To Users:

Thanks for choose and buy DAHAN tower crane!

Please read the manual carefully before operation.

Please pay attention to sentences with “Notice” in the manual.

DAHAN is dedicated to improvement of tower crane products, and there will be no inform for parts structure or parameters changes. Please contact us for any questions.

ID: ___________________

Release date: _______________
General Introduction

TC6015 tower crane is the newest tower crane designed according to the standard of JG/T5037-93 《TOWER CRANE CLASSIFICATION》.

TC6015 tower crane is upper-swing hydraulic climbing tower crane with horizontal jib and trolley radius. Its advantages are as follows:

1. Performance parameters and technical index occupies leading position among domestic products of the same grade. The max. working radius is 60m and the max. hoisting height is 181m.

2. The outline of the complete machine is international fashion, very beautiful and loved deeply by the foreign and domestic users.

3. It has many working modes with largest application range. This machine has the foundation to be fixed, the chassis to be fixed, the outer wall to be attached and walks and so on working methods, is applicable for each kind of different construction object. The free standing hoisting height is 50m, the attached type is in the free standing foundation, increases the tower mast sections and attaching device to realize, the hoisting height can reach 181m, the max. hoisting height for special orders can reach 200m.

4. It has high working speed and better speed governing. Trolley mechanism and slewing mechanism adopt the most advanced international frequency control methods, which can make the working more steady and reliable.

5. Electric control system adopts electric components produced through introducing advanced foreign technology by professional producer. Its lifespan is 3 to 4 times longer than home-made components with less malfunctions, simple maintenance and reliable work.

6. This tower crane is equipped with all kinds of safety device, which are mechanical or mechanical-electrical intergrative products, which can be used for bad construction circumstances to assure the working reliable.

7. Adhere to absorb and adopt domestic and international mature and reliable advanced technology to improve technical levels of the complete machine. Mature and reliable advanced technologies are as follows:
1) Professional electric factory introduces the electric components produced by French TE company’s technology.

2) Introducing international advanced technology and home-made weight limiter, moment limiter, height limiter, radius limiter, swing limiter, slewing brake and trolley brake, etc, safety device.

3) Trolley breaking prevention device (slip prevention) and shaft breaking prevention device;

4) Wire arranging system of hosting mechanism;

5) Tightening system of traction rope;

6) Rigid double tie bar hung from large-span hoisting arm. Hoisting jib has good rigid, light selfweight, small section, small wind resistance, beautiful shape and the length has several changes, which can make it satisfy different constructions requirements.

7) The cabin is set outside separately with good view and large inside space, which can creat better working enviroment for operators.

8) Adopt advanced linkage platform to operate the movement of each mechanism, convenient to operate and simple to maintain.

9) Adopt slewing limiter, and it is convenient for the driver to walk across the medium of the tower crane up and down.

8. Design completely accords with or is better than the relevant national standard. Because the crane has above characters, it is applicable for high or higher civil construction, bridge and water convervancy projects, large-span workshops, and large chimneys and silos adopting slippery mold method under construction, etc, big building projects.

9. Tower crane technical performance

9.1 Tower crane characteristic table and diagram
§QTZ125 (TC6015) tower crane

1. 60m jib

<table>
<thead>
<tr>
<th>Radius (m)</th>
<th>2.8~14.6</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
<th>26</th>
<th>26.37</th>
<th>28</th>
<th>30</th>
<th>32</th>
<th>34</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load weight (t)</td>
<td>2 rate</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.64</td>
<td>4.25</td>
<td>3.92</td>
<td>3.60</td>
<td>3.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 rate</td>
<td>10.0</td>
<td>9.05</td>
<td>7.91</td>
<td>6.99</td>
<td>6.24</td>
<td>5.62</td>
<td>5.09</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radius (m)</td>
<td>38</td>
<td>40</td>
<td>42</td>
<td>44</td>
<td>46</td>
<td>48</td>
<td>50</td>
<td>52</td>
<td>54</td>
<td>56</td>
<td>58</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Load weight (t)</td>
<td>2/4 rate</td>
<td>3.09</td>
<td>2.87</td>
<td>2.68</td>
<td>2.50</td>
<td>2.34</td>
<td>2.19</td>
<td>2.05</td>
<td>1.92</td>
<td>1.81</td>
<td>1.70</td>
<td>1.59</td>
<td>1.50</td>
</tr>
</tbody>
</table>

2. 55m jib

<table>
<thead>
<tr>
<th>幅度 (m)</th>
<th>2.8~15.3</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
<th>26</th>
<th>27.7</th>
<th>28</th>
<th>30</th>
<th>32</th>
<th>34</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load weight (t)</td>
<td>2 rate</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.93</td>
<td>4.52</td>
<td>4.16</td>
<td>3.84</td>
<td>3.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 rate</td>
<td>10.0</td>
<td>9.56</td>
<td>8.37</td>
<td>7.41</td>
<td>6.62</td>
<td>6.00</td>
<td>5.41</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radius (m)</td>
<td>38</td>
<td>40</td>
<td>42</td>
<td>44</td>
<td>46</td>
<td>48</td>
<td>50</td>
<td>52</td>
<td>54</td>
<td>56</td>
<td>58</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Load weight (t)</td>
<td>2/4 rate</td>
<td>3.31</td>
<td>3.08</td>
<td>2.87</td>
<td>2.69</td>
<td>2.52</td>
<td>2.36</td>
<td>2.21</td>
<td>2.08</td>
<td>1.96</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Moment curve diagram

力矩曲线图 (60m) 力矩曲线图 (55m)
Figure's explanation: 力矩曲线图: Moment curve diagram

9.2 Technical performance parameter table of the complete machine (table 9-1)

<table>
<thead>
<tr>
<th>Working level of mechanism</th>
<th>Hoisting mechanism</th>
<th>Slewing mechanism</th>
<th>Trolley mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoisting working radius m</td>
<td>Min. 2.8</td>
<td>Max. 60</td>
<td></td>
</tr>
<tr>
<td>Max. working radius m</td>
<td>fixed</td>
<td>attached</td>
<td></td>
</tr>
<tr>
<td>Max. load capacity t</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hoisting mechanism</th>
<th>Type</th>
<th>Rate</th>
<th>Hoisting speed m/min</th>
<th>Power kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>α=2</td>
<td>101</td>
<td>37/37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>α=4</td>
<td>50.4</td>
<td>50.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.5</td>
<td>25.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trolley mechanism</th>
<th>Speed m/min</th>
<th>Power kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55/27.5/9.6</td>
<td>5.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slewing mechanism</th>
<th>Speed r/min</th>
<th>Power kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.62</td>
<td>3.7×2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Climbing mechanism</th>
<th>Speed m/min</th>
<th>Power kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.60</td>
<td>7.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working pressure Mpa</th>
<th>25</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Counter weight</th>
<th>Jib length M</th>
<th>Weight t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55</td>
<td>16.8</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>18.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total power kW</th>
<th>49.4 (not include hydraulic system)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Working temperature ℃</th>
<th>-20~+40</th>
</tr>
</thead>
</table>

9.3 Technical performance parameter table of mechanism (table 9-2)

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
<th>JR100S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoisting</td>
<td>Max. traction</td>
<td>N</td>
</tr>
</tbody>
</table>
### QTZ125 (TC6015) tower crane

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Wire Rope</th>
<th>Specification</th>
<th>Max. line speed</th>
<th>Slewing speed</th>
<th>Cope capacity</th>
<th>Max. line speed</th>
<th>Slewing speed</th>
<th>Cope capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll</td>
<td></td>
<td></td>
<td>35×7-16-1770 or 6T29Fi+IWR-16-1670</td>
<td>202</td>
<td>118</td>
<td>360 (winding layers 4 layers)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor</th>
<th>Type</th>
<th>YZRSW250M-4/8</th>
<th>Power</th>
<th>kW</th>
<th>37/37</th>
<th>Slewing speed</th>
<th>r/min</th>
<th>1425/725</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reducer type</th>
<th>Type</th>
<th>ZQ60-16-IV-CA</th>
<th>Brake moment</th>
<th>N.m</th>
<th>1250</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Braker</th>
<th>Type</th>
<th>YWZ3 -315/90-10</th>
<th>Brake moment</th>
<th>N.m</th>
<th>1250</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Trolley mechanism</th>
<th>Type</th>
<th>Unit</th>
<th>Max. traction</th>
<th>N</th>
<th>9000</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Wire Rope</th>
<th>Specification</th>
<th>Trolley speed</th>
<th>m/min</th>
<th>55/27.5/9.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55m jib</td>
<td>m</td>
<td>Wire rope I</td>
<td>106</td>
<td>Wire rope I</td>
</tr>
<tr>
<td>60m jib</td>
<td>m</td>
<td>Wire rope II</td>
<td>116</td>
<td>Wire rope II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Roller slewing speed</th>
<th>r/min</th>
<th>0~ 33.5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Motor</th>
<th>Type</th>
<th>YZTDE160M-4/8/20</th>
<th>Power</th>
<th>kW</th>
<th>5.0</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reducer ratio</th>
<th>43</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Brake moment</th>
<th>N. m</th>
<th>75</th>
</tr>
</thead>
</table>
### QTZ125 (TC6015) tower crane

<table>
<thead>
<tr>
<th>Slewing mechanism</th>
<th>Motor</th>
<th>Type</th>
<th>YZR132M2-6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power</td>
<td>kW</td>
<td>3.7×2</td>
</tr>
<tr>
<td></td>
<td>Slewing speed</td>
<td>r/min</td>
<td>908</td>
</tr>
<tr>
<td>Reducer</td>
<td>Transmittion ratio</td>
<td></td>
<td>157</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Climbing mechanism</th>
<th>Motor</th>
<th>Power</th>
<th>kW</th>
<th>7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slewing speed</td>
<td>r/min</td>
<td>1440</td>
<td></td>
</tr>
<tr>
<td>Hydraulic pump station</td>
<td>flux</td>
<td>l/min</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Working pressure</td>
<td>MPA</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbing ram</td>
<td>Cylinder diameter</td>
<td>mm</td>
<td>160/110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max.climbing force</td>
<td>t</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climbing speed</td>
<td>m/min</td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>
9.4 Outline dimensions of the complete machine

9.4.1 Outline dimensions of the freestanding complete machine (figure 1)

Figure's explanation:
至基础平面 50000: Distance from the foundation 50000
加强节: strength sections 标准节: Mast sections

Figure 1 TC6015 tower crane leg fixed freestanding outline dimensions
9.4.2 Outline dimensions of the attaching complete machine

Figure 2 TC6015 tower crane leg fixed attaching outline dimensions

Figure's explanation:
至基础平面 181300: Distance from the foundation 181300
附着装置: Attaching device
Article 1  Installation of tower crane

Chapter 1  Install tower crane

1.1 Introduction
Clients should read the instruction manual to install the tower crane correctly and quickly. Truck crane of 25t is needed when crane is installed before achieving the position which may rise and add mast sections.

