156OMA3204

NEW FRONTIERS. NEW DREAMS

OPERATION & MAINTENANCE MANUAL

BE220/BE220G/BE240HD

HYDRAULIC EXCAVATOR

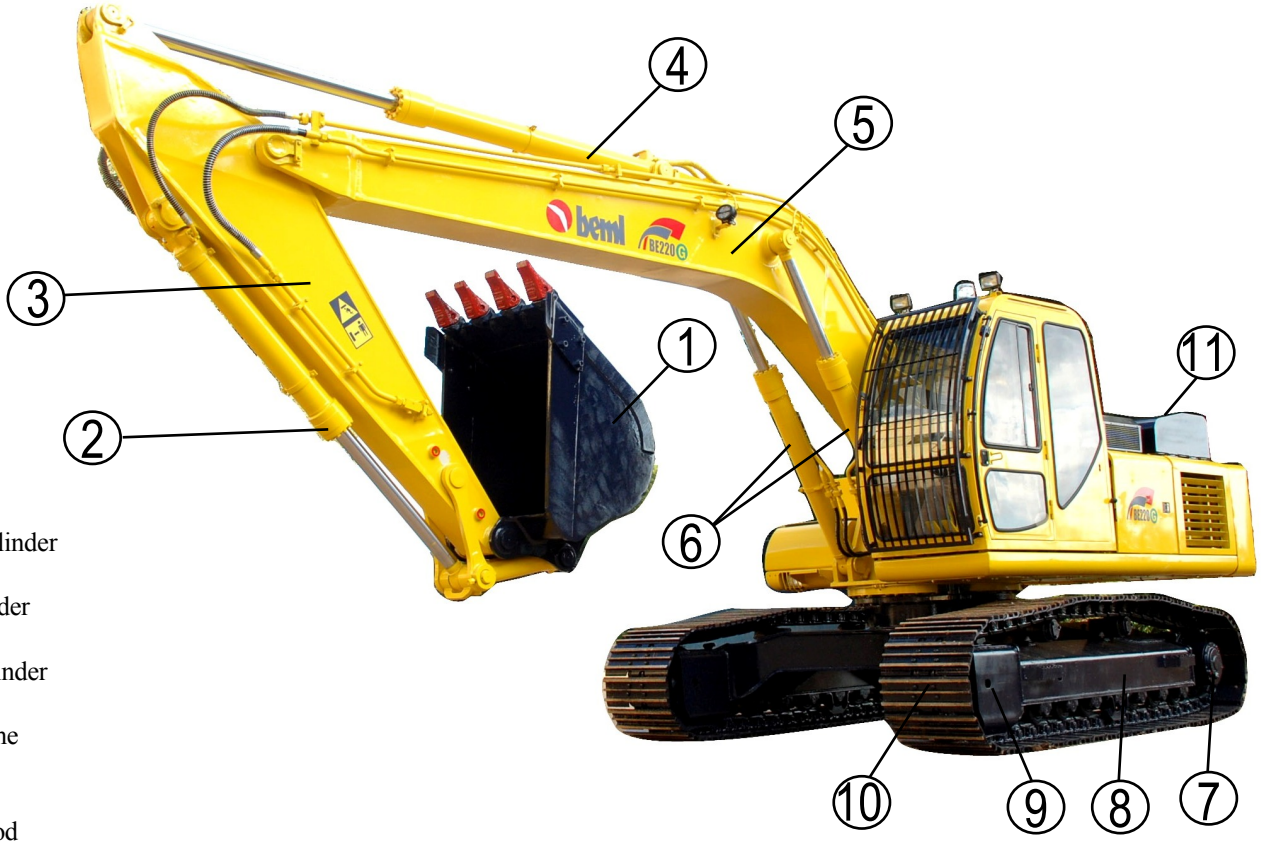
BEML LIMITED

INDIA

GENERAL VIEW- BE220 / 240HD

1. Bucket
2. Bucket Cylinder
3. Arm
4. Arm Cylinder
5. Boom
6. Boom Cylinder
7. Sprocket
8. Track Frame
9. Idler
10. Track Shoe

GENERAL VIEW- BE220G



1. Bucket
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7. Sprocket
8. Track Frame
9. Idler
10. Track Shoe
11. Engine Hood

FOREWORD

This manual describes procedures for operation, handling, maintenance,lubrication, checking and adjustment. It will help the operator or anyone realize peak performance through effective, economical and safe machine operation and maintenance.

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

BREAKING IN YOUR NEW MACHINE

Each machine is carefully adjusted and tested before shipment. However, a new machine requires careful operation during the first 100 hours to break in the various parts.If a machine is subjected to unreasonably hard use at the initial operation stage, the potential of performance will prematurely deteriorate and the service life will be reduced. A new machine must be operated with care, particularly with regard to the following points:

- After starting, let the engine idle for 5 minutes, to allow proper engine warm-up prior to actual operation.
- Avoid operation with heavy loads or at high speeds.
- Sudden starting or acceleration, unnecessarily abrupt braking and sharp turning should be avoided.
- During the initial 100 hours, the work equipment fixing pins are to be greased before each operation. Greasing is to be repeated after operation of the boom, arm and bucket is conducted several times.
- At the first 250 hours of operation, the machine should be maintained in the following manner:
  1) Checking and adjustment of engine valve clearance.
  2) Changing fuel filter cartridge see maintenance table in the maintenance section.

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

* Hours of operation are indicated by the service meter.

CONTENTS

OPERATION

MAINTENANCE

GENERAL LOCATIONS AND SPECIFICATIONS

1. Bucket
2. Bucket cylinder
3. Arm
4. Arm cylinder
5. Boom
6. Boom cylinder
7. Sprocket
8. Track frame
9. Idler
10. Track shoe

OPERATING WEIGHT : BE220 / BE240HD

22800 kg / 23750 kg

PERFORMANCE:

Bucket capacity [SAE]	-	1.0
(m^3) [CECE]	-	0.9
Travel Speed (km/h)	-	3.4
Swing Speed (rpm)	-	13

ENGINE :

1. Model	:	BS6D105 Diesel engine
2. Rated Rpm	-	2000 Rpm
3. Flywheel horsepower	-	148 HP

NOTE : Specifications are subject to change without notice.

GENERAL LOCATIONS AND SPECIFICATIONS

1. Bucket
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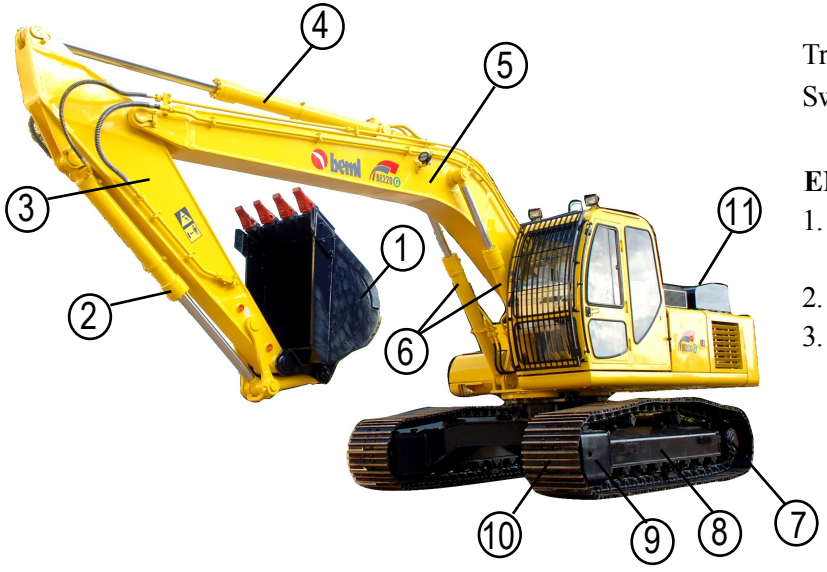

OPERATING WEIGHT : 22800 kg

PERFORMANCE:

Bucket capacity [SAE]	-	1.0
(m^3) [CECE]	-	0.9
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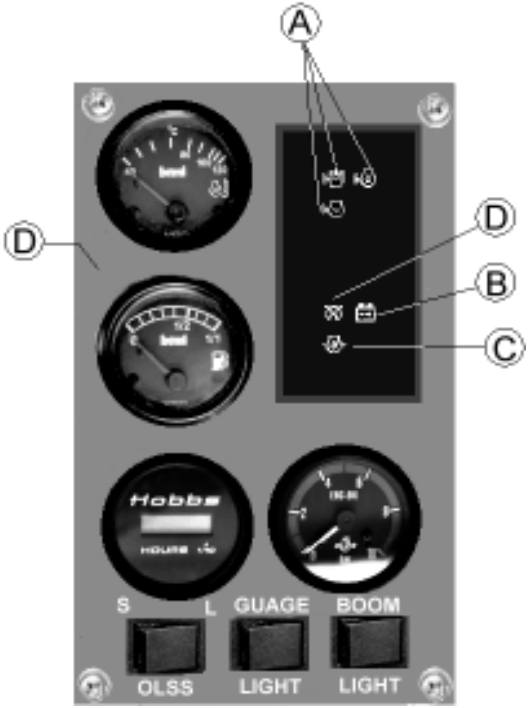
INSTRUMENTS AND CONTROLS

MONITOR PANEL - BE220 / BE240HD

This monitor system consists of monitor lamp group (A), (B) (C) and meter group (D)

- To check the monitor system,turn the starting switch to ON before starting the engine. Then all the monitor lamps and the gauges light up and the alarm buzzer sounds for about 3 seconds. After that all lamps go off and the buzzer stops. If any monitor lamp does not light up, ask your BEML representative to inspect that monitor lamp.

- The monitor lamps cannot be checked for breakage until 30 seconds after the engine has been stopped.



A). CHECK MONITOR GROUP
(Check items before starting)

If there is any abnormality, the appropriate monitor lamp will flash.

- When the engine is started, these monitor lamps will go off even if there are abnormalities.

(B). CAUTION MONITOR GROUP
(Caution Items)

If any abnormality occurs while the engine is running, the appropriate monitor lamp will flash and the alarm buzzer will sound intermittently at the same time.

- The buzzer does not sound if the battery charge is low.
- Even if any monitor lamp flashes the machine can be operated. But it should be repaired as soon as possible.

(C). CAUTION MONITOR GROUP
(Emergency warning items)

If any abnormality occurs while the engine is running, the appropriate monitor lamp will flash and the alarm buzzer will sound intermittently at the same time.

- The buzzer does not sound if the battery charge is low. If any monitor lamp flashes, stop the engine or run it at a low idling speed and repair it immediately.

(D). METER GROUP

This group consists of engine water temperature gauge, fuel gauge, engine preheating monitor lamp (optional) and service meter.

(A) CHECK MONITOR GROUP
(Check items before starting)

Make the check by referring to the section on CHECK BEFORE STARTING.

1. RADIATOR PRE MIXED COOLANT LEVEL MONITOR

This monitor indicates a low radiator coolant level.
If the monitor lamp flashes, check the coolant level and add Pre mixed coolant as required.

2. ENGINE OIL LEVEL MONITOR

This Monitor Indicates a low oil level in the engine oil pan.
If the monitor lamp flashes, check the oil level in the engine oil pan and add oil as required.

3. HYDRAULIC OIL LEVEL MONITOR

This Monitor indicates a low oil level in the hydraulic tank. If the monitor lamp flashes, check the oil level in the hydraulic tank and add oil as required.

B. CAUTION MONITOR GROUP

If any abnormality occurs while the engine is running, the appropriate monitor lamp will flash to indicate the abnormality at the same time.

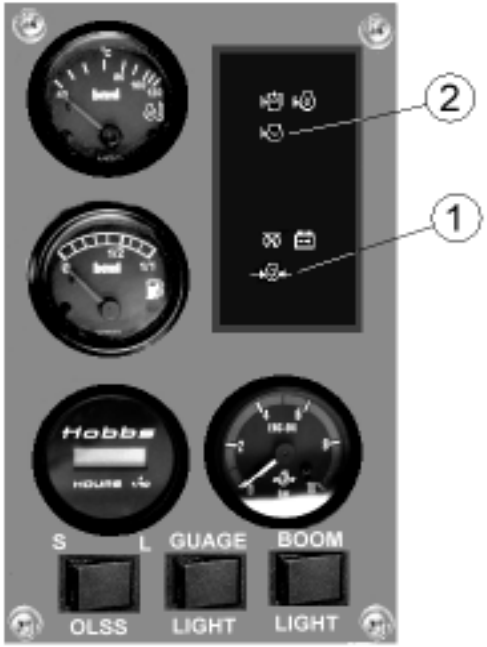
1. CHARGE MONITOR

This Monitor indicates and abnormality in the charging system while the engine is running.
If the monitor lamp flashes, check the charging circuit.

- Park the machine on level ground and check the monitor lamps.
- Confirm that these monitor lamps light for about 3 seconds after turning the starting switch to ON.
  If any monitor lamp does not light, ask your BEML representative to inspect that monitor lamp.

(C). CAUTION MONITOR GROUP
(Emergency warning items)

- If any monitor lamp flashes, stop the engine or run it at a low idling speed and repair it immediately.



1. ENGINE OIL PRESSURE MONITOR

This monitor indicates a low engine oil pressure.

If the alarm buzzer sound and this lamp flashes, the engine oil pressure is below the lower limit. Immediately stop the engine.

• If this monitor lamp lights and the alarm buzzer sounds momentarily when the starting switch is turned to ON immediately after the engine is started, it does not indicate an abnormality.

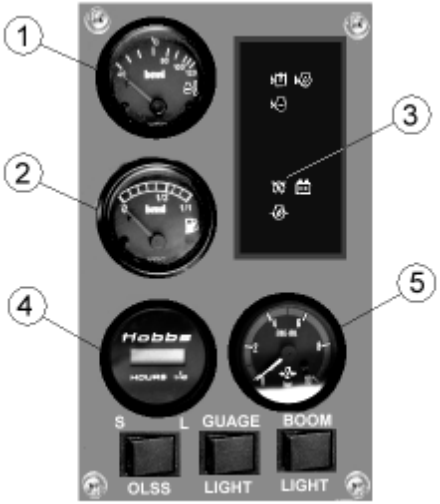
2. RADIATOR COOLANT LEVEL MONITOR

This monitor indicates a low radiator coolant level.

Check the coolant level when the alarm buzzer sounds and this monitor lamp flashes, stop engine and add water as required.

- Park the machine on level ground and check the monitor lamps.
- Confirm that these monitor lamps light for about 3 seconds after turning the starting switch to ON. If any monitor lamp does not light, ask your BEML representative to inspect that monitor lamp.

D. METER GROUP



1. ENGINE COOLING WATER TEMPERATURE GAUGE

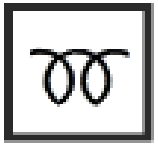
The gauge indicates the temperature of the cooling water. The temperature is normal during operation when it is in green range (Refer colour band sticker).

When it is in red range during operation, the alarm buzzer will sound and the engine water temperature monitor lamp will flash at the same time. If this occurs,stop the machine and run the engine at a low idling speed until it falls into green range.

2. FUEL GAUGE

This gauge indicates the amount of fuel in the fuel tank. If there is enough fuel in the tank while the engine is running, it remains in green range. If it is in red range add fuel, as there is less fuel in the tank.

3. ENGINE PREHEATING MONITOR LAMP (OPT)



This lamp shows the preheating condition when starting the engine at temperature below 5°C.

The monitor lamp lights when the starting switch is turned to HEAT position and flashes after about 36 seconds to show that the preheating is completed. (The monitor lamp will go off after about 16 seconds.)

4. SERVICE METER

This meter shows the total operation hours of the machine. The service meter advances while the engine is running - even if the machine is not travelling.

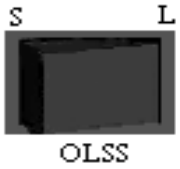
5. ENGINE OIL PRESSURE GAUGE

- 0-1 bar - Red
  1 -7 bar - Green
- During operation, oil pressure is normal when indicator is in green
- When the indicator is in red range, stop the engine, determine the cause & take necessary corrective steps.

- Park the machine on level ground and check the monitor lamps.
- Confirm that gauges (1), (2) and monitor lamp (3) will light, when the starting switch is turned to ON before the engine is started. If any gauge or monitor lamp does not light, ask your BEML representative to inspect that monitor lamp or gauge.
- Confirm that these monitor lamps light for about 3 seconds after turning the starting switch to ON. If any monitor lamp does not light, ask your BEML representative to inspect that monitor lamp.

SWITCHES

1. MODE SELECTOR SWITCH



This switch is used to change the mode.

S : For **general** work.
L: For **light duty** work.

2. GAUGE LIGHT SWITCH

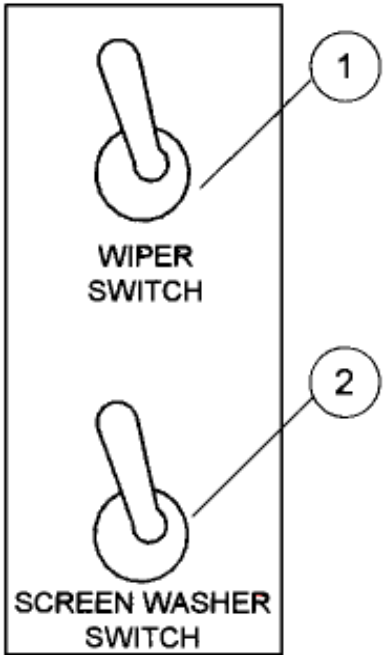
This switches the panel lamp ON and OFF.

ON position : Lamp lights up

3. BOOM LIGHT SWITCH

This switches the head lamp and working lamp **ON**

ON Position : Lamp lights up



1. WIPER SWITCH

This switch is used to turn on the front windshield wiper.

2. SCREEN WASHER

This switch is used for splashing water over windshield glass (if equipped).

OPERATING MODE SELECTOR SWITCH

The mode selector switch is used to change the mode to match the conditions and purpose of the work, and thereby achieve higher efficiency. Use the mode selector switch effectively according the following table.

MODE SELECTOR SWITCH (OLSS)

* The letters S and L in the table refer to the positions of the switch in the above figure.

HOW TO READ THE TABLE AND STANDARD FOR SELECTION

The most appropriate modes for various combinations of work and soil are shown below. Select the mode according to the jobsite and type of work.

• **Standards of use (2-stage type)** **I :** For normal work

II : When speed is not necessary but the fuel should be saved.

Description of work / Standard of use / Type of Soil	Digging		Loading		Leveling		Backfilling and Leveling		Rock Crushing	Carrying
	I	II	I	II	I	II	I	II		
Soft clay	S	L	S	L	L	L	S	L	S	S
Crumbled sandy soil	S	L	S	L	L	L	S	L		
Compact sandy soil	S	L	S	L	L	L	-	-		
Gravel and Ore	S	L	S	L	S	L	-	-		
Compact soil containing gravel	S	L	S	L	S	L	-	-		
Soft rock	S	S	S	S	S	S	-	-		

INSTRUMENT PANEL AND CONTROLS

1. PV380 LCD display
2. Mode Switch
3. Head Lamp Switch

PV380 LCD Display

A 3.8” monochrome LCD screen displays gauges, soft key commands, and fault messages, as well as menu options for setup and configuration.

Soft Keys and Commands

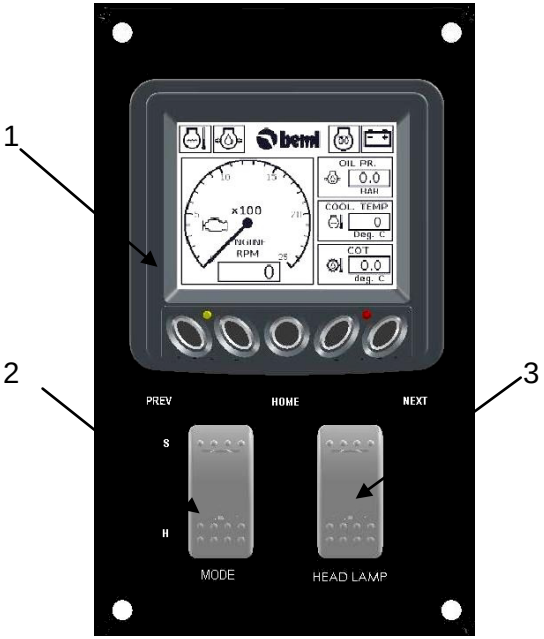
The five tactile push buttons on the bottom of the display correspond to the options available for the screen being displayed.

MENU

Pressing any Soft Key will display the list of menu options.

Alarms

Red and amber warning LEDs; Set point triggered output for external piezo buzzer.



1. PV380 LCD DISPLAY :

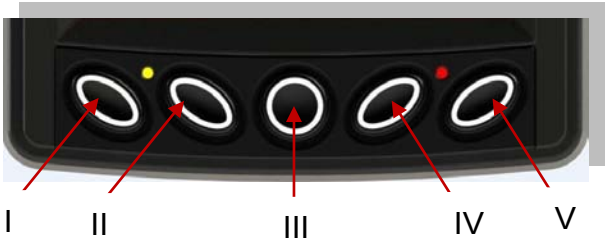
Power Up sequence: The Power View display is installed with power connected to the ignition. When the ignition is turned on, the following sequence occurs:

Power up Sequence:

(a) BE220G image with BEML logo appears for about 2-3 sec.

(b) Screen '1' appears.

DESCRIPTION OF KEYS: There are five number of keys on PV380 panel for operator interface.



I. PREVIOUS: Pressing the PREVIOUS Key takes the display to previous selected page.

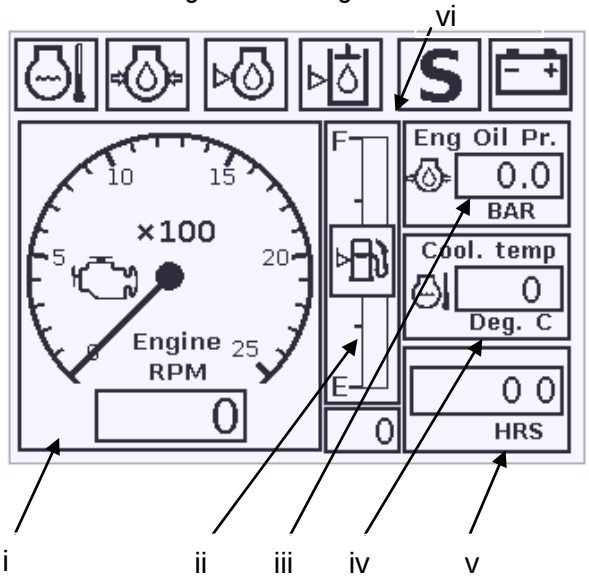
II. Brightness key: Pressing this Key toggles the brightness of screen between 90% and 50%.

III. HOME Key: Pressing the HOME Key takes the display to first screen.

IV. Brightness key: Pressing this Key toggles the brightness of screen between 90% and 10%.

V. NEXT key: Pressing the Key takes the display to next page.

PAGE – 1: Gauges & Warning



The Page – 1 displays the following engine parameters.

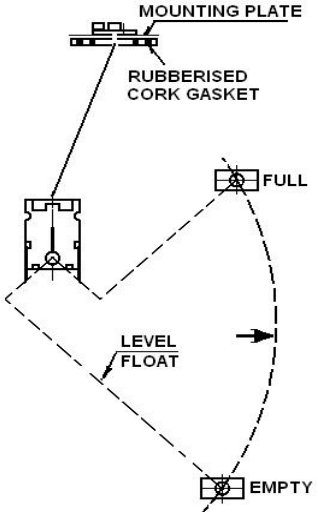
i) Engine RPM Gauge: This displays engine RPM in analog and digital format. If engine RPM exceeds 2350 then, "Engine over speed" warning pops up and Red LED on the panel starts blinking.

Fuel level gauge: This gauge indicates the level of diesel in fuel tank. The letter 'F' at the top of the bar

indicates full level where as 'E' at the bottom indicates empty. A digital read-out is provided below fuel level indicator and gives the level of fuel in tank in terms of percentage. Fuel level is sensed by the resistance type sensor fitted on the fuel tank.

Tank level	Resistance ohm
FULL	$180^{+12 / -7}$
EMPTY	3±3

Fuel Level Sensor



i) Engine Oil Pressure Gauge :

★ Displays the value of engine oil pressure while engine is running in Digital format.

ii) Engine Coolant Temperature Gauge :

★ Displays the value of engine coolant temperature in Digital format when the starting switch is turned to ON position.

Engine Oil Pressure and Coolant Temperature Sensor

i) Hour meter :

★ This indicates the number of hours of engine operation.

ii) Warning Display :

★ Audio-Visual Warning Indicators will appear on the all the pages (1, 2 & 3) of display unit, for the following parameters, in the event these parameters go beyond the safe value. A delay of about 5 sec has been introduced to trigger the warning for these parameters to avoid occurrence of momentary fault.

(i) Low Fuel level

(ii) Low Engine Oil Pressure

(iii) High Coolant Temperature

(iv) Battery Charge

(v) Low Engine Oil Level

(vi) Low Hydraulic Oil Level

(vii) Engine Over speed

(i) Low Fuel level warning

This warning indicator appears when the fuel level become less than 15%. Top-up the tank immediately after the low fuel warning appears on the display unit.

(ii) Low Engine Oil Pressure Warning

a) This warning indicator appears, with Amber LED flashing on the display, when the engine oil pressure goes below 1.2 bar.
b) This warning indicator appears, with Red LED flashing on the display, when the engine oil pressure goes below 0.8 bar. Shut down the equipment immediately and alert the maintenance staff.

(iii) High Coolant Temperature Warning

a) This warning indicator appears, with Amber LED flashing on the display, when the coolant temperature reaches 95°C.
b) This warning indicator appears, with Red LED flashing on the display, when the coolant temperature reaches 97°C. Shut down the equipment immediately and alert the maintenance staff.

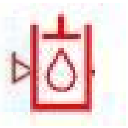
(iv) Battery Charge Indicator

This warning indicator disappears when the engine is started and alternator starts charging the battery.

(v) Low Engine Oil Level

This warning indicator appears, with Red LED flashing on the display, when oil level in engine sump reaches below the safe level. Stop the engine immediately and top-up with recommended oil.

vi) Low Hydraulic Oil Level



This warning indicator appears, with Red LED flashing on the display, when hydraulic oil level in the tank goes low. Check the level in the hydraulic tank and add oil as required.

