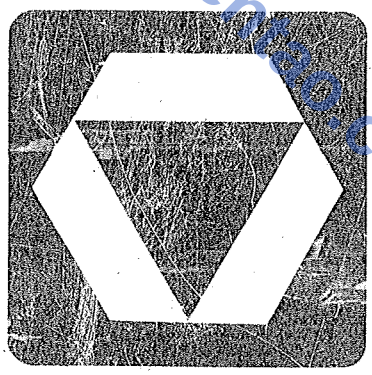
XCMG徐工集团

塔式起重机使用说明书

TOWER CRANE OPERATION MANUAL



徐州建机工程机械有限公司
XUZHOU CONSTRUCTION MACHINERY CO.,LTD.

XCMG
徐工集团

XGL4015K-6 Tower Crane Installation and Operation Instruction

徐工集团徐州建机工程机械有限公司

XCMG-Xuzhou Construction Machinery CO., Ltd.

XGL4015K-6 动臂塔式起重机安装操作手册

XGL4015K-6 Luffing Tower Crane Installation and Operation Instruction

出厂编号 Production No.	
出厂日期 Production Date	

安装操作手册是产品的一部分，应始终放在手边以备查阅。**安装操作产品前请阅读该手册。**

本产品的设计和制造符合 GB/T13752-1992、GB/T5031-2008 和 GB5144-2006 标准规定。

Installation and operation instruction is a part of our product so it is necessary to preserve it for future reference. Read this instruction before installing product.

This product is designed and manufactured in accordance with the requirements of GB/T13752-1992, GB/T5031-2008 and GB5144-2006.

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前言

本安装操作手册适用于 XGL4015K-6 动臂塔式起重机。

本安装操作手册叙述了 XGL4015K-6 动臂塔式起重机(以下简称塔机)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，务必仔细阅读本安装操作手册，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”、“检查”的内容。

⚠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。

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。

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。

在产品保修期内，如果塔机出现任何故障或者异常情况，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。

本《安装操作手册》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，公司将不会承担因为不按本《安装操作手册》操作而产生的任何不良后果。特殊情况时，为确保塔机安全工作，请与我公司联系，我们将为您提供及时有效的技术支持。

⚠注意 在维修保养过程中，用户更换主要配套零部件时，必须采用产品出厂时配置的同厂家同型号零部件，否则，我公司不承担由此造成的损失。

公司保留随技术改进而不断修改《安装操作手册》内容的权力，如有变更，恕不另行通知。本手册中可能部分图文与实物不符，但是不影响您使用，产品状态以实物为准。

符号及其含义：

危险——警告词“危险”表示即将发生的危险状况。如果不能避免，将导致死亡或重伤。

警告——警告词“警告”表示潜在的危险状况。如果不能避免，可能会导致死亡或重伤。

注意——警告词“注意”表示潜在的危险情况。如果不能避免，可能导致轻伤或者中度等程度的伤害。

——需要根据要求进行相关检查

Preface

This installation and operation manual is applicable to topless tower crane XGL4015K-6.

This installation and operation manual gives a detailed description of parts assembly, vertical tower installation procedures, debugging of safety protection device, specific operations of tower cranes, etc. Since tower crane operation is full of dangers, please carefully read this installation and operation manual, become familiar with and make use of the information contained in the manual, and operate in strict accordance with the manual before tower crane installation and operation, so as to ensure operation 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”**.

Warning **This tower crane can only be operated by trained and qualified personnel with a qualification certificate.**

Please pay special attention to the regular inspection & maintenance of tower crane safety devices, and do not use the safety device when any fault or operating failure is detected, in other words, you must comply with the highest standard: Safety First.

This manual is applicable to tower crane 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.

If any fault or failure is 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.

This installation and operation manual shall be properly kept during the service life of the product because it is the composition of this product. This manual provides an essential basis for the installation and operation of this tower crane, and the company will not be responsible for any consequences resulted from the operations not

following this installation and operation manual. Under special circumstance, please contact our company so as to ensure safety operation of the tower crane, and we will provide timely and effective technical support for you.

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 claim to be responsible for the loss caused.

The company reserves the right to continuously modify the contents of *Installation and Operation Manual* according to technological improvement. This manual is subject to change without notice. Some graphics of this manual may possibly be different from actual objects, but will not bring any influence on specific application. See the actual objects for detailed sizes.

Symbols and Their Meanings:

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.

——Inspect according to specific requirements.

第 1 章塔式起重机一般安全规则

Chapter 1 General Safety Rules for Tower Cranes

1.1 正常使用安装操作手册

(1) 安装操作手册是产品的组成部分。

(2) 在产品寿命期内要妥善保存它们。

(3) 把安装操作手册传给产品的任何后续持有者。

(4) 安装操作手册包含该动臂塔机各个系统及部件的重要信息，塔机司机在操作塔机时和安装人员在安装塔机时，一定要首先阅读《安装操作手册》，以免由于操作错误而造成事故的发生。

1.1 Proper Use of Installation and Operation Manual

1) The installation and operation manual is the composition of this product.

2) Properly keep them during the service life of product.

3) Hand over this installation and operation manual to any subsequent product holders.

4) The installation and operation manual describes the important information about each system and component of the tower crane (hereinafter referred to as "crane"). The tower crane maintenance personnel must carefully read this manual first before operating and installing the crane, so as to avoid unexpected accidents caused by incorrect operation.

1.2 安装单位和安装人员的要求

(1) 安装单位的要求

1) 安装单位必须具有塔机安装资质证书。

2) 安装单位必须在安装过程中指定一个安装人员作为“安装主管”。

(2) 安装人员的要求

1) 安装人员必须符合以下条件：

a) 具有安装本塔机的资格证书。

b) 年龄大于 18 周岁。

c) 适应该项工作，特别是视力、听力、灵活性和反应能力。

d) 具备安全搬运重物，包括安装塔机的体力。

e) 能够登高作业。

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。

g) 经过吊装及信号技术的培训。

h) 具有根据载荷的情况选择吊具和附件的能力。

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。

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。

k) 完全熟悉并掌握安装操作手册中相关章节的要求。

l) 能熟练并正确使用所有个人安全防护装备。

⚠ 注意 安装人员的职责：依据安装操作手册进行安装塔机。

2) 安装主管除满足安装人员的条件外还应满足以下条件：

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。

b) 熟悉并拥有该塔机的安装操作手册。

c) 接受过对塔机安装拆卸人员进行管理的培训。

d) 能证实安装过程中使用设备的适用性。

3) 安装主管的职责如下：

a) 安装主管在塔机的整个安装、拆卸、爬升过程中不能离开现场。

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。

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)。

d) 保证塔机的附属设施与安装报告完全一致。

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。

f) 保证通道设备随安装进程的进度而被逐步正确安装，以便安装人员使用。

g) 安装主管在认为场地条件、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。

⚠ 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。

1.2 Requirements for Installation Units and Personnel

(1) Requirements for installation units

1) The installation unit must have qualification certificate for tower crane installation.

2) The installation unit must designate an installer as the "installation supervisor" during installation.

(2) Requirements for installation personnel

1) The installation personnel must satisfy the following conditions:

a) Holing qualification certificates.

b) Over 18 years old.

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

d) Physical strength to safely transport heavy objects, including the physical strength to install tower cranes.

e) Being able to work at height.

f) Being capable of estimating the load mass, balancing the load and determining the distance, height and clearance.

g) Having received trainings on hoisting operation and signaling technology.

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

i) Having received comprehensive trainings on tower crane installation, disassembly and operation of installed cranes.

j) Having received comprehensive trainings on the installation and commission of safety devices for installed cranes.

k) Being completely familiar with and mastering the requirements described in related chapters and sections of the installation and operation manual.

l) Being able to skillfully and correctly use all the personal safety protective equipment.

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

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

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) Knowing well about and having the installation and operation manual of this tower crane.

c) Having received trainings on how to manage the personnel responsible for mounting and dismounting tower cranes.

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

3) Responsibilities of installation supervisor:

a) The installation supervisor needs to be present throughout the entire process of the

installation, disassembly and lifting of the tower crane.

b) 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.

c) Providing technical measures (i.e., installation scheme) to ensure that the crane can work according to the installation plan.

d) Making sure that the ancillary facilities are exactly consistent with the installation report.

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

f) 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.

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

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

1.3 塔机司机和起重工的要求

(1) 塔机司机的要求

1) 对塔机的操作，只能由下述人员进行：

a) 经过考试，并取得塔机操作合格证的人员。

b) 为了执行任务需要进行操作的维修、检测人员。

c) 经上级任命的劳动安全监察员。

2) 塔机司机必须具备的条件：

a) 具有能够操作本塔机的资格证书。

b) 年龄大于 18 周岁。

c) 视力(包括矫正视力)在 0.7 以上，无色盲。

d) 听力能满足具体工作条件的要求。

e) 熟悉所操作塔机各机构的构造和技术性能。

f) 掌握塔机操作规则和有关法令。

g) 掌握起重指挥信号，操作准确。

h) 熟悉塔机保养和基本的维修知识。

(2) 塔机起重工的要求

1) 具有资格证书。

2) 年龄大于 18 周岁。

3) 掌握起重指挥信号，指挥准确并符合标准规定。

1.3 Requirements for Tower Crane Driver and Lifting Worker

(1) Requirements for tower crane driver

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

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

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

c) Labor and safety supervisors appointed by higher authorities.

2) Tower crane driver must satisfy the following requirements:

a) Holing qualification certificates.

b) Over 18 years old.

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

d) Hearing satisfying the requirements for specific working conditions.

e) Being familiar with the structure and technical performance of each mechanism of the crane being operated.

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

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

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

2) Requirements for tower crane lifting work

a) Holing qualification certificates.

b) Over 18 years old.

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

1.4 塔机工作阶段的安全规则

(1) 塔机操作者要做到“十不吊”

1)指挥信号不明确或违章指挥不吊。

2)超载不吊。

3)工件或吊物捆绑不牢不吊。

4)吊物上面有人不吊。

5)安全装置不齐全或动作不灵敏、失效不吊。

6)吊物埋在地下、与地面建筑物或设备有钩挂不吊。

7)光线阴暗视线不佳不吊。

8)棱角物件无防切割措施不吊。

9)斜拉歪拽工件不吊。

10)遇到大雷雨、暴雨和塔机最高处风速超过 20m/s 时不吊。

(2)起重工操作安全规则

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。

2)绳、链所经过的棱角处应加衬垫,防止绳、链被棱角割断。

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。

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。

5)多人绑挂时，必须由一人负责指挥。

(3)在塔机使用前的安全规则

1)听取工地负责人的指令。

2)认真阅读塔机的工作日志，了解前一班塔机的运行情况。

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。

4)检查钢丝绳端头固定情况、查看钢丝绳有无磨损。

5)检查塔机金属结构部分有无漏电现象。

6)检查各传动部位及润滑点的润滑油量。

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。

8)检查所有保护和安全装置是否处于正常状态。

(4)在塔机使用过程中的安全规则

1)用空载低速试验塔机各机构的动作是否正常。

2)塔机动作时，不要将起吊载荷从人员上方经过。

3)起吊载荷进入视线之外区域时，必须有人导向。

4)不要在规定的幅度以外吊起超重的载荷。

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。

6)不要将限制器和限位器当作正常停车的装置使用。

7)禁止将安全保护装置短接、改动其调整的安全工作状态。

8)确保塔机与空中电线之间有足够安全距离。

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。

10)不要在有载荷的情况下调整起升、变幅机构的制动器。

11)塔机工作时，不能进行检查和维修。

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。

13)塔机应按作业条件，依据有关标准，合理选择吊索具。严禁将不同种类或不同型号的索具连在一起使用。

14)群塔作业时，应保证以下作业原则：

a)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另一台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应小于 2m。

b)低塔顶升加节时，高塔停止作业。高塔顶升，低塔不得在高塔顶升范围内作业。

c)低塔让高塔：低塔在转臂前应先观察高塔运行情况再进行作业。

d)后塔让先塔：在两塔机塔臂交叉区域内运行时，后进入该区域的塔机避让先进入该区域的塔机。

e)运行塔让静塔：在两塔机塔臂交叉区域内作业时，进行运转的塔机应避让处于静止状态的塔机。

f)轻车让重车：在两塔机同时运行时，轻载荷塔机应主动避让重载荷塔机，塔吊在转臂时，严禁与相邻塔吊在同一地点同时进行吊装作业。

15)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。

16)夜间施工必须有足够的照明，塔吊上要有警示灯。

17)当气候恶劣，伴随着雨、雾、雪等使操作者视线不佳时，务必停止操作。

18)起吊重物时，应缓慢加速或减速，防止吊臂及机械平台产生过大的应力。

19)避免在回转过程中突然起制动，控制回转速度，以防止重物摆出作业半径。

20)当多台塔机起吊同一重物时，操作人员及指挥人员可按需要考虑降低额定载重、降低

吊物、吊臂位置及起升速度。

警告 对上面提到的要点如果不遵守，可能会导致人员伤亡和机器损坏。

(5)在塔机使用完成后的安全规则

1)将塔机起重臂放到15°位置，并将吊钩升到最高点，吊钩上严禁吊挂重物。

2)将塔机停泊在适当位置，以免被工地上其他设备撞击。

3)凡是回转机构带有止动装置或常闭式制动器的起重机，在停止作业后，司机必须松开制动，绝对禁止限制起重臂随风转动。

4)认真填写塔机的工作日志。

5)关闭所有控制开关。

6）切断塔机总电源。

警告 对上面提到的要点如果不遵守，可能会导致人员伤亡和机器损坏。

1.4 Safety Rules for Working Stages of Tower Crane

(1) "Ten impermissibilities for hoisting work" to be followed by tower crane operators

1) Unclear commanding signal or command against rules.

2) Overload.

3) Loose binding of work piece or lifting objects.

4) Someone above the lifting objects.

5) Incomplete safety device or inflexible and ineffective lifting.

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

7) Poor light and poor vision.

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

9) Work piece to be improperly pulled or dragged.

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

(2) Safety operation rules for lifting worker

1) The hoisting rope must meet the requirements for safe lifting. The angle between hanging ropes shall be less than 1200 during hoisting in order to prevent the hanging ropes from being excessively pressed.

2) The edges where ropes and chains pass shall be padded to prevent the ropes and chains

being cut off.

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) Please firstly contact the crane operator and arrange support devices to avoid accidents when operating under the suspended objects.

5) One person must be responsible for directing the operation when more than one worker is involved in towing and lifting operation.

(3) Safety rules to be followed before using

1) Follow the instructions of the person in charge of site construction.

2) Carefully read the operation records of tower crane and know about the operating condition for the prior tower crane.

3) Check each bar of the crane steel structure for deformation, and connection bolts for looseness.

4) Check whether the ends of wire ropes are fixed and check the wire ropes for wear.

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

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

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

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

(4) Safety rules to be followed during using

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

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

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

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

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) The limiter and the stopper cannot be used as the common devices for stopping the crane.

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

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

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

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

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

Warning **In the case of failure to comply with the above mentioned points, personnel casualties or damage to the machine may be caused.**

(5) Safety rules to be followed after using

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

2) Retract the trolley at the maximum radius.

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

4) Carefully keep record of the tower crane conditions.

5) Cut off all control switches of tower crane.

6) Cut off the main power supply of tower crane.

1.5 预防、防护和应急措施

(1) 触电事故的应急措施

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：

1) 操作者应保持冷静，不要惊慌。

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。

3)将塔机立即开出危险区。

4)立即告知周围的人远离塔机。

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。

6)在确认接触电线断电前不要离开驾驶室。

(2)雷击和地震的安全预防措施

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。

1)停止作业，将吊重物体放置地面。

2)切断所有电路。

3)撤离到安全地方。

(3)火防护措施及自救逃生方法

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。

(4)塔机的清洁防护

塔机的平台和通道应保持清洁、干燥，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。

(5)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。

⚠警告 对上面提到的要点疏忽检查或不遵守，可能会导致人员伤亡和机器损坏。

1.5 Prevention, Protection and Emergency Measures

(1) Emergency measures for electric shock accident

1) 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:

2) Keep clam and do not panic.

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

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

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

6) 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.

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

(2) Safety precautions for lightning and earthquake

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

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

2) De-energize all the circuits.

3) Evacuate to a safe place.

(3) Protective measures as well as self-help and escape means

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.

(4) Cleaning and protection of tower cranes

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.

(5) Personal protective equipment

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

Warning **In the case of failure to check or comply with the above mentioned points, personnel casualties or damage to the machine may be caused.**

1.6 安全资料

(1) 安全距离

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表 1-1 的规定。

表 1-1 塔机任何部位与架空输电线安全距离

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

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。

⚠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。

2) 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。

(2) 物象风速(见表 1-2)

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。

表 1-2 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，寻常的风向标转动
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	中强风	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(烟囱顶部及平顶摇动)
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

平均风速(m/s)	瞬时风速(m/s)	名称	级数	说明(陆地)
>32.7	>49.1	飓风	12	陆上绝少，其摧毁力极大

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。

1.6 Safety Data

1.6.1 Safe Distance

1. In the case of overhead transmission lines, the safe distance between any part of the tower crane and the transmission line shall satisfy the provisions of Table 1-1.

Table 1-1 Safe Distance between Any Part of the Tower Crane and Overhead Transmission Line

Safe Distance/m	Voltage/kV				
	<1	1～15	20～40	60～110	220
Vertical Direction	1.5	3.0	4.0	5.0	6.0
Horizontal Direction	1.0	1.5	2.0	4.0	6.0

If safe distances 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.

Danger If the tower crane operates near the high voltage transmission lines, the safe distance between any part 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.

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

3. 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.

1.6.2 Wind speed of images (see Table 1-2)

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".

Table 1-2 Image Anemometer

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.

Warning Before operating, the operators must obtain related information on wind speed and wind force from meteorological department. It is forbidden to operate if wind speed exceeds the specified value, so as to prevent unexpected accidents.

1.7 标牌说明

1)产品铭牌上具有产品型号、出厂编号、塔机额定起重力矩、最大工作幅度、最小工作幅度、独立高度、最大附着高度、最大额定起重量和各机构的速度等信息。

2)产品标牌上具有塔机各种组合臂的起重性能参数表和塔机安全操作的基本操作原则等方面的信息。

3) 安全标志给出了各部位或者整机的需要注意的安全信号。

⚠ 注意 对标牌、标识中的内容必须引起高度的注意，以避免不必要的事故的发生。

1.7 Signboard Instructions

1) On the mark plate of product are product type, production number, rated moment, maximum and minimum radius, load at max radius, max rated load and speeds of mechanisms.

2) The mark plate of lifting performance and lubricating is mainly about the lifting performance of tower crane at various jib combinations, lubricating period and grease type etc.

3) The mark plate of safety operation covers the contents of safety operation principles of tower crane.

4) There are safety signals in safety mark about the positions of each parts and whole machine.

⚠ Caution Paying more attention to the contents of mark plates and signals contributes to avoid accidents.

1.8 用户须熟练掌握的标准

用户除了熟练掌握本安装操作手册外，还必须熟练掌握以下标准及其最新版本，并按照其内容进行操作，标准如下：

GB 5144-2006 《塔式起重机安全规程》

GB 5082-1985 《起重吊运指挥信号》

GB/T 5031-2008 《塔式起重机》

JG/T 100-1999 《塔式起重机操作使用规程》

以及国家、行业、地方相关法律、法规、标准、规范。

1.8 Standards to be mastered by the User

In addition to the provisions specified in this installation and operation manual, users must also get familiar with and comply with the following standards and their latest versions, and operate in accordance with their requirements. Relevant standards are listed as follows:

GB 5144-2006 Safety Code for Tower Cranes

GB 5082-1985 The Commanding Signal for Lifting and Moving

GB/T 5031-2008 Tower Crane

JG/T 100-1999 Tower Crane Specification for Operation

National, industrial, local laws, regulations, standards and norms.

第2章 概述

Chapter 2 Overview

2.1 塔机使用条件

(1)工作环境温度-20℃～+40℃，在此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。

⚠ 注意 当环境温度低于或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。

(2)工作状态时塔机顶部风速≤20m/s。

(3)安装和顶升时塔机顶部风速≤12m/s。

(4)非工作状态的风速设计值是按部件离地面高度来进行取值。当高度为 0～20m 时，风速取 35.8m/s；当高度为 20～100m 时，风速取 42m/s；当高度＞100m 时风速取 45.6m/s。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)。

⚠ 注意 塔机在安装、顶升和工作时必须根据当时的风速，按照上述几点来开展工作，否则将会造成机毁人亡的后果。

(5)不能在易燃、易爆气体、粉尘等危险场所进行使用。

(6)海拔高度 1000m 以下。

(7)塔机的工作级别为 A4。

(8)塔机的总功率为 49.5kW。

2.1 Service Conditions of Tower Cranes

1. Ambient operating temperature: -20℃ to +40℃, service life of tower crane components and lifting operation safety may be affected when operating against this temperature. In addition, special operating environment shall be indicated when ordering if the crane is operated beyond this temperature range.

⚠ Caution **When ambient temperature exceeds the normal operating temperature, the operator has the right to stop operating the crane on the premise that secondary danger will not be caused.**

2. The wind speed at the top of the tower crane under working state is less than or equal to 20m/s.

3. The wind speed at the top of the tower crane during installation and lifting is less than or equal to 12m/s.

4. The wind speed design vale under out-of-service conditions is taken in accordance with the height above the ground. When the height is 0 to 20m, wind speed shall be 35.8m/s; when the height is greater than 20m to 100m, wind speed shall be 42m/s; when the height is greater than 100m, wind speed shall be 45.6m/s. Tower cranes shall not be used under out-of-service conditions where wind speed is greater than the wind speed design value.

⚠ Caution Installation, lifting and operation of the tower crane must be conducted as mentioned above in accordance with the wind speed at that time; otherwise, disastrous accident will be caused.

5. The machine shall not be operated in flammable or explosive gas and dust atmospheres and other dangerous places.

6. The altitude is below 1000m.

7. The tower crane classification group is A4.

8. The total power of tower crane is 71KW.

2.2 主要特点

XGL4015K-6 塔机是由徐州建机工程机械有限公司设计的新型建筑用塔机，该塔机为动臂变幅、上回转、自升式多用途塔机。主要适用于修建超高层建筑、居民住宅、高层工业建筑、大跨度工业厂房、体育场、桥梁、高大烟囱及筒仓等建筑工程。其起重臂有 42.51m、37.51m、32.51m、27.51m 四种臂长的组合，最大起重量为 6t。该机的主要特点如下：

(1)整机安装拆卸方便。起升机构、变幅机构均通过销轴连接安装于平衡臂上，拆卸安装极为方便。

(2)起升机构、变幅机构和回转机构均采用当今国际上先进可靠的调速方案，运行冲击小，工作更加平稳可靠。

(3)工作范围大，工作方式多，适用对象广。

(4)主要电气控制元件寿命长和可靠性高。控制系统自动化程度高，给司机提供安全、可靠、简便地操作。

(5)各种安全装置齐全。该塔机设有起升高度限位器、回转限位器、变幅限位器、力矩限制器、起重量限制器、风速仪、障碍灯以及各机构的制动器等安全装置，可保证塔机安全可靠的工作。

(6)整机布局合理、外形美观，安装、使用、维护及维修均非常方便。

2.2 Main features

Luffing-boom tower crane XGL4015K-6, which is a new-type tower crane for construction designed by Xuzhou Construction Machinery Co., Ltd. is a multi-purpose self-elevating tower crane characterized by its luffing boom, trolley slewing and upper slewing mechanisms. This tower crane is mainly used for construction works, such as, high-rise hotel, residential building, high-rise industrial building, long-span industrial workshop, stadium, bridge, chimney stalk and silo, etc. The crane boom is the combination of five boom lengths (42.51m、37.51m、32.51m、27.51m), and the maximum lifting capacity is 6t.The main characteristics are listed as follows:

1) It is very convenient to mount and demount the whole tower crane. The power unit, hoisting mechanism and luffing mechanism are installed on the turntable, which has reduced the requirements to installation. It is easy to mount and demount.

2) The lifting mechanism, luffing mechanism and slewing mechanism are adopted with speed-regulating technology which is leading to the industry and reliable, so that its running and operation is smoother and more reliable, and with smaller impact.

3) Large operating range, multi-style work and wide scope of application.

4) The elements for electrical control are imported, which are reliable and have long life. The control system is highly automating so at that it is convenient to operate tower crane and keep all the functioning data of tower crane under control. Thus the driver of tower crane can easily and safely operate the tower crane,

5) Complete safety devices.

This tower crane is equipped with many safety devices to ensure safe and reliable operation, including hoisting stopper, slewing stopper, trolley luffing stopper, moment limiter, lifting load limiter, anemometer, obstacle light and brakes of each mechanism.

6) The cab is space-capsule type and separately arranged which provides a nice view and creates a pleasant working environment for the operator.

7) Reasonable layout and pleasant appearance; easy to install, use and maintain.

2.3 术语

(1) 最大起重量 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)。

(2)起升高度 H

塔机运行或固定独立状态时，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。对于动臂塔机，起升高度分为最大幅度时起升高度和最小幅度时起升高度。

(3)幅度 R

起重机回转中心线至吊钩中心线的距离，也称工作幅度。

(4)最大起重力矩 M

最大额定起重量重力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。

(5)安全距离

塔机运动部分与周围障碍物之间的最小距离。

(6)工作状态

塔机处于司机控制之下，进行作业的状态(吊载运转、空载运转或间歇停机)。

(7)非工作状态

已经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。

(8)最大工作压力

正常操作状态下，液压回路或元件中的最大压力。

2.3 Terminology

(1) Maximum Lifting Capacity Q (see Figure 2-1)

It refers to the maximum permissible lifting weight of the crane under various safe conditions. The maximum mass is the sum of the weight of any part lower than the hook (excluding the weight of hook).

(2) Lifting Height H (see Figure 2-1)

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.

(3) Range R

It refers to the distance between the rotating centerline and centerline of the hook for the tower

crane, also known as the working range.

(4) Maximum Hoisting Moment M

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) Safe Distance

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

(6) Working State

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

(7) Non-working State

It refers to the condition where the installed and erected crane will not carry load, all the mechanisms stop working, power supply is cut off and wind protection measures are taken.

(8) Maximum Working Pressure

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

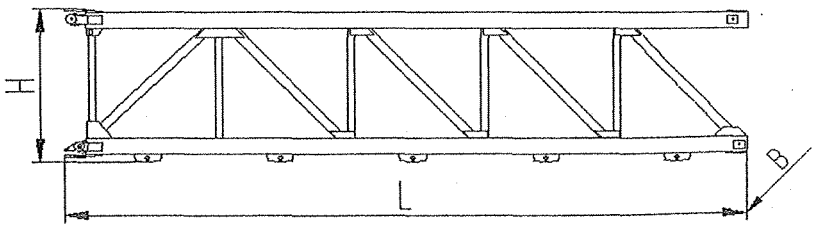
2.4 塔机性能参数

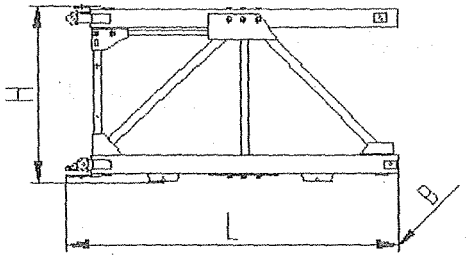
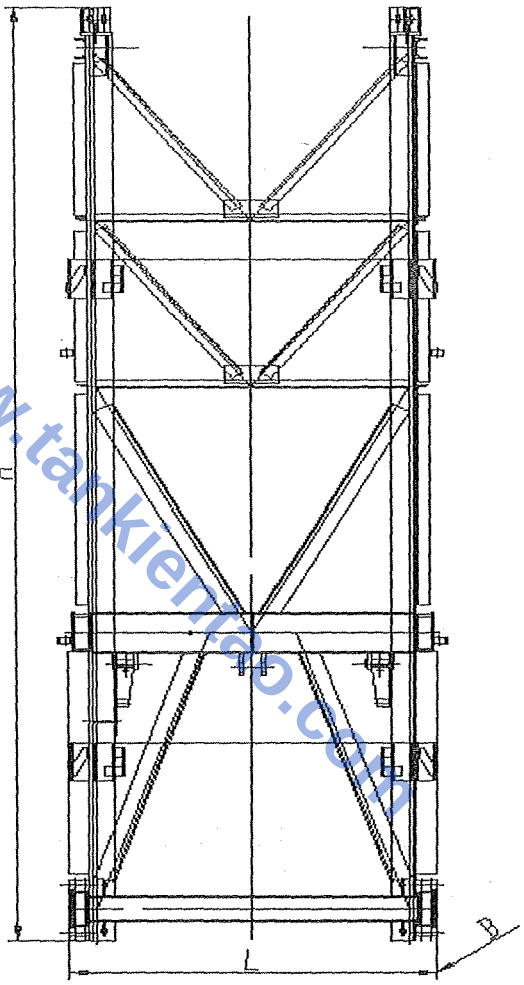
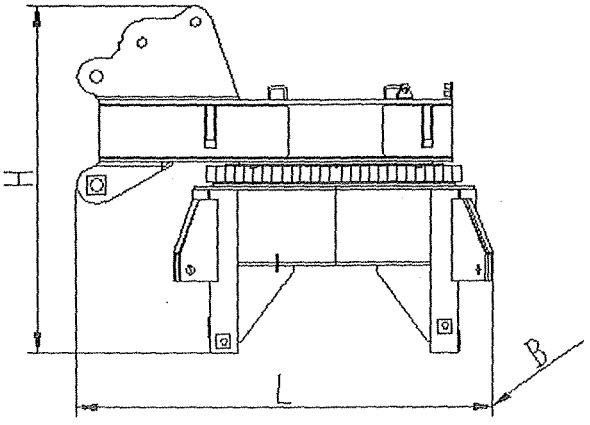
(1) 塔机外形尺寸和部件组成(见表 2-1)

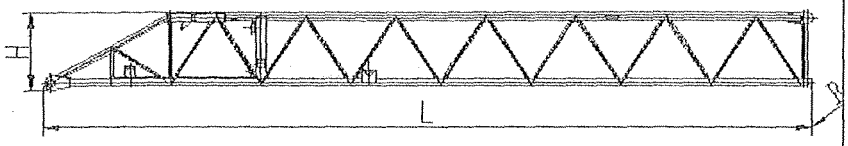
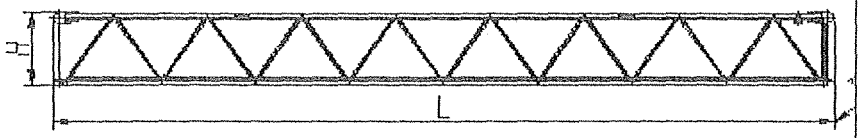
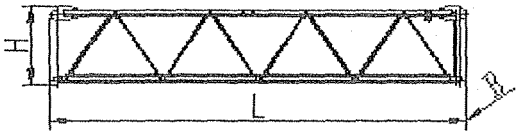
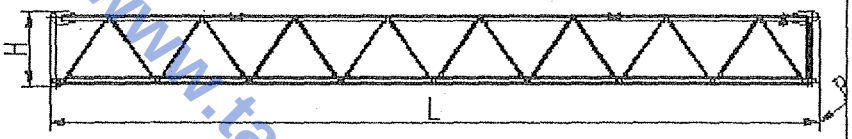
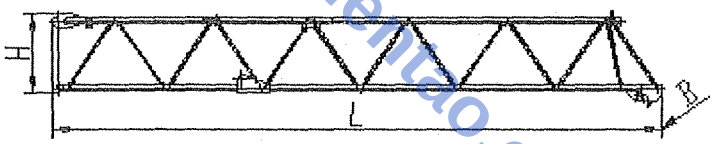
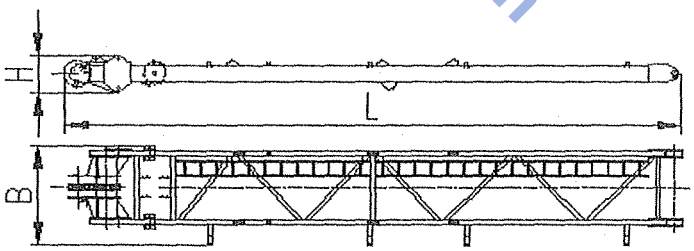
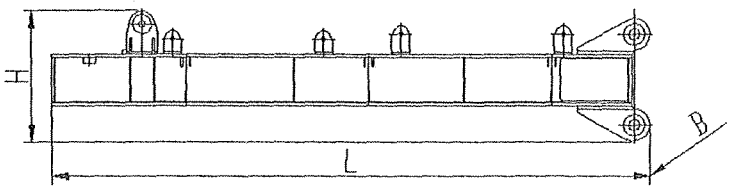
2.4 Tower Crane Performance Parameters

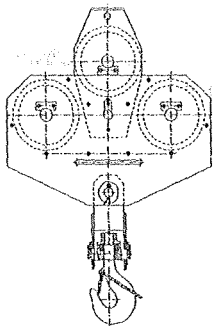
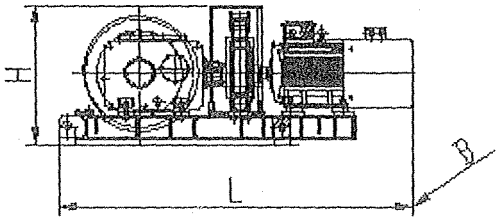
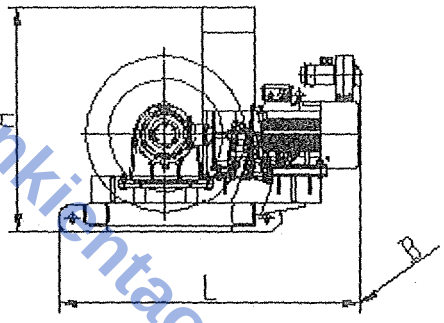
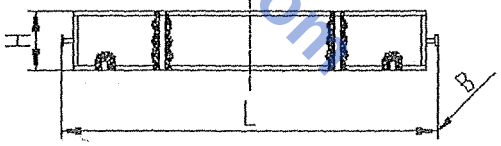
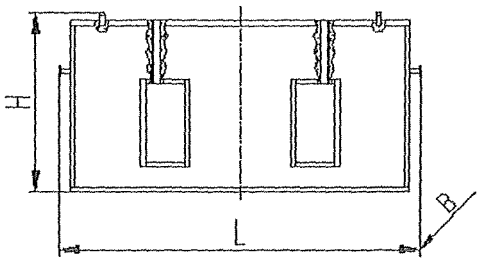
(1) Dimensions and components of fixed tower cranes (see Table 2-1)

表 2-1Table 2-1

序号 No.	总成名称 Unit Name	简图 Sketch	尺寸 Size (m)
1	基础节 Basic mast		L=7.76 B=1.29 H=1.34

2	标准节 Tower mast		L=3.26 B=1.29 H=1.34
3	顶升套架 Jacking frame		L=1.79 B=1.76 H=6.79
4	回转总成 Slewing unit		L=2.53 B=1.93 H=2.09

5	起重臂 jib	节 1 Jib 1		L=10.14 B=1.05 H=1.03
		节 2 Jib 2		L=10.16 B=1.05 H=0.97
		节 3 Jib 3		L=5.16 B=1.05 H=0.96
		节 4 Jib 4		L=10.16 B=1.05 H=0.96
		节 5 Jib 5		L=7.60 B=1.19 H=1.14
6	A 形架 A-frame			L=10.63 B=1.53 H=0.69
7	平衡臂 Counter jib			L=4.58 B=1.36 H=1.05

8	吊钩 Hook			L=0.80 B=0.31 H=1.48
9	起升机构 Lifting mechanism			L=1.66 B=1.82 H=1.03
10	Luffing mechanism			L=1.79 B=1.71 H=1.05
12	配重 Counterweight	配重 1 CW1		L=2.90 B=0.50 H=0.50
		配重 2 CW2		L=2.90 B=0.50 H=1.53

(2) 起重性能特性

(2) Lifting performance characteristics

1) 塔机配置 42.51m 起重臂时的起重性能特性(见表 2-2)

1) The tower crane lifting performance characteristics with 42.51m jib. (Table 2-2)

表 2-2 42.51m 起重臂起重性能特性表

Table 2-2 Lifting Performance of 42.51m jib

幅度 (m) Radius (m)		Max (m/kg)	10	15	20	25	30	35	40
起重量 Load (kg)	2 倍率 2-fall	3.685-27m 3000kg	3000				2558	1960	1500
	4 倍率 4-fall	2.65-16.1m 6000kg	6000		4558	3331	2495	1890	1433

2) 塔机配置 37.51m 起重臂时的起重性能特性(见表 2-3)

2) Lifting performance for37.51m jib (Table 2-3)

表 2-3 37.51m 起重臂起重性能特性表

Table 2-3 Lifting Performance of 37.51m jib

幅度 (m) Radius (m)		Max (m/kg)	10	15	20	25	30	35
起重量 Load (kg)	2 倍率 2-fall	3.162-28m 3000kg	3000				2781	2150
	4 倍率 4-fall	3.162-16.7m 6000kg	6000		4799	3551	2701	2084

3) 塔机配置 32.51m 起重臂时的起重性能特性(见表 2-4)

3) Lifting performance for32.51m jib (Table 2-4)

表 2-4 32.51m 起重臂起重性能特性表

Table 2-4 Lifting Performance of 32.51m jib

幅度 (m) Radius (m)		Max (m/kg)	10	15	20	25	30
起重量 Load (kg)	2 倍率 2-fall	2.639-29m 3000kg	3000				2900
	4 倍率 4-fall	2.639-17.12m 6000kg	6000		4962	3699	2835

4) 塔机配置 27.51m 起重臂时的起重性能特性(见表 2-5)

4) Lifting performance for27.51m jib (Table 2-5)

表 2-5 27.51m 起重臂起重性能特性表

Table 2-5 Lifting Performance of 27.51m jib

幅度 (m) Radius (m)		Max (m/kg)	10	15	20	25
起重量 Load (kg)	2 倍率 2-fall	2.12-25m 2900kg	3000			
	4 倍率 4-fall	2.12-16.81m 6000kg	6000		4871	3630

(3) 整机技术参数表(见表 2-6)

(3)Technical performance table of the crane (Table 2-6)

表 2-6 整机技术参数表

Table 2-6 Technical Performance of the Crane

机构工作级别 Mechanism working level		起升机构 Lifting mechanism	M5				
		回转机构 Slewing mechanism	M4				
		变幅机构 Luffing mechanism	M4				
		顶升机构 Jacking mechanism	M1				
最大起重量（t） Max lifting capacity (t)		6					
起重臂长度（m） Jib length		42.51	37.51	32.51	27.51		
最小幅度（m） Minimum radius		3.69	3.17	2.65	2.13		
最大幅度（m） Maximum radius		40.00	35.17	30.34	25.51		
臂根铰点高度（m） Hinged point height at jib root		36.65					
附着高度（m） Attached height		135.65					
平衡重（t） Counterweight		6.2					
起升机构 Lifting mechanism	倍率 Fall	2			4		
	速度（m/min） Speed	75	56	38	38	28	19
	起重量（t） Lifting capacity	0.75	1.5	3	1.5	3	6
	功率（kW） Power	22					
回转机构 Slewing mechanism	速度（r/min） Speed	0.6					
	功率（kW） Power	5.5					
变幅机构 Luffing	变幅时间（min） Luffing time	2.8					

mechanism	功率（kW）Power	22
顶升机构 Jacking mechanism	速度（m/min）Speed	0.5
	功率（kW）Power	7.5
	工作压力(MPa) Working pressure	25
总功率（kW）Total power (kW)		49.5（不含顶升）(Excluding jacking)
电源要求 Power supply		380V±10%、50Hz
工作温度 Ambient temperature		-20～40℃

(4) 机构技术性能参数表(见表 2-7)

(4) Technical parameters of mechanisms (see Table 2-7)

表 2-7 电动机机构技术性能参数表

起升机构 Lifting mechanism	单绳额定拉力 Rated pull of single rope	钢丝绳直径 Rope diameter	钢丝绳长度 Rope length	卷筒容绳量 Rope capacity
	1.5(t)	Φ12(mm)	420(m)	400(m)
	减速机的传动比 Drive ratio of reducer	电机型号 Motor model	功率 Power	转速 Rotary speed
	40.2	YZP2-180L-4B 30L	22(kW)	1440(r/min)
变幅机构 Luffing mechanism	单绳牵引力 Traction force of single rope	钢丝绳直径 Rope diameter	钢丝绳长度 Rope length	卷筒容绳量 Rope capacity
	2.5(t)	Φ16(mm)	225(m)	200(m)
	减速机的传动比 Drive ratio of reducer	电机型号 Motor model	功率 Power	转速 Rotary speed
	38.5	YZP2-200L1-6B 30L	22(kW)	965(r/min)
	制动器型号 Brake model	YQP50-D-940×20(pump) XYYZ-17/8(Brake)		

回转机构 Slewing mechanism	回转支承型号 Slewing bearing model	011.45.1250			
	减速机的传动比 Drive ratio of reducer	电机型号 Motor model		转速 Rotary speed	
	195	YTRVFW132M1-6F1 5.5kW		900(r/min)	
	机构输出齿轮 Output gear of mechanism			回转支承齿轮 Gear of slewing bearing	
	模数 Modulus	齿数 Tooth number	变位系数 Modification coefficient	齿数 Tooth number	变位系数 Modification coefficient
	12	15	+0.5	118	+0.5

第3章 安装条件

Chapter 3 Installation Requirements

3.1 固定式基础

固定式塔机的混凝土基础，用户可以根据现场的地基承压力和所需要的塔机独立高度选择基础的大小，并浇注混凝土基础。当配置的基础图不能满足现场条件时，用户可以根据载荷参数设计基础图或与我公司联系。

3.1.1 地基承压力的计算和基础的选择

M_v:倾翻力矩(KN*m)　F_h:水平力(KN)　F_g:基础重量(KN)

F_v:塔机重量(KN)　b:基础尺寸(m)　e:偏心距(m)

T:扭矩(KN*m)　p_B:地耐力(KN/m²)

$[p_B]$:许用地耐力(KN/m²)

$$e=\frac{M_v+F_h*h}{F_v+F_g}\le\frac{b}{3}\quad p_B=\frac{2(F_v+F_g)}{3bl}\le[p_B]$$

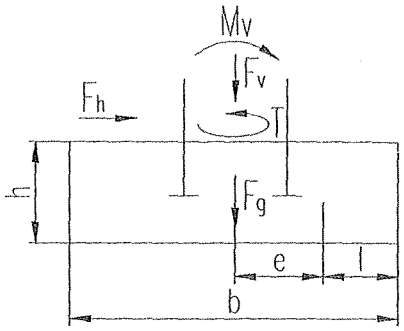


图 3-1

上述代号见图 3-1。

3.1.1.1 载荷参数(见表 3-1)

3.1 Fixed Base

Concrete base of fixed tower cranes: users can choose the base size and pour concrete base according to the on-site ground bearing pressure and required stand-alone height of the crane. When the base drawing provided fails to meet the site conditions, users can refer to the base drawing of load parameter design or contact us.

3.1.1 Calculation of ground bearing pressure and base selection

M_v: tilting moment (KN*m)　F_h: horizontal force (KN)　F_g: base weight (KN)

F_v: tower crane weight (KN)

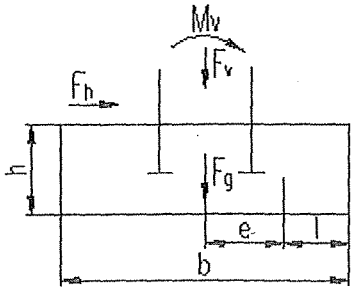
b: base size (m)

e: eccentric distance (m)

p_B: ground endurance (KN/m²)

$[p_B]$: permissible ground endurance (KN/m²)

$$e=\frac{M_v+F_h*h}{F_v+F_g}\le\frac{b}{3}\quad p_B=\frac{2(F_v+F_g)}{3bl}\le[p_B]$$



Above codes are shown in Figure 3-1. Figure 3-1 Schematic Diagram of Load

3.1.1.1 Load parameters (see table 3-1)

表 3-1 载荷参数表

Table 3-1 List of Load Parameters

塔身独立高度 Independent height	工作状态 Working state				非工作状态 Non-working State			
	M_v	F_h	F_v	T	M_v	F_h	F_v	T
36.65m	1827	31	461	153	2630	101	402	0

3.1.1.2 基础选用见表 3-2

3.1.1.2 See table 3-2 for base selection

表 3-2 基础选用表

Table 3-2 Base Selection List

基础尺寸重量、参数 Base size, weight and parameters			塔机 36.65m 高度对应的地耐力(KPa) Ground endurance corresponding to tower crane height of 36.65m (KPa)
b(m)	h(m)	Fg(t)	39.7m
5.8	1.7	137.3	0.16
6.4	1.7	167.1	0.12

3.1.2 混凝土基础

混凝土基础图见附图，采用整体钢筋混凝土基础时，对基础的基本要求如下：

(1) 混凝土强度等级不小于 C35。

(2) 基础开挖至老土找平(基础承载力必须达到表 3-2 中要求)，回填 100mm 左右卵石夯实，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，周边配模拆除以后回填卵石。

(3) 进行固定支脚预埋时，需用基础节连接固定支脚或采用基础工装连接固定支脚和标准节。需要进行调整固定支脚的放置位置，确保基础节安装后的水平度小于 1/750，其中心线与水平面垂直度误差为 1.5/1000。

3.1.2 Concrete base figure is shown in the following. Integral reinforced concrete foundation must be adopted. Basic requirements for the base are as follows:

1) Strength level of concrete should not be lower than C35.

2) Excavate the base until the natural soil leveling layer is reached (bearing capacity of the base must meet the requirements in Table 3-2). Backfill with about 100mm cobbles and tamp it. Pouring concrete to the bars shall be done after the surrounding is configured with formworks or bricklaying

is finished. The surrounding ground shall be at least 100mm lower than the base to facilitate drainage. Backfilling of cobbles shall be done after the surrounding formworks have been configured and dismantled.

3) The concrete filling rate under the base plate of small-outrigger base shall be over 95%, the levelness of the upper plane of four base plates shall be ensured, and the permissible embedded depth of the base plate into the concrete ranges from 5 to 6 mm.

4) The relative positions of the four-group anchor bolts of small-outrigger base shall be accurate. After assembly, be sure the diagonal error of the anchor bolt hole is no greater than 2mm to ensure proper installation of basic mast.

5) Adding gasket between base seat of small-outrigger and the base plates is allowed. The area of gasket must be greater than 90% of base plate area and the number of gaskets for each outrigger shall be no more than two. Make sure the levelness of fixed basic mast is less than 1/750 after installation and the verticality error between its centerline and horizontal plane is 1.5/1000.

3.2 塔机接地

为避免雷击，塔机主体结构和所有电气设备的金属外壳、导线的金属保护管均应可靠接地，其接地电阻应不大于 4Ω。采用多处重复接地时，其接地电阻应不大于 10Ω。为防止触电，所有电气设备的金属外壳、导线的金属保护管均进行接地，其接地电阻不大于 4Ω。要求避雷接地体和防漏电接地体分别放置，并离开一定距离。

接地体的电阻应很小，接地体应埋在潮湿的地方。如果土壤导电不良，有必要在凹处埋入氯化钠，然后灌水。

接地体的引出铜导体的截面面积≥25㎜²，常用的接地方式如下：

(1)接地桩采用正规的接地桩、等边角钢 L70×7 长 1.5m、钢管 Φ33×4.5 长 1.5m，进行立埋(见图 3-2)。

(2)接地板采用钢板或其他可延金属板制作，面积为 1m2，板的宽度≥150㎜，进行立埋(见图 3-3)。

(3)埋导线采用截面≥28㎜²的铜导体或截面≥50㎜²的铁导体埋入地下，其埋置长度决定于接地电阻的大小(见图 3-4)。

3.2 Tower Crane Grounding

In order to prevent lightning stroke, main structure of tower crane, motor frame, metal case of

any electrical equipment as well as metal protective tubes of the wires shall be reliably grounded, and grounding resistance shall not be greater than 4Ω.Grounding resistance shall not exceed 10Ω when multiple grounding is applied. In case of electric shock, all the metal covers of electrical equipment and wires need to be grounded.

The resistance of grounding body shall be extremely small, and the grounding body shall be buried in damp areas. If conductivity of the soil is poor, it is necessary to embed sodium chloride in the sunken places and then pour water into it.

Cross section area for outlet cooper conductor of the grounding body is greater than or equal to 25mm2, and common grounding methods are listed as follows:

1. Regular ground stud is applied and vertically buried, with equal angle steel (L70×7) of 1.5m and steel pipe (φ33×4.5) of 1.5m (see Figure 3-4).

2. Ground plate is made of steel plate or other extensible steel plates and is vertically buried, with an area of $1m^2$ and a width greater than or equal to $150mm^2$ (see Figure 3-5).

3. Buried wire is buried underground through copper conductors (sectional area is greater than or equal to $28mm^2$) or iron conductors (sectional area is greater than or equal to $50mm^2$), and its embedment length is dependent upon the value of grounding resistance (see Figure 3-6).

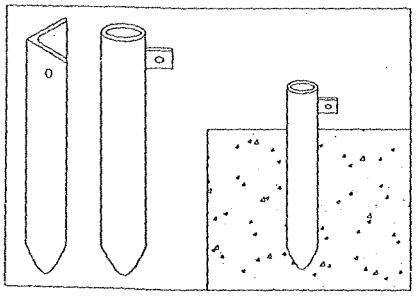


图 3-2 接地桩图

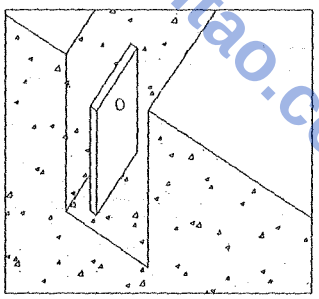


图 3-3 接地板图

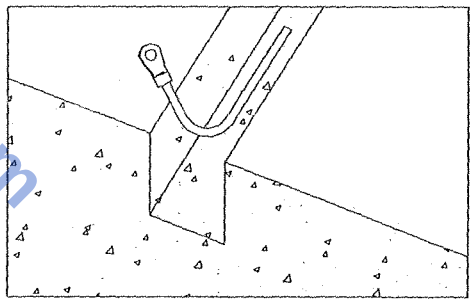


图 3-4 埋导线

Figure 3-2 Ground stud **Figure 3-3 Ground plate** **Figure 3-4 Buried wire**

3.3 塔机平衡重

混凝土平衡重图见附图，本塔机平衡重为混凝土平衡重。平衡重具有三块，两块为相同的 2.3t，另一块为 1.6t。平衡重安装定位于平衡臂上。为保证安全，具有锁紧平衡重的螺杆。

3.3 Counterweight of tower crane

The drawing of counterweight is enclosed with the Instruction. The counterweight of tower crane is concrete, 2 kinds (one is 2.3t, two block and another is 1.6t). Counterweights are installed

on counter jib and the 6.2t counterweight is at below. For easy and safe installation, 6.2t counterweight has positioning pins and screw rods to lock counterweights.

第 4 章初始安装

Chapter 4 Initial Installation

4.1 安装程序规则

(1) 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。

(2) 安装架设时塔机顶部风速不大于 12m/s。

(3) 混凝土基础具有 80%以上强度时才能进行立塔工作。

(4) 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) 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) 立塔安装必须按照立塔说明顺序进行安装。

(7) 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) 对所吊物品的重心和重量不清楚时必须进行试吊。

(9) 在未安装完成前，不能用塔机吊运载荷。

(10) 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) 开口销的安装必须正确（见图 4-1），要求使用新的或状态良好的开口销。

4.1 Installation Procedures and Rules

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

(2) The wind speed at the top of the tower crane during installation and erection is not greater than 12m/s.

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

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

(5)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.

