MANUAL
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RETRO PALA | 101-25II

MICHIGAN®

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OPERATION MANUAL BUTTERFLY

THIS SYMBOL MEANS 'WARNING! SAFETY' AND SHOWS IMPORTANT SAFETY MESSAGES. WHEN YOU SEE THIS SYMBOL. CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH

⚠ WARNING

- THIS MANUAL GIVES YOU INFORMATION REGARDING THE OPERATION AND MAINTENANCE OF YOUR NEW BACKHOE LOADER. TO ACHIEVE RESULTS, IT IS RECOMMENDED TO GO THROUGH THE MANUAL BEFORE UTILISING THE BACKHOE LOADER.
- THE INSTRUCTIONS GIVEN HEREIN ARE DESIGNED TO HELP YOUR OPERATING AND MAINTENANCE STAFF TO ENSURE TROUBLE FREE OPERATIONS, SAFETY, ECONOMY AND LONG LIFE OF THE BACKHOE LOADER.
- IF, AT ANY TIME, YOU HAVE A SERVICE PROBLEM WITH YOUR BACKHOE LOADER, CONTACT YOUR NEAREST AUTHORISED DEALER WHO WILL BE ASSISTING YOU IN THE SHORTEST POSSIBLE TIME.
- THE DATA GIVEN IN THE BOOK IS SUBJECTED TO VARIATIONS (INCLUDING DIMENSIONS, WEIGHTS ETC.) AND THE ILLUSTRATIONS MAY NOT NECESSARILY SHOW THE EQUIPMENT IN STANDARD CONDITION.
- IN LIGHT OF CONTINUOUS IMPROVEMENTS WE RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE

Table of Contents

FOREWARD

Dear Customer, we wishes you very happy, safe and productive machine operations.

This operation and maintenance manual is a guide for better understanding of the machine and to carryout safe and trouble free productive machine operations, For a trouble free machine operation one must know- what to do, when to do and how to do. Therefore one must study this manual thoroughly before going to any operation and maintenance.

There should be no compromise with the safety. The safety must come first. All safety measures required to be read and taken care of while using the machine have been described in the SAFETY chapter. General description is machine at a glance.

Instruments, switches and all controls have been described in single manner. Operating tips have been provided to boost operator's confidence.

The machine down time can be minimized by carrying out timely maintenances. This manual explains when the scheduled maintenances are to be carried out.

Trouble shooting guide will help in carrying out minor repairs on your own with confidence. Warranty policy must be read & understood clearly, Records must be kept up dated for carrying out timely maintenances.

The operation and maintenance manual, must be treated as a part of machine and should be kept with the machine at a handy and safe place in good condition.

You are always welcome to contact us if you have any query or required any information about the machine. Our contact details are given below.

KNOW YOUR MACHINE

AN INTRODUCTION TO BACKHOE LOADER

BACKHOE LOADER, also called a LOADER BACKHOE, and commonly shortened to BACKHOE, is an earthmoving equipment. Now a days backhoe Loaders are very common and can be used for a wide variety of tasks.

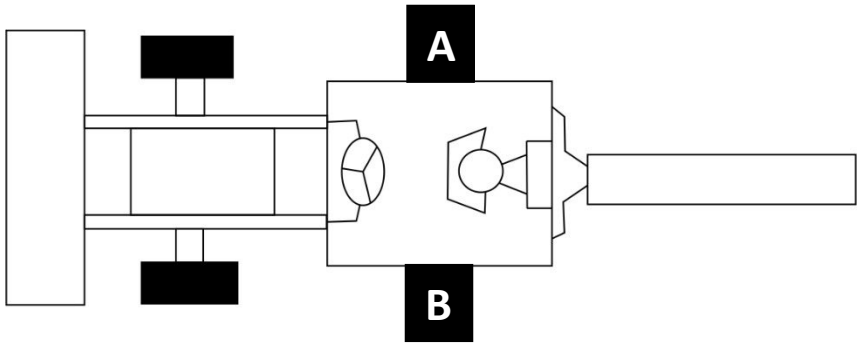
The backhoe Loader is a very versatile machine. It can do digging, trenching, dozing, grading, backfilling, truck loading, small demolitions, light transportation of building materials, etc.

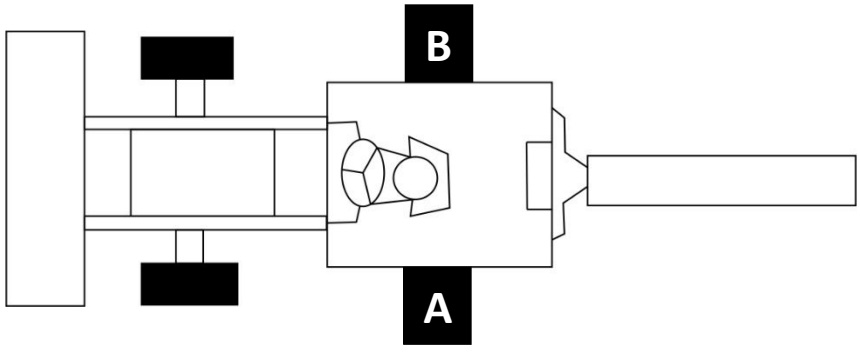
The Backhoe Loader is in fact two machines in one which has separate controls and procedure for each. Therefore it is required that a skilled operator who is proficient in the use and control of the machine functions should operate the machine.

RIGHT, LEFT, FRONT AND REAR OF THE MACHINE

The terms ‘right’, ‘left’, ‘front’ and ‘rear’, when used in this manual, indicate the sides of the machine as seen from the operator’s seat.

This is when you are facing the loader (front) or backhoe (rear).





IDENTIFY YOUR MACHINE

1. Owner's name & address : _____

   _____

2. Machine Model : _____

3. Machine Serial No. : _____

4. Machine Engine No. : _____

5. Machine Chassis No. : _____

6. Tyre Sr. No., Size & Make

   a. Rear L.H./ R.H. : _____

   b. Front L.H./ R.H. : _____

7. Alternator No. & Make : _____

8. F.I,P. No. & Make : _____

9. Name & Address of Dealer : _____

10. Date of purchase : _____

11. Date of installation : _____

12. Registration No. : _____

13. Insurance Policy No. : _____

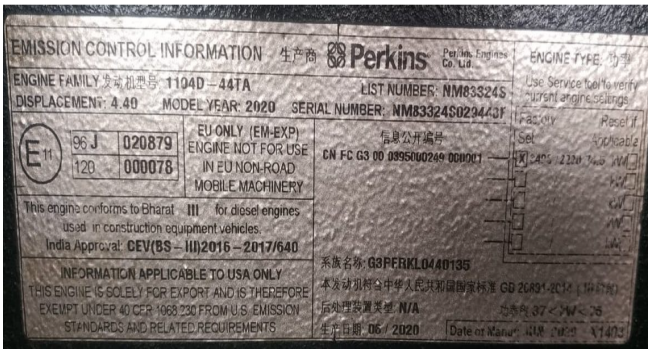
TYPE, SERIAL NUMBER AND YEAR OF MANUFACTURE OF THE MACHINE

When ordering parts, reques ng informa on or assistance, always give your local dealer the model/type and serial number of your machine.

Write the model/type, serial number and year of manufacture of your machine and the serial numbers on the various hydraulic and mechanical components in the spaces provided below

Engine

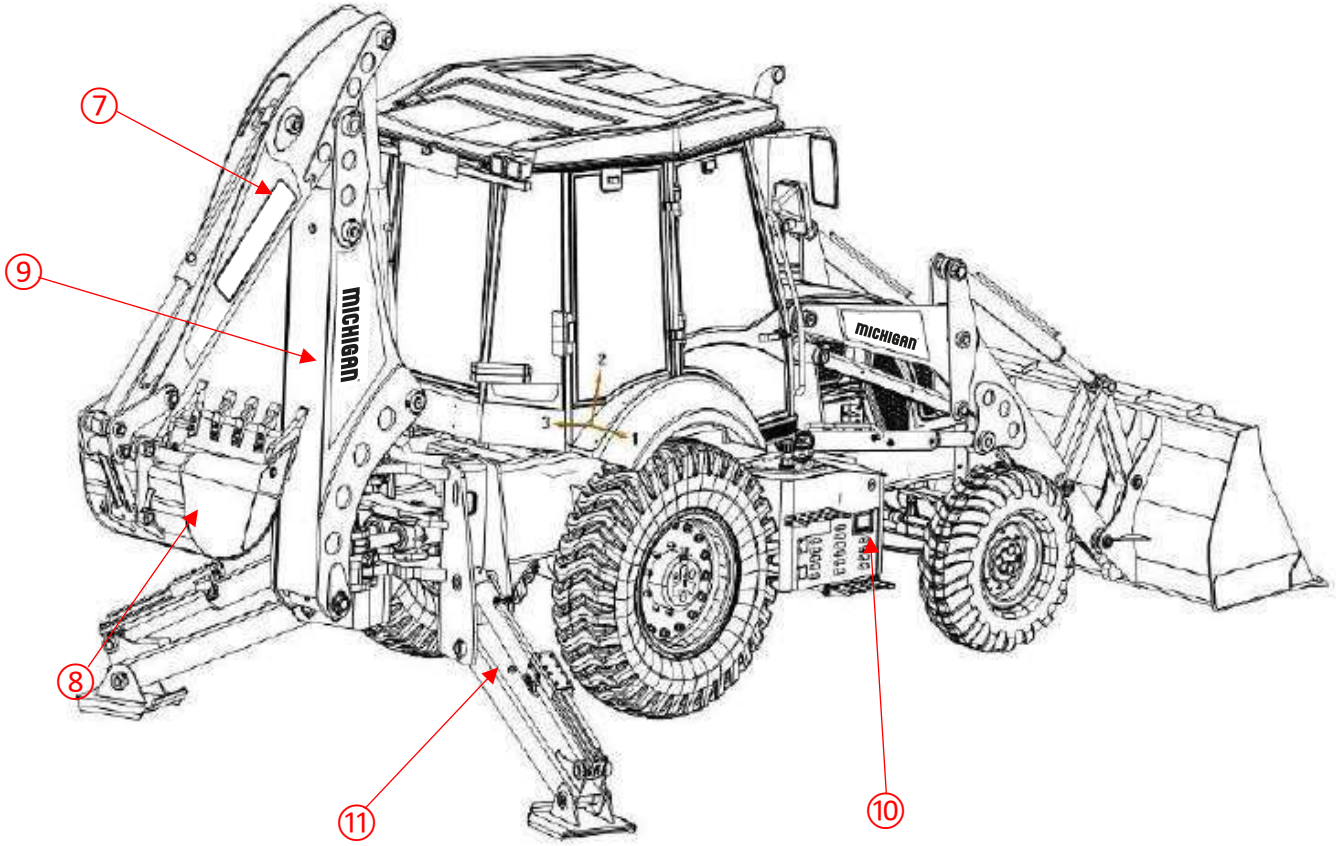
It is punched on the right hand side of the engine block
Viewing from the flywheel end.



Rear Axle

It is stamped on a plate mounted on the LH front side
Of the axle and can be seen from the front of the
Machine as shown.

IDENTIFICATION OF MAIN COMPONENTS



1. Loader bucket
2. Loader beam
3. Front axle (4 wheel drive)
4. Ba ery box
5. Rear axle
6. Cabin
7. Backhoe dipper
8. Backhoe bucket
9. Backhoe boom
10. Main frame
11. Stabilizers

SAFETY INSTRUCTIONS

Your safety and that of people around you depends on you. It is essential that you understand this manual for the correct operation, inspection, lubrication and Maintenance of this machine.
Read this manual carefully and check that:

- You understand fully the symbols on the controls and the safety signs used in this manual and on the machine.
- You understand fully the speed, stability, braking and steering characteristics of the machine. If you are in any doubt, consult your local dealer.
- The safety messages in this section concern situations which may arise during normal machine operation and servicing. These safety messages also indicate the different ways of coping with these situations. Other safety messages are used throughout the manual to indicate specific dangers.
- The information given in this chapter is a summary of the basic rules to respect at all times and does not exempt you from observing traffic regulations or the requirements of insurance companies.
- Always keep this manual in the storage compartment provided for it. Make sure that it is always complete and in good condition. Consult your local dealer to obtain extra manuals.

BEFORE USING THE MACHINE

- Read and ensure that you understand the instructions and warnings given in this manual before operating the machine.
- The presence of grease, oil, mud or ice on the steps and access handles can cause accidents. Make sure they are always clean.
- Remove anything which might hinder visibility. Clean the windshield, windows and rear view mirrors.
- Before travelling or working at night, check that the lighting and signaling systems are operating correctly.
- Make sure the doors (cab version) and the engine bonnet are correctly fastened before undertaking any travel.
- Make sure that no loose object or tool is left on the machine or in the operator's compartment.
- The operator should be the only person on the machine. Make sure there is nobody on or near the machine. Passengers should not be carried.
- When mounting or dismounting from the machine always face the machine and use the steps and access handles on the left-hand side of the machine.
- The right-hand side is to be used only in case of emergency. Be prepared for emergencies. Always keep a first aid kit and a fire extinguisher close at hand on the machine. Make sure that the fire extinguisher is serviced in accordance with the manufacturer’s instructions.
- Make sure that you fully understand the location and function of every control. Operating the controls wrongly can cause serious physical injury.
- Make sure you know ways of getting out of the machine (emergency exit via the right-hand side) in case the machine falls over or if access via the left-hand side is not possible. Make sure that the right-hand door is not locked.
- Check the condition and pressure of the tyres regularly.
- The integrity of the vehicle electrical installation is paramount to the machines performance, hence in no uncertain terms should the electrical system be modified without written consent from the manufacturers engineering.

ROAD OPERATION

- Check that both the cab doors are closed correctly before undertaking any road travel.
- Before undertaking any road travel, lock the working attachments and install the safety systems required by regulations. Raise the stabilizers completely.
- On Four Wheel Steer (4WS) machines do not undertake any road travel unless the steering mode switch is locked in the Two Wheel Steer (2WS) position.

ON THE JOB SITE

- Operating the machine requires your full attention. Caution on the part of the operator can prevent accidents. Make sure you know the capabilities and limits of the machine and the space needed for it to operate. There are areas of poor visibility in the machine's working range. Have someone guide you for all jobs which have poor visibility.
- Check all around the machine every day to ensure there are no oil leaks or hydraulic fluid leaks. Tighten connections as necessary and replace any parts as required.
- Make sure you know the hand signals used on your job site so that you can be guided when making delicate maneuvers or for work where direct visibility is not available.
- Check that all the controls and all the safety devices operate correctly in a safe, clear area before beginning work.
- Keep away from dangerous areas such as ditches, over-hangs, soft areas, etc. Walk around the work site before using the machine and look for hazards.
- Inspect and note all possible risks before driving the machine into a new working area. Holes, obstacles, debris and other hazards in the working area can cause serious physical injury.

OPERATING THE MACHINE

ON ROAD AND JOB SITE

- Do not allow anyone to climb onto the machine. A passenger can fall or cause an accident.
- Never operate any of the machine's controls unless you are seated correctly in the operator's seat.
- Adapt your driving style to suit the conditions of work (sloping ground or rough ground), the state of the road and weather conditions.
- Use all the controls gradually so that the machine works smoothly.
- Stop the engine, engage parking brake and remove the starter switch key even for stops of short duration.
- Never leave the cabin when the engine is running.
- When entering or leaving cabin, it is essential that the loader attachment controls are locked. Never try to bypass this basic safety requirement
- Dust, smoke or fog can reduce visibility and cause an accident. Stop the machine or slow down until visibility returns to normal.
- Never jump down from the machine. When dismounting from the machine always face the machine and use the steps and access handles.
- Never leave the loader bucket raised.
- Never travel at full speed with the loader attachment completely raised.
- Never travel at high speed if the loader bucket hinders visibility. You could drive into a hidden object.

ROAD OPERATION

- It is mandatory to make sure that the brake pedals are locked together before any road travel or travel in third or fourth gear. If this instruction is not observed an accident may occur.

ON THE JOB SITE

- On job sites on the public highway, use regulation signals, taking into account the working range of the machine. National or local regulations define the number, type and location of reflector strips.
- Avoid running the engine in an enclosed space. If it cannot be avoided, ensure good ventilation under all circumstances.
- Do not work close to live overhead electric lines without first making sure that the minimum distances are observed:
- Make sure you know the location of pipes and cables before starting work. Electrical cables, gas pipes, water pipes or other underground installations can cause serious physical injury.
- Do not allow anyone to stand in the machine working area. If the operator uses the swing or attachment controls wrongly, this could cause an accident. Stop all movement until the person has moved away.
- Before moving the stabilizers make sure that no person is within the working range of the stabilizers.
- When moving the machine onto a trailer, place the gear change lever in first gear. Keep the loader bucket 20 cm (8 inch) from the ground.
- Load lifting must be carried out In accordance with the instructions shown in this manual and in accordance with current regulations

- Before using the backhoe attachment make sure that the machine is clear of the ground by means of the stabilizers and the loader attachment.
- Any uncontrolled movement of the machine can cause an accident. Before turning the operator's seat to the backhoe attachment working position, it is essential to place the direction of travel control lever and the gear change lever in the neutral position and to immobilize the machine by means of the parking brake lever.
- If you are using the backhoe attachment or if you are carrying out maintenance operations, use the engine throttle lever. The use of the lever for any other operations can cause accidents.
- In case of any operational problem or damage, move the machine to a place of safety, lower the loader attachment and the backhoe attachment to the ground, stop the engine, engage parking brake, and remove the starter switch key. Find the cause of the defect or inform responsible personnel. Take measures to prevent the use of the machine.
- When the machine is being lifted, nobody must be allowed to remain in the area surrounding the machine.

MAINTENANCE AND ADJUSTMENTS

- Do not carry out any maintenance operations until you have read and understood the instructions and warnings given in this manual.
- Wear suitable clothing when servicing the machine.
- When servicing the machine, place a “Do not start up” label on the instrument panel.
- Always wear eye protection when using a tool which might project metal particles. Use a hammer with a soft face, such as copper, for installing pins.
- Incorrectly performed maintenance or adjustments can cause serious injury. If you do not understand a maintenance or adjustment procedure, consult your local dealer.
- If the attachment is raised or the machine moves when there is no operator, serious injury can result. Before carrying out any maintenance on this machine, proceed in the following manner:

a. Park the machine on flat, level ground.
b. Lower the loader and backhoe attachments until they are resting on the ground.
c. Stop the engine and remove the starter switch key.
d. Engage the parking brake.
e. Lock the loader attachment controls (if equipped).
f. Block the wheels to prevent any machine movement. If a servicing operation requires the loader attachment to be raised (e.g. working on the engine), install the loader attachment support strut.

