

**DIRECTORATE GENERAL BORDER ROADS**  
**GENERAL MAINTENANCE INSTRUCTION NO 193**

**ON**

**GREAVES BOMAG SINGLE DRUM WHEEL DRIVE VIBRATORY ROLLER BW 212/D**

**1. INTRODUCTION**

1.1 Greaves Bomag single drum vibratory rollers of the BW 212 series are self-propelling soil compactor for earth works and have been inducted in BRO. They are fitted with 6 cyls Kirlosker HA 694 diesel engine which drive the hydraulic pump for the travel drive, vibration and steering at a constant speed. Compaction is achieved by the vibration of the drum. For all types, the travel pump acts on the rubber type drive wheel and in case of BW 212 D on the drum as well.

1.2 These instructions are issued as guidelines for general and schedule maintenance, lubrication chart and safety precautions.

**ACTION BY**

2.1 USER UNITS: - To carry out maintenance-scheduled inspection, servicing and preventive maintenance task as laid down by mobile maintenance team and follow safety precaution for optimal utilization.

2.2 FIELD WORKSHOP (GREF)

2.2.1 To monitor the record maintenance and lubrication as carried out by mobile maintenance of the equipment during its inspection and repairs when carried out as per maintenance and lubrications scheduled given in this instruction.

2.2.2 To advise user unit in respect of any lapse noticed.

**3. DETAILS**

3.1 The details of maintenance fuel lubricants and safety precautions are as under:-

3.1.1 General maintenance - Appx 'A'

3.1.2 Fuels, lubricants and capacities - Appx 'B'

3.1.3 Hourly periodic maintenance - Appx 'C'

3.1.4 Safety precautions - Appx 'D'

4. Please acknowledge receipt.

Sd/xxxxxx  
(AJS Khalsa)  
SE (E&M) SG  
Dir Tech  
For Dir Gen Border Road

Dated : 30 Aug 91

## GENERAL MAINTENANCE

### 1. General

- 1.1 Careful maintenance of the machine ensures maximum reliability and prolongs the service life of important components. The work involved is small compared to the problems, which may occur if these instructions are not observed.
- 1.2 Clean the machine and engine thoroughly before all maintenance work.
- 1.3 Carry out maintenance work on a flat base.
- 1.4 Only perform maintenance work with the engine shut down.
- 1.5 Depressurize hydraulic hoses before performing work on them (secure machine with handbrake and shut down engine).
- 1.6 Before performing work on electrical components of the machine, disconnect the battery and cover with insulating material or remove.
- 1.7 The terms "right/left" are always referred to the direction of travel.

### 2. Running-in Instructions

2.1 The following maintenance work must be performed as appropriate when commissioning new machines or when engines have overhauled:-

