# Safe Operation & Maintenance Manual

## FOREWORD

This manual describes procedures for operation, handling, lubrication, maintenance, checking, and adjustment. It will help an operator or anyone to make the machine realizing a good performance through effective, economical and safe operation and maintenance.

- Please read this manual carefully **BEFORE** operating the machine.
- Please continue studying this manual until proper operation is completely reinforced into personal habit.
- This manual describes the basic techniques. Skill is performed as the operator or anyone get the correct knowledge and performance of the machine.
- Operation, inspection and maintenance should be carefully carried out, and the safety must be given the first priority. Safety precautions are indicated with "⚠" marks and technical precautions with "★" marks in this manual. The safety information contained in this manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
- Some photographs and illustration pictures are different from your machine as technical improvement is continuously reflected on it. Revision to up-to-date manual's content is performed in later editions.
- This operation and maintenance manual may contain attachment and optional equipment that are not available in your area. Please contact us for those items you may require.
- About engine and transmission instructions in this manual, if thy are different from the "ENGINE OPERATION INSTRUCTION" and the "TRANSMISSION OPERATION INSTRUCTION" provided for your machine, the latest operation instructions should be taken as the standard.
- Materials and specifications are subject to change without notice.

## BREAKING IN YOUR NEW MACHINE

Each machine is carefully adjusted and tested before shipment. However, a new machine requires careful operation during the first 100 hours to break in the various parts.

If a machine is subjected to unreasonably hard use at the initial operation stage, the potential of performance will prematurely deteriorate and the service life will be reduced. A new machine must be operated with care, particularly with regard to the following items:

- After starting, let the engine idle for 5 minutes to allow proper engine warm-up prior to actual operation.
- Avoid operation with heavy loads or at high speeds.
- Sudden starting or acceleration, unnecessarily abrupt braking and sharp turning should be avoided.
- If the machine is delivered without any cooling water in the radiator, flush the cooling system with ample clean water to clean the system, then fill the radiator with cooling water.

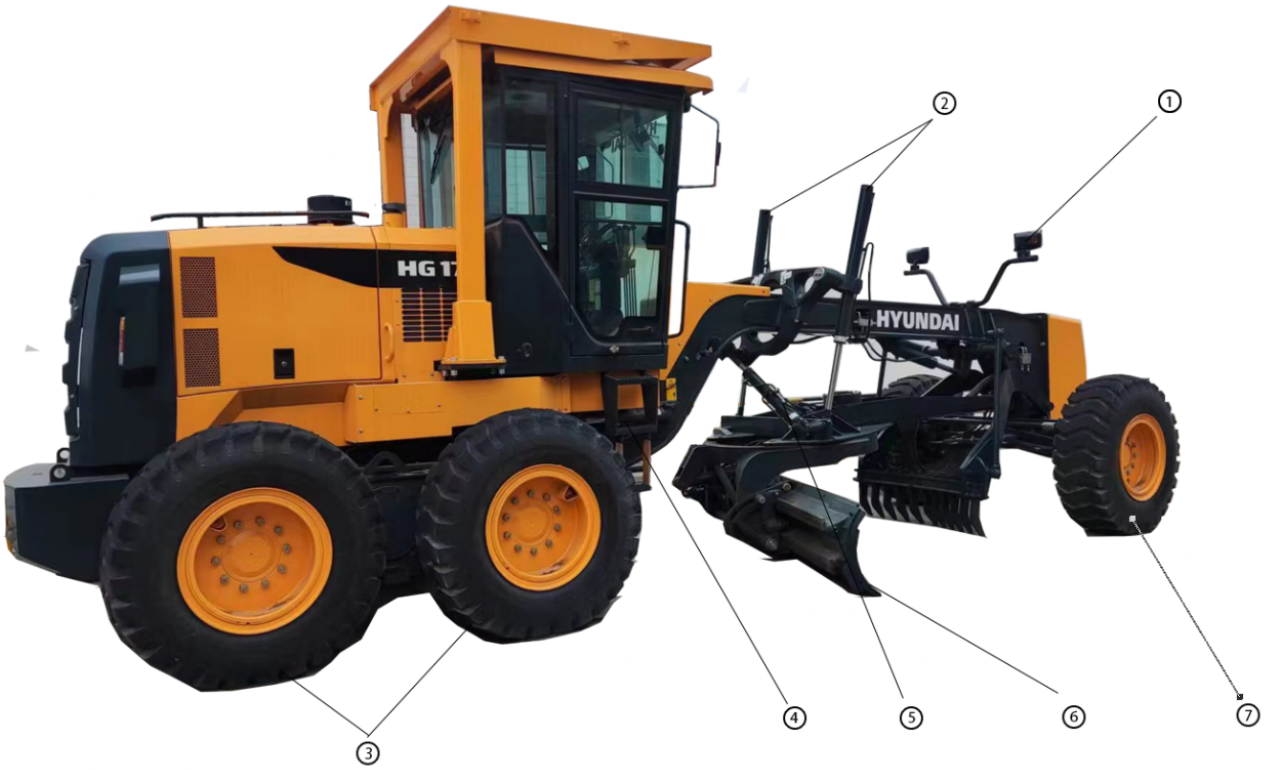
★ When checking, adding or changing the cooling water, fuel or lubrication oil, be sure not to let any dust or dirt get in.

★ When replacing oil filters elements (cartridges), check their interiors for dirt and dust. If heavily collected, check for possible cause before starting operation.

★ Hours of operation are indicated by the service meter.

# General Locations and Specifications

1. Head Lamp
2. Blade Lift Cylinder
3. Rear Tire
4. Articulation Cylinder
5. Drawbar Side Shift Cylinder
6. Blade
7. Front Tire



## ENGINE

| | HG130-3 |
|---|---|
| Model | DF Cummins5.9-C150 |
| Type | Vertical, in-line, water-cooled, 4 strokes |
| Aspiration | turbocharged aftercooling |
| No. of cylinders | 6 |
| Bore | 102 mm |
| Stroke | 120 mm |
| Piston displacement | 5.9 L |
| Horsepower - Gross | 113kW/2,200rpm |
| Maximum torque | 690Nm/1,500rpm |
| Torque rise | 32% |
| Air cleaner | Dry type |
| Electrical | 28V，70A |
| Battery | 12V*2；900cca |

## TRANSMISSION AND TORQUE CONVERTER

| | HG130-3 |
|---|---|
| Speed (at rated engine speed) | Forward / Reverse (km/h) |
| 1st | 5.7/5.7 |
| 2nd | 8.9/14.3 |
| 3rd | 14.3/31.4 |
| 4th | 21.6 |
| 5th | 31.4 |
| 6th | 44.3 |

## TANDEM DRIVE

| | | HG130-3 |
|---|---|---|
| Oscillating welded box section | | 614*225 mm |
| Side wall thickness | Inner | 22 mm |
| | Outer | 22 mm |
| Whell axle spacing | | 1,535.4 mm |
| Tandem oscillation | | ±13 ° |

## FRONT AXLE

| | HG130-3 |
|---|---|
| Type | Solid bar construction welded steel sections |
| Ground clearance at pivot | 610 mm |
| Wheel lean angle, right or left | ±17 ° |
| Oscillation, total | 32 ° |

## REAR AXLE

| | HG130-3 |
|---|---|
| Alloy steel, heat treated, full floating axle with lock/unlock differential | NO-SPIN differential |

## STEERING

| | HG130-3 |
|---|---|
| Hydraulic power steering providing stopped engine steering meeting ISO 5010 | Hydraulic power steering |
| Minimum turning radius | 6.6 mm |
| Maximum steering range, right or left | 49 ° |
| Articulation | ±26 ° |

## BRAKES

| | HG130-3 |
|---|---|
| Service brake | Foot operated, hydraulically actuated on four tandem wheels, 3,671 ㎠ total braking surface |
| Parking brake | Flexible shaft control, drum brake |

## FRAME

| | HG130-3 |
|---|---|
| Height | 299 mm |
| Width | 280 mm |
| Side | 16 mm |
| Upper, Lower | 16 mm |

## DRAWBAR

| | HG130-3 |
|---|---|
| | A-shaped, u-section press formed and welded construction for maximum strength with a replacable drawbar ball |
| Drawbar frame | 200*12 mm |

## CIRCLE

| | HG130-3 |
|---|---|
| | Four circle support shoes with replaceable wear surface. Circle teeth hardened on front 180°of circle |
| Diameter (outside) | 1,300 mm |
| Circle reversing control hydraulic rotation | 360 ° |

## MOLDBOARD

| | HG130-3 |
|---|---|
| | Replaceable metal wear inserts, cutting edge and bits. Cutting edge and end bits are hardened. |
| Dimensions | 3,658*580*18 mm |
| Arc radius | 329 mm |
| Cutting edge | 152*16 mm |

## BLADE RANGE

| | | HG130-3 |
|---|---|---|
| Circle center shift | Right | 525 mm |
| | Left | 530 mm |
| Moldboard side shift | Right | 815 mm |
| | Left | 840 mm |
| Maximum shoulder reach outside rear tire (frame straight) | Right | 1,886 mm |
| | Left | 1,916 mm |
| Maximum lift above ground | | 410 mm |
| Maximum cutting depth | | 560 mm |
| Maximum blade angle, right or left | | 90 ° |
| Blade tip angle | | 29-77 ° |

## HYDRAULICS

| | HG130-3 |
|---|---|
| | Hydraulic system of double pump and double multi way valve. Priority braking and steering. There are hydraulic locks on the scraper lifting, front wheel tilting, traction frame tilting, power tilting, frame articulation and other oil circuits |
| Output (at engine rated prm) | 140.8 L/min |
| Maximum system pressure | 17.5 MPa |

## INSTRUMENT

| | | HG130-3 |
|---|---|---|
| Gauge | Standard | Engine coolant temperature, fuel level, torque converter oil te mperature |
| Warning lights / indicator | Standard | Battery charge,directional indicator, engine oil pressure, parking brake |

## CAPACITIES (REFILLING)

| | HG130-3 |
|---|---|
| Fuel tank | 370 L |
| Cooling system | 24 L |
| Crank case | 17 L |
| Transmission | 28 L |
| Final drive | 18 L |
| Tandem housing (each) | 45*2 L |
| Hydraulic system | 65 L |
| Circle reverse housing | 4 L |

## OPERATING WEIGTHT (APPROXIMATE)

| | | HG130-3 |
|---|---|---|
| Includes lubricants, coolant, full fuel tank | Total | 13500 kg |
| | On rear wheels | 9450kg |
| | On front wheels | 4050 kg |
| With front mounted scarifier | Total | 14150 kg |
| | On rear wheels | 9480kg |
| | On front wheels | 4670kg |
| With rear mounted ripper and front push plate | Total | 14500 kg |
| | On rear wheels | 10585 kg |
| | On front wheels | 3915 kg |

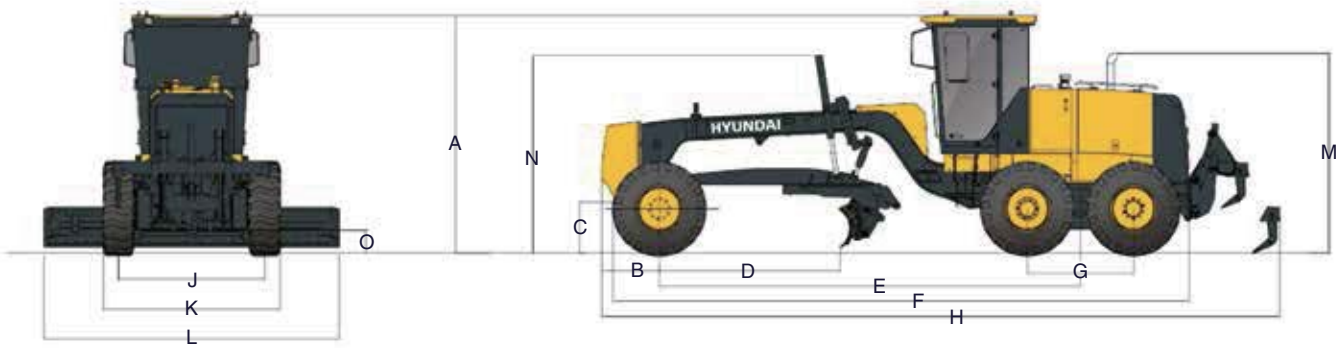
## SCARIFIER (OPTIONAL)

| | | HG130-3 |
|---|---|---|
| Middle, V-type | Working width | 1,325 mm |
| | Scarifying depth, maximum | 210 mm |
| | Scarifier shank holders | 11 |
| | Scarifier shank holders spacing | 130 mm |
| Rear | Working width | - |
| | Scarifying depth, maximum | - |
| | Scarifier shank holders | - |
| | Scarifier shank holders spacing | - |

## RIPPER (OPTIONAL)

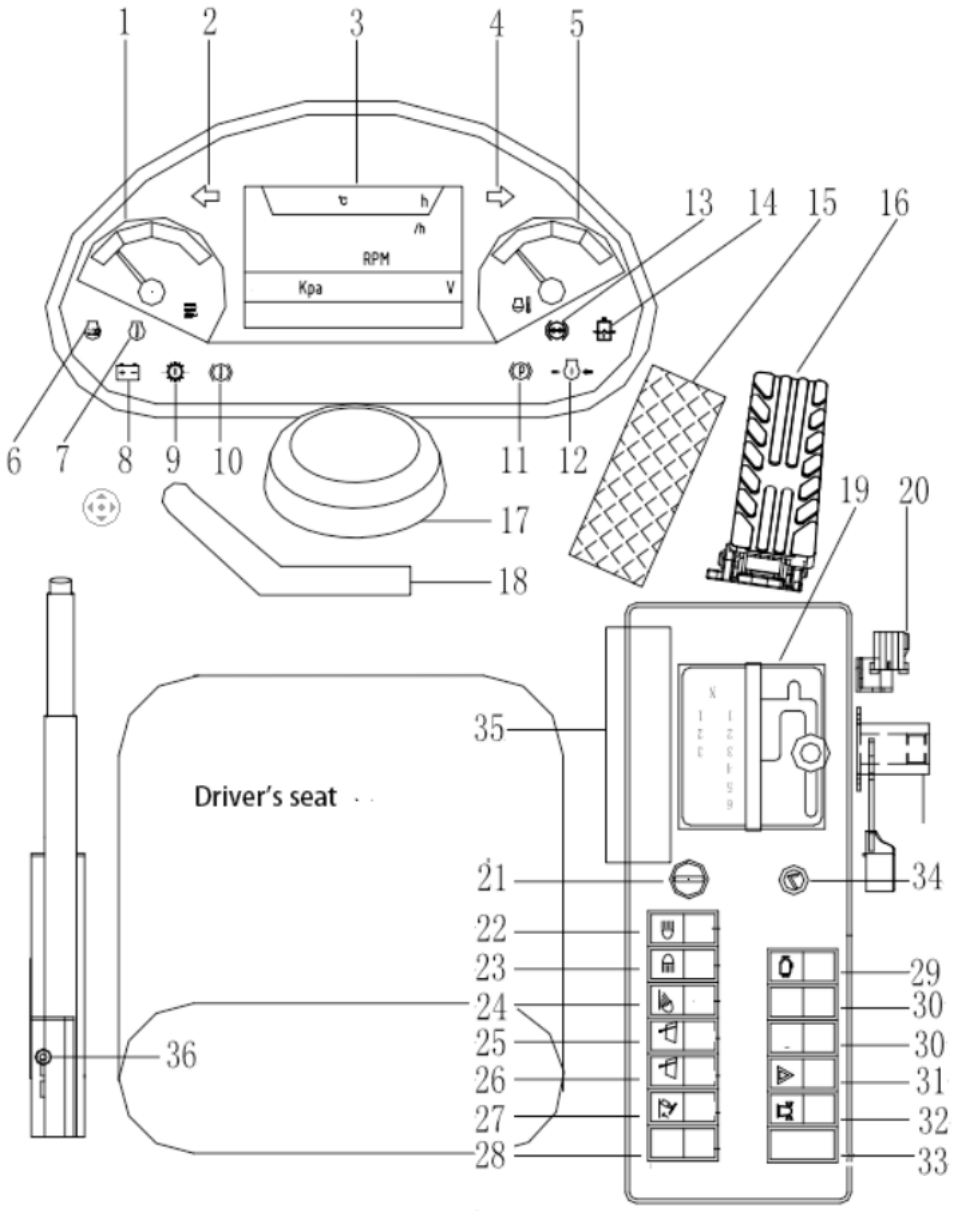
| | HG130-3 |
|---|---|
| Ripping depth, maximum | 350 mm |
| Ripper shank holders | 3-teeth (standard)<br>5-teeth (optional) |
| Ripper shank holder spacing | 455 mm |
| Machine length increase, beam raised | 1,000 mm |

## DIMENSIONS




| Item | Description | HG130-3 |
|---|---|---|
| A | Height to Top of Non-ROPS Cabin | 3510 mm |
| | Height to Top of ROPS Frame | 3635 mm |
| B | Center of Front Axle to counterweight | 675 mm |
| C | Ground Clearance to Center Front Axle | 869 mm |
| D | Length of Front Axle to Moldboard | 2,470 mm |
| E | Length of Front Axle to Mid Tandem | 5,870 mm |
| F | Length of Front Tire to Rear of Machine | 8,125 mm |
| G | Length of Between Tandem Axles | 1,535 mm |
| H | Length of Between Counterweight to Ripper | 8,125 mm |
| J | Width of Tire Center Lines | 2,120 mm |
| K | Width of Outside Tires | 2,565 mm |
| L | Width of Moldboard | 3,658 mm |
| M | Height to Exhaust Stack | 2,582 mm |
| N | Height to Top of Cylinders | 2,793 mm |
| O | Ground Clearance to Trans. Case | 339 mm |

## Instructions, Switches and Pilot Lamps




| | | |
|---|---|---|
| 1. Fuel gauge | When the oil level indicator is in the red zone, it will prompt to add oil |  |
| 2. Left turn indicato | When the steering lamp handle switch is pushed down, the indicator light and the front and rear combination light left turn light will be on. |  |
| 3. LCD display | Display main parameters |  |

| | | |
|---|---|---|
| 4. Right turn indicator | When the turn signal switch is pushed upward, the indicator light and the front and rear combination light right turn signal light will be on |  |
| 5. Water temperature gauge | Display of the engine cooling water temperature |  |
| 6. Preheat indicator | The indicator light is always on when the preheater is heating up; when the preheating process is finished and ready to start or when a fault is detected in the preheating relay, the indicator light flashes on; if there is no fault or no need for preheating, the preheating light flashes on once and then goes |  |
| 7. Fault diagnosis Indicator | Normal state: when the diagnostic switch is disconnected, the indicator light is on before starting and off after starting; the indicator light keeps flashing after pressing the diagnostic switch to start. |  |
| 8. Charging indicator | The light comes on when the key switch is powered on and goes off when it is activated. |  |
| 9. Low gear pressure Indicator | When the gearbox gear pressure is <1.2MPa, this indicator light comes on. |  |
| 10. Running brake indicator | This light comes on when the foot brake is used and is normally used when driving. |  |
| 11. Parking brake Indicator | Indicator light comes on when handbrake is pulled up. |  |
| 12. Low oil pressur Indicator | When the engine oil pressure is <0.08MPa, the indicator li ht comes on. |  |
| 13. Low brake fluic pressure indicator | When the running brake fluid pressure is <11.5MPa, the indicator light comes on. |  |

| | | |
|---|---|---|
| 14. Oil and water separation indicator | This indicator lights up when the water level in the oil-water separator increases to a certain level. |  |
| 15. Footbrake pedal | Control of the hydraulic system and gearbox to stop or slow down the grader |  |
| 16. Electronic accelerator pedal | The engine ECU receives a voltage signal that controls how much fuel is injected into the pump and thus controls the engine speed. |  |
| 17. Horn button | |  |
| 18. Turn signal handle switch | When the handle is in the middle, the turn signals do not work; when the handle is down, the left turn signal comes on; when it is up, the right turn signal comes on. |  |
| 19. Gear selector | Forward, reverse and stop (neutral) operation of the whole vehicle by means of the handle |  |
| 20. Electronic hand throttle | The engine ECU receives a voltage signal that controls how much fuel is injected into the pump and thus controls the engine speed. |  |
| 21. Cigarette lighter | For smoking and ignition. Can be converted to a back-up power supply. |  |
| 22. Headlight rocker Switch | Switch with three positions for headlight off, low beam and high beam illumination |  |
| 23. Rear light rocker Switch | Control of cab rear light illumination. |  |
| 24. Work light rocker Switch | Control of cab headlight and cutterboard work light illumination |  |

25. Alarm light rocker Switch

Controls the operation of the cab top warning light. (Optional)

26. Front wiper rocker Switch

Controls the operation of the front wiper motor (with three speeds)

27. Rear wiper rocker Switch

Controls the operation of the rear wiper motor (with three speeds)

28. Washing water spray rocker switch

Controls the operation of the washer spray valve to spray water from the front and rear wipers.

29. Troubleshooting rocker switches

Press the switch and the fault indicator flashes, different frequencies represent different fault problem codes.

30. Covers

Spare

31. Instrument light rocker switch

Press the switch and all rocker switches and instrument background lights come on.

