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YISHAN

Operation & Maintenance Manual



TIANJIN CONSTRUCTION MACHINERY WORKS
THE PEOPLE'S REPUBLIC OF CHINA

YISHAN- T160, T180, TS180, TSc180
TY160, TY180

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CRAWLER TYPE BULLDOZERS

OPERATION AND MAINTENANCE MANUAL

Tianjin Construction Machinery Works

Tianjin

People's Republic of China

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F O R E W O R D

Yishan T160/T180 series of crawler type bulldozers consist of six models -- Yishan T160, Yishan T180, Yishan TS180, Yishan TSc180, Yishan TY160 and Yishan TY180. This series of bulldozers are manufactured on the basis of Technical Cooperation Contract signed between Tianjin Construction Machinery Works (China) and Komatsu Limited (Japan), strictly in accordance with the product drawings, technological documents and quality inspection standards of D60/D65-8 supplied by Komatsu Limited, and have come up to the 1980s world level.

This series of bulldozers may be equiped with various kinds of blades and other accessories, such as ripper, planetary winch, ROPS etc., each and all can satisfy the users' widespread working requirements.

The Yishan-T160/T180 series of crawler type bulldozers, which may be equiped with 6130 diesel engine (made in China) or 6D125-1 diesel engine (made in Japan), are characterized by sufficient engine power, larger torque reserve coefficient, advanced economic indicators and lower fuel consumption.

The transmission system is divided into two kinds: the mechanical drive type and the torqflow drive type. Two kinds

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of tracks are provided: dry type (dust seal) and lubrication type, making a feature of longer life, less maintenance cost. Moreover, build-up type segmented sprocket rim is used, for easy to repair or replace at the construction site.

This Operation and Maintenance Manual describes the procedures for correct handling, necessary checking, routine maintenance and adjustment. Because these machines' construction and operation methods are special, therefore even for those who have rich experiences in driving, it is recommanded to read this manual carefully.

If you have any unclear or questionable points in the course of reading this manual, please consult with us. We shall give you a satisfactory reply as soon as possible. And, we shall correct the errors, if any, and make necessary improvements in the next edition, so as to be able to serve our customers better, and thereby to make greater contributions for the Four Modernizations of our motherland.

We apologize to users for unable to inform them one by one about the alterations made in practical production, since our products are still in continuous improvement.

We would like to take this opportunity to express our heartfelt thanks to you for purchasing our products.

In addition to the contents described in this manual, for the purpose of safe operation, please pay more attentions to

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the safety precautions indicated with ⚠ marks. Moreover, anyone who has not been approved to be qualified for driving shall not be allowed to operate this machine! All operators should at first acquire the qualification approval for driving. About this point, please refer to the section "Qualification for Driving". (See page 2)

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OPERATION

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As the drivers of this machine, the operators must be qualified for having been approved in the following respects:

1. Have been given the qualification for operating the machine through rigorous training in works or departments concerned.
2. Have definite fundamental knowledge of labour protection and safety.
3. Have a certain educational level to read the technical documents accompanied with this machine, and under the guidance of these technical documents concerned, have the ability to operate this machine correctly, to carry out the required daily maintenance works and to eliminate the common occurred troubles.

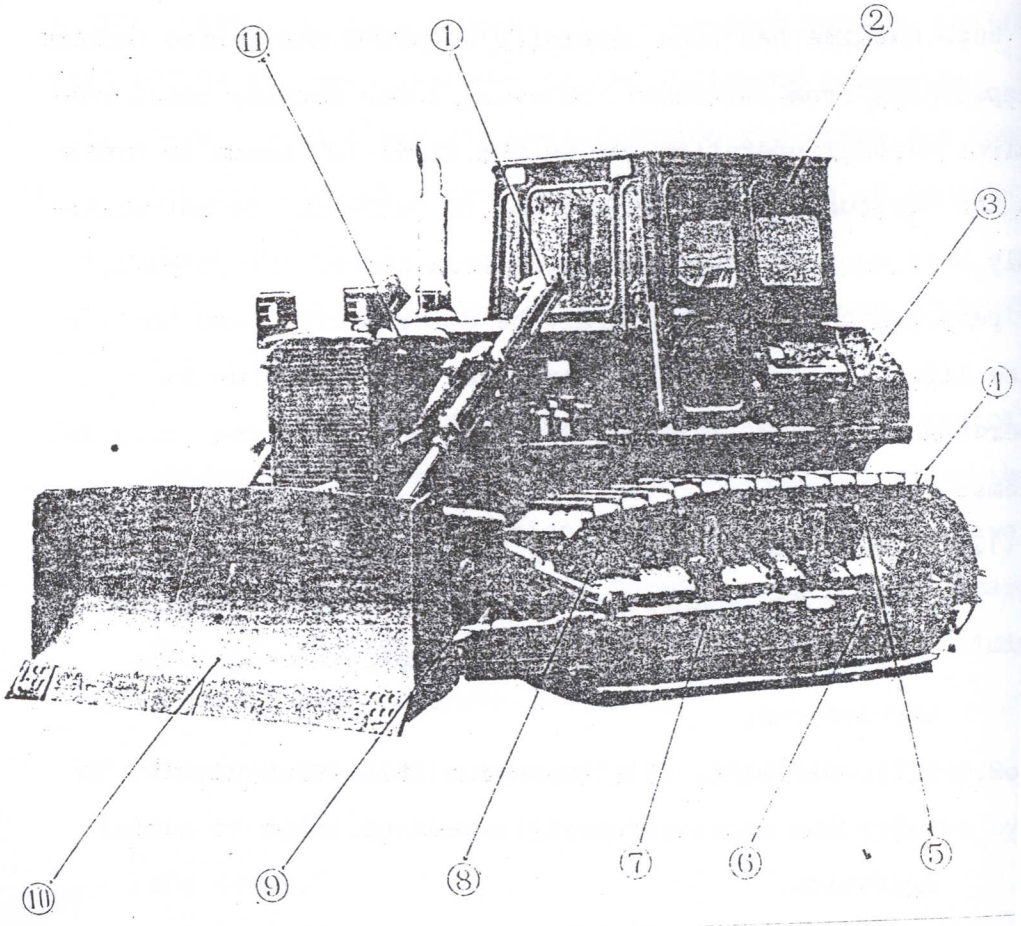
* The training centre set up by the institute of our works may accept all kinds of training tasks put forward by the users.

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Each machine had been carefully adjusted and tested before dispatching from our works. However, a new machine still requires careful operation during the first 100 hours to break in the various parts. If a machine is subjected to unreasonably hard use at the initial operation stage, the potential of performance will prematurely be deteriorated, and the service life will be reduced. Therefore, a new machine must be operated with care, particularly with regard to the following items:

1. In order to ensure safety operation of the machine, prevent the occurrence of the hidden troubles, pre-operative check and periodic maintenance must be carried out.
2. After starting, let the engine idle for 5 minutes to allow the engine properly warmed up prior to actual operation.
3. Avoid operation with heavy loads or at high speeds.
4. Sudden starting or acceleration, unnecessary abrupt breaking and sharp turning should also be avoided.

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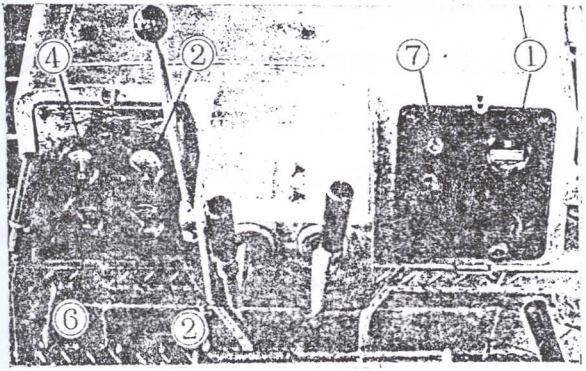


1. Blade lift cylinder 2. Cabin
3. Fuel tank for working equipment 4. Track
5. Sprocket 6. Track frame 7. Blade frame
8. Idler 9. Blade 10. Tilt cylinder
11. Engine cover

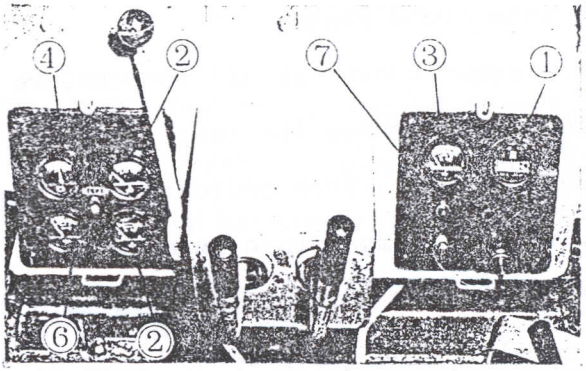
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. Descriptions of each kinds of instruments

(T160, T180, TS180, TSc180)



(TY160, TY180)



1. Service meter

This meter indicates the integrated work hours. The ser-
ce meter progresses by 1 when the engine is operated for 1
ur, regardless of the engine speed. In other words, if the
gine is running, the service meter will advance even though
e machine does not move.

2. Engine water temperature gauge and
Engine oil temperature gauge

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The water temperature gauge shows the temperature of cooling water in the engine; the oil temperature gauge shows the temperature of lubricating oil in the engine. When indicators are in the green range during operation, it shows that the water and oil temperatures are normal.

If the indicator moves from green into red range during operation, it shows the temperature is higher. At this time, run the engine at low idling speed until the indicator returns to the green range.

After engine start-up, warm up the engine until indicator moves into green range.

3. Torque converter oil temperature gauge (TY160,TY180)

This gauge shows the temperature of the lubricating oil in the torque converter. When indicator is in green range during operation, the oil temperature is normal.

If indicator moves from green into red range, reduce the work load until the oil temperature goes down.

4. Ammeter

When the engine is running, the condition of charging system is shown by the ammeter. When the pointer of ammeter is in the green range, it shows the charging is normal.

5. Charge lamp (for 6D125-1 diesel engine)

This lamp will come on when starting switch is turned ON. The charging is normal if lamp goes off as the engine revolutions increase.

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6. Engine oil pressure gauge

This gauge is used for indicating the pressure of engine lubricating oil. Oil pressure is normal when the pointer is in the green range during operation. If the pointer is in the white or red range, it shows the oil pressure is lower or higher. Stop the engine, determine the cause and take necessary corrective measures.

7. Engine oil pressure warning lamp

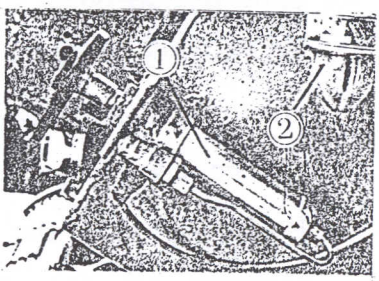
(for 6D125-1 diesel engine)



This lamp indicates pressure of engine lubricating oil.

Oil pressure is normal when lamp is off during operation. If lamp is on, it shows the oil pressure is lower. Stop the engine, determine the cause and take necessary corrective measures.

8. Low temperature starting arrangements



This arrangement consists of hand-pump (1), inlet pipe, reservoir (2), liquid feed pipe, noozle and starting liquid pressure tank. When pushing and pulling the hand-pump, the compressed air is generated, and then pressurized through the inlet pipe into the reservoir. Under the action of air pressure, the starting liquid is pressurized further passing through the

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liquid feed pipe to the noozle, which is fixed on the inlet pipe, and then from there the noozle injects a misty starting liquid to the engine inlet pipe. The misty starting liquid enters into the cylinder along with the inlet air flow. Since the fire point of starting liquid is very low, it forms the sparking centre at first when the engine is starting, and then ignites the fuel, promoting the quick starting of the engine.

9. Heater signal (for 6D125-1 diesel engine)

This signal is red heated after the starting switch is turned to HEAT about 30 seconds, it shows the engine can be started.

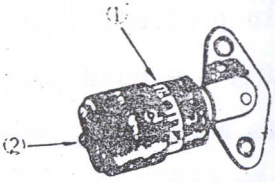


10. Dust lamp

This indicating lamp lights up when the air cleaner element is clogged, at this time, it should be cleaned immediately.

11. Dust indicator (for 6D125-1 diesel engine)

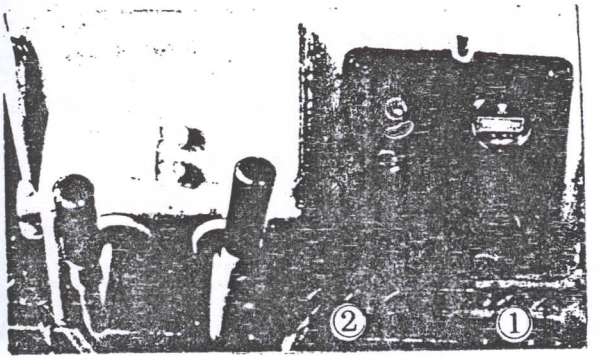
When the red piston appears in the transparent part of this indicator (1), the element is clogged. Immediately clean the element. After cleaning, push indicator button (2) to return red piston to original position.

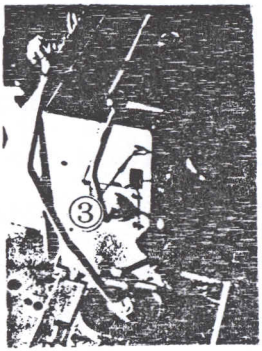


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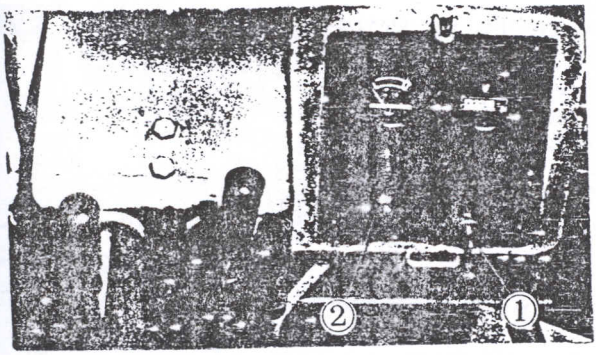
II. The usage of the switches

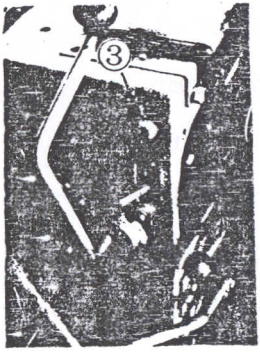
(T160,T180,TS180,TSc180)





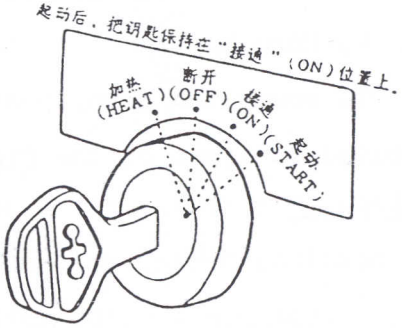
(TY160,TY180)





1. Starting switch

(used for starting the engine)



OFF

The key is in the insertion-withdrawal position. None of electrical circuits activate.

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ON

Charging and lamp circuits activate.

Keep the key at ON position after starting.

START

At this key position, the starting motor will crank the engine. Release the key immediately after starting.

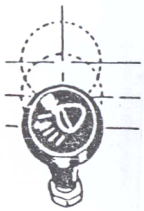
2. Heat (for 6D125-1 diesel engine)

Turn to this position when starting in cold weather, for the purpose of starting easily, because it can warm the intake air of the engine.

Release the key to allow it to return automatically to OF and then without delay, turn it to START.

3. Lamp switch

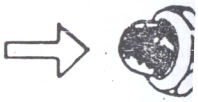
With the lamp switch in position 1, the head lamp and the illuminating lamp for gauges will light.



With the lamp switch in position 2, the rear work lamp will also light.

4. Horn button

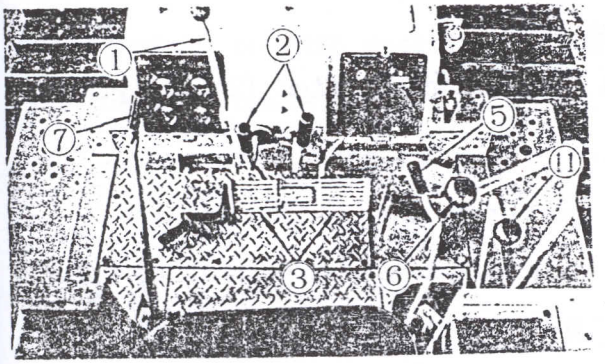
To sound the horn, push the button located in front of the right hand side arm rest.

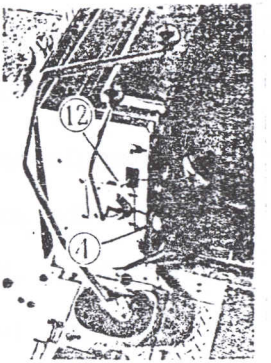


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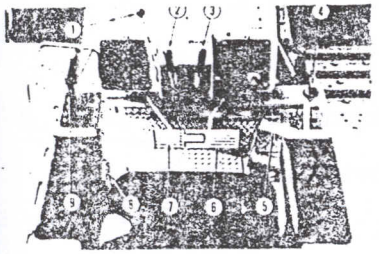
III. The usage of control levers and pedals

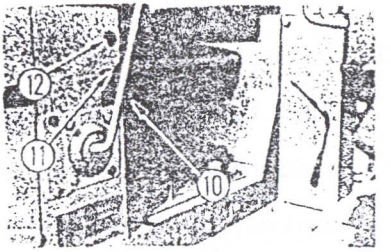
(T160,T180,TS180,TSc180)





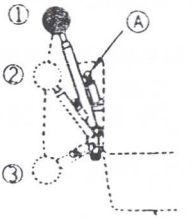
(TY160,TY180)





1. Fuel control lever

This lever is used to control the engine speed and its output.



1) Engine stop position:

Push the lever fully.

* When stopping engine, place lever in engine stop position by pushing lever beyond the low idling position after pulling the knob (A). (for 6D125-1 engine)

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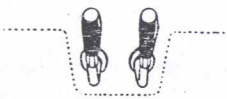
2) Low idling position:

Pull the lever from engine stop position (1) until you feel the operating force falls off.

3) High idling position:

Pull the lever from low idling position (2) fully.

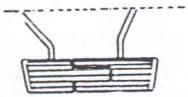
2. Steering lever



To turn the machine gently to one direction, pull the steering lever on the same side halfway.

When the steering lever is further pulled all the way out, the machine will make a sharp pivot turn.

3. Brake pedal

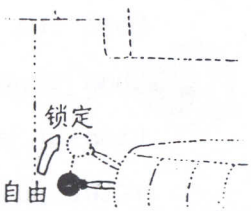


When two brake pedals are depressed simultaneously by stepping on the centre area, both right and left brakes are actuated.

When right or left brake pedal is depressed separately, the brake of the corresponding side is actuated.

⚠ Do not place your foot on pedals when unnecessary.

4. Brake lock lever



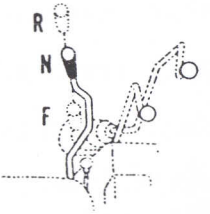
This is a locking device of the brake pedal when parking. Pull the brake lock lever upward,

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while the right brake pedal being depressed, the latter will be locked in brake position. But, if the right brake lock lever being pushed downward, the right brake pedal will return to FREE position. (There is no lock device on the left brake pedal.)

