected, wires before the total power breaker is in power. Pay attentions in operation, maintenance, and repair, and avoid electric shock.

执行总电源通电操作前，必须检查所有电气系统连接正常，否则会造成人员触电、电器件烧毁等危险事故。

Before powering on the main power supply, we must check whether all electrical system connections are normal, otherwise electric shock, electrical part burned, and other dangerous accidents may occur.

以下情况必须立即切断空气开关！

The air switch must be disconnected immediately in the following conditions:

a. 遇到危急情况而电控系统失灵时，（如接触器触头烧粘、联动台上急停按钮失灵时）。

a. The electronic control system fails in emergencies, such as contactor contact burning or emergency stop button on the linkage platform failure.

b. 司机下班或因事离开驾驶室时。

b. A driver leaves a cab due to off duty or accidents.

4）司机室电源断路器的操作

4) Operation of power circuit breaker in a cab

司机室电源断路器 QFE 位于驾配箱内，主要用作各种灯、风扇、用户取暖设备的短路保护。当操作司机室电源断路器合闸（将断路器的操作手柄往上扳）后，司机室电源供电回路得电（单相 220V）。此时可以通过司机室内的开关控制司机室内照明灯、风扇的开或

关。当操作司机室电源断路器断开（将断路器的操作手柄往下扳）后，司机室电源断开。司机室电源断路器合上后不必每次下班时拉断。

A power circuit breaker QFE in a driver's cab is installed in the driving box, and mainly used for short circuit protection for all kinds of devices, including lights, vans, and user heating equipment. When a power circuit breaker in the cab is connected (an operating handle of the circuit breaker is pushed up), the power supply circuit in a cab is powered on (single-phase 220 V). At this time, the driver's indoor switch can be used to control the driver's light and fan. When cab power circuit breaker is disconnected (an operating handle of the circuit breaker is pulled down), the cab power is disconnected. The cab power supply circuit breaker does not need to be pulled off after work every day.

将刀开关开关合闸后，即使电源总断路器处于断开状态，司机室电源供电回路也是有电的，请请在操作、检修、维修、维护保养过程中注意安全，避免触电。

If a knife switch is turned on and the total power circuit breaker is disconnected, power supply circuits in a cab are in power. Pay attentions in operation, maintenance, and repair, and avoid electric shock.

5）启动与急停按钮的操作

5) Operations of start and emergency stop buttons

a. **启动按钮**（绿色）位于右联动台面板上。它是一个双功能按钮，即：启动和电笛功能。总断路器闭合后，当旋转释放联动台急停按钮、并按下此按钮时，系统启动（主回路的总接触器和控制回路的总接触器接通），左联动台上的绿色系统启动电源指示亮。当按下急停按钮时，系统停止，左联动台上的绿色系统启动电源指示灭。此外，当系统启动后，无论何时，只要按下启动按钮，就可以控制电笛鸣叫。

a. Start button (green): is located on the right linkage panel. It is a double function button, that is, the function of starting and horn. After a main breaker is connected, an emergency stop button on the linkage platform is released, and the start button is started (general contactor of the major loop is connected and the general contactor controlling circuits is connected), the system starts and the green system starting indicator turns on. When the emergency stop button is pressed, the system stops, the green system starting indicator turns off. In addition, when the system starts, you can control the horn

sounding by pressing the start button.

b. **急停按钮**（红色）也位于右联动台的面板上，为一红色自锁式蘑菇头按钮。与启动按钮相反，急停按钮的作用时切断主回路的总接触器和控制回路的总接触器，从而使各机构紧急停车。

b. Emergency stop button (red): is also located on the panel of the right linkage table. It is a red self-locking mushroom head button. Being contrary to the start button, the main contactor of the main circuit and the contactor of the control circuit controlling circuits when the emergency stop button works, so as to shutdown each mechanism emergently.

当塔机运行遇到危急情况，来不及按正常程序停车时，或操作手柄失控时，必须立即按下急停按钮！而非紧急情况下，不得使用急停按钮作正常停车用。否则产生很大的冲击。

You must press the emergency stop button immediately when a tower crane runs in a critical situation, such as being too late to stop according to a normal procedure or operating handle being out of control. In a non-emergency situation, the emergency stop button should not be used as normal. Otherwise, a big impact may occur.

5）控制变压器输入侧电压等级调节的操作

5) Operation of adjusting levels of control transformer input voltage

为适应各施工现场塔机供电电源不稳定或存在差异的情况，电控系统中的控制回路变压器输入侧具有 365V、380V、400V、415V 不同的电压等级，一般出厂默认接入 380V 电压等级（非标设计除外）。如果工地主电源供电电压偏低（360V 左右）时，请将控制变压器输入侧的接入电压等级由 380V 调到 365V；如果工地主电源供电电压偏高（400V 左右）时，请将控制变压器输入侧的接入电压等级由 380V 调到 400V；如果工地主电源供电电压偏高（415V 左右）时，请将控制变压器输入侧的接入电压等级由 380V 调到 415V；如果工地主电源供电电压偏高（440V 左右）时，请将控制变压器输入侧的接入电压等级由 380V 调到 440V。

In order to adapt to unstable or different voltages of crane power supply at construction sites, there are different input voltage levels including 365 V, 380 V, 400 V, and 415V in an electronic control system. Generally, a factory default voltage of 380 V is set (excluding non-standard design). If a power supply voltage at site is low (about 360 V), adjust the access voltage level at the input side of the control transformer from 380 V to 365 V. If a power supply voltage at site is high (about 400 V), adjust the access voltage level at the input side of the control transformer

from 380 V to 400 V. If a power supply voltage at site is high (about 415 V), adjust the access voltage level at the input side of the control transformer from 380 V to 415 V; If the work power supply voltage is high (about 440V), please access the input side of the transformer voltage level control from 380V to 440V.

2.1.2.2.2 各机构的操作

2.1.2.2.2 Operation of each mechanism

当电控系统启动成功后，即可进行各机构的操作了。操作时使用联动台上的两只操作手柄和各种按钮。在使用操作手柄时，应先用食指和中指将手柄球头内的滑动块往上拉，解除零位自锁，方能推动自如。操作时请留意电控系统发生的声光报警信号。一般来说，当声光报警信号发生时，电控系统会自动作出相应的反应（如禁止某机构的运动，某方向运动减速等）。关于报警信号详见前面的“2.1.2.1 系统提示与报警信号”一节。

When the electronic control system is successfully started, you can perform the operation of each mechanism. During operating, two operating handles and all kinds of buttons on the linkage table are used. When using an operating handle, we should use the index finger and middle finger to pull the slider to the handle ball head to perform zero position self-locking, so as to promote free movement. Please pay attention to sound and light alarm signals produced by the electric control system during operations. Generally speaking, when sound and light alarm signals are generated, the electronic control system will make the corresponding reaction automatically (such as prohibiting the movement of a certain mechanism and slowing down in a certain direction, etc.). For details about alarm signals, see section 2.1.2.1 "System prompt and alarm signal."

1） 升降操作

1) Lifting and descending operations

升降操作通过右联动台上的手柄控制。上升时往里拉，下降时往外推。上升和下降各分五或三个档位，分别对应于五或三种速度。切换档位时必须逐级切换。

Lifting and descending are controlled by the handle on the right linkage table. Pull the machine inside during lifting and pull it outside during descending. There are 3 or 5 gears for both lifting and descending, which correspond to 3 or 5 speeds, respectively. Gear shifting must be performed step by step.

提示

Hint

在有些情况下，驾驶员需要将吊钩上升到某一位置时，但由于起升上升停止限位的缘故而不能实现，这时可以用左手按下按下左联动台上的“旁路”按钮，右手操作联动台上的起升上升手柄就可以将吊钩以一档的速度上升到位。

In some cases, a driver will need to lift the hook to a position, which cannot be realized due to lifting limitation. At this time, the driver can use his/her left hand to press the "bypass" button on the left linkage platform and use the right hand to operate the lifting handle on the linkage platform, lifting a hook to a certain position with a speed at gear 1.

注意

Caution

在进行起升旁路操作时，驾驶员要时刻保持高度注意谨防吊钩冲顶，在将吊钩上升到合适位置时，应及时将手柄打到零位位置，若发生紧急情况，请及时按下急停按钮。

During an operation of bypass operation, a driver should always maintain much attention and prevent hook against the top, and shift the handle to gear 0 when the hook is lifted to a proper position in a timely manner. In case of an emergency, please press the emergency stop button.

2）变幅操作

2) Trolleying operation

变幅操作通过左联动台的手柄控制。向外变幅时将手柄竖直地往前推，向内变幅时将手柄竖直地往里拉。外变幅和内变幅各分三或两档。对应于从低到高三或两种速度。在进行操作时，无论是从低速至高速，还是从高速至低速都必须逐级切换。

The trolleying operation is controlled using the left linkage platform. Push the handle upwards when outward trolleying occurs, and inwards when inward trolleying occurs. Both inward and outward have 2 or 3 gears, corresponding to 2 or 3 speeds, respectively. In operation, speed shifting must be performed step by step.

提示

Hint

在某些场合，驾驶员想让变幅小车开到臂根部，但由于变幅内限位的缘故而不能实现，这时可以用右手按下按下左联动台上的“旁路”按钮，左手操作联动台上的手柄就可以将变幅小车以一档的速度开到位。

In some occasions, a driver wants a trolleying car to drive to the arm root, which cannot be realized due to trolleying internal limit. At this time, the driver can use his/her right hand to press the "bypass" button on the left linkage platform and use the left hand to operate the handle on the linkage platform, driving the trolleying car to a wanted position with a speed at gear 1.

在进行变幅旁路操作时，驾驶员要时刻保持高度注意谨防变幅小车撞到挡块，在将变幅开到合适位置时，应及时将手柄打到零位位置，若发生紧急情况，请及时按下急停按钮。

During an operation of bypass operation, a driver should always maintain much attention and prevent the trolleying car from running into a block, and shift the handle to gear 0 when the trolleying car drives to a proper position in a timely manner. In case of an emergency, please press the emergency stop button.

3） 回转操作

3) Slewing mechanism operation

在进行回转操作前，将左联动台上的顶升/回转联锁选择开关选择到回转位置时，才允许进行回转操作，而禁止顶升操作。如果此选择开关在顶升位置时，允许进行顶升操作，而不允许进行回转操作。

Shift the lifting/slewing interlocking selection switch on the left linkage platform to the original slewing position before performing a slewing operation. Lifting is prohibited. If this switch is located at the lifting position, lifting instead of slewing is allowed.

回转操作通过左联动台的手柄进行控制。左回转时将手柄横着往左扳，右转时将手柄横着往右扳。左回转和右回转各分四档，对应于从低到高四种速度(RCV 为无极调试)。在进行操作时，无论是从低速至高速，还是从高速至低速都必须逐级切换。

A slewing operation is controlled through a handle on the left linkage platform. Pull the handle leftwards transversely when left slewing occurs, and rightwards when right slewing occurs. Both left slewing and right slewing have 4 gears, corresponding to 4 speeds in an ascending order (stepless RCV debugging), respectively. In operation, speed shifting must be performed step by step.

当回转机构为常开式制动器时，即通电闭合刹车，断电打开刹车。在操作过程中，在操作过程中，如需要回转停止，可以旋转左联动台上的回转制动开关至制动位置，使回转制动停止。建议除在特殊情况或紧急危险状态下，不允许在回转档位运行过程中操作回转制动开关，尤其是在回转高速运行中，因为起重臂在回转急停过程中具有大惯性冲击易造

成危险事故。

When the slewing mechanism is a normally open brake, that is, the brake is powered on when being connected and the brake is powered off when being disconnected. During an operation, you can rotate the slewing braking switch on the left linkage platform to the braking position to stop braking. You are not advised to operate the slewing braking switch when driving at the slewing gear, especially at a high speed, excepting in special or emergent conditions, because emergent jib stop in a slewing process has large inertia impact, which may lead to dangerous accidents.

当回转机构为常闭式制动器时，即通电打开刹车，断电闭合刹车。在操作过程中，如需要回转停止，可以按下左联动台上的回转制动风标按钮使回转制动停止。建议除在特殊情况或紧急危险状态下，不允许在回转档位运行过程中按回转制动风标按钮，尤其是在回转高速运行中，因为起重臂在回转急停过程中具有大惯性冲击易造成危险事故。

When the slewing mechanism is a normally closed brake, that is, the brake is powered on when being disconnected and the brake is powered off when being connected. During an operation, you can press the slewing braking wind vane button on the left linkage platform to stop braking. You are not advised to press the slewing braking button when driving at the slewing gear, especially at a high speed, excepting in special or emergent conditions, because emergent jib stop in a slewing process has a large inertia impact, which may lead to dangerous accidents.

另外，若塔机回转配置有风标装置时，即当驾驶员下班时如遇大风天气则同时按下回转制动风标按钮和按钮 5 秒以上开启风标装置，若联动台上的风标指示灯亮绿色，则表明风标释放成功，大臂能自由随风摆动，避免因天气原因导致大臂折断或塔机倒塔。

In addition, if a tower crane is equipped with a wind vane device, the wind vane device will be started if a driver presses the slewing braking wind vane button for more than 5 seconds when meeting windy weather on the way back home from work. If the wind vane indicator turns green, the wind vane is successfully released and the big arm can swing with the wind, avoiding situations that a big arm is broken or the tower crane falls because of the weather.

回转和制动操作时应注意以下几点：

Pay attention to the following points during slewing and braking operations:

a. 由于塔臂很长，惯性很大回转操作必须平稳。加速时手柄必须逐级地扳，减速时也必须逐步地退回。

The slewing mechanism operation must be stable for long tower arm and large inertia. During speed shifting, the handle must be pulled down step by step.

b. 除带有液力耦合器的回转机构外，严禁采用打反车的方法进行减速。

It is forbidden to slow down through reverse braking excepting slewing mechanisms with fluid coupling.

c. 严禁在塔臂未停稳时使用制动开关或制动按钮。

It is forbidden to use a braking switch or a braking button when the tower arm is not stably stopped.

d. 当风速超过 6 级，严禁使用“制动”开关。

It is forbidden to use a braking switch when the wind speed is higher than 6-level.

e. 若系统的回转制动回路配有免维护蓄电池时，在外部电源停电或者突然断电情况下，如果“回转—制动”开关仍扳至“制动”位置，则回转盘式制动器仍然正常工作至少一小时。

If a slewing braking circuit of the system is equipped with maintenance-free batteries, an external power supply is powered off, and the slewing braking switch is shifted to the braking position, the slewing disc brake can normally work for at least one hour.

f. 若系统的回转制动回路配有免维护蓄电池时，驾驶员下班时必须将“回转—制动”开关仍扳至“回转”位置，以免蓄电池过度放电造成损坏。

If a slewing braking circuit of the system is equipped with maintenance-free batteries, a drive must shift the slewing braking switch to the braking position after work, preventing damages due to excessive battery discharging.

在使用中，有时会出现以下现象：

In use, following phenomena may occur sometimes:

a. 回转启动困难，启动时间长。

Slewing starting is difficult and requires a long period.

b. 回转停车时塔机晃动大。

Serious shaking of tower crane during slewing stopping.

c. 工作一段时间后，回转电机发热严重。

The rotating motor serious heats after working for a period of time.

此时，应首先检查供电电源，如在正常范围内，请通知本公司派员检修。

At this point, we should first check the power supply. If the value is a normal range, please inform the company of sending personnel for overhaul.

4） 行走操作（选配）

4) (Optional) Walking operation

在操作行走前,请先将右联动台上的行走允许/禁止选择开关旋转到行走允许位置后，才能进行行走操作。在不需要进行行走操作时，请将此选择开关选择到行走禁止位置。

Shift the walking permit/prohibition selection switch on the right linkage platform to the permit position before performing a walking operation. If a walking operation is not required, shift this button to the walking prohibition position.

行走操作由右联动台上的手柄控制。将此手柄往左扳，大车前行，往右扳大车后行。手柄左右方向各分两档，对应于从低到高两种行走速度。启动时，应先从手柄中位扳到低速档，然后再扳到高速档；停止时，应先从高速档回到低速档，然后再回到停止档位。

A walking operation is controlled through a handle on the right linkage platform. Pull the handle leftwards for upward trolley driving, and rightwards for backward trolley driving. Both left slewing and right slewing have 2 gears, corresponding to 2 speeds in an ascending order, respectively. When starting a car, you should shift the handle from the neutral position to the low-speed position, and then the high-speed position. When stopping a car, you should shift the handle from the high-speed gear, to the low-speed gear, and then the stop position.

除紧急情况外，严禁从高速档直接回到停止档位。

It is forbidden to shift from a high-speed gear to a low-speed gear directly excepting emergent conditions.

2.1.2.3 作业前检查

2.1.2.3 Pre-operation inspection

a. 每次通电后，在进行作业前，操作者必须在空钩状态下首先检查各开关按钮（尤其是“急停按钮”）、操作手柄、制动器、行程限位及保护开关是否工作正常；

a. An operator must check whether each switch button (especially the "emergency stop button"), operating handle, brake, and travel limit and protection switch are working properly in an empty emergency ditch hook status before an operation and after powering on.

b. 各限位保护开关是否调整好（具体调整方法参见主机使用说明书的相关章节）；

b. Check whether each position limitation protection switch is adjusted (for details about the adjustment method, see related sections in host instructions).

c. 各限位保护开关动作后，电控系统是否执行相应的保护功能（参见前述的内容）；

c. Check whether the electric control system performs a corresponding protection function after the limit protection switch is operated (see content above).

d. 如发现故障应立即停机检修。在故障或安全隐患未排除前，不得将塔机投入作业运行；

d. If a fault is found, the machine should be shut down for maintenance immediately. The tower crane shall not be put into operation before the failure or potential safety hazard is ruled out.

e. 如遇潮湿天气，请在每次通电前检查电控柜及电阻柜，如有凝露现象，请勿开机工作，待水气蒸发或采用其他除湿措施后再使用，以免造成元器件的损坏。

e. In case of wet weather, please check the electrical cabinet or resistor cabinet before each time of powering on. If condensation exits, do not start the machine until the water vapor is evaporated or other dehumidification measures are taken, so as to avoid damage to components.

2.1.2.4 检修与维护

2.1.2.4 Overhaul and maintenance

电控系统应经常检修与维护，以排除故障，消除安全隐患，保证整机的正常运行，延长设备的使用寿命。应由具有相关从业资格的专业人员进行检修与维护工作，具体如下：

The electronic control system should be regularly checked and maintained to eliminate the trouble and hidden dangers, ensure the normal operation of the whole machine, and extend the service life of the equipment. It should be inspected and maintained by professionals with relevant qualifications:

a. 每天应对电控系统进行外观检查，防止触、漏电等事故发生。

a. Perform visual inspection on the electric control system every day to prevent accidents such as electric shock and electric leakage.

b. 经常检查所有电线、电缆有无损伤，如有损伤应及时用电胶布包扎或更换。

b. Check whether all wires and cables are damaged. If being damaged, the wires or cables should be bandaged using electric tapes or replaced.

c. 遇到电机有过热现象时要及时停车检查，排除故障后再继续运行，同时保证电机轴承润滑良好。

c. An overheated motor must be stopped in time for troubleshooting. Ensure good lubrication of motor bearings.

d. 电机各部分电刷的接触应保持清洁，电刷接触面积不应小于 50%。

d. Contact of a brush for each part of a motor should be kept clean, and the contact area of the brush should not be less than 50%.

e. 各电控箱、配电箱应经常保持清洁，在总电源切断情况下清除电气设备和电气元件上的灰尘。

e. Each electrical control box and distribution box should be kept clean. Clean electrical equipment and electrical components when the total power is cut off.

f. 各安全装置的行程开关的触点开闭必须灵敏可靠。

f. Opening and closing of the travel switch for each safety device must be sensitive and reliable.

g. 各电机及其它电气设备绝缘良好，其绝缘电阻应不小于 0.5MΩ。

g. The insulation of each motor and of other electrical equipment is good, and its insulation resistance should be no less than 0.5 MΩ.

h. 各电机、电控柜及其它电气设备的外壳接地端的接地电阻不得大于 4Ω。

h. The grounding resistance of shell grounding terminals for the motor, electrical cabinet and other electrical equipment shall not be greater than 4 Ω.

i. 检查交流接触器是否有卡滞、吸合不良、触点烧坏等现象，若有请及时修复或更换。

I. Check whether AC contactor is stuck, poorly pulled in, or burn out in contact points. If necessary, please repair or replace it in time.

j. 检查接线是否有松动、发热、烧蚀等现象。

J. Check whether the wiring is loosening, heated, or burnt.

⚠ 警告

⚠Warning

若在检修中发现上述中的非正常现象，请及时紧固、修复、更换、调整。

If the abnormal phenomenon is found in the overhaul, please fasten, repair, replace, and adjust it in time.

2.1.3 电气图形符号

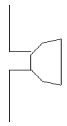
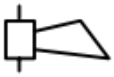
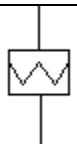
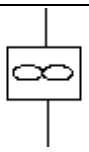
2.13 Graphical symbols for electrical devices

2.1.3.1 附件类图形符号

2.1.3.1 Accessory graphical symbols

表 2.1-1 附件类图形符号

Table 2.1-1 Accessory graphical symbols

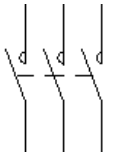
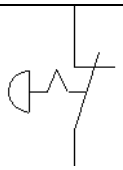
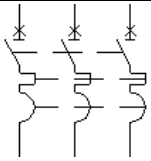
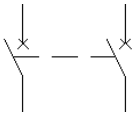
	蜂鸣器	Buzzer		电阻	Resistance
	电笛	Horn		加热器	Heater
	避雷器	Lightning arrester		轴流风机	Axial fan
	熔断器	Fuser		照明灯或指示灯	Light
	插座	Socket		电压表	Voltmeter

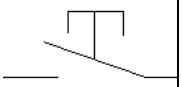
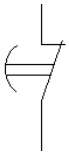
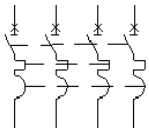
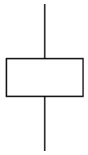
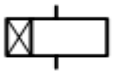
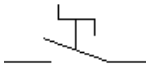
2.1.3.2 开关类图形符号

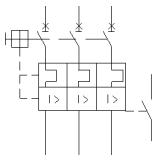
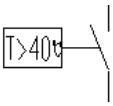
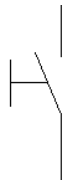
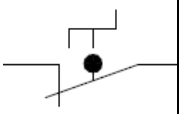
2.1.3.2 Switch graphical symbols

表 2.1-2 开关类图形符号

Table 2.1-2 Switch graphical symbols

	接触器触点 Contactor contact		急停按钮 Emergency stop button		三极断路器 Three-pole circuit breaker
	双极断路器 Double-pole cutout		单极断路器 Single-pole cutout		限位开关常开触点 Normally open contact of a limit switch

	限位开关常闭触点 Normally closed contact of a limit switch		平头按钮 DF-AG		延时断开的常开触点 Normally open contact during long-time disconnection
	常开触点 Normally open contact		常闭触点 Normally closed contact		延时闭合的常闭触点 Normally closed contact during long-time connection
	延时断开的常闭触点 Normally closed contact during long-time disconnection		四极断路器 Quadrupole circuit breaker		继电器线圈或接触器 Relay coil or contactor
	通电延时继电器线圈 Relay coil for delayed-switching-on		断电延时继电器线圈 Relay coil for off-delay operation		转换开关触点 Change-over switch contact

	延时闭合的常开触点 Normally open contact during long-time connection		热断路器 Thermal circuit breaker		温度开关 Temperature switch
	照明灯或风扇开关 Light or fan switch		零位开关 0-position switch		

2.1.3.3 接线类图形符号

2.1.3.3 Wiring graphical symbols

表 2.1-3 接线类图形符号

Table 2.1-3 Wiring graphical symbols

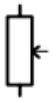
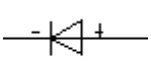
	地线 Ground wire		接线端 Terminal		连接器插头 Connector plug
	参照插头 Reference plug		接线端子 Amphenol connector		连接器插座 Connector plug

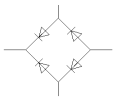
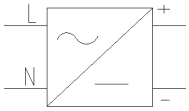
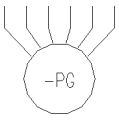
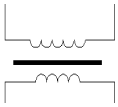
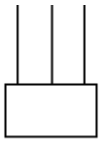
2.1.3.4 电子类图形符号

2.1.3.4 Electronic graphical symbols

表 2.1-4 电子类图形符号

Table 2.1-4 Electronic graphical symbols

	温度传感器 Temperature sensor		电位计 Electrometer		整流器二极管 Rectifier diode

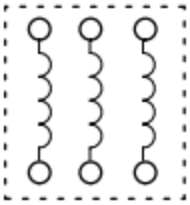
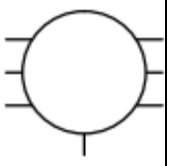
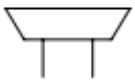
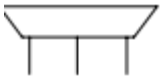
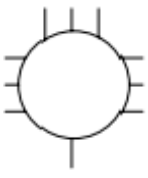
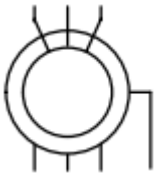
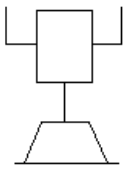
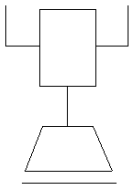
	单相整流桥 Single-phase rectifier bridge		开关电源 Switching power supply		编码器 Encoder
	变压器 Transformer		相序保护器 Phase sequence relay		

2.1.3.5 **电机类图形符号**

2.1.3.5 Electric machinery graphical symbols

表 2.1-5 电机类图形符号

Table 2.1-5 Electric machinery graphical symbols

	电磁线圈或直流电感线圈 Solenoid coil or DC inductance coil		三相电感线圈 Three-phase inductance coil		双绕组电机 Double-winding motor
	单线圈电磁制动器 Single-coil electromagnetic brake		双线圈电磁制动器 Double-electromagnetic brake		单绕组电机 Single-winding motor
	三绕组电机 Triple-winding motor		滑环式电机 Sliding motor		闭式电磁制动器 Close electromagnetic brake
	开式电磁制动器 Open electromagnetic brake				

2.1.3.6 操作类图形符号

2.1.3.6 Operation graphical symbols

表 2.1-6 操作类图形符号

Table 2.1-6 Operation graphical symbols

	起升上升 Lifting		左回转 Left slewing		向外变幅 Elevating outwards
	起升下降 Descending		右回转 Right slewing		向内变幅 Elevating inwards
	向前行走 Going forwards		向后行走 Walking backwards		

2.1.4 电气原理图

2.1.4 Electrical schematic diagram

2.1.4.1 电气原理图文字符号说明

2.1.4.1 Descriptions of letter symbols in an electrical schematic diagram

表 2.1-7 电气原理图文字符号说明

Table 2.1-7 Descriptions of letter symbols in an electrical schematic diagram

符号 Symbol	说明 Description	符号 Symbol	说明 Description
PV	电压表 Voltmeter	QFE	司机室电源断路器 Power circuit breaker in a cab
SEC	司机室风扇开关 Fan switch in a cab	SES	司机室照明开关 Light switch in a cab
EC	司机室风扇 Fan in a cab	EL2	司机室照明灯 Light in a cab

XSC1/2	司机室插座 Socket in a cab	QF	总断路器 Overall circuit breaker
KAP	相序继电器 Phase rotation relay	QF10	控制变压器断路器 Control transformer circuit breaker
TC	控制变压器 Control transformer	KM	总接触器 General contactor
QFF	电控柜风扇断路器 Electric cabinet fan circuit breaker	EF1/2	电控柜风扇 Electric cabinet fan
QF11	控制电路断路器 Control circuit breaker	SZL/R	左右联动台零位 Left and right linkage platform zero positions
SEM	急停按钮 Emergency stop button	SST:1/2	启动/电笛按钮 Start/ horn button
KMC	启动接触器 Contactor starting	KTH	起升热敏开关 Thermoswitch hoisting
HP	启动电源指示灯 Power light starting	FLM	防雷模块 Lightning protection module
QF12/13/14/15	开关电源断路器 Switch power circuit breaker	VC1/2	开关电源 Switch power supply
QFA	开关电源断路器 Switch power circuit breaker	HA	电笛 Horn
QFH	起升断路器 Hoisting circuit breaker	KHB	起升控制接触器 Hoisting control contactor
DCLH	电抗器 Electric reactor	HINV	起升变频器 Hoisting frequency converter
RHB	起升制动电阻 Hoisting brake resistance	QFHF	起升风机断路器 Hoisting fan circuit breaker
PLC	控制器 Controller	KAH*	起升中间继电器 Hoisting intermediate relay

QFS	回转断路器 Rotating shutter	QFSF1/2/3	回转风机断路器 Rotation motor circuit breaker
SINV	回转变频器 Slewing frequency converter	RSB	回转制动电阻 Slewing brake resistance
SW	涡流模块 Vortex module	KSB	回转控制接触器 Slewing control contactor
QF30/31/32/33	回转变压器断路器 Slewing transformer breaker	TD	回转控制变压器 Slewing control transformer
V34/35	整流二极管 Commutation diode	V30/31	续流二极管 Freewheel diode
R30/31	电阻 Resistance	KAS*	回转中间继电器 Slewing intermediate relay
KPP	顶升回转连锁接触器 Lifting slewing linkage contactor	SSP	顶升回转联锁旋钮 Lifting slewing linkage contactor knob
HF	回转风标指示灯 Slewing wind vane indicator	QFV	变幅断路器 Elevating circuit breaker
VINV	变幅变频器 Elevating frequency converter	KAV*	变幅中间继电器 Elevating intermediate relay
RVB	变幅制动电阻 Elevating brake resistance	V40	二极管 Diode
R40	电阻 Resistance	QFP	顶升泵站断路器 Lifting pump station circuit breaker
SSF	回转制动旋钮 Slewing stop knob	SSJ	旁路按钮 By pass button
SSL/R	回转左/右限位开关 Slewing left/right limit switch	HML/A	力矩 100%/80%指示 Moment 100%/80% indication
HLL/C	重量 100%/50%指示 Weight 100%/50% indication	HBZ	蜂鸣器 Buzzer

2.2 工作机构

2.2 Operating mechanism

工作机构包括：起升机构、回转机构、小车变幅机构及液压顶升机构等装置，分别简介如下：

Crane working mechanism include: hoisting mechanism, slewing mechanism, trolleying mechanism and jacking mechanism, the details are described as follows:

2.2.1 起升机构 （见图 2.2-1）

2.2.1 Hoisting mechanism (See figure 2.2-1.)

起升机构对于不同的起吊重量有不同的速度，以充分满足施工要求。

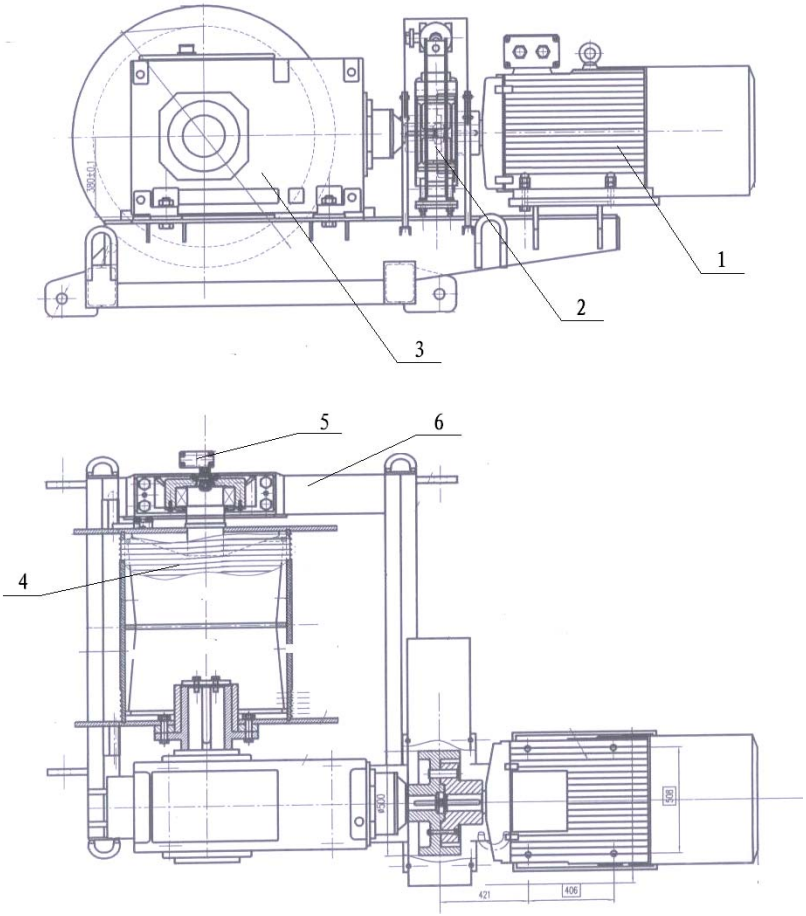
To meet the construction requirements, the hoisting mechanism functions indifferent speeds for different lifting loads.

本机构第一次使用一星期后减速器应立即换油并清洗。

After the first week of employment, the speed reducer should be instantly cleaned and its oil should be replaced.

本机构采用一台 YZP2-315S2-6 90kW 电机，通过圆柱齿轮减速机驱动卷筒。根据吊重可选择不同的滑轮倍率，当选用 2 倍率时，速度可达 70m/min、50 m/min、35 m/min、18 m/min、4 m/min 五种；若选用 4 倍率时，则速度可达 35 m/min、25 m/min、17.5 m/min、9 m/min、2 m/min。为达到起动和制动迅速平稳，在减速机与电机之间安装有电力液压推杆制动器，起升机构不工作时，制动机构处在制动位置。在卷筒轴另一端有高度限位器，高度限位器可根据实际需要进行调整。

The mechanism uses an YZP2-315S2-6 90kW motor to drive the drum through a cylindrical gear reducer. According to the lifting, different pulley magnifications can be selected. If 2-magnification is selected, the speed can be 70 m/min, 50 m/min, 35 m/min, 18 m/min, and 4 m/min; if 4-magnification is selected, the speed can be 35 m/min, 25 m/min, 17.5 m/min, 9 m/min, and 2 m/min. In order to achieve rapid and stable starting and braking, an electric hydraulic push rod brake is installed between the decelerator and the motor. The braking mechanism is in the braking position when the hoisting mechanism does not work. There is a height limiter at the other end of the drum shaft, and the height limiter can be adjusted according to the actual needs.



1、电动机　2、制动器　3、减速机　4、卷筒　5、限位器　6、底架
1. Motor 2. Brake 3. Decelerator 4. Coiling block 5. Limiting stopper 6. Chassis

图 2.2-1　起升机构

Figure 2.2-1 hoisting mechanism

2.2.2 回转机构 （见图 2.2-2）

2.2.2 Slewing system (See figure 2.2-2)

回转机构共 3 套，分布置在大齿轮两旁，采用 2 台 YTRVFW132M3-4F1 9kW 变频电机和 1 台 YTRVFW132M3-4F2 9kW 变频电机驱动。3 台回转电机的功率均为 9kW，采用变频器驱动，为无级调速，起动运行和停车，平稳无冲击。

A total of 3 sets of slewing mechanisms are distributed on both sides of the big gear, and driven using 2 YTRVFW132M3-4F1 9 kW frequency conversion motors and 1 YTRVFW132M3-4F2 9kW frequency conversion motor. The power of each of the 3 slewing motors is 9 kW. A frequency converter is used for driving and stepless speed adjustment is used for starting, running, and stopping, bringing stable operations and no impacts.

YTRVFW132M3-4F1 9kW 型变频电机带涡流制动器、风标装置和常闭式电磁盘式制动器，风标装置和电磁盘式制动器的电压都为 DC24V。YTRVFW132M3-4F2 9kW 变频电

机带涡流制动器，但不带风标和制动器。

YTRVFW132M3-4F1 9 kW converter motor is equipped with an eddy current brake, wind vane device, and normally closed electromagnetic brake, and the wind vane device, normally closed electromagnetic brake are both at voltages of DC24V. YTRVFW132M3-4F2 9kW converter motor is equipped with an eddy current brake but not a wind vane device and a normally closed electromagnetic brake.

1、 回转制动的使用：

1. Use of slewing braking

（1）当回转停止后，处于就位状态时，若因风力过大，就位困难，可按下回转制定按钮，两个回转制动器在弹簧作用下制动。再起动回转时，自动解除制动。

(1) A slewing system keeps in a ready status when not being used. If being ready is difficult for large wind, you can press the slewing braking button to make 2 brakes to stop based on actions of springs. The braking will be automatically released when the next slewing starts.

（2）停机后，回转机构应在自由状态下转动，可利用回转电机上的手动风标来解除制动或采用连续按下联动台上风标按钮 3 秒钟，使制动器打开，并保持在释放状态，可以使塔机自由回转，制动器打开。

(2) After a machine stops, the slewing mechanism should rotate in a free state. You can release the braking by using manual wind vanes or press the wind vane button for 3 seconds, and then the tower crane can freely rotate and the brake turns on.

回转支承型号为 013.60.2240.101.04.03F1，大小齿轮传动比是： i=167/16=10.44, 模数 m=12。

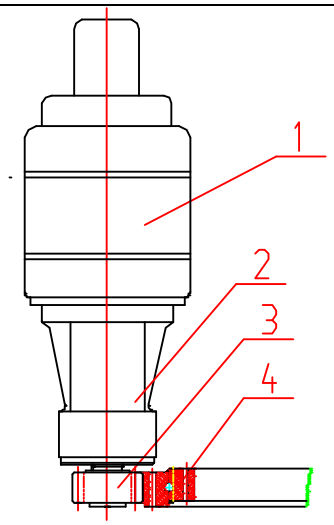
Slewing bearing type: 013.60.2240.101.04.03F1

Transmission ratio of a big gear to a small one 167/16=10.44

Number of modulus: 12

注意：安装回转支承时其滚道淬火软带（外部标记“S”或堵塞孔处）应放置在紧靠回转机构一侧。

Note: when mounting slewing bearing, its track quenching soft belt should be placed near to slewing mechanism side.



1、电动机 2、行星减速机 3、小齿轮 4、回转支承

1. Motor 2. Planetary gear 3. Small pinion 4. Slewing bearing

图 2.2-2 回转机构

Fig 2.2-2 Slewing mechanism

2、回转制动器和风标装置的调整：

2、Slewing brake and wind vane device adjustment:

本塔机共有 2 套回转制动器，为常闭式电磁制动器，见图 2.2-3 所示。制动器供电电压为 DC24V，制动器通电后处于制动打开状态，塔机上部可以转动。仅当塔机停止回转后，为保证起重臂不出现随风转动，才断电制动，严禁使用制动器停车，否则将产生过大冲击损坏回转机构甚至塔身结构，造成严重后果。

This tower crane has 2 sets of slewing brakes, which are normally closed electromagnetic brakes. For details, see Figure 2.2-3. Power supply voltage of brake is DC24V. After electrify the brake is in open state so that the upper tower crane can turn. Only when tower crane stop turning after a boom, in order to ensure jib not to turn with wind, it is cut off braking. Brake parking is strictly prohibited; otherwise it will have a big damaged impact on slewing mechanism and tower structure, and even cause serious consequences.

制动器的维护与保养：

Brake maintenance:

当摩擦片磨损程度较大时，将会影响风标电磁铁的正常动作，严重时将使风标不能手动释放，制动器不能有效地制动。因此，在电动机使用一定时间后应及时调整调节螺母（项 17），以保证风标电磁铁正常动作，必要时更换制动盘（项 7）；

When wearing degree of friction plate is bigger, it will affect normal action of wind vane

electromagnet. Seriously even the scale can't be released by hand, and brake can't effectively work. As a result , when motor is used after a certain period of time, adjusting nut (17) should be timely adjusted in order to ensure normal movement of weathercock electromagnet. Replace brake disc (item 7) when it is necessary.

（1）断开全部电源；

(1) Disconnect all power;

（2）旋下风标盒盖（项 21）；

(2) Spin wind vane lid (21);

（3）旋下调节螺母（项 17）；

(3) Unscrew adjusting nut (17);

（4）旋下风标盒总成（项 12、13、14、15、16、18、20）；

(4) Spin standard assembly of wind vane box (item 12, 13, 14, 15, 16, 18, 20);

（5）旋松调节螺套（项 22），并取出主弹簧（项 19）；

(5) Unscrew adjusting screw (22), and remove spring (19);

（6）用螺丝刀向左旋出定位销钉（项 11），并拉出励磁铁芯（项 10）固定孔至平面外；

(6) Use a screwdriver to left spin out positioning pin (11), and pull out fixed hole of field core (10) to out plane;

（7）旋下励磁铁芯（项 10），小心移开励磁铁芯壳体（注意保护励磁线圈引出线，不使损坏）；

(7) Unscrew field core (10), be careful to remove field core shell (pay attention to protect excitation coil leading wire, which cannot be damaged);

（8）更换制动盘（项 7）；

(8) Replace brake disc (Item 7);

（9）将励磁铁芯（项 10）用螺钉固定在电机后盖上；

(9) Fasten field core (10) to the motor back cover with screws;

（10）将螺丝刀伸入励磁铁芯（项 10），逆时针拨动衔铁（项 8）齿盘，拨至不动为止，左手稍压定位螺钉，右手用螺丝刀顺时针拨动衔铁（项 8）齿盘 3～4 齿；

(10) Insert a screwdriver into field core (Item10), dial armature tooth plate over counter-clockwise (Item8) until motionless. Make a bit pressure on positioning screw with left hand, clockwise turn armature (item 8) plate of 3 ~ 4 teeth with a screwdriver by right hand;

（11）旋紧制动器销钉（项 11）；

(11) Tighten brake pin (11);

（12）装上主弹簧（项 19），并旋压调节螺套（项 21）（旋至制动力矩 20N.m）；

(12) Install on main spring (Item 19), and spin adjusting screw(Item 21) (spin to braking torque 20 N. m);

（13）装上风标盒座总成（项 12、13、14、15、16、18、20）；

(13) Install on wind vane box seat assembly (Item 12, 13, 14, 15, 16, 18, 20);

（14）调整调节螺母（项 17）；

(14) Adjust adjusting nut (17);

注：调整时，自然状态（风标手柄向下），电动机能有效制动；风标手动工作时（风标手柄向上），电机能有效运行（脱离制动状态）。

Note: When it is adjusted at the state of nature (weathercock handle is down), motor can brake effectively; When weathercock works by manual (weathercock handle is up), motor can run effectively (out of braking state).

（15）盖严风标盒盖（项 21）；

(15) Cover tightly the lid of weathercock (Item 21);

检查制动片磨损情况，发现问题及时更换

Check the brake wearing. Found the problem and timely replace it.

每 200 小时或每个月进行一次保养。

Make maintenance every 200 hours or every month.

经常检查制动器内有无异物（水泥、沙子、油脂等），若有异物及时清理。

Often check and make sure there are no foreign bodies in the brake (cement, sand, oil, etc.), if there is foreign body , clean up in time.