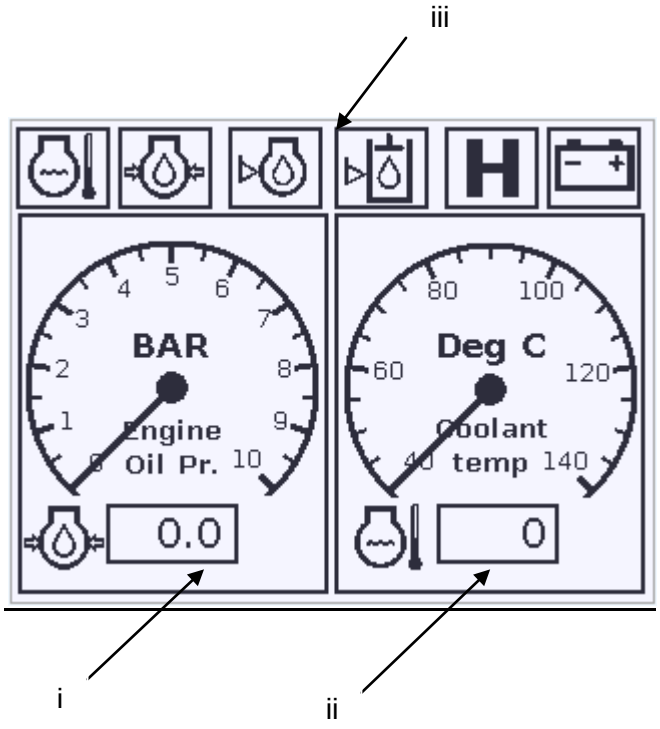
(vii) Engine Over speed

a) This warning indicator appears, with Amber LED flashing on the display, when the engine speed reaches 2350 rpm.

b) This warning indicator appears, with Red LED flashing on the display, when the engine speed exceeds 2400 rpm. Reduce engine speed to safe level by lowering the throttle.

Operation Mode: This refers to the present mode of equipment operation. The operator can select the mode S or H by operating the Mode Selector Switch provided on the instrument panel. Corresponding to the S & H mode, icon with letter 'S' or 'H' appears on the display.

B. PAGE -2: This page of the LCD panel is configured to display the following equipment parameters in Analogue and digital format.



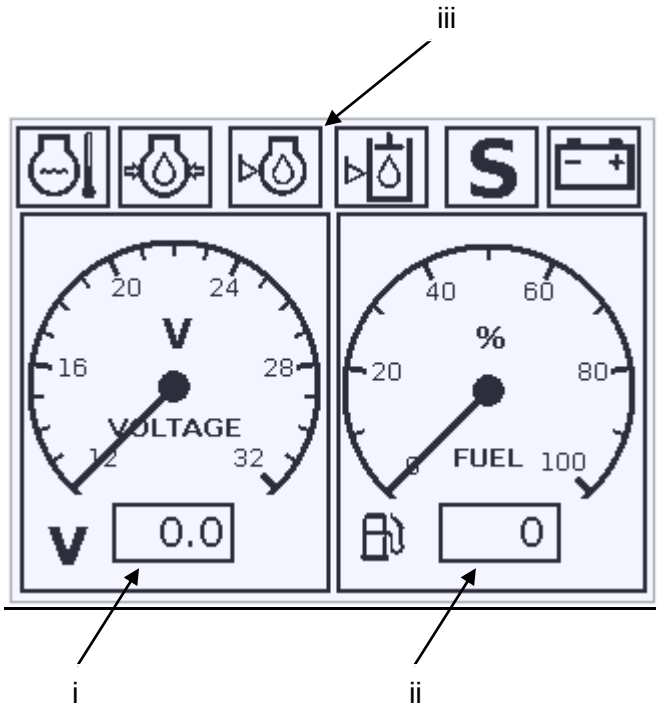
(i) Engine Oil Pressure Gauge (0-10 bar)

(ii) Engine Coolant Temperature Gauge (40-140 deg C)

(iii) Warning indicators

The description for the above gauges and warning indicators is same as given under section 'Page – 1'.

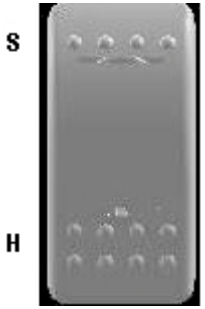
C. PAGE -3 : This page of the LCD panel is configured to display the following equipment parameters in Analogue & digital format.



(i) Voltmeter (12 -32V)
(ii) Fuel Level Gauge (0-100%)
(iii) Warning indicators

The description for the above gauges and warning indicators is same as given under section 'Page – 1'

1. MODE SELECTOR SWITCH :

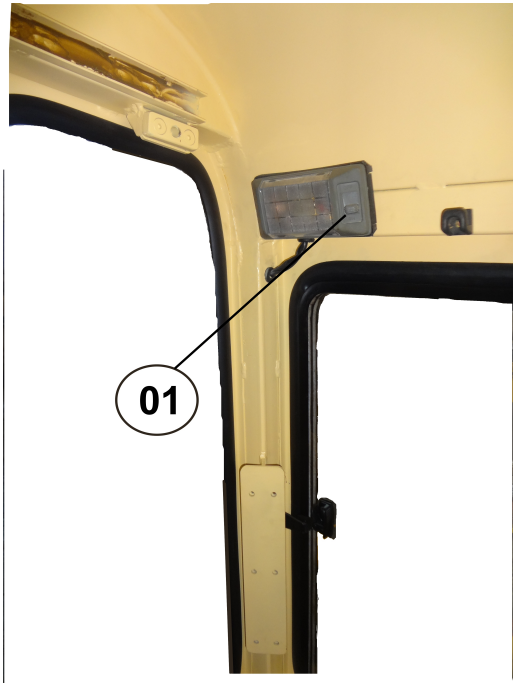


This switch is Rocker, ON-OFF type and is used to select the mode of operation.
S : For Standard mode.
H : For Heavy duty mode.

3. HEAD LAMP SWITCH:

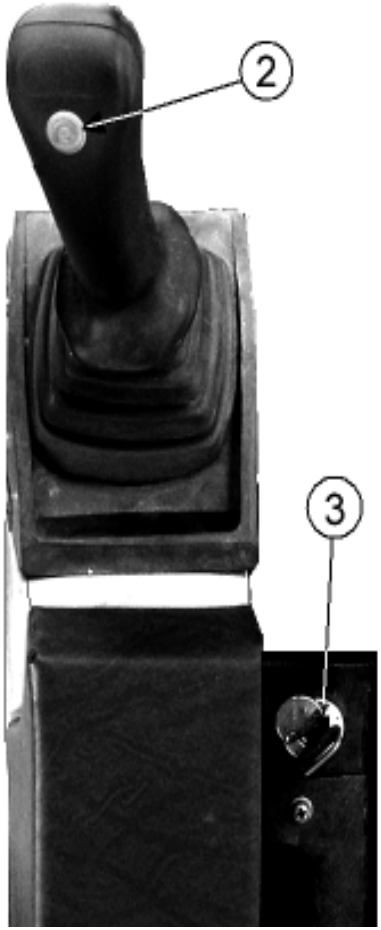
This switch is Rocker, ON-OFF type and used to operate head/work lamps..

SWITCHES AND LAMPS



1. ROOM LAMP SWITCH

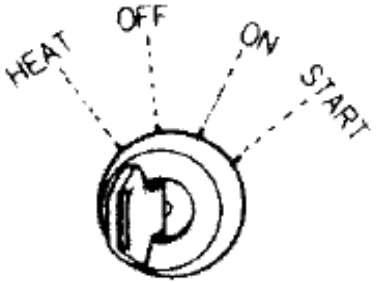
When this switch is moved to ON position, room lamp will light.



2. HORN SWITCH

When this switch is pressed, the horn will sound.

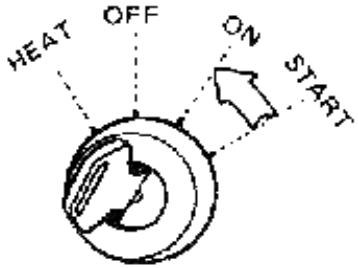
3. STARTING SWITCH



OFF
Key insertion-withdrawal position. None of electrical circuits activate.

ON
Charging and lamp circuits activate. Keep key at ON after starting.

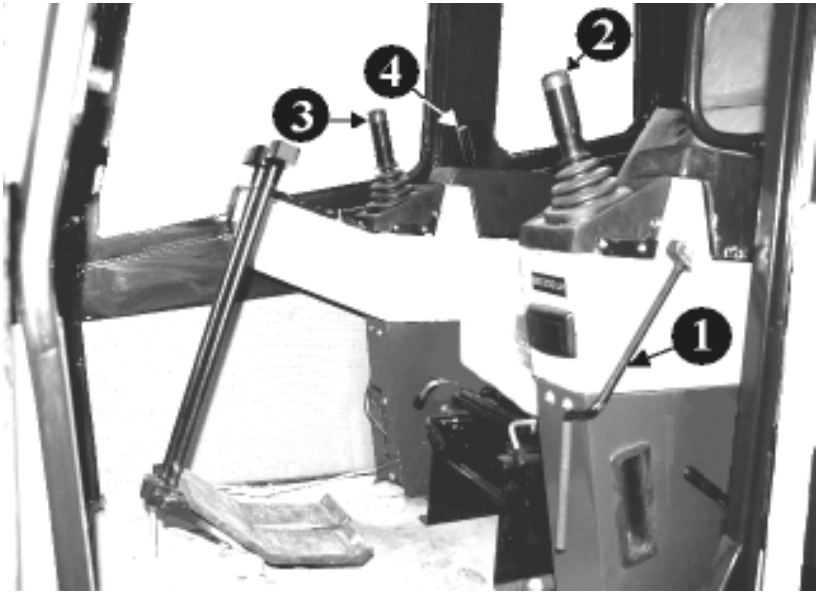
HEAT
Use this position when starting in cold weather.
Release the key to allow it to return automatically to OFF and then, without delay, turn it to START.



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

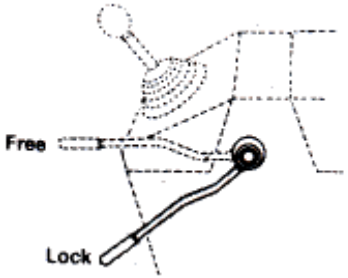
* When starting, be sure to use the starting key.

LEVERS



1. SAFETY LEVERS

(For work equipment levers)

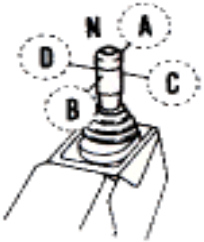


The safety levers are used to lock the work equipment levers.

⚠ When stopping the machine or leaving the machine, be sure to lower the bucket to the ground, then operate the levers to lock the left and right work equipment levers.

2. LEFT WORK EQUIPMENT LEVER

(Arm / Swing Control Lever)



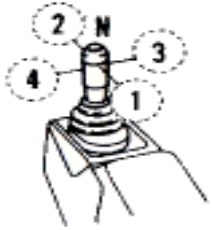
Ⓝ **Neutral:**
When the lever in this position, the upper works and the arm will be retained in the position in which they stop.

Arm operation
Ⓐ Arm moves out.
Ⓑ Arm moves in.

SWING OPERATION
Ⓒ Upper works swings to the right.
Ⓓ Upper works swings to the left.

3. RIGHT WORK EQUIPMENT LEVER

(Boom / Bucket Control Lever)



Ⓝ **Neutral:**
When the lever in this position, the boom and the bucket will be retained in the position in which they stop.

Boom operation
① Boom raises
② Boom lowers.

Bucket operation
③ Bucket dumps
④ Bucket curls

4. FUEL CONTROL LEVER

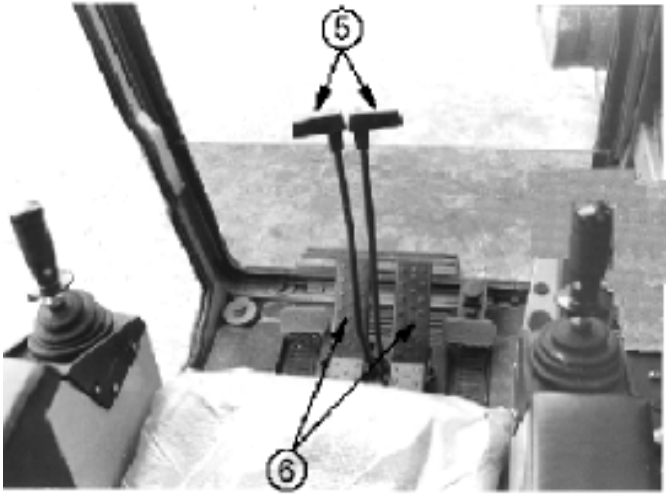
This lever is used to control the engine speed and output.

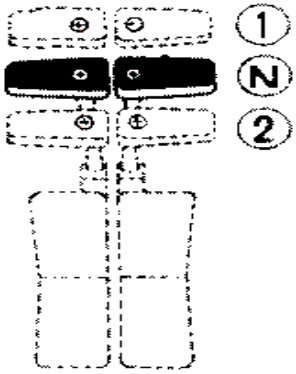
① Engine stop position:
Push the lever fully.

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

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

5. TRAVELING AND STREERING LEVERS





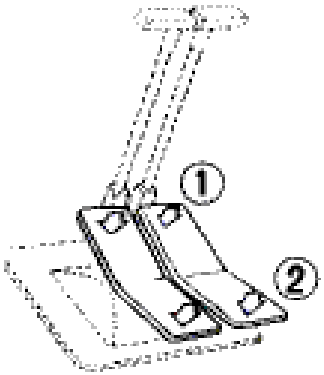
The traveling and steering levers are used to operate the left and right travel motors.

(1) Forward:
Push the levers forward.

(2) Reverse:
Pull the levers forward.

(N) Neutral
Parking brake is applied and the machine stops.

6. TRAVELLING AND STEERING PEDALS



These pedals are used to operate the left and right travel motors as travelling and steering levers.

① Forward:
Depress the front part of pedals.

② Reverse:
Depress the rear part of pedals.

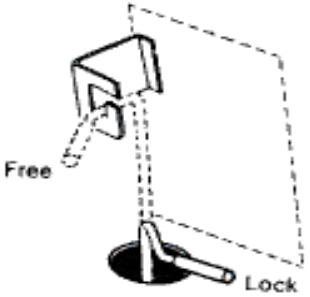
⚠ Do not place your foot on pedals unnecessary.

⚠ If the track frame is facing backwards, operate the traveling and steering levers or pedals in the reverse manner to that when the track frame is facing forward.

⚠ Before operating the traveling and steering levers or pedals, check whether the track frame is facing forward or backwards. Assuming the machine is in a position to advance by means of being the sprocket at the rear.

When operating the machine with only the traveling and steering pedals, that is, without using the travelling and steering levers, pull out the travelling and steering levers and keep them in the operators compartment.

7. SWING LOCK LEVER



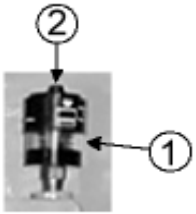
When this lever is placed to the lock position, the upper works is locked.

* Swing lock lever must be in lock position during traveling of machine.

* This lever must be in the lock position after the upper works is parallel with the track frame.

⚠ Do not attempt to rotate the upper works, when the swing lock lever is in the lock position.

DUST INDICATOR

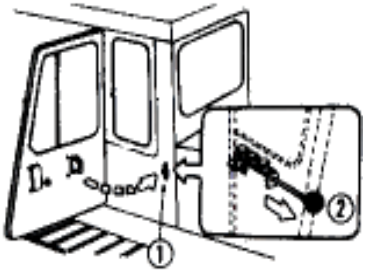


This device indicates clogging of the air cleaner element. When red piston (1) appears in the transparentpart of this indicator, the element is clogged. Immediately clean element.

After cleaning, push indicator button (2) to return red piston to original position.

Dust indicator is on air cleaner bracket in engine hood.

DOOR LOCK



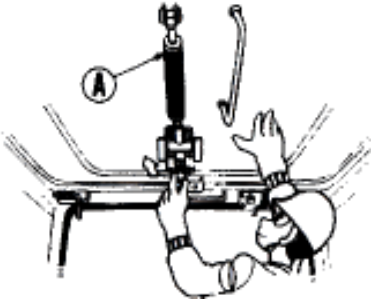
Use the door lock to fix the door in position after opening it.

The door will become fixed in place when it is pressed against magnetic catch (1).

To release the door, pull knob (2) on the left side of the operator's seat so as to remove the lock.

* When fixing the door, fix it firmly to the magnetic catch.

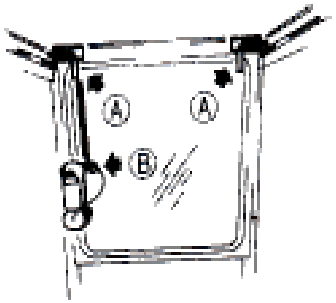
CEILING WINDOW

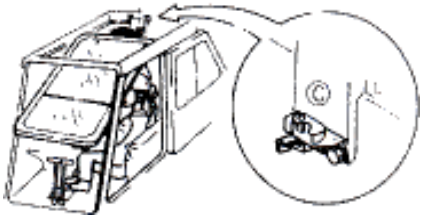


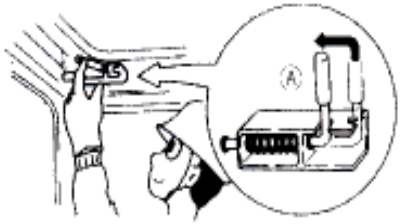
Ceiling window is opened by releasing the lock in the direction of the arrow and pushing the handle.

* When opening or closing the ceiling window, grasp the handle. Do not push in grasping stay dumper (A).

FRONT WINDSHIELD







It is possible to pull up the front windshield flush with the ceiling of the cab.

* Before opening or closing the windshield, be sure to lower the working equipment with the machine on level ground, stop the engine and lock the left and right working equipment levers.

OPENING SEQUENCE

1. When lock pin (A) at t he left and right of the top of the front windshield are pulled to the inside, the lock will be removed.

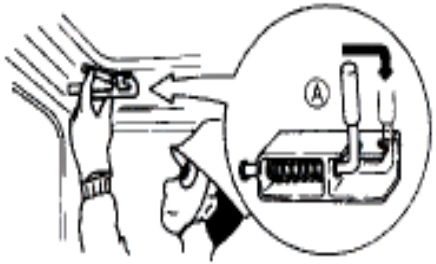
2. Disconnect the wiring of the wiper motor at socket (B).

3. Grip the lower handle with the left hand and the upper handle with the right hand from the inside of the operator's cab, then pull up the windshield and push it firmly against catch (C).

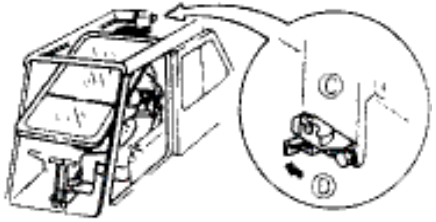
4. Then , after checking that the windshield is properly locked, be sure to retain it with left and right lock pins (A).

CLOSING SEQUENCE

1. Free left and right lock pins (A).

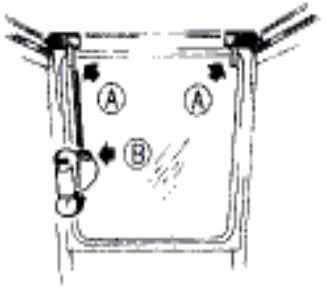


2. To release the lock form catch (C), move release lever (D) in the direction of the arrow. (When releasing the lock, grasp the handle at the lower part of the front windshield with the left hand and the upper part of the windshield with the right hand, then carefully ower the front windshield.)



3. Be sure to retain the windshield with left and right lock pins(A).

4. Connect the wiring of the wiper motor at socket (B).



OPERATOR'S SEAT

The seat adjustment should be checked at the beginning of each shift and when operator change.

Forward-Backward adjustment

Move lever (1) to the right, move the seat to the best position and release the lever. The seat can be moved forward or backward over 160 mm in eight stages.

OPERATOR'S SEAT

Suspension Type

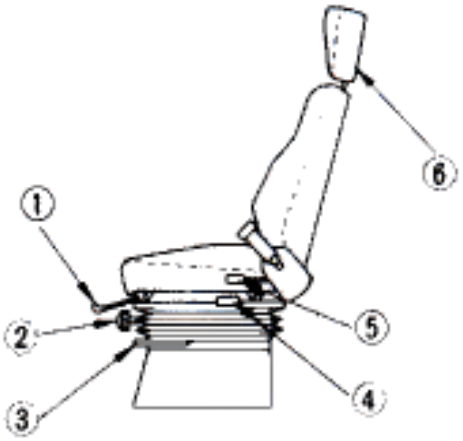
Height adjustment

Turn knob (2) clockwise to lower seat.
Turn conterclockwise to raise. The adjustable amount is 190mm.

Backrest adjustment

Pull level (3) in the direction of arrow, move the back-rest to the desired position and release the lever.

A limiter is provided to enlarge the reclining angle at the seat forwards postion. Return the backrest to its original position when moving the seat backward.



1. Front height adjustment

Pull lever (1) upwards to adjust seat height. Front of seat cushion moves up or down (tilts) to any of 5 different positions. (May be used in conjunction with lever (4).

2. Weight adjustment

Adjust seat suspension for operator body weight. Turn handwheel (2) until figure corresponding to weight in kg appears between indicators. Turn clockwise to increase weight (viewed from front) i.e. "+" direction.
Adjustment range is 40 - 130 kg.

3. Forward - Backward adjustment

Pivot lever (3) upward, move seat to best position and release lever. The seat can be moved forward or backward within a range of 150 mm.

4. Rear height adjustment

Pull lever (4) upwards to adjust rear of seat height. rear of seat cushion moves up or down (tilt) to any of 5 different positions. (May be used in conjunction with lever (1).

OPERATOR'S SEAT

Bucket type

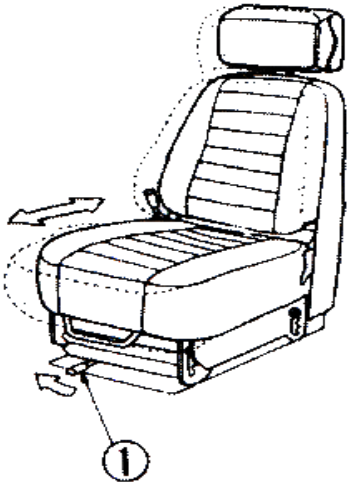
The seat adjustment should be checked at the begining of each shift and when operators change.

5. Backrest adjustment

Pull lever (5) upward to adjust the angle of the backrest (squab) forwards or backwards. Squab is spring loaded to move forward on moving lever. Release lever to lock squab in the desired position. Squab may be adjusted to any of 19 different positions.

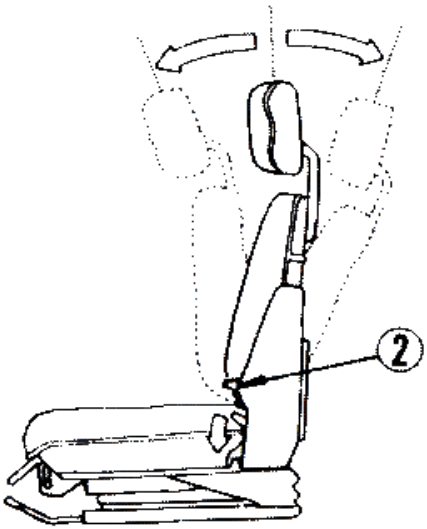
6. Headrest adjustment

Pivot headrest (6) forwards or backwards to best position. The angle is adjustable within a range of 33 degrees. Pull upwards to increase height of headrest to desired position. Vertical adjustment, 125 mm.



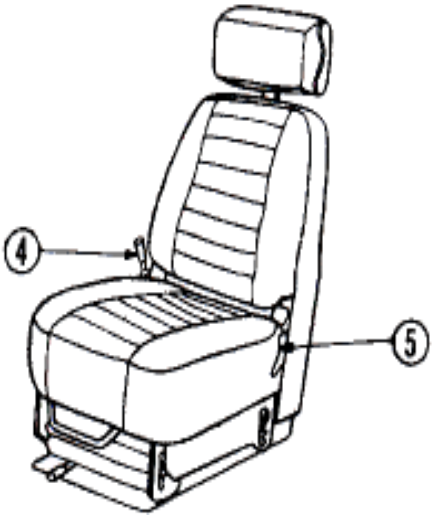
Forward-backward adjustment

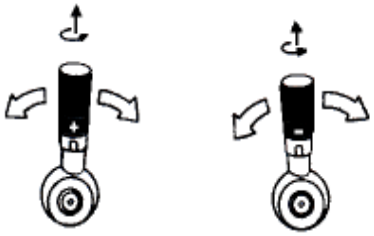
Move lever (1) to the right, move the seat to the best position and release the lever. The seat can be moved forward or backward within a range of 150 mm.

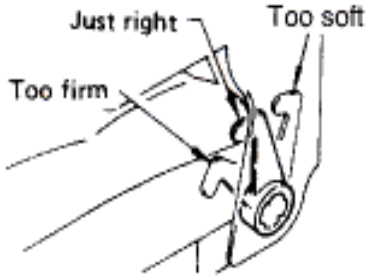


Backrest adjustment

Lower lever (2), and tilt the seat backward or pull it forward.







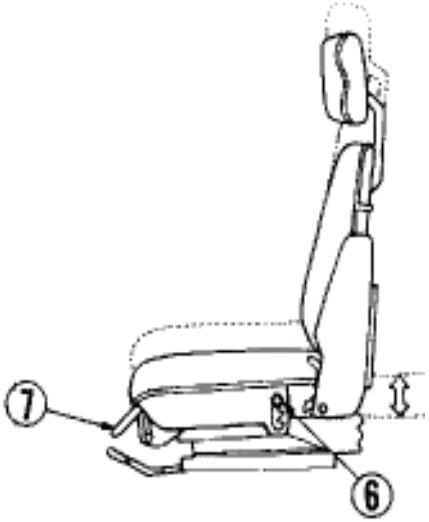
Seat cushion adjustment

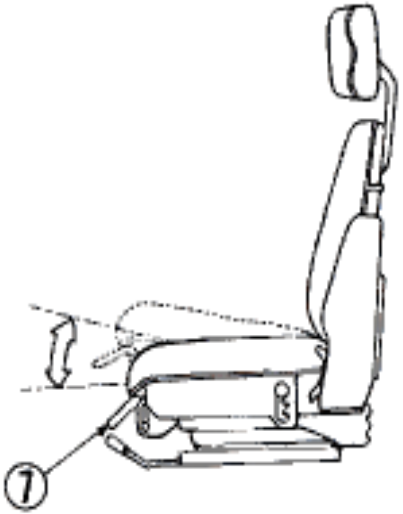
The ride of the seat can be adjusted according to the weight of the operator (50 to 120 kg).

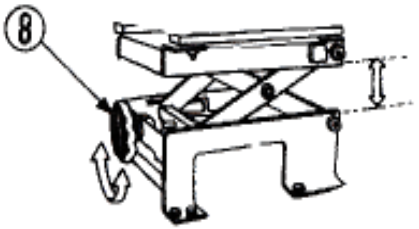
1) For a firmer ride :
Turn the knob of adjustment handle (4) to the plug (+) side, and move the handle.

