YANMAR

OPERATION & MAINTENANCE MANUAL

EXCAVATOR

ViO15-2A

S/N 28167 & Above

Be sure to read this Operation Manual for you to use this product safety and correctly. Even after reading it, carefully keep it, making clear to all personnel concerned where it's kept so that the operator, mechanic or supervisor will have an access to it whenever he wants to read or refer to it.

13. Operating Instructions

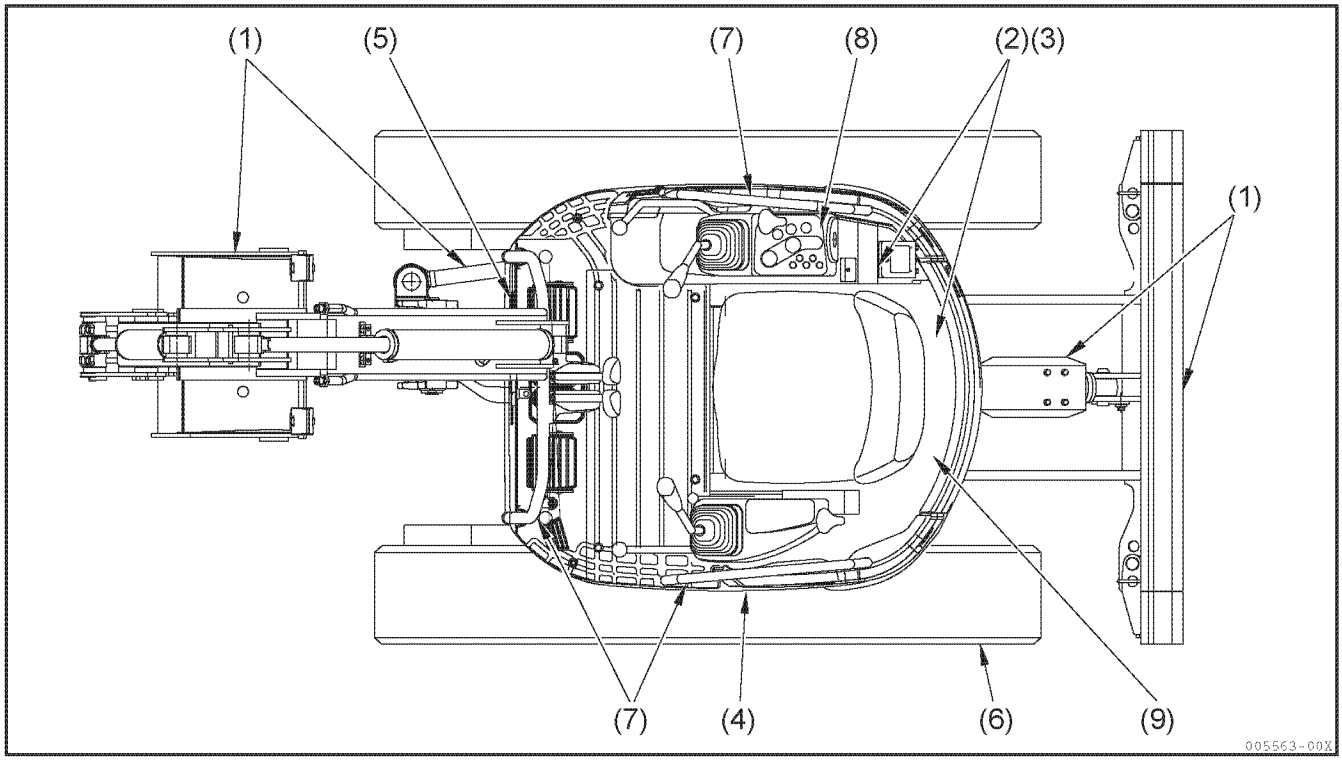
13-1. Checking before starting the engine

13-1-1. Walking check (visual inspection) around the machine

⚠ WARNING

- **If there are any combustibles in any heat build-up areas, or if there are any fuel and/or oil leaks, a fire can result.**
- **Check for possible fire causes carefully. If there is anything abnormal, be sure to take corrective action or contact your dealer.**

Before starting the engine, visually check the outside and underside of the machine as follows:
Check bolts and nuts for loose connections; check the fuel, oil, and water for leaks; and also check the implement and the hydraulic system to see that they are operating properly. In addition, check the electrical wiring for loose connections and for dust deposits in the heat build-up areas.
Check the following points before initial start-up for the day.



(1) Checking the implement, hydraulic cylinders, linkages, and hoses for damage, wear and loose connections

Check the implement, hydraulic cylinders, linkages, and hoses for damage, wear and loose connections. If any abnormality is found, take corrective action.

(2) Removing dust deposits from around the engine, battery, and radiator

Check to confirm that there are no dust deposits or other combustibles around the engine, on the radiator, or in other heat build-up areas, such as the muffler. If there are any, remove them.

(3) Checking the engine and its accessories for oil or water leakage

Check the engine for oil leakage and the cooling water system for water leakage.
If oil or water leakage is found, take corrective action.

(4) Checking the hydraulic system, hydraulic oil tank, hoses, and joints for oil leakage

Check for oil leakage. If oil leakage is found, take corrective action.

(5) Checking the grease piping for grease leakage

Check for grease leakage or ooze. If grease leakage or ooze is found, take corrective action.

(6) Checking the undercarriage (crawler, sprockets, and idlers) for breakage, wear, loose bolts, and oil leakage around the rollers

If any breakage or wear is found, correct it. Retighten the bolts if necessary.
If oil leakage is found, take corrective action.

(7) Checking the handrails and steps for breakage and loose bolts

If any breakage is found, take corrective action. Retighten the bolts if necessary.

(8) Checking the gauges and the monitor for breakage and loose bolts

Check the gauges and the monitor for breakage and loose bolts. If any abnormality is found, replace the gauge or the monitor with a new one, or retighten the bolts if necessary. Clean the surfaces of the gauges and monitor.

(9) Checking the water separator to see whether the red ring has sunk down to the cup bottom

If the red ring has sunk down to the cup bottom, no water has mixed into the oil; if the red ring is floating in the cup, water is mixed into the oil under the red ring. In this case, take out the cup to remove the water. Refer to Section "25-4-3. Cleaning the water separator element" for the removal and reinstallation procedure for the cup.

13-1-2. Checking before start-up

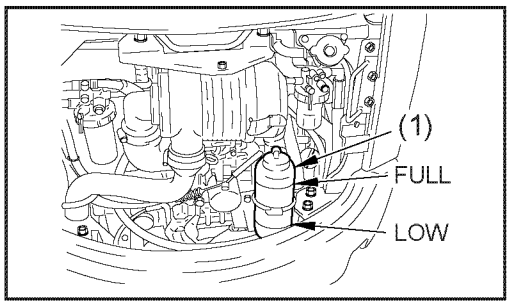
Check the following points before initial start-up for the day.

■ **Checking and replenishing the cooling water**

⚠ WARNING

- **Normally do not open the radiator cap.**
- **Check the cooling water level in the sub-tank when the engine is cool.**

1) Open the engine hood. Then check whether the cooling water level in the sub-tank (1) (illustrated in the figure at the right) is between the FULL and LOW marks. If the water level is below the LOW mark, refill the sub-tank up to the FULL mark through the water supply port of the sub-tank (1).
   For the cooling water to be used, refer to Section "21. Fueling, Oiling and Greasing Based on Temperature Range".
2) After replenishing, securely tighten the cap.
3) If the sub-tank is empty, check it for water leakage, and then, check the water level in the radiator.
   If the water level is low, refill the radiator first, then refill the sub-tank (1).
4) If the cooling water level is proper, close the engine hood.

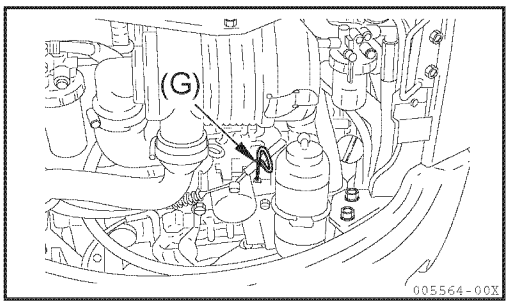


■ Checking and replenishing the engine oil

⚠ WARNING

- **At operating temperature, oil and dipstick areas are hot.**
  Do not allow hot oil or hot components to contact the skin, to prevent bodily injury.
- **Check oil level and replenish oil after engine has cooled down.**

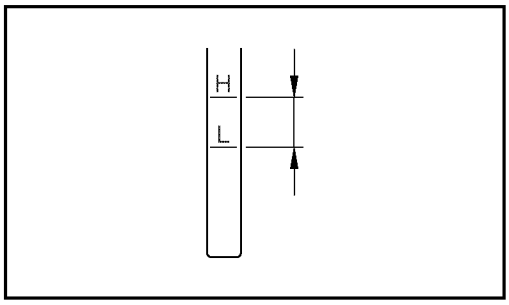
1) Open the engine hood and securely lock it in that position with the stopper rod.



2) Pick up the dipstick (G) and wipe it with a rag to remove oil deposits.

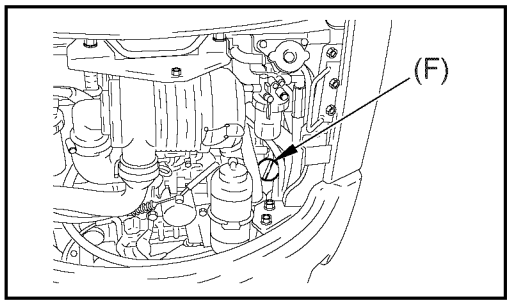
3) Fully insert the dipstick (G) into the dipstick tube, then draw it out.

4) If the dipstick (G) is wet above the midpoint between the H and L marks, the engine oil level is appropriate. If the oil level is below the midpoint between the H and L marks, add engine oil through the oil supply port (F). For the quality of the engine oil to be used, refer to Section "21. Fueling, Oiling and Greasing Based on Temperature Range".



5) If the engine oil level is above the H mark, remove the excessive amount of oil through the drain plug (P), then recheck the engine oil level.

6) After verifying that the amount of engine oil is appropriate, securely retighten the oil supply port cap and close the engine hood.

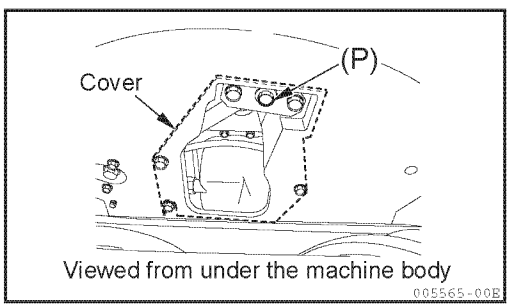


Note :

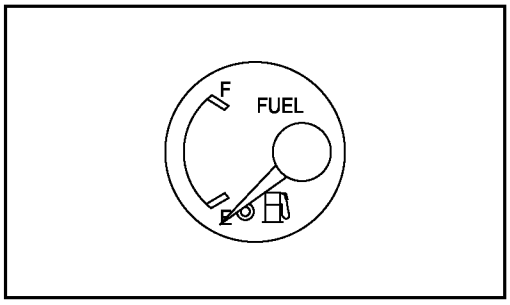
When checking the engine oil level after starting up the engine, stop the engine and allow more than 15 minutes for the engine to cool down.

If the machine is slanted, reposition the machine to ensure it is level before checking the engine oil level.

Keep in mind that the excess engine oil must not be disposed of on the ground or the road.



■ **Checking and replenishing the fuel in the fuel tank**

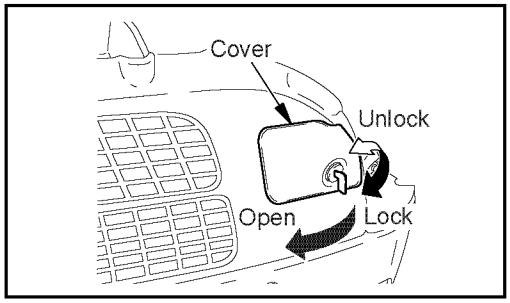


⚠ WARNING

Be careful not to overfill the fuel tank because it could cause a fire. If the tank is overfilled, completely wipe off the spilled fuel.

⚠ CAUTION

- **Do not remove the strainer from the fuel supply port of the fuel tank when supplying fuel.**
- **Be careful not to allow any water that may be in the fuel container or dirt on the refueling equipment to enter the fuel tank.**

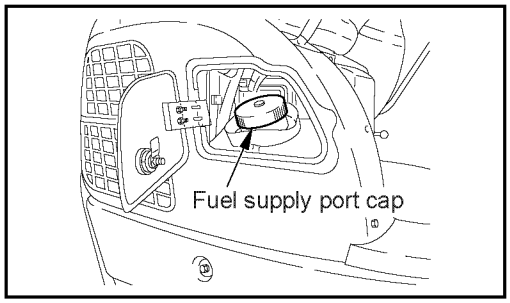


1) Turn the starter switch key to the "ON" position, and check the fuel level with the fuel meter.

   When the fuel meter pointer is at "E", approximately 1.32 Gals. (5 L) of fuel is left in the tank.

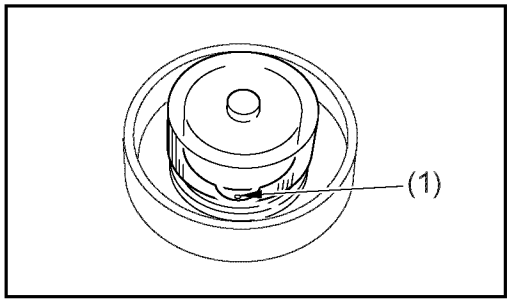
   Fuel tank capacity : 5.28 Gals. (20 L)

   For the quality of the fuel to be used, refer to Section "21. Fueling, Oiling and Greasing Based on Temperature Range".



2) Insert the starter switch key and turn it counterclockwise to unlock the cover for the fuel supply port.

3) Open the cover and add fuel to the fuel supply port.



4) After refueling, securely install and tighten the fuel supply port cap, and then close the cover.

5) Turn the starter switch key clockwise to lock the cover.

Note :

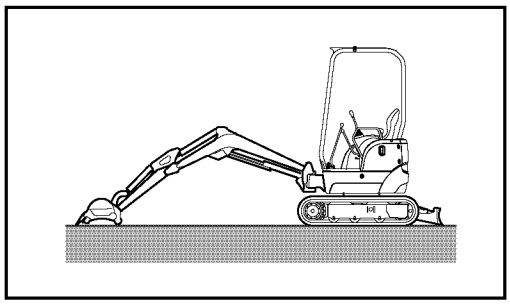
If the breather hole (1) in the fuel supply port cap is clogged, the pressure in the fuel tank will decrease and the fuel will not be supplied adequately to the engine. Clean the engine breather hole from time to time, to prevent that from happening.

■ Checking and replenishing the hydraulic oil in the hydraulic oil tank

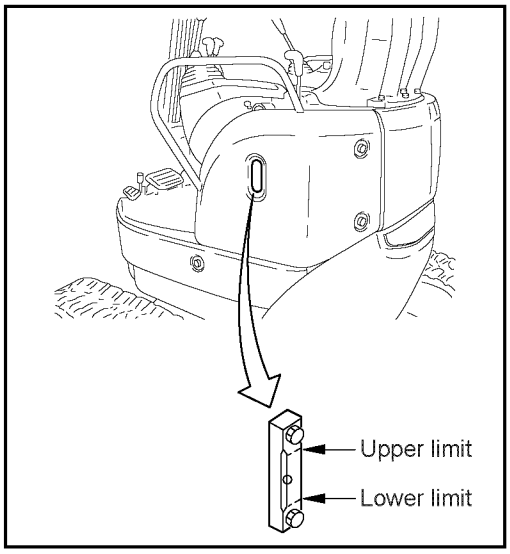
⚠ WARNING

When removing the plug of the oil supply port, slowly loosen it to gradually relieve the internal pressure in the tank, or oil may spurt from the tank.

1) Park the machine as illustrated in the figure at the right. If the machine is not in that posture, start the engine, retract the bucket and arm cylinders to their stroke ends at low speed, lower the boom until the bucket teeth contact the ground, lower the blade to the ground, and stop the engine.



2) Check the oil level by reading the oil level gauge on the left side of the machine. Confirm that the oil level is between the upper and lower limit marks.

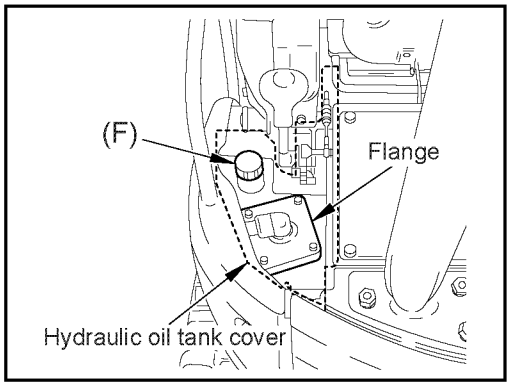


IMPORTANT

Do not replenish hydraulic oil above the upper limit mark on the oil level gauge. An excessive amount of hydraulic oil may damage the hydraulic system by placing stress on its components, causing a dangerous high-pressure leak.

3) Remove the hydraulic oil tank cover and add oil to the oil supply port (F) if the oil level is below the lower limit.

   For the quality of the oil to be used, refer to Section "21. Fueling, Oiling and Greasing Based on Temperature Range".