32. Hazard Warning Switch Lamps

Press when stopping, the left and right turn signals flash to indicate a roadblock hazard warning

33. Throttle changeover rocker switch

Press the switch to activate the hand throttle, disconnect to activate the foot throttle

34. Key switch

OFF: the key can be inserted and withdrawn in this position; when the key is turned to this position, the controlled circuit is switched off.
START: When the key is turned to this position, the starter motor works and drives the engine. Once the engine has been started, the switch should be released and the key automatically turned back to the "ON" position.

35. Main control box

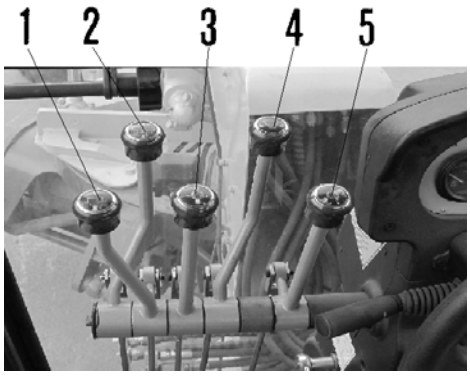
Integration of electrical components such as relays, flashers and fuses into one unit

36. Hand brake switch

Combined with the parking brake indicator to show the status of the brake handle position.

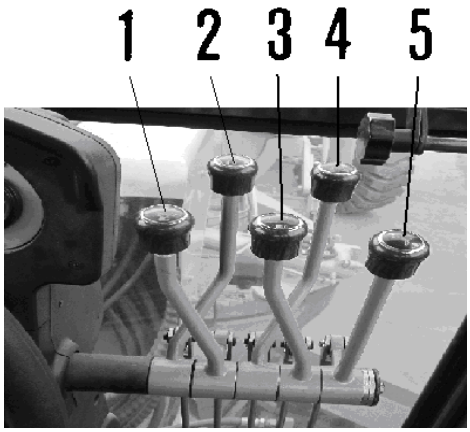
**Control Lever and Pedals:**

**1. Work equipment control lever:**




These levers operate the work equipment.

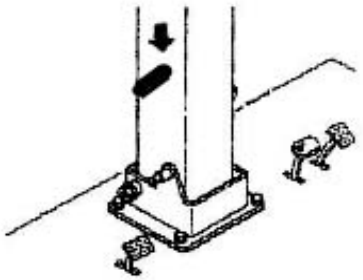
1. Left blade lift lever
2. Ripper control lever（OPTIONS）
3. Blade side shift lever
4. Power tilt control lever
5. Blade rotation control lever




These levers operate the work equipment.

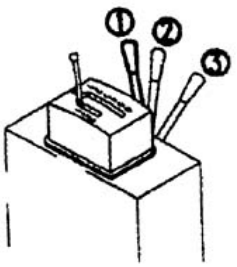
1. Draw bar side shift lever
2. Articulation control lever
3. Right blade lift lever
4. Front wheel leaning lever
5. Scarifier lift lever（OPTIONS）

**2. Steering Post Tilt Lever**



Turn the ratchet wheel, and the steering post can be tilted. (the most lean 25°) Turn the pin of the handle, and achieve replacement.

**3. Fuel Control Lever** This lever adjusts the engine speed and output.



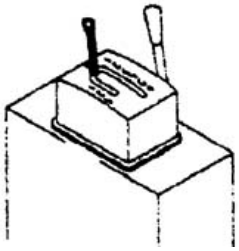

① Engine stop position: Push the lever fully.

② Low idling position: Pull the lever from engine stop position ① until you feel the operation force falls off.

③ High idling position: Pull the lever from low idling position ② fully.

★ Use the fuel control lever only during actual work. When running the machine along a road, use the accelerator pedal.

**4. Gear Shift Lever**



This lever is used to change the transmission gear. Simply moving this lever to desired speed position could perform 6-speed forward and 3-speed reverse transmission. When the lever is left placed in any position other than neutral, the engine is prevented from starting. When the lever is moved to a reverse position, the back up buzzer sound.

**5. Accelerator Pedal**

This pedal controls the engine speed and output. The engine speed can freely controlled between low idling and full speed.
If the pedal is raised from low idling position, the engine will stop.

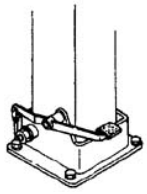
**6.Brake Pedal**

The brake is applied on the four rear wheels when this pedal is depressed.

▲ Do not put your foot on this pedal unnecessarily.

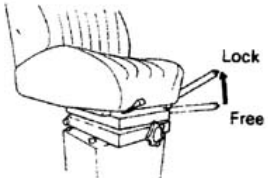
**7. Pedal for Bank Lock-pin Control**

This pedal is used for controlling the blade to the bank cut position and shoulder reach position.



**8. Parking Brake Lever**

The brake is applied to the output shaft of the transmission by pulling this lever to the limit.

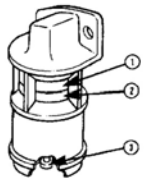



▲ When parking or leaving the machine, be sure to apply the parking brake.

**9. Dust Indicator**

This device indicates clogging of the air cleaner element. When red position ② appears in the transparent part of this indicator①, the element is clogged. Immediately clean the element.

After cleaning, push the indicator button ③ to return the red piston to the original position.



**10. Articulate Lock Pin**

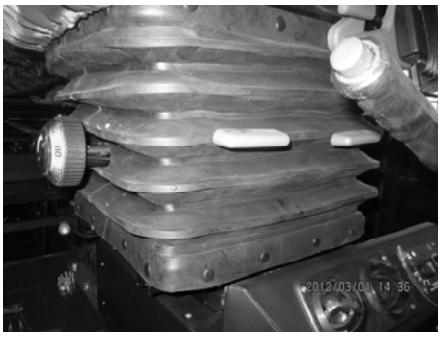
This pin is used to lock the front and rear frame to prevent the machine from bending when the machine is serviced or transported.

▲ Always use this lock pin when servicing or transporting.

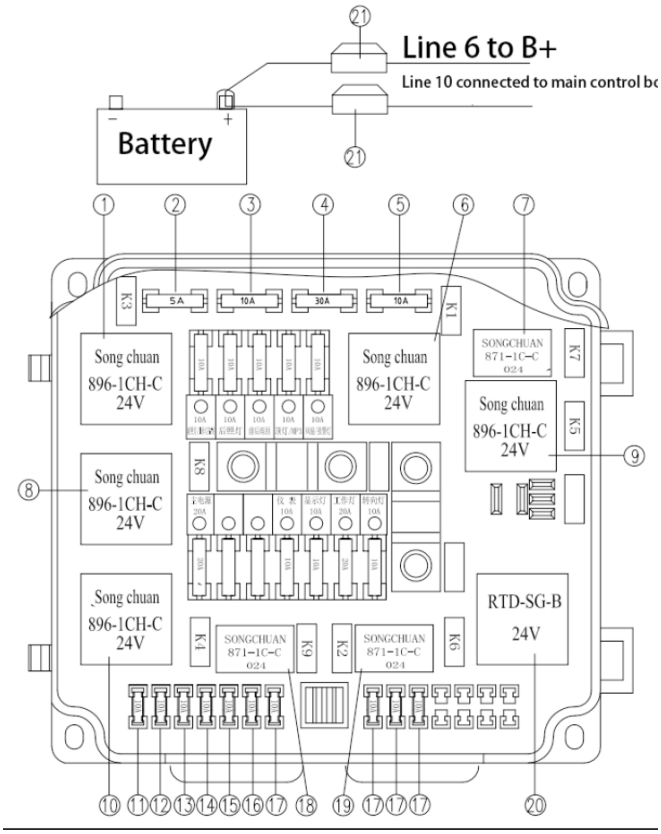
▲ Operating the articulation system when traveling, always remove the lock pin.

**Operator's Seat**

According to the instructions of the seat adjustment handle, adjust the seat forward and backward, up and down to the appropriate position.

**Main control box**



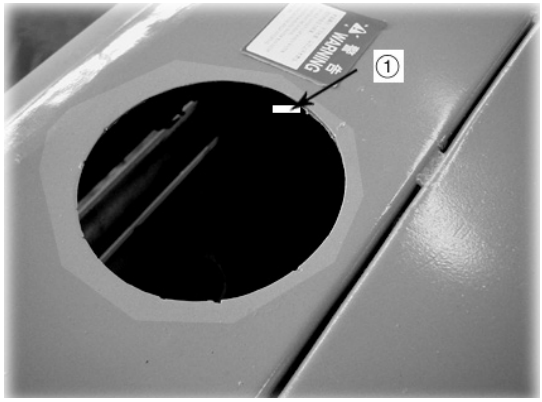

| Ref | Name | Description |
|---|---|---|
| 1 | Relay K3 | Controls engine ECM power, headlight power and work light control power, rear light power, front and rear wiper power, dome light and MP3 power, fan and warning light power |
| 2 | Fuse ATS-5A | Engine ECM power supply |
| 3 | Fuse ATS-10A | Keyswitch power supply |
| 4 | Fuse ATS-30A | Air conditioning power supply |
| 5 | Fuse ATS-10A | Power supply for reversing lamp and reversing buzzer |
| 6 | Relay K1 | Power supply for control instrument, display lamp, turn signal lamp and work lamp |
| 7 | Relay K7 | Control the power supply of reversing lamp and reversing buzzer |
| 8 | Relay K8 | Control neutral start |
| 9 | Relay K5 | Control the power supply of air conditioner, reversing lamp and reversing buzzer |
| 10 | Relay K4 | Control the power supply of horn, brake light and transmission brake signal, knife plate solenoid valve, transmission gear valve, cigarette lighter and pin extractor solenoid valve |
| 11 | Fuse ATN/10A | Horn power supply |
| 12 | Fuse ATN/10A | Brake light, transmission brake signal power supply |
| 13 | Fuse ATN/10A | Knife plate solenoid valve power supply |
| 14 | Fuse ATN/10A | Transmission gear valve power supply |
| 15 | Fuse ATN/10A | Cigar lighter power supply |
| 16 | Fuse ATN/10A | Pin puller solenoid power supply |
| 17 | Fuse ATN/10A | spare |
| 18 | Relay K9 | Control the engine ECM main power supply |
| 19 | Relay K2 | Control work light power supply |
| 20 | Flasher K6 | Turn signal power is converted into flash signal output |
| 21 | Single fuse 100A | Main power output from the whole vehicle system or generator |

# Check before Starting

This check before starting shall never be neglected as troubles are prevented by the check.

a. Walk around the machine body and check whether is any trace of oil or water. In particular, the joint of high-pressure hose and hydraulic cylinder should be paid special attention. In case leakage is found, inspect the leaking location and stop the leakage. When leakage is not stopped, you are begged to request repair to Hyundai distributor.

b. Inspect the tightening of bolts and nuts on every section. When loosed ones are found, apply increased tightening. In particular, attachment positions of air cleaner and muffler should be paid special attention.




**c. Check and Refill Coolant**

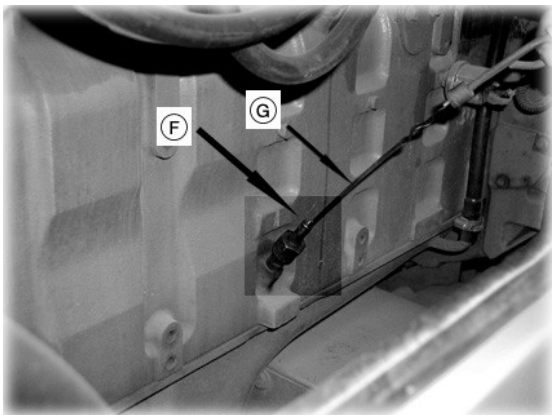
Remove radiator cap (1) at the top rear of the machine and check that the cooling water reaches the area marked by shaded lines. Add water if necessary.

★ If the volume of coolant added is more than usual, check for possible water leakage.

▲ Do not remove the cap while cooling water is hot. Hot water may spout out.

When removing radiator cap, lift the lever to relieve pressure.

**d. Check Oil Level in Engine Oil Pan**



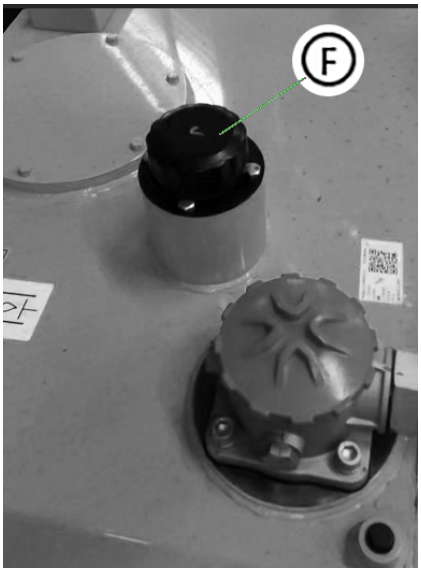

1. Use dipstick (G) to check the oil level.

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

★ The type of lubricant used depends on the ambient temperature. Select according to the table “FUEL, COOLANT AND LUBRICANTS”.

★ When checking the oil level, park the machine on a flat surface, stop the engine and wait for 15 minutes before checking.

## e. Check and Refill Fuel Tank



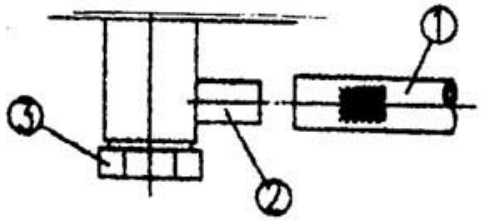

1. Check the level of the fuel.
2. Top up the tank through the filler (F) after the day's work is over.

★ A clogged cap breather hold may stop the fuel flow to the engine. Check it from time to time and clean.

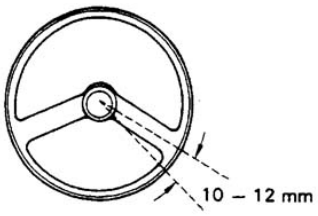
★ Fuel Capacity : 270 L.

★ When adding fuel, never let the fuel overflow. This may cause a fire.

## f. Drain Water and Sediment in the Fuel Tank

| | |
|---|---|
|  | Use the rubber hose (1) with right length to hitch up the connector (2), then loosen the drain valve (3) and drain sediment and water accumulated at the bottom, together with fuel. |

**h. Check and Adjust Steering Wheel**



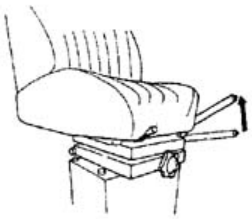

When checking steering wheel play, start engine and raise front wheels off ground. The standard steering wheel play is 10～12 mm. Please contact with Hyundai Company if the play is over the standard or the rotation of the steering wheel is unusual.

**i. Check and Adjust Braking Ability**

The braking ability is enough if the braking distance is 13 meters or below at the initial speed of 30 km/h.

★ For insufficient braking ability, refer to Every 250 Hours Service (Wheel Brake).

**j. Check Parking Brake for Normal Lever Travel**



The lever travel is found normal if the brake is normally applied when the lever grip is pulled until two or three ratchet clicks are felt. If six or more clicks are counted before the parking brake comes into effect, refer to the Every 250 Hours Service for inspection and adjustment procedures.

★ If the machine is started in travel with the parking brake lever left in pulled position, brake lining will be burnt and braking effect will be greatly deteriorated.

★ If a brake lining is once burnt, normal braking effect will not recover unless very thin, burnt layer on the lining surface is polished with sandpaper.

**k. Check and Adjust Tire Pressure**

Make sure the tire and rim is free from wear and damage, and that hub nuts are not loose.

| | |
|---|---|
| Standard Pressure: | (17.5 – 25 – 12PR L-3)<br>Front wheel 3.0 kg/cm$^2$<br>Rear wheel 3.0 kg/cm$^2$ |

**l. Check lamps for switching, dirt and damage.**
**m. Check rear view mirror for positioning, dirt and damage.**
**n. Check horn.**
**o. Is the color of exhaust gas normal?**
**p. Do the instruments function normally?**
**q. Have any defects in which were found during the previous day's operation been corrected?**
**r. Check the door lock for normal function.**
**s. Check the windshield wiper for normal function.**
**t. Check electrical wiring**

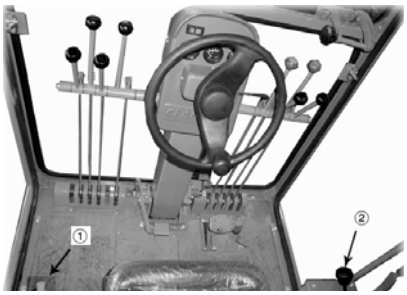
Check for damage of the fuse and any sign of disconnection or short circuits in the electric wiring. Check also for loose terminals and tighten any loose parts.
Check the following points carefully:

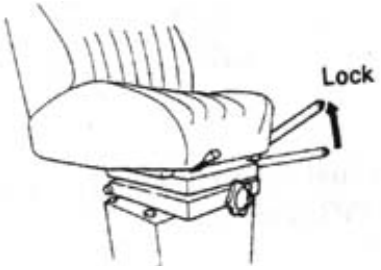
- Battery
- Starting motor
- Alternator

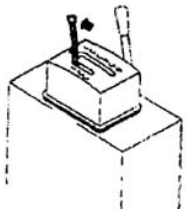
▲ If the fuse is damaged or there is any sign of short circuit in the electric wiring, always investigate the cause and correct it.
★ Please contact your Hyundai distributor for investigation and correction of the cause.

# Operation of Grader

## Before starting the engine



▲ If the control lever is touched by accident, the work equipment may move suddenly. When leaving the operator's compartment, always set the lock lever securely to the LOCK position.

▲ Before starting the engine, use a damp cloth to wipe off the dust accumulated on the top surface of the battery.

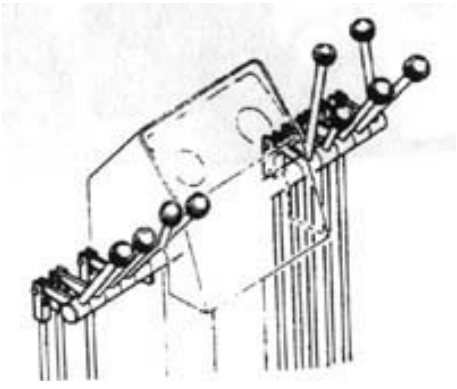
1. Before starting the engine, check the position of all levers.

★ Carry out an initial inspection. (For details of the inspection, please see Check Before Starting.)

2. Is parking brake lever (1) in the LOCK position?
3. Is gearshift lever (2) in the NEUTRAL position and locked?

★ Engine will not start unless gearshift lever is in NEUTRAL.

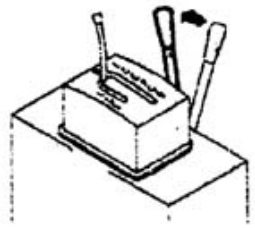
4. Is work equipment control lever at the neutral (HOLD) position?



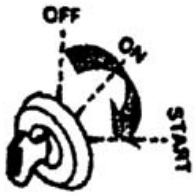
**To start the engine:**

1. Put the chopper switch to ON position.

2. Put fuel control lever in LOW IDLING position.



3. To start the engine, put the key to START position and turn over the starting motor.



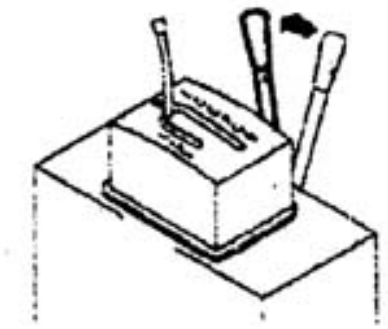

4. As soon as the engine starts, release the starting switch key to allow it to return automatically to ON position.


★ Do not leave the key in START position for more than 20 seconds.
★ If engine will not start, repeat the starting procedure after about 2 minutes.
★ To start engine in cold weather, refer to Cold Weather Operation.

**Special Starting:** When starting after running out of fuel, fill with fuel, then fill the fuel filter cartridge with clean fuel and bleed the air from the fuel system before starting.
Refer to Fuel Filter in Every 500 Hours Service

**Check After Starting:**

After starting the engine, do not operate the machine immediately. First carry out the following operations and checks.



1. Pull fuel control lever (1) and run the engine at medium speed for about 5 minutes with no load.
2. Run engine with light load until engine water temperature gauge indicator move into green range.
3. After warm-up run, check all gauges and wiring lamps for proper operation.
4. Check for normal coloration of exhaust, any abnormal sound or vibration.

★ Don't run the engine at low idling or high idling for more than 20 minutes. If it's necessary to run the engine at idling, apply a load from time to time to raise the engine speed to a midrange speed.

**To Move the Machine off**

1. Free parking brake lever and check that parking brake pilot lamp goes off.

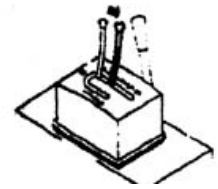

1. Set the gearshift lever to 1st speed.

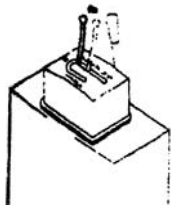
★ When starting the machine, check that the parking brake pilot lamp goes out.

★ Set the gear shift lever to 1st speed first, then set it to higher speed by degrees.