⚠ Whenever machine is parked, lock right brake pedal without fail.

5. Forward-reverse lever (T160,T180,TS180,TSc180)

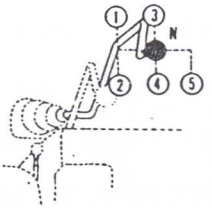


This is the lever for changing the forward and reverse direction of transmission.

F: pull the lever backward.

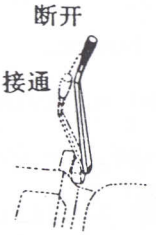
R: push the lever forward.

6. Gear shift lever (T160,T180,TS180.TSc180)



This is the lever for changing the gear shifts of transmission. There are five gear shifts for changing speed.

7. Main clutch lever (T160,T180,TS180.TSc180)

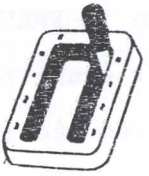


When pushing this lever forward, the main clutch is disengeged. When pulling this lever backward, the main clutch is engaged. It is necessary to use the main clutch whenever changing speed, starting and stopping.

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8. Gear shift lever (TY160,TY180)

This is the lever for changing the speed of power shift transmission.



Three speed forward and three speed reverse travel can easily be selected by simply shifting this lever to any desired speed position.

* Place the gear shift lever in the N (neutral) position before starting the engine.

9. Safety lever (TY160,TY180)



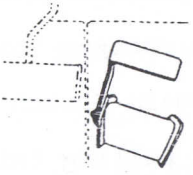
This is the locking device of the gear shift lever. Push downward this lever, it will be locked.

⚠ When the machine is stopped for a while, be sure to place the gear shift lever in N (neutral) position and set the safety lever to LOCK.

10. Decelerator pedal

(T160,T180,TS180,TSc180,TY160,TY180)

This pedal is used to decelerate the engine speed.



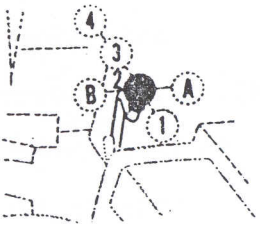
⚠ When arriving at the top of a slope, or when dumping earth from a cliff, the machine will increase its speed with the sudden loss of load.

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At this very moment, quickening of the machine may result in danger. The machine should be slowed down by depressing the decelerator pedal.

11. Blade control lever (straight-tilt blade)

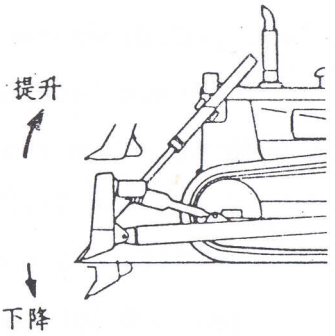
(used for operating the blade)



1: RAISE

2: HOLD

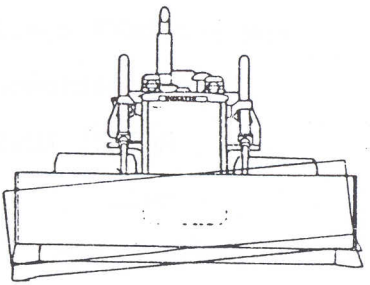
Stop the blade and hold it in the original position.



3: LOWER

4: FLOAT

The blade will float freely under the action of external force.



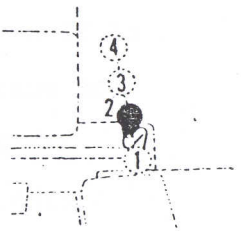
A: RIGHT TILT

B: LEFT TILT

The right and the left end of the blade respectively falls.

12. Blade control lever (angle blade)

(used for operating the blade)



1: RAISE

2: HOLD

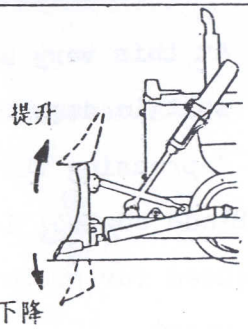
Stop the blade and hold it in this position.

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3: LOWER

4: FLOAT

The blade will move freely under the action of external force.



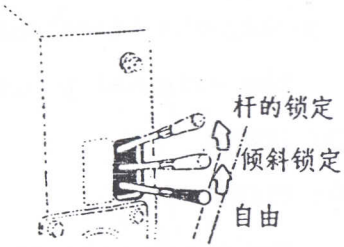
13. Safety lever (for locking the blade control lever)

1) Straight-tilt dozer

This is the locking device of blade control lever.

Lever lock position:

Lock the RAISE, LOWER and TILT operation.



Tilt lock position:

Only the tilt side is locked, but the RAISE and LOWER operation may be carried out.

Free position:

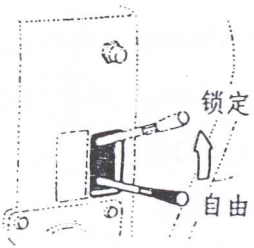
RAISE, LOWER and TILT operation may be carried out.

2) Angle dozer

This is the locking device of blade control lever.

Lock position:

RAISE and LOWER operation is locked.

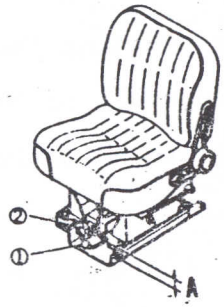


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Free position:

RAISE and LOWER operations may be carried.

D. Operator's seat



Front-rear adjustment:

When making the front-rear adjustment of the seat, only pulling the lever (1) to the left side is necessary.

Release the lever after the seat has been adjusted to the desired position.

The front-rear adjustment value is 160 mm, and it is divided into 9 stages.

Height adjustment:

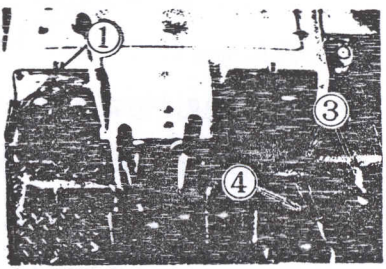
Turn the knob (2), the gap between chain's top end and rail's underside (A) can be adjusted to 0, then the most comfortable condition of the seat is obtained.

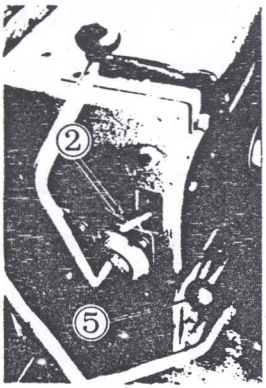
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A. Starting of bulldozers of the mechanical drive type (T160, T180, TS180 and TSc180)

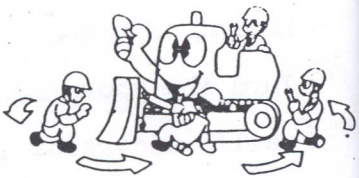
1. Before starting

Before starting the engine, make sure all of the control levers are in their correct positions.





* Carry out the pre-operative checks.
(About the check items, refer to "periodic maintenance")



1) Pull the main clutch lever (1) forward, making the main clutch to be disengaged.

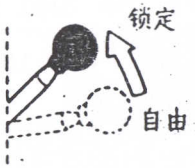


2) Adjust the seat so that the brake pedal can be depressed all the way with the operator's back against the backrest.

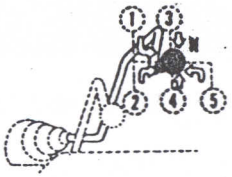


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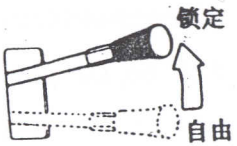
3) Make sure the right brake pedal has been locked by the brake locking lever (5).



4) Make sure the gear shift lever (3) has been moved into N (neutral) position.



5) When parking the machine, lower the blade on the ground, make sure the blade control lever has been locked by the safety lever.

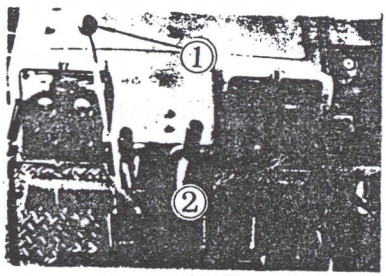


6) Make sure the FORWARD-REVERSE lever (4) has been placed in N (neutral) position.



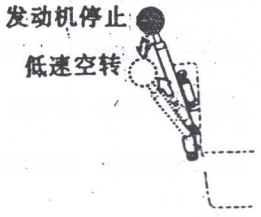
2. Starting

When starting the engine, make sure whether it is safety or not around the machine.

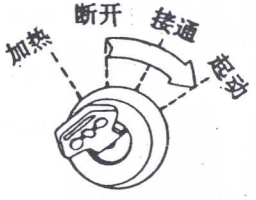


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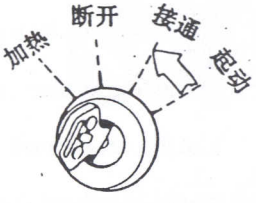
1) Set the fuel control lever
(1) to LOW IDLING position.



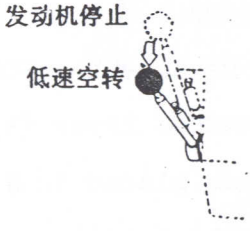
2) Turn the starting key (2) to START and start the engine.



3) After starting, turn the key (2) to ON position.



4) Place the fuel control lever
(1) to LOW IDLING position.



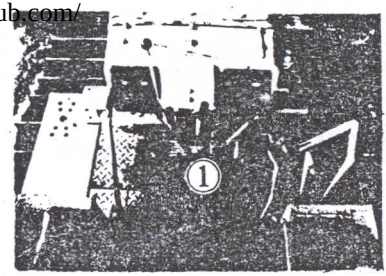
* Do not leave key in START for more than 20 seconds. If engine will not start, repeat the starting procedure after about 2 minutes.

3. Checks after starting

After starting the engine, the following items should be confirmed:

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1) Continue to run the engine at light load, until the pointers of both the water temperature gauge and the oil temperature gauge fall within the green range.

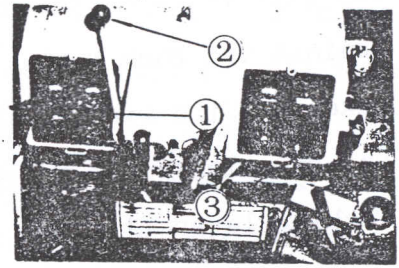


2) After warm-up run is completed, check all the gauges, caution lamp and charge lamp for proper operation.
3) Check for normal coloration of exhaust, and check whether there is any abnormal sound or vibration.

Stopping of the engine

When stopping the engine, it should be cooled slowly at first.

1) Cool the engine by running it at low idling speed for about 5 minutes.
2) Place fuel control lever (2) in ENGINE STOP position with pulling stopper knob (1).



3) Return the starting switch key (3) to OFF position and

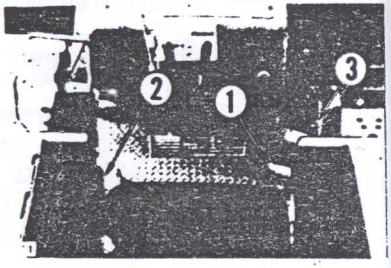
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engine to idle instead of immediate stoppage so that the engine can be gradually cooled down and ready for stoppage.

B. Starting of bulldozers of the torqflow drive type (TY160, TY180)

1. Before starting

Before starting the engine, make sure all of the control levers are in their correct positions.



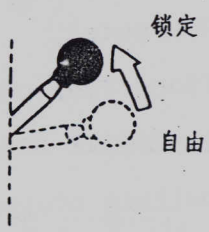
* Carry out the pre-operative checks.

(About the check items, refer to "Periodic maintenance".)

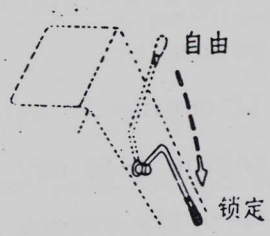
1) Adjust the seat so that the brake pedal can be depressed all the way with the operator's back against the back rest.



2) Make sure the right brake pedal has been locked by the brake locking lever (1).

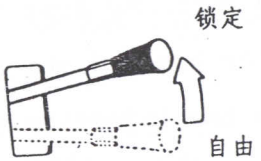


3) Make sure the gear shift lever is in the N (neutral) position, and is locked by safety lever (2).



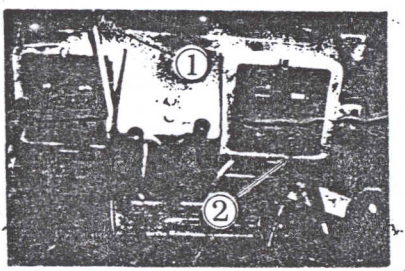
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4) When lowering the blade on the ground, make sure the blade control lever has been locked by the safety lever (3).



2. Starting

When starting the engine, make sure whether it is safety around the machine.



1) Set the fuel control lever (1) to the LOW IDLING position.

2) Insert the key (2) of the starting switch, turn the key to START position and start the engine.

3) After starting, return the key (2) of the starting switch to ON position. (Release the key, it will return automatically to ON.)

* Do not leave key in START position for more than 20 seconds. If the engine does not start, repeat the starting procedure after about 2 minutes.

C. Starting in cold weather

1. Starting with low temperature starter

(used for engine of Chinese make)

At first, it is necessary to pull the fuel control lever (1) slightly to allow it leave the LOW IDLING position,

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then open the dust cover of the receiver, insert the injector head of the starting liquid pressure reservoir into the injection port of the receiver, push the pressure reservoir to inject the liquid into the receiver (fill adquate amount of starting liquid according to the local atmospheric temperature).

Then turn the starting switch to START position. At the same time, push and pull the hand pump to start the engine, until it enters a steadily running condition.

As soon as the engine runs normally, turn the key of the starting switch to the ON position.

⚠ If a engine knock is heard when starting, you should reduce the push-pull speed and stop to pump the liquid, adjust the injection amount, so as to make the engine to start smoothly. As soon as the engine is started, the remaining starting liquid in the receiver may be used next time.

The starting liquid is combustible easily, therefore it must be placed to a place far from any heat source and prevented from direct sunlight.

2. Starting by means of heater

(used for 6D125-1 diesel engine)

At first, pull the fuel control lever (1) slightly, let it leave the LOW IDLING position, and then turn the key of starting switch to HEAT position, observe the signal

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light of the heater. As for the time needed for preheating, please refer to the following table.

atmospheric temperature	preheating time
above -5°C	——
under -5°C	30 sec

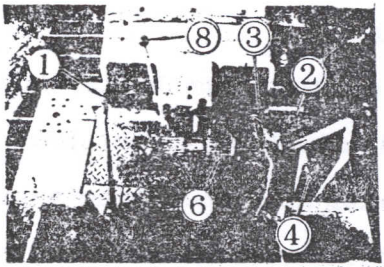
The next, when the signal light of the heater becomes red, turn the key of the starting switch to START, allowing the engine to start. As soon as the engine is started, you should turn the key of the starting switch to HEAT, so as to reach quickly a smooth running condition. At this time, you should turn the key of the starting switch to ON. The time for heating should not exceed 3 minutes.

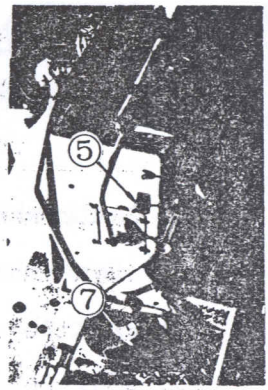
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A. Before operating

(T160, T180, TS180, TSc180)

Before operating you should examine the safety conditions around the machine.

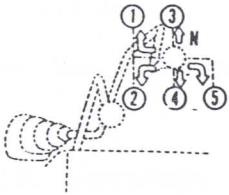




1. Push the main clutch lever (1) forward, allow it to enter the disengaged condition.



2. Set the gear shift lever (2) to the desired position.

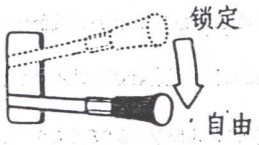


3. Push the forward/reverse lever (3) to FORWARD or REVERSE side.

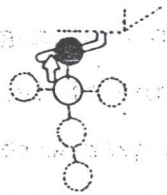


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4. Set the safety lever (5) of the blade control lever (4) to the FREE position.



5. Set the blade control lever (4) to the RAISE position, raise the blade to a height of 400 - 500 mm.



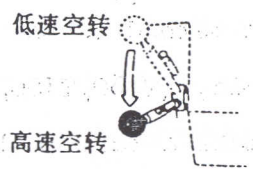
6. Depress the right brake pedal (6), and release the brake lock lever (7) to FREE position.



7. Pull the main clutch control lever (1) slowly, so as to engage the main clutch, making the machine to advance.



8. Pull the fuel control lever to increase engine speed.



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* When it is difficult to make the gears to engage, you should move the gear shift lever to N(neutral) position, and allow the main clutch to disengage slightly, so that you may change the gear's position. And then to move again the gear shift lever. you must guard against to allow the gears to be forcibly engaged.
* When starting the machine on a steep uphill grade, run engine at full throttle and move gear shift lever into 1st gear with brake pedals depressed. When machine has started slowly (or track shoes are slipping), propel the machine by slowly releasing brake pedals.

B. Gear shifting (T160,T180,TS180,TSc180)

Push forward the main clutch control lever, depress the brake pedal. When the machine has been stopped, move the gear shift lever to the desired position. The operation is the same as described in A.

C. Forward-reverse shifting (T160,T180,TS180,TSc180)

Push forward the main clutch control lever, depress the brake pedal. When the machine has been stopped, change the forward-reverse lever to the desired direction. The operation method is the same as described in A.

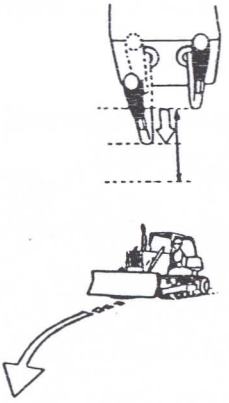
D. Turning (T160,T180,TS180,TSc180,TY160,TY180)

To make a turn while travelling, pull steering lever (1) on the side in which you would like to turn.

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1. To make a gradual left turn

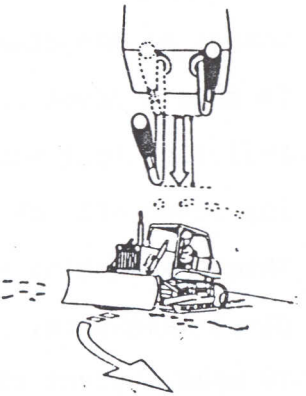
Pull the left hand side steering lever halfway (to the detent). The steering clutch will be disengaged, allowing the machine to make a gradual left turn.



* To make a gradual right turn, manipulate the right hand side steering lever in the same manner as described above.

2. To make a pivot left turn

Pull the left hand side steering lever all the way backward. The steering clutch will be disengaged and the steering brake will begin to work. Then the machine will make a pivot left turn.



* To make a pivot right turn, manipulate the right hand side steering lever in the same manner as described above.

