

Preface

This User Manual is a guide for the correct use and maintenance of the machine. It should always be kept in the cab. If it is damaged or lost, please ask your dealer for a new manual immediately.



Warn!

Do not operate this machine or perform any maintenance before carefully reading and thoroughly understanding the contents of this instruction manual. Correct maintenance and use methods are essential for the safety, reliability and operability of the machine. The maintenance and operating procedures described in this manual are the most effective methods for operating and performing maintenance work. Following these instructions will help ensure the effectiveness, economy and reliability of the equipment. Carefully read the relevant contents of the "Notes" and "Warnings" in the manual to minimize the risk of personal injury and the risk of machine damage or unsafe factors caused by improper maintenance.

This instruction manual has been adapted to suit all markets. However, optional and special equipment for

different markets are not taken into account, as these equipment may not be suitable for your machine. We reserve the right to change and improve the product's technical parameters, specifications, design, operation and maintenance instructions, and also reserve the right to improve or supplement such products without installing these supplements on previously manufactured products without prior notice.

Safety Rules

Always operate and use this machine in accordance with the relevant regulations of the state, province, autonomous region and government authorities. Therefore, the operating safety information contained in this instruction manual is only some helpful suggestions. The following symbols, together with the text, appear in the instruction manual and their meanings are:



Warn!

Warning, stay alert! It is related to your own safety! Ignoring this hazard may result in accidents, serious injuries or death. The operator is responsible for ensuring that all warning signs are intact on the machine and ensure their

readability. Otherwise, accidents are likely to occur. Familiarize yourself with the functions and limitations of this machine



Warn!

Before operating the machine, the excavator operator must have sufficient operating skills and read the instruction manual carefully.

Untrained operators may cause serious injury or death.

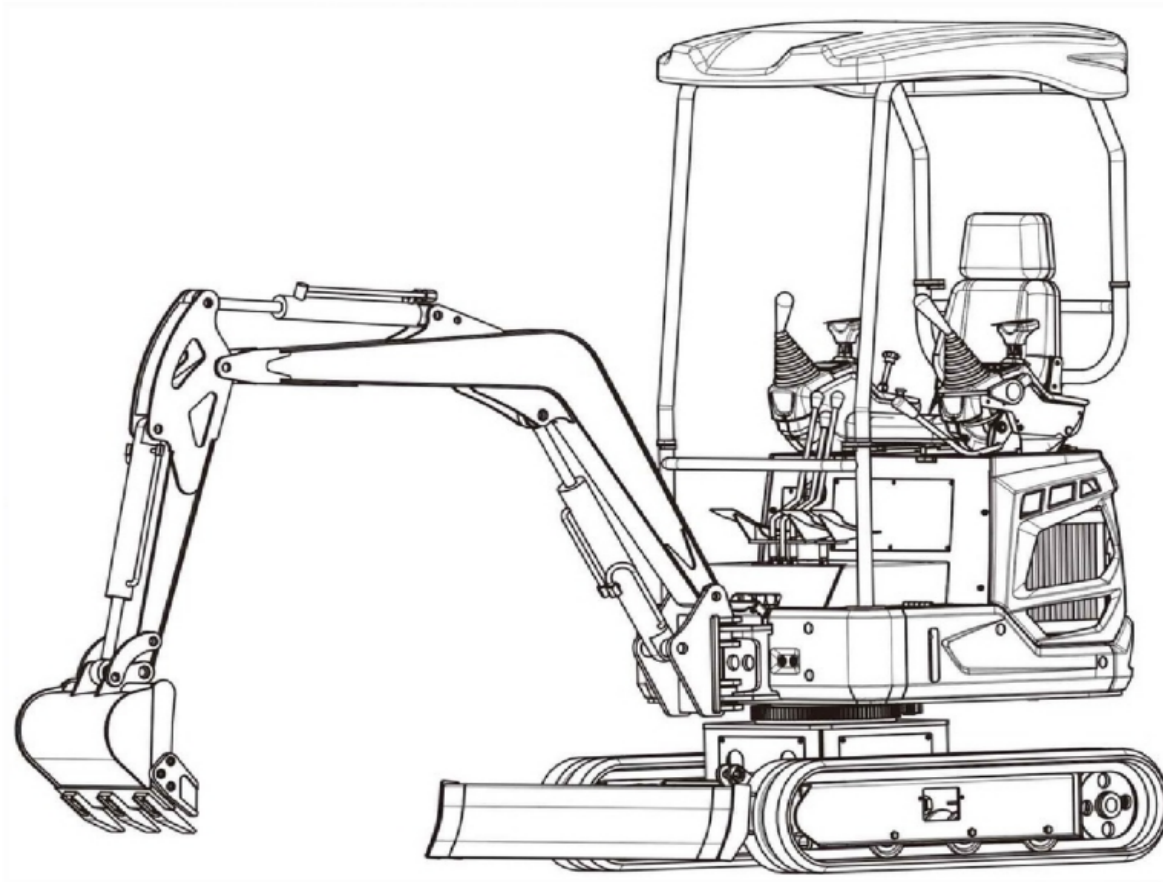
Never use the machine without the "Instruction Manual". Before operating this machine, you should be familiar with the various warning signs and symbols on the vehicle and the instruction manual of the vehicle.

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1.Introduction



(1)Overview

Specified Uses

The various uses of this machine described in this instruction manual are settings under normal conditions. If used for other purposes or in potentially hazardous environments, such as areas with flammable and explosive materials or dust containing asbestos, special regulations must be observed and the machine must be equipped with devices for the corresponding use. For details, please contact the manufacturer or dealer.

Engine

Project	Unit	Specification	
Engine model		D722-E4B-SXN-1	D902-E4B-CBH-1
Engine code		1J323-24000	1J325- 27000
Type		Vertical, water-cooled, 4-cycle IDI diesel engine	Vertical, water-cooled, 4-cycle IDI diesel engine
Number of cylinders		3	3
Cylinder inner diameter	mm	67.0	72
Journey	mm	68.0	73.6
Combustion type		Spherical (E-TVCS)	Spherical (E-TVCS)
Total displacement	L	0.719	0.898

Power speed (SAE J1995, Maximum Torque)	kW/rpm	10.2 / 2500 (13.9 / 2500)	11.8 / 2300 (16.1 / 2300)
	(PS/rpm)	42.9 / 2000	51.3 / 1800
Maximum idle speed	N-m / rpm	Less than 28,000 (total)	Less than 2670 (total)
Minimum idle speed	rpm	1200~1300	1275~1375
Emission order	rpm	1-2-3	1-2-3
turn around		Counterclockwise (from the flywheel side)	Counterclockwise (from the flywheel side)
Jet Pump		Bosch MD mini pump	Bosch MD mini pump
Fuel injection pressure	Mpa (kgf/cm ²)	13.7 (140)	13.7 (140)
Fuel injection timing	deg.	18.0 Before T.D.C (High pressure over-flow method)	Before 16.0 TDC
Compression ratio		23.5	24.0
Speed regulator type		Full speed mechanical governor	Full speed mechanical governor
Fuel		Diesel No.2-D	Diesel No.2-D
Start the system		Battery starter (with glow plugs)	Battery starter (with glow plugs)
Start output	V-kW	12 - 1.4	12 - 1.4
Alternator output	V - A	12 - 40	12 -40
cooling system		Pressurized radiator, forced circulation with water pump	Pressurized radiator, forced circulation with water pump
Lubrication system		Forced lubrication with a cycloidal pump	Forced lubrication with a cycloidal pump
lubricating oil		It is recommended to use CF grade lubricants	It is recommended to use CF grade lubricants according to API classification

		according to API classification	
Lubricating oil capacity	L	3.8	3.7
Dimensions (L x W x H)	mm	See dimensional drawing	See dimensional drawing
Side PTO		-	
Emissions regulations		EPA/CARB TiAl4/Eu StiPeV/中国 GB3	EPA/CARB TiAl4/Eu StiPeV/中国 GB3
Intake resistance	kPa(mmAq)	≤ 2.45 (250)	≤ 2.45(250)
Exhaust back pressure	kPa(mmHg)	≤ 9.33 (70)	≤ 9.33 (70)
Engine heat dissipation required	kcal/h	9,180	10700
Air intake (25°C, atmospheric pressure 750mmHg)	m3/min	0.78	0.90
Exhaust volume (25°C, atmospheric pressure 750mmHg)	m3/min	1.93	2.16
Net weight	kg	Approx. 65	72

Electrical System

The electrical system includes the engine starting system, charging system, whole machine monitoring system, engine-pump control system and air conditioning system. The engine speed is controlled by a continuous button

that gradually increases in stages and an automatic idle system. The automatic idle and speed-up system automatically reduces the engine speed for 5 seconds or more after the machine stops operating, and automatically increases the engine speed to the set speed within 0.1 second after detecting the operation signal.

Hydraulic pump

The hydraulic pump assembly consists of two quantitative gear pumps connected by splines and driven by the engine at the same time. The pump consists of a blade group and a housing. The flow output of the main pump is driven according to the output power of the engine.

Main control valve

The control valve consists of an 8-slide valve group, including 4 slide valves for excavation devices, 2 slide valves for continuous travel, a slide valve for rotary use, a slide valve for optional devices, a main overflow valve, several outlet overflow valves, and a check valve.

Travel motor

The travel motor is a cycloidal motor or a plunger motor with a pressure compensation function. The motor has a

large output torque and can withstand a high radial load.

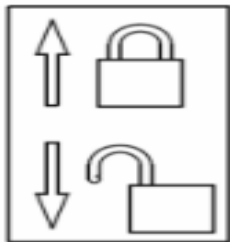
Steering motor

Cycloid hydraulic motor, with pressure compensation function, has large output torque and can withstand high radial load. Double bearing support structure, can withstand large radial force. Flange and housing are integrated, can withstand frequent reversing impact. Adopting inlaid gear stator and rotor pair, it runs smoothly, has long working life and high working pressure. Low starting pressure, easy reversing, can be used in series or parallel in hydraulic system.

(2) Information and warning signs

Below are warnings and messages and text instructions that can be found on the machine.

Safety lock



Warning! It is rotating, please do not approach

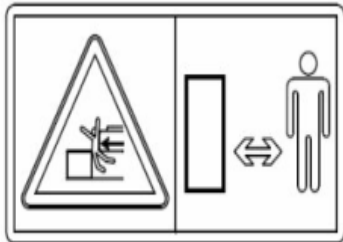


WARNING! Coolant is hot and under pressure, avoid burns.

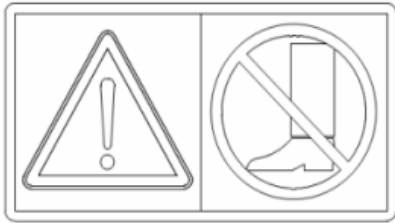


Keep away from the sign.

Do not approach within the rotation radius.



Warning! Do not step on it to prevent slipping.



Walking direction



Keep away from the sign Excavator working area, do not approach.



Precautions



Notice

- Before operating the vehicle, you must read the "Operation Manual" in detail.
- Before starting the vehicle, you should check it. Do not start the vehicle if there are unsafe factors.
- Workers must clearly know the safe distance from the high-voltage wire.
- Before leaving the driver's seat, you must comply with the following items:
 - Lower the working device to the ground;
 - Lock the joystick with the safety lock and stop the engine;
 - When using the boom or dipper to lift the vehicle body, personnel must not enter under the vehicle body;
 - When parking on a slope, a block must be placed under the track; when adjusting the track tension, the valve relaxation must not exceed one turn. If it exceeds, the high-pressure grease inside may spray out.
- When stopping the engine, let the engine idle for 5 minutes at the minimum throttle, and then stop.
- When removing a part of the hydraulic cylinder or the circulation system and reassembling it, the air must be discharged according to the following procedures:
 1. Let the engine idle at low speed.
 2. Initially extend and retract the cylinder piston 4-5 times, and stop the piston 100 mm away from the end of the stroke.
 3. Then move the piston of each cylinder to the end of the stroke 3-4 times.
- For track adjustment, please refer to the User Manual.
- After a long period of parking, the following procedures must be followed when starting the engine:
 1. Turn the engine starter switch to the "ON" position.
 2. Start the engine.
- Select the engine lubricant according to the ambient temperature. Please refer to the User Manual.

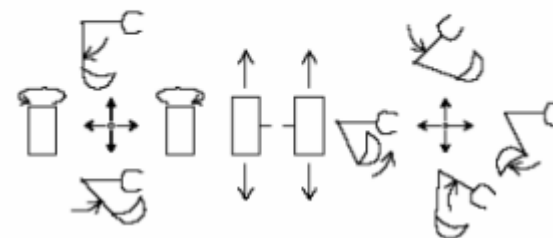
Operational matters



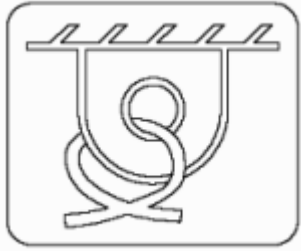
Notice

To prevent personal injury or death due to misoperation, please confirm the machine's operating status and the displayed operating mode when operating the machine. When confirming the machine's operating status, pay attention to the surrounding parts and operate slowly.

ISO



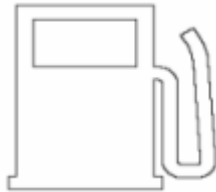
Lifting and fixing position



Warning! Flammable and explosive, please stay away from fire



Notice



Fuel
Diesel

When refueling, the engine must be stopped and all lights and open flames must be kept at a safe distance.

(3) Repair and maintenance

Summary

If you want to minimize the cost of using the machine, you must perform good maintenance and repair. The maintenance and repair intervals apply to machines working in normal environments and working conditions. The maintenance work described in the "Operation Manual" can be performed by the operator. Further adjustments and repairs should be performed by authorized special maintenance centers or manufacturers.

Delivery inspection

Before the machine leaves the factory, the corresponding tests and adjustments have been completed. According to the instructions in this manual, the dealer should also do a further "delivery inspection" before delivering it to the user.

Warranty inspection

It is important to perform regular inspections on the machine at the beginning of operation. The inspection content includes: checking the tightness of each bolt, comparing each set value with the actual value and making minor

adjustments. Therefore, follow-up inspections are divided into three stages: the first one is carried out after 500 hours, the second one is carried out after 1000 hours, and the third one is carried out after 2000 hours. Our company has the right to change the inspection time without prior notice.

General use of off-road engines

The maintenance guide is based on the premise that the machine is used as specified in the "Operation Manual" and only the specified fuel and lubricants are used.

Off-road engine maintenance

Off-road engines are of conventional design. Any local dealer can complete the off-road engine emission control maintenance tasks specified in this manual.

It is especially recommended that users follow the off-road engine maintenance instructions in the "Basic Preventive Maintenance" section. Such maintenance includes the maintenance of engine emission control devices. In order to have written evidence of the status of the regular maintenance and repair that has been

carried out, our company recommends that users keep all maintenance records and receipts. These records and receipts should be given to all users who purchase off-road engines.

Services that local dealers should provide

Local dealers are equipped with original parts, special tools, the latest technical information and well-trained maintenance technicians provided by the manufacturer, so they are able to provide you with high-quality and reliable services. Please inform your local dealer of your maintenance service requirements. He will develop a special maintenance plan based on your needs. For regular maintenance work, you'd better contact your local dealer first to agree on a time to dispatch the necessary equipment and maintenance technicians to repair your machine in order to ensure and improve the utilization rate of your machine.

Preventive Maintenance and Maintenance Plan

In order to maintain engine reliability, noise radiation and exhaust emissions control, it is very important to regularly maintain, inspect, adjust and repair the engine.

Fuel System

Fuel recommendations:

The fuel used must be clean, safely distilled, stable and non-corrosive. The distillation range, cetane number and sulfur content are the most important factors in selecting fuel to achieve optimal combustion efficiency and minimize wear. As for cold characteristics and cetane number, the engine operating conditions and ambient temperature affect the choice of fuel. In cold climates, such as temperatures below 0°C, it is best to use lighter distillation or higher cetane number. (Final boiling temperature 349°C and minimum cetane number 45).

In order to avoid the formation of too much precipitation and minimize the emission of sulfur dioxide in the exhaust gas, the lowest sulfur fuel should be selected. It is recommended that the diesel used in the engine should meet the requirements of the American Society for Testing and Materials ASTM: D975No1D(C-B) or No.2D (T-T) and cetane number not less than 42, sulfur content not more than 0.5% by weight.

Check for fuel leaks

When the engine is running at a high idle speed, visually check the fuel joints and hoses.

Inspect the fuel hose

- Aging
- Cracking
- Blistering
- Wear

Check the fuel tank

- Drain condensate
- Check for cracks and damage
- Check installation
- Check for leaks

(4) Instruments and control systems

Overview



Warn!

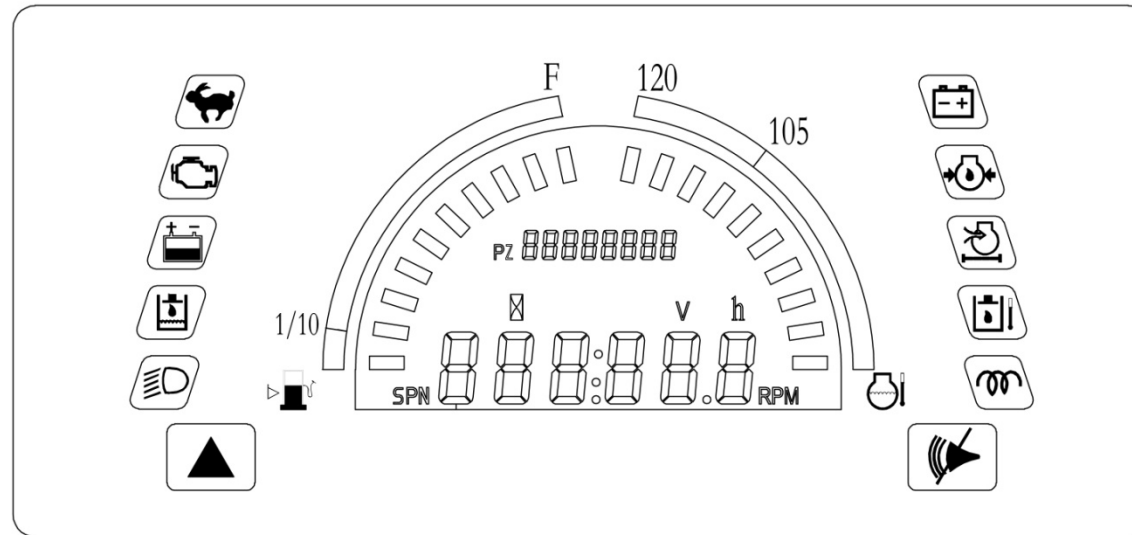
Before you know the position, function and usage of the instrument and control controller, do not operate the machine. Read and familiarize yourself with this part carefully. Check the information displayed on the instrument at any time and take appropriate measures to avoid damage to the machine.

The electronic monitor of 18 excavator uses LDW-3.4 series electronic monitor. The parameter display of this electronic monitor has been upgraded from the previous light-emitting row to LCD display, and the switch alarm is also integrated into the electronic monitor, which greatly saves the space of the left and right armrest boxes. The monitor uses a whole LCD display mode with a viewing angle of 180 degrees. The drive mode adopts dynamic drive, thereby reducing the drive components and reserving sufficient space for multi-function realization. The LDW-3.4 series electronic monitor has a real-time engine speed feedback display function (optional), as well as

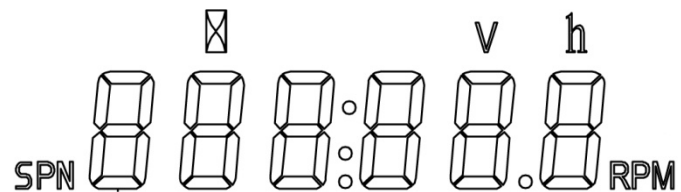
the engine's cooling water temperature, oil pressure, and other parameter displays, so that the driver can understand the working condition of the engine in a timely and accurate manner. The monitor also displays the fuel level (optional) and hydraulic oil temperature, which realizes the detection of the vehicle's heavy pressure parameter indicators, providing an important basis for the vehicle to work in the best state.

Detailed explanation of instrument functions

Main interface



Graphical analysis



The digital display here is a partial parameter switching display such as: current time, working timer, engine speed, and the matching National III engine will also display the engine fault code (SPN code).

The "SPN" display area is the SPN code currently received by the system

The "V" display area is the current voltage value of the system

The "h" display area is the current working time

The "RPM" display area is the current speed value

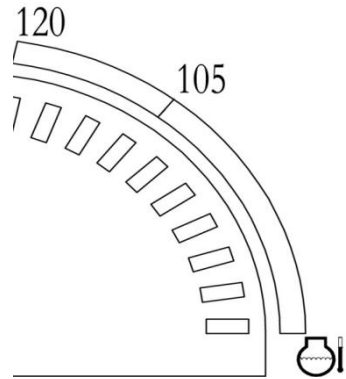
1. Working time (speed) display

1-1 The cumulative working time of the whole machine, the timing unit is 0.1 hours (6 minutes count once, less than 6 minutes, not included in the cumulative time).