- Unauthorized modifications of the machine can cause serious injuries. Do not carry out any modification on this machine without obtaining prior authorization from your local dealer. Any modification carried out must be in conformity with the machine’s technical specifications and must conform to current safety regulations.
- Do not carry out any welding operation on the machine without prior authorization from your local dealer.
- Some of the machine’s components are subject to type approvals. It is mandatory when replacing those components to ensure that they are in conformity with regulations. For safety’s sake, always use genuine parts.
- Hydraulic fluid or grease under pressure which penetrates the skin can cause serious injury. Take the necessary safety precautions (protective clothing and face and hand protection) to prevent all such risks. In addition, before handling these products, read the manufacturer’s specific instructions for their use. If hydraulic fluid penetrates the skin a doctor must be called immediately.
- When carrying out a welding operation on the machine, as authorized by the manufacturer and in accordance with his specifications, disconnect the alternator plug and connect the welding set earth lead to the component on which the welding is to be carried out. Never connect the earth lead to a hydraulic system component.
- A burst tyre can cause serious injury. Regularly check the condition of tyres and always observe the inflation pressures defined in accordance with the type of tyre and ground concerned.

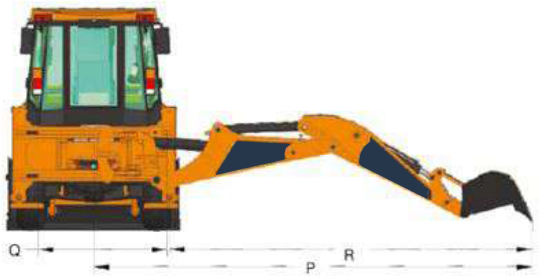
PREVENTION OF FIRE OR EXPLOSIONS

- Engine fuel can cause an explosion or a fire.
    - Never re-fuel when the engine is running.
    - Do not smoke during re-fuelling.
    - Take all the necessary safety measures when welding, grinding or when working near a naked flame.
- Use a non-inflammable product for cleaning parts.
- Clean the machine regularly, remove all debris and material which may catch fire.
- Check for leaks. Replace damaged hoses, pipes and unions. Clean the machine after any repair work before operating it.

KEEP CABIN MOUNTED PROPERLY

- Do not try to weld or straighten the cabin.
- Do not modify the cabin (or frame) in any manner. Unauthorized modification, such as welding, drilling, cutting and adding attachments, as well as any damage resulting from collisions or the machine rolling over, could weaken the structure and reduce your protection. Replace the cabin (or frame) if subjected to roll over or damage. Do not attempt to repair it.
- If you operate this machine without a cabin (or frame) and the machine rolls over, you can be seriously injured or killed. Remove the cabin only for service or replacement. Do not operate the machine with the cabin (or frame) removed.
- Do not install accessories (fixed or otherwise) which can increase the weight of the machine. This could cause serious accidents. Do not exceed the maximum weight shown on the cabin (or frame) (identification plate).
- Improper cabin (or frame) inspection or maintenance can cause serious injury. Carry out the recommended cabin (or frame) inspection procedure shown in this manual. If it is necessary to replace parts or cabin (or frame), use only the replacement parts shown in the Parts Catalogue for your machine.

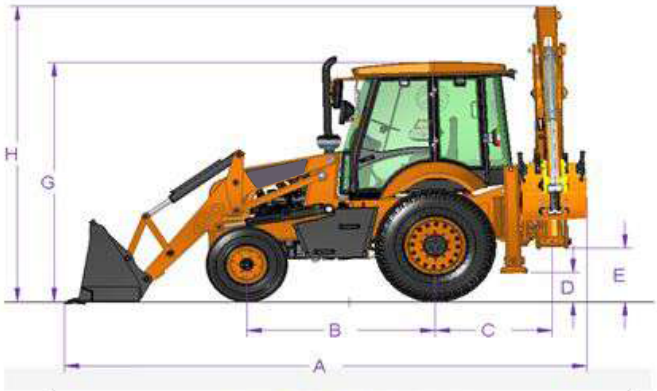
SPECIFICATION BK105



LOADER PERFORMANCE	
A Dump height	2760
B Load over height	3348
C Bucket Pin height	3637
X Max. reach at full height	1320
E Reach at full height fully dumped	826
H Dump angle (deg)	46
G Rollback at ground (deg)	44
D Reach at ground	1772

EXCAVATOR PERFORMANCE	
I Maximum dig depth	4065
J Reach ground level to rear wheel centre	6757
K Reach ground level to slew centre	5409
N Reach at full height to slew centre	2508
L Max. Working height	5609
M Max. Load over height	3893
O Bucket rotation power (deg)	183
E Side Reach to centre line of machine	5859
Q King post travel	922

SPECIFICATION BK105



STATIC DIMENSIONS	
A Overall Length	7360
A Transportation Length	6244
B wheelbase	2250
C Slew centre to rear axle centre	1370
D Minimum ground clearance	290
E Slew ground clearance	590
G Height to top of cab	2950
H Overall height	3570
L width over bucket	2320

TRACK WIDTH FRONT	2030
TRACK WIDTH REAR	1540

Transmission

The transmission is of the power shuffle type with 4 forward and 4 reverse speeds. The transmission is provided with electrically actuated forward/reverse control. Steering Column mounted shuttle lever enable smooth shifting of gears from forward to reverse using fingertip operations.

Speeds

I Gear	Kmph	6
II Gear	Kmph	13
III Gear	Kmph	18
IV Gear	Kmph	28

Power Train

The power train consists of the engine, torque converter shuttle gear box, Axle and connecting propeller shaft.

Optional Equipment

1. 6 – in – 1 loader bucket
2. Rock Breaker
3. Excavator bucket: 0.09 cu.m./ 0.12 cu.m. & 0.30 cu.m.
4. Heavy Duty Tyres (14.00x25)
5. Telematics

Filling Capacities

1.	Hydraulic Tank	Liters	80
2.	Fuel Tank	Liters	150
3.	Engine Oil	Liters	11.5
4.	Transmission	Liters	17
5.	Rear axle	Liters	17.5
	(Planetary Gear Box)	Liters	(03)
	(Differential Housing)	Liters	(14.5)

Hydraulics

Main pump flow @2200 rpm	Lpm	118
Steering Pump @2200 rpm	Lpm	46
Pressure setting – MRV	Bar	210
Pressure – ARVs	Bar	225

Cabin

The spacious cabin is surrounded on all sides by weather proof toughened glass for excellent visibility. The cushioned seal with shock absorbing springs can be swung through 360^{o} with a manual lock for backhoe operation. Hydraulic stabilizers are provided for backhoe operation. Windshield wiper assist good visibility in poor weather and working conditions.

Engine oil pressure, water temperature, rpm and hour meter, Ammeter and transmission oil temperature gauges, indicators and switches are provided on instrument panel.

Front & reverse drive control lever is placed on the steering column. The gear shift & loader control levers are on the right side of the operator for easy control.

Tires

	4WD:	12.5 X 80	50- 55 PSI/ 3.44- 3.79 BAR
Rear:	Standard	14 X 25	35- 40 PSI/ 2.41- 2.75 BAR
		16.9 X 28	35- 40 PSI/ 2.41- 2.75 BAR

Rear axle

The heavy-duty rigid rear axle is of outboard planetary type built in multi disc brakes for compact mounting & extended service life.

Front axle

The steerable front axle is provided generous bearing for terrain. The kind pin inclination gives directional stability maximum axle oscillation angle is 8^{o} per side.

Service Brakes

The multi disc oil immersed service brakes provide effective braking and long disc life.
Hydraulically operated service brakes with single wheel braking option.

Parking Brake

The hand operated parking brakes actuates on the rear axle

Steering

Hydraulically operated steering system consists reliable steering unit & safety valves and dedicated pump.

Turning Radius – Without brake – 9.3 Mtr.

Electrical system & lights

The electrical system is a 12-volt negative earth system powered by a belt driven alternator and a battery.

Working lights are provided on both front and rear. Driving headlights, direction indicators, parking

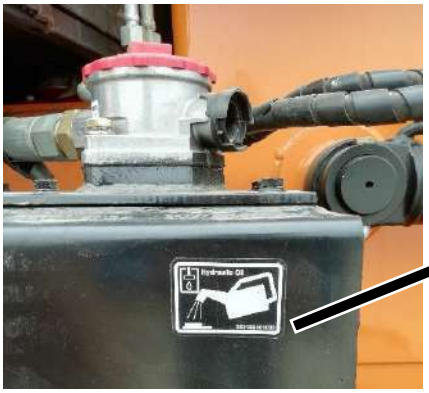
Lamps and brakes lamps are provided as per standards and road transport regulations

DECALS/STICKERS

Battery

Filling the fuel tank

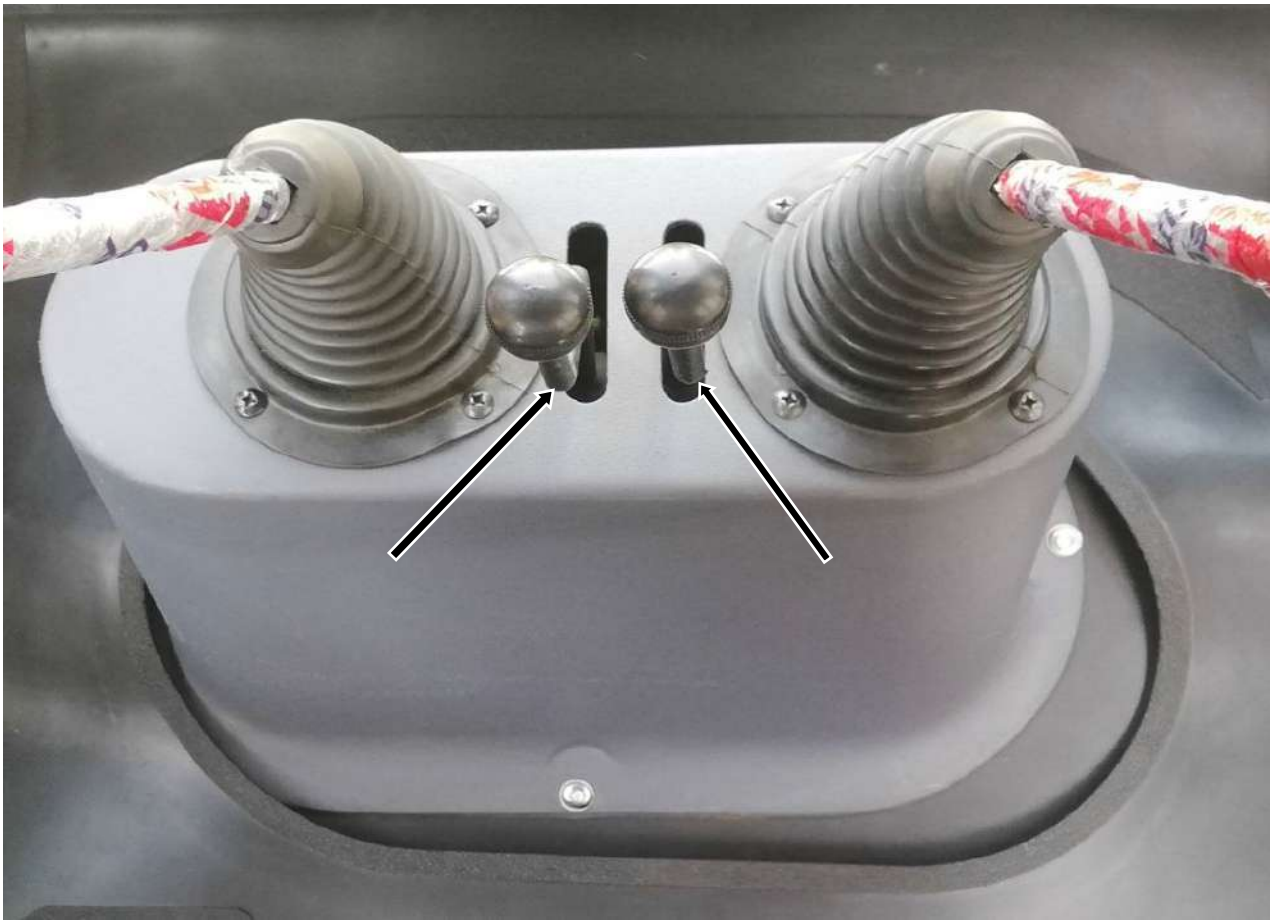
Filling the hydraulic reservoir



Controls for loader attachment

Backhoe attachment controls

Stabilizer controls

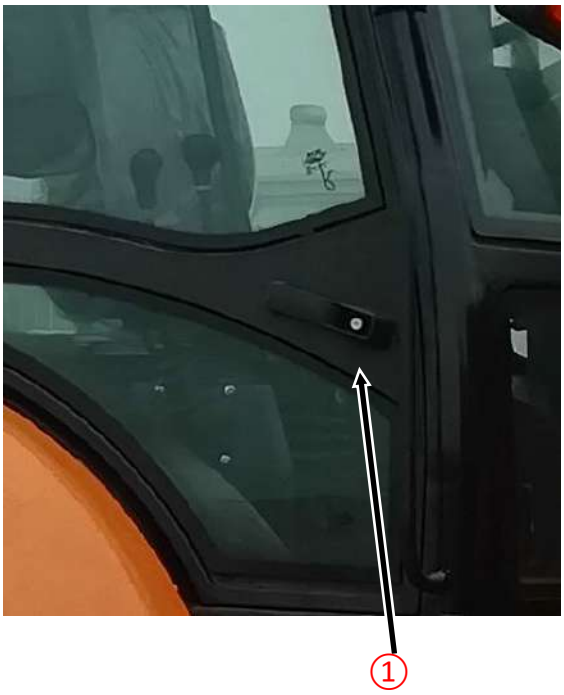


Adjusting the operator's seat

Tyre Pressure

TYRE PRESSURE		
TYRE SIZE	P.S.I.	BAR
FRONT 9.00X16 (2WD)	60-70	4.13-4.82
FRONT 12.5X80 (4WD)	50-55	3.44-3.79
REAR 14X25	35-40	2.41-2.75
REAR 16.9X28	35-40	2.41-2.75

Cabin Doors



The doors are opened with the handle
(1) from the outside and with the handle
(2) from the inside.

STEPS AND ACCESS HANDLES

Use the steps and access handles when entering or leaving the operator's compartment and enter from le side only un l it’s an emergency.

INSTRUMENT CLUSTER METER

1. ENGINE OIL PRESSURE GAUGE- This warning lamp comes on when the engine oil pressure is too low. If the lamp comes on when the machine is working, move the machine to a place of safety, stop the engine, engage parking brake, remove the starter switch key and find the cause of the problem.

2. FUEL LEVEL GAUGE - This gauge shows the quantity of fuel in the fuel tank.

3. ENGINE TACHOMETER GAUGE- The tachometer shows the engine speed in revolutions per minute. The figures indicated must be multiplied by 100

4. ENGINE COOLANT TEMPERATURE GAUGE - This gauge shows the temperature of the engine coolant. When the temperature is normal the needle is in the white area. If the needle is beyond 100 deg C, move the machine to a place of safety, stop the engine, engage parking brake, remove the starter switch key and check the engine coolant level. Make sure that the radiator and oil cooler are perfectly clean and that all the thermostats function correctly.

5. TRANSMISSION OIL TEMPERATURE GAUGE – Indicates the working temperature of transmission system oil.

6. MAIN BEAM INDICATOR LIGHT - This indicator lamp comes on when head lights are on main beam.

7. PARKING BRAKE INDICATOR LIGHT - This indicator lamp comes on when the parking brake lever is engaged (wheels braked).

8. BATTERY CHARGING – Light up when battery charging circuit fails while engine is running. The light should go after the engine has started.

9. **NEUTRAL LIGHT** - This indicator lamp comes on when the lever is in neutral position.

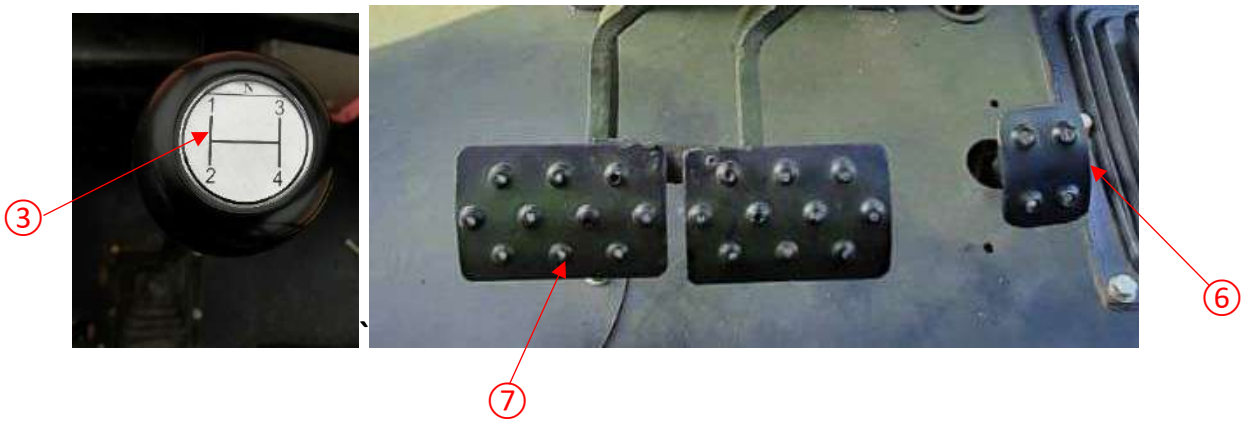
10. **RIGHT INDICATOR** - This indicator lamp comes on when the vehicle turn on right side.

11. LEFT INDICATOR - This indicator lamp comes on when the vehicle turn on left side.

MAIN PANEL

1. 2 WD, 4WD SWITCH
2. CANOPY LAMP SWITCH
3. WIPER SWITCH
4.KPC SWITCH
5. FAN SWITCH
6. REAR WORK LAMP SWITCH
7. REAR WORK LAMP SWITCH
8. HAZARDS SWITCH
9. IGNITION SWITCH: This is operated by ignition/starting key. There are three positions. The first position is OFF position (0). When the key is inserted in the STOP. The second position is ON position (1) where in the battery to all the circuits are connected. The third position (2) is the self-start position. Once the key is turned in the clockwise direction the engine starts and the key returns to position (1) due to spring effect.
10. STARTER SWITCH
11. CHARGER SOCKET
12. HOUR METER

CABIN CONTROLS



1. **HAND THROTTLE LEVER**: Pull this lever upwards to increase engine speed. Push the lever downwards for idling speed.
2. **ENGINE SHUT OFF BUTTON:** The lever is connected to end of a cable which when pulled will shut off fuel supply to engine and hence stops it. It is located on right by the side of instrument panel, pedals the stop lamps glow when this switch is pressed by the brake pedals on application.
3. **GEAR SHIFT LEVER:** To select a gear, move the lever as shown on the shift pattern. When the machine is stationary, make sure that the forward/reverse lever is at neutral (N) and the engine at the idle, before selecting a gear.
   The machine can be moved off in any gear, depending on ground conditions. To change the gear on the move
   a) Pull the FNR lever to N.
   b) Select the next gear.
   c) Engage the FNR lever.

