

Operation & Maintenance Manual

PC5500-6

HYDRAULIC MINING SHOVEL

SERIAL NUMBER 15040

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- 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 Z25489

- (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 46 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 manual actuator switch for the fire suppression system, if so equipped.

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 54 for more information
- (15) Emergency escape ladder
- (16) Exhaust muffler
- (17) Engine air cleaners
- (18) Hydraulically driven grease pump of the Central Lubrication System (CLS) for attachment
- (19) Hydraulically driven grease pump of the Central Lubrication System (CLS) for superstructure
- (20) Hydraulically driven grease pump of the Swing circle pinion Lubrication System (SLS)
- (21) Counterweight

WARNING

The chambers of the counterweight are filled with a mixture of concrete, granulated ore and steel pellets. This mixture can create explosive gases which will accumulate in the chambers of the counterweight. Before any welding, flame-cutting, grinding or drilling procedures are carried out on the counterweight it is vital to expel these gases from the counterweight chambers. Failure to properly expel the gases from the counterweight chambers can result in an explosion with serious personal injury or death. Follow the instructions given in PARTS & SERVICE NEWS No. AH04518 for expelling the gases from the counterweight chambers.

Legend for illust. Z24090

- (1) Sliding window, serves also for emergency exit
- REMARK**
- If the operator's cab is equipped with external metal sun visors, disengage the four catches and push out the sun visor panel.
- (2) Release lever for hinged railing bar (3)
 - (3) Hinged railing bar
 - (4) Rigidly mounted emergency escape ladder. The rigidly mounted emergency escape ladder with rope ladder extension provides the means to go down to the ground.
 - (5) Rope ladder. The upper end of the rope ladder is fixed onto the lower rung of the rigid escape ladder (4) by means of the fasteners (6), see detail (X). The lower end of the rope ladder is fixed on brackets (8) and secured with rubber fasteners (7), see section (A-A).
 - (6) Hooks for fastening the rope ladder onto the rigid ladder (4)
 - (7) Rubber fasteners for rope ladder in lifted position
 - (8) Bracket for rope ladder in lifted position. The lower rung of the rope ladder is hooked up into the brackets (8)

Using the emergency escape ladder

In case of emergency with normal walkways obstructed use escape ladder (4) and (5) for leaving the machine. Proceed as follows:

1. Move up lever (2) and pull out.
2. Open the hinged railing bar (3).
3. Unhook fasteners (7) and take out rope ladder rung from brackets (8).
4. Let the rope ladder fall down to the ground. The upper end of the rope ladder is fixed onto the lower rung of the rigid ladder (4).
5. Use the rigid ladder (4) and then the rope ladder (5) for leaving the shovel.

Operator's Seat Adjustment

Before operating the Shovel adjust the seat and mirrors for Operators maximum comfort, visibility, and complete control of the Shovel.

Legend for illust. (Z 21420):

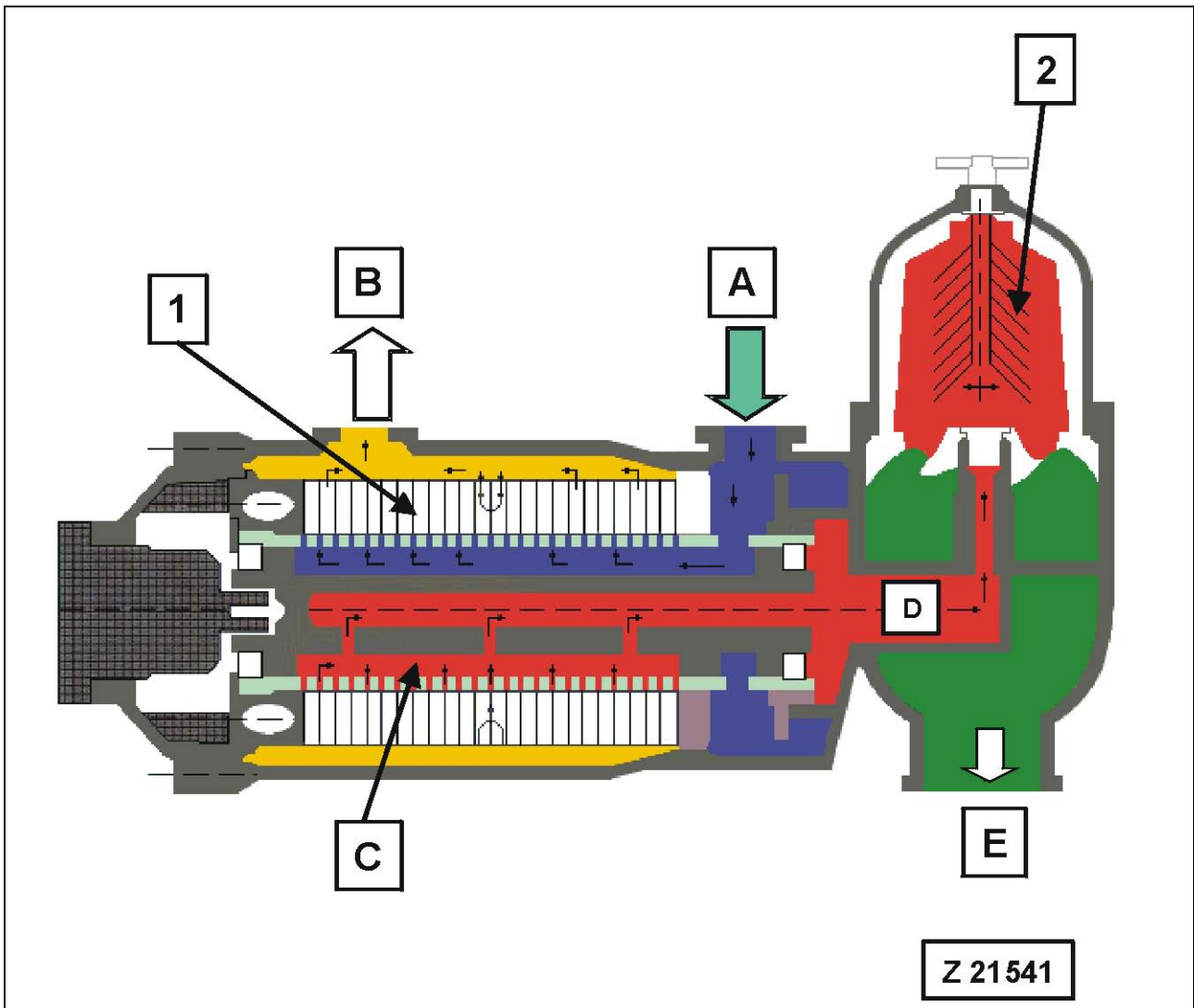
- (1) Seat suspension adjustment (firm to soft ride)
- (2) Height adjustment
- (3) Seat depth adjustment
- (4) Seat cushion tilt adjustment
- (5) Fore/aft adjustment
- (6) Not used on this model
- (7) Control lever carrier
- (8) Headrest (optional)
- (9) Seat heater switch (optional)
- (10) Lumbar support adjustment
- (11) Armrest, foldable
- (12) Armrest adjustment
- (13) Backrest adjustment
- (14) Fore/aft isolator
Seat belt (not shown)