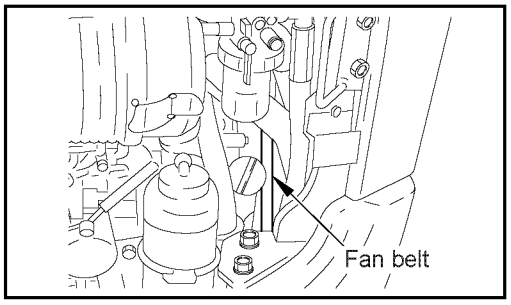


Note :

Note that the oil level varies with the oil temperature. When reading the oil level, follow these guidelines:

- *Before start-up, the oil level gauge should read at or near the midpoint of the gauge scale [oil temperature : 50 to 86°F (10 to 30°C)].*
- *During normal operation, the oil level gauge should read at or near the upper limit mark of the gauge scale [oil temperature : 122 to 176°F (50 to 80°C)].*

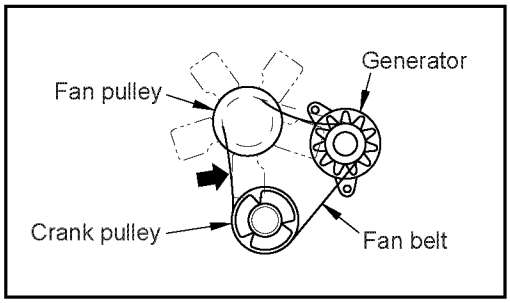
■ Checking and adjusting the fan belt tension



1) Open the engine hood.

2) Press down on the fan belt between the fan pulley and the crank pulley with a finger, to check the fan belt tension.

   Pressing force : Approximately 22.1 lbs. (10 kg)
   Correct slack : 0.4 to 0.6 in. (10 to 15 mm)



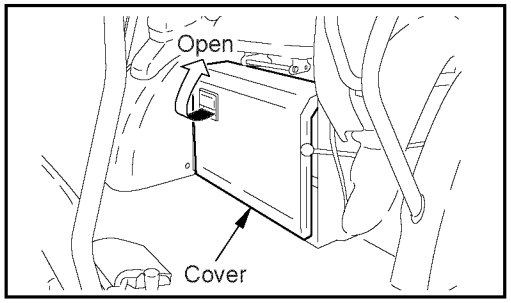
3) Adjust the tension if necessary.
   Refer to Section "25-3-5. Checking and adjusting the fan belt tension" for the adjustment procedure.

4) When the tension is proper, close the engine hood.

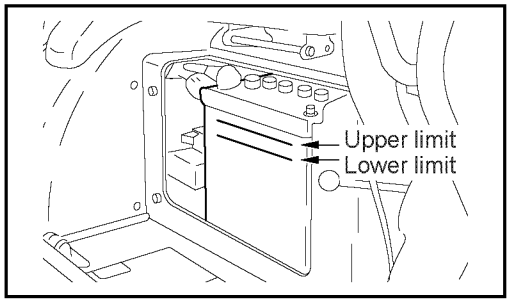
■ Checking and replenishing the battery electrolyte

⚠ DANGER

- **The battery generates flammable gas and can cause a fire and an explosion.**
  Keep sparks, flames and lit cigarettes away from the battery.
- **Battery electrolyte is strong acid. To avoid serious injury, do not allow the electrolyte to contact your skin or splash into your eyes.**
- **Always wear safety goggles and protective clothing, when adding electrolyte.**
- **Do not use the machine with the battery which is short of battery electrolyte. The shortage of battery electrolyte not only will reduce the life of the battery but also could cause an explosion.**



1) Open the cover to check the battery electrolyte level with the battery electrolyte level gauge. If the battery electrolyte level is at the midpoint between the upper and lower limit marks, the battery electrolyte level is appropriate.
2) If the battery electrolyte level is below the lower limit mark, replenish the battery electrolyte.



■ Greasing

IMPORTANT

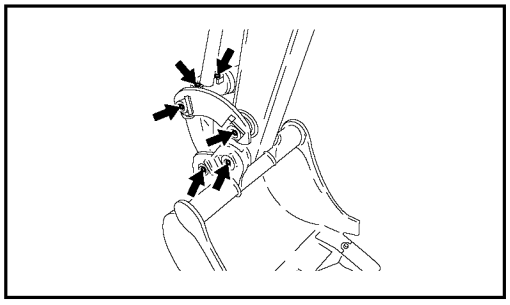
Grease the fittings thoroughly after washing the machine or after operation in rain, on soft ground, or in muddy water.

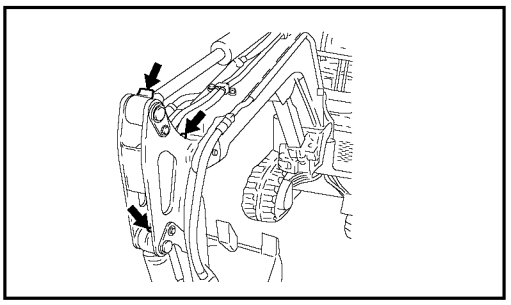
1) Put the bucket and the blade on the ground and stop the engine.

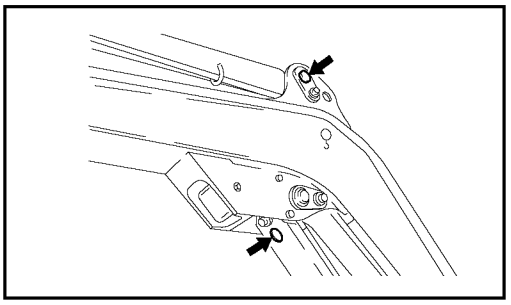
2) Clean the grease nipples indicated by arrows in the figures at the right and grease them with a grease gun.

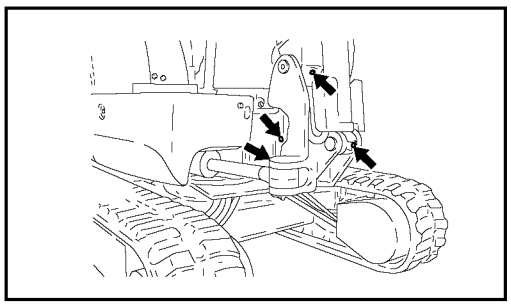
3) After greasing, wipe off any excess that remains.

■ Implement

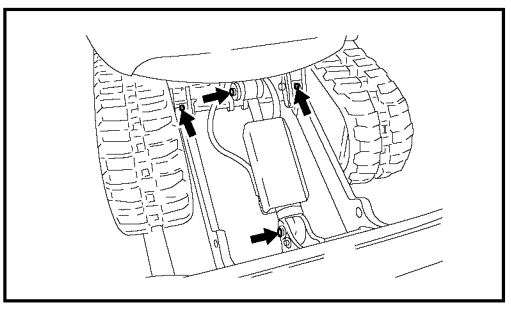








■ Blade



■ **Checking the electrical equipment**

⚠ CAUTION

If a fuse blows out frequently, contact your dealer for assistance.

Check fuses for damage, wiring for poor connections or short circuits, and battery terminals for corrosion or loose fits. Take corrective action.

Check the following items after the starter switch is turned to the "ON" position.

1) Check the monitor functions
- Check the fuel meter, water temperature gauge, and hourmeter.
- Check the engine oil pressure alarm lamp, battery charge alarm lamp and water temperature alarm lamp.

2) Check that the switch functions correctly and all lamp lights correctly.
- Check the horn
- Check the boom lights

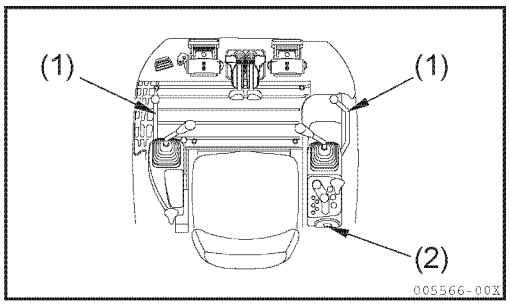
3) Check the travel alarm function.
- To check the travel alarm function, push or pull the travel levers.

13-1-3. Operating and checking instructions before starting up the engine

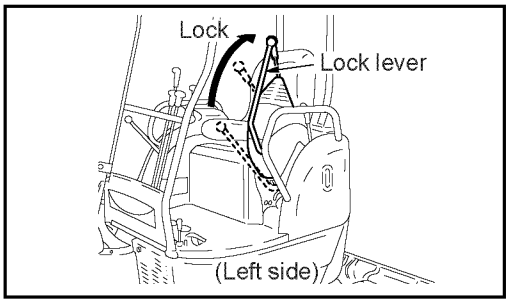
⚠ WARNING

- **Accidentally operating a control lever can cause the machine to move suddenly, possibly causing a serious accident.**
- **When leaving the operator's seat, be sure to place the lock levers securely in the lock position.**

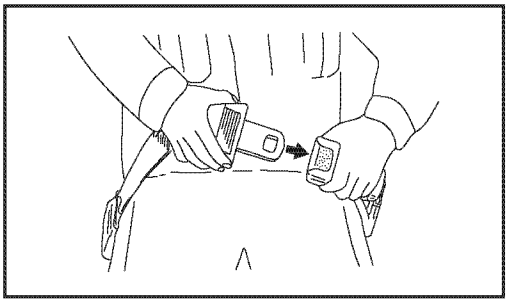
1) Check that the lock levers (1) are in the lock position.



2) Check that all other levers are in their appropriate positions.



3) Fasten the seatbelt snugly.

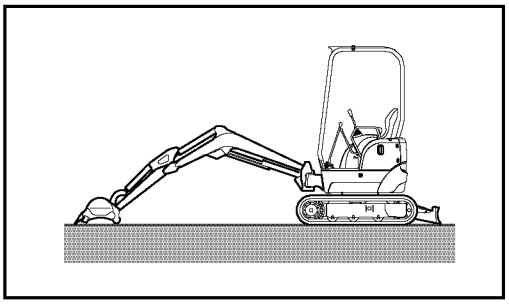


4) Insert the starter switch key into the starter switch (2) and set it to the "ON" position. Then check the following points:

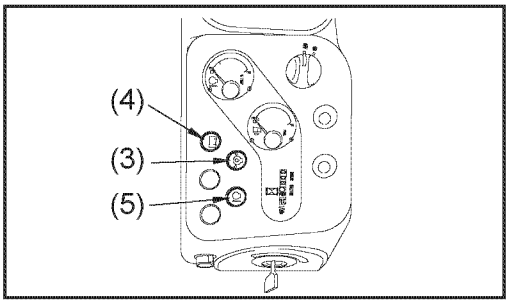
[1] The buzzer will sound, and the following alarm lamps will go on.

- Engine oil pressure alarm lamp (3)
- Battery charge alarm lamp (4)
- Water temperature alarm lamp (5)

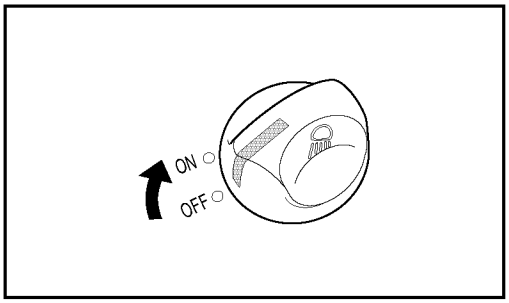
(It goes off in 2 to 3 seconds)



If any of the alarm lamps do not go on or the buzzer does not sound, it may mean that an alarm lamp has blown out or is broken. Take corrective action, or consult your dealer for assistance.



[2] Turn the light switch "ON" to see whether the boom light will go on. If it does not go on, the lamp might have blown out or might be broken. Take corrective action, or consult your dealer for assistance.

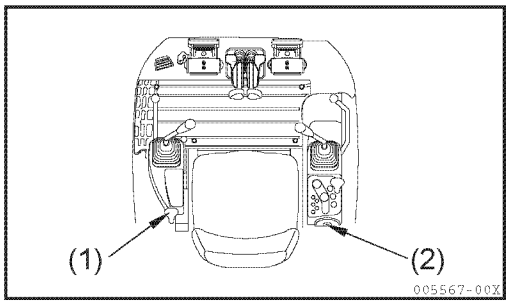


13-2. Starting up the engine

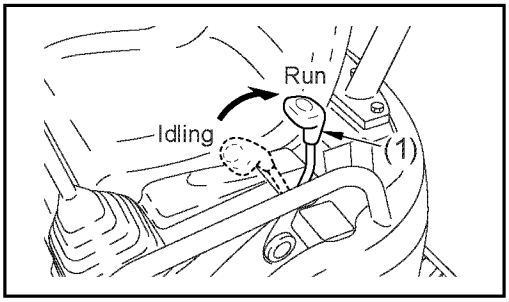
13-2-1. Normal start-up

⚠ WARNING

- **First check that there are no people or obstacles around the machine.**
  Then sound the horn and start the engine.
- **Be sure that you are seated on the operator's seat when starting the engine.**
- **When starting the engine in an enclosed place, be sure that there is adequate ventilation so that the exhaust gases can escape.**

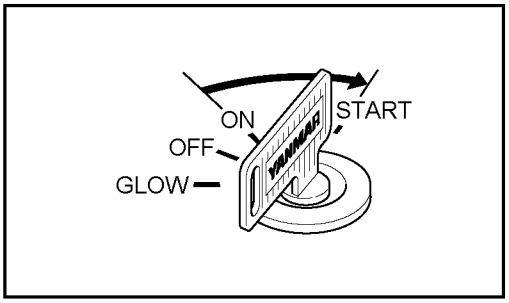


1) Pull the accelerator lever (1) back to the "RUN" position.



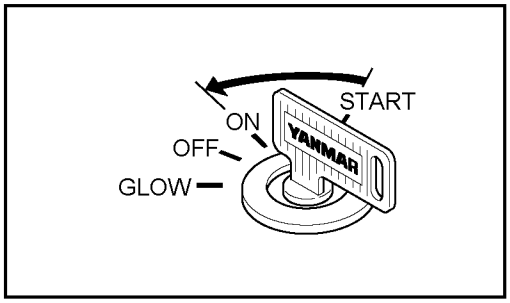
2) Set the starter switch key in the starter switch (2) to the "START" position. The engine will start.

3) After the engine has started, let go of the starter switch key.
   The starter switch key will return to the "ON" position by itself.



Note :

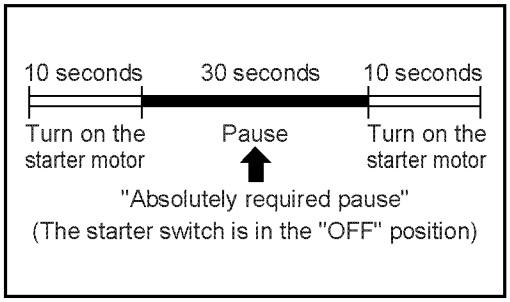
When the engine is warm, the engine can start up even if the accelerator lever is left in the "IDLING" position.



IMPORTANT

To protect the starter motor and the battery:

- **Do not keep the starter switch key in the "START" position for more than 10 seconds.**
- **If the engine fails to start, do not attempt to start the engine immediately again, but set the switch to the "OFF" position and wait for approximately 30 seconds, then start the engine again.**

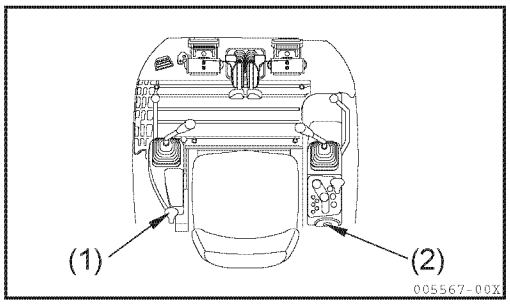


The swing motor brake is engaged when the engine is "OFF", but is released when the engine starts.

13-2-2. Starting the engine in cold weather

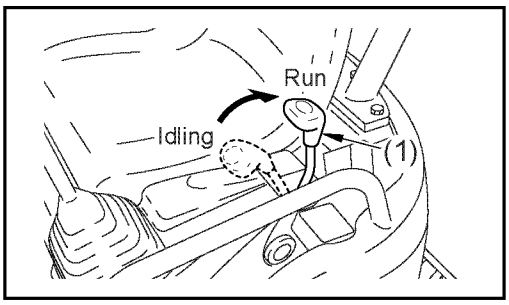
⚠ WARNING

- **First check that there are no people or obstacles around the machine.**
  Then sound the horn and start the engine.
- **Be sure that you are seated on the operator's seat when starting the engine.**
- **When starting the engine in an enclosed place, be sure that there is adequate ventilation so that the exhaust gases can escape.**

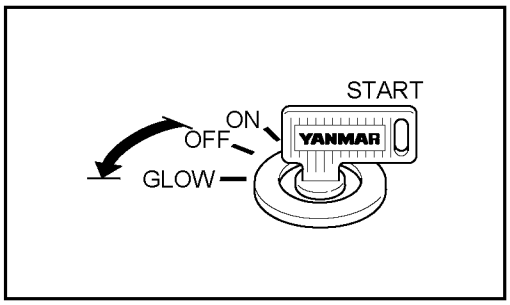


To start the engine when the outside air temperature is low, follow the steps below:

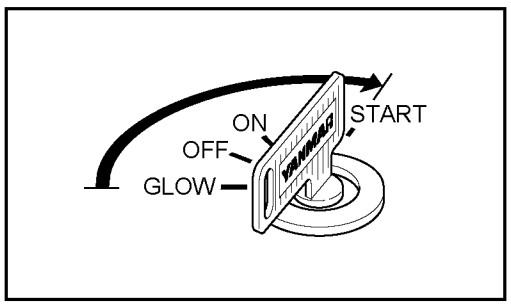
1) Pull the accelerator lever (1) back to the "RUN" position.



