BI015805
October 2014

Operation and Maintenance Manual

6090FS
Hydraulic Shovel

No. DHS90003, DHS90004

PART 3 - INSPECTION AND SERVICING

PART 1 - INTRODUCTION

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Operating manual		Target group
Part 1	**INTRODUCTION** **FUNDAMENTAL SAFETY INSTRUCTIONS**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 2	**OPERATION**	**Operating personnel** The operating personnel must have know-how relevant to the operation and the application of this or comparable machines.
Part 3	**INSPECTION AND SERVICING**	**Inspection and servicing personnel** The inspection and servicing personnel must have know-how relevant to the inspection and servicing of this or comparable machines.
Part 4	**REPAIR WORK**	**Repair personnel** The repair personnel must have know-how and experience relevant to the repair of this or comparable machines.
Part 5	**ANNEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 6	**INDEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**

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NOTES

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Demand control / Zero-flow regulation

In the fine-control range, swivelling of the hydraulic pumps, and thus variation of the oil flow, are proportional to control lever and pedal valve travel. This means that, during work, the pumps supply only as much hydraulic oil as required to perform the working movement. In the neutral position of the control levers, the pumps are automatically swivelled to zero flow.

These special features offer the following advantages:

- reduced fuel consumption
- minimum power losses
- reduced temperature of the hydraulic oil
- greater service life of hydraulic pumps and diesel engines

Automatic engine speed reduction

If the control pedal and control levers and thus the servovalves are not actuated for a period of 10 seconds or more (programmable), the engine speed is automatically reduced to idling. This function is a further contribution to fuel economy.

Board Control System (BCS)

The BCS is a data-evaluating and data-processing system whose function is to collect, evaluate and store data about the excavator's operating status and to display these to the operator.

The BCS is based on a microprocessor. The measured values (actual values) supplied by sensors and transducers installed in the excavator are compared with preset nominal values. Out-of-limit conditions are display in the form of error messages in the driver's cab.

Critical operating conditions are additionally indicated by optical and acoustic warning signals.

Further details are set out in the **Board Control System operating instructions.**

Electrical system

The electrical system operates on 24 volts.
The voltage for the floodlamps and the warming-up system is 110 V AC, 60 Hz (3-phase).

Automatic fire-extinguishing system

The excavator operator and the maintenance personnel must familiarize themselves with the automatic fire-extinguishing system.
Such instruction should be given by a qualified instructor.

The fire-extinguishing system is activated automatically in an emergency. Individual extinguishing circuits, e.g. for engine 1 or 2 (left or right) can be activated manually.

Refill extinguishers immediately after use ready for further deployment.

The automatic fire extinguishing system prevents fire from spreading. It is, however, assumed that that the machine be thoroughly cleaned of combustible and easily flammable substances.

Inspection

Have the extinguishing system inspected regularly by an expert. This is required by authorities and insurance companies and is in the interests of your own safety.

Have the extinguishing system check at the prescribed intervals by authorized testing institutes.

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(Fig. 5)

No.	Element	Function	Symbol
69	**Indicator lamp Boom/stick angle**	Lights up when the boom/stick angle is in the normal working range.	
70	**Warning lamp Boom/stick angle**	Lights up when the boom/stick angle is in the hazard range. (the tracks may be damaged by the working equipment) **Increase the angle.** The buzzer (118) sounds until angle has resumed the normal working range.	

(Fig. 10)

No.	Element	Function	Symbol
117	**Buzzer**	Gives an acoustic warning signal if a fault is reported - Fault in engine system (engine 1 and/or 2; left and/or right) - Coolant level (engine 1 and/or 2; left and/or right) too low - Engine oil pressure (engine 1 and/or 2; left and/or right) too low - Engine oil temperature (engine 1 and/or 2; left and/or right) too high - Hydraulic oil level too low - Distributor gearbox temperature (1 and/or 2, left and/or right) too high - Slewing pump temperature (1, 2 and/or 3; left and/or right) too high - Slewing gearbox temperature (1, 2, 3, 4 ,5 and/or 6) too high - Fault in lubricating system **Lower equipment to the ground and shut off engine immediately if the buzzer (117) sounds and the BDS indicates a fault. The buzzer (117) continues to sound until the fault has been rectified.**	

Assemblies or reservoirs	Measuring device	Remarks
Cooling system reservoir	Inspection glass (4, Fig. 13) BCS display (Fig. 14)	Top up cooling fluid when the fluid level in the inspection glass has drop to the "min." mark. The BCS gives a warning signal. Stop filling when the inspection glass is filled with cooling fluid.
Grease container - central lubricating system	BCS display (Fig. 14)	The BCS gives a warning signal when the grease container is empty. Switch on the display system with the toggle switch (33, Fig. 15). Stop filling when the grease container is full. The indicator lamp (34) lights up. On completion of filling, switch the display system off again with the toggle switch (33).

