OMPC40008172

Operation & Maintenance Manual

PC4000-6

HYDRAULIC MINING SHOVEL

SERIAL NUMBERS PC4000-6 8172

Printed in U.S.A.
Komatsu Mining Germany

December 2006

- 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 Z25473

(1) Hydraulically operated access ladder, see page 50 for more information.

(2) Battery main switches

NOTICE
After switching OFF the main key switch in the Operator's cab, wait at least 3 minutes before switching OFF the battery main switches. The Vehicle Health Monitoring System (VHMS) needs this period for saving data. If batteries are switched OFF before this time period is over, data will be lost.

(3) Lift cylinder for access ladder

(4) Location of batteries below the catwalk

(5) Control switch for access ladder

(6) Emergency engine shut down switch

⚠ CAUTION

Never stop the engine 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.

(7) Fuel tank

(8) Cab base, contains the electronic components of the VHMS system and the electrical switch boards.

(9) Sliding window of operator's cab, see page 54 for more information

(10) Swing circle guard

(11) Emergency escape ladder, see page 54 for more information.

(12) Engine air cleaners

(13) Exhaust mufflers

(14) Air duct

(15) Extinguishing agent tank assemblies, only on machines equipped with a fire detection, actuation and suppression system.

Legend for illustration Z 23018

(A) Access ladder in lowered position

(B) Access ladder in upper position (Working position)

(C) Stop bar

(D) Manual actuator for fire suppression system (if so equipped)

(E) Pull chain for emergency lowering of the access ladder

⚠ CAUTION

Use this chain only in emergency cases, when the Operator does not respond to other communication signals.

(S84) Ladder control switch for lowering the ladder

(S84B) Ladder control switch for lifting the ladder

(S84A) Safety switch for emergency lowering of the access ladder. When the chain (E) is being pulled down with the engine running, the pilot control system is made inoperative, preventing further movements of the Shovel.

(S22) Safety sensor, located on ladder pivot bracket
Function of sensor (S22): Cut out of the pilot control system and actuation of the hydraulic swing brake with the ladder in lowered position.

(S91) Monitor and control sensor
Function of sensor (S91):
This sensor monitors the ladder position and controls the moving speed of the ladder. In case the sensor (S22) fails to function properly, the sensor (S91) prevents unintended movement of the ladder.

(S33a) Emergency shutdown switch for engine

Operating the hydraulic Access Ladder

⚠ WARNING

- **Make sure the moving range of the ladder is clear of all persons before raising the ladder. Stop raising the ladder by releasing the control switch (S84B) if there are any obstacles within the moving range of the ladder.**
- **Mount the ladder only in completely lowered position. Entering the ladder in any other position can result in serious injury or death.**
- **DO NOT lift persons with the hydraulic access ladder. Death or serious injury can result.**
- **DO NOT lift objects (tools) with the hydraulic access ladder.**

Legend for illustration Z25444

C Top View of Operator's Cab

(1) Co-driver's seat, refer to page 68 for more information

(2) Windshield washer reservoir, refer to page 63 for more information.

(3) Washbasin with water tap

(4) Refrigerator box

(5) Portable fire extinguisher located behind the Operator's seat. Make sure the fire extinguisher is always charged and ready for use.

(6) Heater unit located in the seat base

(7) Safety lock lever.

- This lever locks the controls for working equipment, swing and travel drive when placed in the fully rear position (L).
- Start the engine with lock lever in LOCKED position (L). Thereafter set the lock lever to free position (F) in order to enable operation of the hydraulic control system.

⚠ WARNING

Before leaving the operator's cab set the safety lock lever to LOCK position (L). If the controls are not locked, and they are touched inadvertently, this may lead to a serious accident.

(8) Instrument panel, see page 89 for more information.

(9) Monitor of the **V**ehicle **H**ealth **M**onitoring **S**ystem -**VHMS-**, see page 96 for more information.

(10) Pedal for closing the bottom dump bucket (Face shovel only)

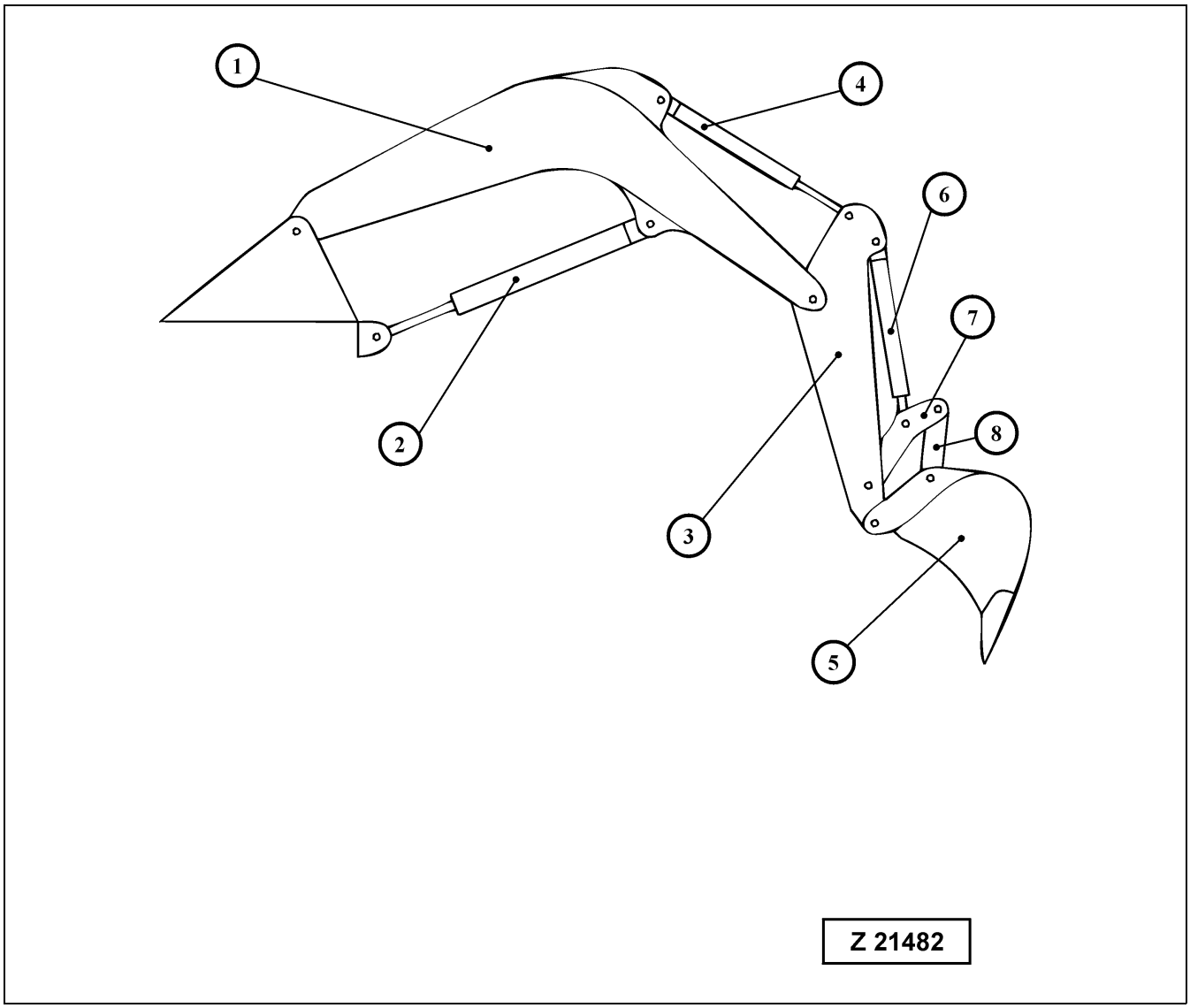
(11) Pedal for opening the bottom dump bucket (Face shovel only)