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

(7)Be careful when hoisting the tower crane parts by using a truck crane, and make sure that truck crane is reliably supported, the range and lifting weights are matched, it is not overloaded and

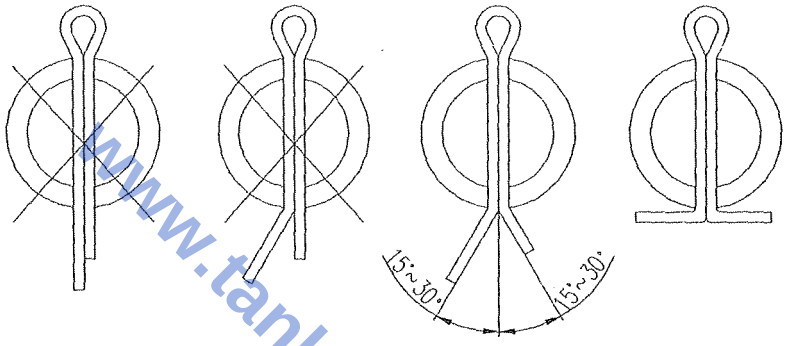
the position of lifting point is accurate.

(8)Test lifting must be made if the center of gravity and weight of the lifting objects are unknown.

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

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

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



不好 不好 好 有障碍物时

Unacceptable Unacceptable Acceptable With Obstacles

图 4-1 开口销的安装

Figure 4-1 Installation of Cotter Pins

(12) 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) 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) 安装过程中需要导向绳，防止起吊货物旋转引发事故。

⚠ 注意 在安装过程中，如果遇到特殊问题或其他困难，请与我公司联系。

4.2 汽车吊的选择

(1) 该安装程序是先用辅助汽车吊将塔机安装成较低的高度，后采用顶升加节的方式将塔机升至独立高度。

(2) 汽车吊的基本性能主要由初始安装所需要吊起物件的高度和重量及空间要求决定，下面给出主要部件需要的吊装高度(最高点距基础上表面的距离)和起吊重量（见表 4-1)。主要部

件的外形尺寸见第二章表 2-1。

(12) 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.

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

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

Caution **Please contact us if you have any special problems or other difficulties during installation.**

4.2 Selection of Truck Crane

1. Installation process to be followed: firstly, adjust the tower crane to a lower position via an auxiliary truck crane, and then hoist the tower crane to a stand-alone height by jacking and adding sections.

2. Basic performance of the truck crane is mainly determined by the height, weight and space requirements of objects to be lifted during initial installation. The hoisting heights (distance between the peak and upper surface of the base) of main components and the height to be reached by the hook of truck crane are shown as follows (see Table 4-1).See Table 2 in Chapter 2 for the dimensions of main components.

表 4-1 汽车吊选择参数表

Table 4-1 Parameters Selected by Truck Crane

序号 No.	名称 Name	吊装高度 Lifting height	起吊重量 Lifting Weight
1	安装基础节 Installation of base mast	10.0m	3072kg
2	安装一节加强节 Installation of one strengthened mast	13.0m	1259kg
3	安装爬升架 Installation of climbing frame	20.0m	3615kg

4	安装回转总成 Installation of slewing unit	16.0m	4500kg
5	安装平衡臂 Installation of counter jib	16.0m	2726kg
6	安装起升机构 Installation of Hoisting mechanism	16.0m	1050kg
7	安装变幅机构 Installation of Luffing mechanism	16.0m	1720kg
8	安装平衡重 Installation of counterweight	16.0m	2300kg
9	安装塔顶 Installation of tower top	26.0m	3280kg
10	安装起重臂 Installation of jib	30.0m	3418kg

4.3 安装前需核准事项

(1) 塔机的布置位置是否合理。

(2) 塔机的基础及地基处理是否符合要求。

(3) 塔机的爬升方案是否确定、合理。

(4) 塔机安装是否有足够的场地、施工完成后是否便于拆卸。

4.3 Inspections before installation

(1) Whether the position of tower crane is reasonable.

(2) Whether the foundation and ground base meet the requirements.

(3) Whether the program of tower crane jacking is reasonable.

(4) Whether there is sufficient space and site for erecting and demounting.

4.4 安装前准备

(1) 基础铺设经测量达到使用标准后，即可准备安装。

(2) 根据塔机部件尺寸及重量准备安装工具并组织安装人员到位。

(3) 根据现场情况准备安装用的起重机及相应的起重工具。

4.4 Preparations before installation

(1) The foundation and base have meted the requirements.

(2) All the tools and equipments for tower crane and its installation are prepared, as well as the installation personnel.

(3)Truck crane for installation is on site and other related lifting tools.

4. 5 安装工艺流程

4.5Installation procedure

表 4-2 塔机安装工艺流程表

Table4-2The Installation procedure of tower crane

步骤	内容
第 1 步	塔机基础的预埋(场内)
第 2 步	塔机的检查维修保养(场外)
第 3 步	塔机进场
第 4 步	汽车吊就位吊装区域
第 5 步	零部件分装
第 6 步	安装基础节
第 7 步	安装一节加强节
第 8 步	安装套架
第 9 步	安装回转总成
第 10 步	安装平衡臂
第 11 步	安装平衡重
第 12 步	安装塔顶
第 13 步	安装起重臂
第 14 步	穿绕钢丝绳
第 15 步	安装检修绳
第 16 步	电气安装
第 17 步	塔机安装调试及检查

Steps	Contents
Step 1	Pre-embedding foundation of tower crane (in the field)
Step 2	Repair and maintenance of tower crane (out of the field)
Step 3	Move in the tower crane
Step 4	Prepare and position truck crane in erecting area
Step 5	Assembly of parts
Step 6	Installing base mast
Step 7	Installing one strengthened mast section
Step 8	Installing climbing frame
Step 9	Installing slewing assembly
Step 10	Installing counter jib
Step 11	Installing counterweight
Step 12	Installing tower top
Step 13	Installing jib
Step 14	Installing steel wire rope
Step 15	Installing and inspecting rope
Step 16	Installing electrical equipment
Step 17	Debugging and inspection of tower crane

4.6 独立固定式塔机立塔

先进行零部件的安装，可降低安装难度，节约安装时间，减少安装费用。

4.6.1 安装基础节（见图 4-2）

将基础节吊起后放置在小支腿上面，找正位置后缓慢放下。用销轴（Φ65×164），插销（Φ20×183.5）和开口销(GB/T91-5×40)将基础节和小支腿进行连接。注意基础节上有踏步的一面要垂直于建筑物，以便于拆塔。

4.6 Erection of stationary tower crane

Do the assembly of parts at first to reduce the installation time and expense and easily installation.

4.6 .1Installing basic mast (Figure 4-2)

Place basic mast on the small outriggers rightly and connect it with the outriggers together using pin shaft (Φ65×164) and cross pins (φ20×183.5) as well as cotter pins (GB/T91-5×40). Assure that the step side of basic mast is vertical to building for easy dismantling.

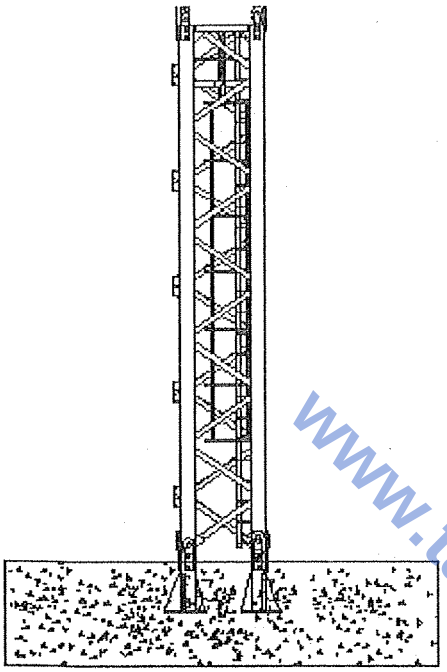


图 4-2 基础节安装示意图

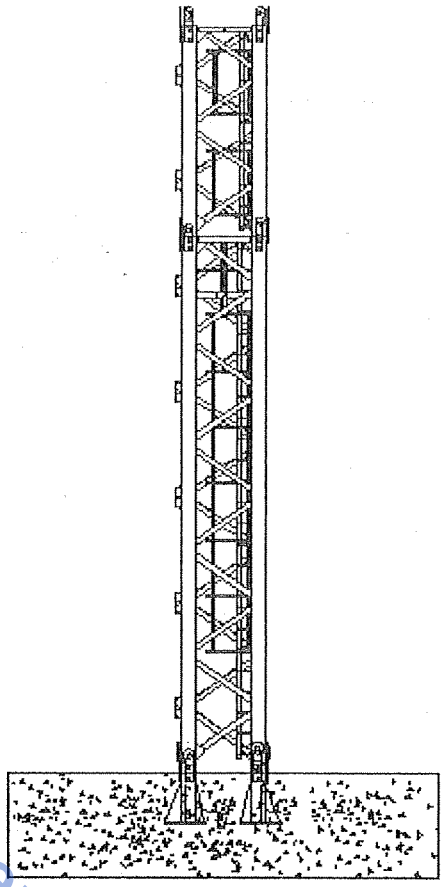


图 4-3 加强节安装示意图

Figure 4-2 Basic mast installationFigure 4-3strengthened mast installation

4.6.2 安装一节加强节（见图 4-3）

将加强节吊起后放置在基础节上面，找正位置后缓慢放下。用销轴((φ55×141)，插销(φ20×183.5)和开口销(GB/T91-5×40)将基础节和标准节进行连接。安装时标准节踏步与基础节踏步处于同一平面。

4.6.2 Installing one mast (Figure 4-3)

Set the strengthened mast on basic mast rightly and connect them together by pin shaft ((φ55×141) and cross pins (φ20×183.5) as well as cotter pins (GB/T91-5×40). During mounting, mast step is at the same plane with basic mast step.

4.6.3 安装顶升横梁(见图 4-4)

将顶升横梁吊至基础节焊有顶升踏步一侧，当顶升横梁的挂靴位于基础节的第二个踏步位置时（从下往上数踏步），将顶升横梁的挂靴挂在踏步上。

4.6.3 Jacking beam installation (Figure 4-4)

Lift the jacking beam to one side of the basic mast that is welded with climbing lugs, and and

hang on the pothook of jacking beam on the second step (numbered from bottom to top) of basic mast.

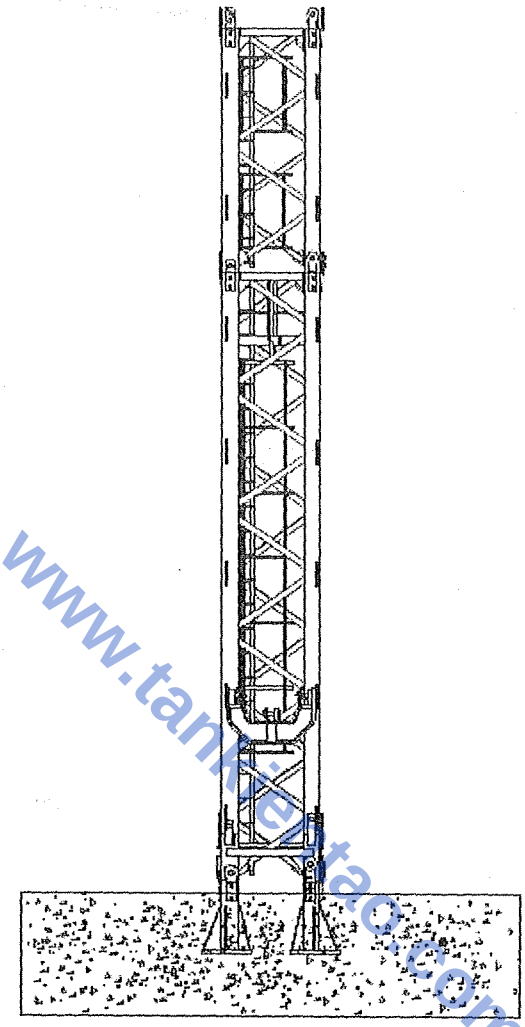


图 4-4 顶升梁安装示意图

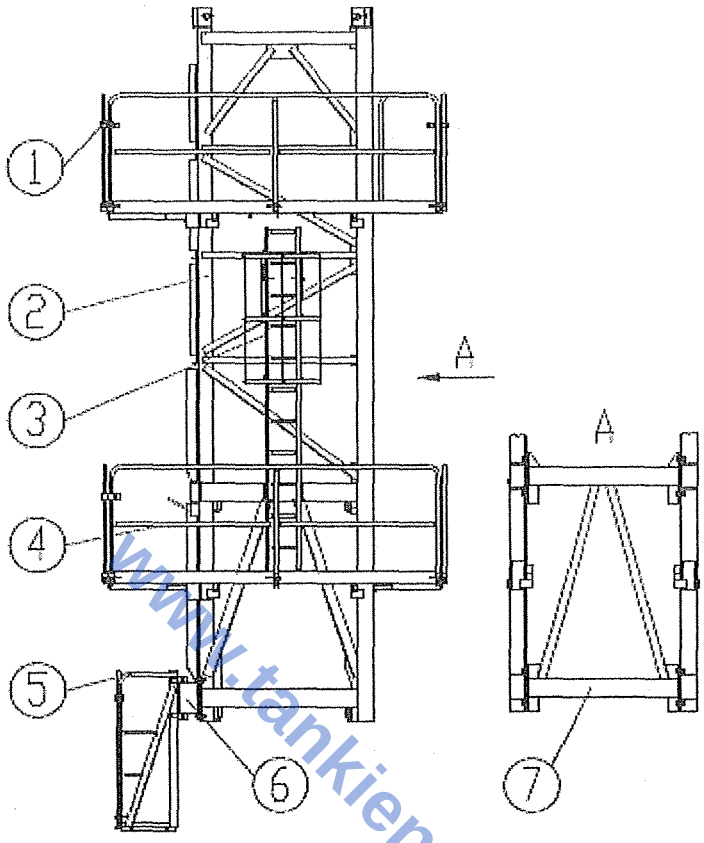
Figure 4-4 Jacking beam installation

4.6.4 安装爬升架

爬升架的装配包括安装套架上层平台、下层平台、套架爬梯和顶升油缸，拼装完成后吊装爬升架；然后安装小平台；最后缓慢伸出油缸，将油缸与顶升横梁进行连接。爬升架组成见图 4-5。

4.6.4 Installing climbing frame

The assembly of climbing frame includes mounting upper and lower platforms of the frame, ladders and jacking oil cylinder. And after assembly, hoist and mount the climbing frame. Then install the small platform; extend oil cylinder slowly to connect it with jacking beam. The components of climbing frame are shown in Figure 4-5.



1、上平台 2、爬升架结构 3、爬梯 4、下平台

5、小平台 6、爬升架后梁 7、爬升架前片

图 4-5 爬升架组合示意图

1. Upper platform 2. Climbing frame structure 3.Ladder 4. Lower platform

5. Small platform 6. Rear beam of climbing frame 7. Front piece of climbing frame

Figure 4-5 Components of climbing frame

4.6.4.1 爬升架拼装

用特制铰制孔螺栓将爬升架后梁与爬升架结构进行连接，共用 8 套螺栓（每套含 1 个螺栓 M22×77，1 个垫片，1 个螺母 M22）。

用特制铰制孔螺栓将爬升架前片与爬升架结构进行连接，共用 16 套螺栓（每套含 1 个螺栓 M22×62，1 个垫片，1 个螺母 M22）。

注意 **爬升架的铰制孔螺栓的预紧力矩为 350N•m。**

4.6.4.1 Assembly of climbing frame

Fix the rear beam of climbing frame and the frame structure together by special hinged bolts (8

sets, each set including one bolt M22×77, one washer and one nut M22).

Fix the front piece of climbing frame and the frame structure together by special hinged bolts (16 sets, each set including one bolt M22×62, one washer and one nut M22).

Caution The pre-tension torque of hinged bolts of climbing frame is 350N•m.

4.6.4.2 安装上层平台

爬升架上层平台及栏杆的具体安装位置见图 4-6，夹板安装见图 4-7。将各个平台吊至相应位置后与爬升架结构进行连接。用开口销(GB/T91-10×100)将栏杆安装在平台上。最后用 6 套螺栓(每套螺栓包含 1 栓 1 母，螺栓 GB/T5782-M14×70、螺母 GB/T6172.1-M14)分别将 12 件夹板安装在栏杆上。

4.6.4.2 Mounting upper platform

The specific mounting positions of upper platform and railing of climbing frame are shown in Figure 4-6. The mounting of splint is shown in Figure 4-7. Hoist each platform to its mounting position and connect it with the climbing frame. Mount the railings on platform by cotter pins (GB/T91-10×100). At last fix 12 clamp plates on railing by 6 sets of bolts (each set of bolt includes one bolt of GB/T5782-M14×70and one nut of GB/T6172.1-M14)

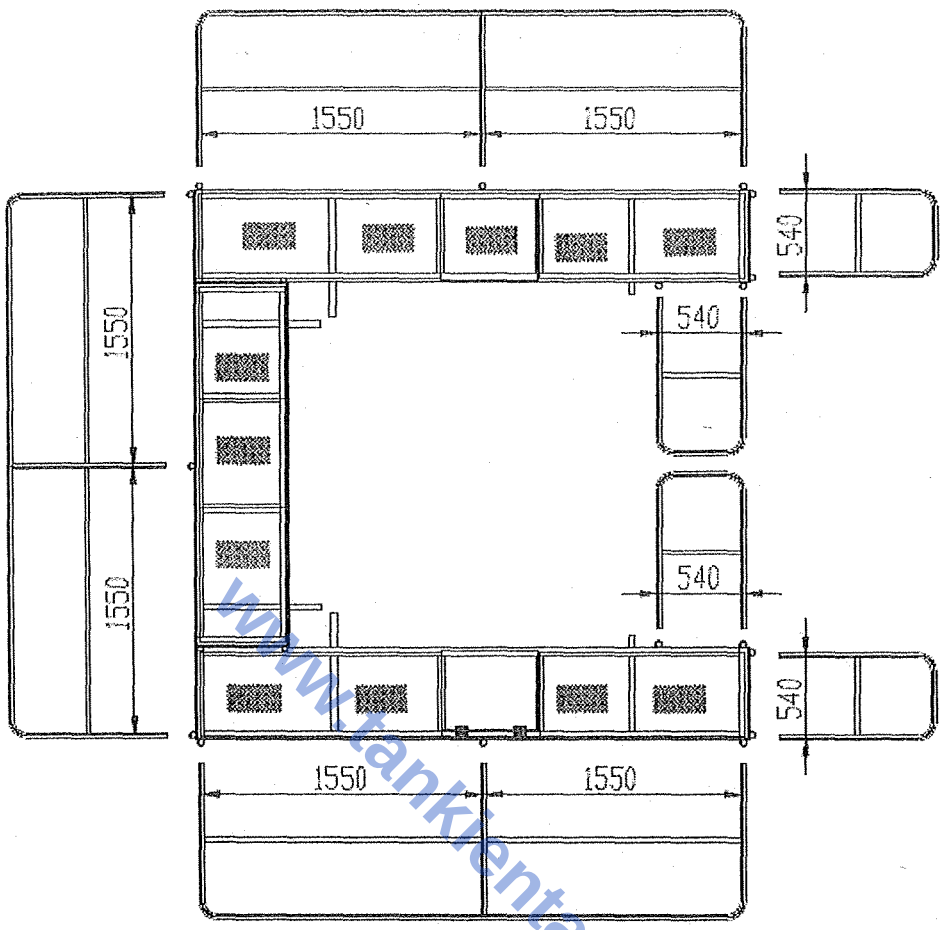
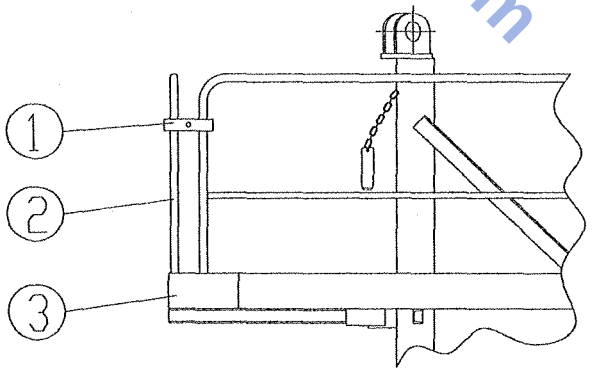


图 4-6 上层平台及栏杆示意图

Figure 4-6 upper platform installation



1、夹板 2、栏杆 3、平台

1. Splint 2.railing 3.platform

图 4-7 夹板安装示意图

Figure 4-7 clamp plates installation

4.6.4.3 安装下层平台

爬升架上层平台及栏杆的具体安装位置见图 4-8，夹板安装见图 4-7。将各个平台吊至相应位置后与爬升架结构进行连接。用开口销(GB/T91-10×100)将栏杆安装在平台上。最后用

4 套螺栓(每套螺栓包含 1 栓 1 母，螺栓 GB/T5782-M14×70、螺母 GB/T6172.1-M14)分别将 8 件夹板安装在栏杆上。

4.6.4.3 Mounting lower platform

The specific mounting positions of lower platform and railing of climbing frame are shown in Figure 4-8. The mounting of Splint is shown in Figure 4-7. Hoist each platform to its mounting position and connect it with the climbing frame. Mount the railings on platform by cotter pins (GB/T91-10×100). At last fix 8 clamp plates on railing by 4 sets of bolts (each set of bolt includes one bolt of GB/T5782-M14×70and one nut of GB/T6172.1-M14).

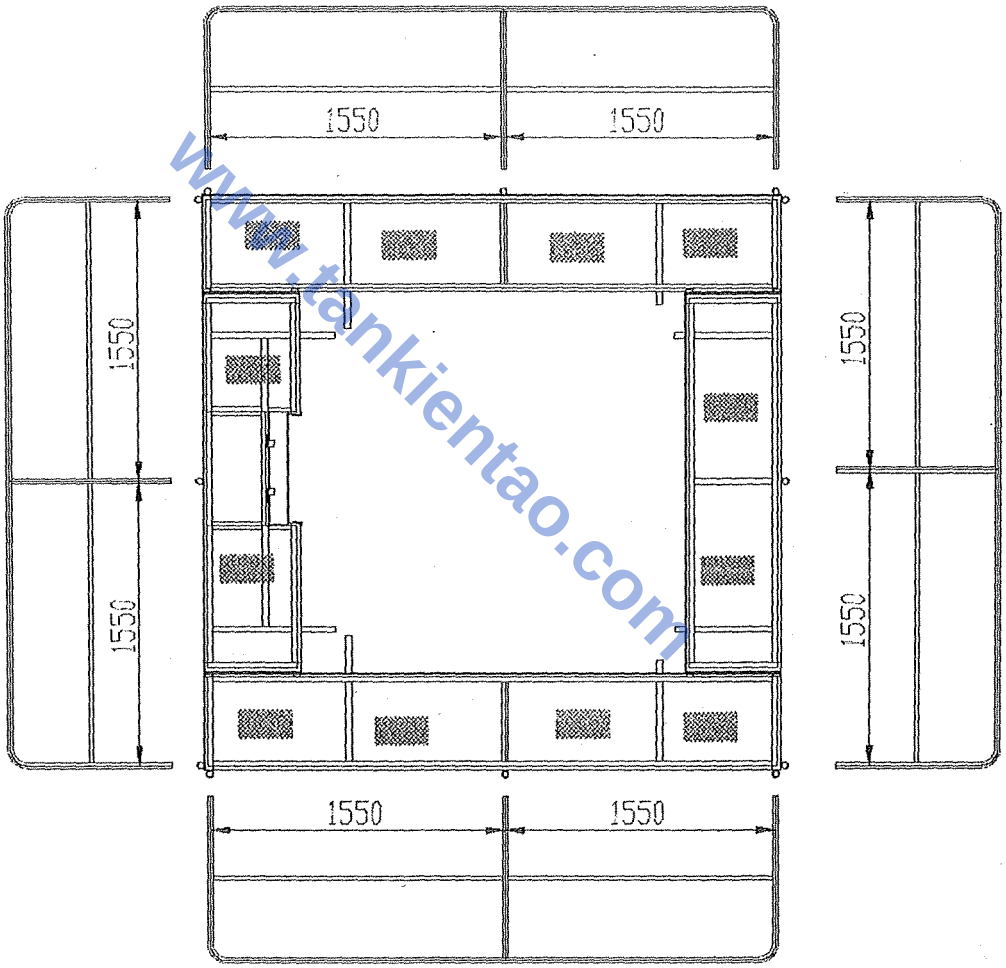


图 4-8 下层平台及栏杆示意图

Figure 4-8 lower platform installation

4.6.4.4 安装爬梯

将爬梯吊至相应位置后，用开口销(GB/T91-10×100)将爬梯安装在爬升架结构上。

4.6.4.5 安装顶升油缸

将顶升油缸吊至安装位置后，用带头销轴（φ50×140）和开口销(GB/T91-10×100)将油

缸和爬升架连接起来，然后使顶升油缸处于自然垂直状态后进行捆绑，防止顶升油缸在安装过程中晃动。安装时液压缸的端头朝上，液压杆的端头朝下。

4.6.4.6 安装操作杆（见图 4-9）

用螺母（GB/T6172.1-M14）和垫片（GB/T93-14）将操作杆安装在爬升架上。

4.6.4.4 Mounting ladder

Hoist the ladder to it mounting position and mount it on climbing frame structure by cotter pins (GB/T91-10×100).

4.6.4.5 Mounting jacking oil cylinder

Hoist the jacking oil cylinder to its mounting position and connect it with climbing frame by headed pin shafts (φ50×140) and cotter pins (GB/T91-10×100). After the oil cylinder is in natural state, tie it up to prevent it swaying in mounting process. During mounting, the head of hydraulic cylinder is upward and the head of hydraulic rod is downward.

4.6.4.6 Mounting joystick (Figure 4-9)

Mount the joystick on the climbing frame by nut (GB/T6172.1-M14) and washer (GB/T93-14).

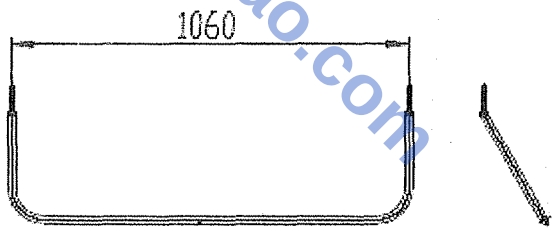


图 4-9 操作杆示意图

Figure 4-9 Joystick

4.6.4.7 爬升架整体吊装（见图 4-10）

4.6.4.7 Climbing frame installation (Figure 4-10)

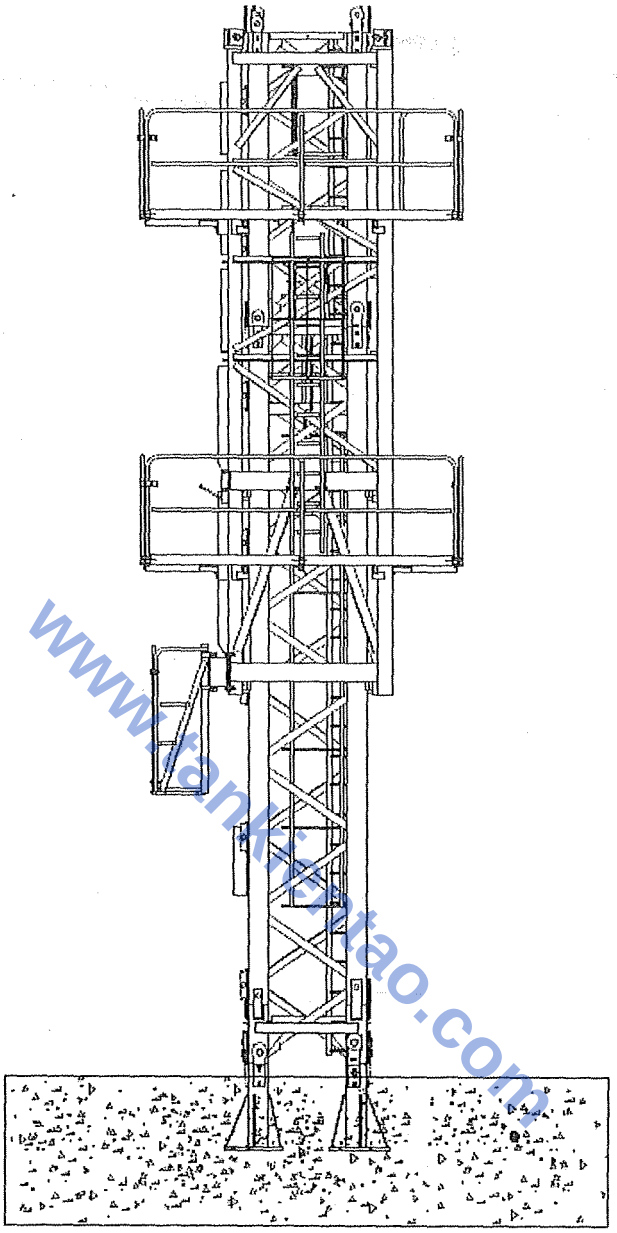


图 4-10 爬升架安装示意图

Figure 4-10 Installation of climbing frame

爬升架整体吊装前首先应操纵杆使顶升棘爪处于打开位置。这样在爬升架装入时不会与顶升踏步发生干涉。顶升棘爪打开后将操纵杆固定住。

从地面吊起爬升架至已安装好的塔身上方，转动爬升架使顶升油缸处于顶升梁一侧(即有踏步的一侧)，爬升架中心对准基础节中心缓缓下降，使爬升架上的导轮与塔身外框对准，继续缓慢下降，最终将顶升棘爪顶在基础节的第 4 个踏步上（从下往上数踏步)。

Ahead of mounting the whole climbing frame, open the jacking detent so as to the climbing frame will not interfere with jacking step during installation. After that, fix the joystick.

Hoist the assembled climbing frame from the ground beyond mounted tower body and rotate the climbing frame to make the jacking cylinder at the jacking beam side (step side). Drop the climbing frame after confirming its center is aligning with basic mast center and its guide wheels are aligning with tower crane frame until the jacking detent is attached to the fourth step of basic mast (from bottom to top).

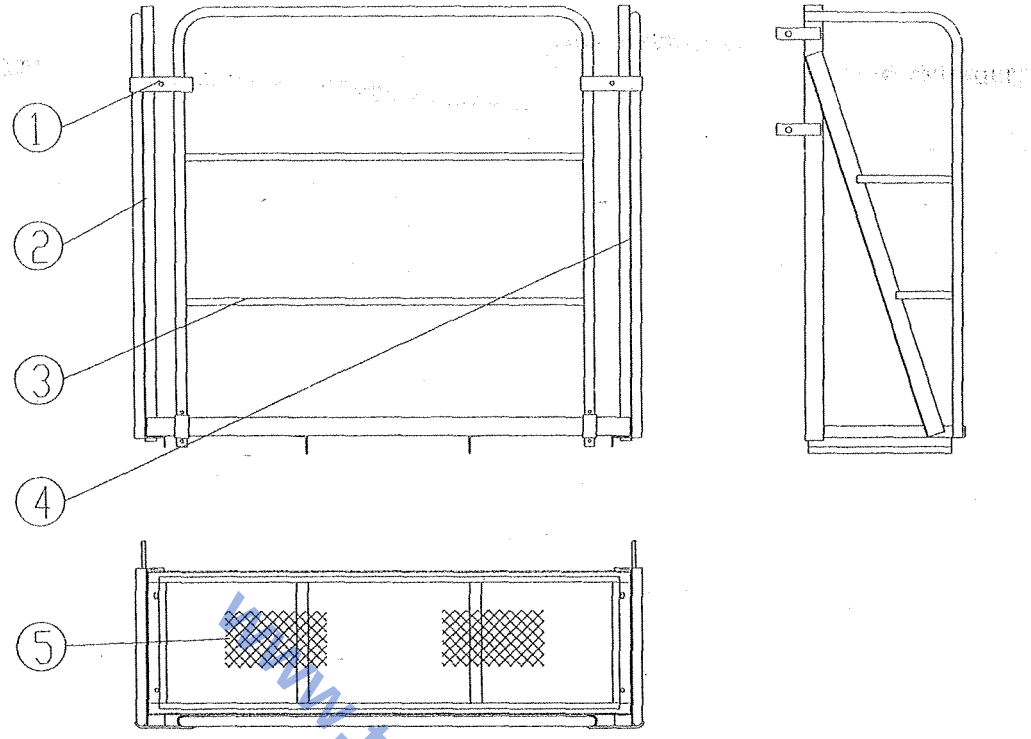
4.6.4.8 安装小平台

如果小平台没有组装，则用 4 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5783-M12×30、螺母 GB/T6170-M12、垫圈 GB/T93-12)将走道、左侧栏、右侧栏进行连接；用开口销(GB/T91-10×80)将栏杆安装在走台上，用 2 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5782-M12×65、螺母 GB/T6170-M12、垫圈 GB/T93-12)分别将 4 件夹板安装在栏杆上（见图 4-11）。

将小平台吊至安装位置用 4 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5783-M20×55、螺母 GB/T6170-M20、垫圈 GB/T93-20)将小平台和爬升架结构进行连接。

4.6.4.8 Installing small platform

If the small platform is not assembled, connect it using four sets of bolt (each set including one bolt of GB/T5783-M12×30, one nut of GB/T6170-M12 and one washer of GB/T93-12); mount railings on the platform by cotter pins (GB/T91-10×80) and mount four pieces of clamp plates by 2 sets of bolt (each set including one bolt of GB/T5782-M12×65, one nut of GB/T6170-M12 and one washer of GB/T93-12). (Figure 4-11)



1、夹板 2、左侧栏 3、栏杆 4、左侧栏 5、走道

图 4-11 小平台拼装示意图

1. Splint 2. Left-side railing 3.Railing 4.Left-side railing 5. Passage

Figure 4-11 Assembly of small platform

Hoist the platform to its mounting position and mount it together with climbing frame structure by four sets of bolt (each set including one bolt of GB/T5783-M20×55, one nut of GB/T6170-M20 and one washer of GB/T93-20).

4.6.4.9 连接液压杆和顶升横梁

当塔机液压系统的管路和电气接通、液压油加注完成后，缓慢伸出液压杆，最终用销轴（φ50×170）和开口销(GB/T91-10×100)将液压杆和顶升横梁连接起来。

After the connections of pipes of hydraulic system and electricity, as well as filling oil are finished, slowly stretch out hydraulic rod to connect it with jacking beam using pin shaft (φ50×170) and cotter pins (GB/T91-10×100).

4.6.5 安装回转总成

4.6.5.1 回转总成拼装

在地面上先将司机室平台、维修平台、栏杆、回转机构及电机安装到回转总成上(回转总成含上、下支座、回转支承)，其安装位置见图 4-12。

用销轴(φ30×95)和开口销(GB/T91-6.3×70)将左平台、右平台与上支座相连。用开口

销(GB/T91-10×100)将栏杆安装在上支座、左平台、右平台上。用 4 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5782-M10×65、螺母 GB/T6170-M10、垫圈 GB/T93-10)将 8 件夹板安装在栏杆上。

用螺栓（GB/T5783-M16×55)、垫圈（GB/T93-10)将回转机构安装在上支座上。

注意 回转支承安装螺栓的预紧力矩为 700N•m。

4.6.5 Mounting slewing unit

4.6.5.1 Assembly of slewing unit

Assembly the cab platform, maintenance platform, railings, slewing mechanism on the ground and motor on the slewing unit (including upper and lower supports and slewing bearing), shown in Figure 4-12.

Connect the cab platform and maintenance platform with the upper support by pin shafts (φ30×95) and cotter pins (GB/T91-6.3×70). Mount the railings on the upper support and cab platform by cotter pins (GB/T91-10×100). Fix 4 clamp plates on railing by 2 sets of bolts (each set of bolt includes one bolt of GB/T5782-M12×70and one nut of GB/T6170-M12 and one washerGB/T93-12).

Mount the slewing mechanism on the upper support using bolts (GB/T5783-M14×50), pads and gaskets.

Caution **The pre-tension torque of mounting bolts of slewing bearing is 700N•m.**

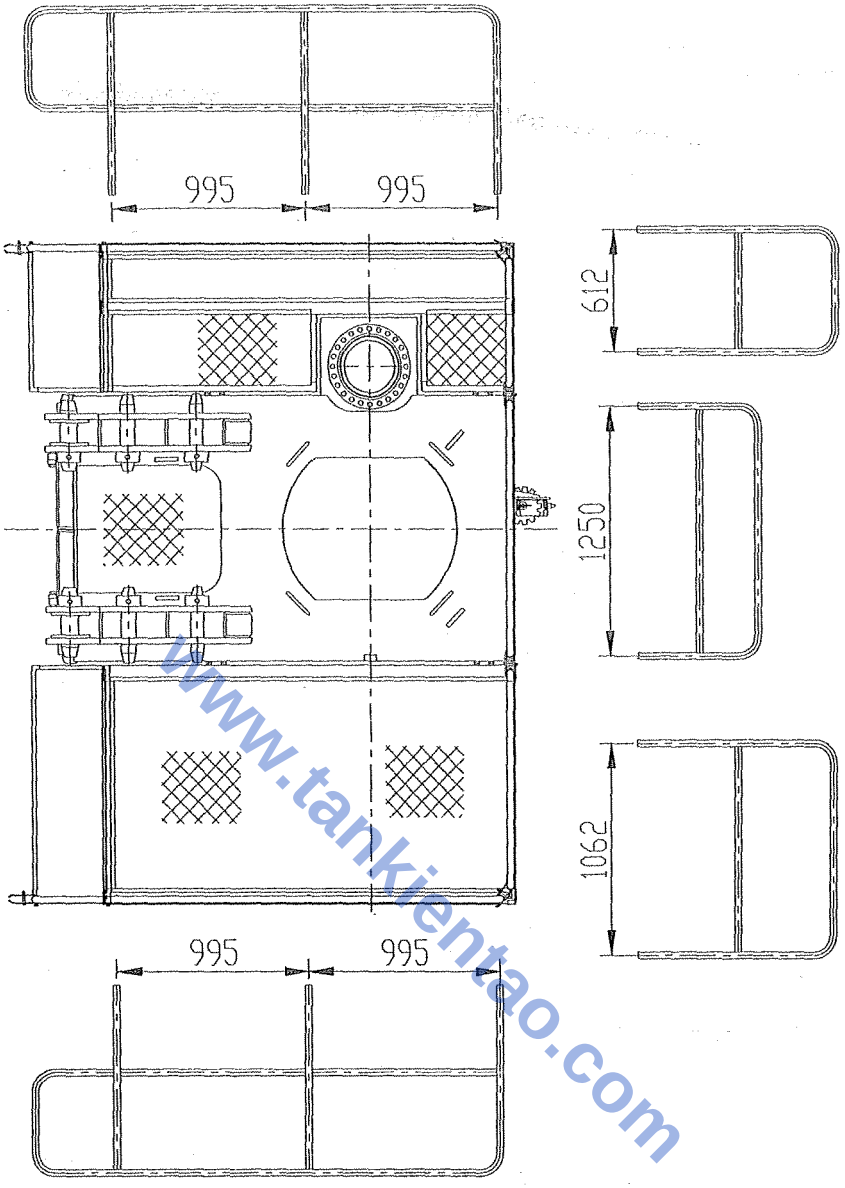


图 4-12 回转平台及栏杆安装示意图

Figure 4-12 Installation of slewing platform and railings

4.6.5.2 吊装回转总成

将回转总成吊起安装在标准节上，用销轴(φ55×141)，插销(φ20×183.5)和开口销(GB/T91-5×40)将下支座和标准节相连。见图 4-13。

4.6.5.2 Installing slewing assembly

Mount the slewing assembly on mast and connect the lower support and mast together by pin shafts (φ50×120) and cross pin (φ20×183.5) as well as cotter pins (GB/T91-5×40).

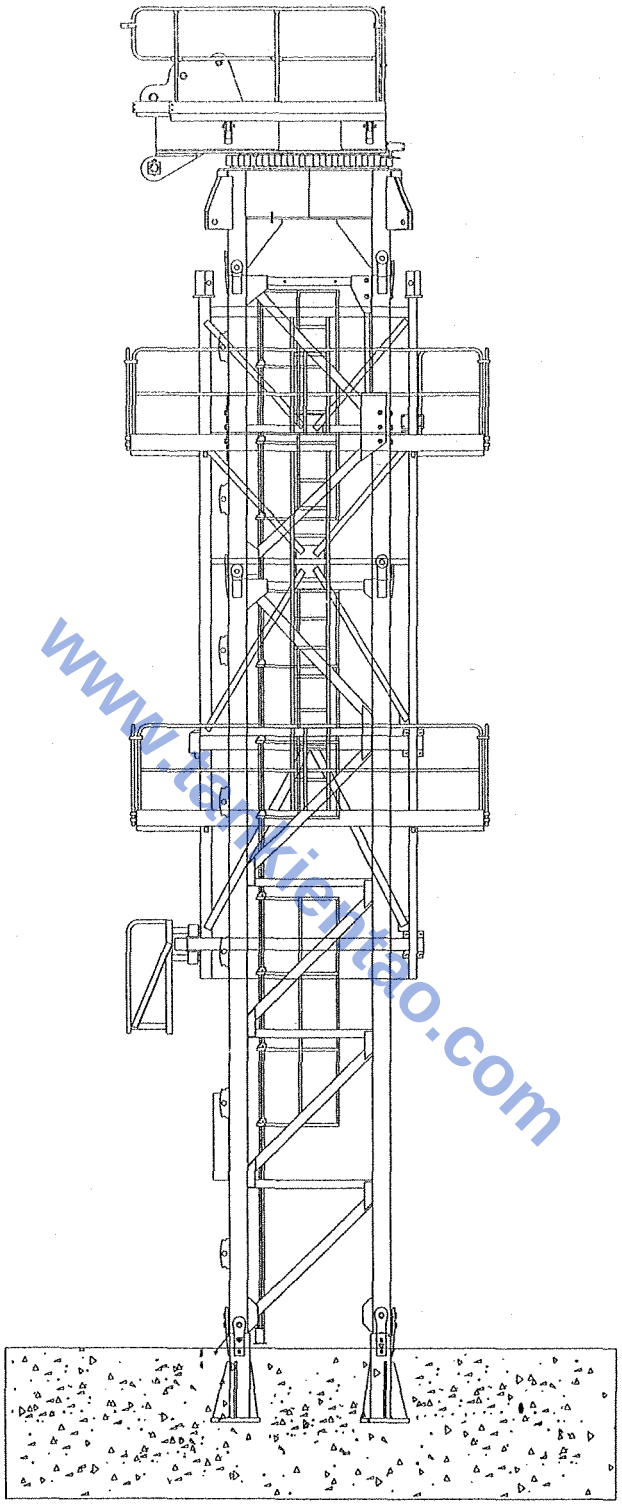


图 4-13 安装回转总成示意图

Figure 4-13 Installation of slewing assembly

4.6.6 安装平衡臂

4.6.6.1 安装起升机构和变幅机构（见图 4-14）

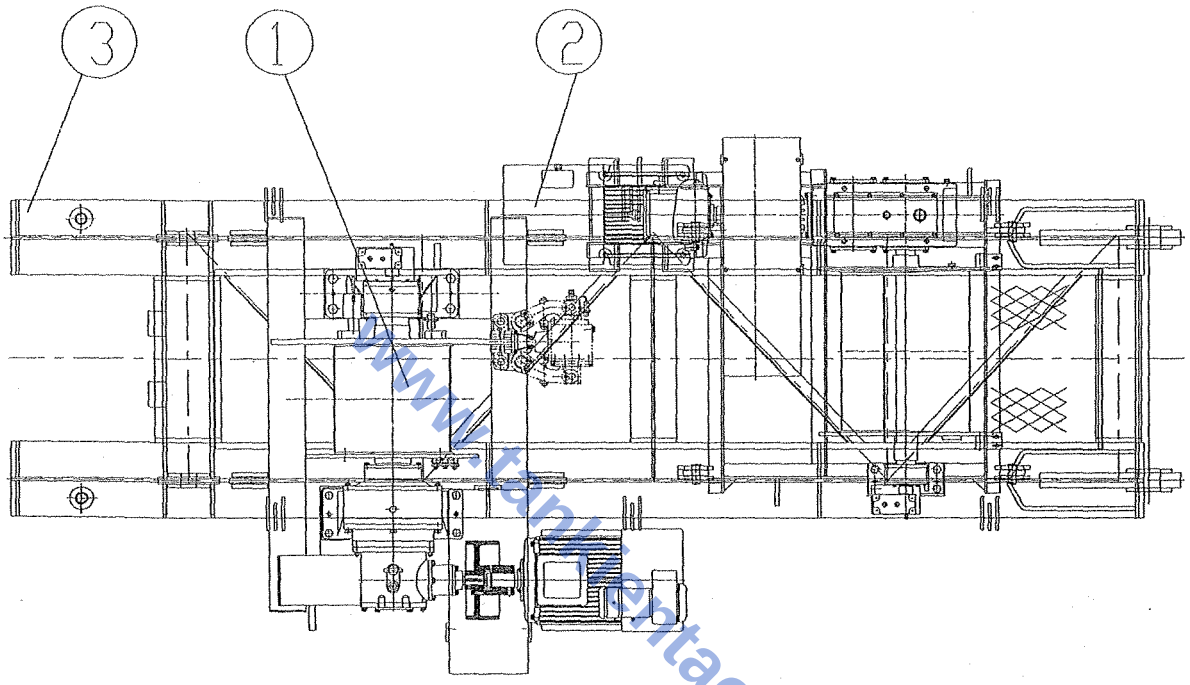
用销轴（φ50×65）将变幅机构安装在平衡臂上，用销轴（φ50×65）将起升机构安装在平衡臂上，每个销轴安装后穿上开口销（GB/T91-6.3×80）。起升机构和变幅机构也可在平衡臂

安装在上支座后，再安装在平衡臂上。

4.6.6 Installing counter jib

4.6.6.1 Installing lifting mechanism and luffing mechanism (Figure 4-14)

Mount luffing mechanism (φ50×65) and lifting mechanism by pins (φ50×65) on the counter jib. After that, fit each pin shaft with cotter pins (GB/T91-6.3×80).



1. 变幅机构 2. 起升机构 3. 平衡臂结构

图 4-14 机构安装示意图

1. Luffing mechanism 2. Lifting mechanism 3. Counter jib structure

Figure 4-14 Installation of mechanisms

4.6.6.2 平衡臂拼装（见图 4-15）

用销轴(Φ25×80)进行平衡臂结构与平台的连接，用销轴(Φ25×72)进行平衡臂结构、平台与撑杆的连接，每个销轴安装后穿上开口销(GB/T91-6.3×50)。用开口销(GB/T91-10×100)将栏杆安装在平台上。用 2 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5782-M12×70、螺母 GB/T6170-M12、垫圈 GB/T93-12)将 4 件夹板安装在栏杆上。

4.6.6.2 Assembly of counter jib (Figure 4-15)

Use pin shaft (φ25×80) to connect counter jib structure and platform and pin shaft (φ25×72) to connect the strut with counter jib structure and platform. Each pin shaft after assembly is fitted with cotter pins (GB/T91-6.3×50). Mount railings on the platform by cotter pins (GB/T91-10×100) and mount four splints on railings by 2 sets of bolts (each set of bolt including one bolt of

GB/T5782-M12×70, one nut of GB/T6170-M12 and one washer of GB/T93-12).

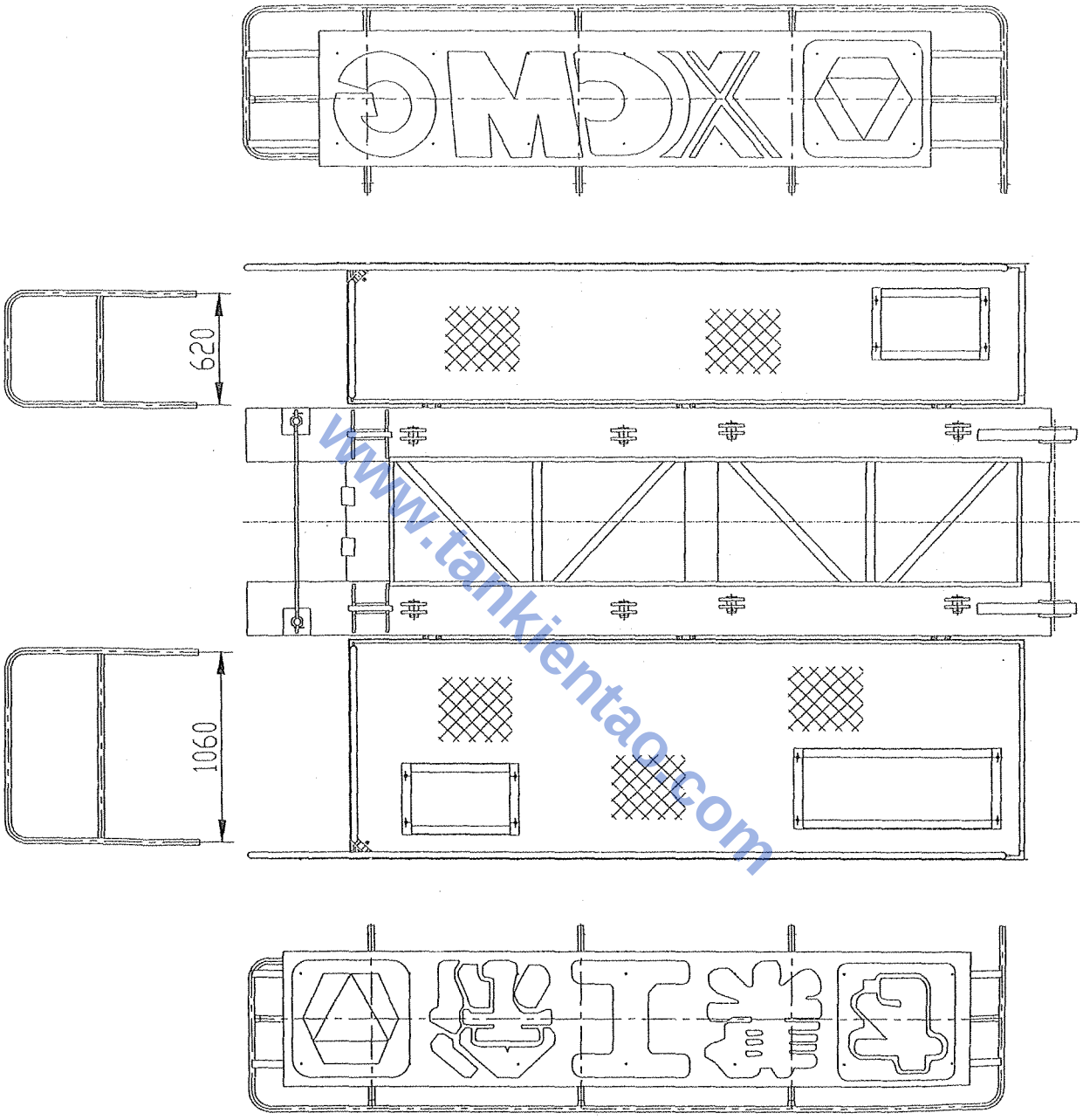


图 4-15 平衡臂拼装示意图

Figure 4-15 Counter jib installation

4.6.6.3 平衡臂吊装（见图 4-16）

将拼装好的平衡臂吊至安装位置后，用销轴(φ90×219)将平衡臂与上支座进行连接，每个销轴安装后装入立销（φ20×130），最后在立销上穿开口销(GB/T91-5×40)。完成安装连接后将小平台用 8 套螺栓（每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5783-M12×30、螺母 GB/T6170-M12、垫圈 GB/T93-112）安装在平衡臂平台和上支座平台之间。用 2 套螺栓(每套

螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5782-M10×65、螺母 GB/T6170-M10、垫圈 GB/T93-10)将 4 件夹板安装在栏杆上。

4.6.6.3 Mounting counter jib (Figure 4-16)

Hoist the assembled counter jib to its mounting position and connect it with upper support by pin shaft (φ90×219), each of which is equipped with vertical pin (φ20×130) with cotter pins (GB/T91-5×40). After that, mount the small platform between counter jib platform and upper support platform. Mount four clamp plates on railings by 2 sets of bolts (each set of bolt including one bolt of GB/T5782-M12×70, one nut of GB/T6170-M12 and one washer of GB/T93-12).