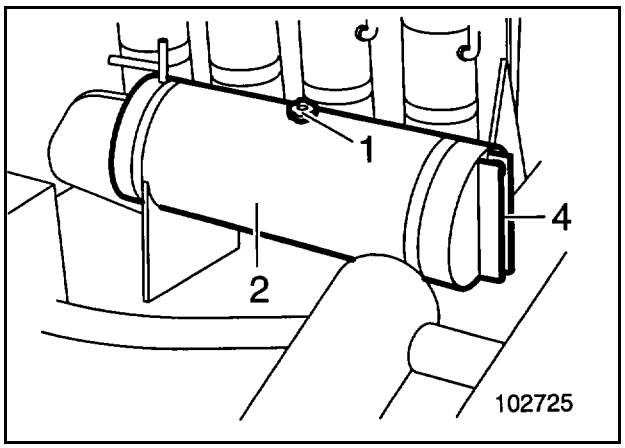

Fig. 13

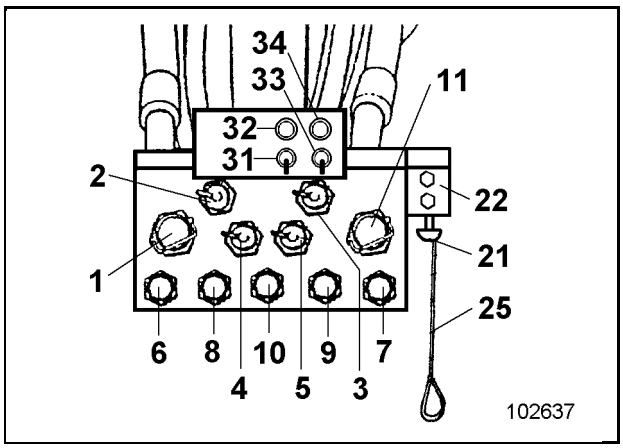

Fig. 15

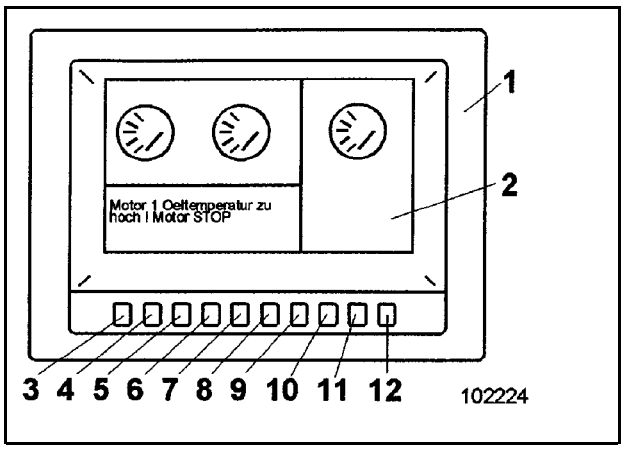

Fig. 14

Transporting the machine

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Transport - Safety instructions

The machine must be loaded and transported only after all safety regulations have been observed and complied with.

Entrust loading and transporting of the machine to a company experienced in the transport of heavy equipment.

The responsibility for loading and transporting lies with the transport company or their representative.

Remove oil, grease, soil, mud, snow, ice and other materials from the excavator's crawler tracks and from ramps and loading platforms of the transport vehicle to minimize slipping.

Secure the transport vehicle against rolling away.

Use only tying equipment of sufficient strength (the weights and dimensions of the excavator are set out in the "Technical specifications").

Transport

The dimensions and the service weight of the fully assembled excavator do not allow the excavator to be transported in an undismantled state on a low-bed trailer over public roads.

Therefore, the following components and modules must be dismantled beforehand.

Weights and suspensions points are marked on the modules.

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NOTES

Inspection and servicing plans - Instructions

Intervals

The inspection and servicing plan lists all jobs which have to be done on the machine at regular intervals.

The individual inspection and servicing plans are marked with letters providing a link between the operating hours (OH) recorded by the hours-run meter of the machine and the inspection and servicing plans.

Plan	Do all jobs ....
V	.... once prior to initial commissioning.
N	.... after initial commissioning and during the running-in period.
T	.... every 10 OH or every working shift[1)].
W	.... every 60 OH or once a week[1)].
A	.... after every 250 OH.
B	.... after every 500 OH.
C	.... after every 1000 OH.
D	.... after every 5000 OH.
E	.... after every 10000 OH.