(12) Travel control pedal, left track forward - reverse

(13) Travel control pedal, right track forward - reverse

(14) Swing brake pedal

Loader attachment with backhoe bucket



Legend for illustration Z 21482

(1)	Boom	(5)	Backhoe bucket
(2)	Boom cylinders	(6)	Bucket cylinders
(3)	Stick	(7)	Link
(4)	Stick cylinders	(8)	Rod

EURO Control Pattern

Legend for illustration Z25460

(1) Control lever for stick and swing machinery

(2) Control lever for boom and bucket

(3) Toggle switch for engine speed selection
Low idle – High idle

(4) Push button for Truck counter number 1 (TR1)
For counting loaded trucks press this button. The total number of trucks loaded is shown on the VHMS monitor field TR1, refer to page 96 for more information. A second truck counter switch is located on the control panel, refer to page 89 for more information.

NOTICE
The push button (4) has a second function. When the Vehicle Health Monitoring System is switched to the PM CLINIC group within the SERVICE MENU, selected PM CLINIC data can be frozen by pushing button (4). Frozen data can then be stored in the PM CLINIC MEMORY. For more information refer to the SERVICE MANUAL VHMS-System.

(5) Swing speed switch. This switch has two positions:

- Left side down - Normal swing speed.
- Right side down - Increased swing speed.

It is recommended to use the higher swing speed for slewing angles greater than 90°.

(6) Signal horn button

(7) Travel control pedal, left track forward - reverse

(8) Travel control pedal, right track forward - reverse

(9) Slew brake pedal

For more information see page 178.

Switch Board (continued)

Legend for illustration Z25446

(10) Switch for main working lights

(11) Toggle switch, swing parking brake

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

⚠ CAUTION

The parking brake should only be applied with superstructure at complete standstill, except in case of emergency. Refer to page 176 for more information.

(12) 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 swing brake is applied. After completion of replenishment procedure, swing back the service arm to its home position and set switch (12) to OFF position ”0”.

(13) Switch, manual actuation of central lubrication system

(14) Switch, windshield washer

(15) Switch, mirror heating

(16) Switch, cab ventilation blower. Blower runs with low speed, even with switch in -0- position. (Cab pressurizing prevents ingress of dust).

(17) Switch, manual actuation of swing ring gear pinion lubrication system

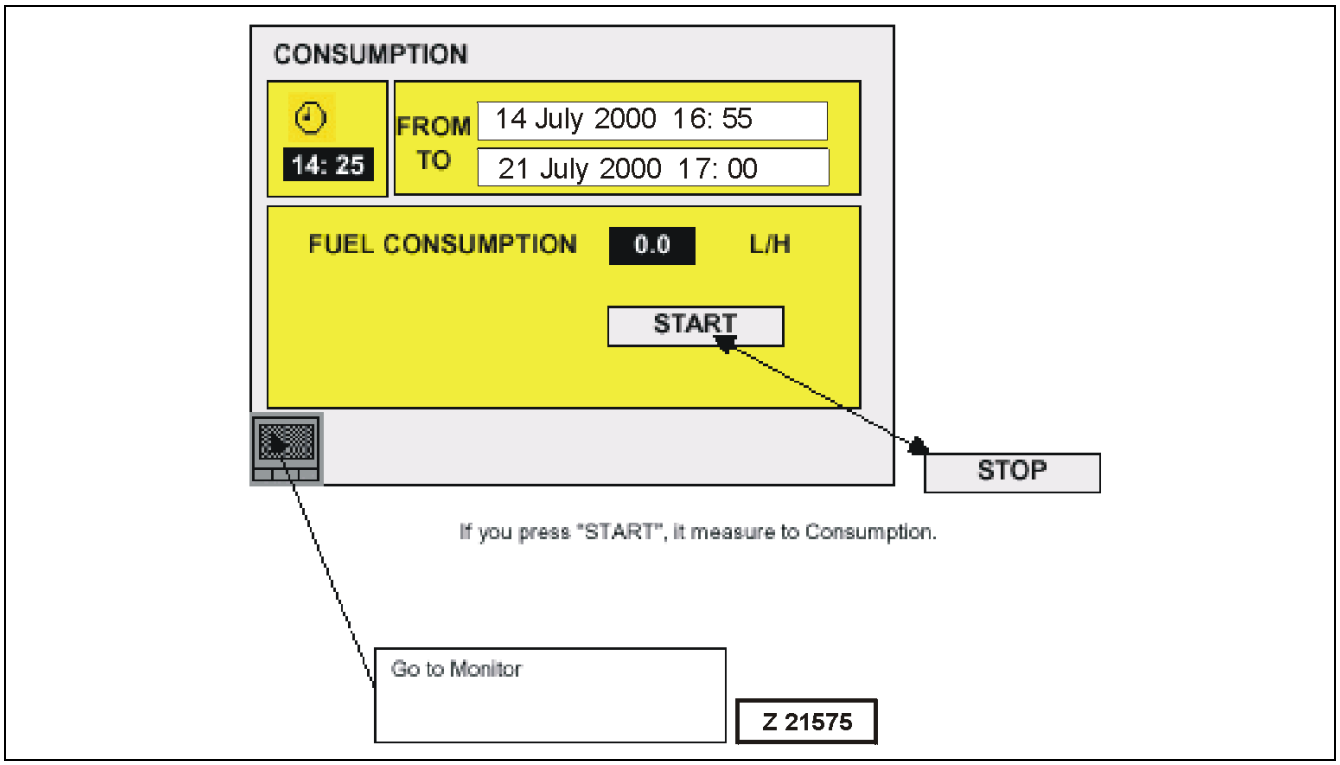
(18) Switch for upper and lower windshield wiper
0 - Off
1 - Interval stage
2 - Slow stage
3 - Fast stage