2.1.1 After 50 minutes `running lime, tighten the V -belt, Engine HA-694.

2.1.2 After 50 operating hours, perform the following maintenance operations:-

2.1.2.1 Exchange the engine oil filter.

2.1.2.2 Change the engine oil.

2.1.2.3 Check the both valve clearance and adjust if necessary at 0.15mm when engine is cold.

2.1.2.4 Tighten nut and bolt connections on the suction and exhaust tubes and on the oil pan and engine mounts.

2.1.2.5 Tighten nut and bolt connections on the machine.

2.1.2.6 Change drive axle oil.

2.1.2.7 Change planetary gear oil.

2.1.2.8 The engine oil level must be checked twice per day for approximately the first 250 operating hours.

2.1.3 After 250 operating hours

2.1.3.1 Check valve clearance. Inlet & exhaust 0.15 mm when engine is cold.

### 3. Fuels and lubricants

#### 3.1 Engine oil

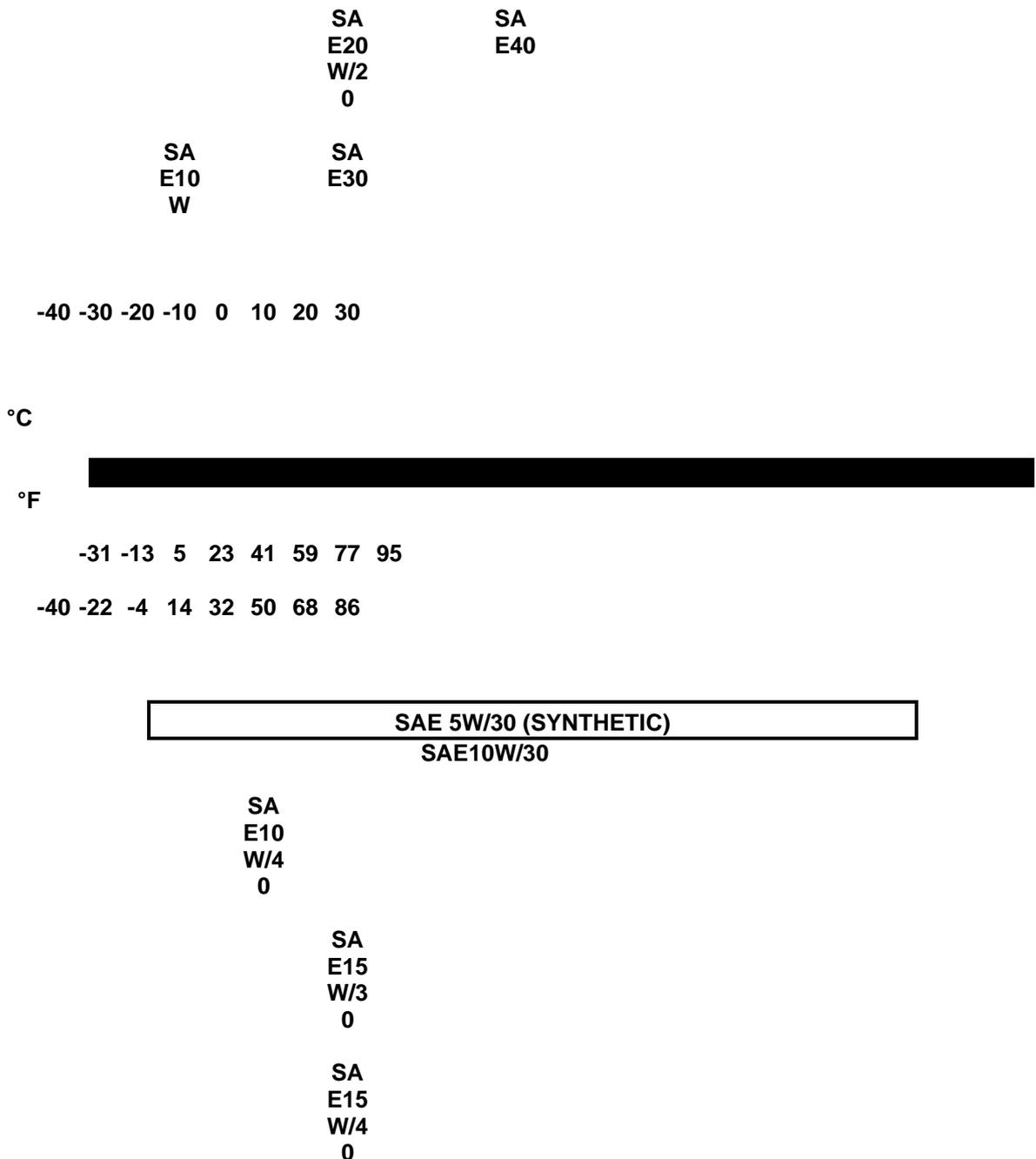
3.1.1 Use only winter grade engine oil at low temperatures!

3.1.2 To ensure a perfect cold start, it is important to choose the viscosity (SAE grade) of the engine oil in accordance with the ambient temperature.

3.1.3 The oil change intervals must be reduced when operating at temperatures below 10<sup>0</sup> C ie 125 hrs/run interval. Lubrication oil with a too high viscosity index will cause starting difficulties. The temperature when starting the engine is therefore decisive for selecting the correct viscosity for winter operation.

#### 3.2 Oil Viscosity

3.2.1 Since the viscosity of the lubrication oil changes with temperature, the ambient temperature at the engine's operating location determines the viscosity class (SAE GRADE) to be chosen (see diagram).



3.2.2 Although cold starting ability may be impaired if the temperature occasionally falls below the limits (e.g. use of SAE 15W/40 down to 15<sup>0</sup> C), this will not cause engine damage. Having to change the lubrication oil due to changes in temperature can be avoided by using multigrade oils. The oil change intervals given below also apply for multigrade oils.

### 3.3 Regular lubrication oil changes

3.3.1 The longest period that the lubrication oil should remain in the engine in one year. If the oil change intervals specified below are not reached during a year, the lubrication oil must be changed at least once yearly irrespective of the operating hours worked.

### 3.4 Lubrication oil change intervals

3.4.1 Oil change intervals (operating hours) for different oil qualities for engine 250 operating hours.

3.4.2 These intervals only apply if using a diesel fuel with a maximum of 0.5% sulfur (by weight) and for ambient temperatures above 10<sup>0</sup> C.

3.4.3 When using fuels with more than 0.5% - 1% sulfur or at ambient temperatures below -10<sup>0</sup> C, the oil change intervals given in the table are to be halved. In the case of fuels having a sulfur content of 1% .....1.5%, the intervals for changing the engine oil must be halved and the engine oil must have a TBN\* of approx. 12x%S e.g. use in tropical climates : Fuel 0.8% sulfur, lubrication oil CD/SE, oil change every 250 operating hours. Use in tropical climates : Fuel 1.2% sulfur, oil change every 250 operating hours, lubrication oil CD/SE or CD/SF with RBN\* approx. 14 mg KOH/g.

3.4.4 When changing over to a higher quality oil after longer operating periods, recommend that the first change of the higher grade oil is performed after 20 operating hours. The lubrication oil filter cartridge is to be renewed at the same time.

\*TBN "Total Base Number" specifies the oil's neutralization ability.

### 4. Fuels

4.1 Only use commercially available brand diesel fuel with a sulfur content of less than 0.5% and pay attention to cleanliness when refueling. Higher sulfur contents will affect the oil change intervals. At low temperatures, only ever use winter grade diesel fuel. The machine should never be allowed to run out of fuel, otherwise the filter and injection lines will have to be bled.

