Operation & Maintenance Manual

PC5500

HYDRAULIC MINING SHOVEL

SERIAL NUMBER 15011

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.
Due to this continuos program of research and development, periodic revisions may be made to this publication. It is recommended that customer contact their distributor for information on the latest revision.

December 2000

KOMATSU
MINING GERMANY

- Always keep at a distance from the edges of building pits and slopes.
- Avoid any operation that might be a risk to machine stability.
- Never travel across slopes; always keep the working equipment and the load close to the ground, especially when travelling downhill.
- On sloping terrain always adapt your travelling speed to the prevailing ground conditions. Never change to a lower gear on a slope but always before reaching it.
- Before leaving the driver's seat always secure the machine against inadvertent movement and unauthorized use.

SPECIAL WORK IN CONJUNCTION WITH UTILIZATION OF THE MACHINE AND MAINTENANCE AND REPAIRS DURING OPERATION; DISPOSAL OF PARTS AND CONSUMABLES

- Observe the adjusting, maintenance and inspection activities and intervals set out in the Operation,- Lubrication and Maintenance Manual, including information on the replacement of parts and equipment. These activities may be executed by skilled personnel only.
- Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.
- In any work concerning the operation, conversion or adjustment of the machine and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the start-up and shut-down procedures set out in the Operation,- Lubrication and Maintenance Manual and the information on maintenance work.
- Ensure that the maintenance area is adequately secured.
- If the machine is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by:
  - locking the principal control elements and removing the ignition key and/or
  - attaching a warning sign to the main switch
- Carry out maintenance and repair work only if the machine is positioned on stable and level ground and has been secured against inadvertent movement and buckling.
- To avoid the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically perfect lifting gear and suspension systems with adequate lifting capacity. Never work or stand under suspended loads.

INSTRUCTIONS FOR USE

Open the lock, lift the harness by the catch hook (C), the blue straps (leg straps J) are below. The harness is being put on just like a jacket. Pull the belly strap (E) through the lock, as shown on the illustration, and secure it.

By closing the breast strap, you avoid the shoulder straps to side-slip. Bring the leg straps (J) around the legs to the front, pull them in, as shown in the illustration, and tighten them. Adapt the harness to body form, seeing to perfect fit, in particular that the catching hook (C) be in the center of the back.

The safety harness should belong to its wearer personally.

The safety harness should only be used together with connectors acc. to EN 354, and fall arrest acc. to EN 355, or fall protection devices acc. to EN 360.

The attachment point for the safety harness should be above the wearer, and the carrying capacity of the attachment point should be sufficient to correspond with the minimum carrying capacity acc. to EN 795.

Legend for illustration Z21710

(1) Final drive, hub type travel gear

(2) Crawler carrier

(3) Track roller

(4) Carrier roller

(5) Guide wheel

(6) Swing circle guard

(7) Hydraulically operated access ladder, see page 44 for more information

(8) Hydraulic cylinder for access ladder

(9) Control switch for access ladder

(10) Battery main switches

(11) Emergency engine shut down switch and manuall actuator switch for the fire suppression system

⚠ CAUTION

Never stop the engines from a full load except in case of emergency.
If a hot engine is shut down without previous idling period of three to five minutes, the temperature in certain engine parts rising sharply after the cooling system ceases to function. The resulting thermal stress, especially in the turbochargers, may cause serious damage.

(12) Radiator of rear engine, designation number **1**

(13) Radiator of front engine, designation number **2**

(14) Sliding window of operator's cab, see page 52 for more information

(15) Emergency escape ladder, see page 48 for more information

(16) Exhaust muffler

(17) Engine air cleaners

(18) Grease barrel of Central Lubrication System (CLS)

(19) Grease barrel of Swing circle pinion Lubrication System (SLS)

(20) Counterweight

Legend for illust. Z 21646

A	Emergency escape ladder in storage position
B	Emergency escape ladder fastened on platform railing, ready for use.
C	Emergency escape ladder completely lowered to the ground
(1)	Sliding window, serves also for emergency exit
(2)	Emergency escape ladder with metal rungs and wire ropes
(3)	Hooks for fasten the ladder on the platform railing and for keeping the ladder in storage position
(4)	Bracket for emergency escape ladder in storage position

Using the emergency escape ladder

In case of emergency with normal walkways obstructed use escape ladder (2) for leaving the machine. Proceed as follows:

1. Remove hooks (3) with ladder (2) from bracket (4), see A detail (D).
2. Take out ladder package from hooks (3) and fasten hooks onto the railing, see B detail (E).
3. Remove clamps from ladder package (2) and lower the ladder to the ground, see C.

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Switch Board

Legend for illust. (Z 21722)

(14) Switch, interior illumination

(15) Switch, dashboard illumination

(16) Switch, warning beacon on cab roof *)

(17) Switch, main working lights (1)

(18) Switch, cab ventilation blower. Blower runs with low speed, even with switch in "0" position. (Cab pressurising prevents ingress of dust).

(19) Switch, mirror heating

(20) Not used

(21) Switch, manual actuation of central lubrication system

(22) Switch, manual actuation of slew ring gear pinion lubrication system

(23) Toggle switch, slew parking brake

- "0" Parking brake released - UP
- "1" Parking brake applied - DOWN.

⚠ CAUTION

The parking brake must only be applied with superstructure at complete standstill. Refer to page 217 for more information.

(24) Switch, windshield washer (main windshield and head light glasses)

(25) Switch, main windshield wiper (slow - fast) and wipers of head light glasses

(26) Enable switch for hydraulic service arm operation. Set this switch to ON position "1" before lowering the service arm. With this switch in ON position, the pilot control system is made inoperative and the hydraulic slew brake is applied. After completion of replenishment procedure, swing back the service arm to its home position and set switch (26) to OFF position "0".

(27) Key operated main switch

*) Special equipment

Legend for illust. Z21730

(A) Display with basic information

(B) Key board with 8 keys. For the function of the keys refer to page 81.

(C)) Key operated switch for enabling access to the INPUT-OUTPUT levels and input of operational data.

(D) Key section with 4 keys for menu control of Service Functions and for INPUT-OUTPUT functions (On Screen Display).

(9) RETURN Key, this key is used for returning to previous level of INPUT-OUTPUT or Service Functions.