2) For a softer ride:
Turn the knob of adjustment handle (4) to the minus (-) side, and move the handle.

When sitting on the seat, the ride of the seat is adjusted properly if indicator panel (5) is vertical. If it tilts forward, the ride is too firm; if it tilts backward; it is too soft.







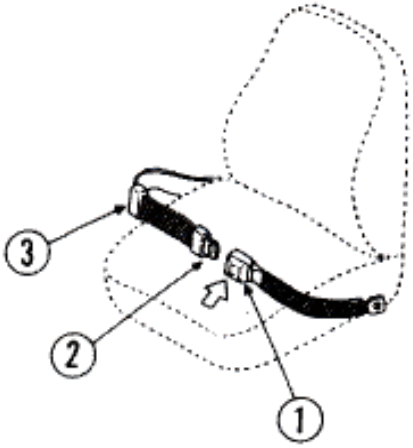
Seat height and angle adjustment
Both the height and angle of the seat can be adjusted.

1. Adjusting the height of the seat
   Remove lock bolt (6), set the rear of the seat to the desired height, then tighten the bolt. Move lever (7) upward, and set the seat to the desired height. The seat can be set within 60 mm.

2. Adjusting the angle of the seat
   Move lever (7) upward and set the seat to the desired angle. It can be set to four steps within 60 mm.

Seat height adjustment
Turn knob (8) clockwise to lower the seat, and vice verse.
The seat can be adjusted within a range of 190 mm.

SEAT BELT (IF EQUIPPED)



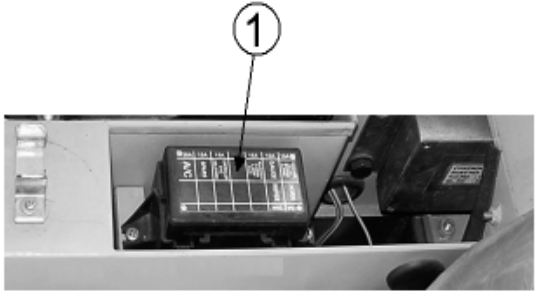
⚠ Before fastening the seat belt, inspect the securing brackets and belt for abnormal conditions.

Fasten the belt and remove it in the following manner

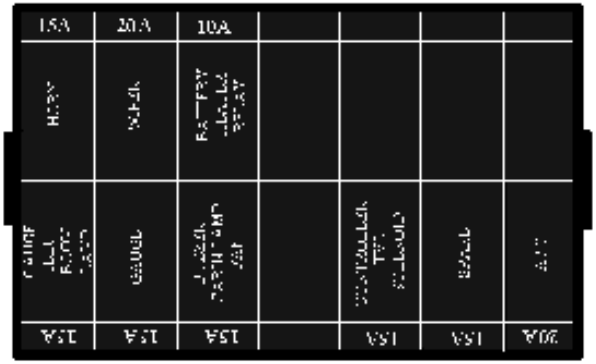
1. Adjust the seat with the operator's back against the backrest.
2. Sit in the seat. Hold buckle (1) and insert (2) into buckle (1). Adjust the length with (3).
3. When removing the belt, push the portion indicated by an arrow.

* If the seat belt is scratched or frayed or if any of the fittings are broken or deformed from long service, replace the seat belt immediately.

FUSE BOX



Fuse arrangement and circuit



Remove cover (1). Replace a fuse with another of the same capacity.

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

* Spare fuses (two of 15A, one of 10A and 20A) are kept in the spare fuse box.

Sl.No.	Fuse Capacity	Circuit	Remarks
1	15A	Gauge Light / Boom lamp	
2	15A	Gauge	
3	15A	Buzzer, Cabin Lamp,Fan	
4	15A	Controller, TVC Solenoid	
5	15A	Spare	
6	20A	A/C	
7	15A	Horn Relay	
8	20A	Wiper	
9	10A	Battery / Heater Relay	

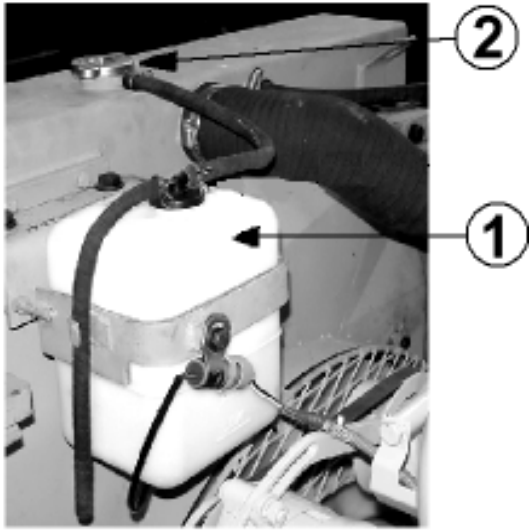
CHECK BEFORE STARTING

Pre-operation checks forestall machine trouble. Never neglect them.

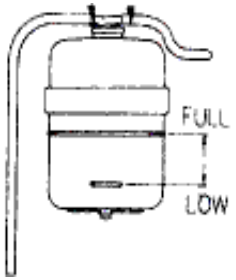
a.WALK-AROUND CHECK

1. Check for oil leak at high pressure hose, high pressure hose joints and hydraulic cylinder seal.
2. Check tightness of idler mounting bolt.
3. Check tightness of battery terminal.
4. Check radiator for premix coolant leak.
5. Check around the engine for pre mixed coolant and oil leaks.
6. Check final drive case for oil leaks and check tightness of sprocket mounting bolt.
7. Check tightness of air cleaner mounting bolt.
8. Check for sealing foam around radiator assembly and cover. Ensure that all possible gaps are sealed properly otherwise which will allow hot air to reenter cooler / radiator. Use additional sealing foam, if necessary.

b. CHECK AND REFILL PRE MIXED COOLANT



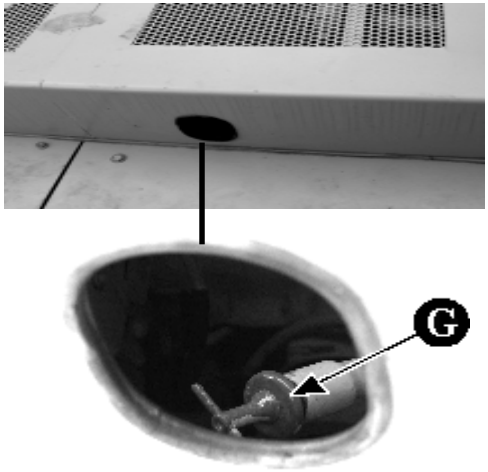
⚠ **When removing the cap, release radiator pressure little by little by loosening cap slowly, then remove cap.**

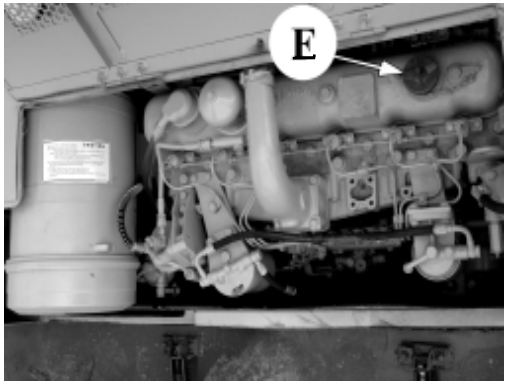


1. Open the engine hood and check if the cooling premix coolant level in subtank (1) is within the range shown above.
2. Refill through filler (2) if level is too low.

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

C. CHECK OIL LEVEL IN ENGINE OIL PAN





1. Use the dip stick (G) to check the oil level.

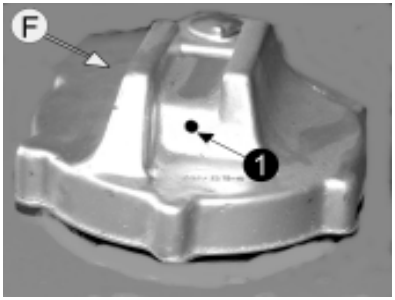
2. The oil level should be between mark L and H, if necessary, add oil at the oil filler (E).

* The oil and lubricants recommended in the table "fuel coolant and lubricants" are applicable to ambient temperature range -5° C to + 50°C. For applications beyond this range BEML or its authorised distributor shall be contacted.

* Stop the engine when checking the oil level.

D. CHECK FUEL LEVEL

1. Check the fuel level in the fuel gauge,if required. Upon completion of work, pour in addition fuel from filter (F) until the fuel tank is full.

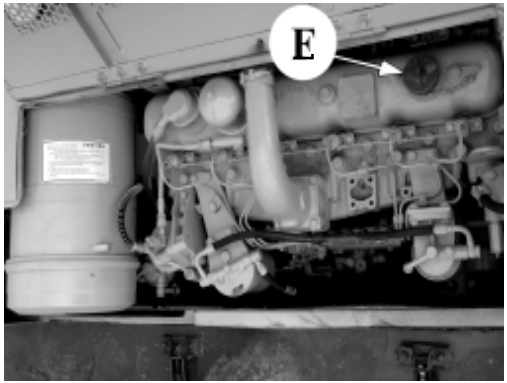


* If breather hole (1) in the cap is blocked up, fuel flow to the engine may stop. Accordingly, clean it from time to time.

* Fuel Capacity 280 Lts.

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

C. CHECK OIL LEVEL IN ENGINE OIL PAN



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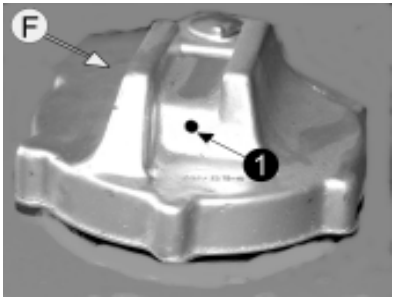
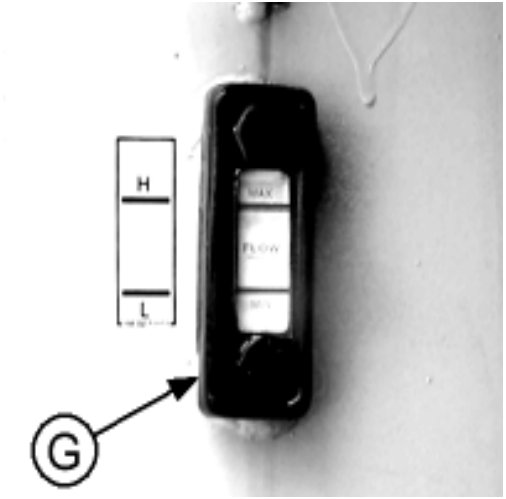


* If breather hole (1) in the cap is blocked up, fuel flow to the engine may stop. Accordingly, clean it from time to time.

* Fuel Capacity 280 Lts.

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

E. CHECK OIL LEVEL IN HYDRAULIC TANK



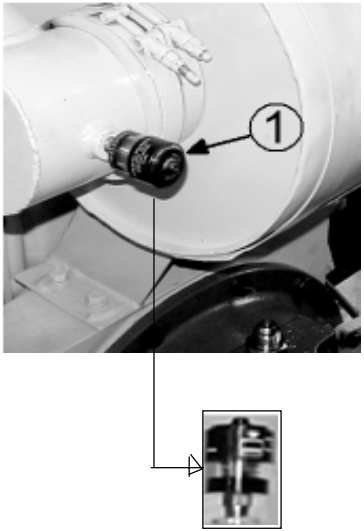
1. Run the engine at low speed, retract the arm and bucket cylinder to the stroke end, lower the boom until the tip of arm touches the ground (as shown in picture) and then stop the engine.
2. Move each control lever (for working equipment and travel) to its full travel to release the internal pressure.
3. If the level of hydraulic oil is not between top H and bottom L lines of sight gauge (G), pour in additional oil from filler of hydraulic tank.

* The oil and lubricants recommended in the table "fuel coolant and lubricants" are applicable to ambient temperature range - 5° C to +50° C. For applications beyond this range BEML or its authorised distributor shall be contacted.
* Do not pour in additional oil if the level is above the top line H of the sight gauge.
* The oil level will vary depending upon the oil temperature. Accordingly, use the following as a guide.

i). When the oil temperature is true (10 to 30° C), the level will be close to bottom line L on the sight gauge.

ii). When the oil temperature is the normal operating temperature (50 to 80°C), the level will be close to top line H on the sight gauge.

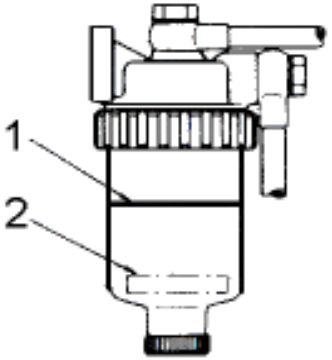
F. CHECK DUST INDICATOR



When the air cleaner element is clogged, the red piston of dust indicator (1) reaches the service level and gets locks.

In that case, clean the element, refer to the section "WHEN REQUIRED" After cleaning the element, push the button to return the red piston.

G . CHECK FOR SEDIMENT AND PREMIXED COOLANT IN THE PMC SEPARATOR



The PMC separator separates premixed coolant mixed in the fuel, if float (2) is at or above red line (1), drain the premixed coolant. For the draining procedure, see section "When Required".

* Even if a PMC separator is installed, be sure to check the fuel tank to remove premixed coolant & sediment. in the fuel.

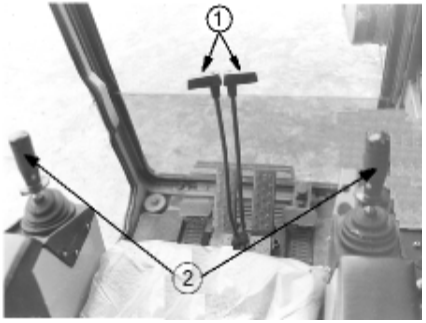
H. CHECK ELECTRIC WIRING

Check the broken electric wiring, short circuit and loose terminals, if any fault is detected, replace repair or retighten.

In particular check for electric wiring of the battery, the starting motor and the alternator.

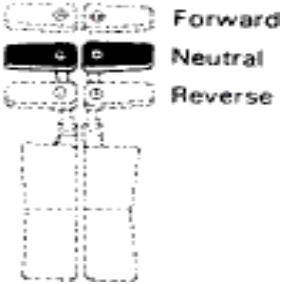
OPERATING YOUR MACHINE

BEFORE STARTING THE ENGINE

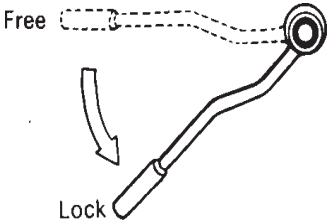


1. Carry out an initial inspection. (For details of the inspection, see CHECK BEFORE STARTING.)

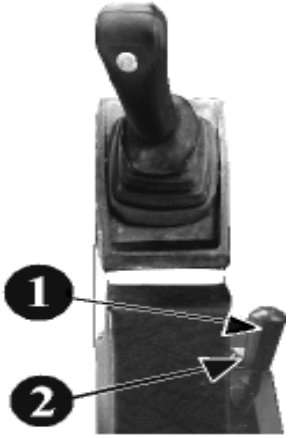
2. Put the traveling and steering control levers (1) in the N (neutral) position.



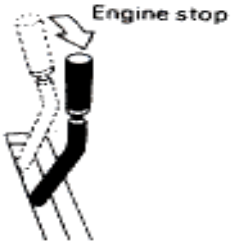
3. Put the left and right working equipment levers(2) in neutral and check that safety levers are locked.



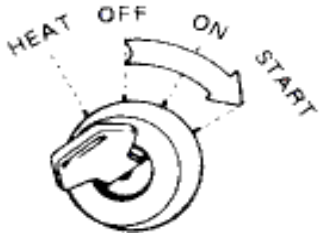
TO START THE ENGINE



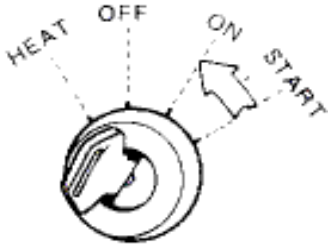
1. Pull fuel control lever (1) a little towards you from the low idling position.



2. Turn starting key (2) to the START position.



3. When engine is started, release starting key (2) and the key will return automatically to ON.



HEAT: IF YOUR ENGINE IS FITTED WITH HEATING COIL (OPTIONAL)

* If engine will not start, repeat the starting procedure after about 2 minutes.

* Do not leave the key in START for more than 20 seconds.

* Do not put the key in OFF position while the engine is running.

* To start engine in cold weather, refer to COLD WEATHER OPERATION.

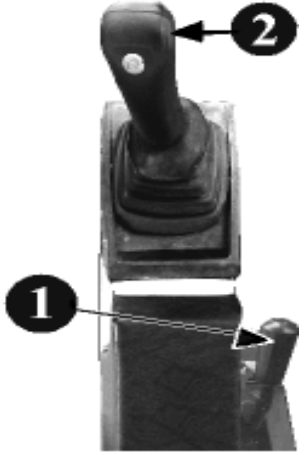
Special starting

When starting after running out of fuel, fill with fuel, then fill the fuel filter cartridge with fuel and bleed the air from the fuel system before starting.

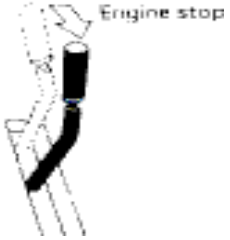
Refer to FUEL FILTER in EVERY 500 HOURS SERVICE.

CHECKS AFTER STARTING

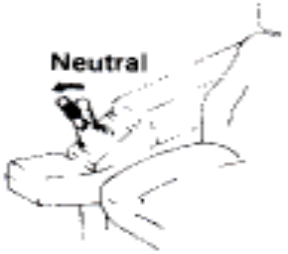
After starting, make the following checks



1. Pull fuel control lever(1)and run the engine at medium speed. Then run the engine at no load for about 5 minutes.



2. Leaving bucket control lever (2) in either pushing or pulling side, run the engine for about 5 minutes to warm up the hydraulic oil.



3. After warm-up run is completed, check gauges, monitor lamps for proper operation.

* Continue to run the engine at light load until the green range of the engine water temperature gauge lights.

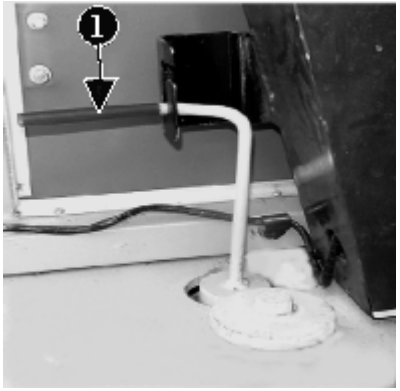
4. Check if the exhaust color is normal or whether there is any abnormal noise or vibration.

* Avoid abruptly accelerating the engine until the completion of warm-up.

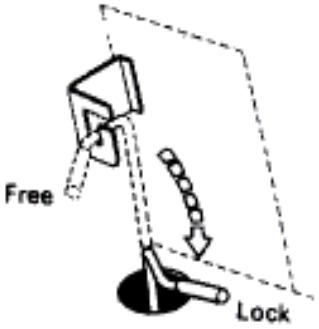
* Do not run for more than 20 minutes at low idling or at high idling.

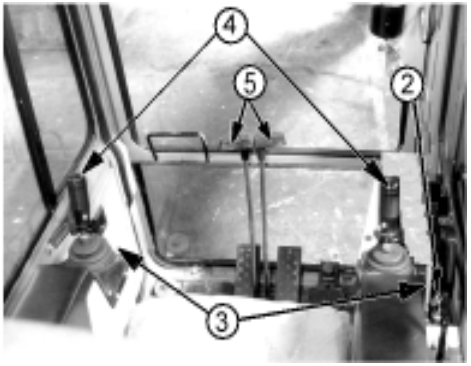
* The hydraulic oil temperature should ideally lie within the range 50 to 80°C. If the machine is operated after raising the oil temperature to 20°C, the life of the machine will be extended.

TO MOVE THE MACHINE OFF



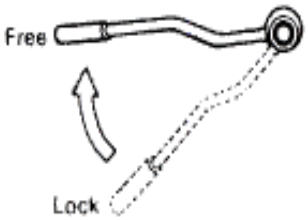
1. Put swing lock lever (1) into the lock position by pushing the lever down.



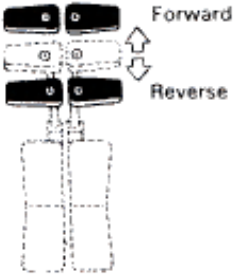


2. Pull fuel control level (2) to increase engine speed.

3. Free safety levers (3) of left and right working equipment levers (4), move the work equipment in and raise it to a height of about 40 to 50 cm.



4. Slowly incline left and right traveling and steering levers (5) in the forward (forward moving off) or reverse (reverse moving off) direction, and move off.



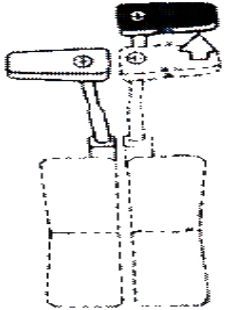
⚠ Check whether the track frame is facing forward or backward before operating the traveling and steering levers.

⚠ Avoid abruptly operating the traveling and steering levers with the fuel control lever fully open, as this will cause the machine to move off suddenly.

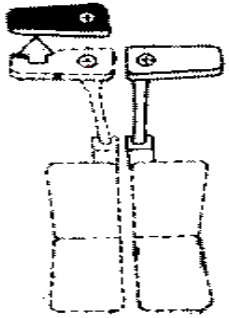
TURNING

Operate the two traveling and steering levers in the following manner.

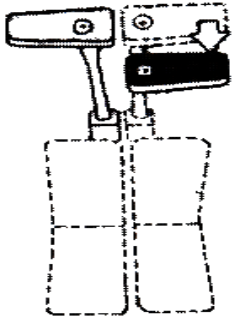
Left pivot turn (forward)



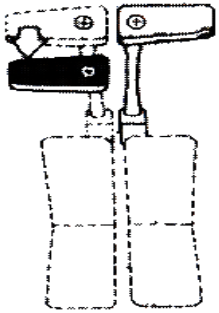
Right pivot turn (forward)



Left pivot turn (reverse)



Right pivot turn (reverse)



When changing the direction of a stationary machine

When making a left turn, incline the right traveling and steering lever forward to cause the machine to turn left in the forward direction, or pull it back to make the machine turn left in the reverse direction.

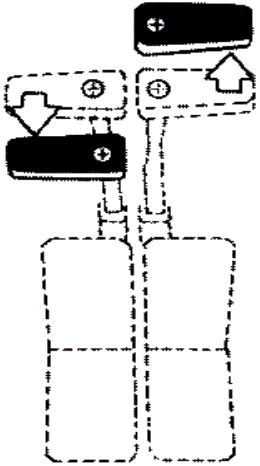
In the case of a right turn, operate the left traveling and steering lever in a similar manner to the above.

When changing the direction of running machine (when left and right traveling and steering levers are inclined in the same direction)

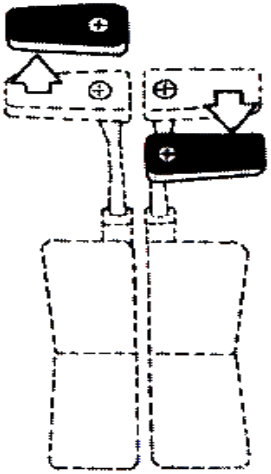
When making a left turn, return the left traveling and steering lever to the neutral position. This will cause the machine to make a pivot turn to the left.

In the case of a right turn, operate the right traveling and steering lever in a similar manner to the above.

Counterrotation turn (left)



Counterrotation turn (right)



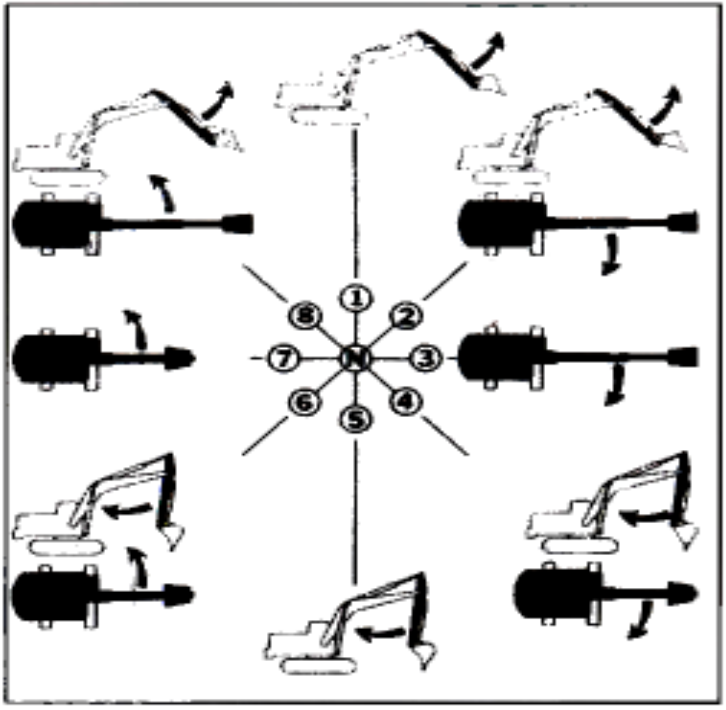
- **When performing counterrotation**
  To counterrotate the machine to the left, pull back the left traveling and steering lever and push forward the right traveling and steering lever.

* The above applies to the running operation of the lower mechanism. When the upper works is facing backward as opposed to the track frame, the various traveling and steering operation methods will be reversed. It is therefore necessary to always keep in mind the direction of the track frame when operating the machine.

* Avoid abruptly changing the direction of the machine as far as possible. In particular, before counterrotating the machine, first bring it to a halt.

