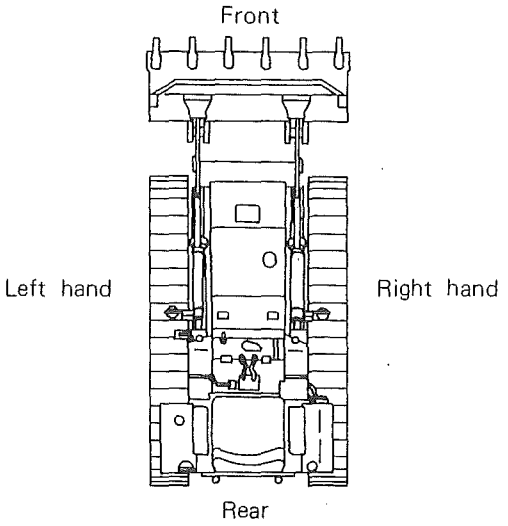
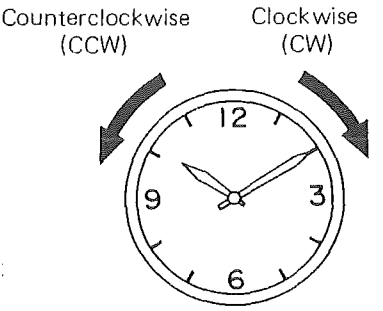
GENERAL INFORMATION

Frequent referrals to the terms, "front," "rear," "right hand," and "left hand," are used in this operation manual. Their application is as indicated here:





NOTES, CAUTIONS and WARNINGS

NOTES, CAUTIONS and WARNINGS are used in this manual to emphasize important and critical instructions. They are used for the following conditions:

NOTE . . . . . An operating procedure, condition, etc., which it is essential to highlight.

CAUTION . . . . . Operating procedures, practices, etc., which if not strictly observed, will result in damage to or destruction of machine.

WARNING . . . Operating procedures, practices, etc., which if not correctly followed, will result in personal injury or loss of life.

ABBREVIATIONS

The following abbreviations frequently appear in this manual:

DD : Direct drive machine

DPS: Direct powershift machine

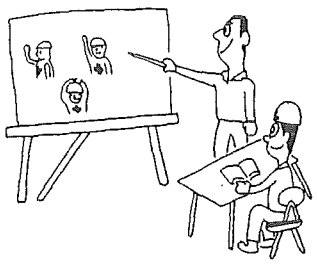
MACHINE MODELS COVERED

This operation manual furnishes operating and maintenance information for the following models:

BS3F F-DD	1S0	00001 ~
BS3F S-DD	1S1	00001 ~
BS3F F-DPS	1S5	00001 ~
BS3F S-DPS	1S6	00001 ~

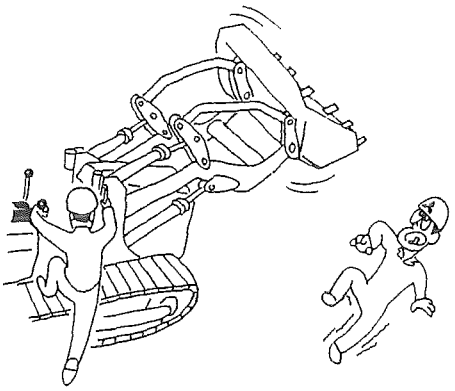
EVERY OPERATOR HAS A SAFETY PROGRAM

The operator is the key to safe job performance and should study this safety program to be aware of basic safety precautions to help prevent serious injury and damage to the machine. This EVERY OPERATOR HAS A SAFETY PROGRAM is designed to present situations which exemplify some of the daily work problems encountered by the operator and other personnel.



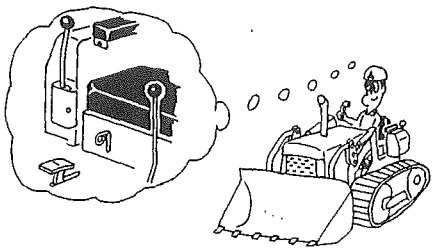
PREPARE FOR SAFE OPERATION!

Learn the hand signals to be used on a job, and who is responsible for signaling. Learn thoroughly the rules to be observed at the work site.



MOUNT SAFELY!

Climb aboard your machine carefully—from left-hand side. There is BUCKET CONTROL LEVER on right-hand side; touching it can cause an accident.

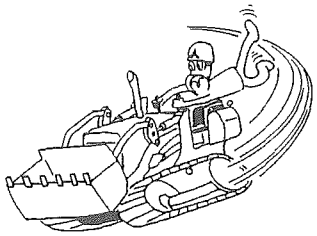


START ENGINE SAFELY!

Make certain that SPEED SELECTOR LEVER and BUCKET CONTROL LEVER are in neutral position – with BRAKE PEDAL locked in applied position.

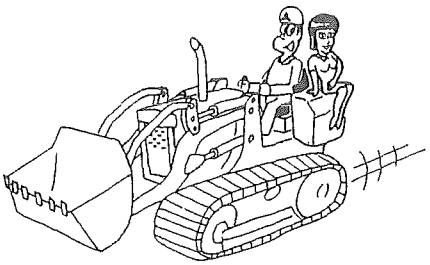
MOVE CAREFULLY!

Again make sure the coast is clear – that no people or objects are in your path. Use the horn if necessary.



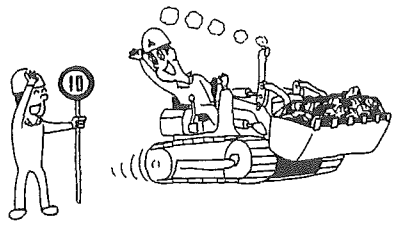
DRIVE AND TRAVEL CAREFULLY!

Start at speeds slow enough to insure you have complete control at all times. Travel slowly over rough ground and on hill side.



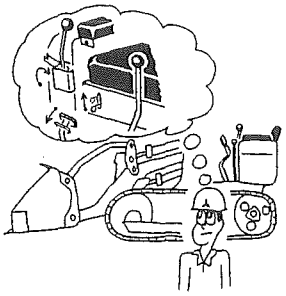
REMEMBER THE OTHER GUY!

Say NO! to riders. If you do carry a mechanic for inspection, don't let him ride any place but in the specific safe position as provided.



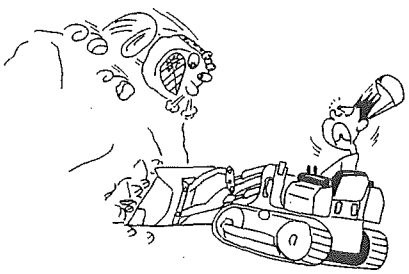
FOLLOW TRAFFIC RULES!

Always watch for "Slow Moving Vehicle" signs, and go with caution. Know the terrain where you are working, and what hazards to expect.



PARK SAFELY!

Park in a non-operating area. Make sure the tracks are on a firm footing, and there is no danger of sliding. Lower ALL ATTACHMENTS to the ground. Lock BRAKE PEDAL and SAFETY LEVERS, and remove STARTING SWITCH KEY.

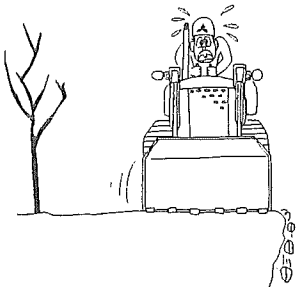


HAZARDOUS OPERATIONS

Be extremely alert during any dangerous operation. When undercutting high banks, the whole mass can become unstable and cave in.

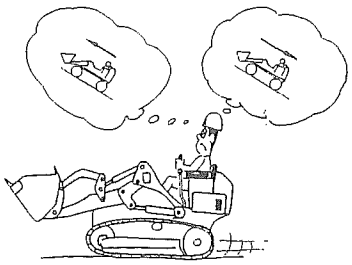
TRAFFIC COURTESY

Take it slow and easy when traveling through congested areas. Traffic courtesy pays off. Maintain a safe distance from other vehicles. Pass cautiously when necessary.



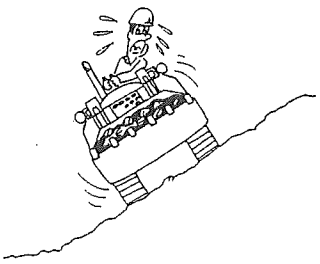
DANGEROUS AREAS

Always check work area for dangerous features. Avoid operating your machine too close to an overhang. Beware of caving edges! Beware of falling rocks!



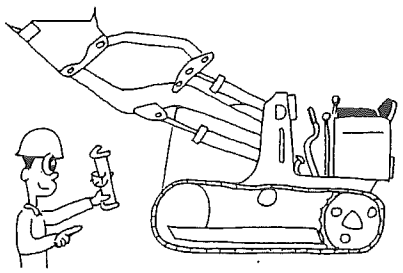
WORK SAFELY!

Don't obstruct your vision when traveling or working. Carry the bucket at a height of about 40 cm (16 in.) above the ground for maximum visibility while traveling.



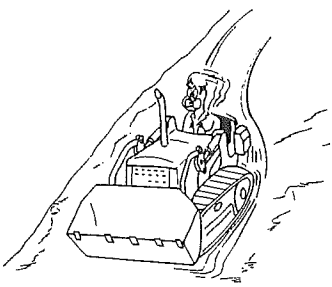
OPERATING ON SLOPES

Avoid sidehill travel whenever possible. Drive up and down the slope. Should your machine start slipping sideways on a grade. turn it immediately in the direction of downgrade.



SERVICING WITHOUT ACCIDENT

Before servicing, adjusting or repairing a tractor shovel, LOWER the bucket to the ground, or if necessary to raise the bucket for access to certain parts, support it by lift cylinder support (furnished). Don't rely on controls to support or position the attachment for servicing. Avoid working on the machine with the engine running. If it is necessary to make checks with the engine running, use TWO MEN – one (the operator) at the controls, the other checking where the operator can see him.



AVOID JERKY STOP

Such a stop tends to swerve the rear end of your machine – and you may lose the control.

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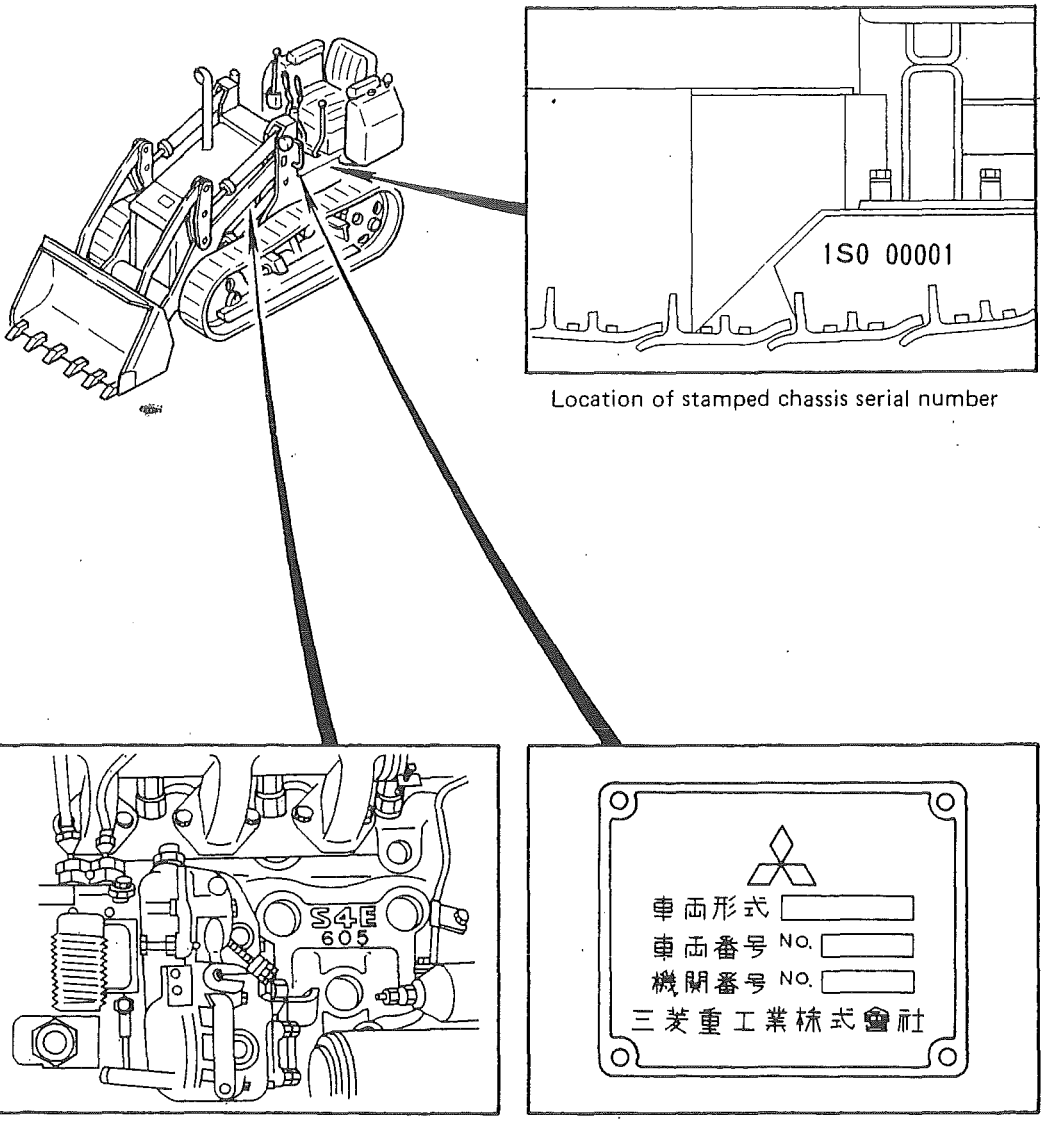
LUBRICATION INSTRUCTIONS

MAINTENANCE INSTRUCTIONS

INSTRUCTIONS FOR ORDERING PARTS

Location of chassis and engine serial numbers

In communicating with the MITSUBISHI dealer or MITSUBISHI-authorized service shop concerning the supply of replacement parts, servicing, etc., give the chassis and engine serial numbers to facilitate identification of the parts.



Location of stamped chassis serial number

Location of stamped engine serial number

Location of chassis nameplate

When changing the place of work

Every MITSUBISHI machine at work is MITSUBISHI's concern. MITSUBISHI is always eager to extend its servicing arm to the user – to help him make the best use of his machine wherever it works.

Your BS3F tractor shovel is registered in a MITSUBISHI dealer from which you bought it. When you change the place of work from one dealer's territory to another, you are requested to contact your dealer about such a change to reserve your right to get the full benefits of MITSUBISHI warranty and to receive attention of skilled MITSUBISHI technicians.

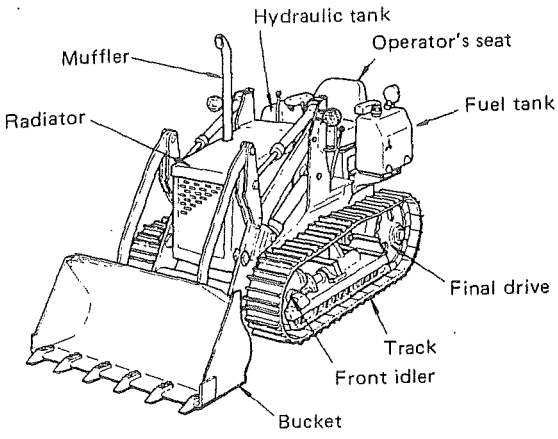
The importance of genuine MITSUBISHI parts

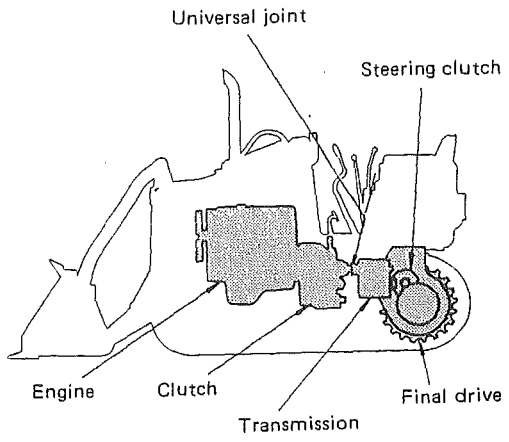
Satisfactory and efficient service in the operation of your machine is endangered by the use of inferior parts – in most cases, imitations, as cheap parts invariably mean short life and high cost.

MITSUBISHI bears the full responsibility for the quality and fit of each part it supplies. Dealers carrying out repairs on MITSUBISHI machines, and the owners of such machines, are urged to use ONLY genuine parts in order that the machine may be maintained in first-class operating condition. The use of any part other than the genuine MITSUBISHI-engineered part releases MITSUBISHI from any guarantee.

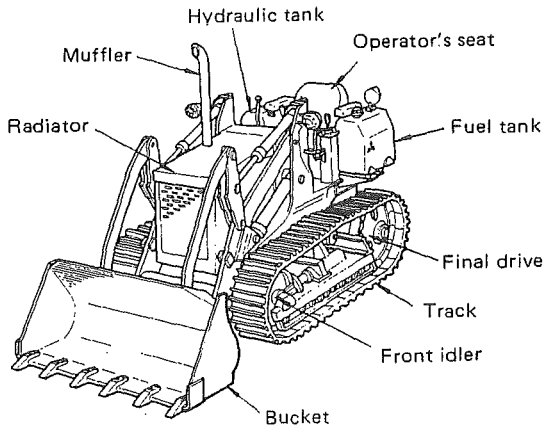
OPERATION INSTRUCTIONS

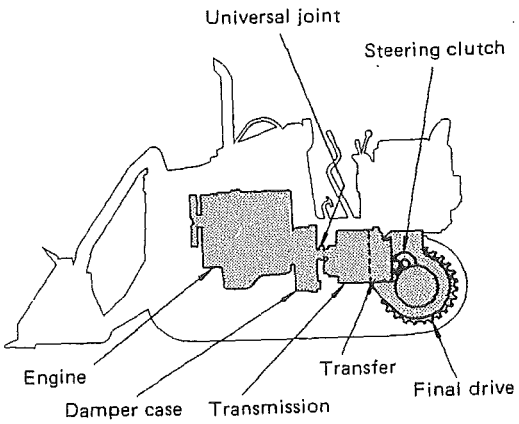
Names of principal components





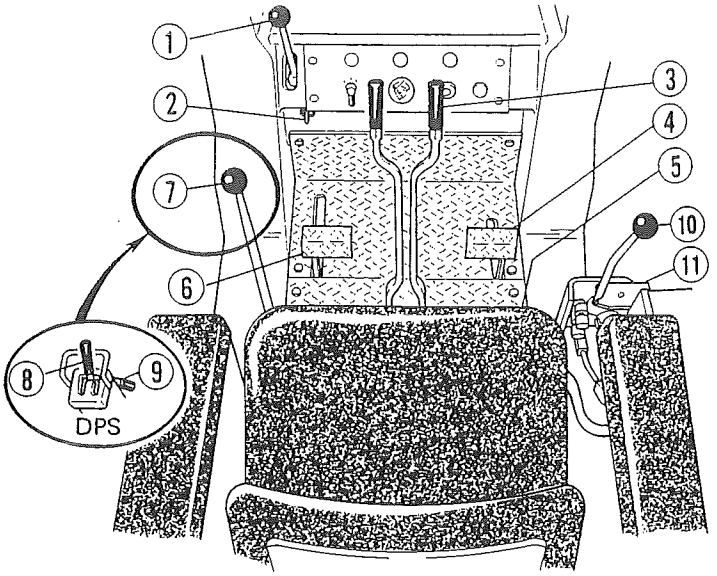
Direct drive machine



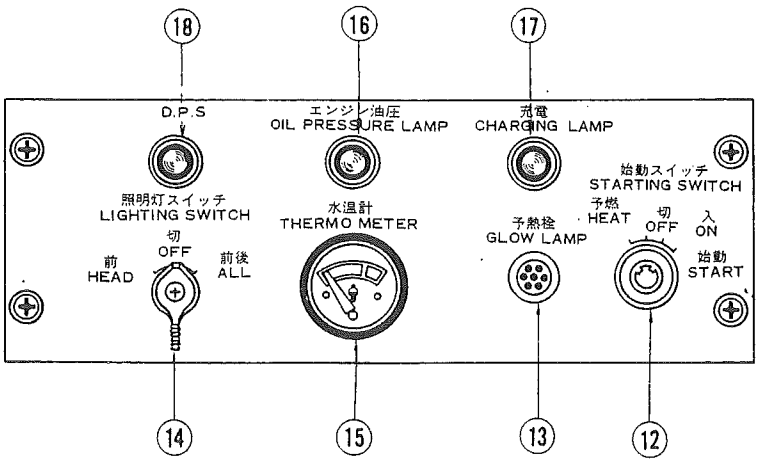


Direct powershift machine

Controls and instruments



1-Accelerator lever
2-Engine stop lever
3-Steering clutch control lever
4-Brake pedal (parking brake)
5-Safety lock control lever for brake pedal
6-Clutch pedal
7-Speed selector lever (DD)
8-Speed selector lever (DPS)
9-Safety lock control lever for speed selector lever (DPS)
10-Bucket control lever
11-Bucket control lever lock plate



12-Heat and start switch
13-Glow plug indicator
14-Lighting switch
15-Water temperature-gauge
16-Engine lube oil pressure warning lamp
17-Battery charge warning lamp
18-Transmission oil filter warning lamp (DPS)

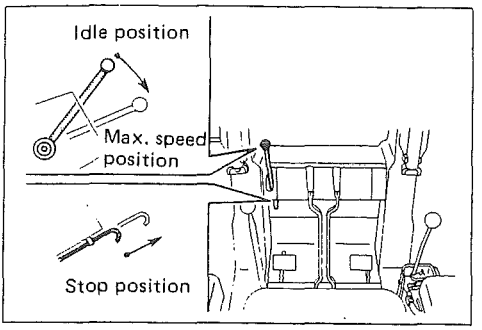
Controls

Accelerator lever (1)

Raise the engine speed by pushing down this lever. The lever remains in any desired speed position when released to maintain the engine speed.

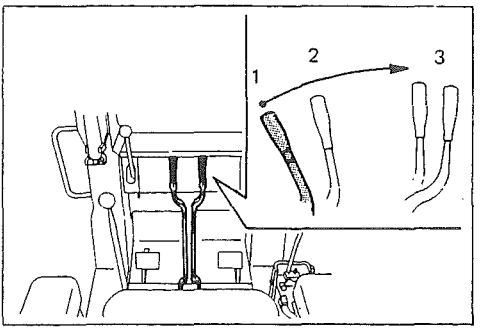
Engine stop lever (2)

Stop the engine by pulling this lever all the way back to the shut-off position.



Steering clutch control levers (3)

Make a right turn by pulling the right-hand lever back. Pulling the lever 1/3 to 1/2 disengages the right-hand steering clutch and pulling it all the way applies the clutch brake on the same side to allow the tractor to make a right turn. The same is true of the left-hand lever.



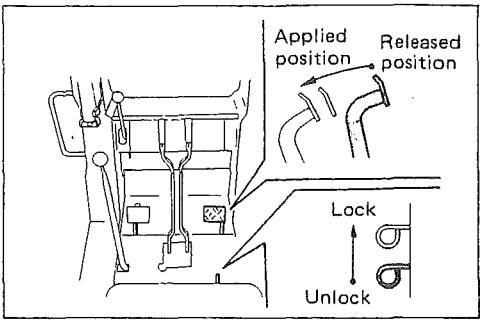
1-Engaged position
2-Disengaged position
3-Brake applied position

Brake pedal (parking brake) (4)

Apply the steering clutch brake by depressing the right-hand pedal. Do not attempt to disengage the steering clutch when applying this brake. This pedal has a locking means to be used as a parking brake.