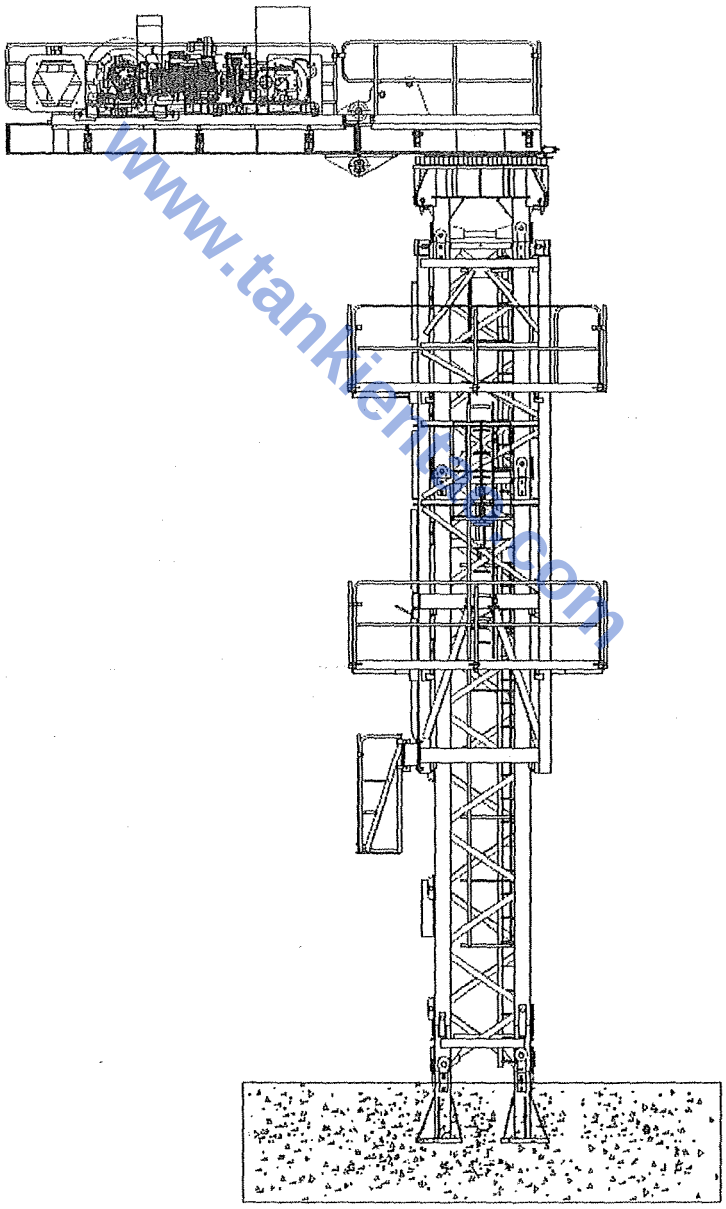


图 4-16 平衡臂吊装示意图

Figure 4-16 Mounting counter jib

4.6.7 安装平衡重（见图 4-17）

依次吊装 2.3t 平衡重两块、1.6t 平衡重。吊装完成后先安装固定螺杆和横杆，固定螺杆安装需要装好垫片和螺母，横杆安装好后需要穿上开口销(GB/T91-5×40)。所有变臂组合时，平衡重的重量不变。

4.6.9 Mounting counter jib (Figure 4-17)

Mount two block of counter weight 2.3t and then 1.6t counterweight. After that, mount the fixing screw rods which should be equipped with washer and nut, and cross rods which should be fitted with cotter pins (GB/T91-5×40) after mounting. For any jib combinations, weight of counter weight remains the same.

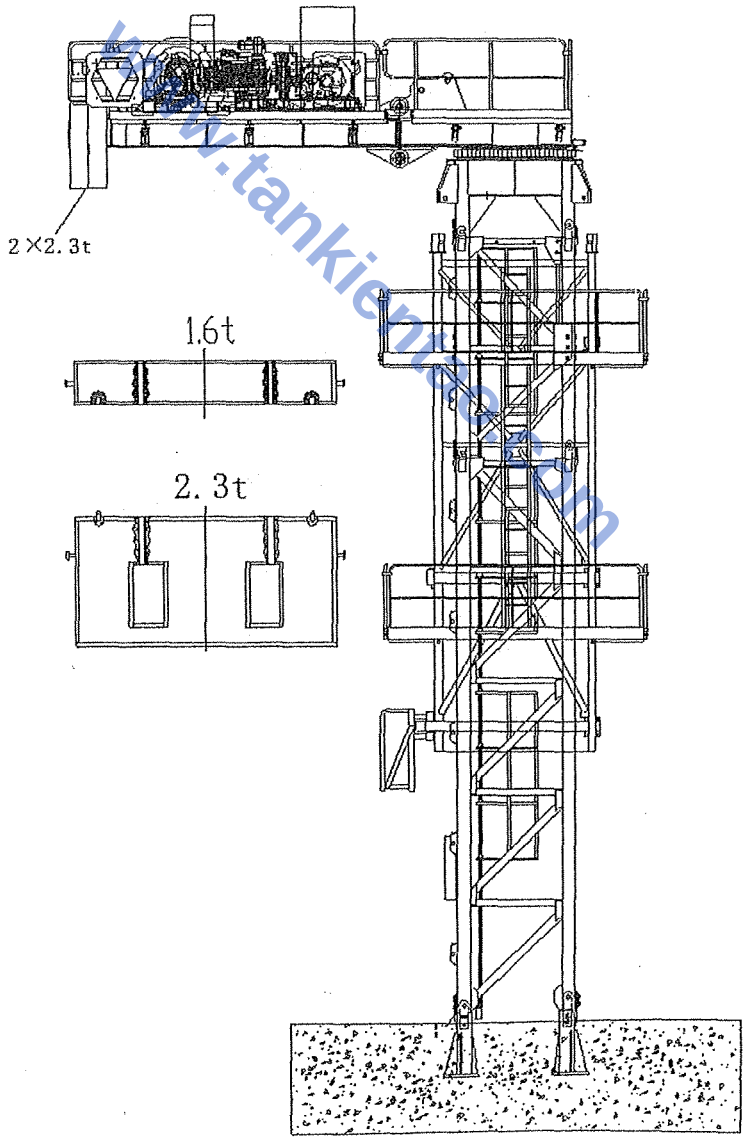


图 4-17 平衡重吊装示意图

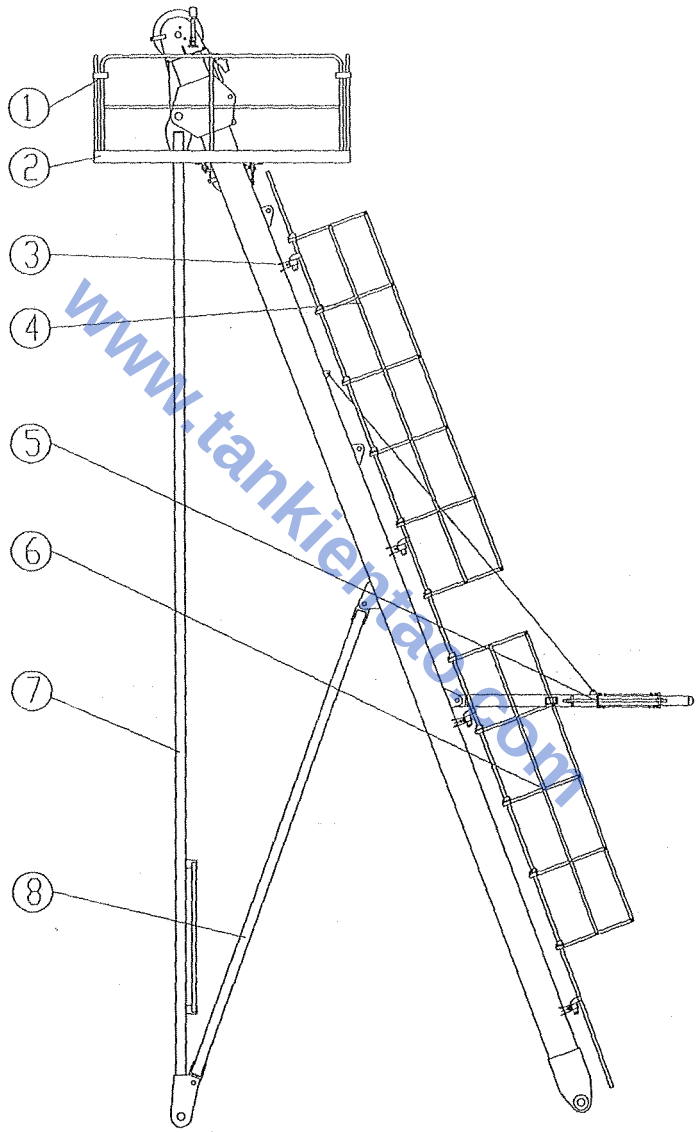
Figure 4-17 Mounting counterweights

4.6.8 安装塔顶

塔顶由平台、栏杆、塔顶结构、拉杆、撑杆、缓冲器、爬梯组成（图 4-18）。安装时首先进行地面拼装，然后再进行吊装。

4.6.8 Installing tower top

Tower top is composed of platform, railings, tower top structure, pull rods, struts, buffer and ladder (Figure 4-18). Prior to installing, assemble it on the ground.



1. 栏杆 2. 平台 3. 塔顶结构 4. 爬梯 1
5. 缓冲器 6. 爬梯 2 7. 拉杆 8. 撑杆

图 4-18 塔顶组成图

1. Railing 2. Platform 3.Tower top structure 4. Ladder 1
5. Buffer 6. Ladder 2 7. Pull rod 8. Strut

Figure 4-18 Tower top components

4.6.8.1 塔顶拼装

用销轴(φ60×125)将塔顶结构与拉杆进行连接，销轴装好后穿好开口销（GB/T91-10×100)。用销轴(φ40×129)将撑杆与拉杆进行连接，销轴装好后穿好开口销（GB/T91-8×70)。用销轴(φ40×70)将撑杆与塔顶结构连接，销轴装好后穿好开口销（GB/T91-8×70)。用开口销（GB/T91-10×80）将爬梯 1、爬梯 2 安装在塔顶结构上。用索具和销轴(φ40×57)将缓冲器安装在塔顶结构上，销轴装好后穿好开口销（GB/T91-8×70)。

平台栏杆的安装位置见图 4-19。用 8 套螺栓（每套螺栓包含 1 栓 1 母 1 平垫 1 弹垫，螺栓 GB/T5786-M20×1.5×60、螺母 GB/T6171-M20×1.5、平垫 GB/T1230-20、弹垫 GB/T93-20）将前后平台安装在塔顶结构上，用开口销（GB/T91-10×63）将左平台安装在前后平台上。用开口销（GB/T91-10×100）将各栏杆安装在平台上。最后用 10 套螺栓(每套螺栓包含 1 栓 1 母 1 垫，螺栓 GB/T5783-M12×70、螺母 GB/T6170-M12、垫圈 GB/T93-12)将 20 件夹板安装在栏杆上。

4.6.8.1Tower crane assembly

Connect the tower top structure with pull rod using pin shafts (φ60×125) with cotter pins (GB/T91-10×100), the strut together with pull rods using pin shafts (φ40×129) with cotter pins (GB/T91-8×70) and strut together with tower top structure by pin shafts (φ40×70) with cotter pins (GB/T91-8×70). Mount the ladder 1 and 2 on tower top by cotter pins (GB/T91-10×80). Install buffer on tower top by rigging and pin shafts (φ40×57) with cotter pins (GB/T91-8×70).

Mounting positions of platform railings are shown in Figure 4-19. Install the front and rear platforms on tower top by 8 sets of bolt (each set including one bolt of GB/T5783-M20×60, one nut of GB/T6170-M20, one flat washer of GB/T97.1-20and one spring washer of GB/T93-20), with cotter pins (GB/T91-10×50) to mount railings on front and rear platforms. Use cotter pins (GB/T91-10×100) to install each railing on platform. Finally, take 10 sets of bolt to install 20 pieces of splint on railings (each set including one bolt of GB/T5782-M12×70, one nut of GB/T6170-M12 and one washer of GB/T93-12).

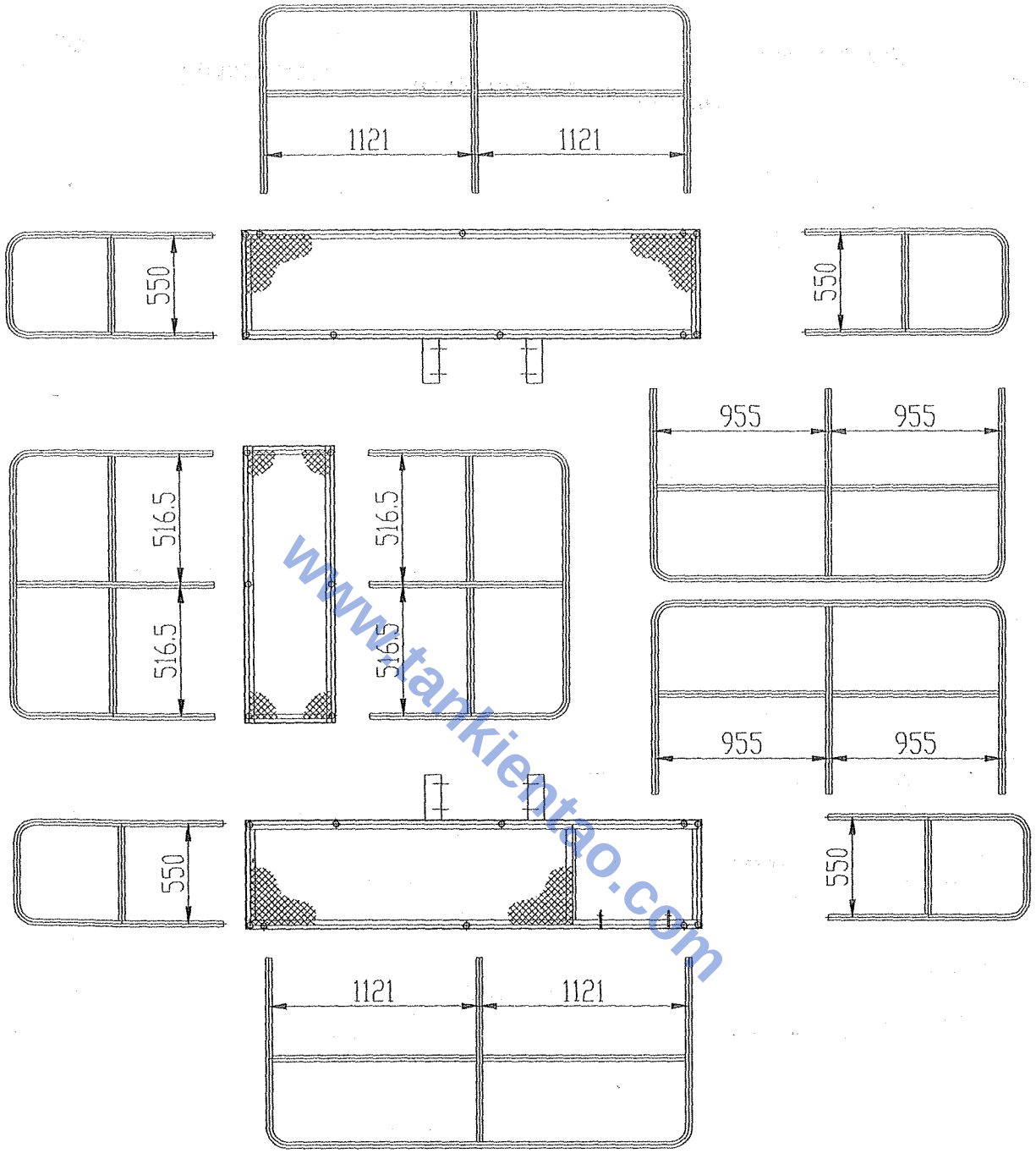


图 4-19 平台栏杆安装位置图

Figure 4-19 Mounting position of platform and railings

4.6.8.2 塔顶吊装(见图 4-20)

将拼装好的塔顶吊至安装位置，用销轴(φ60×129)连接平衡臂与拉杆，销轴装好后穿好开口销（GB/T91-10×100)。用销轴(φ75×249)连接平衡臂与塔顶结构，每个销轴安装后装入立销（φ20×130)，最后在立销上穿开口销(GB/T91-5×40)。

4.6.8.2 Mounting tower top (Figure 4-20)

Hang the assembled tower top to its mounting position and connect the counter jib and pull

rods together by pin shaft (φ60×129) with cotter pins (GB/T91-10×100). Then connect counter jib and tower top structure together by pin shafts (φ75×249)，each of which is equipped with vertical pin (φ20×130) with cotter pins (GB/T91-5×40).with cotter pins (GB/T91-10×120).

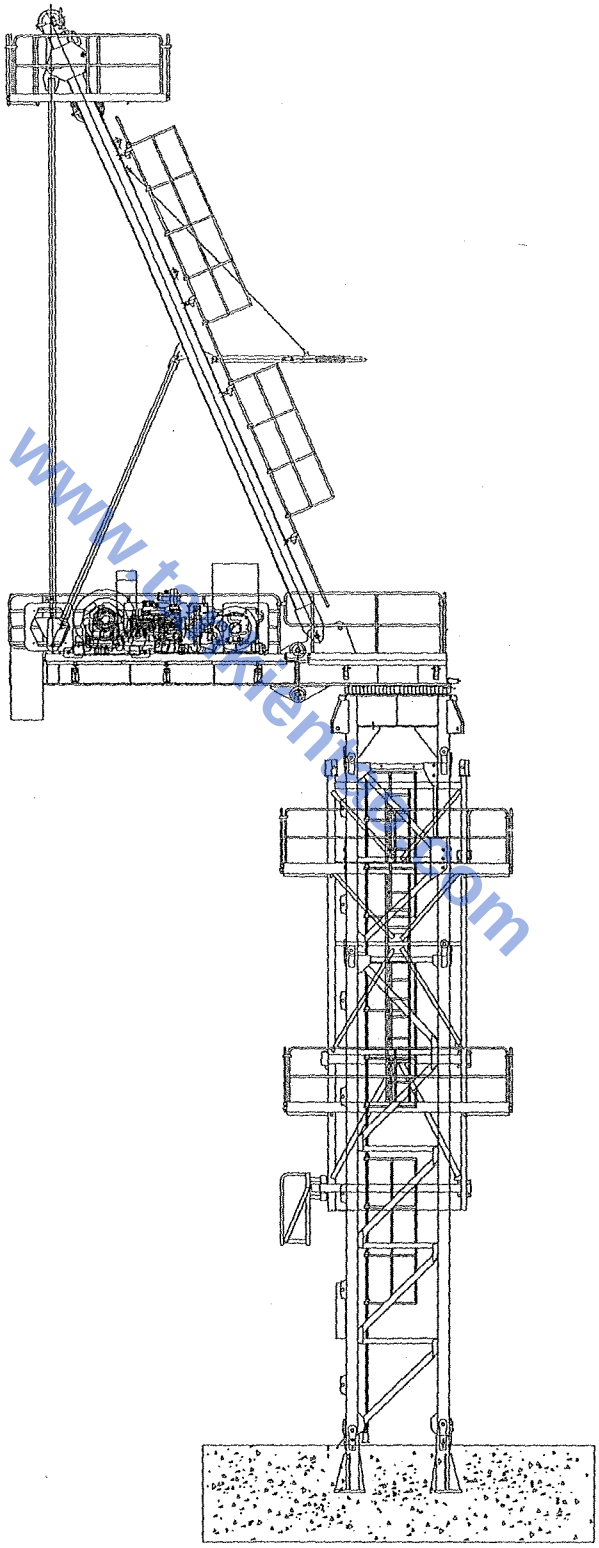


图 4-20　塔顶吊装示意图

Figure 4-20 Mounting tower top

4.6.9 起重臂的安装

起重臂的安装应先将起重臂各臂节按照臂长组合进行装配，同时起重臂拉杆也应按照臂长组合进行装配。起重臂和起重臂拉杆装配在一起后进行吊装。

4.6.9.1 起重臂装配（见图 4-21、表 4-3）

用销轴(φ45×67)连接各臂节的上弦，销轴装好后穿好开口销（GB/T91-10×70)。

用销轴(φ40×90)连接臂节 1 与臂节 2、销轴装好后穿好开口销（GB/T91-10×63)。用销轴(φ35×78)连接臂节 2 与臂节 3、臂节 3 与臂节 4、臂节 4 与臂节 5 的下弦，销轴装好后穿好开口销（GB/T91-8×63)。

用螺栓（包含 1 栓 1 母 1 平垫 1 弹垫，螺栓 GB/T5782-M16×120、螺母 GB/T6170-M16、平垫 GB/T97.1-16、弹垫 GB/T93-16）将拉杆支架安装在起重臂上弦上。

用螺栓（包含 1 栓 1 母 1 平垫 1 弹垫，螺栓 GB/T5782-M20×120、螺母 GB/T6170-M20、平垫 GB/T97.1-20、弹垫 GB/T93-20）将滑轮组支架安装在起重臂上弦上。

4.6.9 Installation of jib

At first, assemble jib sections according to jib length required, as well as corresponding pull rods. Then hoist and install the jib and its pull rods together.

4.6.9.1Assembly of jib (Figure 4-21 and Table 4-3)

Connect upper chords of each jib sections using pin shafts (φ45×67), with cotter pins of GB/T91-10×70.

Connect jib sections 1 and 2 using pin shafts (φ40×90), with cotter pins of GB/T91-10×63.

Connect lower chords of jib sections 2 and 3 ,3and 4,4 and 5 using pin shafts (φ35×78), with cotter pins of GB/T91-8×63.

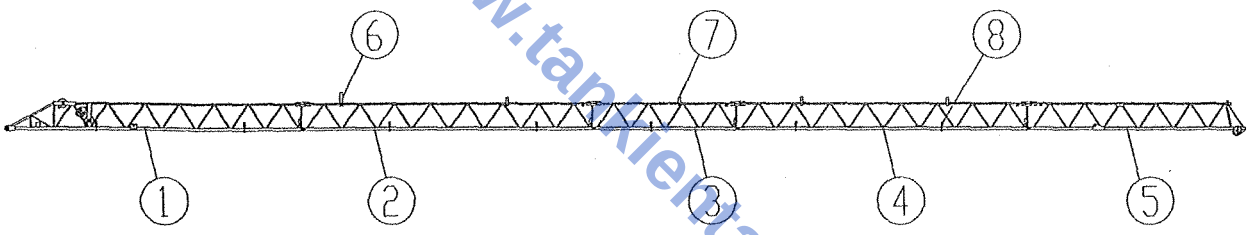
Mount pull rod bracket on upper chord of jib by bolt (including one bolt of GB/T5782-M16×120, one nut of GB/T6170-M16, one flat washer of GB/T97.1-16 and one spring washer of GB/T93-16).

Mount pulley unit bracket on upper chord of jib by bolt (including one bolt of GB/T5782-M20×120, one nut of GB/T6170-M20, one flat washer of GB/T97.1-20 and one spring washer of GB/T93-20).

表 4-3 起重臂组合表

Table 4-3 Jib combination table

臂长（m） Jib length	臂节组合 Jib combinations
42.51	臂节1+臂节2+臂节3+臂节4+臂节5 jib 1+jib 2 +jib 3+jib 4+jib 5
37.51	臂节1+臂节2+臂节4+臂节5 jib 1+jib 2 +jib 4+jib 5
32.51	臂节1+臂节2+臂节3+臂节5 jib 1+jib 2 +jib 3+jib 5
27.51	臂节1+臂节2+臂节5 jib 1+jib 2 +jib 5



1. 臂节 1　2. 臂节 2　3. 臂节 3　4. 臂节 4

5. 臂节 5　6. 滑轮支架　7. 拉杆支架　8. 钢绳支架

图 4-21 起重臂装配示意图

1. Jib 1 2. Jib 2 3. Jib 3 4. Jib 4 5. Jib 5 6. Pulley frame

7. Pull rod bracket 8. Jib 8

Figure 4-21 Jib assembly

4.6.9.2 起重臂拉杆装配（见图 4-22、表 4-4）

用销轴（φ45×135.5）将滑轮组与拉杆进行连接，销轴装好后穿好开口销（GB/T91-10×70）。用销轴（φ45×67.5）将进行拉杆之间的连接，销轴装好后穿好开口销（GB/T91-10×70）。用销轴（φ45×147.5）将拉板与拉杆进行连接，销轴装好后穿好开口销（GB/T91-10×70）。用销轴（φ45×155）将拉板与起重臂进行连接，然后装入锁销（φ17×64），最后穿好开口销（GB/T91-6.3×40）。

4.6.9.2 Assembly of jib pull rods (Figure 4-22 and Table 4-4)

Connect the pulley unit with pull rod by pin shaft (φ45×135.5) which after assembly needs

to be fitted with cotter pins (GB/T91-10×70). Connections between pull rods use pin shaft (φ45×67.5) with cotter pins (GB/T91-10×70), between pull plate and pull rod use pin shaft (φ45×147.5) with cotter pins (GB/T91-10×90) and between pull plates and jib use pin shaft (φ45×155) with lock pins (φ17×64) and cotter pins (GB/T91-6.3×40).

表 4-4 起重臂拉杆组合表

Table 4-4 Jib pull rod combinations

臂长（m） Jib length	拉杆组合（m） Jib pull rod combinations
42.51	0.72+5.02+4.95+4.95+4.95+4.95+1.45=26.99m
37.51	0.72+5.02+4.95+4.95+4.95+1.45=22.04m
32.51	0.72+5.02+4.95+4.95+1.45=17.09m
27.51	0.72+5.02+4.95+1.45=12.14m

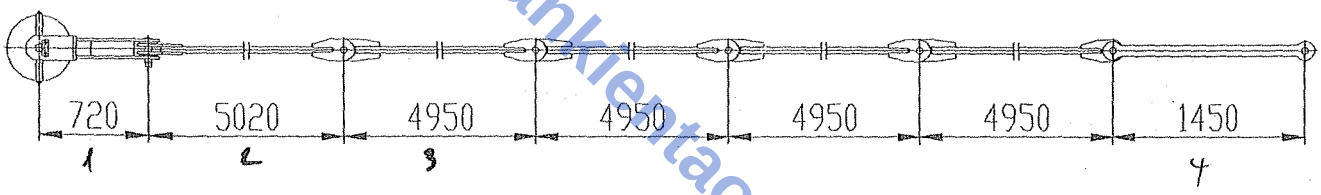


图 4-22 起重臂拉杆装配示意图

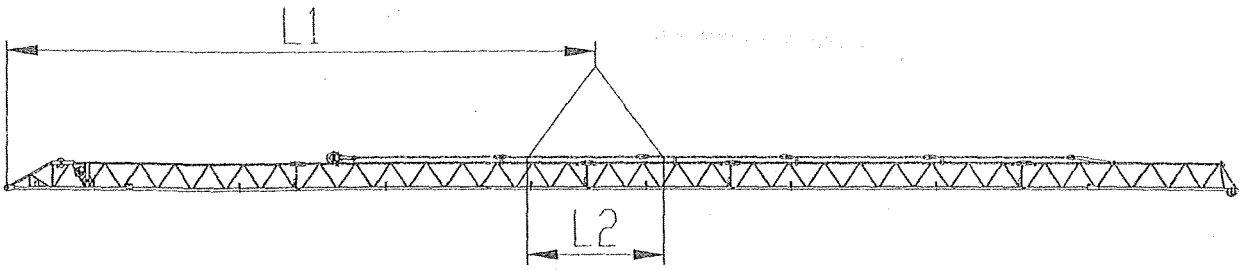
Figure 4-22 Jib pull rod assembly

4.6.9.3 安装起重臂

吊装过程中为准确找到起重臂（保证起重臂和拉杆）的重心位置可进行试吊。起重臂的重心及吊绳的间距可见图 4-23。

4.6.9.3 Installing jib

During installing, you can conduct trial lifting to figure out the gravity center of jib (jib and its pull rods). The gravity center of jib and lifting rope distance are shown in Figure 4-23.



臂长（m） Jib length	42.51	37.51	32.51	27.51
L1（m）	19.87	17.48	15.20	12.85
L2（m）	10∽15	10∽15	10∽15	10∽15
G(kg)	3695	3295	2940	2542

图 4-23 起重臂重心及吊绳间距示意图

Figure 4-23 Gravity center of jib and lifting rope distance

将拼装好的起重臂吊至安装位置，用销轴（φ65×249）连接起重臂与平衡臂，每个销轴安装后装入立销（φ20×130），最后在立销上穿开口销(GB/T91-5×40)。（见图 4-24）

Lift up the assembled jib to mounting position and connect the jib and counter jib by pin shaft (φ65×249). After that, fix the pin shafts with lock pins (φ20×130) and cotter pins (GB/T91-5×40).(Figure 4-24)

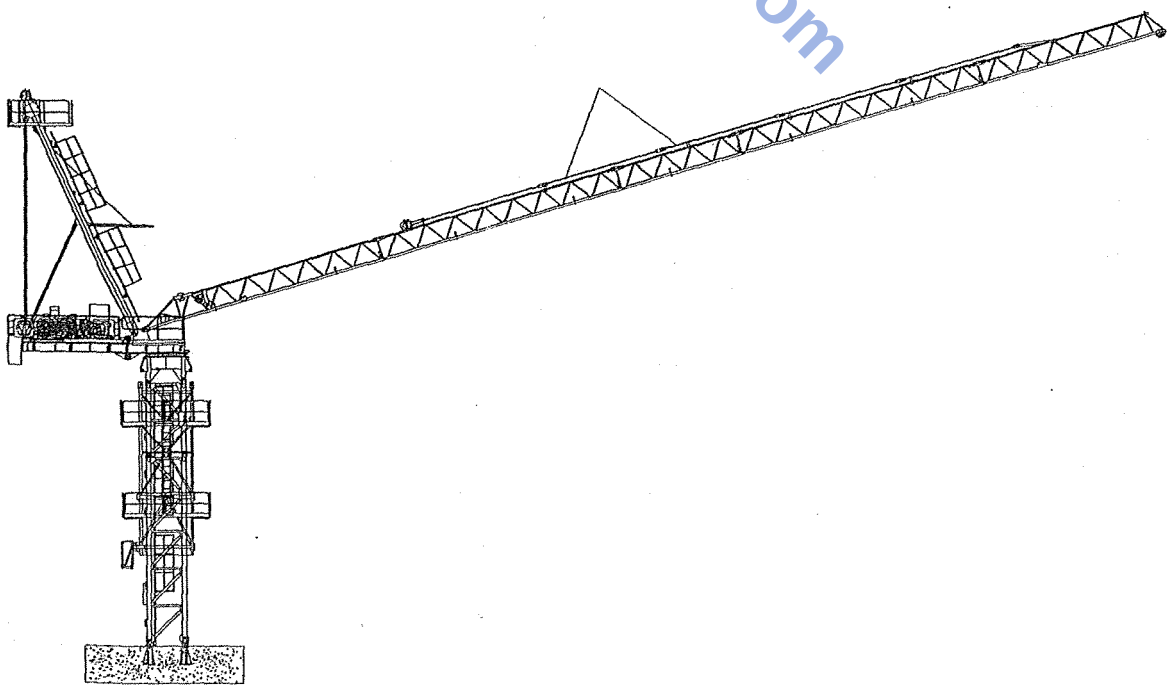


图 4-24 起重臂吊装示意图

Figure 4-24 Installing jib

4.6.12 安装检修钢丝绳

塔机在使用一定时间后，变幅钢丝绳或者变幅滑轮组中的滑轮因磨损而需要更换时，可采用检修钢丝绳将起重臂固定在一定的位置后，更换变幅钢丝绳或者变幅滑轮组中的滑轮。在塔机正常使用时，不允许安装检修钢绳。对于某些国家法律要求，动臂式塔机在使用时必须安装检修钢绳就需要安装挡绳架。使用检修钢丝绳时，臂架应缓慢下放，直到钢丝绳受力拉直。

4.6.12 Installing repair rope

After a period of use, luffing rope or its pulleys may need to be changed due to wear. At this time employ the repair rope to fix the jib at certain position to replace luffing rope or its pulleys. If the tower crane is in normal use, it is not allowed to install repair rope. If it must to mount repair rope for luffing tower crane in use in some countries, mount a rope-retaining device as well. When using repair rope, drop the jib slowly until the rope is straightened.

4.6.12.1 安装挡绳架（见图 4-27）

用螺栓(包含 1 栓 1 母 1 垫，螺栓 GB/T5782-M10×120、螺母 GB/T6170-M10、垫圈 GB/T93-10)将挡绳架安装在起重臂的下弦杆上。

4.6.14.1 Installing rope-retaining device (Figure 4-27)

Mount the rope-retaining device on lower chord of jib using bolt (including one bolt of GB/T5782-M10×120, one nut of GB/T6170-M10 and one washer of GB/T93-10).

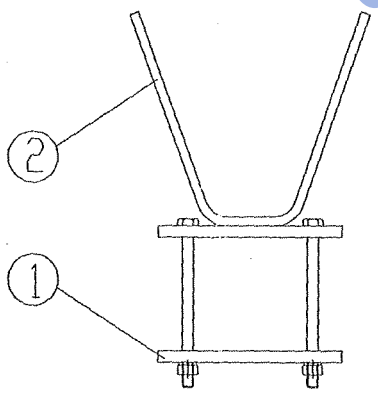


图 4-27 挡绳架安装示意图

Figure 4-27 Rope-retaining device installation

4.6.12.2 安装检修绳（见图 4-28）

塔机的检修钢丝绳共需要组合两根，每根长度应根据臂架组合选择钢丝绳的具体配置(当臂长为 42.51m 时，绳总长 40.65m；当臂长为 37.51m 时，绳总长 35.85m；当臂长为 32.51m

时，绳总长 31.05m；当臂长为 27.51m 时，绳总长 26.25m）。绳的两端用销轴分别连接在塔顶和起重臂上（拉杆附近的连接点）。

4.6.12.2 Installing repair rope (Figure 4-28)

Repair rope of tower crane is combined by two ropes, lengths of which depend on jib combinations), (When jib is 42.51m , total rope length is 40.65m; When jib is 37.51m total rope length is 35.85m; When jib is 32.51m total rope length is 31.05m; When jib is 27.51m total rope length is 26.25m). Two ends of rope are separately connected to tower top and jib (connection points near pull rod) by pin shafts.

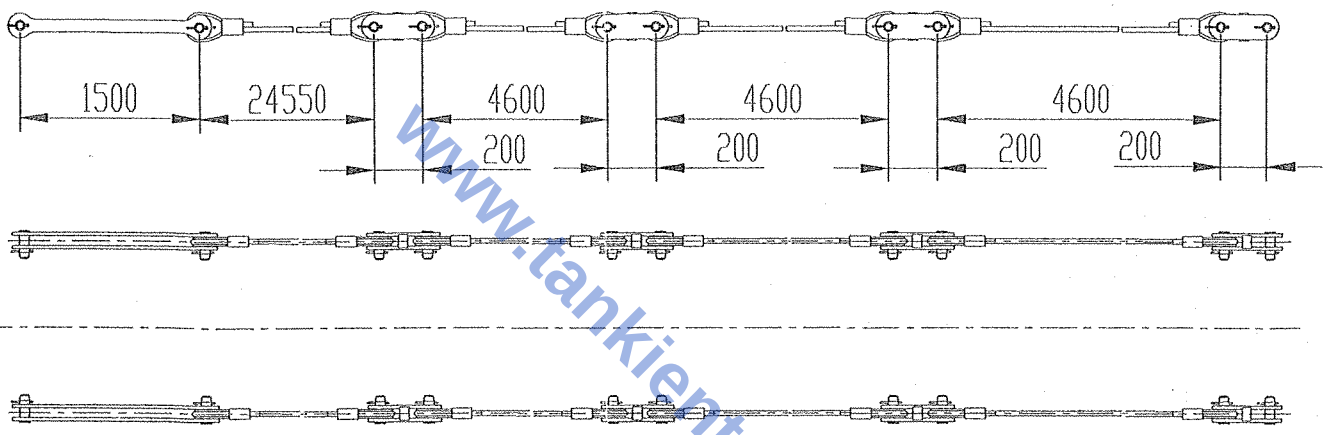


图 4-28 42.51m 臂长时检修绳装配示意图

Figure 4-28 Repair rope assembly for 42.51m jib

经过以上安装，塔机的主要部件安装完成，所有电气系统安装完成后可进行顶升及塔机调试。以上安装完成后如图4-29。

Above all, main components of tower crane have been installed, so after having installed all electrical system, users can conduct jacking process and tower crane debugging. The tower crane after having installed is as shown in Figure 4-29.

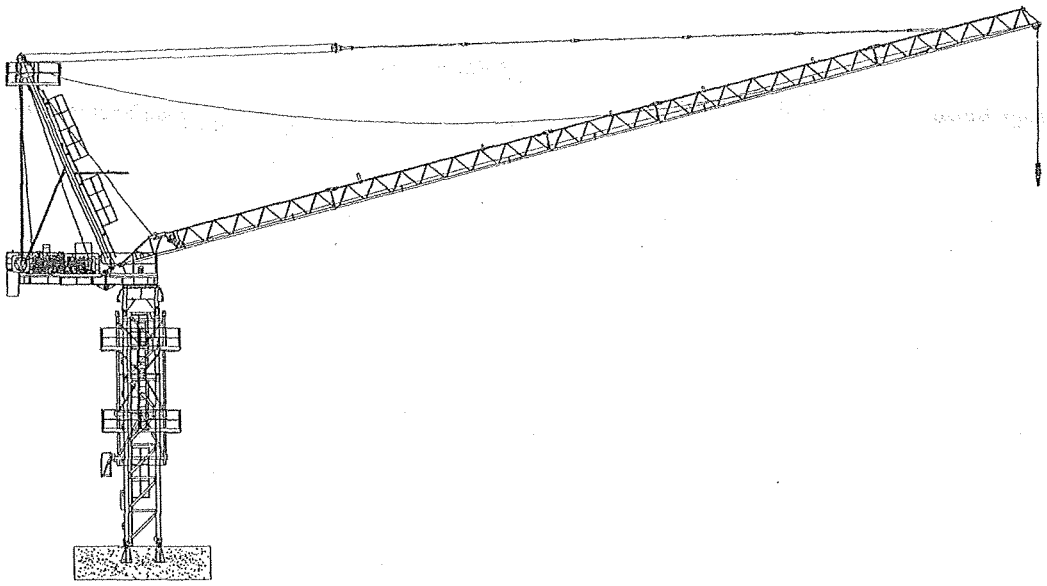


图 4-29 基本安装后示意图

Figure 4-29 General installation schematic

4.7 立塔完成后的检查

检查所有用螺栓连接处的螺栓是否漏装，规格和性能等级是否与要求的一致，连接是否紧固。特别是基础、标准节、爬升架、回转支承的连接螺栓是否达到规定的预紧力矩。

检查所有用销轴连接处的销轴是否漏装，规格是否与要求的一致。

检查开口销是否漏装，规格是否与要求的一致。

检查起升机构、回转机构、变幅机构、顶升机构、回转支承滚道和回转支承外齿的润滑处的润滑油油量是否合适。

4.7 Check after tower erection

Check whether all the joints to be bolted are bolted, whether their specifications and performance levels meet relevant requirements, whether the connection is tight, and particularly whether the tightening torque of the connecting bolt between the standard section and the slewing mechanism reaches the specified value.

Check whether all the joints to be pinned are pinned and whether their specifications meet relevant requirements.

Check for missing cotter pins and check whether their specifications meet relevant requirements.

Check whether the lubricating locations of the hoisting mechanism, slewing mechanism, trolley mechanism, lifting mechanism, slewing bearing raceway and slewing bearing external gear

are lubricated properly.

4.8 电气安装

4.8.1 立塔时电气安装

整机控制系统由一个主控柜、司机室驾配箱、一个电阻箱、和各限位开关等组成。在立塔过程中，电气安装按以下步骤进行：

1、在立塔前的两天内，应对所有电动机进行绝缘检查，电机相线对地绝缘电阻应大于0.5 兆欧，对绝缘电阻不合格的电机不准通电，直至满足绝缘要求。将各电机、各限位开关的电缆线按外部接线图接好，注意接线螺栓需拧紧；

2、在立塔地面拼接钢结构时，先将起重量限制器安装到起重臂安装位置处；

3、将主控柜安装到平衡臂总成的位置上；

4、将一个障碍灯安装到起重臂臂端位置；

5、当塔身安装好后，将塔身靠近基础的配电箱安装到塔身上，并将工地上的总电缆线接入此配电箱内，将此配电箱内断路器打到断开状态；

6、回转总成安装好后，安装司机室总成到司机室平台上，并将塔机总电缆线套入电缆挂套中，注意电缆挂套的方向，收紧电缆挂套，将电缆挂到下支座的挂钩上，再将电缆拉到司机室内的驾配箱内，并接在驾配箱接线端子上，同时将断路器扳到断开位置，再将电缆线另一头接到靠近基础的电源箱内的断路器上；

7、当平衡臂安装完成后，将起升机构、回转机构和驾驶室的电缆线接到电控柜内；

8、按照外部接线图和电气原理图检查电控柜内各限位开关的短接线，确认都已短接无误，同时检查所接各机构的电缆线，确认正确后，将工地上的电源接通，将塔机各电控柜的所有断路器合闸通电。按下总起动按钮，先用最低速运行一下各个机构，确认机构运转方向无误后即可，若方向相反，改变电机该档位三相电源线中的任意两相即可；

9、当起重臂安装时，需要操作回转和起升卷扬；起重臂安装好后，将变幅机构的电缆线接到电控箱内，用低速运行一下变幅机构，若方向相反，改变电机该档位三相电源线中的任意两相即可；

10、塔机主体钢结构安装完成后，将另两个障碍灯分别安装到塔顶和平衡臂安装位置处，将力矩限制器和塔机安全监控系统安装好(风速传感器安装在塔顶安装座上)；

11、将塔机所有电缆线用扎带扎好，注意走线合理、美观；

12、当穿钢丝绳时，起动一下起升中速，注意用点动操作，确认运行方向，若方向相反，则按前面方式更改电机接线；

4.8Electrical installation

4.8.1 Electrical installation during tower erection

The complete machine control system is composed of one main control cabinet, one cab distribution cabinet, one resistance box and limit switches, etc. The electrical installation shall be conducted as follows during tower erection:

1. Within two days before tower erection, conduct an insulation inspection on all motors. The ground insulation resistance of motor phase line shall be greater than 0.5 megohm. Motors with unqualified insulation resistance can't be electrified until the insulation requirements are satisfied. Connect the cables of all motors and limit switches according to the external wiring diagram, and be sure that the connection bolts are screwed tightly;

2. When assembling steel structures on the tower erection ground, please install the hoisting weight limiter on the mounting position of the jib firstly;

3. Install the main control cabinet on the counter jib;

4. Install an obstruction light at the boom end;

5. After tower mounting is completed, please install the distribution box besides the foundation on the tower body, connect the bus cable on the construction site to this box and disconnect the breaker in the distribution box;

6. After mounting the slewing assembly, install the cab assembly onto the cab platform, insert the bus cable of tower crane into the cable sheath (paying attention to the sheath direction), tighten the sheath, put the cable on the hook of lower support, pull the cable to the cab distribution cabinet in the cab and connect it's one end to the terminal of the cab distribution cabinet, disconnect the breaker, and then connect the other end of the cable to the breaker in the power box near the foundation;

7. After the tower top and counter jib are installed, please connect the cables of hoisting mechanism, slewing mechanism, slewing resistor and cab into the electrical cabinet;

8. Check the shorting stubs of the limit switches in the electrical cabinet for correct shorting, as well as the cables of each connected mechanism for correct connection in accordance with the external wiring diagram and electrical schematic diagram; after that, supply power to the construction site and switch on all breakers in the electrical cabinet. Press the master start button, run all mechanisms at lowest speed to confirm the correct running direction, in case the direction is

opposite, please change two phases of the three-phase power line of the motor at this position;

9. It's necessary to operate the slewing and hoisting mechanism when installing the boom; after the boom is installed, connect the cable of trolley mechanism into the electric cabinet and run the mechanism at low speed, if the direction is opposite, please change two phases of the three-phase power line of the motor at this position;

10. After the main steel structure of the tower crane is installed, please install the other two obstruction lights on the mounting positions of the tower top and counter jib respectively, then install the moment limiter and safety monitoring system of the tower crane (the wind speed sensor shall be installed on the mounting seat of tower top);

11. Wrap up all cables of tower crane with ties in a reasonable and beautiful manner;

12. When winding the steel wire rope, please conduct the lifting at intermediate speed and apply inching operation, determine the moving direction, in case it's opposite, change the motor wiring by using the above method;

4.8.2 通电调试：

将地面电源开关合上，送到驾驶室，检查三相电源应三相平衡，且电压应为 380V±10%，地面电网应能提供足够的容量，以保护电机正常启动和运转。

合上断路器，检查启动与急停按钮是否正常工作。

起升机构的调试：

先操作起升手柄，观察起升运转情况，当起升手柄向内拉时，吊钩向上运动，向外推时，吊钩向下运动，否则应重新调整起升电机的电源相序，以符合以上要求。

起升机构调试完毕后，分别操作回转和变幅手柄，回转手柄向左推时，起重臂应向左转，手柄向右推时，起重臂应向右转；变幅手柄向内拉时，起重臂向上，手柄向外推时，起重臂应向下；否则应调整接至各电机电源线的相序，以符合以上要求。

以上机构分别调试完毕后，应再做不少于三次组合动作。

⚠ 注意

- **电送到司机室后，司机室照明可通过配电柜上的开关送电。**
- **按启动按钮时，各操作手柄必须归零位，总接触器才可得电自锁。**
- **回转无法打反车，在起重臂向右(向左)转后，须有几秒的加速时间，才能达到最高速。回转手柄归零后，不能马上刹车，须减速到起重臂停止运转后才能刹车。**
- **顶升之前要检查泵站电机转向是否与要求一致，否则应将电机转向调整正确方可进行顶**

升，顶升时严禁回转、变幅和起升，以防止发生安全事故。

- 控制箱如果更换元件则应按电气原理图上要求调整正确。

4.8.2 Power-on debugging

Switch on the ground power switch, take it to the cab, and check to make sure that the three-phase power is of three-phase equilibrium and its voltage shall be 380V±10%. The ground power grid shall be capable of providing enough capacity to maintain the normal start and operation of the motor.

Switch on the breaker and check whether the start and scram button can work normally.

Hoisting mechanism debugging:

Operate the hoisting lever and observe the hoisting conditions at first, the hook will move upward when the lever is pulled inward, and the hook will move downward if the lever is pushed outward, otherwise the power phase sequence of the lifting motor shall be re-adjusted to meet the above requirements.

After hoisting mechanism debugging is completed, please operate the slewing and trolley levers separately, the boom will turn left when the slewing lever is pushed towards the left and the boom will turn right if the lever is pushed towards the right; The boom will move upward if the trolley lever is pulled inward and the boom will move downward if the lever is pushed outward; otherwise the phase sequence connected to the power line of each motor shall be re-adjusted to meet the above requirements.

After the debugging of mechanisms, do the above actions tat least three times.

⚠ Caution

- **After the cab is supplied with power, the lighting of the cab can be managed by the switches on distribution box.**
- **All operating levers shall return to zero when pressing the start button, only then can the master contactor be self-locked after being powered on.**
- **Swing is managed by means of variable frequency speed control (sudden application of reverse gear is not allowed), and after the boom turns right (left), several seconds of acceleration are required to reach the highest speed. After the slewing lever returns to zero, the machine can't be broken at once until the speed is reduced to a degree at which the boom stops running.**

- **Check whether the direction of motors at the pump station complies with the requirements before the climbing, if not, please correct the direction. Slewing, trolley and hoisting are forbidden during the climbing in order to avoid accident.**

- **The electrical schematic diagram shall be referred to when replacing the elements of control cabinet to ensure a right operation.**

4.9 塔机调试

4.9.1 引言

塔机中的安全装置是为保证人身和设备安全而设置的重要装置。其中的力矩限制器、起重量限制器是将塔机设置在非倾翻区和非断绳区的警戒线，一经调整完毕后，不可轻易变动，各机构的限位开关也是为了限制机构的运动范围。塔机安全装置是司机和维护人员重点监察对象，必须定期检查及校验，每个工作日开始工作时必须检查所有安全装置的运行状况，以确保工作正常!

4.9 Tower crane debugging

4.9.1 Introduction

The safety devices inside the tower crane refer to the important devices used to guarantee personnel and equipment safety. Among them, the moment limiter and hoisting weight limiter are the warning line to set the tower crane in the non-tilting area and non-rope breaking area which can’t be changed once being adjusted. The limit switches of mechanisms are used to limit their operating scope. The safety devices inside the tower crane are the main monitoring objects of the driver and maintainer, so they must be inspected and calibrated regularly. Check the operation state of all safety devices each workday when starting working to guarantee normal working conditions!

4.9.2 力矩限制器

4.9.2 Moment limiter

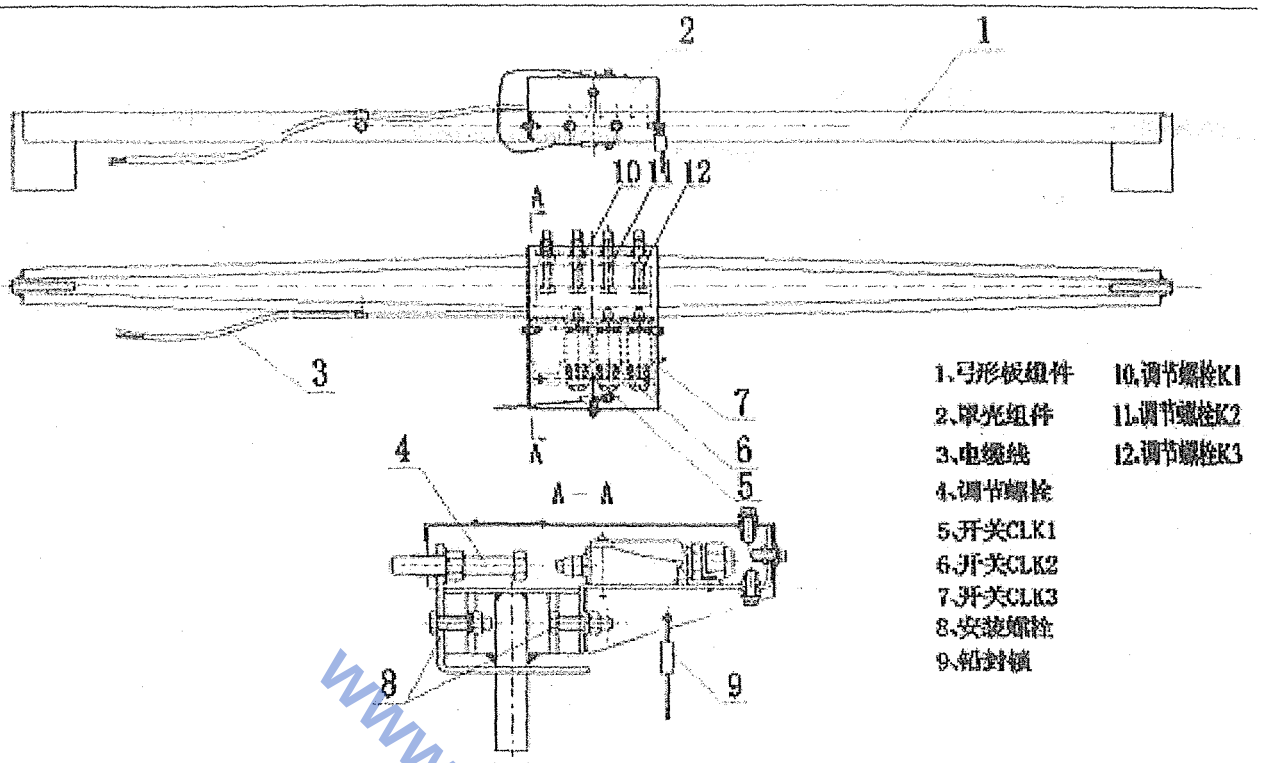


图 5-54 力矩限制器图

Figure 5-54 Diagram of Moment Limiter

1.顶部紧固螺帽 2.拉杆松紧调整螺帽 3.上拉铁 4.拉杆上端紧固螺帽

5.拉杆 6.拉杆下端紧固螺帽 7.侧紧固螺钉 8.环体

9.下拉铁 10.K1～K4 调整螺钉

1. steel plates components 2. Shelly shield 3. cable 4. Adjusting bolt 5. SwitchCLK1 6. SwitchCLK2 7. Switch CLK3 8.bolt 9.lock 10. Adjustment screw of K1 11. Adjustment screw of K2 12. Adjustment screw of K3

用途：

塔机是按恒定的最大载荷力矩设计计算，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。

工作原理:

该装置安装在人字架后拉杆下部，它由一对弹性钢板，四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。

力矩限制器的调整:

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。

Use:

The tower crane is designed based on the maximum constant load moment which can't be exceeded during application, the moment limiter is used to check the rated hoisting and forward trolley and thus to avoid over-moment happening in the tilting area which can cause accident.