4.2 The following fuel specifications are permitted :-

4.2.1 DIN 51601; Nato codes F-54, F-75, F-76; BS 2869: A1 and A2: ASTM D 975 -78: 1-D and 2-D; VV-F-800 a: DF-A, DF-1 and DF-2.

4.3 Only ever mix diesel fuel with standard grade gasoline (never premium grade) in the tank itself, first fill up with the necessary amount of gasoline and then add diesel fuel. Diesel-gasoline mixtures are just as flammable as gasoline itself.

4.4 Winter fuel - Blending of diesel in sub zero temp as under :-

Ambient temperature	Blend ration % of normal HSD	5 of ATF
+10 <sup>0</sup> C	Normal	Nil
From 0 <sup>0</sup> C to 18 <sup>0</sup> C	30	70
From 18 <sup>0</sup> C to 125 <sup>0</sup> C	22	78
From 25 <sup>0</sup> C to 40 <sup>0</sup> C	20	80

As regards adding lubricating oil, 2% of OM36 may be added for 100% ATF and accordingly its ratio to be calculated for the above referred blends.

### 5. Hydraulic oil

5.1 The hydraulic system is used with hydraulic oil HLP 46 (ISO) with a kinematics viscosity of 46 mm/s at 40<sup>0</sup> C i.e., Servo Hydrex TH 46.

### 6. Gear oil

6.1 Only use multi-purpose gear oils of class API-CL5 for the axle drive and the planetary final drives, i.e., servo gear super 80W-90.

6.2 This is top performance class hypoid oil for axle drives subject to heavy loads.

6.3 The additives in this oil ensure wear-resistant lubrication under all application conditions.

### 7. Lubricating grease

Use of EP high-pressure grease, lithium soaped (penetration 2) for lubrication purposes is servo grease MP.

8. Notes on the fuel system

- 8.1 The service life of the diesel engine is governed primarily by the cleanliness of the fuel.
- 8.2 Keep the fuel free of contamination and water, otherwise the engine's injection elements will be damaged.
- 8.3 Do not store fuel in zinc-lined drums.
- 8.4 Fuel drum should be left undisturbed for a longish period before the fuel is tapped.
- 8.5 Under no circumstances should the drum be rolled to the tapping location just before drawing off the fuel.
- 8.6 The fuel should be stored where no damage can be caused if any fuel is spilt.
- 8.7 Do not let the suction pipe disturb the sludge at the bottom of the drum.
- 8.8 Fuel should not be siphoned off from near the bottom of the drum.
- 8.9 The fuel left in the drum is not suitable for the engine and should only be used for cleaning purposes.

9. Notes on the Hydraulic system

- 9.1 Cleanliness is of utmost importance when maintaining the hydraulic system. Ensure that no dirt or other contaminating substances get into the system. Small particles can flute the valves, cause pumps to seize and block throttle and control bores, thereby resulting in costly repairs.
- 9.2. If during the daily check the level of the hydraulic oil is found to have dropped, check all lines, hoses and units for leaks.
- 9.3 Immediately block off all external leaks.
- 9.4 Hydraulic – oils drums should not be stored outdoors unless they have at least a cover protection. Water can penetrate through the bung hole as a result of changing weather conditions.
- 9.5 If drums have to be stored outdoors, they should be laid horizontally.
- 9.6 Before hydraulic oil is drawn off, the drum must stand undisturbed at the tapping point for a longish period. Under no circumstances should the drum be rolled to the tapping point.
- 9.7 If possible, fill the hydraulic system with the filling unit.
- 9.8 Clean the fittings, the filler cap and their immediate areas before removing oil so as to prevent any dirt from penetrating.
- 9.9 Do not leave the tank opening uncovered any longer than necessary so as to prevent contamination and impurities from falling into the tank.

**FUELS, LUBRICATIONS AND CAPACITIES**

Assembly	Summer	Winter	<b>CAUTION</b> Note: Filler marks! Quantity approx BW 212 D
Engine Engine oil	SAE 30 (+5 <sup>0</sup> C to +30 <sup>0</sup> C) SAE 40 (+25 <sup>0</sup> C to +40 <sup>0</sup> C)	SAE 10W (-5 <sup>0</sup> C to -20 <sup>0</sup> C) SAE 20W/20 (+10 <sup>0</sup> C to -10 <sup>0</sup> C)	14 1* 12 1**
Fuel	Diesel (gas oil)	(Winter-grade diesel fuel down to - 12 <sup>0</sup> C)***	
Hydraulic system	Hydraulic oil (ISO, HV 46, Pneumatic Viscosity 46mm/CST at +40 <sup>0</sup> C ) Servo hydrex TH-46		120 1*
Vibration bearing	Engine oil as (engine)		8 1 per sid
Drive shaft, Travel bearing, Articulated joint	High pressure grease (lithium soap) Servo grease MP		As required

Planetary gear	Gear oil SAE 90, as per MIL-L-2105 B, API GL 5 Servo gear super 90	2 1 per gear
Drive Axle	-do-	Approx. 12 1

\* Initial filling

\*\* Oil change (without filter)

\*\*\* Lower temperatures, see mixing table of blending of diesel (i.e., appx 'A' of this GMI)

## **HOURLY PERIODICAL MAINTENANCE**

### 1. Maintenance every 10 operating hours

#### 1.1 Checking the Engine oil level

1.1.1 The machine must be horizontal and the engine shut down.

1.1.2 Take out the oil dipstick wipe it off with a clean, lint-free cloth and insert it again until it bottoms.

1.1.3 Remove the oil dipstick again. The oil level should be between the "Min" and "Max" marks. If the oil level is lower, immediately top up with oil.