(10) QUI Key, this key is used for access to the next lower level of INPUT-OUTPUT or Service Functions and going back to the Standard Display from a displayed current message.

(11) "0" Key, this key is used for selection of horizontal menu items within a main section of the inputs-outputs or service levels (LH direction).

(12) ”1” Key, same function as key (11) but in RH direction. Refer to page 113 Menu Control, for more information about the key section (D).

(13) Acoustic warning signal (Buzzer)

- This signal is heard for approximately 1 second when a fault message appears on screen (B).
- Continuous sound when the hydraulic oil level is too low.

⚠ CAUTION

In case of too low hydraulic oil level this signal sounds continuously. Shut down the Excavator, locate and correct the cause immediately. Fill up hydraulic oil to the correct level.

(14) Switch for truck counter on RH control lever. The loaded trucks can be counted by actuating this switch. The total number of trucks loaded will then be displayed on screen (A) for five seconds.

(E) Plug socket for connecting remote printer or other data downloading equipment.
For printing out the contents of the **Statistics** memory, press key (8) and key (6).For printing out the contents of the **Protocol** memory, press keys (7, 6 and 3). Keep key (3) depressed until all messages are selected and then press key (6) two times. Refer also to page 103 for more detailed information.

Automatic Display of Messages

If a fault or an information condition occurs during operation, the basic display is automatically replaced by a message in text. If a further condition occurs, another message is displayed so that the operator is always shown the latest message.
The message text provides the operator with an explanation of the condition in standard texts.

When a fault message is displayed, further ”HELP” information relating to the fault message can be obtained by pressing the ”DOWN” key (3), illust. Z21730. All fault and information messages are listed in section ”Message Texts”. Each message is related to a page. These MESSAGE PAGES are numbered and can be called up individually. When a fault message is displayed the number of operating hours is displayed and stored at the same time. Fault and information messages are held as long as their cause is existent

Maintenance Schedule

In accordance with the operating hours of the Excavator, the initial and periodic maintenance intervals are automatically displayed.

Example:

After the first 250 operating hours of the Excavator the following message will be displayed:

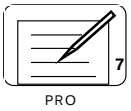
Initial 250 h Maintenance
Perform initial 250 h Maintenance.

Perform maintenance according to the Maintenance section.

Acknowledgement of performed maintenance.

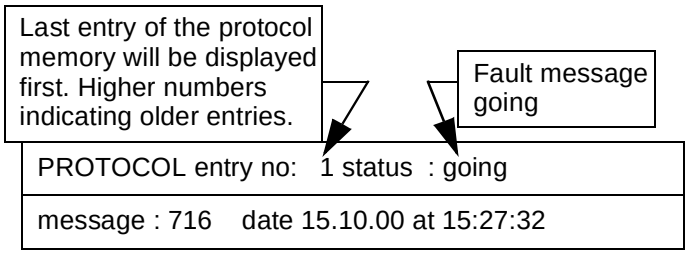
The acknowledgement of performed maintenance is obtained in the main group ”Service” under menu item ”Maintenance” refer to Menu Control Chart -V- on page 127.

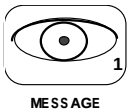
Display the Contents of Record (PROTOCOL) Memory, illust. Z21730



Press to display Protocol memory.

Display:

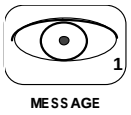




Press to display message 716.

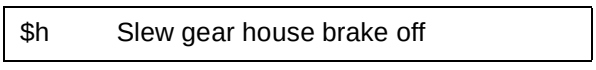
Example for other entries (e.g. Message No. 980)

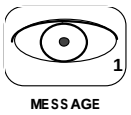
Press until the desired message **no. 980** appears.



Press to display message 980.

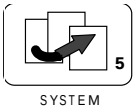
Display: Fault Message No. 980:





or

Press to return to the last message text.



Press to return to the basic display (Standard display) or to the last current message

Return to SYSTEM level:

Display of the Last Message Received or Menu
(Standard Display)

Operation of the keyboard (B) has no influence to the recording of input messages. For example, if the record memory is called up via keyboard (B), the ECS switches back to SYSTEM level after a period of 20 seconds when no further key is actuated within this period. For immediate return to SYSTEM level (message display or menu) press key 5 (SYSTEM).

Setting of Screen Brightness
Increase brightness: Press keys (5 and 2) simultaneously.
Decrease brightness: Press keys (5 and 3) simultaneously.

Ex works the display is adjusted to maximum brightness (basic setting). Any change of the screen brightness via keyboard (B) will be kept until the system is switched off. When the system is switched on again, the maximum brightness of screen (A) will be restored automatically (basic setting).

System Languages

The text of the messages and of the menu control of the ECS-System is available in 2 languages and can be selected in the main group SERVICE with the menu control.
Refer to the section ”SERVICE FUNCTIONS AND MENU CONTROL” for further information.

Message Numbers and Message PAGE Numbers

Each message of the two available system languages is related to a message page. The **message number** and the **message PAGE number** are identical for the **first language,** e.g. English.
The **message PAGE numbers** of the second language have always a higher number (offset), although the **message number** itself remains the same.
If, for example, the **message number. 500**
($h: Start blocked because of main Shut-Off (gate) valve)
is displayed in the English (first) language, the applying **message PAGE number is also 500.** In the second language e.g. German the message page number is 503. The message number displayed on the screen never changes, only the related message page number in the second language changes. If the contents of the protocol memory are printed out in the second language, only the message page numbers of the second language are shown on the print. Depending on the type of the message, the **message PAGE number** of the second language will be **higher** than the **message number** by the following numbers (offsets):

Message number range **500-1309**: message pages with **3** numbers offset
Message number range **1310-1349**: message pages with **1** number offset
Message number range **1350-1439**: message pages with **2** numbers offset

Message number range **1440-1515**: message pages with **5** numbers offset

Menu Control with Key Switch (C) and Key Group (D)

Display of Menu Options

Example: Display of **INPUTS-OUTPUTS**, starting from basic display on level -0-, see Menu Control Charts I and III.

The main group *INPUTS-OUTPUTS* is basically used for Testing procedures through authorized service staff and therefore locked during normal operation. Access to the *INPUTS-OUTPUTS* can be obtained in the main group *SERVICE* as described below.