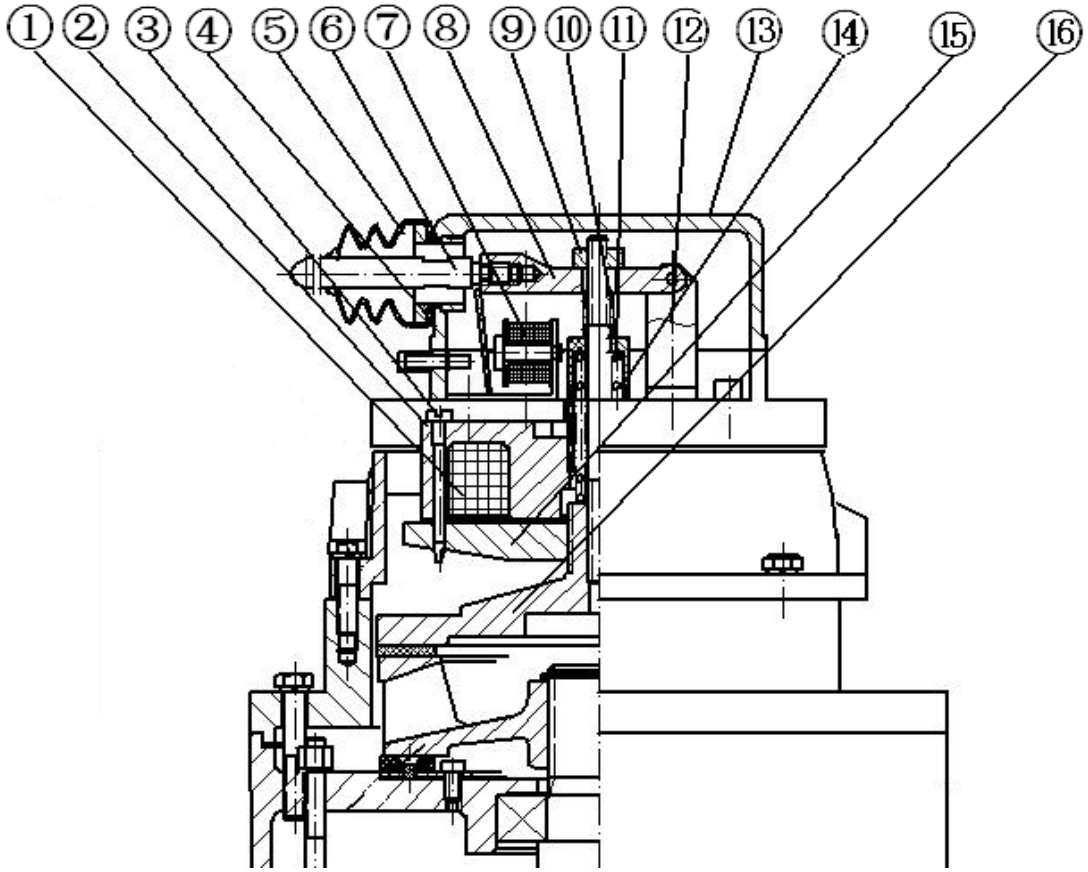


图 2.2-3　　回转制动器及风标装置 Slewing brake and wind vane device

1.励磁线圈　2.励磁铁芯　3.定位销钉　4.风标底座　5.风标防雨套
6.风标手柄　7.风标线圈　8.风标连接杆　9.调节螺母　10.调节弹簧
11.风标主弹簧　12.风标支架　13.风标盖　14.调节螺套　15. 衔铁
16.制动盘

1. Excitation coil　2.Field core　3.Positioning pin　4. Wind pre-tender seat　5. Rain wind vane sets　6. Wind vane handle　7. Wind vane circle line 8. Wind vane link rod 9. Adjusting nut 10. Adjust spring 11. Weathercock main spring 12. Weathercock stents 13. Weathercock cover　14. Adjust screw 15. Armature 16. Brake disc

2.2.3 小车变幅机构 （见图 2.2-4）

2.2.3 Trolleying mechanism (see figure 2.2-4)

小车变幅机构是载重小车变幅的驱动装置，电机（YVFE3-160L-4H 15kW）经由行星减速机（电机尾部安装有电磁盘式制动器，制动器电压 DC24V）带动卷筒，通过钢丝绳（GB 8918-2006 12 6×19W＋FC 1670 U ZS）使载重小车在 0～60m/min 的速度在臂架轨道上作变幅运行运动。牵引绳一端缠绕后固定在卷筒上，另一端则固定在载重小车上，变幅时靠绳的一收一放来保证载重小车的正常工作。

The trolleying mechanism is driving device for elevating of a loaded trolley. Motor (YVFE3-160L-4H, 15kW) drives the coiling block via a planetary reducer (with an electromagnetic disk brake installed at the end of a motor and the brake voltage of DC 24V) and enables a loaded trolley to perform elevating movements on the boom rail at a speed of 0-60 m/min using a wire rope (GB 8918-2006 12 6 x 1670 U ZS 19WFC). One end of the pulling rope is fixed on the winding drum and the other end is fixed to the loaded trolley. Wire rope deploying and retracting are used to ensure normal work of the trolley during elevating.

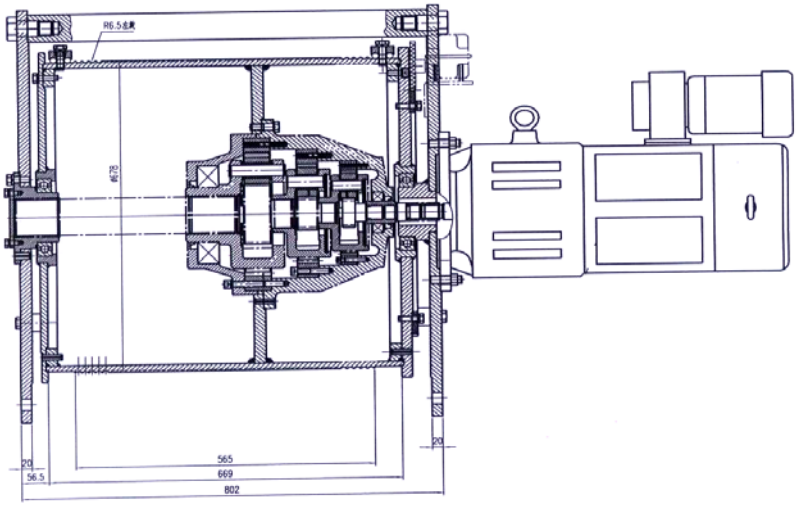


图 2.2-4 小车变幅机构

Figure 2.2-4 Trolleying mechanism

2.2.4 液压顶升机构 （见图 2.2-5）

2.2.4 Jacking mechanism

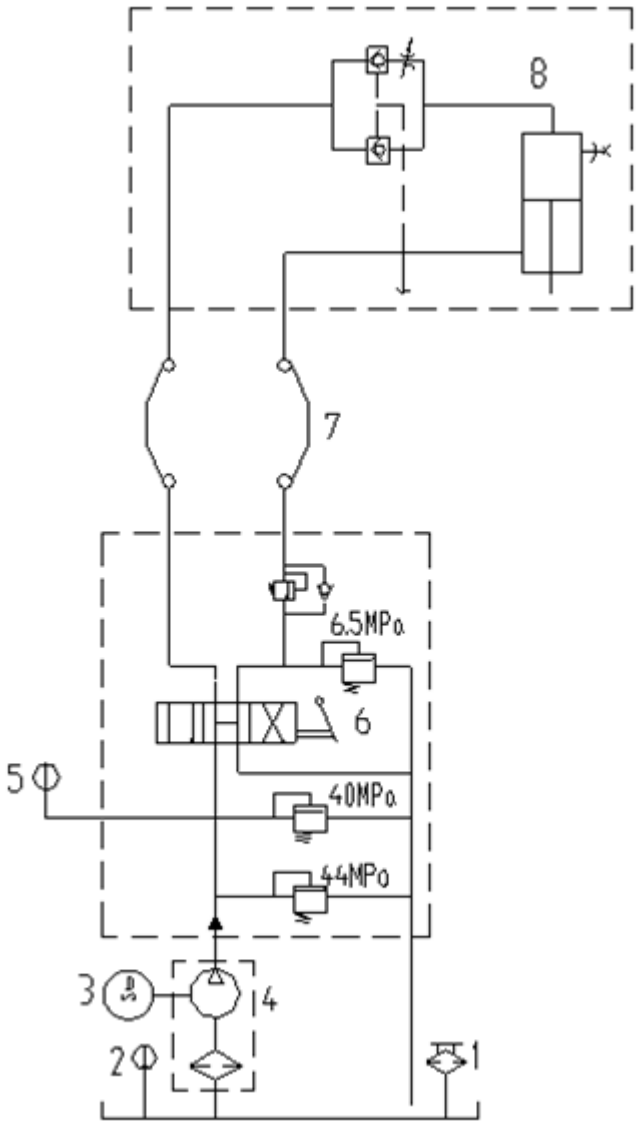


图 2.2-5 液压顶升机构原理图

Figure 2.2-5 Jacking mechanism schematic diagrams

技术参数
Technical parameters
1. 溢流阀调定压力 Overflow valve setting pressure: 41MPa
2. 安全阀调定压力 Safety valve setting pressure: 45MPa
3. 低压溢流阀调定压力
Low-pressure overflow setting ressure: 6.5 MPa
4. 满载流量 Full-load flow: 15.3L/min
5. 空载流量 Empty-load: 17L/min
6. 功率 Power: 15Kw

液压顶升系统的工作，主要是靠安装在套架内侧的一套液压油缸和油压系统来完成。当需要顶升时，先由起重吊钩吊起一节标准节，放置在套架引进梁上。顶升梁顶在塔身就近的踏步上，把塔身标准节与下支座的 8 个连接销轴退出，开动液压系统，使活塞杆全部伸出，顶起上部结构，然后，操纵爬爪挂在标准节踏步上。油缸全部缩回，重新使顶升梁顶在塔身上另一踏步上，再次开动液压系统顶升，这样，三个工作循环可加一节标准节。

The function of hydraulic system depends on the oil cylinder set and oil pressure system. When lifting, hook up one mast and put it on introduction beam of climbing frame. The introduction beam, on the nearest tower step move the eight pin shafts connecting tower masts and lower support. Start hydraulic system to extend all pistons out to jack upper structure up. And then hang operating claw on mast step. Move all cylinders back and put introduction beam on another step and start hydraulic system again. Do this process three times to add one mast.

液压顶升过程的动力传递：当电机开动时，带动高压油泵输出压力油（压力由负载决定，正常额定工作压力可达 37Mpa，流量约为 15.3L/min），油泵供出的高压油进入手动三位四通换向阀（中间装有一只压力表，便于观察油压读数），手动换向阀为的是控制油液的进油和回油方向的调整，手动换向阀的液压油经过液压锁输送到油缸中去，进行油缸的伸缩顶升工作。液压油缸的高压腔装有液压锁，可防止起重机在顶升过程中，因油路系统故障引起油管爆裂，而不至于负载下降，同时还可以防止负载下降速度过快。油泵出口的管路中装有溢流阀，以控制液压系统压力。

The power transmission in hydraulic jacking process: when motor starts, it drives high pressure pump to output pressure oil (the pressure is depending on the load, the normal working pressure is 37Mpa, with current of 15.3L/min) into manual directional valve of three-position-four-pass (in the middle is a pressure gage to observe oil pressure) which is used for controlling oil take-in and adjusting return direction. The hydraulic oil of manual directional valve is delivered to oil cylinder via hydraulic lock to achieve stretching and jacking of cylinder. Cylinder high-pressure cavity equips with hydraulic pressure lock to prevent oil pipe from exploding during jacking because of oil system breakdown. It also prevents dropping too fast with load. There is an overflow valve in oil pump export to control hydraulic system pressure.

说明：请用户在使用前详细液压系统的《使用说明书》。

Note: before using hydraulic system, the users should read the detailed Operation Instruction of Hydraulic Mechanism first.

整个液压系统的主要性能参数如下：

Main parameters of system are following:

顶升速度：V=0.34m/min

Jacking speed: V=0.34m/min

工作流量：Q=15.3L/min

Working current: Q=15.3L/min

安全溢流阀调定压力：P=45MPa

Rated pressure of overflow safety valve: P=44MPa

顶升行程：H=1600mm

Jacking distance: H=1600mm

最大顶升力：W=162.7t

Maximum jacking force: W=162.7t

表 2-1 液压泵站主要技术参数

Table 2-1 Main parameters of hydraulic pumping station

额定工作压力 Rated Working Pressure (MPa)	满载流量 Full-load Flow （L/min）	电机功率 Motor Power （kW）	配高压胶管 High-pressure hose	油箱容积 Fuel tank capacity （L）	用 油 Oil
37	15.3	15	JB1885-77	190	夏季：L-HM46 抗磨液压油 冬季：L-HM32 抗磨液压油 In summer: L-HM46 anti-rub hydraulic oil In winter: L-HM32 anti-rub hydraulic oil

表 2-2 顶升油缸主要技术参数

Table 2-2 Main parameters of jacking oil cylinder

额定压力 Rated pressure （MPa）	缸 径 Cylinder diameter （mm）	杆 径 Rod diameter （mm）	行 程 Distance （mm）	安装距 Installing distance （mm）	顶升速度 Lifting speed （m/min）	最大顶升力（t） Maximum lifting force (t)
37	240	160	1600	2220	0.34	162.7

2.2.4.2 液压系统的安装及使用

2.2.4.2 Installation and use of hydraulic system

1）油液的清洁处理

1) Cleaning oil

首先旋开空气滤清器，经过滤油网将液压油加至油箱上油标上限为止，方可启动油泵电机（俯看电动机风叶旋向是否与泵座上所标方向一致）。

First, unscrew the air filter, add hydraulic oil through oil network to the oil tank upper limit before starting the pump motor (overlooking whether motor blades spin direction is consistent with standard direction marked on pump base).

⚠ 注意

泵的旋向有左右之分，如接错，该系统不能工作。

⚠ Caution Pump system does not work if the spin direction of pump is wrong, which is different towards right and left.

2）系统管路连接

2) System piping connections

首先检查高压胶管口清洁与否，然后将液压站的两个管口与油缸两腔油口通过高压胶管连接并拧紧接头。

First check and make sure the high-pressure hose orifice is clean, and then link and tighten the two orifices of pumping station and two hydraulic cylinder chamber orifices together via high pressure hose.

3）系统的排气

3) Exhaust of system

启动电机，拧松油缸上的进（出）口或出（进））高压胶管接头，移动手动换向阀的手柄（以下简称操作手柄）于上升（或下降）位置，使液压油进入管内，将空气从进（出）口或出（进）口溢出，直至油液从接头处流出且无气泡时为止，然后拧紧高压胶管接头。油缸空载时推动操作手柄，让油缸活塞杆全行程上下运动几次，将油缸内的空气通过油管挤入油箱而排尽。

Start the motor, and loosen the cylinder hose joint of intake (export) or out (import). Move the manual handle valve 4 (hereinafter referred to as the operating handle) on rising (or falling) position to lead hydraulic oil into hose and spill air from the import intake (export) or out (import), until there is no bubble from oil when it is flowing out of joint. Later tighten high-pressure hose joints. Push handle when cylinder is in no-load operation, allowing the cylinder rod to move up and down a few times at whole route so that the air in cylinder are squeezed into tanks through the pipe and finally all are cleared out.

⚠ 注意

操作时应注意：当活塞杆运动到上（或下）极限位置后，应立即扳回操作手柄，使之处于中间位置，并停留几分钟，待挤入油箱液压油的气泡消失后，再进行下一个操作。

⚠ Caution Note in operation: **When the piston rod moves to upper (or lower) limit position, the operating handle should be pulled back immediately to keep the piston rod in the middle position for a few minutes. Don't do the next step until the air bubble in hydraulic oil tank is squeezed to disappear.**

4）系统的使用

4) Use of the system

操作前检查油缸与机架联接是否正确、可靠，检查塔机有关部分是否达到有关技术要求后再进行如下操作。

Before operation, check connection of fuel tank and chassis is correct and reliable, and whether the relevant parts of tower crane meet the relevant technical requirements. And then proceed as follows.

a) 系统最大工作压力的调定：拧松高压溢流阀的调节螺杆和锁紧螺母，启动电机，移动操作手柄于上升位置，让油缸活塞杆伸长至极限位置，此时压力表的读数上升，不断拧紧溢流阀调节螺杆，直至压力表的读数稳定在 41MPa 为止。然后拧紧高压溢流阀调节螺杆上的锁紧螺母（不允许未经培训合格人员擅自调动溢流阀），反向操作手柄收回活塞杆，最后是操作手柄回复中位。

   a. Set the maximum working pressure of system: loosen adjusting screw and locknut of high pressure overflow valve. Start motor, and move operating handle to the up position, so that cylinder rod is stretched to the limit position. At this time, the number on pressure gauge continuously increases, so continue to tighten overflow valve adjustment screw until the number on pressure gauge stays at 41MPa. After that tighten the locknut on adjustment screw of overflow valve (personnel unqualified or without training are not allowed to adjust overflow valve). Afterwards operate reversely the operating handle to recover piston rod, and the last thing is to restore the operating handle to middle position.

b) 上升（或下降）操作：启动电机，将操作手柄移至对中位置，油缸活塞伸出，将连接在活塞杆上的顶升横梁两端的销轴放置在合适的塔身节踏步圆弧槽内，进行顶升加节（或拆卸塔身）工作。

b. Rise (or fall): Start the motor, and move the operating handle to middle position, resulting at moving cylinder piston out. Place connecting pin on piston rod for two ends of crossbeam jacking beams in the appropriate section of tower step arc groove, and then conduct jacking and adding mast (or demounting tower body).

2.2.4.3 液压系统的维护，保养及注意事项

2.2.4.3 Maintenance of hydraulic system, the related precautions:

该液压系统属于高压液压装置，从加油到调整全过程都应严格按使用说明书规定进行。

The hydraulic system is a high-pressure hydraulic system, so the entire process from filling to adjusting should be strictly in accordance with regulations in the instruction manual.

1）液压系统用油

1) Hydraulic oil

a) 该液压系统油品选用要求：使用 L-HM46 液压油（夏季）和 L-HM32 抗磨液压油（冬季），不允许混合使用其它液压油，不允许未经过滤直接加注液压油，当发现油液发泡、乳化时，应及时清洗油箱，更换新油。

a. The hydraulic system is recommended to use L-HM46 hydraulic oil in summer and L-HM32 anti-wear hydraulic oil in winter, not allowing other hybrid hydraulic oil or adding oil unfiltered. When discovering oil foaming, emulsification, clean the tank and replace with new oil timely.

b) 液压系统的加油：第一次加油应装满油箱，开机后伸出油缸活塞杆，再缩回活塞杆，这时向油箱内补油至油位达到油箱油标上限为止。

b. Refueling hydraulic system: tank should be filled at the first fueling. After starting tower machine, extend the cylinder piston rod, and then retract it, during this time fill oil to the tank to the oil limit.

c) 此液压系统属于高压系统，各方面都要求较严，所以对油液清洁度有明确要求，在油液清洁度满足要求时方可开机使用。

c. This hydraulic system is a high hydraulic system, and has high requirements for all aspects, so it can be used only when the clean degree meets the requirements.

d) 液压系统每工作 200 小时后，应完全换油。

d. The system should completely exchange oil after it works 200 hours at a time.

2）该系统散热条件较差，不工作时，请及时关机，以免温升过高影响使用。

2) Please shut down the machine if the cooling system in poor condition and does not work, so as not to affect its function because of overheating.

第三章　钢丝绳
Chapter 3　Steel rope

3.1 钢丝绳基本知识
3.1 Basics of rope

3.1.1 钢丝绳的结构

3.1.1 Rope structure

如图 3.1-1 所示，钢丝绳是由一定数量的钢丝一层或多层的股绕成螺旋形而形成的结构。

As shown in Figure 3.1-1, steel wire is a helical structure composed of a number of shares of one or more layers.

3.1.2 钢丝绳的捻向(见图 3.1-2)

3.1.2 Rope lay direction (see Figure 3.1-2)

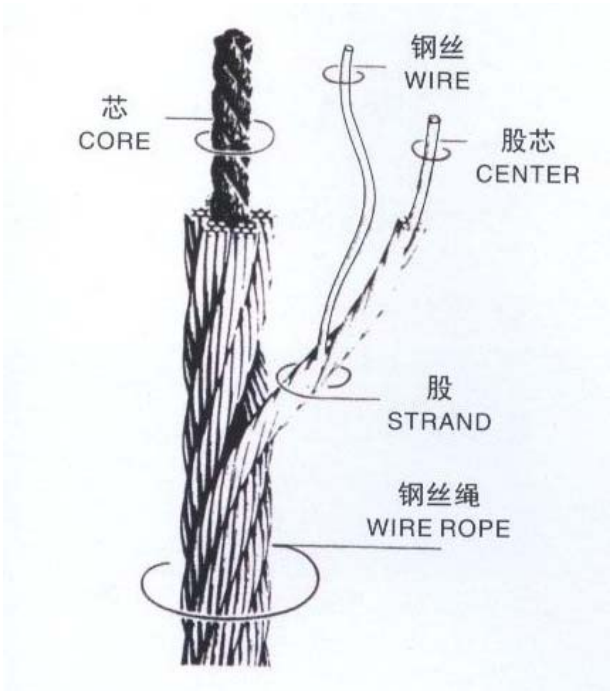


图 3.1-1
Figure 3.1-1

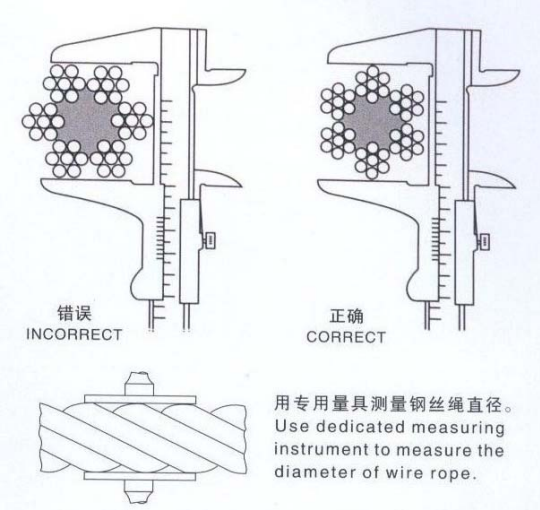
图 3.1-2
Figure 3.1-2

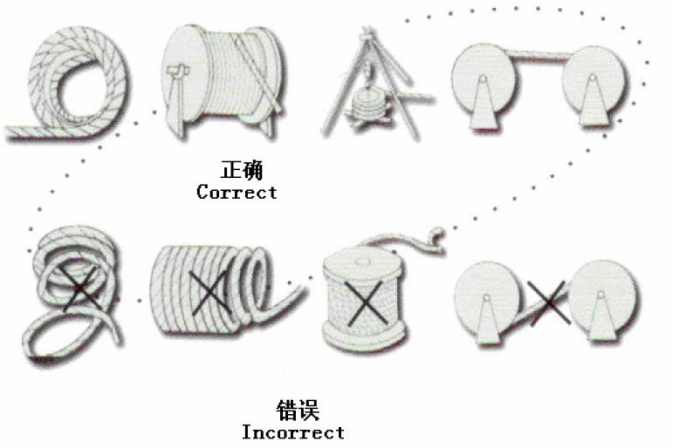
3.1.3 钢丝绳直径测量

3.1.3 Wire rope diameter measurement

在测量钢丝绳直径时，注意正确的测量方法，如图 3.1-3 所示。

When measuring the wire rope diameter, pay attention to the correct measurement method, as shown in Figure 3.1-3.





3.1.4 钢丝绳的解卷

3.1.4 Rope unwinding

解卷时应将绳盘放在专用的支架上，也可用一根钢管穿入绳盘孔，两段套上绳套吊起，将绳盘缓缓转动，如图 3.1-4 所示。

When unwinding the rope, put rope on a special support, or lift the rope up with a steel bar penetrating through hole of rope with rope sleeve at two ends, and move rope block slowly, as shown in Figure 3.1-4.

3.1.5 钢丝绳夹

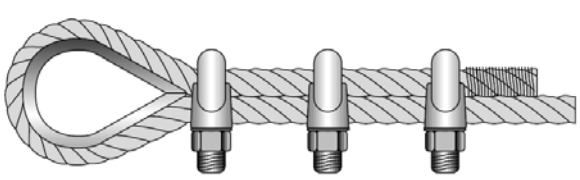
3.1.5 Rope clips

3.1.5.1 钢丝绳夹的布置

3.1.5.1 Rope clamp arrangement

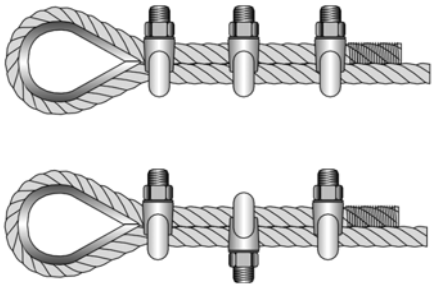
钢丝绳夹应按图 3.1-5 所示把夹座扣在钢丝绳的工作段上，U 形螺栓扣在钢丝绳的尾段上。钢丝绳夹不得在钢丝绳上交替布置。

As Figure 3.1-5, put clip seat at the working section of wire rope, with U-bolt buckling tail rope. Wire ropes should not be arranged alternately.



钢丝绳卡正确安装

Right way



钢丝绳卡错误安装

Wrong way

图 3.1-5
Fig. 3.1-5

3.1.5.2 钢丝绳夹的数量

3.1.5.2 Number of wire rope clips

对于符合本标准规定的适用场合，每一连接处所需钢丝绳夹的最少数量，推荐如表 3.1-1 所示。

For suitable occasions compliant with this standard, the minimum number of wire rope clips required for each connection, is recommended as shown in Table 3.1-1.

表 3.1-1 钢丝绳夹的数量

Table 3.1-1 Number of wire rope clips

绳夹公称尺寸 mm（钢丝绳公称直径 dr） Rope clip nominal size (mm) (Nominal diameter dr)	钢丝绳夹的最少数量（组） Minimum number (group)	绳夹公称尺寸 mm（钢丝绳公称直径 dr） Rope clip nominal size (mm) (Nominal diameter dr)	钢丝绳夹的最少数量（组） Minimum number (group)
≤19	3	>38~44	6
19~32	4	>44~60	7
32~38	5		

3.1.5.3 钢丝绳夹间的距离

3.1.5.3 Distance between wire rope clips

如图 3.1-6 所示，钢丝绳夹间的距离 A 等于 6～7 倍钢丝绳直径。

As shown in Figure 3.1-6, distance A between rope clips is equal to the 6 to 7 times the rope diameter.

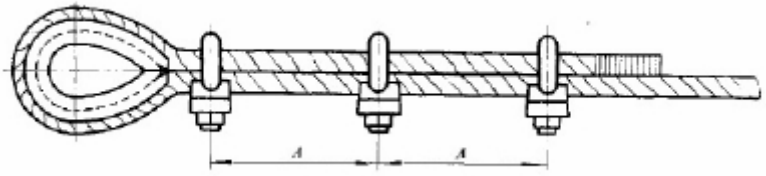


图 3.1-6
Fig. 3.1-6

3.1.5.3 钢丝绳夹的紧固方法

3.1.5.3 Fastening methods of rope clip

紧固绳夹时须考虑每个绳夹的合理受力，离套环最远处的绳夹不得首先单独紧固。离套环最近的绳夹（第一个绳夹）应尽可能靠近套环，但仍须保证绳夹的正确拧紧，不得损坏钢丝绳的外层钢丝。

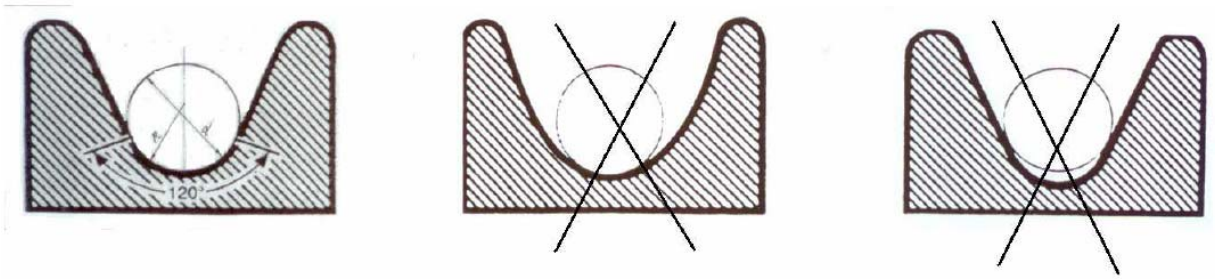
When fastening the rope, reasonable force of each rope clip needs to be considered. The clip at the most distant from socket ring rope should not be separately fastened at first. The nearest rope clip from socket ring (first rope clip) should be set as close to the ring. Make sure the correct tightening of rope clips, without damaging outer wires.

3.1.5.4 钢丝绳直径与轮槽的关系

3.1.5.4 Relationship between the rope diameter and groove

合适的轮槽与钢丝绳应为图 3.1-7a 所示。轮槽过大（图 3.1-7b），会增加钢丝绳及金属绳芯疲劳断丝；轮槽过小（图 3.1-7c），会严重磨损钢丝绳。轮槽半径 R 与钢丝绳公称直径 d 之比应为 0.525~0.559 之间。

Suitable wheel groove of rope is shown in Figure 3.1-7a. Too large groove (Figure 3.1-7b), will increase the rope and its mental core fatigue and break. Too small groove (Figure 3.1-7c), will badly worn rope. The ratio between wheel groove radius R and diameter d should be between 0.525 ~ 0.559.



(a)正确　　（b）错误　　（c）错误

图 3.1-7 钢丝绳与轮槽的关系

a) Right　　（b）Wrong　　（c）Wrong

Figure 3.1-7 Relationship between the rope diameter and groove

3.2 钢丝绳的安装

3.2 Installation of wire rope

当从卷筒上抽出钢丝绳时，应采取措施防止钢丝绳打环、扭结、弯折或粘上杂物。在钢丝绳投入使用之前，用户应确保与钢丝绳工作有关的各种装置已安装就绪并运转正常。新更换的钢丝绳应与原安装的钢丝绳同类型、同规格。如钢丝绳系由较长的绳上切下，应在切断的两端进行处理，以防切断处引起钢丝绳的松散。

When withdrawn from drum, wire rope should be taken measurement to prevent fighting ring, kink, bend or glue debris. Before using rope, the user should ensure that a variety of devices related to wire rope has been installed in place and functioning properly. The new wire rope should be replaced with the same type and specification of the original rope. If the rope is too long and needs to be cut a little, the two ends of rope after cut should be treated to prevent loosing the whole rope.

3.3 钢丝绳的报废

3.3 Scrapped rope

3.3.1 断丝的性质和数量

3.3.1 Nature and number of broken wires

表 3..3-1 考虑了这些因素，因此，当与（2）～（19）款中的因素结合起来考虑时，它适用于各种结构的钢丝绳。

Table 3. 3-1 refers to these factors, which are suitable for all kinds of steel rope when combined with Item (2) to (19).

3.3.2 绳端断丝

3.3.2 Break of rope end

当绳端或其附近出现断丝时，即使数量很少也表明该部位应力很大，可能是由于绳端安装不正确造成的，应查明损坏原因。如果绳长允许，应将断丝的部位切去重新安装。

When it appears break near rope end, even if it is a small number, also indicates that this part is stress a lot. The reason may be the rope is not installed correctly. Identify the causes of damage and cut the broken part and reinstall if possible.

3.3.3 断丝的局部聚集

3.3.3 Partially gather of broken wire

如果断丝紧靠一起形成局部聚集，则钢丝绳应报废。如这种断丝聚集在小于 6d 的绳长范围内，或者集中在任一支绳股里，那么，即使断丝数比表 9.4-1 列的数值少，钢丝绳也应予以报废。

If the broken wire is close together partially, the rope should be scrapped. If such gather is in less than 6d of rope length, or focuses on any strand, the rope should also be scrapped even if the broken wires are less than the number listed in Table 9.4-1.

3.3.4 断丝增加率

3.3.4 The increasing of broken wire

在某些使用场合，疲劳是引起钢丝绳损坏的主要原因，断丝则是在使用一个时期以后才开始出现。当断丝数逐渐增加，其时间间隔越来越短时，为了判定断丝的增加率，应仔细检验并记录断丝增加情况。利用这个规律可用来确定钢丝绳未来报废的日期。

In some occasions, fatigue is the main cause of damage to wire rope, while wire break begins to appear after a period of use. When the number of broken wires increasing and its intervals becoming shorter, carefully examine and record the increase of broken wires to figure out the increase rate of broken wires. This rule can be used to determine future retirement date if rope.

表 3.3-1 钢丝绳允许断丝数

Table 3.3-1 Steel rope allowable broken wire number

外层绳股承载钢丝数 n Bearing number of outer Wire strand N	起重机械中钢丝绳必须报废时与疲劳有关的可见断丝数 The number of visible broken wire rope related to fatigue for lifting machinery when rope							
	机构工作级别 M5、M6、M7、M8 Classification Group of Mechanisms				机构工作级别 M5、M6、M7、M8 Classification Group of Mechanisms			
	交互捻 Regular lay		同向捻 Lang lay		交互捻 Regular lay		同向捻 Lang lay	
	长 度 范 围 Length range				长 度 范 围 Length range			
	6d	30d	6d	30d	6d	30d	6d	30d
n≤50	2	4	1	2	4	8	2	4
51≤n≤75	3	6	2	3	6	12	3	6
76≤n≤100	4	8	2	4	8	16	4	8
101≤n≤120	5	10	2	5	10	19	5	10
121≤n≤140	6	11	3	6	11	22	6	11
141≤n≤160	6	13	3	6	13	26	6	13
161≤n≤180	7	14	4	7	14	29	7	14
181≤n≤200	8	16	4	8	16	32	8	16
201≤n≤220	9	18	4	9	18	38	9	18

221≤n≤240	10	9	5	10	19	38	10	19
241≤n≤260	10	21	5	10	21	42	10	21
261≤n≤280	11	22	6	11	22	45	11	22
281≤n≤300	12	24	6	12	24	48	12	24
n>300	0.04n	0.08n	0.02n	0.04n	0.08n	0.16n	0.04n	0.08n

注：

(1) 填充钢丝不能看作承载钢丝，因此要从检验数中扣除。多层股钢丝绳仅考虑可见的外层绳股，带钢芯的钢丝绳，其绳芯看作内部绳股而不予考虑。

(2) d 为钢丝绳公称直径，单位 mm。

Note:
(1) Filler wire cannot be regarded as bearing steel therefore it needs to be deducted from the number of checkout. For multi-strand wire, the visible outer strands are only considered. The rope wire rope with steel core which is regarded as an internal rope strand would not be considered.
(2) d is the nominal diameter of rope, and its unit is mm.

Note:
(1) Filler wire cannot be regarded as bearing steel therefore it needs to be deducted from the number of checkout. For multi-strand wire, the visible outer strands are only considered. The rope wire rope with steel core which is regarded as an internal rope strand would not be considered.
(2) d is the nominal diameter of rope, and its unit is mm.

3.3.5 绳股断裂

3.3.5 Strand break

如果出现整根绳股的断裂，则钢丝绳应报废。

If it occurs to the whole of strands fracture, the rope should be scrapped.

3.3.6 绳芯损坏而引起的绳径减小

3.3.6 Rope diameter reduced caused by cord damage

当钢丝绳的纤维，芯损坏或钢芯（或多层结构中的内部绳股）断裂而造成绳径显著减小时，钢丝绳应报废。

When the rope diameter is reduced because of the damage on rope fiber, core and steel core (or internal strands in multilayer structure) the rope should be scrapped.

微小的损坏，特别是当所有各绳股中应力处于良好平衡时，用通常的检验方法可能是不明显的。然而这种情况会引起钢丝绳的强度大大降低。所以，有任何内部细微损坏的迹象时，均应对钢丝绳内部进行检验予以查明。一经证实损坏，则该钢丝绳，就应报废。

Slight damage may not be obvious in usual test methods, particularly when the stress of all strands in a good balance. However, this situation will lead to reduce greatly the strength of the rope. Hence, check the internal rope when there are any subtle signs of internal damage on rope.

After proven out the damage, the rope should be scrapped.

3.3.7 外部磨损

3.3.7 External wear

钢丝绳外层绳股的钢丝表面的磨损，是由于它在压力作用下与滑轮或卷筒的绳槽接触摩擦造成的。这种现象在吊载加速或减速运动时，在钢丝绳与滑轮接触的部位特别明显，并表现为外部钢丝磨成平面状。

Wear of outer surface of wire rope strands, is because of its frictional under pressure contacting with the rope groove of pulley or drum. This phenomenon is evident at the contacting part of rope and pulley when in acceleration or deceleration, with the outer wire is rubbed into flat surface.

润滑不足或不正确的润滑以及存在灰尘和砂粒都会加剧磨损。

Lack of lubrication or improper lubrication and existence of dust and sand will increase wear.

磨损使钢丝绳的断面积减小而强度降低。当钢丝绳直径相对于公称直径减小 7%或更多时，即使未发现断丝，该钢丝绳也应报废。

Wear will lead to the reduction of rope section and strength. When the rope diameter is reduced 7% or more relative to the nominal diameter of, the rope should be scrapped even if not found broken wires.

3.3.8 弹性降低

3.3.8 Elasticity reduction

在某些情况下，钢丝绳的弹性会显著降低，继续使用是不安全的。钢丝绳的弹性降低较难发现，如检验人员有任何怀疑，应征询钢丝绳专家的意见。

In some cases, the elastic rope is significantly reduced, and continuing use is unsafe. Elasticity reduction of rope is difficult to find, if personnel who have any doubt should consult rope experts.

虽未发现断丝，但钢丝绳明显的不易弯曲和直径减小比起单纯是由于钢丝磨损而引起的减小要严重得多。这种情况会导致在动载作用下钢丝绳突然断裂，故应立即报废。

Although the rope is not found to be broken, more serious is that the rope cannot be bended easily or its diameter is reduced. This case will result at sudden rupture of rope so the rope should be immediately scrapped.

3.3.9 外内部腐蚀

3.3.9 External and internal corrosion

外部钢丝的腐蚀可用肉眼观察。当表面出现深坑，钢丝相当松弛时应报废。

External corrosion can be visually observed. When the surface is pitted and the rope is considerably slack, the rope should be scrapped.

如果有任何内部腐蚀的迹象，则应由主管人员对钢丝绳进行内部检验。若确认有严重的内部腐蚀，则钢丝绳应立即报废。

If there are any signs of internal corrosion of rope, responsible person should be carried out internal inspection. If it is confirmed as serious internal corrosion, the rope should be immediately scrapped.

3.3.10 波浪形

3.3.10 Wavy

如图 3.3-1 所示，出现波浪形时，在钢丝绳长度不超过 25d 的范围内，$d_1 \geq \frac{4}{3}d$ 则钢丝绳应报废。式中 d 为钢丝绳的公称直径，d1 是钢丝绳变形后包络的直径。

As shown in Figure 3.3-1, if the rope appears to be wavy, and the rope length is less than 25d, $d_1 \geq \frac{4}{3}d$ the rope should be scrapped. d means nominal diameter of rope, d_1 is diameter of rope after deformed.

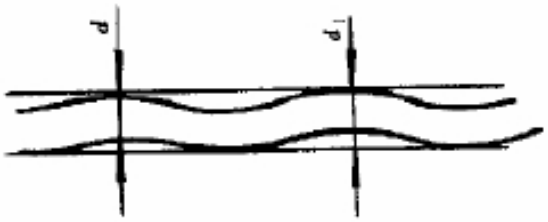


图 3.3-1 波浪变形

Fig. 3.3-1 Wave deformation

3.3.11 笼状畸变

3.3.11 Cage-like distortion

这种变形出现在具有钢芯的钢丝绳上，当外层绳股发生脱节或者变得比内部绳股长的时候就会发生这种变形，如图 3.3-2 所示。笼状畸变的钢丝绳应立即报废。

This distortion occurs on wire with steel core. This deformation occurs when outer strands are out of line or longer than internal strands, as shown in Figure 3.3-2 divorced or outer strands occur. Cage-like distorted rope should be immediately scrapped.

图 3.3-2 笼状畸变

Figure 3.3-2 Cage-like distortion

3.3.12 绳股挤出

3.3.12 Extrusion of strands

这种状况通常伴随笼状畸变一起产生，绳股被挤出说明钢丝绳不平衡，如图 3.3-3 所示。绳股挤出的钢丝绳应立即报废。

This condition is usually produced accompanying with a cage-like distortion. The strands are squeezed out, which means the rope is imbalanced, as shown by 3.3-3 Show. The rope with extruded strands should be immediately scrapped.

图 3.3-3 绳股挤出

Fig. 3.3-3 Strand extrusion

3.3.13 钢丝挤出

3.3.13 wire extrusion

此种变形是一部分钢丝或钢丝束在钢丝绳背着滑轮槽的一侧拱起形成环状，这种变形常因冲击载荷而引起，如图 3.3-4 所示。若此种变形严重时，则钢丝绳应报废.

Such distortion is part of the wire rope or wire bundles in the side of the pulley groove backs arched to form a ring, often due to the deformation caused by the impact load, as shown in Figure 3.3-4. If this deformation is serious, the rope should be scrapped.

图 3.3-4 钢丝挤出

Fig. 3.3-4 Steel wire extrusion

3.3.14 绳径局部增大

3.3.14Partially increase of rope diameter

钢丝绳直径有可能发生局部增大，并能波及相当长的一段钢丝绳。绳径增大通常与绳芯畸变有关(如在特殊环境中，纤维芯因受潮而膨胀)，其必然结果是外层绳股产生不平衡，而造成定位不正确，如图 3.3-5 所示。绳径局部严重增大的钢丝绳应报废。

Wire diameter may occur partially increase which may influence quite a long rope. Rope diameter increases is normally associated with distortion of rope core (such as in special circumstances, the fiber core swells due to damp), and the inevitable result is that the outer strands is unbalanced and consequently incorrect positioning, as shown in Figure 3.3-5. If part of rope diameter is seriously increased the rope should be scrapped.

图 3.3-5 绳径局部增大

Figure 3.3-5 Partial increase of rope diameter

3.3.15 扭结

3.3.15 Kink

扭结是由于钢丝绳成环状在不可能绕其轴线转动的情况下被拉紧而造成的一种变形。其结果是出现捻距不均而引起格外的磨损，严重时钢丝绳将产生扭曲，以致只留一下极小一部分钢丝绳强度，如图 3.3-6 所示。严重扭结的钢丝绳应立即报废。

A rope is deformed due to the tightening when the rope with a kink cannot rotate about its

axis. The result is the emergence of wear caused by uneven lay distance, and in more terrible situation, the rope will be distorted, leaving only a tiny part of rope strength, as shown in Figure 3.3-6. The rope with a serious kink should be immediately scrapped.

