

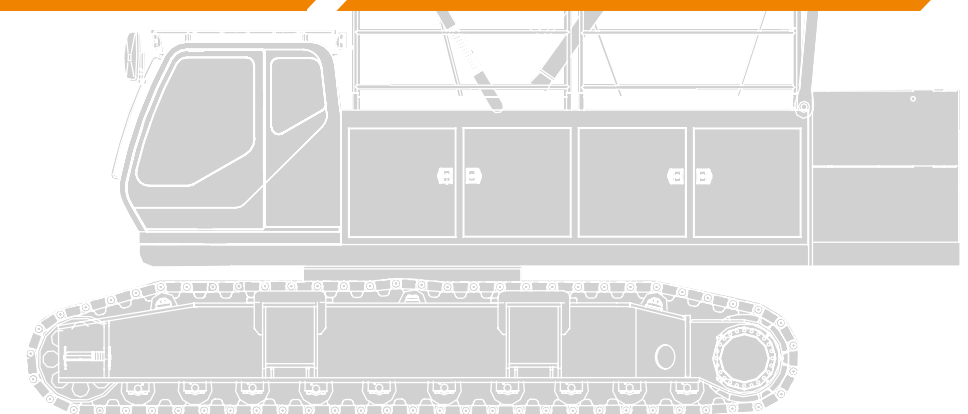


Vision creates future



CRAWLER CRANE

CRAWLER CRANE OPERATOR'S MANUAL



OPERATOR'S MANUAL

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ZCC1100H Crawler Crane Operator's Manual

Edition 1 5, 2014

To Users

Zoomlion appreciates your selection of ZOOMLION crawler crane for your application.

No one should operate the crane unless they read and understand the information in this manual.

This manual contains the instructions and data on the safety and operation of the crawler crane. Follow the operation procedures to make sure that your machine operates at MAXIMUM EFFICIENCY. The operator must keep this manual in the cab of the crane.

If there is anything in the manual that is not clear or you do not understand, please contact our service technician. We (Zoomlion) are NOT responsible for damages from an operator who does not obey the instructions in the *OPERATOR'S MANUAL*.

The *OPERATOR'S MANUAL* is an important part of the crane. If the crane becomes the property of a different person, make sure that the manual stays in the cab of the crane.

The data (data, specifications, illustrations) in this manual is for cranes in production at the time of this manual's publication. We reserve the right to make changes to this manual at any time, without obligation.

The manual has been translated to be best of our knowledge. Zoomlion assumes no liability for translation errors. The Chinese version of the *OPERATOR'S MANUAL* is solely applicable for factual accuracy.

Thank you!

Mobile Crane Branch Company of Zoomlion Heavy Industry Science and Technology Co., Ltd.

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Operator's Manual for Crawler Crane

Chapter 1 Safety



Chapter 1 Safety

1.1 Important instructions

1.1.1 Notes

- a) Read this manual and familiarize yourself with any associated documents before operating this crane.
- b) Ensure that a copy of this manual is available to any person installing, using, maintaining or repairing this equipment. Training should be provided to ensure safe working practices.
- c) To avoid the risk of electric shock, always isolate this equipment from the power supply prior to carrying out any maintenance adjustment or removing any guards or covers.
- d) Always follow the procedures outlined in the *Operator's Manual* and *Maintenance Manual*.
- e) If in doubt, do not take personal risk.
- f) Only trained personnel can be allowed to install, set, operate, maintain, and commission this equipment.
- g) End-user (the owner) should follow the restrictions of using the crane and all the relevant parameters specified by the manufacturer. If technical parameters can not be obtained clearly, experienced and qualified engineer should judge the restrictions of using, which should be recorded in the archive. Do not exceed the rated capacity specified in the documents associated with the crane.
- h) End-user should comply with requirements in 29CRS, OSHA about CC section.

1.1.2 Alarms and warnings

- a) As to the persistent danger mentioned in this manual, affix the warning symbols in proper positions of the crane.
- b) Alarm symbols
 - 1) You can be injured if you do not obey the safety instructions as indicated on warning stickers.
 - 2) Ensure that safety instructions and warnings attached to the crane are always complete and perfectly legible.
 - 3) Keep warnings and instruction labels clean.
 - 4) Replace unreadable or missing labels with new ones before operating the crane. Make sure the replacement parts include warning or instruction labels where necessary.



- (1) Follow the warnings and instructions for the sake of personal safety.
- (2) For the position of warnings and instruction labels, please see chapter 3 "Safety Guidelines".

1.2 Safety tips

1.2.1 Safety precautions

- a) Do not use this equipment with guards removed or incorrectly fastened.
- b) Do not use this equipment with safety devices maladjusted or removed.

1.2.2 Precautions for operator safety

- a) Safety component – crane emergency stop button. Ensure all safety components are in place.
- b) Support plates, handrails, tread plates and fixed guards are provided to assist the personnel to climb on the crane.

1.3 Environmental safety

- a) A regular service should be taken on the crane strictly in accordance with maintenance procedures to ensure that engine emission is close to a minimum value.
- b) Consumable materials
 - 1) Diesel spillages must be dealt with immediately.
 - 2) Only use the lubricating oil recommended in the maintenance manual.
 - 3) Local regulations must be observed strictly when disposing of waste.
 - 4) Improper disposal of waste will affect the ecological environment, which is also illegal.
 - 5) Potentially harmful waste used on this crane includes such items as hydraulic oil, fuel, coolant, filters and batteries, etc.
 - 6) Use leak-proof containers for draining fluids. Do not use food or beverage containers that may mislead someone into drinking or eating them.
 - 7) Do not pour waste into the ground, into sewer system or into any water source.
 - 8) Ensure that all consumable and replaced parts are disposed of safely and with minimum environmental impact.
- c) Machine disposal. This machine must only be disposed of by a special machine breaker.

1.4 Personnel protective equipment (PPE)

- a) Loose or baggy clothing can get caught in running machinery.
- b) Where possible when working close to engines or machinery, only do so when they are stopped. If this is not practical, remember to keep tools, test equipment and other tools that will enable parts of your body away from the moving parts.
- c) For reasons of safety, long hair must be tied back or otherwise secured. Garments must be close fitting and no jewellery such as rings may be worn.
- d) Correctly wear personnel protective equipment.
- e) Recommended personnel protective equipment includes:

- Hard hat
- Safety glasses/Goggles
- Hearing protection device
- Close fitting overalls
- Safety boots
- Industrial gloves
- High visibility vest or jacket

1.5 Organizational safety measures

- a) The crane must only be operated by a suitably qualified operator who holds a current license in line with construction site or international legislation.
- b) Understand the service procedure before doing work. Keep working area clean and dry.
- c) Never lubricate, clean or adjust crane while it is moving (excluding central lubrication).
- d) Keep hands, feet and clothing clear of power driven parts or running nip-points.
- e) Keep all parts in good condition. Ensure that all parts are properly installed. Fix damage immediately. Replace worn and broken parts. Remove grease, oil and debris in time.
- f) Disconnect battery ground cable and power supply before making adjustments on electrical systems.
- g) Disconnect battery ground cable, switch off the engine and unplug all plugs of controllers before welding on machine.
- h) During maintenance only use the correct tool for the job.
- i) Never make any modifications, additions or changes which might affect safety without the manufacturer's approval.
- j) In the event of safety relevant modifications or changes in the behavior of the machine during operation, stop the machine, lock it immediately and report the malfunction to the relevant authority / person.

1.6 Personnel qualification, requirements and responsibilities

- a) Any work on and / or with the crane must be executed by trained, reliable and authorized personnel only.
- b) Maintenance work must only be undertaken by suitable qualified engineers with specialist knowledge of this crane.
- c) Work on the hydraulic system must be carried out only by personnel with special knowledge and experience of hydraulic equipment.

1.7 Safety advice regarding specific operation phases

- a) Standard operation
 - 1) Take necessary precautions to ensure that the crane is used in a safe and reliable state.
 - 2) This crane is a conventional assembly & dismantling machine. Do not apply the crane for other purpose. Operate the crane only for its designed purpose and only if all guarding, protective and safety-orientated devices, emergency shut-off equipment, sound proofing element and exhausts, are in place and fully functional.
 - 3) Ensure that any local barriers erected to stop unauthorized entry to this equipment are in place.
 - 4) Before starting the engine, ensure it is safe to do so.
- b) Malfunction

In the event of any malfunction or operational difficulty, stop the crane immediately.
- c) Unguarded areas
 - 1) In-running nip points on moving machinery can cause serious injury or even death.
 - 2) Do not reach into unguarded machinery. Your arm could be pulled in and amputated.
 - 3) Stop the crane before removing any safety devices or guarding devices.
 - 4) Limit access to the machine and its surrounding where barrier guards are appropriately erected to reduce the risk of potential mechanical hazards, such as falling lifted loads.

1.8 Special Hazards

1.8.1 Electrical power

- a) External considerations and hazards

When working with the crane, maintain a safe distance from the overhead electric lines. If overhead lines are in the immediate vicinity, a risk assessment must be completed prior to operating this crane.

If your machine comes into contact with a live wire:

 - Vacate the area
 - Warn others against approaching and touching the crane.
 - Report the incident and have the live wire de-energized.
- b) Machine – Electrical
 - The electrical equipment of the crane must be inspected at regular intervals. Defects such as loose connections, scorched or otherwise damaged cables must be rectified immediately.
 - Use only original fuses with the specified current rating.
 - Switch off the machine immediately if trouble occurs in the electrical system.

- This crane is wired on a negative earth. Always observe correct polarity.
- c) Battery
 - Always disconnect battery leads before carrying out any maintenance to the electrical system.
 - Recharge the battery in a well ventilated area.
 - The battery contains sulphuric acid, an electrolyte which can cause severe burns and produce explosive gases. Avoid contact with the skin, eyes or clothing.
 - No smoking when maintaining battery.
 - Wear appropriate PPE.

1.8.2 Gas, dust, steam, smoke and noise

- a) Always operate internal combustion engines out of doors or in a well ventilated area.
- b) If a crane is operated for maintenance purposes in an enclosed area, ensure that there is sufficient ventilation.
- c) Observe the rules and regulations at different working sites.
- d) Dust found on the crane or produced during work on the crane must not be removed by blowing with compressed air.
- e) Toxic dust / waste must only be handled by authorized persons, dampened, placed in a sealed container and marked, to ensure safe disposal.

1.8.3 Welding or naked flames

- a) Welding, flame cutting and grinding work on the crane must only be carried out if this has been expressly authorized, as there may be a risk of explosion and fire.
- b) No welding that will affect its structural integrity should be undertaken on this crane.
- c) Avoid all naked flames in the vicinity of this crane.
- d) Only when a fire extinguisher with a specification of no less than 10BC is equipped in the operator's cab, can the crane work.

1.8.4 Hydraulic equipment

- a) Work on hydraulic system must be carried out by persons having special knowledge and experience of hydraulic system.
- b) Check all lines, hoses and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Sprayed oil may cause personal injury and fire.
- c) Always relieve pressure from the hydraulic system before carrying out any kind of maintenance or adjustment work.
- d) Depressurize all system components and pressure pipes (such as hydraulic system, compressed air system) to be removed in accordance with the specific instructions for the unit concerned before carrying out any repair work.

- e) Hydraulic lines and compressed air lines must be laid and fitted properly. Ensure that no connections are interchanged. The fittings, lengths and quality of the hoses must comply with the technical requirements.
- f) Only fit replacement components of a type provided by the manufacturer.
- g) Always keep hydraulic elements clean.
- h) Hydraulic fluid under pressure can penetrate the skin and cause serious injury.
- i) Once the fluid is injected under/into the skin, seek medical help immediately.



Operator's Manual for Crawler Crane

Chapter 2 Description of Crane



Chapter 2 Description of Crane

2.1 Product model

2.1.1 Product name plate and its position

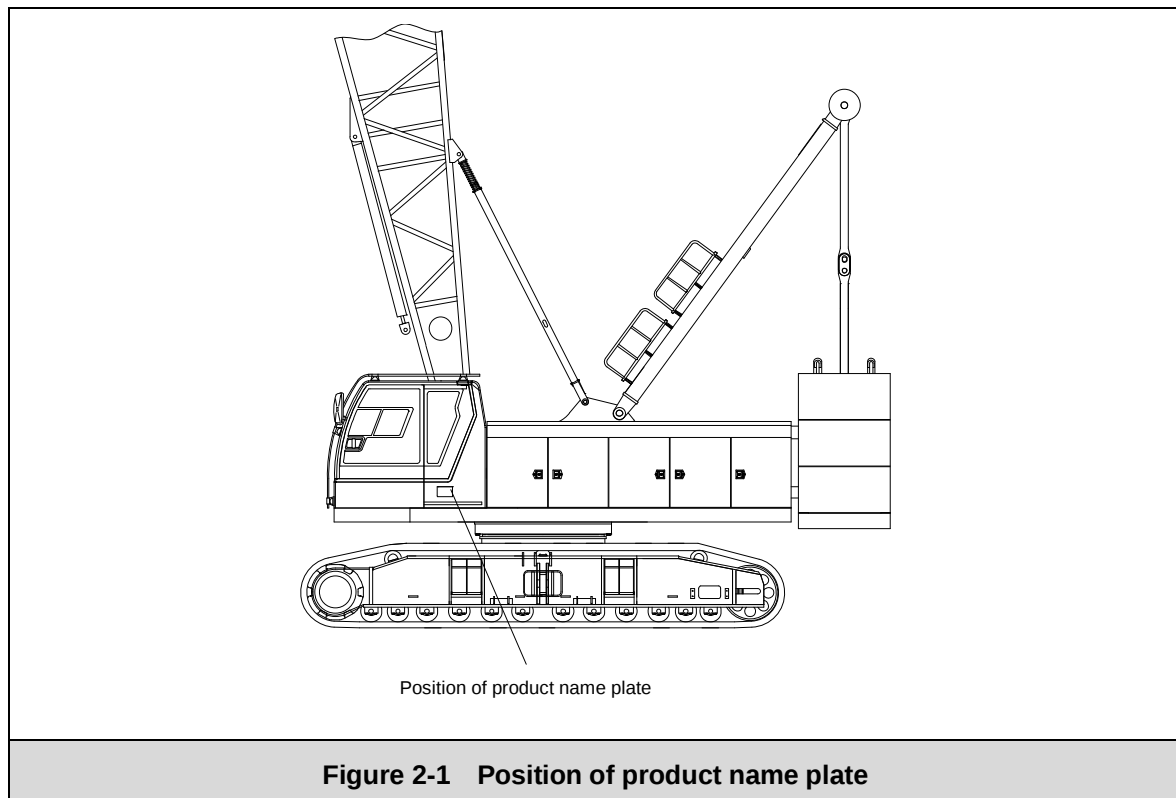


Figure 2-1 Position of product name plate

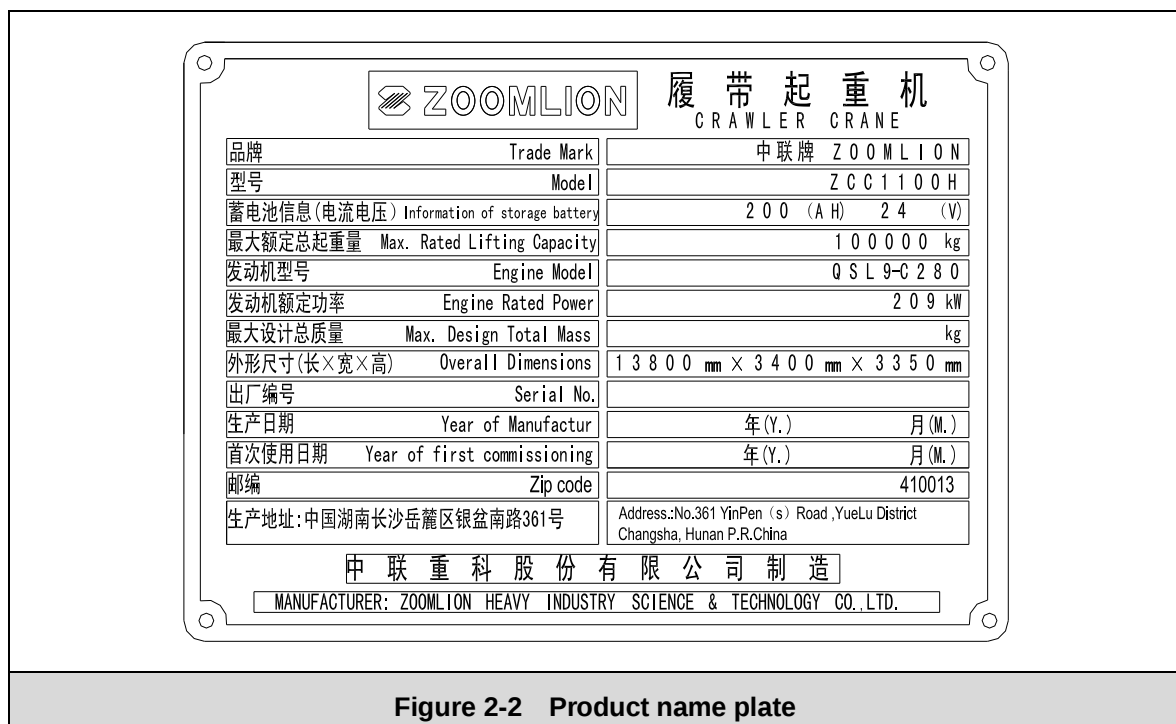


Figure 2-2 Product name plate

2.1.2 Engine type and its manufacturer

QSL9-C 280, American Cummins (Imported)

2.1.3 Intended use of the crane

This crawler crane is designed for lifting loads!

It is prohibited to transport people with this equipment! In many cases, there have been serious injuries when people have been transported using this equipment (or even on the hook or on loads). Under such circumstances, they have no control over the crane movements and are not protected against bumps or falls. Even the smallest error can cause vital injury! In exceptional cases, please consult the responsible authorities concerning safety regulations.

It is expressly forbidden to use the crane for jumps with rubber ropes (bungee jumping)! Using the crane for such jumps represents a misuse of the crane and entails extreme danger for life and limb!

The crane is designed exclusively for assembly operation, i.e. lifting loads, non-continuous use of crane. Any other type of use or otherwise use which goes beyond its limits specified, such as handling of general cargo or grab operation, are not classified as intended use. The manufacturer shall not be liable for any damage caused. The operator bears full responsibility for this type of misuse.

The use of two hoisting winches for lifting loads (twin hook operation) is only permitted following consultation with the crane manufacturer.

The intended use also includes the observation of *Operator's Manual* and *Maintenance Manual*.

2.1.4 Classification of the crane

2.1.4.1 General

The crane has been constructed using state of the art technology and in accordance with recognized safety regulations. Nevertheless, its use can lead to hazards for the life and limb of the operator and third parties, and/or damage to the machine and other objects.

Use the crane only when it is in full working order and only for its intended use, paying attention at all times to safety and potential hazards, and in observance of the *Operator's Manual* and *Maintenance Manual*.



Have any malfunctions which might impair safety rectified immediately.

2.1.4.2 Classification of the crane

The crane group of the crane is A1, operating class is U2 and the load collective class is Q1. All important components of the crane are designed and manufactured for normal assembly operation. Operating conditions or types of use other than assembly operation require the permission of the manufacturer and normally lead to a reduction in the lifting capacities. Otherwise, the life of the crane will reduce. The classification of various mechanisms is shown in table 2-1.

Table 2-1 Classification of various mechanisms

No.	Working mechanism	Operating class	Load collective class	Crane group
1	Hoisting winch	T3/T5	L2/L3	M4/M6
2	Slewing mechanism	T2	L2	M2
3	Derricking mechanism	T2	L2	M2
4	Travel gear	T2	L1	M1

Note:

Among hoisting winches, the group of winch with free-fall function is M6, and group of normal winch is M4.

2.1.4.3 Service life

Classification of the crane is based on a total operating life (service life) of 20 years under the following conditions:

- The crane is operated as an assembly crane. The load capacity charts specified for the crane are for assembly operation only. General cargo handling or grab operation can only be permitted following express permission from the manufacturer under suitable conditions.
- The entire number of the crane's load cycles
A "load cycle" encompasses processes which begin when a load is lifted and end when the crane is ready to lift the next load, including the time of crane operation and normal break. The entire number of the crane's load cycles with operating class U2 is 32000 – 63000 (for example: 8 – 20 strokes / day on 200 days / year).
- The load collective class of the crane
The load spectrum coefficient of the crane with load collective class Q1 $K_p \leq 0.125$ (lift the rated load rarely, but the medium-duty load frequently), the calculation of load spectrum coefficient is expressed as follows:

$$K_p = \sum \left[\frac{C_i}{C_T} \left(\frac{P_{Qi}}{P_{Q\max}} \right)^3 \right]$$

Where,

P_{Qi} is the i value appearing in the whole service life of the crane.

$P_{Q_{max}}$ is the max. load value appearing in the crane's entire service life.

C_i is the crane's load cycles corresponding to P_{Qi} load in the crane's entire service life.

C_T is the entire number of the crane's load cycles in the crane's service life.

The examples of load spectrum coefficient are as follows:

10% of crane's load cycles in the crane's entire service life is under the maximum load.

40% of crane's load cycles in the crane's entire service life is under 40% of the maximum load.

50% of crane's load cycles in the crane's entire service life is under 10% of the maximum load.

"Load" is to be understood in this connection as the sum total of load, load handling devices and lifting tackle (e.g.: load + load hook + sling rope).

Under these circumstances, assuming that maintenance work is carried out properly, the theoretical service life can be more than 20 years. Harder operating conditions lead to a reduction in the service life.

If the user uses the crane according to other operating class and load collective class, the corresponding entire number of crane's load cycles and load spectrum coefficient are adjusted, which result in a change of crane service life.



Some components (for example, wire rope, pulley and bearing) are not designed for the entire service life of the crane, but must be replaced after a certain amount of time.

2.2 Terminology

2.2.1 Crane modes

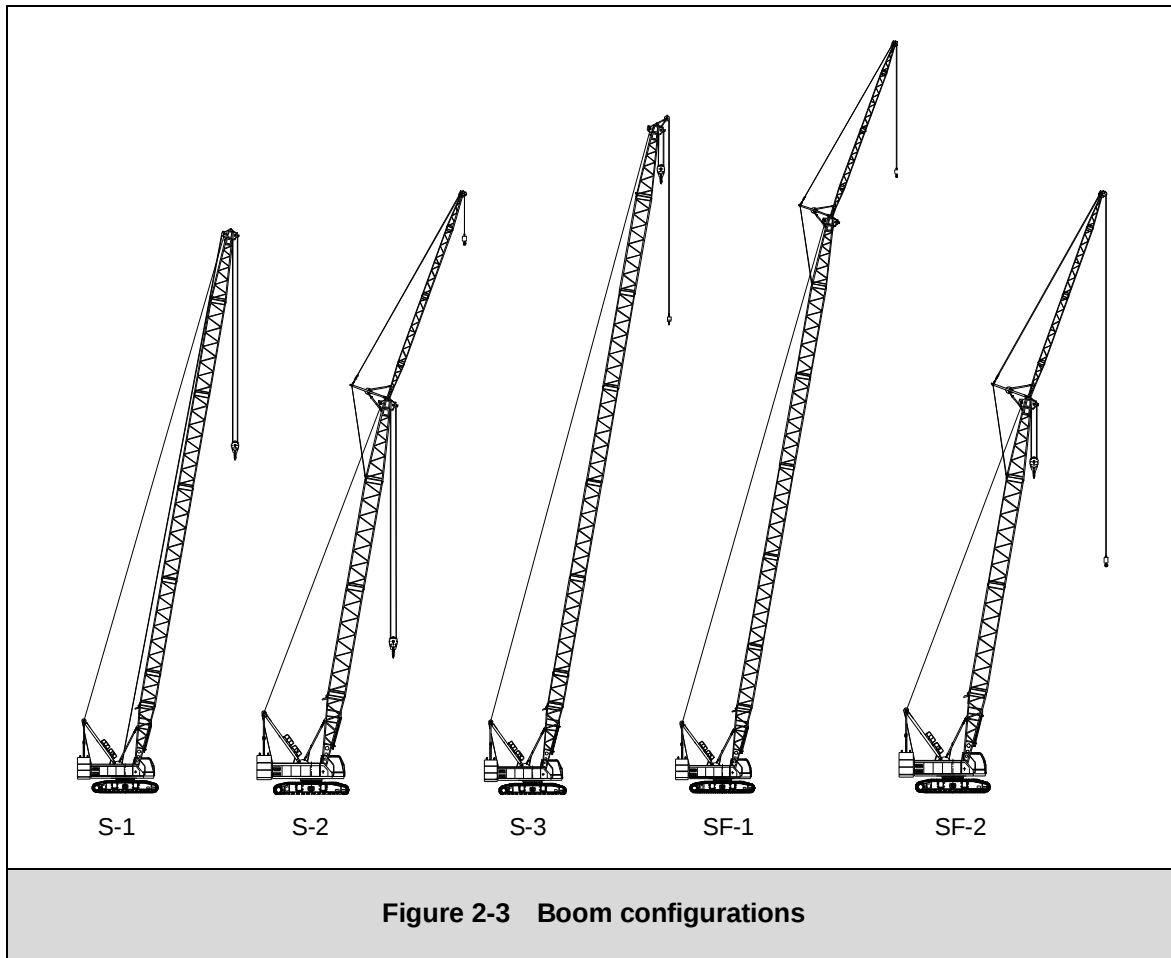
2.2.1.1 Working mode

The boom configurations of ZCC1100H crawler crane in working mode are shown in the table 2-2.

Table 2-2 Boom configurations of ZCC1100H crawler crane in working mode

Configuration no.	Description	Length of main boom	Length of fixed jib	Remarks
S-1	Main boom	42'8"(13m)-219'10"(67m)	No	The load is attached onto main boom.
S-2	Main boom with fixed jib	101'9"(31m)-180'5"(55m)	19'8"(6m)-59'(18m)	The load is attached onto main boom.
S-3	Main boom with tip boom	42'8"(13m)-200'2"(61m)	No	
SF-1	Main boom with fixed jib	101'9"(31m)-180'5"(55m)	19'8"(6m)-59'(18m)	The load is attached onto fixed jib.
SF-2	Main boom with fixed jib	101'9"(31m)-180'5"(55m)	19'8"(6m)-59'(18m)	Main boom is attached with a load hook. However, the load is attached onto fixed jib.

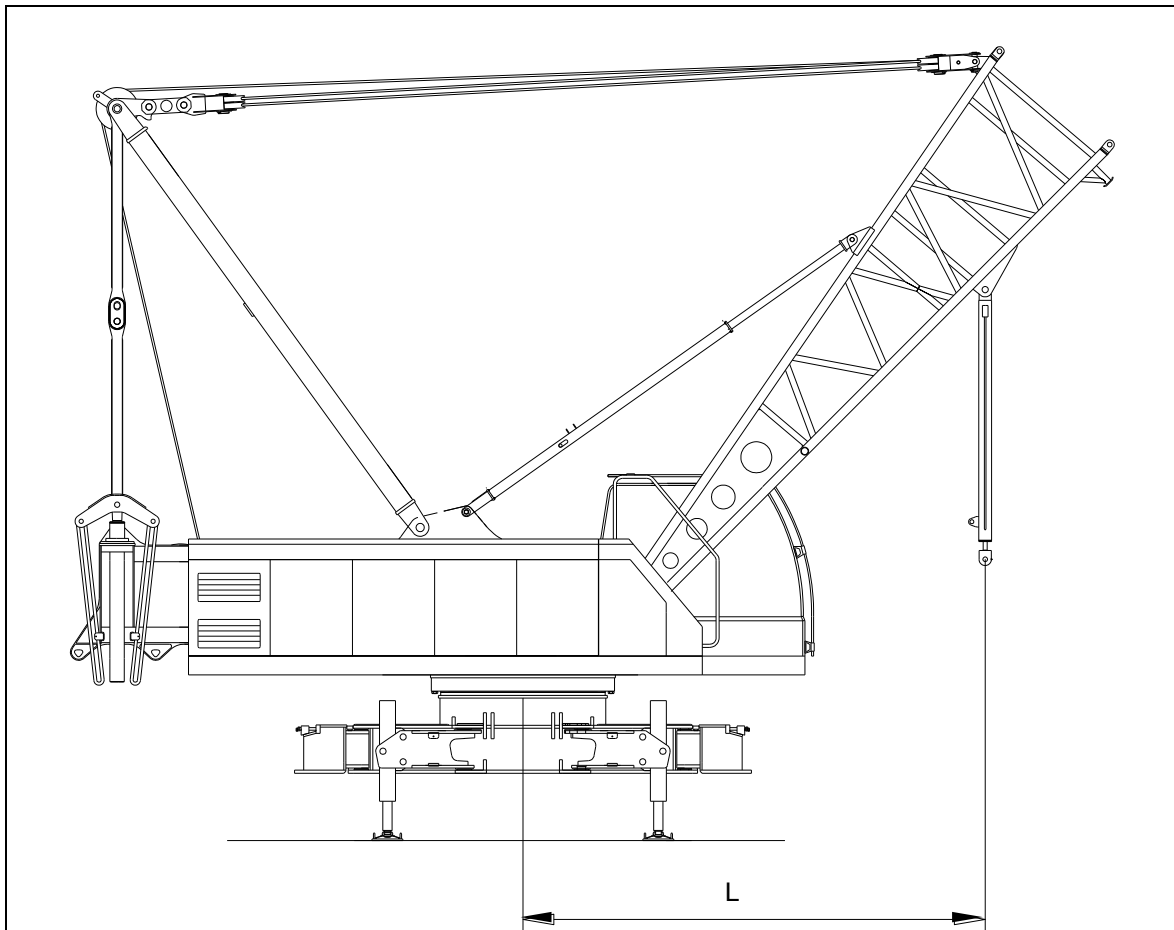
The boom configurations are shown in the figure 2-3.



It's prohibited to lift a load by use of two hooks (twin hook operation) without the permission of the manufacturer under the boom configurations S-2, S-3, SF-2, otherwise, the crane may topple over.

2.2.1.2 Assembly mode

There exists an assembly mode for ZCC1100H crawler crane, which is used for crane self-assembly and dismantling during crane conversion. During crane self-assembly and dismantling operation, mounting cylinder is used to lift a load. The maximum lifting capacity of mounting cylinder is 26460lb (12t). The assembly mode of crane is shown in figure 2-4, however, when the crane is attached with crawler carriers, the mounting cylinder can also be used to lift a load. At this time, the assembly mode in load moment limiter is SA.



Note: L is the working radius in assembly mode.

Figure 2-4 Assembly mode

! CAUTION

Whenever using mounting cylinder on the boom to lift the load, be sure to make the crane in assembly mode.

According to actual requirements, there are five working modes and an assembly mode available for this crawler crane. For the details, please refer to relevant documents of load moment limiter.

2.2.2 Description of main components

2.2.2.1 Components on superstructure

The positions of components on slewing table are shown in the figure 2-5, and the description of components is shown in the table 2-3.

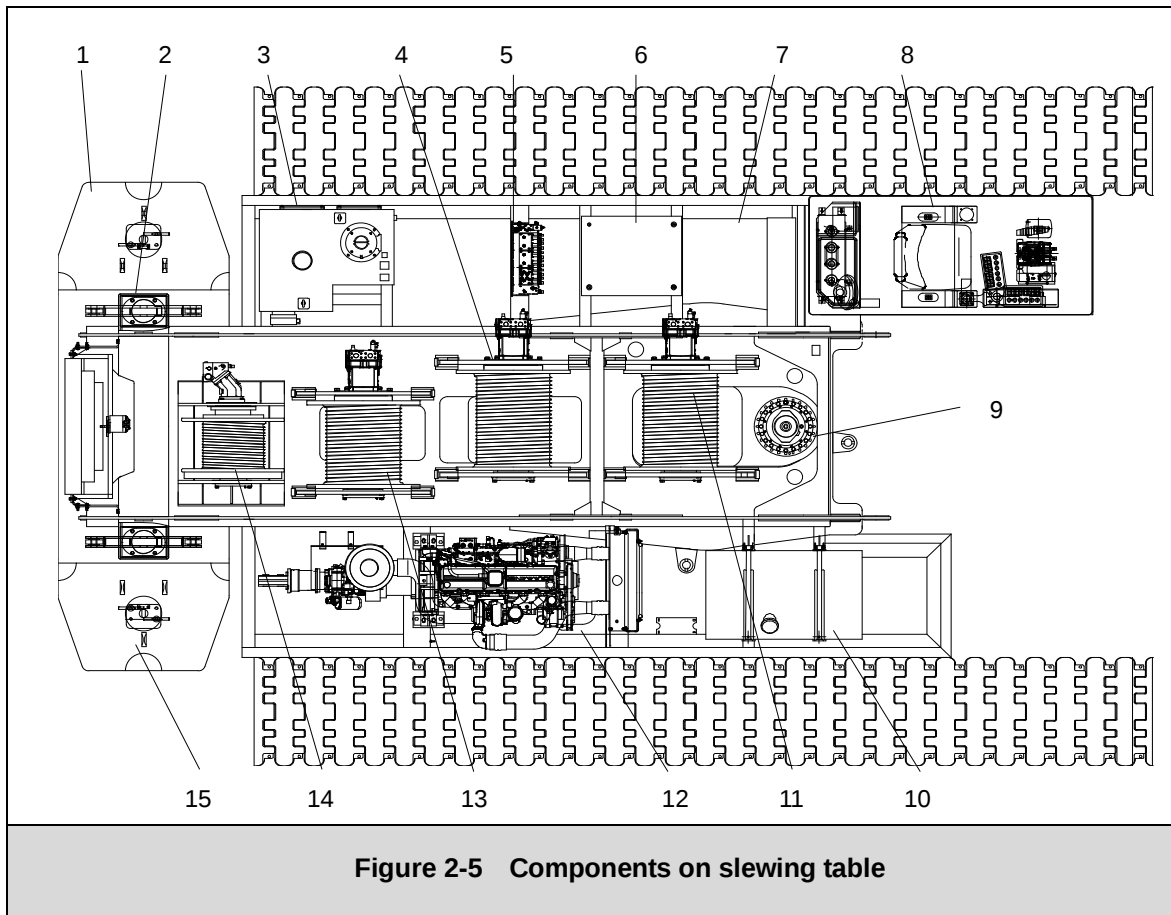


Figure 2-5 Components on slewing table

Table 2-3 Description of components on slewing table

No.	Names of the components	No	Names of the components
1	Rear counterweight	9	Slewing mechanism
2	Counterweight lifting cylinder	10	Fuel tank
3	Hydraulic oil tank	11	Hoisting winch 1
4	Hoisting winch 2	12	Engine
5	Main valve	13	Hoisting winch 3 (optional)
6	Battery box	14	Derricking winch
7	Tool box	15	Counterweight assembly
8	Operator's cab		

2.2.2.2 Components on undercarriage

The positions of components on undercarriage are shown in the figure 2-6, and the description of components is shown in the table 2-4.

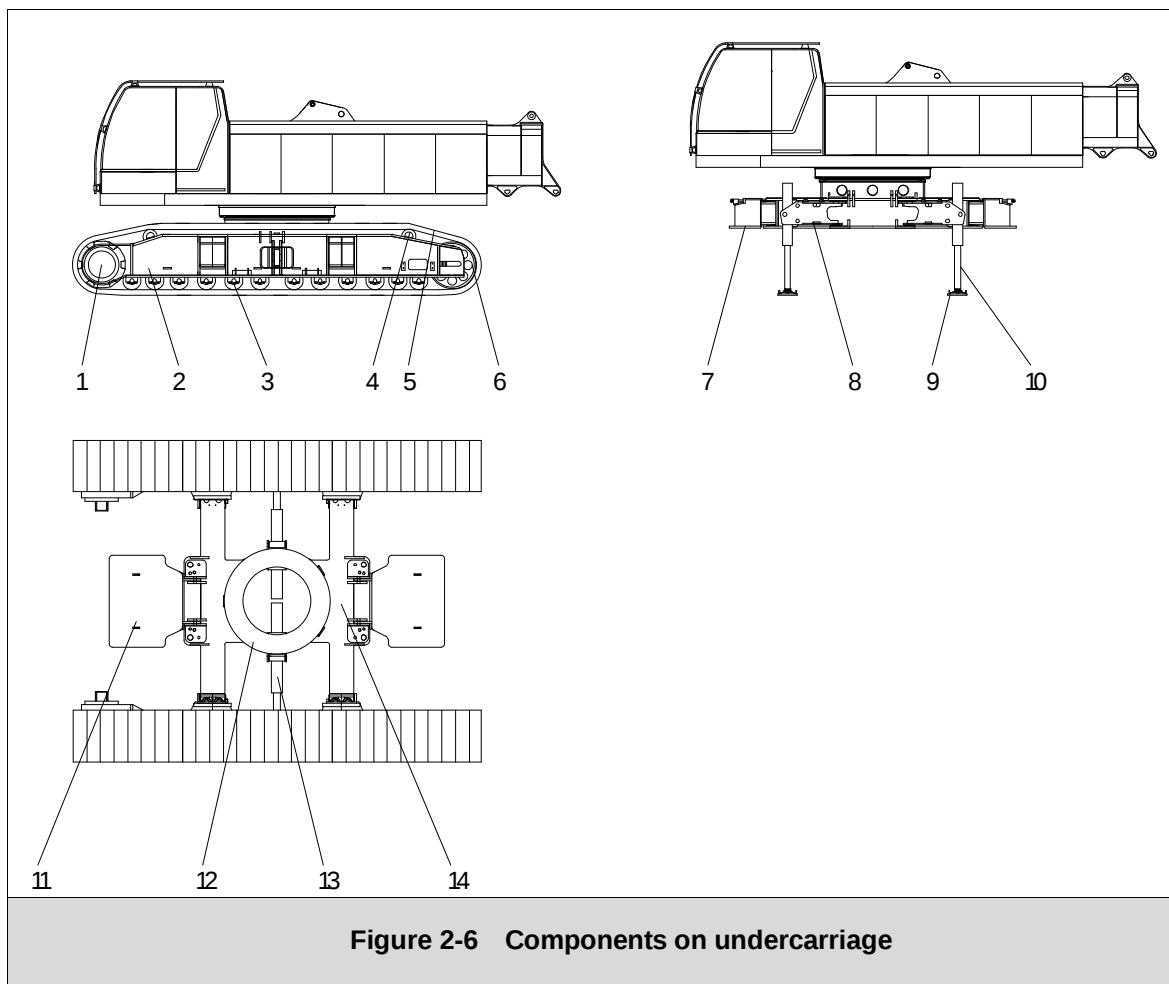


Figure 2-6 Components on undercarriage

Table 2-4 Description of components on undercarriage

No.	Names of the components	No	Names of the components
1	Drive sprocket	8	Vertical support (optional)
2	Crawler carrier	9	Support plate (optional)
3	Track roller	10	Support cylinder (optional)
4	Track carrier roller	11	Central counterweight
5	Track pad	12	Undercarriage central section
6	Driven sprocket	13	Horizontal cylinder
7	Folding bracket	14	Undercarriage control lever

2.3 Product description

2.3.1 Crane working environment

Working temperature: -20°C -40°C

Allowed air relative humidity: 85% (100% is allowed for a short period of time)

Allowed in-service wind speed: 9.8mps

Allowed out-of-service wind speed: 13.8mps

2.3.2 Crawler travel gear

Travel gear

Adopt flat track pad; crawler width: 2'7" (0.8m); distance between track center: 13'9" (4.2m).

Travel drive

The crawlers are driven independently through hydraulic motor and planetary reducer. Such traveling moments are available as traveling straight ahead/ backwards, turning on the spot.

Drive performance

Infinitely variable speed from (0-0.78) mph (0-1.25kmph)

2.3.3 Crane superstructure

Slewing table

Self-manufactured and high-rigid welded structure of high-stiffness structural steel; connected to undercarriage via a single-row roller four-point connecting slewing ring for 360° continuous rotation.

Crane engine

6-cylinder diesel engine, manufactured by Cummins, type QSL9-C280, rated power 280 HP (209 KW) at 2100 rpm; maximum torque 1050 Lb·ft (1424 N.m) at 1500 rpm



The rated output power of the engine at a height above sea level 7872' (2400m) or below will not be reduced, but it will be reduced if the altitude is higher than 7872' (2400m). For details, please consult the local service provider of the engine or technological department of crawler crane of Zoomlion.

Crane drive

The driving force is supplied by diesel engine, and it is transmitted by a coupling to

- A piston variable pump, which provides oil for travel gear and winches;
- A piston variable pump, which provides oil for slewing mechanism;
- A constant-pressure piston variable pump, which provides oil for auxiliary mechanism;
- A gear pump, which provides oil for oil cooler motor;
- A gear pump, which provides oil for control system.

Crane control

CAN bus technology connecting engine, PLC controller and digital display; All motions are controlled by two 4-way control levers

Crane winches

Both hoisting winches and derricking winch, are hydraulically driven by axial piston variable displacement pump and planetary gear with spring loaded multi-disc brake

Slewing mechanism

Hydraulically powered by axial piston variable displacement pump and planetary gear with spring-loaded multi-disc brake;

Infinitely variable speed from 0 to 2.3 rpm

Counterweight

61740 lb (28 t) in total;

The counterweight is attached symmetrically to the rear of the superstructure.

Crane operator's cab

All-steel construction cab with safety glass;

Fitted with operator's seat, control and operating instruments

Safety equipment

Angle indicator, load moment limiter, hoisting limiter, support cylinder locking device, safety valves, derricking limiter and so on

Electrical system

24v DC, negative ground

2.3.4 Overall dimensions

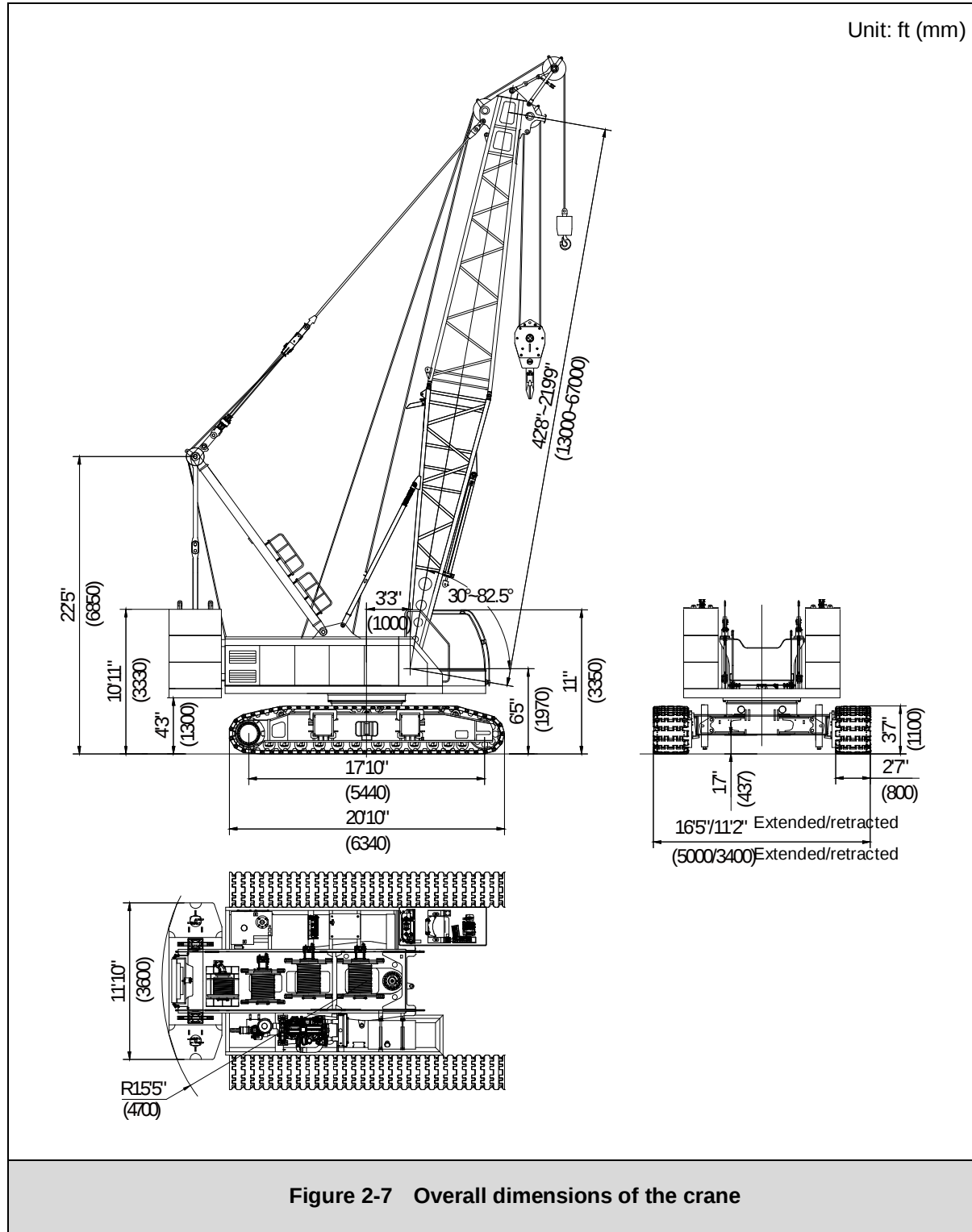


Figure 2-7 Overall dimensions of the crane

2.4 Technical data

2.4.1 Main technical parameter

Table 2-5 Technical parameter of ZCC1100H crawler crane

Item		Unit	Value	Remarks
Max. lifting capacity/radius		US Tons / ft (t/m)	110/10'6" (100/3.2)	
Max. lifting capacity of fixed jib		US Tons (t)	8.8 (8)	
Length of main boom		ft (m)	42'8"-219'10" (13-67)	
Length of fixed jib		ft (m)	19'8"-59' (6-18)	
Max. length of main boom with fixed jib		ft (m)	180'5"+59' (55+18)	
Main boom angle		°	30-82.5	
Fixed jib angle		°	10, 30	
Rope speed of hoisting winches 1 and 2/	With free-fall function	ft/min (m/min)	374 (114)	On the 6 th rope layer
	Without free-fall function	ft/min (m/min)	425 (129)	On the 5 th rope layer
Single rope speed of derricking winch		ft/min (m/min)	190 (58)	On the 4 th rope layer
Max./rated single rope force of hoisting winches 1 and 2	With free-fall function	Lbs (t)	44100/29988 (20/13.6)	On the 1 st rope layer
	Without free-fall function	Lbs (t)	24255/22050 (11/10)	On the 4 th rope layer
Max. single rope force of derricking winch		Lbs (t)	15656 (7.1)	On the 1 st rope layer
Slewing speed		r/min	0-2.3	
Travelling speed (high/low speed)		mph (km/h)	0.78/0.31 (1.25/0.5)	
Gradeability		% (°)	30% (16.7°)	
Max. transport weight of basic machine		Lbs (t)	99887 (45.3)	
Deadweight with basic boom		Lbs (t)	189630 (86)	

Item		Unit	Value	Remarks
Counterweight		Lbs (t)	61740 (28)	Rear Counterweight
			22050 (10)	Central counterweight
Slewing radius		ft (m)	15'5" (4.7)	
Overall dimensions (L×W×H) (m)		ft (m)	45'3"×11'2"×11' (13.8×3.4×3.35)	
Ground clearance of the undercarriage		ft (mm)	17" (437)	
Engine	Type		Cummins QSL9-280	
	Rated (max.) power	HP @ RPM (Kw @ RPM)	280 @ 2100 (209 @ 2100)	
	Torque	Lbs·ft @ RPM (N·m @ RPM)	1050 @ 1500 (1424 @ 1500)	
	Exhaust emission		According to U.S. EPA Tier 3	
Distance between track center × crawler contact length × crawler width		ft (m)	8'2"×17'10"×2'7" (2.5×5.44×0.8)	Crawler carrier retracted
			13'9"×17'10"×2'7" (4.2×5.44×0.8)	Crawler carrier extended

Note:

- (1) The max. single rope force mentioned in above table is not decided by the strength of wire rope. The rope speed and travelling speed of the crane are calculated on the basis of engine speed of 2100rpm.
- (2) Max. transport weight of basic machine in the table refers to the weight of basic machine whose hoisting winches 1 and 2 have free-fall functions.

2.4.2 Specification of load hook and selection of rope reeving

There are four types of load hooks available for ZCC1100H crawler crane. In actual operation, choose appropriate load hook according to the weight of load and the length of boom.

Table 2-6 Hook information

Specification of load hook (UST/t)	Number of pulleys	Maximum rope reeving	Weight of load hook (lbs/kg)
110/100	5	10	3352/1520
55/50	3	7	2712/1230
33/30	3	7	1720/780
8.8/8	No	1	595/270



The specification of load hook in above table is not the standard load hook configuration. It is subject to the contract signed with the customer.

2.4.3 Performance of wire rope and winch

2.4.3.1 Hoisting rope reeving

Under crane operation with main boom, maximum hoisting rope reevings for different boom lengths are shown in the table 2-7. When crane is working with fixed jib, the hoisting rope reeving is 1.

Table 2-7 Hoisting rope reeving and wire rope length in main boom configuration

Length of main boom ft(m)	Reeving	Length of wire rope needed ft(m)	Length of main boom ft(m)	Reeving	Length of wire rope needed ft(m)
42'8"(13)	10	541'2"(165)	141'2"(43)	3	600'2"(183)
52'6"(16)	10	646'2"(197)	150'11"(46)	3	636'4"(194)
62'4"(19)	9	685'6"(209)	160'10"(49)	3	675'8"(206)
72'3"(22)	8	705'2"(215)	170'8"(52)	3	715'(218)
82'(25)	7	708'6"(216)	180'5"(55)	2	570'8"(174)
91'11"(28)	6	688'9"(210)	190'4"(58)	2	600'2"(183)
101'9"(31)	5	652'8"(199)	200'2"(61)	2	629'9"(192)
111'6"(34)	5	711'9"(217)	210'(64)	2	659'3"(201)
121'5"(37)	4	646'2"(197)	219'10"(67)	2	688'9"(210)
131'3"(40)	4	695'4"(212)			



If the crane is working with hoisting rope reeving less than the value listed in the above table, single hoisting rope load and rope layers on the drum must be checked to make sure that they satisfy the rated single rope force in the tables 2-9, 2-10, and 2-12 in section 2.4.3.3.

2.4.3.2 Parameters of wire rope

Table 2-8 Parameters of wire rope

	Wire rope of hoisting winch 1	Wire rope of hoisting winch 2	Wire rope of derricking winch
Rope diameter (mm)	26	26	20
Rope length ft (m)	721'7"(220)	557'7"(170)	541'2"(165)
Type of rope	35(W)X7-26-S-left-hand ordinary lay-1960	35(W)X7-26-S-left-hand ordinary lay-1960	6X29Fi+IWR-20-right-hand lang-lay-1910

Note:

If hoisting winch 3 is mounted, its wire rope type will be the same with that of hoisting winch 2.

2.4.3.3 Parameters of winches

The tables 2-9 to 2-12 show the performance parameters of hoisting winch 1, hoisting winch 2, derricking winch and hoisting winch 3. The maximum single rope force is not determined by the strength of the wire rope. The speed in the table refers to the wire rope speed.

Table 2-9 Parameters of hoisting winches 1 and 2 with free-fall function

Working layer of wire rope	Maximum single rope force kips (t)	Rated single rope force kips (t)	Winch speed with max. load ft/min (m/min)	Winch speed without a load ft/min (m/min)	Permissible length of wire ropes on each layer ft (m)
1	44.1 (20)	30 (13.6)	82 (25)	255 (78)	126 (38.6)
2	40.3 (18.3)	27.5 (12.5)	88 (27)	278 (85)	138 (42.1)
3	37.2 (16.9)	25.5 (11.6)	95 (29)	301 (92)	149 (45.6)
4	34.6 (15.7)	23.8 (10.8)	98 (30)	324 (99)	160 (49.0)
5	32.4 (14.7)	22.2 (10.1)	104 (32)	347 (106)	172 (52.5)
6	30.4 (13.8)	20.9 (9.5)	111 (34)	373 (114)	183 (55.9)

Table 2-10 Parameters for hoisting winches 1 and 2 without free-fall function

Working layer of wire rope	Maximum single rope force kips (t)	Rated single rope force kips (t)	Winch speed with max. load ft/min (m/min)	Winch speed without a load ft/min (m/min)	Permissible length of wire ropes on each layer ft (m)
1	31.3 (14.2)	27.3 (12.4)	108 (33)	305 (93)	135 (41)
2	28.4 (12.9)	25.7 (11.7)	114 (35)	334 (102)	148 (45)
3	26.3 (11.9)	23.8 (10.8)	124 (38)	364 (111)	161 (49)
4	24.2 (11)	22 (10)	131 (40)	393 (120)	174 (53)
5	22.4 (10.2)	20.5 (9.3)	141 (43)	423 (129)	187 (57)

Table 2-11 Parameters of derricking winch

Working layer of wire rope	Maximum single rope force kips (t)	Rated single rope force kips (t)	Winch speed with max. load ft/min (m/min)	Permissible length of wire ropes on each layer ft (m)
1	15.6 (7.1)	15.6 (7.1)	147 (45)	72 (22)
2	14.3 (6.5)	14.3 (6.5)	160 (49)	79 (24)
3	13.2 (6)	13.2 (6)	173 (53)	85 (26)
4	12.3 (5.6)	12.3 (5.6)	190 (58)	92 (28)
5	11.4 (5.2)	11.4 (5.2)	203 (62)	99 (30)
6	10.8 (4.9)	10.8 (4.9)	216 (66)	105 (32)

Table 2-12 Parameters of hoisting winch 3 (optional)

Working layer of wire rope	Maximum single rope force kips (t)	Rated single rope force kips (t)	Winch speed with max. load ft/min (m/min)	Winch speed without a load ft/min (m/min)	Permissible length of wire ropes on each layer ft (m)
1	28.4 (12.9)	24.2 (11)	108 (33)	308 (94)	118 (36)
2	26.2 (11.9)	22.2 (10.1)	114 (35)	337 (103)	131 (40)
3	24.2 (11)	20.7 (9.4)	124 (38)	364 (111)	141 (43)
4	22.4 (10.2)	19.1 (8.7)	131 (40)	393 (120)	150 (46)
5	20.9 (9.5)	17.8 (8.1)	141 (43)	419 (128)	164 (50)



WARNING

If rated single rope force on the corresponding layer is exceeded, the service life of winch reducer will reduce obviously.

2.4.4 Lifting height

2.4.4.1 Lifting height on main boom

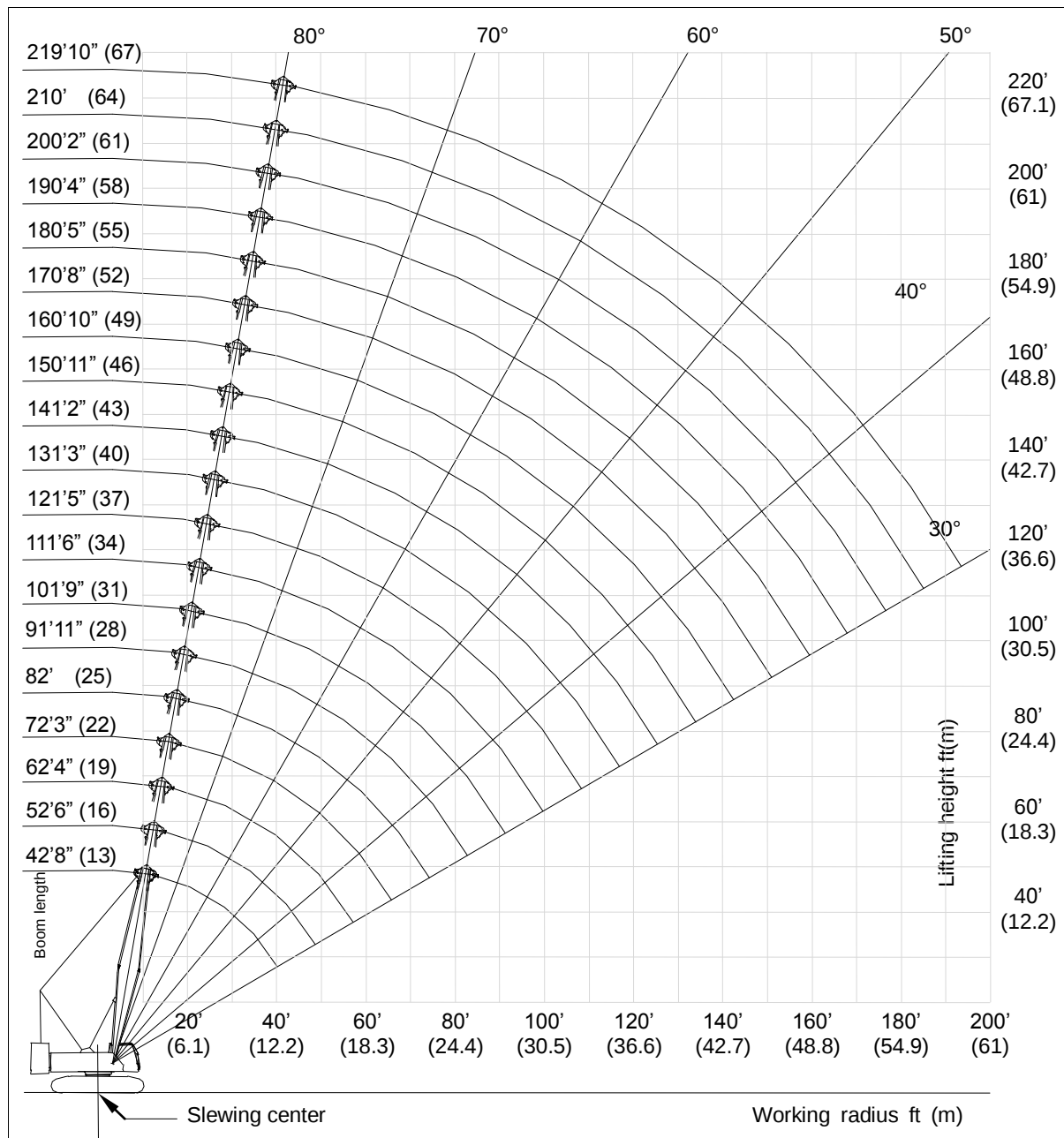
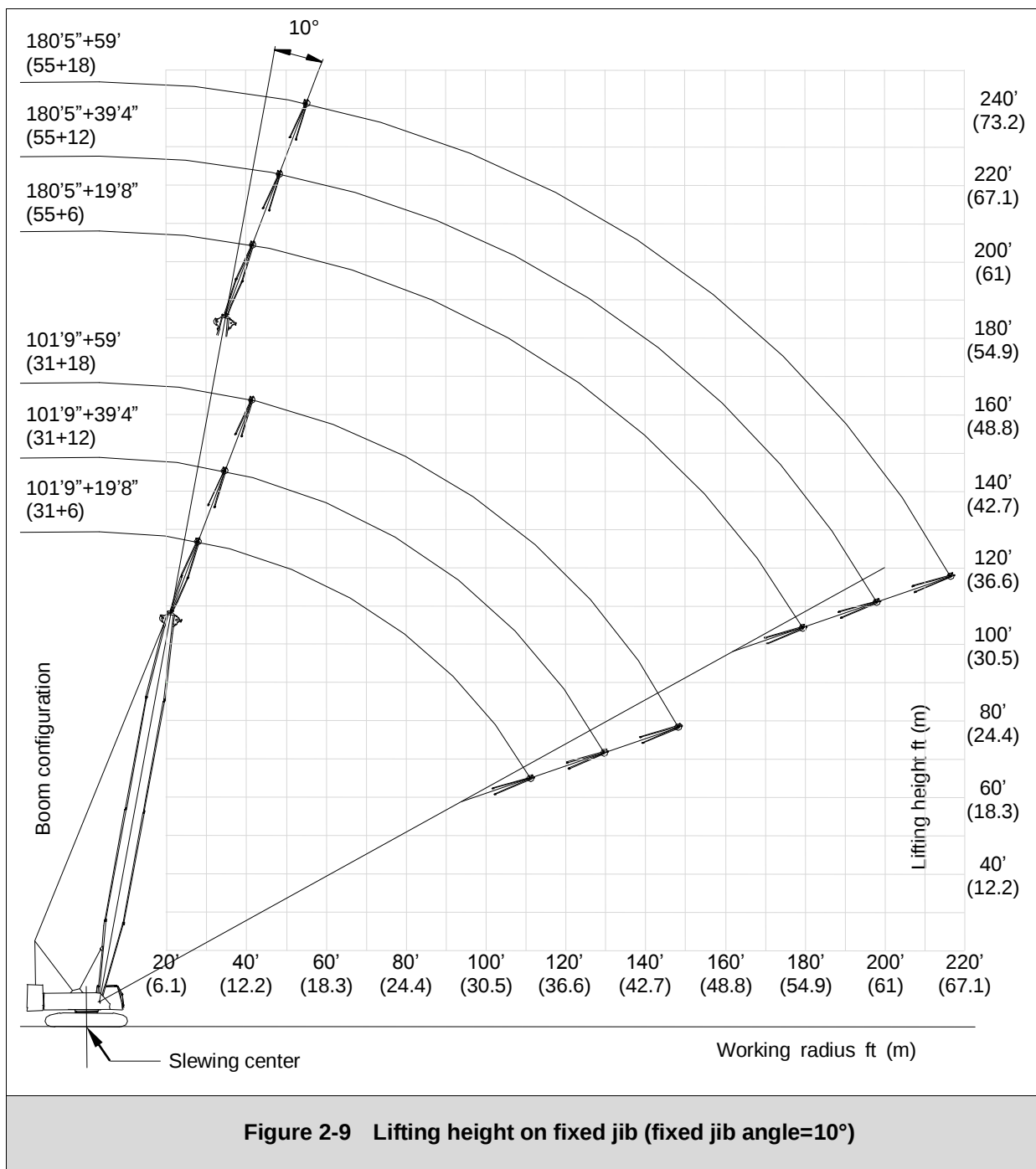


Figure 2-8 Lifting height on main boom

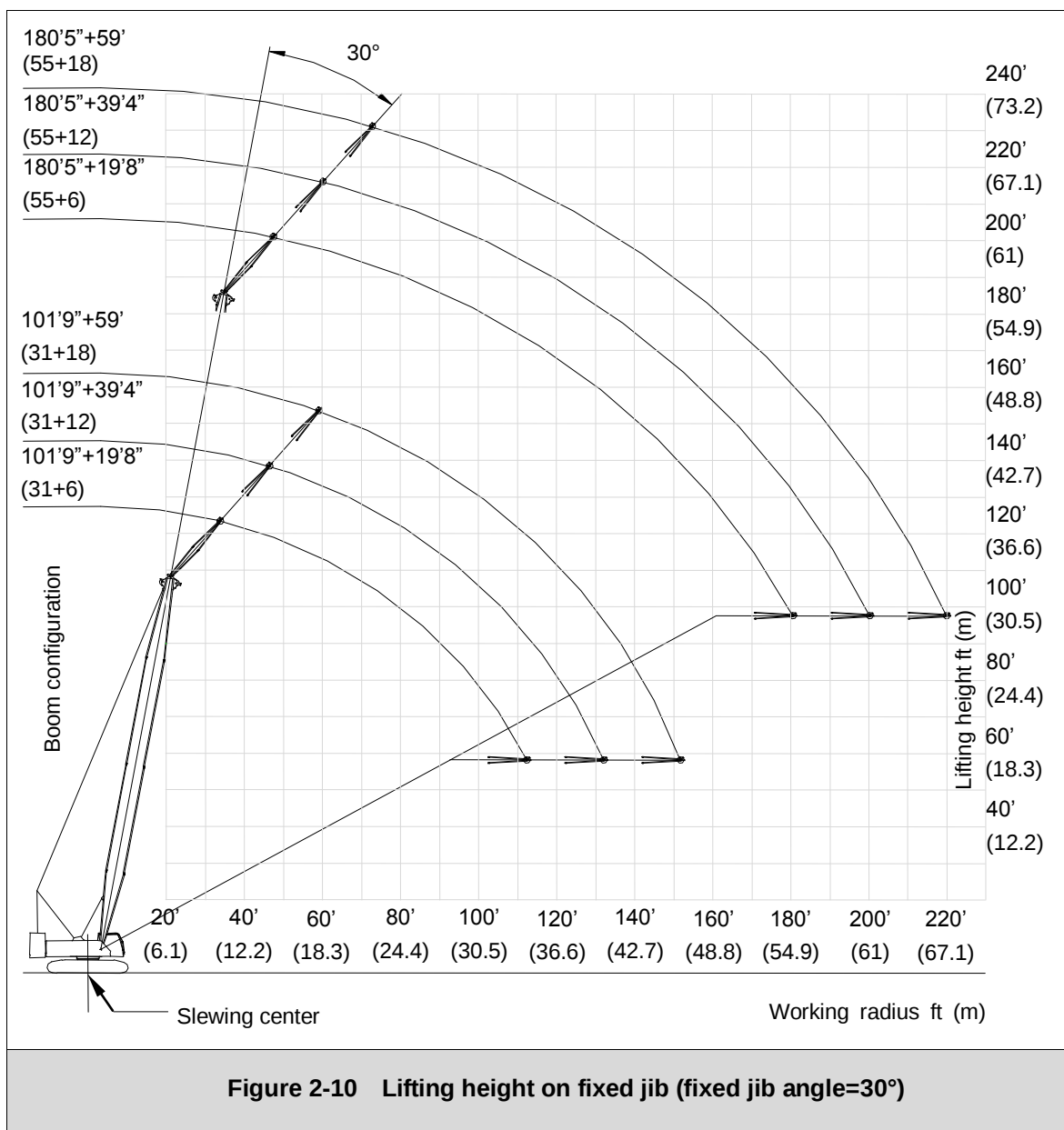


- (1) The X-axis indicates the working radius in ft(m), and the Y-axis indicates the lifting height in ft(m).
- (2) The boom lifting height curve is drawn without considering boom deflection.

2.4.4.2 Lifting height on fixed jib



- (1) The X-axis indicates the working radius in ft (m), and the Y-axis indicates the lifting height in ft (m).
- (2) The boom lifting height curve is drawn without considering boom deflection.



CAUTION

- (1) The X-axis indicates the working radius in ft (m), and the Y-axis indicates the lifting height in ft (m).
- (2) The boom lifting height curve is drawn without considering boom deflection.

2.4.5 Lifting capacity chart

2.4.5.1 Lifting capacity on main boom

- a) The value given in the lifting capacity chart is the permissible maximum lifting capacity, which is obtained from the calculation when the load is suspended (according to the standard ASME/ANSI B30.5). The value can not exceed 75% of the overturning lifting capacity when the crane is on firm and flat ground.
- b) The value mentioned in the chart is the lifting capacity when the crane is working with 61740Lbs (28t) rear counterweight and 22050lbs (10t) central counterweight in 360° range. The crawler carriers of the crane are extended completely.
- c) The sign “*/*” in the chart indicates “lifting capacity/radius”.

Table 2-13 Lifting capacity on S-1 boom

Unit: kip (ton)

Radius ft(m)	Main boom length ft(m)									Radius ft(m)
	42'8" (13)	52'6" (16)	62'4" (19)	72'3" (22)	82' (25)	91'11" (28)	101'9" (31)	111'6" (34)	121'5" (37)	
10'6" (3.2)	220.5 (100)									10'6" (3.2)
12 (3.7)	193.2 (87.6)									12 (3.7)
13 (4)	179.9 (81.6)									13 (4)
14 (4.3)	171.1 (77.6)									14 (4.3)
15 (4.6)	161.2 (73.1)	159.0 (72.1)								15 (4.6)
16 (4.9)	151.9 (68.9)	151.7 (68.8)	146.0 (66.2)							16 (4.9)
17 (5.2)	142.9 (64.8)	142.4 (64.6)	138.7 (62.9)							17 (5.2)
18 (5.5)	134.9 (61.2)	134.3 (60.9)	131.4 (59.6)	131.4 (59.6)						18 (5.5)
19 (5.8)	127.9 (58)	127.2 (57.7)	126.1 (57.2)	124.1 (56.3)						19 (5.8)
20 (6.1)	120.2 (54.5)	121.1 (54.9)	120.2 (54.5)	119.7 (54.3)	116.2 (52.7)					20 (6.1)
25 (7.6)	89.3 (40.5)	89.1 (40.4)	89.1 (40.4)	88.8 (40.3)	88.8 (40.3)	88.6 (40.2)	88.4 (40.1)	88.2 (40.0)		25 (7.6)
30 (9.1)	69.5 (31.5)	69.2 (31.4)	69.0 (31.3)	68.8 (31.2)	68.8 (31.2)	68.6 (31.1)	68.4 (31.0)	68.1 (30.9)	67.9 (30.8)	30 (9.1)
35 (10.7)	55.8 (25.3)	55.6 (25.2)	55.3 (25.1)	55.3 (25.1)	55.1 (25.0)	54.9 (24.9)	54.7 (24.8)	54.5 (24.7)	54.2 (24.6)	35 (10.7)
40 (12.2)	47.0 (21.3)	46.7 (21.2)	46.7 (21.2)	46.5 (21.1)	46.3 (21.0)	46.1 (20.9)	45.9 (20.8)	45.6 (20.7)	45.4 (20.6)	40 (12.2)
50 (15.2)		35.3 (16)	35.1 (15.9)	35.1 (15.9)	34.6 (15.7)	34.6 (15.7)	34.4 (15.6)	34.2 (15.5)	34.0 (15.4)	50 (15.2)
60 (18.3)			28.9/57 (13.1/17.4)	27.6 (12.5)	27.3 (12.4)	27.1 (12.3)	26.9 (12.2)	26.7 (12.1)	26.5 (12.0)	60 (18.3)
70 (21.3)				24.5/65 (11.1/19.8)	22.5 (10.2)	22.3 (10.1)	22.1 (10.0)	21.8 (9.9)	21.6 (9.8)	70 (21.3)
80 (24.4)					20.1/75 (9.1/22.9)	18.5 (8.4)	18.3 (8.3)	18.1 (8.2)	17.9 (8.1)	80 (24.4)
90 (27.4)							15.7 (7.1)	15.4 (7.0)	15.2 (6.9)	90 (27.4)
100 (30.5)								13.2 (6.0)	13.0 (5.9)	100 (30.5)
110 (33.5)									11.2 (5.1)	110 (33.5)

Table 2-13 Lifting capacity on S-1 boom

Unit: kip (ton)

Radius ft(m)	Main boom length ft(m)										Radius ft(m)
	131'3" (40)	141'2" (43)	150'11" (46)	160'10" (49)	170'8" (52)	180'5" (55)	190'4" (58)	200'2" (61)	210' (64)	219'10" (67)	
30 (9.1)	67.7 (30.7)	67.7 (30.7)									30 (9.1)
35 (10.7)	54.2 (24.6)	53.8 (24.4)	49.6 (22.5)	41.9 (19)	40.1 (18.2)						35 (10.7)
40 (12.2)	45.2 (20.5)	45.0 (20.4)	44.8 (20.3)	40.1 (18.2)	38.4 (17.4)	33.7 (15.3)	31.3 (14.2)				40 (12.2)
50 (15.2)	33.7 (15.3)	33.5 (15.2)	33.3 (15.1)	33.1 (15.0)	32.9 (14.9)	30.2 (13.7)	29.8 (13.5)	27.3 (12.4)	26.2 (11.9)	26.2 (11.9)	50 (15.2)
60 (18.3)	26.2 (11.9)	26.0 (11.8)	25.8 (11.7)	25.6 (11.6)	25.4 (11.5)	25.1 (11.4)	24.9 (11.3)	24.7 (11.2)	24.5 (11.1)	23.6 (10.7)	60 (18.3)
70 (21.3)	21.4 (9.7)	21.2 (9.6)	20.9 (9.5)	20.7 (9.4)	20.5 (9.3)	20.3 (9.2)	20.1 (9.1)	19.9 (9.0)	19.4 (8.8)	19.1 (8.7)	70 (21.3)
80 (24.4)	17.6 (8.0)	17.4 (7.9)	17.2 (7.8)	17.0 (7.7)	16.8 (7.6)	16.5 (7.5)	16.3 (7.4)	15.8 (7.2)	15.7 (7.1)	15.7 (7.1)	80 (24.4)
90 (27.4)	15.0 (6.8)	14.8 (6.7)	14.6 (6.6)	14.3 (6.5)	14.1 (6.4)	13.9 (6.3)	13.7 (6.2)	13.2 (6)	13.0 (5.9)	12.8 (5.8)	90 (27.4)
100 (30.5)	12.8 (5.8)	12.6 (5.7)	12.3 (5.6)	12.1 (5.5)	11.9 (5.4)	11.7 (5.3)	11.5 (5.2)	11.0 (5.0)	10.8 (4.9)	10.6 (4.8)	100 (30.5)
110 (33.5)	11.2 (5.1)	10.8 (4.9)	10.6 (4.8)	10.4 (4.7)	10.1 (4.6)	9.9 (4.5)	9.7 (4.4)	9.3 (4.2)	9.0 (4.1)	8.8 (4.0)	110 (33.5)
120 (36.6)	10.1/115 (4.6/35.1)	9.3 (4.2)	9.0 (4.1)	8.8 (4.0)	8.6 (3.9)	8.3 (3.8)	8.2 (3.7)	7.9 (3.6)	7.7 (3.5)	7.5 (3.4)	120 (36.6)
130 (39.6)		8.6/125 (3.9/38.1)	7.9 (3.6)	7.7 (3.5)	7.5 (3.4)	7.3 (3.3)	7.1 (3.2)	6.6 (3.0)	6.4 (2.9)	6.2 (2.8)	130 (39.6)
140 (42.7)			7.3/135 (3.3/41.1)	6.6 (3.0)	6.4 (2.9)	6.1 (2.8)	5.9 (2.7)	5.7 (2.6)	5.5 (2.5)	5.1 (2.3)	140 (42.7)
150 (45.7)					5.5 (2.5)	5.3 (2.4)	5.1 (2.3)	4.9 (2.2)	4.6 (2.1)	4.2 (1.9)	150 (45.7)
160 (48.8)						4.6 (2.1)	4.4 (2)	4.0 (1.8)	3.7 (1.7)	3.5 (1.6)	160 (48.8)
170 (51.8)							3.7 (1.7)	3.3 (1.5)	3.1 (1.4)	2.9 (1.3)	170 (51.8)
180 (54.9)								2.9/175 (1.3/53.4)	2.4 (1.1)	2.2 (1.0)	180 (54.9)

 CAUTION

- (1) The values in **bold** are the lifting capacity determined by the strength of the machine, while the values that are not in **bold** are the lifting capacity determined by the stability of the machine.
- (2) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged.
- (3) The value in the chart is the maximum lifting capacity of the crane, including the weight of lifting device, hook, wire rope at the end of the hook and so on.
- (4) The value in the chart is the lifting capacity of the crane without a tip boom. When main boom is fitted with tip boom, the lifting capacity must include the weight of main load hook, wire rope, lifting device as well as the weight of tip boom, auxiliary hook, and wire rope.

2.4.5.2 Lifting capacity on S-2 boom

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 101'9"(31)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
30 (9.1)	64.3 (29.1)	64 (29)	63.4 (28.7)	62.7 (28.4)	62.3 (28.2)	61.2 (27.7)	30 (9.1)
35 (10.7)	51 (23.1)	50.7 (23)	49.8 (22.6)	49.4 (22.4)	48.7 (22.1)	48.1 (21.8)	35 (10.7)
40 (12.2)	42.1 (19.1)	41.9 (19)	41 (18.6)	40.8 (18.5)	39.9 (18.1)	39.2 (17.8)	40 (12.2)
50 (15.2)	30.6 (13.9)	30.4 (13.8)	29.8 (13.5)	29.3 (13.3)	28.7 (13)	28.2 (12.8)	50 (15.2)
60 (18.3)	23.2 (10.5)	23.2 (10.5)	22.3 (10.1)	22.3 (10.1)	21.4 (9.7)	20.9 (9.5)	60 (18.3)
70 (21.3)	18.5 (8.4)	18.5 (8.4)	17.6 (8)	17.4 (7.9)	16.5 (7.5)	16.3 (7.4)	70 (21.3)
80 (24.4)	14.8 (6.7)	14.8 (6.7)	13.9 (6.3)	13.9 (6.3)	13 (5.9)	12.8 (5.8)	80 (24.4)
90 (27.4)	12.3 (5.6)	12.1 (5.5)	11.5 (5.2)	11.2 (5.1)	10.4 (4.7)	10.4 (4.7)	90 (27.4)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 111'6"(34)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
30 (9.1)	64 (29)	63.7 (28.9)	63.1 (28.6)	62.6 (28.4)	62 (28.1)	61.1 (27.7)	30 (9.1)
35 (10.7)	50.7 (23)	50.5 (22.9)	49.8 (22.6)	49.4 (22.4)	48.7 (22.1)	47.8 (21.7)	35 (10.7)
40 (12.2)	41.9 (19)	41.7 (18.9)	41 (18.6)	40.6 (18.4)	39.9 (18.1)	39.2 (17.8)	40 (12.2)
50 (15.2)	30.4 (13.8)	30.2 (13.7)	29.5 (13.4)	29.1 (13.2)	28.4 (12.9)	28 (12.7)	50 (15.2)
60 (18.3)	22.9 (10.4)	22.9 (10.4)	22.3 (10.1)	22.1 (10)	21.2 (9.6)	20.7 (9.4)	60 (18.3)
70 (21.3)	18.3 (8.3)	18.3 (8.3)	17.4 (7.9)	17.2 (7.8)	16.5 (7.5)	16.1 (7.3)	70 (21.3)
80 (24.4)	14.6 (6.6)	14.6 (6.6)	13.9 (6.3)	13.7 (6.2)	12.8 (5.8)	12.6 (5.7)	80 (24.4)
90 (27.4)	12.1 (5.5)	11.9 (5.4)	11.2 (5.1)	11.2 (5.1)	10.4 (4.7)	10.1 (4.6)	90 (27.4)
100 (30.5)	9.9 (4.5)	9.9 (4.5)	9.0 (4.1)	9.0 (4.1)	8.2 (3.7)	8.2 (3.7)	100 (30.5)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 121'5"(37)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	50.5 (22.9)	50.3 (22.8)	49.6 (22.5)	49.2 (22.3)	48.5 (22)	47.6 (21.6)	35 (10.7)
40 (12.2)	41.7 (18.9)	41.5 (18.8)	40.8 (18.5)	40.3 (18.3)	36.7 (18)	39 (17.7)	40 (12.2)
50 (15.2)	30.2 (13.7)	30 (13.6)	29.3 (13.3)	29.1 (13.2)	28.4 (12.9)	27.8 (12.6)	50 (15.2)
60 (18.3)	22.9 (10.4)	22.7 (10.3)	22.1 (10)	21.8 (9.9)	20.9 (9.5)	20.7 (9.4)	60 (18.3)
70 (21.3)	18.1 (8.2)	18.1 (8.2)	17.2 (7.8)	17.2 (7.8)	16.3 (7.4)	16.1 (7.3)	70 (21.3)
80 (24.4)	14.3 (6.5)	14.3 (6.5)	13.7 (6.2)	13.4 (6.1)	12.8 (5.8)	12.3 (5.6)	80 (24.4)
90 (27.4)	11.9 (5.4)	11.9 (5.4)	11.0 (5)	11.0 (5)	10.1 (4.6)	9.9 (4.5)	90 (27.4)
100 (30.5)	9.7 (4.4)	9.7 (4.4)	8.8 (4)	8.8 (4)	7.9 (3.6)	7.9 (3.6)	100 (30.5)
110 (33.5)	7.9 (3.6)	7.9 (3.6)	7.3 (3.3)	7.1 (3.2)	6.2 (2.8)	6.2 (2.8)	110 (33.5)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 131'3"(40)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	50.3 (22.8)	50.0 (22.7)	49.4 (22.4)	48.9 (22.2)	48.3 (21.9)	47.6 (21.6)	35 (10.7)
40 (12.2)	41.7 (18.9)	41.4 (18.8)	40.8 (18.5)	40.4 (18.3)	39.7 (18)	39 (17.7)	40 (12.2)
50 (15.2)	30.2 (13.7)	30 (13.6)	29.3 (13.3)	29.1 (13.2)	28.4 (12.9)	27.8 (12.6)	50 (15.2)
60 (18.3)	22.7 (10.3)	22.5 (10.2)	21.8 (9.9)	21.6 (9.8)	20.9 (9.5)	20.5 (9.3)	60 (18.3)
70 (21.3)	17.9 (8.1)	17.9 (8.1)	17.0 (7.7)	17.0 (7.7)	16.1 (7.3)	15.9 (7.2)	70 (21.3)
80 (24.4)	14.3 (6.5)	14.3 (6.4)	13.4 (6.1)	13.2 (6)	12.6 (5.7)	12.3 (5.6)	80 (24.4)
90 (27.4)	11.7 (5.3)	11.7 (5.3)	10.8 (4.9)	10.8 (4.9)	9.9 (4.5)	9.7 (4.4)	90 (27.4)
100 (30.5)	9.5 (4.3)	9.5 (4.3)	8.6 (3.9)	8.6 (3.9)	7.7 (3.5)	7.7 (3.5)	100 (30.5)
110 (33.5)	7.7 (3.5)	7.7 (3.5)	7.1 (3.2)	6.8 (3.1)	6.2 (2.8)	6.0 (2.7)	110 (33.5)
115 (35.1)	6.8 (3.1)	6.8 (3.1)	6.2 (2.8)	6.2 (2.8)	5.3 (2.4)	5.3 (2.4)	115 (35.1)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 141'2"(43)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	50 (22.7)	49.8 (22.6)	49.2 (22.3)	48.7 (22.1)	48.3 (21.9)	47.4 (21.5)	35 (10.7)
40 (12.2)	41.4 (18.8)	41.2 (18.7)	40.6 (18.4)	40.1 (18.2)	39.7 (18)	38.8 (17.6)	40 (12.2)
50 (15.2)	29.8 (13.5)	29.5 (13.4)	28.9 (13.1)	28.7 (13)	28 (12.7)	27.3 (12.4)	50 (15.2)
60 (18.3)	22.5 (10.2)	22.3 (10.1)	21.6 (9.8)	21.4 (9.7)	20.7 (9.4)	20.3 (9.2)	60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17 (7.7)	16.8 (7.6)	16.1 (7.3)	15.7 (7.1)	70 (21.3)
80 (24.4)	14.1 (6.4)	13.9 (6.3)	13.2 (6)	13 (5.9)	12.3 (5.6)	12.1 (5.5)	80 (24.4)
90 (27.4)	11.5 (5.2)	11.5 (5.2)	10.6 (4.8)	10.6 (4.8)	9.7 (4.4)	9.5 (4.3)	90 (27.4)
100 (30.5)	9.3 (4.2)	9.3 (4.2)	8.6 (3.9)	8.4 (3.8)	7.7 (3.5)	7.5 (3.4)	100 (30.5)
110 (33.5)	7.5 (3.4)	7.5 (3.4)	6.8 (3.1)	6.8 (3.1)	6 (2.7)	5.7 (2.6)	110 (33.5)
120 (36.6)	6 (2.7)	6 (2.7)	5.3 (2.4)	5.3 (2.4)	4.4 (2)	4.4 (2)	120 (36.6)
125 (38.1)	5.3 (2.4)	5.3 (2.4)	4.6 (2.1)	4.6 (2.1)	3.7 (1.7)	3.7 (1.7)	125 (38.1)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 150'11"(46)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
40 (12.2)	41.2 (18.7)	41.0 (18.6)	40.4 (18.3)	39.9 (18.1)	39.5 (17.9)	38.6 (17.5)	40 (12.2)
50 (15.2)	29.8 (13.5)	29.5 (13.4)	28.9 (13.1)	28.7 (13)	28 (12.7)	27.6 (12.5)	50 (15.2)
60 (18.3)	22.3 (10.1)	22.1 (10)	21.4 (9.7)	21.2 (9.6)	20.5 (9.3)	20.1 (9.1)	60 (18.3)
70 (21.3)	17.4 (7.9)	17.4 (7.9)	16.8 (7.6)	16.5 (7.5)	15.9 (7.2)	15.4 (7)	70 (21.3)
80 (24.4)	13.9 (6.3)	13.7 (6.2)	13 (5.9)	12.8 (5.8)	12.1 (5.5)	11.9 (5.4)	80 (24.4)
90 (27.4)	11.2 (5.1)	11.2 (5.1)	10.4 (4.7)	10.4 (4.7)	9.7 (4.4)	9.5 (4.3)	90 (27.4)
100 (30.5)	9.0 (4.1)	9.0 (4.1)	8.4 (3.8)	8.1 (3.7)	7.5 (3.4)	7.3 (3.3)	100 (30.5)
110 (33.5)	7.3 (3.3)	7.3 (3.3)	6.6 (3)	6.6 (3)	5.7 (2.6)	5.5 (2.5)	110 (33.5)
120 (36.6)	5.7 (2.6)	5.7 (2.6)	5.1 (2.3)	5.1 (2.3)	4.2 (1.9)	4.2 (1.9)	120 (36.6)
130 (39.6)	4.9 (2.2)	4.9 (2.2)	4.0 (1.8)	4.0 (1.8)	3.1 (1.4)	3.1 (1.4)	130 (39.6)
135 (41.1)	4.2 (1.9)	4.2 (1.9)	3.3 (1.5)	3.3 (1.5)	2.6 (1.2)	2.4 (1.1)	135 (41.1)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 160'10"(49)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
40 (12.2)	35.9 (16.3)	35.9 (16.3)	35.3 (16)	34.8 (15.8)	34.2 (15.5)	33.5 (15.2)	40 (12.2)
50 (15.2)	29.5 (13.4)	29.3 (13.3)	28.7 (13)	28.5 (12.9)	27.8 (12.6)	27.3 (12.4)	50 (15.2)
60 (18.3)	22.1 (10)	21.8 (9.9)	21.2 (9.6)	21 (9.5)	20.3 (9.2)	19.8 (9)	60 (18.3)
70 (21.3)	17.2 (7.8)	17.2 (7.8)	16.5 (7.5)	16.3 (7.4)	15.7 (7.1)	15.2 (6.9)	70 (21.3)
80 (24.4)	13.7 (6.2)	13.5 (6.1)	12.8 (5.8)	12.8 (5.8)	11.9 (5.4)	11.7 (5.3)	80 (24.4)
90 (27.4)	11 (5)	11 (5)	10.4 (4.7)	10.2 (4.6)	9.5 (4.3)	9.3 (4.2)	90 (27.4)
100 (30.5)	8.8 (4)	8.8 (4)	8.2 (3.7)	7.9 (3.6)	7.3 (3.3)	7.1 (3.2)	100 (30.5)
110 (33.5)	7.1 (3.2)	7.1 (3.2)	6.4 (2.9)	6.4 (2.9)	5.5 (2.5)	5.5 (2.5)	110 (33.5)
120 (36.6)	5.7 (2.6)	5.5 (2.5)	4.9 (2.2)	4.9 (2.2)	4 (1.8)	4 (1.8)	120 (36.6)
130 (39.6)	4.6 (2.1)	4.6 (2.1)	3.7 (1.7)	3.7 (1.7)	3.1 (1.4)	2.9 (1.3)	130 (39.6)
140 (42.7)	3.5 (1.6)	3.5 (1.6)	2.6 (1.2)	2.6 (1.2)			140 (42.7)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 170'8"(52)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
40 (12.2)	34.4 (15.6)	34.2 (15.5)	33.5 (15.2)	33.1 (15)	32.6 (14.8)	31.7 (14.4)	40 (12.2)
50 (15.2)	29.3 (13.3)	29.3 (13.3)	28.7 (13)	28.2 (12.8)	27.8 (12.6)	27.1 (12.3)	50 (15.2)
60 (18.3)	21.8 (9.9)	21.6 (9.8)	20.9 (9.5)	20.7 (9.4)	20.1 (9.1)	19.6 (8.9)	60 (18.3)
70 (21.3)	17 (7.7)	17 (7.7)	16.3 (7.4)	16.1 (7.3)	15.4 (7)	15 (6.8)	70 (21.3)
80 (24.4)	13.5 (6.1)	13.2 (6)	12.6 (5.7)	12.6 (5.7)	11.9 (5.4)	11.5 (5.2)	80 (24.4)
90 (27.4)	10.8 (4.9)	10.8 (4.9)	10.1 (4.6)	9.9 (4.5)	9.3 (4.2)	9.1 (4.1)	90 (27.4)
100 (30.5)	8.4 (3.8)	8.4 (3.8)	7.7 (3.5)	7.5 (3.4)	6.8 (3.1)	6.6 (3)	100 (30.5)
110 (33.5)	6.8 (3.1)	6.8 (3.1)	6.2 (2.8)	6.2 (2.8)	5.3 (2.4)	5.3 (2.4)	110 (33.5)
120 (36.6)	5.5 (2.5)	5.3 (2.4)	4.6 (2.1)	4.6 (2.1)	4.0 (1.8)	3.8 (1.7)	120 (36.6)
130 (39.6)	4.2 (1.9)	4.2 (1.9)	3.3 (1.5)	3.3 (1.5)	2.6 (1.2)	2.4 (1.1)	130 (39.6)
140 (42.7)	3.3 (1.5)	3.3 (1.5)	2.6 (1.2)	2.4 (1.1)			140 (42.7)
150 (45.7)	2.4 (1.1)	2.4 (1.1)					150 (45.7)

Table 2-14 Lifting capacity on S-2 boom

Unit: kip (ton)

	Main boom length ft(m) 180'5"(55)				
Radius ft (m)	Fixed jib length ft(m)				Radius ft (m)
	19'8" (6)		39'4" (12)		
	Fixed jib angle(°)				
	10	30	10	30	
50 (15.2)	26.2 (11.9)	26.2 (11.9)	25.6 (11.6)	25.2 (11.4)	50 (15.2)
60 (18.3)	21.6 (9.8)	21.4 (9.7)	20.9 (9.5)	20.5 (9.3)	60 (18.3)
70 (21.3)	16.8 (7.6)	16.8 (7.6)	16.1 (7.3)	15.9 (7.2)	70 (21.3)
80 (24.4)	13.2 (6)	13 (5.9)	12.3 (5.6)	12.3 (5.6)	80 (24.4)
90 (27.4)	10.4 (4.7)	10.4 (4.7)	9.7 (4.4)	9.5 (4.3)	90 (27.4)
100 (30.5)	8.2 (3.7)	8.2 (3.7)	7.5 (3.4)	7.3 (3.3)	100 (30.5)
110 (33.5)	6.6 (3)	6.6 (3)	6 (2.7)	6 (2.7)	110 (33.5)
120 (36.6)	5.3 (2.4)	5.1 (2.3)	4.4 (2)	4.4 (2)	120 (36.6)
130 (39.6)	4.0 (1.8)	4.0 (1.8)	3.3 (1.5)	3.1 (1.4)	130 (39.6)
140 (42.7)	3.1 (1.4)	3.1 (1.4)	2.4 (1.1)	2.2 (1)	140 (42.7)
150 (45.7)	2.2 (1)	2.2 (1)			150 (45.7)



- (1) The values in bold are the lifting capacity determined by the strength of the machine, while the values that are not in bold are the lifting capacity determined by the stability of the machine.
- (2) The values given in the lifting capacity chart are the permissible maximum lifting capacity, which is obtained from calculation when the load is suspended (according to the standard ASME/ANSI B30.5). The value can not exceed 75% of the overturning lifting capacity when the crane is on firm and flat ground.
- (3) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged.