[1)] Whichever comes first.
OH = Bh = Operating hours

Change of engine oil

The intervals stated for **changing the engine oil** apply to fuels with a sulphur content of $\leq$ 0.5% and a permanent ambient temperature down to -10°C.

In cases of a higher sulphur content and/or a permanent ambient temperature of below -10°C, shorter intervals are required.

If the engine oil change intervals are not reached within **6 months**, the oil must be changed at least after **6 months**.

Air-intake system

The air filter must be serviced only if the BCS so indicates. Replace the filter elements after one year at the latest.

Oils / Greases

For the specification of oils and greases to be used, refer to the "Lubricants" section.
The numerals in the "Oil / Grease" column of the inspection and servicing plans have the following meaning:

I	Oils for combustion engines and compressors
II	Oils for hydraulic systems
III	Oils for gearboxes
V	Greases for bearings and slewing rings

Cleaning jobs

Cleaning jobs, especially on cooling systems, must be done at shorter intervals if the machine is exposed to severe dust build-up.

Plan A - after every 250 OH
(at 250, 750, 1250 ... OH)

Plan B - after every 500 OH
(at 500, 1500, 2500 ... OH)

Plan C - after every 1000 OH
(at 1000, 2000, 3000, 4000 ... OH)

Plan D - after every 5000 OH
(at 5000, 15000, 25000 ... OH)

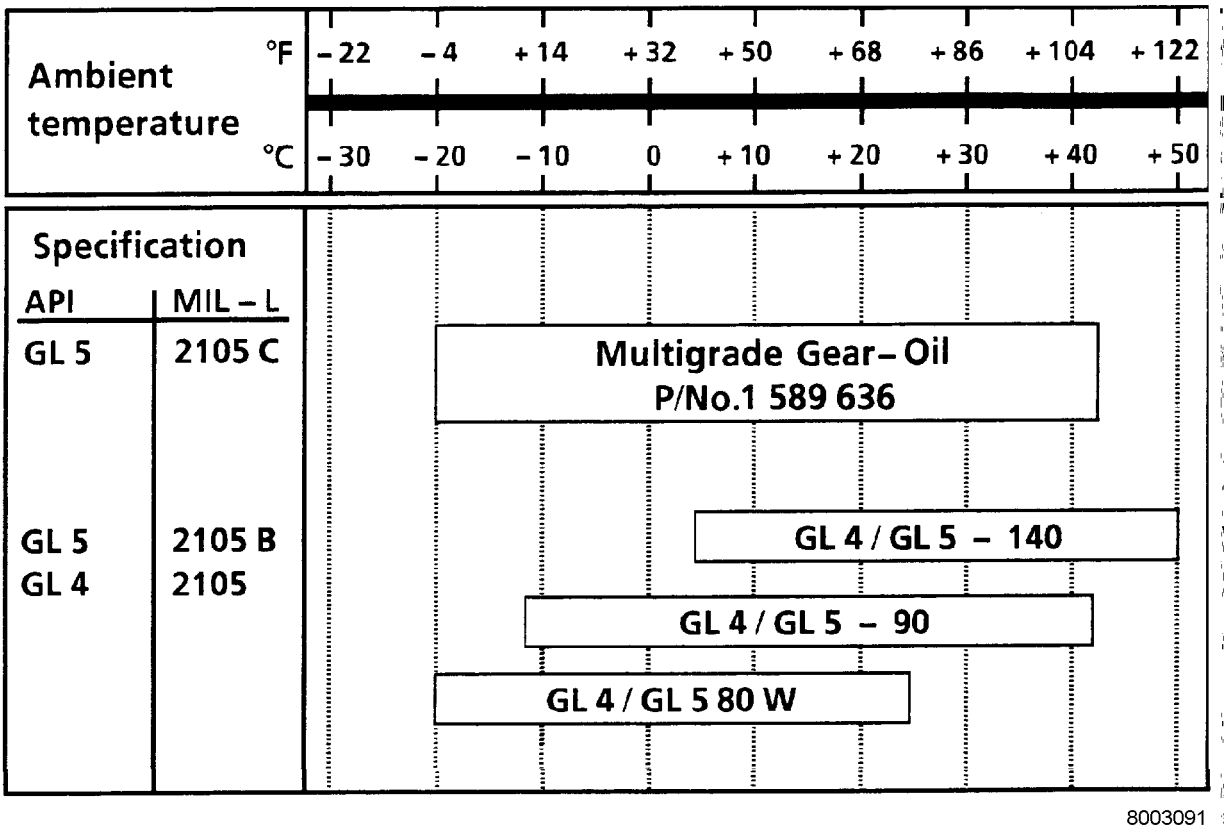
Plan E - after every 10000 OH
(at 10000, 20000, 30000 ... OH)

