Dear users:

Thank you for choosing LONKING CDM816D wheel loader!

This Manual briefly describes safety instructions, performance parameters, structural principle and requirements for operation, maintenance, adjustment and others of LONKING CDM816D wheel loader for use and reference of machine operators, servicemen, and technical managers.

The Manual is the guideline for proper machine operation and maintenance; therefore, please read carefully and comprehend the manual before machine application and operation and strictly follow the corresponding instructions and requirements for machine operation, lubrication, maintenance and repair. Many faults are resulted from human factors such as careless reading of *Operation Manual*; High safety awareness and proper maintenance guarantee a safe and efficient operation, thus benefitting you a lot. Therefore, please read and comprehend the safety instructions before operation and strictly follow the relevant instructions and requirements. Incorrect operation, lubrication, maintenance and repair are dangerous and may cause personal casualties.

Since we will continuously strive to improve product quality and synthesis performance to achieve better cost performance and higher working efficiency, the information in this manual will be changed without notice.

The technical parameters involved in this manual will not be taken as the inspection or test basis of the third party.

In order to better service you and improve product and service quality, please inform us by correspondence of the problems and improvement comments found when using LONKING products and their *Operation Manual*.

This is the first edition.

Best wishes for your business!

LONKING (Shanghai) Road Construction Machinery Co., Ltd.

Jan. 30, 2012

Foreword

Documentation

Operation & Maintenance Manual shall be properly preserved in the cab for review at any time. Read and comprehend this manual by all means.

This manual may not incorporate contents generated due to continuous product improvement and update.

Some structures or accessories shown on photos or pictures in this manual may be different from those on your machine.

In case of any doubts about the machine or this manual, please consult the LONKING dealers for the latest information.

Manual structure

This maintenance manual consists of 7 parts: forward, safety (Chapter I), product information (Chapter II), operation (Chapter III), maintenance (Chapter IV), hoisting of loader& loaderfixing in transportation (Chapter V), common malfunctions and troubleshooting (Chapter VI) and reference table for densities of common materials.

Safety

This part lists a series of basic safety preventions, various warning labels as well as their respective content and position applied.

Product information

This part lists the usage, performance and parameters of the product.

Operation

This part describes the instruments, switches, control mechanism of machine and tooling as well as materials on transportation and towing.

Maintenance

This part specifies the maintenance cycle of all machine parts. The items given in the Table of Maintenance Cycle shall be done within the specified cycle. The items without the specification for maintenance cycle shall be listed under the “maintenance when necessary”.

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Chapter I. Safety

I. Safety instructions

Failure to follow or completely follow the basic safety regulations during the operation, maintenance or repair is the chief plotter for frequent accidents. Therefore, always keeping the safety awareness is a guarantee for accident elimination.

The operators of this machine shall possess high safety awareness and strong sense of responsibility as well as have received adequatetrainings in safety rules, operating skills, usage of machine and tools, emergency troubleshooting and other aspects so as to be capable for machine operation.

To ensure your safety, please do not make any maneuver to this machine unless you have carefully read and comprehend the Operation& Maintenance Manual.

Improper machine operation, maintenance or repair is dangerous and likely to cause casualties!

The machine is applied with various safety warning labels, which are described in this Manual in detail. If you fails to pay due attention to them, each operation step will possibly lead to irretrievable damage to yourself or others.

Each kind of possible danger has been identified by safety warning labels like “Warning”, “Danger” or “Caution” applied on the machine with corresponding hint provided, as per which you can take correct measures; absolutely, we cannot predict all kinds of possible dangers in reality. Therefore, it is necessary to remind the machine operators to ensure the safety of themselves and others as well as prevent the machine against any damage or breakage.

Danger:

Definition to the label heading:

① There exist dangers possibly threatening your personal safety;

② Do not operate arbitrarily; any action may influence the normal performance of machine as well as cause machine damage or dangerous accidents.

Warning:

Definition to heading of “Warning”:

① There exist potential dangers possibly threatening your and others’ personal safety;

② Do not operate arbitrarily; any improper operation may lead to machine damage or influence its

normal performance.

Caution:

Definition to heading of “Caution”:

① There exist dangers possibly threatening your personal safety;

② Please operate as per the instructions; any incorrect operation or non-operation may influence the normal performance of machine or damage it.

Correct operation, maintenance and repair are essential for a higher operating efficiency and application safety.

The information and relevant pictures provided in this manual are the most accurate during its preparation but may be changed due to the prolonging of its service time and the constant product improvement. The machine owner shall pay attention to any information changes and timely inform them to the operator. It is a must to obtain the most accurate information and material about the machine before maintenance, repair or operation; in case of any difficulties hereinto, please consult the local LONKING sales-service department for those information or material.

Prior to maintenance or repair, please carefully read and fully comprehend the relevant safety instructions; failure to pay sufficient attention to those instructions may cause injuries or even death to yourself or others; the relevant safety instructions can be referenced in the following documents:

★Safety labels applied on the machine or its interior parts

★This manual

★Accessory catalog of the overall unit

★Operation & Maintenance Manual of Machine Accessories

★Accessory Catalog of Machine Accessories

★Specific Safety Instructions distributed by LONKING Holdings Limited

The followings describe the safety rules in terms of basic operation, maintenance and repair procedure. Always abide by those provisions for correct machine operation, maintenance and repair.

Always abide by those provisions for correct machine operation, maintenance and repair:

1.1 Safety hints

1.1.1 The machine may be operated only by the trained, qualified and designated personnel.

1.1.2 Most accidents in the operation, maintenance and repair of products are caused by the non-compliance with the basic safety rules or precautions. If the potential dangers can be recognized in advance, the accidents may always be avoided. The staff shall be warned of a variety of potential dangers and trained for the necessary skills and the correct operating methods.

1.1.3 Incorrect operation, maintenance or repair is dangerous and may cause personnel casualties.

1.1.4 After power-on but before startup, please sound the horn twice to alarm the people around to watch out, for the loader is ready to start; the loader is shut down electrically under the control of key. For this purpose, shift to the ”OFF” position and keep for 3-5s; return to the power-off gear to cut off the power after the engine has been stopped, and then take out the key to avoid electricity leakage and other accidents. **Always remember to disconnect the power when parking** to ensure the safety of personnel and machine; cut off the master power switch after each operation to avoid electricity leakage.

1.1.5 Unauthorized modification to the machine may damage its functions or weaken the safety and influence its service life.

1.1.6 In case of any machine faults, please have it repaired at the designated special service center and purchase the special LONKING accessories.

1.1.7 Please use the LONKING special oil when replacing or refilling with oil (grease); notice that the fuel tank is on the right side in the forward direction of the machine and the hydraulic oil tank on the left side. When servicing (refilling with) oil, never mix the oils at different grades and from different manufacturers together; it is a must to apply the LONKING special brake fluid, for the inacceptable brake fluid may lead tobrake locking, insufficient braking force or brake failure, thus causing machine non-operation and even safety accidents.

1.1.8 If the brake plate of the caliper brake has been worn for 2/3, replace it with a new acceptable one; or else, braking may be failed.

1.1.9 Do not adjust the set pressure of the hydraulic system on your own.

1.1.10 The vehicle speed shall be slowed down to lower than 4km/h upon shoveling and loading materials. Never insert the bucket into the material by means of impact force and never lift the boom mandatorily when the bucket has not been retracted; or else, the machine parts may be damaged seriously.

1.1.11 It is a must to park the vehicle and shift to neutral position before changing the driving direction (from forward to backward or vice versa) to prevent the transmission parts from damage due to inertia impact of machine parts.

1.1.12 During the long-distance transfer by yourself, keep driving at medium/low speed and never drive at high speed.

1.1.13 When topping up or performing repair, pay highly attention to keeping the cleanness of oil (grease) and machine parts; or else, the system may be so contaminated to accelerate the machine wear and even substantially shorten the machine service life.

1.1.14 Replace the damaged protective sleeves immediately to avoid other serious malfunctions.

1.1.15 Safety precautions and warnings are included in the manual and product. The ignorance of these warnings may lead to the personal casualties and economic losses of yourself or others.

1.1.16 Dangers shall be identified with the “safety warning symbols” and such “label texts” as "Danger", "Warning" and "Caution".

1.1.17 The model shall not work in a contaminated environment.

1.1.18 The model does not apply to the environment subject to falling objects.

1.1.19 Always check the operating handle before starting the machine to ensure that the handle is at the neutral position.

1.1.20 The left door of cab is for entrance/exit (the forward direction is positive) and the right door is for emergency exit.

1.1.21 Lower the boom and bucket on the ground before shutting down the engine except in special conditions.

1.1.22 Properly support the lifted boom (if required) during repair.

1.2 Safety labels

1.2.1 There are special safety labels sticking to your machine, and their accurate location and corresponding dangers will be described in this part in detail. Please familiarize yourself with the safety labels before operation.

1.2.2 Ensure that all safety labels are clear and legible.

1.2.3 Clean or replace the illegible safety labels.

1.2.4 Replace the label with illegible icon.

1.2.5 To clean the safety labels, use cloth, water and soap instead of solvent, gasoline or other aggressive chemicals which may cause adhesiveness loss of the sticking agent for label application and even shedding of safety labels from the machine.

1.2.6 Replace any damaged and missing safety labels.

1.2.7 If the replaced part is applied with safety label, reapply the label on the new part.

1.2.8 Various brand-new safety labels are available at any LONKING after-sales facilities.

1.3 Understanding signal words

1.3.1 On safety labels, the words indicating the danger degree - DANGER, WARNING or CAUTION - are used together with the safety marks. "Danger" refers to the immediate danger and may cause death or serious personnel injury if not avoided.

1.3.2 “Warning” refers to the existence of potential dangers, which may cause casualties if not avoided.

Fig. 1

1.3.3 “Caution” refers to the existence of potential dangers, which may cause light or medium injury if not avoided.

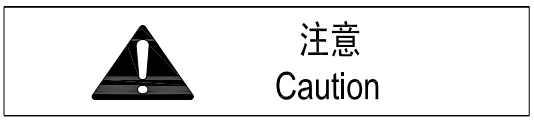

Fig. 2

1.3.4 "Danger" or "Warning" safety labels are set near the specific hazard areas. For the conventional safety protections, see "Caution" labels.

1.3.5 Some safety labels include the words not mentioned above after the safety warning marks have been used on the machine.

1.4 Schematic diagram for layout of safety labels and additional labels

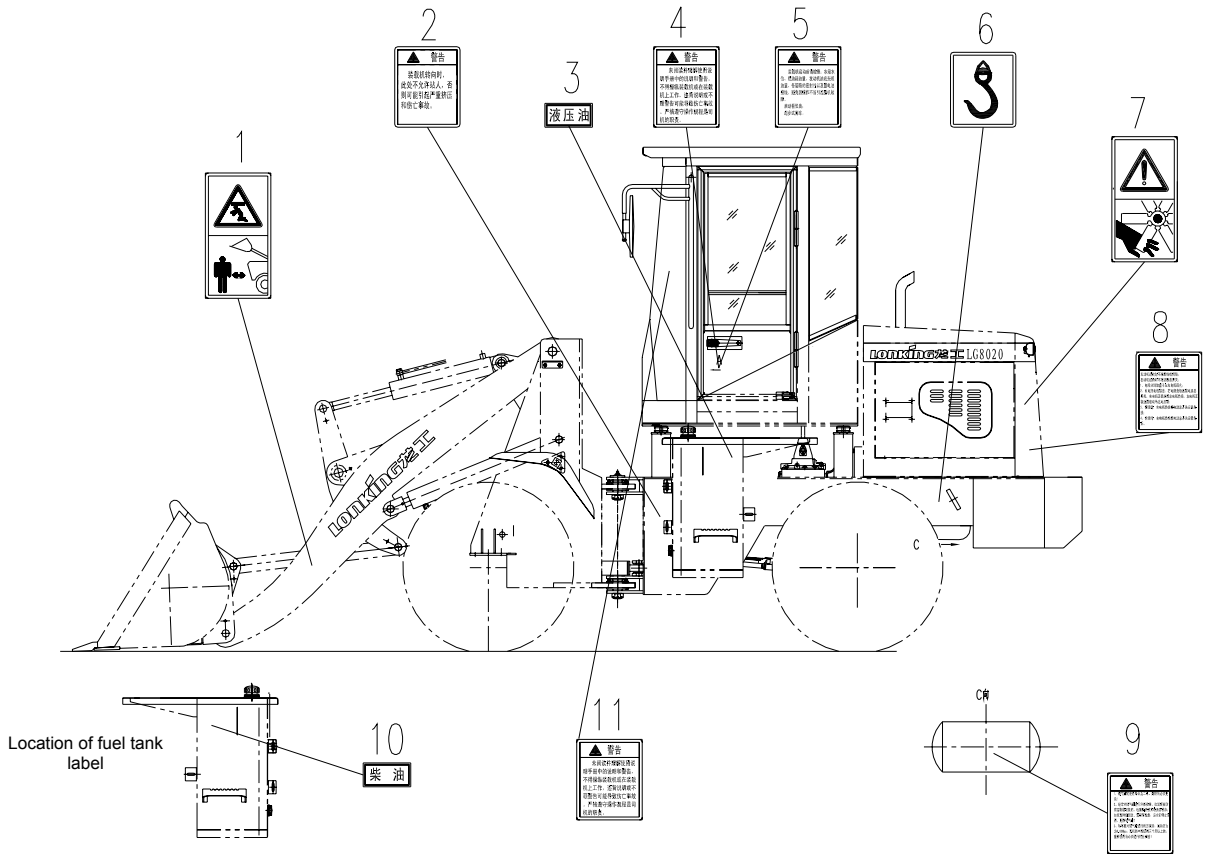

Fig. 3

Warning label for boom (1)

Location: outside the left plate of boom

Never stand under the lifted boom; or else, serious damages or even death are possibly caused.

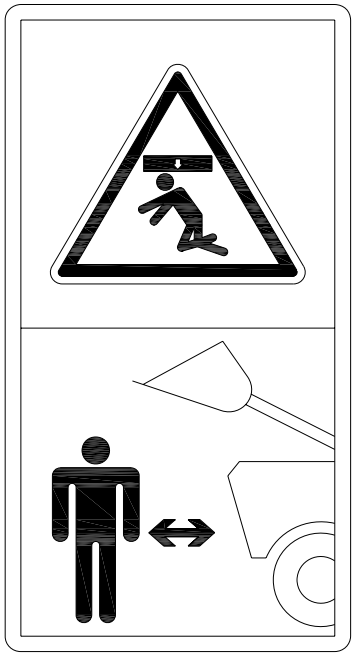

Fig. 3-1

Safety label of hinge (2)

Label location: outside the main plate of front frame of loader

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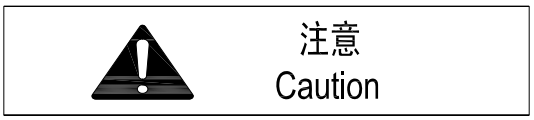
Risk of crushing. Do not stand here when the vehicle makes turning. Otherwise, injury or death may be caused due to crushing. Always lock the bogies of front and rear frames when transporting loader or repairing the hinges.

Before the wheel loader returns to work, remove the steering lock device and put it away.

Fig. 3-2

Label for hydraulic oil (3)

Label location: near the round dipstick of left hydraulic oil tank in the forward direction of overall unit.



Refill with the hydraulic oil in time to avoid loader stop; incorrect oil filling may disenable or even damage the machine.

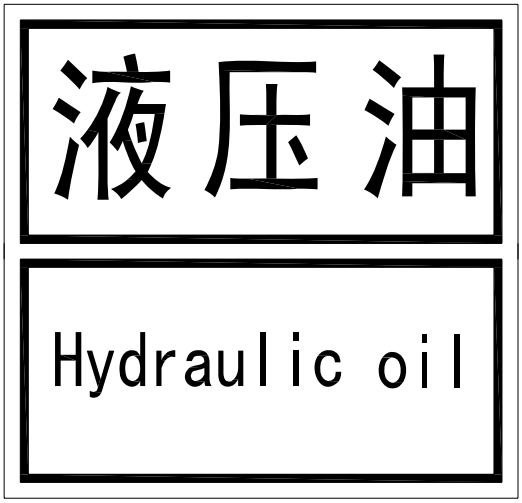


Fig. 3-3

Label for user warning (4)

Label location: left rear of cab seat

Always operate the machine as per the label; otherwise, machine damage or personal injuries may be caused.

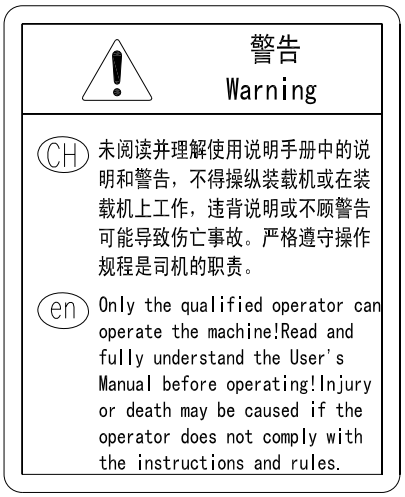


Fig. 3-4

Label for preparation before start-up (5)

Label location: left rear of cab seat

Always operate the machine as per the label; otherwise, machine damage or personal injuries may be caused.

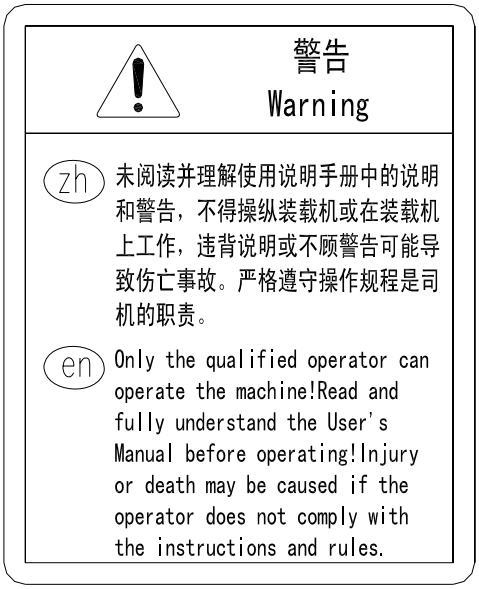
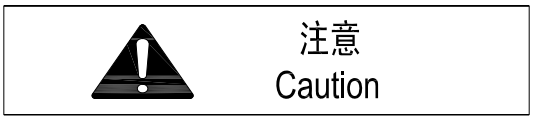


Fig. 3-5

Labels of lifting (6)

Label location: near the lifting eyes of front and rear frames



For loader lifting, hang the hook into the lifting eye on the body and adjust the length of the lifting ropes before the lifting to keep the vehicle basically level; check whether the hooks are secured firmly during lifting. Please use the special slings to protect parts such as hood and cab against scratch from steel rope.

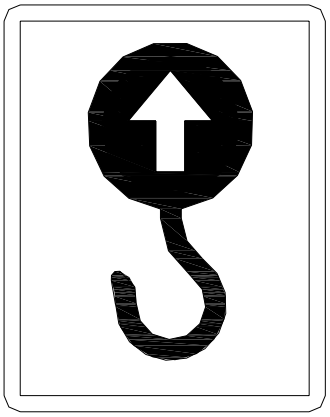


Fig. 3-6

Warning labels of fan (7)

Label location: both sides of rear engine hood

Do not have your hands approach to the fan when the engine is running; otherwise, serious injury or death may be caused.

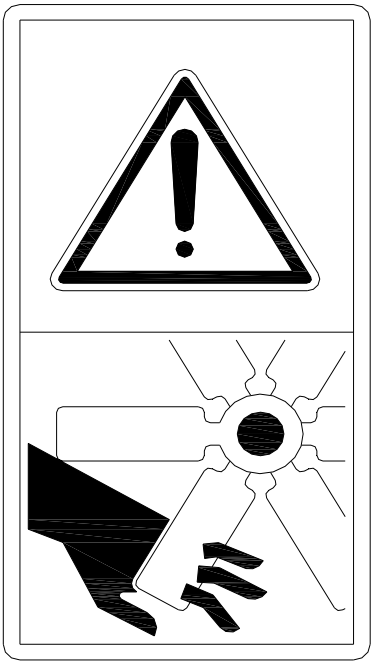


Fig. 3-7

Warning label of battery wiring (8)

Label location: left rear of cab seat

Risk of explosion! Incorrect connection and jumper of wires may lead to explosion and personal casualties. Notice that the battery may be stored at different parts.

Fig. 3-8

Tips for air reservoir application (9)

Label location: beside the lifting eye of rear frame of overall unit

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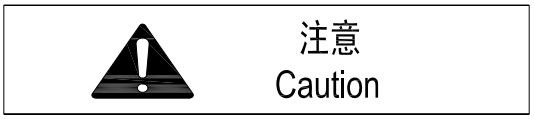

Always operate the machine as per the label; otherwise, machine damage or personal injuries may be caused.

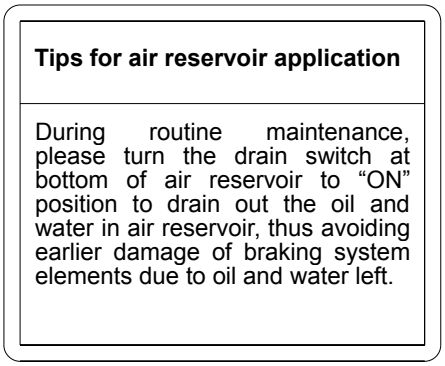

Fig. 3-9

Fuel label (10)

Label location: near the round dipstick of right fuel tank in the forward direction of overall unit

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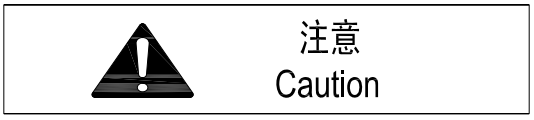


Refill with the fuel in time to avoid engine stop; incorrect oil filling may disenable and even damage the machine.

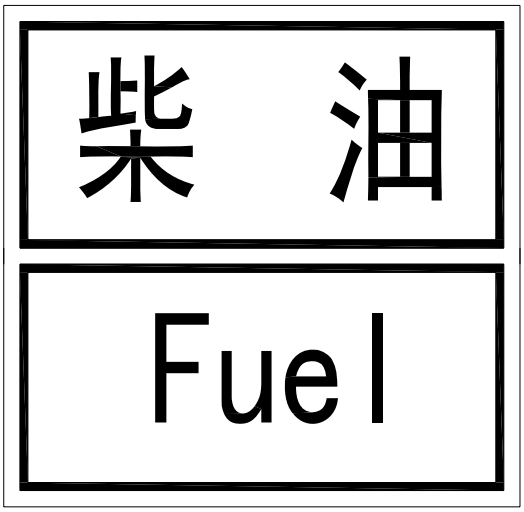


Fig. 3-10

Label of regular check and maintenance requirements (11)

Label location: on window at the right side of cab in the forward direction of overall unit Fig. 3-11

LONKING 龙工

Requirements for Regular Check and Maintenance

- Carefully read this *Operation & Maintenance Manual* to ensure an efficient machine operation.
- Immediately repair the defects to avoid deterioration.
- The fault due to the application of oil not specified by LONKING is out of the range of warranty.
- It is prohibited to mix two oils at different grades or from different manufacturers when servicing (refilling with) oil.
- Tyre pressure shall be controlled within 0.28-0.32 MPa (2.8-3.2kg/cm^2)

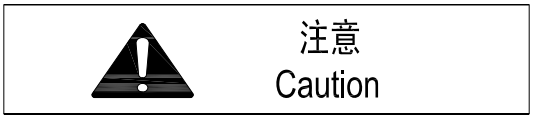
Please purchase the special oil for LONKING loader:

- Special diesel engine oil (CD15W/40 engine oil)
- Special transmission and torque converter oil (8# hydraulic transmission oil)
- Special hydraulic oil (46# anti-wear hydraulic oil)
- Special brake fluid (719# brake fluid)

All above-mentioned oil shall be used at a temperature higher than -10℃.