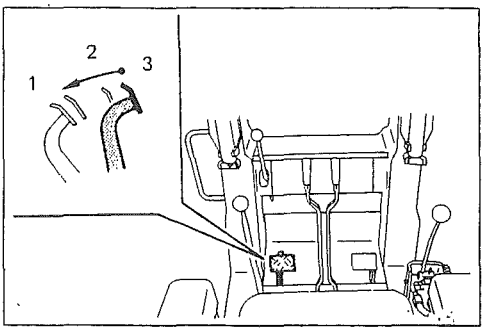
Safety lock control lever for brake pedal (5)

Lock the brake pedal in its applied position by pulling up on the lever all the way. To unlock the pedal, depress it.



Clutch pedal (DD) (6)

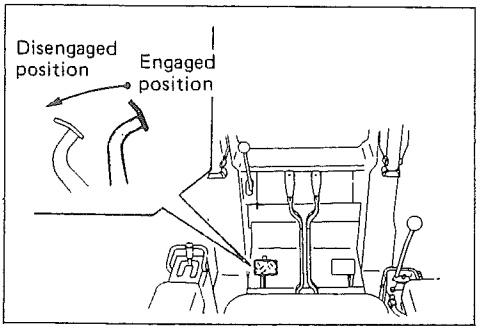
Disengage the main clutch by depressing the left hand pedal about 1/2; depressing it all the way applies the inertia brake.



1-Brake applied position
2-Disengaged position
3-Engaged position

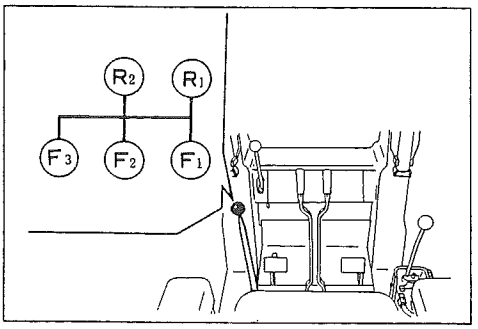
Clutch pedal (DPS) (6)

Disengage the transmission clutch by depressing the left hand pedal all the way.



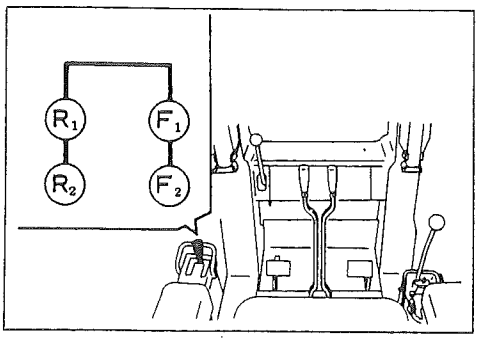
Speed selector lever (DD) (7)

Shift this lever to the desired position by depressing the clutch pedal to select speed. Stop the machine when shifting the lever.



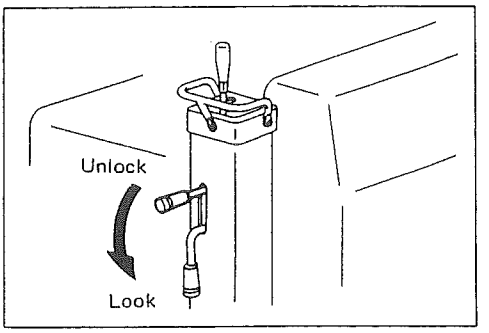
Speed selector lever (DPS) (8)

Just shift this lever to select speed. No need for you to depress the clutch pedal. You can instantly shift "on-the-go," that is, without stopping the machine.



Safety lock control lever for speed selector lever (DPS) (9)

Lock the speed selector lever in the safe (neutral) position by pushing down the control lever. Always lock the speed selector lever when leaving the machine.



Bucket control lever (10)

A single control lever having six positions — RAISE, HOLD, LOWER, FLOAT, ROLLBACK and DUMP—is used.

RAISE the bucket by pulling the control lever back.

HOLD the bucket at any desired height by placing the control lever in neutral position.

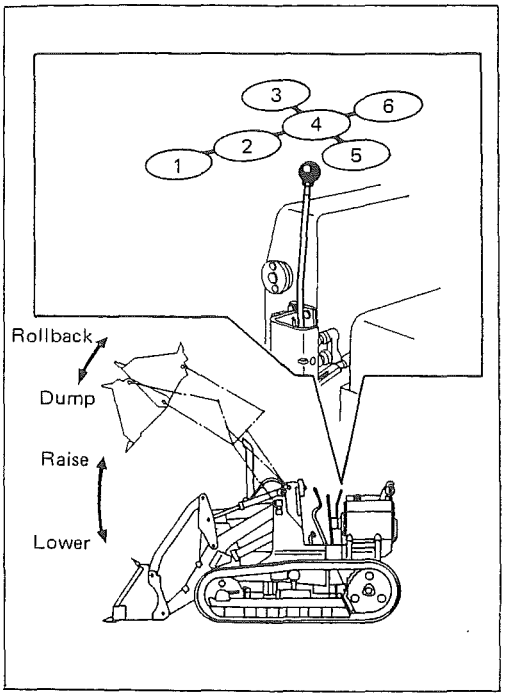
LOWER the bucket by pushing the control lever forward until the resistance is felt in the lever. The lever will automatically return to the hold position when released.

FLOAT position is obtained by pushing the control lever through the lowering position. In this position, the bucket will lower under its own weight.

The lever will remain in the float position until it is pulled back and released to return to the hold position.

ROLLBACK the filled bucket to carry full loads by moving the control lever toward you. The lever will automatically return to the hold position when released.

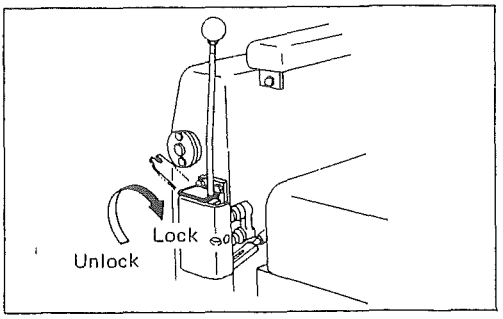
DUMP the bucket by moving the control lever away from you. The lever will also automatically return to the hold position when released.



1-Float position
2-Lower position
3-Dump position
4-Hold position
5-Rollback position
6-Raise position

Bucket control lever lock plate (11)

Push down the plate with the bucket control lever in neutral to lock it. Be sure to lock the lever when leaving the machine.



Instruments

Heat and start switch (12)

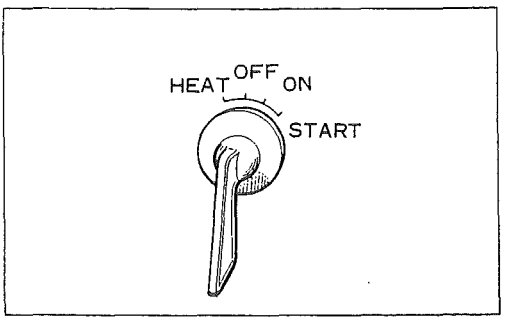
This switch comprises a heat switch and a start switch. Its functions are as follows:

OFF position permits the switch key to go in and come off. Place the switch in this position when the engine is stopped.

ON position energizes all the electric circuits. Leave the switch in this position to keep the engine running.

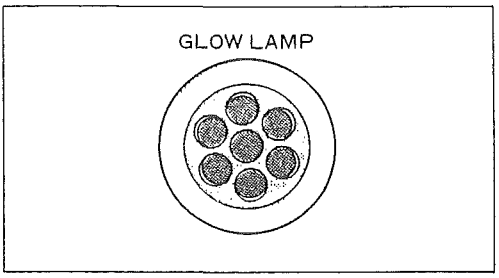
HEAT position energizes the glow plugs in the engine precombustion chambers. Move the switch to this position for about 25 seconds before cranking a cold engine for starting up under ordinary climatic condtions.

START position is used to crank the engine. The switch automatically returns to the ON position when released.



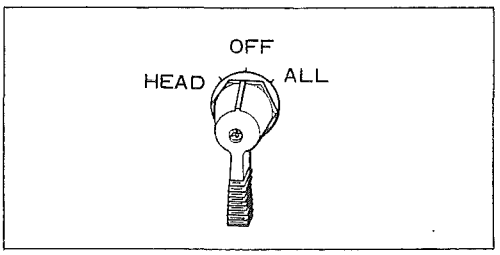
Glow plug indicator (13)

This indicator simulates the operation of the glow plugs, enabling you to observe the length of time for preheating.



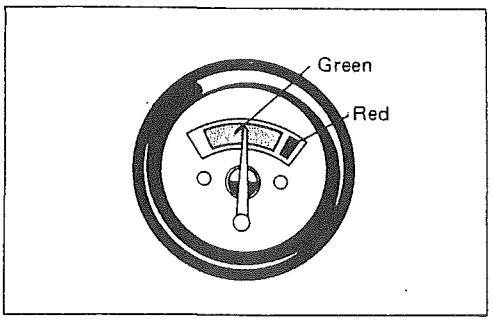
Lighting switch (14)

Move the switch to the HEAD position to turn the head lamps on; move it to the ALL position to turn the head lamps and working lamps on.



Water temperature gauge (15)

After the engine has warmed up, the indicator on the water temperature gauge should be in the GREEN range. If not, reduce the engine speed to low idle to allow some of the hot areas in the engine to gradually cool.



Engine lube oil pressure warning lamp (16)

This warning lamp lights up when the start switch is moved to the ON position in starting up the engine and goes out after the engine starts. This lamp remains OFF when the engine lubrication system is working properly. By lighting up, this lamp warns the operator that the lube oil pressure is lost; in such a case, stop the engine and make a search for the loss.

Battery charge warning lamp (17)

This warning lamp also lights up when the start switch is moved to the ON position and goes out after the engine picks up speed. If it remains ON, stop the engine and check for the cause of the trouble.

Transmission oil filter warning lamp (DPS) (18)

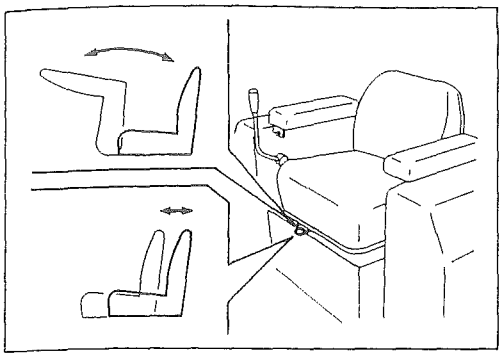
This warning lamp lights up when the oil filter has become internally clogged. If it does, clean or replace the filter element.

Others

Operator's seat

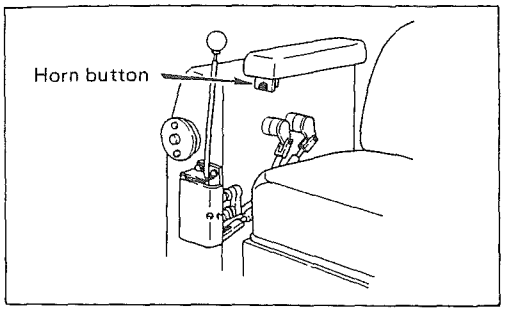
The entire seat will slide forward or backward to any desired position. The seat can be adjusted to three positions by the amount of 20 mm (3/4 in.) at a time by moving the lever toward the right. The seat will be locked when the lever is released.

The seat can also be turned forward as shown by pulling the lock lever forward.



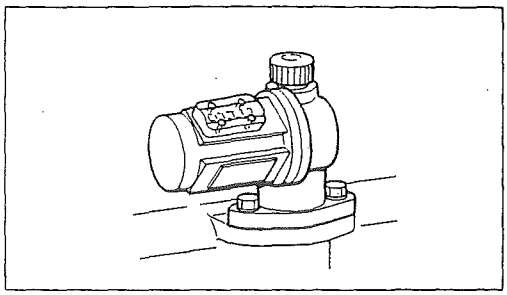
Horn button

The horn sounds off when the button just below the right-hand arm rest is pushed.



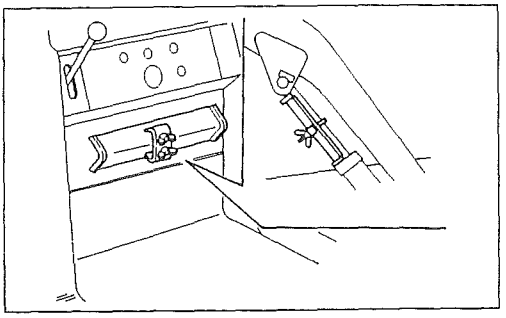
Service meter

Located on the right-hand side of the engine, this meter advances one dial number when the crankshaft turns as many revolutions as are made in an hour at average operating speeds on an average job application. The purpose of this meter is to indicate when to perform the recommended servicing and lubrication operations.



Lift cylinder support

This support is carried right below the instrument panel.

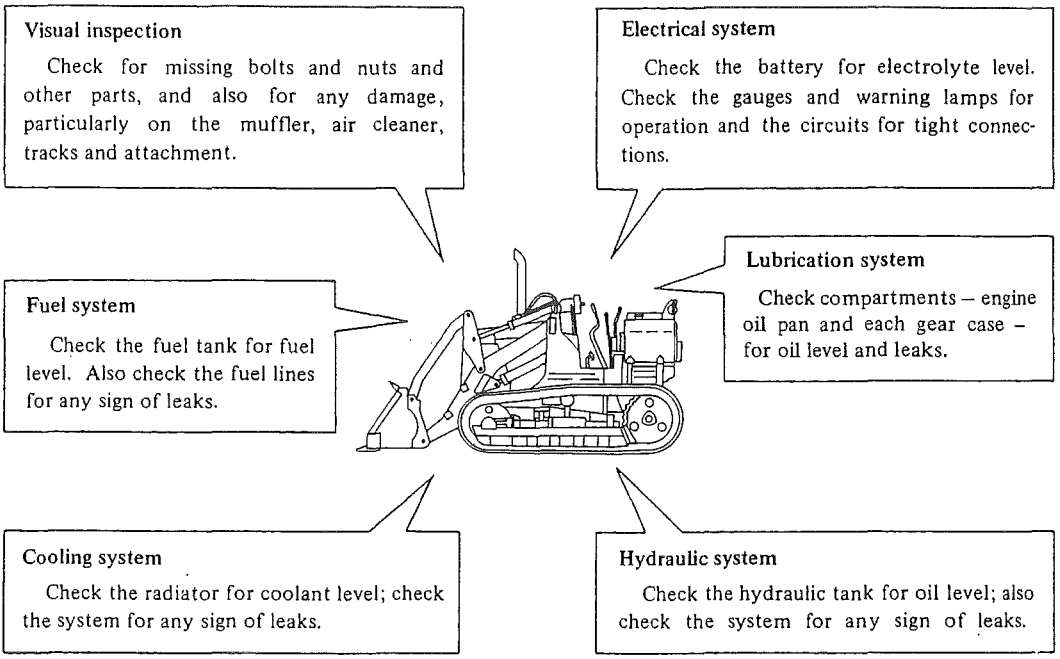


WARNING

If it is necessary to raise the bucket for access to certain parts for servicing, adjusting or repairing, securely support the bucket by using the lift cylinder support.

New machine initial service

Before placing your machine in initial operation, give it a detailed inspection by referring to this diagram:



After the initial 100 service hours of a new or reconditioned machine: –

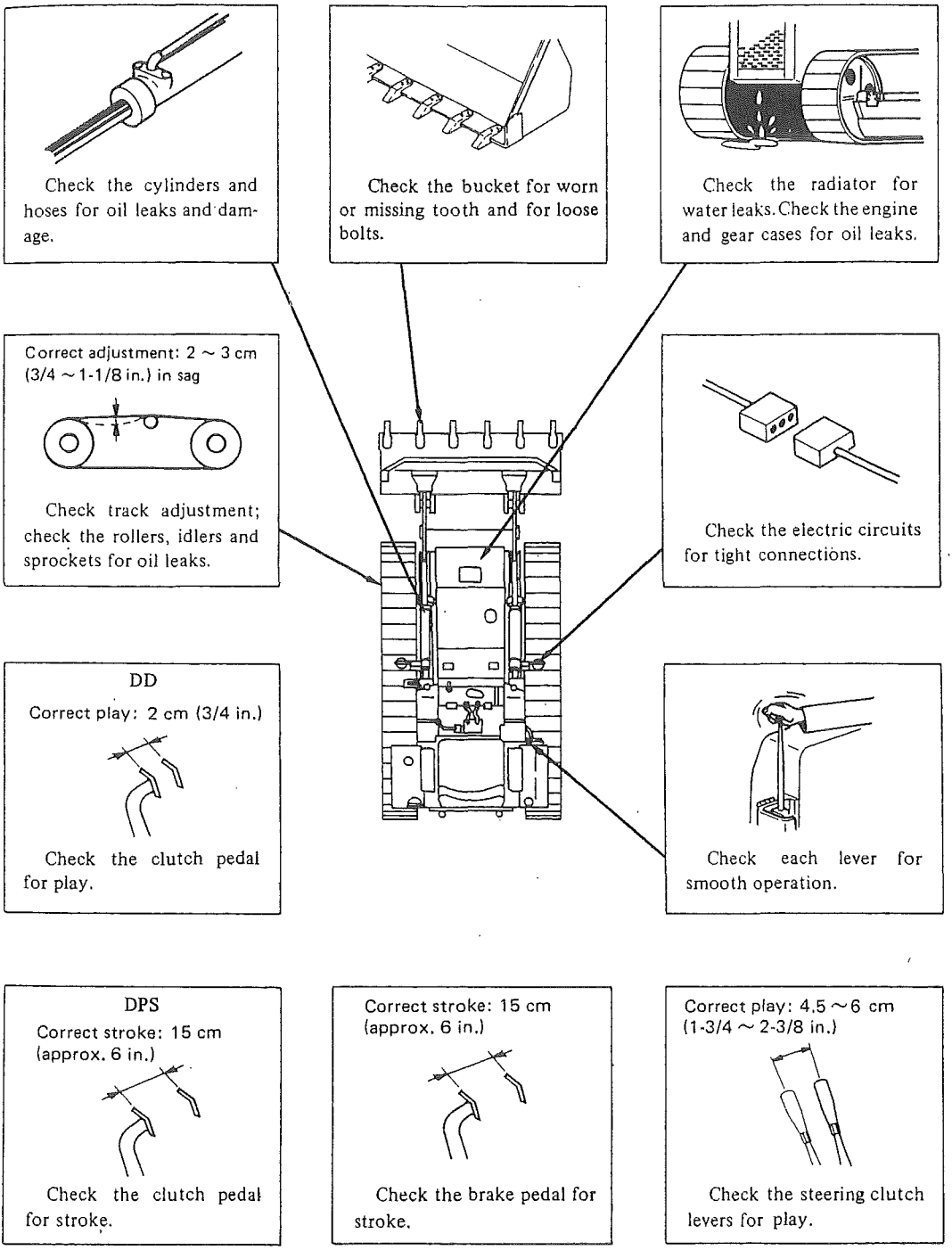
1) Change the engine oil (page 42).
2) Change the engine oil filter element (page 42).
3) Change the clutch case oil (DD) (page 44).
4) Change the transmission case oil (DD) (page 44).
5) Change the hydraulic oil filter element (page 46).
6) Retighten the bolts on the engine (page 34).

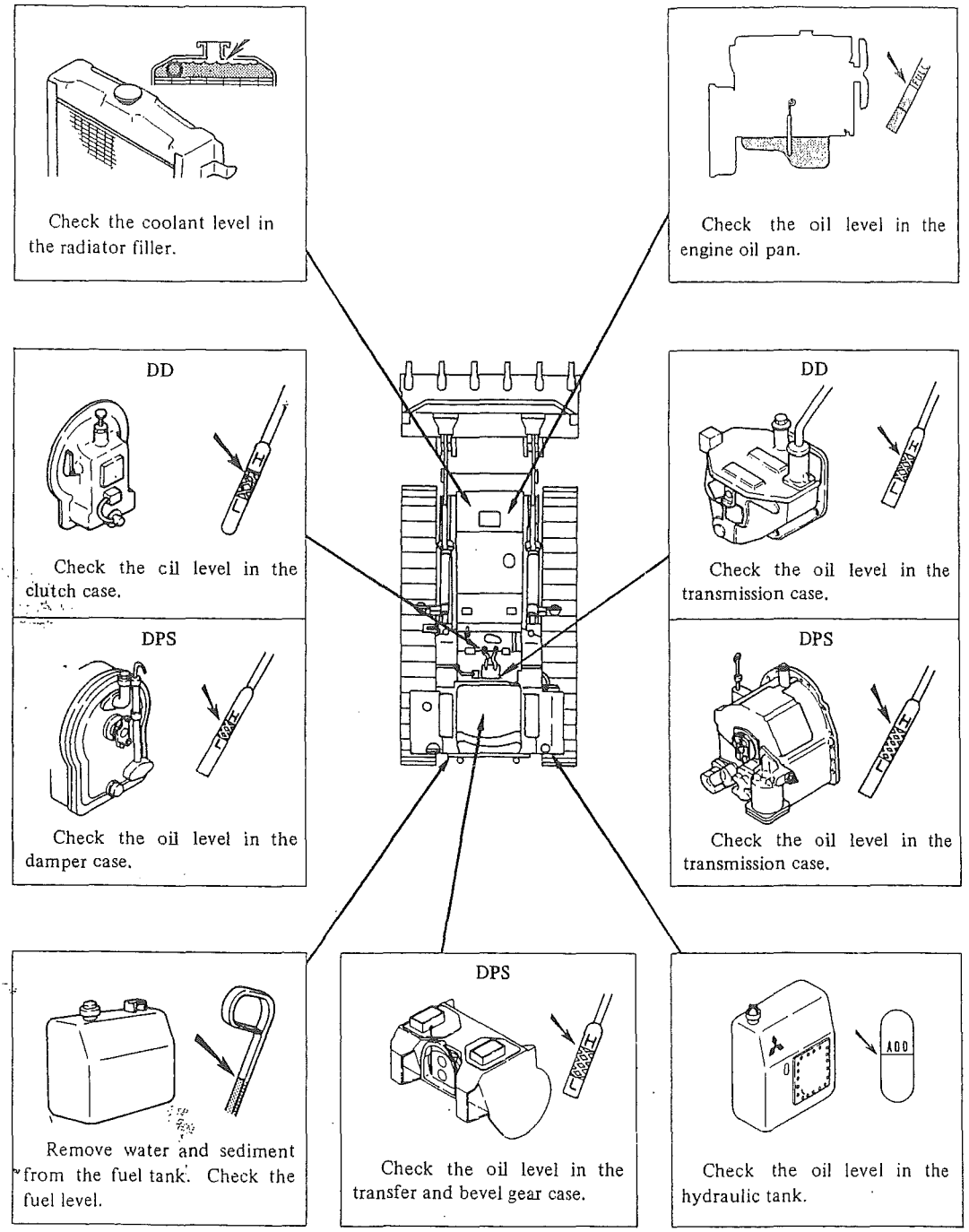
Rules of initial operation

- "Break-in" the machine by first 100 service hours.
- After each cold engine starting, warm it up thoroughly.
- Refrain from revving the engine. Revving or racing is hard on a new engine.
- Avoid high-speed driving, darting in standing start, quick acceleration, quick braking and sharp turning. Operate the machine with 60% to 70% of full load.