Proceed as follows:

1. Press the ”QUI” key (10), the menu level -1- *TRUCKS* appears on the display, see Chart I.
2. Press key (12) three times, the main group *SERVICE* appears on display.
3. Press key (10), the menu level -2- with the starting group *Language* appears on the display.
4. Press key (12) four times, the group *INPUTS-OUTPUTS ON/OFF* appears on the display.
5. Press key (10), the menu level -3- with Menu item INPUTS-OUTPUTS Condition: 0 **(OFF)**” is displayed.
6. Press key (12), *OPERATE KEY SWITCH* appears on the display.
7. Operate key switch (C) ”Condition: 0 (OFF)” appears on the display.
8. Press key (12) to change the condition from ”0” to ”1 **(ON)**” Now access to main group *INPUTS-OUTPUTS* is possible.
9. Press the ”RET” key (9) two times for returning to the menu level -1-. The main group *SERVICE* appears on the display.
10. Press key (12), for display of the main group "INPUTS-OUTPUTS*.
    All menu levels and items within the main group INPUTS-OUTPUTS are now accessible by means of key group (D), refer to menu control charts on the following pages.

Data Transfer from Protocol and Statistics Memory to various Downloading Equipment

The illustration (Z 20731) shows typical arrangement of several downloading equipment connected to the text display interface plug socket (X27).

Legend for illust. (Z 20731)

(1)	Text display unit on instrument panel (E35)
(2)	Plug socket (serial interface X27) for connecting data transfer cable to units (4, 5, 6 or 9)
(3)	Plug socket for connecting current supply cable to units (5 or 6)
(4)	MODULAR MINING field computer system ”MMS”
(5)	Printer
(6)	Memory Card System ”MCS”. As a special equipment, this system can also be installed in the instrument panel ex works.
(7)	Memory card
(8)	Protective box for memory card
(9)	Laptop or PC
(10)	Soft- and hardware package for PROSTAT operation program
(11)	Data transfer cable (VL3)
(12)	Adapter for 25 pin interface on PC or laptop
(13)	3,5” disk PROSTAT software
(14)	Instruction manual PROSTAT (Service Bulletin No. 21-538)
(15)	Change-over switch for connecting the internal output channel to plug socket (2) or to the onboard MCS system (6) if so equipped
(E6)	Programmable Logic Controller ”PLC”
(VL4)	Data transfer cable to Memory card system (6)
(VL5)	Current supply cable to Memory Card System (6)
(VL6)	Data transfer cable to printer (5)
(VL7)	Current supply cable to printer (5)
(VL8)	Data transfer cable to field computer system (4)

REMARK

The downloading units shown in illust. (Z 20731) are special equipment.
More information to these units on request.

Level 4: Service / Settings / SLEW RING GEAR LUBE SYSTEM (SLS)

- 4 - Settings (minutes) * PAUSE TIME : *
- 4 - Settings (minutes) * MONITORING TIME : *
- 4 - Settings (minutes) * PRESSURE RELIEVE TIME : *
- 4 - Settings * LUBE CYCLE COUNTER : *

Level 5: Service / Settings / SLS / PAUSE TIME

- 5 - Settings OPERATE KEY SWITCH
pause time: new pause time:

Level 5: Service / Settings / SLS / MONITORING TIME

- 5 - Settings OPERATE KEY SWITCH
monitoring time: new monitoring time:

Level 5: Service / Settings / SLS / PRESSURE RELIEVE TIME

- 5 - Settings OPERATE KEY SWITCH
pres. relieve time: new pres. relieve time:

Level 5: Service / Settings / SLS / LUBE CYCLE COUNTER

- 5 - Settings OPERATE KEY SWITCH
cycle counter value: new cycle counter value:

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS / Y6b-1 VALVE FAN DRIVE 1 OIL COOLER (medium speed)

-4- Output signals | OPERATE KEY SWITCH
-4- Valve fan drive 1 oil cooler | 0 | 1 | Y6b-1 (A3.3):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS / Y6b-2 VALVE FAN DRIVE 2 OIL COOLER (medium speed)

-4- Output signals | OPERATE KEY SWITCH
-4- Valve fan drive 2 oil cooler | 0 | 1 | Y6b-2 (A3.4):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS / Y14a-1 VALVE FAN DRIVE 1 RADIATOR (minimum speed)

-4- Output signals | OPERATE KEY SWITCH
-4- Valve fan drive 1 radiator | 0 | 1 | Y14a-1 (A3.5):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS / Y14a-2 VALVE FAN DRIVE 2 RADIATOR (minimum speed)

-4- Output signals | OPERATE KEY SWITCH
-4- Valve fan drive 2 radiator | 0 | 1 | Y14a-2 (A3.6):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS / Y14b-1 VALVE FAN DRIVE 1 RADIATOR (medium speed)

-4- Output signals | OPERATE KEY SWITCH
-4- Valve fan drive 1 radiator | 0 | 1 | Y14b-1 (A3.7):

Fault No. 794: (797)	$h: Coolant temperature of engine 1 too high. Main pumps shifted to half power
Help:	Message through sensor B14.1 The engine operates with reduced load for a cooling down period.
Fault No. 800: (803)	$h: Faulty pressure switch for gear oil filter of PTO gear 1
Help:	Closed contact of pressure switch B27.1 for PTO-gear lubrication filter 1 with switched off engine. - Check pressure switch and cables.
Fault No. 806: (809)	$h: Faulty pressure switch for pump regulation oil filter
Help:	Closed contact of pressure switch B22 for pump regulation filter with switched off Engine. - Check pressure switch and cables..
Fault No. 812: (815)	$h: Faulty pressure switch for oil tank breather filter
Help:	Closed contact of pressure switch B24 for oil tank breather filter with switched off Engine. - Check pressure switch and cables.
Fault No. 818: (821)	$h: Faulty pressure switch for return oil filter
Help:	Closed contact of pressure switch B26 for return oil filter with switched off Engine. - Check pressure switch and cables.
Fault No. 824: (827)	$h: Faulty pressure switch for leak oil filter
Help:	Closed contact of pressure switch B25 for leak oil filter with switched off Engine. - Check pressure switch and cables.
Fault No. 830: (833)	$h: No 24 V voltage at circuit breaker F13
Help:	No 24 V behind circuit breaker F13. - Check circuit breaker F13. - Check current supply to circuit breaker.