图 3.3-6 钢丝绳扭结

Figure 3.3-6 Rope kink

3.3.16 绳径局部减小

3.3.16 Partial decrease of rope diameter

钢丝绳直径的局部减小常常与绳芯的断裂有关。应特别仔细检验靠绳端部位有无此种变形，如图 3.3-7 所示。绳径局部严重减小的钢丝绳应报废。

Partially reduced diameter of is related to rope core fracture. Particularly inspect carefully the rope end parts for such distortion, as shown in Figure 3.3-7. Partially serious reduced diameter rope should be scrapped.

图 3.3-7 绳径局部减

Figure 3.3-7 Partial decrease of rope diameter

3.3.17 部分被压扁

3.3.17 wire rope is partially flattened

钢丝绳部分被压扁是由于机械事故造成的，如图 3.3-8 所示。严重时则钢丝绳应报废。

The wire rope is flattened due to a mechanical accident, as shown in Figure 3.3-8. Such wire rope should be scrapped.

图 3.3-8 部分被压扁

Figure 3.3-8 wire rope is partially flattened

3.3.18 弯折

3.3.18 Bend

弯折是钢丝绳在外界影响下引起的角度变形，如图 3.3-9 所示。这种变形的钢丝绳应立即报废。

Rope is bent to deform by the impact, as shown in Figure 3.3-9. This deformed rope should be immediately scrapped.

图 3.3-9 钢丝绳的弯折

Figure 3.3-9 Bending of wire rope

3.3.19 由于热或电弧的作用而引起的损坏

3.3.19 Damage due to heat or arc

钢丝绳经受了特殊热力的作用其外表出现可资识别的颜色时，该钢丝绳应予报废。

When the wire rope appears to be recognizable subjected to special heat, such wire should be scrapped.

3.4 钢丝绳的维护保养

3.4 Maintenance of rope

钢丝绳使用一段时间后，润滑油脂会逐渐减少，且钢丝绳表面会沾有尘埃、碎屑等污物，引起钢丝绳和滑轮的磨损以及钢丝绳生锈。因此，应定期清洗和加油。简易的方法就是先用钢丝刷刷掉钢丝绳表面的污物，把加热熔化的润滑油脂均匀地涂抹在钢丝绳表面，也可把机油喷浇在钢丝绳表面。

After being used for a period of time, the lubricating grease of rope will gradually decrease and the rope surface will be stained with dust, debris and dirt, causing the wear and rust of rope. Therefore, regular clean and add grease on rope. One easy way is to brush off the dirt on rope surface firstly, and then paint the grease heated to melt evenly on the surface, or spray oil poured on it.

使用钢丝绳必须定期检查并做好记录，除上述清洗加油外，还应检查钢丝绳的磨损程

度、断丝情况、腐蚀程度以及吊钩、滑轮槽等部件磨损情况。如发现异常必须及时调整或更换。

Regularly check and make a record during the use of steel rope. In addition to the above cleaning and adding-oil, also check degree of wear, wire break, degree of corrosion, and wear of hooks, pulleys groove, and other components. If there is any abnormal to the above components, replace or adjust timely.

第四章　安全保护装置
Chapter 4　Safety protection device

塔机安全保护装置主要包括：行程限位器和载荷限制器。

Tower crane safety devices includes: Position stopper and load limiter.

行程限位器有：起升高度限位器、回转限位器、变幅限位器和大车行走限位器；

Position stopper are: lifting height stopper, slewing stopper and radius stopper, and travelling stopper;

载荷限制器有：起重力矩限制器、起重量限制器，此外安全保护装置还包括风速仪、小车断绳保护装置、小车防坠落装置、钢丝绳防脱装置。

Load limiters are: lifting moment limiter, load limiter. Besides there are safety protection device: anemometer, trolley-rope anti-break protection device, anti-drop device as well as anti-release rope device.

4.1 多功能限位器

4.1 Multi-functional stopper

本塔机的起升高度限位器、变幅限位器、回转限位器分别为 DXZ-4/7（i=1: 274）、DXZ-4/8（i=1: 78）、DXZ-4（i=1: 60）三个多功能行程限位器。（图 4.1-1）

The stoppers for lifting height, radius and slewing of tower crane are three versatile stoppers: DXZ-4/7(i=1: 274), DXZ-4/8(i=1: 78), DXZ-4(i=1: 60). (Figure 4.1-1)

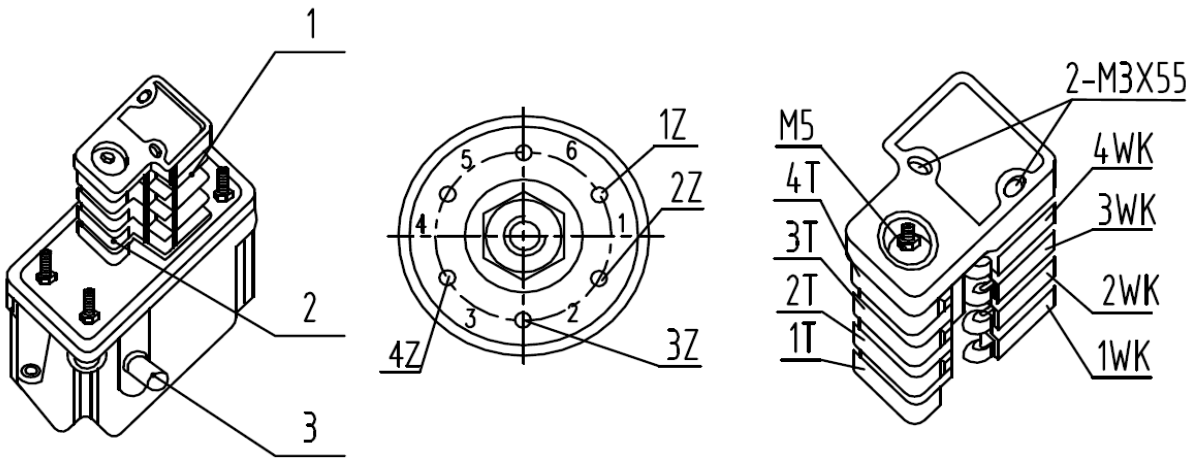


图 4.1-1　多功能行程限位器结构图

Figure 4.1-1 Multi-function distance stopper structure

4.1.1 调整程序

4.1.1 Adjustment procedure

4.1.1.1 拆开上罩壳，检查并拧紧 2 个 M3×55 螺钉；

4.1.1.1 Open the upper cover, check and tighten the two M3 × 55 screws;

4.1.1.2 松开 M5 螺母；

4.1.1.2 Loosen nut M5;

4.1.1.3 根据需要将被控机构开至指定位置（空载状态），这时控制该机构动作时相对应的微动开关瞬时切换。即：调整对应的调整轴（Z）使记忆凸轮（T）压下微动开关（WK）触点；

4.1.1.3 According to the related needs to move the charged mechanism to a specified location (no load), then switchover instantaneously the corresponding inching switch during action of the charged mechanism. Namely: adjust the corresponding adjustment axis (Z) so that the memory cam (T) depresses contacts of inching-switch (WK);

4.1.1.4 拧紧 M5 螺母（螺母一定要拧紧，否则将产生记忆紊乱）；

4.1.1.4 Tighten the M5 nut (nut must be tightened, otherwise it will generate memory disorder);

4.1.1.5 机构反复空载运行数次，验证记忆位置是否正确（有误时重复上述调整）；

4.1.1.5 Repeat load operation several times to verify whether (repeat the above adjustment when it is incorrect) memory location is correct;

4.1.1.6 确认位置符合要求，紧固 M5 螺母，装上罩壳；

4.1.1.6 Confirm that the location meets the requirements, fastening nut M5 and mounting cover;

4.1.1.7 机构正常工作后，应经常核对记忆控制位置是否变动，以便及时修正。

4.1.1.7 After the mechanism functions normally, constantly check whether there is any change in the memory control position to make sure timely correction.

4.1.2 起升高度限位器的调整方法

4.1.2 Adjustment method of lifting height stopper

4.1.2.1 调整在空载下进行，用手指分别压下微动开关（1WK、2WK），确认限制提升或下降的微动开关是否正确；

4.1.2.1 adjustments is conducted with no under load, press inching switch (1WK, 2WK) with fingers, confirming that inching switch of limiters for rising and falling is correct;

4.1.2.2 提升极限限位时，使载重小车与吊钩滑轮的最小距离不小于 3 米时，调动（1Z）轴，使凸轮（1T）动作并压下微动开关（1WK）换接。拧紧 M5 螺母；

4.1.2.2 When increasing the lifting limit position, so that the minimum distance of the trolley and hook pulley is not less than 3m. Adjust axis (1Z), and operate the cam (1T) action and press inching switch (1WK) for access. Tighten the nut M5;

4.1.2.3 用户根据需要可通过 2WK 以防止操作失误，使下降时吊钩再接触地面前（确保卷筒上不少于 3 圈钢丝绳），能终止下降运动，其调整方法同 4.1.1 条（2Z-2T-2WK）；

4.1.2.3 Users may be needed to prevent operational errors by 2WK stopping dropping hook to the ground (to ensure that there are at least 3 circles of rope on drum). The adjustment method is same as 4.1.1 (2Z-2T-2WK);

4.1.2.4 更换钢丝绳后必须重新调整高度限位器，特别是提升极限限位器的调整。

4.1.2.4 Readjust the height stopper after having replaced rope, especially adjustment of increasing limit position stopper.

4.1.3 回转限位器调整方法（调整程序同 4.1.1）

4.1.3 Adjustment method of slewing stopper (adjustment program same as 4.1.1)

4.1.3.1 在电缆处于自由状态时调整回转限位器；

4.1.3.1 Adjust the slewing stopper when cable in a free state;

4.1.3.2 调整在空载下进行，用手指逐个压下微动开关（WK）确认控制左右方向的微动开关（WK）是否正确；

4.1.3.2 Conduct the adjustment with no load, and press the inching switch (WK) with fingers to confirm whether the switch (WK) for right and left direction is right.

4.1.3.3 向左回转 540°（1.5 圈）按 4.1.1 条程序，调动调整轴（4Z），使凸轮（4T）动作至微动开关（4WK）瞬时换接，然后拧紧 M5 螺母；

4.1.3.3 Turn left 540 ° (1.5 round) as 4.1.1 program, adjust the adjustment axis (4Z), act the cam (4T) to the inching-switch (4WK) instantaneously for access, then tighten the nutM5;

4.1.3.4 向右回转 1080°（3 圈）按 4.1.1 条程序，调动调整轴（1Z），使凸轮（1T）动作至微动开关（1WK）瞬时换接，并拧紧 M5 螺母；

4.1.3.4 Turn right 1080 ° (3 rounds) as Item 4.1.1 adjust the adjustment axis (1Z), act the cam (1T) to inching switch (1WK) instantaneously for access, and tighten the nut M5;

4.1.3.5 验证左右回转动作。

4.1.3.5 Verify action towards left and right.

4.1.4 幅度限位器的调整方法（调整程序同 4.1.1 条）

4.1.4 Adjustment method of radius stopper (adjustment program same as 4.1.1)

4.1.4.1 向外变幅及减速和起重臂臂头极限限位：将载重小车开到距离起重臂臂头缓冲器 1.5m 处，调整轴（2Z）使记忆凸轮（2T）转至将微动开关（2WK）动作换接。（调整时应同时使凸轮（3T）与（2T）重叠，以避免在制动前发生减速干扰），并拧紧 M5 螺母，再将载重小车开至起重臂臂尖缓冲器 500mm 处按程序调整轴（1Z）使（1T）转至将微动开关（1WK）动作，拧紧 M5 螺母；

4.1.4.1 Luffing outward, deceleration and jib end limit: move the trolley to the point 1.5m away from the jib buffer, and adjust axis (2Z) to move the memory cam (2T) so that inching switch (2WK) acts for access. (Stay the cam (3T) and (2T) overlapping to avoid deceleration interference before brake action). Tighten the nut M5, and then move trolley to the point 500mm away from the jib buffer and adjust axis (1Z) according to the procedure driving (1T) rotating until the inching switch (1WK) acts, and then tighten the nut M5.

4.1.4.2 向内变幅及减速和起重臂臂根限位：调整方法同“4.1.4.1”，分别距起重臂臂根缓冲器 1.5m 和 500mm 处进行（3Z-3T-3WK，4Z-4T-4WK）减速和起重臂臂根限位和调整。

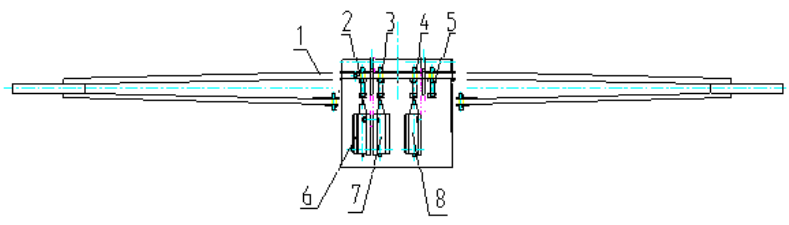
4.1.4.2 Luffing inward jib boom, deceleration and jib root limit: adjustment method is same as "4.1.4.1". Conduct limit and adjustment of jib root as well as deceleration (3Z-3T-3WK, 4Z -4T-4WK) at the distance respectively 1.5m and 500mm from the jib root buffer.

4.1.4.3 验证和修正。

4.1.4.3 Verification and correction.

4.2 力矩限制器（图 4.2-1）

4.2 Moment limiter (Fig 4.2-1)



1- 弹性板　2、3、4、5- 调整螺栓Ⅰ、Ⅱ、Ⅲ、Ⅳ　6、7、8- 行程开关Ⅰ、Ⅱ、Ⅲ

1- elastic plate　2、3、4、5- adjusting bolt Ⅰ、Ⅱ、Ⅲ、Ⅳ　6、7、8- limit switch Ⅰ、Ⅱ、Ⅲ

图 4.2-1 力矩限制器结构示意图

Figure 4.2-1 Moment limiter diagrams

4.2.1 用途

4.2.1 Use:

塔机是按恒定的最大载荷力矩设计计算的，使用中不能超过最大载荷力矩，力矩限制器的用途就是检测额定载荷的起升和向外变幅，防止超力矩到达倾翻区发生事故而设定。

Tower crane is calculated depending on constant maximum load moment design, and does not exceed the maximum load moment in employment. Moment limiter is used for detecting the rated load hoisting and luffing forward to prevent over-moment reaching to tipping position where accidents occur.

4.2.2 工作原理

4.2.2 Working theory:

该装置安装在塔顶靠平衡臂一侧，它由一对弹性钢板，三个微动开关及安装底座，调节螺钉，外罩等组成。当有载荷时，在载荷力矩的作用下，弹性板弯曲变形(两弹性板距离变小)，当载荷超过规定值时，其中一弹性板上的调整螺栓压下固定在另一弹性板上的开关触头，使开关动作切断其控制电路，机构停止运行，达到保护目的。

The device is mounted on the side of counter jib, which consists of a pair of elastic plates, three inching and its mounting base, adjusting screws, cover and other components. When loading, because of the load, the elastic plate will bend and deform (distance between the two elastic plates becomes smaller). When the load exceeds a predetermined value, please press and fix the adjusting bolt of one plate on the switch contacts of another plate, so that the switch works and cut off the controlling circuit and then the mechanism will stop running and achieve protection.

4.2.3 力矩限制器的调整

4.2.3 Moment limiter adjustment:

⚠ 警告 调整力矩限制器之前，必须首先确认本塔机的额定力矩之后，再查找对应的数据进行调试。

⚠Warning Before adjustment of the moment limiter, you should firstly confirm the tower crane's rated moment, and then choose the corresponding data for debugging.

①调整定幅变码力矩限制器 CLK1

① Adjustment moment limiter CLK1at fixed-radius and variable-weight

各参数见表 4.2-1，重复 3 次，均应满足要求。

The parameters are shown in Table 4.2-1. Repeat three times, it is qualified if it meets the

requirements each time.

在最大工作幅度 Ro 处以正常工作速度起升额定起重量 Qo，力矩限制器不应动作，能够正常起升。载荷落地，加至 1.1Qo 后以最慢速度起升，力矩限制器应动作，载荷不能起升，并输出报警信号。

Lift up the rated load Qo with normal speed at max radius, adjusting the switch K1 so that the moment limiter should not act and lift normally. Drop the load to the ground and add it to1.1Qo and lift up slowly again, so that the moment limiter should act, and the load cannot be lifted up, releasing alarm signal.

在 0.7 倍最大额定起重量（0.7Qm）相应允许的工作幅度（$R_{0.7}$）处，以正常工作速度起升 0.7 倍最大额定起重量（0.7Qm），力矩限制器不应动作，能够正常起升。载荷落地，加至 0.77 Qm 后以最慢速度起升，力矩限制器应动作，载荷不能起升，并输出报警信号。

At the allowed radius R0.7 of 0.7 times rated load0.7Qm, lift up with normal speed the 0.7 times rated load0.7Qm, so that the moment limiter should not act and lifting operation is normal. Drop the load to the ground and add it to0.77Qm and lift up slowly again, so that the moment limiter should act, and the load cannot be lifted up, releasing alarm signal.

表 4.2-1 力矩限制器定幅变码调试的载荷及幅度表

Table 4.2-1 Parameters and radius moment limiter at fixed-radius and variable-weight

最大工作幅度 Max. working radius	4 倍率 4-fall				
Ro(m)	Qo(t)	1.1Qo(t)	0.7Qm(t)	0.77Qm(t)	$R_{0.7}$(m)
80	3.7	4.07	17.5	19.25	22.94
75	4.7	5.17	17.5	19.25	25.35
70	5.7	6.27	17.5	19.25	27.47
65	6.8	7.48	17.5	19.25	29.06
60	7.8	8.58	17.5	19.25	29.95
55	8.8	9.68	17.5	19.25	30.21
50	10.2	11.22	17.5	19.25	31.05
45	12.0	13.2	17.5	19.25	32.19

②调整定码变幅力矩限制器 CLK2 和定码变幅 80%力矩限制器 CLK3：

② Adjustment of moment limiter CLK2 and 80% moment limit CLK3 at fixed-weight and variable-radius:

各参数见表 4.2-2，重复 3 次，均应满足要求。

The parameters are shown in Table 4.2-2. Repeat three times, it is qualified if it meets the requirements each time.

空载测定对应最大额定起重量（Qm）的最大工作幅度 Rm、0.8Rm 及 1.1Rm 值，并在地面标记。在小幅度处起升最大额定起重量（Qm）离地 1m 左右，慢速变幅至 Rm～1.1Rm 间时，力矩限制器应动作，切断外变幅和起升回路电源，并输出报警信号。退回，重新从小幅度开始，以正常速度向外变幅，在到达 0.8Rm 时应能自动转为低速往外变幅，在到达 Rm～1.1Rm 间时，力矩限制器应动作，切断外变幅和起升回路电源，并输出报警信号。

Detect the max radius Rm, 0.8Rm and 1.1Rm with corresponding max load Qm in empty-load testing, and mark on the ground. At the small radius lift the max rated load Qm about 1m from the ground, slowly move trolley to Rm～1.1Rm point. At this time the moment limiter should be active and stop the high speed of luffing outward and release the alarm signal. Return the trolley back and start again from the small radius point, move outward with normal speed. It moves outward to the point 0.8Rm and automatically turns to low speed. At the time when the trolley is moving to the point between Rm ~1.1Rm the moment limiter should be active and stop luffing outward and lifting circuit power supply, releasing the alarm signal.

空载测定对应 0.5 倍最大额定起重量（0.5Qm）的最大工作幅度 $R_{0.5}$，$0.8R_{0.5}$ 及 $1.1R_{0.5}$ 值，并在地面标记。在小幅度处起升 0.5 倍最大额定起重量（0.5Qm）离地 1m 左右，慢速变幅至 $R_{0.5}$～$1.1R_{0.5}$ 间时，力矩限制器应动作，切断外变幅和起升回路电源，并输出报警信号。退回，重新从小幅度开始，以正常速度向外变幅，在到达 $0.8R_{0.5}$ 时应能自动转为低速往外变幅，在到达 $R_{0.5}$～$1.1R_{0.5}$ 间时，力矩限制器应动作，切断外变幅和起升回路电源，并输出报警信号。

Detect the radius $R_{0.5,}$ $0.8R_{0.5}$ and $1.1R_{0.5}$ with the corresponding max load0.5Qm in empty-load testing, and mark on the ground. At the small radius lift the 0.5 times max rated loadQm about 1m from the ground, slowly move trolley to $R_{0.5}$～$1.1R_{0.5}$ point. At this time the moment limiter should be active and stop the high speed of luffing outward and release the alarm signal. Return the trolley back and start again from the small radius point, move outward with normal speed. It moves outward to the point 0.8 $R_{0.5}$ and automatically turns to low speed. At the time when the trolley is moving to the point between $R_{0.5}$ ~1.1 $R_{0.5}$ the moment limiter should be active and stop luffing outward and lifting circuit power supply, releasing the alarm signal.

表 4.2-2　力矩限制器定码变幅调试的载荷及幅度表

Table 4.2-2 Parameters and radius moment limiter at fixed-weight and variable-radius

臂长 Arm length	4 倍率 4 fall				4 倍率 4 fall			
R(m)	Qm(t)	0.8Rm(m)	Rm(m)	1.1Rm(m)	0.5Qm(t)	0.8R0.5(m)	R0.5(m)	1.1R0.5(m)
80	25	13.22	16.53	18.18	12.5	25.28	31.6	34.76
75	25	14.63	18.29	20.12	12.5	27.97	34.96	38.46
70	25	15.74	19.68	21.65	12.5	30.09	37.61	41.37
65	25	16.75	20.94	23.03	12.5	32.01	40.01	44.01
60	25	17.25	21.56	23.72	12.5	32.96	41.2	45.32
55	25	17.45	21.81	23.99	12.5	33.35	41.69	45.86
50	25	17.94	22.43	24.67	12.5	34.30	42.88	47.17
45	25	18.57	23.21	25.53	12.5	35.48	44.35	48.79

4.3 起重量限制器（图 4.3-1）

4.3 Load limiter (Fig 4.3-1)

4.3.1 用途

4.3.1 Use:

塔机结构及起升卷扬钢丝绳是按最大载荷设计计算的，工作载荷不能超过最大载荷。起重量限制器就是用于限制超载现象的发生而设定的一种安全装置。

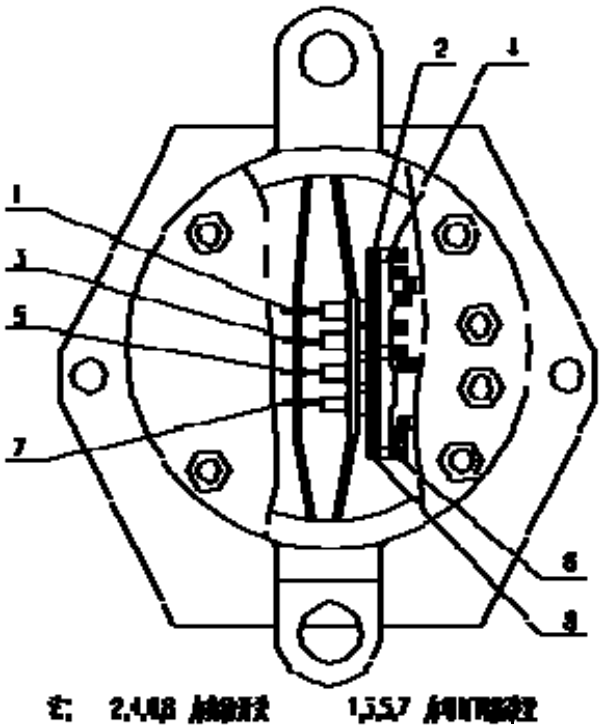
The tower crane structure and lifting rope is calculated depending on the designed max load. The working load shall not be over the max load. The load limiter is a safety device used to limit over-loading.

4.3.2 工作原理

4.3.2 Working principles:

起升钢丝绳经过测力环滑轮时，由于载荷的作用，钢丝绳产生张力，张力传到与滑轮连接的测力环上，该测力环随着负载的变化而发生变形，使固定于环内的金属板条亦发生变形(原理同力矩限制器)，其上装有微动开关及可调螺栓，根据载荷的要求，经适当调整后，压开微动开关起到控制电路的作用。

When getting through the dynamometer ring pulley, because of load, the rope has tension sent on the dynamometer ring connected with pulley. The dynamometer ring will deform with the change of load, and it is same to metal strip in ring (the principle is same to moment limiter). The inching-switch and adjustable bolt after being adjusted, according to load requirements, can control the electric circuit when in switch-on.



注：2、4、6、8 为微动开关；1、3、5、7 为螺钉调整装置

Note: 2, 4, 6 and 8 are inch switches, and 1, 3, 5 and 7 are screw adjusting devices.

图 4.3-1　起重量限制器图

Figure 4.3-1 Load limiter

4.3.3 起重量限制器的调整

4.3.3 Adjustment of load limiter:

⚠ 警告 调整起重量限制器之前，必须首先确认本塔机的额定吊重量后，再查找对应的数据进行调试。

⚠Warning Before adjustment of the moment limiter, you should firstly confirm the tower crane's rated moment, and then choose the corresponding data for debugging.

①调整 35%重量高速限制器 SWQ：

① Adjust 35% weight high-speed limiter SWQ:

先以低速起吊载荷 V1，然后再以高速起升。调整螺栓(1)直至其头部接触到微动开关(2)。

Start lifting load V1 at a low speed, and then lift it at a high speed. Adjust bolt (1) until the

head touches the micro switch (2).

降下载荷，增重 10%，以低速起吊新增重载荷 W1，然后试换速高速起升，此时不应有高速 5 档。如果得到高速，应重新调整。

Lower the load and increase weight by 10%. Restart lifting the new load W1 with a low speed, and then try to lift the load at a higher speed (a high-speed gear does not exist). A high speed shall be adjusted.

重复 3 次，均应满足以上要求。

Repeat it for 3 times. The above requirements shall be met.

②调整 75%重量高速限制器 SWH：

② Adjust 75% weight high-speed limiter SWH:

先以低速起吊载荷 V2，然后再以高速起升。调整螺栓(3)直至其头部接触到微动开关(4)。

Start lifting load V2 at a low speed, and then lift it at a high speed. Adjust bolt (3) until the head touches the micro switch (4).

降下载荷，增重 10%，以低速起吊新增重载荷 W2，然后试换速高速起升，此时不应有高速 4 档。如果得到高速，应重新调整。

Lower the load and increase weight by 10%. Restart lifting the new load W2 with a low speed, and then try to lift the load at a higher speed (a high-speed gear does not exist). A high speed shall be adjusted.

重复 3 次，均应满足以上要求。

Repeat it for 3 times. The above requirements shall be met.

③调整最大起重量限制器 SWL：

③ Adjust maximum weight limiter SWL:

以低速起吊载荷 X，调整螺栓(5)直至其头部接触到微动开关(6)为止。

Start lifting load X at a low speed, and adjust bolt (5) until the head touches the micro switch (6).

降下载荷，增重 10%，试以低速起吊该载荷 Y，如果载荷被吊起，则应重新调整。

重复 3 次，均应满足以上要求。

Lower the load and add its 10% on it making it become the new load Y. If it is lifted up, readjust it.

Repeat three times, it is qualified if it meets the requirements each time.

对于不同的载荷值 V、W、X、Y，参见表 4.3-1。

The values of V, W, X, Y are shown in the below Table 4.3-1.

表 4.3-1　起重量限制器调试参数表

Table 4.3-1 Debugging parameters of load limiter

倍率 Magnification	限高速起重量限制器(SWQ) 35%最大起重量 Limited speed wright limiter (SWQ) 35% maximum hoisting weight		限高速起重量限制器(SWH) 75%最大起重量 Limited speed wright limiter (SWH) 75% maximum hoisting weight		限最大起重量限制器(SLchPV) 100%最大起重量 Limited maximum wright limiter (SLchPV) 100% maximum hoisting weight	
	V1(t)	W1(t)	V2(t)	W2(t)	X(t)	Y(t)
2 倍率 2-magnification	4.37	4.81	9.37	10.31	12.5	13.75
4 倍率 4-magnification	8.75	9.62	18.75	20.62	25	27.5

4.4 小车断绳保护装置

4.4 Trolley-rope anti-break protection device

该塔机小车上安装了安全锤，作为双向小车变幅断绳保护装置。

The tower crane is installed with safety/emergency hammer as the protection device preventing trolley rope from break.

4.5 小车防坠落装置

4.5 Trolley anti-drop device

该塔机设置小车防坠落装置，即使车轮失效小车也不脱离臂架坠落。

This tower crane is equipped with an anti-drop device for trolley. So even though the trolley wheels do not work, the trolley would not fall from the boom.

4.6 钢丝绳防脱装置

4.6 Anti-release rope device

该塔机的滑轮、起升卷筒均设有钢丝绳防脱装置，该装置表面与滑轮或卷筒侧板外缘间的间隙不超过钢丝绳直径的 20% ,该装置可能与钢丝绳接触的表面没有棱角。

There are anti-release rope devices both on pulley of tower crane and on lifting drum. The gap between the device surface and outer edge of pulley or drum is not exceeding 20% of steel rope diameter. And the device surface contacting with steel rope is likely pointedness.

第五章　保养与维修

Chapter 5　Maintenance and Repair

为确保安全经济地使用塔机，延长其使用寿命，必须做好塔机的保养与维修及润滑工作。

To ensure safe and economical use of tower cranes and to extend its life, do good maintenance and repair work and lubrication of tower crane.

5.1 塔机的保养

5.1 Maintenance of tower crane

5.1.1 检查各减速器的油量，及时加油。

5.1.1 Check the reducer oil, timely refueling.

5.1.2 检查各部位钢丝绳有无散股、断丝、磨损等现象，超过有关规定必须及时更换。

5.1.2 Check whether the various parts of rope for loose strands, broken wires, wear and so on. Replace the rope which doesn't meet the relevant regulations.

5.1.3 每班工作前检查制动器的效能、间隙，必须保证可靠的灵敏度。

5.1.3 Check the brake performance and clearance to ensure its reliable sensitivity.

5.1.4 检查各安全装置的灵敏可靠性。

5.1.4 Check the reliability of sensitivity of safety devices.

5.1.5 检查各螺栓连接处，尤其塔身标准节连接螺栓，当每使用一段时间后，必须重新进行紧固。

5.1.5 Check all bolted connections, particularly tower mast bolts. After being used a period of time all these must be re-tightened.

5.1.6 检查各钢丝绳头压板、卡子等是否松动，应及时紧固。

5.1.6 Check whether the head rope clips, clamps, etc. is loose. If loose, tighten it timely.

5.1.7 钢丝绳、卷筒、滑轮、吊钩等的报废，应严格执行 GB/T5144-2006 和 GB5972-2009 规定。

5.1.7 The scraping treatment of rope, rolls, pulleys, hooks and other parts should be strictly accordant with the requirements of GB/T5972-2009 and GB5144-2006.

5.1.8 检查各金属构件的杆件，腹杆及焊缝有无裂纹，特别应注意油漆剥落的地方和部位，尤以油漆呈 45°的斜条裂纹剥离最危险，必须迅速查明原因并及时处理。

5.1.8 Check whether there are cracks on metal rod member, belly bars and weld, paying

particular attention to the position where paint is peeled. The most threatened is 45 °oblique crack, which must be quickly identify the cause and deal with timely.

5.1.9 塔身各处（包括基础节与底架的连接）的连接螺栓螺母，各处连接直径大于 Φ20 的销轴等均为专用特制件，任何情况下，绝对不准代用，而塔身安装时每一个螺栓必须用双螺母拧紧。

5.1.9 Connecting bolts and nuts on tower crane (including the base mast and base frame connection), and pins with diameter greater than Φ20, are special-made piece. No replacement is allowed in any condition. Each bolt should be tightened by double-nut.

5.1.10 回转支承螺栓性能等级为 10.9 级，螺母性能等级为 10 级（双螺母防松），螺栓头部顶面和螺母头部顶面必须有性能等级标志，否则一律不准使用。

5.1.10 performance rating of connecting bolt for mast of piece-type is 10.9 grade, nuts' is 10-grade (single nut). On the top surface of bolt head there must be performance rating mark, otherwise the bolt is not allowed to use.

5.1.11 整机及金属机构每使用一个工程后，应进行除锈和喷刷油漆一次。

5.1.11 The whole machine and metal bodies after used in each project should be eliminated rust and painted again.

5.1.12 起升钢丝绳经过一段时间使用磨损拉长后，需要重新按规定调整高度限位器。

5.1.12 The height stopper should be readjusted as the requirements after the lifting rope is used and stretched over a period of time.

5.1.13 观察各电器触头是否有氧化或烧损，若有接触不良应修复或更换。

5.1.13 Check whether electrical contacts have oxidation or burning damage, and if there is bad contact, repair or replace the electrical contacts timely.

5.1.14 各限位开关和按钮不得失灵，零件若有生锈或损坏应及时更换。

5.1.14 Limit switches and buttons cannot fail, if it is rusted or damaged, replace it timely.

5.1.15 各电器开关，开关板等的绝缘必须良好，其绝缘电阻不应小于 0.5MΩ。

5.1.15 Switches and switch boards of each insulated electrical parts must have good insulation with resistance of not less than 0.5MΩ.

5.1.16 检查各电器元件之紧固螺栓是否松动，电缆及其它导线是否有破裂并及时排除。

5.1.16 Check all the electrical components for whether the fastening bolt is loose, and for whether cables and other wires have cracks, and promptly remove.

5.2 主要故障及排除方法

5.2 Common Breakdown and Clear methods

5.2.1 严重故障及排除

5.2.1 Common Breakdown and Clear methods

表 5.2-1
Table 5.2-1

序号 No.	故障现象 The phenomenon of the breakdown	故障原因 The cause of the breakdown	排除方法 Clear way
1	重量限制器、力矩限制器和各种限位开关失灵; Failures of the weight limiter switch, torque limiter switch, and other switches		
2	主要结构件焊缝开裂或结构产生永久变形; Main structural part weld failures and structure permeant deformation	过载或疲劳 Overload or fatigue	补焊或更换主要结构件。 Repair welding or replace main structural parts.
3	机构驱动电机烧坏 Burning out of a motor driven by a mechanism	1.负载过大; 2.负载持续及工作不符合规定; 3.电源两相运行; 4.电源电压过低或过高; 5.电机绕组接地或匝间、相间短路; 6.摩擦片间隙不对; 7.制动和释放时间不对; 8.电机通风不畅，温度升高。 1. Excessive large 2. Continues load or work not conforming to the regulations 3. Two-phase operation of a power supply 4. Excessive high or low supply voltage 5. Motor winding grounding or interturn or inter-phase short circuit 6. Abnormal friction plate gap 7. Incorrect braking and releasing time	1.测定子电流，如大于额定值要减小负载; 2.按规定进行运行测三相电流，排除故障; 3.检查输入电压并纠正; 4.找出原因，并修复; 5.按要求调节间隙; 检查制动器电压及延迟断 6.电器动作时间，消除故障; 7.保持通风道畅通。 1. Check the sub current. Reduce the load if the current is greater than the rated one. 2. Check 3-phase current for troubleshooting according to regulations. 3. Check and correct the input voltage. 4. Find out the cause and repair the fault. 5. Adjust clearance according to requirements. 6. Check the electrical action

		8. Obstructed motor ventilation and rising temperature	time to eliminate the fault. 7. Keep the ventilation duct open.
4	机构传动件破坏，减速器壳体开裂 Transmission parts are damaged and the reducer shell is cracked.		
5	回转支承卡阻 Slewing bearing jam	主要看是否有异物卡在齿轮处； Check whether foreign matters are stuck in gears.	清除异物 Clear foreign matters.
6	塔身、回转支承、塔顶、回转塔身等主要结构件连接件破坏 Main structural parts of tower body, slewing bearing, overhead tower and slewing tower are destroyed.	受冲击载荷大、不均匀 Large and unbalanced impacts	更换主要结构件 Replace main structural parts.
7	机构制动系统失灵 Failure of mechanism braking system	1.制动力矩过小； 2.摩擦片磨损间隙增大； 3.励磁，电压不足。 1. The braking torque is too small. 2. Wear gap of friction plate increase. 3. Excitation and insufficient voltage	1.调整或更换制动器弹簧； 2.调整间隙； 3.查出并纠正 1. Adjust or change the brake spring. 2. Adjust the clearance. 3. Find out and correct the fault.
8	变幅小车脱离运行轨道 Trolleying car out of operating rail		
9	漏油严重，影响工作 Serious oil leakage, affecting operation	联接部位贴合面的密合性差，轴端密封圈磨损严重。 Poor adaptation of binding face at the joint and serious worn of sealing ring at ends of a shaft	更换密封圈。 Replace a sealing ring
10	起升绳或变幅绳断股 Wire breakage for lifting or elevating rope	疲劳或刮碰 Fatigue or scrape	更换钢丝绳 Replace a wire rope.

5.2.2 一般故障及排除

5.2.2 General faults and troubleshooting

序号 No.	故障现象 Phenomenon	故障原因 Cause	排除方法 Troubleshooting
1	机构减速器或支架紧固螺栓松动 Loosening of fastening bolts for mechanism reducer or bracket	机构震动 Mechanism vibration	定期加固 Periodic reinforcement
2	回转支承、各机构减速箱有异常的响声 Abnormal noises of a slewing bearing and reducer of each mechanism	1.齿轮箱内缺油、轴承严重缺油或损坏； 2.齿轮磨损或打坏； 1. Gear box lacking of oil, bearing seriously lacking of oil or being damaged 2. Gear wear or broken	1.清洗轴承加润滑油或更换轴承； 2.更换齿轮； 1. Clean bearing, add lubricating oil, or change a bearing. 2. Change gears.
3	轴承、轴承壳或其他机构过热 Overheating of bearings, bearing housings, or other mechanisms	1.轴承烧坏； 2.润滑脂过多或过少 1. Bearing is burn out. 2. Grease is excessive much or less.	1.更换轴承； 2.按要求加润滑脂。 1. Replace a bearing. 2. Add lubricating oil according to requirements.
4	回转机构启动不了。 A slewing mechanism cannot be started.	1.主要看是否有异物卡在齿轮处； 2. 回转电机烧坏或回转接触器触点烧坏。 1. Check whether foreign matters are stuck in gears. 2. A slewing motor or slewing contactor is burn out.	1.清除异物； 2.更换回转电机或接触器。 1. Remove foreign matters. 2. Replace a slewing motor or slewing contactor.
5	顶升太慢。 Slow lofting	1.油泵磨损、效率下降； 2.油箱油量不足或滤油器堵塞； 3.手动换向阀阀杆与阀孔磨损严重； 4.油缸活塞密封有损伤出现内泄漏。 1. Oil pump wear and efficiency declining 2. Insufficient oil in a tank or blockage of an oil filter 3. Serious wear of a hand-directional valve rod or valve hole 4. Internal leakage due to damages to sealed piston	1.修复或更换损坏件； 2.加足油量或清洗滤油器； 3.更换油缸密封件。 1. Repair or replace damaged parts. 2. Add enough oil or wash oil filter. 3. Replace the oil cylinder seal.

6	顶升无力或不能顶升。 Powerless lifting or lifting not allowed	1.油泵严重内泄； 2.溢流阀调定压力过低； 3.手动换向阀阀芯过度磨损； 4.溢流阀卡死，无所需压力。 1. Serious internal leakage of an oil pump 2. Low setting pressure of an overflow valve 3. Serious wear of a core of the hand-directional valve 4. Overflow valve stuck, with no pressure required	1.修复或更换磨损件； 2.按要求调节压力； 3.清洗液压阀。 1. Repair or replace worn parts. 2. Adjust pressure according to the requirements. 3. Clean the hydraulic valve.
7	顶升升压时出现噪声振动。 Noise and vibration occurs during lifting	滤油器堵塞。 Blockage of an oil filter	清洗滤油器。 Clean the oil filter.
8	顶升系统不工作。 The lifting system does not work.	电机接线错误使油泵转向不对。 Wrong wiring of a motor makes the oil pump to turn wrong.	改变电机旋转。 Change the motor rotating direction.
9	顶升时发生颤动爬行。 Vibrated creep occurs during lifting	1.油缸活塞空气未排净； 2.导向机构有障碍。 1. Air in the cylinder piston is not discharged. 2. A guide mechanism has obstacles.	按有关要求排气、更换油泵 Exhaust and replace the oil pump according to the relevant requirements.
10	顶升有负载后自降。 Automatic descending occurs when lifting is equipped with a load.	1.缸头上的平衡阀出现故障； 2.油缸活塞密封损坏。 1. The balance valve on the cylinder head is faulty. 2. Cylinder piston seal is damaged.	排除故障，更换密封件 Remove the failure and replace the sealing element.
11	起升机构不能起动。 A hoisting mechanism cannot be started.	1.控制接线错误； 2.熔丝烧断； 3.电机绕组短路，接地或断路； 4.电机电压过低； 5.绕组接线错误； 6.电磁制动器未松闸； 7.负载过大或传动机械有故障。 1. Control wiring error 2. Fuse burning off 3. Motor winding short circuit, grounding, or open circuit 4. Excessive low motor voltage 5. Winding wiring error	1.核对接线图； 2.检查熔丝容量是否太小，如太小更换大的； 3.测量电网电压； 4.按各挡位分别供电短路、断路予以修复； 5.检查制动器电压及绕组是否有断路或卡住。 1. Check the wiring diagram. 2. Check whether fuse capacity is too small. If yes, replace it with a fuse with large capacity. 3. Measure a grid voltage. 4. Repair short circuit and open circuit according to each gear

		6. Non-brake-releasing of electromagnetic brake 7. Excessive large load or faulty transmission machinery	position. 5. Check whether the brake voltage and winding are broken or jammed.
12	启动按钮失灵。 Starting button failure	1.操作手柄没归零； 2.电控柜变压器烧坏； 3.启动按钮或急停按钮接触不良。 1. An operation handle does not return to zero position. 2. A cabinet transformer is burn out. 3. Poor contact of a start button or emergency stop button.	1.将手柄归零位； 2.更换变压器； 3.维修或更换按钮触点。 1. Reset the handle to zero position. 2. Replace the transformer. 3. Repair or replace button contacts.
13	起升动作时跳闸。 Tripping operation during lifting	1.起升电机过流； 2.工地变压器容量不够或变压器至塔机动力电缆的线径不够。 1. Overcurrent of a lifting motor 2. The capacity of the transformer is insufficient or the line diameter of the power cable of the tower crane is insufficient.	1.检查起升刹车是否打开，过流稳定值是否变化； 2.更换变压器或加粗电缆。 1. Check whether the brake is open and whether the overcurrent stability value changes. 2. Replace the transformer or thickening cable.

