

YQ Truck Crane
Instructions for Operation and Maintenance



Shenli

Machinery



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Crane Operation Instruction

1. The crane's operator should follow the cranes' luffing and height specification table, the lifting weight should not exceed the specified height and the corresponding rated lifting weight, overweight lifting is strictly forbidden.
2. It is prohibited to use crane to pull the buried objects if the pull force is unknown. It's prohibited to lift the items staggered squeezed against each other. It's prohibited to lift the frozen object in winter. It's prohibited to pull or lift in a slant angle.
3. Avoid sudden start or stop, especially when lifting heavy, large size objects with a great lifting height.
4. Before operating a crane, check if the steel ropes are still perfect, if rate is in the safe range. Timely adjustment should be made.

一、 Outrigger Operation

- 1、 Before extending the outrigger, check the ground support strength, reasonably choose the material and thickness of pads, ground contact area and location to avoid outrigger sinking during operation.
- 2、 Pay attention to the order of extending legs. Generally, extend the rear legs first, then front legs. Use the opposite order for retract outrigger.
- 3、 H-shape outrigger shouldn't be very high. Generally, it is proper if the tires are just above the ground a little bit. During extending the outrigger, pay attention to make the slewing table horizontal.
- 4、 After extending the outrigger and before putting the crane into work, check again the outrigger's contact with the ground to make sure all the vertical legs touch the ground, 3 legs' contact with the ground is not allowed.
- 5、 It's prohibited to adjust the outrigger during lifting. If it is necessary to adjust the outrigger, put the lifted object on the ground first, stop the operation, adjust the outrigger, then, perform the lifting again.

二、 Weight lifting Operation

- 1、 The crane operator should check if the working conditions meet the requirements, if there are any adverse factors affecting the weight lifting operation, especially be careful if weight lifting is performed in a special environment.
- 2、 Check the lifting status to see if the matched count weight is added.
- 3、 Check the status of the crane's each work unit; check the steel rope and if the ratio of the pulley set matches the weight of the lifting object.
- 4、 Make sure the operating handle in the neutral position and being able to move freely.
- 5、 When the temperature is below 1°C, make sure to warm up sufficiently. The hydraulic crane can't be put into work until the hydraulic oil's temperature is above 15°C. During warm up, check every oil line, oil pipe connection, and hydraulic parts. Cleaning the leaked oil and solve any abnormal problem timely.
- 6、 Loose hook, raise boom, and operate every working unit at low speed. Smoothly operate lifting, luffing, extending and retracting, slewing as well as brake pedal. Don't put the crane into work until being certain that each part functions normally.

三、 Luffing operation

- 1、 During luffing, don't go beyond the safe elevation angle range. Must make steady and smooth stops when luffing down.
- 2、 When luffing with load, the distance between the lifted weight and the boom must be guaranteed to prevent the risk of the weight hitting the outrigger or luffing cylinder.
- 3、 Luffing up from horizontal position will reduce the lifting torque, which is safe. Luffing down to the horizontal position with load will increase lifting torque. It is mandatory to luffing between the safe lifting range. Otherwise, there is potential risk of capsizing.
- 4、 The boom's normal operation range is 50° – 60°. Try not to operate the boom below 50°.

四、Telescopic boom operation

- 1、 When extending the boom, first priority is paying attention not to exceed the torque limit, especially paying attention not to exceed the torque and boom length limit for the steel cable telescopic boom. Otherwise, there will be risk of breaking the steel cable.
- 2、 On the basis of ensuring the work need, try to use the shortest boom, which is the safest lifting operation.
- 3、 In general, don't extend or retract the boom with load. Doing so will worsen the sliders' wear between the booms. For steel cable telescope boom, doing so will increase the cable's bending force, make the cable wear off early and greatly reduce the cable's lifetime.
- 4、 Operate the telescopic boom and lifting system at the same time. Pay attention to keep the hook's safe distance to prevent the lifting cable overwind.
- 5、 It's prohibited to extend or retract the boom with load. Otherwise, there will be risk or the crane might be damaged.

五、Lifting operation

1、 Before lifting operation, check if the ratio of the pulley set is appropriate, counterweight status, the brake's function. After changing the ratio of the pulley set, the hook's rotation axle must keep perpendicular to the ground.

2、 The lifted weight should not exceed the limit allowed by the crane's working condition. When lifting heavier object, lift up the object 10-20cm first, then check the brake, lifting sling, outrigger status, and the overall stability. If there is any abnormal condition, put down the lifted object, after carefully checking to ensure no risk, perform lifting operation again, the lifting operation should be smooth, don't make mechanical shocks.

3、 During lifting operation, if there is sign of crane capsize or other dangers, put down the lifted object immediately,

4、 Pay attention to the hook's lifting height. Make sure to keep the safe distance between the hook and the boom tip.