Content of Regular Check		Cycle of Regular Check (●Check and Adjustment; ▲Replacement)						
		Daily	50h	100h	300h	600h	1200h	2400h
1.	Check the volume of cooling water or clean the water tank.	●	●	●	●	●	●	●
2.	Check the oil pan and oil level of regulator (injection pump).	●	●	●	●	●	●	●
3.	Check the belt for looseness and damage.	●	●	●	●	●	●	●
4.	Check the diesel engine for startability, smoke and abnormal noise.	●	●	●	●	●	●	●
5.	Clean the coarse screen of fuel and replace the paper core.		▲	▲	▲	▲	▲	▲
6.	Replace the oil filter and change diesel engine oil.			▲	▲	▲	▲	▲
7.	Clean the air filter core and replace it if necessary		●	●	●	●	●	●
8.	Clean the transmission and torque converter oil pan filterscreen, replace the core and change the oil.			▲	●	▲	▲	▲
9.	Check the performanceof the transmission and torque converter and dismantleandoverhaul it if necessary				●	●	●	●
10.	Check the service brake.	●	●	●	●	●	●	●
11.	Check and refill with the brake fluid.		●	●	●	●	●	●
12.	Adjust the hand brake clearance and drain the air reservoir.		●	●	●	●	●	●
13.	Check the brake plate for wear (not more than 2/3) and replace it if necessary.			●	●	●	●	●
14.	Check and clean the booster pump; change the brake fluid.					▲	▲	▲
15.	Check the steering flexibility.	●	●	●	●	●	●	●
16.	Refill the (mechanical booster) steering gear with new oil.					●	●	●
17.	Check systems for the leakage of oil, water	●	●	●	●	●	●	●

	and air.							
18.	Check the monitoring instrument for normal operation.	●	●	●	●	●	●	●
19.	Check the parts for abnormal noise and overheating.	●	●	●	●	●	●	●
20.	Check the tyres for pressure, crack or abnormal wear.	●	●	●	●	●	●	●
21.	Check the switch, pedal, handle and button for normal operation	●	●	●	●	●	●	●
22.	Check the bolts and nuts at all parts for looseness or shedding.	●	●	●	●	●	●	●
23.	Check especially bolts of rim, drive shaft and axle bolt for looseness.	●	●	●	●	●	●	●
24.	Remove the pollutants on surface of water tank and radiator.		●	●	●	●	●	●
25.	Check the fastening bolts of brackets of transmission and engine.		●	●	●	●	●	●
26.	Check the working device, frame and outer parts for cracks.		●	●	●	●	●	●
27.	Check the control levers for flexibility and apply the lubricating grease.	●	●	●	●	●	●	●
28.	Apply lubricating grease at the hinged points and hinge pin sleeves.	●	●	●	●	●	●	●
29.	Apply lubricating grease at points such asdrive shaft and fan shaft.	●	●	●	●	●	●	●
30.	Check the hydraulic oil level and refill if necessary.		●	●	●	●	●	●
31.	Replace the hydraulic oil filter element, clean the tank and change the oil.					●	▲	▲
32.	Check the gear oil level of drive axle or change the gear oil.				●	▲	▲	▲
33.	Check and repair the front and rear axles, differential and wheel reducer.							●



Always operate the machine as per the label; otherwise, machine damage or personal injuries may be caused.

1.5 Other safety information

1.5.1 Compliance with safety instructions

1.5.1.1 Before the maintenance of equipment, hang a safety warning label on the starting switch or control handle, such as "No Operation".

1.5.1.2 Get to know the width of operating machine to keep a distance with the fence or boundary obstacle when working around them.

1.5.1.3 Beware of the buried high-voltage wires and cables. The crash between the machine and these dangerous objects may cause casualties due to an electric shock.

1.5.2 Safety precautions

1.5.2.1 In the operation of machine, do not wear loose clothes or jewels which may enmesh or lock the control handle or other parts on the equipment.

1.5.2.2 Make sure that all guard plates and covers are fixed on the corresponding locations of the equipment.

1.5.2.3 Never pile up debris on the machine. Clear the debris, oil, tools, etc. on the machine floor, channel and ladder.

1.5.2.4 Properly keep the scattered items, such as the lunch boxes, tools and other items which are not the machine parts.

1.5.2.5 Be familiar with the specific hand signals on the site, and only receive the signals sent by a person

1.5.2.6 Do not smoke in the maintenance of air conditioner or in the places possibly with refrigerant gas. Inhaling the smoke released by the combustion of AC refrigerant may cause personnel injury or death.

1.5.2.7 Do not put the maintenance fluids into the glass containers and discharge all maintenance fluids into a suitable container.

1.5.2.8 Carefully use the detergent and report all the items in need of overhaul.

1.5.3 Check of machine

1.5.3.1 Before starting the machine each day or shift, walk around the machine to check it carefully, so as not to cause economic loss or personnel injury

1.5.3.2 Check if the fixing levers for locking of front and rear frames are at the unlock position;

1.5.3.3 Check if each instrument is working normally. Start the engine only in the cab. Never short the starter motor terminal or battery. Short circuit may cause the starting failure of engine and also the damage to the circuit system.

1.5.3.4 Adjust the seat so that the driver is still able to press the pedal to the end when sitting against the backrest.

1.5.3.5 Check the seat belts and fasteners. Replace the damaged or worn parts. Regardless of the appearance, replace the seat belt used for three years.

1.5.3.6 Ensure the good vision around the cab with the scene outside the cab clearly displayed.

1.5.3.7 Make sure that the lighting system will meet the requirements of working conditions and all of the lighting lamps can work properly.

1.5.3.8 Do not leave the parts and tools around the seat of operator. Due to the vibration in the walking and operation, these things may fall and damage the control lever or switch or make the control lever move to start the working device, leading to accidents.

1.5.3.9 Check the coolant level, fuel oil level and engine lubricating oil level, and check if the air filter is clogged.

1.5.3.10 It is recommended that the machine is equipped with fire extinguishers. Operator shall know

the storage location of fire extinguisher and be familiar with the use method.

1.5.4 Entry intocab

1.5.4.1 Before entering the cab, remove the sludge and fine sands on the shoes which will accumulate on the supporting points of throttle pedal and brake pedal and impede the pedal reset and may speed up the wear of pushing lever. The accumulated sediments on these places shall be cleaned immediately.

1.5.5 Pressure stranded in the system

1.5.5.1 The pressure may be trapped in the hydraulic system. When releasing the pressure trapped in the system, the machine or optional components may suddenly move. Carefully remove the hydraulic pipes or fittings. The released high-pressure fluids may swing the pipe and may eject out. The fluids penetrated into the body may cause serious personnel injury and even death. The pressure relief of working hydraulic pipes can be realized by laying the bucket flat on the ground and moving the boom and bucket control lever back and forth 5 to 6 times at lowering, lifting, tilting forward and tilting backward positions.

1.5.6 Penetration injury fromfluids

1.5.6.1 Even if the engine has been shut down for a long time, the pressure may still exist in the hydraulic circuit. If the pressure is not properly released, it will lead to high-speed ejection of the hydraulic oil or pipe plug, etc.

1.5.6.2 Prior to the release of pressure, it is prohibited to remove any hydraulic part, otherwise personnel injury may be caused

1.5.6.3 When checking the leakage, be sure to use the wooden board or cardboard as a baffle. Ejected fluids under pressure may penetrate the human tissue. The fluids penetrated into the body may cause serious personnel injury or even death. Even a pinhole leakage may also lead to serious personnel injury. If the fluids are sprayed onto your skin, you shall be treated immediately by the doctor familiar with this type of personnel injury.

1.5.7 Compressed air and high-pressure fluid

1.5.7.1 Compressed air or pressure water will make the debris or hot water splash, possibly causing personnel injury.

1.5.7.2 When conducting the cleaning operation with the compressed air or pressure water, wear the protective clothes, protective shoes, and goggles or face shield.

1.5.7.3 The maximum pressure of the air for cleaning shall be lower than 0.2MPa.

1.5.7.4 The maximum pressure of the water for cleaning shall be lower than0.25MPa.

1.5.8 Prevention of crush and laceration

1.5.8.1 Support the equipment properly before conducting any operation or maintenance under the machine. Do not support the equipment with hydraulic cylinder, for the device may fall if the control handle is moved or hydraulic pipe is cracked,

1.5.8.2 Support the cab properly before conducting any operation under it.

1.5.8.3 Unless otherwise indicated, never make any adjustment when the machine is moving or the engine is running.

1.5.8.4 The gap of link mechanism for controlling the equipment may change with the movement of equipment or machine. Stay away from the area where the gap may change suddenly due to the movement of machine or equipment.

1.5.8.5 Avoid all rotating and moving parts.

1.5.8.6 Some of the protective covers are required to be removed in the process of maintenance, and reinstall them after the maintenance.

1.5.8.7 Make the objects away from the rotating fan blades which will cast the object or cut it.

1.5.8.8 Never use the twisted or worn steel rope, and wear gloves when touching the steel rope.

1.5.8.9 When knocking the positioning pin, it may fly out and hurt the people, so confirm no other people nearby and wear the protective glasses to avoid the eye injury. When you strike the objects, debris will fly out, so ensure that no one will be damaged by the flying debris.

1.5.9 Protection fromfire and explosion

1.5.9.1 All fuels, most of lubricating oils and some of coolant mixtures are flammable.

1.5.9.2 The flammable fluid leaking or splashing on hot surfaces or electrical parts may cause a fire, resulting in personnel injury and property loss.

1.5.9.3 Clear the flammable materials attached on the surface of machine, and avoid any inflammable accumulation.

1.5.9.4 Do not operate the machine near the open flame.

1.5.9.5 Do not perform the welding or the flame cutting on the pipe or tank containing the flammable fluid before cleaning it thoroughly with the non-flammable solvent.

1.5.9.6 Check all the wires before starting the machine every day. Before operating the machine, repair the loose or worn wires, clean and tighten all the connectors.

1.5.9.7 Check all the pipelines for aging or damage before starting the machine every day, and replace the aging or damaged pipelines timely to prevent the fire due to the fluids leakage. Make sure that the pipelines of machine are in good usable status.

1.5.9.8 Carefully add the fuel, lubricating oil or other fluids. Do not smoke or perform the adding near the open flames or sparks. Be sure to shut down the engine before the adding and add the fuel tank outdoor.

1.5.9.9 The gas comes out from the battery may explode. Make the open flames or sparks away from the top of battery. Do not smoke at the charging site of battery.

1.5.9.10 Check the charging status with voltmeter or hydrometer not by bridging the metal object on the terminals.

1.5.9.11 Incorrect jumper cable may cause an explosion, resulting in personnel injury. For specific instructions, see the section of Use, Maintenance and Notes of Wheel Loader Battery in the manual.

1.5.10 Pipeline

1.5.10.1 Do not bend or knock the high-pressure pipelines. Do not install any bent or damaged pipeline.

1.5.10.2 Repair all loose or damaged pipelines. The leakage may cause fire. Consult the LONGKING agents about the matters for repairing or replacing the parts.

1.5.10.3 Carefully check the pipelines, and please check for the leakage with wooden board or cardboard other than bare hands.

1.5.10.4 In case of any of the following conditions, replace the parts:

1. End fitting is damaged or leaked;
2. Outer layer is worn or cut;
3. Metal wire is exposed;
4. Outer layer is swelled;
5. Hose is distorted;
6. End fitting is moved.

1.5.10.5 Make sure that all the folders, shields and insulation boards are installed correctly. This helps to prevent the vibration of machine and the wear and overheating of parts.

1.5.11 Tyredescription

1.5.11.1 The explosion of pneumatic tyre is caused by the gas explosion due to the internal heating, and the explosion due to the heat source may be caused by the welding, heating on the rim parts, outside spark or excessive brake.

1.5.11.2 Tyre explosion is more lethal than the rupture. Its explosive power may cast the tyres, rim parts and axle parts from the machine for 500m or even farther. The explosive power and the cast parts may cause damage to buildings and casualties.

1.5.11.3 Do not come near the hot tyre. Do not use water or calcium as the counterweight. It is recommended to inflate the tyre with the dry gas. In order to avoid the excessive inflation, it is necessary to provide the professional inflating equipment and the training for the proper use. Improper equipment or incorrect use will cause tyre rupture or rim damage.

1.5.11.4 In the process oftyre inflation, stand behind the tread and use theclampprovided.

1.5.11.5 It is dangerous to repair the tyres and rims, so the repairshall be performed by the specially trained personnel with the right tools and work procedures. When repairing the tyres and rims, the incorrect procedure may lead to the explosive power which may burst the installation pieces, resulting in casualties.

1.5.12 Prevention of lightning injury

1.5.12.1 In case of lightning near the machine, operator shall not conduct the following operations:

1. Board the machine;

2. Come down from the machine.

1.5.12.4 In case of lightning, do not leave the cab or be sure to stand away from the machine.

1.5.13 Start of engine

1.5.13.1 If a warning label is attached on the start switch or control device, do not start the engine or pull the control device.

1.5.13.2 Before the start of engine, move all the hydraulic control levers to neutral position.

1.5.13.3 Engage the transmission operating device into the neutral position.

1.5.13.4 Apply the parking brake.

1.5.13.5 The exhaust of diesel engine contains the harmful combustion products. Operate the engine in a well-ventilated place, and exhaust the gas to the outdoor in case of the closed place.

1.5.14 Safety of getting on and off the machine

1.5.14.1 Get on and off the machine only along the ladder and/or handrail. Before boarding the machine, sweep and check the ladder and handrail. Perform all the necessary repairs.

1.5.14.2 When getting on or off the machine, face the machine and keep three-point contact with the ladder and handrail. Note: Three-point contact may be both feet and one hand or one foot and both hands.

1.5.14.3 Do not board or come down from a moving machine and never jump down from the machine. Do not get on or off the machine carrying the tools or items. Pull the equipment onto the platform with the drawstring. Do not take the control lever as the handrail when getting in and out of the cab.

1.5.15 Preparations for the operation

1.5.15.1 Make sure that no one is around the machine.

1.5.15.2 Clear all obstructions along the driving route of machine. Beware of the obstructions which may easily lead to the danger, such as the wires, ditches, etc.

1.5.15.3 Make sure that all windows are cleaned and doors/windows are fixed at the open or closed position.

1.5.15.4 Adjust the rear-view mirror to get the best line of sight around the machine.

1.5.15.5 Make sure that the horn, reverse alarm (if equipped) and all other alarm devices are working properly.

1.5.16 Operation

1.5.16.1 Only when you sit in the driver's seat and wear the seat belt, you can operate the machine. Only when the engine is running, you can operate the control lever.

1.5.16.2 Operate the machine and working tools on open ground, and check if all the controllers and protection facilities are acting correctly.

1.5.16.3 Before switching on the machine, ensure that no one is in the dangerous zone.

1.5.16.4 Unless there are additional seats and seat belts on the machine, it is not allowed to carry people.

1.5.16.5 In the operation of machine, pay attention to and report where is in need of repair.

1.5.16.6 Do not come near the edge of the cliffs, tunnels and precipices.

1.5.16.7 Do no operate the machine across the slope. Whenever possible, make the machine toward the uphill and downhill in the operation. Once the machine is sliding on the slope, you shall immediately remove the load and turn the machine to the direction of downhill.

1.5.16.8 Avoid any situation that might cause the machine to tip over. The machine may tip over at the shore and sloping land or across the trenches, ridges or other unexpected obstacles.

1.5.16.9 Maintain control of the machine, and do not let the load to exceed the capacity of machine.

1.5.16.10 Ensure the enough hooks and drag devices. Traction devices can only be connected to the traction pin or hook. Do not let people straddle the steel rope.

1.5.16.11 Before mobilizing the machine, make sure that no personnel is between machine and equipment. Support the traction equipment and align it to the traction pin, and connect the machine to the equipment for dragging. You shall know the maximum size of the machine.

1.5.17 Shutdown of engine

1.5.17.1 After the engine is working under the load, do not immediately stop the engine, which may cause the overheating and accelerated wear of the engine parts.

1.5.17.2 After the machine is stopped and parking brake is engaged, let the engine run for five minutes and then shut it down, which allows the high-temperature parts in the engine to cool down.

1.5.18 Parking

1.5.18.1 Park the machine on level ground. If the machine must be parked on a downhill ramp, wedge the tyres.

1.5.18.2 Stop the machine with service brake. Engage the transmission controller into neutral position.

1.5.18.3 Apply the parking brake.

1.5.18.4 Shut down the engine.

1.5.18.5 Turn the starting switch of the engine to OFF position and remove the key.

1.5.18.6 Turn the master power switch to ○ position so as to prevent the possible battery discharge due to the short circuit, leakage of certain parts or vandalism.

1.5.19 Operation on slope

1.5.19.1 Different machines have the different performances. Safe operation under the different conditions depends on the configuration, maintenance, running speed, working place, tyre pressure, etc. The most important thing is the driving skill and judgment of operator.

1.5.19.2 Operator shall receive the good training of operating skills, and these training courses shall equip the students with the ability to observe the working and environmental conditions, control the

machine and identify the potential danger.

1.5.19.3 In the operation on the slope, you shall consider the following important factors:

1. At the higher speeds, the stability of the machine will deteriorate due to the inertia;

2. In the rugged terrain, the stability of the machine will deteriorate;

3. Machine will slip on the meadow, muddy road and gravel road;

4. Maintain the balance of machine;

5. Overweight loads may cause the machine to tip over;

6. Do not operate across the slope, the machine shall be toward the uphill or downhill any time;

7. Operating the machine on the slope will affect the play of performance and increase the instable and unsafe factors.

8. If the machine has to be parked on a slope, add wedges under the tyres to prevent the machine moving.

1.5.20 Containing of spilled fluids

1.5.20.1 Carefully perform the inspection, maintenance, testing, adjustment and repair, and ensure that the spilled fluids are contained properly. Before opening any chamber or removing any parts containing fluids, prepare the appropriate container to hold the fluid.

1.5.21 Operation safety on rainy, snowy and foggy days

1.5.21.1 The machine’s operations will be affected on rainy, snowy and foggy days and operation safety should be paid full attention to.

1.5.21.2 In case of low visibility, clearance lamp and illuminating lamp must be turned on to facilitate the operation.

1.5.21.3 Machine is likely to slip on a muddy, snowy or frozen road, thus it is recommended to install tyre chain or adjust the load appropriately, and the driving and operation speed should be slowed down and sudden braking, stopping and turning shall be avoided.

1.5.21.4 Ona frozen road, the ground will become soft if the temperature rises and the road surface condition is unstable. Operator shall drive very carefully to prevent insufficient driving force or sinking of the whole machine.

1.5.21.5 After a heavy snow, the debris at the road shoulder and road side are buried and difficult to discover. Sweep the snow carefully to prevent damaging the tyre.

1.5.22 Notes in cold climate:

1.5.22.1 For working in cold climate, adequate measures should be taken to ensure that the machine’s working performance will not be affected. Preheat the machine before operation. Before starting to operate the control lever, fully preheating the machine can prevent slow response of the machine and avoid accidents.

1.5.22.2 Operate the control levers and circulate the hydraulic oil in the hydraulic system (increase the

system pressure to the system set value and then release the pressure and drain the oil back to the hydraulic oil tank) to heat the hydraulic oil, which can ensure good response of the machine and prevent malfunction.

1.5.22.3 When the battery electrolyte has been frozen, do not charge the battery or start the engine with other power supply, which is very dangerous, and may cause the battery to fire. Before charging the battery or starting the engine with other power supply, melt the battery electrolyte and check for leakage.

1.5.22.4 After the operation, clear all the water, snow and mud sticking to the wire, wire connector, switch, sensor and the covering parts of these parts, otherwise, the water will get frozen, which may cause failure of machine parts next time the machine is used.

1.5.23 Safety in operation and overhaul of components

★Radiator:

1.5.23.1 Depending on the different regional environments, antifreeze fluid in different proportions should be added to the coolant;

1.5.23.2 Clean softened water should be used for the radiator. No corrosive fluid should be added to the radiator. No entrained mud or sand, etc;

1.5.23.3 When opening hot radiator cap, loosen it slowly to allow steam to escape, and remove the cap;

1.5.23.4 When the engine is overheating, don't fill the radiator with low temperature coolant to prevent engine cylinder head and jacket pipe from cracking due to temperature jump;

1.5.23.5 For the cooler with an expansion chamber, in the process of filling, the coolant from the refill pipe of the upper chamber continuously flows through the radiator outlet to the expansion chamber. It takes a long time to fully fill the cooler, and don't start the engine until the filling is finished;

1.5.23.6 For the cooler with an expansion chamber, leave appropriate space in the upper part of the chamber when filling it, and don't over-fill it.

★ High temperature components and fluid after operation:

1.5.23.7 The engine, radiator, and transmission parts may be hot. During operation or immediately after shutdown, do not touch high temperature components. If you have to, take enough safety protective measures, i.e. wear protective goggles and high temperature resistant gloves;

1.5.23.7 It is prohibited to service high temperature components during machine operation to prevent high temperature fluid from splashing to damage people;

1.5.23.8 The temperature of the added fluid can be at most 10℃ lower than that of the high temperature components to prevent machine material from cracking due to sudden cold;

★ Brake:

1.5.23.9 The brake is an important safety component of the machine. After startup and before operation, always test brake performance for correct operation of the braking device;

1.5.23.10 During operation, in case of no special need, do not hold your foot on the brake pedal or

repeatedly depress the pedal;

1.5.23.11 The braking capacity of the brake is limited. To ensure safety, when the vehicle walks down the slope, never shut the engine down, perform gear shift or put the transmission in neutral position, but use the engine as the brake;

★ Battery:

1.5.23.12 The battery is installed in the battery case on the counterweight at the rear of the machine. There are two batteries, one for one side;

1.5.23.13 The battery contains electrolyte, which is an acid substance. Injury may be caused if the electrolyte comes into contact with the skin or eyes. Wear safety goggles and gloves during maintenance of battery;

1.5.23.14 The battery will emit flammable smoke and mist. Do not smoke when checking electrolyte level and keep good ventilation;

1.5.23.15 Prevention of danger:

The battery electrolyte is an acid substance, which may produce hydrogen. Therefore, improper handling of battery may result in burn or fire; In order to keep safe, you must take the following precautions:

1. Do not expose the battery to a lit cigarette or open flame;

2. When contacting battery or performing maintenance, please wear rubber gloves and protective goggles;

3. If electrolyte spills on cloth or skin, wash it immediately with plenty of water;

4. The electrolyte can cause blindness, and if it splashes into your eyes, immediately wash them with plenty of water and go to see a doctor as soon as possible;

5. In case of accidental electrolyte ingestion, you should drink plenty of water, milk, raw eggs or rape oil, and immediately turn to emergency center for help;

6. Before performing any work related to the battery, shut down the engine;

7. A short circuit occurring between positive terminal (+) and negative terminal (-) of a battery will cause heating or even explosion. Avoid contact of metal object (like repair tools) with battery, which can cause a short circuit;

8. When installing a battery, first connect positive terminal; while disconnecting battery, disconnect negative terminal (ground wire side) first.

9. Before removing or installing battery, first check for positive and negative terminals. After installing, make sure to tighten nut firmly to prevent failure due to loose electrode;

10. Only use dry cloth to wipe battery. Do not use organic solvent or cleaning agent like gasoline;

11. Remove battery from machine before charging;

12. Do not charge a battery with frozen electrolyte or start the engine with other power. Otherwise, the battery is easy to catch fire and explode; when charging or start the engine with other power, melt the

frozen electrolyte and check for leakage;

1.5.23.16 Cause of electricity insufficiency of battery

1. The machine is parked for long, the leakage current is too high or additional electrical equipment is applied, causing battery discharging;

2. Abnormal operation such as switching on the electrical equipment for too long while the machine is not started;

3. The machine is started frequently;

4. The fault of the machine charging system, for example, failure of the generator and its electronic elements, the too low set charging voltage of the generator voltage regulator, the loose engine drive belt, results in abnormal charging of the battery, thus causing electricity insufficiency, blacking of the battery charge indicator or even the failure to start the machine.

5. The unloaded battery is stored for more than 6 months;

Tips: The battery with insufficient electricity due to above causes can be recovered to normal working conditions through correct charging processes.