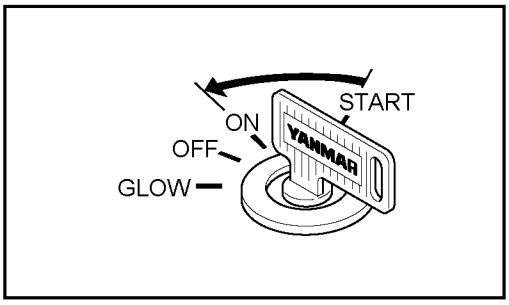
2) Turn the starter switch key in the starter switch (2) to the "GLOW" position and keep it there for approximately 10 to 15 seconds to preheat the intake air of the engine.



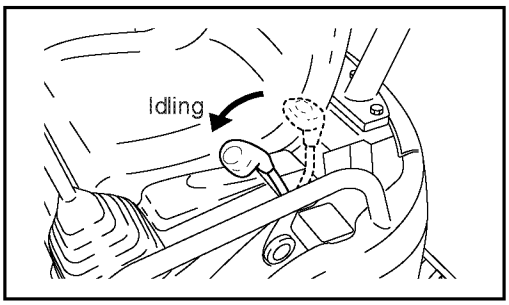
3) Turn the starter switch key in the starter switch (2) to the "START" position to start the engine.



4) After the engine has started, let go of the starter switch key.
   The starter switch key will return to the "ON" position by itself.



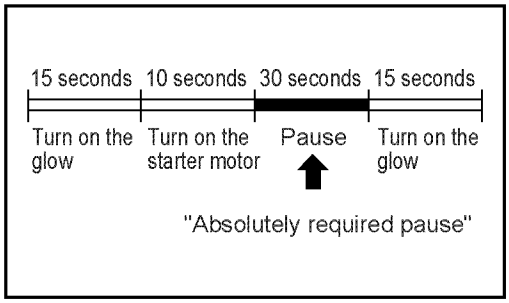
5) When the engine speed has increased, push the accelerator lever forward to the "IDLING" position immediately.



IMPORTANT

To protect the starter motor and the battery:

- **Do not keep the starter switch key in the "START" position for more than 10 seconds.**
- **If the engine fails to start, do not start the engine immediately again, but set the switch to the "OFF" position and wait for approximately 30 seconds, then start the engine again.**
- **Traveling or operating the machine without adequate warming in cold weather may adversely affect the machine performance.**



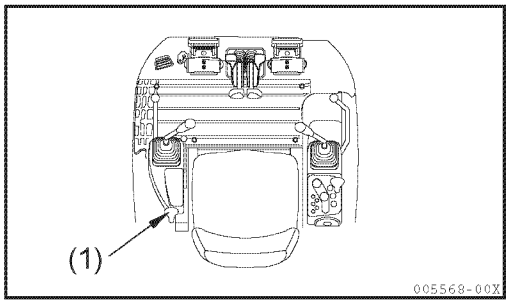
13-3. Operating and checking instructions after starting the engine

⚠ WARNING

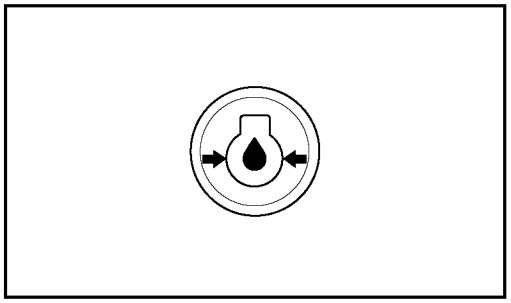
- Emergency stop.
  If abnormal operation occurs, turn the starter switch key to the "OFF" position, to shut off the electrical system and the engine. Then ask your dealer to check the machine.
- Be sure to warm up the engine. If you operate the implement without full warm-up, the machine may not respond or operate properly, especially in cold weather.

IMPORTANT

- The proper hydraulic oil temperature is between 122°F and 176°F (50°C and 80°C).
  If you have to operate the machine at a low hydraulic oil temperature, increase the hydraulic oil temperature to about 68°F (20°C) before operating the implement.
- In the event that you have to operate any control lever at a temperature lower than 68°F (20°C), operate it gently.
- Do not accelerate the engine rapidly until the engine warms up.

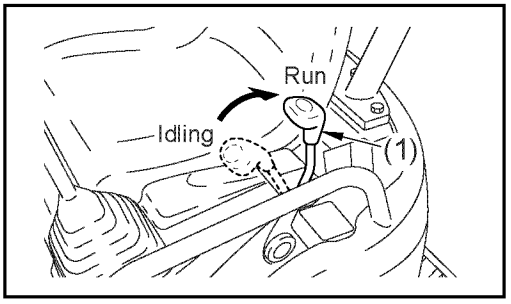


After starting the engine, do not start operating the machine immediately but follow this procedure:

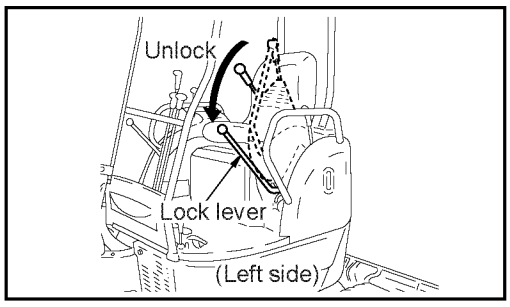


1) Idle the engine, to check that the engine oil pressure alarm lamp is off.

2) Pull the accelerator lever (1) to the midpoint between the "IDLING" and "RUN" positions, and run the engine with no load at medium speed for approximately five minutes.



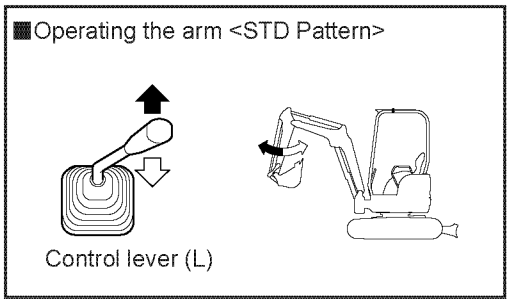
3) Unlock the lock levers, and lift the bucket from the ground.



4) Operate the bucket and arm control levers slowly to move the bucket and arm cylinders to their stroke ends. Operate the bucket for thirty seconds and the arm for thirty seconds alternately for approximately five minutes to increase the hydraulic oil temperature to 68°F (20°C).

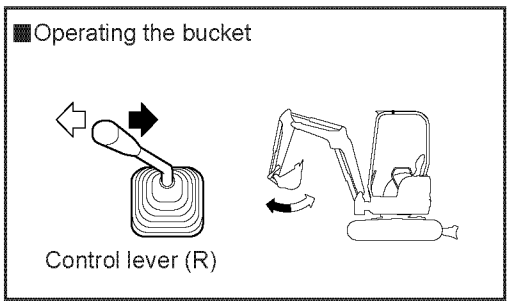
IMPORTANT

When moving the implement, be careful not to bump it against the machine or the ground.

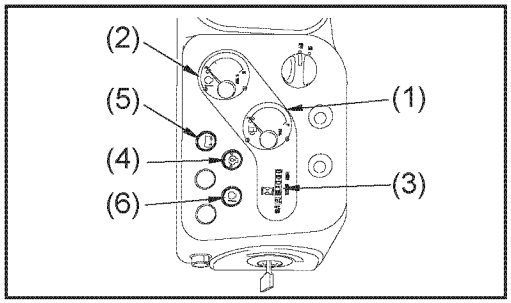


5) After warming up the engine, check that the gauges and the monitor are in the following status. If there is anything abnormal, take corrective action.

- Fuel meter (1), water temperature meter (2) and hourmeter (3) ..... Normal
- Engine oil pressure alarm lamp (4) ..... Off
- Battery charge alarm lamp (5)..... Off
- Water temperature alarm lamp (6) ..... Off



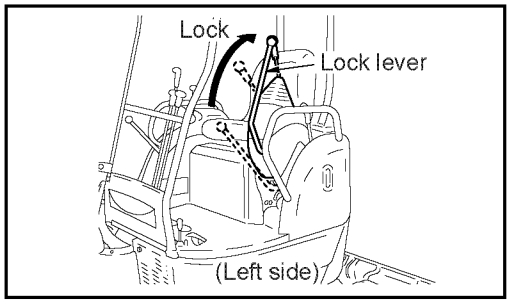
6) Check the exhaust gas color, the machine noise, and the vibration level for abnormality. If something is abnormal, take corrective action.



7) Set the lock levers to the "LOCK" position to confirm that the implement cannot be operated and the upperstructure cannot be swung with the left and right control levers.

8) Unlock the lock levers and operate the control levers to check that the implement can be operated and the upperstructure can be swung normally. If something is abnormal, take corrective action.

9) Check that the swing brake valve operates normally. If something is abnormal, take corrective action.



10) Check that no abnormal noise is heard from the hydraulic pump. If any abnormal noise is heard, take corrective action.

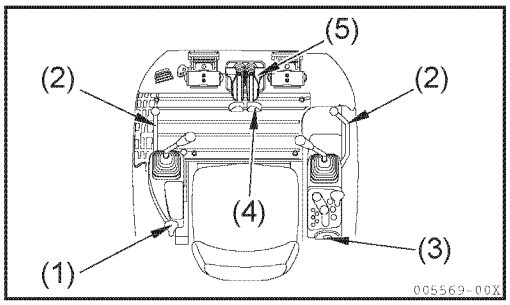
Ask your dealer to resolve any problems identified in steps 1) to 10) above.

13-4. Traveling

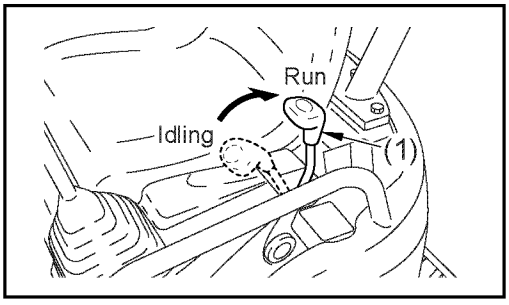
13-4-1. Traveling forward

⚠ WARNING

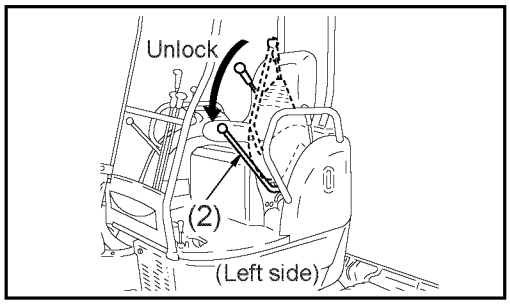
- **Always check the position of the blade before operating the travel levers and pedals. When the blade is in the rear, the travel levers and pedals operate in the reverse of the normal operation.**
- **A signal person should be in attendance to give signals at sites which are dangerous or not clearly in view of the operator.**
- **Clear all people from the working area.**
- **Sound the horn before beginning travel, to alert the people near the machine.**
- **Clear obstacles from the path of the machine.**
- **Do not operate the travel levers and pedals rapidly while the engine is running at high speed. Otherwise, the machine may move unexpectedly, causing a serious accident.**



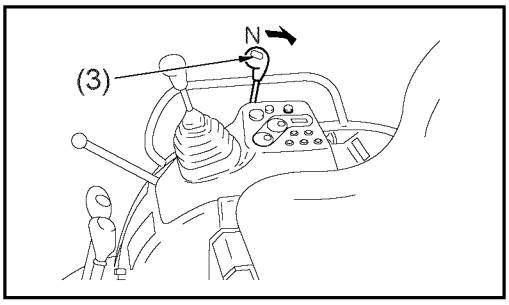
1) Pull the accelerator lever (1) back to the "RUN" position to increase the engine speed.



2) Unlock the lock levers (2), and retract the implement to raise it 16 to 20 in. (40 to 50 cm) above the ground.

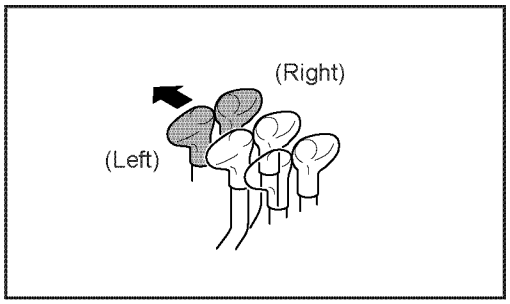


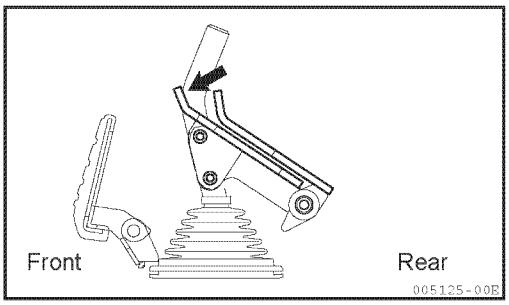
3) Pull back the blade lever (3) to raise the blade.



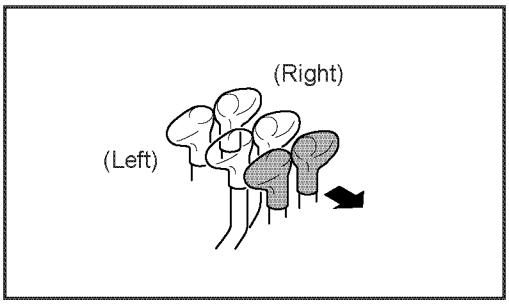
4) Operate the left and right travel levers (4) or pedals (5) as follows:

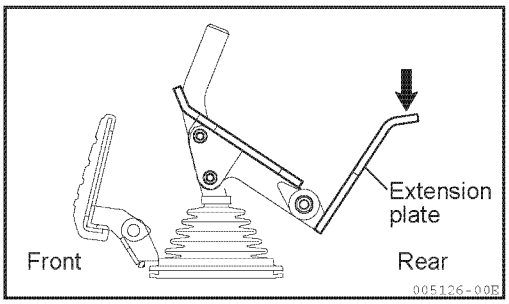
• When the blade is in the front of the machine;
Slowly push the travel levers (4) forward or step on the front of the pedals (5) to move the machine forward.





• When the blade is in the rear of the machine;
Slowly pull the travel levers (4) back or unfold the extension plate to step on it in order to move the machine forward.

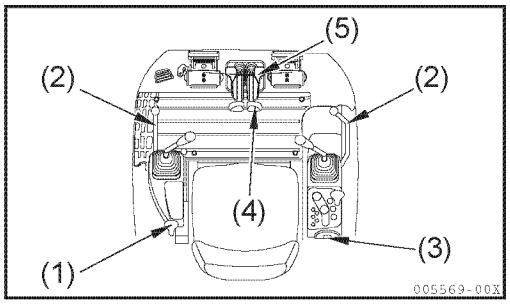




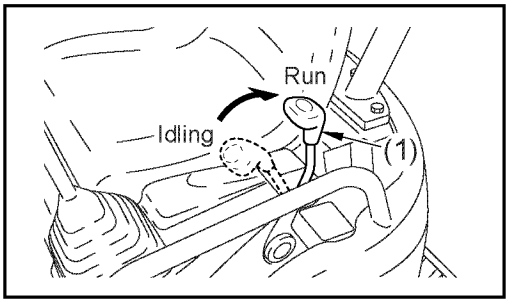
13-4-2. Traveling in reverse

⚠ WARNING

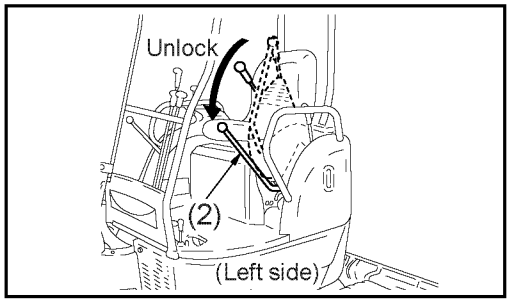
- **Always check the position of the blade before operating the travel levers and pedals.**
  When the blade is in the rear, the travel levers and pedals operate in the reverse of the normal operation.
- **A signal person should be in attendance to give signals at sites which are dangerous or not clearly in view of the operator.**
- **Clear all people from the working area.**
- **Sound the horn before beginning travel, to alert the people near the machine.**
- **Clear obstacles from the path of the machine.**
- **There is a blind spot behind the machine. Make sure that no people are in the blind spot before traveling backwards.**
- **Do not operate the travel levers and pedals rapidly while the engine is running at high speed. Otherwise, the machine may move unexpectedly, causing a serious accident.**



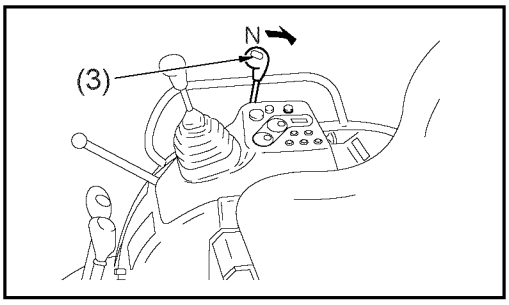
1) Pull the accelerator lever (1) back to the "RUN" position to increase the engine speed.



2) Unlock the lock levers (2), and retract the implement to raise it 16 to 20 in. (40 to 50 cm) above the ground.