1.2 Attentions of assembly
a. Installation of crane can be carried out when the wind is below 8m/s.
b. Abide by the process of setting up crane.
c. Pay attention to the choice of hanging points; choose handling devices which are of proper length and liability according to hoisted parts.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of parts</th>
<th>Weight kg</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Counterjib</td>
<td>2206</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hoisting mechanism</td>
<td>2800</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Counterjib tie bar</td>
<td>625</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tower head</td>
<td>2140</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Moment limiter</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cabin</td>
<td>560</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Trolley mechanism</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hoisting Jib</td>
<td>6425</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Jib tie bar</td>
<td>2118</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hook block</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Load trolley</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Electric system</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Slewing mast</td>
<td>1285</td>
<td>Include weight limiter</td>
</tr>
<tr>
<td>14</td>
<td>Slewing mechanism</td>
<td>600</td>
<td>Total weight of two sets</td>
</tr>
<tr>
<td>15</td>
<td>Upper bracket</td>
<td>1992</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Lower bracket</td>
<td>1600</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Slewing bearing X=+0.5</td>
<td>500</td>
<td>Xuzhou slewing bearing factory</td>
</tr>
<tr>
<td>18</td>
<td>Climbing frame</td>
<td>3143</td>
<td>Not include pump station, hydraulic ram</td>
</tr>
<tr>
<td>19</td>
<td>Climbing mechanism</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Tower mast strengthen section</td>
<td>1300/section</td>
<td>7 sections</td>
</tr>
<tr>
<td></td>
<td>Mast section</td>
<td>1200/section</td>
<td>11 sections</td>
</tr>
<tr>
<td>21</td>
<td>Attaching frame</td>
<td>1645/unit</td>
<td></td>
</tr>
</tbody>
</table>
d. All dismountable pivots of every crane component, bolts for tower and nuts are special parts. Clients can’t replace them at will.

e. Prepare all protective devices before installation, such as ladder, platform and guardrail and carry out security examination when necessary.

f. According to the jib, ensure the quantity of counterweight correctly (See relevant paraFigure), before installing the lifting jib, a counterweight of 2.395t and 1.95t should be first installed in the counterjib and pay attention to prevent exceeding this quantity.

g. After installing the lifting jib, prevent suspended load before the counterjib has not installed the stipulated counterweight.

h. Installation of mast sections and strengthen sections should not be exchanged the position willfully, otherwise unable to carry out climbing.

i. Normal mast sections can be installed after 10 units tower strengthen sections installed.

j. Installation location of crane worksite must ensure the distance of above 1.5m between max. Slewing sections of tower and the surrounding buildings. Safety distance between any spot of the tower crane and overhead electric wires should conform to the stipulations of the attached list 2.

k. Prepare for the commonly used tools such as lifting devices, crossties, ropes, bights etc.

l. Reference dimension of crane installation site (Fig.1.2-1)

m. Before climbing, the trolley should be driven to equilibrium position, the lifting jib turns to the guide girder, straight ahead.

n. In the process of climbing, prevent rotating the lifting jib and making the hook up and down.
### 附表二 起重机距离输电线的安全距离

<table>
<thead>
<tr>
<th>电压/kV</th>
<th>安全距离 m</th>
<th>&lt;1</th>
<th>1 ~ 15</th>
<th>20 ~ 40</th>
<th>60 ~ 110</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>沿垂直方向</td>
<td></td>
<td>1.5</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>沿水平方向</td>
<td></td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>4.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

### 图1.2-1 安装场地

Figure's explanation:

附表二 起重机距离输电线的安全距离:

Safety distance between tower crane and power line

电压：Voltage
安全距离：Safety distance
沿垂直方向：Along vertical direction
沿水平方向：Along horizontal direction
标准节踏步：Step of mast sections
附着架基座：Pedestal of attaching frame
建筑物长度方向：Length direction of building
图 1.2-1 安装场地：Figure 1.2-1 Install sit

### 1.3 General arrangement of the tower crane

1.3.1 Freestanding assemble relation with main components (Fig.1.3-1)

Rope of double or quadruple ratio can be used for load-lifting when freestanding load-lifting height is 50m. Tower is a whole structure which is made up of the main limb by quadrat tube. The bottom of tower connects with base pad by Underbed. The top of tower connects with the Slewling bearing and
upper bracket by lower bracket. The cabin is set side above upper bracket. The front surface (of Slewing tower) connects with lifting-jib and the back connects with counter-jib. Hoisting mechanism is on the back of counter-jib. Slewing mechanism lies on one side of the upper bracket symmetrically. The derricking trolley is dragged by derricking mechanism with back and forth movement along jib. The lifting-jib and counter-jib connect with tower head by rigid pull rods.

Climbing frame lies on the outer of tower, the top of which is connected to the lower bracket. Climbing mechanism of the tower crane can jack the upper structure of the tower mast, introduce mast sections and hoist the height according to construction requirements.

Figure’s explanation:


1.3.1 Assemble relation of main components
1.3.2 The max. lifting height of the freestanding crane is 50m. When the lifting height exceeds 50m, attaching devices are arranged on the height of tower to enhance its stability and rigid. The max. lifting height of attaching crane is up to 181m. When the working height is no more than 90m, it can adopt rope of double or quadruple ratio to hoist. Independent and attaching crane have the same structure arrangement. The tower mast add mast sections only so as to increase lifting height. (Fig. 2) When the working height is up to 181m, seven attaching devices are needed. Many sets of attaching devices are arranged on the height of tower to enhance its stability and rigid. The distance dimension among attaching devices must be strictly consistent with what is shown in Fig. 2. Sections hanging from the tower mast above attaching frame must be satisfied with the stipulations of every attaching frame. The distance between the centre line of tower and building needs to be no more than 5m. If the actual distance is not consistent with this, please contact with our company.

After attached the first time: suspended sections of tower mast above attaching frame ≤ 27.5m, max. working height 69.3m, 10 reinforcing sections from bottom to top, 14 mast sections.

After attached the second time: suspended sections of tower mast above attaching device ≤ 27.1m, max. working height 88.9m, 10 reinforcing sections from bottom to top, 21 mast sections.

After attached the third time: suspended sections of tower mast above attaching frame ≤ 26.7m, max. working height 108.5m, 10 reinforcing sections from bottom to top, 28 mast sections.

After attached the fourth time: suspended sections of tower mast above attaching frame ≤ 26.3m, max. working height 128.1m, 10 reinforcing sections from bottom to top, 35 mast sections.

After attached the fifth time: suspended sections of tower mast above attaching frame ≤ 25.9m, max. working height 147.7m, 10 reinforcing sections from bottom to top, 42 mast sections.

After attached the sixth time: suspended sections of tower mast above attaching frame ≤ 25.5m, max. working height 167.3m, 10 reinforcing sections from bottom to top, 49 mast sections.

After attached the seventh time: suspended sections of tower mast above attaching frame ≤ 21.5m, max. working height 181.3m, 10 reinforcing sections from bottom to top, 58 mast sections.

1.4 Fixed foundation and counter weight
1.4.1 Leg fixed foundation load
(shown in Fig.1.4.1-1, Table 1.4-1)

<table>
<thead>
<tr>
<th>Work condition</th>
<th>$F_h$ (KN)</th>
<th>$F_v$ (KN)</th>
<th>Bending moment (KN.m)</th>
<th>$M_n$ Torque (KN.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work condition while working</td>
<td>27.6</td>
<td>709</td>
<td>2426</td>
<td>300</td>
</tr>
<tr>
<td>Work condition while not working</td>
<td>99.4</td>
<td>592.5</td>
<td>2661.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Remark: In Table 1.4-1, $F_h$, $F_v$ and bending moment $M_n$ is work condition load of max. bending moment of foundation, torque $M_n$ is work condition load of max. torque of foundation.

1.4.2 Leg fixed base foundation (shown in Fig.1.4.2-la, 1.4.2-lb)

Base foundation of the fixed tower crane is the necessary condition to guarantee safety use of the tower crane. It requests this foundation according to different soil condition to strictly conform to the regulations. This crane adopts holistic concrete foundation. The essential requirements for the foundation are as follows:

1) Soil of foundation should be massive. According to soil condition, it can adopt different foundation. (Fig.1.4.2-la,1.4.2-lb)

2) Intensity grade of concrete shouldn’t be less than C35. The resistance force of concrete foundation shouldn’t be less than the stipulations of Fig.1.4.2-la,1.4.2-lb.

3) Deepness of concrete foundation shouldn’t be more than 1350mm.

4) Upper surface of 4 fixed leg of concrete foundation should be flat. The flatness error should be less than 1/500.

1.4.3 Installation of fixed leg

a. Installation of fixed leg is very important, must guarantee that (Please refer to the following procedure for construction)

1) Assemble 4 fixed leg together with a reinforcing section.

2) According to construction convenience, when reinforcing steel bar binds up to a certain extent, put assembled fixed leg and reinforcing section into reinforcing mat.

3) Quantities of reinforcing steel bar around fixed leg shouldn’t be reduced and cut off.

4) Allow main reinforcement to avoid the leg through which when it has difficulty.

5) Hoist the whole of assembled fixed leg and reinforcing sections and the
concrete is poured. Plumb line is hung in the center line of two directions of reinforcing sections. Guarantee that verticality between the center line of reinforcing sections and level surface is no more than 1.5/1000.

6) Concrete filled rate around the fixed leg must be over 95%.

b. The foundation figures are at the last page

Figure 1.4.3-1 explanation:
固定支腿：Fixed support leg

Attention: 1. 固定支腿预埋位置必须准确 Embedded place of fixed support leg should be right
2. 固定支腿是塔机最重要的受力部件之一，应采用本公司提供的支腿，否则后果自负 Fixed support leg was the most important strength parts on the tower crane, it should be adopt our company’s support leg, otherwise at your own risk.

图 1.4.3-1 固定支腿固定方式示意图：Figure1.4.3-1 Fixed support leg fixed type diagram

Figure 1.4.3-2 explanation
图 1.4.3-2 固定支腿：Figure1.4.3-2 Fixed support leg

Figure1.4.3-3 explanation
沿垂线：Along droop line 塔身加强节：Strength sections of crane
铅锤：plumb 固定支腿：Fixed support leg

图 1.4.3-3 浇注固定支腿和塔身加强节（基节）Figure 1.4.3-3 Pouring fixed support leg and crane strength sections (basic sections)
注意：
1. 固定支腿预埋位置必须准确；
2. 固定支腿是塔机最重要的受力部件之一，
    应采用本公司提供的支腿，否则后果自负。

图1.4.3-1固定支腿固定方式示意图
§TC6015 tower crane
图 1.4.3-3 贯注固定支腿和塔身加强节(基节)
1.4.4 Counter weight

1) Counter weight has two specifications in common and all adopt reinforced concrete casting into form. The specific outline dimensions are shown in figure. (Fig. 1.4.4-1 and fig. 1.4.4-2)

![Counter weight diagram](image)

**Figure 1.4.4-1 explanation**

图 1.4.4-1 平衡重示意图: Figure 1.4.4-1 Counter weight diagram
2) The essential requirements for counter weight are as follows:
   a) Weigh after using concrete to cast into form, allowable difference of weight 2%, concrete mark not less than $c_{35}$.
   b) Configure of counter weight varies with the length of jib. Shown in value of table (1.4-2)

<table>
<thead>
<tr>
<th></th>
<th>60m Jib</th>
<th>55m Jib</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter</td>
<td>$7 \times 2.395t$</td>
<td>$7 \times 2.395t$</td>
</tr>
<tr>
<td>weight</td>
<td>$1 \times 1.950t$</td>
<td>$0$</td>
</tr>
<tr>
<td>Total</td>
<td>$18.715t$</td>
<td>$16.765t$</td>
</tr>
</tbody>
</table>

1.5 Crane Installation

Installation process of crane is carried out according to Table 1.5-1.
1.5.1 Installation of mast section

1.5.1.1 Structure introduction

The freestanding tower mast is made up of two kinds of standard sections: The bottom of leg fixed freestanding tower mast is reinforcing sections (shown in Fig.1.5.5-1). Every tower has ten sections in common; The top of tower mast is normal sections. Leg fixed tower crane has seven normal sections. Attaching crane to be added is also normal standard sections (shown in Fig.1.5.1-2). The outline difference in two standard sections is that each end of reinforcing section has 12 connecting hole of bolt and each end of normal section has 8 connecting hole of bolt.

Ladder and platform are set inside standard section for climbing up and down.
1.5.1.2 Installation of two reinforcing sections

a. Put hanger on the reinforcing sections, and hoist, then install two reinforcing sections on the reinforcing sections of buried fixed foundation, each of which is connected perfectly with 12 degree bolts (10.9 grade) with high strength. (The side with pedal of reinforcing section should be prepared for installing the lower direction of counterjib). This time there are 3 reinforcing sections in the foundation.
b. Pretightening moment of high strengthen bolts of M36 is 538 KN. Each high strengthen bolt should be assembled a washer and two nuts and screwed down. Between two nuts locknut and tightening torque should be no less than 538 KN.

c. Use transit or hanging method to check its verticality. The vertical error of four sides of main chord shouldn’t be more than 1.5/1000.

1.5.2 Installation of climbing frame

1.5.2.1 Structure introduction (1.5.2-1)

Climbing frame mainly includes frame structure, platform, ladder, hydraulic climbing system and standard sections pulling-in device, etc. The climbing operation mainly depends on this climbing frame.

Climbing oil cylinder is installed on the beam which lies on the back of climbing frame. Hydraulic pump station lies on the platform at the side of hydraulic cylinder. There are 16 rolling wheels inside the climbing frame braced at the outer of tower main robs which serve as leading and supporting components.
Platform should be installed in the middle of climbing frame and upper position for climbing assembly and safety requirements, also in leading in beam. When hoisting, the operator stands on the platform, operates hydraulic...
system, and complete work of climbing, leading-in standard sections and fixed tower bolts.

1.5.2.2 Installation of climbing frame

Figure 1.5.2-2 explanation
踏步侧面：Step profile 项升油缸：Jacking fuel tank
图 1.5.2-2 吊装爬升架：图 1.5.2-2 Install climbing frame

a. After climbing frame assembled according to requirements of fig. shown in Fig.1.5.2, put hanger on climbing frame, tighten rope to hoist. (Attention: Installation location of hydraulic ram must be at the side with pedal of tower.

b. Climbing frame lies on the outer of 3 reinforcing sections.

c. Put the claw of climbing frame in the pedal of upper section of the second reinforcing section, and then adjust the gap (2-3mm) between 16
climbing guide-wheels and mast sections.

d. Assemble the hydraulic ram, then hoist hydraulic pump station to one corner of platform, connect the oil pipe, check the movement of hydraulic system, and ensure the rotation for the fan blades of oil pump motor is dextrorotation.