Location	Servicing work	Quantity / No.	Plan A	Plan B	Plan C	Plan D	Plan E
Pump transfer gearbox	Change oil	2[2)]			•	•	•
- Pre-chamber	Check oil level	2 x 9		•	•	•	•
- Breather filter	Clean	2 x 1			•	•	•
Slewing gearbox	Change oil	6[2)]				•	•
- Venting bore	Check/clean	6			•	•	•
- Slewing gear neck	Lubricate	6 x 2[10)]				•	•
Travel gearbox	Check oil level	2		•	•	•	•
	Change oil	2[2)]				•	•
- Magnetic screw	Clean	2 x 4				•	•
- Pre-chamber	Check oil level	2 x 2		•	•	•	•
	Change oil	2 x 2				•	•
Slewing ring	Check grease filling	1		•	•	•	•
Gearing/pinion	Check condition			•	•	•	•
Fastening screws (slewing ring, undercarriage and superstructure)	Check for tightness (torque wrench)						•
Superstructure							
Cab							
- Bearing							
- Fastening screws	Check for tightness				•	•	•
-Rubber bearing	Check condition				•	•	•
- Door							
- Hinge	Lubricate	3 x 3			•	•	•
Central lubricating system							
Grease sieve	Check/clean	2 x 2			•	•	•
Grease container							
- Breather filter	Check/replace	1			•	•	•
Ramp-type ladder							
- guide pulleys	Lubricate	3			•	•	•
- locking bolt	Lubricate	1			•	•	•

[2)] cf. "Filling quantities - Oil" table

[10)] Lubricate bearings at least once a year
[11)] Change oil at least once a year
[12)] Replace filter at least once a year

III. Oils for gearboxes (selection)



COOLING SYSTEM

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Read and observe: Inspection and servicing - Safety instructions.

Secure the machine as described under "Securing the machine".

Shut off engines and leave to cool down.

Risk of scalding from hot coolant.

Collect escaping coolant and discard without polluting the environment.

Protect the skin from potentially harmful contact with coolant.

Wear protective gloves and firm protective clothing.

Temperature

The coolant circuit is controlled by a thermostat. The max. admissible temperature is ca. 100°C. At higher temperatures the BCS displays a warning on the monitor (Fig. 1).

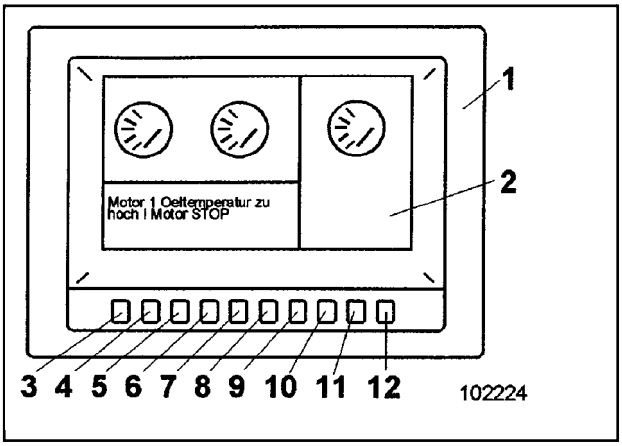

Fig. 1

Radiators

The radiators are located on the superstructure in the counterweight module.

Weekly checks:

- Check radiator fins for dirt; clean if necessary.

Coolant level

If the coolant level is too low, this is displayed by the BCS on the monitor (Fig. 1).

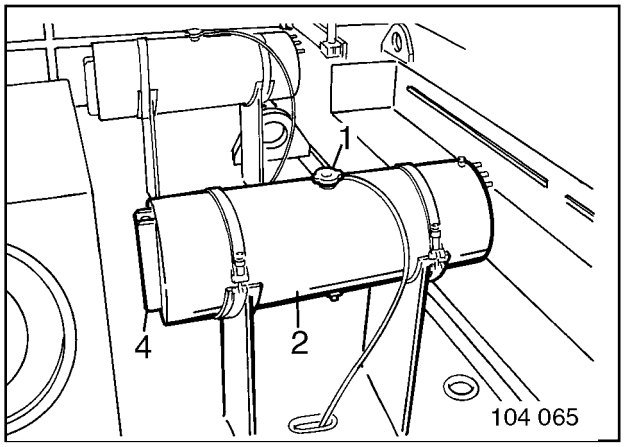

Fig. 2

The coolant level can also be seen in the inspection glass (4, Fig. 2).

The coolant level should reach the lower edge of the filler plug; top up if necessary.
The inspection glass (4) must be full to the top.