1.1.4 After approx. 1 min of operation, check the oil level again with the engine shut down.

### 1.2 Operating the Dust Discharge Valve of the Air Filter

1.2.1 The service life of the filter cartridge in the air filter depends on the correct removal of dust by the dust discharge valve. If the discharge valve is jammed or clogged, the cartridge very rapidly becomes clogged itself due to excessive dust. Squeeze the dust discharge valve and clean the discharge slot.

### 1.3 Cleaning the fuel pre-cleaner

1.3.1 Close the cock valve on the fuel tank.

1.3.2 Loosen the tension nut.

1.3.3 Swing fixing clamps the side.

1.3.4 Remove filter bowl with strainer and clean in fuel.

1.3.5 Make sure that there are no leakages after assembly.

### 1.4 CAUTION

1.4.1 Open the cock valve on the tank.

### 1.5 Checking the Hydraulic oil level

1.5.1 Check level at inspection glass. Normal level : 1 cm below the upper marking on the inspection glass.

1.5.2 If a drop in the hydraulic oil level is discovered during the daily oil level check, then check all lines, hoses and units.

### 1.6 Checking the fuel level

1.6.1 Check fuel level at inspection glass.

1.6.2 During normal operation, a full fuel tank lasts for around 10 operating hours.

### 1.7 CAUTION

1.7.1 Never run the fuel tank dry, otherwise, the fuel system will have to be bled. Capacity: 185 Lts.

### 1.8 Checking the parking brake

1.8.1 Pull handbrake level up as far as it will go (3..4 notches); the warning light on the console lights up. Carry out trial run : the machine must be braked.

### 2. Maintenance every 50 operating hours

## 2.1 Greasing the Articulated joint

2.1.1 Clean the 7 grease nipples and lubricate with approx 5 shots of servo grease MP from the grease gun.

## 2.2 Checking the tyre pressure

2.2.1 With the tyre valve at the top measure air pressure of tyres at tyre valve. Nominal value 1.1 bars (16 PSI). Ensure all tyres are at the same pressure.

## 2.3 Adjusting the scrapers (BW 212D)

2.3.1 Check setting and condition of front and rear scrapers and adjust or exchange if necessary.

2.3.2 The adjust the scrapers loosen the mounting screws in the slots and slide the scraper holder up against the drum.

2.3.3 Retighten the mounting screws.

## 2.4 Greasing the travel bearings

2.4.1 The BW 212 D only a grease nipple on the vibration drive side.

2.4.2 Clean grease nipple and lubricate with approx 10 shots from the grease gun.

## 2.5 Greasing the drive shaft

2.5.1 Clean the 3 grease nipples and lubricate with approx 3 shoots from the grease gun.

## 2.6 Checking the Battery

2.6.1 No naked fire when working on the battery! Do not smoke.

2.6.2 Do not let acid come into contact with skin or clothing.

2.6.3 Wear goggles!

2.6.4 Do not place any tools on the battery!

2.6.5 Remove seat.

2.6.6 Unscrew screws and lift up battery box cover.

## 2.7 Non-maintenance free Batteries

2.7.1 Remove battery and clean battery compartment

2.7.2 Clean outside of battery.

2.7.3 Open plug and check acid level.

## 2.8 With Control Elements

2.8.1 Acid level down to the bottom of the control of the control elements.

## 2.9 Without control elements

2.9.1 Measure acid level 10...15 mm above upper edge of lead plate using clean wooden sticks.

2.9.2 Only use distilled water to top up.

2.9.3 Clean battery poles and terminals and grease with pole grease (Vaseline).

2.9.4 Check battery mounting.

## 2.10 With transparent Battery Box

2.10.1 Acid level up to mark on box.

## 2.11 Maintenance – Free Batteries

2.11.1 Perform only the following points :-

2.11.1.1 Check cleanness

2.11.1.2 Grease poles.

2.11.1.3 Check terminals are secure.

2.11.2 It is only necessary to top up with distilled water if the electrical system is defective or during long periods of operation.

2.11.3 Reinstall battery.

2.11.4 Close and secure battery box cover.

2.11.5 Install seat.

## 3. MAINTENANCE EVERY 250 OPERATION HOURS

3.1 Greasing the hinges on Doors Windows and flaps optional.

3.1.1 Clean all grease nipples or grease, points and lubricate with high pressure grease/from the grease gun or lubricate with oil.

3.2 Checking the condition and tension of the alternator V-belt, exchanging the V-belt.

3.2.1 Checking the V-belt.

3.2.1.1 Inspect the full length of the V-belt for damage or cracks. It should be exchanged if damaged or cracked.

3.2.1.2 Apply thumb pressure to check whether the V-belt can be depressed by more than 10...15 mm between the V-belt pulleys and tighten belt if necessary.

3.2.2 Tightening the "V" belt

3.2.2.1 Directly loosen Allen screws

3.2.2.2 Pull alternator until V-belt is at correct tension

3.2.2.3 Retighten Allen screws

### 3.2.3 Exchanging the V-belt

3.2.3.1 Unscrew the three horizontal mounting screws on the vibration pump coupling and slide the sleeves towards the vibration pump.