1-2 Speed display part When the engine speed is >500 rpm, it is displayed at the timing position, and the speed and timing are displayed alternately (interval 5S)

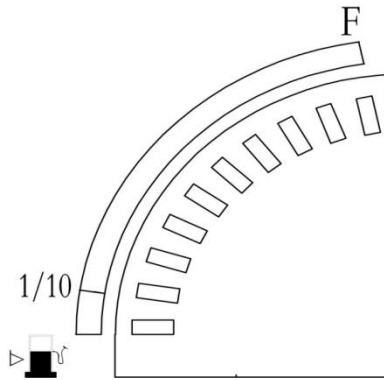
1-3 If the matching National III electronic fuel injection engine ECU is faulty, the engine SPN code will be displayed here to remind the driver to analyze and handle the fault.

2. Cooling water temperature display



Displays the current engine operating temperature. The light grid display allows you to more intuitively understand the cooling water temperature. If the water temperature gauge shows that the water temperature is between 40°C-102, it means that the water temperature is normal during operation. If the water temperature gauge shows that the water temperature exceeds 102, it means that the water temperature is too high. The engine water temperature alarm icon displays and the monitor sounds an alarm. At this time, you should stop the car immediately or reduce the engine speed to idle speed and check the cooling water condition. The water temperature parameters are read through CAN communication!

2. Fuel level display



The left light grid is the fuel level display area

Indicates the amount of fuel in the fuel tank. If the fuel level is normal during operation, the light grid will display two or more grids (including two grids); if only one grid is displayed during operation, the fuel level alarm indicator flashes, and the monitor sounds an alarm, it means that there is not much fuel left in the tank, and it should be checked and refueled in time.

Appendix 1 Fuel Level Sensor Parameter Table (General)

Technical parameters (after the float drops to the bottom, it rises for testing)		
Oil level position (H)	Gear	Resistance value (Ω)
52	Full	3
82	16/17	9.8
112	15/17	16.6
142	14/17	23.4
172	13/17	30.2
202	12/17	37
232	11/17	43.8
262	10/17	50.6
292	9/17	57.4
322	8/17	64.2
352	7/17	71
382	6/17	77.8
412	5/17	84.6
442	4/17	91.4
472	3/17	98.2
502	2/17	105
532	1/17	110.8
>532	0位	118.3

4. Hydraulic oil temperature display

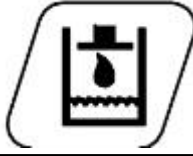
Displays the current hydraulic oil working temperature. The hydraulic oil temperature parameter is collected by the single chip microcomputer as analog quantity collection, and the display part is the switch quantity indicator display. If the water temperature exceeds 85°C during operation, the hydraulic oil temperature alarm indicator

flashes and the monitor sounds an alarm. At this time, you should stop the car immediately or reduce the engine speed to idle speed and check the condition of the hydraulic oil.

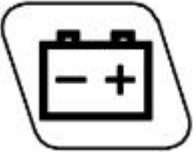
Appendix 2 Oil temperature sensor parameter table (general)

Temperature (°C)	50	60	80	100	110	120	140
	226	153	76	40.4	30.3	23	16

5. Common switch quantity display instructions

	Instrument alarm mute button
	Engine fault warning indicator light
	Battery undervoltage alarm
	Engine oil-water separation fault warning indicator
	Headlight indicator

	Air filter warning indicator
	Hydraulic oil temperature warning indicator
	Indicates the working status of the engine oil pressure. When the engine oil pressure is working normally, this symbol is not displayed. When the engine oil pressure is abnormal, it indicates that the oil pressure is too low, the oil pressure alarm icon is displayed, and the monitor emits an audible and visual alarm. At this time, you should stop the car immediately and check the engine oil condition
	High and low speed display

	Preheating Instructions
	Indicates the working status of the generator. When the generator is working normally, the symbol is always on. When the generator is working abnormally and not charging, the symbol is not displayed. At this time, the working status of the generator should be checked.

1.Diagnosis and troubleshooting of common faults:

2.Use a quick and easy judgment method to check whether the monitor is normal:

3.1. When the start switch is turned to the "on" position, the instrument should have a 5-second self-test. If not, it means that the monitor itself may be faulty.

4.2. When the engine is running, the charging indicator light is always on, indicating that the generator is working normally; when the generator is working, the charging indicator light is off or flashing, then the generator is not working, the generator is broken or the wiring harness has poor contact.

5.3. Use the short-circuit method to quickly determine whether the "oil temperature and fuel level" of the instrument are working properly:

6.No indication of fuel level:

7.Disconnect the fuel level sensor connector, ground the connector at the wiring harness end instantly, and observe whether the monitor fuel analog display is fully lit. If it is fully lit, it proves that the monitor is normal and the fuel sensor is faulty.

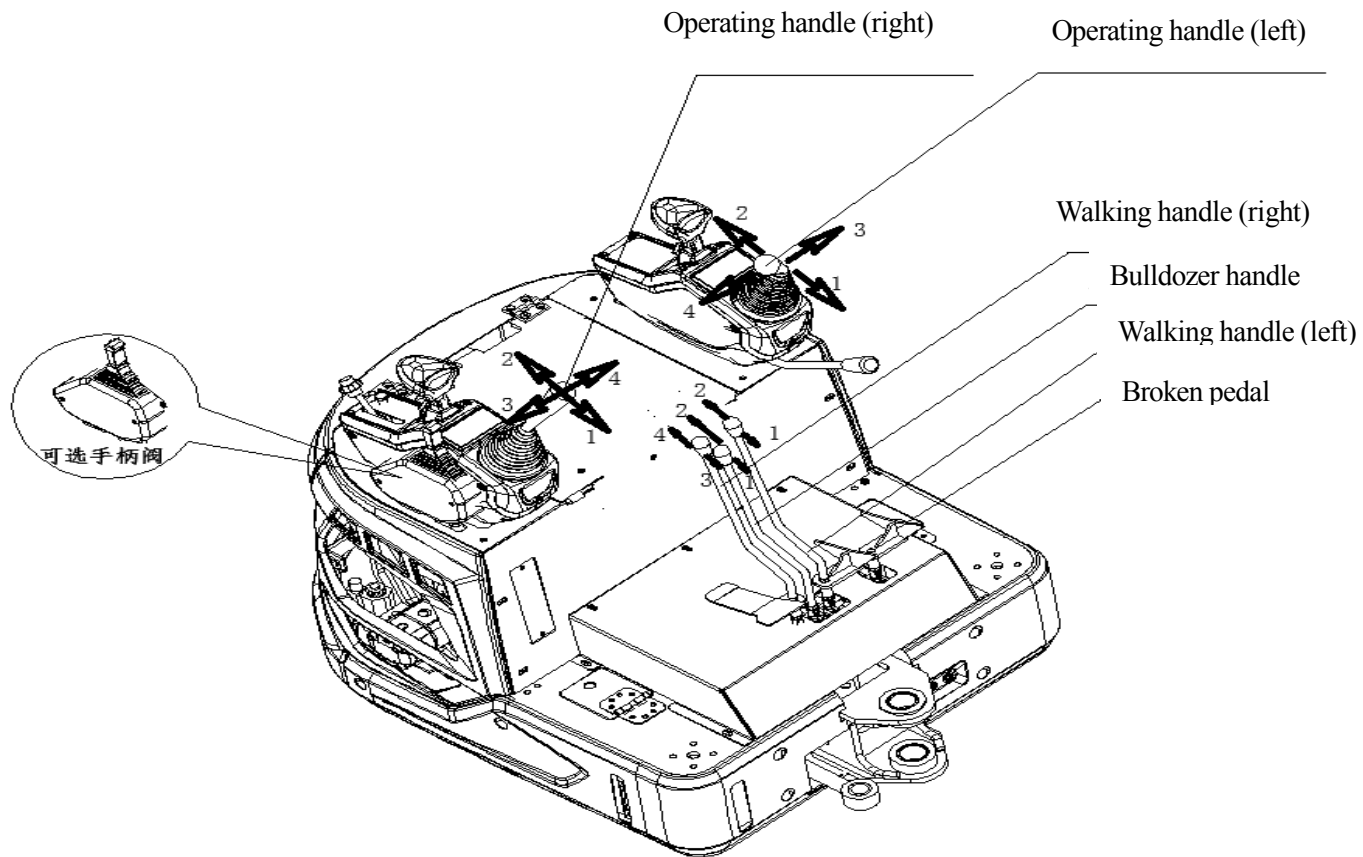
8.Remarks and instructions

9.The above introduces the main screen of the whole set of monitors and their operation steps. The following items need to be noted during the entire operation process:

1. To prevent misoperation, there is a certain delay.
2. Pressing two buttons at the same time will result in invalid instructions.
3. When operating the buttons, the button conversion function has a certain adjustment time, and frequent operation is prohibited.
4. When you just turn on the key, you must wait for the system to self-check before starting the machine.

Note: (optional) means that this function may or may not be available depending on the model and stage.

(5) Controller



1. Control handle (left): used for rotation (press the button on the top of the handle to swing the boom sideways)

and arm control

- 1 Extend the boom;
- 2 Retract the boom;
- 3 Rotate to the left (press the button on the top of the handle to swing the boom to the left);
- 4 Rotate to the right (press the button on the top of the handle to swing the boom to the right);

2. Control handle (right): used for boom and bucket control

- 1 Lower the boom;
- 2 Raise the boom;
- 3 Flip the bucket outward;
- 4 Retract the bucket;

3. Travel handle



Warn!

Do not step on the walking pedal when working. When operating the walking handle/pedal, make sure the direction of the track. When the drive wheel is in front, the walking operation sequence is reversed.

- 1 3 forward;
- 2 4 backward;
- 1 right turn;
- 3 left turn;

Operating 1, 4 or 2, 3 at the same time can achieve turning on the spot

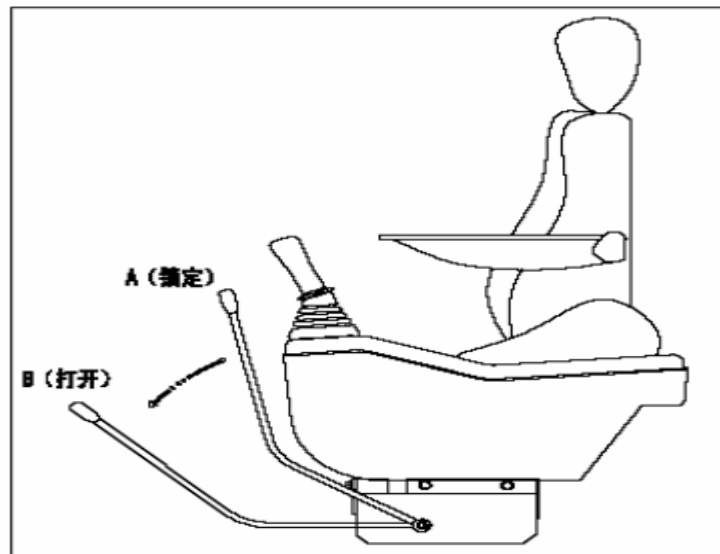
- 4. Crushing foot pedal: used for crushing hammer operation
- 5. Optional handle valve: (for optional function)

(6) Safety locking system



Warn!

Remember to lift the safety lock lever before starting work. If the safety lock lever is not in the "locked" A position, the machine will move if the joystick handle is accidentally touched, which may cause serious injury.



Safety lock handle

A-locked position (when the safety lock lever is in this position, the engine can be started)

B-open position (when the safety lock lever is in this position, the engine cannot be started) This system is used to lock the working device, slewing and traveling devices.

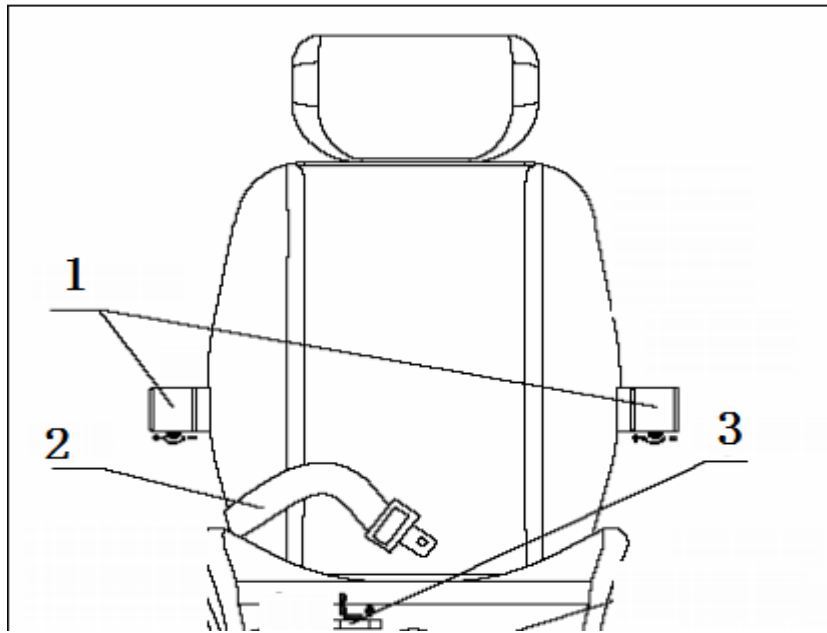
When the safety lock lever is in the A (locked) position, all control handles are disabled and the engine can only be started in this position.

(7) Operator seat



Warn!

It is designed for one person only. Do not adjust the seat during excavation and stay away from moving parts.



1. Armrest height adjustment

2. Safety belt

3. Seat front and rear adjustment: Lift this handle upwards and the seat can be adjusted forward and backward.

(8)Safety belts



Warn!

If the seat belt is worn, damaged or deformed in an accident, replace it immediately.

- If the seat belt needs to be cleaned
 - Use a mild soap solution.
 - Allow the seat belt to dry fully stretched before rolling it up.
 - Make sure the seat belt is installed correctly.
- No modifications to the seat belt or its bracket are allowed.

- The seat belt is intended for use by one adult only.
- The seat belt must be replaced every 2 years, regardless of whether it is used or not.

2. Operation Instructions

Introduction

This chapter contains the rules for operation and safety, which must be followed to ensure the correct and safe operation and operation of the machine. However, compliance with these rules does not mean that the operator can avoid the responsibilities and obligations stipulated by national, provincial and municipal laws and regulations on transportation safety, traffic safety, industrial safety and welfare.

Overview

Important!

Check the pressure and temperature of the hydraulic oil frequently. During the first 50 hours of running-in, the machine should be operated with caution. This will increase the hardness and smoothness of all bearing surfaces,

thereby greatly increasing their service life. The following is a description of the running-in and interval periods applicable during the running-in period.

Engine Schedule Maintenance

Project		Maintenance interval												
		Every												
		50 Hour	75 Hour	100 Hour	150 Hour	200 Hour	400 Hour	500 Hour	1 or 2 months	1 year	800 Hour	1500 Hour	3000 Hour	2 years
* Check fuel hose and pipe clamps		☆												
Change the oil	(1) Oil pan depth (101mm,3.98 in.)	★	☆											
	(2) Oil pan depth (121 mm, 4.76 in.)	★		☆										
	(3) Extended oil pan depth (101 mm, 3.98 in.)	★		☆										
Check fan belt tension and damage				☆										
* Clean the air filter element (please replace the filter element after cleaning 6 times)				☆										
Clean the fuel filter (element type)				☆										

Check the battery electrolyte level				☆										
Replace the oil filter element	(1) Oil pan depth (101 mm, 3.98 in.)	★			☆									
	(2) Oil pan depth (121 mm, 4.76 in.)	★				☆								
	(3) Extended oil pan depth (101 mm, 3.98 in.)	★				☆								
Check radiator hoses and clamps						☆								
* Check the air intake line						☆								
*Replace fuel filter														
Clean the water pipe sleeve and the inside of the radiator								☆						
Replace the fan belt								☆						

(1) This oil pan depth is an optional value for Z482-E3B and D722-E3B.

(2) This oil pan depth is a standard value for Z482-E3B, D722-E3B and D782-E3B.

(3) This oil pan depth is a standard value for Z602-E3B and D902-E3B.

★ After the first 50 hours of operation, please replace the engine oil and oil filter element.

* Based on the U.S. Environmental Protection Agency (U.S.EPA) non-road engine emission standards, the above items (marked with *) are listed by Kubota as important emission-related parts. As the owner of the engine, it is your responsibility to perform necessary maintenance on the engine in accordance with the above instructions.

Project	Maintenance interval												
	Every												
	50 Hour	75 Hour	100 Hour	150 Hour	200 Hour	400 Hour	500 Hour	1 or 2 months	1 year	800 Hour	1500 Hour	3000 Hour	2 years
Recharge the battery								☆					
*Replace the air filter element									☆				
Check valve clearance										☆			
* Check the nozzle condition											☆		
* Check injection timing												☆	
* Check the injection pump												☆	
* Replace the air intake line													☆
Replace the battery													☆
Replace radiator hose and clamps													☆
*Replace fuel hose and pipe clamp													☆
Replace radiator coolant (long-life coolant)													☆

*According to the U.S. Environmental Protection Agency (U.S.EPA) non-road engine emission standards, the above items (marked with *) are listed by Kubota as important emission-related parts. As the owner of the engine, it is your responsibility to perform necessary maintenance on the engine according to the above instructions.

Engine lubrication and cooling system precautions

1. Overview

The cooling system removes heat generated by combustion and friction of moving parts in the combustion chamber, allowing the engine to continue to operate within the normal temperature range.

[Coolant flow]

The cooling system cools the running engine to prevent the engine from overheating and maintain normal operating temperature.

The Kubota engine adopts a pressurized, forced circulation cooling system.

The system includes a radiator (1), a water pump (2), a cooling fan (3), a thermostat (4) and a coolant

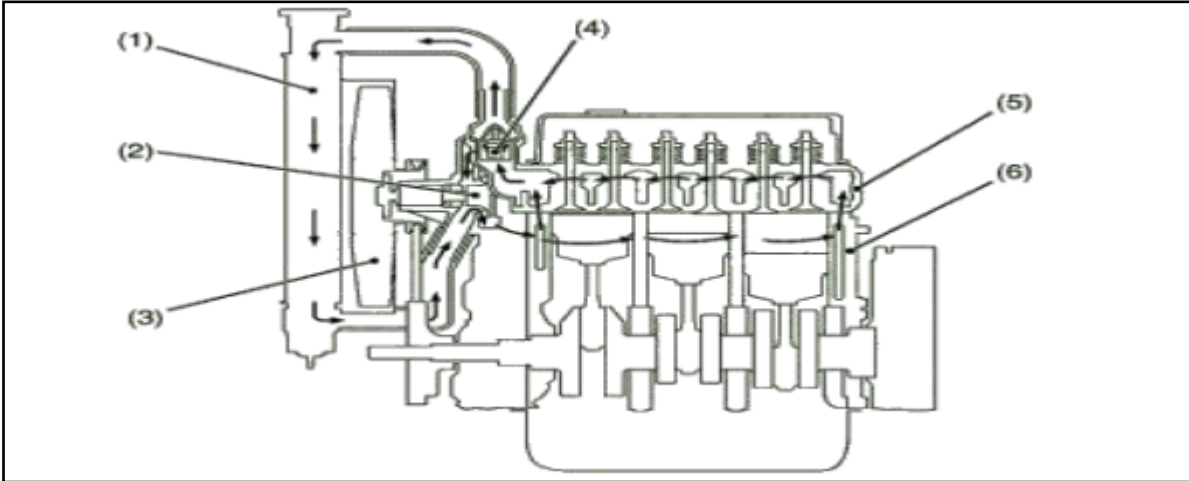
temperature sensor (some models).

The coolant is cooled by the radiator core. The fan installed behind the radiator draws cooling air into the radiator core to improve the cooling effect.

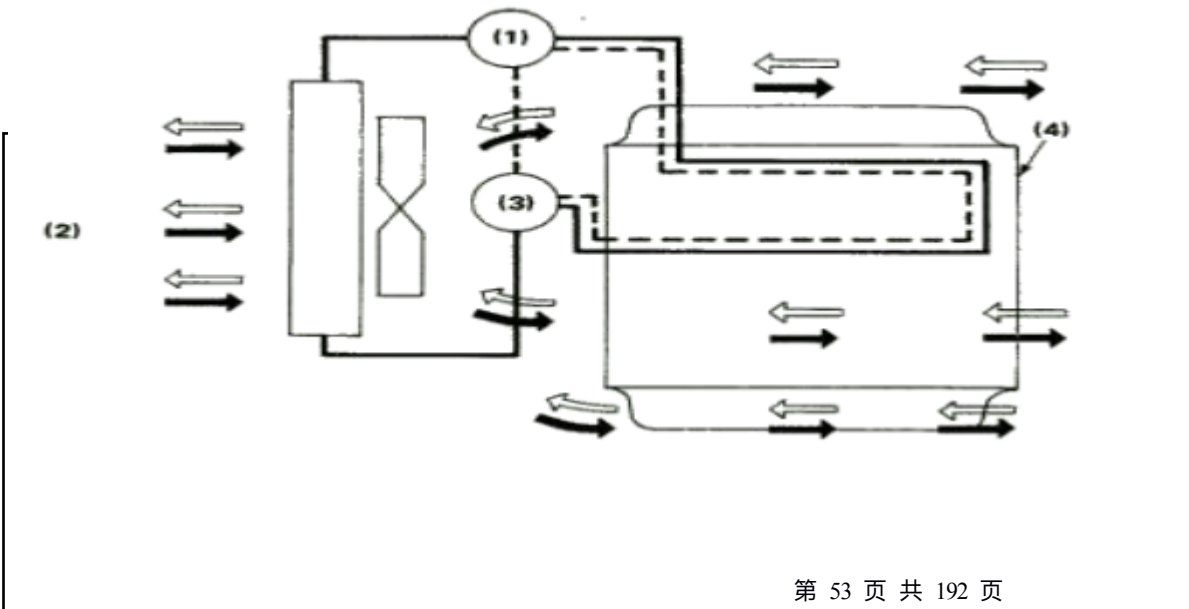
When the coolant temperature in the engine is low, the thermostat valve will close, allowing the coolant to circulate in the engine through the bypass pipe.