Venting the fuel system

The fuel tanks are vented with breather valves (3, Fig. 4).

Clean breather valves at regular intervals.

- Remove breather valve, flush with paraffin oil and blow clean with compressed air.

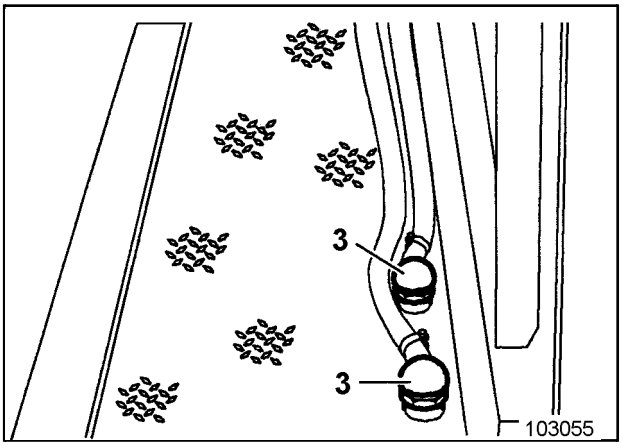

Fig. 4

Cleaning the fuel tanks

Explosion hazard

Read and observe: "Inspection and servicing - Safety instructions".

Never use white spirit, paraffin oil or other solvents.

Use diesel fuel for flushing and cleaning.

Avoid potentially harmful skin contact with diesel fuel.

Wear firm protective clothing.

Wear protective gloves or use a barrier cream.

Fuel must be prevented from penetrating into the soil. Keep fuel for re-use or discard without polluting the environment.

- Use up as much fuel as possible.
- Check how much fuel is left in the tank and place a sufficiently large collecting recipient under the drain plugs of the tank.
- Connect hose to drain plug.
- Unscrew automatic drain plug (7, Fig. 5) at fuel tank and drain off fuel.
- Flush out tank with diesel fuel.
- Screw automatic drain plug (7) back in place.

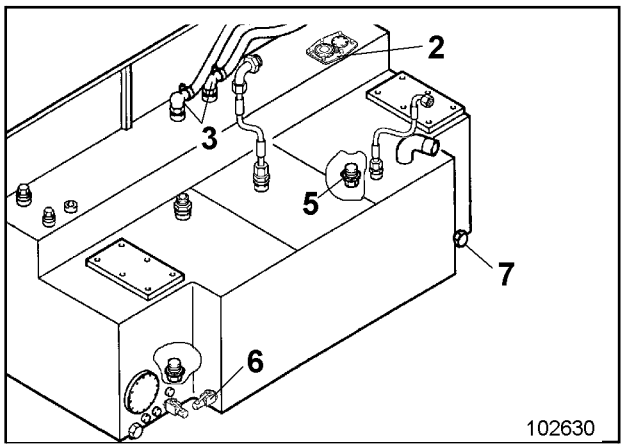

Fig. 5

Bypass valves (hydraulic oil reservoir)

Read and observe: "Inspection and servicing - Safety instructions".

Shut off engines.

Risk of scalding due to hot hydraulic oil.

The hydraulic oil reservoir may also be hot.

Avoid potentially harmful skin contact with hydraulic oil.

Wear protective gloves and firm protective clothing.

Collect escaping hydraulic oil and discard without polluting the environment.

Cleaning the filter screens

- Remove cover (3, Fig. 13 and/or Fig. 14) together with sealing ring (5, Fig. 14).
- Unscrew screws (22).
- Remove holder (26) and screen (21).
- Clean screen (21) in white spirit or paraffin oil, or replace if necessary.
- Remove bypass valve (23) together with sealing ring (24).
- Check sealing ring for damage, replacing if necessary.
- Re-insert bypass valve (23) with sealing ring (24).
- Fasten screen (21) with holder (26).

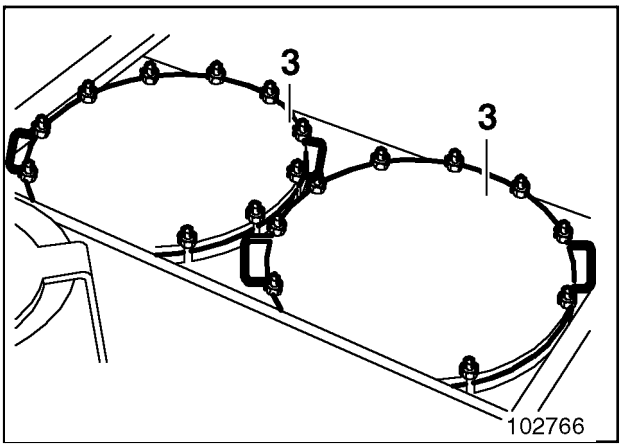

Fig. 13

- Install cover (3, Fig. 13) together with sealing ring (5).
- The screens of the bypass valves in the filter housing (cooling system) must also be cleaned. The bypass valves are located under the cover (30, Fig. 15).
  (Cf. "Bypass valves / Filter housing (cooling system").

