SEN06694-04

Shop Manual

HYDRAULIC
EXCAVATOR

PC3400-11M0

SERIAL NUMBERS 36301 and up

KOMATSU

2.4.12 STARTING MOTOR

2.4.12.1 WARNING TAG

– If there is a "DANGER DO NOT OPERATE!" warning tag displayed, it means that someone is carrying out inspection and maintenance on the excavator (Fig. 2-19). If the warning sign is ignored and the excavator is operated, there is a danger that the person carrying out the inspection or maintenance may be caught in the rotating parts or moving parts and suffer personal injury or death. Do not start the motor or touch the levers.

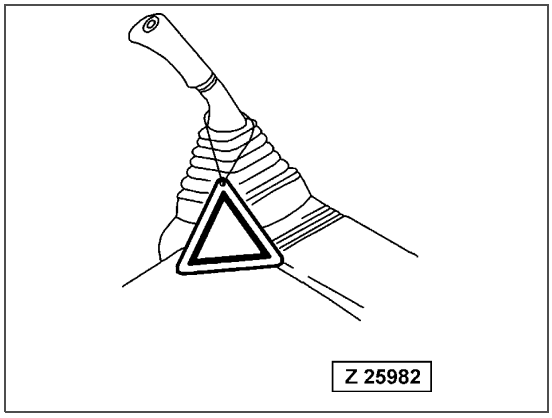


Fig. 2-19

2.4.12.2 CHECKS BEFORE STARTING MOTOR

Carry out the following checks before starting the motor at the beginning of the day's work to ensure that there is no problem with the operation of the excavator. If this inspection is not carried out properly, problems may occur with the operation of the excavator, and there is the danger that this could lead to serious personal injury or death.

– Remove all dirt from the surface of the window glass to ensure a good view.
– Completely remove all flammable materials accumulated around the motor and battery, and remove any dirt from the windows, mirrors, handrails, stairway.
– Check the coolant levels, fuel levels, and oil levels, and check for damage to the electric wiring.
– Adjust the operator's seat to a position where it is easy to carry out operations, check the camera system functions and check that there is no damage or wear to the seat belt or mounting clamps.
– Check the operation of the instruments and gauges, check the angle of the mirror, and check that the control levers are all at the neutral position.
– Before starting the motor, check that lock lever (Fig. 2-20) is in LOCK position (L).
– Adjust the mirrors so that the rear of the excavator can be seen clearly from the operator's seat.
– Check that there are no persons or obstacles above, below, or in the area around the excavator.

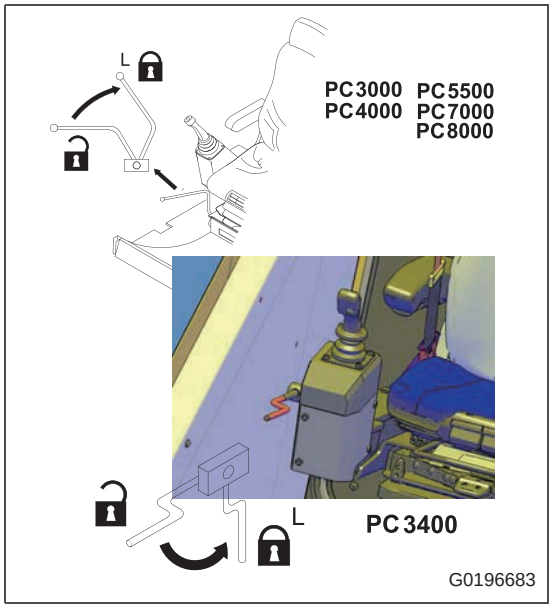


Fig. 2-20

2.4.12.3 PRECAUTION WHEN STARTING MOTOR

– Start and operate the excavator only while seated.
– Do not short circuit the starting motor circuit to start the motor. Short circuiting can cause fire.
– When starting the motor, sound the horn as a warning.
– Do not let any person on the excavator other than the operator and the operator's assistant (1 person). For demonstration purposes or during training, more than two people can be present in the operator’s cab at the same time. All personnel within the cab at such times must secure good hand-holds and be aware of sudden movements. All appropriate relevant safety measures are to be observed.

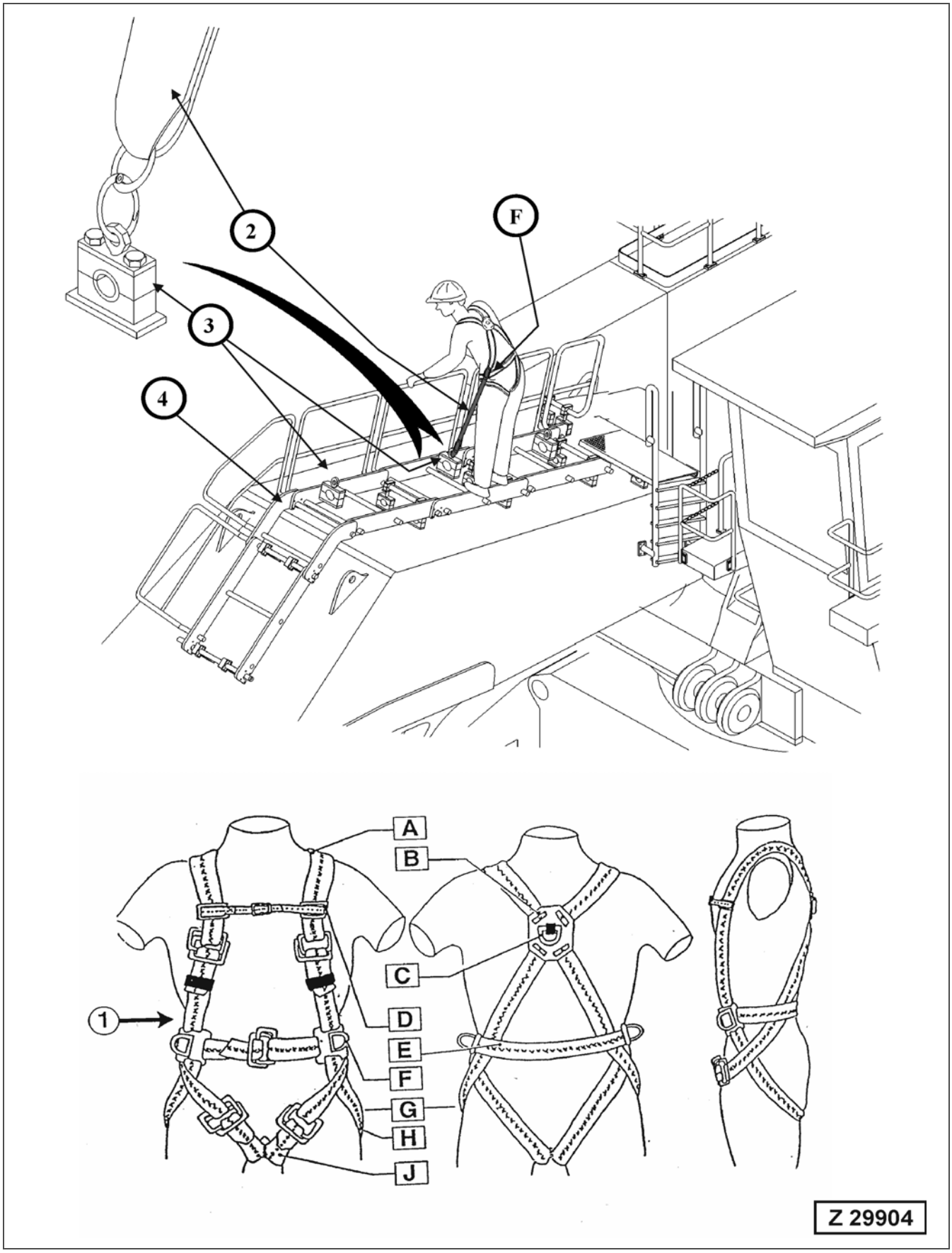


Fig. 2-53

Legend for Fig. 3-4:

(1) Engine air cleaner
(2) Exhaust muffler
(3) Coolant expansion tank
(4) Radiator
(5) Reserve oil tank (engine oil)
(6) Diesel engine
(7) Eliminator filter (if equipped)
(8) Suction oil tank
(9) Fuel filter (first stage)
(10) Control plate
(11) Main hydraulic pumps
(12) Leak oil manifold
(13) Fuel filter (second stage)
(14) Machine house frame

3.16 COUNTERWEIGHT

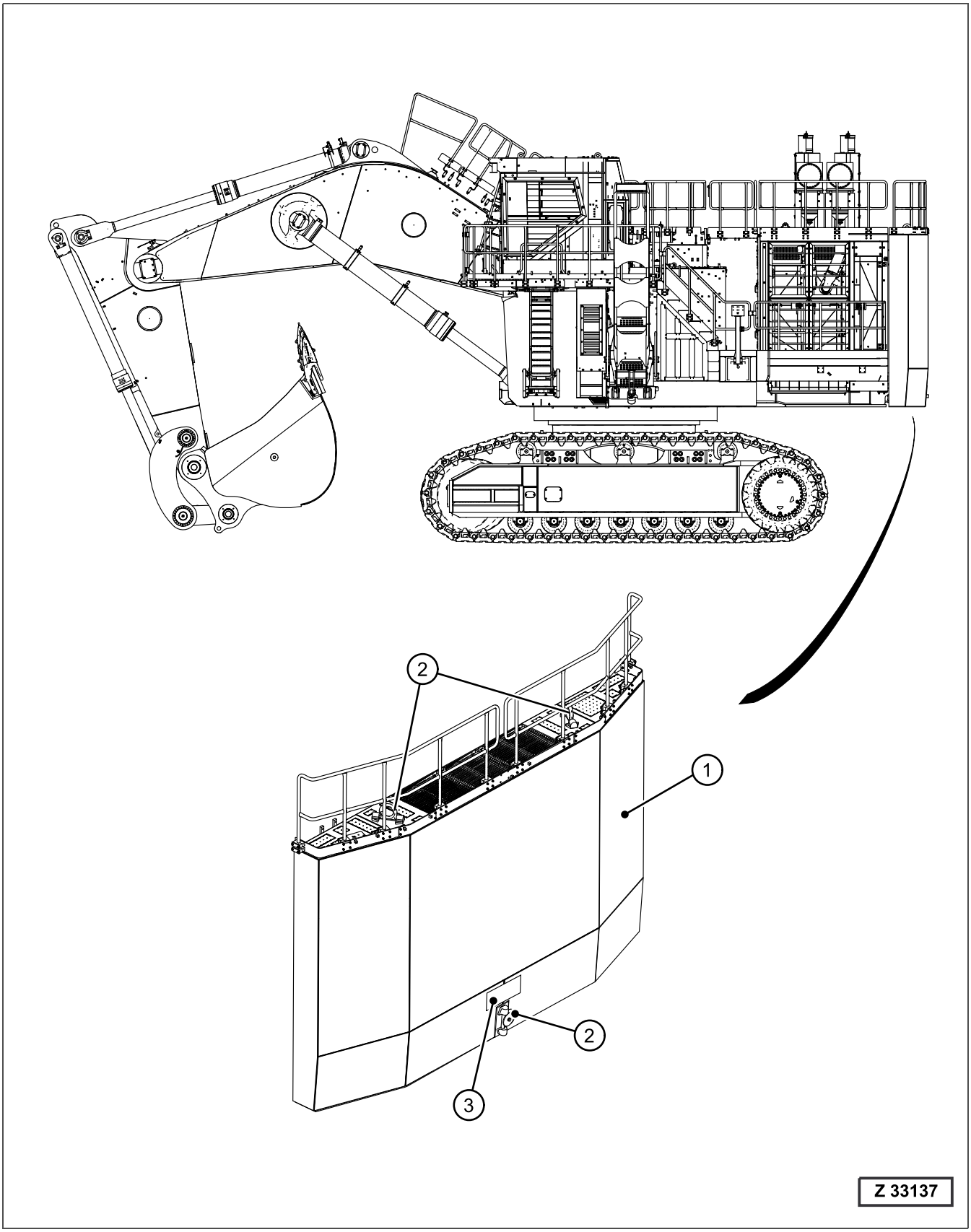


Fig. 3-18 Counterweight

Legend for Fig. 4-17:

(A)	Oil inlet and breather
(B)	Oil level plug
(C)	Oil drain plug
(1)	Universal pump distributor gear (PTO)
(2)	Port for main pump #1
(3)	Port for main pump #2
(4)	Port for main pump #3
(5)	Port for gear oil pump
(6)	Suction port for gear oil pump
(7)	Refill and drain connection to service arm
(8)	Valve return port
(9)	Leak oil port from valve
(10)	Oil cooler bypass port
(11)	Type plate
(12)	Location of temperature sensor (57B049-1)
(13)	Oil level dipstick
(14)	Ports for heater rods (optional)

Description

The universal pump distributor gear (PTO) is a spur gear design which can be driven by Diesel engine or electric motor (50 Hz & 60 Hz).

The PTO gear runs in anti-friction bearings and it has been provided with a splash lubrication system. The oil supply of the bearings and tooth contacts takes place by spray nozzles. The gear wheels are of case-hardened steel.

The hydraulic pumps are directly attached to the gearbox. O-rings seal the connection between pump and drive shaft housing

The gearbox housing is a one-piece design and made of grey cast iron and is provided with a connection for a separate cooling system.

NOTE! PTO gear oil type: CLP 150 (standard oil type)
Filling capacity: approx. 87 liter.

NOTE! For arctic environment an optional heating system is available.

5.5 BACK PRESSURE VALVE

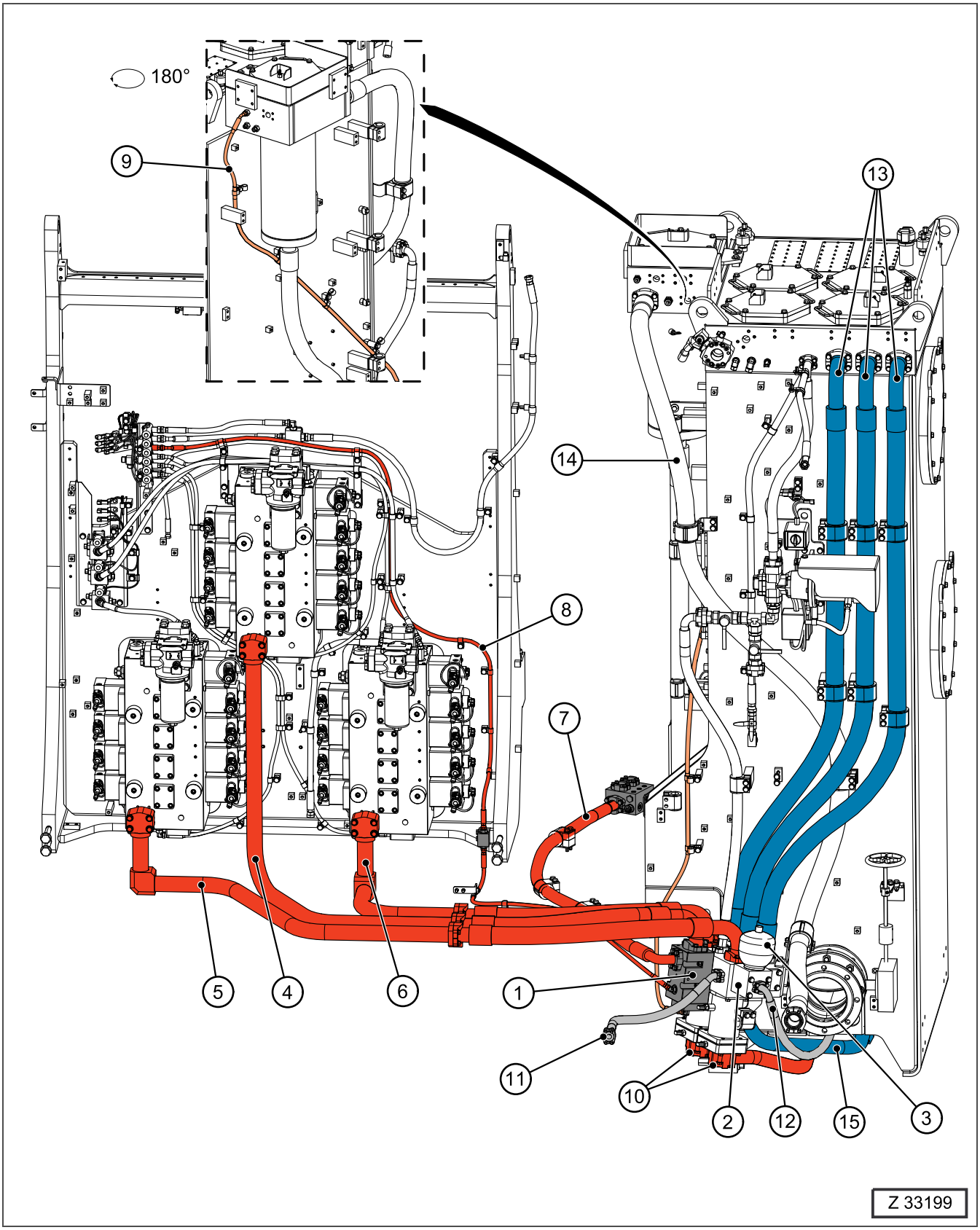


Fig. 5-5 Back pressure valve

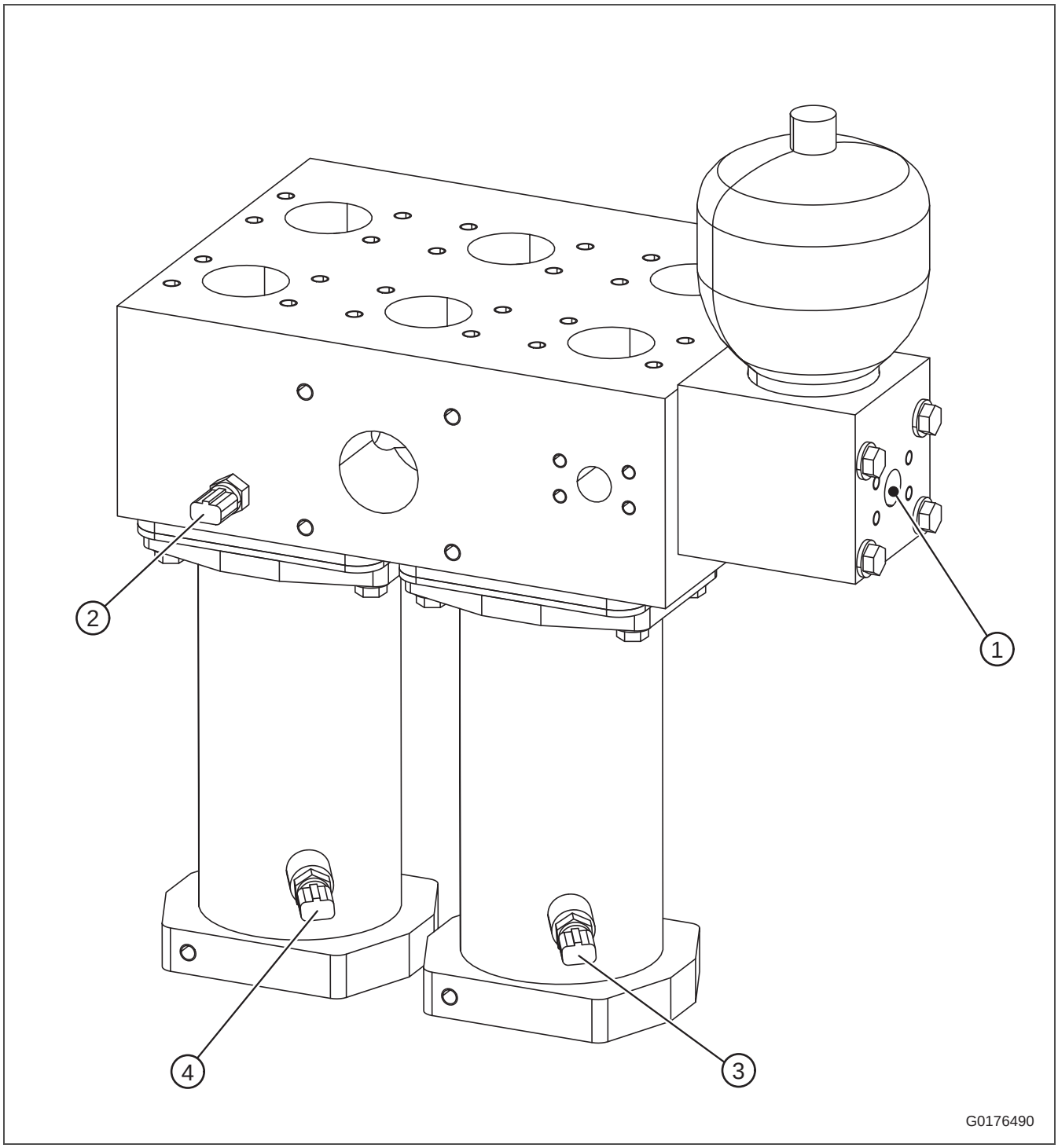


Fig. 6-8 Bypass valve connections

(1) Port return line from hyd. oil cooler fan drive

(2) Bypass valve return oil pressure sensor (40B166)

(3) Oil cooler pressure sensor (40B165a)

(4) Oil cooler pressure sensor (40B165b)

The preload valve return oil pressure sensor 40B166 (Fig. 6-8, Pos. 2) and oil cooler pressure sensor 40B165a and b (Fig. 6-8, Pos. 3 and 4) monitors the clogging status of the screens (differential pressure 2.0 bar).

7.5.1 CONTROLLER SETTING FOR LEVER CONTROL AND ATTACHMENT TYPE IN THE EXCAVATOR CONFIGURATION

If it is required to change the controller setting for EURO control ↔ KG control, refer to section 16.18.2 on page 16-169.

If it is required to change the controller setting for the attachment type FLSA ↔ BHA, refer to section 16.18.3 on page 16-171.

Legend for Fig. 8-2:

(1) Main control valve (MCV) 1
(2) High pressure screen 1
(3) Main control valve (MCV) 2
(4) High pressure screen 2
(5) Main control valve (MCV) 3
(6) High pressure screen 3
(7) Main control valve frame
(8) Slow return valve for boom bottom
(9) Slow return valve for stick bottom
(10) Slow return valve for bucket bottom
(11) Slow return valve for clam head
(12) Suction and safety relief valve for clam bottom
(13) Floating valve for boom lowering
(14) Floating valve for stick in

8.10 MAIN CONTROL VALVES SPOOL FUNCTIONS (BHA)

8.10.1 MAIN CONTROL VALVE 1

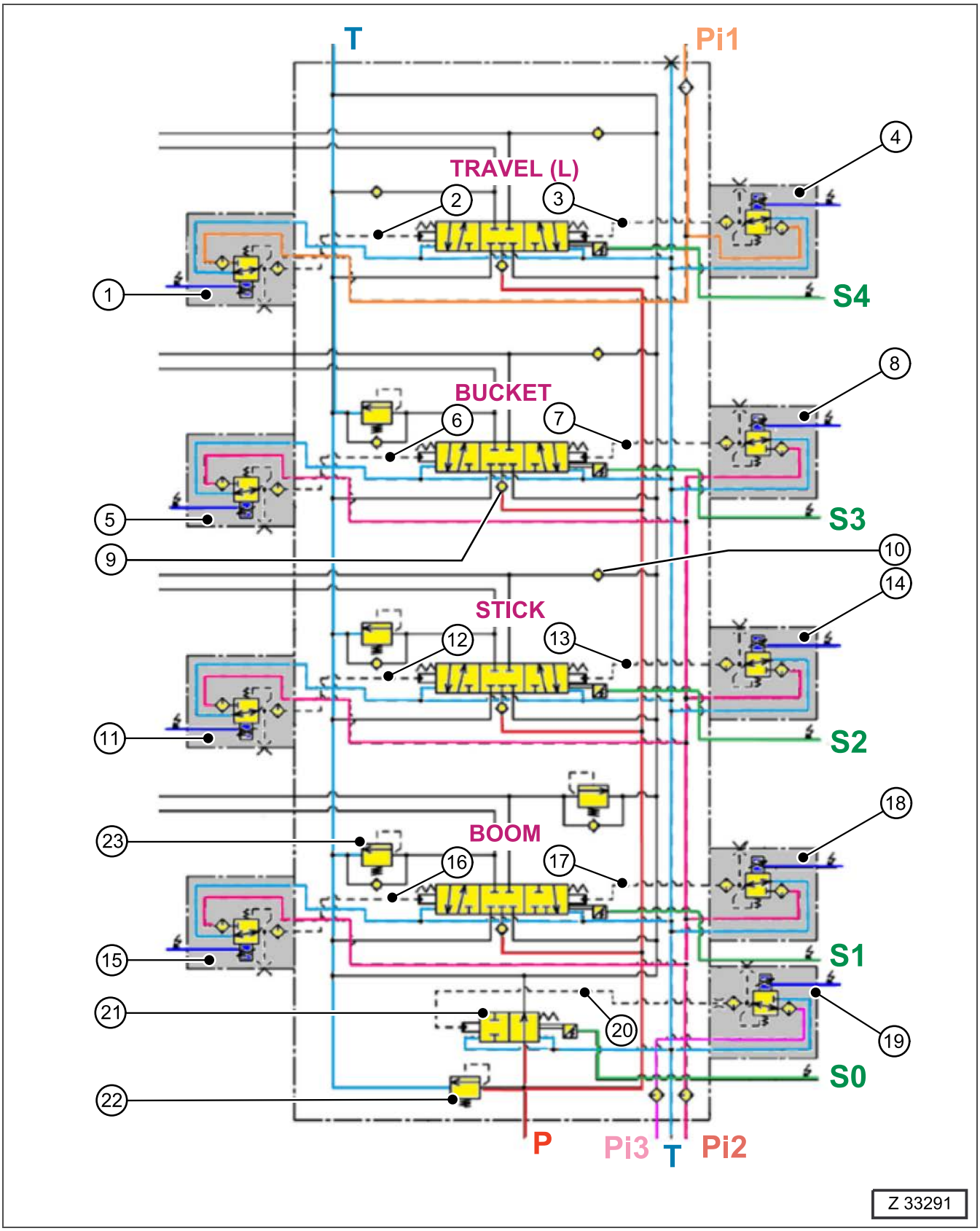


Fig. 8-15 Main control valve 1

Legend for Fig. 8-32:

(1) Hexagon

(2) Spring

(3) Screen element

(4) Screen housing

(5) Screen head

(6) Back-up ring

(7) O-ring

(8) Spring

REMARKS: High-pressure screens are installed in each pump line.

Function

The high-pressure in-line screens prevent the hydraulic circuits from contamination (particles > 200 µm) in case of high amount of wear particles (main pump failures).

The screens are installed between the main hydraulic pumps and the main control valves blocks.

REMARKS: An periodically maintenance is not necessary!

If a contamination is detected in this circuits locate the problem and replace the defective parts. Always install new screens and seals.