5、 When descending the unloaded hook, take advantage of the gravity to improve efficiency. But make sure to operate it together with brake (This function only works for the lifting system with both high and low speeds.

6、 When descending a heavy object, decelerate the load smoothly to a stop (must work with the foot brake if there is any). Sudden stop may cause damage to the boom, luffing cylinder, the winch system, and even cause accidents.

7、 When the descending object reaches lower position, make sure that there are at least 3 safe rounds on the reel.

8、 The crane operator should have a clear idea of the crane's lifting load limit allowed by its working conditions. The crane operator should also know the load's weight. If the load's weight is unclear, but the operator think it's near the limit, there should be a trial lifting, i.e., lift up the load a little bit above the ground, then check the crane's stability, don't lift the load further until the safety is ensured.

六、Slewing Operation

1、 Before the slewing operation, check if there is any person or object within the slewing radius of the frame and the tail slewing table. Check if there are any air-lines or other high altitude objects within the boom's moving area.

2、 The slewing speed should be slow and smooth. It's prohibited to make sudden acceleration. Sudden acceleration will cause load vibration and increase the working radius. Therefore, it is very risky.

3、 Before the lifted object slews to its destination, recover the operating lever slowly first, stop the slewing movement slowly to avoid the swing movement caused by the sudden stop. It's forbidden to make slewing operation if the lifted object has any swing movement.

4、 Don't make slewing operation until the lifted object is completely above the ground.

5、 Before slewing the lifted object, double checking the outrigger's status. This is very important. If any leg becomes weak or has adverse support, accident may happen.

Main Structure and System Sketches

1、 Power Takeoff and Oil Pump

When a crane uses the truck's original power, the chassis engine turns the oil pump through power takeoff (PTO) transmission shaft, makes the oil pump output pressure oil to drive all working parts to work. It's only allowed to use PTO when operating the crane. It's mandatory to disengage the PTO when the truck travels. The engage and disengage of the PTO is controlled through an air valve installed in the cab. If the valve operating handle is pulled out, the pressure air in the air tank will enter into the PTO cylinder and drive the cylinder piston. The PTO shift fork is attached to the cylinder piston rod. Therefore, when the compressed air enters the air cylinder, the cylinder piston rod drives the PTO shift fork and engages the PTO gear. If the valve operating handle is pushed in, the cylinder is open to the atmosphere, the cylinder piston is pulled back by the spring force, and thus, disengages the PTO. If the chassis uses oil brake equipped with manual PTO, moving the handle will work. This function needs to be used with clutch.

2、 Slewing Bearings (Rotary Table)

Manganese steel slew Bearing has a single row of isolated rolling balls inside. There are internal toothed and external toothed types. The internal gear has one ring fixed on the chassis and the other ring fixed on the rotary table. The pinion gear of the slewing system meshes with the ring gears. Since the ring gears are fixed, the rotation of the pinion slews the rotary table. Fill lubricant grease every 20 hours.

Cast steel slew bearing (Fig. 4) is composed of internal ring, external ring, track, and steel balls. The internal ring is fixed to the upper plate by high strength bolts. The external ring is fixed to the track and the lower plate by high strength bolts. There are adjustable shims between the external ring and the track to adjust the space between the external ring and the track. There are a ring of steel balls between the internal ring and the external ring and a ring of steel balls between the internal ring and the track. This way, the upper plate and the lower plate can only rotate relatively. After the cast steel slew bearing works 500 – 1000 hours, the internal ring, the external ring, and the track of the cast steel slewing bearing will wear out. It is required to reduce the number of shims to adjust the space. If the track rail worn out without adjusting the space in time, the lifting stability will be affected. The slew bearing will be damaged quickly. Fill lubricant oil every 20 hours.

3、 Lifting system

Winch system is composed of inclined axial piston high speed a hydraulic motor, a steel cable, a reel, two level planetary deceleration gears, and a hydraulic controlled normally closed brake. The pressure oil enters into brake piston through a selector valve, pushes the piston to open the brake, the motor starts to rotate and turns the reel through two planetary gear deceleration mechanism to retract or release the steel cable, and therefore, to lift or descend the heavy object accordingly.

Sheave hoisting system is composed of a hydraulic motor, a transmission (see Fig. 3), a steel cable, a reel, and the brake pot fixed on the reel. The pressure oil enters into the hydraulic motor through a selector valve. The motor starts to turn and sets the reel to rotate after the transmission changes speed, which in turn retract or release the steel cable so that to lift or descend the heavy object accordingly. The transmission has 3 shift positions, i.e., fast, slow, and neutral. The fast position is for lifting or lowering object not heavier than 500kg. The slow position is for lifting object heavier than 500kg. The working principle of the transmission (Extra-wide type gear for 5T or over, $m = 3.5$ for 4T or under): When the hydraulic motor turns, the gear 1 ($z=17$ extra-side type for 5T or over, $z=17$ for 4T or under) fixed on the motor meshes with the gear 2 ($z=42$) fixed on the transmission shaft and sets the transmission shaft and the gear 3 to rotate. There are conjoined gears ($z_1=25, z_2=37$) on the drum shaft on which the conjoined gears can slide. The slide is pulled by a fork. When the gear 4 meshes with gear 3, the drum shaft rotates at 40 – 60 rpm. When the gear 2 meshes with gear 5, the drum shaft rotates at

80 – 100 rpm. For the model without the operating cab, the operating handle can make the fork slide on the drum shaft. For the model with operating cab, the operating handle in the cab moves the fork shaft and the fork shaft in turn makes the fork slide.