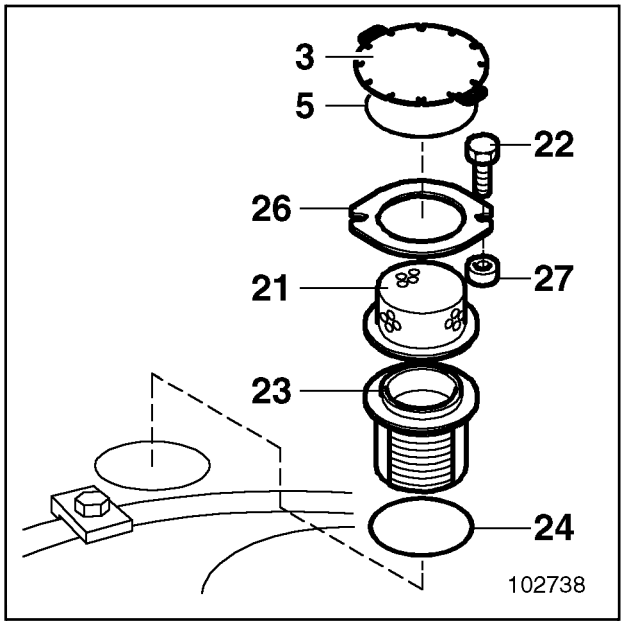

Fig. 14

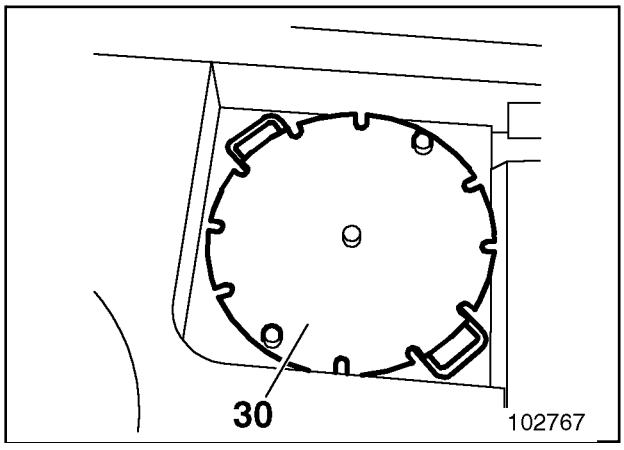

Fig. 15

Cleaning the hydraulic oil reservoir

Explosion hazard

Read and observe: "Inspection and servicing - Safety instructions".

Shut off the engines

Use no white spirit, paraffin oil or other solvents for cleaning purposes.

Use diesel fuel or special flushing oil.

Avoid potentially harmful skin contact with hydraulic oil.

Wear protective gloves and firm protective clothing.

Discard contaminated hydraulic oil separately from other waste without polluting the environment.

- Draw off hydraulic oil as described under "Drawing off the hydraulic oil".
- Remove cover (3, Fig. 31).
- Remove return-flow filter.

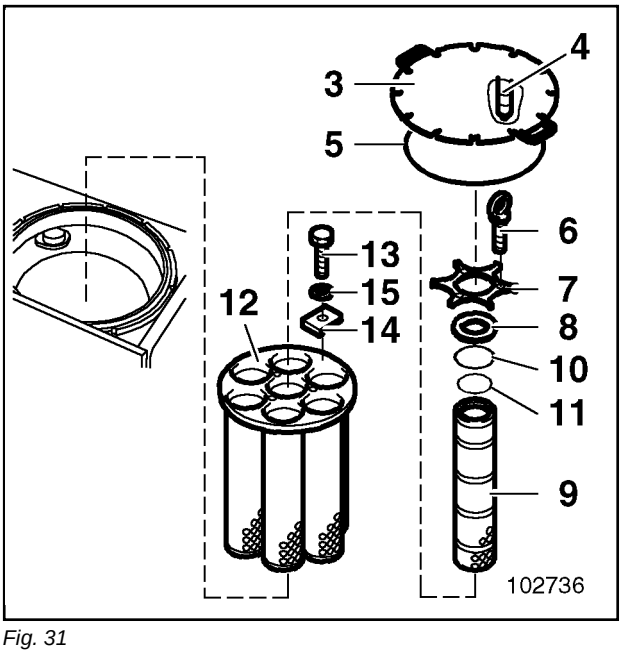

Fig. 31

- Place a collecting recipient for the flushing oil under the drain plug (1, Fig. 32) of the hydraulic oil reservoir.
- Unscrew drain plug (1).
- Clean the inside of the hydraulic oil reservoir with diesel fuel or flushing oil.
  Remove all deposits and all cleaning-agent residues thoroughly.
- Screw drain plug (1) in again.
- Refit cover (3, Fig. 31).