- (4) The values in the chart are the lifting capacity when the crane is working with 61740 Lbs (28t) rear counterweight and 22050lbs (10t) central counterweight in 360° range.
- (5) The value in the chart is the maximum lifting capacity of the crane, including the weight of lifting device, hook, wire rope at the end of hook and so on.
- (6) The crawler carriers are extended completely. The hook on the fixed jib is nearest to the jib head.

2.4.5.3 Lifting capacity on S-3 boom

Table 2-15 Lifting capacity on S-3 boom

Unit: kip (ton)

Radius ft (m)	Main boom length ft(m)									Radius ft (m)
	42'8" (13)	52'6" (16)	62'4" (19)	72'3" (22)	82' (25)	91'11" (28)	101'9" (31)	111'6" (34)	121'5" (37)	
14 (4.3)	17.6 (8)									14 (4.3)
15 (4.6)	17.6 (8)									15 (4.6)
16 (4.9)	17.6 (8)	17.6 (8)								16 (4.9)
17 (5.2)	17.6 (8)	17.6 (8)								17 (5.2)
18 (5.5)	17.6 (8)	17.6 (8)	17.6 (8)							18 (5.5)
19 (5.8)	17.6 (8)	17.6 (8)	17.6 (8)							19 (5.8)
20 (6.1)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)						20 (6.1)
25 (7.6)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)			25 (7.6)
30 (9.1)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	30 (9.1)
35 (10.7)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	35 (10.7)
40 (12.2)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	40 (12.2)
50 (15.2)	17.6/ 45 (8/13.7)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	50 (15.2)
60 (18.3)		17.6/55 (8/16.8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	60 (18.3)
70 (21.3)			17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	70 (21.3)
80 (24.4)					17.6 (8)	16.1 (7.3)	15.9 (7.2)	15.6 (7.1)	15.3 (7)	80 (24.4)
90 (27.4)						14.3/85 (6.5/25.9)	13.2 (6)	12.8 (5.8)	12.8 (5.8)	90 (27.4)
100 (30.5)							11.9/95 (5.4/29)	10.6 (4.8)	10.6 (4.8)	100 (30.5)
110 (33.5)								9.3/105 (4.2/32)	8.8 (4)	110 (33.5)
120 (36.6)									7.9/115 (3.6/35)	120 (36.6)

Table 2-15 Lifting capacity on S-3 boom

Unit: kip (ton)

Radius ft (m)	Main boom length ft(m)								Radius ft (m)
	131'3" (40)	141'2" (43)	150'11" (46)	160'10" (49)	170'8" (52)	180'5" (55)	190'4" (58)	200'2" (61)	
30 (9.1)	17.6 (8)								30 (9.1)
35 (10.7)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)					35 (10.7)
40 (12.2)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)		40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	17.6 (8)	70 (21.3)
80 (24.4)	15.2 (6.9)	14.9 (6.8)	14.7 (6.7)	14.5 (6.6)	14.3 (6.5)	14.1 (6.4)	13.9 (6.3)	13.7 (6.2)	80 (24.4)
90 (27.4)	12.5 (5.7)	12.3 (5.6)	12.1 (5.5)	11.9 (5.4)	11.7 (5.3)	11.2 (5.1)	11 (5)	10.8 (4.9)	90 (27.4)
100 (30.5)	10.3 (4.7)	10.1 (4.6)	9.9 (4.5)	9.7 (4.4)	9.3 (4.2)	9 (4.1)	8.8 (4)	8.6 (3.9)	100 (30.5)
110 (33.5)	8.8 (4)	8.4 (3.8)	8.2 (3.7)	8.2 (3.7)	7.7 (3.5)	7.5 (3.4)	7.1 (3.2)	6.9 (3.1)	110 (33.5)
120 (36.6)	7.1 (3.2)	6.8 (3.1)	6.6 (3)	6.4 (2.9)	6.2 (2.8)	6 (2.7)	5.7 (2.6)	5.5 (2.5)	120 (36.6)
130 (39.6)		5.3 (2.4)	5.3 (2.4)	5.3 (2.4)	5.3 (2.4)	4.6 (2.1)	4.4 (2)	4.2 (1.9)	130 (39.6)
140 (42.7)			4.2 (1.9)	4.2 (1.9)	4 (1.8)	3.8 (1.7)	3.6 (1.6)	3.4 (1.5)	140 (42.7)
150 (45.7)				3.5/145 (1.6/44.2)	3.1 (1.4)	2.9 (1.3)	2.7 (1.2)	2.5 (1.1)	150 (45.7)
160 (48.8)					2.6/155 (1.2/47.3)	2.2 (1)	2 (0.9)	1.8 (0.8)	160 (48.8)



- (1) The values in bold are the lifting capacity determined by the strength of the machine, while the values that are not in bold are the lifting capacity determined by the stability of the machine.
- (2) The value given in the lifting capacity chart is the maximum permissible lifting capacity, which is obtained from calculation when the load is suspended (according to the standard ASME/ANSI B30.5). The value can not exceed 75% of the overturning lifting capacity when the crane is on firm and flat ground.

- (3) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged.
- (4) The value in the chart is the lifting capacity when the crane is working with 61740Lbs (28t) rear counterweight and 22050lbs (10t) central counterweight in 360° range.
- (5) The sign “*/*” in the chart indicates “lifting capacity/radius”.
- (6) The value in the chart is the maximum lifting capacity of the crane, including the weight of lifting device, hook, wire rope at the end of hook and so on.
- (7) Choose the type of hook on the main boom before the system is switched to S-3 configuration.
- (8) The crawler carriers are extended completely. The hook on the main boom is nearest to the main boom head.

2.4.5.4 Lifting capacity on SF-1 boom

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 101'9"(31)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)	17.6 (8)	17.6 (8)				40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	14.8 (6.7)	12.3 (5.6)	8.4 (3.8)	70 (21.3)
80 (24.4)	16.8 (7.6)	17.0 (7.7)	17.4 (7.9)	13.7 (6.2)	11.9 (5.4)	7.7 (3.5)	80 (24.4)
90 (27.4)	14.6 (6.6)	14.3 (6.5)	15.0 (6.8)	12.6 (5.7)	11.2 (5.1)	6.8 (3.1)	90 (27.4)
100 (30.5)	12.3 (5.6)	12.3 (5.6)	12.8 (5.8)	11.0 (5)	10.6 (4.8)	6.4 (2.9)	100 (30.5)
110 (33.5)		10.6 (4.8)	11.0 (5)	10.8 (4.9)	9.7 (4.4)	6.2 (2.8)	110 (33.5)
120 (36.6)			9.5 (4.3)	9.7 (4.4)	9.0 (4.1)	5.7 (2.6)	120 (36.6)
130 (39.6)				8.4 (3.8)	7.7 (3.5)	5.5 (2.5)	130 (39.6)
140 (42.7)					7.1 (3.2)	5.3 (2.4)	140 (42.7)
150 (45.7)						5.1 (2.3)	150 (45.7)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 111'6"(34)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	14.8 (6.7)	12.6 (5.7)	8.4 (3.8)	70 (21.3)
80 (24.4)	16.8 (7.6)	16.8 (7.6)	16.8 (7.6)	13.2 (6)	12.1 (5.5)	8.4 (3.8)	80 (24.4)
90 (27.4)	14.1 (6.4)	14.6 (6.6)	14.6 (6.6)	12.3 (5.6)	11.7 (5.3)	7.5 (3.4)	90 (27.4)
100 (30.5)	11.9 (5.4)	12.3 (5.6)	12.1 (5.5)	11.9 (5.4)	10.8 (4.9)	6.6 (3)	100 (30.5)
110 (33.5)	10.4 (4.7)	10.6 (4.8)	10.8 (4.9)	10.8 (4.9)	10.1 (4.6)	6.4 (2.9)	110 (33.5)
120 (36.6)		9.0 (4.1)	9.3 (4.2)	9.5 (4.3)	9.2 (4.2)	6.0 (2.7)	120 (36.6)
130 (39.6)			7.9 (3.6)	8.2 (3.7)	8.2 (3.7)	5.7 (2.6)	130 (39.6)
140 (42.7)				7.1 (3.2)	7.1 (3.2)	5.5 (2.5)	140 (42.7)
150 (45.7)					6.4 (2.9)	5.3 (2.4)	150 (45.7)
160 (48.8)						4.9 (2.2)	160 (48.8)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 121'5"(37)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	13.2 (6)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	15.4 (7)	12.6 (5.7)	8.4 (3.8)	70 (21.3)
80 (24.4)	16.5 (7.5)	16.5 (7.5)	17.2 (7.8)	14.1 (6.4)	12.3 (5.6)	7.7 (3.5)	80 (24.4)
90 (27.4)	14.1 (6.4)	14.3 (6.5)	14.3 (6.5)	13.2 (6)	11.9 (5.4)	7.5 (3.4)	90 (27.4)
100 (30.5)	11.9 (5.4)	12.1 (5.5)	12.1 (5.5)	12.6 (5.7)	11.0 (5.0)	6.6 (3)	100 (30.5)
110 (33.5)	10.1 (4.6)	10.4 (4.7)	10.4 (4.7)	10.8 (4.9)	10.1 (4.6)	6.4 (2.9)	110 (33.5)
120 (36.6)	8.6 (3.9)	8.8 (4)	9.0 (4.1)	9.3 (4.2)	9.3 (4.2)	6.2 (2.8)	120 (36.6)
130 (39.6)			7.7 (3.5)	8.2 (3.7)	8.2 (3.7)	6.0 (2.7)	130 (39.6)
140 (42.7)			6.8 (3.1)	7.1 (3.2)	7.1 (3.2)	5.5 (2.5)	140 (42.7)
150 (45.7)					6.2 (2.8)	5.5 (2.5)	150 (45.7)
160 (48.8)					5.3 (2.4)	5.3 (2.4)	160 (48.8)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 131'3"(40)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	17.2 (7.8)	13.2 (6)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	15.9 (7.2)	12.8 (5.8)		70 (21.3)
80 (24.4)	16.5 (7.5)	16.8 (7.6)	16.8 (7.6)	15.0 (6.8)	12.6 (5.7)	7.9 (3.6)	80 (24.4)
90 (27.4)	13.7 (6.2)	13.9 (6.3)	14.1 (6.4)	13.7 (6.2)	12.1 (5.5)	7.5 (3.4)	90 (27.4)
100 (30.5)	11.5 (5.2)	11.7 (5.3)	12.1 (5.5)	12.6 (5.7)	11.2 (5.1)	7.1 (3.2)	100 (30.5)
110 (33.5)	9.7 (4.4)	9.9 (4.5)	10.4 (4.7)	10.6 (4.8)	10.1 (4.6)	6.6 (3)	110 (33.5)
120 (36.6)	8.4 (3.8)	8.6 (3.9)	8.8 (4)	9.0 (4.1)	9.3 (4.2)	6.2 (2.8)	120 (36.6)
130 (39.6)	7.3 (3.3)	7.5 (3.4)	7.7 (3.5)	7.9 (3.6)	7.7 (3.5)	6.0 (2.7)	130 (39.6)
140 (42.7)			6.6 (3)	6.8 (3.1)	6.8 (3.1)	5.5 (2.5)	140 (42.7)
150 (45.7)			5.7 (2.6)	6.0 (2.7)	6.0 (2.7)	5.5 (2.5)	150 (45.7)
160 (48.8)					5.3 (2.4)	5.3 (2.4)	160 (48.8)
170 (51.8)					4.6 (2.1)	4.6 (2.1)	170 (51.8)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 141'2"(43)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)		17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.8 (7.6)	13.2 (6)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	15.9 (7.2)	12.8 (5.8)		70 (21.3)
80 (24.4)	15.9 (7.2)	16.5 (7.5)	16.8 (7.6)	15.0 (6.8)	12.6 (5.7)	8.4 (3.8)	80 (24.4)
90 (27.4)	13.2 (6)	13.9 (6.3)	13.9 (6.3)	13.9 (6.3)	12.1 (5.5)	7.7 (3.5)	90 (27.4)
100 (30.5)	11.2 (5.1)	11.5 (5.2)	11.9 (5.4)	12.3 (5.6)	11.2 (5.1)	7.3 (3.3)	100 (30.5)
110 (33.5)	9.7 (4.4)	9.9 (4.5)	10.1 (4.6)	10.6 (4.8)	10.1 (4.6)	6.6 (3)	110 (33.5)
120 (36.6)	8.2 (3.7)	8.4 (3.8)	8.6 (3.9)	9.0 (4.1)	8.8 (4)	6.4 (2.9)	120 (36.6)
130 (39.6)	7.1 (3.2)	7.1 (3.2)	7.3 (3.3)	7.7 (3.5)	7.5 (3.4)	6.2 (2.8)	130 (39.6)
140 (42.7)	6.0 (2.7)	6.0 (2.7)	6.4 (2.9)	6.6 (3)	6.6 (3)	5.7 (2.6)	140 (42.7)
150 (45.7)			5.5 (2.5)	5.7 (2.6)	5.7 (2.6)	5.5 (2.5)	150 (45.7)
160 (48.8)			4.6 (2.1)	4.9 (2.2)	5.1 (2.3)	5.3 (2.4)	160 (48.8)
170 (51.8)					4.2 (1.9)	4.4 (2)	170 (51.8)
180 (54.9)						3.7 (1.7)	180 (54.9)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 150'11"(46)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)		17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		70 (21.3)
80 (24.4)	15.9 (7.2)	16.3 (7.4)	16.3 (7.4)	15.4 (7)	12.6 (5.7)	8.3 (3.8)	80 (24.4)
90 (27.4)	13.2 (6)	13.7 (6.2)	13.9 (6.3)	14.3 (6.5)	12.6 (5.7)	7.7 (3.5)	90 (27.4)
100 (30.5)	11.2 (5.1)	11.5 (5.2)	11.5 (5.2)	12.1 (5.5)	11.2 (5.1)	7.5 (3.4)	100 (30.5)
110 (33.5)	9.5 (4.3)	9.5 (4.3)	9.9 (4.5)	10.1 (4.6)	10.1 (4.6)	6.8 (3.1)	110 (33.5)
120 (36.6)	7.9 (3.6)	8.2 (3.7)	8.4 (3.8)	8.6 (3.9)	8.6 (3.9)	6.6 (3)	120 (36.6)
130 (39.6)	6.8 (3.1)	6.8 (3.1)	7.1 (3.2)	7.5 (3.4)	7.5 (3.4)	6.4 (2.9)	130 (39.6)
140 (42.7)	5.7 (2.6)	6.0 (2.7)	6.2 (2.8)	6.4 (2.9)	6.4 (2.9)	6.2 (2.8)	140 (42.7)
150 (45.7)			5.3 (2.4)	5.5 (2.5)	5.5 (2.5)	5.7 (2.6)	150 (45.7)
160 (48.8)			4.4 (2)	4.6 (2.1)	4.6 (2.1)	5.1 (2.3)	160 (48.8)
170 (51.8)			3.7 (1.7)	4.0 (1.8)	4.0 (1.8)	4.4 (2)	170 (51.8)
180 (54.9)					3.5 (1.6)	3.5 (1.6)	180 (54.9)
190 (57.9)					2.9 (1.3)	3.1 (1.4)	190 (57.9)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 160'10"(49)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.8 (7.6)	12.8 (5.8)		70 (21.3)
80 (24.4)	16.1 (7.3)	16.1 (7.3)	16.3 (7.4)	15.4 (7)	12.6 (5.7)	8.4 (3.8)	80 (24.4)
90 (27.4)	13.0 (5.9)	13.2 (6)	13.5 (6.1)	14.3 (6.5)	12.3 (5.6)	8.2 (3.7)	90 (27.4)
100 (30.5)	10.8 (4.9)	11.0 (5)	11.2 (5.1)	11.9 (5.4)	11.2 (5.1)	7.7 (3.5)	100 (30.5)
110 (33.5)	9.0 (4.1)	9.3 (4.2)	9.5 (4.3)	9.9 (4.5)	9.7 (4.4)	7.3 (3.3)	110 (33.5)
120 (36.6)	7.7 (3.5)	7.9 (3.6)	7.9 (3.6)	8.6 (3.9)	8.4 (3.8)	6.6 (3)	120 (36.6)
130 (39.6)	6.6 (3)	6.6 (3)	6.8 (3.1)	7.3 (3.3)	7.1 (3.2)	6.4 (2.9)	130 (39.6)
140 (42.7)	5.5 (2.5)	5.7 (2.6)	5.7 (2.6)	6.2 (2.8)	6.0 (2.7)	6.2 (2.8)	140 (42.7)
150 (45.7)	4.6 (2.1)	4.9 (2.2)	4.9 (2.2)	5.3 (2.4)	5.1 (2.3)	5.7 (2.6)	150 (45.7)
160 (48.8)	3.7 (1.7)	4.0 (1.8)	4.2 (1.9)	4.4 (2)	4.4 (2)	4.9 (2.2)	160 (48.8)
170 (51.8)				3.7 (1.7)	3.7 (1.7)	4.2 (1.9)	170 (51.8)
180 (54.9)					3.1 (1.4)	3.5 (1.6)	180 (54.9)
190 (57.9)					2.6 (1.2)	2.9 (1.3)	190 (57.9)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 170'8"(52)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)						50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)				60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.8 (7.6)	13.2 (6)		70 (21.3)
80 (24.4)	15.7 (7.1)	15.7 (7.1)	16.1 (7.3)	15.4 (7)	12.8 (5.8)	8.4 (3.8)	80 (24.4)
90 (27.4)	12.6 (5.7)	13.2 (6)	13.2 (6)	13.5 (6.1)	12.6 (5.7)	8.2 (3.7)	90 (27.4)
100 (30.5)	10.6 (4.8)	11.0 (5)	11.0 (5)	11.7 (5.3)	11.2 (5.1)	7.5 (3.4)	100 (30.5)
110 (33.5)	8.8 (4)	9.3 (4.2)	9.3 (4.2)	9.7 (4.4)	9.5 (4.3)	7.3 (3.3)	110 (33.5)
120 (36.6)	7.3 (3.3)	7.7 (3.5)	7.9 (3.6)	8.4 (3.8)	8.2 (3.7)	6.6 (3)	120 (36.6)
130 (39.6)	6.2 (2.8)	6.4 (2.9)	6.6 (3)	7.1 (3.2)	6.8 (3.1)	6.4 (2.9)	130 (39.6)
140 (42.7)	5.3 (2.4)	5.3 (2.4)	5.7 (2.6)	6.0 (2.7)	6.0 (2.7)	6.2 (2.8)	140 (42.7)
150 (45.7)	4.4 (2)	4.6 (2.1)	4.9 (2.2)	5.1 (2.3)	5.1 (2.3)	5.5 (2.5)	150 (45.7)
160 (48.8)	3.5 (1.6)	3.7 (1.7)	4.0 (1.8)	4.2 (1.9)	4.2 (1.9)	4.6 (2.1)	160 (48.8)
170 (51.8)	2.9 (1.3)	3.1 (1.4)	3.3 (1.5)	3.5 (1.6)	3.5 (1.6)	4.0 (1.8)	170 (51.8)
180 (54.9)			2.6 (1.2)	2.9 (1.3)	2.9 (1.3)	3.3 (1.5)	180 (54.9)

Table 2-16 Lifting capacity on SF-1 boom

Unit: kip (ton)

	Main boom length ft(m) 180'5"(55)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)						50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)				60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	17.0 (7.7)	13.2 (6.0)		70 (21.3)
80 (24.4)	15.0 (6.8)	15.4 (7)	15.9 (7.2)	16.1 (7.3)	13.0 (5.9)		80 (24.4)
90 (27.4)	12.3 (5.6)	12.8 (5.8)	12.8 (5.8)	13.7 (6.2)	12.6 (5.7)	8.2 (3.7)	90 (27.4)
100 (30.5)	10.4 (4.7)	10.6 (4.8)	10.6 (4.8)	11.5 (5.2)	11.2 (5.1)	7.7 (3.5)	100 (30.5)
110 (33.5)	8.6 (3.9)	8.8 (4)	9.0 (4.1)	9.7 (4.4)	9.3 (4.2)	7.5 (3.4)	110 (33.5)
120 (36.6)	7.1 (3.2)	7.5 (3.4)	7.5 (3.4)	8.2 (3.7)	7.7 (3.5)	7.1 (3.2)	120 (36.6)
130 (39.6)	6.0 (2.7)	6.2 (2.8)	6.4 (2.9)	6.8 (3.1)	6.6 (3)	6.6 (3)	130 (39.6)
140 (42.7)	4.9 (2.2)	5.1 (2.3)	5.3 (2.4)	5.7 (2.6)	5.5 (2.5)	6.2 (2.8)	140 (42.7)
150 (45.7)	4.2 (1.9)	4.2 (1.9)	4.4 (2)	4.9 (2.2)	4.6 (2.1)	5.1 (2.3)	150 (45.7)
160 (48.8)	3.3 (1.5)	3.3 (1.5)	3.7 (1.7)	4.0 (1.8)	3.7 (1.7)	4.4 (2)	160 (48.8)
170 (51.8)	2.9 (1.3)	2.6 (1.2)	3.1 (1.4)	3.1 (1.4)	3.1 (1.4)	3.5 (1.6)	170 (51.8)
180 (54.9)		2.0 (0.9)	2.4 (1.1)	2.4 (1.1)	2.4 (1.1)	2.9 (1.3)	180 (54.9)
190 (57.9)				1.8 (0.8)	1.8 (0.8)	2.2 (1)	190 (57.9)



- (1) The values in bold are the lifting capacity determined by the strength of the machine, while the values that are not in bold are the lifting capacity determined by the stability of the machine.
- (2) The value given in the lifting capacity chart is the permissible maximum lifting capacity, which is obtained from calculation when the load is suspended (according to the standard ASME/ANSI B30.5). The value can not exceed 75% of the overturning lifting capacity when the crane is on firm and flat ground.

- (3) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged;
- (4) The value in the chart is the lifting capacity when the crane is working with 61740 Lbs (28t) rear counterweight and 22050lbs (10t) central counterweight in 360° range.
- (5) The value in the chart is the maximum lifting capacity of the crane, including the weight of lifting device, hook, wire rope at the end of hook and so on.
- (6) The crawler carriers of the crane are extended completely.

2.4.5.5 Lifting capacity on SF-2 boom

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 101'9"(31)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)	17.6 (8)	17.6 (8)				40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		60 (18.3)
70 (21.3)	16.1 (7.3)	16.1 (7.3)	16.3 (7.4)	14.8 (6.7)	12.3 (5.6)	8.4 (3.8)	70 (21.3)
80 (24.4)	15.2 (6.9)	15.4 (7)	17.6 (7.3)	13.7 (6.2)	11.9 (5.4)	7.7 (3.5)	80 (24.4)
90 (27.4)	13 (5.9)	12.8 (5.8)	13.7 (6.2)	12.6 (5.7)	11.2 (5.1)	6.8 (3.1)	90 (27.4)
100 (30.5)	10.8 (4.9)	10.8 (4.9)	11.5 (5.2)	11.0 (5)	10.6 (4.8)	6.4 (2.9)	100 (30.5)
110 (33.5)		9.0 (4.1)	9.7 (4.4)	9.5 (4.3)	8.6 (3.9)	6.2 (2.8)	110 (33.5)
120 (36.6)			8.2 (3.7)	8.4 (3.8)	7.5 (3.4)	5.7 (2.6)	120 (36.6)
130 (39.6)				7.0 (3.2)	6.6 (3)	5.5 (2.5)	130 (39.6)
140 (42.7)					6.0 (2.7)	5.3 (2.4)	140 (42.7)
150 (45.7)						5.1 (2.3)	150 (45.7)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 111'6"(34)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		60 (18.3)
70 (21.3)	16.1 (7.3)	16.1 (7.3)	17.6 (7.3)	14.8 (6.7)	12.6 (5.7)	8.4 (3.8)	70 (21.3)
80 (24.4)	15.2 (6.9)	15.2 (6.9)	15.4 (7)	13.2 (6)	12.1 (5.5)	8.4 (3.8)	80 (24.4)
90 (27.4)	12.6 (5.7)	13 (5.9)	13.2 (6)	12.3 (5.6)	11.7 (5.3)	7.5 (3.4)	90 (27.4)
100 (30.5)	10.4 (4.7)	10.8 (4.9)	10.8 (4.9)	10.6 (4.8)	10.8 (4.9)	6.6 (3)	100 (30.5)
110 (33.5)	8.8 (4)	9.0 (4.1)	9.5 (4.3)	9.5 (4.3)	9.0 (4.1)	6.4 (2.9)	110 (33.5)
120 (36.6)		7.5 (3.4)	7.9 (3.6)	8.2 (3.7)	8.2 (3.7)	6.0 (2.7)	120 (36.6)
130 (39.6)			6.6 (3)	6.8 (3.1)	7.1 (3.2)	5.7 (2.6)	130 (39.6)
140 (42.7)				5.7 (2.6)	6.0 (2.7)	5.5 (2.5)	140 (42.7)
150 (45.7)					5.3 (2.4)	5.3 (2.4)	150 (45.7)
160 (48.8)						4.9 (2.2)	160 (48.8)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 121'5"(37)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
35 (10.7)	17.6 (8)						35 (10.7)
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	13.2 (6)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	15.4 (7)	12.6 (5.7)	8.4 (3.8)	70 (21.3)
80 (24.4)	15 (6.8)	15 (6.8)	15.9 (7.2)	14.1 (6.4)	12.3 (5.6)	7.7 (3.5)	80 (24.4)
90 (27.4)	12.6 (5.7)	12.8 (5.8)	13 (5.9)	13.2 (6)	11.9 (5.4)	7.5 (3.4)	90 (27.4)
100 (30.5)	10.4 (4.7)	10.6 (4.8)	10.8 (4.9)	11.2 (5.1)	9.9 (4.5)	6.6 (3)	100 (30.5)
110 (33.5)	8.6 (3.9)	8.8 (4)	9 (4.1)	9.5 (4.3)	9.0 (4.1)	6.4 (2.9)	110 (33.5)
120 (36.6)	7.1 (3.2)	7.3 (3.3)	7.7 (3.5)	7.9 (3.6)	8.2 (3.7)	6.2 (2.8)	120 (36.6)
130 (39.6)			6.4 (2.9)	6.8 (3.1)	7.1 (3.2)	6.0 (2.7)	130 (39.6)
140 (42.7)			5.5 (2.5)	5.7 (2.6)	6 (2.7)	5.5 (2.5)	140 (42.7)
150 (45.7)					5.1 (2.3)	4.4 (2)	150 (45.7)
160 (48.8)					4.2 (1.9)	4.2 (1.9)	160 (48.8)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 131'3"(40)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
40 (12.2)	17.6 (8)						40 (12.2)
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	17.2 (7.8)	13.2 (6)		60 (18.3)
70 (21.3)	16.1 (7.3)	16.1 (7.3)	16.3 (7.4)	15.9 (7.2)	12.8 (5.8)		70 (21.3)
80 (24.4)	15 (6.8)	15.2 (6.9)	15.4 (7.0)	15.0 (6.8)	12.6 (5.7)	7.9 (3.6)	80 (24.4)
90 (27.4)	12.1 (5.5)	12.3 (5.6)	12.8 (5.8)	12.3 (5.6)	12.1 (5.5)	7.5 (3.4)	90 (27.4)
100 (30.5)	9.9 (4.5)	10.1 (4.6)	10.8 (4.9)	11.2 (5.1)	9.9 (4.5)	7.1 (3.2)	100 (30.5)
110 (33.5)	8.2 (3.7)	8.4 (3.8)	9 (4.1)	9.3 (4.2)	8.8 (4)	6.6 (3)	110 (33.5)
120 (36.6)	6.8 (3.1)	7.1 (3.2)	7.5 (3.4)	7.7 (3.5)	7.9 (3.6)	6.2 (2.8)	120 (36.6)
130 (39.6)	5.7 (2.6)	6 (2.7)	6.4 (2.9)	6.6 (3)	6.4 (2.9)	6.0 (2.7)	130 (39.6)
140 (42.7)			5.3 (2.4)	5.5 (2.5)	5.5 (2.5)	5.5 (2.5)	140 (42.7)
150 (45.7)			4.4 (2)	4.6 (2.1)	4.6 (2.1)	4.4 (2)	150 (45.7)
160 (48.8)					4 (1.8)	4.2 (1.9)	160 (48.8)
170 (51.8)					3.3 (1.5)	3.5 (1.6)	170 (51.8)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 141'2"(43)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)		17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.8 (7.6)	13.2 (6)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	15.9 (7.2)	12.8 (5.8)		70 (21.3)
80 (24.4)	14.3 (6.5)	15 (6.8)	15.4 (7)	15.0 (6.8)	12.6 (5.7)	8.4 (3.8)	80 (24.4)
90 (27.4)	11.7 (5.3)	12.3 (5.6)	12.6 (5.7)	12.6 (5.7)	12.1 (5.5)	7.7 (3.5)	90 (27.4)
100 (30.5)	9.7 (4.4)	9.9 (4.5)	10.6 (4.8)	11 (5)	9.9 (4.5)	7.3 (3.3)	100 (30.5)
110 (33.5)	8.1 (3.7)	8.4 (3.8)	8.8 (4)	9.3 (4.2)	8.8 (4)	6.6 (3)	110 (33.5)
120 (36.6)	6.6 (3)	6.8 (3.1)	7.3 (3.3)	7.7 (3.5)	7.5 (3.4)	6.4 (2.9)	120 (36.6)
130 (39.6)	5.5 (2.5)	5.5 (2.5)	6 (2.7)	6.4 (2.9)	6.2 (2.8)	6.2 (2.8)	130 (39.6)
140 (42.7)	4.4 (2)	4.4 (2)	5.1 (2.3)	5.3 (2.4)	5.3 (2.4)	5.7 (2.6)	140 (42.7)
150 (45.7)			4.2 (1.9)	4.4 (2)	4.4 (2)	4.4 (2)	150 (45.7)
160 (48.8)			3.3 (1.5)	3.5 (1.6)	3.7 (1.7)	4.2 (1.9)	160 (48.8)
170 (51.8)					2.9 (1.3)	3.3 (1.5)	170 (51.8)
180 (54.9)						2.6 (1.2)	180 (54.9)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 150'11"(46)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)		17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		60 (18.3)
70 (21.3)	17.6 (8)	17.6 (8)	17.6 (8)	16.3 (7.4)	12.8 (5.8)		70 (21.3)
80 (24.4)	14.3 (6.5)	14.8 (6.7)	14.8 (6.7)	15.4 (7)	12.6 (5.7)	8.4 (3.8)	80 (24.4)
90 (27.4)	11.7 (5.3)	12.1 (5.5)	12.6 (5.7)	13.0 (5.9)	11.2 (5.1)	7.7 (3.5)	90 (27.4)
100 (30.5)	9.7 (4.4)	9.9 (4.5)	10.1 (4.6)	10.8 (4.9)	9.9 (4.5)	7.5 (3.4)	100 (30.5)
110 (33.5)	7.9 (3.6)	7.9 (3.6)	8.6 (3.9)	8.8 (4)	8.8 (4)	6.8 (3.1)	110 (33.5)
120 (36.6)	6.4 (2.9)	6.6 (3)	7.1 (3.2)	7.3 (3.3)	7.3 (3.3)	6.6 (3)	120 (36.6)
130 (39.6)	5.3 (2.4)	5.3 (2.4)	5.7 (2.6)	6.2 (2.8)	6.2 (2.8)	6.4 (2.9)	130 (39.6)
140 (42.7)	4.2 (1.9)	4.4 (2)	4 (2.2)	5.1 (2.3)	5.1 (2.3)	5.1 (2.3)	140 (42.7)
150 (45.7)			3.1 (1.8)	4.2 (1.9)	4.2 (1.9)	4.6 (2.1)	150 (45.7)
160 (48.8)			3.1 (1.4)	3.3 (1.5)	3.3 (1.5)	4 (1.8)	160 (48.8)
170 (51.8)			2.4 (1.1)	2.6 (1.2)	2.6 (1.2)	3.3 (1.5)	170 (51.8)
180 (54.9)					2.2 (1)	2.4 (1.1)	180 (54.9)
190 (57.9)					1.5 (0.7)	1.8 (0.8)	190 (57.9)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 160'10"(49)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)	17.6 (8)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)		13.2 (6.0)		60 (18.3)
70 (21.3)	15.9 (7.2)	16.1 (7.3)	16.1 (7.3)	16.8 (7.6)	12.8 (5.8)		70 (21.3)
80 (24.4)	14.6 (6.6)	14.6 (6.6)	14.8 (6.7)	15.4 (7)	12.6 (5.7)	8.4 (3.8)	80 (24.4)
90 (27.4)	11.5 (5.2)	11.7 (5.3)	11.9 (5.4)	13 (5.9)	11 (5)	8.2 (3.7)	90 (27.4)
100 (30.5)	9.3 (4.2)	9.5 (4.3)	9.7 (4.4)	10.6 (4.8)	9.9 (4.5)	7.7 (3.5)	100 (30.5)
110 (33.5)	7.5 (3.4)	7.7 (3.5)	8.2 (3.7)	8.6 (3.9)	8.4 (3.8)	7.3 (3.3)	110 (33.5)
120 (36.6)	6.2 (2.8)	6.4 (2.9)	6.6 (3)	7.3 (3.3)	7.1 (3.2)	6.6 (3)	120 (36.6)
130 (39.6)	5.1 (2.3)	5.1 (2.3)	5.5 (2.5)	6 (2.7)	5.7 (2.6)	6.4 (2.9)	130 (39.6)
140 (42.7)	4 (1.8)	4.2 (1.9)	4.4 (2)	4.9 (2.2)	4.6 (2.1)	5.1 (2.3)	140 (42.7)
150 (45.7)	3.1 (1.4)	3.3 (1.5)	3.5 (1.6)	4 (1.8)	3.7 (1.7)	4.6 (2.1)	150 (45.7)
160 (48.8)	2.2 (1)	2.4 (1.1)	2.9 (1.3)	3.1 (1.4)	3.1 (1.4)	3.7 (1.7)	160 (48.8)
170 (51.8)				2.4 (1.1)	2.4 (1.1)	3.1 (1.4)	170 (51.8)
180 (54.9)					1.7 (0.8)	2.4 (1.1)	180 (54.9)
190 (57.9)						1.5 (0.7)	190 (57.9)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 170'8"(52)						
Radius ft (m)	Fixed jib length ft(m)						Radius ft (m)
	19'8" (6)		39'4" (12)		59'1" (18)		
	Fixed jib angle(°)						
	10	30	10	30	10	30	
50 (15.2)	17.6 (8)						50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)				60 (18.3)
70 (21.3)	15.9 (7.2)	16.1 (7.3)	16.1 (7.3)	16.8 (7.6)	13.2 (6)		70 (21.3)
80 (24.4)	13.9 (6.3)	14.1 (6.4)	14.6 (6.6)	14.1 (6.4)	12.8 (5.8)	8.4 (3.8)	80 (24.4)
90 (27.4)	11 (5)	11.7 (5.3)	11.7 (5.3)	12.1 (5.5)	11.2 (5.1)	8.2 (3.7)	90 (27.4)
100 (30.5)	9. (4.1)	9.5 (4.3)	9.5 (4.3)	10.4 (4.7)	9.9 (4.5)	7.5 (3.4)	100 (30.5)
110 (33.5)	7.3 (3.3)	7.7 (3.5)	7.7 (3.5)	8.4 (3.8)	8.2 (3.7)	7.3 (3.3)	110 (33.5)
120 (36.6)	5.7 (2.6)	6.2 (2.8)	6.6 (3)	7.1 (3.2)	6.5 (3.1)	6.6 (3)	120 (36.6)
130 (39.6)	4.6 (2.1)	4.9 (2.2)	5.3 (2.4)	5.8 (2.6)	5.5 (2.5)	5.3 (2.4)	130 (39.6)
140 (42.7)	3.7 (1.7)	3.7 (1.7)	4.4 (2)	4.6 (2.1)	4.6 (2.1)	5.1 (2.3)	140 (42.7)
150 (45.7)	2.9 (1.3)	3.1 (1.4)	3.5 (1.6)	3.7 (1.7)	3.7 (1.7)	4.4 (2)	150 (45.7)
160 (48.8)	2 (0.9)	2.2 (1)	2.6 (1.2)	2.9 (1.3)	2.9 (1.3)	3.5 (1.6)	160 (48.8)
170 (51.8)		1.5 (0.7)	2 (0.9)	2.2 (1)	2.2 (1)	2.9 (1.3)	170 (51.8)
180 (54.9)				1.5 (0.7)	1.5 (0.7)	2 (0.9)	180 (54.9)

Table 2-17 Lifting capacity on SF-2 boom

Unit: kip (ton)

	Main boom length ft(m) 180'5"(55)				
Radius ft (m)	Fixed jib length ft(m)				Radius ft (m)
	19'8" (6)		39'4" (12)		
	Fixed jib angle(°)				
	10	30	10	30	
50 (15.2)	17.6 (8)				50 (15.2)
60 (18.3)	17.6 (8)	17.6 (8)	17.6 (8)		60 (18.3)
70 (21.3)	15.9 (7.2)	16.1 (7.3)	16.1 (7.3)	15.7 (7.1)	70 (21.3)
80 (24.4)	13.2 (6.0)	13.9 (6.3)	14.3 (6.5)	14.8 (6.7)	80 (24.4)
90 (27.4)	10.8 (4.9)	11.2 (5.1)	11.2 (5.1)	12.3 (5.6)	90 (27.4)
100 (30.5)	8.8 (4)	9.0 (4.1)	9 (4.1)	10.1 (4.6)	100 (30.5)
110 (33.5)	7.1 (3.2)	7.3 (3.3)	7.5 (3.4)	8.4 (3.8)	110 (33.5)
120 (36.6)	5.5 (2.5)	6 (2.7)	6 (2.7)	6.8 (3.1)	120 (36.6)
130 (39.6)	4.4 (2)	4.6 (2.1)	4.8 (2.2)	5.5 (2.5)	130 (39.6)
140 (42.7)	3.3 (1.5)	3.5 (1.6)	4 (1.8)	4.4 (2)	140 (42.7)
150 (45.7)	2.6 (1.2)	2.6 (1.2)	3.1 (1.4)	3.5 (1.6)	150 (45.7)
160 (48.8)	1.8 (0.8)	1.8 (0.8)	2.4 (1.1)	2.6 (1.2)	160 (48.8)
170 (51.8)			1.8 (0.8)	1.7 (0.8)	170 (51.8)



- (1) The value in bold is the lifting capacity determined by the strength of the machine, while the value that is not in bold is the lifting capacity determined by the stability of the machine;
- (2) The value given in the lifting capacity chart is the permissible maximum lifting capacity, which is obtained from calculation when the load is suspended (according to the standard ASME/ANSI B30.5). The value can not exceed 75% of the overturning lifting capacity when the crane is on firm and flat ground.

- (3) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged;
- (4) The value in the chart is the lifting capacity when the crane is working with 61740 Lbs (28t) rear counterweight and 22050lbs (10t) central counterweight in 360° range.
- (5) The hook on the main boom is nearest to the boom head.
- (6) The value in the chart is the maximum lifting capacity of the crane, including the weight of lifting device, hook, wire rope at the end of hook and so on.
- (7) Choose the type of hook on the load moment limiter before the system is switched to SF-2 configuration.
- (8) The crawler carriers of the crane are extended completely.

2.4.6 Lifting capacity in assembly mode

Use the mounting cylinder on the boom to lift a load during crane self-assembly and dismantling operation. The lifting capacity chart is shown in the table 2-18.

Table 2-18 Lifting capacity chart in assembly mode

Radius ft (m)	Main boom angle (°)	Lifting capacity kip (t)
7' (2.15)	84	26.4 (12)
8'2" (2.5)	79.6	26.4 (12)
9'10" (3)	73	26.4 (12)
11'5" (3.5)	66	26.4 (12)
13'1" (4)	58.5	24.2 (11)
14'9" (4.5)	50	22 (10)
16'5" (5)	39.8	20.9 (9.5)
18' (5.5)	24.9	18.7 (8.5)

CAUTION

- (1) Do not lift a load in the area which is not in the lifting capacity range, otherwise the crane may topple over or be damaged.
- (2) The crane must stand on firm and flat ground.
- (3) The value in the lifting capacity chart is the permissible maximum lifting capacity of the crane, which is determined by the strength of the crane.
- (4) The value in the above chart is the maximum lifting capacity of the cylinder, including the weight of lifting device, cylinder and so on.



Operator's Manual for Crawler Crane

Chapter 3 Safety Guidelines



Chapter 3 Safety Guidelines

3.1 Operational planning

In addition to a perfectly working crane and a well-trained crew, operational planning is an important precondition for safe and reliable crane operation.

The crane operator must obtain or receive the necessary information (familiarize himself with the operating manual, basic knowledge about pneumatic, electrical and hydraulic drive, and notes for safe operation as well as operating environment) before starting the crane, in particular:

- a) Clearly define the area of responsibility of all personnel concerned.
- b) Type of crane operation and required working mode.
- c) Distance between the lifting points and surrounding buildings.
- d) Influence of public facilities (including the overhead high/low voltage lines and underground gas pipes).
- e) Space requirements at the work site.
- f) Movement restrictions due to surroundings (e.g. is there another crane nearby in working).
- g) Number, material, dimensions, and weight of load(s) to be lifted.
- h) Required lifting height and slewing radius.
- i) Load-bearing capacity of soil or surface to be operated upon.
- j) Height and width of thoroughfares leading to the site.
- k) Other factors affecting the site (e.g. weather, live lines, etc.).
- l) Communication means adopted between signalman and crane operator.
- m) Take appropriate measures to keep people and equipment unconcerned away from the working area.

Based on the above information, the crane operator must assemble the equipment required to operate the crane:

- Required working mode for crane operation
- Hook blocks/load hook(hook with/without pulley)
- Weight of counterweight, etc



- (1) A correct and complete operational planning is vital for safe and problem-free operation of the machine. The operation planner must plan a safe and reliable operational planning by obtaining and analyzing all necessary information about the operation and considering all the factors that may impair safety of crane operation.**
- (2) If the crane operator does not possess all necessary and required information, it may prove impossible to carry out the intended work and accidents may be the result!**

3.1.1 Correct use of the crane

Using the crane correctly is a fundamental safety requirement, and slackness is not allowed.

No unauthorized use of crane for other purpose besides its designed function is allowed.

The manual lists the precautions and protective measures in the process of dismantling, test and maintenance of the crane.

The range for correct use of crane includes:

- a) Abide by the safety regulations on the work site;
- b) Accept and be familiar with the safety information in the operating manual;
- c) All safety devices can function normally;
- d) Use the fuel and lubricant properly in relevant manual or instructions.

Using the equipment correctly also includes appropriate repair and inspection of the equipment.

Without the written consent from the manufacturer and using the crane for purpose beyond its designed function is deemed as improper use. And the consequences arising therefrom will be the sole responsibility of the operator.

3.1.2 Possible consequences resulting from improper use of the crane

a) Improper use of crane may cause the following consequences:

- 1) The life of the operator and other related personnel will be threatened;
- 2) The equipment and property will be damaged;
- 3) The manufacturer will stop its maintenance for the equipment in warranty period.

b) Improper use of crane includes:

- 1) Unauthorized modification of the crane structure without written consent from the manufacturer;
- 2) Without acceptance test before commissioning the equipment;
- 3) Commissioning by unauthorized person;
- 4) Commissioning the crane without knowing the content of the manual;
- 5) Dangerous operation of the equipment;
- 6) Hoisting person using hoisting winch;
- 7) Lifting the load from the ground using main boom derricking winch;
- 8) Dragging the load on the ground;
- 9) Pulling the object with a force 2% more than the maximum load;
- 10) Not using the specified safety equipment when operating the crane, such as load moment limiter, hoisting limiter etc;
- 11) Not complying with the lifting capacity chart;
- 12) Installing unauthorized parts without the written consent from the manufacturer;
- 13) Operating the crane in dangerous area.

3.1.3 Responsibility of relevant personnel

a) Responsibility of the manufacturer:

- 1) Ensure the completeness of the equipment, accessories and the related technical documents upon its first delivery.
- 2) Supervise the performance of the product and update the related technical documents.
- 3) Provide worldwide service and maintenance service.
- 4) Build training center to train the equipment operator and maintenance personnel.

b) Responsibility of the user:

- 1) Ensure only the operator who has received professional training, read and know/knew about the operating manual will operate and maintain the equipment.
- 2) Make clear the responsibilities and obligations of the operator and maintenance personnel.
- 3) Provide necessary protecting device for operator and maintenance personnel.
- 4) Remind the personnel about their safety when working.
- 5) Once safety is threatened, close the equipment at once.
- 6) Inspect the crane according to the specified local regulations.
- 7) Inspect the crane according to the requirement from the manufacturer.
- 8) Make sure maintain and service the equipment in specified time period.
- 9) Allow relevant personnel from the manufacturer to approach the equipment to supervise its performance in a better way.
- 10) Make operating plan.

c) Responsibility of the crane operator:

- 1) Be responsible for the safety of the crane.。
- 2) Be equipped with necessary protecting devices to protect the safety of himself.
- 3) Make sure all control devices are in their neutral positions before starting the engine.
- 4) Check for function work of brake, emergency stop device for functional work before daily operation.
- 5) Operate according to lifting capacity chart strictly.
- 6) Once abnormal situation affecting equipment safety is found, report to the superior department or user immediately.
- 7) If safe operation of the crane is not guaranteed, stop the operation.
- 8) Make sure all control devices are in their neutral position and the engine is off before leaving the operator's cab.
- 9) After finishing the operation, put the igniting key in the off position, take down the cab key and engine key, and lock the door to prevent unauthorized person from operating the crane.
- 10) Keep the windshield, platform and step clean and stacking of sundries is not allowed.

3.1.4 Work area

Only the operator is allowed to stay on the equipment when the crane is working.

The operator can't leave the cab at any time when the crane is working.

In order to build a safe and comfortable working environment, the following requirements should be followed:

- a) Keep the cab clean. Clean the pedal and ashtray and put the drinks in the designated place.
- b) Don't put the magazines or other items on the control panel.
- c) Don't put the tools in the cab.
- d) No articles is allowed to put on the thoroughfare, such as clothes, protecting device, personal article, etc
- e) Snow, ice or other obstacles should not be put in the entrance of the cab.
- f) Keep all the windows and rearview mirrors clean without condensed water and ice.

3.2 Safety technical notes

3.2.1 Safety instructions for crane operator

The crane operator's primary responsibility is to control, operate and adjust the crane in a manner that is safe for both himself and others. Therefore the crane operator should meet the following requirements.

- a) The operator must be familiar with the operating manual for the crane, and know the working principle, structure performance and the safety devices' function and adjusting methods, as well as master the operation essentials and maintenance skills.
- b) The operator should inspect brake, load hook, wire rope and safety devices before operating the crane. Any irregularities detected during inspection should be removed immediately.
- c) The operator must focus his attention on his work during operation and is forbidden to chat with others. Generally speaking, the operator can only follow signal sent out by appointed persons. But for a stop signal, the operator must obey it at all times, no matter who gives it. He should refuse to accept signal which violates operation regulations. Stop the crane immediately if somebody is found climbing the crane.
- d) Operator who is in low spirits or poor health is not allowed to operate the crane.
- e) Crane operator and signaller should be familiar with safety rules, signals and symbols. Operating the crane after drinking is prohibited.
- f) Be qualified with the work in hearing, eyesight and reaction ability; be strong enough to operate safely, and has the ability to estimate distance, height and clearance correctly.
- g) Be familiar with the usage of fire extinguisher and be well trained; know how to survive under emergencies.
- h) Make sure that only authorized personnel are allowed to operate the crane.



Operate the crane correctly for the sake of safety and be familiar with the possible dangers caused by the work.

3.2.2 The requirement for the crane operator during the whole operation

The following improper operating errors should be avoided:

- a) Slewing too quickly;
- b) Quick braking when lifting the load;
- c) Quick braking during free fall process (optional);
- d) Diagonal pulling and slewing of the load to be lifted which is still in contact with the ground.
- e) Loose wire rope formations on the winch;
- f) Overloading or improperly attaching the load;

- g) Driving (or slewing) too fast with a load, or setting up and loading on an uneven surface;
- h) Diagonally pulling the load, or loosening of the lifted load;
- i) Swinging of suspended load;
- j) Crashing into bridges, roofs or high - voltage wiring;
- k) Incorrect assembly or disassembly of booms.



- (1) Operate the crane correctly for the sake of safety and be familiar with the possible dangers caused by the work.**
- (2) The operator must check that there is no obstacle or person in the slewing radius before starting any slewing movements, otherwise, the chance of accident will increase.**
- (3) Make a sound signal before slewing the crane.**
- (4) Control the speed of the crane movement by moving the control lever and adjusting the engine speed. Start and stop the slewing movements slowly and smoothly so as to make the speed under control.**
- (5) Quick starting or stopping slewing movement may swing the load, which may damage the boom or turn over the crane!**
- (6) Sudden brake of load during free-fall process is forbidden and the brake process should be under control, otherwise, the boom may be destroyed or the crane may topple over.**

3.2.3 Safety instructions for the rigger

The rigger is responsible for ensuring that the load is slung or released safely, and carefully using the lifting device and component correctly.

Qualifications of rigger:

- a) With crane operation certificate;
- b) Be qualified with the work in hearing, eyesight and reaction ability;
- c) Be strong enough to carry the lifting device or component;
- d) Be able to estimate the weight of the load, balance the load and judge the distance, height and clearance correctly;
- e) Be trained in the skill of handling load;
- f) Be able to choose proper lifting devices and components according to the loading condition;
- g) Be trained in hand signals for operation and familiar to use them;
- h) Be able to use audio equipment (such as interphone) safely to send out oral order exactly and clearly;
- i) Be capable of controlling and conducting the crane to move the load safely;
- j) Make sure that only authorized personnel are allowed to carry out the work.



Operate the crane correctly for the sake of safety and be familiar with the possible dangers caused by the work.

3.2.4 Safety instructions for the signalman

The main job of a signalman is to assist crane operator to carry out operation safely. Potential damage to property or personal injury could be avoided if the crane operator carries out the crane movement following the signals given out by appointed signalman. The signalman can take the place of the rigger to direct the operator to move the crane and the load. However, only one signalman or rigger could work with the crane operator at a time.

Qualifications for signalman:

- a) Familiar with the lifting task so as to cooperate with crane operator and other workers safely;
- b) Make sure that only authorized personnel are allowed to carry out the work;
- c) Be qualified with the work in hearing, eyesight and reaction;
- d) Be able to estimate the distance, height and clearance correctly;
- e) Be trained in professional hand signals for crane operation and familiar to use them;
- f) Use standard hand signals for crane operation. If necessary, use a radio device to send out correct and clear oral order;
- g) Be capable of conducting the crane to move the load safely;
- h) Position himself in a safe location from where he can see the whole process of operation and be seen clearly by all the personnel.



Operate the crane correctly for the sake of safety and be familiar with the possible dangers caused by the work.

3.2.5 Safety instructions for crane operating crew

- a) Any unsafe operation must be corrected or any dangerous situations must be reported to the supervisor.
- b) All the persons in the vicinity of the crane must observe the acoustic warning signals of the machine so as to ensure his and others' safety.
- c) All the workers must know about the content of the task and working sequence;
- d) Check whether dangerous situations occur during operation of the machine, and inform crane operator and signalman of the unsafe factors such as high-voltage power line, unauthorized persons and equipment, and poor ground conditions.

3.2.6 Electromagnetic influences

Strong electromagnetic fields are likely to be present if the construction site is close to a transmitter.



These electromagnetic fields can pose direct or indirect danger to persons or objects, for example:

- (1) Effect on human organs due to too high temperature.**
- (2) Danger of burns or inflammation due to too high temperature.**
- (3) Spark or electric arc formation.**

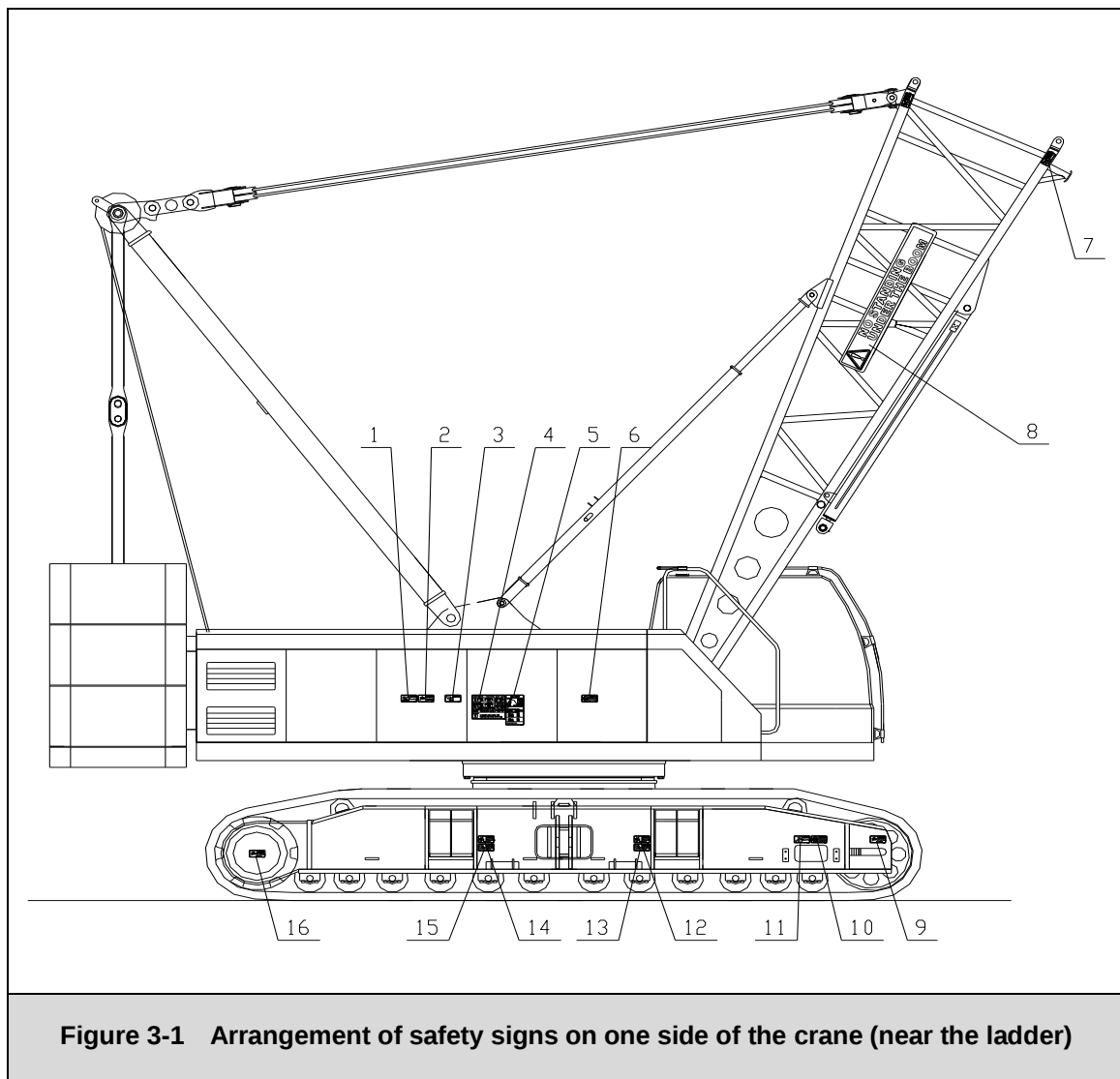
In any case, before working with the crane near transmitters, contact Zoomlion representatives. In addition, consult a high - frequency specialist.

- a) The whole crane must be “totally” grounded. Check visually or with a simple tester to ensure that the ladder, cab and cable pulleys are grounded.
- b) All personnel working on the crane or with large metal objects must protect themselves from burns by wearing non-conductive gloves and suitable clothing while working.
- c) If one feels a little increase in temperature, there is no need to panic. It is caused by the influence of high-frequency ray on the tools, structural steel member or support. At this time, stop the crane safely and leave it at once.
- d) The temperature of objects affected by high frequency radiation depends on their ‘size’. Cranes, undercarriage and coverings, for example, are “hotter”.
- e) Contacting with other crane loads (arcing) is not permitted when moving the crane. Since defects caused by burns can reduce rope carrying capacity, any such occurrences must be reported immediately to the machinery supervisor so that the ropes can be inspected.
- f) An insulator is required at all times between the crane load hook and the lifting device. It is strictly prohibited to remove this insulator.
- g) The ropes are strictly prohibited from touching the above insulator.
- h) Crane with attached loads may not be touched by any unprotected parts of the body after the load without insulator has been lifted or put down.
- i) Do not work with a bare upper torso or in short pants, this is prohibited.
- j) To minimize absorption of high frequency radiation, loads should be transported horizontally if possible.
- k) Loads must be grounded, or additional insulation used (rubber material between the tools used and gloves) when manual work is required.
- l) To avoid accidents, use a safety belt when working on components that are high off the ground.

- m) Handling explosive matter (such as refueling) may only be carried out at least 6 m away from the place where sparks could form due to handling of large metal parts. Use only conductive rubber hoses to refuel.
- n) Any accidents and unexpected events must be reported immediately to the local project manager and the safety engineer.

3.2.7 Safety signs

The positions on the crane that may pose danger or potential danger are labeled with safety signs. The arrangement of safety signs on one side of the crane (i.e. near the ladder on the slewing table) is shown in the figure 3-1. The arrangement of safety signs on the other side of the crane (i.e. near the operator's cab) is shown in the figure 3-2. As to the description of safety signs, please see the table 3-1.



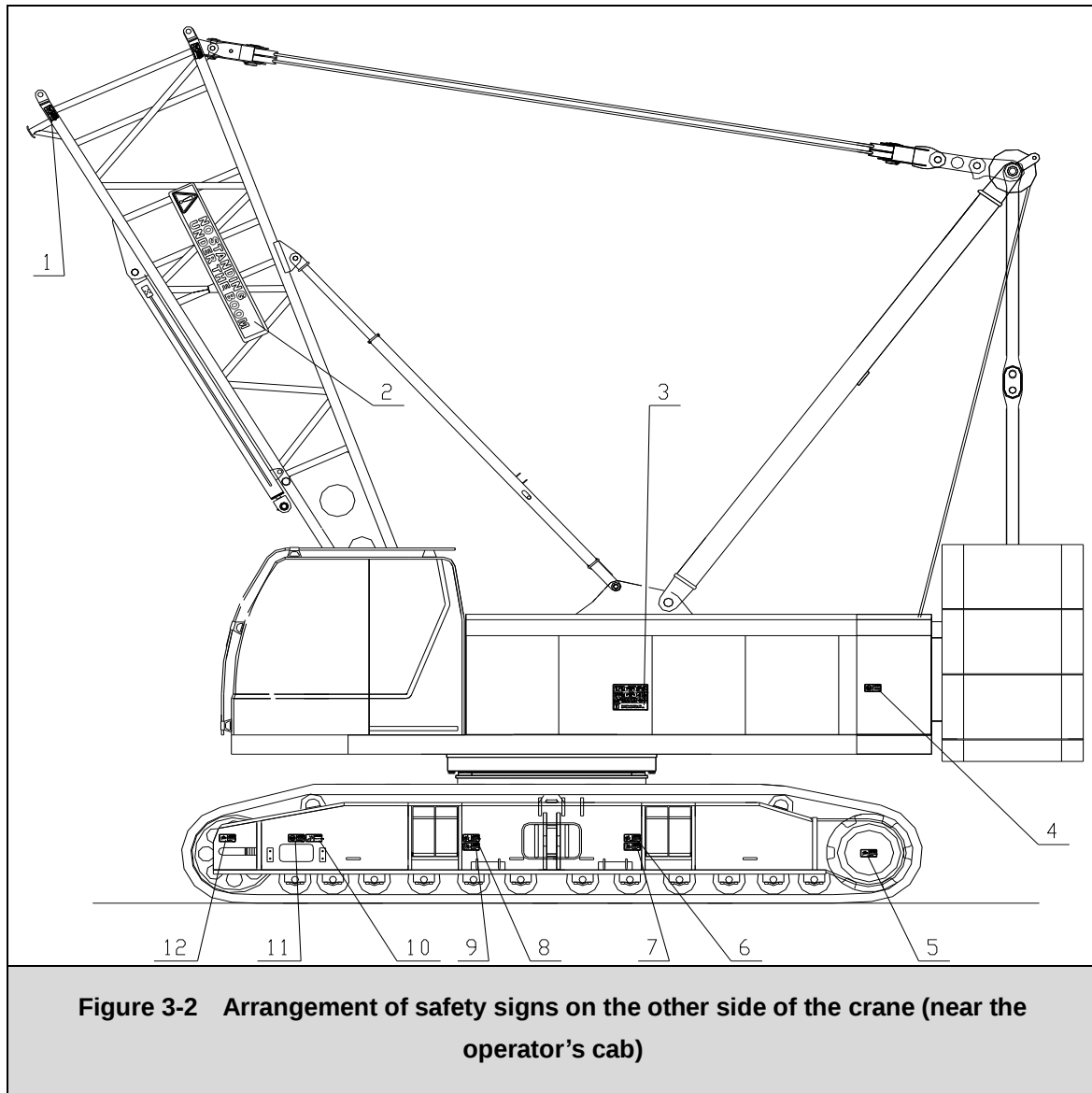


Table 3-1 Description of safety signs near the ladder and operator's cab

Figure 3-1	Figure 3-2	Safety signs	Description
1			Risk of burn

Table 3-1 Description of safety signs near the ladder and operator's cab

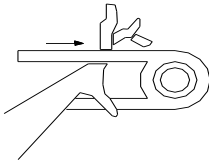
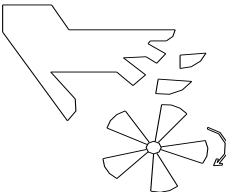
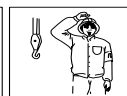
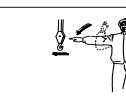
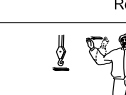
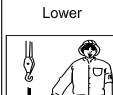
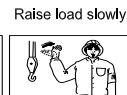
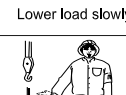
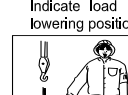
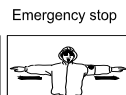
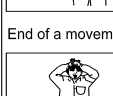
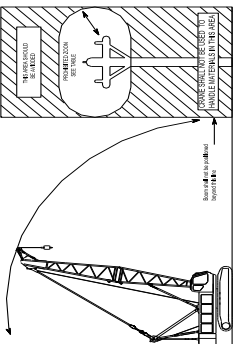
Figure 3-1	Figure 3-2	Safety signs	Description																												
2		 WARNING Moving parts can crush and cut. Do not operate when the engine is running.	Moving parts can crush and cut. Do not operate when the engine is running.																												
3		 WARNING Moving parts can crush and cut. Keep hands clear. Do NOT operate with the door opened.	Moving parts can crush and cut. Keep hands clear. Do not operate with the door opened.																												
4	3	Preparation  Use main hoist  Rotate Turn left/right  Raise boom  Lower boom  Use auxiliary hoist  Hoist  Rotate slowly  Raise boom slowly  Lower boom slowly  Lower  Raise load slowly  Lower load slowly  Indicate load lowering position  Stop  Emergency stop  End of a movement  STANDARD HAND SIGNAL FOR CONTROLLING CRANE OPERATION	Standard hand signal for controlling crane operation. For the details, please refer to section 10 of chapter 3.																												
5		DANGER  Table Required clearance For Normal Voltage in Operation Near High-Voltage Power Lines and Operation in Transit With No Load and Boom or Mast Lowered <table><tr><th>Normal Voltage , KV (Phase to Phase)</th><th>Minimum Required clearance ft(m) [Note (1)]</th></tr><tr><td colspan="2">Operation Near High-Voltage Power lines</td></tr><tr><td>To 50</td><td>10(3.05)</td></tr><tr><td>Over 50 to 200</td><td>15(4.60)</td></tr><tr><td>Over 200 to 350</td><td>20(6.10)</td></tr><tr><td>Over 350 to 500</td><td>25(7.62)</td></tr><tr><td>Over 500 to 750</td><td>35(10.67)</td></tr><tr><td>Over 750 to 1000</td><td>45(13.72)</td></tr><tr><td colspan="2">Operation in Transit With No Load and Boom or Mast Lowered</td></tr><tr><td>To 0.75</td><td>41(12.2)</td></tr><tr><td>Over 0.75 To 50</td><td>61(18.3)</td></tr><tr><td>Over 50 To 345</td><td>103(30.5)</td></tr><tr><td>Over 345 To 750</td><td>164(87)</td></tr><tr><td>Over 750 To 1000</td><td>206(10)</td></tr></table> Environmental conditions such as fog smoke or precipitation may require increased clearances	Normal Voltage , KV (Phase to Phase)	Minimum Required clearance ft(m) [Note (1)]	Operation Near High-Voltage Power lines		To 50	10(3.05)	Over 50 to 200	15(4.60)	Over 200 to 350	20(6.10)	Over 350 to 500	25(7.62)	Over 500 to 750	35(10.67)	Over 750 to 1000	45(13.72)	Operation in Transit With No Load and Boom or Mast Lowered		To 0.75	41(12.2)	Over 0.75 To 50	61(18.3)	Over 50 To 345	103(30.5)	Over 345 To 750	164(87)	Over 750 To 1000	206(10)	Required safety distance when working near the high-voltage power line.
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To 50	10(3.05)																														
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Over 50 To 345	103(30.5)																														
Over 345 To 750	164(87)																														
Over 750 To 1000	206(10)																														

Table 3-1 Description of safety signs near the ladder and operator's cab

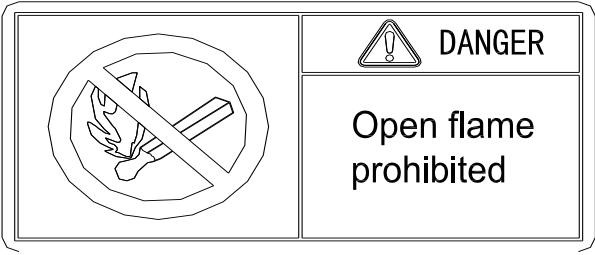
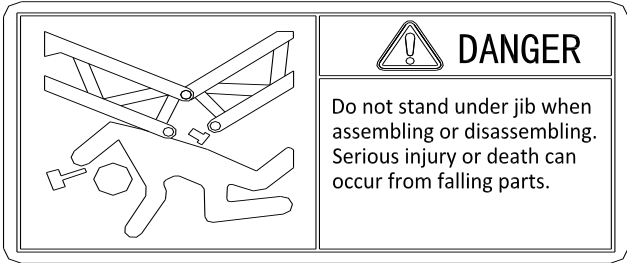
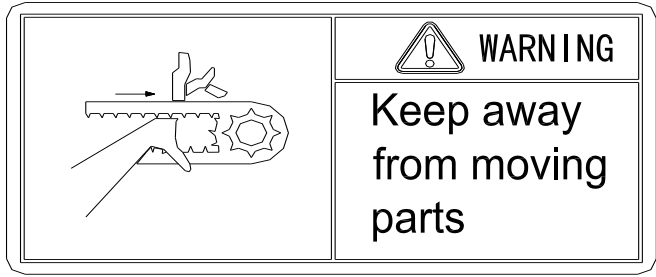
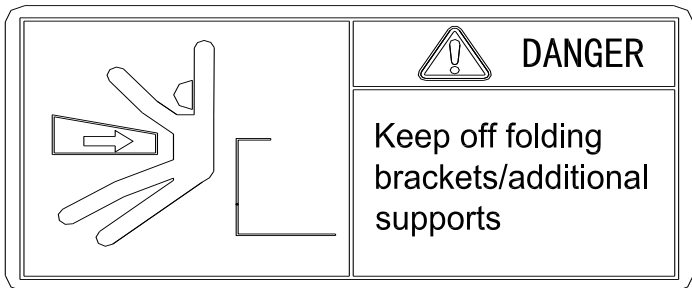
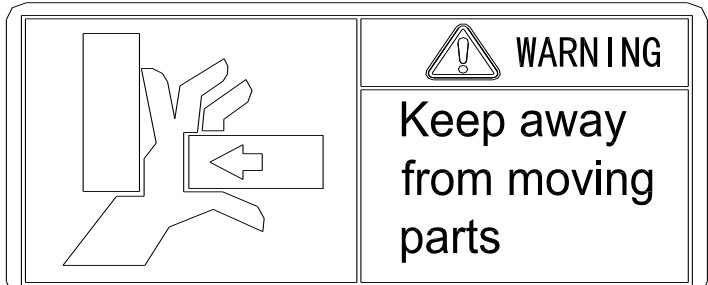
Figure 3-1	Figure 3-2	Safety signs	Description
6	4		Open flame prohibited.
7	1		Do not stand under the jib during assembling and disassembling process.
8	2		No standing under the boom.
9,16	5,12		Keep away from moving parts.
10	11		No access for unauthorized personnel.

Table 3-1 Description of safety signs near the ladder and operator's cab

Figure 3-1	Figure 3-2	Safety signs	Description
11	10		Risk of falling.
12,14	6,8		Keep off folding brackets/additional supports.
13,15	7,9		Keep away from moving parts.

The arrangement of safety signs on the slewing table is shown in the figure 3-3, and the description of safety signs is shown in the table 3-2.

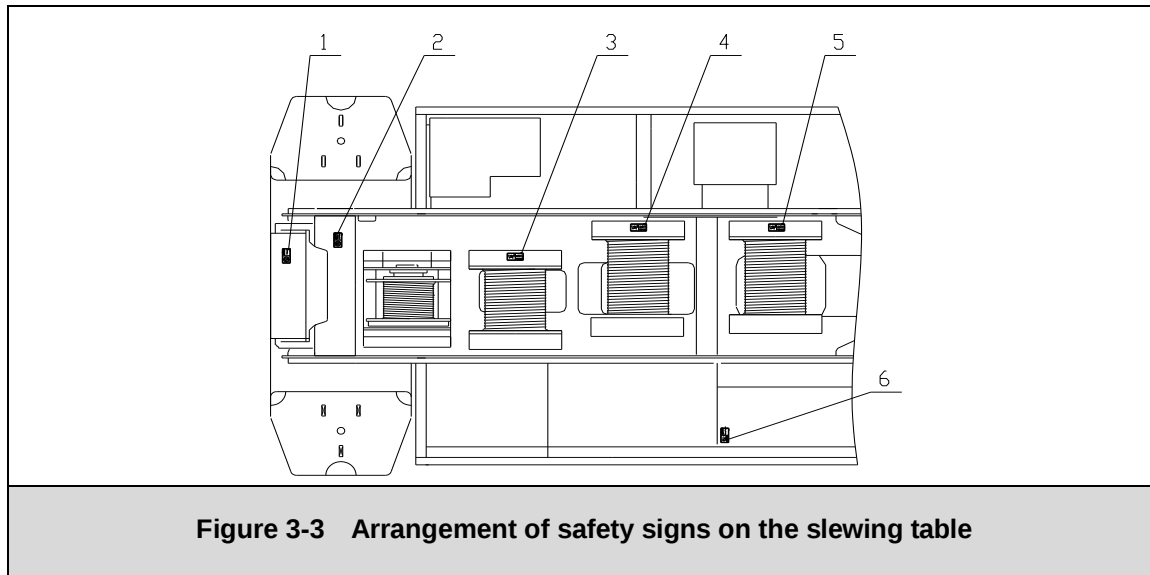


Table 3-2 Description of safety signs on the slewing table

No.	Safety signs	Description
1		Step off.
2		Access prohibited.
3,4,5		Keep away from moving parts.
6		Risk of burn.

Arrangement of safety signs in the front of slewing table is shown in the figure 3-4, and the description of safety signs is shown in the table 3-3.

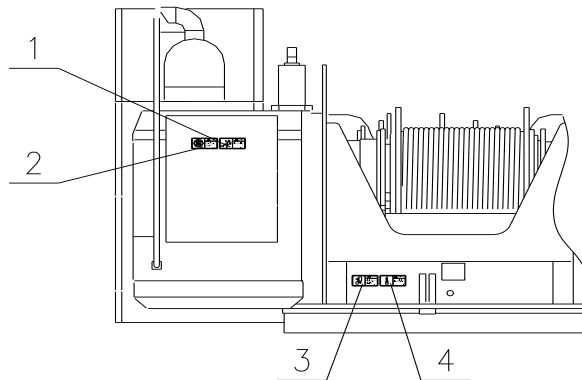
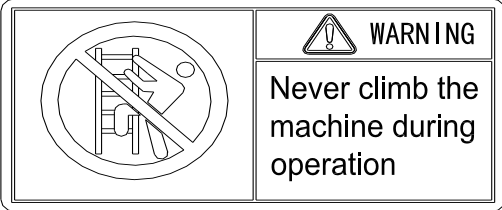
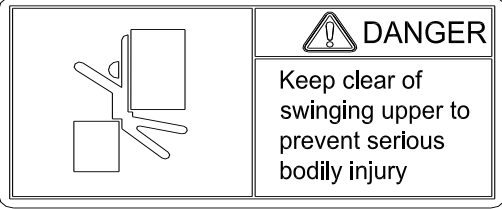
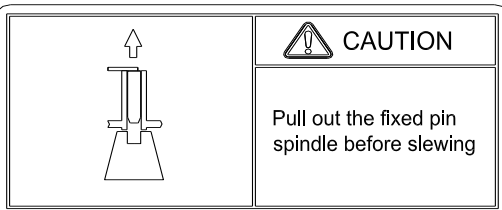


Figure 3-4 Arrangement of safety signs in the front of slewing table

Table 3-3 Description of safety signs in the front of slewing table

No.	Safety signs	Description
1		Risk of falling.
2		Never climb the machine during operation.
3		Keep clear of swinging area to prevent serious body injury.
4		Pull out the fixed pin spindle before slewing.

Arrangement of safety signs at the rear side of slewing table is shown in the figure 3-5, and the description of safety signs is shown in the table 3-4.

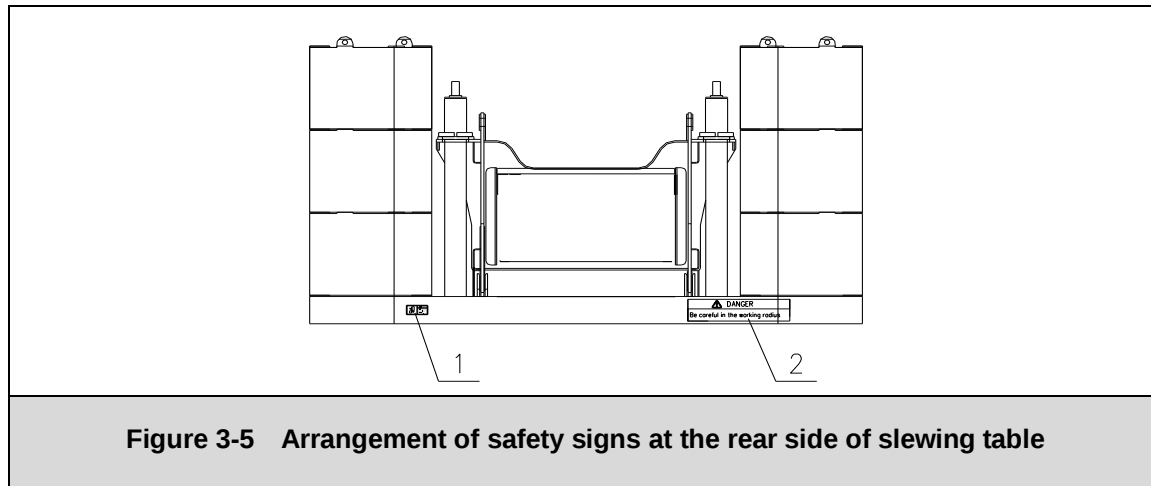
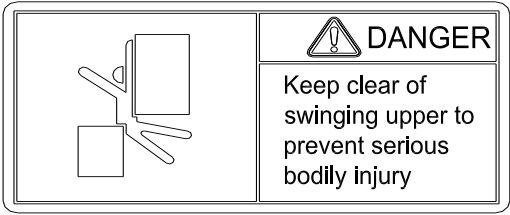


Figure 3-5 Arrangement of safety signs at the rear side of slewing table

Table 3-4 Description of safety signs at the rear side of slewing table

NO.	Safety signs	Instructions
1		Keep clear of swinging area to prevent serious body injury.
2		Be careful in the working radius.

Arrangement of safety signs on the derricking traveling block is shown in the figure 3-6, and the description of safety signs is shown in the table 3-5.

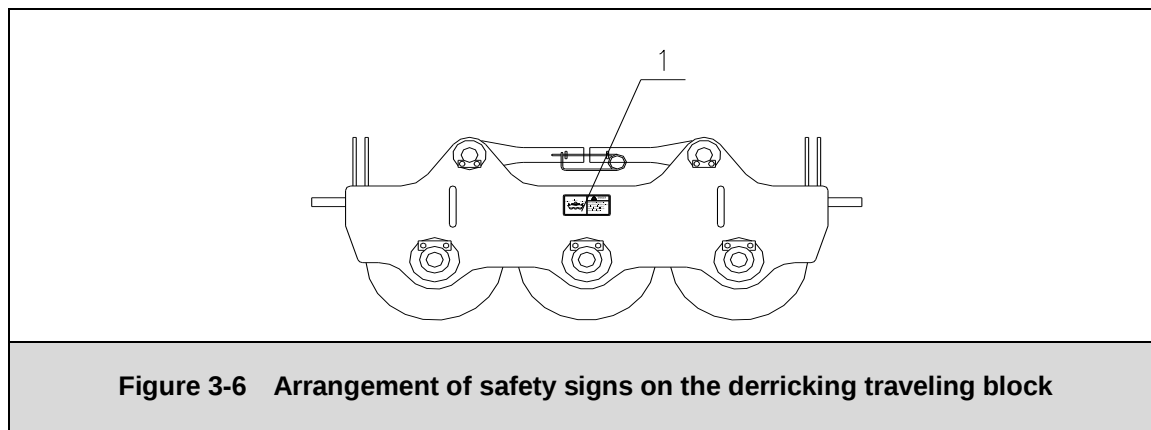
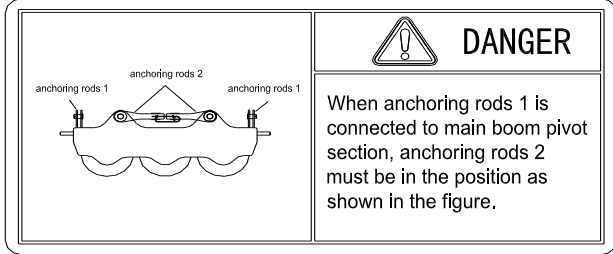


Figure 3-6 Arrangement of safety signs on the derricking traveling block

Table 3-5 Description of safety signs on the derricking traveling block

NO.	Safety signs	Description
1		After the derricking travelling block is fastened to the main boom pivot section, fold and secure the crossing coupling of guy lines.



- (1) When the safety sign is damaged or illegible, please order it from appointed supplier.
- (2) It is forbidden to cover or take off the safety signs casually.
- (3) If the safety sign is covered with dust, clean it in time.
- (4) The operator's cab should be equipped with an emergency hammer which can be used to smash the window in an emergency so that the operator can run away from the cab in an emergency.

3.2.8 The potential dangers existing in crane operation

- a) Do not stand under a suspended load!
- b) No one should be in danger zone of the machine.
- c) Do not reach into moving drives or parts of the machine.
- d) Access to the top of the upper carriage is only permitted
 - To carry out assembly, maintenance or service work,
 - With appropriate safety measures against falling, such as wearing non-slip boots.

Do not walk on the roof of the operator's cab.
- e) Secure the open sliding doors or the front windscreen of the cab, as well as the open engine compartment doors, against inadvertently closing.
- f) When driving bolts or pins in or out,
 - Never stand between or below the boom intermediate sections,
 - Never align bolt connections by hand,
 - Use appropriate special tools (mandrel, stud wrench, etc),
 - Always wear safety goggles.
- g) Safety instructions and preventive measures to avoid mechanical hazards:
 - 1) Only remove protective hoods and safety covers
 - When the machine has come to a standstill or
 - Is secured against an accident restart.

- 2) Before starting operation, check that
 - All protective covers and casings are fitted correctly,
 - All the engine compartment doors are locked,
 - All the safety devices are operational.
- 3) Do not use cables or chains that are damaged or not up to lifting the specified load.
- 4) Always wear protective gloves when handling cables.
- h) Do not allow limbs or objects to come into contact with the engine fans. Objects that fall into the fan are shredded or hurled out and can cause serious injury.



Dangers exist during the process of crane operation, which can endanger the operator and the persons around.

3.2.9 Injuries due to hydraulic energy

These safety instructions and preventive measures can protect against injuries:

- a) Repairs to hydraulic equipment may only be carried out by qualified technicians with specialized knowledge and experience of hydraulics.
- b) Before starting repair work, depressurize all pressure hoses and the system sections that are to be opened.
- c) When leaks are small, it is sometimes hardly possible to see the hydraulic oil seeping out. Never try to locate the leak with your bare hand, always use a piece of cardboard or wood for this purpose.
- d) Check all hoses, hose connections and hydraulic fittings regularly, at least once a month, for possible leaks and damage.
- e) Damaged hoses and hose connections must be replaced immediately with the original manufacturer's spare parts.



Escaping hydraulic oil under high pressure can cause serious injury if it

- **Penetrates clothing and the surface of the skin,**
- **Enters the flesh and causes tissue damage**
- **And/ or gets into the bloodstream.**

First aid for injuries:

Bandage injured area(s) with anti-bacterial bandage and seek medical attention at once.

3.2.10 Scald

These safety instructions and preventive measures protect against burns:

- a) Always wear protective gloves when working near hot components.
- b) The engine cooling system is pressurized and the escaping steam can cause scald injuries. Therefore
 - Only check the coolant level after the cover on the equalizing reservoir has cooled to the point where it can be touched.
 - Then turn the cover on the equalizing reservoir carefully by 90°, to release the excess pressure.
- c) Avoid touching
 - The coolant or parts bearing hydraulic oil,
 - The hot hydraulic or engine oil,
 - The hot exhaust and the turbocharger.
- d) Carry out the cleaning and maintenance work once the machine has cooled.



Certain equipment surfaces and operating media can reach an operating temperature of over 65° [149°F].

First aid for burns:

- **Immediately run cold water over the burn and to cool it down**
- **Cover the burn with an anti-bacterial bandage and seek medical attention immediately.**

3.2.11 Risk of chemical burns

- a) First aid after contacting with battery acid:
 - 1) Acid sprayed into the eyes or on the skin must be rinsed away as quickly as possible with a lot of clean water. In the event of eye injuries, go to the hospital immediately to let the professional medical workers deal with it.
 - 2) In the event of skin injuries, cover the injured area with anti-bacterial bandage and seek medical attention immediately.
 - 3) Neutralize escaping battery acid with a soda solution: dissolve soda powder, available as detergent or baking power, in water. Pour the solution carefully on the acid until it no longer foams.
- b) Follow these safety instructions:
 - 1) Always disconnect battery leads before doing any maintenance to the electrical system.
 - 2) When working with or near a battery, the operator must always wear safety goggles and protective gloves.