OPERATION OF THE WORKING EQUIPMENT

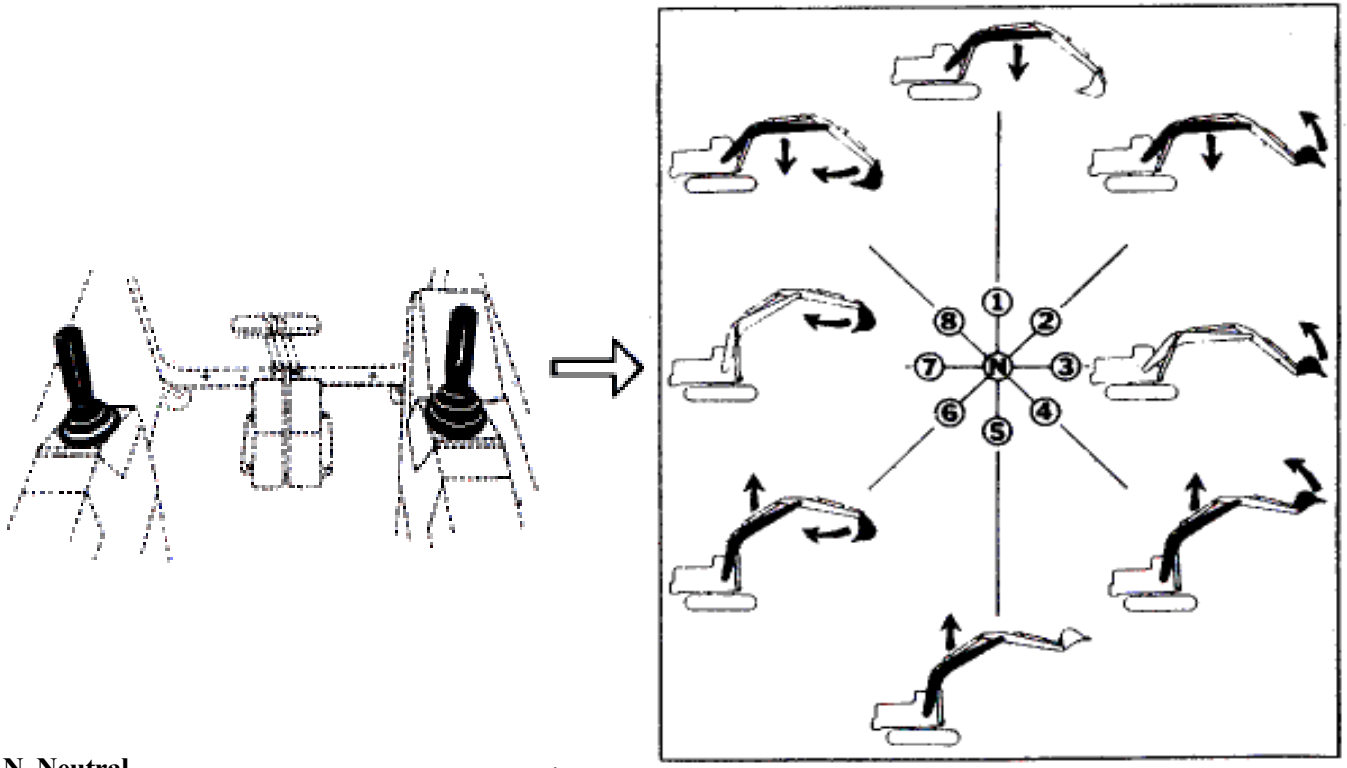
N. Neutral
1 Arm out
2. Arm out and swing right
3. Swing right
4. Arm in and swing right
5. Arm in
6. Arm in and swing left
7. Swing left
8. Arm out and swing left



The working is operated by means of the left and right working equipment levers. The left lever is used to operate the arm and swing the machine and the right lever is used to operate the boom and the bucket.

The motion of the lever and working equipment is as shown in the diagrams.

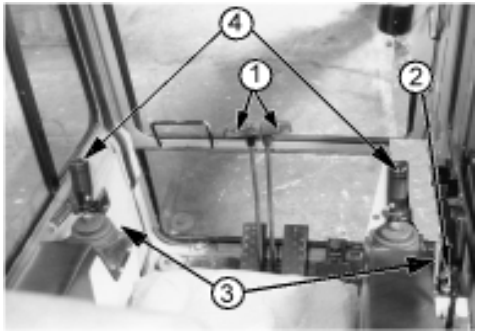
* Before swinging the upper works, make sure that the swing lock lever has been in free.



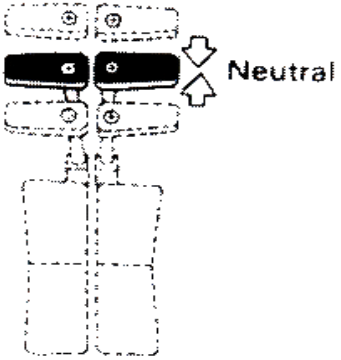
N. Neutral

1. Boom lower
2. Boom lower and bucket dump
3. Bucket dump
4. Boom raise and bucket dump
5. Boom raise
6. Boom raise and bucket curl
7. Bucket curl
8. Boom lower and bucket curl

TO STOP THE MACHINE



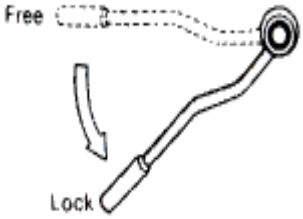
1. Put the left and right traveling and steering levers (1) in the neutral position.



2. Lower the engine speed using fuel control lever (2).

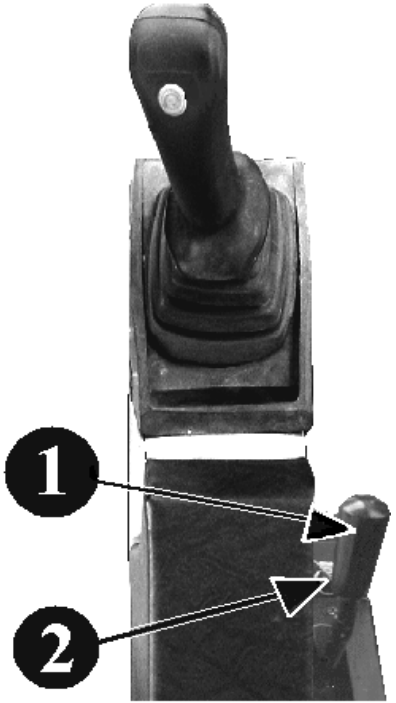
3. Lower the bucket horizontally until its underside touches the ground.

4. Lock safety levers (3) for work equipment levers (4).



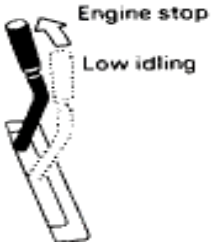
⚠ **When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the bucket into the ground.**

TO STOP THE ENGINE

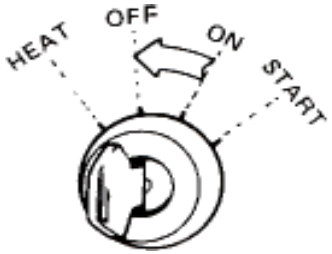


1. Run the engine at low idling speed for about 5 minutes to allow it to gradually cool down.

2. Put fuel control lever (1) in the engine stop position and stop the engine.



3. Return starting key (2) to the OFF position and remove key.

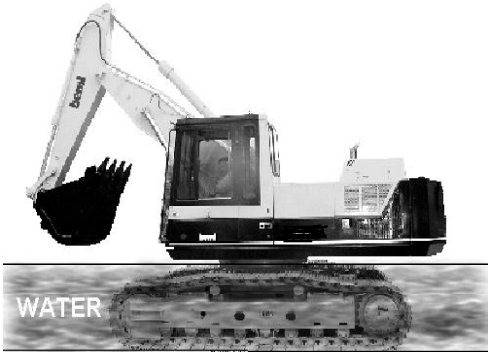


* If the engine is abruptly stopped before it has cooled down, engine life may be greatly shortened. Consequently, do not abruptly stop the engine apart from an emergency.

* In particular, if the engine has overheated, do not abruptly stop it but run it at medium speed to allow it to cool gradually, then stop it.

PRECAUTIONS FOR OPERATION

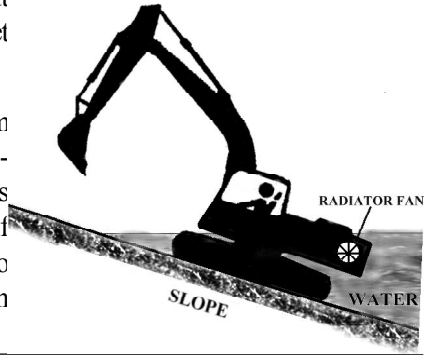
- Be careful not to compact the soil or damage earth mounds as a result of the swinging force.
- When swinging, do not dig the bucket teeth into the soil.
- Do not move off and excavate with the bucket leaving dug into the ground.
- When working with the machine, do not move the cylinder to the end of its stroke but leave a small safety margin.
- Do not use the dropping force of the bucket as a pickaxe, breaker, or pile driver.
- Do not use the dropping force of the machine for digging.
- It is better to excavate hard rocky ground after breaking it up by some other means. This will not only reduce damage to the machine but make for better economy.
- When descending a steep slope, adjust the speed by means of the traveling and steering levers and the fuel control lever.



- Do not immerse the machine in water by more than the permissible depth (under swing circle). In addition, properly grease parts which have been immersed in water for a long time, until the old grease comes out from the bearings (vicinity of bucket pins, swing circle system, etc.,)
- When removing the machine from water, if the machine is given a posture of climbing at a steep angle (less than 30°, however), the rear part of the upper swing body may dip into the water with its radiator fan scooping up water. (See picture)

In that event, then fan may break. Be sufficiently careful when removing the machine from water for this reason.

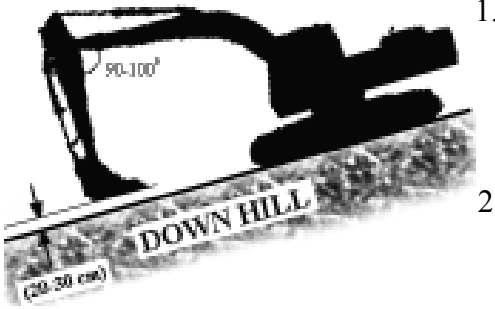
- To brake the machine during downhill runs, put the traveling and steering lever in the neutral position. This will cause the brake to be automatically applied.
- When climbing a hill, if the shoes slip or the travel motor relieves, preventing the machine from climbing by means of the tracks alone, it is possible to use the force of the arm as an aid.



- When the engine stops on a slope, move the traveling and steering levers to neutral position and lower the bucket. Thereafter, turn starting key to START.
- Note that the following phenomena are not faults:

1. When the arm is pulled back, it will sometimes stop when becomes more or less vertical.
2. The arm may sometimes stop when the bucket teeth become more or less horizontal.
3. At the beginning and end of a swinging, a noise may sometimes be emitted from the brake valve.
4. When descending a steep slope at low speed, a noise may sometimes be emitted from the travel motor.

- The wide triple grouser shoe (700,800, 900 mm) and swamp shoe (860 mm) are designed for use on soft, weak ground. Do not use them on rocky ground, gritty ground or unlevelled ground.



- When travelling down a hill, adjust the speed with the travel lever and fuel control lever. If the grade exceeds 15°, set the machine in the posture shown in the diagram and reduce the engine speed.

⚠ **Do not travel on slopes of over 30 ° as there is danger that the machine may overturn.**

- Matters for attention at special work sites

1. If operation is executed in water, if the work equipment fixing pins come in contact with water, greasing is to be performed after every under water operation.
2. Greasing of the work equipment fixing pins is to be performed every time before heavy digging or deep digging.

* After greasing is done, the boom, arm and bucket are to be operated several times. This should be followed by re-greasing.

HOW TO ESCAPE FROM MUD

Always operate carefully to avoid getting stuck in mud. If the machine does get stuck in mud, use the following procedures to get the machine out.

- **When one side is stuck**

  When only one side is stuck in mud, use the bucket to raise the track, then lay boards or logs and drive the machine out. if necessary, put a board under the bucket also.

  * When using the boom or arm to raise the machine, always have the bottom of the bucket in contact with the ground. (Never push with the teeth) The angle between the boom and arm should be 90° to 110° .

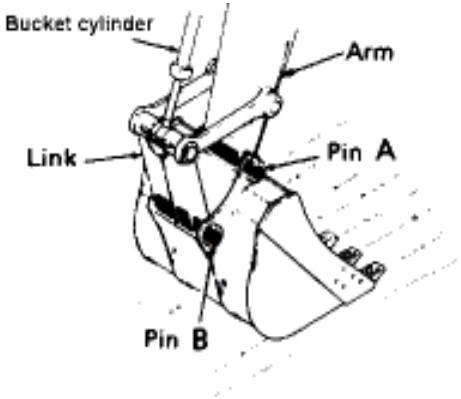
  The same applies when using the inverting bucket.

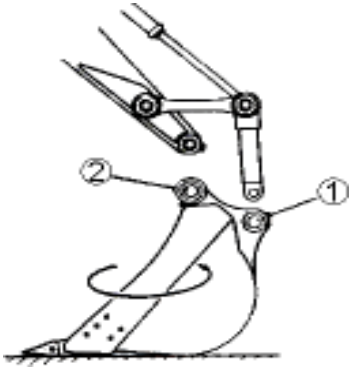
- **When both sides are stuck**

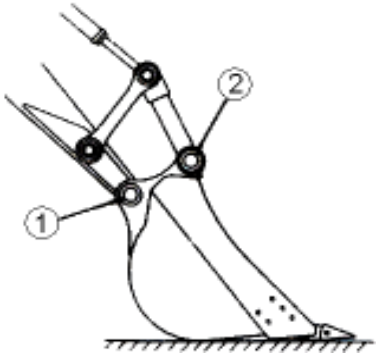
  When the tracks on both sides are stuck in mud and the machine will not move, lay boards as explained on the left, and dig the bucket into the ground in front. Then pull in the arm as in normal digging operations and put the travel levers in the FORWARD position to pull the machine out.

INVERSION AND REPLACEMENT OF BUCKET (CONSULT BEML)

Stop the machine on a firm, flat surface. When performing joint work, make clear signals to each other and work carefully for safetys sake.







1. Select a flat surface and stabilize the bucket.
2. After removing the stop bolt and nut for each pin, extract pins A and B.

   * After removing the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing on both sides do not become damaged.

3. Reverse the bucket.

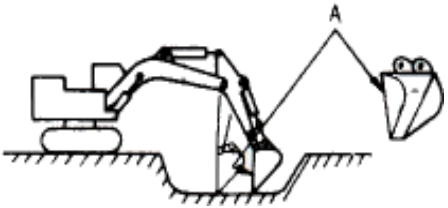
   * After reversing the bucket correct the direction and inclination of mounting pin holes (1) and (2) then firmly stabilize the bucket so that it does not shake about.

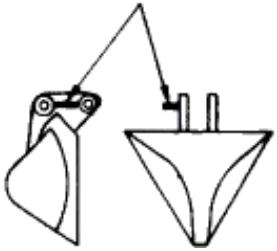
4. Couple the arm to hole (1), then connect the link to hole (2).
5. After mounting the stop bolt and nut for each pin, apply grease to each pin.

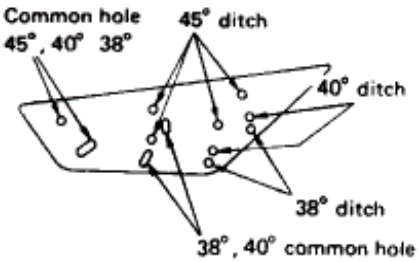
   * When replacing bucket, adjust bucket clearance.

HANDLING THE TRAPEZOIDAL BUCKET

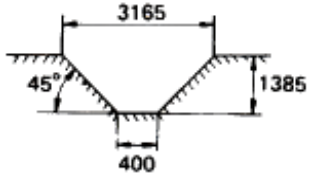
(IF EQUIPPED)



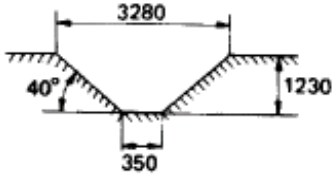




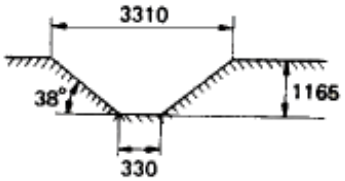
Shape of ditch by 45° bucket



Shape of ditch by 40° bucket



Shape of ditch by 38° bucket



This bucket is used in sloped ditch digging work in the farm.

The three different ditch inclination can be obtained by changing the angle of the attached plate.

The angles available are 45° , 40° and 38°.

Install the bucket using the holes for 45° , 40°, and 38° ditch.

How to perform excavation

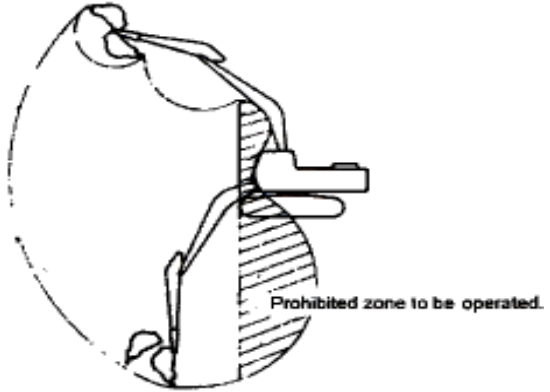
Operate the boom, the arm and the bucket to make the line A of the side-plate of the bucket vertical.

The guide plate B to check this position is installed beside the bucket pins. Accordingly, hold this plate horizontal when digging.

* Hold the plate horizontal for every ditch angle.

USING THE EXTENSION ARM
(IF EQUIPPED)

When the extension arm is installed, be careful when retracting the arm because the bucket hits the foot of the boom cylinder or the lower frame of the swing circle.



- Use the narrow bucket (width : 750 mm) without the side - cutter when installing the extension arm. When you use the standard width bucket, the machine stability is lost. Also the bucket will hit the cab when the arm is retracted.

- Work in hard soil or rocky terrain will shorten the life of the extension arm, the boom and the arm. It is better not to use the extension arm in such conditions.

HANDLING THE CLAMSHELL BUCKET
(IF EQUIPPED)

This bucket is used for digging and loading in side- ditches or the confined spaces.

How to perform excavation

Carry out digging work by lowering the boom keeping the clamshell opened.
Close the bucket while raising the boom gradually. When you begin to dig and find the bucket rotating, do as follows.
Extend the bucket cylinder fully and hold, the bucket will soon stop rotating.

* Make the teeth of the bucket vertical in digging.
* For safety, always avoid abrupt traveling, swing and stopping.
* Do not swing the bucket to crush the rock or to cut through soil.
* Do not use the bucket for hammering or pulling out piles etc.
* Before leaving the machine, open the bucket and lower it to the ground.
* Remove the bucket from the arm when transporting the machine.

COLD WEATHER OPERATION

PREPARATION FOR LOW TEMPERATURE

- Change lubrication oil with that of prescribed viscosity.
- Fuel of a low pouring point should be used. ASTM D975 No. 1 diesel fuel should be used at atmospheric temperature lower than -10°C.
- Add 50:50 Premixed coolant EG based(Ethylene Glycol Based) to Radiator tank.

Operating conditions of 50:50 Premixed coolant EGbased(Ethylene Glycol based)

Min./Max Atmospheric Temperature (°C)	**0 to** -34 °C	0 to +55 °C
Amount of 50:50 Premixed coolant (EG) Ethylene glycol based	44lts	44lts

Cautions for using 50:50 Premixed coolant EG Based (Ethylene Glycol based)

1. **50:50 premixed coolant EG based should be used.**
2. Cooling system must be thoroughly flushed before filling with 50:50 pre mixed coolant EG based.
3. 50:50 premixed coolant EG based (Ethylene Glycol based) is an anti freeze mixture.
4. 50:50 Premixed coolant EG based (Ethylene Glycol based) will operate under extreme weather (high altitude) conditions from -34 °C to +55°C ambient temperature (Topup 10Lts after every 250hrs of operation.)

Care in using antifreeze

Use 50:50 Premixed coolant (Ethylene Glycol based), no change of coolant is required for a year or 2000 hours of operation whichever is earlier.

* Never use any antifreeze made from alcohol, which may be a cause of engine trouble.

* Do not mix one antifreeze with a different brand.

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

* **Battery**

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

* Measure the specific gravity of fluid and obtain the rate of charge from the following conversion table:

Rate of Charge \ Temp. of Skin	20°C	0°C	-10°C	-20°C
100%	1.28	1.29	1.30	1.31
90%	1.26	1.27	1.28	1.29
80%	1.24	1.25	1.26	1.27
75%	1.23	1.24	1.25	1.26

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

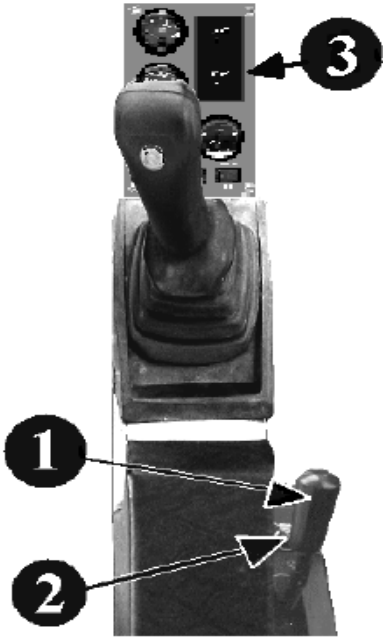
To avoid gas explosions, do not bring fire or sparks near the battery.

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

STARTING IN COLD WEATHER (IF EQUIPPED)

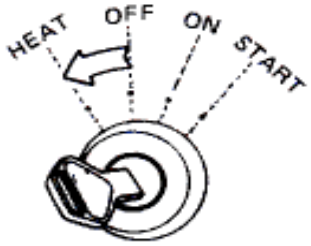
For the pre and post-starting inspection, refer to the section

OPERATING YOUR MACHINE

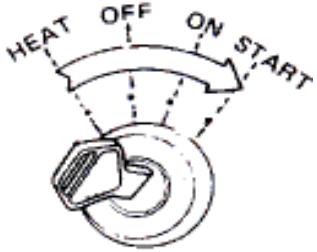


1. Pull fuel control lever (1) a little towards you from the low idling position.

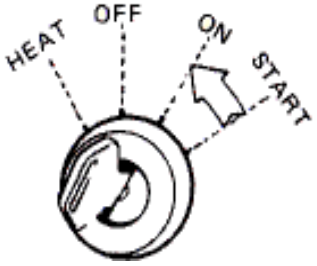
2. Turn starting key (2) to HEAT, and confirm that engine preheating monitor lamp (3) comes on. After about 36 seconds, preheating monitor lamp (3) will flash for about 16 seconds to indicate that preheating is finished.



3. After preheating monitor lamp (3) starts to flash, turn the key (2) to START and start the engine.



4. Release starting key (2), and the key will return automatically to ON.



* If the engine does not start up under the above procedure, repeat steps 2 and 3 after waiting for about 2 minutes.

⚠ **Never use starting aid as fluids as they may cause explosions.**

CAUTIONS AFTER COMPLETION OF WORK

1. Mud and water on the machine body should be completely removed.

   Park the machine on concrete or hard ground. If this is impossible, park the machine on wooden boards. This will prevent the accessories from freezing or the track and undercarriage from freezing to the ground thereby preventing vehicle movement the next morning. Particular attention should be given to water drops collected on the surface of the hydraulic cylinder piston rods. Such droplets must be fully wiped off because if water is frozen to the rod when the cylinder is utilized, the cylinder oil seals may be damaged.

2. Drain premixed coolant collected in fuel system so that such water may be frozen at night.

3. As battery capacity drops at low ambient temperature, cover the battery or remove it from the machine to be kept warm at night.

PERIODIC MAINTENANCE

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

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

MAINTENANCE TABLE

No.	ITEM	service	PAGE
	CHECK BEFORE STARTING		
a	Walk-around check		33
b	50:50 Premixed coolant (Ethylene glycol based)	Check and supply	33
c	Engine oil pan	Check and supply	34
d	Fuel	Check and supply	34
e	Hydraulic tank	Check and supply	35
f	Dust indicator	Check	36
g	Water separator	Inspect float position	36
	EVERY 100 HOURS SERVICE		
a	Swing machinery case	Check and supply	63
b	Fuel tank	Drain water and sediment	63
c	Lubricating		64
-1	Boom cylinder foot pin	Lubricate 2 points	64
-2	Boom foot pin	Lubricate 2 points	64

No.	ITEM	SERVICE	PAGE
-3	Boom cylinder rod end pin	Lubricate 2 points	65
-4	Arm cylinder foot pin	Lubricate 1 point	65
-5	Boom-Arm coupling pin	Lubricate 1 point	65
-6	Arm cylinder rod end pin	Lubricate 1 point	65
-7	Bucket cylinder foot pin	Lubricate 1 point	65
-8	Arm-bucket coupling pin	Lubricate 1 point	66
-9	Arm-link coupling pin	Lubricate 1 point	66
-10	Link coupling pin	Lubricate 2 points	66
-11	Bucket-link coupling pin	Lubricate 2 points	66
-12	Bucket cylinder rod end pin	Lubricate 1 point	66
	INITIAL 250 HOURS SERVICE		
a	Fuel filter/Pre-filter	Replace cartridge	67
b	Engine valve clearance	Check and adjust	71

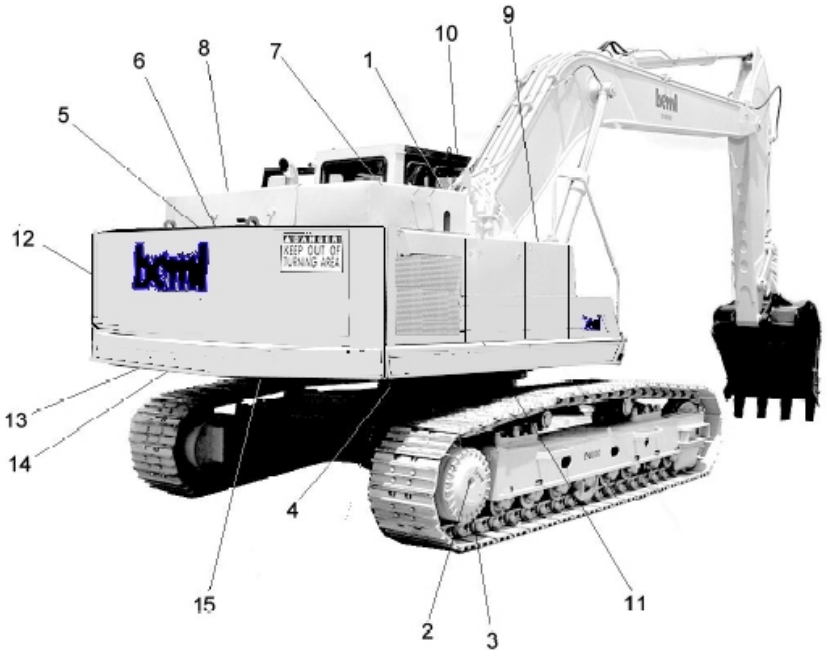
No.	ITEM	SERVICE	PAGE
	EVERY 250 HOURS SERVICE		
a	Final Drive case	Check and supply	67
b	Engine oil pan and filter	Change oil and replace cartridge	68
c	Water pumb belt	Check tension	69
d	Hydraulic filter	Replace element	71
e	Swing circle	Lubricate 3 points	71
f	Battery electrolyte	Check fluid level	72
	EVERY 500 HOURS SERVICE		
a	Swing circle pinion	Lubricate with grease	73
b	Radiator fins and oil cooler fins	Clean	73
c	Pre-filter	Replace cartridge	74
	EVERY 1000 HOURS SERVICE		
a	Fuel filter	Replace	74
b	Swing machinery case	Change oil	76
c	Turbocharger clamping joint	Check and retighten	77
d	Turbocharger rotor	Check play	78

No.	ITEM	SERVICE	PAGE
	EVERY 2000 HOURS SERVICE		
a	Hydraulic tank	Change oil	79
b	Hydraulic tank strainer	Clean	81
c	Final drive case	Change oil	81
d	Turbocharger	Clean blower impeller	82
e	Engine breather	Clean	83
f	Alternator and starting motor	Check	83
g	Engine vibration damper	Check	83
h	Engine valve clearance	Check and adjust	83
	EVERY 4000 HOURS SERVICE		
a	Water pump	Check	84

No.	ITEM	SERVICE	PAGE
	WHEN REQUIRED		
a	Cooling sytem	Clean	85
b	Air Cleaner element	Check, Clean or replace when required	88
c	Track	Check and adjust tension	91
d	Electrical intake air heater	Check once a year	93
e	Track shoe bolts	Check and retighten	93
f	Bucket teeth	Replace	94
g	Water separator	Drain water	95

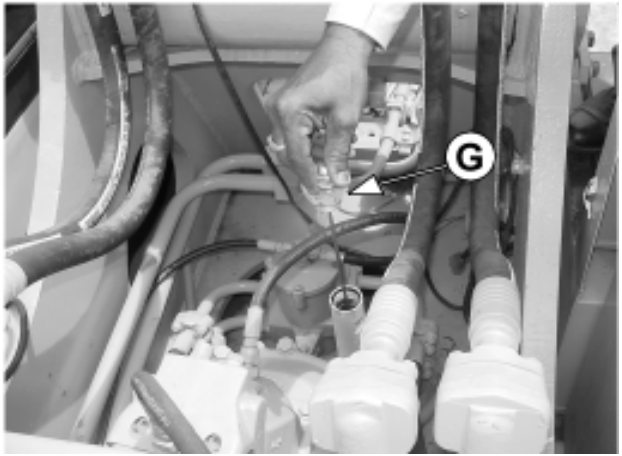
OIL FILLER AND LEVEL GAUGE POISTIONS

1. Swing machinery case oil filler
2. Final drive case oil filler
3. Final drive case drain plug
4. Swing machinery case drain plug
5. Engine oil pan oil filler
6. Engine oil pan level gauge
7. 50:50Premixed coolant(Ethylene Glycol based)
8. Hydraulic tank oil filler
9. Fuel tank oil filler
10. Fuel level gauge meter
11. Fuel tank drain valve
12. Hydralic tank level gauge
13. Hydraulic tank drain plug
14. Cooling water drain valve
15. Engine oil pan drain plug



EVERY 100 HOURS SERVICE

a. SWING MACHINERY CASE



Inspect the oil level using dipstick (G) and if it is insufficient, pour in additional engine oil from gauge hole.