▲ WARNING

- **Use seat belt in accordance with the local safety regulations and laws.**
 - **Check condition and fastening of the seat belt. Replace any worn or damaged part of the seat belt system.**
 - **To ensure proper functioning of the seat belt replace the seat belt and securing parts after every three years.**
-
-

For more Information, refer to the separate Operating Instruction Manual "AIR SUSPENSION SEAT" in volume 2 binder.

Eliminator Engine Oil Filtration System



Legend for illust. Z 21541 (schematic illustration)

- | | | | |
|-----|--|-----|--|
| (A) | Oil inlet from engine (100%) | (E) | Oil flow to engine oil pan (5%) |
| (B) | Oil outlet to engine (95%) | (1) | Stainless steel filter removes particles as small as 20 µm |
| (C) | Backflush oil (5%) for cleaning the filter | (2) | Centrifugal separator removes particles up to a size of 2 µm |
| (D) | Oil flow to centrifuge (5%) | | |

3.3.3 OPERATOR'S CONSOLE

Legend for illustration Z25396

- (1) Analog gauges, see page 83 for more information
- (2) Text display with key board of the Electronic Control and Monitoring System (ECS). Refer to page 92 for more information.
- (3) Ashtray
- (4) Switch board, see page 83 for more information
- (5) Heater control panel, see page 198 for more information
- (6) Air conditioning control panel, see page 198 for more information
- (7) Switch for adjustment of left and right cab mirror
- (8) Cigarette lighter
- (9) Plug sockets 24V DC
- (10) Radio
- (11) Switch board lighting with flexible arm

⚠ CAUTION

**Make sure the cab door is always closed when working with the Shovel.
Secure the door in open position with the locking device provided.**

Interface Panel for Diagnostics and Controls for Heating and Air Conditioning (continued)

Legend for illust. Z25354

- (5) Control module for the engine independent auxiliary cab heater.
Special Equipment
 This module is used for switching ON and OFF the auxiliary cab heater during operation of the shovel with the Diesel engines running, and for pre-selection of heater start times and duration of heating periods. For detailed setting instructions of the control module refer to the separate operating instruction sheet in volume 2 binder.
- (6) Button for actual time indication
- (7) Button for preselection of heating time
- (8) Button for heating indication
- (9) Button for settings backwards
- (10) Button for settings forward
- (11) Not used
- (12) Display shows the operating condition of the auxiliary cab heater
- (13) Thermostat for engine independent auxiliary cab heater.
Special Equipment
 This unit is used to maintain a desired temperature in the cab during standstill periods of the shovel. For operation of the auxiliary cab heater, power supply must be provided by an external power source connected to the 1X1 plug socket at the cab stairway. The battery main switches and the pre-heating system main switch must be in ON position. See section PRE-HEATING SYSTEMS on page 226 and section OPERATING THE HEATER; VENTILATION AND AIR CONDITIONING on page 198 for more information. The fuel shut-off cock for the water heater HYDRONIC must be in open position, see page 201 for more information. Activate the heater with control module (5). With switched off pre-heating system, the control unit (13) is inoperative.
- (14) Temperature selector button
- (15) Air conditioner temperature control knob
REMARK
 To lower the cab air temperature (maximum cooling output) rotate the control knob to the left (-) sign. To reduce cooling output rotate the knob to the right (+) sign.
- (16) Air conditioner blower control knob
- (17) Indicator light, air conditioning ON
- (18) Indicator light, air conditioning blower ON

3.4.2 OPERATING THE ELECTRONIC MONITORING SYSTEM

1.0 TEXT DISPLAY (A) with integrated KEY BOARD (B) illust. Z25237

After switching on the Shovel's key operated main switch, the following introductory messages will be displayed on screen (A):

1st. # Please be Safety Conscious when working!

This message will be displayed for approximately 10 seconds.

2nd. |QUI| Did you check the Operating Safety of the Shovel?

Press the "QUI" key (10) to acknowledge this message.

3rd. |QUI| Did you do Maintenance according to the Service Literature?

Press the "QUI" key (10) to acknowledge this message. Thereafter the basic ECS display normally automatically appears on the screen (A) if no information - or fault messages are present. Present information - or fault messages overwrite the introductory messages no. 2 and 3.

-0-	Date	h:	M1 *1) 1/min:
	Time		M2 *2) 1/min:

*1) **M1** = Short form for Rear Engine on counterweight side designated as Engine 1.

*2) **M2** = Short form for Front Engine on Operator's cab side designated as Engine 2.

All messages related to one of the two engines, their connected cooling systems and pump distributor gears are identified by the figure 1 or 2.

Example of an engine related message:

Fault No. 512:
(515)

\$h:	CENSE ECM indicates major fault of engine 1 Park the excavator safely
------	--

Help:

- Stop the engine 1 immediately.

This message applies to the **rear engine** on counterweight side "**Engine 1**".

Emergency Indication of Operating Conditions.

The ECS system is equipped with an emergency indication. In case the text display (A) fails to work, it indicates faults in important operating systems of the Shovel. The indication is effected by means of LED's at the **Programmable Logic Controller "PLC"** installed in the cab base. Refer to page 208 for the location of the **"PLC"**.

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. NOTICE The LED "H31" monitors all six high pressure filters. Refer to page 221 for description of the diagnostic codes flashed out by LED "H31".	H31
Coolant pressure	H33
Coolant temperature	H34
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 (if so equipped)	H135

How to print out Contents of Record (PROTOCOL) Memory:

Print out the *complete* Contents of Record (PROTOCOL) Memory

Display:

Press until the maximum amount of entries (**39**) is reached

Print from the last	>	1< PRO entries
page no all * PRO has		39 entries *P*

The complete PROTOCOL is now being printed out.