1.5.23.17 Before charging the battery, check the appearance quality of the battery. Perform the following operation if abnormality is found:

1. If the battery shell is broken or the battery leaks acid, it shall not be charged. Replace the battery after identifying causes;

2. If the terminal post is broken, the battery shall not be charged; replace the battery after identifying causes;

3. The battery with white charge indicator shall not be charged. Replace the battery;

4. If there is oxide scale on the surface, clean the terminal post and remove the oxide scale before charging.

1.5.23.18 Charging of battery:

If incorrect operation is performed to the battery in charging status, it may explode; please follow the processing regulations and instructions to charge the battery, and pay attention to the following notes:

1. The mixture of oxygen and hydrogen may be released from the vent hole during the charging and testing of battery; when the concentration of the hydrogen in the ambient air exceeds 4%, aopen flame, a sparkle or high heat may cause explosion, so when charging, always keep ventilation and do not smoke to prevent sparkles and open flame;

2. The battery shall be charged under normal temperature; put on protective glasses when charging;

3. Connect the battery’s cathode first after charging; disconnect its anode first when disconnecting before charging;

4. Connect the anode (+) charging clip of the charger to the positive (+) terminal of the battery, and then the cathode (-) charging clip to the negative (-) terminal; secure the two terminals, and never connect the batteries in series (24 V) for charging;

5. It is recommended to use a charger with 16.0 V constant voltage (no more than 16.2 V, otherwise most of the water in the electrolyte will be electrolyzed, thus resulting in dropped level, whitened charge indicator, or scrapped battery) and 25 A limited current to charge the battery until the indicator turns green, which means the charging is done;

6. If the voltage of the battery is lower than 11 V, the charging may not be successful at the beginning, for within the battery of severe power insufficiency, the specific gravity of the acid in the electrolyte is similar to that of pure water and the internal resistance of the battery is high. It is suggested to use a charger with smaller charging current or larger power for charging, or charge the battery by connecting it to another one in parallel. As the charging proceeds, the specific gravity of the sulfuric acid of the battery will increase, and the charging current of the battery will recover gradually;

7. If acid is sprayed out of the vent hole when charging, stop the charging immediately and find out the cause;

8. When the temperature of the battery exceeds 45 degrees during charging, stop and find out the cause;

9. When the temperature of the battery exceeds 45 degrees during charging, stop and wait until the temperature drops to the room temperature, cut the charging current to half and carry on charging;

10. Check the charge indicator once every hour during the charging process; if the indicator is green, which means that the charging is done, stop charging;

11. After charging and quality test, it is recommended to apply butter to the terminal posts of the battery to prevent electric corrosion;

12. Too high charging current may result in electrolyte leakage or evaporation which may cause fire or explosion.

1.5.24 Noise emission standard:

1.5.24.1 Noise for driver’s position: 88dB;

1.5.24.2 Noise outside of the machine: 104dB.

Chapter II Applications, Main Technical Performance and Parameters

I. Applications

CDM816D wheel loader is a multi-purpose construction machinery mainly used for spading, loading and transporting loose materials, applicable for the national defense, mine, water conservation, infrastructure, freight yard, road construction, port and wharf, and capable of loading, transportation, bulldozing, excavating and lifting. Besides, it is a widely used and generally used construction machinery, which can undertake traction, leveling and piling, etc.

II. Overallperformance parameters

1. Rated bucket capacity (m^3)	0.95
2. Rated load (t)	1.6
3. Boom lifting time (S)	4.9
4. Total cycle time (S)	9.4
5. Traveling speed (km/h)	
Forward gear I	7.4
gearII	20.8
Reverse gearI	7.2
gearII	20.4
6. Max. breakout force (KN)	52
7. Max. grade ability (°)	30
8. Min. turning radius (mm)	
Tyre center	4350
Outer side of bucket	5030
9. Physical dimensions (mm)	
Vehicle length (with the bucket placed on the ground flatwise)	5600
Vehicle width (outer side of wheel)	1800
Bucket width	1950
Vehicle height	2930
Wheelbase	2040

Wheel track	1400
Min. ground clearance	310
Max. dumping height (dumping distance ≥841)	2700
10. Steering angle (º)	±35
11. Operating weight (kg)	5500
III. Engine	
1. Model: YT4A2-24	
2. Type:	In-line, water-cooled, direct injection
Number of cylinders - bore × stroke (mm)	4—105×120
Rated power (kW)/speed (rpm)	55/2400
Max. torque (N·m)/speed (rpm)	235/1680
Fuel consumption at rated condition (g/KW.h)	251.6
Fuel	0# or 10# light diesel oil
OD of exhaust fan (mm)	Φ490
3. Air compressor	
Rated speed (rpm)	1000
Actual displacement (m^3/min)	0.1
4. Starter motor	
Type	QD2636A
Power (KW)	4.6
Voltage (V)	24
IV. Powertrain	
1. Hydraulic torque converter	
Type	Single-stage three-element
Torque conversion ratio Ko	3.7
Cooling mode	oil-cooling pressure circulation
Torque converter inlet oil pressure (Mpa)	0.50-0.60

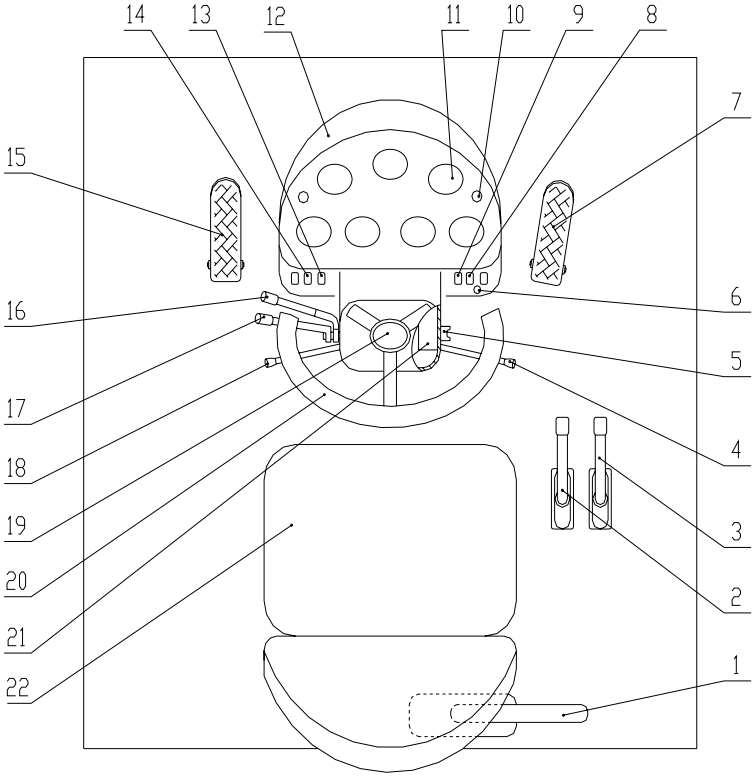
Torque converter outlet oil pressure (Mpa)	0.20-0.30
Max. allowabletorque converter outlet temperature (℃)	120
Max. efficiency	0.82
2. Transmission	
Type	Fixed-shaft hydraulic shift
Gears	Two forward gears and two reverse gears
Gear ratio	
Forward gear I	2.47
Forward gear II	0.88
Reverse gear I	2.52
Reverse gear II	0.898
Working oil pressure (Mpa)	1.2-1.5
Lubricating oil pressure (Mpa)	0.2-0.3
Transmission oil pump	
Model	CBG1025
Speed (rpm)	2400
Flow (L/min)	60
3. Main reducer	
Type	Single-reduction with spiral bevel gear
Reduction ratio	5.833:1
4. Hub reducer	
Type	Straight toothed spur gear planetary drive
Reduction ratio	4.4:1
5. Drive axle and wheel	
Type	FWD
Tyre	16/70-20
Tyre pressure (Mpa)	0.28-0.30

V. Brakingsystem	
1. Foot brake	
Type	Air booster caliper disc four wheel brake
Brake disc diameter (mm)	Φ410
Brake piston diameter (mm)	Φ75(4 PCS)
Workingair pressure (Mpa)	0.7-0.78
Braking oil pressure (Mpa)	9.8MPa
Braking torque (N.m)/PCS	4300
2. Hand brake	
Type	Flexible-shaft controlled caliper disc brake
Brake disc diameter (mm)	210
Brake pad dimension (mm) (length ×width ×thickness)	110×46×15
VI. Steering hydraulic system	
Steering type	Load-sensing full hydraulic steering system
Steering gear	BZZ1－315
Priority valve	YXL-F160-N7 (160L/min)
Number of steering cylinders - bore × stroke (mm)	2—Φ63×280
VII. Working hydraulic system	
Distribution valve	ZL20DJL-02
Number of boom cylinders - bore x stroke (mm)	2-Φ90×607
Number of tilt cylinders - bore x stroke (mm)	1-Φ100×387
Gear pump	
Type	CBG2050
Rated speed (rpm)	2400
Flow (L/min)	120
System pressure (Mpa)	12

VIII. Electrical system	
System voltage (V)	24
Battery (2 sets)	
Model	G31
Rated voltage (V)	12
Rated capacity (Ah)	90
Bulb voltage (V) (DC)	24
Diesel engine starting (V)	24V(DC)electrical starting

Chapter III Operation

I. Control mechanism and instrument



1. Hand brake
2. Control lever of tilt cylinder
3. Control level of boom cylinder
4. Steering lamp/ headlamp/ instrument lamp switch
5. Ignition start switch
6. Flameout cable
7. Accelerator pedal
8. Rear working lamp switch
9. Fan switch
10. Steering indicator lamp
11. Instrument (engine oil pressure gauge, water temperature gauge, torque converter oil temperature gauge, transmission oil pressure gauge, barometer, hour meter, and ammeter)
12. Instrument panel frame
13. Parking warning switch
14. Ceiling lamp switch
15. Foot brake pedal
16. Forward/ backward control lever
17. High/low speed control lever
18. Wiper switch
19. Horn button
20. Steering wheel
21. Fuse box
22. Driver's seat

Fig. 2-1 Control mechanism and instrument

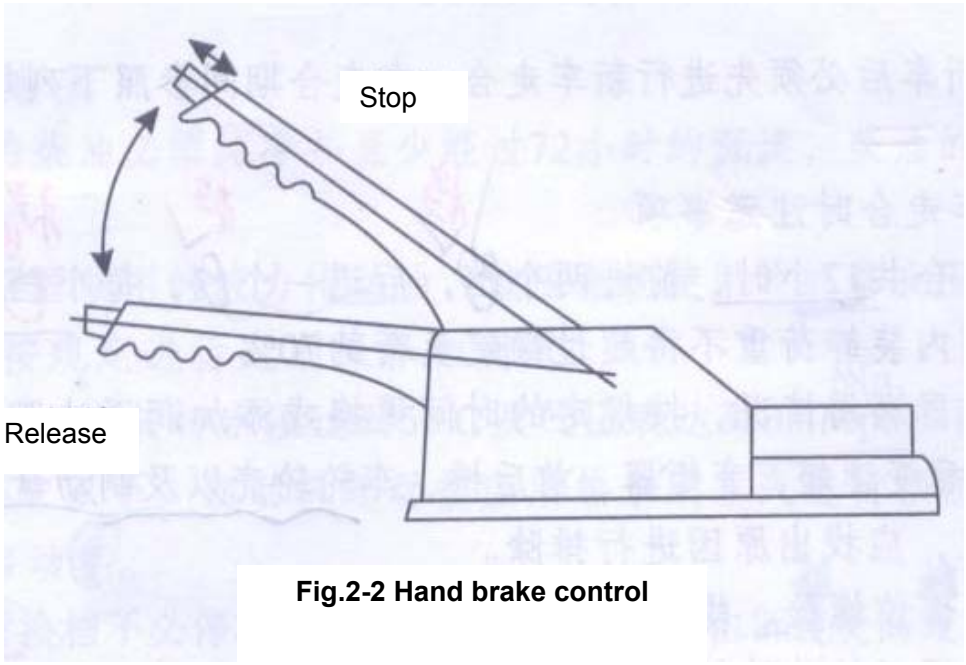


Fig.2-2 Hand brake control

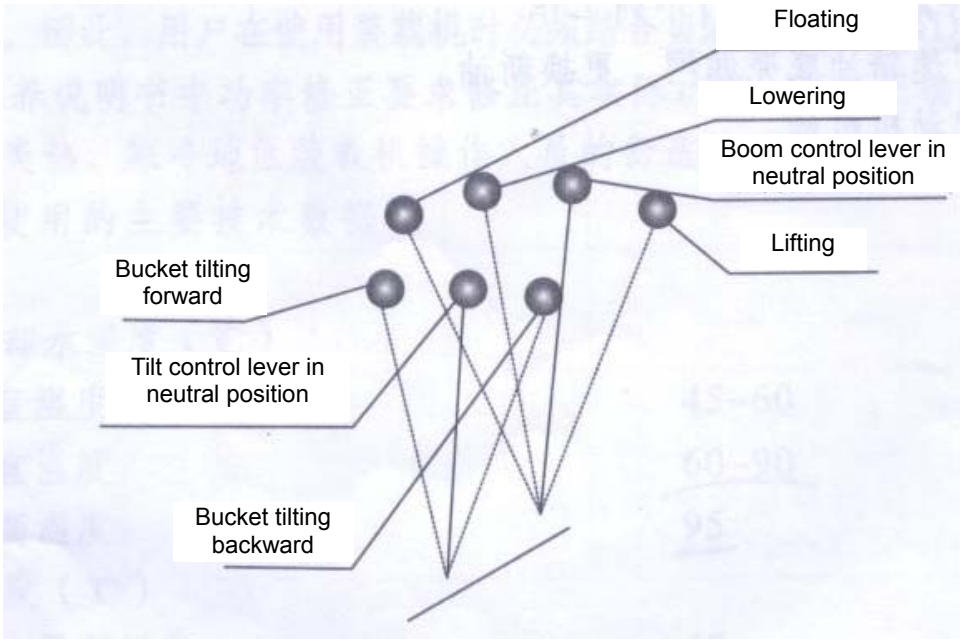


Fig. 2-3 Working device control

II. New vehicle running-in

The new vehicle must first undergo a running-in period and during this period, use and maintenance shall be paid attention to according to the following specifications.

(i) Notes on new vehicle running-in

1. The new loader shall be subject to a running-in period for a total of 12 hours in a manner of two forward gears and two reverse gears applied uniformly.

2. During the running-in period, the loading/unloading load shall not exceed 70% of the rated load.

3. Pay attention to the lubrication conditions and change or add grease at the specified time.

4. Please pay close attention to the temperatures of transmission, torque converter, front and rear axles, wheel hub housing as well as brake disc and brake drum. In case of overheat, identify the cause and perform troubleshooting.

5. Check the tightening conditions of bolts and nuts at all positions.

6. During the running-in period, porous materials loading are preferred, free from violent and sudden actions.

(ii) Carry out the following jobs upon completion of running-in for 8 hours:

1. Comprehensively check the tightening conditions of all the bolts and nuts, especially cylinder head bolts, exhaust pipe bolts, front and rear axles fixing bolts, rim nuts, transmission shaft connecting bolts, etc.

2. Wash the coarse and fine oil filters and fuel filter.

3. Check the degree of tightness of fan belt and note whether the generator charges the battery normally.

4. Check the electro-hydraulic proportion and capacity of battery, and tighten battery cable connector.

5. Check the oil quantity in transmission.

6. Check the sealing of hydraulic system, pneumatic system, braking system, etc.

7. Check the connection of each control handle, throttle lever, etc.

8. Check the connection at each part of the electrical system, the power supply status of the engine and the working conditions of lighting and turning signals.

(iii) Carry out the following jobs upon completion of running-in:

1. Wash the oil pan screen of the transmission and replace with new oil.

2. Replace the engine oil.

III. Operation of wheel loader

(i) Notes onoperation

1. The fuel used for the loader must be pure and undergo at least 72h precipitation, with the grade compliant with the specified quality requirements.

2. The hydraulic transmission oil for the transmission and torque converter and the anti-wear hydraulic oil for the hydraulic system must be clean.

3. The loader must undergo the periodic maintenance and lubrication as specified.

4. The engine shall run idly after starting, and when the water temperature reaches 55℃ and the air pressure gauge 0.4 Mpa, the vehicle can start to run.

5. In general, if the temperature is below 5℃, the engine shall be preheated with hot water or vapor to be above 40℃ prior to start.

6. During the driving, the forward gear shifting can be made without stopping the vehicle and stepping down the brake pedal. When shifting from low speed to high speed, the throttle pedal shall be firstly released and the gear lever shall be operated at the same time, and then the throttle pedal shall be stepped down; and on the other hand, slow down first to make the rotation speed of transmission output shaft approach that of the transmission shaft before gear shifting.

7. The direction change (from forward to backward or backward to forward) can only be carried out after stopping.

8. To apply the brake during driving, there is no need to firstly set the gear lever in the neutral, and the brake pedal can be directly stepped down.

9. The full-load running can be made only when the water temperature of the diesel engine is higher than 55℃ and the oil temperature is above 45℃. During the operation, the water and oil temperatures of the engine shall not exceed 95℃, and the oil temperature of torque converter shall not be higher than 110℃.If the water or oil temperatureexceeds the allowable value due to the heavy-duty operation, stop the vehicle and allow such fluid to cool.

10. After operating the boom or tilt control lever to make an action, the control valve stem shall be put in the neutral.

11. It is not allowed to lift the bucket to the highest position to carry the materials, and the lower hinge point of boom shall be about 300 mm above the ground during the transport, to ensure the stable driving.

12. The power of the diesel engine for this loader decreases with the increase of altitude, ambient temperature and relative temperature; consequently, users are required to correct the actual power of loader in combination with the local environment according to the requirements for power correction stated in ZH4100 or the provided diesel engine operation and maintenance instruction, to correctly use the loader.

(ii) Main technical data for normal operation

1. Engine

A. Temperature of the circulating coolant (°C)

Appropriate temperature of water inlet:	45-60
Appropriate temperature of water outlet:	60-90
Max. temperature of water outlet:	95

B. Engine oil temperature (℃)

Min. temperature in the oil pan:	45
Appropriate temperature in the oil pan:	80
Max. temperature in the oil pan:	95

C. Reading of the engine oil pressure gauge (Mpa)

For idle speed:	0.15-0.18

For rated speed: 0.35-0.5

2. Transmission and Torque Converter

Pressure (MPa): 1.2-1.5

Max. temperature (℃) ＜120°C

3. Braking system (Mpa)

Min. pressure: 0.44

Working air pressure: 0.7

4. Ammeter indication

The pointer swinging to the left (-) (negative scale direction) indicates battery discharging; when the engine is started, the pointer swings to the left.The pointer swinging to the right (+) (positive scale direction) indicates that the engine is charging the battery.

(iii) Fuel, lubricating oil, grease and coolant

1. Fuel, lubricating oil & lubricating grease (see Table 2-1)

Table 2-1

Type	Grade & Name	Added Quantity	Oil Storage Position	Remarks
Fuel	0# Light diesel fuel -10 & -20# Light diesel fuel	80L	Fuel tank	Normal temperature Winter
Transmission and torque converter oil circuit system	6 & 8# Hydraulic transmission oil	≥18L	Transmission oil pan	
Diesel engine lubricating system	CD15W/40 Oil	14L	Diesel engine oil pan	
Drive axle lubricating system	GL-4 85W/90 Vehicle gear oil	16L	Axle housing	
Oil for hydraulic system	L-HV 46# Low temperature hydraulic oil	80L	Hydraulic tank	
Oil for braking system	719 Synthetic brake fluid	1.6L	Booster pump oil cup	
Bearing and hinge lubrication	2# Calcium-based lubricating grease	2kg	Bearing and hinge positions	

Note: Use -35# light diesel fuel in cold area, and use CD15W/40 oil for diesel engine oil, and useL-HV 46# low temperature hydraulic oil for hydraulic system, and use 309 lithium lubricating grease for bearing and hinge positions.

2. Coolant

Generally, it is advisable to use the rain, tap water or clear river water. The well water contains many

minerals and tends to generate the scale in the water chamber of diesel engine, affecting the cooling effect and causing the malfunction, consequently, it is not preferred or shall be softened prior to use. For the diesel engine used in cold area or in winter, the antifreeze fluid can be added to the coolant, so as to prevent the coolant freezing after stopping of the vehicle. The formulas for common antifreeze liquid are as follows:

(1) Alcohol: 43%; glycerin: 15%; water: 42% (by weight)

(2) Ethylene glycol (glycol): 50%; water: 50% (by volume)

(3) Glycerin: 66.7%; water: 33.3% (by weight)

(iv) Dailycheck &maintenance before departure

1. Electrical appliance and instrument of the engine

(1) Check the level of the water tank.

(2) Check the fuel quantity in the fuel tank.

(3) Check the oil quantity in the engine oil pan.

(4) Check the tightness of the oil pipes, water pipes, air pipes and parts.

(5) Check the connection of battery.

2. Chassis

(1) Check the quantity of hydraulic operating oil.

(2) Check the tightness of hydraulic system pipelines and accessories.

(3) Check if foot brake and hand brake work reliably.

(4) Check if control levers are flexible and put in the neutral.

(5) Check if tyre pressure is normal.

3. Engine start

(1) Check if each instrument indications are normal.

(2) Check the working conditions of lighting equipment, indicator, horn, wiper and brake lamp.

(3) Operate the working device and check its action.

(4) Listen to the engine at low speed to check if it is working normally.

(5) Engage the gears for running.

(v) Check &maintenance after daily operation

Check after daily operation:

(1) Check the fuel quantity.

(2) Check the oil level and cleanness of the engine oil pan, and if the oil level is too high and the fuel is thinned, causes shall be identified and troubleshooting shall be done.

(3) Check oil pipes, water pipes, air pipes and accessories for leakage.

(4) Check if the transmission, torque converter, hydraulic oil pump, steering gear and front and rear axles are properly fixed, sealed, and too hot.

(5) Check if rim bolt, transmission shaft bolt and pin shafts are loose.

(6) Check if the working device is normal.

(7) Check if the tyre appearance and pressure are normal.

(8) In case of temperature below -5℃, the coolant shall be drained out, or may not be drained out if the antifreeze liquid is added.

(9) Inject the butter to the oiling points of working device as specified.

(10) Clean the machine appearance and remove the dirt and impurities from the bucket.

(vi) Start, stop and operation control

1. Start

Perform the “check before departure” and confirm that the parts are normal prior to engine start.

Before starting, shift the gearshift lever and control lever to the Neutral separately, release the hand brake, turn the master power switch to “ON” position, depress the throttle slightly and turn the start switch.

The duration of each start is 5-8 seconds (continuous operating period of starter motor shall be no longer than 15s), and if the start is failed, release the start switch immediately, and the second start shall be done after a minute. If the start is failed after three consecutive operations, identify the cause and start it after troubleshooting.

After start, heat the engine at550-650rpm, and pay close attention to engine instruments indications (especially engine oil pressure gauge), and meantime check the diesel engine and other systems for abnormality.

2. Stop

Drive the vehicle to the garage or flat ground, put the gear lever in the neutral, flatly place the operating bucket on the ground and pull the hand brake control lever. Prior to engine stop, it shall run for several minutes to allow the parts to cool down evenly. After stop in winter, timely unscrew all the water drain valves of engine and drain out the water in the cooling system, so as to avoid damaging the machine due to frost. If the antifreeze liquid is added to the water, it is unnecessary to do so. If the temperature drops to -18℃, remove the battery and take it into the warm house so as to prevent frost crack.

3. Operation control

1. Operation preparation

(1) To load the materials, the loader speed shall be below 4km/h.

(2) Clear the operation site, fill the pit and remove the sharp rocks and obstacles damaging the tyre and hindering the operation.

2. Operation mode

(1) Loading

Generally, loading can be done in the following two ways:

As shown in Fig. 2-4 (A), the distance between (1) and (2) is 10m, and the freight vehicle shall be stationaryto ensure higher operation efficiency.In Fig. 2-2 (B), the loader and the freight vehicle are combined to perform the operation, which is appropriate for continuous transport of the fleet.

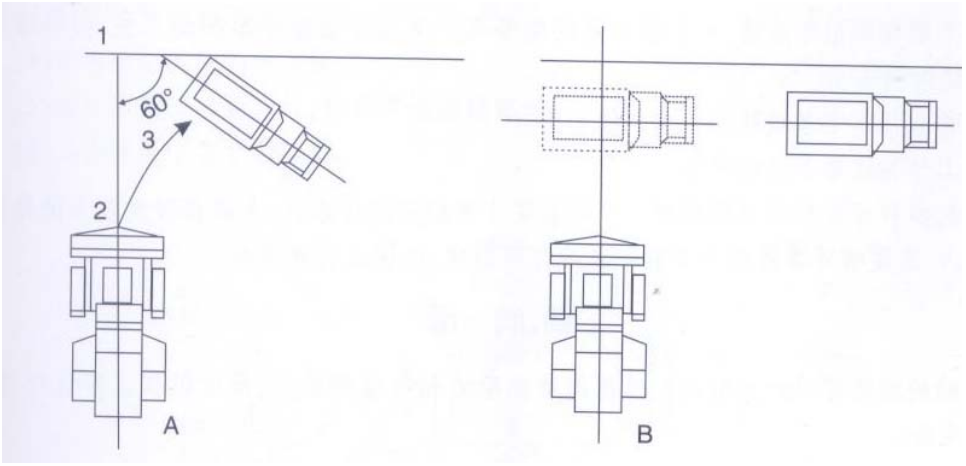


Fig. 2-4 Schematics of Loading Modes

(2) Shovel-loading

① Head for the material pile with gear I applied, and the lower hinge point of the boom shall be 250mm above the ground and the bucket shall be parallel to the ground, as shown in Fig. 2-5 (a).