9.1.1 MAIN PUMP AND AUXILIARY PUMP BLEEDING PROCEDURE

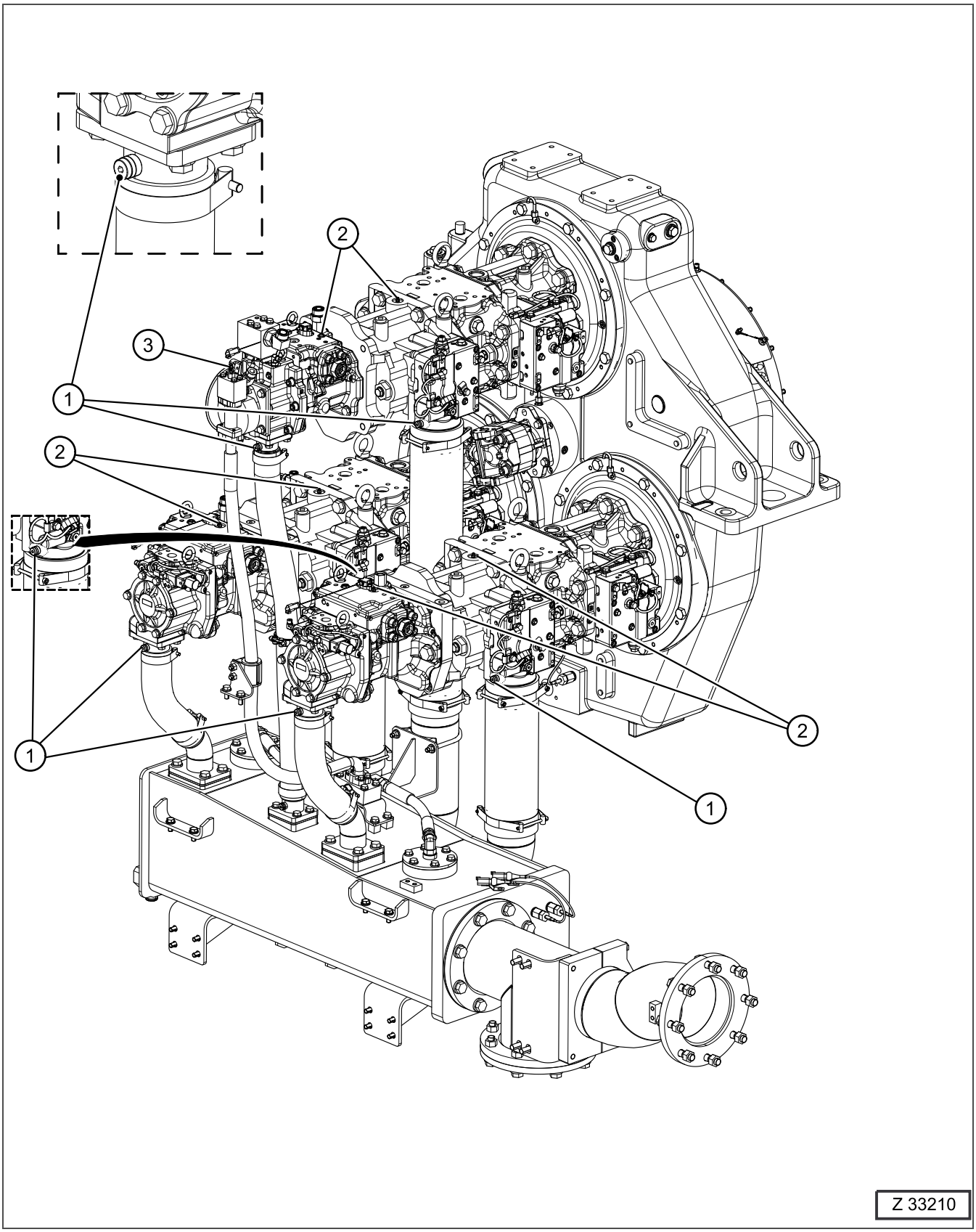


Fig. 9-2 Bleeding process

Monitoring ID	Monitoring item	Unit / Condition
01332	P1F EPC Sol. Min Calib. Current	mA
01333	P1F EPC Sol. Max Calib. Current	mA
01334	P1R EPC Sol. Min Calib. Current	mA
01335	P1R EPC Sol. Max Calib. Current	mA

Monitoring Items VALVE 2:

Monitoring ID	Monitoring item	Unit / Condition
76500	Hydr. Oil Temperature	°C
76501	Hydr. Temp. Sensor Volt	V
76504	Pump2F/Pump2R Press.	bar
76505	Pump2F/Pump2R Press. Sensor Volt	V
76506	Pump2F Displacement	cc/rev
76507	Pump2F Swash Plate Sensor Volt	V
76508	Pump2R Displacement	cc/rev
76509	Pump2R Swash Plate Sensor Volt	V
13102	Pump2F Absorption Torque	Nm
13103	Pump2R Absorption Torque	Nm
01336	P2F EPC Sol. Min Calib. Current	mA
01337	P2F EPC Sol. Max Calib. Current	mA
01338	P2R EPC Sol. Min Calib. Current	mA
01339	P2R EPC Sol. Max Calib. Current	mA

Monitoring Items VALVE 3:

Monitoring ID	Monitoring item	Unit / Condition
76600	Pump3F/Pump3R Press.	bar
76601	Pump3F/Pump3R Press. Sensor Volt	V
76602	Pump3F Displacement	cc/rev
76603	Pump3F Swash Plate Sensor Volt	V
76604	Pump3R Displacement	cc/rev
76605	Pump3R Swash Plate Sensor Volt	V
76637	Pump3F EPC Sol. Current	mA
76638	Pump3R EPC Sol. Current	mA
76654	Pump3F Absorption Torque	Nm
76655	Pump3R Absorption Torque	Nm

10.2.5 ELECTRIC / HYDRAULIC FLOWCHART "STICK OUT" (BHA)

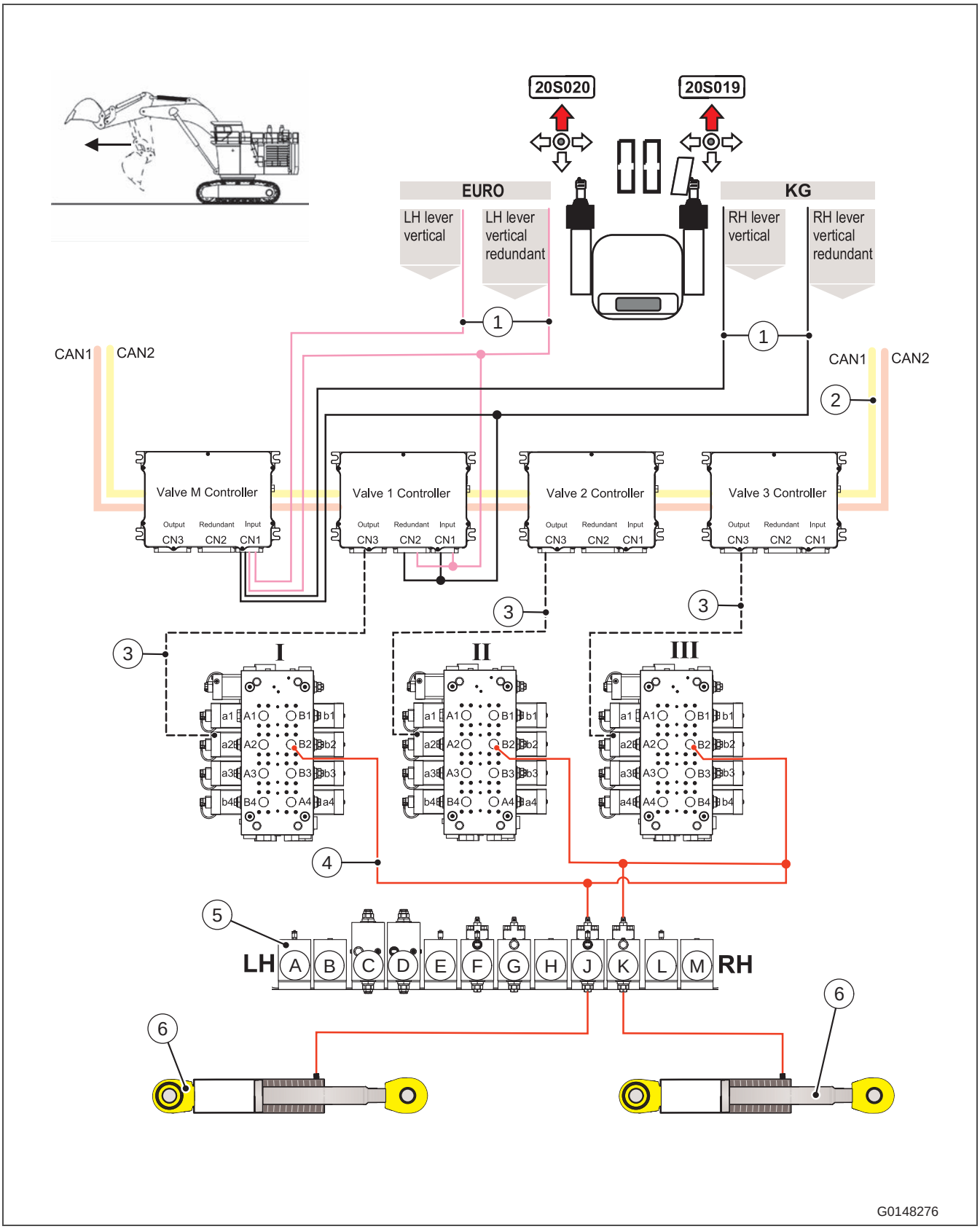


Fig. 10-7 Electric / hydraulic flowchart "Stick out" (BHA)

Legend for Fig. 10-22:

(1) Manifold

(2) Adjustment shaft

(3) Lock nut

For maximum permissible lowering speed refer to the PM-CLINIC sheet for your excavator.

Checks and adjustments

1. Run the engine at high idle (TH3).
2. Use a stop watch to measure the time for the cylinder movement (from start to final stop).

REMARKS: Pay attention to measure the time of the cylinder movement only.

3. Raise the fully extended attachment with empty bucket to the position shown in illustration Fig. 10-22, Pos. A.
4. Rapidly move the control lever 20S019 to the BH:left / FS:right end position (start the stop watch when the bucket starts moving) and hold the control lever in this position until the final position (Fig. 10-22, Pos. B) is reached (stop the stop watch).

REMARKS: Curl bucket slightly until final stop. Move the bucket carefully to final stop, because there is no end cushioning function).

5. If the lowering speed is too high (measured time is less than the permissible time), the speed must be reduced by adjusting the slow return valves section BHA: F and G / FSA: L and M at the distributor manifold (Fig. 10-22, Pos. 1).

   Adjust as follows:

   – To decrease the lowering speed, loosen the lock nut (Fig. 10-22, Pos. 3) and turn the adjustment shaft (Fig. 10-22, Pos. 2) clockwise.
   – To increase the lowering speed, loosen the lock nut (Fig. 10-22, Pos. 3) and turn the adjustment shaft (Fig. 10-22, Pos. 2) counterclockwise.

REMARKS: Since there are several valves throttling the return oil flow, the valves must be adjusted synchronously (see Fig. 10-23).
The adjusting screws have to be turned in or out by the same amount of revolutions.

6. Check the lowering speed again and repeat the adjustment if necessary.
7. When the adjustment is finished, tighten the lock nut (Fig. 10-22, Pos. 2).

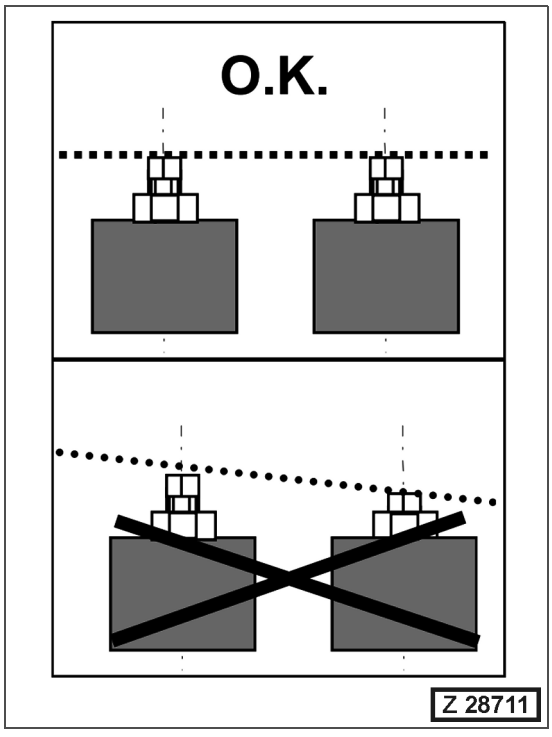


Fig. 10-23

10.3.5 SLEW BRAKE VALVE

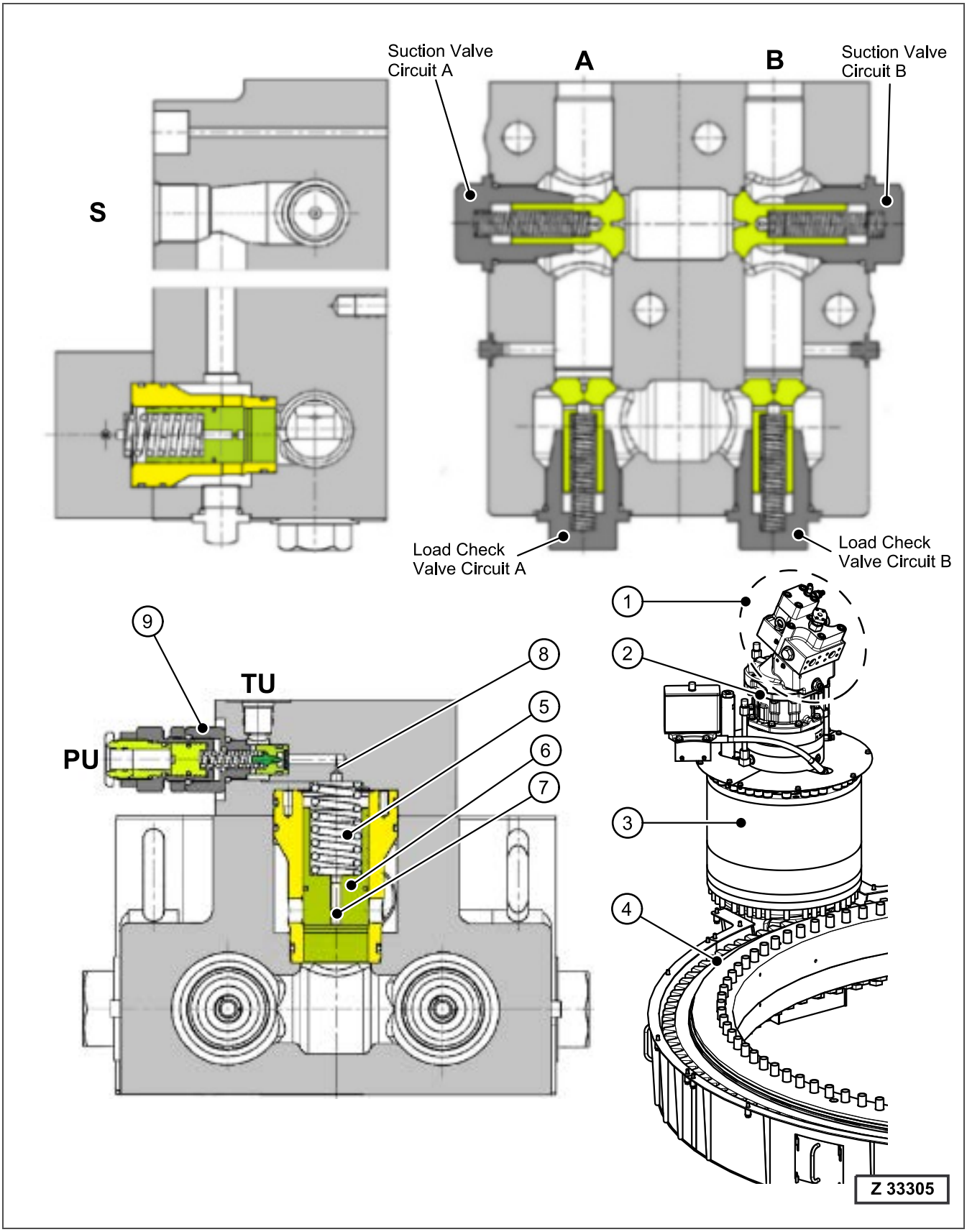


Fig. 10-60 Slew brake valve

Please continue reading on the next page.

11.2 FUNCTIONAL DESCRIPTION

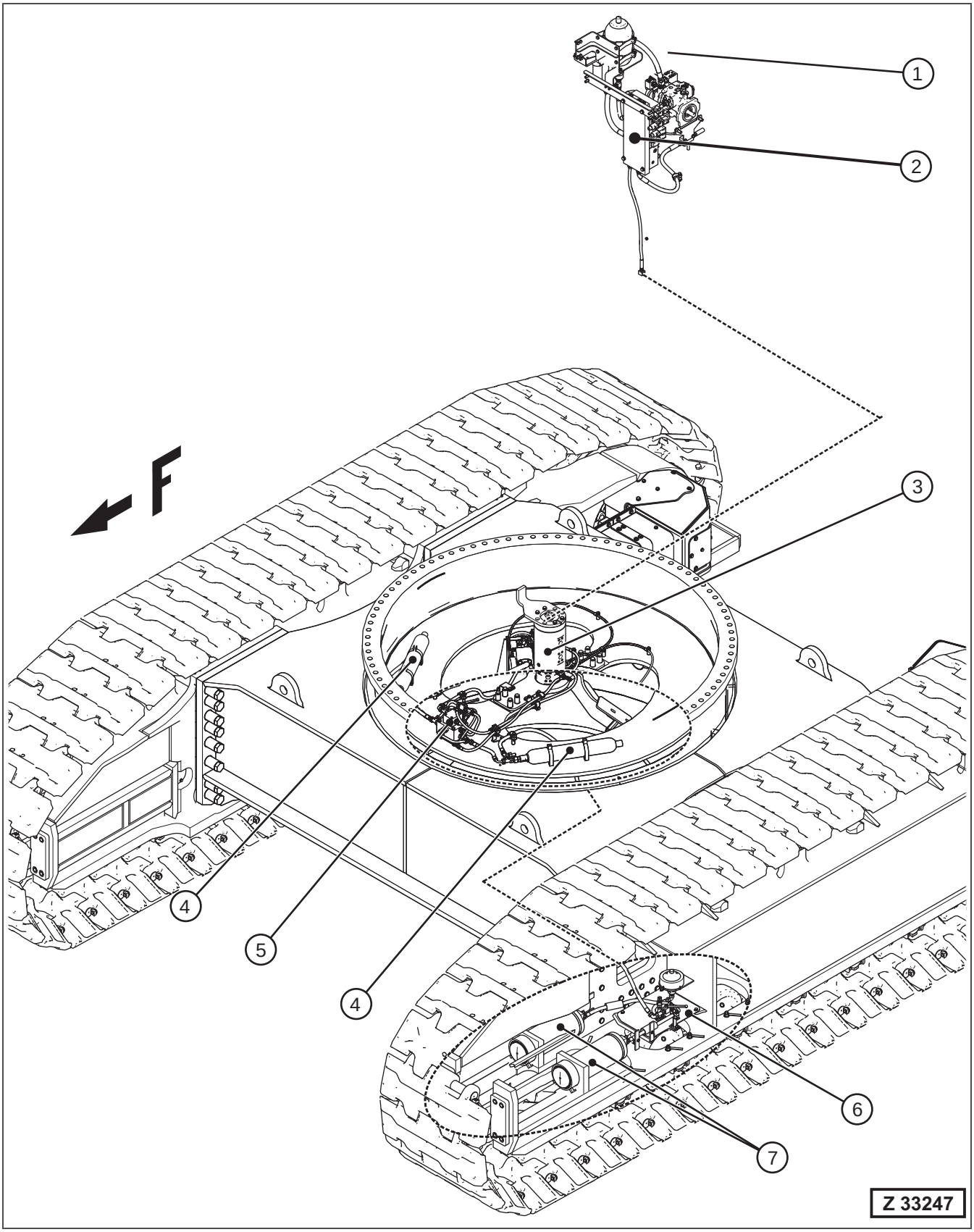


Fig. 11-2 Functional description

12.3 HYDRAULIC SCHEMATIC STAIRWAY MOVEMENT

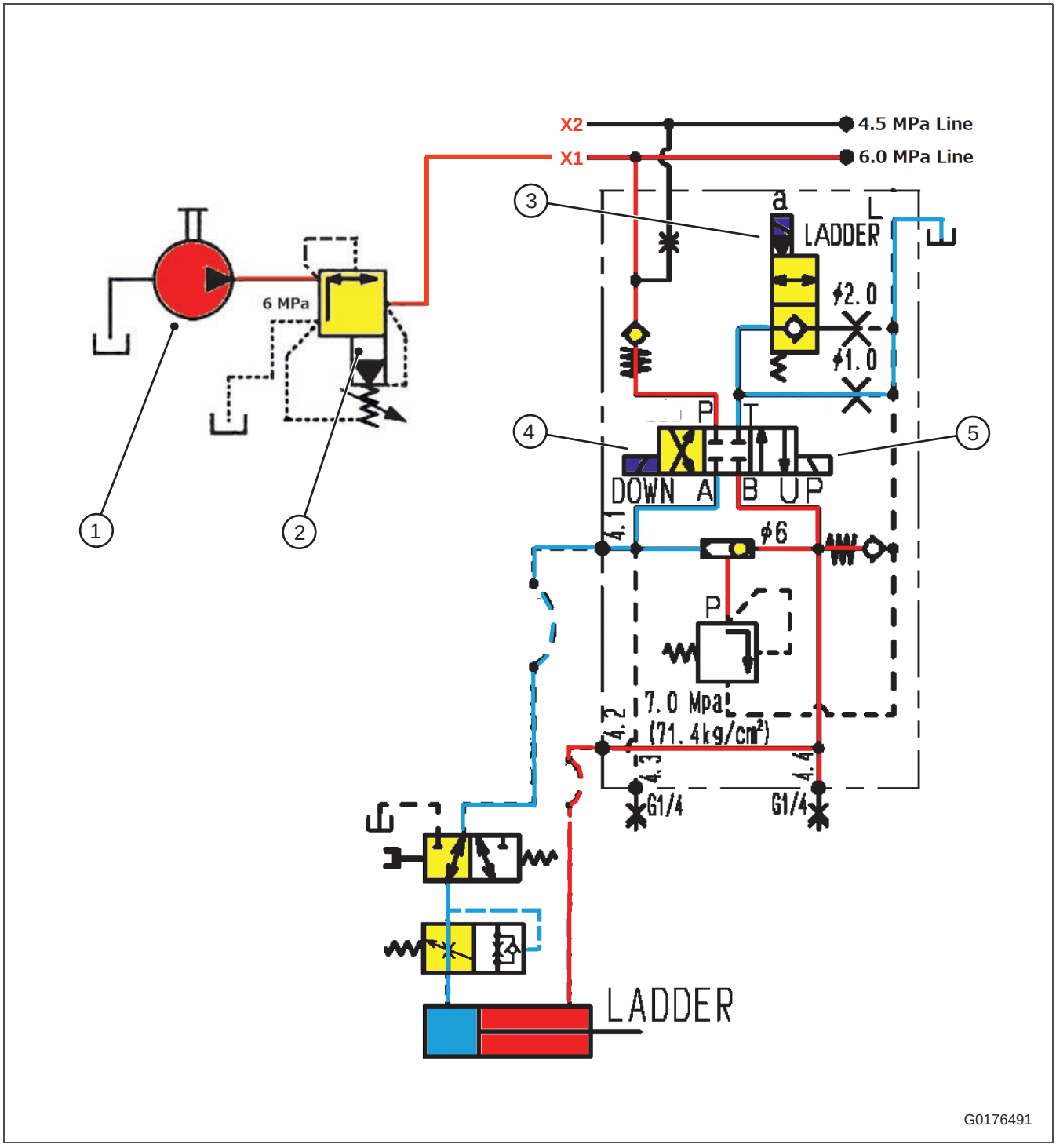


Fig. 12-9 Stairway down

(1) Pilot pump and aux. pump

(2) Pressure reducing valve 60 bar

(3) Solenoid valve 70Q625

(4) Solenoid valve57Q623b

(5) Solenoid valve 57Q623a

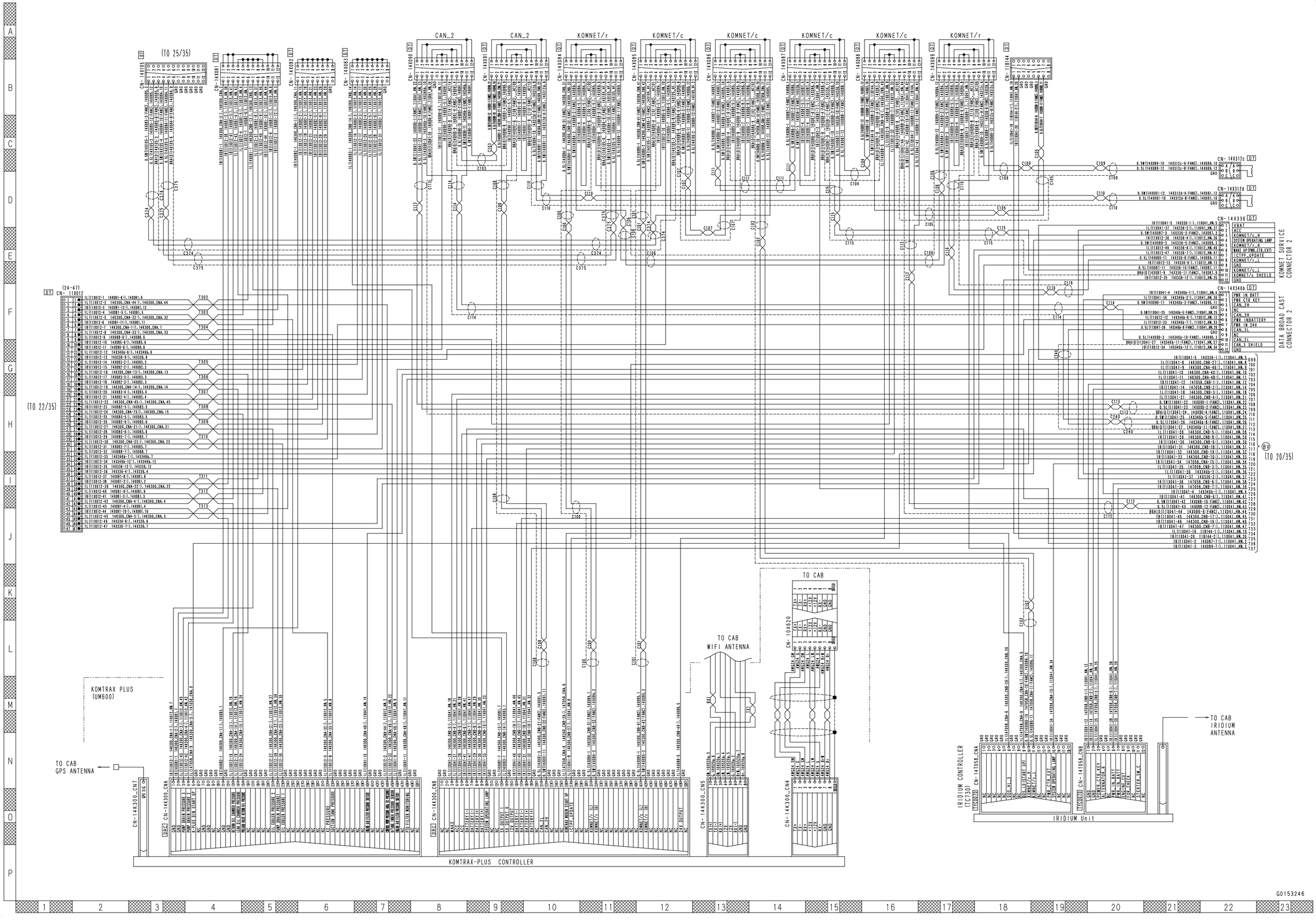
14.3 HYDRAULIC CIRCUIT DIAGRAM

15.4.7 ELECTRICAL CIRCUIT DIAGRAM (7/35)

PC3400-11M0

REMARK

This figure includes the equipment and device that are not available as optional items in some areas.