Fault No. 1238: (1241)

$h: Shutdown through maintenance safety switch S58.

Help:

Maintenance safety switch S58 in machinery house actuated.
- Find cause

Fault No. 1244: (1247)

$h: Faulty monitor channel for level central lube system.

Help:

Level sensor B108 shows inadmissible values.
- Check monitor channel and sensor.

Fault No. 1250: (1253)

$h: Bucket motion switched off due to lubrication system failure

Help:

Automatic lubrication suspended for 4 hours.
- Perform manually actuated lubrication.
- Repair lubrication system.

Fault No. 1256: (1259)

$h: Faulty switch hydraulic oil level or lack of hydraulic oil

Help:

Stop the engines.
- Check level sensor B4 and B50.
- Check hydraulic oil level.

Fault No. 1262: (1265)

$h: Lack of hydraulic oil !
Fill up hydraulic oil !

Help:

Hydraulic oil level too low.
- Fill up hydraulic oil.

Fault No. 1268: (1271)

$h: Faulty monitor channel for level swing ring gear-lube system.

Help:

Level sensor B109 shows inadmissible values.
- Check monitor channel and sensor.

Fault No. 1274: (1277)

$h: Problems pump control.

Help:

Problem in the pump control.
- If the fault further exist, inform service.

3.6.1 EMERGENCY ENGINE SHUTDOWN SWITCHES

Legend for illustration Z 21749

(1) Pulling chains for emergency shut down from ground man (special equipment). When one of the chains (1) is being pulled down for emergency shut down of both engines, the Operator will be informed by the following message, displayed on the ECS screen: " # Engine shut down has been actuated from ground man"

(2) Emergency engine shutdown switch (S33a) on radiator door

(3) Emergency engine shutdown switch (S33b) behind front power house door

(4) Emergency engine shutdown switch (S33c) in pump compartment on center post

(5) Emergency engine shutdown switch (S33d) in rear engine room

(A) Push button of emergency shutdown switches (2, 3, 4 and 5) for stopping the engines

⚠ WARNING

- **In case of emergency push in the button (A) to stop the engines.**
- **Never stop the engines from a full load except in case of emergency. If a hot engine is shut down without previous idling period of three to five minutes, the temperature in certain engine parts rising sharply after the cooling system ceases to function. The resulting thermal stress, especially in the turbochargers, may cause serious damage.**

NOTICE

- **For restarting, first pull out button (A) and then start the engines in the normal way at control panel in the operator's cab. The engines can not be started with button (A) in depressed position.**
- **When one of the Shutdown switches (2 - 5) is activated, the ECS display informs the Operator by a corresponding message.**

Emergency Indication of Operating Conditions

The ECS system is equipped with an emergency indication via LED's on the Programmable Logic Controller "PLC" (E6), illust. Z21753.

In case of a malfunction of the text display in the operator's cab, the LED's in the fifth column (A13/A7) of the "PLC" indicating failures in vital operating systems of the Excavator.

The following faults are indicated:

Fault:	LED No.:
The ECS system is by-passed (By-pass switch S27 actuated)	H30
Start of engine 1 and/or engine 2 blocked, resp. engine shifted to low idle speed by one or more of the six high pressure filters or by the chip indicators of the main pumps. **NOTICE** **The LED "H31" monitors all six high pressure filters and the six chip indicators. Refer to page 191 for description of the diagnostic codes flashed out by LED "H31".**	H31
Engine overspeed	H32
Coolant pressure	H33
Coolant temperature	H34
Crankcase pressure	H35
Engine oil pressure	H36
Start of both engines blocked, resp. engine shut down, due to closed main shut-off (gate) valve hydraulic tank	H37
Faulty monitor channel for hydraulic oil temperature	H38
Too low hydraulic oil level! Stop the engines	H39
Faulty monitor channel engine speed	H112
Emergency shut down switch actuated	H116
Engine shutdown from ground man	H135

⚠ CAUTION

Before starting the Engines, make sure that no one will be endangered when starting the Engines.

CHECK THE FOLLOWING ITEMS

Legend for illustration Z 21756

(1) Engine oil pan dipstick oil level gauge

(2) Oil filler tube for engine oil pan

(3) Coolant expansion tank of front and rear engine radiators

(4) Coolant level sight gauge on front and rear coolant expansion tanks

(5) Cover plates on power house roof above front and rear radiator pressure caps

(6) Radiator pressure caps

Walk-around Inspection

Make a ”Walk-around” inspection of the Excavator. Refer to Maintenance Section 4. for the daily inspection items.

Engine oil level of Front and Rear Engine

Check oil level with Excavator standing on level ground. Check oil level in engine oil pan with the dipstick oil gauge (1). For accurate readings, the oil level should not be checked until the oil has settled into the oil pan after the engine has been shut down (about 5 minutes). Keep the oil level as near the H (high) mark as possible.

COOLANT LEVEL

⚠ WARNING

DO NOT remove the radiator pressure cap (6), illust. Z21756 from a hot engine. Wait until the temperature is below 50°C before removing the pressure cap (6). Failure to do so can result in personal injury from heated coolant spray or steam. Turn the radiator cap (6) slowly counterclockwise to the safety stop to allow the pressure to escape, then continue to turn until cap is free to be removed.

The coolant level should be in the upper field of the sight gauges (4). If necessary add coolant.

REMARK

Refer to the Engine Manual for the correct coolant composition.

Emergency By-pass Switch for the ECS- Shut-down Function.

The unit is equipped with an Emergency By-pass Switch for the ECS-system.
This switch is located on the ”X2” switch board in the cab base compartment and marked with **”S27”**.
If an automatic shut-down of the Excavator happens, with a dangerous situation for man or machine, which needs the Excavator to be operable to overcome the dangerous situation, actuate this switch to override the shut-down function of the system and to enable a restart of the engines.

⚠ CAUTION

As soon as the immediate situation of danger is over, shut down the unit. Correct the fault that caused the shut down and re-set the Emergency By-pass switch.

REMARK

When a battery voltage fault has occurred, the operational data (oil vicosities, timer settings etc.) stored in the Programmable Logic Controller (PLC) can be lost and must be re-entered after the correct battery voltage has been re-established.