- 3) Never short circuit the battery.
- 4) Never place any tools on the batteries.
- 5) Discharged battery:
 - Can burst open upon freezing.
 - Stored in frost-proof rooms.
- 6) In storage:
 - Always keep horizontal,
 - Do not store near hot objects of any type,
 - Do not expose to direct sunlight,
 - Check that whether the battery has sufficient charge every four weeks and if not, recharge the battery.



- (1) Batteries are filled with sulfuric acid, and can produce explosive gases under high-rate charging or discharging.**
- (2) Battery acid can lead to blindness if it comes into contact with the eyes. It also can lead to chemical skin burns, destroy body tissue, and ruin clothing.**

3.2.12 Risk of fire and explosion

Procedure in case of a fire:

- a) Switch off the engine immediately.
- b) If possible use the radio to call for help.
- c) Turn ignition key to the "0" position and leave the operator's cab.
- d) Evaluate the situation; only if there is absolutely no risk to your personal safety, you must attempt to fight the fire.
- e) Use the fire extinguishers equipped on the crane to fight the fire.
- f) Find the seat of the fire. Only spray the seat of the fire from below.
- g) While fighting the fire, ask a co-worker to
 - Call the fire department.
 - Help with extinguishing the fire by using more fire extinguishers rated for the particular type of fire.

Follow these safety instructions and preventive measures:

- a) Always know the number and location of every fire extinguisher, and familiarize yourself with how to use them.
- b) Always refuel the equipment in a well ventilated area.
- c) Before filling the fuel tank or the hydraulic tank, the following must be turned off:
 - 1) The engine;
 - 2) The cab's heater;
 - 3) The auxiliary heating.

- d) While filling the fuel tank or the hydraulic tank: smoking and the use of fire or open flames is strictly prohibited.
- e) When filling the fuel tank through the filler pipe, electrostatic discharges may occur between the equipment and the fuel dispensing system:
 - 1) Always make sure that there is a good metallic contact between the pump nozzle and the filler pipe.
 - 2) Or before refueling, create a conductive connection between the equipment and the fuel dispensing system.
- f) If any fuel has spilled while refueling,
 - 1) Wipe all excess or spilled fuel off the equipment immediately.
 - 2) Neutralize any fuel on the ground with bonding agents.
- g) After refueling, only start the diesel engine when:
 - 1) The tank cap which can be locked has been properly replaced on the tank.
 - 2) The equipment has left the area and the suction hose of the refueling system has been removed.
 - 3) Auxiliary staff is no longer in the vicinity of the equipment.
- h) Do not use starting auxiliary device containing ether due to the risk of explosion.
- i) Do not carry any combustible liquids on the equipment, except for the tanks provided for this purpose.
- j) Never use any combustible liquids to clean the equipment.
- k) In the center power unit area:
 - Never store cleaning cloths, rags, etc.
 - Always remove flammable residues and deposits (for example: pools of oil, dry leaves, pine needles, ash, waste paper, etc) regularly.
- l) Irregularly check that protective covers, cable and hose holders are complete and fit tightly.
- m) The following are strictly prohibited near the battery acid electrolyte: smoking, fire and open flame, ignition sources/electrical devices.

 CAUTION

Hydraulic oil that is on fire can only be successfully extinguished with a fire extinguisher at the very start of the fire. If not extinguished quickly, the fire will expand into a full-fledged fire resulting in a total loss of the equipment.

 WARNING

- (1) When refueling the equipment, an explosive mixture of gases may be created.**
- (2) Escaping diesel fuel or hydraulic oil may ignite if it comes into contact with a hot surface.**

- (3) During high-rate charging or discharging, batteries can produce a explosive gas, even an explosion.**

3.2.13 Risk of poisoning and asphyxiation

Symptoms of carbon monoxide poisoning, with increasing intensity:

- a) Slight: headaches, short of breath without much exertion, heart palpitations.
- b) Medium: also tired, dizzy and confused.
- c) Serious: impaired judgment, nausea with vomiting, cramps and unconsciousness. Death results from respiratory and circulatory failure.

First aid for initial carbon-monoxide poisoning

When the symptoms of poisoning appear

- a) Switch off the machine engine and all fuel driven units;
- b) Leave the driver's cab and the site of the machine immediately;
- c) Breathe in plenty of fresh air and seek medical attention.

Protecting yourself when rescuing unconscious persons:

Ventilate closed rooms thoroughly before entering them.

Follow these safety instructions and preventive measures:

- a) Make sure there is adequate ventilation before operating the machine in an enclosed area.
- b) Do not operate the auxiliary heating equipment in an enclosed area.
- c) In areas where there are hazardous materials, always wear suitable protective gear.
- d) If a breathing mask is necessary, wear it at all times and renew the filter elements in time.



Carbon-monoxide gas:

- (1) Blocks the intake of oxygen and leads to death by asphyxiation.**
- (2) Is odorless and colorless gas.**
- (3) Is heavier than air therefore, does not rise.**



- (1) The engine exhaust gases contain carbon monoxide and other gases that are harmful to the operator's health. Never operate the engine in a confined or poorly ventilated area.**
- (2) When the equipment is used in areas where there are hazardous materials, such as toxic waste dumps, it is possible for the operator to come into contact with materials and gases that are injurious to health.**

3.2.14 Endangering the environment

Follow these safety instructions and precautionary measures:

- a) Fix any leaks on the machine immediately.
- b) Neutralize escaped hydraulic oil, fuel or lubricating oil straight away with a binding agent.
- c) Comply with the environmental protection regulations relating to the disposal of fuels and lubricants applicable in the particular country.
- d) When draining fuels and lubricants, use only containers that are big enough, do not leak and are resistant to oil, fuel and other chemicals.
- e) Use separate containers to collect and dispose of the different fuels and lubricants.



Fuels, hydraulic oil, cleaning agents or similar liquids can damage or pollute the environment if they get into the ground, into river or into the sewer system.

3.3 Slings

3.3.1 Hooks

- a) Usage:
 - 1) The hook must be selected to work with the cable, the chain or the strap used in the lifting device.
 - 2) The hook needs to be made according to correct size so that it can hold the load securely.
- b) Types:
 - 1) There are many types of hooks available from multiple manufacturers.
 - 2) Hooks must be made of forged steel and equipped with safety latches.
- c) Capacity:
 - 1) Hooks are rated at maximum capacity for vertical pulls and reduces capacity when side loaded.
 - 2) The limit lifting capacity for a hook used in the manner for which it is intended must be equal to or exceed the rated load of the chain, the wire rope, or other suspension member to which it is attached.
 - 3) The designed limit lifting capacity means the limit weight put on the hook bearing point from the load.
 - 4) The manufacturer's identification must be forged or die stamped on a low-stress and non-wearing area of the hook.
- d) Safe operation:
 - 1) Do not side load hooks.
 - 2) Force on the safety latch can cause failure of hooks.

3.3.2 Rigging introduction

Care and attention to the rigging is a fundamental part of the operation safety:

- a) Perform frequent and periodic inspections of the rigging hardware, wire rope, and slings.
- b) A written equipment record must be kept monthly. Reviewing the history can provide vital information, for example, reveal a faster wear that can be attributed to defects in the crane.
- c) Remove from service rigging equipment that has been damaged.
- d) Inspect rigging accessories before each shift.
- e) Determine the weight of the load and choose appropriate equipment.



The strength and the integrity of the rigging hardware is another fundamental part of the safe lifting operations. To maintain rigging hardware and its components, frequent and periodic inspections are required.

3.3.3 Slings introduction

The predominant characteristics of a sling are determined by the components of that sling. For example, the strengths and the weaknesses of a wire rope sling are essentially the same as those of the wire rope from which it is made.

- a) Slings are generally one of the following six types:
 - 1) Chain;
 - 2) Wire rope;
 - 3) Metal mesh;
 - 4) Natural fiber rope;
 - 5) Synthetic fiber rope;
 - 6) Synthetic web.
- b) Factors that must be taken into consideration when choosing the best sling for the job include:
 - 1) Size of the load;
 - 2) Weight of the load;
 - 3) Shape of the load;
 - 4) Temperature;
 - 5) Sensitivity of the material to be moved;
 - 6) Environmental that the sling will be used.
- c) Sling identification tags: all slings should be labeled with identification tags. The information required to be on the identification tags is as follows:
 - 1) Manufacturer's name or trademark;
 - 2) Diameter or size of sling;
 - 3) Material of sling;
 - 4) Rated load for the types of sling used;
 - 5) Lifting angle the load rating is based.

3.3.4 Sling safety

- a) Before making a lift, check to be certain that the sling is properly secured around the load and that the weight and balance of the load have been accurately determined. If the load is on the ground, do not drag the load along the ground. This could damage the sling.
- b) Position the hook directly over the load and seat the sling squarely within the hook bowl. This gives the operator maximum lifting efficiency without stressing the sling.
- c) Make sure that the load is not clamped, or bolted to the floor.
- d) Guard against shock loading by pulling the slack sling straight slowly.
- e) Apply power cautiously so as to prevent jerking at the beginning of the lift, and accelerate or decelerate slowly.

- f) Check the tension on the sling. Raise the load a few inches, stop, and check for proper balance and that all items are clear of the path. Never allow anyone to ride on the hook or load.
- g) Keep all personnel clear before the load is being raised, moved, or lowered. Crane operators and the rigger should watch the load all the time when it is in motion.



Never allow anyone to ride on the hook or load !

3.3.5 Sling safety guide

- a) Sling must not be shortened with knots, or other makeshift devices.
- b) Sling legs cannot be kinked.
- c) Slings cannot be loaded in excess of their rated capacities.
- d) Slings using a basket hitch can have the loads balanced to prevent slippage.
- e) Slings must be securely attached to their loads.
- f) Slings must be padded or protected from the sharp edges of their loads.
- g) Suspended loads must be kept clear of all obstructions.
- h) All personnel must be kept clear of loads that is about to be lifted and of suspended loads.
- i) Hands or fingers cannot be placed between the sling and its load while the sling is being tightened around the load.
- j) Do not impact the load.
- k) Do not pull the lifting devices under the load before the load is lifted off the ground.

3.3.6 Taglines

The safest method for a rigger to control a load attached onto the hook is with a tagline (refer to the figure 3-7):

Taglines are used to control load spin. Keep the tagline away from the center of gravity.

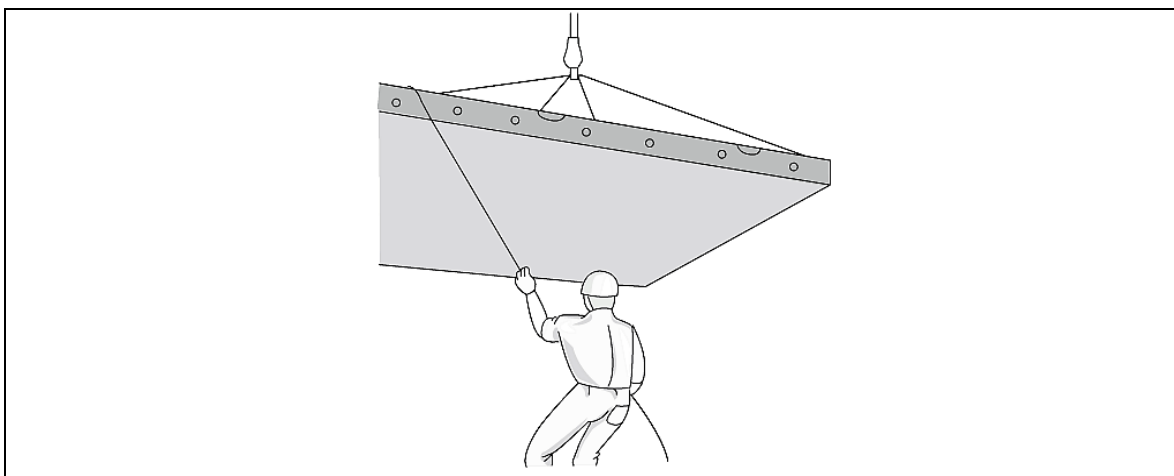


Figure 3-7 Tagline diagram



- (1) Never stand directly underneath a lifted load. Observe the instruction “No person is allowed to stand under the boom when the crane is operated”.**
- (2) Tail the load by tagline with proper force. Otherwise the crane may topple over.**
- (3) Never wrap the tagline around your body or limbs.**

3.3.7 Load center of gravity

a) The center of gravity

The center of gravity of an object is the point at which the weight of the object acts as though it were concentrated.

All loads to be lifted must be equipped with lifting device and rigging above the center of gravity in order to prevent tipping and possible hazards to equipment and workers. The lifting force must always be located above the center of gravity. Exert a straight vertical pull to prevent swinging of the load. In all crane lifts, the center of gravity must remain below the hook and below the point of attachment for any rigging.

A center of gravity above the hook is unstable and will cause the load to flip as the load will attempt to ‘find’ the center of gravity during lifting process. Similarly, loads which are not balanced horizontally can slip from the rigging.

The overall stability of the load is a combination of balance with respect to center of gravity, distribution of weight, and proper rigging practices.

b) To determine the center of gravity

The center of gravity of a regularly shaped object may be estimated accurately by determining its approximate center.

Finding the center of gravity of irregularly-shaped objects can be more difficult, but it is necessary. A load will always hang from its attachment point through the center of gravity. It is important to visualize this before making a lift.

3.4 Requirements for operating site

It is very important to choose an appropriate location for crane operation in order to minimize safety risks. The operating site should be selected so that:

- a) Crane movement can be carried out within the smallest possible radius.
- b) No obstacles hinder necessary movements.
- c) The ground of the operating site is able to support expected loads.



The most essential requirement for safe crane operation is working on firm ground with the capacity to support your loads.

3.4.1 Slopes and trenches

The crane can not be too close to slopes or trenches. A safety distance must always be kept from them depending on the type of soil.

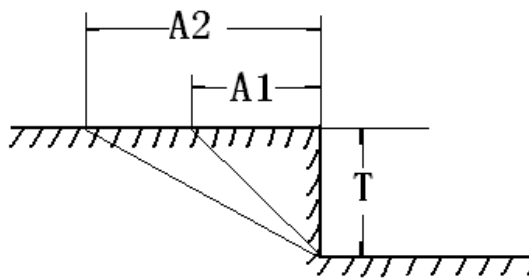


Figure 3-8 Safety distance from slopes and trenches



Safety distance is measured from the foot of the trench and it is:

1. Soft or backfilled soil = $2 \times$ depth of trench ($A2 = 2 \times T$) ;
2. Hard or natural soil = $1 \times$ depth of trench ($A1 = 1 \times T$).



If a safe distance is not maintained, the slope or trench must be firmly filled. Otherwise, there is a danger that the edge of the slope or trench will collapse.

3.4.2 Permissible ground pressure

The ground upon which the crane works must be flat and firm

The recommended ground endurance: 50t/m^2

The following table 3-6 shows the bearing capacity of various grounds, for reference only.

Table 3-6 Bearing capacity of various grounds

No	Soil type	Load-bearing capacity (unit: $\times 0.1\text{MPa}$)
A)	Back-filled, not naturally compacted ground	0-1
B)	Natural soil, without apparent disturbance	
1	1. Mud, peat, marshy soil	0
2	Non-cohesive, sufficiently compactly layered soil	
2.1	Fine to medium grained sand	1.5
2.2	From coarse-grained sand to gravel	2
3	Cohesive soil	
3.1	Loamy/Fertile	0
3.2	Soft	0.4
3.3	Stiff	1.0
3.4	Semi-solid	2.0
3.5	Hard	4.0
4	Rock with few fissures, in healthy, un-weathered condition and in a favorable location:	
4.1	In cohesive layer order	15
4.2	In massive or column-style shape	30
C)	Artificially compacted ground	
1	Asphalt	5-15
2	Concrete	
2.1	Concrete group B I	50-250
2.1	Concrete group B II	350-550



CAUTION

If there is any doubt about the load-bearing capacity of the ground at the operating site, soil test should be carried out.

3.4.3 Travel on level ground or slope without a load

- a) The ground must be firm and flat and can provide adequate load-bearing capacity;
- b) Pay attention to trenches and hunches on the ground;
- c) Consider the specified slope degree (vertical) and the horizontal slope as well;
- d) Avoid toppling over the crane due to deflection of center of gravity. Prevent the hook colliding with the boom frame, especially when boom angle is bigger;
- e) High-speed traveling without a load on flat ground is permitted but not in making a turn;
- f) Crane simultaneous movements can only be carried out when travel straight without a load;
- g) The operation should be stable and never initiate and/or stop the operation jerkily.

3.4.4 Travel on level ground or slope with a load

- a) The crane can travel with boom frame installed and with a load;
- b) When travelling with a load, refer to the load capacity charts and the following load reducing requirements;
- c) Normally, the load should be close to the ground as possible as it can and the range should be small as possible as it can;
- d) The crane can only travel with a load in low speed. The smaller change of the speed, the better;
- e) Avoid swinging the load all the time (if necessary, the load should be fastened on the rope);
- f) The ground must be firm and/, flat and can provide adequate load-bearing capacity;
- g) The largest wind velocity shouldn't exceed 9.8m/s when travelling with a load;
- h) The load can be put down stably for any possible mistakes;
- i) If the ground can't reach the requirement, it must be leveled;
- j) The operation must be stable and never initiate and/or stop the operation jerkily.



- (1) The load should be in the sight of the operator, and the load should be close to the ground as possible as it can be.
- (2) The speed of other movements should be under control during travel.
- (3) The maximum travelling speed should not exceed 0.4km/h.

3.4.5 The requirements for crawler crane with attachments on uphill slopes

The maximum climbing ability of a crawler crane is limited by the following condition:

- a) The center of gravity of the whole crane;
- b) The friction coefficient between roadway and track pad;
- c) The transfer between the horizontal and the inclined.

 CAUTION

To travel crawler crane uphill, the following conditions must be observed:

- (1) The ground must be able to support possible ground pressure.
- (2) The friction coefficient between roadway and track pad must be large enough to produce enough drive forces.
- (3) Slippery ground can cause the crane to slip sideways and move into an impermissible side incline position. There is a danger of accidents.
- (4) The slewing table must be aligned to the crawler carriers and must be secured to prevent it from turning.
- (5) The maximum permissible wind velocity is 9.8m/s.
- (6) Side incline is not permitted!
- (7) Travel slowly, and perform all acceleration and deceleration motions with utmost caution.
- (8) The transfer from the horizontal to the incline and from the incline to the horizontal must be made very evenly. The change of gradient must be continuous.

3.5 Operation weather

3.5.1 Snow and ice



- (1) Danger of accidents (due to ice falling down);
- (2) Increased danger of damage due to frozen height limit switches on the main boom, the fixed jib heads.

Precautions:

- Lay down the boom and carefully knock off the ice that has collected.
- Carefully remove the ice from all sensitive parts, such as limit switches, guides, etc.



- (1) Snow and ice deposits on the boom:
 - Increase the boom weight
 - Increase the surface area the wind blows on.

These factors can lead to a premature shutdown of the movement of the crane.
Work can continue, but definitely not at the maximum permitted load.
- (2) The load moment limiter (usually abbreviated to LMI)
 - Must only be triggered in an emergency.
 - Can not be used in normal operations as a device shutting down the crane.
- (3) Is not a substitute for judgment of the crane operator.

3.5.2 Lightning Strikes

Inside the enclosed cab, the equipment operator is well protected against the direct effects of lightning strikes. The cab can deflect the lightning strike over the entire unit.

If the working site is attacked by windstorm frequently or the operation range is limited, the operator is liable to put down the boom. When to lay down the main boom is a matter of opinion and is the responsibility of the equipment operator, when in doubt, always lower the main boom.

It's the manufacturer's recommendation that the main boom should be laid down promptly when a storm is approaching.

Measures to take after observing or suspecting a lightning strike on the equipment:

- a) Thoroughly check the equipment, check for any damaged cables or lines for leaks.
- b) Check the entire control system.
- c) Slowly move the slewing gear and listen for unusual noises in the rotary connection, especially in the slewing ring.

- d) Lay down the boom and examine for damage; repair damage to the paint work at the point where the lightning struck.



When lightning strikes the equipment, there is danger of serious injury or even death to all personnel in the immediate vicinity.

Precautions:

- Lay down the boom of the equipment before the storm begins.
- During the storm do not go near the equipment or any large metallic objects.



A lightning strike can cause extensive damage to the equipment, including:

- Total failure of the control system;
- Damage to local welding spots or bearings on the rotary connection between the upper and lower carriages.

3.6 Electrical safety

3.6.1 Safety regulations for auxiliary power supply (220V AC)

If the auxiliary power is supplied by power (220V AC), there exists a danger.

The following dangerous circumstances may occur:

- The protective wire is damaged (caused by old wire or improper installation)
- The wire connection is loose
- The protective measure is damaged or invalid, which will cause insulation fault.



Damp penetration or machine damage will cause insulation fault, resulting electricity leakage. Any one contacting with the machine may get an electric shock.



Qualified electrician can use proper testing tools to check protective measures or decide whether the electricity can be supplied by comprehensive power supply network according to VDE.

3.7 Underground cables

With special equipment, the crane can also be used for underground working.

3.7.1 In underground working, it is possible to damage:

- a) Underground electric cables
- b) Gas pipes
- c) Telephone, TV, and data cables
- d) Sewage pipes, district heating supply pipes, etc.



- (1) If a live underground cable is damaged, lives are at risk from electric shock.**
- (2) There is an extreme danger of explosion and fire in the vicinity of a damaged gas pipe.**

Measures to be taken during operational planning:

The construction company doing the work is responsible for gathering accurate information about possible underground cables within the working area of the equipment so that work can be done safely:

- a) Obtain relevant information from the relevant utility companies.
- b) Examine the "as completed" plans of:
 - 1) Utility companies (electricity, gas and water)
 - 2) Cable users (telecom companies, factories, transport companies)
 - 3) Building authorities.
- c) Only use the latest and effective plans.
- d) If there are any deviations or extensions to a project, initiate new inquiries.
- e) If in doubt, localize the underground cables around the site using a locating device.
- f) The relevant utility companies, cable users and public authorities:
 - Must be informed in good time about the start of the work.
 - Must be asked for written approval for the civil engineering work to be done.
- g) When several construction companies are involved, their activities must be coordinated. All companies must have the same up-to-date information on underground pipes, etc. on the construction site.

3.7.2 Safety precautions and protective measures when operating the equipment near underground cables

- a) Do not start work until you have obtained all the approvals from the utility companies and the cable users.
- b) The equipment operator must obtain all relevant information about the exact location of all underground cables before starting work. These plans must be readily accessible at the construction site.

- c) Operate the equipment with particular care near underground cables, all applicable local safety guidelines as well as the special guidelines and safety measures of the utility companies must be noted and obeyed.
- d) In the event of any unexpected encounters with underground cables or associated warning sign and protective coverings, cease working with the equipment immediately and inform the appropriate superiors.
- e) It is prohibited to uncover underground cables with the equipment. The underground cables must only be uncovered manually with blunt tools.
- f) Secure, support, or prop up all exposed underground cables so that they cannot sway, slide, or become deformed.
- g) Stabilize the cable ducts and trenches and secure the edges to prevent caving.

3.7.3 Notes in connection with gas pipes

- a) Whenever the position of the gas pipe casing changes or the casing is damaged, report this to the appropriate gas company. The gas pipe can only be backfilled after inspection, repair, and approval by specialist personnel from the gas company.
- b) All devices of the gas supply network around the site must remain accessible (fittings, valve boxes, manhole covers, etc.). Existing markings and information signs must not be covered, rearranged or removed.

3.7.4 The consequences of a gas pipe's damage

The escaping gas:

- a) Forms an inflammable gas-air mixture around the affected area.
- b) Can strike personnel or equipment if it is under high pressure.
- c) Not only endangers personnel and equipment on the site, but also passers-by and residents in the neighborhood.

A gas fire can develop in seconds and spread explosively. In a conventional supply pipe with a leak of 2" (50 mm), for example, the flames can be up to 10 m (33 ft) high if the gas is escaping at a pressure of 1 bar (14.5 psi). The equipment and surrounding construction equipment will be burned quickly.

Even a minor change in the position of the gas pipe can result in damage to other sensitive points of the gas network, for example connection points or house feeder pipes. Leaks and small leaks that are not immediately detectable are very dangerous if gas is allowed to escape over a lengthy period of time and penetrate along the gas pipe network into the surrounding buildings. An explosive gas-air mixture is formed considerably quicker in enclosed areas than in the open air. Every source of ignition, such as On /Off switches on electrical equipment or the turning on of a light, can trigger an explosion.

Corrosion can cause leaks to form within 5 -10 years with minor damage to the casings of metal gas pipes.

3.7.5 Measures adopted if a gas pipe is damaged and the gas escapes, or a leak is suspected

- a) Stop work immediately.
- b) Leave the crane after shutting down the engine and all additional fuel powered units.
- c) Alert all site personnel, avoid producing any sparks and maintain a strict no-smoking policy.
- d) Switch off all construction equipments and shut down the engine near the construction equipments.
- e) Clear the dangerous area and secure a wide area with barriers. Do not allow access by unauthorized personnel.
- f) Inform the relevant gas company of the following:
 - The extent of the damage
 - The exact location of the site
 - The circumstances of the accident
 - How long ago the accident occurred
 - A name and telephone number for a return call.
- g) If there is the slightest suspicion that the gas is leaking into a building, alert the local occupants by knocking personally or calling loudly. Do not ring the door bell or call them by telephone, as this may trigger an explosion.

If the odor of gas is present in the building, especially around the area where the gas pipe is known to enter the house; do not operate any electrical systems or equipment. Open all doors and windows widely for ventilation purposes and leave the building immediately.

- h) In the event of major damage, evacuate the occupants of all the surrounding buildings with the cooperation of the police or fire department.
- i) Building site personnel:
 - Must assist all special personnel from the gas company during the repair work.
 - Can only leave the building site with the consent of the special personnel.
 - Work on the building site can only begin again if authorization has been given by the relevant gas company.

3.7.6 Measures adopted in the event of a gas fire



- (1) Extinguishing a gas fire requires specialist knowledge.**
- (2) A gas fire that has already been extinguished can flare up again if more gas escape and break out in an unexpected spot.**
- (3) Precautions in the event of a gas fire:**
 - **Inform the local fire department of the fire.**

- **Do not attempt to put out the fire before the fire department arrives unless lives are in danger or there is a risk of major damage to property.**
- **If the gas fire is not causing any immediate danger, it is sometimes better to let the gas burn. As soon as the gas company shuts off the gas pipe, the fire will extinguish itself.**

3.7.7 Notes in connection with underground electric cables

- a) For excavation work, observe the minimum safe distance from the underground cable (at least 3'4" (1 m).
- b) Even minor damage to the outer casing of an underground cable should be reported to the relevant power station. If damp is allowed to penetrate, the cable could fail in the future. The location of such a fault is to be precisely measured to establish who or what caused the damage.

3.7.8 The consequences of damaging an underground cable

- a) After it has penetrated the insulation, the machine can become charged with a dangerously high voltage.
- b) If an underground cable is sheared, burn-out at the fault location with strong electrical arcing may occur.
- c) If a high-voltage power cable becomes damaged, a hazardous resistance area may form around the fault location.



- (1) **The safety devices of the various national electricity networks react differently in the event of a fault. Therefore it cannot be taken for granted that there will be an automatic and lasting shut-down following damage to an underground cable.**
- (2) **The machine and the damaged underground cable can therefore still be under hazardous voltage levels and form a resistance area, even if there are no discharge, smoke formation or cracking noises.**

3.7.9 The measures taken when the machine damages an underground cable

- a) First, remain calm – do not panic.
- b) Do not leave the operator's cab.
- c) If the controls are still functioning:
 - 1) Initiate travel in the opposite direction immediately and disconnect the underground cable.
 - 2) Then drive the machine out of the danger area.
 - 3) Only stop the machine once the distance from the fault location is
 - At least 17ft (5 m) in the case of a low-voltage cable (lower than 1000V),

- At least 33ft (10 m) in the case of a high-voltage cable, or if uncertain about the voltage of the underground cable.
- 4) Inform the relevant power station of the accident. Prevent access to the area around the fault location: fence off an area with a radius of 33ft (10 m).
- 5) Thoroughly inspect the machine before resuming operation.
- d) If the control no longer functions, use the radio or call
 - 1) To everyone in the vicinity not to come any closer to or touch the machine, the hoisting rope or load; tell them to keep at least 33ft (10 m) away.
 - 2) To arrange for the power lines to be switched off by the relevant power station.



Only leave the driver's cab if you have reliable confirmation that the underground cable has been switched off.



Even an underground cable that has been switched off can be switched on again manually, or by automatic safety devices, for fault detection purposes.

3.8 Checking safety measures

3.8.1 Daily inspection of the crane

The crane must be checked daily to ensure safe and good state, the items to be inspected includes:

- a) Check the daily record of work to ensure that all regular inspections, maintenance, and repair work have been performed.
- b) Check the lowering limiter, the boom angle indicator, the tilting-back supports, and other safety devices for functional operation.
- c) Check the load-bearing parts carefully, such as the wire rope (the hoisting rope, the derricking rope, and the anchoring rods etc), the boom frame, the outriggers, and the load hook.
- d) Check if there are missing bolts, nuts, and pins, and if the components are cracked or damaged.
- e) Ensure that no modification has been made to the crane without permission, for example, an increase or decrease in general counterweight or improper repair of boom frame.
- f) Check the fuel lines and the hydraulic oil lines for leakage.
- g) Check if the values shown on the instruments are correct after starting up the engine.
- h) Check if the control mechanisms are working normally.
- i) Check the brake and the clutch. Test the braking performance by lifting a load away from the ground and holding it in the air for a moment.
- j) Check if there lacks lubricant, grease or antifreeze fluid.
- k) Check if sundries accumulate too much.



Check the crane daily for safety and familiarize yourself with the potential dangers brought by the work.

3.8.2 Safety checking before crane operation

The safety condition of the crane should be checked thoroughly prior to operating the crane, including:

- a) Check whether the ground provides adequate load-bearing capacity.
- b) Check whether there is sufficient safety clearance to slopes and trenches.
- c) Check whether the crane is adjusted to be horizontal.
- d) Check whether there are live electrical wires within the working range of the crane.
- e) Check whether there are obstacles which will hinder required crane operation.



The crane operation belongs to dangerous operation; so much attention should be given to the working condition of the crane before and during crane operation.

3.9 Crane operation with a load

Before beginning any work, the crane operator must be convinced that the crane is in safe operating condition. All safety devices, such as load moment limiter, hoist limiter switches, and brakes, etc., are in good working order.

- The load moment limiter must be set according to the current crane configuration.
- The lifting height of crane as given in the load capacity charts must be adhered to. The load given in the load capacity charts must not be exceeded during operation.
- The crane operator must know the weight and dimensions of the load before operating the crane.
- Lifting device, slings and fixed pulley block must be set in accordance with specified safe operation requirements.
- Make sure that the total weights of lifting device, wire rope and the actually lifted load won't exceed the rated lifting capacity, referring to table 3-7.

Table 3-7 Calculation of lifting capacity

Items	Weight (lb / t)
Rated lifting capacity	66150 / 30
Weight of load hook	2205 / 1
Weight of wire rope	22 / 0.1
Weight of actually lifted load	63724 / 28.9

3.9.1 Counterweight

Extend the crawler carrier fully, then we can get that the weight of the rear counterweight is 61740 lb (28 t) and that of central counterweight is 22050lb (10 t).



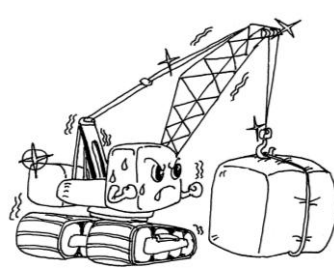
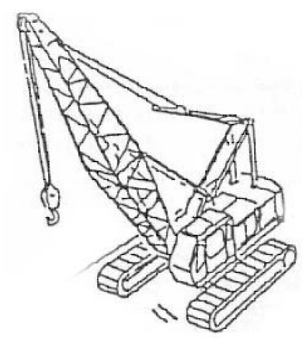
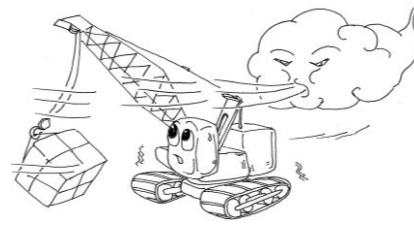
If the counterweight is not installed properly according to the lifting capacity chart, there is a danger of the crane toppling over.

3.9.2 Crane operation

3.9.2.1 Operating conditions

The crane must satisfy the conditions in the table 3-8 when working.

Table 3-8 Operating conditions

No.	Conditions	Examples
1	All components of crane are in running-in state at the initial operating period. So, for the first 100 operating hours, the working load should not be too great and the working speed should not be too fast. The maximum lifting load can not exceed 80% of its rated load. And the maximum working speed is forbidden.	
2	The ground on job site should be firm and flat and the gradient should not be greater than 1/100. The complete vehicle should be level and the supporting ground should not be sunken during operating. If the ground is soft, a steel plate should be placed under the track pad.	
3	The permitted temperature range for crane operation is -20°C – 40°C. Relative humidity should not exceed 85%; however, high humidity up to 100% is only permitted for a short period of time. The crane should be operated and supported on a ground lower than 1000m above seal level.	
4	The maximum in-service wind velocity should be not more than 9.8m/s during operation; the maximum out-of-service wind velocity should be no more than 21m/s when only main boom is assembled, and no more than 15m/s when fixed jib is assembled. Please refer to table 3-8 to estimate the wind velocity more accurately.	

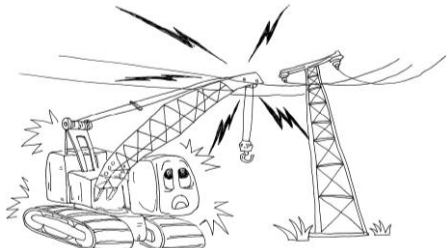
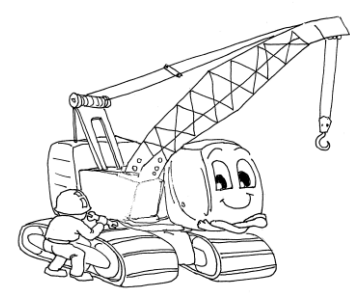
No.	Conditions	Examples
5	When the crane is working near the high-voltage power line, the safe clearance between any part of the crane and overhead power line should comply with regulations in table 3-9.	
6	Only the crane without fault is allowed to work.	

Table 3-9 Beaufort scale chart

Wind force			Effects of the wind in the inland
Beaufort scale	Description	Wind speed (m/s)	
0	Calm	0-0.2	No wind, smoke rises straight up
1	Light air	0.4-1.4	Wind direction is shown only by observing the trail of smoke, not by the wind sock
2	Light breeze	1.6-3	Wind can be felt on the face, the leaves rustle, wind sock moves slightly
3	Gentle breeze	3.4-5.3	Leaves and thin twigs move. Wind extends a small breeze flag.
4	Moderate breeze	5.5-7.8	Swirls up dust and loose paper, moves twigs and thin branches
5	Fresh breeze	8-10.6	Small deciduous trees begin to sway, foam forms at sea.
6	Strong breeze	10.8-13.7	Thicker branches move; telephone lines begin to whistle, umbrellas are difficult to use
7	Stiff wind	13.9-17	Entire trees swaying; difficult to walk into wind
8	Gale force wind	17.2-20.6	Breaks twigs off trees, walking becomes difficult
9	Gale	20.8-24.5	Minor damage to property(chimney tops and roofing tile are blown off)
10	Severe gale	24.7-28.3	Trees are uprooted, significant damage to property

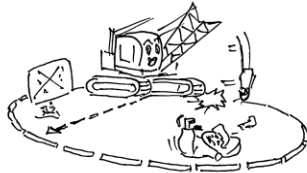
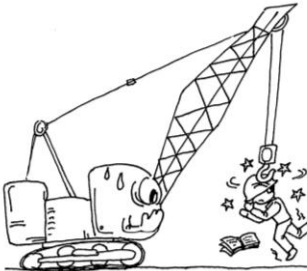
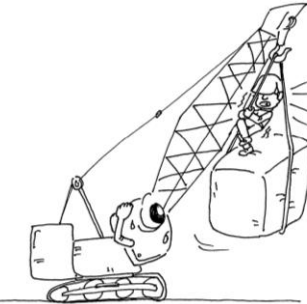
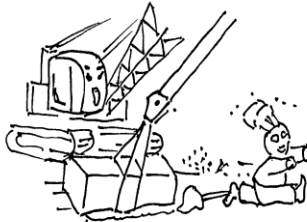
Table 3-10 Safe clearance when the crane is working near high-voltage power line

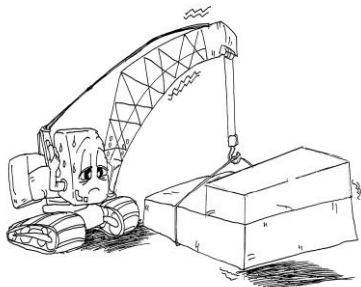
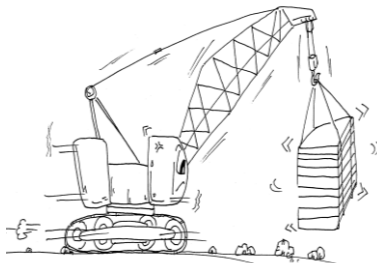
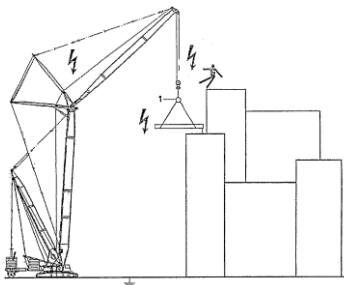
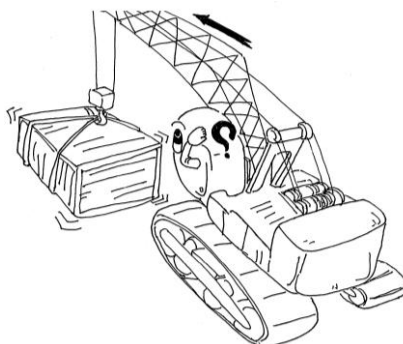
Output voltage of high-voltage power line V (kV)	$V \leq 1$	$1 < V \leq 15$	$15 < V \leq 40$	$40 < V \leq 100$	$100 < V \leq 200$
Safe clearance (m)	1.5	3	4	5	6

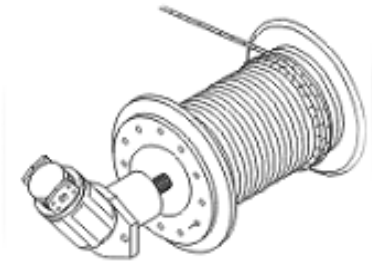
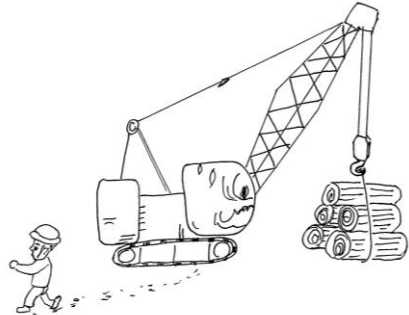
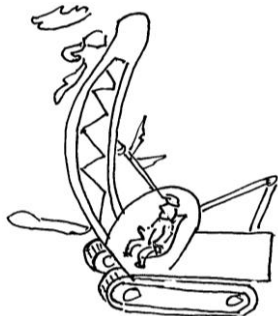
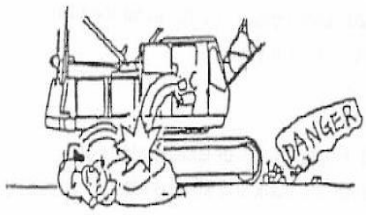
3.9.2.2 Instructions for safe operation

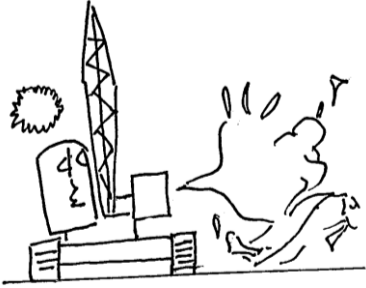
The instructions for safe operation during crane operation are shown in the table 3-11.

Table 3-11 Instructions for safe operation

S/N	Instructions	Examples
1	No person is allowed to stand under the boom or on the slewing table when the crane is operated.	
2	It is forbidden to lift load over people.	
3	It is forbidden to lift the load when someone stands on it.	
4	Overloading operation and lifting staggered load is prohibited. Never pull load obliquely.	

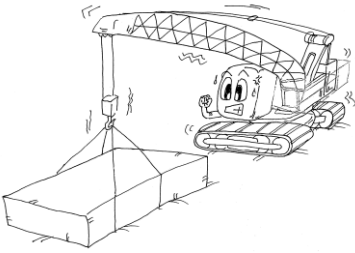
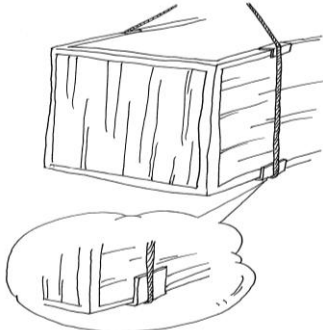
S/N	Instructions	Examples
5	It is forbidden to lift the load hidden in the ground or frozen on the ground.	
6	The crane can travel with a load of 100% of the rated load when the gradient is equal to or less than 1/100 and the travelling speed is less than 0.4 kmph. In this case, the boom frame must be located in the driving direction. The distance from the load to the ground should be less than 50cm. The longer the boom, the slower the travelling speed. Meanwhile, the distance from the load to the ground should be as low as possible.	
7	If the crane is operated in the vicinity of transmission systems (e.g. transmitters), strong electromagnetic field will be generated there, so measures should be taken to protect the crane against high frequency interference and all workers who stand on large metal plates should wear special isolating gloves and clothes to avoid being burnt.	
8	The brake of hoisting winch can not be adjusted when the crane is lifting a load.	

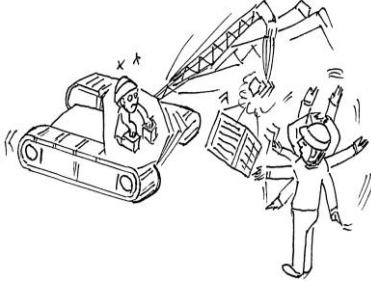
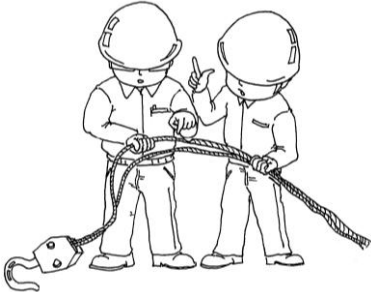
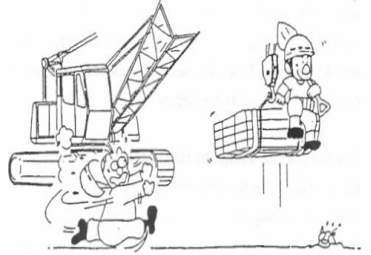
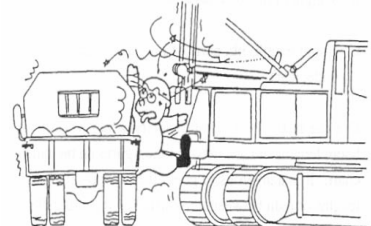
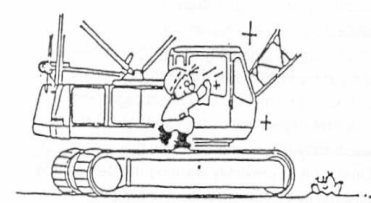
S/N	Instructions	Examples
9	Under any condition, there must be at least three windings of wire rope left on the hoisting drum.	
10	When a load is suspended in the air, the operator is not allowed to leave the cab.	
11	Operation should be carried out stably and gently. Never operate control lever jerkily and carry out switch-over operation abruptly.	
12	When actual load reaches 90% of the rated one, the load moment limiter will sound an alarm, to which great attention should be given.	
13	Getting on and off the crane should be careful to avoid casualty.	

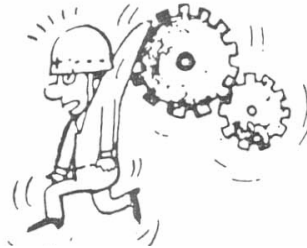
S/N	Instructions	Examples
14	It is prohibited to make any modifications to the crane without permission; otherwise you should take the consequences.	

Stop the crane operation if one of the conditions in the table 3-12 occurs:

Table 3-12 Conditions to stop and inspect the crane

S/N	Conditions to stop the crane	
1	The crane is overloaded or the weight of load is uncertain	
2	The load falls down due to bad binding or hanging	
3	No protective mat is added between the edges of load and wire rope	

S/N	Conditions to stop the crane	
4	In case of poor visibility and /or darkness, it is difficult to identify the load or signal	
5	There is defect or damage of configuration or components which will impair safe operation, for example, the brake and safety equipment fail, or the wire rope is damaged etc.	
6	No one is permitted to ride on the load hook, slings or load.	
7	Leave an ample space for stopping the crane; otherwise persons nearby may be hurt by crane counterweight due to narrow distance between counterweight and surrounding building.	
8	Keep the windows of crane operator's cab clean to ensure good visibility; stop crane operation immediately in case of poor visibility; replace the broken window as soon as possible.	

S/N	Conditions to stop the crane	
9	Serious accident may occur when climbing the crane. Make sure that climb the crane after the crane stops stably, with two hands and ensuring firm stepping.	
10	Make sure the crane clean and dry because wet platform, ladder, tools, rubbish or other loose parts may cause falling.	
11	Make sure that the load to be lifted does not contact with other objects because when the lifting load is adhered to, frozen with or stuck to other objects, the crane may topple over, and the boom will be damaged.	
12	Drive the crane with great cautiousness, in working site or not. Observe the conditions surrounding the crane such as overhead power line, low-lying land, narrow clearance, restriction to bridge and road, uneven ground and gradient of road. If necessary, appoint a signalman to assist operator to move the crane. Lock slewing mechanism during traveling.	
13	It is more dangerous that two cranes carry out lifting operations together. Therefore, a careful calculation must be made before commencing the work, and the following important requirements for this type of operation must be observed. 1) The load is not casually attached to the crane. It must be calculated carefully so that the actual lifting capacity of the crane can not exceed the rated lifting capacity. 2) Ensure that each lifting tackle can bear specified load weight which is calculated during design. 3) The crane operator, signalman and other worker must evaluate the operational planning together before operation. 4) Ensure that the crane can move properly in the whole process of operation.	
14	When you leave the machine in an emergency without taking any measures, you are putting your life at risk. Therefore, you must take the following measures prior to leaving the machine. 1) Detach the load from the hook and set it down on the ground; if necessary, lower the boom frame. 2) Apply slewing brake or lock slewing mechanism. 3) Apply parking brake. 4) Lock travel gear. 5) Cut off power supply or switch off the engine.	
15	Do not wear loose clothing, scarves, open jackets or open shirt sleeves, and do not wear jewellery (rings, bracelets, earrings or similar). Otherwise, there is serious danger of injury from being pulled into moving machine parts.	

3.9.2.3 Preparation for crane operation

Crane operator should perform the following checks before operating the crane:

- a) Check the daily record of work to ensure that all regular inspections, maintenance and repair works are performed.
- b) Check the boom frame limiter, boom angle indicator, tilting-back support and other safety equipment for functional work.
- c) Check if the load-bearing parts such as wire rope (hoisting rope, derricking rope and sling etc.), boom, outriggers, hook and load handling devices are kept in good working order.
- d) Check if there are some bolts, nuts and pins lost, and whether the components are cracked or damaged.
- e) Ensure that no modification has been made to the crane without permission, e.g., increase or decrease in counterweight plate and improper repair of boom frame.
- f) After starting up the engine, check if the values shown on instruments are normal.
- g) Check fuel lines and hydraulic oil lines for leakage.
- h) Check all control mechanisms for functional work.
- i) Check brakes and clutch. Test the braking performance by lifting a load away from the ground and suspend it in the air for a moment.
- j) Keep communication between the operator and rigger.
- k) Estimate the weight and dimensions of load to be lifted in advance.
- l) Crane operation can be carried out within minimum working radius. No obstacles hinder necessary movements. The ground at the job site is able to support expected loads.
- m) Ensure that no obstacles are within working radius and the operator can see the load clearly from the cab. Check if the communication between operator and signaller is kept smooth so as to ensure safe crane operation.
- n) Make sure that the crane has enough load-bearing capacity before operating the crane. What's more, the ground should be firm, level and flat. Never operate the crane on the soft and uneven surface or on the ground of high water content or covered with frozen soil. If the crane is set up close to trenches, reinforce the trenches to avoid landslide. If the ground does not have adequate load-bearing capacity, the crane is liable to turnover. In this case, crosstie, steel plates should be padded underneath the crawler to distribute load so that the load-bearing capacity of the ground will not be exceeded; make sure that the crane is levelled.
- o) Make sure that the crane is operated on level ground and the inclination is not more than 1% ($\pm 0.57^\circ$).
- p) The method for checking if the crane is levelled:
After the crane is placed well, lift the load hook in a proper position so that it can swing freely. At this time, the operator must stand in front of the crane and observe the following conditions.

When the boom is less than 275'6"(84 m), the centre of load hook must/should be aligned with the centres of slewing table and boom frame.

- q) If a deviation of load hook is detected, measure the crane inclination via a inclinometer on the edge of slewing ring, and make sure the inclination is not more than 1% ($\pm 0.57^\circ$).
- r) Inspection before slewing operation of the load:
Check the inclination of the ground in the slewing radius, and the checking method is the same with what is described above.

3.9.2.4 Notes for crane operation

- a) Estimate the weight and dimensions of load to be lifted in advance.
- b) Use load lifting devices (wire rope or chain) correctly. Make the vertical line of the hook pass through the center-of-gravity of the load.
- c) If any part of the crawler crane or load handling devices come in contact with the high-voltage power line, or emergent situation occurs, the operator should stop the vehicle at once.
- d) The load capacities as given in the load lifting capacity tables must be adhered to. The loads given in the load lifting capacity tables must not be exceeded. Driving (or slewing) too fast with a load, or setting up and loading on an uneven surface, and swinging of suspended load should be avoided.
- e) Diagonal pulling (slewing or travelling) of the load to be lifted which is still in contact with the ground is prohibited.
- f) It should be avoided that the load or auxiliary lifting device collides with structural members of the crawler crane.
- g) If the crane gets caught in a thunderstorm during operation, the following measures should be taken at once:
 - Stop work on the crane immediately.
 - Always set down the load and boom frame on the ground.
 - Apply brake or lock winch and slewing gear.
 - Switch off the crane engine and cut off the power of load moment limiter and limit switch
 - Ask all crane workers to leave away.
- h) If the crane is struck by thunderbolt, the following checks should be performed:
 - Check whether there are burnt or damaged components
 - Check the performance of the electrical parts and load moment limiter
 - Check the associated components for functional work.
- i) If earthquake occurs when the crane is operated, the following measures should be taken immediately:
 - Stop work on the crane immediately
 - Always set down the load and boom frame on the ground.

- Apply brake or lock winch and slewing gear
- Switch off the crane engine and cut off the power of load moment limiter and limit switch
- Ask all crane workers to leave away.

After earthquake, the following checks should be performed prior to crane operation:

- Check the performance of the electrical parts and load moment limiter
 - Check the associated components for functional work
- j) If any part of the crawler crane or load handling device is in contact with high-voltage lines, the best way to guarantee personal safety of the operator is to stay in the operator's cab until the danger is obviated. If the operator must leave the crane, he'd better jump rather than climb down the cab.
- k) The operator's cab should be equipped with an emergency hammer which can be used to smash the window in an emergency so that the operator can run away from the cab.
- l) The load moment limiter, once be triggered, should be kept in that state until the crane is not overloaded.
- m) If the load moment limiter is not set to the actual configuration status of the crane, it can not fulfill its function as a safety device.
- n) Examine if the pressure sensor, angle indicators and tension force sensor are in function.
- o) The crane may topple over backwards if a load is suddenly freed since the tension created in the boom can cause it to jerk back violently.
- p) Make sure that the loads and working radius contained in the lifting capacity tables are not exceeded.
- q) When working in the vicinity of power cables, a sufficient safety clearance must be maintained, if the cables are not isolated by electricity engineers or the hazardous area is not fenced off.
- r) For all crane movements, the crane operator must always keep the load, as well as the crane hook or hook block when the crane is not loaded, in his field of vision. If this is not possible, the crane operator may only operate the crane according to instructions given to him by a signalman. These instructions may be given in the form of hand signals or over an interphone. Whatever method is used, precautions must be taken to eliminate the risk of misunderstanding.



If all measures taken, there are still electrical discharges, the following measures should be taken:

- (1) Keep calm.**
- (2) Do not leave the driver's/operator's cab.**
- (3) Tell people around the crane not to move and touch the crane.**
- (4) Move the crane out of the dangerous zone.**

Failure to observe the above points will cause serious accident and damage!

3.9.2.5 Checks after operation

- a) When the crawler crane and auxiliary lifting device are in non-working condition, never park the vehicle near the embankment liable to collapse or low-lying land subject to be washed away by water.
- b) Set down the load on the ground, and if necessary lower the boom frame to some extent; lock the slewing gear and traveling gear and apply the brake.
- c) Shut down the engine and cut off power.
- d) Check if there is leakage in some place and repair it if necessary.
- e) Clean such components as movable parts and exposed part of the piston rod of cylinder.
- f) Check if bolts and nuts are fitted tightly. Any defects found should be eliminated at once. It is prohibited to operate the crane with fault.
- g) Record the operating conditions and abnormal symptoms.
- h) Check if the quantity of tools and accessories meet specified requirements.
- i) Lock the operator's cab or safety devices.
- j) Take precaution measures against storm or lightning strikes.
- k) Take precaution measures against frostbite in winter.

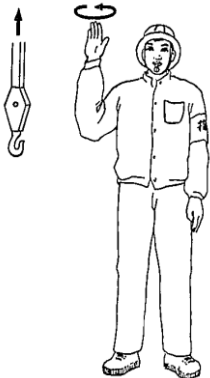
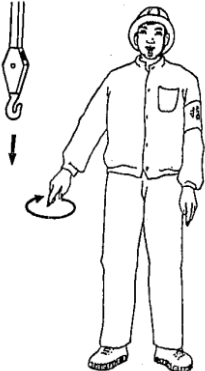
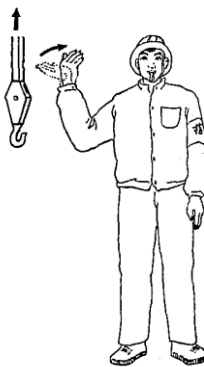


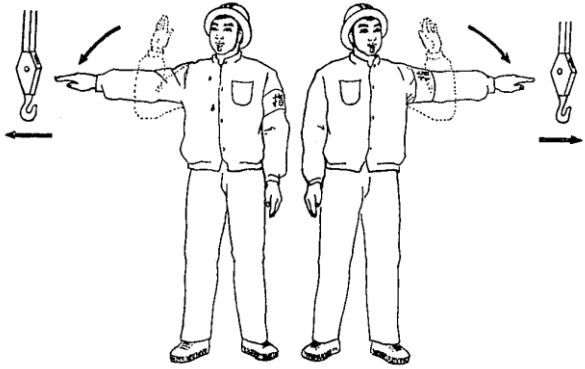
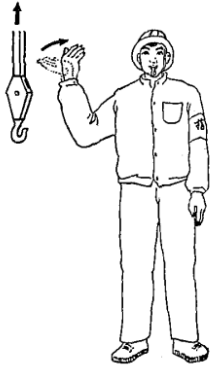
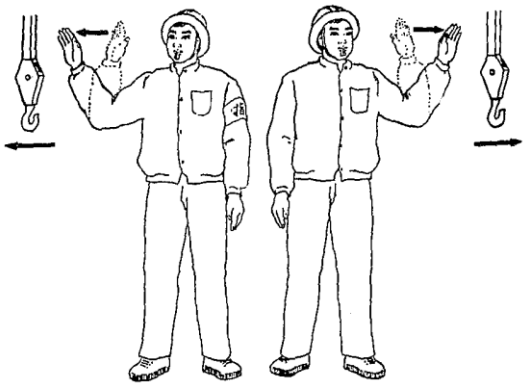
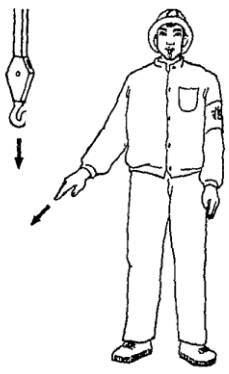
To avoid engine from freezing in winter, drain all cooling water when park the vehicle, if no anti-freeze is added into the cooling water.

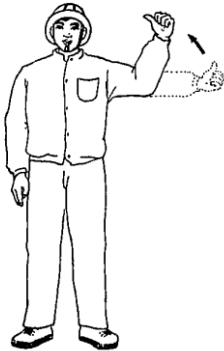
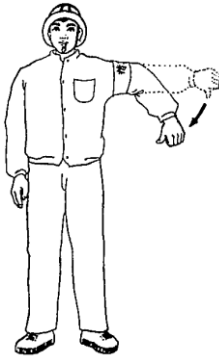
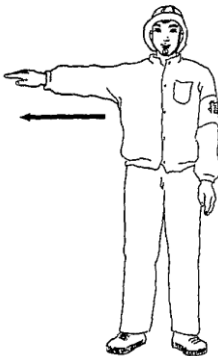
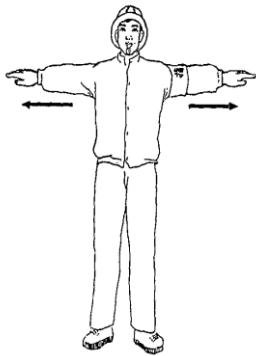
3.10 Hand signals for controlling crane operations

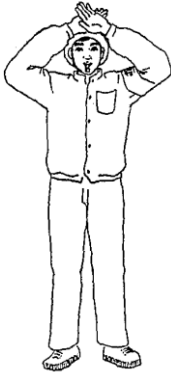
The hand signals for controlling crane operations are shown in the table 3-13.

Table 3-13 Hand signals for controlling crane operations

Ser. No.	1	2	3
Signal	Preparation	Use main hook	Use auxiliary hook
Description	Hold the right arm stretched out over the head, the palm facing forwards.	Tap fist on the safety helmet, then give further hand signals.	Bend the left hand and hold it upward, tap the underside of the elbow with the right hand, then give further hand signals.
Illustration			
Ser. No.	4	5	6
Signal	Hoist	Lower	Raise load slowly
Description	Bend the right arm and hold it upwards. The palm faces forwards. The hand makes small, circular movements.	Hold the right arm down with a 30° angle to the body. The extended index finger points downwards. The hand makes small, circular movements.	Stretch out right arm. The palm faces upwards. Wave the hand up repeatedly.
Illustration			

Ser. No.	7		8
Signal	Rotate		Lower load slowly
Description	Turn left: With right forearm vertical, the palm of the hand facing outwards, lower the forearm sideways horizontally, fingers pointing at the direction of rotation.	Turn right: With left forearm vertical, the palm of the hand facing outwards, lower the forearm sideways horizontally, fingers pointing at the direction of rotation.	With arm extended downwards with a 30° angle to the body, palm of the hand facing downwards, wave hand down repeatedly.
Illustration			
Ser. No.	9		10
Signal	Rotate slowly		Indicate load lowering position
Description	Turn left: With right forearm vertical, the palm of the hand facing outwards, move forearm horizontally and repeatedly, fingers pointing at the direction of rotation.	Turn right: With left forearm vertical, the palm of the hand facing outwards, move forearm horizontally and repeatedly, fingers pointing at the direction of rotation.	Extend the fingers to point at the position where the load should fall on.
Illustration			

Ser. No.	11	12	13
Signal	Raise boom	Lower boom	Raise boom slowly
Description	With arm stretched sideways horizontally, thumb pointing upwards, the remaining fingers closed, wave forearm up.	With arm stretched sideways horizontally, thumb pointing downwards, the remaining fingers closed, wave forearm down.	Bend the left arm. Move the thumb up and down, pointing upwards. Place the right arm above it.
Illustration			
Ser. No.	14	15	16
Signal	Lower boom slowly	Stop	Emergency stop
Description	Bend the left arm. Move the thumb up and down, pointing downwards. Place the right arm below it.	Stretch out one arm horizontally. The palm faces downwards. Swing the arm to one side of the body.	Stretch out both arms horizontally. The palms face downwards. Swing the arms to both sides of the body.
Illustration			

Ser. No.	17
Signal	End of a movement
Description	With fingers extended, cross both hands before the forehead.
Illustration	

The crane operator must watch the load before carrying out any movements and especially pay attention to the hook or hook pulley when moving the crane without load. If it's difficult to do so, the operator can only operate it according to the signal given by the signal man, which can be conducted by hand signal or interphone. Vigilance is needed no matter which method is used to avoid misunderstanding.

! CAUTION

- (1) We recommend using the hand signals illustrated above. However, users can decide on their own hand signals depending on actual condition, as different countries and regions may differ in the expression of hand signals.
- (2) Hand signals must first be discussed and mutually agreed upon and clearly executed. Misunderstanding of hand signals may lead to serious accidents.

! CAUTION

In any case, national traffic regulations must always be observed when operating abroad.



Operator's Manual for Crawler Crane

Chapter 4 Crane Operation



Chapter 4 Crane Operation

4.1 Operating and control instruments

4.1.1 Operator's cab, overview

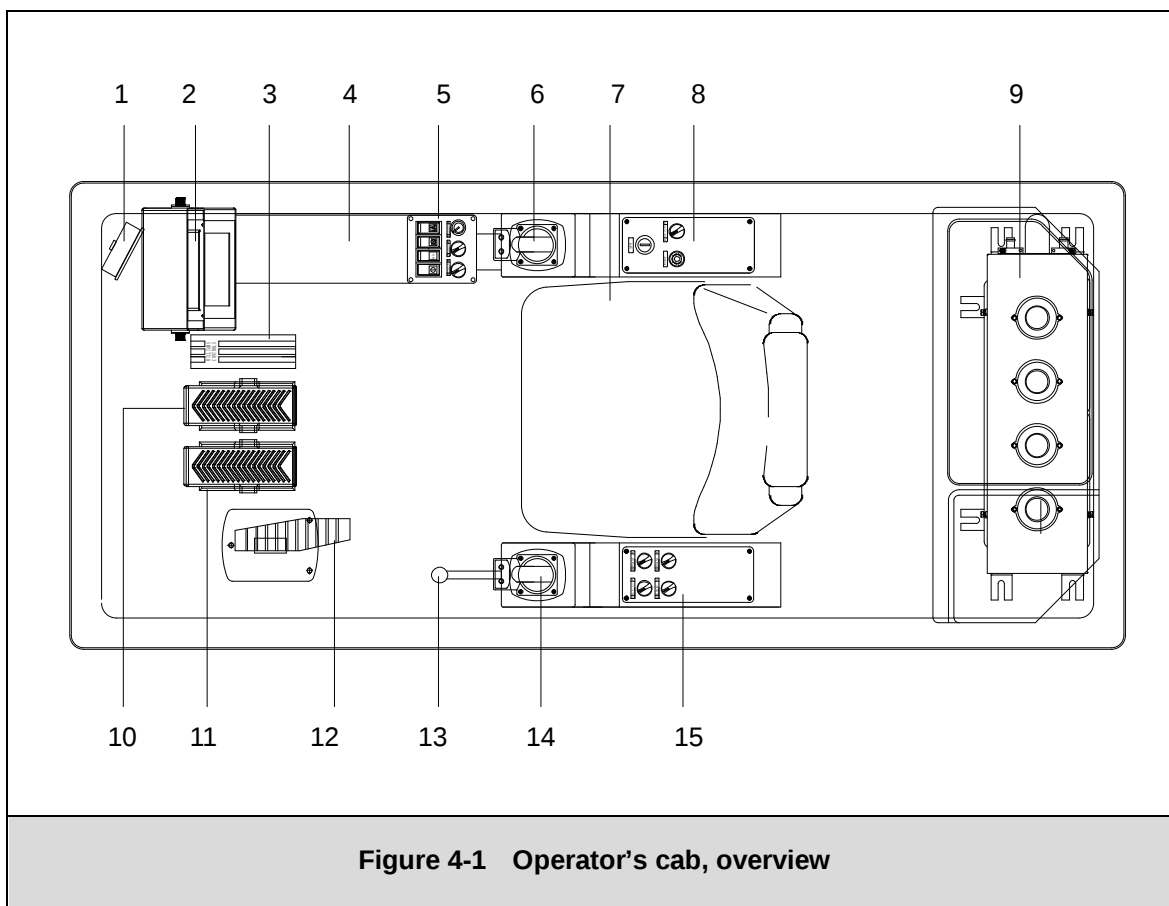


Figure 4-1 Operator's cab, overview

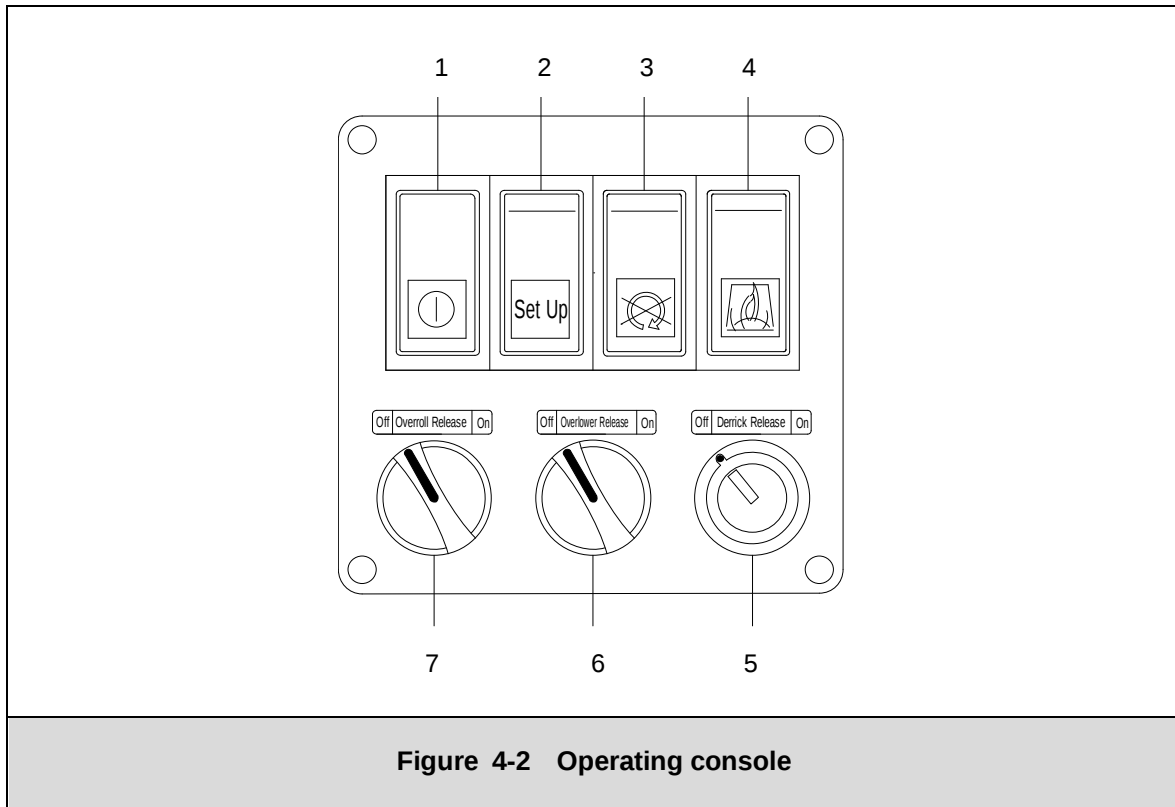
The arrangement of operating and control instruments in the operator's cab is shown in the figure 4-1. For detailed information, please see table 4-1.

Table 4-1 Description of operating and control instruments

No.	Names of instruments	Remarks
1	Winch monitoring system	Monitor the working status of the winch and the condition behind the crane.
2	Digital display system	One is LCD screen of load moment limiter, and the other is LCD screen of electrical system. (For more information, please see section 4.2.)
3	Accelerator pedal	Control the engine speed. Depress the pedal, the speed is increased; Release the pedal, the speed is returned to idle speed.

No.	Names of instruments	Remarks
4	Electrical control box	Arrange the electric elements.
5	Operating console	Arrange the switches for electric elements. (For details, please see section 4.1.2.)
6	Right control lever	Control the movements of hoisting winches 1 and 3, derricking winch and mounting cylinder. (For details, please see section 4.1.3.2)
7	Operator's seat	It is adjustable. (For details, please see section 4.3.1)
8	Right control panel	Arrange the switches for electric elements. (For details, please see section 4.1.5)
9	Central unit of air conditioning	It is located at the back of the cab. (For details, please see <i>Maintenance Manual</i> .)
10	Right travel gear pedal	Control the movements of right travel gear.
11	Left travel gear pedal	Control the movements of left travel gear.
12	Free-fall brake pedal	Control the braking of hook in free-fall mode. (Only when the crane has free-fall function, can this pedal is fitted.)
13	Safety lever	Pull up the safety lever before the operator gets into or out of the cab, the power of crane is cut off, but the engine is not shut down. Lower the safety lever before lifting operation, the crane is electrified, and the crane movements can be carried out.
14	Left control lever	Control the movements of hoisting winch 2 and slewing mechanism. (For details, please see section 4.1.3.1)
15	Left control panel	Arrange the switches. (For details, please see section 4.1.4.)

4.1.2 Operating console



The switches on the operating console are detailed in the table 4-2.

Table 4-2 Description of switches on the operating console

No.	Names of the switches	Remarks
1	Power switch of electrical system	Switch on or off the power supply of electrical system.
2	SetUp switch	After overloading warning is triggered (100%<moment percent<110%), never spool up hoisting winch, and raise or lower the main boom. At this time, press this switch to release the limited movements.
3	Engine shutdown switch	Press this switch to shut down the engine.
4	Engine preheating switch	When ambient temperature is less than -20℃, press this switch to preheat the engine.
5	Derricking bypass switch	After overloading warning is triggered (100%<moment percent<110%), never raise or lower the main boom. At this time, press "SetUp" switch. After the icon  appears on the load moment limiter, turn the switch clockwise and keep it there. After the icon  appears, main boom can be raised and lowered.

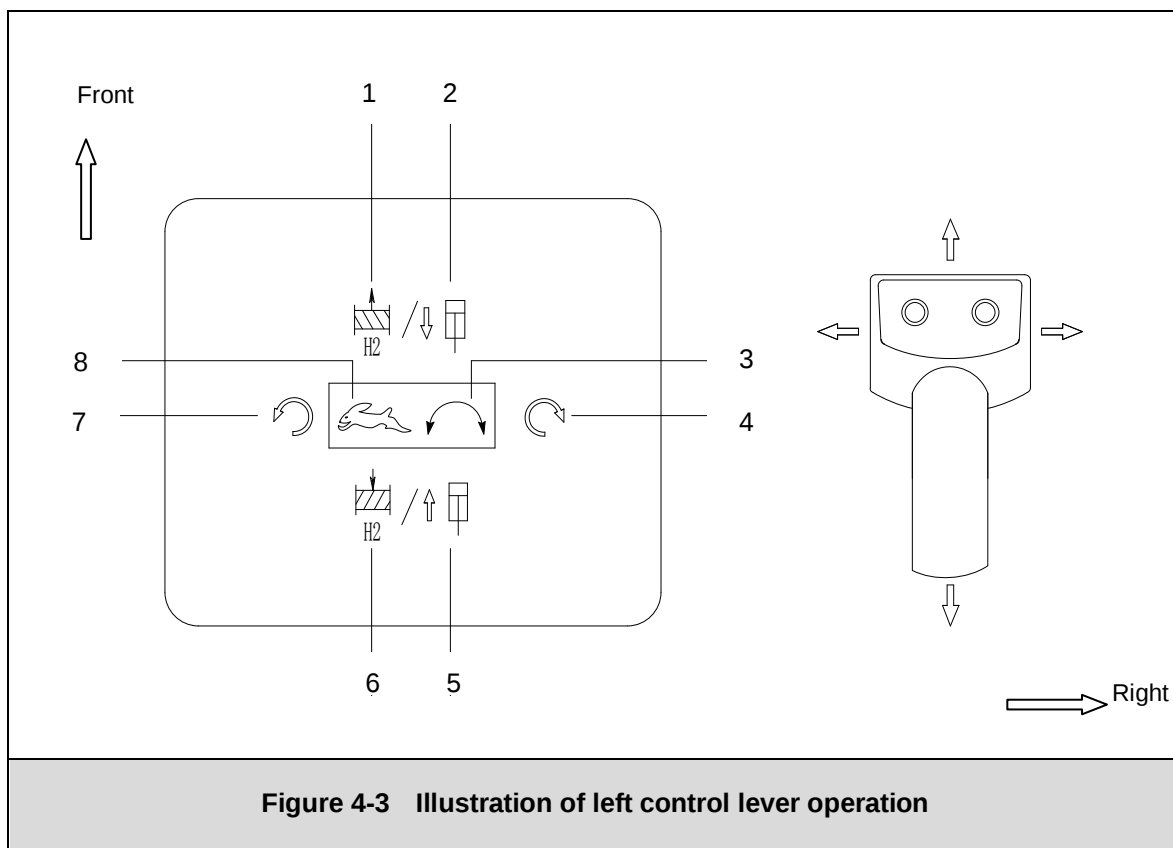
No.	Names of the switches	Remarks
6	Lowering bypass switch	After lowering warning is sent, never reel off hoisting winch. Turn the switch clockwise and keep it there at this time. When the icon  appears on the load moment limiter, the hoisting winch can be reeled off.
7	Hoisting bypass switch	After hoisting warning is sent, never spool up the hoisting winch. Turn the switch clockwise and keep it there at this time. When the icon  shows on the load moment limiter, the hoisting winch can be spooled up.

CAUTION

- (1) After the engine is shut down, release the ignition starter switch to the initial position after 30s. Otherwise, the work hour of engine this time can not be saved.
- (2) Return the shutdown switch to initial position before starting the engine.

4.1.3 Control lever

4.1.3.1 Left control lever



As shown in the figure 4-3, the left is the operating board for left control lever. It is stuck on the left glass of the cab. The four directions shown on the right means that the control lever can be moved forwards, backwards, leftwards and rightwards. There are two buttons on the control lever. For their functions, please see the table 4-3.

Table 4-3 Operation of left control lever

No.	Meaning of the symbol	Remarks
1	Reel off H2	Push left control lever forwards, reel off H2.
2	Extend mounting cylinder	Push left control lever forwards, extend mounting cylinder.
3	Swing free running	Correspond to the right button on the top of control lever. Protect the boom against damage by reducing the side force acting on the boom.
4	Slew to right	Move left control lever to right, slew the superstructure to right.
5	Retract mounting cylinder	Pull left control lever backwards, retract mounting cylinder.
6	Spool up H2	Pull left control lever backwards, spool up H2.
7	Slew to left	Move left control lever to left, slew the superstructure to left.
8	High speed	Correspond to the left button on the top of control lever. It is used to control the high-speed operation of slewing mechanism, H2 winch and left travel gear.



Avoid stopping slewing movements suddenly during operation. Otherwise, the load will shake violently.

4.1.3.2 Right control lever

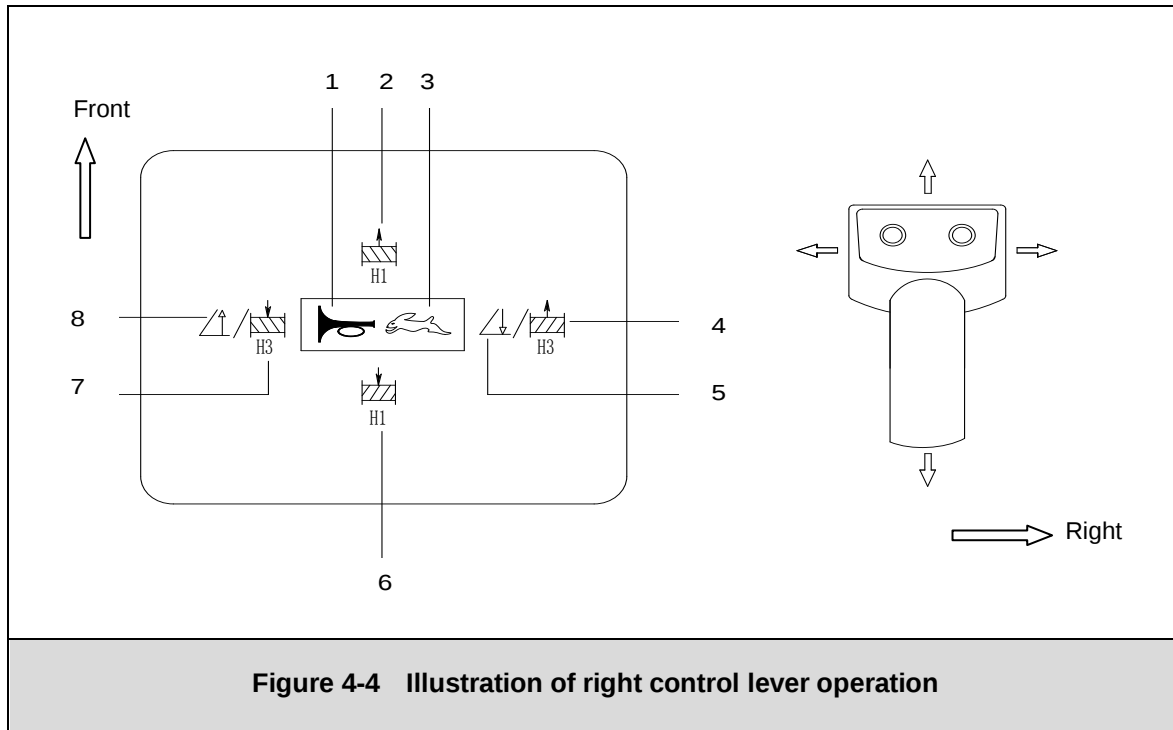


Figure 4-4 Illustration of right control lever operation

As shown in the figure 4-4, the left is the operating board for right control lever. It is stuck on the left glass of the cab. The four directions shown on the right means that the control lever can be moved forwards, backwards, leftwards and rightwards. There are two buttons on the control lever. For their functions, please see the table 4-4.

Table 4-4 Operation of right control lever

No.	Meaning of the symbol	Remarks
1	Horn	Correspond to the left button on the top of control lever. It is used to control the horn.
2	Reel off H1	Push right control lever forwards, reel off H1.
3	High speed	Correspond to the right button on the top of control lever. It is used to control the high-speed operation of H1 winch, H3 winch and right travel gear.
4	Reel off H3	Move right control lever to right, reel off H3.
5	Reel off derricking winch	Move right control lever to right, reel off derricking winch.
6	Spool up H1	Pull right control lever backwards, spool up H1.
7	Spool up H3	Move right control lever to left, spool up H3.
8	Spool up derricking winch	Move right control lever to left, spool up derricking winch.

 CAUTION

The horn can only be actuated in emergency condition to warn the person in the vicinity of the crane.

4.1.4 Left control panel

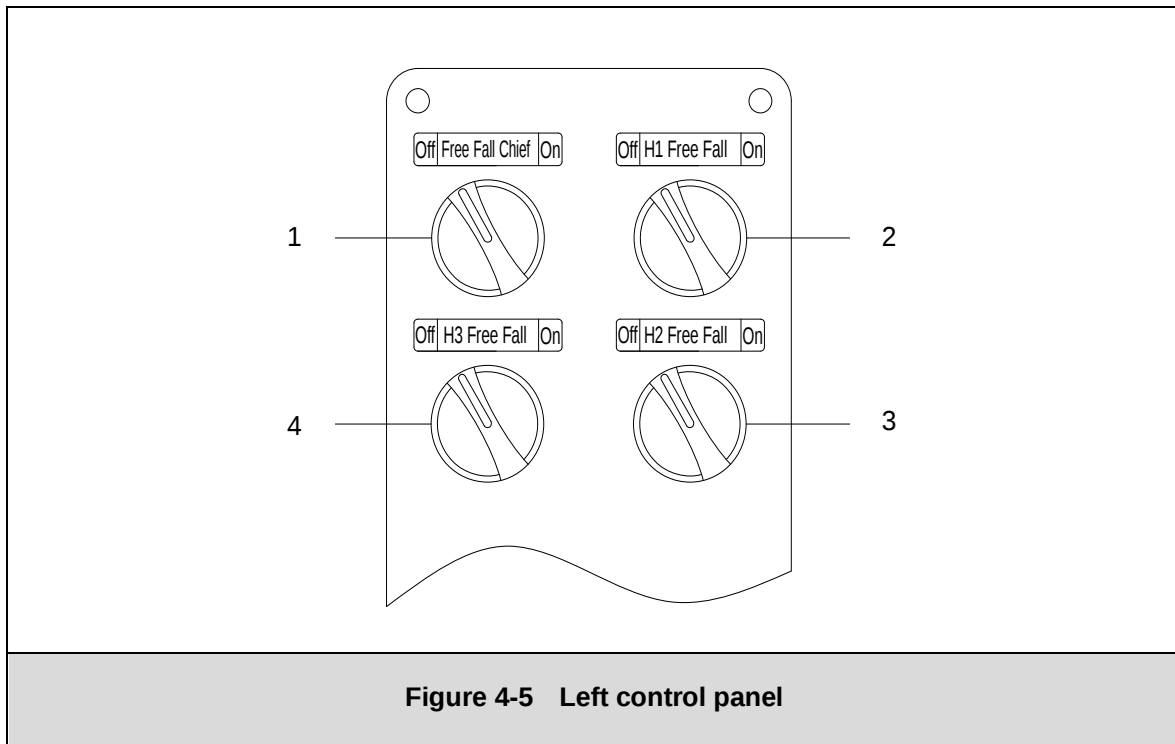


Figure 4-5 Left control panel

When the crane has free-fall function, the left control panel will be described in the table 4-5.

Table 4-5 Description of left control panel (crane with free-fall function)

No.	Names of the switches	Remarks
1	Free-fall master switch	Turn on this switch before any free-fall operation of hoisting winch.
2	H1 free-fall switch	In order to carry out free-fall operation of H1 winch, the operator must first turn on "free-fall master switch", and then switch on "H1 free-fall switch".
3	H2 free-fall switch	Control the free-fall operation of H2 winch. The operating method is the same as above.
4	H3 free-fall switch	Control the free-fall operation of H3 winch. The operating method is the same as above.

 DANGER

- (1) If free-fall operation is not finished (i.e. the wind drum does not stop rotating), never set the free-fall switch of corresponding winch to the initial position.
- (2) When the hoisting winch is controlled by control lever, never switch on any free-fall switches.

4.1.5 Right control panel

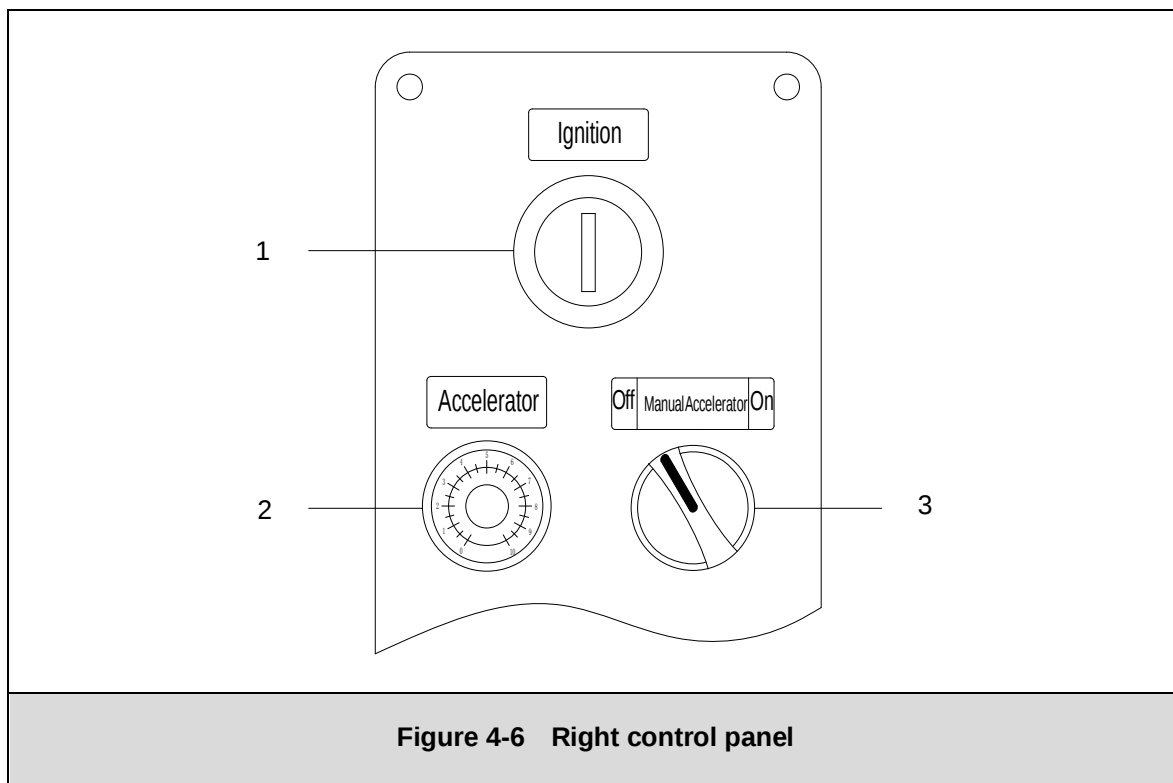


Figure 4-6 Right control panel

The right control panel will be described in the table 4-6.