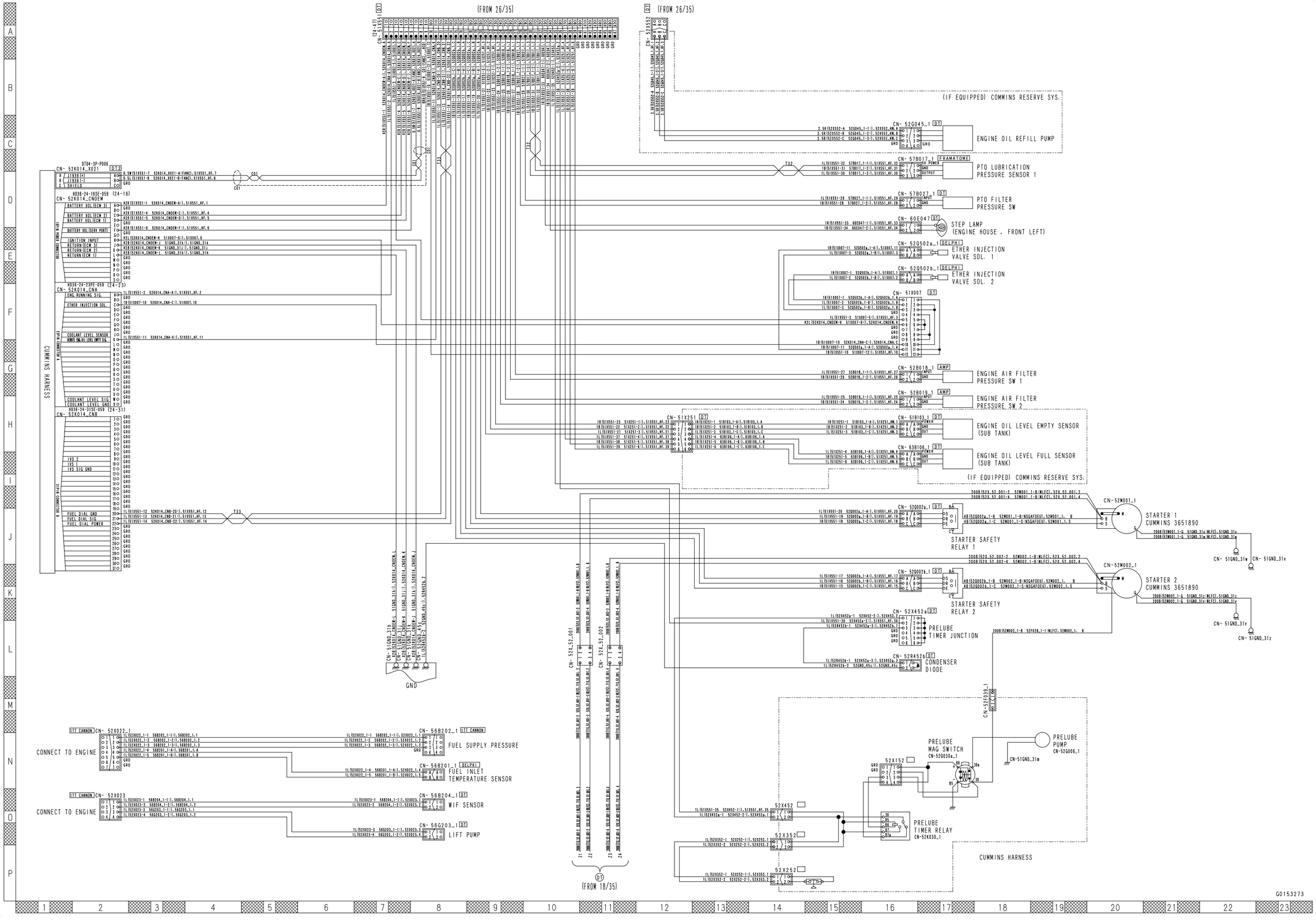


15.4.34 ELECTRICAL CIRCUIT DIAGRAM (34/35)

PC3400-11M0

REMARK

This figure includes the equipment and device that are not available as optional items in some areas.



16.2.1 MAIN GAUGE SCREENS

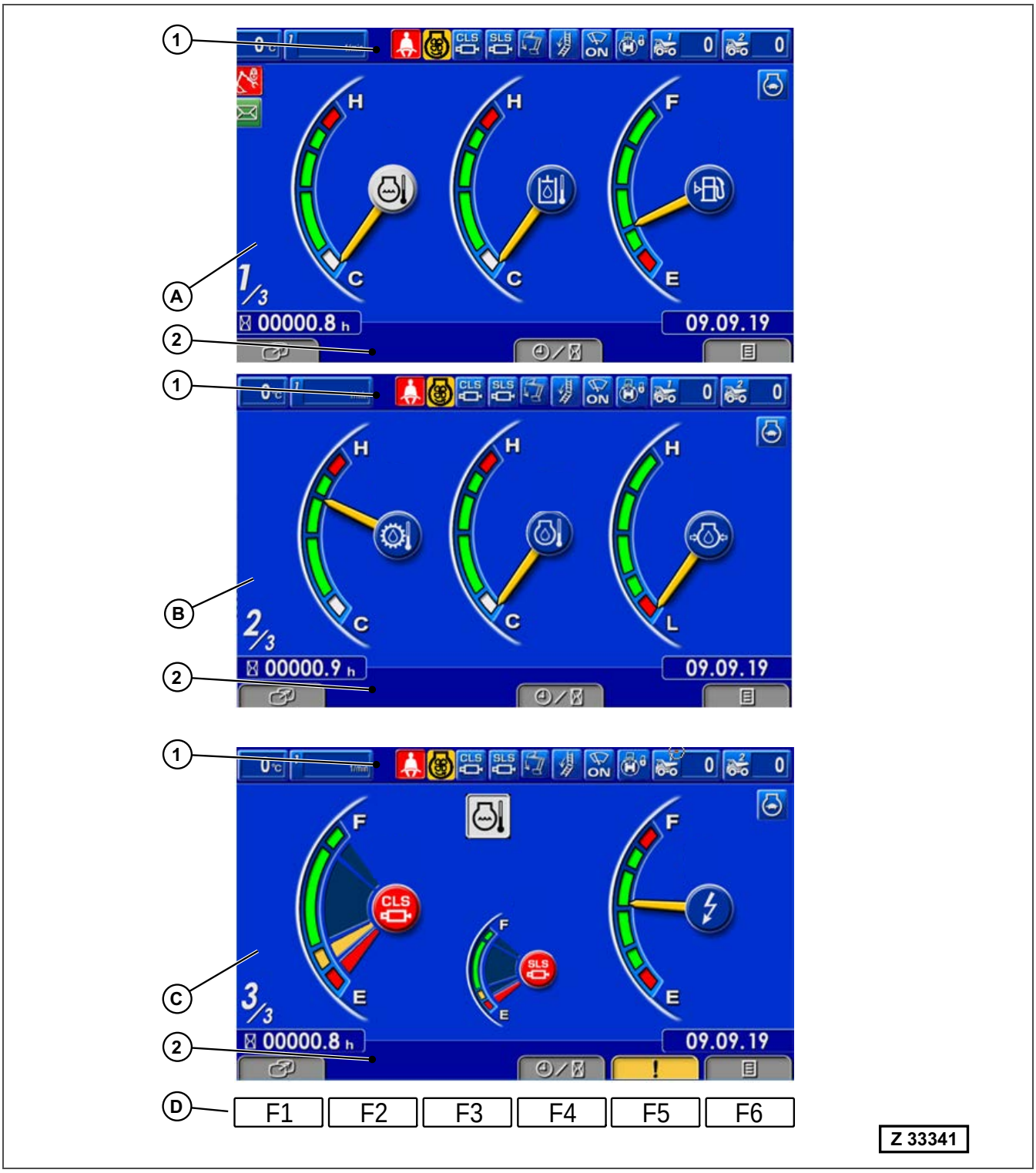


Fig. 16-5 Main gauge screens 1...3

(A...C) Main gauge screens 1...3

(D) Function keys **F1**...**F6**

(1) Topline of main gauge screens 1...3

(2) Footer of main gauge screen 1...3

Procedure

1. Press **F6** to select the *Operator menu*.
2. Press **F2** to select item *Monitor Setting*.
3. Press **F3** to select item *Clock adjustment* and press **F6**.
4. Select item *Time* and press **F6**.

At first the ***hour*** field is highlighted yellow.

5. Press **F3** and **F4** to adjust the *hours*.
6. Press **F6** to change to the ***minutes*** field.
7. Press **F3** and **F4** for adjust the *minutes*.
8. Press **F6** to confirm the complete time adjustment.
9. To leave the screen without time change, press **F5**.

Failure code	Symbol	Action code	Failure description	Fault detect.	K+ MH 810	Buzzer	Fault class	Shut down
DLMAKA		L01	Oil cooler fan2 speed sensor open circuit	VALVE M	●	OFF	SYS	-
DLMAKB		L01	Oil cooler fan2 speed sensor short circuit	VALVE M	●	OFF	SYS	-
DWM2KA		L03	Valve1 W/E PPC pressure shut off valve solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWM2KB		L03	Valve1 W/E PPC pressure shut off valve solenoid short circuit	VALVE M	●	ON_2	SYS	-
DWM2KY		L03	Valve1 W/E PPC pressure shut off valve solenoid hot short circuit	VALVE M	●	ON_2	SYS	-
DWM3KA		L03	Valve2 W/E PPC pressure shut off valve solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWM3KB		L03	Valve2 W/E PPC pressure shut off valve solenoid short circuit	VALVE M	●	ON_2	SYS	-
DWM3KY		L03	Valve2 W/E PPC pressure shut off valve solenoid hot short circuit	VALVE M	●	ON_2	SYS	-
DWM4KA		L03	Valve3 W/E PPC pressure shut off valve solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWM4KB		L03	Valve3 W/E PPC pressure shut off valve solenoid short circuit	VALVE M	●	ON_2	SYS	-
DWM4KY		L03	Valve3 W/E PPC pressure shut off valve solenoid hot short circuit	VALVE M	●	ON_2	SYS	-
DWM5KA		L04	Travel left PPC pressure shut off valve solenoid open circuit	VALVE M	●	ON_3	SYS	-
DWM5KB		L04	Travel left PPC pressure shut off valve solenoid short circuit	VALVE M	●	ON_3	SYS	-
DWM5KY		L04	Travel left PPC pressure shut off valve solenoid hot short circuit	VALVE M	●	ON_3	SYS	-
DWM6KA		L04	Slew PPC pressure shut off valve solenoid open circuit	VALVE M	●	ON_3	SYS	-

16.5 TABLE OF C-CODES - DIESEL ENGINE TIER2

Failure code	Symbol	Action code	Failure description	Fault detect.	K+ MH 810	Buzzer	Fault class	Shut down
CA143		L01	Low Oil Press	ENG/M	●	ON_2	Mech	-
CA146		L01	Coolant Temp Above Normal	ENG/M	●	ON_2	Mech	-
CA151		L03	High Coolant Temp	ENG/M	●	ON_2	Mech	-
CA197		L01	Coolant Level Below Normal	ENG/M	●	OFF	Mech	-
CA234		L02	Coolant Level Below Normal	ENG/M	●	ON_2	Mech	-
CA235		L03	Low Coolant Level	ENG/M	●	OFF	Mech	-
CA415		L03	Very Low Oil Pressure	ENG/M	●	ON_2	Mech	-
CA418		L00b	WIF Indicator Warning	ENG/M		OFF	Mech	-
CA1357		L01	Remote Oil Level Below Normal	ENG/M	●	OFF	Mech	-
CA1852		L01	WIF Indicator Above Normal	ENG/M	●	ON_2	Mech	-
CA2216		L01	Fuel Pump Delivery Press High Error	ENG/M	●	OFF	Mech	-
CA2261		L01	Fuel Pump Delivery press high Error	ENG/M	●	OFF	Mech	-
CA2963		L01	Engine Coolant Temp Above Normal	ENG/M	●	OFF	Mech	-

Details of the monitoring sub-items for VALVE M controller

Monitoring ID	Monitoring main item + sub-items	Unit / Indication
01903	PPC Signal info. 1	
	- Boom up.	ON - OFF
	- Boom down.	ON - OFF
	- Stick in.	ON - OFF
	- Stick out.	ON - OFF
01904	PPC Signal info. 2	
	- Bucket Fill	ON - OFF
	- Bucket Dump	ON - OFF
	- Clam Open	ON - OFF
	- Clam Close	ON - OFF
01905	PPC Signal info. 3	
	- Slew Left	ON - OFF
	- Slew Right	ON - OFF
	- Travel Left Forward	ON - OFF
	- Travel Right Forward	ON - OFF
	- Travel Left Backward	ON - OFF
	- Travel Right Backward	ON - OFF
02304	Solenoid Valve 1	
	- V1 W/E PPC Shutoff Sol.	ON - OFF
	- V2 W/E PPC Shutoff Sol	ON - OFF
	- V3 W/E PPC Shutoff Sol	ON - OFF
02305	Solenoid Valve 2	
	- Travel L PPC Shutoff Sol.	ON - OFF
	- Travel R PPC Shutoff Sol.	ON - OFF
	- Slew PPC Shutoff Sol.	ON - OFF
02306	Solenoid Valve 3	
	- Boom Rec. PPC Shut Sol.	ON - OFF
	- Boom Rec. PPC Shut Sol. 2	ON - OFF
02341	Solenoid Valve 4	
	- Radiator Fan1 Reverse Sol.	ON - OFF
	- Radiator Fan2 Reverse Sol.	ON - OFF
	- O/C Fan1 Reverse Sol.	ON - OFF
	- O/C Fan2 Reverse Sol.	ON - OFF
03809	Controller Output 1	
	- Engine1Motor1 Shut Relay	ON - OFF
	- Engine Oil Present Sig.	ON - OFF
	-Travel Alarm Relay	ON - OFF
	-Travel Parking Brake Sol.	ON - OFF
	-Slew Parking Brake Sol.	ON - OFF
03810	Controller Output 2	
	- Horn Relay	ON - OFF
	- Engine 1 Starter Cut Relay	ON - OFF
	- Sol Power Self Hold Relay	ON - OFF
	- PTO Lube Preload Sol.	ON - OFF

Table 16-4 Monitoring sub-items for VALVE M controller

16.13 SERVICE MENU - ITEM 06 SNAP SHOT

– In the SERVICE MENU press **F3** or **F4** to move up or down.

– Select item *06 Snap Shot* and press **F6**.

Fig. 16-75 Service Menu - selection 07

Contents of Snap Shot

Allows to capture data for a period of max. 7:30 minutes.

NOTE! Items like hydr oil temp are given and not changeable.

The K+ system is programmed to carry out frequently snap shots in the background. The snap shots can be downloaded with the *K+ PC-Tool* for diagnostic and analysis.

1. To start the *Snap Shot* recording function, press **F1** (START) on the 1st screen.
   - The timer starts to count minutes and seconds.
2. If you want to cancel the snap shot recording, press **F1** (STOP)
3. Otherwise the recording process is finished after 7:30 minutes.
4. After that press **F6** to leave the snap shot screen.
   - The snap shot data are saved in the K+ controller.

For any analysis of the manual Snap Shot data it is necessary to download these data onto the laptop.

REMARKS: For download and analysis the automatically snap shots software package *PC-Tool for K-Plus* is required.

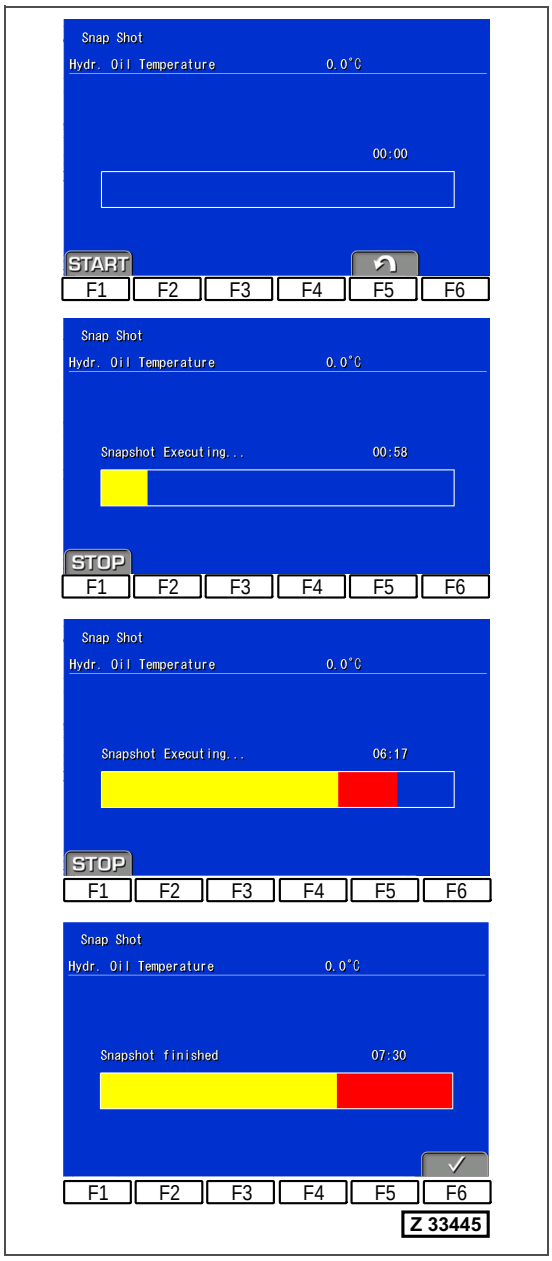


Fig. 16-76 Service Menu - Snap Shot

16.19 SERVICE MENU: ITEM 12 FAN REVERSE MODE

– In the SERVICE MENU press **F3** or **F4** to move up or down.
Select item *12 Fan reverse mode* and press **F6**.

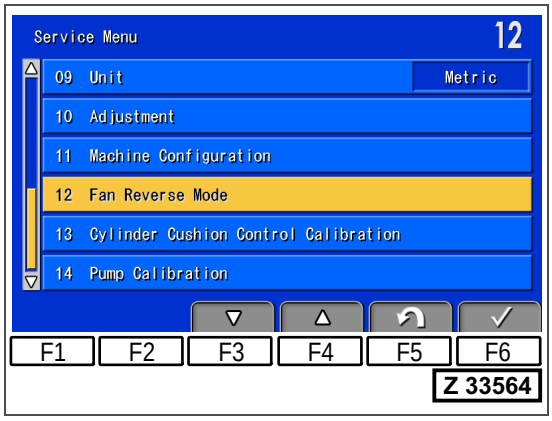


Fig. 16-98 Service Menu - Adjustment

Contents of Fan reverse mode

– This function allows to select the fan rotation direction (normal or reverse).
– Hydr. oil cooling system
normal fan / air direction = Air flow from inside to outside
– Radiator cooling system
normal fan / air direction = Air flow from outside to inside

The fan reverse mode used for maintenance purpose (cooler cleaning) only.

The fan reverse mode function changes the radiator & hydr. oil cooler fan direction automatically.

After the cleaning process of the cooler elements are finished - reverse back to standard.

REMARKS: Fan reverse mode is a maintenance tool to increase excavator availability.

Hydr. oil & radiator cooler elements have be cleaned manually according to OMM.

4. Press ***F6*** *to set fan rotation to reverse.*

Fig. 16-99

The system starts automatically the fan reverse mode function.

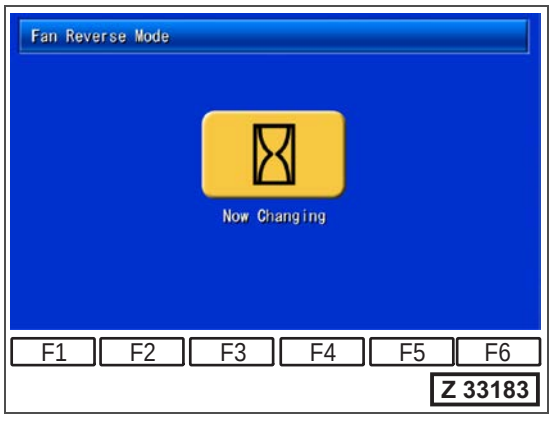


Fig. 16-100

Legend for Fig. 17-4:

(1) Lubrication pump station (CLS & SLS)

(2) Grease tank

(3) Grease bypass to grease tank

(4) Grease out put from grease pump

(5) Return oil line from grease pump

(6) Hydraulic oil supply line (X1 pressure = 60 ±1 bar)

(7) Return line to hydraulic oil tank

(8) Lubricant pump drive (hydraulic cylinder)

(9) Grease shut-off valve

(10) Coupler (Grease pressure gauge)

(11) Flow control valve

(12) CLS / SLS grease pump solenoid 62Q507 / 62Q509

(13) Grease level sensors (binary type)

(14) Vent valve

(15) Lubricant pump

(16) Oil supply line for grease pump

(17) Valve block

(18) Joint to grease tank

(19) Grease refilling filter for SLS system

(20) Grease refilling filter for CLS system

(21) Outlet to injectors

(22) Grease level dipstick

Description

The lubrication pump station includes the grease tank (Fig. 17-4, Pos. 2) and the tank cover with the pump system. The tank is fix-mounted. With the refilling arm the tank is rechargeable via the grease refilling filters (Fig. 17-4, Pos. 19 & 20).

The lubrication pump station is mounted onto the tank cover. It includes the lubricant pump drive (Fig. 17-4, Pos. 8 & 15), valves (Fig. 17-4, Pos. 9 & 11 &14), three grease level sensors (Fig. 17-4, Pos. 13).

The pump station of the CLS and the SLS basically have the same design.

2.1 PREPARATIONS FOR WORK

1. Before adding oil or making any repairs, park the excavator on hard and level ground. Isolate the excavator according to local regulations.

2. Before starting work, make sure that the work equipment is lowered to the ground. Also make sure that the safety service switch (50S058) is switched OFF and locked with a padlock. In addition hang up warning signs.

3. When disassembling or assembling, support the respective unit with blocks, jacks, or stands as necessary before starting work.

4. Remove all mud and oil from the steps or other places used to get on and off the excavator. Always use the handrails, stairways or steps when getting on or off the excavator. Never jump on or off the excavator. If it is impossible to use the handrails, stairways or steps, use a stand to provide safe footing.

2.2 PRECAUTIONS DURING WORK

1. Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.

2. The coolant and oil in the circuits are hot when the engine is stopped, so be careful not to get scalded. Wait for the oil and coolant to cool before carrying out any work on the oil or water circuits.

3. Before starting work, stop the engine. When working on or around a rotating part, in particular, stop the engine. When checking the excavator without stopping the engine (measuring revolving speed, temperature, etc.), take extreme care not to get rolled or caught in rotating parts or moving parts.

4. Before starting work, remove the leads from the negative (–) terminal first.

5. When raising a heavy component (heavier than 25 kg), use a hoist or crane. Before starting work, check that the slings (wire ropes, chains, and hooks) are free from damage. Always use slings which have ample capacity and install them to proper places. Operate the hoist or crane slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.

6. When removing a cover which is under internal pressure or under pressure from a spring, always leave 2 bolts in diagonal positions. Loosen those bolts gradually and alternately to release the pressure, and then remove the cover.

7. When removing components, be careful not to break or damage the electrical wiring. Damaged wiring may cause electrical fires.

8. When removing piping, stop the fluid from spilling out. If any oil drips onto the floor, wipe it up immediately. Oil on the floor can cause you to slip and can even start fires.

9. As a general rule, do not use gasoline to wash parts. Do not use it to clean electrical components, in particular.

10. Be sure to assemble all parts again in their original places. Replace any damaged parts and parts which must not be reused with new parts. When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the excavator is operated.

11. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. In addition, check that connecting parts are correctly installed.

12. When assembling or installing parts, always tighten them to the specified torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.