   Use the accelerator pedal for a smooth gear change.

4. **STEERING WHEEL:** Turn the wheel in the direction you want to steer the vehicle, either to left or to right.
5. **FORWARD AND REVERSE SWITCH:** You and others can be killed or injured if you operate the forward/reverse lever while travelling. The machine will immediately reverse direction without warning to others. Follow the recommended procedure for proper use of this selector.
   Stop the machine before switching this. To select forward, reverse or neutral, press switch to the position as shown. All four gears are available in both forward and reverse. The engine will only start if the lever is in neutral (N).
6. **ACCELERATION PEDAL:** Press this pedal down to increase engine speed. Let the pedal up to reduce engine speed with your foot off the pedal the engine will idle (600-650 RPM).
7. **BRAKE PEDALS:** Press down the brake pedals to slow or stop the machine. Use the brakes to prevent over speeding down the slope. The brakes can be operated separately or can be locked together. For site use at low speeds the brakes can be operated separately. This brakes one wheel to help make tight turns. For road travel the brake pedals must be locked together.
8. **PARKING BRAKE LEVER:** This lever is provided to operate the parking brake. To apply/engage the parking brake, pull the lever upward. The lever will remain in the same position, to keep the parking brake applied.
   To release/disengage the brake, push the button on the tip of the lever and bring the lever down.
   Parking brake pilot lamp provided on the instrument panel glows ON when the parking brake applied and goes OFF, when released

DIRECTION INDICATOR LEVER, HORN AND LIGHTING SWITCH: Located on the right side of steering.

STORAGE AREAS AND COMPARTMENTS:

CABIN INTERIOR LIGHT:

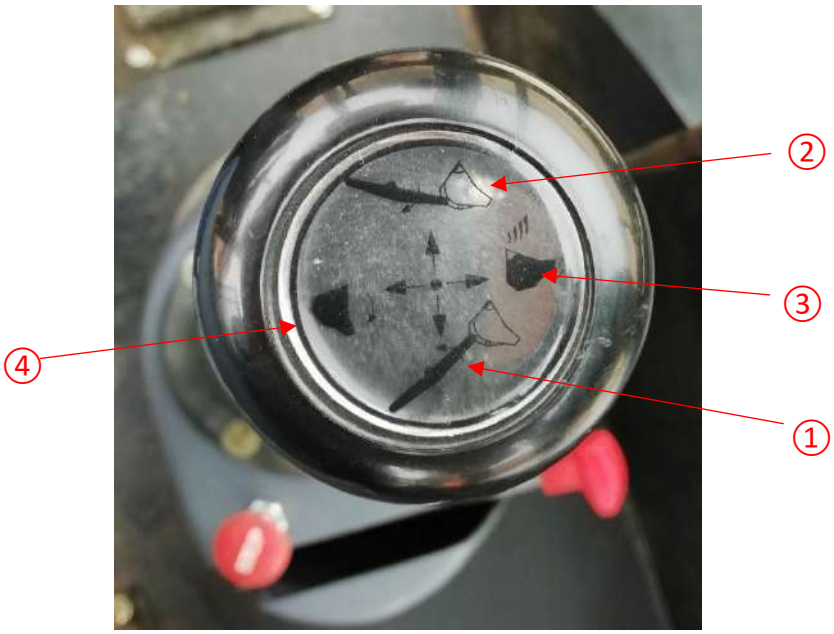
RADIO COMPARTMENT:

OPERATOR'S SEAT

1. FORWARD, REAR AND SWIVEL ADJUSTMENT
2. SUSPENSION ADJUSTMENT

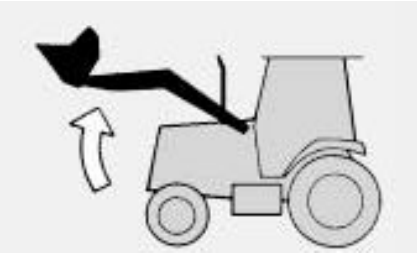
1. SEAT BACK ANGLE ADJUSTMENT

LOADER ATTACHMENT CONTROLS

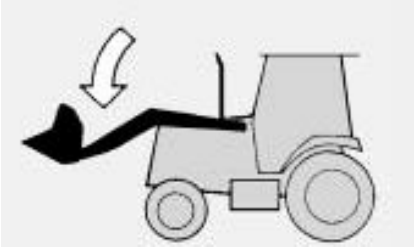


Neutral

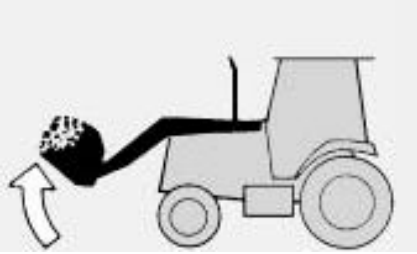
When the lever is in neutral position (0) the loader beam and bucket will not move. The lever is spring loaded to neutral position (0) and will automatically return to this position when released, movement of the loader beam and/or bucket will stop.



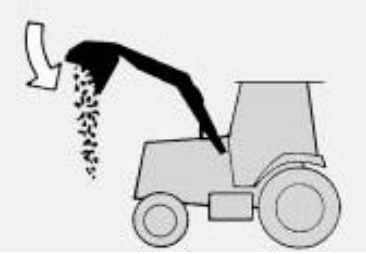
With the lever in position (1), The loader beam rises



With the lever in position (2), The loader beam lowers



With the lever in position (3), the bucket rolls back



With the lever in position (4), the bucket dumps

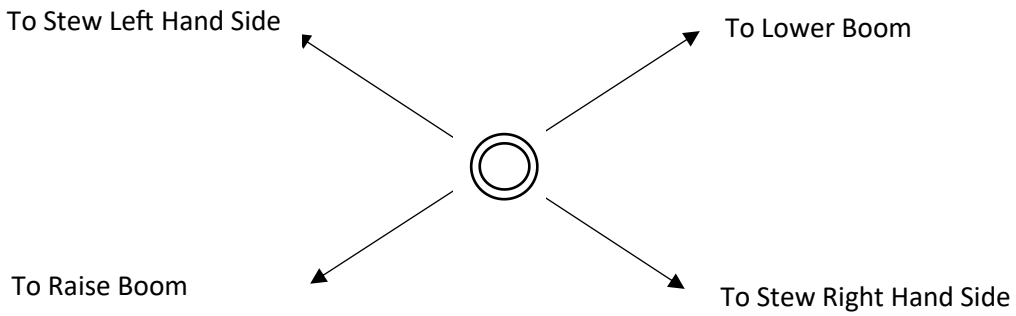
BACKHOE ATTACHMENT CONTROLS

There are two control levers provided for the backhoe operations. The two levers are located to be operated by RH (Right Hand) and LH (Left Hand) respectively.

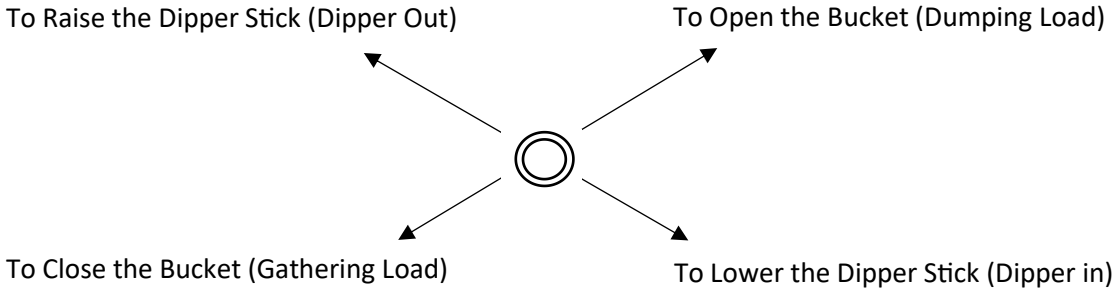
The LH control lever operates the boom and slew.
The RH control lever operates the dipper and bucket.
Both the levers moved in 'X' pattern.
Both the levers can be operated at the same time for more efficient backhoe operations.

MOVEMENT OF CONTROL LEVER AND ITS ACTION

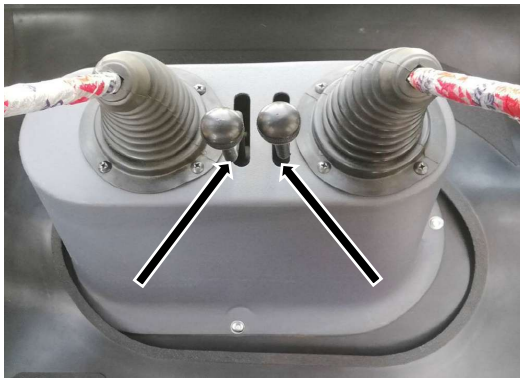
LH Control Lever



RH Control Lever



STABILIZER CONTROLS



STABILIZER CONTROL LEVERS

The Machine is equipped with two stabilizers – LH side & RH side, for levelling & providing stability while operating backhoe. Each stabilizer has its own control lever to be operated together or independently as per the opera onal requirements.

Push Forward (away from you) – To raise the stabilizers and lower the machine.

Pull Backward (Towards you) – To lower the stabilizers and raise the machine.

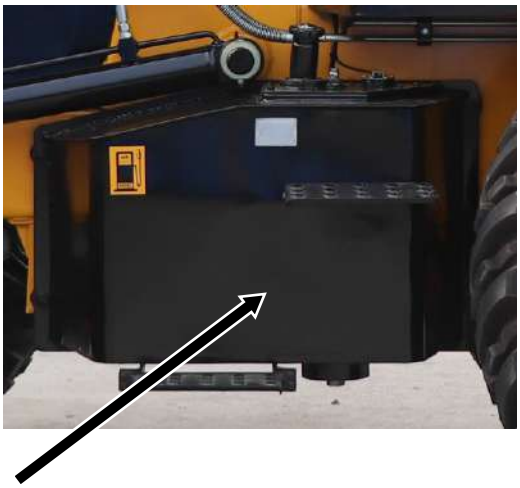
OPERATOR'S COMPARTMENT WINDOWS

Full opening

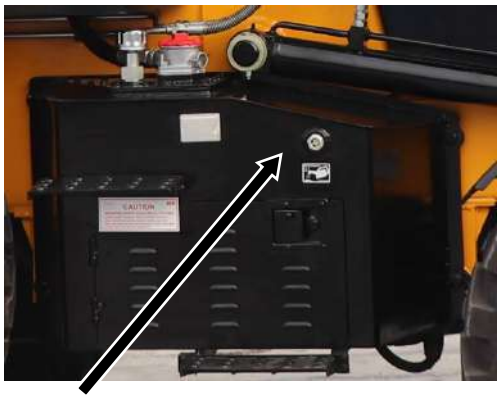
Closing

COMPARTMENT IDENTIFICATION

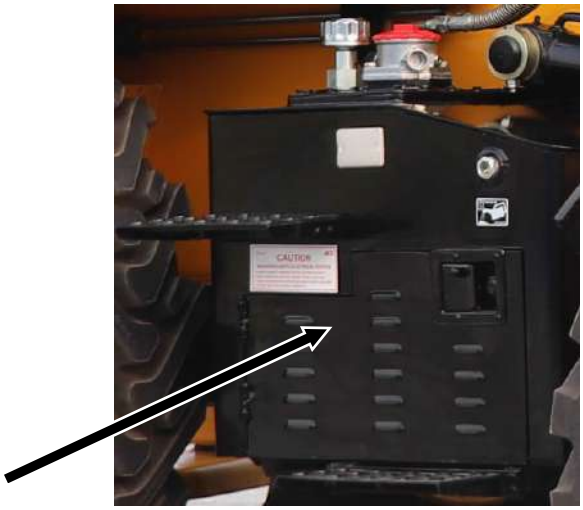
FUEL TANK



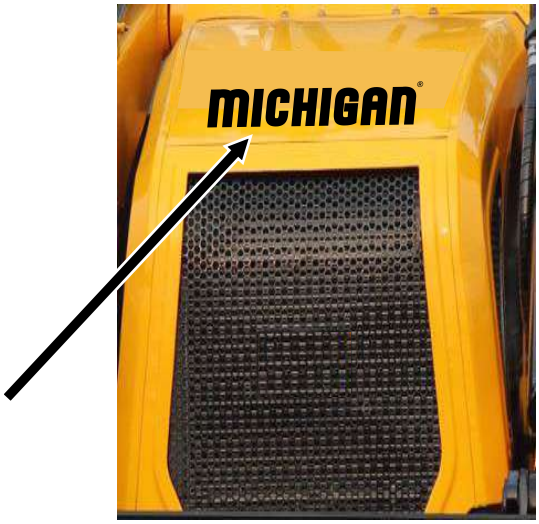
HYDRAULIC RESERVOIR



BATTERY BOX



ENGINE BONNET



BEFORE OPERATING THE MACHINE

- Before operating the machine, observe the following instructions:
- Check the levels (engine oil, transmission oil, hydraulic fluid and engine coolant) and make sure that the various fluids correspond to the conditions of use.
- Carry out the daily maintenance operations.
- Walk round the machine, look for any leaks and inspect the hoses. Tighten or replace any items as required.
- Before undertaking any road travel, lock the attachments, raise the stabilizers completely and install the safety systems required by regulations.
- Before any road travel or job site work at night, check that the lighting and signaling systems are operating correctly.
- Check the condition and pressure of the tyres.
- Clean the steps and access handles. The presence of oil, mud or ice (winter) can cause accidents. Make sure they are always clean.
- Clean or replace safety decals which are no longer legible.
- Make sure that the engine bonnet is closed and latched correctly.
- Make sure that the cabin doors are closed correctly.
- Remove anything which might hinder visibility. Clean the windshield windows.
- Make sure that no objects or tools are left on the machine or in the operator's compartment.
- Make sure you know how to evacuate the machine in case access by the left-hand side is impossible.
- Make sure that nobody is under or on the machine. The operator should be the only person on the machine.
- Make sure that nobody is within the working range of the machine.

OPERATING THE MACHINE

- When operating the machine the following instructions must be observed:
- Start the engine taking into account weather conditions.
- Regularly consult the hour meter to ensure Servicing intervals are observed.
- Make sure that you know the location of underground services such as gas, electricity, and telephone or mains water before starting work.
- Do not work near overhead high-voltage electrical cables without checking beforehand that all necessary measures have been taken to respect the minimum distances:
- On job sites or the public highway, use regulation signals, taking into account the working range of the machine. Local regulations define the number, type and location of reflective strips.
- Make sure that the operator's seat is correctly adjusted and positioned.
- Never operate any control or driving component unless you are seated correctly in the operator's seat with the seat belt adjusted and attached correctly.
- Adapt your operating style to the type and conditions of work.
- Do not allow anyone to stand in the machine working area. Stop all movement until the person has moved away.
- Use all the controls gradually so that the machine works smoothly.
- Load lifting should be carried out in accordance with the instructions given in this manual and in accordance with prevailing regulations.
- Avoid running the engine in an enclosed space. Ensure good ventilation under all circumstances.
- Dust, smoke or fog can reduce visibility and cause an accident. Stop or slow down the machine until normal visibility is restored.
- If there is any operating problem or damage move the machine to a place of safety, stop the engine, engage parking brake, remove the starter switch key. Find the cause or contact your local dealer and take the necessary measures to prevent the use of the machine. Place a "Do not start up" label on the instrument panel.

OPERATION BEFORE STARTING THE ENGINE:

1. Lower the attachment to the ground.

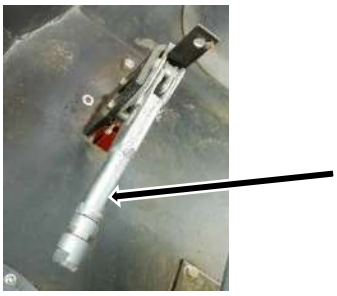
   Lower the backhoe bucket and loader shovel to the ground, if they are not already there. The attachments will lower themselves under their own weight when you operate the levers. Operate the levers carefully to control the rate of decent.

2. Do a pre-start Inspection

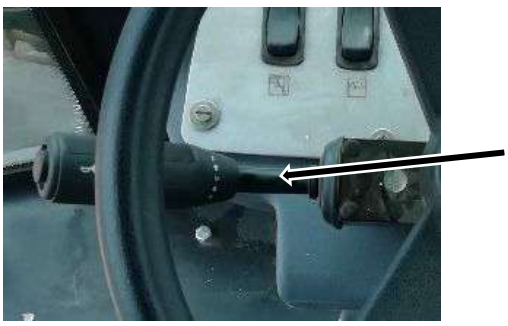
   For your own safety and others and for a maximum service life of your machine, do a prestart inspection before starting the engine.

3. Check that the seat is properly locked in the loader attachment working position.

4. Check that the parking brake is engaged.

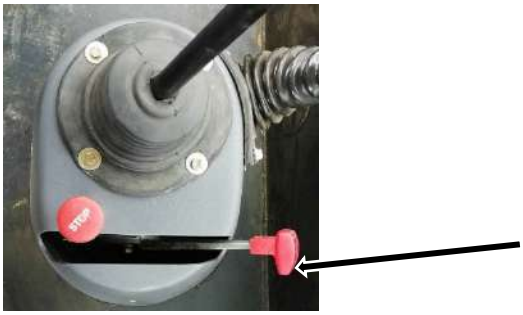


5. Check that forward/reverse lever is in the neutral position.



6. Check that the gear change lever is in the neutral position.

7. Set the hand throttle lever to minimum D. Push the hand throttle lever as far as it will go down.



8. Start the Engine

   Turn the starter switch to ignition ON position (1) wherein the red lights, battery charging will light up. Turn the key in the clockwise direction to the starter position (2) and start the engine with the accelerator pedal slightly depressed. Ease off on the accelerator pedal to reduce the engine speed.

9. Check the warning lights
   Note: if any warning lights fall to go off, or come on while the engine is running. Stop the engine as soon as it is safe to do so.
   Once the engine has started, check that all the warning lights have gone off.

10. Warm up the engine and hydraulics.
    Allow the engine to warm up at idle speed for five minutes. Operate the backhoe a few times to help warm up the hydraulics system.