(19) Switch for Truck counter number 2 (TR2). For counting loaded trucks rotate this switch. The total number of trucks loaded is shown on the VHMS monitor field TR2, refer to page 96 for more information. The push button for Truck counter number 1 (TR1) is located on the RH control lever.

(20) Swing speed switch.
0 - Normal swing speed.
1 - Increased swing speed.
It is recommended to use the higher swing speed for slewing angles greater than 90°.

Fuel Consumption Screen (No. 1.2.2)

See illust. (Z 21575)



When the fuel consumption button (2) is pressed, the screen No. 1.2.2 is displayed. The last data are displayed in each field on the screen. Pushing the ”START” button will erase them and ”TO” and ”FUEL CONSUMPTION” fields are changed to blank. If you want to start fuel consumption measurement, push the ”START” button. The Date and local Time will be inserted into the ”FROM” field. The ”START” button changes to ”STOP” button. Push the (Go to Monitor) button to go back to the Standard Monitor 1.

When the time period for fuel consumption measurement is over, for example after 4 days, select the CONSUMPTION Screen from any of the three Monitors No. 1.2, 1.3 or 1.4 by pushing the fuel consumption button (2). The displayed consumption screen shows the starting date and time of fuel consumption measurement. Push the ”STOP” button. The current date and time is inserted into the ”TO” field and the average fuel consumption calculated during the time period ”FROM – TO” is inserted into the ”FUEL CONSUMPTION” field.

- **Clock symbol:** current time
- **FROM:** date and time when the ”START” button is pushed
- **TO:** date and time when the ”STOP” button is pushed
- **FUEL CONSUMPTION:** Average consumption data between Start and Stop.

Push the (Go to Monitor) button to go back to the Standard Monitor 1.

3.4.4 TABLE OF ALL TOP MESSAGES PROVIDED BY THE SYSTEM

NOTICE
The Instruction Messages belonging to the TOP Messages are listed in a separate Table. The number shown in the Instruction Message column indicates the applying Instruction Message for the TOP Message.

ErrorCode (Message number) G = Shovel C = Engine 1	Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN	Instruction Message Number. Refer to separate Table	TOP Message with colored background **REMARK** Messages w/o color code are not displayed. These messages are stored in the history memory only.
G00001	0	1	Trouble Shut-Off (gate) valve
G00002	2	37	Test speed 1800 rpm
G00003	1	38	Trouble pump controller
G00005	1	39	Low hydraulic oil level
G00007	0	2	Trouble hydraulic oil level
G00008	0	3	Trouble HPF 1
G00009	0	3	Trouble HPF 2
G00010	0	3	Trouble HPF 3
G00011	0	3	Trouble HPF 4
G00012	1	17	CLS grease level too low
G00013	1	17	SLS grease level too low
G00020	0	4	Trouble Shut-Off (gate) valve (Start blocked)
G00021	0	5	Trouble monitoring HPF 1
G00022	0	5	Trouble monitoring HPF 2
G00023	0	5	Trouble monitoring HPF 3
G00024	0	5	Trouble monitoring HPF 4
G00060	0	6	Fire in the power house
G00061	0	2	Trouble monitoring, engine speed too low
G00062	0	2	Trouble monitoring, engine speed too high
G00063	0	2	Trouble monitoring hydraulic oil temp
G00064	0	2	Trouble monitoring hydraulic oil level
G00065	1	2	Very low hydraulic oil level
G00066	0	7	Trouble hydraulic oil temperature
G00067	1	2	Trouble battery voltage too high
G00069	1	2	Trouble monitoring oil temp gear (PTO)
G00070	1	2	Trouble oil temperature gear (PTO)

Message No.	Instruction Message
18	Swing gear house brake OFF - Inform service till end of shift and then press cancel button.
19	Travel gear house brake OFF - Inform service till end of shift and then press cancel button.
20	Inform service and then press cancel button.
21	Hydraulic oil far below operating temperature ! - Pre-heat hydraulic oil or warm up at low idle speed and reduced power.
22	Engine runs (starter motor inactive).
23	A fuel reserve only is still in the tank. - Order tanker.
24	Engine shutdown has been actuated from ground man.
25	Hydraulic oil below operating temperature. - Operate with reduced power !
26	Swing gear house brake ON
27	Hydraulic oil overheat - engine power derated
28	The VHMS is by-passed. - Reset by-pass switch.
29	Engine shutdown by key switch before proper engine cool down. - Before you switch off the engine, cool down the engine at low idle speed for 2 - 3 minutes.
30	Hydraulic oil far below operating temperature ! Pre-heat hydraulic oil or warm up at low idle speed and reduced power.
31	Continue shift but advise service.
32	Stop engine call service.
33	Derate active continue to work. Later shutdown possible. Inform service.
34	Call service because of shutdown.
35	Interrupt work and inform service about "Speed Derate".
36	Continue work until next PM (Schedule work for next PM)
37	Switch Test speed in cab base forces the engine to run constantly 1800 rpm.
38	If failure exist further, inform service.
39	Inform service if attachment in defined position.
40	Continue to work and inform service about "Power Derate"

3.6.3 CENTRAL CONTROL AND FILTER PANEL

Legend for illustration Z 23021

(1) Central control and filter panel

(2) Valve bank

(2.1) Valve block, pump load limiting circuit

(2.2) Valve block, fixed pump 1and 3 for swing

(2.3) Valve block, pilot oil circuit

(2.4) Valve block, pump control circuit

(2.5) Valve block, travel circuit

(2.6) Valve block, swing circuit

(2.7) Valve block, hydraulic access ladder circuit

(2.8) Valve block, hydraulic swing down service arm circuit

(3) Change over valve lever for operation modes of pump control system.
Lever Positions:
E - Electronic operation mode (normal operation mode)
H - Hydraulic operation mode (e.g. for testing purposes)

REMARK

The standard operation mode of the pump control system is the Electronic Operation Mode.
For testing purposes the pump control system can be changed to the hydraulic operation mode. In case of a failure in the electronic control system use the hydraulic operation mode to continue operation.