Working Principle:

This device is installed at the central position of the tower top, which is composed of a pair of elastic steel plates, three micro switches, mounting base, adjusting screw and enclosure, etc. The elastic steel plate will be bent and deformed (i.e. the distance between two plates will be shorter) under the action of load moment; when the load exceeds the rated value, the adjusting screw on one plates will be pressed and fixed on the switch contactor of the other plate, the control circuit will be disconnected by the switch and the machine will stop running to protect itself.

Adjustment of moment limiter:

Warning **Confirm the rated moment of this tower crane before adjusting the moment limiter by looking for the corresponding data.**

1）调整定幅变码力矩限制器（四倍率）

在工作幅度 R_{11} 处以正常工作速度起升起重量 Q_{11}，力矩限制器不应动作，能够正常起升。载荷落地，加至 $1.1Q_{11}$ 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。此项试验重复 3 次，每次必须满足。各参数见表 5-3。

Lift up the lifting loadQ_{11} with normal speed at the radius of R_{11}, so that the moment limiter should not act but lift normally. Drop the load to the ground and add it to$1.1Q_{11}$ and lift up slowly again, so that the moment limiter should act, and the load cannot be lifted up, releasing alarm signal.Repeat this test three times, it is qualified if it meets the requirements each time. The parameters are shown in Table 5-3.

表 5-3 力矩限制器定幅变码调试的载荷及幅度表

Table 5-3 Parameters and radius moment limiter at fixed-radius and variable-weight

起重臂长度 Jib length	R_{11}	Q_{11}	$1.1Q_{11}$	起重臂长度 Jib length	R_{11}	Q_{11}	$1.1Q_{11}$
40m	40m	1.433t	1.58t	30m	30m	2.835t	3.12t
35m	35m	2.084t	2.29t	25m	25m	3.63t	3.99t

在工作幅度 R_{12} 处以正常工作速度起升起重量 Q_{12}，力矩限制器不应动作，能够正常起升。载荷落地，加至 $1.1Q_{12}$ 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。此项试验重复 3 次，每次必须满足。各参数见表 5-4。

Lift up the lifting loadQ_{12} with normal speed at the radius of R_{12}, so that the moment limiter should not act but lift normally. Drop the load to the ground and add it to$1.1Q_{12}$ and lift up slowly again, so that the moment limiter should act, and the load cannot be lifted up, releasing alarm signal.The parameters are shown in Table 5-4. Repeat this test three times, it is qualified if it meets the requirements each time.

表 5-4 力矩限制器定幅变码调试的载荷及幅度表

Table 5-4 Parameters and radius moment limiter at fixed-radius and variable-weight

起重臂长度 Jib length	R_{12}	Q_{12}	$1.1Q_{12}$	起重臂长度 Jib length	R_{12}	Q_{12}	$1.1Q_{12}$
42.51m	40m	6t	6.6t	32.51m	30m	6t	6.6t
37.51m	35m	6t	6.6t	27.51m	25m	6t	6.6t

2）调整定码变幅力矩限制器（四倍率）

空载测定工作幅度 R_{13}、$0.8R_{13}$ 及 $1.1R_{13}$ 值，并在地面标记。在小幅度处起升起重量 Q_{13} 离地 1m 左右，慢速变幅至 R_{13}～$1.1R_{13}$ 间时，力矩限制器应动作，切断向外变幅和起升上升回路，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 $0.8R_{13}$ 时应能自动转为低速往外变幅，在到达 R_{13}～$1.1R_{13}$ 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。此项试验重复 3 次，每次必须满足。各参数见表 5-5。

2) Moment limiter adjustment at fixed-weight and variable-radius (2-fall)

Detect the radius R_{13}, $0.8R_{13}$ and $1.1R_{13}$ in empty-load testing, and mark on the ground. At the small radius lift the liftingloadQ_{13} about 1m from the ground, slowly move trolley to R_{13}～$1.1R_{13}$ 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_{13} and automatically turns to low speed. At the time when the trolley is moving to the point between R_{13} ~1.1 R_{13} the moment limiter should be active and stop luffing outward and lifting circuit power supply, releasing the alarm signal. The parameters are shown in Table 5-5. Repeat this test three times, it is qualified if it meets the requirements each time.

表 5-5 力矩限制器定码变幅调试的载荷及幅度表

Table 5-5 Parameters and radius moment limiter at fixed-weight and variable-radius

起重臂长度 Jib length	Q_{13}(t)	R_{13}(m)	$0.8R_{13}$(m)	$1.1R_{13}$(m)	起重臂长度 Jib length	Q_{13}(t)	R_{13}(m)	$0.8R_{13}$(m)	$1.1R_{13}$(m)
42.51m	6	16.1	12.88	17.71	32.51m	6	17.12	13.696	18.832
37.51m	6	16.7	13.36	18.37	27.51m	6	16.81	13.448	18.491

空载测定工作幅度 R_{14}、$0.8R_{14}$ 及 $1.1R_{14}$ 值，并在地面标记。在小幅度处起升起重量 Q_{14} 离地 1m 左右，慢速变幅至 R_{14}～$1.1R_{14}$ 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 $0.8R_{14}$ 时应能自动转为低速往外变幅，在到达 R_{14}～$1.1R_{14}$ 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。此项试验重复 3 次，每次必须满足。各参数见表 5-6。

Detect the radius R_{14}, $0.8R_{14}$ and $1.1R_{14}$ in empty-load testing, and mark on the ground. At the small radius lift the liftingloadQ_{13} about 1m from the ground, slowly move trolley to R_{14}～$1.1R_{14}$ 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_{14} and automatically turns to low speed. At the time when the trolley is moving to the point between R_{14} ~1.1 R_{14} the moment limiter should be active and stop luffing outward and lifting circuit power supply, releasing the alarm signal. The parameters are shown in Table 5-6. Repeat this test three times, it is qualified if it meets the requirements each time.

表5-6 力矩限制器定码变幅调试的载荷及幅度表

Table 5-6 Parameters and radius moment limiter at fixed-weight and variable-radius

起重臂长度 Jib length	Q_{13}(t)	R_{13}(m)	$0.8R_{13}$(m)	$1.1R_{13}$(m)	起重臂长度 Jib length	Q_{13}(t)	R_{13}(m)	$0.8R_{13}$(m)	$1.1R_{13}$(m)
42.51m	4.2t	21.5	17.2	23.6	32.51m	4.2t	23.0	18.4	25.3
37.51m	4.2t	22.4	17.9	24.6	27.51m	4.2t	22.7	18.2	25.0

4.9.3 调整电子式起重量限制器

正常起升起重量 Q_{15}，起重量限制器应不动作，允许起升。此项试验重复3次，每次必须满足。

载荷落地，加载至$1.1Q_{15}$后，以最慢速度起升，起重量限制器应切断起升上升回路，载荷

不能起升并给出报警信号。此项重复3次试验，每次必须满足。各参数见表5-7。

4.9.3 Adjustment of electronic lifting load limiter

Lift up load Q_{15} normally. Consequently the lifting load limiter shall not act and the lifting operation is allowed. Repeat this test three times, it is qualified if it meets the requirements each time.

Drop the load to the ground and add it to$1.1Q_{15}$ and lift up slowly again. The lifting load is supposed to cut off the upward circuit. So the load cannot be lifted up and there will be an alarming. Repeat this test three times, it is qualified if it meets the requirements each time. The parameters are shown in Table 5-7.

表5-7 调整起重量限制器调试的载荷表

Table 5-7Loads for adjusting lifting load limiter

起重臂长度 Jib length	Q_{15}	$1.1Q_{15}$	起重臂长度 Jib length	Q_{15}	$1.1Q_{15}$
42.51m	6	6.6t	32.51m	6	6.6t
37.51m	6	6.6t	27.51m	6	6.6t

4.9.4 调整电子式起升高度限位器：

采用 4 倍率或 2 倍率时，当吊钩装置顶部升至起重臂下端的最小距离为 5m 时，应能立即切断起升上升控制回路，但能进行吊钩下降运行。此项试验重复 3 次，每次必须满足。

当起升机构卷筒上还有三圈钢丝绳之前，停止起升下降运动。此项重复试验 3 次，每次必须满足。

4.9.5 调整机械式幅度限位器

塔机上设有内外两个方向的大臂行程限位开关、幅度限位开关和限速开关，具体为 2 个内行程限位开关，1 个内限位开关，1 个内限速开关，1 个外行程限位开关，1 个外限位开关和 1 个外限速开关。当臂架到达极限位置时限位开关应动作，停止臂架向危险方向运行，当臂架到减速位置时减速限位开关应动作，切断臂架的高速运行，自动转为低速运行。此项重复 3 次试验，每次必须满足。

4.9.6 调整电子式角度传感器：

本塔机起重臂根部设有角度传感器，时时检测臂架角度，显示在司机室显示器上，当臂架到达极限角度时控制器应动作，停止臂架向危险方向运行，极限角度为向内变幅到 84°角，向外变幅到 15°角。此项重复 3 次试验，每次必须满足。

4.9.4 Adjustment of electronic lifting height stopper

The height stopper should act to cut off the upwards control circuit when the hook top is reaching up to the distance of 5m to jib bottom at 2-fall or 4-fall, while the hook can go down. Repeat this test three times, it is qualified if it meets the requirements each time.

When there is three circles of steel rope left on the drum of lifting mechanism, stop the lifting-up action and drop down the hook. Repeat this test three times, it is qualified if it meets the requirements each time.

4.9.5 Adjustment of mechanical radius stopper

It is equipped with inside and outside switches forradius stroke switch, radius stopper and speed limit on upper support. The switches are two for innerradius stroke switch，one for inner position stopper, one for inner speed-limiting, one for outerradius stroke switch, one for outer position stopper and outer speed-limiting. When the boom is at extreme position the position stopper will act to stop the boom action from dangerous running. When the boom is reaching at the deceleration position, the deceleration stopper switch will act to cut off the high-speed running of the boom. And then the boom consequently turns into low-speed running. Repeat this test three times, it is qualified if it meets the requirements each time.

4.9.6 Adjustment of electronic angle sensor

At the jib root of the tower crane, there is an angle sensor which is used to detect the boom angle timely. The results are shown on the displayer in cab. If the boom is approaching to the extreme angle, the controller would act to stop the boom from dangerous running. The angle limit is 84°inwards and 15°outwards. Repeat this test three times, it is qualified if it meets the requirements each time.

4.9.7 调整机械式回转限位器

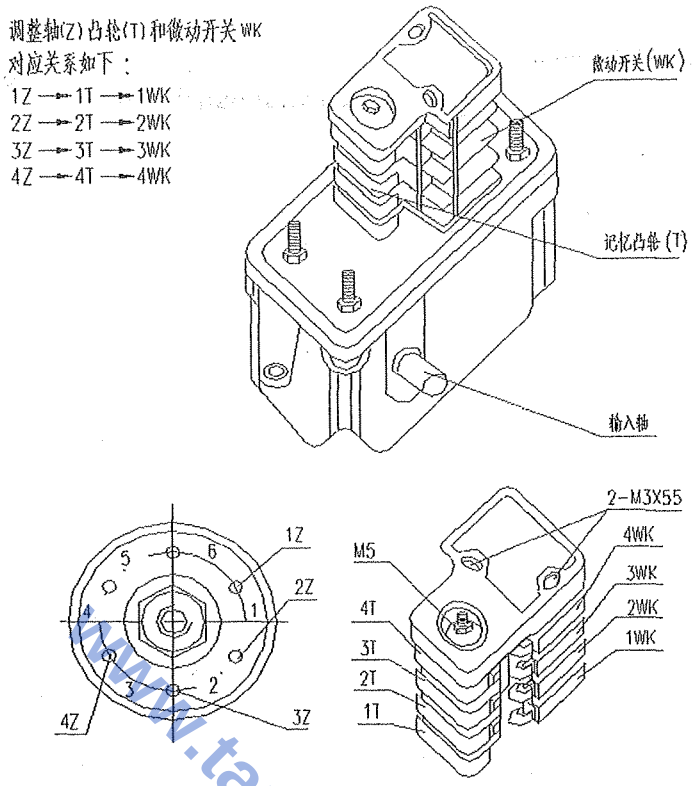


图 5-55 回转限位器图

Figure 5-55 Diagram of Slewing Stopper

用途：

该装置用于防止电缆缠绕及损坏。回转限位器允许最大回转圈数为 3 圈。

工作原理：

回转限位器带有由小齿轮驱动的减速装置，小齿轮直接与回转齿圈啮合，当塔机回转时，限位器减速装置带动凸块 4T、1T 旋转，凸块又控制微动开关 4WK、1WK，这样通过调整即可在适当位置使回转停止运行，见图 5-43。

回转限位器的调整：

在空载下进行调整，控制做回转或右回转，调整触点(4Z)，确定切断回转运动的是哪一个。

调整右回转限位器：旋转臂架使电缆不致缠绕，向右回转一圈半，然后调整凸块(4T)检查其动作，直至其压下相应的触点(4WK)。

重复 3 次，均应满足以上要求。

然后调整左回转限位器：向相反的方向转 3 圈，调整凸块(1T)直至其压下触点(1WK)。

重复 3 次，均应满足以上要求。

4.9.8 调整电子式起升机构与变幅机构三圈保护器

起升机构与变幅机构在卷筒钢丝绳放出至剩余三圈前，必须停止卷筒继续转动，停止继续卷出钢丝绳，只能向相反方向转动，以卷入钢丝绳。电子式三圈保护器的调整分减速限位与极限限位两个，在卷筒剩余钢丝绳圈数转为 10 圈时调整减速限位，卷筒转速自动转为最低速（10%最高速度），在卷筒剩余钢丝绳圈数转为 5 圈时调整极限限位，卷筒立刻停止运行，保证卷筒上剩余钢丝绳不少于 3 圈为满足要求。此项重复试验 3 次，每次必须满足。

4.9.7Adjustment of mechanical Slewing stopper

Application:

This device can be used to avoid cable winding and damage. The maximum slewing cycles for the slewing stopper is 3.

Working Principle:

The decelerator, which is driven by the pinion, is installed on the slewing stopper, and the pinion is directly engaged with the slewing gear ring. The stopper decelerator will drive the lugs 4T and 1T to rotate while the tower crane is slewing, as the lugs can control the micro switches 4WK and 1WK in return, the slewing can be stopped at appropriate positions through proper adjustment. (see Figure 5-55)

Slewing stopper adjustment:

Conduct the adjustment under un-loading conditions, control the left slewing or right slewing, and adjust the contactors (4Z) to determine which one can stop the slewing.

Adjust the right slewing stopper SRR: rotate the boom frame to separate the cables, slew to the right by one cycle and a half, adjust the lug (4T) and check its motions until the corresponding contactor (4KW) is pressed downward.

Repeat this for 3 times and comply with the above requirements.

After that, please adjust the left slewing stopper SRL: turn to the opposite direction for 3 cycles, and adjust the lug (1T) until the corresponding contactor (1KW) is pressed downward.

Repeat this for 3 times and comply with the above requirements.

4.9.8 Adjustment of electronic lifting mechanism and 3-circle protection device of luffing mechanism

Before the last three circles of steel rope on drum is released, the lifting and luffing mechanism shall be operated to stop the drum from releasing rope and to rotate reversely to involve rope. The adjustment of electronic 3-circles protection device includes two kinds: deceleration limit and

extreme limit. It is adjusted to deceleration limit when the left rope circle number is ten. Automatically the rotating speed is turned into the lowest speed (10% of the highest speed); it is adjusted to extreme limit when the left rope circle number is five and the drum stops instantly to make sure that there are 3 circles of rope on drum. Repeat this test three times and it needs to meet the requirements each time.

第五章塔机顶升

Chapter 5 Tower Crane Jacking

5.1顶升注意事项

(1)当塔机顶部风速超过12m/s 时，塔机严禁顶升。

(2)顶升过程中，塔机应处于平衡状态。

(3)顶升过程中，禁止进行任何吊钩起升或者下降操作。

(4)顶升过程中，禁止塔身上部进行回转操作。

(5)顶升进行前，应将起重臂回转至套架引进标准节一侧。

(6)顶升前注意检查电缆的悬挂位置，防止顶升过程中损坏电缆。

(7)在顶升操作过程中，确认新加标准节与原标准节已连接好。

(8)顶升完成后将爬升架落到塔身最低位置。如果加节高度超过塔机自由高度，则需将爬升架落到附着框附近并利用自身爬爪固定在标准节上。

5.1 Notes for jacking operation

(1) When the tower top wind speed exceeds 12m/s, the tower crane lifting is prohibited.

(2) In jacking process, the tower crane should be in equilibrium.

(3) It is prohibited to operate the lifting hook for any lifting or lowering operation during jacking operation.

(4) In jacking process, the upper part of the tower is prohibited for rotation operation.

(5) Before jacking, rotate the boom to the mast-introduction side of climbing frame.

(6) Pay attention to check cables hanging position before jacking, to prevent damage to the cable during lifting process.

(7)In jacking process, confirm that the newly-added mast has been connected with the original mast.

(8) After jacking operation, fell the climbing frame on the lowest position of tower body. If the added height exceeds the free height of the tower crane, you need to fall the climbing frame near to the tie frame and fix it on the mast using its own climbing claws.

5.2顶升准备

塔机顶升是一项技术性很强的操作，作业前要作好充分的准备，作业过程中要注意各分工人员之间密切配合，且必须要有技术人员现场指挥。顶升时，现场人员必须佩带安全帽，高空作业人员必须佩带安全带。

5.2 Jacking preparation

Jacking is a highly technical operation, so it should be fully prepared. In the process pay attention to the division of labor between the staff and the technical staff must be on-site for command. When lifting, field personnel must wear helmets and high-altitude operations personnel must wear seat belts. The following are requirements for jacking preparations:

5.2.1安装引进梁

为使塔机利用最小幅度，有时需将引进梁拆下，当进行顶升作业时再将引进梁安装就位。初始安装时，为便于安装可在地面将引进梁安装在下支座上后与回转总成一起整体吊装。

5.2.1.1 在下支座上安装引进梁

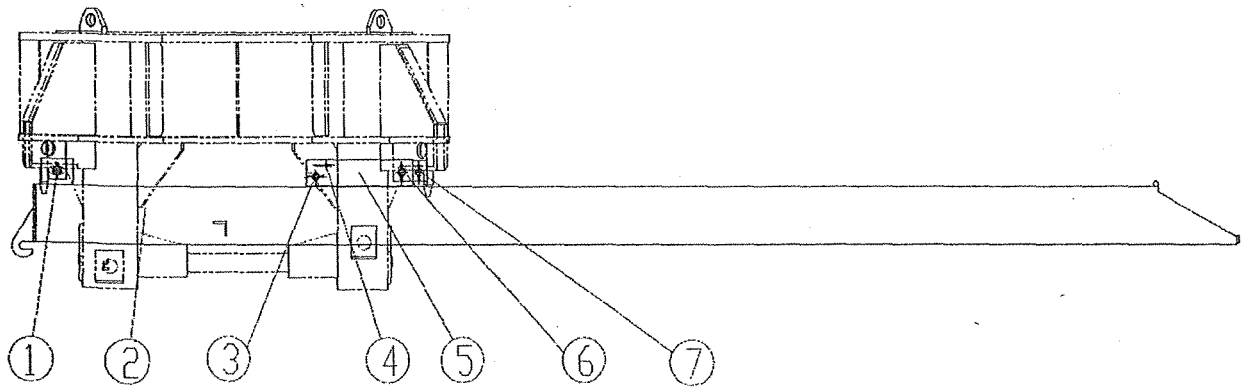
用销轴 1（φ30×68）、销轴 2（φ30×160）、销轴 3（φ16×160）、销轴 4（φ30×160）、销轴 5（φ30×68）将引进梁、支承板按图 5-1 所示安装在下支座上，每个销轴安装后装好开口销（GB/T91-6.3×50）。

5.2.1 Removal and Installation of the Inlet Beam

In order to make the tower crane use the minimum luffing position, the inlet beam shall be removed when necessary and the inlet beam shall be re-installed when jacking operation is conducted.

5.2.1.1 Mounting inlet beam on the lower support

Mount the inlet beam and supporting plate according to Figure 5-1 on the lower support by y pin 1 (φ30×68), pin 2 (φ30×160), pin 3 (φ16×160), pin 4(φ30×160) and pin 5 (φ30×68). After that, fit each pin with cotter pins (GB/T91-6.3×45).



1.销轴1 2.引进梁 3.销轴2 4.销轴3 5.支承板 6.销轴4 7.销轴5

图5-1 在下支座上安装引进梁示意图

1. Pin shaft 1 2. Inlet beam 3. Pin shaft 2 4. Pin shaft 3

5. Supporting plate 6. Pin shaft 4 7. Pin shaft 5

Figure 5-1 Mounting inlet beam on the lower support

5.2.1.2拆卸引进梁方法（图5-2）

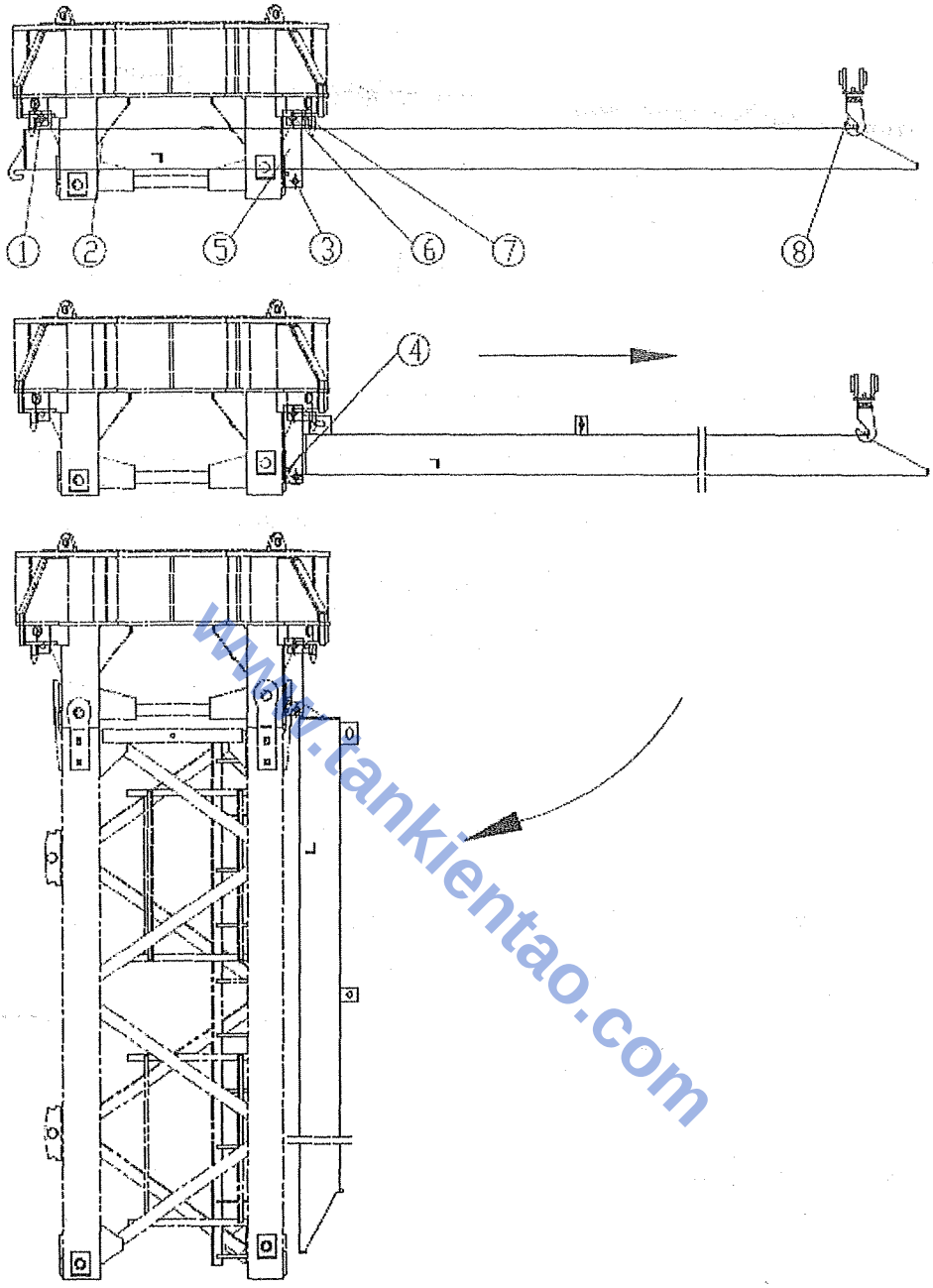
为了不妨碍吊钩在最小幅度范围内工作，工作前必须将引进梁拆下靠近塔身一侧。由于动臂塔机的引进梁很长，必要时应架设平台方便挂钩。

在下支座引进梁处用销轴2（φ30×160）、销轴4（φ30×160）安装支承板，用引进吊钩挂在引进梁外部圆钢上，拆下销轴1（φ30×68）、销轴5（φ30×68）。向外变幅使引进梁后部挂钩钩住支承板下部销轴2后安装销轴3（φ16×160）。下降吊钩，使引进梁悬垂于塔身一侧。每个销轴安装后装好开口销（GB/T91-6.3×50）固定。最后摘下引进吊钩。

5.2.1.2 Inlet Beam Removal Method (see Figure5-2)

In order not to hinder the operation of trolley at the minimum radius, the inlet beam must be removed after jacking for adding sections, and arranged on one side of tower body.

Install supporting plate by pin 2 φ30×160) and pin 4(φ30×160) at the inlet beam of lower support and hang the inlet hook on the outside round steel of inlet beam and remove the pin 1 (φ30×68) and pin 5 (φ30×68). Move the luffing trolley outward to enable the rear pothook of inlet beam to get hooked with the pin 2 below the supporting plate and then mount the pin 3 (φ16×160). Lower the hook to make the inlet beam hang on one side of tower body. Install cotter pins (GB/T91-6.3×60) on pins after mounting. At last remove the inlet hook.



1.销轴1 2.引进梁 3.销轴2 4.销轴3
5.支承板 6.销轴4 7.销轴5 8.加节吊钩

图5-2 拆卸引进梁示意图

1. Pin shaft 1 2. Inlet beam 3. Pin shaft 2 4. Pin shaft 3
5. Supporting plate 6. Pin shaft 4 7. Pin shaft 5 8. Hook for adding mast

Figure 5-2 Dismantling inlet beam

5.2.1.3安装引进梁方法（见图5-3）

用引进吊钩挂住引进梁前部圆钢并将引进梁提升到水平位置，拆下销轴 3（φ16×160），向内变幅使引进梁后端到达安装孔位置，用销轴 1（φ30×68）安装引进梁。稍稍提升引进

1、每次顶升时最后一节应有一个歇息平台。

2、在塔机安装高度大于标准塔高时，每两个歇息平台间隔不大于三个标准节。

歇息平台具体位置参见表5-1。

Please keep to the following principles for positions of passages on tower body:

1. During each jacking process, the last mast should be the one with a resting platform.

2. The distance between two channels must below 10m when installation height is higher than the standard height. The following are details about the positions of passages (see Table 5-1)

9										D
8									D	A
7								D	A	A
6							D	A	D	D
5						D	A	D	A	A
4					D	A	A	A	A	A
3				D	A	D	D	D	D	D
2			D	A	D	A	A	A	A	A
1		A	A	A	A	A	A	A	A	A
0	D	D	D	D	D	D	D	D	D	D
节数	0	1	2	3	4	5	6	7	8	9

表5-1 固定式通道组合表

Table 5-1 Passage combinations

注：0表示基础节，1表示加强节 2-9表示标准节。

A 表示无平台、D 表示有平台。

本通道组合适用于为固定式和附着式，当标准节数量大于10时，可按通道组合表类推。

Note: 0 indicates the basic mast, 1 indicates the strengthened mast and 1 to 10 indicates the mast.

A indicates without platform ,D indicate with platform

The passage components are used together with the tower masts, including three types of A and D.

The passage combination in the figure is fit for the fixed and attached tower cranes. If mast number is over 9, the passage to be installed can be according to the passage combination table.

5.2.3顶升系统检查

顶升前需要检查顶升系统是否完好。启动顶升系统，来回伸、缩油缸数次。检查液压系统各部件是否完好，有无漏油、渗油现象；顶升油缸运动是否顺畅、到位；检查顶升油箱油位计显示油量在油缸完全收回时是否在1/3到2/3刻度之间，如果油量减少应及时补油。

5.2.3 Jacking system inspection

Please verify before lifting about whether jacking system is intact. Start jacking system to stretch oil cylinder back and forth several times. Check whether the various components of the hydraulic system are sound, whether there is oil leakage, and whether jacking cylinder movement is smooth and in-place. Check whether the lifting oil level displayed on oil tank is when the fuel tank is fully retracted between 1/3 and 2/3. If the fuel has reduced, fill oil promptly.

5.2.4顶升系统测试

操作顶升控制手柄进行试顶升动作，当液压系统压力到达溢流阀设定的压力后保持10秒，如果压力一直保持不变，则顶升系统可进行顶升加节操作。

5.2.4 Jacking system testing

Operate the control handle for jacking trial action. When the hydraulic system pressure reaches up to the set pressure of relief valve for 10 seconds, if the pressure remains constant, the jacking system can be operated for jacking and mast-adding operation.

5.3顶升加节

顶升加节应按照吊装标准节至引进梁上、配平、顶升的步骤进行。

5.3.1吊装标准节

先将引进小车安装在标准节上，然后吊起引进小车挂到引进梁上，将顶升平衡配重调至相应幅度。

5.3.1.1引进小车安装（见图5-6）

用 2 套螺栓（每套包含 1 栓 1 母，螺栓 GB/T5783-M16×90，螺母 GB/T6170-M16）将连杆安装在引进小车上。将装好的小车吊至代加标准节上方，用 2 套螺栓（每套包含 1 栓 1 母，螺栓 GB/T5783-M20×60，螺母 GB/T6170-M20）将连杆与标准节连接。

5.3 Jacking for adding mast

Steps of adding mast are mounting mast on inlet beam, balancing and jacking up.

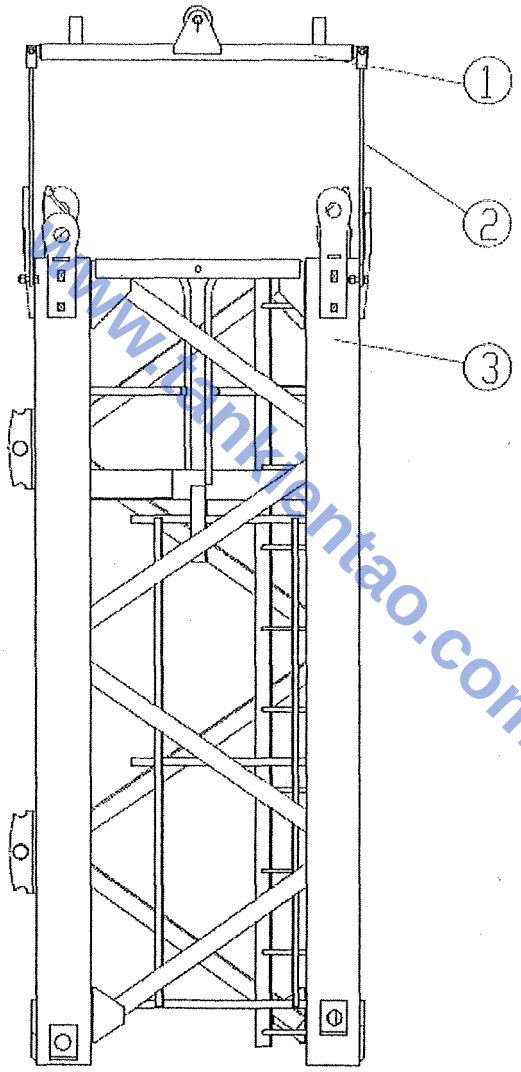
5.3.1 Lifting the mast

First mount inlet trolley on mastand then lift up the inlet trolley onto inlet beam, balancing and

adjusting balance weight to certain radius.

5.3.1.1 Mounting inlet trolley (Figure 5-6)

Mount connecting rod by two sets of bolts (each set includes one bolt (M16×90), one nut (GB/T6170-M16))on inlet trolley. Then suspend the assembled trolley unit beyond the mast to be added and fix the connecting rod with mast by two sets of bolts (each set includes one bolt (M20×66), one nut (GB/T6170-M20)).



1.引进小车 2.连杆 3.标准节

图5-6 引进小车安装示意图

1. Inlet trolley 2. Connecting rod 3. Mast

Figure 5-6 Installation of inlet trolley

5.3.1.2标准节吊装（见图5-7）

将吊钩上的钩头拆除，安装上加节吊钩。开动机构将挂在引进小车上后吊起标准节，最

后将标准节挂至引进梁上。

5.3.1.2 Mounting masts (Figure 5-7)

Remove the hook head on the hook and mount a special hook for adding mast. Actuate the mechanisms to hang up the mast on inlet trolley and then to suspend it on inlet beam.

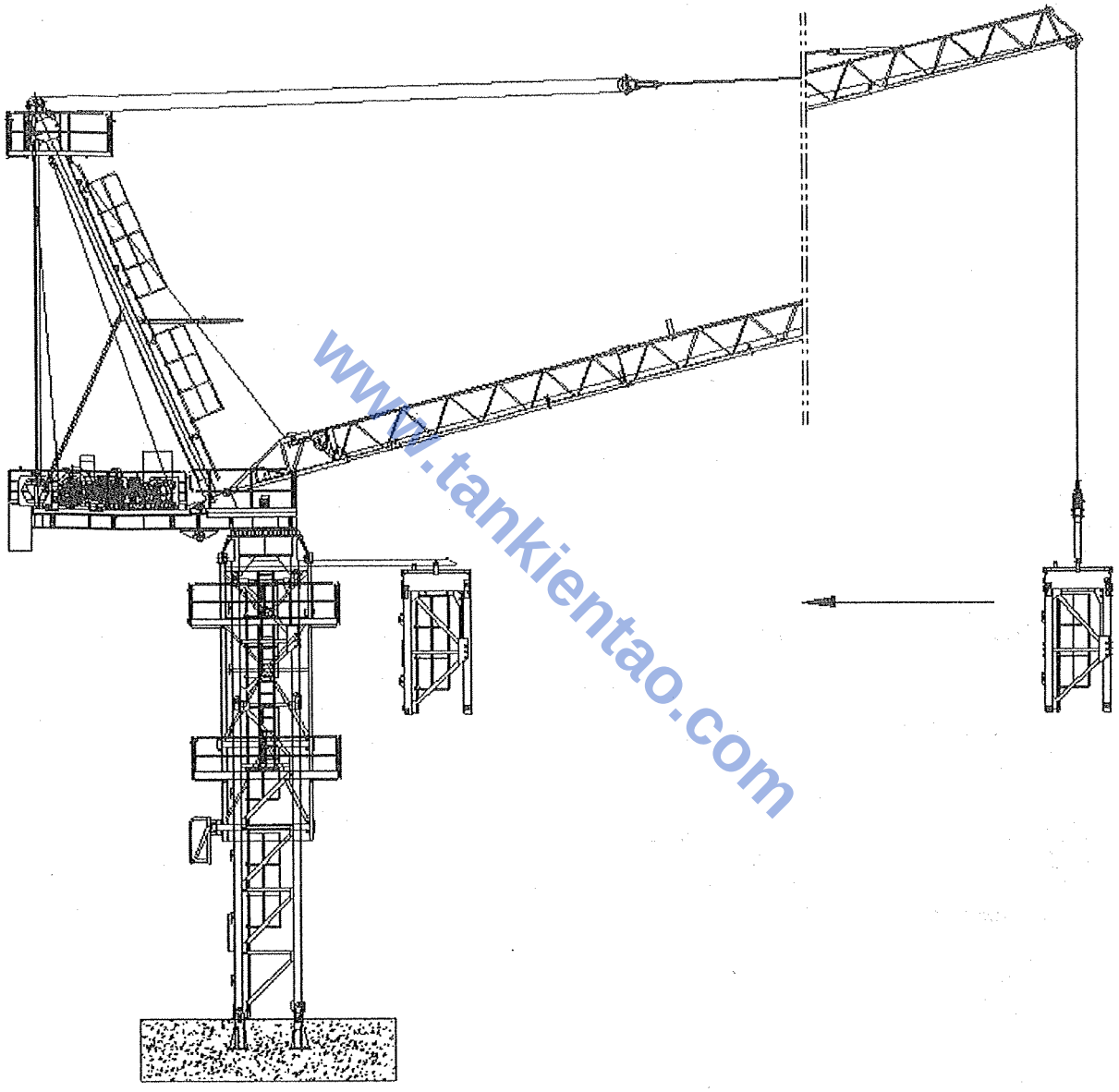


图5-7 标准节吊装示意图

5.3.2顶升配平(见图5-8)

按理论配平的状态，在相应工作幅度起吊相应重量(见表5-2)。当达到理论配平状态后，将标准节与下支座的连接销轴拆吊，缓慢启动顶升液压系统稍微顶起少许(一般顶出5～10mm即可)，观察前后平衡情况。若不平衡，则继续缓慢进行变幅来进行调整，直到前后平衡力矩相等。

5.3.2 Jacking trimming (see Figure 5-8)

According to the theoretical trim state, lift up the corresponding weight at corresponding

working range (Table 5-2). At the theoretical trim state, remove connection bolts for mast and the lower support, observing the torque value displayed on the man-machine interface. Slowly start the hydraulic jacking system a little (typically jacking about 5 ~ 10mm), observing the balance condition before and after. If the deviation, continue to move the boom back and forth slightly for adjustment back and forth until the balance moments are equal.

表5-2 顶升配平表

Table 5-2 Jacking trimming

臂长（m） Arm length	配平衡重幅度 Trimming radius（m）	配平重量 Trimming weight（t）
42.51	31.2	0
37.51	21.2	1.11(1个标准节)(1 mast)
32.51	22.1	1.11(1个标准节)(1 mast)
27.51	16.4	2.22(2个标准节)(2 mast)

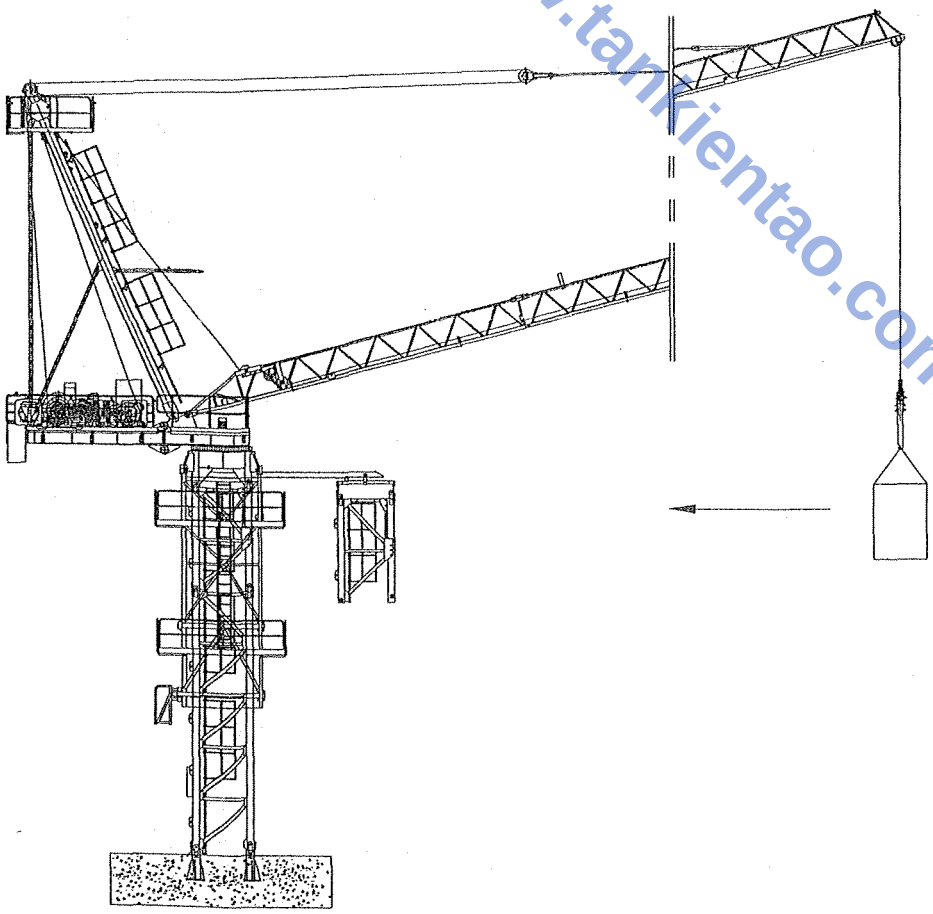


图5-8 顶升配平示意图

Figure 5-8 Balance for jacking operation

5.3.3增加标准节

在顶升加节时应将起重臂旋转至引入塔身标准节方向，同时放松电缆长度略大于总的爬升高度，检查并保证电缆不被其它物件挂住，以免在顶升过程中被损坏。顶升步骤如下：

1）在顶升时如果下支座和标准节之间连接有销轴，需要拆下下支座与标准节的连接销轴。操作液压泵站操纵杆使液压油缸带动爬升架以上部分向上运动。当爬升架顶升棘爪靠近踏步时，操作棘爪操纵杆使顶升棘爪与塔身分离。

2）继续向上顶升，当爬升架顶升棘爪能够顺利挂在上一踏步时，操作棘爪操纵杆使顶升棘爪与塔身贴合。操作液压泵站操纵杆使液压油缸带动爬升架以上部分向下运动，通过顶在踏步上的顶升棘爪使爬升架以上部分临时固定在踏步上。

3）拉出顶升横梁上的销轴，操作液压泵站操纵杆使顶升横梁向上移动。当顶升横梁的销轴能安装在上一踏步时，将顶升横梁的销轴安装在踏步上。

5.3.3 Adding mast

During adding mast, rotate jib to the direction of bringing in mast. At the same time, the released cable length needs to be slightly larger than the total climbingheight.Check and ensure that the cable is not caught by other objects, so as not to be damaged in the lifting process.The jacking steps are:

1) if there are connecting pins between lower support and mast during jacking process, it needs to remove the connecting pins. Actuate the joystick of hydraulic pump to make upper partabove climbing frame move upward. When the jacking detent is close to step, operate detent joystick to take apart the detent from tower body.

2) Continue to jack up until the detent of climbing frame is hooked on the upper step. Operate the joystick to detent close to tower body. Actuate the joystick of hydraulic pump to make upper partabove climbing frame move downward. Through the detent on step to fix temporarily the upper parts above the climbing frame on steps.

3) Pull out the pins on jacking beam and operate the joystick of pump to move jacking beam upward so that the pin of jacking beam can be mounted on the upper step.

该过程要重复三次方能形成可将一节标准节放进顶升套架内的空间。将爬升架引进梁上的标准节拉进至塔身正上方，稍微缩回油缸，将新引进的标准节落在塔身顶部并对正，然后拆下引进小车上的标准节。用标准节连接销轴将两节标准节连接稳固。再次缩回油缸，将下支座

落在新加的标准节顶部并对正，用标准节连接销轴将下支座与标准节连接牢靠（若连续加多节标准节，可用爬升架上的加节销轴临时将下支座与标准节连接起来。完成加节后用标准节连接销轴将下支座与标准节连接牢靠），即完成一节标准节的加节工作。

若连续加几节标准节，则可按照以上步骤重复几次即可。

注意 回收顶升横梁时，应注意防止顶升横梁与标准节的踏步、鱼尾板、螺栓干涉。

This process needs to be repeated three times to complete the operation of placing one mast into climbing frame. Pull the mast on introduction beam right above the tower body, and retract the oil cylinder a little to drop the mast right on the top of tower body. And then release the mast on introduction car. Fasten the upper and lower tower masts with connecting pins. After that, retract the oil cylinder again to place the lower support on the newly-added tower body top aligning at the same time and connect them by connecting pins of masts (if you want to add more mast continuously, connect temporarily the lower support and mast by pin shafts for adding masts on climbing frame. After having added masts, fix lower support and mast firmly by connecting pins of mast). That is whole process of adding mast.

If you want to continue adding more masts, repeat the above steps several times as you need.

When retracting jacking beam, attention to avoid interfering of jacking beam with steps, fishplates or bolts of mast.

第 6 章附着安装

Chapter 6 Anchoring Installation

当 XGL4015K-6 塔式起重机附着工作时，塔机的最大附着高度为 135.65 米。基础中心距建筑物为 3.2 米，其起重臂安装方向应便于拆塔。不同臂长的附着高度见图 6-1。

When theXGL4015K-6tower crane works in anchoring manner, its lifting height is 135.65 meters. The center of the base is 3.2 meters from the building, and the direction of the boom shall parallel with the building during climbing.Adhesion heights for different jib lengths are shown in Figure 6-1.

6.1 安装前准备工作

6.1.1 混凝土基础的施工

根据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。

6.1.2 附着间距

各种臂长组合时的附着间距、附着点位置和能达到的最大高度见图 6-1。

6. 1 Preparation before installation

6. 1. 1 Construction of concrete base

Users and installation units construct the concrete base according to the given drawing of stationary base with ballast and meet the required technical requirements simultaneously.

6.1.2 Adhesion distance

Adhesion distances for various jib combinations, forms and positions and possible max adhesion height are shown in Figure 6-1. To reduce adhesion reaction and adhesion layers, prior to install adhesion, jack up one mast.

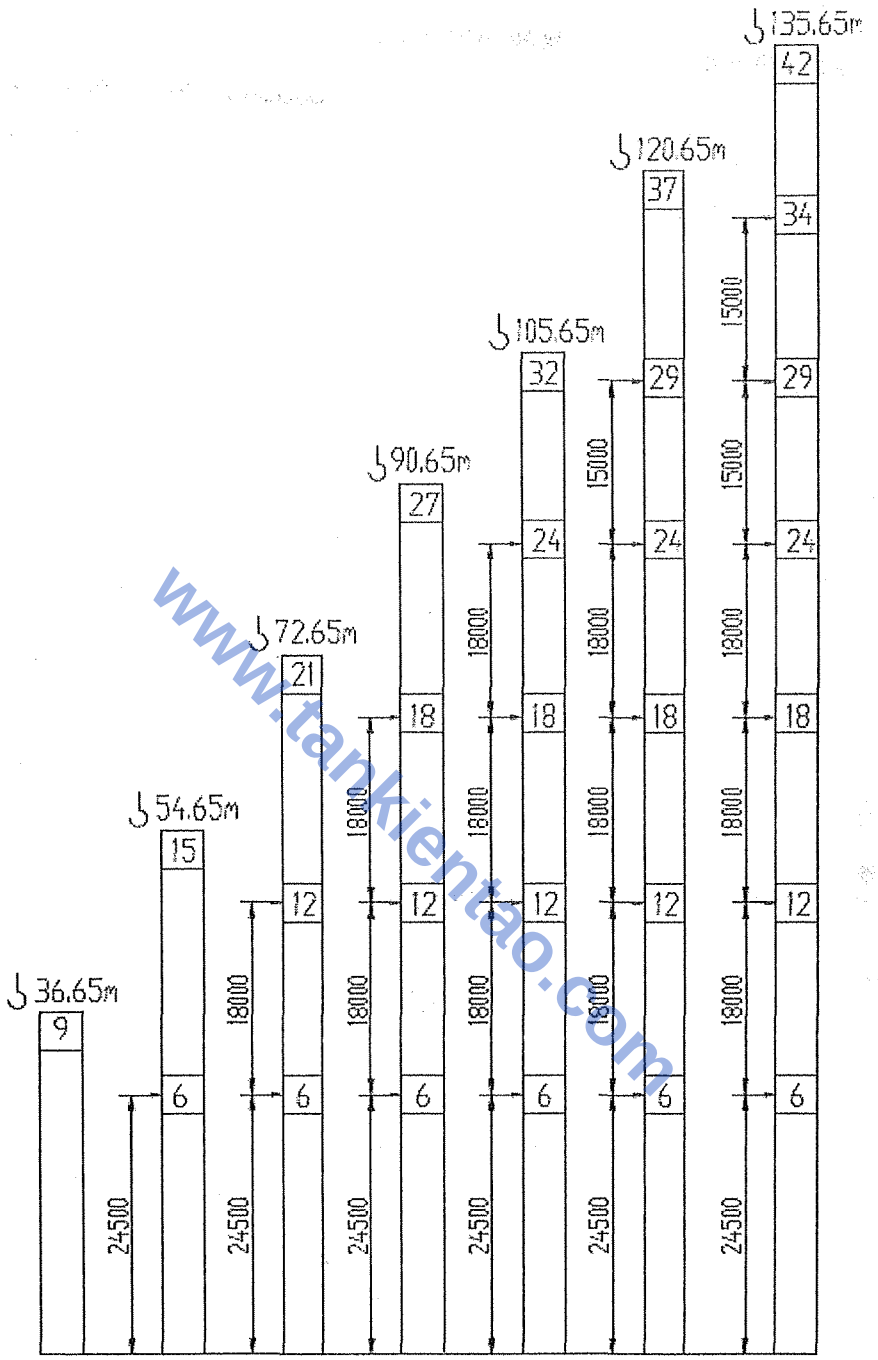


图 6-1 附着示意图

Figure 6-1 Schematic Diagram of Anchoring

6.1.3 附着点的布置

6.1.3.1 垂直方向上的附着点位置

当塔机计划使用总高度确定以后，可按附着间距确定垂直方向上的附着点位置。

6.1.3.2 水平方向上的附着点位置

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。附着的布置应使附

着杆的受力明确，受力较小；附着点最好选取建筑物的承载能力较强的位置。

应根据塔机的附着反力，对附着点的建筑物承载能力进行计算，不要盲目作出决定。同时对附着杆和预埋件的承载能力也应进行计算。当采用标准附着间距、图 6-1 的附着形式及位置时，附着点反力见图 6-2。遇到非标附着请咨询我们。

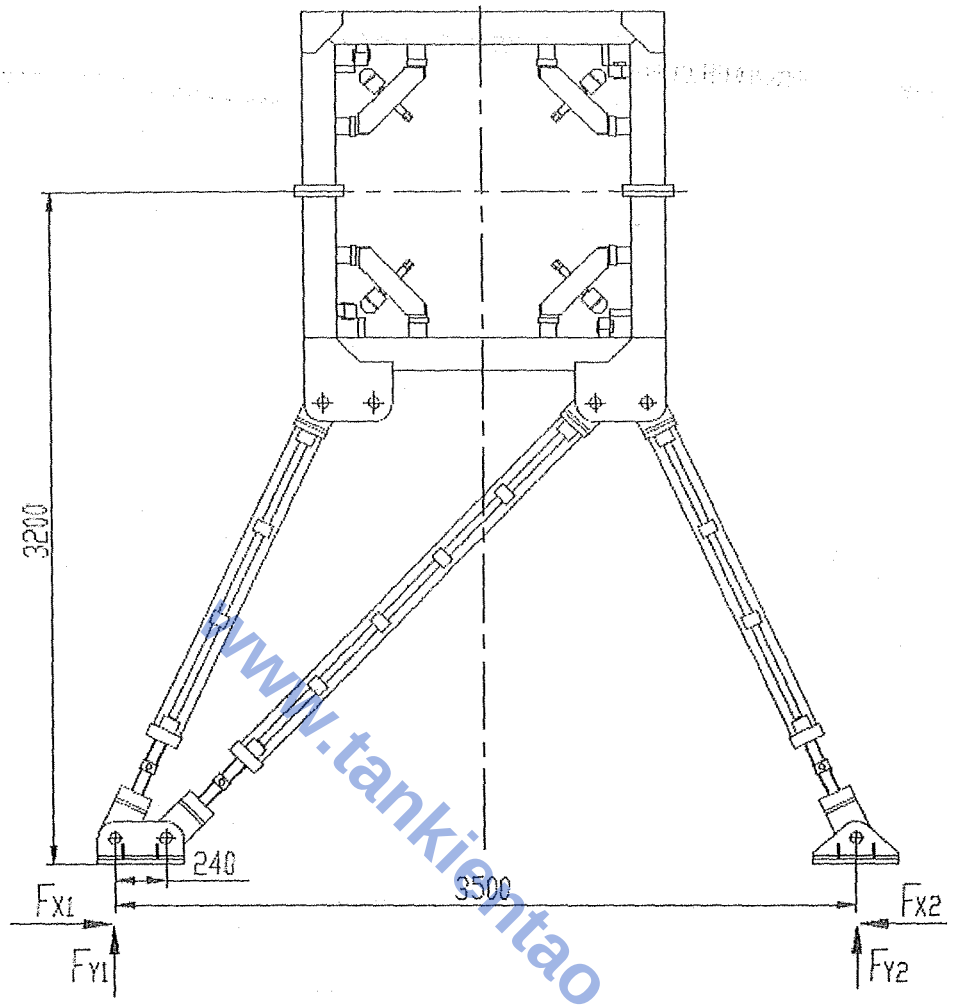
6. 1. 3 Layout of the anchoring points

6. 1.3. 1 Anchoring points in vertical direction

After the planned total height for the tower crane is determined, the anchoring points in vertical direction may be determined according to adhesion distance.