When descending an empty hook, it's required to step on the brake firmly first, then slowly releasing the brake foot pedal after shifting the handle to the neutral position. It's prohibited to use the neutral position to descend the hook with heavy load. During the procedure of descending heavy object, it's required to release the brake foot pedal slowly and let the heavy object slowly descend. If the descending speed is too high, the brake may lose its function. The hydraulic motor inner chamber accumulates extra negative pressure, causes inner leakage and the loss of self lock function, and even causes accidents.

Please see the following table for the appropriate length of lifting steel cable.

Boom type	2.5T 15m	3T 16m	4T 18m	5T 20m	6T 20m	8T 22m	12T 24m
Cable length	45m	50m	54m	60m	62m	68m	75m

4、Slewing System

The slewing system is installed in the middle of the rotary table or on one side.

The slewing system is composed of a piston motor, a hydraulic controlled normally closed brake, two level planetary deceleration gears, and an output pinion. Operate the slewing selector valve to let the pressure oil pass through the valve and enter the hydraulic motor. At the same time, the pressure oil enters the brake oil chamber, pushes the brake piston and opens the brake. The motor starts to turn and outputs the motion by an output pinion after two level planetary decelerations. The output pinion meshes with the slew bearing gears and sets the ring on the rotary table to rotate and, therefore, makes the rotary table to rotate.

The slewing transmission is composed of a hydraulic motor, a transmission, and output pinions. The pinion ($m=3.5$, $z=15$) on the motor meshes with a big gear ($m=3.5$, $z=49$) on shaft 1. The pinion ($m=4$, $z=13$) on shaft 1 meshes with a big gear ($m=4$, $z=61$) on shaft 2. The output gear ($m=8$, $z=15$) on shaft 2 meshes the gear ring of the slew bearing. When the pressure oil enters into the hydraulic motor through the selector valve, the motor starts to turn. The output pinion rotates through the transmission output and sets the slew bearing gear ring fixed on the rotary table to rotate, and, therefore, to make the rotary table turn. (Note: shaft 1 two 6307 bearings, shaft 2 top 390 bearing, bottom 310 bearing, 311 bearing for 5T over)

5、Luffing System

Luffing system uses one or two luffing cylinders to support the boom and make the boom luff. Balance valve is installed at the bottom for some models to control the boom descending speed. (See Fig 2 for details)

6、Telescopic Boom System

The boom has a box structure welded with Q235 or Q345 steel plates consisting of either 3 or 4 concentric sections designed to slide into one another. On the relative sliding surface of the boom, there are nylon sliders installed on the top, bottom, and each side (or rollers on the top and bottom). The position of the sliders (or the rollers) should guarantee the boom with a certain upturn value under the unloaded and fully extended condition.

The telescopic boom driven by oil cylinder (See Fig. 5 for details) is composed of a double-acting single- stage oil cylinder, pulley, and steel cable system. The cylinder is an inverted type. The cylinder extends or retracts the second section boom and the second section boom pulls the third section boom to extend or retract at the same time through steel cable.

A balance valve is installed on the cylinder to guarantee the boom's smooth telescopic motion and to prevent the boom from retracting automatically to cause any accident when the oil pipe breaks unexpectedly. The telescopic boom pulled by cable (See Fig. 6 for details) is composed of a hydraulic motor, a sheave structure at the tail of the boom, pulley, and steel cable. When the hydraulic motor turns, it sets the second section boom to extend or retract through the sheave structure and the second section boom pulls the third section boom to extend or retract at the same time through the steel cable. Therefore, the second and third sections of the boom can extend or retract at the same time. The working principle of the sheave structure: The motor is fixed on the side of the boom tail. A pinion ($m=3.5$, $z=17$) on the motor meshes with a gear ($m=3.5$, $z=41$) fixed on a drum shaft at the tail of the boom. The steel cable for pulling the second section boom is fixed on the drum shaft. A ratchet is installed on one side of the drum shaft. A pawl is fixed on the boom tail. When lifting weight, the pawl engages with the ratchet to prevent the second and third sections of the boom from sliding down.

When the telescopic boom pulled by cable retracts after unloading, raise the base boom a little bit first, move the pawl at the same time to disengage the ratchet, then, retract the boom.