Distinctive marks for "OLD" and "NEW" entries:

New entries, not yet displayed / called up / printed or downloaded are marked with *P*.

After being displayed / called up / printed or downloaded the marking will change to -P-.

Print out the *last* Entries of the Record (PROTOCOL) Memory

1st. Possibility - The last (X) Entries under consideration of all Messages

(X) = desired number of the last entries e.g. **10** (the last 10 entries of 39 total entries)

Press until the desired nos. of entries are reached, e.g. 10.

The record memory with the last 10 entries is now being printed out.

Print from the last	>	10< PRO entries
page no all * PRO has		39 entries *P*

Menu Control with Key Switch (C) and Key Group (D)**Display of Menu Options, see Menu Control Chart I (Z23063)**

EXAMPLE: Display of **TRUCK COUNTER READING**, starting from basic display on level -0-

Proceed as follows:

1. Press the "QUI" key (10), the menu level -1- with the current truck counter reading appears on the display.
2. If you want to reset the counter, press the "QUI" key (10) again. Menu level -2- appears on display. Use key (12) for setting the counter to zero.
3. Press "RET" key (9) twice for return to the standard display, level -0-.

EXAMPLE: Display of **LUBRICATION SYSTEMS CYCLE COUNTER READINGS**, starting from basic display on level -0-

Proceed as follows:

1. Press the "QUI" key (10), the menu level -1- with the starting item truck counter reading appears on the display.
2. Press key (12) once the Central lubrication system cycle counter reading appears on display. By pressing key (12) again the swing ring gear cycle counter reading is displayed.
3. For returning to the standard display level -0- press "RET" key (9).

REMARK

Changing of the lubrication cycle counter settings can be carried out in the main group SERVICE under the section *SETTINGS*, see also menu control chart III.

EXAMPLE: Display of **Service *POWER CHECK*** starting from basic display on level -0-

1. Press the "QUI" key (10), the menu level -1- with the starting item truck counter reading appears on the display.
2. Press key (12) three times the menu item *SERVICE* appears on the display.
3. Press the "QUI" key (10), Service *LANGUAGE* appears.
4. Press key (12) once the menu item Service *POWER CHECK* appears on the display.
5. Press the "QUI" key (10), the menu level -3- with the starting item Power check *DISPLAY* appears on the screen.

Continue according to description on next page, menu control chart II.

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 IV (Z 23066).

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 (PARTS & SERVICE NEWS No. AH02512)
- (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 3: Service / Settings / DATE

- 3 - Settings OPERATE KEY SWITCH
date: new date:

Level 3: Service / Settings / TIME

- 3 - Settings OPERATE KEY SWITCH
time: new time:

Level 3: Service / Settings / OPERATING HOURS

- 3 - Settings OPERATE KEY SWITCH
operating hours h: new operating hours h:

Level 3: Service / Settings / PROTOCOL

- 3 - Settings OPERATE KEY SWITCH
protocol cancelled:

Level 3: Service / Settings / STATISTICS

- 3 - Settings OPERATE KEY SWITCH
statistics cancelled

Level 3: Service / (Menu item) INPUTS - OUTPUTS ON / OFF

- 3 - Menu item INPUTS - OUTPUTS OPERATE KEY SWITCH
- 3 - Menu item INPUTS - OUTPUTS 0 1 Condition :

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):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS
/ Y14b-2 VALVE FAN DRIVE 2 RADIATOR
(medium speed)

-4- Output signals OPERATE KEY SWITCH
-4- Valve fan drive 2 radiator 0 1 Y14b-2 (A3.8):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS
/ Y17 VALVE PUMP REGULATION QMIN

-4- Output signals OPERATE KEY SWITCH
-4- Valve pump regulation Qmin 0 1 Qmin Y17 (A1.4):

Level 4: Inputs - Outputs / DIGITAL-OUTPUTS
/ Y17a VALVE WARMING-UP TIME 1/2 QMAX

-4- Output signals OPERATE KEY SWITCH
-4- Valve warming-up time 0 1 1/2 Qmax Y17a (A1.6):

Fault No. 788: (791)	\$h: Shutdown through emergency stop switch S33D.
Help:	Emergency stop switch S33D at counterweight actuated. - Find cause
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. 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: Acoustic warning signal 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.

3.5.4 AUXILIARY HEATER FOR OPERATOR'S CAB

Special Equipment

REMARK

The auxiliary cab heater is located in the compartment below the stair to the operator's cab. View A-A shows the arrangement of components and the flow of water, fuel and air.

Legend for illustration Z25357

- (1) Fuel tank
- (2) Stair to operator's cab
- (3) Heater unit HYDRONIC 10, refer to the separate operation manual HYDRONIC 10 for all operating and maintenance instructions. The manual is filed in volume 2 binder.
- (4) Water supply line from engine to cab heater
- (5) Water return line
- (6) Water line to auxiliary heater
- (7) Hot water line from auxiliary heater to cab heater
- (8) Check valve
- (9) Fuel shut off-cock for fuel supply to heater (3)
- (10) Fuel strainer
- (11) Fuel supply line
- (12) Fuel dosing pump
- (13) Combustion air intake line
- (14) Exhaust muffler
- (15) Fuel shut-off solenoid valves

Operation

To activate the heater (3), open fuel shut off-cock (9). Select the desired heating stage with the control module (5) and thermostat (13) shown on page 198.

REMARK

During the warm season the fuel shut-off cock (9) should be closed.

3.7.2 SWITCH BOARD (X2) IN CAB BASE

Legend for illustration Z25356

- (S27) Emergency By-pass switch for the shutdown function of the PLC (E6). If an automatic shutdown is initiated by Shovel systems, with a dangerous situation for man or machine, which needs the Shovel to be operable to over-come the dangerous situation, actuate this switch to override the shutdown function of the system and to enable a restart of the Diesel engine.

NOTICE

This switch can not override engine initiated shutdowns.

CAUTION

As soon as the immediate situation of danger is over, shutdown the unit. Correct the fault that caused the shut down and re-set the Emergency By-pass switch (S27).