Screw in dipstick (G) until O-ring on the dipstick contacts the guide and check the oil level.

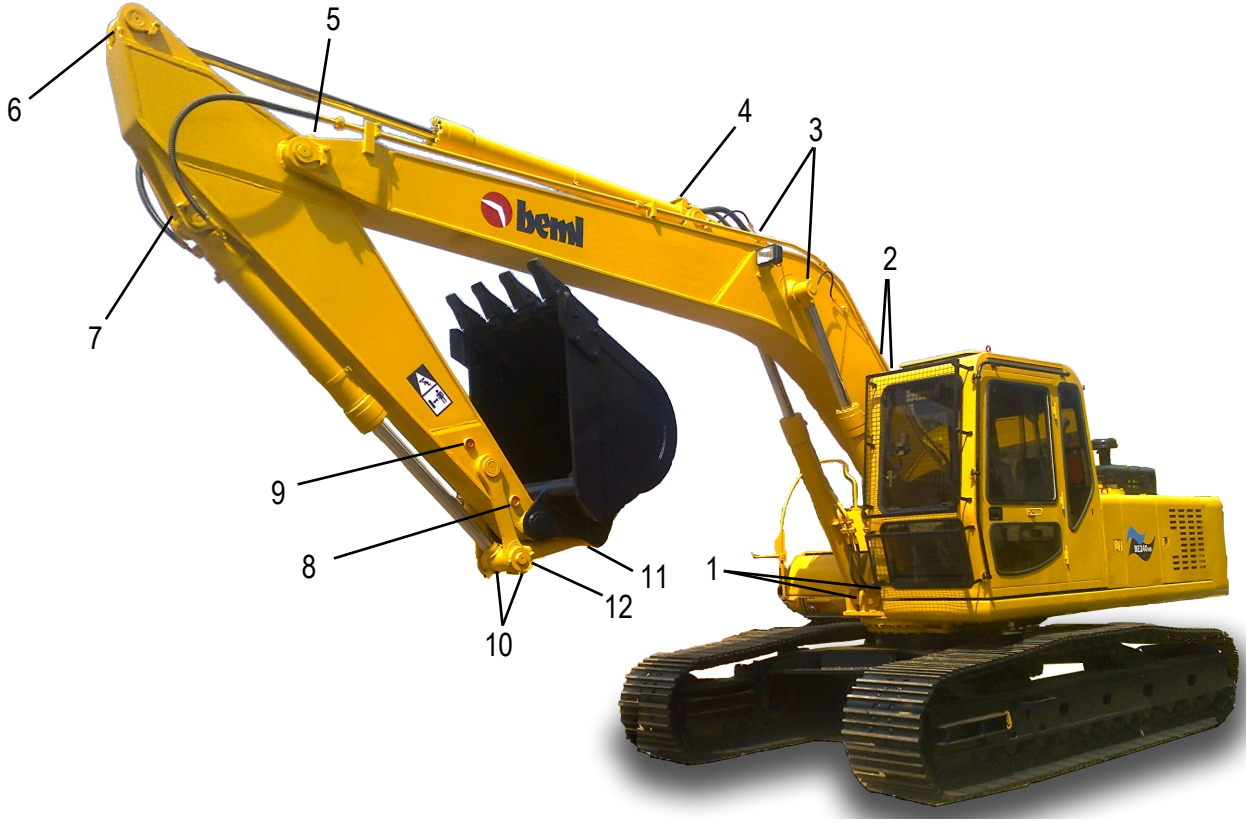
b. FUEL TANK

Loosen valve (1) on the bottom of the fuel tank so that the precipitation and mixed water will be drained in along with fuel.

* The oils and lubricants recommended in the table "fuel, coolant and lubricants" are applicable to ambient temperature range - 5°C to + 50°C. For applications beyond this range your nearest BEML office shall be contacted.

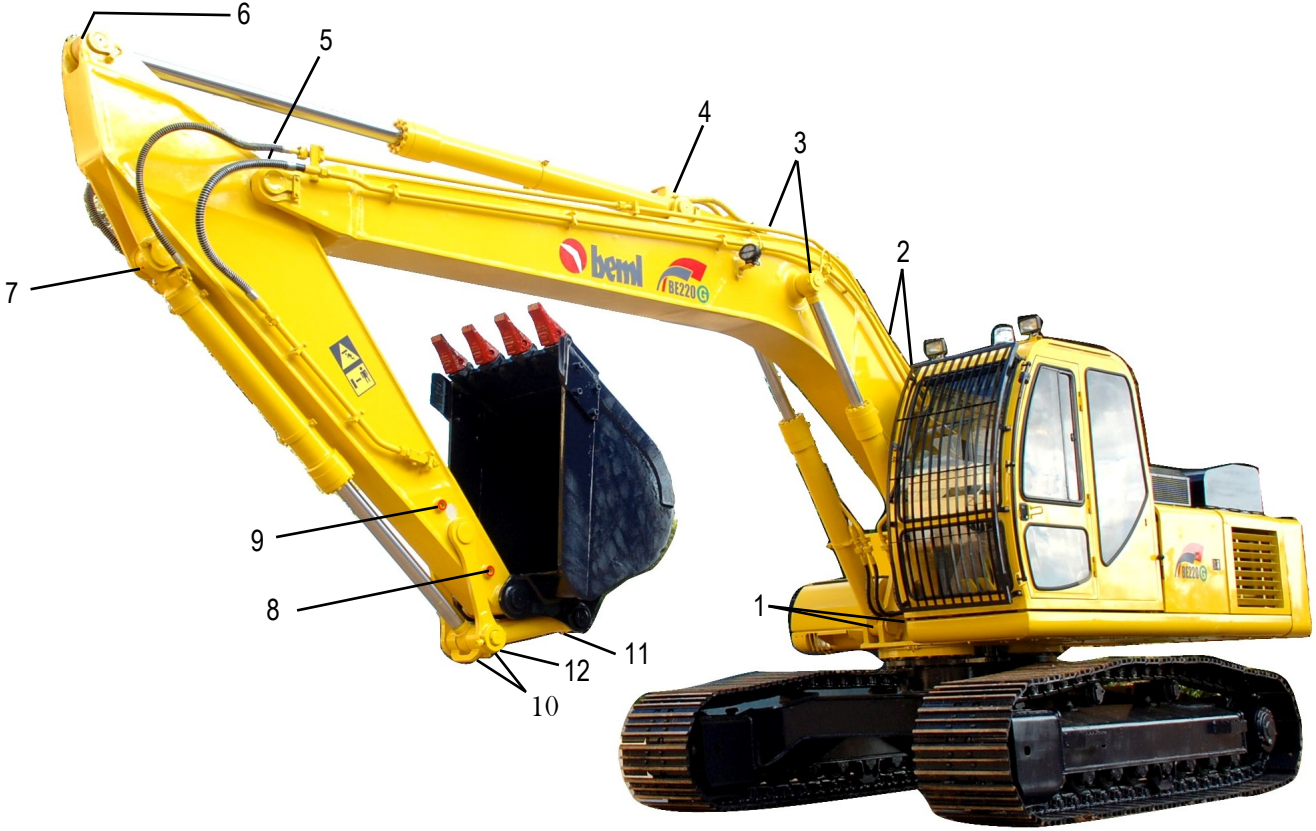
c. LUBRICATING

Apply grease to the grease fittings shown by below.

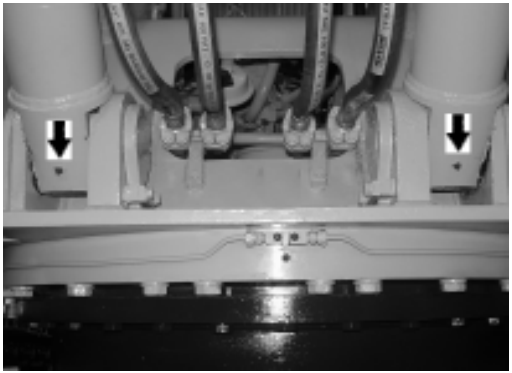


c. LUBRICATING

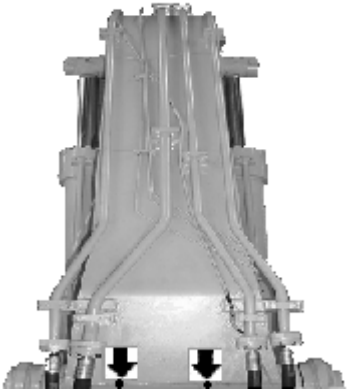
Apply grease to the grease fittings shown below



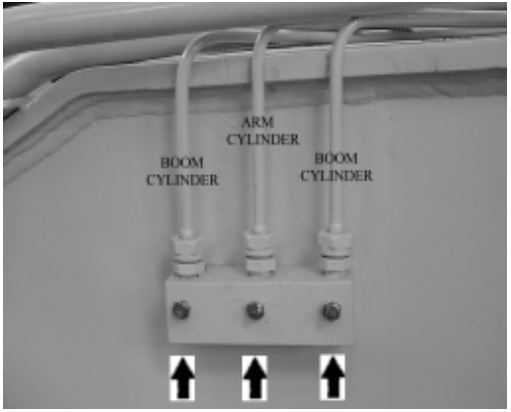
1.Boom cylinder foot pin (2points)



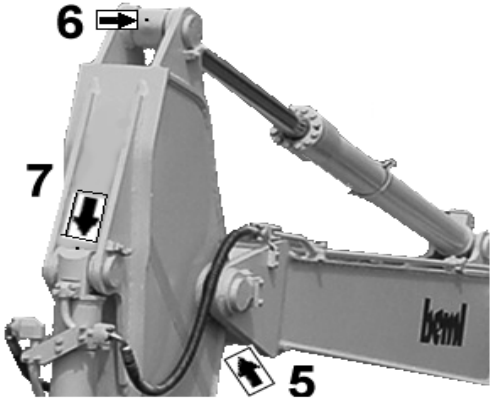
2. Boom foot pin (2 points)



3. Boom cylinder rod end pin (2 points)
4. Arm cylinder foot pin (1 point)



5. Boom -Arm coupling pin (1 point)
6. Arm cylinder rod end pin (1 point)
7. Bucket cylinder foot pin (1 point)



8. Arm-Bucket coupling pin (1 point)
9. Arm-Link coupling pin (1 point)
10. Link coupling pin (2 points)
11. Bucket-Link coupling pin (1 point)
12. Bucket cylinder rod end pin (1 point)

INITIAL & EVERY 250 HOURS SERVICE

INITIAL 250 HOURS SERVICE

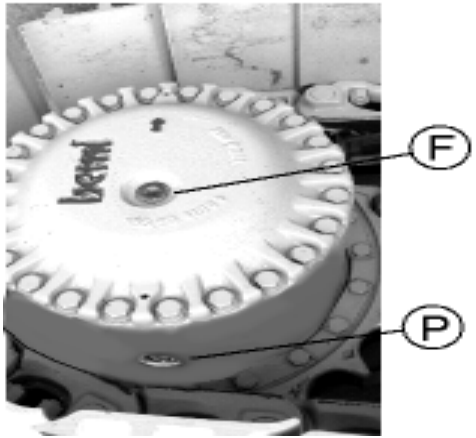
Perform the following maintenance after running the machine for the first 250 hours.

a. FUEL FILTER/PRE-FILTER
b. ENGINE VALVE CLEARANCE

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

EVERY 250 HOURS SERVICE

A. FINAL DRIVE CASE



1. Set the machine with plug (F) and drain plug (P) perpendicular to the ground surface.
2. Remove plug (F), and check that oil level is within 10 mm below the bottom of the plug hole. If it is not within this range, add engine oil through the plug hole.

* The oils and lubricants recommended in the table "fuel, coolant and lubricants" are applicable to ambient temperature range - 5° C to + 50° C. For applications beyond this range BEML or its authorised distributer shall be contacted.

FINAL DRIVE CASE

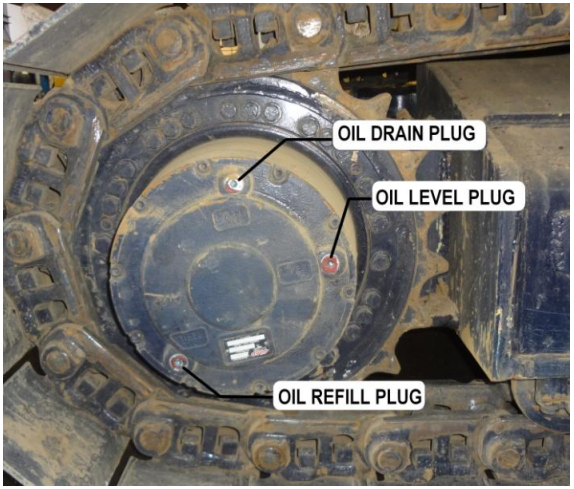
Make sure to fill the gear box with appropriate oil quantity prior to operating it. For correct use of the unit, it is recommended to use the following oil type - **SAE 80W90 / API GL5**

FOR OIL FILLING OPERATION FOLLOW THESE STEPS -

Step 1: Rotate the gearbox until the “oil level “level plug is set horizontally (see fig). The “oil refill” fill plug must be above the level plug.
Step 2: Unscrew the refill plug and the level plug.
(see fig). Fill the gear box from “oil refill “fill plug.
Step 3: The oil quantity is sufficient when the oil reaches the “oil level “level plug.
Step 4: Put the plugs with their washers back in place.
Step 5: Run the unit and after few minutes check the oil level.
Step 6: Top up oil if necessary.

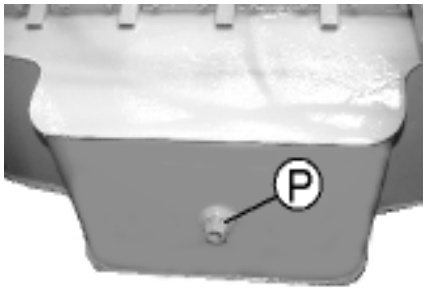
OIL DRAINING

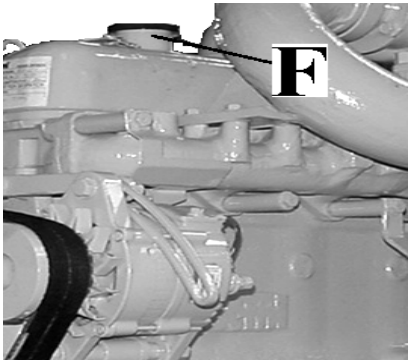
Step 1: Rotate the gear box until the plug level is set horizontally (see fig.) The fill plug, identify as “oil drain” must be on bottom.
Step 2: In order to facilitate oil draining it is recommended to remove the oil level plug.
Step 3: Remove the drain plug and allow all the oil to flow out of the gear box.



OPERATION	INTERVAL
Oil level control	Every 150 operating hours of the gear box
First oil change	After 100 operating hours of the gear box
Regular oil change	Every 1000 operating hours or 1 year
First screw tightness control	After the first 50 operating hours
Regular screw tightness control	Every 1000 operating hours

B. ENGINE OIL PAN AND FILTER





1. Remove engine oil pan drain plug (P) to drain oil. After draining, tighten the drain plug.

2. Using a filter wrench, remove cartridge (1) of the engine oil filter by turning it counter clockwise.

3. Clean the filter base, apply a dab of oil to the gasket of the new cartridge, and after the gasket contacts the seal face, tighten it up by hand 1/2 to 3/4 of a turn.

4. After replacing the cartridge, pour in the specified quantity of engine oil from oil filter (F).

5. After pouring in oil, run the engine for several minutes, then once again check the oil level and ensure that it is correct.

* Refill capacity: 17.5 L

* The oils and lubricants recommended in the table "fuel coolant and lubricants" are applicable to ambient temperature range - 5° C + 50° C. For applications beyond this range BEML or its authorised distributer shall be contacted.

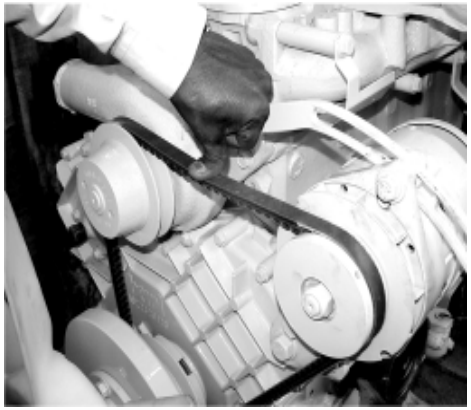
* Be sure to fit a genuine BEML cartridge.

* Replace once every 6 months, regardless of the number of hours operated.

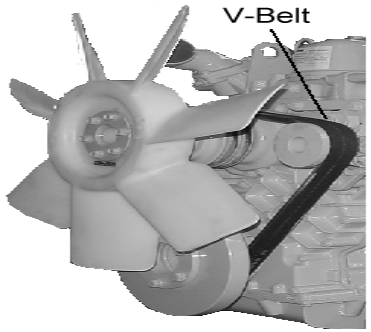
* When supplying oil, be careful not to get oil on the alternator.

* If filter cartridge (1) is removed immediately after stopping the engine, oil will spill. Wait at least 10 minutes after stopping the engine before replacing the filter cartridge.

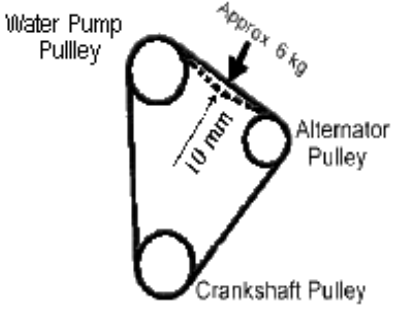
* Use API category CD Class oil. If CC class oil must be used, change the oil and replace the oil filter at half the usual interval (125 hours).

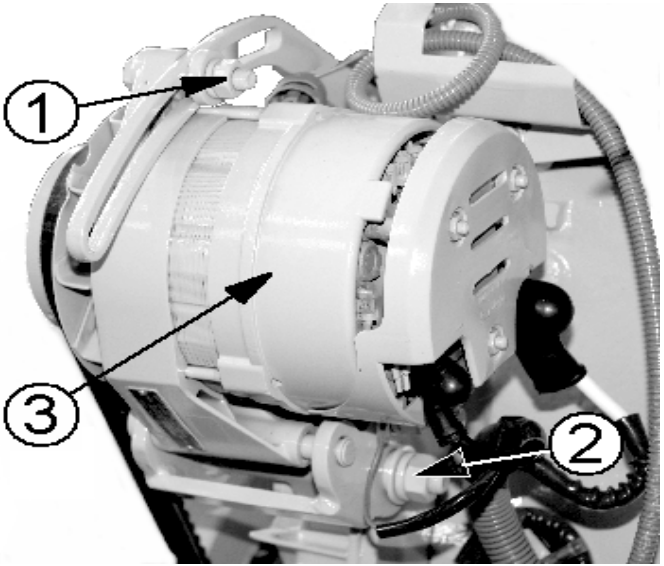


C. WATER PUMP BELT



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

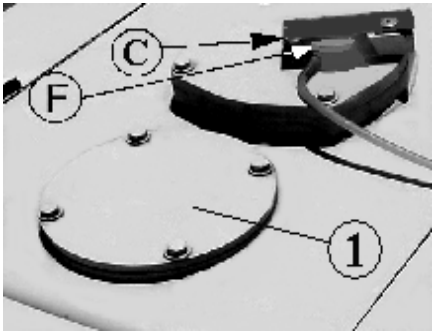


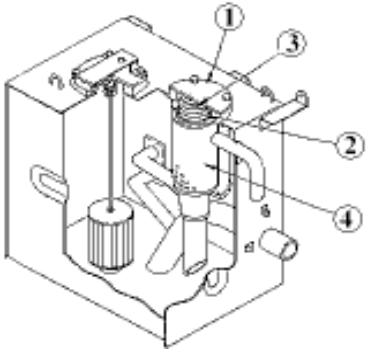


2. To adjust the belt tension, loosen nut (1) and nut (2) and shift alternator (3) slightly.
3. After adjustment, tighten nut (1) and nut (2) securely.

* When adjusting the V-belt, do not attempt to push alternator (3) directly with a bar or the like, but use a wood pad to prevent damage to the core.
* Check each pulley for damage, and V-grooves and V-belt for wear. Particularly, check whether V-belt is in contact with bottom of V-groove through wear.
* Replace belt, if it has stretched leaving no allowance for adjustment, or if there is a cut or crack on belt.

D. HYDRAULIC FILTER





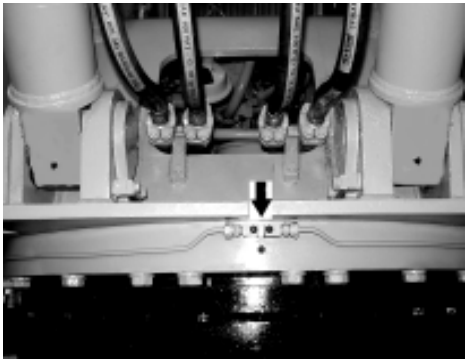
1. Remove cover (C) and open the cap (F) of hydraulic tank.
2. Remove cover (1), spring (2) and valve (3) at the top of the hydraulic tank, then remove element (4).
3. Clean removed parts and install a new element.

* Be sure to use a genuine BEML element.

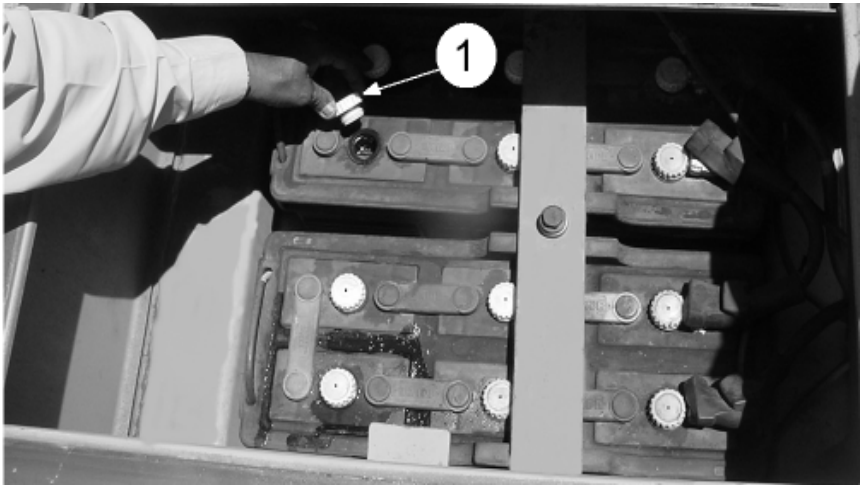
⚠ When removing the cap, turn it slowly to relieve the inner pressure.

⚠ When removing the cover (1), undo the bolts (4 bolts) gradually to prevent the cover flying off under the force of the spring (2).

E. SWING CIRCLE



Lubricate to the 3 grease fittings shown by an arrow.



2. If the electrolyte level is lower than the prescribed level (10 to 12 mm above the plate), supply distilled water.

* Should any of the acid be spilt, have it replenished by the nearest battery shop with acid of the correct specific gravity.

* When inspecting electrolyte level, clean the air hole of the battery cap (1).

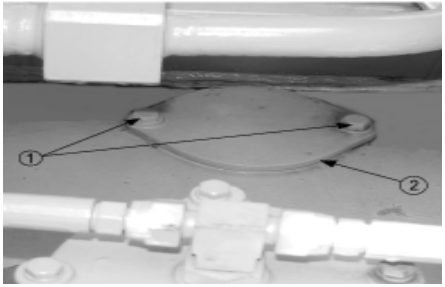
⚠ If the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water.

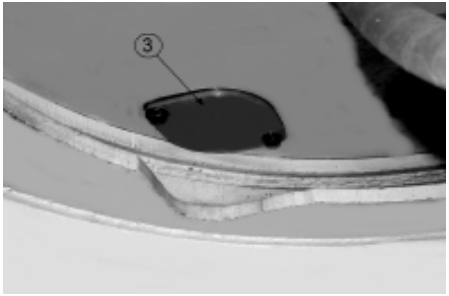
⚠ To avoid gas explosions, do not bring fire or sparks near the battery.

EVERY 500 HOURS SERVICE

* **Maintenance for every 100 and 250 hours should be carried out at the same time.**

a. SWING CIRCLE PINION





1. Remove bolts (1) (2 bolts) on the top of the revolving frame and remove cover (2).
2. Check with scale that grease depth is about 44 mm. If there is insufficient grease, replenish it.