13. When aligning 2 holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.

Legend for Fig. 3-1:

(1) Pull chain for emergency lowering of the access/ingress stairway

(2) Engine shut off switch from ground LH / RH (54S051 / 54S052)

(3) Service arm rope switch (55S087)

Information on relay bank 2

Nr.	Location (from left to right)	
(1)	front	PPC lock lever safety relay (11Q048e)
(2)	rear	Mirror heater relay (11Q026)
(3)	front	Emergency cut relay 75A (11Q044c)
(4)	rear	Service arm light relay 1 (11Q005)
(5)	front	Travel alarm relay (10Q010)
(6)	rear	Service arm light relay 2 (11K255)
(7)	front	Travel alarm on stairway movement relay (11Q010b)
(8)	rear	Rotary light relay (11Q096)
(9)	front	Horn relay (11Q020)
(10)	rear	Stairway up sol. cut relay (11K134)
(11)	front	Washer relay (11K501)
(12)	rear	CLS grease shut off valve relay (62K108)
(13)	front	Service arm safety relay (11Q048c)
(14)	rear	SLS grease shut off valve relay (62K109)
(15)	front	Stairway safety relay (11Q048d)
(16)	rear	Starter cut relay (11K001a)
(17)	front	Transfer pump cut relay (11K409)
(18)	rear	Starter cut relay 2 (11K001b)
(19)	front	Stairway speed control relay (11Q132)

Information on main power circuit

Nr.	Location (from left to right)	
(1)	front	Transfer pump power (11X_10_301)
(2)	front	Engine controller 1 power (11X_10_302)
(3)	front	Engine oil refill pump power (11X_10_401)
(4)	front	Sol. power self-holding relay (VALVE M controller)(11X_10_402)
(5)	front	ComVision standby off switch (11S009)
(6)	front	Engine oil refill pump LED (11P143)

System	Component name	Component code	Inspection method	Judgement table	Measurement conditions
PTO & related parts	PTO lube oil pressure sensor	57B017	Measure voltage	If the condition is within the range shown in the table below, it is normal. Between (1) - (2): 5 V	1) 20S001 OFF 3) Disconnect connector 3) Insert T-box 4) 20S001 ON 5) Engine high idle → Switch point 1 bar
				Between (2) - (3): Output: 0.5...4.5 V	6) Depend. on press. refer to chart in SHOP MANUAL
	Radiator fan pump press. sensor / Oil cooler fan pump press. sensor	57B159 57B160	Measure voltage	If the condition is within the range shown in the table below, it is normal. Between (1) - (3): 5 V	1) 20S001 OFF 2) Disconnect connector 3) Insert T-box
				Between (2) - (3): Output: 0.5...4.5 V	4) Depend. on press. refer to chart in SHOP MANUAL
	PPC pump, radiator fan pump, Oil cooler fan pump - EPC valve	57K666 57K667 57K668	Measure resistance	If the condition is within the range shown in the table below, it is normal. Between (1) - (2): 7 ± 1.0 Ω	1) 20S001 OFF 2) Disconnect connector 3) Insert T-box
Stairway	Stairway limit switch *[N.O. switch]*	Up: 70B122 70B122a Down: 70B091	Measure voltage	If the condition is within the range shown in the table below, it is normal. Between (A) - (C): 22 - 24 V Between (B) - (C): 0 V	1) 20S001 OFF 2) Disconnect connector 3) Insert T-box 4) 20S001 ON 5) If sensor has no contact to stairway
				Between (B) - (C): 22 - 24 V	6) If sensor has contact to stairway
	Stairway solenoid valve → lower	57Q623b	Measure resistance	If the condition is within the range shown in the table below, it is normal. Between (1) - (2): 20 ± 1.0 Ω	1) 20S001 OFF 2) Disconnect connector 3) Insert T-box

Failure code	Symbol	Action code	Failure description	Fault detect.	K+ MH 810	Buzzer	Fault class	Shut down
DWM8KY		L03	Boom recirculation valve PPC pressure shut off valve solenoid hot short circuit	VALVE M	●	ON_2	SYS	-
DWMEKA		L03	Boom recirculation valve PPC pressure shut off valve2 solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWMEKB		L03	Boom recirculation valve PPC pressure shut off valve2 solenoid short circuit	VALVE M	●	ON_2	SYS	-
DWMEKY		L03	Boom recirculation valve PPC pressure shut off valve2 solenoid hot short circuit	VALVE M	●	ON_2	SYS	-
DWNCKA		L03	Oil cooler fan pump solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWNCKB		L03	Oil cooler fan pump solenoid short circuit	VALVE M	●	ON_2	SYS	-
DWN5KA		L03	Radiator fan pump solenoid open circuit	VALVE M	●	ON_2	SYS	-
DWN5KB		L03	Radiator fan pump solenoid short circuit	VALVE M	●	ON_2	SYS	-
DXQ0KA		L03	Control pump solenoid open circuit	VALVE M	●	ON_2	SYS	-
DXQ0KB		L03	Control pump solenoid short circuit	VALVE M	●	ON_2	SYS	-
DW7BKA		L01	Radiator fan1 reverse solenoid open circuit	VALVE M	●	OFF	SYS	-
DW7BKB		L01	Radiator fan1 reverse solenoid short circuit	VALVE M	●	OFF	SYS	-
DW7BKY		L01	Radiator fan1 reverse solenoid hot short circuit	VALVE M	●	OFF	SYS	-
DW7XKA		L01	Radiator fan2 reverse solenoid open circuit	VALVE M	●	OFF	SYS	-
DW7XKB		L01	Radiator fan2 reverse solenoid short circuit	VALVE M	●	OFF	SYS	-

Failure code	Symbol	Action code	Failure description	Fault detect.	K+ MH 810	Buzzer	Fault class	Shut down
CA156		L03	Int Man Temp 2 Ckt Failed High	ENG/M	●	ON_2	SYS	-
CA157		L03	Int Man Temp 2 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CA158		L03	High Int Man Temp 2	ENG/M	●	ON_2	SYS	-
CA159		L03	Int Man Temp 3 Ckt Failed High	ENG/M	●	ON_2	SYS	-
CA161		L03	Int Man Temp 3 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CA162		L03	High Int Man Temp 3	ENG/M	●	ON_2	SYS	-
CA163		L03	Int Man Temp 4 Ckt Failed High	ENG/M	●	ON_2	SYS	-
CA164		L03	Int Man Temp 4 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CA165		L03	High Int Man Temp 4	ENG/M	●	ON_2	SYS	-
CA187		L03	Sensor Supply 2 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CB187		L03	Sensor Supply 2 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CC187		L03	Sensor Supply 2 Ckt Failed Low	ENG/M	●	ON_2	SYS	-
CA195		L01	Coolant Level Ckt Failed High	ENG/M	●	OFF	SYS	-
CA196		L01	Coolant Level Ckt Failed Low	ENG/M	●	OFF	SYS	-
CA212		L01	Oil Temp Ckt Failed High	ENG/M	●	OFF	SYS	-

AA10NX - Air Cleaner1 Clogging

[1/2]

Trouble code **AA10NX**	Message	Air Cleaner1 Clogging
Contents of trouble	- The message is displayed if sensors 52B018-1 & 52B019-1 of the engine air filters detect clogged air filters. - The system assumes that the monitoring circuits of the engine air filter sensors are not disturbed.	
Related information	Sensors 52B018-1 & 52B019-1 watch the vacuum pressure in the inlet manifolds between air filters and engine.	
Controller / Monitoring	Error detection: KOM PLS controller (14K300) Error condition: Input voltage at K+ controller CNA.46 is 0 V >3 s Monitoring: 02263 KOMTRAX Plus Engine Air Filter1 Sig. [ON/OFF] Engine Air Filter2 Sig. [ON/OFF]	
Action of controller		Action code level: L01 Buzzer: no sound
Problem that appears on the excavator	With clogged air filter(s) the following problems occur: Loss in rated engine power - Poor exhaust emission quality - Increased fuel consumption - Increased exhaust gas temperature - Reduced engine lifetime **REMARKS:** If excavators are operated at locations higher than 2590 m, they sooner will be affected by the above mentioned effects, even though the system does not yet display any trouble message.	

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
The engine air filters are clogged (inner and outer elements).	1	▶ Main key switch 20S001 OFF – Engine OFF – Safety service switch 50S058 OFF & locked		
		Replace the outer filter elements (4 pieces) and the inner filter elements. **How to identify a clogged outer engine air filter element** The only correct method to identify the clogged condition of an outer engine air filter element is to compare the weights of a new and a clogged outer air filter element. Example: Weight of a new air filter element: approx. 9 kg Weight of a clogged air filter element: approx. 20 kg – The replacement interval depends on the respective environmental conditions. Always monitor the engine air filter elements according to your local operation conditions. – The air filter box must be cleaned thoroughly after the period of every 1000 operating hours. Go to final step 2.		
Final check.	2	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

B@L4NX - Leak Oil Filter Clogging

Trouble code **B@L4NX**	Message	Leak Oil Filter Clogging
Contents of trouble	Differential pressure between inner tank pressure 40B167 and leak oil chamber pressure 40B164 is higher than 2 bar.	
Related information	- The trouble code is set if the pressure in the leak oil chamber exceeds 2 bar. - The trouble code is not set until the hydraulic oil temperature reached TH3.	
Controller / Monitoring	Error detection: KOM PLS detects differential pressure between A.14 and A.45 higher than 2 bar for 5 sec. Monitoring: 38305 Leak Oil Chamber Press 38306 Leak Oil Chamber Press Sens Volt 38323 H / Tank Inner Pressure 38324 H / Tank Inner Pressure Sensor Volt	
Action of controller	Action code level: L01 Buzzer: no sound	
Problem that appears on the excavator	Unfiltered leak oil flows through the bypass of the filter into the hydraulic oil tank.	

Temperatur in °C temperature in °C	Viskosität nach ISO viscosity grade according to ISO				
	VG22	VG32	VG46	VG68	VG100
TypNr. / type no.	1	2	3	4	5
TH1 (1000 cSt)	-20	-14	-6	0	5
TH2 (100 cSt)	9	16	25	32	39
TH3 (30 cSt)	32	41	50	58	67
TH4 (10 cSt)	63	74	84	85	85

Z 30692-5

Sample

Hydraulic oil: VG100

TH3 67 °C

T_{actual} 45 °C

In this case the trouble code is not set until the hydraulic oil temperature reached 67 °C.

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
The leak oil filter is clogged.	1	▶ Main key switch 20S001 OFF - Engine OFF - Safety service switch 50S058 OFF & locked			
		Remove the cover retainer on top of the leak oil chamber. For details refer to the OPERATION & MAINTENANCE MANUAL, section *Hydraulic System - Filter Service*. Is the leak oil filter clogged?	Yes	Replace the leak oil filter as described in the OPERATION & MAINTENANCE MANUAL. Locate the cause of the contamination and rectify the problem.	
			No	Go to next step.	
Pressure sensor 40B164 or 40B167 is defective.	2	▶ Main key switch 20S001 OFF - Engine OFF - Safety service switch 50S058 OFF & locked			
		The pressure sensor has an internal stuck. Remove the sensor and replace it by a new one. After that recheck the system for proper function.		Go to final step 3.	
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

DBY7KP - 24 V sensor power abnormality VALVE 2
DBW7KP - 24 V sensor power abnormality VALVE M

[1/1]

Trouble code **DBY7KP, DBW7KP**	Message	24 V sensor power abnormality VALVE 2 / VALVE M
Contents of trouble	Short circuit detected in the 24 V sensor power supply (by VALVE 2 / VALVE M controller).	
Related information	The power supply for 24 V sensors is cut out. Monitoring: VALVE 2 03233 Solenoid Power Voltage for 59B015 VALVE M 03229 Solenoid Power Voltage for 57B049_1	
Controller / Monitoring	Error detection: VALVE 2 / VALVE M controller (14K304 and 14K302), output terminal CN1.16 Error condition: Short circuit detection at CN1.16	
Action of controller		Action code level: L02 Buzzer: intermittent sound
Problem that appears on the excavator	Sensors 59B015 and 57B049_1 are not operative.	

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
Short circuit in the 24 V sensor supply circuit for 59B015 & 57B049_1 (including connectors and terminals).	1	▶ Main key switch 20S001 OFF.		
		Refer to the Wiring Diagram, disconnect the cables, and check for continuity: a) from VALVE 2 controller 14K304 CN1.16 to 14X042.6 - 11X011.3 - 11X061.9 - 10X456.9 - 51X456.9 to 59B015, pin A. b) from VALVE M controller 14K302 CN1.16 to 11X013.10 - 11X063.39 - 10X356.39 - 51X351.39 to 57B049_1, pin A.	Repair or replace faulty wiring or terminals or connector as necessary.	R_{max} = 1 Ω
Final check.	2	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

Wiring Diagram - 24 V sensor power abnormality (DBY7KP, DBW7KP)

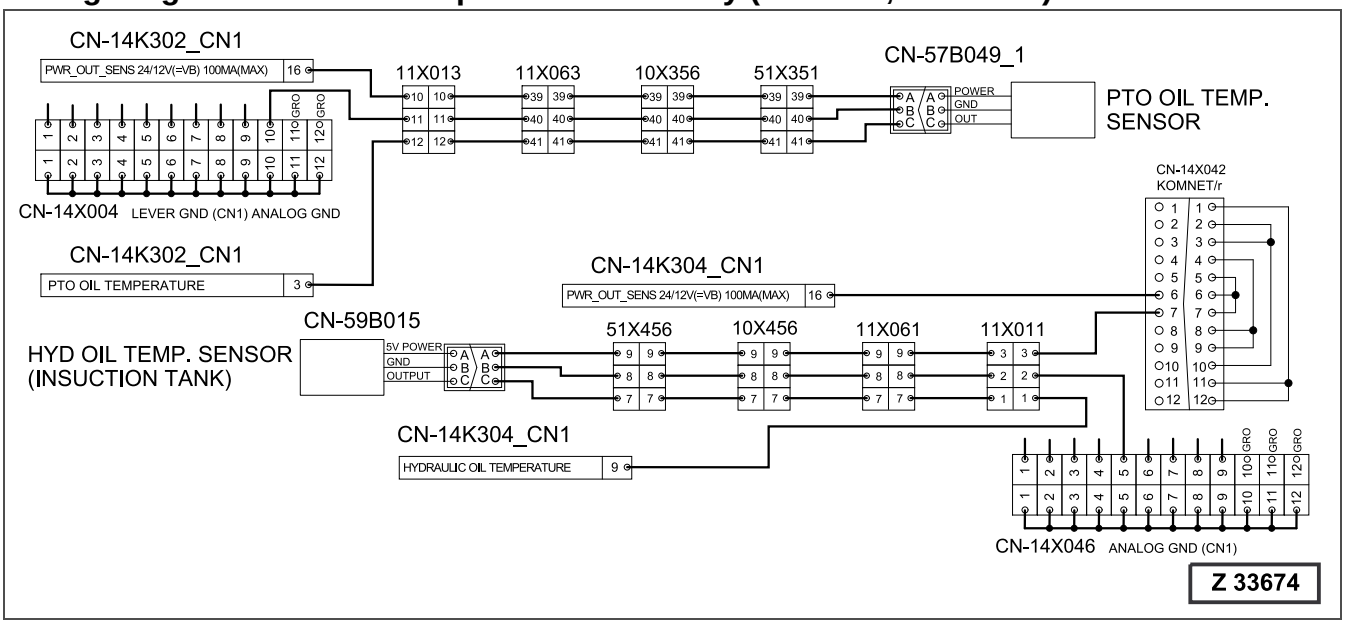


Fig. 6-24 Wiring Diagram - 24 V sensor power abnormality (DBY7KP, DBW7KP)

Please continue reading on the next page.

DBWXKQ - Motor1 frequency select abnormality

Trouble code **DBWXKQ**	Trouble	Motor1 Frequency Selection Abnormality
Contents of trouble	VALVE M controller motor/engine selection: Mismatch detected between wiring connection and controller memory value.	
Related information	Failure detection criteria Motor/engine selection wiring is: Electric motor → CN2.07 (motor select) connected to GND **Diesel engine** → CN2.07 (engine select) OPEN (not connected to GND)	
Controller / Monitoring	Error detection: VALVE M controller (14K302), terminal CN2.07 Monitoring: 02237 Switch Input1 Motor select [ON/OFF]	
Action of controller		Action code level: L04 Buzzer: continuous sound
Problem that appears on the excavator	VALVE M controller function not available → excavator start not possible.	

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
Wrong wiring between VALVE M controller and 11GND line.	1	▶ Main key switch 20S001 OFF.		
		1) Verify that VALVE M controller terminal CN2.07 is not connected to 11GND. → 11GND connection at CN2.07 would determine E-motor drive instead of Diesel engine drive.	Refer to the Wiring Diagram. Modify the wrong wiring as defined for Diesel engine.	
Final check.	2	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

Wiring Diagram - Motor1 frequency selection abnormality (DBWXKQ)

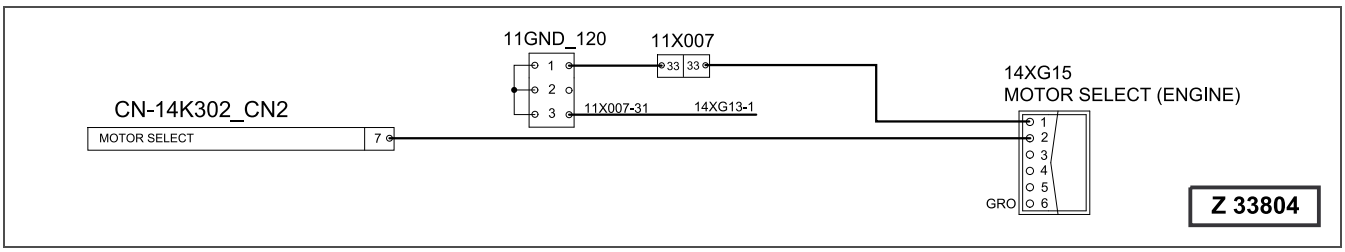


Fig. 6-56 Wiring Diagram - Motor1 frequency selection abnormality (DBWXKQ)

DKUWL8 - L lever right-left potentio error

Wiring disconnection (including connectors and terminals).	2	▶ Main key switch 20S001 OFF.		
		Check the wiring for continuity: 14K302 CN1.01 via all connectors 20S020.Q. & 14K302 CN1.24 via all connectors to CN20S020.N.	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

Wiring Diagram - L lever right-left potentio error (DKUWL8)

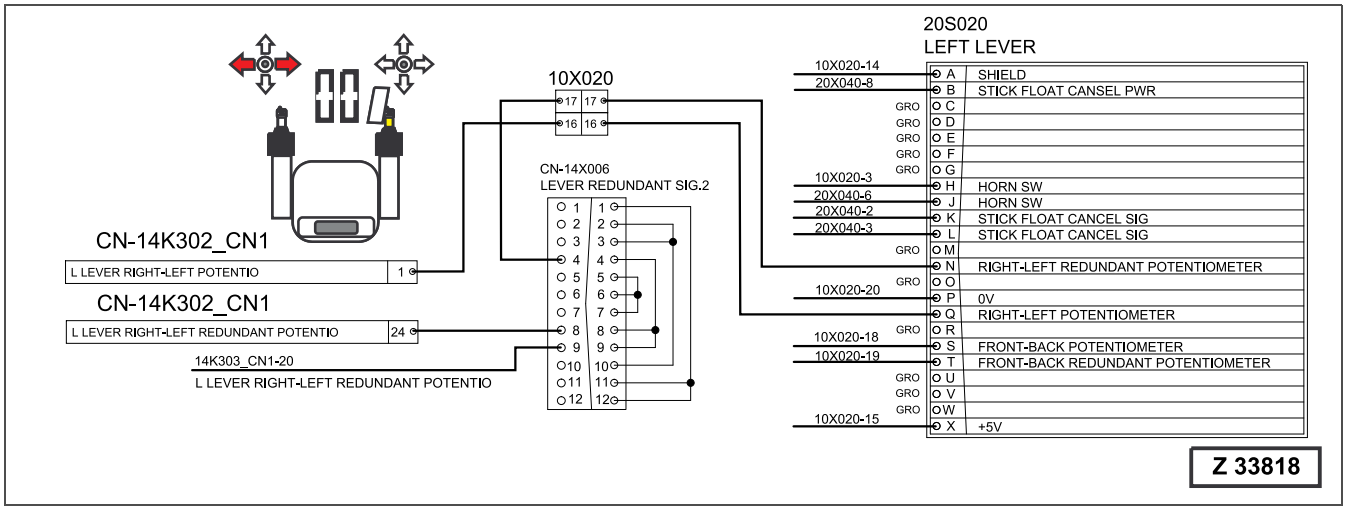


Fig. 6-69 Wiring Diagram - L lever right-left potentio error (DKUWL8)

DKW7MA - Clam open potentio abnormality

Trouble code	Trouble	Clam open potentio abnormality
DKW7MA		
Contents of trouble	Clam open pedal 20S024: Signal wiring to VALVE M faulty or pedal defective.	
Related information	–	
Controller / Monitoring	Error detection: VALVE M controller (14K302), terminal CN2.36 Error condition: Input voltage <1.9 V or >4.6 V Monitoring: 75219 Clam Open Pedal Pot. Volt	
Action of controller	Action code level: L04 Buzzer: continuous sound	
Problem that appears on the excavator	Corresponding machine control is not operative.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
Clam open pedal defective	1	▶ Main key switch 22S001 ON.			
		Open Monitoring on the machine monitor Select → VALVE M controller Select → 75219 Action → Press clam pedal in open direction Monitor → Potentiometer voltage Are the signals OK?	Yes	Signal problem (intermittent). Replace the clam open pedal.	
			No	Go to next step.	
	Info	Control pedal specification: Supply voltage 5 V ±0.2 V Power input of 5 V <40 mA each axis Signals Pedal with 2 directions: 1 V...2.5 V...4 V for A 4 V...2.5 V...1 V for B ratiometric* for 5 V Pedal with 1 direction: 2.5 V...4 V 2.5 V...1 V *ratiometric = Describing any system in which an output is directly proportional to an input.			
Wiring disconnection (including connectors and terminals)	2	▶ Main key switch 22S001 OFF.			
		Check the wiring between VALVE 0 (14K302) CN2.36 and 20S024.M for continuity.	Refer to the Wiring Diagram. Locate the program in the faulty circuit and repair or replace as necessary.		R_{max} = 1 Ω
Final check.	3	Bring the machine back into the original condition. Start the machine and verify that the trouble code does not arise again.			

DKWCL4 - Hyd. slew brake sig. mismatch (VALVE M)

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
Wiring disconnection (including connectors and terminals).	2	▶ Main key switch 20S001 OFF.		
		1) Check the wiring for continuity: VALVE M (14K302) CN1.18 via all connectors to CN20S022.L & VALVE 1 (14K303) CN1.05 via all connectors to CN20S022.L. 2) Disconnect the cables and check for continuity.	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

Wiring Diagram - Hyd. slew brake sig. mismatch (VALVE M) (DKWCL4)

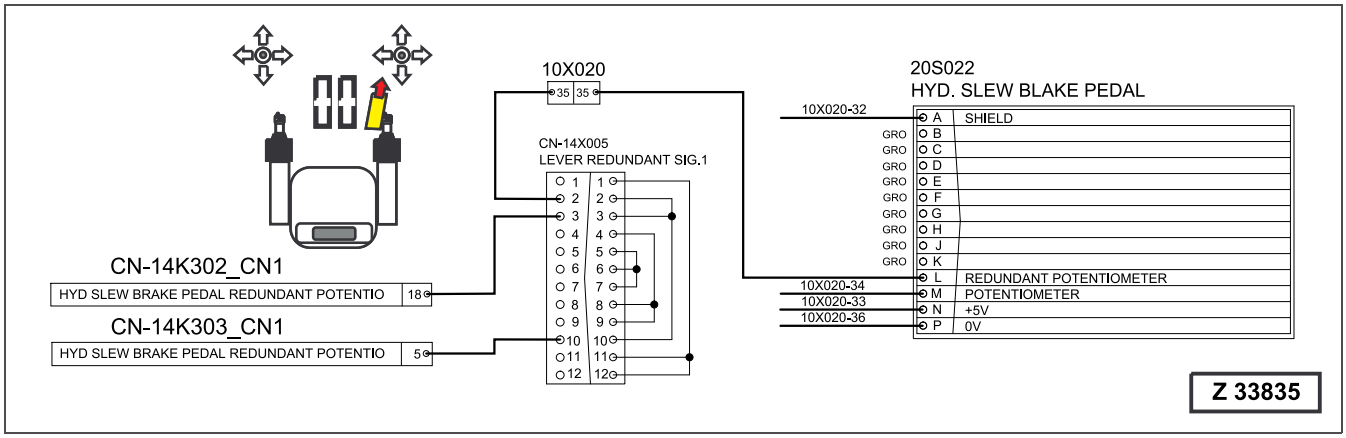


Fig. 6-94 Wiring Diagram - Hyd. slew brake sig. mismatch (VALVE M) (DKWCL4)

DWM6KB - Slew PPC pressure shut off valve solenoid short circuit

[1/2]

Trouble code **DWM6KB**	Trouble	Slew PPC pressure shut off valve solenoid short circuit
Contents of trouble	Short circuit to GND detected between VALVE M (14K302) controller output CN3.17 and solenoid valve 61K613b.	
Related information	The slew function is not available, because the solenoid valve is not energized.	
Controller / Monitoring	Error detection: VALVE M controller (14K302), terminal CN3.17 Error condition: Controller diagnosis system detects: Overcurrent > 1,4 A Solenoid power voltage >= 18 V Monitoring: 02305 Solenoid Valve2 Slew PPC Shutoff Sol. [ON/OFF]	
Action of controller		Action code level: L04 Buzzer: continuous sound
Problem that appears on the excavator	The slew left / right function is not available.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
Solenoid valve 61K613b defective. Internal short circuit.	1	▶ Main key switch 20S001 OFF.			
		Disconnect 61K613b. Measure the internal resistance between solenoid terminals 1 and 2. Is the coil resistance correct?	Yes	Go to next step.	$R_{solenoid}$ = 40 ±20 Ω
			No	Replace the defective solenoid valve 61K613b.	
Short circuit to GND in the power leading wire between controller output CN3.17 and solenoid valve 61K613b.	2	▶ Main key switch 20S001 OFF and ON.			
		Take 2 measurements between: 14K302 CN3.17 and solenoid valve 61K613b, pin 1. 1) Disconnect the cable and check for continuity (20S001 OFF). 2) Check for external power feed in (20S001 ON). If the controller output cable is OK in steps 1) and 2), check the following cables for continuity (20S001 OFF) and for power feed in (20S001 ON): 3) Wiring between: Solenoid valve 61K613b, pin 2 and 11SOLGND.1.4.		Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω $PWR_{Feed\ in}$ = 0 V
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

DWNPKA - Service arm up solenoid open circuit

Trouble code **DWNPKA**	Message	Service arm up solenoid open circuit
Contents of trouble	Disconnection detected in the loop between VALVE 3 controller (14K305) output CN2.09 and *service arm up* solenoid valve 57Q624a, or disconnection between 57Q624a and GND.	
Related information	Solenoid valve 57Q624a is permanently de-energized and the *service arm up* function is disabled.	
Controller / Monitoring	Error detection: VALVE 3 controller (14K305), terminal CN2.09 Error condition: Controller diagnosis system detects: Feedback voltage = 2,5 V....7 V & Solenoid power: > 18 V Monitoring: 02343 Solenoid Valve2 Service Arm up Sol. [ON/OFF]	
Action of controller		Action code level: L03 Buzzer: intermittent sound
Problem that appears on the excavator	The *service arm up* function is not available.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
Wiring disconnection between controller output and 57Q624a or between 57Q624a and GND (including connectors and terminals).	1	▶ Main key switch 20S001 OFF.			
		Take 2 measurements for continuity between: 1) 14K305 CN2.09 and solenoid valve 57Q624a, pin 1. 2) GND wiring from: Solenoid valve 57Q624a, pin 2 via all connectors to 11SOLGND.2.6. Is wiring continuity OK?	Yes	Go to next step.	R_{max} = 1 Ω
			No	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	
Solenoid valve 57Q624a defective. Internal disconnection.	2	▶ Main key switch 20S001 OFF.			
		Disconnect 57Q624a. Measure internal resistance between solenoid terminals 1 and 2.		Replace the defective solenoid valve.	$R_{solenoid}$= 20 ±1 Ω
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

Wiring Diagram - Service arm up solenoid open circuit (DWNPKA)

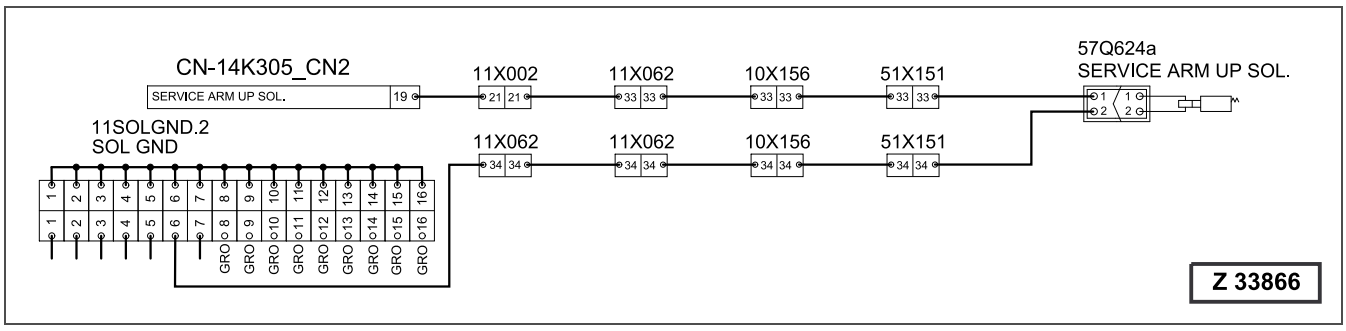


Fig. 6-125 Wiring Diagram - Service arm up solenoid open circuit (DWNPKA)

DKYAMA - Boom valve2 stroke main sensor abnormality
DKYCMA - Stick valve2 stroke main sensor abnormality
DKYFMA - Bucket valve2 stroke main sensor abnormality

[1/2]