1.5.3 Installation of slewing bearing assembly
1.5.3.1 Structure introduction

Slewing bearing assembly is composed of lower bracket, swing bearing, upper bracket, slewing mechanism. (shown in Fig.1.5.3-1.)

The lower bracket has the structure of whole-box, the under part of lower bracket is connected with tower standard section and climbing frame separately. The top surface is tightly connected with the under surface of housing washer of swing bearing by high strength bolts.

The upper bracket has the structure of plate-shell. Flange with swing mechanism is welded on its left and right sides. Working platform is arranged on four sides of the upper bracket. Cab is installed on the front of right working platform. At the back there is bracket for swing limiter, in the front there is a slab for electric siren. The top surface of upper bracket is connected with swing tower by 8 high strength bolts of 10.9 grade.

Figure 1.5.3-1 Slewing assembly

回转支承：Slewing bearing 下支座：Bottom bracket
总重：Total weight

图 1.5.3-1 回转总成：Figure 1.5.3-1 Slewing assembly
1.5.3.2 Assembly of swing mechanism

Lower bracket, swing bearing and upper bracket are connected into integration with 80 high strength bolts M24 of 10.9 grade. The pre-tightening torque of each bolt is 900 N·m, the tightening torque of locknut between double nuts should be slightly greater than or equal to 900 N·m.

a. Shown in Fig.1.5.3-2, put hanger under the earcaps of four support in upper bracket.

Figure 1.5.3-2 Hook slewing assembly

b. 8 connecting pins of lower bracket face to 8 connecting pins of 4 main chord of tower sections slowly. Hoist swing bearing assembly on tower top. Remember that the diagonal bars of lower bracket should be in the same direction with diagonal bars which installs ladder of tower section. When lower bracket is connected with climbing frame, please face to the sign of 4 corners.

c. Joint lower bracket and standard section with 8 M36 high strength bolts of 10.9 grade. (each bolt is fixed by double-nuts to prevent it from loosing, the pre-tightening torque of bolt is 538KN, the tightening torque of locknut between double-nuts is slightly greater than or equal to 538KN.)

d. Operate climbing system, stretch hydraulic ram to the pedal of the second standard section, and hoist climbing frame on ear-panel of lower bracket, and then joint climbing frame and lower bracket with 16 M24 bolts (each bolt is fixed by double-nuts to prevent it from loosing, the pre-tightening torque of bolt is 900 N·m)

1.5.4 Installation of swing tower

1.5.4.1 Introduction of swing tower assembly

Swing tower assembly is made up of swing tower and lifting limiter (shown in Fig.1.5.4-1).
Figure 1.5.4-1 explanation:

与平衡臂连接（A向）：Contact with balanced jib (A direction)

与起重臂连接（B向）：Contact with balanced jib (B direction)

重量：Weight

图1.5.4-1 回转塔身总成：Figure 1.5.4-1 Slewing sections assembly

Swing tower has the structure of whole frame. There is double-ear plate on its top surface connecting with tower head, lifting jib and counter-jib by 4 pivots. Load-lifting limiter is installed on the beam of swing tower in order to limit max. load capacity.

1.5.4.2 Installation of swing tower

Shown in Fig. 1.5.4-2, put hanger on 4 main chord of swing tower section and tighten the sling.
a. Hoist swing tower section (pay attention to the direction of ear-plate for assembling counter-jib and lifting-jib), make the ear-plate close to load-lifting limiter uniform in the direction of lifting-jib of upper bracket.

b. Joint swing tower and upper bracket firmly with 8 M36 high strength bolts of 10.9 grade and 16 M36 high strength nuts (double nuts to prevent from loosing) of 10 grade. The pre-tightening torque of bolt is 538KN, the tightening torque of locknuts between double-nuts should be greater than or equal to 538KN.

1.5.5 Installation of tower head
1.5.5.1 Structure introduction (shown in Fig.1.5.5-1)
Tower head has the structure of rectangular pyramid. Pulling plate frame, pulling plate of lifting-jib and counter-jib are welded on its top, connecting with pull rods of lifting-jib and counter-jib by pivots. In order to install conveniently, working platform is arranged on the top of tower head connecting with tower head by pivots. There are a hoist rope-guiding pulley and a pulley for installation of lifting-jib pull rod onto top of tower head. Moment limiter and ladder with guard ring are arranged at the back of top tower and lower section of main chord. At the bottom of tower head, there are four ear panels, connecting with slewing mast by four pivots.

1.5.5.2 Installation of tower head

Before hoisting install the platform of tower head, guardrail, ladder and moment limiter. To install counter-jib conveniently, we can also install two pull rods of counter-jib on each two sides of tower head back.

a. Shown in Fig.1.5.5-2, hook tower head on the slewing section.

b. Hoist tower head to swing tower section and be careful that the vertical side of tower head should face to the orientation of lifting-jib.

c. Connect tower head to swing tower section with four pivots and install cotter pins.

1.5.6 Installation of counter-jib assembly
1.5.6.1 Structure introduction (Fig.1.5.6-1)
Counter-jib is the structure that is welded by channel steel and angle steel, which is divided into two sections and connected by pivots. Guardrail and aisle are arranged on counter-jib. Operating platform is set up at the end of counter-jib. One end of counter-jib is connected with swing tower by 2 pivots. The other end is connected with tower head by 2 combined rigid pull rods. There’re counter-weight, lifting mechanism, resistance box and electric control box are set up at the end of counter-jib. Lifting mechanism has its independent underbed itself and is fixed on counter-jib by 4 bolts. Weight of counter-weight varies with the length of lifting-jib. Shown in value of table 1.4-2.

Figure 1.5.6-1 explanation:
- **平衡重**: Balanced weight
- **起升机构**: Hoisting mechanism
- **电控柜**: Electric control box
- **总重**: Total weight: about 2206kg not include counter weight

1.5.6.2 Installation of counter-jib

Assemble two counter-jibs on the ground and install lifting mechanism, electrical control box, resistance box and pull rod of counter-jib and connect them firmly. Lifting mechanism connects with temporary power supply, put the upper section of slewing bearing to install counter-jib conveniently.
Fig.1.5.6-2 吊平衡臂: Hook counter jib 总重约 6600kg: Total weight 6600kg

a. Shown in Fig.1.5.6-2, hoist counter-jib (There are 4 lifting lug of installation on counter-jib.)

b. Connect counter-jib to swing tower with pivots.

c. Raise the counter jib little by little, up to a appropriate place. Connect with counter jib tie bar and tower head's counter jib tie bar by pin, dressed the pin and splay the open pin.

d. Put counter-jib down slowly, hoist in turn two piece of counter-weight of 1.95t and 2.395t, and install it at the front of counter-jib. (shown in Fig.1.5.6-5)
Figure 1.5.6-5 安装平衡臂拉杆：Install counter jib tie bar
Figure 1.5.6-5 explanation

特别注意：Attention

1. 安装销的挡块必须紧靠平衡重块：Baffle plate of installing pin must be next to counter weight.
2. 安装销必须超过平衡臂上安装平衡重的三角挡块。
Installing pin must be exceed the triangle baffle plate which install counter weight on the balanced jib.

放大: Amplify  三角挡块: triangle baffle plate
销轴挡板: Pin baffle plate  
平衡重: counter weight

图 1.5.6-5 吊一块平衡重: Figure 1.5.6-5 Hook a counter weight

1.5.7 Installation of cab
1.5.7.1 Structure introduction (shown in Fig.1.5.7-1)

Cab has the structure of thin plate, side-equipped in the front of right platform of upper bracket with a large area of glass windows. The front upper window can be opened with wide vision. The cab inside is decorated by polyken panel, beautiful and convenient, in which is set linkage platform.

1.5.7.2 Installation of cab
After the electrical equipments inside the cab are installed completely,
   a. Shown in Fig.1.5.7-2, hoist the cab.
   b. Hoist the cab to the front of the right platform of upper bracket, aim at the position of upper hole of ear-plate and then connect it with 3 pivots and install cotter pin. (After the cab and swing bearing assembly are installed completely as a whole, hoist them one-off.

1.5.8 Installation of lifting jib
Lifting jib assembly is made up of lifting jib, pull rods of lifting-jib, load trolley and trolley mechanism. Pulling rods of lifting jib are installed on the holder of pull rods of upper chord of lifting-jib.

1.5.8.1 Structure introduction (shown in Fig.1.5.8-1)
Upper chords and lower chords are rectangle tube welded by two angle irons. The whole jib frame has the section of triangle divided into 10 sections. Sections are connected by bolts for convenient disassembly and assembly. In order to improve lifting performance and reduce the weight of lifting-jib, lifting-jib adopts double hanging points, changing the section into space truss structure. Traction mechanism is set on the first section of lifting-jib. Load trolley moves in an orbit with lower chord of lifting-jib. Pulled by traction mechanism, it can move in lifting-jib back and forth. Hoisting basket is designed for trolley for convenient installation and maintenance.

The first section of the root lifting-jib is connected with swing tower by pivots. In order to guarantee the horizontal lifting-jib, two hoisting points are arranged separately on the second and the seventh section, by which pull rods of lifting-jib are connected with tower head.

While assemble lifting-jib, strictly assemble in accordance with the sequence number of each section of jib, not allowed to misplace or assemble at will. According to construction requirements may assemble lifting-jib into jib of 55m.
1.5.8.2 Installation of lifting-jib

a. Assemble lifting-jib on the level crossties (or bracket, about height of 0.6m) near tower crane. (Fig. 1.5.8-5a). Attention: No matter that assemble how long the lifting-jib is, put the load trolley on the guide rail of lower chord of lifting-jib.

b. Tighten hoisting basket for maintenance firmly with load trolley and make load trolley close to the min. radius of lifting-jib root.

c. Assemble traction mechanism of lifting-jib root. Two steel ropes come from the winding drum. One is fixed at the back of load trolley by guide wheel of jib root. The other is fixed in the front of load trolley by the middle of lifting-jib and guide wheel of jib head, shown in Fig. 1.5.8-3. There are 3 rope clips at the back of load trolley. The pressure plate of rope clips should be in the side of wire rope force. The distance between rope clips is 6~9 times as diameter of wire ropes. Tension device is set on the front of wire ropes and trolley. If trolley ropes are loose, adjust tension device that can tighten steel ropes. There is another tension device of trolley ropes at the lifting-jib root. During use when trolley ropes are loose, it can use this device to...
tightly steel ropes.

Figure 1.5.8-3 explanation:
- **Guiding reel**
- **Hoisting jib center pulley**
- **Hoisting jib tip guiding pulley**
- **Hoisting jib base guiding pulley**
- **Tensioning rope and anti-break rope device**

**Traction steel wire rope circeling rope diagram**

d. Assemble pull rods of lifting-jib and connect the pull rods to hanging points with pivots. Install cotter pin, put in fixed bracket of upper chord of lifting-jib.

e. Check whether electrical circuit of lifting-jib is in good condition or not. Use the temporary power supply of swing mechanism to put the upper structure of tower crane to the positon for installation of lifting-jib conveniently.

f. Hang ropes as shown in Fig.1.5.8-5a. Try to hoist to see the balance, or move the position of hanging ropes properly. Hoist lifting-jib assembly to the height of installation. Connect swing tower to lifting-jib root with pivots as shown in Fig.1.5.8-5b.

Attention: Record the hanging points of assembling lifting-jib for convenient disassembly.

g. Switch on power supply of hoisting mechanism, loosen rope and wind according to Fig.1.5.8-6, use mobile crane to hoist lifting-jib gradually, at the same time start lifting mechanism to lock rope till pull rods of lifting-jib joint to pull plate of tower head. Connect pull rods to pull plate I、II of tower head with pivots according to Fig.1.5.8-7 and install cotter pin. Loosen rope of lifting mechanism and lower jib slowly.

h. Put pull rods in the state of being strained, at this time lifting-jib hoists about 1/70, and loosen hoisting rope on pulley block at last.