3.2.3.2 Firmly press the tightening pulley for the blower V-belt onwards and remove the latter. Check the V-belt and exchange if necessary.

3.2.3.3. Slightly loosen allen screws.

3.2.3.4. Press alternator in direction against the Engine.

3.2.3.5. Remove old V-belt from the V-belt pulleys.

3.2.3.6. Fit new V-belt onto the V-belt pulleys.

3.2.3.7. Tension V-belt as described earlier.

3.2.3.8. Tighten new V-belts after 30 minutes of operation.

3.2.3.9. Fit blower V-belt.

3.2.3.10. Reassemble the coupling for the vibration pump.

### 3.3 Cleaning the cooling fins of the engine oil and hydraulic oil coolers.

3.3.1 Dirt tends to accumulate on the engine cooling fins where surfaces are contaminated with oil or fuel; you should therefore always immediately repair any oil or fuel leaks in one area of the cooling blower and the cylinders and then clean the cooling fins.

3.3.2 Loosen the locking devices of the air duct and remove the latter.

3.3.3 Remove cooling air duct plate from hydraulic oil cooler.

3.3.4 Using a suitable brush remove dry dirt from the cooling fins of the engine, the engine oil cooler and the hydraulic oil cooler.

3.3.5 Blow out the cooling air ducts with compressed air.

3.3.6 If contamination is oily, spray the engine with diesel oil or cooler cleaning agent and clean it with a water jet after an adequate soaking time.

- 3.3.7 If a steam jet clearer is available this is to be preferred to all other cleaning methods.
  - 3.3.8 Re-attach the air duct and sealing air duct plate.
  - 3.3.9 Allow the engine to warm up to avoid corrosive.
  - 3.3.10 Cover all parts of the electrical system ; do not subject them directly to the jet.
- 3.4 Checking the condition of the cooling blower V-belt. Exchanging the V-belt, checking the correct functioning of the V-belt warning device.
- 3.4.1 Checking the V- belt.
    - 3.4.1.1 Check the full length of the v- belt for damage or cracks. it should be exchange if damaged or cracked.
  - 3.4.2. Exchanging the V-belt
    - 3.4.2.1. Unscrew three horizontal mounting screw from the vibration sump coupling and slide the sleeves towards the vibration pump.
    - 3.4.2.2. Firmly press in tightening pulley and remove old V- belt.
    - 3.4.2.3. Check the alternator V-belt and exchange if necessary.
    - 3.4.2.4. Fit new blower V-belt.
    - 3.4.2.5. Reassemble coupling for vibration pump torque mounting screws to 10 Nm.
    - 3.4.2.6. Check the correct functioning of the V-belt warning device.
    - 3.4.2.7. If the event of a V-belt tearing the electrical switch it actuated by the tightening of the pulley and an acoustic and optical sign triggered.
    - 3.4.2.8. Switch on ignition.
    - 3.4.2.9. Do not perform maintenance work with the engine running.
    - 3.4.2.10. Perform functioning check by pressing in the contact pin; the signal horn sound and the warning light on the console lights up.
- 3.5. Checking the oil level of the drive axle.
- 3.5.1. Unscrew oil filler plug.
  - 3.5.2. Oil must reach up to the lower edge of the bore.
  - 3.5.3. Top up oil if necessary i.e. Servo gear super.
  - 3.5.4. Screw oil filler plug back in securely.
- 3.6. Checking the oil level if the planetary gear.
- 3.6.1 Move drive wheel so that the oil level mark on the plug is horizontal
  - 3.6.2. Unscrew the plug.
  - 3.6.3. Oil level must reach up to the lower edge of the bore.
  - 3.6.4. Top up the oil if necessary i.e. Servo Super 90.
  - 3.6.5. Screw plug back in securely.
- 3.7. Checking the oil level of the vibration bearing on the right hand and left sides of the drum. Cleaning the breather bores.
- 3.7.1. Only, perform check in warm operating state after approx 30 minutes running with vibration.
  - 3.7.2. Move drum so that oil filler plug is at the highest point.
  - 3.7.3. Clean drum breather bore in the cover and under the vibration motor.
  - 3.7.4. Undo control plug on the left hand side of the drum and control plug on the right hand side of the drum. A little oil must emerge from the bores.
  - 3.7.5. If necessary top up engine oil.
  - 3.7.6. Securely seal bores with plugs.
- 3.8. Adjusting the linings, adjusting the parking brake (mechanical)

- 3.8.1 Pull cotter pin out of the castle nut.
- 3.8.2. Tighten castle nut until the gap between the brake shoes and brake disk is approx 0.5...0.6 mm (0.0.2.....0.024 inch) on each side.
- 3.8.3. Secure castle nut with cotter pin.

### 3.9. Adjusting the brake cable.

- 3.9.1. Check the path traveled by the hand brake lever and adjust if necessary.
- 3.9.2. To adjust, loosen counter nut and tension the brake cable using the hexagon nut on the brake lever until the brake engages after 3....4 notches.
- 3.9.3. Adjust the linings first and then the hand brake lever.
- 3.10. Tightening the bolts on the articulated joint.
- 3.10.1. Torque the bolts on the cover of the axle bolt to 30 Nm (22ft-lb).