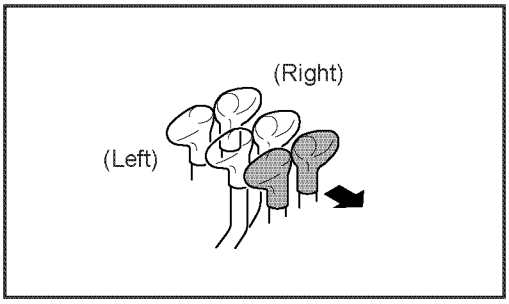


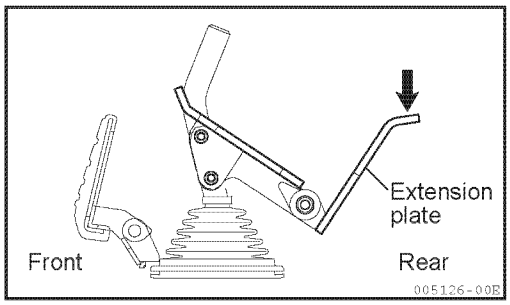
3) Pull back the blade lever (3) to raise the blade.



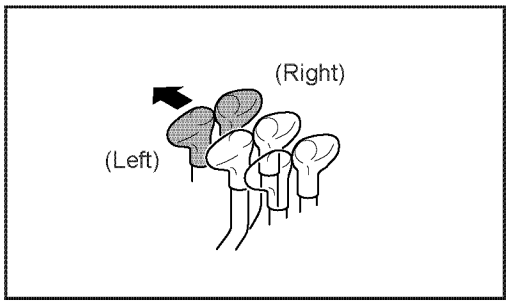
4) Operate the left and right travel levers (4) or pedals (5) as follows:

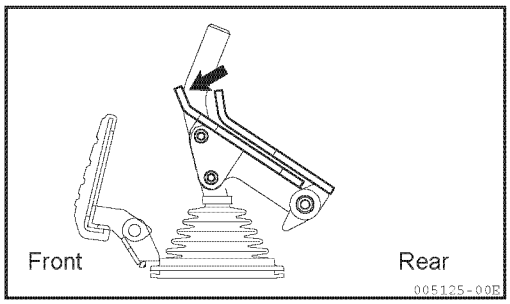
• When the blade is in the front of the machine;
Slowly pull the travel levers (4) back or unfold the extension plate to step on it in order to move the machine backward.





• When the blade is in the rear of the machine;
Slowly push the travel levers (4) forward or step on the front of the pedals (5) to move the machine backward.





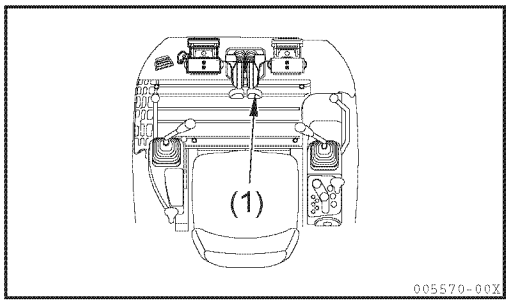
13-5. Steering

13-5-1. Steering (turning the machine)

⚠ WARNING

Always check the position of the blade before operating the travel levers.
When the blade is in the rear, the travel levers operate in the reverse of the normal operation.
Do not use the travel pedals to steer the machine, or the machine may not be controlled expectedly, causing a serious accident.

To steer the machine, operate the travel levers only.
Do not turn the machine too sharply. Before spin-turning, always stop the machine first.
Operate the two travel levers (1) as follows:

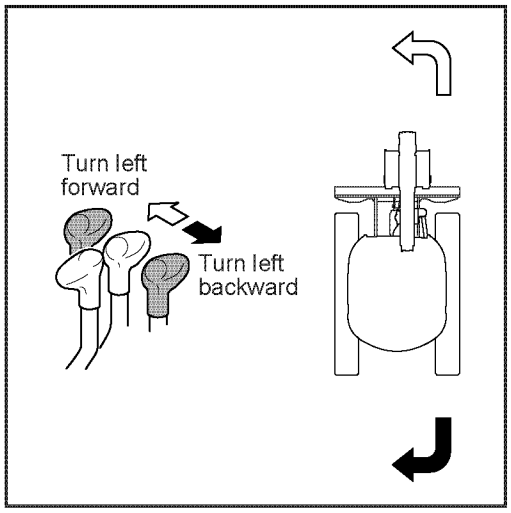


■ **Steering the machine when it is not traveling**

To turn left, push the right travel lever forward and start traveling forward to the left. Pull the right travel lever back and start traveling in reverse to the left.

Note :

To turn right, operate the left travel lever in the same manner as above.

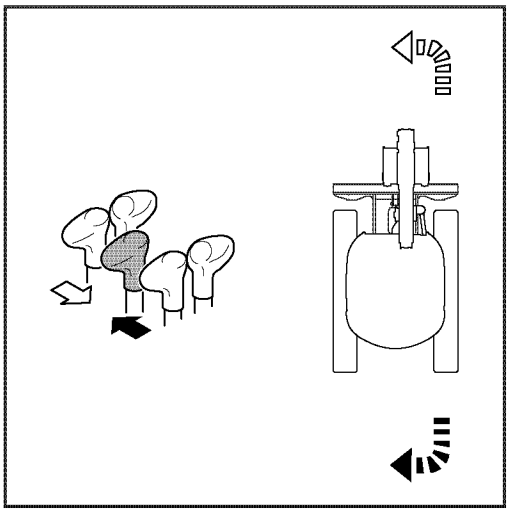


■ **Steering the machine while traveling (the left and right travel levers are both tilted in the same direction)**

To turn left, return the left travel lever to the neutral position.

Note :

To turn right, return the right travel lever to the neutral position.

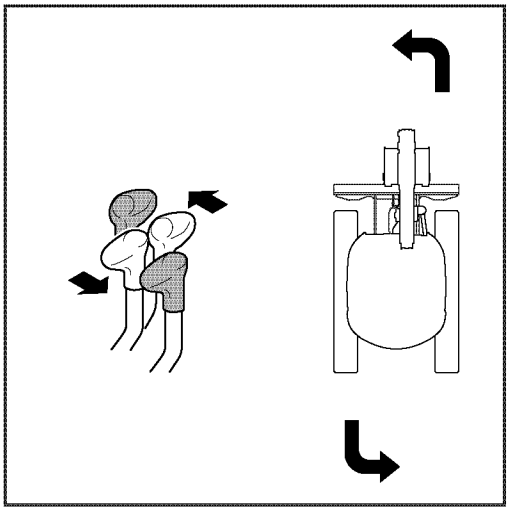


■ **Spin-turning the machine when it is not traveling**

To spin-turn left, push the right travel lever forward while pulling the left travel lever back.

Note :

To spin-turn right, push the left travel lever forward while pulling the right travel lever back.



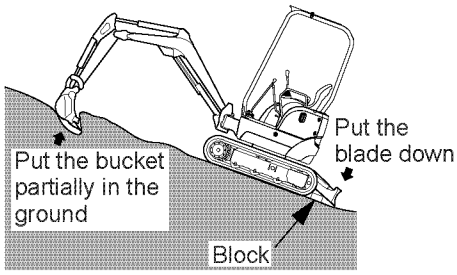
13-6. Stopping the machine

⚠ CAUTION

Do not stop the machine suddenly but provide a safety margin.

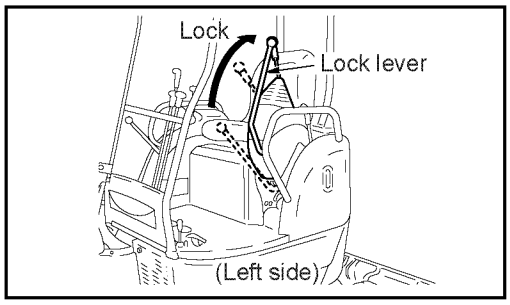
⚠ WARNING

- **Park on solid, level ground.**
- **Do not park on a slope. If it is unavoidable to park on a slope, place solid blocks of wood behind the crawlers, place the blade on the ground, and dig the bucket into the ground.**

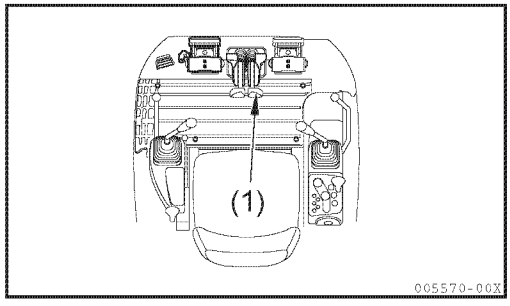


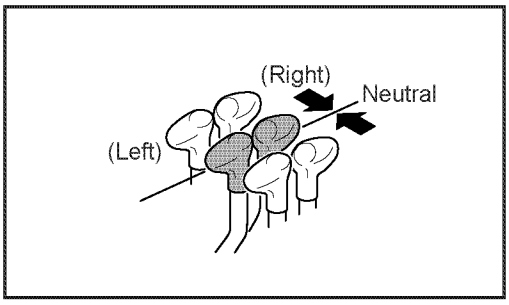
⚠ WARNING

- **Do not touch the control levers and pedals accidentally. Otherwise, the implement or the machine may move unexpectedly, causing serious bodily injury.**
- **Whenever leaving the operator's seat, be sure to place the lock levers securely in the lock position and remove the starter switch key.**



1) Set the right and left travel levers (1) to the neutral position to stop the machine.



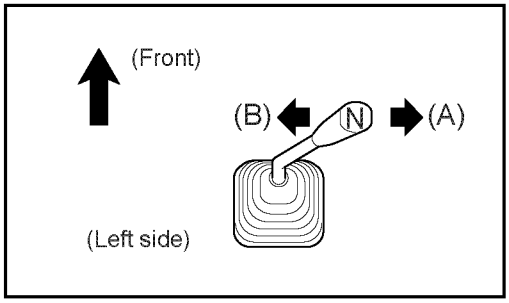


13-7. Swinging the upperstructure

⚠ WARNING

Before swinging, make sure that there are no people or obstacles within the swing range of the implement or the machine tail.

1) To swing the upperstructure, operate the left control lever as illustrated in the figure at the right.
   (A) : Swing right
   (B) : Swing left



13-8. Operating the implement

⚠ WARNING

- **Check the area around the machine for safety and sound the horn before beginning to operate the machine.**
- **The setting of the pattern change lever alters control lever operation. Always chose the pattern (STD VS. OPT) that you prefer to use.**
- **To prevent accidental injury, never operate the Excavator before confirming the setting of the pattern change lever.**
- **Never operate or load excavator bucket with track gauge narrowed to prevent bodily injury.**

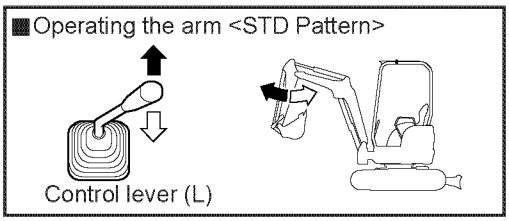
Operate the machine using the right and left control levers, the boom swing pedal and the blade lever.

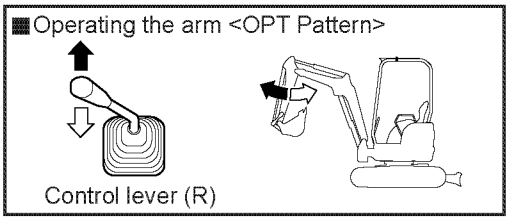
<STD Pattern>
- Control lever (L) : Operates arm and upperstructure swing.
- Control lever (R) : Operates boom and bucket.

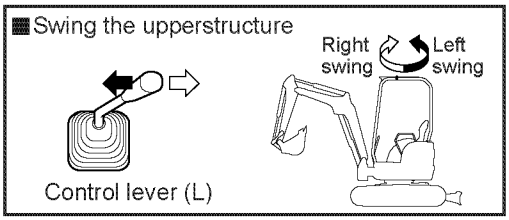
<OPT Pattern>
- Control lever (L) : Operates boom and upperstructure swing.
- Control lever (R) : Operates arm and bucket.

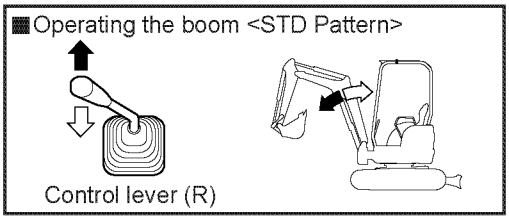
- Boom swing pedal : Operates boom swing.
- Blade lever : Operates blade.

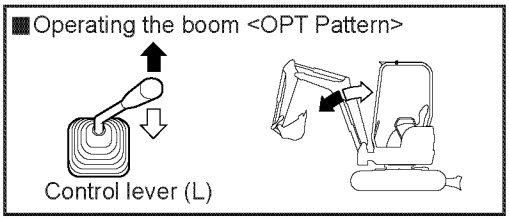
The relationships between the operation of the control levers, the boom swing pedal and the movement of the implement are shown in the illustrations at the right.
On releasing the control levers and the boom swing pedal, they will return to their neutral positions and the implement will stop moving.

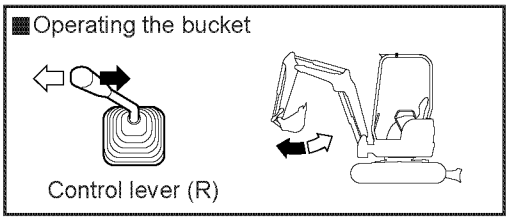


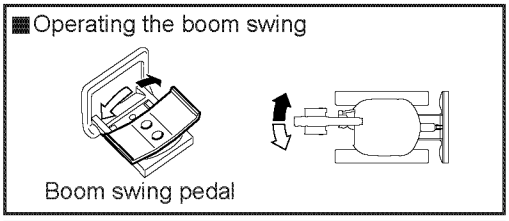


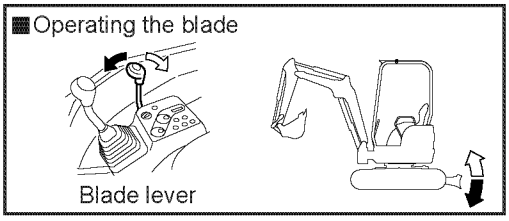












13-9. Operating the track gauge change

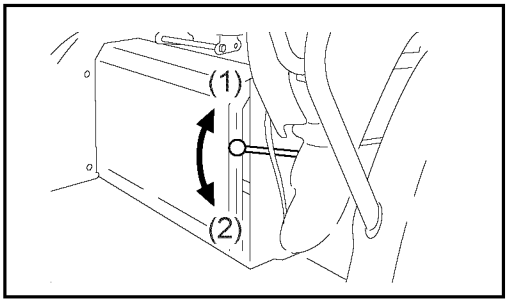
⚠ WARNING

- **Be sure to operate the track gauge change control lever at middle engine speed to avoid hazard.**
- **When operating the track gauge change, the crawlers move widthwise. Be sure to operate it from the operator's seat only to prevent your body from being caught between the crawler and the upperstructure or between the crawler and nearby obstacles.**
- **Never operate the track gauge change control lever when the machine is in motion.**

Do not operate the track gauge change control lever while the machine is traveling.

IMPORTANT

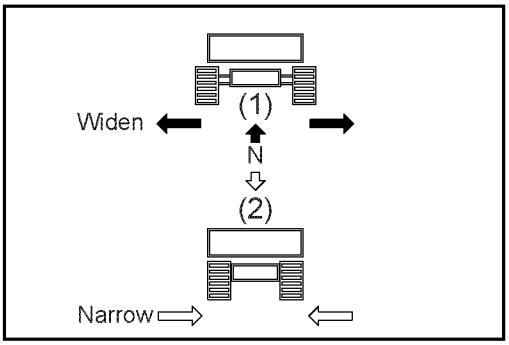
- **Mud or readymixed concrete adhering to the track gauge change system may cause the system an abnormal operation.**
  - **While working, operate the track gauge change system periodically to make it discharge mud or readymixed concrete.**
  - **After working, be sure to operate the track gauge change system to make it discharge mud or readymixed concrete.**
- **If mud adheres to the moving parts for changing the track gauge, widen and narrow the variable track gauge type crawlers to remove it. (Remove mud before it gets hard.)**
- **In cold whether, to prevent the moving parts for changing the track gauge from getting stuck due to frozen mud or water deposits on it, carefully remove them after working.**



13-9-1. Changing the track gauge

1) Park the machine on level ground.
2) Operate the track gauge change control lever until the crawlers stop moving.

(1) Pull the lever up to widen the track gauge.
(2) Push the lever down to narrow the track gauge.

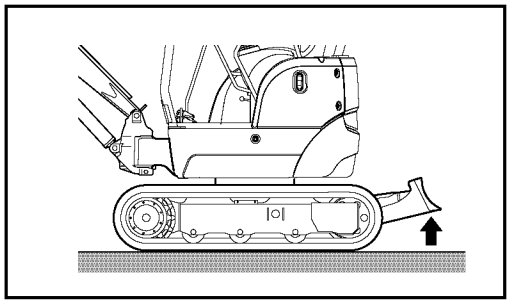


Notes:

- *To set the track gauge back to what it was, follow the above procedure.*
- *Normally operate the machine with the track gauge widened to keep it more stable.*

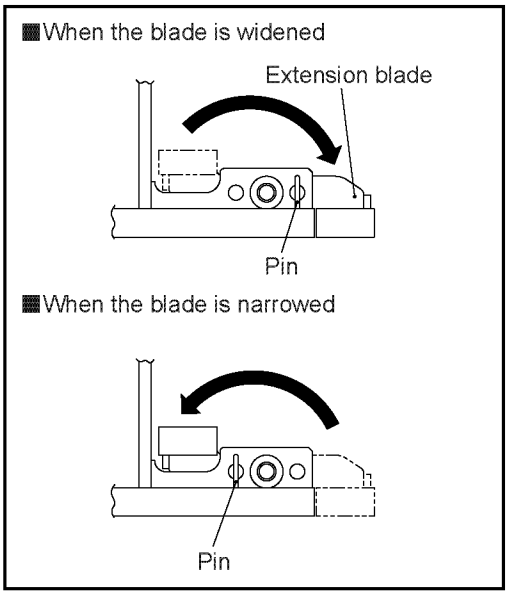
13-9-2. Changing the blade width

The blade width can be adjusted to 37.4 in. or 47.2 in. (950mm or 1200mm) by changing the positions of the pins.