② When the loader is 1m from the material pile, lower the boom to make the bucket bottom touch the ground and horizontally stretch into the pile.

③ Depress the throttle to make the bucket fully stretch into the material pile, and the digging and loading shall be combined in case of great resistance, i.e. operate the bucket interruptedly to rotate upward and lift the boom at the same time, until the bucket is full.

④ When the bucket is full, lift the boom up to the required height, and then shift the boom control lever to the neutral.

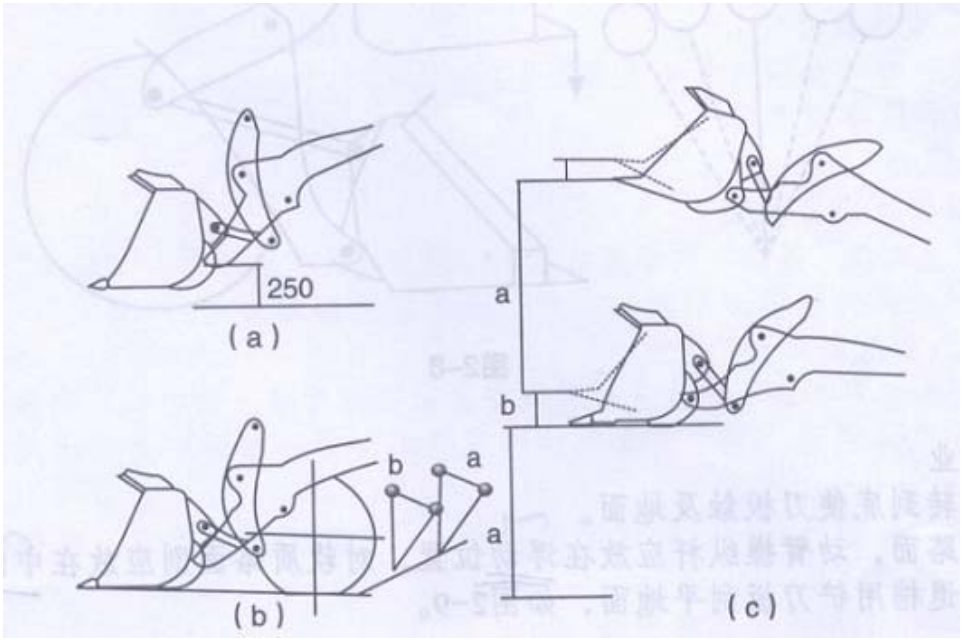


Fig. 2-5

(3) Handling

Self-handling is adopted in the following cases:

① The road is soft, the place is not flattened, and it is impossible to use freight vehicle.

② The handling distance is within 500m and it is a waste of time to handle with freight vehicle.

The handling speed depends on the road conditions. To ensure the safety, stability and good sight during operation, make the bucket rotate upward to the extreme position and keep the lower hinge point of boom in the transport position (about 300 mm above the ground).

(4) Unloading

When unloading materials to the freight vehicle or yard, the boom should be lifted to the height that the bucket cannot contact the trunk bed or stockpiles when turning forward, and push the tilt control lever forward to tilt the bucket forward for unloading, and the materials can be unloaded completely or partly by controlling the tilt control lever, and keep slow and gentle when unloading to reduce materials impact to the vehicle.

When the materials stick to the inside of the bucket, turn the control lever back and forth to shake the bucket so that the stuck materials may fall off, as shown in Fig. 2-6.

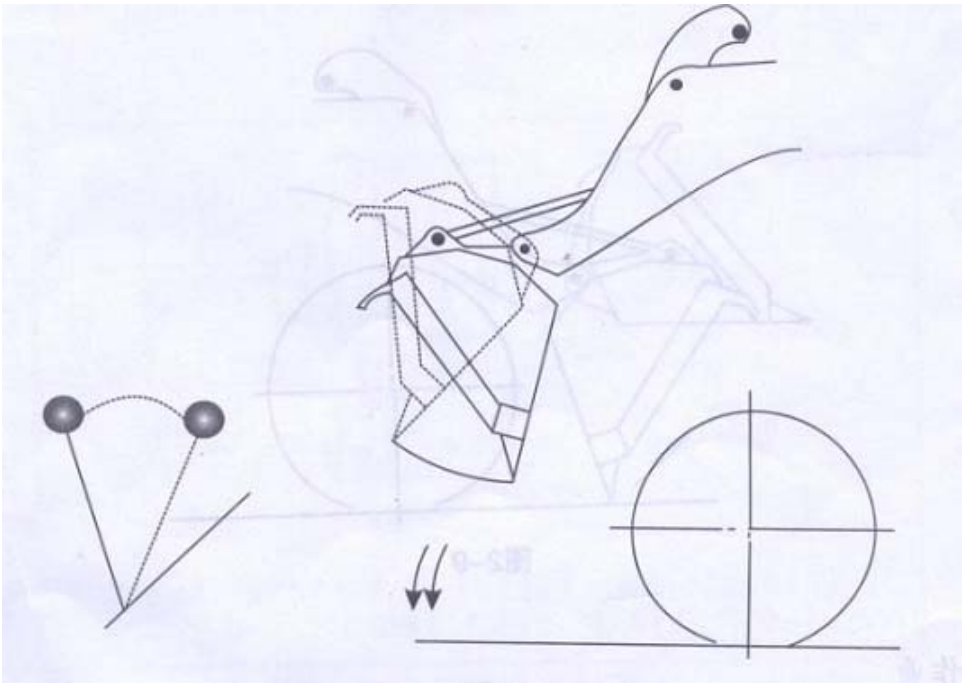


Fig. 2-6

(5) Push-transportation

① Make the bucket press closely against the ground.

② Depress the throttle to move ahead, and if the loader is found to be hindered by obstacles, slightly lift the boom and move on. When lifting or lowering the boom, the control lever shall be between the lowering and lifting positions but not at the lifting or lowering position, to ensure the smooth operation, as shown in Fig.2-7:

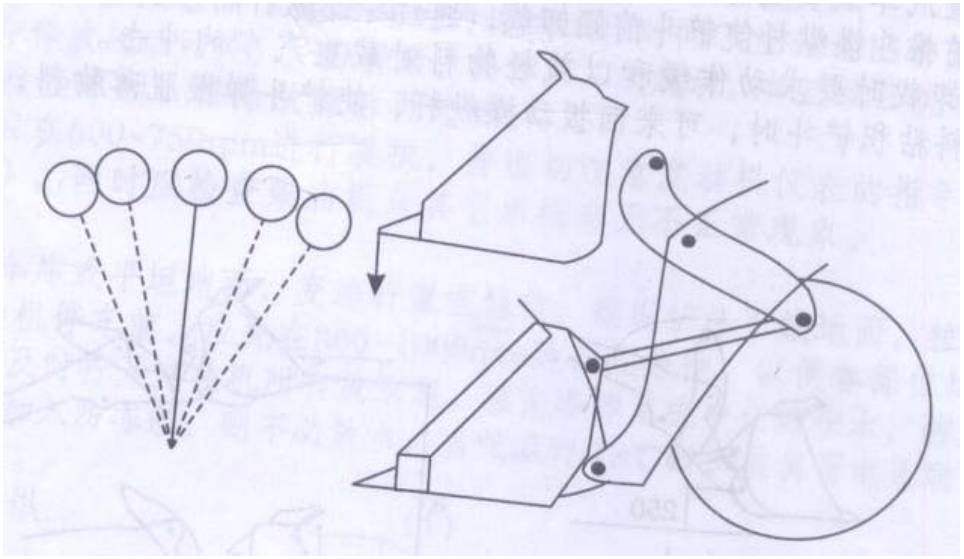


Fig. 2-7

(6) Scraping

① Turn over the bucket to the end to make the scraper touch the ground.

② For hard pavement, the boom control lever shall be in the floating position, and for soft pavement, it shall be in the neutral.

③ Engage the reverse and level the ground with the scraper.

(7) Traction

① Securely fix the towing tractor to towing pin.

② Put the working device in the transport state.

③ The start and stop shall be gentle and slow, and the braking system shall be checked prior to driving down the slope and the brake of towing tractor shall be applied when transporting the materials on the road with greater gradient, to ensure the driving safety.

(8) Hoisting

The hoisting can be performed by mounting appropriate sling.

IV. Lubrication

Correct lubrication can significantly reduce the frictional resistance to the loader and wear to parts, thus ensuring the normal operation of the loader and extending its service life.

(i) Notes on fuel filling:

1. Clean the fuel filling containers and parts, in case of damage to butter nipple, immediately replace it.

2. Always maintain the loader in a level state when checking the oil quantity

3. For the front and rear axles, add from the oil filling hole in the left and right wheel housings until oil spills from the oil level plug in axle housing.

4. For the transmission, the upper oil level check plug shall be taken as the benchmark, and the oil level shall be between the upper and lower oil level check plugs. The working oil tank shall be filled up to the oil pointer (higher than the lower oil pointer hole or lower than the upper oil pointer hole). In the filling for the first time, start the engine and allow it to run for 5 min and check the oil level again.

(ii) Type and grade of lubricant (See Table 2-1)

(iii) Adding oil and injecting grease with pressure

1. Engine oil

Engine oil is used for the engine lubricating system.

The marking line “Static Full” on the oil dipstick indicates the oil level required before the diesel engine starts; the “Dynamic Full” indicates the oil level required to maintain when the diesel engine is running; the “Danger” indicates that oil shall be added immediately.

2. Oils for torque converter and transmission

Add oil from the transmission oil filler until the oil can drained from the drain plug. The minimum oil level shall not be lower than the drain plug after the engine starts. The oil is used for torque transmission and lubrication.

3. Drive axle oil

Add the oil from the oil filler on left and right wheel housings until the oil spills when the oil plug in the middle of axle housing is open.The oil is used to lubricate the main reducer and hub reducer.

4. Oils for steering system and working hydraulic system

Add oil from the oil filler at the engine oil tank until the oil pointer in the tank points between the upper and lower oil pointer holes. The oil is used by the system as pressure oil produced by the oil pump.

5. Injecting grease with pressure

Inject grease at various sliding or rolling bearing sections, and see Fig. 2-10:

(1) Water pump of diesel engine and fan bearing.

(2) Bearing for transmission shaft joint fork.

(3) Bearing for control handle.

(4) All pin sleeve pairs at both ends of the oil cylinders.

(5) Hinge pin sleeve pairs of front and rear frames; swing pin sleeve pairs for sub-frame.

(6) Each pin set in working device.

Chapter IV Structures of Main Components

I. Diesel engine

For detail descriptions, see *Operation and Maintenance Manual* for the diesel engine provided for this model.

Notes:

1. When the loader shall travel for long distance or stops with antifreeze fluid not filled in the coolant during cold weather (the ambient temperature is below the freezing point), switch on the water draining switches for diesel engine body, water pump, oil cooler, water tank lower chamber and torque converter oil cooler to drain out the water to avoid frost crack.

2. If the coolant contains oil or the diesel engine oil pan oil contains water, check the oil cooler core of torque converter for crack while checking diesel engine.

II. Hydraulic torque converter

Here is equipped with a single-stage three-element hydraulic converter between its engine and transmission mechanism (transmission).

(i) Features

1. The hydraulic torque converter can automatically adjust the output torque and rotation speed so that the loader can automatically change the traveling speed and traction force according to the road condition and resistance, adapting to changing working conditions. After gear engagement, the machine can start stably and accelerate to the maximum speed with good performance and automatic stepless speed change. In case of a steep slope or a sudden obstacle, it will decelerate automatically without gear shifting to increase traction force and can travel at any low speed. After the obstacle is passed and the external resistance is reduced, it can automatically accelerate quickly to increase working efficiency. For material shoveling, it can stretch the bucket into the material at a high speed and then, with the resistance increase, automatically decelerate to increase the wheel traction force to ensure deep shoveling. The above-mentioned advantages provide a high average traveling speed and a short cycle time, improving the productivity.

2. The hydraulic torque converter has one turbine which can realize automatic shift between low speed with heavy load and high speed with light load, significantly reducing the transmission gears, simplifying structure and reducing manufacturing cost.

3. The high torque conversion ratio and wide high efficiency range make the loader bring the traction force and speed into full play by utilizing the engine power, providing good economy performance.

4. The hydraulic torque converter with oil as the medium supersedes the mechanically connected main clutch and the working oil absorbs and eliminates the vibration and shock from the engine and external loads, protecting the diesel engine and power train system, prolonging the loader's service life and reducing maintenance and cost. Even if the external load increases suddenly or cannot be overcome, the engine will not stop, ensuring pump operation and improving the loader safety and reliability.

5. The elimination of vibration and shock, removal of main clutch, stepless speed change and

reduction of gear shifts substantially reduce the driver's labor intensity and increase the comfort.

(ii) Working principle:

The torque converter comprises pump pulley, turbine and guide wheel. The working chamber is filled with working oil. The pump pulley is used to transform the mechanical energy from engine into the kinetic energy of liquid. It is driven by the engine and rotates at the engine speed to force the oil in working chamber to impact the turbine with high pressure at a high speed. The turbine absorbs and transforms the kinetic energy into mechanical energy. The guide wheel (9) is fixed, due to which when the liquid flow strikes the guide wheel (9) blade and imposes a torque on it, the guide wheel will produce an equal and opposite counter torque and transmit it back to the turbine via fluid to change its output torque. The blades of four components have their specific shapes and inlet/outlet angles so that the liquid can flow in/outflow from the specified channels and directions. However, as the pump pulley speed changes under the control of throttle and the turbine speed changes with the rotation speed change imposed by the external load (feedback through axle and transmission) on the output shaft (e.g. the wheels have no movement in case of starting or braking), the speed, pressure and relative angle of attach with which the liquid flows into each component are subject to frequent and quick change and the torque from the pump pulley and the torque reflected by guide wheel also change. When the torque that the turbine receives from the pump pulley via fluid is forward, the turbine output torque increases; otherwise, it reduces. The presence of fixed guide wheel makes the torque conversion of torque converter possible.

(iii) The inlet pressure of torque converter is 0.50-0.60 MPa and the lubricating oil pressure is 0.20-0.30 MPa. They have been adjusted well at machine delivery and need no adjustment.

(iv) The structure and transmission principle are specified in Transmission part.

III. Transmission

(i) Structure and transmission principle

The transmission, torque converter and diesel engine are assembled into a whole (see Fig. 3-1).

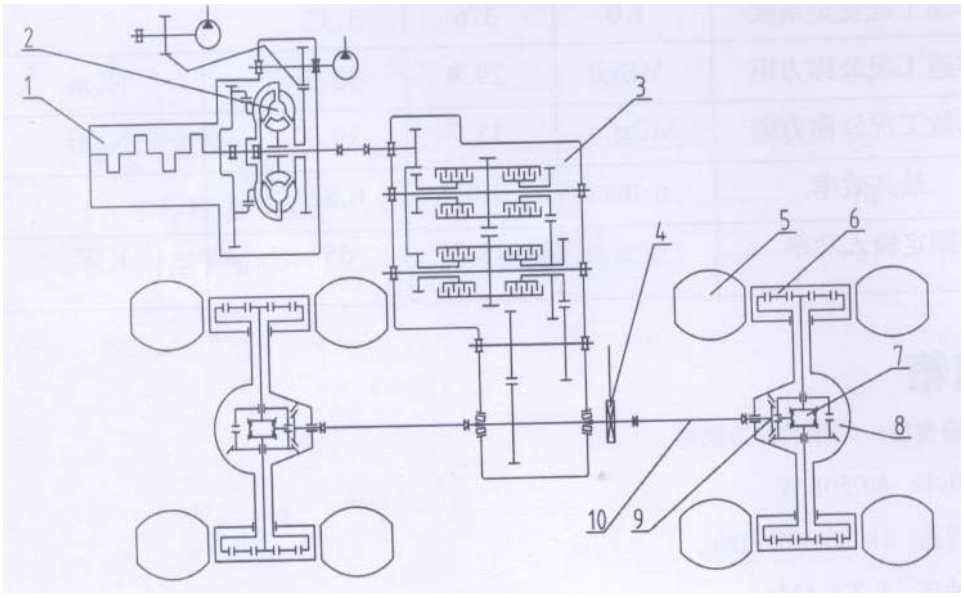


Fig. 3-1 Schematic Diagram of Drive System

1. Engine 2. Hydraulic torque converter 3. Transmission 4. Hand brake 5. Wheel
6. Wheel-side reducer 7. Differential 8. Drive axle 9. Main drive 10. Propeller shaft

The transmission is mainly composed of transmission housing, 4 gearshift clutches (i.e. forward clutch, reverse clutch, gear I clutch and gear II clutch), transmission control valve, oil filter as well as shaft and gear.

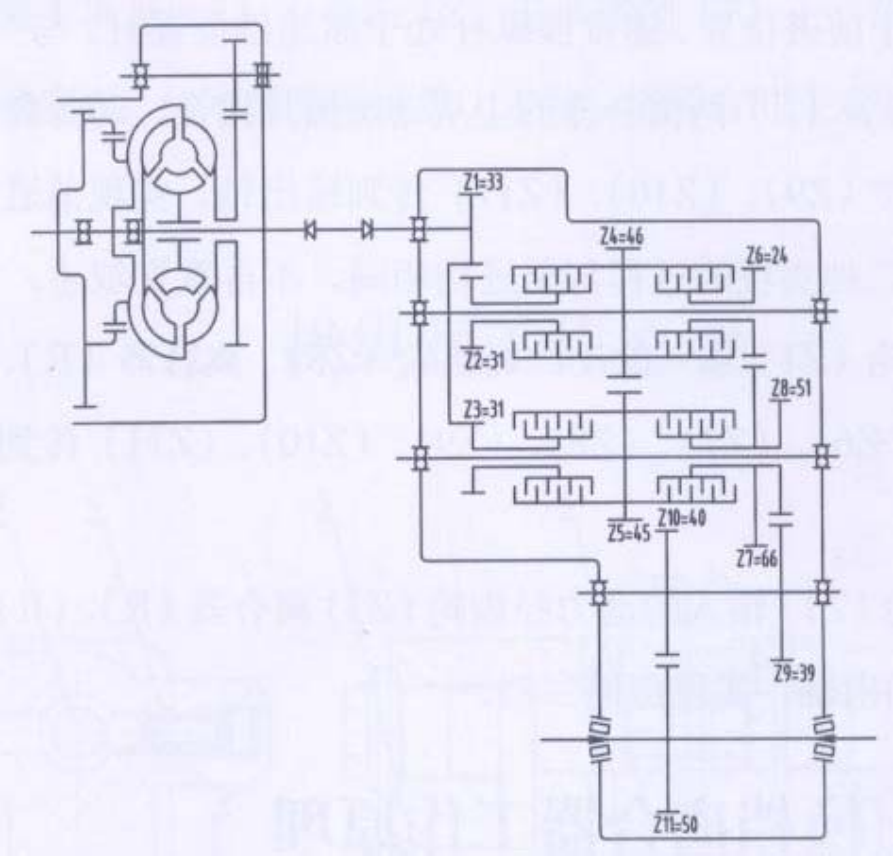


Fig. 3-2 Schematic Diagram of Working Principle of Transmission

Working principle of transmission (Fig. 3-2):

The power from diesel engine is transmitted to flange, transmission shaft and related gear (Z1) after the torque converter changes torque.

(ii) Hydraulic system of torque converter / transmission

The working oil in transmission oil pan is sucked by transmission pump, then passes through the filter (with a bypass valve for smooth oil flowing in case of filter blockage, having pressure difference of 0.3MPa) and flows into the relief valve (see Fig. 3-2). The pressure oil flows into the upper end of relief valve stem from the orifice on relief valve stem (2) (see Fig. 3-3). The relief valve stem is pushed down, and the pressure oil partly flows into the torque converter through torque converter oil intake pressure valve and partly flows into the transmission valve through clutch cut-off valve. Under the action of gearshift distribution valve lever (4) operated manually, the pressure oil will enter into different clutch piston cylinders to perform operations in different gears. At the same time, the pressure oil flows into the lower end of lower slide block (7) of pressure valve through the orifice and pushes the slide block

up to get a stable control of oil pressure (1.2~1.5 MPa).

The oil returned from torque converter flows into the cooler for cooling at first and then into the transmission for lubrication and cooling through lubricating oil pressure valve which has a pressure of 0.10~0.20 MPa (1-2kg/cm^2).

(iii) Maintenance of torque converter/transmission

Whether the torque converter and transmission work properly is related to the performance of the whole loader, therefore, in addition to normal maintenance, the following items shall be noted:

1. Working oil level in transmission

Before starting the engine, check the two drain plugs on the right of the transmission, with upper one at the max. level and lower one at min. level.

2. Pressure of working oil in torque converter/transmission

The inlet and outlet pressures of torque converter have been adjusted in manufacturing factory. The pressure reading of the working oil in transmission on the pressure gauge shall be within 1.2~1.5MPa after running the engine, in case of abnormality, check it.

3. Oil temperature

The max. oil temperature shall not exceed 120℃ during normal operation and driving, if it is exceeded, stop the loader to cool and check.

4. After running-in period, the oil shall be replaced with new one for the transmission after driving for 600 hours generally; however, if oil deterioration or impurity mixture is found during check, wash, check and replace with new oil of specified brand.

IV. Drive axle

The drive axles include front axle and rear axle for which the only difference lies in the hand of spiral of spiral bevel gear of main reducer pair. The driving spiral bevel gear of front axle is left-hand and that of rear axle is right-hand. However, thestructures are the same.

(i) Main structural features:

The drive axles are designed with double reduction drive structures. The first–stage reduction gear is driven by spiral bevel gear, which features high input torque, high transmission efficiency and stable work; the second-stage reduction gear is designed with a planetary reduction drive structure (NGW) with good overall movement rigidity and stable output speed. Between two reduction gears, a full-floating axle shaft is used to transmit power, thus overcoming the impact of axle housing on axle shaft drive during work and transformation.

(ii) Working principle (see Fig. 3-4)

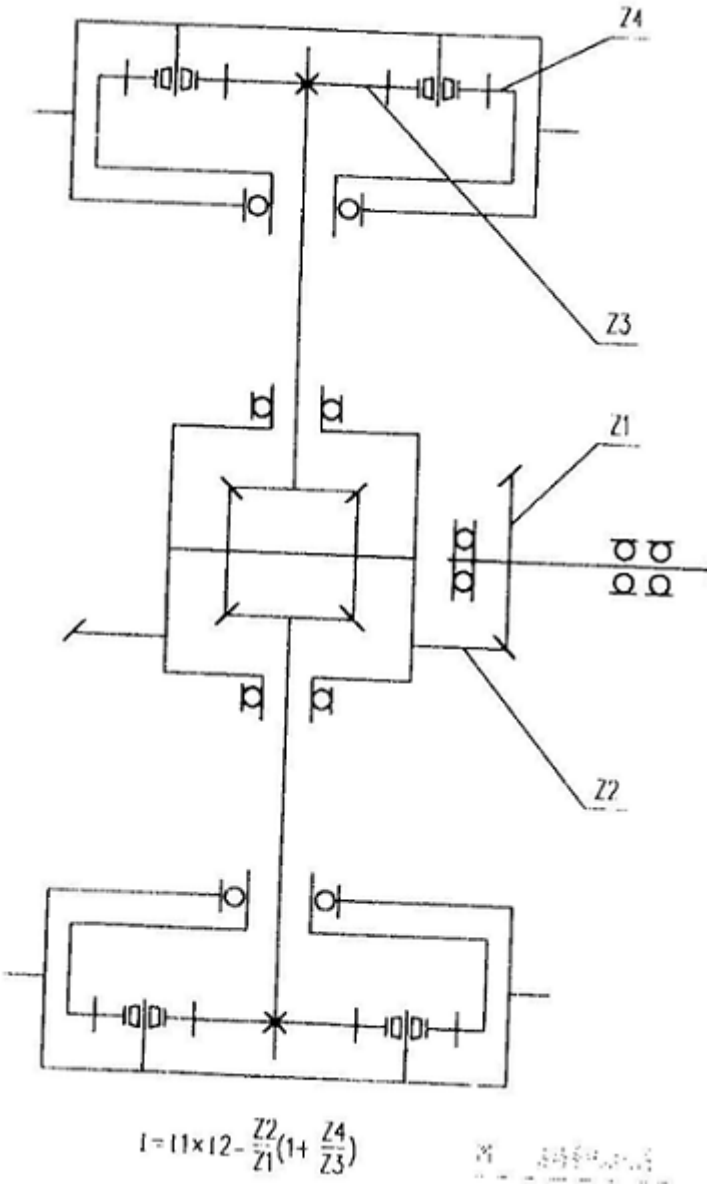


Fig. 3-4 Schematic Diagram of Working Principle of Axle

The main engine torque is transmitted from drive axle input flange through transmission shaft. After reduction by main reducer, it changes the rotation direction to drive the driven spiral bevel gear and differential housing to rotate. The differential housing transmits the power to the axle shaft gear by driving cross axle and planetary gear, and then the axle shaft gear partly transmits the power to wheel-side reducer on both sides through the axle shaft and finally to planetary carrier after reduction by wheel-side planetary gear to drive the wheels forward. The transmission line is as follows:

Main engine torque——Input flange——Main reducer——Differential——Axle shaft——Wheel-side reducer——Wheel.