5.2.3 与电气有关的故障及排除

5.2.3 Electrical breakdown and troubleshooting

因电气元件接触不良或元件损耗，导致与之相应的动作失灵或不准确等故障。请参看有关电控部件的说明书，查找原因，排除故障。

The breakdowns are working failure or imprecision caused by bad contact of parts and component loss. Please see the reference instruction of related electrical parts, find out the reason and troubleshoot.

5.2.4 各部润滑表

5.2.4 Lubrication table

表 5.2-3
Table 5.2-3

序号 No.	零部件名称 Name	润滑部位名称 Position	润滑剂种类 Type	润滑方法及周期 Method & Period
1	钢丝绳 Steel wire	起升钢丝绳 变幅钢丝绳 Lifting wire Luffing wire	石墨钙基润滑脂 ZG-SSY1405-65 Graphite Albany grease ZG-SSY1405-65	每运行 30 小时适当涂油, 每大、中修时煮油. Add oil one time after working 30 hours, when big and middle rest, boil with oil
2	减速器 Reducer	起升机构变速箱 Hoisting mechanism transmission	Ep Omala 320(壳牌) /VG320(美孚)中负荷工业齿轮油 Ep Omala 320(Shell) /VG320(Mobil) load industrial gear oils	每运行 240 小时适当加油，1500 小时换油一次 Add oil one time after working 240 hours and change oil one time after working 1500 hours
		变幅机构减速器 The speed reducer of trolleying mechanism	00号锂基润滑脂 Lithium grease	在检修时，更换或补充润滑脂。 When repairing, replace or add grease.
		回转机构减速器 The speed reducer of slewing mechanism	00号锂基润滑脂 Lithium grease	在检修时，更换或补充润滑脂。 When repairing, replace or add grease.
3	滚动轴承 Rolling bearing	减速器中各滚动轴承 Rolling bearing of reducer	3 号锂基润滑脂 No.3 Lithium grease	每工作 160 小时，适当加油，每半年清除一次 Add oil properly after working 160 hours; clear one time every half-year
		卷筒轴承 Drum bearing	ZG-2	
		吊钩止推轴承 Hook thrust bearing	钙基润滑脂 Albany grease	
		回转支承装置 Slewing bearing device		
4	电动机轴承 Bearing of motor	所有电动机 All motors	3 号锂基润滑脂 No.3 Lithium grease	每工作 1500 小时，换油一次 change oil one time after working 1500 hours
5	定、动滑轮	起升机构定、动滑	3 号锂基润滑脂	每工作 240 小时换油一

	组 Fix and movable pulley block	轮各导向轮 Each guiding wheels of Fix and movable pulley block of hoisting mechanism	No.3 Lithium grease	次 Add oil one time after working 240 hours
6	滑动轴承 Sliding bearing	变幅机构滑动轴承 电缆卷筒滑动轴承 trolleying mechanism sliding bearing Cable reel sliding bearings	3 号锂基润滑脂 No.3 Lithium grease	每工作 160 小时，适当加油，每半年清除一次 Add oil properly after working 160 hours; clear one time every half-year
7	制动器杠杆系统铰点 Two hinge point of lever system	各个铰点 Each hinge point	机油 Machine oil	每工作 56 小时用油壶加油一次 pour one time after working 56 hours
8	起重臂与塔身二铰点 Two hinge point of jib and tower body	各个铰点 Each hinge point	3 号锂基润滑脂 No.3 Lithium grease	拆卸与安装前 Before mounting and demounting
9	换倍率装置 Fall-alteration device	各运动部位及导向槽 All running position and guiding pulley	机油 Machine oil	每工作 160 小时，油壶加油一次 Add oil properly after working 160 hours
10	齿轮联轴器 Gear coupling	各机构、齿轮联轴器 Each mechanism and gear coupler	3 号锂基润滑脂 No.3 Lithium grease	一季度注油一次 Pour oil quarterly
11	液压顶升泵站 Hydraulic jacking pumping	油箱 Oil tank	夏季：L-HM46 冬季：10 号航空液压油 Summer: L-HM46 Winter: No.10 aviation hydraulic oil	工作 200 小时增添部分清洁油，工作 2400 小时后完全更换油 Add part cleaning oil after working 200 hours and totally change the oil after working 2400 hours

注：表中所提及的工作时间是指该零部件的实际累积工作时间 Note: The working date mentioned in the table is the actual accumulated of the part.

5.3 工作寿命及报废标准

5.3 Working life and scrap criteria

5.3.1 结构件的报废及工作年限；

5.3.1 Structural parts to be scrapped and working period;

a）塔机主要承载结构件由于磨损或腐蚀而使结构的计算应力提高，当超过原计算应力的15%时，应给予报废；对无计算条件的当腐蚀深度达原厚度的 10%时应给予报废；

a) Due to wear or corrosion of tower crane main bearing structural parts, the calculated stress of structure will be increased. When the calculated stress is more than 15% of the original calculated stress, the parts should be scrapped; to the parts without evaluation condition need to be scrapped if there is corrosion to 10% of original thickness;

b）塔机主要承载结构件如塔身、起重臂等，失去整体稳定性时应报废；如局部有损坏并可修复的，则修复后不应低于原结构的承载能力；

b) The main bearing structural parts of tower crane, such as the tower body and jib, etc., ought to be scrapped if losing overall stability; if partly damaged and repairable, to be repaired at the basis of not lower than the bearing capacity of original structure;

c）塔机的结构件及焊缝出现裂纹时，应根据受力和裂纹情况采取加强和重新施焊等措施，并在使用中定期观察其发展；对无法消除裂纹影响的应予以报废；

c) When the tower crane structural parts and weld cracks, strengthening and re-welding and other measures should be taken in accordance with the force and cracks. And regularly observe their development in use; if the impact of the crack cannot be eliminated, the parts should be scrapped;

d）塔机主要承载结构件的正常工作年限为 15 年；当不正常工作时应予提前报废；

d) The normal working life of tower crane main bearing structural parts is 15 years; when they are not working abnormally, those parts should be scrapped in advance;

5.3.2 吊钩禁止补焊，有下列情况之一的应予报废：

5.3.2 No repair welding to hook, and the hook should be scrapped at any one of the following conditions:

a）用 20 倍放大镜观察表面有裂纹；

a) Cracks to surface by 20 times magnifying glass;

b）钩尾和螺纹部分等危险截面及钩筋有永久性变形；

b) Permanent deformation to hook tail, thread section and hook tendons, and other dangerous section;

c）挂绳处截面磨损量超过原高度的 10%；

c) Cross-section of hanging rope is worn over 10% of the original height;

d）心轴磨损量超过其直径的 5%；

d) The wear amount to mandrel is more than 5% of its diameter;

e）开口度比原尺寸增加 15%；

e) An increase of 15% to the opening of the original size;

5.3.3 卷筒与滑轮，有下列情况之一的应予报废：

5.3.3 Drum and pulleys should be scrapped at any one of the following conditions:

a）裂纹和轮缘破损；

a) Cracks and rim damage;

b）卷筒磨损量打原壁厚的 10%；

b) The amount of wear to drum reaches up to 10% of the original wall thickness;

c）滑轮绳槽壁厚磨损量达原壁厚的 20%；

c) The wear to pulley rope groove reaches up to 20% of the original wall thickness;

d）滑轮槽底的磨损量超过相应钢丝绳直径的 25%。

d) The wear to pulley groove bottom is more than 25% of corresponding pulley rope diameter.

5.3.4 制动器零件有下列情况之一的应予报废：

5.3.4 Brake parts should be scrapped if having one of the following conditions:

a）可见裂纹；

a) Visible cracks;

b）制动块摩擦衬垫磨损量达原厚度的 50%；

b) The wear to brake pad friction pad is amounted to 50% of the original thickness;

c）制动轮表面磨损量达 1.5mm～2mm；

c) The surface of the brake wheel is worn about 1.5mm ~ 2mm;

d）弹簧出现塑性变形；

d) Plastic deformation to spring;

e）电磁铁杠杆系统空行程超过其额定行程的 10%。

e) The empty travelling distance of Solenoid lever system is more than 10% of its rated distance.

5.3.5 塔机各机构零部件正常工作寿命参考其使用说明书，达到报废条件时应及时给予报废；

5.3.5 Normal working life of tower crane parts and mechanisms refer to its manual, and should be scrapped timely if achieving the scrap conditions;

第六章　各类附表
Chapter Ⅵ Various Schedules

6.1

附表一　起重机用钢丝绳明细表

Table Ⅰ List of tower crane rope

	标准、规格与参数 Standard, specifications and parameters	绳径（mm） Rope diameter	数量 Qty	绳长度（m） Rope length		
起升钢丝绳 Lifting steel wire	GB/T8918-2006 钢丝绳型号：22 35W×7 1870 U ZS Steel wire type: 单位重量：223 kg/100m Unit weight: 抗拉强度：1870 MPa Tensile strength: 破断拉力：326 kN Breaking force: 捻向：右交互捻 Direction of twist: Right interaction 绳表面：涂防锈润滑油脂 Rope appearance: Coated with anti-rust lubrication 绳截面： Rope section	Φ22	1	450		
小车变幅钢丝绳 Trolleying car steel wire	GB/T8918-2006 钢丝绳型号：12 6×19W+FC 1670 U ZS Steel wire type: 单位重量：53.1 kg/100m Unit weight:	Φ12	绳Ⅰ与绳Ⅱ各1根 1 rope I and 1	**起重臂长 Jib length**	绳Ⅰ Rope Ⅰ	绳Ⅱ Rope Ⅱ
				45 m	95	65
				50m	105	70
				55m	115	75

	抗拉强度：1670 MPa Tensile strength: 破断拉力：79.4 kN\ Breaking force: 捻向：右交互捻 Direction of twist: Right interaction 绳表面：涂防锈润滑油脂 Rope appearance: Coated with anti-rust lubrication 绳截面： Rope section 		rope II	60m	125	80
				65m	135	85
				70m	145	90
				75m	155	95
				80m	160	100

注：
Note:
1.此表小车变幅机构一栏中，钢丝绳的长度变化是与选用何种起重臂臂长相对应的。
1. In Trolleying mechanism volume, the changes of rope length are subjected to the changes of jib length.
2.此表起升钢丝绳长度适配起升高度 74m 四倍率用户应根据实际使用高度决定所需长度。
2. The hoisting rope length is provided for 2-fall with lifting height of 259m. Users can decide the actual height according to actual needs.

6.2

附表二　　易损件明细表
Table 2 Wearing parts list

序号 No.	名称及规格 Name and specification	数量 Qty	易损情况 Wearing condition	使用位置 Use position	备注 Remark
1	开口销 5×36 Cotter pin 5×36	72	安装、拆卸 Mounting and demounting	标准节连接处 Connection parts of masts	
2	销 6.3×60 Pin 6.3×60	36	安装、拆卸 Mounting and demounting	平衡臂结构与平台 Counter jib structure and platform	
3	销 10×100 Pin 10×100	58	安装、拆卸 Mounting and demounting	平衡臂平台、起重臂 Counter jib platform and jib	
4	销 8×70 Pin 8×70	36	安装、拆卸 Mounting and demounting	平衡臂拉杆、上支座平台 Counter jib drag rods and upper support platform	
5	销 10×140 Pin 10×140	22	安装、拆卸 Mounting and demounting	起重臂拉杆销轴连接处 Pin connections of jib drag rods	
6	销 10×80	60	安装、拆卸 Mounting and demounting	套架、上支座栏杆连接处 Climbing frame and railing connections of upper support	
7	销 10×150 Pin 10×150	9	安装、拆卸 Mounting and demounting	起重臂各臂节 Each jib section	
8	油杯 M10×1 Oil cup M10×1	26	堵塞 Blocking	各润滑点 Each lubricating points	
9	起升钢丝绳 φ22 Lifting wire rope φ22	1	疲劳、磨损 Fatigue and wear	起升机构 Hoisting mechanism	
10	变幅钢丝绳 φ12 Luffing wire rope φ12	2	疲劳、磨损 Fatigue and wear	变幅机构 Trolleying mechanism	
11	止推轴承 51310 Trust bearing 51310	1	疲劳、磨损 Fatigue and wear	吊钩钩头 Hook head	GB/T301-1995
12	起升机构制动片 Hoisting brake	2	磨损 Wear	起升机构 Hoisting mechanism	

	blade E3-400-160×14				
13	变幅机构制动片 Elevating brake blade DLTZ3-150	1	磨损 Wear	变幅机构 Trolleying mechanism	
14	防撞块 Bumper block	4	磨损 Wear	小车 Trolley	
15	轴承 6204-Z Bearing 6204-Z	4	疲劳、磨损 Fatigue and wear	小车导向轮 Guiding wheels of trolley	GB/T276-1994
16	轴承 6210-Z Bearing 6210-Z	4	疲劳、磨损 Fatigue and wear	小车导向轮 Guiding wheels of trolley	GB/T276-1994

6.3

附表三 安全装置明细表
Table 3 Safety device

名称 Name	型号 Type	数量 Qty
力矩限制器开关箱 Moment limiter	BWL-D5B-K	1
起重量限制器 Loadlimiter	BWL-25T-φ650-Z	1
变幅限位器 Elevating limiter	DXZ-4/5 (1:78)	1
回转限位器 Slewing limiter	DXZ-1(1:60)	1
起升限位器 Lifting limiter	DXZ-4/7 (1:274)	1

6.4 整机 2 年期备件明细表（见下表）
6.4 Spare parts list for 2 years (see table below)

序号 NO.	名 称 及 规 格 Name and standard	执行标准或图号 Executive standard or mark	数 量 Quantity	用 途 Usage	物料号 Remark
1	起升制动器摩擦片 Hoisting brake disk	E3-400-140×14	3	起升机构 Hoisting mechanism	800358993
2	变幅机构制动器摩擦片 Trolley brake disk	DLTZ3-150 摩擦片 friction plate	2	变幅机构 Trolleying mechanism	800358991
3	起升风机 Lifting fan	L-064/1500W	1	起升机构 Hoisting mechanism	803588478
4	变幅制动器 Slewing brake	DLTZ3-150 摩擦片 friction plate	2	变幅机构 Trolleying mechanism	800358991
5	力矩限制器开关箱 Moment limiter	BWL-D5B-K	1		803747456
6	限位器 Limiter	DXZ-4/FW 1：274(带电位计) (with a potentiometer)	3	起升机构 Hoisting mechanism	803745507
7	限位器 Limiter	DXZ-4/5W 1：78(带电位计) (with a potentiometer)	3	变幅机构 Trolleying mechanism	803589814
8	限位器 Limiter	DXZ 1:60 带电位计 (with a potentiometer)	3	回转 Slewing	803589812
16	编码器 Encoder	ETF100-H850921 A	2	控制系统 Control system	803587955
17	编码器卡 Encoder card	VW3A3401	1	控制系统 Control system	803685551

18	涡流模块 Whirlpool module	ODC-24P/3O	2	控制系统 Control system	803690535
19	接触器 Contactor	LC1-D245M7C	2	控制系统 Control system	803745739
20	接触器 Contactor	LCD1-D38M7C	1	控制系统 Control system	803684036
21	PLC	XGC-T4040BTD	1	控制系统 Control system	803743657
22	变压器 Transformer	BK1000-T5	2	控制系统 Control system	803746115
23	变压器 Transformer	BK1000-T3	2	控制系统 Control system	803745125
24	防雷模块 Lightning protection module	Mpguard-D	1	控制系统 Control system	803684670
25	相序继电器 Phase rotation relay	XJ3-D AC380V	3	控制系统 Control system	803684127
26	辅助触头 Auxiliary contact	LADN11C	5	控制系统 Control system	803743441
27	热断路器 Thermal breaker	GSM8-3210FW11	3	控制系统 Control system	803688054
28	热断路器 Thermal breaker	GSM8-3204FW11	3	控制系统 Control system	803685554
26	滑轮（含轴承、挡圈） Pulley (including bearing and retainer ring)	C8030.02.5 滑轮组 pulley block	5	起升 Lifting	440500131
27	滑轮（含轴承、挡圈） Pulley (including bearing and retainer ring)	XGT500.06.1.10 滑轮组 pulley block	2	变幅 Elevating	441301623
28	滑轮（含轴承、挡圈） Pulley (including bearing and retainer ring)	C8030.07.18 滑轮组 pulley block	3	起升 Lifting	440500780
29	滑轮（含轴承、挡圈） Pulley (including bearing and retainer ring)	C8030.02.4 滚轮组 roller group	4	小车 Trolleying car	440500128
30	滑轮（含轴承、挡圈） Pulley (including bearing and retainer ring)）	C8030.02.7 导轮 guide wheel	2	小车 Trolleying car	440500145

6.5 附图 （见下表）
6.5 Attached diagrams (see the table below).

序号 No.	名　称 Name	图　号 Diagram No.	份数 Number	备　注 Remarks
1	平衡重 Counterweight	XGTT580.31	1	
2	独立固定基础 Independent fixed base	XGTT580.12	1	用户自制 Used made
3	电气原理图 Electrical schematic diagram	DT025BBB0A02000	1	用户用于检修 Used for check

塔机部件检查记录表
Inspection Record of Tower Crane component

序号 No.	零部件名称 Name	检查周期 Time	检查内容及方法	检查人 Inspector	检查日期 Date	部件状况及处理方法 Problems & Solution
1	塔身、起重臂、回转支承、平衡臂拉杆、卷筒、刹车制动器及换倍率处等 Tower crane, jib, slewing bearing, balance arm rod, brake drum, brake and magnification changing	每班工作前 Before each shift	内容：检查主要部位的销轴、螺栓等是否连接松动 Content: checking whether there is loosening or disengaging to pin shafts and bolts of main parts 方法：目测 Method: Visual inspection			

2	安装销轴的耳板及附近的母材，塔顶和回转塔身 Eyebars and its parent material for installing pin shafts, tower head & slewing tower body	每月 Monthly	内容：检查焊缝有无明显可见的裂纹等缺陷 Content: checking the welds for cracks 方法：观察抽查，必要时采用测量仪器进行测量 Method: observing and sampling inspection, using tools and equipments for measurement if necessary			
3	起重臂上弦杆的连接耳板和下弦杆的接头及其附近的母材 Connecting ear plate of upper boom and joint of lower boom and its parent material	每三个月 Quarterly	内容：检查是否有裂纹、永久变形、油漆剥落 Content: checking for cracks, deformation or paint-off 方法：观察抽查，必要时采用测量仪器进行测量 Method: observing and sampling inspection, using tools and equipments for measurement if necessary			
4	塔身节的踏步及液压顶	每次顶升加节	内容：检查是否有塑性变形、			

	升系统的顶升横梁 Step of tower body and cross beam of hydraulic jacking system	或降塔减节 Each time of increasing or decreasing mast	严重锈蚀（或腐蚀）和可见裂纹。 Content: checking for deformation, serious erosion or visible cracks 方法：观察抽查，必要时采用测量仪器进行测量 Method: observing and sampling inspection, using tools and equipments for measurement if necessary			
5	高强度螺栓 High-strength bolt	先一周二次、再一周一次、两周一次，然后一月一次 Twice per week first, then once per week or once two week, and then once per month	每年内拆下 2~3 组螺栓检查其变形、腐蚀等情况 Removing two or three couples of bolts and checking for deformation and erosion.			
6	钢丝绳 Steel wire	至少每周 At least weekly	1、尽可能对钢丝绳的任何可见部件进行观察，以便-发现损坏与变形情况特别应留心钢丝绳在机械上的固定位置。			

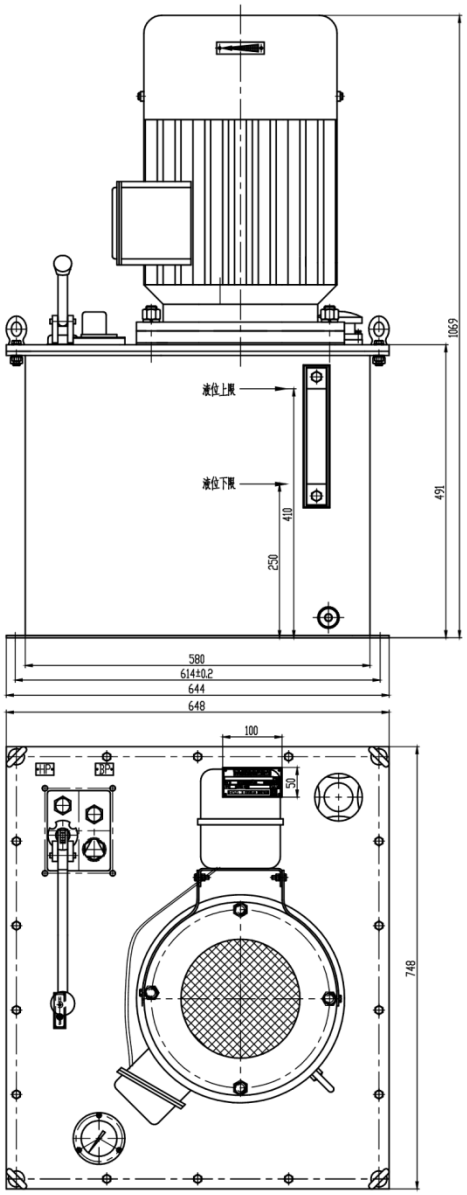
			1. Inspect every part of steel wire which can be seen for any damages and deformation every shift, paying attention to the fixing position of wire on machine. 2、每日工作前和塔机工作时司机和地面工作人员应注意载重小车和吊钩的钢丝绳是否有跳绳现象，发现跳绳现象应立即停止工作，穿好钢丝绳再工作 2. Both operators and workers on the ground should look out whether there is the rope skipping phenomenon of steel wire of trolley and hook or not, if it is, stop operation instantly and adjust the wire rope and then work again			

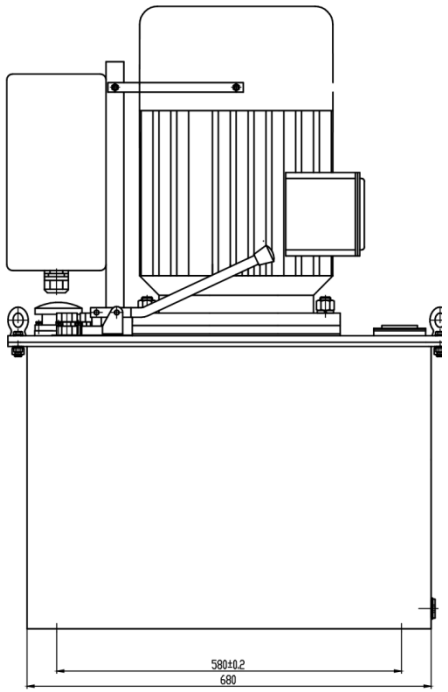
塔机各部件检润滑记录表
Lubrication Record of Tower Crane Component

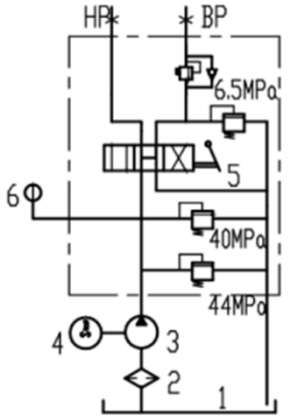
序号 No.	零部件名称 Name	润滑部位名称 Position	润滑剂种类 Type	润滑方法及周期 Method & Period	润滑人 Lubricating person	润滑日期 Date
1	钢丝绳 Steel wire	起升钢丝绳 Lifting wire 变幅钢丝绳 Trolley wire	石墨钙基润滑脂 Graphite Albany grease	每工作一周涂润滑脂一次，每大、中修时油煮 Lubricate after working one week, and boil it in oil each big and middle shift		
2	减速器 Reducer	起升机构变速箱 变幅机构减速器 The adjustable speed transmission of hoisting mechanism, speed reducer of trolleying mechanism	夏季 HJ-30 机械油 冬季 HJ-20 机械油 In summer: HJ-30 Machine oil In winter: HJ-20 Machine oil	每工作 200 小时加油一次，1500 小时换油一次 Add oil one time after working 200 hours and change oil one time after working 1500 hours		
		回转机构行星减速器 The planetary speed reducer of slewing mechanism	夏季 N220 齿轮油 冬季 N150 齿轮油 In summer: N220 gear oil In winter: N150 gear oil			
3	滚动轴承 Rolling bearing	所有滚动轴承 All the rolling bearings	ZGⅢ钙基润滑脂 ZGⅢ Albany grease	每工作 160 小时，适当加油，每半年清除一次 Add oil properly after working 160 hours; clear one time every half-year		
4	回转支承、齿轮 Slewing bearing & gear	回转支承上、下坐圈跑道，回转机构开式齿轮 The open gear of slewing mechanism, the upper and bottom part of external tooth, sit ring runway	夏季 ZG-V 钙基润滑脂 冬季 ZG-Ⅱ钙基润滑脂 In summer: ZG-V Albany grease In winter: ZG-Ⅱ Albany grease			

5	电机轴承 Motor bearing	所有电机轴承 All motor bearings	夏季 ZG-Ⅴ钙基润滑脂 冬季 ZG-Ⅱ钙基润滑脂 In summer: ZG-V Albany grease In winter: ZG-Ⅱ Albany grease			
6	定、动滑轮组 Fixed and movable pulley block	所有滑轮组 All the pulley blocks	夏季 ZG-Ⅴ钙基润滑脂 冬季 ZG-Ⅱ钙基润滑脂 In summer: ZG-V Albany grease In winter: ZG-Ⅱ Albany grease	每工作 240 小时加油一次 Add oil one time after working 240 hours		
7	液力推杆制动器 Hydraulic pushrod brake	各个铰点 Each articulated point	YA-N46 液压油 YA-N46 hydraulic oil	每工作 56 小时注油一次 Pour one time after working 56 hours		
8	顶升泵站 Jacking pump station	油箱 Oil cylinder		工作 200 小时增添部分清洁油，工作 2400 小时后完全更换油 Add part cleaning oil after working 200 hours and totally change the oil after working 2400 hours		
9	齿轮练轴器 Gear coupling	各机构、齿轮联轴器 Each mechanism and gear coupler	钙基润滑脂 Albany grease	一季度注油一次 Pour oil quarterly		

附图一：液压部套图 Drawing I: explanatory drawing of hydraulic pressure components







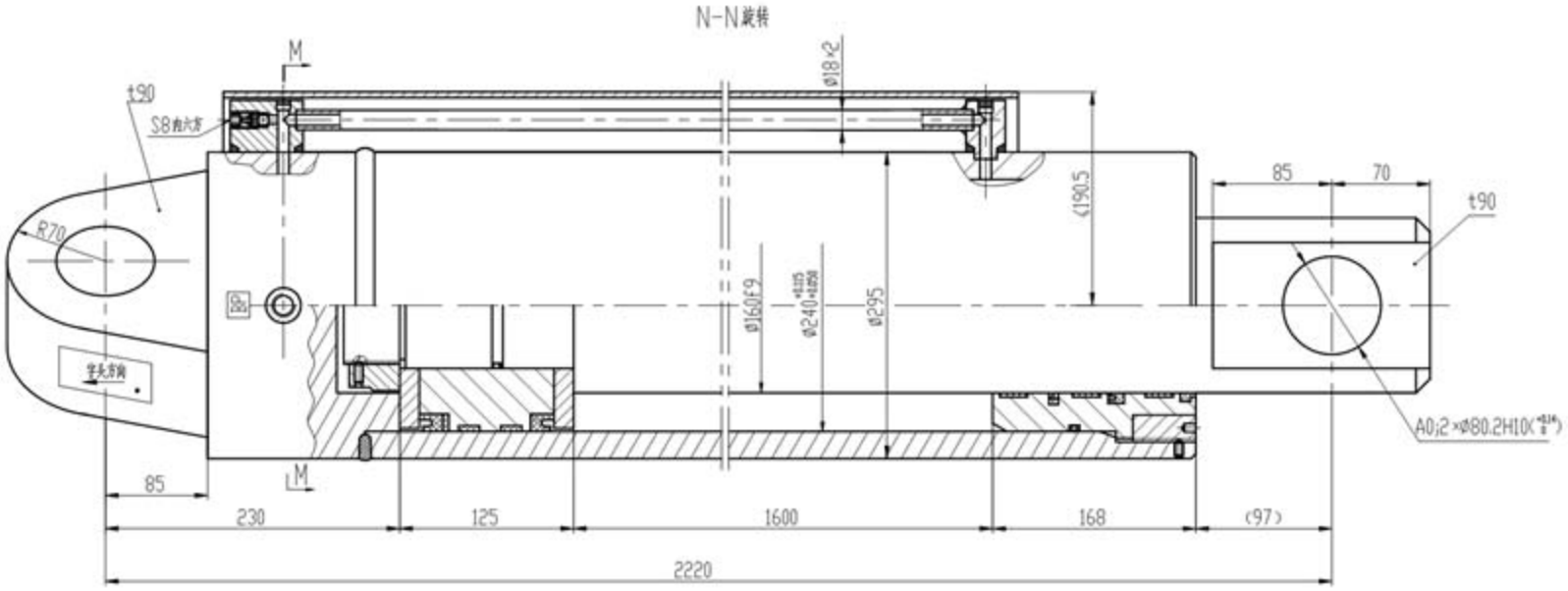
1、油箱
2、滤油器
3、柱塞泵
4、电动机
5、集成阀组
6、压力表

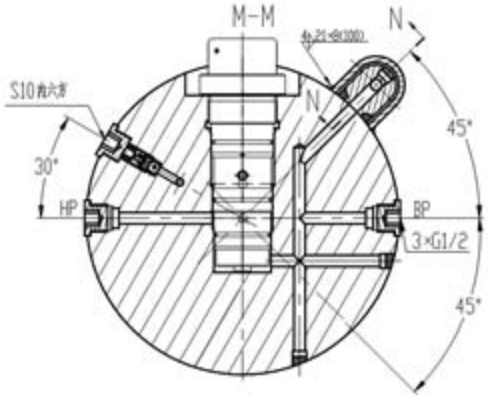
1.Fuel tank
2. Oil filter 3. Plunger pump
4.Electric motors
5.integrated valve group
6.Pressure gauge

技术参数：

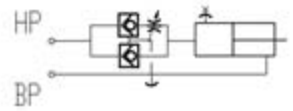
Technical reference

1.溢流阀调定压力 relief valve setting pressure :41MPa
2.安全阀调定压力 safety valve setting pressure :45MPa
3.低压溢流阀调定压力 low pressure relief valve setting pressure :6.5MPa
4.满载流量 full load flow :15.3L/min
5.空载流量 no-load flow:17L/min
6.功率 power:15kW





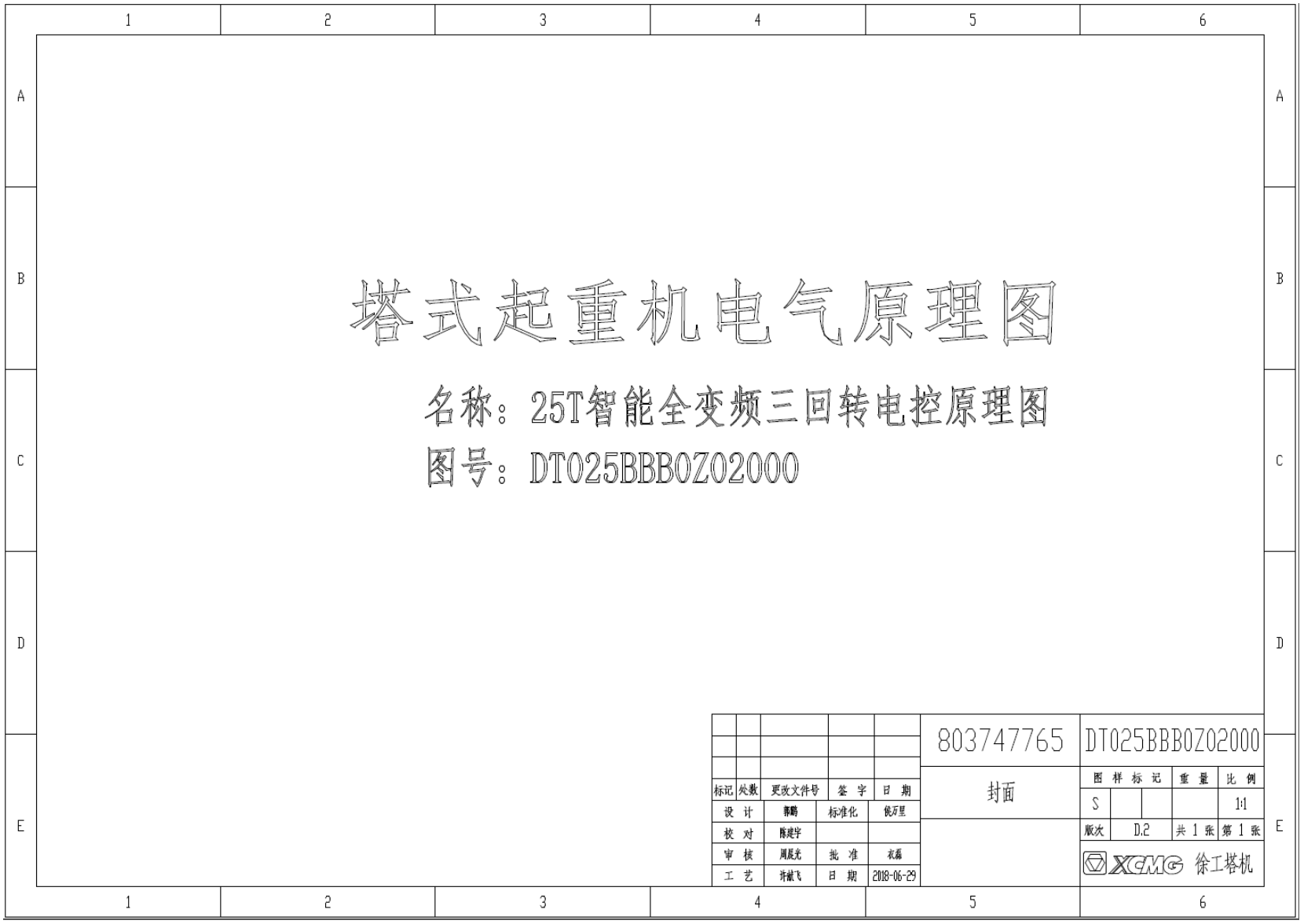
技术参数
1、缸径:240
2、杆径:160
3、行程:1600
4、无杆腔工作压力: 41MPa
有杆腔工作压力:20MPa
5、职能符号:



Technical reference

1.Cylinder diameter :240
2. Piston rod diameter :160
3. Itinerary :1600
4.Working pressure without rod cavity :41MPa
Working pressure with rod cavity :20MPa
5.Functional symbols

附图二：电气原理图 Drawing II. electrical schematic diagram



序号	图号	名称
1	DT025BBB0Z02001	图样目录
2	DT025BBB0Z02101	控制原理图（电源供电回路）
3	DT025BBB0Z02102	控制原理图（起升主回路）
4	DT025BBB0Z02103	控制原理图（起升控制回路）
5	DT025BBB0Z02104	控制原理图（回转主回路1）
6	DT025BBB0Z02105	控制原理图（回转主回路2）
7	DT025BBB0Z02106	控制原理图（回转控制回路）
8	DT025BBB0Z02107	控制原理图（变幅主回路）
9	DT025BBB0Z02108	控制原理图（变幅控制回路）
10	DT025BBB0Z02109	控制原理图（限位报警）
11	DT025BBB0Z02110	控制原理图（模拟量限位）
12	DT025BBB0Z02111	控制原理图（总线部分）
13	DT025BBB0Z02201	电气连接图（联动台部分）
14	DT025BBB0Z02202	电气连接图（驾配箱部分）
15	DT025BBB0Z02203	电气连接图（主控柜部分1）
16	DT025BBB0Z02204	电气连接图（主控柜部分2）
17	DT025BBB0Z02205	电气连接图（总线部分）
18	DT025BBB0Z02301	元器件布置图（驾配箱部分）
19	DT025BBB0Z02302	元器件布置图（主控柜部分）