Inspection before starting the day's work

For working efficiency, for service life and for safety, check on the following items before starting the engine for the day's work:



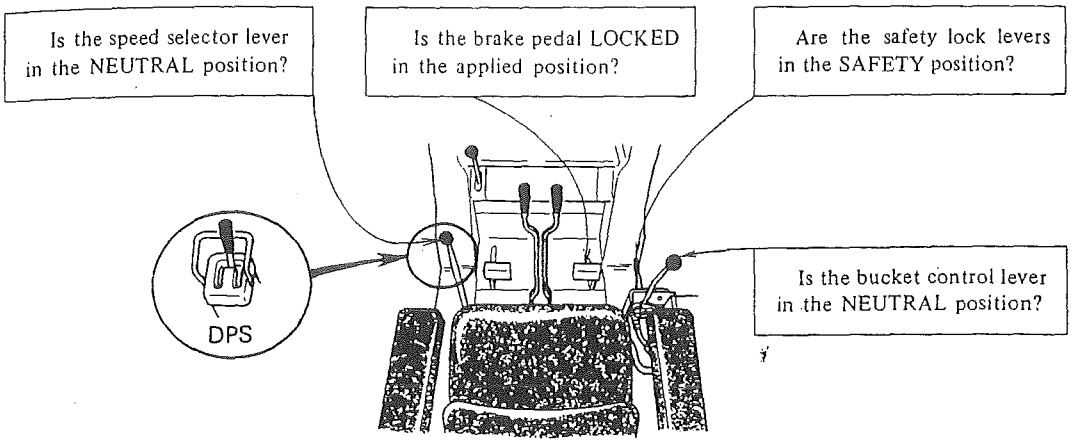


CAUTION

Oil level in each gear case must be maintained between H and L marks on gauge at all times. Operating with the oil level above H mark or below L mark causes trouble.

Engine starting and stopping

Positioning the controls for starting



CAUTIONS

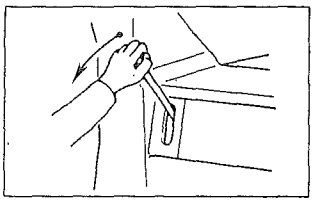
a) On the DPS machine, the engine can be started with the speed selector lever in any position other than neutral but the machine cannot be moved. For moving the machine, first shift the speed selector lever to neutral and then move it to the desired position.

b) Be careful not to move the heat and start switch to the START position when the engine is running.

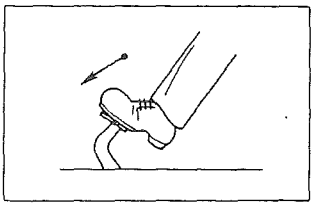
c) If the engine fails to start after 30 seconds of cranking, release the heat and start switch and wait 2 minutes before re-cranking.

d) About 25 seconds of heating will be enough for starting a cold engine under normal climatic conditions. 40 to 50 second heating will be necessary in colder weather.

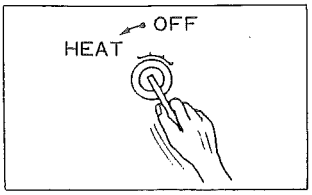
Starting the engine



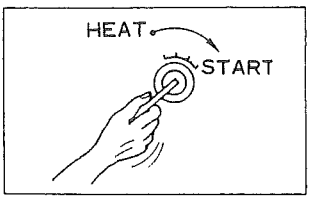
1. Set the accelerator lever to the correct starting position.



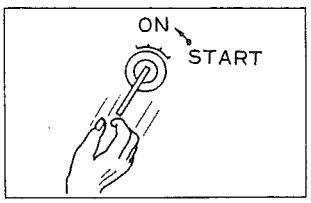
2. Depress the clutch pedal for making it easy to start. (DD)



3. Insert the key into the heat and start switch, and turn it to the HEAT position.



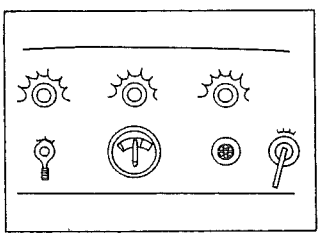
4. Move the key to the START position.



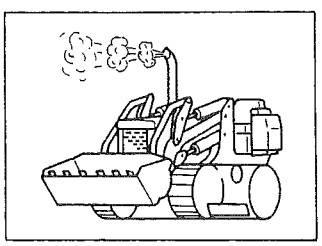
5. As soon as the engine starts, release the key; the key will automatically return to the ON position.

Inspection after starting the engine

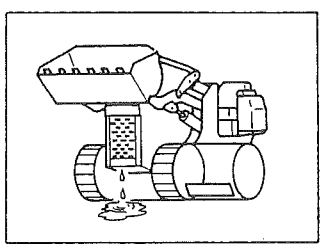
After the engine starts, warm it up by running it at low speed for 5 minutes and at medium speed for 5 minutes without load. During this period, check on the following points:



Is the water temperature gauge properly working? Are all warning lamps OFF?

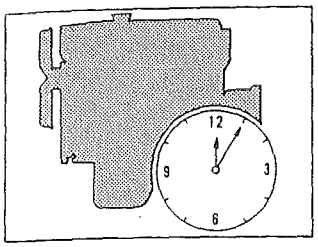


Are exhaust noise and smoke color normal?

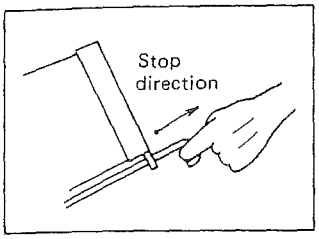


Are all gear compartments, cooling system and hydraulic system free from any leaks?

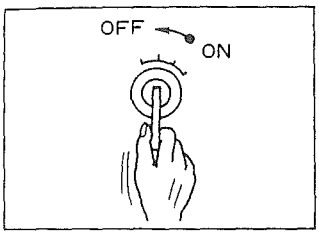
Stopping the engine



1. Allow the engine to idle for 5 minutes.



2. Pull the engine stop lever in the STOP direction.



3. Turn the heat and start switch to the OFF position, and remove the key from the switch.

Inspection after stopping the engine

⚠ WARNINGS

When leaving the machine:

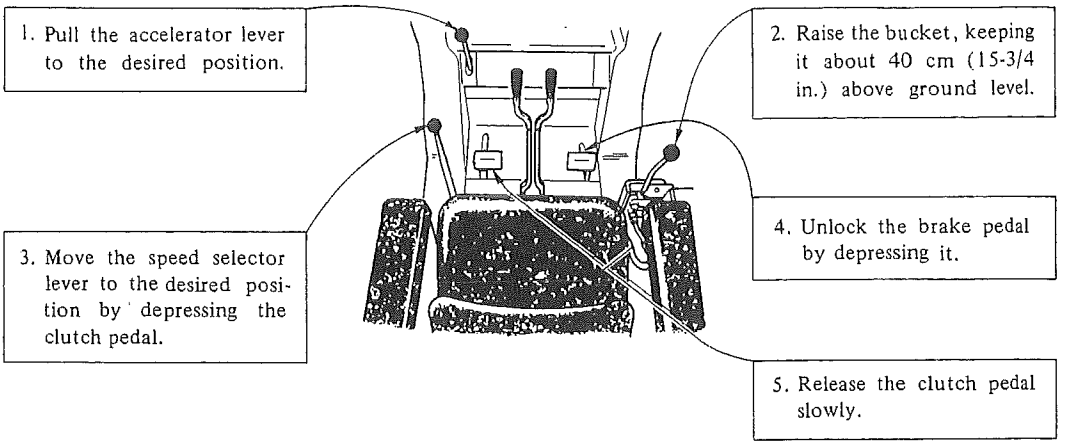
a) Lower the bucket to the ground, move the speed selector lever and bucket control lever to the NEUTRAL position, and place the safety lock control levers in the SAFETY position.

b) Remove the key from the heat and start switch.

c) Park the machine on level ground in a non-operating area. When parking on a grade, be sure to use chocks to keep the machine from moving.

Driving the machine

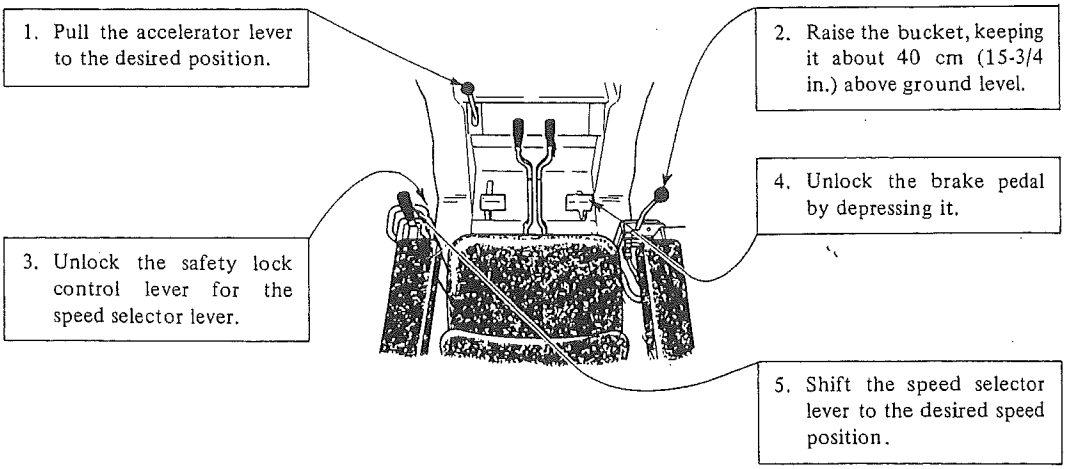
Starting (DD)



CAUTION

Keep the foot off the clutch pedal or the brake pedal while the machine is traveling.

Starting (DPS)



Stopping (DD)

1. Slow down the machine by depressing the brake pedal and at the same time –
2. Depress the clutch pedal and bring the machine to a stop.
3. After stopping the machine, shift the speed selector lever to the neutral position.

NOTE

If the machine is not used soon, proceed as follows:

4. Lower the bucket to the ground.
5. Return the accelerator lever.
6. Lock the brake pedal in applied position.

Stopping (DPS)

1. Slow down the machine by depressing the brake pedal.
2. Move the speed selector lever to the neutral position and bring the machine to a stop.

NOTES

a) You do not need to depress the clutch pedal.

b) If the machine is not used soon, proceed as follows:

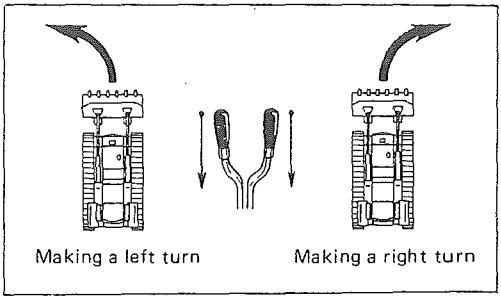
3. Lower the bucket to the ground.
4. Lock the speed selector lever in the neutral position.
5. Return the accelerator lever.
6. Lock the brake pedal in applied position.

Steering

- **Making a left or right turn**

Pull the left-hand steering clutch control lever to make a left turn.

Pull the right-hand steering clutch control lever to make a right rurn.



CAUTION

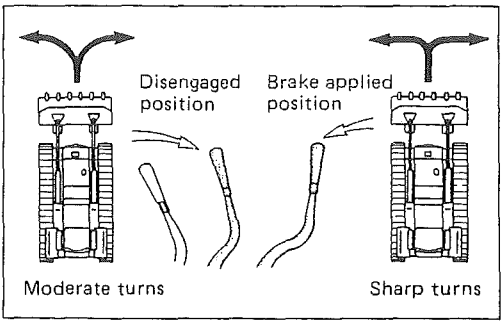
Avoid a sharp turn when the machine is traveling at high speed since this will cause the track parts to wear rapidly or the tracks to slip off.

- **Making a moderate turn**

To make a moderate turn, pull the steering clutch control lever just enough to disengage the steering clutch.

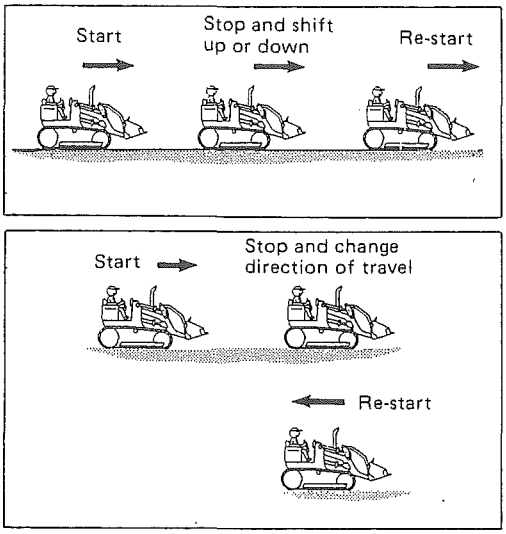
- **Making a sharp turn**

To make a sharp turn, pull the lever all the way back until the steering clutch brake is applied.



Shifting (DD)

1. Depress the brake pedal, and move the speed selector lever to the neutral position by depressing the clutch pedal to stop the machine.
2. Shift the speed selector lever into any desired position.
3. Release the brake, and release the clutch pedal to re-start the machine.



CAUTIONS

a) Be sure to stop the machine completely when shifting gears or backing the machine.

b) When it is hard to shift the speed selector lever, apply the clutch brake by depressing the clutch pedal.

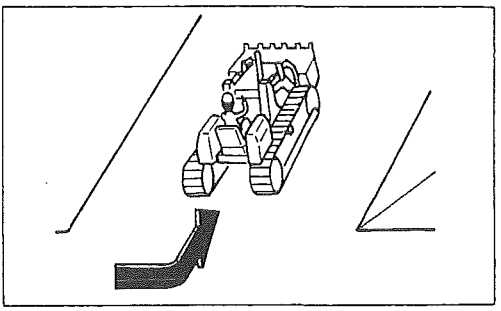
Shifting (DPS)

You do not need to depress the clutch pedal; just move the speed selector lever into any desired speed position without stopping the machine. Be sure to bring the machine to a complete stop when changing the direction of travel.

Tips on safe operation

Operation on slopes

Avoid sidehill travel whenever possible. Drive up and down the slope in 1st or 2nd speed. In steep downhill operation, do not allow the engine to overspeed. Select proper gear speed before starting the machine downgrade.

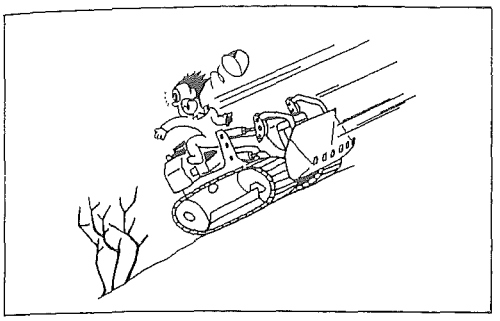


- **Going upgrade**

No quick steering should be made while going upgrade. The danger of tipping over is always present since steering effect becomes more effective than when going on level ground.

DD machine

Avoid shifting on grade whenever possible, but if such a shifting has to be made, be sure to stop the machine by depressing the brake pedal and at the same time shift the speed selector lever by disengaging the clutch. Delayed clutch disengagement makes it hard to shift the speed selector lever and if this is the case, slightly move the machine forward before shifting again.

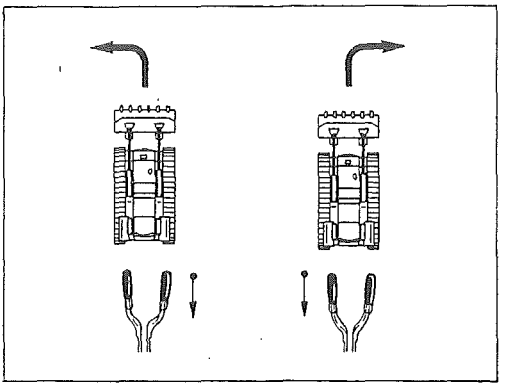


DPS machine

Be sure to stop the machine by moving the speed selector lever to the neutral position and depressing the brake pedal when shifting has tobe made.

- Going downgrade

When going down a steep grade and the engine is acting as a brake, the operation of the steering clutches should be reversed. For example, to make a RIGHT turn under these conditions, release the LEFT-hand steering clutch, but do not apply the brake. This allows the left-hand track to travel faster while the right-hand track is held back by the engine (acting as a brake).

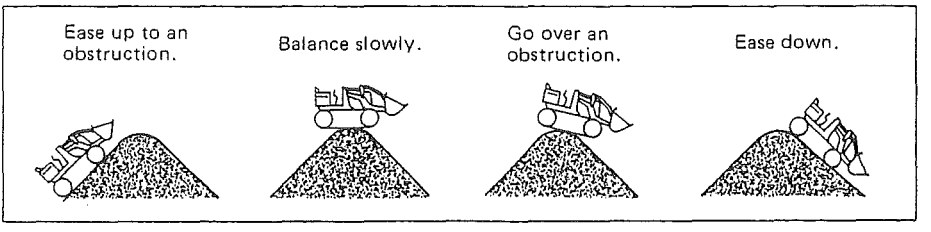


⚠ WARNING

Never coast or free wheel downgrade with the speed selector lever in neutral. Always stay in gear when going down grade.

Operating over an obstruction

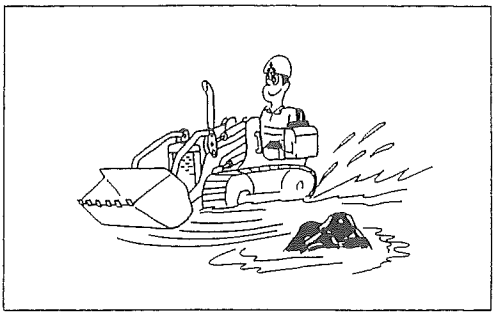
Avoid operating over obstructions such as rocks, logs, curbs, ditches, ridges and railroad tracks whenever possible. The type and size of an obstruction that can be safely crossed will depend on many factors including good judgment. When an obstruction must be crossed, do so with extreme care at an angle, over and down, if possible. Reduce speed. Downshift. Ease up to the "breakover" point, balance slowly on the obstruction, and ease down to minimize the jolt of contact on the other size.



Operating over rough terrain

Drive the machine in low speed. Avoid a sharp turn and frequent turns.

Operating in deep mud or water



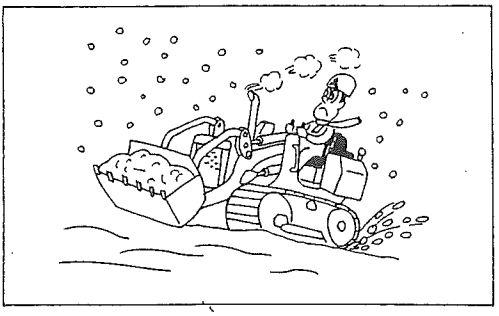
If the machine must be operated for any length of time in deep mud or water, certain precautions are necessary.

1. See that the plug is tight in place under each gear compartment.
2. Remove the drain plugs from under the steering clutch cases and drain out water.
3. Check the oil in the final drives frequently for mud or water, and drain, wash and refill as soon as the oil shows presence of mud or water.
4. Avoid excessive spinning of the tracks. Such spinning can convert smooth area into ruts that tend to tip the machine.
5. When starting to mire down in mud, do not spin the tracks or try to "seesaw" machine. Get traction by dropping the load.

Operating in rocky terrain

When working on rocky footing, the undercarriage parts are subject to undue stress and strain. To relieve the stress and strain, loosen the track adjustment so that the measurement at (A) (page 51) is 40 to 60 cm (15-3/4 to 23-5/8 in.).

Operating on frozen or snowy ground



It is advisable to use SNOW-AND-ICE GROUSER SHOES. These shoes are designed to provide good penetration on ice or hard packed snow.

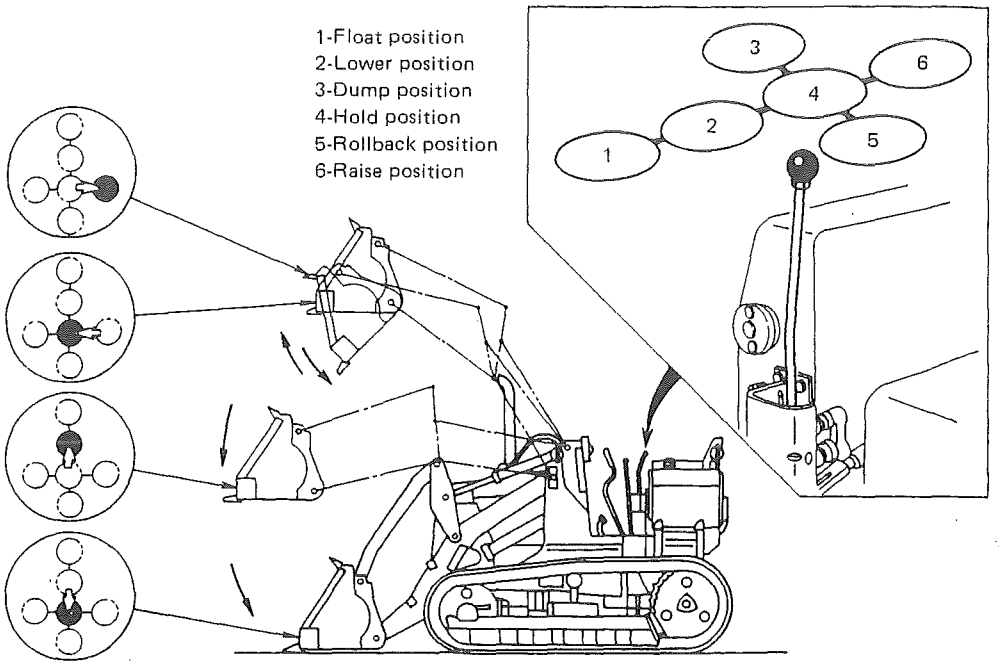
At the end of the day's run, clean snow or mud from around the track links, sprockets, idlers, rollers and guards to prevent freezing of the tracks.

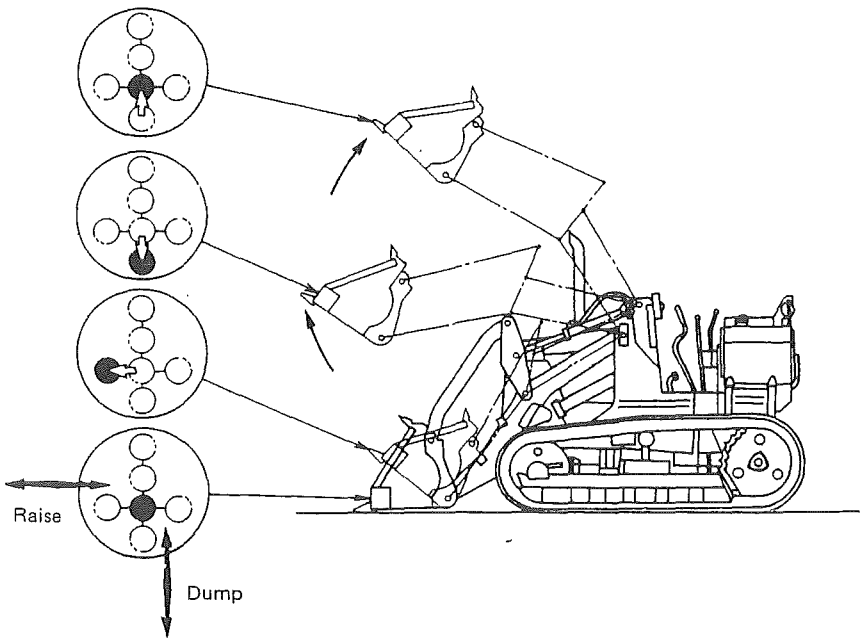
Bucket operation

Bucket control lever

When the new operator of the BS3F tractor shovel gets on the machine to begin operation, he should raise and lower the bucket until he feels sure of what is going to happen when he moves the bucket control lever.

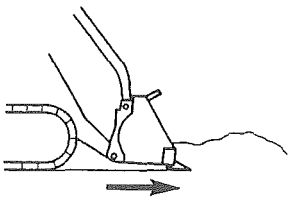
The six operating positions of the bucket control lever and the function of the bucket in each lever position are as illustrated.