- (S57.1) Diagnostic switch for flashing out fault codes via lamp (H97.1) of the CENTRY system for engine 1.
- (S57.2) Diagnostic switch for flashing out fault codes via lamp (H97.2) of the CENTRY system for engine 2.
- (H97.1) Fault lamp for flashing out diagnostic fault codes of the CENTRY system for engine 1.
- (H97.2) Fault lamp for flashing out diagnostic fault codes of the CENTRY system for engine 2.

Diagnostic Fault Codes of the Engine CENTRY System

The fault lamps (H97.1 and H97.2) will light for about 2 seconds after main key switch-on and then go out when no faults are being detected. When a fault condition exist, the fault lamp will turn "ON" for warning faults, and "ON FLASHING" for more severe faults that can affect engine operation and need immediate attention. To determine an active fault, shut off the engine and turn main key switch to "ON" position (engine not running). Press diagnostic switch (S57.1 or S57.2) for 1 to 2 seconds and then release. If the corresponding fault lamp illuminates while the diagnostic switch is held depressed, there is an active fault or faults. Active faults **MUST** be corrected as soon as possible.

For more information, refer to the separate Operation and Maintenance Manual CENTRY, filed in volume 2 binder.

High Pressure Filter "HPF" Identification Codes of LED H31

The LED "H31", illust. Z 21753, monitors all six high pressure filters. If a failure condition of a high pressure filter occurs, the LED "H31" will begin flashing out a diagnostic code for identification of the concerned filter. If more than one filter send a failure signal at the same time, the LED will always show the diagnostic code of that filter with the lowest number.

High Pressure Filter "HPF" number:

Code HPF #1	1			1				1						1					
Code HPF #2	0.5s	2s						1	2					1	2				
Code HPF #3	0.5s	0.5s	0.5s	2s				1	2	3				1					
Code HPF #4	0.5s	0.5s	0.5s	0.5s	0.5s	2s								1	2	3	4		
Code HPF #5	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	2s						1	2	3	4		
Code HPF #6	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	2s						1	2	3
	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	2s							

Example:
Identification Code for High Pressure Filter #4 :

When the differential pressure switch of high pressure filter #4 sends the signal "Filter restricted", the LED H31 will flash four times at regular intervals of 0.5 seconds and then after two seconds pause time will start again flashing four times at regular intervals of 0.5 seconds and so on.

The number of the four 0.5 seconds interval flashing groups corresponds to the number of the high pressure filters.

Hydraulic Oil and PTO Gear Oil Heatings

Junction Box for Hydraulic Oil Heating and Location of Heaters and Thermostats, illustration Z 21755

- (1) Junction box for hydraulic oil heating
- (2) Switch, hydraulic oil heating ON/OFF.
- (3) Warning light, heating system failure,
- (4) Indicator light, hydraulic oil heating ON.
- (5) Immersion heaters installed in the suction oil reservoir
- (6) Immersion heaters installed in the main oil reservoir
- (7) Immersion heaters installed in the PTO's (pump distributor gears)
- (8) Thermostats installed in the main oil reservoir, suction oil reservoir and in the PTO's (pump distributor gears)
- (9) Adapter flange for heater element
- (10) Heater plates for batteries

3.10.1 STARTING PROCEDURE

REMARK

Start the engines one after another, e.g. first rear engine (1) then front engine (2). Both engines are started in the same way.

1. Insert battery main switch keys and turn to operating position.

REMARK

Start the engines with the safety lock lever (13), illustration Z25492 in the fully rear LOCKED position. When the engines are running move the safety lock lever fully to the front in FREE position.

2. Insert key into the switch (1) and turn to operating position. The warning buzzer (2) must give an acoustic test signal. If the buzzer fails to function, corrective action must be taken.
3. Observe ECS display (3). Normally the basic display appears on screen (3). If a FAULT message or INFORMATION item is displayed, proceed according to section "ELECTRONIC MONITORING AND CONTROL SYSTEM ECS" on page 92.
4. Set toggle switch (4) to low idle speed position.
5. Sound the signal horn (5).
6. Start the engines by turning starter switches (6 and 9).

REMARK

Each engine is equipped with a prelubrication system which is activated by the starter switch (6/9). Turning and holding the switch in the start position sends current to the prelubrication starter solenoid which then prelubricates the engine. This solenoid timer prevents current from flowing to the conventional starting motor until 17 kPa (2.5 psi) oil pressure has been achieved in the cam oil rifle. After a subsequent 3 second delay, current is then directed to the starting motors for cranking the engine.

7. Cold Weather Starting

To facilitate starting at low outside temperatures (below 0° C) and with the engines cold, use the cold starting aid. Take into account, that the prelubrication period will be longer at low ambient temperatures. Inject starting fluid only after the prelubrication period is finished and the engine starts to crank. Engage the starter and while cranking, apply metered amounts of starting fluid using switch (8/11) until the engine idles smoothly.

▲ CAUTION

Use the cold starting aid only during starting and with the engines cold.

▲ WARNING

- Travelling on a grade requires special care. Plan your work so that the Shovel travels up- and downhill parallel to the grade. The superstructure must be parallel with the undercarriage and the working attachment must face to the front in travel direction. The travel gears must be at the rear in the direction of travel.
 - **DO NOT** use the **FAST TRAVEL SPEED RANGE** when travelling on a grade.
 - For maximum stability carry the bucket as close to ground level as possible. Operate the travel control pedals sensitively. Avoid jerky acceleration and deceleration of travel motions. Travel speed must be conform to the ground conditions.
-

NOTICE**Two Speed Range Travel Drive**

If the Shovel is equipped with a Two Speed Range travel drive, always use the low speed range when travelling on a slope.

Never go downhill with fast speed range engaged.

The low travel speed range must also be used during cornering.

PARKING BRAKE

The Shovel is equipped with spring loaded disk type parking brakes. These brakes engaging and releasing automatically. They are arranged between the hydraulic motors and travel gears. When the motor/engine is running the parking brakes are automatically released by pilot oil pressure. With the motor/engine at standstill the parking brakes are engaged.

TRAVEL ALARM / BACK-UP ALARM

(Special equipment)

The Shovel can be equipped with one of the above alarm systems. The back-up alarm will sound at reverse travel. The travel alarm will sound at forward and reverse travel.