标记	处数	更改文件号	签字	日期
设计		陈建宇	标准化	钱万里
校对		郭鹏		
审核		衣磊	批准	米成宏
工艺		许献飞	日期	2018-01-23

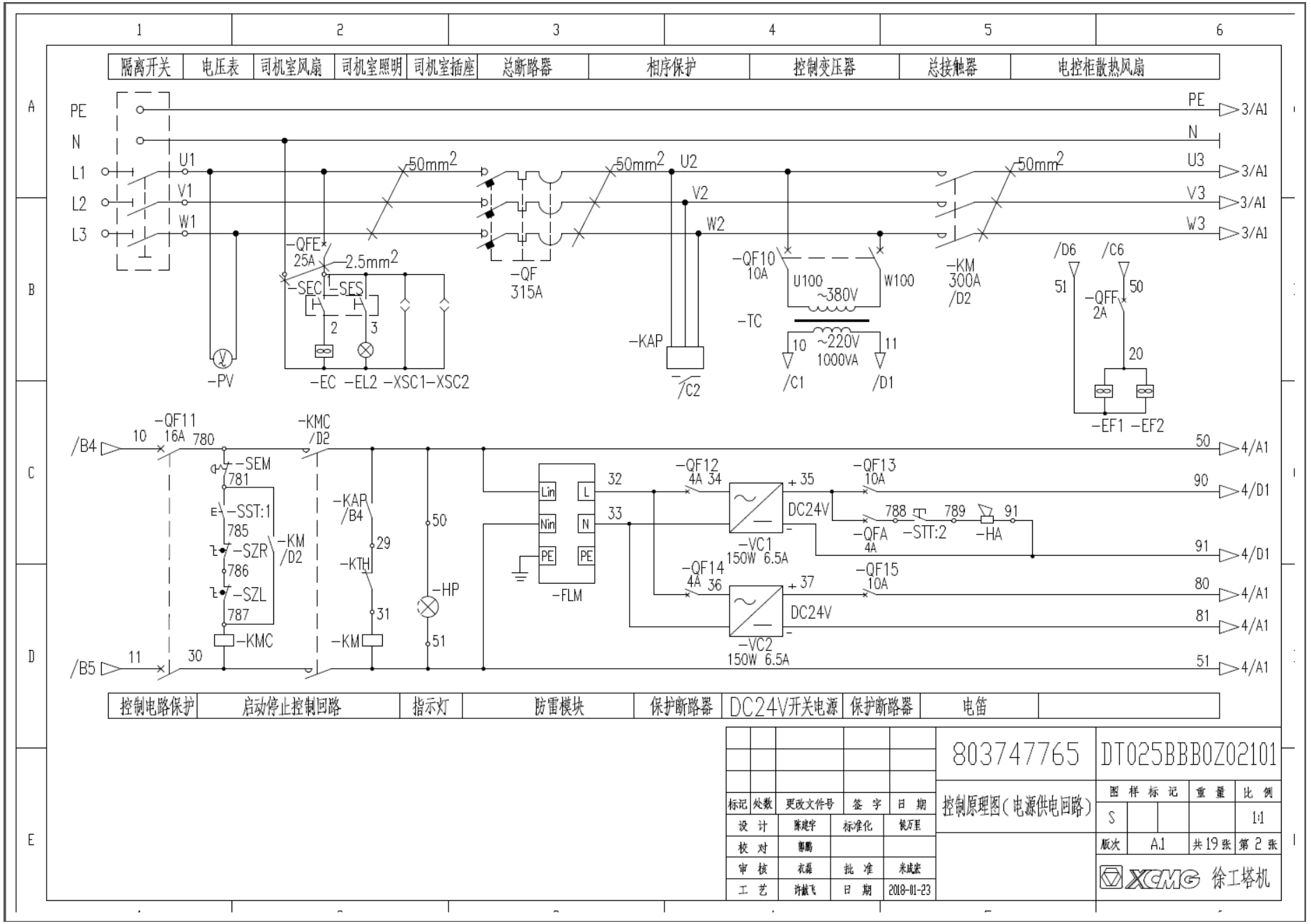
803747765

图样目录

DT025BBB0Z02001

图样标记	重量	比例
S		1:1
版次 A.1	共19张	第1张

XCMG 徐工塔机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电压表
司机室风扇
司机室照明
司机室插座
总断路器
相序保护
控制变压器
总接触器
电控柜散热风扇
PE
N
L1
L2
L3
U1
V1
W1
50mm2
-QFE
25A
2.5mm2
-SEC
-SES
-QF
315A
U2
V2
W2
-KAP
-QF10
10A
U100
W100
~380V
-TC
~220V
1000VA
-KM
300A
/D2
U3
V3
W3
/D6
/C6
-QFF
2A
-PV
-EC
-EL2
-XSC1-XSC2
/C2
/C1
/D1
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-EF2
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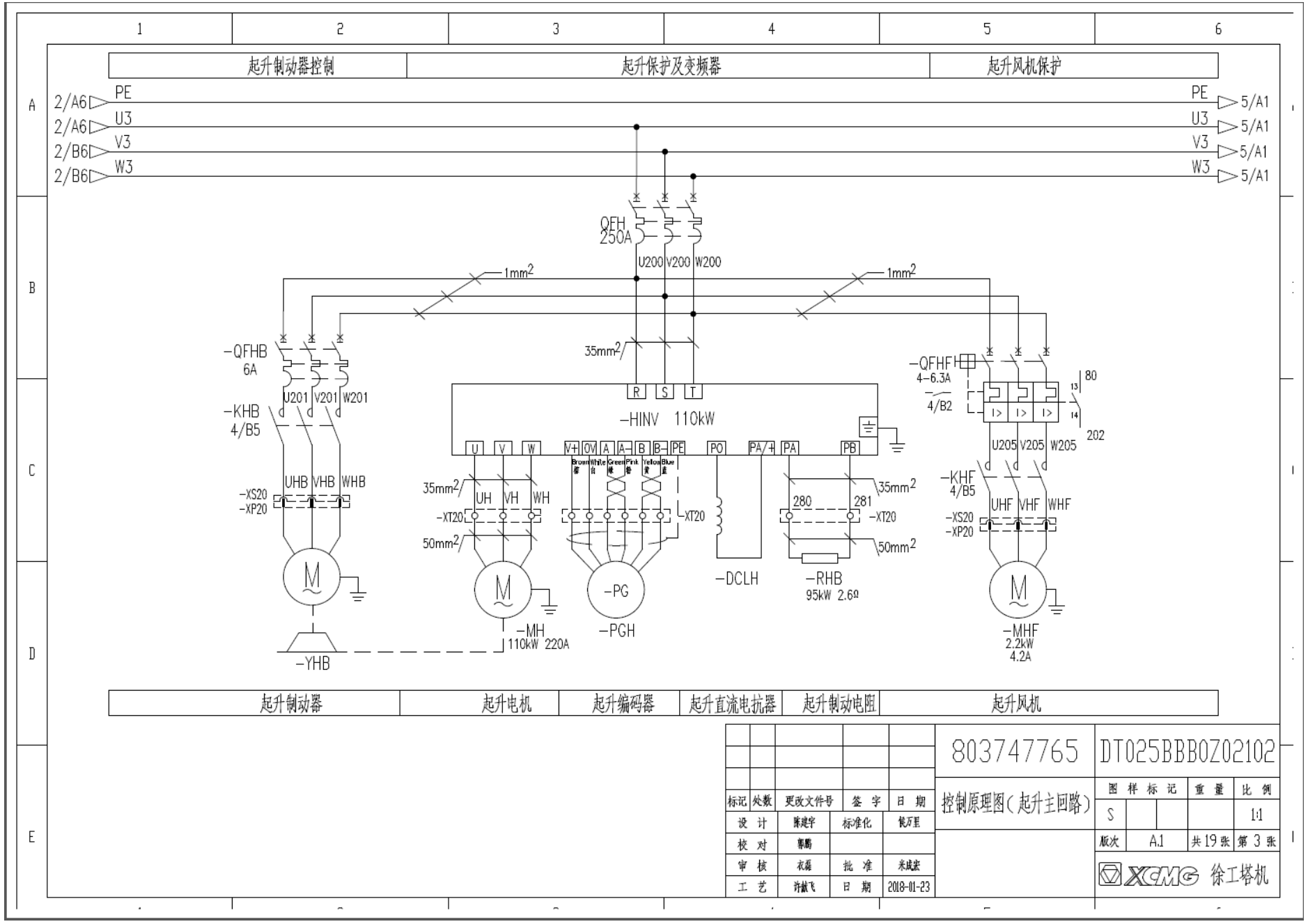
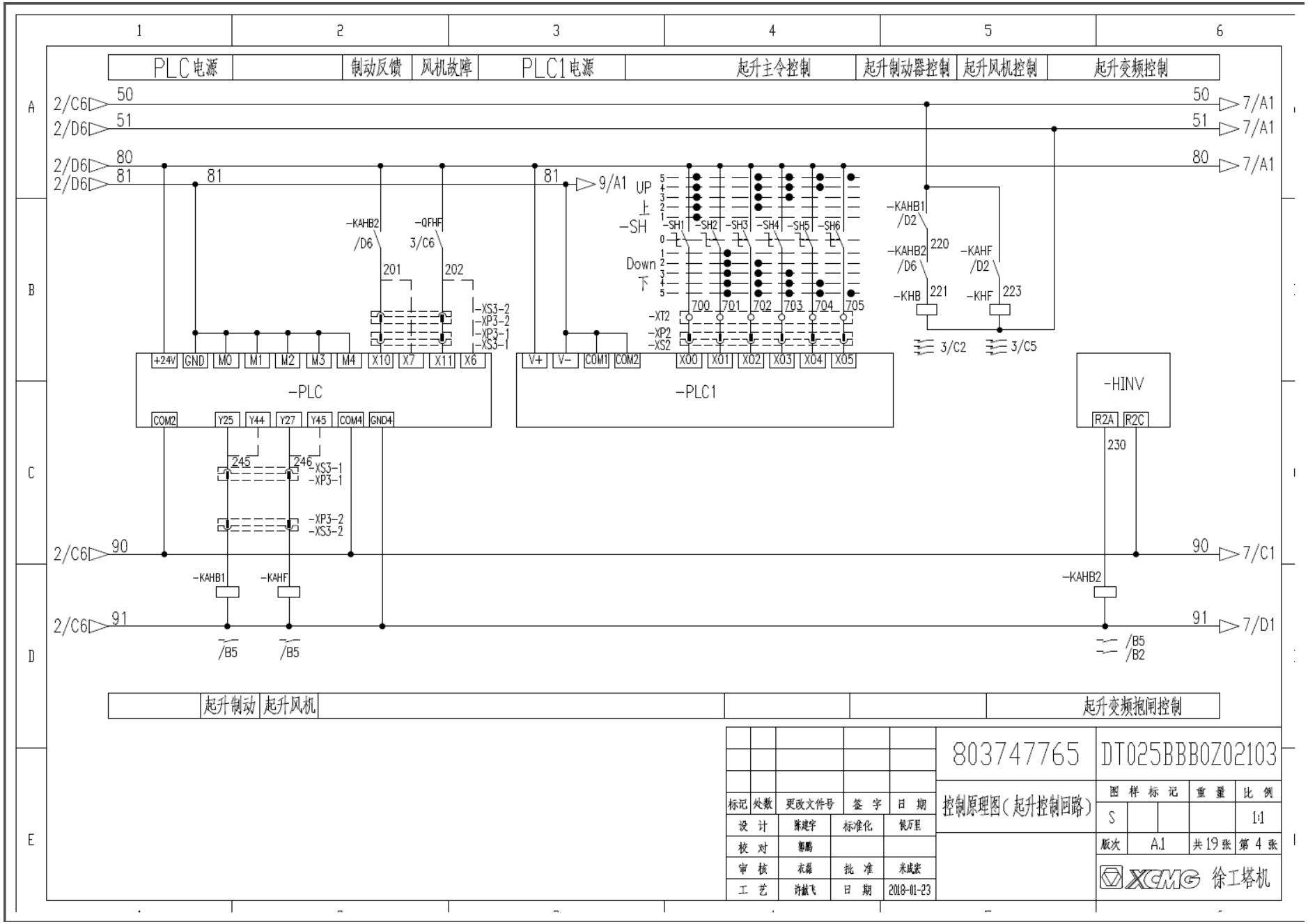
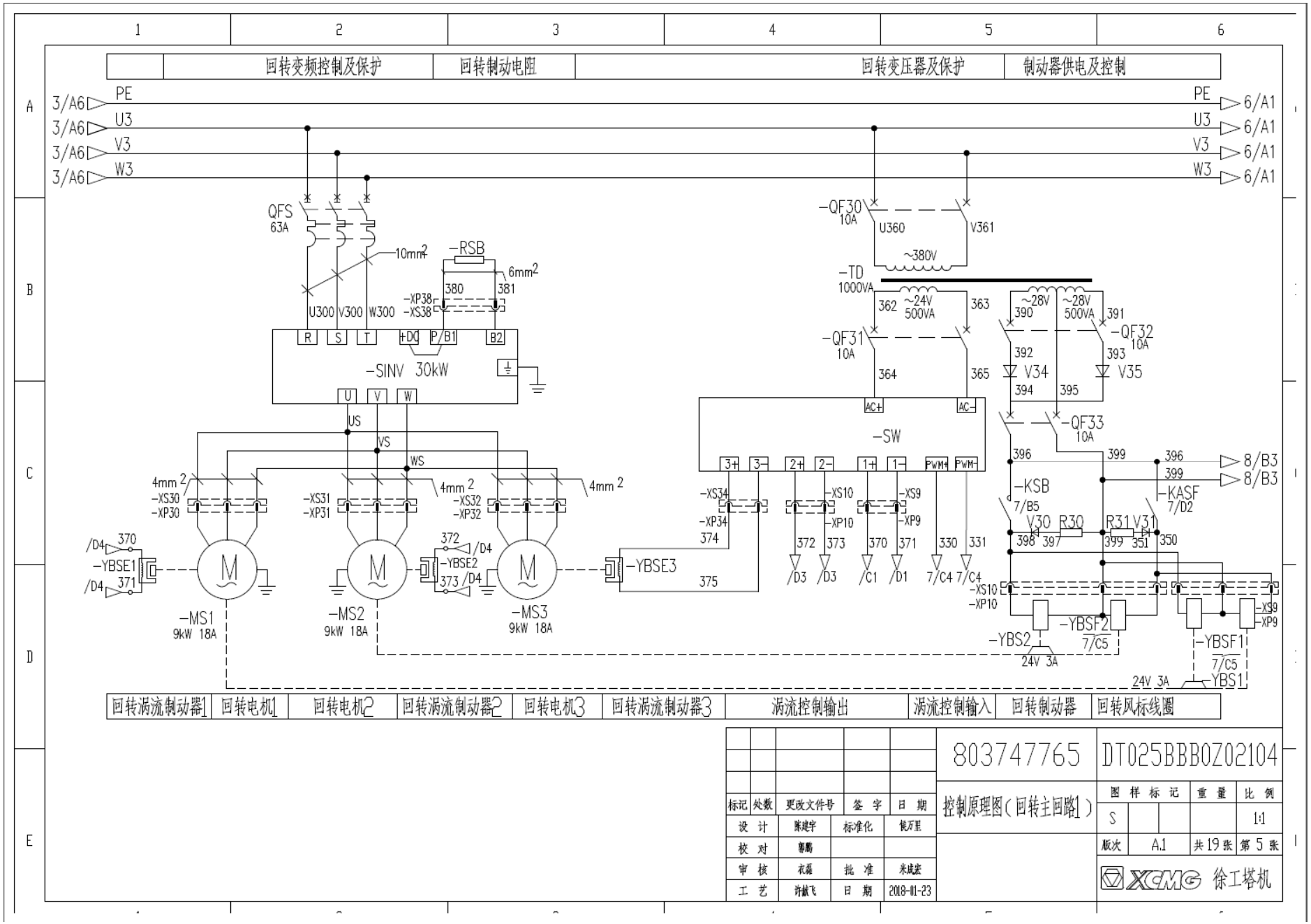
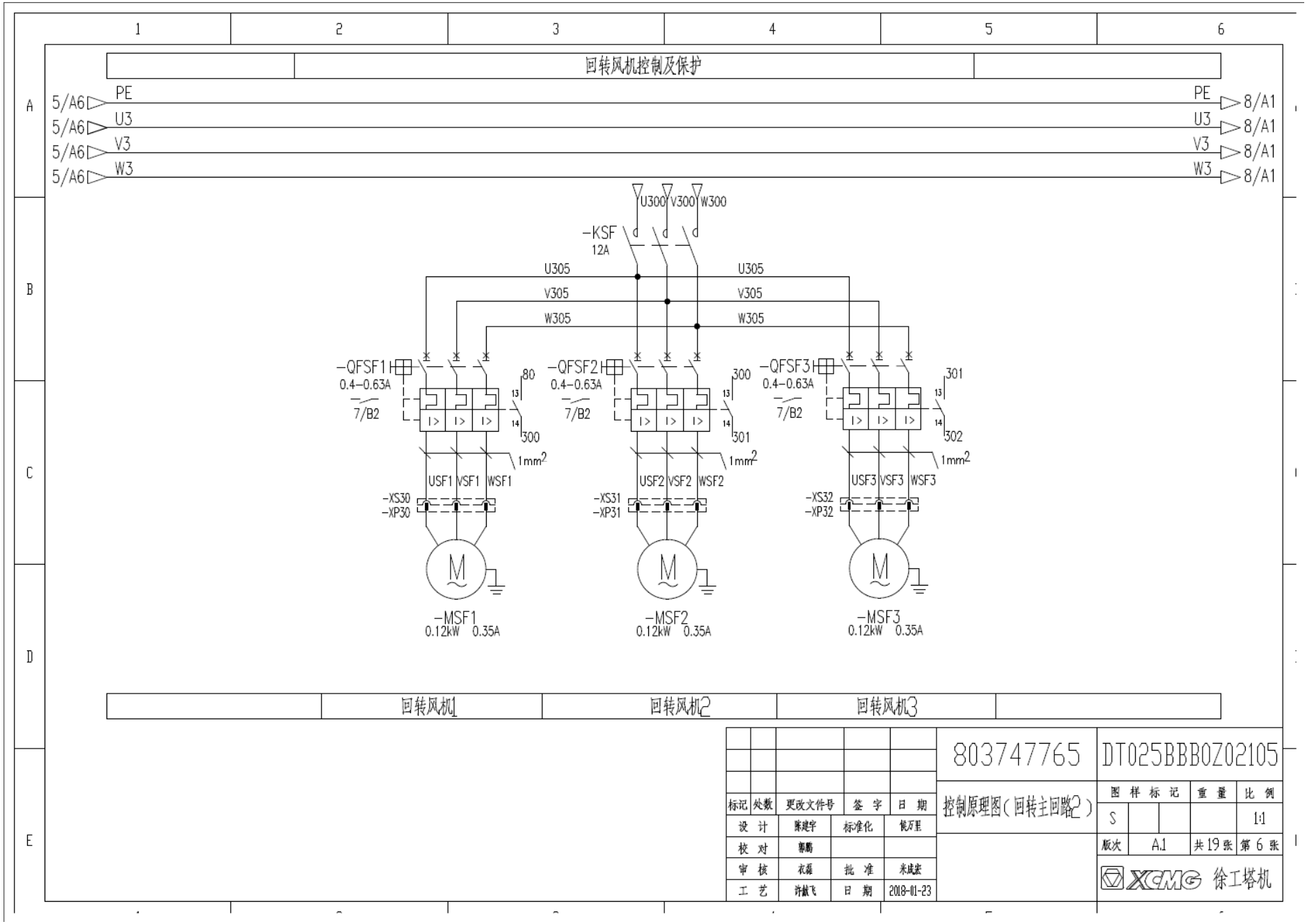
780
-KMC
/D2
/B4
/B5
-SEM
781
-SST:1
785
-SZR
786
-SZL
787
-KM
-KAR
-KTH
-HP
-FLM
-QF12
4A
-QF13
10A
-QF14
-QF15
DC24V
-VC1
150W 6.5A
-VC2
-QFA
-STT:2
-HA
4/A1
4/D1
控制电路保护
启动停止控制回路
指示灯
防雷模块
保护断路器
DC24V开关电源
保护断路器
电笛
803747765
DT025BBB0Z02101
控制原理图(电源供电回路)
徐工塔机


起升制动器控制
起升保护及变频器
起升风机保护
PE
U3
V3
W3
2/A6
2/A6
2/B6
2/B6
5/A1
QFH
250A
U200 V200 W200
1mm2
35mm2
-QFHB
6A
U201 V201 W201
-KHB
4/B5
UHB VHB WHB
-XS20
-XP20
-HINV 110kW
R S T
U V W V+ 0V A A- B B- PE PO PA/+ PA PB
Brown White Green Pink Yellow Blue
-XT20
-DCLH
-RHB
95kW 2.6Ω
280 281
-QFHF
4-6.3A
4/B2
80
202
U205 V205 W205
-KHF
4/B5
UHF VHF WHF
-MH
110kW 220A
-PG
-PGH
-YHB
-MHF
2.2kW
4.2A
起升制动器
起升电机
起升编码器
起升直流电抗器
起升制动电阻
起升风机
803747765
DT025BBB0Z02102
控制原理图(起升主回路)
图样标记
重量
比例
S
1:1
版次
A.1
共19张
第3张
XCMG 徐工塔机
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 郭鹏
审核 衣磊 批准 米成宏
工艺 许航飞 日期 2018-01-23


PLC电源
制动反馈
风机故障
PLC1电源
起升主令控制
起升制动器控制
起升风机控制
起升变频控制
2/C6 50
2/D6 51
2/D6 80
2/D6 81
50 7/A1
51 7/A1
80 7/A1
81 9/A1
UP 上
-SH
Down 下
-SH1 -SH2 -SH3 -SH4 -SH5 -SH6
-KAHB2 /D6
-QFHF 3/C6
201 202
-XS3-2 -XP3-2 -XP3-1 -XS3-1
-KAHB1 /D2
220
-KAHF /D2
-KHB 221
-KHF 223
3/C2 3/C5
+24V GND M0 M1 M2 M3 M4 X10 X7 X11 X6
-PLC
V+ V- COM1 COM2 X00 X01 X02 X03 X04 X05
-PLC1
-HINV
R2A R2C
230
COM2 Y25 Y44 Y27 Y45 COM4 GND4
245 246
-XS3-1 -XP3-1
-XP3-2 -XS3-2
2/C6 90
90 7/C1
-KAHB1 -KAHF
-KAHB2
2/C6 91
91 7/D1
/B5 /B5
/B5 /B2
起升制动 起升风机
起升变频抱闸控制
803747765
DT025BBB0Z02103
控制原理图(起升控制回路)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 郭鹏
审核 衣磊 批准 米成宏
工艺 许航飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A.1 共19张 第4张
徐工塔机


回转变频控制及保护
回转制动电阻
回转变压器及保护
制动器供电及控制
PE
U3
V3
W3
3/A6
6/A1
QFS
63A
10mm2
-RSB
6mm2
-XP38
-XS38
380
381
U300 V300 W300
R S T +DC P/B1 B2
-SINV 30kW
U V W
US
VS
WS
4mm 2
-XS30
-XP30
-XS31
-XP31
-XS32
-XP32
-YBSE1
-YBSE2
-YBSE3
370
371
372
373
374
375
/D4
-MS1
9kW 18A
-MS2
9kW 18A
-MS3
9kW 18A
-QF30
10A
U360
V361
~380V
-TD
1000VA
362
~24V
500VA
363
-QF31
10A
364
365
~28V
390
~28V
500VA
391
-QF32
10A
392
393
V34
V35
394
395
-QF33
10A
AC+
AC-
-SW
3+ 3- 2+ 2- 1+ 1- PWM+ PWM-
-XS34
-XP34
-XS10
-XP10
-XS9
-XP9
372 373 370 371 330 331
/D3 /D3 /C1 /D1 7/C4 7/C4
396
399
8/B3
-KSB
7/B5
-KASF
7/D2
V30 R30 R31 V31
398 397 399 351 350
-YBS2
24V 3A
-YBSF2
7/C5
-YBSF1
7/C5
YBS1
回转涡流制动器1
回转电机1
回转电机2
回转涡流制动器2
回转电机3
回转涡流制动器3
涡流控制输出
涡流控制输入
回转制动器
回转风标线圈
803747765
DT025BBB0Z02104
控制原理图(回转主回路1)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱厉里
校对 郭鹏
审核 衣磊 批准 米成宏
工艺 许航飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A.1 共19张 第5张
XCMG 徐工塔机



标记	处数	更改文件号	签字	日期
设计		陈建宇	标准化	倪万里
校对		郭鹏		
审核		衣磊	批准	朱成宏
工艺		许航飞	日期	2018-01-23

803747765

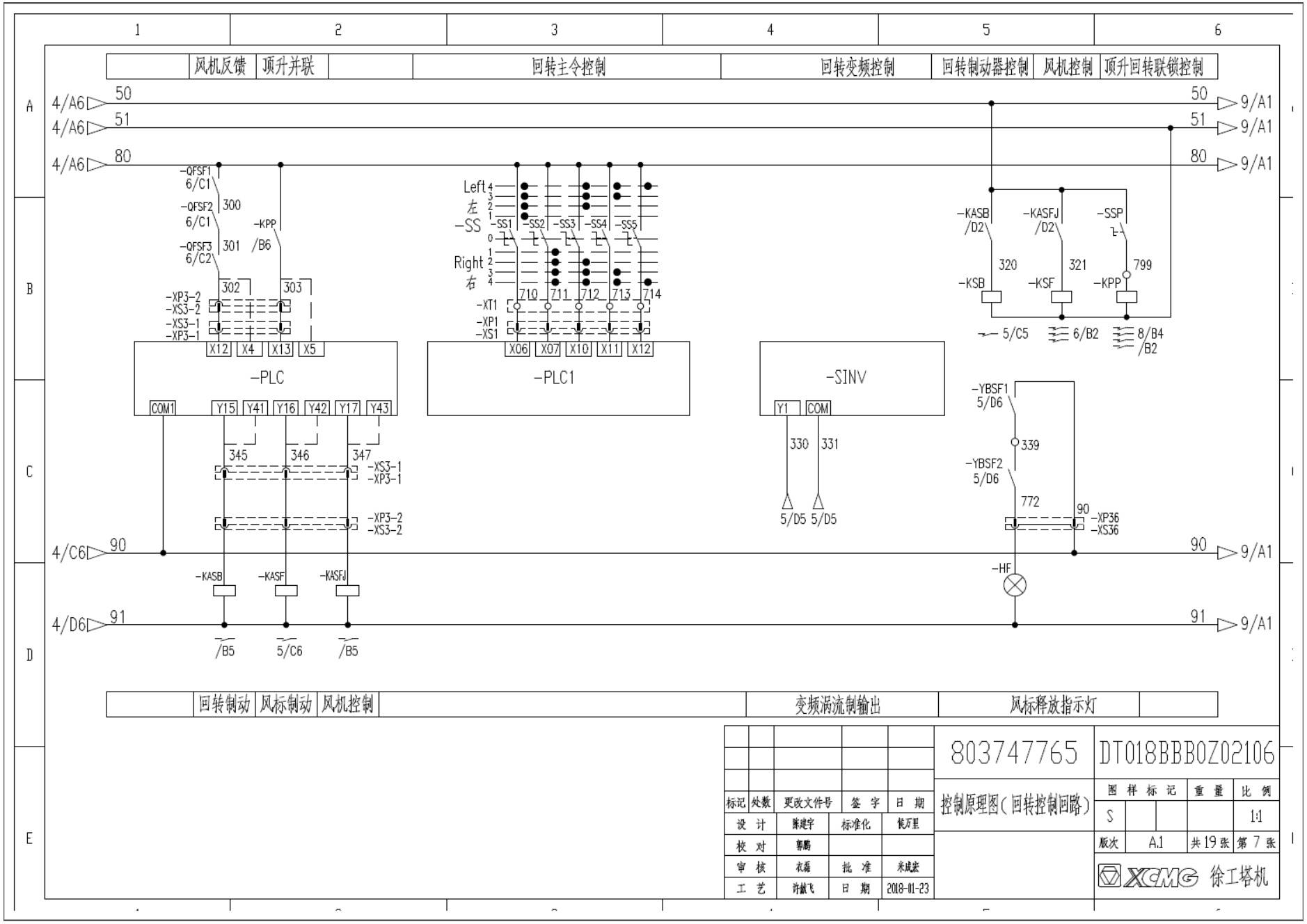
DT025BBB0Z02105

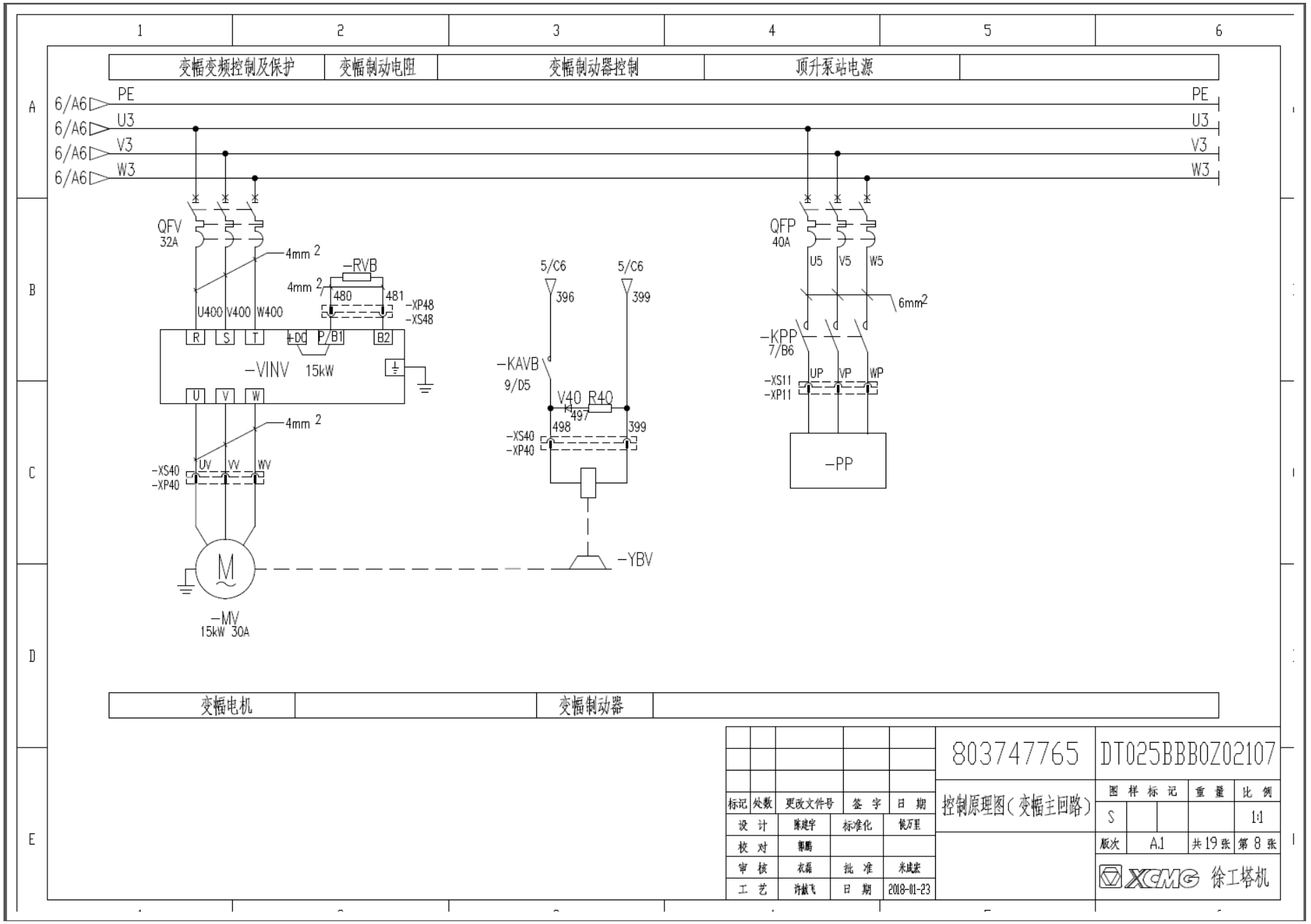
控制原理图(回转主回路2)

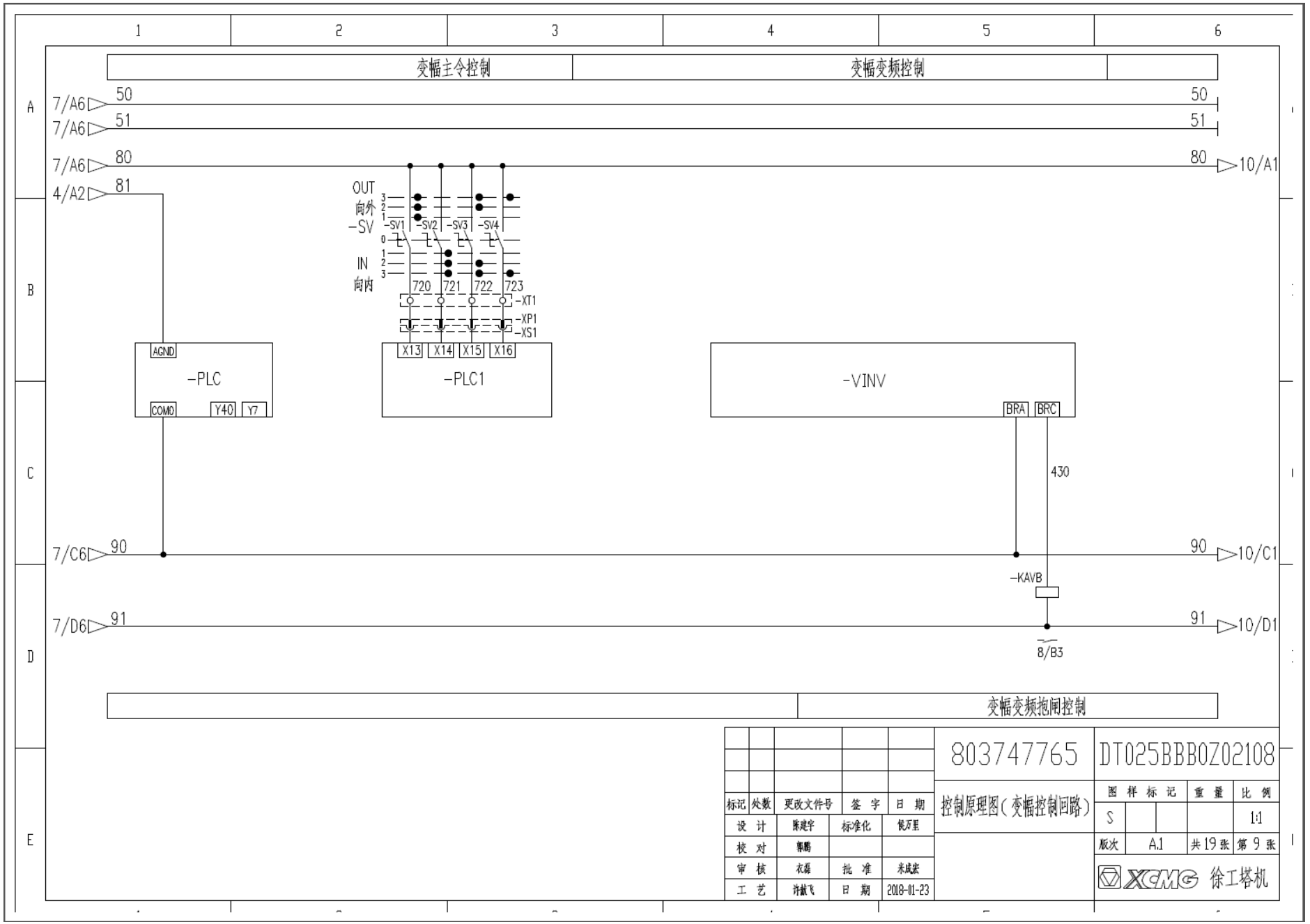
图样标记	重量	比例
S		1:1

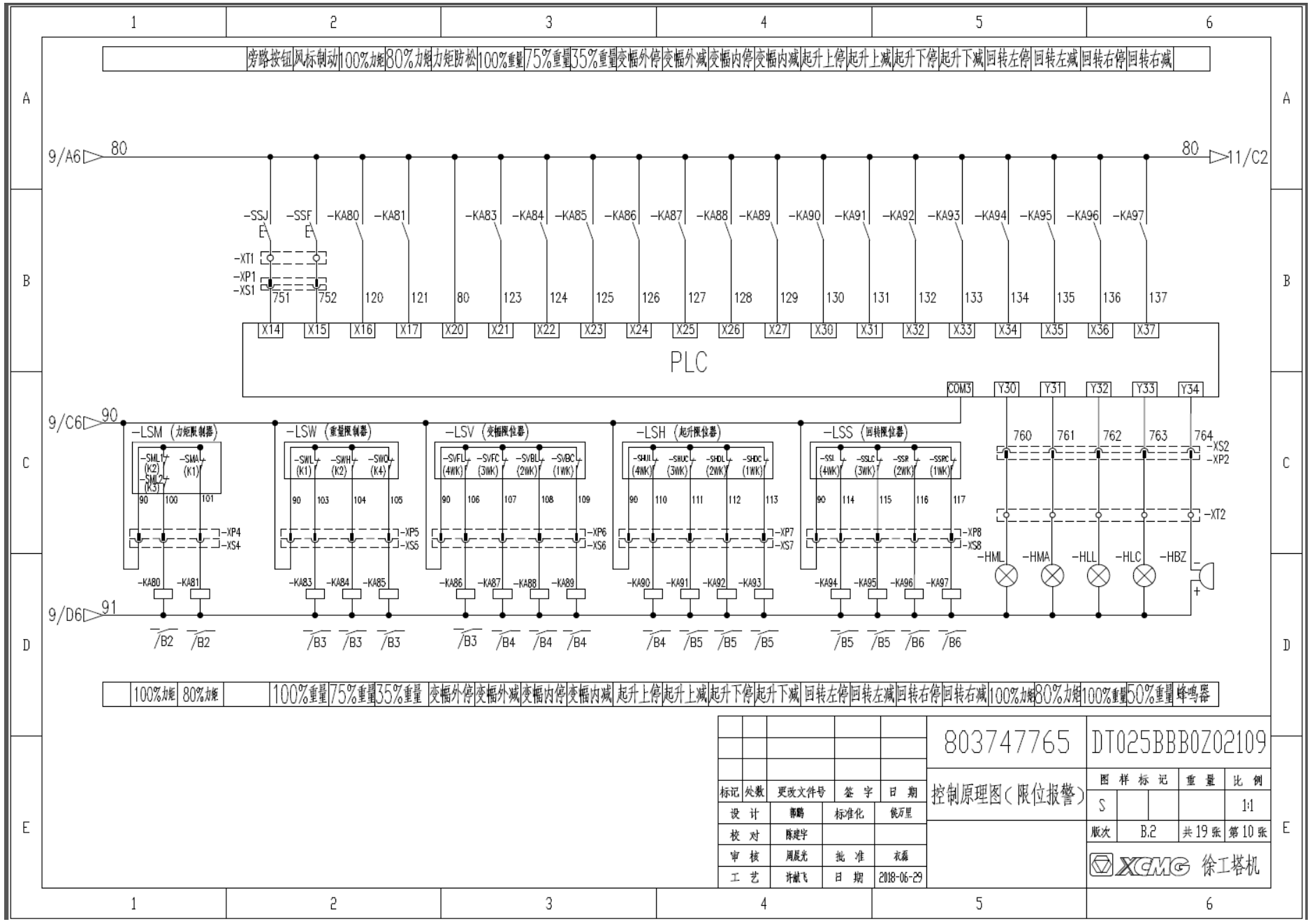
版次	共19张	第6张
A.1		

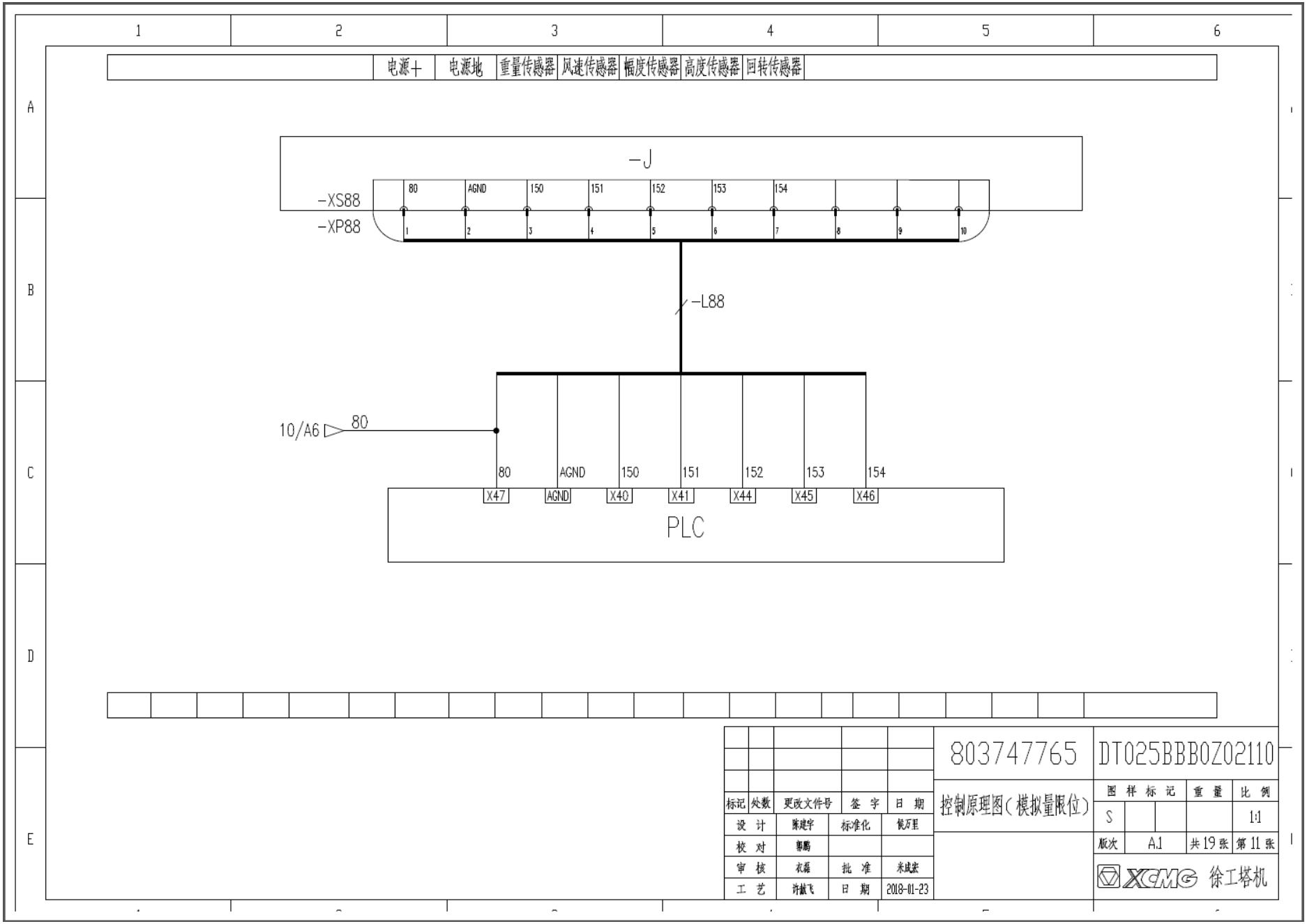
XCMG 徐工塔机

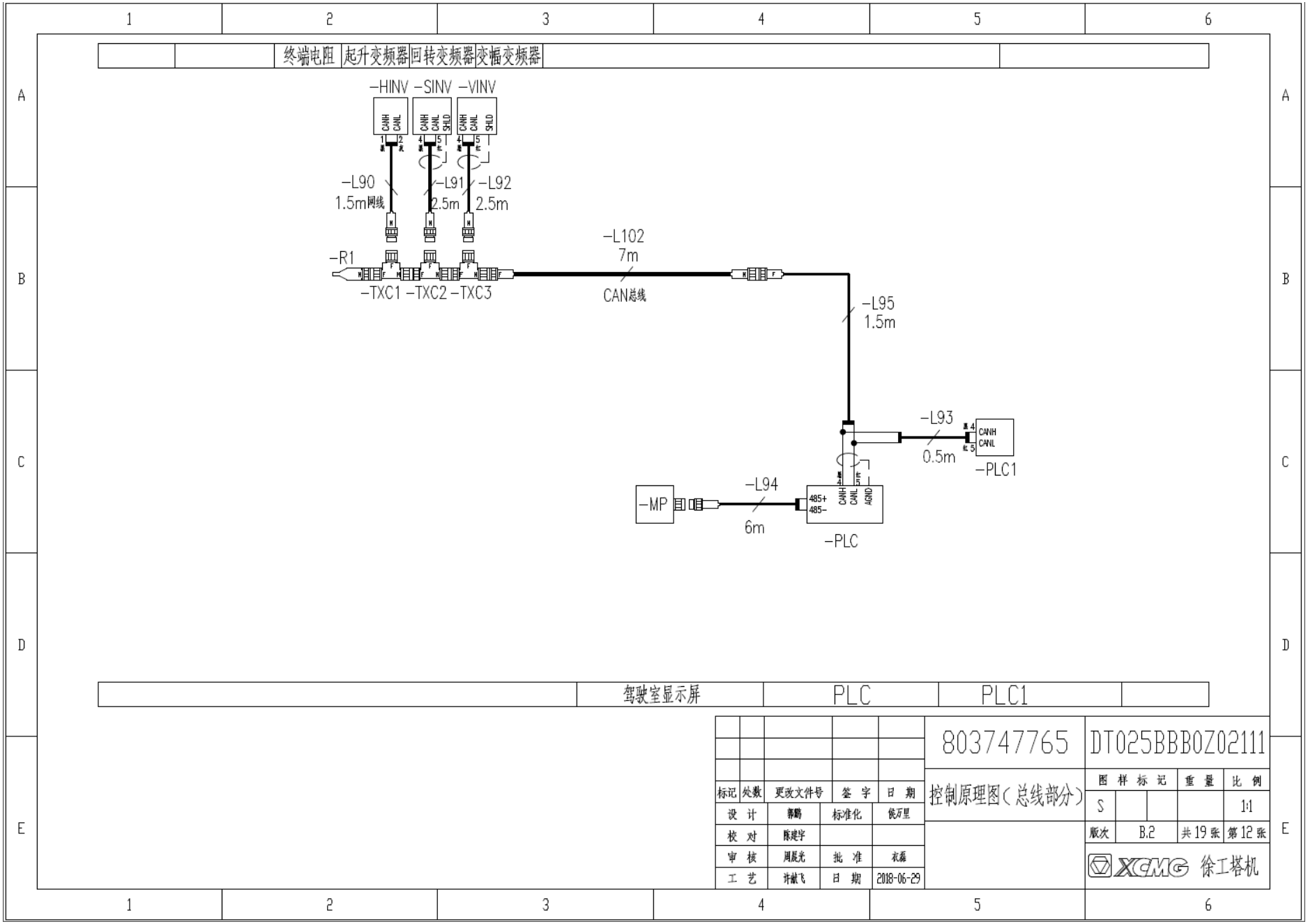

风机反馈
顶升并联
回转主令控制
回转变频控制
回转制动器控制
风机控制
顶升回转联锁控制
4/A6 50
4/A6 51
4/A6 80
50 9/A1
51 9/A1
80 9/A1
-QFSF1 6/C1
-QFSF2 6/C1
-QFSF3 6/C2
300
301
302
303
-KPP /B6
-XP3-2 -XS3-2 -XS3-1 -XP3-1
X12 X4 X13 X5
-PLC
Left 左 -SS -SS1 -SS2 -SS3 -SS4 -SS5
Right 右
-XT1 -XP1 -XS1
710 711 712 713 714
X06 X07 X10 X11 X12
-PLC1
-SINV
Y1 COM
330 331
5/D5 5/D5
-KASB /D2
-KASFJ /D2
-SSP
320 321 799
-KSB -KSF -KPP
5/C5 6/B2 8/B4 /B2
-YBSF1 5/D6
-YBSF2 5/D6
339
772
90
-XP36 -XS36
-HF
COM1 Y15 Y41 Y16 Y42 Y17 Y43
345 346 347
-XS3-1 -XP3-1
-XP3-2 -XS3-2
4/C6 90
90 9/A1
-KASB -KASF -KASFJ
4/D6 91
91 9/A1
/B5 5/C6 /B5
回转制动
风标制动
风机控制
变频涡流制输出
风标释放指示灯
803747765
DT018BBB0Z02106
控制原理图(回转控制回路)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 郭鹏
审核 衣霆 批准 米成宏
工艺 许献飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A1 共19张 第7张
XCMG 徐工塔机


变幅变频控制及保护
变幅制动电阻
变幅制动器控制
顶升泵站电源
PE
U3
V3
W3
6/A6
QFV
32A
4mm 2
-RVB
480
481
-XP48
-XS48
U400 V400 W400
R S T +DO P/B1 B2
-VINV 15kW
U V W
-XS40
-XP40
UV VV WV
-MV
15kW 30A
5/C6
396
399
-KAVB
9/D5
V40 R40
497
498
QFP
40A
U5 V5 W5
6mm2
-KPP
7/B6
-XS11
-XP11
UP VP WP
-PP
-YBV
变幅电机
变幅制动器
803747765
DT025BBB0Z02107
控制原理图(变幅主回路)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 郭鹏
审核 衣磊 批准 米成宏
工艺 许航飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A1 共19张 第8张
徐工塔机