(iii) Requirements on checking and commissioning items in the process of use

1. The meshing clearance of spiral bevel gear pair is 0.2～0.3mm, and the contact impression in tooth length and height directions shall be greater than 60% and the contact impression shall be centered in the tooth. It will tilt to small end at no-load, and the clearance and contact impression shall

be adjusted through increasing/reducing the number of adjusting shims at bearing bush and of the adjusting nuts at the bearings on both sides of the differential.

2. Adjustment of wheel-side hub bearing clearance:

Tighten the round nut until the hub can rotate hardly, and then turn the round nut by 1/10 circle reversely. After the operation, the hub shall rotate freely without seizing and be free from obvious axial clearance and deflection. Finally, clip the thrust shim into the slot of round nut for locking.

(iv) Maintenance:

1. Before assembling the drive axle, fill a proper amount of lubricating oil (recommended lubricating oil is GL-4 85W/90 heavy-duty vehicle gear oil). Ensure to fill the oil from the axle package oil level hole in the middle of axle housing and from the wheel oil port on both sides.

Filling capacity: 3kg at axle package, 2.5kg at wheel rim on each side.

2. After the new axle operating with the main engine for 50 h, change the lubricating oil. The axle should be cleaned before changing oil.

Check main reducer housing, wheel-side end cover for early heating; if any, check whether the oil level meets requirements.

Check the fastening of all fasteners; if any fastener is loosened, retighten it.

Check for abnormal noise during operation; if any, stop the loader for troubleshooting.

Check each oil seal for seepage; if any, replace with a new oil seal.

3. Change with new lubricating oil every 1,200 h for the main reducer and wheel-side reducer, and note that the required lubricating oil shall be used according to different regions and seasons.

When changing lubricating oil, drain the waste oil whenit's hot, and remember to checkthe metallic impurity content in the waste oil.

Perform disassembly inspection every 2,400 h. (Check the clearance, meshing and wear of main reducer spiral bevel gear pair; check the wear of differential gear, bevel gear shim, wheel side gear, wheel-side planetary gear roller needle and bearing.)

If the tyre is damaged, the 4 wheels shall be replaced normally, and at least 2 wheels for the same axle shall be replaced to ensure normal operation of the differential.

(v) Fault analysis &solutions:

Items	Faults	Causes	Solutions
Main reducer and differential	Loud noise	1. Excessive gear clearance 2. Wear of rolling bearing	Adjust gear clearance Replace bearing
	Early heating of housing	Poor lubrication, no or excessive lubricating oil	Fill oil to specified level
	Periodic abnormal noise	1. Teeth collision on gear 2. Foreign matters inside 3. Looseness of fasteners	Replace gear Drain oil for inspection Tighten fasteners
	Differential	Broken cross axle	Replace cross axle

	failure		
	Oil leakage	1. Oil seal aged or worn 2. Sealant failure 3. Looseness of fasteners	Replace oil seal Remove old sealant and reapply new one Tighten fasteners
Wheel-side reducer	No rotation at wheel side	1. Broken axle shaft 2. Failure of differential system	Replace axle shaft Adjust and replace differential system
	Abnormal noise	1. Teeth collision on gear 2. Foreign matters	Replace gear Drain oil for inspection
	Early heating of housing	Poor lubrication, no or excessive lubricating oil	Fill oil to specified level

V. Hydraulic steering system

The single pump split-flow structures are adopted for the CDM816D hydraulic steering system and working device hydraulic system. The hydraulic steering system is mainly composed of full hydraulic steering gear, pilot valve, steering cylinder, gear pump, oil pipe and oil tank. See Fig. 3-5 Schematic Diagram of Hydraulic Steering System.

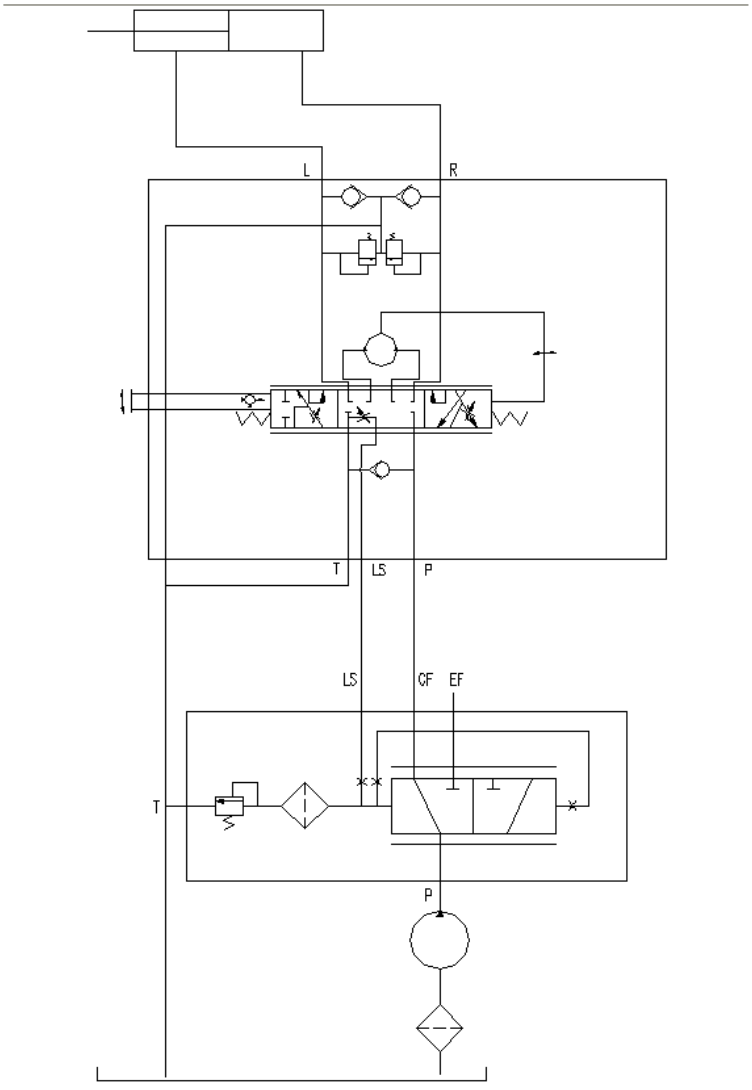


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Fig. 3-5 Schematic Diagram of Hydraulic Steering System

(i) Working principle of steering system

The pressure oil from oil pump first flows into the pilot valve which distributes oil flow to steering gear preferentially no matter how high or low the load, pressure and steering wheel speed are, or whether the engine is idling or running at high speed, so as to ensure sufficient oil supply for steering and stable and reliable steering actions. When the engine is running at high speed or not steering or steering slowly, the pilot valve will supply the remaining oil to the working device hydraulic system.

The one-way valve installed on the full hydraulic steering gear inlet pipe is used to prevent the oil in steering cylinder from flowing back into the flow amplifying steering gear, resulting in steering kickback. When turning the steering wheel right, the oil flows into the small chamber of steering cylinder through steering gear to make the loader turn right; on the contrary, when turning the steering wheel left, the oil flows into the large chamber of steering cylinder through the steering gear to make the loader turn left. If the system pressure exceeds 16 MPa when a wheel encounters an obstacle or the wheels are turned to limit positions, the safety valve in pilot valve will be opened to unload and the oil returns into the oil tank to prevent the system against overload.

(ii) Structures & performances of main components

(1) YXL-F160L-N7 pilot valve

Nominal pressure: 16MPa

Nominal flow: 160L/ min

Working principle:

When the steering gear is set at neutral position, the oil from pilot valve partly flows to LS port through the orifice in the steering gear and acts on one side of pilot valve core, and partly flows through the control port in the pilot valve core and acts on the other side (PP port). The pressure at pilot valve PP port shall be greater than that at LS port and the elastic force of the spring, under the action of the pressure at PP port, only a small amount of oil flows into the steering gear through CF port and the remaining oil from the steering pump flows into the working device hydraulic system through EF port.

When the steering gear moves away from the neutral position, the pressure at LS port increases and the pilot valve core moves toward PP port under the action of elastic force, so as to supply the oil from steering pump to the steering gear and meet the steering requirements.

(2) BZZ5-315 steering gear

Nominal pressure: 14MPa

Theoretical output: 315ml / r

Working principle:

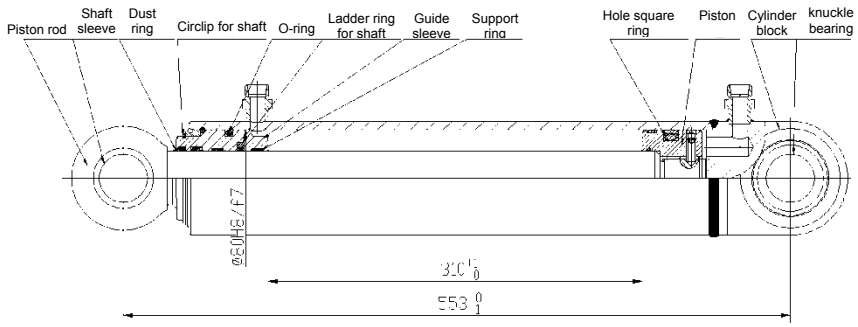
When the steering gear does not work, the oil from it flows to the oil inlet of steering gear valve body through the pilot valve, and the oil partly flows to the rear of the valve core through the thermal balance port between the valve core and valve sleeve and then to the oil return hole of the steering gear through the hole in the valve core and finally to the oil return tank. The remaining oil flows to the ring

groove, then to the distributing groove of the valve core, to the load ring groove of the valve sleeve and finally to the load port of the valve body. It is connected with pilot valve through pipeline to get ready to transmit the steering pressure signal. In this case, no pressure oil from the steering gear flows into the stator and rotor. Most oil from the pump flows to other working device and then returns to the oil tank through the EF port of the pilot valve.

When the steering gear turns left or right, the thermal balance port is closed and the load port produces a pressure signal to transmit it to the pilot valve. At this time, the pilot valve core begins to move and the CF port expands to supply oil to the steering gear according to the speed of the steering wheel during steering.

(3) Steering cylinder

Structure view of steering cylinder Fig. 3-6 Steering Cylinder



(iii) Maintenance of steering system

(1) The working oil in the steering system shall be kept clean and changed every half a year generally.

(2) Overhaul or clean the components (such as steering gear, pilot valve, steering cylinder) for the steering system after working for six months to one year. When disassembling, be careful to protect the parts from bumps or damages.

VI. Implementhydraulic system

The working device hydraulic system is used to control the movements of the boom and bucket, so as to meet various operation requirements. It mainly composed of gear pump that's shared between working device hydraulic system and steering system, multi-way change valve, boom cylinder, tilt cylinder, oil suction/return filter, oil tank etc. The working principle is shown in the Fig. 3-7.

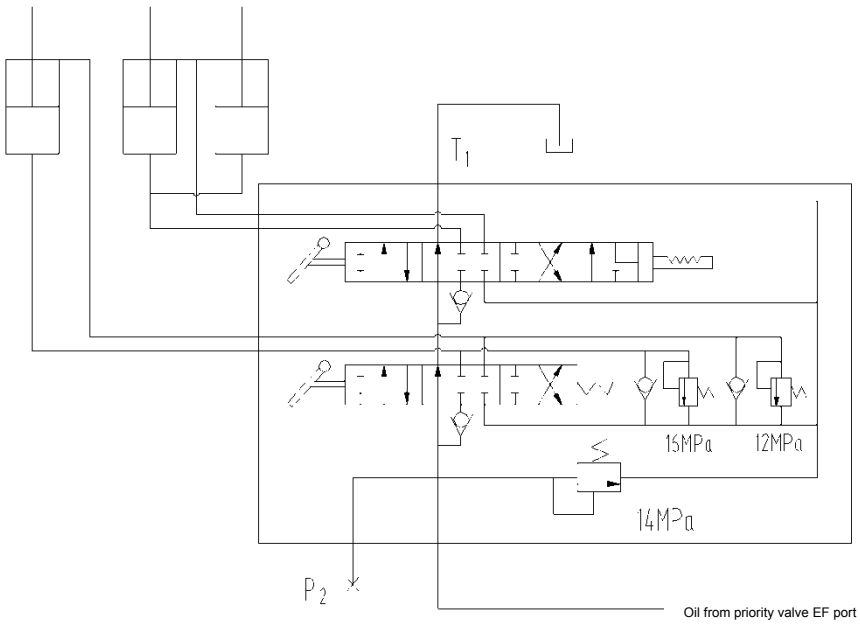


Fig. 3-7 Schematic Diagram of Implement Hydraulic System

(i) Working principle

The engine operation is realized by driving the gear via torque converter. When two control levers are at neutral positions, the tilt valve stem and the boom valve stem of the multi-way valvewill be also at the neutral positions. The oil from the gear pump returns to the oil tank through the multi-way valve.

There are three control positions (i.e. “Tilt Down”, “Neutral”, “Tilt Up”) for the tilt control level to control the movement of the bucket.

When the engine is running, the tilt control lever is pushed forward, at this time, the tilt valve stem moves forward, the pressure oil from the main oil circuit flows into the small chamber of the tilt cylinder through first part of the multi-way valve to push the cylinder piston backward, thus realizing the tilt-down of the bucket.

When pulling back the control lever, the tilt valve stem moves backward, and the pressure oil from the main oil circuit flows into the large chamber of the tilt cylinder through first part of the multi-way valve to push the cylinder piston forward, thus realizing bucket retraction.

When the valve stem is at neutral position, the tilt valve stem is kept at the neutral position under the action of the return spring. Meanwhile, the tilt oil chamber is in locking state.

There are four control positions (i.e. “Lift”, “Neutral”, “Lower” and “Float”) for the boom cylinder control lever to control the lifting of boom.

When pushing the control lever forward, the boom valve stem moves forward and the pressure oil from the main oil circuit flows into the small chamber of the lifting cylinder through second part of the multi-way valve to push the cylinder piston move down, so as to realize lowering. Meanwhile, the oil in the large chamber of the lifting cylinder returns to the oil tank through the multi-way valve.

When pulling back the control lever, the boom valve stem moves backward and the pressure oil from the main oil circuit flows into the large chamber of the lifting cylinder through second part of the

multi-way valve to push the cylinder piston move up, so as to realize lifting. Meanwhile, the oil in the small chamber of the lifting cylinder returns to the oil tank through the multi-way valve.

When the control lever is at neutral position, the boom valve stem is kept at the neutral position under the action of the return spring. Ensure that the large and small chambers of the lifting cylinder are in locking states and the boom stops working.

After pushing the control lever forward to “Lower” position, continue to move it tothe “Float” position. In this case, the multi-way valve switches on oil pump, oil tank, large and small chambers of the lifting cylinder, and the lifting cylinder piston is in floating state in the cylinder so that the bucket cutting edge can float up and down with topographic relief.

The operations of boom “Lower” and bucket “Tilt Down” are as follows when the engine is shutdown:

When the boom is at “Lift” position, in case of a sudden shutdown, lower the boom to the ground slowly.

When pushing the control lever forward to “Lower” or “Float” position, the boom valve stem moves forward to connect the oil port of the lifting cylinder large chamber with oil tank. Under the action of the working device’s deadweight, the bucket drops to the ground.

To achieve the bucket “Tilt Down”, move the tilt valve stem forward so that the oil in the large chamber of the tilt cylinder can return into the oil tank. At this time, open the filling valve of the first part of multi-way valveto ensure that the oil port of the tilt cylinder small chamber is also connected with oil tank. Under the action of the working device’s deadweight, the “Tilt Down” is achieved.

(ii) Structures & performances of main components

1. Oil return filter: used for filtering the returned oil of the system.

2. Gear pump: shares model CBG2050 with hydraulic steering system. Output: 50ml/r.

3. Oil suction filter: used for filtering the oil sucked by oil pump.

4. Oil tank: shared between working device hydraulic system and hydraulic steering system with a capacity of 80L.

5. Lifting cylinder

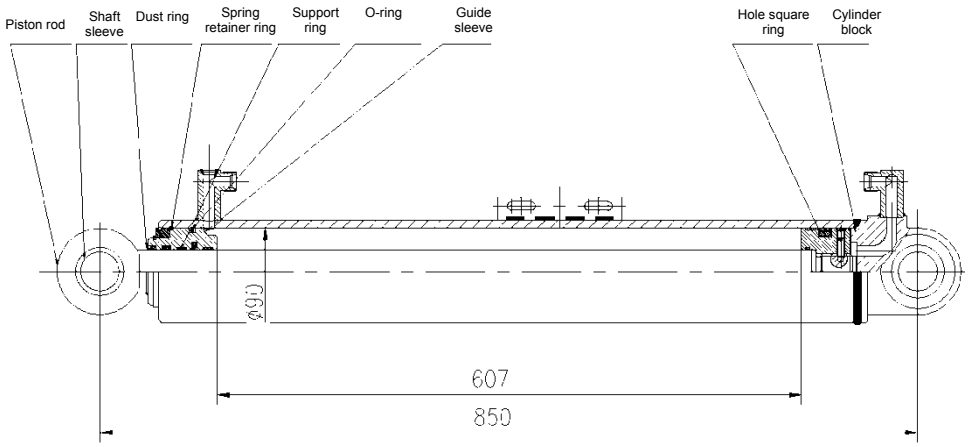


Fig. 3-8 Boom Cylinder

6. Tilt cylinder:

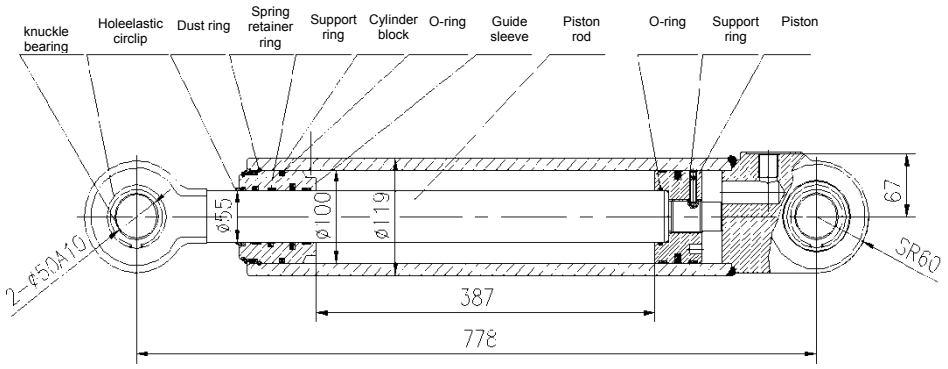


Fig. 3-9 Tilt Cylinder

7. Multi-way valve (duplex):

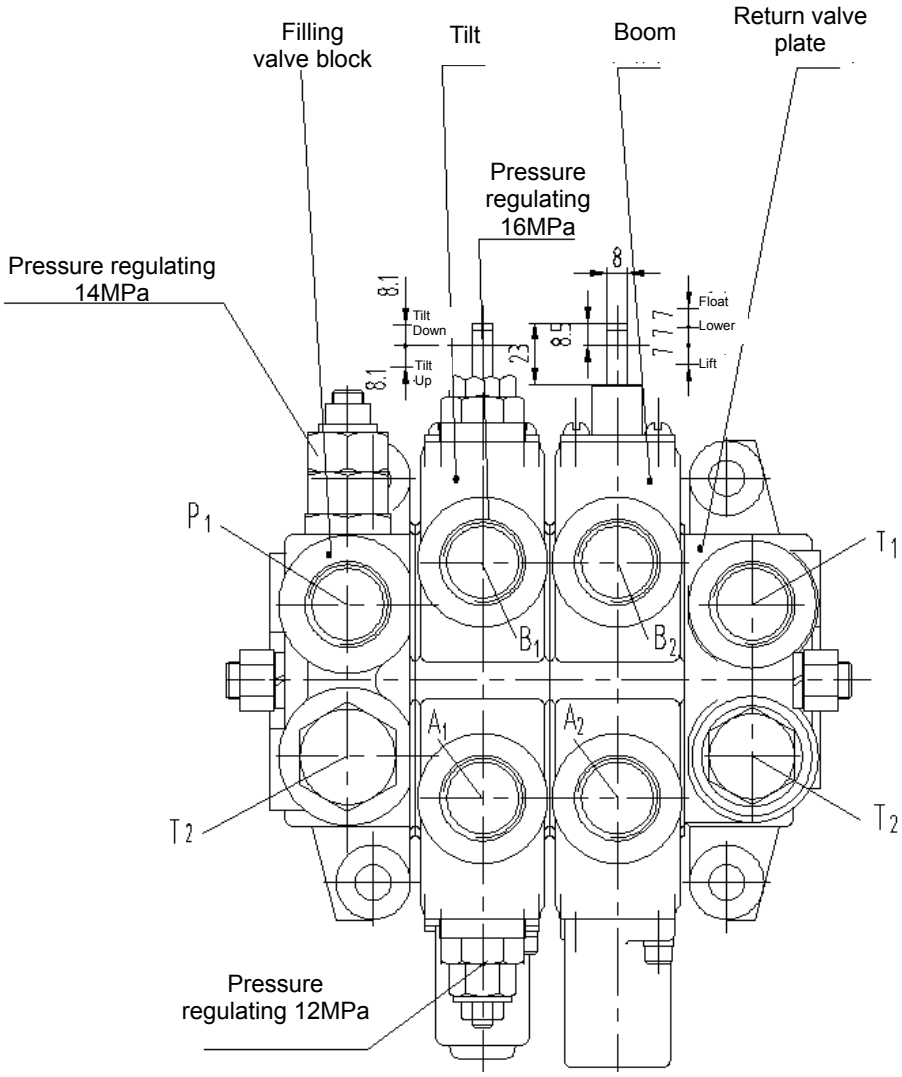


Fig.3-10 Outside View of Multi-way Valve

The nominal flow is 160/min and the pressure of main safety valve is set to 14MPa.

The A1 port of tilt valve is provided with an overload valve and its pressure is set to 12MPa; the B1 port is equipped with an overload filling valve and the overload pressure is set to16MPa;

The schematic diagram of interior structure is as follows:

The oil circuit controlled by this valve is designed with a series structure and is used to control the movement direction of tilt cylinder and boom cylinder by changing the oil flow direction to keep each part at a fixed position, thus meeting various operation requirements for engineering machinery.

The tilt change valve is 3-position 6-way valve. It can control the up tilting, back tilting and closing of the bucket.

The boom change valve is a 4-position 6-way valve. It can control the lifting, closing, lowering and floating of the boom.

The safety valve is used to control system pressure. When the system pressure exceeds the rated pressure, the valve is opened and the pressure oil returns to the oil tank to protect the hydraulic system against damage due to high pressure.