1-Float position
2-Lower position
3-Dump position
4-Hold position
5-Rollback position
6-Raise position
1
2
3
4
5
6

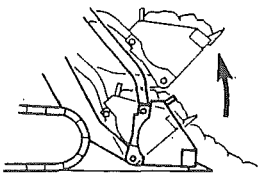

Raise
Dump

Loading from stockpile

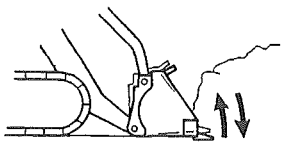
After the bucket is loaded, and it is desired to carry the load to the disposal point, tilt the bucket fully back and carry it at a height of about 40 cm (16 in.) from the ground.



To load loose material from a stockpile, position the bucket with the bucket control lever so that its bottom is level with the ground. Drive the machine forward, forcing the bucket so positioned into the stockpile.



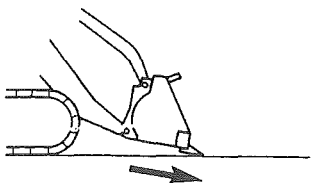
After the bucket has entered the material a sufficient distance, roll the bucket all the way back with the bucket control lever while moving the machine forward.



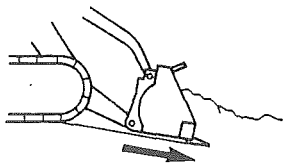
When it is difficult to penetrate the bucket into loading material, operate the bucket control lever to produce a few degrees up and down movement of bucket bit. This will aid in working the bucket into the material.

Digging below ground level

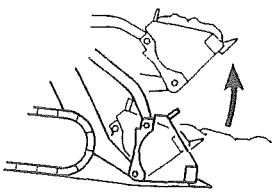
10 to 15 cm (4 to 6 in.) digging depth is proper at a time.



To dig or excavate below the ground line, lower the bucket to the ground and position it with the bucket control lever to have a slight digging angle.



As the machine travels forward, apply down pressure by operating the bucket control lever. As soon as sufficient penetration has been obtained, move the bucket control lever to the hold position.



With the machine traveling forward, level cuts can be maintained by raising and lowering the bucket with the bucket control lever. After the bucket is loaded and it is desired to carry the load to a disposal point, roll the bucket fully back and carry it at a height of about 40 cm (16 in.) from the ground.

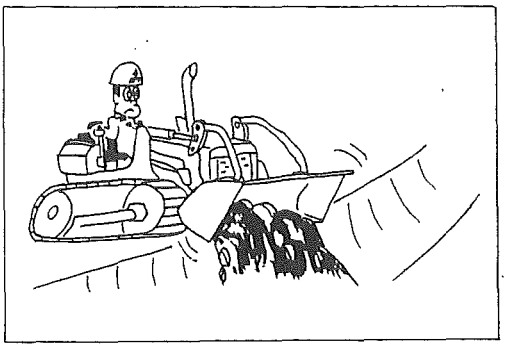
⚠ WARNINGS

a) When going upgrade with the bucket fully loaded, drive the machine forward; when going downgrade with the bucket so loaded, drive the machine backward.

b) When digging or excavating below the ground line, particularly in hard material, do not cause one corner of the bucket to dig deeper than the other.

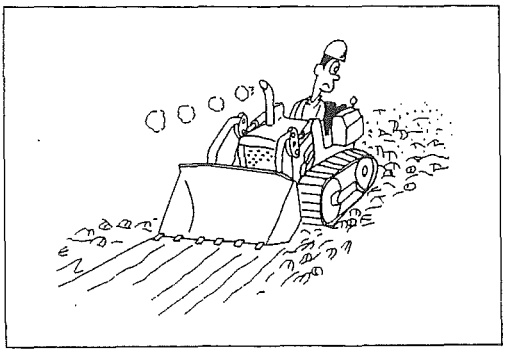
Backfilling

Position the bucket with the bucket control lever so that its bottom is level with the ground. Drive the machine toward a ditch, pushing or drifting the fill material. When the bucket bit comes over the edge of the ditch, dump the bucket with the bucket control lever to place a batch of fill in the ditch.



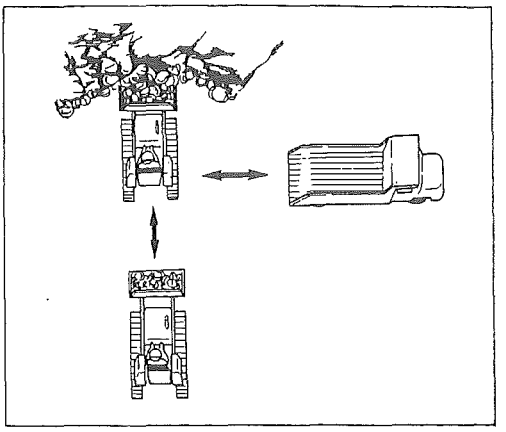
Stripping or leveling

In stripping or leveling, the process of removing a shallow layer of ground for a considerable distance is a fundamental operation. To do this properly, control the cut so that the bucket is gradually filled while the machine is in forward motion.



When a great amount of fine grading or leveling and spreading is to be done, a bulldozer blade replacing the bucket may be used to a better advantage. To spread and level with the bucket, dump the bucket fully with the bucket control lever. With the machine traveling forward, operate the bucket control lever to produce a few degrees up and down movement of the bucket bit. Finally, place the control lever in the float position and drive the machine backward at low speed by dragging the bucket.

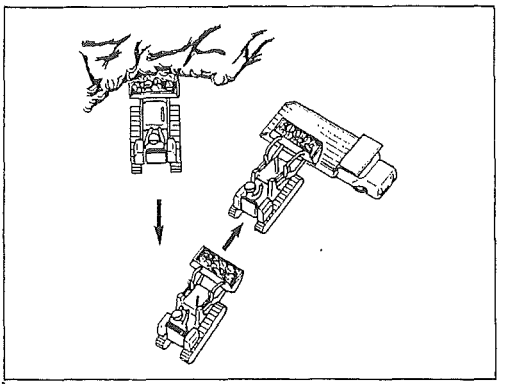
Loading trucks



• Cross-drive (90° turn) loading

1. Let the truck driver spot his truck at an angle of about 90° with the direction of machine travel as shown.
2. Drive the machine forward to the loading point and, after the bucket is loaded, drive it straight backward.
3. After the truck moves back to the loading point, drive the machine forward and load the truck.

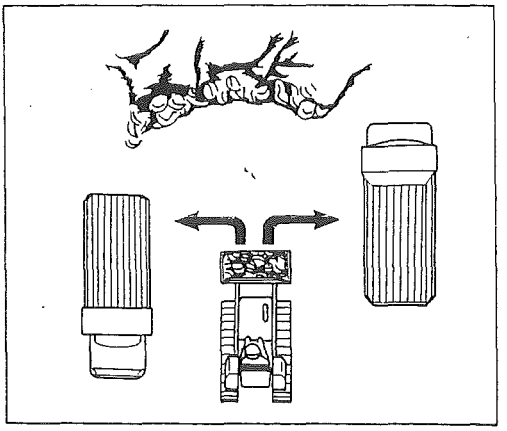
This method reduces the loading cycle to a minimum.



• V-shape (60° turn) loading

1. Let the truck driver spot his truck at an angle of about 60° with the direction of machine travel as shown.
2. After the bucket is loaded, drive the machine backward and steer it to the right (shown) or to the left so that the machine can face the truck squarely.
3. Drive the machine forward and load the truck.

In this method, the smaller the turning angle, the loading cycle is more reduced.



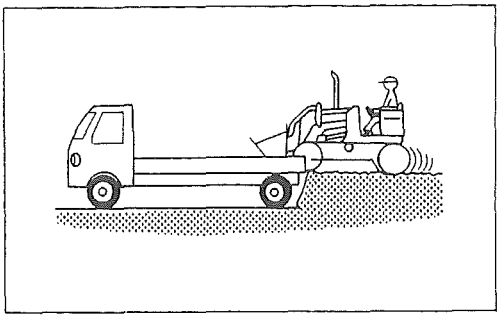
• Side-by-side (two-truck) loading

1. Let the truck drivers spot their trucks side by side with respect to the machine as shown.
2. Load the right and left trucks by moving the machine as indicated by arrows.

This method equalizes the wear on the steering clutches.

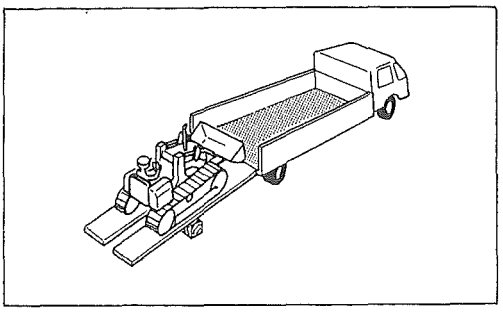
Transportation

How to load the machine on hauling truck



- When using a temporary loading platform:

1. The platform should be wider than the overall machine width along its length.
2. The slope of the approach apron must be as gentle as possible for minimized approach angle.
3. The platform must be thoroughly compacted in order to provide a strength enough to carry the weight of the machine.
4. The platform height must be tailored to the bed height of the truck.



- When using ramp boards:

1. The ramp boards, right and left, must be of the same material and size. They must be supported from underside along the entire length, with the elevated ends firmly rested on the truck bed.
2. The ramp boards when set up must have a gradient of 10 to 15 degs.

⚠ WARNINGS

a) Drive up the machine forward when loading; drive it down backward when unloading.

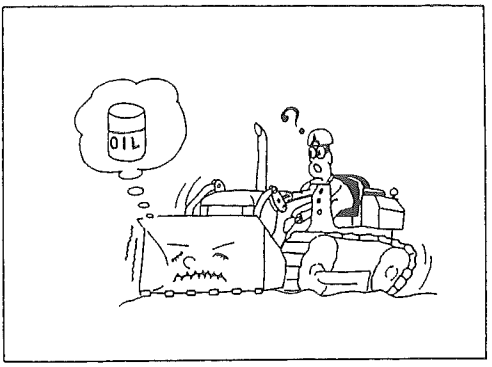
b) Drive up and down straight without steering. If the machine shows a tendency to slip or turn to one side on the ramp boards, immediately stop the machine, drive it back down to the ground and try again.

c) Be sure to chock the truck wheels before starting loading.

d) If the machine is equipped with a relatively heavy rear-end attachment, for example, a backhoe or a trencher, drive it backward.

COLD-WEATHER INSTRUCTIONS

Lubricants and fuels



- The grade of lubricating oils is classified in terms of viscosity (fluidity) and is identified with numbers called SAE NUMBERS. Lube oils with lower SAE numbers are more fluid and flow more readily than do those with the higher numbers. In selecting the oils, refer to the FUEL AND LUBRICANT SELECTION CHART on the page 28.
- There is no world-wide standardization of diesel fuels and the ASTM (the American Society for Testing Materials) classifications are not used in many export territories. For these reasons, it is advisable to consult your MITSUBISHI dealer who is familiar with fuels that are marketed in his particular area.

Care of the battery

- Try to keep the battery in fully charged state at all times. Addition of distilled water to the battery for raising the electrolyte level up to the marked line in each cell should be carried out just before the engine is started up for the day's run. This ensures that the water will mix thoroughly with the existing electrolyte.
- A specific gravity of 1.20 or lower will permit the battery to freeze at a temperature of only -20°C (-4°F). Charge the battery so that the electrolyte S.G. is higher than 1.26.
- In extremely cold weather, even a fully charged battery does not work properly, often resulting in hard engine start-up or electrolyte freeze-up. Keep the battery as warm as possible.

Care of the coolant

- When the temperature is below freezing point, sufficient anti-freeze should be used in the cooling system to prevent freezing.
- It is advisable to use anti-freeze solution containing rust inhibitor. The use of this anti-freeze solution in the cooling system will prevent rust formation; it will also retard, and in some cases, completely eliminate mineral deposits within the engine.

Lowest expected temperature °C (°F)	-10 (14)	-20 (-4)	-30 (-22)
Anti-freeze solution ℓ (pints)	3.3 (7.0)	4.9 (10.4)	6.1 (13.0)
Water ℓ (pints)	9.7 (20.5)	8.1 (17.0)	6.9 (14.6)

- The percentage of anti-freeze solution in the coolant, shown above, is of the solution used in the engine of a new machine shipped from the factory. The percentage varies from one brand of anti-freeze solution to another; for this reason, it is advisable to consult your MITSUBISHI dealer when filling the engine of your machine with anti-freeze solution.

NOTES

a) Anti-freeze solution to be used in the cooling system should be of permanent (ethylene-glycol) type.

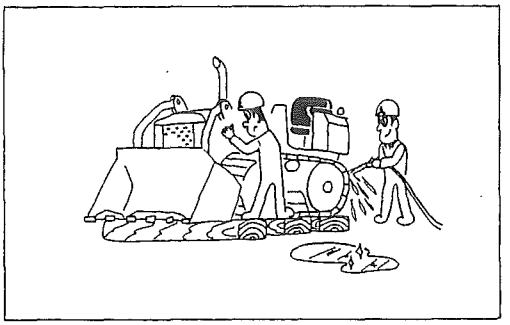
b) Water used in the system should be soft, or as free as possible from scale forming minerals.

c) When mixing anti-freeze solution, drain the system of the existing coolant and wash it thoroughly.

d) Never use an open flame on or around anti-freeze solution.

Good servicing habits

At the end of the day's run, proceed as follows:



- Clean snow or mud from around the track links, sprockets, idlers, rollers and guards to prevent freezing of the tracks. Park the machine on solid dry ground, planks, logs or brush to prevent the machine from freezing.
- Wipe dirt and foreign material from around the piston rods of the hydraulic cylinders. Moisture permits dirt to get inside the cylinders, resulting in nicks, scratches or inclusion on the rods, or cuts or distortion of the packings.
- Open the drain cock at the bottom of the fuel tank to drain off any sediment or water which may accumulate in the tank.

Cold-weather starting

- In cold weather, a cold engine is hard to start and the starting motor draws heavy current from the battery in each cranking. For ease of starting the engine, move the heat and start switch to the HEAT position for 40 to 50 seconds. If the engine does not start, move the switch to the HEAT position for the same length of time before cranking the engine again.
- After the engine starts, warm it up at low idle speed without load until the water temperature gauge indicates normal range.

LUBRICATION INSTRUCTIONS

Fuel and lubricant selection chart

Point	Lubricant, etc.	Quantity liter (U.S. gal)	Ambient temperature °C (°F): −25 (−13), −15 (5), −5 (23), 0 (32), 5 (41), 15 (59), 25 (77)
Fuel tank	Diesel fuel	60 (16)	Consult your MITSUBISHI dealer.
Engine crank-case	Engine oil (CC)	7 (1.8)	SAE10W / SAE20 / SAE30
Clutch case (DD)	Engine oil (CD)	6 (1.6)	SAE5W / SAE10W
Damper case (DPS)	Engine oil (CD)	2.7 (0.7)	SAE5W / SAE10W
Transmission case (DD)	Gear oil (GL-4)	9 (2.4)	SAE80 / SAE90
Transmission case (DPS)	Engine oil (CD)	7.5 (2.0)	SAE5W / SAE10W
Transfer and bevel gear case (DPS)	Gear oil (GL-4)	6.5 (1.7)	SAE80 / SAE90
Final drive case	Gear oil (GL-4)	13 (3.4)	SAE80 / SAE90
Hydraulic tank	Hydraulic oil (CC)	37 (9.8)	SAE5W / SAE10W
Grease fittings on attachment	Grease (NLGI)		No. 0 / No. 1 / No. 2
Radiator	Water	13 (3.4)	Anti-freeze / Soft water

NOTE: See page 26 for anti-freeze solution.

ENGINE OIL: Use an engine oil designated as "CC" or "CD" by API (American Petroleum Institute) service rating classification.

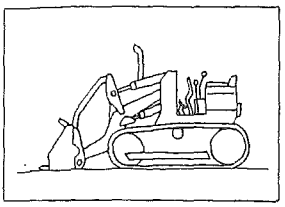
GEAR OIL: Use a gear oil designated as "GL-4" by API service rating classification. The oil should contain an EP (extreme-pressure) additive that retains lubricating films strong enough to resists high pressure for preventing metal-to-metal contact. It should also contain a foam inhibitor that reduces the interfacial tension of small bubbles, thus preventing emulsion.

GREASE: Use a multi-purpose grease of good quality. Select its consistency according to the ambient temperature.

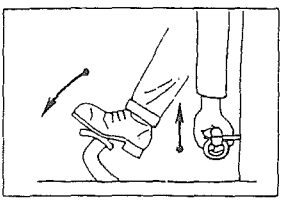
HYDRAULIC OIL: As in the case of engine oil, the hydraulic oil to be used in the tractor must be of good quality, high in viscosity index.

MAINTENANCE INSTRUCTIONS

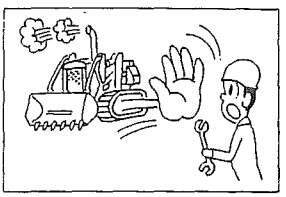
Safe working habits



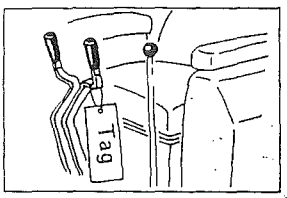
- Before servicing, adjusting or repairing the machine, lower the bucket to the ground. If it is necessary to raise it for access to certain parts, securely support it by lift cylinder support.



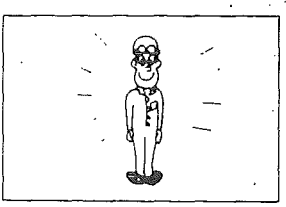
- Chock the tracks or lock the brake pedal and stop the engine.



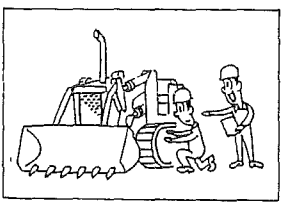
- Avoid working on the machine when the engine is running. If it is necessary to make checks with the engine running, always use two men.



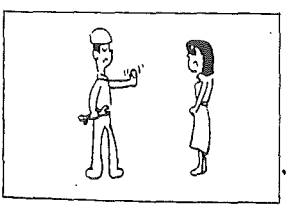
- Have a tag, reading "servicing work in progress," attached to the control lever when inspecting and servicing work is going on.



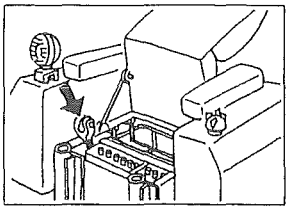
- Wear safety shoes, safety goggles, hard hat, heavy gloves or respirator if necessary. Always avoid loose clothing or any accessary – flopping cuffs, dangling neckties and scarves, etc. that can catch in moving parts.



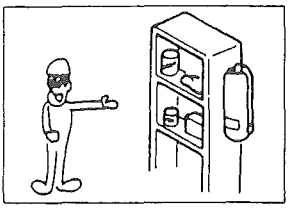
- Don't perform any work on the machine unless authorized to do so. Then be sure you know what you are doing now. Follow manufacturer's recommended procedures.



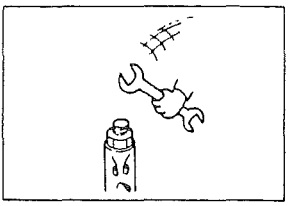
- Never allow an unauthorized person to get near the machine. Say NO! to her.



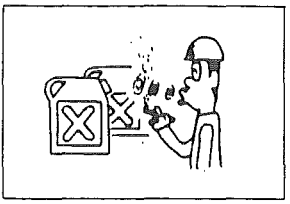
- Be sure to disconnect the battery cable before servicing, adjusting or repairing any electrical equipment.



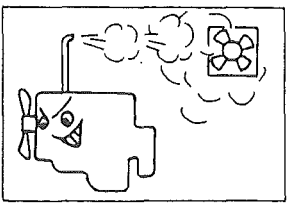
- Know how to use a first aid kit and a fire extinguisher – and where to get the aid and assistance. In an emergency, split second action is the key to safety.



- Use only tools of right kind for the work that you are about to do – as instructed.



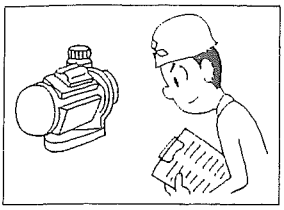
- First, put out your cigarette when checking the levels of fuel, coolant, hydraulic fluid and lubricating oil.



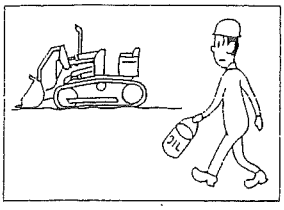
- If it is necessary to start an engine within an enclosed area, provide an adequate ventilation. Exhaust fumes can kill.

Remember, SAFETY is up to you.

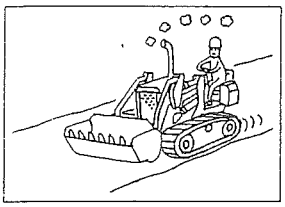
Other servicing tips



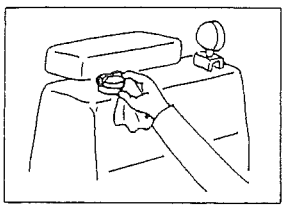
- Read the service meter indication daily and log the reading in the operating hour log book. Refer to this book to determine when to give the periodical lubricating and servicing attentions according to the schedule or time table.



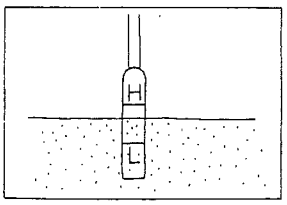
- Have the machine standing on level surface when checking oil levels. Use lubricants of the same brands.



- To change the oil in the engine oil pan or in the gear compartment, drain out the oil when it is still hot after a long duty operation. A hot oil flows out readily to wash out the sludge, if any, that has accumulated on the bottom.



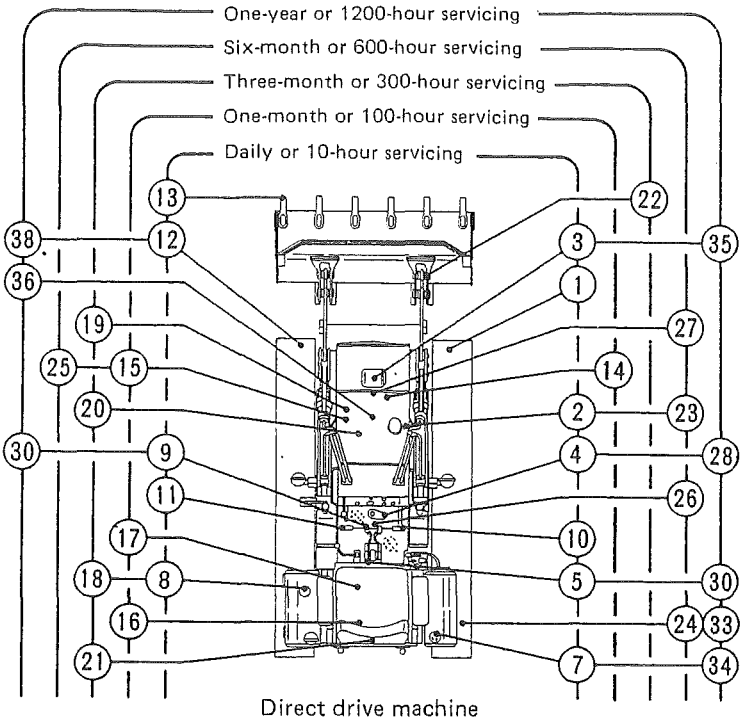
- Before lubricating the various parts of the machine, clean oil fillers, grease fittings and lubricating tools by wiping with cloth.