Engine warm-up

After starting let the engines run for a warm-up period before increasing the engine speed. This is necessary to avoid piston and bearing seizure.
Refer to the engine operation and maintenance manual for the most favourable coolant temperature.

Hydraulic oil warm-up

- On machines without hydraulic oil pre-heating system:
  DO NOT start the engines if the ambient temperature (oil temperature) is below the starting temperature shown in column "1" of the hydraulic oil viscosity chart on page page 212 in this section.

- On machines with hydraulic oil pre-heating system:
  Before starting the engine, warm-up the hydraulic oil to the starting temperature shown in column "1" of the hydraulic oil viscosity chart.

Releasing the Parking Brake

Move up toggle switch (4) to position **"0"**. In this position the switch is automatically pulled down by spring force.

NOTICE
Be sure to release the parking brake before slewing the superstructure.

Hydraulic Slew Brake actuated by hydraulic access Ladder and Service Arm of Central Refilling System

The hydraulic slew brake will be applied automatically when the access ladder and/or the service arm of the central refilling system is not in its completely lifted position.

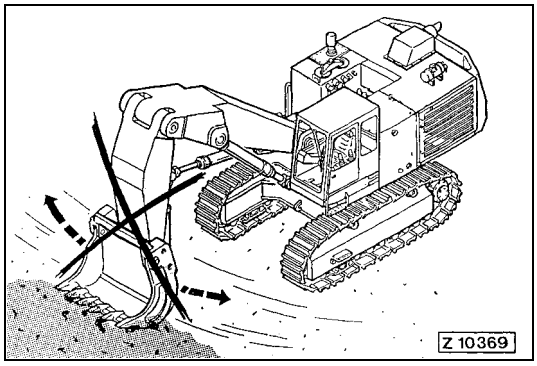
Important Instructions for Slewing the Superstructure

⚠ WARNING

- **DO NOT swing over persons or over the unprotected cab of a truck.**
- **DO NOT level the ground in front of the excavator by turning superstructure back and forth.**
- **DO NOT jump off the rotating superstructure.**
- **Never swing against the wall of a pit. First raise the attachment out of the pit and then start rotating the superstructure.**
- **Start digging only after finishing the slewing operation.**

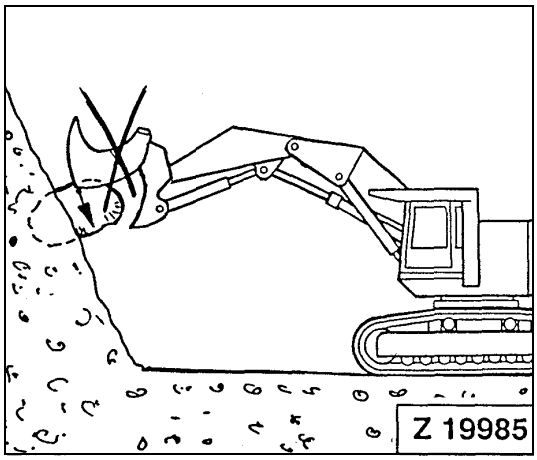
⚠ CAUTION

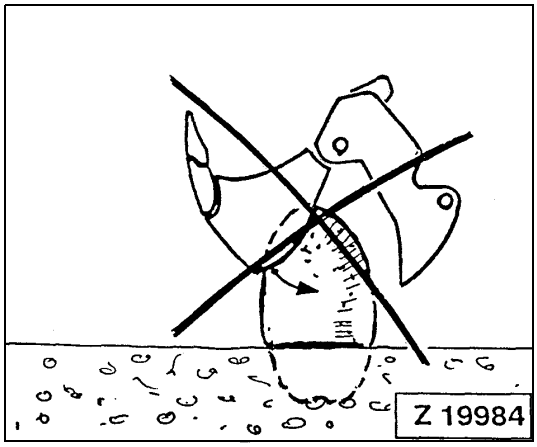
DO NOT "Sweep" with the loader attachment, illust. (Z 10369), as this may result in severe damage on slew gear components.



⚠ CAUTION

DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.





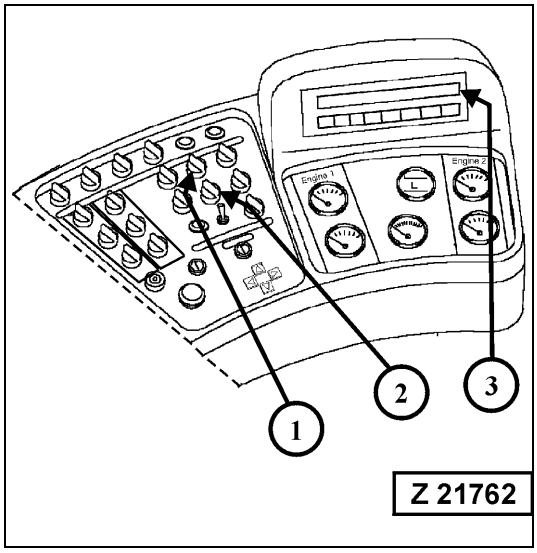
SWING CIRCLE LUBRICATION SYSTEM ”SLS”

Repairs on the swing circle lubrication system with the Engine running or with the Engine OFF and Main Switch Key in ON position

If repairs under the above conditions have been carried out it is necessary to reset the control circuit of the lubrication system by actuating the rotary switch (2), illust. (Z 21762) for a full lube cycle.

If this manually actuated lube cycle is not being carried out, the fault message ”LUBE SYSTEM FAILURE” will remain on the ECS display (3).

Resetting of the lube system control circuit can also be done by shutting down the engine and switching OFF the main switch key.



NOTICE
For more information regarding inspection, trouble shooting and maintenance of the lubrication system, refer to the separate manual LUBRICATION SYSTEMS in part 3 of this binder.

ADJUSTMENTS OF THE SWING CIRCLE-LUBRICATION SYSTEM

The following adjustments can be made in the service menu of the ECS system:

Level 4: Service Menu / Settings

- *PAUSE TIME
- *MONITORING TIME
- *PRESSURE RELIEF TIME
- *LUBE CYCLE COUNTER

Refer to section "ELECTRONIC MONITORING AND CONTROL SYSTEM ECS" for description of adjustment procedure.