When the coolant temperature reaches the valve opening temperature of the thermostat (4), the thermostat (4) will open the valve to allow the heated coolant to flow back to the radiator (1).

The water pump (2) draws in the heated coolant, presses it into the cylinder block (6) and sucks out the hot coolant. The 03-M, 07 and V3 series engines use a bottom bypass system to improve the cooling performance of the radiator, and a three-stage valve opening thermostat to completely reduce thermal shock.



(1) Radiator
 (2) Water pump
 (3) Fan
 (4) Thermostat
 (5) Cylinder head
 (6) Cylinder block
 Figure 8-1 Cooling system



(1) Thermostat
 (2) Cooled air
 (through blower fan $\leftarrow$)
 (through suction fan $\rightarrow$)
 (3) Pump
 (4) Engine

9. Cooling System Precautions

(1) Prevent air stagnation

If air enters the cooling system at the connection point, it may cause abnormal boiling, reduced pump performance and local overheating. This may cause coolant loss due to air expansion and other problems.

The connection must be carefully checked. By the same token, a cylinder head gasket failure may cause exhaust gas intrusion.

(2) Radiator surface cleaning

The radiator surface is very important to the overall cooling performance. If the surface becomes dirty, it may cause overheating. Sometimes a dust screen is set on the front of the radiator and a scraper is installed to automatically clean the radiator surface according to actual conditions.

(3) Radiator support

If the engine is installed on a moving vehicle, the radiator must be properly supported to prevent vibration and impact.

Figure 8-24 shows a typical radiator installation situation.

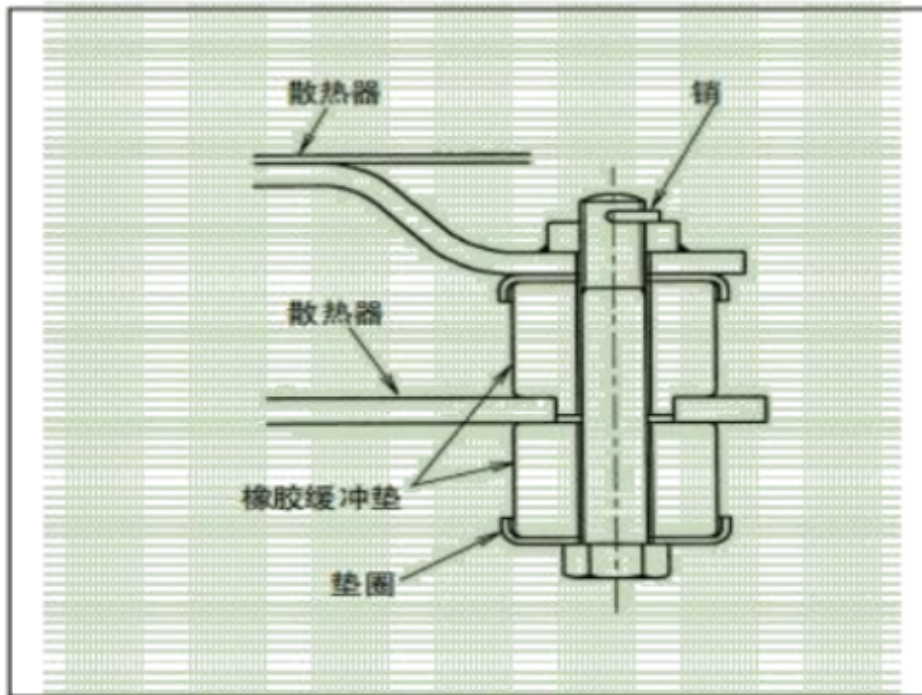


Figure 8-24 Installation example of Kubota radiator

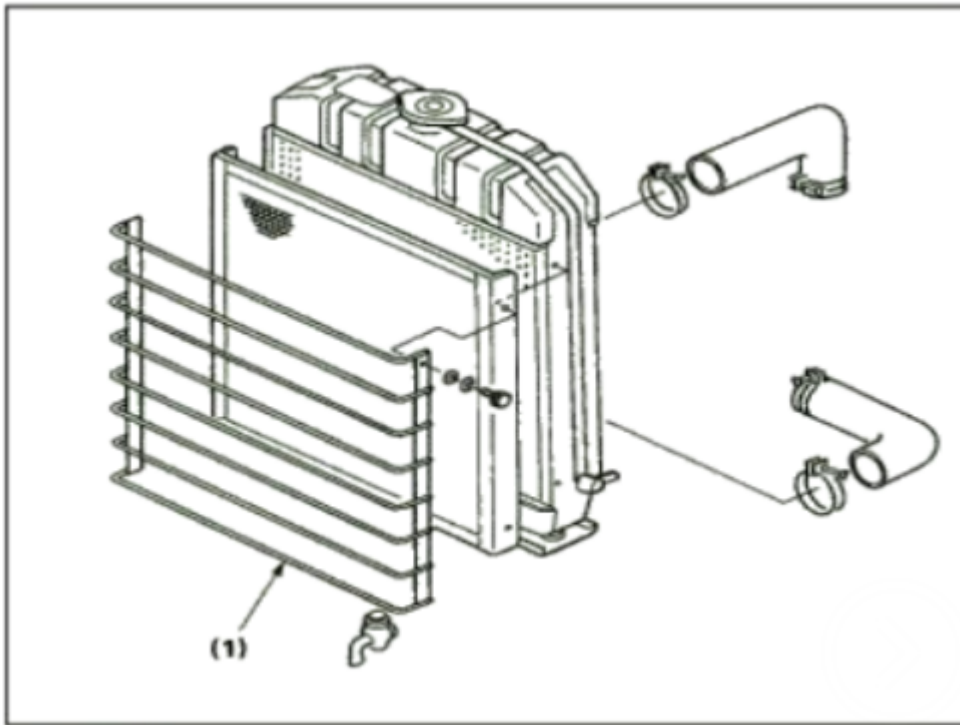
Note:

Please use the upper bracket according to the vibration level.

(4) Radiator protection

If the radiator surface is directly exposed, a protective frame should be installed around it.

Figure 8-25 is a typical example.



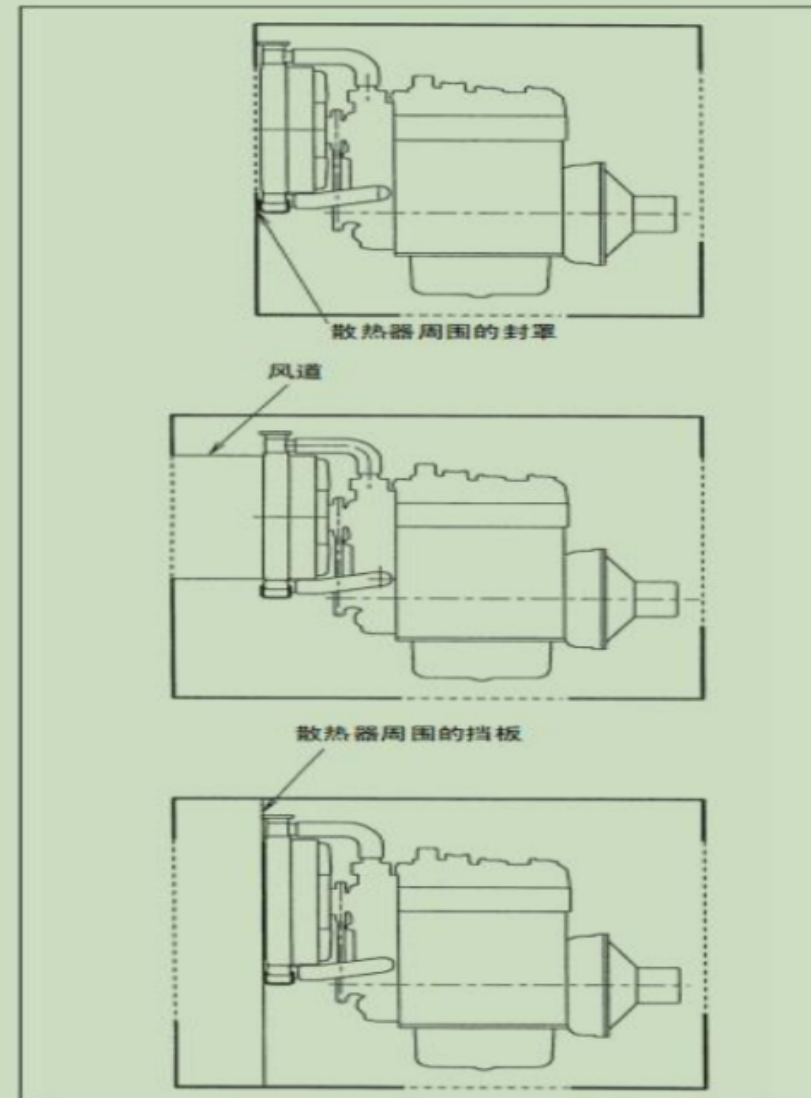
(1) Protective frame

(5) Prevent air recirculation

For optimal cooling, it is critical to draw cool air into the radiator.

Therefore, when designing the engine compartment, it is important to consider setting up appropriate barriers and air ducts around the radiator to prevent hot air from recirculating.

The following is an example of an engine compartment design.



(6) Airflow in and out

Ensure sufficient airflow in and out opening area to prevent airflow reduction.

The opening area should be at least equal to or larger than the radiator core area. Openings at the bottom of the engine compartment are an effective way to reduce oil temperature.

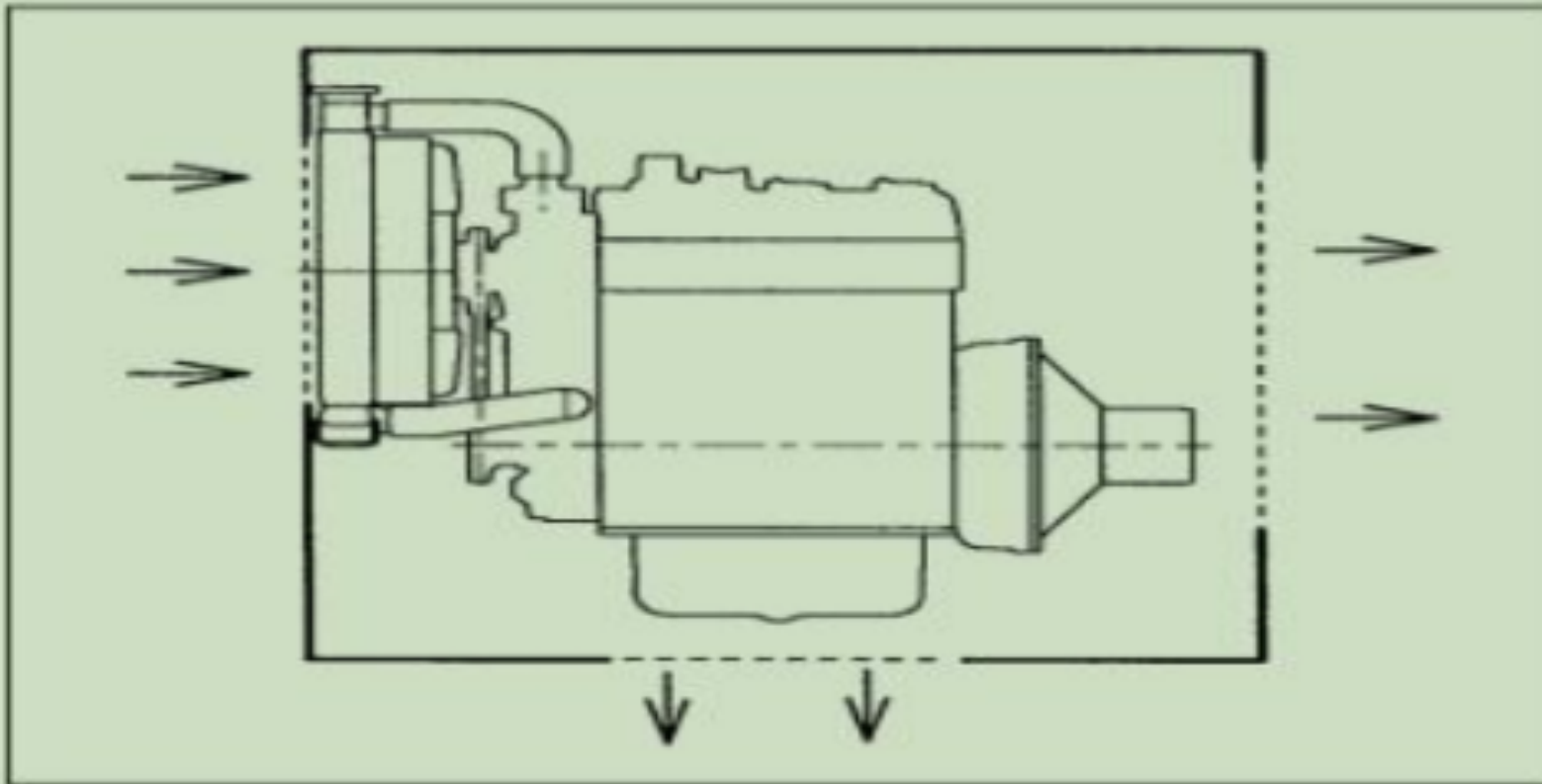


图 8-27

Lubrication system

1. Overview

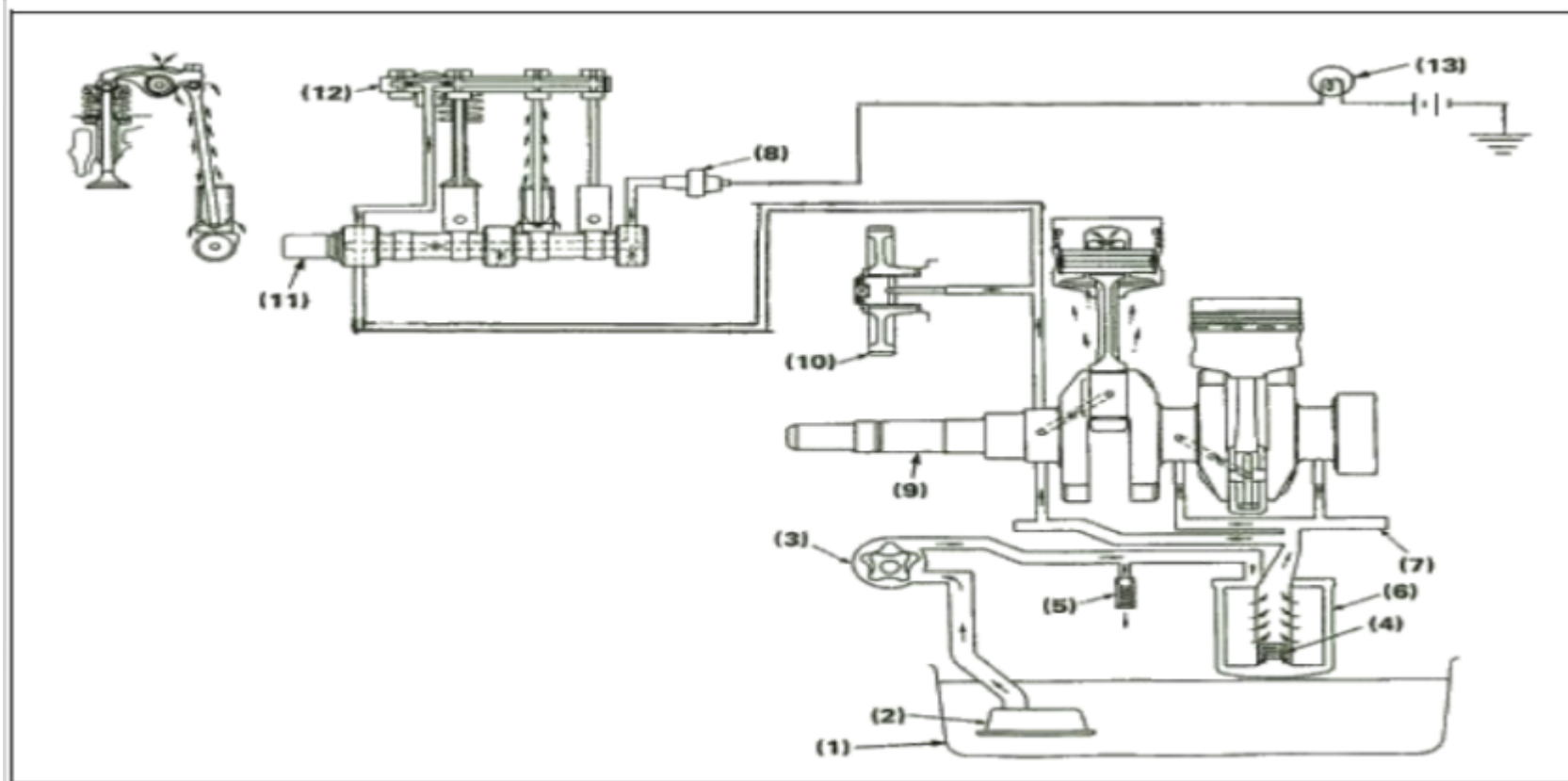
In order to ensure the normal operation of the moving parts of the engine, they must be lubricated. For this purpose, a large amount of lubricating oil circulates in the engine, and its functions are as follows. In addition to reducing friction, the lubricating oil also plays a role in cooling the engine, controlling the expansion and displacement of the bearing surface, sealing, preventing rust, preventing dust, and purifying the products of incomplete combustion in the cylinder.

[1] Lubrication system

A typical lubrication system is shown in Figure 5-1, that is, the lubricating oil in the oil pan circulates in the entire system in the direction shown in the figure under the action of the oil pump. Before returning to the oil pan, the

lubricating oil is always maintained at a pressure of 245~343kPa (2.5~3.5kgf/cm, 35.6~49.8psi) and is delivered to various parts of the engine.

There are two main oil channels. One is the oil channel along the crankshaft to the crankpin bushing, and the other is the oil channel along the inner wall of the crankcase to the valve rocker arm shaft. If the oil pressure drops for some reason, it will cause component scratches or other problems. Depending on the engine type, when the oil pressure drops below 49.03 kPa (0.5 kgf/cm², 7.11 psi) or 98.06 kPa (1.0 kgf/cm², 14.22 psi), the warning indicator light will light up to indicate that there is a drop in oil pressure.



- | | | | |
|------------------------|------------------|-----------------|-------------------|
| (1) Oil pan | (2) Oil filter 1 | (3) Oil pump | (4) Bypass valve |
| (5) Overflow valve | (6) Oil filter 2 | (7) Oil channel | (8) Oil switch |
| (9) Crankshaft | (10) Idle gear | (11) Camshaft | (12) Rocker shaft |
| (13) Warning indicator | | | |

The lubrication system of the diesel engine is composed of an oil pan (1), an oil filter 1 (2), an oil pump (3), a valve (5), an oil filter 2 (6) and an oil switch (8). The oil cooled in the oil pan (1) first flows through the oil filter 1 (2) under the suction of the oil pump, and then flows into the oil filter 2 (6) after being pressurized by the cycloid pump (3) to filter out fine impurity particles therein. Then, the oil is forcibly transported to the crankshaft (9), connecting rod, idler gear (10), camshaft (11) and rocker shaft (12) through the oil channel (7) (oil channel in the crankcase) to lubricate them. The oil splashes around or drips along the gaps between the components under the action of the crankshaft, thereby completing the lubrication of the piston, cylinder connecting rod head, fuel camshaft, tappet, push rod, intake/exhaust valve and timing gear.

Lubricating oil

Note:

- It is not recommended to use synthetic oil.
- Poor quality oil will shorten the service life of the engine.

Please only use the specified lubricant.

[1] Functions of engine oil

(1) Friction reduction

The primary function of engine oil is to prevent parts from sticking and reduce friction, thereby minimizing the

wear caused by friction between moving parts and contact surfaces (such as cylinder walls and piston rings, connecting rod ends, crankshaft bearings, camshafts, tappets, etc.).

(2) Cooling

The temperature in the combustion chamber is usually very high. In addition to lubricating the friction parts of the piston, engine oil can also act as a heat transfer medium to cool the engine, thereby preventing sticking and oxidation of the engine oil due to high temperature. Cooling is a vital function. Excessive oil viscosity or insufficient supply will lead to insufficient cooling capacity, which will cause sticking.

(3) Sealing

The combustion chamber is sealed through the cooperation of the cylinder wall and the compression ring to ensure the smooth progress of the compression process.

The function of lubricating oil is to form a sealing oil film in the gap between the cylinder wall and the crankshaft ring (to ensure better sealing effect), prevent compressed air leakage (to maintain a certain compression pressure) and prevent combustion gas from flowing back into the crankcase, thereby preventing the engine output power from being reduced and the oil from being contaminated due to insufficient fuel combustion.