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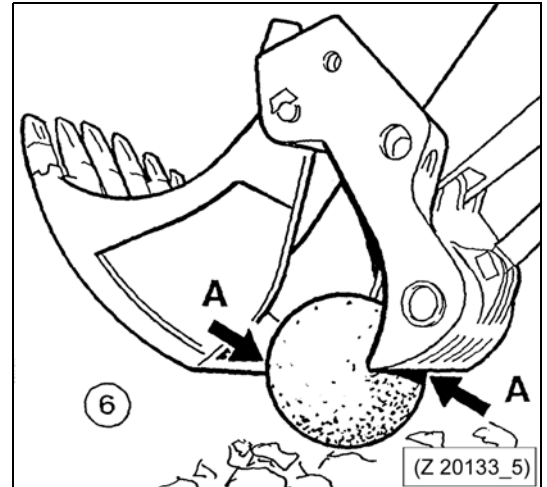


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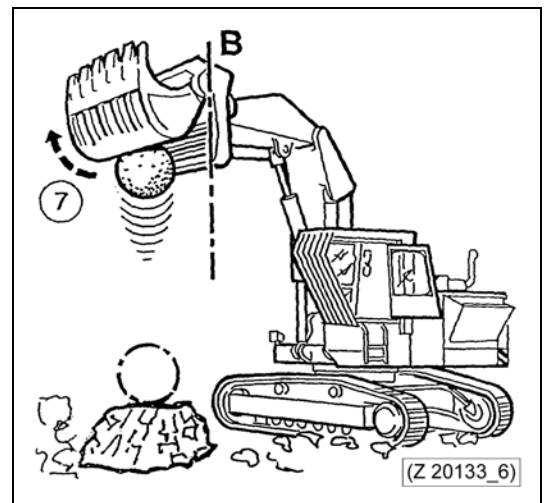
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Legend for illustration Z 20133_5

- (6) Pick-up position of the drop ball
 A - Greatest circumference of the drop ball

**Legend for illustration Z 20133_6**

- (7) Drop height, level with cab roof
 B - Back wall of the bucket in vertical position

**WORKING HINTS**

Place the rock to be crushed on a solid and level ground with the impact surface in a horizontal position.

If so equipped lift up the cab front guard (1). The roof mounted beacon will then automatically switched on for warning other persons.

Change the impact surface of the rock by 90°, if after two to three drops the rock is not being crushed.

3.16.1 RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM

▲ WARNING

With the engines at standstill and main switch (1) in ON position, move all controls for working attachment and crawlers several times through all shift positions to relieve the pressure in the hydraulic system. The necessary oil pressure for shifting the spools of the main control valves is provided by a pressure accumulator in the pilot oil circuit.

NOTICE

The pressure accumulator in the pilot oil circuit serves also for lowering a raised working attachment to the ground with the engines at standstill. If, for example, the engines stall with the working attachment in a raised position, lowering of the working attachment is possible by operating the respective control lever.

6. Set main switch key (1) to "0" position and remove.
7. Set safety lock lever (13) fully to the rear in LOCKED position.
8. Switch off the battery main switches and remove keys.

3.18.4 INDICATION OF OPERATIONAL MODES AT CONTROL MODULE, AFTER AUTOMATIC ACTUATION OF THE FIRE SUPPRESSION SYSTEM

Alarm to Shutdown Period - The RED alarm LED and the audio alarm will pulse at a rate of 2 times per second.

Shutdown to Discharge Period - The RED alarm LED and the audio alarm pulses "on" four times per second.

Timer Setting (factory adjustment)

- Alarm to Shutdown: 5 seconds
- Shutdown to Discharge: 10 seconds

▲ WARNING

In Case of Fire

- Act according to the circumstances and the applying safety regulations.
 - Evacuate area to lessen risk of injury from flames, heat, hazardous vapours, explosions, or other hazards that may be created.
 - Evacuate endangered Persons.
 - Inform the fire brigade.
 - Fight the fire.
-
-

▲ CAUTION

For continued protection, the Detection and Actuation System and the Fire Suppression System must be recharged through authorized Service Personnel immediately after operation.

3.20.1 SYSTEMS CONNECTED TO THE REFILLING SYSTEM

The following systems are connected to the receiver panel (5) of service arm (3), illust. (Z25495):

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

Legend for illustration Z25495

- (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 Shovel movement possible.

3.20.4 REFILLABLE GREASE CONTAINERS OF THE AUTOMATIC LUBRICATION SYSTEMS

Legend for illustration Z25409

- (1) Grease container of the central lubrication system for the superstructure
- (2) Grease container of the central lubrication system for the attachment
- (3) Grease container of the swing circle pinion lubrication system
- (4) Grease filter for central lubrication systems. 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.
- (5) 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.
- (6) Hydraulically driven grease pumps
- (7) Grease pressure gauge
- (8) In-line grease filter
- (9) Grease level gauge for manual checking of the grease level
- (10) Breather filter

REMARK

The grease containers (1 and 2) are linked together by an opening in the upper part of the containers for compensation of the grease level.

Refill the respective grease container, when the Fault message "Central lube system grease container on reserve" or "Swing circle lube system grease container on reserve" 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 volume 2 binder.

As soon as a grease container is filled up to the correct level the corresponding indicator lamp (7, 7A or 8), illust. (Z22469A) lights up and the signal horn sounds. In order to ensure proper operation of the lubrication systems carry out the periodic maintenance of the grease filters (4 and 5), illust. (Z25409). Refer to maintenance section 4, item no. 4.8. Periodic inspection of the grease pumps (6) 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.

3.25.4 PREPARING FOR OPERATION

1. Remove grease from all machined unpainted surfaces (piston rods).
2. Install fully charged batteries.
3. Remove all coverings.
4. Fill up fuel tank with an approved Diesel fuel.
5. Check cooling system for leaks, loose connections and coolant level. Check mixture ratio of antifreeze, refer to the engine manual for details.
6. Service the engine according to the engine manual. Tighten all drive belts. Make sure the alternator is correctly connected.
7. Carry out the maintenance according to the lubrication and maintenance manual of the Shovel.
8. Start the engine and run at low idle speed until the normal oil pressure and temperature are reached. DO NOT place the Shovel under load before the normal values are indicated.
9. If the engine is misfiring or loss of power is evident, check the fuel system for restriction or loose parts.
10. Carry out several complete working cycles. Check the function of special equipments (central lubricating system, swing circle pinion lubricating system, fire detection and suppression system etc.).