**Figure 1.5.8-5 a explanation:**
- **Center of gravity**
- **trolley**
- **bracket**

**Attention 1.** Reference center place include long and short tie bar, guiding mechanism, load trolley, and when the load trolley place at the root place.
Figure 1.5.8-5b explanation: Hook hoisting jib
Figure 1.5.8-6 explanation:
起升卷简：Hoisting reel    排绳滑轮：guide rope pulley
塔顶安装滑轮：Install pulley on the tower head    拉杆滑轮：tie bar pulley
塔顶上固定点：The fixed point on the tower head
图 1.5.8-6 安装起重臂拉杆时起升钢丝绳绕法：Figure 1.5.8-6 Hoisting steel wire rope’s circling method when install hoisting jib tie bar

Figure 1.5.8-7a explanation:
拉板：tie plate
图 1.5.8-7a 塔顶与起重臂拉杆连接处结构：Figure 1.5.8-7a Connecting configuration between tower head and hoisting jib tie bar

Figure 1.5.8-7b explanation
拉板：tie plate    滑轮：pulley    连接板：connecting plate
拉杆：tie bar
图 1.5.8-7b 起重臂拉杆与塔顶连接处结构：Figure 1.5.8-7b Connecting configuration between hoisting jib tie bar and tower head

Figure explanation: 臂长: Jib length
塔身方向: Tower section’s direction

1.5.9 Assembly of counter-weight

The weight of counter-weight varies with the length of lifting-jib (Table 1.4-2), according to the length of lifting-jib and the requirements of Fig.1.5.9-1 assemble counter-weight. Disposition of counter-weight and installation site under the working condition of three jib lengths of lifting-jib should be assembled according to requirements.
1.6 Rope system of hoisting mechanism

1) Wind rope

After finishing assembly, start to wind rope. Shown in Fig. 1.6-1, let the hoisting rope out from the drum, through mechanism upper pulley.

Figure explanation:

塔顶导向滑轮: Tower head guiding pulley
回转塔身上起重量限制器滑轮: Hoisting weight limiter pulley of slewing tower section
起升卷筒: Hoisting reel
小车定滑轮: Trolley crown block
吊钩滑轮: Hook pulley

图 1.6-1 起升钢丝绳绕绳示意图: Figure 1.6-1 Hoisting steel wire rope’s winding diagram

1.7 Electrical installation and debugging

1.8 add sections when jacking

1.8.1 Preparation

1) Fill hydraulic pump with oil in regular pump station, confirm whether the
wiring of the electric motor is correct or not, the fan rotation is dextrorotation.

2) Clean each of tower sections, smear butter on upper standard section. Line up the standard sections that are going to be added to tower in a row under jib lying on climbing position, to save time in the whole progress of adding section without using swing mechanism.

3) Loosen cable length slightly longer than the total climbing height and fasten cables.

4) Swing lifting-jib to front of climbing frame and counter-jib lies back of frame (climbing oil cylinder lies rear of frame.)

5) Prepare leading in pulley for leading in platform and prepare tower high strength bolts for the climbing frame platform.

1.8.2 Tower balancing before climbing (shown in Fig.1.9-1)

1) Before tower balancing, first hoist one reinforcing section (or normal section) to leading in beam, and then drive trolley to balancing reference position according to Fig.1.9-1 and hoist one standard section or other load (in table the position of trolley is approximation. While climbing, adjust it according to practical condition.) Then disassemble four legs of lower pivot and connecting bolts of mast sections.

![Diagram](image)

Figure explanation:
至塔机中心： Distance to the center of tower crane

2) Push the control rod of hydraulic climbing system to “climbing direction” and hoist climbing frame to the tower main chord position that just breaks away
from the legs of lower bracket.

3) Check whether the support leg connected with lower bracket and standard section is in a vertical line with tower main chord or not, and observe whether the gap between 8 guiding wheels of climbing frame and main chord of tower crane is basically the same or not, in order to check whether the balance of tower crane, if not, adjust the balancing position of trolley until achieve the balance, make the gravity of upper part of tower crane in the position of hydraulic ram beam.

4) Record the balancing position of trolley, it can also tie a cloth to this diagonal rod as a sign, but pay attention that the position of this sign varies with different jib lengths. After finishing, get rid of it.

5) Operating hydraulic system lowers telescoping cage and connects the connecting bolts between lower bracket and tower standard sections.

1.8.3 Climbing work (shown in Fig.1.9-2)

1) Hoist one reinforcing section or normal section (in general, standard section) directly above leading in beam of climbing frame. Assemble 4 leading in wheels at the bottom of standard sections and decline the hook to put leading-in wheels of standard sections down to leading-in beam properly, then take off the hook.

2) Drive trolley to climbing equilibrium position (shown in Fig.1.9-1)

3) Operate the swing brake of swing mechanism to keep the upper part of crane in the state of swing brake and don’t allow swing movement.

4) Disassemble 8 high strengthen bolts on the top of tower section connected with lower bracket.
1.9-2 add sections when jacking

5) Put climbing beam in arc grooves of the nearest pedal of standard section (arrange specialists specially observe whether the pins of two sides of climbing beam are in the arc groove of claw or not). After confirming that, start hydraulic system and stretch piston rod to hoist the climbing frame and its upper section to 10-50mm and then stop. Check whether climbing beam, climbing frame, etc, power-transmission parts are in good conditions or not and whether piston rod of oil cylinder withdraws automatically or not, etc, abnormal phenomena. After confirming normally, and continue to hoist; after hoisting height slightly over half of a standard section and make the mobile claw of climbing frame slide a pair of pedals and reset automatically, stop hoisting and withdraw oil cylinder, then emplace climbing beam renewably to the claw in arc groove of pedals. Stretch oil cylinder again until there is just space for slightly over half of a standard section on the top of tower. Lead standard section on leading-in beam of climbing frame in above tower and withdraw hydraulic ram slightly, put the newly introduced standard sections down to the top of tower, align it, disassemble leading-in rolling wheel and assemble 12(or 8) M36 high strengthen bolts (each bolt must have two nuts and a washer). Connect lower standard sections firmly.

Withdraw hydraulic ram again, put lower bracket down to the top of new tower and align it, then connect lower bracket with the tower by 8 M36 high strengthen bolts firmly, thus finish the work of adding one section. If adding several standard sections in succession, just repeat several times according to the above steps. In order to make lower bracket fall over the top of tower and aim at the connecting bolt hole. Before withdrawing the ram, insert 4 guide rod (a piece in each corner) into the bolt hole of four corners of lower bracket and withdraw the ram, then fall down lower bracket.

Attentions in climbing process:

a. Stop climbing when the wind speed at the topest of tower crane is more than 8m/s.

b. Ensure lifting-jib is consistent with leading in standard section in the process of climbing and brake lifting-jib by slewing brake, and trolley must stop in the balancing position of climbing.

c. If several standard sections need to be installed continuously, each main chord of tower and lower bracket must be connected with 8 M36 bolts after
installation of a section before hoisting the next one. If no more section needs to install, the eight high strengthen bolts are allowed (each bolt only use one nut).

d. Peals of the standard sections to be installed must be adjusted positive to the existing standard sections.

e. Before connecting lower bracket with the tower by M36 bolt, prohibit swing, trolley and hoisting work.

f. In the process of climbing, if hydraulic climbing system appears abnormal condition, stop climbing and withdraw oil cylinder, put lower bracket down to the tip of tower, and connect lower bracket and with the tower by 8 M36 high strengthen bolts, then solve the problems of hydraulic system.

g. After adding sections to the needed height (but no more than the freestanding height), slew jib to different angle to examine the tightening state of each connection point of tower, bolts of basic landing leg (which main chord lies under the counter-jib, tighten all nuts of this main chord down to up, and use double nuts to prevent loosening for the above connection).

1.8.4 Attachment of tower crane.

When the working height of tower crane surpasses its freestanding height, add attaching device. The attaching device is composed of 4 sets of frame beam which fasten an attaching frame by 24 M20 bolts, nuts, washer (the pre-tightening moment of bolt is 370N.m) and 4 inner strut tie. There are 4 attaching strut ties which are connected with 4 apexes of attaching frame. There is connecting ear support at the end of 4 attaching strut tie that is connected with the connecting chassis attached to a building. 4 strut ties should be on a line as possible; Push inner strut tie against 4 main chords by adjusting bolts. (shown in Fig.1.8-3)
Figure 1.9-3 explanation:
1. 螺栓连接: Bolt connection  
2. 框架: Frame  
3. 内撑杆: Inner stay bar  
4. 调节螺栓: Adjusting bolt  
5. 附着撑杆: Attaching stay bar  
图 1.9-3 附着装置  

Figure 1.9-3 Attaching device
Figure explanation:
1. 连接基座: Connecting pedestal  
2. 短撑杆: Short stay bar  
3. 长撑杆: Long stay bar  
4. 附着框架: Attaching frame  
5. 连接螺栓: Connecting bolt  
6. 内撑杆: Inner stay bar  
7. 调节撑杆: Adjusting stay bar  
8. 调节螺栓: Adjusting bolt  

图 1.9-4 附着架示意图: Attaching frame diagram

a. Install attaching frame according to Fig.1.8-4, when in actual use, not consistent with the distance value of the design, please contact with the manufacturer; The connected ways between connecting base on the building attachment and building depend on the actual situation.

b. Put the attaching frame round the tower, and tighten 4 main chords by 4 inner strut ties, then connect with diagonal rods; connect one end of anchored strut tie with attaching frame by pins, and the other end is fixed the connecting basic bracket of building.

c. Keep each attaching device of the 4 anchored strut tie in the same plane. But when assembling the attaching frame and inner strut tie, if intervening in some parts of tower standard section, it may properly hoist or lower installation height of attaching frame, the allowable height difference between attaching frame and connecting base is not more than 200mm.

d. It is allowable in the anchored strut tie to set up the springboard from the
building to tower crane, but strictly prohibit piling up heavy loads.

e. Attaching point load

Before installation of tower crane for the users or installation unit, we should evaluate the load capacity of attaching point (the place to fix connecting base) and the work date of reinforced concrete which can affect the intensity of attaching point. Figure 1.9-1 has provided the details about the disposition and format of supporting rods and working conditions. Users decide the the fixed ways and partial structure processing mode between connecting base and the building according to the load capacity, the specific place for attaching point on the building structure.

Attention: Attaching point load varies substantially from the relative distance between tower crane and building, the layout and dimension of attaching rods, the length of upper part of attaching frame. So when the tower crane attaches the building, as the position of tower crane, the layout and dimension of attaching rods differ from figure 2 and figure 1.8-4, please consult to our company. Do not solve the problem by blindly applying the figures in table 1.8-1, in order to avoid safety incidents.

<table>
<thead>
<tr>
<th>Building anchoring points force diagram 1.8-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1(kN.)</td>
</tr>
<tr>
<td>Working load</td>
</tr>
<tr>
<td>Offworking load</td>
</tr>
</tbody>
</table>

f. When assemble the attaching devices, use theodolite to check the verticality of tower crane axes, and the deviation should not surpass the whole tower height 5/1000. It is allowed to achieve that height by adjusting the length of attaching support rods.

g. The connection between attaching rods, attaching frame and connecting base, attaching frame, tower crane, and inner supporting rods must be reliable. The inner supporting rods should be reliably against the main chords of tower
crane, and clamp with the diagonal rods of tower, tighten each connecting bolts. After adjusting the bolts, the nuts should be tightened firmly. Cotter pins should open at a regulation, after running should often check whether they are loosen and adjust them in time.

Attention: No matter how many times attach, the inner supporting rods are only installed in the toppest attaching frame. That is to say, when happens a new attachment, the inner supporting rods should be moved into the newest attaching frame.

1.9 Work before use

Work before use is to make sure that tower crane can operate correctly and run under safe conditions. These works are mainly for checking components and adjusting each safety device.

1.9.1 Checking components

Make sure installation correctly and safe operation, we should carry out a series of trial operation for tower crane each component and a thorough examination.

a. Check fastening of each component;
b. Check installation of supporting platform and guardrails;
c. Make sure rope winds correctly;
   Check running of cables;
d. Check fastening of counterjib weight;
e. Make sure there are incidentals or not on walkway, while tower crane running, prevent sundries from dropping;
f. Check lubricating plane and lubricating point.

1.9.2 Safety device debugging

Tower crane safety device are mainly composed of travel limiter and load limiter. Travel limiter is composed of hoisting height limiter, slewing limiter and radius limiter. Load limiter is composed of load moment limiter and load capacity limiter. Otherwise it also includes anemoscope.

Adjusting approach is shown in Chapter 2 and chapter 3.