(4) Cleaning effect

Lubricating oil can remove deposits in the engine, thereby preventing wear caused by deposit accumulation.

(5) Anti-corrosion effect

Lubricating oil can prevent metal parts such as bearings from being corroded by acid.

(6) Anti-rust effect

Engine oil can prevent rust caused by condensation of acidic gases.

【Classification of Lubricants】

(1) Classification by Viscosity

Motor oil viscosity grades are usually classified according to the SAE (Society of Automotive Engineers) standard. Viscosity is an important property of motor oil. The higher the viscosity, the thicker the oil film formed on the metal surface; the thinner it is.

Viscosity changes with temperature: the higher the temperature, the lower the viscosity; the lower the temperature, the higher the viscosity. Motor oil should have an appropriate viscosity and its viscosity should be less affected by temperature changes. In other words, the motor oil must have a high viscosity index. Multigrade motor oil with relatively low viscosity (SAE 10W-30) has excellent lubrication performance under both low and high

temperature conditions and is available all year round.

*“High viscosity index” means that the oil viscosity is less affected by temperature changes.

Viscosity Grade	*Maximum viscosity (CP) under various temperature conditions	**Maximum temperature at which the pump discharges best performance °C(F)	Viscosity at 100°C (212°F)	
			Minimum	Maximum
0W	3250 -30°C (-22°F)h	238(-35)	3.8	
5W	3500 -25°C (-13°F)h	243(-30)	3.8	
10W	3500 -20°C (-4°F)h	248(-25)	4.1	
15W	3500 -15°C (5°F)h	253(-20)	5.6	
20W	4500 -10°C (14°F)h	258(-15)	5.6	

25W	6000 -5°C (23°F) ^h	263(-10)	9.3	
20	-	-	5.6	<9.3
30	-	-	9.3	<12.5
40	-	-	12.5	<16.3
50	-	-	16.3	<21.9

Measured using CCS viscometer (ASTM D-2602).

**Measured using micro-rotational viscometer (ASTM D-3829).

The highest temperature measured when the viscosity is less than 30,000 cp.

(2) Recommended oil for E3 engine

- For applicable oil grades (classified by the American Petroleum Institute (API)), refer to the table below and determine according to the engine type (with internal EGR, external EGR or without EGR) and the type of fuel used:

(low sulfur, ultra-low sulfur or high sulfur fuel).

Fuel Type	Engine oil grade (API grade)	
	Engine without EGR Engine with internal EGR	Engine with external EGR
High sulfur fuel oil [0.05% (500ppm) ≤ sulfur content <0.50% (5000ppm)]	CF (If "CF-4, CG-4, CH-4 or CI-4" oil is used with high sulfur fuel, change the oil at shorter intervals (about half the time)).	-

Low sulfur fuel oil [sulfur content < 0.05% (500ppm)] or ultra low sulfur fuel oil [sulfur content < 0.0015% (15ppm)]	CF, CF-4, CG-4, CH-4 or CI-4	CF or CI-4 (CF-4, CG-4 and CH-4 grade oils cannot be used in EGR type engines.)
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EGR: Exhaust Gas Recirculation

- CJ-4 grade oil is used for engines with DPF (diesel particulate filter) and is not recommended for Kubota E3 specification engines.
- The engine oil used should have API grade and appropriate SAE oil viscosity according to the ambient temperature when the engine is running.
- Under the current strict emission control regulations, CF-4 and CG-4 oils are generally used with low sulfur fuel and are mainly used in road vehicle engines. If non-road vehicle engines are running with high sulfur fuel, it is recommended to use "CF or higher" grade oil with a higher total base number (recommended T total base number of at least 10).

Hydraulic system

- The hydraulic return filter element, hydraulic oil suction filter element and pilot oil filter element must be replaced after the first 250 hours.
- After that, the return filter element and suction filter element should be replaced every 500 hours, and the pilot oil filter should be replaced every 1000 hours.
- The lubricating oil in the slewing motor reducer and the travel motor reducer should be replaced after the first 500 hours.
- After that, the lubricating oil in the slewing motor reducer should be replaced every 1000 hours, and the lubricating oil in the travel motor reducer should be replaced every 2000 hours.

(1) Safety and responsibility

Operator's responsibilities

Operators are responsible for understanding the potential hazards of their work area and the specific requirements for machine operation and personnel safety. This is an indispensable condition to avoid serious personal and property losses and fatal accidents.

Other personnel's responsibilities

When operating the machine, any injuries and accidents must be avoided. The operator has the obligation and responsibility to prevent such accidents. When the machine is working, no one may enter the working area of the machine without notifying the operator. If someone must enter the working area of the machine to perform certain work, he must be careful not to pass behind the machine or appear in the danger zone without

reason. If someone is in the working area of the machine, the operator must be particularly careful and only operate the machine when he is sure of the location of this person.

Damage

Damage and wear that endangers the safe operation of the machine is the operator's responsibility to report.

Operator Qualifications



Warn!

Only trained and qualified personnel may operate the machine.



Warn!

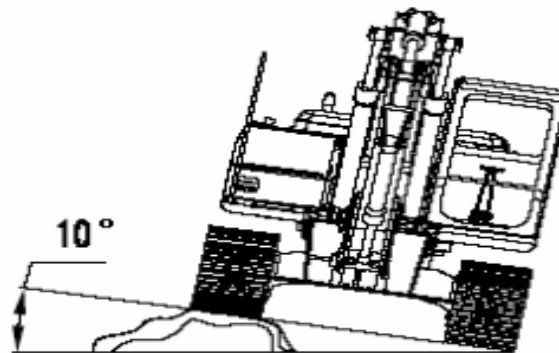
Do not stand on a working machine in a manner that would prevent the operator from operating the machine correctly and safely.

Mechanical knowledge

During the inspection, maintenance and repair of the machine, only personnel who are familiar with the machine operation and instruments can be in the cab.

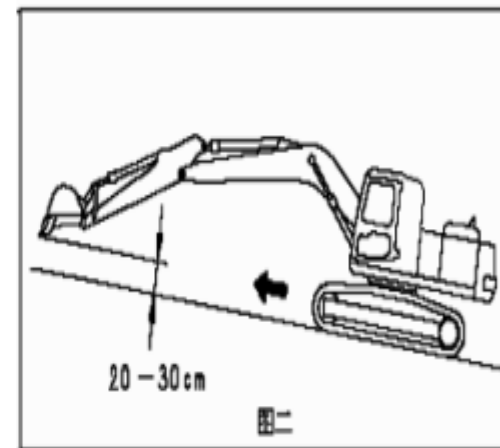
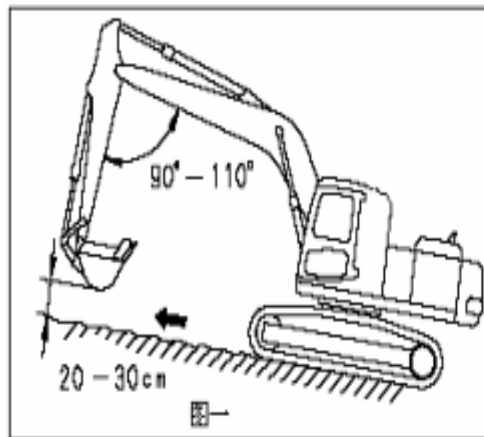
Precautions when walking

If walking on flat ground, the working device must be retracted and lifted 40~50cm off the ground. When crossing obstacles such as gravel and stumps, the machine is subjected to a huge impact, so the driving speed should be reduced, the bulldozer should be raised, and the center of the crawler should cross the obstacle. These obstacles should be removed as much as possible or not crossed. If walking on rough ground, the right tilt angle should not exceed 10 degrees during operation.

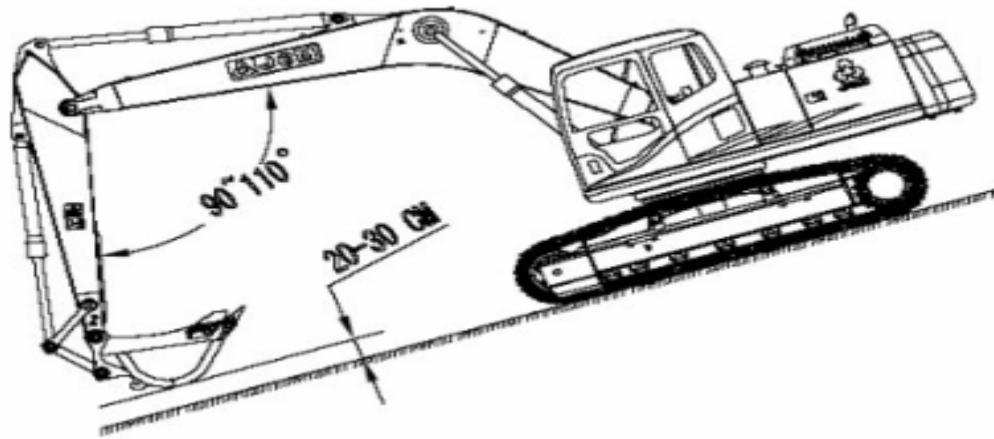


Precautions for driving uphill

Note: When driving on a slope, adjust the working device to the state shown in Figure 1 below. In an emergency, the working device can be quickly lowered to the ground. When driving up a slope of 15 degrees or more, adjust the working device to the state shown in Figure 2 below to improve balance and drive at a low speed. If the crawler slips, push the bucket into the soil to help the traveling mechanism push the machine upward.



When traveling down a slope of 15 degrees or more, the machine should be positioned as shown in the figure below and travel at a low speed.



Do not approach high-voltage wires

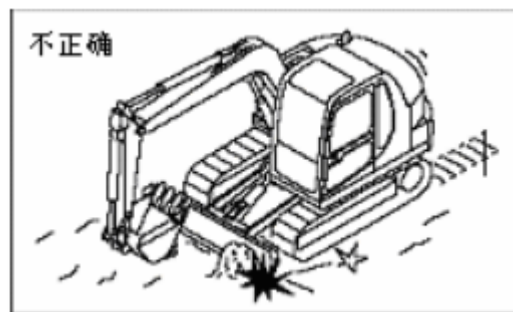
If the machine approaches high-voltage wires, people may receive electric shock. Although direct contact is not necessary, there is still a possibility of danger. If working near high-voltage wires, no one is allowed to approach the machine. Before working near high-voltage wires, first contact the power company. For safety reasons, the

following minimum distances must be maintained between the machine and high-voltage wires. If the working device accidentally touches the wires, the operator must stay in the cab and, if the machine is still able to work, try to carefully move the working device away from the high-voltage wires to avoid the risk of electric shock.

Voltage	Minimum distance from wires
0~1 kV	2m(7 feet)
1~55 kV	4m(13 feet)
55~500 kV	6m(20 feet)

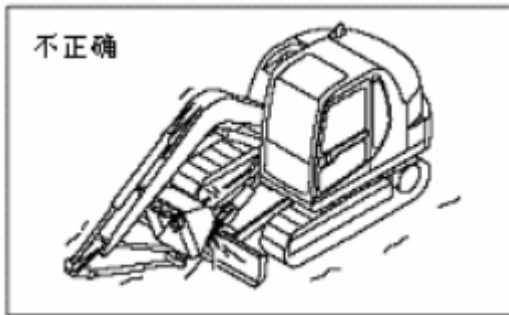
Avoid collisions with the bulldozer

Note: Do not hit the bulldozer with rocks or curbs, as this may cause premature damage to the bulldozer or cylinder.



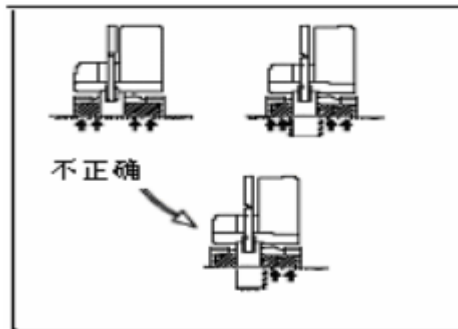
Folding the working device

Note: When the working device is put into traveling or transporting state, be careful not to let the bucket hit the bulldozer.



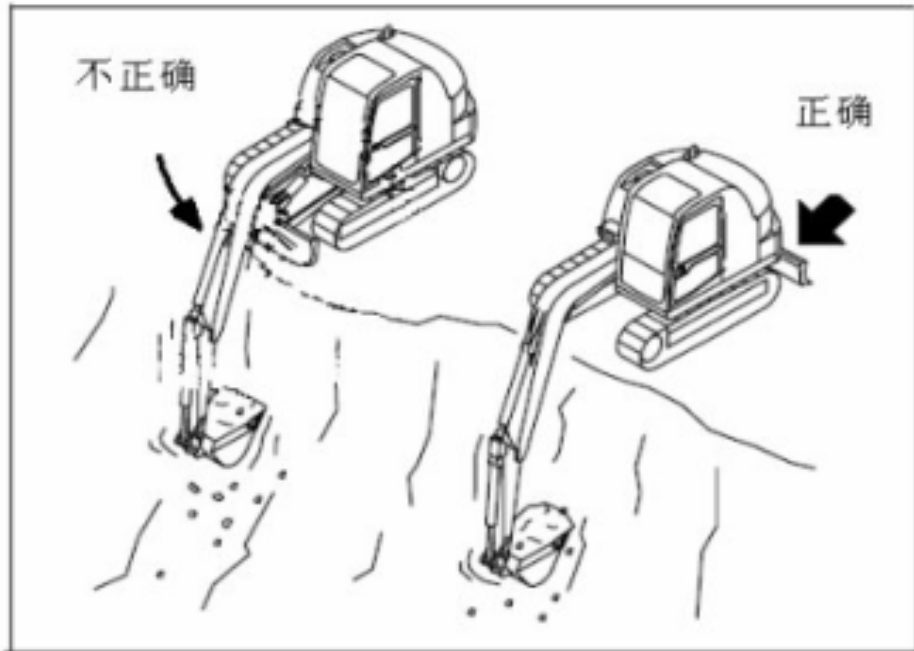
Supporting the Dozer Blade on Both Sides

NOTE: When using the dozer blade as an outrigger, do not support the machine by the end of the dozer blade.

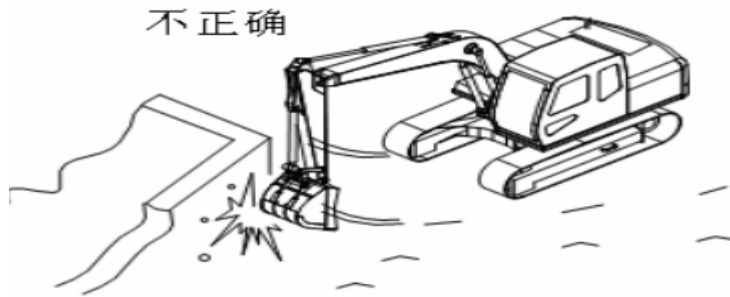


Bulldozer during backhoe operation

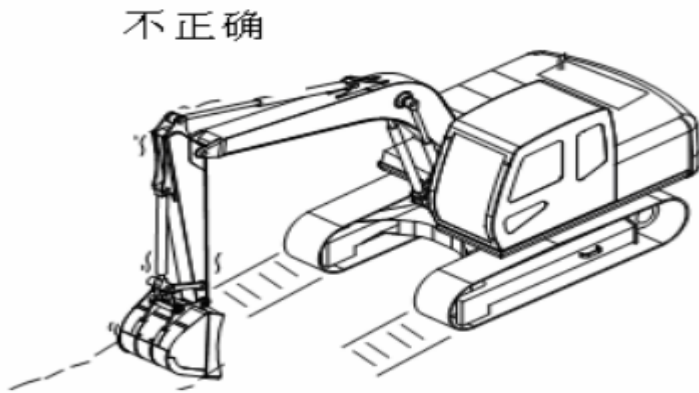
Note: When performing deep digging with the bulldozer in the front position, be careful not to let the boom cylinder hit the bulldozer. In addition to the bulldozer being in the front position, always place the bulldozer in the rear position.



Do not use rotary force to compact soil or soil piles and walls. Do not insert the bucket teeth into the soil when rotating. These actions will damage the working device.

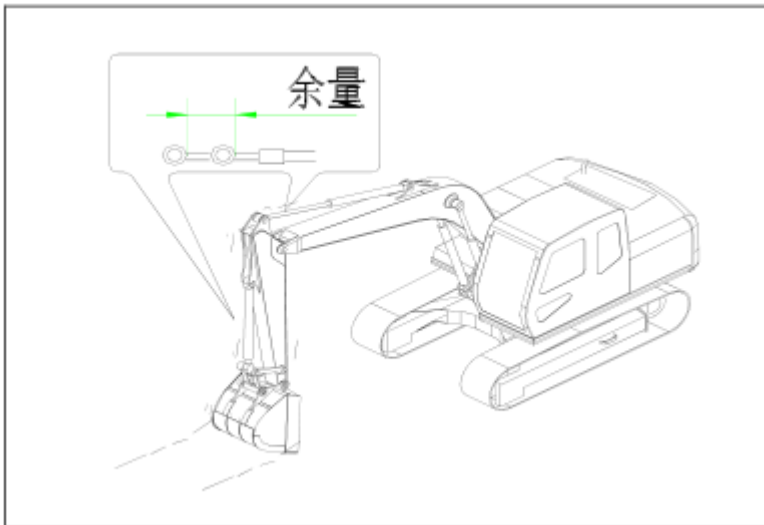


Do not use walking force to dig with the bucket digging into the soil. This will cause excessive force on the rear of the machine.



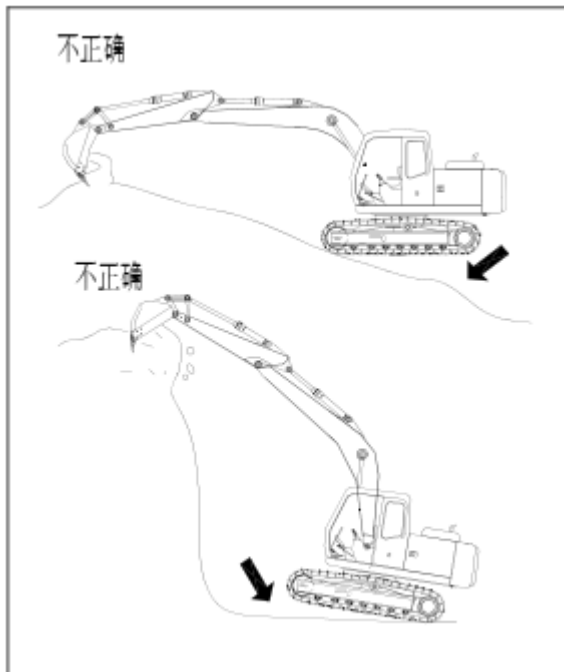
Precautions when operating the hydraulic cylinder to the end of its stroke

During operation, if the hydraulic cylinder is operated to the end of its stroke, the force will act on the limit ring inside the cylinder, thereby reducing the service life of the machine. To prevent this from happening, a small safety distance should always be maintained when operating the cylinder.



Operations that prohibit the use of bucket drop force

1. Do not use the bucket drop force as a breaker or pile driver;
2. Do not use the machine's drop force for excavation. The above two situations will cause the rear of the machine to bear excessive force, which will not only damage the machine, but is also very dangerous.



(2) Transportation of machinery

Loading and unloading



Warn!

When transporting the machine, the legal provisions on the weight, height and length of the load should be observed. Choose a solid and level site with sufficient distance from the road curb. Remove grease and other debris on the trailer that may cause the machine to slip. Choose a low position for operation.

Mounting on the machine

1. Brake the trailer reliably;
2. Place anti-skid triangular pads under the trailer tires;
3. Ensure that the ramp on the towing platform is stable, strong and thick enough for safety;
4. The maximum horizontal angle of the ramp on the towing platform to the ground is 15° , which should be as small as possible, and the height on the left and right is consistent;

5. Use low speed;
6. Cancel automatic idling;
7. Determine the direction and drive slowly to the shipping platform;
 - Do not let the bucket cylinder rod hit the trailer
 - When the machine is on the trailer platform, try not to operate any handle except walking.
8. Secure the machine to the trailer.

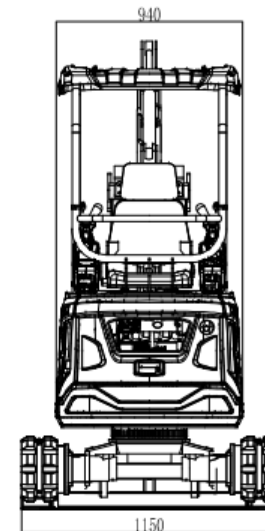
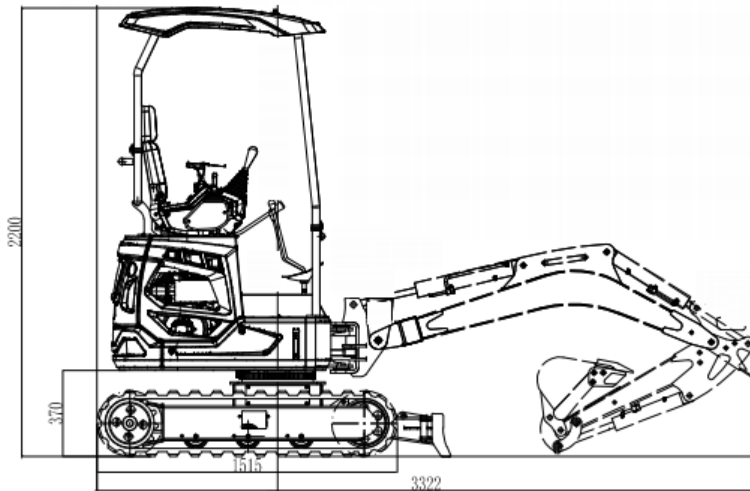
Secure the machine

1. Lift the safety lock handle;
2. Turn off the engine and remove the starter key;
3. Turn off the battery switch;
4. Lock the door;
5. Use triangular pads to fix both ends of the track; use wire ropes to fix so that the machine cannot move.