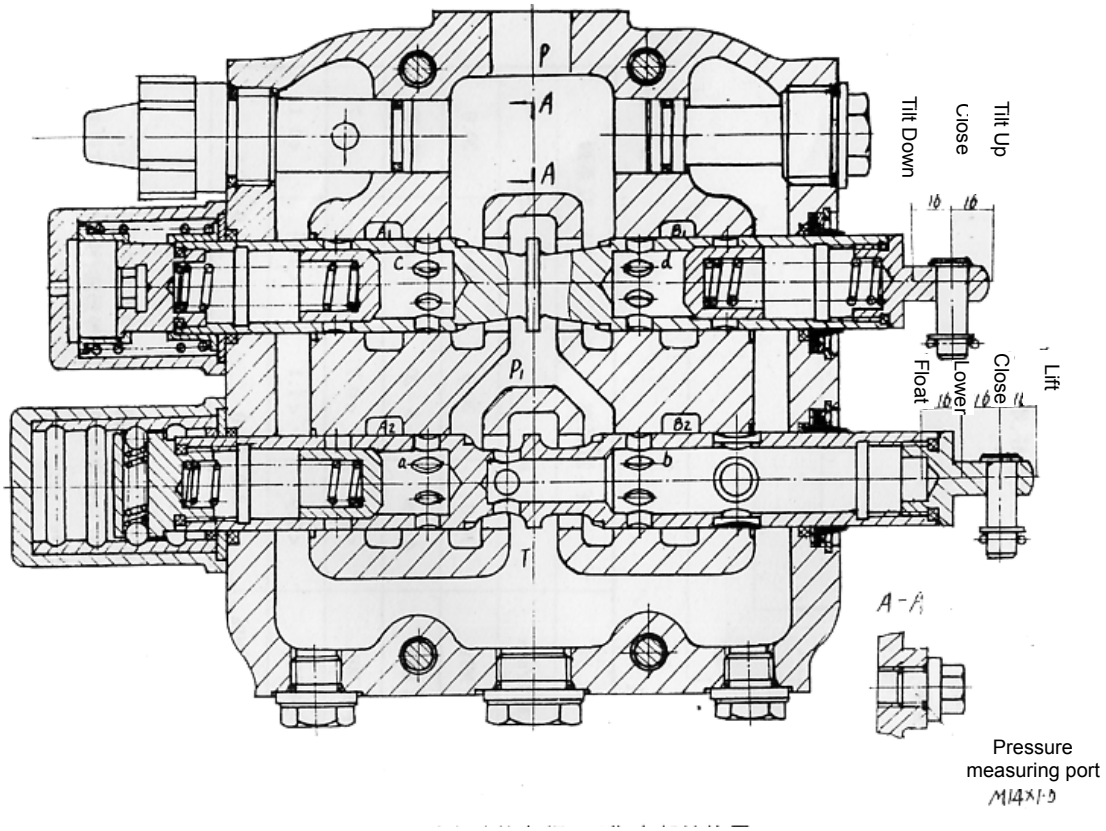


Fig. 3-11 Interior Structure of Multi-way Valve

(1) Neutral Position (closed)

The bucket and boom are stopped at certain positions as the oil circuits at both ends of tilt cylinder and boom cylinder are blocked. At this time, the oil from the oil pump flows from the oil inlet through internal oil circuit to oil return port and then to oil tank through pipeline, the safety valve is closed and the system cycles with no load.

(2) Boom “Lift”

Move the boom slide valve right to close “T” chamber and the hydraulic oil flows to “a” port from “P1” chamber to open the one-way valve and then into the lower chamber through “A_2” port to lift the boom. The hydraulic oil in the upper chamber of boom cylinder returns to the oil tank through “B_2” port, “b” port and “T” chamber.

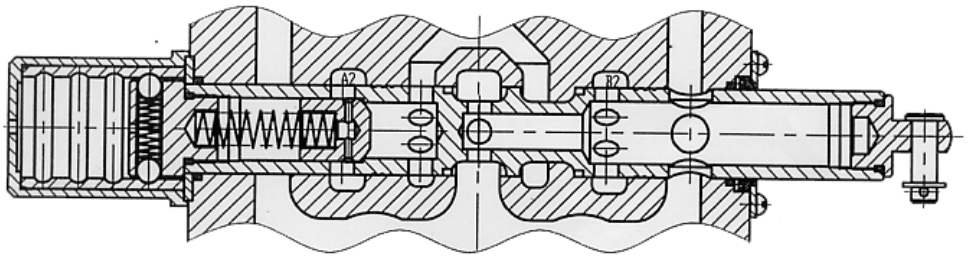


Fig. 3-12 Lifting Position for Boom Slide Valve

(3) Boom slide valve “Lower”

Move the boom slide valve left (as shown in the Fig.) to close “T” chamber and the hydraulic oil flows to “b” port from “P_1” chamber and then into the cylinder upper chamber through “B_2” port to lower the boom. The hydraulic oil in the lower chamber of boom cylinder flows through “A_2” port and “a” port to open the one-way valve and then returns to the oil tank.

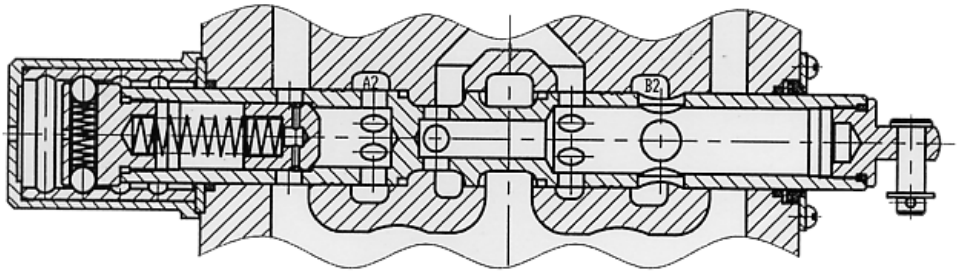


Fig. 3-13 Lowering Position for Boom Slide Valve

(4) Boom “Float”

Move the boom slide valve left (as shown in the Fig..). At this time, both “A_2” port and “B_2” port are connected to “b” port, “T” chamber and “P_1” chamber, the upper and lower chambers are connected and under low pressure. In this case, the cylinder can make the free floating state under the action of working device weight and ground acting force.

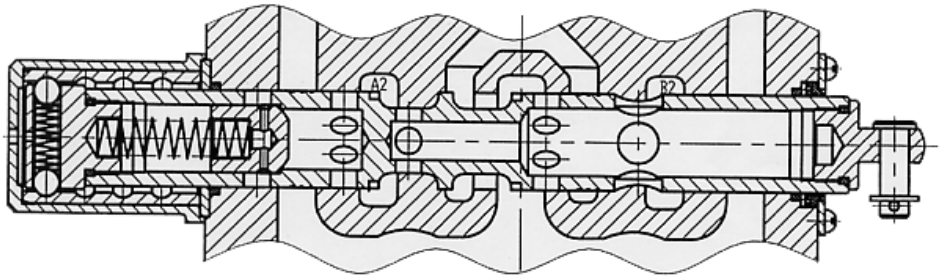


Fig. 3-14 Floating Position for Boom Slide Valve

(5) Bucket “Tilt Up”

Move the tilt slide valve right (as shown in the Fig..) to close “P_1” chamber and “T” chamber and the hydraulic oil flows to “c” port from “P” chamber to open the one-way valve and then into the rear cylinder chamber through “A_1” port to tilt up the bucket. The hydraulic oil in front cylinder chamber flows to “d” port from “B_1” port to open the one-way valve and then return into the oil tank

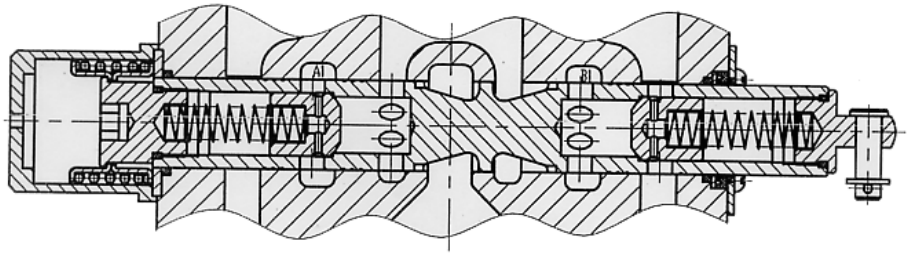


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Fig.3-15 Bucket “Tilt Up”

(6) Bucket “Tilt Down”

Move the tilt slide valve left (as shown in the Fig. 3-16) to close “P_1” chamber and “T” chamber and the hydraulic oil flows to “d” port from “P” chamber to open the one-way valve and then into the front cylinder chamber through “B_1” port to tilt down the bucket. The hydraulic oil in the rear cylinder chamber flows to “c” port from “A_1” port to open the one-way valve and then returns into the oil tank.

When the external force on the slide valve is removed, the valve returns to the neutral (closed) position automatically under the action of the elastic force of return spring.

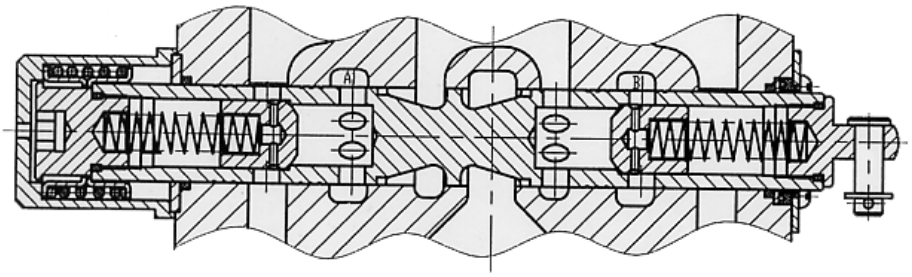


Fig.3-16 Bucket “Tilt Down”

(7) Overload filling valve (for interior structure, see Fig. 4)

The oil circuit of front/rear chamber of tilt cylinder is equipped with one overload filling valve respectively (with the quantity being changed willfully as required). This valve is used to eliminate oil trapping or negative pressure in cylinder when the bucket is subject to external impact loads or interference from other mechanisms.

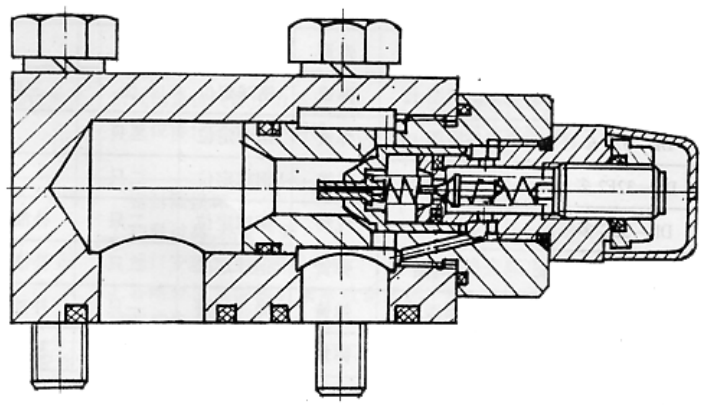


Fig.3-17 Interior Structure of Overload Filling Valve

8. The oil tank (see Fig. 3-18), with a capacity of 80L, is shared between the working device and steering system. Air filter used to refuel is on the top, two joints used to fit hydraulic system inlet/return pipe are located in the left, and two oil filters are fitted to the inside to remove impurities in the oil. To clean oil filters periodically, it only needs to remove 6 bolts on right flange cover to remove the cover and to pull out oil filter. Drain plug on the bottom of oil tank is used for periodic oil-replacing and cleaning.Replace oilonce per year (2400h) at least

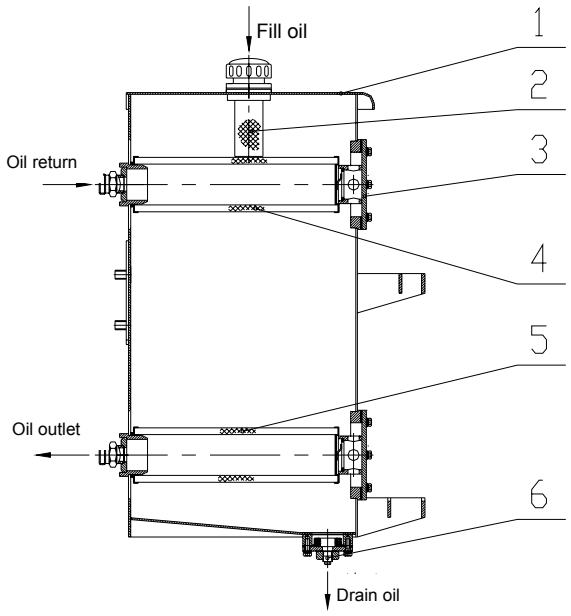


Fig. 3-18 Hydraulic Oil Tank

1. Hydraulic oil tank body 2. Air filter 3. Flange cover 4. Oil return filter

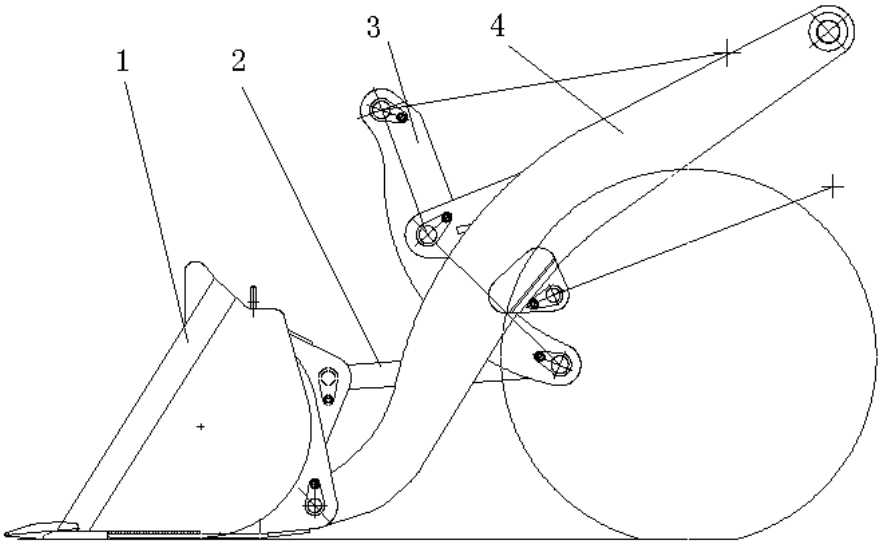
5. Oil suction filter 6. Plug

VII. Implement&frame

(i) Implement

The working device for the loader is mainly composed of bucket, pull rod, boom and rocker arm. See Fig. 3-19. The tilt mechanism for the loader is provided with a single rocker arm and single pull rod and

performs “Z” shaped reverse tilt. It is characterized by large unloading height, high breakout force and large bucket up-tilt angle, good lateral movement ability, easy fill-up and little material falling during lifting. When the boom is lowered directly to the lowest position after unloading at the highest position, the bucket will be automatically switched to cut-in state.



1. Bucket 2. Pull rod 3. Rocker arm 4. Boom

Fig. 3-19 Schematic Diagram of Implement

The boom is a single-plate structure, with rear end supported on front frame, front end connected with the bucket and the middle connected with boom cylinder. When the boom cylinder extends/retracts, the boom rotates around the axis pin at its rear end to lift or lower the bucket.

The middle of rocker arm is connected with the boom. When the tilt cylinder extends/retracts, the rocker arm rotates around its middle supporting point to tilt the bucket up or down through the pull rod linkage. With cooperation with the boom movement and vehicle traveling, various operations can be completed.

The bucket is a toothed flat bucket. The teeth are bolted to the main cutting edge and can be replaced in case of wear. If the main cutting edge is excessively worn, the cutter shall be replaced.

The working device has seven articulation points: bucket - boom, bucket - pull rod, pull rod - rocker arm, rocker arm - boom, boom - frame, boom - cylinder, and rocker arm - cylinder. The fitting clearance is 0.06-0.22 mm. Wear will occur between the axis pin and bushing during working. If the clearance exceeds 0.6-0.7 mm, the bushing or axis pin shall be replaced

(ii) Frame

Frame is the base for the connection or installation of all parts and components. It is mainly composed of front frame and rear frame which is equipped with an oscillating frame (see Fig. 3-20). Front and rear frames are articulated by articulating axis pin. Front frame is located on front axle with anworking device arranged on it. Rear frame is connected with rear axle through oscillating frame, on which the engine, torque converter, transmission, cab and control mechanism are installed. Under the action of

steering mechanism, front and rear frames rotate around the articulating axis to realize steering. Rear frame and oscillating frame are connected through articulating pin. The oscillating frame can swing up/down by 10° around the pin center so as to make the loader remain stable even when traveling on rough roads.

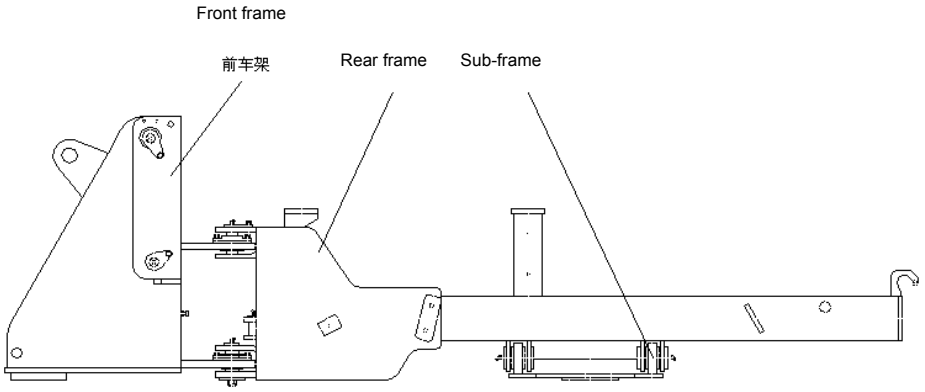


Fig. 3-20 Frame

VIII. Braking system

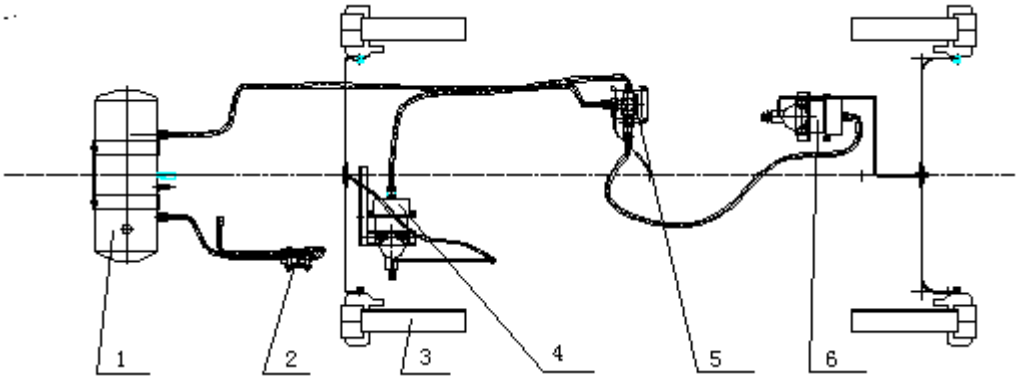
i. General

The braking system is used for vehicle deceleration or braking during traveling and long-time vehicle stop on flat ground or slopes. The braking system of this loader includes service brake system (foot brake) and parking brake system (hand brake).

ii Service brake system

The service brake system, also called foot brake, is used for frequent speed control during general traveling. The service brake system of this loader is composed of caliper disc brake, gas pushedoilbooster pump and pedal. Front/rear wheel braking torque conversion ratio is 1:1. The front and rear wheel brakes are exchangeable and equipped with front and rear booster pumps respectively. The whole service brake system is characterized by stable braking, safety, reliability, simple structure, convenient maintenance, easy sewage disposal and good recovery performance.

1. Main structure and principle of service brake system:



1. Air reservoir 2. Relief valve 3. Caliper disc brake

4. Rear booster pump 5. Foot brake master valve 6. Front booster pump

Fig. 3-21 Service brake system

The system structure is shown in Fig. 3-21. The compressed air from air compressor driven by engine flows into air reservoir (1) through the relief valve (2) and the system pressure is 0.7~0.78MPa. One port of the air reservoir is connected to the air inlet of air brake valve (5). The other port of the air reservoir is equipped with an air take valve which is used to inflate tyres or remove the dust on diesel engine air filter element.

Depress the pedal of brake master valve (5) and the compressed air from air reservoir flows into the front booster pump (5) and rear booster pump (4) through the air brake valve. The pressure oil pressurized by the rear booster pump pushes the piston of disc brake (3) to press the brake pad to brake disc (pressure about 9.8MPa) to realize deceleration. Release the pedal and the compressed air in front and rear booster pump flows into atmosphere to release the braking.

2. Main components of service brake system:

The service brake system is composed of air compressor, relief valve, air reservoir, air brake master valve, front and rear booster pumps, and disc brake.

A. Air compressor

Air-cooled double-cylinder piston air compressor, one of diesel engine accessories, is fitted to the front of fuel pump of diesel engine, driven by engine timing gear, provided with lubricating oil by the engine and cooled by air. Air compressor air suction pipe is connected to inlet pipe of diesel engine. Engine oil from diesel engine, limited by gauge hole, flows to oil sump of air compressor and the oil level is kept. Excessive oil will return to diesel engine.

With no compressed air being used, after the air compressor works continuously for tens of minutes, if the braking system pressure keeps stable, it means that the air compressor works normally; if the air pressure drops significantly or fluctuates frequently, check the air discharge valve of air compressor and carry out grinding if necessary to keep its tightness.

When the air compressor is working, there shall be no much oil seeping into compressed air. If the engine oil accumulated in relief valve exceeds10-15cm^3after 24 hours of working, find out the cause. If the piston ring is worn seriously, replace it.

B. Relief valve

Purpose: It can automatically adjust the working pressure of air braking system and discharge the oil, water and dust filtered by itself. It can also inflate tyre if equipped with a special joint.

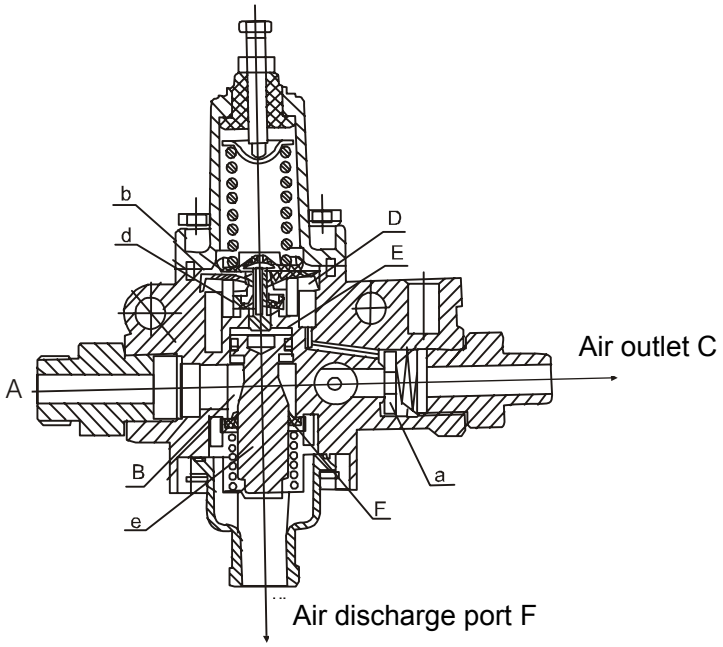


Fig. 3-22

a. One-way valve b. Diaphragm d. Pressure regulating valve assembly e. Exhaust valve stem f. Exhaust valve

Working principle: As shown in Fig. 3-22, the compressed air from air compressor flows into chamber (B) through air inlet (A) and then to air outlet (C) through one-way valve (a) to charge the air reservoir. When the pressure in air reservoir reaches 0.748MPa, the air in chamber (D) pushes diaphragm (b) to open the pressure regulating valve assembly (d). Then, the air flows into chamber (E) and push the air discharge valve rod (e) down to open the air discharge valve (f). The compressed air in chamber (B), together with the water and impurities accumulated at the bottom of chamber (B) is discharged into atmosphere through air outlet (F) to make the air compressor operate with no load. If the pressure in air reservoir drops, the pressure regulating valve assembly (d) and air discharge valve (f) will be closed in turn and the relief valve continues to supply air to the air reservoir.

After service, the relief valve, air inlet and air outlet shall be installed correctly. The adjusting screw on the assembly has been adjusted properly before machine delivery and the user shall not adjust or remove it without permission.