Full crane safety device installation site (Fig.1.10-1)
### Figure explanation:

1. 起升机构（制动器、高度限位器）：Hoisting mechanism (brake, height limiter)
2. 力矩限位器：Moment limiter
3. 起重量限位器：Hoisting weight limiter
4. 变幅机构（制动器，幅度限位器）：Derricking mechanism (brake, radius limiter)
5. 回转机构（制动器，回转限位器）：Slewing mechanism (brake, slewing limiter)

图 1.10-1 整机安全保护装置的安全位置：Figure 1.10-1 Safety position of whole crane’s safety protection device

### 1.9.3

<table>
<thead>
<tr>
<th>Checking items</th>
<th>Checking content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundation</strong></td>
<td><strong>Check the tightening condition of foot bolt.</strong>&lt;br&gt;<strong>Check the safe distance between transmission line and max.slewing section of tower crane.</strong>&lt;br&gt;<strong>Check cable to prevent damage.</strong></td>
</tr>
<tr>
<td><strong>Tower section</strong></td>
<td><strong>Check fastening for mast section bolts.</strong>&lt;br&gt;In the state of no-load and no wind side verticality between tower axis and supporting is 4/1000.</td>
</tr>
<tr>
<td><strong>Climbing frame</strong></td>
<td><strong>Check joint with lower bracket.</strong>&lt;br&gt;<strong>Check rolling wheel and climbing claw is flexible and liable or not.</strong>&lt;br&gt;<strong>Check fastening of sidewalk and rails.</strong></td>
</tr>
<tr>
<td><strong>Upper and lower bracket</strong></td>
<td><strong>Check fastening for bolts connecting swing ring.</strong>&lt;br&gt;<strong>Check running of cables.</strong>&lt;br&gt;<strong>Check fastening for platform &amp; guardrails.</strong>&lt;br&gt;<strong>Check connection with cabin.</strong>&lt;br&gt;<strong>Forbid preserving grease oil, cotton oil and another tinder in cabin.</strong></td>
</tr>
<tr>
<td><strong>Cabin</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Tower head</strong></td>
<td><strong>Check installation of lifting-jib and counter-jib tie bar.</strong>&lt;br&gt;<strong>Check installation of ladder, platform and guardrail.</strong>&lt;br&gt;<strong>Check whether lifting rope winds correctly or not.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Check the installation of pins, washer and cotter pin.</strong></td>
</tr>
</tbody>
</table>
| Lifting jib | Check operation of trolley and fastening of manned nacelle.  
Check winding and fastening of hoisting and derricking rope. |
| Counter jib | Check fastening of counter jib.  
Check installation of counter jib guardrail and walkway. Make sure there are not incidentals on walkway. |
| Hoist device | Check changing rate device and prevention for ropes of hook are safe and reliable or not.  
Check defect of lifting hook.  
Check type and specification of lifting ropes and derricking ropes.  
Check wearing degree of rope. |

### 1.10-1

<table>
<thead>
<tr>
<th>Checking items</th>
<th>Checking content</th>
</tr>
</thead>
</table>
| Mechanism      | Check installation and operation of each mechanism.  
Make sure the gap of each mechanism brake adjusts properly.  
When trolley separately drives to the min. and max. radius, make sure ropes on trolley winch roller has safe circles of more than 3 circles.  
Check fastening of rope head. |
| Safety device  | Every safety device must be adjusted according to the requirements of the instructions.  
Check installation and fastening of all ladders, guardrail and rest platform. |
| Lubrication    | Check lubrication according to the instruction. |

1.9.4 Do the following examination in turn after crane is assembled. (Each construction site must be experimented.)

1.9.4.1 Unload test

Each mechanism should operate for several times respectively, and then operate comprehensively for 3 times. There should not be any abnormal phenomena in operation process. Each mechanism brake, control system, linkage device and limiter should operate accurately and reliably. Otherwise fix a breakdown timely.
1.9.4.2 Dead-load test
At max. radius separately hoist corresponding rated load capacity, 25%, 50%, 75%, 100%, do the experiment according to the requirements of 1.9.4.1. There should not be any abnormal phenomena in operation process. Each mechanism brake, moment limiter and hoisting limiter should operate accurately and reliably. Otherwise fix a breakdown timely.

1.9.4.3 Static test of over load 25%
Static over-load test should be carried out after the qualified unload test and dead-load test.
According to different lifting jibs, static over-load test load is as follows:

<table>
<thead>
<tr>
<th>Jib</th>
<th>Items</th>
<th>Radius</th>
<th>Tip load</th>
<th>Radius</th>
<th>Tip load</th>
</tr>
</thead>
<tbody>
<tr>
<td>60m</td>
<td></td>
<td>14.6m</td>
<td>10t</td>
<td>60</td>
<td>1.5t</td>
</tr>
<tr>
<td>55m</td>
<td></td>
<td>15.3m</td>
<td>10t</td>
<td>55</td>
<td>1.9t</td>
</tr>
</tbody>
</table>

At the above radius I, radius II, at the lowest safe speed, hoist corresponding tip load 0.5m from the ground, stop 10min, after disassembling check whether metal structure and welding line have the crack, residual deformation, loose connection or not.

Attention: static over-load test is not allowed to carry out derrick and slewing.

1.9.4.4 Dynamic overload experiment
Tip load 1.5t (60m jib 1.87t 55m jib 2.37t) at max. radius, Whole process according with each mechanism carry out 3 times movement, each mechanism should be flexible, brake should be reliable, machine and each parts have no abnormal, connecting have no loosen and destruction.

Chapter 2    Disassembly of crane

2.1 Atentions during disassembly of crane are shown as follows:
a. Before dismantling crane from worksite, climbing mechanism should maintain and operate, because climbing mechanism wasn’t use for a long time.
b. In the course of operation, limiter and slewing brake should be examined purposefully.
c. After standard sections of tower have been disassembled, before connecting lower bracket with tower section by M39 high strengthen bolts, prohibit using slewing mechanism, trolley mechanism and hoisting mechanism.

d. It’s a continuous heavy load work for climbing mechanism to disassemble crane. Therefore, components suffered loads of climbing mechanism should be examined regularly.

e. When climbing mechanism working, all operators should observe relative moving parts normal or not. (For example, between rolling wheel and main chord, between climbing frame and tower), if there is deflection between climbing frame and tower when climbing frame is ascending, stop climbing and descend at once.

f. Wind speed should be less than 8m/s when assembling, because building has been built up, The worksite was limited. Take care, or security accident may easily happen.

2.2 Disassembly specific procedure of crane

Special notice: dismantle crane is a high technical work, particularly dismantle tower mast section, counter weight, counter jib and hoisting jib. If neglected, it can lead to fatal crash. Therefore, when customers disassemble these parts, they need to operate strictly according to the stipulations of this instruction book. The operators on the tower must be trained and received a certificate.

Pay special attention: two moving climbing claw may not restore level condition automatically for some corrosion reasons. When add mast section or dismantle mast section, pay more attention to climbing claw, and carry out inspection and maintenance beforehand.

Revolving tower crane to the disassembling area, this area should have no dismantling barrier.

Dismantling tower crane. Dismantling process are opposite to install tower crane.

The specific procedures of dismantling crane are as follows
1) Lower tower mast sections (if there are attaching devices, disassemble correspondingly.)
2) Disassemble balanced jib’s counter weight (stay two counter weight of 2.395t and 1.95t);
3) Disassemble lifting jib;
4) Disassemble counterjib (dismantle two counterweight of 2.395t and 1.95t firstly);
5) Disassemble cabin; (disassemble together with slewing assembly)
6) Disassemble tower head;
7) Disassemble slewing tower section;
8) Disassemble slewing bracket assembly;
9) Disassemble climbing frame and tower reinforcing sections.
10) Disassemble press heavy and chassis (only for chassis fixed tower crane.)

2.2.1 Disassembly of crane (Fig.2.2.1-1)

Figure 2.2.1-1 explanation:  踏步：Step

标准节 1: Mast section 1  标准节 2: Mast section 2
标准节 3: Mast section 3  标准节 4: Mast section 4

1. 拆除标准节 1 的上下螺栓 Dismantle upper and bottom bolt of mast section 1
2. 爬升架上升 Climbing frame raise
3. 推出标准节 1: Pushing out mast section 1
4. 扳开活动爬爪： Switch out moving climbing claw
5. 爬升架下降： Climbing frame declining
6. 活动爬爪落在下一个踏步上: Moving climbing claw drop on the next step
7. 横梁顶在下一个踏步上: Cross beam located at the top of next step
8. 爬升架稍微上升: Climbing frame raising a little
9. 扳开活动爬爪: Switch out moving climbing claw
10. 爬升架下降: Climbing frame declining
11. 紧固连接螺栓: Fixed the connecting bolt
12. 吊走标准节: Hook away tower section

图 2.2.1-1 塔身拆卸: Dismantling crane sections

1）Slew lifting jib to the guiding direction of mast sections (that is, climbing frame’s open side), keep slewing brake in a brake state, and trolley stops at the balance spot (that is, which is consistent with the balance spot of trolley when climbing and adding sections during assembly of tower crane).

2）Disassemble upper and lower connecting bolts of the toppest tower mast section and install guiding roller wheels on the bottom connecting sleeve.

3）Stretch out jacking oil cylinder, emplace climbing beam in groove of the fourth pedal from top to down, and hoist upper structure; when the first mast section (that is, mast section 1) departs from the top surface of mast section 2 about 2~5cm, stop climbing.

4）Push the first mast section along leading in beam.

5）Cock the moving claw, withdraw oil cylinder, after the moving claw hides from the nearest pair of pedals, put back and flat, continue to descend to the moving claw to support the next pair of pedals. After supporting upper structure, withdraw oil cylinder.

6）Emplace climbing beam in the next pair of pedals, when slightly hoisting the climbing claw to turn over, after hiding from the previous supporting pedals and stop, cock the moving claw, continue to withdraw oil cylinder to the next mast section until connecting with lower bracket.

7）Notice: after the mast section of dismantled put to the outside of the telescoping cross beam, at the proceeding of climbing frame descend, moving climbing claw should be flip artificially when moving climbing claw of the climbing frame cross the main chord if tower section. At the same time, telescoping yoke and guiding wheel should be charged by somebody, and
observed whether there have locking of barrier or not when the climbing frame descend. so that climbing frame can descend all right

Repeat the above action, and dismental the tower section in turn

After tower section dismantled to the installation high, it should continue dismental the crane, counter weight of the counter jib must be dismantled

2.2.2 Dismental counter weight of the counter jib

Crane can be fixed to the root of the counter jib and dismental the counter weight by assistant tower crane

The opposite order of install counter weight, each counterweight dismental in turn, only leaves two counter weight which weight 2.395t and 1.95t

2.2.3 Dismental the hoisting jib

1) Put the hook down to the ground, and dismental the connection of prevent twisting forward part of hoisting jib and hoisting wire rope

2) Lifting points lay out sling according to chart 1.5.8-5a

3) Hoisting jib be hant gently, hoisting wire rope be fixed to the pivot of tower head, hoisting winch started slowly, the head of the tie bar should be near the tower head; pin connector of the tie bar frame and tower head dismental, and put down the tie bar to the hoisting jib for fixing; pin connector of the hoisting jib and slewing tower section should dismental, also the wire rope.

4) Lay down the hoisting jib, and put it to the bracket which fill up crosstie.

2.2.4 Dismental the counter jib

All the counter weight hang, and counter jib should be hant by four installation hang eyes of counter jib, and make the tie bar of counter jib to be relaxation, then dismental the tie bar and connect with the pivot. so it can dismental the connection which between the counter jib and slewing tower section, and put the counter jib to the ground

2.2.5 Disassemble cabin

2.2.6 Disassemble tower head

Before disassembly, check whether there are still cables connecting with the adjacent parts or not.

2.2.7 Disassemble slewing tower

2.2.8 Disassemble slewing assembly

Put the climbing claw of climbing frame to support the tower, disassemble down the connection among lower bracket, climbing frame and tower, and then hoist and disassemble slewing assembly by a sling.

2.2.9 Disassemble climbing frame and tower reinforcing sections

1) Hoist climbing frame, hang slowly along mast section of main chord on ground.
2) Pull down each reinforcing sections in turn.

2.3 Attentions after disassembly of crane

1) After disassembly of crane, engineer and technicians and professional maintenance carry out inspection and maintenance.

2) For structural parts of main force check the fatigue of metal, weld crack, structural deformation and so on, check whether each component of tower crane is damaged or hurt, etc.

2) After inspection and after defect and hidden danger have been repaired, and then carry out rust and painting.

Article 2 Use and maintenance of tower crane

Chapter 1 Safety operation instruction of tower crane

1.1 Driver and hoisting personnel

1.1.1 Implementing the corresponding regulation of 《operation instruction of tower crane》, drivers and hoisting personnel must be those who pass the examination and get the certificate according to corresponding regulations of labor personnel department.

1.1.2 Drivers must know about the working principle of operation. They must be familiar with construction of crane, functions of safety device and adjustment methods. They must master operation methods of each feature of crane and maintenance technology of crane.

1.1.3 Strictly operate according to hoisting characteristic table of this instruction book and forbid overloading.

1.1.4 Operational motion of hoisting mechanism, slewing mechanism, and trolley mechanism will be gentle and convert gradually from low speed to high speed. Operating handle should not be pushed with a rush from static (or low speed) to middle speed or high speed.

1.1.5 Forbid pulling things inclined and hoisting things with unknown weight or rooted things.

1.1.6 When there’s hanging things in the sky, driver and hoisting personnel can’t leave worksite.

1.1.7 Commanding signal, gesture and flag should comply with the regulation of GB5082-85.

1.1.8 Drivers must make well the operation, repairs and maintenance of crane and record the shift well.

1.1.9 Strictly prohibit that drivers operate after drinking.
1.2 Mechanical parts and others

1.2.1 Operating temperature of crane is -20°C ~ +40°C. Wind should be below 12m/s when working.

1.2.2 All safety device of crane must be maintained at any moment, strictly prohibit moving and disassembling at random and over-load application.