(4) Pressure oil filter for hydraulic oil cooler fan drive circuit

(5) Pressure oil filter for pump control and pilot oil circuit

(6) Pressure oil filter for PTO gear lubrication circuit

(7) Pressure oil filter for engine radiator fan drive circuit

Pressure Switches

(B16) Swing brake

(B17) PTO lubrication oil

(B21) Radiator fan drive oil filter

(B22) Pump control and pilot oil filter

(B27) PTO lubrication oil filter

(B28) Oil cooler fan drive oil filter

(B48) Travel parking brake

(B85) Pump control oil pressure X1

(B86) Pilot oil pressure X2

Checking active diagnostic Fault Codes of the engine control system QUANTUM and of the engine monitoring system CENSE

REMARK

With the engine diagnostic enable switch in ON position, the three indicator lamps
(H94.1) STOP, (H95.1) WARNING, and (H96.1) FLUID will illuminate together for approximately five seconds; then all three lamps will be turned off at the same time if no faults are present.
If active faults are present, then fault code flashout will start if the engine diagnostic switch is ON and the engine is off. QUANTUM faults will be flashed out on the red STOP indicator lamp and CENSE faults will be flashed out on the yellow WARNING indicator lamp. The white FLUID lamp will remain on as long as a fault condition is present.

To check for active fault codes proceed as follows:

1. Stop the engine and turn the Excavator main key switch to OFF position.

2. Turn the engine diagnostic enable switch to ON position. The diagnostic switch is located on the operator console, see page 93 for more information.

3. All active QUANTUM faults are flashed out first on the red STOP indicator lamp (H94.1). After all QUANTUM fault codes are flashed out, the active CENSE fault codes will be flashed out on the yellow WARNING indicator lamp (H95.1).
   The fault code flash out will begin with the first active QUANTUM fault. The first digit will be flashed out (0.3 seconds between each flash), followed by a 1 second delay; then the second digit will be flashed out, followed by the third digit. There will be a 2 second delay before the next fault is flashed out. Once all QUANTUM fault codes are flashed out, CENSE fault codes will start to flash out on the yellow WARNING indicator lamp (H95.1). The same timing sequence, described above, is used for the CENSE faults. Once all faults have been displayed, there will be a 3 second delay before the fault code flashout begins again.

⚠ CAUTION

**Active faults MUST be corrected as soon as possible.
Contact your Komatsu dealer for repair.**

REMARK

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

Pre-heating System (continued)

Engine Coolant and Engine Oil Heatings

REMARK

Use the heating system during stand-still periods e.g. over night and low ambient temperatures.
The heating system should be energized as soon as the engine is stopped. This allows the heating system to maintain the desired temperature with the use of minimum power.

Legend for illustration Z 22892

(1) Coolant heating system, installed on LH side member of the main frame.

(2) Switch, coolant heater ON/OFF.

(3) Indicator light, coolant heating ON,

(4) Coolant hose from engine to coolant heater

(5) Coolant hoses, preheated coolant to the engine.

(A) Coolant inlet

(B) Coolant outlet

(C) Engine oil heater installed in the engine oil pan

(D) Thermostat for engine oil heater installed in the engine oil pan

REMARK

The engine oil reserve tank is also equipped with a heater element and thermostat, see next page for details.

To activate the coolant heating, set main switch (1Q1) on the switch board in cab base to ON position. The coolant heating can then be switched on with switch (2) on the control panel. The lamp (3) illuminates with coolant heating ON.

NOTICE

Before starting the shovel engine, switch OFF the coolant heater.

REMARK

For more information about the coolant heating system, refer to the manufacturer’s manual -KIM HOTSTART Coolant Heating System- delivered with the heating system.

NOTICE

- **Before starting read the Engine Operation Manual. Observe the instructions for starting the Engine.**

⚠ WARNING

- **After repairs on the Diesel engine or starter motors, make sure that the ground cables are correctly connected before starting the engine. Loose or missing ground cables can cause fire, serious injury or death.**
- **Start the engine from the operator's seat only. Never attempt to start the engine by shorting across starter terminals. This can cause fire, serious injury or death.**
- **Before each starting make sure that all controls are in neutral position.**
- **Be sure to sound the signal horn before starting to make your intention clear.**

⚠ CAUTION

Before starting the engine and again before starting work, pay attention to the hydraulic oil temperature. Refer to paragraph "Hydraulic Oil Warm-up" in this section.

Legend for illustration Z25449

(1) Key operated main switch

(2) Acoustic warning signal

(3) Health monitor

(4) Engine speed selector switch
- Low idle - High idle

(5) Signal horn button

(6) Rotary switch - engine start

(7) Rotary switch - engine stop

(8) Strike button - emergency engine shutdown and cut out of pilot control system

(9) Safety lock lever

⚠ 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

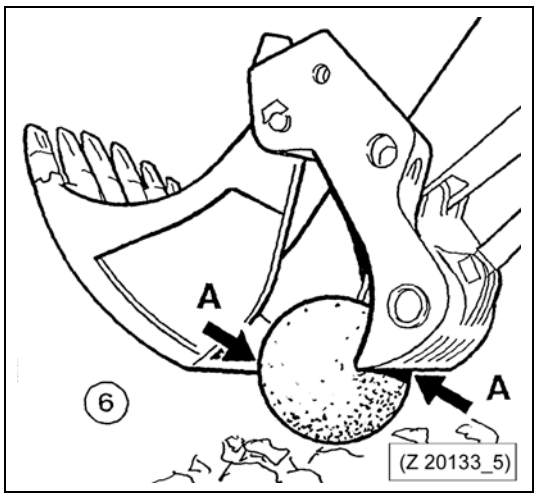
(Special equipment)