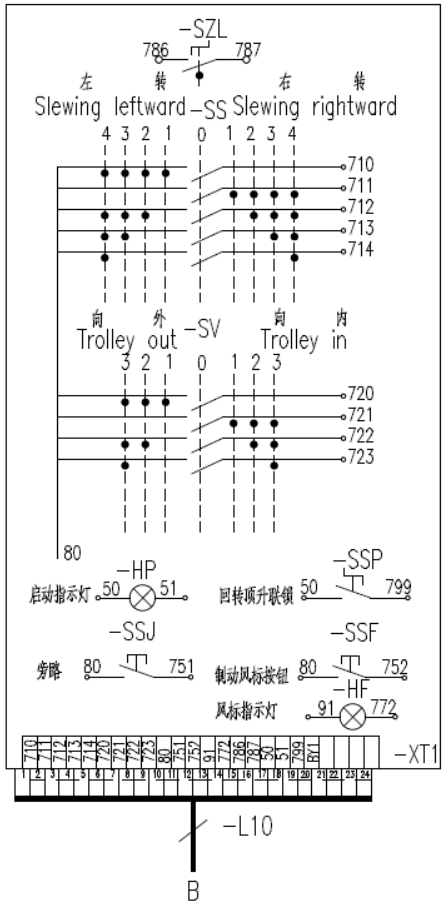

变幅主令控制
变幅变频控制
7/A6
50
51
80
81
4/A2
OUT
向外
-SV
IN
向内
-SV1
-SV2
-SV3
-SV4
720
721
722
723
-XT1
-XP1
-XS1
X13
X14
X15
X16
AGND
-PLC
COM0
Y40
Y7
-PLC1
-VINV
BRA
BRC
430
7/C6
90
10/C1
-KAVB
7/D6
91
10/D1
8/B3
变幅变频抱闸控制
803747765
DT025BBB0Z02108
控制原理图(变幅控制回路)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 倪厉里
校对 韩鹏
审核 衣磊 批准 米成宏
工艺 许献飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A1 共19张 第9张
徐工塔机

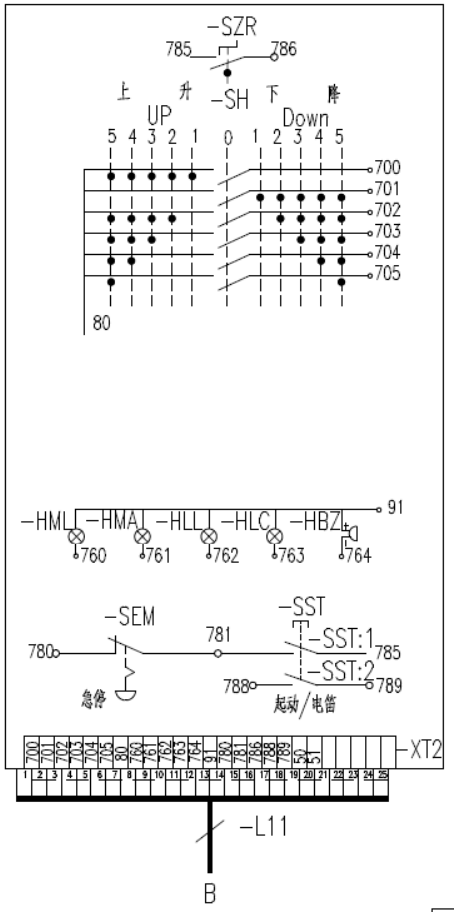

旁路按钮 风标制动 100%力矩 80%力矩 力矩防松 100%重量 75%重量 35%重量 变幅外停 变幅外减 变幅内停 变幅内减 起升上停 起升上减 起升下停 起升下减 回转左停 回转左减 回转右停 回转右减
9/A6
80
11/C2
-SSJ -SSF -KA80 -KA81 -KA83 -KA84 -KA85 -KA86 -KA87 -KA88 -KA89 -KA90 -KA91 -KA92 -KA93 -KA94 -KA95 -KA96 -KA97
-XT1
-XP1
-XS1
751 752 120 121 80 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137
X14 X15 X16 X17 X20 X21 X22 X23 X24 X25 X26 X27 X30 X31 X32 X33 X34 X35 X36 X37
PLC
COM3 Y30 Y31 Y32 Y33 Y34
9/C6
90
-LSM (力矩限制器)
-SML1 (K2) -SML2 (K3) -SMA (K1)
-LSW (重量限制器)
-SWL (K1) -SWH (K2) -SWQ (K4)
-LSV (变幅限位器)
-SVFL (4WK) -SVFC (3WK) -SVBL (2WK) -SVBC (1WK)
-LSH (起升限位器)
-SHJL (4WK) -SHJC (3WK) -SHDL (2WK) -SHDC (1WK)
-LSS (回转限位器)
-SSL (4WK) -SSLC (3WK) -SSR (2WK) -SSRC (1WK)
760 761 762 763 764
-XS2
-XP2
-XT2
-HML -HMA -HLL -HLC -HBZ
-XP4 -XS4 -XP5 -XS5 -XP6 -XS6 -XP7 -XS7 -XP8 -XS8
-KA80 -KA81 -KA83 -KA84 -KA85 -KA86 -KA87 -KA88 -KA89 -KA90 -KA91 -KA92 -KA93 -KA94 -KA95 -KA96 -KA97
9/D6
91
/B2 /B2 /B3 /B3 /B3 /B3 /B4 /B4 /B4 /B4 /B5 /B5 /B5 /B5 /B5 /B5 /B6 /B6
100%力矩 80%力矩 100%重量 75%重量 35%重量 变幅外停 变幅外减 变幅内停 变幅内减 起升上停 起升上减 起升下停 起升下减 回转左停 回转左减 回转右停 回转右减 100%力矩 80%力矩 100%重量 50%重量 蜂鸣器
803747765
DT025BBB0Z02109
控制原理图(限位报警)
标记 处数 更改文件号 签字 日期
设计 郭鹏 标准化 倪厉里
校对 陈建宇
审核 周展光 批准 衣磊
工艺 许献飞 日期 2018-06-29
图样标记 重量 比例
S 1:1
版次 B.2 共 19 张 第 10 张
徐工塔机

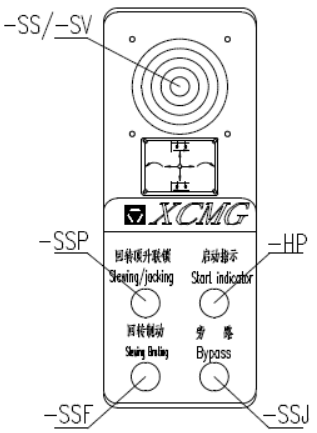

1
2
3
4
5
6
A
B
C
D
E
电源+
电源地
重量传感器
风速传感器
幅度传感器
高度传感器
回转传感器
-J
-XS88
-XP88
80
AGND
150
151
152
153
154
1
2
3
4
5
6
7
8
9
10
-L88
10/A6
80
80
AGND
150
151
152
153
154
X47
AGND
X40
X41
X44
X45
X46
PLC
803747765
DT025BBB0Z02110
控制原理图(模拟量限位)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 倪厉里
校对 郭鹏
审核 衣磊 批准 宋成宏
工艺 许航飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A1 共19张 第11张
XCMG 徐工塔机

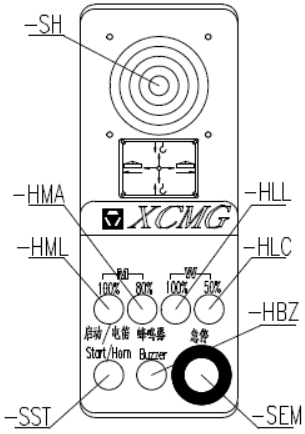

终端电阻
起升变频器
回转变频器
变幅变频器
-HINV
-SINV
-VINV
CANH
CANL
SHLD
-L90
1.5m网线
-L91
2.5m
-L92
2.5m
-R1
-TXC1
-TXC2
-TXC3
-L102
7m
CAN总线
-L95
1.5m
-L93
0.5m
-PLC1
-MP
-L94
6m
485+
485-
AGND
-PLC
驾驶室显示屏
PLC
PLC1
803747765
DT025BBB0Z02111
控制原理图(总线部分)
标记
处数
更改文件号
签字
日期
设计
韩鹏
标准化
倪厅里
校对
陈建宇
审核
周展光
批准
衣磊
工艺
许献飞
日期
2018-06-29
图样标记
重量
比例
S
1:1
版次
B.2
共19张
第12张
徐工塔机

QCG543F Console Layout









序号	代 号	名 称	数量
1	-SH,-SS,-SV	主令开关	3套
2	-SZL,-SZR	左/右台零位开关	2
3	-HP	起动指示灯	1
4	-SSF	风标制动按钮	1
5	-SSJ	旁路按钮	1
6	-HML	100%力矩指示灯	1
7	-HMA	80%力矩指示灯	1
8	-HLL	100%重量指示灯	1
9	-HLC	50%重量指示灯	1
10	-SST	起动/电笛按钮	1
11	-HBZ	蜂鸣器	1
12	-SEM	急停按钮	1
13	-HF	风标指示灯	1
14	-SSP	回转联升联锁开关	1

标记	处数	更改文件号	签 字	日 期
设 计		郭鹏	标准化	倪万里
校 对		陈建宇		
审 核		周辰光	批 准	衣磊
工 艺		许献飞	日 期	2018-06-29

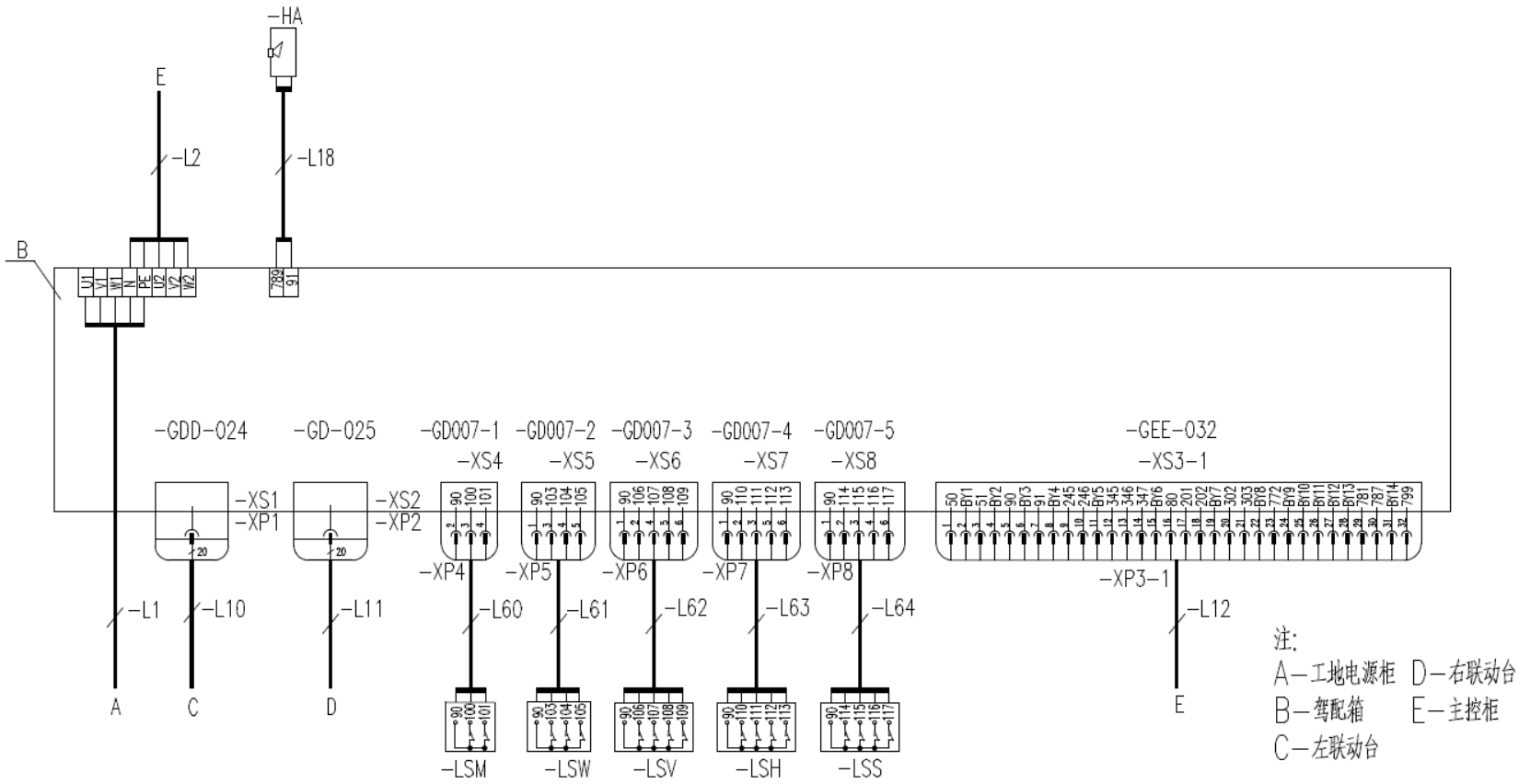
803747765

DT025BBB0Z02201

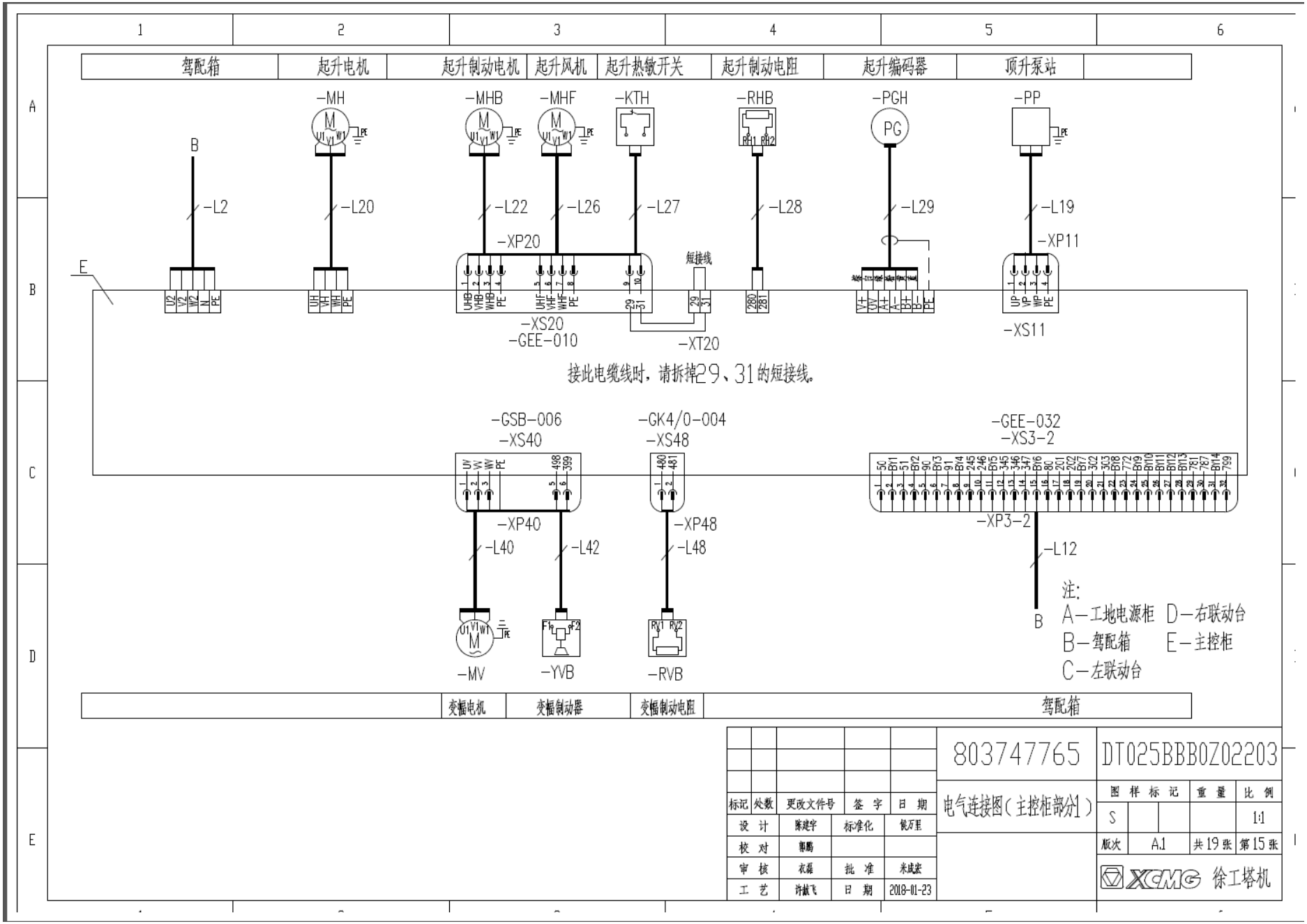
电气连接图(联动台部分)

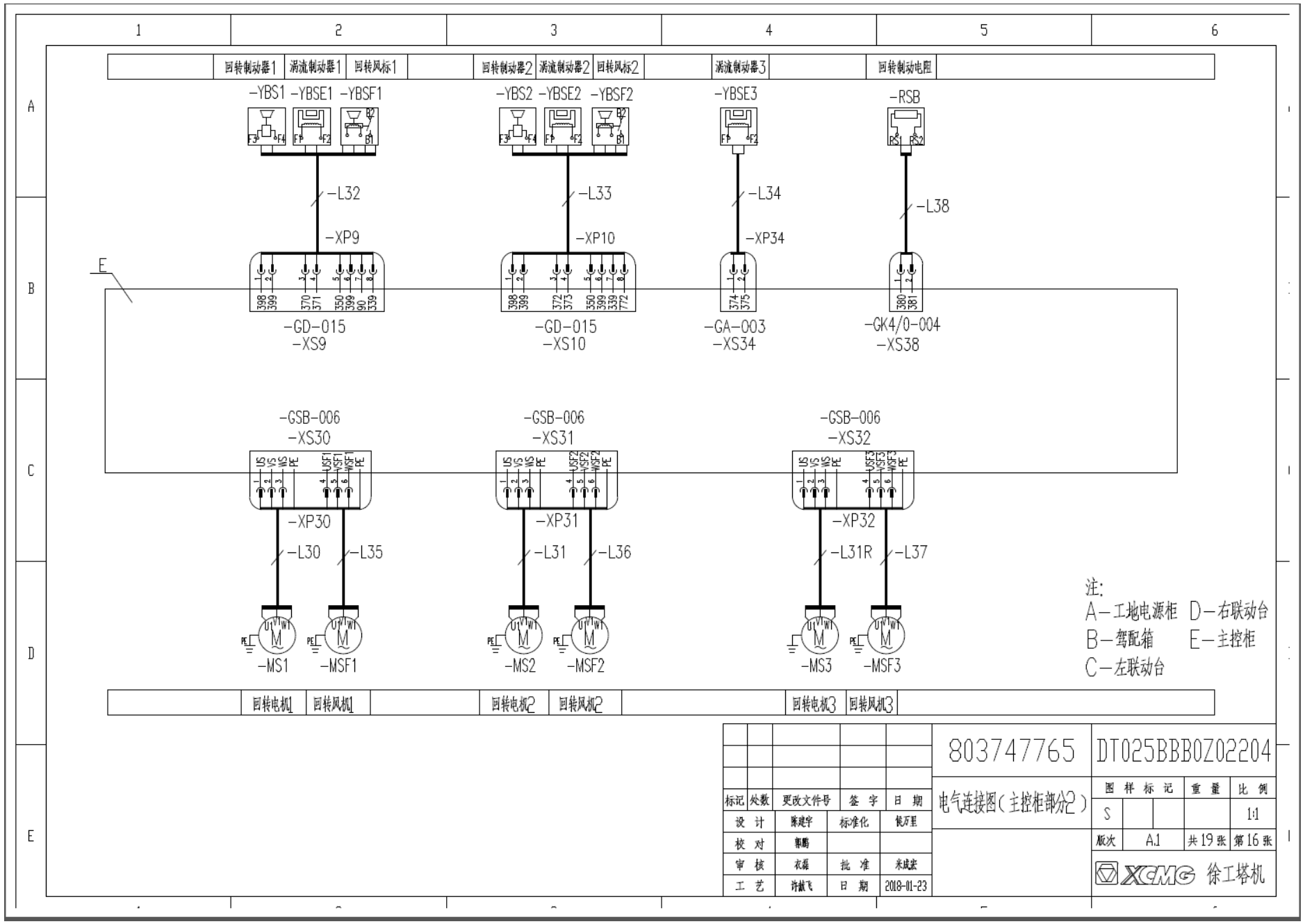
图样标记	重量	比例
S		1:1
版次 B.2	共 19 张	第 13 张

XCMG 徐工塔机



803747765				DT025BBB0Z02202	
电气连接图(驾配箱部分)				图样标记	重量	比例
				S		1:1
				版次 B.2	共 19 张	第 14 张
标记	处数	更改文件号	签字	日期	徐工塔机	
设计	郭鹏	标准化	倪万里			
校对	陈建宇					
审核	周辰光	批准	衣磊			
工艺	许献飞	日期	2018-06-29			


驾配箱
起升电机
起升制动电机
起升风机
起升热敏开关
起升制动电阻
起升编码器
顶升泵站
-MH
-MHB
-MHF
-KTH
-RHB
-PGH
-PP
-L2
-L20
-L22
-L26
-L27
-L28
-L29
-L19
-XP20
-XP11
短接线
-XS20
-GEE-010
-XT20
-XS11
接此电缆线时，请拆掉29、31的短接线。
-GSB-006
-XS40
-GK4/0-004
-XS48
-GEE-032
-XS3-2
-XP40
-XP48
-XP3-2
-L40
-L42
-L48
-L12
-MV
-YVB
-RVB
注:
A—工地电源柜 D—右联动台
B—驾配箱 E—主控柜
C—左联动台
变幅电机
变幅制动器
变幅制动电阻
驾配箱
803747765
DT025BBB0Z02203
电气连接图(主控柜部分1)
图样标记 S
重量
比例 1:1
版次 A.1
共19张 第15张
XCMG 徐工塔机
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 郭鹏
审核 衣磊 批准 米成宏
工艺 许献飞 日期 2018-01-23



标记	处数	更改文件号	签字	日期	
设计		陈建华	标准化	钱厉里	
校对		郭鹏			
审核		衣磊	批准	米成宏	
工艺		许献飞	日期	2018-01-23	

803747765

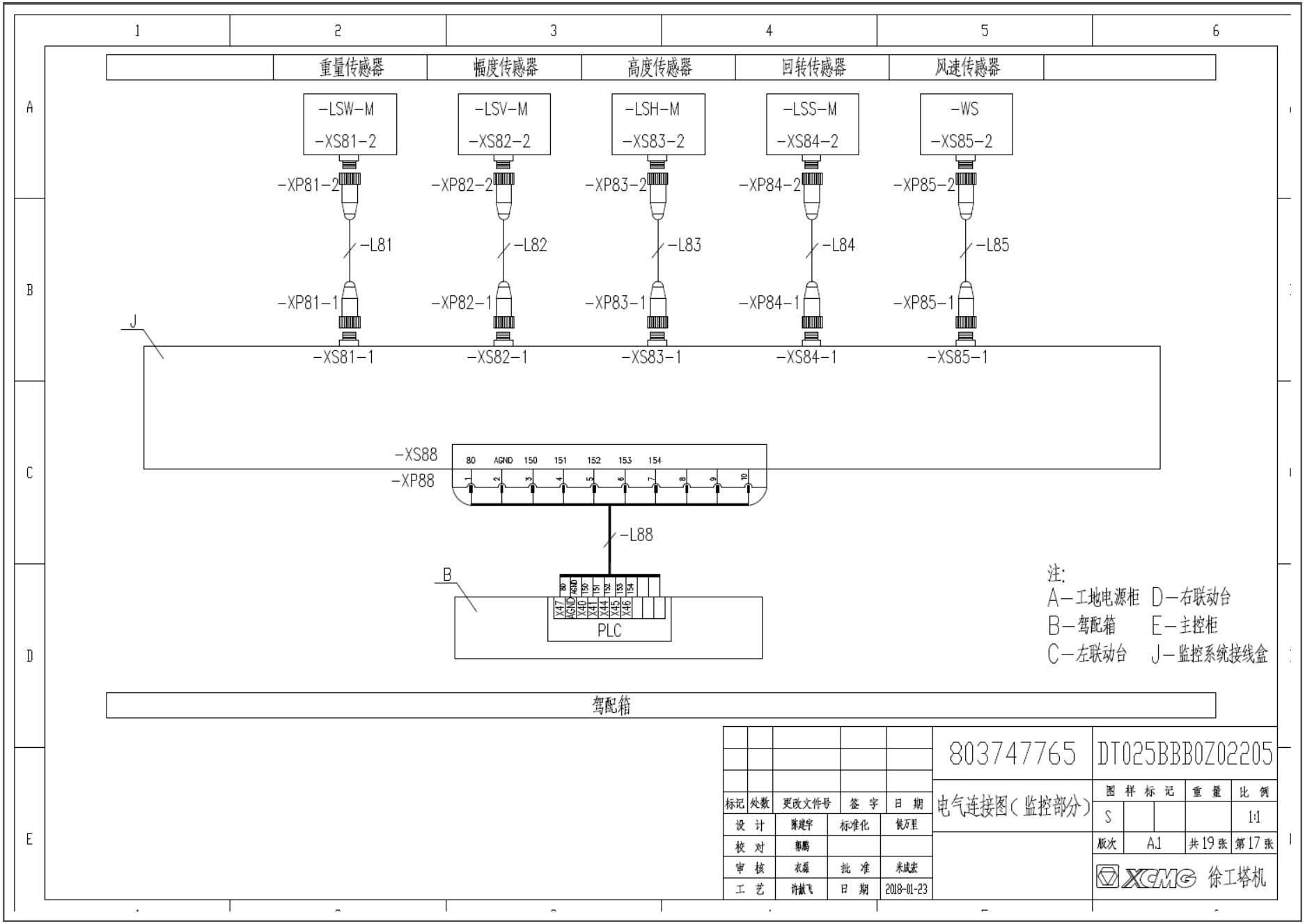
电气连接图(主控柜部分2)

DT025BBB0Z02204

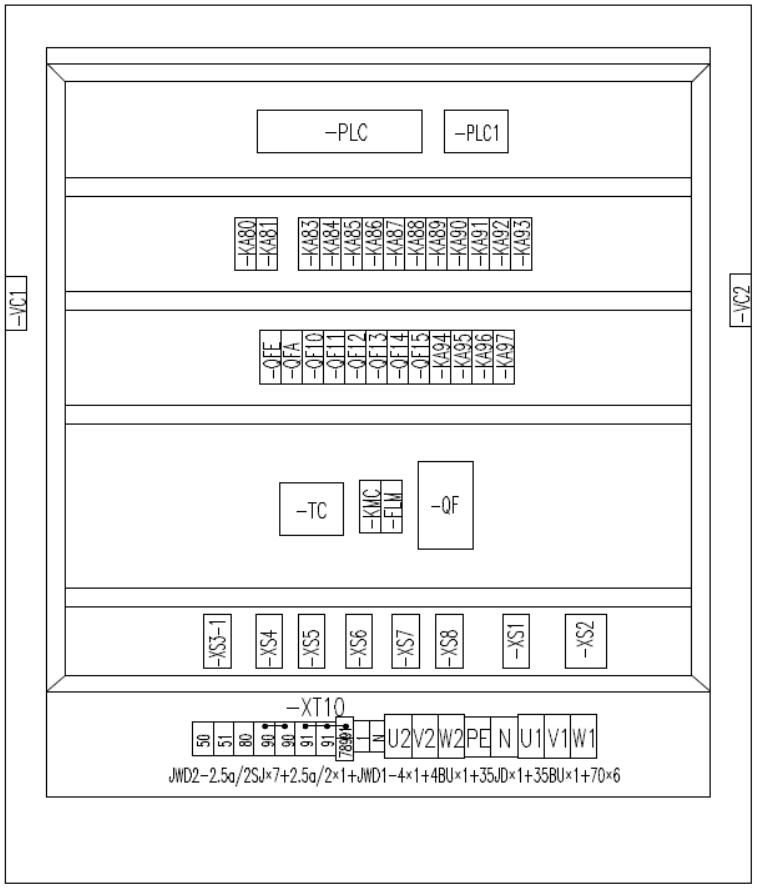
图样标记	重量	比例
S		1:1

版次	共19张	第16张
A.1		

徐工塔机



标记	处数	更改文件号	签字	日期	803747765	DT025BBB0Z02205	
设计		陈建宇	标准化	钱万里	电气连接图(监控部分)	图样标记	重量 比例
校对		韩鹏				S	1:1
审核		衣霞	批准	米成宏		版次 A1	共19张 第17张
工艺		许献飞	日期	2018-01-23		XCMG 徐工塔机	



标记	处数	更改文件号	签字	日期
设计		郭鹏	标准化	倪厉里
校对		陈建宇		
审核		周展光	批准	衣磊
工艺		许献飞	日期	2018-06-29

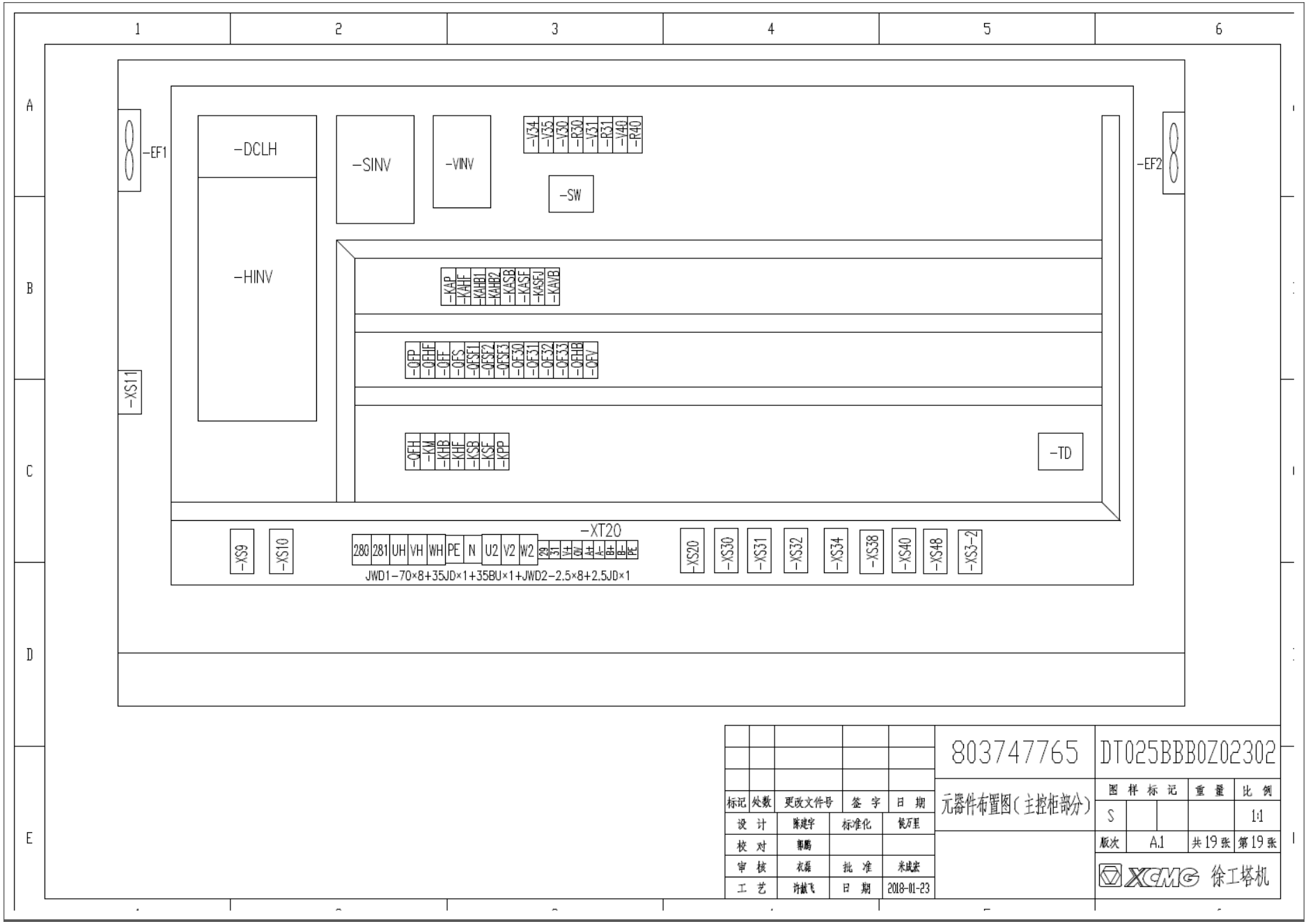
803747765

元器件布置图(驾配箱部分)

DT025BBB0Z02301

图样标记	重量	比例
S		1:1
版次 C.2	共 19 张	第 18 张

徐工塔机


1
2
3
4
5
6
A
B
C
D
E
-EF1
-DCLH
-HINV
-SINV
-VINV
-V34
-V35
-V30
-R30
-V31
-R31
-V40
-R40
-SW
-EF2
-XS11
-KAP
-KAHF
-KAHB1
-KAHB2
-KASB
-KASF
-KASFJ
-KAVB
-QEP
-QEHF
-QEF
-QFS
-QFSF1
-QFSF2
-QFSF3
-QF30
-QF31
-QF32
-QF33
-QEHB
-QEV
-QFH
-KM
-KHB
-KHF
-KSB
-KSF
-KPP
-TD
-XS9
-XS10
-XT20
280
281
UH
VH
WH
PE
N
U2
V2
W2
29
31
V4
0V
A+
B+
B-
PE
JWD1-70×8+35JD×1+35BU×1+JWD2-2.5×8+2.5JD×1
-XS20
-XS30
-XS31
-XS32
-XS34
-XS38
-XS40
-XS48
-XS3-2
803747765
DT025BBB0Z02302
元器件布置图(主控柜部分)
标记 处数 更改文件号 签字 日期
设计 陈建宇 标准化 钱万里
校对 韩鹏
审核 衣磊 批准 米成宏
工艺 许航飞 日期 2018-01-23
图样标记 重量 比例
S 1:1
版次 A1 共19张 第19张
XCMG 徐工塔机

名称	上升	下降	多段速1	多段速2	多段速3	起升制动	起升风机
输出点						Y25	Y27
上升一档	ON		ON			ON	ON
上升二档	ON			ON		ON	ON
上升三档	ON		ON	ON		ON	ON
上升四档	ON				ON	ON	ON
上升五档	ON		ON		ON	ON	ON
下降一档		ON	ON			ON	ON
下降二档		ON		ON		ON	ON
下降三档		ON	ON	ON		ON	ON
下降四档		ON			ON	ON	ON
下降五档		ON	ON		ON	ON	ON

标记	处数	更改文件号	签字	日期
设计		陈建宇	标准化	钱万里
校对		郭鹏		
审核		衣磊	批准	米成宏
工艺		许振飞	日期	2018-01-23

803747765

动作控制逻辑图(起升部分)

DT025BBB0Z02401

图样标记	重量	比例
S		1:1
版次 A.1	共 3 张	第 1 张

徐工塔机

名称	左回转	右回转	多段速1	多段速2	多段速3	回转制动	回转风机
输出点						Y15	Y17
左回转一档	ON		ON			ON	ON
左回转二档	ON			ON		ON	ON
左回转三档	ON		ON	ON		ON	ON
左回转四档	ON				ON	ON	ON
右回转一档		ON	ON			ON	ON
右回转二档		ON		ON		ON	ON
右回转三档		ON	ON	ON		ON	ON
右回转四档		ON			ON	ON	ON

标记	处数	更改文件号	签字	日期
设计		陈建宇	标准化	钱万里
校对		郭鹏		
审核		衣磊	批准	米成宏
工艺		许献飞	日期	2018-01-23

803747765			DT025BBB0Z02402
动作控制逻辑图(回转部分)	图样标记	重量	比例
	S		1:1
	版次 A1	共 3 张	第 2 张
	XCMG 徐工塔机		

名称	向外变幅	向内变幅	多段速1	多段速2	变幅制动
输出点					KAVB
向外一档	ON		ON		ON
向外二档	ON			ON	ON
向外三档	ON		ON	ON	ON
向内一档		ON	ON		ON
向内二档		ON		ON	ON
向内三档		ON	ON	ON	ON

标记	处数	更改文件号	签字	日期
设计		陈建宇	标准化	钱万里
校对		郭鹏		
审核		衣磊	批准	米成宏
工艺		许献飞	日期	2018-01-23

803747765

DT025BBB0Z02403

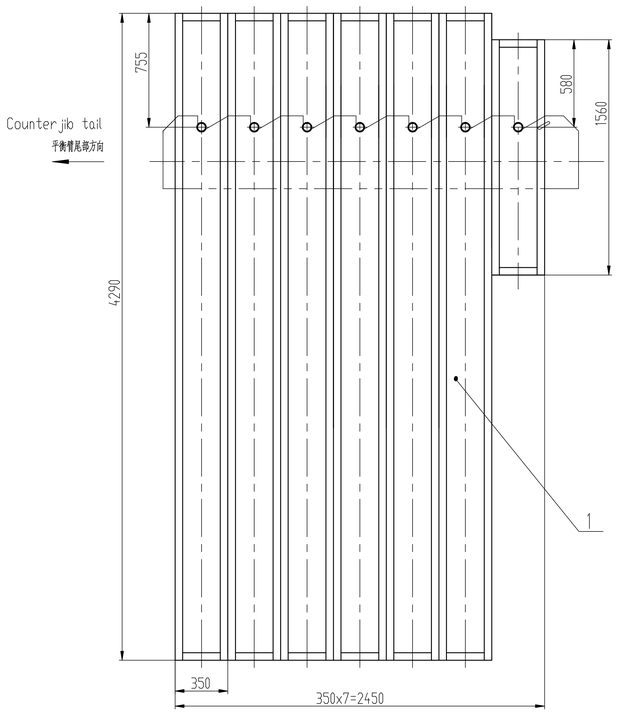
动作控制逻辑图（变幅部分）

图样标记	重量	比例
S		1:1
版次 A.1	共 3 张	第 3 张

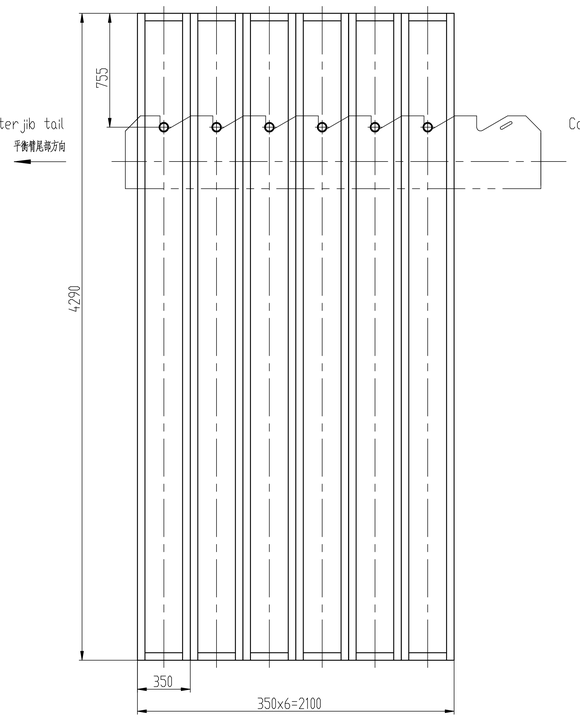
徐工塔机

XGTT580.31

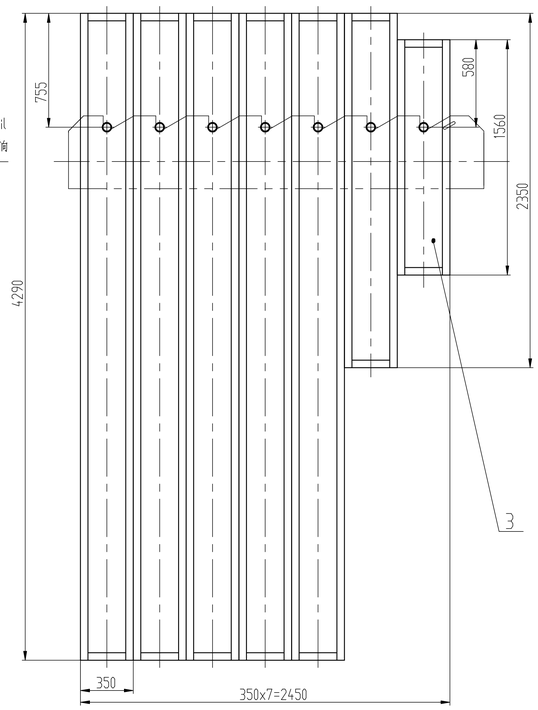
Counterweight for 80m、75m jib



Counterweight for 70m jib



Counterweight for 65m、45m jib

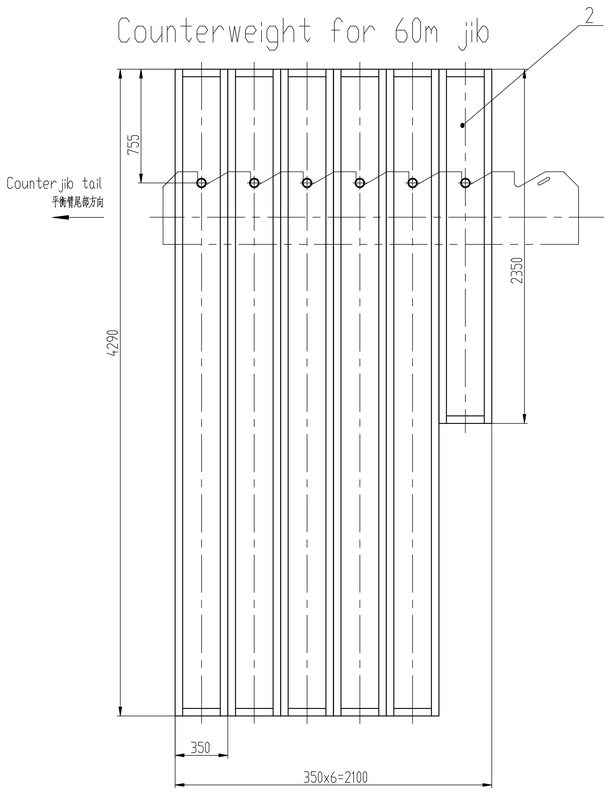


XGTT580 tower crane have
3 different counterweights:
counterweights 5500
counterweights 3000
counterweights 2000

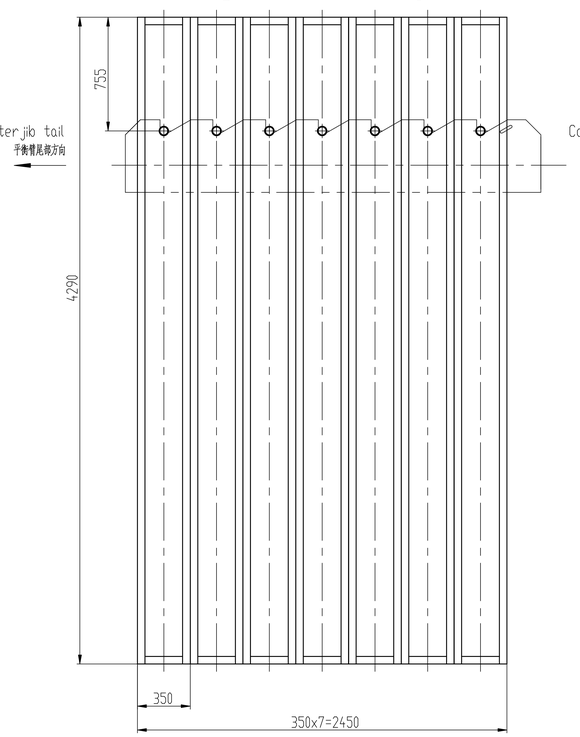
Different counterweights configured for different arm length:

Arm length(m)	CounterweightA (block)	CounterweightB (block)	CounterweightC (block)	Total weight (kg)
80	6	0	1	35000
75	6	0	1	35000
70	6	0	0	33000
65	5	1	1	32500
60	5	1	0	30500
55	7	0	0	38500
50	6	1	0	36000
45	5	1	1	32500

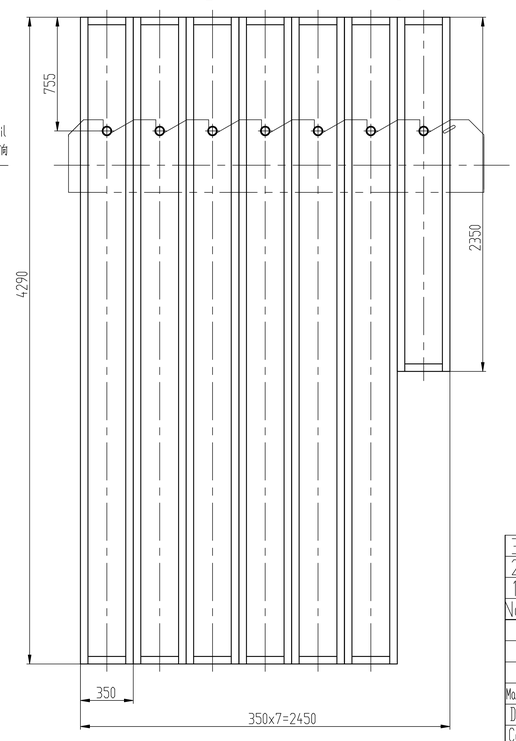
Counterweight for 60m jib



Counterweight for 55m jib



Counterweight for 50m jib



Technical specification

1. The balance weight must be placed exactly in accordance with the drawing's position and order.
2. When the weight less than 7, please note the vacancy.