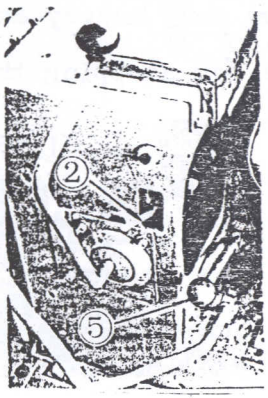
E. Turning while descending a slope

When descending such a sharp slope that the machine will go down of its own weight, or when going down a slope with a scraper or the like, you should exercise great care.

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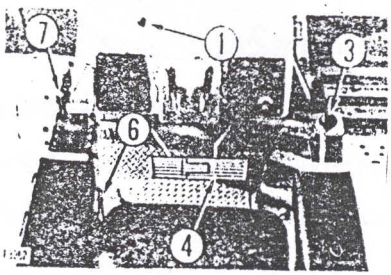
section "Handling of engine".

⚠ Always stop the machine on flat and stable ground. Avoid parking in a dangerous place.



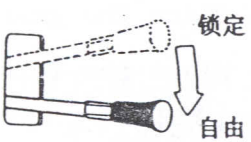
G. Before operating (TY160,TY180)

Before operating, you should make sure the environmental safety conditions of your machine.

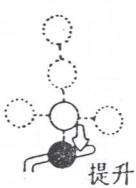


1) Pull fuel control lever(1) to increase engine speed.

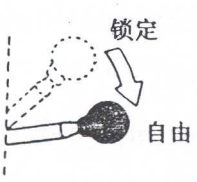
2) Unlock blade control lever(3) with safety lever(2).



3) Put blade control lever(3) in RAISE position to raise blade about 400-500 mm.



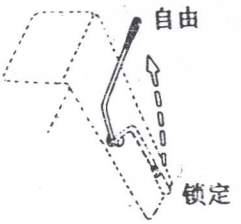
4) Depress right hand side brake pedal(4) and place brake lock lever(5) in FREE position, to



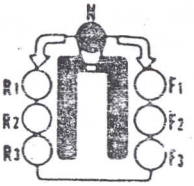
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allow the brake pedal return to original position.

5) Unlock gear shift lever(7) with safety lever(6).



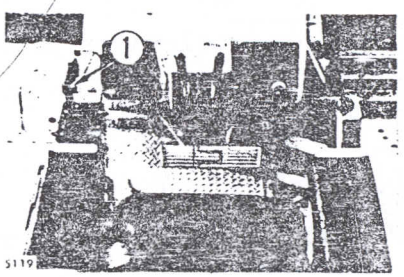
6) Put the gear shift lever(7) to a desired position and start the machine.



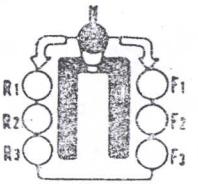
* When starting the machine on a steep uphill grade, run engine at full-throttle and put gear shift lever in 1st with brake pedals depressed. When the machine has started slowly (or track shoes are slipping), propel the machine by slowly releasing brake pedals.

- Shifting (TY160,TY180)

There is no need to stop the machine to shift gears.



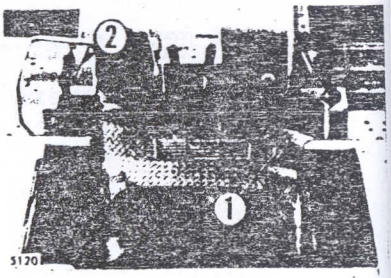
Gears can be shifted into any desired position by the gear shift lever(1).



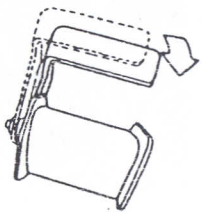
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I. Forward-reverse shifting (TY160,TY180)

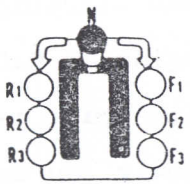
For safety purpose and preventing shock to machine, forward-reverse shifting should be made after reduction of machine speed.



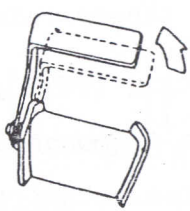
1) Lower the engine speed by depressing the decelerator pedal(1).



2) Put gear shift lever(2) to the desired position.



3) Increase engine speed by releasing decelerator pedal(1).

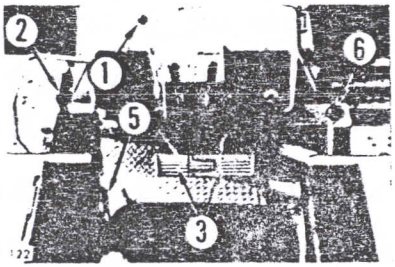


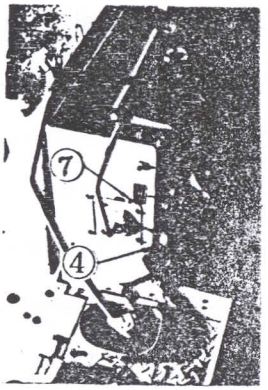
J. Stopping machine (TY160,TY180)

Stop abruptly should be avoided, leave some leeway as far as possible for stopping the machine.

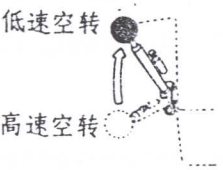
* For stopping the engine, refer to the description in section "Handling the engine".

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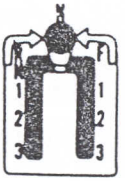




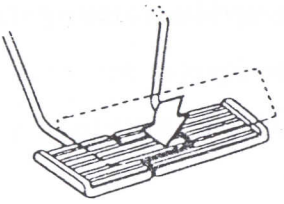
1) Push the fuel control lever(1) forward to reduce engine speed.



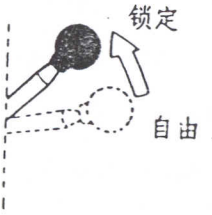
2) Place the gear shift lever(2) in N(neutral) position.



3) Depress the intersecting part of both brake pedals(3) to stop the machine.

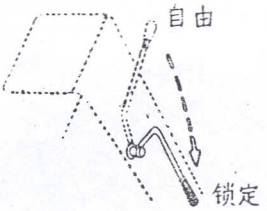


4) Lock brake pedals(3) with brake lock lever(4).

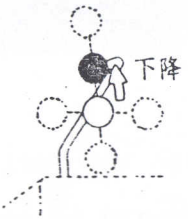


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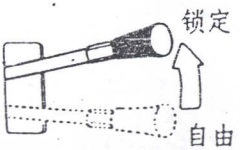
5) Lock gear shift lever(2) with safety lever(5).



6) Put blade control lever(6) in LOWER position to lower the blade to ground while keeping it horizontal.



7) Lock blade control lever(6) with safety lever(7).

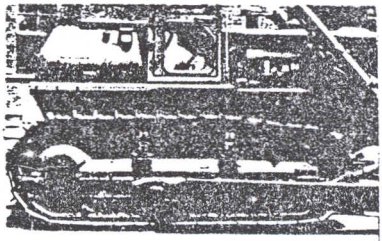


⚠ Always stop the machine on flat and stable ground. Avoid parking in a dangerous place.

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Precautions for machine operation

1. When operating the machine, if one side of the steering clutch is used frequently, or if many gradual turns are made with steering clutch half-engaged, the steering clutch will wear out in a short period. Therefore, you should select the travel road well and steer the machine properly.
2. When going downhill, put gear shift lever in low speed to run engine at slow speed and travel down slope using the engine as a brake.
3. At this time if there is danger of overrunning the engine, slow down the machine by braking.
4. When operating the machine in water, do not operate it in such a depth that carrier rollers are submerged.



5. When the engine stops on a slope, depress the brake pedals immediately and stop the machine with the work equipment lowered. Then, lock the brake pedals by applying the brake lock lever.

   Thereafter, move the gear shift lever to neutral position and proceed to the engine starting procedure again.
6. When the torque converter oil temperature gauge indicator exceeds the green range while operating, reduce load and

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wait lowering of temperature. (only for TY160,TY180)

. When operating on a dusty field, it is recommanded to spray water at first.

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The working range of bulldozers can be expanded further by attaching various kinds of optional equipments, in addition to the following illustrations.

1. Dozing

   Bulldozers may be used for digging and transporting soil and sand in a forward direction.

   Slope excavation can also be more effectively carried out by proceeding from the top downward. When dozing towards one side only, operate with angled blade (angledozer).

2. Smoothing

   Uneven ground surfaces remained after digging can be levelled off by fine operation of blade. The basic method is to operate the machine at low speeds with the blade fully loaded with soil and sand. A flat finished surface is also possible by slowly backing the machine with the blade "floating" so it is dragged across the surface. However, avoid this on rocky or stony ground, as it may damage the blade.

3. Cutting into hard or frozen ground or ditching

   For digging and ditching, hard or frozen ground can be dug effectively by a tilted or angled blade. If the ground is harder, ripper attachment may be used for better efficiency.

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4. Tree-felling and root-dozing

Trees of 100-300 mm in diameter may be fallen with the help of bulldozer by forcibly pushing 2-3 times with the blade raised. And then drive the machine backward to doze roots with the end bit of the blade. When operating, it is necessary not to drive in high speed, and try to avoid the dangers caused by shock and falling of the trees.

⚠ When tilting and angling the blade, not to do any severe operations such as root-dozing etc.

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Undercarriage life greatly varies depending on operation method, inspection and maintenance. For most efficient operations, keep the following points in mind.

A. Operation method

* Select the track shoe that best suits the type of soil to be encountered in service. Refer to the selection of track shoes, please consult with our works.

1) Do not allow shoe slipping to occur during operation. If shoe slipping occurs, reduce load until slipping stops.
2) Avoid sudden starts, acceleration or stops, unnecessary high speeds and sharp turns.
3) Always operate machine in a straight line whenever possible. When making turns, be careful not to allow the machine to stay to one side, so operation in both turning directions can be done properly. Make turns with the largest possible radius.
4) Prior to operation, clear boulders and obstacles to prevent machine from riding over them while operating.
5) On a slope, operate the machine parallel to the inclination of the slope. Do not operate across the slope. Also when on a slope, the machine should face toward the top of the slope.
6) In digging operation, if the terrain is inclined toward

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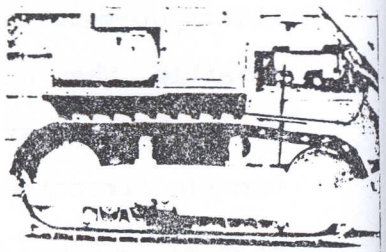
the left or the right side, do not operate on the original slope conditions, but to drive back to the horizontal ground so that to make a fresh start to dig.

7) In ripping and dozing operations, if there are exposed obsta- obstacles hardly to remove so that slipping of idlers and sprockets occurs, do not operate forcibly.

B. Inspection and adjustment .

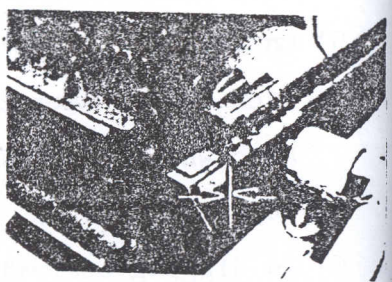
1) Properly adjust track tension.

Tension should be measured at clearance shown in photograph —— usually 20-30mm at this point. For rocky terrain, tighten tracks slightly. In clay or sandy areas, slightly loosen them. (for inspection and adjustment procedures, refer to the paragraph "Inspection and adjustment of track tension" in the section "Non-periodic maintenance".)



2) Check idlers and rollers for oil leakage as well as for loose bolts and nuts. If any trouble is detected, repair immediately.

3) Check idler guide plate for clearance. If clearance increases, idler may develop side motion and tracks may come off.



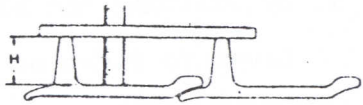
C. Inspection and repair

Frequent inspection and prompt repair will reduce repair costs.

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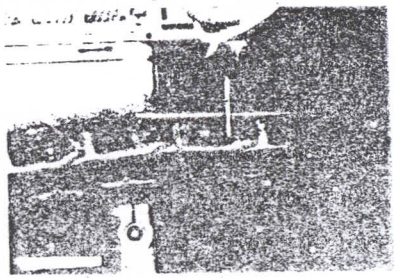
D. Measuring height of grouser

After taking up slack in track shoes, measure height at center of shoe as shown in photo.



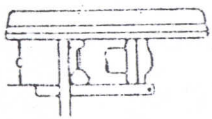
* Standard height(H) 65mm

Repair limit 25mm

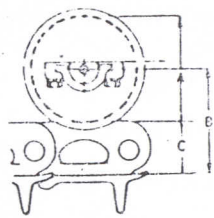


E. Measuring outside diameter of track roller

1) Measure height(size C) of link tread as shown.



2) Stop machine at position where link tread, whose size C has been measured completely, contacts roller tread. Then measure size B.



3) Calculate outside diameter of tread (size A):

$$A = (B - C) \times 2$$

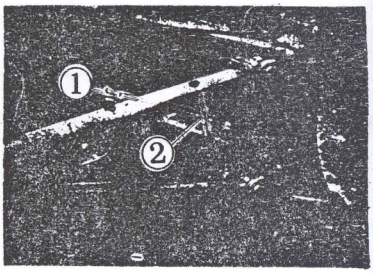
* Standard size (A) 210mm

Repair limit 195mm

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A. Tilting and digging angle adjustment (straight-tiltdozer)

1. By shifting the blade control lever to right or left side, 470mm or 445mm of tilting amount respectively is possible.



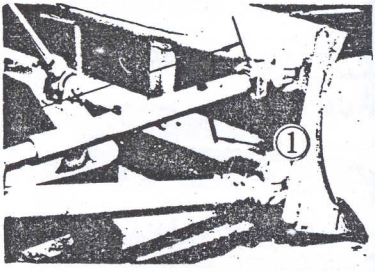
If more tilting amount is required, it may be adjusted according to the following procedure.

Lengthen the brace(1) by turning bar(2) at one side of t blade until 800mm of maximum tilting can be obtained.

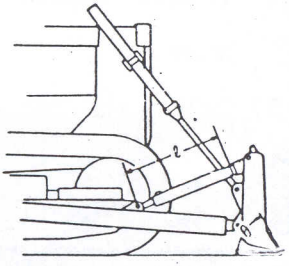
* Tilt the blade up within a range of 800mm.

2. Adjusting the digging angle

Blade cutting angle (θ) is adjustable to obtain the optimum angle for each kind of soil.



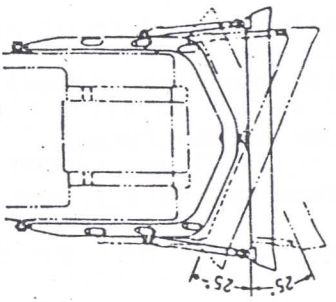
Extend the length(l) of the brace when the bar(1) handles to increase the angle (θ), and vice versa.



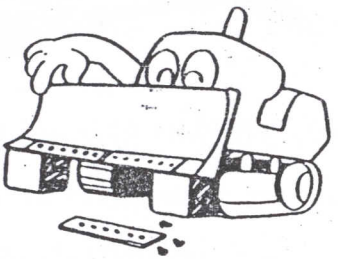
* Standard digging angle (θ) is 55 degrees.

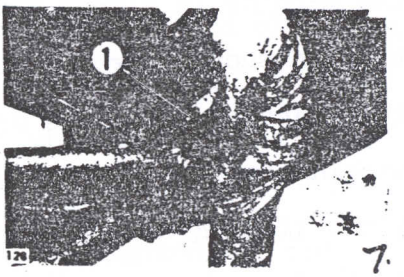
B. Angling of blade (angledozer)

Angle of 25° is provided on both sides of the blade.

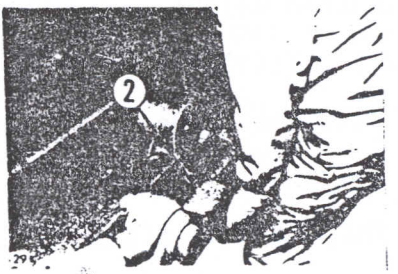


1. Raise the blade 400-500mm above ground level and apply block to the frame.



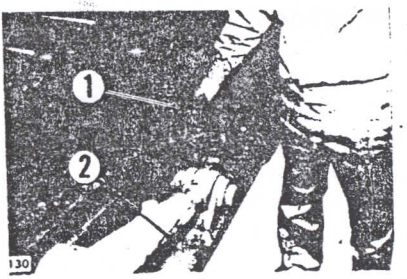


2. Pull out pins(1) on both sides and remove arm(2) from the frame.



⚠ Care must be taken as the blade can move freely after removing arm(2).

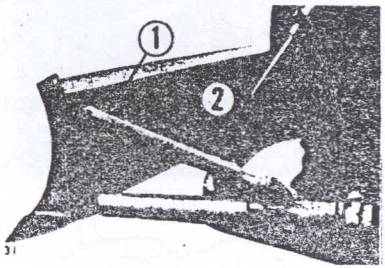
3. To angle the blade, fit arm(2) to the desired bracket and lock with pin(1).



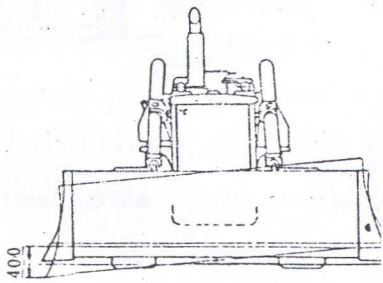
1. Raise the blade 300-400mm above ground level and apply block to the frame.

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2. Loosen set bolt(1) and insert a bar handle into the hole(2). Turn the brace on one side of the machine in either direction to shorten or lengthen the brace and turn the brace on the opposite side of the machine in the reverse direction.



3. After tilting the blade to any desired height, securely tighten set bolt(1) on each brace.



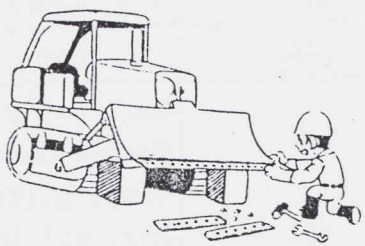
* Tilt the blade up within a range of 400mm.
* This maximum tilting amount (400mm) should not be exceeded.

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Reverse the cutting edge before it is worn out to the blade end. If, due to neglect to reverse and replace, it has been worn out up to the fitting surface, repair the fitting surface and then reverse or replace.

1. Raise the blade to a proper height and apply a block to the frame so as to prevent fall of the blade.
2. Remove the cutting edge and the end bit, and clean the mounting surface.
3. Reverse or replace the cutting edge and the end bit.

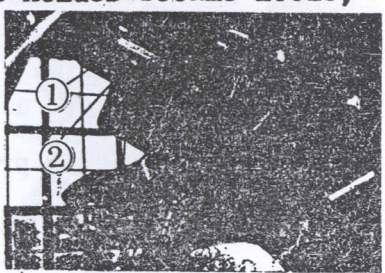
* Nut tightening torque: 441 ± 49 N m.
* After several hours of running, retighten the nuts.
* If the cutting edge on both sides are worn out, replace with new one.



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REPLACEMENT OF FUSE

Fuse box is mainly used for protecting the electrical appliances and wires from burned. When fuse was burned or corroded, or the connection between fuse and fuse holder became loose, it should be replaced.