3. Depress the accelerator pedal and the machine will start.

**Changing Gear Speed**





**1. Acceleration**

Partially release the accelerator pedal and shift gearshift lever to the next stepped up position.

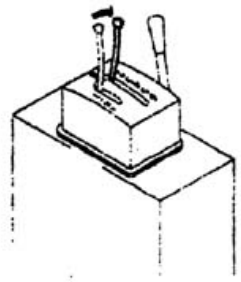
**2. Deceleration**

Release the accelerator pedal to reduce the traveling speed and shift the gearshift lever to the next stepped-down position.

★ When shifting gear, always shift one speed at a time.

**Forward/Reverse Shifting**

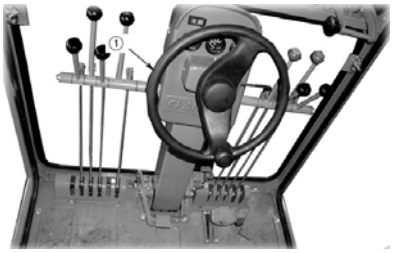
Always stop the machine when switching between FORWARD and REVERSE.



1. Depress the brake pedal to reduce the travel speed and to stop the machine.
2. Set the gearshift lever to the desired position, then depress the accelerator pedal slowly and release the brake pedal to start the machine.

★ The engine running speed should be reduced when shifting.

**Turning**

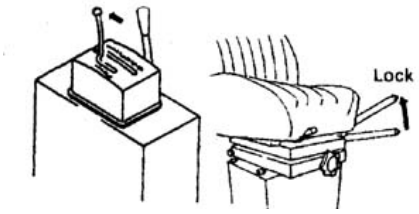



The grader turns to the desired side by turning the steering wheel (1) to that side.

★ Leaning to the turning side will minimize the turning radius. In case the grader turns while reversing, leaning to the opposite of the turning side will minimize the turning radius.

★ In case the leaning was used for turning, return the steering wheel after the leaning was returned to the desired position.

**TO STOP THE MACHIMNE**




1. Release accelerator pedal.
2. Depress brake pedal to stop the machine.
3. Set gearshift lever to neutral position, and then pull the parking brake lever to apply the parking brake.

## CAUTIONS FOR OPERATING

- Drive the machine straight during uphill or downhill traveling. Specially, turning the machine on the gravelly or clayey slant will cause the machine to slip easily.
- If the engine stops on the slant, depress the brake pedal immediately with full force, and at the same time, pull the parking brake lever to stop the machine. Then place the gearshift lever in N (neutral) and start the engine again.

▲ If the engine stops, the brake booster will not work, so the pedal will become heavier and the braking effect will drop even if the brake is depressed with the same force.

- When tires get stuck while working in swamp or mud, travel with repeated articulation to simplify getting out of the poor ground.
- This machine has two brake control systems. If one brakes down, the other is still effective. However because braking capacity is reduced, drive slowly when traveling.
- Operating the articulation system when traveling at high speed may cause the machine to overturn. Always perform this operation at a speed below 10 km/h. (with articulated)

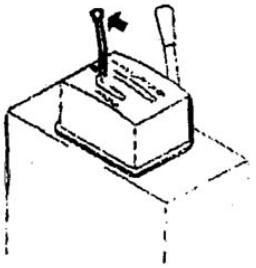
## WHEN TRAVELING DOWNHILL

When traveling downhill, use the same speed range as when traveling uphill, and make full use of the engine to brake the machine.

If travel speed is still too fast, use the foot brake.

▲ Never shift gear or place the transmission in neutral when traveling on a slope. It is dangerous to do this, as the engine cannot be used to brake the machine. Always place the transmission in the appropriate speed range before starting to travel downhill.

▲ To prevent overrun, always shift down one gear at time. Allowing the engine to overrun may cause damage to the engine or transmission.



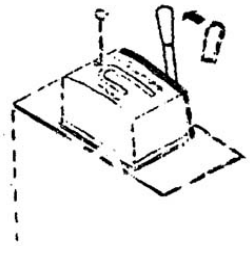
▲ Stop the machine on hard and even ground to prevent it from falling down or slipping.

▲ When the machine is to be left stopped for a while, leave the engine in low idling or stop the engine. Apply the gearshift lever lock and the parking brake.

▲ Emergency brake

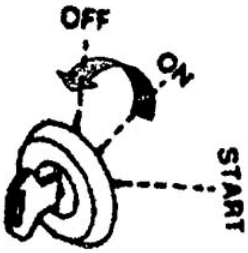
▲ If an emergency stop has been made when the machine is traveling, use the parking brake together with the wheel brake.

When the emergency brake has been used, check the parking brake lining, and then replace the lining.



## TO STOP THE ENGINE

1. Idle the engine at low speed for about 5 minutes to cool it.




2. Set the fuel control lever to the STOP position to stop the engine.

★ It is also possible to release the accelerator pedal to STOP position and stop the engine.

3. Return the staring switch to the OFF position, and withdraw the key.

★ Do not attempt to stop a hot engine immediately unless it is necessary. Such unreasonable operation will case remarkable shortage of life of the various engine parts.

★ Specially when stopping an overheated engine, be sure to cool the engine gradually by idling it at a middle idling speed.

4. Set the chopper switch on OFF position.

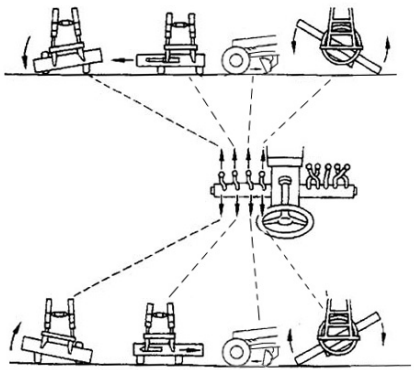
# OPERATION OF WORK EQUIPMENT

## OPERATION METHOD OF THE WORK EQUIPMENT CONTROL LEVER

There are provided eight work equipment control levers, which are operated as are indicated in the following figures.

### Left-side Control Lever

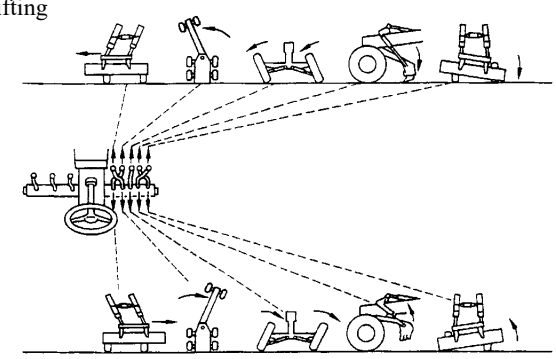
Blade lifting  Blade side shifting  Power tilt  Blade rotation



When operating the work equipment control lever, sufficient attention is required for the movement of the work equipment and its movement range must be limited, as the work equipment or the hydraulic cylinder possibly hit against parts, damaging them.

### Right-side Control Lever

Drawbar side shifting  Articulation  Leaning  Scarifier  Blade lifting

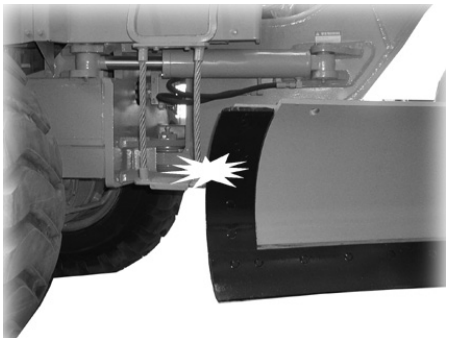


## CAUTIONS IN OPERATION OF WORK EQUIPMENT

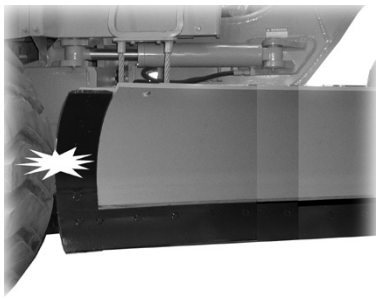
When the work equipment is operated, special attention should be given to contracts at the following parts.

Front wheel and blade

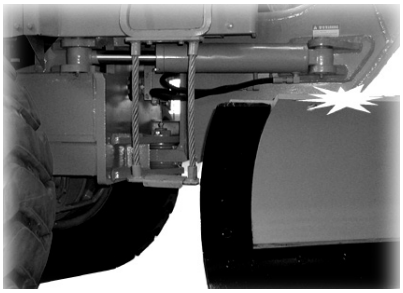
Blade and step



Rear wheel and blade



Blade and frame



**ADJUSTMENT IN SHIFTING OF WORK ATTACHMENT**

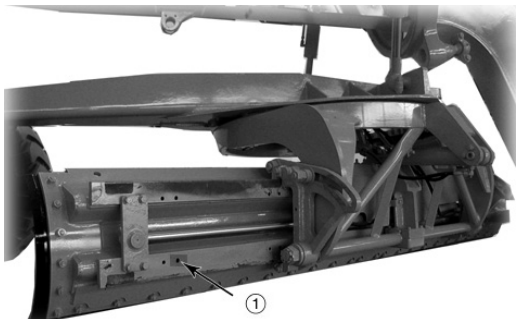
It is essential to shift the work attachment to an optimum position for each work to allow high job efficiency.

**BLADE PROJECTION**

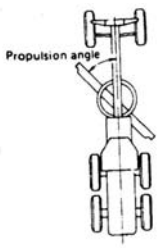
The degree of projection is controllable by the control lever during operation. If further projection is needed, stop the grader for a while and change the installing position of the blade horizontal shifting cylinder piston rod, as follows.

• Projection to left

Position (1)




**PROPULSION ANGLE OF BLADE**




Angle of blade and body centerline is called the blade propulsion angle. In the normal scraping work, set the angle at 60° , more or less. Set at a lesser angle when the scraping resistance is great, or when the soil is hard, or when the soil in front of the blade is difficult to carry or throw to the side.

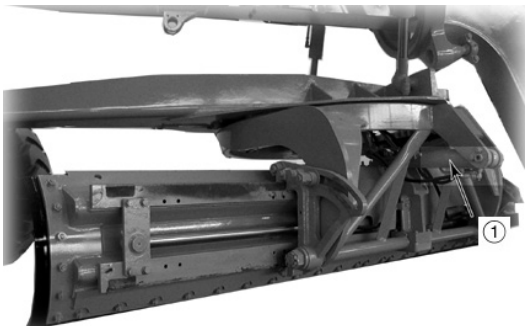
**ADJUSTMENT OF BLADE CUTTING ANGLE**

In hard soil cutting, it is advisable to lean the blade forward. As the soil becomes softer, lean the blade more backward. This operation will improve job efficiency.

It is essential to adjust the cutting angle of blade, depending on the soil condition.

**STANDARD BLADE CUTTING ANGLE (32°)**

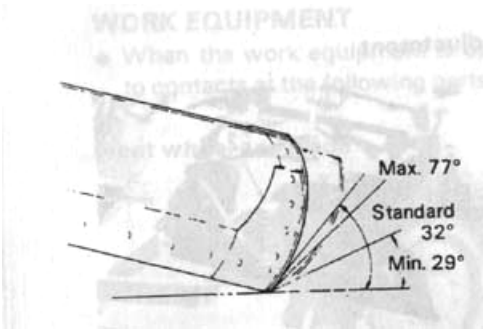
**ADJUSTMENT**




Standard cutting angle position can get by operating power tilt control lever.

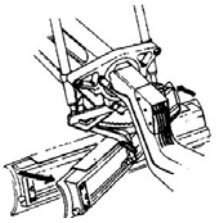
1. Turn the blade so as not to touch the grader body and set the blade in the same direction to the body.

2. Then，Operate power tilt control lever(1) .

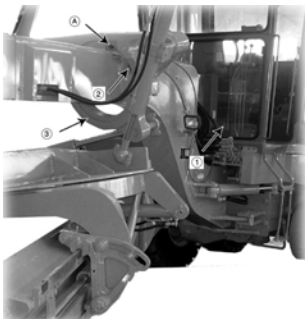



During the operation of scraping, when the rotation is required, if encounter resistance，don't force the rotation, please bring the soil scraping plate and rotary, after the angle is adjusted, then re-process the operation of scroping.

**BANK-CUTTING POSTURE (RIGHT SIDE)**



1) Fully protrude the blade and draw bar to the right so that blade angle shown in the figure can be obtained.
2) Depress lifter lock pin pedal (1) on operator´s compartment to remove pin(2).



★ If the blade cannot be removed because of interference with lifter (3), operate the blade lift cylinders as necessary.

3) Rotate lifter (3) by protruding the right-hard blade lift cylinder piston rod and retracting the left-hard blade lift cylinder piston rod. When top hole (A) in lifter approaches pin(2), release lifter lock pin pedal(1) and slowly rotate the lifter until pin(2) enters hole(A).
4) Retract the right-hard lift cylinder and protrude the left-hard cylinder. Repeat this several times so that circle is rotated with the blade raised on the right-hard side, and desired bank-cut posture can be attained.

★ When bringing the blade into bank-cut posture, be careful not to clash the blade against various portions of the machine.

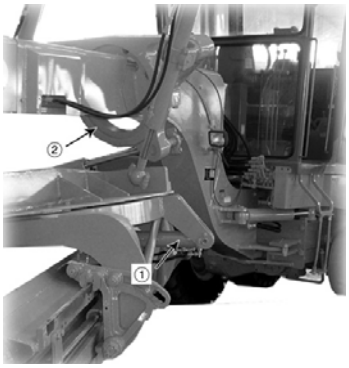
★ When bringing the blade into bank-cut posture on the left-side of the machine, change every “left-hand” and “right-hand” in the above mentioned description with each other.

★ Cutting edge of the blade may brake pavement if the blade is brought into bank-cut posture on the roadway. Cover the pavement with iron plate at the portion with the blade cutting edge may come into collision.

★ Relocating the blade side-shift cylinder piston rod mounting position to the right (when right-hand bank cutting is made) or to the left (when left-hand bank cutting is made) will improve band cutting efficiency.(See side –shifting of the Blade)

▲ Do not attempt to depress the bank control lock pin removing pedal unless the blade is rested on the ground. If the pin is removed with the blade raised off the ground, dangerous falling of the blade with rotation of the circle may result.

**SHOULDER REACH POSTURE (RIGHT SIDE)**



1) Rotate lifter (1) in a similar manner to the bank cutting posture, and lock it using bank control lock pin (2).
2) Rotate the circle to the desired position.

★ Put the machine in the left hand side shoulder reach posture using the same procedure as the above.

★ When increasing the size of the shoulder reach, change the mounting position of the piston rod of the blade horizontal feed cylinder. (Refer to the section on blade thrust)

★ The banking performance is improved, if the mounting position for the piston rod of the blade horizontal feed cylinder is changed as follows:

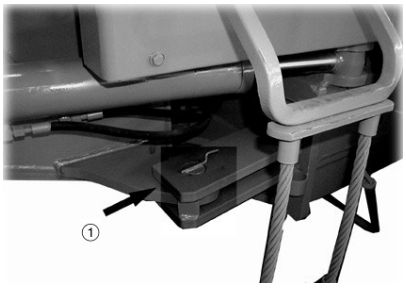
• When banking to right, to a position where the blade is thrust to right.

• When banking to left, to a position where the blade is thrust to left.

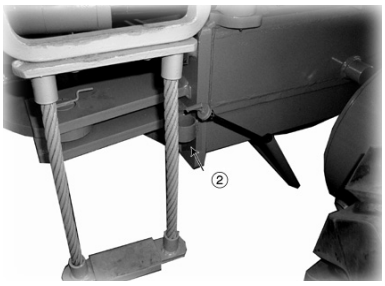
**ARTICULATED OPERATIONS**

When performing operations with the machine articulated, remove the lock line on the left side of the machine.

The machine can be articulated 26° to both right and left, giving a minimum turning radius of 6.6 m.




1. Take off lock line (1).




2. Set the lock line to the bracket (2) in the rear.

★ Do not articulate the machine with propulsion angle of the blade. Otherwise, the blade may bend the step.

★ When turning with the machine articulated, pay particular attention to the clearance between the blade end and the rear wheel.

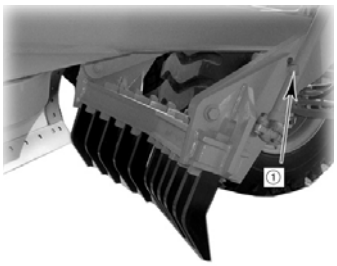
▲For normal traveling operations, do not remove the lock link.

**ADJUSTMENT OF SCARIFIER**

**a. ADJUSTMENT OF CUTTING ANGLE**

As the soil becomes harder, a wider cutting angle increases job efficiency.

**Adjustment**




Remove bolt (1) and select a bolt hole adequate to the cutting angle. The cutting angle is adjustable from 58° to 68° (standard)

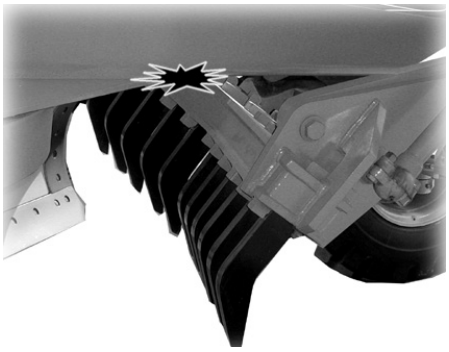
## b. ADJUSTMENT OF CUTTING DEPTH

As the cutting depth is adjustable from tooth, adjust the tooth to job property.

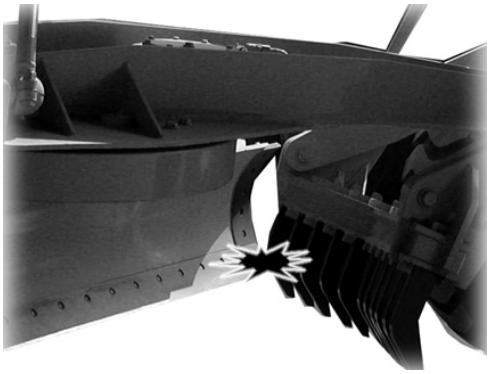
**Adjustment**


Remove the cotter pin, pull wedge (1) and change the notch of tooth.

## PRECAUTIONS FOR SCARIFIER OPERATION



When the machine body is raised by using the blade as a jack, while the scarifier is lifted to the top position, the draw bar will come into collision with the scarifier. This will cause damage to the draw bar.

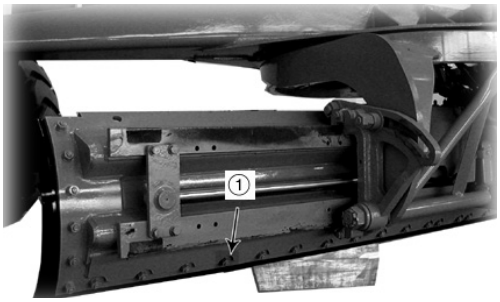


When turning the blade, with it several cm off the ground, the blade may touch the scarifier. This may damage the upper part of the blade.

## REVERSING AND REPLACEMENT OF CUTTING EDGE AND END BIT

Be sure to replace cutting edges and side edges before they wear down to a width of less than 10 mm from blade base.
When wear is extended to the mounting faces, their repair must be done prior to replacing.

### TURNING AND REPLACTING




1. Lift the blade to a suitable height and put a block underneath the blade rail to prevent its falling.

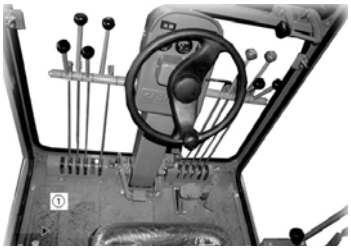
▲ Do not raise the blade unnecessarily high. Be sure not to put your body underneath the blade when blocking it.

2. Clean the mounting face after detaching the cutting edge and the end bit.
3. Mount the cutting edge after inverting it, or replacing it with a new one.
4. Mount the end bits after inverting and switching right for left, or replacing with new ones.

★ Tightening torque for the mounting nuts : 265±35N. m
★ Tighten the nuts again after several hours' operation.
★ If both ends of the cutting edge and side edges are worn out, replace them with new ones.

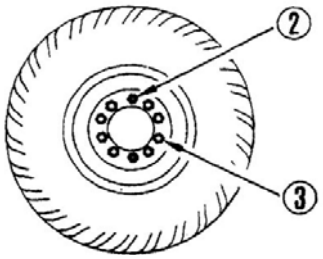
# CHANGING TIRES

## HOW TO CHANGE TIRES



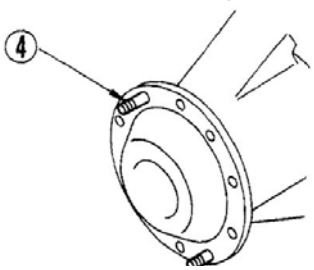
1. **Front wheel**

1) Place the work attachment on a ground and pull fully parking brake lever (1).

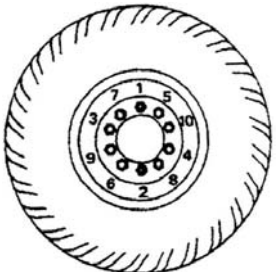



2) Then, attach the socket wrench (accessory machine tool) to hub nuts (2) and bolts (3) and loosen all the hub nuts and bolts by 3/4 to 1 turn.