No.	number	Code	Name	Material	Qty	Weight	Remark
3		XGT560.07.13.3	CounterweightC	Concrete	1	2000	
2		XGTT580.31.2	CounterweightB	Concrete	1	3000	
1		XGTT580.31.1	CounterweightA	Concrete	7	5500	

Mark	Point	Document Amend	Signature	Y M D
Design		Standard		
Collate				
Check		Confirm		
Construction		Date		2016.03

XGTT580.31

Counterweight

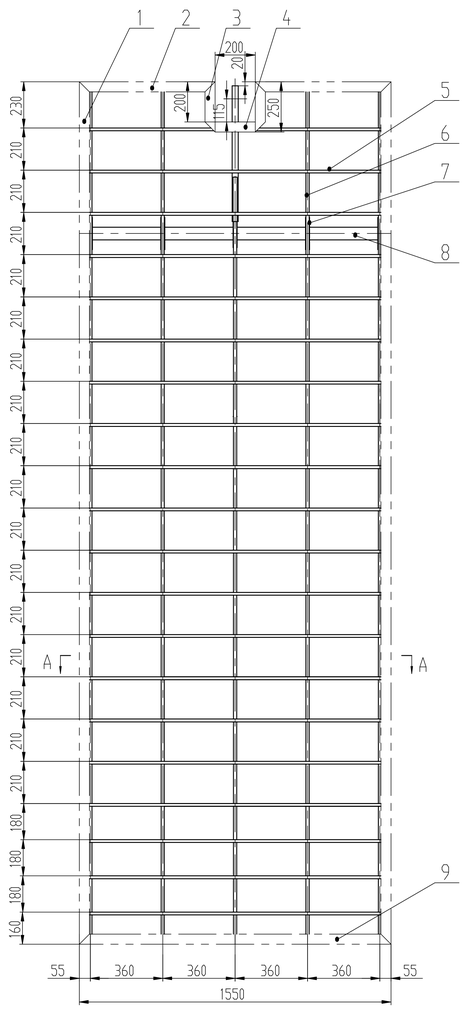
Component

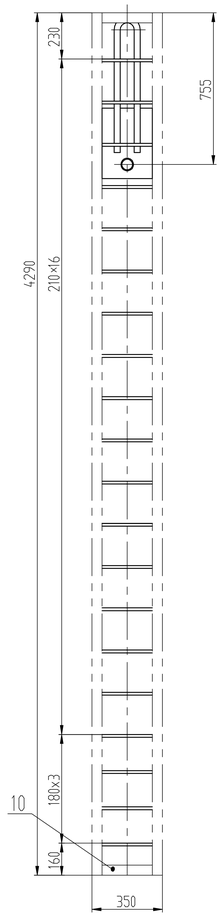
Pattern Mark	Weight	Ratio
	43500	1:20
Edition	Total	page of

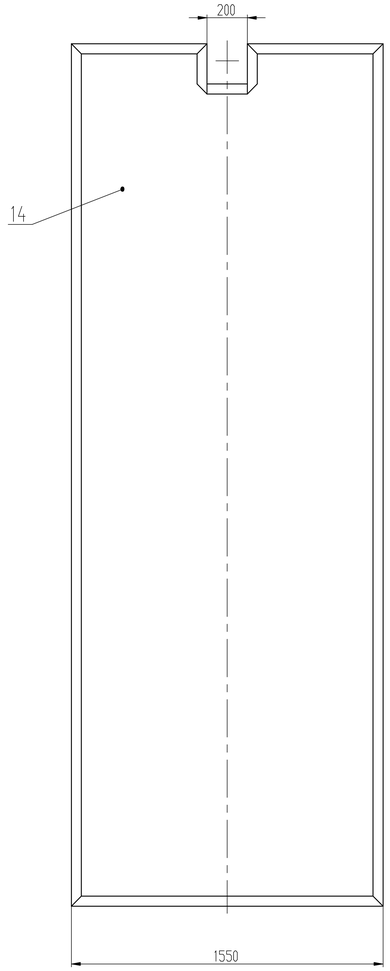
XUZHOU CONSTRUCTION MACHINERY CO, LTD

借用件登记
存储代号
旧底图总号
底图总号
签 字
日 期

XGTT580.31.1







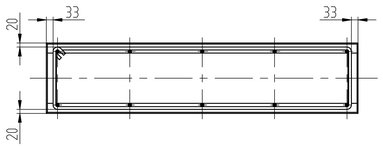
Lug component

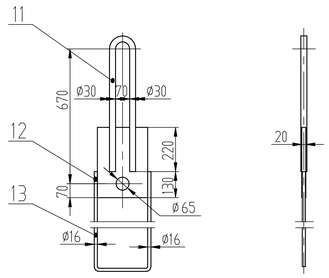
No.	Standard	Shape	No.	Standard	Shape
1	Angle steelL50×50×5-4290	45° 45° 4290	8	Steel tubeØ63×5-1550	
2	Angle steelL50×50×5-675	45° 45° 675	9	Angle steelL50×50×5-1550	45° 45° 1550
3	Angle steelL50×50×5-250	135° 45° 250	10	Angle steelL50×50×5-250	250
4	Angle steelL50×50×5-200	200	11	Lifting lug	See the detail
5	Steel barØ14×3625	See the detail	12	Lug connection plate	See the detail
6	Steel barØ16×9005	See the detail	13	Round steelØ16-7326	See the detail
7	Board	120 Ø65 160 250			

Technical requirement

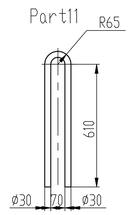
1. The weight error does cannot exceed 1%, the concrete strength rating is no less than C35, and the density is 2.4t/m3.
2. Fix the steel mesh onto the outer frame first during pouring concrete.
3. The concrete, after poured, needs to be stayed naturally at least three weeks, so that the moisture content is below 8% and PH value below 9.5 (PH paper comparison test widely). Before painting, its surface has to be cleaned by 5% zinc sulfate liquor. One day after, clean it with tap water. After it is dry, do the painting.
4. Before painting, remove the rust on the outside surface of steel material; use clean cloth to rub off the foreign things on its surface, and clean the oil dirty by organic solvent. Till and level it up by cement and repair the damaged part. And then level it up by combining putty. And then rub it down.
5. All the steel materials revealed outside needs to be painted with red iron bi-component polyurethane primer. After it is dry, paint the steel material and concrete surface with white bi-component acrylic polyurethane finishes.

A-A

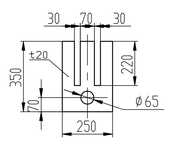




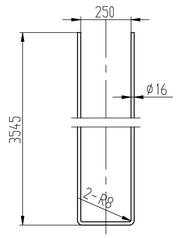
Part11



Part12



Part13

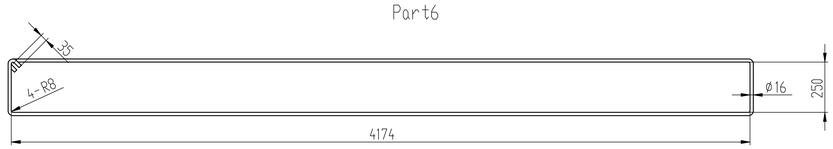


Length:7326

Part5

Length:3625

Part6



Length:9005

No.	number	Code	Name	Material	Qty	Weight	Remark
14		XGTT580.31.1-101	Concrete	C35	1	5192	No drawing
13		XGTT580.31.1-3	Round steelØ16-7326	Q235B	1	11.55	
12		XGT560.07.13.1-12	Lug connection plate	Q235B	1	11.1	
11		XGT560.07.13.1-11	Lifting lug	Q235B	1	7.64	
10		XGT560.07.13.1-10	Angle steelL50×50×5-250	Q235B	8	0.94	No drawing
9		XGT560.07.13.1-9	Angle steelL50×50×5-1550	Q235B	2	5.84	
8		XGT560.07.13.1-8	Steel tubeØ63×5-1550	20	1	11.1	
7		XGT560.07.13.1-7	Board	Q235B	4	5.76	
6		XGTT580.31.1-2	Steel barØ16-9005	HRB335	4	14.17	
5		XGT560.07.13.1-5	Steel barØ14-3625	HRB335	20	4.38	
4		XGT560.07.13.1-4	Angle steelL50×50×5-200	Q235B	2	0.75	No drawing
3		XGT560.07.13.1-3	Angle steelL50×50×5-250	Q235B	4	0.94	
2		XGT560.07.13.1-2	Angle steelL50×50×5-675	Q235B	4	2.54	
1		XGTT580.31.1-1	Angle steelL50×50×5-4290	Q235B	4	16.1	

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	2016.03

Counterweight A

Concrete

XGTT580.31.1

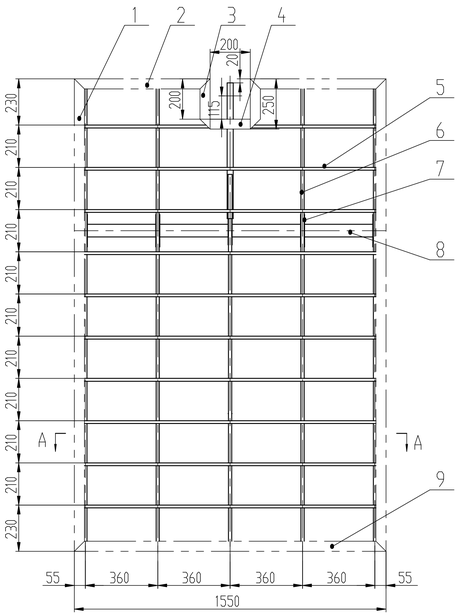
Pattern Mark	Weight	Ratio
	5500	

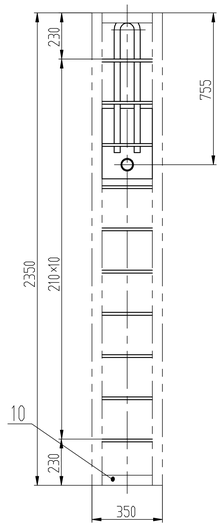
Edition | Total | page of

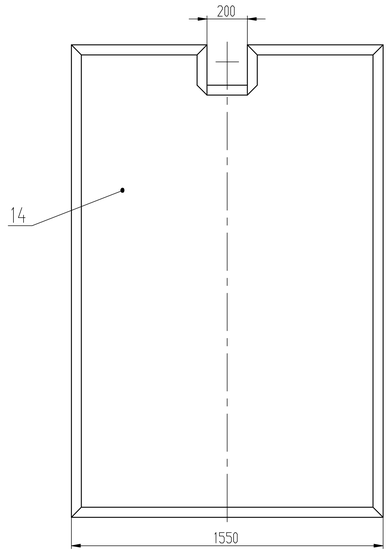
XCMG XUZHOU CONSTRUCTION MACHINERY CO, LTD

信息件登记
存储代号
旧底图总号
底图总号
签 字
日 期

XGTT580.31.2





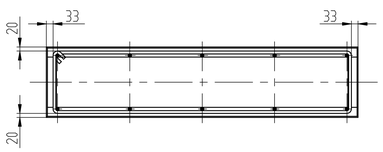


No.	Standard	Shape	No.	Standard	Shape
1	Angle steelL50×50×5-2350	45° 2350	8	Steel tube⌀63×5-1550	
2	Angle steelL50×50×5-675	45° 675	9	Angle steelL50×50×5-1550	45° 1550
3	Angle steelL50×50×5-250	135° 45° 250	10	Angle steelL50×50×5-250	250
4	Angle steelL50×50×5-200	200	11	Lifting lug	See the detail
5	Steel bar⌀14×3625	See the detail	12	Lug connection plate	See the detail
6	Steel bar⌀16×5125	See the detail	13	Round steel⌀16-3446	See the detail
7	Board	⌀65 t20 160 250			

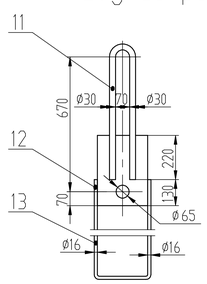
Technical requirement

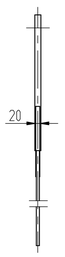
1. The weight error does cannot exceed 1%, the concrete strength rating is no less than C35, and the density is 2.4t/m3.
2. Fix the steel mesh onto the outer frame first during pouring concrete.
3. The concrete, after poured, needs to be stayed naturally at least three weeks, so that the moisture content is below 8% and PH value below 9.5 (PH paper comparison test widely). Before painting, its surface has to be cleaned by 5% zinc sulfate liquor. One day after, clean it with tap water. After it is dry, do the painting.
4. Before painting, remove the rust on the outside surface of steel material; use clean cloth to rub off the foreign things on its surface, and clean the oil dirty by organic solvent. Till and level it up by cement and repair the damaged part. And then level it up by combining putty. And then rub it down.
5. All the steel materials revealed outside needs to be painted with red iron bi-component polyurethane primer. After it is dry, paint the steel material and concrete surface with white bi-component acrylic polyurethane finishes.

A-A

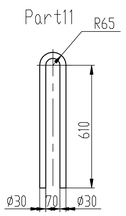


Lug component

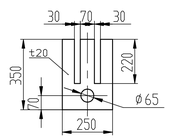




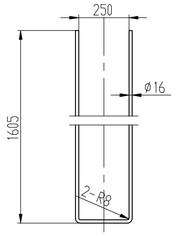
Part11



Part12



Part13

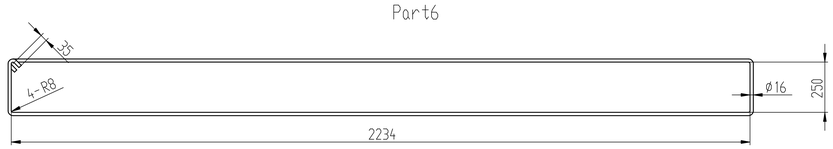


Length:3446

Part5

Length:3625

Part6



Length:5125

No.		Code	Name	Material	Qty	Weight	Remark
14		XGTT580.31.2-101	Concrete	C35	1	2792	No drawing
13		XGTT580.31.2-3	Round steel⌀16-3446	Q235B	1	5.43	
12		XGT560.07.13.1-12	Lug connection plate	Q235B	1	11.1	
11		XGT560.07.13.1-11	Lifting lug	Q235B	1	7.64	
10		XGT560.07.13.1-10	Angle steelL50×50×5-250	Q235B	8	0.94	No drawing
9		XGT560.07.13.1-9	Angle steelL50×50×5-1550	Q235B	2	5.84	
8		XGT560.07.13.1-8	Steel tube⌀63×5-1550	20	1	11.1	
7		XGT560.07.13.1-7	Board	Q235B	4	5.76	
6		XGT580.31.2-2	Steel bar⌀16-5125	HRB335	4	8.06	
5		XGT560.07.13.1-5	Steel bar⌀14-3625	HRB335	10	4.38	
4		XGT560.07.13.1-4	Angle steelL50×50×5-200	Q235B	2	0.75	No drawing
3		XGT560.07.13.1-3	Angle steelL50×50×5-250	Q235B	4	0.94	
2		XGT560.07.13.1-2	Angle steelL50×50×5-675	Q235B	4	2.54	
1		XGT580.31.2-1	Angle steelL50×50×5-2350	Q235B	4	8.86	

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date	2016.03		

Counterweight B

Concrete

XGTT580.31.2

Pattern Mark	Weight	Ratio
	3000	

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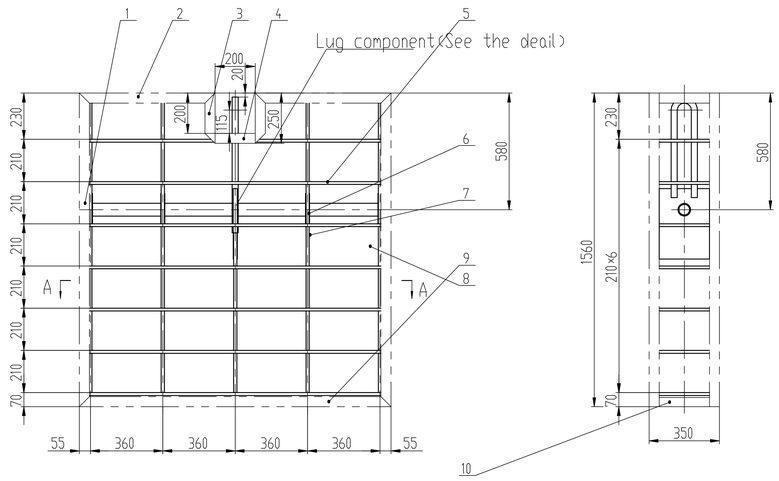
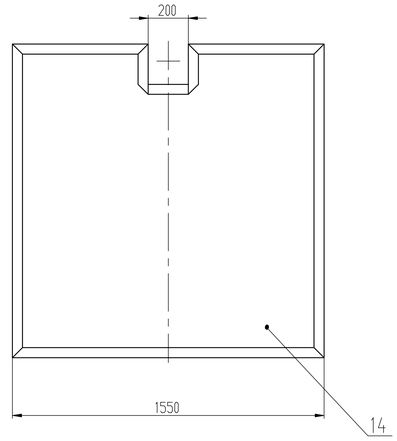
XUZHOU CONSTRUCTION MACHINERY CO, LTD

借用件登记
存储代号
旧底图总号
底图总号
签 字
日 期

XGT560.07.13.3



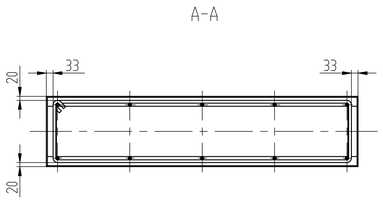


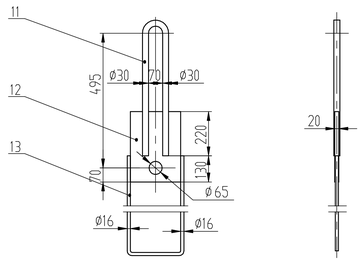
No.	Standard	Shape	No.	Standard	Shape
1	Angle steelL50×50×5-1560	45° 45° 1560	8	Steel tubeØ63×5-1550	
2	Angle steelL50×50×5-675	45° 45° 675	9	Angle steelL50×50×5-1550	45° 45° 1550
3	Angle steelL50×50×5-250	135° 45° 250	10	Angle steelL50×50×5-250	250
4	Angle steelL50×50×5-200	200	11	Lifting lug	See the detail
5	Steel barØ14×3625	See the detail	12	Lug connection plate	See the detail
6	Steel barØ16×3545	See the detail	13	Round steelØ16-2216	See the detail
7	Board	t20 ø65 150 250			

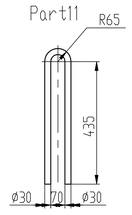
Technical requirement

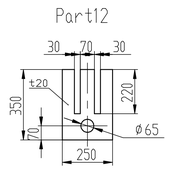
1. The weight error does cannot exceed 1%, the concrete strength rating is no less than C35, and the density is 2.4t/m3.
2. Fix the steel mesh onto the outer frame first during pouring concrete.
3. The concrete, after poured, needs to be stayed naturally at least three weeks, so that the moisture content is below 8% and PH value below 9.5 (PH paper comparison test widely). Before painting, its surface has to be cleaned by 5% zinc sulfate liquor. One day after, clean it with tap water. After it is dry, do the painting.
4. Before painting, remove the rust on the outside surface of steel material; use clean cloth to rub off the foreign things on its surface, and clean the oil dirty by organic solvent. Till and level it up by cement and repair the damaged part. And then level it up by combining putty. And then rub it down.
5. All the steel materials revealed outside needs to be painted with red iron bi-component polyurethane primer. After it is dry, paint the steel material and concrete surface with white bi-component acrylic polyurethane finishes.

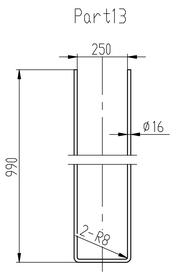
Lug component



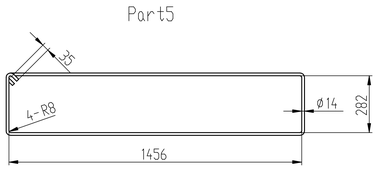




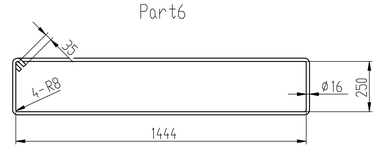




Length:2216



Length:3625



Length:3545

No.	Code	Name	Qty	Material	Per Weight	Total Weight	Remark
14	XGT560.07.13.3-14	Concrete	1	C35	1833	1833	No drawing
13	XGT560.07.13.3-13	Round steelØ16-1866	1	Q235B	3.5	3.5	
12	XGT560.07.13.3-12	Lug connection plate	1	Q235B	11.1	11.1	
11	XGT560.07.13.3-11	Lifting lug	1	Q235B	5.5	5.5	
10	XGT560.07.13.3-10	Angle steelL50×50×5-250	8	Q235B	0.94	7.52	No drawing
9	XGT560.07.13.3-9	Angle steelL50×50×5-1550	2	Q235B	5.84	11.68	
8	XGT560.07.13.3-8	Steel tubeØ63×5-1550	1	20	11.1	11.1	No drawing
7	XGT560.07.13.3-7	Board	4	Q235B	5.76	23.04	
6	XGT560.07.13.3-6	Steel barØ16-3545	4	HRB335	5.59	22.36	
5	XGT560.07.13.3-5	Steel barØ14-3625	7	HRB335	4.38	30.66	
4	XGT560.07.13.3-4	Angle steelL50×50×5-200	2	Q235B	0.75	1.5	No drawing
3	XGT560.07.13.3-3	Angle steelL50×50×5-250	4	Q235B	0.94	3.76	
2	XGT560.07.13.3-2	Angle steelL50×50×5-675	4	Q235B	2.54	10.16	
1	XGT560.07.13.3-1	Angle steelL50×50×5-1560	4	Q235B	5.88	23.52	

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	2016.03

XGT560.07.13.3

Counterweight C

Concrete

Pattern Mark | Weight | Ratio

2000

Edition | Total | page of

XCMG XUZHOU CONSTRUCTION MACHINERY CO, LTD

借(通)用件登记

描 图

描 校

旧底图总号

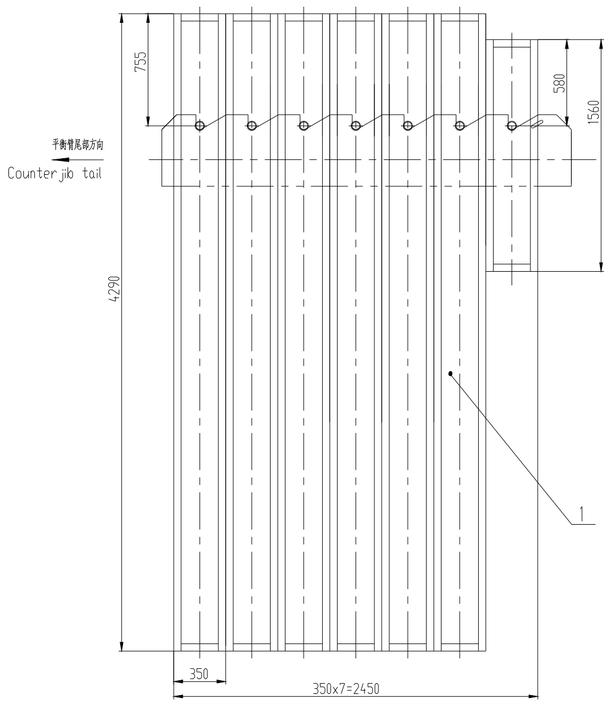
底图总号

签 字

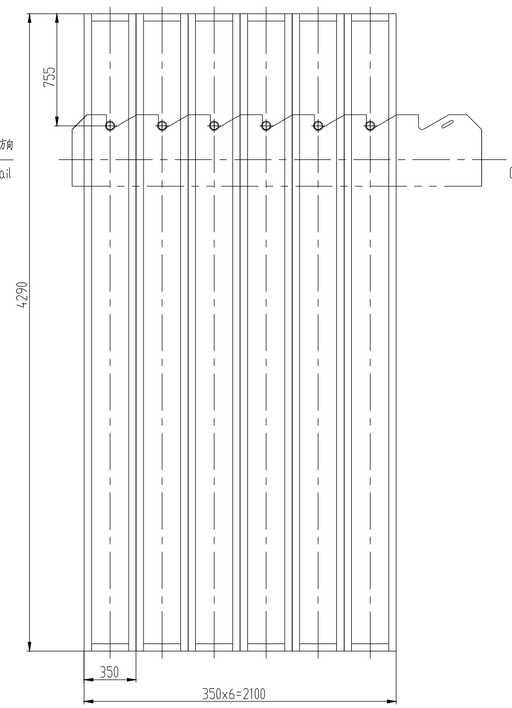
日 期

XGTT580.31

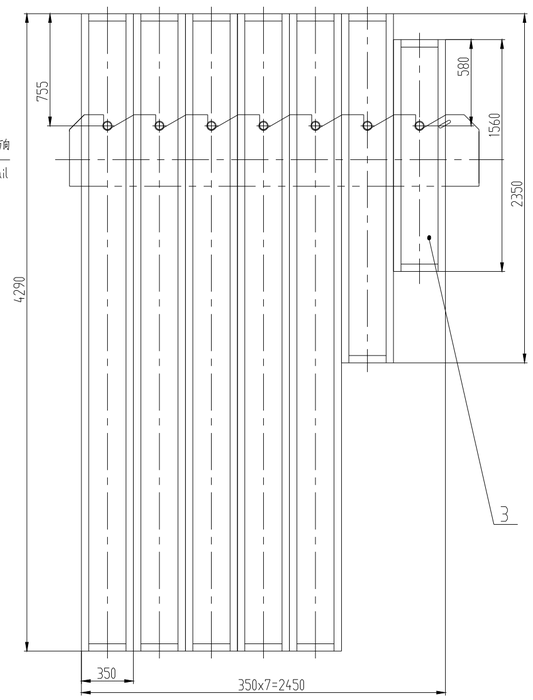
80m/75m臂长时平衡重配置(jib=80/75m)



70m臂长时平衡重配置(jib=70m)



65m/45m臂长时平衡重配置(jib=65/45m)

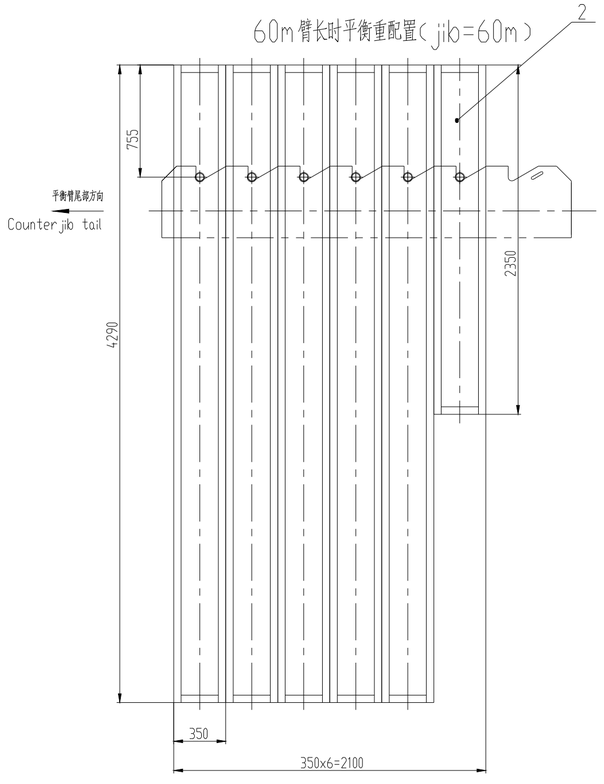


XGTT580塔机平衡重有三种：平衡重A(5500kg)
平衡重B(3000kg)
平衡重C(2000kg)

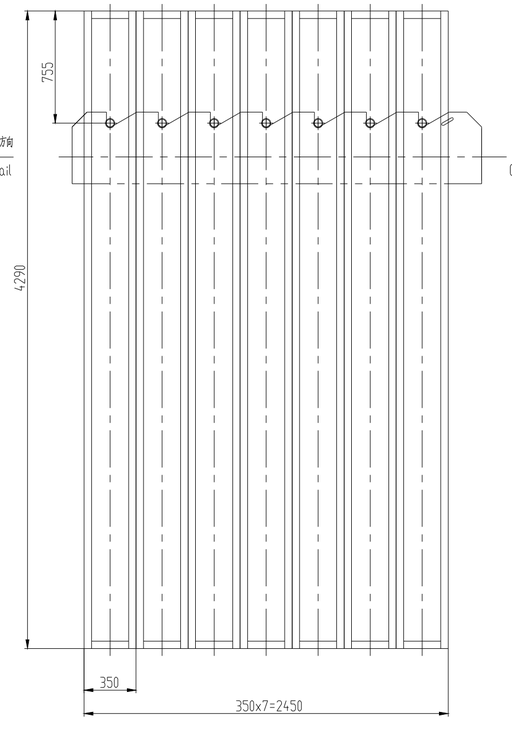
各种臂长平衡重配置见下表

臂长(m)	平衡重A(块)	平衡重B(块)	平衡重C(块)	总重(kg)
80	6	0	1	35000
75	6	0	1	35000
70	6	0	0	33000
65	5	1	1	32500
60	5	1	0	30500
55	7	0	0	38500
50	6	1	0	36000
45	5	1	1	32500

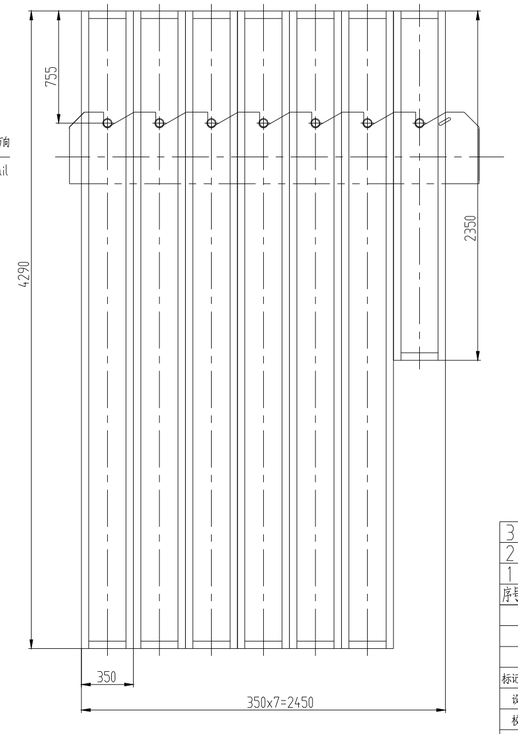
60m臂长时平衡重配置(jib=60m)



55m臂长时平衡重配置(jib=55m)



50m臂长时平衡重配置(jib=50m)



技术要求

1、在安装塔机或变臂时必须根据臂长严格按照图示位置和顺序放置平衡重。
2、当配重不足7块时，请注意空缺位置。

Technical specification

1、The balance weight must be placed exactly in accordance with the drawing's position and order.
2、When the weight less than 7, please note the vacancy.

序号	分类编号	代号	名称及规格	材料	数量	单重	备注
3		XGT560.07.13.3	平衡重C	砼	1	2000	借用
2		XGTT580.31.2	平衡重B	砼	1	3000	
1		XGTT580.31.1	平衡重A	砼	7	5500	

标记	处数	更改文件号	签字	日期
设计			标准化	
校对				
审核			批准	
工艺			日期	

平衡重

组件

XGTT580.31

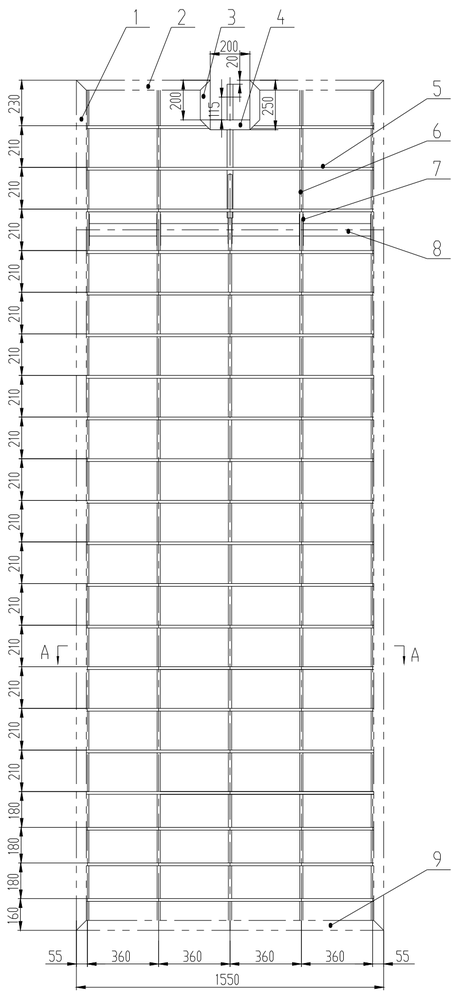
图样标记	重量	比例
	43500	1:20

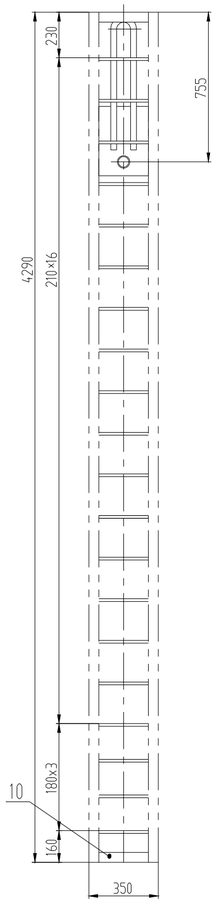
版次　　共　张　第　张

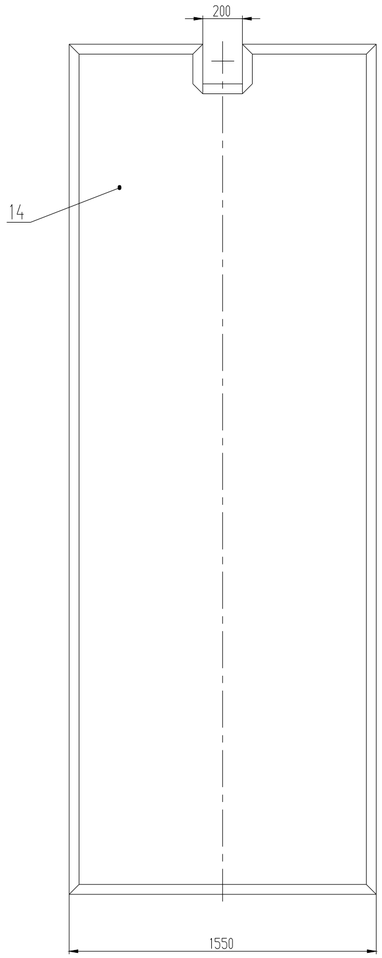
XCMG 徐工塔机

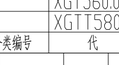
借用件登记
存储代号
旧底图总号
底图总号
签字
日期

XGTT580.31.1







序号	规　格	形 状	序号	规　格	形 状
1	角钢_50×50×5-4290		8	钢管Ø63×5-1550	
2	角钢_50×50×5-675		9	角钢_50×50×5-1550	
3	角钢_50×50×5-250		10	角钢_50×50×5-250	
4	角钢_50×50×5-200		11	吊耳	见详图
5	钢筋Ø14×3625	见详图	12	吊耳连接板	见详图
6	钢筋Ø16×9005	见详图	13	圆钢Ø16-7326	见详图
7	加强板				

技术要求：

1、钢筋采用II级螺纹钢；

2、焊接时，先焊接吊耳组件，然后把吊耳组件和件8焊接；

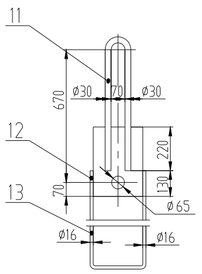
最后在和件6、件7焊接；

3、螺纹钢、圆钢与角钢框架焊接，保护层25mm；

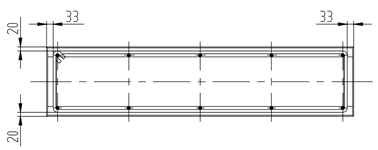
4、重量误差不得超过7%；

5、砼强度等级为C35，密度2.38t/m³；

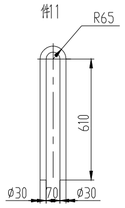
吊耳组件



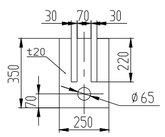
A-A



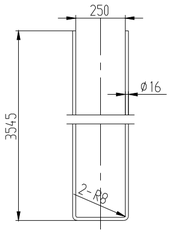
件1



件2



件3

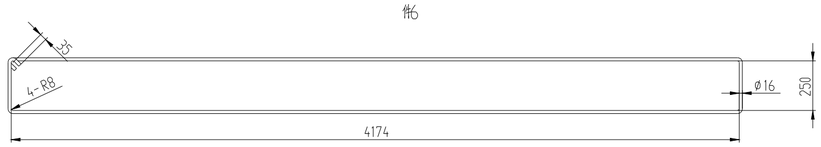


展开长度：7326

件5

展开长度：3625

件6



展开长度：9005

序号	图号	名称	材料	数量	单重	备注
14	XGTT580.31.1-101	混凝土	C35	1	5192	无图
13	XGTT580.31.1-3	圆钢Ø16-7326	Q235B	1	11.55	见本图
12	XGT560.07.13.1-12	吊耳连接板	Q235B	1	11.1	借用(见本图)
11	XGT560.07.13.1-11	吊耳	Q235B	1	7.64	借用(见本图)
10	XGT560.07.13.1-10	角钢_50×50×5-250	Q235B	8	0.94	无图借用
9	XGT560.07.13.1-9	角钢_50×50×5-1550	Q235B	2	5.84	借用(见本图)
8	XGT560.07.13.1-8	钢管Ø63×5-1550	20	1	11.1	借用(见本图)
7	XGT560.07.13.1-7	加强板	Q235B	4	5.76	借用(见本图)
6	XGTT580.31.1-2	钢筋Ø16-9005	HRB335	4	14.17	见本图
5	XGT560.07.13.1-5	钢筋Ø14-3625	HRB335	20	4.38	借用(见本图)
4	XGT560.07.13.1-4	角钢_50×50×5-200	Q235B	2	0.75	无图借用
3	XGT560.07.13.1-3	角钢_50×50×5-250	Q235B	4	0.94	借用(见本图)
2	XGT560.07.13.1-2	角钢_50×50×5-675	Q235B	4	2.54	借用(见本图)
1	XGTT580.31.1-1	角钢_50×50×5-4290	Q235B	4	16.1	见本图

分类编号	代　号

标记	处数	更改文件号	签　字	日　期
设　计			标准化	
校　对				
审　核			批　准	
工　艺			日　期	

XGTT580.31.1

平衡重A

砼

图样标记	重　量	比　例
	5500	1:15
版次	共　张	第　张

XCMG 徐工塔机

借用件登记

存储代号

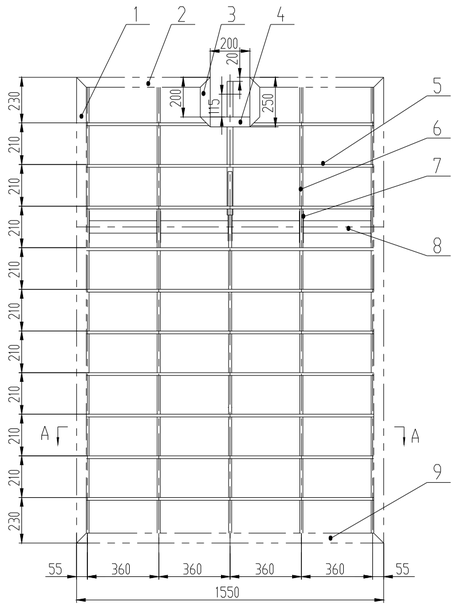
旧底图总号

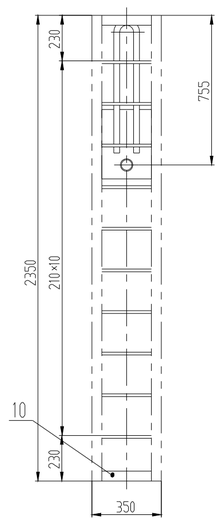
底图总号

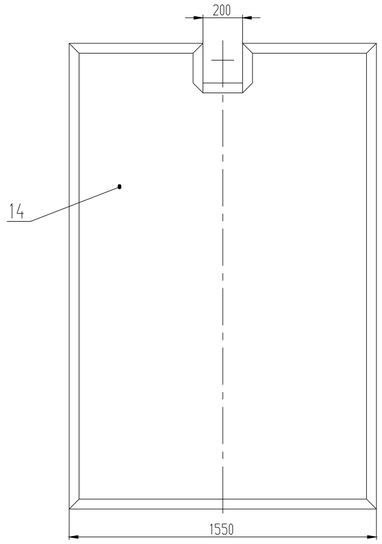
签　字

日　期

XGTT580.31.2







序号	规　格	形 状	序号	规　格	形 状
1	角钢_50×50×5-2350	45° 45° 3790	8	钢管Ø63×5-1550	
2	角钢_50×50×5-675	45° 45° 675	9	角钢_50×50×5-1550	45° 45° 1550
3	角钢_50×50×5-250	135° 45° 250	10	角钢_50×50×5-250	250
4	角钢_50×50×5-200	200	11	吊耳	见详图
5	钢筋Ø14×3625	见详图	12	吊耳连接板	见详图
6	钢筋Ø16×5125	见详图	13	圆钢Ø16-3446	见详图
7	加强板	120 Ø65 150 250			