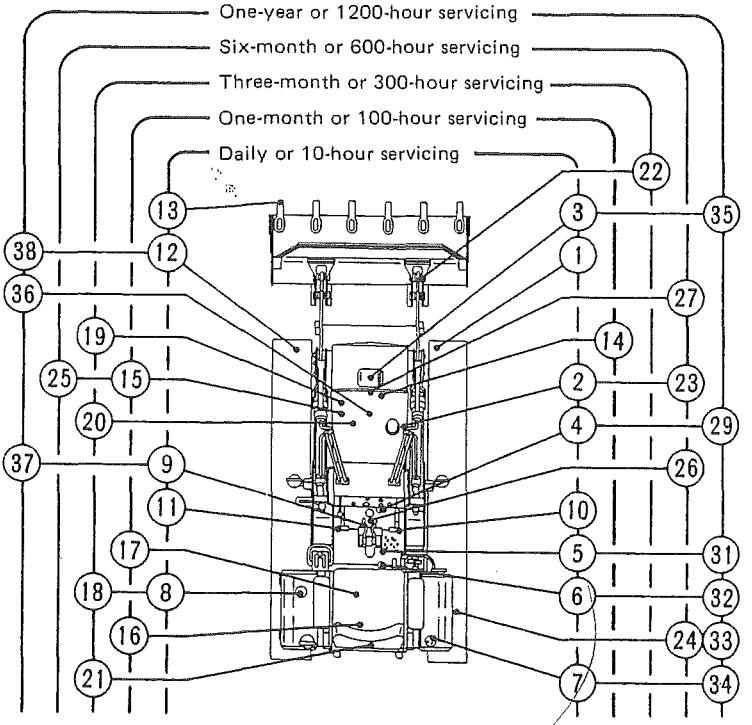
- Oil level gauge or dipstick is marked "H" for high and "L" for low, and oil level must be maintained between these marks at all times.

For special servicing jobs on your machine, rely on the expert knowledge of the servicemen, and the service facilities of your MITSUBISHI dealer's workshop.

Inspection and servicing charts



Direct drive machine



Direct powershift machine

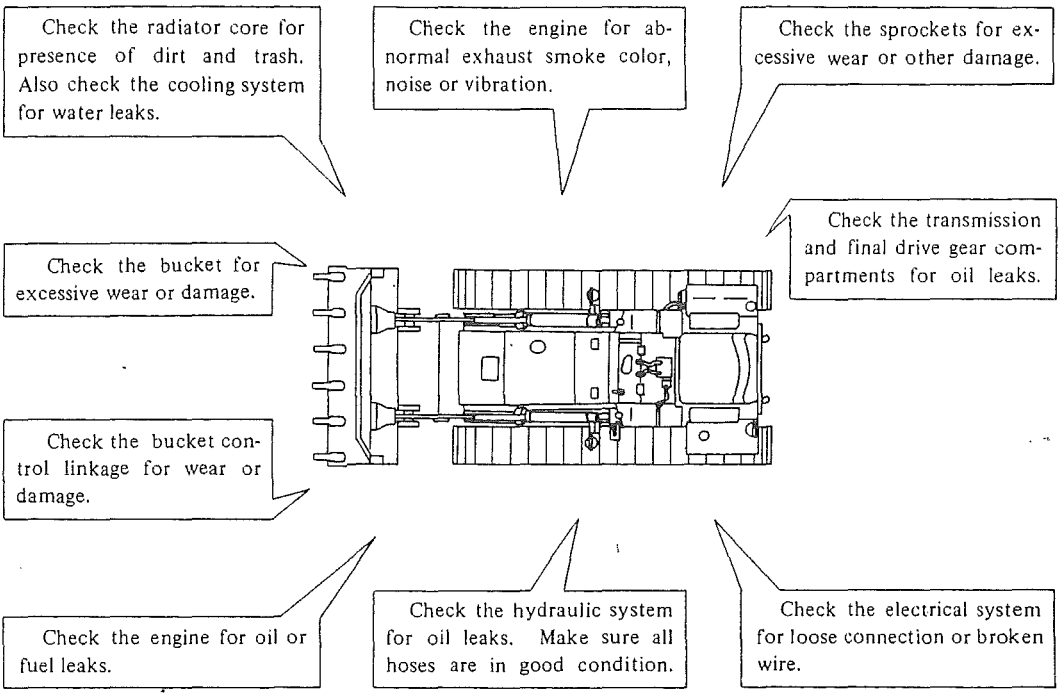
Inspection and servicing schedule

Ref. No.	Inspection and servicing	Remarks	Page
	Daily or 10-hour servicing		
1	Walk-around checks		35
2	Check oil level in engine oil pan		35
3	Check coolant level in radiator		35
4	Check oil level in clutch case (DD) Check oil level in damper case (DPS)		36
5	Check oil level in transmission case (DD) Check oil level in transmission case (DPS)		36
6	Check oil level in transfer and bevel gear case (DPS)		36
7	Check oil level in hydraulic tank		37
8	Drain water and sediment from fuel tank – check fuel level	60 liters (16 U.S. gal)	37
9	Check steering clutch lever play	Correct play: 4.5~6 cm (1-3/4 ~ 2-3/8 in.)	37
10	Check brake pedal stroke and play	Correct stroke: 15 cm (6 in.), max	37
11	Check clutch pedal stroke and play	Correct play (DD): 2 cm (3/4 in.) Correct stroke (DPS): 15 cm (6 in.), max	37
12	Check track adjustment	Correct sag: 2 ~ 3 cm (3/4 ~ 1-1/4 in.)	38
13	Check bucket control linkage pivot pins and teeth for wear		38
	One-month or 100-hour servicing		
14	Check fan belt tension	Correct belt deflection: 2 cm (3/4 in.) at a point half way between pulleys.	39
15	Drain water and sediment from fuel filter		39
16	Check electrolyte level in battery		39
17	Lubricate steering clutch shifters		39
	100-hour servicing (Initial 100 hours of a new or reconditioned machine)		
	Change engine lube oil and filter	7 liters (1.8 U.S. gal)	42
	Change oil in clutch case – wash strainer (DD)	6 liters (1.6 U.S. gal)	44
	Change oil in transmission	9 liters (2.4 U.S. gal)	44

Ref. No.	Inspection and servicing	Remarks	Page
	Change oil and filter in hydraulic tank	37 liters (9.8 U.S. gal)	46
	Check bolts of these parts for tightness: cylinder head, exhaust manifold, generator bracket, starting motor, etc.	Consult your MITSUBISHI dealer.	
	Three-month or 300-hour servicing		
18	Clean fuel tank strainer		40
19	Clean fuel feed pump filter		40
20	Clean air cleaner element		40
21	Drain water from steering clutch cases		40
22	Lubricate hydraulic cylinders, bucket control linkage and lift arm pivot pins	9 grease fittings on each side	41
	Six-month or 600-hour servicing		
23	Change engine lube oil and filter.	7 liters (1.8 U.S. gal)	42
24	Check oil level in final drive gear cases		42
25	Change fuel filter element		43
26	Lubricate universal joints	2 grease fittings	43
27	Lubricate hydraulic pump universal joints	2 grease fittings	43
	One-year or 1200-hour servicing		
28	Change oil in clutch case – wash strainer (DD)	6 liters (1.6 U.S. gal)	44
29	Change oil in damper case (DPS)	2.7 liters (0.7 U.S. gal)	44
30	Change oil in transmission case (DD)	9 liters (2.4 U.S. gal)	44
31	Change oil filter in transmission case – wash strainer (DPS)	7.5 liters (2.0 U.S. gal)	45
32	Change oil in transfer and bevel gear case (DPS)	6.5 liters (1.7 U.S. gal)	46
33	Change oil in final drive gear cases	6.5 liters (1.7 U.S.gal) on each side	46
34	Change oil and filter in hydraulic tank	37 liters (9.8 U.S. gal)	46
35	Drain and flush cooling system		47
36	Check engine valve clearance	Correct clearance: 0.25 mm (0.0098 in.)	48
37	Check steering clutches and brakes		49
38	Check undercarriage parts for wear		49

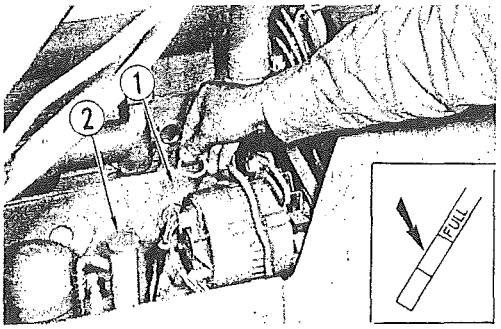
Daily or 10-hour servicing

❶ Walk-around checks



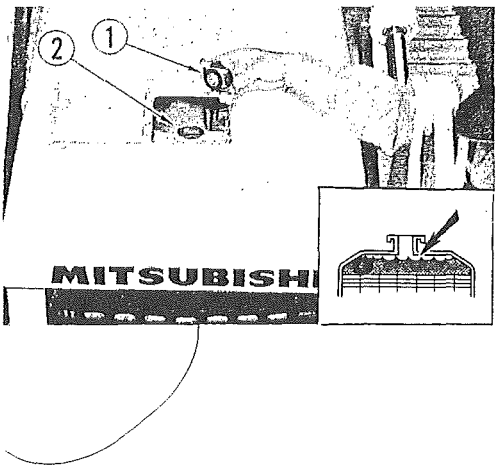
❷ Check oil level in engine oil pan.

1. Use level gauge (1). Oil level should be between two lines on gauge.
2. Replenish with recommended oil at filler (2).



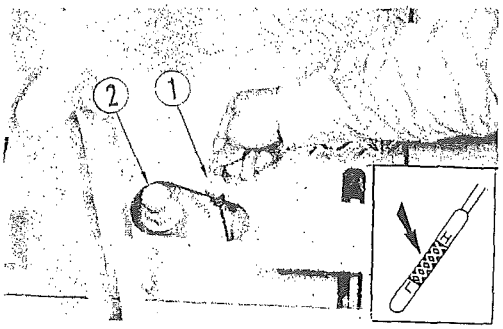
❸ Check coolant level in radiator.

Remove filler cap (1) and check. Coolant should be visible in filler neck.



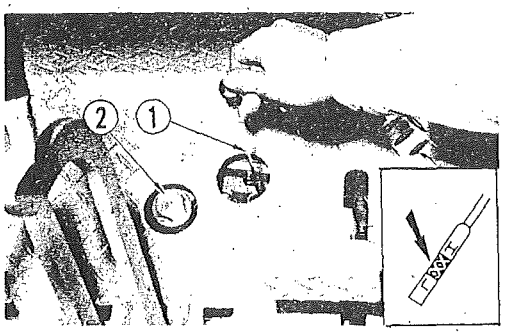
④ Check oil level in clutch case (DD).

1. Use level gauge (1). Oil level should be between "H" and "L" marks on gauge.
2. Replenish with recommended oil at filler (2).



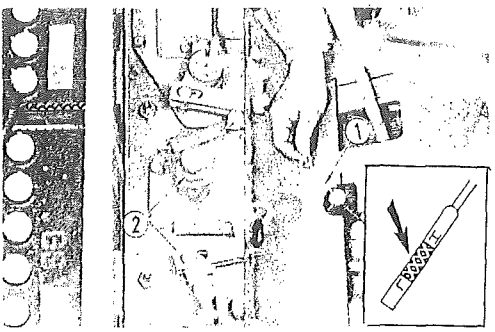
④ Check oil level in damper case (DPS).

1. Use level gauge (1). Oil level should be between "H" and "L" marks on gauge.
2. Replenish with recommended oil at filler (2).



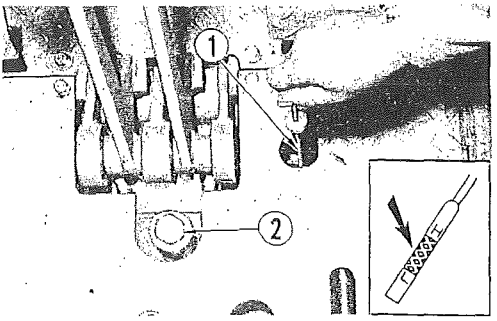
⑤ Check oil level in transmission case (DD).

1. Use level gauge (1). Oil level should be between "H" and "L" marks on gauge.
2. Replenish with recommended oil at filler (2).



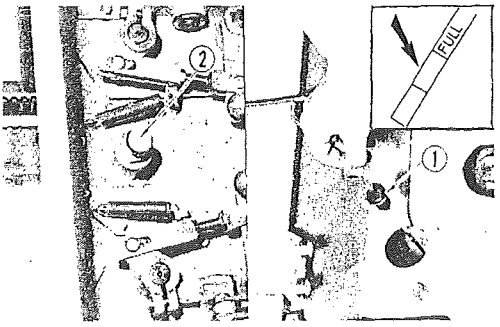
⑤ Check oil level in transmission case (DPS).

1. Use level gauge (1). Oil level should be between "H" and "L" marks on gauge.
2. Replenish with recommended oil at filler (2).



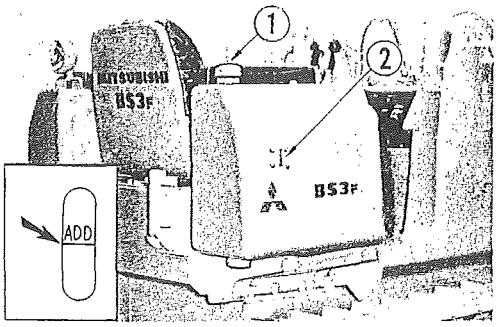
⑥ Check oil level in transfer and bevel gear case (DPS).

1. Use level gauge (1). Oil level should be between "H" and "L" marks on gauge.
2. Replenish with recommended oil at filler (2).



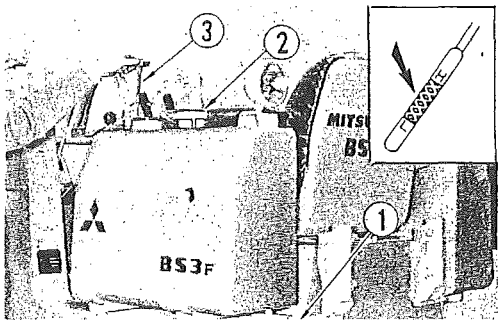
⑦ Check oil level in hydraulic tank.

1. See sight gauge (1). Oil level should be up to "ADD" mark.
2. Replenish with recommended oil at filler (2).



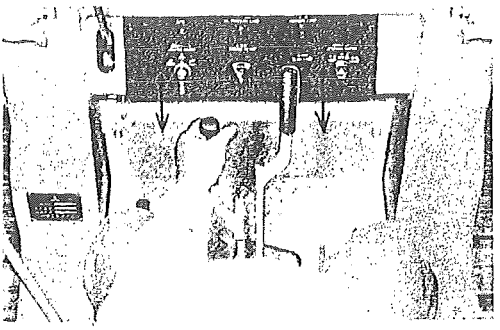
⑧ Drain water and sediment from fuel tank – check fuel level.

1. Open drain cock (1) for draining.
2. Remove filler cap (2) and use level gauge (3).



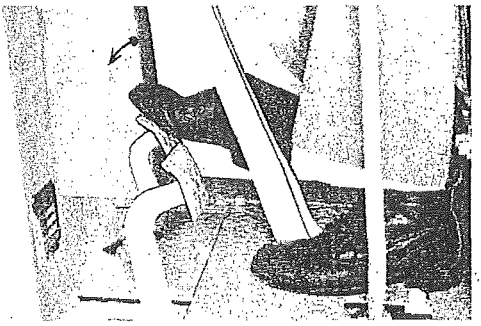
⑨ Check steering clutch lever play.

1. Pull lever back to check play. The play should be 4.5 ~ 6 cm (1-3/4 ~ 2-3/8 in.).
2. Check steering clutch for proper engagement. See page 53 for adjustment.



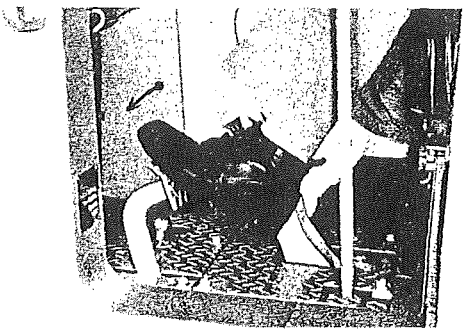
⑩ Check brake pedal stroke and play.

1. Depress brake pedal to check stroke. The stroke should not exceed 15 cm (6 in.).
2. Check brake for application.



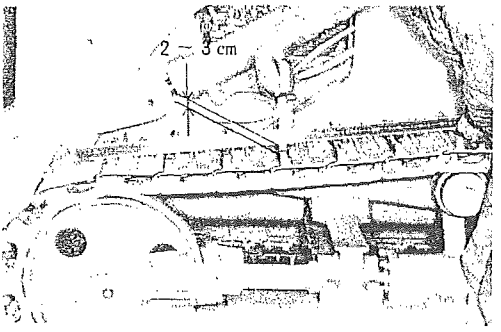
⑪ Check clutch pedal stroke and play.

1. Depress clutch pedal to check stroke. The play should be about 2 cm (3/4 in.) (DD). The stroke should not exceed 15 cm (6 in.) (DPS).
2. Check clutch for disengagement. See page 53 for adjustment.



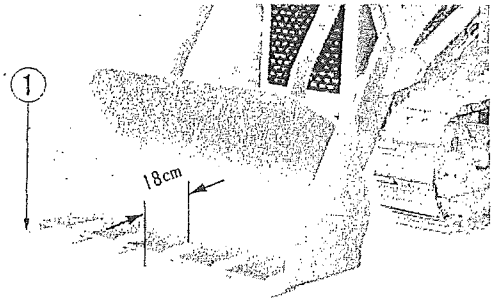
⑫ Check track adjustment.

1. Move the machine back and forth on the level ground.
2. Check track adjustment as shown. The sag should be 2 ~ 3 cm (3/4 ~ 1-1/4 in.). See page 51.



⑬ Check bucket control linkage pivot pins and teeth for wear.

1. Check the pins for excessive wear and damage.
2. Replace teeth if they are worn down to 18 cm (7 in.).

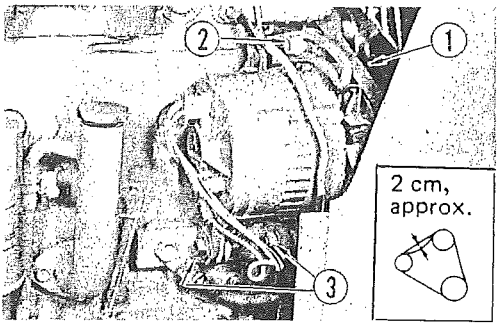


One-month or 100-hour servicing

(Daily or 10-hour servicing should also be carried out.)

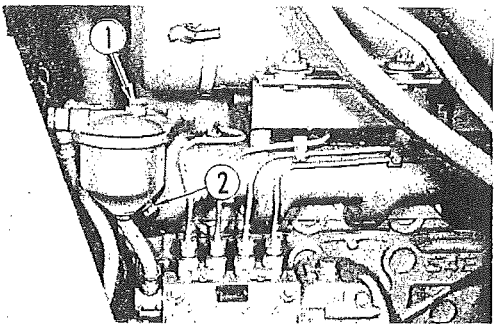
⑭ Check fan belt tension.

1. Belt (1) should have a deflection of 2 cm (3/4 in.) at a point half way between pulleys.
2. To adjust, loosen bolts (2)(3) and displace the generator.



⑮ Drain water and sediment from fuel filter.

1. Close fuel supply cock.
2. Loosen air vent plug (1).
3. Remove drain plug (2) to let out collected water and sediment.
4. Re-install drain plug (2) in place, and open fuel supply cock.
5. Bleed entrapped air out of fuel system. See page 51.

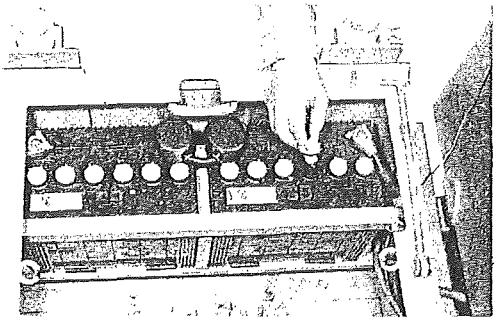


⑯ Check electrolyte level in battery.

1. In each cell, electrolyte should be 1 cm (3/8 in.) above the cell plates.
2. Add distilled water, if necessary.

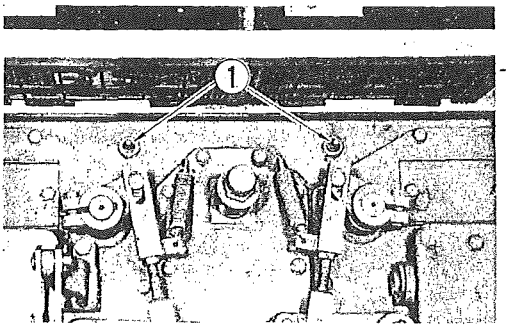
⚠ WARNING

Immediately wash off electrolyte if it spills over the clothes or if it comes in contact with the body.



⑰ Lubricate steering clutch shifters.

1. Lubricate through grease fittings.
2. Two shots of grease given by a hand-operated gun will be enough for each shifter. Excess grease will cause steering clutches to slip.

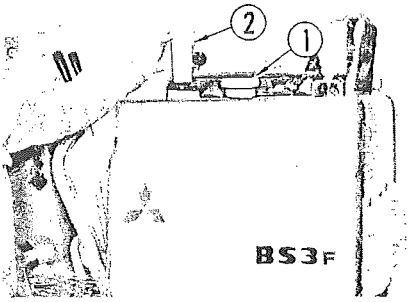


Three-month or 300-hour servicing

(Daily or 10-hour servicing and one-month or 100-hour servicing should also be carried out.)

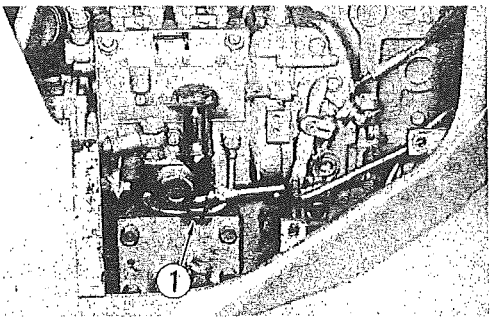
⑱ Clean fuel tank strainer.

1. Remove filler cap (1).
2. Take out strainer (2) and wash it.



⑲ Clean fuel feed pump filter.

1. Remove screw (1) from under the pump.
2. Take out the filter and wash it.

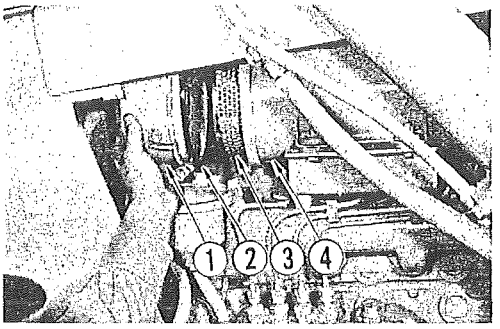


⑳ Clean air cleaner element.

⚠ WARNING

Do not attempt to service the air cleaner element when the engine is running.

1. Remove covers (1) (2), and take out element (3).
2. Clean element and check it for damage. See page 50.
3. Clean internals of case (4).
4. Install cleaned element and covers in place.



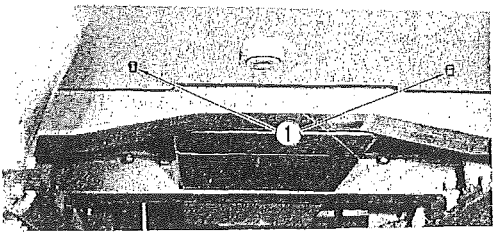
NOTES

a) Replace the element at least once a year.

b) Use a genuine MITSUBISHI element.

㉑ Drain water from steering clutch cases.

Remove drain plugs (1) for draining.