Cold Weather Warm-up

IMPORTANT: If hydraulic oil is cold, hydraulic functions move slowly. Do not attempt machine operations until hydraulic functions move at close-to-normal cycle times.
In extremely cold conditions, an extended warming up period will be necessary.
Avoid operation of hydraulic functions until engine is warmed up. Remove ice, snow and mud from machine before operation.

1. Run engine at idle speed for 15 minutes.
   IMPORTANT: To prevent damage to bucket levelling tube due to cold oil, cycle bucket three times at hood height before using under normal operation.
2. Raise loader lift arms to hood height, Cycle bucket from stop to stop three times.
3. Cycle all remaining hydraulic functions to distribute warmed oil until all functions operate freely.

INSPECTION AFTER STARTING

IMPORTANT: To prevent possible machine damage. Do not operate machine when instrument panel is inoperable or detective. Check instrument panel gauges for correct readings and indicating lights. Service lights for serviceability. All switches for proper functioning. Serviceability of reverse alarm unit.

STOPPING THE ENGINE

IMPORTANT: Before stopping engine after load operations, run the engine at idle speed for 1-2 minutes to cool the engine. 1. Park machine on a level ground. 2. Lower all equipment to ground. 3. Move FNR lever to neutral.

CAUTION: Prevent possible injury from unexpected machine movement. Always engage parking brake to hold machine. 4. Pull parking brake lever to engage parking brake. 5. Turn ignition key switch to OFF. Remove key from key switch. 6. Release hydraulic pressure by moving control levers, till equipment comes to a half.

SETTING THE MACHINE IN THE BACKHOE ATTACHMENT WORKING POSITION

1. Check that the direction of FNR lever is in the neutral position.
2. Make sure that the gear change lever is in the neutral position.
3. Make sure that the parking brake is engaged.
4. Start the engine. Place the loader bucket in the dumping position. Lower the bucket to the ground until the front wheels are about 10 cm (4 inch) above the ground.
5. Start the engine. Place the loader bucket in the level position. Lower the bucket to the ground until the front wheels are about 10 cm (4 inch) above the ground. Turn the seat round to the backhoe attachment position and adjust if necessary.
6. Lower the stabilizers. The rear wheels must be about 10 cm (4 inch). off the ground and the machine must be in a horizontal position.
7. Run the engine
8. Raise the boom. Pull the lever up to release the lock.

OPERATING STABILIZERS

You must be in seat, facing the rear window before operating the stabilizer controls.

Do not operate the stabilizers from outside the machine. Otherwise you could be crushed when the machine moves.

The stabilizers must be down when you use the excavator, or the machine will rock violently. Each stabilizer has its own control lever and can be operated independently.

Lower each stabilizer to level the machine and take the weight off the rear tyres. The loader shovel should be used along with the stabilizers to level and steady the machine.

OPERATING- BOOM, DIPPER & BUCKET

WARNING

Do not operate the backhoe controls from outside the machine, or you could be crushed by the backhoe.

On the backhoe there are two control levers. The right hand control operates the boom and stew, the left hand control A operates the dipper and bucket. The stabilizers are operated as described in stabilizers controls.

Both levers move in a +pattern for individual backhoe actions.

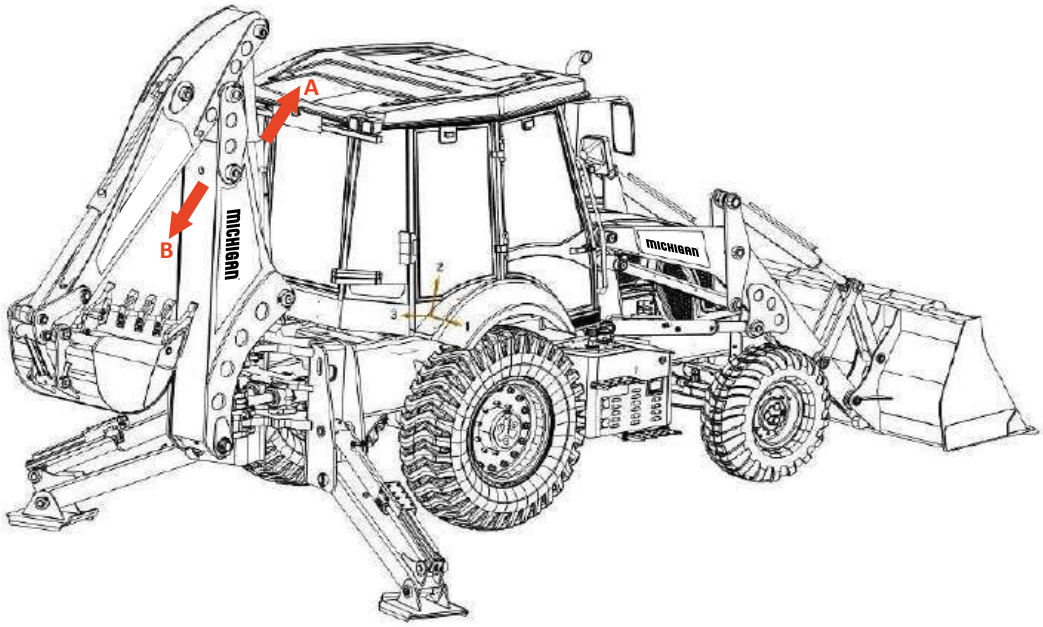
Both control levers can be operated at the same me, for more efficient opera on. The speed of the backhoe ac on depends on how far you move the levers. Further you move a lever, the faster the ac on.

Both control levers will 'hold' to their posi on. The backhoe will stay in any posi on un l you move the control levers.

A plas c decal near the control shows, by symbols, what movements cause which backhoe ac ons. The symbols, control movements and backhoe ac ons are explained on the following pages.

Raise Boom A
To raise the boom, pull the lever straight and towards you. Before raising the boom check that it is clear overhead

Lower Boom B
To lower the boom, push the lever straight away from you.



Slew Le C

To Slew the boom to your le , pull the lever le from the center of the machine.
Note: Some backhoe buckets and a achments may collide with the stabilizer legs if slewed to far round. Check this before using different a achments.

Slew Right D
To slew the boom to your right, pull the lever right and towards center of machine.

Dipper in E

To bring the dipper in, pull the lever straight and towards you.

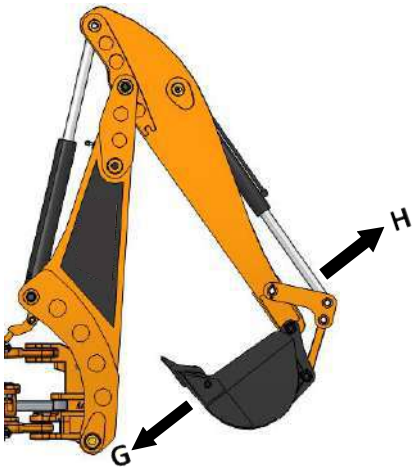
Note: Some backhoe attachments may collide with the boom if brought to far in. Check this before using different a achments.

Dipper out F

To push the dipper out, push the lever straight and away from you. If the boom is already up, check that it is clear overhead before swinging the dipper out.

Close Bucket G
To close the bucket (say to gather a load) pull the lever left and towards the center of the machine.

Open Bucket H
To open the bucket (say to dump a load) push the lever right and away from the center of the machine.



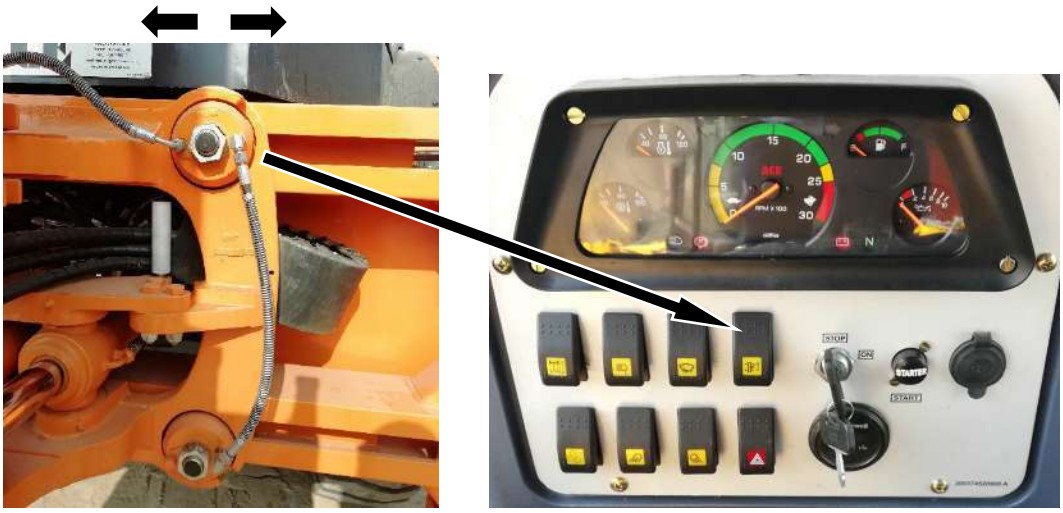
SIDE SHIFTING THE BACKHOE

Note: Before side shifting the backhoe, make sure that the swivel mechanism rails are clear of debris.

1. Set the machine level.
   Use the stabilizers to set the machine level and keep the swivel mechanism vertical.
2. Position the Backhoe

Reset the bucket on the ground, straight behind the machine.

3. Release the Clamps



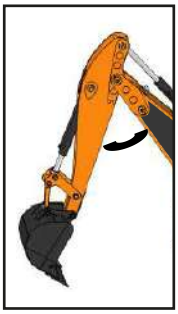
Position the clamp switch to release the swivel mechanism clamps.

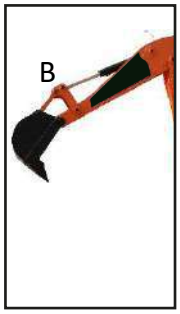
4. Loosen the Swivel mechanism
   To loosen the swivel mechanism on the rails. Operate the boom up and down a few mes.
5. Position the Backhoe

   Raise and slew the backhoe directly to one side of the machine. Slew to the left if you want to sideshi to the right. Slew to the right if you want to sideshi to the left. Set the bucket on the ground, with the dipper, at 90 degree to the boom as shown.

6. Sideshift:

   Open the bucket. As the bucket opens, the swivel mechanism will be pushed across the back of the machine A. If the swivel mechanism sticks in mid-travel, raise or lower the boom slightly to keep the swivel mechanism vertical to rails B.





7. Tighten the clamps:

   Once the swivel mechanism is in the position you want, tighten the clamps by turning the lever and operating boom up for 2-3 times.

INSTRUCTIONS FOR USE

Before carrying out any road travel, lock the attachments and install the safety systems required by regulations. The machine must be within the maximum dimensions permitted on the road in accordance with local road traffic regulations.
Raise the stabilizers completely.
Check that the lighting and signaling systems operate correctly.
Check that the brakes and steering operate correctly.
Check the condition and pressure of the tyres.
Never leave the operator's compartment with the engine running.

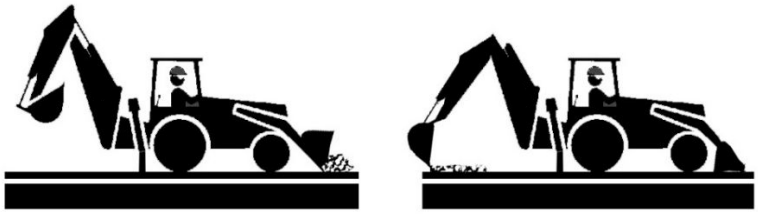
Moving the machine forwards when working on flat ground

It is possible to use the backhoe attachment to push the machine forward whilst excavating.
1. Make sure that no other person or obstacles are in the working range of the machine.
2. Make sure that the front wheels are straight.
3. Start the engine
4. Release the machine's brakes by means of the parking brake.
5. Make sure that the FNR lever is in neutral position.
6. Raise the boom and retract the dipper, then move the boom so as to place the backhoe bucket teeth on stable ground.
7. Raise the stabilizers and the loader bucket from the ground.
8. Use the boom and dipper to move the machine.
9. After moving the machine, lower the stabilizers and place the loader bucket on the ground, then level the machine.
10. Use the parking brake to brake the machine.

IMPORTANT: This procedure can only be used on flat ground. Never use it on sloping ground. On sloping ground it is essential to turn the operator's seat to the loader attachment position to move the machine by the normal procedure.

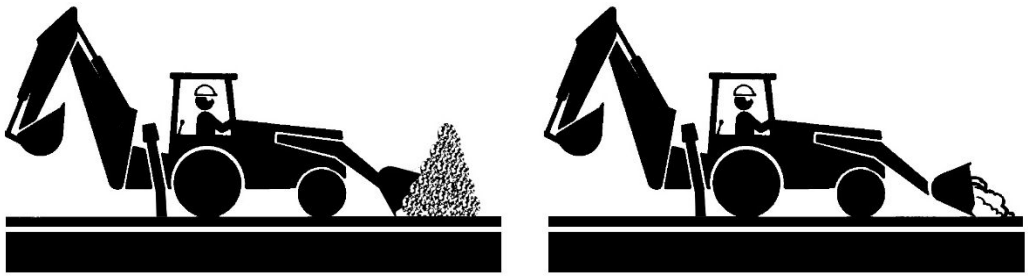
FILLING THE BACKHOE BUCKET

Fill the backhoe bucket by maneuvering the boom and dipper. Keep the bottom of the backhoe bucket parallel to the cut. The backhoe bucket teeth and blade must cut the ground like the blade of a knife. The depth of dig varies depending on the type of material.



WORK AT PROPER ANGLES

Work perpendicular or at an angle to stockpile to prevent highest part of the pile from collapsing onto machine. Use backhoe bucket to remove material that may fall onto machine. Work perpendicular or at an angle to excava on to prevent cave-ins. Do not operate near the edge of an excava on or trench. Use backhoe bucket to fill areas where cave-ins occur.



DIGGING ON SLOPES:

To dig a trench across a slope, use the stabilizers and loader shovel to level the machine. On steeper slopes, cut a level base to work from. Dump the trench material on the uphill side of the trench, far enough away to prevent it falling back into the trench.

POSITIONING OF SPOIL PILES:

To prevent cave-ins, place spoil pile at least 3 away from edge of excava on. Deeper excava ons require larger area for spoil pile due to increased pile size. Place spoil piles in convenient loca ons for easier truck loading or backfilling. On slopes, place piles on the upper side for improved machine stability and easier backfilling.

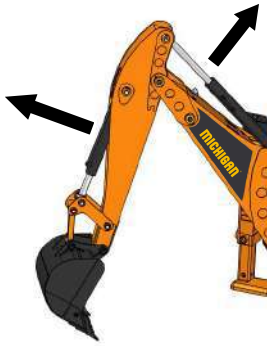
MOVING THE MACHINE WHILE DIGGING ON THE LEVEL GROUND:

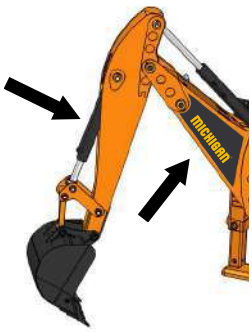
If you are digging on level ground you can move the machine along the trench line with the backhoe.

WARNING: Do not use this procedure to move the machine downhill. See moving the machine while digging downhill.

1. Lower the engine speed.
2. Make sure that the front wheels are poin ng straight forward.
3. Raise the boom and bring the bucket towards your end of the trench. Set the bucket down in the trench on ground that is firm.

4. Raise the loader shovel and stabilizers clear of the ground.
5. Make sure the FNR lever and gear lever are at neutral. Release the parking brake.
6. Move the machine by moving the dipper out while lowering the boom.





7. At the new dig posi on, engage the parking brake and lower the shovel.
8. Raise and level the machine on the stabilizers.

MOVING THE MACHINE WHILE DIGGING DOWNHILL:

WARNING: When moving the machine downhill make sure you are in the correct driving posi on. Keep the a achments low to the ground.

To move the machine when digging down a hill, raise the backhoe stabilizers and shovel and carefully drive the machine to its next posi on in first gear.

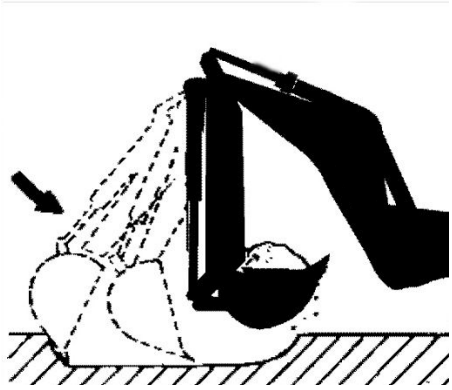
USING BACKHOE BUCKET:

Use type of digging which is best suited for your specific job.

CROWD DIGGING

For most general excava ng, levelling material, and digging trenches. For digging use the dipper cylinder for majority of movement.

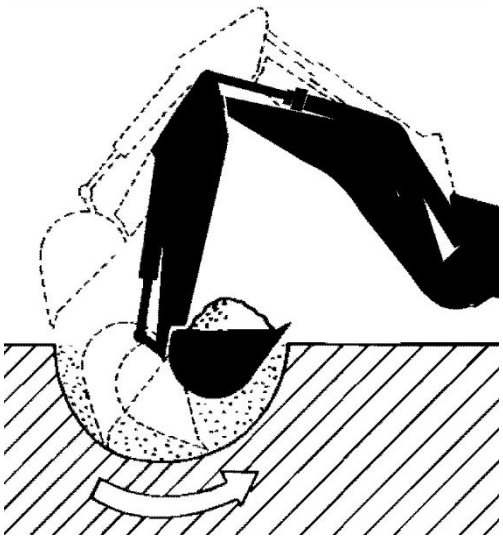
1. Posi on dipper s ck In ver cal posi on and then move away from machine approximately 2 .
2. Retract dipper s ck and curl bucket simultaneously to make first cut. First cut should be approximately 4 long and 3-4 inch deep.
3. Repeat steps 1 & 2 for remaining cuts and increase depth to 100-150 mm (4-6 inch) deep.



BUCKET DIGGING:

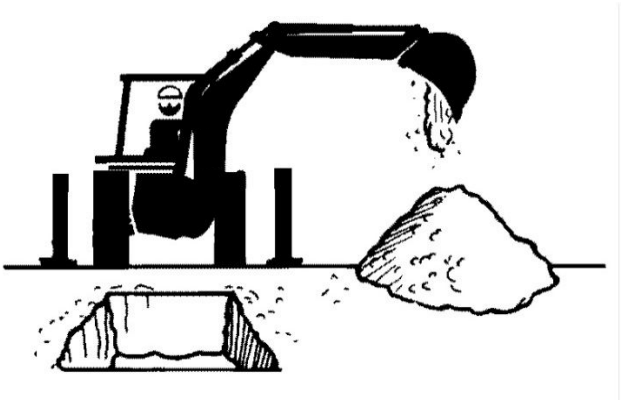
For power digging or working in a small area. Use bucket cylinder (B) for digging.