Trouble code **DKYAMA, DKYCMA and DKYFMA**	Message	Boom valve2 stroke main sensor abnormality Stick valve2 stroke main sensor abnormality Bucket valve2 stroke main sensor abnormality
Contents of trouble	A malfunction in the monitoring loop for the boom / stick and bucket valve2 main stroke sensor (61B624 / -25 / -26) is detected. Defective wiring or defective sensor (61B624, 61B625 and 61B626)	
Related information	VALVE 2 controller (14K304) CN2.35, CN2.25 and CN2.15 = input voltage < 0.2 V or > 4.8 V.	
Controller / Monitoring	Error detection: VALVE 2 controller (14K304), CN2.35 / 2.25 / 2.15 Error condition: Input voltage < 0.2 V or > 4.8 V detected Monitoring: VALVE 2 controller 76517 Boom2 Spool Stroke 76518 Boom2 Spool Sensor Volt 1 76519 Stick2 Spool Stroke 76520 Stick2 Spool Sensor Volt 1 76521 Bucket2 Spool Stroke 76522 Bucket2 Spool Sensor Volt 1	
Action of controller		Action code level: L01 Buzzer: no sound
Problem that appears on the excavator	The monitoring for boom2, stick2 and bucket2 valve2 stroke sensor is inoperative.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
PWR or GND disconnection at stroke sensor (61B624, 61B625 and 61B626) (including connectors and terminals).	1	▶ Main key switch 20S001 OFF and ON.			
		Take 3 measurements for continuity from: Boom valve2 stroke sensor 61B624, pin 1 via all connectors to 14X043 5 V Power CN2.05 & Stick valve2 stroke sensor 61B625, pin 1 via all connectors to 14X043 5 V Power CN2.06 & Bucket valve2 stroke sensor 61B626, pin 1 via all connectors to 14X043 5 V Power CN2.07. GND wiring from: Boom valve2 stroke sensor 61B624, pin 2 via all connectors to 14X044 ANALOG GND CN1.05 & Stick valve2 stroke sensor 61B625, pin 2 via all connectors to 14X023 ANALOG GND CN1.06 & Bucket valve2 stroke sensor 61B626, pin 2 via all connectors to 14X023 ANALOG GND CN1.07. Are PWR and GND connection and wiring continuity OK?	Yes	Go to next step.	
			No	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω V_{supply} = 5 V

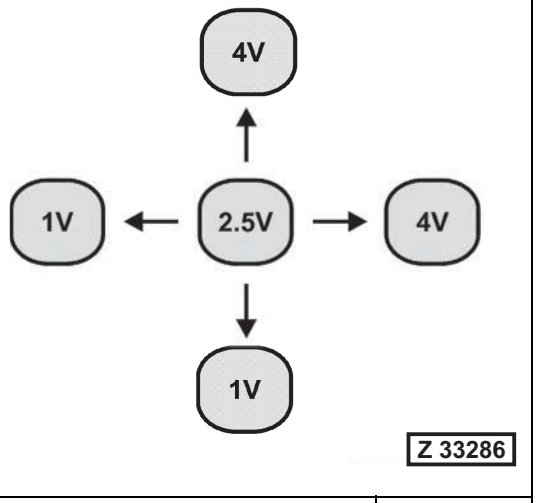
Details of the above 6-digit failure codes (BHA)

Failure code	Monitoring VALVE 3 (14K305)	VALVE 3 output	to EPC pin 1	from EPC pin 2 via connectors & pins	to EPC_GND	Refer to Wiring Diagram	Action code level
DXR5KB	76640	3.17	61K630a	61X461, pin D 10XA61, pin 4 11X068, pin 4 11X042, pin 5	14X069 CN3.11	Fig. 6-153	L03
DXR8KB	76641	3.27	61K630b	61X461, pin F 10XA61, pin 6 11X068, pin 6 11X042, pin 8	14X069 CN3.12		L03
DXRBKB	76642	3.37	61K629b	61X461, pin H 10XA61, pin 8 11X068, pin 8 11X042, pin 11	14X068 CN3.02		L03
DXREKB	76643	3.06	61K629a	61X461, pin K 10XA61, pin 10 11X068, pin 10 11X042, pin 14	14X068 CN3.03		L03
DXRHKB	76644	3.16	61K628b	61X461, pin M 10XA61, pin 12 11X068, pin 12 11X042, pin 17	14X068 CN3.04		L03
DXRLKB	76645	3.26	61K628a	61X461, pin O 10XA61, pin 14 11X068, pin 14 11X042, pin 20	14X068 CN3.05		L03
DXRPKB	76646	3.36	61K631b	61X461, pin P 10XA61, pin 16 11X068, pin 16 11X042, pin 23	14X068 CN3.06		L03
DXRSKB	76647	3.05	61K631a	61X461, pin S 10XA61, pin 18 11X068, pin 18 11X042, pin 26	14X068 CN3.07		L03

DKWHMA - R lever right-left redu pot. abnorm (VALVE 1)

[1/2]

Trouble code **DKWHMA**	Trouble	R lever right-left redundant pot. abnormality (VALVE 1)
Contents of trouble	Faulty lever signal of the RH lever 20S019 detected: - Redundant right-left direction signal wiring to VALVE 1 faulty or - Defective lever	
Related information	–	
Controller / Monitoring	Error detection: VALVE 1 controller (14K303), terminal CN1.09 Error condition: Input voltage < 0.4 V or > 4.6 V Monitoring: 75228 R Lever Right-Left Red. Pot Volt	
Action of controller		Action code level: L04 Buzzer: continuous sound
Problem that appears on the excavator	Corresponding machine control is not operative.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
RH control lever defective.	1	▶ Main key switch 20S001 ON.			
		Open *Monitoring* VALVE 1 controller Select → 75228 Action → Move RH lever in ↔ direction Monitor → Redundant potentiometer voltage Are the signals OK?	Yes	Signal problem (intermittent). Replace the RH control lever.	
			No	Go to next step.	
	Info	Control lever specification: Supply voltage 5 V ±0.2 V Power input of 5 V < 40 mA each axis Signals 1 V...2.5 V...4 V for A 4 V...2.5 V...1 V for B ratiometric* for 5 V *ratiometric = Describing any system in which an output is directly proportional to an input.			
Wiring disconnection (including connectors and terminals).	2	▶ Main key switch 20S001 OFF.			
		Check the wiring for continuity: 14K303 CN1.09 via all connectors to CN20S019.N		Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

DKX6L4 - Hyd. slew brake signal mismatch (VALVE 1)

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
Wiring disconnection (including connectors and terminals).	2	▶ Main key switch 20S001 OFF.		
		1) Check the wiring for continuity between: 14K302 CN1.18 via all connectors to 20S022.L & 14K303 CN1.05 via all connectors to 20S022.L. 2) Disconnect the cables and check for continuity.	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

Wiring Diagram - Hyd. slew brake signal mismatch (VALVE 1) (DKX6L4)

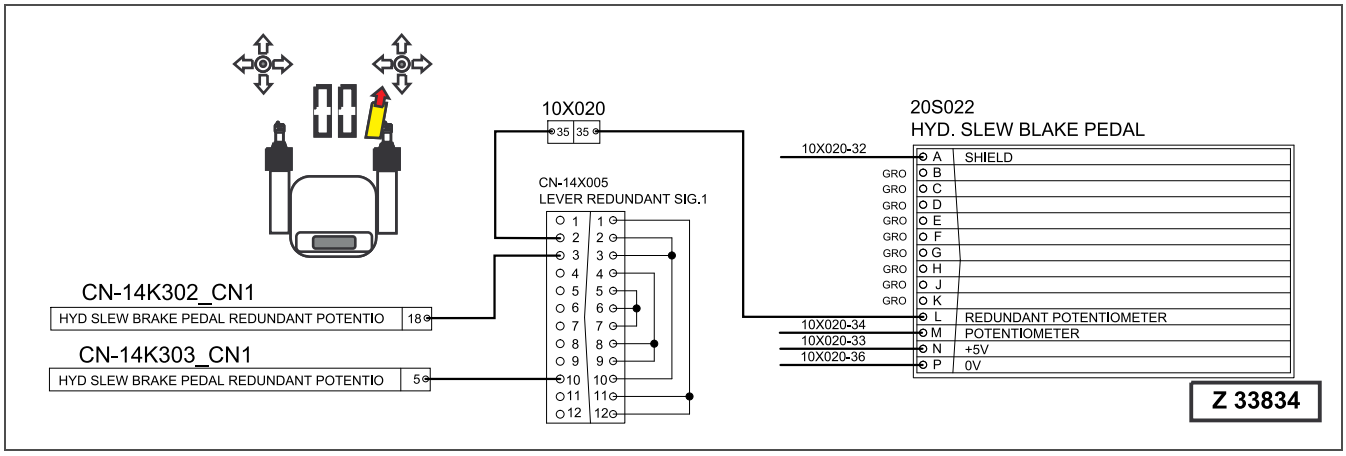


Fig. 6-181 Wiring Diagram - Hyd. slew brake signal mismatch (VALVE 1) (DKX6L4)

DKULMA - Lock lever PPC lock relay abnormality

[1/2]

Trouble code **DKULMA**	Message	Lock lever PPC lock relay abnormality
Contents of trouble	PPC Lock lever safety relay 11Q048e or the related circuit has abnormality.	
Related information	Error detection condition: PPC lock valve sol. monitor input = ON Lock lever release switch (VALVE 3) = OFF	
Controller / Monitoring	Error detection: VALVE 3 controller (14K305) terminal CN3.09 Monitoring: 02731 Switch Input4 PPC Lock Valve Sol. [ON/OFF] PPC Lock Switch2 [ON/OFF]	
Action of controller		Action code level: L04 Buzzer: continuous sound
Problem that appears on the excavator	Lock lever can not cut the PPC lock relay.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
Abnormality in the controller output cable (including connectors and terminals).	1	▶ Main key switch 20S001 OFF.			
		Disconnect the cable between 14K305 CN3.09 and PPC lock lever safety relay 11Q048e, pin 5. - Measure the cable for continuity. Is the continuity correct?	Yes	Go to next step.	R_{max} = 1 Ω
			No	- Refer to the Wiring Diagram. - Locate the problem in the faulty circuit and repair or replace as necessary.	
Safety relay 11Q048e has an internal short circuit.	2	▶ Main key switch 20S001 OFF.			
		Disconnect relay 11Q048e. Measure the relay voltage between terminals 1 - 2 → Pin 2 must be connected to GND. → Check wire of pin 2 for continuity to GND.		Replace the defective relay 11Q048e.	
Final check.	3	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

Wiring Diagram - Attachment selection abnormality (DBYYKQ, F81YKQ)

[2/2]

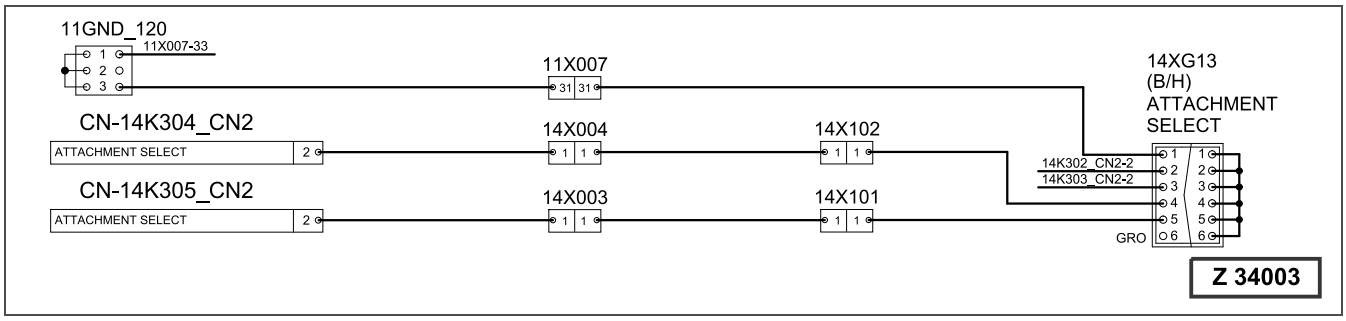


Fig. 6-214 Wiring Diagram - Attachment selection abnormality (DBYYKQ, F81YKQ)

DJE5L4 - SLS sensor system abnormality

[1/2]

Trouble code **DJE5L4**	Message	SLS sensor system abnormality
Contents of trouble	Malfunction detected in the monitoring loop for the SLS grease level sensors 62B109a (full), 62B109b (warning), 62B109c (empty). Defective wiring or defective sensor.	
Related information	Error detection criteria (1) or (2): (1) For 60 s [SLS full ON (24 V)] & [SLS warning OFF (0 V)] or [SLS empty OFF (0 V)] (2) For 60 s [SLS warning ON (24 V)] & [SLS empty OFF (0 V)]	
Controller / Monitoring	Error detection: VALVE 2 controller (14K304) Monitoring: 02251 Switch Input 3 SLS Grease Full Sig. SLS Grease Low Sig. SLS Grease Empty Sig.	
Action of controller		Action code level: L01 Buzzer: no sound
Problem that appears on the excavator	Monitoring of the SLS grease level not possible.	

Possible cause	Step	Test condition & Inspection		Procedure	Nominal value
Wiring disconnection in the SLS level sensor PWR or signal or GND line (including connectors and terminals).	1	▶ Main key switch 20S001 OFF / ON.			
		1) Check wiring between: - Level sensor 62B109a, pin A via all connectors to SENSOR_PWR & - Level sensor 62B109b, pin A via all connectors to SENSOR_PWR & - Level sensor 62B109c, pin A via all connectors to SENSOR_PWR. 2) Check wiring between: - 14K304 CN3.10 via all connectors to level sensor 62B109a, pin C & - 14K304 CN3.20 via all connectors to level sensor 62B109b, pin C & - 14K304 CN3.30 via all connectors to level sensor 62B109c, pin C. 3) GND wiring from: - Level sensor 62B109a, pin B via all connectors to SENSOR_GND & - Level sensor 62B109b, pin B via all connectors to SENSOR_GND & - Level sensor 62B109c, pin B via all connectors to SENSOR_GND. Are connections and continuity OK?	Yes	Replace the defective SLS grease level sensor.	R_{max} = 1 Ω
			No	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	
Final check.	2	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.			

Please continue reading on the next page.

DBPQKR - CAN 2 Discon (KomVision)

[1/2]

Trouble code **DBPQKR**	Message	CAN 2 Discon (KomVision)
Contents of trouble	CAN 2 disconnection detected between KomVision controller (20K310) and monitor (22P047).	
Related information	**Definition for KOMNET/c and KOMNET/r** Unfortunately there is a discrepancy between Trouble Message and Wiring Diagram. → **CAN2 in a trouble message is KOMNET/c in the Wiring Diagram** Shown trouble message at K+ is CAN 2. Electric plan illustration is KOMNET/c. KOMNET/c_L = CAN 2 KOMNET/c_H = CAN 2 KOMNET/r_L = CAN 1 KOMNET/r_H = CAN 1	
Controller / Monitoring	Error detection: MON (22P047) Error condition: Monitor CAN 2 port detects no CAN communication from KomVision controller (20K310). Monitoring: –	
Action of controller		Action code level: L01 Buzzer: no sound
Problem that appears on the excavator	KomVision fault codes and monitoring are not displayed on the monitor.	

Possible cause	Step	Test condition & Inspection	Procedure	Nominal value
CAN 2 wiring disconnection. (including connectors and terminals).	1	▶ Main key switch 20S001 OFF.		
		Check the CAN 2 wiring (H) & (L) between: (H) 20K310 CN2.42 via all connectors and CAN 2 to machine monitor 22P047 & (L) 20K310 CN2.41 via all connectors and CAN 2 to machine monitor 22P047. ▶ See the CAN 2 overview in following illustration.	Refer to the Wiring Diagram. Locate the problem in the faulty circuit and repair or replace as necessary.	R_{max} = 1 Ω
Final check.	2	Bring the excavator back into the original condition. Start the excavator and verify that the trouble code does not arise again.		

SEL006 - Engine does not start (pre-lube does not stop)

[2/2]

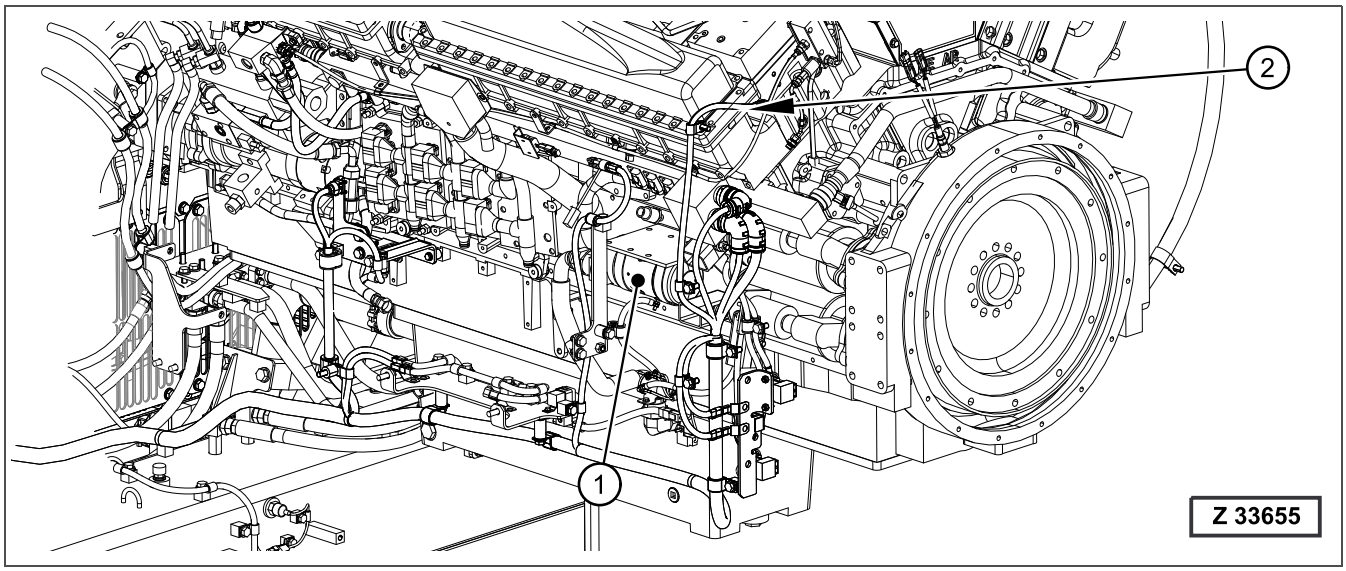


Fig. 7-2 Engine does not start (SEL006)

(1) Pre-lube pump

(2) Pre-lube pressure switch

SHY009 - Slew acceleration is poor

[1/3]

Trouble code	Trouble	Slew acceleration is poor
SHY009		
Contents of trouble	The excavator slew acceleration is poor (too long acceleration time or too short acceleration time). All other operating functions are going well.	
Related information	For the basic adjustment procedures refer to the SHOP MANUAL, section 10.3.10 Checks and adjustments for the slew circuit. For the target adjustment values refer to PM-CLINIC sheets.	
Problem that appears on the excavator	The slew acceleration is poor and standard slew & load movements are not possible. Basic adjustment of the double stage valve is not possible (pressure can not be reached).	
Possible causes	The double stage valve is defective or its adjustment is wrong. The slew brake valve is defective (internal leak in the ACV's). The O-rings between slew brake valve and motor have an internal leak (oil flows from A to B side), no external leak visible. Slew motor defective (internal leakage).	

Possible cause	*Step*	*Test condition & Inspection*		*Procedure*	*Nominal value*
The double stage valve is defective or its adjustment is wrong.	1	▶ Engine running at high idle (TH3) & slew lock switch ON.			
		Perform the basic adjustments of the slew circuit according to the SHOP MANUAL and PM CLINIC sheets. Is a correct pressure and acceleration adjustable?	Yes	Go to next step.	SHOP MANUAL PM CLINIC
			No	Replace both double stage valves and perform the basic adjustments. If - after replacement of the double stage valves - the slew acceleration is still poor, replace the complete slew brake valve blocks on top of the slew motors. Refer to next step.	
The slew brake valve is defective (internal leak in the anti-cavitation valves).	2	▶ Main key switch 20S001 OFF & safety service switch 50S058 locked.			
		- Perform the following steps according to the Safety Notes in the SHOP MANUAL. - Disconnect the high pressure hoses from the slew brake block. **NOTE!** Before mounting the new block in the next work step, also see step 3 in this troubleshooting chart. - Replace the complete block with new double stage valves and O-rings. - Adjust the double stage valves according to the SHOP MANUAL and PM CLINIC sheets. Is a correct acceleration now available?	Yes	Bring the excavator back to operation.	SHOP MANUAL chapter 10, section 10.3.5 PM CLINIC
			No	Go to next step.	

SME006 - There is a big abnormal noise when moving / stopping slew movement

[1/2]

Trouble code	Trouble	There is a big abnormal noise when moving / stopping slew movement
SME006		
Contents of trouble	A big abnormal noise occurs when moving / stopping slew movement. The abnormal noise may also exist permanently during slew movement.	
Related information	First check all oil levels at the slew gearboxes. Verify the oil level and the used oil viscosity in the slew gearboxes (CLP 220 only). Verify the oil level and the used oil viscosity in the slew parking brake housing (HLP 32). Verify the oil level and the used oil viscosity in the motor adapter housing (HLP 32). Also refer to the OPERATION & MAINTENANCE MANUAL and to the SHOP MANUAL.	
Problem that appears on the excavator	Abnormal noise and in consequence a damage can arise.	
Possible causes	Slew gearbox - internal damage. Bottom bearing of the slew gearbox pinion fault (external grease lubrication). Slew parking brake - internal damage (discs are welded together). Mechanical connection between the hydraulic slew motor and the slew gearbox damaged (motor adapter housing, excessive wear at the connection).	

Possible cause	***Step***	***Test condition & Inspection***		***Procedure***	***Nominal value***
Slew gearbox - internal damage.	1	▶ Engine running at high idle (TH3) & smooth slew movement of superstructure.			
		- Check for proper tightening of the slew gearboxes, and re-tighten if necessary. - During slew movement, check and listen for noise at the respective gearbox. Is there any abnormal noise coming from the slew gearbox?	Yes	Replace the defective slew gearbox.	Refer to the tightening chart in the SHOP MANUAL
			No	Go to next step.	
Bottom bearing of the slew gearbox pinion fault (external grease lubrication).	2	▶ Engine running at high idle (TH3) & smooth slew movement of superstructure.			
		- During slew movement check the movement of the slew gearbox pinion.	Yes	Replace the defective slew gearbox.	SHOP MANUAL, Compo-nent structure and grease system
		- During slew movement also check and listen for noise at the lower side of the respective slew gearbox. - Check the grease supply and volume (injector adjustment) at the pinion bearing. Is there any abnormal noise or abnormal movement of the slew gearbox pinion?	No	Go to next step.	

Item no. of Data Sheet	Note	Action required
22 Secondary Relief Pressure **e-f Slew Circuit (DSV) High - Low Press.**	C PM	- continued - **Adjustment** 1 Turn lower stage (170 bar) at both DSV to final stop 2 Install a pressure gauge to any test port M28 on the slew brake block (front/rear) 3 Activate slew - adjust both DSV (high press. stage 299 bar) to nominal value 4 Activate slew - adjust both DSV (low press. stage 170 bar) to nominal value 5 Keep lever neutral & PPC control active - remove plug from both DSV pilot hoses 6 Reconnect hoses to DSV valves 7 Remove pressure gauge
23 Slew Brake Pressure		1 Connect a pressure gauge to test port M39 at the valve cartridge block 2 Move the attachment to ground to prevent slew movement 3 Start the engine → high idle - TH3 4 Push the slew brake foot pedal fully down and keep it pressed down **Adjustment** 1 Service Level → 10 Adjustments - VALVE1 2 Select item 24 and adjust the max. current of the hydraulic slew EPC valve until the pressure stays at the nominal value 3 Release the foot brake **Slew parking brake movement test** 1 Disconnect solenoid valve 57Q505 2 Carefully activate slew-left & slew-right fully against the slew brake → The superstructure must stand still, no movements 3 Note the condition 4 Reconnect 57Q505. 5 Remove pressure gauge

HYDRAULIC MINING EXCAVATOR

PC3400-11M0

Excavator model	Serial numbers
PC3400-11M0	36301 and up

50 Disassembly & Assembly

Release 0 02/2021

3.1 SUPERSTRUCTURE OVERVIEW

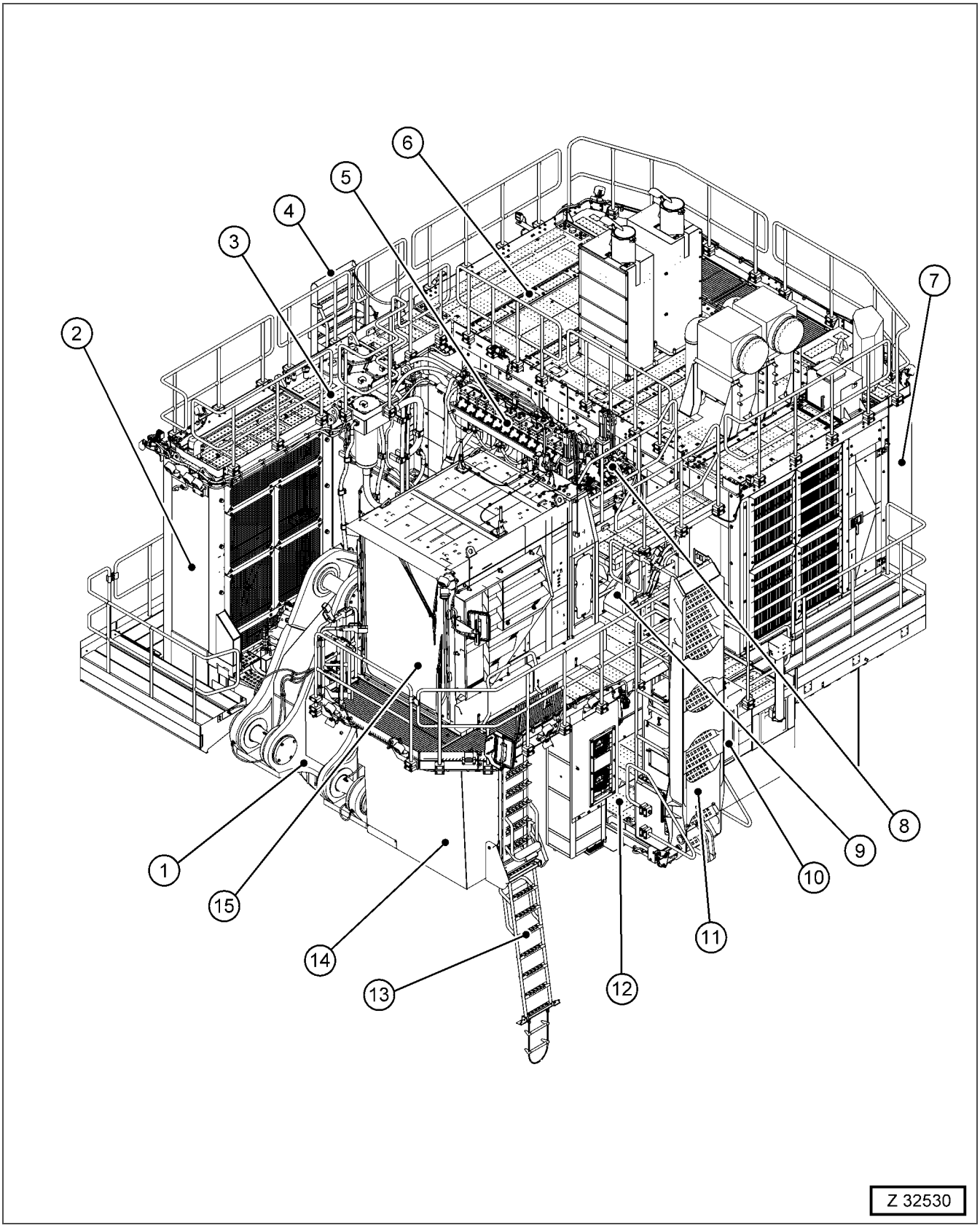


Fig. 3-1 Superstructure overview

Assembling of the exhaust pipes:

8. If required:
   Disassemble all bolts, nuts & washers (Fig. 3-21, Pos. 1) and remove the cover (Fig. 3-21, Pos. 2) of the muffler housing.