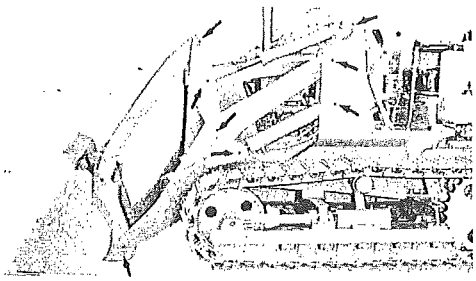


㉒ Lubricate hydraulic cylinders, bucket control linkage and lift arm pivot pins. (9 fittings on each side)

NOTES

a) Use a grease gun (furnished). Three shots of grease from the gun will be enough for each grease fitting.

b) Lubricate the bushings at shorter intervals when operating in deep mud or water.



Six-month or 600-hour servicing

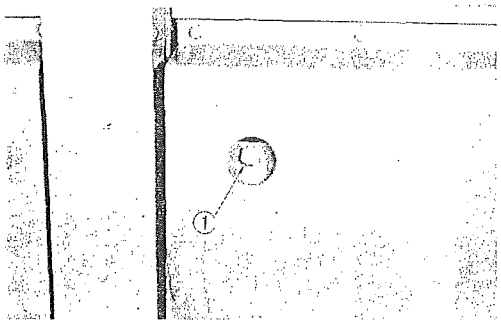
(Daily or 10-hour servicing, one-month or 100-hour servicing and three-month or 300-hour servicing should also be carried out.)

㉓ Change engine lube oil and filter.

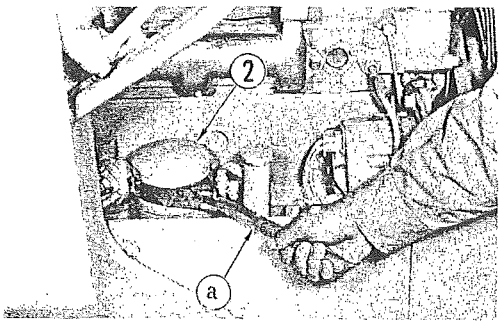
NOTE

Before draining, start and run the engine to warm up the oil.

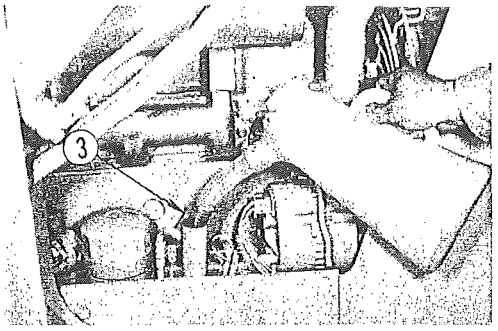
1. Remove drain cock (1) from under the engine.



2. Using the filter wrench (a) (special tool), remove filter (2).



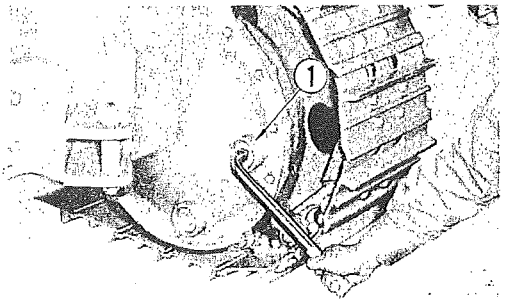
3. Clean the filter housing base. Make sure that no seal is left on the base.
4. Apply a coat of engine oil to the seal of a new filter.
5. Install the filter, tightening it by the hand.
6. Clean the drain plug and install it in place.
7. Refill the engine crankcase with 7 liters (1.8 U.S. gallons) of oil.



8. Run the engine at low-idle speed for a while, then add oil to bring oil level to full mark on gauge.
9. Check the filter housing for oil leaks.

㉔ Check oil level in final drive gear cases.

1. Remove filler plug (1).
2. Be sure that oil is up to overflowing level at the plug.
3. Replenish with recommended oil at filler (1).

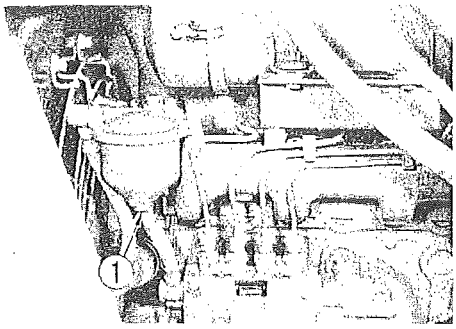


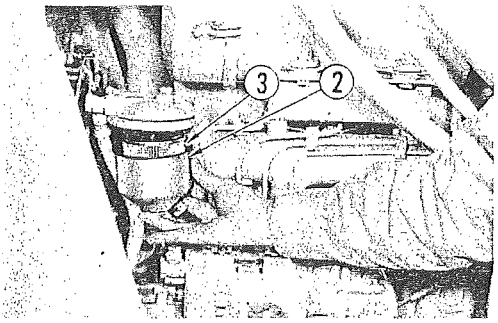
NOTE

Change oil regardless of service hours when the tractor is operated in deep mud or water.

㉕ Change fuel filter element.

1. Close the fuel supply cock at the bottom of fuel tank.
2. Remove bolt (1) and take out filter case (2), together with element (3).

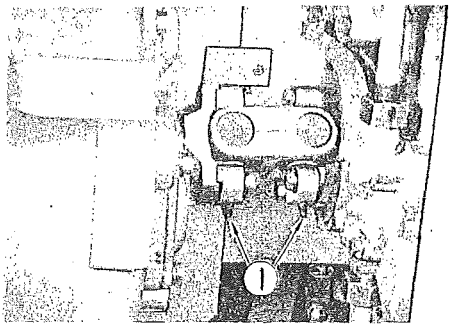




3. Clean the case internals.
4. Put a new element in the filter case, and install the case to the head.
5. Carry out air-bleeding operation. See page 51.

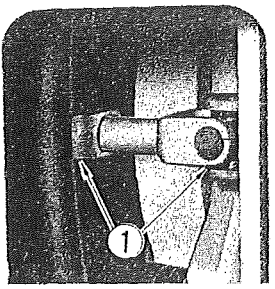
㉖ Lubricate universal joints.

1. Remove rear underguard.
2. Lubricate grease fittings (1).



㉗ Lubricate hydraulic pump universal joints.

1. Remove the cover from under radiator.
2. Lubricate grease fittings (1).

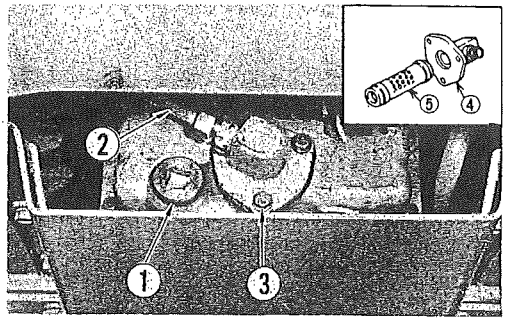


One-year or 1200-hour servicing

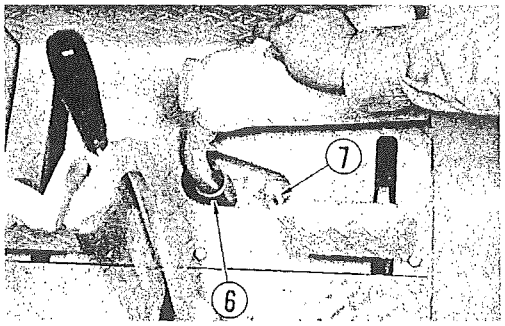
(Daily or 10-hour servicing, one-month or 100-hour servicing, three-month or 300-hour servicing and six-month or 600-hour servicing should also be carried out.)

㉘ Change oil in clutch case – wash strainer (DD).

1. Remove the rear underguard.
2. Remove drain plug (1), and drain out oil.
3. Remove oil pipe (2) and bolts (3), and take off cover (4).
4. Take out strainer (5), and wash it with kerosene.



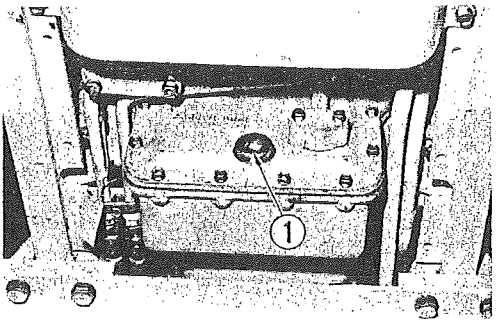
5. Clean the strainer and drain plug, and put them in the case.
6. Refill with recommended oil at filler (6) up to the full mark on level gauge (7). The capacity is 6 liters (1.6 U.S. gallons).



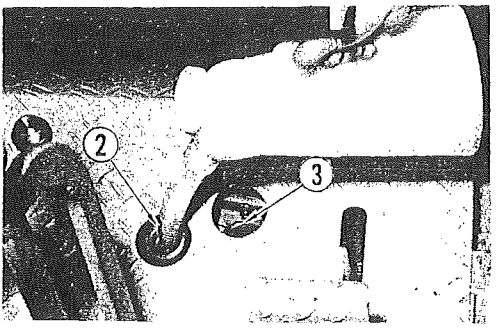
7. Start and run the engine at low speeds to fill filter body with oil. Check the oil lever, and add oil if necessary.
8. Check for any sign of oil leakage.

㉙ Change oil in damper case (DPS).

1. Remove the rear underguard.
2. Remove drain plug (1) to drain out oil.

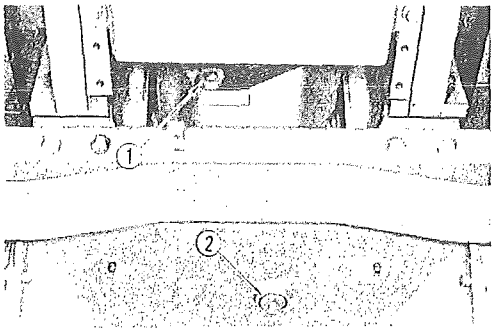


3. Refill with oil at filler (2) up to the full mark on the level gauge (3). The capacity is 2.7 liters (0.7 U.S. gallon).

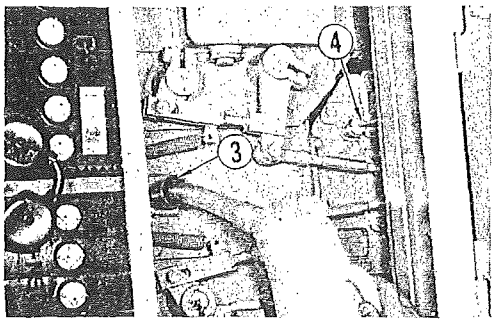


㉚ Change oil in transmission case (DD).

1. Remove the rear underguard.
2. Remove drain plugs (1) (2), and drain out oil.
3. Clean the drain plugs, and install them in place.

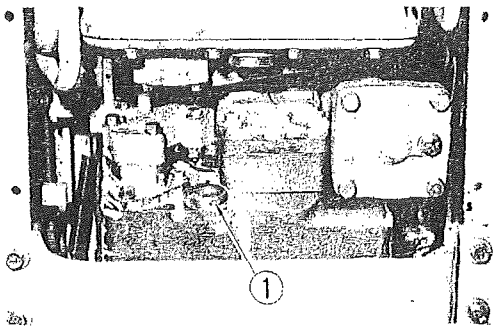


4. Refill with oil at filler (3) up to the full mark on the level gauge (4). The capacity is 9 liters (2.4 U.S. gallons).

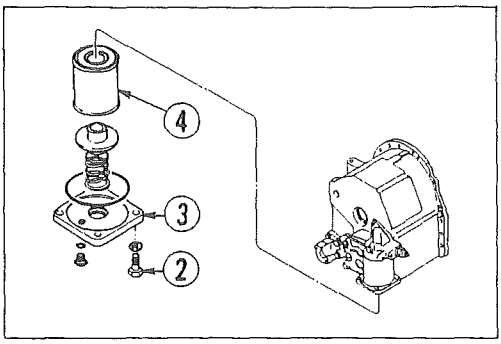


㉛ Change oil filter in transmission case – wash strainer (DPS).

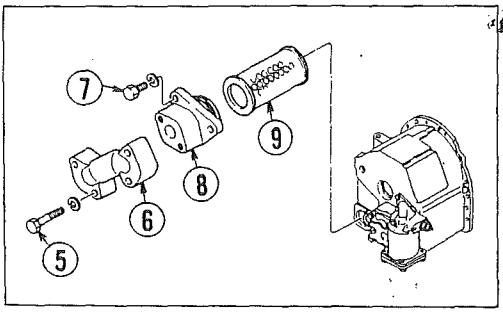
1. Remove the rear underguard.
2. Remove drain plug (1), and drain out oil.



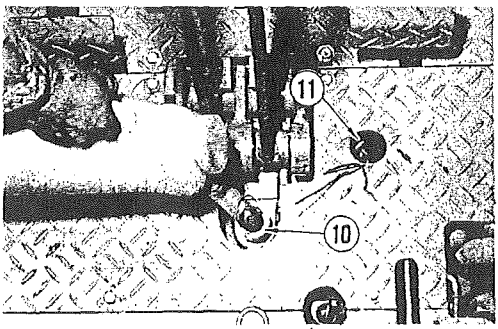
3. Remove bolts (2).
4. Take out filter cover (3) and filter (4).
5. Clean filter body interior.



6. Replace the filter with a new one.
7. Remove bolts (5), and take off pipe (6).
8. Remove bolts (7), and take off cover (8).
9. Take out strainer (9), and clean it with kerosene.



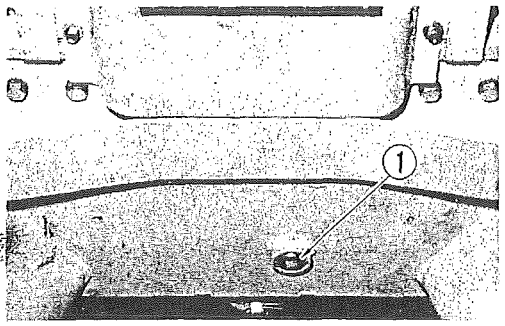
10. Clean the drain plug, and install it in place.
11. Refill with recommended oil at filler (10) up to the full mark on the level gauge (11). The capacity is 7.5 liters (2.0 U.S. gallons).



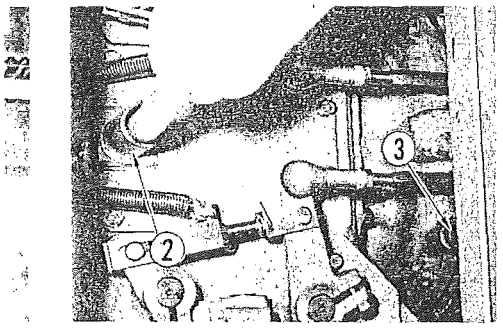
12. Start and run the engine at low speed to fill filter body with oil. Check the oil level and add oil if necessary.
13. Check the transmission for any sign of oil leakage.

㉜ Change oil in transfer and bevel gear case (DPS).

1. Remove drain plug (1), and drain out oil.

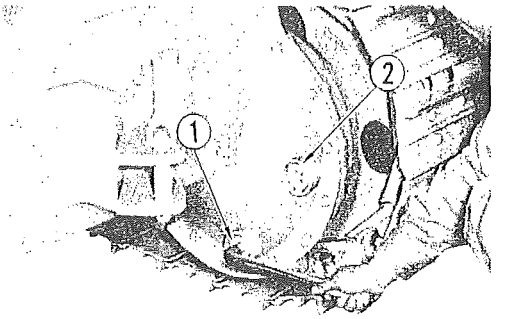


2. Clean the drain plug, and install it in place.
3. Refill with recommended oil at filler (2) up to the full mark on the level gauge (3). The capacity is 6.5 liters (1.7 U.S. gallons).



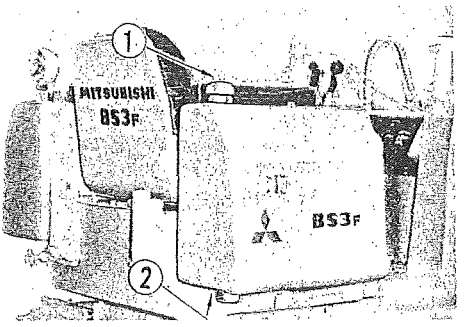
㉝ Change oil in final drive gear cases.

1. Remove drain plug (1), and drain out oil.
2. Clean the drain plug, and install it in place.
3. Remove filler plug (2) and refill with oil up to the plug level. The capacity of each case is 6.5 liters (1.7 U.S. gallons).

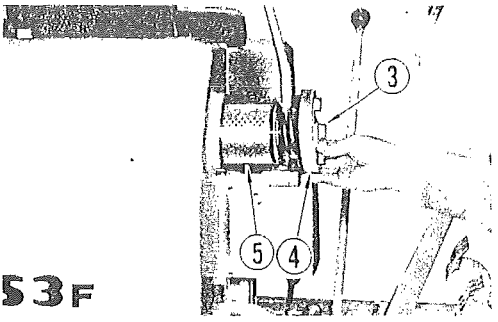


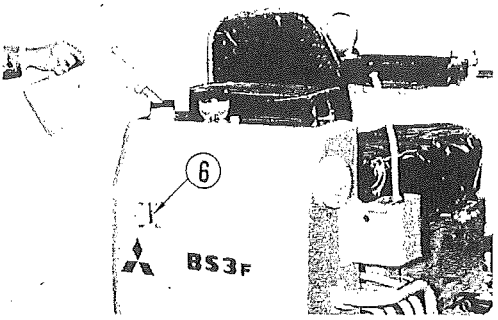
㉞ Change oil and filter in hydraulic tank.

1. Remove filler cap (1).
2. Remove drain plug (2), and drain out oil.



3. Clean the drain plug, and install it in place.
4. Loosen bolt (3), and remove filter cover (4) complete with filter (5).
5. Install a new filter in place.
6. Refill with recommended oil up to the ADD mark on sight gauge (6) on the side of the tank.





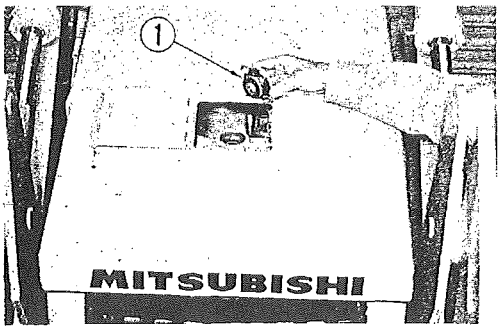
7. Operate the attachment for a few minutes, and check the oil level in the tank. The capacity is 37 liters (9.8 U.S. gallons).
8. Check for any sign of oil leakage.

㉟ Drain and flush cooling system.

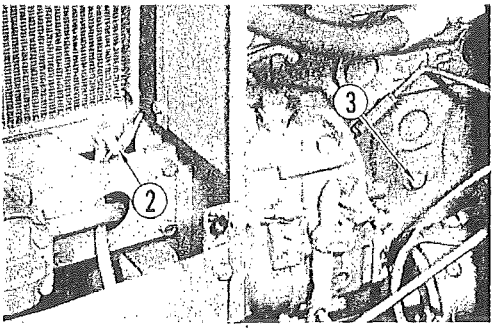
NOTE

Run the engine at low speed until it reaches the normal operating temperature.

1. Erect the lever at radiator filler cap (1) to release the pressure.



2. Remove the front lower cover from the radiator.
3. Open drain cocks (2)(3) to drain out the coolant.

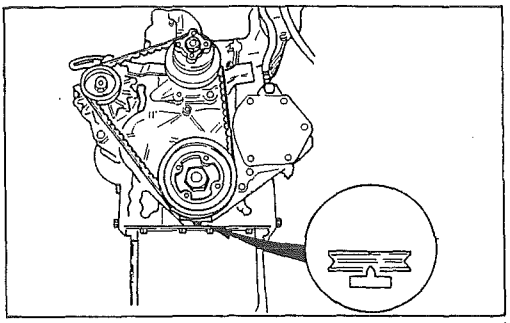


4. Close the drain cocks and fill the system with a mixture of water and sodium hydrogen sulfate, in proportions of 1 liter (2 pints) of water and 25 grams (0.9 oz) of the sulfate.
5. Start and run the engine for 30 minutes.
6. Stop the engine. Oepn the drain cocks to drain out the mixture. Wash the system by pouring straight water into it. Keep on washing until the overflowing water becomes clean.
7. Close the drain cocks and refill the system with a neutralizing mixture of water and sodium carbonate, in proportions of 1 liter (2 pints) of water and 6 grams (0.2 oz) of the carbonate.
8. Start and run the engine for 10 minutes.
9. Stop the engine and open the drain cocks to drain out the mixture. Wash the system with straight water.
10. The cooling system is now ready to be filled with the coolant, be it straight water or anti-freeze.

㊱ Check engine valve clearance.

- Check the clearance between each valve and rocker when the engine is in cold state.
- The clearance should be 0.25 mm (0.0098 in.) with the piston brought to the top dead center position on compression stroke.

1. Turn the crankshaft a little at a time with the starter or the cranking handle, and when the exhaust valve rocker arm has moved up and the intake valve rocker arm just starts to move down on the No. 4 cylinder, set the mark (IT) on the crank pulley to the matching mark on the gear case.



2. The No. 1 cylinder is now at the top dead center position on compression stroke. Insert a thickness gauge between valve and rocker, and check the clearance on:

   Intake and exhaust valves of No. 1 cylinder

   Intake valve of No. 2 cylinder

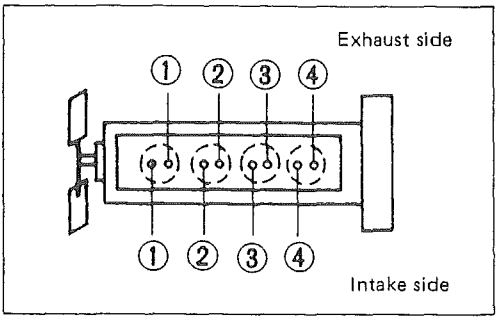
   Exhaust valve of No. 3 cylinder

3. Turn the crankshaft one complete turn (360°) to bring the No. 4 cylinder piston to its top dead center position on compression stroke. Check the clearance on:

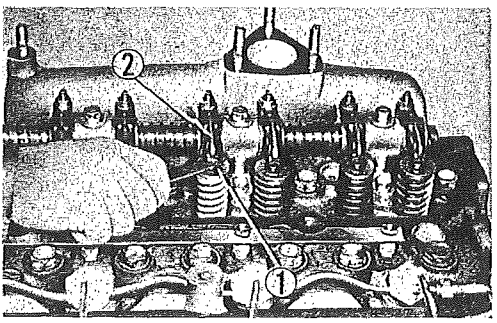
   Exhaust valve of No. 2 cylinder

   Intake valve of No. 3 cylinder

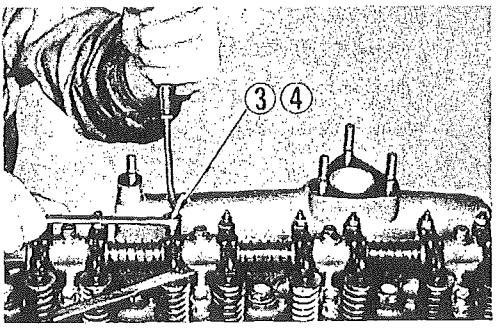
   Intake and exhaust valves of No. 4 cylinder



4. Check by inserting a 0.25 mm (0.0098 in.) thickness gauge into between valve (1) and rocker (2).



5. To adjust, loosen lock nut (3), and turn adjusting screw (4) in either direction.



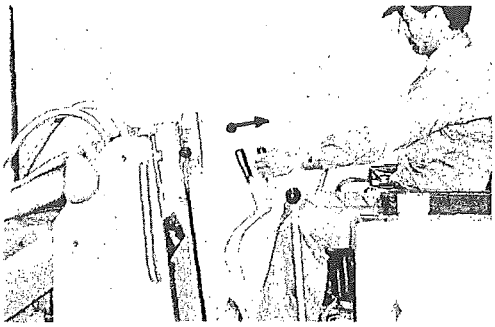
6. Hold the adjusting screw with a wrench, and tighten the lock nut.