3.18.1 SYSTEMS CONNECTED TO THE REFILLING SYSTEM

The following systems are connected to the receiver panel (5) of service arm (3), illust. (Z 21764):

- Fuel Tank
- Water Tank for Hand Wash Sink in the Operator's Cab
- Front and Rear Engine Oil Pan
- Front and Rear Engine Coolant Radiator
- Main Hydraulic Oil Reservoir
- Central Lubrication System (CLS)
- Swing circle pinion Lubrication System (SLS)

Legend for illustration Z 21764

(1) Enabling switch for hydraulic service arm operation

(2) Actuating chain for lowering and lifting of hydraulic service arm (3)

(3) Service arm, hydraulically operated

(4) Monitoring and control box

(5) Receiver panel

(6) Actuating chains for Operator Warning System or Emergency Shutdown of the Engines (if so equipped).

Operation of the hydraulic Service Arm

⚠ WARNING

- **Never enter, or allow anyone else to enter the moving range of the service arm (3). Death or serious injury can result.**
- **DO NOT loosen any connections on the hydraulic circuit of the service arm. The circuit is under pressure. Lower the service arm completely before carry out any work on the hydraulic circuit.**

REMARK

With Enabling switch (1) in ON position "1" and/or Service Arm (3) not in fully lifted home position, the pilot control system is inoperative i.e. no Excavator movement possible.

3.18.4 REFILLABLE GREASE CONTAINERS OF THE CENTRAL LUBRICATION SYSTEM AND SWING CIRCLE LUBRICATION SYSTEM

Legend for illustration Z 21766

(A) Location of grease filters in the power house (on rear engine radiator side)

(2) Grease filter for central lubrication system. Before filling the grease container make sure the filter is not obstructed. Service the filter element according to the instructions in the maintenance section 4, item no. 4.8.

(3) Grease container of the central lubrication system

(4) Hydraulically driven grease pump

(5) Grease pressure gauge

(8) Grease filter for swing circle pinion lubrication system. Before filling the grease container make sure the filter is not obstructed. Service the filter element according to the instructions in the maintenance section 4, item no. 4.8.

(9) Grease container of the swing circle pinion lubrication system

(10) Hydraulically driven grease pump

(11) Grease pressure gauge

Refill the respective grease container, when the Fault message

”Central lube system grease container empty”
or
”Swing circle lube system grease container empty”

is being displayed on the ECS monitor.

⚠ CAUTION

The central lubrication system and the swing circle pinion lubrication system have to be filled with different types of grease. Select the correct greases according to the Lubricant Charts in part 3 of the Service Literature Binder.

As soon as a grease container is filled up to the correct level the corresponding indicator lamp (12 or 14), illust. (Z 21765) lights up. In order to ensure proper operation of the lubrication systems carry out the periodic maintenance of the grease filters (2 and 8), illust. (Z 21766). Refer to maintenance section 4, item no. 4.8. Periodic inspection of the grease pumps (4 and 10) at least once a year is advisable. After finishing the refilling operation, cover the adapters with the protection caps provided. Carry out a test-run of the lubrication systems by actuating the switches on the instrument panel.

4. MAINTENANCE

Service Intervals	Service Point	Service	See
Every 250 operating hours or monthly	Refrigerant compressor	Check drive belt tension	page 331
	Undercarriage pin connections	Lubricate	page 333
	Signal horn compressor	Lubricate	page 333
	Oil cooler fan bearings and Radiator fan bearing	Check oil level in bearing housings	page 333
	Automatic lube systems	Clean in-line grease screens	page 335
	Cab, air filter	Clean or replace filter element	page 339
	Engine	Maintenance	(1)
	Fire suppression system	Inspection	(2)
	Air conditioning for Operator's cab	Inspection	(3)
Every 500 operating hours or quarterly	Batteries	Check fluid level	page 341
	Flexible Couplings	Check oil level	page 343
	Fuel tank	Drain condensation	page 345
	Crawler tracks	Inspection	page 347
	Fire detection and actuation system	Maintenance	(2)

(1) Perform maintenance according to separate Engine Operation an Maintenance Manual filed in part 3 of this binder.

(2) Perform inspections according to the separate Manuals "FIRE DETECTION AND ACTUATION SYSTEM" and "FIRE SUPPRESSION SYSTEM" filed in part 3 of this binder.

(3) Perform inspections according to the separate Manual "OPERATING INSTRUCTIONS AC" filed in part 3 of this binder.

⚠ CAUTION

Carry out initial service according to item 4.6.1.

Air Cleaner Maintenance, illustration Z 20716

NOTICE

- **If the fault message "Air cleaner element restricted" is again displayed on the ECS screen after installation of a new main filter element the safety-filter element has also to be replaced.**
- **If faulty service or a defect has been detected while servicing the main filter element also the safety filter element has to be replaced.**
- **After having the main filter element cleaned three-times or replaced also the safety filter element has to be replaced.**

Replacing the safety filter element (7):

1. Remove element in sequence of ref. no. (1 to 7).
2. Cover air intake opening.
3. Install new safety filter element (7).

⚠ WARNING

The safety filter element may not be cleaned and re-used

4. Remove cover from air intake opening.
5. Install safety and main filter element, take care service indicator (6) is correctly secured by cotter pin (5).

General Service Tips

The air cleaners should be inspected periodically to maintain maximum engine protection and maximum service life. These inspections should include the following points.

1. Inspect the air transfer duct between the air cleaner and the engine to be sure all clamps are tight, all flange joints are tight, and there are no cracks in the ducting.
2. Air cleaner mounting bolts and clamps must be tight to hold the air cleaner securely.
3. Check the dust caup to make sure it is sealing 360° around the air cleaner body.
4. Automatic dust unloader valve (if so equipped) must be in place, not inverted or damaged, and free from obstruction.