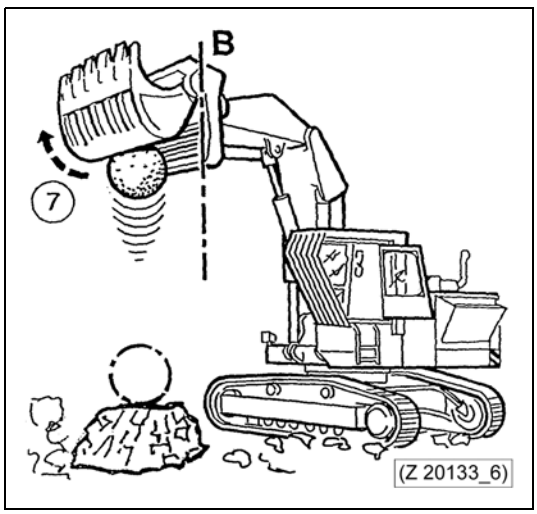
The Shovel can be equipped with one of the above alarm systems. The back-up alarm will sound at reverse travel. The travel alarm will sound at forward and reverse travel.

3.12.4 DROP BALL OPERATION

⚠ WARNING

- **Make sure all safety devices are correctly installed on your machine.**
- **Always walk-around and look for hazards before you operate your machine in the work area.**
- **Consult the supervisor of the job site for instructions concerning safe operation in the work area.**
- **Know the rules for movement of people and machines on the job site. Follow the instructions of the supervisor.**
- **Before starting drop ball operation, clear area of other persons and sound the signal horn. Stop drop ball operation when other persons approaching to the work area.**
- **The drop ball must never be placed loosely in the bucket. Always pick-up the drop ball at its greatest circumference, see detail (A) in the illustration number (6).**
- **When lifting the drop ball, make sure the back wall of the bucket remains in a vertical position, see detail (B) in illustration no. (7). The ball drop height is reached, when the bucket is on a level with the cab roof.**
- **With the drop ball lifted, never tilt back the bucket beyond the vertical position (B), otherwise the drop ball could roll over and fall on the Shovel.**
- **Before leaving the Shovel locate the drop ball on a safe place. DO NOT leave the drop ball in the bucket.**





⚠ CAUTION

Never stop the engine from full load except in case of emergency.
Before shutting down run the engine at idling speed for approximately 5 minutes. This cooling down period prevents heat accumulation and thermal stress, especially in the turbochargers.

⚠ CAUTION

For EMERGENCY SHUTDOWN of the Engine, use STRIKE BUTTON (8).
Additional emergency shut-down switches are located on the power house. For more information → See "POWER HOUSE" on page 126.

Stopping procedure, illustration Z25449

1. Park the Shovel at a safe place on level and solid ground.

   For more information → See "PARKING THE SHOVEL" on page 189.

2. Deposit the working attachment onto the ground, proceed as follows:

   - **A - Backhoe Attachment**
     Lower the backhoe attachment fully extended onto the ground as shown on the oil level plate at the main hydraulic oil reservoir.

   - **B - Bottom Dump Bucket Attachment**
     Lower the bottom dump bucket attachment onto the ground with the stick fully retracted and with the bucket resting completely flat on the ground. This position is shown on the oil level plate at the main hydraulic oil reservoir.

   The positions A or B are necessary to prevent unintentional movement of the working attachment when the pressure in the hydraulic system is relieved, and for correct checking of the hydraulic oil level.

3. Move all controls into neutral position.

4. Set toggle switch (4) to low idle speed position. Let the engine idle for about five minutes without load.

5. Turn switch (7) clockwise to stop position. When the engine has come to standstill, relieve the pressure in the hydraulic system.

3.17.1 HIGH LEVEL ALARM ”FIRE”

The high level alarm (8), illlust. Z 21619 will sound approximately 15 seconds before discharge of the fire suppression system in case of automatic actuation of the system. Act according to the circumstances and the applying safety regulations. Evacuate area to lessen risk of injury from flames.

3.17.2 ENGINE SHUT-DOWN THROUGH FUEL SHUT-OFF SOLENOID VALVE

The fuel shut-off solenoid valve for the engine is actuated through pressure switch (9), illust. Z 21619.

When the fire detection system detects a fire, the valve will be closed shutting-off fuel supply to the engine (Shut-down of the engine).

3.17.3 ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEM

MANUAL ACTUATION

Via strike button (2) in operator’s cab or strike button of switches (6) on radiator door and (7) at the rear power house door.

⚠ WARNING

Manual actuation will result in immediate system discharge which may obscure vision. Make certain the Shovel is stopped safely before manually actuating the system. Manual actuation will bypass all auxiliary shutdown and alarm functions.

NOTICE
For manual actuation via switches (4, 6 or 7), pull ring (3) and strike button (2).

AUTOMATIC ACTUATION

Via detection wires routed through the engine - and hydraulic pump compartments.

A - Pumping the oil from the Suction Oil Reservoir (11) into the Main Oil Reservoir (continued)

6. The suction oil reservoir and the suction hoses are filled, when bubble free oil flows out at the vent plug openings on each main pump. Install vent plugs and tighten securely.

7. Check oil level in all main pump housings and vent the hydraulic pumps according to page 399 in the Maintenance Section 4.

8. Check oil level in the main reservoir. Fill up with new hydraulic oil as necessary.

9. Start the engine and run without load to allow trapped air to be removed from the hydraulic system.

⚠ CAUTION

DO NOT start the engine when the suction oil reservoir is empty.

B - Pumping the Oil from the Return Oil Collector Pipe (12) and back-pressure valve pipe (13) into the Main Reservoir

1. To empty the collector pipe (12), open cock (2).

2. Switch on pump with switch (6).

3. Observe oil level sight gauge at the main oil reservoir. As soon as the oil level remains constant the return oil collector pipe is empty. Now switch off the transfer pump (4) and close cock (2).