NOTE

After adjusting, make a double check of the clearance on each valve, making sure it is correct.

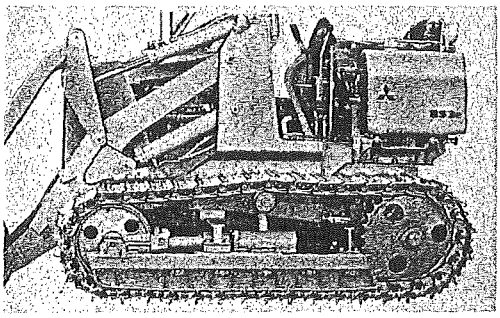
㊲ Check steering clutches and brakes.

Adjust steering clutch lever so that they are identical in the play and stroke. See page 53.



㊳ Check undercarriage parts for wear.

1. Check the track rollers, carrier rollers and sprockets for badly worn flanges.
2. If the rollers or sprockets are badly worn, replace them.



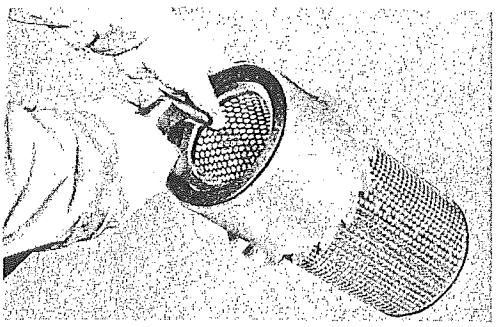
When required

Cleaning the air cleaner element

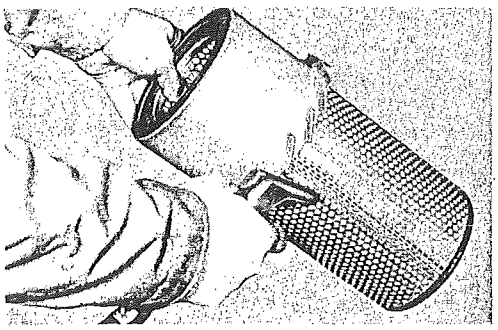
Clean the element using one of the following methods:

- Use clean, dry air, at a pressure not to exceed 7 kg/cm^2 (100 psi).

1. Direct air against the inside of the element to loosen any imbedded dirt. Move the nozzle so that air is directed along the complete length of the element.



2. Blow off loose dirt by directing air against the outside of the element.
3. Repeat this procedure until the element is clean. Make sure that no dirt is inside the element.



WARNING

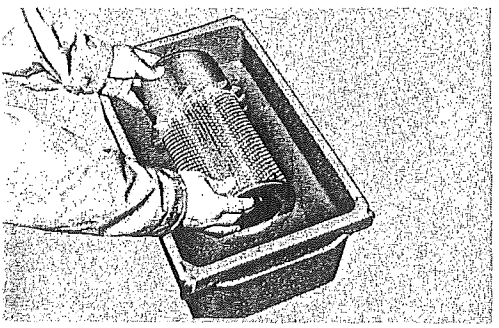
When cleaning the element using the air, be sure to wear a safety goggles.

- Use clean water, at a pressure not to exceed 3 kg/cm^2 (43 psi).

1. Direct water against the inside of the element to loosen any imbedded dirt. Move the nozzle so that water is directed along the complete length of the element.
2. Wash off dirt by directing water against the outside of the element.
3. Repeat this procedure until the element is clean. Make sure that no dirt is inside the element and thoroughly dry the element before installing.

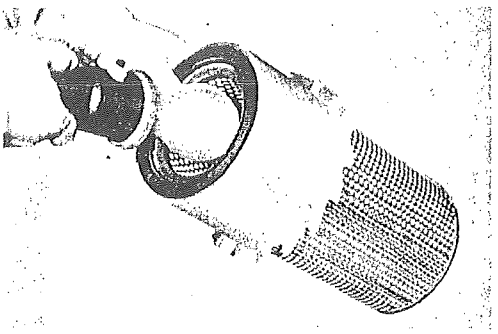
- Use a good household non-sudsing detergent.

1. Wash the element in a solution of warm water and the detergent.
2. Rinse the element with clean water, at a pressure not to exceed 3 kg/cm^2 (43 psi).



- Inspecting the element

Visually inspect the sealing ends of the element and the pleats for condition, in the manner as demonstrated.



CAUTION

Do not use elements with damaged pleats, gaskets or seals.

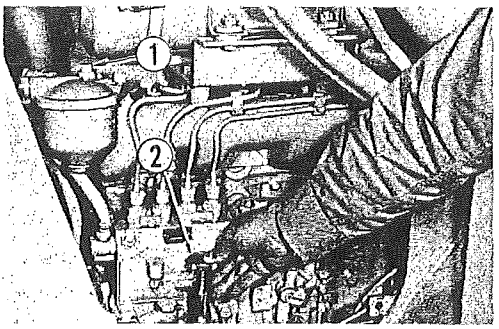
NOTE

Have spare elements on hand to use while cleaning the existing elements.

Air bleeding on fuel system

- **On fuel filter**

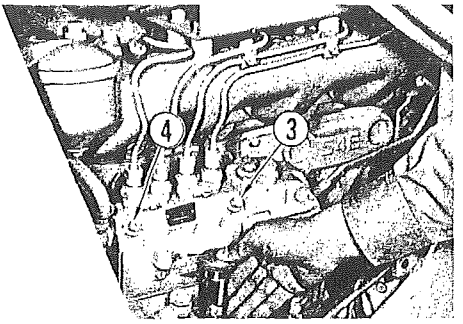
1. Loosen air vent plug (1) on the fuel filter.
2. Unlock priming pump (2) (on the feed pump) by turning its handle counterclockwise and operate it until fuel begins to flow out of the vent hole on the filter.



3. When the overflowing fuel no longer carries air bubbles, tighten the air vent plug, and lock the priming pump by turning its handle clockwise while pressing it downward.

- **On fuel injection pump**

1. Loosen air vent plugs (3) (4) on the injection pump.
2. Unlock and operate priming pump (2) until the fuel begins to flow out of the vent holes.



3. When the overflowing fuel no longer carries air bubbles, tighten the air vent plugs and lock the priming pump.

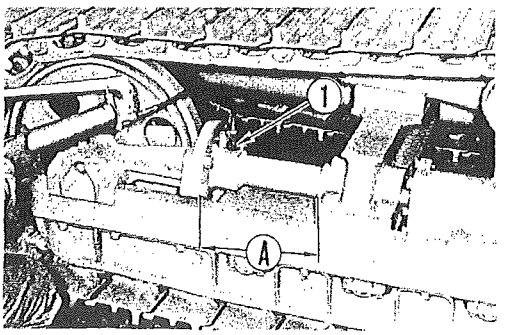
Adjusting the track

- **To tighten track adjustment**

Apply multi-purpose grease, with a grease gun, into the fitting (1) of the filler valve until correct slack develops in the track.

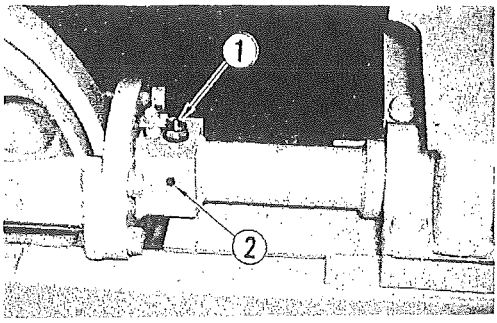
To tighten track adjustment, make sure that the measurement at (A) between flange and rigid bar is within 34 cm (13-3/8 in.).

If this measurement is greater than 34 cm (13-3/8 in.), repair is necessary. Consult your MITSUBISHI dealer.



● **To loosen track adjustment**

Turn filler valve (1) slowly counterclockwise and allow grease to escape from vent hole (2). Tighten the filler valve when correct slack has developed in the track.



When properly adjusted, there should be no less than 2 ~ 3 cm (3/4 ~ 1-1/8 in.) slack measured at a point half way between the carrier roller and front idler.

After adjustment, operate the machine backward and forward to equalize the adjustment.

Recheck the adjustment.

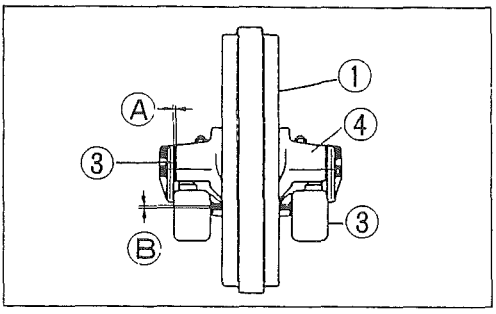
⚠ WARNING

Use extreme caution in applying grease. Remember, the track cylinder is pressurized highly!

Adjusting the front idler-to-guide clearance

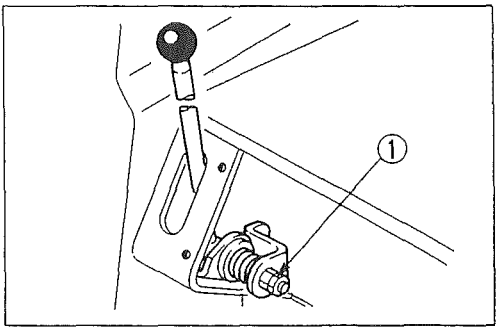
Whether or not front idler (1) properly slides on track frame (2) is based on the correct clearance at (A) and (B).

1. Using a thickness gauge, check the clearance (A) on each side. If the clearance is greater than 3 mm (0.118 in.), adjust it by subtracting shims (3).
2. If one of the No. 1 track roller flanges is badly worn, replace shims so that the center of the roller is shifted to the less-worn flange side.
3. If the clearance (B) is greater than 3 mm (0.118 in.), replace strip (4). Consult your MITSUBISHI dealer.



Adjusting the accelerator lever

This lever should provide a reasonably hard pull when it is moved. If the lever pull is abnormally hard, adjust its brake by turning double nut (1) in either direction.



NOTE

Never attempt to oil the brake to lessen the lever pull since this will cause the brake to slip, resulting in a failure of the lever to be held in the desired position.

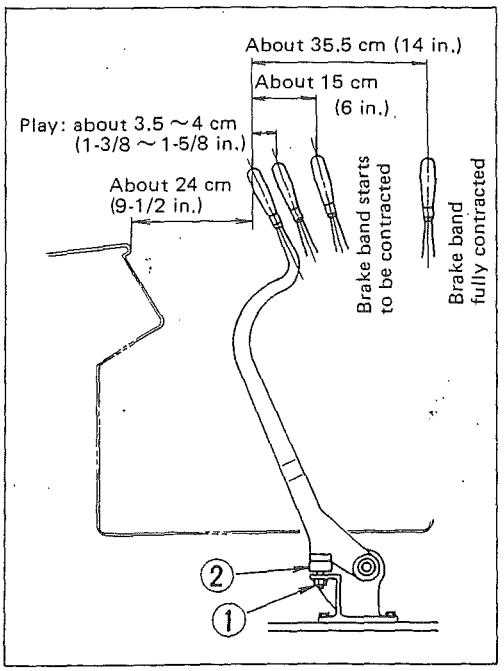
Adjusting the steering clutches

The steering clutch and brake are interlocked. This makes it necessary to adjust the clutch and brake at a time.

● "Released" position of steering clutch levers

The "released" position of the lever is prescribed to be about 22 cm (8-5/8 in.) as measured from the top of dash board, as shown. To adjust, proceed as follows:

1. Remove floor plate, and loosen lock nut (1).
2. Adjust the "released" position of the lever to the specification by turning stopper bolt (2).
3. Upon adjusting this lever position, tighten lock nut (1) good and hard.



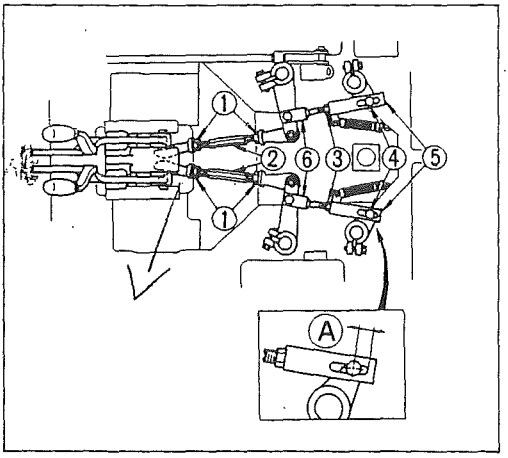
● Steering clutch lever play

Before making this adjustment, be sure that the "released" position of the lever is correct.

The lever play is prescribed to be 3.5 to 4 cm (1-3/8 to 1-5/8 in.). To adjust, proceed as follows:

1. Remove floor plate. Loosen lock nut (1), and turn rod (2) to adjust the play.
2. Upon adjusting the play, tighten lock nut (1) good and hard.
3. Loosen lock nut (3), and turn rod (6) so that pin (4) comes into contact with the rearmost end of the oblong hole in clevis (5) and the brake band starts to be contracted when the lever is pulled about 15 cm (6 in.) from "released" position. The dimension "A" must be 1.3 cm (about 1/2 in.) when the lever is released.
4. After adjusting, tighten lock nut (3) good and hard.

The lever position where the brake band is fully contracted will be about 35.5 cm (14 in.), provided that the brake is properly adjusted.

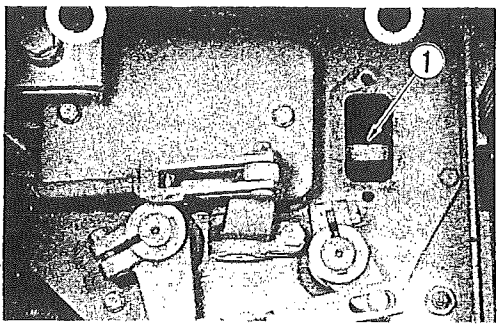


- Steering clutch brakes

Excessively worn brake linings are often evidenced by an increase in the steering clutch lever stroke.

The lever stroke is prescribed to be about 35.5 cm (14 in.) as measured at the tip of the lever. To adjust, proceed as follows:

1. Screw adjusting nut (1) all the way, and unscrew it 2-2/3 turns.
2. After adjusting, check to be sure that the stroke is about 35.5 cm (14 in.).

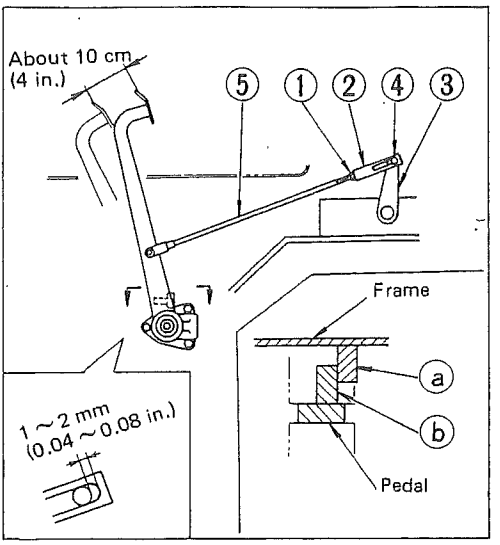


- Brake pedal (DD)

Clutch brake adjustment varies pedal stroke, making it necessary to readjust the stroke.

The pedal stroke is prescribed to be about 10 cm (4 in.). To adjust, proceed as follows:

1. Remove the floor plate, and loosen lock nut (1).
2. With stopper (a) on the lower side of the pedal borne on frame-side stopper (b), adjust the length of rod (5) by turning clevis (2) so that the clearance between the pin (4) of lever (3) and the rearmost end of the oblong hole in the clevis is 1 to 2 mm (0.04 to 0.08 in.).
3. After adjusting, tighten lock nut (1) good and hard.

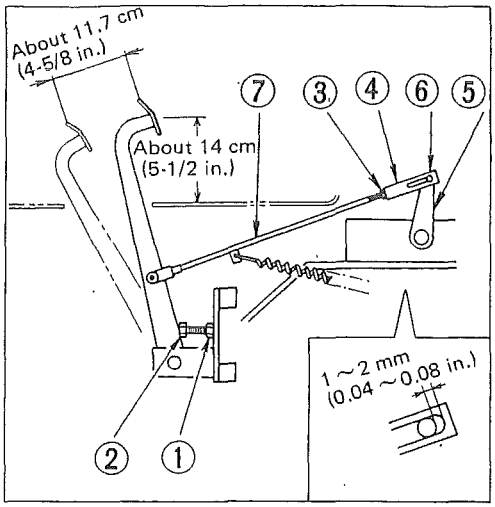


- Brake pedal (DPS)

Clutch brake adjustment varies pedal stroke, making it necessary to readjust the stroke.

The pedal stroke is prescribed to be about 11.7 cm (4-5/8 in.). To adjust, proceed as follows:

1. Remove the floor plate. Loosen lock nut (1), and turn adjusting bolt (2) so that the center of the pedal is about 14 cm (5-1/2 in.) above the floor plate.
2. Loosen lock nut (3) with the pedal arm borne on adjusting bolt (2). Then adjust the length of rod (7) by turning clevis (4) so that the clearance between pin (6) of lever (5) and the rearmost end of the oblong hole in the clevis is 1 to 2 mm (0.04 to 0.08 in.).
3. After adjusting, tighten lock nut (1)



Adjusting the main clutch (DD)

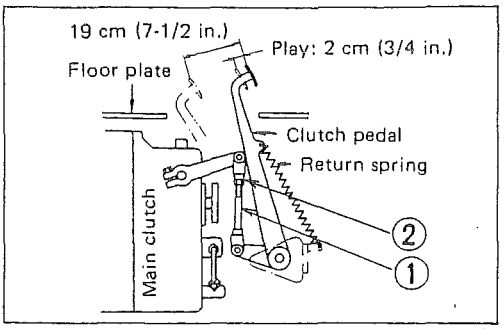
- **Clutch pedal**

If the pedal play is too small or if the main clutch is suspected to be slipping in engaged condition, adjust the pedal as follows:

The pedal play is prescribed to be about 2 cm (3/4 in.). To adjust, proceed as follows:

1. Remove the floor plate. Loosen lock nut (1), and adjust the length of rod (2). (Lengthening the rod increases the pedal play, and vice versa.)
2. After adjusting, tighten lock nut (1) good and hard.

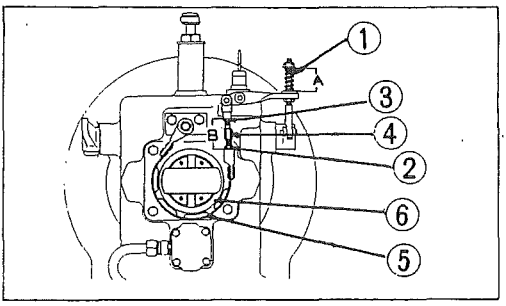
The pedal stroke is prescribed to be about 19 cm (7-1/2 in.). The pedal will bear on the stopper bolt when it is depressed over this much stroke.



- **Inertia brake**

With the engine running, the inertia brake is capable of stopping rotating universal joint in 2.5 seconds when the clutch pedal is depressed all the way, provided that the brake is properly adjusted.

1. Make sure that the length (A) of spring (1) is 4 cm (1-5/8 in.).
2. Loosen lock nuts (2) (3), and tighten adjusting bolt (4) until brake band (5) makes full face contact with drum (6).
3. Unscrew the adjusting bolt by 2.5 or 3 turns to obtain correct clearance between the drum and band.



NOTE

If the inertia brake is too effective, increase the dimension (B) of adjusting bolt; decrease it if the brake is ineffective.

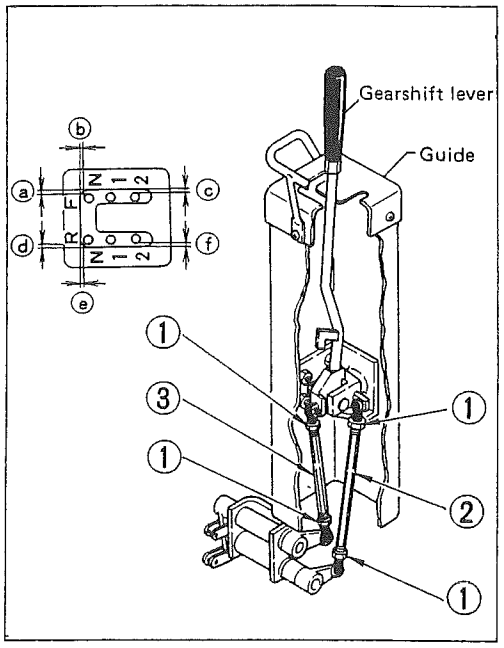
4. Tighten lock nuts (2) (3).

Adjusting the Direct Power Shift transmission (DPS)

- Gearshift lever

Move the gearshift lever into these positions, NF, NR, F2 and R2, making sure that the clearance between the guide and lever is 0.5 to 2 mm (0.02 to 0.08 in.) at (a) through (f) in the figure below. If not, adjust as follows:

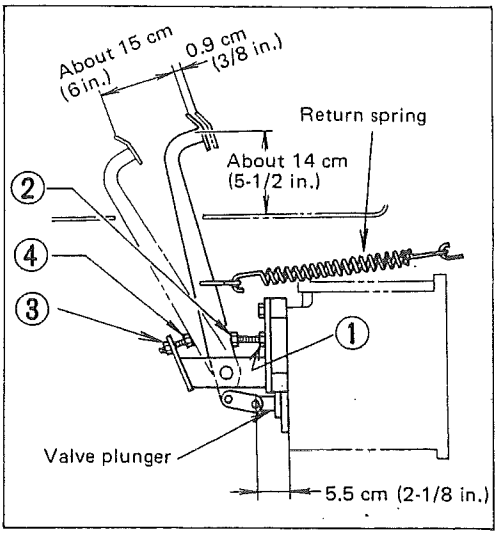
1. Remove the cover from the side face of control box. Also remove the rear floor plate.
2. Loosen four lock nuts (1), and turn rods (2) (3) to obtain 0.5 to 2 mm (0.02 to 0.08 in.) clearance at (a) through (f).
3. After adjusting, tighten lock nuts (1) good and hard.



- Clutch pedal

The pedal stroke is prescribed to be about 15 cm (6 in.). To adjust, proceed as follows:

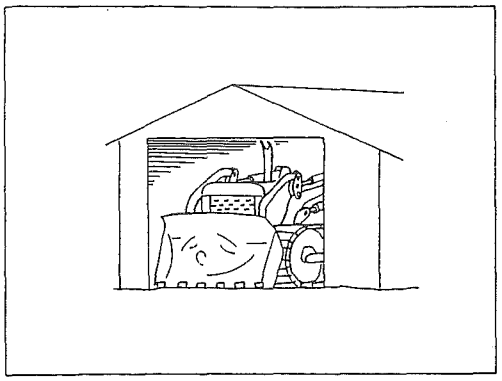
1. Remove the floor plate, and loosen lock nut (1).
2. Screw adjusting bolt (2) to pull out the clutch valve plunger as far as it goes [5.5 cm (2-1/8 in.)].
3. With the pedal depressed by about 0.9 cm (3/8 in.) from the position described in step 2 above, position adjusting bolt (2), and tighten lock nut (1) good and hard.
4. Loosen lock nut (3), and reposition stopper bolt (4) so that the pedal bears on this bolt when it is depressed by about 15 cm (6 in.) from the position stated in step 3 above.
5. After adjusting, tighten lock nut (3) good and hard.