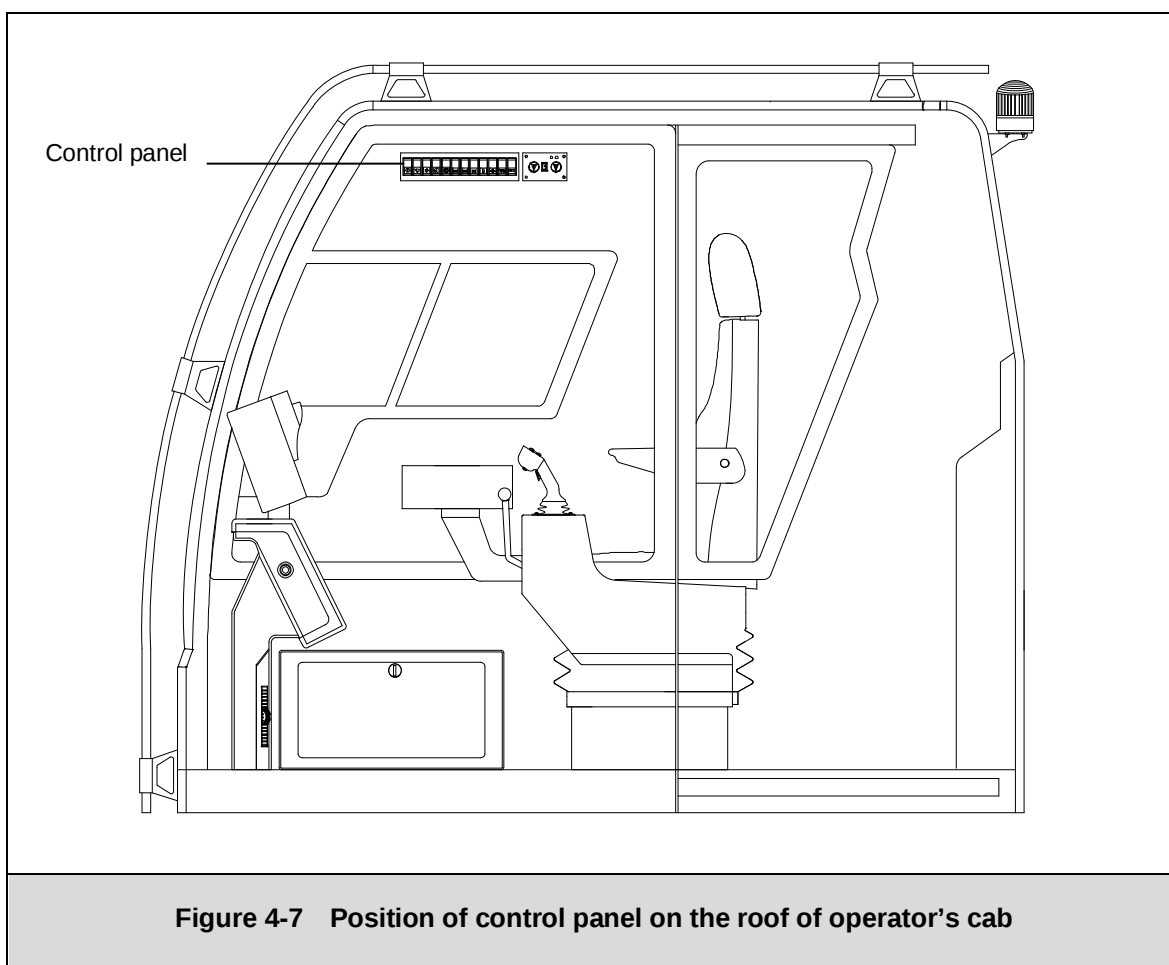
Table 4-6 Description of right control panel

No.	Names of the switches	Remarks
1	Ignition key switch	Insert the key into the ignition key switch and rotate it clockwise to 1 st position, then the power is turned on. Continue to rotate the key to the 2 nd position, then the engine is started.
2	Accelerator control knob	The engine rotational speed is adjusted through the knob under the manual accelerator mode. Clockwise rotate the knob, the engine speed will increase.
3	Manual accelerator switch	Turn the switch clockwise, the accelerator control mode is changed into the manual control. At this time, the accelerator is controlled by the knob (No. 2 in the figure 4-6) rather than the accelerator pedal (No. 3 in the figure 4-1).

! CAUTION

- (1) Before starting the engine each time, first set the ignition key switch in initial position.
- (2) The engine will be started after automatic preheating when it is cold. Moreover, delay start of the engine is normal.

4.1.6 Control panel on the roof of operator's cab



Refer to figure 4-7 for the position of control panel on the roof of operator's cab and refer to figure 4-8 for details.

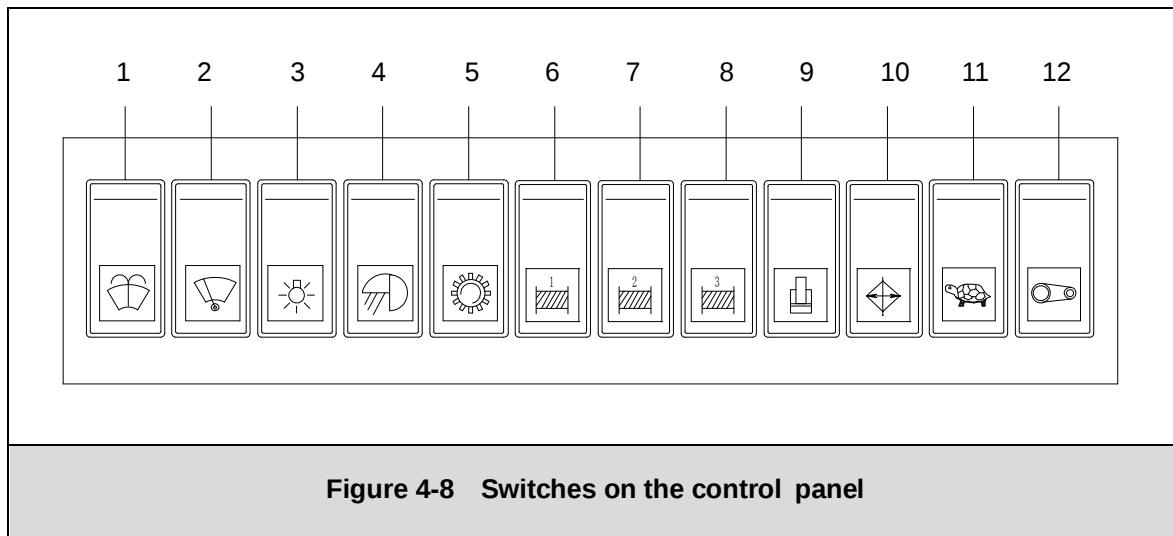


Figure 4-8 Switches on the control panel

As to the functions of switches on the control panel, refer to figure 4-7.

Table 4-7 Description of switches on the control panel

No.	Names of switches	Functions
1	Washer switch	Control the washer
2	Front windshield wiper switch	Control the front windshield wiper
3	Master lighting switch	Turn it on the 1 st position, the LED on instruments and control panel will light up. Turn it on the 2 nd position, the working floodlights on the roof of operator's cab will light up.
4	"Working floodlight on the slewing table" switch	The switch will work when the master lighting switch is placed on 2 nd position. It will control all working floodlights on the slewing table, including lighting of monitoring system.
5	Derricking ratchet pawl switch	If derricking mechanism does not work for a long time, turn on derricking ratchet pawl switch, and then reel off derricking winch slowly until ratchet pawl is engaged into the ratchet wheel completely. At this time, the derricking rope can not be unwound continuously. When there is a need to move the boom, turn off derricking ratchet pawl switch, and then spool up derricking winch to make ratchet pawl disengaged from the ratchet wheel.
6	H1 winch switch	Turn on this switch to carry out H1 winch movements.
7	H2 winch switch	Turn on this switch to carry out H2 winch movements, meanwhile turn off mounting cylinder switch.
8	H3 winch switch	When the switch is turned off, you can operate derricking winch. When it is turned on, H3 winch movements can be carried out.

No.	Names of switches	Functions
9	Mounting cylinder switch	Turn on this switch to operate mounting cylinder on main boom pivot section, and turn off H2 winch switch at the same time.
10	Oil cooling fan switch	Turn on this switch to make the oil cooling fan work when there is a need to cool the hydraulic oil.
11	Winch low-speed switch	All winch movements will slow down after the switch is turned on.
12	Travel gear switch	Turn on this switch to operate the travel gear.

**CAUTION**

- (1) Never operate H2 winch and mounting cylinder at the same time.
- (2) Never operate derricking winch and H3 winch at the same time.

4.2 Instruction for digital display system

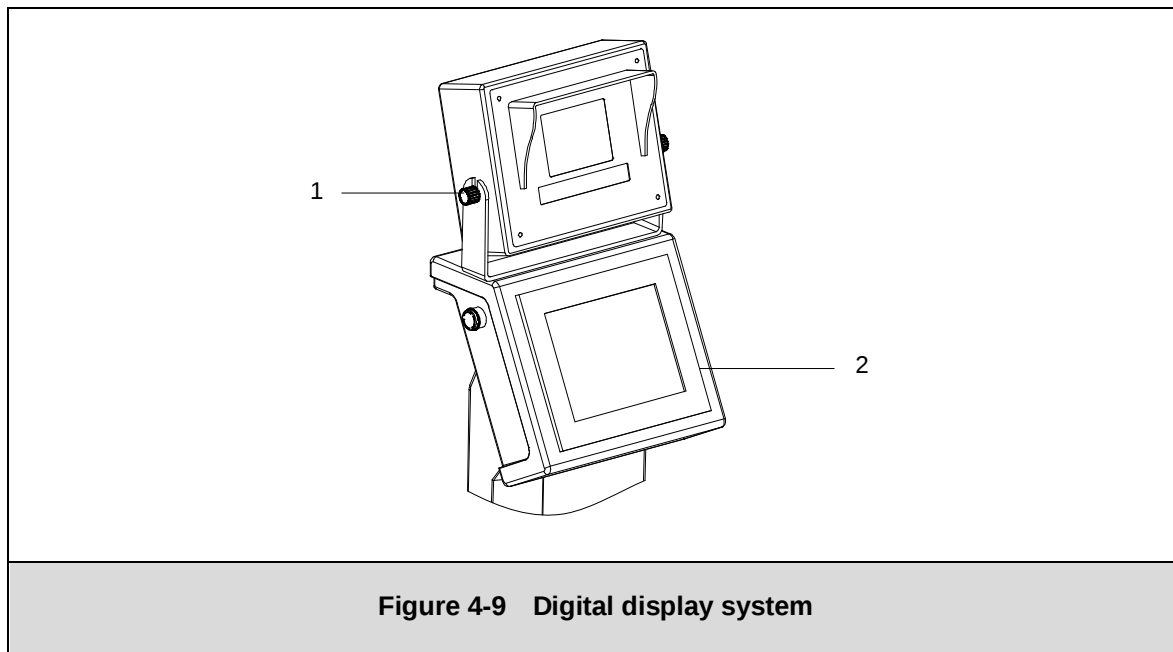


Figure 4-9 Digital display system

The description of digital display system is shown in the table 4-8.

Table 4-8 Description of digital display system

No.	Names of the components	Remarks
1	LCD screen of load moment limiter	Display information about crane such as current load, boom length, boom angle and moment percent. When abnormal conditions occur, the corresponding warning icons will flash.
2	LCD screen of electrical system	Show the working status of crawler crane in real time. When abnormal conditions occur, the corresponding warning icons on the screen will flash. Monitor the main parameters of the crane and engine, and set the parameter of electrical system in real time.

4.2.1 Load moment limiter

As to detailed operation, refer to ***Load Moment Limiter Operating Manual***.

4.2.2 Electrical system

The main screen of electrical system is shown in the figure 4-10.

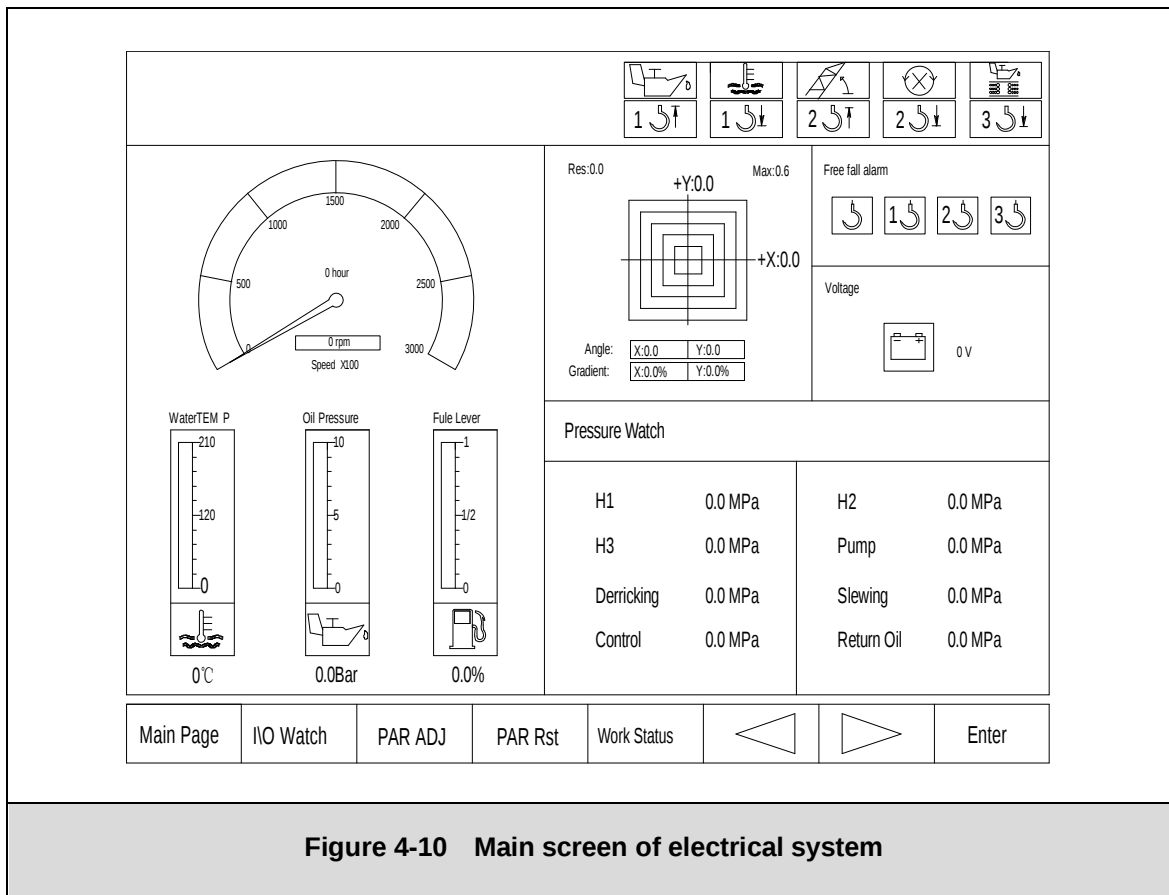


Figure 4-10 Main screen of electrical system

The main screen is subdivided into five main areas.

- Alarm functions
- Engine information
- Monitored additional functions
- Pressure monitoring of hydraulic system
- Function keys area

4.2.2.1 Alarm functions

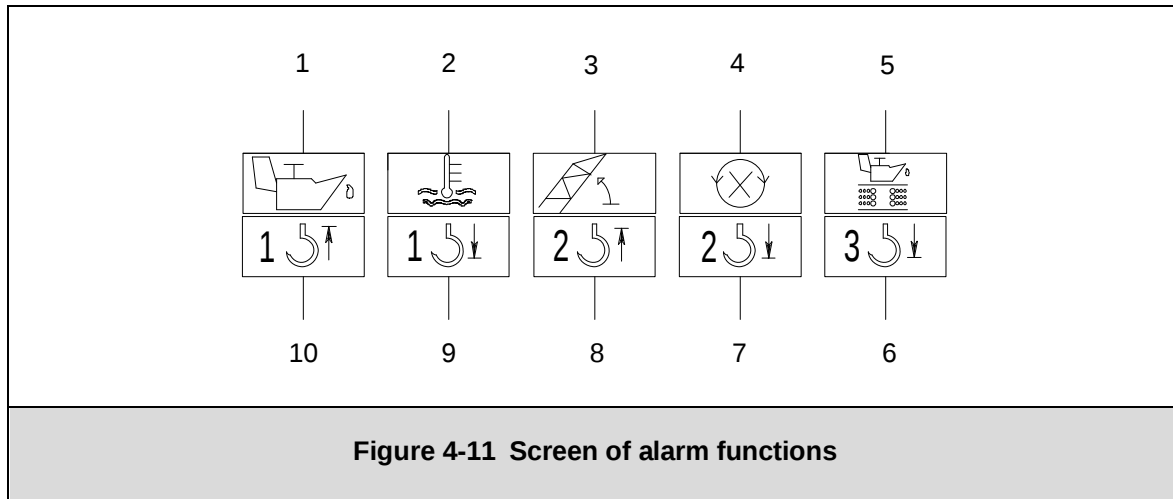


Figure 4-11 Screen of alarm functions

The screen of alarm functions will be described in details in the table 4-9.

Table 4-9 Description of alarm functions screen

No.	Meaning of the icons	Remarks
1	Icon "Engine oil pressure"	When engine oil pressure is less than 0.06MPa, this icon will flash
2	Icon "Engine coolant temperature"	When engine coolant temperature is higher than 98℃, this icon will flash.
3	Icon "Max. main boom angle"	When main boom angle reaches the maximum value, this icon will flash.
4	Icon "Detection of slewing fixing pin"	When the slewing fixing pin is not pulled out, this icon will flash.
5	Icon "Oil pipeline clog"	When oil pipeline is clogged, this icon will flash.
6	Icon "Lower limit switch on H3 winch"	When there are only three windings of wire rope left on H3 winch, this icon will flash.
7	Icon "Lower limit switch on H2 winch"	When there are only three windings of wire rope left on H2 winch, this icon will flash
8	Icon "Upper limit switch on H2 winch"	When the load hook comes into contact with the hoisting limit switch weight during its upward movement, this icon will flash.
9	Icon "Lower limit switch on H1 winch"	When there are only three windings of wire rope left on H1 winch, this icon will flash.
10	Icon "Upper limit switch on H1 winch"	When the load hook comes into contact with the hoisting limit switch weight during its upward movement, this icon will flash.

4.2.2.2 Engine information

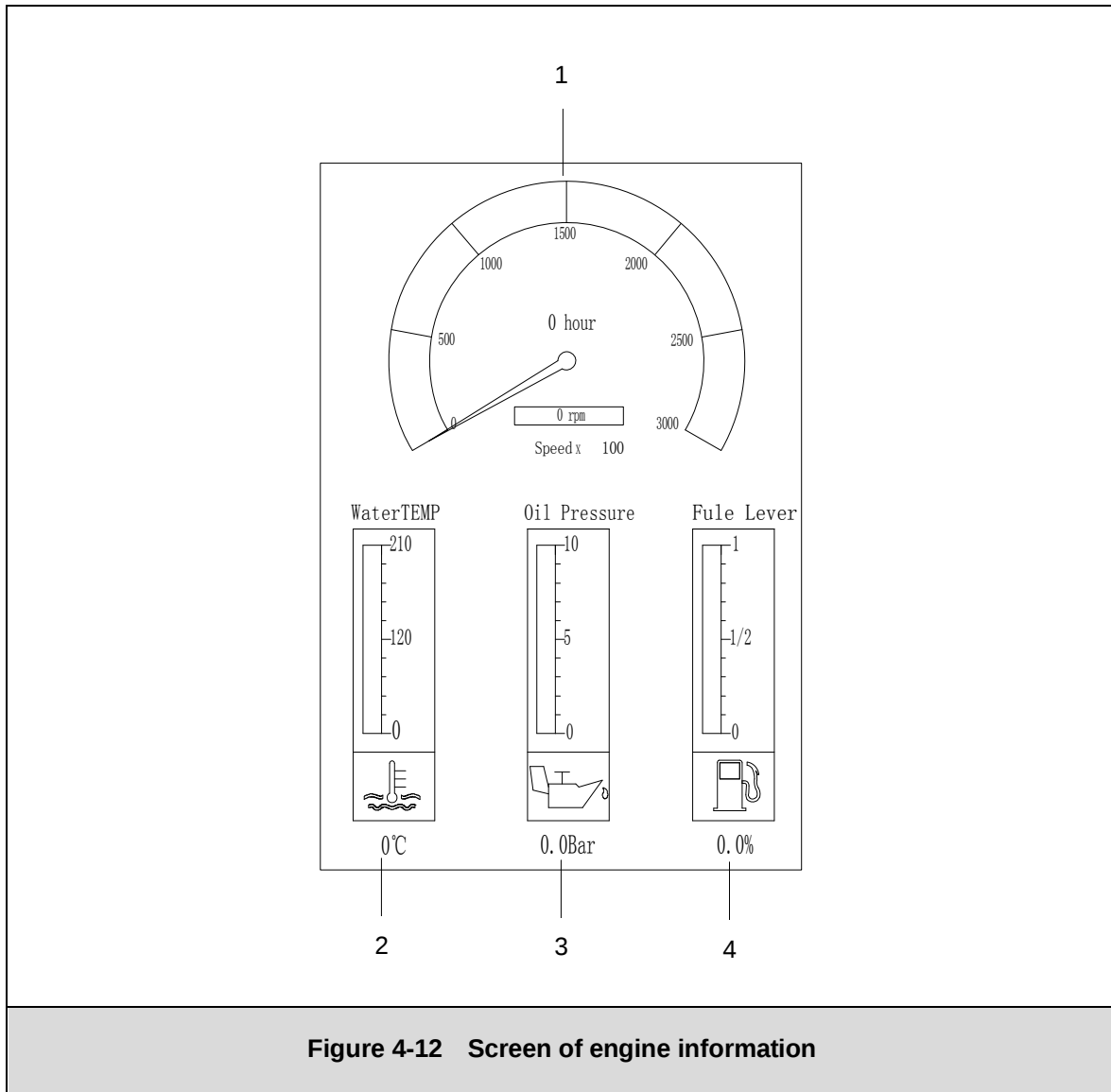


Figure 4-12 Screen of engine information

The screen of engine information will be described in detail in the table 4-10.

Table 4-10 Description of engine information screen

No.	Engine information	Remarks
1	Engine speed and working time	Show current engine speed and total working hours
2	Engine coolant temperature	Show engine coolant temperature
3	Engine oil pressure	Show engine oil pressure
4	Fuel level	Show fuel level in the fuel tank

4.2.2.3 Monitored additional functions

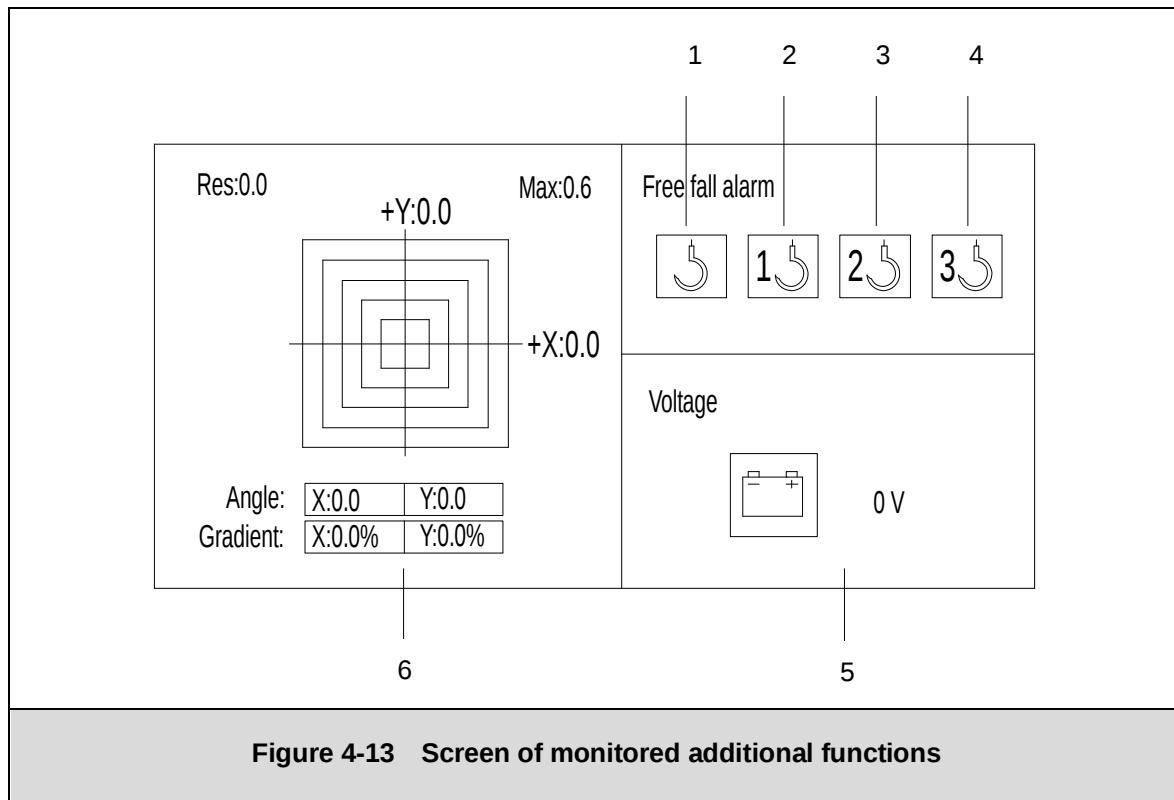


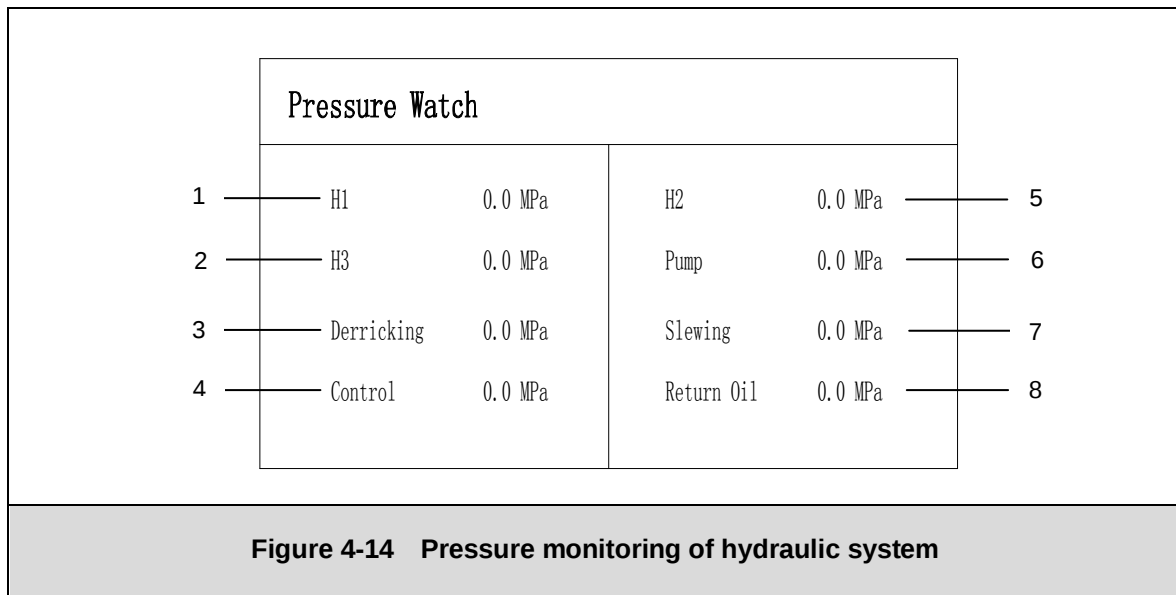
Figure 4-13 Screen of monitored additional functions

The screen of monitored additional functions will be described in detail in the table 4-11.

Table 4-11 Description of monitored additional functions screen

No.	Monitored additional functions	Remarks
1	"Free-fall function" warning	The icon will flash after the free-fall master switch (No.1 in figure 4-5) is turned on.
2	"H1 free-fall" warning	The icon will flash after H1 free-fall switch (No.2 in figure 4-5) is turned on.
3	"H2 free-fall" warning	The icon will flash after H2 free-fall switch (No.3 in figure 4-5) is turned on.
4	"H3 free-fall" warning	The icon will flash after H3 free-fall switch (No.4 in figure 4-5) is turned on.
5	Battery voltage	Show the current voltage of crane battery.
6	Crane inclination	Show the inclination of crane to the horizontal in longitudinal and lateral direction. Note: The traveling direction of crane is taken as positive direction.

4.2.2.4 Pressure monitoring of hydraulic system



The pressure monitoring of hydraulic system will be described in details in the table 4-12.

Table 4-12 Description of pressure monitoring of hydraulic system

No.	Pressure monitoring	Remarks
1	H1 pressure	Show the oil pipeline pressure of H1 winch
2	H3 pressure	Show the oil pipeline pressure of H3 winch
3	Derricking pressure	Show the oil pipeline pressure of derricking winch
4	Control pressure	Show the control oil pipeline pressure of hydraulic system
5	H2 pressure	Show the oil pipeline pressure of H2 winch
6	Pressure of main pump	Show the pressure of main pump
7	Slewing pressure	Show the pressure of slewing pump
8	Oil return pressure	Show the oil return pipeline pressure of hydraulic system

4.2.2.5 Function key area

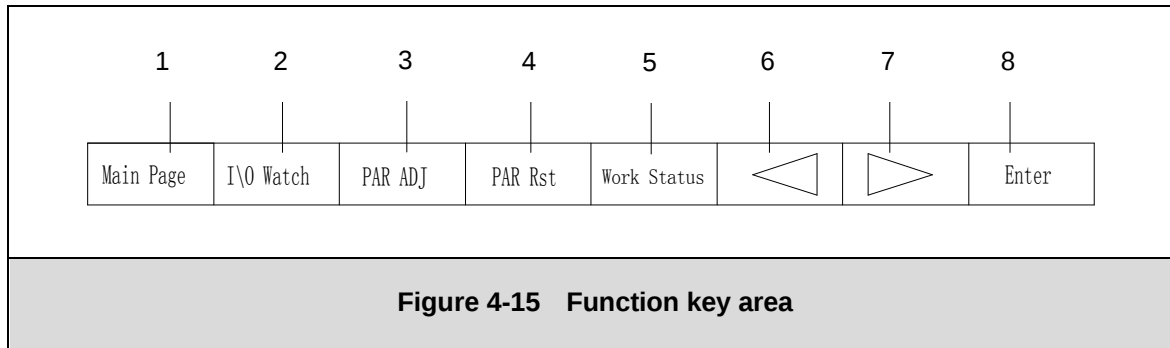
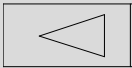
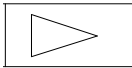


Figure 4-15 Function key area

The function key area will be described in the table 4-13.

Table 4-13 Description of function key area

No.	Function keys	Remarks
1	Key "Main screen"	Press this key in any other screen, the system can be switched into "main screen" directly.
2	Key "I/O screen"	Press this key to enter "I/O screen". In this screen, all the input/output points of PLC can be checked.
3	Key "Parameter adjustment"	Press this key to enter "Parameter adjustment" screen, then you can adjust relevant parameters of main motions.
4	Key "Parameter resetting"	Press this key to enter "Parameter resetting" screen, then you can restore all parameters to the factory setting.
5	Key "Work status"	Press this key, the system can be switched into "work status" screen. In this screen, the working status for all crane movements can be checked.
6		Page up
7		Page down
8	Key "Enter"	Confirm the previous operation or save the modified parameters.

4.3 Startup of the crane

4.3.1 Adjustment of crane operator's seat

a) Vertical adjustment of headrest

The height of headrest is adjusted manually with proper strength.

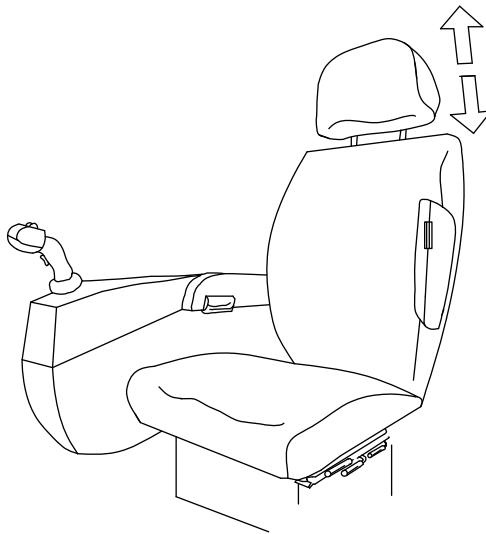


Figure 4-16 Adjustment of headrest

b) Adjustment of armrest

The height of armrest can be adjusted by the adjusting knobs.

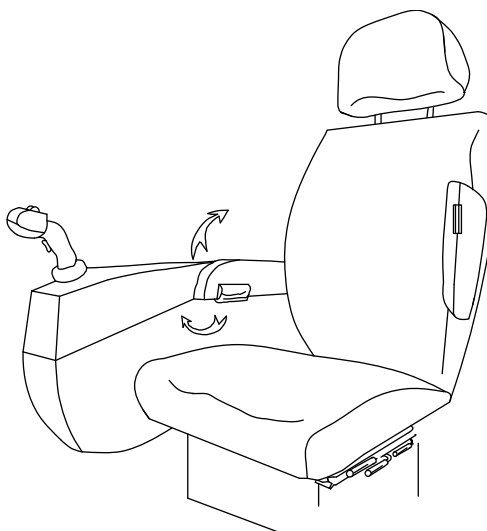


Figure 4-17 Adjustment of armrest

- c) Horizontal adjustment of seat
Pull the lever upwards;
Move the seat to required position;
Release the lever.

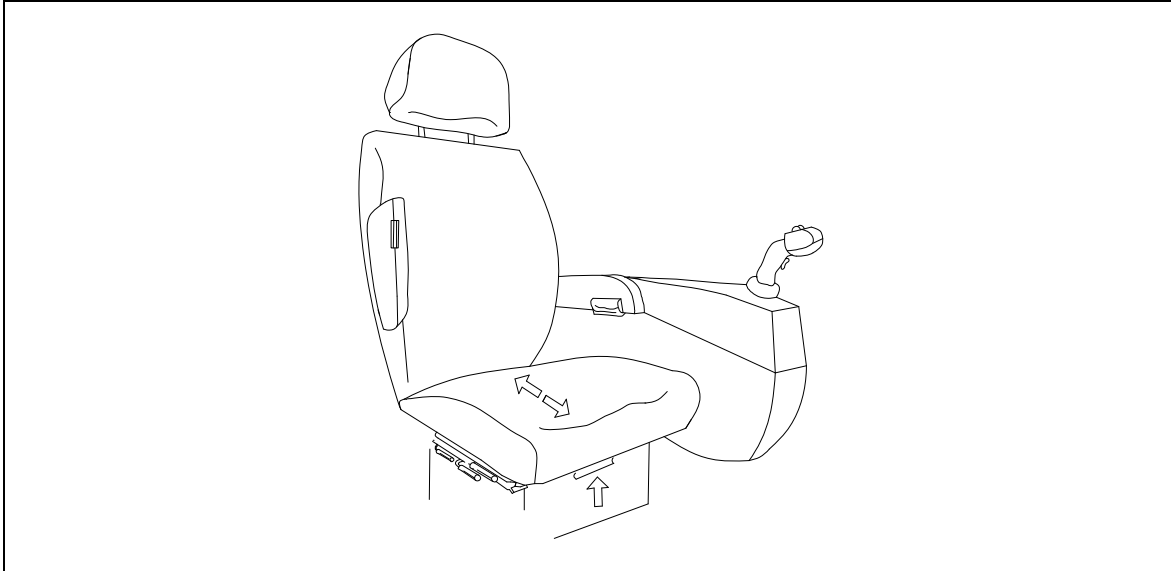


Figure 4-18 Horizontal adjustment of seat

- d) Adjustment of seat height
There are two levers to adjust the seat height. The left lever adjusts the height of the front part of the seat, and the right lever adjusts the height of the rear part of the seat.
Pull the left lever upwards, the front part of the seat is raised up.
Pull the right lever upwards, the rear part of the seat is raised up.

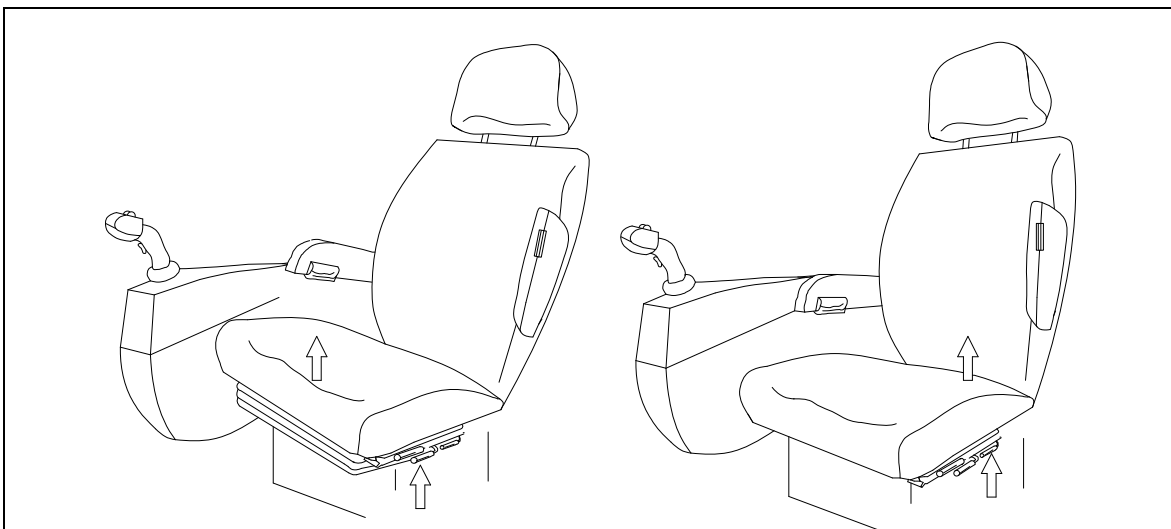
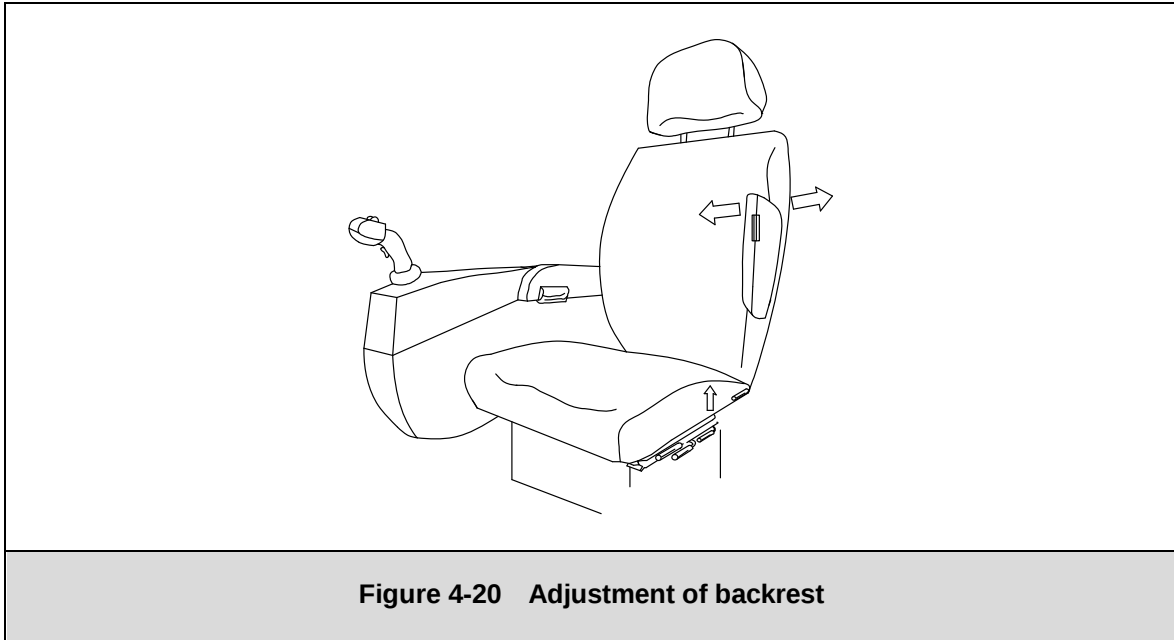


Figure 4-19 Adjustment of seat height

e) Adjustment of backrest

Pull the horizontal adjustment lever upwards, pull the backrest to proper position and release the lever.



4.3.2 Checks before startup

The following checks should be performed before startup of the engine.

- a) Check oil filter and oil level
 - 1) Oil level of diesel engine
 - 2) Oil level of hydraulic oil tank
 - 3) Oil filter on hydraulic oil tank
- b) Check coolant level

Add coolant to the rim on the filling nozzle.

- c) Check the general conditions of the crane

Before starting up the crane, the operator must ensure that the following conditions are fulfilled:

- 1) The crane is horizontally aligned.
- 2) The gear of the slewing ring must be clean and greased.
- 3) The air inlet of oil coolant radiator is not blocked.
- 4) All cowlings and covers on the sides must be closed and locked.
- 5) No person or object is within the slewing radius of the crane.
- 6) No ice or snow is on wire rope, winding drum and limit switches.
- 7) There are no loose parts on slewing table or on the boom.
- 8) The shutoff valve on hydraulic oil tank should be opened.
- 9) The battery master switch must be placed in “ON” position. Otherwise, the whole machine can not be energized.

DANGER

- (1) Never check the coolant level before the engine is cooled down. Otherwise, you may get scalded.
- (2) Before carrying out any boom movements, make sure that there are no loose parts on the boom such as pin, or retaining spring. Otherwise, these falling parts may hit persons or other objects.

4.3.3 Turn on power supply

Insert ignition key into ignition lock and turn it clockwise to the 1st position, then the power supply is turned on. See the figure 4-21.

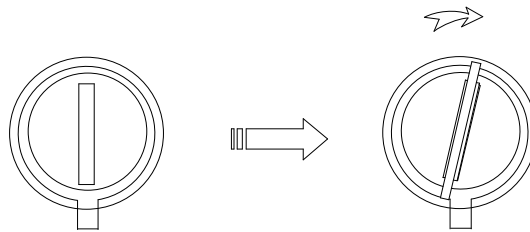


Figure 4-21 Turn on power supply

4.3.3.1 Checking main screen of electrical system

After the power supply is turned on, press the power switch (no. 5 in the figure 4-2) on the operating console, both the LCD screen of load moment limiter and LCD screen of electrical system are started. At this time, check the following items as shown in the figure 4-22.

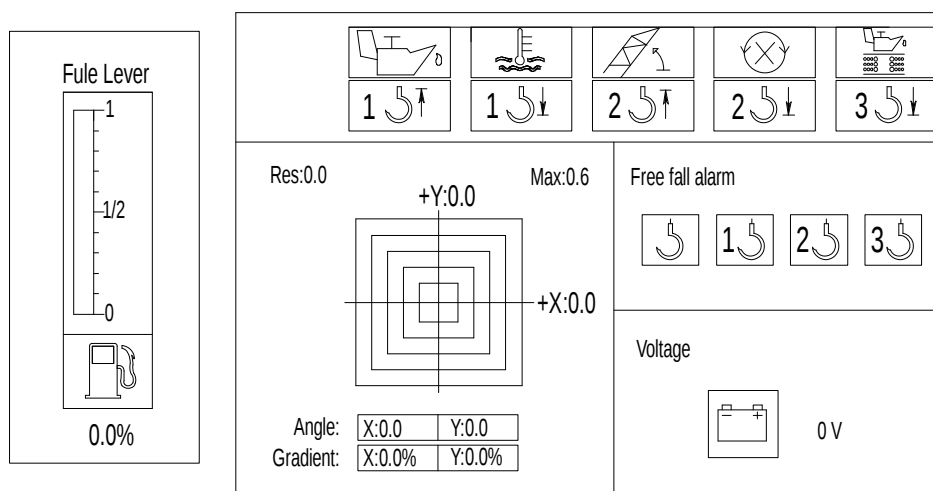


Figure 4-22 Screen of alarm function

Items to be inspected

- a) Check engine oil level;
- b) Check if slewing fixing pin is pulled out;
- c) Check hoisting limit switches on H1, H2;
- d) Check if free-fall switches are switched off;
- e) Check the maximum main boom angle;
- f) Check crane battery voltage;
- g) Check crane inclination.



(1) Add diesel oil in time if the fuel level is too low.

(2) The maximum in-service wind speed should not exceed 9.8m/s.

The maximum out-of-service wind speed should not exceed 21m/s when the crane is only fitted with main boom.

The maximum out-of-service wind speed should not exceed 15m/s when the crane is fitted with main boom and fixed jib.

If wind speed reaches or exceeds these values, the entire boom should be lowered down.

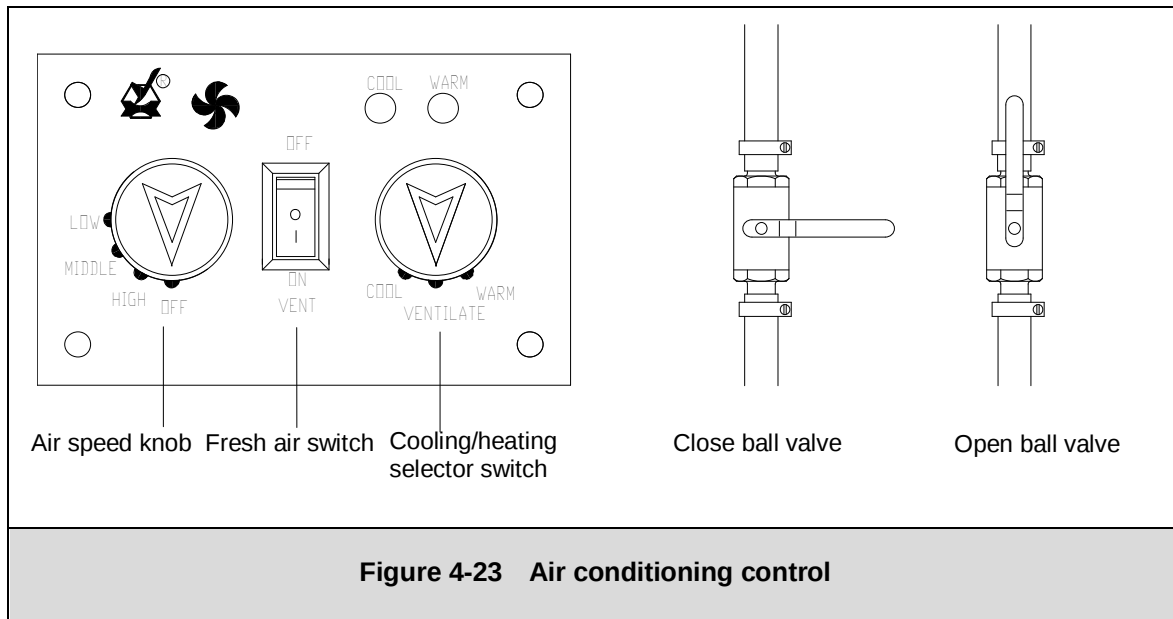
(3) The inclination range for the superstructure: the inclination should be less than 1% in both lateral direction and longitudinal direction. If this range is exceeded, the crane operator must adjust the crane to horizontal position firstly.

4.3.3.2 Checking load moment limiter

- a) Check if the load moment limiter is working properly.
- b) Correctly set work mode on the screen of load moment limiter.
- c) Check if overloading occurs.

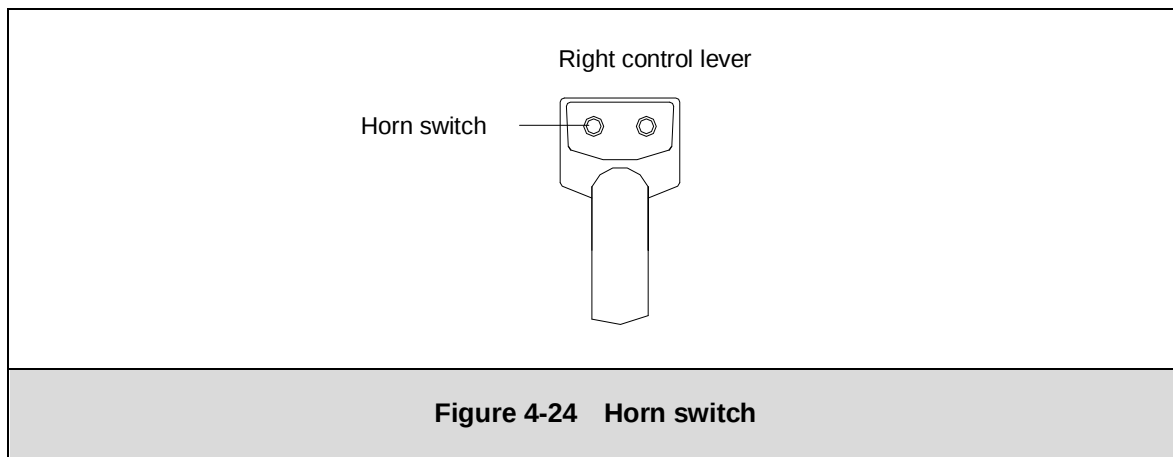
4.3.4 Operation of air conditioning in operator's cab

The crane operator's cab can be heated or cooled according to the expected temperature, and the control panel is located above the wallboard on the right side of the cab. Refer to figure 4-23.



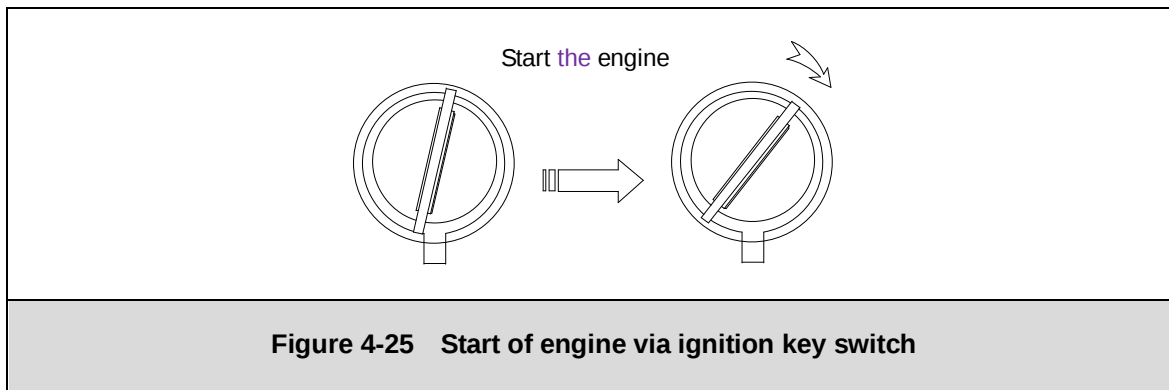
4.3.5 Horn

Press horn switch before starting the work to check if the horn can be sounded. See the figure 4-24.

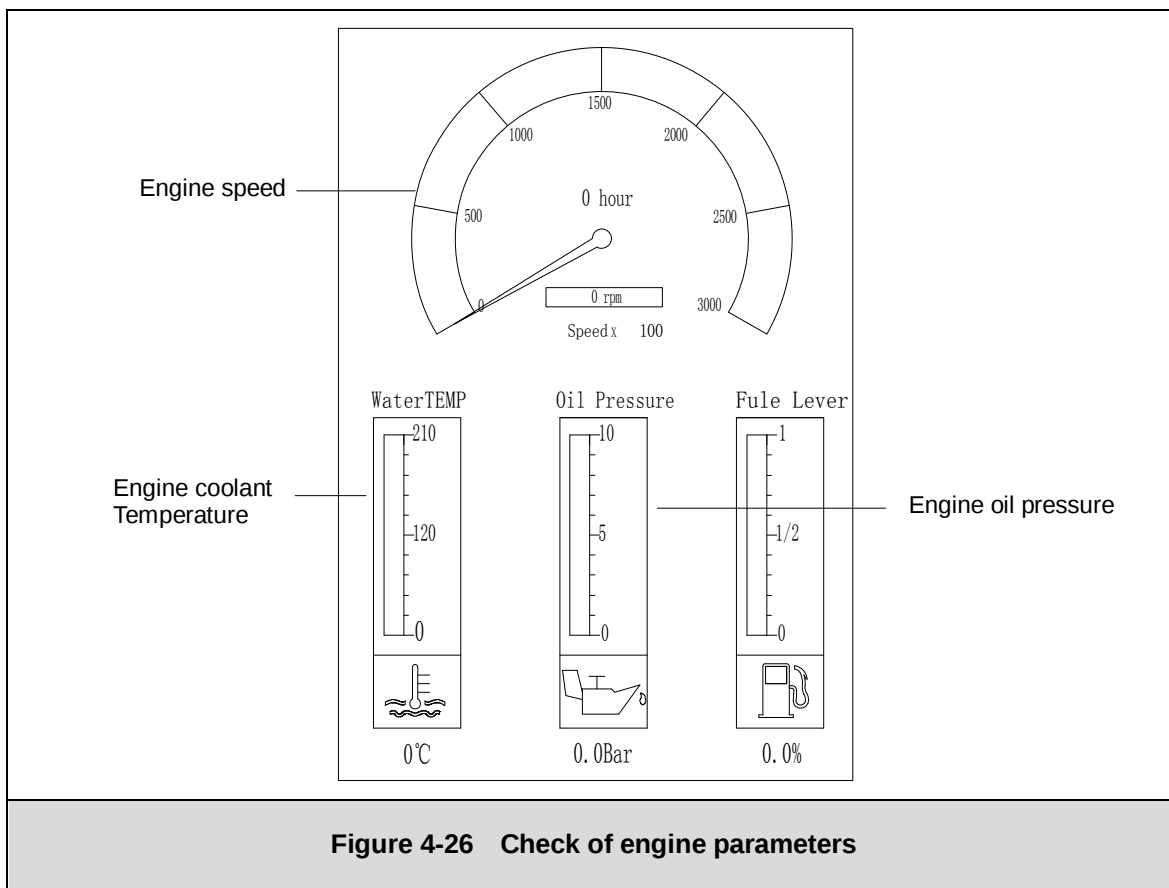


4.3.6 Start of engine

Insert ignition key into ignition lock and turn it clockwise to the 2nd position, the engine can be started.



After the engine is started, check if the following items of engine are normal. See the figure 4-26.



Items to be inspected:

- Check if the engine speed is normal.
- Check if the engine coolant temperature is normal.
- Check if the engine oil pressure is normal.

 CAUTION

- (1) Compared with routine conditions, it takes longer time to preheat the engine automatically in cold weather. This is a normal phenomenon.
- (2) Do not use accelerator when starting engine.
If the engine fails to start after approx. 5s, slowly depress the accelerator pedal all the way down.
If the engine can not be started within 5-10s, give up the starting attempt and wait approx. 1 minute before trying again.
If the engine still can not be started continuously for three times, stop starting engine at once and check it for fault.
If the temperature of engine is high, do not depress accelerator pedal when starting the engine to avoid black smoke discharging.
After the engine starts, release ignition key switch at once to let it return to initial position, and check the parameters of the engine at the same time.
- (3) When ambient temperature is less than -20°C, start the engine via cold-start device.
Before starting cold-start device, the operator must first turn off power switch of electrical system (No.1 in the figure 4-2), set ignition key switch (No.1 in the figure 4-6) in 1st position to turn on the power supply, and then switch on cold-start rocker switch (no. 7 in the figure 4-2).
Only after running cold-start device for 10mins, the engine can be started.
If engine coolant temperature is slightly lower than normal in cold weather, start cold-start device to increase coolant temperature.
- (4) The crane engine can only become full loaded when it achieves the running temperature.

4.4 Safety device

The crane operator must check all safety devices for functional work before every crane operation.



Operating crane with faulty safety devices is prohibited!

4.4.1 Emergency stop button

As soon as this emergency stop button is pressed,

- a) The electrical control system is switched off and the diesel engine shuts down;
- b) All crane movements stop immediately.

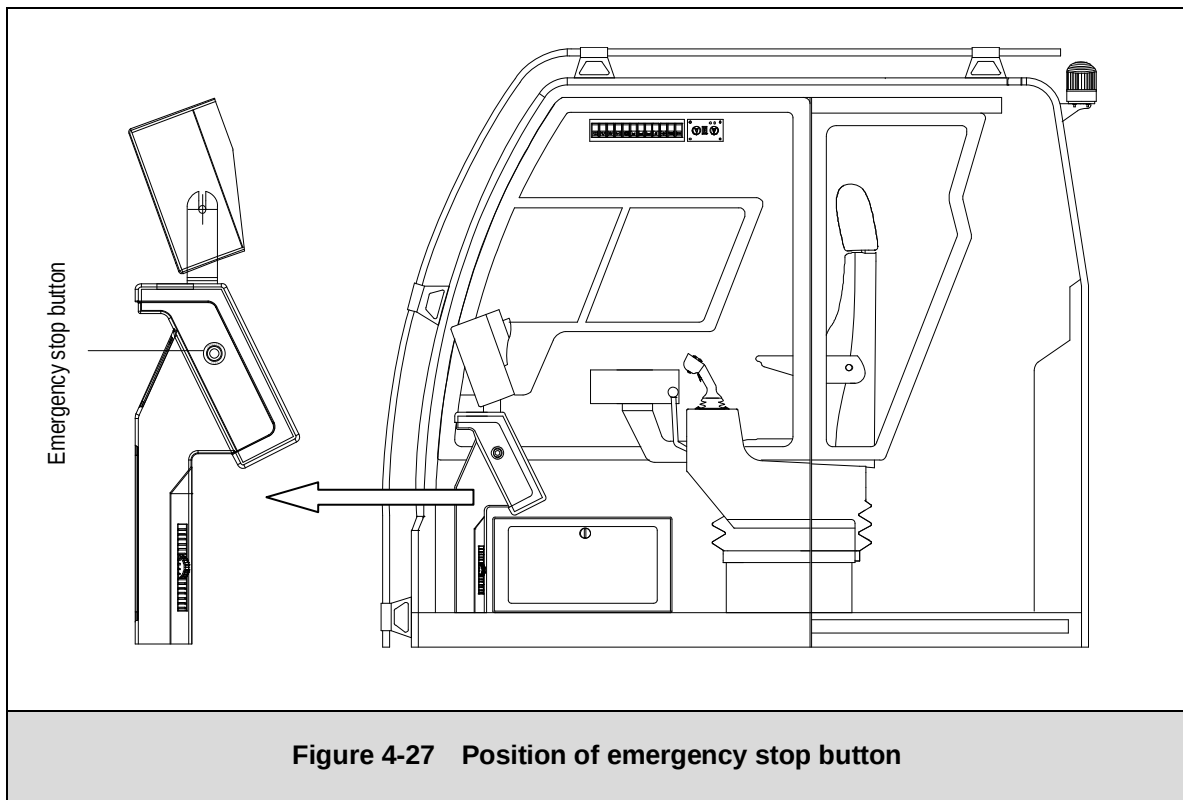


Figure 4-27 Position of emergency stop button

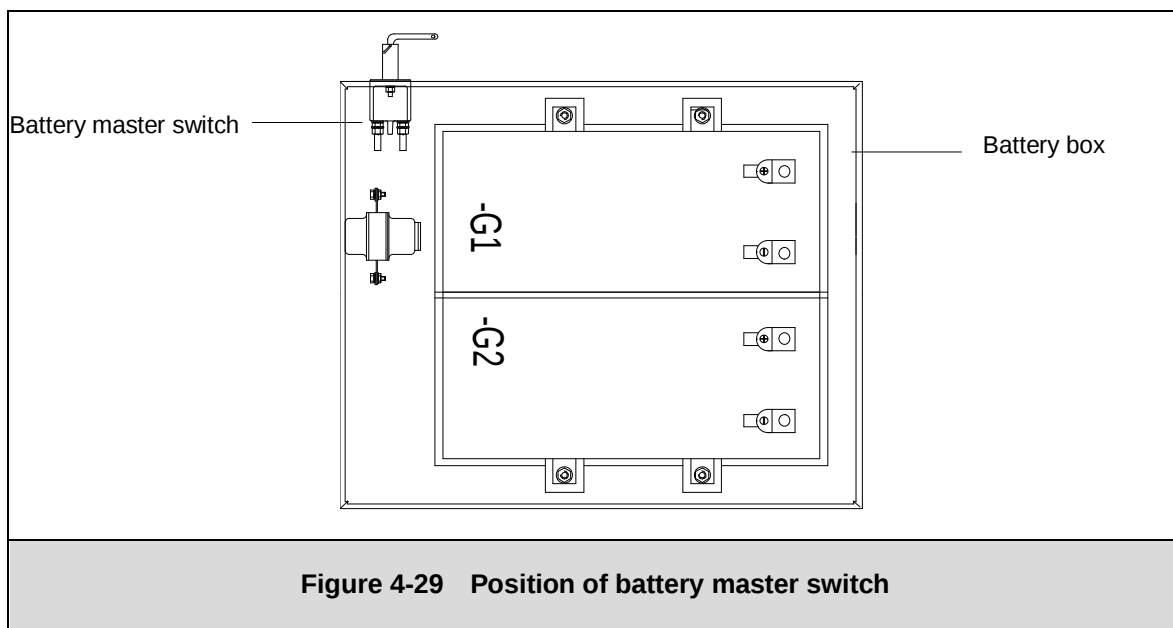
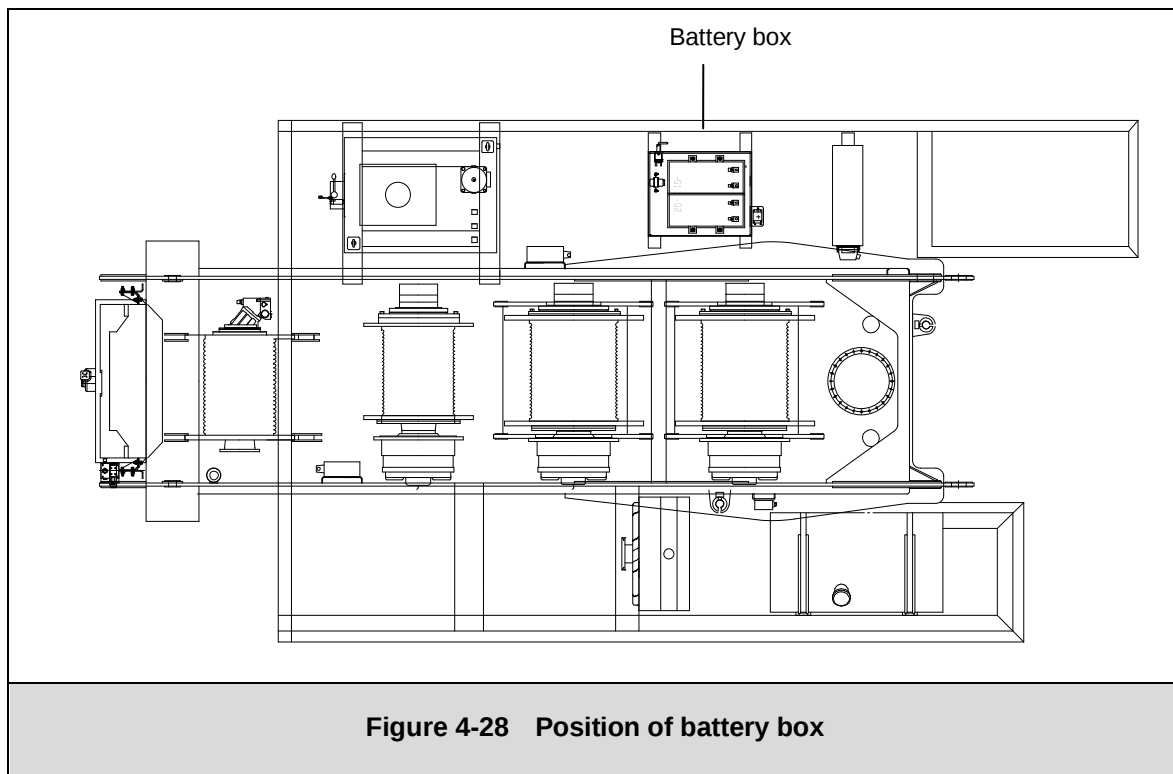


The emergency stop button must only be used in case of emergency and not as a normal procedure for shutting down the diesel engine!

If an emergency stop is triggered while a load is being lifted, there may be a risk of accident owing to swinging of load.

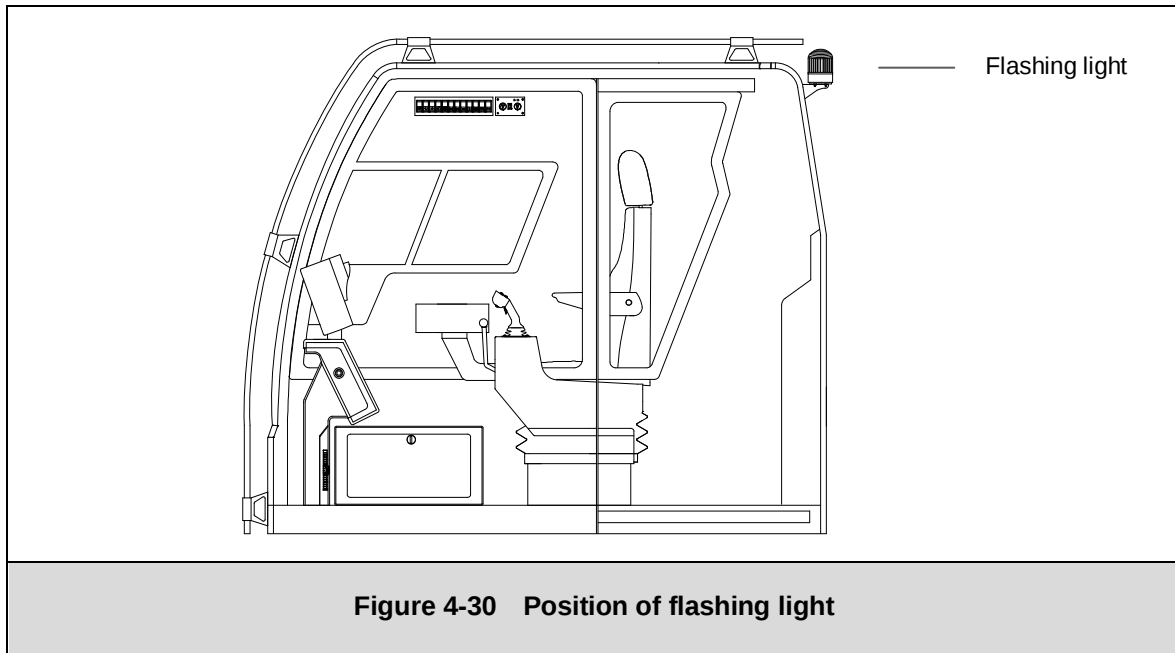
4.4.2 Battery master switch

Battery master switch is located in the battery box on the slewing table. Set battery master switch in "OFF" position during long-time work breaks so as to prevent the electricity of battery from discharging excessively.



4.4.3 Flashing light

When the crane is electrified via ignition key switch, the flashing light will light up. It will warn people around and shows that the crane is working.



4.4.4 Load moment limiter

When permissible load moment is exceeded, the crane movements which will increase load moment will be cut off, and only those movements that will decrease load moment are allowed. However, the presence of load moment limiter does not relieve the crane operator of his duties and responsibilities for safe crane operation. Before lifting a load, he must know the approximate weight of load and decide if the crane is in a position to carry out this job with the help of lifting capacity chart.

DANGER

The load moment limiter must be adjusted before using the crane to the current set up condition in accordance with the lifting capacity chart. Only in this way can it be able to fulfill its protective task.

If crane operator does not observe this safety obligation, the crane may overturn and may be damaged beyond repair, despite the load moment limiter is working normally. The load moment limiter can not monitor and control all possible operating conditions; this is still primarily the responsibility of the operator.

CAUTION

The "Bypass" in this chapter means that the limited movement is allowed to move towards dangerous direction via bypass switch after the alarm is sent out and the system cut off the dangerous movement. This does not mean the alarm is canceled.

4.4.4.1 Moment percent between 100%-110%

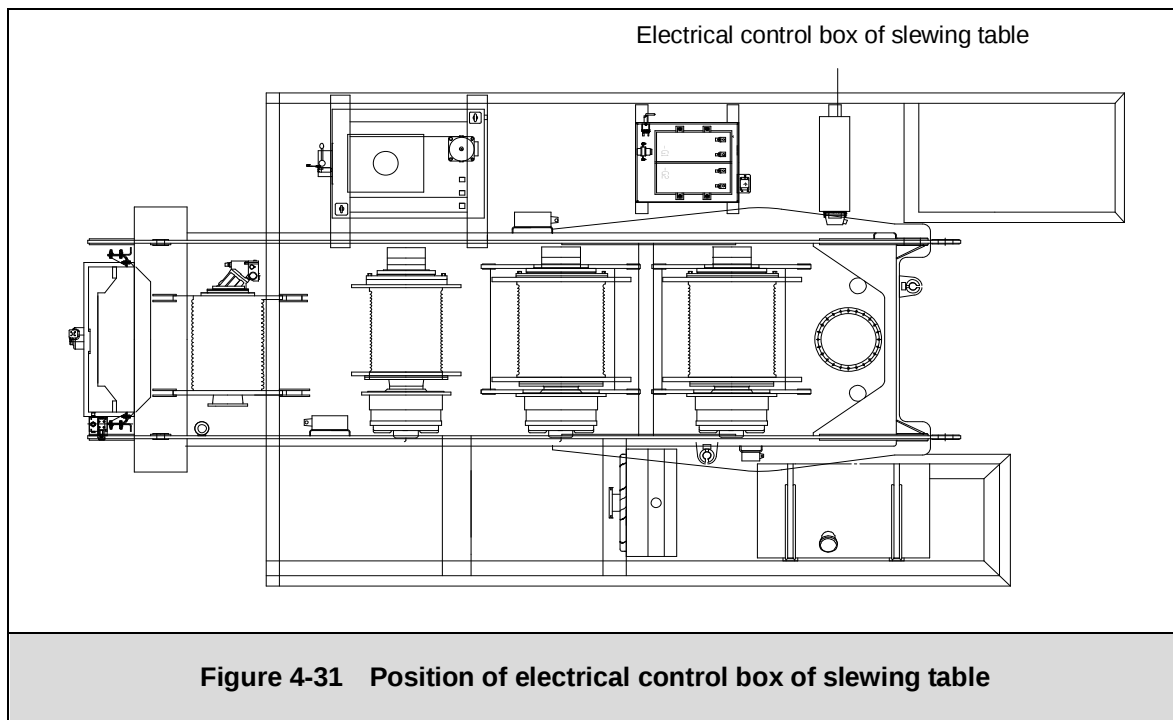
If the moment percent shown on the load moment limiter is between 100% and 110%, it means that the actual load of crane reaches 100% - 110% of the rated load. At this time, crane movements "spool up H1, H2 and H3", "derrick boom up and down" are cut off, the tricolor light sends out yellow and red warning and the buzzer sounds continuously.



Bypass those limited movements in accordance with the following methods:

- (1) Turn bypass switch (in the electrical control box of slewing table) clockwise until the icon  appears on the load moment limiter. At this time, the limited movement "derrick boom up" is bypassed. However, the tricolor light sends out red warning and the buzzer sounds continuously.
- (2) Press "Setup" switch (No. 2 in the figure 4-2) on the operating console, the icon  will appear on the load moment limiter if rated load is lifted. At this time, rotate derricking bypass switch (No. 5 in the figure 4-2) clockwise, the limited movement "derrick boom up" is bypassed. However, derricking speed is reduced, the tricolor light sends out yellow and red warning, and the buzzer sounds continuously.

Press "Setup" switch (No. 2 in the figure 4-2) on the operating console, the icons  and  will appear on the load moment limiter if non-rated load is lifted. At this time, the limited movement "derrick boom up" is bypassed. However, derricking speed is reduced, the tricolor light sends out yellow warning, and the buzzer sounds continuously.



4.4.4.2 Moment percent more than 110%

If the moment percent shown on the load moment limiter is more than 110%, it means that the actual load of crane exceeds 110% of the rated load. At this time, crane movements "spool up H1, H2 and H3", "derrick boom up and down" are cut off, the tricolor light sends out yellow and red warning and the buzzer sounds continuously.



Bypass those limited movements in accordance with the following method:

Turn bypass switch (in the electrical control box of slewing table) clockwise until the icon  appears on the load moment limiter. At this time, all limited movements are bypassed. However, the tricolor light sends out red warning and the buzzer sounds continuously.

4.4.4.3 Moment percent less than 100%

When crane is not lifting the rated load, please see section 4.4.4.1.



- (1) Once the limited movements are bypassed by bypass switch, their speeds will be reduced to 15% of original speed.
- (2) Press "Setup" switch, the bypass of cutoff is valid. After the limited movement is bypassed, return the control lever for 10s, or press "Setup" switch again, or the engine stops, or the controller is electrified again, the bypass of cutoff is invalid. Press bypass switch, the bypass of cutoff is valid for 30mins. If the switch is pressed again, or the engine stops, or the controller is electrified again, the bypass of cutoff is invalid.

4.4.5 Boom angle indicator

Boom angle indicator is fitted on the lower rear end of main boom pivot section (i.e. on the right side of the crane operator's cab). In this way, the operator, even in crane operator's cab, can clearly read boom angle shown on the indicator.

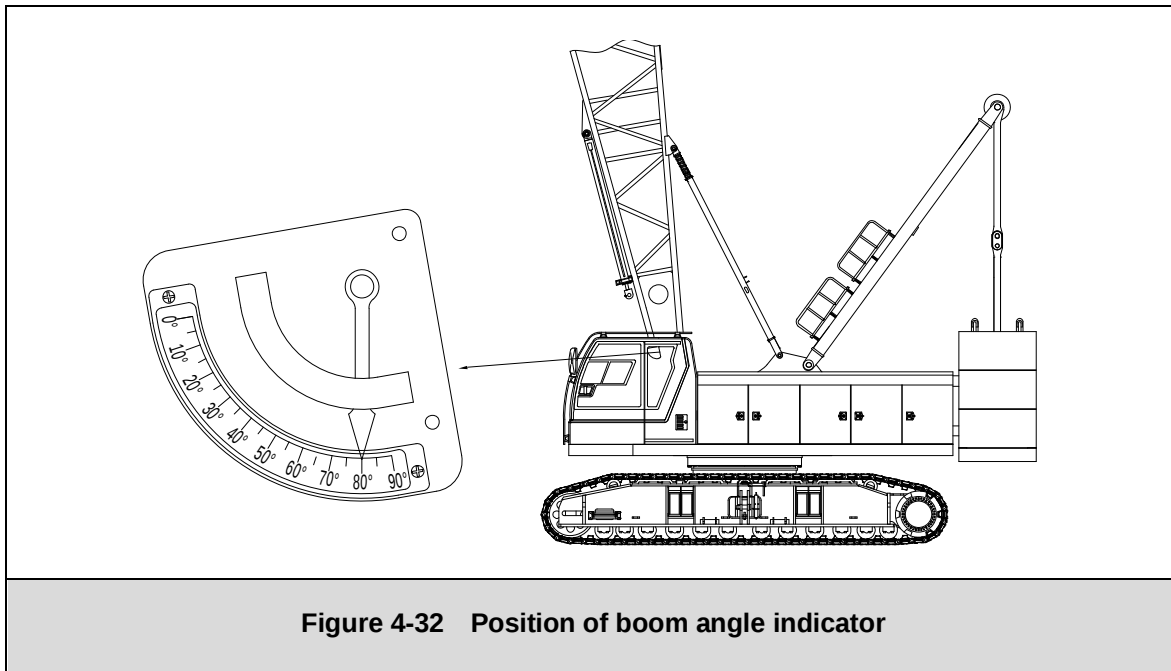


Figure 4-32 Position of boom angle indicator

4.4.6 Derricking limiter

It is used to detect main boom angle in real time according to the data collected by angle sensors. Once detected angle exceeds safe angle range, an alarm will be sent out and dangerous movements will be switched off so as to ensure safe crane operation.

a) Crane operation with main boom

When main boom angle reaches the maximum value within the minimum radius, the crane movement "raise main boom" will be cut off automatically, the icon  will appear on the load moment limiter, the tricolor light will send out yellow and red warning, and the buzzer will sound.

When main boom angle is less than 2° of the maximum angle, the buzzer will sound, but main boom can still be raised up.

b) Crane operation with main boom and fixed jib

The requirements for main boom angle under this boom configuration are the same as that under "Main boom" configuration. The fixed jib can be fitted in the angle of either 10° or 30° to main boom.

4.4.7 Lowering limiter

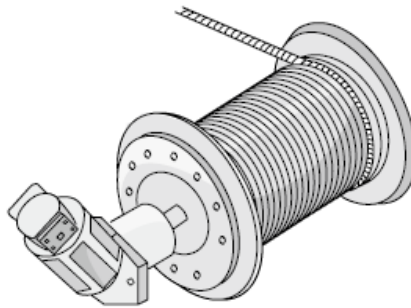


Figure 4-33 Lowering limiter

In order to prevent wire rope from being wound in the opposite direction after it is unwound completely, the lowering limit switches fitted on H1, H2 and H3 are triggered when there are only three windings of wire rope left on the drums. Under this condition, the buzzer will sound, the tricolor light will send out yellow and red warning continuously, and the icon  appears on the load moment limiter. At this time, the movement of "reel off winch" is switched off, and only the movement of "spool up winch" can be carried out.

CAUTION

Bypass those limited movements in accordance with the following methods:

- (1) Turn bypass switch (in the electrical control box of slewing table) clockwise until the icon  appears on the load moment limiter. At this time, the limited movement "reel off winch" is bypassed. However, the tricolor light sends out red warning and the buzzer sounds continuously.
- (2) Rotate lowering bypass switch (No.6 in the figure 4-2) clockwise until the icon  appears on the load moment limiter. At this time, the limited movement "reel off winch" is bypassed. However, the tricolor light sends out yellow and red warning, and the buzzer sounds continuously.

DANGER

- (1) The lowering bypass switch or bypass switch is only used in commissioning and maintenance condition or to avoid accident occurring.
- (2) If lowering limiter is bypassed, there is a risk of increasing accidents!

4.4.8 Hoisting limiter

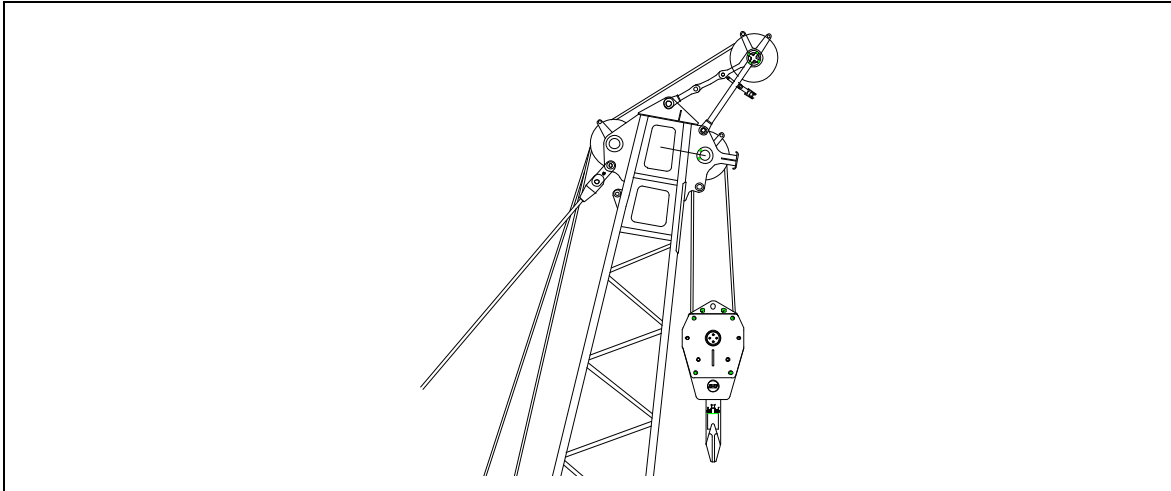


Figure 4-34 Hoisting limiter

The hoisting limiter is installed to prevent the hook pulley from colliding with the boom head. Before using the crane every time, inspect the switch by lifting the hook to the upper limit and colliding with the hoisting limit switch weight.

If the load hook comes into contact with the hoisting limit switch weight during its upward movement, the hoisting limit switch is triggered. Under this condition, the buzzer will sound, the tricolor light will send out yellow and red warning continuously, and the icon  appears on the load moment limiter. At this time, the crane movements “spool up H1, H2 and H3” and “derrick boom down” are switched off.



Bypass those limited movements in accordance with the following methods:

- (1) Turn bypass switch (in the electrical control box of slewing table) clockwise until the icon  appears on the load moment limiter. At this time, the limited movements are bypassed. However, the tricolor light sends out red warning and the buzzer sounds continuously.
- (2) Rotate hoisting bypass switch (No.7 in the figure 4-2) clockwise until the icon  appears on the load moment limiter. At this time, the limited movements are bypassed. However, the tricolor light sends out yellow and red warning, and the buzzer sounds continuously.



- (1) The hoisting bypass switch or bypass switch is only used in commissioning and maintenance condition or to avoid accident occurring.
- (2) If hoisting limiter is bypassed, there is a risk of increasing accidents!

4.4.9 Anemometer

The anemometer fitted on the main boom or fixed jib head can detect the wind speed on the top of the boom in real time.

When the in-service wind speed exceeds 9.8m/s, the crane operation should be stopped immediately.

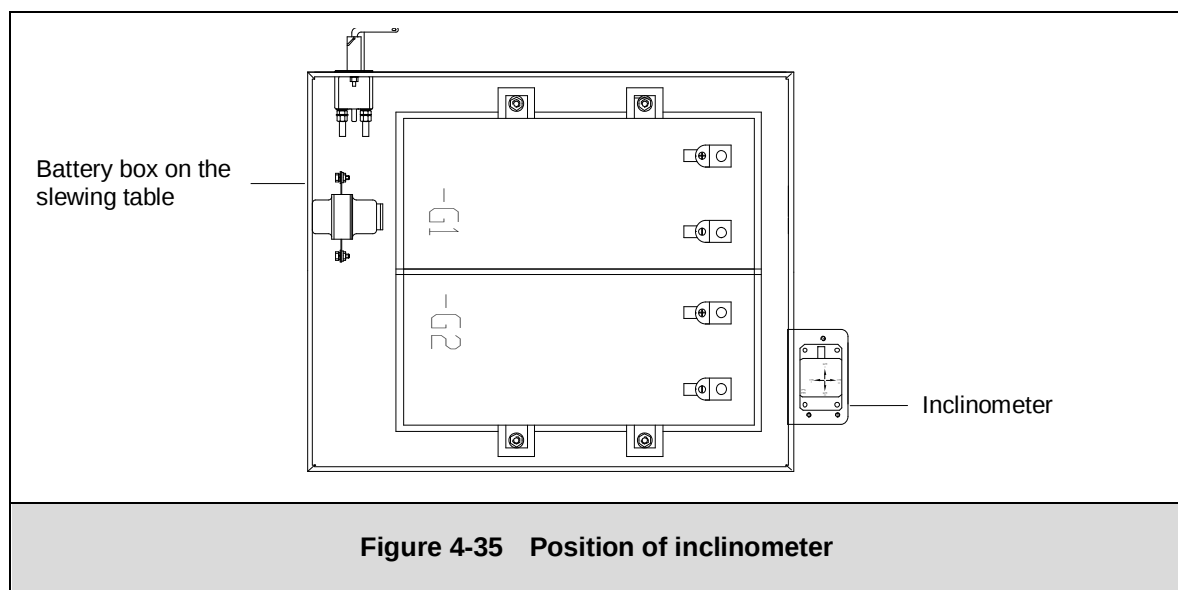
When the out-of-service wind speed for "Main boom" configuration exceeds 21m/s, the entire boom should be placed on the ground.

When the out-of-service wind speed for "Main boom with fixed jib" configuration exceeds 15m/s, the entire boom should be placed on the ground.

The operator should constantly observe the wind speed displayed on the screen.

4.4.10 Crane inclinometer

Crawler crane is fitted with an electric inclinometer. The crane inclination can be shown on the screen of electrical system (No. 6 in the figure 4-13) in real time.



4.4.11 Checklist of safety device

Table 4-14 Checklist of safety device

No.	Prerequisite	limited movements	Bypass methods	Movement speed
1	The load hook of hoisting winch comes into contact with the hoisting limit switch weight during its upward movement. (take H1 winch as an example)	- The crane movement "lift the hook" is cut off. - The icon  flashes on the load moment limiter. - The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	- Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the limited movement is bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously. - Rotate hoisting bypass switch clockwise until the icon  appears on the load moment limiter. The limited movement is bypassed. However, the tricolor light sends out red and yellow warning, and the buzzer sounds continuously.	- When bypass switch is turned on, the speed of crane movement decrease. - When pressing the "hoisting bypass switch", the speed of crane movement is kept the same.
2.	There are only three windings of wire rope left on the hoisting winch. (take H1 winch as an example)	- The crane movement "lower the hook" is cut off. - The icon  flashes on the load moment limiter. - The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	- Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the limited movement is bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously. - Rotate lowering bypass switch clockwise until the icon  appears on the load moment limiter. The limited movement is bypassed. However, the tricolor light sends out red and yellow warning, and the buzzer sounds continuously.	- When bypass switch is turned on, the speed of crane movement decrease. - When pressing the "lowering bypass" switch, the speed of crane movement is kept the same.
3	90% ≤ moment percent ≤ 100%	The tricolor light sends out yellow warning, and the buzzer sounds continuously.		No work mechanism slows down.

No.	Prerequisite	limited movements	Bypass methods	Movement speed
4	Overloading: $100\% \leq \text{moment percent} \leq 110\%$	- The crane movements "lift main/auxiliary hook" and "raise/lower boom" are cut off. - The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	- Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the limited movements are bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously. - Press "Setup" switch, the icon  will appear on the load moment limiter if the load moment percent reaches 100%. And the movement "lift the hook" is bypassed. At this time, rotate derricking bypass switch clockwise, the limited movement "raise / lower boom" is bypassed. However, the tricolor light sends out yellow and red warning, and the buzzer sounds continuously. Press "Setup" switch, the icons  and  will appear on the load moment limiter if the load moment percent is less than 100%. At this time, all movements are bypassed. However, the tricolor light sends out yellow warning, and the buzzer sounds continuously.	- When bypass switch is turned on, the speed of crane movement decrease. - When "Setup" switch is pressed, and load moment percent is less than 100%, the speed of crane movement is not reduced. - When "Setup" switch is pressed, and load moment percent is 100%, the speed of crane movement is reduced.
5	Overloading: $110\% \geq \text{moment percent}$	- The crane movements "lift main/auxiliary hook" and "raise/lower boom" are cut off. - The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the limited movements are bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously.	The speed of crane movement is reduced.

No.	Prerequisite	limited movements	Bypass methods	Movement speed
6	Main boom angle is less than minimum angle.	1. The crane movements "lift main/auxiliary hook" and "lower boom" are cut off. 2. The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	1. Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the limited movements are bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously. 2. Press "Setup" switch, the icons  and  will appear on the load moment limiter. At this time, the tricolor light sends out yellow warning, and the buzzer sounds continuously.	1. When bypass switch is turned on, the speed of crane movement decreases. 2. When "Setup" switch is pressed, the speed of crane movement is not reduced.
7	Main boom angle >80°	The buzzer sounds intermittently.		
8	Main boom angle >max. main boom angle (refer to table 4.15 for details)	1. The crane movement "raise main boom" is cut off. 2. The icon  appears on the load moment limiter. 3. The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.		
9	Main boom angle >max. main boom angle set by the user, or main boom angle < min. main boom angle set by the user	1. The crane movement "raise main boom" is cut off. 2. The tricolor light sends out yellow and red warning, and the buzzer sounds continuously.	Turn the bypass switch clockwise until the icon  appears on the load moment limiter. At this time, the crane movement "raise main boom" is bypassed. However, the tricolor light sends out red warning, and the buzzer sounds continuously.	The speed of crane movement is reduced.

 CAUTION

- (1) Once the limited movements are bypassed by bypass switch, their speeds will be reduced to about 15% of original speed.
- (2) Press "Setup" switch, the bypass of cutoff is valid. After the limited movement is bypassed, return the control lever for 10s, or press "Setup" switch again, or the engine stops, or the controller is electrified again, the bypass of cutoff is invalid. Press bypass switch, the bypass of cutoff is valid for 30mins. If the switch is pressed again, or the engine stops, or the controller is electrified again, the bypass of cutoff is invalid.