## 4. MAINTENANCE EVERY 500 OPERATING HOURS

### 4.1 Changing the engine oil (BW 212 D)

- 4.1.1 Only drain engine oil with the engine warm
- 4.1.2 Danger of scalding when draining hot oil
- 4.1.3 Do not let old oil seep into the ground.
- 4.1.4 Oil change at 500 operating hours refers to oil quality PAI : CD/SE or CD/SF (see appx 'B').
- 4.1.5 Unscrew from oil filler neck.
- 4.1.6 Unscrew drain plug and collect the draining oil.
- 4.1.7 Fit new seal to drain plug and screw drain plug back in.
- 4.1.8 Pour in new engine oil through oil filler neck.
- 4.1.9 Screw cover back on.
- 4.1.10 After a brief trial run, check the oil level on the dipstick and, if necessary, top up to upper mark ("Max").
- 4.1.11 For oil type and quantity, refer to "Fuels and lubricants" i.e., appx 'B'.

### 4.2 Exchanging the engine oil filter Cartridge

- 4.2.1 Loosen and unscrew the engine oil filter cartridge with a suitable filter wrench.
- 4.2.2 Do not let draining oil seep into the ground.
- 4.2.3 Clean the sealing surface on the engine.
- 4.2.4 Apply a thin film of clean oil to the rubber gasket of the new filter cartridge.
- 4.2.5 Screw on the new filter cartridge and tighten firmly by hand.
- 4.2.6 After the engine has had a short trial run, check for leaks and check the oil level; top up if necessary.

### 4.3 Draining the fuel tank sludge.

- 4.3.1 No naked flames when working on the fuel system ! Do not smoke.
- 4.3.2 Do not spill fuel !
- 4.3.3 Collect the draining fuel ; do not let it seep into the ground.
- 4.3.4 Cover the engine, do not allow draining fuel to contaminate the engine.
- 4.3.5 Drain the fuel tank.
- 4.3.6 To do this, disconnect the fuel line from the fuel pump connection.
- 4.3.7 Unscrew the six mounting screws of the cover so that the remaining fuel can drain out.
- 4.3.8 After all the fuel has drained out, detach the cover completely.
- 4.3.9 Check the gasket and replace with new one if necessary.
- 4.3.10 Clean the sealing surfaces and reattach the cover.
- 4.3.11 Pour in fuel and bleed the fuel system if necessary.

## 5. MAINTENANCE EVERY 1000 OPERATING HOURS

### 5.1 Checking and adjusting the valve clearance.

- 5.1.1 Check and adjust the both inlet and outlet valve clearance of 0.15 mm only when the engine is cold.

- 5.1.2 After the engine has had a short trial run, check for leaks.
- 5.1.3 Detach all cylinder head covers.
- 5.1.4 Check the gasket and exchange if necessary.
- 5.1.5 Use a straight ring spanner to turn the engine.
- 5.1.6 Until both valves "overlap" on cylinder 1 (i.e. the outlet valve is not quite closed, the inlet valve starts to open). Adjust the valve.
- 5.1.7 Little resistance must be felt when a feeler gauge of 0.15 mm thickness is inserted between the pad of the rocker and the valve.
- 5.1.8 If the gap for the feeler gauge is too wide or too narrow, an adjustment must be made.
- 5.1.9 Loosen counter nut by 2...3 turns. Use a screwdriver to regulate the setscrew so that, when the counter nut is tightened, the feeler gauge can be inserted and removed with little resistance.
- 5.1.10 Carry out checking and adjustment work on all adjustable valves.
- 5.1.11 As a check, mark the valves with chalk once they have been adjusted.
- 5.1.12 Turn the crankshaft a further 360 degrees (do this by putting e.g. chalk marks on the flywheel or V-belt pulley) ; refer to "crankshaft adjustment 2".
- 5.1.13 Check and adjust all other valves.
- 5.1.14 Assembly is in the reverse sequence of steps.

## 5.2 Cleaning the fuel pump strainer

- 5.2.1 No naked flames when working on the system! Do not smoke!
- 5.2.2 Do not spill fuel!
- 5.2.3 Collect the draining fuel. Do not let it seep into the ground.
- 5.2.4 Unscrew bolt and remove cover.
- 5.2.5 Remove gasket and strainer.
- 5.2.6 Clean strainer in diesel fuel.
- 5.2.7 During assembly, examine the condition of the gasket and ensure that it fits correctly.
- 5.2.8 Check engine for leaks after a short trial run.

## 5.3 Exchanging the fuel filter cartridge, bleeding the fuel system.

- 5.3.1 No naked flames when working on the fuel system! Do not smoke.
- 5.3.2 Do not spill fuel!
- 5.3.3 Collect the draining fuel. Do not let it seep into the ground.
- 5.3.4 Loosen fuel filter cartridge with suitable filter and unscrew.
- 5.3.5 Clean sealing surface of filter bowl.
- 5.3.6 Apply a thin film of oil to the rubber seal of the new filter cartridge.
- 5.3.7 Screw on a new fuel filter cartridge and tighten securely by hand.
- 5.3.8 Never allow the tank to run dry
- 5.3.9 Air in the fuel system results in irregular engine running, a drop in performance and engine stalling and makes starting impossible.
- 5.3.10 For this reason, the fuel system must be bled not only after the tank has been run dry but also after exchange the fuel filter or working on the fuel pipe system.
- 5.3.11 Loosen the over flow valve on the hexagon bolt 2...3 turns.
- 5.3.12 Press the priming lever downward against the spring pressure as often as necessary until fuel emerges from the loosened overflow valve without bubbles; if necessary, turn the engine a little further. Retighten the overflow valve during pumping.