技术要求：

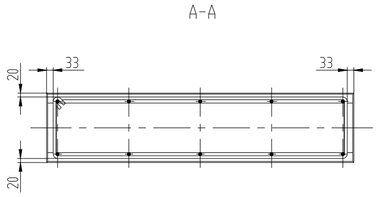
1、钢筋采用II级螺纹钢；

2、焊接时，先焊接吊耳组件，然后把吊耳组件和件8焊接；
　最后在和件6、件7焊接；

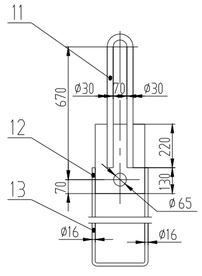
3、螺纹钢、圆钢与角钢框架焊接，保护层25mm；

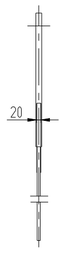
4、重量误差不得超过1%；

5、砼强度等级为C35，密度2.38t/m³；

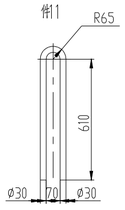


吊耳组件

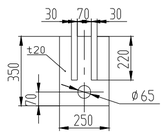




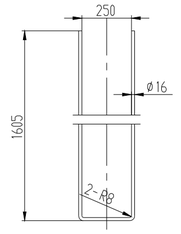
件1



件2

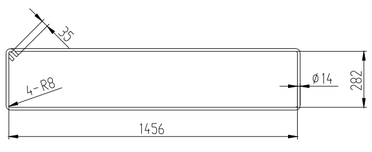


件3



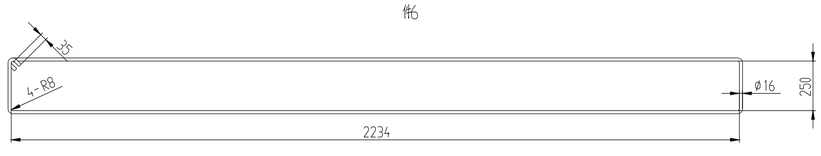
展开长度：3446

件5



展开长度：3625

件6



展开长度：5125

序号	分类编号	代　号	名称及规格	材　料	数量	单　重	备　注
14		XGTT580.31.2-101	混凝土	C35	1	2796	无图
13		XGTT580.31.2-3	圆钢Ø16-3446	Q235B	1	5.43	见本图
12		XGT560.07.13.1-12	吊耳连接板	Q235B	1	11.1	借用(见本图)
11		XGT560.07.13.1-11	吊耳	Q235B	1	7.64	借用(见本图)
10		XGT560.07.13.1-10	角钢_50×50×5-250	Q235B	8	0.94	无图借用
9		XGT560.07.13.1-9	角钢_50×50×5-1550	Q235B	2	5.84	借用(见本图)
8		XGT560.07.13.1-8	钢管Ø63×5-1550	20	1	11.1	借用(见本图)
7		XGT560.07.13.1-7	加强板	Q235B	4	5.76	借用(见本图)
6		XGTT580.31.2-2	钢筋Ø16-5125	HRB335	4	8.06	见本图
5		XGT560.07.13.1-5	钢筋Ø14-3625	HRB335	10	4.38	借用(见本图)
4		XGT560.07.13.1-4	角钢_50×50×5-200	Q235B	2	0.75	无图借用
3		XGT560.07.13.1-3	角钢_50×50×5-250	Q235B	4	0.94	借用(见本图)
2		XGT560.07.13.1-2	角钢_50×50×5-675	Q235B	4	2.54	借用(见本图)
1		XGTT580.31.2-1	角钢_50×50×5-2350	Q235B	4	8.86	见本图

标记	处数	更改文件号	签　字	日　期
设　计			标准化	
校　对				
审　核			批　准	
工　艺			日　期	

平衡重B

砼

XGTT580.31.2

图样标记	重　量	比　例
	3000	1:15
版次	共　张	第　张

XCMG 徐工塔机

借用件登记

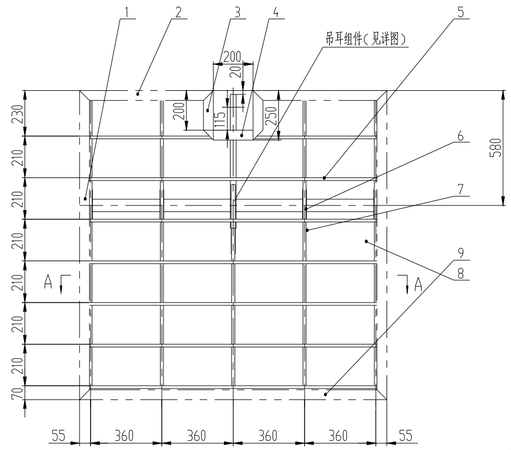
存储代号

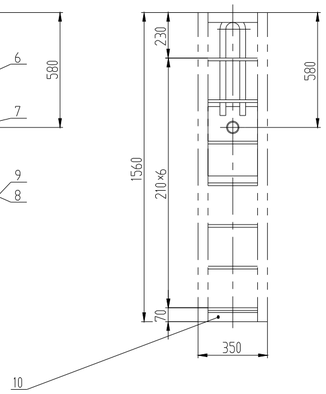
旧底图总号

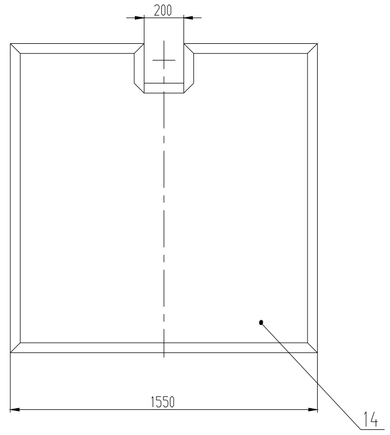
底图总号

签　字

日　期

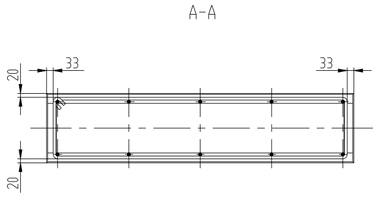


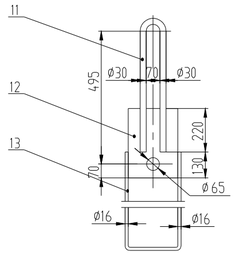


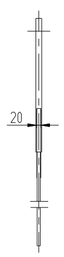


序号	规　格	形 状	序号	规　格	形 状
1	角钢_50×50×5-1560	45° 45° 1560	8	钢管Ø63×5-1550	
2	角钢_50×50×5-675	45° 45° 675	9	角钢_50×50×5-1550	45° 45° 1550
3	角钢_50×50×5-250	135° 45° 250	10	角钢_50×50×5-250	250
4	角钢_50×50×5-200	200	11	吊耳	见详图
5	钢筋Ø14×3625		12	吊耳连接板	见详图
6	钢筋Ø16×3545		13	圆钢Ø16-2216	
7	加强板	t20 Ø65 160 250			

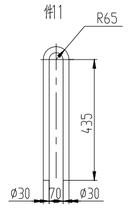
吊耳组件



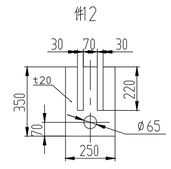




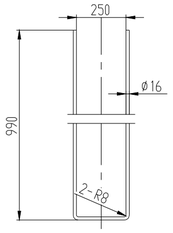
件1



件2

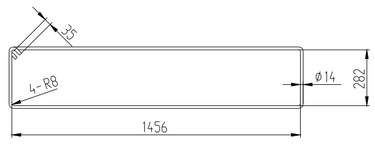


件3



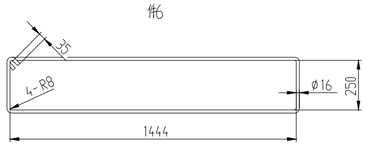
展开长度:2216

件5



展开长度:3625

件6



展开长度:3545

技术要求:

1、钢筋采用II级螺纹钢;
2、焊接时,先焊接吊耳组件,然后把吊耳组件和件8焊接;
　最后在和件6、件7焊接;
3、螺纹钢、圆钢与角钢框架焊接,保护层25mm;
4、重量误差不得超过7%;
5、砼强度等级为C35,密度2.4t/m³;

序号	代　号	名　称	数量	材　料	单件总计 重量		备　注
14	XGT560.07.13.3-14	混凝土	1	C35	1833	1833	无图
13	XGT560.07.13.3-13	圆钢Ø16-1866	1	Q235B	3.5	3.5	见本图
12	XGT560.07.13.3-12	吊耳连接板	1	Q235B	11.1	11.1	见本图
11	XGT560.07.13.3-11	吊耳	1	Q235B	5.5	5.5	见本图
10	XGT560.07.13.3-10	角钢_50×50×5-250	8	Q235B	0.94	7.52	无图
9	XGT560.07.13.3-9	角钢_50×50×5-1550	2	Q235B	5.84	11.68	见本图
8	XGT560.07.13.3-8	钢管Ø63×5-1550	1	20	11.1	11.1	无图
7	XGT560.07.13.3-7	加强板	4	Q235B	5.76	23.04	见本图
6	XGT560.07.13.3-6	钢筋Ø16-3545	4	HRB335	5.59	22.36	见本图
5	XGT560.07.13.3-5	钢筋Ø14-3625	7	HRB335	4.38	30.66	见本图
4	XGT560.07.13.3-4	角钢_50×50×5-200	2	Q235B	0.75	1.5	无图
3	XGT560.07.13.3-3	角钢_50×50×5-250	4	Q235B	0.94	3.76	见本图
2	XGT560.07.13.3-2	角钢_50×50×5-675	4	Q235B	2.54	10.16	见本图
1	XGT560.07.13.3-1	角钢_50×50×5-1560	4	Q235B	5.88	23.52	见本图

标记	处数	分区	更改文件号	签名	年月日
设计			标准化		
校对					
审核					
工艺			批准		

XGT560

砼

阶段标记	重量	比例
	2000	1:15

共　张　第　张

徐州建机工程机械有限公司

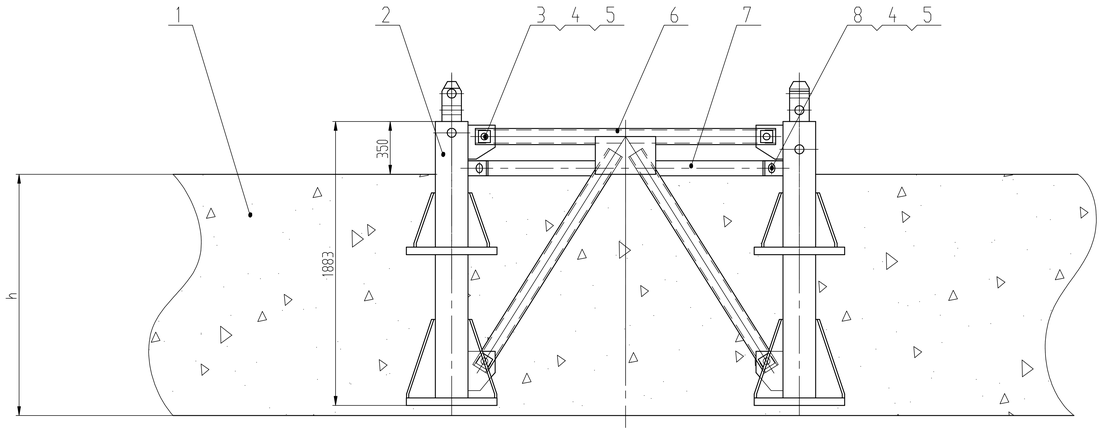
平衡重

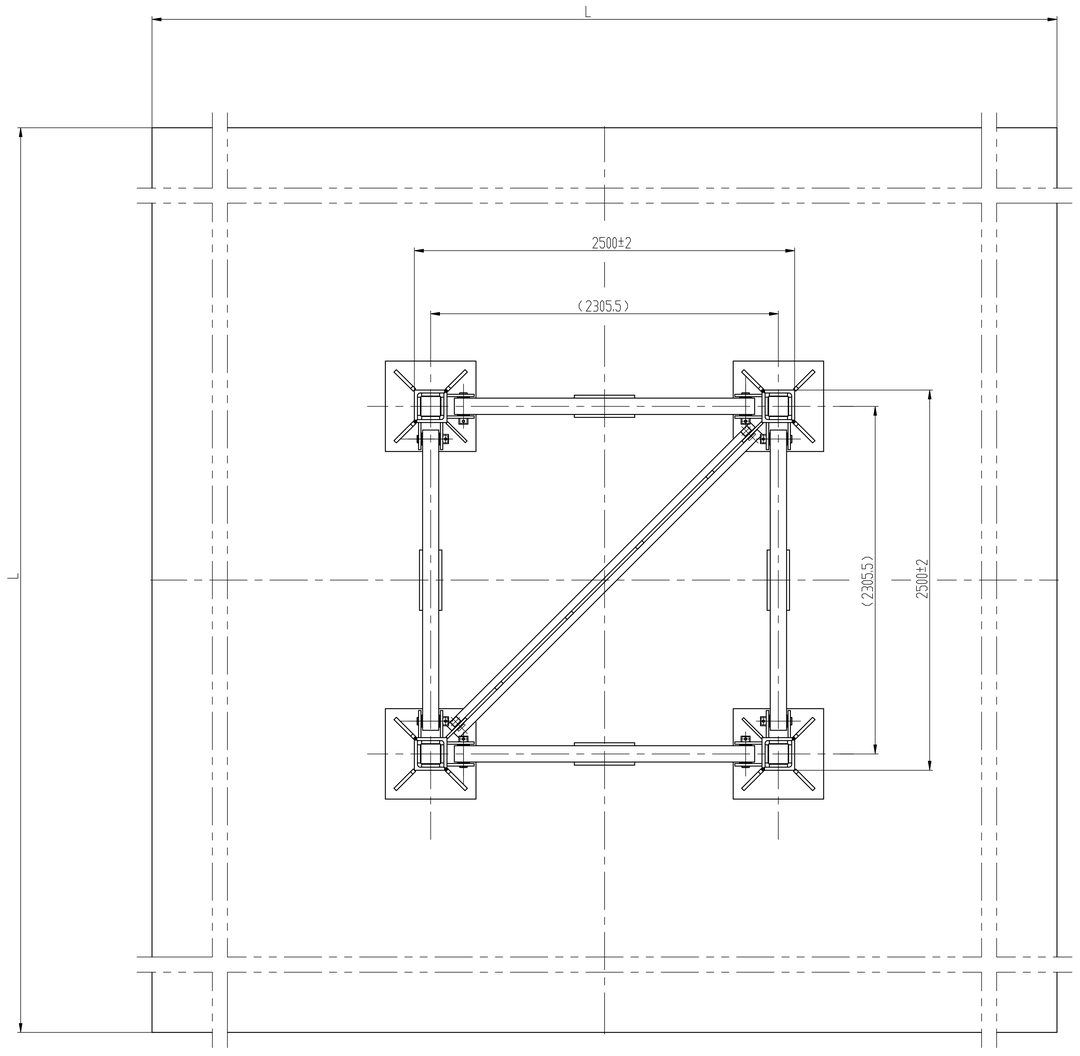
平衡重C

XGT560.07.13.3

件(通)用件登记
描　图
描　校
旧底图总号
底图总号
签　字
日　期

XGT580.12





技术要求

1、基础开挖至老土找平，基础承载力必须达到各形式要求，当地基地耐力≤0.16MPa时须回填不小于200mm厚度的碎石或卵石夯实，周边配模或砌砖后再进行编筋浇注混凝土，基础周围地面低于混凝土表面100mm以上以利排水，周边若配模，拆模以后回填卵石；

2、砼基础强度等级不低于C35，安装塔机时基础混凝土应达到80%以上设计强度，塔机运行时基础混凝土应达到100%设计强度；

3、四个固定支脚顶面水平度1/1000；

4、固定支脚与钢筋干涉时允许钢筋避让，但不允许切断钢筋。

不同地耐力下基础尺寸及重量

基础参数 / 地耐力/10^6Pa	基础长度 L/mm	基础厚度 h/mm	基础质量 t
≥0.25	7600	1800	250
≥0.22	7800	1800	263
≥0.20	8000	1800	277
≥0.17	8500	2000	347
≥0.15	9000	2000	350

序号	代号	名称	数量	材料	单件重量	总计重量	备注
8	XGT500.11.1-10	销轴	2	42CrMo	1.1	2.2	借用
7	XGT500.11.1.9	连杆	1	焊件	52	52	借用
6	XGT500.11.1.4	三角片II	4	焊件	180.72	722.88	借用
5	GB/T91-2000	开口销4×30	36	低碳钢	0.01	0.36	
4	XGT500.11.1-8	插销	18	40Cr	0.12	2.16	借用
3	XGT500.11.1-7	销轴	16	42CrMo	2.6	41.6	借用
2	XGT500.12.2	固定支脚	4	组件	668.89	2675.56	借用
1	XGT580.12.1	砼基础	1	钢混			

标记	处数	分区	更改文件号	签名	年月日
设计			标准化		
校对					
审核					
工艺			批准		

XGT8039-20

部件

徐州建机工程机械有限公司

固定基础

阶段标记 | 重量 | 比例 1:20

共 张 第 张

固定基础

XGTT580.12

借(通)用件登记

描图

描校

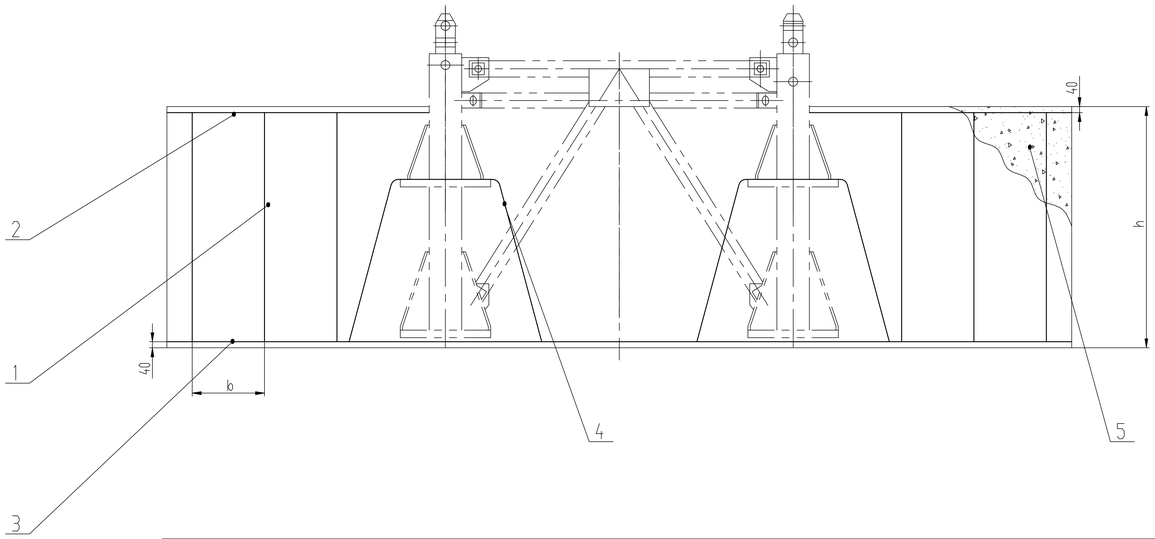
旧底图总号

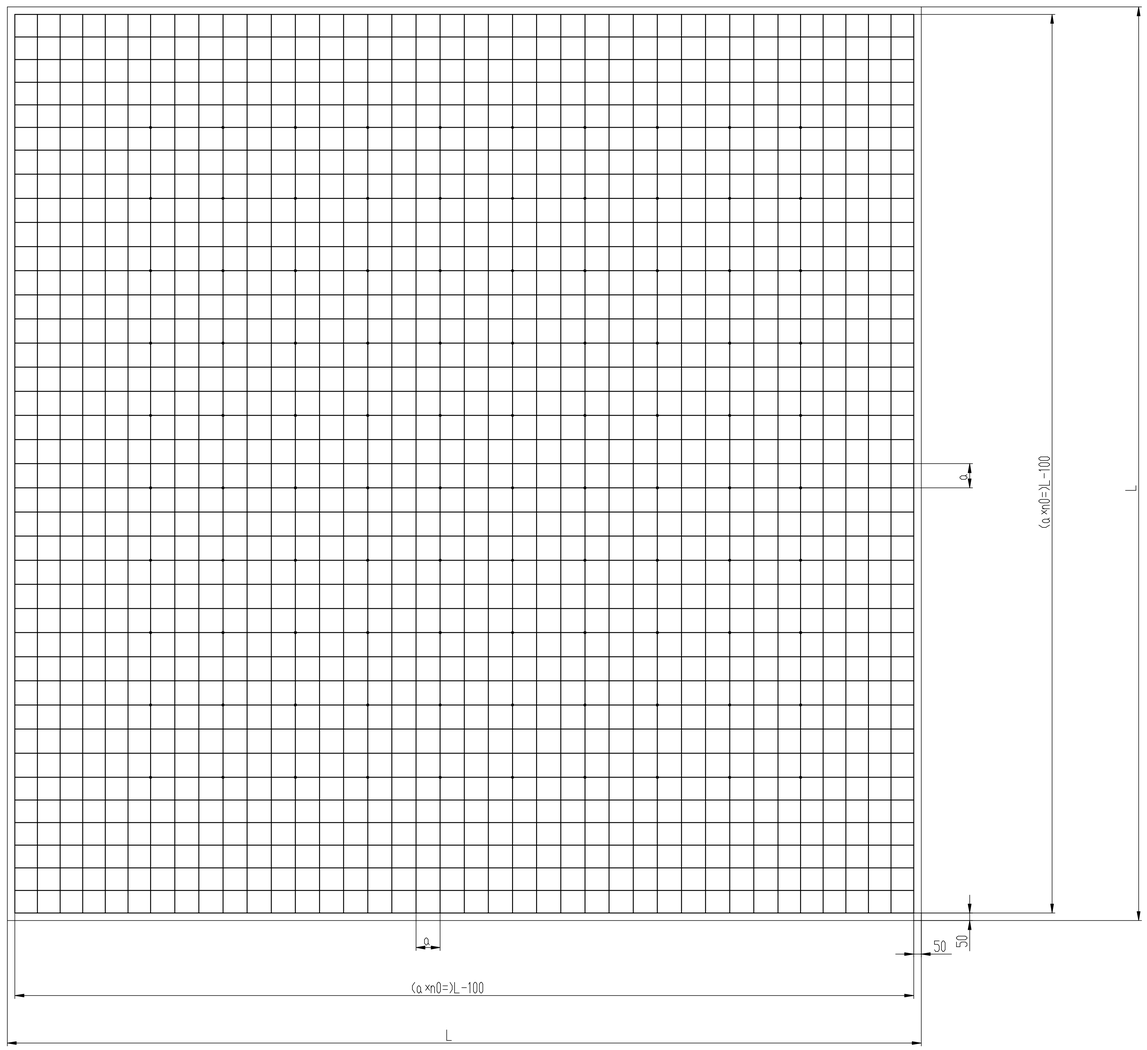
底图总号

签字

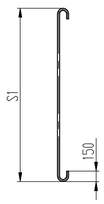
日期

XGTT580.12.1

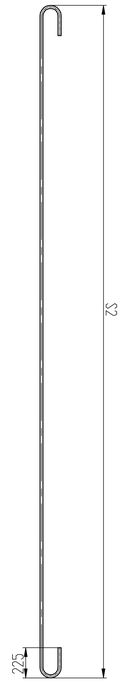




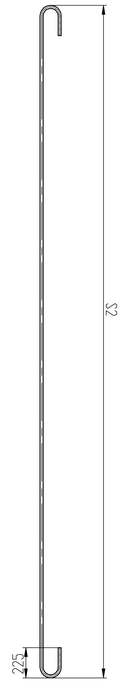
件1
Φ16



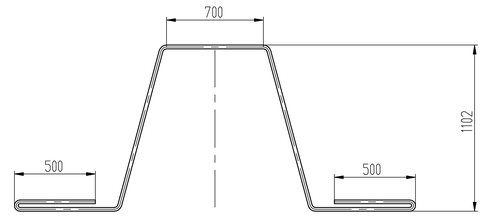
件2
Φ25



件2
Φ30



件3
Φ25



参考展开长度:5460

不同地耐力下基础参数(长度单位为mm)

基础参数 \ 地耐力/10^6Pa	0.25	0.22	0.20	0.17	0.15
基础长度 L	7600	7800	8000	8500	9000
基础高度 h	1800	1800	1800	2000	2000
横筋间隔(参考) a	150	150	150	150	150
立筋间隔(参考) b	450	450	450	450	450
立筋长度 S1	1720	1720	1720	1920	1920
横筋长度 S2	7500	7700	7900	8400	8900
横筋间隔数 n0	50	51	52	56	59
立筋数量 n1	324	324	361	400	441
单层横筋数量 n2	102	104	106	114	120

技术要求

1. 砼基础强度等级不低于C35

序号	代号	名称	数量	材料	单件总计 重量		备注
5		砼	1	C35			
4	XGTT580.12.1-4	定位筋 Φ25	4	HRB335			见本图
3	XGTT580.12.1-3	底层横筋 Φ30	n2	HRB335			见本图
2	XGTT580.12.1-2	上层横筋 Φ25	n2	HRB335			见本图
1	XGTT580.12.1-1	竖筋 Φ16	n1	HRB335			见本图

标记	处数	分区	更改文件号	签名	年月日
设计			标准化		
校对					
审核					
工艺			批准		

XGT8039-25

组件

阶段标记	重量	比例
		1:20

共 张 第 张

徐州建机工程机械有限公司

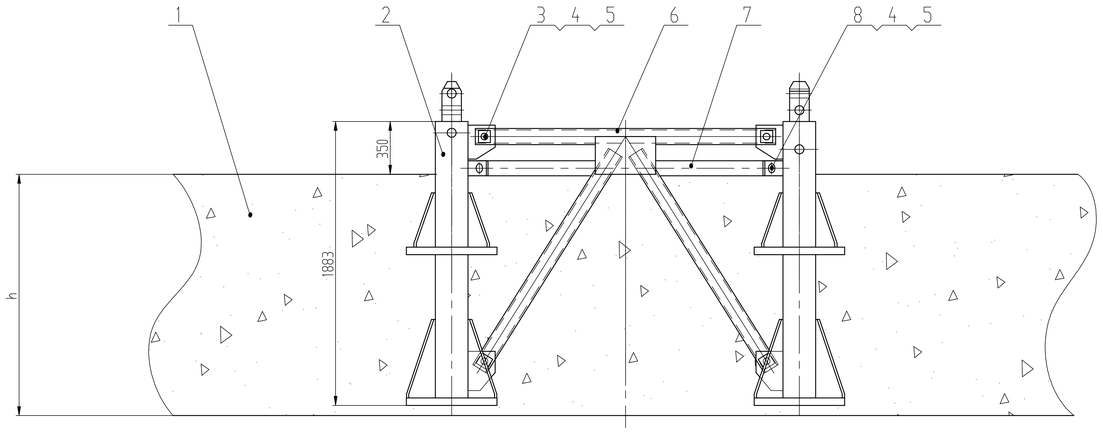
固定基础

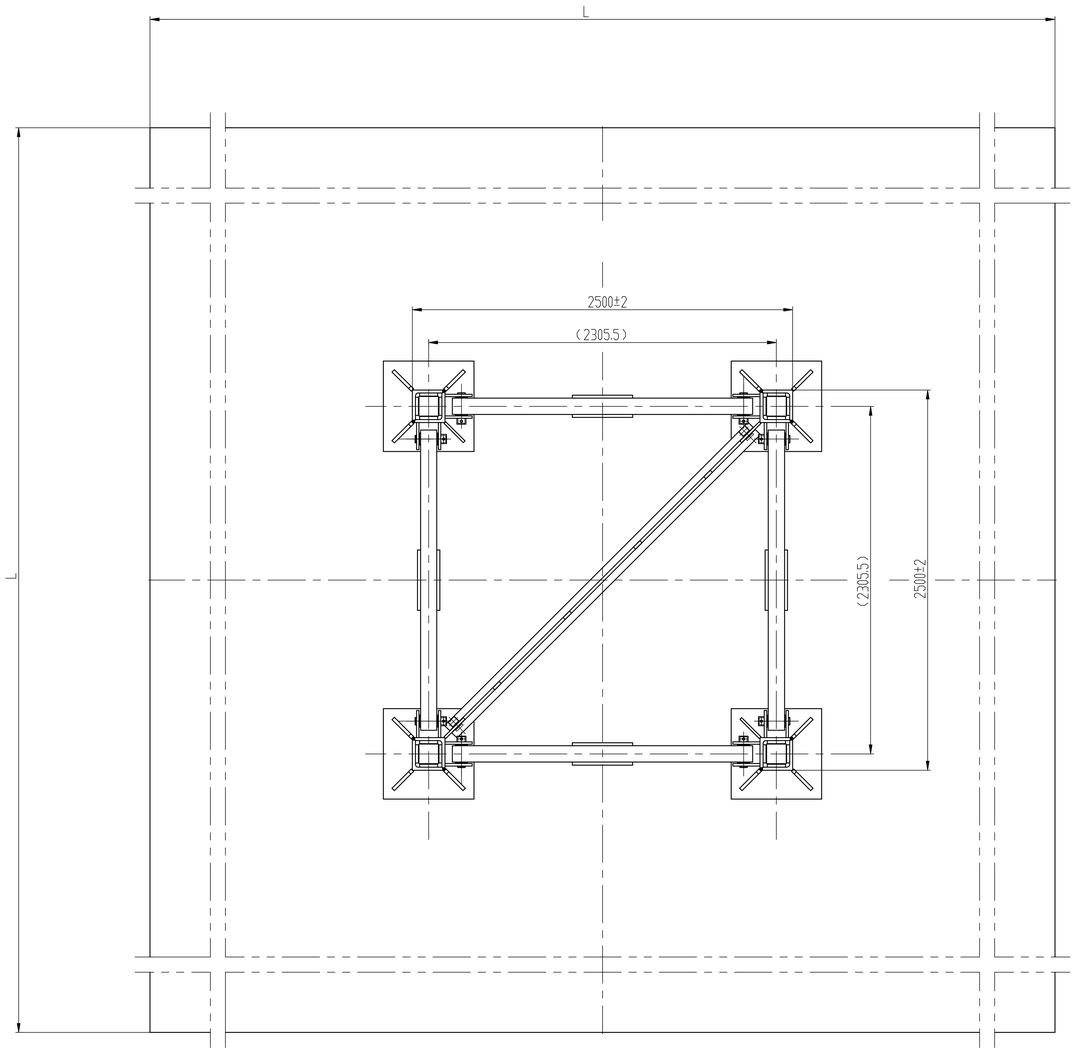
砼基础

XGTT580.12.1

借(通)用件登记
描 图
描 校
旧底图总号
底图总号
签 字
日 期

XGT1580.12





Technical requirements

1. Excavate foundation to aged earth and leveling. The bearing capacity of foundation must meet the various requirements. When local base endurance ⩽ 0.16, backfill compacted gravel or pebbles not less than 200mm, surrounded with mold or laid-brick, and then pour into the concrete after weaving steel-bar. The ground around the foundation is better to be more than 100mm below the concrete surface for the convenience of drainage. If the foundation is surrounded with mold, backfill gravel after the mold is removed;
2. Concrete strength should not be less than C35. Only the concrete strength of fixed foundation reaches up to the 80% of designed value, can the tower crane installation be done; however, the foundation strength, when tower crane is started to work, must be at the state of 100%.
3. Top surface horizontality of four fixed angles is 1/1000.
4. If the fixed angles are interfering with steel bars, it is allowed to adjusting steel bars to make way for fixed angles, but forbidden to cut off steel bars.

The foundation parameter under diffrent endurence

Foundation parameter / Endurence /10⁶Pa	Foundation Length L/mm	Foundation tickness h/mm	Foundation weight t
⩾0.25	7600	1800	250
⩾0.22	7800	1800	263
⩾0.20	8000	1800	277
⩾0.17	8500	2000	347
⩾0.15	9000	2000	350

No.	Code	Name	Qty	Material	Per Weight	Total Weight	Remark
8	XGT500.11.1-10	Pin shaft	2	42CrMo	1.1	2.2	
7	XGT500.11.1.9	Connecting rod	1	Welded part	52	52	
6	XGT500.11.1.4	Triangle II	4	Welded part	180.72	722.88	
5	GB/T91-2000	Cotter pin 4×30	36	Low-carbon steel	0.01	0.36	
4	XGT500.11.1-8	Pin	18	40Cr	0.12	2.16	
3	XGT500.11.1-7	Pin shaft	16	42CrMo	2.6	41.6	
2	XGT500.12.2	Fixed foot	4	Assembly	668.89	2675.56	
1	XGT580.12.1	Concrete Foundation	1				

Mark	Point	Subarea	Document #end	Signature	Y M D
Design			Standard		
Collate					
Check					
Construction			Confirm		

XGT8039-25
Component

XUZHOU CONSTRUCTION MACHINERY CO., LTD

Fixed foundation

Stage Mark | Weight | Ratio
1:20

Total page of

Fixed foundation
XGTT580.12

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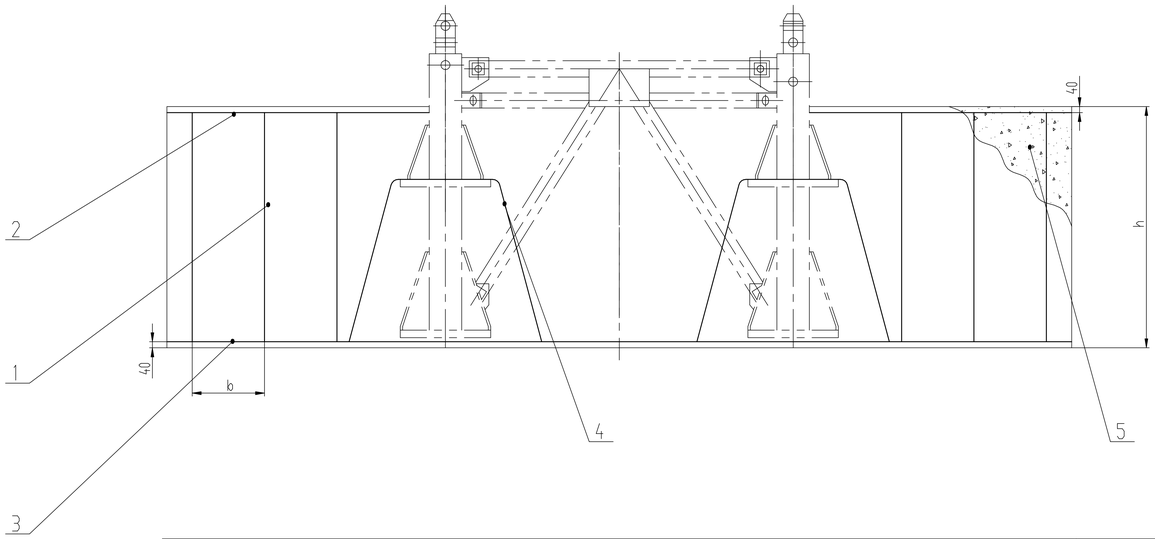
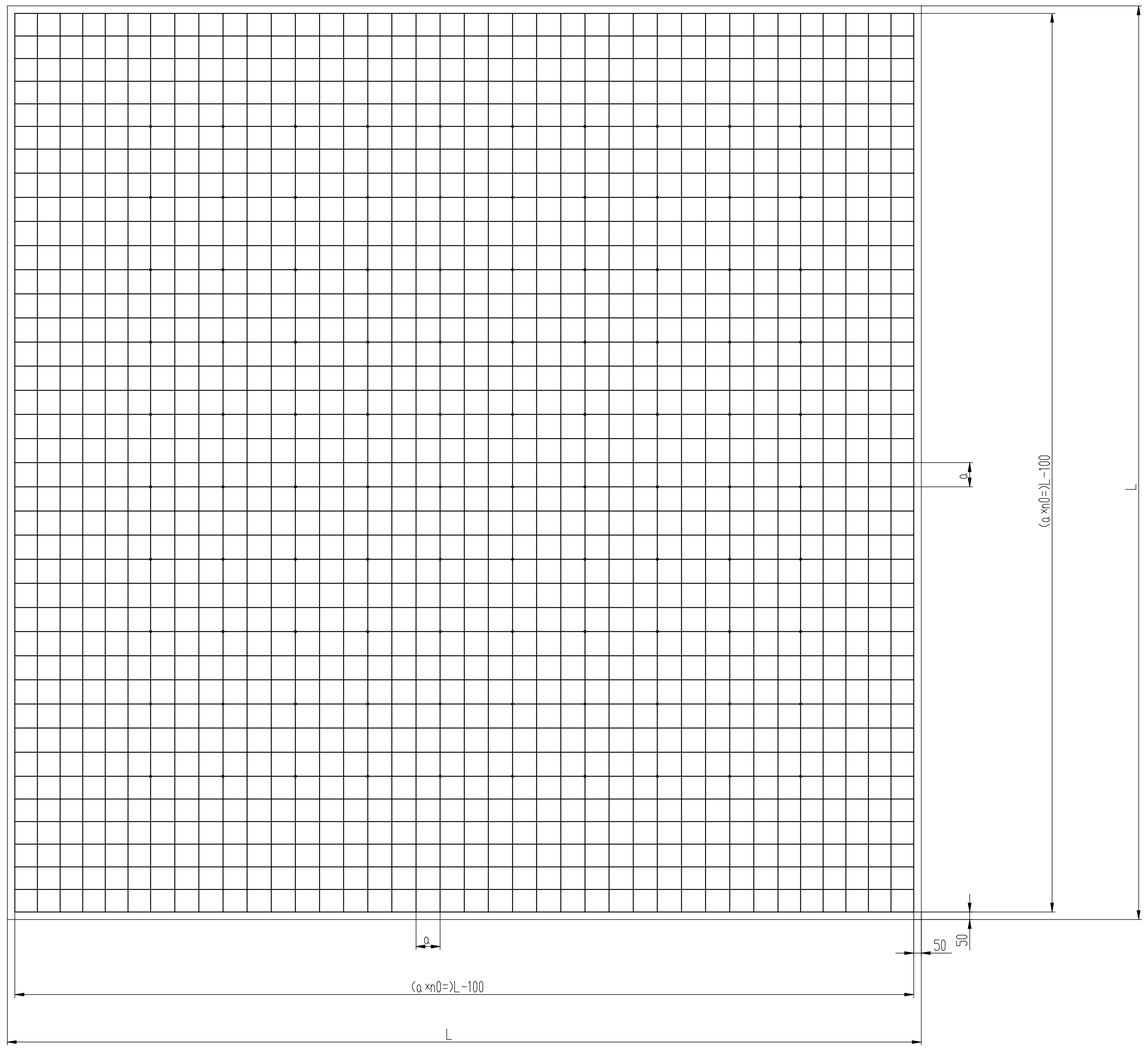
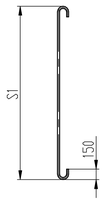
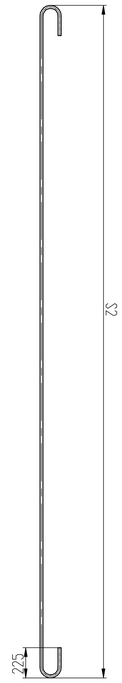




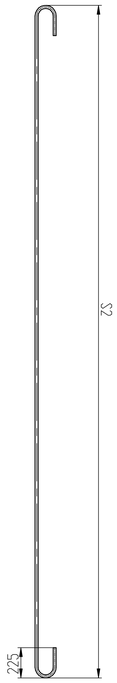
Part 1
Φ16



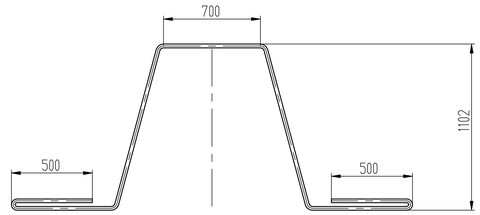
Part 2
Φ25



Part 2
Φ30



Part 3
Φ25



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The foundation parameter under diffrent endurence (Unit of length:mm)

Foundation parameter \ Ground endurance/10⁵Pa	0.25	0.22	0.20	0.17	0.15
Foundation Length L	7600	7800	8000	8500	9000
Foundation Height h	1800	1800	1800	2000	2000
Cross rod space(reference) a	150	150	150	150	150
Vertical rod space(reference) b	450	450	450	450	450
Vertical rod Length S1	1720	1720	1720	1920	1920
Cross rod Length S2	7500	7700	7900	8400	8900
Cross rod space number n0	50	51	52	56	59
Vertical rod quantity n1	324	324	361	400	441
Monolayer Cross rod quantity n2	102	104	106	114	120

Technical requirement
1. The strength level of concrete foundation is not lower than C35

No.	Code	Name	Qty	Material	Per Weight	Total Weight	Remark
5		Concrete	1	C35			
4	XGTT580.12.1-4	Positioning rob Φ25	4	HRB335			
3	XGTT580.12.1-3	Lower cross rod Φ30	n2	HRB335			
2	XGTT580.12.1-2	Uper cross rod Φ25	n2	HRB335			
1	XGTT580.12.1-1	Vertical rod Φ16	n1	HRB335			

Mark	Point	Subarea	Document Anend	Signature	Y M D
Design			Standard		
Collate					
Check					
Construction			Confirm		

XGT8039-25

XUZHOU CONSTRUCTION MACHINERY CO, LTD

Fixed foundation

Stage Mark | Weight | Ratio
1:20

Total page of

Concrete Foundation

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