Disassembly required for transportation

Note: When transporting, comply with local, provincial, and national regulations on load weight, width, height, and length. When choosing a transportation route, consider the restrictions and travel time of various bridges and roads.

Machine size:



During the disassembly and lifting process, pay attention to protecting the cylinder and fixing the movable parts.

At the same time, use coverings at the corners where the sling contacts the parts to prevent the corners from damaging the sling and causing danger.

Disconnect the hydraulic lines



Warn!

When the machine operation has just finished, the hydraulic oil temperature is very high and may burn unprotected skin. In addition, there is residual pressure in the hydraulic system, so before any maintenance work is performed on the hydraulic system, the residual pressure must be released. To prevent personal injury.

1. Place the machine on a flat, solid ground;
2. Fully extend the bucket cylinder;
3. Fully retract the arm cylinder;

4. Retract the boom cylinder until the working device bucket is securely on the ground;
 5. Turn off the engine;
 6. Keep the safety lock handle in the open state;
 7. Keep the engine start key switch in the on state but do not start the engine;
 8. Move the operating handle several times in all directions to release the residual pressure in the hydraulic system;
 9. Turn off the engine start key switch;
 10. Release the pressure in the tank through the hydraulic tank cap;
 11. Disassemble the corresponding pipelines that need to be disassembled
- Note: Pay attention to protecting the environment when handling hydraulic oil!
12. Disassemble parts such as: boom, arm, bucket, counterweight

(3) Lifting machinery



Warn!

Do not lift the machine if there are people in the cab or on the machine.

Use an approved lifting device with adequate load capacity.

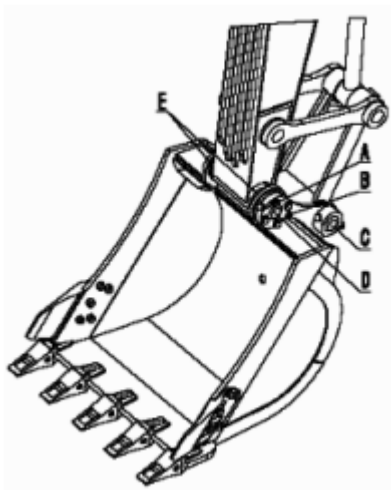
(4) Replace the bucket

Removal of bucket



Warn!

When using a hammer to hit and remove the bucket pin, metal fragments may fly, so goggles, a safety helmet and gloves must be worn when working, and the removed bucket must be kept stable.



1. Lower the working device so that the bucket contacts the ground;
2. Remove the tightening bolts A and nuts B (2 sets);
3. Remove the bucket connecting pins C and D;

Installing the bucket



Warn!

Do not put your fingers deep into the pin hole to check whether the pin is aligned, otherwise a serious crushing accident may occur.

1. Align the dipper arm with the bucket connection hole;
2. Apply a proper amount of grease in the hole;
3. Install the pins C and D respectively;
4. Install the locking bolt A and nut B (2 sets, double nuts tightened).

(5) Before operation

General provisions



Warn!

Failure to comply with these regulations may result in serious injury or even death.

-Read and understand

- Read and understand the Instruction Manual before you start to operate the machine.
- Read and understand the signs and instructions attached to the vehicle before starting to operate the machine or performing repairs.

-Before starting, faults or defects that affect safety must be eliminated.

-When starting the engine indoors, make sure that the ventilation system is sufficient.

-When starting the engine, always sit on the seat.

-The cab door must be closed during operation.

- Never operate the machine for a long time without ventilation
- Use the seat belt when performing various operations.
- Never operate the machine under the influence of alcohol, drugs or other drugs.
- To avoid pinching hands or fingers, keep hands away from places where there is a risk of pinching hands (covers, doors, windows, etc.).
- When entering and exiting the machine, always face the machine and use steps and handrails. Always use the three-point method, that is, two hands and one foot or one hand and two feet. Never jump!
- Do not climb on surfaces that are not designed for climbing, only use surfaces equipped with anti-slip material.
- Wear clothing suitable for safe operation.
- Wear a hard hat to increase head protection.
- Do not overload the machine. Otherwise, safety will be compromised.

Pre-Start Procedure

Important! Before starting, make sure that no one is near the machine.

1. Position the machine for maintenance.
2. Perform routine maintenance.
3. Adjust the seat so that you can operate the controls and pedals comfortably and safely.
4. Check the instruments and controls.
5. Check that the headlights, windshield wipers/washers, reflectors, etc. are in working order.
6. Check for leaks.
7. Check for defective or loose parts that could cause damage.
8. Check that there is fuel in the tank.
9. Check that the hood is closed.

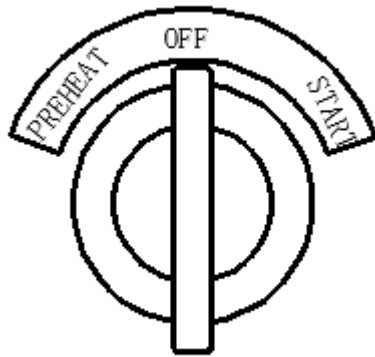
If the fuel runs out or air has entered the system for some reason, the air must be bled out before the engine is started.

Before starting

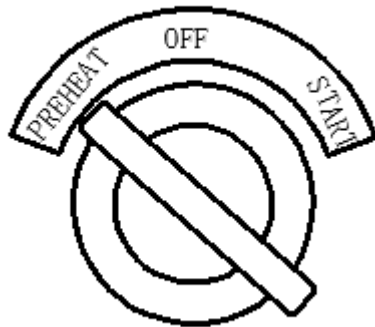
1. Always sit in the operator's seat when starting the engine/machine, refer to "Starting the Engine".
2. Fasten the seat belt before performing any operation.
3. Wait until the display shows "Wait to Start" before operating.
4. Check that all gauges, controls and instruments are operating normally.
5. Before starting the machine, check that no one is near the machine.
6. Sound the horn.
7. Finally, lift the safety lock handle and start the machine.

(6) Start switch

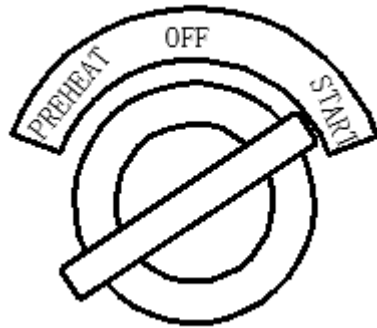
The start switch has 3 positions



Stop position: OFF The engine stops immediately



Preheat position: PREHEAT The engine must be preheated before starting (rotate to this position and stay for 1 minute)



Starting position: START The starter motor is engaged and the engine starts.

(7) Start the engine



Warn!

After checking for people and obstacles around the machine, start the engine.

Do not operate any operating handles or switches during starting.

Important!

Do not keep the key in the (start) position for more than 20 seconds. This will seriously damage the starting system. After 2 minutes, try to start the engine. If there is an abnormal sound, excessive vibration or abnormal situation, immediately turn the key to the stop (stop) position and turn off the engine.

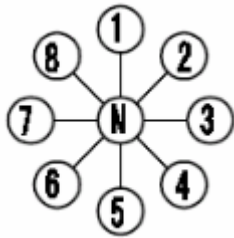
Note: When starting the engine at any temperature, you need to turn the key switch to the (PREHEAT) position and preheat for 1 minute.

When it is very cold below -15°C , after the engine is started, do not immediately start high-intensity work, let the engine idle for 10~15 minutes.

(8)Operating the machine

Operating working equipment

Left operating handle



This handle controls the swing (boom swing) and the boom.

N Neutral position

1. Boom extends
2. Boom extends and swings right
3. Swings right (press and hold N position button, boom swings right)
4. Boom retracts and swings right
5. Boom retracts

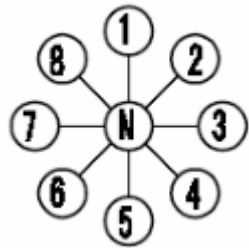
6. Boom retracts and swings left

7. Swings left (press and hold N position button, boom swings left)

8. Boom extends and swings left

Right joystick

This handle controls the boom and bucket



N Neutral position

1 Boom down

2 Boom down and bucket extended

3 Bucket extended

4 Boom retracted and bucket extended

5 Boom up

6 Boom up and bucket retracted

7 Bucket retracted

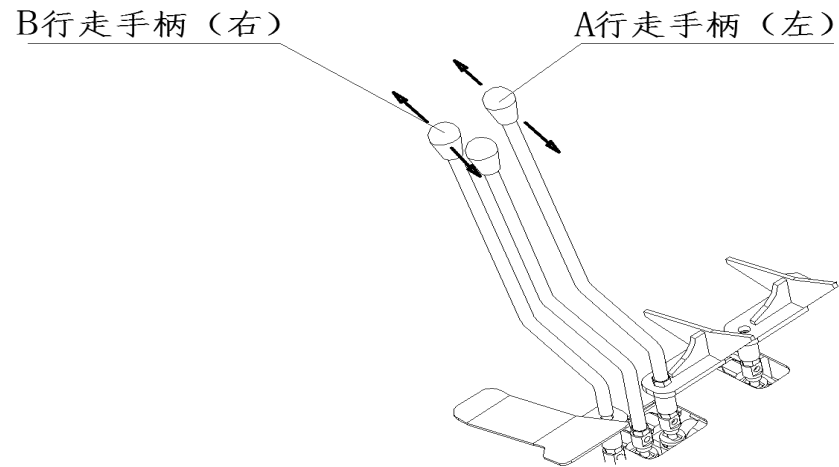
8 Boom down and bucket retracted

Walking direction control



Warn!

Before operating the travel handle or pedal, check the direction of the crawler track. If the sprocket is at the front of the machine, the travel handle (pedal) must be operated in the opposite direction. Do not change the travel direction quickly. Especially when changing direction when stationary.



Forward travel

1. Increase the engine speed.
2. When the sprocket is at the rear of the machine, slowly push the travel handles A and B forward, or slowly press the front of the pedal.

When the sprocket is at the front of the machine, slowly pull the travel handles A and B backward, or slowly press the back of the pedal.

Reverse travel

1. Increase the engine speed.
2. When the sprocket is at the rear of the machine, slowly pull the travel handles A and B backward, or slowly press the rear of the pedal.

When the sprocket is at the front of the machine, slowly push the travel handles A and B forward, or slowly press the front of the pedal.

Left turn

When the sprocket is at the rear of the machine:

Push the right travel handle B forward, the track will turn in the forward direction, and the machine will turn forward to the left.

Pull the left travel handle A backward, the track will turn in the backward direction, and the machine will turn backward to the left.

When the sprocket is at the front of the machine: operate the handle in the opposite direction to the above

Right turn

When the sprocket is at the rear of the machine:

Push the left walking handle A forward, the track will turn in the forward direction, and the machine will turn right forward.

Pull the right walking handle B backward, the track will turn in the backward direction, and the machine will turn right backward.

When the sprocket is at the front of the machine: operate the walking handle in the opposite direction to the above.

Note: The different amplitudes of the walking handle movement will also produce a steering effect. When the sprocket is at the rear of the machine, the machine will turn to the side with a smaller amplitude, and when the sprocket is at the front of the machine, the machine will turn to the side with a larger amplitude.

Turn on the spot

Push the left travel handle A forward and pull the right travel handle B backward to turn the machine clockwise on

the spot.

Push the right travel handle B forward and pull the left travel handle A backward to turn the machine counterclockwise on the spot.

(9) After the operation



Warn!

When entering or exiting the machine, always face the machine and use steps and handrails to avoid slipping.

When climbing or descending from the machine, always use three-point support, two hands and one foot or one hand and two feet. Do not jump.

Stopping the machine

Important!

Select a level surface to park the machine.

Put the left and right travel handles in a neutral position.

Pull the engine speed handle to the low idle position.

Lower the bucket to the ground, keeping the bottom of the bucket parallel.

Lift the safety lock handle and retract it firmly into the hydraulic system.

Stop the engine

Important!

Before stopping, let the engine run at idle speed for a few minutes to protect the engine.

- Turn the start switch to the stop position.

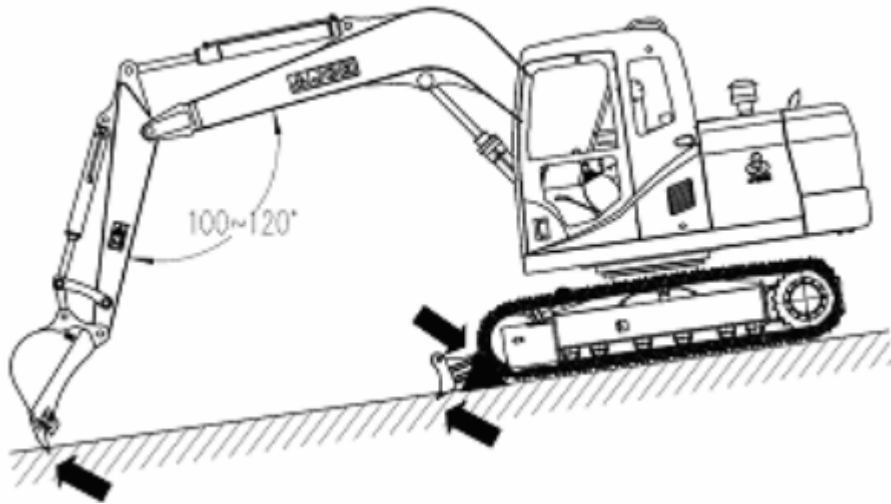
Note: If the machine is to be stopped for a period of time (no matter how long), the battery switch should be disconnected (some models have a power electromagnetic switch installed, and the power electromagnetic switch will automatically cut off the power when the key switch is turned to the OFF position)

(10) Parking the machine

Overview

Important!

Choose a level surface to park the machine. If you must park on a slope, place a wooden stop under each track and push the bucket teeth into the ground.



- Pay attention to weather conditions and take appropriate measures to prevent the machine from freezing to the ground, sinking, or suffering any other adverse consequences.
- Turn switches and joysticks to the off/neutral position.
- Lift the safety lock handle to securely lock the system.
- Close windows and lock the cab and all covers.
- Turn off the battery disconnect switch.

Long-term parking of machines

In addition to complying with the above parking regulations, the following points must also be followed:

- Check the machine for oil or water leaks, and whether the attachments and tracks are faulty.
- Remove dirt and debris attached to the tracks and rollers.
- Perform rust prevention treatment on exposed components and lubricate the machine thoroughly.
- Fill the fuel and hydraulic oil to the maximum capacity mark.

(11)Working with a bucket

An excavator is a multifunctional machine that can be equipped with a variety of attachments to perform a variety of tasks.

The following only describes the simplest operations.

Excavation work

Excavation work is performed in places where the slope of the machine is small. The cylinder works most efficiently when the angle between the bucket cylinder and the rocker arm, and the angle between the arm cylinder and the arm are 90° respectively.

If you are doing excavation work, you should use this angle to improve your work efficiency. The range of the digging work of the bucket arm is about 30° forward to 45° backward. From the perspective of digging depth, the difference may be very small. When using a cylinder, do not let it reach the end of the stroke, which can protect the cylinder.

Trenching

Attach an appropriate bucket to perform trenching. Align the tracks in the direction of the trenching so that they can work efficiently. When digging a wide trench, dig the sides first and then the center area.

Loading

When parking the dump truck, the operator should have good visibility to work efficiently. It is also possible to load the dump truck at the back instead of on the side, which will make the operator's job easier and improve efficiency. Prohibitions during operation

- Do not use swing force to rake the ground, demolish buildings or push the bucket teeth into the ground for swinging action. Such operations may damage the machine and attachments.
- Do not use walking force to work. These operations may cause the machine to overload and damage the crawler drive mechanism.
- Do not extend the cylinder to the end of its stroke. This may overload the buffer and stopper in the cylinder and shorten their service life. The cylinder should be as far away from the end of the stroke as possible during

operation.

- Do not use the force of the bucket and boom to hit the work. At this time, a breaker should be used instead of dropping the boom or using a bucket. This will overload the machine or damage the working device. This is very dangerous.
- Do not perform lifting operations directly. Basically, it is prohibited to use the machine as a crane. However, if necessary, it is necessary to properly install a top push hook and a certified lifting device.

(12)Exit from the muddy ground

Be very careful when working on soft and muddy ground.

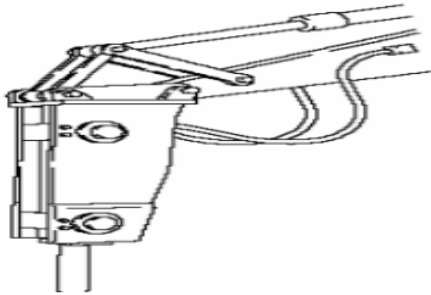
- When one track is stuck, use the bucket to support the stuck track and put a piece of wood under the track.
- When both tracks are stuck, put a wooden board under the track. Push the bucket teeth into the ground, retract the bucket rod as if digging and push the travel handle to the forward position to allow the machine to get out of the swamp.

Important! When using the boom or bucket rod to support the machine, use the bottom of the bucket (not the bucket teeth). Set the angle between the boom and the bucket rod between 90° and 100°. After working in water or exiting muddy ground, add grease to the pins of the working device. Check the lubricating oil in the guide wheels, supporting wheels, drag chain wheels and track drive box. If the lubricating oil is contaminated, replace the lubricating oil.

(13) Optional components

IMPORTANT! Choose the right attachment for the machine you want to install it on. The type of attachment you will install will vary depending on the type of machine.

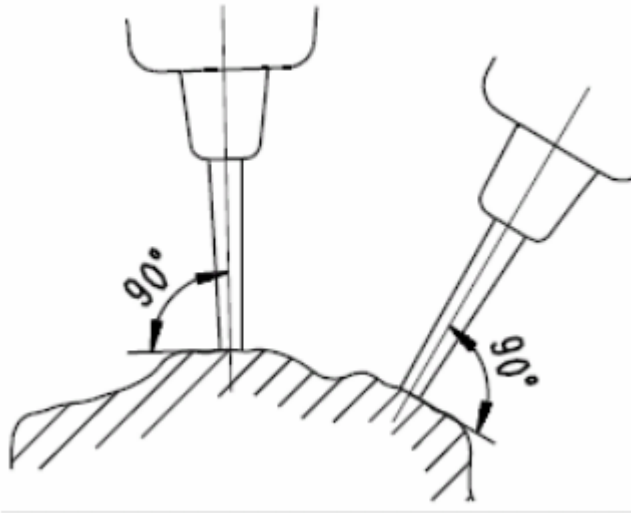
Hydraulic Breaker



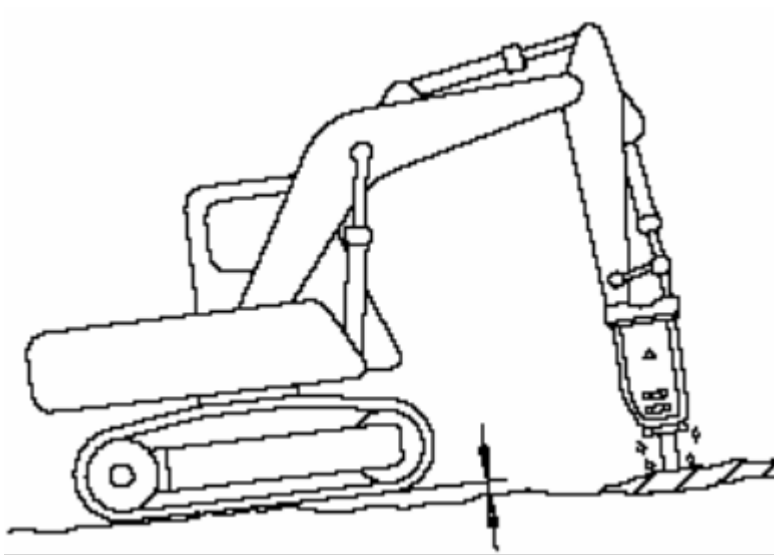
- Breaking stones
- Demolition work
- Repairing roads

Hydraulic breakers are widely used for demolishing buildings, breaking road surfaces, tunneling work, crushing slag and breaking or cutting stones.

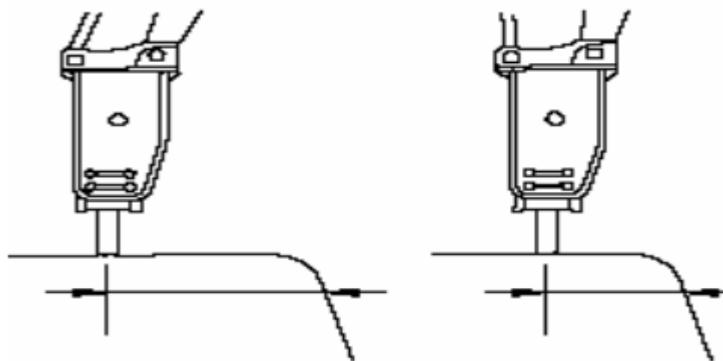
- Press the hammer head firmly against the surface at a right angle, as shown in the figure.