Table 4-15 Max. main boom angle for different boom length

No.	Boom length(m)	Max. main boom angle (°)
1	13	82.5
2	16	80
3	19	80
4	22	80
5	25	80
6	28	80
7	31	80
8	34	80
9	37	80
10	40	80
11	43	80
12	46	80
13	49	80
14	52	80
15	55	80
16	58	80
17	61	78
18	64	78
19	67	78

4.5 Crane operation

4.5.1 Preparation for operation

- a) Assemble boom sections and rear counterweight according to load capacity charts, and retract crawler carriers completely.
- b) The gradient of the ground is less than 1%, and the ground has sufficient load-bearing capacity.
- c) The diesel engine is running.
- d) The hoisting rope is reeved in the hook block properly in accordance with the rope reeving plan.
- e) All safety devices are properly set according to requirements.
- f) There are no objects and person within the dangerous area.



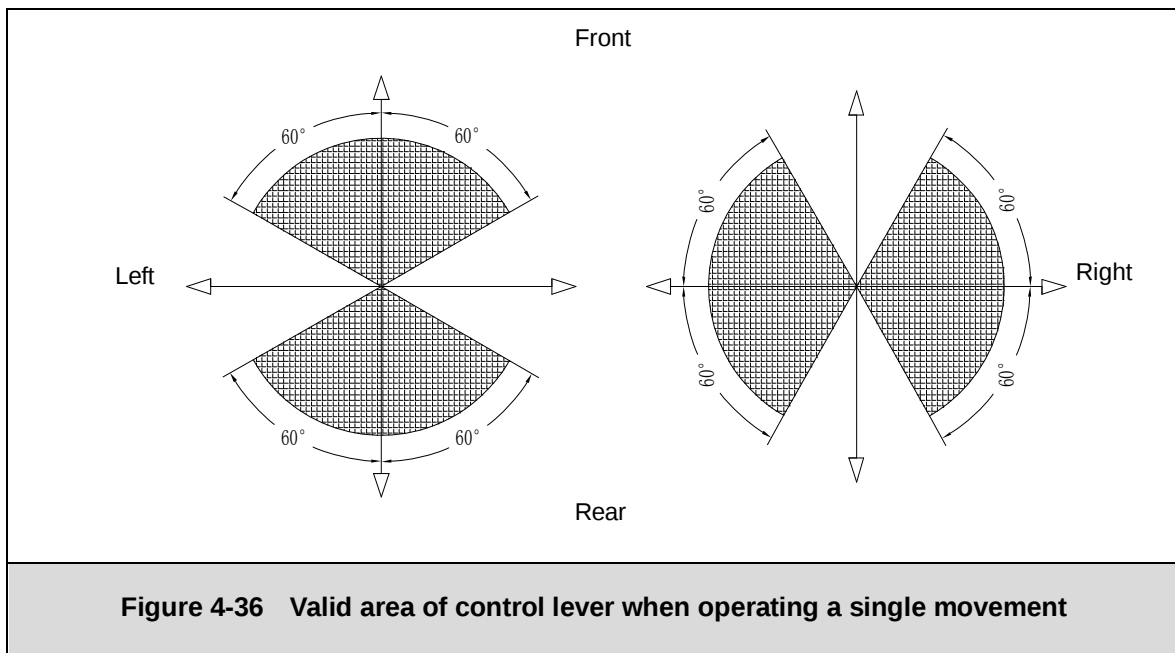
- (1) Sensitive and slowly operate the control levers, thus extending the service life of the crane, but also avoiding accidents.**
- (2) Ensure that no barriers or personnel are within the danger zone during operation.**
- (3) Make a sound before operation to warn the persons in the vicinity of the crane.**

4.5.2 Inspection during operation

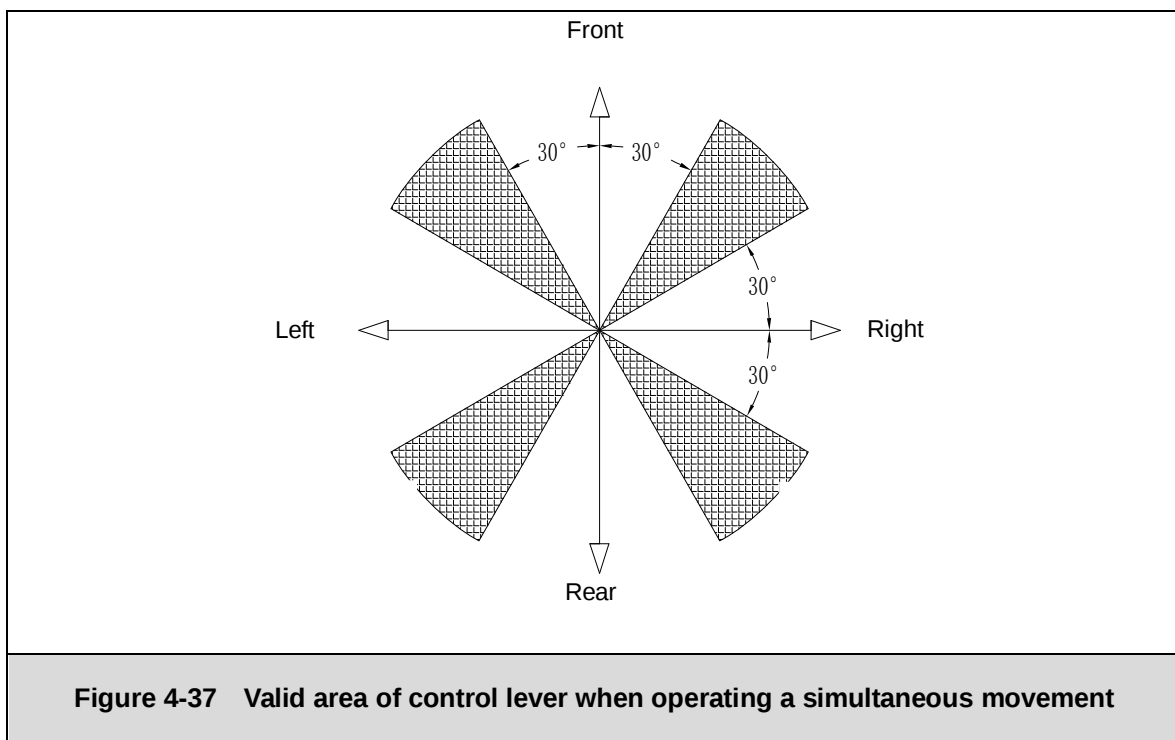
- a) If the crane has been working for a long time or the ambient temperature is too high during operation, press “oil cooling fan” switch (No.10 in the figure 4-8) to cool down the oil.
- b) If any warning icons mentioned in section 4.2.2.1 “Alarm functions” flash during operation, stop operation, shut down the engine, make inspections for relevant working mechanisms, and fix the breakdown.
- c) Check the conditions of load moment limiter during operation, and observe the lifting load conditions. If overloading or other abnormal phenomena arise, stop operation to make inspections, and solve the problems in time.
- d) If the crane works at night, turn on the master lighting switch and work floodlight switch, then the LED of control panel and switches are on, and all work floodlights on the crane light up.

4.5.3 Valid area of control lever

To carry out a single movement, the operator must move control lever within -60° - 60° areas at front, rear, left and right sides. The gridding area in the following figure is the valid area of the control lever.



To carry out a simultaneous movement with one control lever, the operator must move control lever within 30° - 60° areas. The gridding areas A, B, C, D in the following figure is the valid areas of the control lever.



4.5.4 Setting of work mode

For detailed steps of setting work mode, please see ***Load Moment Limiter Operating Manual***.

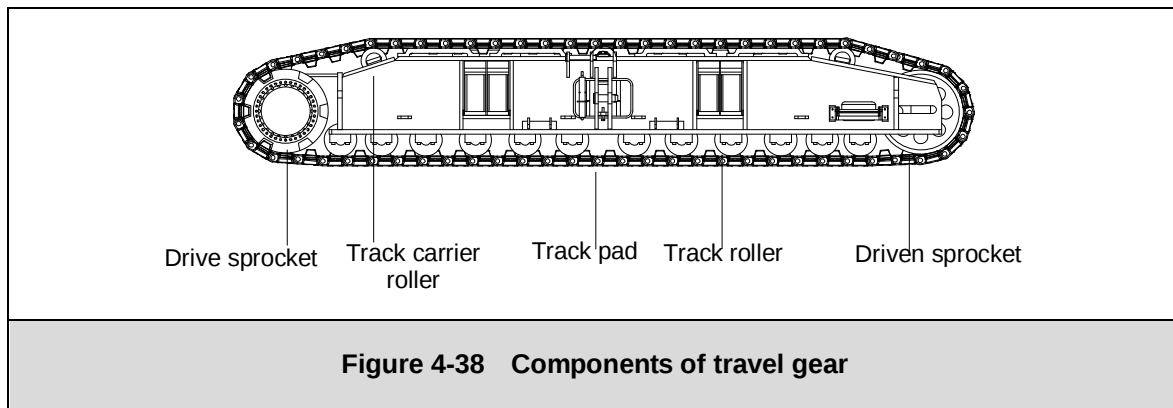


Set correct work mode in load moment limiter in accordance with actual conditions. Setting of work mode will affect the winch by the control system, otherwise accidents may occur.

4.5.5 Operation of travel gear

4.5.5.1 Components of travel gear

The travel gear comprises drive sprocket, driven sprocket, track-carrier roller, track roller and track pad, crawler carrier as well as traveling reducer. Both right crawler carrier and left crawler carrier are fitted with an independent traveling reducer. The hydraulic oil in traveling motor is supplied by superstructure main pump through main valve and central revolving joint.



4.5.5.2 Operation of travel gear

The traveling movements are controlled by left and right travel gear pedals (No. 10, 11 in the figure 4-1). The movements "left crawler forwards" and "left crawler backwards" are controlled by left travel gear pedal, and the movements "right crawler forwards" and "right crawler backwards" are controlled by right travel gear pedal. In a word, the crane can carry out such movements as traveling straight ahead/backwards, steering during traveling and turning on spot.

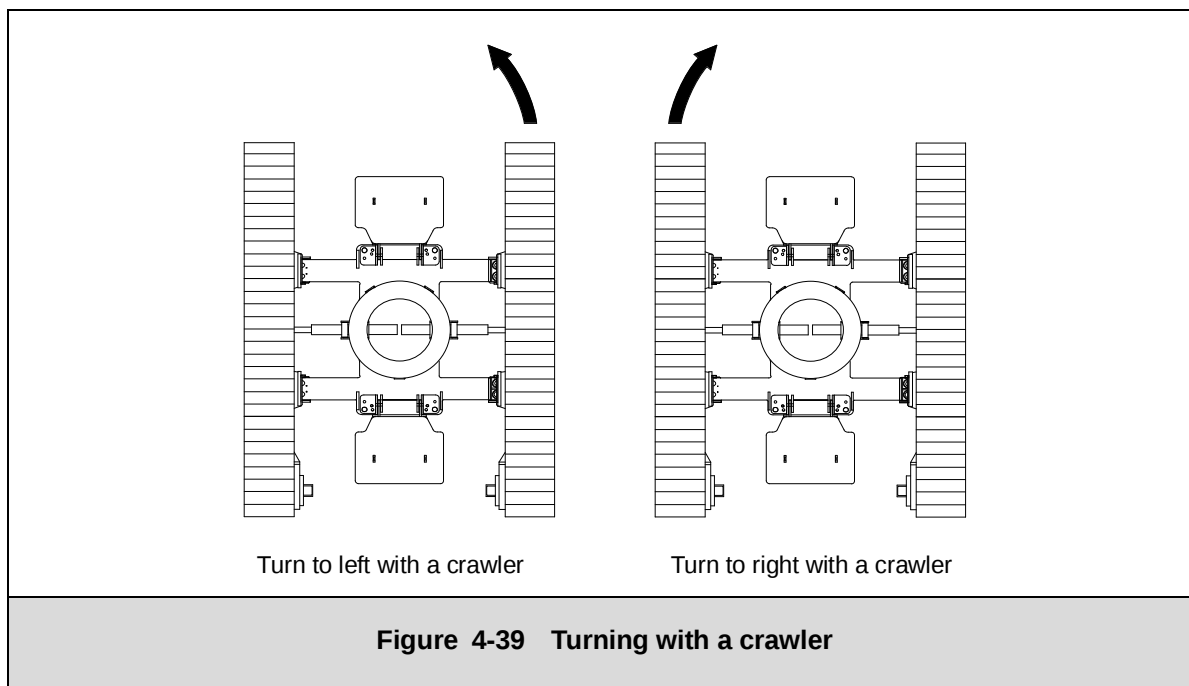
a) Traveling on level road

Traveling straight ahead: Depress two travel gear pedals forwards at the same time

Traveling straight backwards: Depress two travel gear pedals downwards at the same time

Turning to left with a crawler: Depress right travel gear pedal forwards

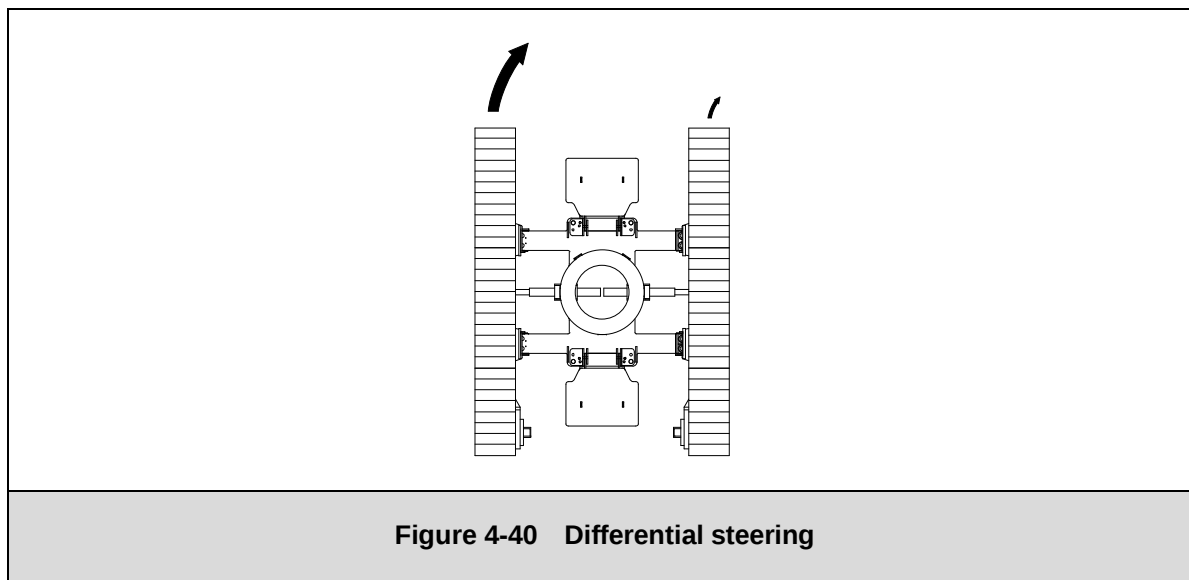
Turning to right with a crawler: Depress left travel gear pedal forwards



! CAUTION

The high speed is not allowed when the crane is turning with a crawler.

1) Differential steering



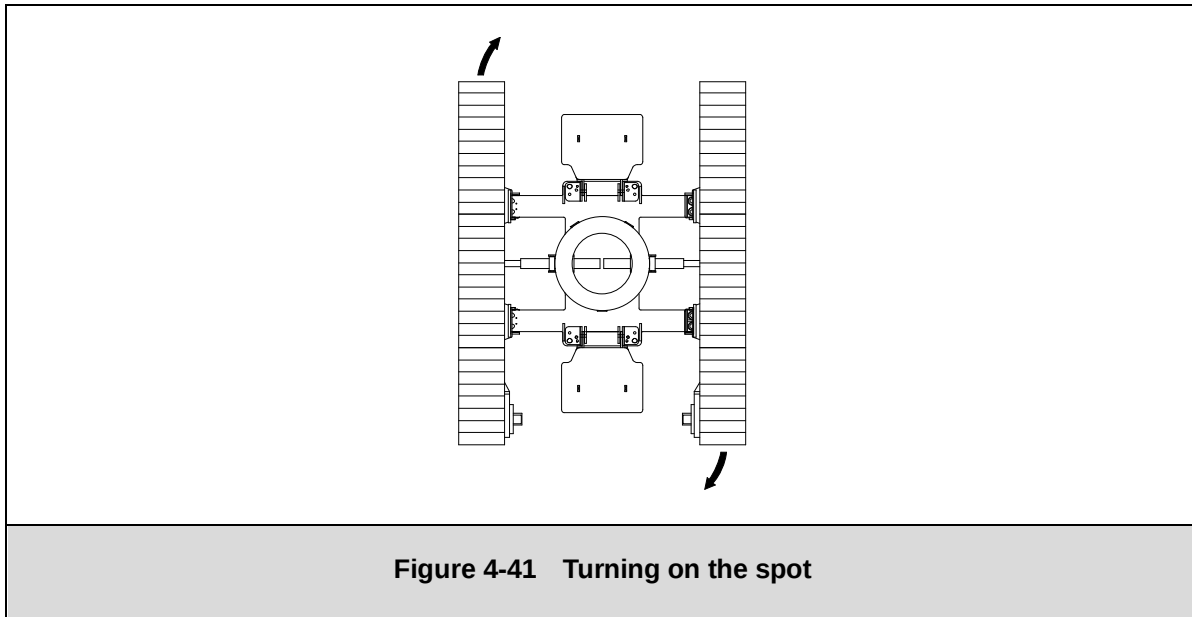
Differential steering to right:

Depress left travel gear pedal forwards heavily, while depressing right travel gear pedal forwards slightly to make the speed of left crawler faster than that of right crawler.

Differential steering to left:

Depress right travel gear pedal forwards heavily, while depressing left travel gear pedal forwards slightly to make the speed of right crawler faster than that of left crawler.

2) Turning on the spot



Turning to right on the spot:

Depress right travel gear pedal downwards heavily, then right crawler will turn to left.

Depress left travel gear pedal downwards heavily, then left crawler will turn to right.

Turning to left on the spot:

Depress left travel gear pedal downwards heavily, then left crawler will turn to right.

Depress right travel gear pedal downwards heavily, then right crawler will turn to left.



- (1) **High speed is not allowed when both left and right crawlers are turning at the same time.**
- (2) **When there is a need to stop traveling or steering, return the travel gear pedal to neutral (zero) position, the traveling brake will be activated automatically.**
- (3) **When the crane is traveling with a load for a long distance, ensure that the boom is located straight ahead, and the traveling reducer is behind the slewing table.**

b) Traveling on a slope

Crawler crane travels forward, and left control lever is placed in neutral (zero) position. When the crane is traveling uphill, the engine speed must be controlled within medium speed range. When crawler crane is traveling on a slope with maximum permissible gradient, it can only be fitted with basic boom. And the counterweight should be in the direction of uphill, the drive sprocket is the direction of downhill. While when it goes downhill, the drive sprocket should be in the direction of uphill.

Turning on the slope

If crawler crane needs to turn on the slope, some treatments should be taken to the undulations to form a gentle slope curve (see the following figure), which can prevent crane's center of gravity from deviating and load from concentrating on a section of crawler when crawler crane is traveling over undulations.

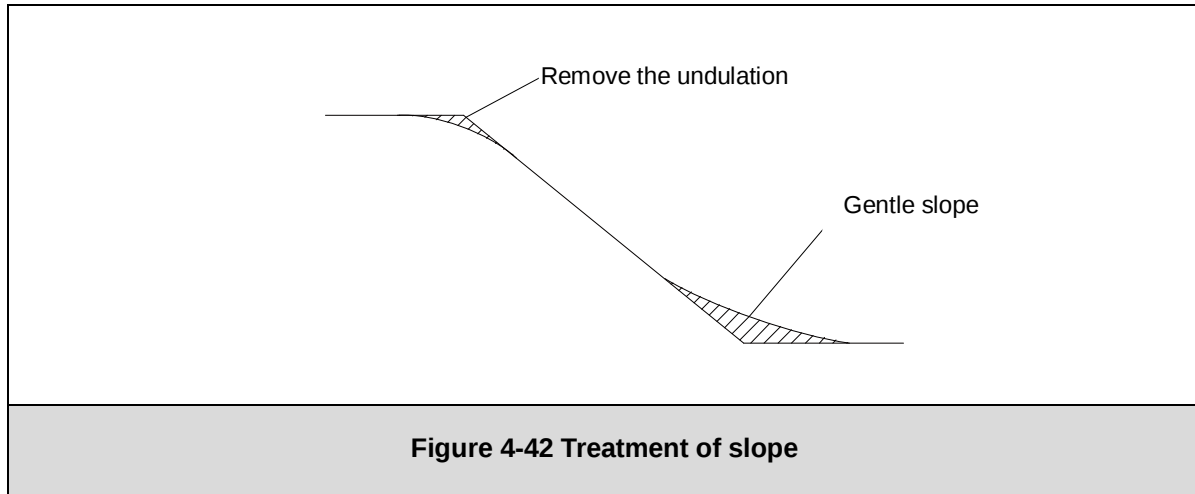


Figure 4-42 Treatment of slope

! CAUTION

- (1) When crawler crane is traveling from the horizontal ground to the slope, if its center of gravity deviates forwards, stop the crane to adjust the center of gravity.
- (2) For the sake of safety, demount the counterweight and boom when the crane is traveling on a slope with permissible maximum gradient, and the operator does not know about the ground condition.
- (3) The crane can travel with suspended load, providing that the following precautions are taken:
 - The ground surface must be flat and level (no gradient).
 - The subsoil must be capable of bearing the crane's maximum service weight and the weight of suspended load.
 - Only minimum traveling speed is permitted and the boom should be in the direction of travel.
 - Jerky crane movements must be avoided.
 - The suspended load must be lashed to prevent it from swinging.
 - Steering of crawler is forbidden.
- (4) High-speed traveling
Press high speed switch (No. 3 in the figure 4-2), then traveling movements can be performed at high speed.
Only when the crane is travelling straight without a load, can the high speed switch be used.

4.5.6 Operation of crane winches

4.5.6.1 Hoisting winches

a) Components of hoisting winch

The hoisting winch consists of hydraulic motor, winch reducer, brake, lowering limiter, hoisting limiter, wire rope, main and auxiliary load hooks etc.. The lifting speed of load can be changed by adjusting the inclination angle of control lever. The bigger the inclination angle is, the quicker the lifting speed is.

b) Operation of hoisting winch

The crane is fitted with three hoisting winches: hoisting winch 1, hoisting winch 2 and hoisting winch 3. All of them have three working speeds: inching speed, normal speed and high speed.

Move the control lever forwards to lower the winch, and move it backwards to raise the winch.

- 1) Inching-speed operation: press inching speed switch, and then move control lever.
- 2) Normal-speed operation: only move control lever.
- 3) High-speed operation: press high speed switch, and then move control lever.



- (1) Choose proper rope reeving in accordance with boom length.
- (2) If the hoisting rope tangles, the operator can not operate the crane to lift the load. Only after the hoisting rope is undone, can the load be lifted.
- (3) Under any conditions, there must be at least three windings of wire rope left on the winding drum.
- (4) When a load is lifted away off the ground, it should first be suspended in the air for a moment. Do not lift the load until the operator confirms that there is no safety hazard. Do not lift the load with boom if the load is still in contact with the ground.
- (5) Do not change control lever between "lift hook" and "lower hook" jerkily. The operator must return the control lever to neutral position and ensure that the winding drum has stopped before changing control lever from "lift hook" to "lower hook". Otherwise, the machine will be damaged.
- (6) If the main boom length is extended in "main boom" configuration, the lifting height of the crane will increase accordingly, which will therefore make the wire rope not be long enough. Such problem can be solved by changing the rope reeving of wire rope. Before changing the rope reeving, fit a hoisting limit switch weight.

When the crane is overloaded, or wire rope on hoisting winch is excessively wound / unwound, the dangerous movements will be switched off automatically and an alarm will be given out.

- (7) When the system sends out the alarm, the operator should operate the crane towards safe directions. If it is necessary to operate the crane towards dangerous directions, the operator can refer to Section 4.4.
- (8) The high-speed switch is only used when the crane is working without a load or with a light load and only the hoisting winch is operated.

4.5.6.2 Free-fall operation

Procedures for free-fall operation:

- a) Turn the free-fall master switch (No.1 in the figure 4-5) to “ON” position.
- b) Depress the free-fall brake pedal (No.12 in the figure 4-1) completely.
- c) Rotate the free-fall switch of corresponding winch (e.g. “H1 free fall” switch) clockwise to “ON” position, and then release the free-fall brake pedal gradually. At this time, the hook starts to lower freely. In this process, the foot of operator should be placed on the free-fall brake pedal and the operator can adjust the lowering speed of the hook by depressing the free-fall brake pedal.
- d) Depress the free-fall brake pedal again to stop the free-fall movement of the hook.
- e) After the winding drum stops completely, release the free-fall switch of corresponding winch, and turn the free-fall master switch to “OFF” position.

DANGER

- (1) If free-fall operation is not finished (i.e. the winding drum does not stop rotating completely), never reset the free-fall switch of corresponding winch.
- (2) When using control lever to operate the hoisting winch, never turn on any free-fall switches.
- (3) Under fixed jib configuration, the free-fall operation is used only when the crane is working without a load.
- (4) In the free-fall process, never depress the free-fall brake pedal suddenly to stop free-fall operation. Otherwise, the crane may be damaged or the personnel may be injured.
- (5) Calculate hoisting rope length before free-fall operation so that there are at least three windings of rope left on the drum.

CAUTION

- (1) Each hoisting winch can perform free-fall operation independently, however, only one free-fall brake pedal is used to brake the hoisting winch during free-fall operation.
- (2) After free-fall master switch is turned on, the system will cut off any operation of winch automatically.
- (3) To carry out free-fall movement, the operator must first turn on the free-fall master switch, and then switch on the free-fall switch of winch. Otherwise, the operation is invalid.

4.5.6.3 Derricking mechanism

a) Components of derricking mechanism

Through changing the length of wire rope reeved between derricking pulley blocks (includes derricking crown block and derricking traveling block), the derricking mechanism, via derricking winch, can adjust boom angle so as to change the working radius. We can use A-frame and boom frame to carry out derricking movement. During derricking, the derricking crown block is located at the top of A-frame, while the derricking traveling block is on the other end of anchoring rod, so the boom angle can be changed with the variation in the length of wire rope between the derricking pulley blocks.

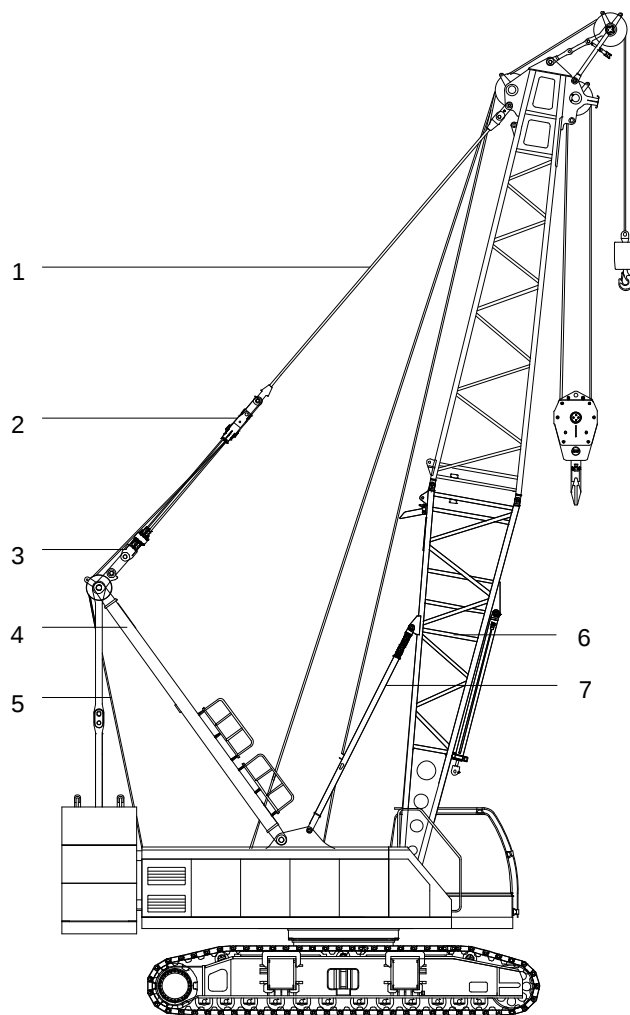


Figure 4-43 Components of derricking mechanism

The components of derricking mechanism will be described in the table 4-16.

Table 4-16 Components of derricking mechanism

No.	Names of the components
1	Anchoring rods
2	Derricking traveling block
3	Derricking crown block
4	A-frame assy.
5	Derricking rope
6	Main boom
7	Main boom tilting-back support

b) Operation of derricking mechanism under different boom configurations

Move right control lever to left, spool up derricking winch to raise boom.

Move right control lever to right, reel off derricking winch to lower boom.

1) Main boom configuration

Main boom angle can vary from 0° to 84° under self-assembly & dismantling condition, while main boom angle can vary from 0° to 82.5° under any other working condition. And derricking winch is used to control main boom.

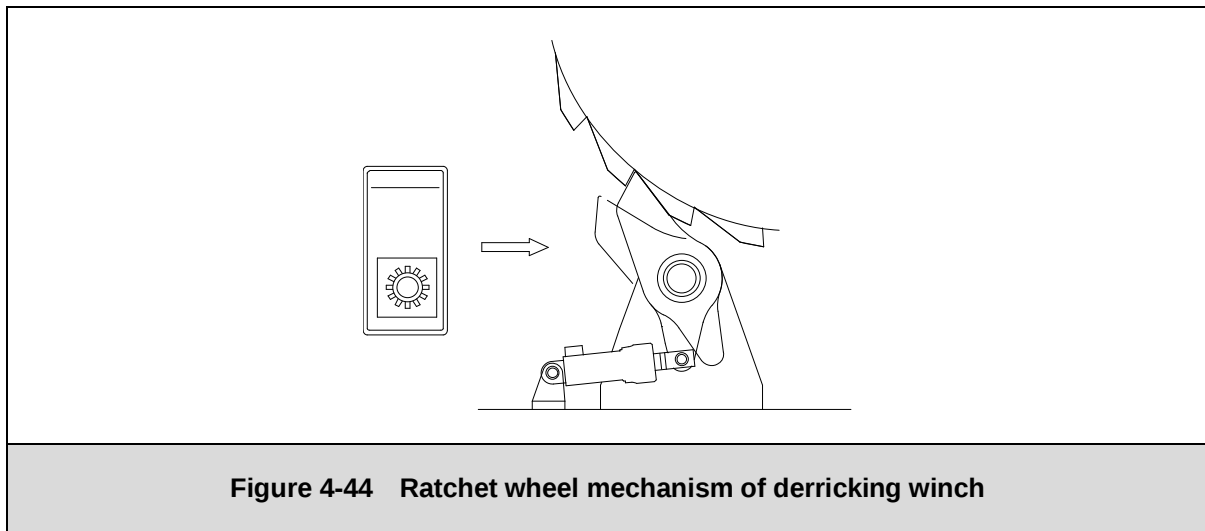
2) Main boom with fixed jib configuration

The fixed jib can be mounted in the angle of either 10° or 30° to main boom. Once the angle is set, it can not be changed during operation.

The main boom can be raised and lowered via derricking winch. The angle between the fixed jib and main boom can not be changed.

3) Ratchet wheel mechanism

Derricking winch is fitted with a brake and a ratchet wheel mechanism. The derricking winch can be locked by ratchet wheel if the crane does not work for a long time so that the boom can be placed at anywhere. The ratchet pawl is controlled by derricking ratchet pawl switch (No.5 in the figure 4-8).



If derricking mechanism does not work for a long time, turn on derricking ratchet pawl switch, and then reel off derricking winch slowly until ratchet pawl is engaged into the ratchet wheel completely. At this time, the derricking rope can not be unwound continuously.

When there is a need to move the boom, turn off derricking ratchet pawl switch, and then spool up derricking winch to make ratchet pawl disengaged from the ratchet wheel.

 CAUTION

- (1) **Derricking operation should be performed stably. When the crane is lifting a load, jerky operation will bring great impact on the crane.**
- (2) **When the crane is lifting a load, the operator should not derrick boom towards dangerous directions. Otherwise, the crane may topple over.**
- (3) **Before derricking mechanism is operated, first derrick boom down a little, and then operate ratchet wheel mechanism according to the correct methods mentioned above. In this way, ratchet pawl can be disengaged from ratchet wheel successfully. Do not operate the derricking mechanism before the ratchet pawl is disengaged from ratchet wheel completely.**
- (4) **Before switching off the derricking mechanism, press ratchet wheel switch and hold it till the ratchet pawl engages with the ratchet wheel tooth.**
- (5) **If ratchet pawl is not disengaged from ratchet wheel completely, derricking winch is only permitted to spool up.**

4.5.7 Operation of slewing mechanism

4.5.7.1 Components of slewing mechanism

The slewing mechanism consists of hydraulic motor, planetary gear reducer, brake, drive gear and slewing ring, etc. The superstructure can carry out 360° continuous rotation via the slewing ring which is driven by drive gear. The slewing speed can be adjusted by changing the inclination angle of control lever.

An independent variable piston pump is applied to the hydraulic system to supply oil. It can adjust the slewing speed accurately.

4.5.7.2 Operation of slewing mechanism

Two slewing alarms on the rear counterweight will sound during slewing.

Move left control lever to right, slew to right.

Move left control lever to left, slew to left.



- (1) Before carry out slewing movement, an acoustic signal should be given out.
- (2) Operating with high slewing speed will cause an increased risk of accidents! Before initiating any slewing movements, the operator must make sure that there are no persons or obstacles within slewing radius. Otherwise, there is an increased risk of accidents.
- (3) Longer boom – slower slewing speed. Heavier load – slower slewing speed.
- (4) Check the gradient of the working ground before slewing with a load.

4.5.7.3 Fixing device for slewing table

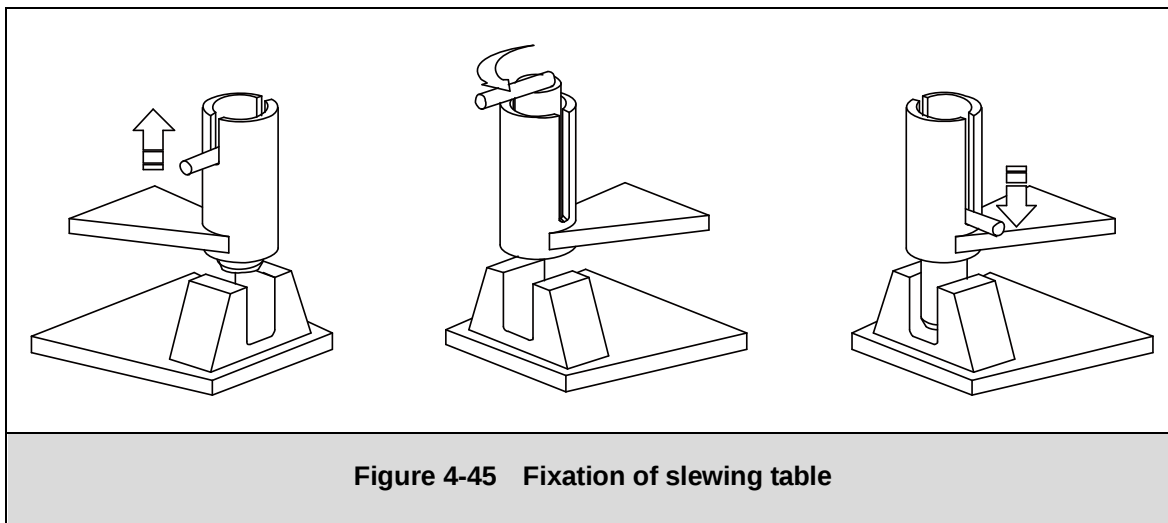
a) Slewing fixing pin

During transportation, the slewing table is fixed on the undercarriage via the slewing fixing pin so as to avoid accidents.

Procedure for fixation of slewing table:

- Slew superstructure to front or right position;
- Pull out the slewing fixing pin;
- Rotate the fixing pin for 180°;
- Insert the fixing pin.

See the following figure.

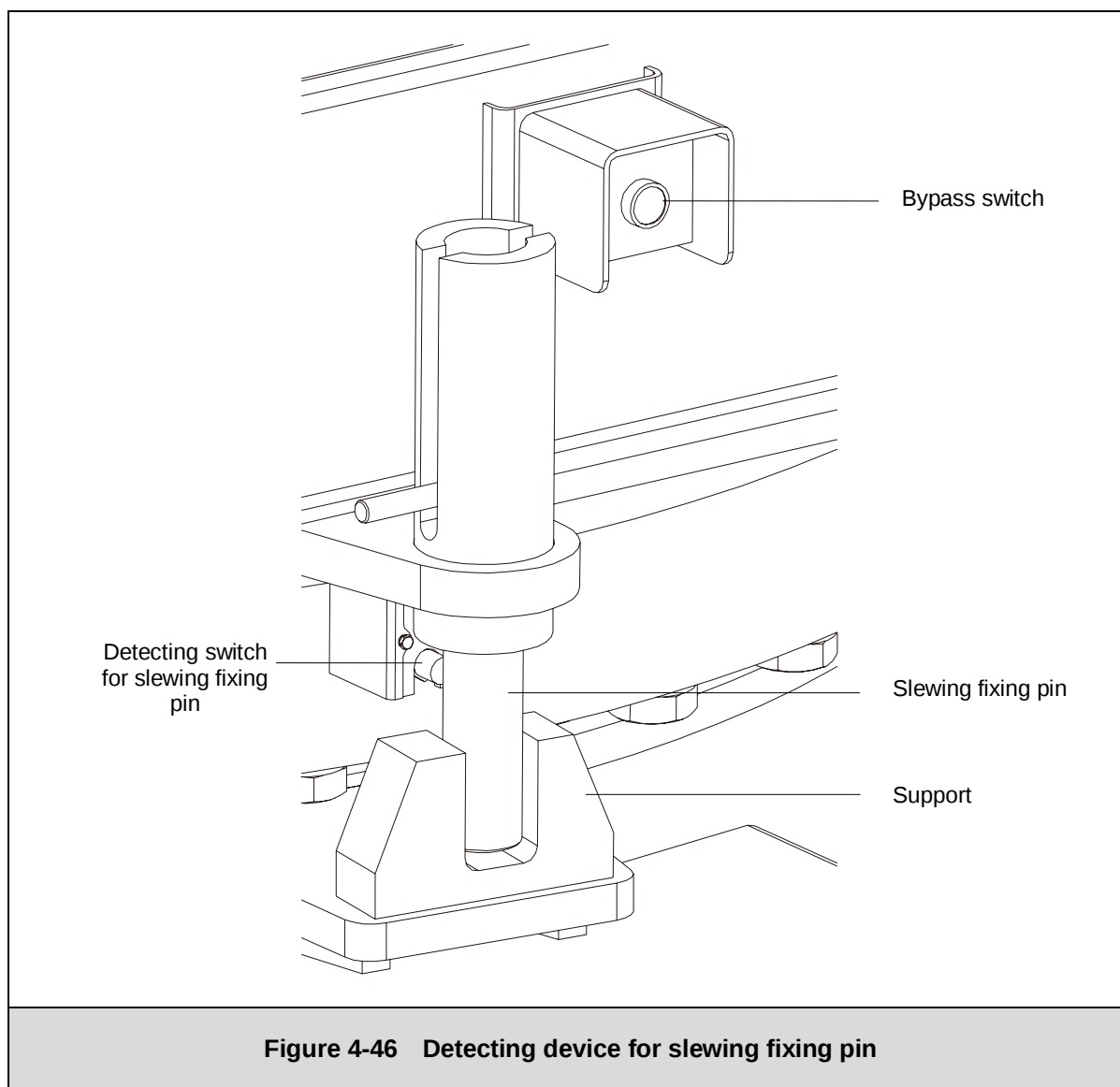


b) Detecting device for slewing fixing pin

When the fixing pin is not pulled out, it will damage the support or do an injury to the person in the vicinity of the crane if slewing motion is carried out.

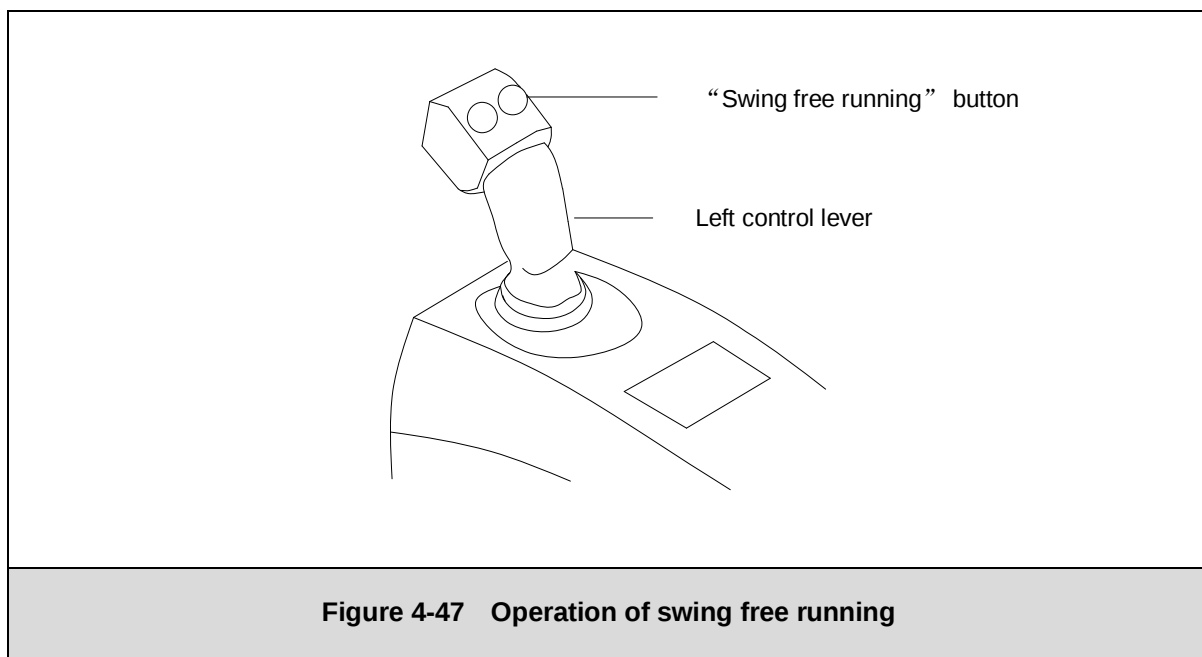
This detecting device is a proximity switch, which is used to check if the slewing fixing pin is pulled out. If the fixing pin is not pulled out, the electrical system will automatically cut off the slewing motions.

Sometimes it is difficult to pull out the fixing pin due to the support. At this time, operate slewing motion slightly so as to pull out the fixing pin. Therefore, a bypass switch is specially set. Press this switch, the slewing motion can be performed temporarily even though the fixing pin is not pulled out.



4.5.7.4 Operation of swing free running

If a load hook is not positioned vertically over the load's center of gravity before lifting operation, the operator can operate left control lever and press the "Swing free running" button on the control lever at the same time. At this moment, the boom will enforce the slewing table, under the influence of side force of wire rope, to rotate toward the direction of load's center of gravity till the hoisting wire rope is vertical. In this way, the boom can be protected against damage due to side force. When the wire rope is vertical, please release the button. The "Swing free running" button is shown in the following figure.



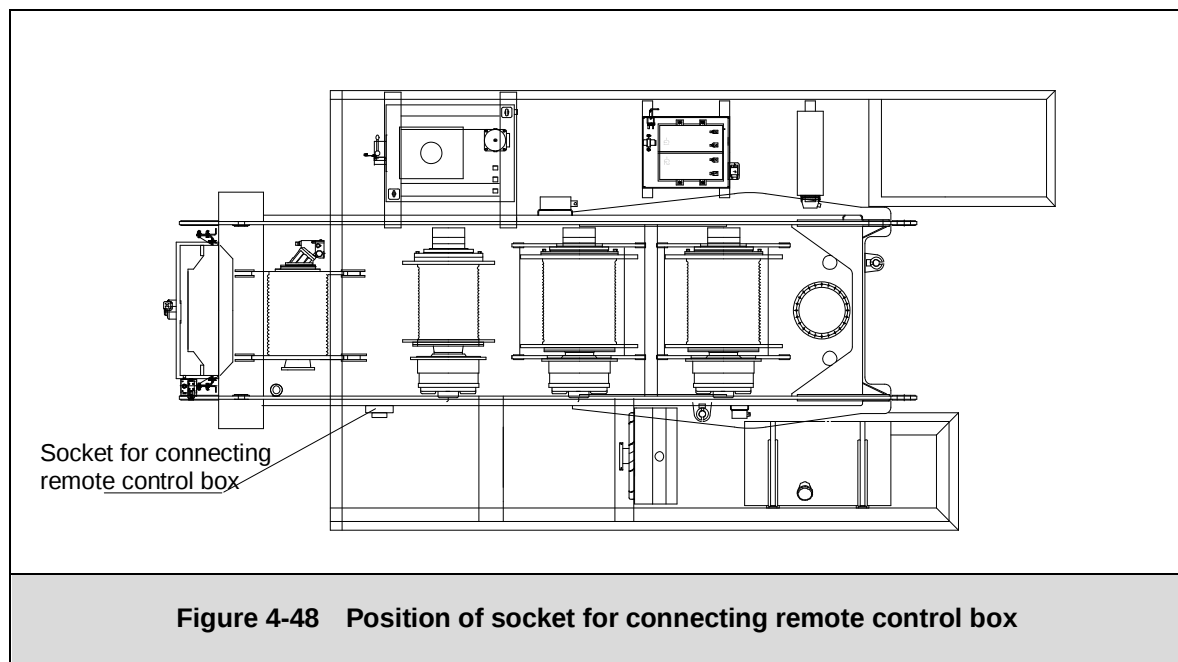
CAUTION

- (1) When carrying out the movement "Swing free running", operate control lever to lift the hook at the same time. In this way, a side force will be produced on the wire rope to make load hook vertical to boom.
- (2) Ensure that there are no obstacles in the crane slewing area and no person is in the danger zone before slewing operation. Give out a short warning signal (horn) before starting a crane movement.
- (3) Avoid stopping slewing movement or changing slewing direction jerkily. Do not swing the lifted load.
- (4) Longer boom - slower slewing speed.
- (5) Heavier load - slower slewing speed.
- (6) It is not permitted to slew the superstructure on the trailer.

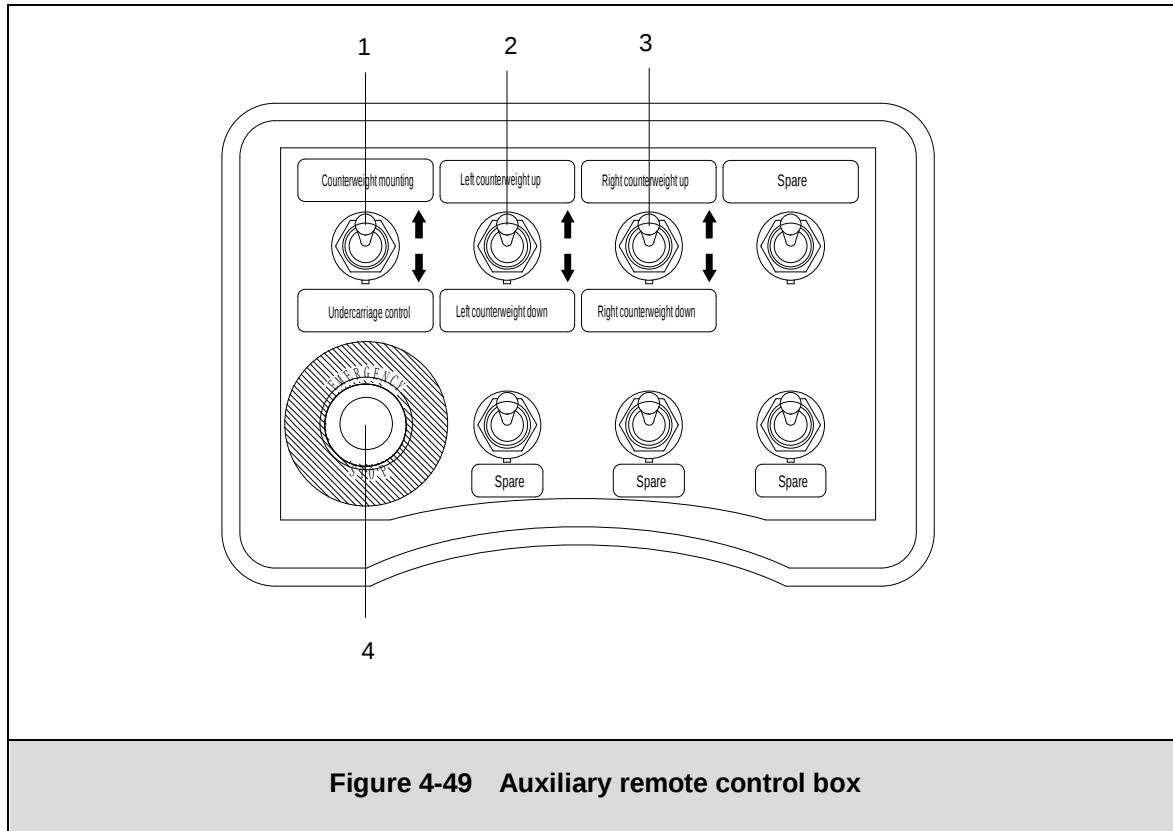
- (7) For the sake of safety, the user must check slewing ring bolts with 1800N.m tightening torque after the initial 100 operating hours. Then check and tighten them after 300 operating hours. After that, do the checks every 500 operating hours.
- (8) When operator has to leave the machine during traveling or transportation, never rely solely on the slewing brake to lock the slewing mechanism. Even though the slewing brake is applied, the superstructure may still slew, because it is not a positioning lock.
- (9) Activating slewing brake switch to stop slewing operation abruptly should be avoided, since it may cause damage to the superstructure.

4.5.8 Auxiliary remote control box

Auxiliary remote control box is mainly used for self-assembly & dismantling operation. The operator only inserts the connector of auxiliary remote control box into the corresponding socket at the rear right side in the slewing table. Please see the following figure.



The function of auxiliary remote control box is shown in the following figure.



The auxiliary remote control box will be described in the table 4-17.

Table 4-17 Description of auxiliary remote control box

No.	Names of the switches	Operation	Function
1	Counterweight lifting / undercarriage auxiliary device selector switch	Push it up	Counterweight lifting is selected.
		Push it down	Undercarriage auxiliary device (such as crawler carrier extending and retracting, support cylinder) is selected.
2	Left counterweight control switch	Push it up	Extend left counterweight lifting cylinder
		Push it down	Retract left counterweight lifting cylinder
3	Right counterweight control switch	Push it up	Extend right counterweight lifting cylinder
		Push it down	Retract right counterweight lifting cylinder
4	Emergency stop switch	Control the power of auxiliary remote control box	

4.6 Rope reeving

4.6.1 Hoisting rope guidance and reeving

- a) Preparation
 - 1) Choose a correct rope reeving in accordance with section 2.4.3 in Chapter 2.
 - 2) The boom is placed straight ahead of the crane.
 - 3) An assistant is present to guide the hoisting rope.
- b) Assembly procedure
 - 1) Place required hook block under the pulley head of boom.
 - 2) On the hook block, remove the retaining springs and pull out rope guard tubes.
 - 3) Start the crane engine.
 - 4) Lay the hoisting rope over the upper rope pulley and reeve it between the pulley head and the hook block.
 - 5) Reinsert the rope guard tubes and then secure them with retaining springs.

WARNING

When the assistant guides the hoisting rope to the pulley head, the crane operator must operate the winch. This procedure must be done in such a manner that the rope does not slacken up on the winding drum.

DANGER

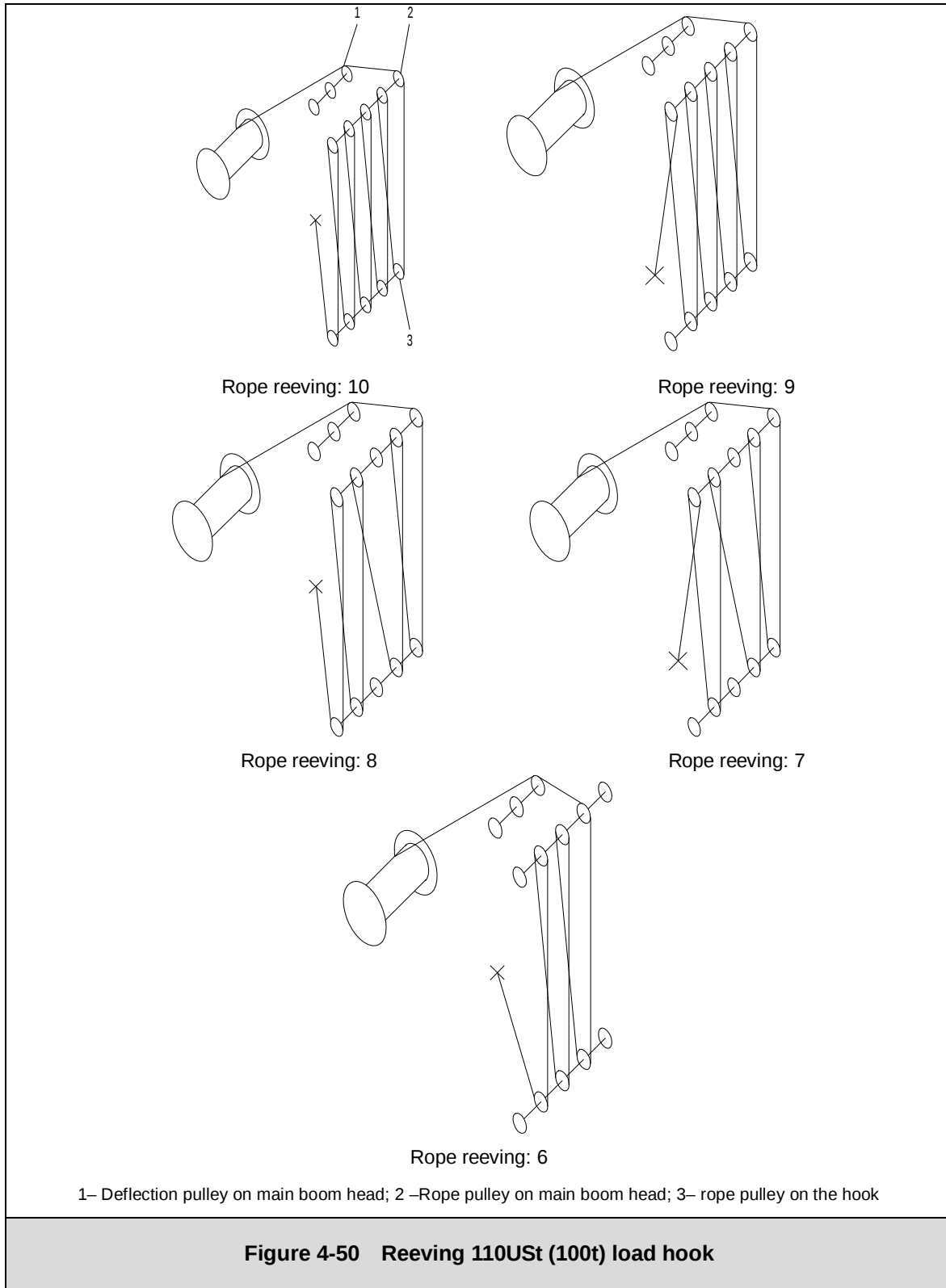
- (1) Complete the assembly operation on a safe area! If it is unavoidable that the rope must be hand-guided over the boom to the pulley head, proceed with great caution when walking on the boom.
- (2) There is a great danger of causing a serious accident if the crane function is not operated properly and the person guiding the rope slips on the boom.
- (3) Rope reeving for main boom and tip boom:
 - 110USt (100t) load hook, 5 rope pulleys, corresponding rope reevings of 10, 9, 8, 7, 6.
 - 55USt (50t) load hook, 3 rope pulleys, corresponding rope reevings of 6, 5, 4.
 - 33USt (30t) load hook, 3 rope pulleys, corresponding rope reevings of 4, 3, 2.
 - 8.8USt (8t) load hook, without rope pulley, 1 rope reeving.

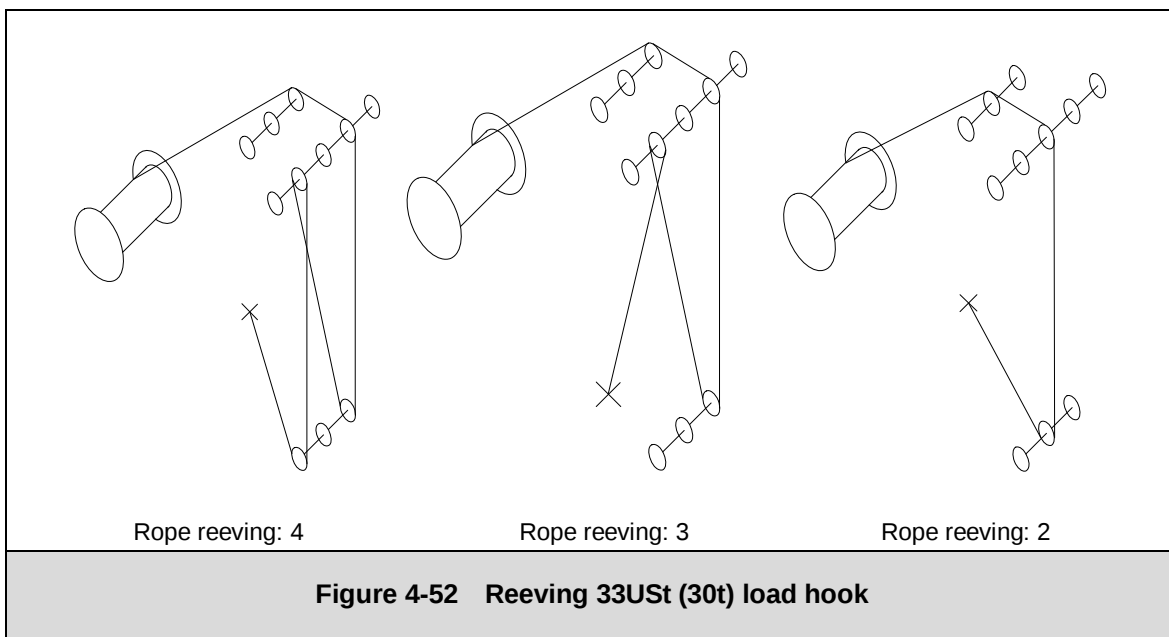
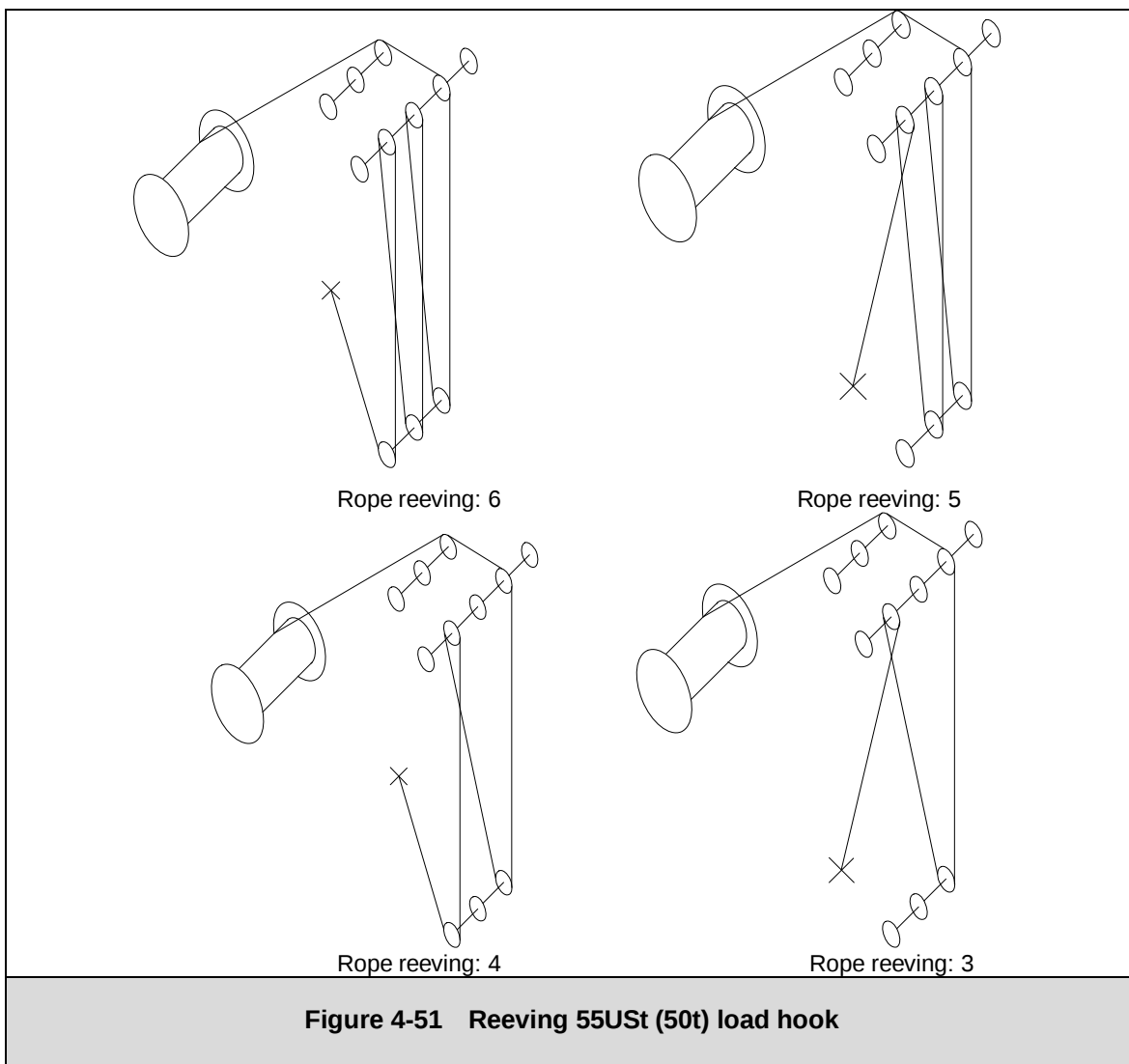
From Figure 4-50 to Figure 4-52, the methods for rope reeving are shown when different rope reeving is available. During operation, select proper load hook according to actual lifting capacity, and reeve in hoisting rope in accordance with reeving plan.

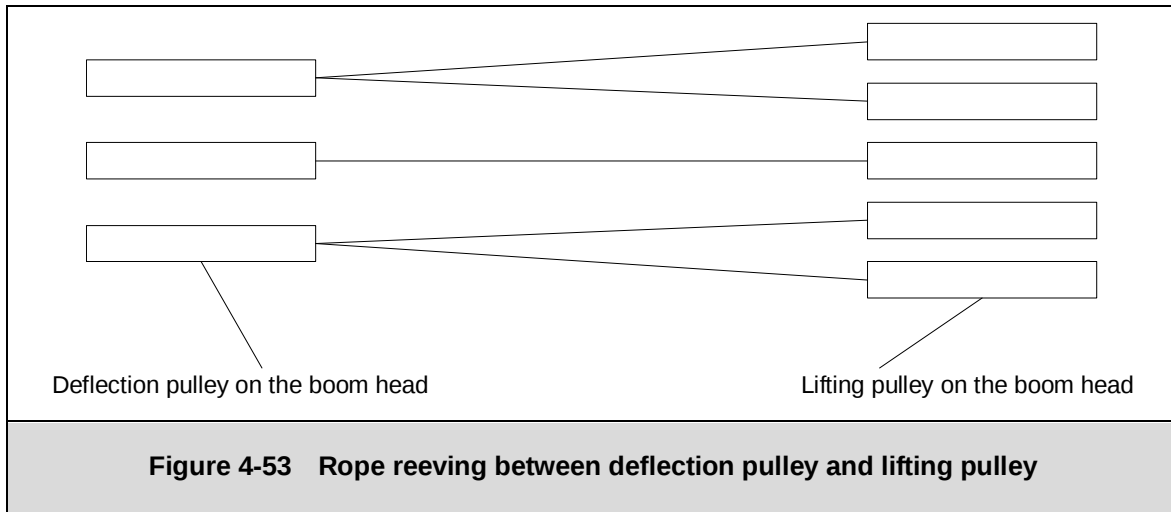
When hoisting rope is guided over the deflection pulley on the main boom head to hook block, ensure that the deviation angle of rope between these two pulleys is the minimum angle. In other words, the guidance of hoisting rope from deflection pulley to hook block must be complied with the requirements in the figure 4-53.

! WARNING

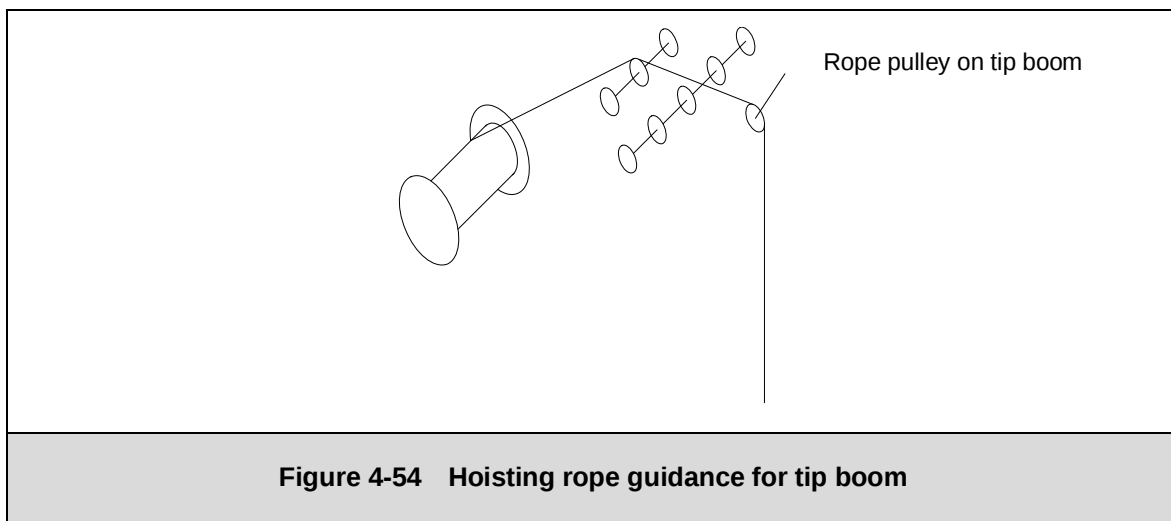
If wire rope is not reeved in according to the figure 4-50 to figure 4-52, the service life of wire rope will be shortened.



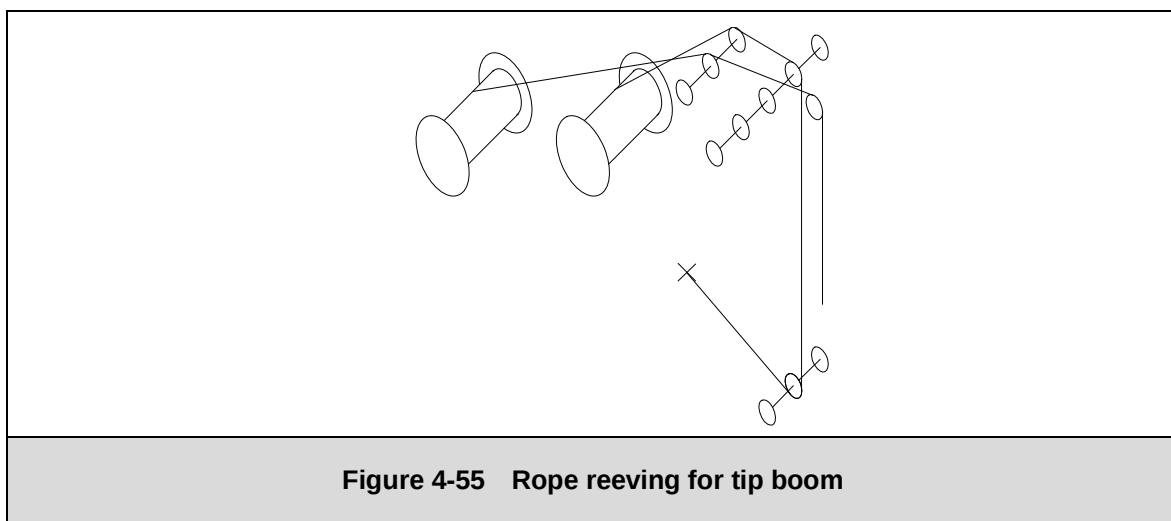




Hoisting rope guidance for tip boom is shown in the figure 4-54. The load hook on main boom is reeved in according to the Figure 4-50 - Figure 4-52.

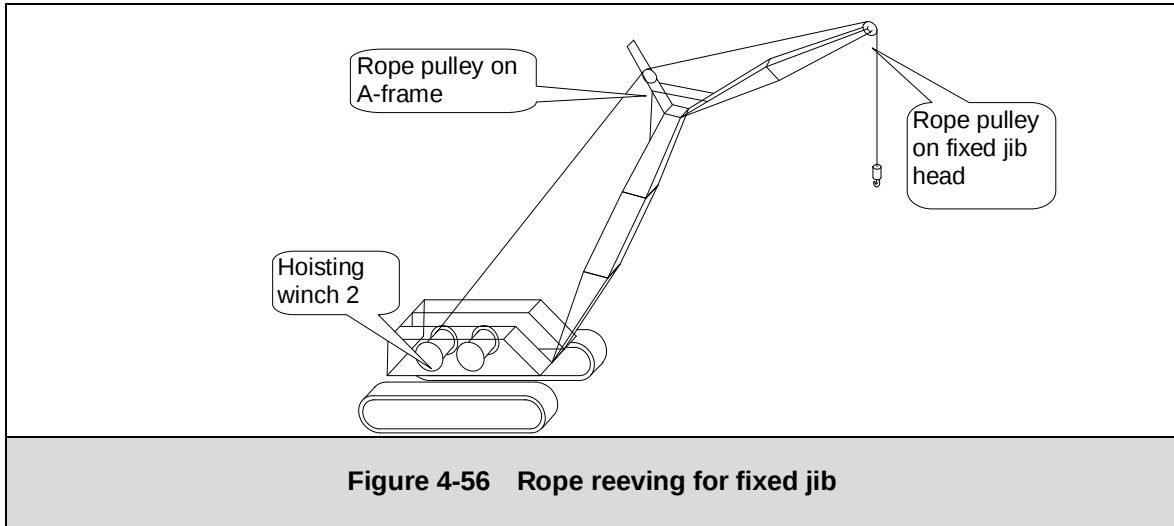


When rope reeving is 2 and the tip boom is fitted on the main boom head, the rope must be guided over the deflection pulley on the middle position of main boom head, and reeved in according to the figure 4-56.



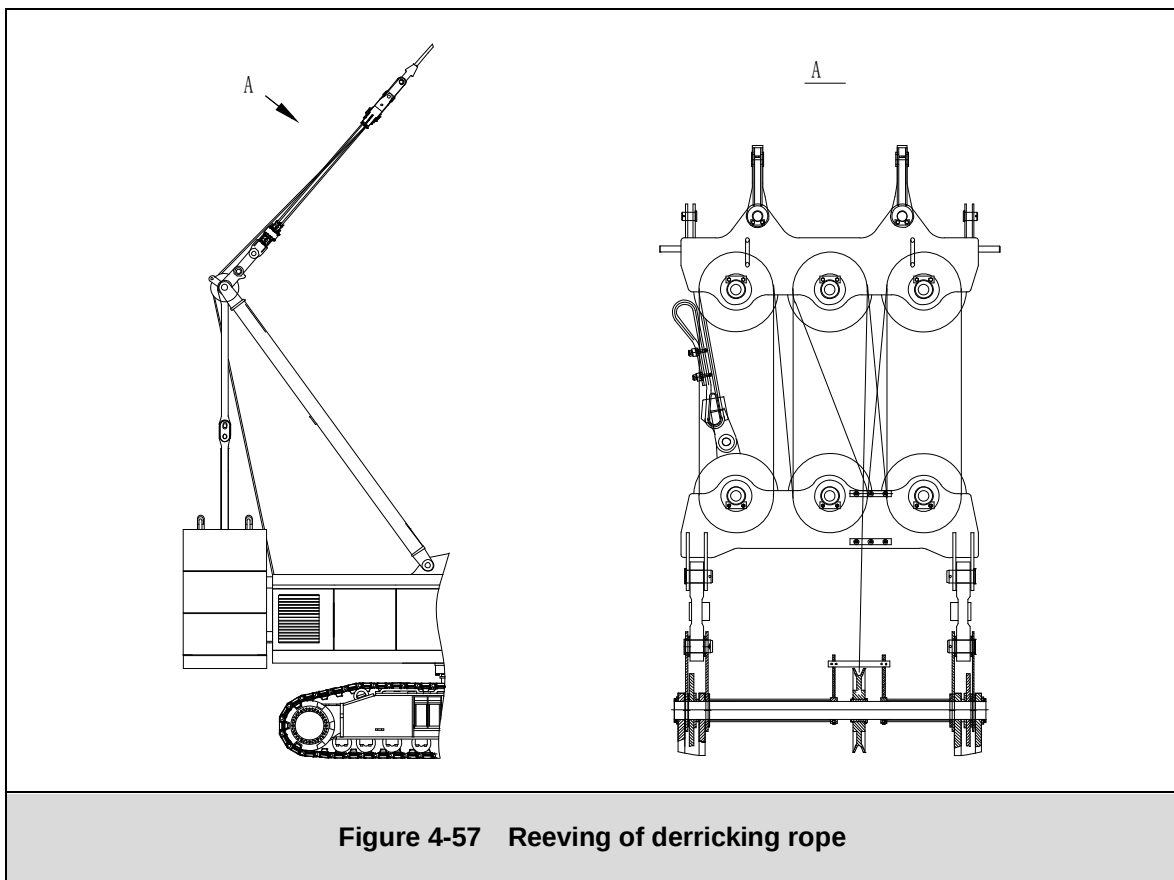
4) Rope reeving for main boom with fixed jib

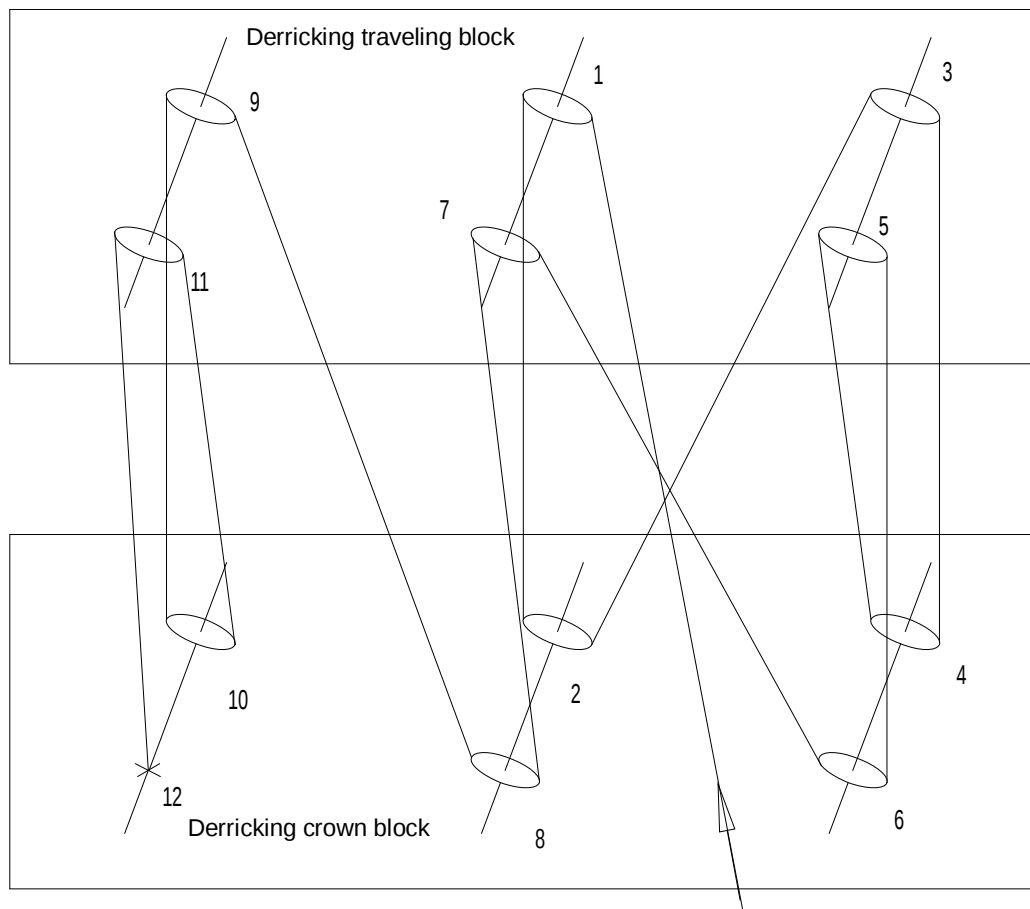
Rope reeving for main boom with fixed jib is shown in the figure 4-56.



4.6.2 Derricking rope reeving

The reeving of derricking rope is shown in the Figure 4-57 – Figure 4-58.





Note:

Rope pulleys 1, 2, 3, 4, 9, 10 are the derricking upper pulleys, while rope pulleys 5, 6, 7, 8, 11 are the derricking lower pulleys.

Figure 4-58 Reeving of derricking rope between derricking pulley blocks

4.6.3 Fixation of rope end point

The rope end point must be fixed in accordance with the following steps:

Step 1: insert wire rope (1) into rope lock (2)

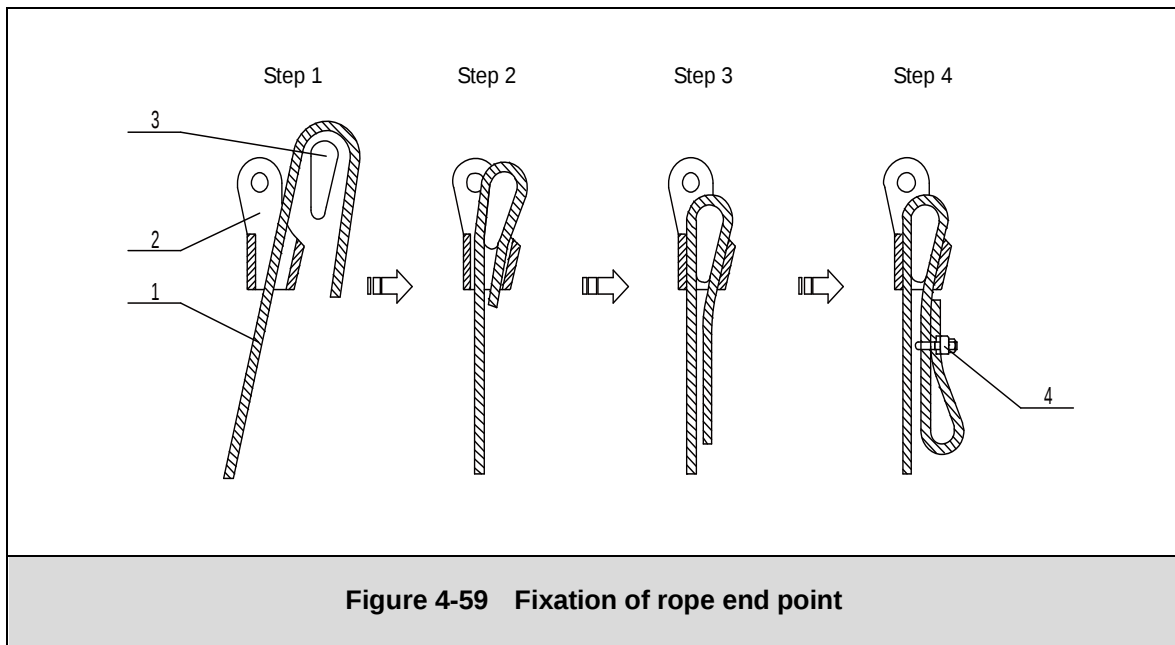
Step 2: put wire rope (1) around rope thimble (3) and then insert them together into rope lock (2) again

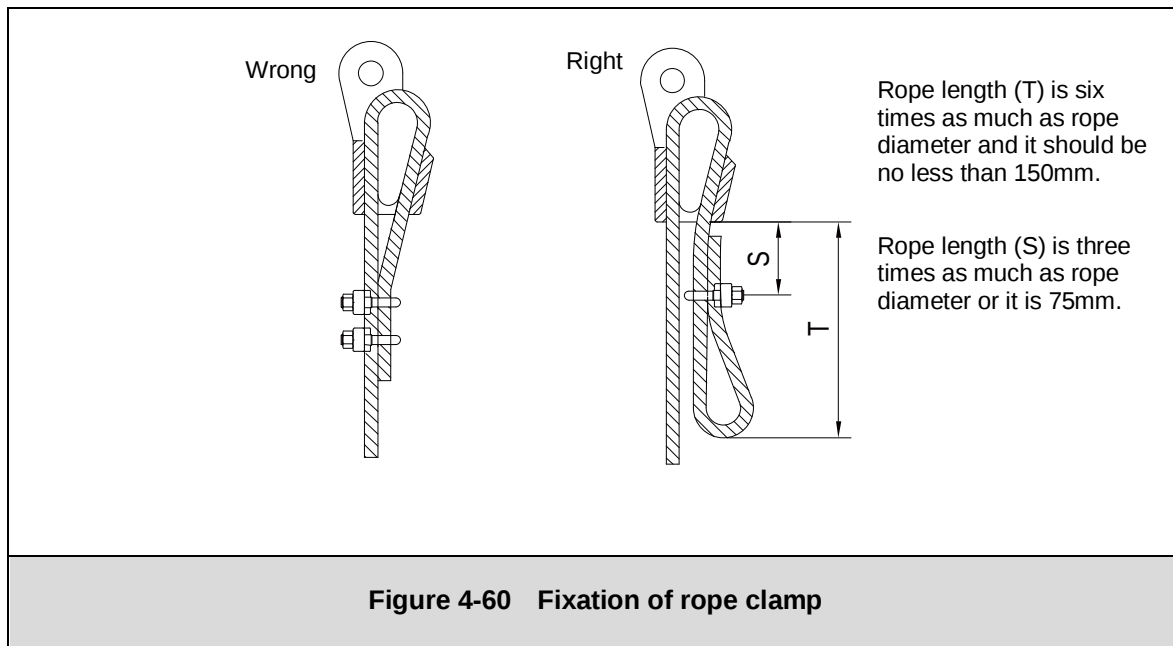
Step 3: pull wire rope (1) tightly to make it fixed between rope thimble (3) and rope lock (2) closely

Step 4: Fix wire rope with a rope clamp (4).

CAUTION

- (1) Incorrect fixation of rope end point can diminish the performance of rope and damage the rope.
- (2) Fix rope end point in accordance with the method mentioned in the figure 4-61.
- (3) The tightening torque of rope clamp for hoisting rope is 450N.m, while the tightening torque for derricking rope is 230N.m.
- (4) The rope clamp must be tightened regularly so as to avoid looseness of rope end point due to reduction of rope diameter.







Operator's Manual for Crawler Crane

Chapter 5 Assembly and Dismantling



Chapter 5 Assembly and Dismantling

5.1 Safety-technical notes

5.1.1 Notes on assembly

- a) Make sure that the crane complies with operating requirements. Then check the positions of A-frame, anchoring rod, FA-frame and assembly sequence of boom intermediate sections one by one according to combination mode of boom.
- b) Reeve the hoisting rope between the rope pulleys on the boom head and hook block in accordance with the corresponding hoisting rope reevings.
- c) Extend the crawler carrier to the required position, and assemble counterweight according to relevant requirements.
- d) Safe assembly platform must be used during crane assembly. Otherwise, there is a risk of falling down.
- e) Remove obstacles away from the ground on the site before assembling and dismantling. In addition, the ground on the site should be cordoned off to prevent access by unauthorized person.
- f) Choose a flat ground to erect the boom.
- g) Main boom length must be complied with load capacity chart under crane operation with fixed jib. Reeve hoisting rope strictly in accordance with the reeving plans.
- h) Each dismantled parts should not only satisfy the requirement of load-bearing capacity under operating conditions, but also meet the art technology requirement of self-assembly & dismantling operation.
- i) Lattice components which are not in contact with the ground during assembly & disassembly must be supported by appropriate and stable objects.
- j) Make sure that no one stands beneath the lattice boom when the lattice boom is pinned or unpinned.

5.1.2 Checking safety measures

- a) Clearly define the duty and area of responsibility of all personnel concerned.
- b) Check whether the crane is adjusted to be horizontal.
- c) Check whether there is sufficient safety clearance to slopes and trenches.
- d) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane (including the load) shall be at least 10 feet; Except where electrical distribution and transmission lines have been de-energized and visibly grounded at the job site.

For lines rated over 50 kV., minimum clearance between the lines and any part of the crane (including the load) shall be 10 feet plus 0.4 inch for each 1 kV. Over 50 kV., or twice the length of the line insulator, but never less than 10 feet.

- e) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV., and 10 feet for voltages over 50 kV., up to and including 345 kV., and 16 feet for voltages over 345 kV. up to and including 750 kV.
- f) Check whether an appropriate operating site has been selected so that the crane movements can be performed within maximum and minimum working radiuses.
- g) Check whether there are obstacles which will hinder required crane operation.
- h) The equipment must not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.
- i) Know clearly about the type of crane operation and operating mode.
- j) Check the distance between the lifting points and surrounding buildings.
- k) Influence of communal facilities on crane operation (including the overhead high/low voltage lines and underground gas pipes).
- l) Movement restrictions due to surrounding structures (e.g. is there another crane nearby in working).
- m) Number, weight, dimensions, material of load(s) to be lifted.
- n) Required lifting height and slewing radius.
- o) Heights and widths of thoroughfares leading to the site.
- p) Check the communication ways adopted by signaller and crane operator.
- q) Take appropriate measures to keep people and equipment unconcerned away from the danger area of the crane.



To master the actual condition of lifting operation accurately and ensure safe operation, the safety measures mentioned above should be checked and a proper operational planning should be carried out.



- (1) Due to lack of necessary safe facilities, this crane is not permitted to work at those sites where the combustible and explosive objects exist such as gas station, oil-gas lines, corrosive objects etc. Additionally, the crane is prohibited to transport the combustible and explosive objects.**
- (2) This crane is not allowed to perform underground operation.**

5.1.3 Checking wire rope, load hook, rope pulley and anchoring rod

5.1.3.1 Checking wire rope

The ropes must be checked by an expert before assembly and after certain working period in order to detect possible damage or wear and tear at an early stage.

The rope must be removed immediately and replace it with a new one if any of the following damage is detected. (For details, please refer to *Maintenance Manual*.)