For the telescopic boom pulled by steel cable, it's mandatory to pay attention that once the pulling boom cable appears having broken wire or being fluffy, replacement must be taken in time to prevent any accident.

Replacement method: First, untie the end of the cable on the base boom, pull out the two ends of the cable to see if it can move freely; Then, weld one end of the new cable together with the untied end of the used cable, must weld together firmly and no thickening welding crumbles remain to avoid stuck in the pulley slot. After finishing the welding, pull the other end of the used cable, the new cable will follow the used cable to complete rolling around the pulley set in the boom. After pulling out the new cable, discard the used cable, fix the new cable in the same way as the original (See Fig. 6 for details).

When replacing the cable for a small section of the boom, the small section boom should be lifted off to make the replacement.

The cable replacement method for telescopic boom driven by oil cylinder:

Since the second section of the boom is driven by the cylinder, and then, the second section pulls the third and the fourth sections to extend or retract at the same time through the sheave structure, when replacing the used cable with a new one, open the rear cover of the boom first, then the pulling cables installed on the tail of the third section and fourth section are visible through the opening at the boom tail. Take off the axle pin of the pulling cable, then, take off the adjusting sliders installed on both sides at the front ends of the boom, lift up the boom section which need the cable replacement, replace with new cable and check the slider's wear status, then, install the new cable to the original place (See Fig. 6 for details).

7、 Hook

The Hook consists of hook itself, cross-beam, pulley set, plywood for lifting up heavy objects.

When the lifted object is heavier than 1T, it is required to adjust the rounds of the cable on the boom pulley and the hook pulley to change the lifting rate. The specific operating steps for increasing the rounds are as follows: unlock the rope locking clasp used for fixing the cable end, hold the cable end, circle around another pulley at the tip of the boom, and then, circle around the pulley at the corresponding position of the hook, fix the cable end to the original place and lock it with the rope locking clasp.

Some models are equipped with auxiliary hook. The auxiliary hook is for lifting lighter objects. Because single cable is used, fast descending is achievable, and therefore, the lifting efficiency is improved. The load limit for the auxiliary hook is 0.5T.

After a new crane completes two lifting, the cable locking clasp for fixing the cable end should be unlocked and the cable should be let out completely to release its stress. After releasing the stress, circle the cable around the original place and fix it.

8、Outrigger and Underframe

The crane's underframe serves as the support of the lifting operation. It is connected with the beam of the chassis by U-shaped bolts or high strength bolts or welding together. It was made into a single box frame structure by welding section formed steel and low alloy structural steel plates, which has both good rigidity and strength.

The outrigger adopts H-shaped structure, which has bigger supporting span. Vertical supporting legs and feet are connected with universal balls, which guarantee the good contact between the supporting feet and the ground. The extension and the retraction of the horizontal legs as well as the vertical legs are controlled by double-acting oil cylinders.

Some models are equipped with bidirectional hydraulic lock on the top of the oil cylinder to prevent extending legs while traveling and retracting legs while lifting. After the outrigger raise up the chassis, the space between the tires and the ground shouldn't be less than 20mm.

9、Mounting the Monitor

The luffing angle monitor should be mounted on the boom. The weight pointed by the pointer on the monitor indicates the rated weight for the current boom length and the current elevation angle. The crane operator should strictly follow the rated weight on the monitor to lift load. It's forbidden to lift any load which is heavier than the rated weight specified for the corresponding elevation angle.

10、Hydraulic system and Hydraulic parts

(1) Hydraulic System Overview

Hydraulic system is mainly composed of the oil lines for lifting, slewing, luffing, telescopic boom, outrigger, etc. When a crane's each component is in a non working state, after the gear pump is driven by the transmission shaft from the PTO (or driven by a powered belt transmission from the separator), its suction port sucks oil through an oil filter from a hydraulic oil tank. The working oil output from the gear pump enters the outrigger operating valve. The outrigger operating valves are composed of four monolithic selector valves, one directional control valve, and an overflow valve. When the directional control valve is in neutral position, the pressure oil enters the slewing oil line through the central slewing joint (arbitrary slewing model). Operating directional control valve makes the oil enter the outrigger line. The joint action of selector valve and directional control valve make the horizontal legs and vertical legs extend or retract accordingly.

After finishing the lower system work (the outrigger providing solid support), start the upper system work. When the upper system working, the oil for the slewing, luffing, telescopic boom, and lifting is supplied by the oil pump.

(2) The Principle and Instructions for Main Hydraulic Parts

Bidirectional hydraulic lock is mainly composed of valve body, valve core, valve sleeve, spring, piston, stopper, and seals. The two chambers of the hydraulic lock are connected, respectively, with the entrance and exit of the outrigger operating valve's selector valve while these two oil ports are connected, respectively, with the rod chamber and rodless chamber of the oil cylinder.