4. To empty the back-pressure valve pipe (13), open cock (3).

5. Switch on pump with switch (6).

6. Observe oil level sight gauge at the main oil reservoir. As soon as the oil level remains constant the back-pressure valve pipe is empty. Now switch off the transfer pump (4) and close cock (3).

⚠ CAUTION

DO NOT start the engine during servicing.

RECEIVER PANEL WITH MONITOR BOX

Legend for illust. Z 21623

18	Adapter for filling the water tank in the Operator's cab. The water tank has a capacity of 50 liters. The filling line of the water tank is equipped with a drain cock. Before filling the water tank, drain the old water by opening this drain cock. Close the drain cock and fill in 50 liters of clear water.

NOTICE
If freezing temperatures are expected, drain the water from the filling line by opening the drain cock. Switch on the engine-independent auxiliary cab heater during standstill periods to prevent freezing of the water in the cab water tank.

⚠ WARNING

- **DO NOT drink the water from the water-tap in the Operator's cab.**
- **Use for hand washing only.**

REMARK
The overflow line of the hand wash sink and water tank must not be obstructed. The overflow line is routed inside the cab base through a hole in the base floor to the outside. Excess water will flow through this line to the outside just below the cab base.

Refilling Procedure:

REMARK
Refer to Maintenance section 4, for the correct lubricant specifications and filling capacities.
For Engine Lubricants and Coolants refer to the separate Engine Operation & Maintenance Manual in volume 2 Binder.

1. Connect supply lines to the respective adapters.
2. Monitor the respective fluid/lubricant level at the indicator lights (9, 13, 15 and 17).
3. After finishing the refilling operation, cover the adapters with the protection caps provided and swing back hydraulic service arm (3) to its home position.

⚠ CAUTION

Recheck fluid levels before operating the machine.

3.23.4 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.)
Engine cooling system	475.0
Engine oil pan	290.0
Engine oil reserve tank	580.0 (457.0 Refill)
Fuel tank	6400.0
Hydraulic oil reservoir	3900,0
Hydraulic system	5900.0
Flexible coupling between engine and PTO	1.3
PTO (Pump distributor gear)	150.0
Swing machinery (Manufacturer L&S), each	42.0
● Motor adapter housing	0.6
Swing machinery (Manufacturer Siebenhaar), each	60.0
● Motor adapter housing	*1)
● Brake housing	*1)
Travel gears, each	155.0
● Motor adapter housing	0.6
● Brake housing	0.5
Drive shaft housing, final drives, each	145.0
Track rollers, each	2.4
Guide wheels, each	2.9
Support rollers, each	4.0
Fan bearing housing of radiator	*2)
Fan bearing housings of hydraulic oil cooler	*2)
Water tank for hand wash sink in Operator’s cab	50.0
Water tank for windshield washer system	7.0

REMARK

Capacities listed above are approximate values.
For proper checking use level plugs, dipsticks, and inspection openings, provided for this purpose.

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

***2)** Fill up to lower edge of level plug opening.

4.6.4 EXTENDED SERVICE INTERVALS FOR ENGINES EQUIPPED WITH ENGINE OIL MANAGEMENT SYSTEM

REMARK

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

Reserve System Oil Flow Schematic, illustration Z25458

(1) Reserve oil tank, usable contents 457 liters. Refilling interval, approx. 400 - 500 operating hours

(2) Oil level sight gauge. Check oil level in the reserve tank before starting the engine. If necessary refill reserve tank via service arm adapter, refer to page 213 for more information.

(3) Pumping unit, located on the side member of the power frame.

(4) Oil filter of the supply system. Replace both filter elements after every 400 - 500 operating hours.

(5) Crankcase breather filter

(6) Suction lines

(7) Oil supply line from pump (3) to engine oil pan

(8) Withdrawal oil line from oil pan to pump (3)

(9) Oil feed-back line to reserve tank (1)

(10) Reserve tank breather filter

(11) Oil drain plug

(12) Power frame side member

Servicing Intervals

- **Every 10 operating hours**

  Check oil level in engine oil reserve tank (1) on sight gauge (2). Keep oil level between MIN and MAX mark on the gauge. Check also the oil level in the engine oil pan.

REMARK

The oil level in the engine oil pan can vary between the MIN and MAX marking on the oil level gauge 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 the gauge. 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 (3) is monitored by an indicator light located on the "X2" switch board in the cab base.

4.7.3 AUTOMATIC LUBRICATION SYSTEMS FILL GREASE BARRELS

Fill the grease barrels of the Central Lubrication System and Swing circle pinion Lubrication System when the corresponding message "grease barrel empty" is displayed on the health monitor. Make sure the grease filters in the filling line are not obstructed. If necessary service the Grease Filters.

Legend for illustration Z 23030

(A) Grease supply line to the injectors for lubrication of the loader attachment, swing circle bearing and swing machinery pinion bearing

(B) Grease supply line to the injectors for lubrication of the swing circle toothing

(P) Pressure oil supply from pilot oil circuit to hydraulically driven grease pumps (5 and 12)

(R) Return oil to main hydraulic oil reservoir

(1) Grease refilling line from service arm adapter to grease filter (2) of the central lubrication system

(2) Grease filter for central lubrication system.

(3) Grease refilling line from grease filter (2) to grease container (4) of the central lubrication system

(4) Grease container of the central lubrication system

(5) Hydraulically driven grease pump

(6) Grease pressure gauge

(7) Grease supply line to the injectors of the central lubrication system, see (A).

(8) Grease refilling line from service arm adapter to grease filter (9) of the swing circle pinion lubrication system

(9) Grease filter for swing circle pinion lubrication system.

(10) Grease refilling line from grease filter (9) to grease container (11) of the swing circle pinion lubrication system

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

(12) Hydraulically driven grease pump

(13) Grease pressure gauge

(14) Grease supply line to the injectors of the swing circle pinion lubrication system, see (B).

(15) Grease level gauge. Check grease level in both containers at regular intervals.

(16) Breather filter

CHECK GREASE INJECTORS FOR PROPER OPERATION

NOTICE
There are two types of grease injectors installed “SL1” and “SL11” injectors, see illust. (Z 20840).

Legend for illustration Z 20840

A	Injectors on bottom dump bucket
B	Injectors on stick
C	Injectors on boom
(1)	Indicator stem for visual indication of injector operation
(2)	Output adjusting screw
(3)	Protection cap
(4)	Grease fitting
(5)	Grease fittings on backhoe bucket linkage **REMARK** Backhoe bucket linkage must be lubricated manually, if not connected to the central lubrication system.