* If the grease is particularly milky due to ingress of water, etc., then remove cover (3) from the bottom of the track frame and remove the grease. Replace all of the grease with new grease. The total amount of grease is 15.5 ltrs [14 kg].

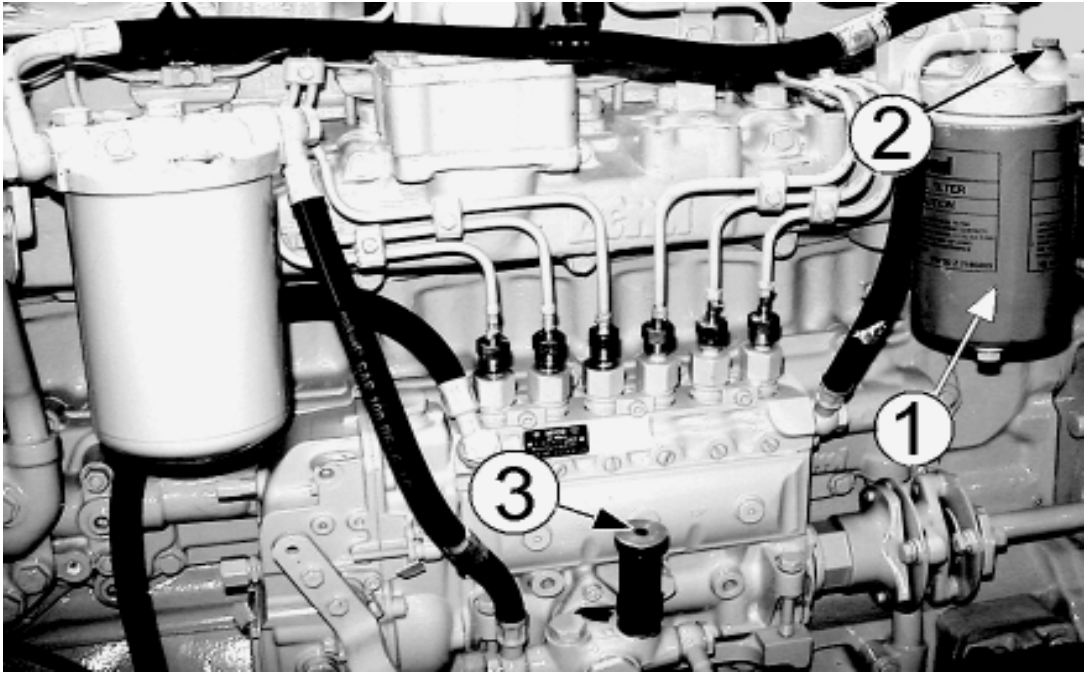
b. RADIATOR FINS AND OIL COOLER FINS

Clean the radiator fins and oil cooler fins clogged with mud, dust and leaves with compressed air. Steam or water may be used instead of compressed air.

* The rubber hose should be checked at the same time. If the hose is found to have cracks or to be hardened by ageing, such hose should be replaced by new one. Further, loosened hose clamp should also be checked.

* **Check for any damage of sealing foam around radiator assembly and cover. If damaged replace with new sealing foam.**

c. FUEL FILTER



1. Using a filter wrench, remove cartridge (1) by turning it counter clockwise.
2. Fill the new cartridge with fuel and refit it after applying a dab of oil to the gasket face.

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

* Drain the fuel filter bowl by loosening the drain plug on bottom of the bowl. Loosen the centre bolt and remove the bolt. Remove the element and clean bowl, then replace the new element and fit the same on the assembly and tighten the centre bolt giving 2 kg-m torque.

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

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

5. After air bleeding, tighten up air vent plug (2) and push in feed pump knob (3) and tighten it.

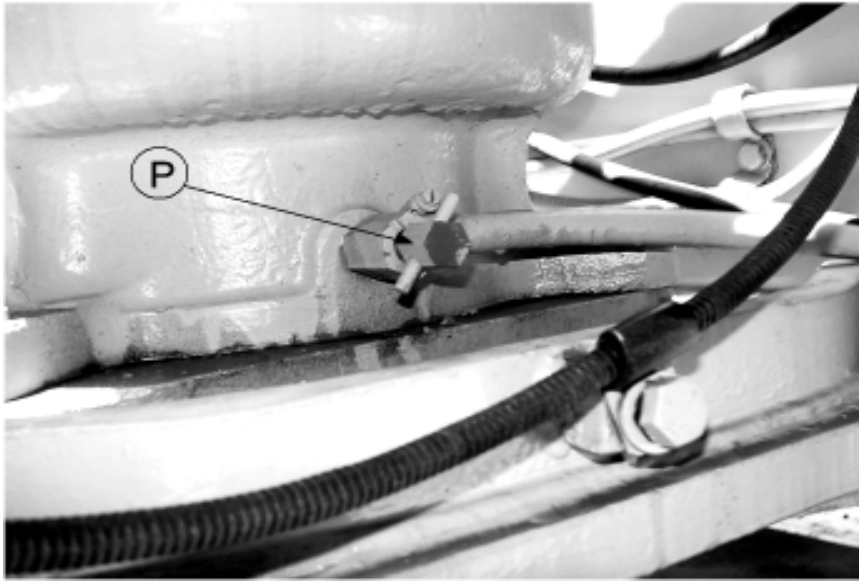
* After replacing the cartridge, start up the engine and check the filter seal face for possible oil leakage.

* Be sure to use a genuine BEML cartridge.

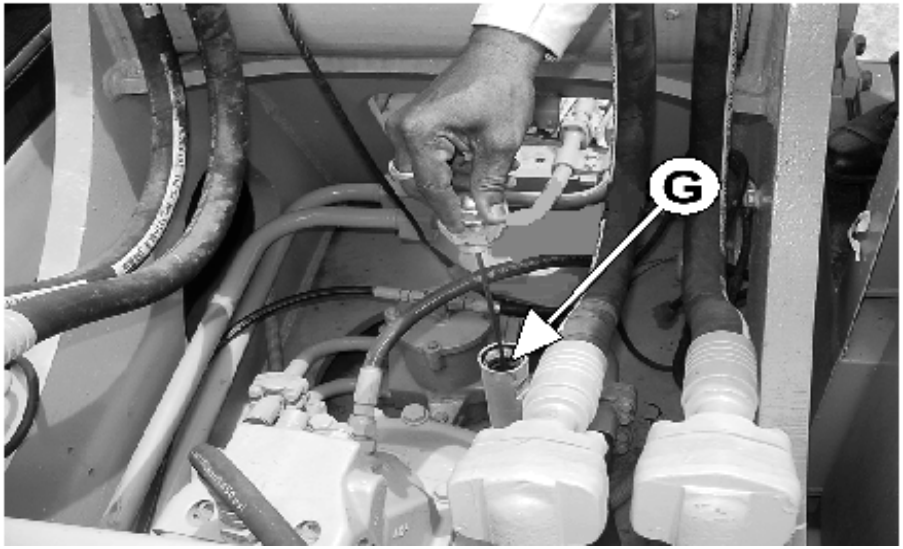
EVERY 1000 HOURS SERVICE

* Maintenance for every 100, 250 and 500 hours should be carried out at the same time.

a. SWING MACHINERY CASE



1. Drain off oil from drain plug (P) at the bottom of the machine. After draining, tighten the drain plug (P)



2. Pour in the specified amount of engine oil from gauge hole (G). (Refer to EVERY 100 HOURS SERVICE).

* The oils and lubricants recommended in the table "fuel, coolant and lubricants" are applicable to ambient temperature range -5° C to + 50° C. For applications beyond this range BEML or its authorised distributer shall be contacted.

* Refill capacity: 7 ltrs

c. TURBOCHARGER CLAMPING JOINT

Contact your nearest beml office for checking or proceed as follows:

Periodically inspect all joints for looseness. Tighten when necessary.

d. TURBO CHARGER ROTOR PLAY

Contact your nearest beml office for checking, or proceed as follows:

Remove air intake and exhaust pipes from turbocharger.

1. Axial play
   Check axial by moving rotor in axial direction.;
   Play : Standard : 0.16 mm
2. Radial play
   Measure radial play by moving rotor holding both ends by hands in radial direction in parallel. Play : Standard : 0.43 mm

* If the play is over the limit, consult your nearest beml office.
* If the rotor is excessively soiled with dust or carbon or if any oil leakage caused by turbocharger trouble is noted, have the turbocharger repaired by your nearest beml office.

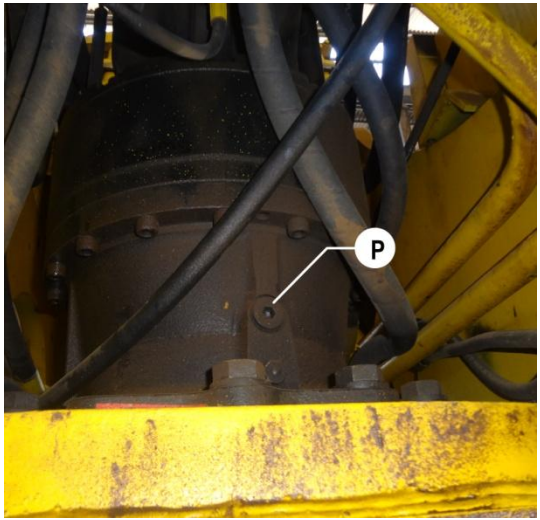
OIL FILLING

Make sure to fill the gear box with appropriate oil quantity prior to operating it. For correct use of the unit, it is recommended to use the following oil type - **SAE 80W90 / API GL5**

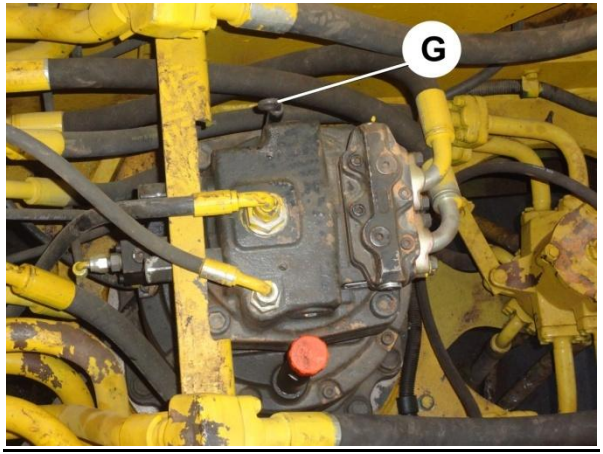
SWING DRIVE MAINTENANCE CHART

OPERATION	INTERVAL
Oil level control	Every 150 operating hours of the gear box
First oil change	After 100 operating hours of the gear box
Regular oil change	Every 1000 operating hours or 1 year
First screw tightness control	After the first 50 operating hours
Regular screw tightness control	Every 1000 operating hours

SWING MACHINERY CASE



1. Drain off oil from drain plug (P) at the bottom of the machine. After draining, tighten the drain plug (P)



Inspect the oil level using dipstick (G) and if it is insufficient, pour in additional engine oil from gauge hole. Screw in dipstick (G) until O-ring on the dipstick contacts the guide and check the oil level.
Admissible oil temperature range (working conditions): -20°C / +90°C (-4°F / 194 °F). Gearbox must be immediately stopped and cooled down if oil temperature reaches +90°C (194°F).
*Refill capacity: 5ltrs

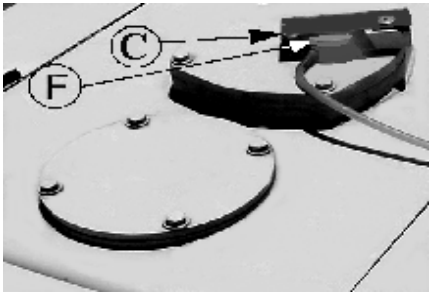
EVERY 2000 HOURS SERVICE

* Maintenance for every 100, 250, 500 and 1000 hours should be carried out at the same time.

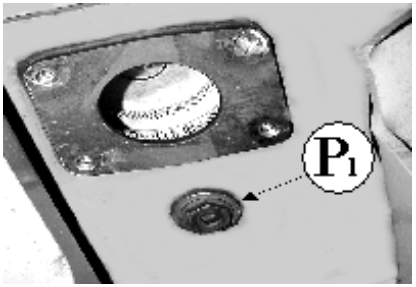
a. HYDRAULIC TANK

1. Retract the arm and bucket cylinder to the stroke end, then lower the boom and put the tip of the arm in contact with the ground (See picture).

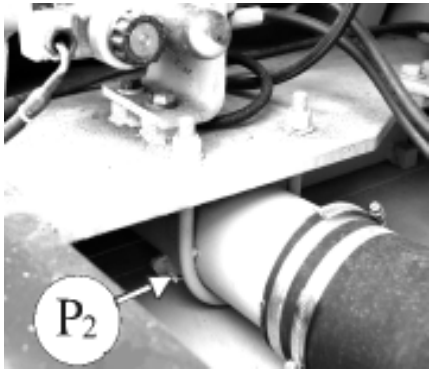
2. Remove cover (C) and cap (F).



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



3. Remove drain plugs (P1) and (P2) to drain off the oil, After draining off the oil, tighten up drain plugs (P1) and (P2).



4. Pour in the specified amount of engine oil from oil filler (F).
(REFER TO CHECK BEFORE STARTING).

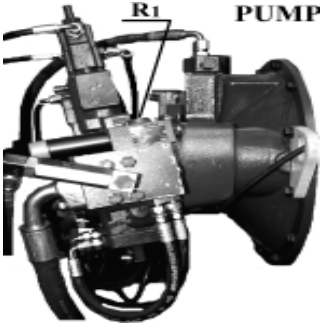
* The oils and lubricants recommended in the table "fuel, coolant and lubricants" are applicable to ambient temperature range - 5°C to + 50°C. For applications beyond this range BEML or its authorised distributer shall be contacted.

* After changing oil, put the control levers in N (neutral) position and run the engine at low idling speed for a few minutes before operation of working equipment.

* Refill capacity:150 ltrs

When the hydraulic oil or the main pump is replaced or when the suction pipe of the pump or gear pump is removed, bleed the air according to the following procedure:

AIR BLEEDING PROCEDURE



The following procedure needs to be carried out for bleeding the air whenever any maintenance work is done on the control valve, pump, motor, pipe lines OR there is any chance of air setting in through any leakage points.

1). Fill the SAE-30 hydraulic oil into the hydraulic oil tank through hydraulic filtration unit.

2). Open the metal plug of the pump labelled as R1 and allow the oil to fill the void inside. Tighten the metal plug of R1 port of the pump after the case is full with the oil and no air bubbles are coming out.

3). Fill the filtered oil into the housing of both travel & swing motor till there is no sign of entrapped air in both the motors.

4). After bleeding the air completely from the pump, start and run the engine at low idle speed.

5). Remove the air bleed M6 screw located at the top of the pilot cover of the main control valve.

6). Operate the swing joystick gently and allow the oil to come out from. The swing spool section's top pilot cover of the main control valve.

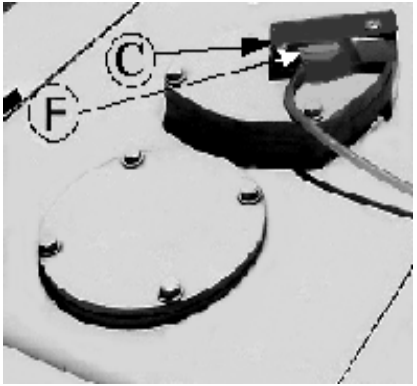
7). Let the void inside the swing pilot cover be escaped & the pilot cover is full with the hydraulic oil.

8). Check & ensure that the oil coming out from the pilot cover should be free from air bubbles when the joy stick is operated gently. After bleeding, tighten back M6 air bleeding screw.

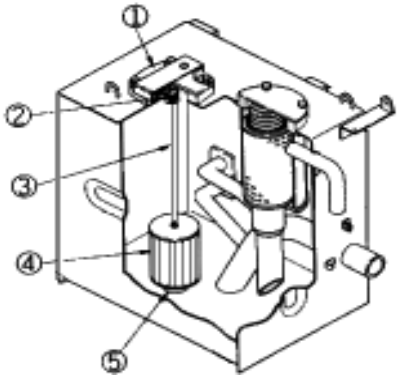
9). Follow the same procedure as mentioned above from point 4 to 8 to bleed the pilot covers of all the other implements & travel sections of the control block.

10). Bleeding of the pilot cover at the bottom of the control valve shall be carried out by operating all the implements & travel in both directions repeatedly.

b. HYDRAULIC TANK STRAINER



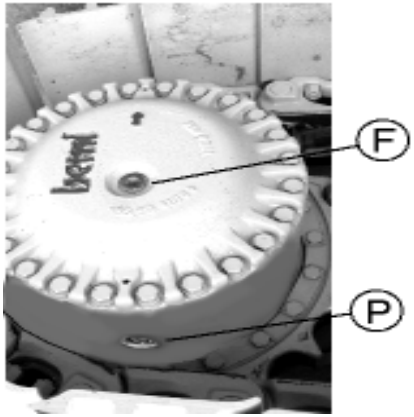
1. Open the cover (C)& remove cap (F).
2. Remove cover (1) and lift up the top of rod (3) from above the take out spring (2) and strainer (4).
3. Wash the strainer with fuel oil. If strainer (4) is damaged, replace it with a new one.
4. Refit strainer (4) by inserting it into tank projecting part (5).



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

⚠ When removing cover (1). undo the bolts (4 bolts) gradually to prevent the cover flying off under the force of spring (2).

c. FINAL DRIVE CASE



1. Set the machine with plug (F) and plug (P) perpendicular to the ground surface.
2. Drain the oil from drain plugs (P) on both sides of the machine. After draining, tighten the drain plugs.
3. Then, supply new engine oil through oil filler (F) respectively to the specified level. (Refer to EVERY 250 HOURS SERVICE).

* The oils and lubricants recommended in the table 'fuel coolant and lubricants' are applicable to ambient temperature range -5° C to + 50°C. For applications beyond this range BEML or its authorised distributer shall be contacted.

* Refill capacity : 4 ltrs (each side)

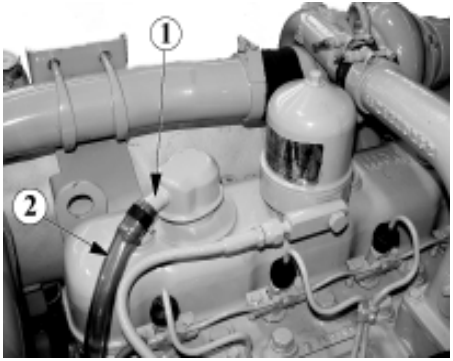
d. TURBOCHARGER

Excessive carbon or oil sludge adhering to the turbocharger blower impleller may deteriorate normal performance of the turbocharger and may sometimes damage it.

Contact your nearest beml office

1. Remove the turbocharger oil supply tube and the drain tube. then, remove the connection area of the intake manifold and the blower housing so that the blower impeller can be seen.
2. Using light oil, wash the impeller to eliminate carbon adhered on the surface. Do not use wire brushes or the like to prevent damage to the impeller surface.
3. Pour light oil through the turbocharger oil filler. Turn the blower impeller several turns so that foreign materials such as sludge can be washed away.
4. Using your fingers, turn the impeller vigorously for one revolution or more. If there is no sigh of interference or catching, the impeller is normal. If the impeller seems to turn heavily, contact your nearest beml office to ask for repair or replacement.
5. If the impeller is found normal after this check, supply engine oil to the turbocharger.

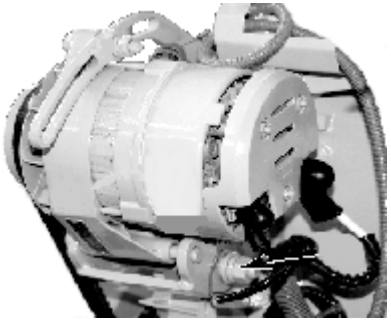
e. ENGINE BREATHER



1. Remove the breather (1) from the cylinder head cover
2. Put the whole breather in diesel oil and rinse. Then dry with compressed air and install again.
3. Check the breather hose (2) and if there is any sediment for deterorated oil (sludge) inside, replace with a new hose or pipe.

* Before removing the breather, wipe off all the dirt around the breather.
* Check the O-ring, and if necessary replace it with a new part.

f. ALTERNATOR & STARTING MOTOR



As the hours of engine employment indicate that the brushes are already worn out, you should request repair from a nearest beml office.

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

g. ENGINE VIBRATION DAMPER

Check the Vibration damper for carcks or separation on rubber surface.

If there are cracks or separation, contact your nearest beml office for replacement.

h. ENGINE VALVE CLEARANCE

Ask nearest beml office to check engine valve clearance because special tools should be used.

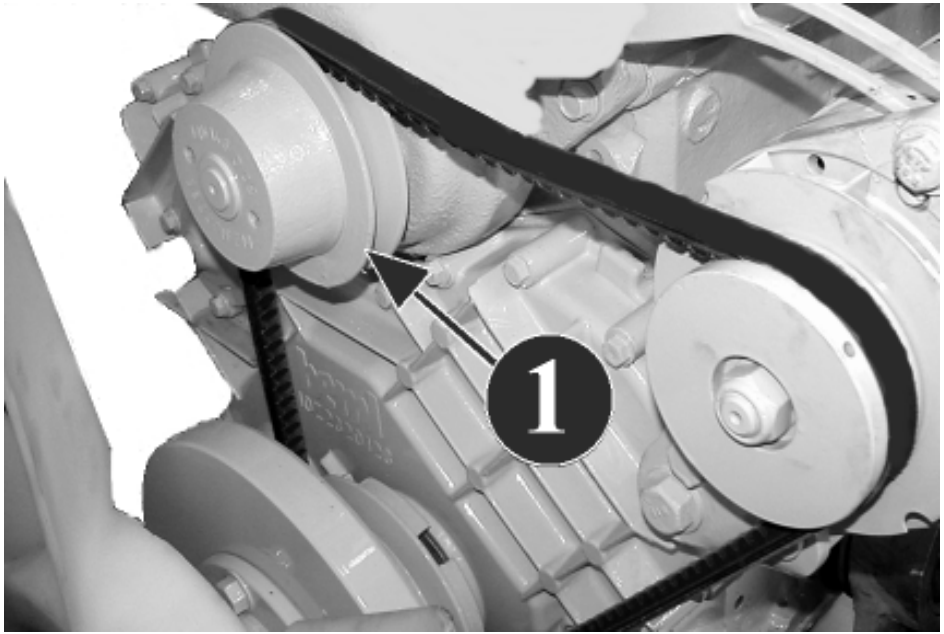
EVERY 4000 HOURS SERVICE

* Maintenance for every 100, 250, 500, 1000 and 2000 hours shoul be carried out at the same time.

a. WATER PUMP

Inspect, the water pump pulley (1) for play, V-belt tension,grease leakage and water leakage.

If any fault is detected, ask nearest beml office to disassemble and repair or replace.



WHEN REQUIRED

a. CLEANING INSIDE OF COOLING SYSTEM

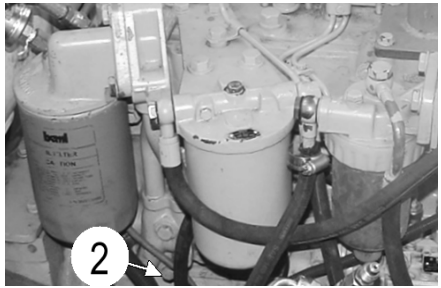
- Clean the inside of the cooling system, replace the 50:50 premixed coolant (Ethylene glycol based)
- Change 50:50 Premixed coolant (Ethylene glycol based) after parking the machine on a level surface.

TYPE OF ANTIFREEZE SOLUTION	CLEANING INSIDE OF COOLING SYSTEM AND REPLACING 50:50 PREMIXED COOLANT (ETHYLENE GLYCOL BASED)
50:50 premixed coolant (Ethylene glycol based.)	Every year (autumn) or every 2000 hours whichever comes first

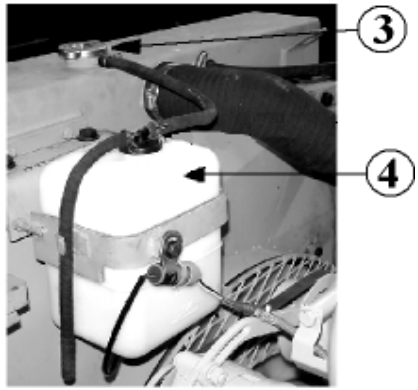
If the 50:50 premixed coolant(Ethylene glycol based) temperature is high, do not remove the cap because of the possibility of scalding premixed coolant, spurting out. When removing the cap, turn the cap slowly to allow pressure to be relieved.

Drain Valve (Bottom of Radiator)

Drain Valve (Cylinder Block)



Water Filler



1. Loosen drain valve (1) at the bottom of the radiator and drain valve (2) at the cylinder block side and drain the premixed coolant(Ethylene glycol base)

2. Close drain valves (1) and (2) and pour in premixed coolant(ethylene glycol based) upto the vicinity of the coolant.

3. When the water reaches the vicinity of the coolant filler, put the engine at low idling, open the drain valves (1) and (2), then pass premixed coolant through the cooling system until premixed coolant comes out from the drain valves for 10 minutes.

* When flushing, adjust the flow so that premixed coolant is added at the same rate as the premixed coolant is drained to keep radiator always full.

4. After washing the cooling system, stop the engine. Open drain valves (1) and (2) to drain coolant and close drain valves (1) and (2).

5. After draining off the premix coolant,wash out the cooling system using commercially available detergent. Follow the instructions on the detergent container.

6. After washing the cooling system, drain all coolant, then close the drain valves and pour in pre mixed coolant(Ethylene glycol based to the vicinity of the filler.

7. When the premixed coolant reaches vicinity of the filler, put the engine at low idling, open the drain valves, then pass premixed coolant through the cooling system until clean water comes out of the drain valves.

* When flushing, adjust the flow so that premixed coolant is added at the same rate as the water is drained to keep the radiator always full.

8. When the Premixed coolant becomes completely clean, stop the engine and close all drain valves.

9. Supply premixed coolant until it overflows from the filler.

10. Run the engine 5 minutes at low idling and then for another 5 minutes at high idling to eliminate air trapped in the cooling system (leave the radiator cap off during the operation).

11. Stop the engine and wait for about 3 minutes. Supply premixed coolant upto the specified level. Tighten the cap.

12. Drain off the cooling water in sub- tank (4), clean the sub-tank interior, and add the premix coolant up to the FULL level.

* Use premixed coolant only for cooling. If river water, well water or other such water supply must be used, contact your nearest beml office.