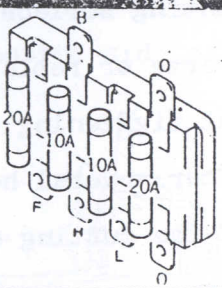


Loosen bolt (1) and remove cover (2).

* Replace the fuse with another one of the same capacity.

⚠ Before replacing a fuse, be sure to turn off the starting switch.

Fuse arrangement and circuit



No.	Terminal mark	Fuse capacity	Circuit	Remark
1	L	20A	Head lamp, Rear lamp	
2	H	20A	Horn	
3	F	10A	Eng. water temp. g.; Torque converter oil temp. g.(TY160,180); Eng. oil temp. g.; (for eng. of Chinese make);Dust indicator	
4	O	20A	Spare circuit system	Spare

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ity	Circuit	Remark
	Auxiliary lamp	
	Ceiling lamp	
		Spare
	Electric fan	

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HANDLING OF BATTERY

When inspecting and mounting the battery, be sure to stop the engine and to turn off the starter switch.

A. Precautions for charging battery

When charging the battery on machine:

1. Before charging, disconnect the cable from the negative(-) terminal of the battery. Otherwise, an unusually high voltage will damage the alternator.
2. While charging the battery, remove all battery plugs for satisfactory ventilation.

⚠ To avoid gas explosion, do not bring fire or sparks near the battery.

3. If the electrolyte temperature exceeds 45°C, stop charging for a while.
4. Turn off the charge as soon as the battery is charged. Overcharging the battery may cause the following troubles:
   1) Overheating the battery.
   2) Decreasing the quantity of electrolyte.

⚠ If the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water.

5. Do not mix up cables positive(+) to negative(-), or negative(-) to positive(+), as it will damage the alternator.
6. When performing any service to battery, besides checking the electrolyte level or measuring the specific gravity, disconnect the cables from the battery.

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B. Removal and installation of battery

1. When removing battery, first disconnect the cable from the ground (normally from the negative(-) terminal). If a tool touches a cable connecting the positive(+) terminal and the chassis, there is a danger of sparks being emitted.
2. When installing battery, the ground cable should be connected to the ground terminal as the last step.

C. Starting engine with a booster cable

When starting up the engine with a booster cable, do as follows:

1. Before connecting the booster cable
   1) Size of booster cable and clip should be suitable for the battery size.
   2) Check cables and clips for breaks, corroded surfaces or other failures.
   3) Keep the starting switch in OFF position.
   4) The battery of the running engine must be the same as that of the engine to be started.
2. Connect the booster cables in the following manner:
   1) Connect one clip of booster cable(A) to the positive (+) terminal of the engine to be started.
      Connect the other clip to the positive(+) terminal of the engine which is running.

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2) Connect one clip of booster cable(B) to the negative(-) terminal of the engine which is running.
Connect the other clip to the body of the machine to be started.

3) Make sure that the clips are firmly connected to the battery terminals.

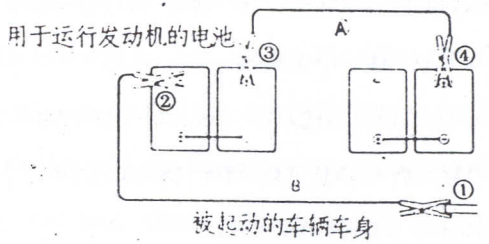
⚠ Make sure that the booster cable connections are correct.
Connect the booster cable to the body as far as possible from the battery.

* Paint on the surface of the connected parts should be cleaned out.

3. Starting the engine

1) Turn the starting switch to START position and start up the engine.

2) If the engine does not start at first, try again after 2 minutes or so.
After the engine has started, the booster cables should be disconnected in the reverse order in which they were connected.

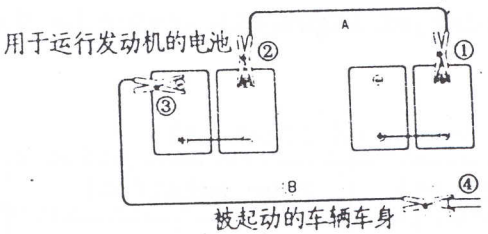


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4. Disconnecting the booster cables

1) Disconnect the clip of booster cable(B) from the body of the machine which was started.
Disconnect the other clip from the negative(-) terminal of the running machine.

2) Disconnect the clip of booster cable(A) from the positive(+) terminal of the running engine.
Disconnect the other clip from the positive(+) terminal of the engine which was started.



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A. Preparation for low temperature

When temperature lowers, certain phenomena, such as hard to start, freezing of cooling water, etc., should happen.

1. Fuel, lubrication oil

1) Change lubrication oil in each unit by that with lower viscosity. According to the ambient temperature, change lubrication oil by that with prescribed viscosity.

2) Fuel of low pour point should be used. It is recommanded to use light oil with pour point 5°C higher than the atmospheric temperature.

As for the pour point of light oil, refer to the following table:

Pour points of light oils

Code No.(GB252-81)	Pour point(°C)
-10# Diesel oil	-10°C
-20# Diesel oil	-20°C
-35# Diesel oil	-35°C

2. Antifreeze

Add antifreeze in the cooling water in order to prevent freezing.

The mixing rate of antifreeze is determined according to the expected minimum temperature.

The following table should be used.

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Mixing rate of water and antifreeze

Amount of antifreeze(l) or water(l) \ Min. atmospheric temperature (°C)		-5	-10	-15	-20
T160, T180, TS180, TSc180	antifreeze	12.5	16.5	20.0	22.5
	water	42.5	38.5	35.5	32.5
TY160, TY180	antifreeze	14.5	19.0	22.5	26.0
	water	48.5	44.0	40.5	37.0

* Permanent type antifreeze shall be used.
* Soft water(e.g. city water) shall be used as mixing water.

⚠ Take care for fire as antifreeze is inflammable.

3. Battery

As ambient temperature drops, battery capacity will drop accordingly, and electrolyte may sometimes freeze if battery charge is low. Maintain battery charge level of approximately 100% and insulate it against cold temperature so that machine can be readily started the next morning.

* Measure specific gravity of fluid and obtain rate of charge from the following conversion table:
(See next page)
* When electrolyte level is low, add distilled water in the morning before work instead of after the day's work. This is to prevent fluid from freezing at night.

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Rate of charge (%) \ Temperature of fluid (°C)	20	0	-10	-20
100	1.28	1.29	1.30	1.31
90	1.26	1.27	1.28	1.29
80	1.24	1.25	1.26	1.27
75	1.23	1.24	1.25	1.26

⚠ Electrolyte is a kind of dangerous substance. In case the electrolyte gets on your skin or eye, immediately wash with plenty of clean water, and accept doctor's treatment.

⚠ Electrolyte may produce inflammable gas, be careful do not allow it to close the fire.

B. Cautions after completion of work

In order to prevent the adhered water and mud on the machine body or the track and undercarriage from freezing to the ground, with the result that the machine will be hard to move the next morning, the following items should be kept in mind:

1) Mud and water on the machine body should be completely cleaned. Particular attention should be given to water drops collected on the surface of the hydraulic cylinder piston rods. Such droplets must be fully wiped off because if water is frozen to the rod, when the cylinder is utilized, the cylinder oil seals may be damaged.

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2) Park the machine on dry and hard ground. If this is impossible, park the machine on wooden boards.

3) Drain water collected in fuel filter or fuel system, to prevent such water from freezing.

C. When temperature rises, in other words, the low temperature season has been passed.

1) Change lubricating oil in each unit to that of recommanded viscosity.

2) Completely drain the antifreeze from cooling system and fill with soft water(e.g. city water) after thorough flushing.

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A. When transporting the machine, observe the various road rules, road transportation vehicle laws and vehicle limit ordinances, etc. At least observe the following for safety.

1. According to the corresponding road transportation vehicle laws, take necessary measures and apply for a pass driving vehicle on the road.

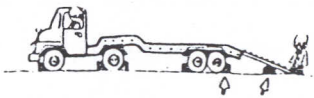
2. When transporting on the road, flat type truck trailer should be used for protecting the road surface from being damaged. If the transportation journey is not long, then wooden boards may be laid beneath the machine along the entire driving line.

* Especially for asphalt road, particular care should be taken, as it is very soft in summer season.

B. Loading and transportation method

1. Properly apply the brakes on the trailer and insert blocks beneath the tires to ensure that it does not move. Then fix the ramps in line with the centers of the trailer and the machine.

* Make sure the ramps have sufficient width, length and thickness to enable the machine to be safely loaded and unloaded.



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2. Determine the direction of the ramps, then slowly load or unload the machine.

⚠ Never change travel direction on the ramps. When changing direction, back up off the ramps and change direction on ground.

3. Load machine at a suitable place on trailer.

4. To prevent machine from moving during transportation, hold it securely in place by applying blocks to front and rear of track shoe and by fastening machine with chain or wire rope. Secure machine with special care to prevent shifting sideways.

5. Lower the blade, keep various control levers in the following places:

   1) Fuel control lever —— in engine stop position

   2) Gear shift lever —— in neutral position

      (T160, T180, TS180, TSc180)

   3) Blade control lever —— in hold position

   4) Brake lock lever —— in lock position



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* Determine the route for transporting the machine by taking into account the width, height and weight of the machine.

⚠ When loading the machine, park the trailer on a flat firm roadbed. Keep a fairly long distance between the road shoulder and the machine.

* Please consult with our works when transporting the machine.



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1. Before storage

To place the machine in storage for an extended period of time, the following measures must be taken:

1) After every part is washed and dried, the machine shall be housed in a dry building. In case it is indispensable to leave it outdoors, lay wood plates on the ground and park the machine on the wood plates, and cover it with canvas etc.

2) Completely fill fuel tank, lubricate and change oil before storage. Do not allow them leak out.

3) Apply a thin coat of grease to the exposed surface part (hydraulic piston rods and front idler adjusting rods).

4) As to batteries, remove the minus(-) terminals and cover them, or remove them from the machine and store separately.

5) When the ambient temperature is anticipated to drop below zero degree, always add antifreeze in the cooling water, or drain off the water in cooling system.

6) Set fuel control lever to the engine stop position. Put the gear shift lever to neutral position. Lock the brake pedals and apply wooden blocks for stopping.

2. During storage

1) Operate the engine and move the machine for a short distance once a month, so that new oil film will be coated

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over movable parts and component surfaces. And charge the battery at the same time.

2) Before operating the working equipment, wipe off the grease on the hydraulic piston rod.

⚠ *If it is unavoidably necessary to carry out rust-preventive* operation while the machine is indoors, open up doors and windows to improve ventilation and prevent the gas poisoning.

C. After storage

After storage (when it is kept without cover or the rust-preventive operation once a month is not made), you shall apply the following treatment before operation.

1) Loosen the drain plugs on oil pan and other cases, and drain mixed water.

2) The following maintenance operations should be proceeded by the service department appointed by our works.

3) Remove the cylinder head cover and lubricate sufficiently valves and rocker arms. And inspect the valve operation.

4) To bleed the air from the hydraulic cylinders or hydraulic piping, run the engine at low idling speed.

5) Operate each hydraulic cylinders 4-5 times, stopping at 100 mm from stroke end.

6) Next, operate each cylinder 3-4 times to the stroke end.

* If the engine is run at high speed at first, or if the

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cylinder is moved to the end of its stroke, the air in the cylinder may damage the piston packing, etc.

7) After the engine is started, operate it until it is warmed up completely.

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Proper lubrication and maintenance may assure trouble-free operation and long machine life. Time and money spent for scheduled periodic maintenance will be amply compensated by prolonged machine operation and reduced operating cost.

All hourly figures given in the following descriptions are based on the service meter readings. In practice, however, it is recommanded to rearrange all of these figures into units of days, weeks and months to make the maintenance schedule more convenient. Under rough job site or operating conditions, it is necessary to somewhat shorten the maintenance intervals prescribed in this manual.

For the operators of the machine, the following items should be clearly understood:

1. Thoroughly wash the machine, so that the improper parts can be easily found. In particular, be careful to clean the filler caps, grease fittings and area around the dipsticks. Be careful not to let any dirt or dust get into the system.
2. Choose the proper lubrication oil with the viscosity specified for the ambient temperature. The containers used should be clean and prevented any dirt from getting into the oil. When checking or changing the oil, do it in a place free of dust.
3. When adding fuel, care should be taken to prevent water

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from entering into the fuel, especially the water on the surface or in the bottom of the reservoir.

4. When feeding or draining the oil circuit or carrying out inspection and maintenance, release the pressure first. The procedure for releasing the hydraulic pressure is as follows: lower the blade to the ground, and stop the engine; move the control levers to each position 2-3 times, and then slowly loosen the oil filler cap. Check the drained oil for any signs of excessive metal particles or other foreign materials.
5. Hang a caution plate in the operator's compartment, to prevent anyone from starting or moving the machine.
6. When the strainer is located in the oil filler, the strainer must not be removed while adding oil.
7. After replacing oil filter element or strainer, bleed the air from the hydraulic piping.
8. After the operation is completed, never drain oil and water or replace elements immediately before the temperature is lowered. When the weather is cold, the oil should be heated properly, generally to 20-40°C.
9. When adding oil or checking the oil level, make sure the oil is at the correct level, both too high or too low is not proper.
10. After greasing up, always wipe off the old grease that

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was forced out, especially the grease which has been contaminated by sand and dust should be cleaned away.

11. When cleaning parts, non-inflammable washing agents or diesel oil should be used. If diesel oil is used, it's important to wash in a place far from any fire of flame.

12. When removing parts containing O-rings, gaskets or seals, clean the mounting surface and replace with new sealing parts.

13. When check an gear case, there is a risk of dropping things in. Before removing the covers to inspect such cases, empty every thing from your pockets. Be particularly careful to remove wrenches and nuts.

14. Always follows all the advices, prescribed on the caution plates which are sticked on various parts of the machine.

15. After replacing the oil in fuel tank and the filter element, removing and mounting the hydraulic cylinders or oil pipings of working equipment, in order to bleed the air from them, put the fuel control lever to LOW IDLING position, and operate each hydraulic cylinders 4-5 times(stopping at 100mm from stroke end), and then operate each cylinders 3-4 times to the stroke end.

* If the engine is run at high speed at first, or if the

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cylinder is moved to the end of its stroke, the air in the cylinder may damage the piston packing.

16. When operating in water or in muddy areas, in rain or in snow, or on the seashore, remember to check whether the plugs and the nuts are loosened or dropped before starting to operate. All parts should be greased, especially the pins of the working equipment operated in muddy areas should be lubricated everyday.

17. When working on the seaside, care should be taken to prevent the electrical arrangements from corrosion.

18. When working in a dusty area, be careful about the following items:

    1) Take care of the dust indicator, which shows the clogging of the air cleaner element, and clean it in time.

    2) The radiator fin should be cleaned frequently, so as not to be clogged.

    3) The fuel filter should be cleaned regularly and replaced periodically.

    4) The electrical units, especially starting motor and alternator, should be purged, take care to prevent them from accumulating of dust.

19. When operating on rocky region, pay attention to prevent the undercarriage from being damaged. Check whether the bolts and nuts are loosened or damaged. The track should

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not be over-tightened.

When the tracks are removed, never put your fingers between the shoes. When handling the cutting edges, always wear gloves.

When working with others, there should be a man in responsible position, and the others should work according to his instruction. Do not perform any other maintenance work beyond the agreed one.

Never handle fuel, oil, grease or oil smeared clothes in places where there is any fire of flame. The operators should know the places where the fire hydrants and other fire-fighting equipments are laid, and their usage should also be understood.

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A. Periodic maintenance

* About the maintenance of the diesel engine of Chinese make, please refer to the "Operation and Maintenance Manual" of the manufacturer.

No.	Item	Service	P
(1)	Check before starting		75
1	Oil and water leak	Check	75
2	Nuts and bolts	Check and retighten	75
3	Electric wiring	Check and retighten	75
4	Coolant	Check and supply	76
5	Fuel	Check and supply	76
6	Engine oil pan	Check and supply	77
7	Main clutch case (T160,T180,TS180,TSc180)	Check and supply	77
8	Transmission case (incl. torque converter case) (TY160,TY180)	Check and supply	77
9	Fuel tank	Drain water and sediment	78
10	Main clutch control lever (T160,T180,TS180,TSc180)	Check travel	78
11	Brake pedal	Check travel	78
12	Dust indicator lamp	Check	79
13	Engine oil temperature g., water temperature g. and oil pressure g.	Check	79

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No.	Item	Service	P
(2)	Initial 250 hours service (All items indicated with * need only once for new machines after 250 hours operation.)		
1	* Fuel filter (for 6D125-1 engine)	Replace cartridge	81
2	* Engine oil pan and filter (for 6D125-1 engine)	Change oil and replace cartridge	81
3	* Main clutch case (T160, T180, TS180, TSc180)	Change oil and clean strainer	81
4	* Transmission case, incl. torque converter case (TY160, TY180)	Change oil and clean strainer	81
5	* Steering clutch case, incl. transmission case and bevel gear case (T160, T180, TS180, TSc180)	Change oil and clean strainer	81
6	* Steering clutch case, incl. bevel gear case (TY160, TY180)	Change oil and clean strainer	81
7	* Final drive case	Change oil	81
8	* Fuel tank and fuel filter	Change oil and replace element	81
(3)	Every 250 hours service		
1	Equalizer bar pin	Lubricate (1 point)	82
2	Cylinder support yoke	Lubricate (4 points)	82
3	Cylinder support shaft	Lubricate (2 points)	82

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o.	Item	Service	P
4	Piston rod bearing	Lubricate (2 points)	83
5	Brace(straight-tilt d.) (angle dozer)	Lubricate (5 points) (4 points)	83
6	Final drive case	Check and supply	83
7	Hydraulic tank	Check and supply	84
8	Transmission case oil filter(TY160,TY180)	Replace element	84
9	Steering clutch case oil filter	Replace oil and element	85
10	Fuel tank bottom filter (for 6D125-1 engine)	Drain water and sediments	85
11	Fuel tank bottom strainer	Clean	86
12	Battery electrolyte level	Check	86
13	Track shoe bolts	Check and retighten	87
14	Fan belt tension	Check and adjust	88
15	Radiator fin	Check and clean	88
(4) Every 500 hours service			
1	Fuel filter (for 6D125-1 engine)	Replace cartridge	89
2	Engine oil pan and filter(for 6D125-1 engine)	Change oil and replace cartridge	90
3	Main clutch case breather (T160,T180,TS180,TSc180)	Clean	91

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No.	Item	Service	P
4	Transmission case breather (TY160,TY180)	Clean	91
5	Steering clutch case breather	Clean	91
6	Final drive case breather	Clean	91
(5)	Every 1000 hours service		
1	Diagonal brace	Lubricate (2 points)	92
2	Universal joint	Lubricate (2 points)	92
3	Main clutch case and strainer (T160,T180,TS180,TSc180)	Change oil and replace strainer	92
4	Transmission case (incl. torque converter case) and strainer (TY160,TY180)	Change oil and clean strainer	93
5	Steering clutch case(incl. transmission case, bevel gear case) and strainer (T160,T180,TS180,TSc180)	Change oil and clean strainer	94
6	Steering clutch case(incl. bevel gear case) and strainer(TY160,TY180)	Change oil and clean strainer	95
7	Final drive case	Change oil	96
8	Hydraulic tank and fuel filter	Change oil and replace element	97
9	Undercarriage components	Check lubricating conditions	97

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No.	Item	Service	P
(6) Every 2000 hours service			98
1	Engine breather	Clean element	98
2	Alternator and starting motor	Check	99
3	Engine valve clearance	Check and adjust	99
(7) Every 4000 hours service			
1	Water pump	Check	99

B. Non-periodic maintenance

No.	Item	Service	P
1	Control lever shaft and pedal shaft	Lubricate	100
2	Track	Check and adjust tension	101
3	Coolant	Change	103
4	Air filter	Check, clean and replace	105
5	Electric heater (for 6D125-1 engine)	Check	108

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Check before starting

1. Oil and water leak

Take a look around the machine, to check whether there is any trace of oil or water leakage, especially in the following positions:

1) Connections of high pressure hose and pipings.
2) Hydraulic cylinders.
3) Final drive case.
4) Floating seals in undercarriage components.
5) Radiator (on all sides).