4.4 FILLING CAPACITIES

Unit or System	Liter (approx.)	Unit or System	Liter (approx.)
Cooling System		Swing Gears made by L&S , each:	42.0
Front Engine	360.0	Motor Adapter Housings	0.6
Rear Engine	360.0	Swing Gears made by Siebenhaar , each:	60.0
Engine Oil		Motor Adapter Housings	*2)
Front Engine Oil Pan	190.0	Brake Housings	*2)
Front Engine Reserve Tank (Refill)	580.0 (425.0)	Travel Gears, each	155.0
Rear Engine Oil Pan	190.0	Motor Adapter Housings, each	2.0
Rear Engine Reserve Tank (Refill)	580.0 (425.0)	REMARK The travel gear brakes are dry type multiple disk brakes. DO NOT fill the housings with oil.	
Fuel Tank	10800.0	Final drive housings, each	165.0
Hydraulic Oil Reservoir	3600.0 *1)	Guide Wheels, each	3.2
Total Hydraulic System	6600.0	Support Rollers, each	7.0
Pump Distributor Gears, each	95.0	Track Rollers, each	2,7
Oil Collector Reservoir, Auxiliary Hydraulic Pumps	1.0	Water tank for hand wash sink in Operator's cab	50.0
Main Hydraulic Pumps, Drive Shaft Housing	1.5	Water reservoir for windshield washer	7.0
Flexible Drive Couplings between Engine and Pump Distributor Gear, each	1.45		

***1)** Oil change quantity including suction oil tank and return oil collector pipes approximately 4450 liter with loader attachment in oil level checking position, see oil level plate on the main hydraulic oil reservoir.

***2)** Fill up to level gauge marking.

REMARK

Capacities listed above are approximate values. For proper checking use level plugs, dipsticks, and inspection openings provided for this purpose. Prior to commissioning check the fluid levels in all units and systems listed above.

4.6.4 EXTENDED SERVICE INTERVALS FOR ENGINES WITH ENGINE OIL MANAGEMENT SYSTEM

REMARK

The engine oil management system of each engine combines the automatic engine oil supply system "**Reserve**" and the oil burning system "**Centinel**" in connection with the "**Eliminator**" oil filtration system.

Legend for illustration Z 22450

- (1) Engine oil level gauge
- (2) Oil filler tube
- (3) Oil filters for the engine oil reserve system
- (4) Suction line from reserve tank
- (5) Suction line to pumping unit
- (6) Supply line from pumping unit to crankcase
- (7) Withdrawal oil line from engine oil pan to pump
- (8) Ventilation line for reserve tank
- (9) Breather filters
- (10) Plug
- (11) Oil feed-back line to reserve tank
- (12) Pumping unit, located in the cross member opposite of the oil filters (3).

Servicing Intervals

- **Every 10 operating hours**

Check oil level in both engine oil pans with Excavator standing on level ground, using oil level gauge (1). Check also oil level in both reserve tanks, see illust. Z 22452A.

REMARK

The oil level in the engine oil pan can vary between the MIN and MAX marking on gauge (1) depending on the operating condition of the reserve system when the engine was stopped. With sufficient oil in the reserve tank and with the reserve system in proper working order, there is no need to fill the engine oil pan even with the oil level at the MIN mark on gauge (1). If the oil level is below the MIN marking on the gauge, corrective action must be taken. Fill the reserve tank and check the reserve system. The function of pumping unit (12) is monitored by an indicator light located on the "X2" switch board in the cab base. See section "SWITCH BOARD (X2) IN CAB BASE" for more information.

Be sure to fill the corresponding reserve tank of rear engine -1- or the reserve tank of front engine -2- when the information message "**Engine oil reserve tank 1 (or 2) empty**" is being displayed on the ECS screen in the operator's cab.

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 cup 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 23060

- (1) Air cleaner for rear engine 1
- (2) Air cleaner for front engine 2
- (3) Cold starting aid mounted on the air cleaner carrier
- (4) Electrically operated valve
- (5) Mounting clamp
- (6) 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 vapors 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-clean tubes.

TRAVEL GEAR BOX - CHECK OIL LEVEL

Illustration Z25244:

Remove oil level gauge (2) and wipe it clean. Screw in the gauge and remove again. Oil level should be at the upper mark of gauge (2). If necessary add oil through filler opening (3). Insert gauge (2) and filler plug (3) and tighten securely. Check breather filter (18), illustration Z25243 on page 373 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

MOTOR ADAPTER HOUSINGS - CHECK OIL LEVEL

Check oil level by removing oil level plugs (8). Oil level should be at lower edge of openings (8). If necessary, remove connector (9) for breather filter line and add oil through filler opening. Install level plugs (8) and screw in breather filter line connectors (9). Check breather filter (19), illustration Z25243 on page 373 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

FINAL DRIVE HOUSING - CHECK OIL LEVEL

Remove oil level gauge (13) and wipe it clean. Screw in the gauge and remove again. Oil level should be at the upper mark of gauge (13). If necessary add oil through filler opening (14). Insert gauge (13) and filler plug (14) and tighten securely. Check breather filter (20), illustration Z25243 on page 373 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

4.9.5 HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY

See illustration Z 20369

⚠ WARNING

- Provide adequate working platform for safe access to the hydraulic oil coolers.
- Before removing mounting bolts (1) of the hydraulic oil cooler door (2) check to make sure that all door hinges are in good condition and properly fastened on their carrier frames. If cracks are found at the welded joints of the hinges, **DO NOT** remove mounting bolts (1) otherwise the cooler door may become detached and fall off. Danger of accidents. Have the damage repaired as soon as possible.

-
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 AIR CONDITIONING FOR OPERATOR'S CAB - CHECK REFRIGERANT LEVEL

Legend for illustration Z 22591

- (1) Air conditioner door with filter mat
- (2) Air conditioner unit
- (3) Sight glass for checking refrigerant filling
- (4) Shut-off valve on dryer cartridge
- (5) Dryer cartridge
- (6) Refrigerant collector reservoir
- (7) Condenser
- (8) Condenser blower
- (9) Low pressure switch
- (10) High pressure switch
- (11) Expansion valves
- (12) Evaporator blower
- (13) Evaporator
- (14) Cool air outlets

Checking the refrigerant level:

Switch on air conditioning equipment and run at maximum capacity for approx. 5 minutes.