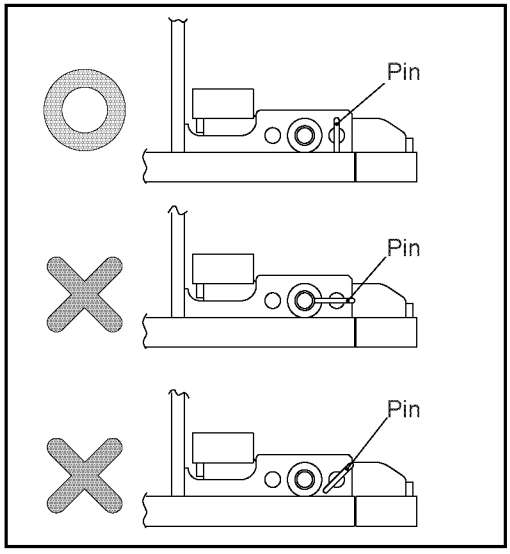
1) Raise the blade to its stroke end.

2) Change the positions of the pins as illustrated in the figure at the right and hold the extension blades to change the blade width.



IMPORTANT

Installing the pin improperly may cause the pin to fall off during work.



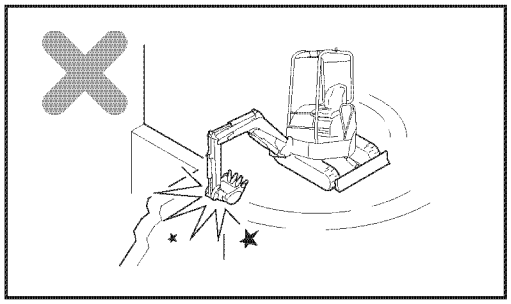
13-10. Precautions for operating the implement

⚠ WARNING

- **Do not operate the control levers while traveling. Stop traveling first and then operate the implement.**
- **Do not operate the implement on any rocky surface.**

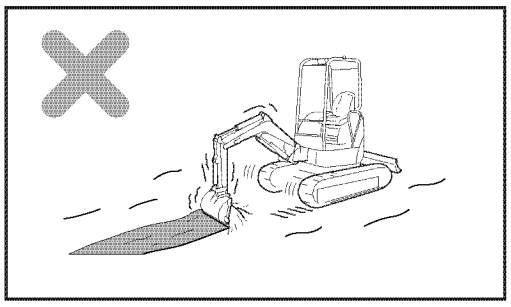
■ Do not use the implement's swing force

Do not level the ground or break down a wall by the use of swing force, and do not dig the bucket teeth into the ground while swinging. Doing these may cause the implement to be damaged.



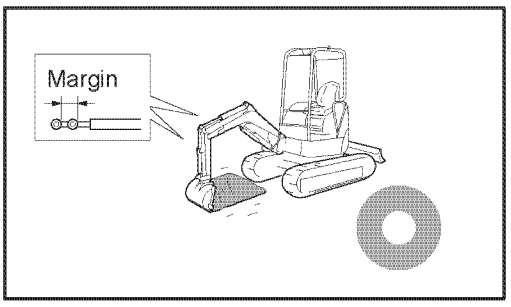
■ Do not use the implement's travel force

Do not excavate the ground by the use of travel force with the bucket teeth in contact with the ground. Doing this may cause excessive force to be imposed on the rear of the machine, shortening the machine life.



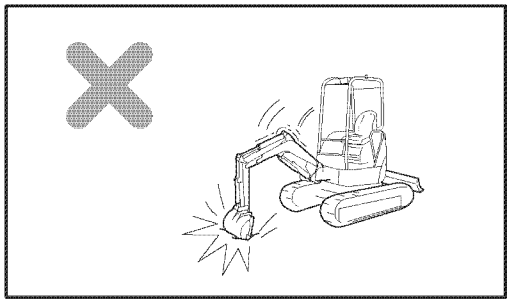
■ Take care not to operate the hydraulic cylinder to the stroke end

Operating the hydraulic cylinder to the stroke end may impose an undue force on the stopper in the hydraulic cylinder, shortening the implement life. Operate with a small safety margin.



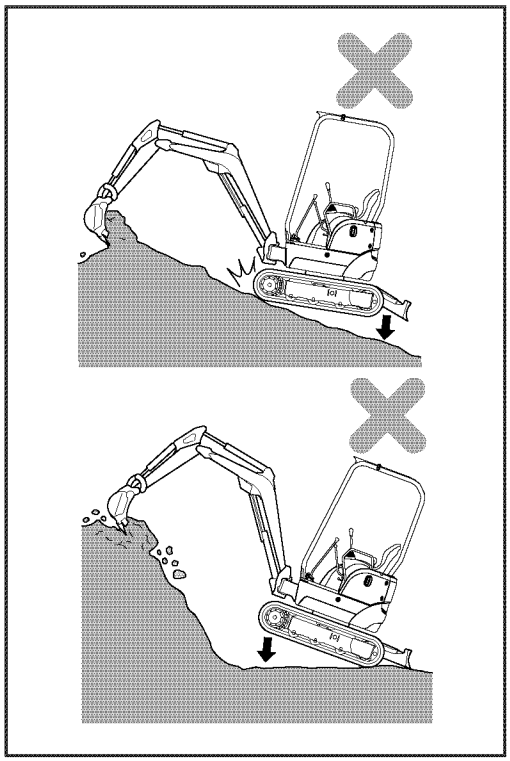
■ Do not operate the implement by the using the dropping force of the bucket

Do not excavate the ground by using the dropping force of the bucket as a pickaxe or pile driver. Doing this may cause excessive force to be imposed on the rear of the machine, shortening the machine life and possibly causing a serious accident.



■ **Do not operate the implement by using the dropping force of the machine**

Do not excavate the ground by using the dropping force of the machine.

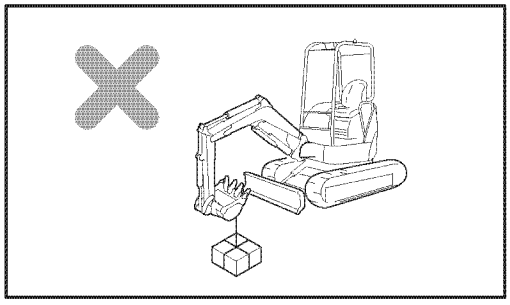


■ **Excavating a hard rock**

It is recommended that a hard rock first be broken into small pieces by other means. Doing so will prevent damage to the machine and will increase economy.

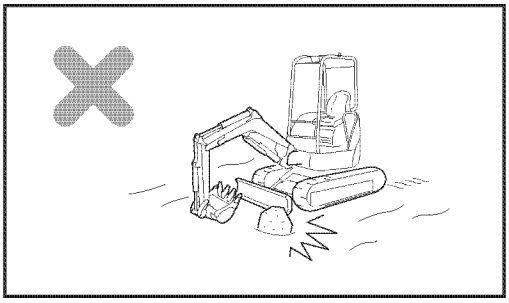
■ **Do not suspend a load unless you use a hooked bucket**

Suspending a load safely requires the use of a hooked bucket. Refer to Section "28. Handling the Hooked Bucket".



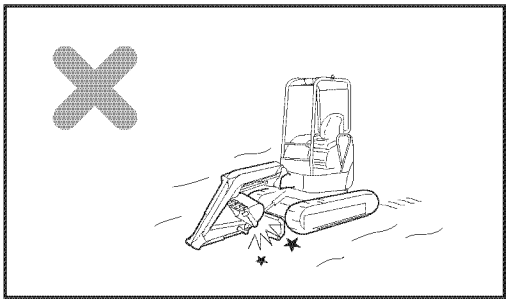
■ **Do not bump the blade against a large rock or boulder**

Never bump the blade against a large rock or boulder. Doing so may cause the blade or the hydraulic cylinder to be damaged.



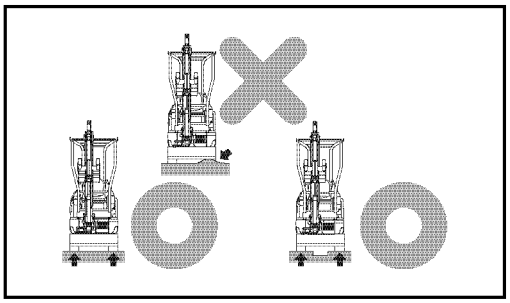
■ **Be careful when retracting the implement**

When retracting the implement for travel or transport, be careful that the bucket and the blade never bump against each other.



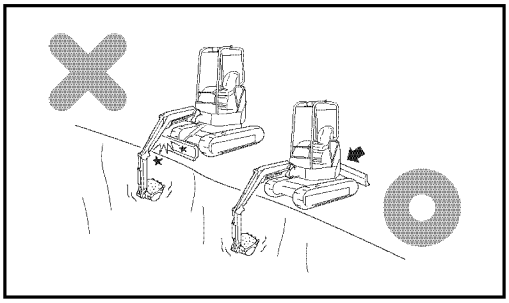
■ **Support the blade on both sides**

When you use the blade as an outrigger, support the blade on both sides.



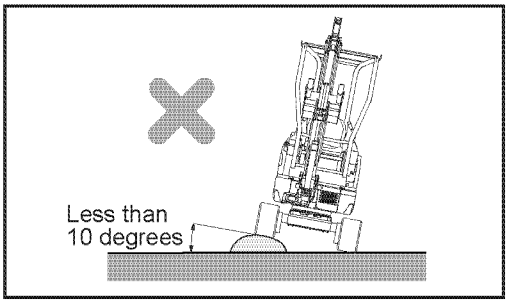
■ **Be careful not to bump the blade when excavating**

When excavating the ground with the blade in front, never let the blade bump against the boom cylinder.
Place the blade in the rear, when it is not being used.



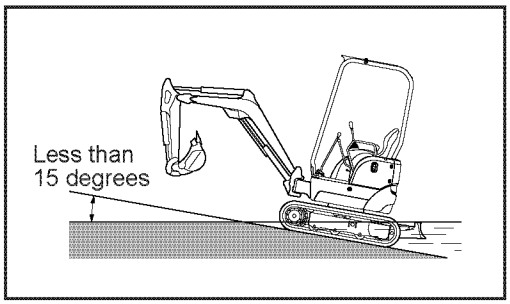
13-11. Precautions for working

■ Precautions for traveling



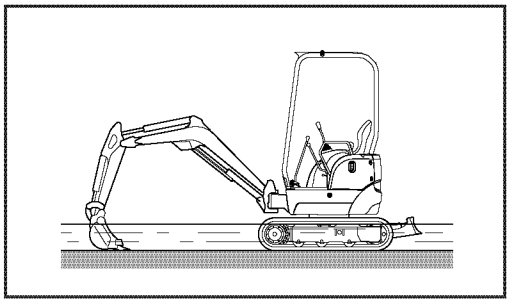
Driving over a stone or a stump subjects the machine (especially undercarriage) to a shock, which may cause damage to the machine.
Avoid such obstacles by driving around them, or removing them.
If driving over them is unavoidable, reduce speed, hold the implement close to the ground, and drive over the obstacles with the center of the track shoes.

■ Allowable water depth



IMPORTANT

When driving out of water, if the machine climbs a slope at an angle of more than 15 degrees, the rear of the upperstructure may submerge too deeply in the water, which may damage the radiator fan. Avoid this if possible when driving out of water.

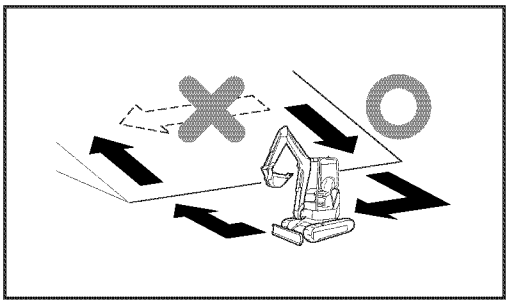


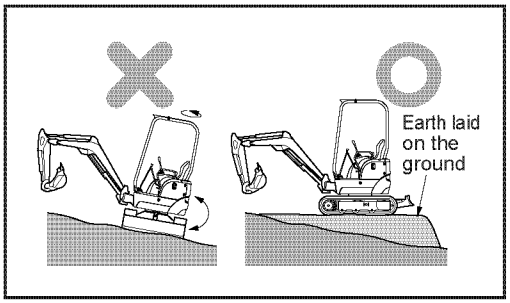
The maximum water depth in which the machine can be used is up to the center of the shoe slide plate.
Apply a generous amount of grease to the moving parts that have been submerged in the water for a long time until the used grease is extruded out of the bearings.
Wipe away the extruded used grease.

13-12. Precautions for going up and down a slope

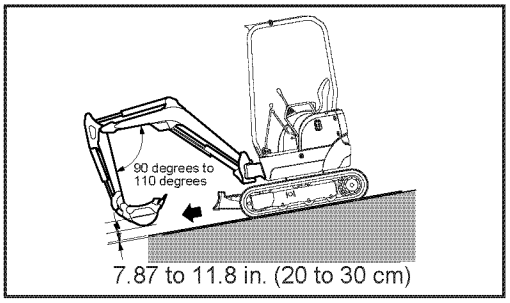
⚠ WARNING

- **When traveling on a slope, place the implement in the direction of travel and raise the bucket 8 to 12 in. (20 to 30 cm) above the ground.**
- **When driving over obstacles such as foot paths, hold the implement close to the ground and drive the machine slowly.**
- **Never turn on or traverse a slope.**
  Descend to flat ground to make a course change.
- **If the machine is starting to slip or you feel that the machine is unstable, place the bucket on the ground and stop the machine at once.**
- **Recognize that the machine may roll over when swinging the upperstructure or operating the implement on a slope.**
  Do not swing the upperstructure toward the downward side of the slope with a load in the bucket.
  If swinging is unavoidable, first lay earth on the slope to maintain the machine as horizontal as possible, then swing the upperstructure.
- **Do not travel on a slope of 20 degrees or more, as the machine may upset.**

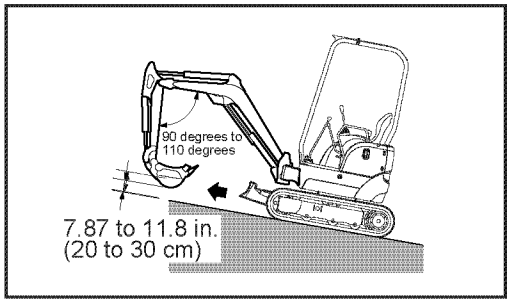




1) Go down slopes at low speed, using the travel levers and accelerator lever to control your speed.
   When going down a slope, drive the machine at low engine speed and position the implement as shown in the figure at the right.
   Also drive the machine with the track gauge widened by operating the track gauge change control lever to keep the machine more stable.



2) When going up a slope, drive the machine with the implement positioned as shown in the figure at the right.
   Also drive the machine with the track gauge widened by operating the track gauge change control lever to keep the machine more stable.



■ Braking when going down a slope

When going down a slope, you can automatically brake the machine by setting the travel levers to the neutral position.

■ When the crawler is slipping

If you cannot go up a slope by operating the travel levers because the crawler is slipping, retract the arm and use the pull-back power of the implement to help you go up the slope.

■ When the engine stops

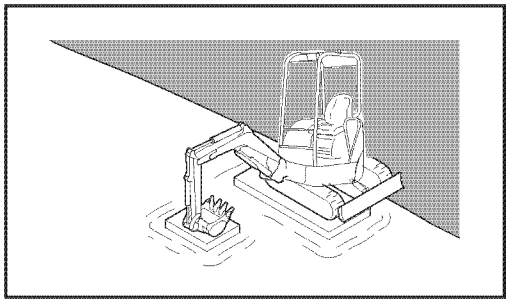
If the engine stops while going up a slope, set the travel levers to the neutral position, stop the machine, and restart the engine.

13-13. Escaping from the mud

Carefully operate the machine not to allow it to get mired in mud. If the machine is mired in mud, the machine can escape as follows:

13-13-1. If only one track is mired in the mud

If only one track is mired in the mud, place the bucket on the muddy side, lift the track above the ground, lay a log or a wood block under the track shoe, and raise the bucket to escape.



IMPORTANT

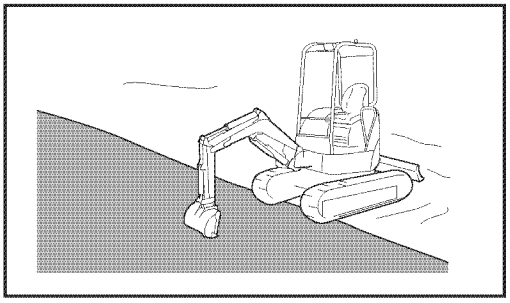
When lifting the machine above the ground with the boom or the arm, press on the ground with the bottom of the bucket. (Do not press on the ground with the bucket teeth.)

In doing this, the angle between the boom and the arm should be 90 degrees to 110 degrees.