C. Air brake master valve

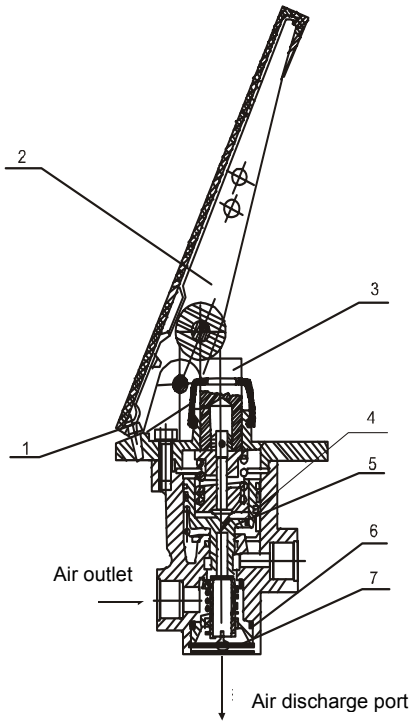


Fig. 3-23 Air brake master valve

1. Adjusting screw
2. Pedal
3. Mandril
4. Balance spring
5. Return spring
6. Piston
7. Air intake valve

Working principle: As shown in Fig. 3-23, when the brake pedal (2) is stepped down, it applies a certain pressure to the balance spring (4) through the mandril to push the piston (6) down to close the passage connecting the air outlet and atmosphere and to open the air intake valve so that the compressed air is charged into braking components through the air outlet and the air pressure at air outlet is relived through air discharge port.

The rubber dust boot at the upper end of air brake valve shall be kept intact. The inner chamber of brake valve shall be cleaned regularly and a thin layer of oil shall be applied on the piston surface after cleaning to ensure piston flexibility. The internal rubber drum membrane and valve shall be kept intact. They shall be made of oil-resistant rubber instead of any other general material.

The booster pump requires clean brake fluid, so the brake fluid shall be filtered at each filling. The oil-filling hole shall be kept unblocked. 719 synthetic brake fluid is filled into the master pump oil cup to improve the braking reliability and reduce “air resistance” in oil circuit system pipeline. Mixture of brake fluid of different models shall not be used. To use the brake fluid of a different model, completely discharge the original brake fluid, clean the system with the new brake fluid, and then fill the system with the new brake fluid. No mineral oil shall be used in the system; otherwise, the rubber components will be damaged.

D. Booster pump:

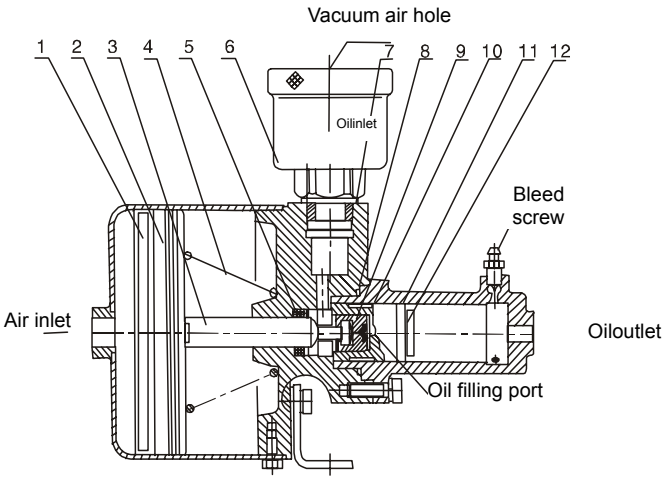


Fig. 3-24

Working principle: The structure is shown in Fig. 3-24. The booster pump is a gas pushed oil booster comprising cylinder and hydraulic master pump. During working, the air entering through air inlet pushes the push rod piston assembly forward and the push rod pushes the push rod seat assembly. The oil intake valve seals the oil-filling hole in the hydraulic piston so that a hydraulic pressure is built up in the hydraulic cylinder and the outputted hydraulic pressure is 10 X90% times as much as the inputted air pressure. When the air pressure is relieved, under the action of return spring, the oil-filling hole is opened and the hydraulic oil returns to the oil cup through the oil-filling hole.

E. Structure of brake:

Hydraulic caliper disc brake features great braking torque and high speed. Every axle is equipped with two auxiliary brakes. Brake consists of inner and outer caliper bodies, piston, brake pad and brake disc and is fastened to the drive axle housing. Brake disc is fastened to hub, and they make the counter rotation to the axle housing shaft pipe.

Working principle:

During braking, high pressure brake fluid flows from brake pipe into hydraulic chamber behind piston through caliper body to drive pistons on both sides to push brake pad to the central position, so that the rotating brake disc fitted to hub is clamped to produce torque of frictional resistance to brake the vehicle.

3. Usage and maintenance of service brake system:

Frequent and proper maintenance of service brake system plays an important role in ensuring braking performance and improving driving safety.

(1) Frequently check the system for leakage and various connectors and connection parts for looseness. There shall be no leakage for the air and oil channel systems.

(2) The high-temperature resistant synthetic brake fluid of 719 type(conforming to the standard of HZY3 product in “GB12981-2003 Brake Fluid of Motor Vehicle”) is preferred. In case of change, only use vegetable brake fluid and add the brake fluid of new brand after cleaning the original brake fluid. Timely refill the brake fluid when the level is low. For each filling, a filter bowl shall be used and the level shall be 20-25mm away from the oil filler. The brake fluid shall not be mixed with mineral oil and

water, otherwise, the rubber components of the system will be quickly damaged and the braking effect will be reduced.

(3) The air in oil channel system will affect the braking performance, so air bleeding shall be carried out after part replacement and repair with the method as follows:

A. Remove the sludge and scales at pipeline, oil storage chamber, oil filler and air bleeding location of the oil channel system;

B. Fill up brake fluid as required;

C. Start the engine until the air pressure reaches 0.67-0.69 MPa and then stop it;

D. Cover a clear plastic pipe onto the air nipple, with the other end of the pipe into the oil container;

E. Continuously step down the brake pedal for several times and then depress it firmly. Release the bleeding nipple at the upper end of front/rear wheel disk brake to bleed the air until the liquid column without bubble flows out, and then screw down the bleeding nipple and release the brake pedal. Pay attention to timely supplement brake fluid into the brake oil cup during air bleeding to avoid air entering into the system;

F. After the air bleeding, open the water drain valve at the bottom of air reservoir to drain out the pressure oil when there is some pressure in the reservoir, otherwise, the water residue will rust the reservoir and thus affect the service life of the rubber components in the air channel system.

(4) For safety, calibrate the relief valve frequently to maintain it in normal status.

A. Frequently check pressure vessels, in case of air leakage and blockage, immediately replace the pressure controller;

B. Calibrate the relief valve at least once a year to ensure its rated pressure is 0.784MPa in serviceable condition;

C. Check the pressure gauge, in case of air leakage and failure, immediately replace it;

D. Have the measurement department or other related specialized department to calibrate the pressure gauge at least once a year to ensure its serviceable condition;

(5) The user shall pay attention to the following items on the air reservoir when using it:

A. The general service life of air reservoir: It is five years if the loader is continuously used, shorter time if its use is interrupted or about three years if it is unused for over one month. When the service life expires, replace the air reservoir by the one with our company's trade mark.

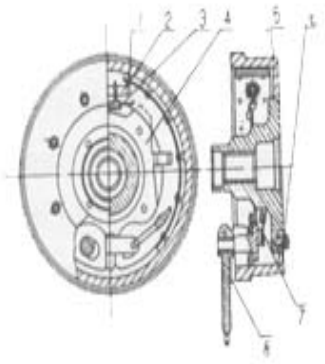
B. Frequently check the outside of the air reservoir, in case of anticorrosive coat stripping, remove the rust and apply anti-rust paint; in case of weld crack or deformation, immediately stop using it and replace with a new one;

C. Carry out a pressure resistance test for the air reservoir every year with a test pressure of 1.2MPa. If the loader has been unused for more than three months, carry out this test before reusing it.

iii Parking brake system

Structure and working principle of main components:

Parking brake system, or hand brake, consists of parking brake, control handle and flexible control shaft to park vehicle for a long time. Parking brake, also called center brake, is a self-servo two-shoe internal expanding brake and fitted to front output shaft of transmission. See Fig. 3-25 for the structure.



1. Brake 2. Adjusting rod 3. Spring
4. Seat board 5. Flange 6. Brake drum
7. Clamping stem 8. Pull rod

Fig. 3-25 Hand Brake

Parking brake is used for parking braking. During the parking braking, the driver pulls up control handle to make the draw bar (8) swing by operating the flexible shaft, and with the swinging of the draw bar, involute cam on the draw bar end deflects, causing both brake shoes (1) expanding to be pressed on the inner circle of brake drum which rotates with transmission shaft.

Notices:

Common faults for parking brake are wearing of friction plate (1), crack on brake drum, wear, dragging mark or grooving on surface, and looseness or looseness of clamping stem (7) in pin hole. Repair and replace it when it is damaged. When friction plate is worn that it is only 0.5mm away from the head of rivet, or it is burned or contaminated seriously (clean oil stain with gasoline generally), replace it. Dragging mark or grooving in inner circle of brake drum is deeper than 1.5mm or worn seriously, causing out-of-roundness, repair or replace it.

Cylindricity for inner diameter of brake drum should be no more than 0.52mm, and runout of working surface to transmission output shaft center line should be no more than 0.12mm. Dynamic balance value should be no more than 80g/cm.

Replace connecting pins if their fitting clearance is more than 0.2mm.

After reassembling, use a screwdriver (2) to adjust the clearance between brake shoe and brake drum and the clearance should be within 0.3-0.5mm. When pulling control lever, effective contact area between shoe plate and brake drum should be more than 82% to park the vehicle at a slope with gradient no less than 8°. After the braking is released, the friction plate should separate from the brake drum.

If adjusting rod does not meet requirement after adjustment, adjust the flexible control shaft by the following steps: pull out split pin on flexible shaft end connected to the draw bar (8), adjust U-fork to change the length of flexible shaft core, thus changing the turning angle of draw bar cam surface and increasing/decreasing clearance between brake shoe and brake drum, and finally perform the fine

regulation with the adjusting rod to meet the above requirements.

IX. Electrical system

The electrical system is composed of silicon rectification generator, regulator, starter (matching with diesel engine), battery, lighting system, oil circuit pressure, oil temperature and cleanliness monitoring systems, low pressure alarm and instruments.

The rated voltage of the system is 24 V, with negative grounding and single-wire system. The wiring diagram is shown in Fig. 3-26.

Two 6-Q-195 batteries or maintenance-free batteries (Bolder 6-QW-120) are connected in series to supply power for motor starting. During normal working, the generator charges the battery. In case of failed or abnormal battery charge for some reason, remove the battery from the vehicle for charge. (For details, see Use and Maintenance of the Supporting Battery in the Loader and Related Notes and Flow Diagram of Battery Fault Judgment).

The battery charge shall be carried out as specified. Check the level of the battery every 5~7 days in summer while 10~15 days in winter, and the level shall be 10~15mm higher than the electrode plate in normal conditions; check if the electrode plate is sulfurized (featuring many white lead sulphate layers on the top of the electrode plate), and the sulfurized battery shall not be used further, so special charge way is required.

If the vehicle is to be stopped for a long time, charge the battery every month. After working, always turn off the master switch of power supply to prevent leakage.

The lamp power is detailed in the table below:

Table 3-1: Lamp power

Name	Working Lamp	Combination lamps	Turn signal Lamp	Brake Lamp	Ceiling Lamp	Indicator Lamp	Instrument Lamp
Power	55／50W X2	55／50W X2	21/10WX4	21WX2	5W	2W	2W

Notices:

1. The electric lock on the instrument panel shall be turned on before starting and turned off after engine stop;

2. After normal engine starting, do not turn off the master switch of power supply randomly to avoid generator operation under no-load condition which will cause sudden voltage rise and consequently burn out the electric equipment;

3. Turning off the electric lock and master switch of power supply under any of the following situations can prevent accidents:

(1) Loss of control caused by large current due to starter motor contact adhesion;

(2) Circuit grounding caused during repair;

(3) Short circuit or grounding of electric equipment.

4. Use and Maintenance of the Supporting Battery in the Loader and Related Notes

After the battery is installed in the whole loader, since the circulation time of the new loader in and out the factory differs, the actual charge capacity of the battery and the discharging degree are also different, so the discharge degree of the battery shall be watched out closely when the loader is on sale, and the concentration of electrolyte solution and end voltage shall not be lower than the acceptable level of discharge rules.

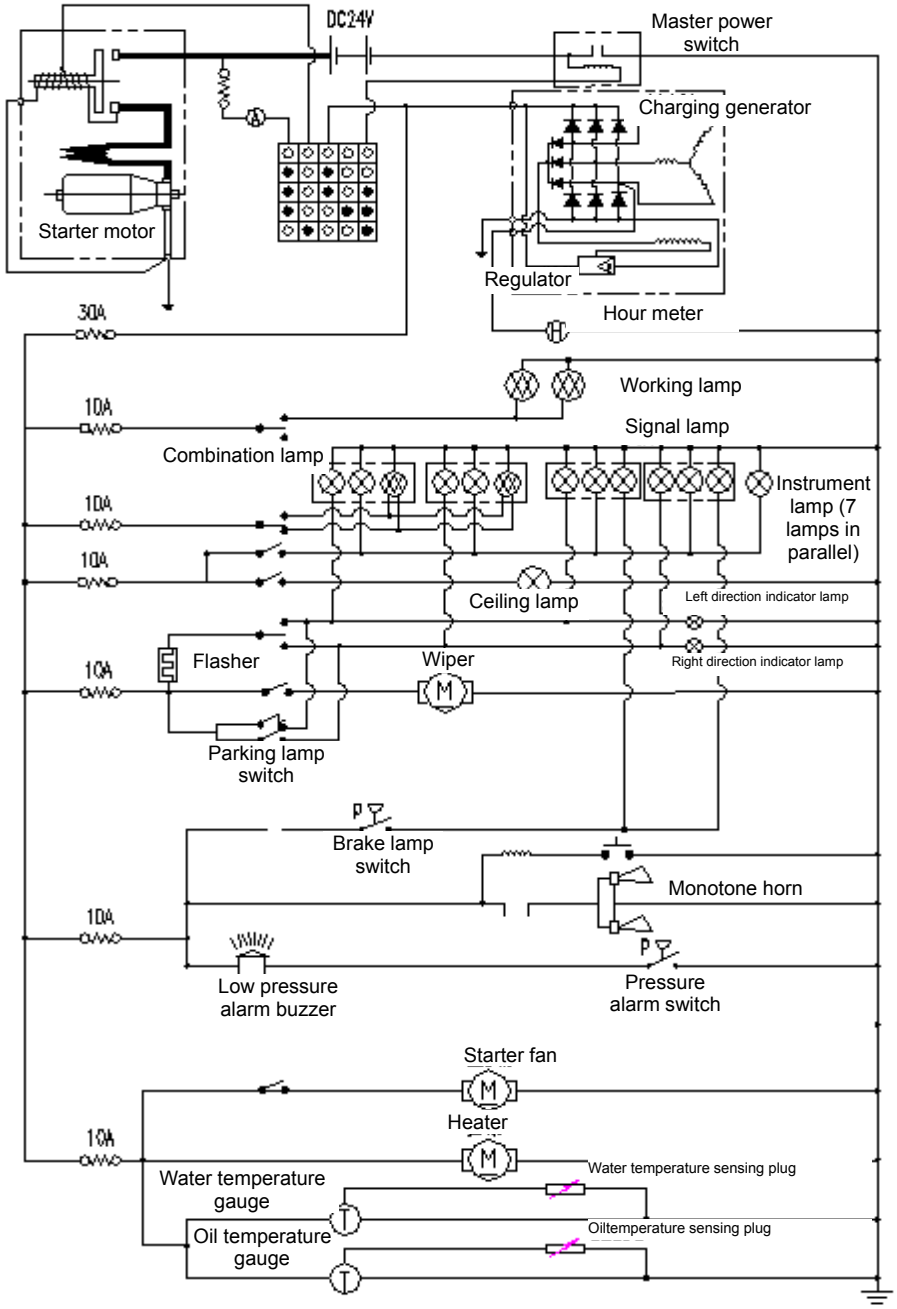


Fig.3-26 Schematic Diagram of Electrical System

1. Battery charging

Charge the battery in time when the density of battery electrolyte is lower than 1.2g/cm (25 0) or single voltage is below 1.75V.

2. Always prevent impact on the battery causing fracture to its case during removing and installing.

3. The battery is equipped with a plastic case which can bear limited pressure and tension force on four edges due to its plasticity. The fixed locking bolt of the battery shall not be fastened tightly to avoid leakage of battery acid solution due to the splitting of seals around the battery case. Burn the crack flat with an iron strip locally padded after cleaning the outer surface if local split is found around the seal.

4. Store the battery added with electrolyte after full charging, and start the loader to charge the battery once at least during 1~3 months.

I. Lubrication

Correct lubrication can significantly reduce the frictional resistance to the loader and wear to parts, thus ensuring the normal operation of the loader and extending its service life.

Notes on Fuel Filling:

1. Clean the fuel filling containers and parts, in case of damage to butter nipple, immediately replace it;

2. Always maintain the loader in a level state when checking the oil quantity;

3. For the front and rear axles, add oil from the oil filling hole in the left and right wheel housings until oil spills from the oil level plug in axle housing;

4. For the transmission, the upper oil level check plug shall be taken as the benchmark, and the oil level shall be between the upper and lower oil level check plug. The working oil tank shall be filled up to the oil pointer (between the upper and lower oil pointer hole). In the filling for the first time, start the engine and allow it running for 5 min and then check the oil level.

(2) Type and Grade of Lubricant (See Table 3-2)

(3) Filling oil and injecting grease with pressure

1. Diesel engine oil

It is used to lubricate the diesel engine. The marking line “Static Full” on the oil dipstick indicates the oil level required before the diesel engine starts; the “Dynamic Full” indicates the oil level required to be maintained when the diesel engine is running; the “Danger” indicates that oil shall be added immediately. The oil shall be changed at 50 h (running-in expires) for the first time and then every 200 h.

2. Oil for torque converter and transmission

Add oil from the transmission oil filler until the oil can be drained from the upper drain plug. The minimum oil level shall not be lower than the drain plug after the engine starts. The oil is used for torque transmission and lubrication, which shall be changed at 12 h for the first time and then every 600 h.

3. Oil for drive axle

Add oil from the oil filler on left and right wheel housing until the oil spills when the oil plug in the middle of axle housing is opened. The oil is used to lubricate the main reducer and wheel-side reducer, which shall be changed at 200 h for the first time and then every 1,200 h.

4. Oil for steering system and working hydraulic system

Add oil from the oil filler at the engine oil tank until the oil pointer in the tank points between the upper and lower oil pointer holes. The oil is used by the system as pressure oil produced by the oil pump. For the steering gear, add oil from the oil filling pipe to lubricate the recirculating ball pair. Change the hydraulic oil every 1,200 h.

5. Injecting grease with pressure

Inject grease with pressure to various sliding bearing or rolling bearing, such as:

(1) Bearings for water pump and fan of diesel engine.

(2) Bearing for transmission shaft cross yoke.

(3) Bearing for control lever.

(4) All pin sleeve pairs at both ends of the oil cylinders.

(5) Hinge pin sleeve pairs for front and rear frames; swing pin sleeve pairs for sub-frame.

(6) Each pin sleeve pair in working device.

Inject grease with pressure on the parts described above every 50 h normally. Please do it in time depending on the specific working conditions.

The user can select a centralized lubricating system.

II. Regular maintenance

Instruction

1. Before any operation or maintenance, make sure the instruction manual of the machine concerning safety, warning and descriptive information has been read and understood completely.

2. The user is responsible for proper maintenance of the machine, including adjusting mechanism, adding lubricants and other operating fluids, replacing filters and replacing parts due to normal wear or aging. Failing to maintain the entire machine according to correct cycles and specified procedures may lead to a drop in performance to the machine as well as accelerated wear on its parts and components.

Note：

1. Before any continuous maintenance cycle, it is necessary to complete all previous maintenance work firstly. In completing any item of maintenance work, it is necessary to ensure that any other items that are supposed to be performed according to cycles shorter than its cycle are done simultaneously with that item of work. For example, if a collection of items of work supposed to be performed once every 500 hours or every three months needs to be done, some other items must be performed simultaneously, including any item supposed to be performed once every 250 hours or every month, once every 100 hours or half a month, once every 50 hours or every week, or once every 10 hours or every day.

2. It is imperative that all maintenance cycles be determined by work time. However, calendar time-based cycles could replace work time-based ones if calendar time-based maintenance plans turn

out to be more convenient and the numbers included in calendar time-based plans are approximate to those in the corresponding work time-based plans. Carry out maintenance work, no matter what time is adopted, work time or calendar time, whichever comes first;

3. It is necessary to shorten time specified in the maintenance cycles table and carry out maintenance more frequently under the extremely harsh, dusty, wet, or other unfavorable working conditions;

I. Routine maintenance items to be performed once every 10 hours or once a day

1. Check the engine coolant and make sure that the engine has been filled to the full; if the machine equipped with attached tank, check the coolant level whether in the normal range or not, add coolant as necessary.

2. Check the engine oil level of engine and the liquid level of injection pump governor, and ensure the level stays within the normal operating range, add it as necessary.

3. Check the hydraulic oil level in the hydraulic oil tank to ensure that the level stays within the normal operating range, add it as necessary.

4. Check the oil level of the transmission to ensure that the level stays within the normal operating range, add it as necessary.

5. Check the fuel whether it is enough or not, add it if necessary.

6. Check the air filter of engine whether it is clean or not, replace it if necessary.

7. Drain all air reservoirs for pneumatic brake machines; but not for hydraulic brake machines;

8. Add lubricating grease to all articulated points, pin shaft sleeves and other positions according to the lubrication schematic diagram of the machine;

9. Check and make sure air pressure of tires is normal and no abnormal wear exists; check all hydraulic components and hydraulic pipes whether spilled oil or existing abnormal wear.

10. Check and make sure all systems could not spill oil, water and air. Visually inspect and make sure engine fan and driving belt no loosening or damage.

11. Check the fixed bolts and nuts on the engine, transmission, drive axle, and rims to ensure that no loosening; inspect the bucket teeth and the knife plate, and replace them as necessary;

12. Check and ensure the start-up performance of the diesel engine, the color of its exhaust, and the sound of the engine are normal; after observing the machine while it operates for ten minutes, inspect whether any alarm of abnormal sound or overheating exist or not.

13. Check and make sure the following parts of the machine work normally: dashboard, lighting lamps, seat belt, reversing alarm system, generator, brake system and steering system. At the same time, ensure that all switches, quick couplers, operating levers, pedals, operating handles, buttons and others elements of the machines can be operated normally.

II. Maintenance items to be performed once every 50 hours or every week

1. Drain the strainer (oil-water separator) of the engine fuel system;

2. Check and add the brake-fluid of the machine. (Note: A brake-fluid of the same model as the original fluid must be used. Otherwise, the original fluid must be completely emptied through a port near the brake caliper and add a new brake-fluid);

3. Check the oil level of the final reducer at each end of the drive axle, and the oil level of the main reducer in the center of the axle housing; add oil as necessary (Note: Oil of the same model as the original oil must be used; Otherwise, the service life of the oil will be affected.).

4. Start the machine, and after finishing one to two operating cycles, lower the arm to the ground and then stop the engine, inspect the oil levels in the hydraulic oil tank and the transmission and replenish the tanks as necessary (Note: Oil of the same model as the original oil must be used; otherwise, the service life of the oil will be affected);

5. Check the gap between any brake pad and the matching brake disk and make replacements as necessary; Tighten the fixed bolts and nuts on all transmission shafts to ensure that no loose bolt or nut exists;

6. Carry out the following operations if these 50-hour maintenance items are performed on the machine for the first time, or skip it: replace the engine oil, engine oil filter and diesel oil filter elements;

III. Maintenance items to be performed once every 100 hours or every half a month

1. Remove foreign articles from all air-cooled radiator surface of the machine to ensure that the cooling system can operate normally;

2. Carry out the following operations if these 100-hour items are performed on the machine for the first time, or skip it: replace the transmission oil, the oil filters of the transmission and torque converter and the outer oil filter of transmission and torque converter; (the filter is optional, not for all machines) open the bottom cover of the transmission; clean the filter net and the magnet carefully and then put them back in place;

IV. Maintenance items to be performed once every 250 hours or every month

1. Check the air intake system of the engine. Visually check the service indicator of the air filter. Clean or replace the filter element of the air filter if the yellow piston of the indicator rises into the red region;

2. Replace the engine oil, the engine oil filter, the fuel oil filter and the oil-water separator filter element. (The filter is optional, not for all machines.)