3) Depress the lift cylinder. If the front tires are lifted, remove hub nuts (2) and bolts (3) and change all the tires.




4) When installing, align the tire with stud (4), then install and tighten lightly with hub nuts (2).




5) Tighten bolt (3) lightly, then raise the lift cylinder, and lower the front tires to the ground. Follow steps 1 to 10 to tighten to the specified torque.

★ Coat the threaded part with molybdenum disulphide grease before tightening.

★ Tightening torque : 450±50N. m

▲ Whenever the front tires are raised off the ground, support the front axle center frame on the stand to assure safety.

2. **Rear wheel**

1) Repeat the front wheel change procedures 1) and 2).

2) Depress fully the right and left lift cylinder and the front tires are lifted about 50cm off ground. Retract the lift cylinder on the side where the tire is not removed, to lift the rear wheels.

3) Install new tires according to the procedure 4) of the front wheel tire change.

★ Coat the threaded part with molybdenum disulphide grease before tightening.

★ Tightening torque : 450±50N. m

▲ Whenever the rear wheel are raised off the ground, stably support the tandem on the block to assure safety.

▲ When a front tire punctures, do not attempt to travel the machine by temporarily applying a pad to the swing stopper. If it is necessary, travel the machine slowly only within the minimum necessary distance.

In the case, be sure to securely keep the punctured tire off the ground with chains, etc.

**HOW TO USE LEANING STOPPER**

When the leaning pipe is damaged, temporarily prevent the front wheels from leaning so that the machine can be successfully self-propelled to the nearest repair shop.

**HOW TO APPLY THE LEANING STOPPER**

Fix the leaning rod to the front axle using the bolt provided in the toolbox.

▲ If the machine is traveled with the leaning cylinder piston rod fluctuating or the front wheels leaning on one side, because of damaged leaning piping, dangerously unstable steering and excessively worn tire will result. Have the faulty leaning pipe repaired by mechanics quickly.

# DRIVING ALONG ROAD

In addition to strict observance of traffic laws and regulations concerned, keep the following in mind:

## POSITION OF BLADE WHEN TRAVELING


When traveling, set the blade at the minimum propulsion angle and raise the blade fully.

## PRECAUTIONS WHEN TRAVELING ON ROAD

To relieve operator' s fatigue, take a rest by 30 minutes to 1 hour and 30 minutes mode, every 80 kilometers or every 2 hours of traveling.

# TOWING

## TOWING THE MACHINE

This machine must not be towed except in emergencies. When towing the machine, take the following precautions.

**When engine can be used**

• Always keep the engine running when towing the machine, so that the steering and braking can be used.

**When engine cannot be used**

• When transporting a disabled machine by towing, the transportation distance should be within 600m at a speed of 8km/h or less. (When towing more than 600m, remove the drive shaft.)

★ If the distance is more than the above mentioned, or it more than one day has elapsed since the engine trouble, be sure to use the trailer for transportation.

★ If the machine is towed without the engine running, no lubrication oil will be supplied to the transmission. The gears and bearing are rotated, so this may cause them to be damaged.

★ When the engine cannot be used or the steering booster cannot be used, operation of steering wheel is difficult, so run the machine slowly.

# COLD WEATHER OPERATION

## PREPARATION FOR LOW TEMPERATURE

If the temperature becomes low, it becomes difficult to start the engine, and the coolant may freeze, so do as follows:

## FUEL AND LUBRICANTS

Change the fuel and oil with low viscosity for all components.

For details of the specified viscosity, see the TABLE OF FUEL, COOLANT AND LUBRICANTS.

## COOLANT

After cleaning inside of the cooling system, add antifreeze to the coolant to prevent the coolant from freezing when the machine is not being used.

- ★ For details of the antifreeze mixture when changing the coolant, see WHEN REQUIRED. **CARE IN USING ANTIFREEZE**

Use a Permanent Antifreeze (ethylene glycol mixed with corrosion inhibitor, antifoam agent, etc.) meeting the standard requirements as shown below. With permanent antifreeze, no change of coolant is required for a year. If it is doubtful that an available antifreeze meets the standard requirements, ask the supplier of that antifreeze for information.

STANDARD REQUIREMENT FOR PERMANENT ANTIFREEZE:

★ Where no permanent antifreeze is available, an ethylene glycol antifreeze without corrosion inhibitor may be used only for the cold season. In this case, clean the cooling system twice a year (in spring and autumn). When refilling the cooling system, add antifreeze in autumn, but do not add any in spring.

★ Absolutely avoid using any water leak preventing agent irrespective of whether it is used do independently or mixed with an antifreeze.

★ Do not mix one antifreeze with a different brand.

▲ Antifreeze is flammable, so keep it away from any flame.

**BATTERY**

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

★ Measure specific gravity of fluid and rate of charge from the following conversion table.

| Tem.of fluid / Rate of charge | 20℃ | 0℃ | -10℃ | -20℃ |
|---|---|---|---|---|
| 100% | 1.28 | 1.29 | 1.30 | 1.31 |
| 90% | 1.26 | 1.27 | 1.28 | 1.29 |
| 80% | 1.24 | 1.25 | 1.26 | 1.27 |
| 75% | 1.23 | 1.24 | 1.25 | 1.26 |

★ When electrolyte lever is low, add distilled water in the morning before work instead of after the day´s work. This is to prevent fluid from freezing at night.

▲ To avoid gas explosions, do not bring fire or sparks near the battery.

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

# MEMO

# PERIODIC MAINTENANCE

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

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

## MAINTENANCE TABLE

| No | ITEM | SERVICE | PAGE |
|---|---|---|---|
| | CHECK BEFORE STARTING | | |
| a | Oil and water leak | Check | 10-12 |
| b | Nuts and bolts | Check and retighten | 10-12 |
| c | Coolant | Check and refill | 10-12 |
| d | Engine oil pan | Check and supply | 10-12 |
| e | Fuel | Check and refill | 10-13 |
| f | Fuel tank | Drain water and sediment | 10-13 |
| g | Dust indicator | Check | 10-13 |
| h | Steering wheel | Check and adjust | 10-14 |
| i | Braking ability | Check and adjust | 10-14 |
| j | Parking brake lever travel | Check and adjust | 10-14 |
| k | Tire pressure | Check and adjust | 10-14 |
| l | Lamp | Check | 10-15 |
| m | Rear view mirror | Check | 10-15 |
| n | Horn | Check | 10-15 |
| | | | |
| | | | |
| | | | |

| No | ITEM | SERVICE | PAGE |
|---|---|---|---|
| o | Exhaust gas color | Check | 10-15 |
| p | Instrument | Check | 10-15 |
| q | Previous day´s defects | Check | 10-15 |
| r | Door lock | Check | 10-15 |
| s | Wiper | Check | 10-15 |
| t | Electric wiring | Check and retighten | 10-15 |
| | | | |
| | | | |
| | | | |
| | EVERY 50 HOURS SERVICE | | |
| a | Lubricating | | 10-46 |
| -1 | Circle | Lubricate | 10-46 |
| -2 | Blade guide rail | Lubricate | 10-46 |
| | EVERY 100 HOURS SERVICE<br>(This item is carried out after the first 100 hours only for new machines.) | | |
| | Filter for transmission case | Change oil, replace element | 10-46 |

| No | ITEM | SERVICE | PAGE |
|---|---|---|---|
| | EVERY 250 HOURS SERVICE<br>(The item marked ★ are carried out after the first 250 hours only for new machines) | | |
| ★ | Fuel filter | Replace cartridge | 10-47 |
| ★ | Engine oil pan and filter | Change oil and replace cartridge | 10-47 |
| ★ | Final drive case | Change oil | 10-47 |
| ★ | Circle reverse case | Change oil | 10-47 |
| ★ | Tandem drive case | Change oil | 10-47 |
| ★ | Hydraulic tank and filter | Change oil and replace element | 10-47 |
| ★ | Engine valve clearance | Check and adjust | 10-47 |
| a | Lubricating | | 10-47 |
| -1 | Leaning cylinder pin | Lubricate 2 points | 10-47 |
| -2 | Leaning rod end | Lubricate 2 points | 10-47 |
| -3 | Steering rod | Lubricate 2 points | 10-47 |
| -4 | Knuckle bracket king pin | Lubricate 4 points | 10-48 |
| | | | |

| No. | ITEM | SERVICE | PAGE |
|---|---|---|---|
| -5 | Steering linkage | Lubricate 2 points | 10-48 |
| -6 | Draw bar ball joint | Lubricate 1 points | 10-48 |
| -7 | Front axle center pin | Lubricate 2 points | 10-48 |
| -8 | Scarifier ball joint（optional） | Lubricate 4 points | 10-49 |
| -9 | Scarifier cylinder pin（optional） | Lubricate 2 points | 10-49 |
| -10 | Scarifier shaft（optional） | Lubricate 2 points | 10-49 |
| -11 | Blade cylinder yoke | Lubricate 6 points | 10-49 |
| -12 | Blade lift cylinder ball joint | Lubricate 2 points | 10-49 |
| -13 | Draw bar side shift cylinder ball joint | Lubricate 2 points | 10-50 |
| -14 | Bank control guide | Lubricate 3 points | 10-50 |
| -15 | Bank control lock pin | Lubricate | 10-50 |
| -16 | Articulation center pin | Lubricate 2 points | 10-50 |
| -17 | Articulation lock pin | Lubricate | 10-50 |
| -18 | Articulation cylinder pin | Lubricate 4 points | 10-50 |
| b | Transmission case | Check and supply | 10-51 |
| c | Final drive case | Check and supply | 10-51 |
| d | Tandem drive case | Check and supply | 10-52 |
| | | | |

| | | | |
|---|---|---|---|
| | EVERY 250 HOURS SERVICE | | |
| e | Circle reverse gear case | Check and supply | 10-52 |
| f | Hydraulic oil tank | Check and supply | 10-52 |
| g | Fan belt | Check and adjust | 10-53 |
| h | Fuel filter | Drain water and sediment | 10-54 |
| i | Parking brake lever travel | Check | 10-54 |
| j | Battery electrolyte level | Check | 10-55 |
| k | Ball joint | Check and clearance | 10-55 |
| l | Wheel hub nut | Check and retighten | 10-55 |
| m | Wheel brake | Check and adjust | 10-56 |
| | | | |
| | | | |
| | EVERY 500 HOURS SERVICE | | |
| a | Fuel filter | Replace cartridge | 10-57 |
| b | Engine oil pan and filter | Change oil and replace cartridge | 10-58 |
| c | Transmission filter | Replace element | 10-58 |
| d | Circle guide | Check clearance | 10-59 |

| No. | ITEM | SERVICE | PAGE |
|---|---|---|---|
| | EVERY 1000 HOURS SERVICE | | |
| a | Lubricating | | 10-60 |
| | Drive shaft | Lubricate 2 points | 10-60 |
| b | Transmission case | Change oil and replace element | 10-60 |
| c | Final drive case | Change oil | 10-61 |
| d | Circle reverse case | Change oil | 10-62 |
| e | Tandem drive case | Change oil | 10-62 |
| f | Hydraulic tank and filter | Change oil | 10-63 |
| g | Draw bar front ball joint | Check looseness | 10-64 |
| h | Toe –in | Check and adjust | 10-64 |
| i | Front wheel bearing play | Check and adjust | 10-65 |
| | Turbocharger rotor | Check play | Refer to the engine manual |
| | Turbocharger various fasteners | Check and retighten | |
| | Corrosion resistor | Replace cartridge | |

| No. | ITEM | SERVICE | PAGE |
|---|---|---|---|
| | EVERY 2000 HOURS SERVICE | | |
| a | Front wheel bearing | Lubricate (both right and left sides) | 10-66 |
| b | Engine breather | Clean | 10-66 |
| c | Turbocharger | Check and clean | 10-67 |
| d | Alternator, starting motor | Check | 10-67 |
| e | Engine valve clearance | Check and adjust | 10-67 |
| f | Vibration damper | Check | 10-67 |
| | | | |
| | EVERY 4000 HOURS SERVICE | | |
| a | Water pump | Check | 10-68 |
| | | | |
| | **WHEN REQUIRED** | | |
| a | Cooling system | Clean | 10-69 |
| b | Air cleaner | Check, clean or replace | 10-71 |

# Oil Fillers and Location of Oil Meters

1. Hydraulic tank oil filler
2. Fuel tank lever gauge and oil
3. Hydraulic tank lever gauge
4. Cooling water inlet
5. Final drive case oil filler
6. Engine oil pan oil filler and lever gauge
7. Tandem drive case oil filler plug
8. Transmission case drain plug
9. Transmission case oil filler and lever gauge
10. Tandem drive case drain plug filler
11. Tandem drive case lever gauge
12. Circle reverse gear case drain
13. Circle reverse gear case oil filler

## EVERY 50 HOURS SERVICE

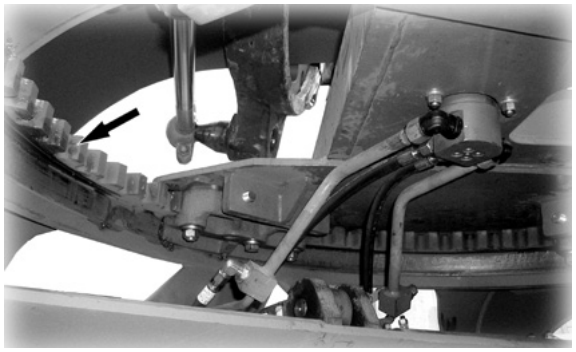
a. **LUBRICATING**

b.

APPLY GREASE TO THE GREASE FITTINGS SHOWN BY ARROWS.

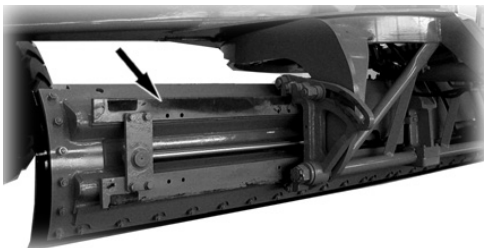
1. Circle

Apply grease all around the circle part.



2. Blade guide rail

Apply grease all over the guide rail.



## EVERY 100 HOURS SERVICE

Carry out the following maintenance only after the first 100 hours.

- Change the transmission oil and replace the filter.

For details of the method of replacing or maintaining, see the section on EVERY 500 HOURS, 1000 HOURS and 2000 HOURS SERVICE.

# EVERY 250 HOURS SERVICE

★ Maintenance for every 50 hours should be carried out at the same time.

Carry out the following maintenance only after the first 250 hours.

- Replace the cartridge of fuel filler.
- Change the oil in engine oil pan and replace the cartridge of oil filler.
- Change the oil of final drive case.
- Change the oil of circle reverse gear case.
- Change the oil of tandem drive case
- Change the oil in hydraulic tank and replace the element of filler.
- Check and adjust the engine valve clearance.

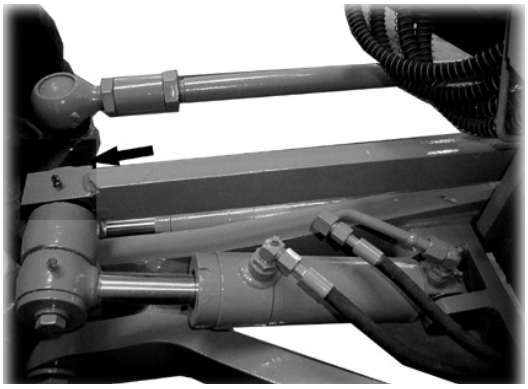
For details of the method of replacing or maintaining, see the section on EVERY 500 Hours, 1000 Hours and 2000 Hours SERVICE.

**a. LUBRICATING**

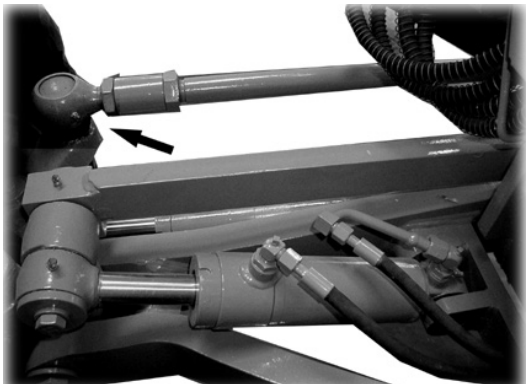
Apply grease to the grease fittings shown by arrows.

1. Leaning cylinder pin (2 points)

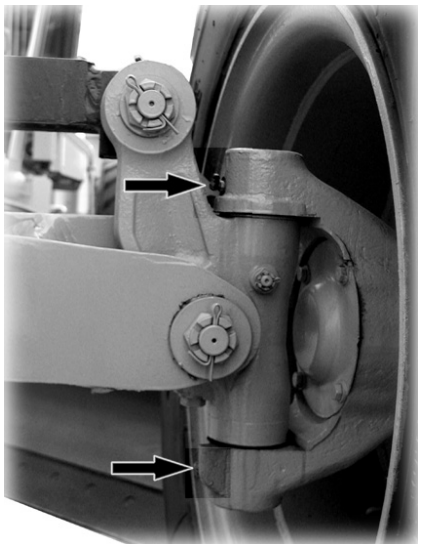
2. Leaning rod end (2 points)



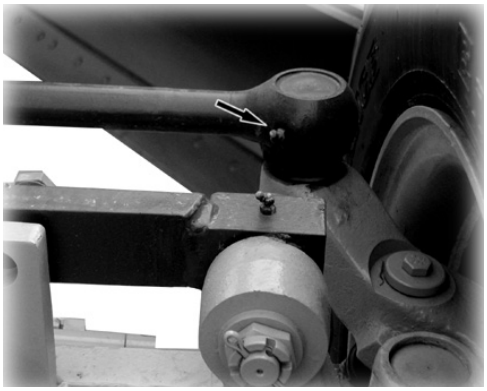
3. Steering rod (2 points)



4. Knuckle bracket king pin (4 points)

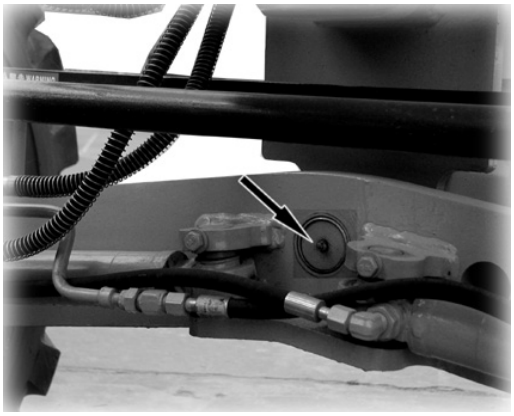


5. Steering linkage (2 points)



6. Drawbar ball joint (1 points)

7. Front axle center pin (2 points)

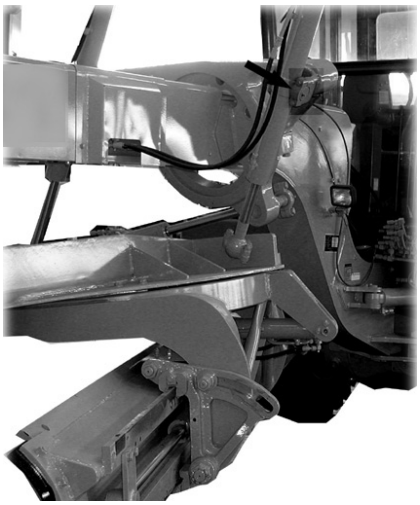


8. Scarifier ball joint (4 points)

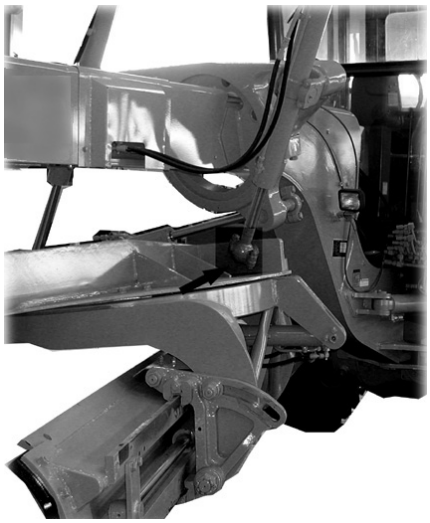
9. Scarifier cylinder pin (2 points)

10. Scarifier shaft (2 points)

11. Blade lift cylinder yoke (6 points)



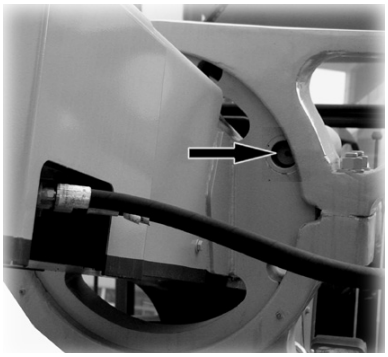
12. Blade lift cylinder ball joint (2 points)



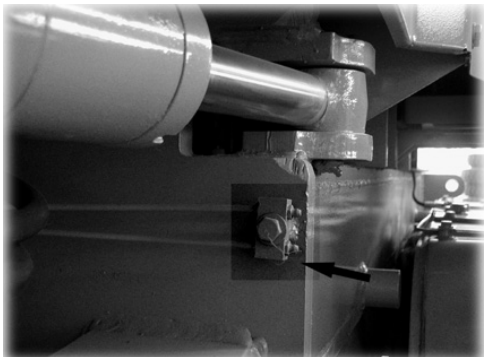
13. Draw bar side shift cylinder ball joint (2 points)

14.Bank control guide (3 points)

15. Bank control lock pin (apply grease)

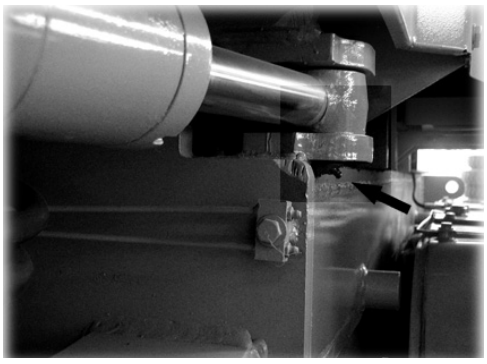


16. Articulation center pin (2 points)

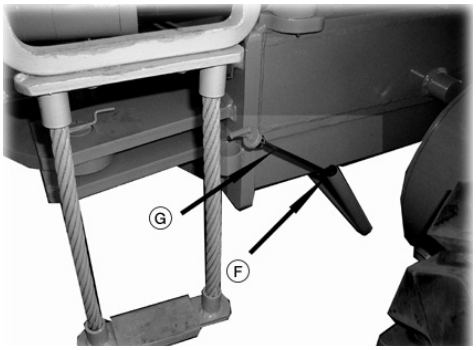


17. Articulation lock pin (apply grease)

18. Articulation cylinder pin (4 points)



**b. TRANSMISSION CASE**

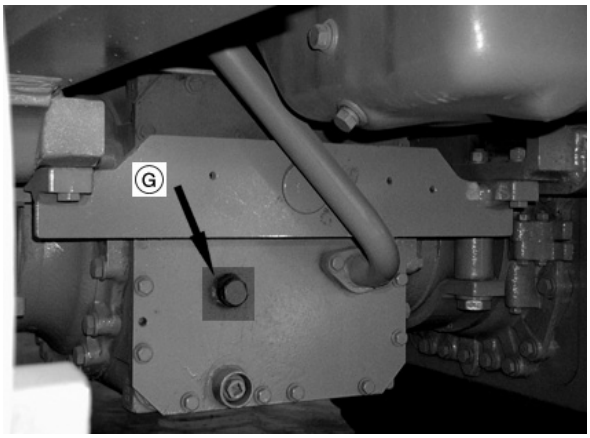



Check the oil lever with oil lever gauge (G). If necessary, add oil through filler (F).