Balance valve is mainly composed of valve body, valve core, valve sleeve, spring, piston, valve cover, and seals. Its working principle can be explained using the lifting oil line for example as follows. When a crane lifts a heavy object, pressure oil flows in through a port and opens the valve sleeve, then the oil flows into motor's chamber A through another port to lift the heavy object. When a crane descends a heavy object, operate the selector valve to make the pressure oil flow into the motor's chamber B. At the same time, the pressure oil enters the control port of the balance valve, Port C

through a damping orifice to push the piston to open the valve core and let the oil flow from port B, through Port A, back to the oil cylinder, the heavy object descends. If the heavy object descends too fast, the valve core tends to close under the spring's action and slows down the descending accordingly. Therefore, the balance valve serves to limit the load's descending velocity. The overflow valve in the upper operating valve combination only guards the safety of lifting oil line. When lifting a heavy object, a high pressure pilot valve plays a regulatory role. Normally set the pressure as much as 1.2 times the pressure for the rated load to avoid the hydraulic system overload and protect the hydraulic parts and lines.

When the lifting valve is operated, the luffing, telescopic, and the slewing valves can be operated at the same time to perform a combined action. However, the luffing, telescopic, and the slewing valve themselves cannot be operated simultaneously.

Instructions for the upper operating valve combination:

- ① Working medium, mineral oil 17-40Acst viscosity;
Medium working temperature: 10-80°C
It's recommended to use L-HM46[#] (or 68[#]) antiwear hydraulic oil
- ② Operating method: According to the standard, pull the lever, the heavy object ascends, rotary table turns left, luffing and telescopic cylinder pistons extend. On the contrary, the heavy object descends, the rotary table turns right, and the piston rod retract.
Overflow valve regulating: clockwise for increasing pressure, anticlockwise for relieving pressure.

11、 Common Troubles and Troubleshooting for Operating Valves

	Troubles	Causes	Troubleshooting
1	The pressure is not up	Main valve core stuck	Remove to make it move free
		Pilot valve and housing bore misalignment	Align them
		Pilot spring free length segment	shim
2	The pressure doesn't relieve	Main valve core stuck	Remove to make it move free
		Pilot valve core stuck	Remove to make it move free
3	Valve junction leakage	Connecting bolts not tightened	Tighten them
		Junction seal defective	Replace them
4	Oil leakage at screw plugs of Technological holes	Screw plug not tightened	Tighten them
		Conjugate pad damage	Replace combination screw plug

The outrigger operating valves are composed of 4 monolithic selector valves, a set of directional control valves, pilot operated check valve, and an overflow valve.

Selector valve is three-position four-way valve. Directional control valve is three-position six-way valve. The coordination of the selector valve and directional control valve controls the extension and retraction of the outrigger.

Overflow valve regulating: clockwise for increasing pressure, anticlockwise for relieving pressure.

The central slewing joint plays a role of connecting the upper system oil circuits and electric circuits with the lower system. It is mainly composed of a sleeve, fixed body, base, conductive ring, seals, etc. The slewing body is connected with the lower system. Hydraulic oil passes through the internal oil passage inside the fixed body, flows into the external oil grooves, then passes through the hole in the sleeve, and enters the upper system. The 3 conductive rings of the central slewing joint supply the electricity to the upper electrical parts.

12、 The Upper Electrical System

The crane's upper electrical system is powered by the truck's power supply through the conductive rings in the central slewing joint. The rated voltage is 24V, which supplies electricity to powered fans, powered screen wiper, working lighting, etc. (For the model equipped with this function)

13、 Operating System

The lower control console is composed of throttle control, outrigger control valves. See the instruction sign on the console for the operating direction.

The upper control console is set in a control room. It consists of pedal accelerator, slewing, telescopic boom, luffing, and lifting operating levers. The levers control the valve stem displacement through a linkage. The throttle control is achieved through hydrostatic transmission. Step on the throttle pedal, a tappet then pushes a piston to discharge oil from the main pump. The oil passes through the passage inside the central slewing joint, then enters working cylinder, makes the piston and tappet in the working cylinder push the engine governor rocker and, therefore, changes the engine's rotational speed to achieve the purpose of changing oil pump's speed. The change in the amount of oil discharged by oil pump governs the speed of each working unit.

Choose brake oil for hydrostatic transmission and frequently check if there is enough oil in the main pump oil cup to avoid speed governor instability.

It's strictly prohibited to expose the cup or ring inside the pump body to mineral oil.

The clutch pump was chosen for the main pump. Clutch transmission cylinder was chosen for the working cylinder.

14、 Chassis

The crane is equipped with either farm vehicles or Tongyong truck as chassis. Read the instructions and maintenance guide carefully before operating it. Be familiar with the function of every instrument and handle and their operation. Perform adjustment, lubrication, and maintenance in accordance with the instructions.