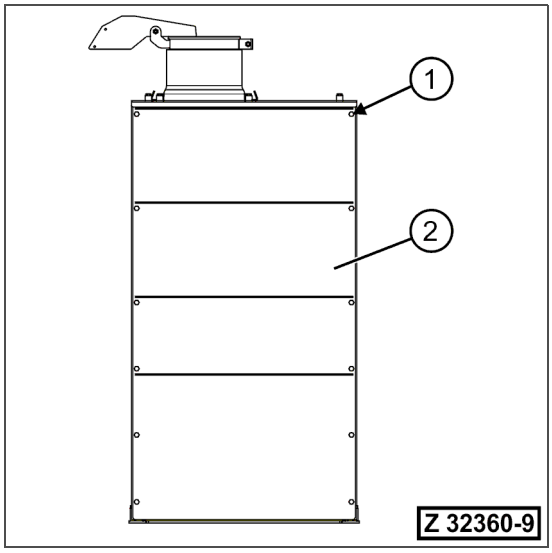


Fig. 3-21

47. Disassemble the engine mounting bolts (Fig. 3-55, Pos. 1) of the rear engine suspensions (Fig. 3-55, Pos. 2) at both sides.

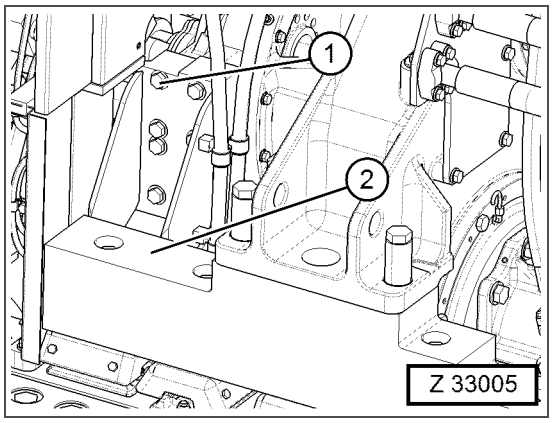


Fig. 3-55

48. Disassemble the mounting bolts (Fig. 3-56, Pos. 1 & 2) at both sides of the engine torque support (Fig. 3-56, Pos. 3).

REMARKS: The front mounting bolts (Fig. 3-56, Pos. 2) run through the flexible mounts (Fig. 3-56, Pos. 4) and are secured by nuts.

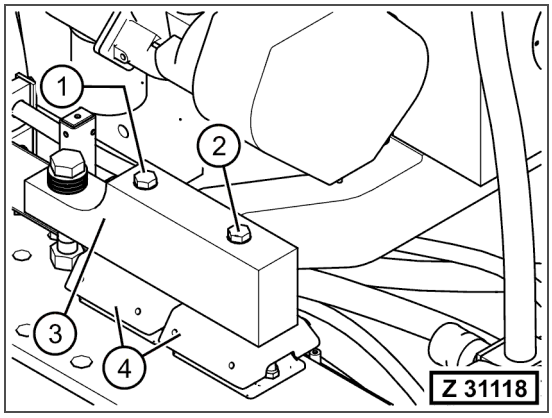


Fig. 3-56

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy excavator parts.

When moving excavator parts using a crane, make sure that nobody steps below or in close range to the lifted excavator part.

49. Move the engine including torque support away from the PTO at first and then lift it out of the machinery house using the crane.

50. Disassemble the engine torque support (Fig. 3-57, Pos. 1) and all other attached components from the engine.

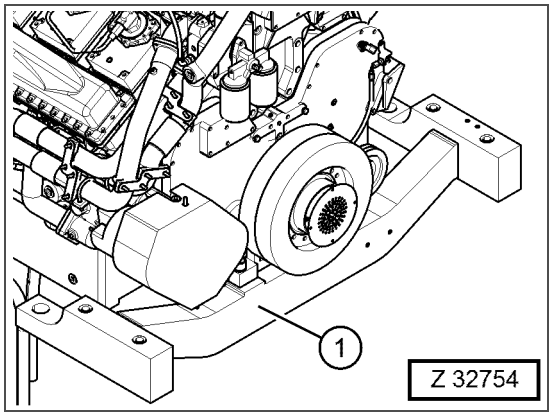


Fig. 3-57 Engine torque support

Assembling the lower radiator fan assembly (Fig. 3-98, Pos. 11):

1. Move the radiator fan into the fan cowl.
2. Move the radiator fan assembly into mounting position.

REMARKS: Two persons are required to handle the radiator fan assembly.

3. Assemble the four mounting bolts (Fig. 3-98, Pos. 7) to attach the radiator fan assembly.
4. Assemble the central nut (Fig. 3-99, Pos. 1) to attach radiator fan at the radiator fan motor (Fig. 3-99, Pos. 5).
5. Assemble the bolt (Fig. 3-99, Pos. 2) to attach the locking plate (Fig. 3-99, Pos. 3) at the radiator fan.

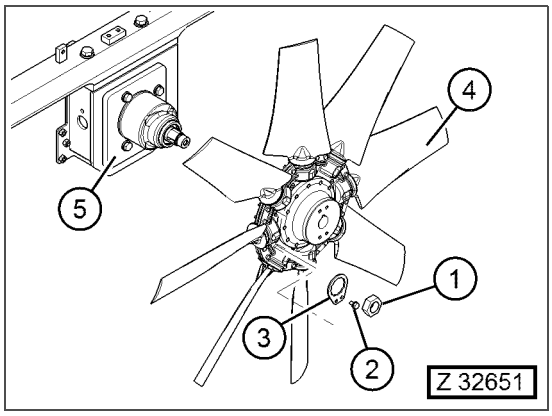


Fig. 3-99

6. Connect the wiring harnesses at the radiator fan motor.
7. Assemble the clamps (Fig. 3-98, Pos. 6).
8. Connect the hydraulic hoses (Fig. 3-98, Pos. 8, 9 & 10) at the radiator fan motor.

Assembling the upper radiator fan assembly (Fig. 3-98, Pos. 12):

9. Move the radiator fan into the fan cowl.
10. Move the radiator fan assembly into mounting position.

REMARKS: Two persons are required to handle the radiator fan assembly.

11. Assemble the four mounting bolts (Fig. 3-98, Pos. 2) to attach the radiator fan assembly.
12. Carry out step 4 & 5 for assembling the radiator fan.
13. Connect the wiring harnesses at the radiator fan motor.
14. Assemble the clamps (Fig. 3-98, Pos. 1).
15. Connect the hydraulic hoses (Fig. 3-98, Pos. 3, 4 & 5) at the radiator fan motor.

3.2.10.4 ASSEMBLING OF THE PTO GEAR OIL PUMP

Special tools:	n/a
Additional equipment:	Paste *Optimol Paste White T*, PN 323 444 40
	PTO gear oil pump: 25 kg
	If there is nothing mentioned explicitly, tighten all bolts according to KOMATSU company standard, refer to section 6.5 on page 6-11.

1. Assemble the intermediate flange (Fig. 3-135, Pos. 2) at the PTO gear oil pump (Fig. 3-135, Pos. 1).
2. Connect the suction oil hose (Fig. 3-135, Pos. 3) at the intermediate flange.

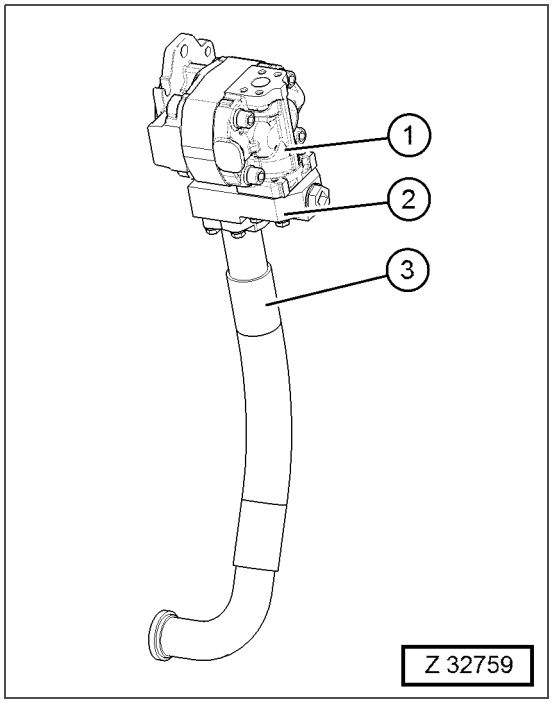


Fig. 3-135

NOTE! Replace the flat seals at hydraulic flange connections when installing used hydraulic lines!
A flat and level sealing surface is essential for proper sealing!

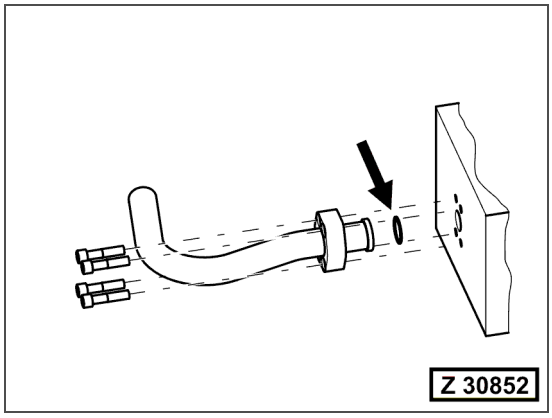


Fig. 3-136 Exemplaric sketch

4. Assemble mounting bolts (Fig. 3-174, Pos.1) with washers from inner side at the hydraulic oil cooler assembly.

5. Assemble mounting bolts (Fig. 3-174, Pos.4) with washers from outer side at the hydraulic oil cooler assembly.

REMARKS: Use new mounting bolts of grade 10.9.
Apply MPG (or roller bearing grease, or grease from the CLS system).

6. Detach the crane and disassemble the swivel hoist rings from the suspension points.

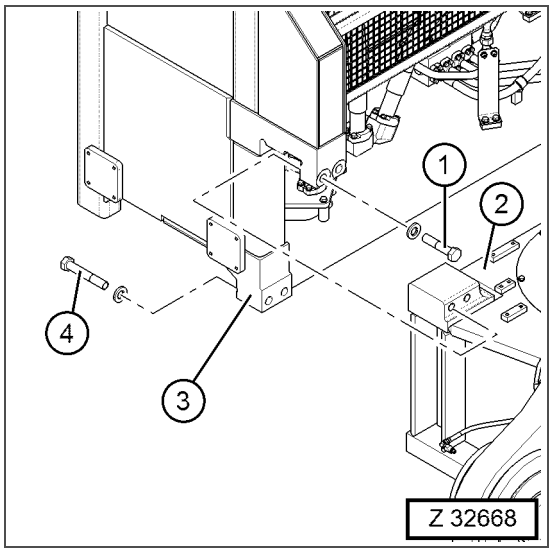


Fig. 3-174

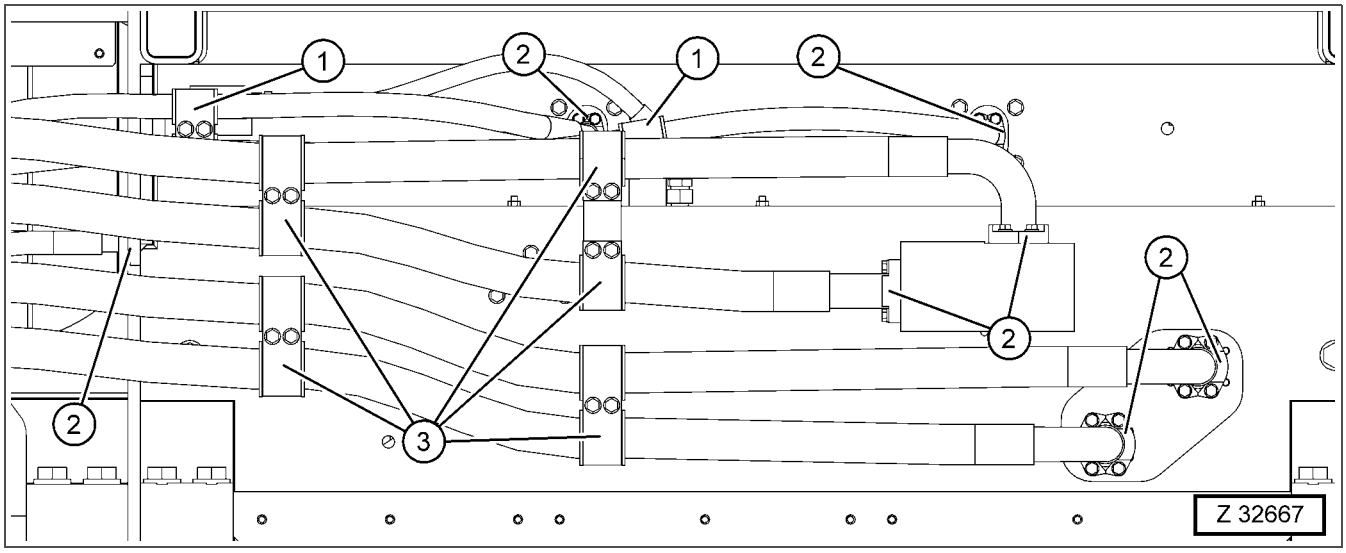


Fig. 3-175 View from below

7. Connect all hydraulic hoses (Fig. 3-175, Pos. 2) coming from the hydraulic oil tank.

8. Install the clamps (Fig. 3-175, Pos. 1 & 3) and attach the hydraulic hoses at the hydraulic oil cooler assembly.

NOTE! Replace the flat seals at hydraulic flange connections when installing used hydraulic lines!
A flat and level sealing surface is essential for proper sealing!

Tighten the mounting bolts of hydraulic flange connections according to the KOMATSU company standard "Torques for hydraulic flange connections", **refer to section 6.9.2 on page 6-39.**

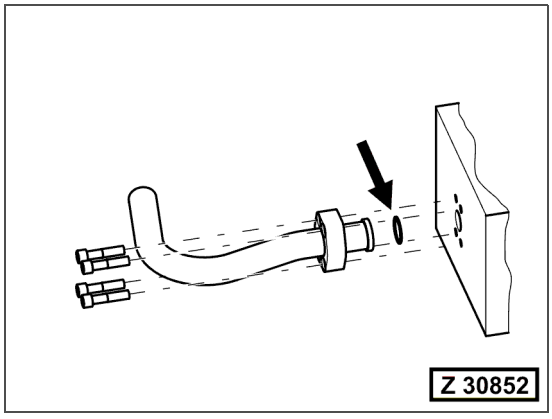


Fig. 3-176 Exemplaric sketch

9. Assemble the hydraulic oil cooler R.H. platform,refer to section 3.9.2.2 on page 3-339.

3.3.3.1 DISASSEMBLING OF THE MAIN CONTROL VALVE ASSEMBLY

Special tools:	n/a
Additional equipment:	Crane Oil drain pan Hoist rings: 4 x M16
	Main control valve 1, 2 and 3: 615 kg (each)
	Dogman/rigger
	For further information about the needed blind plugs, refer to section 6.6 on page 6-18.

1. Prepare an area of flat ground large enough to accommodate the excavator and the additional working equipment (crane, mobile working platforms, forklift, etc.).

2. Park the excavator on the prepared flat ground area.

REMARKS: If the ground condition is too poor to guarantee safe and stable stand of the excavator and the additional working equipment (crane, mobile working platforms, forklift, etc.), make sure that the excavator is moved to any location with appropriate ground condition.

3. Relieve the pressure in the hydraulic system, refer to the OPEREATION & MAINTENANCE MANUAL, chapter 3, section "RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM".

4. Transfuse hydraulic oil from the suction oil tank into the main hydraulic oil tank, refer to the OPERATION & MAINTENANCE MANUAL, chapter 3, section "TRANSFER PUMP FOR HYDRAULIC OIL".

5. Isolate the excavator according to local regulations.

NOTE! Before beginning any work operations set the maintenance safety switch (Fig. 3-211, Pos. 3) to 0 position to prevent starting of the engine during the work. Fold up the flap (Fig. 3-211, Pos. 2) and secure this position by inserting a padlock into the holes (Fig. 3-211, Pos. 4) of the flap and the safety switch (Fig. 3-211, Pos. 1).

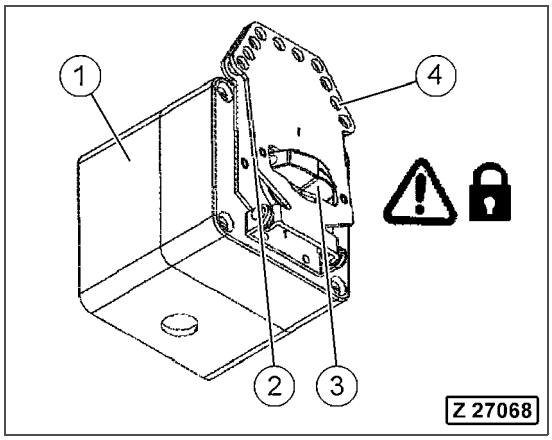


Fig. 3-211 Safety switch

⚠ WARNING

HOT HYDRAULIC OIL!

May result in personal injury from heated oil.

Do not carry out the following work on a hot excavator. Wait until the temperature of the hydraulic oil is below 50 °C.

1. Assemble the MRV (Width across flats: 50 mm) to the control valve blocks.

NOTE! Do not touch Lock nut (2) and Adjustment screw (3) when assemble the MRV (1) to the control valve blocks.
Relief pressure of the MRV is adjusted when shipped.

Tightening torque for the MRV: 422 to 471 Nm

2. Bleed air from the hydraulic system, refer to the OPEREATION & MAINTENANCE MANUAL, chapter 4, section "BLEEDING THE HYDRAULIC SYSTEM".

3. Add specified hydraulic oil up to the specified level, refer to the OPERATION & MAINTENANCE MANUAL, chapter 4, section "FILLING THE HYDRAULIC SYSTEM".

4. Check and adjust the MRV.
Refer to SHOP MANUAL part *10 STRUCTURE & FUNCTION*, chapter 10 for further information.

14. Assemble the slew circle (Fig. 3-272, Pos. 3) at the superstructure platform (Fig. 3-272, Pos. 1) according to the PARTS & SERVICE NEWS No. "AH00511".

Determine the tightening torque and tighten all bolts of the inner slew ring crosswise to the required torque, refer to the PARTS & SERVICE NEWS No. "AH00511".

15. When assembling a new slew circle:
    - Move the guides (Fig. 3-271, Pos. 2) inwards.
    - After adjusting the tooth backlash between slew ring and slew pinion according to the PARTS & SERVICE NEWS No. "AH00511" fix the guides free of clearance to the inner slew ring.

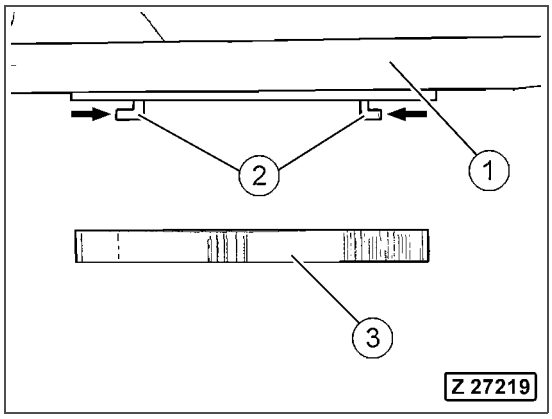


Fig. 3-272

16. Detach the crane.

17. After checking the tooth backlash according to the PARTS & SERVICE NEWS No. "AH00511" assemble the slew motors, refer to section 3.4.2.2 on page 3-201.

18. Assemble the hydraulic lines (Fig. 3-273, Pos. 2).

19. Assemble the hydraulic lines (Fig. 3-273, Pos. 1) at the manifold.

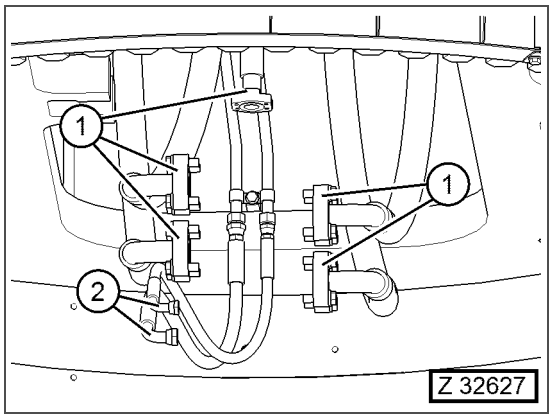


Fig. 3-273

NOTE! Always replace the flat seals at hydraulic flange connections when installing used hydraulic lines! A flat and level sealing surface is essential for proper sealing!

Tighten the mounting bolts of hydraulic flange connections according to the KOMATSU company standard "Torques for hydraulic flange connections",refer to section 6.9.2 on page 6-39.

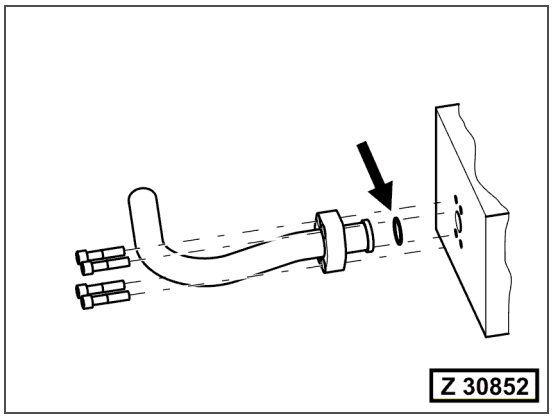


Fig. 3-274 Exemplaric sketch

No. "AH05537".

⚠ DANGER

REFRIGERANT UNDER HIGH PRESSURE!

The air conditioning system is pressurized. Blindness, serious injury, permanent disfigurement, or scarring will result when opening refrigerant lines under pressure.

Make sure that the refrigerant is completely aspirated from the system before disconnecting any hoses or lines of the air conditioning system.

7. Disconnect the drain hoses (Fig. 3-305, Pos. 5).
8. Disconnect the hoses (Fig. 3-305, Pos. 2) of the cab heating system.
9. Disconnect the conditioning hoses (Fig. 3-305, Pos. 3).
10. Disconnect the hydraulic hoses (Fig. 3-305, Pos. 4).
11. Disconnect the ground strap (Fig. 3-305, Pos. 1) of the cab base.

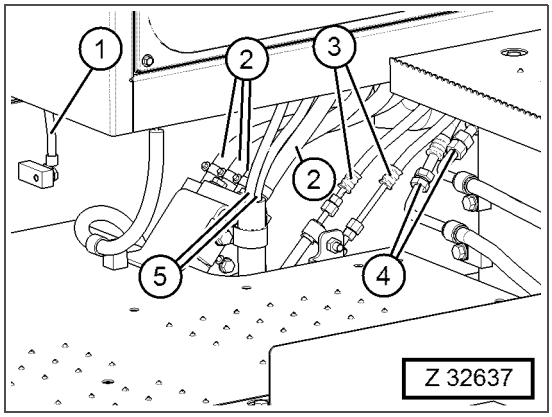


Fig. 3-305

12. Disassemble the plates (Fig. 3-306, Pos. 1).
13. Disassemble the covers (Fig. 3-306, Pos. 2).

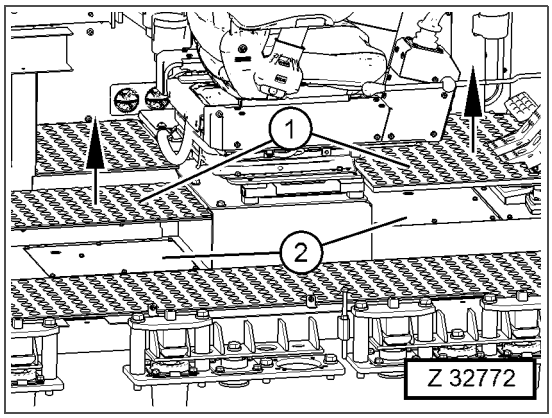


Fig. 3-306

14. Disconnect the wiring harnesses (Fig. 3-307, Pos. 1) behind the operator's seat.

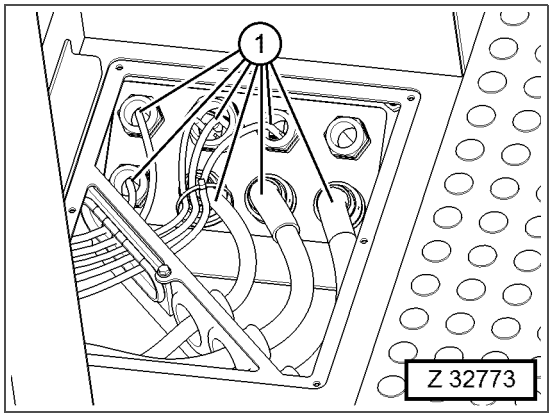


Fig. 3-307

3.6.5 OPERATOR'S SEAT

3.6.5.1 DISASSEMBLING OF THE OPERATOR'S SEAT

Special tools:	n/a
Additional equipment:	n/a
	Operator's seat: 63 kg
	Dogman/rigger

1. Prepare an area of flat ground large enough to accommodate the excavator and the additional working equipment (crane, mobile working platforms, forklift, etc.).

2. Park the excavator on the prepared flat ground area.

REMARKS: If the ground condition is too poor to guarantee safe and stable stand of the excavator and the additional working equipment (crane, mobile working platforms, forklift, etc.), make sure that the excavator is moved to any location with appropriate ground condition.

3. Isolate the excavator according to local regulations.

4. Switch off the battery main switches and remove the keys from the battery main switch.

5. Cut the bands (Fig. 3-336, Pos. 1) to remove the wiring harness (Fig. 3-336, Pos. 2) from the seat frame (Fig. 3-336, Pos. 3).