- a) 10% of a twist (except filled steel wire) in the wire rope breaks.
- b) Breakage of a strand.
- c) Wear and tear in the outer wire rope reaches 4% of its diameter, or reduction in the rope diameter by 7% of the nominal size.
- d) Rope deformation.

The replacement rope must comply with the original rope's specifications, including the elongation rate of length and diameter. The lowering limit switch must be readjusted if a new hoisting rope is used.

Worn rope pulley must be repaired or changed prior to fitting a new hoisting rope. If this is not done, the new hoisting rope will be damaged.

5.1.3.2 Checking load hook

Check load hook according to the following items:

- a) Check load hook for distortions, e.g., at the hook jaw.
- b) Check all bolts and screws, and ensure all cotter pins are complete and open.
- c) Check that the rotary connection of load hook can move easily, and the clearance is not too large.
- d) Check the easy rotation of load hook: Rotate load hook by hand. If it is stiff, it indicates that the bearing has been damaged.
- e) Check safety catch for completeness and functional work.
- f) Check load hook for corrosion and wear.

5.1.3.3 Checking rope pulley

Check rope pulley according to the following items:

- a) Check rope pulley for damage and cracks.
- b) If rope pulleys have been hit during crane operation (for example on buildings) or if they were subjected to other stress factors, they must be then extensively checked for damage or cracks before using next time.
- c) Check for wear on the rope groove. Replace the pulley if the rope pulley has been worn down more than 1/4 of the rope diameter.
- d) If any damage or cracks are found, then the rope pulley must be replaced immediately. If this is not observed, there is great danger of causing a serious accident.
- e) Check rope pulley for tight fit. Loose and shaken rope pulley indicates that the bearing and bearing bush are damaged.

5.1.3.4 Checking anchoring rod

- a) Check if the length of anchoring rod complies with the nominal size.
- b) Check if the surface of anchoring rod has defects.

5.1.3.5 Erecting and lowering the boom

Before erecting or lowering a boom combination, ensure that the following prerequisites are met:

- a) The crane is properly supported and leveled.
- b) The counterweight plates have been attached on slewing table according to the requirements.
- c) All limit switches have been correctly fitted and are fully operational.
- d) The main boom and fixed jib have been attached in accordance with the load capacity chart and operator's manual.
- e) All pinned connections have been secured.
- f) The hoisting rope has been correctly placed in the rope pulleys and it is prevented from jumping out from the rope groove by rope guard tubes.
- g) Ensure that the wire rope end is firmly fastened by the rope clamps, and the wire rope properly falls down on the web members of boom during boom raising and lowering.
- h) There are no loose components on main boom or fixed jib.
- i) In winter, main boom, fixed jib and associated parts (including limit switches, cable drums, solar lamp etc.) must be kept free of ice and snow.



Incorrectly fitted or faulty limit switches and falling parts (bolts, retaining spring, ice etc.) can cause injury.

5.2 Assembly of basic machine

5.2.1 Unloading of basic machine

5.2.1.1 Checks before operation

- a) Check the jobsite
The ground on the jobsite must be firm and flat. If necessary, a steel plate should be padded.
It should be large enough for trailer traveling and auxiliary crane operation.
- b) Check the operating procedure and safety regulations
All operators should be familiar with operating procedure and safety regulations and clear about their areas of responsibility before operation.
- c) Check the basic machine thoroughly before operation.
- d) Switch the system into assembly mode (SA).



When assembling or disassembling the crane, the operator must comply with the requirements in OSHA 29CFR1926 standard.

5.2.1.2 Unloading the basic machine (with crawler carriers)

- a) After the basic machine reaches the jobsite, remove fixing devices and the package. Pull out slewing fixing pin, and slew it for 180°. See the figure 5-1.

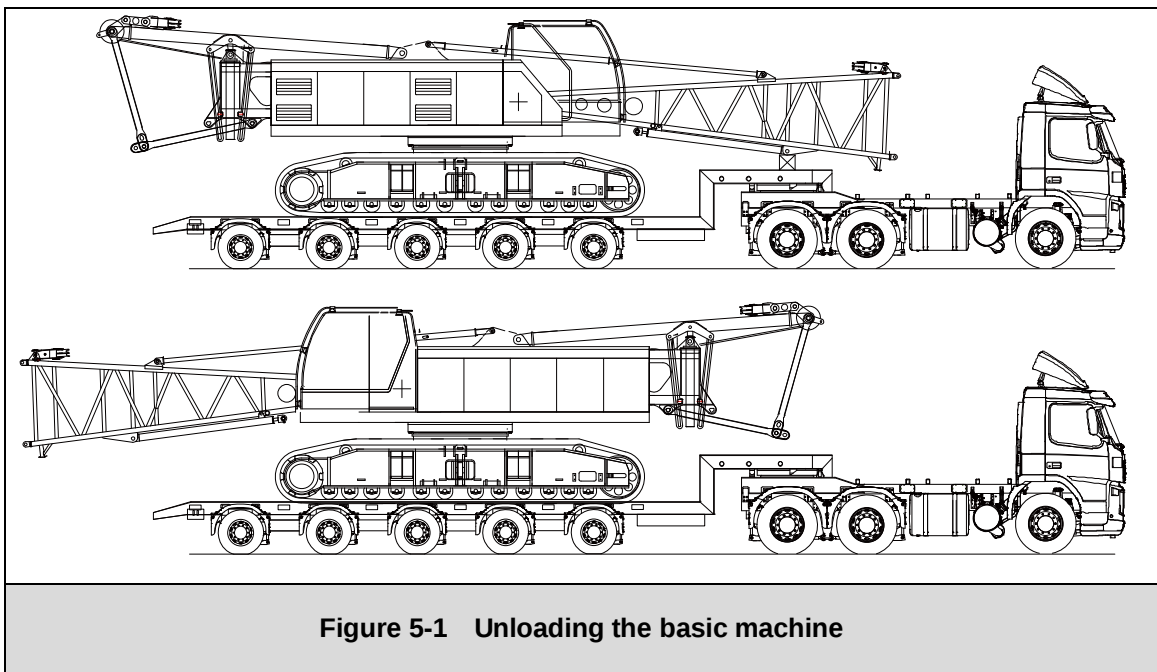


Figure 5-1 Unloading the basic machine

- b) Drive basic machine down off the low-loader (see the figure 5-2), or lift the basic machine away from the lower-loader with the help of an auxiliary crane, and then drive the low-loader away.

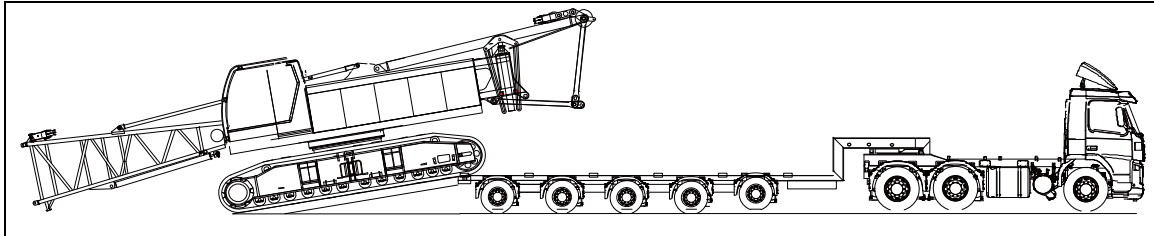


Figure 5-2 Unloading the basic machine

- c) Operate derricking winch to raise main boom until the angle of main boom to front horizontal line reaches about 70°.
Insert the pin spindle to fix the outer pipe and inner pipe of main boom tilting-back support. See the figure 5-3.
- d) Remove the pin spindle between A-frame rear anchoring rods and slewing table. Continue spooling up derricking winch to erect A-frame to required position. Mount A-frame well.

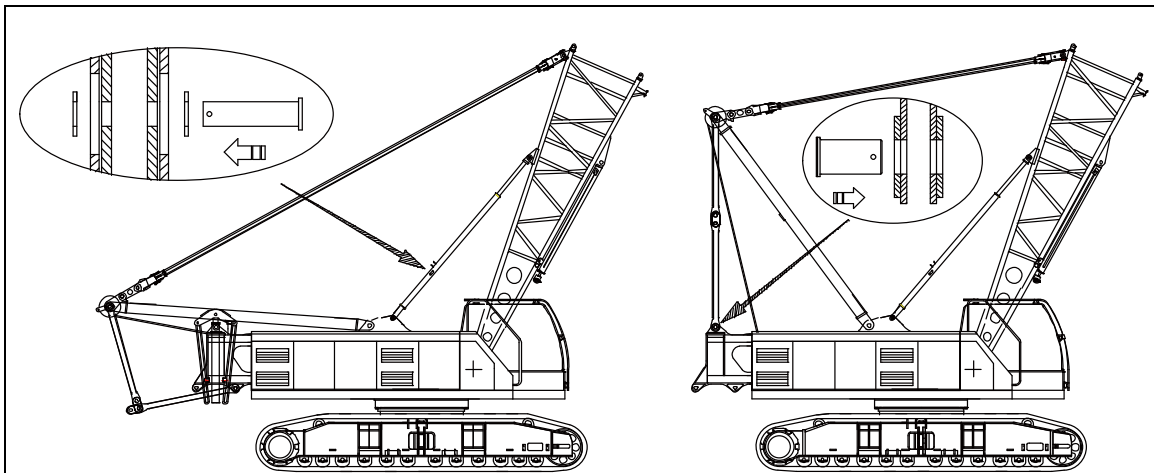


Figure 5-3 Unloading the basic machine

! DANGER

- (1) Before transportation, retract the crawler carrier, lay down the A-frame and place main boom pivot section flatly, and finally lock the slewing mechanism by slewing fixing pin.
- (2) When drive the basic machine off or onto the low-loader, a steel plate (with an inclination less than or equal to 8° to the ground) should be used to connect the low-loader to the ground. The angle of main boom pivot section should be less than 30° in order to protect crane against overturning.

- (3) The slewing fixing pin must be unpinned prior to operating the slewing mechanism. Otherwise, the fixing device for slewing table may be damaged.

5.2.1.3 Unloading of basic machine (without crawler carriers)

- a) After basic machine reaches the jobsite, remove related fixing devices and package. The transport position of basic machine without crawler carriers is shown in the figure 5-4.

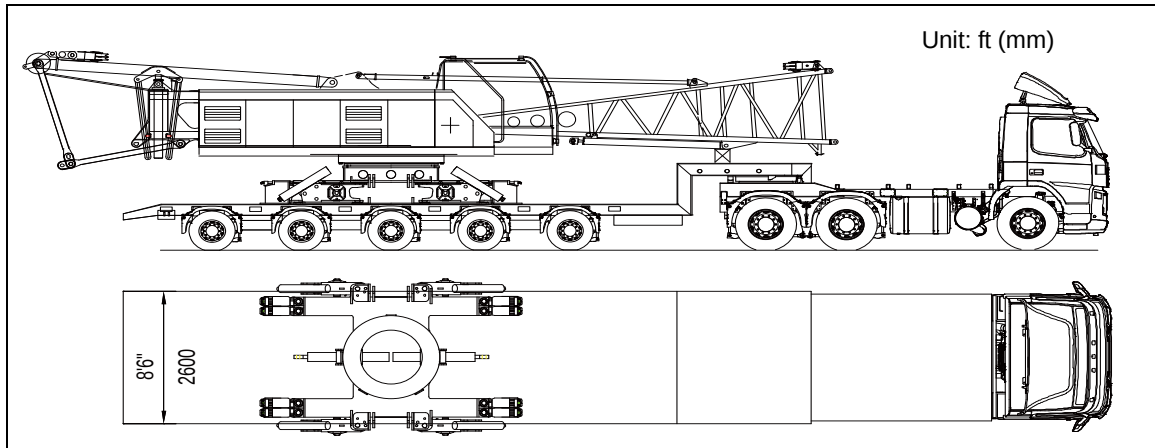
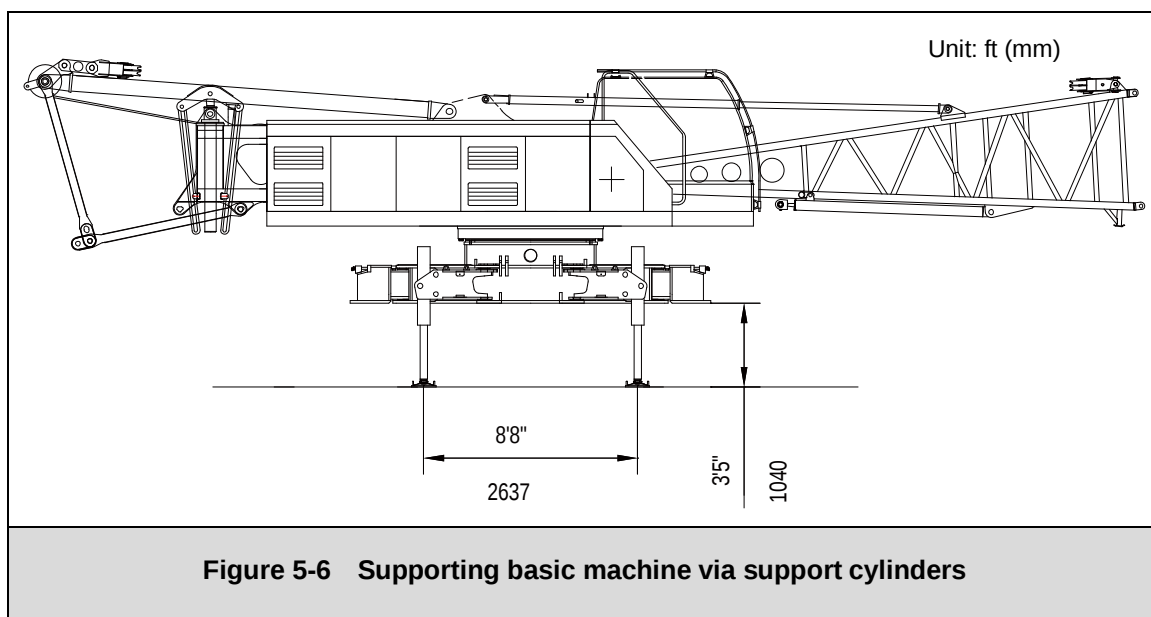
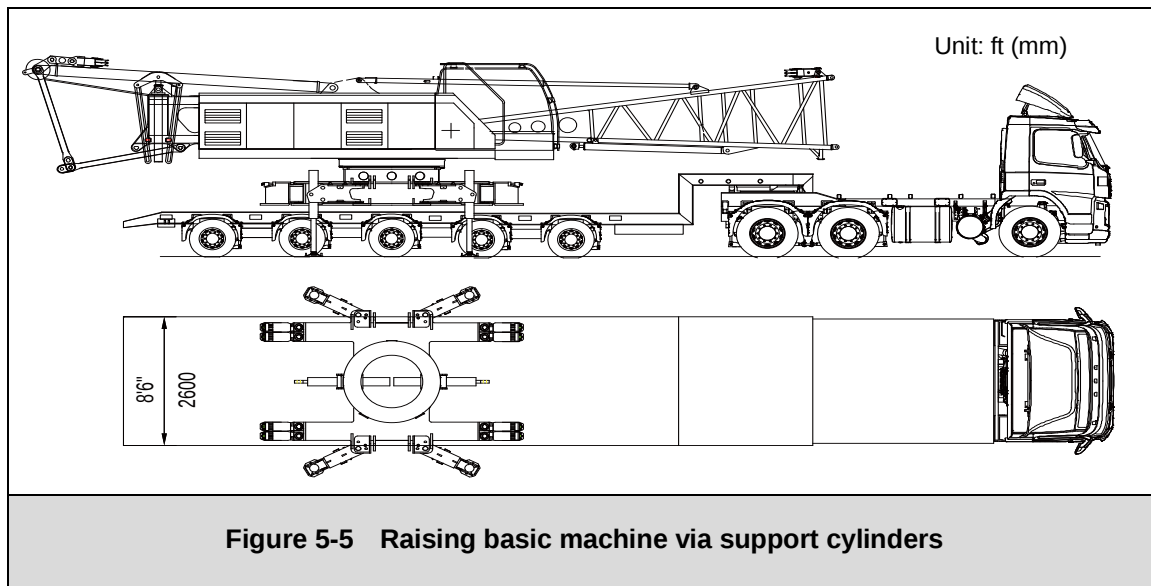


Figure 5-4 Transport position of basic machine without crawler carriers

- b) Swivel out folding brackets, and fix them via fixing pins.
 Rotate support cylinders until they are vertical to the ground, and mount support plates.
 Start the engine, establish electrical connection between auxiliary remote control box and the junction box on the rear right side in the slewing table.
 Turn on power supply and push "Counterweight lifting/undercarriage auxiliary device selector switch" down to choose "undercarriage auxiliary device". (See section 4.5.8 in chapter 4.)
 Extend support cylinders by operating undercarriage control levers to raise basic machine from the loading floor. (See the figure 5-5)
 After basic machine is raised enough (the maximum distance from the base plane of undercarriage central section to the ground can reach 3'5"(1040mm)), drive low-loader out from underneath the basic machine. (See the figure 5-6)



If support cylinders are not lifted high enough, the operator can put the solid squared timbers underneath the support plates.

Undercarriage control levers, which are located in the front of undercarriage central section, can control four support cylinders and two horizontal cylinders. For detailed operation, please see the operating board on the protective cover of control lever.

Insert the plug of auxiliary remote control box into the socket of junction box on the rear right side of slewing table to establish electrical connection of auxiliary remote control box (see the figure 4-48).

Push “Counterweight lifting/undercarriage auxiliary device selector switch” on the control box down to choose “undercarriage auxiliary device”.

Operate horizontal cylinders and support cylinders according to the operating board as shown in the figure 5-7.

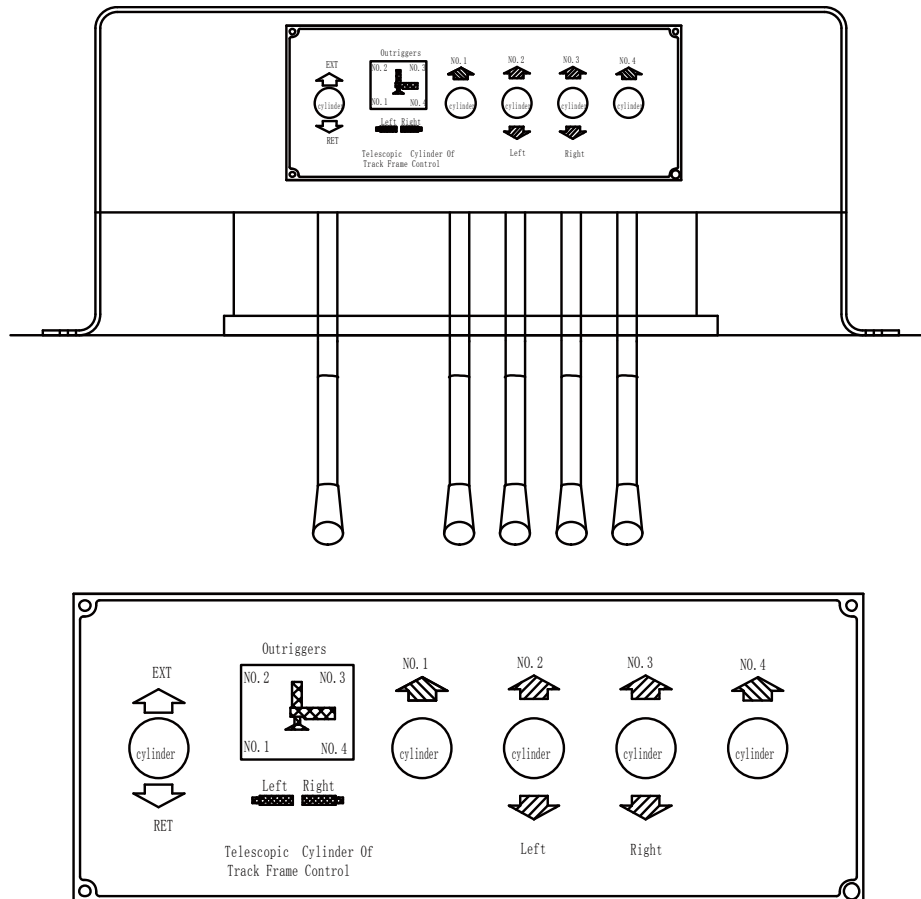


Figure 5-7 Undercarriage control levers and operating instructions

5.2.2 Self-assembly and dismantling of crawler carrier (optional)

5.2.2.1 Components of crawler carrier self-assembly and dismantling mechanism

Crawler carrier self-assembly and dismantling mechanism consists of mounting cylinder, main boom pivot section, main boom tilting-back support, support cylinder, derricking mechanism and so on. See the figure 5-8 and table 5-1.

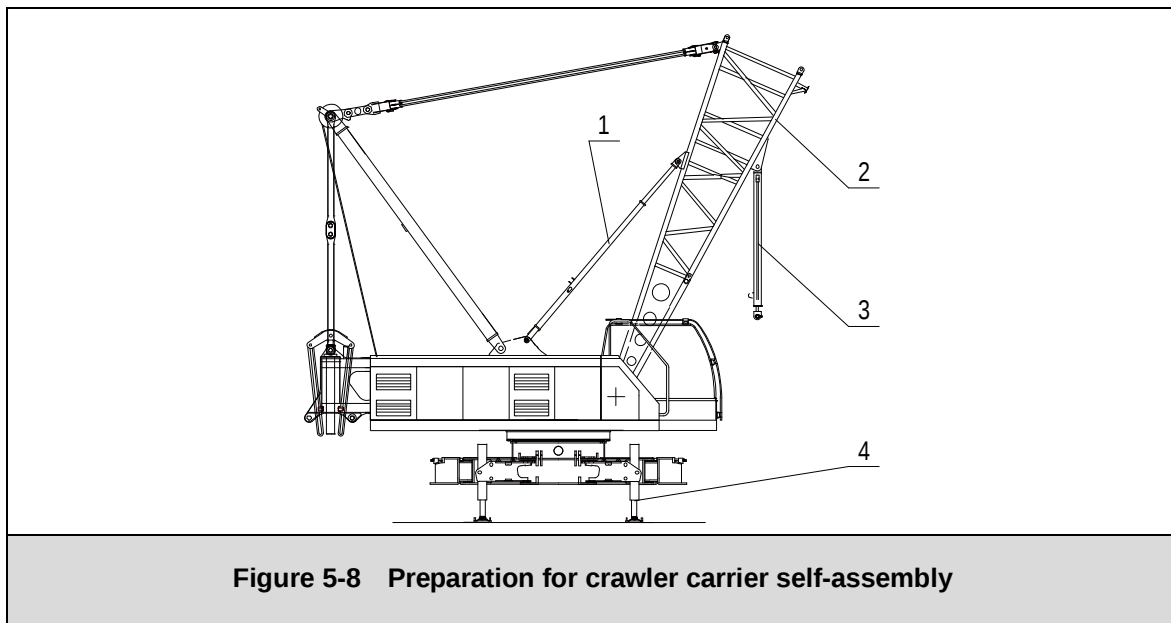


Table 5-1 Parts used for crawler carrier self-assembly

No.	Names of the parts	No.	Names of the parts
1	Main boom tilting-back support	3	Mounting cylinder
2	Main boom pivot section	4	Support cylinder

After basic machine is unloaded from the low-loader via support cylinders, A-frame must be erected to required position for the preparation of crawler carrier self-assembly. The operation of erecting A-frame refers to "Unloading of crane with crawler carrier" mentioned above. During crane self-assembly, the self-assembly & dismantling mode must be selected on the load moment limiter.

The support cylinders used for crane self-assembly are optional, and they are subject to the contract.



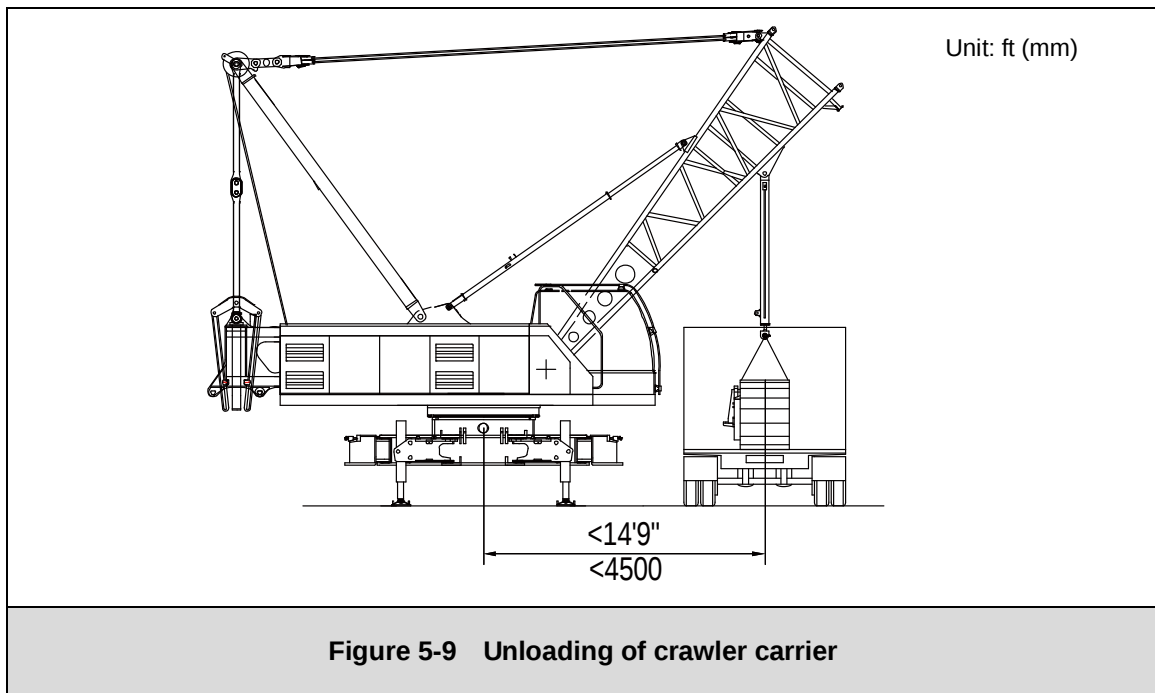
- (1) Before crane self-assembly, check if basic machine is level via inclinometer which is near the undercarriage control levers. If the basic machine is not level, adjust the support cylinders.

- (2) After crawler carrier is assembled on the undercarriage central section via mounting cylinder, the angle of main boom pivot section is large. At this time, pivot section may not be lowered by unwinding the derricking rope. It must be lowered by the weight of lifted load.
- (3) The self-assembly operation must be performed by at least three persons. Before operation, everyone must acquaint himself with self-assembly operation, and define the responsibilities during operation.
- (4) All the operation must be carried out slowly during self-assembly process.

5.2.2.2 Unloading of crawler carrier

Lift crawler carrier via mounting cylinder, and then move it to the required position.

- a) After derricking mechanism is installed, remove the pin spindle which is used to connect inner pipe and outer pipe of main boom tilting-back support, loose the mounting cylinder from main boom pivot section, and establish hydraulic connection of mounting cylinder.
- b) Adjust the support cylinders to ensure that the inclination of machine does not exceeds 1%, and the distance from the base plane of undercarriage central section to the ground does not exceeds 2'2" (650mm).
- c) Stop the low-loader with crawler carrier attached beside the basic machine, slew superstructure for 90°, and then lift crawler carrier via mounting cylinder as shown in the figure 5-9.
- d) Move crawler carrier to required position, and align the connecting hole of crawler carrier with the hole of undercarriage central section. At this time, the angle of main boom pivot section is 76°, and the working radius of load is 9'2" (2800mm).



5.2.2.3 Assembly of left crawler carrier

Procedure for assembling left crawler carrier:

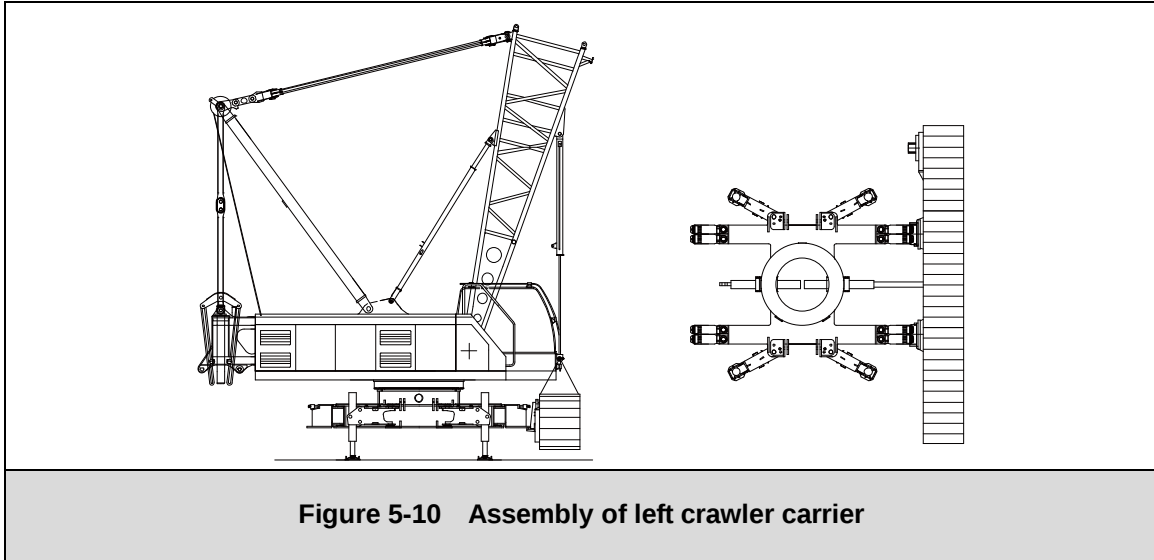


Figure 5-10 Assembly of left crawler carrier

- a) Affirm that four pairs of folding brackets have been positioned by retaining plates (part 4 in the figure 5-17), and the adjusting blocks on the folding brackets have been removed to the lowest position. Otherwise, it will be difficult to assemble the crawler carrier.
- b) Adjust the position of crawler carrier via slewing mechanism, and the height of crawler carrier via derricking mechanism and mounting cylinder. Align the mounting holes of crawler carrier with those of undercarriage central section. (See the figure 5-10)
- c) Attach crawler carrier onto the undercarriage central section with the help of mounting cylinder and main boom pivot section.

If it is difficult to move the crawler carrier, the operator must first check whether there is an object hindering the operation, and then adopt the auxiliary device mentioned in step d) to move the crawler carrier.

- d) Extend left horizontal cylinder (part 1 in the figure 5-11) to make the piston rod pass through the hole in the middle of crawler carrier. After piston rod passes through the retaining plates (part 3) in the hole, mount a pin spindle (part 2) on the piston rod, and slowly retract the horizontal cylinder. At this moment, the pin spindle will catch the retaining plates so as to pull the crawler carrier towards the direction of undercarriage central section.
- e) Move the crawler carrier to a proper position where it is 6'11"(2100mm) from the central line of undercarriage central section with the help of main boom pivot section, mounting cylinder and horizontal cylinder. Adjust the height of support cylinder to make crawler carrier come into contact with the ground.
- f) Remove the pin spindle (part 2) from the horizontal cylinder, and extend horizontal cylinder to its working position. See the figure 5-12.

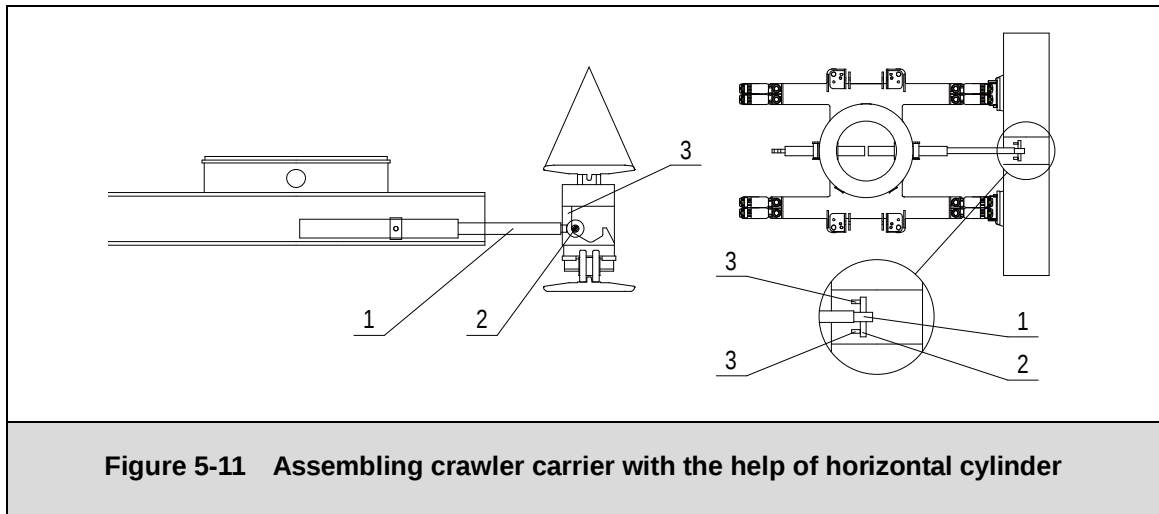
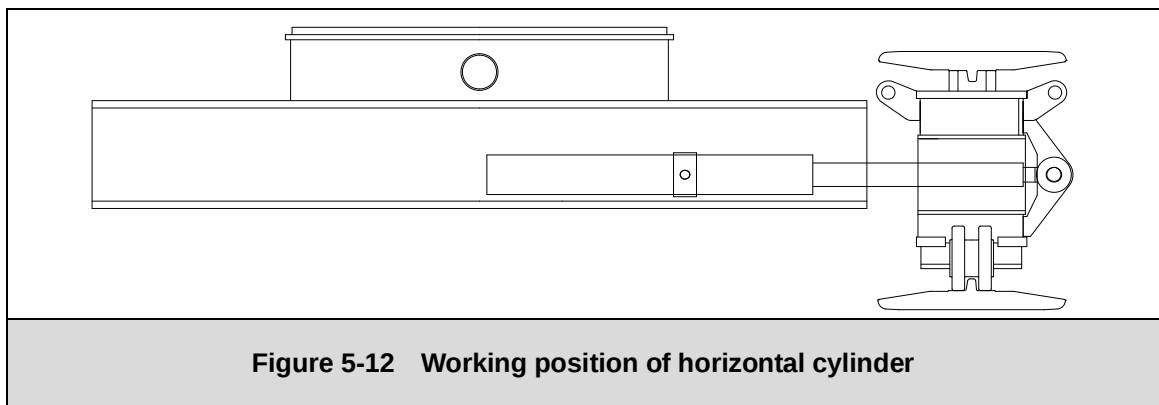
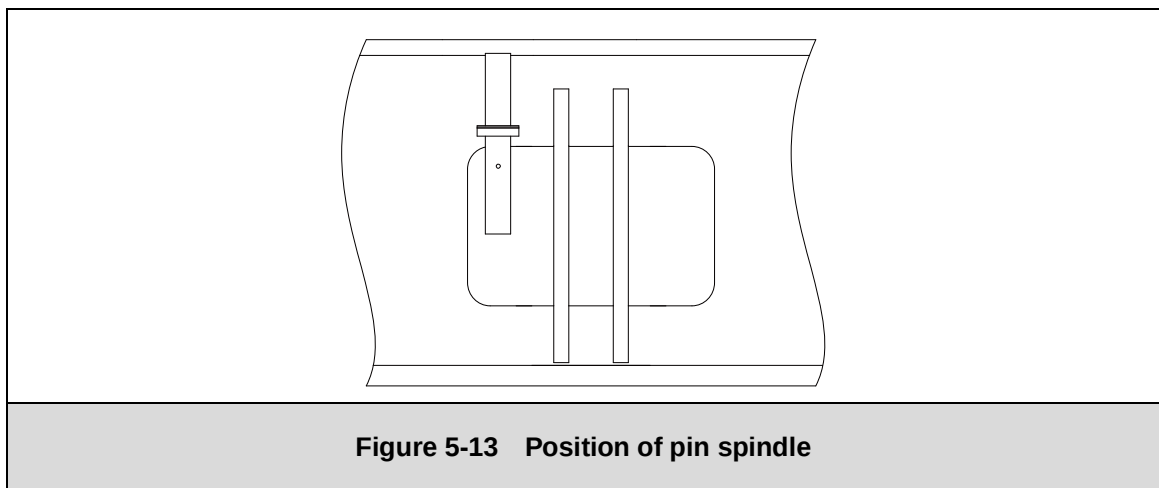


Table 5-2 Parts used for assembly of crawler carrier

No.	Names of the parts	No.	Names of the parts
1	Horizontal cylinder	3	Retaining plate on the crawler carrier
2	Pin spindle		



- g) Put the pin spindle (part 2) on the bracket at the outside of crawler carrier. See the figure 5-13.



5.2.2.4 Assembly of right crawler carrier

The process of assembling right crawler carrier:

- Confirm that left crawler carrier is in contact with the ground (see the figure 5-14). At this time, the crane is inclined slightly, and the superstructure can slew freely.
- Lift right crawler carrier from the low-loader, and assemble it onto the undercarriage central section by use of mounting cylinder and main boom pivot section. If necessary, use right horizontal cylinder to assemble crawler carrier.
- Adjust the height of support cylinder to allow left and right crawler carriers to contact the ground. Extend right horizontal cylinder to working position.

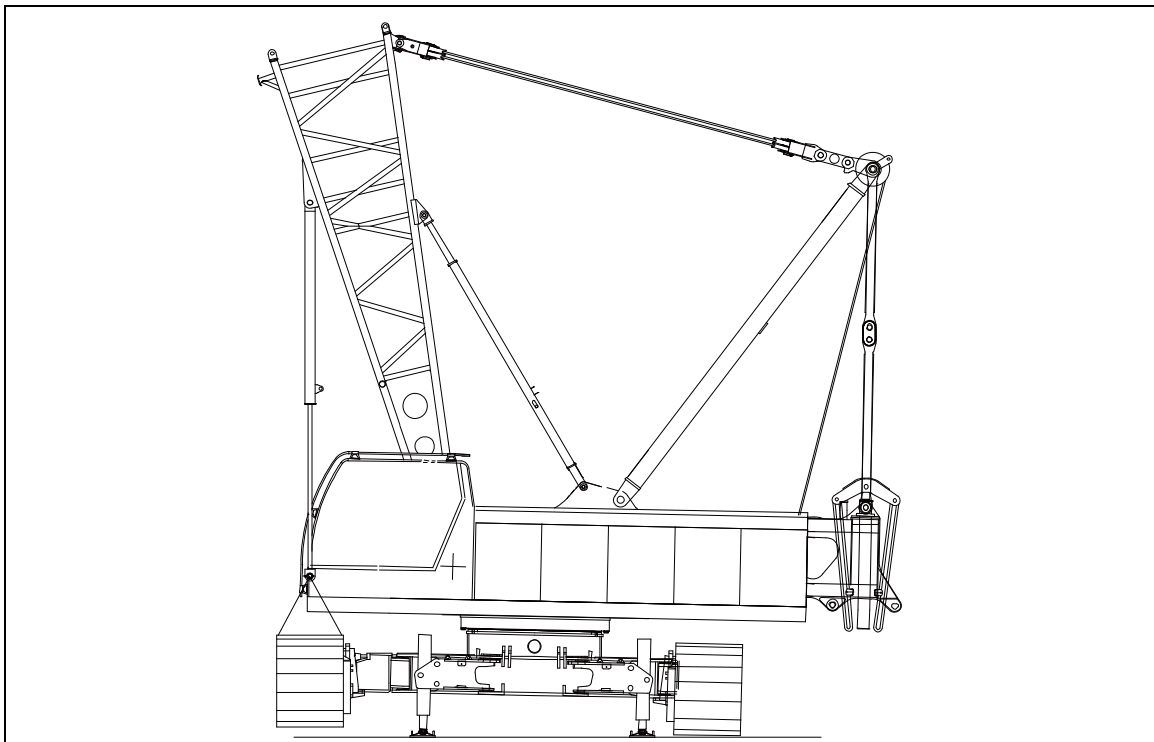


Figure 5-14 Assembly of right crawler carrier



When only one crawler carrier is attached on the crane, the operator must first make this crawler carrier come into contact with the ground, and then slew the tail end of slewing table above the crawler carrier. Otherwise, serious injury or property damage will occur.

5.2.2.5 Follow-up operation

After left and right crawler carriers are attached on the crane, dismantle folding brackets so that the horizontal anchoring rods can be connected, and central counterweight can be assembled. See the figure 5-15.

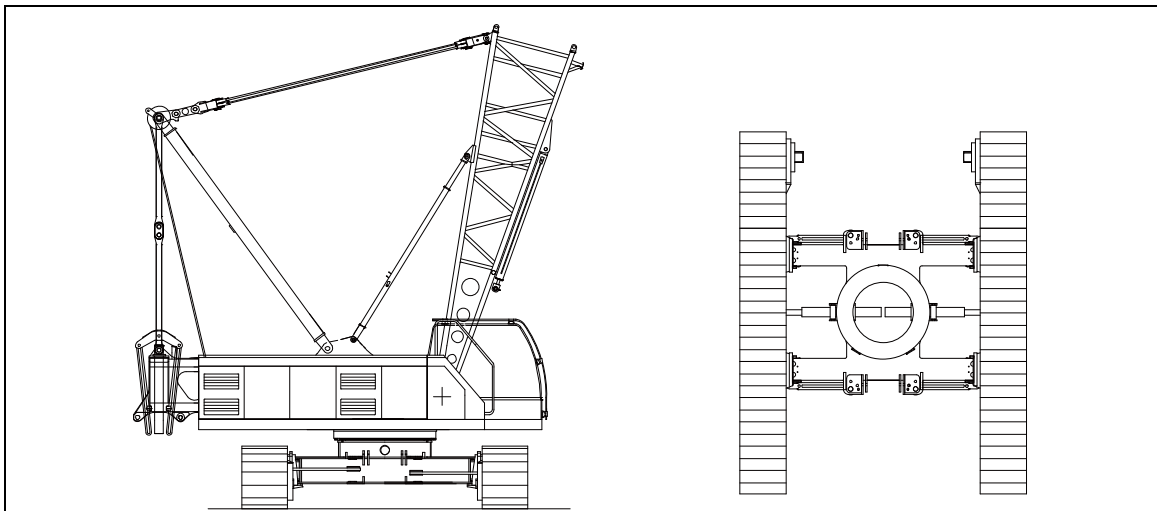


Figure 5-15 Dismantling of folding brackets

- a) Retract support cylinders, put support plates on the attachment points at the side of folding brackets, disconnect hydraulic connection of folding brackets and tilt support cylinder. See the figure 5-16.

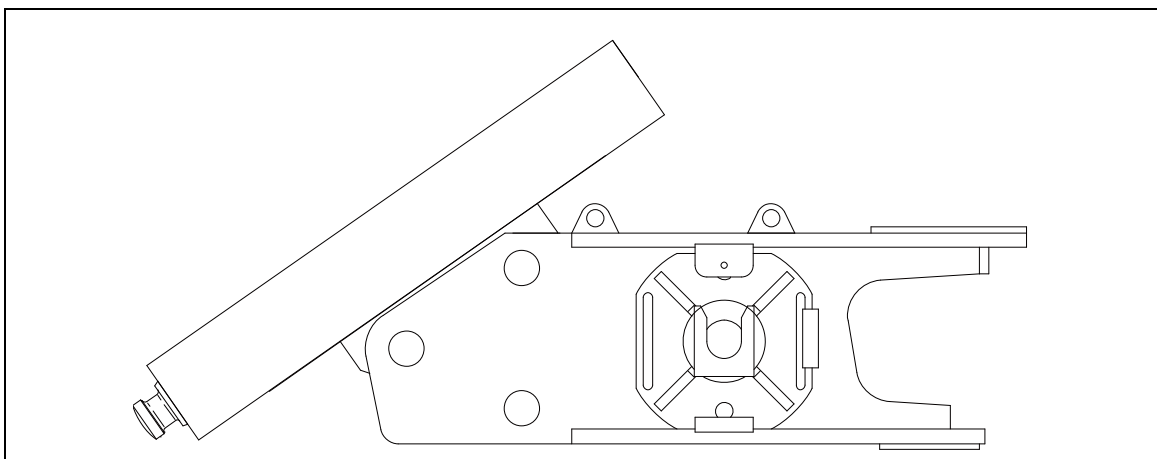


Figure 5-16 Folding brackets to be dismantled

- b) Dismantle folding brackets by use of mounting cylinder or other device, and then connect the horizontal anchoring rods.

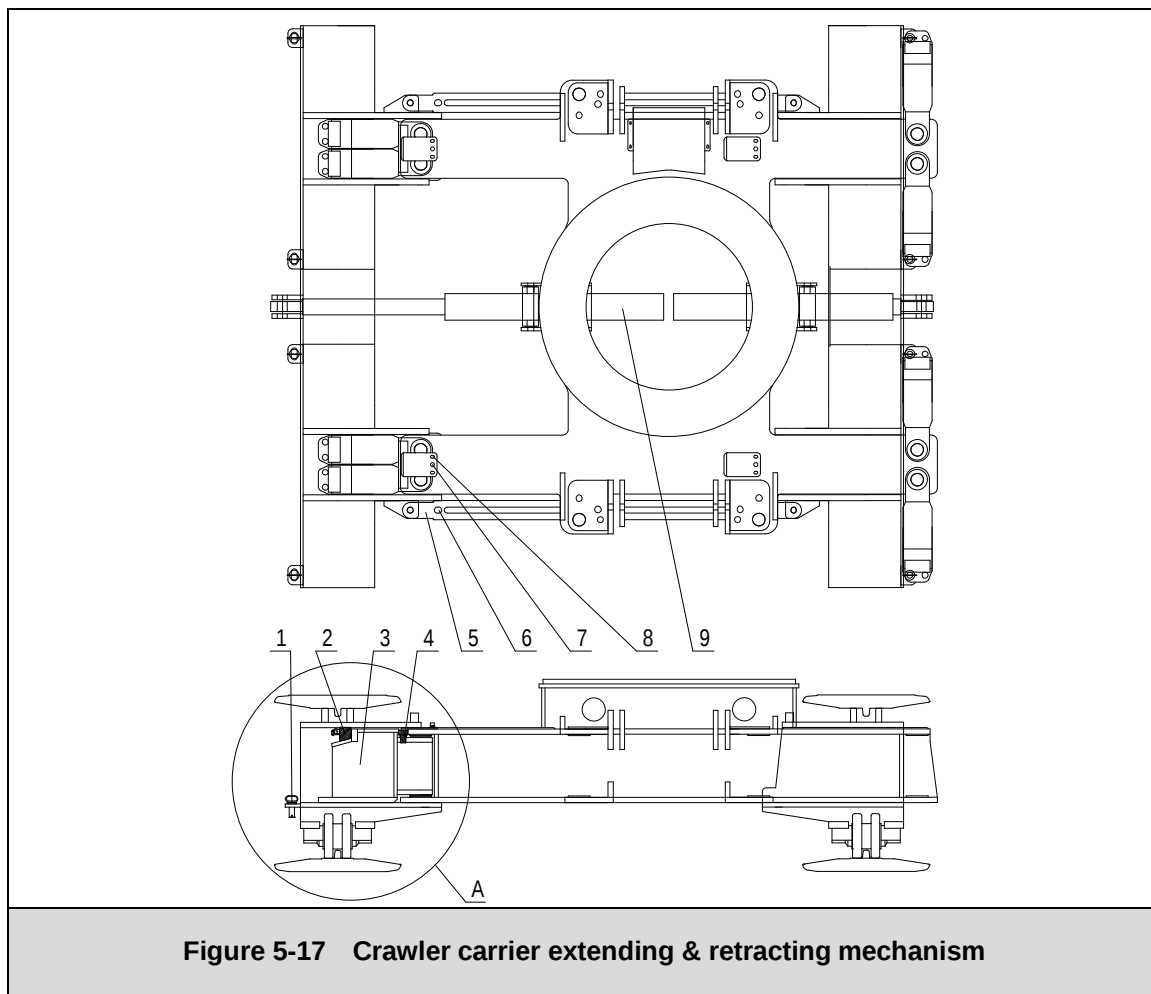
5.2.3 Extending and retracting of crawler carrier

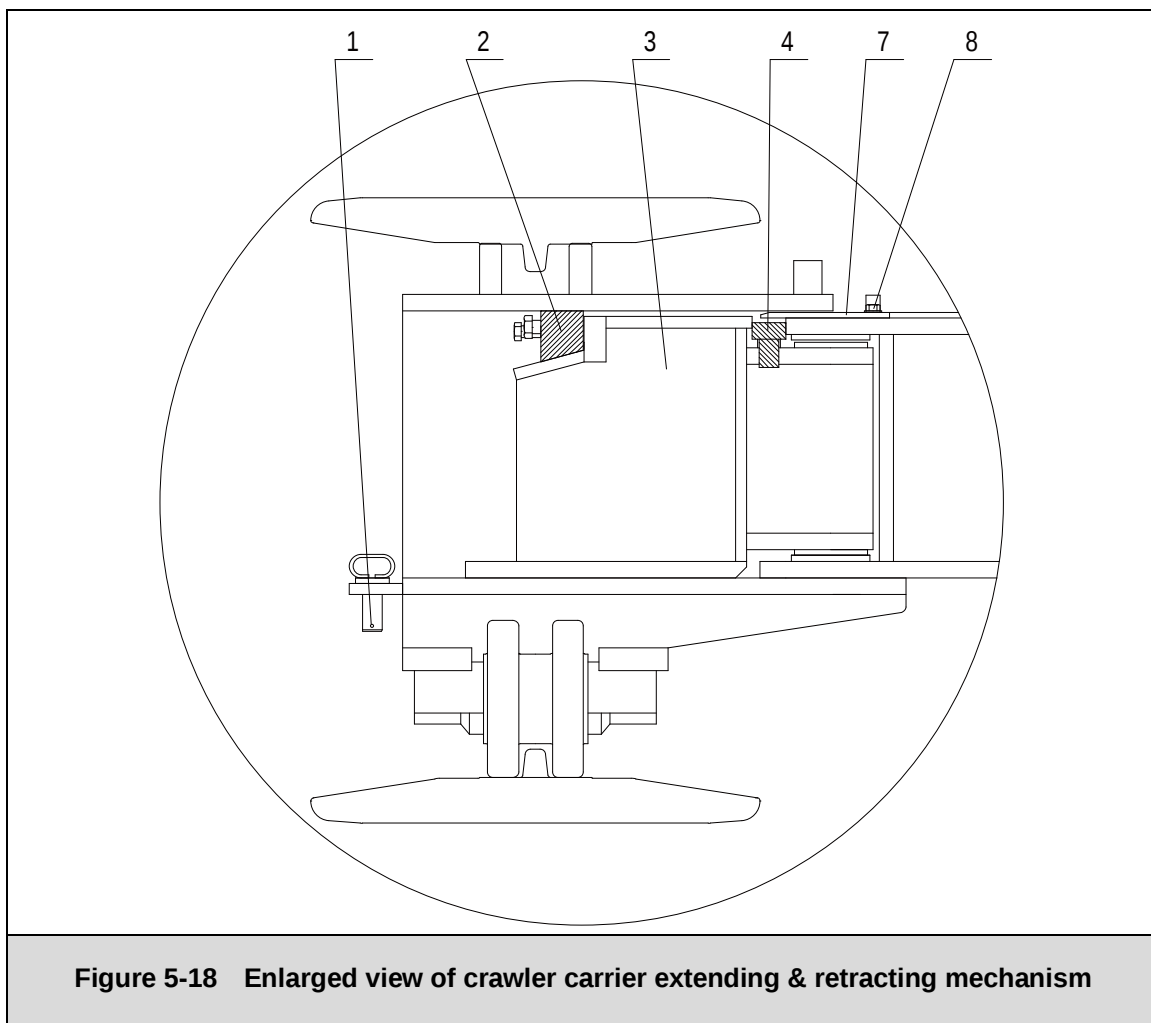
5.2.3.1 Components of crawler carrier extending & retracting mechanism

Crawler carrier extending & retracting mechanism consists of folding brackets, horizontal cylinder, crawler carrier, anchoring rods, pin spindles and so on. Refer to figure 5-17, figure 5-18 and table 5-3.

Table 5-3 Crawler carrier extending & retracting mechanism

No.	Names of the components	No.	Names of the components
1	Pin spindle	6	Pin spindle
2	Adjusting block	7	Wedge block
3	Folding bracket	8	Fastening bolt
4	Retaining plate	9	Horizontal cylinder
5	Horizontal anchoring rods		





! WARNING

Inspect the hose of traveling motor before extending and retracting crawler carrier, and ensure the hose is not damaged during crawler carrier extending and retracting.

5.2.3.2 Use of adjusting block of folding bracket

Adjusting block is located at the upper side of folding bracket. It is used to adjust the clearance between folding bracket and crawler carrier.

There are two statuses for adjusting block: removed status and locked status.

The removed status of adjusting block is shown in the figure 5-19, and the relevant parts are listed in the table 5-4.

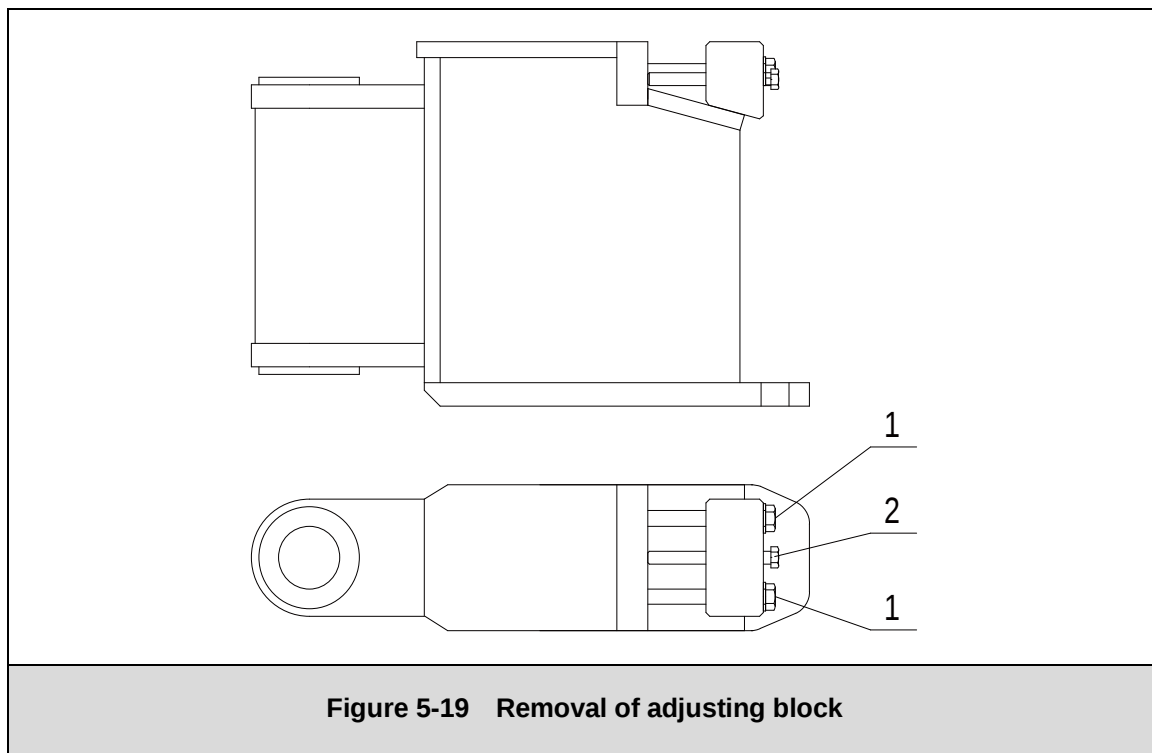
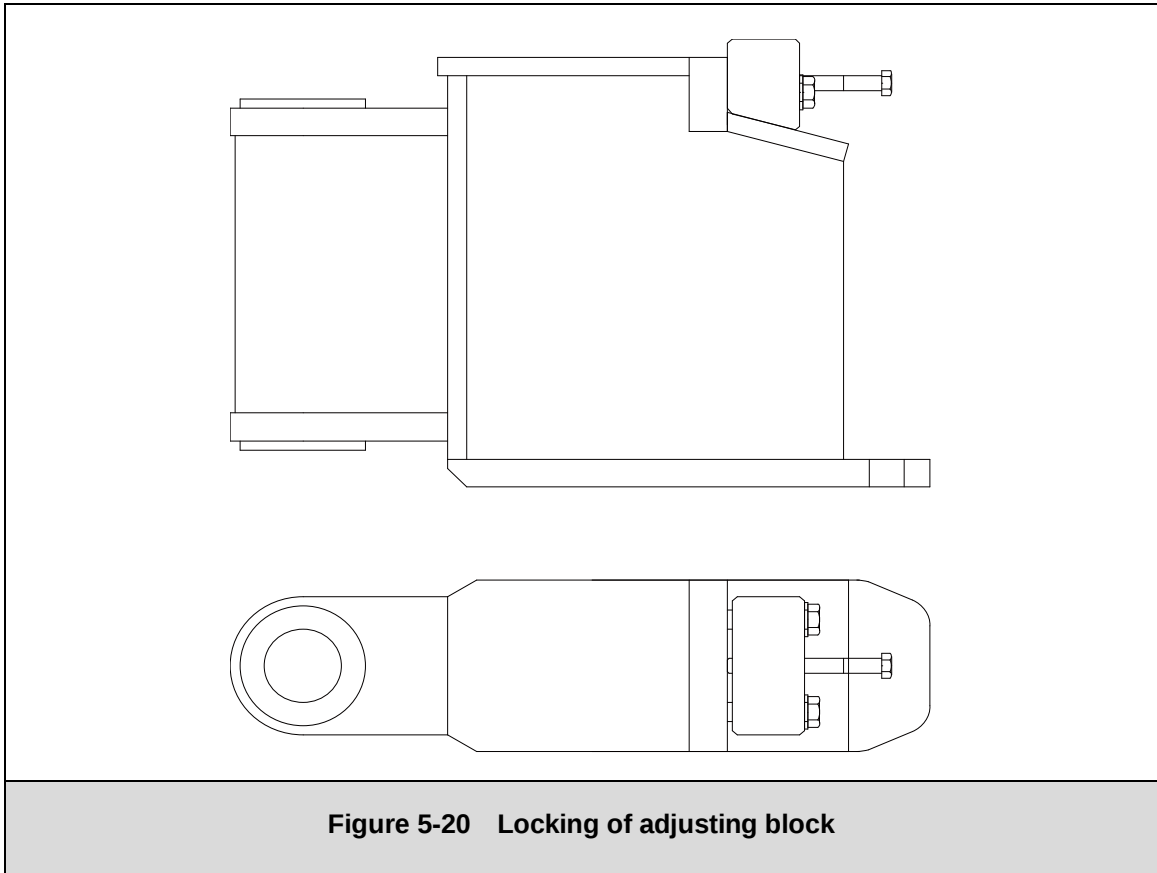


Table 5-4 Positioning bolt of adjusting block

No.	Names of the bolts	No.	Names of the bolts
1	Forward bolt	2	Reverse bolt

- a) Screw out two forward bolts for enough distance via socket wrench.
- b) Screw the reverse bolt. The front of the bolt will prop up the folding bracket, while the reacting force will push out the adjusting block.

The locked status of adjusting block is shown in the figure 5-20.



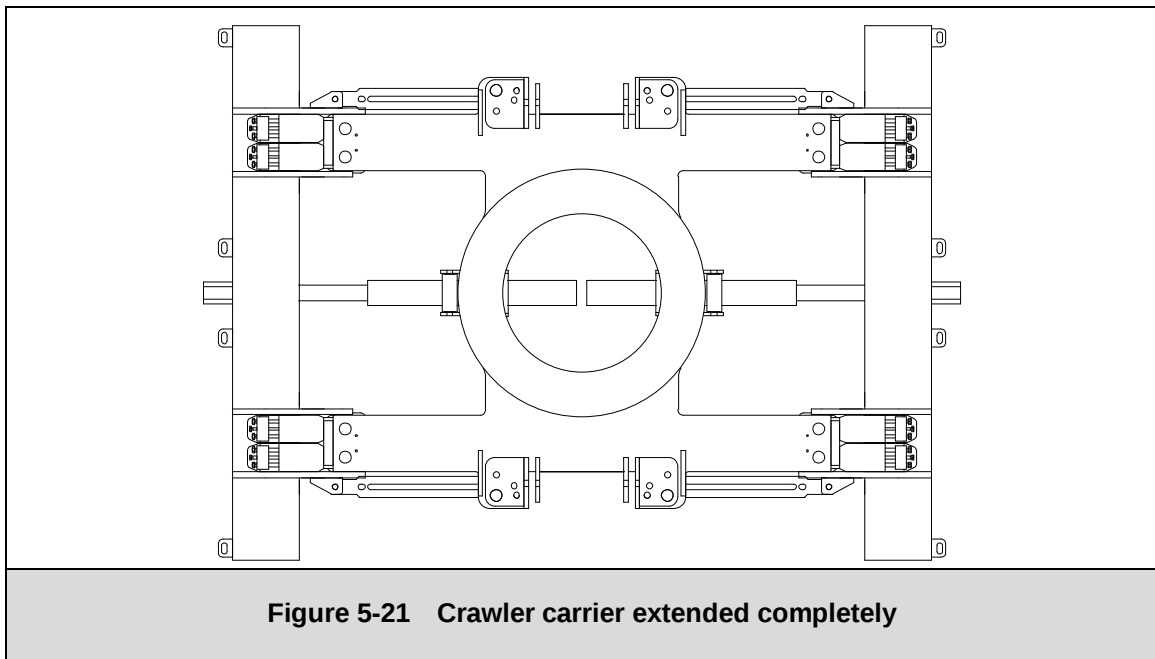
- a) Screw out reverse bolt for enough distance via socket wrench.
- b) Screw two forward bolts by turns to push adjusting block into the required position.

5.2.3.3 Operation of crawler carrier extending & retracting mechanism

The crawler carriers of this crane can be extended and retracted completely.

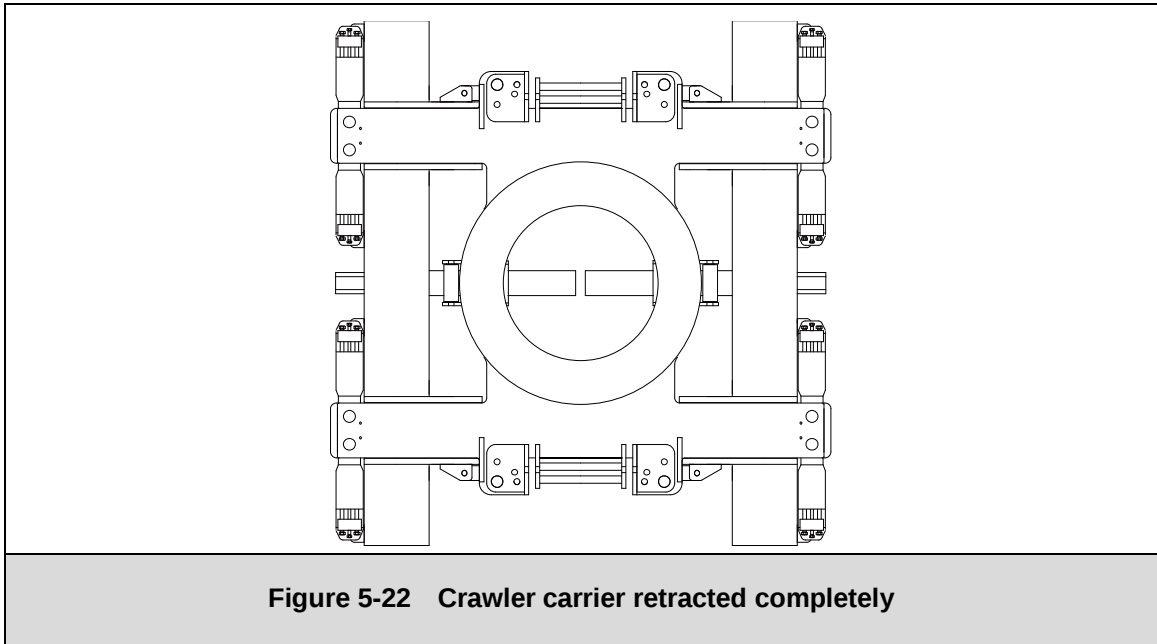
When the crane is working, the crawler carriers are usually extended completely. See the figure 5-21. While during transportation, the crawler carriers are retracted completely. See the figure 5-22.

The operation of extending crawler carriers is shown as follows.



- Lower the adjusting blocks of eight folding brackets via socket wrench to proper positions where the adjusting blocks are in the same level with the upper plane of folding brackets.
- Remove the bracket fixing pins, and swivel four pairs of folding brackets to proper positions so that crawler carrier can be extended completely. Put a retaining plate on each pair of folding bracket to limit swiveling of folding bracket.
- Pull out the positioning pins of horizontal anchoring rods so that the anchoring rods can move with the extending of crawler carriers.
- Extend left horizontal cylinder to push left crawler carrier out. After left crawler carrier is extended to the required position, insert the positioning pin of left horizontal anchoring rods. Extend right crawler carrier to required position, and then fix it well.
- After the right and left crawler carriers are extended completely, and the horizontal anchoring rods have been assembled. Tighten the adjusting blocks of eight folding brackets via socket wrench to ensure that the upper plane and bottom section of folding brackets are in contact with crawler carriers tightly.
- Put wedge blocks between the upper plane of undercarriage central section and crawler carrier, and then fasten it well by the bolts.

The operation of retracting crawler carriers is shown as follows:



- Lower the adjusting blocks of eight folding brackets via socket wrench to proper positions where the adjusting blocks are in the same level with the upper plane of folding brackets.
- Pull out the positioning pins of horizontal anchoring rods so that the anchoring rods can move with the retracting of crawler carriers.
- Retract left horizontal cylinder to pull left crawler carrier in. After left crawler carrier is retracted to the required position, insert the positioning pin of left horizontal anchoring rods. Retract right crawler carrier to required position, and then fix it well.
- After the left and right crawler carriers are retracted completely and the horizontal anchoring rods are mounted, take out the retaining plate on the folding bracket, and then put it on the hook of the crawler carrier.
- Swivel four pairs of folding brackets to proper positions so that the crawler carrier can be retracted completely. Fix the folding bracket on the crawler carrier by a positioning pin.

! DANGER

- (1) In any cases, the extending and retracting of crawler carrier must be carried out by at least two persons. During operation, one person operates the control levers, the other checks if the crawler carrier is extended in the required position, and ensures that the horizontal cylinder moves smoothly.**
- (2) After crawler carrier is extended or retracted properly, insert the pin spindle into the horizontal anchoring rods before traveling.**
- (3) The engine speed must be controlled within middle-low range (900 rpm-1400 rpm) during extending and retracting of crawler carrier.**

- (4) The operation of extending and retracting crawler carrier must be performed on the flat and solid ground. And the crane must be leveled during operation.
- (5) Only one crawler carrier can be extended and retracted at a time. It is prohibited to move two crawler carriers at the same time.
- (6) Monitor the position of oil pipe of traveling hydraulic system when retracting the crawler carriers. Adjust the position of oil pipe if necessary. Otherwise, the oil pipe will be damaged.



- (1) When the crane is fitted with the boom and counterweight, never extend and retract the crawler carriers. Otherwise, the crane may overturn.
- (2) Prohibit lifting the load before the crawler carrier is extended fully.

5.2.4 Assembly of central counterweight

5.2.4.1 Components of central counterweight self-assembly & dismantling mechanism

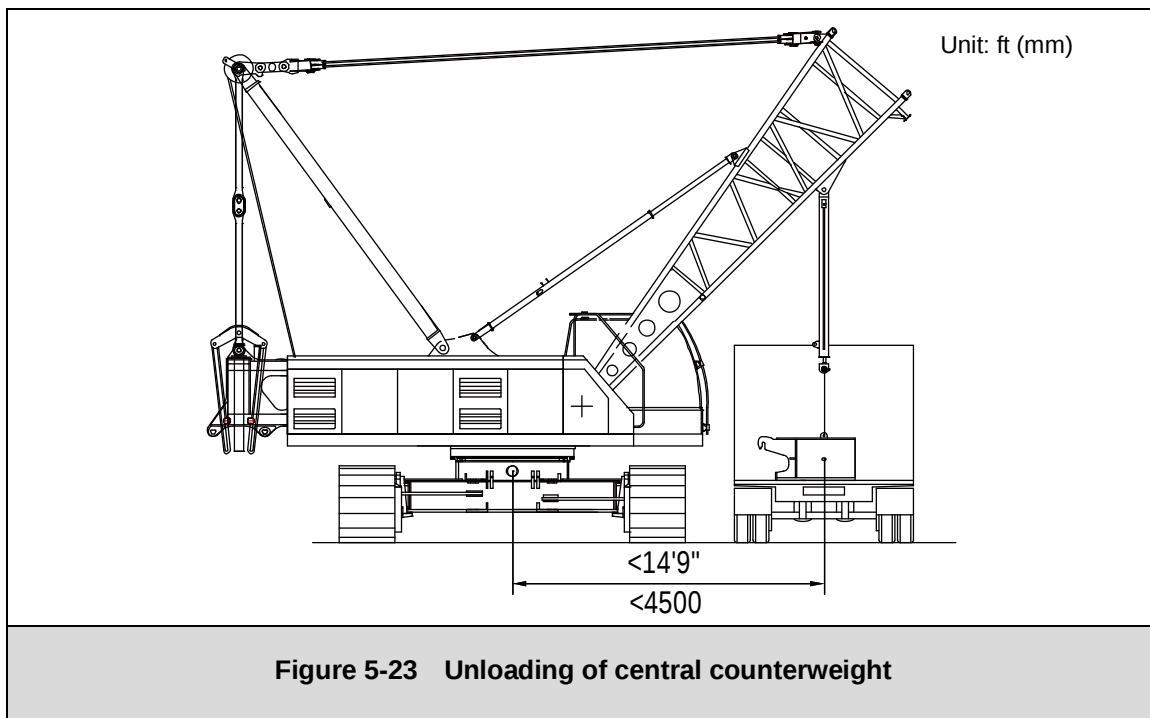
Central counterweight self-assembly & dismantling mechanism consists of main boom pivot section, mounting cylinder, derricking mechanism and so on.

5.2.4.2 Operation of central counterweight self-assembly & dismantling mechanism

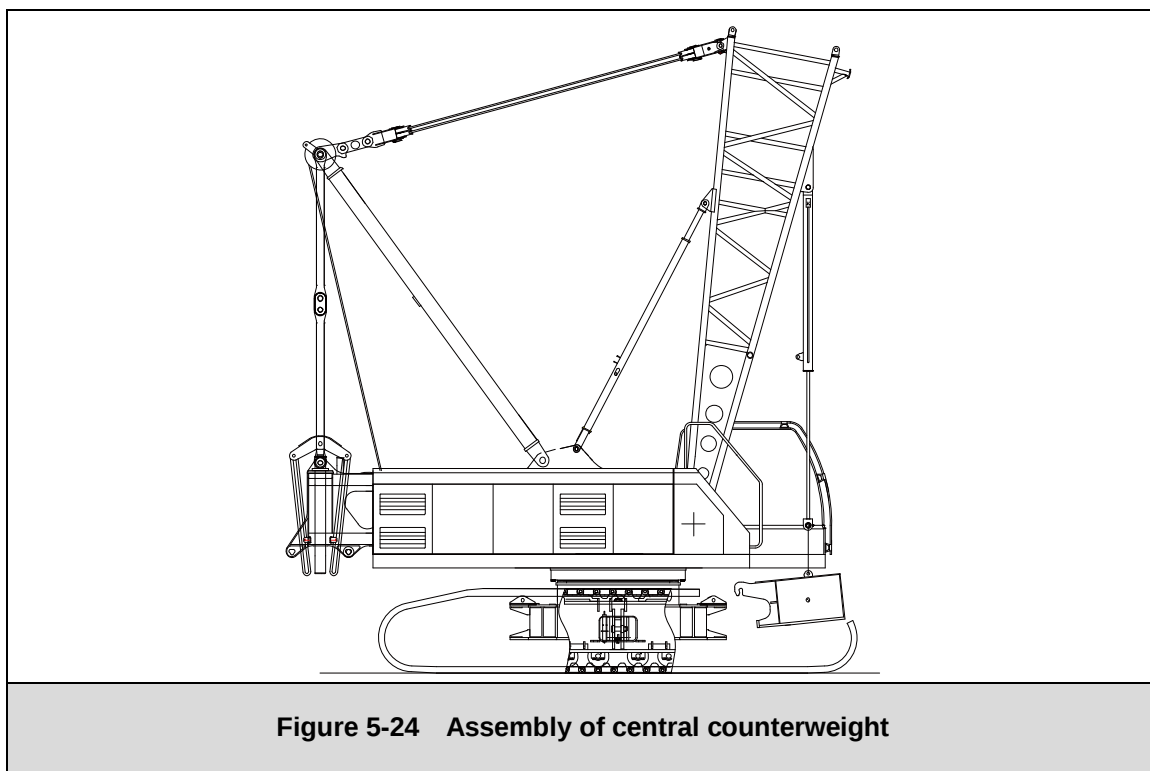


Make sure that the crawler carriers are extended completely and horizontal anchoring rods is installed before assembling central counterweight.

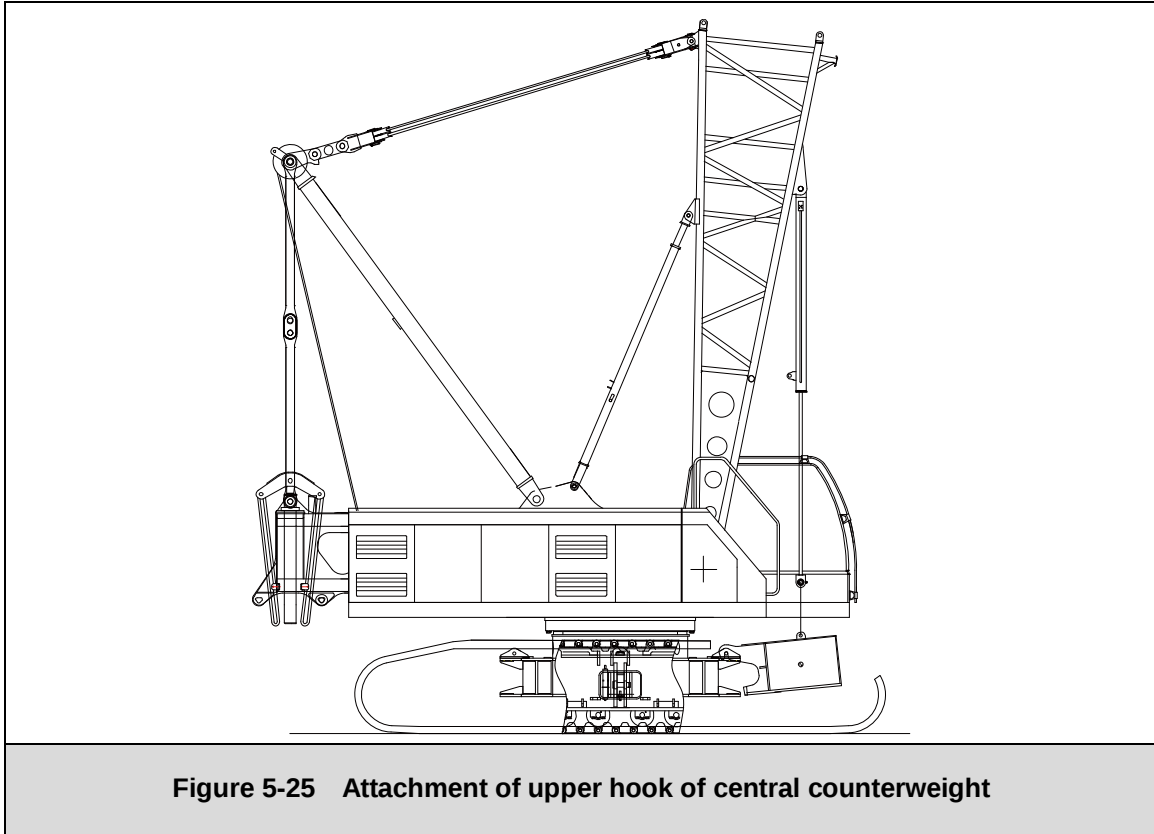
- a) Stop the transport vehicle with central counterweight attached at the side of basic machine, and lift the central counterweight from the vehicle via mounting cylinder. See the figure 5-23.



- b) Raise main boom pivot section to make central counterweight move backwards, and then adjust the height of central counterweight via mounting cylinder. (Note: The angle of main boom pivot section can not exceed 84°.) See the figure 5-24.



- c) When central counterweight is aligned with the undercarriage central section, attach the hooks at the upper side of central counterweight to the attachment points on the undercarriage central section. See the figure 5-25.



- d) Slowly extend mounting cylinder to make central counterweight rotate around the upper attachment points until the central counterweight is in contact with the undercarriage central section completely.
- e) After the central counterweight is assembled, keep the connection between the mounting cylinder and central counterweight. See the figure 5-26.
- f) Unwind derricking rope properly, and then retract mounting cylinder slowly. At this time, main boom pivot section is pulled down to a proper position with the help of mounting cylinder. See the figure 5-27.
- g) When main boom pivot section can be lowered by itself, remove the rope between mounting cylinder and central counterweight. Then the assembly of central counterweight on one side of crane is finished.

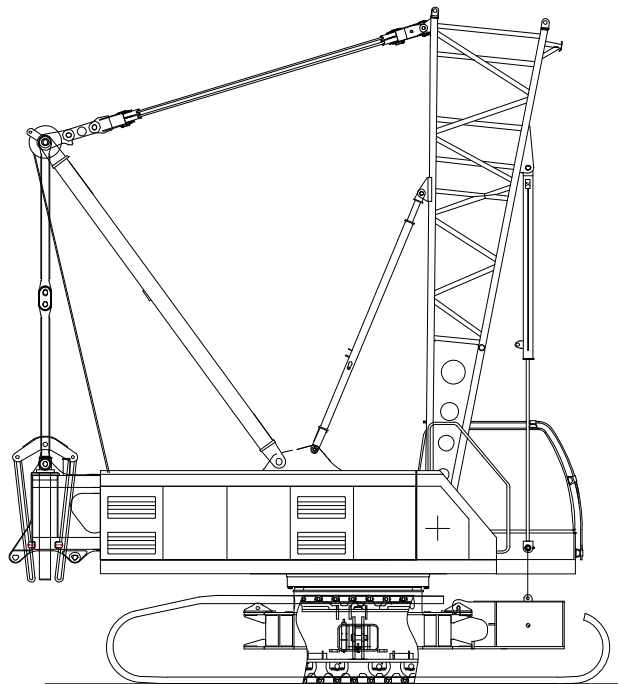


Figure 5-26 Attachment of central counterweight on the undercarriage central section

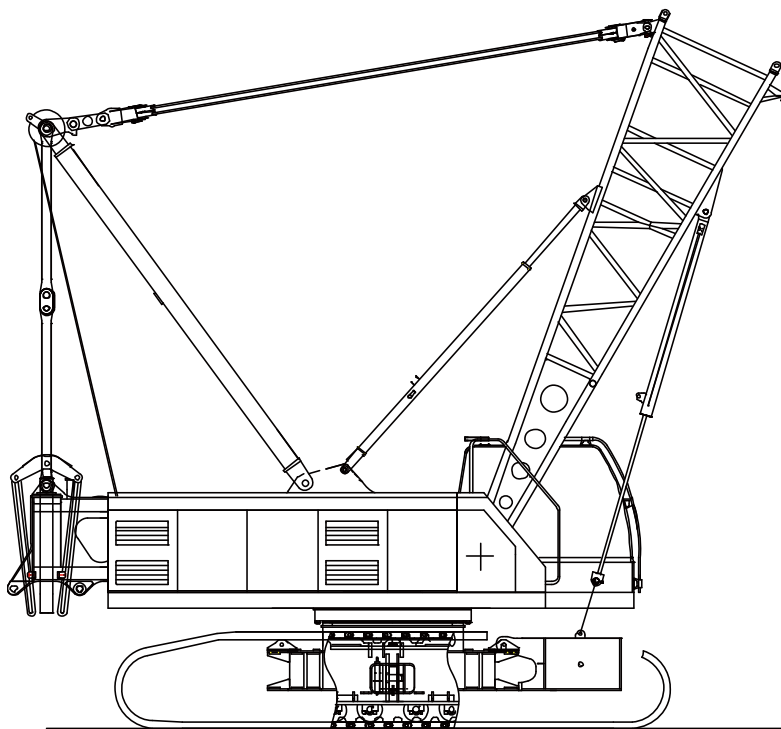
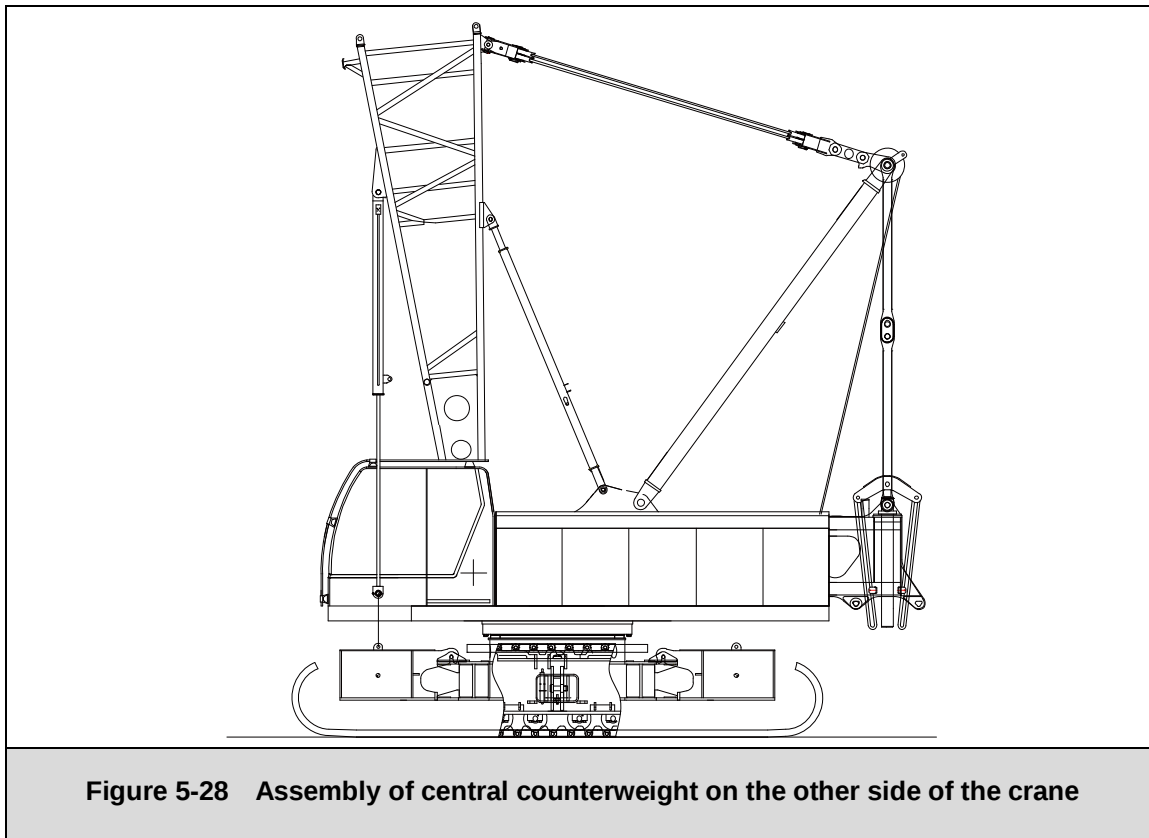


Figure 5-27 Pulling down the main boom pivot section

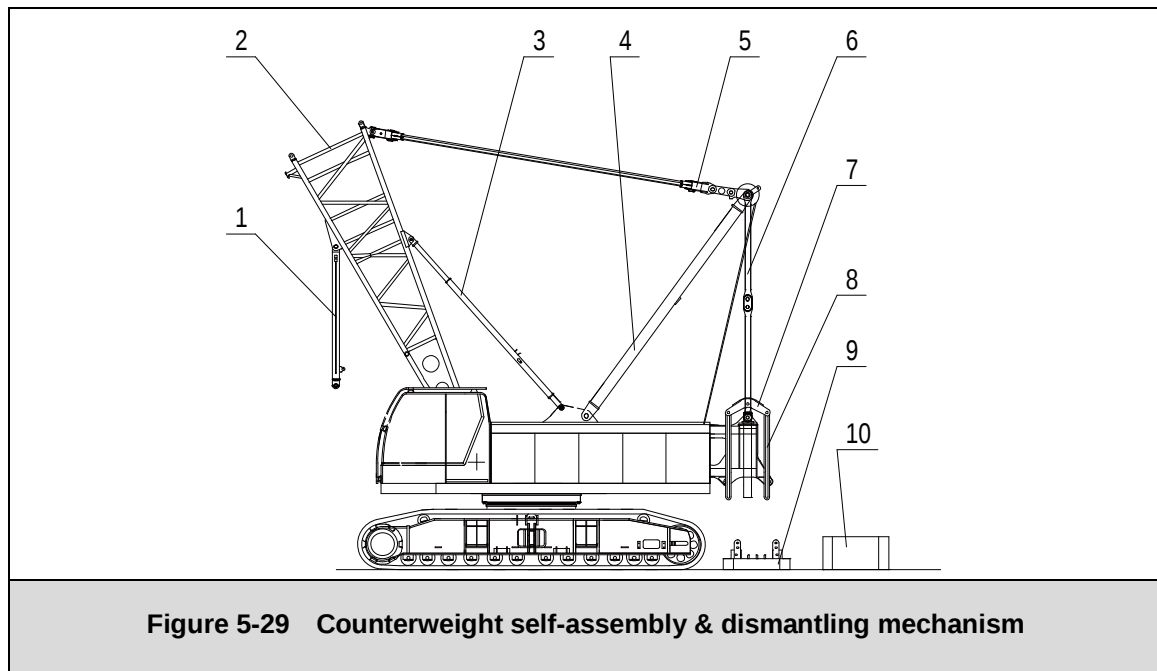
- h) The assembly of central counterweight on the other side of crane is performed in the same way. See the figure 5-28.



5.2.5 Self-assembly and dismantling of counterweight

5.2.5.1 Components of counterweight self-assembly & dismantling mechanism

Counterweight self-assembly & dismantling mechanism consists of mounting cylinder, rear anchoring rods of A-frame, A-frame, derricking pulley block, main boom pivot section, main boom tilting-back support, counterweight lifting cylinder and so on. It is mainly used to assemble counterweight plates onto the basic machine, or dismantle counterweight plates from the basic machine. See the figure 5-29 and the table 5-5.