6. 1. 3. 2 Anchoring points in horizontal direction

There is no fixed way for arranging the anchoring points in horizontal direction and the layout is flexible according to the specific conditions of the building. It is advised to choose the position where struts are clearly at the minimum forced and where the bearing capacity of building is high. Calculate the force condition of the anchored points and do not make a decision blindly.Calculate the bearing capacity of adhesion struts and pre-embedded parts. For employment of standard adhesion distance, forms and positions, the reactions of adhesions are shown in Figure 6-2. For non-standard design, please contact us.



代号 Code	X_1	Y_1	X_2	Y_2
载荷(t) Load	±18.2	±30.3	±14.4	±30.3

图 6-2 三杆式附着点反力

Figure 6-2Three rods reactions

6.1.4 附着撑杆

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。应根据实际距离设计撑杆。有关撑杆的设计要注意如下问题：

(1)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

(2)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。

(3)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。

6. 1. 4 Anchoring strut rod

The tower crane may anchor to different positions in every anchoring so the length of the anchoring strut rod is uncertain. The strut rod shall be designed according to the actual distance.

Following issues shall be observed in the design of strut rod.

(1) First, the axial force suffered by each strut rod shall be calculated and the one which suffers maximum force shall be chosen as the basis for design.

(2) If the anchoring strut rod is long, the effect of additional torque produced by the dead weight of the strut rod to the strut rod shall be considered.

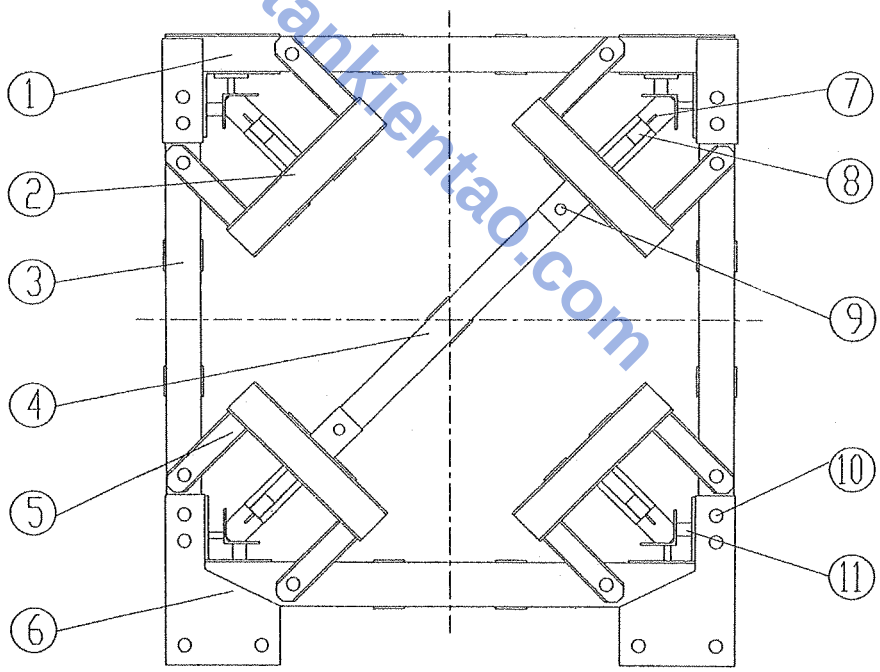
(3) If the anchoring strut rod is long, it can be divided to several parts for manufacturing and assembly on site. Under this condition, the connection form and strength shall be considered thoroughly.

6.2 附着的安装

6.2.1 附着框的组成(如图 6-3 所示)

6.2 Adhesion installation

6.2.1 Tie frame components (as Figure 6-3)



1.后框 2.前框 3.楔块

4.顶块 5.顶杆 6.抱箍

图 6-3 附着框的组成

1. Rear frame 2. Front frame 3. wedge

4. Support block 5. Support rod 6. Clamp

Figure 6-3 Tie frame component

6.2.2 附着框的安装

附着框的安装步骤如下：

(1)首先在准备安装附着框的标准节上搭建一临时平台；

(2) 吊起前框至安装高度使朝向建筑物一侧，用手拉葫芦及绳索将前框临时固定在塔身上（注：前框上焊接的斜块大头必须朝下）。

(3)吊起后框至塔身另一侧，用手拉葫芦及绳索将后框的位置调整好后用 12 套螺栓将前后框连接好（注：前框上焊接的斜块大头必须朝上；螺栓规格为 M24、性能等级为 10.9 级、具有 1 栓 2 母、螺栓的预紧力矩为 600N.m）。

(4)用 8 套螺栓将抱箍进行连接（螺栓规格为 M30、性能等级为 10.9 级、具有 1 栓 2 母 1 垫板），螺栓穿入抱箍后再穿入附着框。

(5)将顶杆拧入螺母后再拧入抱箍，将顶块放到合适位置后进行拧紧顶杆（顶杆端头必须穿入顶块上的孔），最后拧紧螺母。

(6)将楔块板插入附着框斜块的对应位置，依次逐渐打紧楔块。此时要注意楔块安装时的方向，不要装反(如图 6-4 所示)。

(7)检查框架与塔身之间是否贴合紧密，将所有楔块打紧、打实。

6. 2. 2 Mounting and use of the anchoring or tie frame

Mounting steps of tie frame as shown in the following:

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

(2) Hoist a front Frame to the mounting height and make it toward the building, Fix the front frame at the tower body temporarily with a chain block,

Note： the wedge welded on the front frame must have its big end above

(3) Hoist a rearframe to the side of the tower body and connect it with the front frame by 12 sets of bolts（note：the wedge welded on the front frame must have its big end above，the bolt sets are M24， property grade is 10.9 class， have 2 nuts， the pre-tension is 600N.m）

(4)connect the Clamps with Tie frame with eight sets of bolts(the bolt sets are M24， property grade is 10.9 class， have 2 nuts) ,the bolts should be wringed into the clamps firstly.

(5) Insert the Support rod into the Nuts,then insert it to the clamp,and insert the support rod to the support block, then tighten up the Support rod,at last tighten up the nut.

(6) Insert the wedge into the gap between the tie frame and the standard section main

chord,and knock it tighten,note the direction of the wedge, see figure 6-4.

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

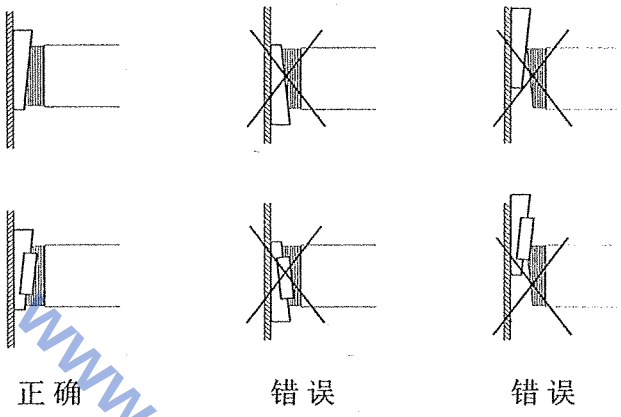


图 6-4 楔块安装方向示意图

Figure 6-4 Mounting direction of wedge blocks

6.2.3 附着撑杆安装和调整

附着撑杆安装和调整和调整步骤如下：

(1)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，两端销轴(Φ55×170)固定好。

(2)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。

(3)锁紧撑杆两端螺母。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。

6.2.4 附着时安装应注意以下几点：

(1)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，应调整通道梯子背圈。

(2)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。

(3)安装附着时，应当用经纬仪检查塔身轴线的垂直度。在空载、风速不大于 3m/s 状态下检测，要求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。

(4)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。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螺栓、楔块松动，并及时进行调整。

6. 2.3Mounting the anchoring strut rod

(1) 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.

(2) 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‰.

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

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.

6. 2.4For the mounting during tower crane anchoring, pay attention to the following points:

(1) 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.

(2) 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.

(3) 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.

(4) 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.

第 7 章拆塔

Chapter 7 Tower Dismantling

拆塔是一项技术性很强的工作（尤其是标准节、平衡臂、起重臂的拆卸），在拆卸过程中如稍有疏忽就会导致机毁人亡。因此用户在拆塔时，需严格按照本说明书的规定操作。拆塔工作人员，必须是经过培训并拿到证书的人员。拆塔时，现场人员必须佩带安全帽，高空作业人员必须佩带安全带。

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.

7.1 拆卸前的注意事项

(1)当塔机顶部风速超过 12m/s 时，严禁拆塔。

(2)在降塔过程中，塔机应处于平衡状态。

(3)在降塔过程中，禁止吊钩进行任何起升或者下降操作。

(4)在降塔过程中，禁止塔身上部进行回转操作。

(5)在降塔过程中，应将起重臂回转至套架引进标准节一侧。

(6)塔机拆塔之前，顶升机构由于长期停止使用，应对顶升机构进行保养和试运转。

(7)应按说明书步骤拆塔，以防止当拆卸某一部件时，其余部分有失去平衡的危险。

(8)在拆塔过程中，吊运钢丝绳及吊带的选择要合理，物件捆绑必须牢固。

(9)在拆塔过程中，确保没有障碍物妨碍拆塔操作。

7.1 Precautions before dismantling

(1) When the tower top wind speed exceeds 12m/s, don't dismantle the tower crane.

(2) During dismantling the tower, the tower crane should be in equilibrium.

(3) It isprohibited to operate the lifting hook for any lifting or lowering operation during dismantling operation.

(4) In dismantling process, the upper part of the tower is prohibited for rotation operation.

(5) Before dismantling, rotate the boom to the mast-introduction side of climbing frame.

(6) Conduct the maintenance and trial operation to lifting mechanism before dismantling if it is disused for a long time.

(7) For disassembly of the components, such as the boom, counter jib, etc. must comply with

related regulations to prevent any danger of losing balance disassembly when one member is disassembled.

(8) In the process of dismantling of the tower, hoisting rope and harness needs to be chosen reasonably and the object must be securely tied.

(9) During dismantling, make sure there is no obstacle.

7.2 拆卸前的准备

7.2.1 顶升系统检查

降塔前需要检查顶升系统是否完好。启动顶升系统，来回伸、缩油缸数次。检查液压系统各部件是否完好，有无漏油、渗油现象；顶升油缸运动是否顺畅、到位；检查顶升油箱油位计显示油量在油缸完全收回时是否在 1/3 到 2/3 刻度之间，如果油量减少应及时补油。

7.2.2 安装引进梁

将引进梁安装至能正常降塔使用的状态（与顶升加节的状态一至）。

7.2.3 连接爬升架与下支座

起动液压顶升系统，使爬升架向上运动。待爬升架与下支座快接触时，找正连接孔位置，用销轴将爬升架与下支座连接好。

7.2.4 顶升系统测试

操作顶升控制手柄进行试顶升动作，当液压系统压力到达溢流阀设定的压力后保持 10 秒，如果压力一直保持不变，则顶升系统可进行顶升加节操作。

7.2 Preparations before dismantling

7.2.1 Jacking system inspection

Please verify before lifting about whether jacking system is intact. Start jacking system to stretch oil cylinder back and forth several times. Inspection items are: Check whether the various components of the hydraulic system are sound, whether there is oil leakage, and whether jacking cylinder movement is smooth and in-place. Check whether the lifting oil level displayed on oil tank is when the fuel tank is fully retracted between 1/3 and 2/3. If the fuel has reduced, fill oil promptly.

7.2.2 Connecting the climbing frame with the lower support

Positioning climbing claws of jacking beam firmly on mast tower steps start hydraulic jacking system for upward movement of climbing frame. When the climbing frame is to almost contact with the lower support, find the aligning hole locations and connect the climbing frame with lower support by pins and cotter pins.

7.2.3 Jacking system testing

Operate the control handle for jacking trial action. When the hydraulic system pressure reaches up to the set pressure of relief valve for 10 seconds, if the pressure remains constant, the jacking system can be operated for jacking and mast-adding operation.

7.3 拆塔顺序

拆塔的步骤与安装立塔顺序向反，在进行拆塔时应先了解安装立塔过程。主要拆踏步骤说明如下：

(1)降塔

降塔是将塔机降至最小高度，以降低对吊装设备的要求。在降塔时应将起重臂旋转至引出标准节方向，同时将塔机配平(与顶升加节的配平方法一样)。降塔顶升步骤如下：

1)在顶升时如果下支座和标准节之间连接有销轴，需要拆下下支座与标准节的连接销轴。操作液压泵站操纵杆使液压油缸带动爬升架以上部分向上运动。当爬升架顶升棘爪靠近踏步时，操作棘爪操纵杆使顶升棘爪与塔身分离。

2)将引进小车拉入连爬升架内后连接标准节，拆除标准节之间的连接销轴后继续顶升，当空间合适后拉出标准节。

3)操作液压泵站操纵杆使液压油缸带动爬升架以上部分向下运动，当爬升架顶升棘爪能够顺利顶在踏步上时，操作棘爪操纵杆使顶升棘爪与塔身贴合。最终通过顶在踏步上的顶升棘爪使爬升架以上部分临时固定在踏步上。

4)拉出顶升横梁上的销轴，操作液压泵站操纵杆使顶升横梁向下移动。当顶升横梁的销轴能安装在下一踏步时，将顶升横梁的销轴安装在踏步上。

7.3 Sequence of dismantling

Order of steps to dismantle the tower is contrary to the order to install the tower crane. So you should firstly understand the installation process. The main steps are as follows:

(1) Lowering tower crane:

The aim is to lower the tower to minimum height to lower the requirements for lifting equipment.During the lowering, rotate jib to the direction of getting out masts and balance tower crane (in the way of jacking and adding masts). The steps of lowering tower crane are:

1) If there are connecting pins between lower support and mast during jacking process, it needs to remove the connecting pins. Actuate the joystick of hydraulic pump to make upper part

aboveclimbing frame move upward. When the jacking detent is close to step, operate detent joystick to take apart the detent from tower body.

2) Move the inlet trolley into the climbing frame and connect it with mast. Remove the connecting pins between masts and continue to jack up until there is enough space to pull out mast section.

3) Actuate the joystick of hydraulic pump so that oil cylinder can make upper partabove climbing frame move downward. Continue to jack up until the detent of climbing frame is hooked on the upper step. Operate the joystick to detent close to tower body. Through the detent on step to fix temporarily the upper parts above the climbing frame on steps.

4) Pull out the pins on jacking beam and operate the joystick of pump to move jacking beam upward so that the pin of jacking beam can be mounted on the lower step.

继续重复第三步和第四步两次后方能拆下一节标准节。拆下标准节后将下支座落在标准节顶部并对正，用标准节连接销轴将下支座与标准节连接牢靠（若连续拆多节标准节，可用爬升架上的加节销轴临时将下支座与标准节连接起来。完成拆节后用标准节连接销轴将下支座与标准节连接牢靠），即完成一节标准节的拆节工作。

(1)若连续拆几节标准节，则可按照以上步骤重复几次即可。

(2)将起升钢丝绳全部圈绕在起升机构卷筒上。

(3)用起升吊稳住起重臂后将变幅绳全部圈绕在变幅机构卷筒上。

(4)依次拆除起重臂、塔顶、平衡重、平衡臂、回转总成、液压系统、爬升架、加强节、基础节、小支腿。

当所有零部件拆下以后，可在地面上进行分解，分解后应做好包装，以便运输和保管。

Continue repeating the steps 3) and 4) twice you can remove one mast. After removing mast, place lower support on mast top in alignment and connect them together by connection pins of mast (if you want to add more mast continuously, connect temporarily the lower support and mast by pin shafts for removing masts on climbing frame. After having removed masts, fix lower support and mast firmly by connecting pins of mast). That is whole process of removing mast.

(1)If you want to continue removing more masts, repeat the above steps several times as you need.

(2) Wind all lifting rope on the drum of lifting mechanism.

(3) Use truck crane to stabilize jib and wind all luffing rope on the drum of luffing mechanism.

(4) Remove the following parts in order: jib, tower top, counterweights, counter jib, slewing unit,

and hydraulic system, climbing frame, strengthened mast, basic mast and small outriggers.

After all parts having been removed, resolve them on the ground and pack them well for transport and storage.

第 8 章电气系统

Chapter 8 Electrical system

8.1 电控系统准备工作

8.1.1 工地电源要求

电源要求为 380V，50Hz。

8.1.2 电气控制系统的组成

电气控制系统是整个塔机的控制中心，它包含以下设备：

a) 左右联动台；

b) 驾配箱、主控柜(变幅回转柜、起升柜)；

c) 三大机构的电机；

d) 重量、力矩、行程限位器等保护装置

8.1.3 电气控制系统的连接

电控系统应按下图连接

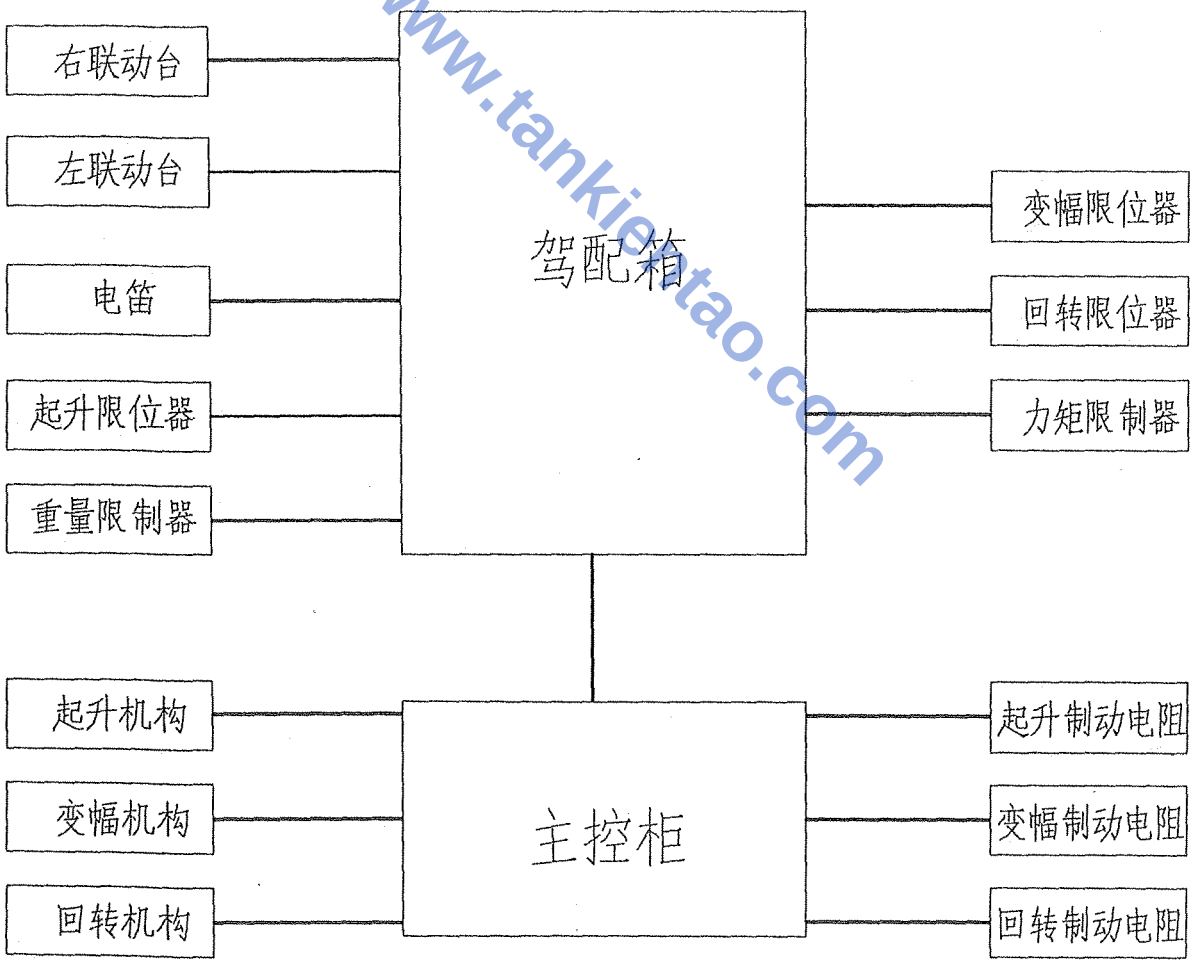


图 8-1 电控系统连接框图

8.1 preparation of electrical control system

8.1.1Power requirement

Power requirement should be 380V，50Hz。

8.1.2The constituent of electrical control system

The electrical control system is the control central of tower crane，include：

a) Left and right console；

b) Cab distribution cabinet、main-control cabinet (luffing-slewing cabinet、hoisting cabinet)；

c) Motor of three main-mechanism；

d) Protection such as load、moment、stroke limiteretc protector.

8.1.3 **The connection of electrical control system**

The electrical control system should connect by following graph

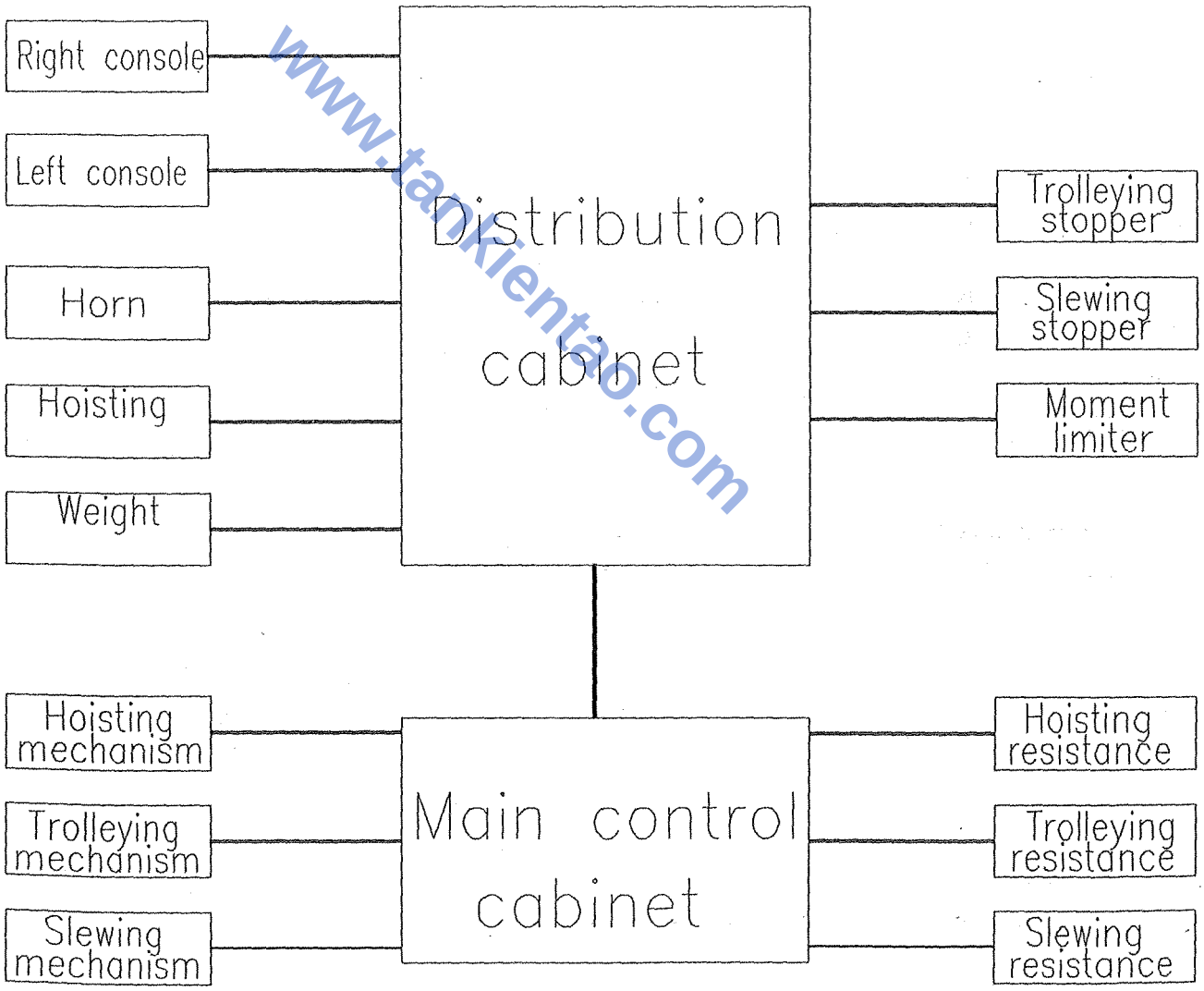


Figure8-1electrical connection schematic

8.2 电控系统使用方法

8.2.1 系统提示与报警信号

驾驶员在使用联动台手柄操作时，每次换挡时都会听到一声“嘀”的提示声。如果换挡时没有听到提示声，表示该档位输入不正常，一般情况下是由于报警原因（详见下面的说明）。

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：

8. 2 Use method of electrical control system

8.2.1 System prompt and alarm signal

While using the handle of the control console for operation, the driver will hear a “tick” prompt tone each time he/she shifts the gear. If the driver fails to hear the prompt tone, it indicates that the gear input is not normal which generally attributes to alarm reasons (see details below).

While operating the electrical control system the drive shall be acquainted with the following alarm signals provided by the system:

1）超力矩信号

当起重力矩超过最大允许值时，电控系统会作如下反应：

a. 联动台上的红色“超力矩”报警灯闪烁。

b. 联动台上的蜂鸣器发出连续的“嘀嘀嘀嘀”连续报警声。

c. 主钩的上升运动被禁止。

d. 小车的向外运动被禁止。

解除方法：内向变幅。

1）Excessive torque signal:

The electrical control system shall act as follows when the lifting moment exceeds the maximum allowable value:

a. The red “excessive torque” warning light on the combination control console flashes.

b. The buzzer in the control console utters successive “dick, dick, dick, dick" alarm sounds.

c. The ascending movement of the main hook is prohibited.

d. The outwards movement of the trolley is prohibited.

Corrective action:The trolley shall travel outwards.

2）超重量信号

当起重量超过最大允许值时，电控系统会作如下反应：

a. 联动台上的红色“超重量”报警灯闪烁。

b. 联动台上的蜂鸣器发出连续的“嘀嘀嘀”连续报警声。

c. 主钩的上升运动被禁止。

解除方法：起升下降操作，减轻吊重。

2）Overweight signal:

The electrical control system shall act as follows when the lifting exceeds the maximum allowable value:

a. The red “overweight” warning light on the combination control console flashes.

b. The buzzer in the control console utters successive “dick, dick, dick, dick" alarm sounds.

c. The ascending movement of the main hook is prohibited.

Corrective actions:Descend the hook and reduce the hoisting weight.

3）力矩预警信号

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：

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。

3）Pre-warning signal of torque:

The electrical control system shall act as follows when the lifting moment exceeds 80% of the maximum allowable value:

a. The yellow “excessive torque” warning light on the combination control console flashes.

b. The buzzer in the combination control console utters successive “dick, dick " alarm sounds.

c. No high speed is attainable when the trolley travels outwards; the trolley traveling outwards at high speed will automatically decelerate to the lowest speed.

4）超 75%重量换速信号

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。

4）Overweight throw-over 75%signal:

The electrical control system shall act as follows when the lifting load exceeds 75% of the maximum allowable value:

a. The yellow “overweight” warning light on the combination control console flashes.

b. The third, fourth and fifth gears fail to function during the lifting operation.

c. If a high-speed gear is applied for the lifting operation, the trolley shall automatically decelerate to the speed of the second gear.

5）超 35%重量换速信号

当起重量超过最大允许值的 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。

5）Overweight throw-over 35%signal:

The electrical control system shall act as follows when the lifting load exceeds 35% of the maximum allowable value:

a. The yellow “overweight” warning light on the combination control console flashes.

b. The fifth gear doesn't function during the lifting operation.

c. If the fifth gear is used for the lifting operation, the trolley will automatically decelerate to the fourth gear.

6）超高限位信号

当吊钩高度已达最大允许值时，电控系统会作如下反应：

吊钩的上升运动被禁止。

6）Ultra-high reduction signal:

The electrical control system shall act as follows when the hook on the rise is several meters away from the ultra-high limit:

The ascending movement of the hook is prohibited.

7）超高减速信号

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：

吊钩上升运动自动减速至第一档速度。

7）Ultra-high reduction signal:

The electrical control system shall act as follows when the hook on the rise is several meters away from the ultra-high limit:

The hook speed will automatically decelerate to the second gear while rising.

8）超低限位信号

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：

吊钩的下降运动被禁止。

8）Ultra-low limit signal:

The electrical control system will act as follows when the hook height reduces to the maximum allowable value:

The descending movement of the hook is prohibited.

9）超低减速信号

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：

吊钩下降运动自动减速至第一档速度。

9）Ultra-low reduction signal:

The electrical control system shall act as follows when the hook height comes to several meters from the ultra-low limit:

The hook speed will automatically decelerate to the second gear while rising.

10）变幅外行程开关信号

当大臂运行到 15 度时，电控系统会作如下反应：

大臂的向外运动被禁止，如正在向外变幅会突然停车。

10）Out-of-working radius stroke switch signal:

The electrical control system shall act as follows when the jib moves to 15 degree angle:

The outward movement of the jib is prohibited; for example, the jib moves outwards will stop suddenly.

11）变幅外限位信号

当大臂运行到 20 度时，电控系统会作如下反应：

大臂的向外运动被禁止，如正在向外变幅会突然停车，此时按住旁路可以 1 档继续向外运行。

11）Out-of-working radius limit signal:

The electrical control system shall act as follows when the jib moves to 15 degree angle:

The outward movement of the jib is prohibited; for example, the jib moving outwards will suddenly stop，Operate with bypass button the jib can moves outwards at the lowest speed.

12）变幅外减速信号

当大臂运行到 25 度时，电控系统会作如下反应：

大臂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。

12）Out-of-working radius reduction signal:

The electrical control system shall act as follows when the jib moves to 25degree angle:

No high speed is attainable when the jib moves outwards; the jib moves outwards at high speed will automatically decelerate to the lowest speed.

13）变幅内减速信号

当大臂运行到 75 度时，电控系统会作如下反应：

大臂向内运动没有高速，如正在以高速向内变幅会自动减至最低速。

13）Within-working radius reduction signal:

The electrical control system shall act as follows when the jib moves to 75 degree angle:

No high speed is attainable when the jib moves inwards; the jib moves inwards at high speed will automatically decelerate to the lowest speed.

14）变幅内限位信号

当大臂运行到 80 度时，电控系统会作如下反应：

大臂的向内运动被禁止，如正在向内变幅会突然停车，此时按住旁路可以 1 档继续向内运行。

14） Within-working radius limit signal:

The electrical control system shall act as follows when the jib moves to 80 degree angle:

The inward movement of the jib is prohibited; for example, the jib moves inwards will stop suddenly.Operate with bypass button the jib can moves inwards at the lowest speed.

15）变幅内行程开关信号

当大臂运行到 84 度时，电控系统会作如下反应：

大臂的向内运动被禁止，如正在向内变幅会突然停车。

15）Within-working radius stroke switch signal:

The electrical control system shall act as follows when the jib moves to 84 degree angle:

The inward movement of the jib is prohibited; for example, the jib moves inwards will stop suddenly.

16）回转左限位信号

当吊臂向左回转超过一圈半时，电控系统会作如下反应：

吊臂的向左回转运动被禁止，如正在向左回转则回转电机会自动失电。

16）Left limit signal for slewing:

The electrical control system shall act as follows when the crane jib slews leftwards for over one and a half circle:

The leftward slewing of the jib is prohibited; the slewing motor will automatically be de-energized if the jib continues slewing leftwards.

17）回转右限位信号

当吊臂向右回转超过一圈半时，电控系统会作如下反应；

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。

17）Right limit signal for slewing:

The electrical control system shall act as follows when the crane jib slews rightwards for over one and a half circle;

The rightward slewing movement of the jib is prohibited; the slewing motor will automatically be de-energized if the jib continues slewing rightwards.

18）过欠压保护信号

当供电电压大于 110%额定电压或低于 85%额定电压时，回转小车柜上的黄色过欠压指示灯会亮。

如果过欠指示灯长期亮，请不要启动和工作以免损坏电机和电器。

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。

18）Over/under voltage protection signal:

When the supply voltage is greater than 110% or lower than 85% of the rated voltage, the yellow over/under voltage indicator light on the slewing trolley cabinet will be lit.

If the indicator light is on for a long time, please do not activate or operate the tower crane to avoid any damage to the motor and electrical appliances.

Over/under-voltage warning prompt is given on the frequency converter; the frequency converter is has the auto-stop protective function under over/under voltage.

19）向前行走减速停止信号

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：

塔机向前行走经几秒减速后停止。

19）Traveling forward deceleration stop signal

When the tower crane walking forward at the end of the track from only a few meters

away,willtrigger the deceleration stop limit. After slowing down a few seconds, the traveling control system will stop .

20）向前行走紧急停止信号

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：

立即切断行走总电源，塔机立即停止向前行走。

20）Traveling forward emergency stop signal

When the crane walking forward away from the end of the track ,will trigger the emergency stop limit. The traveling control system will cut off the total power supply for traveling and stop immediately .

21）向后行走减速停止信号

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：

塔机向后行走经几秒减速后停止。

21）Traveling backward deceleration stop signal

When the tower crane walking backward at the end of the track from only a few meters away,will trigger the deceleration stop limit. After slowing down a few seconds, the traveling control system will stop .

22）向后行走紧急停止信号

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：

立即切断行走总电源，塔机立即停止向后行走。

22）Traveling backward emergency stop signal

When the crane walking backward away from the end of the track ,will trigger the emergency stop limit. The traveling control system will cut off the total power supply for traveling and stop immediately .

8.2.2 电控系统的操作

电控系统的操作步骤如下：

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。

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。

8.2.2operation of electric system

The electric system is operated in the following procedures:

1）Preparations: including operation of lighting circuit breaker, operation of automatic general breaker, as well as the operation of start and emergency stop buttons.

2）Operation of each mechanism, including lifting, slewing, and trolley.

8.2.2.1 准备工作

1）刀开关的操作

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。

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。

8.2.2.1 Preparations

1) The Operation of knife switch

Knife switch mounted on the bottom of the first section of the tower knife switch box, for power isolation. Pushing up the handle when the knife switch is closed, three-phase five-wire power cables into the tower through the upstream distribution box; pull down on the handle, the knife switch is turned off, the tower power failure. After the knife switch is closed, the voltmeter on distribution will indicate the input line voltage. If no display voltmeter or voltage non-compliant, must find out the reason can only further action. After work, the driver shall switch off it.

NOTE: The standard product is not equipped with knife-switch box, when demand if not marked with a knife-switch box, follow the above instructions.

2）总断路器的操作

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。

⚠注意

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。

⚠警告

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。

警告

以下情况必须立即切断空气开关！

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）。

b.司机下班或因事离开驾驶室时。

2) The Operation of total breaker

Only in the ready for the driver in place, you need a job in order to close the total breaker. Checked the voltmeter to see if normal before closing switch. The total circuit breaker located on the cab of the distribution box, the operating handle is exposed outside of the box, easy to operate the driver. Except the power tower cab all outside agencies, such as the control cabinet power breaker are thus controlled.

Caution

After knife switch is closed, even if the main power circuit breaker is in the OFF state, the electric line before the main power circuit breaker is electric, in the operation, maintenance, repair, pay attention to safety during maintenance, to avoid electric shock.

Warning

Before performing the main power-on operation, the system must check all electrical connections properly, otherwise it will cause an electric shock, burning electrical items and other dangerous accidents.

Warning

The following conditions must be cut off breaker!

a. Experience of necessity and electronic control system failure (such as seizing contactor contact, the failure of the emergency stop button on console).

b. The driver from work or because of something when leaving the cab.

3）司机室照明断路器的操作

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。

⚠ 注意

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，请在操作、检修、维修、维护保养过程中注意安全，避免触电。

3) Maneuvering of lighting circuit breaker

The lighting circuit breaker is located to the right of the general breaker in the slewing trolley. It is a monopole automatic circuit breaker, which is mainly intended to provide short circuit protection for various lights, electric sirens and the user's heating equipment. When the lighting circuit breaker is closed (by pulling up the small hand lever of the breaker), the lighting circuit will be energized (single phase 220V). The driver then may use the three switches in the driver's cab to turn on the room light, project lamp and the obstacle light. It is not necessary to open the lighting circuit breaker every time after work when it is closed.

⚠ Caution

After the knife switch switch is closed, even if the main power circuit breaker is in the OFF state, the power supply circuit cab is also charged, when the operation, maintenance, repair, pay attention to safety during maintenance, to avoid electric shock.

4）启动与急停按钮的操作

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。

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。

⚠ 注意

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。

4) Start the emergency stop button operation

a. Start button (green) in the right console table plate. It is a dual-function buttons, namely:

Start function and electric flute. After the total circuit breaker is closed, when the rotational release console emergency stop button, and press this button, the system starts (total contactor main circuit contactor and total control loop is turned on), the left console table green boot power indicator light. When the emergency button is pressed, the system stops, the green power indicator on left console is off. In addition, when the system starts, whenever press the start button, you can control the electric flute sounds.

b. emergency stop button (red) is also located on the right console panel is a self-locking red mushroom button. In contrast with the start button, emergency stop button cut off the role of the main circuit and control circuit contactor total total contact, thereby enabling agencies emergency stop.

⚠ Caution

When the tower crane operation encountered an emergency situation, too late to stop the normal procedure, the time or the operating handle out of control, you must immediately press the emergency stop button! Rather than an emergency, the emergency stop button must not be used as a normal parking available. Otherwise, it will have a great impact.

5）控制变压器输入侧电压等级调节的操作

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。

5) Operation for controlling the voltage level of the input side of the transformer

In order to adapt to the construction site tower crane power supply is not stable or when there is difference, the input side control circuit transformer in electric control system with 365V、380V、400V、415V different voltage levels, general factory default access 380Vvoltage level (excluding non-standard design).If the power supply industry low voltage (about 360V), please access the input side of the transformer voltage level control from 380V to 365V; If the work power supply voltage is high (about 400V), please access the input side of the transformer

voltage level control from 380V to 400V; If the work power supply voltage is high (about 415V), please access the input side of the transformer voltage level control from 380V to 415V; 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;

8.2.2.2 各机构的操作

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“8.2.1 系统提示与报警信号”一节。

8.2.2.2 operating agencies

When the electronic control system starts successfully, you can operate the mechanism. Use two operating lever and various buttons on console. When using the operating handle, you should use the index finger and middle finger head slider handle the ball inside pull up, releasing zero self-locking, in order to promote ease. Please note that sound and light alarm signal control system occur during operation. Generally, when the sound and light alarm signal occurs, the electronic control system will automatically respond accordingly (such as prohibiting the movement of an organization, a movement direction of deceleration). About alarm signal as per the earlier "8.2.1 system prompts and alarm" one.

1）升降操作

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。上升和下降各分五档位，分别对应于五种速度。切换档位时必须逐级切换。

1) Hoisting operation

Hoisting operations through the handle on the right console table. The rising inside pull, push it when you fall. Rise and fall each divided into five positions, corresponding to five speeds. You must progressively switching to switch gears.

2）变幅操作

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档。对应于从低到高三速度。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。

提示

在某些场合，驾驶员想变幅到最大角度，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开到位。

2)Luffing operation

Luffing operation by the handle on left console control. When the handle outward luffing vertically pushed forward, inward luffing vertically inside the handle is pulled. Inner and outer amplitude amplitude sub third gear. Corresponding to the low speed to high school. During the operation, whether it is from low to high, or from high to low speed must be progressively switched.

PS：In some cases, the driver wanted to luffing the maximum angle, but within reason luffing limit can not be achieved, then you can press the left with his right hand pressed linkage platform "bypass" button, left-handed linkage platform can handle will open place.

3）回转操作

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 为无极调调速)。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。

回转机构为常闭式制动器，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。

塔机回转配置有风标装置，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旁路按钮 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。

⚠ 注意

回转和制动操作时应注意以下几点：

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。

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。

c. 严禁在塔臂未停稳时使用制动开关或制动按钮。

d. 当风速超过 6 级，严禁使用“制动”开关。

⚠ 注意

在使用中，有时会出现以下现象：

a. 回转启动困难，启动时间长。

b. 回转停车时塔机晃动大。

c. 工作一段时间后，回转电机发热严重。

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。

3) Slewing operation

Slewing operation is controlled by the handle on the left console. When the handle counterclock wise turning sideways to the left to pull, turn right when you pull the handle sideways to the right. Left and right swivel rotating the sub-fourth gear, corresponding to the four speeds from low to high (RCV is stepless). During the operation, whether it is from low to high, or from high to low speed must be progressively switched.

Slewing mechanism is normally closed brake, the brake open when power, brake closed when power off. During operation, such as the need to stop the rotation, you can press the brake stage rotary vane rotary button on left console to brake to stop. Recommendations except in exceptional circumstances or dangerous state of emergency does not allow the rotary position during operation by the rotary vane brake button, especially in the high speed rotation, since the boom has a large impact on inertia rotation stop process easily lead to dangerous incidents.

Tower crane is equipped with weather vane，that in case of windy weather when the driver is off work while pressing the buttons and rotary vane brake bypass button for 5 seconds or more to open vane, if the weather vane lights green, the weather vane successful release, the boom can swing freely with the wind, to avoid the weather causes the boom to break down the tower or the tower crane.

Caution

Slewing and brake operation should note the following:

a. Because the tower boom is very long, large rotary inertia must operate smoothly. Acceleration stepwise pull handle must also be gradually returned during deceleration.

b. In addition to the rotating mechanism with hydraulic coupler, prohibited the use of anti-vehicle hit a method decelerate.

c. Do not use the brake switch or the stop button when the tower boom on the move.

d. When the wind speed over 6, prohibited the use of "brake" switch.

Caution

In use, sometimes the following behaviors:

a. difficulty in starting rotation, a long start-up time.

b. Tower crane large rock when slewing parking.

c. After working for some time, the motor serious fever.

At this point, you should first check the power supply, such as in the normal range, please notify the company staff overhaul.

4）行走操作（选配）

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。

注意：除紧急情况外，严禁从高速档直接回到停止档位。

4) Traveling operation (optional)

Traveling is operated by the handle on right console. This pull handle to the left, front row carts, pull carts underwent right. Handle left and right directions of the two stages, corresponding to the two kinds of walking from low to high speed. When you start, you should start with the handle to pull the low gear position, and then pull to upshift; stops should start back to high gear downshift, and then back to stop position.

Note: Except in emergency situations, non-stop directly back from the high gear position.

8.2.2.3 其他操作

1、顶升操作

顶升前请先将随机所配的 4 芯电缆接到顶升泵站上，另一端连接 4 针接插件，然后将插头插入位于主电控柜侧面的 4 针插座内。这样就可以通过液压泵站上的操作手柄进行顶升操作了(具体操作方法请参考塔机使用说明书)。

8.2.2. 3 Other operations

1. Jacking operation

Prior to jacking, connect one end of the 4-core cable enclosed along with the machine to the jacking pump station, with the other end of the cable connected to the 4-pin connector assembly, then insert the connector into the 4-pin socket at main control cabinet. Then the jacking may be performed by means of the operating handle on the hydraulic pump station (refer to the operation

manual for specific operation methods).

2、换倍率操作

由于换倍率时吊钩必须越过高度限位去撞换倍率器，因此用左手按下联动台上的“旁路”按钮，右手操作右联动台上的升降手柄，控制吊钩慢速升降，此时高度限位失灵，可以使吊钩上升至更高位置。

注意：换倍率时不能使吊钩速度过快。

有关“旁路”按钮的另一个用法请见前一节“变幅操作”。

2. Multiplying power changing operation

To change the multiplying power, the hook must come across the height limit to strike the multiplying power changing device, therefore, it is required to press the “standby” button on the control console with the left hand and operate the lift lever on the control console with the right handle to control the hook to ascend/descend slowly, at this time the height limit fails so that the hook may rise to higher position.

Note: the hook speed shall not be over-fast while changing the multiplying power.

An alternative usage of the “standby" button shall refer to the previous section of “trolley operation”.

8.2.3 作业前检查

⚠ 注意

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；

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）；

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）；

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；

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。

8.2.3 pre-operational inspection

⚠ Caution

a. After each energized before performing the job, the operator must first check the switch buttons (especially the "emergency stop button") in the empty hook state, the operating handle, brake, limit switches are working properly and protected;

b. Each limit protection switch is adjusted (see host specific adjustment method instructions relevant sections);

c. After each limit protection switch operation, the electronic control system is to perform appropriate protection (see the aforementioned content);

d. If you detect a problem should immediately downtime. Before a failure or a security risk is not excluded, may not be put into operation tower crane operation;

e. In case of wet weather, please check before each power cabinet and resistor cabinet, if condensation phenomenon, do not start work until the water evaporates or adopt other measures dehumidification before use to avoid components damage.

8.2.4 检修与维护

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：

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。

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。

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。

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%。

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。

f. 各安全装置的行程开关的触点开闭必须灵敏可靠。

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。

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。

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。

j. 检查接线是否有松动、发热、烧蚀等现象。

⚠ 警告

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。

8.2.4 Inspection and Maintenance

Electronic control system should always repair and maintenance, to troubleshoot and eliminate safety hazards, to ensure the normal running of the machine, to extend the life of the equipment. By qualified personnel with relevant qualifications of repair and maintenance work, as follows:

a. to deal with daily visual inspection of the electronic control system to prevent contact, leakage and other accidents.

b. Always check all wires, cables for damage, if damaged electrical tape should be wrapped or replaced.

c. the face of the motor overheating phenomenon should be promptly stop checks, troubleshooting, and then continue to run, while ensuring motor bearing lubrication.

d. contacting the various parts of the motor should be kept clean brush, brush contact area of not less than 50%.

e. Each electronic control box, distribution box should be kept clean, remove dust on electrical equipment and electrical components when the main power off situation.

f. Each safety device limit switch contacts opening and closing must be sensitive and reliable.

g. the motors and other electrical equipment good insulation, the insulation resistance should be not less than 0.5MΩ.

h. ground resistance of each motor housing, cabinet and other electrical equipment grounding terminal shall not exceed 4Ω.

i. Check the AC contactor whether there catching bad pull, contact burnout phenomenon, if it please timely repair or replacement.

j. Check for loose wiring, heating, ablation phenomenon.

⚠Warning

If you find the above abnormal phenomenon in the overhaul, please tighten, repair, replacement, adjustment.