★ Make an oil lever check 5 minutes after the engine is stopped.

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS.

**c. FINAL DRIVE CASE**

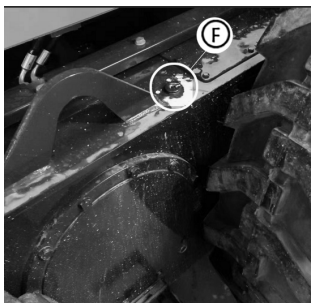




Check the oil lever with oil lever plug (G) 3minutes after stopped the engine. If necessary, add oil through filler (F).

★ The type of lubricant used depends on the ambient temperature. Select according to the table “FUEL, COOLANT AND LUBRICANTS.”

### d. TANDEM DRIVE CASE





Check the oil lever with lever plug (G). If necessary, add oil through filler (f).

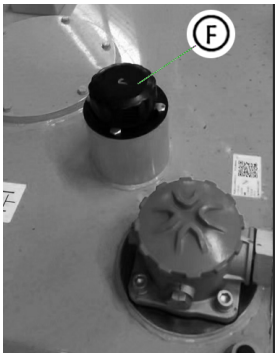
★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS.

### e. CIRCLE REVERSE GEAR CASE


Remove plug (F). Check if the oil lever is at the gear upper face. Add the gear oil through filler (F), if necessary.

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANTAND LUBRICANTS.

### f. HYDRAULIC OIL TANK


1. Set the machine in position as follows to check the oil lever.

• Return the leaning of the front tires to the upright position and face the wheels straight to the front.

• Set the front frame and rear frame facing straight (articulated angle).

• Return the draw bar side-shift and blade side-shift to the center of the machine, set the blade at right angles to the chassis and lower it lightly to the ground.

• Raise the scarifier fully.

2. Check the oil lever with sight gauge (1). Add hydraulic oil through filler (F), if necessary.

★ When removing the filler cap to add oil, confirm that oil in the tank is cold (at about the

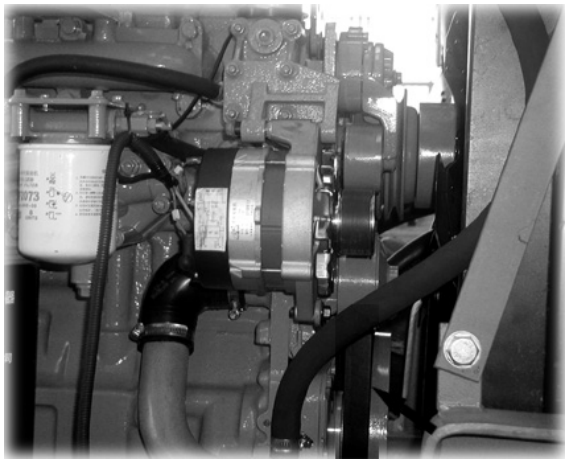
same temperature as the ambient air). The hydraulic tank is sealed, so if the filler cap is removed when oil is hot and the filler cap is tightened, the oil temperature will drop by the following morning. As a result, the pressure inside the tank to drop, and this will cause a drop in the durability of the pump.

★ When working at high altitudes or in cold weather, loosen the hydraulic tank cap to release the pressure inside the tank before starting work (when the oil is cold).

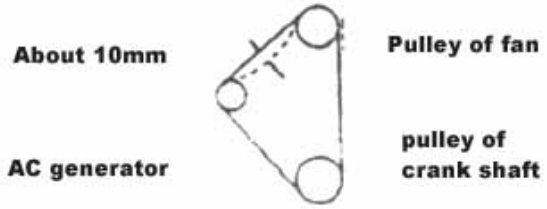
★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS.

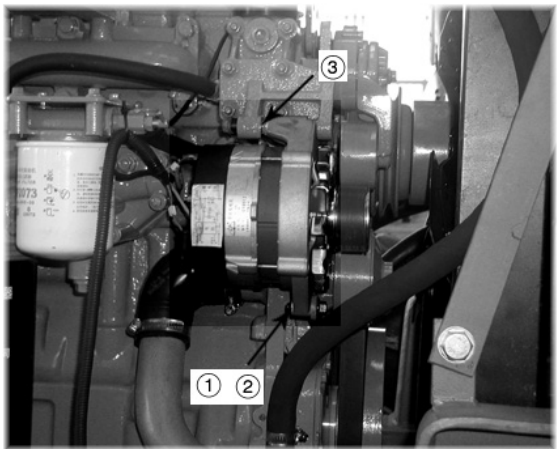
▲ When oil temperature is high, do not move cap. Hot oil sometimes shouts out.
When removing the cap, turn it slowly to relieve inner pressure.

**g. FAN BELT**



1. The belt tension should normally deflect by about 10mm when pressed with the finger at a point midway between the alternator pulley and the fan pulley (approx. 6kg).




2. To adjust the belt tension, loosen bolt (1) and nut (2) and shift alternator (3) slightly.
3. After adjustment, tighten bolt (1) and nut (2) securely.

★ When adjusting the V-belt, do not attempt to push alternator (3) directly with a bar or the like, but use a wood pad to prevent damage to the core.

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

★ Replace belt if it has stretched, leaving no allowance for adjustment, or if there is a cut or crack on belt.

**h. FUEL FILTER**

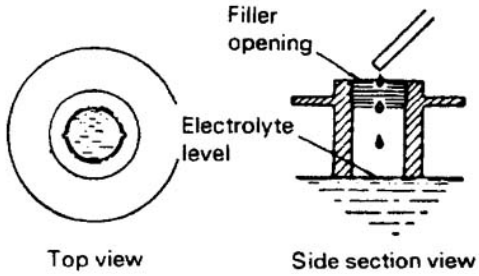

1. Remove drain plug (1) on the bottom of the filter to drain water and sediment accumulated on the bottom. After draining, tighten drain plug (1).
2. Loosen air vent plug.
3. Loosen feed pump knob and move the pump up and down to draw off fuel until air ceases to come out of plug.
4. Tighten air vent plug, push feed pump knob into place, and tighten it.

**i. PARKING BRAKE LEVER TRAVEL**

If the normal braking grip is effective by pulling the brake lever 2 to 3 ratchets from the brake release position, the brake lever travel is considered normal.

If six or more ratchets are counted before the parking brake comes into effect, the parking brake flexible shaft should be adjusted until proper lever travel can be obtained.

**j. BATTERY ELECTROLYTE LEVER**




If the electrolyte level is below the prescribed level of 10 to 12mm above the plate, add distilled water. Should any of the acid be spilt, have it replenished by the nearest battery shop with acid of the correct specific gravity.

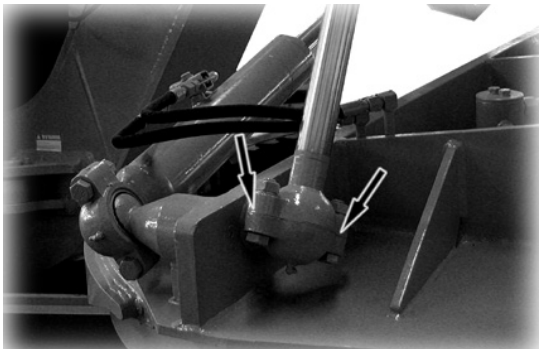
★ Clean the air hole of battery cap along with the level check.

★ Never use metal funnel for electrolyte supply.

▲ To avoid gas explosions, do not bring fire or sparks near the battery.

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

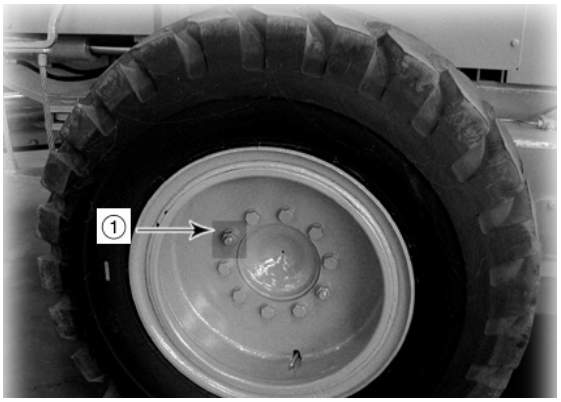
**k. BALL JOINT**



Remove all shims. Tighten the cap in such a manner that the clearances (shown in the picture) on both sides are the same. Measure the clearance with a thickness gauge, and place the shims which are thicker than the measured clearance by one shim. Then, retighten the cap. One shim is equal to 0.2mm thickness.

★ Repeat this procedure for each ball joint in the work equipment linkage.

**l. WHEEL HUB NUT**




Loose wheel hub nuts and bolts (1) will result in shortened life of tires or troubles. Carefully check loosening of the nuts.

★ Tightening torque : 450±50N. m

★ Check all the nuts and bolts for loosening. Also, check the rim for damage. If a hub bolt is broken, replace the total unit of the wheel stud.

★ When checking for loose nuts, always turn the nut in the tightening direction to check.

★ Coat the threaded part with molybdenum disulphide grease before tightening.

**m. WHEEL BRAKE**

**ADJUST**

1. Turn the adjusting gear, with the screwdriver inserted into the hole on the lower side of back plate, until the brake lining comes into close contact with the brake drum.
2. Back the adjusting gear 4 to 5 clicks.
3. Fit a 0.6mm gauge in one side of the inspection window on the left or right and check that the clearance on the other side is less than 0.4mm.
4. After adjusting, check that the travel brake pedal is within 80mm.

★ If deterioration of braking efficiency is suspected, check it as follows :

1) While the machine travels at about 20km/h of traveling speed, try lightly braking the machine (so as not to cause wheel locking) three times.
2) Touch each brake drum by hand to see whether heating of drums is felt or not.
3) Cold drum, if any, may be assumed ineffective.

★ Brake lining with block surface due to burning or lining soiled with oil causes insufficient braking effect. Polish such a lining with sandpaper.

# EVERY 500 HOURS SERVICE

Maintenance for every 50 and 250 hours should be carried at the same time.

**a. FUEL FILTER**


1. Using filter wrench, remove cartridge (1) by turning it counterclockwise.

★ Clean the filter base, and check that there is no filter seal still stuck to the filter base, there will be a gap when the new gasket is installed, and this will cause oil leakage.

2. Fill the new cartridge with clean fuel and refit it after applying a dab of oil to the gasket face.

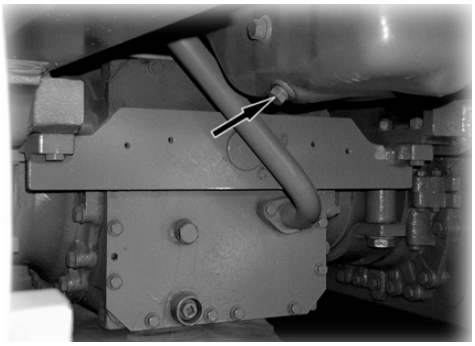
★ To refit the cartridge, place the gasket face in contact with the seal face of the filter stand, then screw up the cartridge 1/2 to 3/4 of a turn.

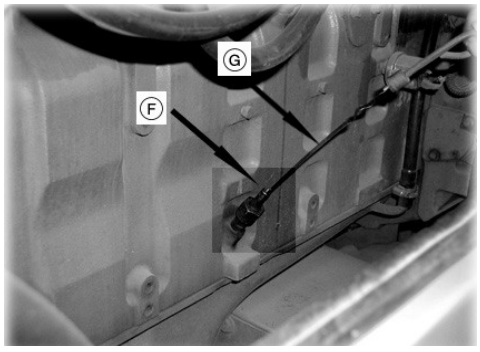
4. Loosen the knob (3) of the feed pump, and operate the pump until no more bubbles come out with the fuel from the air bleed plug.
5. Tighten the air bleed plug.
6. Loosen the fuel injection pump air bleed plug.
7. Operate the feed pump until no more bubbles come out with the fuel.
8. After bleeding the air, tighten the air bleed plug.
9. Push in the feed pump knob (3) and tighten it.

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

★ Be sure to use a genuine HYUNDAI cartridge.

## b. ENGINE OIL PAN AND FILTER




1. Loosen drain plug to drain oil. After draining, tighten it.
2. Using a filter wrench, remove cartridge (1) of the fuel oil filter by turning it counter clockwise.
3. Clean the filter base and fill a new filter cartridge with fuel oil. Then, apply a thin coat of grease to the seal.
4. After replacing the cartridge, fill oil through oil filler (F).
5. Then idle the engine for a while, and use dipstick (G) to check oil level.

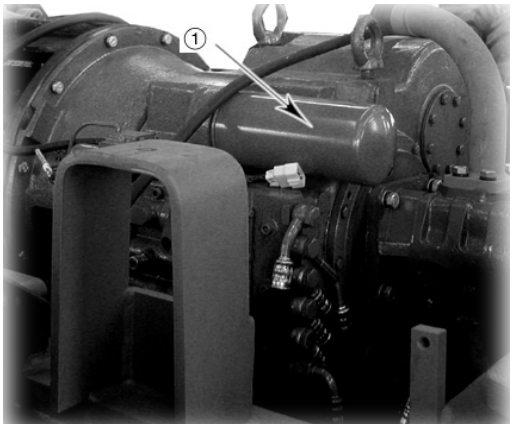
★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS.

★ Refill capacity : 17L

★ Be sure to use a genuine HYUNDAI cartridge.

★ Use API category CD class oil. If CC class oil must be used, change the oil and replace the oil filter at half the interval.

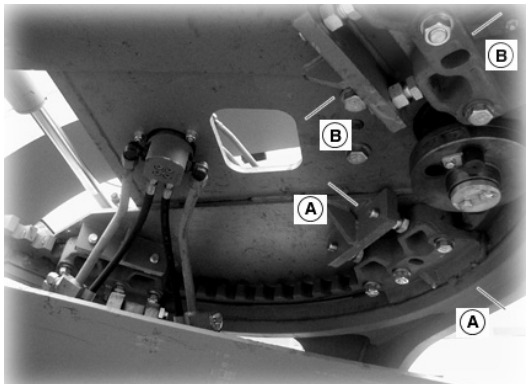
## c. TRANSMISSION FILTER




1. Remove filter case (1) and discard.
2. Install a new filter.

★ Use genuine HYUNDAI filter.

d. **CIRCLE GUIDE**




**CHECKING**

With the blade raised from the ground, check the circle guide clearances at the portions (P) and (Q), using the feeler gauge.

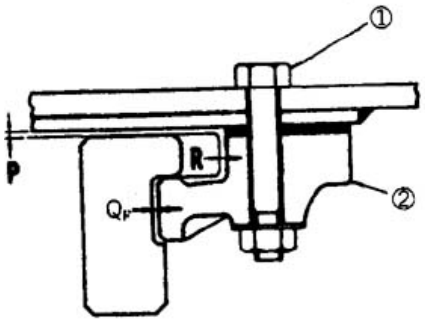
Standard clearances at the portions (P) is 1.5± 0.5mm

Standard clearances at the portions (Q) :

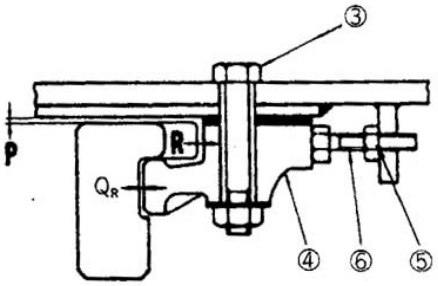
(Q)F =0and(Q)R=1.5mm or (Q)F= (Q)R=1mm

F: Front R: Rear

Section A-A




Section B-B




**ADJUSTING**

Rest the blade on the ground.

1. To adjust the clearance at portion (P), loosen bolt (1) and (3) and adjust thickness of shims for circle guide (2) and (4). Two kinds of shims different in thickness (1mm and 0.5mm) are provided.
2. To adjust the clearance at portion (Q), first loosen the bolt (1), push the circle guide (2) rearward to make the clearance $(Q)_F$ zero, and temporarily tighten the bolt (1).
3. Then, loosen the bolt (3). Loosen lock nut (5) and bolt (6), fastening the bolt (6) and turn in the bolt to push the circle guide (4) until the clearance $(Q)_R$ becomes zero. (Be sure to equally tighten the right and left bolts (6).
4. With the clearance $(Q)_R$ kept in zero, back the bolt (6) half rotation, and tighten the lock nut (5). Back the circle guide (4) until it comes into contact with the bolt (6) and tighten the bolt (3).

★ When either of the following conditions arises, replace the circle guide:

1. Clearance at portion (R) has decreased to zero.
2. Clearance between the circle tooth top and circle reverse pin gear tooth bottom has decreased to zero or clearance between the circle tooth bottom and the circle reverse pin gear tooth top has decreased to zero.

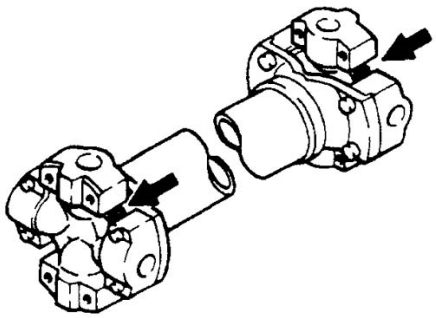
# EVERY 1000 HOURS SERVICE

Maintenance for every 50, 250 and 500 hours should be carried out at same time.

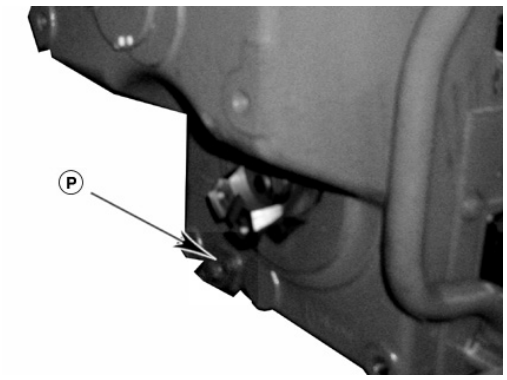
**a. LUBRICATING**

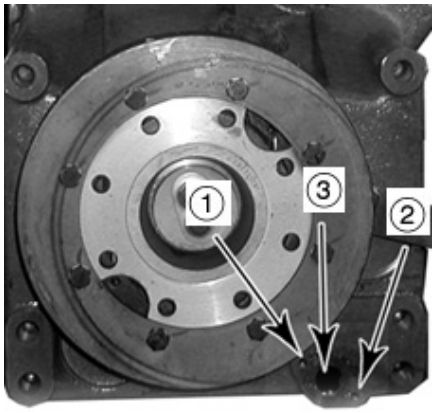
Apply grease to the grease fittings shown by arrows.