Check operation of all grease injectors (A, B and C) by visually watching the cycle indicator stem (1) while operating the central lubrication system manually. Stem (1) must move in and out once a complete lubrication cycle.

If a cycle indicator (1) does not move during a lubrication cycle, grease supply to the lubrication point of the concerned injector is interrupted.

Refer to next page for corrective action.

Carry out same checks on the injectors for swing circle, see next page.

4.8.5 FUEL SYSTEM WATER SEPARATOR - DRAIN WATER

Legend for illustration Z 23062

(1) Fuel tank

(2) Fuel shut-off solenoid valve. This solenoid valve cuts-off fuel supply to the engine when the stop switch on the instrument panel is actuated.

(3) Water separator filter

(4) Engine fuel filters

(5) Return fuel from engine

(6) Fuel inlet to fuel cooler segment of the radiator

(7) Fuel outlet from fuel cooler segment of the radiator

(8) Return fuel to tank

(9) Fuel cooler segment of the radiator

(10) Counterweight

Draining Water

Frequency of water draining is determined by the contamination of the fuel. Inspect or drain the collection bowl of water daily or as necessary. The collection bowl must be drained before contaminants reach the top of the turbine.
Refer to separate Instruction booklet -Fuel Filter/Water Separator- filed in volume 2 binder for draining procedure.

Filter Element Replacement

Frequency of element replacement is determined by the contamination of the fuel. Replace the elements after every 500 operating hours, if power loss is noticed or annually, which ever comes first.
Refer to separate Instruction booklet -Fuel Filter/Water Separator- filed in volume 2 binder for replacement procedure.

4.9.4 PTO (PUMP DISTRIBUTOR GEAR) AND OIL RESERVOIR - CHECK OIL LEVEL

Legend for illustration Z 21657

(1) Oil level gauge

(2) Oil filler plug

(3) Breather filter

(4) Oil collector reservoir for secondary oil pump drive shaft housings

(5) Breather filter with oil level gauge

(6) Main pump drive shaft housings

(7) Oil level plug of main pump drive shaft housing

(8) Oil filler plug with breather pipe of main pump drive shaft housing

(9) Oil drain plug of main pump drive shaft housing

(10) Oil drain plug of PTO gear

CHECK OIL LEVEL OF PTO GEAR

1. Unscrew level gauge (1) and wipe it clean.
2. Insert gauge (1), but DO NOT screw in, see detail (A).
3. Remove level gauge and read the oil level. The oil level should be between the “MIN” and “MAX” mark. If necessary, add oil through filler opening (2) up to the “MAX” mark on gauge (1).

NOTICE
If the oil level is above the “MAX” mark, drain the oil down until the oil level is at the “MAX” mark. Too much oil in the pump distributor gear will cause aeration of the oil.

4. Insert gauge (1) and tighten securely. Remove breather filter (3). Blow out with compressed air from inside to outside and reinstall.

CHECK OIL LEVEL OF OIL COLLECTOR RESERVOIR (4)

Remove breather filter with oil level gauge (5). The oil level should be between the “MIN” and “MAX” mark. If necessary, add oil through the level gauge opening. Clean the breather filter and install.

NOTICE
If oil starts dropping out at breather (5), check oil seals of secondary pump drive shafts for damage.

4.10.6 AUTOMATIC LUBRICATION SYSTEMS - CLEAN IN-LINE GREASE FILTER

Legend for illustration Z 21465

(1) Grease pump drive (Hydraulic cylinder)

(2) Solenoid valve (Oil pressure supply)

(3) Flow control valve

(4) Pressure reducing valve

(5) Hydraulic oil supply line (Pilot pressure)

(6) Hydraulic oil return line

(7) Vent valve (Solenoid valve, de-energized open to barrel)

(8) Grease supply line to injectors

(9) Lubricant level indication, (Sonar sending and receiver principal)

(10) Grease barrel

(11) Pump mechanism

(12) Grease filter element

(13) Hydraulic pressure test plug (Operating pressure)

(14) Grease pressure gauge (Operating pressure)

(15) Vent line to barrel

(16) Breather

(17) Electrical terminal box

Components of In-Line-Grease-Filter:

(12) Filter element

(18) Plug screw

(19) Packing ring

(20) Filter housing

(21) Spring

(22) Spring guide

⚠ WARNING

Before servicing stop the engine/motor and remove ignition key in order to prevent operation of the system. Be sure to vent system pressure before removing plug (18).

A blocked filter can disintegrate under pressure and damage the automatic lube system.

4.11.1 BATTERIES - CHECK FLUID LEVEL

See illustration Z25474

A - Top view of access area

⚠ WARNING

- **Batteries give off highly inflammable gas! Never allow sparks or open flame near the batteries!**
- **Avoid spilling any electrolyte on hands or clothing. Repair or replace all broken wires immediately. All terminals must be clean and securely fastened; never paint connections.**
- **DO NOT short across or ground any terminals of the batteries.**

Check electrolyte level:

NOTICE
The batteries are located below the walkway floor in two separate boxes. To get access to the batteries remove floor plate fastening bolts and open the hinged floor plates.
Secure the open floor plates against falling down with the safety chains provided.

1. Remove the two battery main switch keys (1).
2. Open floor plates (2).
3. Check electrolyte level (4) of batteries (3).
4. If necessary remove filler and breather caps and top up with clean distilled water.
5. See that contact surfaces of battery terminals are bright. Clean if necessary and apply some vaseline to the terminal posts.

⚠ WARNING

- **Care must be taken that the batteries are not overfilled as the electrolyte will expand and overflow when the temperature rises.**
- **On removal always disconnect the ground (-) cables first. When re-installing the batteries connect the positive (+) cables first.**

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 pressure relief cock (5), see illust. Z 20371 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 pressure relief cock (5) must always be in CLOSED position. Open cock (5) 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.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.
- Check condition and fastening of safety chains (1).
- Check the silicone oil filled viscous mounts (2) for leakage and signs of fatigue.