1. Lower extended bucket to digging area and lower boom to force bucket into ground.
2. While retracting the dipper stick, curl (retract) bucket until it is full. If bucket stalls, raise the boom slightly and continue to curl bucket. If dipper stick stalls, roll back bucket to break out.



DIGGING & TRENCHING

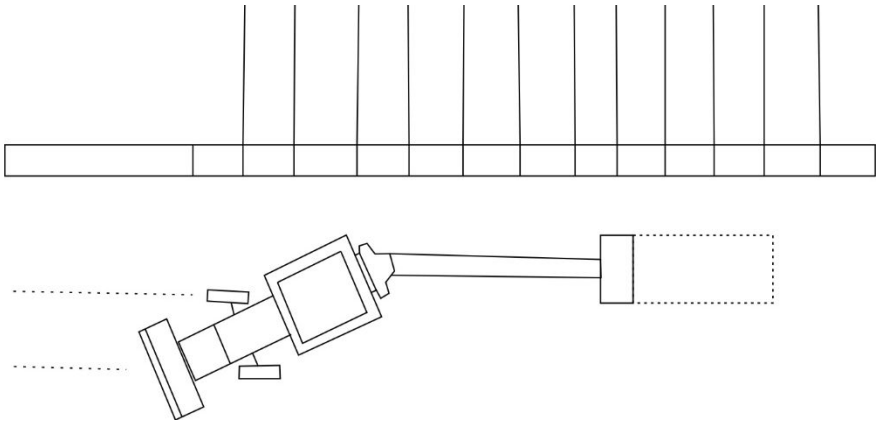
Trenches should be dug in a “V” to prevent cave-ins. (See positioning spoil piles in this chapter for spoil dumping informa on.) If cave-in occurs and cannot be reached from current position, do not back over trench. Drive the machine to side at cave-in, and park at a 90 deg angle.



DIGGING NEAR A WALL OR FENCE

WARNING:

Position the machine close to the wall as shown. Set the front wheels in line with the wall, pointing in the direction of dig.



WORKING WITH THE LOADER:

Remember that you will be driving the machine while using the loader. Keep alert for bystanders and possible hazards. Stay in the correct driving position.

When working with the loader set the backhoe straight behind the machine as for road travel.

Keep the loader shovel low to the ground when travelling. This increase your visibility and makes the machine more stable.

Whenever possible, travel in reverse when you are carrying a loaded shovel downhill. Travel forward when you are going uphill with heavily loaded shovels. Do not travel faster than 8 Km/h.

OPERATING ON A SLOPE:

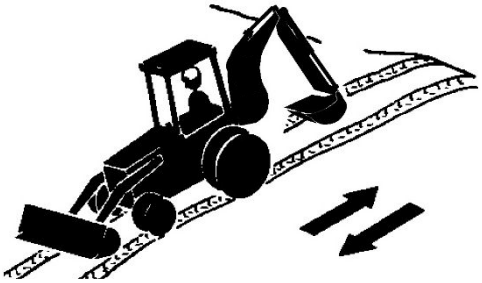
CAUTION: To avoid injury from machine rollover, do not turn while operating on slopes. Driving straight up or down slope with loader and backhoe bucket near ground and dipper stick retracted.

With front bucket loaded:

- Level or slightly retract bucket when driving up slope.
- Fully retract bucket when driving down slope.

With front bucket unloaded:

- Level bucket when driving up slope keeping bucket raised high enough to prevent digging into ground.
- Point bucket down slope and drive slow when travelling down slope.

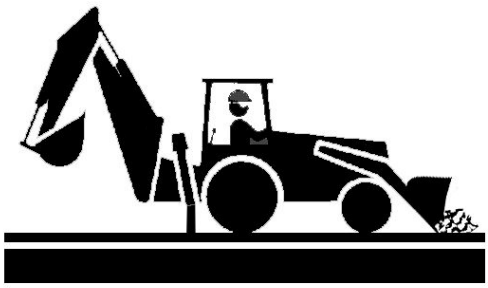


FILLING THE LOADER BUCKET

WARNING: When loading with material from a high bank or pile, remove any overhang first. Watch over for sliding material. If overhanging material falls, you and your machine could be buried.

Pressing the transmission dump switch will give more power to the loader and seed the operation. Try to fill the shovel in one pass. Half full shovels are less productive.
When moving the load, roll the shovel right back to prevent spillage.
When you are loading from a pile of loose material, start at the bottom and follow up the face as shown. Approach the pile with the shovel level and skimming the ground.
In tightly packed material, start at the top and work down.
When removing material from stock pile, start at a shovel's height from the base. Once the height of the stock pile has been reduced, begin loading from the base.

DOZZING/GRADING:



Keep the bo om of the shovel parallel to the ground when using the machine as a dozer or for grading. When grading a site, use forward travel to remove high spots. Use the soil collected this way to fill in the troughs when reversing.

Do not use excessive down pressure on the shovel, or the machine could lose traction. In hard material, use the shovel teeth.

WARNING

Before you start using the backhoe, you must convert the machine into a safe and stable working platform. See preparing to use the backhoe for details.

If you will be working with a laborer, make sure both understand what each other will be doing. Learn and use the recognized signaling procedures. Do not rely on shouting-they will not hear you.

For the best fuel economy when using the backhoe, keep the tachometer pointer in the range of 1700-1800 rpm.

1. Position the backhoe
   Set the backhoe straight behind the machine. Rest the bucket on the ground with the dipper positioned as shown.

WARNING

If two people are doing this job make sure that the person working the controls is a competent operator. If the wrong control lever is moved or if the bucket control lever is moved violently, the other person could be killed or injured.

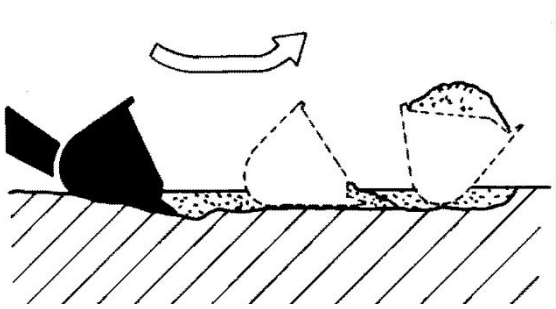
*Before starting backhoe operations without fail remove the actuator lock pin and keep it safely in tool box. The actuator pin is used only while traveling.

2. Preparing to use the backhoe
   When choosing a digging position, avoid digging downhill if possible. Whenever possible, dump the load on the uphill side of the excavation. Both these precautions will help to keep the machine stable.

EXCAVATING WITH THE LOADER BUCKET

NOTE: Buckets with teeth are recommended for excavating.

Position bucket at a slightly downward angle on the ground and drive forward to scoop ground and curl bucket at end of excavating area. If digging in tightly packed, hard or dense ground, use a gentle up-and-down motion to break up ground.



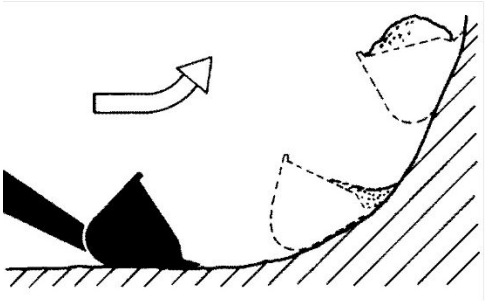
EXCAVATING BANKS/STOCK PILES

CAUTION:

To prevent possible injury from falling material, remove overhangs from top of bank or stockpile before starting excavation. Remove overhang with the backhoe or loader before starting to dig at the base of a bank or stockpile. Using backhoe or loader, reduce required breakout force when digging into hard, dense or tightly-packed material by working from top of the bank or stockpile to bottom. Under normal conditions, start to excavate bank or stockpile from bo om, working up the side. Work face of the bank or stockpile evenly to prevent outcroppings and overhangs. Excavate bank or stockpile with machine at a 90˚ angle to digging surface.

Remove Overhang

Hard Material Start Point



Normal Excavating Position

1. Position bucket on the ground in dig position.

NOTE: Use differential lock as necessary.

2. Place gear shift lever in first or second gear depending on ground conditions.
3. Move forward into the bank or stockpile.
4. Raise and curl bucket as it fills. Remove overhang start point normal excavating position.

SCRAPPING AND CUTTING

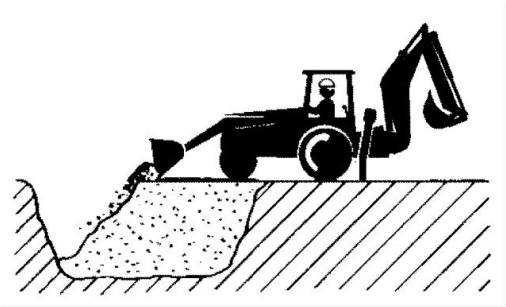
If a deep cut is to be made, do it in steps of about 50 mm (2 inch). DO not forget to adjust the shovel height up when the machine's front wheels enter the cut.

During the final cut, do not make fine adjustments by altering the shovel height. Adjust by altering the shovel angle, or the shovel may leave ruts in the surface.

BACKFILLING

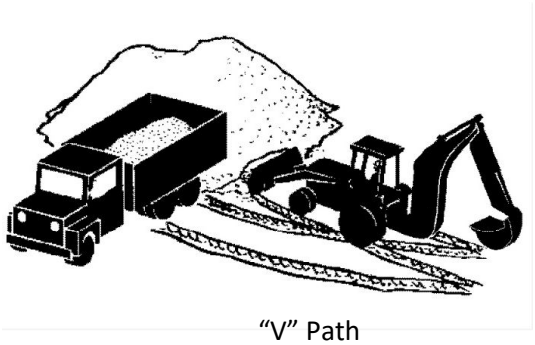
When backfilling on a slope, pile the material on the high side of the trench if possible.

Set the shovel level to the ground. Select a shovel height and gear speed which will give maximum depth of cut without overloading the engine. Work at right angles to the trench is filled. Use the spillage to finish the job by driving the length of the trench with the shovel low to the ground.



LOADING A TRUCK

Level and smooth loading area before loading trucks to increase machine stability. Retract and lock backhoe and dipper stick. Install swing lock pin. Ensure working area is clear of all persons, including truck driver, before loading truck. Park truck close to stockpile to reduce backhoe travel time. If possible, load truck on driver's side for easy communication with driver. If possible, park truck so wind will be at your back to keep dust of the dumped load out of your eyes and away from engine air cleaner. Follow a "V" path between truck and stockpile. Raise loader while moving toward truck and lower while moving away from truck to save time. Load truck box from center front to center rear. Dump load into truck at a steady pace (rather than abruptly) to minimize stress on truck. If loading large rock, first place a load of smaller rock into truck to cushion impact of large. If loading with backhoe bucket, do not swing bucket over truck cab. "V".



"V" Path

MAINTENANCE

INTRODUCTION

A well maintained machine speaks loud about you as an owner. More importantly it will not let you down when you need it most.

Maintenance is one of the most serious aspects of ownership. It determine the longevity, performance and reliability of your machine.

Looking after the machine involves more than taking care of its external cleanliness and shine. Maintenance means taking care of all the parts even those that are inside the bonnet. These are the parts that directly concern the performance of your machine.

Productivity comes from working smarter, not harder.

Breakdowns not only prevent you from completing your task on time, but also they add expense to your machine operational costs.

You can minimize your machine down time and keep costs down by proactive instead of waiting for a breakdown.

Timely performed scheduled maintenance not only prevents expensive and time taking failures, but is far more economical.

Keep and maintain all the records of scheduled maintenance, oil changes and other services-repairs that will give you an accurate idea of what needs to be done and when.

RECOMMENDED LUBRICANTS

LUBRICANT MANUFACTURER	ENGINE	TRANSMISSION	AXLE	HYDRA-ULIC OIL	GREASE
	5W-30 (APICJ4 OR ABOVE)			ISO VG 22	DIVYOL EPX2 (CC)
MOBIL 424 (EXXON)		85W OR 80W	85W OR 80W		
AMBRA MULTI G		85W OR 80W	85W OR 80W		
HY-TRAN PLUS CASE MS 1223		85W OR 80W	85W OR 80W		
HY-TRAN PLUS CASE MS 1209		85W OR 80W	85W OR 80W		
UNIVERSAL 80W		85W OR 80W	85W OR 80W		
GULF UTTF 85W		85W OR 80W	85W OR 80W		

RE-FILL CAPACITIES

Hydraulic Tank	80 Ltrs
Fuel Tank	150 Ltrs
Transmission rear axle	17 Ltrs
Planetary Gear Box	3 Ltrs
Differential Housing	14.5 Ltrs

SAFE MANITENANCE PRACTICE

If any maintenance required to be performed with engine running, the machine must not be left unattended. Keep all parts in good condition and properly installed. Identify damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris. Understand service/ maintenance procedure before doing work. Keep the maintenance/service area clean and dry. Use loader arm safety lock, backhoe boom lock to prevent elements from moving during service. If safety locks are not available, lower the attachments to the grounds. Never lubricate or service any parts of the machine while it is moving. Keep hands, feet and clothing away from moving parts.

Before servicing machine ensure the following:

1. Park machine on a level ground.
2. Lock equipment in raised position or lower to the ground.
3. Move FNR/range lever to NEUTRAL.
4. Availability of required lubricants, spare parts and tools.
5. Empty containers for draining oil/lubricants.

CAUTION: Never rely on FNR lever to stop the machine from moving. Always engage parking brake to prevent machine movement.

6. Engage parking brake.
7. Operate machine at ½ speed without load for two minutes.
8. Move engine speed control lever to SLOW IDLE.
9. Turn ignition key to OFF and remove key from the ignition switch.
10. Release hydraulic pressure by moving control levers until equipment does not move. Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine. Allow the engine to cool.

CHECK EVERY TIME

A: BEFORE STARTING

1. Lower the attachments to the ground.
2. Check & top up (if required)- engine oil, transmission oil, axle oil, Hydraulic oil, Diesel & radiator water.
3. Do a pre-start inspection as described in the operation & maintenance manual.
4. Adjust the seat so that you can comfortably reach all the driving controls. You should be able to apply full brake pedal travel with your back against the seat back.
5. Set the rear view mirror (s) to give you a good view close behind the machine when you are correctly seated.
6. Pull the FNR lever in neutral, Set the hand throttle lever to minimum.

B: AFTER STARTING

1. Check that the warning lights, horn, alarm, indicator lights, all switches, gauges, direction indicators and wiper are in working order.
2. Check for water, oil & fuel leakage if any.
3. Warm up the engine for a few minutes before loading, load the engine gradually.
4. Check all parts for abnormal sound when running.

DAILY OR EVERY 8-10 HRS. MAINTENANCE

1. Clean the machine properly, remove the grease, dirt, oil, odds etc.
2. Inspect for damages & leakages.
3. Clean engine air pre-cleaner & air cleaner outer element.
4. Drain water separator.
5. Check battery terminals.
6. Check fan belt tension.
7. Check & maintain tyre pressure: Front 75-80 psi, Rear 25-28 psi.
8. Check & add if required:
   Engine oil level;
   Transmission oil level;
   Hydraulic oil level;
   Fuel/diesel tank level;
   Battery electrolute level;
   Radiator water/coolant level;
   Brake fluid level.

9. **Check proper tightening torque:**
   Operator cabin mounting bolts/nuts;
   Wheel nuts;
   Drive shaft nut bolts.

10. **Greasing:** (Refer fig. , Backhoe greasing points. * No. of grease points)

1. Loader Arm Pin *2,
2. Loader Center lever pin *4
3. King Post Upper Pin *1
4. Slew Cylinder Mounting Bush *4
5. Boom Cyl. Road side pin *1
6. Dipper Mounting Pin *1
7. Tipping Link Mounting Pin *1
8. Bucket Mounting Main Pin *3
9. Front hub Bearing *2
10. Loader Side Link Pin *6
11. Loader Bucket Link Pin *2
12. King Post Lower pin *1
13. Boom Mounting Pin *2
14. Dipper Cyl. Head side pin *1
15. Bucket cyl. Head side pin *1
16. Tipping Link Pin *1
17. Stabilizer Cyl. Mounting pin *2
18. Front axle Pivots & linkage *8
19. Loader Lift Cylinder *2
20. Loader Bucket Mounting Pin *2
21. Slew Cylinder rod side pin *2
22. Boom Cyl. Head side pin *1
23. Dipper Cyl. Rod Side Pin *1
24. Bucket Cyl. Rod Side Pin *1
25. Tipping Lever Pin *3
26. Drive Shafts *4

IMPORTANT: Change at first 100 Hrs. on new machine:

Engine Oil & Oil Filter, Fuel Filter (Primary & Secondary both), Transmission Oil & Oil Filter, Rear (drive) Axle Oil, Hydraulic Oil Filter & Oil Strainer, Front Axle Oil (4WD).

2. EVERY 45 DAYS OR EVERY 250 HRS MAINTENANCE (whichever occurs early)

Carry out daily maintenance & the following:

Check engine oil & filter

Check fuel filter (Primary and Secondary both)

Check transmission Oil Filter

Check hydraulic oil return line filter

Clean air Filter outer element

Check air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

Check working of all electrical equipment

Check stabilizer legs play, adjust if required.

Check engine mfg. bolts & tightness

Check rear axle mounting bolts

Check operation of foot brakes

3. EVERY 90 DAYS OR EVERY 500 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 Days maintenance & the following:-

Replace engine oil & filter

Replace fuel filter (Primary and Secondary both)

Replace transmission Oil Filter

Replace hydraulic oil return line filter

Replace air Filter outer element

Replace air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

4. EVERY 135 DAYS OR EVERY 750 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days and 90 days maintenance & the following:-

Check engine oil & filter

Check fuel filter (Primary and Secondary both)

Check transmission Oil Filter

Check hydraulic oil return line filter

Clean air Filter outer element

Check air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

Check working of all electrical equipment

Check stabilizer legs play, adjust if required.

Check engine mfg. bolts & tightness

Check rear axle mounting bolts

Check operation of foot brakes

5. EVERY 180 DAYS OR EVERY 1000 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days, 90 days and 135 days maintenance & the following:-

Replace engine oil & filter

Replace fuel filter (Primary and Secondary both)

Replace transmission Oil Filter

Replace hydraulic oil return line filter

Replace air Filter outer element

Replace air Filter Inner element

Replace Transmission case + Torque Converter Oil

Replace rear axle oil 14.5 + Hub 3 Ltr.