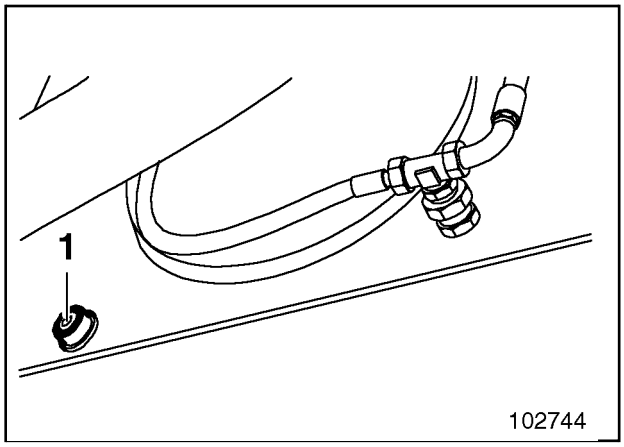

Fig. 32

TRAVEL GEARBOXES

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Read and observe: "Inspection and servicing - Safety instructions".

Shut off the engines.

Risk of scalding from hot gearbox oil.

The gearbox housings may also be hot.

Secure the machine as described under "Securing the machine".

Avoid potentially harmful skin contact with gearbox oil.

Wear protective gloves and firm protective clothing.

Travel gearbox - Checking the oil level / Topping up

Park the machine as described under "Securing the machine".

The oil level must be visible in the level gauge (4, Fig. 1); top up with gearbox oil if necessary.

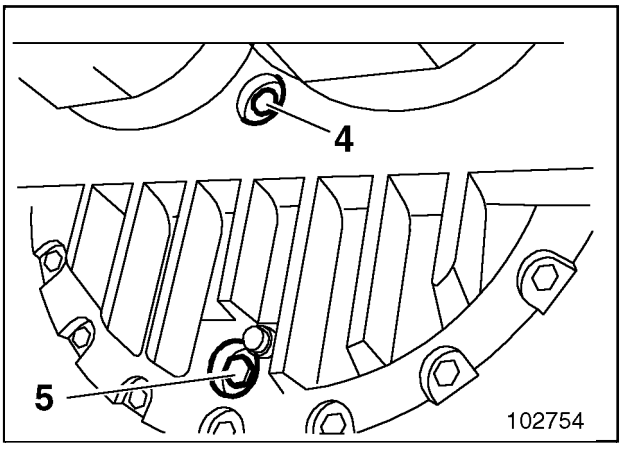

Fig. 1

Travel gearbox - Changing the oil

Park the machine as described under "Securing the machine".

Main gearbox - Draining off oil

Move the excavator until the screw plugs (1, 2 and 3, Fig. 2) are in the position shown in the diagram:
- screw plug (1) in horizontal position
- screw plug (2) in bottom position
- screw plug (3) at ca. 23° from horizontal (2 o'clock position).

- Place a collecting recipient for used oil under the main gearbox. Choose the required capacity in accordance with the "Refilling quantities - Oil" table.
- Unscrew plug (2) and drain off oil completely. Slackening plug (3) allows the oil to run out more readily.
- Clean plugs (2 and 3).
- Screw in plug (2).

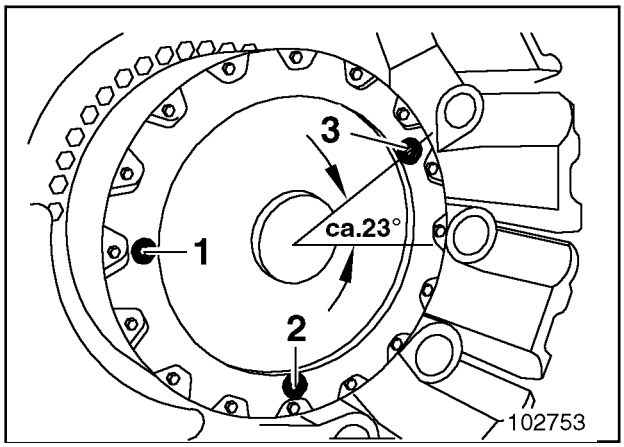

Fig. 2

Preliminary gearbox - Draining off oil

- Place a collecting recipient for used oil under the preliminary gearbox. Choose the required capacity in accordance with the "Refilling quantities - Oil" table.
- Unscrew plug (5, Fig. 1) and drain off oil completely.
- Clean plug (5) and screw back in place.