* If any leakage is checked out, effective measures should be taken.

2. Nuts and bolts

Check tightness of nuts and bolts, and retighten them if required.

1) Air cleaner.
2) Intake and exhaust pipes.
3) Muffler mounting position.
4) Track roller supports.

3. Electric wiring

Check for broken electric wirings, short circuits and loosened terminals. If any, these terminals should be fastened. Besides, the wiring of the following units should also be checked:

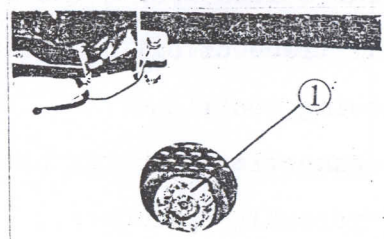
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1) Battery.

2) Starting motor

3) Alternator.

4. Coolant



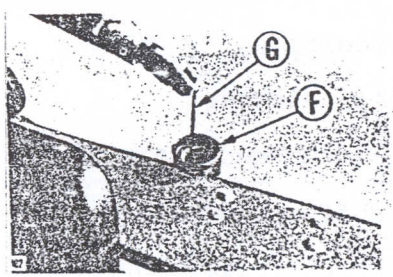
Remove the radiator cap, make sure whether the coolant reaches the vicinity of water filler. If the level is low, add water.

* If more water than normal is required to fill up to the specified level, coolant is considered to be leaking somewhere. Immediately locate the leak and plug it.

⚠ Do not remove cap while cooling water is hot, because hot water may spout out.

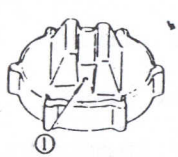
When removing cap, turn it slowly to relieve the inner pressure.

5. Fuel level



1) After removing cap, pull out fuel dipstick(G) and check fuel level.

2) After each operation, fill up the fuel tank through filler(F).



* A clogged cap breather hole(1) may stop the fuel flow to the engine. Check it from time to time and clean.

* Fuel capacity: 320 l.

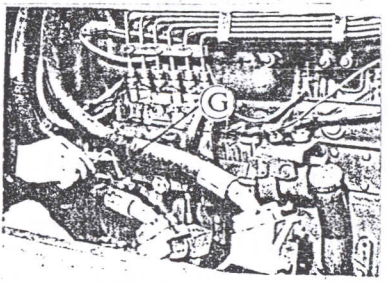
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6. Oil level in engine oil pan

Lift the engine cover, use dipstick(G) to check the oil level.

The oil level should be between marks L and H. If necessary, add oil at oil filler(F).

(Choose class CD 20-30# diesel engine oil according to the ambient temperature.

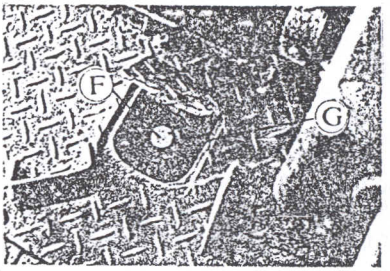


* When checking oil level, park the machine on level ground and stop the engine. Oil level check should be performed 15 minutes or more after the engine is stopped.
* Do not add oil above the H level mark.

7. Oil level in main clutch case(T160,T180,TS120,TSc180)

Use dipstick(G) to check the oil level, if necessary, add oil at oil filler(F).

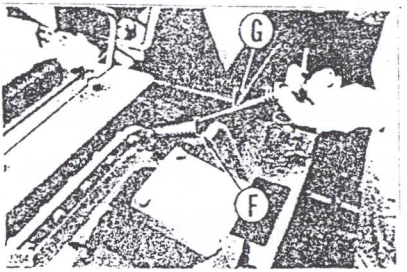
(Irrespective of the ambient temperature, use class CD 20# engine oil.)



8. Oil level in transmission case(including torque converter)

(TY160,TY180)

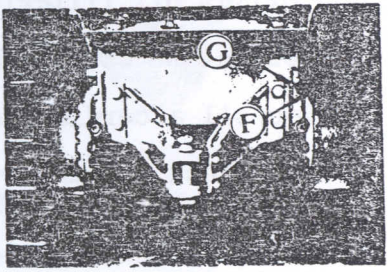
1) Use dipstick(G) to check the oil level 5 minutes after stopping the engine.



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2) If necessary, add oil at filler(F). (According to different ambient temperature use class CD 20-30# engine oil.)

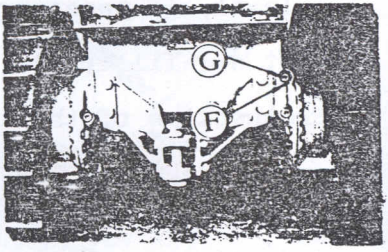
9. Oil level in steering clutch case (including transmission case, bevel gear case) (T160, T180, TS180, TSc180)



Use dipstick(G) to check the oil level. If necessary, add oil at oil filler(F). (According to different ambient temperature, use class CD 20-30# engine oil.)

* In case the work is carried out on slopped land of more than 25° declination, supply oil to H level.

10. Oil level in steering clutch case (including bevel gear case) (TY160, TY180)



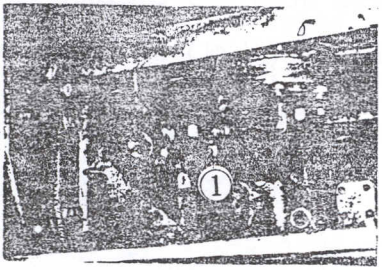
Use dipstick(G) to check the oil level. If necessary, add oil at oil filler(F). (According to the ambient temperature, use class CD 20-30# engine oil.)

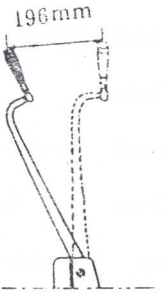
* In case the work is carried out on slopped land of more than 25°declination, supply oil up to H level.

11. Drain water and sediment from fuel tank

Loosen the cock on the bottom of fuel tank and drain water and sediment accumulated on bottom with fuel.

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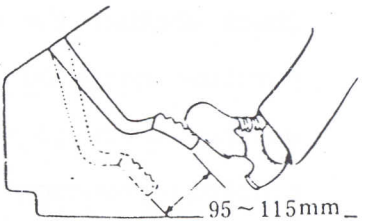
12. Main clutch control lever travel
(T160,T180,TS180,TSc180)
The standard travel is 146-196mm at the top end of the control lever.

* If it does not conform the above standard, adjust the travel. (Please refer to the section "Adjustment".)

13. Inertia brake of main clutch
(T160,T180,TS180,TSc180)
When the engine is running in full speed, press the main clutch pedal to the end. If the main clutch shaft stops in 2.5-3.5 seconds, it may be considered as standard.

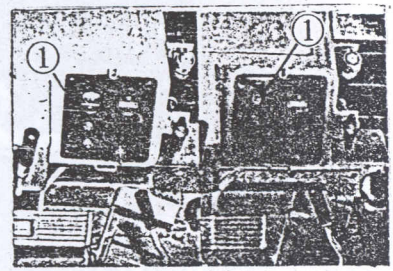
* If it is not standard, adjust it referring to the section "Adjustment".

14. Brake pedal travel
The standard travel is 95-115mm at the top end of the pedal.
When this value exceeds 115mm or the brake fails to work, adjust the pedal referring to the section "Adjustment".



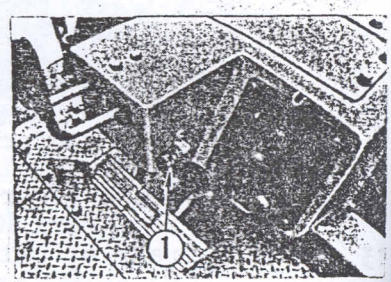
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* When making this measurement, first stop the engine, and then press one side of pedal with 15kg(147N) of treadling force.



15. Dust indicator lamp

When the indicator lamp lights up, it shows that the element of the air cleaner should be cleaned. After cleaning, if the lamp is still on, the element should be replaced.



If Komatsu's 6D125-1 engine is equipped, make sure whether the red piston reaches the service level. If the red piston is exposed, it suggests that the element should be cleaned or replaced. As for the cleaning method, please refer to the corresponding section.

16. Engine oil temperature gauge, water temperature gauge and engine oil pressure gauge

Check whether the engine oil temperature gauge, water temperature gauge and engine oil pressure gauge are normal, whether there is abnormal voice in the engine, if so, the abnormal phenomena should be eliminated.

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Every 250 hours service

* About the check and maintenance of diesel engines of Chinese make, refer to the manufacturer's "Operation and Maintenance Manual".

1. Perform the following maintenance after running the machine for the first 250 hours.

1) Replace the cartridge of fuel filter.
(for 6D125-1 engine)

2) Replace the oil in engine oil pan and the cartridge of the engine oil filter.
(for 6D125-1 engine)

3) Replace the oil in main clutch case and clean the strainer.
(T160, T180, TS180, TSc180)

4) Replace the oil in transmission case (including torque converter case) and clean the strainer.
(TY160, TY180)

5) Replace the oil in steering case (including transmission case, bevel gear case) and clean the strainer.
(T160, T180, TS180, TSc180)

6) Replace the oil in steering case (including bevel gear case) and clean the strainer. (TY160, TY180)

7) Replace the oil in hydraulic tank and the element of the oil filter.

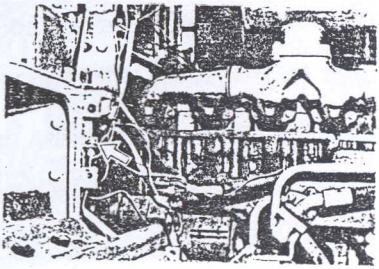
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2. Every 250 hours service

Apply grease to the grease fittings shown by arrows.

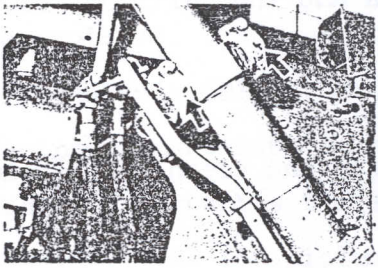
1) Diesel engine front frame.

(1 point)

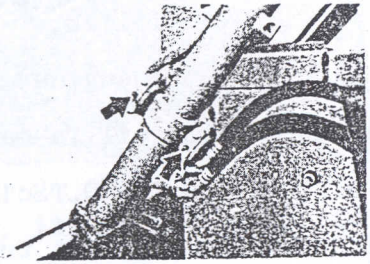


2) Cylinder support yoke.

(Angledozer) (4 points)

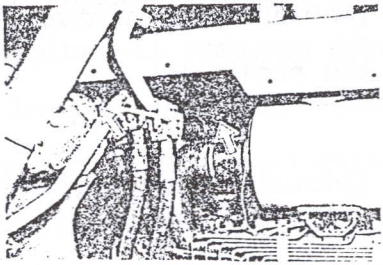


(Straight-tiltdozer)(4 Pts)

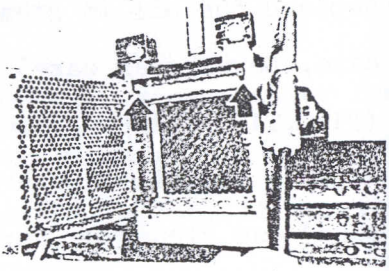


3) Cylinder support shaft.

(Angledozer) (2 points)



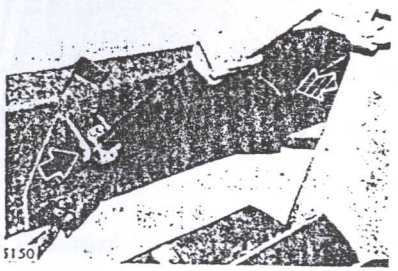
(Straight-tiltdozer)(2 Pts)

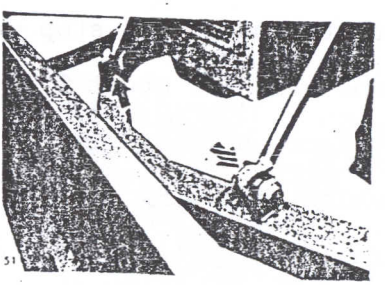


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4) Piston rod bearing

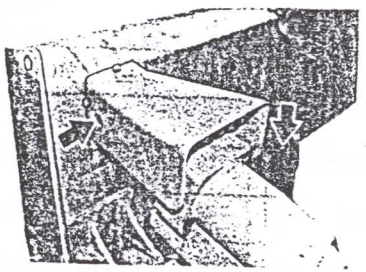
(Angledozer) (2 Points) (Straight-tiltdozer) (2 Pts)

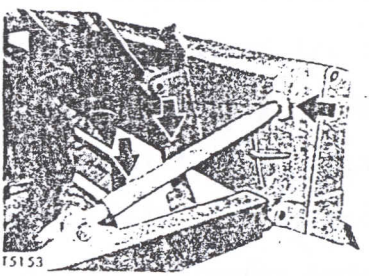


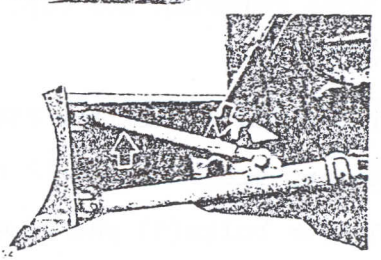


5) Brace

(Angledozer) (4 Points) (Straight-tiltdozer) (5 Pts)

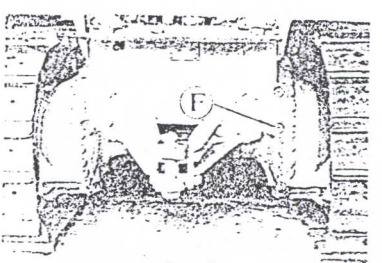






6) Oil level in final drive case

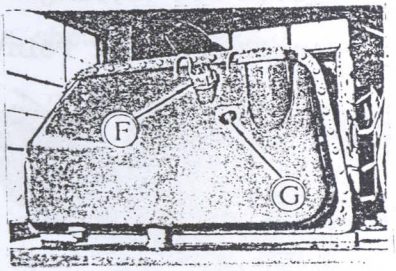
Remove plug(F) and check whether final drive case is filled with oil to lower edge of plug hole. If oil level is below this point, refill with engine oil through plug hole.



* Check while parking the machine on level ground.

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7) Oil level in hydraulic tank

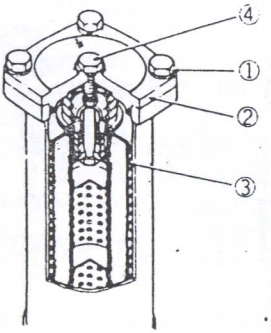


(1) Lower blade to ground in horizontal position, stop engine and wait for about 5 minutes before checking oil level. While observing through sight gauge(G), if oil level is between top and bottom of the red circle in the sight gauge, it shows that the oil level is correct.

(2) If oil level is not between top and bottom of red circle in the sight gauge(G), refill tank with engine oil through oil filler(F). (Irrespective to the ambient temperature, fill class CD 20# engine oil.)

⚠ When removing the cap, turn it slowly to relieve inner pressure.

8) Transmission oil filter element (TY160,TY180)



(1) Remove floor plate.

(2) Remove bolts(1) and cover(2) and take the element(3) out from the case.

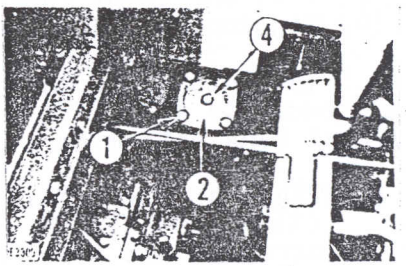
(3) Clean inside of case and the removed parts, install a new element. Fix cover(2) with bolts(1).

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(4) After replacement of element, loosen air vent plug(4) and start engine until no air bubble comes out from plug(4), and tighten plug(4).

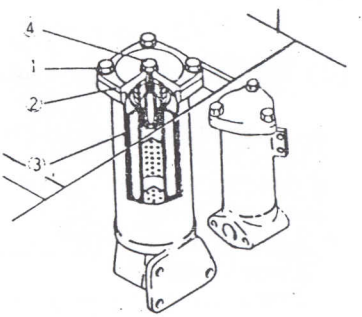
* Use element specified by our works.

9) Steering clutch oil filter element



(1) Remove floor plate.

(2) Remove bolts(1) and cover(2), and take element(3) out from the case.

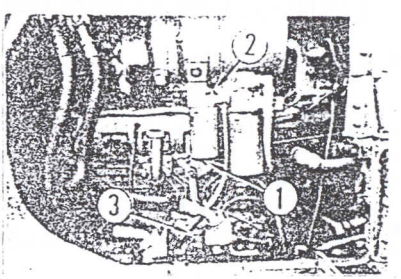


(3) Clean inside of case and the removed parts, and install a new element. Fill case with oil and fix cover(2) with bolts(1).

(4) Loosen air vent plug(4) and start engine, overflow oil until no air bubble comes out from plug(4) and tighten it.

* Use element specified by our works.

0) Water and sediment in fuel filter (for 6D125-1 engine)



(1) Remove the drain plug(1) on the bottom of the filter to drain water and sediment accumulated on the bottom. After draining, tighten the plug(1).

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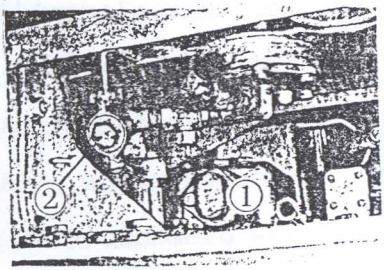
(2) Loosen the air vent plug(2).

(3) Loosen the feed pump knob(3) and move the pipe up and down to draw off fuel until air ceases to come out of the plug(2).

(4) Tighten the air vent plug(2), push the feed pump knob (3) into place and tighten it.

11) Fuel tank bottom strainer

(1) Tighten valve(1) and take the strainer out from case removing cap(2).

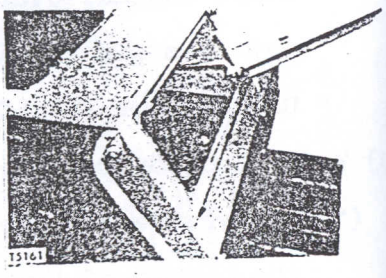


(2) Clean strainer and strainer case with light oil, and then refit.