**Table 5-5 Counterweight self-assembly & dismantling mechanism**

No.	Names of the components	No.	Names of the components
1	Mounting cylinder	6	Rear anchoring rods of A-frame
2	Main boom pivot section	7	Counterweight lifting cylinder
3	Main boom tilting-back support	8	Counterweight anchoring rods
4	A-frame	9	Counterweight base plate
5	Derricking pulley block	10	Counterweight plate

Procedure for assembling counterweight:

- Put counterweight plates on the counterweight base plate via mounting cylinder.
- Move basic machine until the counterweight lifting device at the tail of slewing table is aligned with the counterweight base plate.
- Connect counterweight anchoring rods.
- Lift counterweight to required position via counterweight lifting cylinder, and then fix the counterweight at the tail of slewing table.
- Lock counterweight plates by locking chains.

5.2.5.2 Unloading of rear counterweight

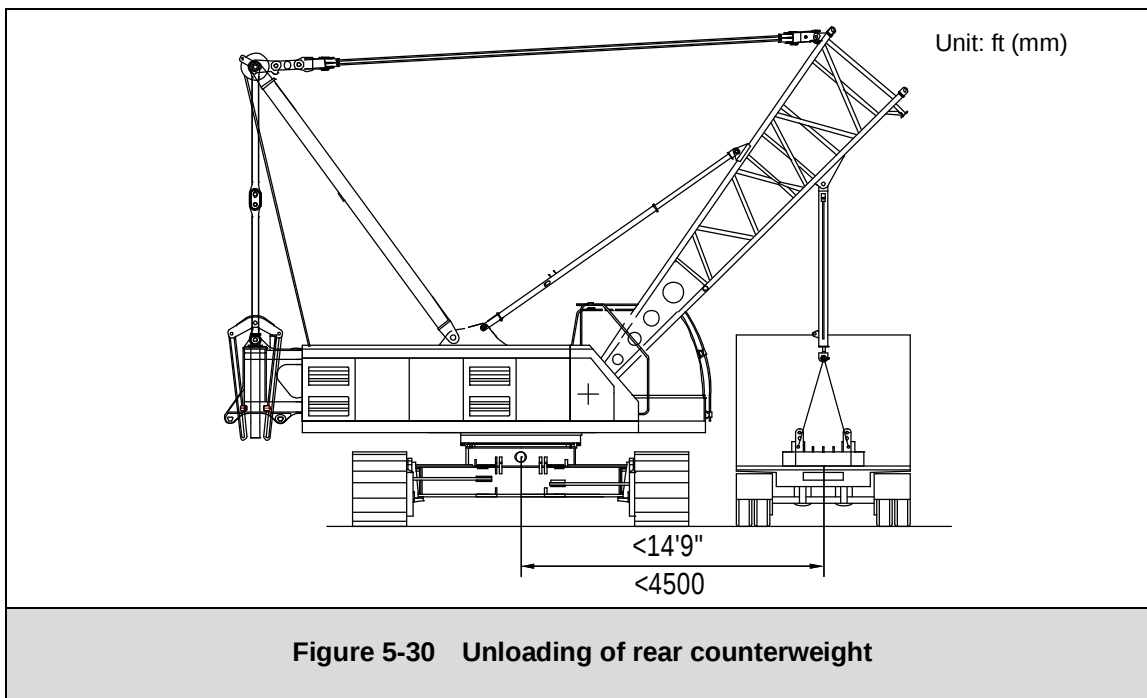
Make sure that the crawler carriers of crane are extended completely before assembling rear counterweight.

Procedure for unloading rear counterweight:

- Stop the counterweight transport vehicle at the side of basic machine.
- Lift the counterweight from the vehicle via mounting cylinder. (see the figure 5-30)

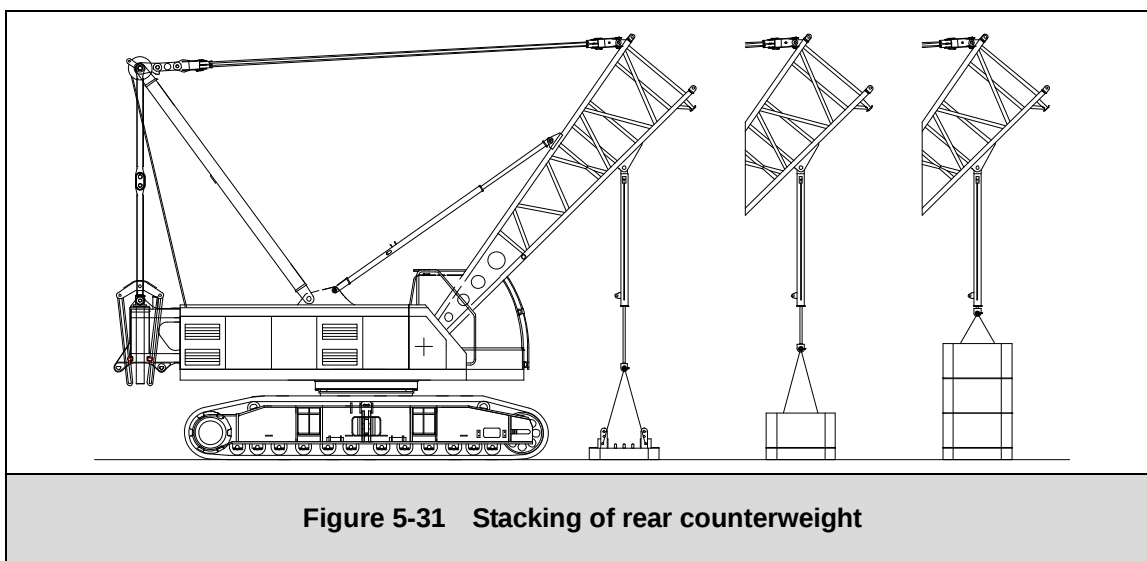
! DANGER

Make sure that the crawler carriers of the crane are extended completely before assembling rear counterweight.



5.2.5.3 Stacking of rear counterweight

Stack counterweight plates on the counterweight base plate via mounting cylinder. See the figure 5-31.

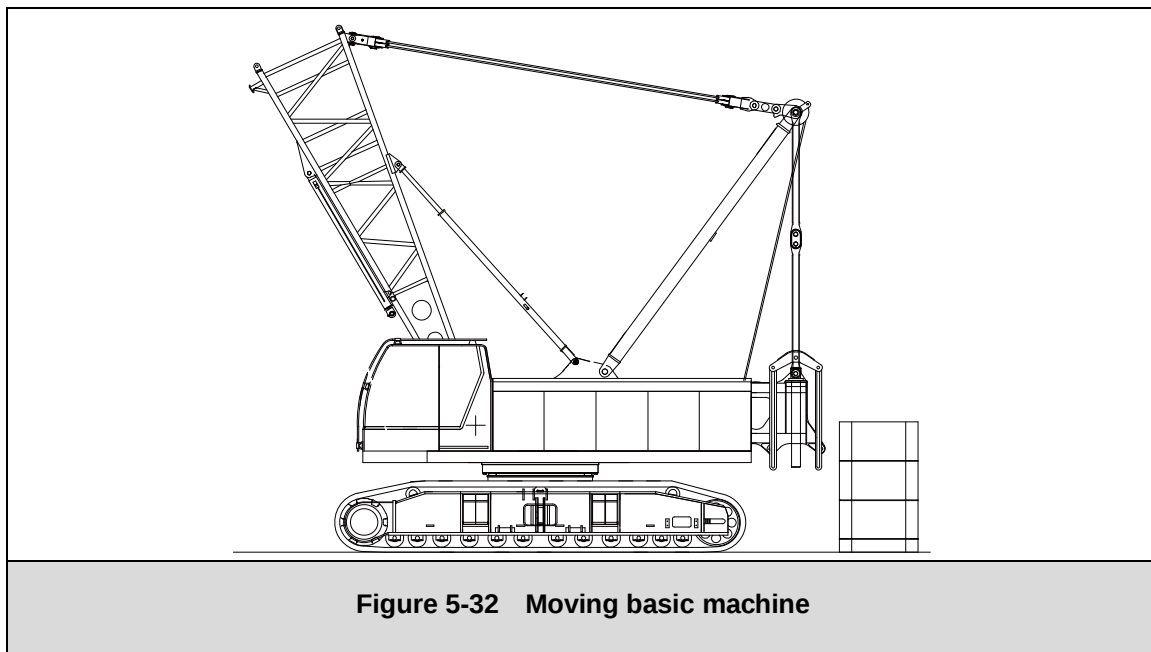


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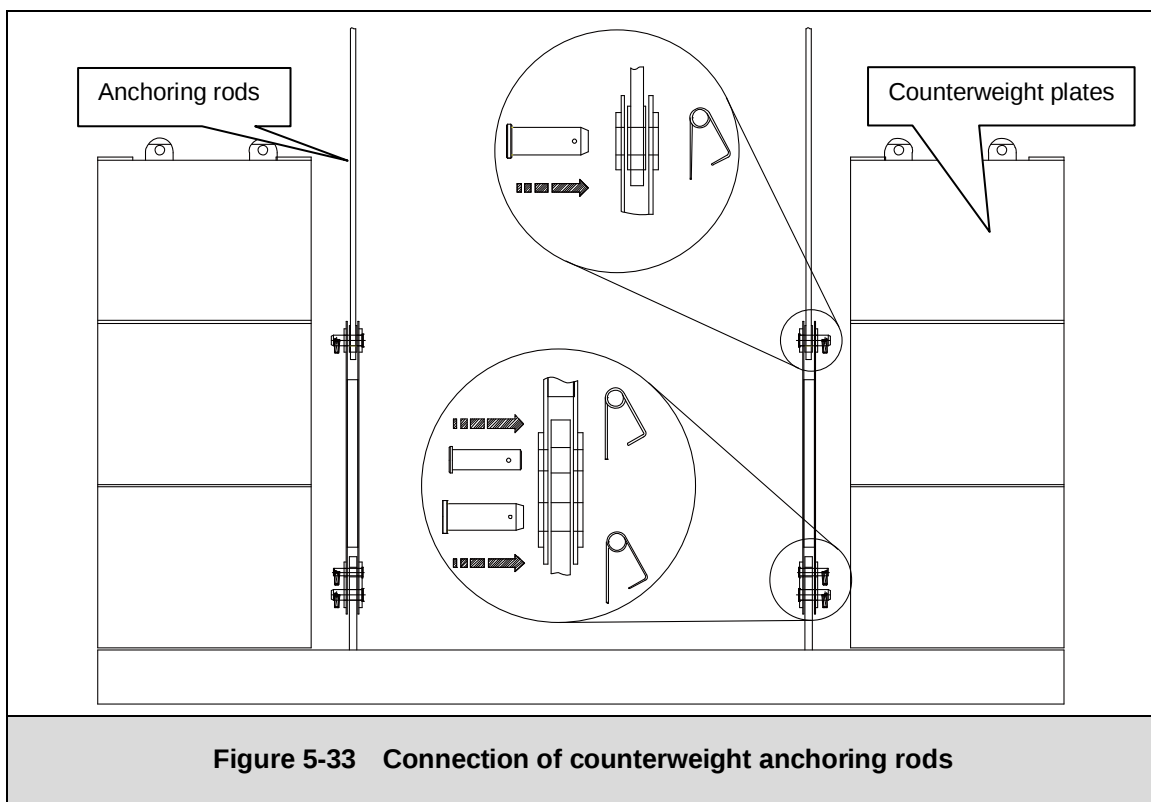
Arrange the counterweight plate neatly in a pile.

5.2.5.4 Lifting of rear counterweight

- a) Move basic machine until the axes of slewing table in longitudinal direction, traveling direction and central line of counterweight are aligned with each other. See the figure 5-32.



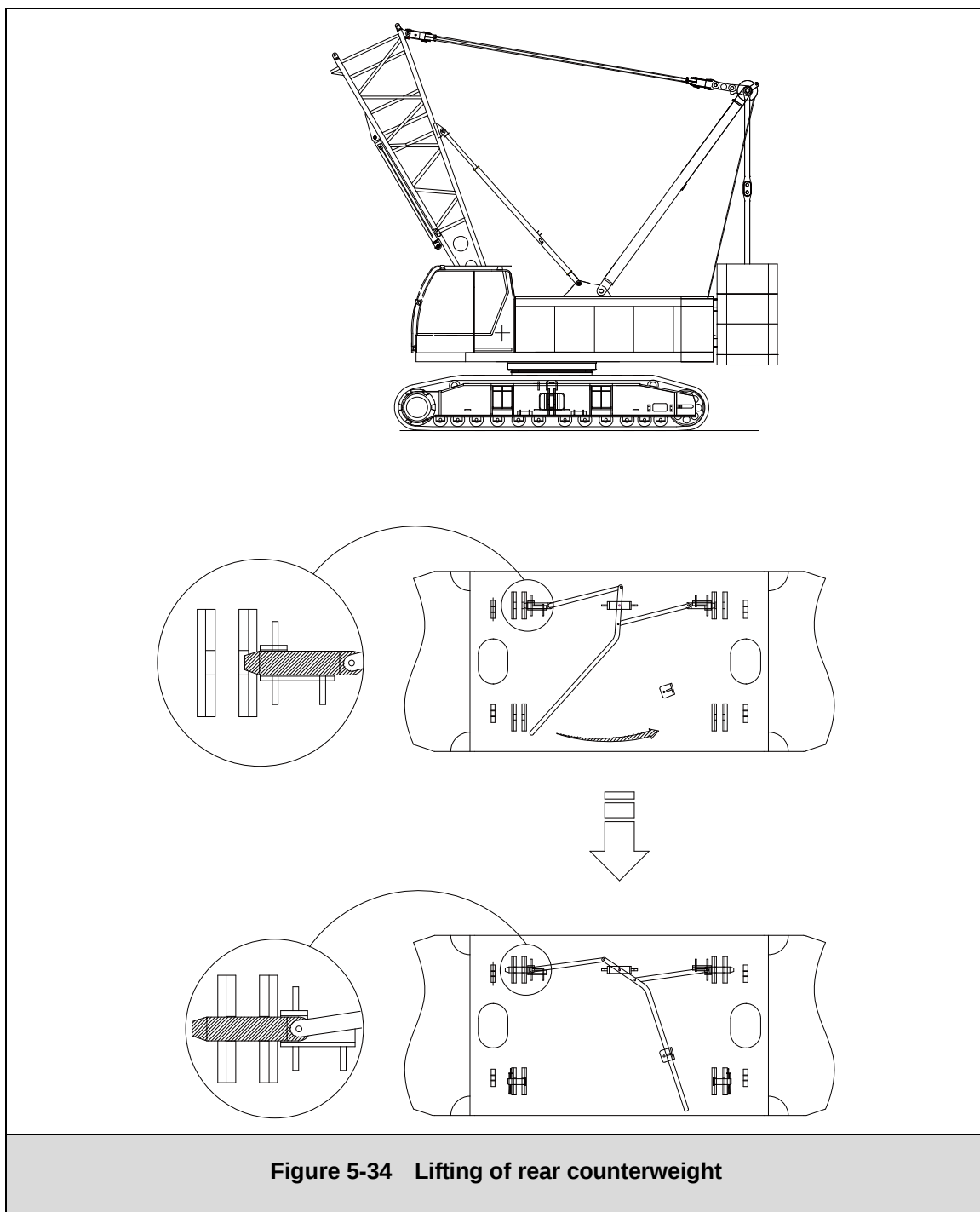
- b) Travel basic machine backwards until the counterweight lifting cylinder is positioned above the mounting hole of counterweight base plate. Connect counterweight anchoring rods. See the figure 5-33.





The pin spindle of counterweight anchoring rods must be inserted towards counterweight plate.

- c) Check if the counterweight plates are stacked neatly and the counterweight anchoring rods are connected properly.
- d) Establish electrical connection from auxiliary remote control box to junction box inside the slewing table, and then push "Counterweight lifting/undercarriage auxiliary device" selector switch to "counterweight lifting" position. For detailed information, please see section 4.5.8 in Chapter 4.
- e) Put the lever control mechanism for pin spindle in "pull out" position.
- f) Carefully and sensitively lift the counterweight until the mounting holes in the front of counterweight base plate is aligned with the mounting holes in the front of slewing table. Insert two fixing pins into the mounting holes via the lever control mechanism.
Adjust the counterweight lifting cylinder to make the mounting holes at the rear side of the counterweight base plate aligned with those of slewing table, and then insert two fixing pins into the mounting holes. See the figure 5-34.
- g) Retract counterweight lifting cylinder, and lock counterweight plate by the locking chains.



- (1) The counterweight plates must be arranged neatly in a pile, otherwise accidents will occur.

- (2) At the initial stage, the counterweight anchoring rods must drop down under its own weight, and it must be aligned with the mounting hole of counterweight base plate. Do not pull the anchoring rods diagonally, otherwise accidents will occur. If the counterweight plates at left and right sides of crane is not level during lifting, put counterweight down on the ground, check if the counterweight plates are stacked neatly, and then adjust lifting position of counterweight by moving crane forwards and backwards.
- (3) The counterweight lifting cylinder must be operated slowly and smoothly during lifting of counterweight. When the counterweight is lifted to required position, check if the counterweight lifting cylinder is aligned with the hole on the counterweight base plate, thus avoiding damaging the cylinder.
- (4) In any cases, the assembly and dismantling of counterweight must be performed by at least two persons.
- (5) The counterweight self-assembly & dismantling mechanism is only used for the assembly and dismantling of counterweight. It can not be used to lift other objects. Otherwise, the accident may occur.
- (6) The dismantling of counterweight is carried out in reverse order of assembly.

5.2.6 Fixation of mounting cylinder

Precondition for fixation of mounting cylinder:

- The crawler carrier, folding bracket, central counterweight and rear counterweight have been dismantled.
- Main boom pivot section is pulled to a proper position via mounting cylinder so that it can be lowered by itself.

Steps of fixing mounting cylinder:

- Raise main boom pivot section to a large angle position, and then fix piston rod on the pivot section.
- Lower main boom to a proper position so that the cylinder can be fixed on the pivot section, and then retract the cylinder.

5.2.6.1 Fixation of piston rod of mounting cylinder

Procedure for fixing piston rod of mounting cylinder:

- Pull down main boom pivot section with the help of mounting cylinder to a proper position so that the pivot section can be lowered by itself.
- Extend mounting cylinder completely.
- Fix piston rod of mounting cylinder on the position A of pivot section via a flexible strap. See figure 5-35.

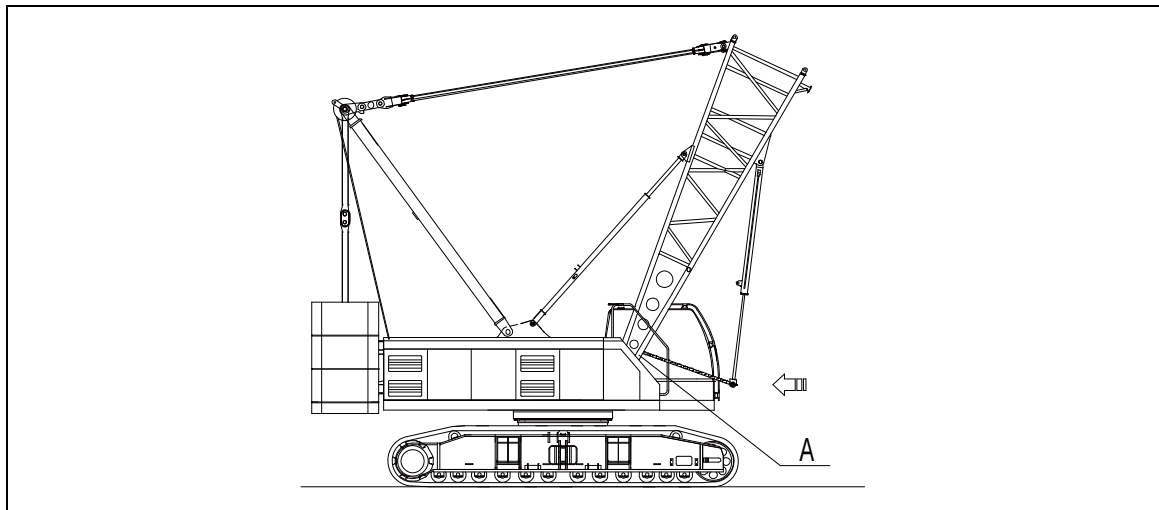


Figure 5-35 Fixation of piston rod of mounting cylinder

5.2.6.2 Fixation of mounting cylinder

Procedure for fixing mounting cylinder:

- Retract mounting cylinder, and then align the attachment point of mounting cylinder with the pin hole at position B on the pivot section.
- Lower main boom pivot section to a proper position so that the operator can fix the cylinder at position B on the pivot section underneath the boom.
- Remove the fixable strap.
- Retract the mounting cylinder completely. See figure 5-36.

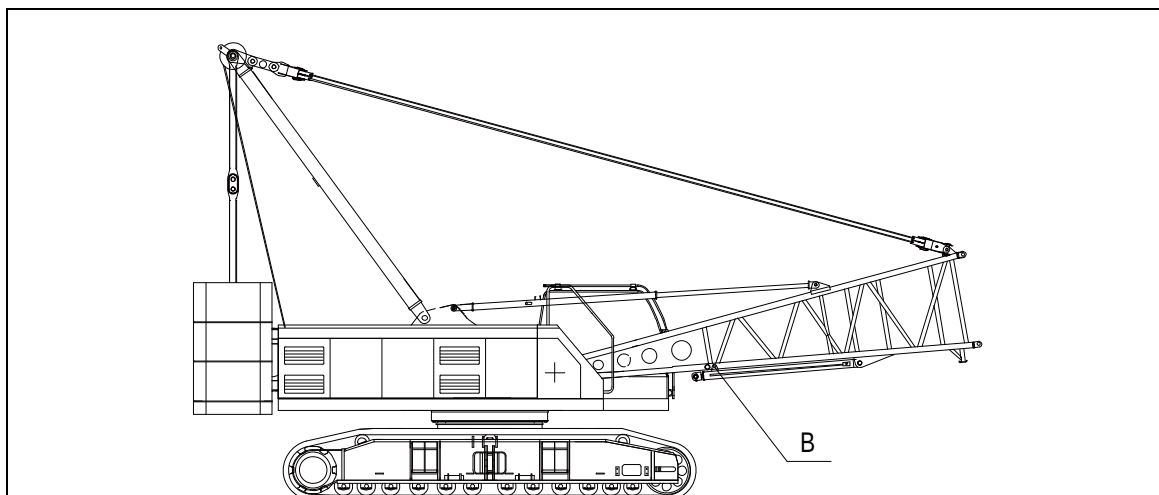


Figure 5-36 Fixation of mounting cylinder

5.3 Available boom configurations

There are two modes for ZCC1100H crawler crane: assembly mode and operating mode. For assembly mode, please refer to section 2.2. The operating mode will be described in the table 5-6.

Table 5-6 Available boom configurations for ZCC1100H crawler crane

Configuration no.	Description	Main boom length	Fixed jib length	Remarks
S-1	Main boom	42'8"(13m)-219'10" (67m)	No	The load is attached onto main boom.
S-2	Main boom with fixed jib	101'9"(31m)-180'5" (55m)	19'8"(6m)-59' (18m)	The load is attached onto main boom.
S-3	Main boom with tip boom	42'8"(13m)-200'2" (61m)	No	
SF-1	Main boom with fixed jib	101'9"(31m)-180'5" (55m)	19'8"(6m)-59' (18m)	The load is attached onto fixed jib.
SF-2	Main boom with fixed jib	101'9"(31m)-180'5" (55m)	19'8"(6m)-59' (18m)	Main boom is attached with a load hook. However, the load is attached onto fixed jib.

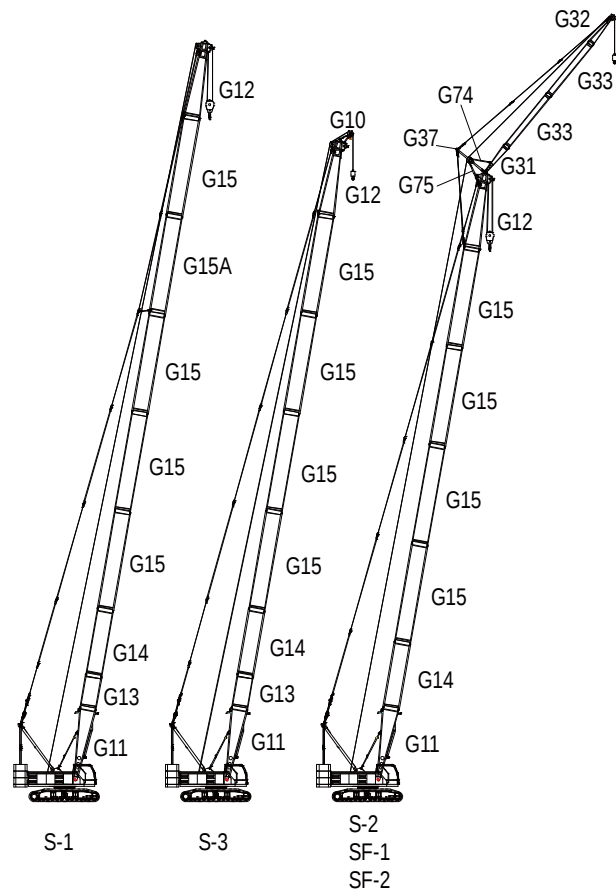


Figure 5-37 Available boom configurations

The components of boom frame in the figure 5-37 will be described in the table 5-7.

Table 5-7 Description of components of boom frame

Code	Names of the components	Length	Weight
G10	Tip boom on main boom head	/	337 lb (0.14t)
G11	Main boom pivot section	21'4" (6.5m)	2761 lb (1.25t)
G12	Main boom head	21'4" (6.5m)	2661 lb (1.21t)
G13	3m main boom intermediate section	9'10" (3m)	562 lb (0.25t)
G14	6m main boom intermediate section	19'8" (6m)	972 lb (0.44t)
G15	9m main boom intermediate section	29'6" (9m)	1393 lb (0.63t)
G15A	9m main boom intermediate section A	29'6" (9m)	1491 lb (0.68t)
G31	Fixed jib pivot section	9'10" (3m)	386 lb (0.18t)
G32	Fixed jib head	9'10" (3m)	492 lb (0.22t)

Code	Names of the components	Length	Weight
G33	6m fixed jib intermediate section	19'8" (6m)	362 lb (0.16t)
G37	FA-frame	/	545 lb (0.25t)
G70	Main boom tilting-back support	/	300 lb (0.14t)
G74	Front tilting-back support of fixed jib	/	102 lb (0.05t)
G75	Rear tilting-back support of fixed jib	/	78 lb (0.04t)

DANGER

- (1) It is prohibited to use any other boom configurations and anchoring rods combination that have not been stipulated in the operator's manual or installation drawings.
- (2) When assembling boom sections, make sure that the intermediate sections are assembled in their specified positions. Otherwise, there is a risk of accidents.

CAUTION

- (1) The principles for boom section combination and anchoring rods combination under SF-1 boom configuration are the same as those under S-2 and SF-2 boom configurations.
- (2) The principles for boom section combination and anchoring rods combination under S-3 boom configuration are the same as those under S-1 boom configuration.

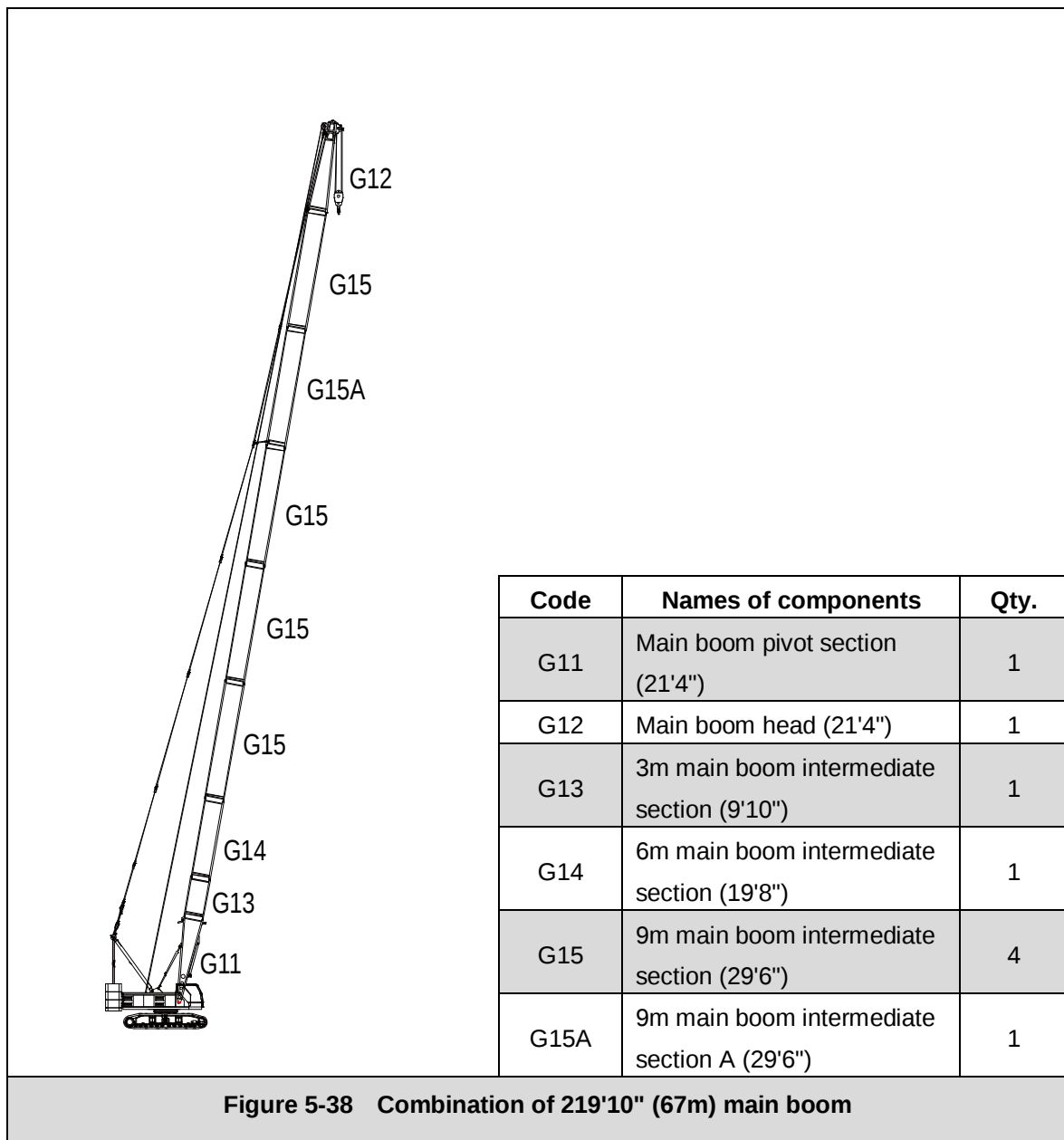
5.4 Boom configuration

5.4.1 Main boom (S-1)

5.4.1.1 Components of main boom (S-1)

Main boom, whose length varies from 42'8" (13m) to 219'10" (67m), consists of basic boom and main boom intermediate sections. The basic boom is 42'8" (13m) long, including main boom pivot section (G11) (21'4") and main boom head (G12) (21'4"). There are three types of main boom intermediate section: 3m main boom intermediate section (G13) (9'10"), 6m main boom intermediate section (G14) (19'8") and 9m main boom intermediate section (G15) (29'6").

The longest main boom of 219'10" (67m), overview:



When different length of main boom is required, crane operator only needs to disconnect main boom pivot section from main boom head, and then install main boom intermediate sections between them. In this way, main boom can be assembled to required length. The assembly of main boom from 42'8" (13m) to 219'10" (67m) is shown in the table 5-8.

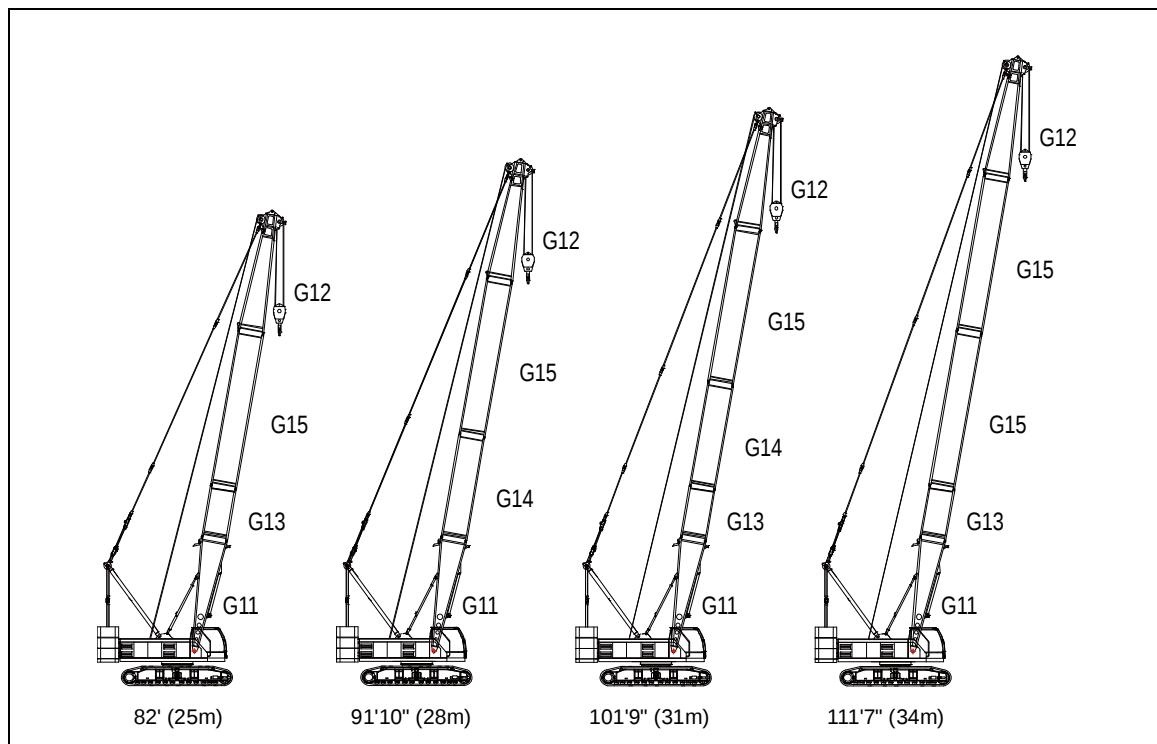
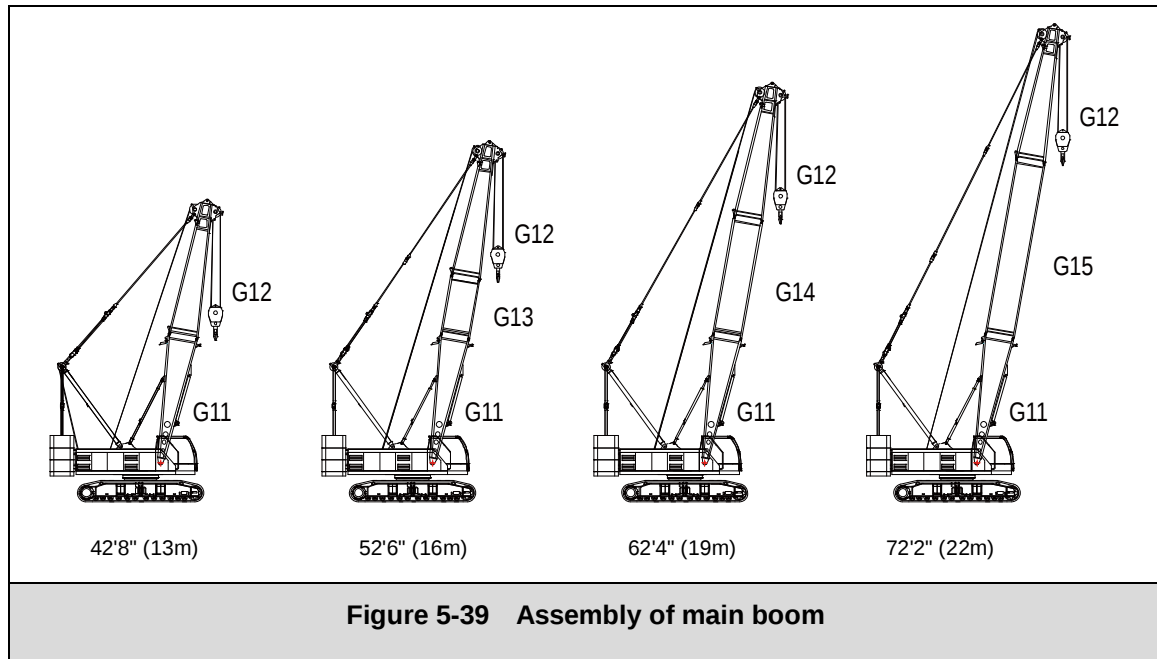
Table 5-8 Assembly of main boom

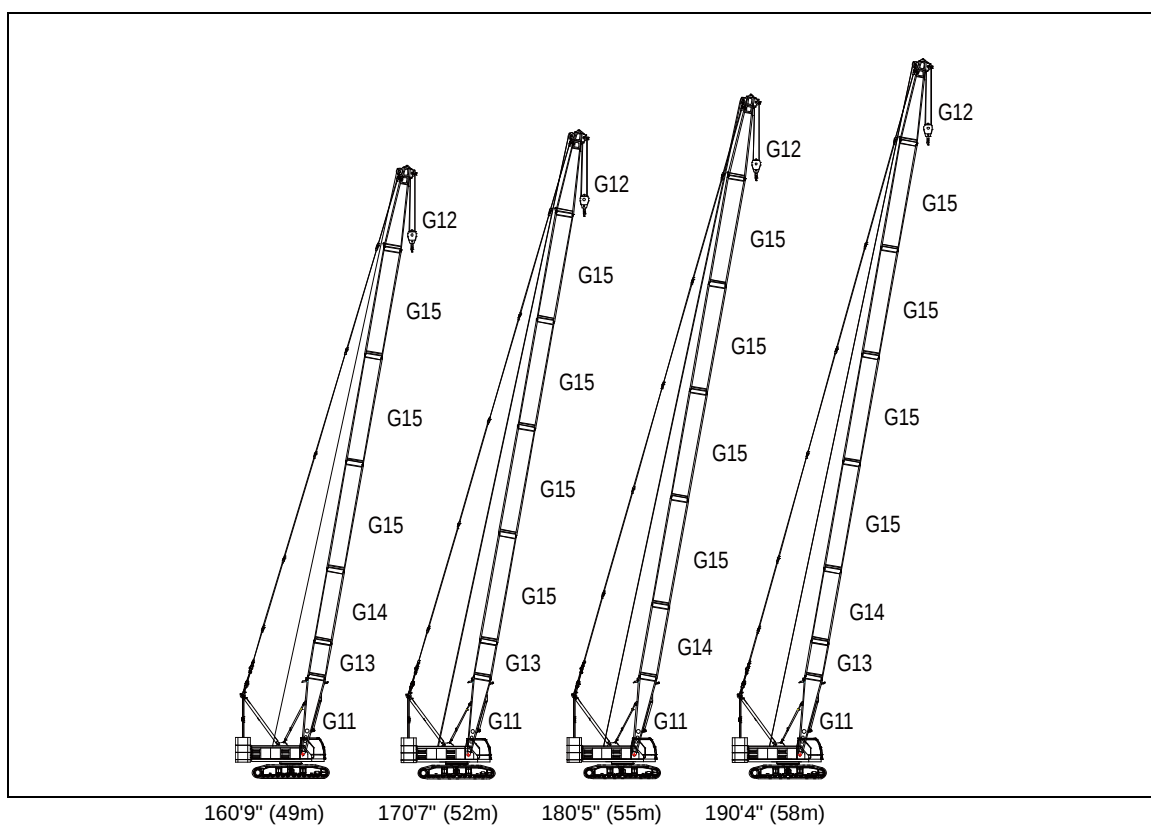
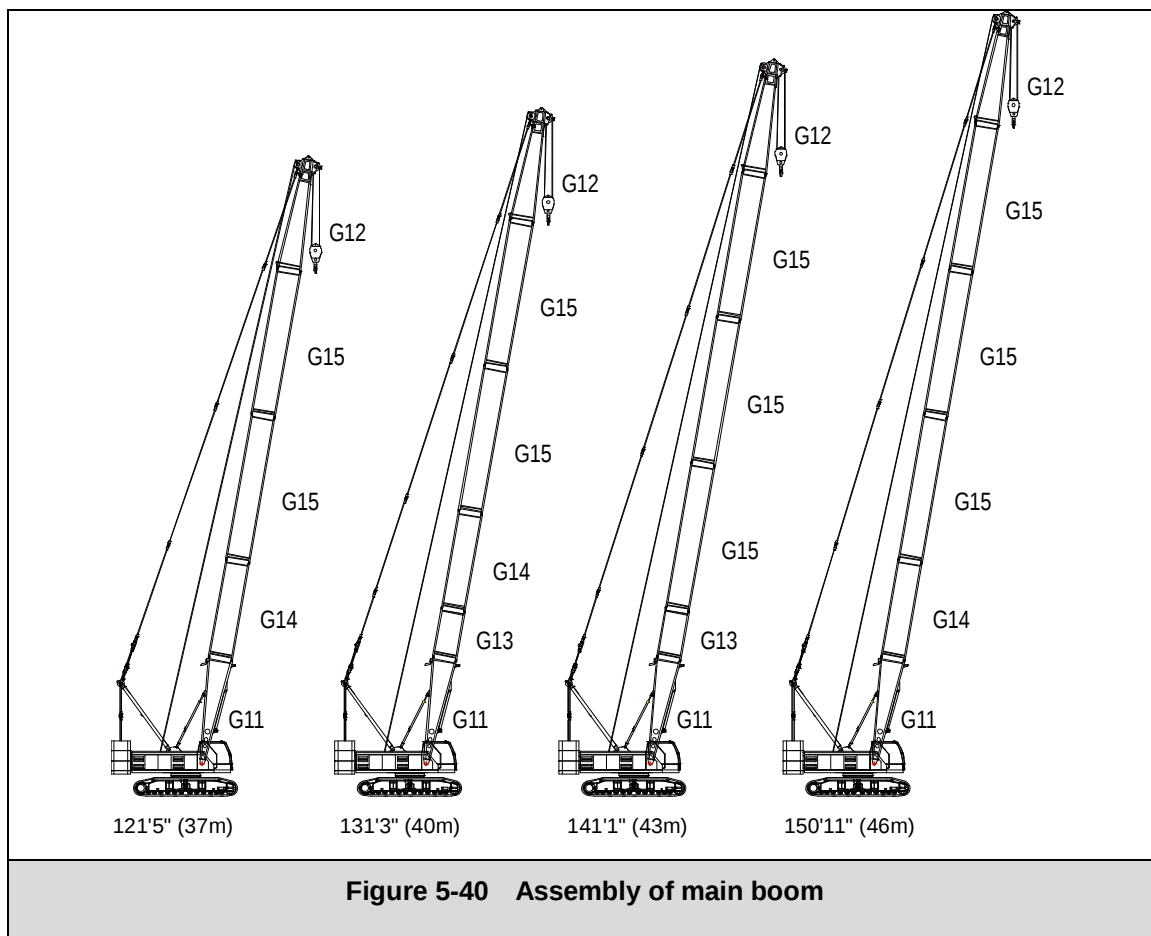
Main boom length	Assembly sequence of main boom sections	Main boom length	Assembly sequence of main boom sections
42'8"(13m)	G11+G12	141'1"(43m)	G11+G13+3×G15+G12
52'6"(16m)	G11+G13+G12	150'11"(46m)	G11+G14+3×G15+G12
62'4"(19m)	G11+G14+G12	160'9"(49m)	G11+G13+G14+3×G15+G12
72'2"(22m)	G11+G15+G12	170'7"(52m)	G11+G13+4×G15+G12
82'(25m)	G11+G13+G15+G12	180'5"(55m)	G11+G14+4×G15+G12
91'10"(28m)	G11+G14+G15+G12	190'4"(58m)	G11+G13+G14+4×G15+G12
101'9"(31m)	G11+G13+G14+G15+G12	200'2"(61m)	G11+G13+3×G15+G15A+G15+G12
111'7"(34m)	G11+G13+2×G15+G12	210'(64m)	G11+G14+3×G15+G15A+G15+G12
121'5"(37m)	G11+G14+2×G15+G12	219'10"(67m)	G11+G13+G14+3×G15+G15A+G15+G12
131'3"(40m)	G11+G13+G14+2×G15+G12		

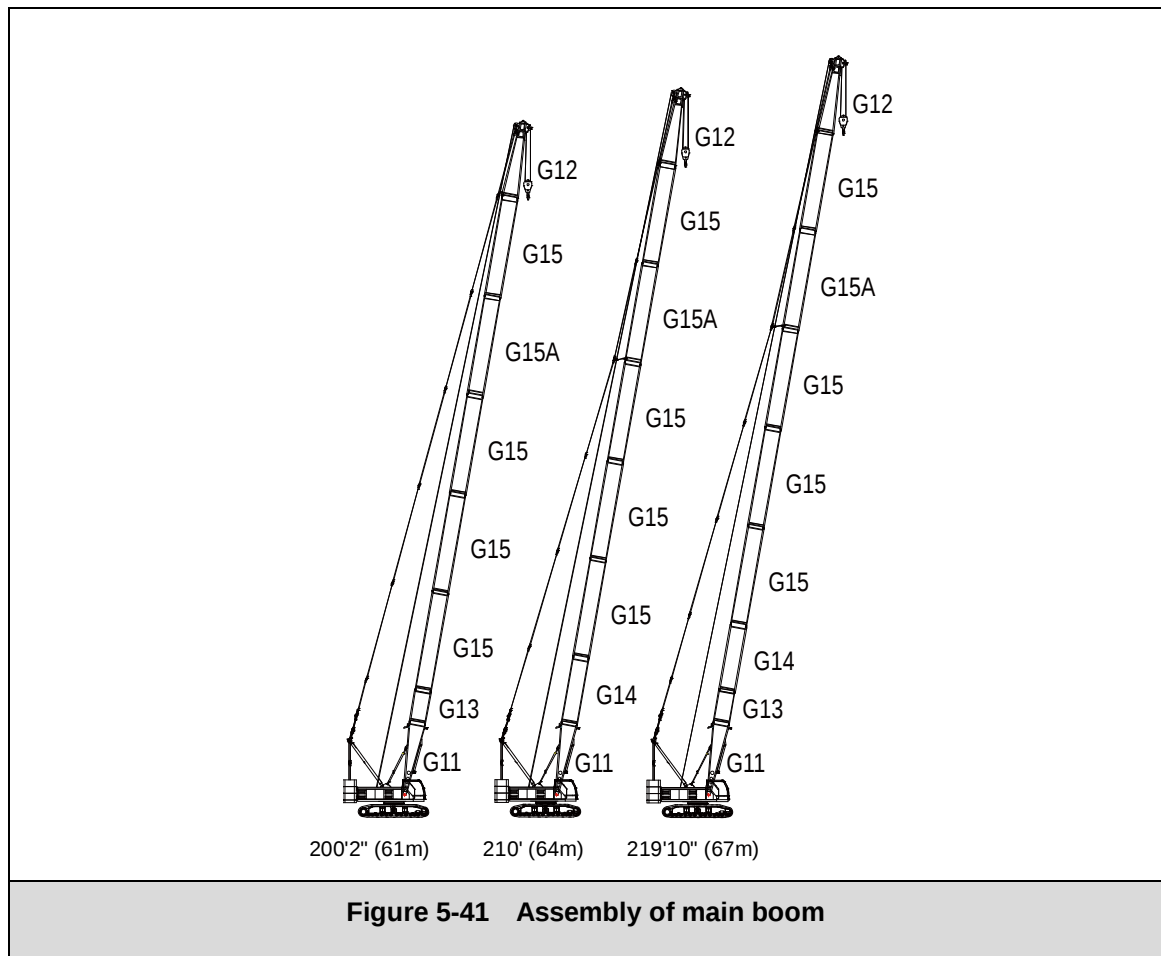


- (1) Principle for assembling main boom: when connecting main boom intermediate sections to main boom pivot section, always bolt the shorter intermediate sections first.
- (2) The combination of 219'10" (67m) main boom in above table is preferable combination.
- (3) The tip boom can be assembled on main boom mentioned above, except for 210' (64m) and 219'10" (67m) main boom.
- (4) Intermediate tensioner must be fitted on 210' (64m) and 219'10" (67m) main boom.

Main boom of different length can be assembled according to the figures 5-39, 5-40, 5-41.





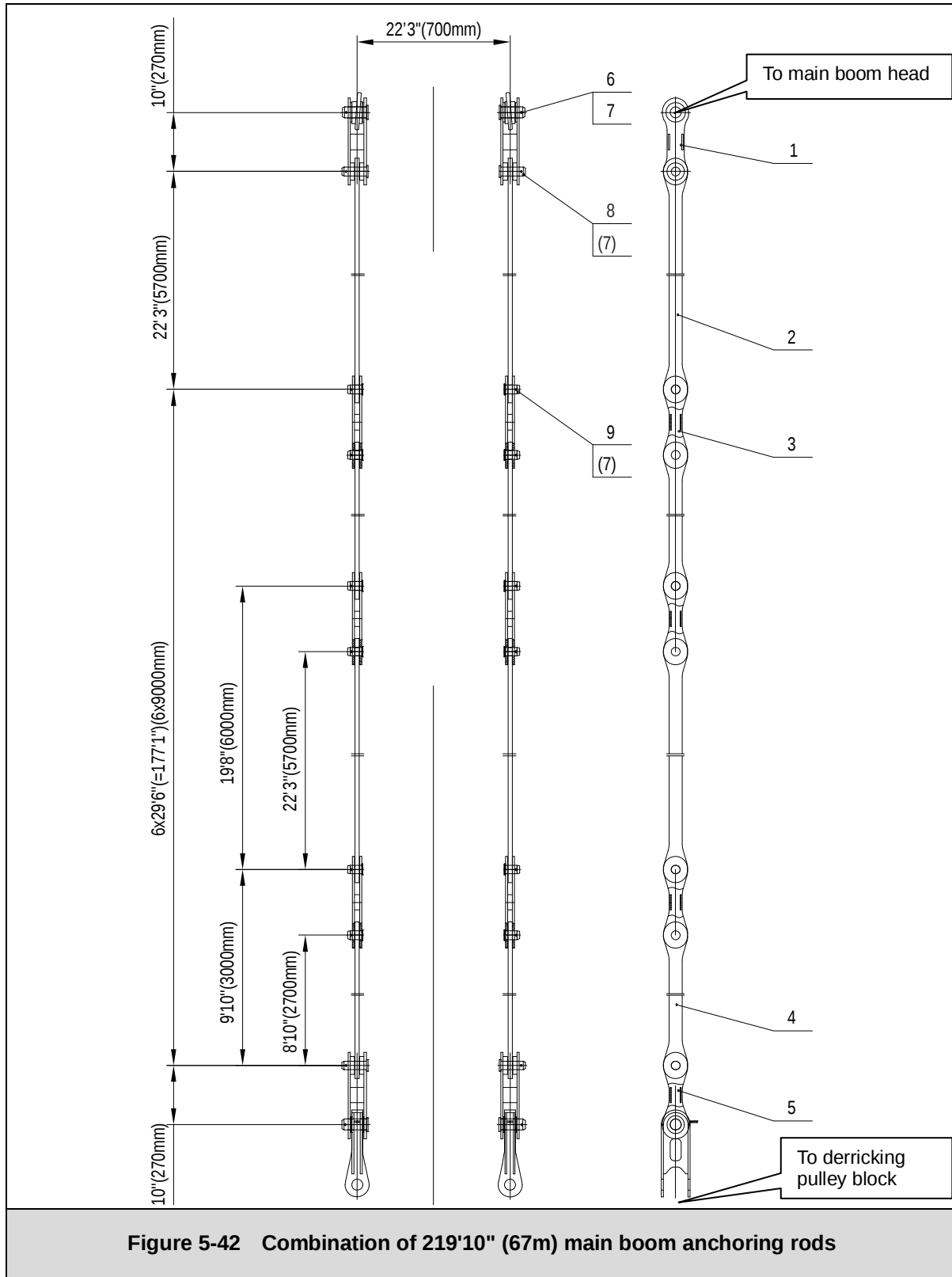


! DANGER

- (1) The combination of 219'10" (67m) main boom in above figure is preferable combination.
- (2) No person is allowed to stand inside the boom or beneath it during the assembly of main boom.

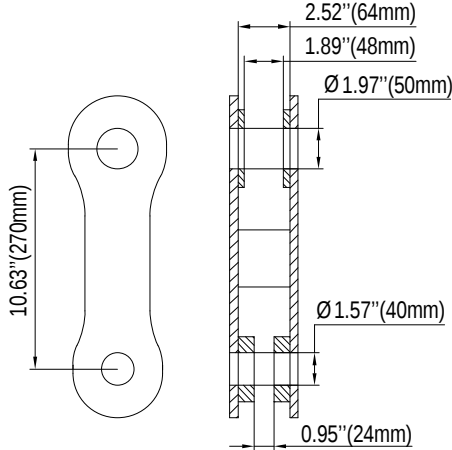
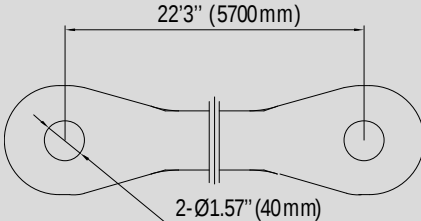
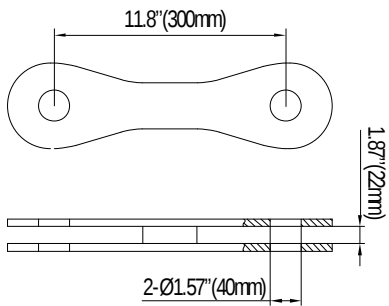
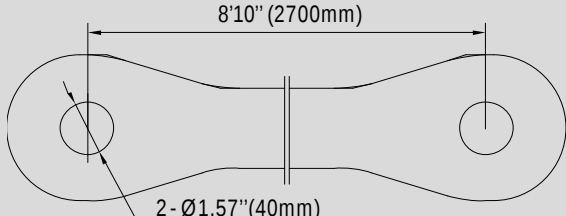
5.4.1.2 Combination of main boom anchoring rods

Now, we will illustrate the connecting methods for 219'10" (67m) main boom anchoring rods. Please see the figure 5-42.



The explanation of component numbers in the figure 5-42 is shown in the table 5-9.

Table 5-9 Components of main boom anchoring rods

No.	Names of the components	Illustration
1	Double anchoring rod	
2	Single anchoring rod	
3	Double anchoring rod	
4	Single anchoring rod	

No.	Names of the components	Illustration
5	Double anchoring rod	
6	Pin spindle	
7	Retaining pin	
8	Pin spindle	
9	Pin spindle	



- (1) The component numbers of main boom anchoring rods given in the figure 5-42 "Combination of 219'10" (67m) main boom anchoring rods" are consistent with those in the table 5-9, so the components of anchoring rods can be found by referring to the component numbers.
- (2) The pin spindle must be inserted outwards.

Principle for determining the length of main boom anchoring rods:

When basic boom is 42'8" (13m) long, the length of anchoring rods must be 20'6" (6240mm).

There are three kinds of anchoring rods in accordance with main boom length: 9'10" (3m), 19'8" (6m) and 29'6" (9m).

When main boom length increases by 9'10" (3m), anchoring rods length will also increase 9'10" (3m), which includes a 11.8" (300mm) long anchoring rod and a 8'10" (2700mm) anchoring rod.

When main boom length increases by 19'8" (6m), anchoring rods length will also increase 19'8" (6m), which includes a 11.8" (300mm) long anchoring rod and a 18'8" (5700mm) anchoring rod.

The diameter of pin spindle for main boom anchoring rods is 1.969" (50mm).

Combination of main boom anchoring rods in "main boom" configuration is shown in the figure 5-43.

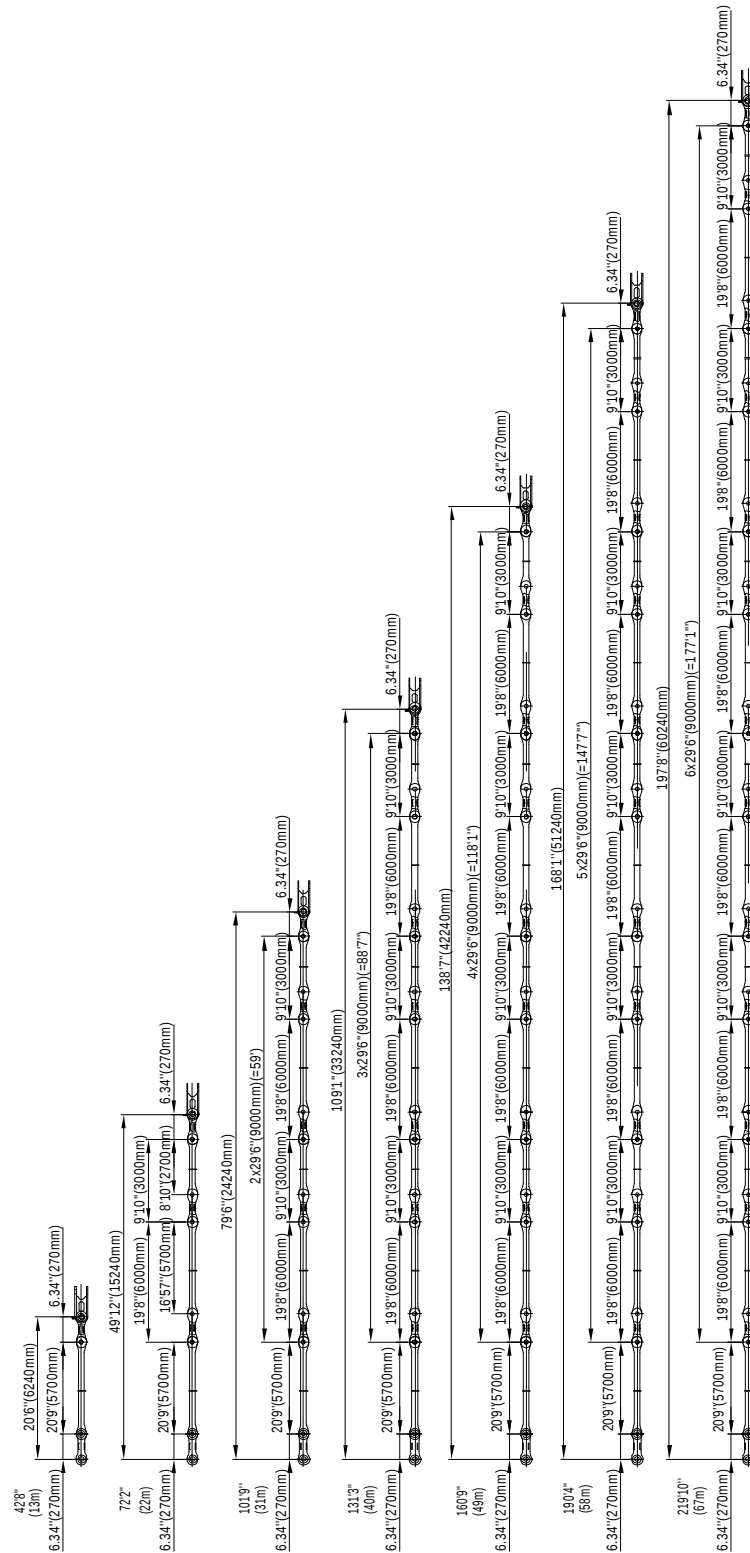
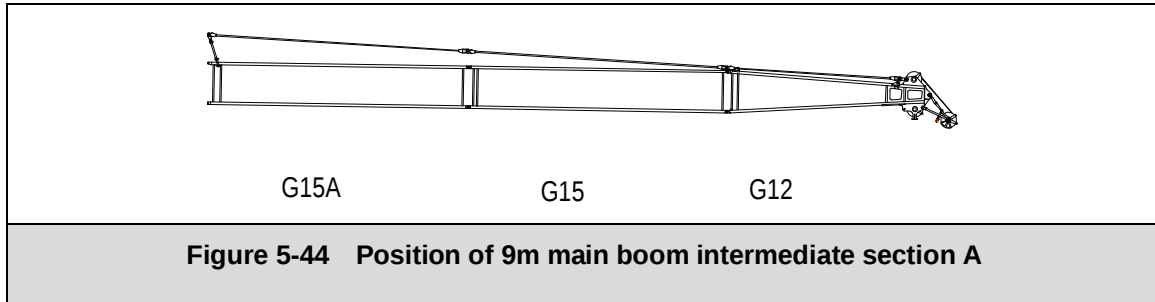


Figure 5-43 Combination of main boom anchoring rods

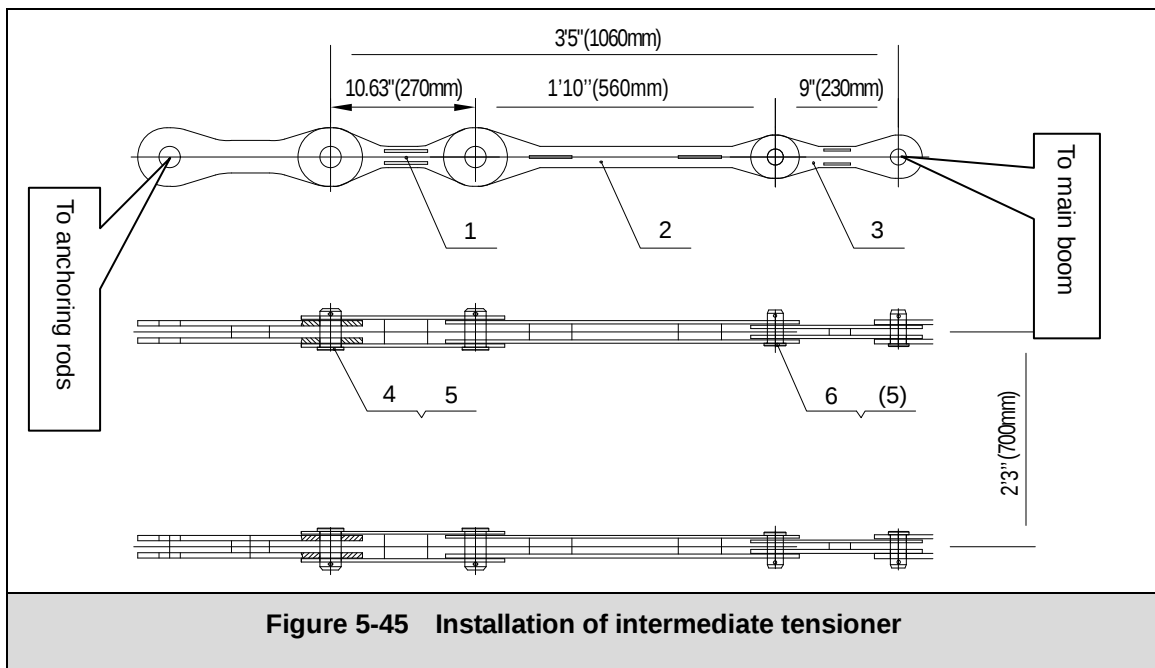
5.4.1.3 Installation of intermediate tensioner

Under main boom configuration, when main boom length is 210' (64m) or 219'10" (67m), the intermediate tensioner must be fitted.

At this time, 9m main boom intermediate section A (code: G15A, length: 29'6") must be used. Its position is shown in the figure 5-44.

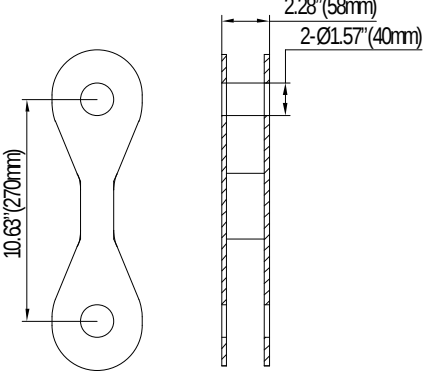
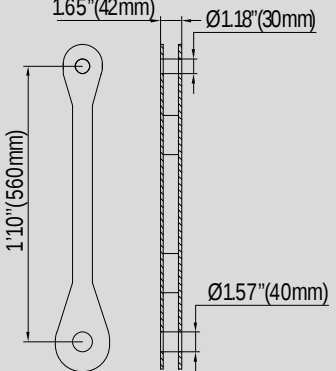
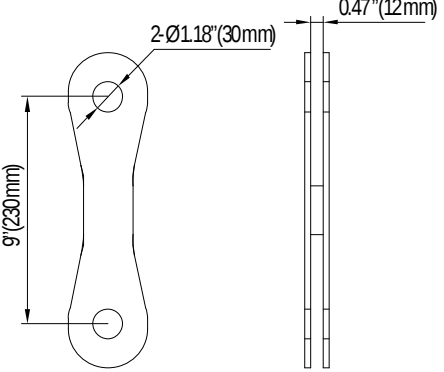
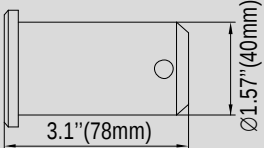


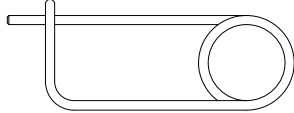
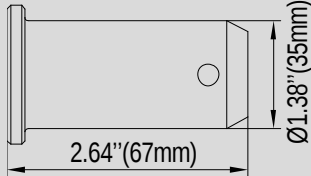
Installation of intermediate tensioner is shown as follows:



The component numbers in the figure 5-45 will be described in the table 5-10.

Table 5-10 Components of intermediate tensioner

No.	Names of the components	Illustration
1	Double anchoring rod	
2	Double anchoring rod	
3	Double anchoring rod	
4	Pin spindle	

No.	Names of the components	Illustration
5	Retaining pin	
6	Pin spindle	

! DANGER

The component numbers of intermediate tensioner given in the figure 5-45 “Installation of intermediate tensioner” are consistent with those in the table 5-10, so the components of intermediate tensioner can be found by referring to the component numbers.

5.4.2 Main boom with fixed jib (SF-1)

5.4.2.1 Components of fixed jib

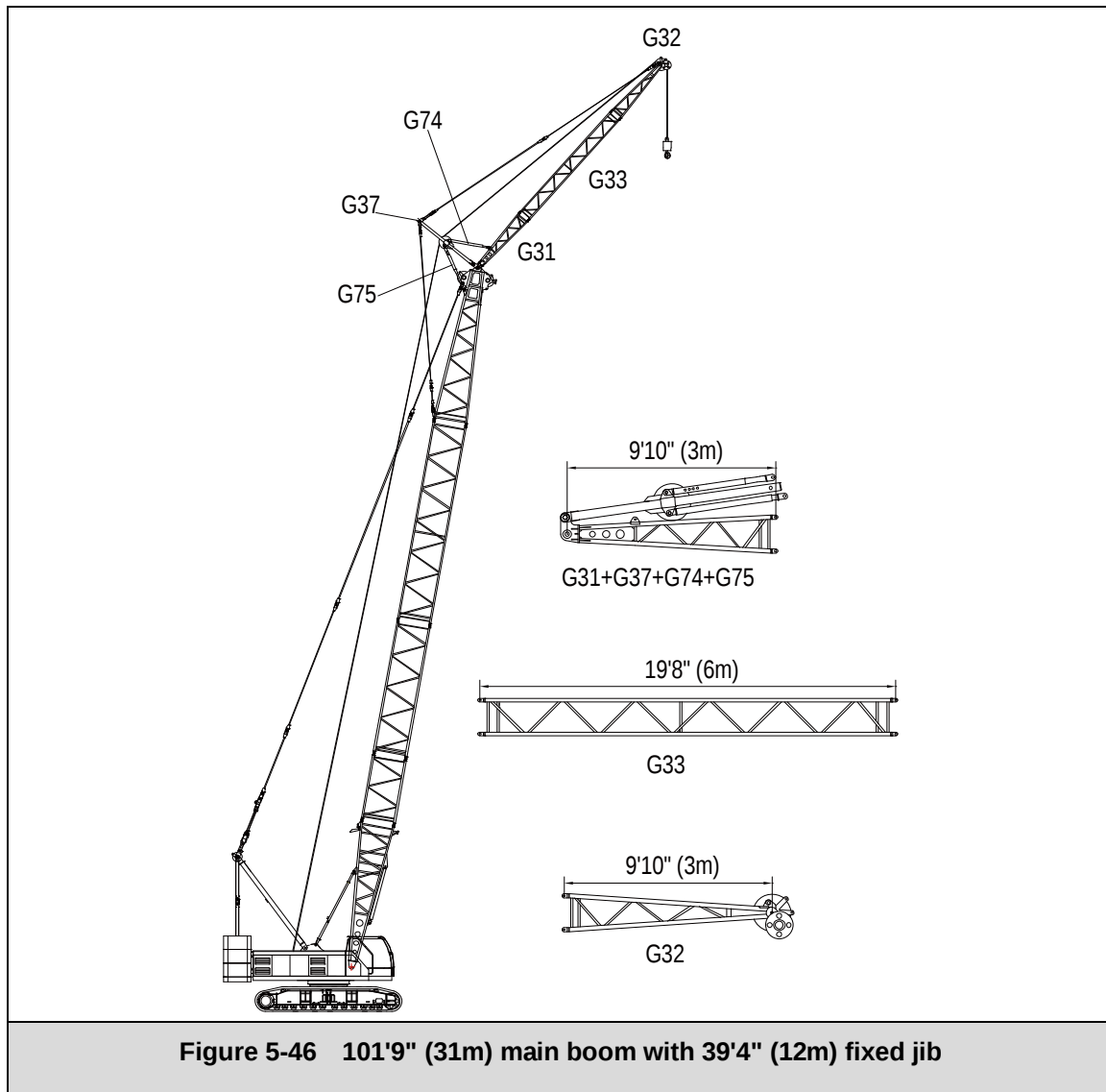
For "Main boom with fixed jib" configuration, main boom length varies from 101'9" (31m) to 180'5" (55m), and fixed jib length varies from 19'8" (6m) to 59'1" (18m).

The fixed jib consists of fixed jib pivot section (G31), fixed jib head (G32) and fixed jib intermediate section (G33). Both fixed jib pivot section and fixed jib head are 9'10" (3m) long, while fixed jib intermediate section is 19'8" (6m) long. The fixed jib can be mounted in the angle of either 10° or 30° to main boom.

When fixed jib of different length is required, the operator only needs to disconnect fixed jib pivot section from fixed jib head, and then install fixed jib intermediate sections between them. In this way, the fixed jib can be assembled to required length.

Main boom sections in this boom configuration are bolted together in the same way as that in "main boom" configuration.

101'9" (31m) main boom with 39'4" (12m) fixed jib, overview:



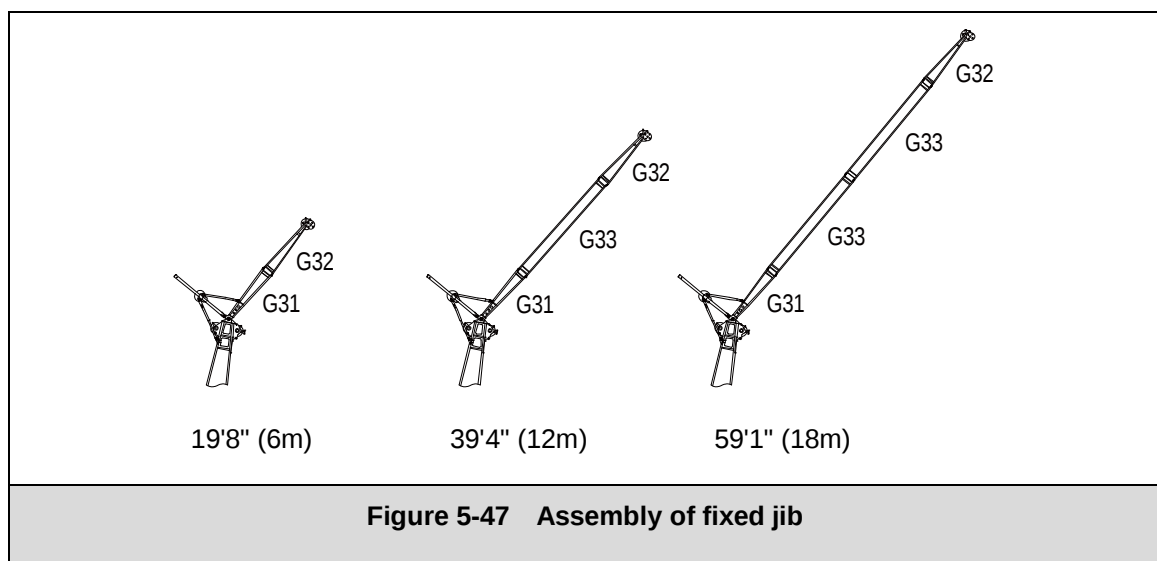
Fixed jib can be assembled to required three lengths of 19'8" (6m), 39'4" (12m) and 59'1" (18m). See the figure 5-47 and table 5-11.

Table 5-11 Assembly of fixed jib

Fixed jib length	Assembly sequence of fixed jib sections	Fixed jib length	Assembly sequence of fixed jib sections
19'8" (6m)	G31+G32	59'1" (18m)	G31+G33×2+G32
39'4" (12m)	G31+G33+G32		

DANGER

Main boom sections and main boom anchoring rods in this boom configuration are bolted together in the same way as those in "main boom" configuration (The main boom length in "Main boom with fixed jib" configuration varies from 101'9" (31m) to 180'5" (55m). For the detailed information, refer to Section 5.4.1.



5.4.2.2 Components of fixed jib anchoring rods

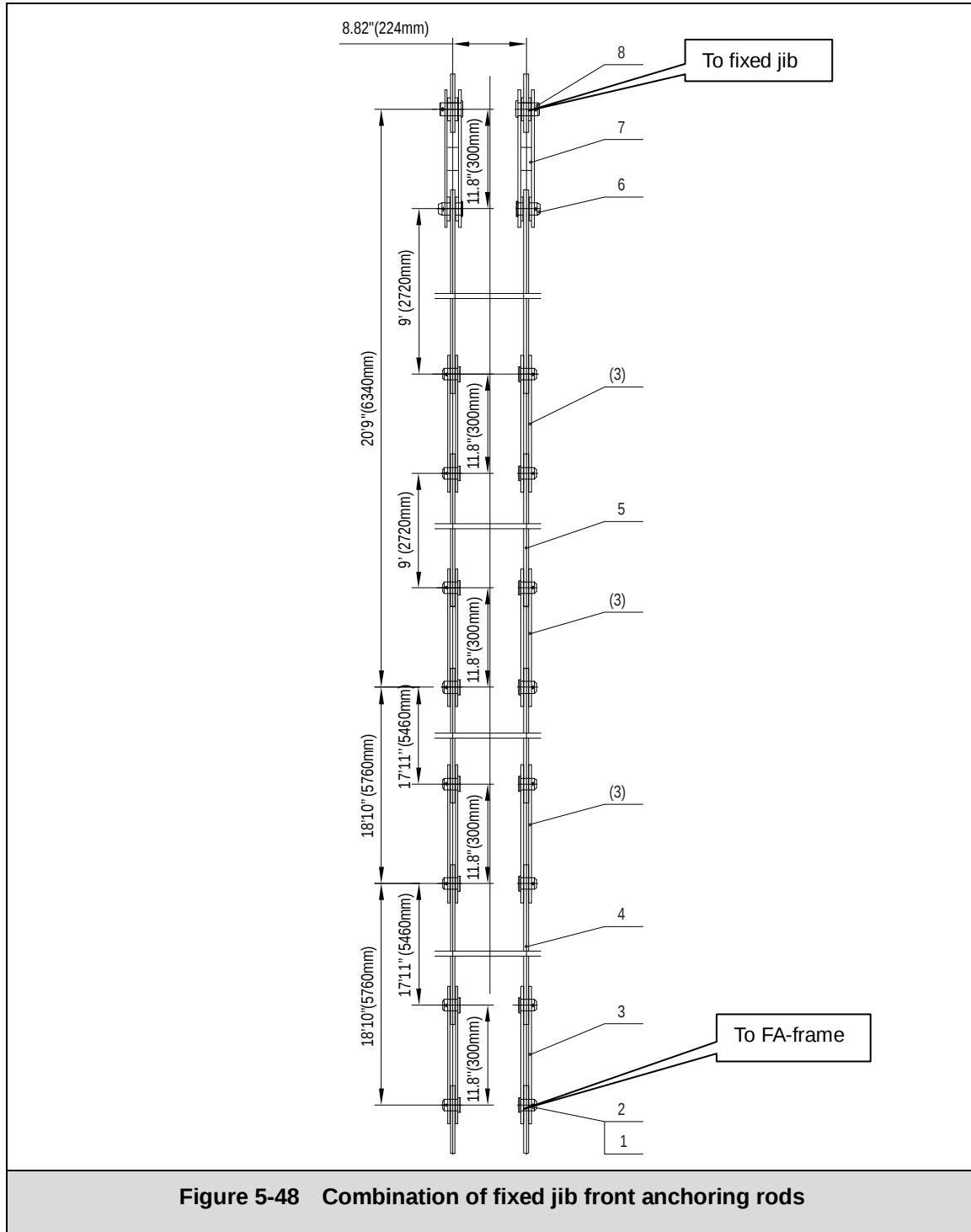
The anchoring rods under "main boom with fixed jib" configuration comprises main boom anchoring rods, fixed jib front anchoring rods and fixed jib rear anchoring rods.

For the components of main boom anchoring rods, see Section 5.4.1.2 "Combination of main boom anchoring rods". (The main boom length in "Main boom with fixed jib" configuration varies from 101'9" (31m) to 180'5" (55m).)

The combination of fixed jib anchoring rods is described as follows.

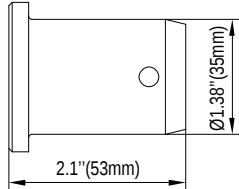
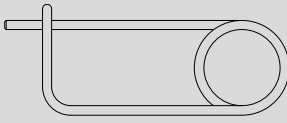
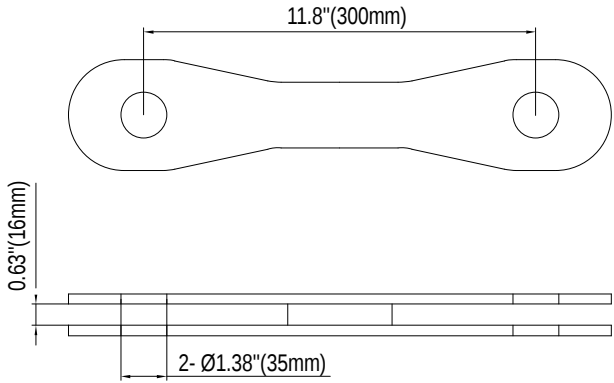
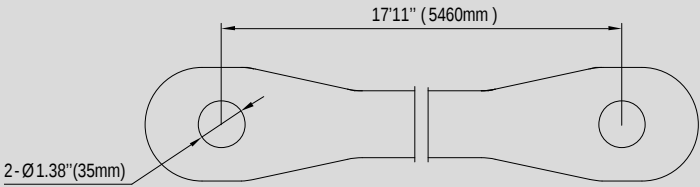
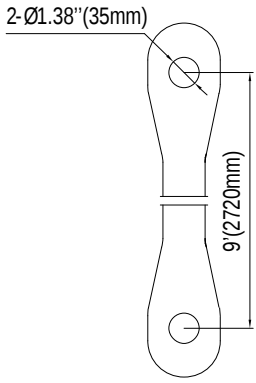
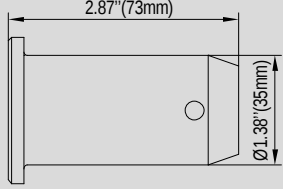
Fixed jib front anchoring rods:

When fixed jib is 59' (18m) long, fixed jib front anchoring rods are composed of the following components as shown in the figure 5-48.



The explanation of component numbers in the figure 5-48 is shown in the table 5-12.

Table 5-12 Components of fixed jib front anchoring rods

No.	Names of the components	Illustration
1	Pin spindle	
2	Retaining pin	
3	Double anchoring rod	
4	Anchoring rod	
5	Single anchoring rod	
6	Pin spindle	

No.	Names of the components	Illustration
7	Double anchoring rod	
8	Pin spindle	

CAUTION

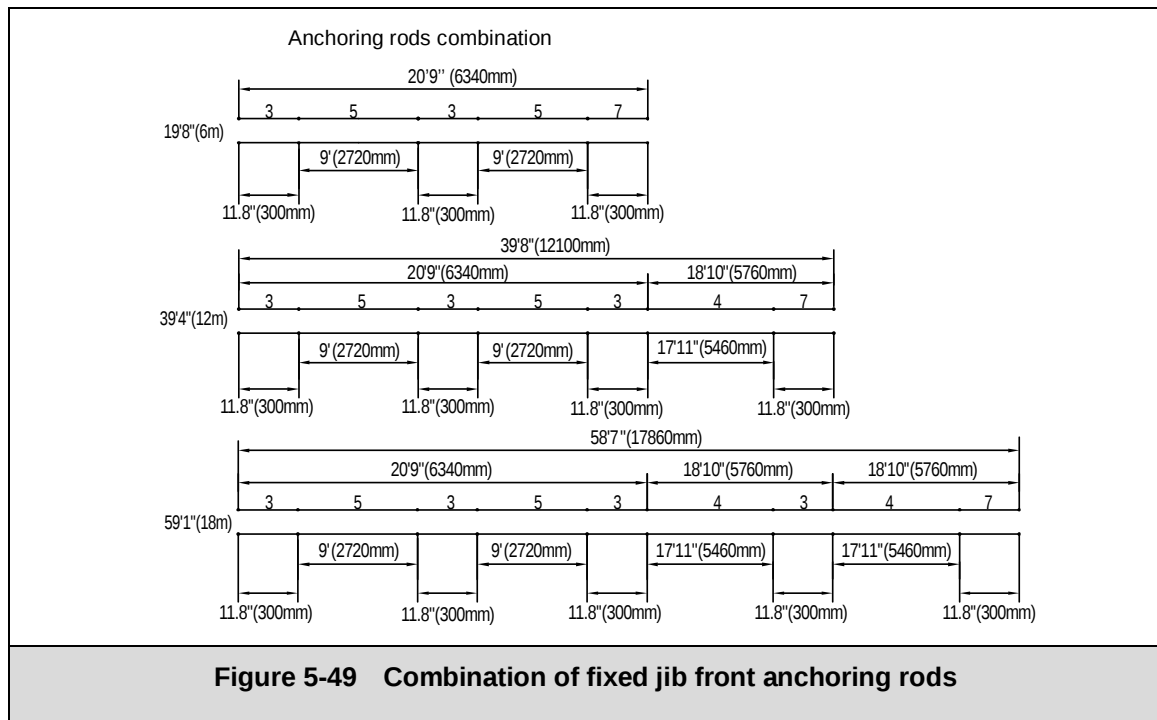
The component numbers of anchoring rods mentioned in “Figure 5-48 Combination of fixed jib front anchoring rods” are consistent with those in the above table, so the components of anchoring rods can be found by referring to the component numbers during assembling.

Principle for determining the length of fixed jib front anchoring rods:

When fixed jib is 19'8" (6m) long, the length of fixed jib front anchoring rods must be 22'1.367" (6740mm).

When fixed jib length increases by 19'8" (6m), a 18'10.783" (5760mm) anchoring rod (part 9) must be added accordingly. The diameter of pin spindle is 1.575" (40mm).

Combination of fixed jib front anchoring rods in “Main boom with fixed jib” configuration is shown in the following figure:



CAUTION

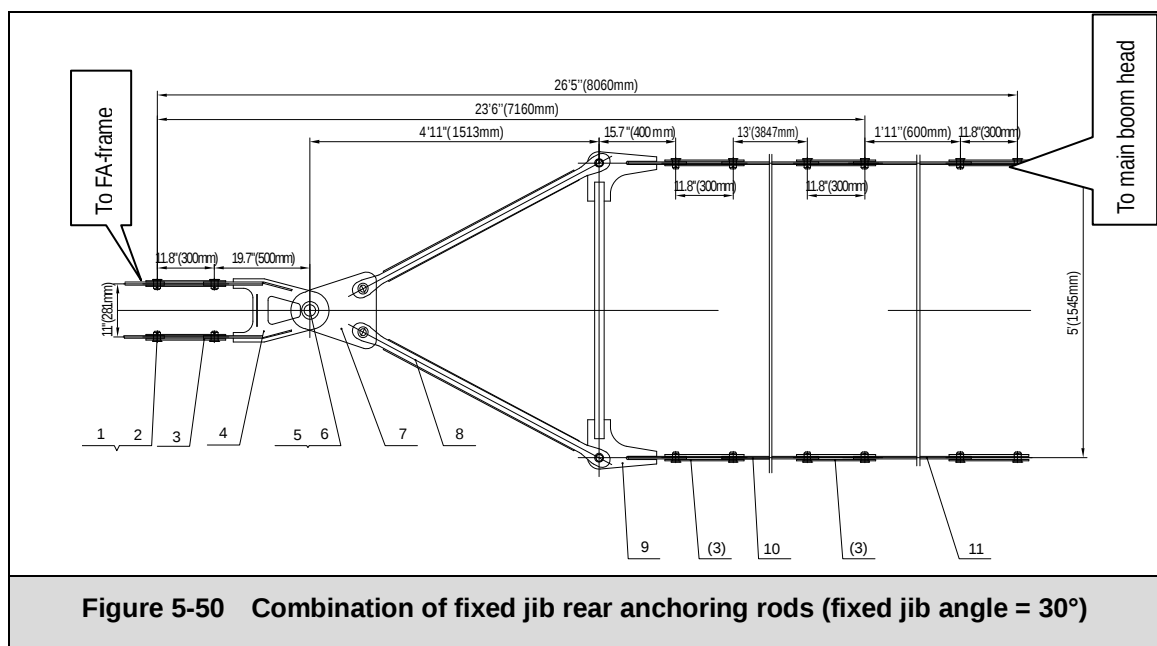
The pin spindle of fixed jib front anchoring rods must be inserted outwards.

Fixed jib rear anchoring rods:

The diameter of pin spindle for fixed jib rear anchoring rods is 1.181" (30mm).

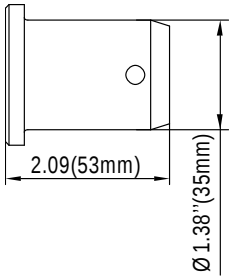
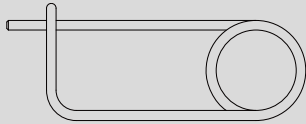
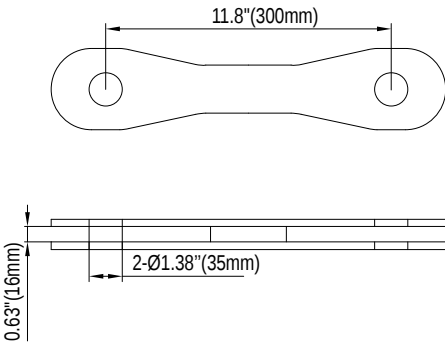
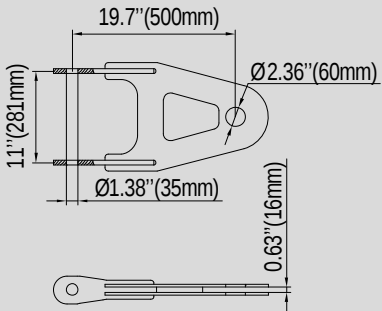
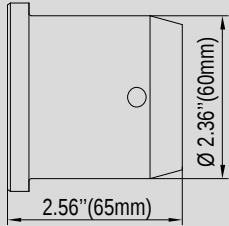
Since fixed jib can be mounted in the angle of either 10° or 30° to main boom, fixed jib rear anchoring rods can be combined in two different ways.