8. 3 电气图形符号

8. 3 Electrical graphic symbols

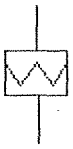
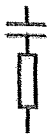
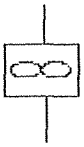
8.3.1 附件类图形符号

8.3.1 Annex class graphic symbols

表 8-1 附件类图形符号

Table 8-1 Annex class graphic symbols

	蜂鸣器	Buzzer		电阻	Resistance

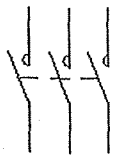
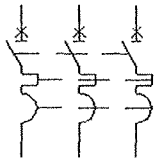
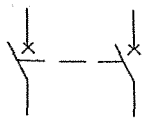
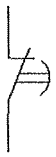
	电笛	Horn		加热器	Heater
	避雷器	Lightning protection		轴流风机	Axial fan
	熔断器	Fusegear		照明灯或指示灯	Light
	插座	Socket		电压表	Voltmeter

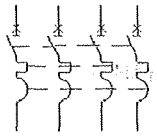
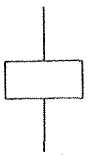
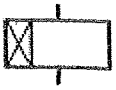
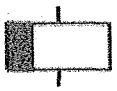
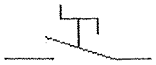
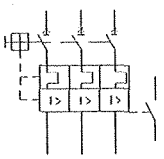
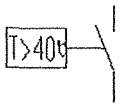
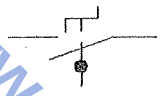
8.3.2 开关类图形符号

8.3.2 Switch symbols

表 8-2 开关类图形符号

Table 8-2 Switch symbols

	接触器触点 Contactor main-contact		急停按钮 Emergency stop button		三极断路器 Three-pole circuit breaker
	双极断路器 double-pole circuit breaker		单极断路器 single-pole circuit breaker		限位常开触点 Normally open contact of limiter
	限位常闭触点 Normally close contact of limiter		平头按钮 Flat button		延时断开的常开触点 Normally open contact with off delay
	常开触点 Normally open contact		常闭触点 Normally close contact		延时闭合的常闭触点 Normally close contact with on delay

	延时断开的常闭触点 Normally close contact with off delay		三极断路器 four-pole circuit breaker		继电器线圈或接触器 Coil
	通电延时继电器线圈 Relay coil with power on delay		断电延时继电器线圈 Relay coil with power off delay		转换开关 Rotary switch
	延时闭合的常开触点 Normally open contact with on delay		热断路器 Motor protection breaker		温度开关 Temperature switch
	照明灯或风扇开关 Rocker switch		零位开关 Zero position switch		

8.3.3 接线类图形符号

8.3.3 Wire connection symbols

表 8-3 接线类图形符号

Table 8-3 Wire connection symbols

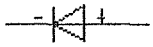
	地线 Earth wire		接线端 Wiring point		连接器插针 Connector pin
	参照插头 Reference plug		接线端子 Connector		连接器插孔 Connector jack

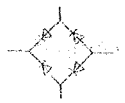
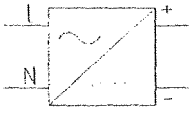
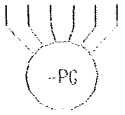
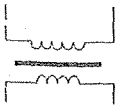
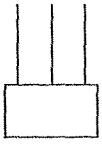
8.3.4 电子类图形符号

8.3.4 Electric symbols

表 8-4 电子类图形符号

Table 8-4 Electric symbols

	温度传感器 Temperature sensor		电位计 Potentiometer		整流二极管 Rectifier diode

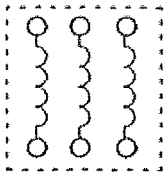
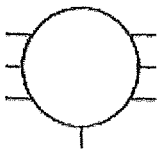
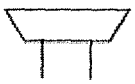
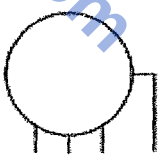
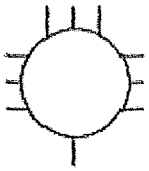
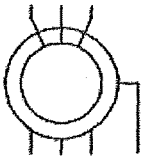
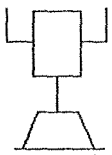
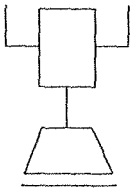
	单相整流桥 Rectifier bridge		开关电源 Switching power		编码器 Encoder
	变压器 Transformer		相序保护器 Phase sequence relay		

8.3.5 电机类图形符号

8.3.5 Electrical symbols

表 8-5 电机类图形符号

Table 8-5 Electrical symbols

	电磁线圈或直流电感线圈	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 coil Electromagnetic brake		单绕组电机	single winding motor
	三绕组电机	three winding motor		滑环式电机	Slip ring motor
	闭式电磁制动器	Normally close electromagnetic brake		开式电磁制动器	Normally open electromagnetic brake

8.4 常见故障及对策

常见故障机对策详见《11 产品维保指南》章节。

8. 4 Common breakdowns and solutions

Common breakdowns and solutions refer to the Chapter 11, *Product maintenance and repair manual.*

8. 5 电气原理图

8.5.1 电气原理图文字符号说明

8. 5 Electrical diagram

8.5.1 Electrical diagram symbol introductions

表 8-6 电气原理图文字符号说明

Table 8-6 Electrical diagram symbol introduction

符号 Symbol	说明	Introduction	符号 Symbol	说明	Introduction
HINV	起升变频器	Hoisting Inverter	PLC	控制器	Controller
PGH	起升编码器	Hoisting Encoder	FLM	防雷模块	Lightning Protection Module
QFH	起升断路器	Hoisting Circuit Breaker	VC1/VC2	开关电源	Switching Power Supply
QFHF	起升风机断路器	Hoisting Fan Circuit Breaker	QF12/QF13/QF14/QF15	开关电源断路器	Switching Power Supply Circuit Breaker
QF20	起升制动器断路器	Hoisting Brake Circuit Breaker	QFE	司机室断路器	Cab Circuit Breaker
RHB	起升制动电阻	Hoisting Brake Resistance	PV	电压表	Voltmeter
KHB	制动器接触器	Brake Contactor	QF	总断路器	Main Breaker
KAHU/KAHD/KAHL/KAHM/KAHB1/KAHB2	起升中间继电器	Hoisting Auxiliary Relay	KMC	启动接触器	Starting Contactor
SINV	回转变频器	Slewing Inverter	KM	总接触器	Main Contactor
QFS	回转断路器	Slewing Circuit Breaker	KAP	相序继电器	Phase Sequence Relay

QFSF1/QFSF2	回转风机断路器	Slewing Fan Circuit Breaker	SEM	急停按钮	Emergency Button
QF30/QF31/QF33	回转变压器断路器	Slewing Transformer Circuit Breaker	HP	启动电源指示灯	Starting Power Indicator light
QFP	顶升泵站断路器	Jacking Circuit Breaker	SSF	制动风标按钮	Brake Weathercock Button
RSB	回转制动电阻	Slewing Brake Resistance	SSJ	旁路按钮	Bypass Button
KSB	回转制动接触器	Slewing Brake Contactor	SST	启动按钮	Starting Button
KPP	回转顶升连锁接触器	Slewing Jacking interlock Contactor	SSP	回转顶升联锁按钮	Slewing & Jacking interlock control
KASL/KAR/KAS1/KAS2/KAB/KAF	回转中间继电器	Slewing Auxiliary Relay	HML/HMA	力矩100%/80%指示	Moment 100%/80% Indicator
SW	回转涡流控制器	Slewing Eddy Control	HLL/HLC	重量100%/50%指示	Weight 100%/50% Indicator
V30/V31/V40	续流二极管	Fly-wheel Diode	SZL	左联动台零位	Left Console Zero Position
R30/R31/R40	电阻	Resistance	SZR	右联动台零位	Right Console Zero Position
V34/V35	整流二极管	Rectifier Diode	KA80/KA81/KA82/KA83/KA84/KA85/KA86/KA87/KA88/KA89	限位中间继电器	Limit Middle Relay
QFF	风扇断路器	Fan Circuit Breaker	KA90/KA91/KA92/KA93	限位中间继电器	Limit Middle Relay
QF10/QF11	控制变压器断路器	Control Transformer Circuit Breaker	SML1/SML2	100%力矩限制器开关	100% Moment Limiter Switch
VINV	变幅变频器	Luffing Inverter	SMA	80%力矩限制器开关	80% Moment Limiter Switch
QFV	变幅断路器	Luffing Circuit Breaker	SFS	力矩防松开关	Moment anti-loose Switch

RVB	变幅制动电阻	Luffing Brake Resistance	SWL	100%重量限制开关	100% Weight Limit Switch
KAVI/KAVO/KAV1/KAV2/KAVB1/KAVB2	变幅中间继电器	Luffing Middle Relay	SWH	75%重量限制开关	70% Weight Limit Switch
SVFL/FC/BL/BC	变幅限位开关	Luffing Limit Switch	SWQ	35%重量限制开关	35% Weight Limit Switch
SSL	回转左限位开关	Slewing left Limit Switch	SHUL/SHUC/SHDL/SHDC	起升限位开关	Hoisting Limit Switch
SSR	回转右限位开关	Slewing right Limit Switch			

第 9 章液压系统

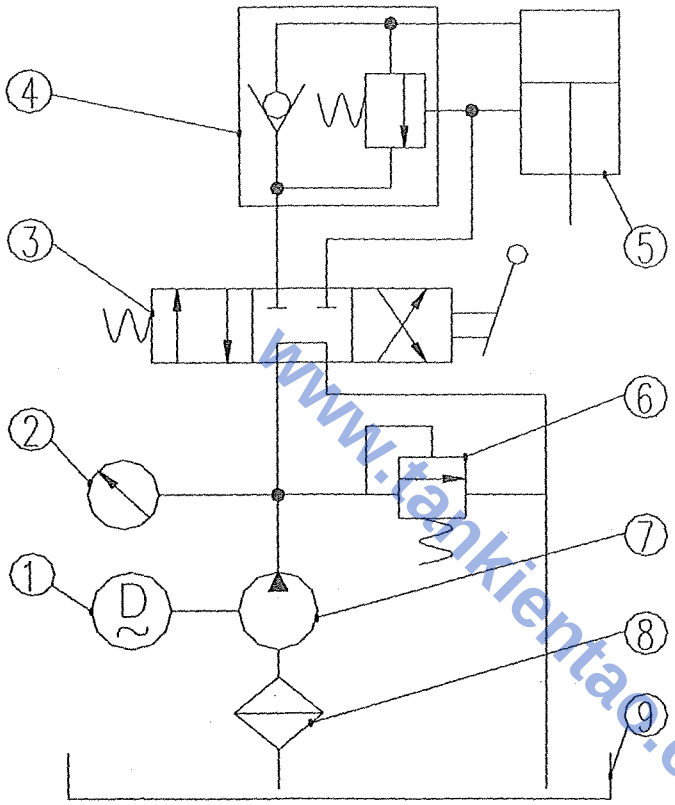
Chapter 9 Hydraulic system

9.1 液压原理图及控制说明

9.1.1 液压原理与液压元件名称(见图 9-1)

9.1 Hydraulic principles and control

1. Hydraulic principles and designation of hydraulic elements (see Figure 9-1).



序号	液压元件名称
1	电机
2	压力表
3	手动换向阀
4	平衡阀
5	顶升油缸
6	溢流阀
7	液压泵
8	滤油器
9	油箱

No.	Designation of hydraulic elements
1	Motor
2	Pressure gauge
3	Hand-operated direction valve
4	Balance valve
5	Jacking cylinder
6	Overflow valve
7	Hydraulic Pump
8	Oil filter
9	Oil tank

图 9-1 液压原理与元件名称图

Figure 9-1 Hydraulic principles and designation of elements

9.1.2 液压控制原理说明

液压系统的电机通过联轴器驱动液压泵。各元件之间采用油管进行连接。通过压力表观

察油路的压力。当油路的压力大于工作压力时溢流阀接通，对油路的压力进行减压。

(1)顶升过程

液压泵使油液从油箱经过滤油器、手动换向阀(手动换向阀处于左位)、平衡阀进入顶升油缸上腔，顶升油缸下腔的油液经过换向阀返回油箱，从而实现顶升。

(2)下降过程或收顶升横梁过程

液压泵使油液从油箱经过滤油器、手动换向阀(手动换向阀处于右位)、进入顶升油缸下腔。当油路的压力大于平衡阀的设定压力时，平衡阀接通，顶升油缸上腔的油液经过平衡阀、换向阀返回油箱，从而实现下降或收顶升横梁。完成下降或收顶升横梁是通过平衡阀多次接通与闭合的反复过程实现的。

(3)中位过程

液压泵使油液从油箱经过滤油器、手动换向阀(手动换向阀处于中位)返回油箱。手动换向阀处于中位，顶升油缸上腔和下腔的油路均被堵住，顶升油缸固定在指定位置。

9.2 液压系统接管

按照图 9-2 进行液压顶升系统油管的安装。

9.1.2. Description of hydraulic control principles

The motor of the hydraulic system drives the hydraulic pump through the coupler, and the elements are connected by the oil pipe. The pressure of the oil circuit is observed by the pressure gauge, when the pressure is greater than working pressure, the overflow value shall be connected so as to reduce the pressure in the oil circuit.

a) Jacking process

The hydraulic pump enables the oil liquid to flow through the oil filter, hand-operated direction valve (the hand-operated direction valve is on the left), the balance valve into the upper chamber of the jacking cylinder, then the oil liquid from the lower chamber flows back through the direction valve to the oil tank to realize jacking.

b) Process for descending or retraction of jacking crossbeam

The hydraulic pump enables the oil liquid run through the oil filter, hand-operated direction valve (hand-operated direction valve is on the right) into the lower chamber of the jacking cylinder. When the pressure of the oil circuit is greater than the designated pressure of the balance valve, the balance valve shall be connected through. Then the oil liquid from the upper chamber of the jacking cylinder runs through the balance valve and the direction valve back to the oil tank to enable

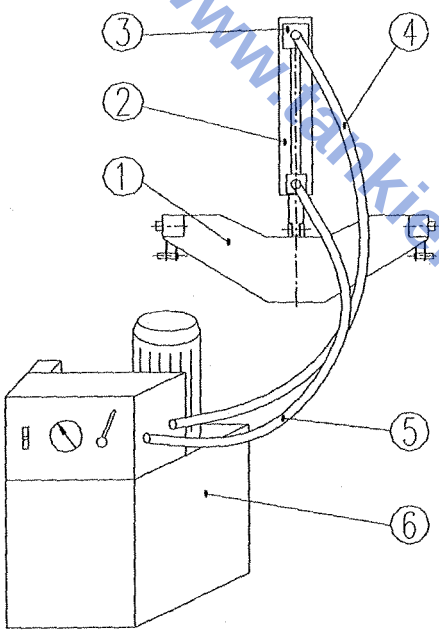
descending or retraction of the jacking crossbeam. Completion of descending or retraction of the jacking crossbeam is fulfilled by repeating connecting and closing the balance valve.

c) Mid-position process

The hydraulic pump enables the oil liquid run through the oil filter, hand-operated direction valve (hand-operated direction valve is on the right) back to the oil tank. When the hand-operated direction valve is in the middle position, both oil circuits in the upper and lower chamber of the jacking oil cylinder are blocked, the jacking oil cylinder is fixed in the designated position.

9.2 Pipe connection for hydraulic system

The oil pipes of the hydraulic jacking system shall be installed according to Figure 10-2.



序号	元件名称
1	顶升横梁
2	顶升油缸
3	平衡阀
4	油管 1
5	油管 2
6	液压站

No.	Designation of elements
1	Jacking crossbeam
2	Jacking cylinder
3	Balance valve
4	Oil pipe 1
5	Oil pipe 2
6	Hydraulic station

图 9-2 液压接管示意图

Figure 9-2 Hydraulic pipe connection

9.3 液压顶升装置

为确保液压顶升装置在塔机使用地正常运行以及正确的维护保养等处置，应遵循制造商/使用说明书对该装置的操作与启动的说明。

9.3.1 液压顶升装置组装

液压顶升装置的组装应按照制造商签发的图纸和使用说明书进行。安装时，高压油管应紧固可靠，以防止震动和移位；高压软管应充分考虑其弯曲半径和足够张弛的余地；特别注意应对高压油管(热弯管或焊接管)、高压软管的内管进行清理作业。

(1)在组装时，对电机、油泵、油缸和各种阀件等部件的机械找正、定位，应按照使用说明书的规定进行。任何不均匀/不规则的紧固都可能出现变形。

(2)液压顶升装置的电机、油泵和阀件应安装在油箱热辐射以及冷却空气不受限制的位置。

(3)液压顶升装置所使用的电源的电压和功率应满足该装置的使用要求。在参照本使用说明书同时，应参照生产厂家的使用说明书。

9.3.2 启动操作

在对油箱注油之前，应对油箱内部、过滤器以及油管进行清理检查。油箱的顶盖和过滤器的密封锁扣应良好。对带有空气干燥过滤器的装置，应特别注意安装质量与精度。

9.3 Hydraulic device

To achieve the proper maintenance and operation of hydraulic jacking device, it is necessary to do according to the Instruction provided by manufacturers.

9.3.1 Assembly of hydraulic device

Do the assembly of hydraulic jacking device according to its instruction provided by manufacturers. When installing, make sure that high-pressure oil pipe shall be reliable, in case of shaking and displacing. It also needs to take its bending radius and relaxation capacity into consideration. Special attention is needed to be taken when cleaning oil pipe and inner pipe of high-pressure pipe.

(1) Position rightly the motor, oil pump, cylinder and valves when assembling, as Instruction required. Any non-uniform fastening may cause deformation.

(2) The motor, oil pump and valves are installed the position where heat radiation and cooling of cylinder are not limited.

(3) The voltage and power of hydraulic jacking device should meet its working requirements, referring to Manufacturer's Instruction.

(2) Starting

Clean and check the oil cylinder, filter and oil pipe before filling oil. Both cover of cylinder and sealing lock of filter needs to be good. Pay attention to its installing quality and accuracy for devices with air filter.

9.3.2.1 油箱注油

液压顶升装置油箱使用的油品规格应按照使用说明书给出的规格选用(相关的油品在过滤器

管座上亦有标注)。油箱注油可用注油机注油，亦可手工注油，但任何注油方式，都必须在进油口上加上滤油网，以防杂物进入。在注油时，由于箱内含有空气等其他因素，油箱的油位会缓慢下降，应关注液位必须至标志位置。

9.3.2.2 油泵轴的旋转方向

检查油泵轴实际旋转方向与装置上标注的旋转方向相一致这很重要。具体的检查操作可释放电机与油泵的联轴器后进行。如联轴器是可拆卸，油泵在注满油液后作无载运转以确定旋转方向。此时电机的操纵应采用点动方式，以防油泵的意外损伤。

9.3.3 启动操作、压力释放

由于油泵的结构不相同，试机时，应关注制造商针对液压顶升装置的具体说明书。

电机启动之前，应检查确认吸入管道油路上所有的阀是打开的。电机操纵按点动方式，确认油泵的吸油功能。

油泵在使用时必须释放空气。释放可借助于排气口进行。排气的结果是使油箱内的油液无气泡为止。压力阀和油泵应按低压进行调节。

规格较小的液压顶升装置。压力释放是由顶升油缸完成的。即：顶升油缸以全行程工作 1～2 次，在油缸活塞杆往返运行到极限时，应暂时停在油缸顶部 2～3 秒。在此操作完毕后，油箱的液位应补充到标志的位置。

注意 **油箱内应留有足够的容积空间。**

9.3.2.1 Filling oil

Choose oil for jacking cylinder as required on Instruction. Filling oil methods are filling mechanically or manually, which both needs filter net to prevent foreign things into. When filling oil, make sure the oil level reaching up to mark position, since oil level will descend slowly because there may be air or something else in cylinder.

9.3.2.2 Oil pump axis rotation direction

It is important to check whether oil pump actual rotation direction is same with the marked direction on device. The detailed inspection can be done after releasing coupler of motor and pump If the coupler is removable, confirm the rotation direction through no-load running after fully filled In this case, motor shall be operated as point-moving in order not to damage oil pump.

10.3.3 Starting operation and pressure releasing

Do commissioning as the instruction because the structure of oil pump varies from differen type.

Before starting motor, guarantee that all valves on input oil pipe are open. The motor is operated as point-moving. Check the oil absorbing function of oil pump.

The air in pump shall be released when using pump to contributing air exhausting, until there is no air at all. Adjust pressure valve and oil pump as low pressure.

For small-specification hydraulic jacking device, its pressure releasing is completed by oil cylinder, i.e. jacking cylinder works at whole stoke 1 to 2 times. When piston rod of oil cylinder runs to and fro, stop at cylinder top at least 2 to 3 seconds. After this, oil in cylinder shall be refilled to mark position.

⚠ Caution Sufficient space in oil cylinder is needed.

9.3.4 功能测试

在功能测试之前，所有的阀(如：流量控制阀、节流阀、载荷自锁阀、分配阀等)应关闭。

压力控制阀(溢流阀)在较小压力时仍可调节。

操纵单向控制阀的手柄，监视压力表，缓缓控制压力控制阀升高至理想工作压力区。流量控制阀固定在适当的压力数值上。

⚠ 注意 压力调节时，不得超过最大值。

9.3.5 压力调节的警示

在操纵压力控制阀进行压力调节时，调节压力仅能到达规定的工作压力为止，不得超出规定的最大压力值。为避免过大的功率消耗和油液的过热，可适当降低些工作压力。确认的最大压力值一般在压力控制阀或其他阀件上标注。

(1)功能测试结束后，可用电磁阀(有配置的)进行电控操作。

(2)操作之前，应检查油箱的液位。必要时应补充油。

(3)油箱工作温度为 50℃，最大不得超过 70℃。

(4)液压顶升装置工作一段时间后 (约 10 小时)，应清洗或更换滤芯。

(5)压顶升装置的功能使用寿命取决于油品的质量(即：纯度)。为此应按使用说明书规定的油品的选用。

(6)在按使用说明书的规定进行短期正常的运行之后，应检查电机、油液、轴承的工作温度正常与否。

⚠ 注意 力控制装置已封，未经许可不得进行压力调节。

10.3.4 Function test

Before test, all valves should be close, such as current valve, throttle valve, load self-lock valve.

Pressure control valve (relief valve) is still adjustable in the lower pressure.

Manipulate one-way valve control handle and monitor pressure gauges. Control pressure valve slowly rises to the desired working pressure area. The flow control valve is fixed to the appropriate pressure value.

Caution The pressure when regulated shall not exceed the maximum.

9.3.5 Warning of pressure regulator

When regulating pressure by pressure control valve, pressure can only reach up to the specified operating pressure and shall not exceed the specified maximum value. In order to avoid excessive power consumption and overheating of the oil, it may be appropriate to reduce work pressure. The maximum pressure value is generally recognized on the pressure mark of control valve or other valve.

Caution Safety valve and pressure control device is sealed, and pressure regulating without permission is prohibited.

1. After function test, do electrical control by solenoid valves (configured).

2. Before the operation, check the tank level. Add oil if necessary.

3. The oil tank temperature is 50 ℃, and the maximum may not exceed 70 ℃.

4. After the hydraulic jacking system working for some time (about 10 hours), you should clean or replace the filter.

5. The pressure lifting device function life depends on the quality of the oil (i.e.: purity). So use specified oil as required.

6. After short-term normal operation in accordance with the provisions of the manual, you should check the operating temperature of motor oil, bearing is normal or not.

9.3.6 维修

液压顶升装置早维修之前，应遵循下列规定：

(1)在打开/取出阀件、油管时，应先释放系统压力。同时系统装置应采取安全防护措施(如：用支撑加固等)；

(2)油箱应该放空；

(3)在打开液压顶升装置时，周围的环境应保持清洁，以防止污染；

(4)维修期间，应采取必要的措施，以防非有关人员启动系统装置，(如：关闭主开关、关闭电源)。

(5)准备适当的金属盘：

(6)系统装置打开后，应做好防污染措施。维修时周围应保持良好的清洁度；

(7)系统装置维修完成后，应检查系统性能。

10.3.7 维护保养

液压顶升装置所有可拆卸的部件均处在稳定的油液中，故无须作太多的维护保养。系统装置的重点维护保养是电机轴承的润滑。其他方而的维护保养应遵循下列规定：

(1)液压顶升装置首次运行40～50小时后，应检查油箱的油量，清洗或更换过滤器滤芯，检查所有油路管道的接头。

(2)液压顶升装置运行 2～3 月后，应检查油液的质量(即：纯度)。具体可根据油液的污染程度或油液的工作时问来决定换油的概率。

(3)液压项升装置运行1000～1200小时后，应换一次油。在换油时，应对油箱内部剩余的油液进行冲洗清除处理。同时在换油时，应检查过滤器，必要时作更换处理。(在装有空气干燥过滤器的装置，应检查干燥剂的颗粒，必要时作更换处理)。

(4)油箱中的油液位应定期检查。对油液消耗过多，应找出原因，排除故障。日常损耗的油液应及时补充至标志油位。污染的油液必须马上更换。

(5)应经常检查油路管道的泄漏情况。对于松动的部件或连接件应检查、紧固，对于损坏的部件应及时更换。

(6)液压顶升装置中的所有的电机、油泵、阀件应按规定的工作压力和工作温度进行检查、校正，以保持正常的运行。

(7)对于液压顶升装置的工作性能和工作状况应经常检查。特别是压力控制阀，应检查其调整压力是否符合工作压力。

9.3.6 Maintenance

Before the early repair of hydraulic jacking equipment, you should follow the following rules:

1. When opening or removing valves, tubing, you should release the system pressure, besides take safety precautions for the system.(e.g.: with support reinforcement);

2. The tank should be vented;

3. When you open the hydraulic jacking system, the surroundings should be kept clean to prevent contamination;

4. During the maintenance period you should take the necessary measures to prevent irrelevant personnel to start the system devices (such as: turn off the main switch or the power supply).

5. Prepare appropriate metal plate:

6. After the system unit is opened, you should be prepared to anti-pollution measures. Cleanliness should be maintained well;

7. After the system device repair is completed, you should check the system performance.

Caution **The system device can not open if above 1) to 5) are not implemented!**

9.3.7 Maintenance

All removable parts hydraulic jacking system is in stable oil, and there is no need for too much maintenance. Focus system maintenance on the motor bearing lubrication. Maintenance of other parties should follow the following rules:

1. After the first time of running 40 to 50 hours of hydraulic lifting device, you should check the oil tank, clean or replace the filter element, and check all oil pipeline joints.

2. After running hydraulic jacking system 2 to 3 months, you should check the quality of oil (i.e.: purity). Specifically, determine the probability of oil change according to the degree of pollution or working time of oil.

3. After running hydraulic jacking system about 1000 to 1200 hours, the oil should be changed once. When changing oil, clean the remaining oil inside the tank. If necessary, replace it. (The device which is equipped with air-dry filter should be checked desiccant granules and if necessary, replace it.

4. The oil level in tank should be checked regularly. For excessive oil consumption, you should find out the reason and troubleshoot it. Daily consumption of oil should be added to the oil level mark. Contaminated fluid must be replaced immediately.

5. You should check for leaks oil pipeline often. For loose parts or connections, you should check and fasten them. For damaged parts, replace them.

6. All motors, pumps, valves of hydraulic jacking system are required to be checked to work under pressure and temperature, in order to maintain normal operation.

7. Work performance and working conditions for hydraulic jacking device should be inspected

regularly. In particular, the pressure control valve should be checked for its adjustment pressure is in compliance with the working pressure.

9.3.8 定期维护保养

液压顶升装置运行一定时间之后，所有液压件应进行维护保养。根据系统装置的类型和使用地的工作条件，定期维护保养应按使用说明书的要求在 5 年之内进行一次。维护保养时，应对管道气体、油液质量(特别是受污染的)以及油泵、油箱、阀、磁性过滤器等进行检查、维护保养。维护保养时应保持周围环境的清洁度，以防止污染。损坏/磨损的密封件或部件应及时更换。

(1)油路管道的紧固件应检查、紧固或更换。

(2)定期维护保养的最佳决策是采用更换处理。届时可将旧件送交制造商进行维修。同时用户应作好更换的记录，并制定定期维护保养的时间表。

⚠ 注意 液压顶升装置时，应保持良好的清洁度。

9.3.8 Regular maintenance

After running the hydraulic jacking system a certain time, all hydraulic parts should be maintenance. Depending on the type and working conditions of the system, regular maintenance should be carried out once as the specification requirements within five years. In maintenance, check and maintain pipeline gas, oil quality (especially contaminated) as well as pumps, tanks, valves, filters, and other magnetic filters, keeping the cleanliness of the environment to prevent contamination. Damaged or worn seals or parts should be replaced.

1. Fasteners of oil pipeline should be checked, tightened or replaced.

2. The best regular maintenance is to take replacement treatment. Old pieces can be sent to the manufacturer for repair. Meanwhile users should be ready to do the record, and to develop a regular maintenance schedule.

⚠ Caution When Opening hydraulic jacking system, you should maintain good cleanliness.

第10章 塔式起重机的操作

Chapter 10 Operation of the tower crane

10.1 手柄功能设置与操作说明

本塔机的操纵使用先进的操纵手柄，操纵手柄置于驾驶室扶手箱前部，分左操纵手柄和右操纵手柄两部分，左操纵手柄控制变幅与回转，右操纵手柄控制起升，左、右手柄均装有使能键，以防止误操作。手柄功能设置图见图 10-1 所示：

10.1 Handle feature set and operating instructions

The tower crane is equipped with advanced operating handle placed in the front of cab before armrest box. It is divided into the left and right handles: the left for luffing and slewing but the right for lifting. Both handles are equipped with Enable keys to prevent misuse. Handle feature set is shown in Figure 10-1:

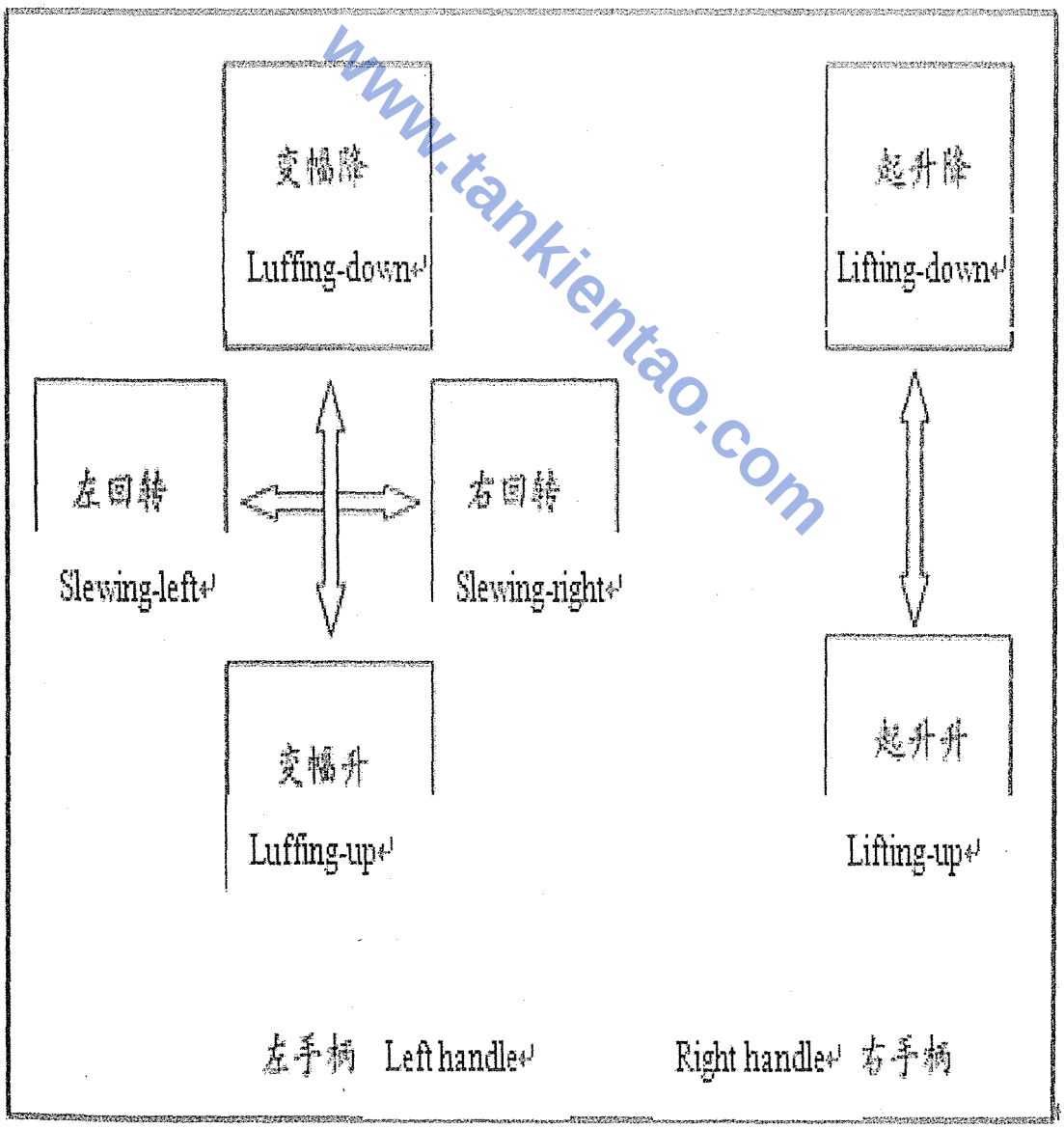
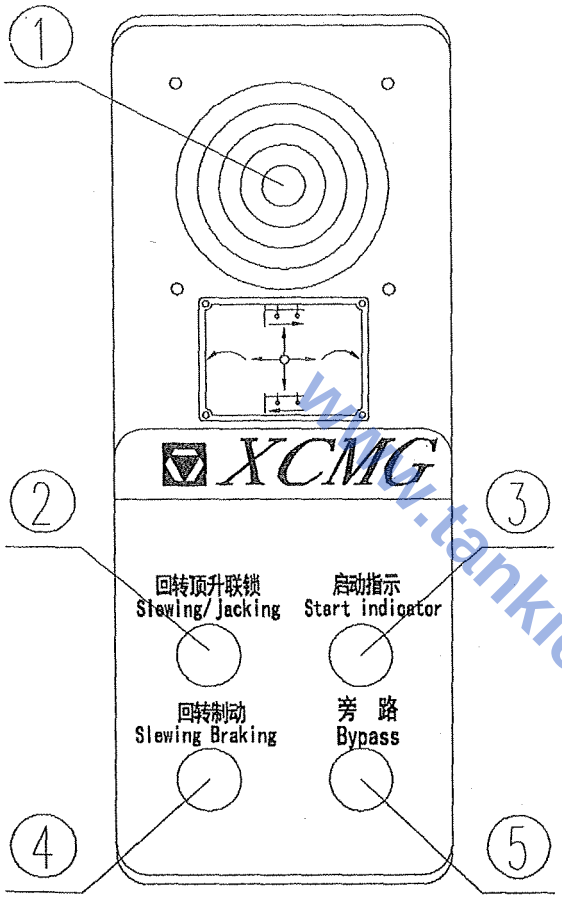


图 10-1 手柄功能设置示意图

Figure 10-1 Handle feature set

10.2 塔机控制面板操作说明

10.2 Tower Crane control panel instruction



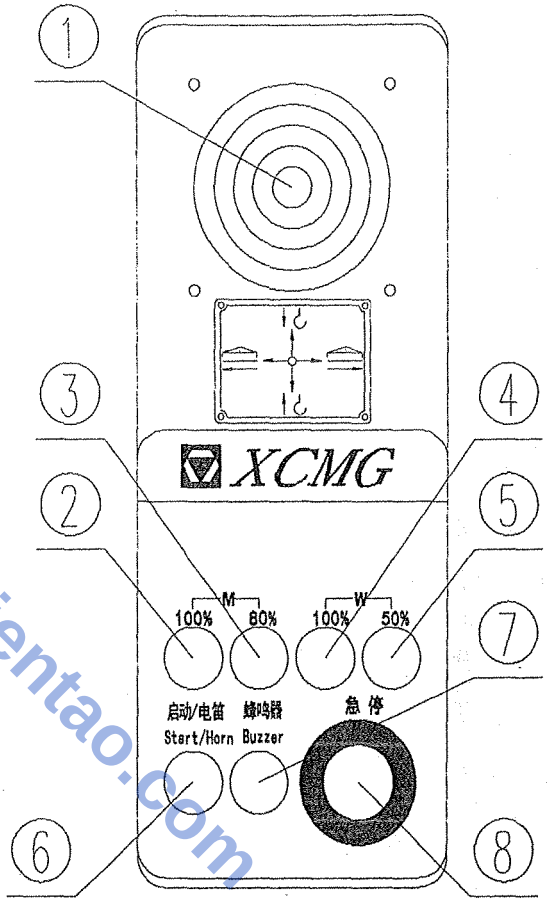


图 10-2 左控制面板图 10-3 右控制面板

Figure 10-2 Left control panel Figure 10-3 Right control panel

（1）左操作台控制面板说明

①左操作手柄：前后为动臂塔机起重臂的上仰和下降操作；左右为回转操作。

②回转顶升联锁旋转开关：当旋转开关旋转到回转位置是，允许回转运行，禁止顶升运行；当旋转开关旋转到顶升位置时，允许顶升运行，禁止回转运行。

③启动指示灯：当塔机控制系统启动成功后，该指示灯亮绿色。

④回转制动按钮：该按钮按下时，塔机回转制动器将闭合，塔机不可以随风转动。

⑤旁路按钮：可以用于解除起升上升停止限位和变幅停止限位（除变幅行程开关）。

(1) Note for left control panel

① Left handle: forward and backward actions are for up and down motion of tower crane jib,

and the left and right is for slewing move.

② Interlock switch of slewing and hoisting: when the switch is rotated to the slewing position, the slewing move of jib is allowed, not the hoisting, while when the switch is rotated to the hoisting position, the hoisting is allowed, not the slewing.

③Start indicator: the indicator lights if the tower crane control system is successful to be started.

④ Slewing brake button: press the button the tower crane slewing brake is closed, not moving with the wind.

⑤Bypass button: it is used to release the stop limit of hoisting-up and luffing（except luffing radius stroke switch ）.

（2）右操作台控制面板说明

①右操作手柄：前后为动臂塔机吊钩的上升和下降操作；左右为行走操作。

②100%力矩：当起重力矩达到 100%以上时，该指示灯亮。

③80%力矩：当起重力矩达到 80%以上时，该指示灯亮。

④100%重量：当起重达到 100%以上时，该指示灯亮。

⑤50%重量：当起重达到 50%以上时，该指示灯亮。

⑥启动/电笛：当按下启动/电笛按钮时，塔机电气系统将通电启动，且电笛响。

⑦蜂鸣器：当电控系统报警时，蜂鸣器响。

⑧急停按钮：塔机紧急情况，按下该按钮，同时塔机所有动作将停止。

(2) Note for right control panel

① Right handle: forward and backward actions are for up and down motion of tower crane jib, and the left and right is for moving operation.

② 100% moment: it lights when the lifting moment is over 100%.

③80% moment: it lights when the lifting moment is over 80%.

④ 100% load: it lights when the lifting load is over 100%.

⑤ 50% load: it lights when the lifting load is over 50%.

⑥ Start/Horn: push it and the tower crane electrical system is powered on and the horn sounds.

⑦Buzzer: it sounds when the electrical system gives an alarm.

⑧Emergency stop button: push the button if tower crane encounters an emergency. If the

button is pushed, all the moves of tower crane would be stopped.

10.3 操作要点

（1）塔机的电气操作要点

1）检查及送电

本塔机的供电电源为 AC380V，控制电路电源为 DC24V 和 AC220V。开机前应检查工地电源状况，电源电压应为 380±10%范围，否则严禁工作。检查各导线接线处、各元器件的固定应牢固，无接触不良、导线破损等现象。检查完毕并确认符合要求后方可合闸送电。

10.3 Operating Highlights

(1)Electrical operating points of tower crane

1) Inspection and power transmission

The tower crane power supply AC380V and the control circuit power supply is DC24V and AC220V.Power supply conditions on the site should be checked before starting the crane and supply voltage should be at the range of 380 ± 10%, otherwise the work is strictly prohibited. Check all wiring conductors and the various components should be firmly fixed, no bad and wire breakage and so on. Checkand confirm all these meet the requirements before power transmission.

2）各机构的运转

首先将工地电源总开关合上，同时将电控箱内所有断路器也合上，整机通电。然后按下右操作台启动/电笛按钮，电源继电器吸合，控制回路通电。操作左右操作台上的把手，可以运行起升、回转、变幅机构运行。如紧急情况下可以拍下右操作台上的急停按钮。

2) Operation ofmechanisms

First, close the main power switch beside the storage battery in power bin, while the close all circuit breakers in the A box, thus the whole machine is powered on. Then turn the system power key switch on the right armrest box to the “ON” position, so the power relay engages and control circuit is energized. Move the ignition switchon the right armrest box to "Start" position and then back to“ON” position after starting the engine. If you need to turn off the running engine, you can rotate the ignition switch to "OFF" position, thus the engine will stop.The emergency stop button can be pressed on the right armrest for emergent cases.

After starting the engine observe the hook, the pitch angle of the boom, tower crane slewing location and the surrounding circumstances at first. After conformation you can operate the mechanisms.

a)起升机构

根据载荷的重量和吊载的距离确定采用哪种速度进行操作，从低速至最高速度本机均可以提供，以满足具体吊载要求。操作时采用重载低速，轻载高速的原则，使整机达到最好的运行效率。本手柄采用无级调速控制方式，根据手柄倾斜角度获得对应的速度。

a) Lifting mechanism

Determine the use of operating speed in accordance with the weight of load and hanging distance, from the dead-slow to the maximum speed can be provided by the mechanism to meet the specific requirements. Based on the principles of low-speed for heavy load and high-speed for light load, the machine can achieve the best efficiency. The handle is adopted with a stepless speed control system so you can obtain the corresponding speed according to the inclination angle of the handle.

b)回转机构

本手柄采用无级调速控制方式，根据手柄倾斜角度获得对应的速度。回转左右运行角度限位为±540°，超过该角度回转将停止运行，只能向相反方向运行。

b) Slewing mechanism

The handle is adopted with a stepless speed control system so you can obtain the corresponding speed according to the inclination angle of the handle.The angle limiter of slewing is ±540° so the mechanism will stop running and run reversely if the handle is over the angle limit.

c) 变幅机构

变幅操作手柄采用无级调速控制方式，根据手柄倾斜角度获得对应的速度。塔机起重臂做正常变幅运行时，在 15°至 84°角度范围内俯仰。在 25°角和 75°角位置有减速限位开关，达到减速角度时自动将为低速运行；在 20°角和 80°角位置有变幅限位开关，在达到变幅限位位置时自动停止变幅运行，此时按住旁路变幅可以 1 档继续运行。在臂架俯仰到大于 84°角时，变幅机构停止向内运行，只能向外运行，返回到安全状态。在臂架俯仰到小于 15°角时，变幅机构停止向外运行，只能向内运行，返回到安全状态。

c) Luffing mechanism

The luffing handle is adopted with a stepless speed control system so you can obtain the corresponding speed according to the inclination angle of the handle. When tower crane boom does normal luffing operation in thetilt angle range of 15 ° to 84 °, there are decelerationlimit switch at 25 °and 75 ° angular position for protection, so it will automatically turn to low-speed running if it

reaches up to limit position and stop luffing . Operate with bypass button the jib can moves inwards at the lowest speed.When the boom pitching angle is more than 84 °, the luffing mechanismwill automatically turn off. After restarting the engine, only luffing outwards is allowed to make sure the boom return to a safe state.When the boom pitching angle is less than 15 °, the luffing mechanismwill automatically turn off. After restarting the engine, only luffing inwards is allowed to make sure the boom return to a safe state.

d)关机

塔机完成施工停止使用时，要把各操作手柄置于零位，按下急停按钮，切断司机室驾陪箱总电源开关，关好司机室门窗，司机下到地面后，断开塔机底部电源箱的总开关。

d) Shutdown

When the construction is completed, all operating handles shall be set to the zero position. Cut off the general switchfor power bin, and close the door and window of the cab. When the driver comes to the ground, he/she shall cut off the general switch of the power box at the bottom of tower crane.

10.4 操作中应注意的事项

(1)司机必须熟悉所操作塔机的性能参数，操作中应遵守安全操作规程，禁止影响塔机安全的操作。具体禁止内容参照 1.4 节“十不吊”。

(2)在机构各项操作中，操作时应逐级增速或减速，不能频繁切换高低速，避免机件损坏，应养成良好的操作习惯。在回转操作中，手柄控制要协调。

(3)吊运重物时，不得猛起猛落，以防吊运过程中发生散落、松绑、偏斜等情况。起吊时必须先将重物吊起离地面 0.2m 左右停住，确定制动、物料捆扎、吊点和吊具无问题后，方可指挥操作。特别是起吊 80%以上最大起重量载荷时，必须先将重物离地 0.2m 左右停住，检查起升制动器和变幅制动器，确认无问题后才可起升。

(4)司机在操作时必须集中精力，当安全装置显示超载并报警时，必须减小吊钩幅度或将重物下降到地面以消除超载报警。

(5)司机必须专心操作，作业中不得离开司机室；起重机运转时，司机不得离开操作位置。

(6)作业中，临时停歇时，必须将重物卸下，升起吊钩，将各操作手柄置于零位。如因整机故障导致无法升、降重物，则应根据现场与具体情况，由有关人员研究，采取适当的措施。

(7)当塔机作业结束后，若周围没有碰到的障碍物，应使塔机处于随风自由回转状态。即

当塔机处于非工作状态时，将回转制动器打开。

(8)操作中若塔机出现故障应及时找维修人员修理，待排除故障后方可作业，绝对不允许塔机带故障运行。

⚠ 注意

在任何状态下，不准随意改动力矩限制器、起重量限制器、变幅限位、起升限位、塔机监控器等安全装置(这些装置在安装调试中已经调整准确)，否则将会造成机毁人亡的严重后果。若以上安全装置确需调整，请专业人员按说明书准确调整。

(9)作业中按规定和说明书要求对塔机需润滑的部位进行润滑，尤其检查钢丝绳的润滑情况及磨损

10.4 Precautions in operation

(1) The driver must be acquainted with the performance parameters of the tower crane, and comply with the safety operation regulations during the operation. Any operation that affects safety of the tower cane shall be strictly prohibited. The specific prohibited matters shall refer to Section 1.4 “Ten impermissibilities for hoisting work”.

(2) While operating the mechanism, the driver shall gear up/down the mechanism step by step, and shall not switch between the low and high gears too frequently as to avoid damages of the elements. A good operating habit should be formed as well. During the slewing operation, the handle shall be controlled in a coordinated way.

(3) While lifting heavy loads, ascending or descending with sudden and great force is not allowed to avoid scattering, loosening, or inclination. During hoisting, the load must firstly be lifted about 0.2 mm from the ground and stay still to ensure that no problem exist in braking, strapping of goods, lifting point and the slings, then the operation can be started as instructed. Especially for hoisting over 80% maximum lifting load, the heavy load shall be lifted about 0.2 m from the ground, and the lifting brake be inspected for braking problems, if no problem occurs, hoisting can be started.

(4) The driver must be concentrated during the operation, when the safety device indicates overload and generates a warning, the driver must reduce the working radius of the hook and lower the load onto ground to eliminate the overload warning.

(5) The driver must be concentrated on operation, and shall not leave the cab while operating; when the crane is operating, the driver shall not leave the operating position.

(6) In case of temporary stop or power cut, the heavy load must be unloaded, the hook be lifted, and each of operating handles be set to the zero position. If it is not possible to lift or descend load due to the power cut, the relevant personnel shall make a survey based on the on-site specific conditions and take appropriate measures.

⚠ Caution

Under no circumstances shall sudden inverse operation be performed during the slewing, or the brake be closed for forced braking during the operation of the jib. Otherwise the small gear of the slewing mechanism and the tooth of the slewing bearing will be damaged, causing severe consequences.

(7) At completion of the tower crane operation, if there is no obstacle in the surrounding, the tower crane shall be left in a state moving with wind. Namely, when the tower crane is in non-operation state, release the slewing brake, and cut off the general power supply for the tower crane.

(8) In case of tower crane failures during operation, ask the maintenance personnel to repair timely and resume the operation after troubleshooting. Tower crane shall not operate with failures until the failures are eliminated.

⚠ Caution

Under no circumstances shall the moment limiter, lifting load limiter, trolley limiter, lifting limiter, the tower crane monitor and other safety devices be modified (since these devices are already calibrated accurately at the installation commissioning), otherwise damages to the tower crane or casualties will be resulted. If the above safety devices do require adjustment, then professional personnel shall perform the adjustment according to the specifications.

(9) The tower crane shall be lubricated according to the requirements during the operation; especial care shall be exercised to the lubrication condition and abrasion of the steel wires.

第 11 章起重吊运指令

Chapter 11 Instructions for Hoisting Operations

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。

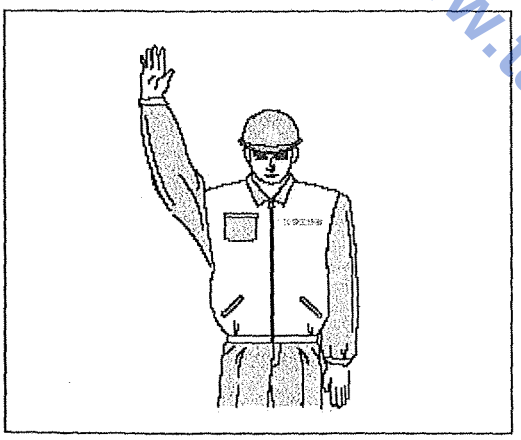
While practicing various actions of crane, driver must be aware of the space around crane. Driver must keep an eye on the load during loaded operation; and on hook during empty-hook actions. To ensure lifting safety, crane operator and driver should have a good knowledge of various commanding signals.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

机组人员必须熟悉标准的起重作业指挥信号手势，保持工作中各成员协调一致。

推荐标准手势如下：

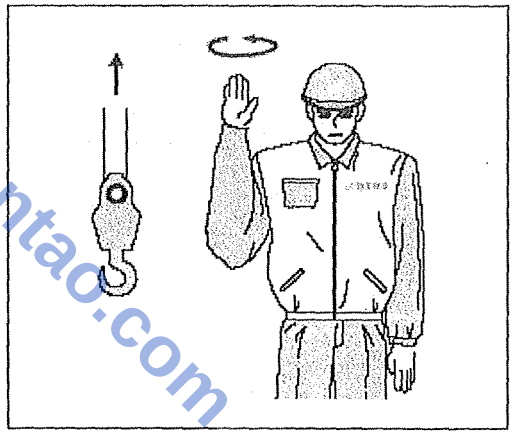
1.“预备”（注意）

手臂伸直，置于头上方，五指自然分开，手心朝前保持不动。



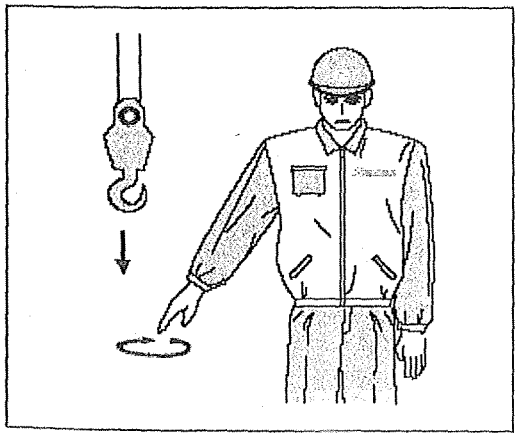
2.“吊钩上升”

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。



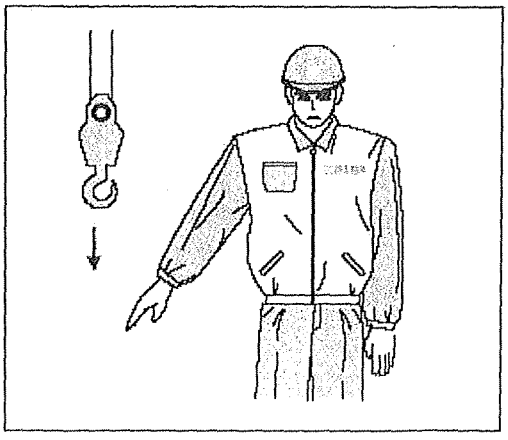
3.“吊钩下降”

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。

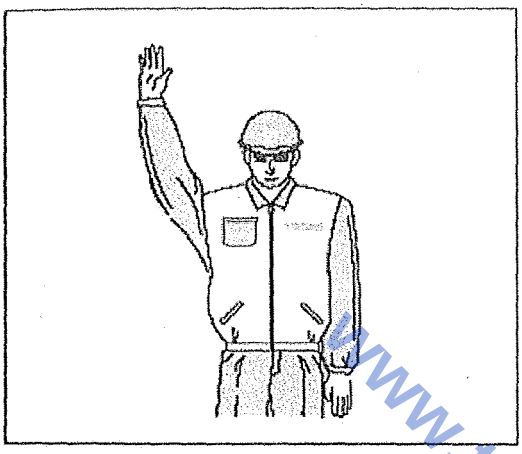


The crew members must be acquainted with the standard commanding signal gestures for hoisting operations, and be in coordination with other crew members during the operation.

The recommended standard gestures are as follows:

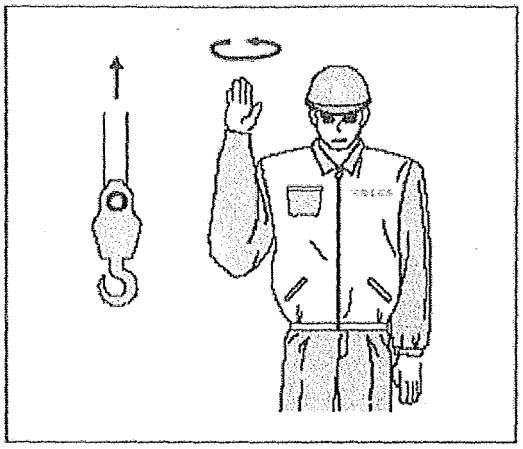
1. "Ready" (attention)

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



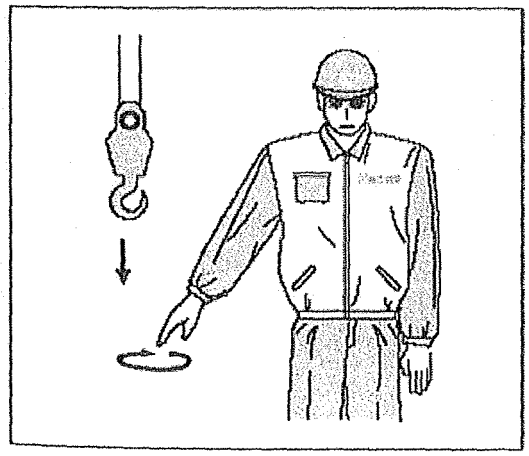
2. "Hook ascending"

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.