The same procedure described above should be utilized when the bucket is in the reverse position.

13-13-2. If both tracks are mired in the mud

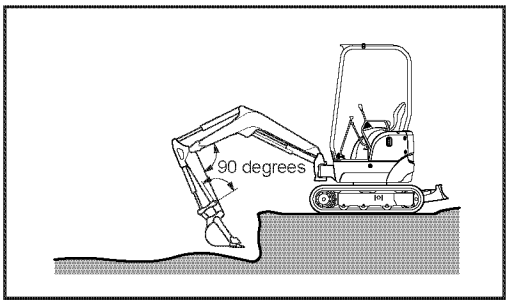
If both tracks are mired in the mud, lay a log or a wood block under the track shoes in the same manner as mentioned above, dig the bucket into the solid ground, retract the arm just as when excavating, and push the travel levers forward to escape from the mud.



13-14. Operations using the bucket

You can greatly widen the range of work described here by using optional attachments.

13-14-1. Backhoe operation

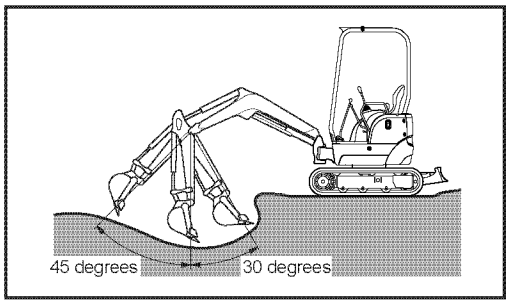


Backhoe operation is suitable for digging the ground below the machine.

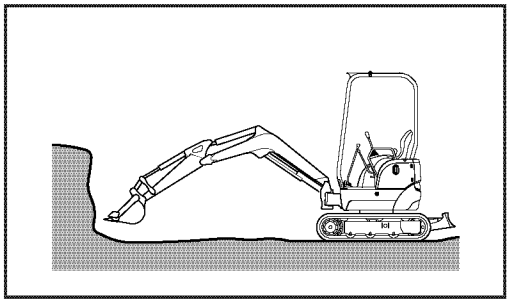
Suppose that the machine is operating as illustrated in the figure at the right : a maximum digging force of each cylinder can be obtained when the angle between the bucket cylinder and the bucket arm as well as between the arm cylinder and the arm is maintained at 90 degrees.

When digging, make good use of this angle to increase the operating efficiency.

To excavate the ground efficiently by manipulating the arm, the arm needs to be operated within a range of angles between 45 degrees forward and 30 degrees backwards, as illustrated in the figure at the right. Though the range differs according to the depth of the work, do not move the implement to the cylinder stroke end.



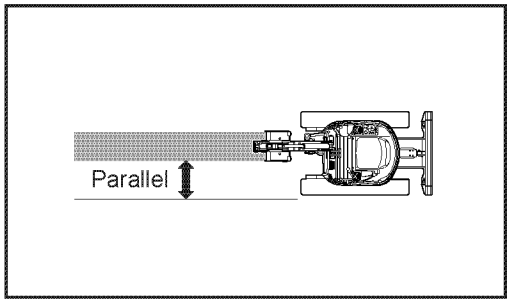
13-14-2. Shoveling



Shoveling is suitable for excavating ground that is higher than the machine bottom.

Install the bucket in the reverse position before operating. For the procedure for installing the bucket in the reverse position, Refer to Section "13-16. Reversing the bucket".

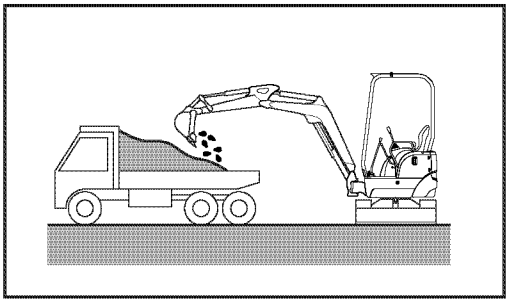
13-14-3. Ditching



To increase work efficiency, install a suitable bucket for ditching and position the tracks in parallel with the ditch to be made.

To make a wide ditch, first dig the two sides, and then dig the center.

13-14-4. Loading



To increase work efficiency, locate the dump truck at a position where the swing angle of the machine will be minimized and the operator can clearly view the dump truck.

Load earth from the rear of the dump truck, because it can be loaded more easily and in larger amounts than from the side.

13-15. Replacing the bucket

⚠ WARNING

- **When driving pins into the bucket with a hammer, metal chips may fly. If metal chips should get into your eyes, they can cause serious injury. Use goggles, a hard hat, and gloves for safety when replacing the bucket.**
- **After removing the bucket, place it on solid ground in a stable position.**
- **When aligning the holes for pin A and pin B, be careful not to insert your fingers into those holes to prevent serious injury to your fingers. Visually check the alignment of the holes.**

Work on level ground with good footing. If two or more persons work together, communicate with signals selected beforehand for safety.

■ Replacement procedure

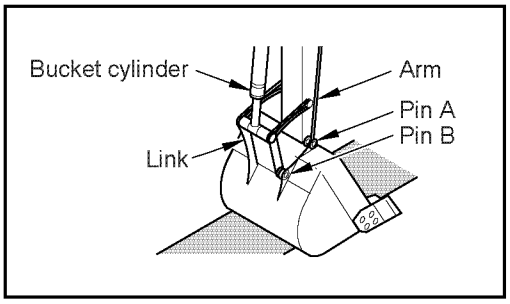
Replace the bucket according to the following procedure:

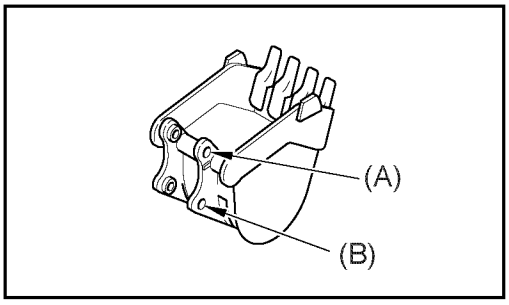
1) Park the machine on level, flat ground, and lower the bucket onto the ground.

2) Stop the engine.

3) Clean around the bucket pin to prevent foreign material from entering the pin holes.

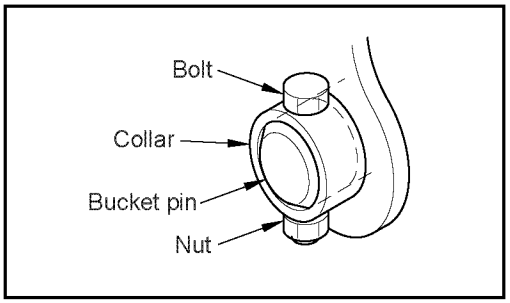
4) Remove pins (A) and (B).





IMPORTANT

- **Keep the pins away from dirt or mud.**
- **The machines have dust seals on either end of the bush. Be careful not to damage them.**



IMPORTANT

- **Check that the O-ring is not damaged. If it is damaged, replace it with a new one.**
- **It is recommend that the O-ring should be replaced when replacing the bucket. (It extends the implement life.)**

5) Connect the arm to (A), and then connect the link to (B).

IMPORTANT

Before mounting the bucket, clean the arm pin hole and grease it.

6) Install the collars and bolts into the bucket pins (A) and (B).

7) Grease the connecting parts.

13-16. Reversing the bucket

⚠ WARNING

- **When driving pins into the bucket with a hammer, metal chips may fly. If metal chips should get into your eyes, they can cause serious injury. Use goggles, a hard hat and gloves for safety when reversing the bucket.**
- **After removing the bucket, place it on solid ground in a stable position.**
- **When aligning the holes for pin A and pin B, be careful not to insert your fingers into the holes to prevent serious injury to your fingers. Visually check the alignment of the holes.**

Work on level ground with good footing. If two or more persons work together, communicate with signals selected beforehand for safety.

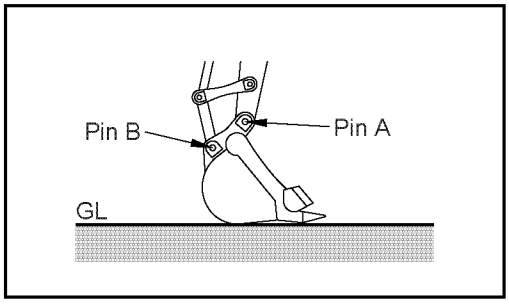
■ Reversing procedure

Reverse the bucket according to the following procedure

1) Park the machine on level, flat ground, and lower the bucket onto the ground.

Note :

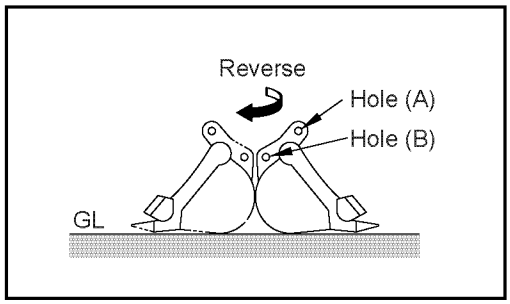
To remove the pins, place the bucket on the ground in such a way that it touches the ground lightly. Lowering the bucket down on the ground by its full weight will increase stresses on the pins and make the pins difficult to remove.

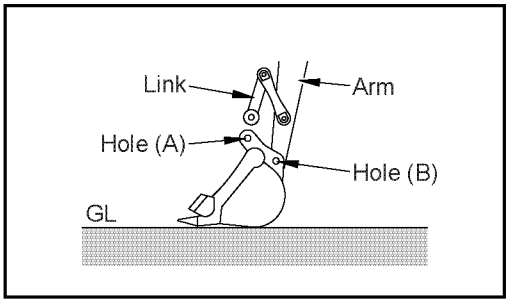


IMPORTANT

Keep the pins away from dirt or mud.

2) Stop the engine.
3) Clean the area around the bucket pins to prevent foreign material from entering the pin holes.
4) Remove pins A and B.
5) Reverse the bucket.
6) Refer to Section "13-15. Replacing the bucket" for installation of the O-ring.
7) Connect the arm to hole (B), and then the link to hole (A). [You can easily align the hole of the link and hole (A) by lifting the bucket slightly.]
8) Install the collars and bolts into the bucket pins A and B.
9) Grease the connecting parts.

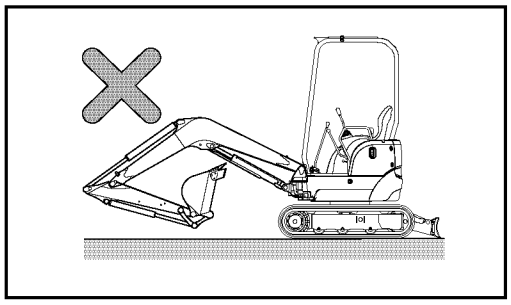




IMPORTANT

When using a reversed bucket, the bucket and the boom cylinder can contact each other when the arm is curled or the boom is lowered beyond the positions indicated in the figure at the right.

Never curl the bucket too much, and never allow it to contact the boom cylinder.



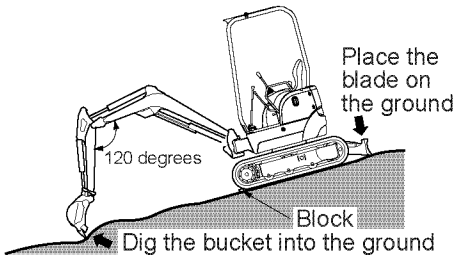
13-17. Parking the machine

⚠ CAUTION

Do not stop the machine suddenly but provide a safety margin.

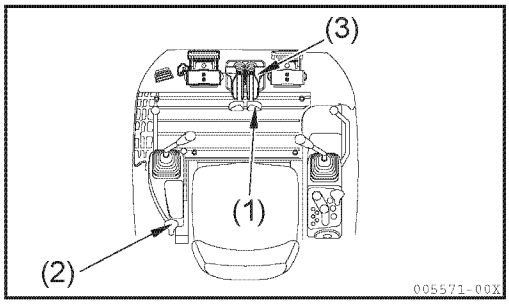
⚠ WARNING

- **Park on solid, level ground.**
- **Do not park on a slope. If it is unavoidable to park on a slope, place solid blocks of wood behind the crawlers, place the blade on the ground, and dig the bucket into the ground.**

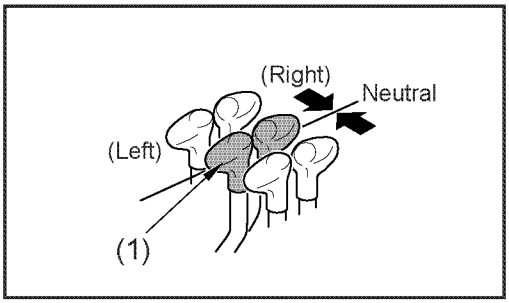


⚠ WARNING

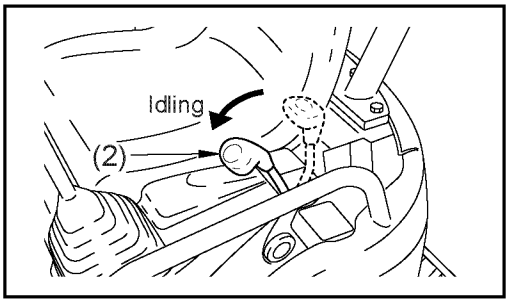
- **Do not touch the control levers and pedals accidentally. Otherwise, the implement or the machine may move unexpectedly, causing a serious accident.**
- **When leaving the operator's seat, be sure to place the lock levers securely in the lock position and remove the starter switch key.**



1) Set the left and right travel levers (1) or pedals (3) to the neutral position to stop the machine.

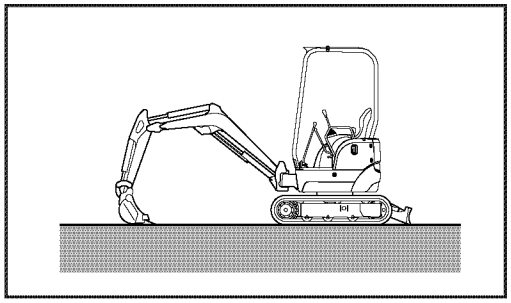


2) Idle the engine with the accelerator lever (2).

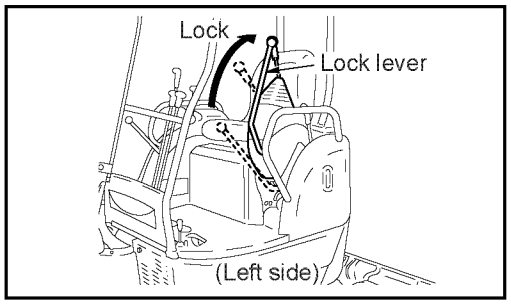


3) Place the bucket on the ground with its bottom surface in contact with the ground.

4) Place the blade on the ground.

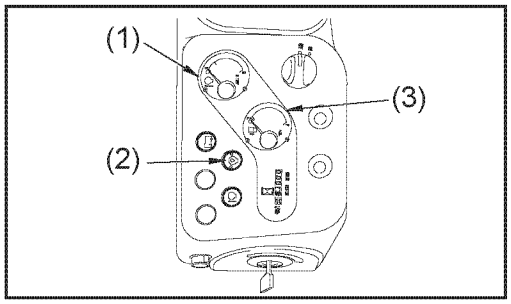


5) Set the lock lever to the "LOCK" position.



13-18. Inspection requirements after completing operation

Check the monitor for the engine cooling water temperature (1), the engine oil pressure (2), and the residual quantity of fuel (3). Take any actions necessary.

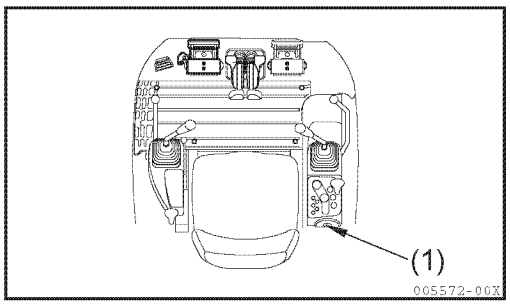


13-19. Stopping the engine

IMPORTANT

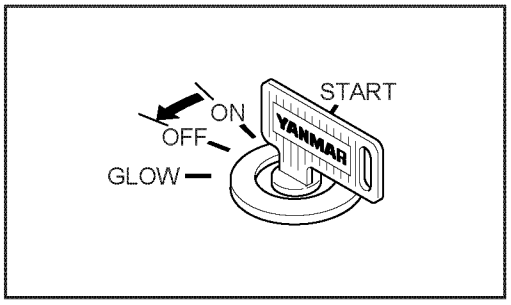
- **Stopping the engine after rotation at high speed may shorten the engine life. Do not stop the engine suddenly except in case of emergency.**
- **If the engine is overheated, do not stop the engine immediately. Gradually lower the engine temperature by rotating the engine at medium rotational speed before stopping the engine.**

1) Idle the engine for approximately five minutes with no load.
   (The engine temperature gradually lowers.)



2) To stop the engine, turn the starter switch key (1) to the "OFF" position.

3) Take the starter switch key out of the starter switch (1).



Note :

The swing motor brake will engage automatically when the engine stops.

13-20. Inspection requirements after stopping the engine

1) Check oil and water for leaks, and visually inspect the implement, the machine, and the undercarriage by walking around them.
   If there are any leaks of oil or water, or any observed abnormality, take corrective action.