1.2.3 There should be enough lighting condition on the construction spot at night.

1.2.4 Attentions before the large reparation or renewing installation for crane:
   a. Carefully examine each joint link and make sure whether the pins are crackle, rusty and abrasive or not.
   b. Examine if the important parts such as rigid pull rod, rope, pulley, hook, changing rate device, etc, conform to the application condition.
   c. Examine if deformation of metal structure parts and welding slit conform to the application condition.
   d. Try to operate hoisting, climbing, slewing and derricking actions until they are in good condition.

1.2.5 Examine whether electrical control system conforms to the requirement or not, when crane is being repaired and maintained. Cut off the total power supply and prohibit operating with electricity.

1.2.6 Specify personnel should be assigned to command crane operation at the sites of ground, floor platform and surface of construction. Strict signal or gesture, flag signal, etc are used to contact with drivers. We’d better contact each other with walkie-talkie.

1.2.7 It should be ensured that crane supplied voltage is within the range of 380v±10%. Otherwise, electrical device is easy to be damaged.

1.2.8 Prohibit hoisting operation when encountering thundstorm, rainstorm and thick fog or wind exceeding 13m/s.

1.2.9 When several cranes come into a construction site at the same time, the arrangement of crane should be appropriate but they can’t intervene and interfere with each other.

1.2.10 When drivers switch on ground power and enter cabin, they should check buttons, operating handles all-round to make sure whether they are in idle state. Start chief button if there is no problem.

1.2.11 Driver must operate crane strictly according to crane technical performance table and hoisting feature curve. Strictly prohibit over-load or forced operation.

1.2.12 Prohibit hook landing on the ground when crane is operated. Not to cause
rope of winding drum disorderly to be damaged. Pay attention to the arrangement of winding drum rope when hook is hoisted again if hook has to land on the ground.

1.2.13 Hoisting hurdle on the side of trolley is used for maintenance, when a certain part of jib needs repairing, personnel can stand in the hoisting hurdle, moving to the assigned position with trolley to complete maintenance. Rated loading weight of hoisting hurdle is 100kg. Strictly prohibit persons standing in hoisting hurdle when lifting heavy-things. Strictly examine if the link between hoisting hurdle and load trolley are in good condition or not when upholding crane and installing lifting-jib on the ground.

1.2.14 When each mechanism needs to operate in the opposite direction, we must start motor in reversal after it stops vice versa.

1.2.15 Cut off power at once when there is abnormal phenomenon in crane, continue to work after the malfunction has been checked up and eliminated.

1.2.16 After a shift of operation has been completed, lifting-jib needs to be turned to the parallel direction of building. When hook ascends to the height away from the highest building, trolley should be at minimum range of lifting-jib and leave after the total power is cut off.

1.2.17 Drivers must be check up and tighten the pivots and bolts on the key components including the tower, jib, swing bearing, rigid pull rod, rod of counterjib, connecting bolts of winding drum and retarder, etc. before work every day. Operation is allowed after no slack or disengage exists.

1.2.18 Drivers should maintain and lubricate retarder, pulley, bearing bracket, etc. every day according to regulations, if there is oil leaking, do with it timely.

1.2.19 Before formal operation, drivers must successively check the liability of safety device. Prohibit forced operation when safety device is not liable or out of order.

1.2.20 When drivers operate hoisting mechanism, different gears speed should be limited by max. load capacity, concrete with reference to table 2.2-1. If using quadruple rate with high speed to hoist heavy objects of more than 5.0t, high speed will be impossible to act and control system will automatically change to middle-speed gear.

<table>
<thead>
<tr>
<th>Rate</th>
<th>Load, Speed</th>
<th>Lower speed</th>
<th>Middle speed</th>
<th>higher speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadruple rate</td>
<td>10t</td>
<td>10t</td>
<td>5t</td>
<td></td>
</tr>
</tbody>
</table>
1.3 Routine inspection of high intensity bolts

Concretely includes routine inspection of tower, slewing assembly, tower head, etc., high intensity bolts. The inspection is as follows:

1) After installation of tower, each bolt should be checked again by moment spanner within three weeks.
2) Each bolt should be checked again every 2~3 month in the future.
3) Disassembly of 2~3 sets of bolts should be checked their transformation and corrosion, etc., conditions every one year.

1.4 Routine regulations of ropes

Rope of hoisting machinery is a wearing part. Lack of maintenance is
1.4.2 It should clean the steel wire at the right moment and spread by the lubricating oil or the lubricant.
1.4.3 Observe the visible part of steel rope on each working day, so that discovering the damages and distorting. Especially pay attention to the steel rope on the fixed parts of tower crane, when discovering any obvious changes, report to the related staffs according to 2.4.2 in 《The Examination and Abandonment Practical Standard for Steel rope of Tower crane》
1.4.4 Ensure check at least one time every week. The guarantee examines one time at least every week.

The second chapter: Organization and electrical operation

2.1 Electrical installation and using.
2.1.1 Electrical installation
2.1.1.1 Electrical installation should carry out after the lower tower crane installed, and refer to the diagram of electrical elements or exterior wiring and wiring of control box, connect each control and moving electric cable, brake electric cable, safety device, grounding device, obstruction light, wind velocity indicator.
2.1.1.2 Electric system should be inspect before power transmission. It can pass electric after according to the question as follows.
2.1.1.2.1 All connection of line must exact and have no error, this fixed cable of electric line should have reliable fixation.
2.1.1.2.2 Electric should be inspected insulation before passing the electric,
insulation resistance of facing to ground for the main loop controlling loop should not be smaller than 0.5 megohm, earthing resistance of tower section right to the ground should not bigger than 4 ohm.

2.1.1.2.3 The main cable (cable of ground and cabin) should penetrate guard circle of cable, then come into the cabin, and leave propriety length, Tower crane should be guarantee that it can’t damage the cable when rotate lap and a half.

2.1.1.2.4 All the operation winch of cabin can be set to the safty place, putting the main switch to the place of power failure, at last connecting the electric cable on the ground.

2.1.2 Debugging electrify.

2.1.2.1 Close the electric switch of ground, and send electricity to the cabin, inspect three-phase power supply for three-phase equilibrium, voltage should be 380V±10% (power grid of ground should provide enough capacity in order to protecting moter’s opening and operation normally.)

2.1.2.2 Loosen wire rope of high limitor, radius limitor, installation with machinery, put on hoisting, load crane.

2.1.1.2.3 Operate hoisting handle first, observer the slewing condition of hoisting, the hook should upword movement when the hoisting handle pull inword, the hook should downword movement when pushing out, otherwise it should adjust to the phase sequence of electricity for hoisting motor in order to according to the above requestions.

2.1.2.4 It operate slewing and derricking handle separately after finishing the hoisting debugging, counter jib should turn left when slewing handle pushing left, counter jib should turn right when slewing handle pushing right, load crane go inward when derricking handle pulling inward; load crane should go outside when the handle pushing outside; otherwise phase sequence of the motor’s electricity should be adjustment according to the requestion as the up follows.

2.1.3 Notes of manipulation

2.1.3.1 Obstacle right and illuminate of cabin can pass electricity by the switch of operate platform, there have electricity on the electricity outlet in order to playing fan.

2.1.3.2 Operating handle must attribute to zero when starting button, total contactor can catch electricity to self-protection

2.1.3.3 Delay device can be set on the electric in order to preventing fight anti-car and emergency brake sprained tower crane, counter jib should not turn left by rated speed immediately after it turned right, it must have few seconds of interval, it must not brake when slewing handle attribute to zero, it
should have few seconds.
2.1.3.4 Even if it has the above delay device, in order to preventing the damage on the electricity, prohibiting reverse brake and immediate brake of swing.
2.1.3.5 Electric pumping station should be inspect whether according to the requestion before jacking,otherwise the right side of swing adjustment can start jacking,prevent slewing,derricking,hoisting when jacking in order to preventing accidents and disconnect cable.
2.1.3.6 Control box should be delay the relay,over-current relay have adjustment,and could not adjustment casually,it should adjustment correctly according to the manual of electrical system if changing components.

2.2 Various organizations of tower crane

Hoisting crane's working mechanism includes: hoisting winch, swinging winch, hauling winch of crane and jacking winch, introduces as follows separately:

2.2.1 Hoisting winch

This tower crane's hoisting mechanism model is JR100S, this motor's model is the YZR5W250-4/8 electrical machinery. The hoisting winch has two grades speeds, can achieve light load and high speed, heavy load and lower speed. Make the products starting and braking stably.

Figure 2.2-1 explanation:
1. 涡流制动器：vortex flow bracket
2. 电动机：Motor
3. 联轴器：coupling
4. 制动器：Bracket
5. 齿形接盘：tooth form acceptance
6. 卷筒：Reel
7. 高度限位器：hight limiter

Figure 2.2-1 hoisting mechanism transmission system diagram

Transmission system of hoisting winch, see the diagram 2.2-1.
There have hoisting height limitor at the end of barrel arbor, hoisting winch
can stop automatic when hoisting goods to the highest position.

2.2.2 Slewng winch (transmission system diagram, see the diagram 2.2-2)

The slewing winch have two sets, and arrange to two side of slewing ring symmetrically, by 2 YZR132M2-6, 3.7kW motor driving, small pinion can be started by reducer of planet pinion, then right and left slewing of hoisting jib and counter jib can be started, there has disc brake in the tail of moter, and disc brake always under opening condition, slewing brake can make the tower crane which working and jacking to the specified position under windy conditions.prohibited strictly stoping by brake.

Figure explanation:
1. 电动机: motor  2. 减速机: reducer  3. 回转小齿轮: Slewing small gear
4. 回转支承: Slewing bearing  5. 小齿轮: Small gear  6. 回转限位器: Slewing limiter

2.2.3 Trolley winch (transmission system drawing see chart 2.2-3)
Figure explanation:
1. Electric plate type brake: Electrical plate type brake 2. Motor
3. Limiter: limiter 4. Reel
5. Double stage planet reducer: double stage planet reducer 6. Bracket

Trolley winch is driver device of load car’s derrick. Coiling block can be started by motor with the planet reducer (one side of the motor have electromagnetic Disc brake) when hoisting and derrick, through steel rope (6×19-9.3-1700-left cross GB1102-74), and make the load crane doing to and fro motion by speed of 55meter/minute on the pass of counter jib, trolley rope have two, one side of the trolley rope fixed to two side of the trolley coiling block, and educe counter jib after tangling, another side of the two trolley rope fixed to the load crane through root of hoisting jib and guide pulley at the end of hoisting jib, these two ropes while closing and opening guarantee to the load crane working normally when derrick, two wire rope of the coiling block’s recycles are not more then three recycles averagely.

2.2.3.1 Adjustment of trolley winch’s brake of crane (diagram see chart 2.2-4)

Friction material of brake will be wear after using a long time, and it can cause increased air-gap between electromagnet and armature reduce the brake moment.
Regulation methods: See Figure (2.2-4), opens the windsail (1), rotate the ring folt, then rotate the six screw, so it can adjust trip of armature and coil. reasonable air-gap should between 0.5~1mm.

Figure explanation:
1. 制动器罩：Brake cover  2. 衔铁：armature  
3,4,5 调整螺母：3,4,5 are adjusting nut  
6. 制动弹簧：Braking spring  7. 导向螺栓：Guiding bolt  
8. 摩擦片：Friction lining  
图2.2-4 小车牵引机构制动器示意图: Figure 2.2-4 Trolley traction mechanism brake diagram
2.2.4 Hydraulic system (Figure 2.2-5)

The hydraulic system is composed of pump station, hydraulic ram, high pressure tube, which can hoist and decline the upper parts of climbing frame, and keep the frame at any position, so it's easy to assemble and dismantle the standard section.