STORAGE

Care of the machine to be stored

If the machine is to be stored or left standing for a long period of time, proceed as follows:



- Clean any oil, grease or mud accumulation from the floor of the operator's compartment. Remove snow or mud from around the track links, idlers, sprockets, rollers and guards to prevent freezing of the machine.
- Keep the machine indoors or under shelter, preferably in a dry place, on solid floor, logs or brush to prevent the machine from freezing. If the machine has to be left standing outdoors, cover it to protect against weather.
- Lubricate all points mentioned in the lubrication chart.
- Apply a thick coating of rust-preventive grease to the exposed metal surfaces of the hydraulic cylinder piston rods and control linkages.
- Disconnect the battery cable and wrap the battery with a vinyl sheet or the like, or remove the battery from the machine and store it in a separate dry place.
- Place the accelerator lever in the stop position. Place other control levers in the neutral position.
- Lower the bucket to the ground, and chock the machine without locking the brake pedal.

⚠ CAUTION

If freezing temperatures are expected, drain the cooling system completely or increase the percentage of anti-freeze solution in the coolant for protection against freezing.

Care of the machine in storage

- Renew the oil film at least once a month by running the engine until it is thoroughly warm. This will circulate the oil and prevent rusting from condensation.
- Charge the battery at least once a month.

Care of the machine to be released from long storage

- Open the drain plug at the bottom of each gear case to drain out water and sediment, if any. Check the oil level and, if necessary, add oil to raise the oil up to the prescribed level.

STORAGE

- Wash off the rust-preventive grease.
- When the engine is started for the first time after storage, run it with low speeds without load and, during this low-speed run, check the various parts of the engine, making sure that they are all in good condition.

TROUBLESHOOTING

Engine trouble

Complaint 1: "The starting motor does not turn, or doesn't crank the engine."

Possible cause	Remedy
a. Battery in run-down condition	a. Recharge.
b. Loose or open terminal	b. Reconnect.
c. Defective starter switch	c. *Repair or replace.
d. Defective starting motor	d. *Repair or replace.
e. Defective starter relay	e. *Repair or replace.
f. Incorrect oil viscosity	f. Use lube oil of proper viscosity.

Complaint 2: "The starting motor cranks the engine, but the engine doesn't start."

Possible cause	Remedy
a. Empty fuel tank	a. Refill.
b. Water in fuel or poor quality fuel	b. Drain water or use good quality fuel.
c. Restricted fuel supply line	c. Replace filter element and bleed air.
d. Air trapped in fuel supply line	d. Bleed air. Retighten connections.
e. Defective fuel injection pump	e. *Repair or replace.
f. Incorrect injection timing	f. *Readjust.
g. Poor compression pressure (due to worn cylinders, piston rings, etc.)	g. *Overhaul engine.
h. Clogged air cleaner element	h. Clean or replace.

Complaint 3: "The engine lacks power."

Possible cause	Remedy
a. Incorrect oil viscosity	a. Use lube oil of proper viscosity.
b. Poor quality fuel	b. Use good quality fuel
c. Clogged air cleaner element	c. Clean or replace.
d. Overcooling	d. Cover radiator or replace thermostat.
e. Overheating due to defective radiator	e. Wash cooling system or replace defective parts.
f. Maladjusted valve clearance	f. Readjust.
g. Defective fuel injection pump	g. *Repair or replace.

Possible cause	Remedy
h. Poor fuel spray from injection nozzles	h. *Repair or replace.
i. Incorrect injection timing	i. *Readjust.
j. Poor compression pressure (due to worn cylinders, piston rings, etc.)	j. *Overhaul engine.

Complaint 4: "The engine gives whitish or bluish exhaust smoke."

Possible cause	Remedy
a. Too high a lube oil level in oil pan	a. Lower oil level.
b. Too low an oil viscosity	b. Use lube oil of proper viscosity.
c. Overcooling	c. Cover radiator or replace thermostat.
d. Incorrect injection timing	d. *Readjust.
e. Poor compression pressure	e. *Overhaul engine.

Complaint 5: "The engine gives blackish exhaust smoke."

Possible cause	Remedy
a. Poor quality fuel	a. Use good quality fuel.
b. Maladjusted valve clearance	b. Readjust.
c. Defective fuel injection pump	c. *Repair or replace.
d. Poor compression pressure	d. *Overhaul engine.
e. Clogged air cleaner element	e. Clean or replace.

Complaint 6: "High fuel consumption"

Possible cause	Remedy
a. Defective injection pump	a. *Repair or replace.
b. Defective injection nozzles	b. *Repair or replace.
c. Incorrect injection timing	c. *Readjust.
d. Poor quality fuel	d. Use good quality fuel.
e. Poor compresssion pressure	e. *Overhaul engine.
f. Clogged air cleaner element	f. Clean or replace.

Complaint 7: "Excessive oil consumption"

Possible cause	Remedy
a. Worn cylinders, pistons or piston rings	a. *Overhaul engine.
b. Too high an oil level in oil pan	b. Lower oil level.
c. Too low an oil viscosity	c. Use lube oil of proper viscosity.
d. Oil leaks	d. Retighten or replace.

Complaint 8: "Low oil pressure"

Possible cause	Remedy
a. Insufficient oil	a. Add oil.
b. Too low an oil viscosity	b. Use lube oil of proper viscosity.
c. Defective oil pump	c. *Repair or replace.
d. Defective pressure regulating valve	d. *Readjust or replace.
e. Clogged oil filter	e. Replace element.

Main clutch trouble (DD)

Complaint	Possible cause	Remedy
a. Slips when engaged	Too small a pedal play	Readjust.
	Worn clutch facing	*Replace.
	Weak or broken clutch springs	*Replace.
b. Drags when disengaged	Too large a pedal play	Readjust.
	Clearance uneven in clutch	Readjust.
	Clutch shaft binding	*Disassemble and repair.
c. Chatters when disengaged or engaged	Poorly lubricated or damaged release bearing	Lubricate or replace.
d. Hard shifting	Oil too viscous	Use SAE10W oil of API CD class.
	Maladjusted inertia brake	Readjust.
e. Abnormal oil temperature rise	Oil level too high	Lower oil level.

Transmission trouble (DD)

Complaint	Possible cause	Remedy
a. Hard shifting	Oil too viscous	Change oil.
b. Noisy	Oil level or viscosity too low	Add or change oil.
	Worn or damaged gears and bearings	Replace.

Transmission trouble (DPS)

Complaint	Possible cause	Remedy
a. No power	Oil level too low	Add oil.
	Low hydraulic pressure	*Repair or replace oil pump.
	Maladjusted linkage	Readjust.
	Clutch seized	*Replace.
	Plugged oil lines	*Clean or replace.
	Worn splines	*Replace.
b. Abnormal oil temperature rise	Oil level too low	Add oil.
	Defective gauge	*Replace.
	Clutch drag	*Replace clutch discs.
	Worn bearings or journals	*Replace.
c. Noisy	Oil too low or too viscous	Add or change oil.
	Broken gears	*Replace.
	Clutch seized	*Replace clutch discs.
	Worn splines	*Replace.

Steering clutch trouble

Complaint	Possible cause	Remedy
a. Slips in engaged condition	Maladjustment	Readjust.
	Weak or broken springs	*Replace.
b. Drags when disengaged	Maladjustment	Readjust.

Complaint	Possible cause	Remedy
c. Clutch brake slips	Maladjustment	Readjust.

Final drive and track trouble

Complaint	Possible cause	Remedy
a. Sprocket teeth wear on their side faces	Too loose a track adjustment	Readjust.
b. Track slips off during operation	Too loose a track adjustment	Readjust.

Attachment (bucket) trouble

Complaint	Possible cause	Remedy
Bucket will not rise or rise too slowly	Insufficient oil in hydraulic tank	Add oil.

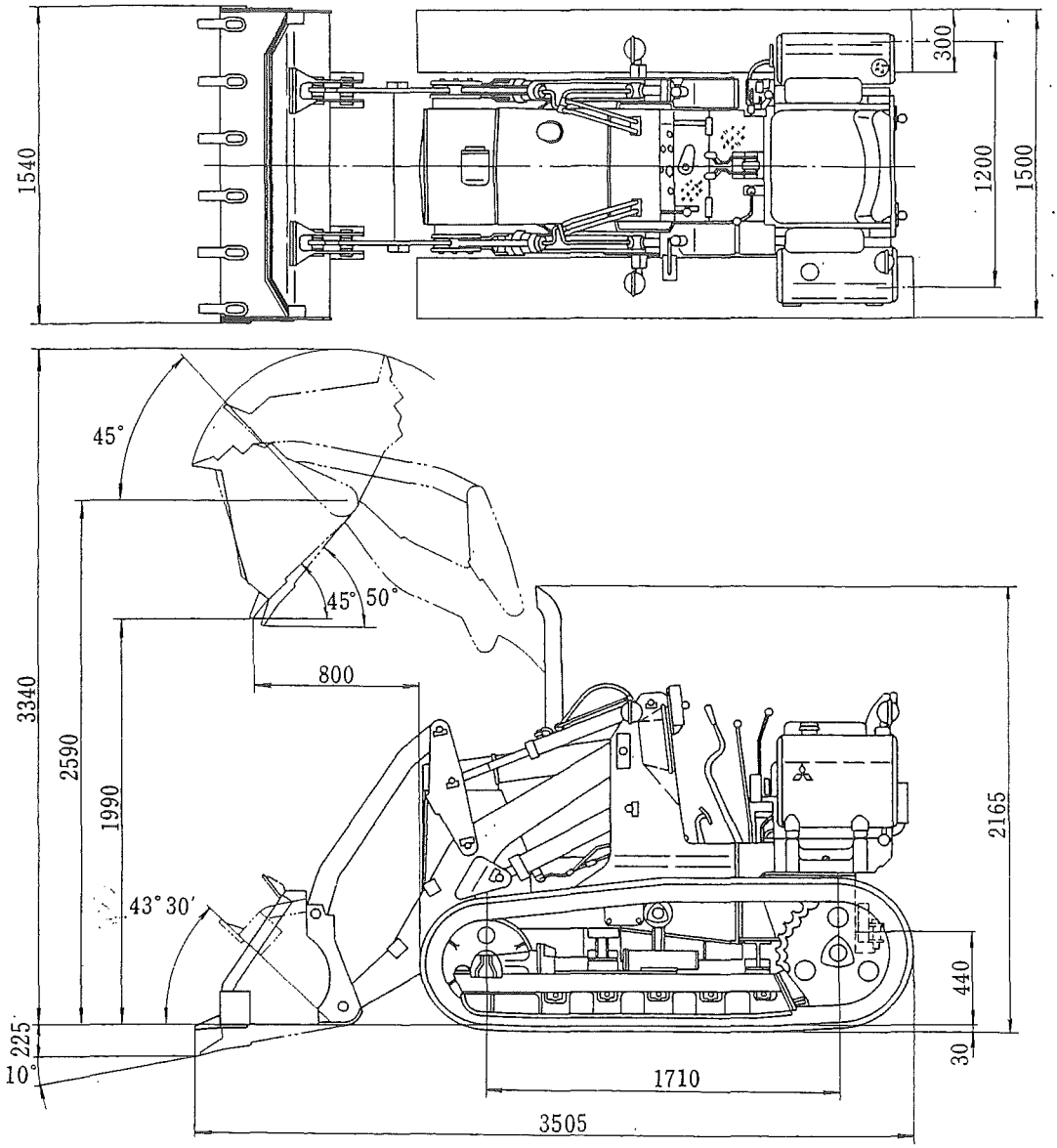
Remarks: 1. Consult your MITSUBISHI dealer for the items identified by asterisk (*).

2. For special service jobs, rely on the expert knowledge of the servicemen, and the service facilities at your dealer's workshop.

3. When ordering parts, give the machine serial number, engine serial number and service meter reading.

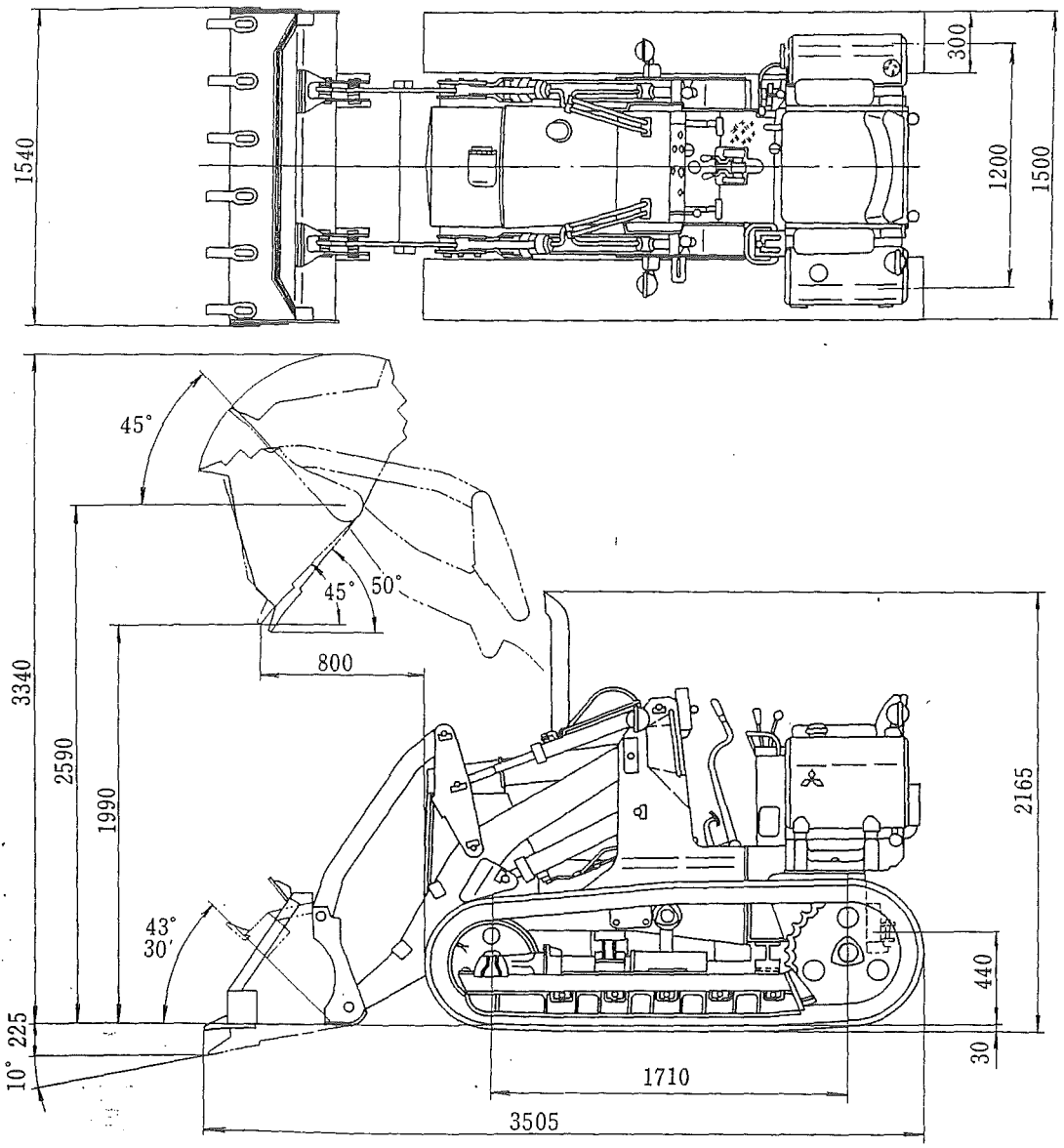
DIMENSIONAL DRAWINGS

Unit: mm



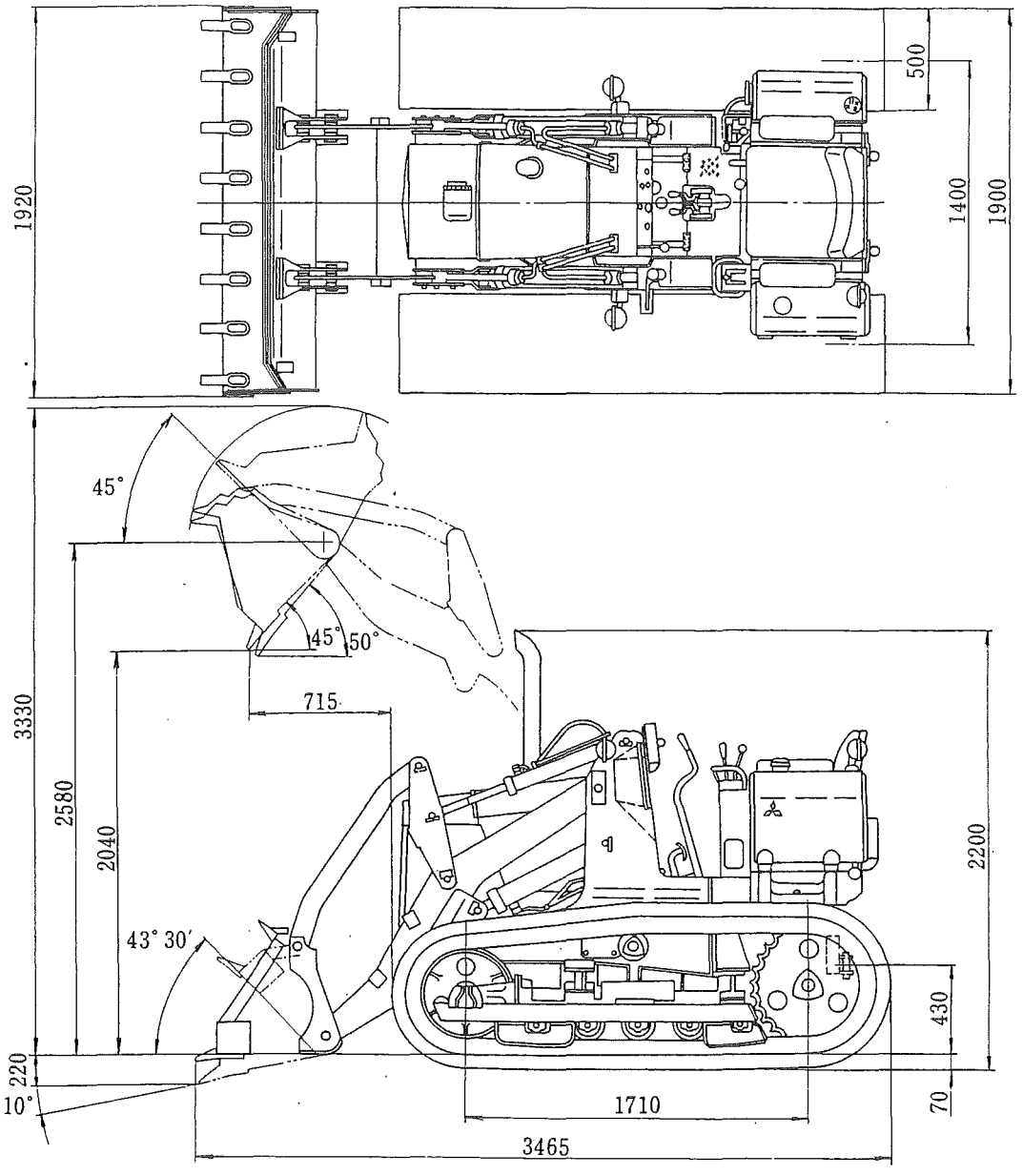
BS3F-F tractor shovel (standard model) (DD)

Unit: mm



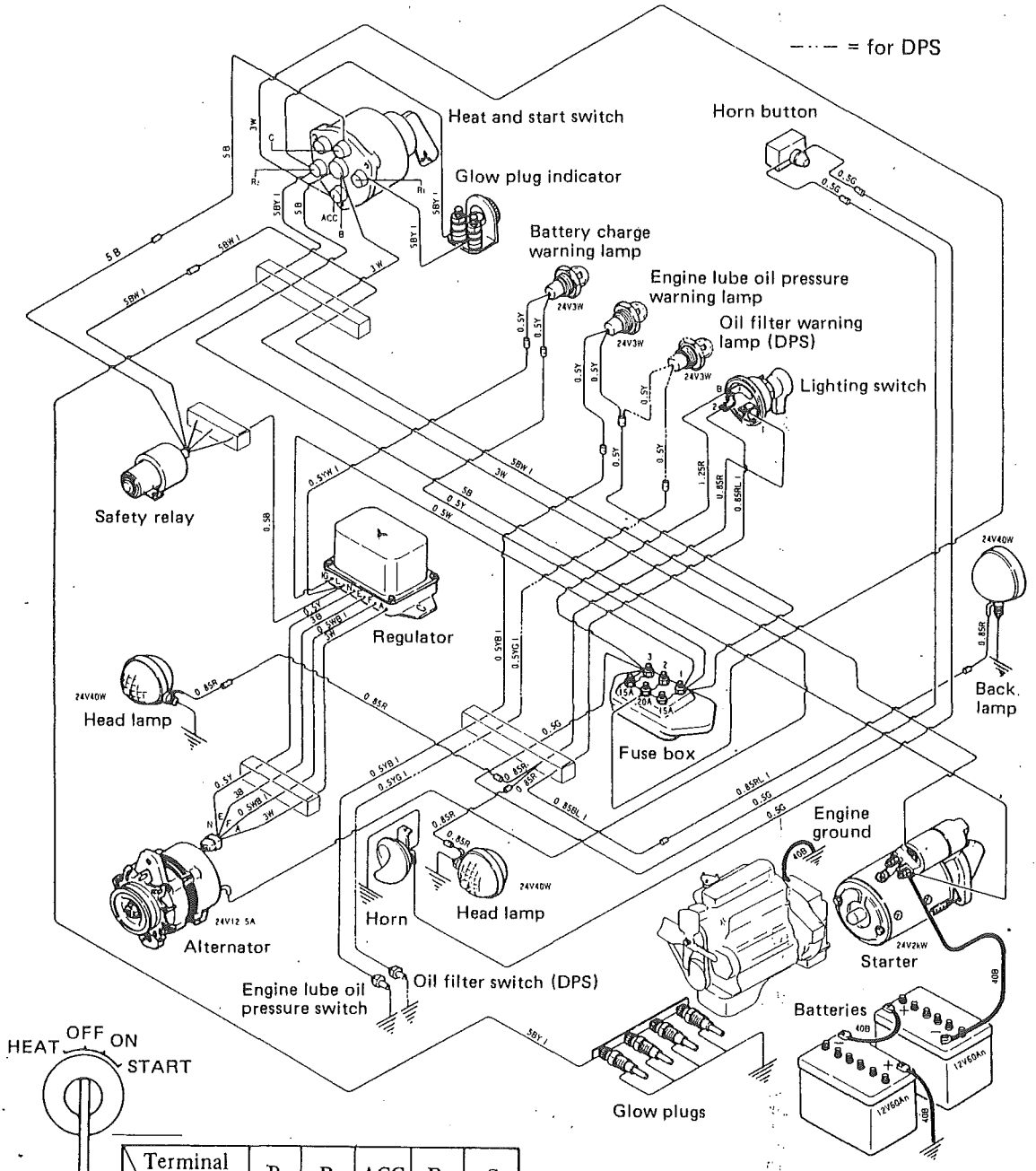
BS3F-F tractor shovel (standard model) (DPS)

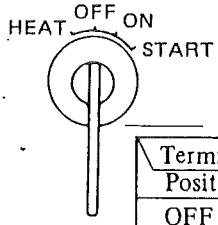
Unit: mm



BS3F-S tractor shovel (swamp model) (DD)

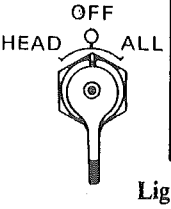
WIRING DIAGRAM





Terminal / Position	B	R_1	ACC	R_2	C
OFF	○				
HEAT	○	○			
ON	○		○		
START	○		○	○	○

Heat and start switch connection diagram



Terminal / Position	B	1	2
OFF	○		
HEAD	○	○	
ALL	○	○	○

Lighting switch connection diagram