* As strainer is soldered to cap(2), take strainer out from case together with cap(2).

12) Battery electrolyte

Remove the cap, add distilled water if battery fluid level is below prescribed level (10-12mm above the plates).



* If electrolyte has been reduced by spilling, fill battery with dilute sulfuric acid of the same strength.

* Clean air vent of battery cap when checking fluid level.

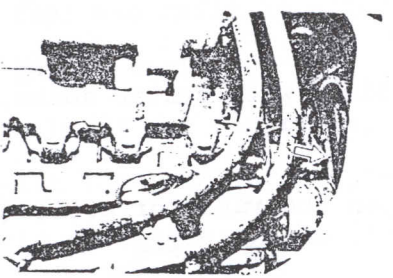
https://truckmanualshub.com/

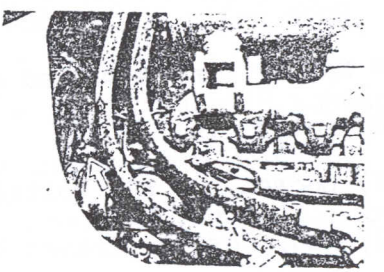
13) Fan belt

Check: Push the belt at the middle between the fan pulley and the alternator pulley with fingers(approximately 58 N of force). If the belt slack is about 10mm, the belt is considered to have the correct tension.

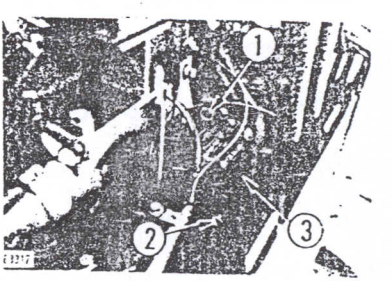
Adjust: Rotate the guide screw, allowing the tensioner to move outside.

If 6D125-1 engine is equiped, the bolt(1) and nut(2) should be loosened at first, and to shift alternator(3).





* Check each pulley for damage, and V-grooves and V-belt for wear. Particularly, check whether V-belt is in contact with bottom of V-groove through wear.

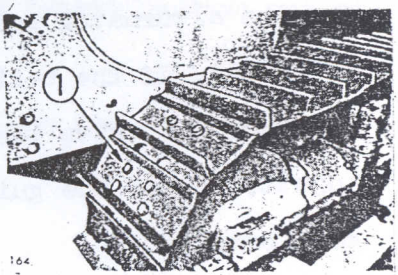


* Replace belt if it has stretched, leaving no allowance for adjustment, or if there is a cut or crack on belt. When two belts are used, replace both belts at the same time.

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14) Track shoe bolt

The shoe bolt(1) attaching the track shoe to the link will be broken if it is used as loosened. So you are required to retighten every time you find a loosened one.



Tightening torque

Master link bolt: 588 ± 60 Nm

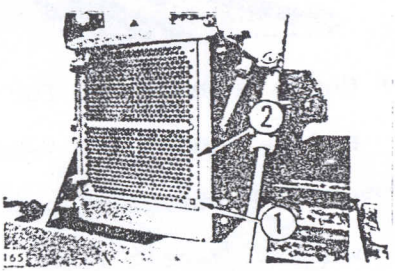
Shoe bolt: 686 ± 80 Nm

* Master pin is marked on both sides with center holes.

15) Radiator fin

1) Loosen the six bolts(1) to open the radiator grille(2).

2) Mud, dust or leaves blocking the fin should be blown off by compressed air. Steam or water may also be employed instead of compressed air.



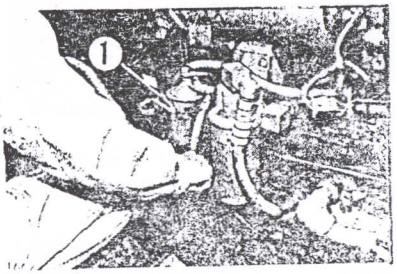
* Check the rubber hose on this occasion and replace hose that is cracked or fragile. Further, also inspect loosen hose clamps.

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Every 500 hours service

* Maintenance for every 250 hours service should be carried out at the same time.

1) Fuel filter (for 6D125-1 engine)

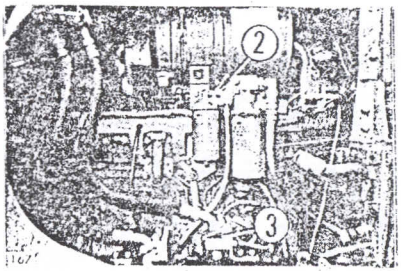


(1) Using the tool provided, remove cartridge(1) by turning it counterclockwise.

(2) Fill the new cartridge with fuel and refit it after applying a dab of oil to the gasket surface.

* To refit the cartridge, place the gasket face in contact with the seal face of the filter stand, then screw up the cartridge 1/2 to 3/4 turn (be careful not to tighten it up excessively).

(3) After replacing the cartridge, loosen air vent plug(2).



(4) Loosen feed pump knob(3) and move the pump up and down to draw off fuel until air ceases to come out of vent plug(2).

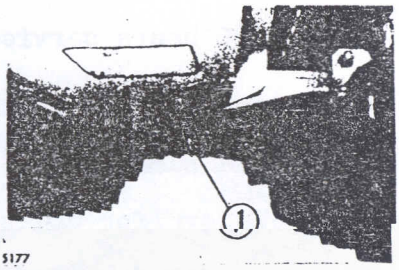
(5) Tighten air vent plug(2), push feed pump(3) into place and tighten it.

* After replacing the cartridge, start up the engine and check the filter seal face for possible oil leakage.

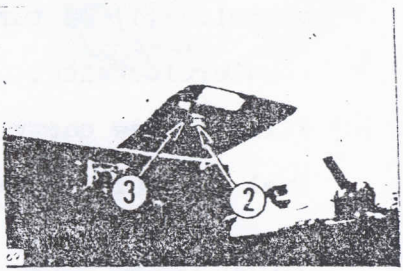
https://truckmanualshub.com/

2) Engine oil pan and filter

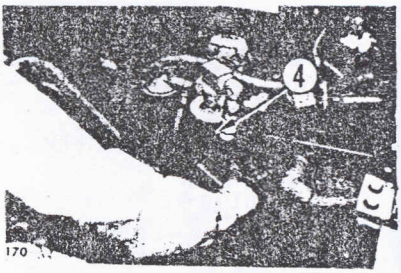
(1) Remove cover(1) mounted under the machine body.



(2) Remove drain plug(2) and loosen drain valve(3). Retighten drain valve(3) and plug(2) after drain oil.



(3) Using a filter wrench, remove cartridge(4) of the engine oil filter by turning it counter-clockwise.



(4) Clean the filter stand. Apply a dab of oil(or grease) to the seal surface of the new cartridge.

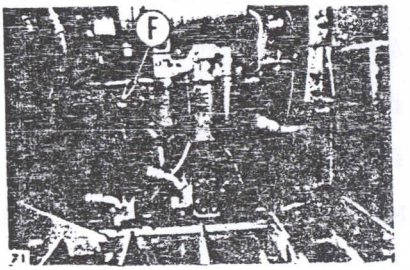
* After the gasket contacts the seal surface, tighten it up by hand 2/3 turn (be careful not to tighten it up excessively).

(5) After replacing the cartridge, fill engine oil of the specified quantity through oil filler(F). (According to different atmospheric temperature, choose class CD

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20-30# engine oil).

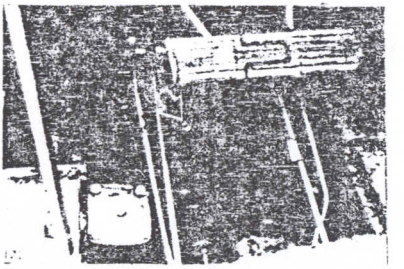
(6) Then idle the engine for a while, and recheck the oil level.



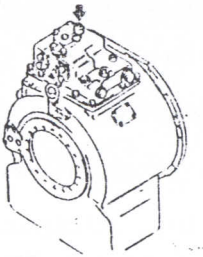
* Refill capacity: 26 l

* Change the engine oil every 6 months regardless of the service hours.

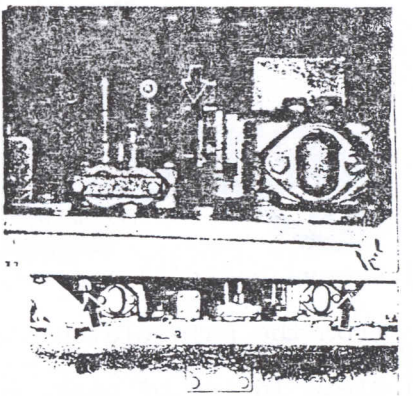
3) Main clutch case breather (T160,T180,TS180,TSc180)
Remove the breather and wash dust remaining inside with clean diesel oil.



4) Transmission case breather (TY160,TY180)
Remove the breather and wash dust remaining inside with clean diesel oil.



5) Steering clutch case breather
Remove the breather and wash dust remaining inside with clean diesel oil.



6) Final drive case breather
Remove the breather and wash dust remaining inside with clean diesel oil.

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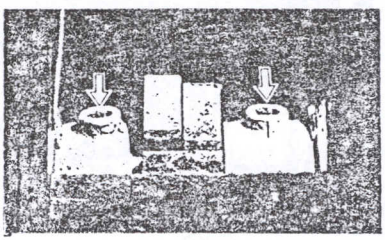
Every 1000 hours service

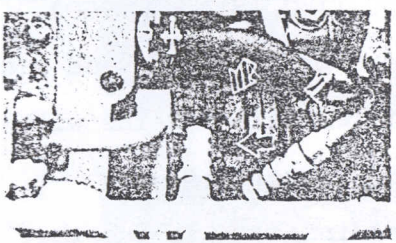
* About the check and maintenance of Chinese make diesel engine, refer to the Operation and Maintenance Manual of the manufacturer's.
* Maintenance for 250 and 500 hours services should be carried out at the same time.

1. Lubricating

Apply grease to grease fittings shown by arrows.

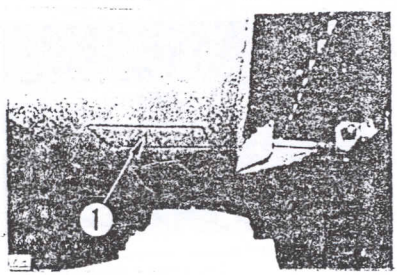
1) Diagonal brace(2 points) 2) Universal joint(2points)

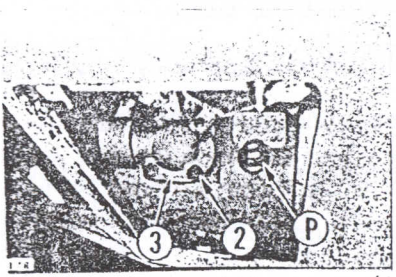




2. Main clutch case and strainer (T160,T180,TS180,TSc180)

1) Remove cover on the underside of machine body and remove drain plug(1) and (2) inside to drain used oil. After draining, retighten drain plugs.



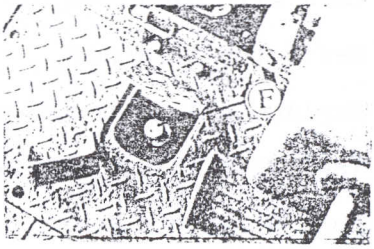


2) Remove bolts(3) and take strainer together with cover(4) from the main clutch case.

3) Clean inside of case, remove parts and strainer, wash them

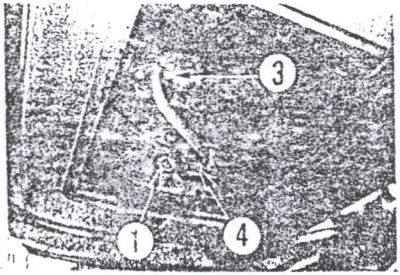
https://truckmanualshub.com/

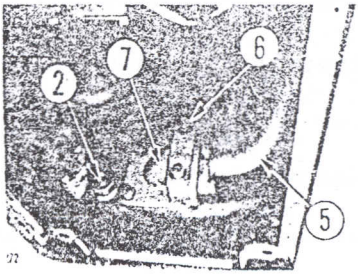
with clean engine oil and refit.
If strainer is damaged, replace it with a new one.



4) Supply the specified amount of engine oil through oil filler(F). (Use class CD 20# engine oil, regardless of the ambient temperature.
5) After refilling, make sure the oil level is correct.
* Refill capacity: 20 l

3. Transmission case (including torque converter case) and strainer





1) Remove cover on the underside of the machine body.
2) Remove drain plugs(1) and (2) inside to drain used oil. After draining, retighten drain plugs.
3) Remove bolts(3) and take strainer together with cover(4) from torque converter case.
4) Remove pipe(5) and bolts(6), take strainer together with cover(7) from case.
5) Clean inside of case, remove parts and strainer, and clean

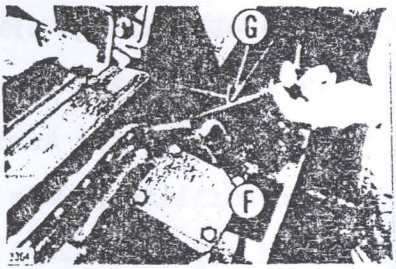
https://truckmanualshub.com/

them with clean engine oil.

6) Refit the strainer.

7) Replace oil filter element in transmission case. (Refer to "Every 250 hours service")

8) Supply the specified amount of engine oil through oil filler(F). (Use class CD 20-30# diesel oil according to different ambient temperature.)



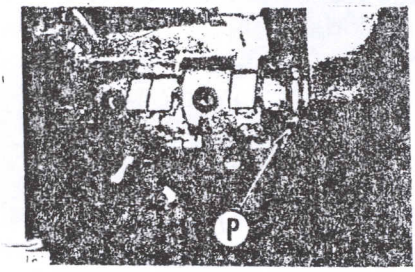
9) Make sure whether the oil level is correct.

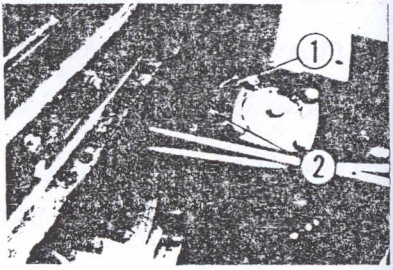
* Refill capacity:47 l.

4. Steering clutch case (including transmission case, bevel gear case) and strainer (T160,T180,TS180,TSc180)

1) Remove drain plug(P) underside the machine body to drain used oil. After draining, retighten drain plug.

2) Remove floor plate inside left step plate. Loosen bolt(1) and remove cover(2) to take out spring(3) and strainer(4).





3) Clean the inside of the case, strainer and other parts removed with cleaned light oil.

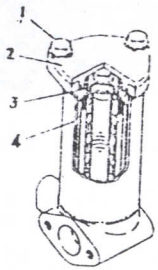
4) Refit strainer(4) and spring(3), and tighten cover(2) with

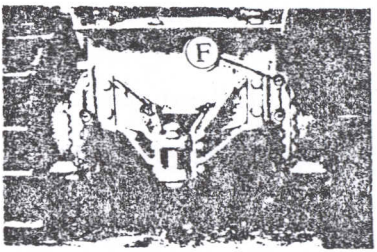
bolt(1).

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5) Replace steering clutch oil filter element (Refer to "Every 250 hours service").

6) Supply specified amount of engine oil through oil filler (F). (Use class CD 20-30# engine oil according to different ambient temperature.)





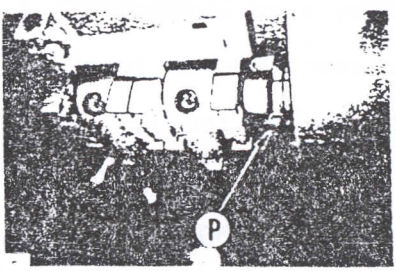
* Refill capacity: 75 l
* If the strainer has been broken, replace it with a new one.

5. Steering clutch case (including bevel gear case) and strainer (TY160,TY180)

1) Remove drain plug(P) underside of the machine body to drain used oil. After draining, retighten drain plug.

2) Remove floor plate inside left step plate.
Loosen bolt(1) and remove cover(2) to take out spring(3) and strainer(4).

3) Clean the inside of the case, strainer and other parts removed with clean engine oil.

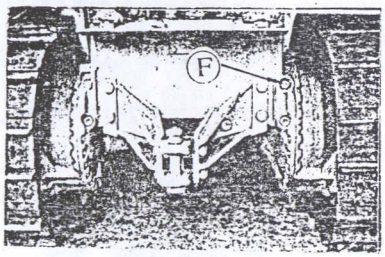


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4) Refit strainer(4) and spring(3), tighten cover(2) with bolt(1).

5) Replace steering clutch oil filter element (refer to "Every 250 hours service")

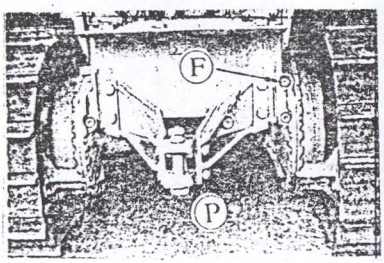
6) Supply specified amount of engine oil through oil filler (F). (Use class CD 20-30# diesel oil according to different ambient temperature.)



* Refill capacity: 75 l
* If the strainer has been broken, replace it with a new one.

6. Final drive case

1) Remove oil filling plug(F) from both sides of the machine.
2) Remove drain plug(P) to drain oil. After draining, tighten plug(P).
3) Fill specified amount of engine oil through respective oil filling plugs(F). According to different ambient temperature, use class CD 20-30# engine oil.
4) Make sure whether oil level is correct (refer to "Every 250 hours service").



* Refill capacity for each side:

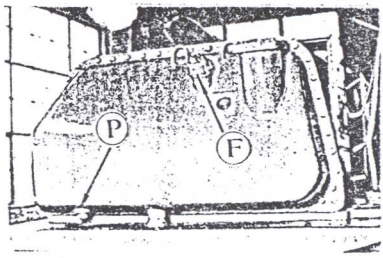
T160,T180,TY160,TY180: 31 l; TS180: 36 l; TSc180: 42 l

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7. Hydraulic tank and filter

1) Place the blade on the ground horizontally. With the engine stopped, move the blade control lever forward and backward, right and left, and slowly turn the cap of the oil filler(F) to purge air. Then remove the cap.

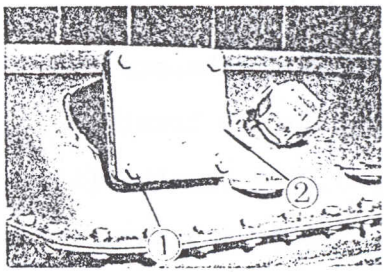
2) To drain oil inside the tank, remove the drain plug(P) under the tank. After draining, re-tighten drain plug(P).



3) Remove bolts(1) and cover(2) to take out the element. Clean the inside of the filter case as well as the parts removed. Then, install a new element.

4) Supply specified amount of oil through the oil filler(F). (Use class CD 20# engine oil regardless of the ambient temperature)

5) Make sure whether the oil level is correct (refer to "Every 250 hours service").