4.7.5 COLD STARTING AID, REPLACE FLUID CYLINDER

Legend for illustration Z 20719

(01) Electrically operated valve

(02) Mounting clamp

(03) T connector

(04) Injection lines

(05) Cold start fluid injectors

(06) Mounting bolts

(07) Cold start fluid cylinder

⚠ WARNING

- **Starting fluid is poisonous and flammable**
- **Do not store replacement cylinders in living areas**
- **Do not smoke while changing cylinders**
- **Use only in well ventilated areas**
- **Use with care to avoid fires**
- **Avoid breathing of vapours or repeated contact with skin**
- **Do not puncture or burn cylinders**
- **Discard cylinders in a safe place**
- **Keep fluid container away from heat, sparks, open flame, or open sunlight. It may explode**
- **Observe instructions on the container**
- **Do not store or use at temperatures above 93° C (200° F)**

4.8.2 AIR CLEANER - CLEAN PRE-CLEANER

Clean dust cups of pre-cleaners

Legend for illust. Z 21770:

(1) Roof mounted air cleaner units

(2) Air intake screen

(3) Clamps

(4) Dust cups

(5) Jet tubes

1. Provide suitable container for collecting the dust before opening the dust cups (4).
2. Loosen the clamps and swing down dust cups (4).
3. Remove dust from pre-cleaner dust cups.
4. Check condition of the dust cup gaskets and replace if necessary.
5. Swing back dust cups (4) to closed position and secure with the clamps provided.
6. Check air cleaner mounting parts for tight fit and security.

NOTICE
When operating the machine under very dusty conditions, check pre-cleaner jet tubes (5) for plugging. Dust plugging of tubes can be removed with a stiff fiber brush.
Never clean tubes with compressed air unless both the primary and safety elements are installed in the air cleaner. Do not steam-cleam tubes.

PLANETARY GEAR BOX - CHECK OIL LEVEL

see view -A-, illustration Z 20316:

Move the Excavator so, that one of the four plugs (2) on the planetary gear box is in line with oil level marking (1). Remove plug (2). The oil level should be at lower edge of opening (2). If necessary add oil through filler opening (3). Insert both plugs (2 and 3) and tighten securely.

SUPPORT BEARING BOX - CHECK OIL LEVEL

see view -A-:

Check oil level by removing oil level plug (5). Oil level should be at lower edge of opening (5). Add oil through filler opening (6) if necessary and install plugs (5 and 6).

SPUR GEAR BOX - CHECK OIL LEVEL

see view -B- and -C-:

Check oil level by removing oil level plug (8).
Oil level should be at lower edge of opening (8), if necessary add oil through filler opening (9). Install level and filler plug (8 and 9).
Check breather filter (19), illustration Z21771 on page page 321 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

BRAKE HOUSINGS - CHECK OIL LEVEL, VIEW -C-:

Check oil level by removing oil level plugs (12). Oil level should be at lower edge of openings (12). If necessary Add oil through filler openings (13) and install plugs (12) and (13).
Check oil level in both brake housings of each gear.

MOTOR ADAPTER HOUSING - CHECK OIL LEVEL, VIEW -C-:

Check oil level by removing oil level plugs (15).
Oil level should be at lower edge of openings (15). If necessary, remove connector (16) for breather filter line and add oil through filler opening. Install level plugs (15) and screw in breather filter line connectors (16).

MILEAGE INDICATOR (Special Equipment)

The mileage indicator is fitted to the center bore of the spur gear box below breather filter connector (11).

NOTICE
Travel gears, Brake- and Motor adapter housings have different types of oil. Refer to page 273 for the correct oil specifications.

4.9.5 HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY

See illustration Z 20369

⚠ CAUTION

Provide adequate working platform for safe access to the hydraulic oil coolers.

1. Loosen mounting bolts (1).
2. Open door (2).

REMARK

Details (A and B) i show LH hinge mounted oil coolers. The description below applies also to RH mounted oil coolers.

3. Loosen fasteners (3) and swing out oil coolers (4 and 5).
4. Secure door (2) and oil coolers (4 and 5) with locking bars (7, 8 and 9).
5. Clean the oil coolers with compressed air. Direct the air flow from inside to outside.
6. After cleaning, bring back the oil coolers to their home position.

PROCEED AS FOLLOWS

- Disengage locking bars (7, 8 and 9) and bring them in storage position (10).
- Swing back inner cooler (5). Take care guide pin (A) fits into hole (B) of main frame (6). Secure cooler (5) with fastener (3).
- Swing back outer cooler (4); observe (A - B) and secure with fastener (3).
- Close door (2); observe (B - A). Install mounting bolts (1) and tighten securely.

NOTICE

When cleaning the oil coolers, inspect also laying and fastening of the hydraulic oil lines.

4.10.7 CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT

Legend for illustration Z 21468

(1) Air cleaner housing located on cab base

(2) Filter element

(3) Cab base wall

(4) Seal ring

(5) Cab blower

(6) Blower housing

(7) Air hose to base roof

(8) Air hose to cab bottom

Clean and inspect filter element (2) as follows:

1. Remove air cleaner housing (1).
2. Remove and inspect element (2). If any rupture, holes or damaged gaskets are discovered replace the element.
3. If the element is useable clean with compressed air from inside to outside and re-install.
4. Inspect seal ring (4), housing (6) and air hoses (7-8) for correct fastening and tightness.

CHECK ADJUSTING RANGE FOR GUIDE WHEELS

Legend for illustration Z 20015

(1) Guide wheel

(2) Slide block

(3) Stop plate

“X” Adjusting range for track tension

The adjusting range for track tension is the distance “X” between guide wheel slide block (2) and stop plate (3). Depending on lenghtening of the track the slide block (2) may come in contact with stop plate (3). In such a case, it must be ensured that the track does not become too loose, Depending on track condition, the removal of one track pad will restore the adjusting range “X”. If necessary contact our Service Department for more information.

⚠ WARNING

Before working on the track adjusting system, relieve all pressure in the system by opening the main shutoff cocks (2 and 3), see illust. Z 21774 on previous page.

NOTICE

- **If removal of a track pad becomes necessary, it must be done on both tracks in order to maintain the same length of both tracks.**
- **During operation, the shutoff cocks (2 and 3) must always be in CLOSED position. Open cocks (2 and 3) for pressure relieve prior servicing any part of the system, e.g. removal of a track pad.**

High-Strength Bolt Connections (continued)

Check mounting of Operator's cab, illust. Z 21683

- Check tightening torque of mounting bolts as indicated in the illustration.
- Check condition and fastening of chains (1).
- Check the silicone oil filled viscous mounts (2) for leakage and signs of fatigue.