Crane Maintenance

1. The crane should be kept clean. After each operation, cleaning the dust and the dirt.
2. Apply lubricant grease to the exposed machined surface.
3. Apply lubricant oil once between the bottom of the boom and the pulley every 60 working hours.
4. Adjust the space of the rotary table regularly and apply lubricant regularly.
5. Apply lubricant to each lubrication point according to the lubrication map (See Fig. 7 for details).
6. Clean and lubricate the steel cable frequently to extend its life time.
7. Don't park the crane outside over a long period to avoid getting rusty after exposing to rain.
8. Clean the oil cylinder's filter net frequently. In general, clean once every month.
9. Replace the return oil paper filter when the pressure is over 0.35MPa. For replacing, remove the top cover of the tank surface filter, pull out the paper filter, replace with a new one, put back the cover.
10. Replace the deteriorated hydraulic oil after using for a while. For a new crane, replace the oil after working the first 20 hours. When replacing the oil, wash the oil tank; discharge the left over in each cylinder. In general, replace the oil once every 1000 hours. After replacing the oil, tighten the tank cover. Only if the hydraulic oil is kept clean, will the lifetime of the hydraulic parts be guaranteed and the normal operation of the hydraulic system be guaranteed. Never mix the hydraulic oil with any water or diesel oil. If mixed with water or diesel, the hydraulic oil will be clogged and generate lots of gas, which will affect adversely the crane's normal lifting operation.
11. When the crane's oil temperature reaches 80°C. Stop running the crane. Let it rest and cool down before running it again.
12. The crane system's preset pressure is 16MPa, which can be adjusted from the multi-way valve. The specific method of the adjustment is as follows. There are two screw nuts side by side on the multi-way valve. Inside is the locking cap. Outside is the screw nut for adjusting the pressure. Clockwise adjusting the nut is for increasing the pressure. Anticlockwise is for relieving the pressure. After pressure adjustments done, tighten the pressure adjustment screw nut using the locking cap. Never recklessly adjust the system pressure higher so that the lifetime of the hydraulic parts can be guaranteed. (See Fig. 8 for details)
13. When overhaul and repair the crane, if it's necessary to remove the hydraulic parts or lines, the first thing need to do is to understand the working principle and learn the structure of each part. When disassembling hydraulic parts such as cylinders, valves, locks, etc., perform the disassembling in a clean, dustless room and keep the parts clean and free of bumps and scratches; prevent missing any part or wrong assembling. If it is possible, perform test and adjustment after assembling. If there is anything wrong with oil pump or motor, they should be repaired in a professional repair shop.
14. Instructions and Maintenance of small hook gearbox: Add yellow grease periodically and check each fastening screw. Especially check the wear and tear of the hydraulic motor pinion (pinion with 17 teeth) and make sure the tablet screws for fastening gears are not loose to avoid unnecessary troubles. After tightening the pinion tablet screws, there should be a 1mm-2mm space between the pinion and the tablet.
15. When the small hook shift to high or low speed, ensure to shift into place. Check the gear and location.
16. Base boom steel cable replacing method: unlock the two ends of the steel cable, there is a round wheel inside, weld one end of the used rope to an end of the new rope and ensure the smoothness of the joint, Lead out the new rope by pulling out the used rope, and lock the ends of the new rope to their individual positions.
17. Straight through valve channeling oil: When running the diesel engine, the motor following it to turn indicates there is problem with straight through valve. Wash clean it or replace it will work.
18. Luffing cylinder falls: Lift a part of luffing cylinder, and then remove the two oil pipes from balance valve. If the entrance port keeps leaking, it indicates the balance valve has problem. Wash clean or replace the balance valve. If the return oil port keeps leaking, it indicates the cylinder has internal leaking. Check and replace the cylinder oil seal.
19. Joint leakage: The crane's oil line joints are sealed with O-shaped seal. If there is leakage at a joint, replace the O-shape seal immediately.

20. Luffing cylinder, telescopic boom cylinder discharge oil method: (1) First, remove the return oil pipe from the luffing cylinder, then lift the luffing cylinder, don't put the pipe back until the used oil is completely discharged. (2) Second, remove the return oil pipe from the telescopic boom cylinder and discharge the used oil completely from the cylinder. During the above two procedures, it is prohibited to retract or extend the boom to avoid mixing new oil with used oil.
21. It is not allowed to extend the base boom over the second yellow line.

Common Troubles and Troubleshooting

When there is any trouble with the crane during its lifting operation, a comprehensive inspection and analysis should be performed, find the cause of the trouble, solve it with appropriate method. The following is a list of common troubles and troubleshooting for reference.