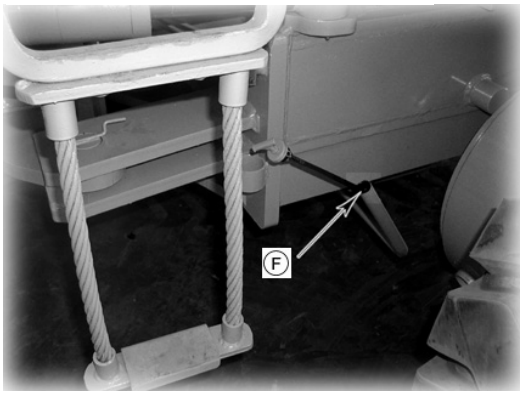
**Drive shaft (2 points**



**b. TRANSMISSION CASE**



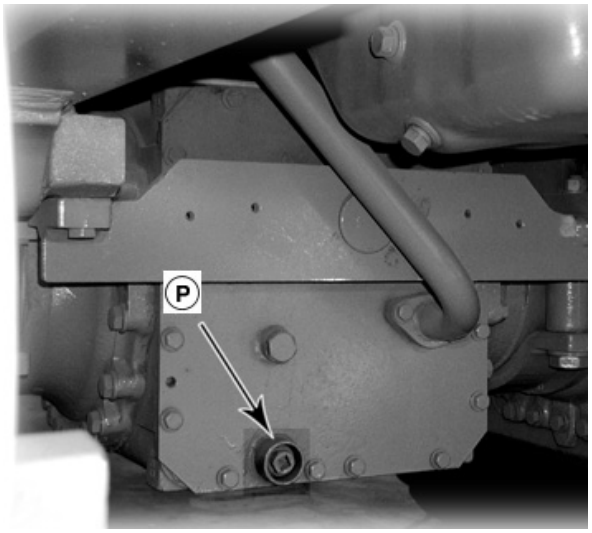




1. Remove drain plug (P). After draining oil, retighten drain plug.
2. Remove bolt (1), (2) and over (3). Wash out dust with diesel fuel.
3. After cleaning, install strainer. OR Install a new filter.
4. Refill engine oil in specified amount through filler (F). For refilling procedure see the section EVERY 1000 HOURS SERVICE.

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS

★ Refill capacity : 28 L

**c. FINAL DRIVE CASE**

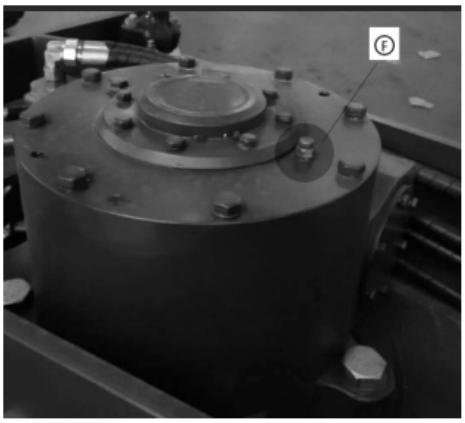



1. Remove drain plug (P) to drain oil. After draining tighten it.
2. Refill the oil through filler (F) up to the prescribed level.
3. For the refilling procedure, see the item "EVERY 250 HOURS SERVICE".

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS

★ Refill capacity : 17 L

**d. CIRCLE REVERSE CASE**

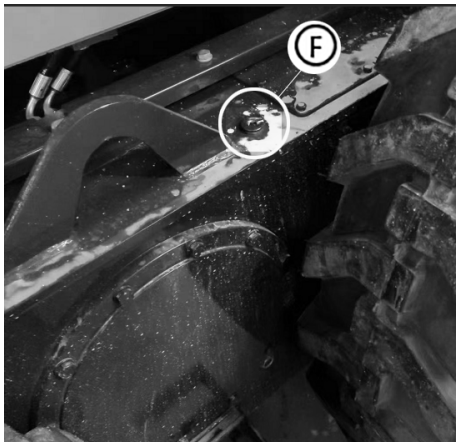

1. Remove drain plug (P) to drain oil. After draining tighten it.
2. Refill the oil through filler (F) up to the prescribed level.
3. For the refilling procedure, see the item "EVERY 250 HOURS SERVICE".

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS

★ Refill capacity : 4 L

★ A gun-metal gear is assembled inside this case, so the drained oil is different from the oil drained from other parts, because it will contain gold-colored particles. However, this is not an abnormality.

**e. TANDEM DRIVE CASE**



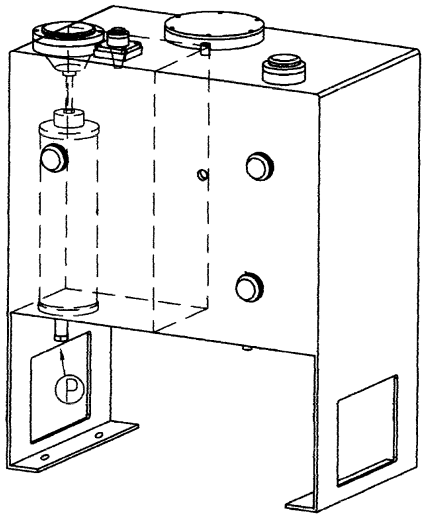


1. Remove drain plug to drain oil. After draining tighten it.
2. Remove Oil level plug (G), then add oil through oil filler (F) until oil comes out from level plug (G)
3. For the refilling procedure, see the item "EVERY 250 HOURS SERVICE".

★ The type of lubricant used depends on the ambient temperature. Select according to the table FUEL, COOLANT AND LUBRICANTS

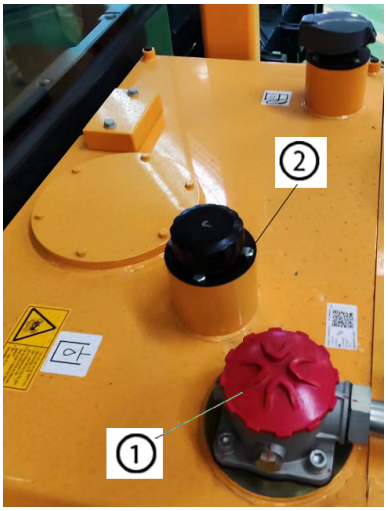
★ Refill capacity : 45L（One side）

## f. HYDRAULIC TANK AND FILTER




Set the machine in position as follows to the check the oil lever.

- Return the leaning of the front tires to the upright position and face the wheels straight to the front.
- Set the front frame and rear frame facing straight (articulated angle).
- Return the draw bar side-shift and blade side-shift to the center of the machine, set the blade at right angles to the chassis and lower it lightly to the ground.




1. Stop the engine and remove drain plug (P). After draining oil, tighten drain plug.
2. Remove cover (1) and take out element. Then clean the inside of the filter housing together with the other remove parts. After cleaning, replace with a new element.
3. Refill oil in specified amount through filler (2).
4. For refilling procedure, see the item “EVERY 250 HOURS SERVICE”.

★ The type of lubricant used depends on the ambient temperature. Select according to the table “FUEL, COOLANT AND LUBRICANTS”.

★ Refill capacity : 47 L

★ Use genuine HYUNDAI elements.

**g. DRAW BAR FRONT BALL JOINT**


Check ball joint connecting nuts (1) at the front of the draw bar for loosening. If the connecting portions are loose, retighten them.

**h. TOE-IN**

Check toe-in and adjust it so that no sideslip is caused. When no side slip tester is available, use the following procedure.

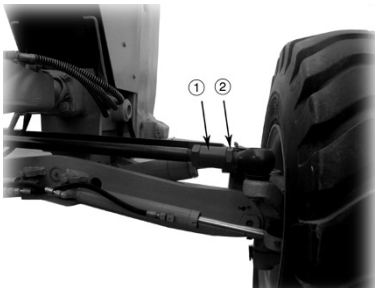
**HOW TO MEASURE TOE-IN:**



1. Park the grader on a level ground without steering and leaning the wheels. Be sure to drive straight at least a few meters before parking.
2. Measure the height from the ground to the center of the front wheel axle.
3. Mark on the front tire surfaces with the same measure taken by the above procedure.
4. Measure the distance between the two marks on the right and left tires. This distance in named “A”.
5. Drive the grader at a low speed and shift backward the mark on the tore. Stop the grader when the mark´s height from the ground surface has become equal to the same value measured in the procedure 2.
6. Measure the distance between the two marks. This distance is named “B”.

**HOW TO ADJUST TOE-IN**

When toe-in B-A is adjusted to 5±1mm of standard range, side slip is decreased to zero. If any value other than the standard range is measured, adjust toe-in using the following procedure:

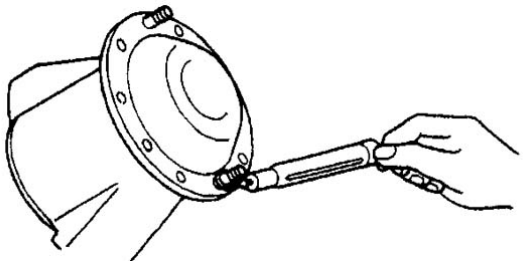



1. Loosen nut (2). Turn the tie rods with a wrench put on square portion (1). Then, tighten the lock nuts.
2. Toe-in increases when the wrench is turned in the direction shown by the arrow, and vice versa. The value of toe-in varies by 6mm when the tie rods are turned 1/3 rotation in the opposite direction to each other.

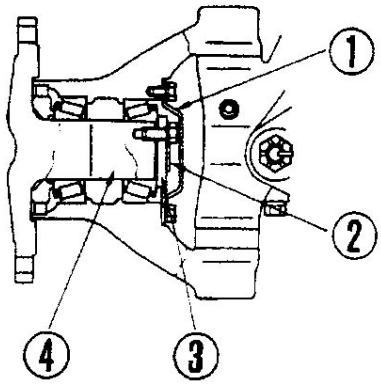
★ Keep the front axle horizontally without any leaning.

**i. FRONT WHEEL BEARING PLAY**

Raise the front wheels off the ground, using the blade or scarifier as a jack. Check hub turning torque with a spring balance hooked to a hub bolt.



1. The bearing play is normal if the front wheel is rotated smoothly with 8 to 12kg of pulling force.
2. If the inspection shows that there is play, or that the rotating force is small, adjust as follows.



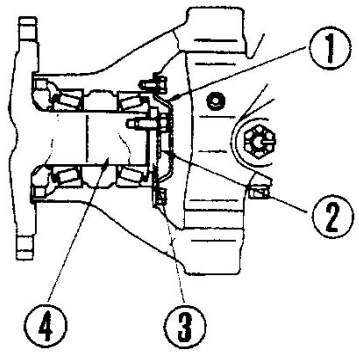

3. Remove cover (1). Select proper shims (2) and set them temporarily. Tighten bolt (3) and rotate the shaft by more than 3 revolutions each for clockwise and count-clockwise directions.
4. Loosen bolt (3). Reduce the number of shims (take out a t=0.1 or t=0.3 shims), and decide the thickness of shims properly so that the pulling force of the spring balance becomes to 8 to 12kg. This measurement of the pulling force should be done after shaft (4) has been rotated by more than 3 turns and after the bearing has ceased rotating.

★Also wait until the bearing gets down to normal room temperature for adjustment.

# EVERY 2000 HOURS SERVICE

Maintenance for every 50, 250, 500 and 1000 hours should be carried out at the same time

**a. FRONT WHEEL BEARING (GREASE BOTH RIGHT AND LEFT SIDES)**




1. Support the front axle on a block to raise the front wheel off the ground. Remove the wheels.

★When raising the front wheels, securely apply the parking brake and rest the blade and scarifier on the ground.

2. Remove cover (1), lock (2), holder (3) and hub shaft (4).

3. Clean the axle and bearing. Thoroughly wash out waste grease from the hub interior. Fill the half space of the cavity with fresh grease.

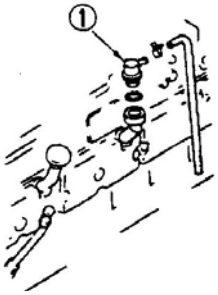
4. Replace the hub seal and the spacer.

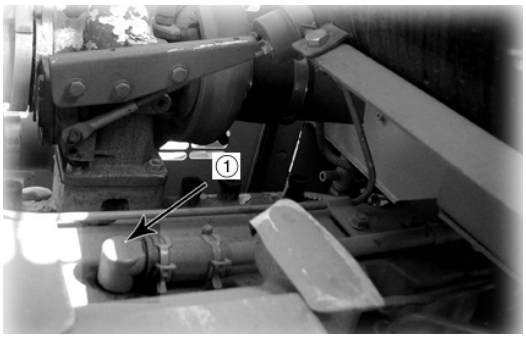
★ Before installing the hub seal, coat the lip surfaces and sliding surfaces with grease and fill the space between lips with grease.

★ Press ample quantity of grease into the axle and bearing. Heat up grease around the bearing. Install the hub.

5. For adjustment of the turning force after installing the hub shaft, refer to the section on inspection and adjustment of play in the front wheel bearing.

**b. ENGINE BREATHER**




1. Remove breather (1) from the cylinder.
2. Rinse the whole breather in diesel oil or flushing oil, dry with compressed air, then install again in the cylinder block.

★ Before taking the breather out of place, wipe the dust off the surrounding area.

★ When restoring the element to its original position, be sure to coat the new 0-ring with engine oil.

**c. TURBOCHARGER**

Excessive carbon or oil sludge adhering to turbocharger blower impeller may lead to deterioration of normal charger performance, and possible damage. Have turbocharger cleaned by Hyundai distributor.

1. Remove the turbocharger oil filler pipe and drain pipe, then remove the intake air pipe connector and blower housing so that the blower impeller can be seen.
2. Using light oil as a cleaning agent, remove the carbon, sludge and other dirt from the blower impeller. Do not use a wire brush or other tool which may damage the impeller.
3. Pour in light oil through the turbocharger oil filler and rotate the blower impeller several times to wash out the sludge.
4. Rotate the impeller by hand at least one turn at speed to check that there is contact noise or catching inside.

If the impeller does not turn smoothly, contact your Hyundai distributor of repair or replacement.

5. If there is no abnormality, dry off the light oil with compressed air after inspection, then add engine oil.

**d. ALTERNATOR AND STARTING MOTOR**

The brush may be worn, or the bearing may have run out of grease, so please contact your Hyundai distributor for inspection or repair.

★ If the engine is started frequently, carry out inspection every 1000 hours.

**e. ENGINE VALVE CLEARANCE**

As special tool is required for removing and adjusting the parts, you shall request Hyundai distributor for service.

**f. VIBRATION DAMPER**

Check that there are no cracks in the damage rubber. If there is any abnormality, contact your Hyundai distributor for repairs.

# EVERY 4000 HOURS SERVICE

★ Maintenance for every 50, 250, 1000 and 2000 hours should be carried out at the same time.

**a. WATER PUMP**

Check that there is no play in the pulley, grease leakage, water leakage, or clogging of the drain hole. If any abnormality is found, please contact your Hyundai distributor for disassembly and repair or replacement.

# WHEN REQUIRED

## a. CLEAN INSIDE OF THE COOLING SYSTEM

Clean the inside of the cooling system, change the coolant, and replace the corrosion resistor according to the table

★ Stop the machine on level ground when cleaning or changing the coolant.

★ Use a permanent type of antifreeze. If, for some reason, it is impossible to use permanent type antifreeze, use an antifreeze containing ethylene glycol.

★ Be sure to replace the corrosion resistor cartridge.

★ Use city water for the cooling water.

If river water, well water or other such water supply must be used, contact your Hyundai distributor.

▲ Antifreeze is flammable, so keep it from any flame.

| Type of antifreeze solution | Cleaning inside of cooling system and changing cooling | Replacing corrosion Resistor |
|---|---|---|
| Non permanent type antifreeze containing ethylene glycol (All season type) | Every year (autumn) or every 2000hours whichever comes first | Every 1000hours and when cleaning the inside of the cooling system and when changing coolant |
| Non permanent type antifreeze containing ethylene glycol (Winter, one season type) | Every 6 months (spring, autumn) (Drain antifreeze in spring, add antifreeze in autumn) | |
| When not using antifreeze | Every 6 months or every 1000hours whichever comes first | |

• Add antifreeze in the cooling water

When deciding the ratio of antifreeze to water, check the lowest temperature in the past, and decide from the mixing rate table.

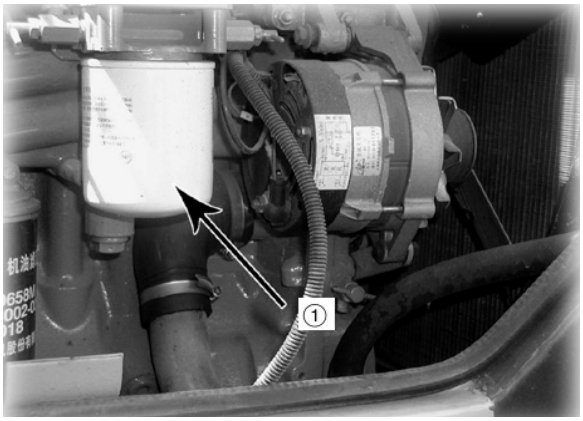
It is actually better to estimate a temperature about 10℃ lower when deciding the mixing rate.

According to the mixing rate of the actual atmospheric temperature, please refer to the mixing rate directions of the antifreeze about the mixing rate of water and antifreeze. The total volume of cooling system is about 45L.

★ We recommend use of an antifreeze density gauge to control the mixing proportion.

## CORROSION RESISTOR

1. Stop the engine and tighten up corrosion resistor valve (1).
2. Turn cap (2) slowly until it comes off.




3. Open drain valve (3) at the bottom of the radiator and plug (4) on the side of cylinder block to drain off the cooling water.
4. Drain off all the water, then close up drain valve (3), plug (4), and pour in soft water (ex: city water) up to the vicinity of the water filler.
5. When the water reaches the vicinity of the water filler, put the engine at low idling, open drain valve (3) and plug (4), then pass water through the cooling system for 10 minutes.

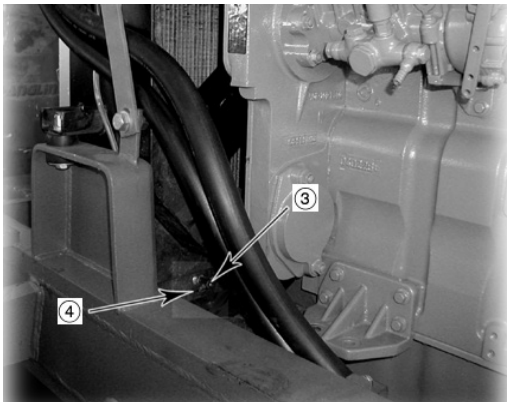
★ When doing this, adjust the inflow and outflow of water so that the radiator is always full.

6. After flushing with water, stop the engine. Close drain valve (3) and drain plug (4) after draining water.

## WATER FILLER


7. After draining water, use a flushing agent to clean.
8. After washing the cooling system, drain off all the water, then close up drain valve (3) and plug (4), and pour in soft water (ex: city water) up to the vicinity of the water filler.
9. When the water reaches the vicinity of the water filler, put the engine at low idling, open drain valve (3) and plug (4), then pass water through the cooling system until clean water comes out from drain valve (3) and plug (4).

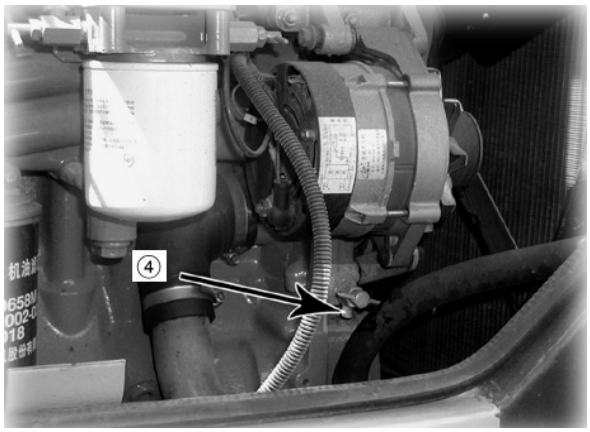
## DRAIN PLUG (BOTTOM OF RADIATOR)



10. When the water becomes completely clean, stop the engine, close drain valve (3) and plug (4).
11. Replace the corrosion resistor cartridge and open corrosion resistor valve (1).

★ For details of replacement of the corrosion resistor, see the maintenance section.

**DRAIN PLUG (CYLINDER BLOCK)**

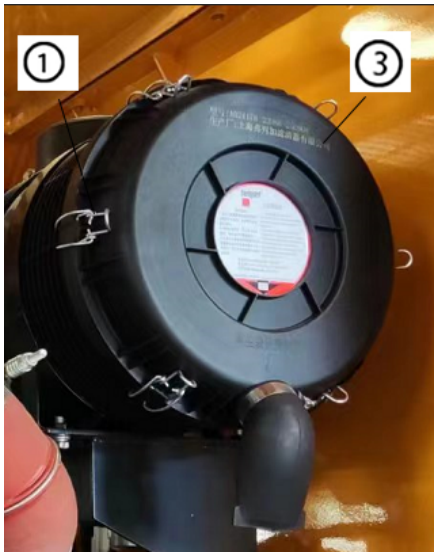



12. Supply water up to the vicinity of the water filler.
13. Run the engine for 5 minutes at low idling to eliminate air trapped in the cooling system, and run the engine for 5 minutes at high idling. (Leave water filler cap (2) off during this operation)

14. Stop the engine and 3 minutes later supply water again up to vicinity of the water filler and tighten water filler cap (2).