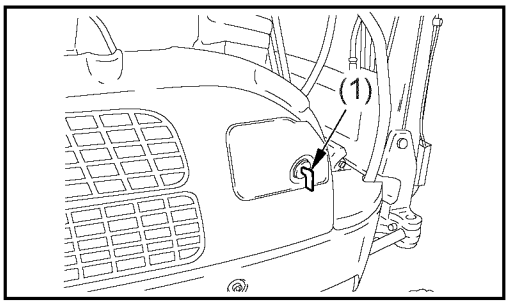
2) Completely fill the fuel tank.

3) Confirm that the engine compartment is free of any foreign matter.
   Combustibles or dust in the engine compartment may cause a fire. Remove them, if any.

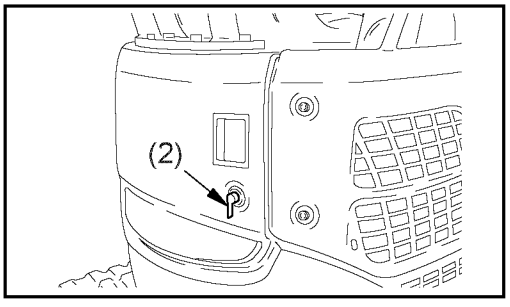
4) Remove mud adhering to the undercarriage of the machine.

13-21. Locking

Make sure that you lock the following :
(1) Cover for fuel supply port
(2) Engine hood



Note :
The starter switch key (1) is used to lock all of the items mentioned above.



13-22. Handling the rubber crawlers

13-22-1. Using the rubber crawlers properly

Rubber crawlers have some advantages over steel crawlers.

However, you cannot take full advantage of them if you use them in the same manner as steel ones. Use care in operating with rubber crawlers in accord with the conditions of the work site and the type of work.

Comparison Table of Rubber and Steel Crawlers

	Rubber	Steel
Low vibration	◇	□
Smooth travel	◇	○
Silent travel	◇	□
Less damage to paved roads	◇	□
Simple handling	◇	□
Susceptibility to damage (strength)	□	◇
Tractive force	◇	◇

◇ : Excellent
○ : Good
□ : Ordinary

Rubber crawlers have many advantages inherent in the unique properties of the material. On the other hand, however, they are low in strength. It is essential that you fully understand the properties of rubber crawlers, and observe the precautions for operating and handling them to prolong their life and get the most out of them. Be sure to read Section "13-22-3. Precautions for using the rubber crawlers" before using them.

13-22-2. Warranty for rubber crawlers

The rubber crawlers are not warranted for free repair or replacement if they are damaged because of misuse by the customer, including the failure to comply with the prohibitions and the instructions for safe operation; (for example, the failure to check the tension of the rubber crawlers or service the rubber crawlers properly, or "using the rubber crawlers on surfaces and terrains which could physically damage them".)

13-22-3. Precautions for using the rubber crawlers

■ Prohibitions

Observe the following prohibitions:

- Do not operate or turn on surfaces or terrains that have sharp stones, a hard, uneven rock base, or that expose the crawlers to steel rods, scrap iron, or edges of iron plates. Failure to observe these prohibitions may damage the rubber crawlers.

- Do not operate the machine on a stony surface like a riverbed. Doing this may damage the rubber crawlers by catching gravel in the crawlers or may cause the crawlers to come off. Forcibly pushing obstacles will also shorten the life of the rubber crawlers.

- Prevent the rubber crawlers from getting exposed to oil, fuel, or chemical solvents. If they are exposed, immediately wipe them. Also, do not travel on roads which have oily surfaces.

- When storing the rubber crawlers for a long time period (more than three months), avoid placing them in a place subject to direct exposure to sunlight or rain.

- Do not operate the machine when the crawlers will be exposed to heat, (i.e., near an open-air fire, on a steel plate that has been exposed to the blazing sun, or on a hot asphalt road.)

- Never run on one rubber crawler track while the other is held above the ground with the implement. Doing this may damage the rubber crawler or cause it to come off.

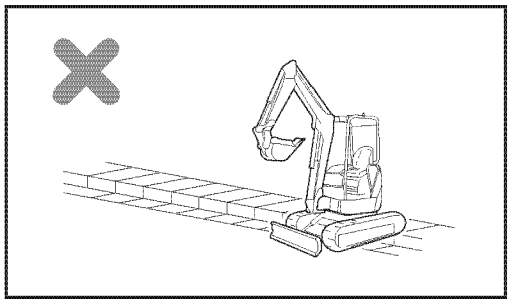
13-22-4. Other precautions for using the rubber crawlers

Observe the following precautions when operating the machine:

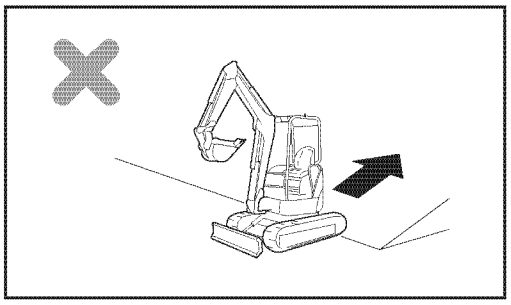
- Never spin-turn on concrete or asphalt roads.
- Do not change course suddenly. Doing this will cause the rubber track to wear early or be damaged.
- Do not turn the machine across a large level gap while traveling. Remember that running over a level gap at a right angle will prevent the crawler from coming off.
- Slowly lower the machine after it has been lifted above the ground with the implement.
- It is not recommended that the machine be used to handle any materials that become oily after being crushed (e.g., soybeans, corn, rapeseed oil seeds, etc.). After unavoidably using the machine to handle such materials, clean the crawlers with water.
- It is not recommended that the machine be used to handle materials such as salt, ammonium sulfate, potassium chloride, potassium sulfate, or superbiphosphate of lime. Handling these materials may affect the core metal adversely. After using the machine to handle such materials, clean the crawlers with water.
- Do not operate the machine at the seashore. Doing this may affect the core metal adversely due to the salt content.
- If a rubber crawler is cracked, it could be easily damaged when exposed to salt, sugar, wheat, or soybeans. Be sure to repair any cracks in the rubber crawler to prevent rubber chips from getting into the materials being handled.
- Do not allow the rubber crawler to rub against a concrete wall.
- The rubber crawlers are prone to slip on snow or on a frozen road. Be careful of skidding when traveling or operating on a slope in cold weather.
- Operating the machine in extremely cold weather will deteriorate the rubber crawlers, shortening their life.
- Use the rubber crawlers between -13°F to +131°F (-25°C to +55°C) because of the physical characteristics of rubber.
- Be careful not to damage the rubber crawlers with the bucket while operating the machine.

- Keep the crawlers in appropriate tension to prevent them from coming off.
  If the tension is too low, the rubber crawlers may come off under the following conditions.
  (Even if the tension is adequate, take care when operating the crawlers under these conditions.)

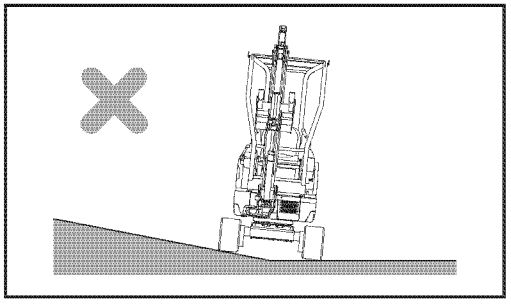
  - Do not steer the machine at an angle other than 90 degrees across a large level gap created by a curbstone or a rock [approximately more than 8 in. (20 cm)]. Run over a level gap at a right angle only to prevent the crawlers from coming off.



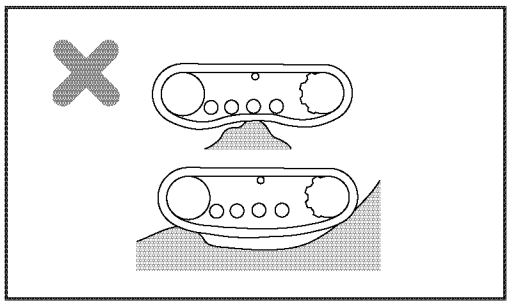
  - Do not steer the machine across a boundary between the flat ground and a slope, while moving backwards. If such travel is not avoidable, slow down the speed.



  - Do not travel with the crawler on one side on a slope or on convex ground (causing a machine angle of more than 10 degrees), and with the crawler on the other side on flat ground, to prevent the rubber crawler from being damaged. Be sure to travel with the crawlers on both sides on the same level surface.

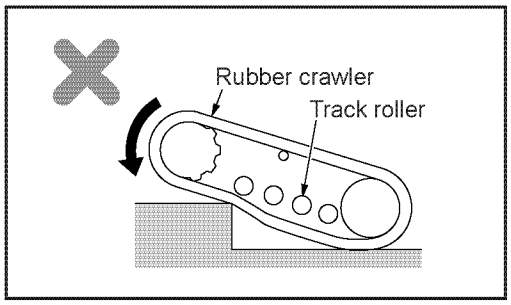


  - The three cases illustrated above are those which could cause the rubber crawlers to loosen. In addition, do not subject the machine to such ground conditions as are illustrated in the figure at the right.

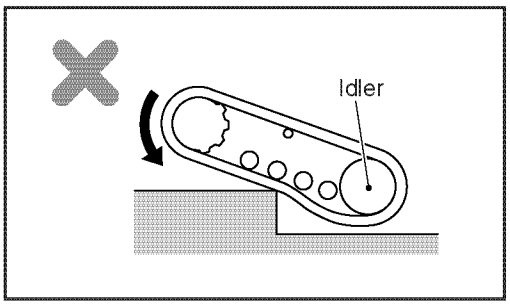


[How the rubber crawlers come off]

1) When running over a level gap, a clearance is created between the crawlers and the track rollers. At this point, the crawlers tend to come off.

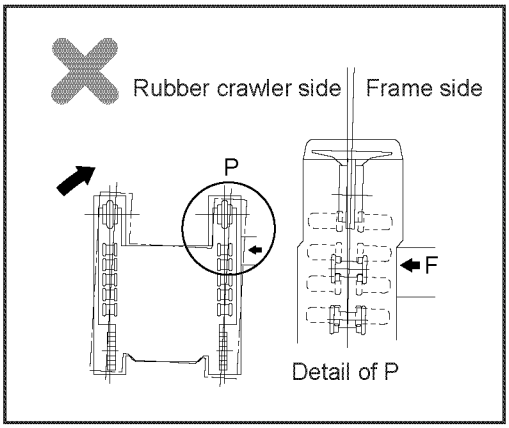


2) If the machine is traveling in reverse, clearance may also be created between the track rollers and the rubber crawlers, and between the idlers and the rubber crawlers, causing the rubber crawlers to come off.



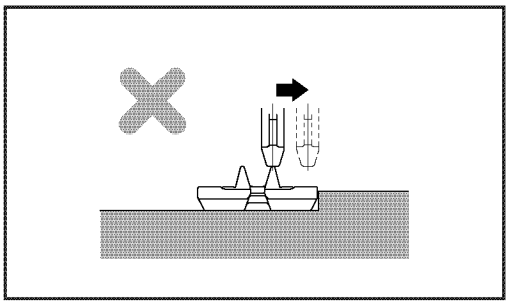
3) Other situations to be avoided.

- When the machine changes the travel direction while the rubber crawlers are blocked sideways by an obstacle or the like.

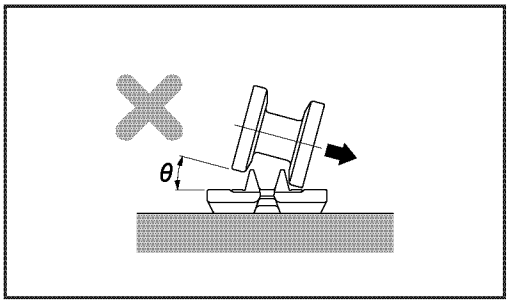


- When the idler and the track rollers are misaligned from the core metal, due to rubber crawler misalignment.

- Traveling in reverse under the condition illustrated will cause the rubber crawlers to come off.



- Changing the travel direction of the machine under the condition illustrated will cause the rubber crawlers to come off.

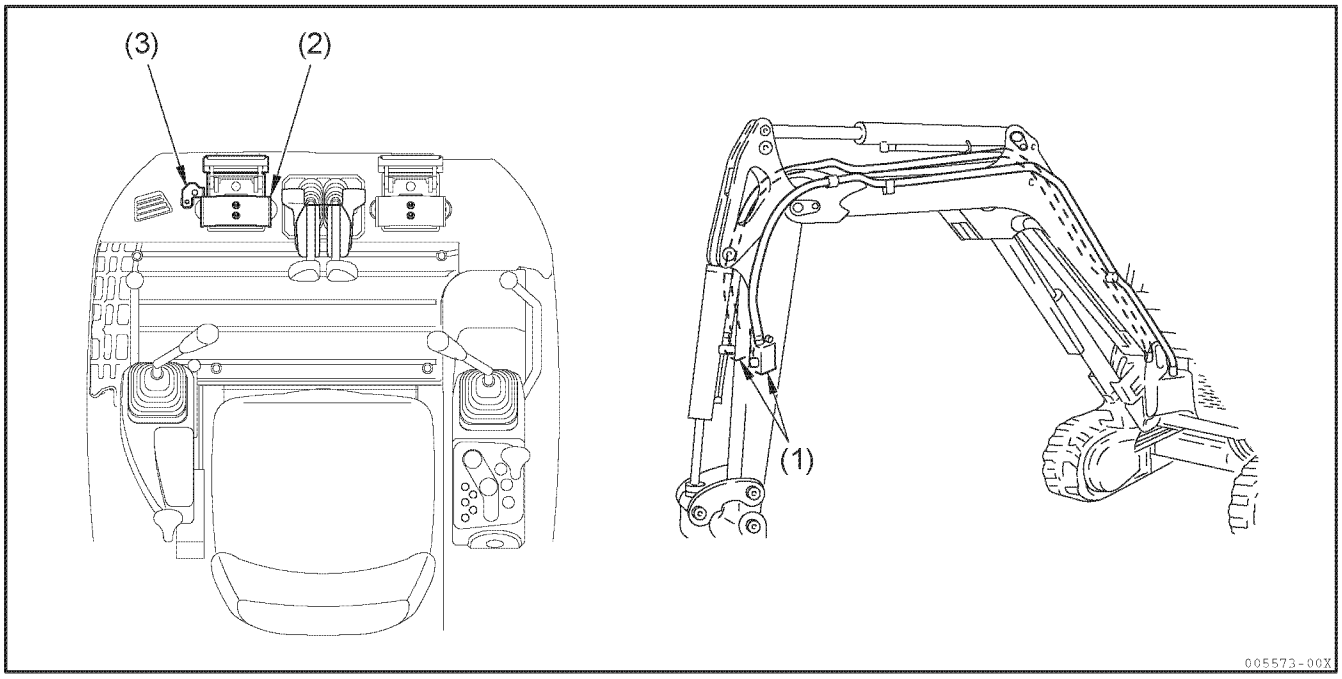


13-22-5. Checking and servicing the machine with rubber crawlers

To check and service the machine with rubber crawlers, refer to and follow Section "24-1. Table of service time intervals".

13-23. Handling hydraulic P.T.O.

13-23-1. Description of stop valve, P.T.O. pedal and pedal lock



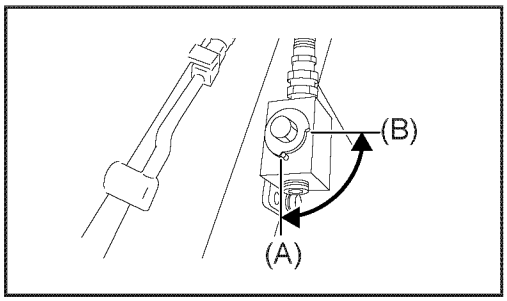
(1) Stop valve

This valve stops the flow of hydraulic oil.

(A) Open : The hydraulic oil flows.

(B) Close: The hydraulic oil stops.

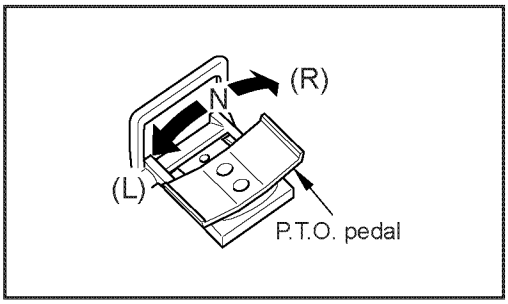
Set this valve at the closed position when removing and installing an attachment.



(2) P.T.O. pedal

Use this pedal to operate the attachment.

- Move the P.T.O. pedal to L side for operating the single acting actuator type of attachments.
  [Examples : Breaker, Hand breaker]



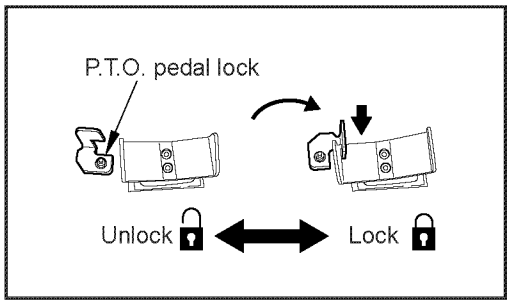
- Move the P.T.O. pedal to L or R side for operating the double acting actuator type of attachments.
  [Examples : Tilt bucket, Clamshell, etc.]

(3) P.T.O. pedal lock (for attachment control pedal)

Use this device to lock the P.T.O. pedal.