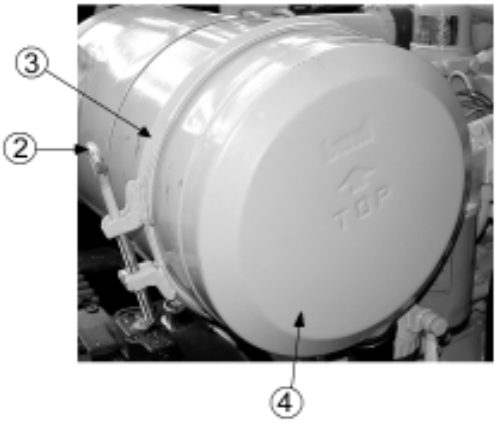
b. CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT

Checking

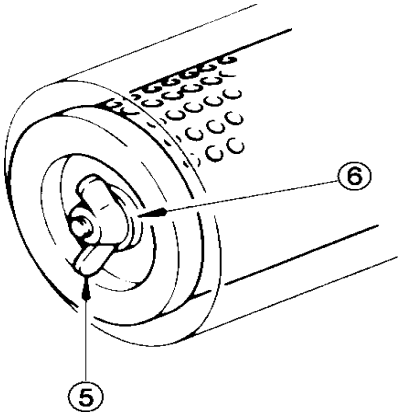
Whenever the red piston in dust indicator (1) appears, clean the air cleaner outer element. Stop the engine when cleaning the element.

Cleaning or replacing outer element

1. Loosen wing nut (2), and remove band (3) and cover (4).
2. Loosen wing nut (5) and remove the outer element.
3. Clean the air cleaner body interior and the removed cover.
4. Clean and inspect the element (See the next page for cleaning procedure). Install the cleaned element.
5. Push button of dust indicator to return red piston.



* Replace the outer element which has been cleaned 6 times repeatedly or used throughout a year Replace the inner element at the same time.
* Replace seal washer (6) or wing nut (5) if they are broken.
* Replace both inner and outer elements when the dust indicator red piston appears soon after installing the cleaned outer element even though it has not been cleaned 6 times.



* Check inner element mounting nuts for looseness and if necessary re-tighten.

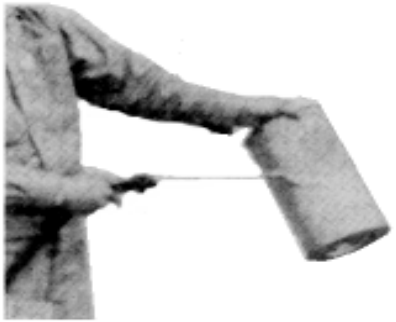
Replacing inner element

1. First remove the cover and the outer element, and then remove the inner element.
2. Cover the air inlet port.
3. Clean the air cleaner body interior Remove the cover from the air inlet port.
4. Fit a new inner element to the connector and tighten it with nuts.
5. Install the outer element and the cover. Push the dust indicator reset button.

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

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

Cleaning the element with compressed air



Direct dry compressed air (less than 7 kg/cm^2) to the element from inside along its folds, then direct it from outside along its folds and again from inside and check the element.

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

The following methods require spare parts.

With water

Dash city water (less than 3 kg /cm^2) on the element form inside along folds, then from outside and again from inside. Dry and check it.

With cleaning agent

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

* Drying can be speeded up by blowing dried compressed air (less than 7 kg/cm^2) form the inside to the outside of the element.
  Never attempt to heat the element.

* Using warm water (about 40° C) instead of soapy water may also be effective.

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

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

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

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

c. CHECK TRACK TENSION

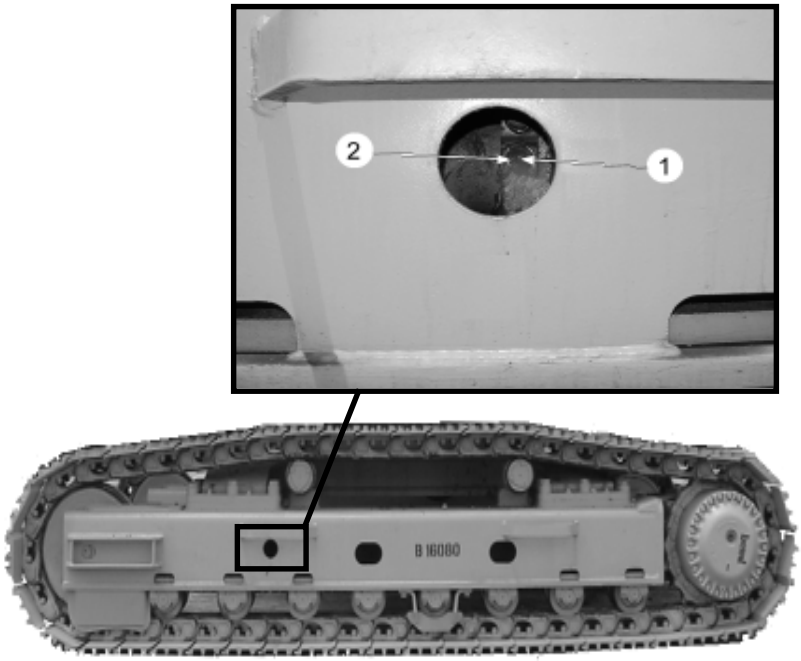
The wear of pins and bushings on the undercarriage will vary with the working conditions and soil properties. It is thus necessary to continually inspect the track tension so as to maintain the standard tension on it.
If the track tension is not at the standard valve, adjust it in the following manner:

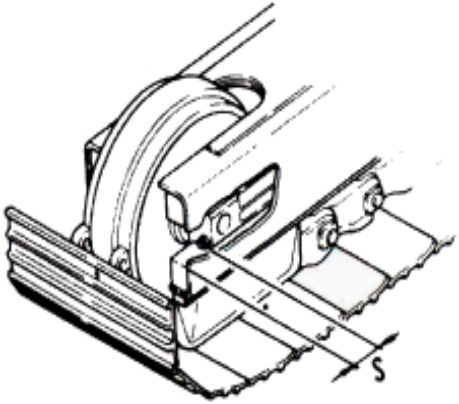
Inspection

Raise the machine by means of the boom and arm, and measure the clearance between the tread of the fourth (the fifth) track roller from the sprocket and the roller contact face of the track link. If the clearance is between 60 and 100 mm, the track tension is normal.
( ): LC type

Adjustment

To increase the track tension, insert grease from grease fitting (1) of lubricator (2) and conversely to reduce tension, gradually return lubricator (2) to expel grease.



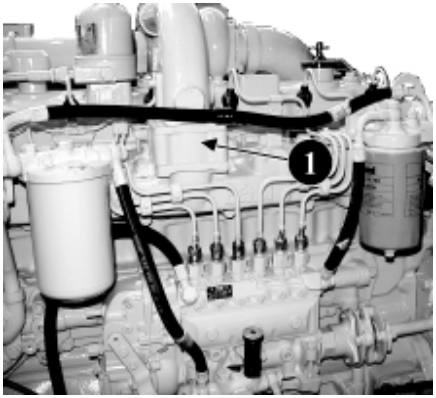


It is permissible to insert grease until S becomes 0 mm. If, despite doing this, the track tension is still low, the pin and bushing have become excessively worn and must either be inverted or replaced.

Have this work done by nearest beml office.

⚠ When loosening lubricator (2), do not slacken it by more than one turn. Also, during this operation, do not loosen any part other than the lubricator. (This is because of the danger of grease spurting out under high pressure.) If the grease comes out sluggishly, move the machine slightly backward and forward.

d. CHECK ELECTRICAL INTAKE AIR HEATER

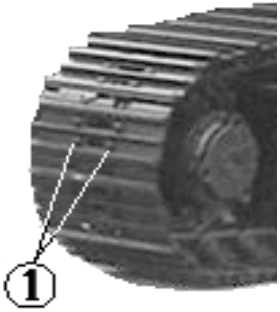


Check electrical intake air heater (1) once a year before commencing work in the cold season.

Remove electrical intake air heater (1) from the engine intake connection, and check it for possible open-circuits and dirt.

When inspecting and replacing electrical intake air heater (1), replace the gasket with new one.

e. TRACK SHOE BOLTS



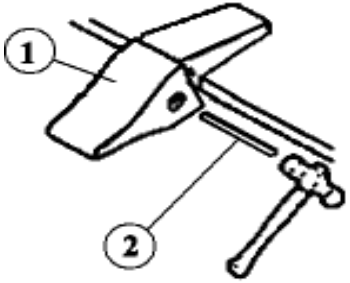
Shoe bolts (l) which secure track shoes to links will break if used in a loosened state.Tighten all loosened bolts.

* Track shoe bolts tightening torque:

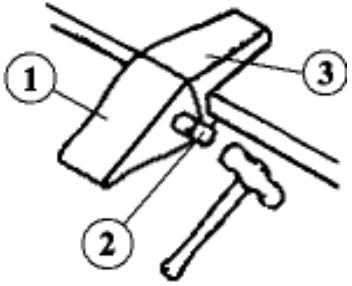
First, 40 ±4 (40 ±5) kgm, tighten a further l20°±10° ( ):

f. REPLACE BUCKET TEETH

Replace the tooth point before the adapter starts to wear



1. Extract pin (2) fitted to the bucket and then remove point (1).
   * When extracting pin (2), strike the part (either the left or right part) with a sharp object. This will enable the pin to be extracted from the opposite side.

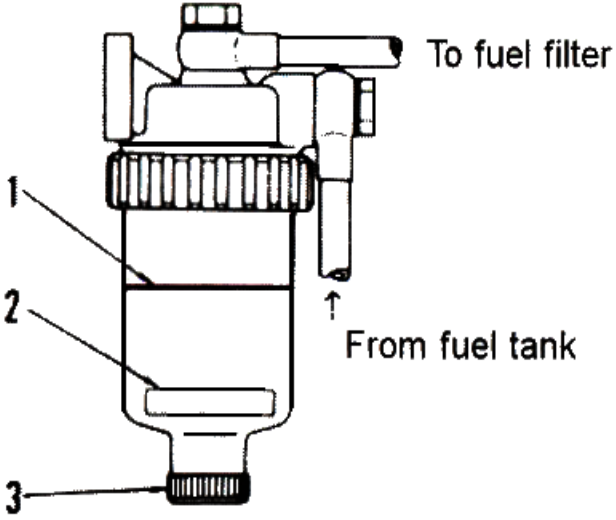


2. Insert the new point (1) into the adapter (3) and insert pin (2) part as shown in the diagram. Then drive it home by means of a hammer.

g. WATER SEPARATOR

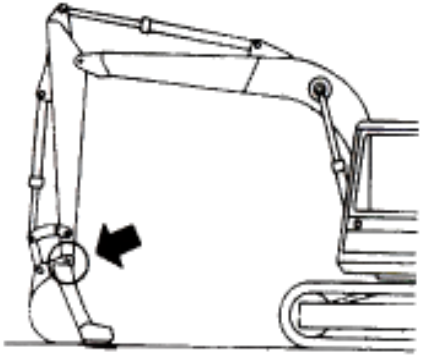
When float (2) is at or above red line (1), drain the water according to the following procedure:

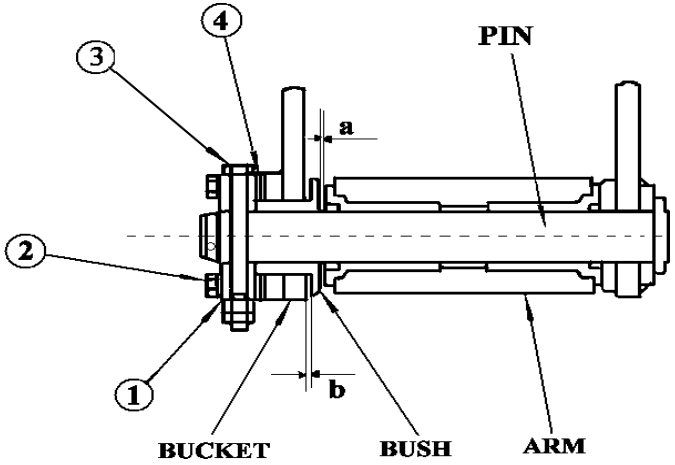
1. Loosen drain plug (3) and drain the accumulated water until the float reaches the bottom.
2. Tighten drain plug (3).
3. If the air is sucked into the fuel line when draining the water, be sure to bleed the air in the same manner as for the fuel filter. (See Fuel Filter Cartridge in EVERY 500 HOURS SERVICE section.)



ADJUSTMENT

ADJUSTMENT OF BUCKET CLEARANCE





If there is excessive free play on the coupling section of the bucket and arm, adjust the bucket clearance in the following manner

* Set the work equipment in the posture as above.

1. Loosen 4 bolts (2), bolt (3) and plate (1).
2. Take out shims (4) equivalent in size to free play "a"

* Thickness of shim (4) is 0.5 mm.
* When free play "a" is less than 0.5 mm, do not compress the shims by tightening bolt (2).

3. Tighten 4 bolts (2) and bolt (3).
   * Tightening torque for bolt (2) is 56 ±6 kgm.

* The, clearance "b' becomes larger and free play "a" is removed.

TROUBLE SHOOTING GUIDE

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

ELECTRICAL SYSTEM

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

- check for loose terminals and open-circuit wiring.
- Adjust belt tension.

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

- Replace the alternator
- Inspect and repair wiring.

Unusual noise is emitted from the alternator.

- Replace the alternator

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

- Inspect and repair the wiring.
- Charge the battery.

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

- Charge the battery.

Starting motor turns the engine sluggishly

- Charge the battery
- Replace the starting motor.

The starting motor disengages before the engine starts up.

- Check and repair the wiring.
- Charge the battery.

The engine pre-heating monitor does not flash.

- Check and repair wiring
- Replace the heater relay.
- Replace the monitor

The engine oil pressure monitor does not light up when engine is stationary (when the starting switch is in ON position).

- Replace the monitor
- Replace the monitor switch.

Charge monitor does not light up when the engine is stationary (when the starting switch is in ON position).

- Replace the monitor
- Inspect and repair-the wiring.

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

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

ENGINE

The engine oil pressure monitor flashes when engine speed is raised after completion of warm-up.

- Add the oil to the specified level.
- Replace the oil element.
- check oil leakage from the pipe or the joint.
- Replace the monitor

Steam is emitted from the top part of the radiator (the pressure valve). The radiator cooling water level monitor flashes.

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

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

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

Exhaust gas is white or blue

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

Exhaust gas occasionally turns black

- clean or replace the air cleaner element.
- Replace the nozzle.
- check engine compression pressure.
- clean or replace the turbocharger.

Combustion noise occasionally changes to breathing sound.

- Replace the nozzle.

Unusual combustion noise or mechanical noise.

- Replace with specified fuel
- check overheating.
- Replace the muffler
- Adjust valve clearance.

CHASSIS

Slow speed of travel, swing, boom, arm and bucket

- Add oil to specified level.

Unusual noise emitted from pump

- Clean the hydraulic tank strainer

No swinging

- Check the left lock pin in place.

Excessive oil temperature rise of hydraulic oil

- Clean the oil cooler
- Add oil to specified level.
- Check sealing around radiator & oil cooler and close the gaps fully. Use additional foam, if necessary.

Track slip out of place
Excessive wear of the sprocket

- Adjust tension of track

Bucket either rises slowly or not at all

- Add oil to specified level

WEAR PARTS

Replace wear parts such as filter element, work equipment's tips and so on at the time of periodic maintenance or before the wear limit is reached. Replace wear parts without fail to utilize the machine more effectively. Use genuine BEML parts.

ITEM	PARTS NAME	QTY	REPLACEMENT FREQUENCY
Hydraulic filter	Element	1	Every 250 hours
Engine oil filter	Cartridge	1	Every 250 hours
Fuel filter	Cartridge	1	Every 500 hours
Air cleaner	Element assy	1	When required
Bucket	Tooth Pin Cutter Lock	5 5 2 5	--
Electrical intake air heater	Gasket	2	--

SERVICE METER

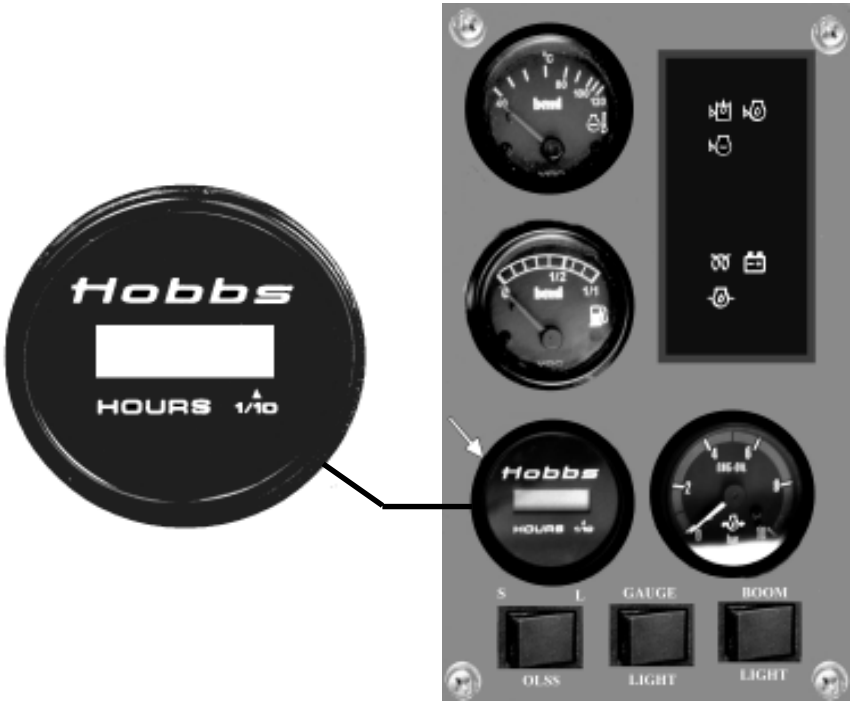
This meter indicates the integrated work hours. So, use it according to the following instructions.

- Record the reading at the start and the end of work, this is the work record of the machine.
- This record will indicate, when periodical maintenance is due.
- It also indicates the integrated working hours when machine problems are encountered.

* **How the meter progresses**

The service meter progresses by digit 1 when the engine is operated for one hour, regardless of the engine speed.
Consequently, if the engine is running, the service meter will advance even if the machine does not move.

- The indicator under the service meter rotates when the engine running to show that the mater is running.



MACHINE AND ENGINE SERIAL NUMBER

When calling for a service of mechanic or when making replacement-parts order, be sure to give nearest beml office the machine and engine serial numbers as well as the service meter reading before mentioned. These numbers are found on the plates shown in the photos.

• Location of the machine serial number mark.

This is seen on the bottom left of the cab.

• Location of the engine serial number mark.

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

FUEL, COOLANT AND LUBRICANTS

TABLE -1

RESERVOIR	KIND OF FLUID	BEML STD.	VISCOSITY GRADE	CAPACITY (LITERS)	
				SPECIFIED	REFILL
ENGINE OIL PAN	ENGINE OIL	C6002-30	CF4 15W 40	25	17.5
SWING MACHINERY CASE FINAL DRIVE CASE		C 6002-03	SAE 30 CD	10 3.7	9.3 3.7
HYDRAULIC SYSTEM		C 6002-03	SAE 30CD	250	150
FUEL TANK	DIESEL	C 6002-01	HSD	280	--
COOLING SYSTEM	PRE MIXED COOLANT (ETHYLENE GLYCOL BASED)	-	-	44	10*
GREASE	NLGI -2 (MOLEX)	C 6003-02	MOLEX GREASE	--	--

Note : Equivalent indigenous brands are indicated in Table -2

*** Topup quantity, 10 litres for every 250 hrs of operation**

NOTE:

(1) When fuel sulphur content is less than 0.5%, change oil in the oil pan every periodic maintenance hours described in this manual.

Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Change interval of oil in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

ASTM : American Society of Testing and Material
SAE : Society of Automotive Engineers

Specified capacity : Total amount of oil including oil for components and oil in piping.

Refill capacity : Amount of oil needed to refill system during normal inspection and maintenance.

EQUIVALENT INDIGENOUS BRAND

SL. NO.	OIL	BEML STD	IOC	CALTEX	TWO	IBP	BL	BPCL
01	CF_4 15W 40	C6002-30	SERVO PREMIUM CF_4 15W 40	TURBO D SUPER SAE 15W 40	VEEDOL MAX PRO CF_4 15W 40	IBP TURBO CF_4 15W 40	PROTOMAC CF_4 15W 40	MAK DIAMOND 15W 40
02	SAE 30 CD	C6002-03	SERVO ULTRA KB-30	BEML SUPER CLEAN ET30	VEEDOL 903-S3-30	IBP ULTRA 30	PROTOMAC ULT 30	MAK CD 30'
03	NLGI-2 GREASE	C6003-02	SERVO MOLEX GREASE	-	VEEDOL ALIMOLY-20	IBP MOLEX	MOLY GREASE ML	MAK MP GREASE-2
04	DIESEL	C6002-01	HSD	-	-	HSD	-	HSD

SL. NO.	COOLANT	M/s IOCL	QTY(Lts)	M/s BASF	QTY(Lts)
1	50:50 PRE MIXED COOLANT (ETHYLENE GLYCOL BASED)	00Z 009 1097 00Z 009 1104 00Z 009 1112	210 20 10	00Z 009 1097 00Z 009 1104 00Z 009 1112	210 20 10

CONTENTS

SAFETY HINTS.....

OPERATION

GENERAL

- Wear well-fitting helmet, safety shoes and working clothes. If the nature of the work requires safety, wear protective goggles or mask, thick gloves, ear plugs or other protection.
- Accidents or injuries are liable to occur when the operator is careless or slack. It is most important to bear safe operation in mind at all time.
- Take care of your health. Do not operate when tired or after drinking.
- Learn the prohibitions, cautions and rules about work procedures in the work site.
  When there is a leader, fix standard signals and always follow these signals when operating.
- If there should be an accident or fire or any other such unexpected mishap, deal with it quickly, using the nearest apparatus.
  Learn beforehand the locations of the first aid boxes and fire extinguishers and how to use them. It is also important to know the emergency contact system.
- Learn about the safety devices on your own machine and about how to use them. Confirm that they are correctly attached in the prescribed position. Such safety device include.
  * Protective - Devices
  * Seat Belts
- Exhaust gas is dangerous. When running the engine for long periods in a poorly ventilated area, there is a danger of gas poisoning, so open the windows or doors to ensure a good supply of fresh air.
- Read the Operation and Maintenance Manual carefully. Learn how to use the control devices, gauges and warning devices. Be sure you understand the meaning of the caution plates. Remember the check points and checking method for engine oil fuel, cooling water and hydraulic oil levels.
- When operating inside a building always be sure of the clearance of the ceiling, entrances, aisles, etc. and the load limit of the floor.
- Never allow other person than the operator to ride on the machine during operation.

- Examine the lay of the land and the kind of soil at the work site to determine the dangerous points and the best method of operation. Proceed with work only after making safely arrangements about the dangerous points.
- Inspect leakages from the fuel, lubricating and hydraulic systems. Check the the shoe bolts are not loose and the no other parts are damaged or missing. Machines having such failures should not be operated.
- When getting on or off the machine, use the handrail provided. Do not jump up or down from the machine.
- Do not leave parts or tools lying around in the vicinity of or on the floor of the operator's cab. Keep everything in its proper place.
- Wipe off thoroughly any grease, oil or mud on the handrail, floor or control levers. Failure to do this may cause you to slip.
- Check the level of the fuel, lubricants and cooling water. Extinguish cigarettes before checking or replenishing. Check that the radiator cap and each oil filler caps or plugs are firmly tightened.
- Adjust the operator's seat until it is in the most comfortable position for operating. Always sit in the seat while operating. Do not operate the machine from any other position.
- To ensure the safety of workers near the machine, always sound the horn to warm them before starting the engine and moving the machine. Be particularly careful to check that the rear is clear before backing the machine.
- Inspect the inside of the engine room and remove any dead leaves or papers. Dead leaves or papers are highly inflammable and can cause fires.
- Before starting the engine, confirm that all control levers are in NEUTRAL.

AFTER STARTING THE ENGINE

- Confirm that all gauges and warning devices are functioning correctly, and that the gauge readings are within the prescribed range.
- Check the play and travel of each lever.
- Operate the work equipment to confirm that they are functioning normally.
- Before operating the travelling and steering levers, check whether the track frame is forward or backward. If the track frame is facing backward, operate the travelling and steering levers in the reverse manner to that when the track frame is facing forward.
- Move the machine slowly and listen carefully to the engine or gears to confirm that they are not making any unusual noises.
- Choosing a safe place, turn the machine to the left and right to confirm that the travelling and steering levers are functioning normally.
- If these tests reveal anything wrong, however slight is may be, contact the man in charge of the machine and operate the machine only after obtaining his permission.

DURING OPERATION

- Maintain the bucket at a height of 40 to 50 cm above the ground so that it can be quickly lowered to the ground and the machine stopped in an emergency.
- As far as possible, operate the machine so that it does not tilt. (Do not tilt it by more than 35° in either the forward, rear, left or right directions, even under static conditions.)
- Always operate slowly in crowded places. On haul rods or in narrow places, give way to loaded vehicles.
- Do not allow unauthorized persons into the work area.
- Before reversing or turning, ensure that there is nobody in the vicinity. Also, be careful of obstacles.

- When operating on slopes, as far as possible, avoid turning the machine on a slope. It may cause the machine to roll over or slip sideways.
- When operating the machine along a road, retract the work equipment to improve machine stability. As far as possible proceed along a flat road.
- The machine should always be operated at a speed where it can be correctly controlled. Never do the following:
  1) Speeding
  2) Sudden starting, sudden braking, sudden turning.
  3) Snaking
  4) Coasting
- When operating on uneven ground or in places where there are obstacles, remember the following points:

* Operate at as low speed as possible and avoid sudden changes in direction.

* Wherever possible, avoid travelling over large rocks, fallen trees, tree stumps and other such obstacles. Either use the work equipment to remove them, or travel round them.
When it is impossible to avoid travelling over them, reduce speed and mount over the obstacle. Just before the front of the machine tips down, reduce speed even more to make the shock of hitting ground as small as possible.

- Never mount over an obstacle at an angle; never disengage one travelling and steering lever to travel over an obstacle.
- The machine condition can be judged from many factors. Changes in the gauges, sound, vibration, exhaust gas colour or response of the control levers can indicate the occurrence of some disorder. If any disorder occurs, park the machine immediately in a safe place and take appropriate action. Be especially careful in the case of a fuel leak as there is danger of fire.
- The work area should be made as flat as possible. If the work area is flat, operation is made much easier and this reduces operator fatigue.