Filling the grease container

Fill grease container through service station (Fig. 4).

The hose line and its use are described under "Hose line for oil and coolant change".

- Switch on the display system with the toggle switch (33, Fig. 4).
- Unscrew cap of express coupling (11).
- Connect filling hose of service vehicle.
- The indicator lamp (34) lights up when the grease container is full.
- Remove hose.
  The express coupling closes automatically.
- Screw on protective cap.

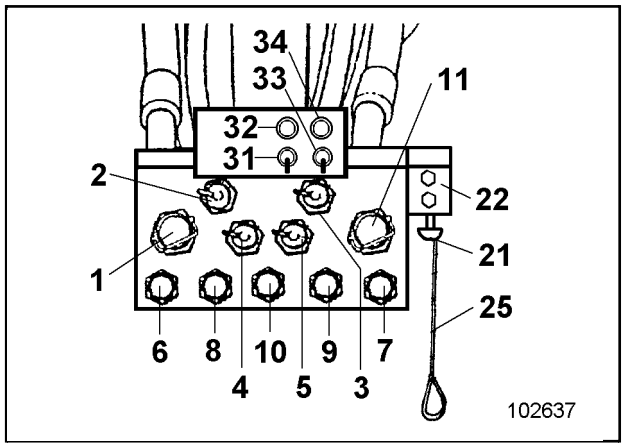

Fig. 4

Breather filter

Check/change the breather filter at regular intervals.

- Unscrew wing nut (1, Fig. 5).
- Withdraw cover (7, Fig. 6) and filter element (8).
- Check filter element. Replace if necessary.
- Re-install breather filter.

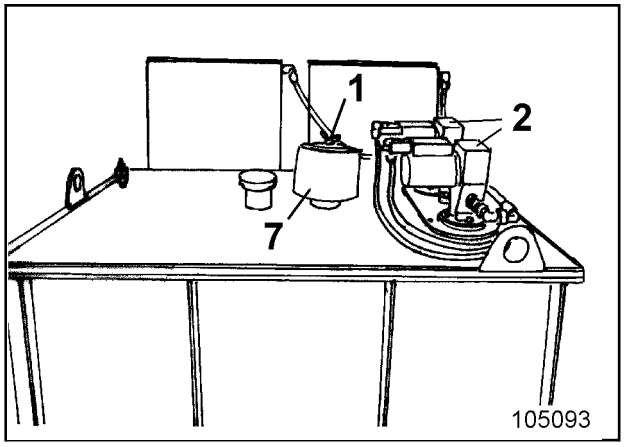

Fig. 5

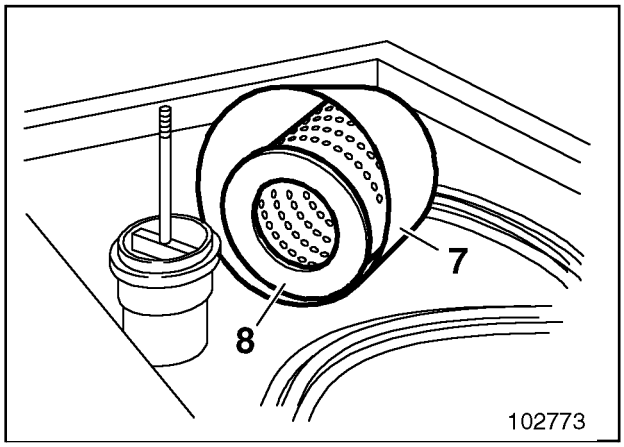

Fig. 6

Central lubricating system - Fault table

Fault					Remedial action	
Grease pump not working, BCS not giving a warning signal Automatic circuit breaker on Grease pump not working, monitoring lamp lit Grease pump working but delivering no grease Greasing pressure too high or too low **Cause**					Check **P** Adjust **E** Replace **W** Top up **A** Reduce **S** Clean **R** Vent **L** 1) Contact the O&K Service **Section**	
•	•			Timer defective		**P/W**
•				Lines between timer and hydraulic motor defective		**P/W**
•	•			Hydraulic motors defective		**P/W**
•	•	•	•	Grease pumps defective		**P/W**
			•	Grease sieve clogged		**P/R**
			•	Distributor defective		**P/W**
		•		Grease container empty		**P/A**
		•		Grease pump not sucking up grease		**P/L**
		•		Leaking lines		**P/L**
		•		Non-return valve defective		**P/W**
			•	Pressure switch defective		**E**