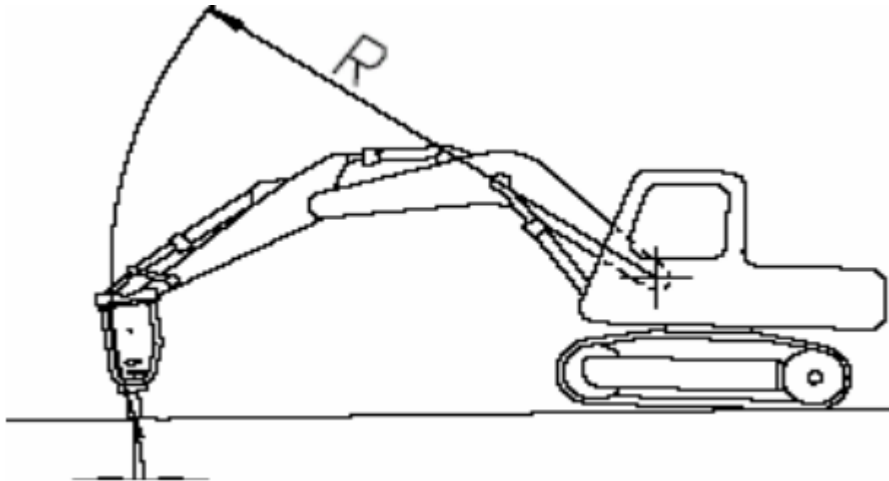
- When striking, press the hammer head tightly against the surface and lift the vehicle body by 5 cm. Do not lift the vehicle body too high.



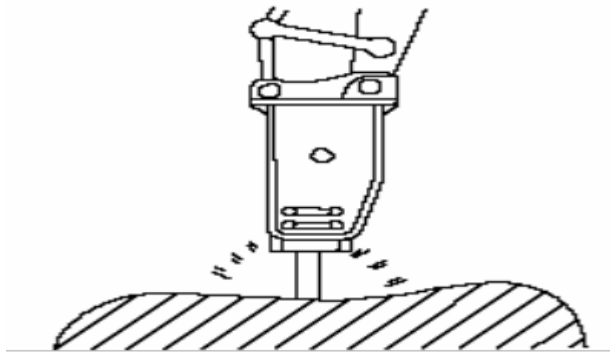
- If the surface does not break up within 1 minute after repeated blows, move the breaker to break it from the end.



- There is a slight deviation between the striking direction of the hammer head and the direction of the crusher body. Therefore, the direction of the bucket cylinder should be constantly corrected to keep it aligned.

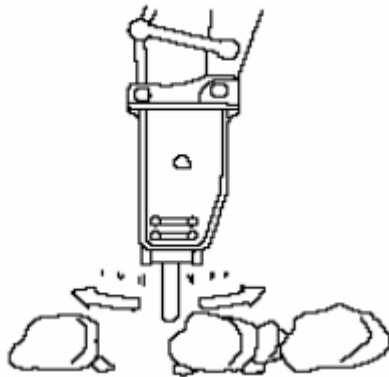


- Properly pressurize the hammer to avoid empty strikes.

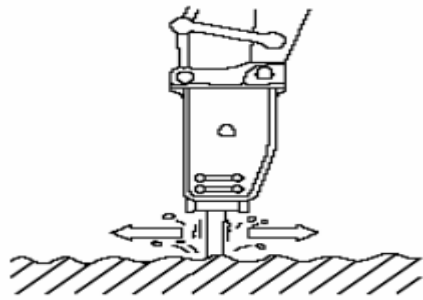


Precautions for operating a hydraulic breaker

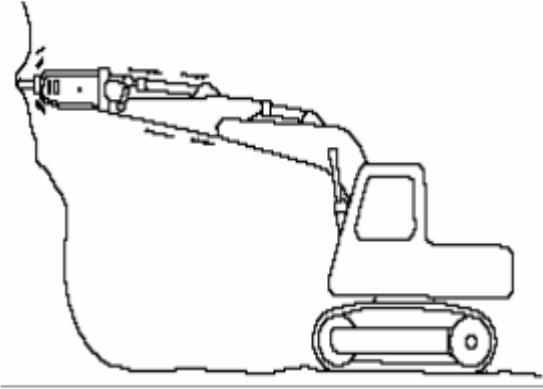
- When operating the cylinder, do not reach the end of its stroke and keep a distance of 5 cm.
- Do not swing the hydraulic breaker against rocks, concrete, etc.



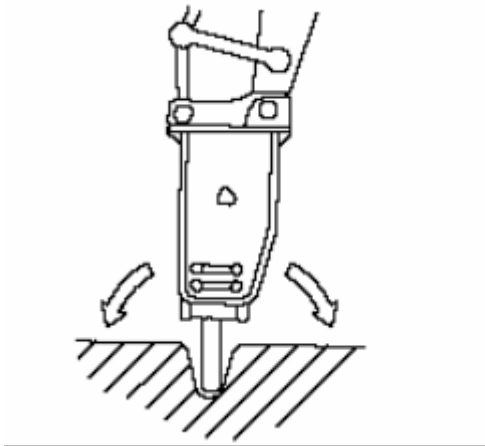
- Do not move the hammer head during impact.



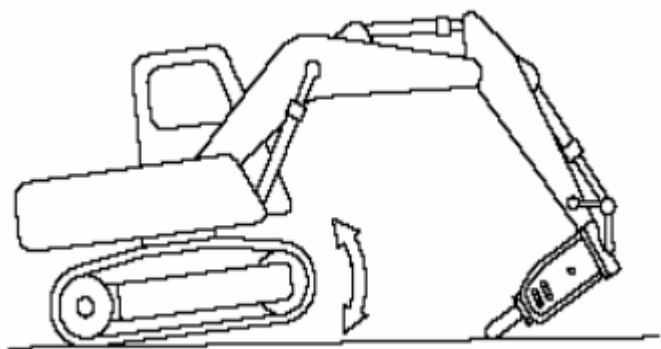
- Do not strike horizontally or upwards.



- Do not twist the hammer head when drilling holes in the ground.



- When raising the machine, do not extend the bucket cylinder to the maximum position.



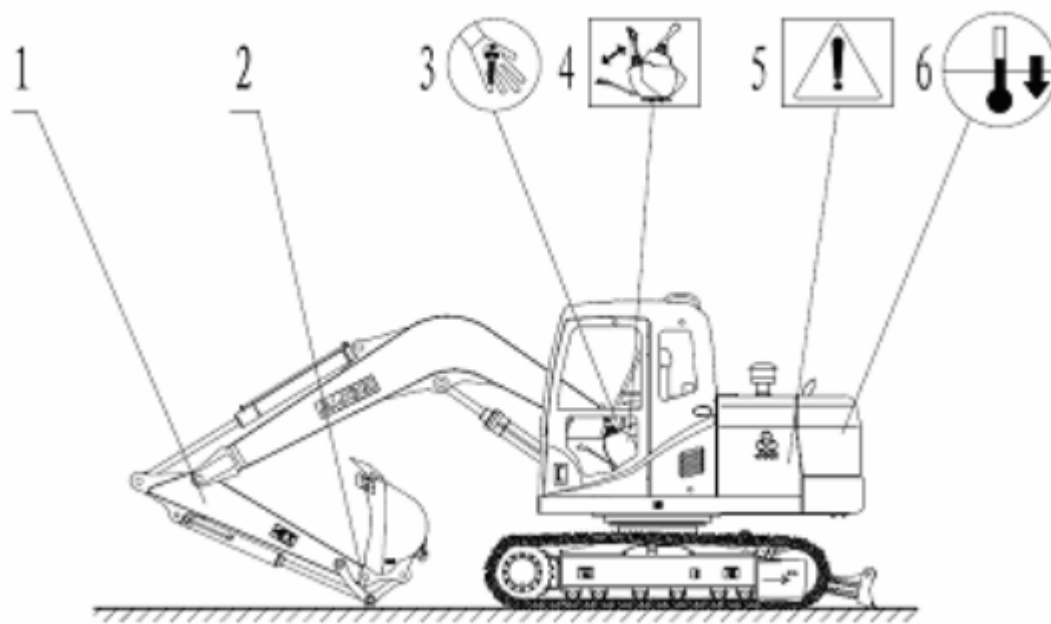
3. Maintenance location



Warn!

If you must perform repairs or maintenance before the machine cools down, be careful to avoid being burned by hot liquids and parts.

Before performing any repair work, park the machine on a level surface and prepare the repair label as shown below:



1. Place the machine on a flat, firm, level surface.
2. Drop the attachment to the ground.
3. Turn off the engine and remove the starter key.
4. Lift the safety lock handle to lock the system.
5. Release the pressure in the booster pipe and container to avoid danger.
6. Cool the machine

※ If repairs or maintenance must be performed before the machine cools down, be careful to avoid burns from hot fluids and parts.

Overview



Warn!

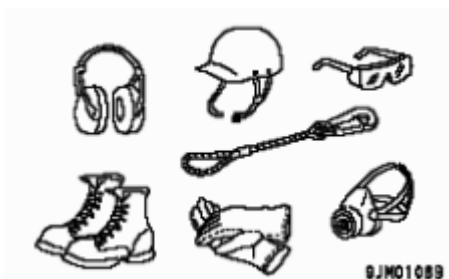
Failure to comply with these regulations could result in an accident, serious injury or death.

- Before repairing the machine, read all labels, graphics and this Operator's Manual. Each instruction contains

important information about the maintenance of the machine.

- Do not perform any work on the machine unless you have the correct knowledge and training for the correct use of the machine.
- Using incorrect repair methods is very dangerous. Make sure that you have sufficient knowledge, correct information, suitable tools and equipment to repair the machine. Tools and equipment required to repair the machine.
- When pouring/draining oil or fuel, avoid spilling it. When the liquid cannot be drained directly into a container, use a pump or connect a hose to drain the liquid safely. Because oil spilled on the ground will pollute the environment and may also cause a fire. Used oil and other liquids should always be handled by an authorized waste disposal company.
- Machines used in contaminated areas (polluted environments and unsanitary areas) should be equipped in a special way. In addition, special safety regulations must be observed when repairing such machines.
- Check that all anti-skid protection is firmly fixed. If not, tighten or replace it.

- Since the various logos and films on the outside of the machine are glued, high-pressure washing should not be directly aimed at their surfaces. If they are damaged or lost, they should be replaced.
- Make sure that there is no oil, diesel fuel, dirt or ice on the surface of the steps, maintenance areas, handles and anti-skid surfaces.
- Do not step on machine parts that are not designed to be stepped on.
- Do not step on machine parts that are not designed to be stepped on.
- When working on the machine, do not wear loose clothing, such as headscarves or jewelry, which may be caught and cause injury.



- Always wear a hard hat, safety glasses, gloves, safety shoes, and other necessary protective equipment.
- When servicing the machine, the engine must be shut off unless otherwise stated on the sign or in this manual.



Warn!

If work must be done before the machine has cooled down, be careful of overheated fluids and parts, which may cause burns.

- When changing the lubricating oil in the engine or the hydraulic oil in the hydraulic system, remember that the oil may be very hot and may cause burns.
- When lifting or supporting parts, the rated load of the lifting equipment used must be at least the same as the weight of the lifted part.
- All lifting devices, such as slings, slings, ratchet locks, etc. must comply with national regulations on lifting devices. The company will not assume any responsibility if the lifting devices, tools or working methods specified in this manual are not used.
- When looking for leaks, paper or wood chips must be used instead of directly using hands.
- Before starting maintenance and inspection work, the pressure in the hydraulic system must be released.

Before opening the engine cover, radiator housing, etc., turn off the engine and make sure that there are no tools and other items left in the machine that may cause damage.

- Before starting the engine, make sure that all covers on the machine are closed and then start the machine.
- All pressure vessels must be opened very carefully to release any residual pressure. When the engine is stopped, residual pressure still builds up in the system. If it is opened before the system pressure has been vented, the fluid will be ejected under high pressure. Similarly, the tightness check of leaking connections and joints should only be carried out after all the pressure in the system has been completely vented.

Hydraulic system: must not be subjected to any external forces.

- Scrapped accumulators should be perforated before being discarded, otherwise they may explode later.
- Do not adjust the pressure of the safety valve to a pressure higher than the pressure recommended by the manufacturer.
- The installation of equipment such as communication radios and mobile phones must be carried out in accordance with the manufacturer's instructions to avoid interference with electronic systems and electronic

components that maintain the function of the machine.

- Do not stay in front of or behind the machine when the engine is running.
- After the maintenance work is completed, close and tighten the engine hood and all protective plates.
- Measures related to electric welding.

(1) Preventive measures



Warn!

If the machine is used in an environment with a high risk of fire, such as an explosive environment, special equipment is required.

Note: If you use a high-pressure water gun to clean the machine, be very careful, because electrical components and wires can be damaged even at relatively low water pressure and temperature. Protect electrical components and wires with appropriate methods. At the same time, turn off the engine and battery switches.

- Be alert to the risk of fire. Learn to use a fire extinguisher and know where to store it so that you can find it immediately when you need it.

- Even if there are only a few signs of fire, have a strong sense of safety and take the following measures if conditions permit:

- Keep the machine away from fire hazards.



- Lower the attachment to its parking position.
- Turn the start switch to the stop position.
- Leave the cab.

- Turn off the battery switch.
- Extinguish the fire. Notify the fire department if necessary. If the machine is equipped with a portable fire extinguisher, it should be of the ABC type, which means that it can extinguish fires caused by both solid organic materials and liquid organic materials, and the extinguishing agent is non-conductive. The effectiveness level 1 means that the fire extinguisher must be effective for at least 8 seconds, level 2 at least 11 seconds, and level 3 at least 15 seconds.
- When filling with fuel or the fuel system is open, smoking is prohibited near the machine and there is no open flame around the machine.
- Diesel is flammable and cannot be used for cleaning. Approved solvents should be used.
- Remember that some solvents can cause skin rashes and constitute a fire hazard. Do not inhale the vapors of such organic solvents.
- Store flammable starting aids in a cool and well-ventilated place. Remember that this auxiliary agent must not be used with electric preheating devices.

- Keep the area where maintenance work is carried out clean. Cleanliness is essential for the proper functioning of each system in the machine. Oil or water can make floors and steps slippery and are also dangerous to the associated electrical systems and power tools. Oily clothing or cloths soaked in grease are serious fire hazards.
- Check machines and equipment every day to keep the various guards free of dirt and oil. This will reduce the risk of fire.
- Keep the machine especially clean when working in sensitive environments (such as sawmills, garbage dumps or similar places). When operating in such environments, the machine should be equipped with suitable equipment (such as muffler covers, radiator baffles, high-power fans or pre-filters, etc.) to reduce the accumulation of flammable materials.
- Any fire-fighting equipment on the machine should be in working order. Some additional equipment can also be used for fire prevention and can be used by the operator in the event of a fire, but these equipment cannot replace the fire prevention work that the operator should do himself.
- Check the wires to confirm that they are not damaged by friction and will not be damaged by friction. This

method is particularly suitable for unfused wires, such as:

- Between batteries
- Between batteries and starters
- Between alternators and starters
- Wires to preheating elements

- It is important to check unfused wires after disconnecting them to confirm that their connection and clamping method will not be damaged by friction. Unfused wires should not be placed against various oil pipes.
- When installing any additional equipment, make sure that all wires (circuits) are connected to a fuse and the selected route and clamped to prevent friction.
- Check the fuel hoses and hydraulic system pipes to confirm that they are not damaged by friction.
- Welding and grinding work can only be carried out in clean places, and not in places filled with compressed air or flammable liquids, such as oil tanks, hydraulic pipes or similar. Special care must be taken when welding and grinding near flammable materials. The operator should always have a fire extinguisher ready.

- Materials such as batteries, plastic objects and other materials that may endanger the environment should not be simply discarded. It should be ensured that the treatment method adopted does not pollute the environment.

Hazards associated with polymers

Working on painted surfaces



Warning! When heated, the paint decomposes and forms a number of compounds. These substances may have a pungent odor and frequent or prolonged exposure to them may be a threat to your health.

CAUTION: Always wear a gas mask during all paint removal operations.

- When welding and gas cutting, first remove the surface paint, including the area within a radius of at least 10 cm (4 inches) around the work point. Heated paint can release gases that are harmful to health.
- Never weld on painted surfaces. In addition to the health risks, this will result in poor weld quality, reduced strength and even possible cracking of the weld in the future.

- Use sandblasting to remove the paint from the work area. If sandblasting does not remove the paint, other methods must be used, such as using a paint stripper.

Rubber and Plastics

CAUTION: Polymeric materials form compounds that are harmful to health and the environment when heated.

- Do not weld or cut close to polymeric materials (rubber and plastic parts) if they are not thermally insulated.
- Do not burn polymeric materials when scraping them.
- Be careful when handling machinery that has been burning or exposed to strong heat.
- Always wear gloves, goggles and an approved gas mask.



Fluorine rubber



WARNING! Some seals are subject to very high operating temperatures (e.g. engines, main valves, hydraulic motors and oil pumps). They are made of fluororubber, which forms hydrogen fluoride and hydrofluoric acid when heated to high temperatures. This acid is very corrosive and cannot be washed off the skin, causing severe burns that take a long time to heal.

Checklist

When handling a machine that has been damaged by fire or exposure to strong heat, the following precautions must be taken in all cases:

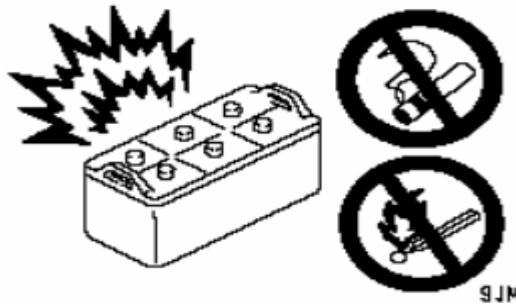
- As a precaution, handle seals (O-rings and other oil seals) in the same way as fluororubber products.
- Do not touch burnt parts, otherwise you may come into contact with molten polymer. First, wash thoroughly with a large amount of limewater (a solution or suspension of calcium hydroxide, i.e. slaked lime in water); use thick protective gloves made of rubber and wear protective glasses that can effectively protect the eyes.

- If it is suspected that the skin has come into contact with burned fluororubber, immediately apply hydrofluoric acid burn ointment, etc. and consult a doctor promptly. Symptoms will appear after several hours.
- Discard protective gloves, rags, etc. that may have come into contact with the burned fluororubber.

(2) Battery

Regulations on batteries

Important! Batteries contain substances that are harmful to health and pollute the environment. Therefore, scrapped batteries must be properly disposed of in accordance with relevant local and national regulations.



- Batteries emit explosive gases. Do not smoke around batteries.

- Electrolyte is corrosive. Prevent electrolyte from splashing onto unprotected skin. If splashed, rinse with water for 10-15 minutes.
- To remove the battery, first disconnect the ground wire (earth wire). To reduce the risk of sparks (which can cause fire), always connect the ground wire last when installing the battery.
- Do not tilt the battery excessively in any direction, otherwise the battery electrolyte may leak.
- When charging the battery, follow the regulations on the next page.
- When using a spare battery to help start the engine, follow the regulations on the next page.
- Do not connect an uncharged battery to a fully charged battery. The current surge can cause the battery to explode.
- Make sure that metal objects (such as tools, rings, watchbands) do not come into contact with the battery terminals, otherwise there is a risk of injury or fire. The poles and battery terminal caps should be reinstalled frequently.
- When using a battery from another machine as a starting power source, do not allow the two machines to come

into contact, as this will damage the electrical systems of both machines.

- Start the engine on the machine with the auxiliary battery first, let it idle for a few minutes, and then start the engine on the machine with the battery to be charged.
- Batteries contain substances that are harmful to health and pollute the environment. Therefore, scrapped batteries must be properly disposed of in accordance with relevant local/national regulations.



Warning! When an uncharged battery is connected to a charged battery, the resulting current shock may cause the battery to explode, resulting in personal injury or death. When starting with an auxiliary battery, check that the battery or other power source has the same voltage as the standard battery.

Proceed as follows:

1. Turn off the battery switch.
2. Remove the battery post cap.
3. Prepare a 12-volt battery for connection.

4. Connect a jumper wire from the (+) terminal of the machine battery to the (+) terminal of the auxiliary battery.
5. Connect another jumper wire between the (-) terminal of the battery and the machine ground point.
6. Turn on the battery disconnect switch and connect the machine battery.
7. Start the engine with the starter key in the cab.
8. After the engine starts, first remove the jumper wire from the machine and then remove the other end of the jumper wire from the (-) terminal of the auxiliary battery pack.
9. Reinstall the battery post cap.

Battery Charging



Warning! When charging the battery quickly, remove the battery cover (except for maintenance-free batteries) until charging is completed. When the battery is charging, an explosive mixture of hydrogen and oxygen will be formed. Short circuit, open flame or spark close to the battery will cause a strong explosion.