	Troubles	Causes	Troubleshooting
PTO	Control malfunctions	<ol style="list-style-type: none"> 1. Air pressure not enough 2. Gas line blockage or leakage 3. Manual air valve malfunction 	<ol style="list-style-type: none"> 1. Increase air pressure 2. Repair gas line 3. Repair air valve
	Hard to operating gears	<ol style="list-style-type: none"> 1. Gears have oil dirt 2. Lever fastening screw loose 	<ol style="list-style-type: none"> 1. Cleaning maintenance 2. Check and repair
	Abnormal noise	<ol style="list-style-type: none"> 1. Gears not in place 2. Bearing damage 	<ol style="list-style-type: none"> 1. Put gears in position 2. Check and replace
Oil pressure	Oil pressure not up	<ol style="list-style-type: none"> 1. The oil level in the oil cylinder too low or oil suction port blockage 2. The pressure for opening overflow valve too low 3. Oil discharge volume is not large enough 4. Pressure line and return oil line collusion or parts' oil leakage too large 5. Oil pump damage or leakage too large 	<ol style="list-style-type: none"> 1. Add oil or check oil suction port 2. Adjust overflow valve 3. Increase machine speed 4. Inspect and repair oil lines, especially valves, central slewing joint, and oil motor. 5. Inspect and repair oil pump
	Pressure too high for empty hook	<ol style="list-style-type: none"> 1. Pipeline system blockage 2. Oil filter blockage 	<ol style="list-style-type: none"> 1. unscrew the joint to remove the blockage 2. Wash clean or replace the filter.

Pump	Insufficient Pressure	Wear and tear, internal leakage	Replace with new pump
	Noise	<ol style="list-style-type: none"> 1. Suction port blockage 2. Suction port sucks in air 3. Pump loose 4. Oil contamination, oil temperature too low 	<ol style="list-style-type: none"> 1. Check and remove the blockage 2. Inspect seal, tightening joint 3. Tightening pump connecting bolts 4. Replace with new oil, start with warm up
	Insufficient flow	<ol style="list-style-type: none"> 1. Low Engine speed 2. Pump has severe wear and tear, too much internal leakage 	<ol style="list-style-type: none"> 1. Step on the gas to increase throttle 2. Replace with new pump
	Generating heat	<ol style="list-style-type: none"> 1. Oil too sticky, too much contamination 2. Pressure too high 3. Oil level too low 4. Internal leakage too much 5. The ambient temperature too high; Working too long 6. Balance valve malfunction 	<ol style="list-style-type: none"> 1. Change oil 2. Adjust overflow valve, check lines 3. Add oil to the specified level 4. Inspect and repair parts 5. Stop running the crane to let it cool down 6. Repair the balance valve
Boom	Pressure too high or shaking when operating telescopic boom	<ol style="list-style-type: none"> 1. Balance valve orifice blocked 2. Friction between the fixed portion and movable portion too large or there is blockage of cylinder 3. There is air in the cylinder 	<ol style="list-style-type: none"> 1. Wash clean the balance valve 2. Repair 3. Discharge the air
	When the boom stays, the heavy object descends slowly	<ol style="list-style-type: none"> 1. The brake power not enough 2. One-way balancing valve internal leakage 3. Luffing cylinder leakage 	<ol style="list-style-type: none"> 1. Repair, adjust brake 2. Inspect balance valve 3. Repair luffing cylinder
Outrigger	Retract, extend malfunction	<ol style="list-style-type: none"> 1. Safety valve malfunction or pressure adjusted too low 2. Bidirectional hydraulic lock malfunction 	<ol style="list-style-type: none"> 1. Check and adjust safety valve 2. Repair bidirectional hydraulic lock
	Slow movement	<ol style="list-style-type: none"> 1. Safety valve pressure too low 2. Selector valve internal leakage 3. Cylinder seal damage 	<ol style="list-style-type: none"> 1. Adjust pressure to specified value 2. Check selector valve 3. Replace seal
	Sink during working	<ol style="list-style-type: none"> 1. Hydraulic lock internal leakage 2. Foreign objects jammed valve seat 3. Cylinder internal leakage 	<ol style="list-style-type: none"> 1. Repair or replace 2. Retract, extend legs, and remove foreign objects until no sinking, wash clean oil filter 3. Repair seal on the piston