High-Strength Bolt Connections (continued)

Machinery house, check mounting of posts and cross member. Check roof frame and roof elements for proper mounting and good condition, illust. Z 21676

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1)	M30	10.9	46	1770	32
(2)	M24	10.9	36	880	12
(3)	M36	10.9	55	3100	12
(4)	M12	8.8	19	74	37
(5)	M12	10.9	19	108	5

* SW = Wrench size

High-Strength Bolt Connections (continued)

Check condition and fastening of main control valves and high pressure filters, illust. Z 21681

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1)	M24	10.9	36	880	4
(2)	M16	10.9	24	265	6
(3)	M16	10.9	24	265	6
(4)	M20	10.9	30	510	16
(5)	M16	10.9	24	265	16

* SW = Wrench size

High-Strength Bolt Connections (continued)

Check condition and fastening of travel gear and sprocket, illust. Z 21679

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1) see NOTICE below	M 30	8.8	46	1250	24
(2)	M 30	8.8	46	1250	24
(3)	M 36	10.9	55	3100	72
(4)	M20	8.8	30	360	16
(5)	M 36	10.9	55	3100	12

* SW = Wrench size

NOTICE
If bolt connections (1) have been found loose, it is necessary to check also the inner bolts (2) for looseness.
For this purpose the travel gear assy has to be removed.

FILTER SERVICE

- Replace breather filter element
- Drain water and sediments from hydraulic oil tank

Legend for illust. Z 21503

(6) Hand wheel of main shut-off valve located between suction oil tank and main oil tank
- To open the valve, turn hand wheel (6) CCW to the stop
- To close the valve, turn hand wheel CW to the stop

A proximity switch located on the gearbox of the shut-off valve monitors the valve position. With the valve not fully open, a corresponding message will be displayed on the VHMS monitor in the operator's cab.

REMARK

Before starting the engine, make sure the valve (6) is completely open.

(11) Breather filter

Replace Element (C) of Breather Filter (11).

1. Remove nut (A).
2. Remove cover (B).
3. Remove filter element (C).
4. Insert new filter element and reassemble the breather filter (15).

Drain Water and Sediments

Drain water and sediments with machine standing an level ground and when machine was out of operation for some time.

Refer to Operation section 3.18 for evacuation procedure.

4.12.4 SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE

See illustration Z 9543

Unscrew collector protection cap (2).
If the fins of the collector are very strongly blackened or coated with verdigris, clean them with emery cloth.
Unscrew ball bearing cover and fill it half way up with grease.

Install removed parts.

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 after 6000 operating hours at the latest.
The pulsation damper must be replaced after every 2000 operating hours.

Legend for illust. Z 21689

(1)	Main oil reservoir
(2)	Back-pressure valve
(3)	Return oil collector pipe
(4)	Drain coupling
(5)	Hand wheel of main shut-off valve
(6)	Return oil strainer
(7)	Bolt
(8)	Bolt
(9)	Intermediate pipe
(10)	Gasket
(11)	Gaskets
(12)	Compensator

Evacuate main hydraulic oil reservoir according to section **Central Refilling System** on page 212.
On machines **without transfer pump** for hydraulic oil attach drain hose (part of tool set) to coupling (4) and drain oil from return oil collector pipe (3). Drain also the oil from return oil manifold, see illustration Z 21690 and from suction oil reservoir, see illustration Z 21691A.
On machines **with transfer pump** for hydraulic oil, proceed according to page 206.

REMARK
Replace return oil strainer (6), illustration Z 21689 after major repairs on the hydraulic system and after every 6000 operating hours. Use new gaskets (10 and 11).

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

Bleed air from all Hydraulic Pumps and check the Oil Level in the four Main Pump Housings

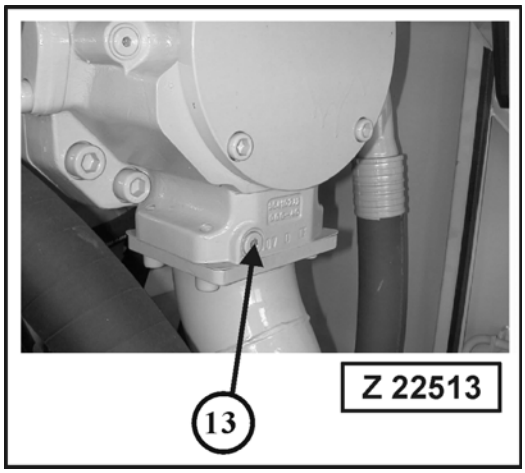
Legend for illust. Z 21693

I - IV	Main hydraulic pumps (swash plate type)
(1)	Axial piston pump for hydraulic oil cooler fan drive
(2)	Axial piston pump for engine coolant radiator fan drive
(3)	Piggy-back gear pump for pump regulation and pilot oil circuit
(4)	Piggy-back gear pump for PTO gear lubrication system
(14)	Oil level and filler plug of main pump housing
(15)	Port of leakage oil return line

Bleeding air from pumps (1 - 4) and main pumps (I - IV)

Bleeding air from the hydraulic pumps and complete filling of the suction oil reservoir and the suction lines is essential, to prevent damages caused by air in the suction system (cavitation).
Proceed as follows:

1. Open vent plug on top of pumps (1 and 2). Close the vent plugs as soon as bubble-free oil flows out.
2. Open vent plug (13), illust. Z22513 on the suction port of gear pumps (3 and 4) and wait until bubble-free oil flows out. Then tighten vent plug (13).
3. Open vent plug (13) on the pump suction port of all four main pumps. As soon as bubble free oil flows out tighten vent plug (13).



Check oil level in main pump housings (I - IV)

1. Remove level and filler plug (14), illust. Z 21693. The oil level in the pump housing must reach the lower edge of the opening.
2. If necessary add hydraulic oil up to the lower edge of the filler opening.
3. Insert level and filler plug (14) and tighten securely.

NOTICE

- **Make sure the main pump housings are correctly filled, otherwise the pump drive shaft bearings could be damaged due to lack of lubrication.**
- **Check hydraulic oil level.**
- **Check the whole hydraulic system for leakages.**

Brake Housing - Change Oil (Siebenhaar)

1. Remove level gauge (8), illustration Z 21694, 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 239.

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 Shovel clean, especially from inflammable materials.
   Clean the Shovel 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 in part 3 of the Service Literature Binder 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 slew ring gear after drying by means of the automatic lube system or manually.