- Before removing the charging clamp, cut off the charging current.
- Ensure good ventilation, especially when charging in a confined space.
- Battery electrolyte contains corrosive sulfuric acid. Any electrolyte spilled on the skin should be removed immediately. Use soap and plenty of water to rinse. If the electrolyte splashes on the eyes or other sensitive parts of the body, immediately rinse with plenty of water and seek medical attention as soon as possible.

(3) Air conditioning

Refrigerant

Overview

R134a refrigerant is used in air conditioning units. Air conditioning units using R134a have a label plate next to the receiver-dryer. R134a does not have the potential to deplete the atmospheric ozone layer, but it increases the greenhouse effect and should not be intentionally discharged into the outdoor air. R134a refrigerant is moderately harmful to health.

Service equipment

Equipment such as pressure vessels, filling stations, vacuum pumps and hoses can be used for service, but only one type of refrigerant can be filled. This type of refrigerant must not come into contact with another refrigerant. Even small amounts of R12, for example, can have a significant decomposition effect on R134a. This in turn can destroy parts in the refrigeration unit.

Personal protective equipment

If there is a risk of contact:

- Wear tight-fitting goggles, protective gloves to protect exposed skin (risk of frostbite).



- Do not wear contact lenses.

Health risks

When the refrigerant is in liquid form, it can cause frostbite. Its gas has some effects on the human body in low concentrations, especially on the nervous system.

Large amounts of gas may have a narcotic effect. Due to the risk of explosion, components or containers containing refrigerant must not be exposed to temperatures above +40°C (+104°F).

First aid measures in the event of an accident

- If you accidentally come into contact with spilled refrigerant, take the following measures:
 - Refrigerant in gaseous form. When heated, in low concentrations, it can be harmful to the human body, especially to the nervous system. In high concentrations, the gas has narcotic properties. In both cases, the person must be removed from the danger zone to the fresh air outdoors. In serious cases, seek medical attention immediately.
 - If a large amount of liquid refrigerant has come into contact with the eyes, rinse them with lukewarm tap water. If

there are other symptoms, consult a doctor.

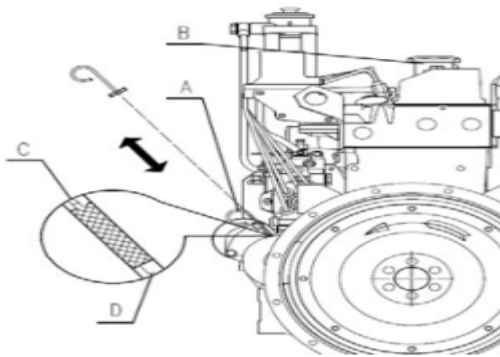
- When working with refrigerants, be extremely careful.
- Air conditioning systems contain pressurized refrigerant. Refrigerant must not be deliberately discharged into the environment. If the air conditioning system must be opened, the refrigerant must first be collected in a special pressure container for reuse or destruction.
- The air conditioning system is a pressurized device and the refrigerant may leak. Do not disconnect the connecting pipes or remove the filling plug on the compressor. If you suspect a leak, do not try to fill it yourself. Contact an authorized special maintenance center, who will take appropriate measures and methods to deal with it.
- When emptying (disassembling) or refilling (charging) the refrigerant, special equipment must be used.
- Refrigerant vapor is heavier than air and will sink to the ground.
- No smoking, welding or other open flames are allowed where refrigerants are used. Otherwise, the refrigerant gas will ignite and form toxic gases. Inhalation of such gases is very dangerous. The gases formed after heating

have a pungent smell in high concentrations.

(4) Engine

Checking the oil level

1. Open the engine hood.
2. Pull out the dipstick (A) and wipe it dry with a clean cloth.
3. Reinsert it and then remove it.
4. If the oil level is between C and D, it is normal. If the oil level is below mark D, add oil to the appropriate level through the filler port (B).



A Dipstick

B Filling port

C High oil level mark H

D Low oil level mark L

Change engine oil



Warn!! Hot lubricant can burn unprotected skin.

Project	Maintenance interval
---------	----------------------

		Every												
		50 Hour	75 Hour	100 Hour	150 Hour	200 Hour	400 Hour	500 Hour	1 or 2 months	1 year	800 Hour	1500 Hour	3000 Hour	2 years
* Check fuel hose and pipe clamps		☆												
Change the oil	(1) Oil pan depth (101mm,3.98 in.)	★	☆											
	(2) Oil pan depth (121 mm, 4.76 in.)	★		☆										
	(3) Extended oil pan depth (101 mm, 3.98 in.)	★		☆										
Check fan belt tension and damage				☆										
*Clean the air filter element (please replace the filter element after cleaning 6 times)				☆										
Clean the fuel filter (element type)				☆										
Check the battery electrolyte level				☆										
	(1) Oil pan depth (101 mm, 3.98 in.)	★			☆									

Replace the oil filter element	(2) Oil pan depth (121 mm, 4.76 in.)	★				☆								
	(3) Extended oil pan depth (101 mm, 3.98 in.)	★				☆								
Check radiator hoses and clamps						☆								
* Check the air intake line						☆								
*Replace fuel filter														
Clean the water pipe sleeve and the inside of the radiator								☆						
Replace the fan belt								☆						

(1) This oil pan depth is an optional value for Z482-E3B and D722-E3B.

(2) This oil pan depth is a standard value for Z482-E3B, D722-E3B and D782-E3B.

(3) This oil pan depth is a standard value for Z602-E3B and D902-E3B.

★ After the first 50 hours of operation, please replace the engine oil and oil filter element.

According to the U.S. Environmental Protection Agency (U.S.EPA) non-road engine emission standards, the

above items (marked with *) are listed by Kubota as important emission-related parts. As the owner of the engine, it is your responsibility to perform necessary maintenance on the engine in accordance with the above instructions.

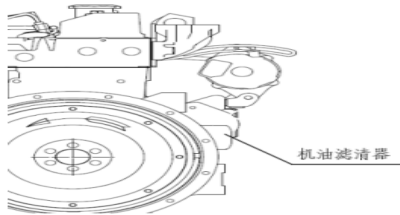
Oil change

1. Place the machine in the maintenance position.
2. Place a container (20 liters or more) at the bottom of the engine oil pan below the drain valve.
3. Open the drain valve.
4. Drain the lubricating oil.
5. Close the drain valve.
6. Fill the lubricating oil through the oil filling port (B).

When handling waste oil and waste liquid, pay attention to protecting the environment!

Replacing the engine oil filter

The engine oil filter should be replaced every time the oil is changed. The lubricating oil filter is a disposable device and cannot be cleaned and reused. It must be replaced in its entirety.



Removal

Use appropriate tools to carry out

After installation

1. Start the engine and check the gasket tightness. If the seal is not good, remove the filter and check the sealing surface.

Note! Usually, tightening the filter too much will not help improve the sealing condition.

Important!

After changing the oil filter, the engine must run at low idle speed for at least 1 minute. It is important to fill the filter

with lubricating oil before installation. This is to ensure lubrication immediately after starting.



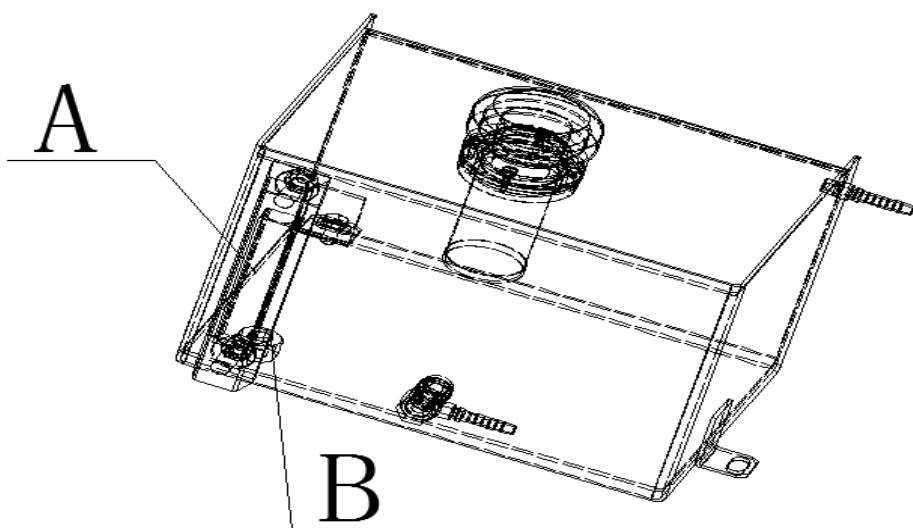
Warn! Waste oil/waste liquid should be disposed of in an environmentally friendly manner.

(5) Fuel system

Fuel tank

A clean fuel tank is essential for trouble-free operation of the diesel engine. The fuel tank holds 15 litres of fuel.

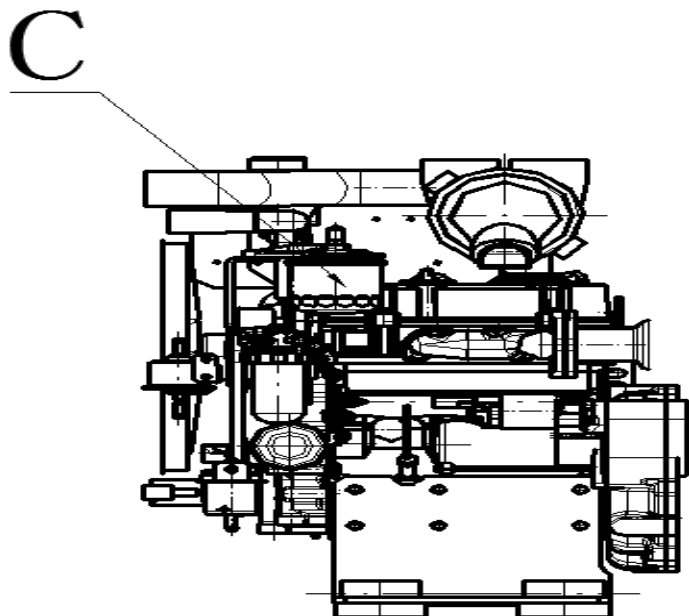
Before opening the fuel cap, wipe the area around it clean. When filling, avoid spills. Spilled fuel attracts dust. In cold weather, keep the fuel tank full to prevent condensation in the tank.



Note: Avoid damage to the fuel tank level gauge (A) by solvents or other contamination. Drain the sediment every 100 hours.

Open the drain valve (B) at the bottom of the fuel tank and drain the sediment.

Replace the fuel filter



Replace the fuel filter every 1000 hours. The filter is a disposable device, which means it does not need to be cleaned and must be replaced completely.

Removal

1. Use the appropriate tool to remove the fuel filter (C).

Installation

1. Coat the gasket with diesel fuel.
2. Screw the filter on by hand until the gasket is in contact with the sealing surface.
3. Then tighten the filter 1/2 turn
4. Expel air.

Draining the water separator

The water separator is located on the side wall of the diesel tank. Place a container at the hose below the water separator and open the drain button to drain the water.

Draining air from the fuel system



Warn! If the oil in the tank runs dry or air enters the system for some reason, the air must be bled from the system.

Under no circumstances should the fuel system be leaked before starting the engine. Otherwise, the fuel injection pump may be seriously damaged.

Overview

1. Wipe around the cylinder head bleed valve bleed plug.

Fuel filter

2. Unscrew the bleed plug and pump oil with a hand oil pump until there are no air bubbles in the flowing fuel.
3. Tighten the bleed nipple while fuel is flowing out

Cylinder block

4. Open the cylinder block bleed valve bleed plug.

5. Operate the hand oil pump until only fuel flows out without air bubbles.
6. Tighten the bleed nipple while fuel is flowing out.

After the air is discharged

7. Let the engine run at a high idle speed for about 10 minutes.
8. Check after starting to confirm that there are no leaks.

(6) Air filter

Overview

The air filter prevents dust and other impurities from entering the engine. The air first enters the main filter and then the auxiliary filter. The degree of wear on the engine depends largely on the cleanliness of the intake air. Therefore, it is very important to check the air filter regularly and maintain it properly. When working with the air filter, keep it clean at a high level.

Important!

Under no circumstances should you operate the engine without a filter installed or with a damaged filter.

Check the hose and duct from the air filter to the engine intake manifold regularly to confirm that there are no leaks. Prepare a spare air filter and store it in a dust-proof place.

Air filter

Cleaning the air filter

When the instrument panel displays the air filter dirty alarm, the air filter should be cleaned

Note: In dusty and humid conditions, it should be cleaned every day.

Proceed as follows:

1. Loosen the mounting nut, open the cover, and carefully pull out the main filter element;
2. Empty and clean the main filter, filter cover and barrel wall;
3. Reinstall.

Main filter

The filter can be cleaned up to 6 times, after which it must be replaced. If the filter is damaged, it should also be

replaced promptly.

Note:

The auxiliary filter cannot be cleaned.

Since the interval between filter changes depends entirely on the working environment of the machine, it may sometimes be necessary to replace the filter more often.

Cleaning the Main Filter

Mechanical Cleaning

1. Carefully tap the end of the main filter on a soft, clean surface.

Note: Do not lean on a hard object to tap.

Clean with compressed air and light inspection.



1. Use clean, dry air at a maximum pressure of 500 kPa. The distance between the nozzle and the filter should not be less than 3-5 cm (1-2 inches)

2. Blow the filter clean from the inside along the folds.

3. Check the filter

Check the filter with the help of a light. Even if there are small holes, scratches, cracks or other damage, the filter must be replaced.

Replacing the main filter

Press the main filter with both thumbs at the same time and pull it out. This prevents the auxiliary filter from being pulled out with the main filter.

Replacing the auxiliary filter

If the main filter is damaged, the auxiliary filter will work as a protective filter. If the main filter has been replaced or cleaned, but the indicator light is on, it means that the auxiliary filter is blocked.

Note: The auxiliary filter can only be replaced and not cleaned. When replacing the main filter, replace the auxiliary filter at the same time.

(7) Cooling system

Overview

If the engine temperature is too high, the radiator should be cleaned even if the coolant level is normal.

Important! Be careful not to damage the fins on the radiator core. If the engine temperature is still too high, contact an authorized special repair center for remedial measures.



Warn! Compressed air, steam or water may harm the body. Protective eyewear must be worn.

Clean all fins every 500 hours

1. Remove all dirt, dust and leaves adhering to the radiator fins with compressed air. After removing the radiator cap, clean the radiator with compressor air.
2. Clean the grid in front of the oil cooler, the condenser fins of the charge air cooler and the air conditioner.
3. Check the rubber hoses for damage and cracks. If damaged, the hoses must be replaced. Check the hose clamps for looseness.

Coolant

Coolant with antifreeze and antirust properties

Antifreeze

Check the antifreeze properties every 500 hours.

When shipped from the factory, the cooling system is filled with a mixture of the main components of the coolant, water and concentrated antifreeze, which can lower the freezing point of the coolant and increase its boiling point.

Rust Prevention

Antifreeze concentrates contain effective rust-inhibiting additives to protect the engine and radiator. These additives have a limited shelf life. Therefore, the coolant should be replaced every 2000 hours, 1 year, or 3000 hours.

Note: Do not mix antifreeze concentrates with any antifreeze or additives from other manufacturers.

Checking the coolant level



Warn! The coolant temperature is still high just after the engine is shut down. Do not open the radiator cap directly until the coolant has cooled.

Replacing the coolant

Replace the coolant every 2000 hours.

Draining the coolant

1. There is a ball valve under the radiator, and place a container under the valve.

2. Loosen the radiator cap.

3. Open the valve.



Warn!

When handling waste liquid, pay attention to environmental protection.

Filling coolant

When changing, the capacity of the cooling system is about 5.2 liters

1. After flushing, close the drain valve and open the radiator cap.

2. Fill the recommended coolant through the water filling port.

3. Let the engine run at low idle speed for 5 minutes.

4. Stop the engine, refill the coolant until it is full, and install the radiator cap.

Important! Never add cold coolant to an engine that is still hot while it is working or has just finished working. This may cause cracks in the cylinder block and cylinder head. Failure to replace the coolant in time may cause the

cooling system to be blocked, and the engine may be stuck to the cylinder.

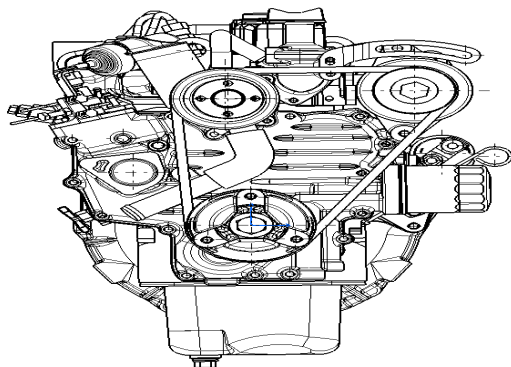
Water pump fan belt tension



Warn! When checking belt tension, the engine must be stopped to avoid injury.

Check the belt every 250 hours.

With the correct belt tension, it should be possible to depress the belt approximately 15 mm. If it is more than 15 mm, it should be replaced with a new belt.



(8) Electrical system

Battery switch

The battery switch uses a power electromagnetic suction switch and is located on the back of the fuse box mounting plate.

Important!

After work, the start key switch must be turned to the "OFF" position, otherwise the battery will run out of power and affect the battery life.

Battery electrolyte level

The battery equipped with this machine is a maintenance-free battery



Warn!

The battery gas (hydrogen) is flammable.

Do not expose it to ignition sources such as open flames, cigarettes or sparks. If the battery electrolyte is spilled

on clothing or skin, rinse immediately with clean water.

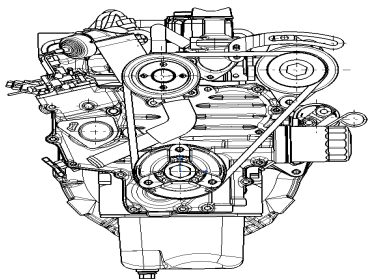
If the battery electrolyte splashes into the eyes, rinse immediately with plenty of water and see a doctor as soon as possible.

Checking the electrolyte level (except maintenance-free batteries)

1. Open the cover of the battery box on the right side of the machine.
2. Loosen the cap. The electrolyte level should be approximately 10 mm above the battery plates. If the level is too low
 1. Fill with distilled water.
 2. Operate the machine after filling to allow the water and battery electrolyte to mix, which is especially important in cold climates.
 3. Check that the cable terminals and poles are clean, well tightened and coated with vaseline or similar.

Alternator

Check belt tension



Warn!

When checking the belt tension, the engine must be stopped to avoid injury.

With the correct belt tension, it should be possible to press the belt down by approximately 15 mm. If it exceeds 15 mm, a new belt is required.

Note: Incorrect wiring can affect the operation of the alternator and damage the machine, so the following instructions should always be observed:

- The battery and alternator cables must not be disconnected while the engine is running. Otherwise,

malfunctions may occur in the alternator and electronic components.

- Before doing any work on the alternator's equipment, disconnect and insulate the battery cables.

Battery Connection

- The battery terminals must not be confused with each other. Each terminal is clearly marked with a (+) or (-) mark. If the cables are connected incorrectly, resulting in a wrong cable, the rectifier of the alternator will be damaged immediately.
- When disconnecting the battery, first use the battery switch to cut off the circuit.

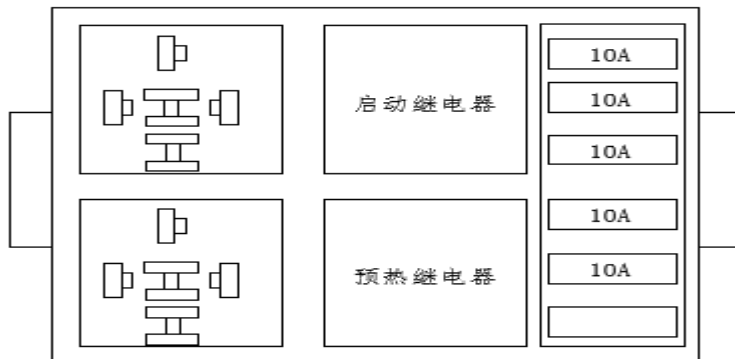
Electric Welding

- Before welding the machine or any device installed on the machine, the battery switch must be turned off.
- Before any electric welding on the machine, the battery cable must be disconnected and the cable plug must be unplugged from the electronic control unit.
- When disconnecting and reconnecting, there should be no current on the wire (turn off the battery switch).
- The grounding wire of the welding equipment should be as close to the welding point as possible.

- Before welding, remove all paint within a radius of at least 10 cm (4 inches) around the welding point. Because heated paint will release harmful gases.
- All paints will decompose when heated and form a large number of compounds, which may cause pain if exposed to them for a long time. Allergies. Health hazards.
- In addition to health hazards, the quality and strength of the weld will also be impaired, and may even lead to fractures in the weld in the future. Therefore, never weld directly on a painted surface.

Fuse Box

The machine is equipped with a fuse box, which is installed on the left side attachment under the seat. The fuse box contains fuses and relays.