The hydraulic device is compact in structure, high efficiency, convenient to use and reliable.
2.2.4.1 Main parameters of hydraulic climbing system

Main technical parameters of hydraulic pump station

<table>
<thead>
<tr>
<th>Rate pressure (MPa)</th>
<th>Fluid L/min</th>
<th>Motor power kW</th>
<th>Pipe of high pressure JB1885-77</th>
<th>Capacity of oil box L</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>14</td>
<td>7.5</td>
<td>A - 10 II</td>
<td>100</td>
<td>ESSO AW46</td>
</tr>
</tbody>
</table>

Main technical parameter of Jacking oilcylinder

<table>
<thead>
<tr>
<th>Rate pressure (MPa)</th>
<th>Cylinder diameter (mm)</th>
<th>Pole diameter (mm)</th>
<th>Stroke (m)</th>
<th>Installation distance (mm)</th>
<th>Jacking speed (m/min)</th>
<th>Max. jacking pressure (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>160</td>
<td>110</td>
<td>1600</td>
<td>2070</td>
<td>0.60</td>
<td>50</td>
</tr>
</tbody>
</table>
Figure explanation:

1. 顶升油缸: Jacking fuel tank
2. 平衡阀: Balanced valve
3. 手动换向阀: Manual divert valve
4. 压力表: Pressure indicator
5. 高压溢流阀: High voltage overflow valve
6. 电机: motor
7. 液位液温计: Liquid warm gauge
8. 斜轴式定量泵: Slant axis constant rate pump
9. 粗滤油器: Coarse oil filter
10. 精滤油器: perfect oil filter
11. 空气滤清器
11. 空气滤清器: Air auto filter

图 2.2-6 顶升液压系统图: Figure 2.2-6 Jacking hydraulic system

2.2.4.2 Hydraulic system's installment and used

2.2.4.2.1 The fat liquor to process cleanly

First turns on the air cleaner 11, joins the filter fineness for 10μ the portable oil filter machine filters the hydraulic fluid to the fuel tank in up to the oil gauge upper limit, only then starts the oil pump electrical machinery (to bend down looked that electric motor wind leaf gyrotropic whether with pump electrical machinery rear part on sign gyrotropic consistent), pay attention to pump's gyrotropic to have the division, if meets wrong, this system cannot work, and causes the oil pump loss by burning

2.2.4.2.2 Connection of the system's pipeline inspect the cleaness of the high pressure host, and then conneted with AB host of hydraulic and ram, and tight the joint.

2.2.4.2.3 System's exhaust

a. The hydraulic pressure station exhaust, twists the overflow valve 5 handles, then loosen A high pressure rubber tube attachment, move anual cross valve 3 handles, making lift position up to again, start moter, the air from A overflow, the oil pump sound normally, not have the unusual noise, the fat liquor not soak.

b. Exhaust the ram, no-load ram, promote the operating handle, make the ram and piston rod movement up and down several times.

Attention: When connecting rod movement after limiting position, it should back handle immediately, take the handle to be in the middle position, and pauses several minutes, after hydraulic fluid tank's class air bubble vanished, then carry on the next action.

2.2.4.2.4 useful of system

Before the operation, you must inspect connection between the ram and crane frame whether correct and reliable, and inspect according parts whether reach to the technical requestion, then operate as follows:

a. max. working pressure of system's adjustment: locking nut before adjust handle of loosen high pressure overflow value 5 when no-jack working condition, start moter 6, move the upper position of operating handle, at the same time, the pressure table ascend, tighten the high pressure overflow value until the pressure table 4 to 25MPa, then tight locking nut of the high pressure table overflow value (not allow the person who not qualification of train.) perate the
handle reverse and take back the piston rod, and make the operating handle to the meso-position.

b. The rise (drop) operates: start moter6, the operating handle will move to the lifting position, pivot of two sides of the telescoping yoke should site to the suit position which in the mast section of tower section’s footfall arc groove (for details see the first chapter 1.9.3 and the second chapter 2.2.1), carrying on add jacking section works (or dismentle tower section).

2.2.4.3 Hydraulic system's maintenance, service and attention:

This hydraulic system belongs to the extra-high voltage or the high pressure hydraulic unit, the process of adjust the entire from refueling to stipulate strictly according to the instruction for use in carries on.

a. This hydraulic system uses American ESSO Corporation anti-to rub hydraulic fluid AW46

b. add gasoline of hydraulic system.

c. gasoline tank should be taken full in the first time, after starting, stretches out the cylinder connecting rod, then retracts again the connecting rod, by now supplemented the partial oil to the fuel tank to the fuel tank oil gauge upper limit up.

d. This hydraulic system belongs to the extra-high voltage or high voltage hydraulic system, various aspects request strictly, therefore it has request strictly to the hydraulic cleanliness, it must use the portable purifier circulation to filter for 4~6 hours, the cleanliness target achieves 7~8 levels (NAS1660), only then starting uses.

e. The hydraulic system start works for 2400 hours later, it should change the oil completely. And work for 200 hours later, it should add parts of cleaning hydraulic.

f. heat dissipation condition of this condition is bad, when does not work, please close down immediately, in order to avoiding influence use as temperature rise excessively high.

**Article three: Safe and Protection device**

Safety and protective device of tower crane mainly includes: travel limiter and load limiter. Travel limiter has hoisting height limiter, slewing limiter and radius limiter; Load limiter has load moment limiter, load capacity limiter, and otherwise includes anemoscope.
3.1 Multifunctional limiter (hoisting height, radius and slewing limiter, shown in Fig.3.1-1)

Hoisting height, radius and slewing limiter of the tower crane is separately DXZ-4/7, DXZ-4/F(i=600), DXZ-4/3, three multifunctional limiter.

3.1.1 Adjust procedure
a. Disconnect upper encloser, check and tighten up 2-M3×55 screw.
b. Loosen M5 nut.
c. According to requirements, drive winch being controled to specified position(no-load), corresponding microswitch immediately switch when controlling this winch action. That is: adjust corresponding adjusting spindle(Z) and make memory gears(T) press contact of microswitch(WK).
d. Tighten up M5 nut (nut must be tightened, or it will produce memory disorder.)
e. Mechanism repeatedly carries on under the idling many times, check whether the postion of memory is correct or not (if there is mistake, repeat the above adjustment.)
f. Confirm the position according to requirements, tighten up M5 nut and assemble upper encloser.
g. After mechanism normally work, often check whether memory control postion changes or not in order to correct it.

3.1.2 Adjust method of hoisting height limiter
a. Adjustment (adjust procedure according to 3.1.1)
b. Adjustment carries on under the idling. Use the finger to press microswitch (1WK、2WK) to confirm whether microswitch which can hoist up or down is correct or not.
c. When promote the limiter, the min. distance not more then 1 meter between the load crane and hook skate, mobilize axis(1Z), and lock nut M5.
d. Customer can change the lower limitor by 2WK, in order to prevent the operating mistake, hook can stop descending motion before hook contact the ground, the methods as the 3.1.1.(2Z-2T-2WK)

3.1.3 Adjust method of slewing limiter (adjust procedure same as 3.1.1)
a. Adjust slewing limiter when jib is in position of assembly (cables are in free
b. Adjustment carries on under the idling. Use the finger to press microswitch (MK) to confirm whether which can control left and right is correct or not.

c. Slewing leftward 540° (1.5 laps), according to procedure of 3.1.1 adjust adjusting spindle (4Z), change from cam (4T) to microswitch (4WK) and screw up M5 nut.

d. Slewing rightward 1080° (three laps) according to procedure 3.1.1 Adjust adjusting spindle (1Z), change from cam (1T) to microswitch (1WK) and screw up M5 nut. Test left and right swing action.

3.1.4 Adjust method of radius limiter (adjust procedure same as 3.1.1)

a. Trolley going outside and speed reduction and jib end limit
When driving trolley to 1.5m from jib end buffer, adjusting spindle (2Z) changes from memory cam (2T) to microswitch (2WK). (while adjusting, which should at the same time make cam (3T) lap over (2T) to avoid causing interference of reducing speed), and screws up M5 nut; then drives trolley to 220m from the buffer of jib end, according to procedure adjusting spindle (1Z) changes from (1T) to microswitch (1WK) and screws up M5 nut.

b. Trolley going inside, speed reducing and jib root limit
Adjusting approach same as“a”, carry through (3Z-3T-3WK, 4Z-4T-4WK) speed reducing and adjustment of jib root limit at 1.5m and 200mm separately from jib root buffer.

c. Test and correct.

3.2 Moment limiter (Fig.3.2-1)
This crane is equipped with protective device of mechanical moment limiter. When moment achieves 90% of rated value, indicator of cabin turns on and buzzer gives alarm. When moment achieves 100% - 110% of rated value, if hoisting, there has no electricity. If trolley goes out, there has no electricity. At the same time buzzer gives over-load alarm.

Fig3.2-1 explanation:
1. 安装块: Install piece
2. 弹簧板: Sping plate
3.行程开关：travel switch
4.调节螺杆：Adjusting screw

Fig 3.2-1 Moment limiter

Moment limiter is composed of two spring plates 2, three travel switches 3, and adjusting screw 4. Through install piece 1 fixed on the chord at the back of tower head, when tower crane operating, tower head become deformed, distance between two spring plates becomes shorter, making drive adjusting screw to move. If adjusting screw touches travel switch, corresponding moment can give alarm and cut off electric circuit which belong hoisting up and trolley radius out.

3.2.1 Adjust moment limiter (quadruple ratio steel wire rope)

The chord member of tower head has a hoisting moment limiter which make up bow plate type and mini-sized limit switch. When the hoisting moment exceed 80% than rated hoisting moment, contactor of limit switch LDM2 was turn off as bumping with screw, and derricking have to move by low speed. When attach to 100% rated hoisting moment, contactor of limit switch LDM1 was turn off as bumping with screw, cut off hoisting control electrical circuit, hoisting can’t working. At the same time cut off control circuit of derricking out, force derricking can’t enhance. It have to derricking inner and descend the load.

3.2.1.1 Adjusting front jib
A. Hook Q(t), at the radius 20m, make the trolly going out and derricking, adjust limit switch LDM2, derricking change to low speed at R(m) radius.
B. Make the trolly back to original
C. Repeat A and B two time, check the stability
D. Make the trolley going out, adjust limit switch LDM1, Hoisting stop climb at the radius S(m), trolly can’t enhance derricking
E. Repeat D three times, record the radius of every no electricity time, check the stability of working.

<table>
<thead>
<tr>
<th>Hoisting jib length(m)</th>
<th>60</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(t)</td>
<td>1.81</td>
<td>2.87</td>
</tr>
<tr>
<td>R(m)</td>
<td>44</td>
<td>34</td>
</tr>
<tr>
<td>S(m)</td>
<td>56</td>
<td>44</td>
</tr>
</tbody>
</table>

3.2.1.2 checking jib root
A. Hook Q(t) at 10 jib length, make the trolley increasing range, check the
radius when LDM2 was working (change to low speed), the radius is near the R(m).
B. Make the trolley back to original, repeat A, check the stability.
C. Make the trolley going out, check the radius when LDM1 working (cut off the electricity of going out), the radius is near the S(m).
D. Repeat C, record the radius of every no electricity time, check the stability of working.

<table>
<thead>
<tr>
<th>Hoisting jib length(m)</th>
<th>60</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(t)</td>
<td>5.0</td>
<td>5.4</td>
</tr>
<tr>
<td>R(m)</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>S(m)</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

3.3 Lifting weight limiter (shown in Fig.3.3-1)

Hoisting weight limiter be installed on the slewing sections, when hook weight, checking proving ring and Max. hoisting weight limit switch (LHM1), make coil relays of control loop off electricity, cut off hoisting control loop, and can’t hoisting. When 50% rated hoisting weight limit switch (LHM3) working, make high speed loop of control loop off electricity, hoisting mechanism can’t operation. When hoisting weight attach to 80% rated value switch (LHM2), change to low speed automatically.

3.3.1 Ajusting 4 rate.
A. Hook 5000kg, radius $\approx 25m$, speed I,II,IV,V of hoisting mechanism go up and down 1 time, each speed can up and down.
B. add 300kg, adjust contactor of upper limit switch LHM2,LHM3 on the hoisting weight limiter. Make the working have no V speed.
C. Repeat A,B 2 times, check the stability.
D. Hook 10000kg, radius $\approx 15.84m$, I-IV both can up and down, but V speed can’t up and down.
E. add 500kg again, adjust contactor of weight limiter switch LHM, make it off, this time each speed can’t hoisting.
F. Repeat E,D 2 times, check the stability of working.
Figure explanation:

注：Notice

2, 4, 6, 8 为微动开关：2, 4, 6, 8 are Micro-motion switch
1, 3, 5, 7 为螺钉调整装置：1, 3, 5, 7 are screw adjusting device

图 3.3-1 起重量限制器：Figure 3.3-1 Limiter of hoisting weight

3.4 Usful of anti-twisting device.(shown Fig.3.4-1)

3.4.1 when hoisting string are not rotate steel rope, this anti-twisting device should be lock the locking screw when the tower crane under working.
3.4.2 Hoisting rope are usual wire rope, this anti-twisting device should open the lock stock when the tower crane under working.
3.4.3 After change the steel rope, the hook is rotating when no-load, at the same time, it should open the anti-twisting device, steel wire rope will rotate to the hook in order to equal, if the anti-twisting device are under locking, steel rope will be take twist if no-load for a long time until the hook isn't rotating.
3.4.4 Wire rope elongate and twist for a long time using, anti-twisting device should be open at this time, and lock again when the wire rope tensioning.
3.4.5 Anti-twisting device will accelerate the damage of the wire rope if the wire rope spread, so it should change the wire rope in time.