▲ Do not remove the cap while cooling water is hot. Hot water may spout out.
When removing radiator cap, turn it slowly to relieve inner pressure.

## b. CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT




### CLEANING OR REPLACING OUTER ELEMENT

1. Loosen the clip ① and remove the cover ②. Then remove outer element.
2. Clean the air cleaner body interior and the removed cover.
3. Clean and inspect the element (see the item "Cleaning outer element" for cleaning procedure).

4. Push the dust indicator reset button to return the red piston to the original position.

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

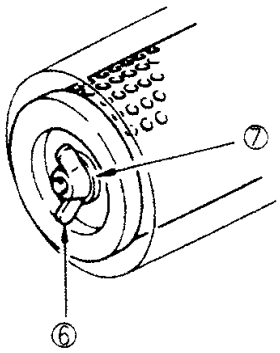
★ Replace both inner and outer elements when the dust indicator red piston appears soon after installing the cleaned outer element even though it has not been cleaned 6 times.

★ Remove one seal from the outer element. The number of times the outer element has been cleaned can be seen by the number of remove seals.

★ Check inner element mounting nuts for looseness and, if necessary, retighten.

★ When inspecting or cleaning the air cleaner, remove evacuator valve and clean with compressed air.

★ Replace seal washer (7) or wing nut (6) if they are broken.




**REPLACING INNER ELEMENT**

1. First remove the cover and the outer element, and then remove the inner element.
2. Place the cover over the air intake part to prevent dust entering.

Clean the air cleaner body interior, and then remove the cover from the air intake port.

3. Fit a new inner element and tighten it with nuts.
4. Install the outer element and the cover. Push the dust indicator reset button.

NOTE: Do not attempt to reinstall a cleaned inner element.

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

**CLEANING OUTER ELEMENT WITH COMPRESSED AIR:**

Direct dry compressed air(less than 7kg/cm² ) to element from inside along its folds, then direct it from inside along its folds and again from inside, and check element.

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

THE FOLLOWING METHODS SPARE PARTS.

WITH WATER:

Dash city water (less than 3kg/cm² ) on element from inside along folds, then from outside and again from inside. Dry and check it.

WITH CLEANING AGENT:

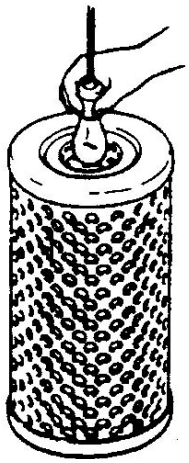
For removing oils and fats as well carbon etc. attach on the element, the element may be cleaned in lukewarm solution of mild detergent, then rinsed in clean water and left to drip dry.

★ Drying can be speeded up by blowing dried compressed air (less than 7kg/cm² ) from the inside to the outside of the element .

Never attempt to heat the element.

★ Using warm water (about 40℃) instead of soapy water may also be effective.

★ If small holes or thinner parts are found on element when it is checked with an electric bulb after cleaning and drying, replace the element.



★ If element is usable, wrap it and store it in dry place.

★ Do not use element whose folds or gasket or seal are damaged.

★ When cleaning element, do not hit it or beat it against something.

# TROUBLE SHOOTING GUIDE

This guide is not intended to cover every condition, however many of the more common possibilities are listed.

**ENGINE**

Engine oil pressure pilot lamp does not go off immediately after starting engine.

- Add the oil to the specified level.
- Replace the oil filler cartridge.
- Check oil leakage from the pipe or the joint.
- Replace the lamp .

Steam is emitted from the top of the radiator (the pressure valve).

Engine cooling water temperature gauge indicates red range.

- Supply the cooling water and check leakage.
- Adjust fan belt tension.
- Wash out inside of cooling system.
- Clean or repair the radiator fin.
- Replace the thermostat.
- Tighten the radiator cap firmly or replace the gasket of it.
- Replace the water temperature gauge

Engine cooling water temperature gauge indicates white range.

- Replace the thermostat.
- Replace the engine cooling water temperature gauge.

The engine does not start when the starting motor is turned over.

- Add fuel.
- replace the injection pump and the nozzle.
- Repair where air is leaking into fuel system.
- Check the valve clearance.
- Check the engine compression pressure.
- Refer to the section of electrical system.

Exhaust gas is white.

- Adjust to specified oil quantity.
- Replace with specified fuel.

Exhaust gas occasionally turns black.

- Clean or replace the air cleaner element.
- Replace the nozzle.

• Check engine compression pressure.

Combustion noise occasionally changes to breathing sound.

• Replace the nozzle.

Unusual combustion noise or mechanical noise.

• Replace with specified fuel.

• Check over-heating.

• Replace the muffler.

• Adjust the valve clearance.

**ELECTRICAL SYSTEM**

Lamp does not glow brightly even when engine runs at high speed.

Lamp flickers while engine runs.

• Check for loose terminals and open-circuit wiring.

• Adjust belt tension.

Charge lamp does not go out even when engine runs at high speed.

• Replace the charge lamp.

• Replace the alternator.

• Check and repair the wiring.

Unusual noise is emitted from the alternator.

• Replace the alternator.

Starting motor does not turn when starting switch is turned on.

• Check and repair the wiring.

• Charge the battery.

The pinion of the starting motor keeps going in and out.

• Charge the battery.

Starting motor turns the engine sluggishly.

• Charge the battery.

• Replace the starting motor.

The starting motor disengages before the engine start up.

• Check and repair the wiring.

• Charge the battery.

Heater signal does not glow red.

• Check and repair the wiring.

• Replace the heater relay.

• Replace the heater signal.

Outside the electrical intake air heater is not warm when touched with the hand.

- Check and repair the wiring.
- Replace the electrical intake air heater.
- Check and repair the heater switch.

**CHASSIS**

Traction is lacking. (Insufficient traveling speed)

- Refer to the section of engine.
- Check transmission.
- Release parking brake level.

Machine falls to start at any gearshift level position.

- Add oil to transmission case.
- Check and adjust transmission.

There is loud noise in the power transmitting system.

- Add oil to transmission case and the tandem case.

Excessive wear of front wheels.

- Adjust toe-in.

Heat generation at front wheel hub.

- Adjust wheel bearing installation nut.
- Apply grease.

Front wheels away while traveling.

- Adjust toe-in.
- Replace steering linkage.
- Equalize tire pressure on each side.
- Check wheel installation.
- Retighten front wheel bearing installation nut.

Steering wheel feels heavy.

- Check front tire pressure.
- Apply grease on each bearing.
- Repair piping.

Steering wheel heavy

- Give equal air pressure to both right and left tires.
- Adjust the mountings for the front wheel bearing.

Steering wheel plays too much.

- Tighten fully the link joint.

Steering wheel rugged

• Filler or replace oil, or disassemble and repair the ball nut.

Parking brake does not operate satisfactorily.

• Adjust brake pad.
• Polish lining surface with sandpaper.
• Disassemble and clean brake drum.

Excessive blade swing during work

• Adjust shims of ball joint and circle guide.
• Replace side bushing.
• Correct blade rail.

Excessive vibration of the blade when rotating under operation.

• Adjust radial clearance of the circle.

During operation, scarifier vibrates up and down.

• Adjust the shims for the hoist cylinder ball joint.

Work equipment is slow to move by operating the control level.

• Add the oil to the specified level.

Wear of parking brake lining

• Adjust clearance of lining.

## SERVICE METER

This meter indicates the integrated work hours. So, use it according to the following instructions.


• Record the readings at the start and the end of work, this is the work record of the machine.

• This record will indicate when periodical maintenance is due.

• It also indicates the integrated working hours when machine problems are encountered.

★ How the meter progresses

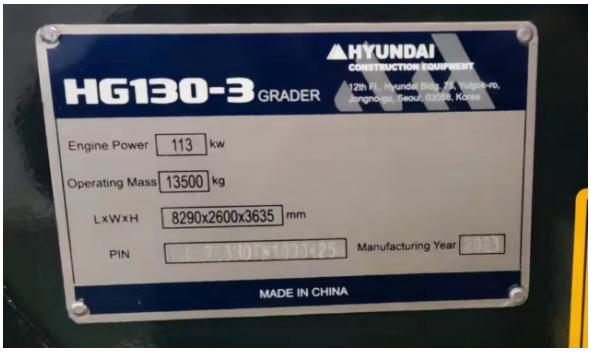
The service meter progresses by 1 when the engine is operated for one hour, regardless of the engine speed.

Consequently, if the engine is running, the service meter will advance even if the machine does not move.

# MACHINE AND ENGINE SERIAL NUMBERS

When calling for service of machine or when making replacement parts order, be sure to give your Hyundai distributor the machine and engine serial numbers as well as the service meter reading before mentioned. These numbers are found on the plates shown in the photos below.

• Location of the machine serial number mark




This is seen on the center left of the front frame.

• Location of the engine serial number mark

It is seen on the upper right of the cylinder block, when seen from the fan side.

# FUEL, COOLANT AND LUBRICANTS

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

## Oil Form of Motor Grader (in Common Condition)

| Type | Season | Temperature℃ | Standard code | Note |
|---|---|---|---|---|
| Fuel oil | Winter | -5～10 | diesel | Fuel tank |
| | Summer | 4～40 | | |
| Diesel engine oil | All the year around | -15～40 | SAE API CF-4 | |
| Torque converter oil | All the year around | -15～40 | **SAE 15W-40** | |
| Hydraulic oil | Winter | -10～10 | ISO VG46, VG68 | Working hydraulic system |
| | Summer | 0～40 | | |
| Gear oil | All the year around | -10～40 | GL-5 | Axle and balancing tank worm gear case |
| Brake oil | All the year around | -20~40 | GB10830-1998 (DOT-3,SAE J1703) | Brake system |
| Grease | All the year around | -20~40 | SH/T0380-1992 Compound lithium grease | Antifriction bearing Various pin |
| Antifreeze | All the year around | -40~40 | SH/T0521-1999 Automobile ethylene glycol refrigerant | |
| | | -15~40 | | |

## Oil Form of Motor Grader (Exported to Cold Region)

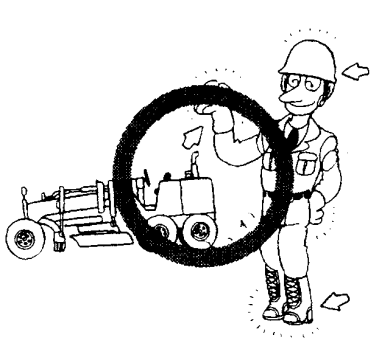
| Type | Season | Temperature℃ | Standard code | Note |
|---|---|---|---|---|
| Fuel oil | Cold | -44～0 | ASTM D975 NO.1 | Fuel tank |
| Diesel engine oil | Cold | -40～40 | SAE API CF-4 | |
| Hydraulic oil | Cold | -38～0 | L-HS | Working hydraulic system |
| Gear oil | Cold | -40～40 | GB13895-1992 GL-5 | Axle |
| Brake oil | Cold | -40～40 | Mobil Universal Brake Fluid DOT 3 | Brake system |

| | | |
|---|---|---|
| 1 | Fuel(diesel) | 270L |
| 2 | Engine lubricating oil | 17L |
| 3 | Oil for converter and gear box | 28L |
| 4 | Oil for hydraulic system | 47L |
| 5 | Oil for driving rear axle | 18L |
| 6 | Tandem box | 90L |

# Safety and Operation

# SAFETY HINTS

## OPERATION GENERAL



- Wear proper clothes

  Loose clothes, ornaments or other things that may possibly contact the control lever or other machine parts must not be worn. Do not let you clothes get caught on protruding parts of the machine. Do not wear oily clothes since they may catch fire.
- Wear well-fitting helmet, safety shoes and working clothes. If the nature of the work requires safety, wear protective goggles or mask, thick gloves, earplugs or other protection.
- Accidents or injuries are liable to occur when the operator is careless or slack. It is most important to bear safe operation in mind at all times.

- Take care of your health. Do not drive when tired, or after drinking.
- Learn the prohibitions, cautions and rules about work procedures in the work site.

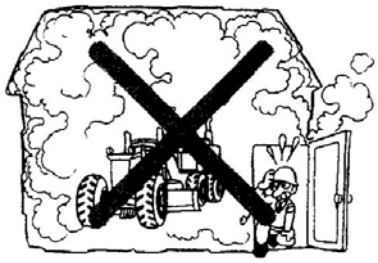
  When there is a leader, fix standard signals and always follow these signals when operating.
- If there should be an accident or fire or any other such unexpected mishap, deal with it quickly, using the nearest apparatus.

  Learn beforehand the locations of the first aid boxes and fire extinguishers and how to use them. It is also important to know the emergency contact system.
- Learn about the safety devices on your own machine and about how to use them. Confirm that they are correctly attached in the prescribed position.

Such safety devices include:

★ Canopies
★ Guards
★ Protective Devices
★ Roll-over Protective Structures
★ Seat Belts, etc.

- Take care not to get caught by protruding parts of the machine. Do not wear oil-stained clothing because it is likely to catch fire.
- Keep fire away from stored fuel, lubricants and anti-freeze.



• Exhaust gas is dangerous. When running the engine for long periods in a poorly ventilated area, there is a danger of gas poisoning, so open the windows or doors to ensure a good supply of fresh air.

• Read the Operation and Maintenance Manual carefully. Learn how to use the control devices, gauges and warning devices. Be sure you understand the meaning of the Caution plates. Remember the checkpoints and checking method for engine oil, fuel, cooling water and hydraulic oil levels.

• When working on a road, pay attention to the safety of passing vehicles and pedestrians. If necessary, assign a signalman or provide temporary barricades.

• Before starting the machine, perform all necessary checks as stated in the Operation and Maintenance Manual.

**BEFORE STARTING OPERATION**

• Examine the lay of the land and the kind of oil at the work site to determine the dangerous points and the best method of operation. Proceed with the work only after making safety arrangements about the dangerous points.

• Inspect leakage from the fuel, lubricating and hydraulic system. Repair any fuel or oil leakage, and wipe off all dirty oil.

• Check that tire inflation pressure is standard, that hub nuts are not loosened, and that no other parts are damaged or missing. Machines having such failures should not be operated.

• When getting on or off the machine, use the hand-rail and step provided. Do not jump or down from the machine.

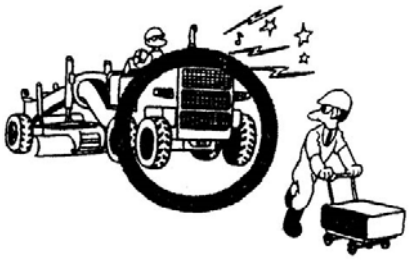
• Do not leave parts or tools lying around in the vicinity of or on the floor of the operator´s compartment. Keep everything in its proper place.

• Wipe off thoroughly any grease, oil or mud on the step, handrail, floor or control levels. Failure to do this may cause you to slip.

• Check the level of the fuel, lubricants and cooling water. Extinguish cigarettes before checking or replenishing. Check that the radiator cap and each oil filler caps or plugs are firmly tightened.

• Adjust the operator´s seat until it is in the most comfortable position for operating.

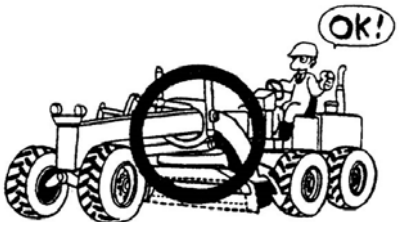
• If a seat belt is provided, always use it. If the belt is damaged or worn, replace it with a new one



- To ensure the safety of workers near the machine, always sound the horn to warn them before starting the engine and moving the machine. Be particularly careful to check that the rear is clear before backing the machine.
- Combustible materials such as pieces of wood, dead leaves, and pieces of paper may cause fire, so inspect the inside of the engine room and remove them.
- Before starting the engine, confirm that all control levels are in “NEUTRAL” or “HOLD” POSITION.

**AFTER STARTING ENGINE**

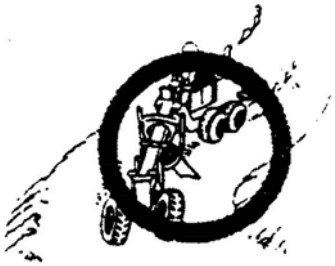
- Confirm that all gauges and warning devices are functioning correctly and that the gauge readings are within the prescribed range.
- Check the play and travel of each level and pedal.




- Operate the blade to confirm that they are functioning normally.

- Move the machine slowly and listen carefully to the engine or gears to confirm that they are not making any unusual noises.

- Operate the gear shift level to confirm that the travel speeds for forward and reverse are functioning normally.



- Choosing a safe place, turn the machine to the left and right to confirm that the steering devices are functioning normally.
- If these tests reveal anything wrong, however slight it may be ,contact the man in charge of the machine and operate the machine only after obtaining his permission.

## DURING OPERATION

• Always concentrate. It is extremely dangerous to allow yourself to be distracted or to think of other things when operating a machine.

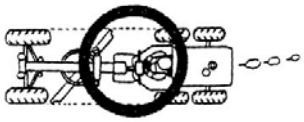
In dangerous place, or where there is restricted visibility, it is important to get down from the machine and confirm whether it is safe before continuing work.

• The work area should be made as flat as possible. If the work area is flat, operation is made much easier and this reduces operator fatigue.

• The machine should always be operated at a speed where it can be correctly controlled. Never do the following:

★ Speeding
★ Sudden starting, sudden braking, sudden turning.
★ Snaking
★ Coasting

• Be careful of those around you, and always confirm that there is no person or obstacle in the way before driving or turning the machine.
• Always operate slowly in crowded places. On haul roads or in narrow places, give way to loaded vehicles.

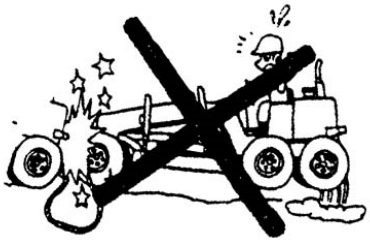


• Raise each work piece of equipment as high as possible and keep the blade within the machine width while traveling. Maintain the specified traveling posture.

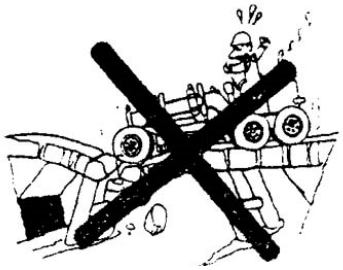
• Do not control the vehicle speed by pressing the brake as it will overheat the brake disc.
• Do not allow unauthorized persons into wok area.

• Always be aware of the operating capacity of the machine. Using the machine to do work beyond its capacity will not only damage the machine, but may even cause unexpected accidents.

- The machine condition can be judged from many factors. Changes in the gauges, sound, vibration, exhaust gas color or response of the control levels can indicate the occurrence of some disorder. If any disorder occurs, park the machine immediately in a safe place and take appropriate action. Be especially careful in the case of a fuel leak, as there is danger of fire.
- If the machine breaks down and needs to be towed, first confirm that the brakes are working properly, and then tow, using a wire rope or any other suitable towing equipment.
- When parking the machine after discontinuing work, put the gear shift level into “NEUTRAL”, apply the brake lock, lower the blade , scarifier and ripper to the ground and put all safety levers into “LOCK”, position. Never leave the operator´ s seat without switching the engine off.



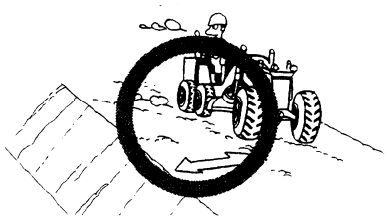
- When continuing operations after rain, remember that conditions will have changed from those before the rain started, so proceed with caution.
- Be particularly careful when approaching the shoulder of the road or cliffs, as they may have been loosened by the rain



- Check the load of limits of bridges before crossing.
- When operating on uneven ground, drive at low speed as possible and avoid sudden changes in direction.
- When operating at the edge of a cliff or on the shoulder of a road, remember the following points:

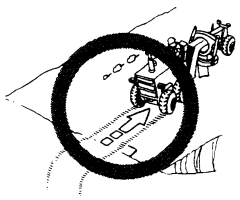
Do not approach the edge of the cliff or road shoulder by mistake.

- When operating in a place where is danger of the machine falling over the side, be doubly careful.

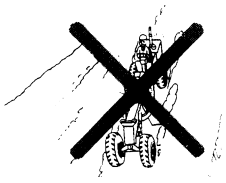


• When working on river embankments or other places made of piled soil, there is the danger that the weight or vibration of the machine may cause the machine to sink into the piled soil, so be extremely careful when operating in such places.

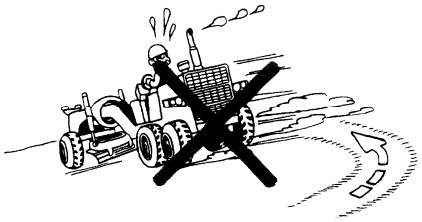
• When operating on slopes, remember the following points:



• When driving on a slope, always drive directly up or down it. Never drive horizontally or diagonally across the slope, as this may cause the machine to roll over or slip sideways.