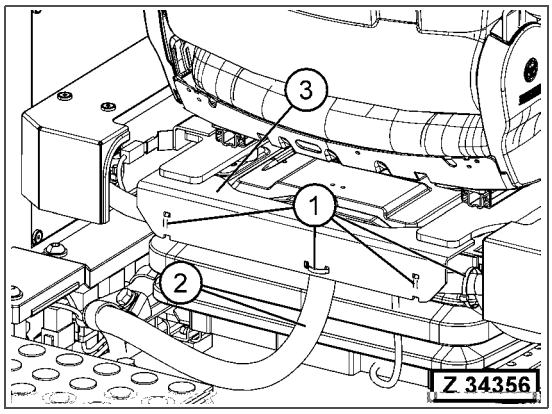


Fig. 3-336

6. Disassemble the operator's seat belt (Fig. 3-337, Pos. 1), refer to section 3.6.5.7 on page 3-284.

7. Disassemble the control carrier left (Fig. 3-337, Pos. 2), refer to section 3.6.5.3 on page 3-280.

8. Disassemble the control carrier right (Fig. 3-337, Pos. 5), refer to section 3.6.5.5 on page 3-282.

9. Disassemble the clamps (Fig. 3-337, Pos. 3) to remove the wiring harness (Fig. 3-337, Pos. 4) from the seat frame.

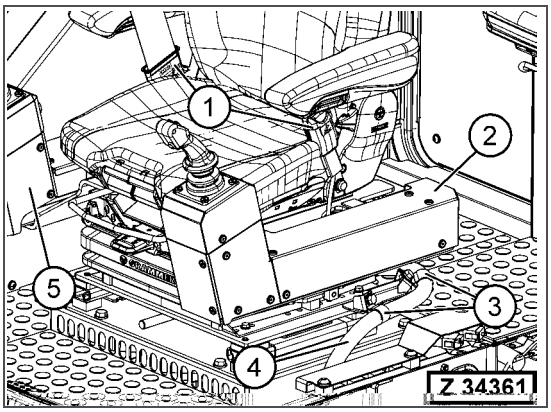


Fig. 3-337

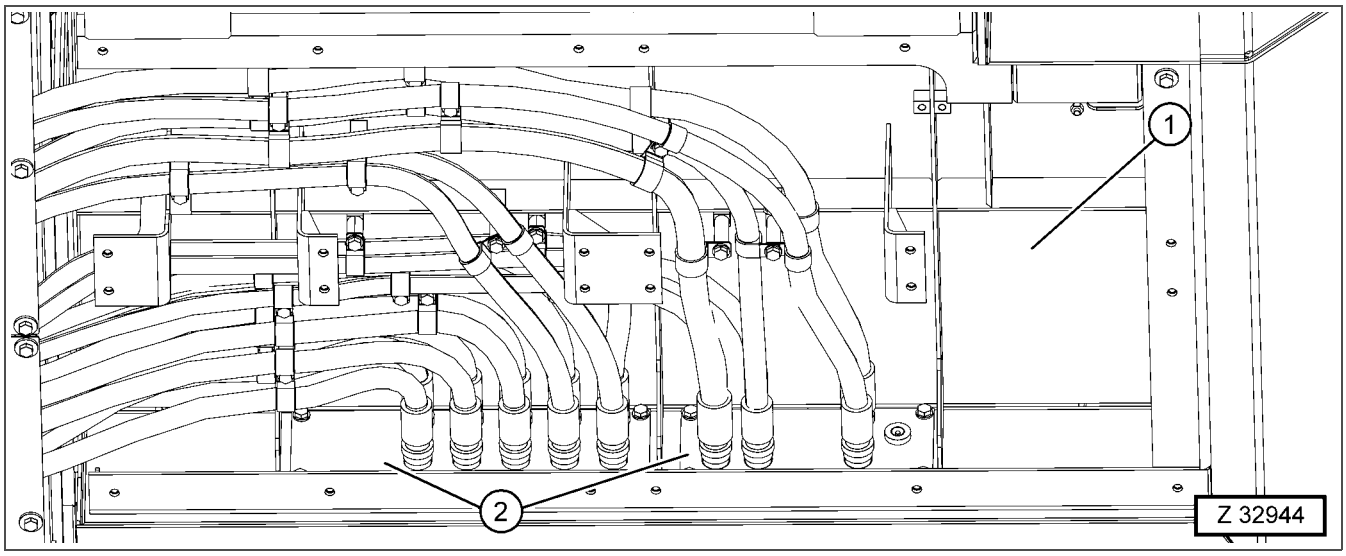


Fig. 3-398 View from below

7. Disconnect the wiring harnesses from the connecting plate (Fig. 3-398, Pos. 2) at the bottom side of the cab base (Fig. 3-398, Pos. 1).

8. Disassemble all clamps and remove the wiring harnesses from the cab base.

9. Disassemble the cover (Fig. 3-399, Pos. 1).

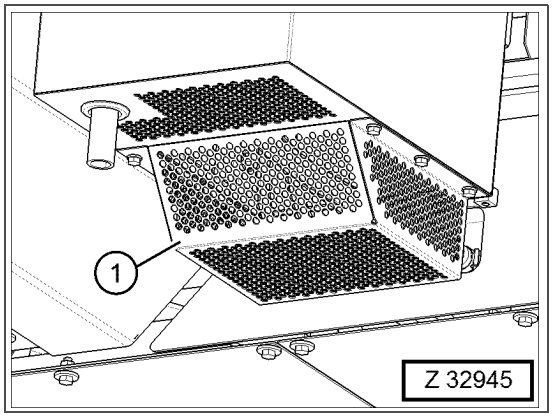


Fig. 3-399 View from below

⚠ WARNING

HOT ENGINE COOLANT!

Personal injury from hot excavator parts, hot coolant or steam may result.

Do not carry out the following work on a hot engine.
Wait until the temperature of the engine is below 50°C.

⚠ WARNING

HAZARDOUS REFRIGERANT

The refrigerant may cause frostbite and toxication when it comes in contact with the skin. The refrigerant is also toxic when inhaled.

Any maintenance, repair or service at the air conditioning system must be carried out by authorized and special skilled service specialists only.

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy excavator parts.

When moving excavator parts using a crane, make sure that nobody steps below or in close range to the lifted excavator part.

22. Disassemble all mounting bolts (Fig. 3-431, Pos. 3) and remove the fuel tank step from the lower step platform.
    Make sure all hydraulic and/or electric lines are disconnected.

23. Detach the crane.

4. Insert three swivel hoist rings into the marked locations at the fuel tank platform (front) (Fig. 3-461).

5. Attach the fuel tank platform (front) to the crane.

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy excavator parts.

When moving excavator parts using a crane, make sure that nobody steps below or in close range to the lifted excavator part.

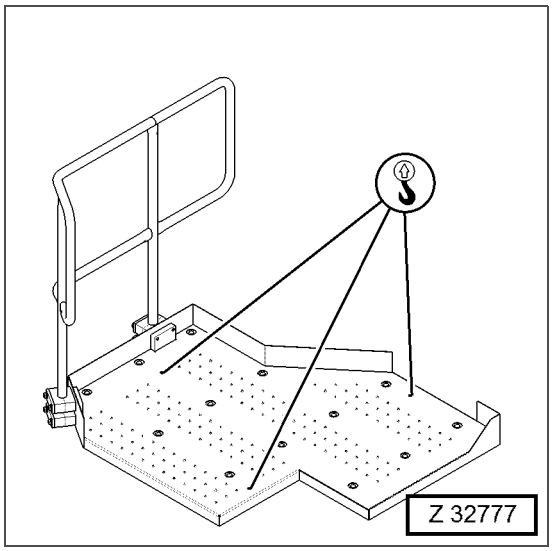


Fig. 3-461 Suspension points

6. Remove the fuel tank platform (front) using the crane and place it on the ground.

7. Detach the crane.

Disassembling of the fuel tank platform (rear):

8. Disassemble the clamps (Fig. 3-462, Pos. 1 & 2) along the fuel tank platform (rear) (Fig. 3-462, Pos. 4) and clear the refrigerant hoses from the fuel tank platform (rear).

9. Disassemble the mounting bolts (Fig. 3-462, Pos. 3).

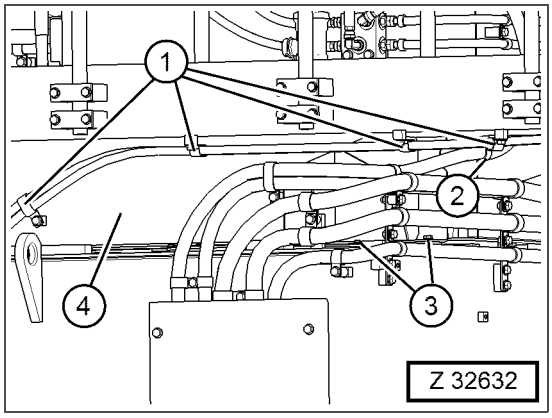


Fig. 3-462 View from below

10. Insert three swivel hoist rings into the marked locations at the fuel tank platform (rear) (Fig. 3-463).

11. Attach the fuel tank platform (rear) to the crane.

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy excavator parts.

When moving excavator parts using a crane, make sure that nobody steps below or in close range to the lifted excavator part.

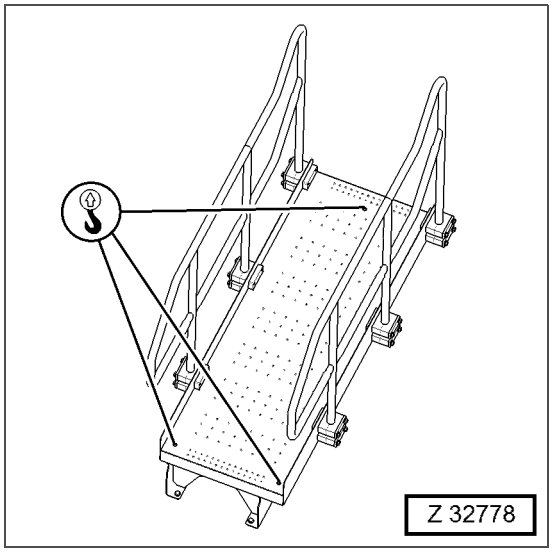


Fig. 3-463

34. Connect the harness connector (Fig. 3-514, Pos. 1).

35. Assemble the clamp (Fig. 3-514, Pos. 2) to attach the wiring harness (Fig. 3-514, Pos. 3).

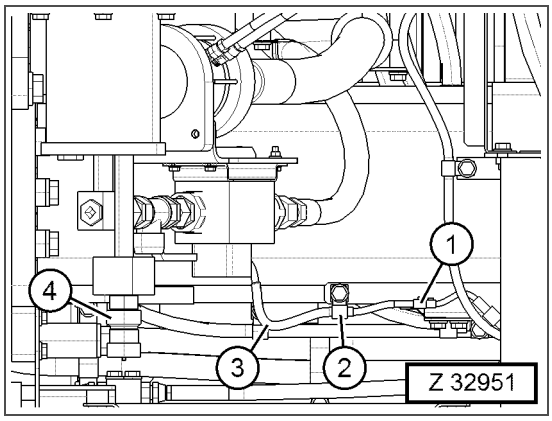


Fig. 3-514

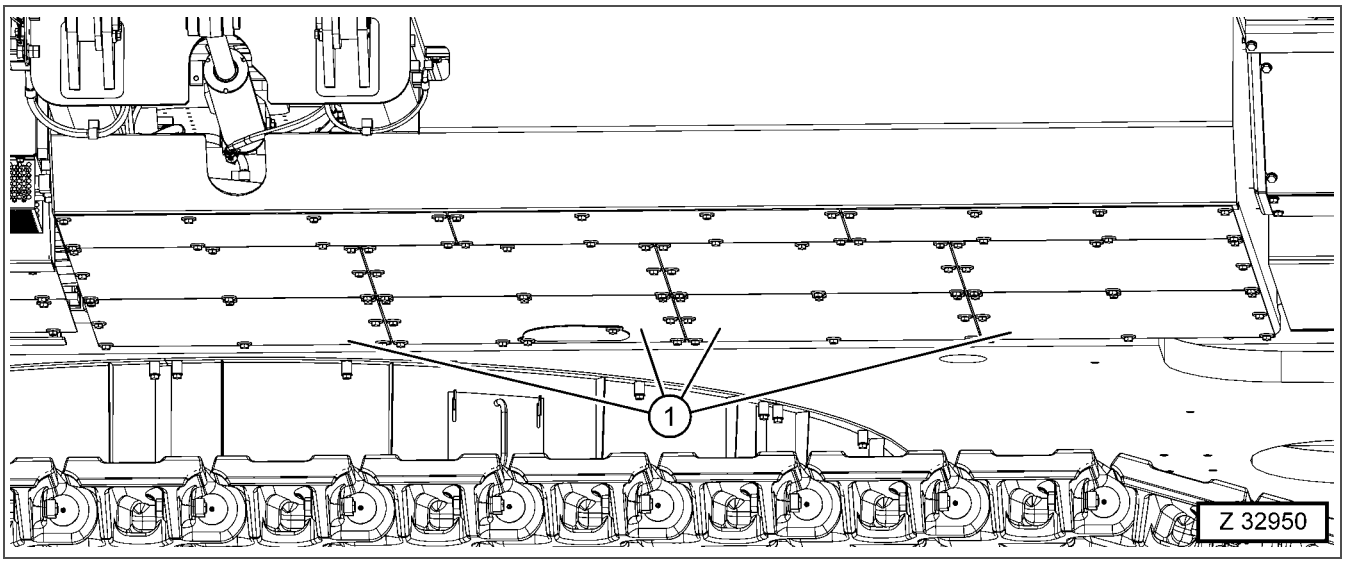


Fig. 3-515

36. Assemble the covers (Fig. 3-515, Pos. 1) at the bottom side of the fuel tank.

Refill the fuel tank.
Refer to the OPERATION & MAINTENANCE MANUAL.

⚠ DANGER

INFLAMMABLE FUEL!

Serious injury, permanent disfigurement and scarring, or death will result from burns caused by burning fuel.

DO NOT smoke or use an open flame when working at fuel lines.

37. Bleed the fuel system.
Refer to the ENGINE OPERATION AND MAINTENANCE MANUAL for further information.

NOTICE

RISK TO DAMAGE THE STOP PLATES EARLY!
The stop plates may get damaged early when the assembling direction of the sliding blocks is wrong.

The bolt surface of sliding blocks (2) must be assembled toward rear side of the machine.

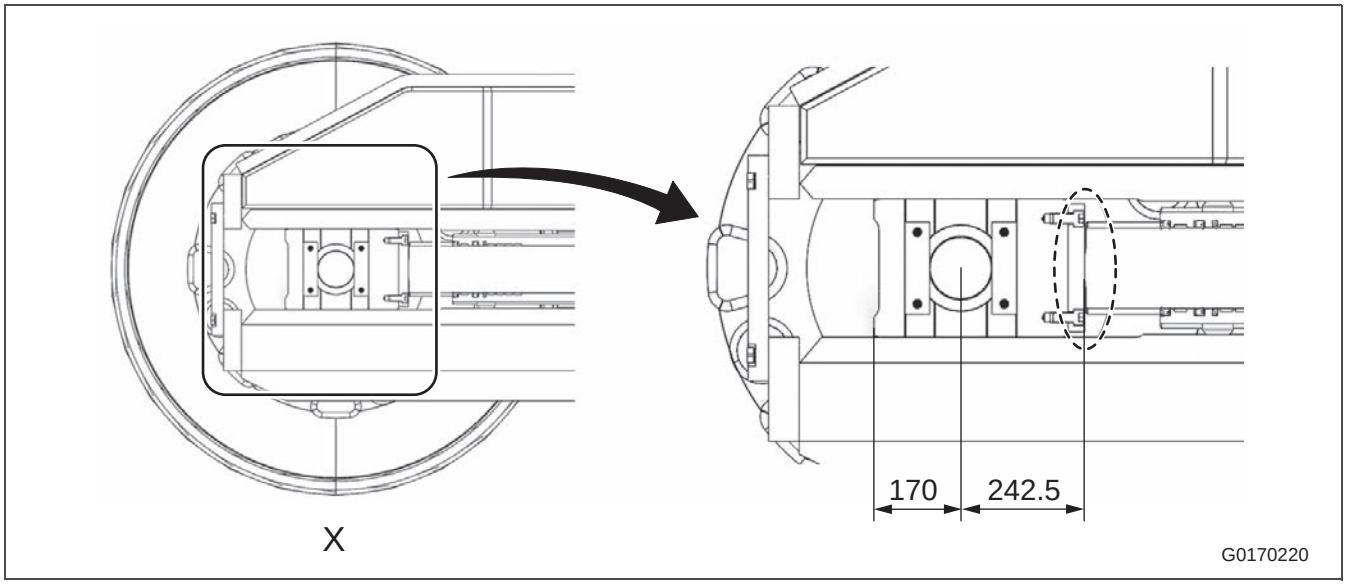


Fig. 4-35

4. Assemble the mounting bolts (Fig. 4-36, Pos. 1) to attach the stop plates at both sides of the guide wheel assembly.

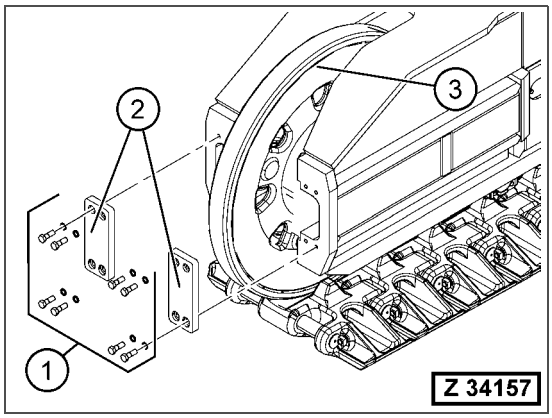


Fig. 4-36

4.2.9.2 ASSEMBLING OF THE TRAVEL MOTORS

Special tools:	n/a
Additional equipment:	Crane Paste *Optimol Paste White T*, PN 323 444 40
	Travel motor: 155 kg
	Dogman/rigger
	If there is nothing mentioned explicitly, tighten all bolts according to KOMATSU company standard, refer to section 6.5 on page 6-11.

REMARKS: Ensure that the mating surfaces are clean and free of paint before assembling.

1. Sling the travel motor and attach it to the crane.

REMARKS: In order to avoid damage to the lifting device, use edge protection at all sharp edges.

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy machine parts.

When moving machine parts using a crane, make sure that nobody steps below or in close range to the lifted machine part.

2. Move the travel motor into mounting position using the crane.
3. Apply "*Optimol Paste White T*" at the line shaft of the travel motor before attaching the travel motor to the motor adapter housing.
4. Align the spline shaft and push the travel motor into the motor adapter housing.
5. Assemble six mounting bolts (Fig. 4-75, Pos. 2) with washers to attach the travel motor ((Fig. 4-75, Pos. 3).

REMARKS: The upper mounting bolts will be assembled later.

Tightening torque for mounting bolts 510 Nm.

6. Assemble the leak oil tube (Fig. 4-75, Pos. 4).
7. Install the flat seals (Fig. 4-75, Pos. 5) into mounting position.
8. Connect the hydraulic flange connection (Fig. 4-75, Pos. 1) to the travel motor.

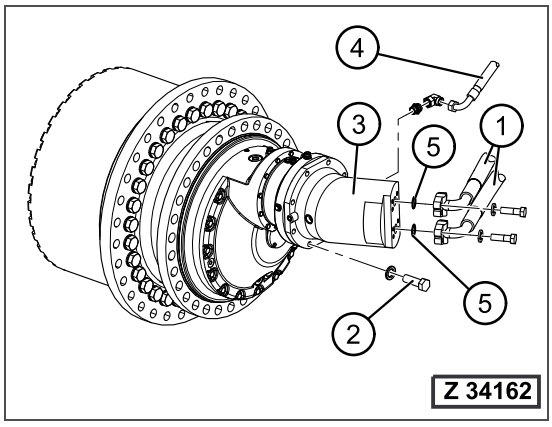


Fig. 4-75

4.2.14.3 REPLACE HYDRAULIC HOSE TO TRAVEL PARKING BRAKE

1. Carry out the precursory work, refer to section 4.2.14.1 on page 4-72.
2. Disassemble all hose clamps to clear the hydraulic hoses (Fig. 4-100, Pos. 2 & 5).
3. Disconnect both ends of the hydraulic hoses and remove the hydraulic hoses.

REMARKS: When a hydraulic line is disconnected hydraulic oil will flow out. Catch it in an oil pan.
Cap the openings with blind plugs to avoid contamination.

4. Install new hydraulic hose in reverse order of disassembling.
   Follow the hints for hydraulic hose installation, refer to section 6.9.2 on page 6-39.
5. Assemble all hose clamps to attach the hydraulic hose.
6. Carry out the subsequent work, refer to section 4.2.14.6 on page 4-78.

4.2.14.4 REPLACE TH HYDRAULIC HOSE LEAK OIL

1. Disassemble all hose clamps to clear the hydraulic hose (Fig. 4-100, Pos. 6).
2. Disconnect both ends of the hydraulic hose and remove the hydraulic hose.

REMARKS: When a hydraulic line is disconnected hydraulic oil will flow out. Catch it in an oil pan.
Cap the openings with blind plugs to avoid contamination.

3. Install new hydraulic hose in reverse order of disassembling.
   Follow the hints for hydraulic hose installation, refer to section 6.9.2 on page 6-39.
4. Assemble all hose clamps to attach the hydraulic hose.
5. Bleed air from the traveling system, refer to the OPERATION & MAINTENANCE MANUAL.
6. Add hydraulic oil up to the specified level.
7. Check the traveling system and adjust if required.
   Refer to part 10 STRUCTURE & FUNCTION, chapter 10 in the SHOP MANUAL for further information.

11. Connect the grease hose (Fig. 5-31, Pos. 1) of the central lubrication system to the grease port at the boom cylinder inner L.H. and R.H side.

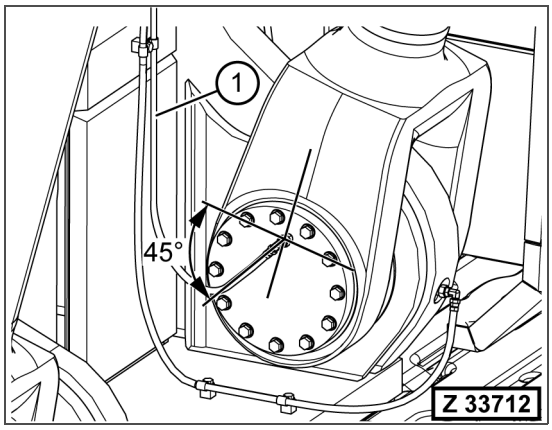


Fig. 5-31

21. Remove the protection plate and disassemble the stick angle sensor (Fig. 5-74, Pos. 1) and the protection plate (Fig. 5-74, Pos. 2).

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy machine parts.

When moving machine parts using a crane, make sure that nobody steps below or in close range to the lifted machine part.

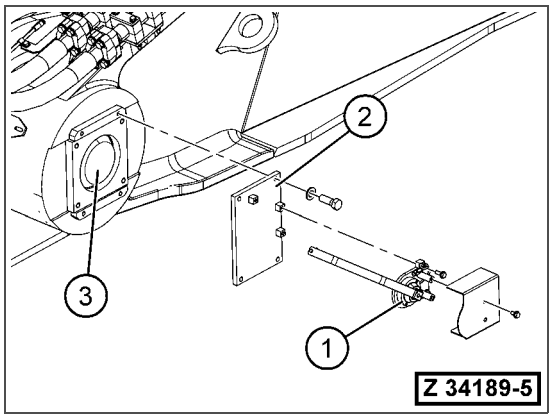


Fig. 5-74

22. Pull the pin (Fig. 5-74, Pos. 3) out completely to clear boom and stick.

NOTE! Sling the pin as soon as it is possible and support it using a crane to prevent the pin from falling.

REMARKS: Use four puller bolts (Fig. 5-75, Pos. 2) in the threads at the pin (Fig. 5-75, Pos. 1) to pull the pin out of the pin bearing.

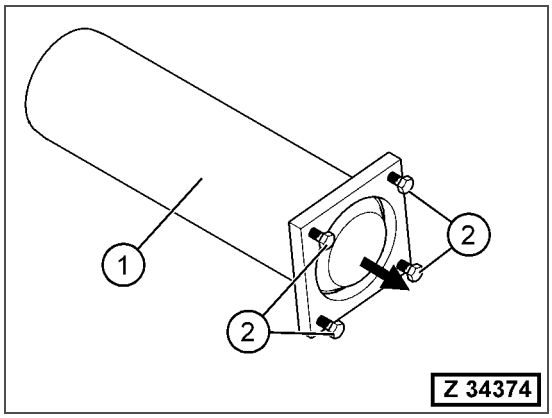


Fig. 5-75 Exemplaric sketch

23. Disassemble the stick assembly using the cranes.

24. Lower the stick assembly to the ground and rest it in an appropriate position.

Working steps and checks in the aftermath of disassembling:

25. Disassemble the bucket link rod and the steering rods, refer to section 5.3.6.5 on page 5-93.

26. Disassemble the bucket cylinders from the stick, refer to section 5.3.6.3 on page 5-78.

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or down-falling of heavy machine parts.

When moving machine parts using a crane, make sure that nobody steps below or in close range to the lifted machine part.

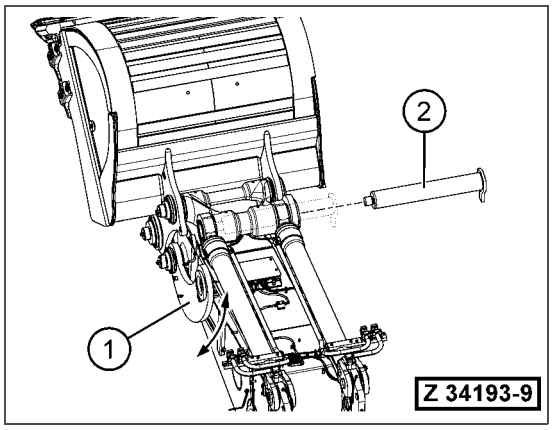


Fig. 5-123

21. Pull out the pin (Fig. 5-123, Pos. 2) connecting the bucket cylinders to the bucket link rod (Refer to Fig. 5-124.)

REMARKS: If disassembling the L.H. cylinder only, pull the pin out just enough to clear the cylinder piston rod.
If the R.H. cylinder is to be disassembled pull the pin out completely.

NOTE! Sling the pin as soon as it is possible and support it using a second crane to prevent the pin from falling when pulling out completely.

22. Swivel down the steering rod(s) (Fig. 5-123, Pos. 1) using the crane.

REMARKS: Use three puller bolts (Fig. 5-124, Pos. 2) in the threads at the pin (Fig. 5-124, Pos. 1) to pull the pin out of the pin bearing.

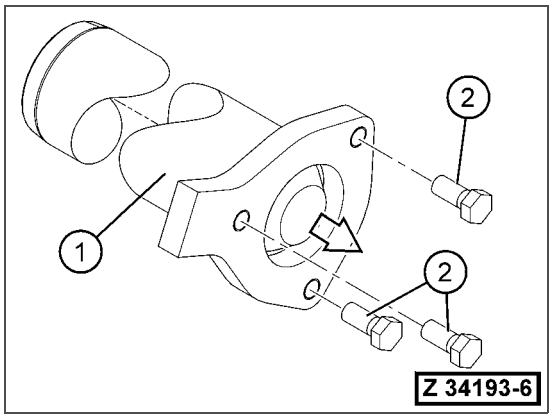


Fig. 5-124 Exemplaric sketch

23. Detach the crane from the steering rod(s).
24. De-isolate the machine according to local regulations.
25. Switch to Q_{min} using the K+, refer to part *"10 Structure & Function"* in the SHOP MANUAL for further information.
26. Fully retract the bucket cylinder(s) at Q_{min}.