* Refill capacity: 108 l

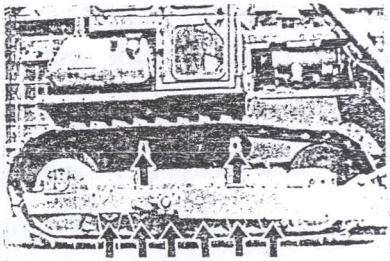
* Use element specified by our works.

8. Undercarriage components

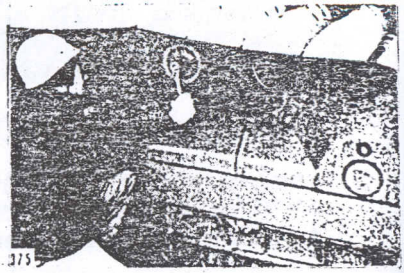
Check consumption of oil in track roller, carrier roller and idler.

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1) Stop machine on level ground.
2) Slowly loosen seal bolt and see if oil oozes out of the screw.
   If oil oozes out, oil is still sufficient.
   Tighten seal bolt immediately.



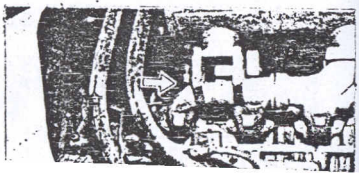
* If oil does not flow even after seal bolt has been removed, it indicates that the oil amount is insufficient.
  Check the reason for leaking and perform necessary repairs.



Every 2000 hours service

* Maintenance for every 250, 500 and 1000 hours service should be carried out at the same time.

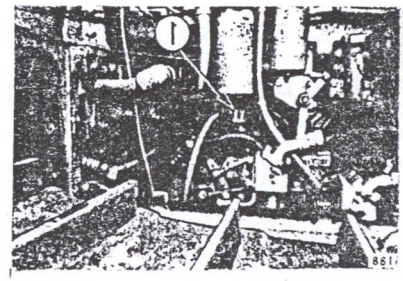
1) Engine breather
   Take breather(1) out of place, and wash the inner element



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2) Alternator and starting motor

When the brushes have been worn out, repair should be performed. Be careful when removing to prevent the sealing gasket from being damaged.



* They should be repaired every 1000 hours, if the machine is frequently operated at night.

3) Engine valve clearance

Special tool is required for removing and adjusting the parts.

Every 4000 hours service

* Maintenance for every 250, 500, 1000 and 2000 hours service should be carried out at the same time.

1) Water pump

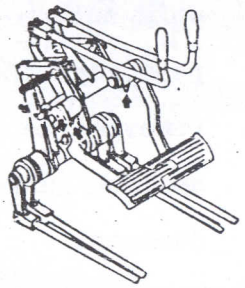
Check for loose pulley, grease leakage or water leakage. If any abnormal phenomenon is found, repair or replace should be performed.

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Lubricating

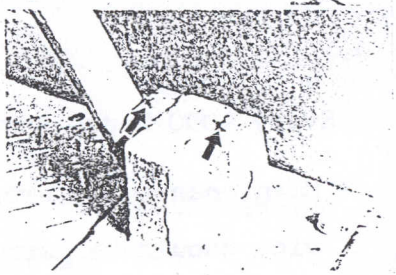
Apply grease to grease fittings shown by arrows.

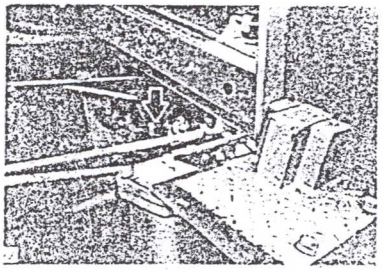
1. Steering clutch brake pedal shaft(4 points).

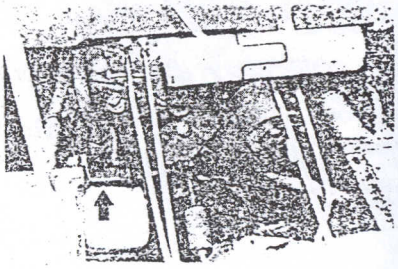


2. Brake lock lever shaft (1 point).
3. Forward-reverse control lever shaft (1 point). (T160,T180,TS180,TSc180)
4. Main clutch control lever shaft (4 points) (T160,T180,TS180,TSc180)



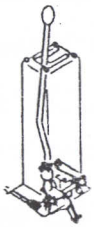




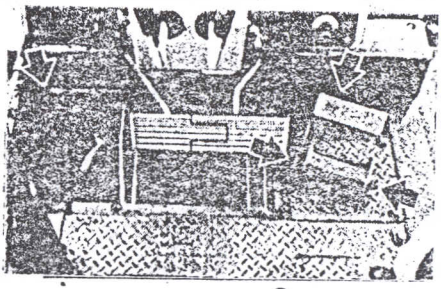


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5. Gear shift lever shaft
   (1 point).
   (TY160, TY180)



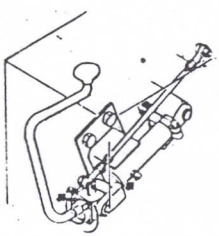
6. Decelerator pedal shaft
   (4 points).
   (T160, T180, TS180, TSc180,
   TY160, TY180)



7. Fuel control lever shaft
   (1 point).



8. Blade control lever shaft
   (2 points).



Track tension

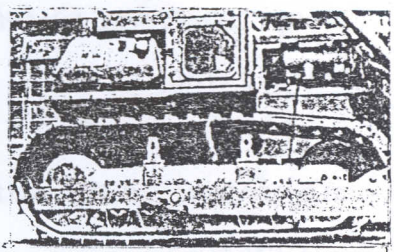
Owing to the difference of working conditions and the kinds of soil, the abrasion wear of the undercarriage components, such as pins, bushes, etc., changes from time to time.

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Therefore the track tension should be examined whenever necessary, to allow it to be kept up in normal tensioning condition.

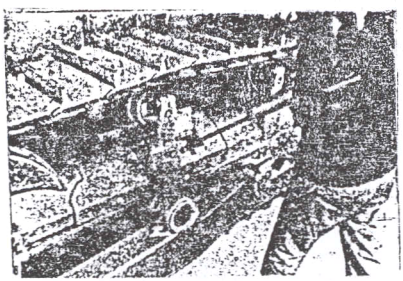
Checking and adjustment should be performed in the same working condition.

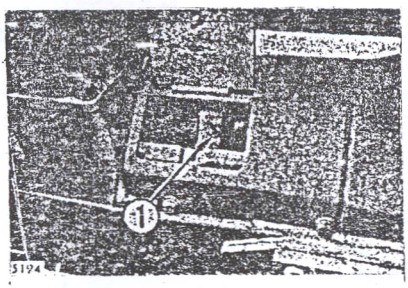
1. Checking



Without applying brakes, stop the machine on a flat land, and put a straight rod on the carrier roller and the idler as shown on the photo. When the distance between the rod and the shoe grouser is 20-30mm at the centre, the tension is standard. Otherwise, the following adjustments should be performed.

2. Adjustment





1) For tightening the tension, pressurize grease through lubricator(1). On the other hand, for loosening the tension, extract the grease by reversely rotating the lubricator(1) for 1 rotation.

2) Grease may be pressurized till S becomes 0 mm. In case

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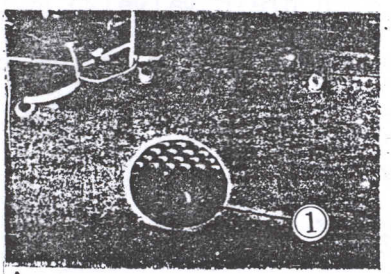
the tension is yet loose after applying pressurized injection of grease till the above mensioned limit, it indicates that the pin bush is reduced by too much abrasion. So it is necessary either to turn or replace the pin and bushings.

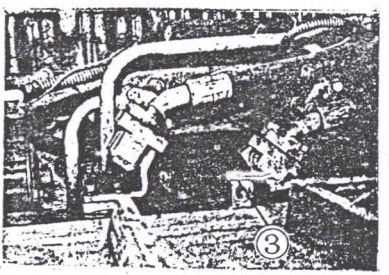
⚠ Do not loosen lubricator(1) over one complete rotation. Also, be careful not to loose any part other than the lubricator(1). If lubricator(1) or any other part is loosened excessively, it will be liable to fly out under the high pressure of jammed grease. If grease does not ooze smoothly, try to move the machine back and forth for a short distance.

Coolant

Change cooling water twice a year in spring and autumn, or every 1000 hours service when antifreeze is not used.
To change cooling water, the machine should be put in a horizontal level position.

1) Stop the engine, turn cap(1) slowly until it comes off.

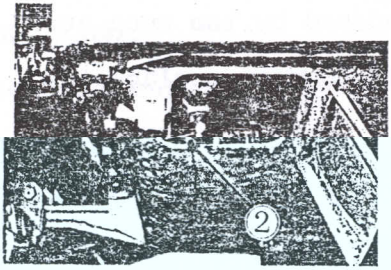


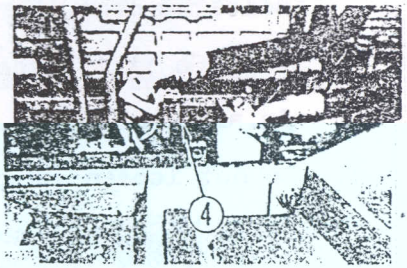


⚠ Do not remove the cap while cooling water is hot.

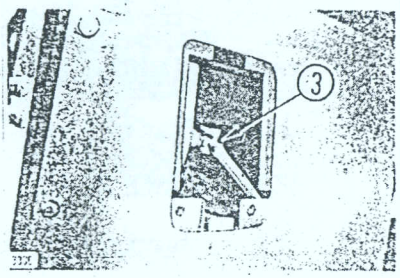
https://truckmanualshub.com/

Since hot water may spout out. When removing the cap, turn it slowly to relieve inner pressure.





2) Open the drain valve(2) at the bottom of the radiator and remove plug(3) on the side of oil cooler to drain off the cooling water.



3) After draining off the cooling water, wash out the cooling system using commercially available detergent.

4) After washing the cooling system, drain off all the water, then close up drain valve(2) and plug(3), pour in soft water (e,g. city water).

5) When the water reaches the vicinity of the water filler, put the engine at low idling, open drain valve(2) and plug(3), then pass water through the cooling system until clean water comes off from drain valve(2) and plug(3).

6) Stop the engine, close drain valve(2) and plug(3), and supply water up to the vicinity of the water filler.

7) After filling the cooling system with water, run the engine for 5 minutes at low idling speed and then for another

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5 minutes at high idling speed to eliminate air trapped in the cooling system (leave water filler cap(1) off during this operation).

8) Stop the engine, about 3 minutes later supply water again up to the vicinity of the water filler and tighten water filler cap(1).

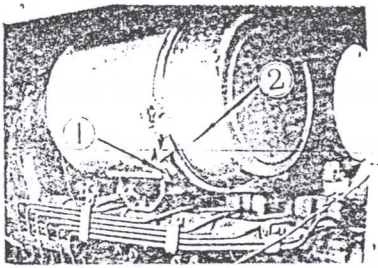
* For the using of antifreeze, please refer to the section "Precautions for low temperature".

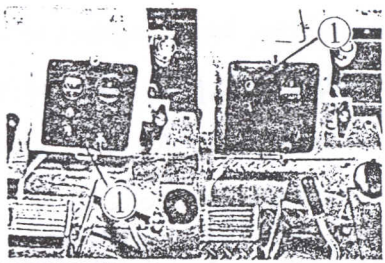
Air cleaner

1. Diesel engine air cleaner of Chinese make

1) Maintenance

When the dust indicator lamp lights up, it shows that the air cleaner should be cleaned.





2) Cleaning and replacing of element

a. Remove bolt(1), cover(2) and take out the element.

b. Clean the air cleaner body interior and the removed cover.

c. Clean and check the element, replace when damaged.

d. Install the cleaned element, cover(2), and tighten the bolt(1).

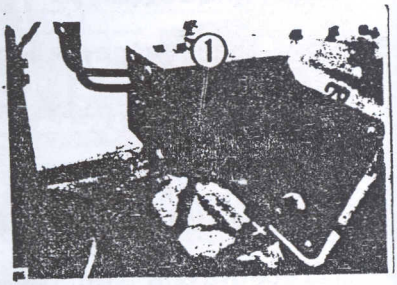
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* Replace the element if the dust indicator lamp lights up soon after installing the element.

2. Diesel engine 6D125-1 of Komatsu Ltd.

1) Maintenance of outer element

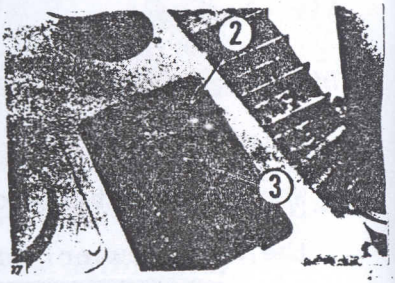
Whenever the red piston in the dust indicator(1) appears, clean the air cleaner element.



2) Cleaning or replacing outer element

a. Remove bolt(1), cover(2) and the outer element.

b. Clean the air cleaner body interior and the removed cover.



c. Clean and check the outer element.

d. Install the cleaned outer element in reverse order to removing. At the same time check seal washer, replace if it is broken.

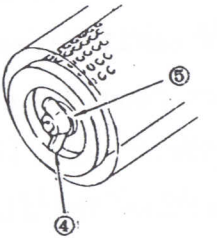
e. Push the button of dust indicator to return the red piston.

* Replace the outer element which has been cleaned 6 times repeatedly or used throughout a year. Replace the inner element at the same time.

* Replace both inner and outer elements when the dust indi-

cator red piston appeared soon after installing the cleaned outer element even though it has not been cleaned 6 times.

3) Replacing inner element



a. Remove the cover and the outer element, and then remove the inner element.

b. Cover the air inlet port using cleaned cloth.

c. Clean the air cleaner body interior. And remove the cover from the air inlet port.

d. Fit a new inner element to the connector and tighten it with nuts.

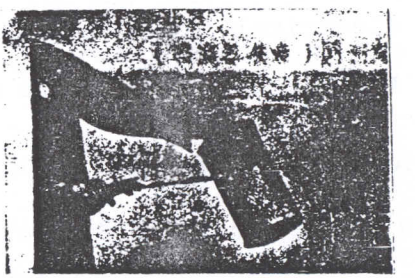
e. Install the outer element and the cover. Push the dust indicator reset button.

* Do not attempt to reinstall a cleaned inner element.

* Do not clean or replace the air cleaner element with the engine running.

4) Cleaning outer element

(With compressed air)



Direct dry compressed air (less than 686 KPa) to element from inside along its folds, then direct it from outside along its folds and again from inside, and check element.

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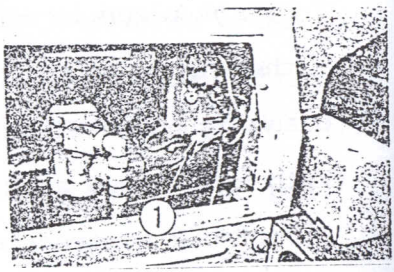
⚠ When using compressed air, wear safety glasses and other things required to maintain safety.

* If small holes or thinner parts are found on element when it is checked with an electric bulb after cleaning and drying, replace the element.
* When cleaning element, do not hit it or beat it against something.
* Do not use element where folds or gasket or seal are damaged.

Electrical intake air heater

(for 6D125-1 engine)

Remove electrical intake air heater(1) from the engine intake connection, and check it for possible open circuits and dirt. When inspecting and replacing the electrical intake air heater, replace the gasket with a new one.



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1. Main clutch (T160,T180,TS180,TSc180)

1) Check

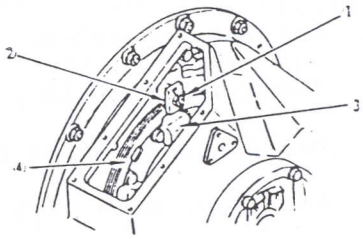
(1) Place the gear shift lever in F3 with engine at full throttle and depress brake all the way down.

(2) Measure the interval from the time when clutch control lever is moved to "engaged" position until engine stalls. If the duration of engine stall is 0.8-1.3 seconds, it shows that it is normal.

* If the time in which the engine stop exceeds the range of 0.8-1.3 seconds, it should be adjusted as follows:

2) Adjustment

(1) Rotate the flywheel so that the lock nut(1) for adjustment comes to the upper side, loosen the lock nut(1).



(2) Rotate the flywheel 180° and the another lock nut(1) and lock plate(2).

(3) Adjust the adjustment ring(4) for the specified operation force by turning it with a wrench applied to the weight link(3).

* When turning the adjustment ring(4) clockwise, the engine stop time is shorted; if turning counterclockwise, the engine stop time is lengthened.

* Tightening torque of lock nut: 80-100 Nm.

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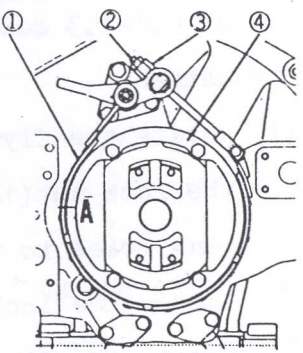
2. Inertia brake (T160,T180,TS180,TSc180)

1) Check

When the engine oil temperature is raised sufficiently after the engine has been running for 10 minutes or so, run the engine at full speed and push the main clutch lever all the way forward. If the main clutch shaft stops in 2.5-3.5 seconds, it shows that the situation is normal.

* If the time exceeds the range of 2.5-3.5 seconds, the following adjustment should be performed.

2) Adjustment



(1) After the main clutch has been adjusted, put the gear shift lever and the forward-reverse lever to "Neutral" position, and lock the brake pedal. Start the engine. After the main clutch lever has been engaged, stop the engine.

(2) Loosen the lock nut(2), run engine at full speed, after the main clutch lever is moved from "engaged" to "released" position, adjust the nut(3) until the brake drum(4) stops running in 2.5-3.5 seconds.

* Turn the lock nut(3) clockwise makes the clearance smaller, on the contrary, the clearance shall be larger.

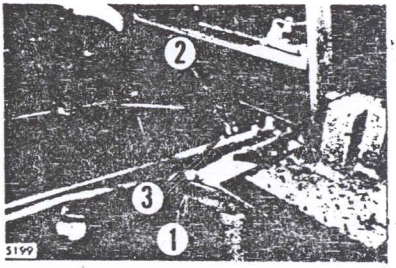
* The standard clearance A between brake lining(1) and drum(4) is 2 mm.

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* After the working equipment has been installed, the inertia brake must be adjusted

3. Interlock device (T160,T180,TS180,TSc180)

This device is used to lock the forward-reverse lever and the gear shift lever when the main clutch is engaged, making it impossible to shift.



Adjustment:

Adjust the length of the lever(1) making it satisfy the above requirement.

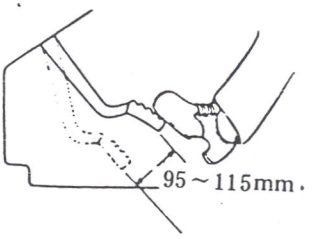
* To shift the gear shift lever to 5th speed, the forward-reverse lever should be put in "Forward" position at first.

4. Brake pedal

When the brake lining is worn out, the travel of the brake pedal becomes large. So, the clearance between the brake band and the brake drum should be adjusted.