- Always concentrate. It is extremely dangerous to allow your self to be distracted or to think of other things when operating a machine. In dangerous places, or where there is restricted visibility, it is important to get down from the machine and confirm whether it is safe before continuing work.
- Be careful of those around you, and always confirm that there is no person or obstacle in the way before moving or turning the machine.
- When using the work equipment, be sure to keep your eyes on it all the time. Failure to do this may result in an accident.
- When passing through a narrow space, be careful of the side and overhead clearances. Take special care not to touch any obstacles on either side or overhead. If necessary, have someone outside the machine call out instructions.
- Be careful not to operate the machine into a bog. In the event that the machine goes into a bog, extract it in the following manner:

  1) If only one track of the machine is in the bog, push the bucket down against the ground on the side of the machine which is stuck so as to float the track. Then place logs or timber underneath the track and free the machine.

* When raising the undercarriage by means of the boom or arm, push the bottom of the bucket against the ground (on no account use the teeth) until the angle between the boom and the arm is 90° to 110° .

  2) If both tracks of the machine are in the bog and slip, preventing the machine from getting in, place logs or timber under the tracks in the manner described in (1), then thrust the bucket into the soil in front of the machine and drag it out by bending the arm in the same manner as when excavating and putting the travelling and steering lever into the forward position.

- After earthquakes, confirm that the ground is still firm; after blasting, confirm that there are no unexploded charges remaining.
- When working on river embankments or other places made of piled soil, there is the danger that the weight of vibration of the machine may cause the machine to sink into the piled soil, so be extremely careful when operating in such places.
- When continuing operations after rain, remember that conditions will have changed from those before the rain started, so proceed with caution.
  Be particularly careful when approaching the shoulder of the road of cliffs, as they may have been loosened by the rain.
- Check the load limits of bridges before crossing.
- When working in water or marshy ground, be careful of the following:
  * When working on soft ground, place thick boards on the ground to prevent the machine sinking. Place the boards horizontally and arrange them as neatly as possible.
- When operating in water or when crossing shallows, first check the bed soil condition and the depth and flow speed of water, then proceed, taking care not to go beyond the permitted depth.

  * First check the water depth, the firmness of the ground and the strength of the current. Do not enter if the water exceeds the permissible depth (up to the bottom of the swing circle).
- When operating in fog, mist or smoke, where visibility is bad, be especially careful to confirm first whether operation is safe.
  When visibility drops below safety level, stop work and wait for the visibility to improve.

- When operating at night, remember the following points:

* Be sure to arrange an adequate lighting system.

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

- Be very careful not to touch electric wires, always bearing in mind that there is a possibility of receiving an electric shock.

* Wear rubber or leather soled shoes.

* Position a full-time watcher at the site to ensure that operator is not exposed to the risk of electric shock.

* Depending upon the supply voltage it is conceivable that an electric shock may be received by merely coming into the vicinity of an electric feeder wire. Accordingly, observe the minimum distances given in the table below, taking into account the inertia of the boom when in motion.

* Become familiar with the necessary measures to be taken in the event that a operator receives an electric shock.

- Do not perform excavation at the bottom of a precipice as it is dangerous practice.

- If it is unavoidably necessary to operate the work equipment lever when travelling the machine in the vicinity of a precipice, road shoulders, on sloping ground or through a confined space, stop the machine momentarily before operating the work equipment lever in order to minimize danger.

- When working on loose, crumbly soil, do not dig deeply and back the machine off smartly. If the ground crumbles, preventing the machine from getting away in time, do not panic and raise the work equipment. It is often better in the interests of stability to leave it down.

Supply voltage (number of insulators)	Minimum safe separation
6.6 k.v. (distribution line)	3 m
33.0 (1 to 3 insulators)	4 m
66.0 (5 to 8 insulators)	5 m
154.0 (10 to 18 insulators)	8 m
275.0 (16 to 30 insulators)	10 m

- Do not undercut the machine, unless absolutely necessary.
  If necessary, always take care to prevent the machine falling.
- When operating at the edge of a cliff or on the shoulder of a road, remember the following points:
  * When operating in a place where there is danger of the machine falling over the side, be doubly careful. Do not aproach the edge of the cliff or road shoulder by mistake.
- If you suspect that there are buried facilities (water or gas pipes, etc.) at the work site, check with the companies responsible for looking after such facilities and also try a different method of excavation. Then, after confirming .the existence and location of such facilities, carefully carry out excavation work.
- Take care not to swing the bucket against the sides of trenches or dump trucks. Load the truck from the rear.

PARKING

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

- If it is absolutely necessary to park the machine on a slope, park it facing downhill and put chocks against the tracks. If the ground is soft enough, dig the bucket into the ground for added safety.
- When parking the machine, return the work equipment levers to neutral, apply the brake lock, lower the bucket to the ground, and put all safety levers in the lock position. Switch off the engine and remove the key.
- Before leaving the machine carry out the following:
  * Apply the swing lock.
  * Lower the bucket to the ground.
  * Put the work equipment lever in neutral and lock it.
  * Stop the engine and remove the key to prevent other people using the machine.
  * Lock the cab.

LOCKING CAP (OPTIONAL)

A locking cap is available as an optional radiator cap, fuel tank cap or hydraulic tank cap. Open and close locking caps as follows:

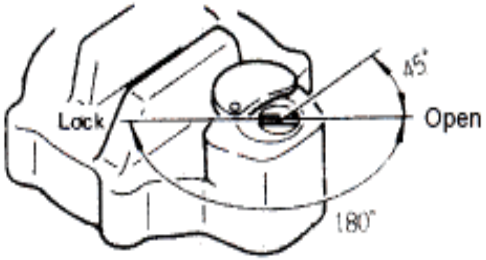
1. To open the cap

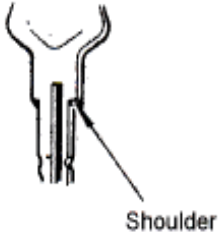
a) Insert the key into the cap.
* Insert the key as far as it will go. If the key is turned before it is inserted all the way, it may break.

b) Turn the key counter clockwise and bring the rotor groove in line with the aligning mark on the cap. Turn the cap slowly until a "clicking" sound is made. This releases the lock and allows the cap to be opened.

2. To lock the cap
1) Turn the cap into place.
2) Turn the key clockwise and take the key out.

* When the cap is locked (against vandalism), it rotates freely.





EXCAVATOR'S WORK

In addition to the following, it is possible to further increase the range of applications by using various attachments.

BACK HOE WORK

A back hoe is suitable for excavation at a position lower than the machine. It is possible to effectively move the arm through 30° in the direction towards the machine and 45° away from the machine, making for efficient work.

SHOVEL WORK

A shovel is suitable for excavating at a position higher than the machine. Shovel work is performed by attaching the bucket in the reverse direction.

LOADING WORK

About half of the time spent during excavating and loading work is taken up swinging. Maximum work efficiency can be attained by carrying out work in such a way that the swinging angle is kept as small as possible in accordance with the terrain.

When loading, it is better to fit the machine in the longitudinal direction of the dump truck and to load from the front of the dump truck body. This both facilitates loading and also enable a greater amount of material to be loaded as compared with loading from the side of the truck.

DITCH DIGGING WORK

Ditch digging work can be performed efficiently by attaching a bucket to match the width of the ditch and then setting the tracks parallel to the line of the ditch to be excavated.

To excavate a wide ditch, first dig out both sides and then finally remove the center portion.

HANDLING OF BATTERY

PRECAUTIONS FOR CHARGING BATTERY

1. Before charging, disconnect the cable from the negative (-) terminal of the battery. Otherwise, an unusually high voltage will damage the alternator
2. While charging the battery, remove all battery plugs for satisfactory ventilation. To avoid gas explosions, do not bring fire or sparks near the battery.
3. If the electrolyte temperature exceeds 45° C, stop charging for a while.
4. Turn off the charger as soon as the battery is charged. Overcharging the battery may cause following:
   1) Overheating the battery
   2) Decreasing the quantity of electrolyte.
   3) Damaging the electrode plate.
5. If, the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water
6. Do not mix up cables (positive (+) to negative (-) or negative (-) to positive (+)), as it will damage the alternator.
7. When inspecting or servicing a battery, be sure to stop the engine and turn the starting switch key to "OFF " position.
8. When performing any service to battery besides checking the electrolyte level or measuring the specific gravity, disconnect cables from the battery.

REMOVAL AND INSTALLATION OF BATTERY

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

STARTING ENGINE WITH A BOOSTER CABLE

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

1. Before connecting the booster cable.

a). Size of booster cable and clip should be suitable for the battery size.

b). Check cables and clips for breaks, corroded surfaces, etc.

c). Make sure cables and clips are firmly secured.

d). Keep the starting switch in the 'OFF" position.

e). The battery of the running engine must be the same capacity as that of the engine to be started.

2. Connect the booster cables in the following manner:

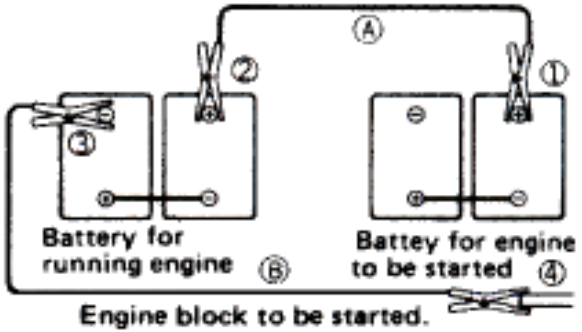
a). Connect one clip of booster cable-A to the positive (+) terminal of the engine to be started.

b). Connect the other clip to the positive (+) terminal of the engine which is running.

c). Connect one clip of booster cable- B to the negative (-) terminal of the engine which is running.

d). Connect the other clip to the engine block to be started.

* Make sure the clips are firmly connected to battery terminals. Then, start the engine.



⚠ When connecting the cables, never contact the positive (+) and negative (-) terminals.

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

3. Starting engine

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

   2) If the engine doesn't start at first, try again after 2 minutes .

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

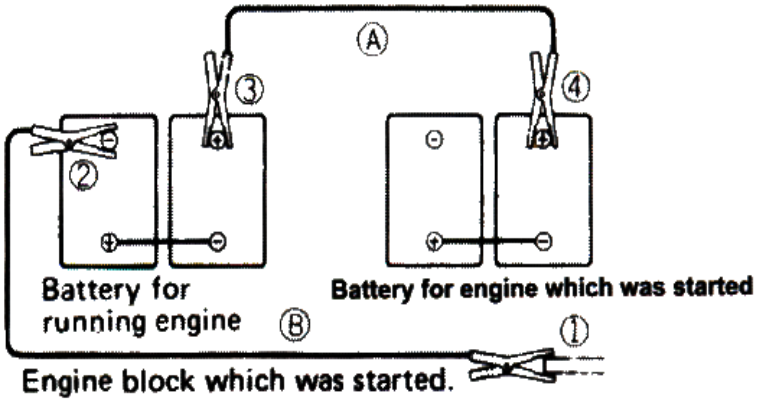
1. Disconnecting the booster cables

   1) Disconnect the clip of booster cable-B from the engine block which was started.

2. Disconnect the other clip from the negative (-) terminal of the running engine.

3. Disconnect the clip of booster cable-A from the positive (+) terminal of the running engine.

4. Disconnect the other clip from the positive (+) terminal of the engine which was started.



TRANSPORTATION

When transporting the machine, observe the various road rules, road transportation vehicle laws and vehicle limit ordinances, etc. It is a good idea to obtain a special platform for loading and unloading the machine. When it is unavoidably necessary to use a gangplank, however, at the very least observe the following for the sake of safety.

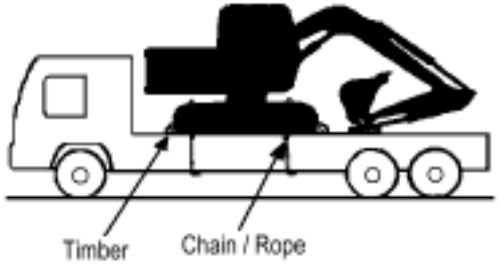
1. Properly apply the brakes on the trailer and insert blocks beneath the tires to ensure that it does not move. Then fix the gangplank in line with the center of the trailer and the machine.
   * Make sure the gangplank has sufficient width, length and thickness to enable the machine to be safely loaded and unloaded. If the gangplank sags apprecibly, reinforce it with blocks, etc.
   * Lock the upperworks using the swing lock lever.
2. Determine the direction of the ganplank, then slowly load or unload the machine.

⚠ Remove the mud from the undercarriage to prevent the machine from slipping to the side on slopes.

* Move the machine backward to get on the trailer.
* Do not on any account change the direction of the machine while it is on the gangplank. To change the direction of the machine, first take it down from the gangplank.

3. Correctly load the machine onto the specified part of the trailer. After loading the machine, fully extend the bucket and arm cylinders, then slowly lower the boom.
   * When transporting the machine, place rectangular timber under one end of the bucket cylinder to prevent it touching the ground, thereby saving it from possible damage.

4. When transporting the machine, place rectangular timber underneath the front and rear track shoes to prevent the machine from moving about. Also, hold it down with chains or rope. Be particularly careful to ensure that the machine does not slip sideways.



5. Lock the swing lock lever and apply the lock to the working equipment lever

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

PRECAUTIONS FOR MAINTENANCE

SAFETY.....

- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles.
- Fuel or oil are dangerous substances. Never handle fuel, oil, grease or oily clothes in places where there is any fire or flame.
  As preparation in case of fire; always know the location and directions for use of fire extinguishers and other fire- fighting equipment.
- Do not handle electrical equipment while wearing wet gloves, or in wet places, as this can cause electric shock.
- During maintenance do not allow any unauthorized person to stand near the machine.
- Exhaust gas is dangerous. When working inside, be particularly careful to have good ventilation.
- Unless you have special instructions to the contrary, maintenance should always be carried out with the engine stopped. Lock the swing lock lever and also all of the safely levers. If maintenance is carried out with the engine running, there must be two men present one sitting in the operator's seat and the other one performing the maintenance. In such a case, never touch any moving part.
- When working underneath the machine, place a sign to that effect on the operator's seat and, if necessary, put a similar signs in the vicinity as well.
- Do not go underneath the machine after raising it up using the boom and the arm.
- When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.
- When maintenance has to be carried out with the work equipment raised, they must be securely supported by blocks.

- Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first.

Method of relieving pressure

1. Lower the work equipment to the ground and stop the engine after idling it for two or three minutes. Then operate the various operation levers. (work equipment, travelling and steering lever through their full stroke in each direction) When removing air instruments or piping, open the drain valve under the air reservoir to relieve air pressure.

2. Gradually unscrew the cap of the hydraulic tank and leave it for a few minutes.

- Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil, fuel antifreeze or electrolyte.

- Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.

- Be particularly careful when removing the radiator cap. If this is done immediately after using the machine, there is a danger that boiling water may spurt out.

- Do not check the fan belt tension while the engine is running. Be sure to turn off the engine before inspecting other rotating parts and the vicinity thereof.

- Do not allow anybody other than the necessary workers to go near the machine while it is being inspected or maintained. Also, be careful of people in the vicinity. It is necessary to exercise particular care when performing grinding or welding, or when swinging a large hammer

- Use the tool which is suitable for the maintenance work.

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

- When the tracks are removed, never put your fingers between the shoes.

- When carrying out other difficult maintenance works, carrying them out carelessly can cause unexpected accidents. If you consider the maintenance is too difficult, always request nearest beml office to carry out it.

MISCELLANEOUS

- Thoroughly wash the machine, particularly the oiling and greasing parts and the vicinity, thereof, in order to prevent the ingress of dust.
- Use genuine BEML replacement parts specified in the parts list.
- Use BEML specified oil and grease. Use oil and grease having the recommended viscosity for the particular ambient temperature.
- Use clean oil and grease and keep them in clean containers to avoid the ingress of dust.
- Inspect or replace oil in a dust free location to prevent the ingress of dirt.
- Drain off used oil after heating it to a suitable temperature (about 20 to 40°C).
- After replacing oil, filter element or strainer, bleed the air from the circuit.
- When the strainer is located in the oil filler, the strainer must not be removed while adding oil.
- When adding oil or checking the oil level, check that the oil is at the correct level.
- After greasing up, always wipe off the old grease that was forced out.
- When changing the oil or filter, check the drained oil and filter for any signs of excessive metal particles or other foreignmaterials.
- When removing parts containing O-rings, gaskets or seals, clean the mounting surface and replace with new sealing parts.
- When washing the machine, ensure that water does not get on to the alternator.
- Special measuring apparatus is needed for testing hydraulic pressure.
- Thoroughly wash the machine. In particular, be careful to clean the filler caps, grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- When check an open cover there is a risk of dropping things in. Be fore removing the covers to inspect cover, empty everything from your pockets. Be particularly careful to remove wrenches and nuts.

- When working on the sea shore, check that the various plugs and valves, etc., are tightened up properly. After the completion of work, thoroughly wash the machine and carefully clean all electrical equipment to ensure that it does not corrode.
- Before working in muddy water, rain or snow, check that the various plugs, valves, are properly screwed up. Upon completion of work, wash the machine, then check the various parts of the machine fro cracking, scratching, loose or missing nuts and bolts. Also, oil and grease the various parts of the machine.
- When working on rocky ground, be careful of damage to the undercarriage, loose nuts and bolts, cracks, wear and other damage. Also, adjust the track tension so that it is a little slacker than usual.
- When working in a dusty location, be careful of the following:

1. Inspect the dust indicator to see whether the air cleaner is blocked up. Clean the air cleaner as soon as it becomes dirty.
2. Clean the radiator core so that it does not become blocked up.
3. Clean or replace the fuel filter as soon as it becomes dirty.
4. Clean the electrical equipment, particularly the starting motor and alternator, to prevent accumulation of dust.

- When installing car radio and a walkie-talkie or citizen band, contact your nearest beml office.
- When washing the machine, take care not to splash water over the electrical equipment. If it is soaked with water, it may not operate normally.
- After disconnecting the connector, cover it with a vinyl bag to prevent oil or dust from sticking to its contact section.
- When welding, be careful of the following:

1. Turn OFF the power (starting switch).
2. Do not continuously apply more than 200 V.
3. Install the ground cable at least 1 m from the range to be welded.
4. Take care not to install the seals between the grounded point and the range to be welded.

STORAGE

BEFORE STORAGE

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

- After every part is washed and dried, the machine should be housed in a dry building. Never leave it outdoors.
  In case it is unavoidable to leave it outdoors, lay wood plates on the ground, and park the machine on the wood plates and cover it with canvas, etc.
- Completely fill the fuel tank, lubricate and change the oil before storage.
- Apply a thin coat of grease to metal surfaces (hydraulic piston rods and front idler adjusting rods).
- As for the batteries, remove the terminals and cover them, or remove them the machine and store separately.
- When the ambient temperature is anticipated to drop below 0°C, always add antifreeze in the cooling water.
- The fuel control lever should be set to STOP position.

DURING STORAGE

- Operate the engine and move the machine for a short distance once a month so that a new film of oil will be coated over movable parts and component surfaces.
- Before operating the working equipment, wipe off the grease on the hydraulic piston rod.

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

AFTER STORAGE

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

- Loosen the drain plugs on oil pan and other cases and drain mixed water.
- Remove the cylinder head cover and lubricate sufficiently valves and rocker arms. And inspect the valve operation.
- After the engine is started, operate it until it is warmed up completely.

Engine with turbocharger only

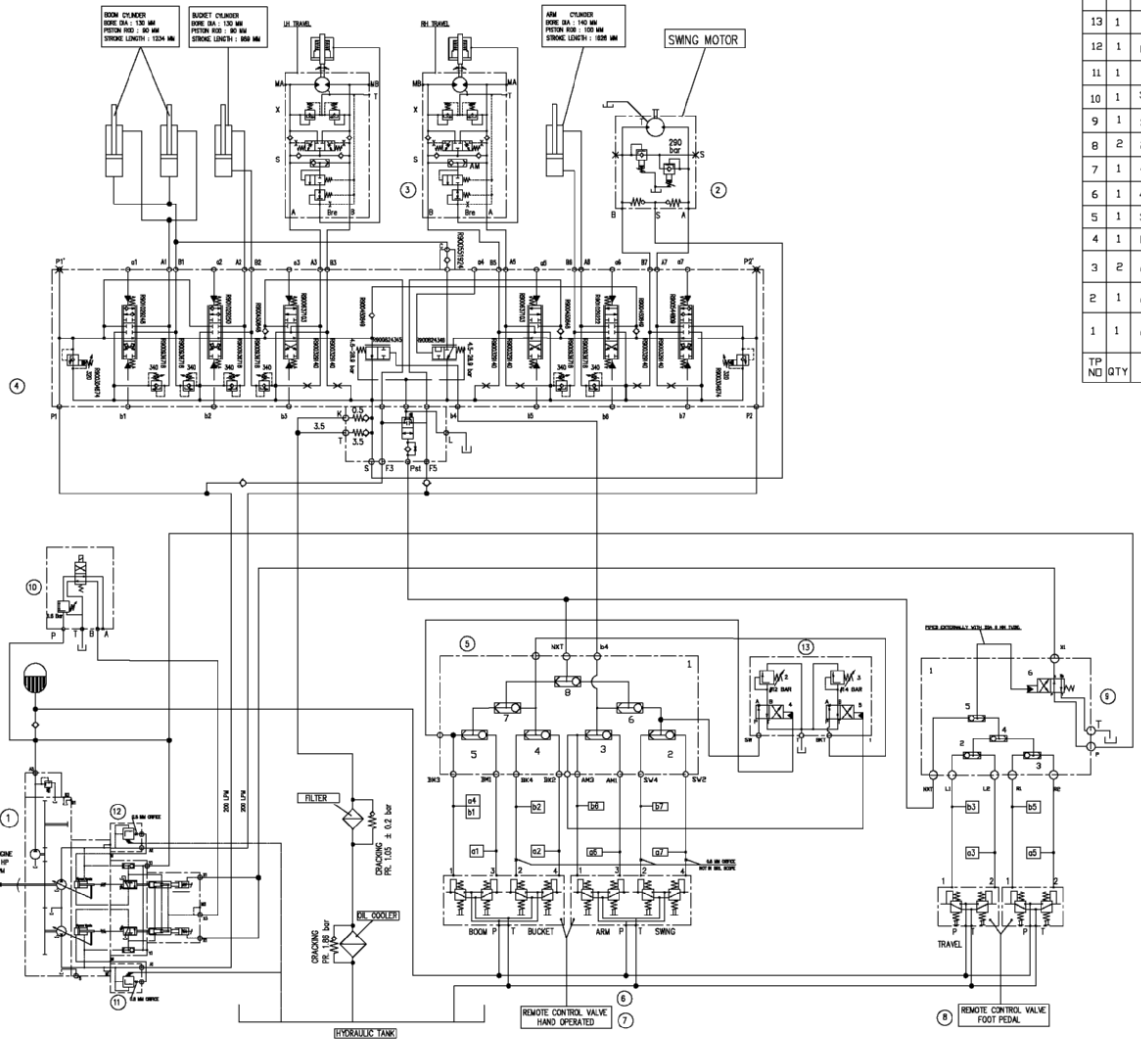
Remove the oil pipe flange on the turbocharger oil inlet, fill with 0.5 to 1 ltr engine oil, and leave the flange lightly loosened. Then, rotate the engine by the starting motor without fuel injection and decompression so that the discharge of oil is confirmed. Then, tighten the flange and start the engine.

BE220, BE240HD,BE220G **LIST OF WEIGHT**

MACHINE MODEL	BE220	BE240HD	BE220G
Engine assembly	783	783	655
● Engine	655	655	655
● Damper	12	12	-
● Main piston pump	116	116	-
Radiator assembly	85	85	130
Hydraulic tank (without hydraulic oil)	196	196	196
Fuel tank (without fuel)	111	111	111
Revolving frame	1965	1965	1864
Operator's cab	395	395	395
Swing machinery	194	194	230
Swing motor assembly	23	23	73
Travel motor assembly	25 x 2	25 x 2	-
7- spool control valve	148	148	195
Center swivel joint assembly	35	35	35
Counter Weight	3935	3935	3935
Track frame assembly	4604	5100	4604
● Track frame	3245	3565	3245
● Carrier roller assembly	22 x 4	22 x 4	22 x 4
● Track roller assembly	36 x 16	36 x 20	36 x 16
● Recoil spring assembly	135 x 2	135 x 2	135 x 2
● Idler assembly	120 x 2	120 x 2	120 x 2
● Final drive assembly	640	640	-
● Sprocket	42 x 2	42 x 2	42 x 2
● Swing circle assembly	243	243	243
Track shoe assembly	2849	3146	2849

Boom assembly	1696	1696	1696
Arm assembly	793	793	793
Bucket assembly	965	965	965
Boom cylinder assembly	187 x 2	187 x 2	187 x 2
Arm cylinder assembly	266	266	266
Bucket cylinder assembly	167	167	167
Link (large) assembly	79	79	79
Link (small) assembly	23 x 2	23 x 2	23 x 2
Boom pin	43+10x2+30+10+32	43+10x2+30+10+32	43+10x2+30+10+32
Arm pin	10 x 2	10 x 2	10 x 2
Bucket pin	20 x 2	20 x 2	20 x 2
Link pin	18 x 2	18 x 2	18 x 2

⚠ **This weight table is a guide for use when transporting or handling components.**



13	1	M. BLOCK ASSY. FOR COMBINE OPERATION	REXROTH 3141004896
12	1	RH M. Block For Pressure Cut Off	REXROTH 3141004781
11	1	LH M. Block For Pressure Cut Off	REXROTH 3141004780
10	1	Stack Assembly For Mode Selection	REXROTH K00175
9	1	Shuttle M. Block With Neutral Cut Off	REXROTH 3141004851
8	2	2TH6 RC71-1X/M01 - Footpedal	REXROTH 07538956
7	1	4TH6 E70-1X/ST23M01	REXROTH 07281258
6	1	4TH6 E 70-1X/ST43M01	REXROTH 07281280
5	1	Shuttle Manifold Block Assembly	REXROTH 3141004788
4	1	M8-1409/7M8-22 - Control Valve	REXROTH R901098046
3	2	A2FM90/61 WVAB181-K+BVD-Travel Motor	REXROTH R902101635
2	1	A2FM90/61 WVAB191J - Swing Motor	REXROTH R902011831
1	1	A8VO107LA1KH3/63R1NZG05F001 - Main Pump	REXROTH R902100245
TP NO	QTY	DESCRIPTION	REMARKS

BE220 / BE240HD HYDRAULIC CIRCUIT

Amendment no 5 : As Built Ckt.

Amendment no 4 : T.P NO. 14 M.Block added for combine operation
0.8 MM orifice added in swing & BKT. Curl pilot line.
2Nos Check valve and 2 'P' lines connected from Main pressure line to Pst block.

Amendment no 3 : 0.8 MM ORIFICE (Qty – 2nos)
ADDED IN 'M' LINE OF PRESSURE CUT-OFF BLOCK

Amendment no 2 : SL NO : 11 & 12 CHANGED TO SL NO : 11,12 & 13

Amendment no 1: COOLER IS PLACED AFTER THE FILTER
IN THE RETURN LINE