Slewing	Slewing no action	<ol style="list-style-type: none"> 1. Overflow valve pressure set too low 2. Shuttle valve malfunction 3. Overflow valve's one-way valve seal damaged 4. Brake jammed shut 	<ol style="list-style-type: none"> 1. Adjust according to specification 2. Repair or replace 3. Repair or replace 4. Repair brake
Telescopic action	Cylinder has no telescopic action	<ol style="list-style-type: none"> 1. Overflow valve pressure set too low 2. Cylinder seal damaged 	<ol style="list-style-type: none"> 1. Adjust according to specification 2. Replace the seal
	Retract when lifting weight	<ol style="list-style-type: none"> 1. Balance valve internal leakage 2. Cylinder seal damaged 	<ol style="list-style-type: none"> 1. Repair or replace 2. Replace the seal
Luffing	Cylinder has no up down action	<ol style="list-style-type: none"> 1. Overflow valve pressure set too low 2. Cylinder piston seal damaged 	<ol style="list-style-type: none"> 1. Adjust according to specification 2. Replace the seal
	Cylinder sink	<ol style="list-style-type: none"> 1. Balance valve internal leakage 2. Cylinder piston seal damage 	<ol style="list-style-type: none"> 1. Repair or replace 2. Replace seal
	Shake when lowering boom	<ol style="list-style-type: none"> 1. Air in the cylinder 2. Balance valve orifice blocked 	<ol style="list-style-type: none"> 1. Perform up and lower actions a few more times without load to discharge air and fill oil 2. Wash clean the balance valve
Lifting weight	Falling when lifting weight	Brake skidding	Adjust brake or replace brake pads
	Shaking when lower down weight	Balance valve opening pressure set low	Adjust pressure value
	Move without load but no action with load	<ol style="list-style-type: none"> 1. There are foreign objects in the overflow valve seat 2. Overload 	<ol style="list-style-type: none"> 1. Move without load repeatedly until the foreign objects removed, wash clean oil filter 2. No overload allowed
	Not able to lift up or lower down weight	<ol style="list-style-type: none"> 1. Oil pressure too low 2. Brake jammed shut 	<ol style="list-style-type: none"> 1. Repair, adjust pump and overflow valve 2. Repair the brake
Operating valve	Operating lever jammed, or valve rod stuck	<ol style="list-style-type: none"> 1. Hydraulic oil too dirty 2. Too much greasy dirt 3. Wrong type Hydraulic oil used 	<ol style="list-style-type: none"> 1. Replace hydraulic oil 2. Clean the greasy dirt on the operating lever and inside the valve 3. Switch to right type hydraulic oil

Oil pipelines	Oil leakage	<ol style="list-style-type: none"> 1. Loose joints 2. Seal damage 3. Missing seals 4. Welding voids 	<ol style="list-style-type: none"> 1. Tightening joints 2. Replace the seals 3. Add seals 4. Repair welding or replace
	Serious noise	<ol style="list-style-type: none"> 1. Air in the pipeline 2. Oil temperature too low 3. Loose pipes and/or parts 4. Oil filter blocked 5. Not enough oil in the oil tank 	<ol style="list-style-type: none"> 1. Operating a few times to remove gas from parts. Repair oil suction pipe to ensure it free from air leakage. 2. Operating oil pump at low speed to warm it up or replace oil 3. tightening 4. Wash clean filter or replace it. 5. Fill more oil

If crane is operated and maintained correctly, there shouldn't be any severe problem. Just in case, when oil line system has problem and regular solution may cause accident, use following emergency solution to unload, and then troubleshoot.

1. Luffing can't be lowered down. Unscrew the oil pipe joint of the luffing cylinder upper chamber, also loose the oil pipe joint connecting the cylinder lower chamber and the balance valve. Let the oil spill out slowly to lower the boom
2. Boom can't be retracted. Unscrew the oil pipe joint of the telescopic cylinder rod chamber, then, lift up the boom slowly to let the boom retract. If the boom can't retract with its own weight, add appropriate weight to the hook to make it retract.
3. If the problem can't be solved with the above solution, please contact the manufacturer.

Replacing the hydraulic oil

When the crane is in the parking state, discharge the hydraulic oil from the hydraulic oil tank completely first, clean the oil tank, remove the oil tank outlet flange, replace oil filter, then, discharge the oil from the oil pipe completely. Install each individual pipe back to the original location on the tank.

Fill the tank with specified type hydraulic oil, start to empty each oil cylinder in the lower part of the crane. Disconnect the return oil pipe of the lower part valve (Note: the pipe connecting the lower part valve to the tank) from the tank, put it in a waste oil drum, then start the engine to let the oil pump work, followed by operating the lower part valve to extend horizontal legs, then, the waste oil flows out from the return oil pipe; After finishing extension of horizontal legs, Start operating the vertical leg cylinder to let the waste oil flow out from the return oil pipe. The waste oil won't be discharged completely until all the cylinders finish extension. Then, connect the return oil pipe, leveling the lower part. Now, start to discharge the waste oil from the oil cylinders of the crane's upper part. Remove the return oil pipe of the boom, then operating the luffing cylinder to lift the base boom. The waste oil now flows out from the return port of the oil cylinder. When the cylinder is empty, the oil will be discharged completely. Reinstall the oil pipe will be ok. Then, start to discharge the telescopic cylinder, in the same way, remove the return oil pipe from the telescopic cylinder and start to extend the boom. The waste oil is discharged completely when the boom extends completely. After the oil pipe is reinstalled, the overall oil replacement is completed.



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