Observe inspection glass (3). A refrigerant flow loaded with bubbles or foam indicates a lack of refrigerant. In this case well equipped refrigeration specialists must check the circuit for tightness and must add the missing quantity or refrigerant. If more than 200 grams per year are lost, the oil level of the refrigerant compressor must also be checked. This is a special procedure and must be carried out by refrigeration specialists only. Isolated small bubbles in the inspection glass may be neglected.

Even with an absolutely tight equipment a certain amount of refrigerant is lost through the walls of the hoses.

Therefore a small annual replenishment of the refrigerant quantity is normal.

The dryer cartridge (5) must be replaced after every 1000 operating hours or once a year by refrigeration specialists.

Clean the filter mats of condenser (7) and evaporator (13).

REMARK

Servicing of the air conditioning systems is restricted to workshops especially equipped for this purpose. Refer to the separate booklet "AIR CONDITIONING" in Service Literature Binder – Volume 2 for more information.

4.11.4 CRAWLER TRACK - INSPECTION

CHECK ADJUSTING RANGE OF GUIDE WHEELS

(Track retensioning range)

GENERAL

The hydraulic track tensioning system, illust. Z 20371 maintains automatically the correct track tension. The pilot pressure oil of the travel brake release circuit is used, to pressurize the four adjusting cylinders (10) and (11). The resulting force moves the guide wheels toward the front, until the correct track tension is obtained. External forces acting upon the guide wheels are absorbed through the pressure accumulators (8A) and (8B).

Legend for illust. Z 20371:

- (1) Rotary distributor
- (2) Supply line, pilot pressure from travel brake release circuit
- (3) Return oil line (leakage oil)
- (4) Valve block
- (5) Pressure relief cock for hydraulic track tensioning system.
"C" - Closed (Normal working position)
"O" - Open
- (6) Shut-off cock in supply line
"O" - Open (Normal working position)
"C" - Closed
- (7) Two stage pilot pressure operated relief valve
- (8A) Pressure accumulator, high pressure (150 bar)
- (8B) Pressure accumulator, low pressure (31 bar)
- (9) Shutoff cocks, RH & LH
"O" - Open (Normal working position)
"C" - Closed
- (10) Track adjusting cylinders, inner
- (11) Track adjusting cylinders, outer
- (12) Test connectors and vent valves

WARNING

Before working on the hydraulic track tensioning system, relieve all pressure in the system by opening cock (5), position 'O'. After finishing the service work close the pressure relief cock (5), position 'C'.

High-Strength Bolt Connections (continued)**Check fastening and condition of cab base, illust. Z 21671**

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1)	M36	10.9	55	3100	8

* SW = Wrench size*

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

High-Strength Bolt Connections (continued)

Check fastening of power house frame (01) to superstructure main frame, illust. Z 20705

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(02)	M30	10.9	46	1770	28
(03)				Washer	28

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

High-Strength Bolt Connections (continued)

Check mounting and security of each Diesel engine and pump distributor gear, illust. Z 21776

- Check all flexible bearings (1) for engine and pump distributor gear.
 - Check the flexible bearings for damage and signs of fatigue. Make sure that there is no contact between the upper and lower metal brackets of the flexible bearings (1). Replace the bearings if necessary.
After new flexible bearings have been installed, check distance (A) on both torque supports.

NOTICE

All flexible bearings (1) and all rubber-bounded metal bars (4) should be replaced during engine overhaul.

- Check distance (A) between torque support and stop bolt (5).
 - With setting of the flexible engine bearings (1) the distance (A) increases and must be adjusted. To do this, loosen lock nut (7) and tighten stop bolt (5) until the correct distance (A) is obtained. Tighten lock nut (7) and recheck distance (A).
If new flexible engine bearings (1) have been installed, replace also cup springs (6) and adjust distance (A) to 29 mm.
- Check tie bolts (2) on front and rear carrier units for looseness.
 - Check to make sure that the self locking retainer nuts (3) are tight and that there is no gap between nut and rubber-bounded metal bar (4).
If necessary retighten retainer nuts (3) snugly.
Check rubber-bounded metal bars (4) for signs of fatigue and damage.
Replace as necessary.

NOTICE

- **Check all bolt connections for correct tightening torque.**

Check condition of engine carrier and brackets. If any damages, failures or wrong condition are found, corrective action must be taken.

High-Strength Bolt Connections (continued)

Swing circle, illust. Z 20614

Check tightening torque of inner and outer mounting bolts (02 and 04) according to PARTS & SERVICE NEWS, No. AH00511.

NOTICE

Checking/retightening of swing circle mounting bolts is only necessary after the first 1000 operating hours.

Check condition and fastening of swing circle guard (10) and bolts (15).

High-Strength Bolt Connections (continued)

Procedure for determination of the tightening torque for the crawler carrier mounting bolts after the first 1000 operating hours, see illustration Z25246

1. Loosen the two measuring bolts (7) at the left crawler carrier and the two measuring bolts at the right crawler carrier.
Do not lubricate the measuring bolts.
2. Tighten the four measuring bolts (7) with 150 Nm.
3. Attach the measuring device (1 - 6).
4. Set the dial gauge (2) to the zero position.
5. Attach the special hydraulic torque wrench (1), see illustration Z24072 on next page to the measuring bolt (7).
6. Increase the pressure at the hydraulic torque wrench until a torque of 2100 Nm is reached and tighten the measuring bolt.
7. Record the pressure and the change of the bolt length in a table.
8. Increase the pressure further by steps of 10 bar until the required elongation of 0.93 mm of the measuring bolts (7) is reached.
9. Record the corresponding hydraulic pressures in a table.
10. Repeat this procedure on all four measuring bolts (7).
11. Add the 4 determined hydraulic pressures and then divide by 4 to obtain an average value.
12. Now loosen only one of the mounting bolts (M48) and tighten up to the determined average pressure.

▲ CAUTION

**DO NOT loosen more than one bolt at the same time.
DO NOT lubricate the bolts (M48).**

13. Repeat this procedure step by step at all of the 156 mounting bolts (M48) .

High-Strength Bolt Connections (continued)

Roof-mounted service crane
Check condition and fastening of crane base and crane

Legend for illust. Z 22635

- (1) Crane base
- (2) Slew crane
- (3) Outrigger
- (4) Electric chain hoist or hydraulic rope winch
- (5) Safety hook
- (6) Electric -.hydraulic power unit

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(7)	M24	10.9	36	880	8
(8)	M20	10.9	30	510	10
(9)	M20	10.9	30	510	2
(10)	M12	8.8	19	74	16

* SW Wrench size

- Re-tighten loose mounting bolts and replace missing bolts.
- Replace self locking nuts which have lost their clamping torque.