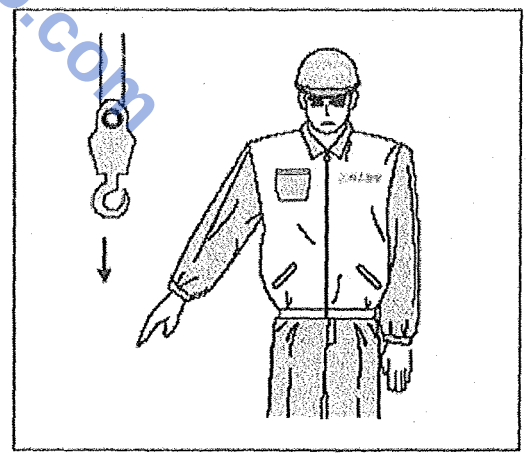
3. "Descend hook"

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.



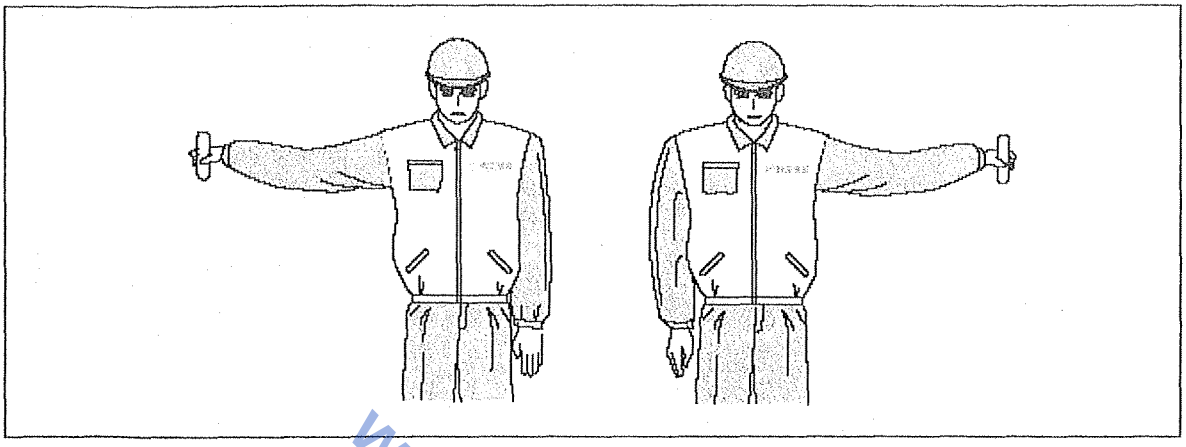
4. "Indicate descending orientation"

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



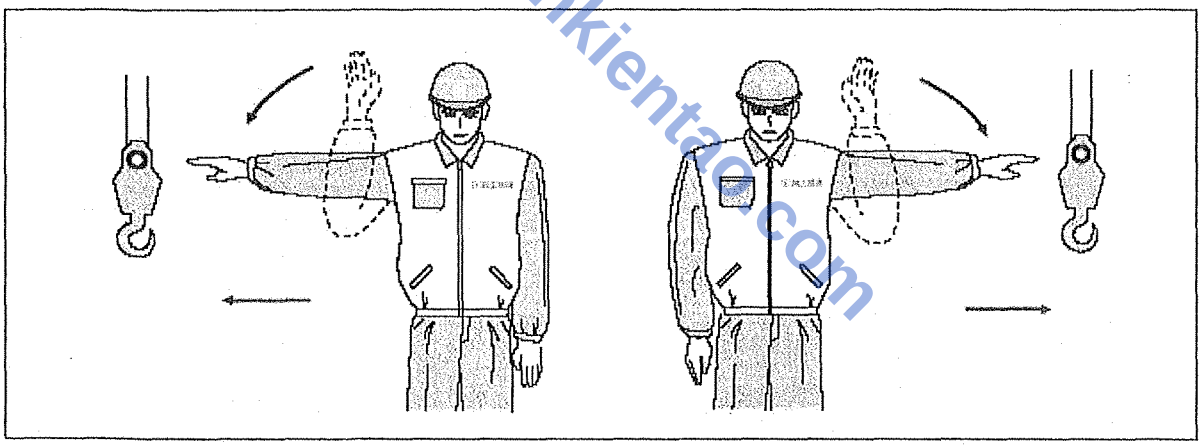
5. “转臂”

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。



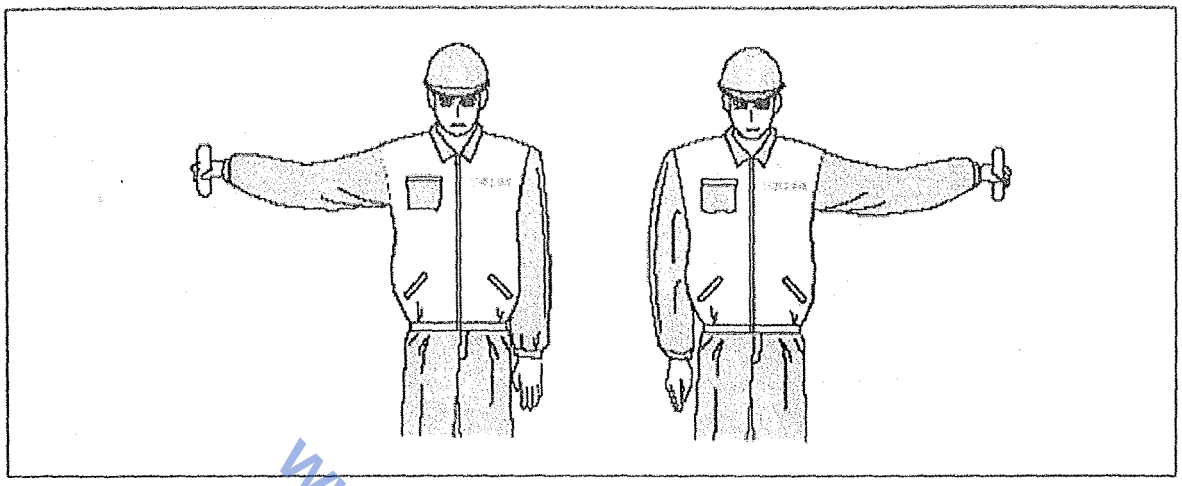
6.“吊钩水平移动”

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。



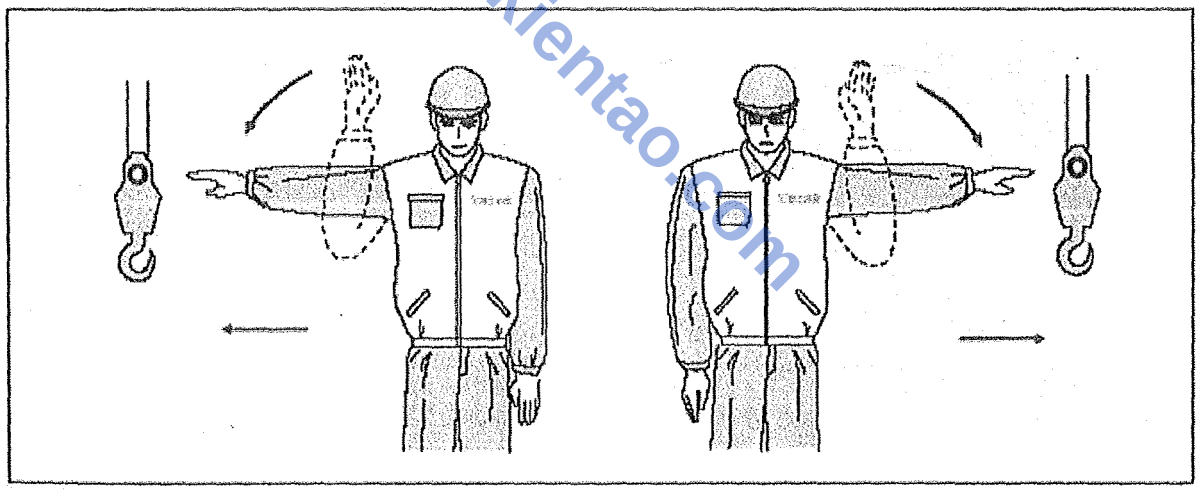
5. "Slew the jib"

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.



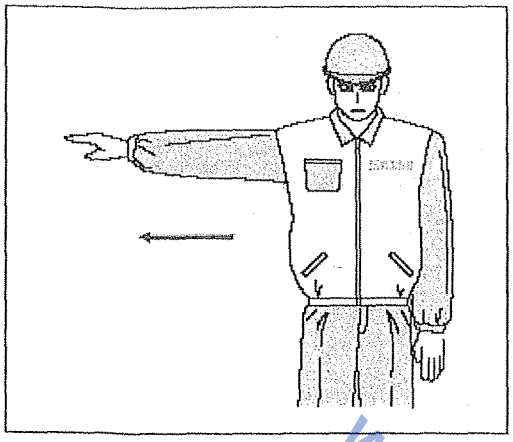
6. "horizontal movement of hook"

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.



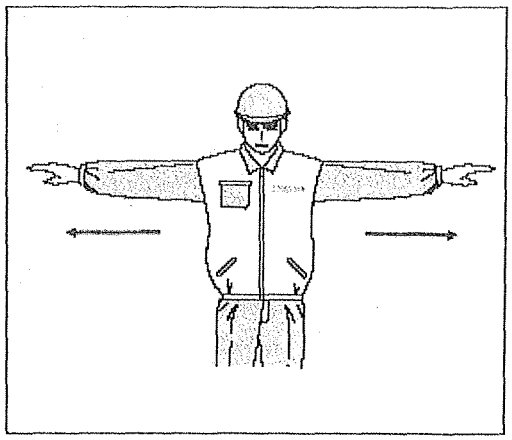
7.“停止”

小臂水平置于胸前，五指伸开，手心朝下，水平挥向一侧。



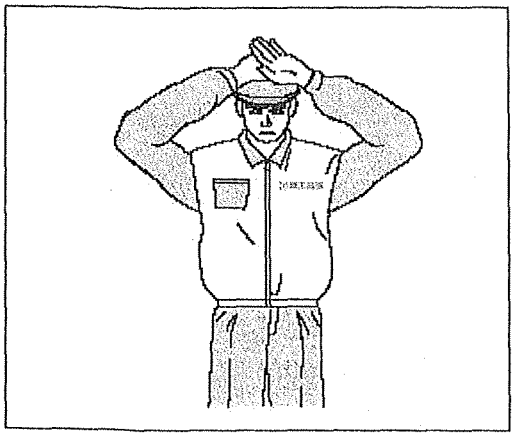
8.“紧急停止”

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。



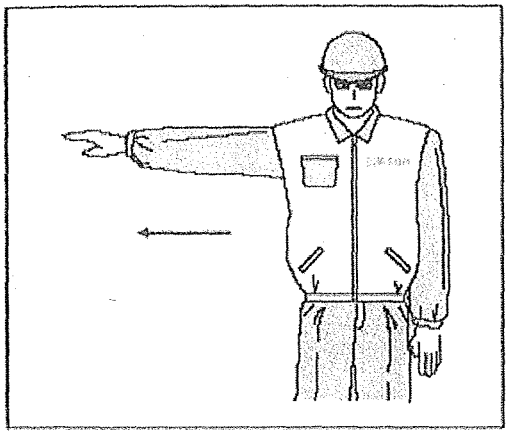
9.“工作结束”

双手五指伸开，在额前交叉。



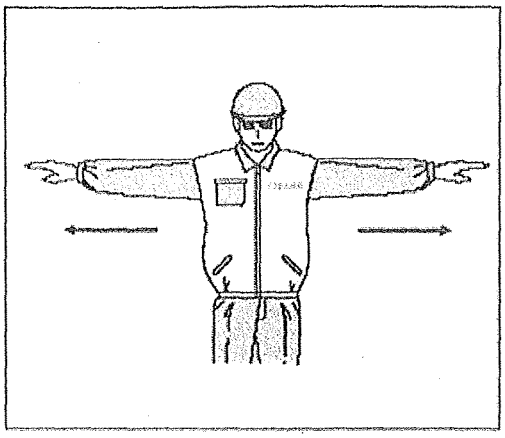
7. " stop"

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.



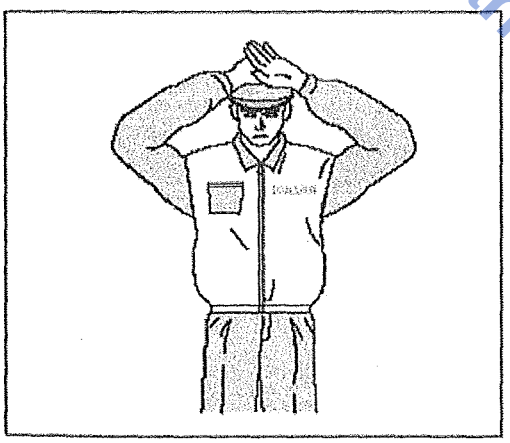
8. "Emergency stop"

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"

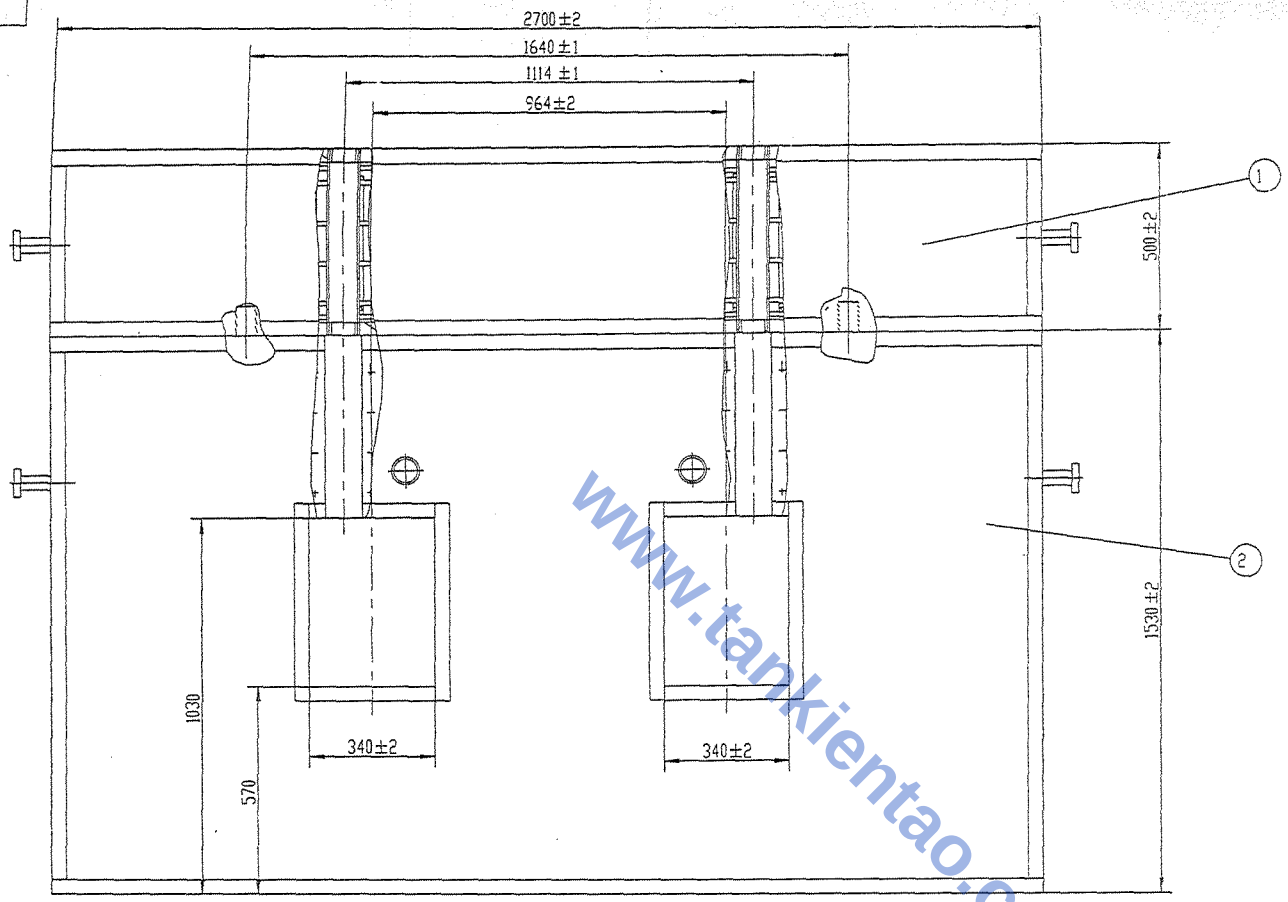
Intersect both hands with singers stretched.

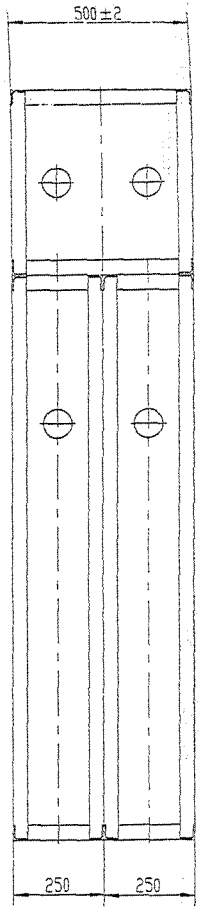


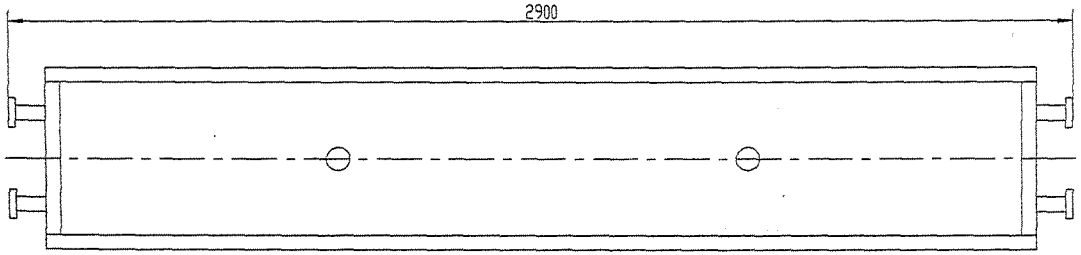
⚠ 注意 本操作手册所给的指挥语言只作为推荐，是基本的指挥语言。如果不能满足，使用单位可根据使用情况增加。指挥信号可参考标准 GB5082-1985《起重吊运指挥信号》。

⚠ Caution **The command words provided in the operation instruction is only for recommendation, as the basic. If it is insufficient, users can increase the command according to actual condition. The command signals takes reference from Standard GB5082-1985 The Commanding Signal for Lifting and Moving.**

XGTL80.31A







No	Point	Name	Material	Q'ty	Weight	Note
2	XGTL80.31A2	Counter weight II	-	2	2300.00	
1	XGTL80.31A1	Counter weight I	-	1	1600.00	

mark	Point	Document word	Signature	Y M D
Design		Standard		
Collate				
Check		Confirm		

Counter weight

XGTL80.31A

Stage	Mark	Weight	Ratio
S		6200.00	1:10

XCMG 徐工塔机

XGTL80.31A.1

Technical Specification

1. remedy of weight not over 1%
2. steelbars serve as I class
3. label of subassembly no less then C35, Density 2.4t/m
4. The two-point dash on the figure is the outer frame

No		Point	Name	Material	Q'ty	Weight	Note
11		XGTL80.31.1-8	Concrete	C35	1	1481.00	
10		XGTL80.31.1.7	sleeve	-	4	0.60	
9		XGTL80.31.1-6	steel bar	Q235B	4	0.65	
8		XGTL80.31.1-5	lug	Q235B	4	4.54	
7		XGTL80.31A.1-103	tube φ89×6-496	20	2	6.09	
6		XGTL80.31.1-4	steel bar	Q235B	21	1.40	
5		XGTL80.31.1-3	steel bar	Q235B	4	5.28	
4		XGTL80.31.1-2	steel bar	Q235B	4	5.38	
3		XGTL80.31.1-1	angle	Q235B	4	1.09	
2		XGTL80.31.1-102	angleL40×40×4-420	Q235B	4	1.02	
1		XGTL80.31.1-101	angleL40×40×4-2700	Q235B	4	6.54	

mark	Point	Document amend	Signature	Y M D
Design		Standard		
Collate				
Check		Confirm		

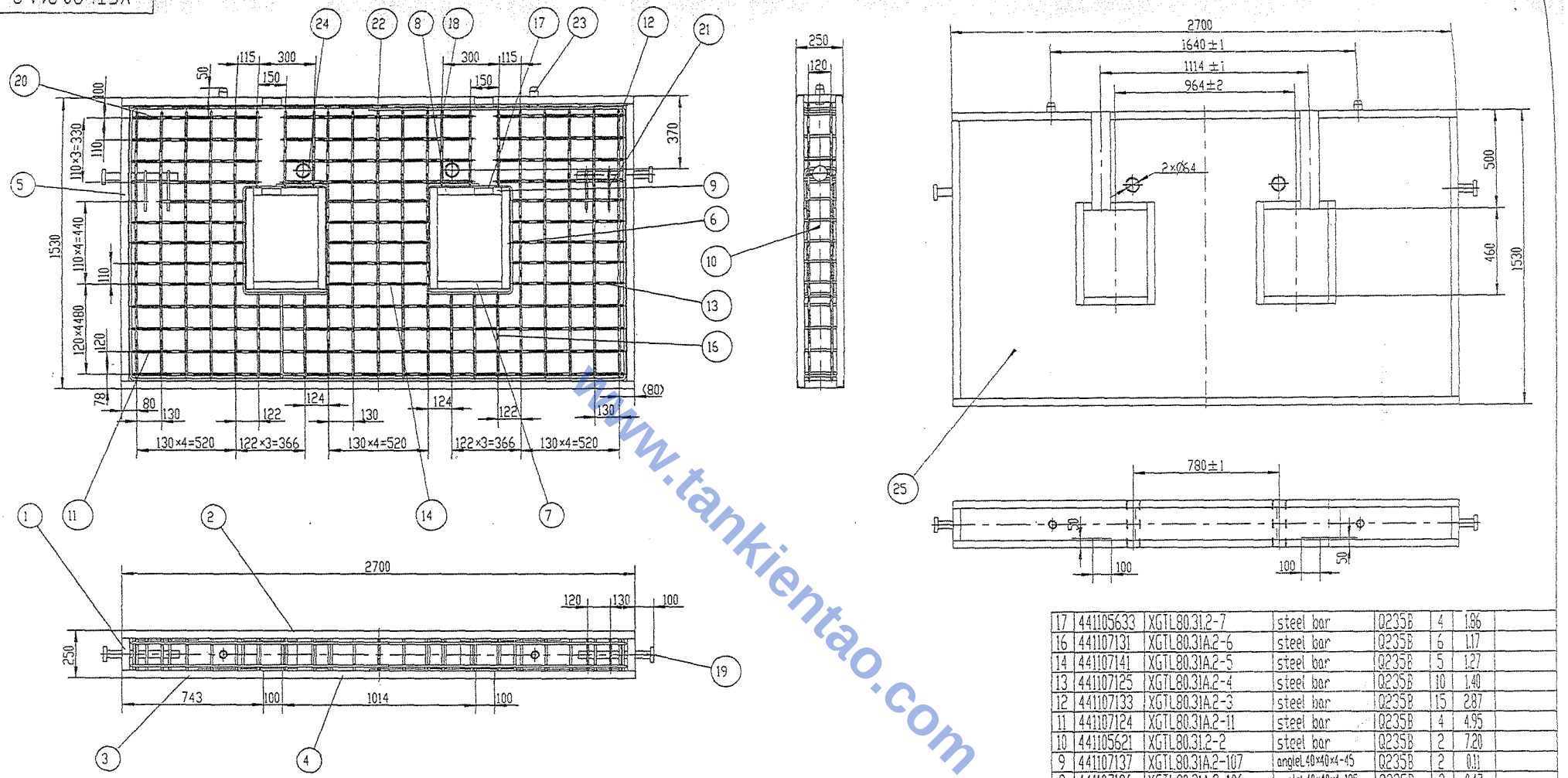
Counter weight I

XGTL80.31A.1

Stage	Mark	Weight	Ratio
S		1600	1:15

XCMG 徐工搭机

XGTL80.31A.2



No	Point	Name	Material	Q'ty	Weight	Note
17	441105633	XGTL80.31.2-7	steel bar	Q235B	4	1.86
16	441107131	XGTL80.31A.2-6	steel bar	Q235B	6	1.17
14	441107141	XGTL80.31A.2-5	steel bar	Q235B	5	1.27
13	441107125	XGTL80.31A.2-4	steel bar	Q235B	10	1.40
12	441107133	XGTL80.31A.2-3	steel bar	Q235B	15	2.87
11	441107124	XGTL80.31A.2-11	steel bar	Q235B	4	4.95
10	441105621	XGTL80.31.2-2	steel bar	Q235B	2	7.20
9	441107137	XGTL80.31A.2-107	angleL40×40×4-45	Q235B	2	0.11
8	441107126	XGTL80.31A.2-106	angleL40×40×4-195	Q235B	2	0.47
7	441105647	XGTL80.31.2-102	angleL40×40×4-340	Q235B	6	0.82
6	441105643	XGTL80.31.2-101	angleL40×40×4-540	Q235B	8	1.31
5	441105645	XGTL80.31.2-1	angle	Q235B	4	3.59
4	441107136	XGTL80.31A.2-105	angleL40×40×4-1014	Q235B	1	2.46
3	441107138	XGTL80.31A.2-104	angleL40×40×4-743	Q235B	2	1.80
2	441105638	XGTL80.31.1-101	angleL40×40×4-2700	Q235B	3	6.54
1	441107128	XGTL80.31A.2-103	angleL40×40×4-170	Q235B	4	0.41

No	Point	Name	Material	Q'ty	Weight	Note
25	441107140	XGTL80.31A.2-10	Concrete	C35	1	3768.00
24	441107127	XGTL80.31A.2-15	tube ϕ76×6-250	20	2	2.59
23	441105644	XGTL80.31.2-9	pin	Q235B	2	1.19
22	441107123	XGTL80.31A.2-14	steel bar	Q235B	4	2.13
21	441107132	XGTL80.31A.2-12	steel bar	Q235B	4	0.50
20	441107134	XGTL80.31A.2-13	steel bar	Q235B	8	1.55
19	441105623	XGTL80.31.1-5	lug	Q235B	2	4.54
18	441107122	XGTL80.31A.2-8	steel bar	Q235B	6	1.05

Technical Specification

1. remedy of weight not over 1%
2. steelbars serve as I class
3. label of subassembly no less then C35,Density 2.4t/m
4. The two-point dash on the figure is the outer frame

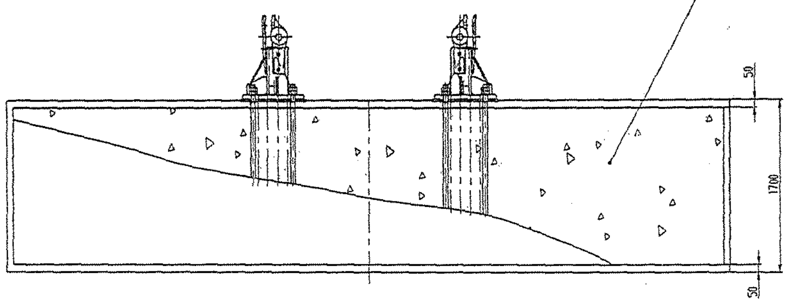
mark	Point	Document word	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction				Y M D

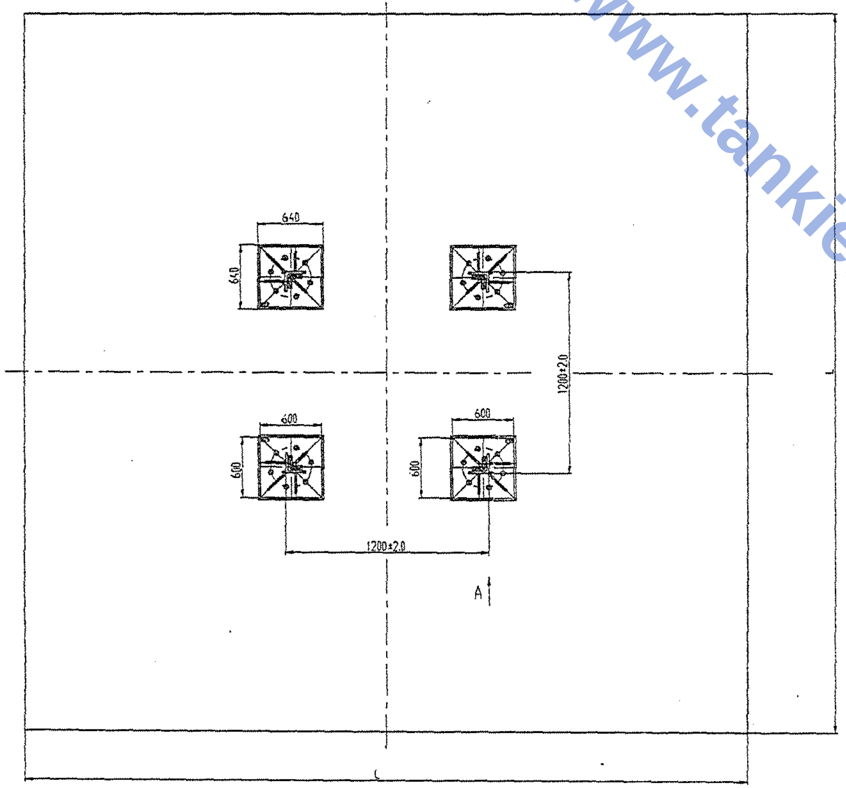
Counter weight II

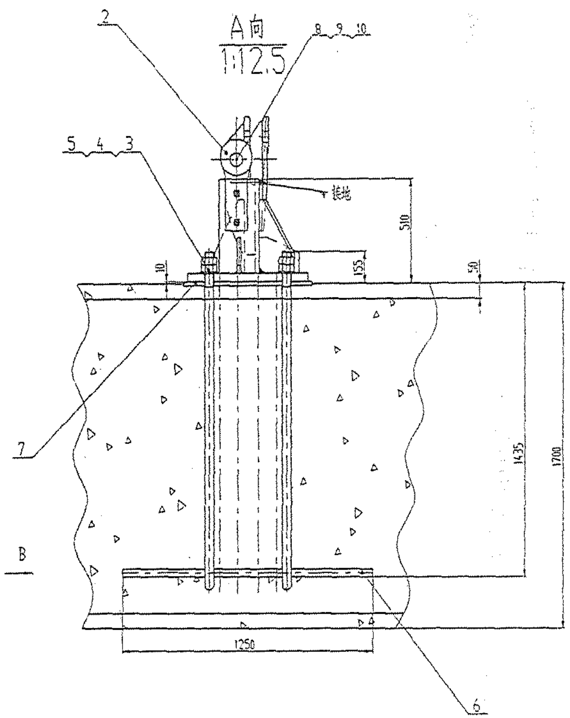
XGTL80.31A.2

Stage	Mark	Weight	Ratio
S		2300	1:15

XCMG 徐工塔机







技术要求

1、砼基础强度等级不低于C35，参照有关规定捣制；

2、四个底座顶面水平度1/1000；

3、垫板下砼填充率≥95%，四垫板上平面保持水平，垫板允许嵌入砼内10mm；

4、允许在底座与垫板间增加垫片，垫片面积必须大于垫板面积的90%，且每个底座下面最多只能增加两块垫片；确保过渡节安装后的水平度1/750，其中心线与水平面垂直度误差为1.5%；

6、四组地脚螺栓（24根）相对位置必须准确，组装后保证地脚螺栓孔的对角线误差不大于2mm，确保底座的安装；

7、地脚螺栓需与基础钢筋（件6）相连，养护期大于15天；

8、固定基础中心距附着墙体距离3.2米。

序号	代号	名称	数量	材料	单件	总计	备注
					重量		
10	GB/T91-2000	开口销5×36	4	低碳钢	0.004	0.016	
9	XGTT200.11-4	销轴	4	40Cr	0.55	2.2	借用
8	XGTT200.12-4	轴	8	35CrMo	4.92	39.36	借用
7	H15B-2	垫板	4	Q345B	62.8	251.2	借用
6	H15B-101	Ⅱ级螺纹钢Φ40-1250	12	HRB335	12.32	147.84	定尺，借用
5	GB/T97.1-2002	垫圈45	24	300HV	0.2	4.8	
4	GB/T6171-2000	螺母M45X3	48	10级	0.6	28.8	
3	H15B-1	地脚螺栓M45X3	24	40Cr	22.78	546.72	借用
2	H15B.01A	底座	4	焊件	231	924	借用
1	XGTL80.12.1	砼基础	1	组件			

XGTL80A.12A

徐州建机工程机械有限公司

部件

固定基础

固定基础

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

阶段标记 重量 比例

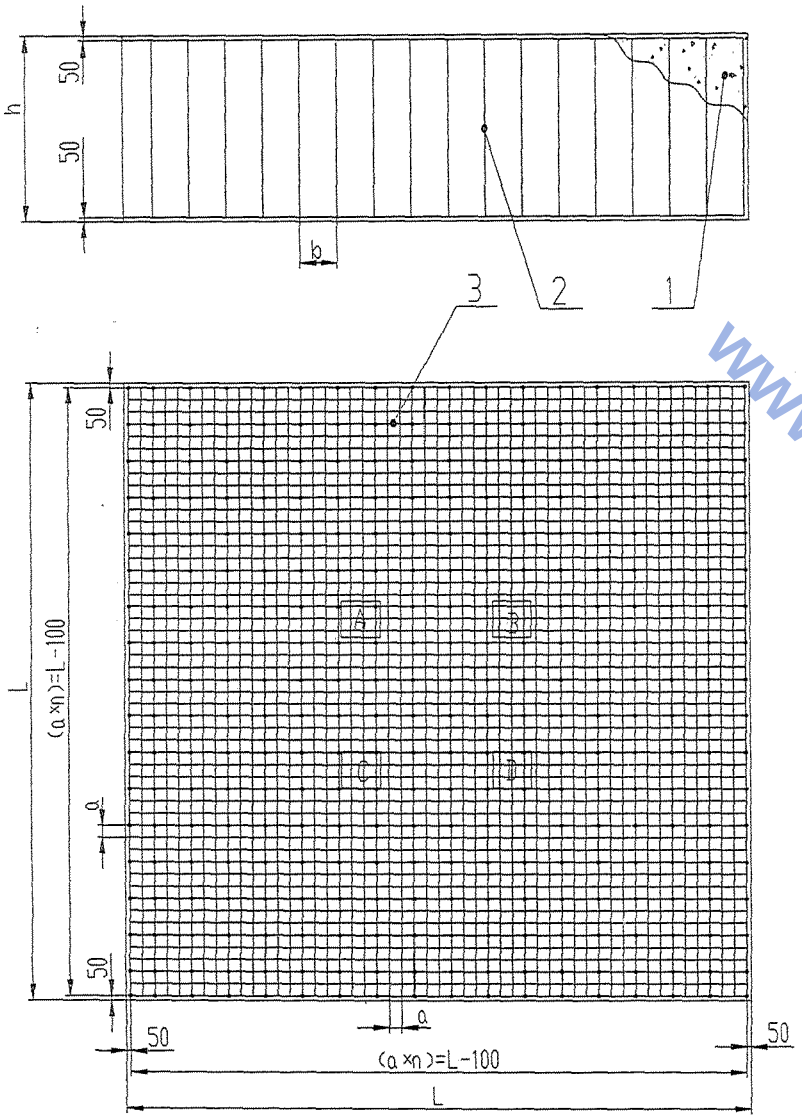
1:25

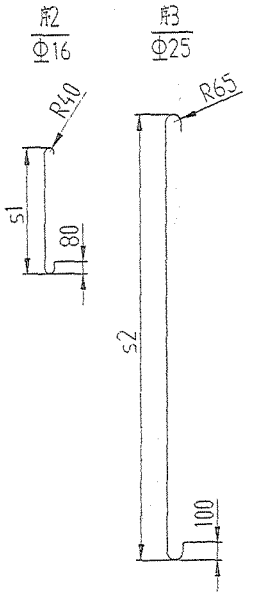
XGTL80A.12A

XGTL80A.12.1

不同地耐力下基础参数（长度单位为mm，质量单位为kg）

基础参数 \ 地耐力/10^5Pa	0.16	0.12
基础长度 L	5800	6400
基础高度 h	1700	1700
横筋间距(参考) a	150	154
立筋间距(参考) b	450	462
立筋长度 S1	1600	1600
横筋长度 S2	5700	6300
横筋间隔数 n	39	42
立筋单重 k1	3.43	3.43
横筋单重 k2	25.3	27.6
立筋数量 n1	196	225
横筋数量 n2	156	168
立筋总重 m1	672.3	771.7
横筋总重 m2	3946.8	4636.8
基础重量	137251	167116





技术要求

1. 根据不同地耐力选取不同基础尺寸及钢筋参数；
2. 钢筋牌号为：HRB335（1499.2-2007）；
3. A、B、C、D为底座位置。

序号	代号	名称	数量	材料	单件	总计	备注
					重量		
3	XGTL80A.12.1-3	横筋 Φ25	n2	HRB335	k2	m2	见本图
2	XGTL80A.12.1-2	立筋 Φ16	n1	HRB335	k1	m1	见本图
1	XGTL80A.12.1-1	砼	1	C35	见表	见表	无图

标记	处数	分区	更改文件号	签名	年月日	组件	徐州建机工程机械有限公司
设计			标准化			阶段标记 重量 比例	固定基础
校对						S 见表 1:60	砼基础
审核						共 张 第 张	XGTL80A.12.1
工艺			批准				

ELECTRICAL SCHEMATIC

NAME: ELECTRIC CONTROL SCHEMATIC

of 6T INVERTER SYSTEM

COOD: DL006BBB0A02000

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747	DL006BBB0A02000			
Cover	Pattern	Mark	Weight	Ratio
	S			1:1
	Edition		1 Page	Page 1

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

NO.	Drawing No.	Name
1	DL006BBB0A02001	Drawing Catalogue
2	DL006BBB0A02101	Control Schematic(Power supply circuit)
3	DL006BBB0A02102	Control Schematic(Hoisting Main Circuit)
4	DL006BBB0A02103	Control Schematic(Hoisting Control Circuit)
5	DL006BBB0A02104	Control Schematic(Slewing Main Circuit)
6	DL006BBB0A02105	Control Schematic(Slewing Control Circuit)
7	DL006BBB0A02106	Control Schematic(Trolleying Main Circuit)
8	DL006BBB0A02107	Control Schematic(Hoisting Clamp Circuit)
9	DL006BBB0A02108	Control Schematic(Trolleying Control Circuit)
10	DL006BBB0A02109	Control Schematic(Stopper Alarm)
11	DL006BBB0A02201	Electrical Connection Schematic(Console)
12	DL006BBB0A02202	Electrical Connection Schematic(Cab Distribution Cabinet)
13	DL006BBB0A02203	Electrical Connection Schematic(Main Control Cabinet 1)
14	DL006BBB0A02204	Electrical Connection Schematic(Main Control Cabinet 2)
15	DL006BBB0A02301	Element Layout (Cab Distribution Cabinet)
16	DL006BBB0A02302	Element Layout (Main Control Cabinet)

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

803745747

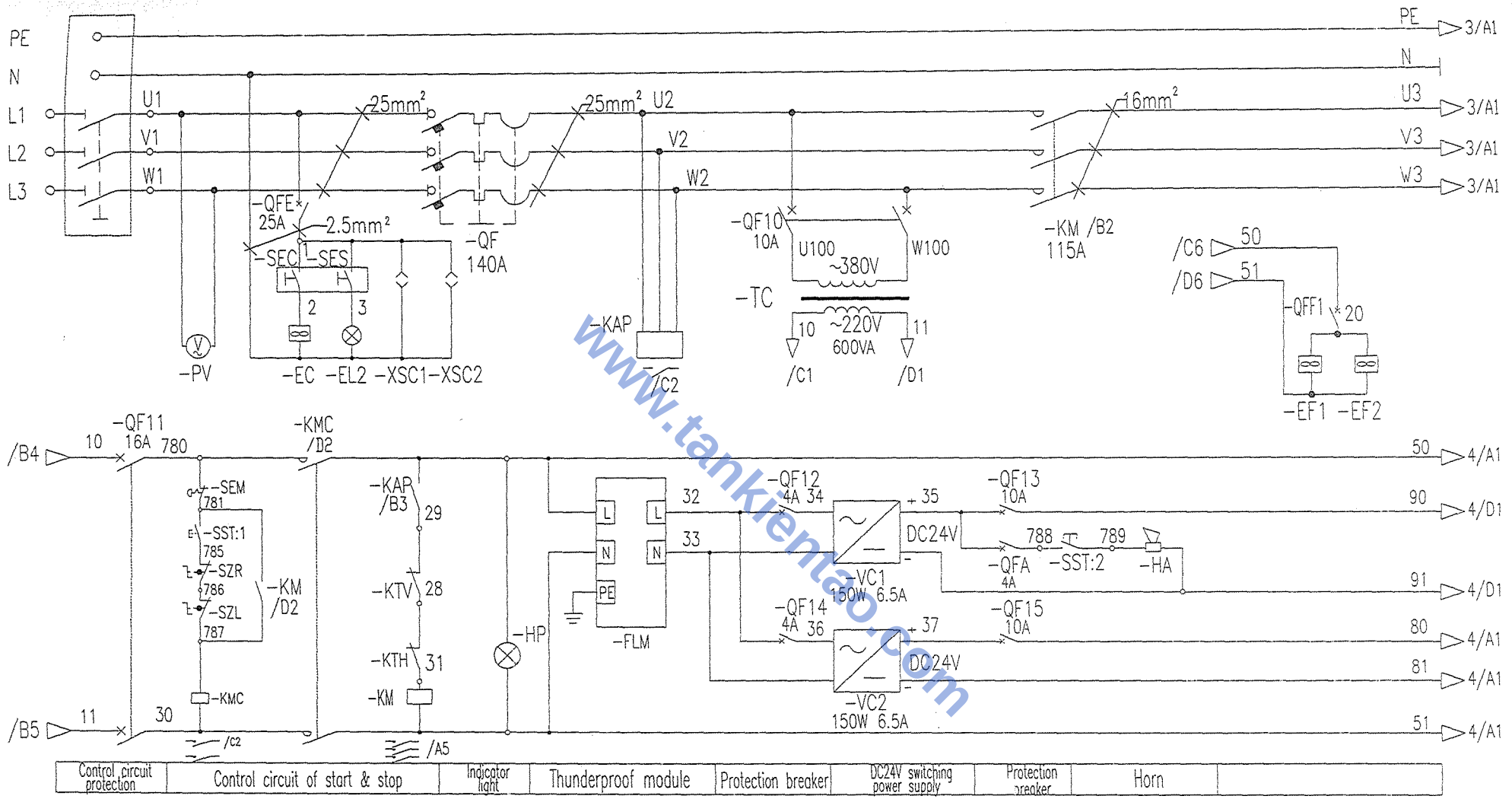
Drawing Catalogue

DL006BBB0A02001

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 1

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

Disconnector switch	Voltmeter	Cab fan	Cab light	Cab socket	Main breaker	Sequence protector	Control transformer	Main contactor	Fan



Control circuit protection	Control circuit of start & stop	Indicator light	Thunderproof module	Protection breaker	DC24V switching power supply	Protection breaker	Horn

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

803745747

DL006BBB0A02101

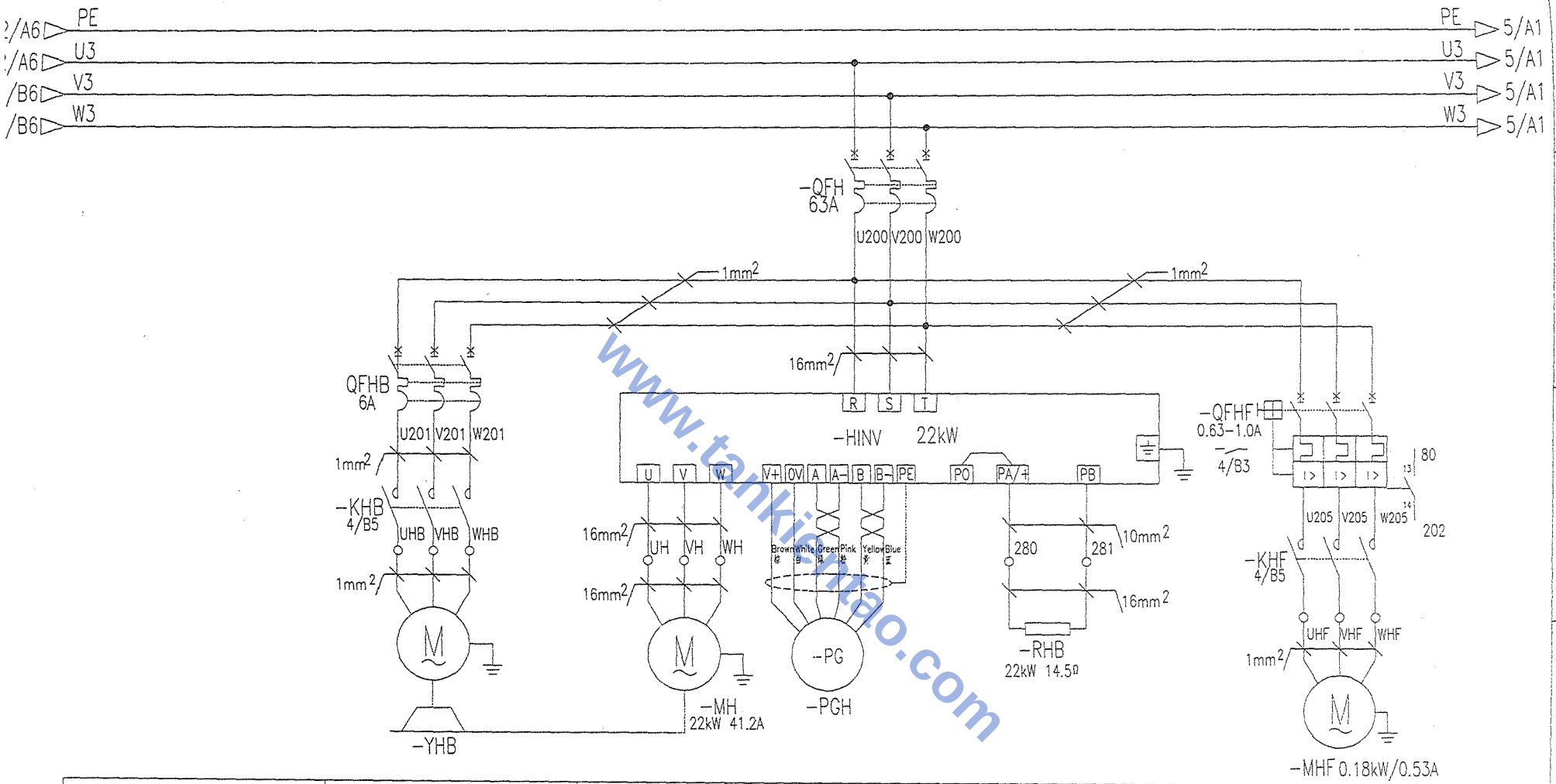
Power supply circuit

Control Schematic

Pattern Mark	Weight	Ratio
S		1:1
Edition	16 Page	Page 2

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

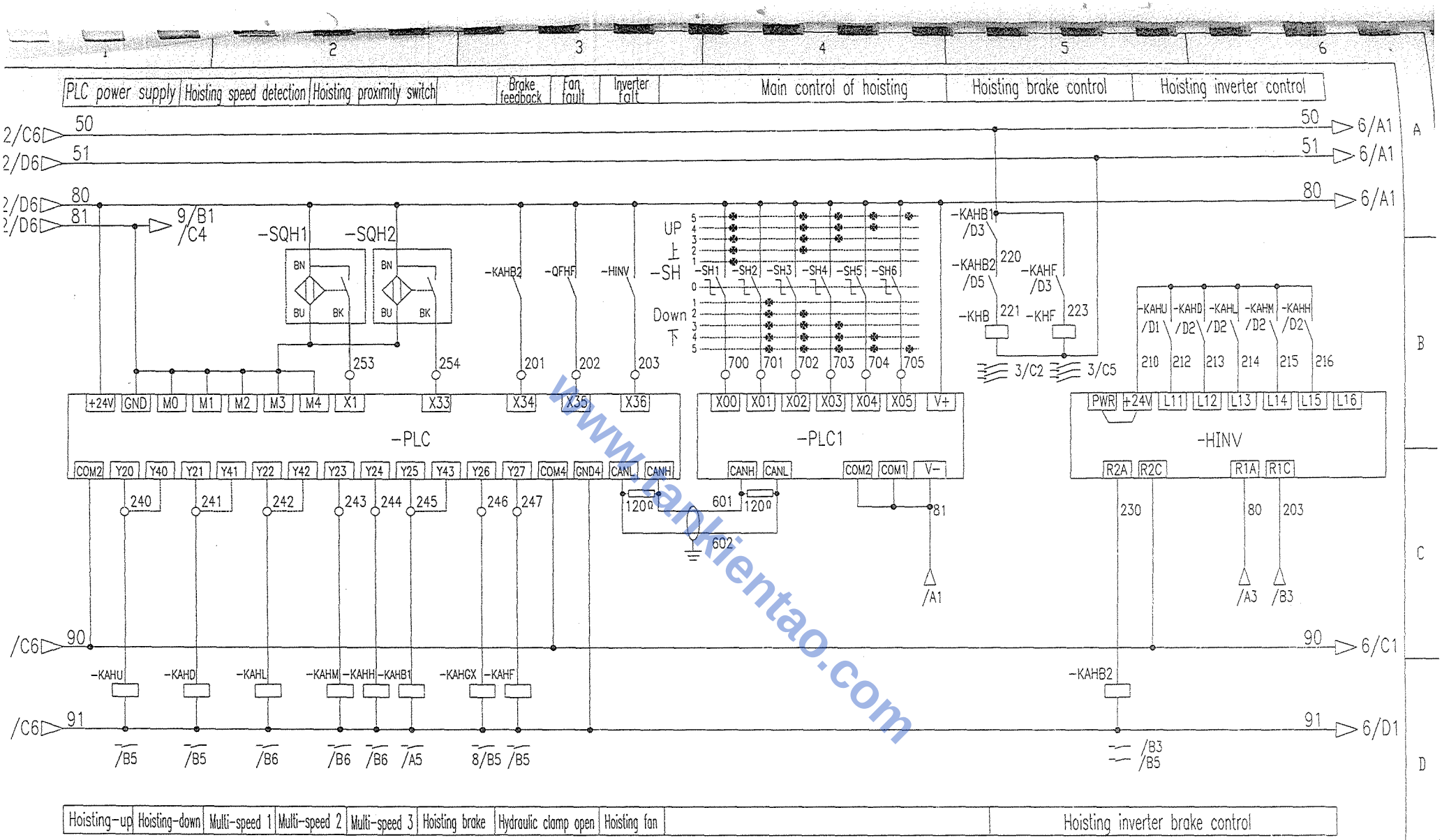
Hoisting brake control	Hoisting protection and inverter	Hoisting fan protection



Hoisting brake	Hoisting motor	Hoisting encoder	Hoisting reactor and brake resistance	Hoisting fan

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

803745747	DL006BBB0A02102
Hoisting Main Circuit	Pattern Mark: S; Weight; Ratio: 1:1
Control Schematic	Edition; 16 Page; Page 3
	XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD



Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

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DL006BBB0A02103

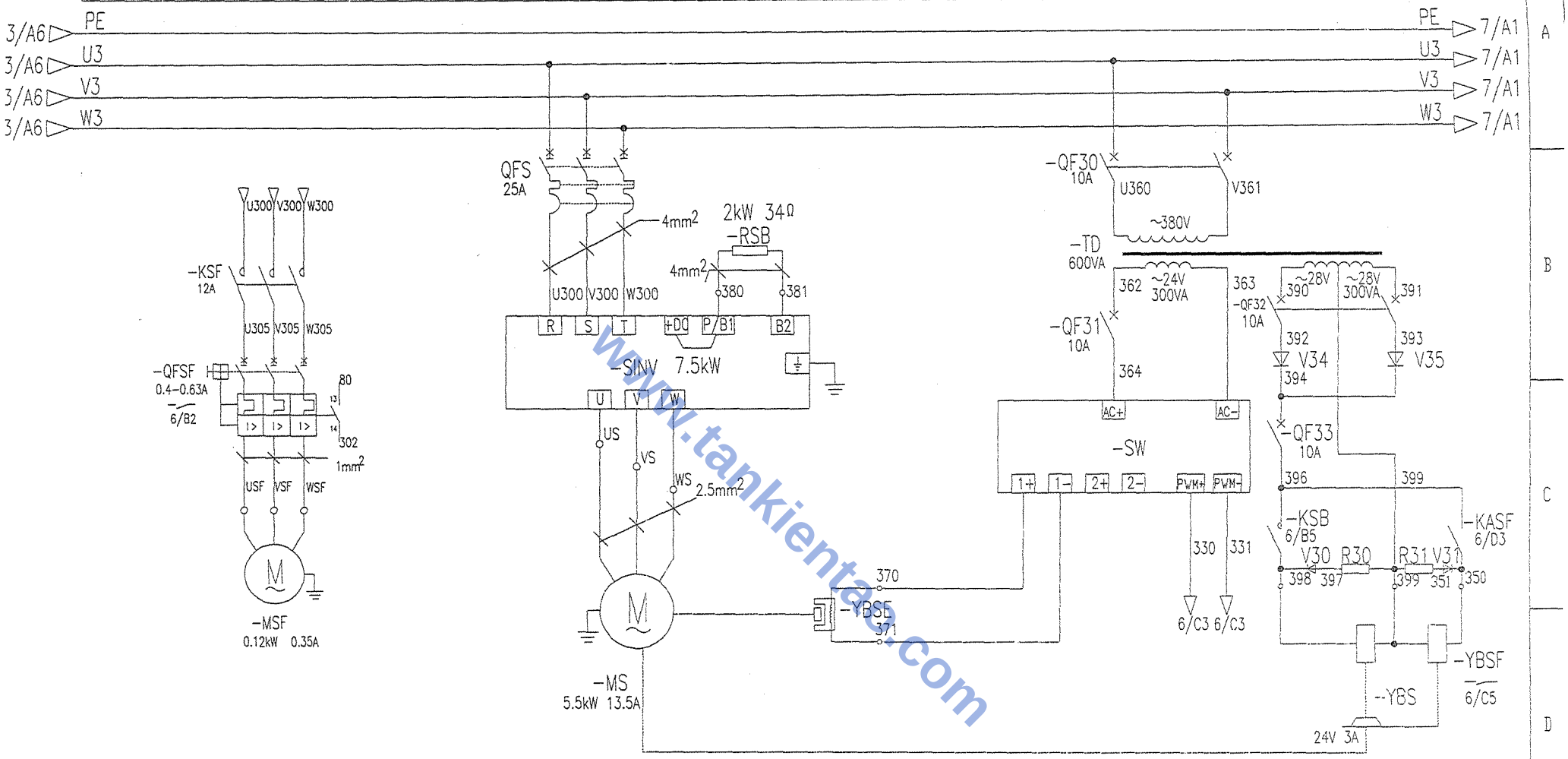
Hoisting Control Circuit

Control Schematic

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 4

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

Protection of slewing fan	Slewing protection and inverter	Slewing reactor and brake resistance	Slewing transformer and protection	Brake power supply and control



	Slewing fan		Slewing motor	Slewing eddy brake	Eddy control output	Eddy control Input	Slewing brake	Slewing weathercock coil

Mark	Point	Document	Amend	Signature	Y	M	D
Design				Standard			
Collate							
Check				Confirm			
Construction				Date			

803745747

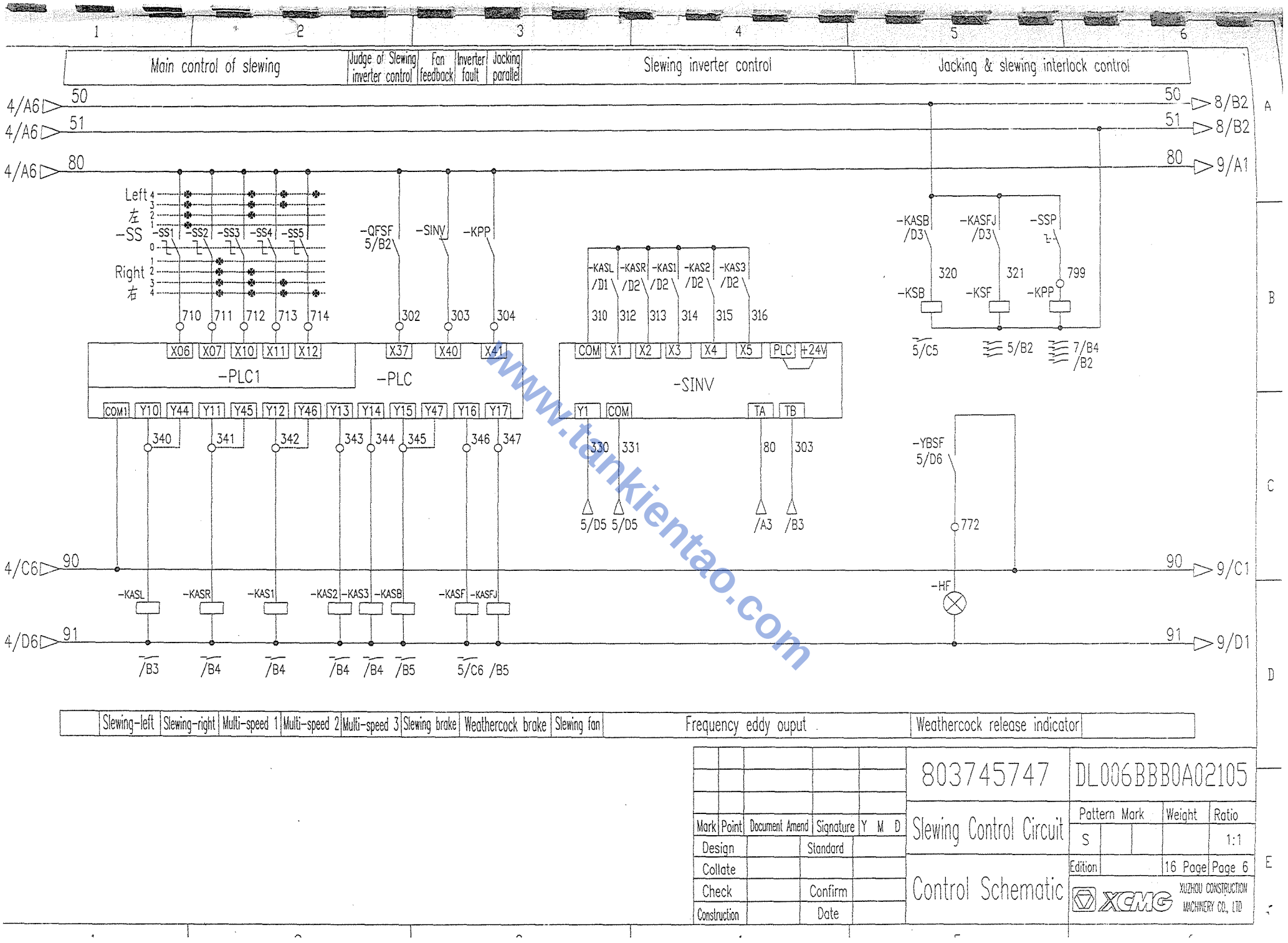
DL006BBB0A02104

Slewing Main Circuit

Control Schematic

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 5

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD



	Slewing-left	Slewing-right	Multi-speed 1	Multi-speed 2	Multi-speed 3	Slewing brake	Weathercock brake	Slewing fan	Frequency eddy ouput	Weathercock release indicator

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747

DL006BBB0A02105

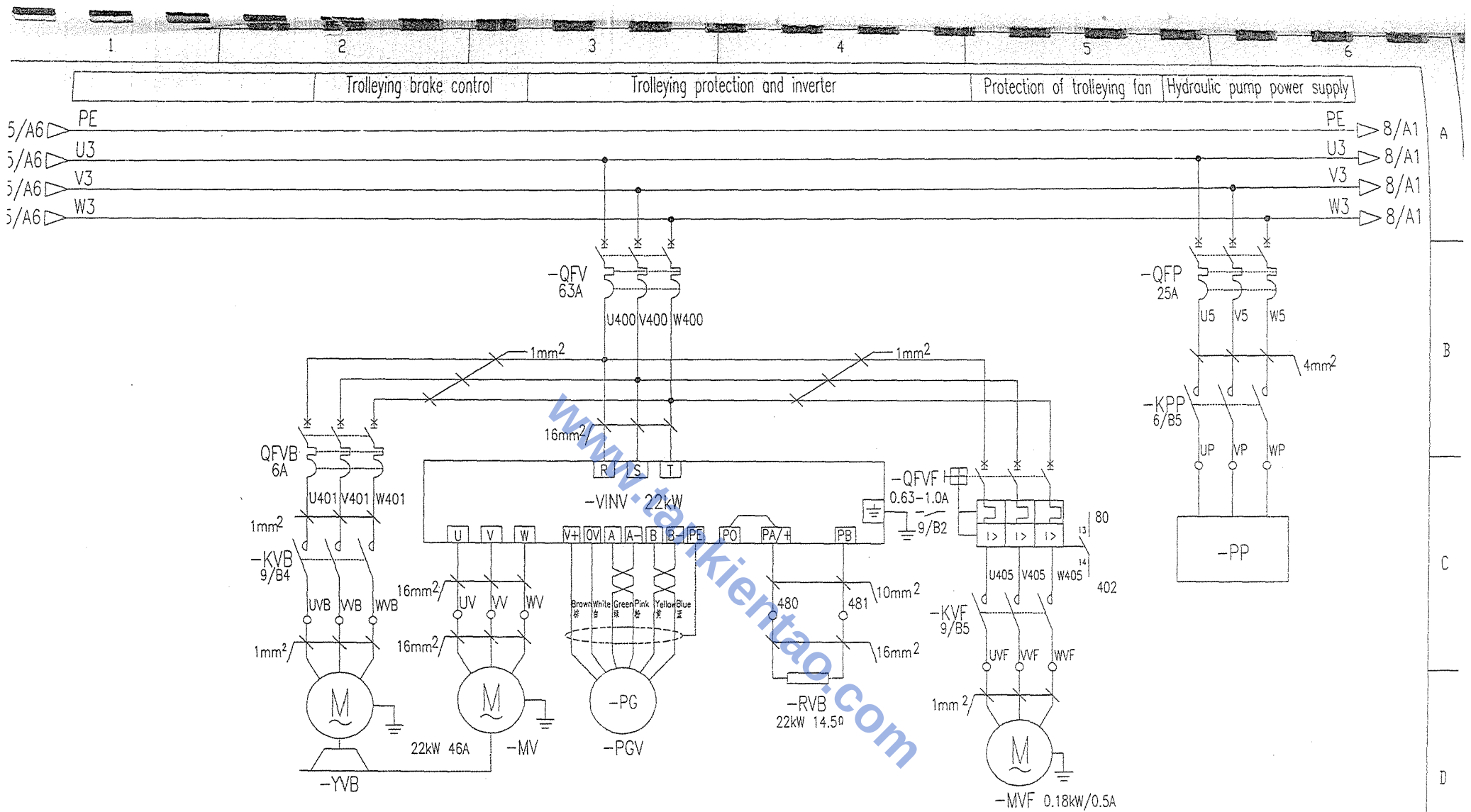
Slewing Control Circuit

Control Schematic

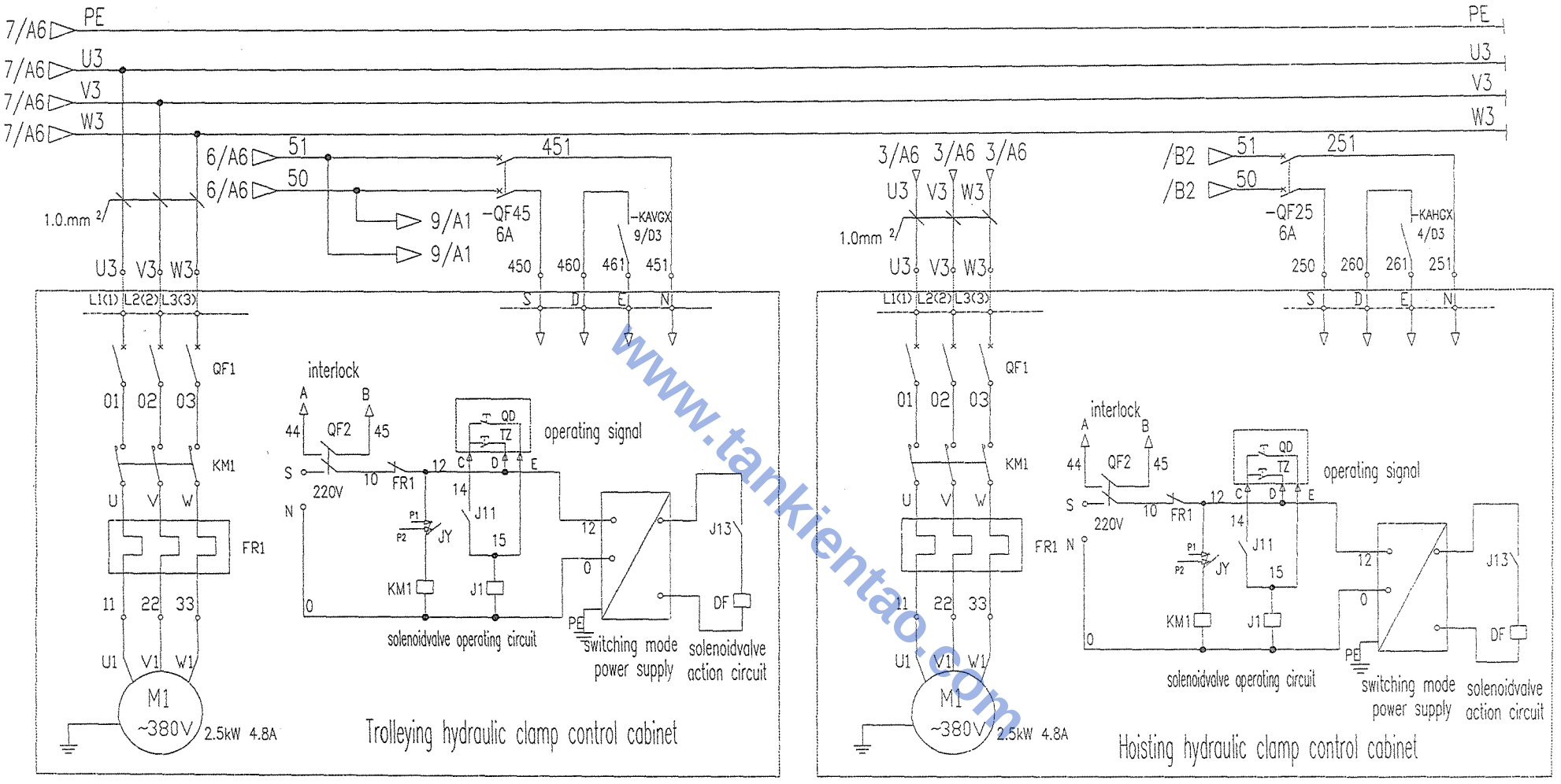
Pattern Mark	Weight	Ratio
S		1:1

Edition	16 Page	Page 6

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD



Trolleying hydraulic clamp pump station motor	Trolleying hydraulic clamp control circuit	Trolleying hydraulic clamp gate control	Hoisting hydraulic clamp pump station motor	Hoisting hydraulic clamp control circuit	Hoisting hydraulic clamp gate control



Trolleying hydraulic clamp pump station motor	Trolleying hydraulic clamp control circuit	For hoisting hydraulic clamp pump station motor	For hoisting hydraulic clamp gate control

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747

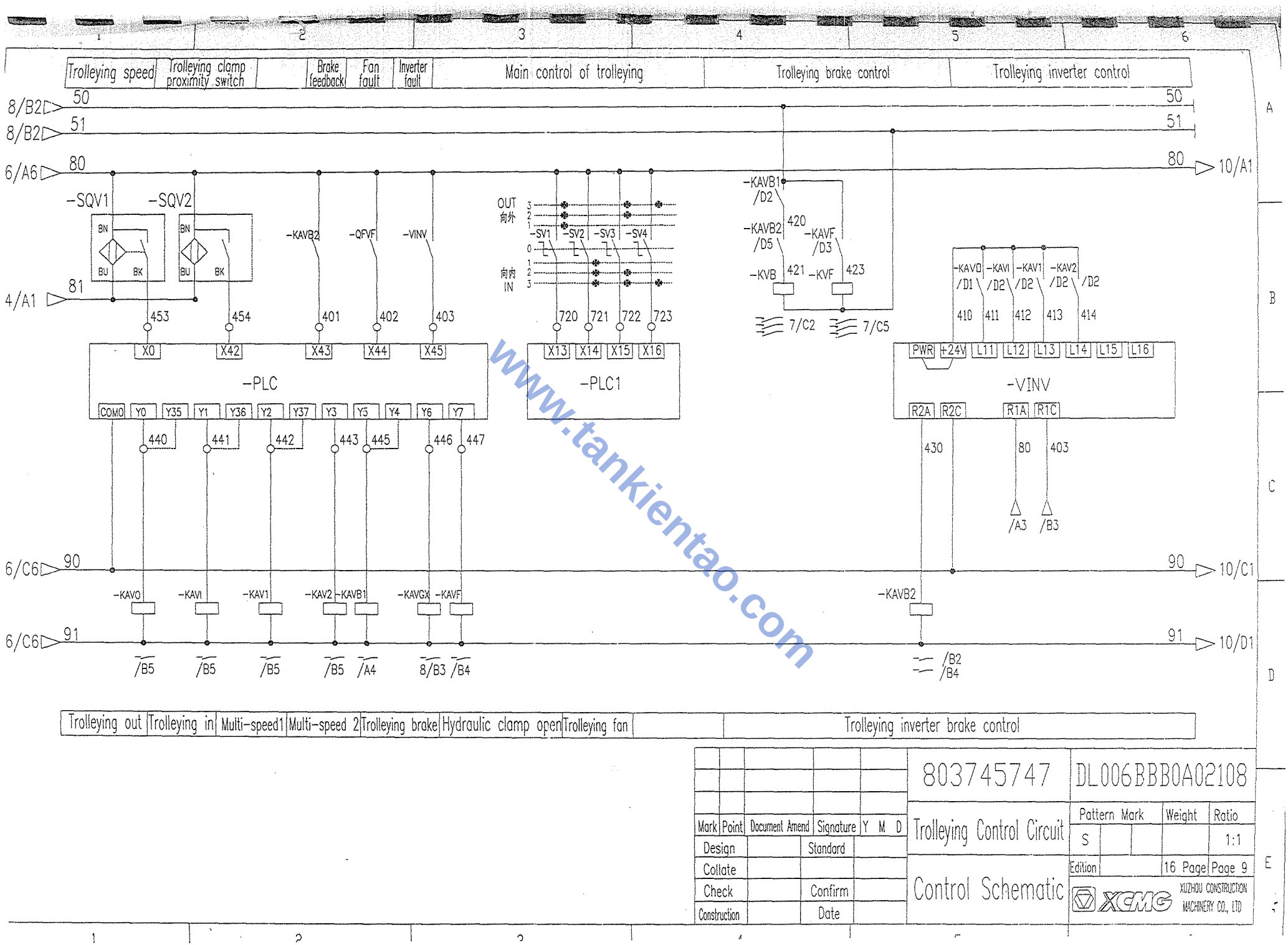
DL006BBB0A02107

Clamp Circuit

Control Schematic

Pattern Mark	Weight	Ratio
S		1:1
Edition	16 Page	Page 8

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD



Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

803745747

DL006BBB0A02108

Trolleying Control Circuit

Control Schematic

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 9

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

Weathercock brake	Bypass		100% moment	80% moment	Moment anti-loose	100% weight	75% weight	35% weight	Trolleying -out stop	Trolleying -out reducing	Trolleying -in stop	Trolleying -in reducing	Hoisting -UP stop	Hoisting -UP reducing	Hoisting -Down stop	Hoisting -Down reducing	Trolleying -out travel	Trolleying -in travel	Slewing -left stop	Slewing -left reducing	Slewing -right stop	Slewing -right reducing

9/A6 80

-SSF -SSJ -KA80 -KA81 -KA82 -KA83 -KA84 -KA85 -KA86 -KA87 -KA88 -KA89 -KA90 -KA91 -KA92 -KA93 -KA94 -KA95

752 751 120 121 122 123 124 125 126 127 128 129 130 131 132 133 144 145

X4 X5 X6 X7 X10 X11 X12 X13 X14 X15 X16 X17 X20 X21 X22 X23 X24 X25 X26

-LSS (Slewing stopper)

-SSL (4WK) -SSLC (3WK) -SSR (2WK) -SSRC (1WK)

80 114 115 116 117

-MCB For anti-collision system

-SMS1 -SMS2 -SMS3 -SMS4

174 175 176 177

X27 X30 X31 X32

-PLC

COM3 COM4 Y30 Y31 Y32 Y33 Y34

760 761 762 763 764

9/C6 90

-LSM (Moment limiter)

-SML1 (K2) -SML2 (K3) -SMA (K1) -SFS (K4)

90 100 101 102

-LSW (Weight limiter)

-SWL (K1) -SWH (K2) -SWQ (K4)

90 103 104 105

-LSV (Trolleying limiter)

-SVFL (4WK) -SVFC (3WK) -SVBL (2WK) -SVBC (1WK)

90 106 107 108 109

-LSH (Hoisting stopper)

-SHUL (4WK) -SHUC (3WK) -SHOL (2WK) -SHDC (1WK)

90 110 111 112 113

-SVFW (3WK)

90 146

-SVBW1 (1WK) -SVBW2 (2WK)

147

90 148

-MCB For anti-collision system

-SMM1 -SMM2 -SMW1 -SMW2 -SMW3 -SMV1 -SMV2 -SMV3 -SMV4 -SMH1 -SMH2 -SMV5

160 161 163 164 165 166 167 168 169 170 171 178

-KA80 -KA81 -KA82 -KA83 -KA84 -KA85 -KA86 -KA87 -KA88 -KA89 -KA90 -KA91 -KA92 -KA93 -KA94 -KA95

-HML -HMA -HLL -HLC -HBZ

9/D6 91

/B2 /B2 /B2 /B3 /B3 /B3 /B3 /B3 /B4 /B4 /B4 /B4 /B4 /B4 /B5 /B5 /B5

	100% moment	80% moment	Moment anti-loose	100% weight	75% weight	35% weight		Trolleying -out	Trolleying -out	Trolleying -in	Trolleying -in reducing		Hoisting -up	Hoisting -up	Hoisting -down	Hoisting -down	Trolleying -out travel	Trolleying -in travel1	Trolleying -in travel2	100% moment	80% moment	100% weight	Super speed weight	Buzzer

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

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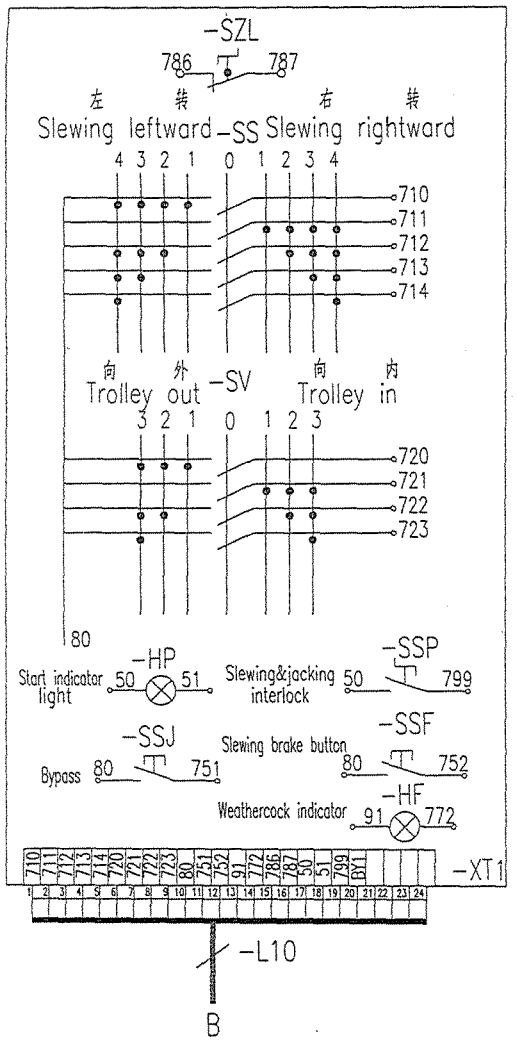
DL006BBB0A02109

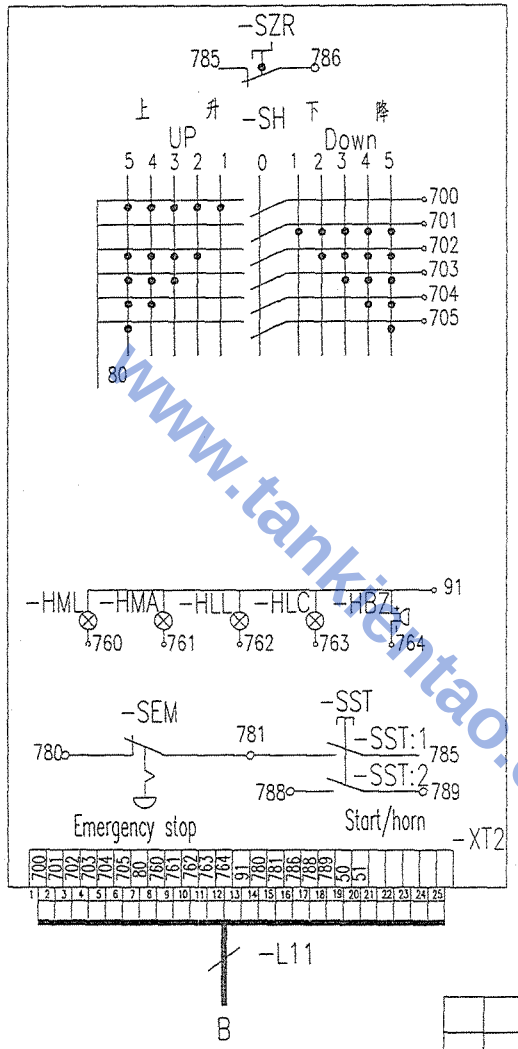
Stopper alarm

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 10

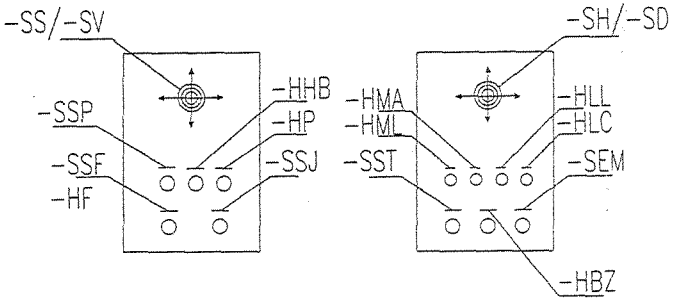
Control Schematic

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD





QCB543F Console Layout



No.	Code	Name	Qty
1	-SH,-SS,-SV	Control switch	3 sets
2	-SZL,-SZR	Zero switch of left/right console	2
3	-HP	Start indicator light	1
4	-SSF	Weathercock brake button	1
5	-SSJ	Bypass button	1
6	-HML	100% moment indicator	1
7	-HMA	80% moment indicator	1
8	-HLL	100% weight indicator	1
9	-HLC	50% weight indicator	1
10	-SST	Start/horn button	1
11	-HBZ	Buzzer	1
12	-SEM	Emergency stop button	1
13	-HF	Weathercock indicator light	1
14	-SSP	Slewing&jacking interlock switch	1

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

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Console

Electrical connection schematic

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 11

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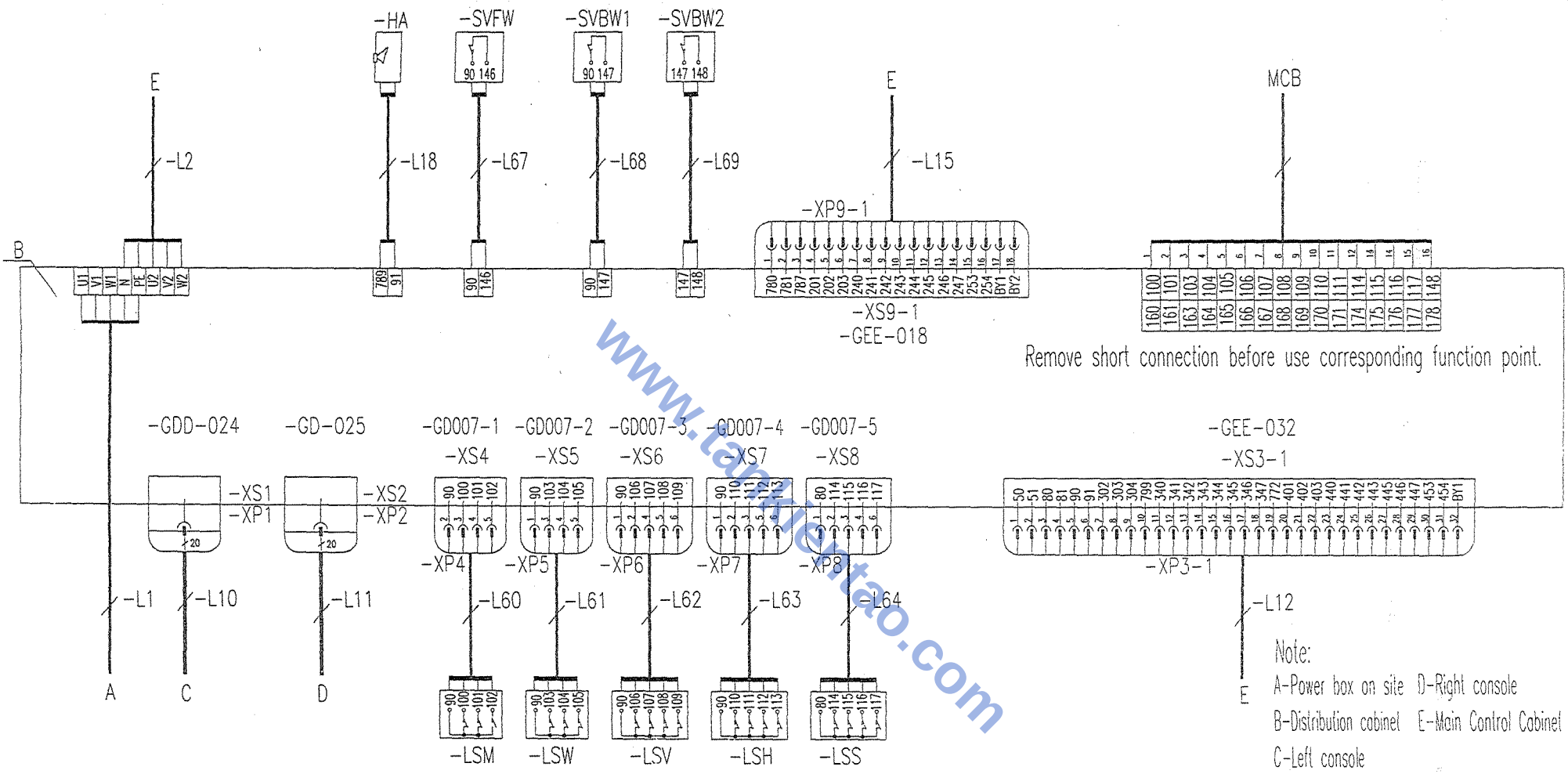
Main Control Cabinet		Horn	Trolleying out travel switch	Trolleying in travel switch	Main Control Cabinet	For MCB



Power supply on site	Left console	Right console	Moment limiter	Weight limiter	Trolleying limiter	Hoisting limiter	Slewing limiter	Trolleying slewing cabinet

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

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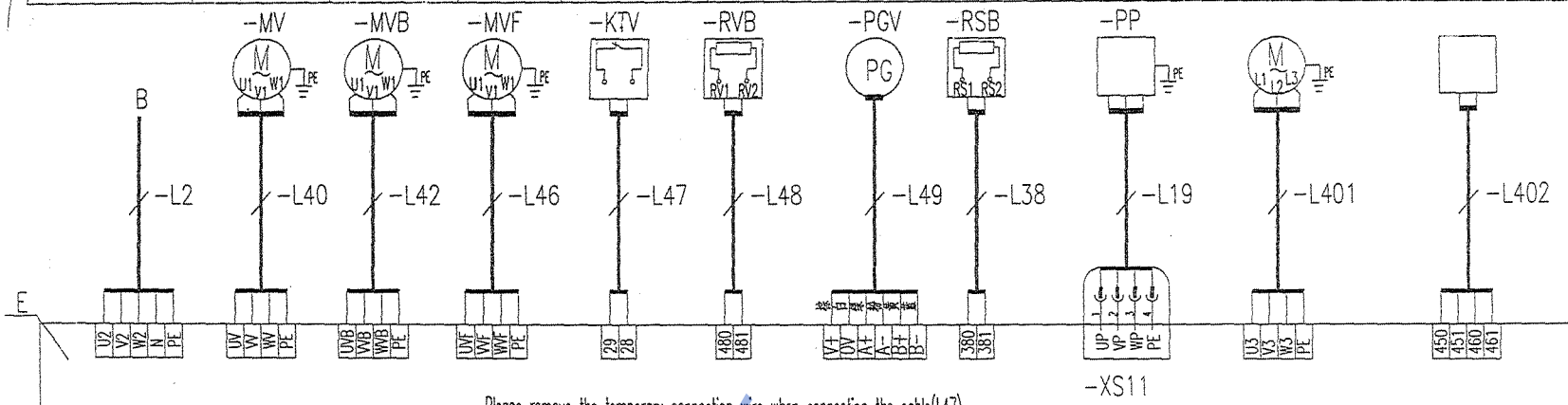
Cab Distribution Cabinet

Electrical connection schematic

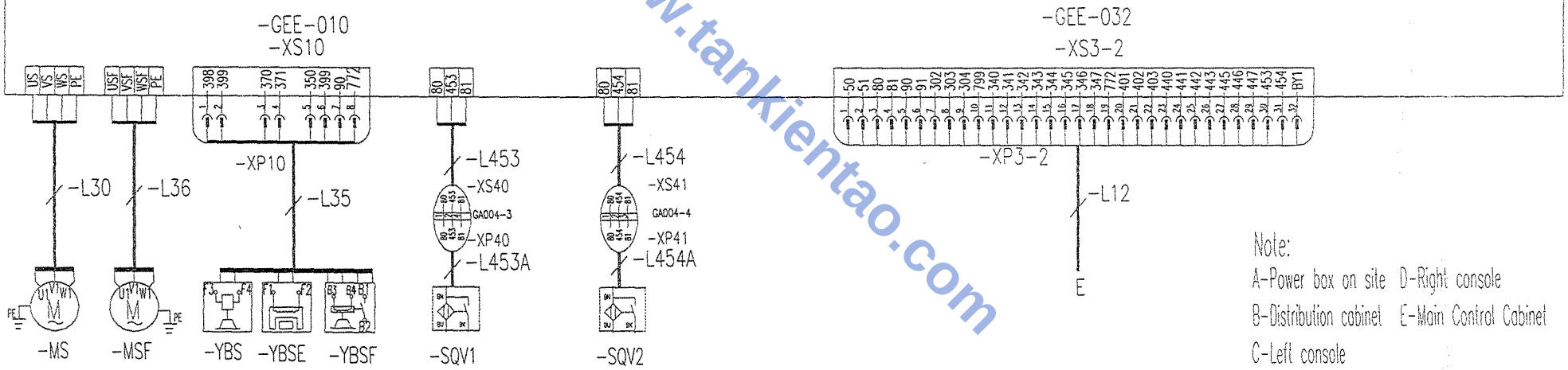
Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 12

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

Hoisting cabinet	Trolleying motor	Trolleying brake	Trolleying fan	Trolleying thermoswitch	Trolleying brake resistance	Trolleying encoder	Slewing brake resistance	Hydraulic pump station	Trolleying hydraulic clamp pump station motor	Trolleying hydraulic clamp control cabinet



Please remove the temporary connection wire when connecting the cable(L47).



Note:
A-Power box on site D-Right console
B-Distribution cabinet E-Main Control Cabinet
C-Left console

Slewing motor	Slewing fan	Slewing brake	Eddy brake	Slewing weathercock	Trolleying speed detection	Trolleying proximity switch	Cab distribution cabinet

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747

DL006BBB0A02203

Main Control Cabinet 1

Electrical connection schematic

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 13

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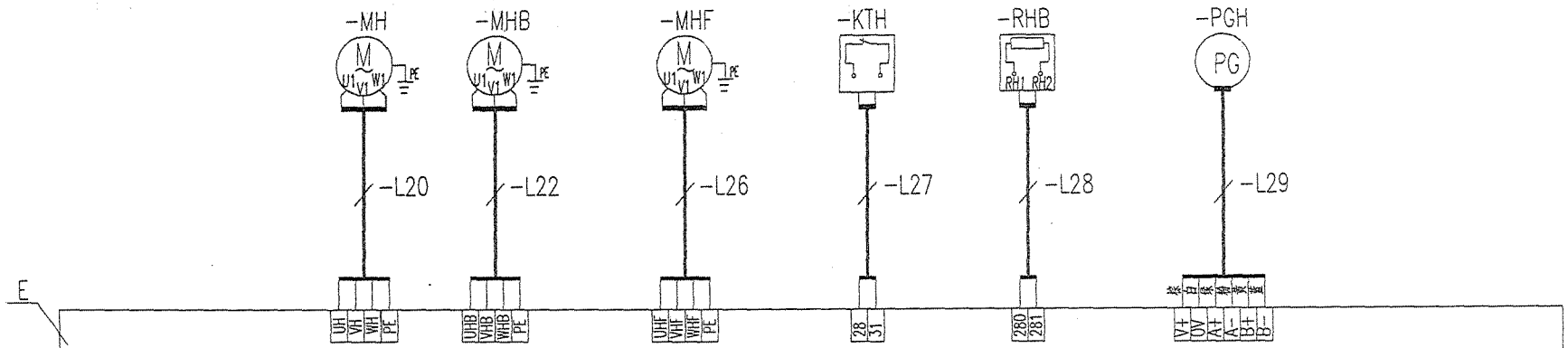
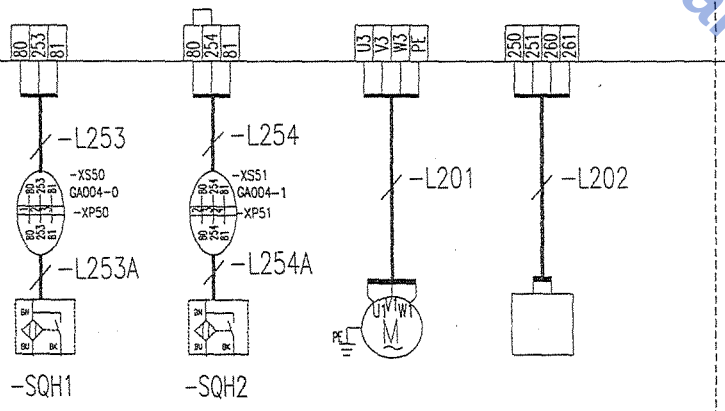
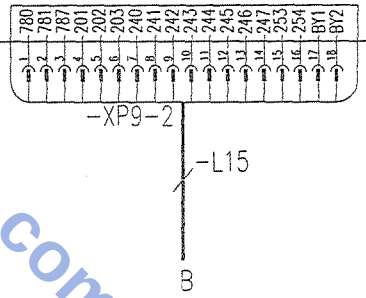


Please remove the temporary connection wire when connecting the cable(L27).

Spare

If there is no hydraulic clamp,short connection is needed.





Note:
A-Power box on site D-Right console
B-Distribution cabinet E-Main Control Cabinet
C-Left console

Hoisting speed detection	Hoisting proximity switch	Hydraulic clamp control cabinet	Distribution cabinet

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747	DL006BBB0A02204
Main Control Cabinet 2	Pattern Mark: S; Weight: ; Ratio: 1:1
Electrical connection schematic	Edition: ; 16 Page; Page 14

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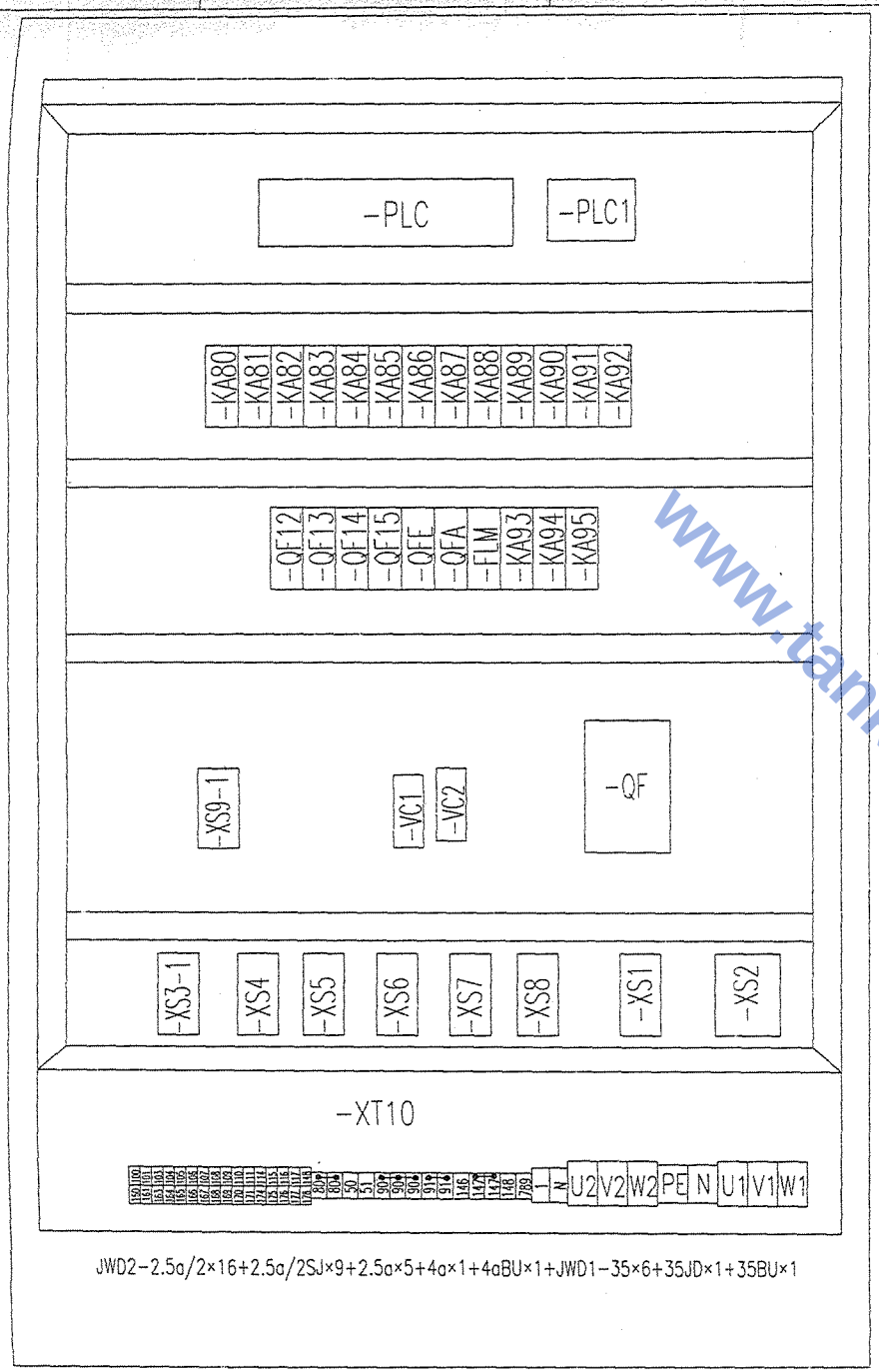

JWD2-2.5a/2×16+2.5a/2SJ×9+2.5a×5+4a×1+4aBU×1+JWD1-35×6+35JD×1+35BU×1

Mark	Point	Document Amend	Signature	Y	M	D
Design			Standard			
Collate						
Check			Confirm			
Construction			Date			

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Cab Distribution Cabinet

Element Layout

DL006BBB0A02301

Pattern Mark			Weight	Ratio
S				1:1
Edition			16 Page	Page 15

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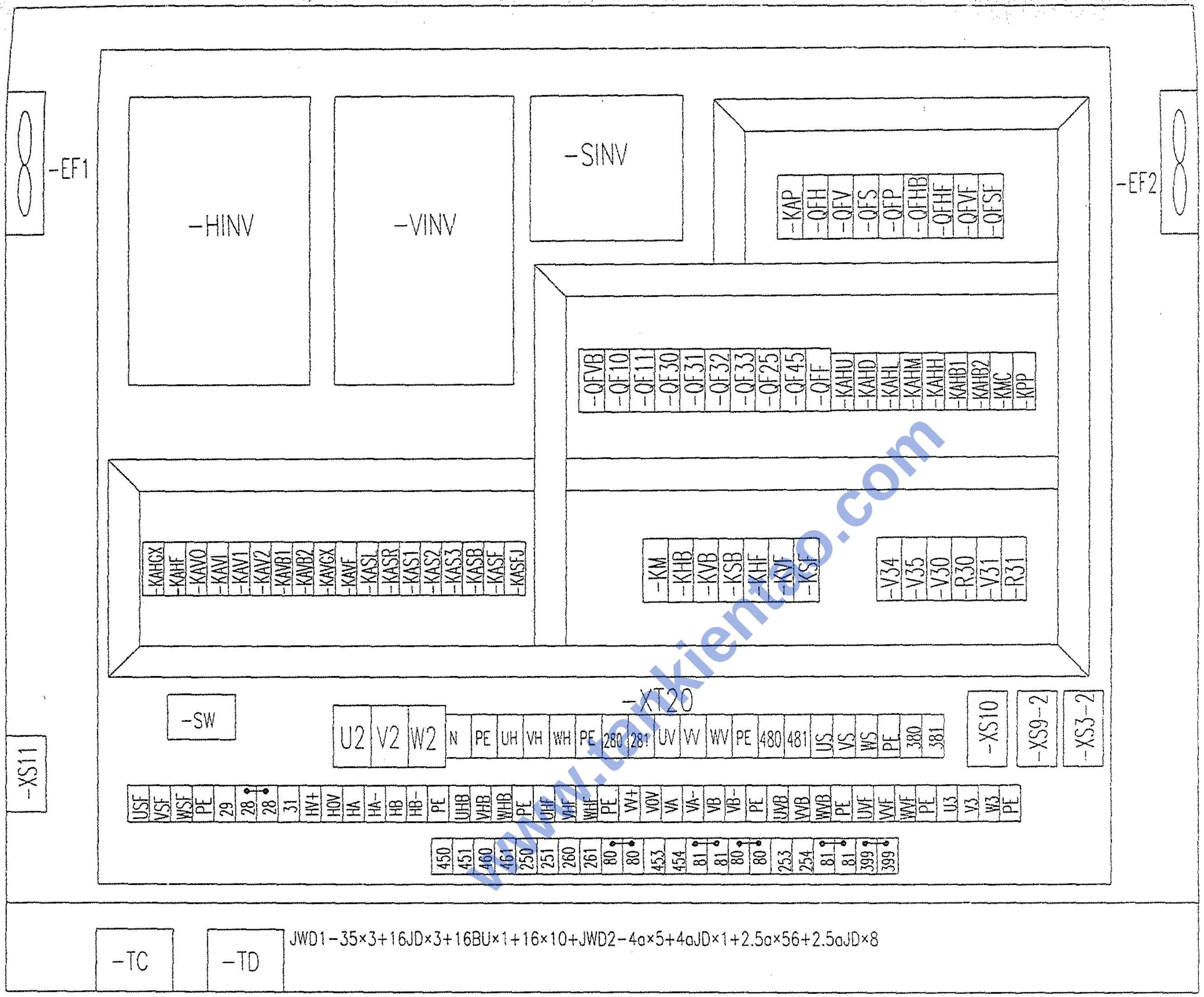

Mark	Point	Document Amend	Signature	Y M D	Main Control Cabinet	Pattern Mark: S · Weight · Ratio 1:1
Design		Standard				
Collate						Edition · 16 Page · Page 16
Check		Confirm			Element Layout	XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD
Construction		Date				

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DL006BBB0A02302

Name	Up	Down	Multi speed1	Multi speed2	Multi speed3	Hoisting brake	Hoisting clamp
Output point	Y20	Y21	Y22	Y23	Y24	Y25	Y26
Up: shift-1	ON		ON			ON	ON
Up: shift-2	ON			ON		ON	ON
Up: shift-3	ON		ON	ON		ON	ON
Up: shift-4	ON				ON	ON	ON
Up: shift-5	ON		ON		ON	ON	ON
Down: shift-1		ON	ON			ON	ON
Down: shift-2		ON		ON		ON	ON
Down: shift-3		ON	ON	ON		ON	ON
Down: shift-4		ON			ON	ON	ON
Down: shift-5		ON	ON		ON	ON	ON

Mark	Point	Document	Amend	Signature	Y	M	D
Design				Standard			
Collate							
Check				Confirm			
Construction				Date			

803745747			DL006BBB0A02401
Hoisting Part	Pattern Mark	Weight	Ratio
	S		1:1
	Edition	3 Page	Page 1
Motion Control Logic Diagram	XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD		

Item	Slewing left	Slewing right	Multi speed1	Multi speed2	Multi speed3	Slewing brake	Slewing Weathercock
Output point	Y10	Y11	Y12	Y13	Y14	Y15	Y16
Left: shift-1	ON		ON			ON	
Left: shift-2	ON			ON		ON	
Left: shift-3	ON		ON	ON		ON	
Left: shift-4	ON				ON	ON	
Right: shift-1		ON	ON			ON	
Right: shift-2		ON		ON		ON	
Right: shift-3		ON	ON	ON		ON	
Right: shift-4		ON			ON	ON	

Mark	Point	Document Amend	Signature	Y M D
Design			Standard	
Collate				
Check			Confirm	
Construction			Date	

803745747

Slewing Part

Motion Control Logic Diagram

DL006BBB0A02402

Pattern Mark			Weight	Ratio
S				1:1
Edition			3 Page	Page 2

XCMG XUZHOU CONSTRUCTION MACHINERY CO., LTD

Item	Trolleying out	Trolleying in	Multi speed1	Multi speed2	Trolleying brake	Trolleying clamp
Output point	Y0	Y1	Y2	Y3	Y5	Y6
Out: shift-1	ON		ON		ON	ON
Out: shift-2	ON			ON	ON	ON
Out: shift-3	ON		ON	ON	ON	ON
In: shift-1		ON	ON		ON	ON
In: shift-2		ON		ON	ON	ON
In: shift-3		ON	ON	ON	ON	ON

Mark	Point	Document Amend	Signature	Y M D
Design		Standard		
Collate				
Check		Confirm		
Construction		Date		

803745747

DL006BBB0A02403

Trolleying Part

Pattern Mark			Weight	Ratio
S				1:1
Edition			3 Page	Page 3

Motion Control Logic Diagram

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