**Figure 3.4-1** Anti-twist device  
Explanation: 起升钢丝绳：Hoisting steel wire rope  
锁紧螺钉 1: Fasten screw 1  
锁紧螺钉 2: Fasten screw 2

### The fourth chapter  Maintenance

In order to ensure to operate tower cranes safely and economically and extend the useful life, we must do well the work related to the maintenance and lubrication.

4.1 Maintenance  
4.1.1 Often keep whole crane clean and clean it timely.  
4.1.2 Check oil quantity of each reducer and fill on timely.  
4.1.3 Check each wire rope, if there have loose ends, broken wire and abrasion. Replace it if they’re out of regulations.  
4.1.4 Check brake’s efficiency, gap, keep reliability and sensitivity.  
4.1.5 Check the sensitivity and reliability of each safety device.  
4.1.6 Check the connection of each bolt, especially the linking bolts of tower mast section. Tighten them again after they’re used for a period of time.  
4.1.7 Check press plate of ropes and clip of ropes, if them are loose or not. Tighten them timely.
4.1.8 Scrap of rope, winding drum, pulley, hook, etc, must strictly conform to the regulations of GB5144-94 and GB5972-86.

4.1.9 Check if there have crackles on rods of metal components, belly rods and welding lines. Especially pay attention to falling paint position. It's very dangerous when the falling paint is 45° stripe. Find out the reason and do with it timely.

4.1.10 Linking bolts and nuts of crane and each pivot where each connection diameter is over $\phi$ 20 are special components. They can't be replaced in any case. Each Bolt must be tightened by two nuts while install tower.

4.1.11 Bolts performance degree of tower mast section is 10.9 grade and nuts degree is 10 grade. There must be performance degree signal on the top surface of bolts and head-top surface of nuts. Otherwise prohibit using.

4.1.12 Crane and metal mechanism should be derusted and painted after every project.

4.1.13 Check automatic changing ratio device of hook tool and hook's anti-escaping device, whether they were safe and reliable or not.

4.1.14 Examine whether each electrical contactor is oxidized or damaged. Repair or replace them if they are abnormal.

4.1.15 Each limit switch and button should not be out of order. Parts which are rusty or damaged should be replaced timely.

4.1.16 Insulation of each electric switch and switch board must be in good state. Its insulation resistance should more than $0.5 \Omega$.

4.1.17 Check whether the tightening bolts of electric components are loose or not, cables and other leads are broken or not. Solve them timely.

### 4.2 Main problems and solutions

#### 4.2.1 Normal problems and solutions

<table>
<thead>
<tr>
<th>No.</th>
<th>Problems</th>
<th>Reasons</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Because of gliding of brakes, hook gliding and derricking trolley gliding out after being braked.</td>
<td>Brake moment is too small. Brakes surface is oiled and brake time is too long.</td>
<td>Adjust spring pressure of brake. Clean oil and adjust brake shoe gap.</td>
</tr>
<tr>
<td>2</td>
<td>The shock of brakes load is too big.</td>
<td>Brake too quickly. Gap of brakes shoes is asymmetri</td>
<td>Increase the gap of brake shoes or increase stroke of hydraulic pushed</td>
</tr>
<tr>
<td>No.</td>
<td>Problems</td>
<td>Reasons</td>
<td>Solutions</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Heat and smoke in the Slewing process of brake.</td>
<td>Gap of brake shoes is too small.</td>
<td>Increase the gap of brake shoes</td>
</tr>
<tr>
<td>4</td>
<td>Temperature of retarder is too high.</td>
<td>Lubricant is too little or too much</td>
<td>Pay attention to increasing or decreasing oil</td>
</tr>
<tr>
<td>5</td>
<td>Temperature of retarder bearing is too high.</td>
<td>Mainly grease is too little or too much; Quality of grease is low.</td>
<td>Replace grease according to rules and adjust gap of bearing or replace bearing</td>
</tr>
<tr>
<td>6</td>
<td>Retarder leaks oil</td>
<td>Seal of connection and seal of axial-end are damaged.</td>
<td>Replace sealed</td>
</tr>
<tr>
<td>7</td>
<td>Slewing mechanism doesn't work</td>
<td>a. Oil pump is damaged, efficiency is low.</td>
<td>Repair or replace damaged parts, increase oil or clean filter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Oil is too little or oil filter is blocked</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Manually director valve and valve opening is damaged seriously</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. The seal of cylinder piston rod is damaged and leaks inner.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>No power for lifting or can't lifting.</td>
<td>a. Pump leaks inner seriously. b. Adjusted pressure of relief valve is</td>
<td>1. Repair or replace damaged parts 2. Adjust pressure according to requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>too low. c. Valve core of manual director valve is excessively abrasive.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Relief valve is dipped.</td>
<td></td>
</tr>
</tbody>
</table>

4.2-1

<table>
<thead>
<tr>
<th>No.</th>
<th>Problems</th>
<th>Reasons</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Appear noise and vibration when increase pressure of lifting</td>
<td>Oil filter is blocked</td>
<td>Clean filter</td>
</tr>
<tr>
<td>10</td>
<td>Climbing system doesn't work</td>
<td>Slewing direction of motor is not the same as oil pump</td>
<td>Replace slewing direction of motor</td>
</tr>
<tr>
<td>11</td>
<td>Appear creeping when lifting</td>
<td>a. There is air in piston rod of cylinder.</td>
<td>Adjust guiding wheel</td>
</tr>
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</tr>
<tr>
<td>12</td>
<td>Drop itself when load is put on climbing system.</td>
<td>b. There is obstacle in guiding mechanism.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Direction-lock on cylinder is in malfunction.</td>
<td>a. There is obstacle in guiding mechanism.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. The seal on piston rod of cylinder is damaged.</td>
<td>b. The seal on piston rod of cylinder is damaged.</td>
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</tr>
<tr>
<td></td>
<td>Resolve the malfunction. Replace the seal.</td>
<td>Resolve the malfunction. Replace the seal.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>It can't work as the whole being started.</td>
<td>Operating lever not at zero-position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuse burned out</td>
<td>Fuse burned out</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad connection condition of start button or stop button</td>
<td>Bad connection condition of start button or stop button</td>
<td></td>
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<tr>
<td></td>
<td>Get operating lever at zero-position</td>
<td>Get operating lever at zero-position</td>
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</tr>
<tr>
<td></td>
<td>Replace the fuse. Repair or replace the button.</td>
<td>Replace the fuse. Repair or replace the button.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Trip in lifting operation</td>
<td>Trip in lifting operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lifting mechanism does not work.</td>
<td>Lifting mechanism does not work.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Controlling wire is incorrectly connected.</td>
<td>1. Controlling wire is incorrectly connected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Fuse fused.</td>
<td>2. Fuse fused.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. The earthing connection is or wires of motor winding group is cut out or broken.</td>
<td>3. The earthing connection is or wires of motor winding group is cut out or broken.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Low motor voltage</td>
<td>4. Low motor voltage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Uncorrect winding connection</td>
<td>5. Uncorrect winding connection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Load is too big or transmission machine is in malfunction.</td>
<td>7. Load is too big or transmission machine is in malfunction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Check connection diagram</td>
<td>1. Check connection diagram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Check fuse capacity and change it if it is not large enough.</td>
<td>2. Check fuse capacity and change it if it is not large enough.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Check the voltage</td>
<td>3. Check the voltage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Find the cutting-out or broken position and repair it.</td>
<td>4. Find the cutting-out or broken position and repair it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Check the broken or not and check the winding resistance clipped or not.</td>
<td>5. Check the broken or not and check the winding resistance clipped or not.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Bearing of derricking mechanism is overhead.</td>
<td>Bearing of derricking mechanism is overhead.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Bearing burned out.</td>
<td>1. Replace bearing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Grease is too much or too little.</td>
<td>2. Grease is too much or too little.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Replace bearing.</td>
<td>1. Replace bearing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Add grease according to</td>
<td>2. Add grease according to</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Problems</td>
<td>Reasons</td>
<td>Solutions</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>17</td>
<td>Derricking mechanism vibrates seriously with noise.</td>
<td>1. Machine scrub each other. a. Stator rotar scrub each other. b. Motor and retarder are not concentric. 2. Bearing is short of oil seriously or damaged. 3. Gear case is short of oil. 4. Gears are weared out. 5. There is noise when two phases operating.</td>
<td>1. Check the gap between stator rotors is uniform or not. 2. Check the block is damaged or not, and replace. 3. Clean bearing and add new lubricating oil or replace bearing. 4. Replace gear case. 5. Switch off power and repair it.</td>
</tr>
<tr>
<td>18</td>
<td>Derricking mechanism electrification</td>
<td>1. Wrong connection of power cord or earthing wire. 2. Bad wire to earth 3. Wiring of motor is grounding.</td>
<td>1. Check and correct it. 2. Correctly grounding</td>
</tr>
<tr>
<td>19</td>
<td>Derricking mechanism brake is out of order.</td>
<td>1. Brake moment is too small. 2. Friction washer is weared seriously.</td>
<td>1. Brake spring is broken or out of order, so replace it. 2. Brush is broken, or voltage is not enough.</td>
</tr>
<tr>
<td>20</td>
<td>Swing mechanism can't work.</td>
<td>There is foreign object clipped in gear.</td>
<td>Clean out the foreign object.</td>
</tr>
<tr>
<td>21</td>
<td>Motor of derricking mechanism is overheat or smokes</td>
<td>1. Load is too big. 2. Load continuing time or operation is against the specification. 3. Two phases operate. 4. Power voltage is too low or too high. 5. Earthing motor winding or brake is cut out. 6. The gap between friction plates is not proper. 7. Brake and release time is</td>
<td>1. Measure the current in stator and reduce the load if the current exceeds rated value. 2. Move according to requirement. 3. Measure three-phase current and solve the problems. 4. Check input voltage and correct it. 5. Find out the problem and resolve it. 6. Adjust the gap according to</td>
</tr>
</tbody>
</table>
8. Motor ventilation is blocked and temperature is high.
7. Check the brake voltage and delay the operating time of breaker and solve the problem.
8. Make it airy.

<table>
<thead>
<tr>
<th>No.</th>
<th>Part name</th>
<th>Lubrication name</th>
<th>Items of lubrication oil</th>
<th>Lubrication method and period (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wire rope</td>
<td>a. Hoisting rope b. Trolley rope</td>
<td>Figureite lime grease ZG-SSY1405-65</td>
<td>Oil boiling when repair it completely.</td>
</tr>
<tr>
<td>2</td>
<td>Reducer</td>
<td>a. Gear box of hoisting mechanism</td>
<td>In Summer: HF20 engine oil In Winter: HJ -40</td>
<td>Add oil every 240 hours of work time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Reducer of trolley mechanism</td>
<td>NLG10 lime grease NL50 or N220</td>
<td>Change the oil every 1500 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Reducer of slewing mechanism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rolling bearing</td>
<td>Slewing bearing device</td>
<td>Lime grease ZG-2</td>
<td>Add oil every 160 hours of working time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clean out every half year</td>
</tr>
<tr>
<td>4</td>
<td>Motor bearing</td>
<td>All motors</td>
<td>winter: ZG-2 In Winter: ZG-2 summer: ZG-5</td>
<td>Change the oil once every 1500 hours of work time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In Summer: ZG-5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>All pulley</td>
<td>All pulley of hoisting mechanism All guide wheel</td>
<td>winter: ZG-2 In Winter: ZG-2 summer: ZG-5</td>
<td>Change the oil once every 240 hours of working time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In Summer: ZG-5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Rolling bearing</td>
<td>a. Rolling bearing of trolley mechanism</td>
<td>winter: ZG-2 In Winter: ZG-2 summer: ZG-5</td>
<td>Add oil every 160 hours of working time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In Summer: ZG-5</td>
<td>Clean out every half year</td>
</tr>
<tr>
<td>7</td>
<td>Brake lever</td>
<td></td>
<td>Engine oil</td>
<td>Add oil every 56 hours</td>
</tr>
<tr>
<td></td>
<td>System</td>
<td>Oil Type</td>
<td>Frequency of Oil Change</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>8</td>
<td>Jib and tower mast</td>
<td>ZG-2 (ZG-5) Lime grease</td>
<td>Before disassembly and assembly</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Change rate device</td>
<td>All movement position and guide groove</td>
<td>Engine oil</td>
<td>Add oil every 160 hours of working time</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Lime grease</td>
<td>Add oil every 3 months</td>
</tr>
<tr>
<td>11</td>
<td>Hydraulic climbing pump station</td>
<td>Oil tank</td>
<td>Antifriction hydraulic oil of American ESSO company</td>
<td>Add oil every 200 hours of working time Change the oil every 1500 hours</td>
</tr>
</tbody>
</table>
QTZ125(6015)拉杆示意图