## 5.4 Checking the diesel engine mounts.

- 5.4.1 Tighten suction pipe and exhaust pipe mounts on the cylinder heads.
- 5.4.2 Check that the sockets and clips on the air filter are secure.
- 5.4.3 Tighten the screw connection of the lubrication oil pan and the engine mount.

## 6. MAINTENANCE EVERY 2000 OPERATION HOURS

- 6.1 Changing the hydraulic oil, cleaning the strainer and ex-change the aeration filter

- 6.1.1 Apart from the normal oil change intervals, the hydraulic oil must also be renewed after performing major repairs on the hydraulic system.
- 6.1.2 Perform oil changes with warm hydraulic oil servo hydrex TH-46.
- 6.1.3 Clean the surrounding area of the hydraulic oil tank, the filter opening and the aeration filter.
- 6.1.4 Never allow pumps to run without oil.
- 6.1.5 Do not use detergents to clean the system.
- 6.1.6 Use only lint-free cleaning cloths.
- 6.1.7 Under no circumstances must the engine to start when the hydraulic oil has been drained off.
- 6.1.8 Unscrew the tank cover with the breather filter.
- 6.1.9 Disconnect the suction hose from the steering pump and drain off all raulic oil.
- 6.1.10 Collect the draining oil.
- 6.1.11 Resecure the suction hose.
- 6.1.12 Clean the breather filter in the tank cover using diesel fuel and blow out with compressed air.
- 6.1.13 Check the strainer in the filter neck for contamination and clean if necessary. To do this, loosen the hexagon nut and remove the strainer. Clean the strainer in diesel fuel and blow out with compressed air. Reinstall the strainer.
- 6.1.14 Pour new hydraulic oil (approx 85 1) through the strainer and screw on the tank cover.
- 6.1.15 Check the oil level at the inspection glass.
- 6.1.16 After pouring in the oil, bleed the hydraulic system.
- 6.1.17 Bleeding the hydraulic system
- 6.1.18 Run the diesel engine at low speed for a maximum of 3 minutes. This bleeds the hydraulic system.
- 6.1.19 Only ever exchange hydraulic oil filters after bleeding. Then bleed again briefly.
- 6.1.20 Do not let old oil seep into the ground.
- 6.1.21 Screw drain plug back in securely.
- 6.1.22 Pour oil through the oil filter bore until it comes up to the lower edge of the bore. Capacity approx 12.1
- 6.1.23 Screw filler plug back in securely.

## 7.1 Changing the planetary gear oil servo super 90.

- 7.1.1 Only drain oil when the machine is warm. Perform oil change at both sides of the axle.
- 7.1.2 Move the drive wheel so that the drain plug is at the bottom. Clean the drain plug and remove it.
- 7.1.3 Drain and collect oil.
- 7.1.4 Do not let oil seep into the ground.
- 7.1.5 Move drive wheel so that oil level mark on the planetary housing is horizontal. Unscrew the oil filler plug.
- 7.1.6 Pour in oil until it comes up to the lower edge of the bore. Check the oil level again after a few minutes. Capacity approx 2 1 per planetary gear.
- 7.1.7 Screw the drain plug and the oil filler plug back in securely.

## 7.2 Exchange the hydraulic oil filters.

- 7.2.1 Exchange the hydraulic oil filters every time the hydraulic oil is changed only after major repair work on the hydraulic system.
- 7.2.2 If the hydraulic oil has to be changed at the same time as the filter is exchanged, exchange the filter only after the oil has been changed and the system bled.
- 7.2.3 Do not let draining oil seep into the ground.
- 7.2.4 The hydraulic oil filter fitted to the travel pump does not have to be exchanged as part of the maintenance work.
- 7.2.5 Hydraulic oil filter of 2-frequency machines in the vibration circuit.
- 7.2.6 Remove the locking wire if present.
- 7.2.7 Unscrew cap nut and remove filter bowl with filter element.