• **Hand breaker position**

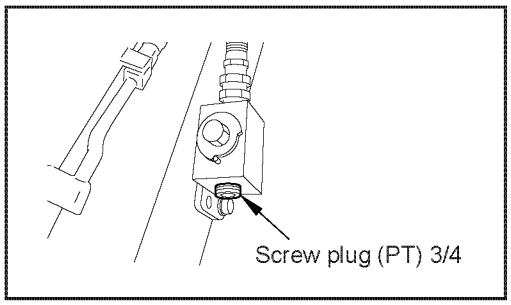
If the P.T.O. pedal lock is moved to the right when the P.T.O. pedal is moved to the left, the P.T.O. pedal will be locked. (Use that lock position when operating the hand breaker).



13-23-2. Hydraulic circuit

1) When mounting any attachment, follow the procedure below to connect the circuit.

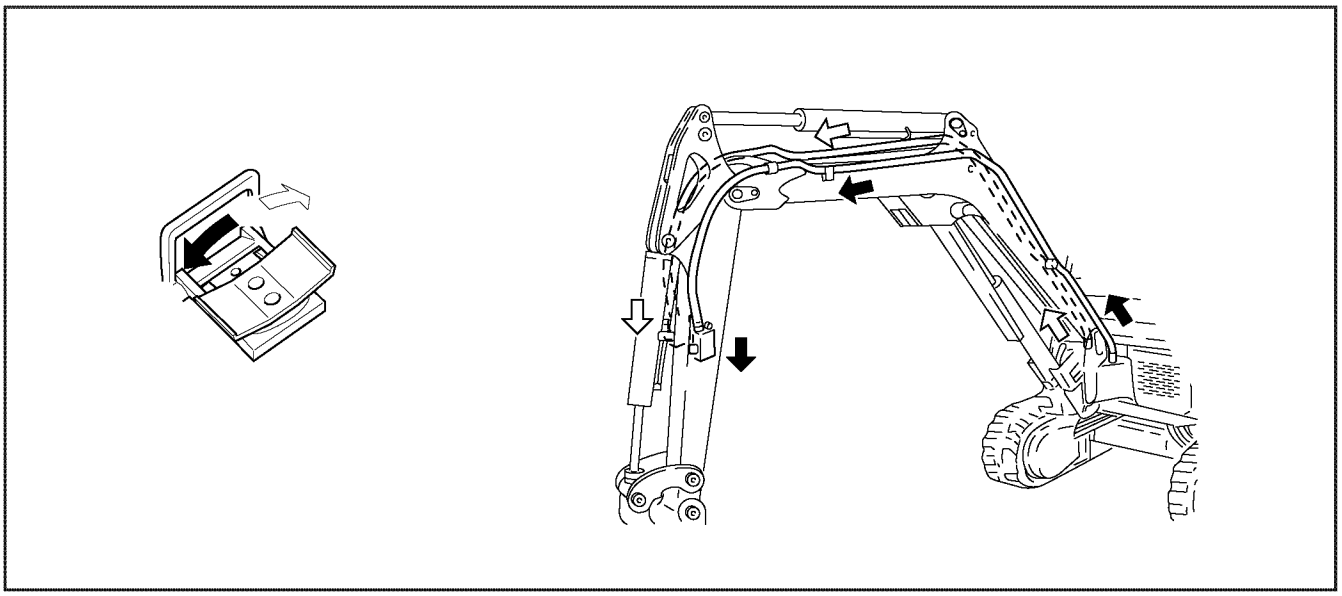
(1) Make sure the stop valves are in the closed position and remove the screw plugs. Take care not to lose or damage the removed parts.



(2) Install the connectors supplied by the manufacturer of the attachment and connect the hoses.

■ Oil flow system

The directions of pedal operation and of the oil flow system are indicated in the figure below.



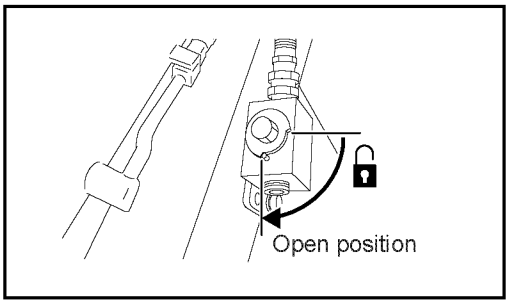
13-23-3. Operating attachment

⚠ WARNING

Before changing a hydraulic piping connection, stop the engine and slowly loosen the connectors to gradually relieve the internal pressure.

To use the oil pressure as the power source for a hydraulic device, connect the piping by using the following procedure after the engine has stopped.

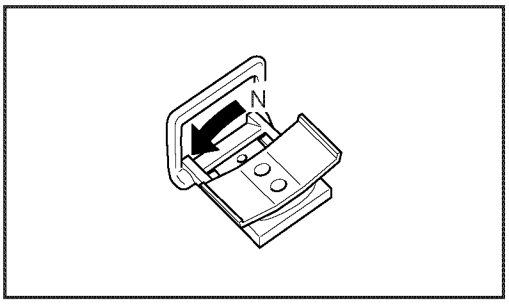
1) Close the stop valve.
2) Remove the screw plugs.
3) Connect the hose for the hydraulic tool.
4) Open the stop valve.



Operate the attachment as follows:

■ **Precautions**

- Make sure the stop valves are in the open position. Refer to Section "13-23-2. Hydraulic circuit" for oil flow system.

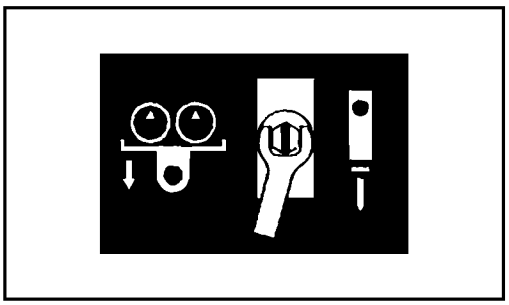


1) When using the breaker.

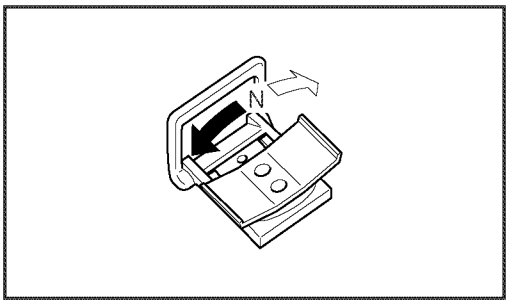
The breaker operates when the P.T.O. pedal is moved to the left.

Refer to Section "13-23-1. Description of stop valve, P.T.O. pedal and pedal lock".

- Always use the breaker in a accordance with the handling instructions in the operation manual provided by the manufacturer of the breaker.



2) When using general attachments such as a tilt bucket :



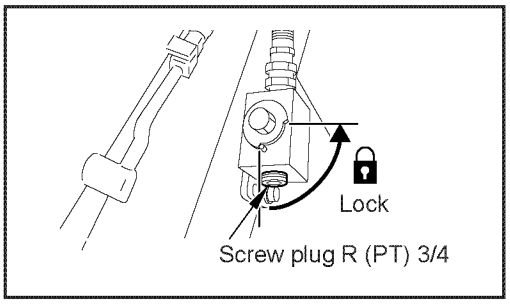
Move the P.T.O. pedal to the right or the left, and the attachment will operate.

Refer to Section "13-23-1. Description of stop valve, P.T.O. pedal and pedal lock".

- Always use the general attachments in accordance with the handling instructions in the operation manuals provided by the manufacturers of the general attachments.

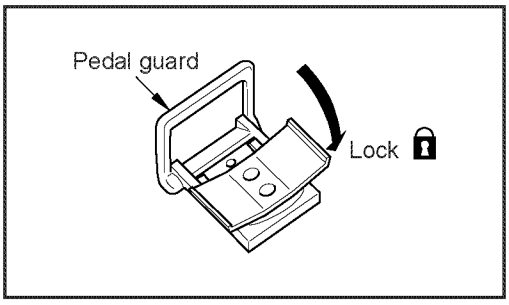
13-23-4. Long-term storage

If a hydraulic tool will not be connected, do the following:



- Close the stop valves.

- Disconnect the hoses for the hydraulic tool. Wrap the screw plugs with seal tape and affix them to the stop valves.



IMPORTANT

Place the pedal guard in the lock position whenever the P.T.O. pedal is not being operated.

Operating the P.T.O. pedal when no attachment is mounted may cause system overheating.

13-23-5. Specification

Hydraulic oil pressure specification

- Oil flow rate : 9.5 GPM (36 L / min)

14. Transportation

14-1. Loading and unloading the machine

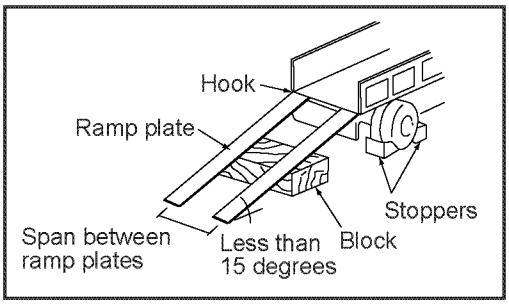
For safety in transporting the machine, comply with all applicable regulations and laws.

⚠ WARNING

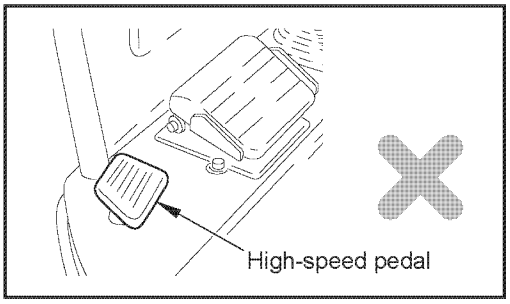
- **Be careful when loading and unloading the machine, because it is a job of high hazard potential.**
- **Load or unload the machine on level, solid ground far away from the shoulder of the road.**
- **Load or unload the machine at a low engine speed.**
- **Load or unload the machine with the track gauge widened to the maximum.**
- **Never operate the track gauge change control lever while loading or unloading the machine.**
- **Use ramp plates of adequate strength having hooks. Check to see that the ramp plates are wide, long, and thick enough to safely sustain the machine so that you can load or unload safely. To prevent the ramp plates from bending too much, support them with blocks.**
- **Securely hook the ramp plates to the deck of the truck so that they will not come off.**
- **Remove mud, grease, and other slippery deposits from the track shoes, and grease, oil, and ice deposits from the ramp plates to prevent the machine from skidding.**
- **Never change the travel direction on the ramp plates. If you need to change the travel direction, go back down the ramp plates, then do this.**
- **Swing slowly when on the truck bed, if it becomes necessary to do so, since the machine's position will be unstable.**

To load or unload the machine, be sure to use the ramp plates and follow the procedures outlined below.

1) Firmly brake the truck and apply wheel stoppers to the tires. Securely install the ramp plates on the bed of the truck in a position where the center of the truck aligns with the center of the machine. Make sure that the left and right ramp plates are at the same level.

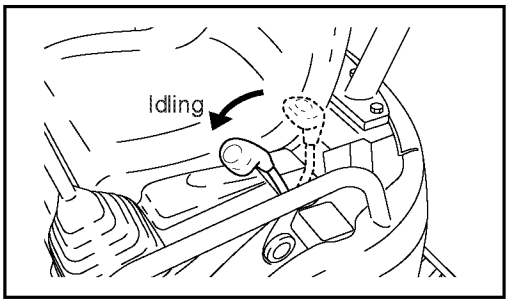


The ramp plates should be set at an angle of less than 15 degrees.
Determine the span between the ramp plates on the basis of the centers of the track shoes.
Do not operate the high-speed pedal.



2) Return the accelerator lever to reduce engine speed.

3) Travel toward the ramp plates at a low speed, and load or unload the machine with the implement lowered as close as possible to the deck of the truck.
Do not operate any levers other than the travel levers while driving on the ramp plates.



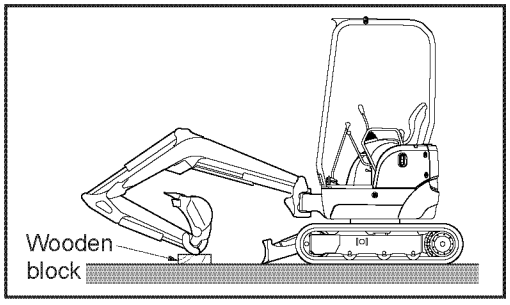
4) Load the machine in a safe position on the truck.

14-2. Precautions for loading the machine

⚠ WARNING

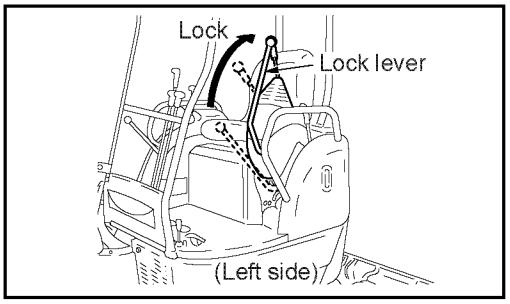
Load or unload the machine on level, solid ground far away from the shoulder of the road.

After loading the machine in a safe position on the truck, secure the machine as follows:



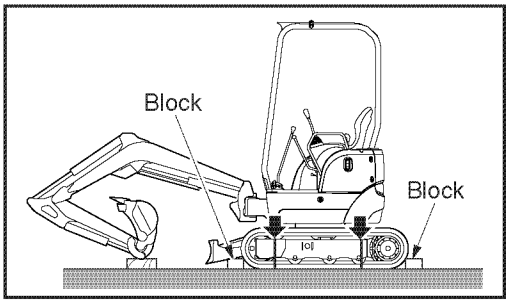
1) Place the blade down on the bed of the truck.

2) Extend the bucket and arm cylinders to the maximum limit, and slowly lower the boom down on a block of wood.



3) Stop the engine to take the starter switch key out of the starter switch.
(The automatic brake locks the swing motor.)

4) Be sure to place the lock levers to the lock position.



5) Provide wooded blocks in the front and back of the crawlers and secure the machine with a chain or a wire rope so that the machine will not move during shipping. In particular, be sure to secure it to prevent sideward motion.

IMPORTANT

To protect the bucket cylinder from being damaged during shipping, place a wooden block under one end of the bucket cylinder to prevent it from directly touching the deck of the truck.

14-3. Precautions for transporting the machine

⚠ WARNING

Select a route for transporting the machine based on the road width and clearance, and the height and weight of the machine.

For safer transportation, comply with all local regulations and laws.

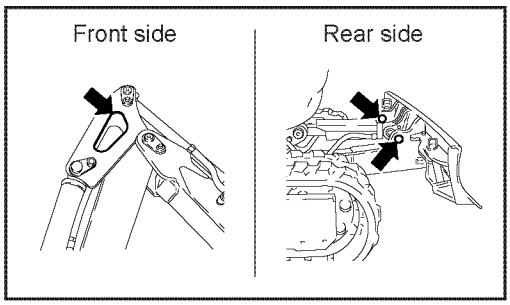
14-4. Suspending the machine

⚠ WARNING

- Never suspend the machine if any person is on the machine or the implement.
- Use wire ropes strong enough for the weight of the machine.
- Do not suspend the machine in any way other than that explained on the following page.
  Failure to suspend the machine as prescribed will throw the machine off balance.
- Do not swing the machine being suspended.
- When suspending the machine, keep the machine in balance taking note of the center of gravity of the machine.
- Never stand near or under the suspended machine.

For safety in suspending the machine, comply with all applicable regulations.

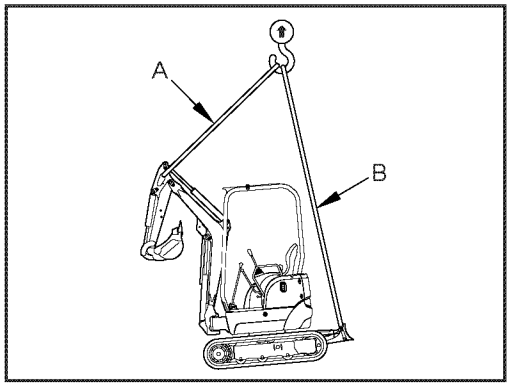
Suspend the machine on level ground as follows:



1) Swing the upperstructure so that the blade is behind the operator's seat.

2) Raise the blade to the highest limit.

3) Extend the hydraulic cylinders of the front implement (except for the boom swing cylinder) to the maximum.

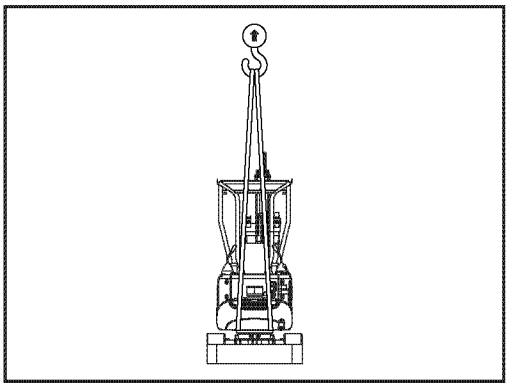


4) Stop the engine, and make sure that nothing is left around the operator's seat before leaving the machine.

5) Put a slingbelt (or a wire rope) through the hole in the arm illustrated in the figure on the right and install shackles in the right and left holes in the side plate of the blade on the rear side, then securely fasten the slingbelt to the shackles.

Note:

The length of sling belt (or wire rope) is as follows :



		A	B
Length	in. (m)	78.7 (2.0)	137.8 (3.5)
Number of sling	belts / machine	1	2

6) Suspend the machine above the ground, wait until the machine is stable and then suspend it slowly.

IMPORTANT

Set each lock lever at the lock position.

Shipping weight:

lbs. (kg)

Machine with rubber crawler
3307.5 (1500)