High-Strength Bolt Connections (continued)

Check fastening and condition of the eight power house posts (75) and transverse carrier (82), illust. Z 20706

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(85)	M30	10.9	46	1770	48
(86)	M24	10.9	36	880	12

* SW = Wrench size

High-Strength Bolt Connections (continued)

- Check fastening and condition of main hydraulic pumps (1-6), illust. Z 20710.
  Mounting bolt size: M20, Grade 8.8, tightening torque 360 Nm.

- Check fastening and condition of auxiliary pumps (8.1 - 8.6) and secondary hydraulic pumps (10.1 - 10.4).
  Mounting bolt size: M12, Grade 8.8, tightening torque 74 Nm.

Pump Description:

(1-6)	Main hydraulic pumps, swash plate type for all working and travelling motions.
(8.1-8.6)	Gear type pumps.
(10.1-10.4)	Axial piston pumps.

High-Strength Bolt Connections (continued)

Check condition and fastening of swivel joint (A), illust. Z 20865

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1)	M 16	10.9	24	265	4
(2)	M 16	10.9	24	265	8

* SW = Wrench size

High-Strength Bolt Connections (continued)

Cable Drum for Excavators with Electric Prime Mover

- Check condition anf fastening of parts (01 - 06) and (10, 30 and 40), illust. Z 20620

Legend for illust. Z 20620

(01) Junction box

(02) Brake motor

(03) Drum body

(04) Cable guide rocker arm

(05) Sliding frame

(06) Drive chain guard

(10) Cable drum carrier frame

(11) Mounting bolts frame (10) to undercarriage center section

(14) Mounting bolts junction box (01) to frame (10)

(19) Mounting bolts drum (03) to frame (10)

(20) Lock nut

(21) Adjusting screw for drive chain tension

(30) Limit switch, cable end

(40) Actuator lever for limit switch (30)

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(11)	M20	10.9	30	510	40
(14)	M20	10.9	30	510	4
(19)	M16	10.9	24	265	4

* SW Wrench size

REMARK

For more information concerning cable drum maintenance refer to the separate booklet CABLE DRUM in part 3 of this binder.

* SW = Wrench size

FILTER SERVICE

High Pressure Filters "HPF", illustration Z 21780

NOTICE

- **The filter reference numbers (1 - 6) correspond to the numbering of the main pumps.**
- **If, for example, the fault message "High pressure filter #5 restricted" is being displayed on the ECS screen, the filter number (5) in the illustration has to be serviced. The engine will be shifted automatically to low idle speed. The fault message can be generated either through a restricted high pressure filter or through the corresponding chip indicator mounted in the main pump sump. Stop work and inform Service staff about the fault message.**

Legend for illustration Z 21780

(1) HPF for pump 1

(2) HPF for pump 2

(3) HPF for pump 3

(4) HPF for pump 4

(5) HPF for pump 5

(6) HPF for pump 6

(7) Drain plug

(8) Filter case

(9) Hexagon

(10) Filter element

(11) Packing ring

(12) O-ring

(13) Back-up ring

(14) O-ring

(15) Filter header

Clean or replace high pressure filter elements:

1. Place working attachment on the ground and shut-off the engines.
   Relieve pressure in the hydraulic system with several movements of the control levers.

2. Place a suitable container below the filter in order to collect outflowing oil.

3. Remove plug (7) and drain the oil.

4. Screw off filter case (8).

4.12.4 SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE

See illustration Z 9543

Unscrew collector protection cap (2).
Unscrew ball bearing cover and fill it half way up with grease.

If the fins of the collector are very strongly blackened or coated with verdigris, clean them with emery cloth.

HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illust. Z 21787

(6) Hand wheel of main shut off valve between main oil reservoir and suction oil reservoir

- To open the valve, turn hand wheel (6) CCW to the stop
- To close the valve, turn hand wheel (6) CW to the stop

NOTICE
Before starting the engines, make sure the shut off valve is completely open by turning the hand wheel (6) fully to the left (CCW).

(11) Compensator

(12) Intermediate pipe

(13) Gaskets

(14) Suction oil strainer

(15) Suction oil reservoir

(16) Drain coupling

Attach drain hose (part of tool set) to coupling (16) and drain oil from suction oil reservoir. Remove intermediate pipe (12) and strainer (14). Install new strainer (14) with new gaskets (13).

REMARK

There are six further strainers installed in the suction oil reservoir (15). Refer to page 431 for replacement instructions.

4.14.1 SWING MACHINERY, BRAKE AND MOTOR ADAPTER HOUSING - CHANGE OIL

Illustration Z 21502

I Front Swing Machinery

II Rear Swing Machinery

- Swing Machinery "G"

(A) Position of oil level gauges for checking the oil levels

(G1) Oil level gauge

(G2) Oil filler plug

G3) Breather filter

(10) Wiggins system

- Brake Housing "B"

(B4) Oil level gauge and filler opening

(B5) Breather filter

(B6) Evacuation nozzle for Wiggins system

- Motor Adapter Housing "M"

(M7) Oil level gauge and filler opening. The level gauge pipe can also be used for evacuation of the oil by inserting the hose of a suction pump.

(M8) Breather filter

(M9) Oil drain plug

BRAKE HOUSINGS - CHANGE OIL

See illustration Z 20316, View -C-

⚠ CAUTION

The brakes must be released for changing the oil.

1. Place wedges at front and rear side of both crawlers.
2. Start the engine and lower the bucket onto the ground.
3. Have a second person for control in the operator’s cab.
4. Change the oil. Remove parts (12 to 14) and drain the oil. Install plug (14) and fill in fresh engine or hydraulic oil up to level openings (12). Install plugs (12 and 13).
5. Change oil in all four brake housings.
6. Shut down the engine.

NOTICE
Be sure to fill the brake housings and motor adapter housings with engine oil or hydraulic oil as specified on page 273.

MOTOR ADAPTER HOUSINGS - CHANGE OIL

1. Remove plugs (15 to 17) and drain the oil completely.
2. Install drain plug (17) and fill-up engine or hydraulic oil to level openings (15). Install plugs (15 and 16).

4.16.1 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE

See illustration Z 20674

On standard Excavators there are no special protective measures necessary.
However, the general protective measures (A and B) must be observed.
On Excavators with a power unit (generator set) mounted to the undercarriage, all electrical connections between the Excavator and the power unit have to be disconnected.