- 7.2.8 Collect the draining oil.
  - 7.2.9 Remove old filter element and clean filter bowl.
  - 7.2.10 Clean the thread of the filter bowl.
  - 7.2.11 Fit filter bowl with new filter element and in doing so, check condition of O-rings.
  - 7.2.12 Run diesel engine at low speed for maximum 3 minutes. This bleeds the hydraulic system.
  - 7.2.13 Check for leaks.
- 7.3 Changing the drive axle oil.
- 7.3.1 The drain and filter plugs of other axle versions are installed slightly differently. Perform oil changes using the following instructions as a guide. Only drain oil when the machine is warm.
  - 7.3.2 Clean filter plug and remove.
  - 7.3.3 Clean drain plug and remove.
  - 7.3.4 Drain and collect oil.
  - 7.3.5 Fit the drain plug.
  - 7.3.6 Refill with fresh oil servo gear super 90 upto level.
  - 7.3.7 Refit the filler plug.
- 7.4 Changing the oil of the vibration bearing on the right hand and left hand sides of the drum.
- 7.4.1 Change oil on both sides when machine is warm.
  - 7.4.2 Roll the drum so that the drain plugs are at the lowest point.
  - 7.4.3 Oil drain plug = oil filler plug.
  - 7.4.4 Remove drain plugs and drain and collect oil.
  - 7.4.5 Do not let draining oil seep into the ground.
  - 7.4.6 After the oil has drained out, move the drum so that the oil filler plugs are at the top.
  - 7.4.7 Remove control plugs at the bottom of the drum. Pour in oil until it emerges from the control bores. Engine oil as engine capacity per drum side approx.
  - 7.4.8 Reseal bores of oil filler plugs and control plugs securely.
  - 7.4.9 Recheck oil level at operating temperature (after approx 1 hour operating with vibration).

## **SAFETY PRECAUTIONS**

### **1. General**

- 1.1 Make sure that you are familiar with all the eqpt of your machine.
- 1.2 Do not drive the roller until you are fully familiar with all the operating and control elements and know precisely how your machine works.
- 1.3 Wear protective clothing such as safety helmet, safety shoes and gloves and ear protection.
- 1.4 Familiarize yourself with the area where you will be working.
- 1.5 Note where the fire extinguishers and first aid box are located and how they are used.
- 1.6 Only use the roller for the purpose it is intended.
- 1.7 **CAUTION:** - Keep away from the machine's articulation area when the engine is running!

### **2. Prior to the start**

- 2.1 Refer to the operating instructions before starting the machine.
- 2.2 Check the machine for any obvious faults.
- 2.3 Do not drive the machine if any instruments control lights or control elements are defective.
- 2.4 All protective devices must be properly secured.
- 2.5 Do not take any loose objects with you or, if you do, secure these to the machine or the cab.
- 2.6 Clean the cab windows and check windscreen wipers.

- 2.7 Keep the machine free of all oily or combustive materials.
- 2.8 Before climbing onto the machine, make sure that there are no person or obstacles near or under the machine.
- 2.9 Take care when climbing onto the machine (use the steps and hand rails)
- 2.10 Adjust your seat and safety belt before starting the engine.

### 3. **Starting**

- 3.1 All control levers must be at "neutral" when starting the engine.
- 3.2 Only start the engine from the operator's seat.
- 3.3 Check all indicators after the start to take sure that everything is functioning correctly.
- 3.4 Do not leave the machine unattended with the engine running.
- 3.5 When starting with a jump lead cable, connect positive to positive and negative to negative. Always connect the earth wire (negative) last and disconnect it first.

### **CAUTION**

Exhaust gases are toxic. Always ensure an adequate supply of fresh air when starting the engine in doors!

### 4. **Operation**

- 4.1 Before setting off, check that the controls, lighting and horn are working properly.
- 4.2 Match the speed of the engine to the operating conditions.
- 4.3 Keep away from edges and slopes.
- 4.4 Switch on the lighting is visibility is poor.
- 4.5 Always drive extremely carefully on slopes and always directly up or down the slope (never at an angle) Always shift to the lower travel speed range when approaching the slope.
- 4.6 Only change the direction of travel when the machine is at rest.
- 4.7 When driving in reverse, ensure that there are not persons or obstacles in the way.
- 4.8 Do not climb onto the machine when is traveling.
- 4.9 Do not use the machine to transport persons.
- 4.10 Watch out for unusual noises or smoke when operating the machine.
- 4.11 Trace the cause and have the fault corrected.
- 4.12 Do not switch on the vibration when the machine is on highly compacted material such as asphalt or concrete.

### 5. **Packing**

- 5.1 Before leaving the machine, switch the control lever to "neutral" apply the parking brake and shut down the engine.
- 5.2 If possible park the machine on level firm ground.
- 5.3 If you have to park on a gradient position your machine at a right angle to the slope and put wedges under the drums or wheels.
- 5.4 Never jump from the machine, but always use the access step & hand rails.

### 6. **Maintenance**

- 6.1 Make sure that the machine is on a flat, firm base when carrying out repair and maintenance work.
- 6.2 When working on the machine, secure the articulated joint with the brace.
- 6.3 Attach a warning sign to the steering wheel if the machine is defective.
- 6.4 Before starting work, check that all drums or wheels are locked in position and that the battery is disconnected.
- 6.5 Check connections and fittings for leaks once all work has been completed.
- 6.6 Wipe away any fuel or oil which has been spilt.
- 6.7 Do not smoke when filling up the tank or when checking the acid level of the battery.

- 6.8 Never check the acid level of the battery, the coolant level or the fuel with a naked flame.
- 6.9 Be careful with cleaning agents gasoline or other easily inflammable substances must be used for cleaning purposes.
- 6.10 There is a danger of scalding if you drain the engine oil or hydraulic oil at operating temperature.
- 6.11 Check whether hydraulic lines are depressurized before removing them.
- 6.12 Never set pressure relief valves above their specified rating.
- 6.13 With the system depressurized check all connections and fitting for leaks once all work has been performed.