Replace Front Axle Oil (4WD)

Replace Coolant for radiator

Replace Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

Drain fuel tank

Drain/ flush out radiator & fill with fresh coolant/water

Clean radiator fins

Check engine tappet settings

6. EVERY 225 DAYS OR EVERY 1250 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days, 90 days, 135 days and 180 days maintenance & the following:-

Check engine oil & filter

Check fuel filter (Primary and Secondary both)

Check transmission Oil Filter

Check hydraulic oil return line filter

Clean air Filter outer element

Check air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

Check working of all electrical equipment

Check stabilizer legs play, adjust if required.

Check engine mfg. bolts & tightness

Check rear axle mounting bolts

Check operation of foot brakes

7. EVERY 270 DAYS OR EVERY 1500 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days, 90 days, 135 days, 180 days and 225 days maintenance & the following:-

Replace engine oil & filter

Replace fuel filter (Primary and Secondary both)

Replace transmission Oil Filter

Replace hydraulic oil return line filter

Replace air Filter outer element

Replace air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

8. EVERY 315 DAYS OR EVERY 1750 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days, 90 days, 135 days, 180 days, 225 days and 270 days maintenance & the following:-

Check engine oil & filter

Check fuel filter (Primary and Secondary both)

Check transmission Oil Filter

Check hydraulic oil return line filter

Clean air Filter outer element

Check air Filter Inner element

Check Transmission case + Torque Converter Oil

Check rear axle oil 14.5 + Hub 3 Ltr.

Check Front Axle Oil (4WD)

Check Coolant for radiator

Check Brake Fluid

Check Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

Check working of all electrical equipment

Check stabilizer legs play, adjust if required.

Check engine mfg. bolts & tightness

Check rear axle mounting bolts

Check operation of foot brakes

9. EVERY 365 DAYS OR EVERY 2000 HRS MAINTENANCE (whichever occurs early)

Carry out daily, every 45 days, 90 days, 135 days, 180 days, 225 days, 270 days and 315 days maintenance & the following:-

Replace engine oil & filter

Replace fuel filter (Primary and Secondary both)

Replace transmission Oil Filter

Replace hydraulic oil return line filter

Replace air Filter outer element

Replace air Filter Inner element

Replace Transmission case + Torque Converter Oil

Replace rear axle oil 14.5 + Hub 3 Ltr.

Replace Front Axle Oil (4WD)

Replace Coolant for radiator

Replace Brake Fluid

Replace Hydraulic Oil

Clean Hydraulic Tank Strainer Filter

Clean Hydraulic Tank Breather Filter

NOTE:

Replace Hydraulic oil return line filter and Hydraulic Oil in every 250 hrs. and 1000 hrs. respectively when using for Rock Breaker Operation.

PREVENTIVE MAINTENANCE

Preventive maintenance does not mean eliminating maintenance, it means eliminating costly maintenance by involving operator maintenance/service personnel and others in activities that prevent machine from breaking down. This means detecting problems while they are small and manageable.

The machine operator is a valuable resource for performing preventive maintenance. Operator is at the machine for far more time than maintenance/ service personal therefore he is an important resource to detect changes in conditions and perform some of the simpler maintenance tasks such as lubricating. Tightening of fasteners and inspecting for a failure.

Preventive- believe that a regular maintenance attention will keep machine failure under control.

POSSIBLE FAILURE CAN BE DETECTED DURING

1. Daily Inspection
2. Pre-start inspection
3. Inspection after starting
4. Stooping the engine
5. Inspection during halt/long operations
6. Daily maintenance

Detected possible failures must be reported to the service/maintenance personal or dealer and planning should be done for performing maintenance/repairs.

The ideal preventive maintenance program would prevent all machine failure before it occurs.

LONG TERM BENEFITS OF PREVENTIVE MAINTENANCE

Improved machine reliability

Improved machine performance

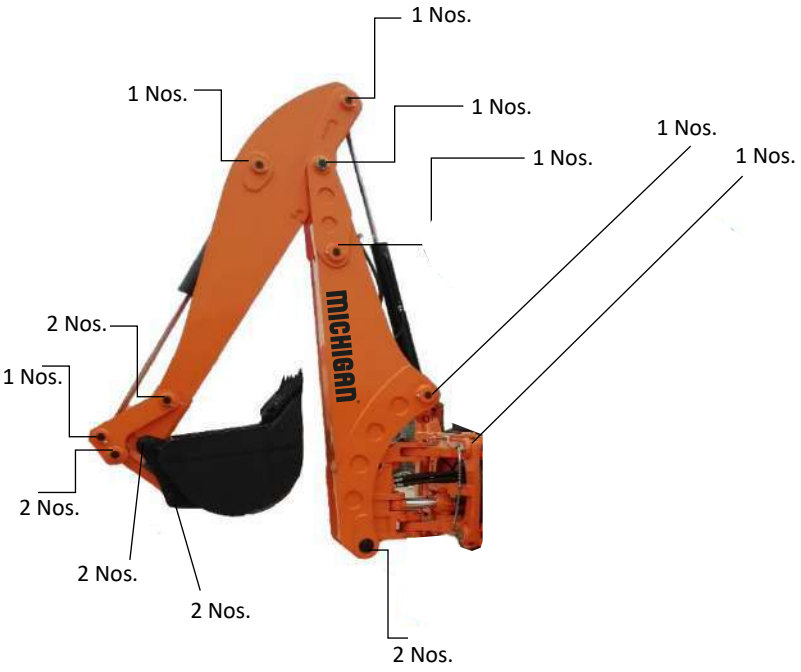
Minimized repair cost

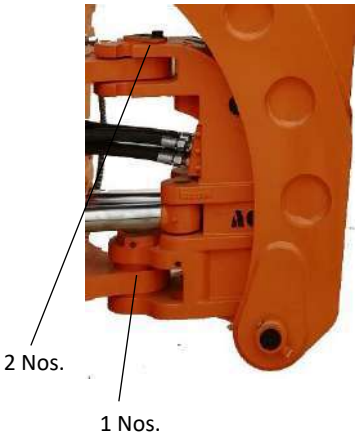
Minimized machine down time

MAINTENANCE CHART

MAINTENANCE SCHEDULE OF BACKHOE LOADER				R-Replace C-Check C-	1st. Service	2nd. Service	3rd. Service	4th. Service	5th. Service	6th. Service	7th. Service	8th. Service	9th. Service	For Rock Breaker Operation
Sr. No.	PART DESCRIPTION	GRADE/ PART NO.	QTY.	EVERY	15 days / 50-100 hrs.	45 days / 250 hrs.	90 days / 500 hrs.	135 days / 750 hrs.	180 days / 1000 hrs.	225 days / 1250 hrs.	270 days / 1500 hrs.	315 days / 1750 hrs.	365 days / 2000 hrs.	
1	Engine Oil -5W-30 (API CJ4 OR ABOVE)	980100004100	11	500 hrs.	R	C	R	C	R	C	R	C	R	
2	Engine Oil Filter	200593400400	1	500 hrs.	R	C	R	C	R	C	R	C	R	
3	Fuel Filter Primary	200593424300	1	500 hrs.	R	C	R	C	R	C	R	C	R	
4	Fuel / Mud Filter Secondary	200593424000	1	500 hrs.	R	C	R	C	R	C	R	C	R	
5	Transmission Oil Filter	200593400300	1	500 hrs.	R	C	R	C	R	C	R	C	R	
6	Hydraulic Oil Return Line Filter	922200003010	1	500 hrs.	R	C	R	C	R	C	R	C	R	Change in Every 250 hrs.
7	Air Filter outer to be clean when the vacuum indicator comes red	200593424200	1	3 Cleaning / 500 hrs.	Clean	Clean	R	Clean	R	Clean	R	Clean	R	
8	Air Filter inner change / not clean	200593424100	1	Along with outer	C	C	R	C	R	C	R	C	R	
9	Transmission Case+Torque Convertor Oil 85W OR 80W GL4 *	85W OR 80W GL4 980100003900	17	1000 hrs.	R	C	C	C	R	C	C	C	R	
10	Rear Axle Oil-85W OR 80W GL4 (14.5 + Hub 3 Ltr.) *	85W OR 80W GL4 980100003900	17.5	1000 hrs.	R	C	C	C	R	C	C	C	R	
11	Front Axle OiL (4WD) 85W OR 80W GL4 *	85W OR 80W GL4 980100003900	9.1	1000 hrs.	R	C	C	C	R	C	C	C	R	
12	Coolant for Radiator	Antifreeze premix	15	1000 hrs.	C	C	C	C	R	C	C	C	R	
13	Brake Fluid	(ISO VG46) PETRONAS	0.5	1000 hrs.	C	C	C	C	R	C	C	C	R	
14	Hydraulic Oil	ISO VG 22 / 980100004200	Tank-80 System-120	Tank-2000 hrs. System-4000 hrs.	C	C	C	C	C	C	C	C	R	Change in Every 1000 hrs.
15	Hydraulic Tank Strainer Filter	92210000700	1	250 hrs.	Clean	Clean	Clean	Clean	Clean	Clean	Clean	Clean	Clean/Replace if found damaged	
16	Hydraulic Tank Breather Filter		1	250 hrs.	Clean	Clean	Clean	Clean	Clean	Clean	Clean	Clean	Clean/Replace if found damaged	
17	Grease - DIVYOL EPX2 (CC)	DIVYOL EPX2 (CC) 980100004300	0.5	10 hrs.	Grease after working of every 10 hours									
*	REFER MANUAL FOR APPROVED OIL													XXXX

BACKHOE GREASING POINT (DAILY)





BACKHOE

For each grease point shown there is another on the other side of the machine.

Note: Do not grease the swivel mechanism, mounting rails.

FRONT STEER AXLE

GREASING

Read greasing paragraphs for general information about greasing.

WARNING

You will be working close to the machine for these jobs. Lower the attachments if possible. Remove the starter key and disconnect the battery. This will prevent the engine being started.

Chock all four wheels before getting under the machine.

LUBRICATION

The following points should be lightly oiled with engine oil every 100 operating hours.

WARNING

Make the machine safe before getting beneath it. Lower the attachments to the ground, remove the starter key, disconnect the battery.

CONTROL LEVER

Oil the clevis at the bottom of every attachment control lever.

TYRES AND WHEELS

WARNING

An exploding tyre can kill, inflated tyre can explode if overheated. Do not cut or weld the rims. Use a tyre wheel specialist for all repair work.

TYRE INFLATION

These instructions are for adding air to a tyre which is already inflated. If the tyre has lost all its air pressure, call in a qualified tyre mechanic. The tyre mechanic should use a tyre inflation cage and the correct equipment to do the job.

WARNING

If, for whatever reasons, a wheel stud is renewed, all the stud for that wheel must be changed as a set, since the remaining studs may have been damaged.

TYRE PRESSURES

Front:- 4WD	12.5 X 80	50- 55 PSI/ 3.44- 3.79 BAR
Rear :- Standard	14 X 25	35- 40 PSI/ 2.41- 2.75 BAR
	16.9 X 28	35- 40 PSI/ 2.41- 2.75 BAR

1. **PREPARE THE WHEEL**

   Before you add air to the tyre, make sure it is correctly fitted on the machine or installed in a tyre inflations cage.

2. **PREPARE THE EQUIPMENT**

   Use only an air supply system which includes a pressure regulator. Set the regulator no higher than 1.38 bar (20 psi) above the recommended tyre pressure.

   Use an air hose fitted with a self-locking air chuck and remote shut off valve.

3. **ADD THE AIR**

   Make sure that the air hose is correctly connected to the tyre valve. Clear other people from the area. Stand behind the tread of the tyre while adding the air.

   Inflate the tyre to the recommended pressure. Do not over-inflate.

CHECKING THE ROAD WHEEL TIGHTNESS

On new machines, and whenever a wheel has been removed, check the wheel nut torques every two hours until they stay correct.

Every day, before starting work, check that the wheel nuts are tight.

BRAKES

WARNING

Faulty brakes can kill. If you have to add oil to the brake reservoir regularly get the brake system checked by ACE rep. Do not use the machine until the fault has been set right.

1. **Check the fluid levels:** Remove the reservoir cap and check the level. The max and min marks are marked on the side of the reservoir. If necessary add fluid to top up the level. If the level has fallen below the min mark, get the system checked by ACE service rep.

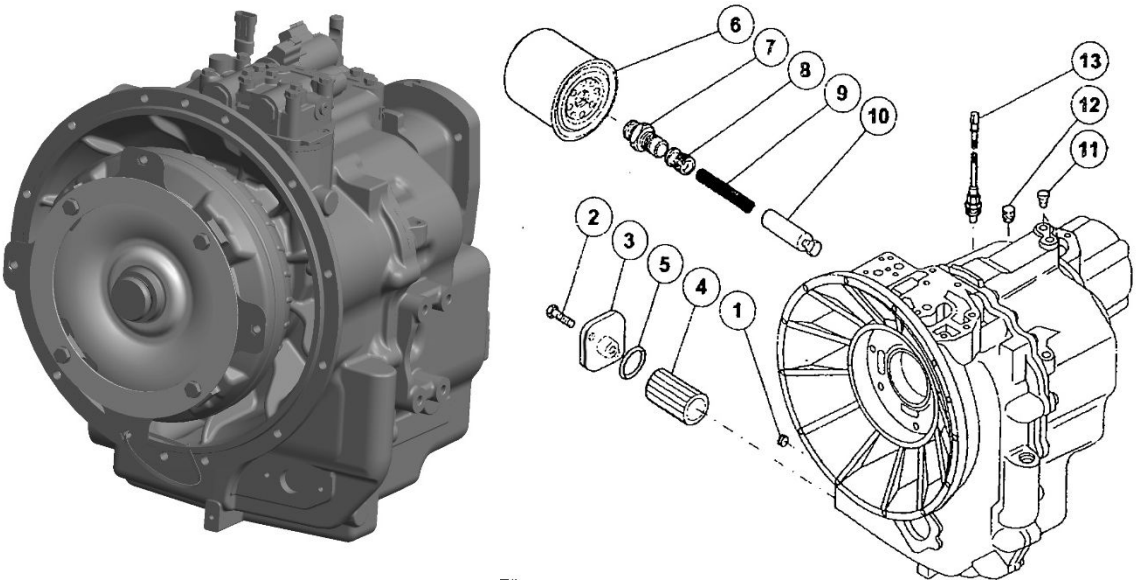
WARNING

Using incorrect brake fluid could damage the system. See the fluids, capacities and lubricants chart in this handbook for correct fluid. The fluid can harm your skin. Wear rubber gloves, cover cuts and grazes.

2. **Add fluid:** Carefully pour the recommended fluid until it reaches the correct level. Avoid spilling it. Wipe up any spillage.

MAINTENANCE OF TRANSMISSION SYSTEM

POWER SHUTTLE TRANSMISSION



CHECKING THE OIL LEVEL

Note: Make sure the engine is stopped. Remove the starter key.

Check oil level in neutral and at idle RPM of engine and operating temperature of transmission oil as mentioned on the dipstick.

CHANGING THE OIL AND FILTER

1. Prepare the machine
   Park the machine on level ground. Engage the parking brake. Lower the attachments to the ground. Stop the engine. Remove the starter key.
2. Remove the drain plug (1) and drain the oil from the transmission.
   a) Place a container that can hold at least 20 ltrs. Beneath the machine (to collect oil)
   b) Remove the bolts (2), remove the cover (3), remove the oil strainer (4), and '0' ring (5).
3. Clean the strainer
   Clean the strainer with a suitable solvent. Follow the solvent manufacturer's instruction on safety.
4. Refit the strainer
   Fill the strainer and a new O ring (5). Apply 'lock tite' to bolts (2) before fitting and tightening them.

5. Renew the filter
   a) Unscrew and remove the filter (6).
   b) Put this coat of oil or grease on the silver gasket.
   c) Screw the new filter in place, hand-tight only.
6. Fill the system
   Fill the system with new oil through the filter cap (12)

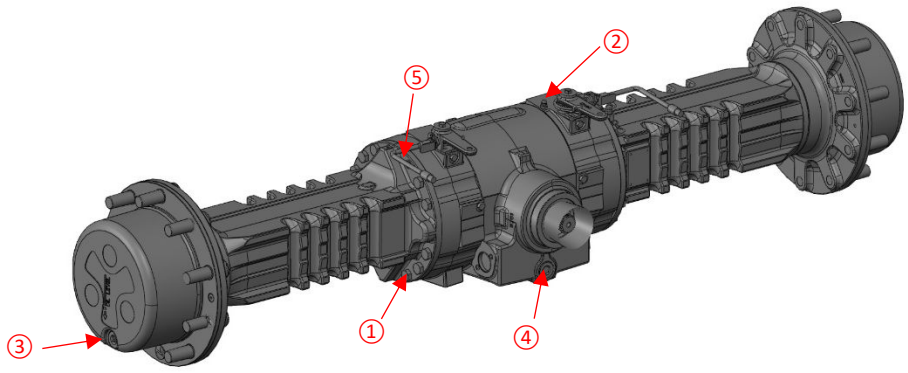
Note: Do not fill past the top mark on the filter cap (13).

REAR AXLE

OIL CHANGE AND CHECKS

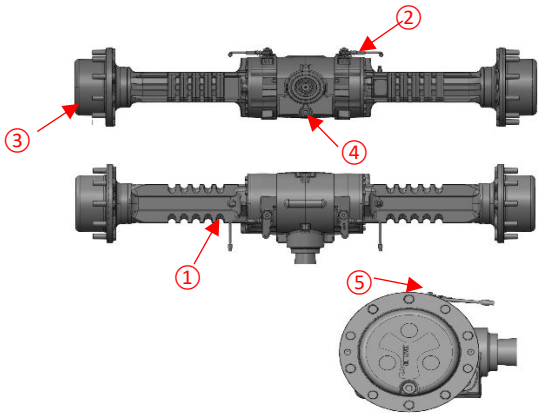
It is essential that the machine is parked on level ground to ensure accurate oil level checking.

1. Prepare the machine
   Park the machine on level ground. Engage the parking brake. Lower the attachments to the ground. Stop the engine. Remove the starter key.



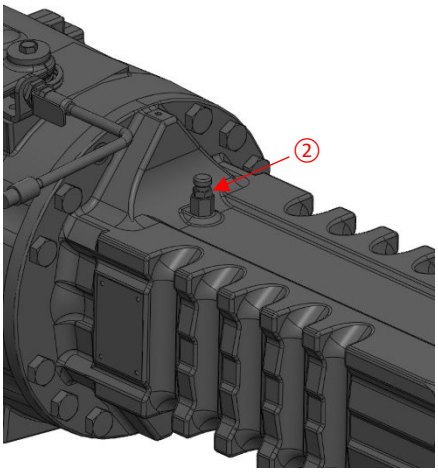
CAUTION

1. It is not recommended that the machine be driven with the axle partially filled with oil.
2. Oil will gush from the hole when drain plug is removed. Keep to one side when you remove the plug.
   Some of the following pictures may not show exactly your axle, but the procedure is the same.