REMARK

For more information concerning crane maintenance refer to the separate Instruction Manual "MKG CRANE HMK 60 Ta1" filed in volume 2 binder.

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. 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.

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

NOTICE

The hydraulic oil change intervals can be extended for a further time period, when an oil sample analysis shows a positive result. When extending the oil change interval, it is necessary to carry out an oil sample analysis after every 1000 operating hours.

However, it is recommended to change the hydraulic oil and the suction strainers after 6000 operating hours at the latest. The pulsation damper must be replaced after every 2000 operating hours.

Legend for illust. Z 21782

- (1) Main oil reservoir
- (2) Oil filler plug
- (3) Back-pressure valve
- (4) Return oil collector pipe
- (5) Drain coupling for collector pipe
- (6) Drain coupling for main oil reservoir
- (7) Hand wheel of main shut-off valve
- (8) Main shut-off valve
- (9) Compensator between main oil reservoir and suction oil reservoir. Check condition and tightness of compensator and connected parts.
- (10) Return oil strainer
- (11) Bolt
- (12) Bolt
- (13) Intermediate pipe
- (14) Gasket
- (15) Gaskets

Evacuate main hydraulic oil reservoir according to section Central Refilling System on page 290.

Attach drain hose (part of tool set) to coupling (5) and drain oil from return oil collector pipe (4). Drain also the oil from return oil manifold, see illustration Z 21785 and from suction oil reservoir, see illustration Z 21787.

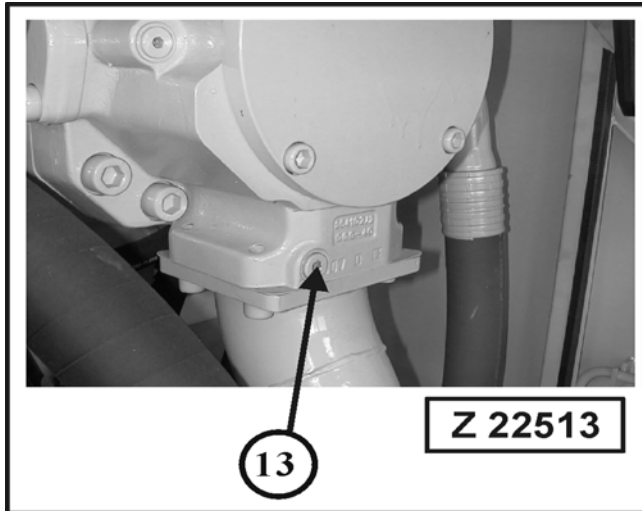
REMARK

Replace return oil strainer (10), illustration Z 21782 after major repairs on the hydraulic system and after every 6000 operating hours. Use new gaskets (14 and 15).

With hydraulic oil reservoir empty, service the return oil filters and inspect the reservoir for sediments. Clean the reservoir if necessary.

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

Vent Hydraulic pumps



1. Open vent plug (13), illust. Z 22513 on the pump suction port of all six main pumps.
2. As soon as bubble free oil flows out, tighten the vent plug (13).
3. Open vent screw on secondary pumps (8 and 9), illustration Z 21171. Close vent screw as soon as bubble free oil flows out.
4. Open vent plug (13) on the pump suction port of the piggy-back gear pumps and wait until bubble free oil flows out then tighten the vent plugs (13).
5. Check hydraulic oil level and the whole hydraulic system for leakage.

Check the Oil level in all six Main Pump Housings (I - VI), illust. 21171:

1. Remove leakage oil return line from port (15). The oil level in the pump housing should reach the lower edge of port (15).
2. If necessary add hydraulic oil up to the lower edge of the filler opening.
3. Connect leakage oil return line to port (15).

NOTICE

Make sure the main pump housings are correctly filled, otherwise the pump drive shaft bearings could be damaged due to lack of lubrication.

Brake Housing - Change Oil (Siebenhaar)

1. Remove level gauge (8), illustration Z24091, drain plug (9) and breather filter (7). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Clean breather filter (7) with compressed air from inside to outside and re-install.
3. Install drain plug (9) and fill-up engine or hydraulic oil through filler opening, up to the "MAX" mark on level gauge (8) and install the level gauge.
4. After short operating period check oil level and housing for leaks.

NOTICE

Be sure to fill the brake housing and motor adapter housing with engine oil or hydraulic oil as specified on page 319.

Motor Adapter Housing - Change Oil

1. Remove level gauge (6) and drain plug (5). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Install drain plug (5) and fill-up engine or hydraulic oil through filler opening, up to the "MAX" mark on level gauge (6) and install the level gauge.
3. After short operating period check oil level and housing for leaks.

PRECAUTIONS

See illustration Z 19360

In order to prevent risks of possible fire break out observe the following items:

1. Keep the excavator clean, especially from inflammable materials.
Clean the excavator after servicing the hydraulic system, engine and fuel system by means of a steam jet.
2. Clean engine compartment, hydraulic pump compartment and service platform of the superstructure.
Thereafter check fuel lines, engine oil lines and hydraulic oil lines for leakage, loose fastenings and damage.
If any leakage, damage or loose fastening is found, corrective action must be taken immediately.
3. Check all electrical cables, terminals and connections for loose fastenings, damage and wear.
Replace or repair defective or worn parts without delay.
4. Check the turbocharger for correct mounting and tight exhaust, intake and lube oil connections.
Carry out all necessary repairs without delay.
5. **On machines equipped with a fire detection, actuation and suppression system:**
Refer to the manufacturers service manuals filed in Service Literature Binder Volume 2 for correct maintenance and inspection of the systems.
When checking the filling level of the dry chemical tanks, make sure that the extinguishing powder (Ansul FORAY dry chemical agent) is not compacted.
Stir up the extinguishing powder with a suitable stick until it is in a free flowing condition.

NOTICE

When cleaning the power house take care the heat detection sensors do not come in contact with hot steam or other hot agent. Otherwise the fire suppression system may be triggered.

6. Make sure fire extinguishers are charged and ready for use.

NOTICE

**After cleaning lubricate all lubrication points by means of central lube system or manually.
Lubricate swing circle gear after drying by means of the automatic lube system or manually.**

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