5.3.7 HYDRAULIC HOSES AT THE BACKHOE ATTACHMENT

5.3.7.1 REPLACE THE BOOM ARC HOSES

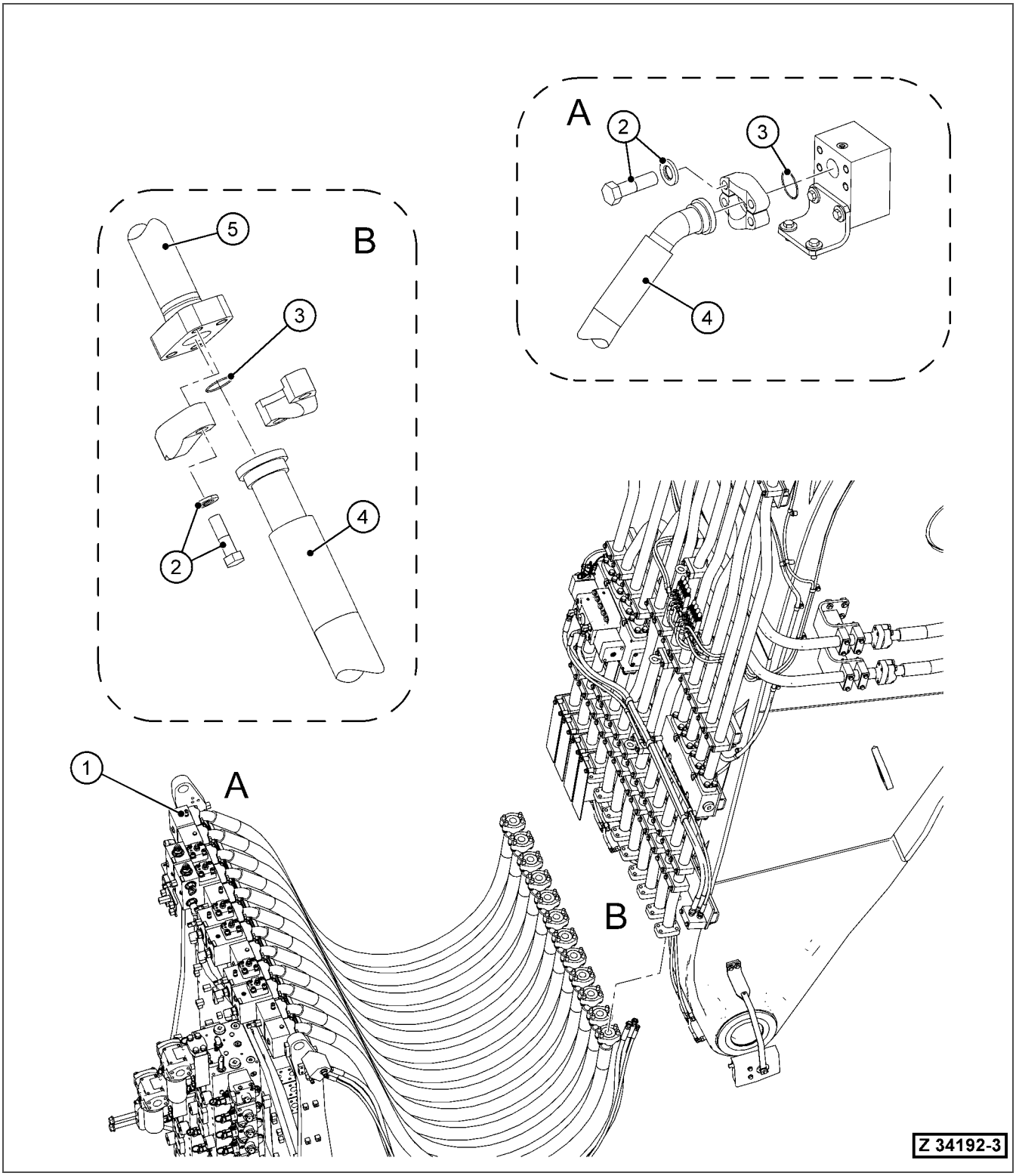


Fig. 5-177 Arc hoses at the boom

⚠ DANGER

FLOATING LOADS!

Death or serious injury will result due to swinging or downfalling of heavy machine parts.

When moving machine parts using a crane, make sure that nobody steps below or in close range to the lifted machine part.

6. Insert the pins (Fig. 5-198, Pos. 6) attaching the boom to the superstructure using the crane.

NOTE! Do not damage the seal rings (Fig. 5-198, Pos. 5).

7. Attach the cover plate (Fig. 5-198, Pos. 2) to the superstructure using the mounting bolts and washers (Fig. 5-198, Pos. 1).

8. Reconnect the grease hose (Fig. 5-199, Pos. 1) at inner L.H. side bearing.

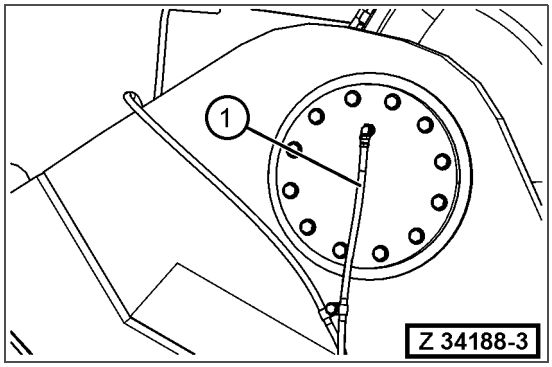


Fig. 5-199 Inner L.H. side bearing

9. Reconnect the grease hose (Fig. 5-200, Pos. 1) at outer L.H. side bearing.

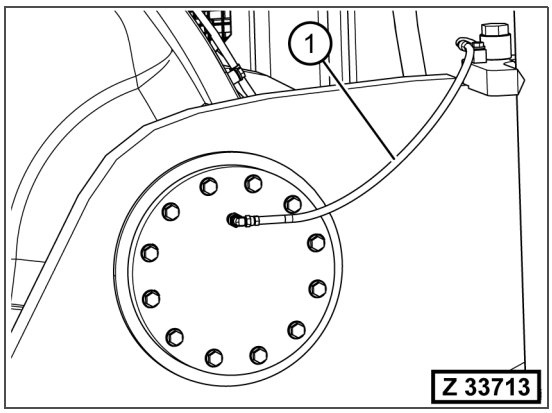


Fig. 5-200 Outer L.H. side bearing

5.4.5 STICK ASSEMBLY

5.4.5.1 DISASSEMBLING OF THE STICK

Special tools:	n/a
Additional equipment:	Safety harness in conformity with DIN EN 361 2 x crane 2 x chain hoist Mobile elevator working platform (telescopic or articulated boom lift)
	Stick: 10,960 kg Pin stick/boom: 163 kg Pin stick cylinder/stick: 52 kg
	Dogman/rigger
	For further information about the needed blind plugs, refer to section 6.6 on page 6-18.

NOTE! Always wear the safety harness when working on high-lying or elevated working positions.
Most of the following operations require the use of men safety cages on elevator working platforms.

1. Prepare an area of flat ground large enough to accommodate the machine and the additional working equipment (crane, mobile working platforms, forklift, etc.).

2. Park the machine on the prepared flat area with the superstructure turned by 90° and position the bucket on the ground as shown (Fig. 5-245).

REMARKS: If the ground condition is too poor to guarantee safe and stable stand of the machine and the additional working equipment (crane, mobile working platforms, forklift, etc.), make sure that the machine is moved to any location with appropriate ground condition.

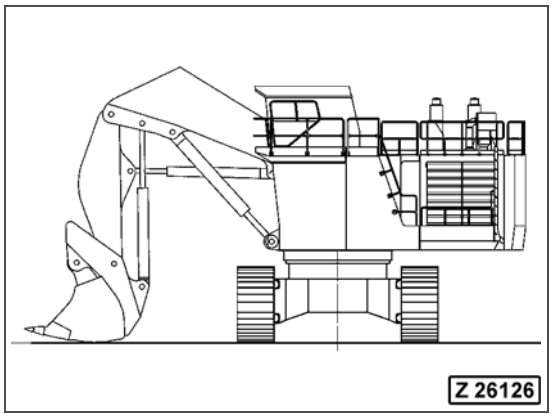


Fig. 5-245 Exemplaric sketch

3. Relieve the pressure in the hydraulic system, refer to the OPERATION & MAINTENANCE MANUAL, chapter 3, section "RELIEVE THE PRESSURE IN THE HYDRAULIC SYSTEM".

4. Isolate the machine according to local regulations.

5. Disassemble the bull clam bucket, refer to section 5.4.6.1 on page 5-180.

6. Support the bucket cylinders in not fully retracted position using appropriate supporting stands, to prevent the cylinder bodies from moving when the hydraulic hoses are disconnected.

7. Disconnect and clear all electric wires from the stick.

6. Disconnect the grease line (Fig. 5-294, Pos. 1) of the central lubrication system from the eye of the corresponding bucket cylinder (Fig. 5-294, Pos. 2).

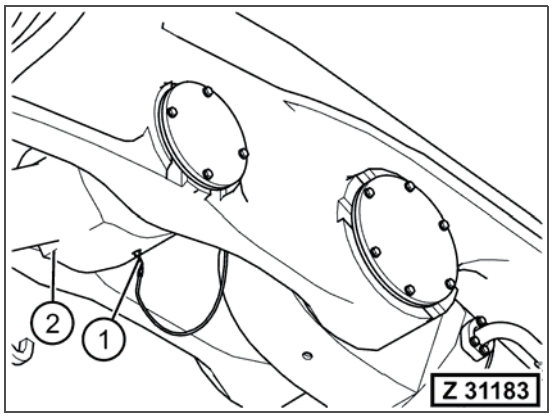


Fig. 5-294

7. Disconnect the grease lines (Fig. 5-295, Pos. 2) of the central lubrication system from the corresponding bucket cylinder (Fig. 5-295, Pos. 1).

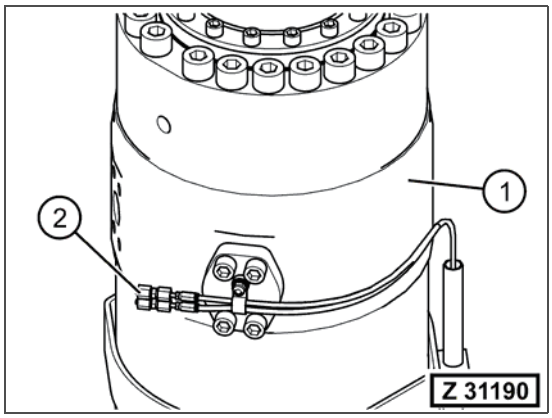


Fig. 5-295

8. Disassemble the seal fixing rings (Fig. 5-296, Pos. 1) located on both sides of the bucket cylinder to be disassembled.

9. Disassemble the cover (Fig. 5-296, Pos. 2) from the bucket cylinder bearing.

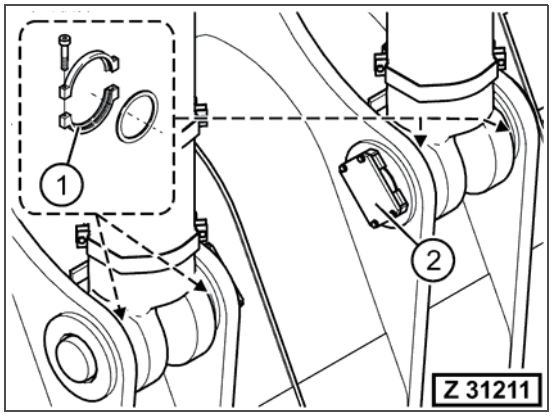


Fig. 5-296

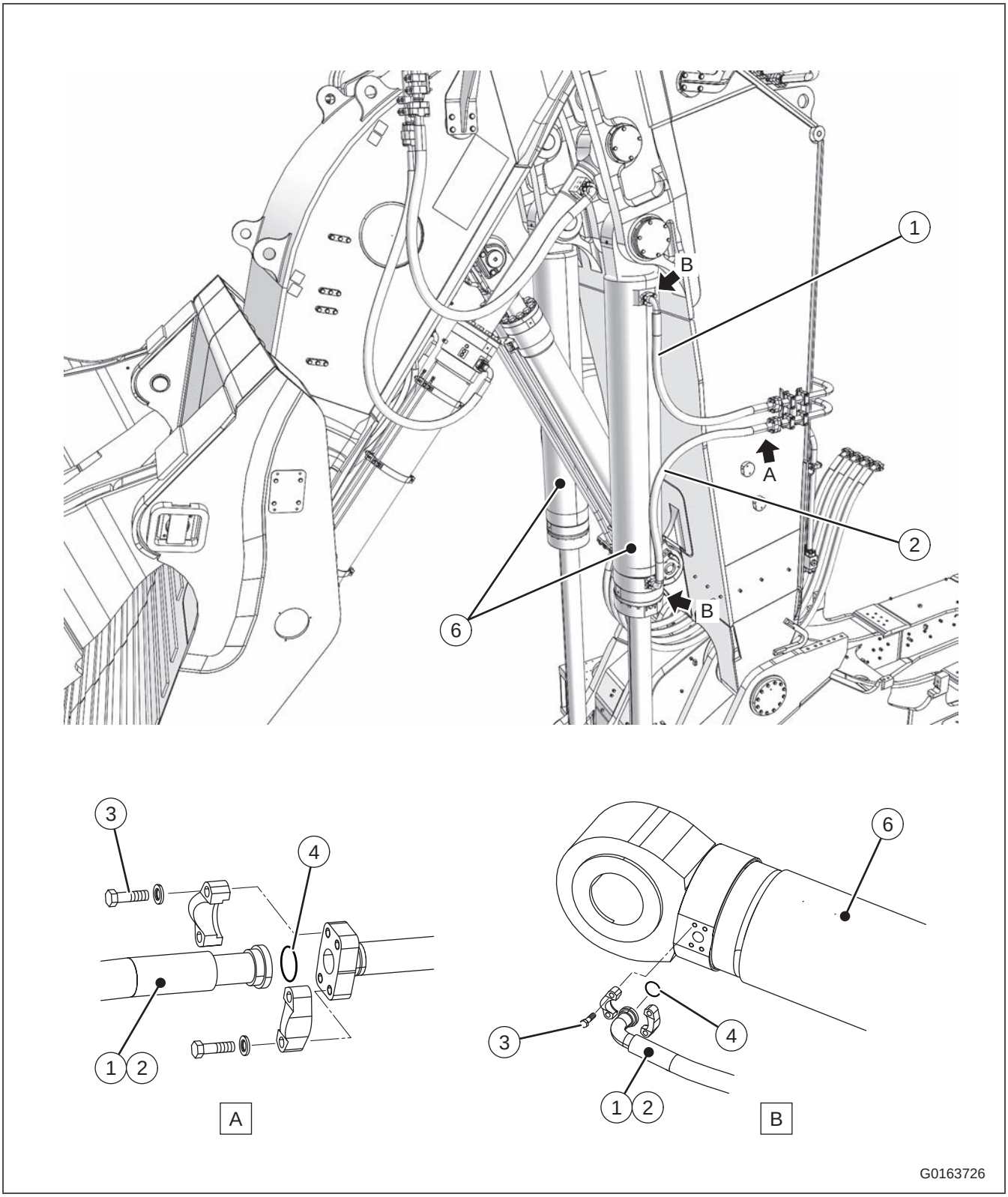


Fig. 5-341 Boom cylinder hoses - replacing

6 SERVICE INFORMATION

6.7.2 MILLIMETER - INCH & KILOGRAM - POUND

Millimeters to Inches

1 mm = 0.03937 in

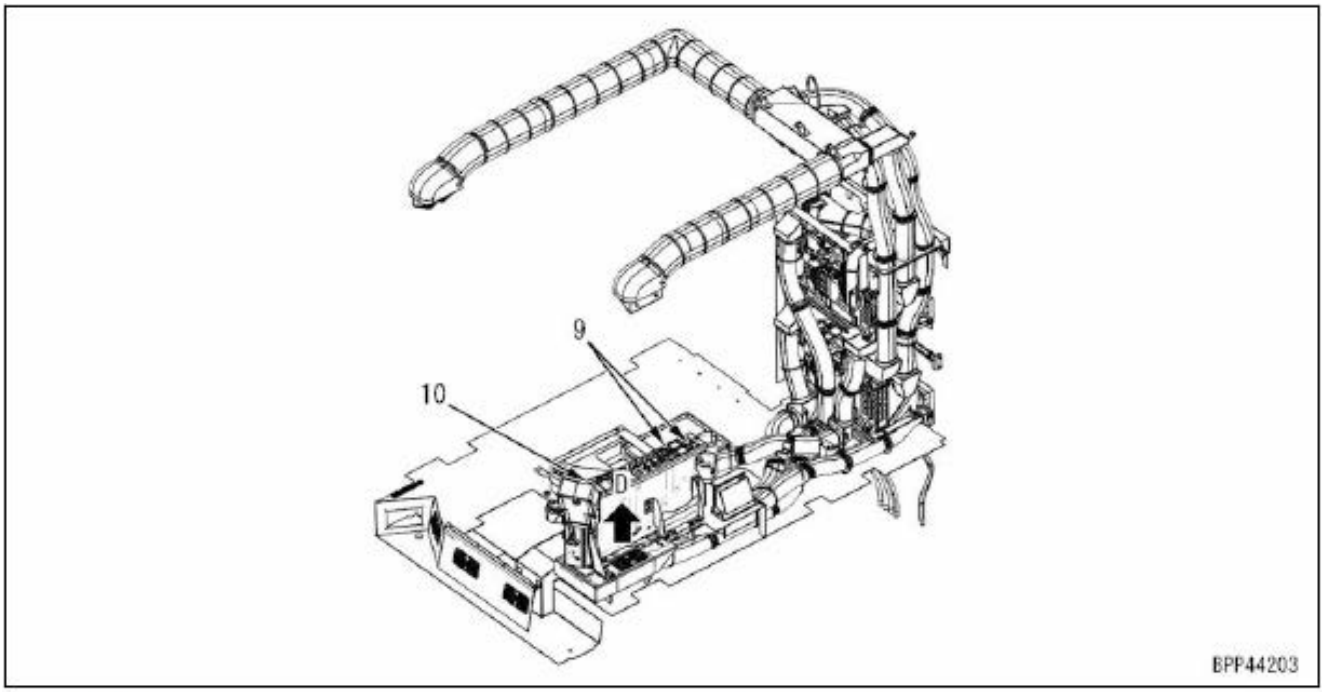
	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Table 6-22 Conversion table mm - inch / kg - pound



A: Front vents
B: Rear vents
E: Foot vents
1: Duct
2: Condenser
3: Air conditioner compressor
4: Hot water return piping
5: Hot water intake piping
D: Defroster vents
E: Recirculation air inlet
F: Fresh air inlet
6: Refrigerant piping
7: Receiver tank
8: Air conditioner unit
9: Air conditioner control panel
10: Sunlight sensor

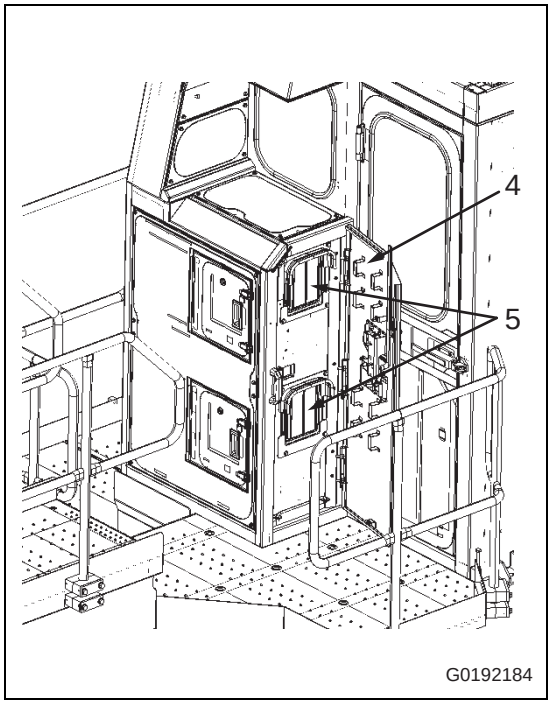
TESTING FRESH/RECIRC AIR CHANGEOVER

⚠ **Park the machine on a level ground, lower the work equipment to the ground in a stable posture, set the lock lever to LOCK position, and stop the engine.**

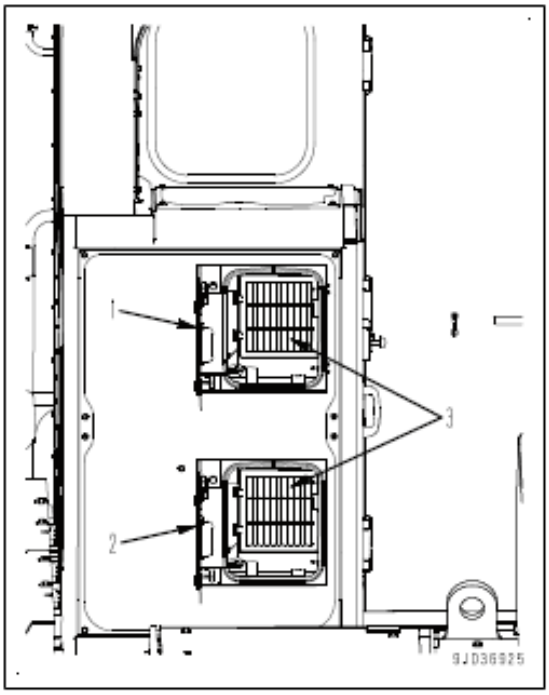
- The FRESH/RECIRC air changeover servomotor is not checked by the self-diagnosis.
- The FRESH/RECIRC air changeover servomotor switches the fresh air and recirculation air by changing the angle of the FRESH/RECIRC air changeover door (damper). Visually check opening and closing of this door (damper).

METHOD FOR TESTING FRESH/RECIRC AIR CHANGEOVER

1. Open the air conditioner box cover (4), pull out the outside air filter (5) contained in it and remove it.
2. Start the engine and turn the power supply of the air conditioner to “ON”.
3. Operate the FRESH/RECIRC air selector switch.



4. Check the opening and closing of the cover (1) and (2) behind the cab.



After completion of test, turn the starting switch to OFF position.

Pressure monitoring

On the **high – pressure side** should be a pressure (manometer indicator) of 12.2 to 20.2 bar under normal conditions.
The pressure will be higher when there is a more thermal loading (sunshine, etc.), at high compressor speeds, when the condenser is dirty or when there is an insufficient airflow through the condenser. The pressure will be lower when there is lower thermal loading and at lower compressor speeds.

On the **low - pressure side** should be a pressure (manometer indicator) of 1.9 bar under normal conditions.
The pressure will be lower when there is less pressure loading (sunshine, etc.), at high compressor speeds, or when there is a sufficient airflow through the evaporator. The pressure will be higher when there is more thermal loading (sunshine, etc.) and at low compressor speeds.

Pressure figures at various outside and inside temperatures for R 134a coolant

Outside temperature in °C	Manometer indicator (high pressure)
25	10.6 – 13.9
30	12.2 – 15.8
35	13.9 – 17.9
40	15.8 – 20.2
45	17.9 – 22.6

Inside temperature in °C	Manometer indicator (low pressure)
20	1.0 – 1.9 bar
25	1.4 – 2.5 bar
30	1.9 – 3.1 bar
35	2.5 – 3.9 bar

Appendix-007 Non-Pressurized Wiggins Service System VR300 for Fuel Tank Refilling (AH08512)

FAILURE CODE: 0400NG

DESCRIPTION:

- **Before carrying out any repairs, read all the safety instructions in the Operation and Maintenance Manual of your shovel.**
- **The local safety rules must also be observed.**

1. Introduction of the fuel refilling system
2. Overview main components
3. How to works the Wiggins VR300 refuelling system

6. Checking the mounting bolts

Check the tightening torque of the bolts after the 1st 1000 operation hours.
If necessary, retighten the bolts with the determined torque.

- Unscrew the eight test bolts (4) of the connection SC / car body.
- Determine the required torque again with these eight test bolts (4)
- Retighten all bolts (4/7/8) with the same torque multiplier you have used for the determination.

7. Lubrication and maintenance (RDV)

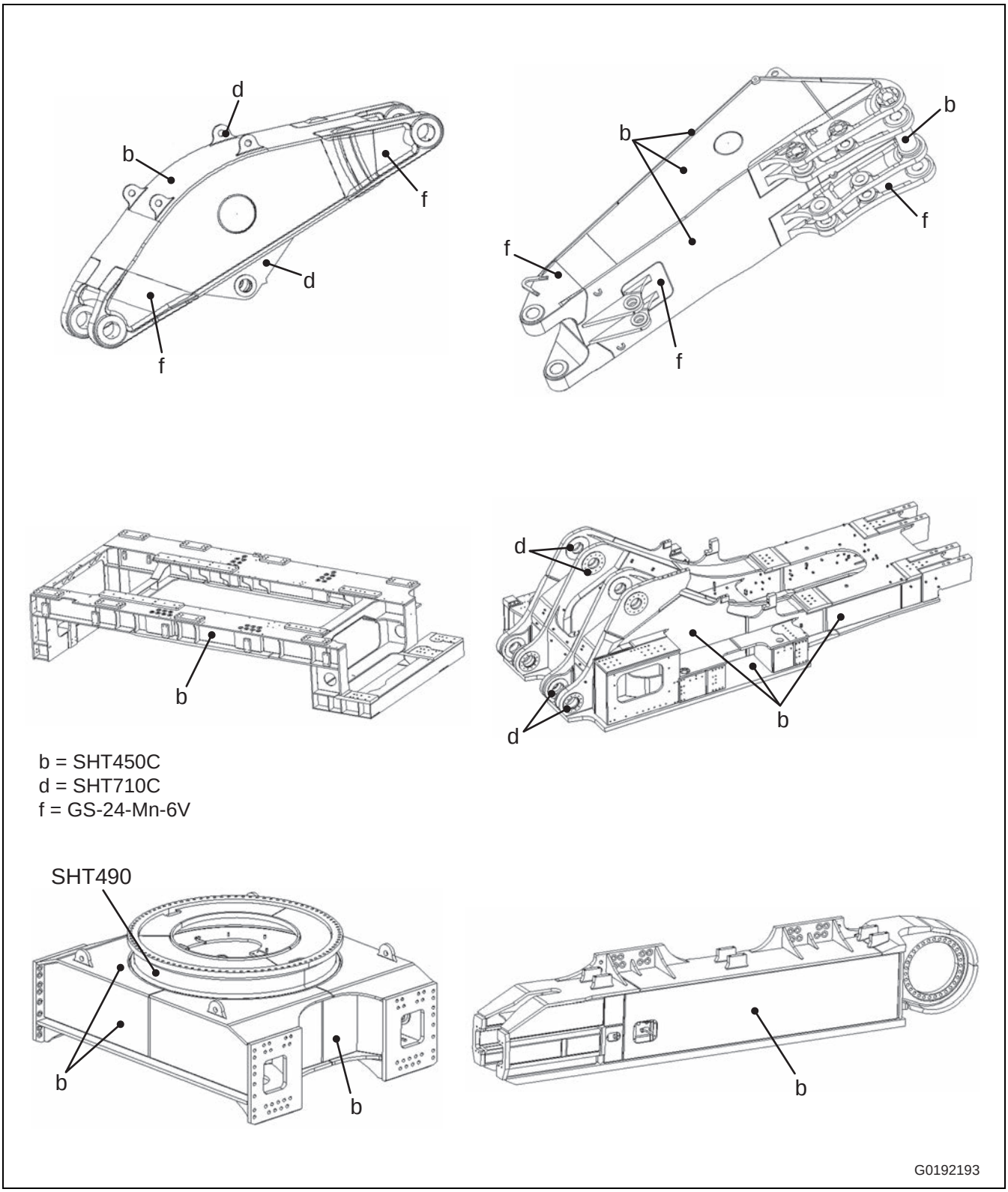
7.1. Roller bearings

Races of roller bearings must be lubricated regularly using high quality brands of lubricants.
This is particularly important before and after longer interruptions of operation (e.g. winter intermission).

The grease content in the race system is intended to avoid friction, to seal and to prevent corrosion. Grease abundantly until a continuous collar of grease pours out of the entire circumference of the upper seal "L" and the lower bearing gap "G".

When greasing check visually the upper bearing seal "L" and, if necessary, replace immediately in order to prevent dirt and/or water to penetrate into the race system.

- **Avoid cleaning agents to enter the race system when cleaning the shovel with high-pressure water or with vapor blast apparatuses. Grease thoroughly before and after each cleaning. The even distribution of grease requires swing circle of the superstructure during greasing.**


d
b
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d
b
b = SHT450C
d = SHT710C
f = GS-24-Mn-6V
SHT490
b
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G0192193