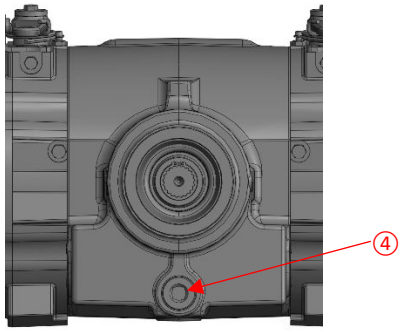


POSITION	DESCRIPTION
1	Differential oil filling and level Plug
2	Oil breather
3	Fill/drain and level plug of epicycle reduction gear oil
4	Differential oil drain plug
5	Brake bleed plug

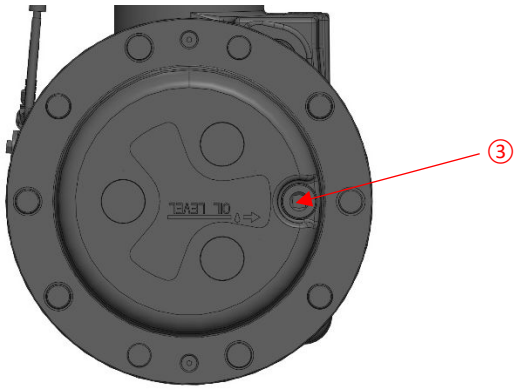
Before draining the oil from axle housing loosen the breather (2) to release possible internal pressure, then tighten the plug to the prescribed torque.



Remove drain plug (4) and drain the oil. Clean the plug and tighten the plug to the prescribed torque.



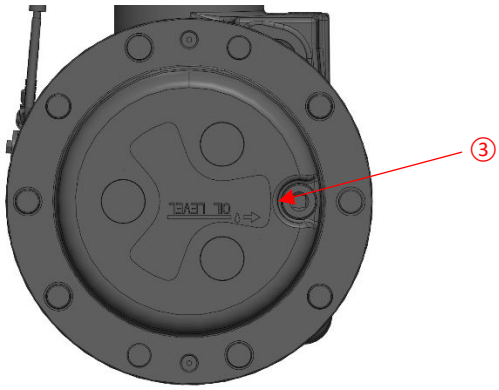
Before draining the oil from wheel ends rotate the wheel ends so that the plugs (3) are at the highest position A and partially unscrew to release possible pressure. Rotate the wheel ends so that the plugs (3) are toward the ground B. Remove the plugs. Drain the oil



Fill to the bottom of the fill plug hole with the specified oil. Wait and allow the oil to flow through the axle. Check the oil level again and fill to the specified level if necessary. Close and tighten to the prescribed torque.

Rotate the wheel end so that the oil level line is parallel to the ground C. Fill to the bottom of the fill plug hole with specified oil.

Tighten the plug to the prescribed torque.

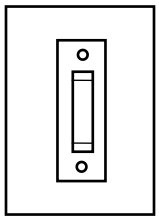


HYDRAULIC SYSTEM

WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

1. Prepare the machine
   Position the machine on level ground. Set the loader shovel on the ground. Raise the boom, swing in the dipper and close the bucket. Stop the engine. Remove the starter key.



HYDRAULIC OIL LEVEL INDICATOR

2. Check the level
   Look at the fluid level in the indicator L. The level should be between the two marks on the tube. If the fluid is cloudy, water or air has entered the system. Water or air in the system could damage the hydraulic pump.
   Contact ACE service rep if the fluid is cloudy.

3. Add Oil
   If necessary, add recommended oil through the filter cap M.

CHANGING THE FILTER ELEMENT

1. Remove the engine hood.
2. Remove the filter.
3. Fit the new element.
4. Add recommended oil through filter. Fit and tighten the filter cap.

HYDRAULIC OIL COOLER

The hydraulic oil cooler is in front of the transmission oil cooler which in turn is in front of the engine radiator. If the hydraulic oil cooler tubes/fins get clogged (by dirt and flies etc) the radiator and cooler will be less efficient.

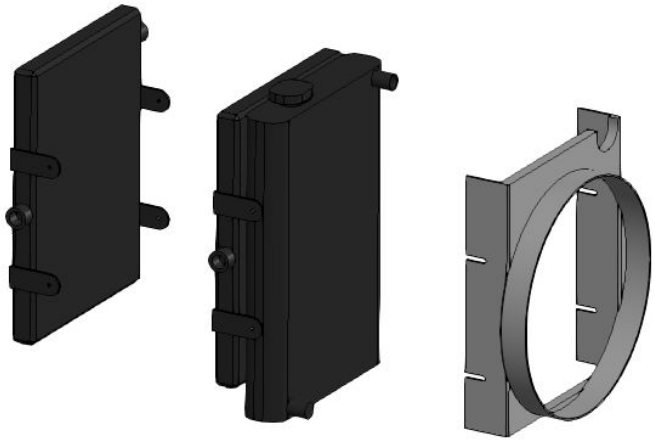
Cleaning the tubes/fins

1. Raise and lock the loader arms.
2. Remove the radiator grills.

   Unscrew radiator mounting bolts. Lift off the radiator.
3. Clean the cooler.

   Brush off all debris from the cooler tubes and fins. Make sure the loosened material is brushed out of the cooler enclosure.
4. Refit the radiator grills.

   Tighten radiator mounting bolts evenly.



MAINTENANCE OF ELECTRICAL SYSTEM

A) MAINTENANCE OF BATTERY

Check the level of electrolyte in the battery after every 10 hrs. Of operation or as operating conditions prove if necessary. Maintain level of solution 10 mm above plates of battery by addition of clean distilled water. Keep battery and cable terminals tight and clean.

AVOID

To prevent possibility of electric short circuit always disconnect the battery before attempting any repair or while cleaning.

If corrosion occurs, clean battery posts and terminals with a strong soda solution and coat terminals lightly with petroleum jelly before connecting them again. The petroleum jelly will prevent further corrosion.

1. Loose or corroded wire connections.
2. Broken wires.
3. Worn generator bushes
4. Oily generator bushes or commutator.
5. Fan belt loose.

THE ELECTROLYTE LEVEL of each cell should be checked at the interval specified on the lubrication chart and water added if necessary. The proper level to maintain is 3/8 to ½ inch above the plates. TO ensure maximum battery life, use only distilled water or water recommended by the battery manufacturer. After adding water in freezing weather, operate the engine for atleast thirty minutes to thoroughly mix the electrolyte.

EXCESSIVE USE OF WATER indicates leakage or overcharging. Normal water usage for a unit operating eight hours per day is about one to two ounces per cell per month. For heavy duty operation (24 hours) normal consumption should be considered as a danger sign.

OVERCHARGING which causes overheating is first indicating by excessive use of water. If allowed to continue, cell covers will push up at the positive ends and in extreme cases the battery container will become distorted and cracked. With any of these indications present, the voltage regulator setting should be carefully checked.

LEAKAGE can be detected by continual wetness of the battery of excessive corrosion of the terminals, battery carrier and surrounding area. (A slight amount of corrosion is normal in acid batteries). Inspect the case, covers and sealing compound for holes, cracks or other signs oF leakage. Check battery hold down connections to make sure the tension is not great enough to crack the battery, or loose enough to allow vibration to open the seams. A badly leaking battery should be replaced.

TO REMOVE CORROSION, clean the battery with a solution of ordinary baking soda and a stiff wire brush and flush with clean water. Make sure none of the soda solution is introduced into the electrolyte as it is highly injurious. Be sure terminals are clean and tight. A light coating of petroleum jelly will prevent corrosion at the terminals. Clean terminals are very important in a voltage regulated system because corrosion creates resistance in the charging circuit which causes undercharging and gradual starvation of the battery.

Addition of acid will be necessary if considerable electrolyte has been lost through leakage. Before addir tery is fully charged. This is accomplished by putting the battery on cl specific gravity readings on each cell. When all the cells are gassing freely and three successive hourly readings show no rise in specific gravity, the battery is considered charged. Additional acid may now be added. Continue charging for another hour and again check specific gravity. Repeat the above procedure until all cells indicate a specific gravity of 1.260 to 1.265 corrected to 80 ◦ F.

NOTE: Use 1.400 strength acid when making gravity adjustments. Acid of higher strength will attack the plates and separators before it has a chance to diffuse into the solution.

HIGH TEMPERATURE OPERATION may make a tropical adjustment of gravity desirable. This will reduce battery maintenance and increase battery life. A tropical climate is considered one in which water never freezes. Under these conditions, it is permissible to lower the specific gravity of a fully charged battery to 1.225. This is accomplished by fully charging the battery and then removing a portion of the electrolyte and replacing it with distilled water. Continue charging to mix the electrolyte thoroughly and check gravity. Repeat the addition of distilled water until the gravity of all cells is 1.225. The following are the states of charge for various specific gravity readings of a battery adjusted for a tropical climate.

SP. GR.	**STATE OF CHARGE**
1.225	FULLY CHARGED
1.180	75% CHARGED
1.135	50% CHARGED
1.090	25% CHARGED
1.045	DISCHARGED

Idle batteries should not be allowed to stand unattended. If equipment is to stand unused for more than two weeks, the batteries should be removed and placed in a cool, dry place where they may be checked periodically and charged when necessary. Remember, all lead-acid batteries discharge slowly when not in use. This self-discharge takes place even though the battery is not hooded up in a circuit and is more pronounced in warm weather than in cold. The rate of self-discharge of a battery kept at 80◦ F is about four times that of one at 50 ◦F. Over a thirty day period, the average self-discharge runs about .002 Sp. Gr. Per day at 80 ◦F.

To offset the results of self-discharge, idle batteries should receive a booster charge (not a quick charge) at least once every thirty days. Batteries allowed to stand for long periods in a discharged condition are attached by a crystallization of cases irreparably damaged. In less severe cases the sulphated battery may be restored to limited service by prolonged charging at a low rate (approximately ½ normal rate).

A battery operated with insufficient charge over a long period due to either a faulty alternator or an incorrect voltage regulator setting is likewise liable to become sulphated. Such a battery should never be subjected to a prolonged over-charge which may happen if the alternator is reset to deliver proper charge. This overcharge will result in severely buckled plates.

This results in perforated separators and an eventual short circuit in the cell. Such an undercharged battery should be removed from the unit and subjected to the unit and subjected to the prolonged low charge.

An undercharged battery is extremely susceptible to freezing when allowed to stand in cold weather. The electrolyte of a battery in various stages of charge will start to freeze at temperatures indicated in the table below.

Specific Gravity Corrected to 80° F	**Freezing Temperature degrees Fahrenheit**
1.280	-90 ° F
1.250	-60 ° F
1.200	-16 ° F
1.150	+5 ° F
1.100	+19 ° F

The above temperature indicate the points at which the first ice crystals appear. Lower temperature must be reached for a solid-freeze. Solid freezing of the electrolyte may crack the container and damage the positive plates. As will be noted a ¾ charged battery is in no danger of freezing. Therefore, a ¾ charge or better is desirable, especially during winter weather.

TESTING

There are two ways of testing a battery to determine its condition. These tests are to be performed when battery alone is suspected of malfunctioning.

FIRST- Put the battery on charge to determine whether it takes a charge satisfactory. If it does, it is probably in good condition.

SECOND- Subject the battery to a high rate discharge test after a long slow charge. This test may be made if the corrected hydrometer reading of the electrolyte is above 1.250. If the

reading falls below this figure, the high discharge test should not be made since the battery will not maintain a good voltage reading.

With the fuel shut off, operate the cranking motor and quickly check the voltage across each cell with a low reading voltmeter. Do not operate the cranking motor for more than thirty seconds at a time without allowing it to cool off for a few minutes or the motor may be damaged by overheating. If there is no electric cranking motor or if the test is made outside the vehicle a current of at least 200 amperes must be drawn from the battery while the voltages are checked.

If the voltage during the high discharge test falls below 1.5 per cell, the battery is either discharged or is wearing out. It should be recharged and tested a second time. Remember that low temperature will cause voltage drops to lower values under the high discharge test. For this reason, it is recommended that the load test be made with the electrolyte at approximately 80 ◦ F.

to lower values under the high discharge test . For this reason, it is recommended that the load test be made with the electrolyte at approximately 80^{o} F.

If after the test the specific gravity, varies more than 0.025 points between cells, one or more things may be wrong. The low cell may be shorted, (discard the battery), the low cell may have lost electrolyte (readjust specific gravity after full charging), or the battery may be wearing out. These above three ailments may also result in a variation of more than 0.2 volts between cells during the high discharge test.

The worn off battery is not difficult to distinguish from one with a shorted cell. A worn off battery can be determined from its length of service and whether it will fully charge. If it does take a full charge, the standing due of self-discharge will probably average .002 to .003 sp. Gr. Points per day due to small internal shorts resulting from long service. Also, a worn out battery will sustain a heavy load such as cranking the engine longer than a battery with a badly shorted cell .A battery run with badly sorted cell although it may show a good charge will not sustain heavy duty discharge more than a few seconds. As the seriousness of the internal short decreases, the ability to sustain heavy duty discharge increases until the battery reacts like a worn out battery. Under this circumstances it must be treated as a worn battery, regardless of the length of service.

Providing the voltage did not fall below 1.5, or the variation between cells did not exceed 0.2 volts during the high discharge test or the specific gravity does not wary more than 0.025 points after completion of the test, the battery is sound

B) ALTERNATOR

The generator is set to keep battery fully charged under normal conditions. The ammeter should indicate a good rate of charge for a short time after starting engine or until generator replaces energy drained from battery during cranking; then it will show

little or no change .It is important that the alternator maintained in good condition 60 that the battery will be kept charged.

Testing and adjustment of generator should not be attempted without dependable testing equipments, therefore it is recommended that these units be taken to a dependable electrical repair shop when service is required. Whenever the generator has been removed for repairs or when generator leads have been disconnected and recommended, the generator must be polarized before engine is started. Polarizing causes current to flow in normal direction through the field coils and will prevent vibration, arcing, burning and sticking of regulator points.

SERVICE PRECAUTION

a) Ensure all connections are secure and clean.
b) Ensure that the connection in the charging circuit, including battery, is broken while the engine is running.
c) Observe correct polarity when refitting the vehicle battery or when using a slave battery to start the engine.
d) Do not flash the alternator output leads to check it's working.
e) Disconnect all the alternator terminals while carrying out any welding on the vehicle.
f) Ensure that the alternator is not mounted close to exhaust manifold without any protection.

MAINTENANCE

a) GENERAL: Keep the alternator re- assembly clean and ensure the ventilation slot or air spaces are clear and unobstructed. Check mounting bolts for tightness.
b) BELT: Ensure that the driving belt on the alternator is in good condition and is neither too slack nor too tight. If necessary the fan belt tension should be adjusted to obtain approximately 1/2" – 3/4" deflection of the belt when pressed at midway of the longest point between pulleys.

   NOTE: A slack belt will rapidly wear and because of slip may not drive the alternator at the required speed. Too tight a belt will impose severe side thrust on the bearings and seriously shorten their life.
c) BATTERY: Check with a hydrometer the specific gravity of the electrolyte in each of the battery cells to ensure that the battery is in good condition. Check for the tightness of the terminals. The specific gravity of the electrolyte should be uniform in all the cells. If the battery is found to be discharged it should be independently charged or substituted before proceeding to further checks.

CHECKING THE CHARGING SYSTEM

a) BATTERY: Check the cable connections and ensure it is tight. Check the battery and ensure that it is in good condition.
b) DRIVING BELT: Check whether the driving belt is slipping. If found slack adjust the same to normal limits.
c) CABLE: Check the external circuit for cable faults and rectify if faulty.
d) ALTERNATOR :
    1) Connect to suitable moving coil voltmeter between positive and negative terminal of the alternator, battery voltage should register.
    2) Connect an external ammeter if the vehicle is not fitted with one.
    3) Switch on the vehicle lights for about 5minutes and switch off.
    4) Start the engine and slowly increase the speed to near maximum. Observe that the warning light goes out and the ammeter records the charging current. The charging current may increase approximately to max. Output of alternator and then will start falling down. Observe the voltmeter connected in the circuit. The voltage should raise to the value between 26 -28 volts. If the voltage rises more than the above limit the regulator is faulty and needs replacement.
e) STARTER

    The starter motor is used for initial cranking of engine starter pinion is charged with the flywheel ring gear, when the main switch is put on, the starter motor rotates which in turn rotates the engine.

PRECAUTION

Never operate the starter motor for more than 10 seconds at a time. If the engine does not start in first instance, wait for 2-3 minutes before making next attempt for starting.

If the engine fails to start within 3, 4 attempts find out the cause and rectify the same. If the starter fails to crank the engine, check the following parts:

1) Broken wire or loose connection.
2) Faulty starting switch.
3) Exhausted battery
4) Worn out pinion teeth.
5) Damaged winding.

NOTE: Put off all lights while using the starter to avoid early discharge of battery.

STORING THE MACHINE

Preparation for storage

1. If the machine is to remain unused for a period exceeding 30 days, store it under cover or cover it with a waterproof tarpaulin.
2. Clean the machine.
3. Grease all the machine's grease fittings.
4. The fuel tank should be filled completely.
5. Operate all the hydraulic controls to release pressure in the hydraulic circuits.
6. Drain the engine oil and replace the oil filter.
7. Drain the cooling system. Leave the drain valves open and do not tighten the radiator cap. Place a "Do not start up" label on the instrument panel.
8. Clean or replace the air filter elements.
9. Coat the exposed portions of the cylinder rods and control valve spools with grease.
10. Paint all parts of the machine where the paint has been damaged.
11. Charge the battery. Remove it from the machine and place it on a wooden pallet in a cool, dry place. If possible, store it in a building where the temperature is above 0°C. Make sure the battery is clean. Check the electrolyte level regularly and make sure it is correct.
12. All the hydraulic jacks should be fully retracted.

TROUBLESHOOTING GUIDE

Introduction

The list of possible troubles and remedies provides no more than an indication of what the problem might be and how to deal with.

IT SHOULD BE REMEMBERED that problems are not caused by just one part so the specialist personnel must identify the problem and its cause than proceed with the necessary repairs.

THE GUIDE ONLY COVERS THE COMMON, CAUSES AND SOLUTIONS.