3. Adjust the tension of the driving pulley of the engine and the air conditioning compressor belt and the generator belt, check the damaged condition and replace it if necessary. Tighten all bolts fixed the battery and clean its top;

4. Check the working device, weld seam of the front and rear parts of the frame and fixed bolts whether they have cracks or loosening.

5. Carry out the following operations if these 250-hour items are performed on the machine for the first time, or skip it: collect and filter the working hydraulic oil, replace the oil intake filter element, replace the return oil filter element for the working hydraulic oil, clean the inside of the hydraulic oil tank, return the filtered hydraulic oil to the hydraulic oil tank, and replenish the hydraulic oil tank as necessary to ensure an appropriate oil level in the tank; (Note: When replacing the hydraulic oil filter

element, the original hydraulic oil must be filtered or replaced)

V. Maintenance items to be performed once every 500 hours or every three months

1. Tighten the bolts for connecting the front/rear axle and the frames, and the plate bolts for articulating the front and rear parts of the frame. Check the structure, hood and cab of the machine whether they are damaged, repair them as necessary.

2. Check and eliminate the water and impurities in the diesel tank, clean the oil filter and respirator; check and adjust the engine air valve.

3. Check the brake pads and disks and replace them if any brake pad is less than 2/3 thick and any damaging brake disk;

4. Collect and filter the working hydraulic oil, replace the oil intake filter element of the hydraulic oil tank, clean the hydraulic oil tank, return the filtered hydraulic oil to the hydraulic oil tank, and replenish the hydraulic oil tank as necessary to ensure an appropriate oil level in the tank; (Note: When replacing the hydraulic oil filter element, the original hydraulic oil must be filtered or replaced.)

5. Replace the oil in the transmission, the oil filters of the transmission and torque converter and the outer oil filter of transmission and torque converter (the filter is optional, not for all machines); open the bottom cover of the transmission, clean the filter net and the magnet carefully, and then put them back in place;

6. Replace the oil for the final reducer at both ends of the drive axle, as well as the oil for the main reducer in the center of the axle housing; replace all the drive axle gear oil once each year even if the total number of work hours is less than 500;

VI. Maintenance items to be performed once every 1000 hours or every half a year

1. Replace the hydraulic oil, the return oil filter element of hydraulic oil, and the oil suction filter element of hydraulic oil, and clean the hydraulic oil tank;

2. Clean the diesel tank and replace the oil suction filter element of diesel tank and the inner filter element of the engine.

3. Check ROPS (it is optional, replace it based on the model);

4. Replace the dryer of the brake system; (it is optional, replace it based on the model)

5. Check the brake system, clean booster pump and replace brake oil.

VII. Maintenance items to be performed once every 2000 hours or every year

1. Replace the coolant of the engine.

2. Check and adjust injection pump on the test stand.

3. Check the differential of the front and rear axle and final reducer, repair them if necessary.

VIII. Maintenance items to be performed once every 4000 hours or every two years

1. Check water pump to ensure that works normally.

2. Check the performance of the engine, and replace the hose of fuel system of the engine.

3. Check the seal of the distribution valve and working cylinder, and repair or replace them if necessary.

4. Check the working condition of torque converter and transmission, repair them if necessary.

IX. Maintenance item to be performed once every 6000 hours or every three years.

1. Check the hydraulic hoses which bearing high oil press and sealing elements and replace them if necessary.

X. Maintenance item to be performed once 10000 hours or every five years.

1. Check the transmission and drive axles, dismantle and repair them if necessary.

Note:

1. The steering bearings of the front and rear parts of the frame need to be checked after working 5000 hours and replace it if exists any abnormal sound.

2. The seat belt needs to be replaced once three years after the date of manufacture or 6000 hours after the date of operating (whichever comes first);

Attachment 1 Machine No.:

Registration Table for Phase-by-phase Checking and Maintenance of the Loader

Work time	50h	100h	250h	500h	1000h	2000h	4000h	6000h	10000h	Check date	Checked by	Brief defect description
50h	●											
100h	●	●										
150h	●											
200h	●	●										
250h	●		●									
300h	●	●										
350h	●											
400h	●	●										
450h	●											
500h	●	●	●	●								
550h	●											
600h	●	●										
650h	●											
700h	●	●										
750h	●		●									
800h	●	●										
850h	●											
900h	●	●										
950h	●											
1000h	●	●	●	●	●							
1050h	●											
1100h	●	●										
1150h	●											
1200h	●	●										
1250h	●		●									
1300h	●	●										
1350h	●											
1400h	●	●										
1450h	●											
1500h	●	●	●	●								
1550h	●											
1600h	●	●										
1650h	●											
1700h	●	●										
1750h	●		●									
1800h	●	●										
1850h	●											
1900h	●	●										
1950h	●											
2000h	●	●	●	●	●	●						
2050h	●											
2100h	●	●										
2150h	●											
2200h	●	●										

Attachment 1 Machine No.:

Registration Table for Phase-by-phase Checking and Maintenance of the Loader

Work time	50h	100h	250h	500h	1000h	2000h	4000h	6000h	10000h	Check date	Checked by	Brief defect description
2250h	●		●									
2300h	●	●										
2350h	●											
2400h	●	●										
2450h	●											
2500h	●	●	●	●								
2550h	●											
2600h	●	●										
2650h	●											
2700h	●	●										
2750h	●		●									
2800h	●	●										
2850h	●											
2900h	●	●										
2950h	●											
3000h	●	●	●	●	●							
3050h	●											
3100h	●	●										
3150h	●											
3200h	●	●										
3250h	●		●									
3300h	●	●										
3350h	●											
3400h	●	●										
3450h	●											
3500h	●	●	●	●								
3550h	●											
3600h	●	●										
3650h	●											
3700h	●	●										
3750h	●		●									
3800h	●	●										
3850h	●											
3900h	●	●										
3950h	●											
4000h	●	●	●	●	●	●	●					
4050h	●											
4100h	●	●										
4150h	●											

Attachment 1 Machine No.:

Registration Table for Phase-by-phase Checking and Maintenance of the Loader

Work time	50h	100h	250h	500h	1000h	2000h	4000h	6000h	10000h	Check date	Checked by	Brief defect description
4200h	●	●										
4250h	●		●									
4300h	●	●										
4350h	●											
4400h	●	●										
4450h	●											
4500h	●	●	●	●								
4550h	●											
4600h	●	●										
4650h	●											
4700h	●	●										
4750h	●											
4800h	●	●										
4850h	●											
4900h	●	●										
4950h	●											
5000h	●	●	●	●	●							
5050h	●											
5100h	●	●										
5150h	●											
5200h	●	●										
5250h	●		●									
5300h	●	●										
5350h	●											
5400h	●	●										
5450h	●											
5500h	●	●	●	●								
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5650h	●											
5700h	●	●										
5750h	●		●									
5800h	●	●										
5850h	●											
5900h	●	●										
5950h	●											
6000h	●	●	●	●	●	●		●				
6050h	●											
6100h	●	●										

Attachment 1 Machine No.:

Registration Table for Phase-by-phase Checking and Maintenance of the Loader

Work time	50h	100h	250h	500h	1000h	2000h	4000h	6000h	10000h	Check date	Checked by	Brief defect description
6150h	●											
6200h	●	●										
6250h	●		●									
6300h	●	●										
6350h	●											
6400h	●	●										
6450h	●											
6500h	●	●	●	●								
6550h	●											
6600h	●	●										
6650h	●											
6700h	●	●										
6750h	●		●									
6800h	●	●										
6850h	●											
6900h	●	●										
6950h	●											
7000h	●	●	●	●	●							
7050h	●											
7100h	●	●										
7150h	●											
7200h	●	●										
7250h	●		●									
7300h	●	●										
7350h	●											
7400h	●	●										
7450h	●											
7500h	●	●	●	●								
7550h	●											
7600h	●	●										
7650h	●											
7700h	●	●										
7750h	●		●									
7800h	●	●										
7850h	●											
7900h	●	●										
7950h	●											
8000h	●	●	●	●	●	●						
8050h	●											

Attachment 1 Machine No.:

Registration Table for Phase-by-phase Checking and Maintenance of the Loader

Work time	50h	100h	250h	500h	1000h	2000h	4000h	6000h	10000h	Check date	Checked by	Brief defect description
8100h	●	●										
8150h	●											
8200h	●	●										
8250h	●		●									
8300h	●	●										
8350h	●											
8400h	●	●										
8450h	●											
8500h	●	●	●	●								
8550h	●											
8600h	●	●										
8650h	●											
8700h	●	●										
8750h	●		●									
8800h	●	●										
8850h	●											
8900h	●	●										
8950h	●											
9000h	●	●	●	●	●							
9050h	●											
9100h	●	●										
9150h	●											
9200h	●	●										
9250h	●		●									
9300h	●	●										
9350h	●											
9400h	●	●										
9450h	●											
9500h	●	●	●	●								
9550h	●											
9600h	●	●										
9650h	●											
9700h	●	●										
9750h	●		●									
9800h	●	●										
9850h	●											
9900h	●	●										
9950h	●											
10000h	●	●	●	●	●	●			●			

The Chinese and Foreign Oil Type List for Wheel Loader

NO.	Oil Name		Chinese standard serial number and type	International standard serial number and type
1	Oil for Engine	Engine Oil	Ordinary CD 15W/40	Ordinary CF-4 15W/40
			LOW temperature CD 5W/40 or CD OW/40	LOW temperature CF-4 5W/30
		Diesel Oil	Ordinary 0#	Ordinary 0#
			LOW temperature -35# or -50#	LOW temperature -35# or -50#
2	Oil for DF Cummins Engine	Engine Oil	Ordinary CH-4/SJ 15W/40	Ordinary VCH-4/SJ 15W/40
			LOW temperature CH-4/SJ 5W/40 or CH-4/SJ OW/40	LOW temperature CH-4/SJ 5W/40 or CH-4/SJ OW/40
		Diesel Oil	Ordinary 0#	Ordinary 0#
			LOW temperature -35# or -50#	LOW temperature -35# or -50#
3	Hydrodynamic Transmission Oils		Ordinary(LOW temperature) 8D N46D Ordinary)8# N46、	PTF-2 1.GM company'sTrack-coach PTF-2 2.Allison company's C-3,C-4,C-5 3.Catepiller company's TO-3,TO-4 4.Mobil company's ATF220 5.BP company's Hydraulic TFCZ 6.Shell company's Rotella 10W
			JARNC-4 which was developed by Xi'an Petroleum University Jiarun Industry and PTF-2 have the same quality 6#(n32)= PTF-2 8#(n46)= PTF-1 N68#(Anti-wear hydrodynamic transmission oils)= PTF-3	PTF-3 1.John-Deer company's J-20B,J-14B,JDT-303 2.Ford company's M2C41A,MIC86A,MIC134A 3.Massay-Ferguson company's M-1135,M-1127A
4	Gear Oil		Ordinary LS-90	OrdinaryAPI GL-5 SAE90 (Recommend Mobil GX90)
			Low temperature LS-80W-90	Low temperature API GL-5 SAE80W-90 (Recommend Mobil GX80W-90)
5	Hydraulic Oil		Ordinary L-HM46#	Ordinary Mobil DTE 15M
			Low temperature L-HV46# or L-HS46#	Low temperature Mobil DTE FM46
6	Lubricating Grease		Ordinary 2# Lithium saponify	Ordinary 2# Lithium saponify
			Centralized lubricating 1# Extreme pressure lithium saponify	Centralized lubricating Mobil EP1
7	Brake Fluid		XILIAN 719#	Mobil DOT3
8	Air Conditioning Refrigerants		R134a	R134a

Chapter V Instructions for Loader Fixing in Hoisting and Transportation

I. Hoisting of loader

To hoist the loader, use the hoisting hook to hook up the reserved lugs on its body. Always adjust the length of the lifting ropes before hoisting to basically keep the loader level. When hoisting, please keep the hooks well secured. (See Fig.5-1)

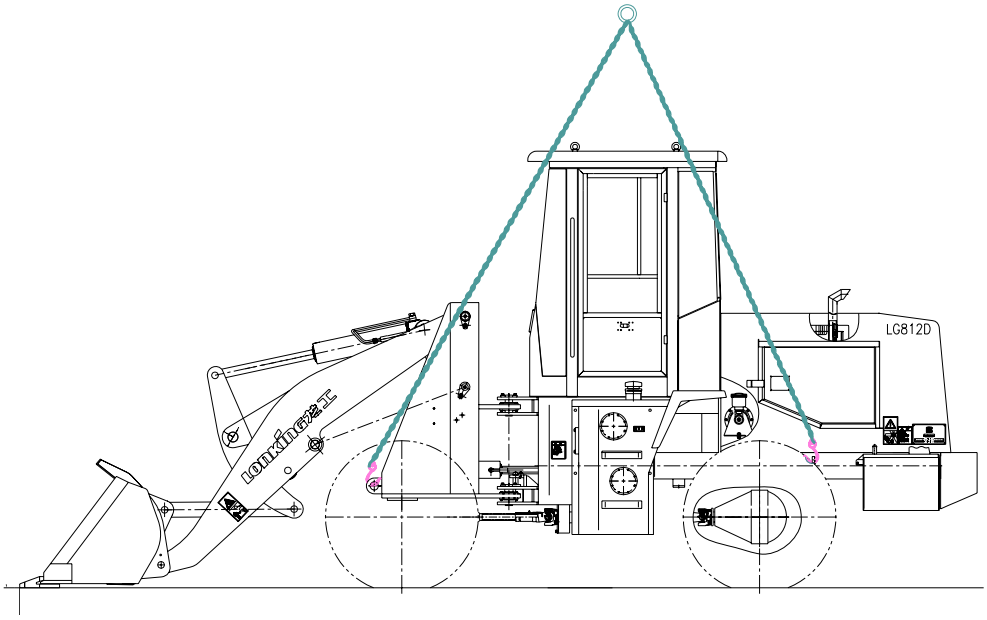

Fig. 5-1

II. Fixing of loader in transportation

When a flat car or similar transportation facility is applied for loader transportation, it is required to fix the chassis of the loader with iron chain so as to prevent it from shaking and bouncing; it is necessary to fasten the fixing rods of the front and rear frames, fix the front and rear wheels with angle steel, and then tie up with steel wire to prevent the machine from moving back and forth on the flat car.

The transportation of the complete machine shall comply with the related regulations of relevant traffic and transportation authority; unless in special cases, do not remove the loader components during the transportation.(See Fig. 5-2)

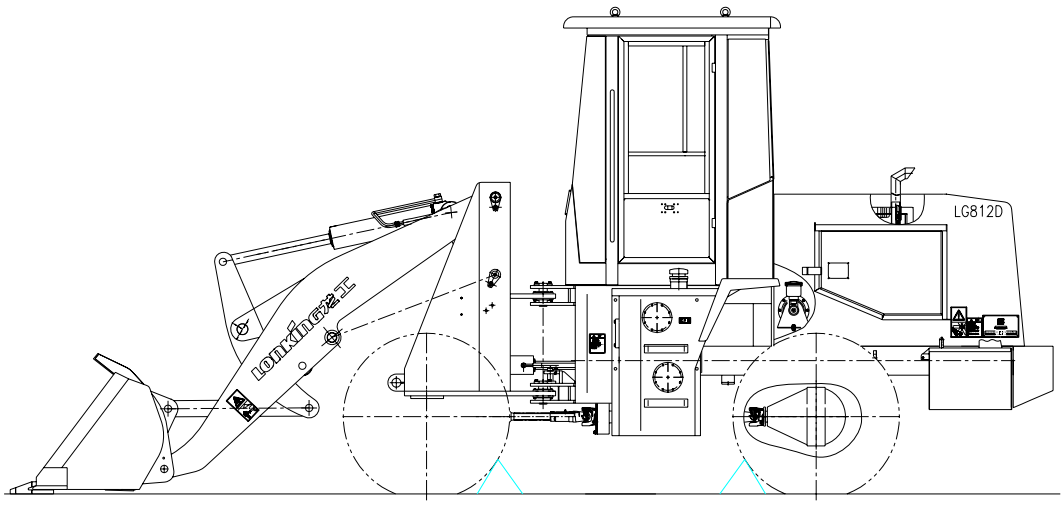

Fig. 5-2

III. Shipping of loader

When the loader is required to be packed for ocean shipping, remove the parts such as bucket, two fuel tanks and tyres (wheel rim).Fix the removed parts with shipping brackets, tie the body, boom and pull rod to the brackets, and place and fix other removed parts according to the loading of the container.

Chapter VI Common Faults and Solutions

Faults Features	Causes	Solutions
Started diesel engine does not work	1. No gear is engaged 2. Transmission oil level is too low 3. The brake lever of gearshift control lever valve can mot return to the original position 4. Transmission oil pump is damaged or oil seal leakage occurs 5. Oil suction of oil pump is unsmooth	1. Engage a gear again and readjust the gearshift control lever 2. Add oil to the specified level 3. Find out the cause of failure to remove it 4. Replace oil pump or oil seal 5. Check oil suction pipe for failure
Insufficient driving power	1. Low oil pressure at torque converter outlet, and pressure adjustment failure 2. Low engine speed 3. Clutch slipping 4. Too high oil temperature of torque converter	Check the transmission oil level, and clean oil filters at oil pan and oil outlet Check the diesel engine speed according to the item “Check of oil pressure and temperature for torque converter”. Check clutch oil pressure and piston oil seal Stop to cool the loader when the oil temperature of torque converter is above 120℃
Too low shift pressure	1. Malfunction of relief valve set 2. Oil filter block 3. Oil pump malfunction 4. Severe oil leaking at clutch oil seal	1. Find out the causes to overhaul 2. Clean the oil filter 3. Replace the oil pump 4. Replace the oil seal
Higher transmission oil level	1. Oil leakage at steering pump shaft end 2. Oil leakage at working pump shaft end in the working hydraulic system	1. Replace the oil seal of steering pump shaft end 2. Replace the oil seal of working pump shaft end
Too high oil temperature of torque converter	1. Too high or too low transmission oil level 2. Clutch slipping 3. Filter block 4. Unsmooth oil suction of transmission pump 5. Damaged transmission pump and insufficient oil supply 6. Blockage at oil cooler	1. Add oil to the specified level 2. Check the oil pressure of clutch 3. Clean the transmission oil strainer and oil filter 4. Check whether the oil suction hose of transmission pump is sucked flat or blocked 5. Check the transmission pump for abnormal inner leaking quantity and

Faults Features	Causes	Solutions
	7. Oil deterioration	remove the fault 6. Check and clean the transmission oil radiator 7. Check if the oil for dual-clutch transmission (oil quantity and quality) meets the requirement 8. Check if the oil return pressure of the torque converter is too high, whether the oil temperature raises rapidly due to too large fluid resistance in the oil return system leads to rapid rising of oil temperature 9. Check the oil thermometer, oil temperature sensor for accuracy
Insufficient steering torque	Insufficient flow due to wear of steering pump Changed pressure of safety valve Serious inner leakage in steering pump	Check or replace the steering pump Adjust the pressure Overhaul or replace
Insufficient foot braking force	1. Oil leakage in brake master pump or slave cylinder 2. Air in the brake hydraulic pipeline 3. Low pressure of compressed air 4. Damaged booster leather cup 5. Oil leakage from wheel rim to brake pad 6. Extremely worn brake pad	1、Replace the leather cup or rectangular seal ring 2、Bleed the air 3、Check the control valve, air reservoir and pipeline of air compressor for sealing performance 4、Replace the leather cup 5、Check or replace the hub oil seal 6、Replace the brake pad
Gear engagement failure after foot brake	1. The limit screw of air brake valve pedal is adjusted improperly, air brake valve fails to return to the original position fully, and transmission pressure gauge does not work 2. The air brake valve position gets stuck, without air return after brake release 3. Inner leakage in pipeline or oil cylinder 4. No compressed air gets into the gearshift control valve	1. Readjust the limit screw of the pedal so that the air brake valve can return to the original position fully 2. Clean and overhaul the piston 3. Remove the brake valve rod for overhaul 4. Check the emergency brake valve

Faults Features	Causes	Solutions
Insufficient boom lifting force or bucket force	1. Worn or damaged oil seal of oil cylinder 2. The distribution valve is excessively worn, and fitting clearance between the valve rod and valve body exceeds the specified valve 3. Oil leakage in pipeline system 4. Severe inner leaking of working pump 5. Improper adjustment of safety valve and too low system pressure 6. Blocked oil suction pipe and oil filter	1. Replace the oil seal 2. Remove, overhaul and repair to get the clearance to the specified value and replace the distribution valve 3. Find out the oil leakage and remove the fault 4. Replace the working pump 5. Adjust the system pressure to the specified value 6. Clean the oil filter and renew the oil
Pressure in air reservoir decreases rapidly after parking	1. The air brake intake valve gets stuck by dirts or damaged 2. Loosened pipe joint or broken pipeline 3. Poor sealing for air inlet one-way valve of air reservoir poor sealing for pressure controller	1、Blow off the dirt by several successive brakings and replace the valve 2、Tighten the joint and replace the brake hose 3、Check for the causes of poor sealing and replace if necessary
Pressure on the brake air pressure gauge increases slowly	1. Loosened pipe joint 2. The air compressor works abnormally 3. Drain plug of oil-water separator is not fastened 4. Poor sealing for intake valve or drum membrane of brake valve 5. Blocked air-bleed hole of pressure controller or air leaking at check valve or drum membrane	1、Tighten the joint 2、Check working conditions of air compressor 3、Fasten again 4、Check and clean inside of brake valve to find out the cause of poor sealing 5、Clean the air-bleed hole, find out the causes for poor sealing of check valve and drum membrane and remove the fault
Air leakage for brake system	1. Pollution to the air source: oil, water, dust and impurities 2. Unacceptable brake fluid has been used 3. Air leakage caused by worn leather ring	1. Clean the pipeline 2. Use acceptable brake fluid 3. Clean the cylinder block and replace the piston leather ring
Brake failure	1. No or little fluid in the oil cup 2. Oil inlet valve and hydraulic	1. Add oil to the oil cup 2. Replace the oil inlet valve and

Faults Features	Causes	Solutions
	leather ring are easy to be worn 3. The piston gets stuck	hydraulic leather ring 3. Replace the whole piston
Brake fatigue	1. Air in the hydraulic pipeline does not be exhausted completely 2. Wearing parts are worn	1. Exhaust the air in the hydraulic pipeline completely 2. Replace the wearing parts
Oil leakage for brake system	1. Oil leakage at connections between end cover and hydraulic cylinder block 2. Oil leakage at central seal ring 3. Oil leakage at connection between oil cup and end cover	Replace the wearing parts

Attached Table：Reference Table for Densities of Common Materials

S/N	Material name	Specific Categories	Reference Density (Kg/m^3)	Remarks
1	Ordinary soil	Stick thin dry soil	1250	
		Caking dry soil	1520	
		Powder dry soil	1550	
		Wet soil	1725	
		Mud-like soil	1730	
		Tight soil	1840	
2	Clay	Wet clay	1750	
		Dry clay	1485	
3	Sand	Loose dry sand	1440	
		Wet sand	1680	
		Water-wet sand	1850	
4	Sandstone	Broken sand stone	1500	
		Solid sandstone	2300	
5	Gravel	Dry gravel	1485~1650	
		Wet gravel	2015	
		Pi gravel	1900	
		Dry clay mixed	1185	
		Wet clay mixed	1650	
		Dry sand mixed	1730	
		Wet sand mixed	2000	
6	Bauxite		1425	
7	Gravel		1600	
8	Slag	Dry	650	
9	Coal	Bituminous coal	1190	
		Smoke peat	950	
		Dry peat	415	
		Wet peat	1125	
10	Weathered rock-soil	75% of the geotechnical	1955	
		50% of the geotechnical	1725	
		25% of the geotechnical	1585	
11	Gypsum	Crushing block	1600	
		Broken block	1810	
		Solid block	2780	
12	Limestone	Fragmentation	1550	
		Solid block	2600	
13	Furnace slag		1760~2100	
14	Granite	Chunky	1650	
		Overall	2800	
15	Hematite		2460	
16	Magnetite		2780	