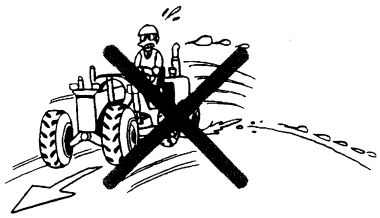


• When going down a slope, use the engine as a brake. If this is not enough to control the speed of the machine, use the wheel brake as well. Never coast down a slope with the gearshift lever in “NEUTRAL” or with clutch disengaged.



• As far as possible, avoid turning the machine on a slope. It may cause the machine to roll over or slip sideways.

• Before going up to down a slope, select a travel speed most suited to the slope. Do not change gear on the slope.



• If the engine stalls on a slope, first use the brake to stop the machine, then return the gear shift lever to “NEUTRAL” before starting the engine again.

• When using the articulation system, be particularly careful not to let the blade damage the rear tires.

• Operating the articulation system when traveling at high speed may cause the machine to overturn.
  Always perform this operation at a speed below 10km/h.

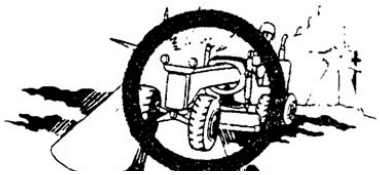
• Always observe the traffic regulations and leave margin for emergencies.

• When operating in a city area, be sure to locate underground pipes and cables before starting the machine to prevent them from being broken.

- When operating inside a building always be sure of the clearances of the ceiling, entrance, aisles, etc, and the load limit of the floor.
- Never allow other person than the operator to ride on the machine during operation.
- When passing through a narrow space, be careful of the side and overhead clearances. Take special care not to touch any obstacles

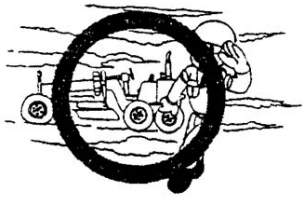
on either side or overhead. If necessary, have someone outside the machine call out instruction.

- When operating at night, remember the following points:



- Be sure to arrange an adequate lighting system.

- At night it is very easy to make mistakes in assuming the distance and height of objects and land.



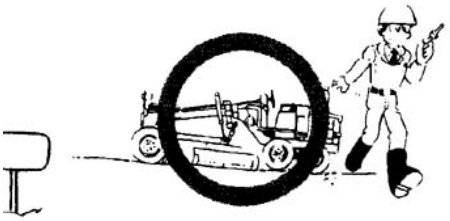
- When operating in fog, mist or smoke, where visibility is bad, be especially careful to confirm first whether operation is safe.
- When visibility drops below safety level, stop work and wait for the visibility to improve.

- cleaning snow, remember the following points:

- Even slight slopes can cause unexpected side slipping, so in such places, operate with extreme caution.
- When show is throw to one side of the machine, take enough caution to obstacles covered under the snow.

- Never use the wheel brake to stop suddenly on slopes. Lowering equipment is a far more effective method.
- During operating, use the seat belt.

**PARKING**

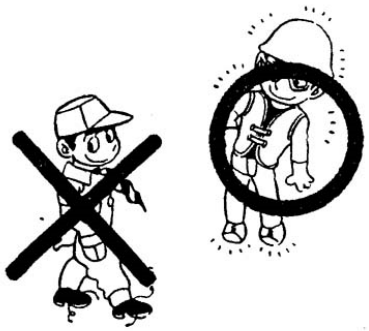


• When parking the machine, park it in a safe place outside the working area, or the specified place. The following factors should be considered when choosing a parking place: it should be on flat, firm ground where there is no danger of rock-fall, landslides or floods. If the machine has to be parked on a slope, it should be parked facing directly up or down the slope, and chocks should be placed under the tires. When the machine is facing downhill, lower the blade so that it cuts slightly into the ground to further increase the safety.

•When parking the machine, return the gear shift lever to “NEUTRAL”, apply the brake lock, lower the blade, scarifier and ripper to the ground, and put all safety levers in the “LOCK” position. Switch off the engine and remove the key.

# PRECAUTION FOR MAINTENANCE

## GENERAL



• Wear proper clothes

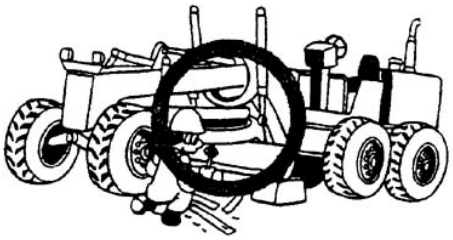
Loose clothes, ornaments or other things that may possible contact the control lever or other machine parts must not be worn.

Do not let you clothes get caught on protruding parts of the machine. Do not oily clothes since they may catch fire.

Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles.


• Fuel or oil are dangerous substances. Never handle fuel, oil, grease or oily clothes in places where there is any fire or flame. As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire-fighting equipment.

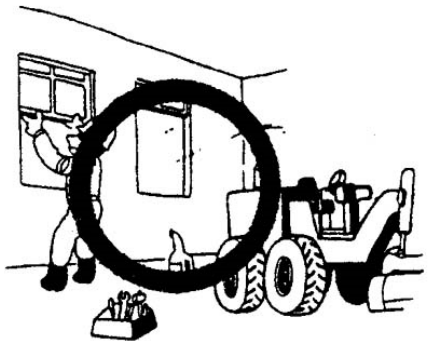
• Always stop the engine before cleaning the machine or adding fuel.



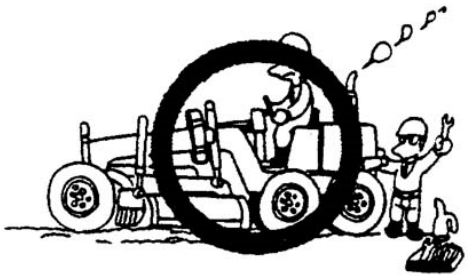
• When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.

• Do not handle electrical equipment while wearing wet gloves, or in wet places, as this can cause electric shock.

• During maintenance, do not allow any unauthorized person to stand near the machine.



• Exhaust gas is dangerous. When working inside, be particularly careful to have good ventilation.



• Unless you have special instructions to the contrary, maintenance should always be carried out with the engine stopping. If maintenance is carried out with the engine running, there must be two men present: one sitting in the operator´s seat and the other one performing the maintenance. In such a case, never touch any moving part.

• Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first. The procedure for releasing the hydraulic pressure is as follows: lower the blade, scarifier and ripper to the ground, and stop the engine,

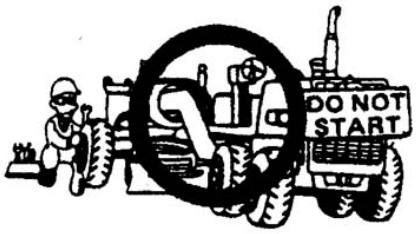
Move the control levers to each position two or three times and then slowly loosen the oil filler cap.

- Always use Hyundai genuine parts for replacement.
- Always use the grades and oil recommended by Hyundai. Choose the viscosity specified for the ambient temperature.
- Always use pure oil or grease, and be sure to use clean containers.
- When checking or changing the oil, do it in a place free of dust, and prevent any dirt from getting into the oil.

**DURING MAINTENANCE**

- Park the machine on firm, flat ground. Lower the blade, scarifier and ripper to the ground and stop the engine. Return the gearshift lever to "NEUTRAL" position, apply the brake lock and set each control lever to "LOCK". When maintenance has to be carried out with the blade, scarifier and ripper raised, they must be securely supported by blocks.

- Thoroughly wash the machine. In particular, be careful to clean the filler caps grease fittings and the area around the dip sticks. Be careful not to let any dirt or dust into the system.




- Hang a caution sign in the operator´s compartment (for example "Do not start" or "Maintenance in progress"). This will prevent anyone from starting or moving the machine by mistake.

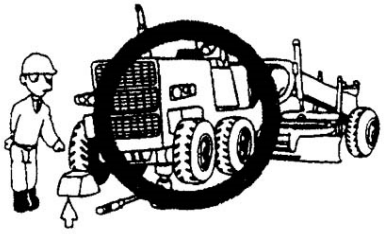
- Flame should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil, fuel, anti-freeze or electrolyte.
- Immediately remove any oil or grease on the floor of the operator´s compartment, or on the handrail. It is very dangerous if someone slips while on the machine.

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

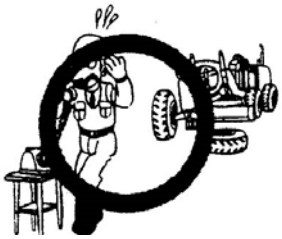
- Before draining the oil, warm up it to a temperature of 20 to 40℃
- Be particularly careful when removing the radiator cap or the hydraulic oil tank filler cap. If this is done immediately after using the machine, there is a danger that boiling water or oil may spurt out.

- After replacing oil, filter element or strainer , bleed the air from the circuit.
- When the strainer is located in the oil filler, the strainer must not be removed while adding oil.
- When adding oil or checking the oil level, check that the oil at the correct level.
  When adding oil or fuel, do not let the oil or fuel overflow.
- If oil or water are spilled, always wipe it up. Spilled oil or water may cause people to slip and the spilled oil may cause fire.
  If oil is piled on top of a place where fuel has been spilled, remove the oil.
- After greasing up, always wipe off the old grease that was forced out.
- When changing the oil or filter, check the drained oil and filler for any signs of excessive metal particles or other foreign materials.
- When removing parts containing 0-rings, gaskets or seals, clean the mounting surface and replace with new sealing parts.

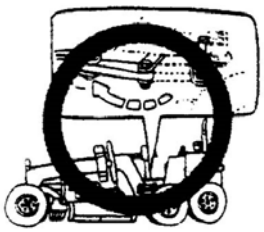
- When the work equipment is raised for inspection or repair, always place blocks underneath to prevent falling.



- When the machine is jacked up, always put chocks against the wheels on the opposite side. After jack up, place blocks prevent the machine from falling.

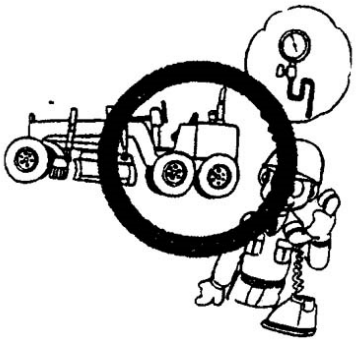


- Disassembly, repair and assembly of tires require special equipment and high skill. Always consult a specialized tire repair shop.



- Always lock the front and rear frames before inspecting and servicing the machine.

• Put the glove when use the wrench to maintain the cutting blade.



• Special measuring apparatus is needed for testing hydraulic pressure.

•Remove the minus terminal from the battery in maintaining the electrical system.

• When carrying out other difficult maintenance work, carrying them out carelessly can cause unexpected accidents. If you consider the maintenance is too difficult, always request the Hyundai distributor to carry it out.

# HANDLING OF BATTERY

## PRECAUTIONS FOR CHARGING BATTERY

▲ Before starting the engine, use a damp cloth to wipe off the dust accumulated on the top surface of the battery.

1. Before charging, disconnect the cable from the negative (−) terminal of the battery; otherwise, an abnormal high voltage will damage the alternator.
2. While charging the battery, remove all battery plugs for satisfactory ventilation. To avoid gas explosions, do not bring fire or sparks near the battery.
3. If the electrolyte temperature exceeds 45℃, stop charging for awhile.
4. Turn off the charger as soon as the battery is charged.

Over charging the battery may cause followings:

1) Overheating the battery
2) Decreasing the quantity of electrolyte
3) Damaging the electrode plate

5. If the electrolyte gets on your skin or clothes, immediately wash plenty of clean water.
6. Do not mix up cables positive (+) to negative (−) or negative (−) to positive (+), as it will damage the alternator.
7. When inspecting or servicing a battery, be sure to stop the engine and turn the starting switch key to "OFF" position.
8. When performing or service to battery besides checking the electrolyte level or measuring the specific gravity, disconnect cables from the battery.

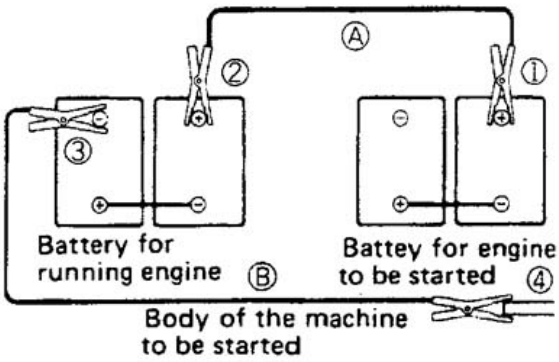
## REMOVAL AND INSTALLATION OF BATTERY

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

## STARTING ENGINE WITH A BOOSTER CABLE

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

1. Before connecting the booster cable
   i. Size of booster cable and clip should be suitable for the battery size.
   ii. Check cables and clips for breakage and corroded surfaces, etc.
   iii. Make sure cables and clips are firmly secured.
   iv. Keep the starting switch key in OFF position.
   v. The battery of the running engine must be the same capacity as that of engine to be started.
2. Connect the booster cables in the following manner:
   1) Connect one clip of booster cable A to the positive (+) terminal of the engine to be started.
   2) Connect the other clip to the positive (+) terminal of the engine which is running.
   3) Connect one clip of booster cable B to the positive (−) terminal of the engine which is running.
   4) Connect the other clip to the body of the machine to be started.



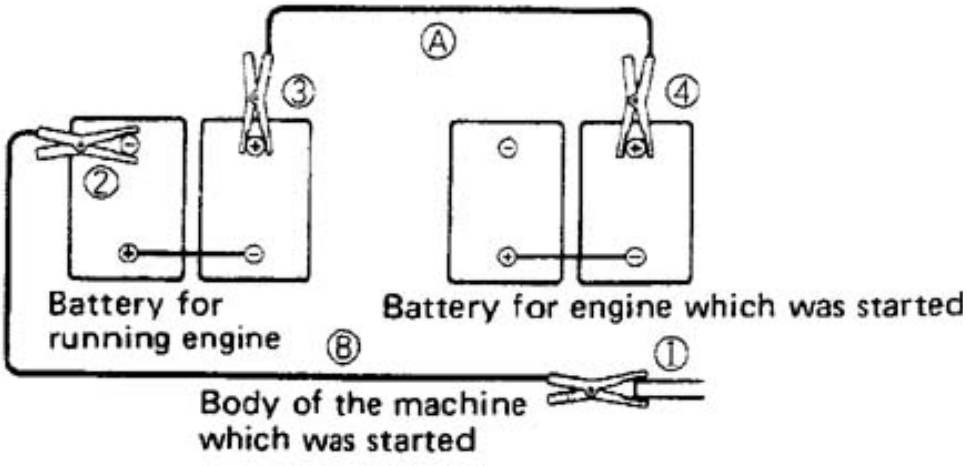

Make sure the clips are firmly connected to battery terminal. Then, start the engine.
When connecting the cables, never connect the positive (+) and the negative (−) terminals.
Make sure that the booster cable connections are correct. Connect the booster cable to the body as far as possible from the battery.

3. Starting the engine
   1) Turn the starting switch key to START position and start up the engine.
   2) If the engine doesn´t start at first, try again after 2 minutes or so.

After the engine has started, the booster cables should be disconnected in the reverse order in which they were connected.

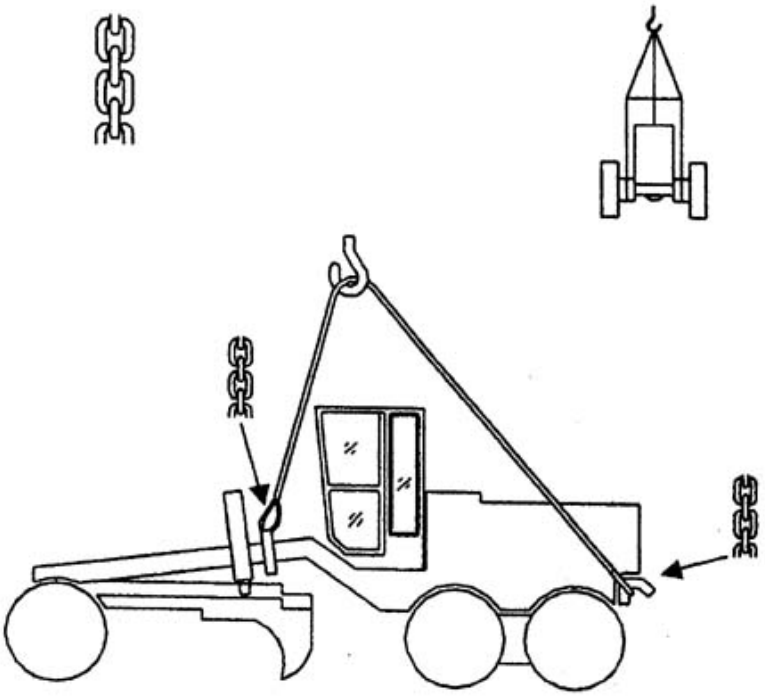
Disconnecting the booster cables

(1) Disconnecting the clip of booster cable B from the body of the machine which was started.
(2) Disconnecting the other clip from the negative (−) terminal of the running engine.
(3) Disconnecting the clip of booster cable A from the positive (+) terminal of the running engine.
(4) Disconnecting the other clip from the positive (+) terminal of the engine which was started.



# HANGING UP

When need to hang up the machine in special case, the articulation lock pin between the front and rear frames should be locked first. Then, use a wire rope to pass through the hang ring on the machine body shown in the below figure, and hang up the machine according to the mark requirement on the tail of the machine.



# TRANSPORTATION

In addition to strict observance of traffic laws and rules concerned, it is desirable to provide a special platform for loading and unloading of the motor grader, if it is necessary to use a ramp when loading a motor grader on a trailer or unloading it from a trailer, observe the following instructions to assure safety:

1. Securely brake the trailer and chock trailer tires. Securely fix the ramp boards in place so that the center of motor grader being loaded coincides with the centerline of the trailer.

★ Width, length and thickness of ramp boards must large enough to assure safe loading and unloading of the motor grader.

▲ Remove the mud form the undercarriage to prevent the machine form slipping to the side on slopes.

2. Slowly travel the motor grader on the ramp straight.

▲ Never attempt to change the direction of travel on the ramp. If it is necessary to change the direction of travel, once return the machine to the original position.

3. Properly load the motor grade on the trailer at the specified position. To prevent the grader on the trailer from moving back and forth during transportation, apply a chock to front and rear of each wheel and fix the motor grader with chains and wire ropes. Pay special care to prevent the grader from slipping sideward.

4. Rest the work equipment on the trailer deck and observe the following:
   - Pull the parking brake lever.
   - Place the gearshift lever in the neutral position.
   - Place work equipment control lever in hold position.
   - Apply safety locks.
   - Pull the starting switch key out.

★ Determine the optimum transportation route, taking width of road and permissible overhead clearance and weight limitation into consideration.

★ Lock the articulation lock pin in the same way as for normal travel.

▲ Do not leave the front wheels raised off the trailer deck using the brake as a jack. The front wheels will fall gradually during transportation.

▲When loading the machine, choose a firm level road surface. Be sure that you are well clear of the road shoulder.

★ When transporting this machine, check with your Hyundai distributor for advice.

# STORAGE

## BEFORE STORAGE

To place the machine in storage for an extended period of time, the following measures must be taken to insure that it can be returned to operation with minimum of service.

- After every part is washed and dried, the machine shall be housed in a dry building. Never leave it outdoors.
  In case it is indispensable to leave it outdoors, lay wood plates on the ground, and park the machine on the wood plates and cover it with canvas etc.
- Completely fill fuel tank, lubricate and change oil before storage.
- Lower the air pressure in the tires to about 80% of the standard operating pressure.
- Give a thin coat of grease to metal surface (hydraulic piston rods and oil seal).
- As to batteries, remove the terminals and place cover on them, or remove them from the machine and store separately.
- In case the atmospheric temperature may drop below 0℃, add antifreeze in the cooling water.

★ Set the gear shift lever to neutral position, set the fuel control lever to engine stop position, and apply the parking brake.

## DURING STORAGE

- Operate the engine and move the machine for a short distance once a month so that new oil film will be generated and exhaustion of oil film in a long period will be prevented.

★ Before using work equipment, wipe off the grease form the hydraulic piston rod.

▲ When it is unavoidably necessary to carry out rust preventive operation indoors, open all windows and doors to circulate the air and prevent the accumulation of poisonous gases.

## AFTER STORAGE

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

- Loosen the drain plugs on oil pan and other cases and drain mixed water.
- You should request Hyundai distributor for following service.

1) Remove the cylinder head cover and lubricate sufficiently valves and rocket arms. And inspect the valves operation.
2) Remove the oil pipe flange on the turbocharger oil inlet, fill with 0.5 to 1L engine oil, and leave the flange lightly loosened
   Then, rotate the engine by the starting motor without fuel injection and decompression so that the dis charge of oil is confirmed. Then, tighten the flange and start the engine.

- To bleed the air from the hydraulic cylinders or hydraulic piping, run the engine at low idling and do as follows.

1) Operate each hydraulic cylinders 4 to 5 times, stopping 100mm from stroke end.
2) Next, operate each hydraulic cylinder 3 to 4 times to the stroke end.

★ If the engine is run at high speed at first, or if the cylinder is moved to the end of its stroke, the air in the cylinder may damage the piston packing, etc.

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