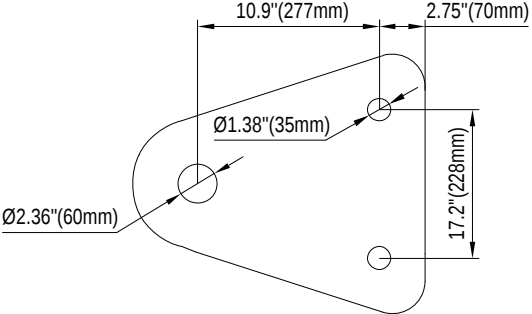
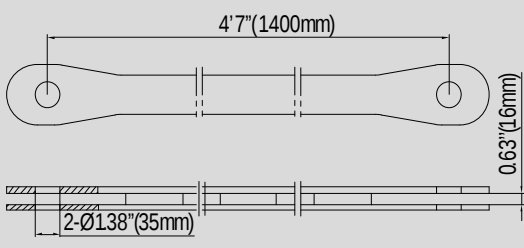
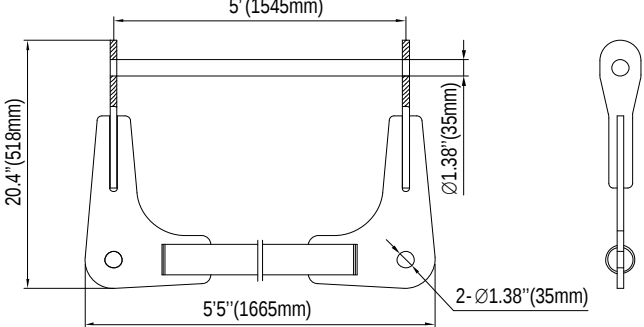
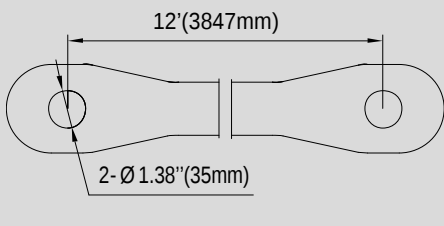
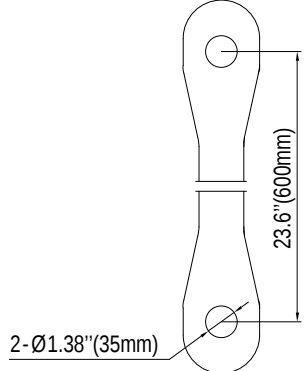
Now, we will illustrate the combination of fixed jib rear anchoring rods when fixed jib is mounted in the angle of 30° to main boom.



The explanation of component numbers in the figure 5-50 is shown in the table 5-13:

Table 5-13 Components of fixed jib rear anchoring rods

No.	Names of the components	Illustration
1	Pin spindle	
2	Retaining pin	
3	Double anchoring rod	
4	Reducing anchoring rod	
5	Pin	6.3*80
6	Pin spindle	

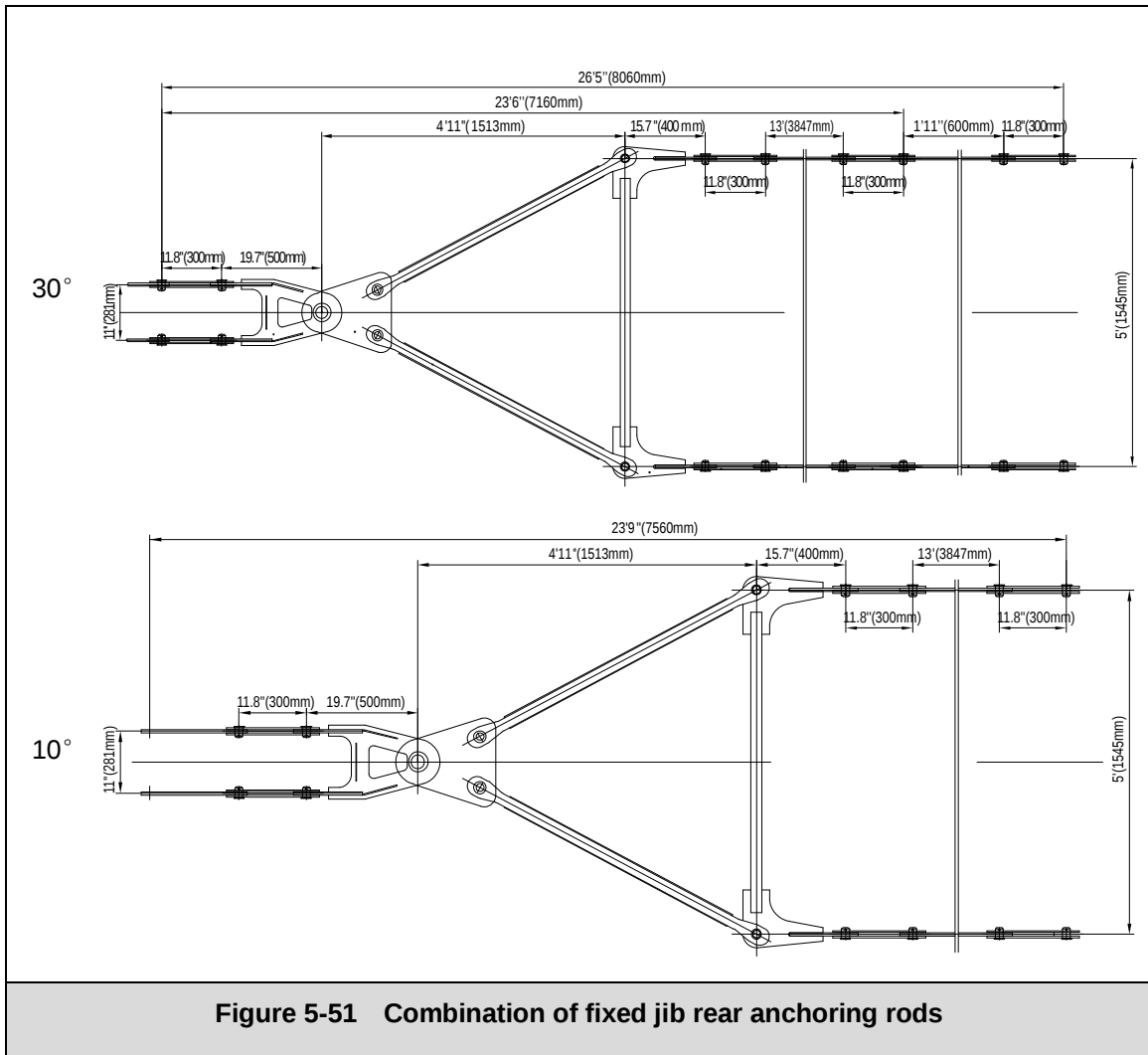
No.	Names of the components	Illustration
7	Reducing piece	
8	Double anchoring rod	
9	Coupling link	
10	Single anchoring rod	
11	Single anchoring rod	

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The component numbers of anchoring rods mentioned in “Figure 5-50 Combination of fixed jib rear anchoring rods (fixed jib angle = 30°)” are consistent with those in the above table, so the components of anchoring rods can be found by referring to the component numbers during assembling.

The combination of fixed jib rear anchoring rods when fixed jib is mounted in the angle of 10° to main boom is different from that when fixed jib is mounted in the angle of 30° to main boom. When fixed jib is mounted in the angle of 10° to main boom, a 2'11" (900mm) anchoring rod must be removed.

When fixed jib angle is 30° or 10°, the combination of fixed jib rear anchoring rods is shown in the figure 5-51.



5.5 Assembly and dismantling of main boom

5.5.1 Preparations for assembly

- a) Choose an appropriate boom configuration and corresponding anchoring rods combination according to the operational planning and load capacity charts.
- b) Choose appropriate load hook and rope reeving in accordance with the working requirements and reeving plan.
- c) Assemble the counterweight according to the requirements.
- d) Make sure that an auxiliary crane is available and the operating personnel get full prepared for the operation.



- (1) For assembly work on the crane, a safe assembly working platform should be used. Improvisations are prohibited. Otherwise, there is a danger of falling down.
- (2) It is prohibited to use any other boom configurations and anchoring rods combination that have not been stipulated in the operating manual.
- (3) Always bolt the shorter intermediate sections first during assembly of boom sections.
- (4) If the ends of boom section are lifted by an auxiliary crane, at least two pieces of lifting chain with a breaking force ≥ 11025 lb (15t) should be used.
- (5) Do not stand on the lattice boom when it is assembled.
- (6) Do not stand beneath the boom when it is being pinned or unpinned.
- (7) The use of squared timbers or pad block to support the chord in the middle position or web members is prohibited; otherwise the boom sections will be damaged.

5.5.2 Assembly of main boom

After unloading the basic machine and fitting the counterweight plate, assemble such components as boom sections and anchoring rods according to working requirements.

5.5.2.1 Assembly of main boom

Attachment of main boom sections:

- a) Preassemble main boom sections according to Section 5.4.1 with the help of mounting cylinder on the pivot section. For detailed operation, refer to the following methods:
 - Bolt main boom intermediate sections of 9'10" (3m), 19'8" (6m) or 29'6" (9m) to each other in the following sequence:
Position two intermediate sections to be bolted in such a way that the connecting holes in one intermediate section are precisely aligned with those in another intermediate section (see the following figure 5-52).

Join the connecting holes with double tapered pins (1) and secure the pins with retaining pins (2).

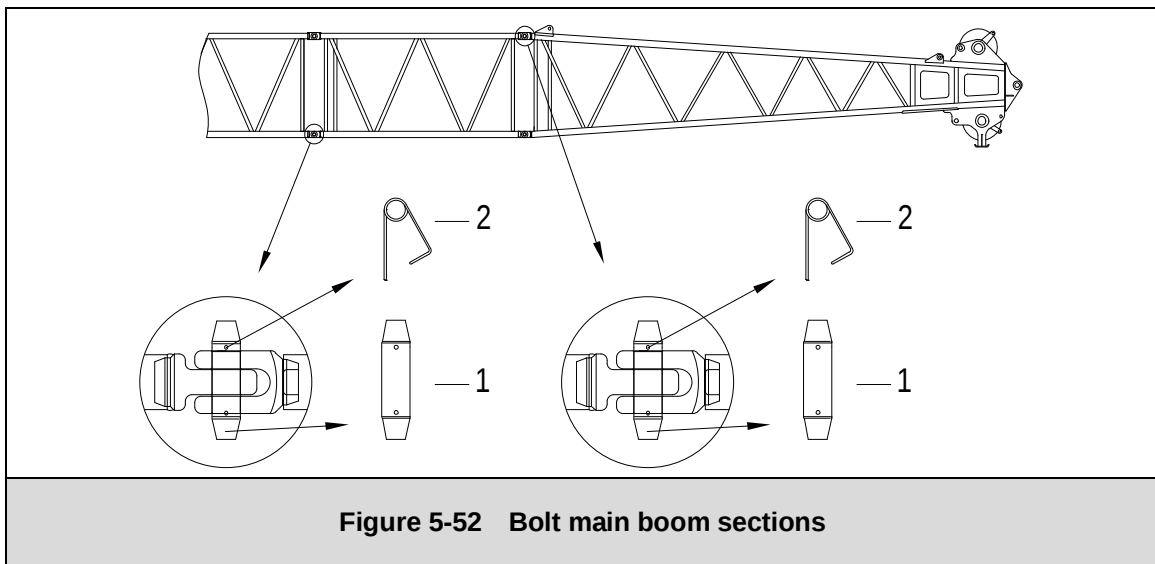
Join other connecting holes in the same way.

- Bolt main boom head with assembled intermediate section in the following sequence:
Position the assembled intermediate section in such a way that the upper connecting holes in it are aligned with those in the boom head.

Join the upper connecting holes with double tapered pins (1) and secure the pins with retaining pins (2).

Join the lower connecting holes together in the same way.

- b) Move the basic machine with main boom pivot section attached to the preassembled main boom.
- c) Operate derricking winch in such a way (see Section 4.6.4) that the upper connecting holes in main boom pivot section are aligned with those in adjacent main boom intermediate section. See the figure 5-53.
- d) Join the upper connecting holes with double tapered pins (1) and secure the pins properly with retaining pins (2).
- e) Operate derricking winch to adjust the derricking rope (or lift main boom intermediate section with the help of auxiliary crane) until the lower connecting holes in main boom pivot section are aligned with those in adjacent main boom intermediate section.
- f) Join the lower connecting holes with double tapered pins (1) and secure the pins with retaining pins (2).



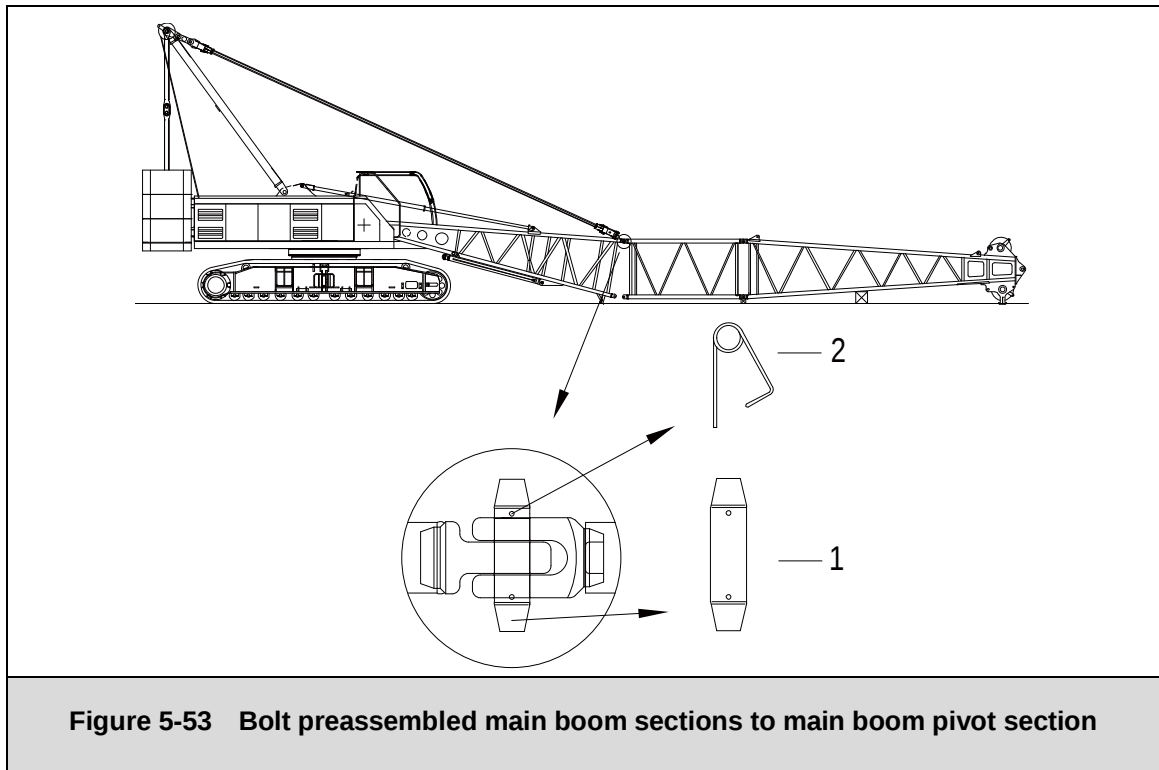
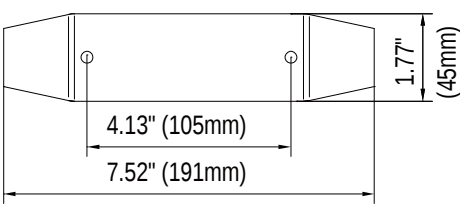
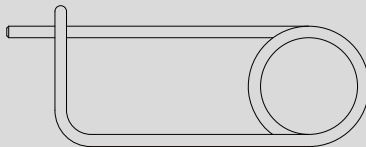


Figure 5-53 Bolt preassembled main boom sections to main boom pivot section

The components used in connecting main boom sections are shown in the table 5-14, and the serial numbers in the table is the same with those in figure 5-52, and figure 5-53.

Table 5-14 Components used to connect main boom sections

No.	Names of the components	Illustration
1	Double tapered pin	
2	Retaining pin	

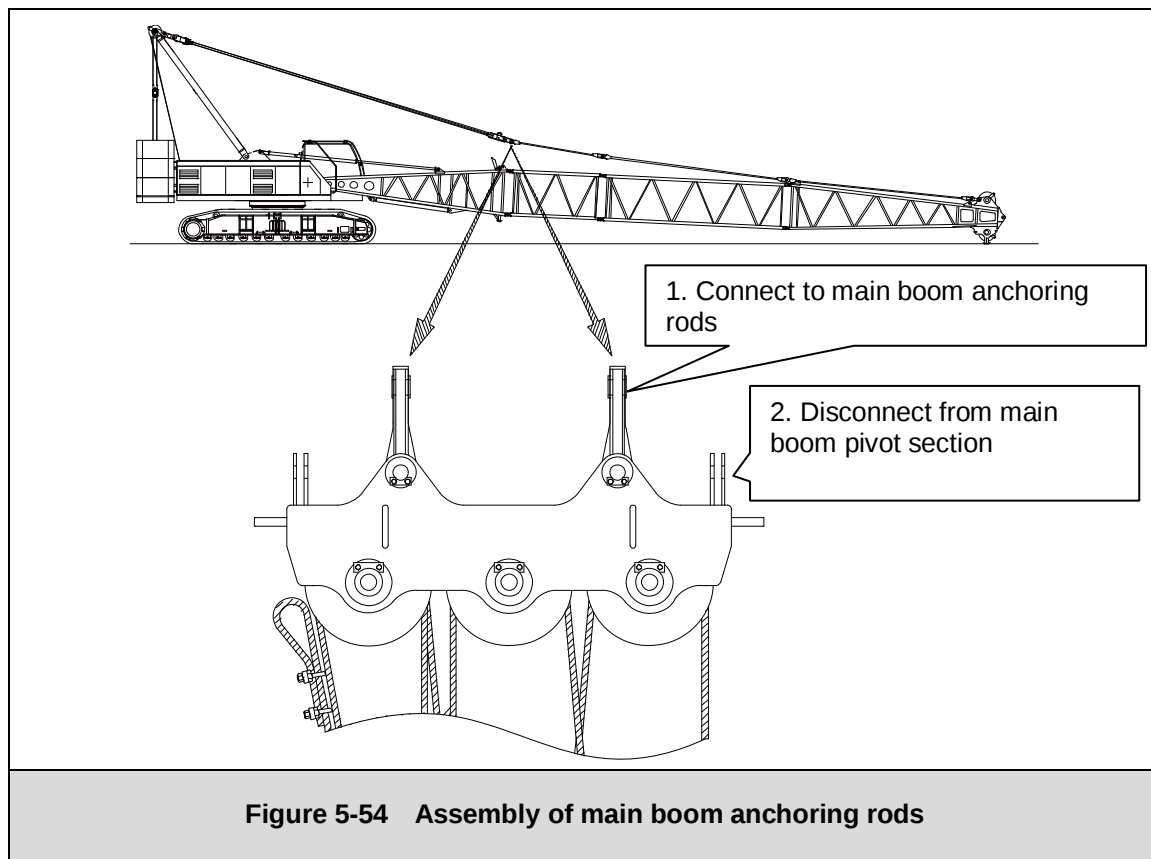
⚠ DANGER

- (1) The connecting pin must always be fitted from outside inwards during assembly.
- (2) It is prohibited to put hand or fingers into the connecting hole during assembly.
- (3) No person is allowed to stand beneath or in the boom during assembly.
- (4) It is prohibited to climb up the boom, stand or walk on the boom.
- (5) Use a ladder or other similar tools to carry out assembly operation.

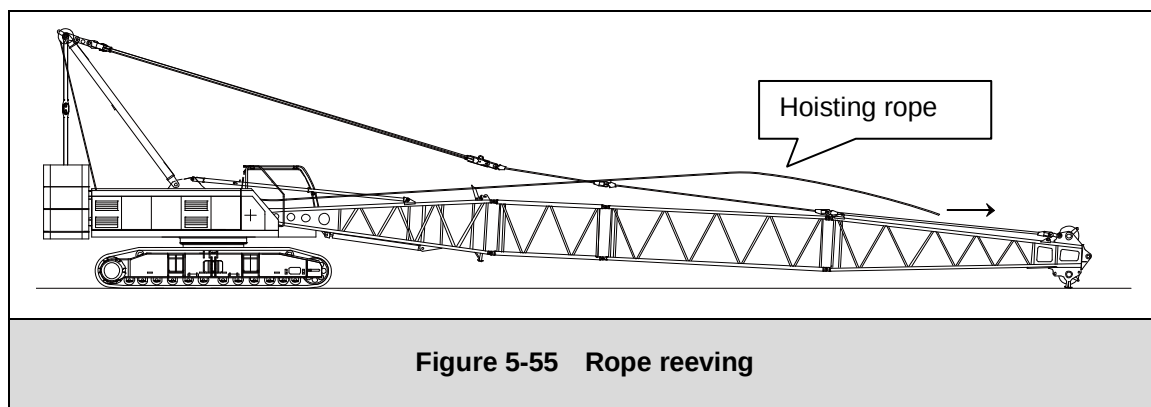
5.5.2.2 Assemble main boom anchoring rods and reeve in hoisting rope

Connect anchoring rods of main boom intermediate sections and anchoring rods of main boom head with each other by pin spindles and secure them with retaining pins. (The combination of main boom anchoring rods are detailed in section 5.4.1.2)

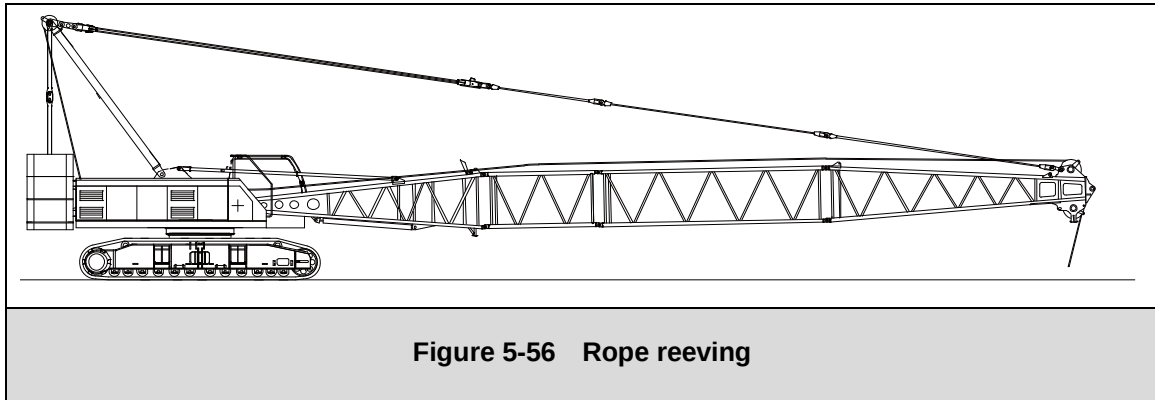
Detach derricking traveling block from main boom pivot section, and then connect it to the assembled main boom anchoring rods. See the figure 5-54.



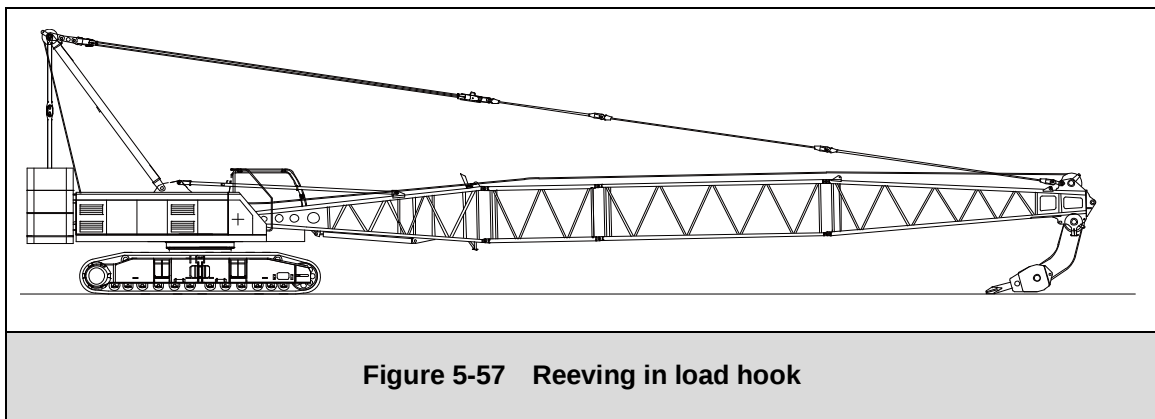
- a) Reel off hoisting winch 1, pull the hoisting rope to main boom head and reserve a certain length of rope for load hook reeving as shown in the figure 5-55.



- b) Move right control lever to the left to spool up derricking winch until the main boom head is raised by the derricking rope to a proper position a littler higher than the load hook, referring to figure 5-56.



- c) Place the load hook directly under main boom head, and then reeve the hoisting rope between hook block and rope pulley on main boom head in accordance with the rope reeving plan (for the details, please refer to section 4.6 “rope reeving” in Chapter 4), finally secure the rope end point with rope lock and rope thimble, referring to the figure 5-57.



! CAUTION

The working personnel who guide the wire rope should take great care to prevent against falling down when walking on the boom frame; otherwise, serious accident may occur.

5.5.2.3 Fixation of derricking traveling block

The machine is fitted with an automatic positioning device for derricking travelling block, which is convenient for dismantling of the pulley block. Taking the fixation of derricking travelling block as an example, illustrate the usage method of the device.

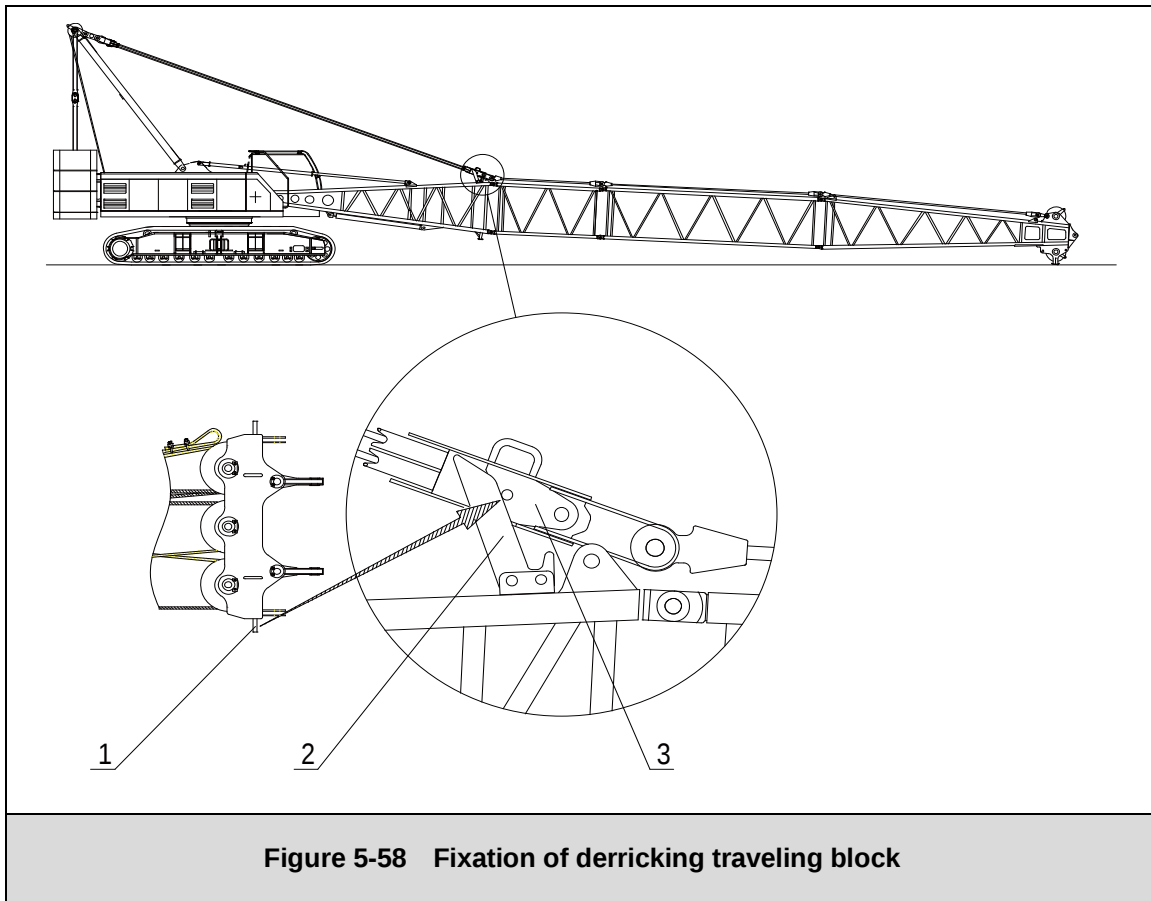
When the basic machine is prepared for conversion, the boom frame should be lowered to the ground. At this time, dismantle the connection between the travelling block and anchoring rod.

When main boom head is in contact with the ground, unwind the derricking rope to lower derricking traveling block (part 3 in the figure 5-58) slowly.

Under the pulling of main boom anchoring rods, the derricking travelling block will move above the guide board (part 2).

Continue to unwind the derricking rope so that the guide rod (part 1) on the derricking travelling block comes into contact with the oblique plane of guide board (part 2), thus guiding the derricking travelling block to lower down to the required position.

When the pin spindle (part 5) on the derricking travelling block (part 3) is aligned with the mounting hole on the main boom pivot section, mount the pin spindle. Disconnect the cross coupling (part 4) on derricking travelling block (part 3) from main boom anchoring rods, rotate the left and right cross couplings 90° to the same direction and fasten them (see figure 5-59). At this time, the derricking travelling block is fastened on main boom pivot section. The relevant parts can be seen in the table 5-15.



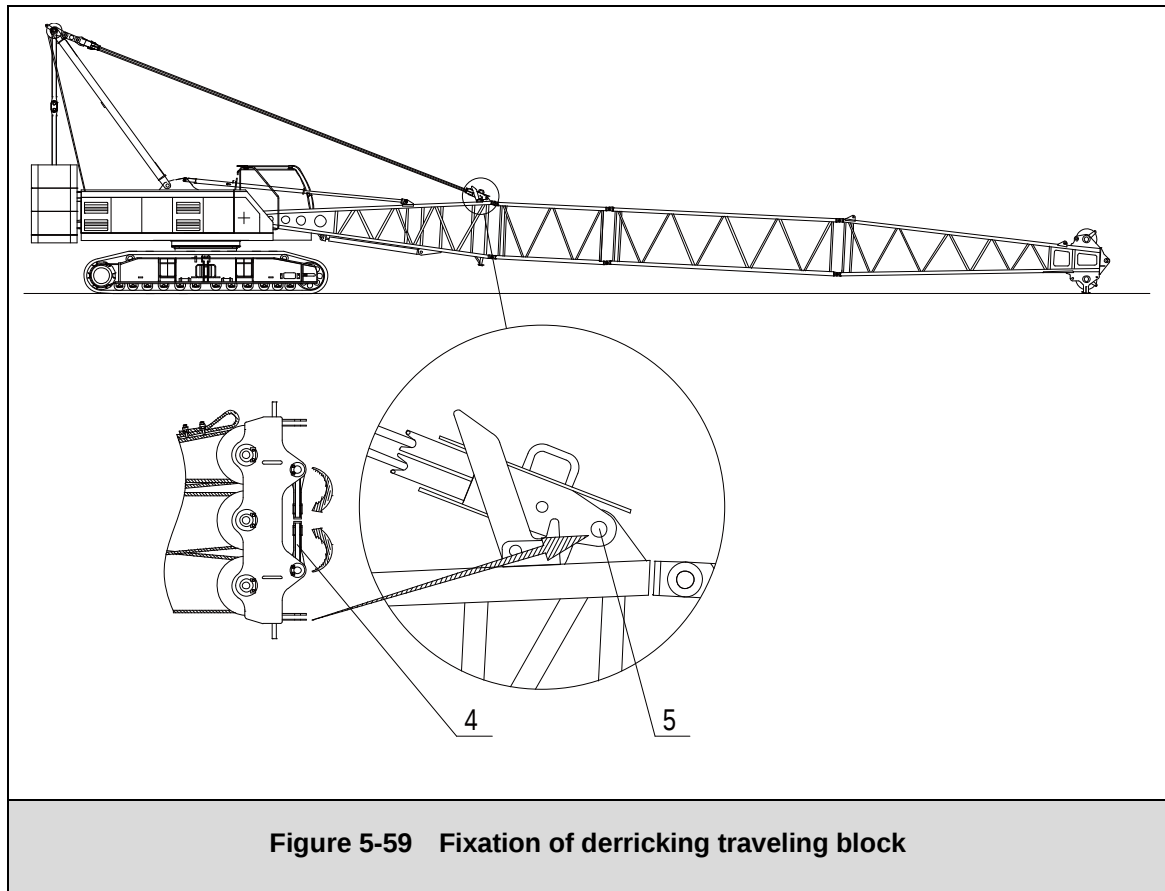


Figure 5-59 Fixation of derricking traveling block

Table 5-15 Fixation of derricking traveling block

No.	Description	No.	Description
1	Guide rod	4	Cross coupling
2	Guide board	5	Pin spindle
3	Derricking travelling block		

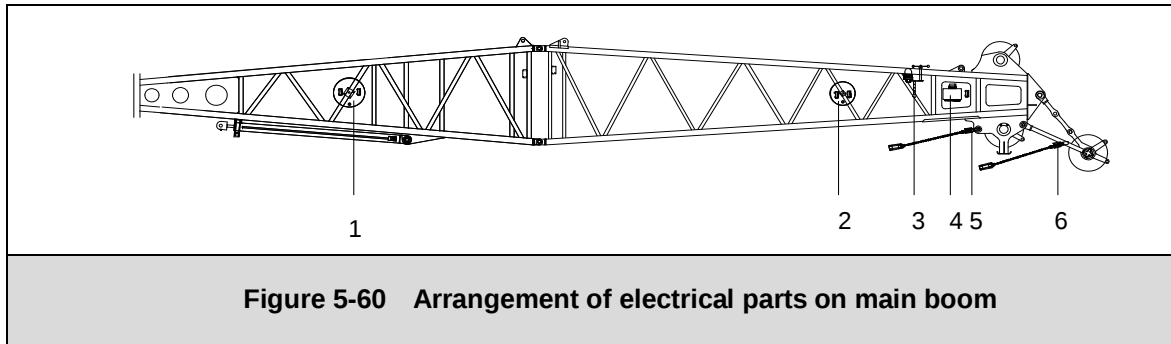
! WARNING

Only after the cross coupling on the derricking travelling block is fastened, can the main boom pivot section be raised, otherwise the boom frame may be damaged.

5.5.3 Electrical connection to main boom

5.5.3.1 Wire layout of main boom

The arrangement of electrical parts on main boom is shown in figure 5-60:



Functions of electrical parts are shown in the table 5-16:

Table 5-16 Functions of electrical parts

No.	Description	Instructions
1	Main boom cable drum assy.	Connect the slewing table cable and junction box on the main boom head
2	Fixed jib cable drum assy.	Connect the junction box on the main boom head to the junction box on the fixed jib head
3	Anemometer and warning light on the boom head	Measure wind speed and send a warning in the air
4	Main boom junction box	Establish electrical connection to various electrical parts of main boom head
5	Hoisting limit switch for H1 winch	Prevent winch 1 from over hoisting
6	Hoisting limit switch for H2 winch	Prevent winch 2 from over hoisting

5.5.3.2 Electrical connections to main boom

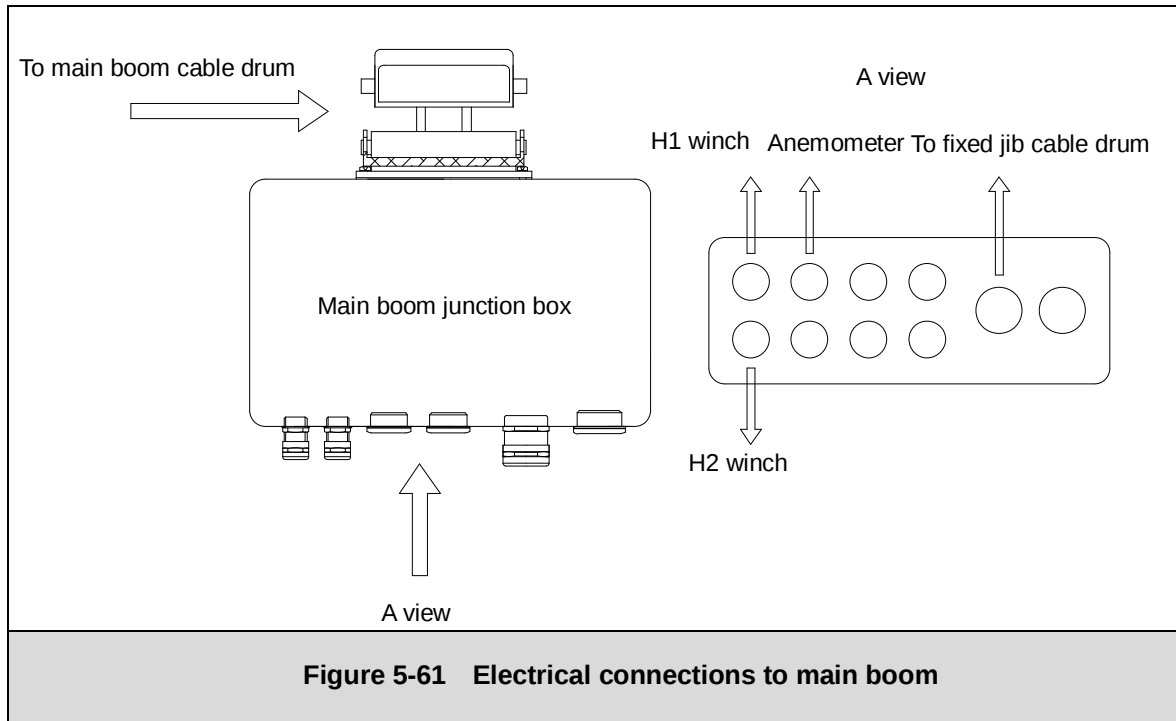


Figure 5-61 Electrical connections to main boom

As is shown in the figure 5-61:

- 1) Unplug the cable plug of main boom cable drum, pull the cable plug along the main boom, fix every section with chains, and then insert it into the corresponding socket on the main boom junction box. Establish the electrical connections from the junction box on the boom head to the associated components respectively.
- 2) There is no need to connect the warning light on the boom head.



When establishing connections, the connection sequence mentioned above should be adhered to what is described in the figure 5-61.

5.5.3.3 Function check

Insert the ignition key into the ignition start switch, and then rotate it clockwise to the 1st position, the power is connected:

- a) Check the warning light on the boom head
The warning light is solar lamp, which can adjust its light according to environments. Cover the warning light with cover in low transparency and check whether the light glows.
- b) Check hoisting limit switch for H1
Support and hold the hoisting limit switch weight for H1 to ensure that the switch is triggered, and then check whether the icon "upper limit switch on H1" on the screen will flash and the buzzer will sound.

- c) Check hoisting limit switch for H2
Support and hold the hoisting limit switch weight for H2 to ensure that the switch is triggered, and then check that the icon "upper limit switch on H2" on the screen will flash and the buzzer will sound.
- d) Check anemometer
One person rotates the vane of anemometer quickly by hand, and the other checks whether there is the wind speed value shown on the screen on the load moment limiter in the cab.

5.5.4 Erecting main boom

5.5.4.1 Requirements for erecting the main boom

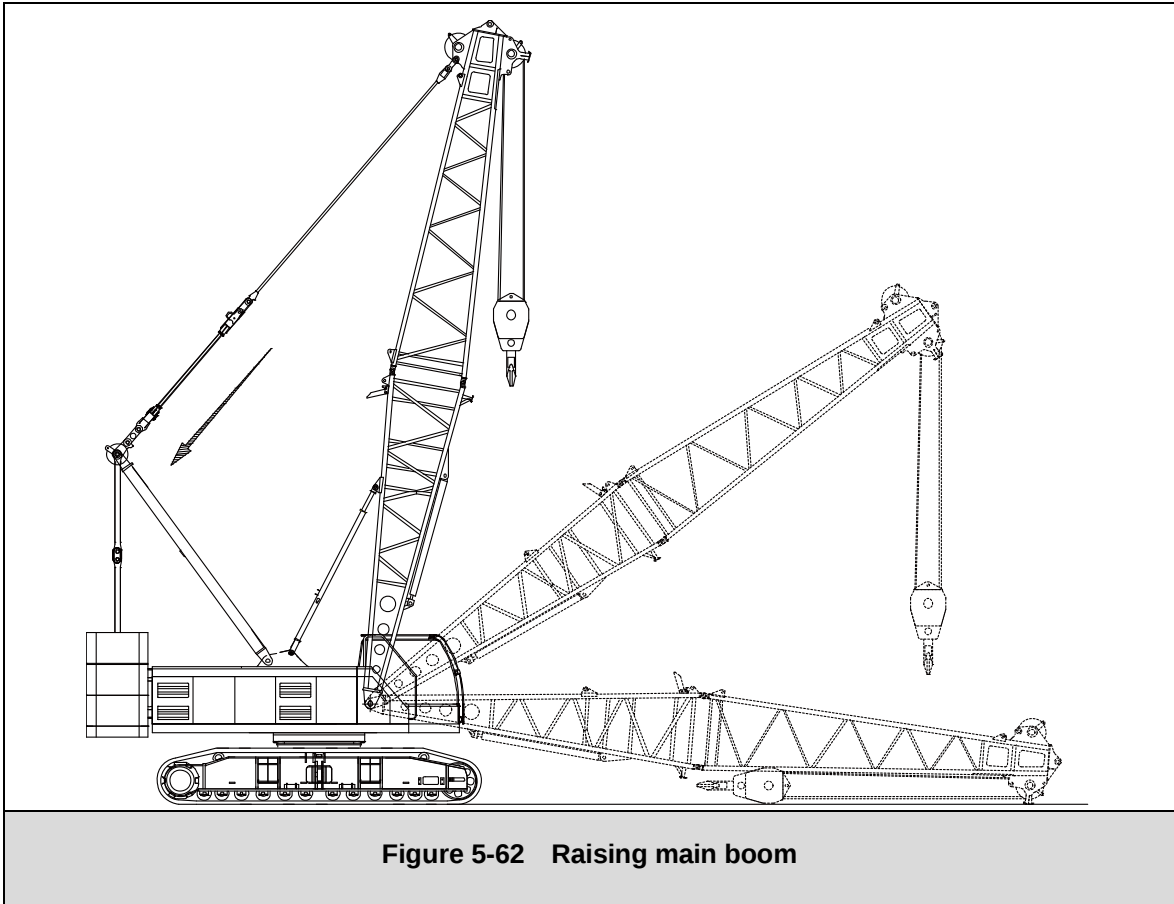
- a) The crane is leveled.
- b) The counterweight plates have been attached.
- c) Select appropriate boom configurations according to the load to be lifted, working radius, lifting height, load capacity charts and lifting height curve; ensure that boom sections have been connected and secured.
- d) All limit switches have been correctly fitted and are fully operational.
- e) All pinned connections have been secured.
- f) The hoisting rope is properly placed in the rope pulleys, and is secured with rope guard tube to prevent against jumping out from rope groove.
- g) No person is present in the danger zone.
- h) There are no loose parts on main boom or fixed jib.
- i) In winter, main boom, fixed jib and associated components (hoisting limit switches, cable drums, warning light on the boom head, anemometer etc.) must be kept free of ice and snow.



Ineffective limit switches and falling parts may cause accident.

5.5.4.2 Raising main boom

- Move right control lever to the left to spool up derricking winch, and main boom anchoring rods will be tensioned gradually.
- Continue to spool up derricking winch to raise main boom.
- After raising main boom to required position, move right control lever to the neutral position to stop raising main boom. See the figure 5-62.
- During boom raising process, reel off hoisting winch properly.



! CAUTION

- (1) Always monitor the wire rope in process of raising main boom to make sure that the wire rope on boom head is kept in the rope groove all the time.
- (2) Before main boom is raised to 30° position, make sure that the hook is in contact with the ground. After main boom is raised to 30° position, the hook can be lifted away from the ground.
- (3) The boom-raising movement should be performed slowly and stably. And during the operation, the crane operator must observe the data shown on the screen, while other workers should pay attention to environmental changes.
- (4) Standing beneath the boom frame is prohibited.
- (5) Working radius stipulated in the load capacity charts should be adhered to, even if no load is attached on the load hook! If this is not observed, the crane may topple over!

5.5.5 Lowering and dismantling main boom

5.5.5.1 Lowering main boom

- Move right control lever to the right to reel off derricking winch, and main boom will be lowered gradually.
- Make load hook come into contact with the ground first when the boom angle is more than 30°.
- Continue to reel off derricking winch until main boom head is lowered on the ground.
- Move right control lever to the neutral position to stop operation.

5.5.5.2 Dismantling boom sections and anchoring rods

After the anchoring rods are lowered down on the nylon support plate on the relevant boom sections, remove the pin spindles on anchoring rods, and then secure the anchoring rods on the supports with pin spindles for transportation.

- a) Dismantle boom sections using an auxiliary crane.
- b) Lower A-frame down on the slewing table.



- (1) Dismantling of main boom is carried out in the reverse order of assembly.
- (2) Warnings and safety precautions for assembly should be observed during dismantling operation.

5.6 Assembly and dismantling of main boom with fixed jib

5.6.1 Preparation for assembly

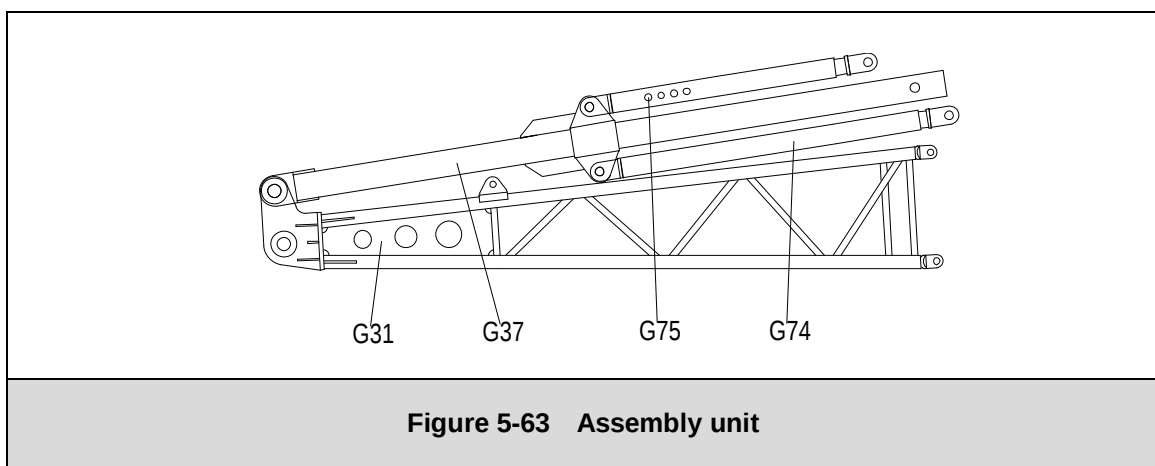
- The crane is leveled.
- The main boom has been installed.
- The counterweight has been mounted according to requirements.
- An auxiliary crane as well as an assembly working platform is available.
- The safe load indicator system of Load Moment Limiter is set according to the data given in the load capacity charts.
- Choose appropriate boom configuration and relevant anchoring rods combination according to operational planning.



- For assembly work on the crane, a safe assembly working platform should be used. Improvisations are prohibited. Otherwise, there is a danger of falling down.**
- Do not stand beneath the boom when it is being pinned or unpinned.**

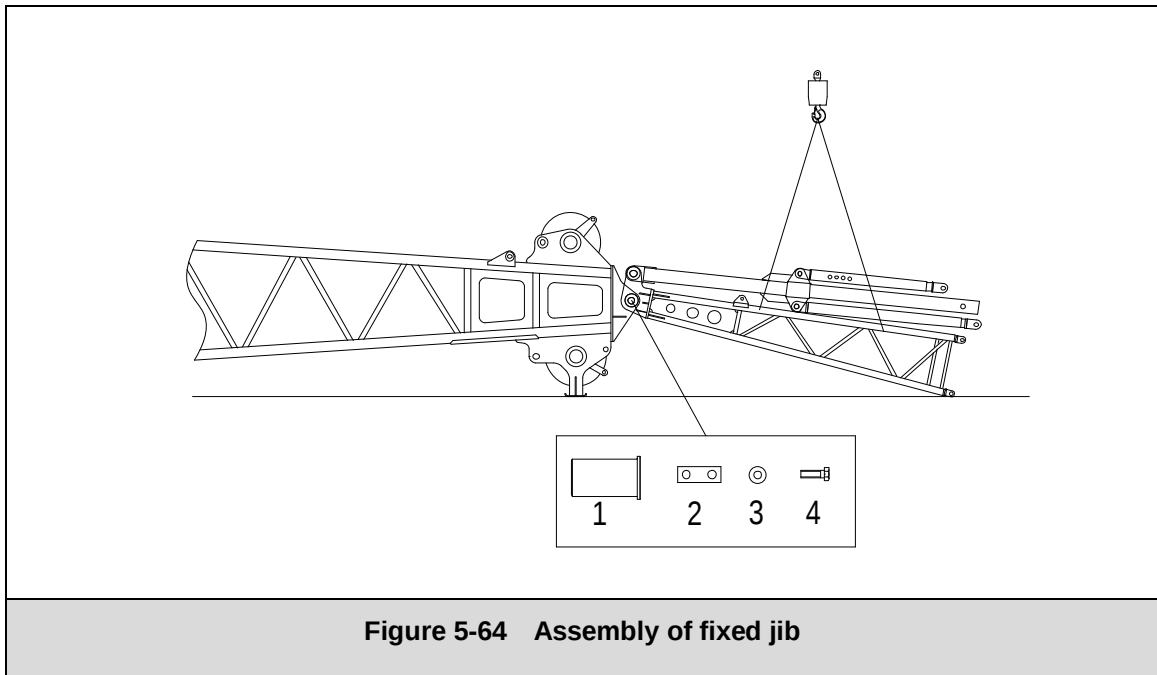
5.6.2 Assembly of fixed jib

During transportation, fixed jib pivot section (G31), FA-frame (G37), front tilting-back support of fixed jib (G74) and rear tilting-back support of fixed jib (G75) are assembled together. See the following figure 5-63.

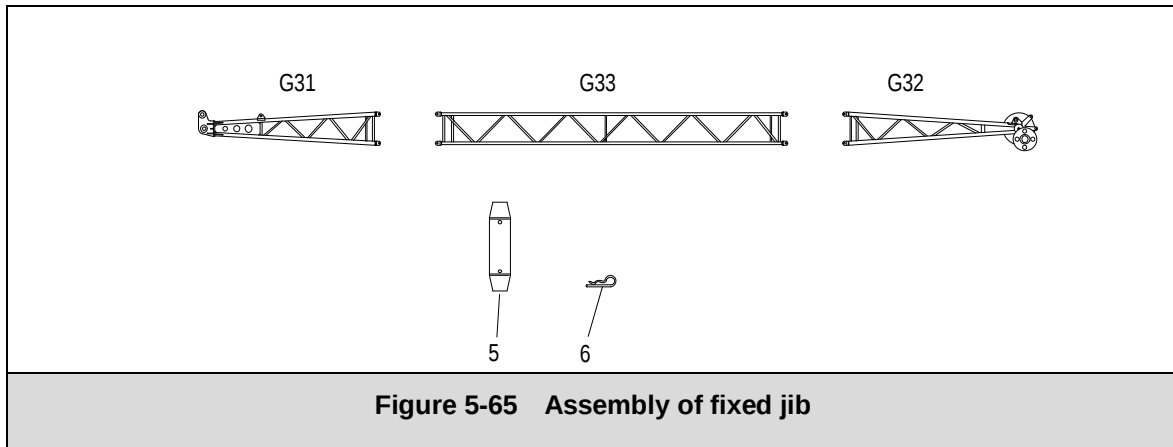


- Assemble required main boom sections according to Section 5.4.1.
- Lift the assembly unit (including fixed jib pivot section, FA-frame, front tilting-back support of fixed jib and rear tilting-back support of fixed jib) with an auxiliary crane until it is aligned with main boom head.

Connect the assembly unit to main boom head with pin spindles (1) and secure them with retaining plate (2), washers (3) and bolts (4). Refer to figure 5-64.

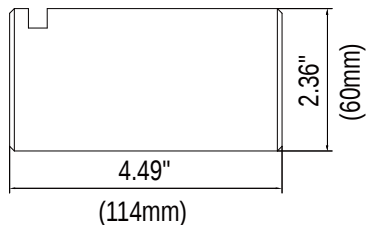
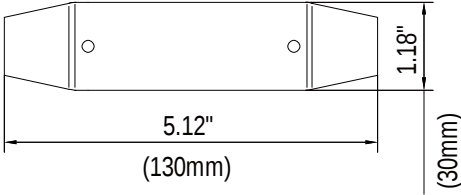
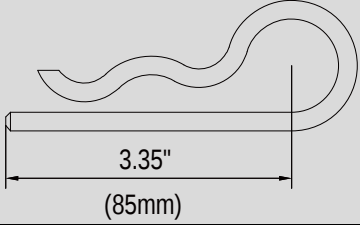


- c) According to actual condition, choose and assemble several 6m fixed jib intermediate sections (G33). All fixed jib intermediate sections are connected with double tapered pins (5), secured the pins on both sides with retaining springs (6) as follows:



The components used to assemble fixed jib are shown in the figure 5-17.

Table 5-17 Components used to assemble fixed jib

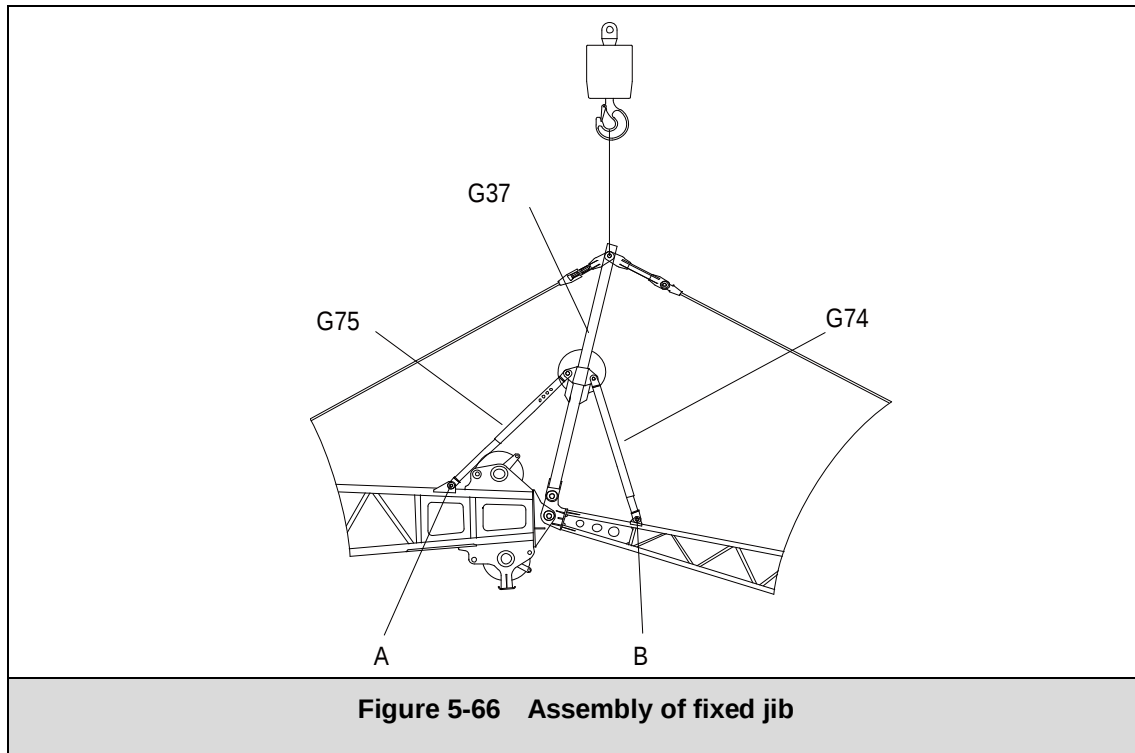
No.	Names of the components	Illustration
1	Pin spindle	
2	Retaining plate	
3	Washer	DIN 137 (12)
4	Bolt	ISO 4017:1999 (M12X45-8.8)
5	Double tapered pin	
6	Retaining spring	

- d) Assemble main boom anchoring rods according to the length of assembled main boom (for the details, see Section 5.4.1);

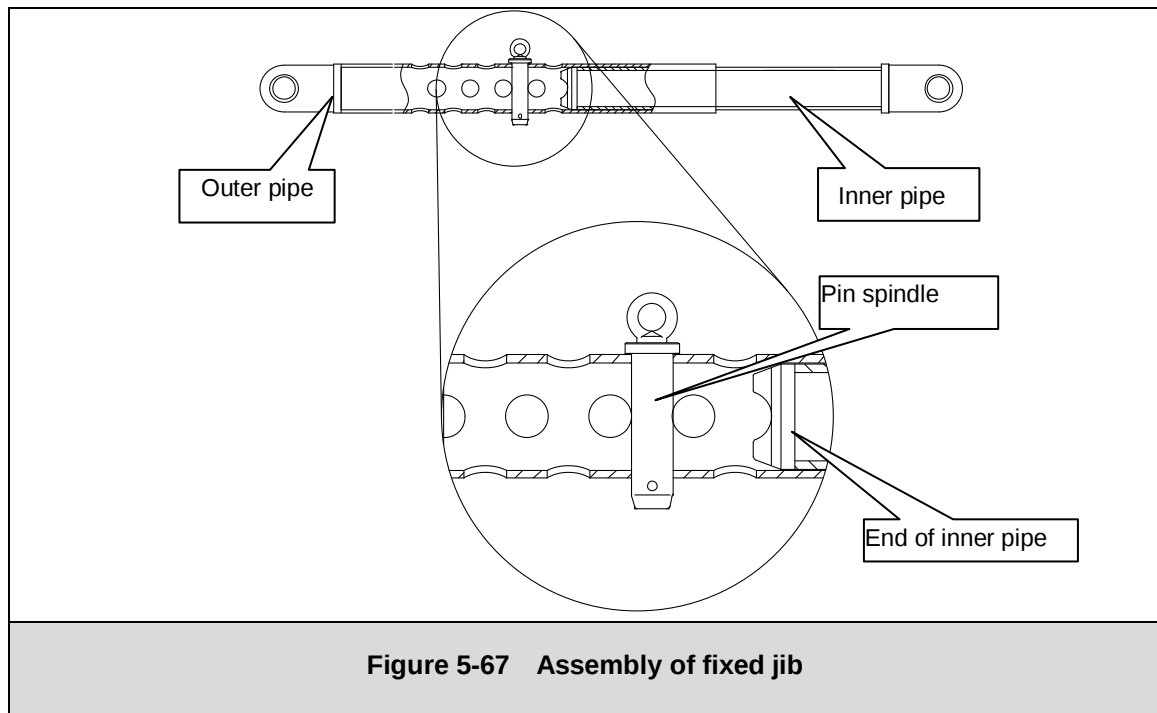
Pre-assemble some fixed jib rear anchoring rods to FA-frame according to the required angle of fixed jib (for the details, see Section 5.4.2.2).

Connect fixed jib front anchoring rods according to the length of assembled fixed jib (for the details, see Section 5. 4.2.2).

- e) Lift FA-frame using an auxiliary crane. Joint the rear tilting-back support (G75) and front tilting-back support (G74) respectively to hinge lug (A) on main boom head and hinge lug (B) on the fixed jib pivot section. See the figure 5-66.



- f) Insert pin spindle to connect the inner pipe and outer pipe of rear tilting-back support of fixed jib, and then secure it with cotter pin. There are many pin holes on the outer pipe and the rules to choose which pin holes should be put into the pin spindle are: take the position of the inner pipe of rear tilting-back support(G75) as the benchmark when the inner pipe of front tilting-back support (G74) just support the spring. Put the pin into the hole nearest to rear tilting-back support (G75), which is shown in the figure 5-67.
- g) Push left control lever forwards to unwind the hoisting rope from the hoisting winch 2, and then pull the rope forwards to the rope pulley at the fixed jib head through the rope pulley on the FA-frame, and reserve a certain length of rope for reeving load hook.
- h) Move right control lever to the left to wind derricking rope, then the main boom will be raised, and the fixed jib is lifted off the ground a little higher than the hook. Put a 6t load hook under the fixed jib head, connect the wire rope of hoisting winch 2 and load hook with rope lock.
- i) Continue to wind the derricking rope to raise main boom, and meanwhile unwind the wire rope of hoisting winch 2 to keep the hook on the ground.
- When main boom is raised to 30° position, wind the wire rope of hoisting winch 2 to lift the hook.
- Continue to operate right control lever to left to spool up derricking winch until main boom is raised to the required position, then stop raising.



! CAUTION

- (1) Check whether the spring is mounted in the outer pipe of front tilting-back support of fixed jib. If the spring is not mounted, the tilting-back support can not prevent it against falling, then the fixed jib may topple over.
- (2) Make sure that the hoisting rope near the boom head is not exposed to crushing force during rope reeving and boom raising process.
- (3) Ensure that the nylon guide on fixed jib head is always rolling on the ground before fixed jib is lifted away from the ground.
- (4) Take great care to connect rear titling-back support of fixed jib to main boom head.
- (5) Install the pin spindle correctly on front tilting-back support according to the procedure (f), otherwise, the fixed jib will be damaged.

5.6.3 Electrical connection to fixed jib

5.6.3.1 Wire layout of fixed jib

Mounting position of electrical parts on fixed jib is shown in the figure 5-68:

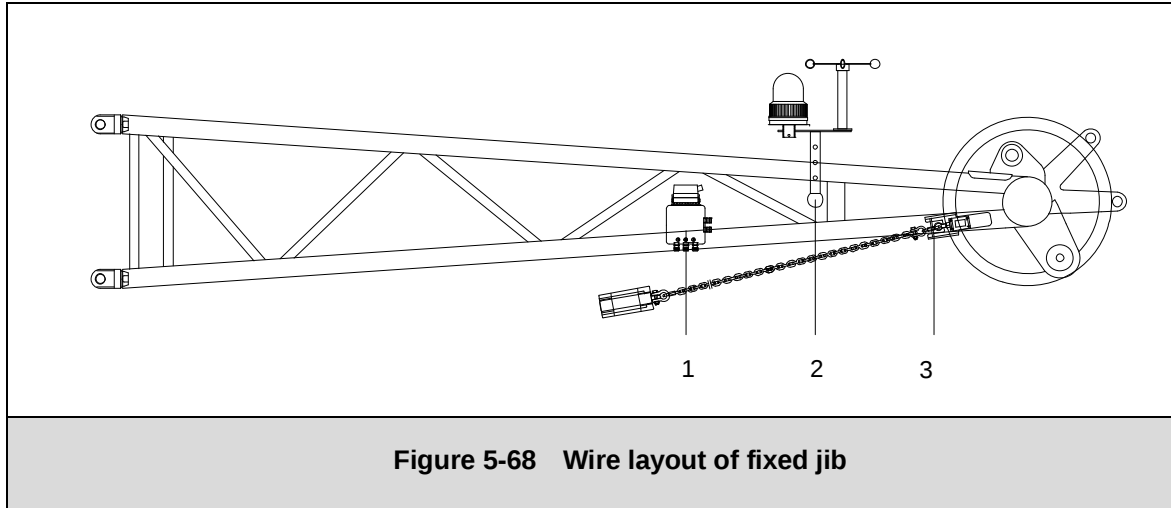


Figure 5-68 Wire layout of fixed jib

Description of electrical parts is shown in table 5-18:

Table 5-18 Functions of electrical parts

No.	Names of the components	Instructions
1	Fixed jib junction box	Connect to various electrical parts on fixed jib head
2	Anemometer and warning light on the boom head	Measure the wind speed and send a warning in the air
3	hoisting limit switch for H2 winch	Prevent winch 2 from over hoisting

After the installation of main boom and fixed jib, pull the cable plug of fixed jib cable drum (part 2 in figure 5-60) along the boom frame to the fixed jib head, and then connect it with fixed jib junction box (part 1 in figure 5-68). Bind the cable with chains. Dismantle the warning light on the boom head, anemometer, hoisting limit switch for winch 2, and install them on corresponding positions on fixed jib head. The wire layout of fixed jib function box is shown in figure 5-69:

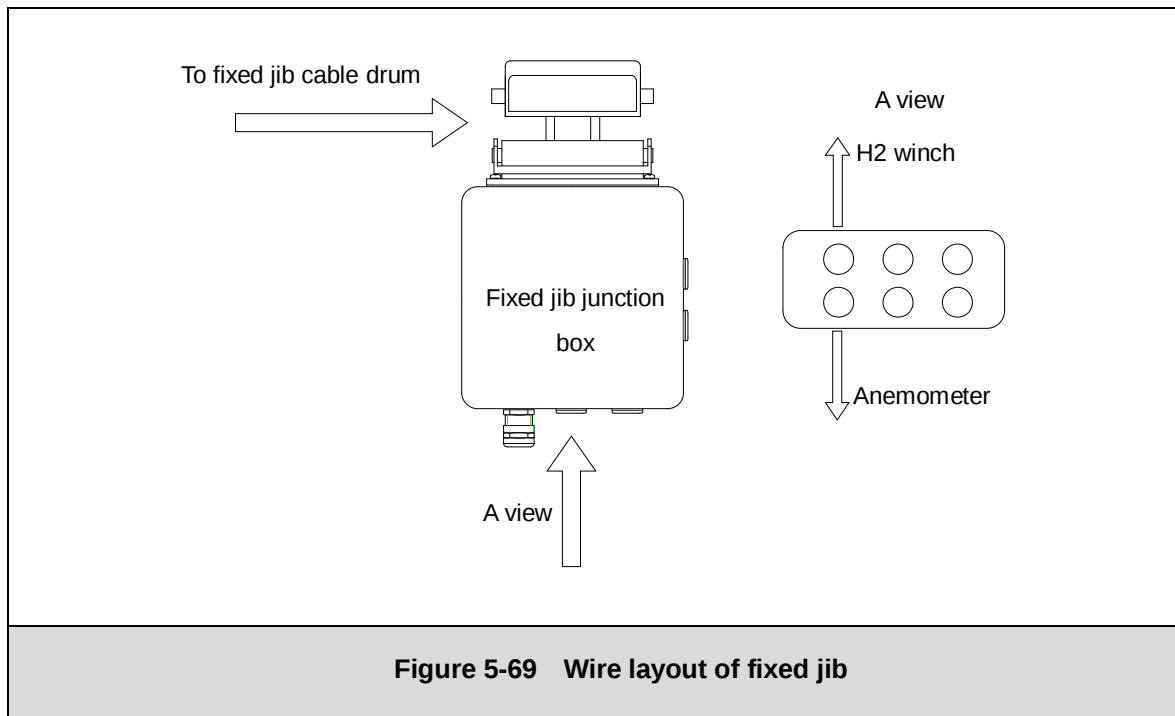


Figure 5-69 Wire layout of fixed jib

5.6.3.2 Function check

Put the key into the ignition key switch, and then turn it clockwise to the 1st position, the power is connected, and then check the following:

- a) Check the warning light on boom head:
The warning light is solar lamp, which can adjust its light according to environment. Cover the warning light with a cover with weak transparency to check whether the warning light glows.
- b) Check hoisting limit switch for H1 (if the main boom is fixed with a load hook):
Support and hold the hoisting limit switch weight for H1 to ensure that the switch is triggered, and then check whether the icon "upper limit switch on H1" on the screen will flash and the buzzer will sound.
- c) Check hoisting limit switch for H2:
Support and hold the hoisting limit switch weight for H2 to ensure that the switch is triggered, and then check whether the icon "upper limit switch on H2" on the screen will flash and the buzzer will sound.
- d) Check anemometer
Rotate the vane of anemometer to check whether the wind velocity shown on the load moment limiter screen in the operator's cab is normal.

5.6.4 Erecting main boom with fixed jib

5.6.4.1 Prerequisites

- a) All electrical connections have been established correctly.
- b) Check limit switches for functional work.
- c) Check warning light on the boom head.
- d) Check hoisting limit switch. Operate the hoisting winch, and adjust the hoisting limit switch on the fixed jib head manually. Requirement for this operation: the hoisting movement of hoisting winch must be stopped when the upper limit has been reached, and the icon "upper limit switch on H2" on the screen will flash.

5.6.4.2 Requirements for erecting main boom with fixed jib

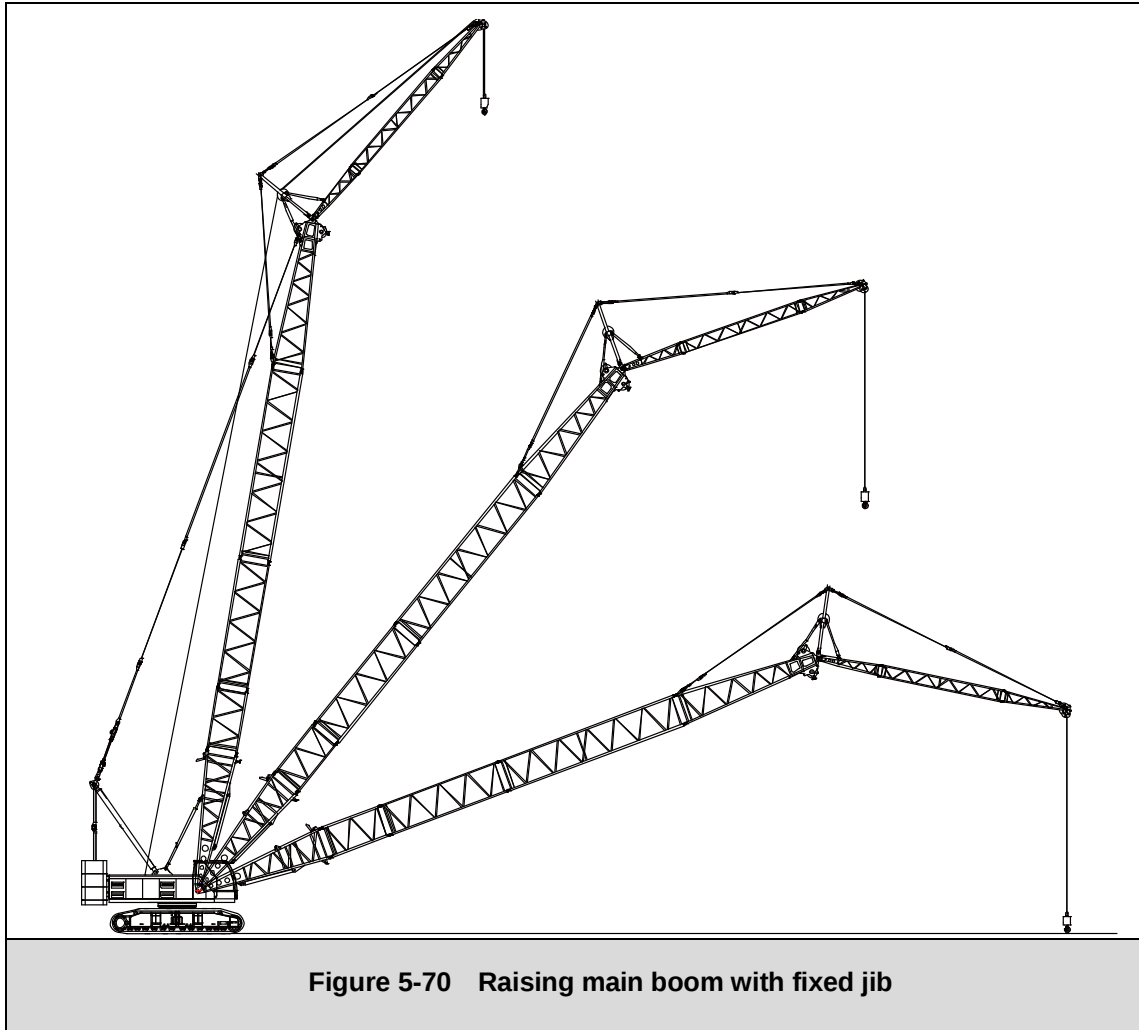
- a) The crane is leveled.
- b) The counterweight plates have been attached in accordance with the load capacity charts.
- c) Required boom sections have been attached in accordance with load capacity charts.
- d) All limit switches have been correctly fitted and are fully operational.
- e) All pinned connections have been secured.
- f) The hoisting rope is properly placed in the rope pulleys, and is secured with rope guard tubes to prevent against jumping out from rope groove.
- g) No person is present in the danger zone.
- h) There are no loose parts on main boom or fixed jib.
- i) In winter, main boom, fixed jib and associated components (limit switches, rope drums, warning light on boom head, anemometer etc.) must be kept free of ice and snow.



Ineffective or faulty limit switches and falling parts (pins, retaining springs etc.) can cause an accident.

5.6.4.3 Raising main boom with fixed jib

Move right control lever to the left to raise the boom until it reaches required position, which is shown in the figure 5-70.



CAUTION

The following safety notes must be observed when erecting and lowering main boom with fixed jib:

- (1) The boom should be positioned straight ahead of the crawler crane (i.e. the drive sprocket is at the back of crane).
- (2) Before erecting the boom, a certain length of hoisting rope should be unwound to guarantee that the load hook is still in contact with the ground before the boom angle has reached 30°. Before lowering the boom, a certain length of hoisting rope should be unwound to ensure that the load hook is lowered down on the ground once the boom angle is less than 30°.
- (3) The boom should be erected or lowered stably at even speed.

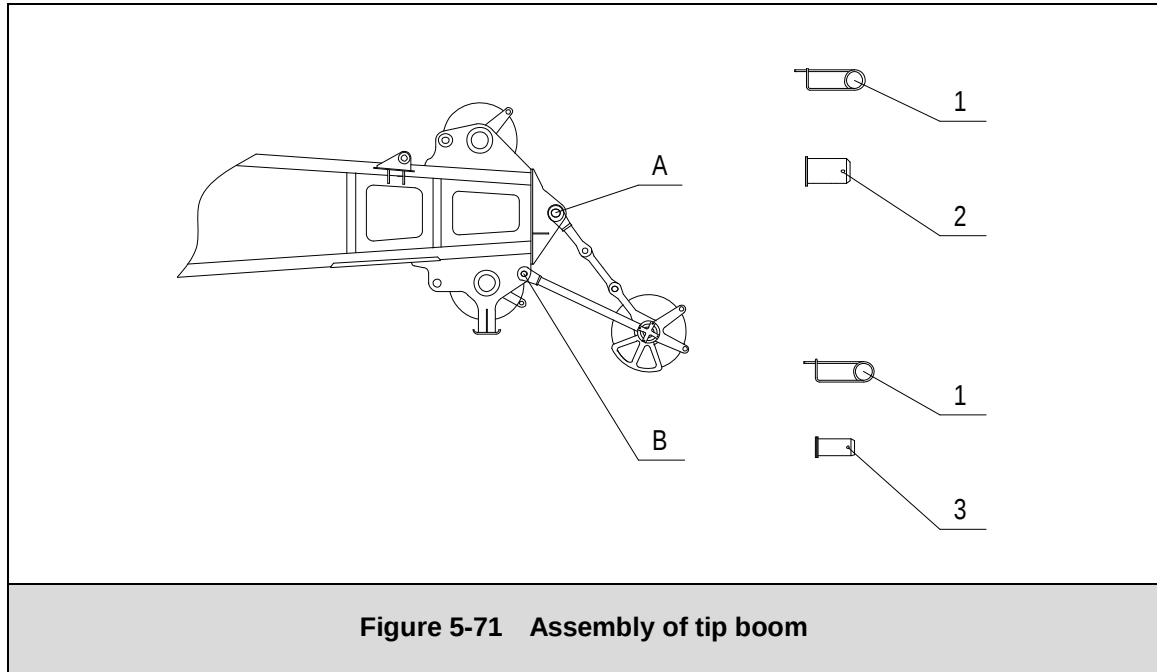
5.6.4.4 Lowering fixed jib

- a) Move right control lever to the right to unwind derricking rope, the boom will be lowered down. When main boom is lowered to 35°-30° position, stop lowering main boom. At this time, unwind hoisting rope to lower the hook down to the ground. Continue to lower the boom to make fixed jib come into contact with the ground.
- b) Move right control lever to the right to unwind derricking rope to make the nylon running wheel get down on the ground, and pull out the pin spindles of outer pipe and inner pipe of rear tilting-back support of fixed jib (G75) manually.
- c) Continue to move right control lever to the right to unwind derricking rope, the nylon running wheel on fixed jib head will roll on the ground until entire boom frame falls down on the ground. Move right control lever to neutral position to stop it.
- d) Pull left control lever backwards to spool up hoisting winch 2 until the wire rope is wound onto the winding drum.
- e) With the help of auxiliary crane, tilt the FA-frame forwards to appropriate position, and dismantle the rear and front anchoring rods of fixed jib.
- f) Dismantle the fixed jib sections orderly from fixed jib head to the pivot section.
- g) Dismantle the fixed jib assembly unit from main boom head.



- (1) The boom-lowering movement should be performed slowly and stably. And during the operation, the crane operator must observe the data shown on the screen, while other workers should pay attention to environmental changes.
- (2) It is prohibited to stand within an area where the crane movement is carried out.
- (3) The boom should be positioned straight ahead of the crawler crane (i.e. the drive sprocket is at the back of crane).
- (4) To prevent the hoisting wire rope from being damaged due to crushing, it should be observed by a person.
- (5) A dedicated person must observe the wire rope when it is wound onto the drum, and there should be no person in the danger zone.
- (6) The speed of spooling up the winch should be even and the wire rope should be wound onto the drum orderly.
- (7) All crane movements should be carried out smoothly, and all safety precautions should be obeyed, otherwise accident may occur.

5.7 Assembly and dismantling of tip boom



The procedures for assembly of tip boom are shown in figure 5-71:

- Align the upper connecting hole of tip boom with the A hole in main boom head.
- Insert pin spindle (part 2) and secure it with cotter pin (part 1).
- Align the lower connecting hole with the B hole in main boom head.
- Insert pin spindle (part 3) and secure it with cotter pin (part 1).

The procedure for dismantling tip boom is the opposite of assembly.

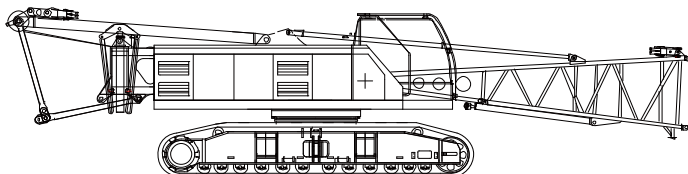
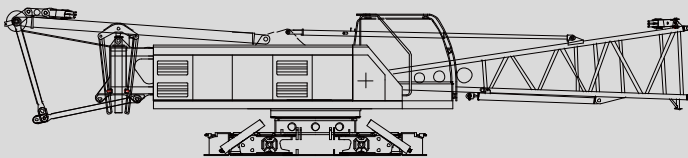
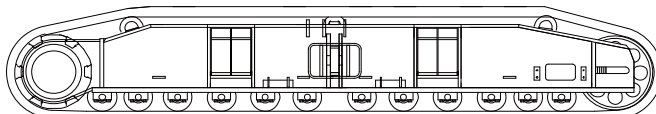
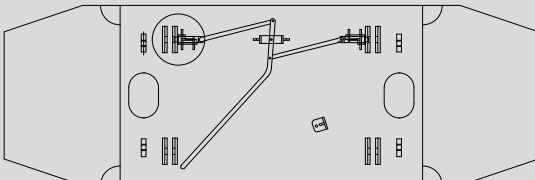
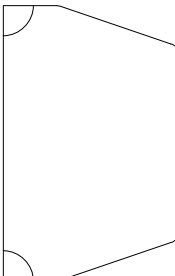
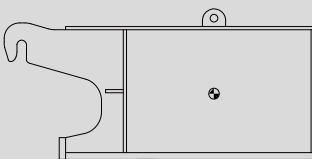


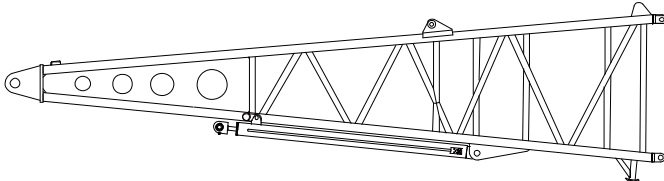
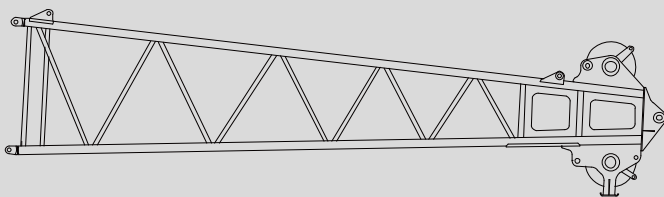
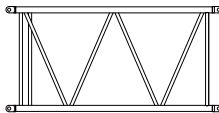
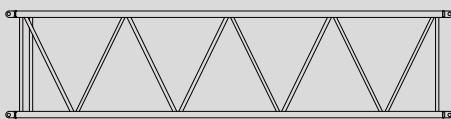
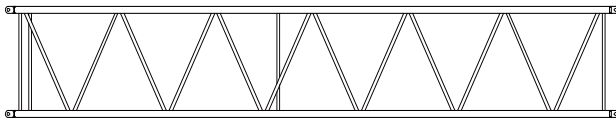
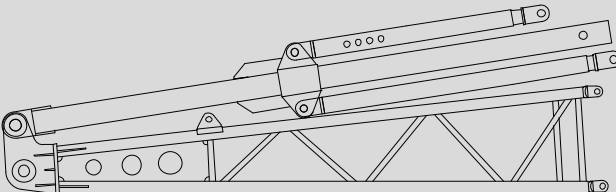
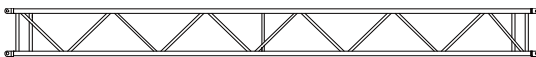
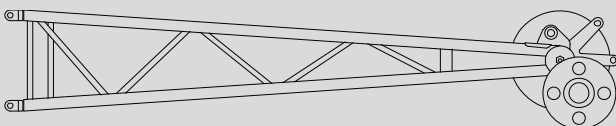
Slowly raise and lower main boom with tip boom to prevent tip boom against damage due to the impact brought by jerky operation.

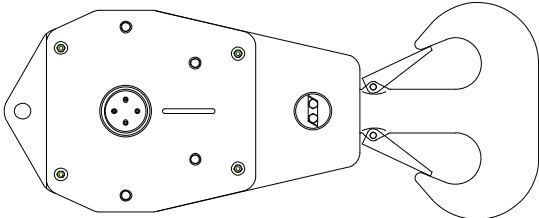
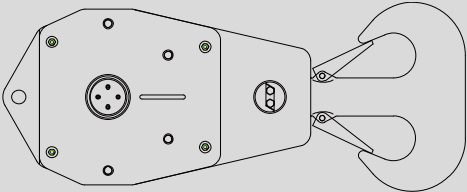
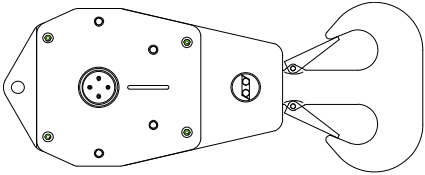
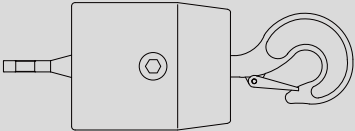
5.8 Transport weights and dimensions of main components

The transport weights and dimensions of main components of ZCC1100H crawler crane are shown in the table 5-19:

Table 5-19 Transport weights and dimensions of main components

Names of the components	Dimensions	Weight (lb*1000)	Qty.	Remarks
Basic machine (with crawler carrier)		99.7 (45.2t)	1	Width 11'2" (3400mm)
Basic machine		59.5 (29t)	1	
Crawler carrier		19.8 (9t)	2	
Counterweight base plate		14.1 (6.4t)	1	Height 8" (200mm)
Counterweight plate		7.9 (3.6t)	6	Height 2' (600mm)
Central counterweight		11 (5t)	2	

Names of the components	Dimensions	Weight (lb*1000)	Qty.	Remarks
Main boom pivot section		2.8 (1.25t)	1	
Main boom head		2.6 (1.2t)	1	
3m main boom intermediate section		0.55 (0.25t)	1	
6m main boom intermediate section		1 (0.44t)	1	
9m main boom intermediate section		1.5 (0.68t)	4	
Fixed jib pivot section + FA-frame		1.32 (0.6t)	1	
fixed jib intermediate section		0.4 (0.16t)	2	
Fixed jib head		0.5 (0.22t)	1	

Names of the components	Dimensions	Weight (lb*1000)	Qty.	Remarks
Load hook (100T)		3.35 (1.52t)	1	
Load hook (50T)		2.71 (1.23t)	1	
Load hook (30T)		1.72 (0.78t)	1	
Load hook (8T)		0.57 (0.26t)	1	

5.9 Transport means and safety precautions for transport

5.9.1 Safety precautions for transport

- a) After crawler crane is dismantled, it can be transported by a low-loader, train or by other transport equipment for a long distance. During transportation, the crane is fixed by rope, with its doors and windows locked up. If necessary, take preventive measures against rain. The crawler crane should be dismantled and transported in accordance with the permissible load carrying capacity of transport vehicle, the weight, dimensions of dismantled parts which are shown in previous figures, and the local traffic laws and regulations. The transport vehicle is forbidden to be overloaded. The weights and dimensions of dismantled parts to be transported can refer to *Package and Transport Manual*.
- b) During transportation, all component parts should be fixed to prevent them from collision and sliding.
- c) The counterweight anchoring rod on A-frame and the rear anchoring rod of A-frame should be secured on the rear end of slewing table.
- d) To understand the detailed transport means, please consult our company.

5.9.2 Other requirements

If the crane is not put into use for a long time (over 6 months), take the following protective measures.

- a) Wipe off the dust and oil dirt to keep the crane clean.
- b) Retract all the piston rods of the cylinders completely.
- c) Put the battery in a dry and ventilating place and charge it periodically.
- d) Grease the surfaces of all exposed components to prevent them from corroding.
- e) Clean the wire ropes and grease them again with ZG-3 graphite calcium base grease.
- f) Store the crane in a garage. If it is placed in the open air, it must be covered up with a water-proof cloth to prevent it from corroding, and antifreeze measure should be taken in winter.
- g) Start the machine once a month and run all the working mechanisms with no load to check whether they are in good condition.
- h) Assign a person responsible for completeness of the crane so that it can be put into operation at any time.



If the crane is not used for a long time, the operator must make a complete and correct check for the crane before stating it up again.