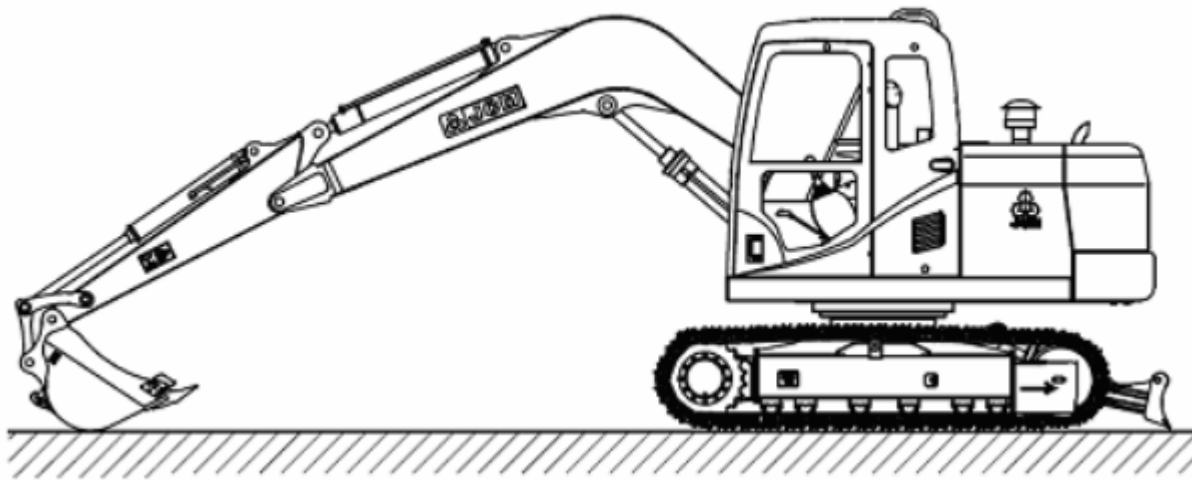




Warning! Never install a fuse with a capacity exceeding that indicated on the label. If the fuse in the same position burns repeatedly, the cause of the fault must be found. Fuses can protect electrical equipment from burning out. If the fuse is corroded, or white powder appears on the surface or the fuse is loose, the relevant circuit fault should be checked and cleared in time. Fuses that are easy to blow cannot be repaired and reused, and should be replaced in time. Note: Only original replacement fuses can be used, and when replacing, be sure to turn the start key to the "OFF" position first.

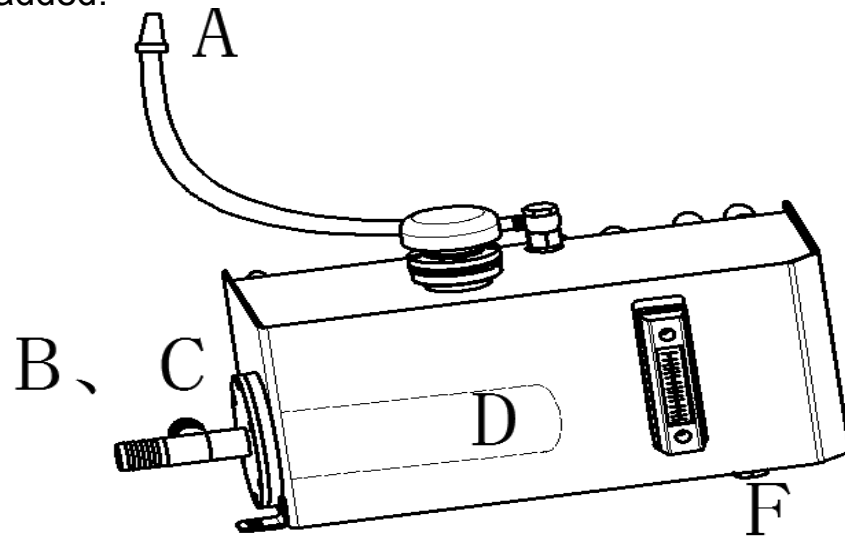
(9)Hydraulic system

Important! When filling the hydraulic oil and the hydraulic system, keep them clean. Check the hydraulic oil level and check the hydraulic oil level every day.



1. Fully extend the bucket cylinder, fully retract the arm cylinder, and lower the working device to the ground, as shown in the figure above;
2. Stop the engine;

3. Lower the safety lock handle, and move the left and right side control handles in each direction several times to remove the residual pressure in the hydraulic system;
4. Lift the safety lock handle.
5. Open the right side cover of the lower structure and check the hydraulic oil level by visual inspection, as shown in the figure below;
6. If the oil level is in the center of the level gauge, the level is normal. If the oil level is low, the hydraulic oil must be added.



Replace hydraulic oil

Replace hydraulic oil every 2000 hours



Warning! Be careful when changing the oil. High-temperature hydraulic oil can burn unprotected skin.

1. Rotate the upper structure so that the drain plug at the bottom of the hydraulic oil tank is between the left and right tracks;
2. Fully retract the bucket cylinder, fully retract the arm cylinder, and lower the working device to the ground. As shown in the attached figure;
3. Stop the engine;
4. Lower the safety lock handle and move the left and right side control handles in each direction several times to remove the residual pressure in the hydraulic system;
5. Lift the safety lock handle;
6. Release the internal pressure of the oil tank through the breathing valve (A) (a seat cover is installed on its

upper part);

7. Unscrew the cover (B);
8. Remove the O-ring (C) and the coarse filter (D);
9. Place a container under the drain plug (F);
10. Unscrew the drain plug (F);
11. Drain the hydraulic oil;
12. Tighten the drain plug (F);
13. Clean the coarse filter (D) thoroughly and reinstall it;
14. Fill the hydraulic oil and reinstall the cover;
15. Check the oil level on the level gauge;

Replace the pilot filter

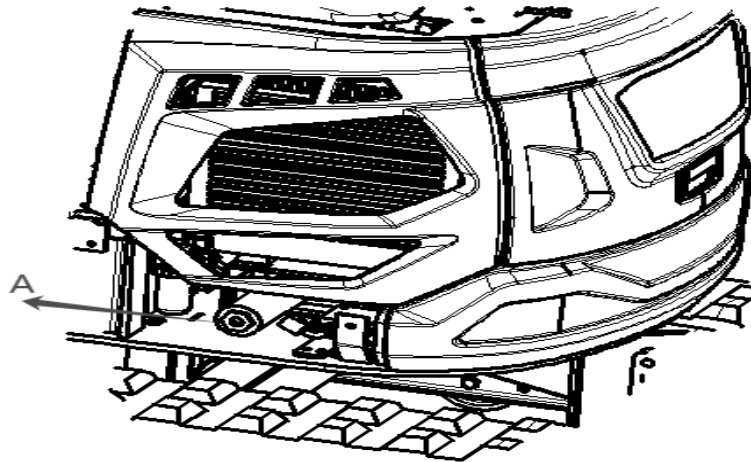
Replace the pilot filter (disposable high-pressure filter) after the first 250 hours of use, and replace it every 1000 hours thereafter.

1. Remove the left lower shell, and the pilot filter is located at A below the radiator seat.

1. Place a container under the filter.

2. Remove the filter body.

3. Replace the pilot filter.



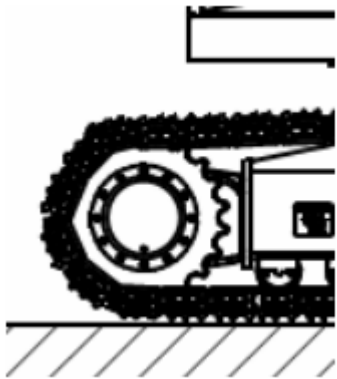
(10)Rotary drive

Overview

Important! The swing motor of this equipment uses hydraulic oil for self-lubrication to ensure the normal operation of the swing motor.

Track drive

Overview



The crawler drive motor uses a cycloidal hydraulic motor or a high-speed or low-speed plunger motor (according to user needs).

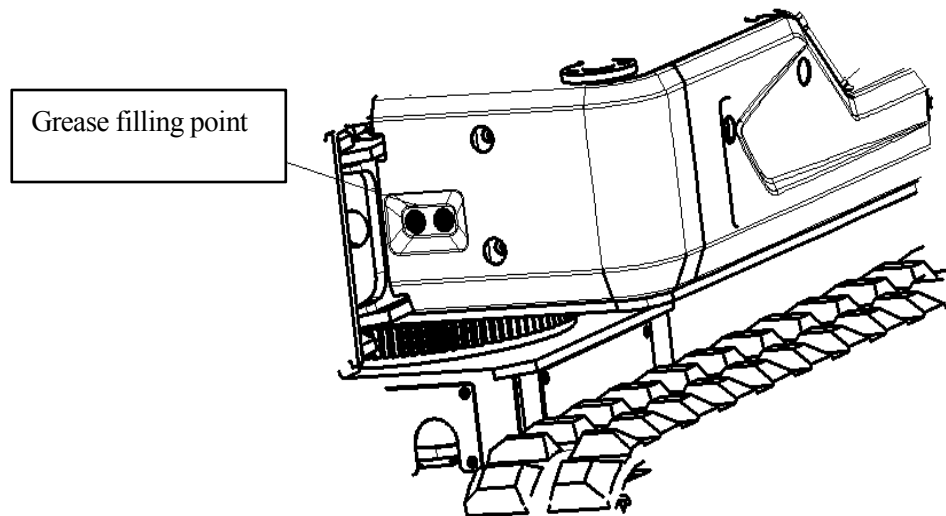
The cycloidal hydraulic motor is an advanced end-face flow distribution structure hydraulic motor. The motor uses a column-mounted rotor-stator pair, which has high working pressure and high working efficiency.

The whole machine has the characteristics of high efficiency, good maintenance and long service life.

The high and low speed plunger travel motor is a travel device that integrates the motor and the reducer. It consists of a double-displacement axial piston motor integrated in the reducer and a travel reducer.

(11) Filling and replacing grease

Grease the slewing support



This grease filling station is used to grease the inside and outside of the slewing support.

Grease every 250 hours

1. Park the machine on level ground.

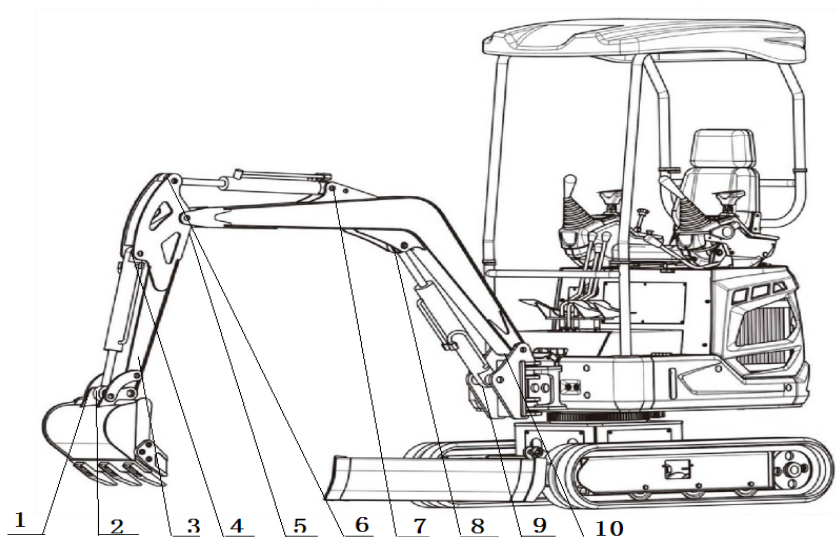
2. Lower the bucket to the ground.
3. Turn the start key to the stop position.
4. Lift the safety lock handle to securely lock the system.
5. Fill grease through the 2 grease filling nozzles.
6. Start the engine, raise the bucket to a few inches off the ground, and then rotate the superstructure one circle.
7. Lower the bucket to the ground.
8. Repeat the operation steps starting from step 3.
9. Fill the slewing support with grease until grease can be seen overflowing from the slewing support.
10. Be careful not to overfill.
11. After grease filling, clean up the overflowed grease.

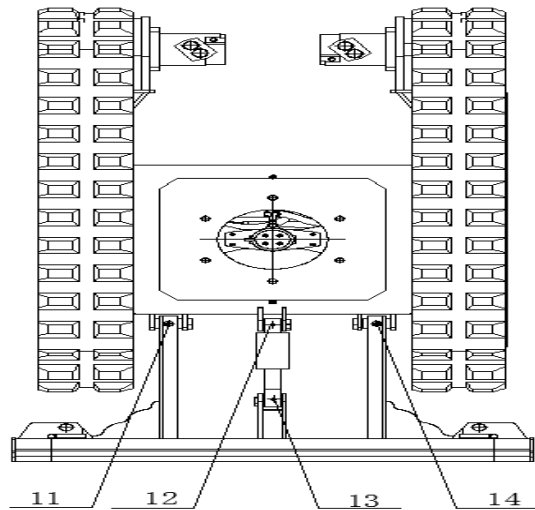
Grease the working device

Within the first 100 working hours, the new machine should be maintained every 10 working hours or every day.

After the first 100 working hours, the connecting rod system of the working device should be maintained every 50 working hours or every week.

Note: In harsh working environments (or after using a hydraulic hammer), mud, water or abrasives may enter the bearings, so the connecting rod system of the working device should also be maintained every 10 working hours or every day.





When filling manually, place the working device on the ground, as shown in the figure above, and turn off the engine. Fill grease manually or using an electric grease gun through the grease filling nozzle. After filling grease, clean up the spilled grease. After working in water, regardless of the grease filling cycle, immediately add new grease to submerged parts such as the bucket pin.

1. Two lubrication points for the pins installed at both ends of the rocker arm
2. Lubrication point for the pin at the front end of the bucket cylinder

3. Lubrication point for the pin at the front end of the arm
4. Lubrication point for the pin at the rear end of the bucket cylinder
5. Lubrication point for the pin connecting the arm and the boom
6. Lubrication point for the pin at the front end of the arm cylinder
7. Lubrication point for the pin at the rear end of the arm cylinder
8. Lubrication point for the pin at the front end of the boom cylinder
9. Lubrication point for the pin at the rear end of the boom cylinder
10. Lubrication point for the pin connecting the boom and the side swing head
- 11.14 Lubrication point for the pin connecting the bulldozer and the chassis
12. Lubrication point for the pin at the rear end of the bulldozer cylinder
13. Lubrication point for the pin at the front end of the bulldozer cylinder

(12)Track tension

Check and adjust track tension

Check track tension every 50 hours

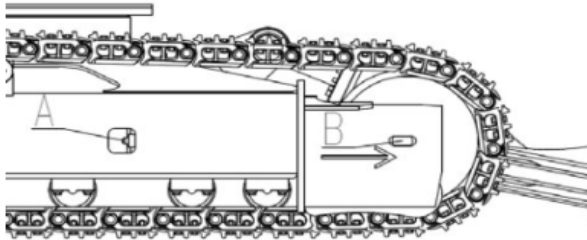
To check track tension, the track must be lifted off the ground. When taking measurements, extreme caution must be exercised to avoid dropping or moving it.

The wear of the belt connecting pins and bushings usually changes with the working conditions or the characteristics of the soil. Check the track tension frequently and keep it at the specified value. When working on wet sand or clay soil, sand and clay will adhere between the moving parts of the chassis, which will prevent the parts from meshing properly, thus causing interference and forming large loads. The abrasive particles in the material can greatly increase the wear of the sprockets, pins/bushings, rollers, idlers and track connections, and increase the load and tension of the track. Usually, the packing effect cannot be controlled, and the only way to deal with it is to clean/remove the packing material frequently.

Therefore, clean the undercarriage thoroughly, at least once a day or more, depending on the soil conditions at

the work site.

检查



1. Use the boom and stick to lift the track. At this time, slowly operate the handle.
2. From window A in the figure, use a wrench to adjust the driven wheel adjustment nut until the track tension is normal. If the track needs to be loosened, use a wrench to adjust the driven wheel adjustment nut from window A in the figure until the track is loose.

Increase track tension

1. To check the adjusted track tension, move the machine forward and backward.
2. Check the tension again. If the tension is incorrect, adjust it again.

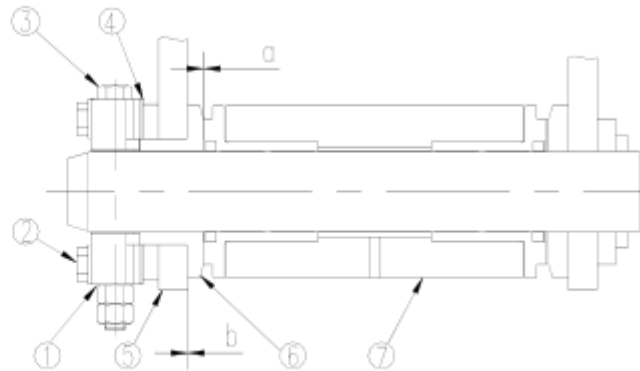
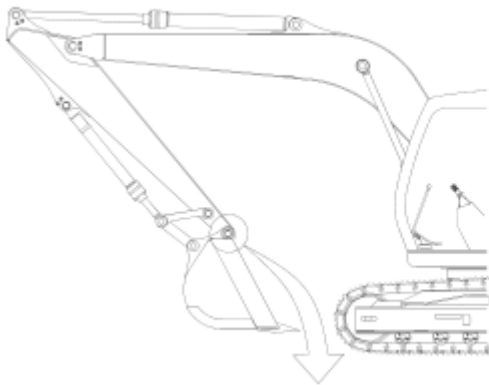
(13) Bucket clearance adjustment



Warning! When adjusting the clearance, the movement of the working device due to misoperation is very dangerous. The working device must be placed in a stable state, the engine must be turned off and the safety lock handle must be raised.

Adjust the gap

Place the working device as shown below:



1. Loosen 4 bolts ②, bolt ③ and plate ①.

2. Take out the gasket ④ that is equal to the gap a

The thickness of the gasket ④ is 0.5mm or 1mm. If the free gap a is less than 0.5mm, no adjustment is required.

3. Tighten bolts ② and ③. After the above adjustment, the gap b becomes larger and a is eliminated. In the figure, ⑤ is the bucket, ⑥ is the sleeve, and ⑦ is the arm.

Replace bucket teeth

Replace bucket teeth before the tooth holder is damaged.



Warn! When replacing bucket teeth, always lower the bucket to the ground so that it is in the most convenient working condition and turn off the engine. Place a block under the bucket and lower the bucket so it is level. Turn off the engine and lift the safety locking handle to securely lock the system.



Warn! When performing replacement operations, there will often be flying pieces, so wear goggles, gloves and other protective tools.

Replacing the tooth

1. Place a metal bar on the pin head and hit the bar with a hammer to knock out the pin. Remove the tooth.
2. Note that a metal bar with a diameter slightly smaller than the pin should be used.
3. Clean the mounting surface. Install the new tooth into the tooth holder, push the pin part way in by hand, and then use a hammer to knock the pin in and lock it to install the tooth into the bucket.

(14) Lubrication

Overview

Lubrication is an important part of preventive maintenance. If the machine is lubricated in the right way, the service life of bearings and pins can be greatly extended. Lubrication maps can make lubrication easier and reduce the risk of forgetting to fill a lubrication point.

Lubrication has two main purposes:

- Supply bearing grease to reduce wear between the pin and the bearing bushing.

- Replace old, dirty grease.

Important! Before re-greasing, clean the grease nozzle and grease gun to avoid sand and dirt particles being introduced when grease is added.

Inspection, oil change and lubrication

Measure	Period
Check: Engine oil level Coolant level Water separator drain Battery electrolyte level Hydraulic oil level Tightening of track shoe bolts Alternator belt tension	Daily = every 10 hours

Measure	Period
After completing routine maintenance: Check: Track tension Lubricate: Add grease to working device Adjust: Check and adjust track tension	Daily = every 50 hours

Measure	Period
Every 100 hours After completing the scheduled and 50-hour maintenance work: Clean: (if necessary) Sediment in the fuel tank	Every 100 hours
Measure	Period
After daily or 50, 100, 200 hour maintenance: Check: Fan belt tension Travel motor oil level	Every 250 hours

Lubrication:	
Grease the slewing support	

Measure	Period
After daily or 50, 100, 200, 250 hour maintenance: Check: Coolant Grease of slewing support gear Replace: Engine oil and filter Hydraulic oil suction filter	Every 500 hours

(First replacement after 250 hours of use) Clean: Radiator, hydraulic oil cooler and condenser fins	
Measure	Period
After daily or 50, 100, 200, 250, 500 hour maintenance: Replace: Fuel filter Water separator Hydraulic element of pilot filter (First replacement after 250 hours of use) (First replacement after 500 hours of use) Cleaning:	Every 1000 hours

Suction filter (hydraulic tank)	
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Measure	Period
After daily or 50, 100, 200, 250 hour maintenance: Check: Coolant Grease of slewing support gear Replace: Engine oil and filter	Every 500 hours

Hydraulic oil suction filter (First replacement after 250 hours of use) Clean: Radiator, hydraulic oil cooler and condenser fins	
Measure	Period
After daily or 50, 100, 200, 250, 500, 1000 hour maintenance: Replace: Air filter main element Air filter protection element Hydraulic oil Oil in travel motor	Every 200 hours

(First change after 500 hours of use) Coolant Clean: Hydraulic oil tank breather valve (if necessary)	
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Measure	Period
After daily or 50, 100, 200, 250 hour maintenance: Check: Coolant Grease of slewing support gear	Every 500 hours

Replace: Engine oil and filter Hydraulic oil suction filter (First replacement after 250 hours of use) Clean: Radiator, hydraulic oil cooler and condenser fins	
Measure	Period
After daily or 50, 100, 200, 250, 500, 1000, 2000 hour maintenance: Replace: Coolant	Every 300 hours