1) Check

The travel of the brake pedal is 95-115 mm at the top end of the pedal. If it exceeds 125 mm, it should be adjusted as follows. The standard clearance between the brake band and the drum is 0.3 mm.



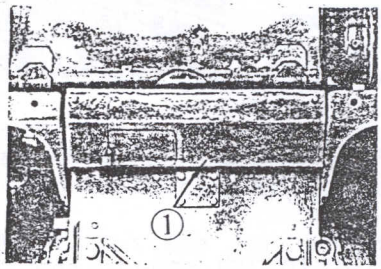
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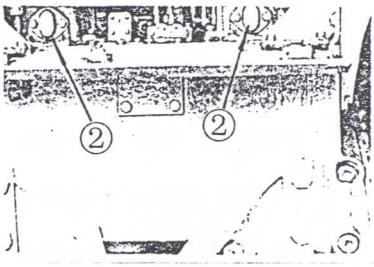
2) Adjustment

(1) Remove rear cover(1) and inspection cover(2).

(2) Tighten adjustment nut (tightening torque is 88 Nm), to make the brake lining keeping close to the drum.

(3) Loosen the adjustment nut about 1 and 5/6 turns from the above position. At last, confirm whether standard clearance and travel have been obtained.





* If brakes still give poor response after adjustment, please consult with the Service Department of our works.

* After adjustment, the travels of the right and the left pedals should not be different. If they are different, one side of the pedals should be adjusted.

* The travel measurement should be performed when the engine stops, using 147 N of treadling force on one side pedal.

5. Idler clearance

When the idler guide has been worn out, the idler may displace traversely, resulting in falling free of the

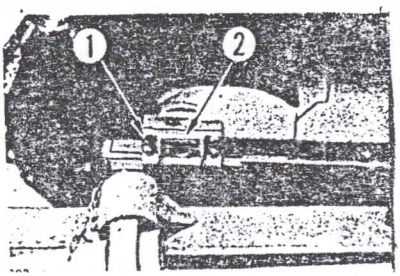
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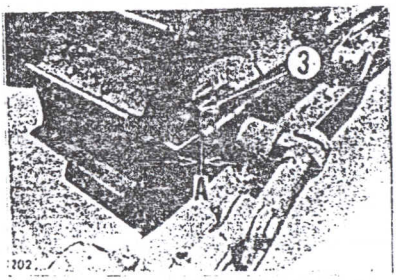
track. In this case, adjustment should be carried out as follows.

1) Adjustment

Move the machine about 1-2 m on a flat ground, measure the clearance A (4 locations: left, right, inside and outside) between the track frame and the guide(2). If the clearance A exceeds 4 mm, loosen bolt(1), pull out the shim(3), to adjust the clearance at one side to 0.5-1.0 mm.

Thickness of one shim is 1 mm.





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All troubles other than that listed in the following table should be examined and repaired by our works.

1. Engine

Problem	Cause	Remedy
The oil pressure warning lamp remains alight (pointer of oil pressure gauge remains in white or red range) when the engine speed is raised after completion of warm up.	-Fuel contents in oil pan is not enough (air being sucked in). -Oil filter element being clogged. -Oil leakage from the pipe or the joint owing to poor connection or damage. -Warning lamp ineffective. (Oil pressure gauge works abnormally.)	-Add oil to specified level. -Replace the oil element. -Check and repair. -Replace.
Steam is emitted from the top part of the radiator (the pressure valve)	-Cooling water is not enough, water leakage. -Fan belt loosened. -Dust or scale accumulated in cooling system.	-Supplu cooling water & check leakage. -Adjust fan belt tension. -wash out the foul inside of cooling system or replace the cooling water.
The pointer of the water temperature gauge is in red range on right hand	-Radiator fin being clogged or distorted. -Thermostat ineffective.	-Clean or repair radiator fin. -Replace.

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Problem	Cause	Remedy
side of the gauge (Water temperature is too high).	-Radiator filler cap being loosened.	-Tighten the radiator filler cap firmly or replace its gasket.
	-Water temperature gauge damaged.	-Replace.
The pointer of the water temperature gauge is in white range on the left hand side of the gauge (water temperature is too low).	-Thermostat damaged.	-Replace.
	-Water temperature gauge damaged.	-Replace.
The engine does not start when the starting motor is turned on.	-Fuel is not enough.	-Add fuel.
	-Air mixed in fuel system.	-Repair and exhaust air.
	-Fuel injection pump or noozle damaged.	-Replace.
	-Rotation speed of the starting motor is slower.	-Refer to the section of "Electrical system".
	-Electrical heater does not glow red.	-Check
	-Compression pressure not sufficient.	
	-Valve clearance not proper.	-Adjust.
Exhaust gas is white or blue and odorous.	-Oil quantity is too much.	-Adjust to specified oil quantity.

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Problem	
	-Fuel i ty.
Exhaust gas occa- sionally turns black.	-Air cl clogge -Noozl -Compr prope
Combustion noise occasionally changes to breathing sound.	-Noozl
Unusual combustion noise or mechani- cal noise.	-Fuel qual -Bein

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Problem	Cause	Remedy
flickers while engine runs.	-Belt tension is not proper.	-Adjust.
Charge lamp does not go out even when engine runs at high speed.	-Alternator defective. -Electrical wiring is not proper.	-Replace. -Check and repair.
Unusual noise is emitted from the alternator.	-Alternator damaged.	-Replace.
Sterting motor does not turn when starting switch is turned on.	-Electrical wiring is not proper. -Battery charge is insufficient.	-Check and repair. -Charge.
The pinion of the starting motor keeps going in and out.	-Battery charge is insufficient.	-Charge.
Starting motor turns the engine sluggishly.	-Battery charge is insufficient. -Starting motor defective.	-Charge. -Replace.
Starting motor disengages before the engine starts up.	-Electrical wiring is not proper. -Battery charge is insufficient.	-Check and repair. -Charge.
Electrical heater signal does not glow red. (for 6D125-1 engine)	-Electrical wiring is not proper. -Heater relay defective. -Heater signal damaged.	-Check and repair. -Replace. -Replace.

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Problem	Cause	Remedy
Oil pressure warning lamp does not light up when engine is stationary (When the starting switch is in ON position.	-Oil pressure warning lamp or oil pressure gauge is damaged. -Warning lamp switch is damaged.	-Replace. -Replace.
Outside the electrical heater is not warm when touched with hand. (for 6D125-1 engine)	-Electrical wiring is not proper. -Electric heater wiring is broken. -Heater relay switch is defective.	-Check and repair. -Replace. -Repair or replace.

3. Chassis

Problem	Cause	Remedy
When steering lever on one side is pulled, machine stops instead of turning, and engine rpm changes.	-Air being sucked into the oil pump. -Oil pump damaged. -Steering linkage is poor adjusted.	-Repair where air is sucked into the oil pump. -Replace. -Adjust.
When steering lever on one side is pulled, machine continues to travel straight forward instead of turning.	-Steering clutch of the pulled side does not disengaged. -Brake of the pulled side does not actuate.	-Refer to the above item. -Adjust brake.
Machine does not stop even when the brake pedal is depressed.	-Brake defective.	-Adjust.

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Problem	Cause	Remedy
Track comes off.	-Track is loosened too much.	-Adjust.
Sprocket abnormal wear develops.	-Track is loosened or tensioned too much.	-Adjust.
Blade rises too slowly or does not rise at all.	-Hydraulic oil quantity not sufficient.	-Add oil to hydraulic tank.

T160, T180, TS180, TSc180

Problem	Cause	Remedy
In shifting, gear rattles and is different to engage (Main clutch shaft does not stop.	-Adjusted stroke is not correct. -Inertia brake does not actuate.	-Readjust. -Adjust.
Main clutch lever is heavy in controlling.	-Booster defective. -Link bush needs lubricating. -Main clutch needs lubricating.	-Check and repair. -Add oil. -Add oil.
Gear shift lever is difficult to shift.	-Inertia brake improperly adjusted.	-Readjust.
Transmission makes crackling noise.	-Transmission case oil quantity no sufficient.	-Add oil to specified level.

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TY160,TY180		
Problem	Cause	Remedy
Oil pressure in the torque converter fails to rise.	-Air being sucked into improperly tightened or damaged oil pipe and pipe joint, resulting in oil leakage.	-Check and repair.
	-Gear pump worn or jammed.	-Check and replace.
	-Transmission case oil quantity insufficient.	-Add oil.
	-Transmission case oil filter element being clogged.	-Clean or replace.
Torque converter is over-heated.	-Fan belt is loosened too much.	-Adjust belt tension.
	-Water temperature in engine is higher.	-Refer to "Handling of engine".
	-Oil cooler being clogged.	-Clean or replace.
	-Oil pressure is too low.	-Refer to the above item.
Machine fails to to start when gear shift lever is placed in higher speed.	-Transmission case oil quantity insufficient.	-Add oil.
	-Oil pressure in transmission case fails to rise.	-Refer to the above item.
	-Steering clutch slips. (Pressure spring is damaged.)	-Check and repair or replace the spring.

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Replace wear parts such as filter element, working equipment's cutting edge, endbit and so on at the time of periodic maintenance or before the wear limit is reached.

Replace wear parts without fail to utilize the machine more effectively.

When replacing the wear parts, please use our works' products.

Wear parts table

(Code numbers listed in ( ) are Komatsu's part numbers.)

Item	Part No.	Description	Q'ty	Replacement frequency
Fuel filter	6130-5302	Element	1	Every 250 Hr
Engine oil filter (for 6D125-1 engine)	6136-51-5120	Cartridge	1	Every 500 Hr
Transmission oil filter (for TY160, TY180)	(281-16-11290) T160·49·57·1 07000-03098	Element (O-ring 97.6x3.5)	2 (2)	Every 250 Hr
Steering clutch oil filter				
Fuel filter (for 6D125-1 engine)	600-311-8291	Cartridge	1	Every 500 Hr
Hydraulic oil filter	144-60-11160 (T160·60·8) 07000-02125	Element O-ring 124.4x3.1-0	1 (1)	Every 1000 Hr
Air cleaner (for 6D125-1 engine)	(6115-81-7602)	Element Ass'y	1	
	(600-181-2300)	Outer element Ass'y	1	

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Item	Part No.	Description	Q'ty	Replacement frequency
Blade (Angle) (for T160, TY160, T180)	(144-70-11311) T160·70-2	Cutting edge	2	
	(144-70-11250) T160·70-1	End bit (L)	1	
	(144-70-11240) T160·71-2	End bit (R)	1	
	(02090-11270)	Bolt M20x1.5x70	28	
	(02091-11205)	Bolt M20x1.5x105	4	
	(02290-11219)	Nut M20x1.5	32	
Blade (Straight) (for T180, TY180, T160, TY160)	(144-920-1120) T160·71-3	Cutting edge	2	
	(144-70-11250) T160·71-1	End bit (L)	1	
	(144-70-11260) T160·71-2	End bit (R)	1	
	(02090-11270)	Bolt M20x1.5x70	24	
		Bolt M20x1.5x110	4	
		Nut M20x1.5	28	
Blade (Straight-tilt) (for TSc180)	(12F-70-31251) TSc180·71-3	Cutting edge	5	
	(13F-A70-1570) TSc180·71-1	End bit (L)	1	
	(13F-A70-1580) TSc180·71-2	End bit (R)	1	
	(02090-11060)	Bolt M20x1.5x60	31	
		Bolt M16x1.5x90	4	
		Nut M16x1.5	35	

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Item	Part No.	Description	Q'ty	Replacement frequency
Blade (Straight-tilt) (for TS180)	(144-70-11131) T160 71-2	Cutting edge	2	
	(13F-Z27-1581) TS180 71-1	End bit (L)	1	
	(13F-Z27-1571) TS180 71-2	End bit (R)	1	
	(02090-11060)	Bolt M20x1.5x70	28	
	(02091-11210)	Bolt M20x1.5x110	4	
	(02290-11219)	Nut M20x1.5x110	32	
Blade (Straight-tilt) (for T160, T180, TY180)	(144-920-1120) T160 71-3	Cutting edge	2	
	(144-70-11250) T160 71-1	End bit (L)	1	
	(144-70-11260) T160 71-2	End bit (R)	1	
	(02090-11270)	Bolt M20x1.5x70	28	
	(02091-11210)	Bolt M20x1.5x110	4	
	(02290-11219)	Nut M20x1.5	32	

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1. Fuel and oil

According to different atmospheric temperature, use different kinds of fluids. (Refer to the following table)

2. Antifreeze

When the atmospheric temperature is lower than 0°C, antifreeze should be added, as for the proportion, please refer to the section "Precautions for Low Temperature".

* Specified oil quantity is the total oil quantity filled in the unit, including the attached pipings.

Refill oil quantity generally means the oil quantity added when performing Maintenance and repair.

* When starting the engine in an atmospheric temperature of lower than 0°C, be sure to use class CD 20# engine oil even though the atmospheric temperature goes up to 10°C or so in the day time.

* As for the cooling water, please use soft water (e.g. city water.

Filling position	Kind of fluid	Ambient temperature							Capacity(l)	
		-2	14	32	50	68	86	°F	Specified	Refil
		-20	-10	0	10	20	30	°C		
Engine oil pan									30	26
Transmission case(incl.torque converter case) (TY160,TY180)									52	47

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Filling position		Kind of fluid	Ambient temperature -2 14 32 50 68 86 °F / -20 -10 0 10 20 30 °C	Capacity(l) Specified	Refill
Steering clutch case(incl. bevel gear case, transmission case) (T160,T180,TS180, TSc180)		Class CD engine oil JB-ZQ 3920-86	30	80	75
Steering clutch case(incl. bevel gear case) (TY160,TY180)			20	70 T160,T180,TY160 TY180 each 31 (L & R)	65
Final drive case				TS180 each 36 (L & R) TSc180 each 42 (L & R)	
Main clutch case (T160,T180,TS180, TSc180)			20	20	20
Hydraulic system				108	108
Fuel tank		Light oil GB252 -81	-10 -20 -30	320	
Cooling system	T160,T180, TS180, TSc180	Water	Add antifreeze	55	
	TY160, TY180			63	
Reservoir		Starting liquid	CH-40 CH-20	Adequate	

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When calling for service of mechanic or when making replacement parts order, be sure to give us the machine and engine serial numbers as well as the service card, etc. These numbers are found on the plates shown on the photos below.

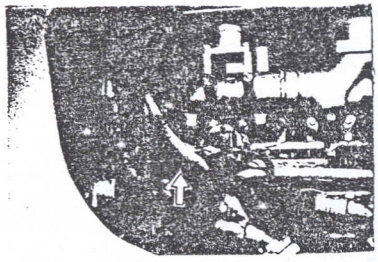
1. Location of the machine name plate number

   On the left bottom side of engine cover

   (T160, T180, TS180, TSc180, TY160, TY180)

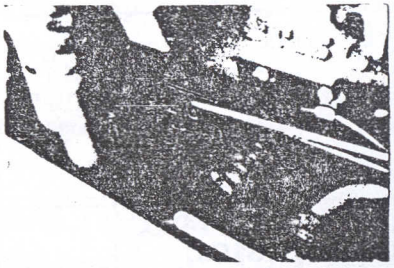
2. Location of the engine serial number mark

   (for model 6130 engine)
   On the right side of the
   engine cylinder block.



3. Location of the engine serial number name plate

   (for model 6D125-1)
   On the right side of the
   engine cylinder block.



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Brief Specifications

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T160(T180)

Performance

Travel speed	Forward	1st	2.7 km/h(2.6km/h)
		2nd	3.7 km/h(3.5km/h)
		3rd	5.4 km/h(4.7km/h)
		4th	7.6 km/h(7.0km/h)
		5th	11.0 km/h(10.3km/h)
	Reverse	1st	3.5 km/h(3.3km/h)
		2nd	4.9 km/h(4.5km/h)
		3rd	7.0 km/h(6.1km/h)
		4th	9.8 km/h(9.1km/h)
Max. tractive force			172.4kN(186.9kN)
Specific ground pressure			67.7kPa(65.9kPa)

Operating weight 17,100kg(18,060kg)

Blade

Installation weight(incl. cylinder 105kg) 2,417kg(2,385kg)

Engine

Model	6130T8A(6130ZT2) diesel engine
Rated output	117.5kW/1850rpm(133kW/1850rpm)
Max. torque	765 Nm/1100rpm(824 Nm/1100rpm)
Starting motor	24V 7.5kW
Alternator	28V 0.5kW
Battery	12V 195Ah x 2

Engine

Model	Komatsu 6D125-1 diesel engine
Rated output	117.5kW/1850rpm(128.7kW/1850rpm)
Max. torque	765 Nm/1100rpm(794 Nm/1100rpm)
Starting motor	24V 7.5kW
Alternator	28V 0.5kW
Battery	12V 195Ah x 2

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TY160(TY180)

Performance

Travel speed	Forward	1st	0-3.8km/h(0-3.9km/h)
		2nd	0-6.6km/h(0-6.8km/h)
		3rd	0-10.6km/h(0-10.9km/h)
	Reverse	1st	0-4.9km/h(0-5.0km/h)
		2nd	0-8.5km/h(0-8.6km/h)
		3rd	0-13.6km/h(0-13.7km/h)
Specific ground pressure			62.8kPa(62.8kPa)
Operating weight			15,890kg(16,770kg)

Blade

Installation weight(incl. cylinder 105kg)	2,417kg(2,385kg)

Engine

Model	6130T8B(6130ZT2A) diesel engine
Rated output	117.5kW/1850rpm(133kW/1850rpm)
Max. torque	765 Nm/1295rpm(824 Nm/1295rpm)
Starting motor	24V 7.5kW
Alternator	28V 0.5kW
Battery	12V 195Ah x 2

Engine

Model	Komatsu 6D125-1 diesel engine
Rated output	117.5kW/1850rpm(125kW/1850rpm)
Max. torque	765 Nm/1100rpm
Starting motor	24V 7.5kW
Alternator	24V 13A
Battery	12V 195Ah x 2

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BRIEF SPECIFICATIONS

TS180(TSc180)

Performance

Travel speed	Forward	1st	2.7km/h(2.7km/h)
		2nd	3.7km/h(3.5km/h)
		3rd	5.4km/h(5.0km/h)
		4th	7.6km/h(7.6km/h)
		5th	11.0km/h(10.3km/h)
	Reverse	1st	3.5km/h(3.2km/h)
		2nd	4.9km/h(4.2km/h)
		3rd	7.0km/h(6.1km/h)
		4th	9.8km/h(9.2km/h)

Max. tractive force 171k N/171.1k N

Specific ground pressure 28.44kPa(20.6kPa)

Operating weight 17,550kg(18,700kg)

Blade

Installation weight 1,975kg(1,666kg)

Engine

Model	6130ZT2 diesel engine
Rated output	133kW/1850rpm
Max. torque	824 Nm/1100rpm
Starting motor	24V 7.5kW
Alternator	28V 0.5kW
Battery	12V 195Ah x 2

Engine

Model	Komatsu 6D125-1 diesel engine
Rated output	121.3kW/1850rpm(125kW/1850rpm)
Max. torque	765 Nm/1000rpm(765 Nm/1100rpm)
Starting motor	24V 7.5kW
Alternator	24V 13A
Battery	12V 195Ah x 2