ENGINE

TROUBLES	POSSIBLE CAUSE	SOLUTION
The starter motor turns the engine too slowly	1- Battery low with new one	Get the battery charged or replace it
	2- Bad electrical connections	Contact your authorized service dealer
	3- Faulty starter motor	Contact your authorized service dealer
	3- Faulty starter motor	Contact your authorized service dealer
	4- Wrong grade of engine oil grade of oil up to correct level	Drain the oil fill with the specific.
The engine is difficult to start	1- Starter motor turns engine too slowly	Follow the instructions as described earlier
	2- Fault in engine shut off cable	Contact your authorized service dealer
	3- Fuel pipe blocked	Contact your authorized service dealer
	4- Fault in fuel feed pump	Contact your authorized service dealer
	5- Dirty fuel filter elements	Contact your authorized service dealer
	6- Restriction in air filter/cleaner /induction system	Clean the air filter elements if required replace with genuine parts
	7- Air in fuel system	Bleed the fuel system and remove the air from the system
	8- Fuel cock is	Check the fuel cock and open

	closed/defective	it/Replace with new one
	9- Restriction in fuel tank vent	Clean the fuel tank vent
	10- Wrong grade of fuel	Contact your authorized service dealer
	11- Fault in atomizers	Contact your authorized service dealer
	12- Restriction in exhaust pipe	Contact your authorized service dealer
	13- Defective fuel injection pump	Contact your authorized service dealer
The engine starts and stops	1- Dirty fuel filter elements	Contact your authorized service dealer
	2- Restriction in air filter /cleaner /induction system	Clean air filter elements if required replace with genuine parts
	3- Air in fuel system	Bleed the fuel system and remove the air from the system
The engine does not start	1- The engine is difficult to start	Follow the instructions as described earlier
	2- Fuel tank empty	Fill the fuel tank with the correct grade of fuel.
Not enough engine power	1- Engine is difficult to start causes sl. no.2 to 13	Follow the instructions as described earlier
	2- Engine temperature either too high or too low	Contact your authorized service dealer
	3- Injection lines loose connection, leak or broken	Contact your authorized service dealer
	4- Injection nozzle defective	Contact your authorized service dealer
	5- Restricted movement of accelerator pedal	Contact your authorized service dealer

The engine misfire	1- Engine difficult to start causes sl. No. 3,4,5,7,11	Follow the instructions as described earlier
	2- Engine temperature is too high	Contact your authorized service dealer
	3- 3- incorrect valve tip clearances	Contact your authorized service dealer
High fuel consumption	1- Engine difficult to start causes sl. No. 6,10,11,12	Follow the instructions as described earlier
	2- Restricted movement of accelerator pedal	Contact your authorized service dealer
	3- Engine temperature too low	Contact your authorized service dealer
	4- Incorrect valve tip clearances	Contact your authorized service dealer
Black exhaust smoke	1- Engine difficult to start causes sl. No. 6,10,11,12	Follow the instructions as described earlier
	2- Engine temperature too low	Contact your authorized service dealer
	3- Incorrect valve tip clearances	Contact your authorized service dealer
Blue or white exhaust smoke	1- Wrong grade of engine oil	Drain the oil and fill with the specific grade of oil up to correct level
	2- Engine oil level too high	Drain the excessive oil and keep it up to correct level
	3- Engine temperature too low	Contact your authorized service dealer
The oil pressure is very low	1- Wrong grade of engine oil	Drain the oil and fill with the specific grade of oil up to correct level

		Top up with the correct and same grade of engine oil up to level
	2- Not enough engine oil	Contact your authorized service dealer
	3- Dirty lubricating oil filter element	Contact your authorized service dealer
	4- Defective oil pressure gauge	
The oil pressure is very high	1- Wrong grade of engine oil	Drain the oil and fill with the specific grade of oil up to correct level
	2- Defective oil pressure gauge	Contact your authorized service dealer
The engine temperature is too high	1- Restriction in air filter /cleaner /induction system	Clean the air filter elements if required replace with genuine parts
	2- Fault in atomizers	Contact your authorized service dealer
	3- Restriction in exhaust pipe	Contact your authorized service dealer
	4- Fan damaged	Contact your authorized service dealer
	5- Engine oil level is too high	Drain the oil and fill with the specific grade of oil up to correct level
	6- Restriction in air or water passage of radiator	Contact your authorized service dealer
	7- Insufficient coolant / water in cooling system	Fill the radiator with the clean and fresh water
The Engine Vibration	1- Fault in atomizers	Contact your authorized service dealer
	2- Restricted movement of accelerator pedal	Contact your authorized service dealer
	3- Engine temperature too high	Contact your authorized service dealer
	4- Fan damaged	Contact your authorized service dealer

	5- Fault in engine mounting or fly wheel housing	Contact your authorized service dealer
The Engine Knocks	1- Fault in fuel feed pump	Contact your authorized service dealer
	2- Fault in atomizers	Contact your authorized service dealer
	3- Engine temperature too high	Contact your authorized service dealer
	4- Incorrect valve tip clearances	Contact your authorized service dealer
	5- Engine oil level is too high	Drain the excessive oil and keep it up to correct level
	6- Wrong grade of fuel	Contact your authorized service dealer

Axle

Wheel Vibration	1- Incorrect installation / defective axle	Correct installation, repair or replace the differential
	2- Over loading / incorrect weight distribution	Remove excessive weight and redistribute load
	3- Different rotation radius of the tires	Replace the tire
	4- Bent half shaft	Replace half shaft
	5- Incorrect use of product	Follow the safety, operation instructions and working capacities
Difficult steering: vehicle goes straight while – its turning	1- Incorrect installation / defective axle	Correct installation, repair or replace the differential
	2- Over loading / incorrect weight distribution	Remove excessive weight and redistribute load
	3- Different rotation radius of the tires	Replace the tire
	4- Broken half shaft	Contact your authorized service dealer
No differential action: jamming while steering	1- Incorrect installation / defective axle	Correct installation, repair or replace the differential

	2-	Over loading / incorrect weight distribution	Remove excessive weight and redistribute load
	3-	Different rotation radius of the tires	Replace the tire
	4-	Broken half shaft	Contact your authorized service dealer
	5-	Bent half shaft	Contact your authorized service dealer
	6-	Incorrect wheel adjustment	Contact your authorized service dealer
	7-	Contamination in the axle box or incorrect assembly of parts	Contact your authorized service dealer
	8-	Incorrect use of the product	Follow the safety, operation instructions and working capacities
Uneven wear of tire	1-	Incorrect installation / defective axle	Correct installation, repair or replace the differential
	2-	Over loading / incorrect weight distribution	Remove excessive weight and redistribute load
	3-	Different rotation radius of the tires	Replace the tire
	4-	Broken half shaft	Contact your authorized service dealer
	5-	Bent half shaft	Replace half shaft
	6-	Blocked differential	Contact your authorized service dealer
	7-	Incorrect wheel adjustment	Contact your authorized service dealer
	8-	Incorrect use of the product	Follow the safety, operation instructions and working capacities

Friction noise	1-	Incorrect installation / defective axle	Correct installation, repair or replace the differential
	2-	Broken half shaft	Contact your authorized service dealer
	3-	Bent half shaft	Replace half shaft
	4-	Spoiled or worn out axle parts	Contact your authorized service dealer
	5-	Contamination in the axle box or incorrect assembly of parts	Contact your authorized service dealer
	6-	Incorrect adjustment of bevel gear set	Contact your authorized service dealer
	7-	Incorrect use of the product	Follow the safety, operation instructions and working capacities
Vibration during forward drive	1-	Incorrect installation / defective axle	Correct installation, repair or replace the differential
	2-	Over loading / incorrect weight distribution	Remove excessive weight and redistribute load
	3-	Different rotation radius of the tires	Replace the tire
	4-	Bent half shaft	Replace half shaft
	5-	Incorrect use of the product	Follow the safety, operation instructions and working capacities

STEERING SYSTEM

1. Steering is hard	a)	Low oil level in hydraulic tank	Check and top up to required level Check and replace the pump parts.
	b)	Steering pump not giving output either due to pump is defective or the drive to the pump is disconnected due to failure of woodruff key	Check the drive gear and nut and replace the woodruff key and tighten the nut with a 6kg.m torque
	c)	Air lock in the	Bleed air from the steering

	steering system	system
	d) Port connections to the steering units are not properly done	Trace and connect the hoses to proper ports P, T, L and R.
2. Pressure is not building in steering system	a) Internal leakage in the steering pump	Check and replace the pump parts or pump if found defects.
	b) Relief valve set too low or struck in position due to contamination	Check the relief valve setting valve using a pressure gauge at the pressure pickup point. Relief set at 105 bars. Remove clean and put back the relief valve
BRAKE SYSTEM		
1. Braking is ineffective. LH & RH braking is not effective	a) Low brake fluid in the reservoir	Top up the fluid in the reservoir with correct oil
	b) Air is getting into the system through the joints	Check and tighten all connections.
	c) Air lock in the system	Bleed the air in the system using bleed screws on the top of the rear axel housing. LH& RH half axles to be bled separately
	d) Internal leakage.	Check the O rings. Replace if necessary
HYDRAULIC SYSTEM MAIN GEAR PUMP & STEERING GEAR PUMP		
1. Leakage through shaft/ seal/ end cover	a) Fastening bolts may be loose or not tightened properly.	Check and tighten the bolts to the required torque.
	b) Damage of the backup ring	Replace with new backup ring
	c) Damaged shaft seal	Check and replace with new shaft seal.
2. Pump is not giving sufficient output/ all operations have become slow. Steering becomes hard in case of steering	a) Low oil level in the reservoir	
	b) Heavy internal leakage inside the pump. To ascertain	Remove and open the pump. Observe for damage of bearings,

	system.	this run the pump under pressure for a few minutes and if any abnormal rise in temp is noticed, it can be concluded that heavy internal leakage.	Bushes, seals and body. If you observe deep score marks, change the components, bushes or body or both and seal kits.
3.	Pressure in the system gradually drops.	a) Internal leakage in the pump. Repeat the analysis at 2(b) above.	Carryout remedy as per 2(b) above.
4.	System pressure is not building.	a) Low oil level in the reservoir	Check and top up level with correct oil up to the required mark with all cylinders in closed conditions.
		b) Pump is not developing sufficient pressure due to internal leakage repeat the analysis given in 2(b)	Remove and open the pump and repeat the procedure given in 2(b).
		c) Main relief valve of backhoe control valve/ loader control valve set too low.	Check the relief setting using a pressure pickup points and set the relief 175 bar, backhoe relief 200 bar.
		d) Relief valve jammed/ struck in contamination in the hydraulic system.	Remove the relief valve assys, clean them and put back in position.
		e) Leakage in the hydraulic system piping /control valve connections.	Check and arrest the leakage at pipe joints/ control valve connections.
		f) Damaged seat of main relief valve/ improper seating of valve seat	Examine the valve seat and replace the complete main relief valve cartridge if found defective.

		g) Air lock in hydraulic system	Bleed the air from the system.
5.	Operation of a backhoe / loader cylinder is slow	a) No oil/ insufficient flow of oil due to partial shifting of the control valve.	Check and correct the cross joints of the control valve operating linkage system.
6.	Backhoe boom descends very slowly or suddenly drop.	a) Incorrect setting of the flow control valve in the boom	Adjust the flow control valve knob position to get correct speed.
7.	Backhoe boom rises very slowly	a) Incorrect direction of mounting of flow control valve in retraction line of boom cylinder	Remove the flow control valve and mount it in the correct direction and adjust the flow setting.
8.	The backhoe swinging is not uniform on either side, from the center line of equipment	a) The flow control valve in the swing circuit are not adjusted equally.	Check and adjust the flow control valve equally.
9.	Hydraulic cylinders are not moving or are unable to take load	a) Damaged of defective piston seals resulting in internal leakage.	Check the condition of piston seals by pressuring from one side and opening the hose connection to the other port. If oil comes through the other port, conclude that seals are damaged.
		b) Pressure is not building in the system as indicated in (4)	Dismantle the cylinder and replace the seals.
		c) Air trapped in the piping/ hoses connecting cylinder ports and control valve.	Repeat the check mentioned in 4(a) to 4(e) bleed air by unscrewing the joints then operate the cylinder slowly several times without load to bleed the complete air from the cylinder.
10.	Hydraulic cylinders are creeping under load	a) Damaged or defective piston seals	Repeat check 9(a) mentioned above

	b) The load drop check valve in the particular control valve spool is not seating properly due to contamination.	Extract the check valve, clean and Put back. if defective, replace the entire check valve unit.
	c) Oil leaking through the rod end of cylinder due to damaged / defective rod seals.	Check and replace the rod end seals.
	d) Leakage of oil in the piping / hose assys connecting the control valve and cylinder ports.	Check the lines and connecting parts. Replace any damaged hoses if necessary.

ELECTRICAL SYSTEM

Check the following before analyzing any defect.

a) Check if battery isolating switch in "ON''
b) Check all fuses.

1. Starting motor turns the engine sluggishly.	a) Low battery charge.	Check and charge the battery if required.
	b) Starting motor defective.	Service or replace the starting motor.
2. Starting motor disengages before engine starts up.	a) Check for defective wiring/ loose connections.	Rectify wiring
	b) Defective battery charge.	Charge the battery.
3. Starting motor does not turn when the key switch is turned to start position.	a) Loose connection.	Tighten key switch terminals.
	b) Defective wiring	Repair wiring.
	c) Low battery charge	Charge the battery.
	d) Defective key switch	Replace key switch.
	e) Defective isolating switch	Replace isolating switch.
	f) Defective transmission neutral switch.	Check the loose connection. Replace the switch.

4.	Battery charge indicator does not extinguish and ammeter does not show positive even after engine is started.	a) Faulty ammeter	Check for loose connection and replace the ammeter.
		b) Alternator belt is broken / loose.	Adjust the alternator belt to the required tension or replace it.
		c) Faulty alternator.	Check the alternator, service it or replace the alternator.
5.	Gauges do not show correct reading.	a) Loose connection in the gauge/ sendor	Tighten the connection.
		b) Faulty gauge.	Replace the gauge.
		c) Faulty sender units.	Replace the sender units.
6.	Head lights / tail lights do not function.	a) Faulty head light switch.	Check the loose connections or replace the switch.
		b) Fused bulbs.	Replace the fused bulbs.
7.	Wiper does not operate.	a) Faulty wiper switch.	Check for loose connection. Replace the switch.
		b) Faulty wiper motor.	Check for proper connection/ replace switch.
8.	Stop lamp does not function.	a) Faulty stop lamp switch.	Check for loose connection. Replace the switch.
		b) Fused bulbs.	Replace the bulbs.
9.	Parking lamps does not function.	a) Faulty stop lamp switch.	Check for loose connection. Replace the switch.
		b) Fused bulbs.	Replace the bulbs.
10.	Horn does not function.	a) Faulty horn switch.	Check for loose connection. Replace the switch.
		b) Defective horn.	Replace the horns.

11. Turn single lamps do not function.	a) Faulty backup alarm unit. b) Fused bulbs. c) Faulty turn single switch.	Check for loose connection. Replace the switch. Replace the bulbs. Replace the switch.
12. Backup lamp and horn do function.	a) Faulty backup alarm unit. b) Faulty backup switch. c) Faulty horn. d) Fused bulb in lamp.	Check for loose connection. Replace the unit. Check for loose connection. Replace the switch. Replace the horn. Replace the bulbs.
13. Work lamps does not function.	a) Faulty work lamp switch. b) Fused bulbs	Check for loose connection. Replace the switch. Replace the bulbs.
14. Cabin fan does not function	a) Faulty switch. b) Faulty fan.	Check for loose connection. Replace the switch. Replace the fan.
15. Cabin light does not function	a) Faulty switch. b) Fused bulbs	Check for loose connection. Replace the switch. Replace the bulbs.
16. Head lamp indicator does not function	a) Loose terminal connections. b) Fused bulbs	Check and tighten. Replace the bulbs.
17. High water temp indicator mal function.	a) Faulty water temp switch. b) Fused bulbs	Check for loose connection. Replace the switch. Replace the bulbs.

18.	Parking lamp indicator mal function	a) Faulty parking brake switch. b) Fused bulbs	Check for loose connection. Replace the bulb. Replace the bulbs.
19.	Direction indicator does not function	a) Fused bulb.	Check for loose connection. Replace the bulb.
20.	Dump solenoid on transmission does not operate.	a) Faulty dump switch	Check for loose connection. Replace the switch.

RECORD KEEPING

FREE SERVICE RECORD				
TYPE OF SERVICE	DUE/DONE	HOUR MTR RDG	DATE	REMARKS
INSTALLATION	DONE			
1ST FREE	DUE	100 HRS/30 DAYS		
	DONE			
2ND FREE	DUE	250 HRS/60 DAYS		
	DONE			
3RD FREE	DUE	500 HRS/90 DAYS		
	DONE			
4TH FREE	DUE	750 HRS/150 DAYS		
	DONE			
5TH FREE	DUE	1000 HRS/180 DAYS		
	DONE			
6TH FREE	DUE	1250 HRS/210 DAYS		
	DONE			
7TH FREE	DUE	1500 HRS/270 DAYS		
	DONE			
8TH FREE	DUE	1750 HRS/330 DAYS		
	DONE			
9TH FREE	DUE	2000 HRS/365 DAYS		
	DONE			

OIL CHANGE RECORD

SL. NO	HRS/DATE	ENGINE	TRANSMISSION	AXLE	HYDRAULIC	REMARKS
1	HRS MTR					
	DATE					
2	HRS MTR					
	DATE					
3	HRS MTR					
	DATE					
4	HRS MTR					
	DATE					
5	HRS MTR					
	DATE					
6	HRS MTR					
	DATE					
7	HRS MTR					
	DATE					
8	HRS MTR					
	DATE					
9	HRS MTR					
	DATE					
10	HRS MTR					
	DATE					
11	HRS MTR					
	DATE					
12	HRS MTR					
	DATE					
13	HRS MTR					
	DATE					
14	HRS MTR					
	DATE					

SL. NO	HRS/DATE	ENGINE	TRANSMISSION	AXLE	HYDRAULIC	REMARKS
15	HRS MTR					
	DATE					
16	HRS MTR					
	DATE					
17	HRS MTR					
	DATE					
18	HRS MTR					
	DATE					
19	HRS MTR					
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20	HRS MTR					
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24	HRS MTR					
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25	HRS MTR					
	DATE					
26	HRS MTR					
	DATE					
27	HRS MTR					
	DATE					
28	HRS MTR					
	DATE					
29						

MAJOR PARTS CHANGE RECORD

Sl. NO.	Date	Report/J.C. No.	Part Description	Part No.	Qty.	Remarks

Sl. NO.	Date	Report/J.C. No.	Part Description	Part No.	Qty.	Remarks

OWNERSHIP TRANSFER RECORD			
Sl. No.	**Date**	**Transfer Details**	**Customer's details**

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