en

Service Manual

Hydraulic excavator
R 9150 E

from serial number 38120

Document identification

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Type no.: 1134
Conformity: CE

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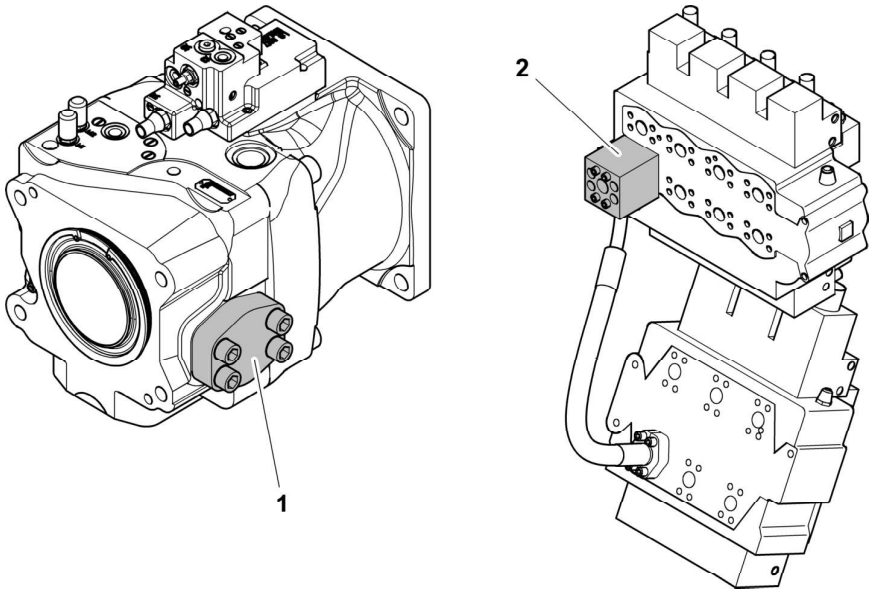
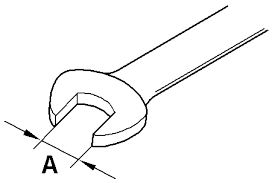
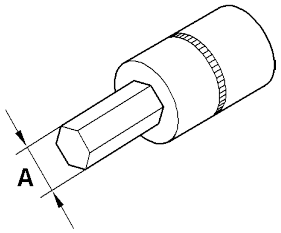


Fig. 2 *Sealing flange **1** and hydraulic block **2***

3.3 Dimensions of the wrenches/tools

				
Size of the screw	**A (mm)**	**A (in)**	**A (mm)**	**A (in)**
M8	13	1/2	6	
M10	16 or 17	11/16	8	
M12	18 or 19	3/4	10	
M14	22	7/8	12	
M16	24	61/64	14	9/16
M18	27	1-1/16	14	9/16
M20	30	1-3/16	17	43/64
M22	32	1-9/32	17	43/64
M24	36	1-7/16	19	3/4
M27	41	1-5/8	19	3/4
M30	46	1-13/16	22	7/8
M33	50	2	24	61/64
M36	55	2-3/16	27	1-1/16
M39	60	2-3/8	27	1-1/16

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Caution!

In case of gap between the corner block and the bucket, the weld size shall be increased of the same amount.

4.2.14 Auxiliary materials

Auxiliary materials are allowed but shall not modify the geometry of the parts.

If the auxiliary materials are tack welded or welded on the parts, they shall be removed after finishing of the part.

After removal, the tack welded and welded areas shall be checked by magnetic particle inspection MT according to the related chapter.

Caution!

It is forbidden to tack weld or weld any auxiliary material within 30mm from the edges of a plate, and on any casting part.

4.2.15 Finishing of plates by grinding / welding

To decrease the stress concentration, and therefore cracking potential, finishing of the welds shall be performed according to the drawings' requirements.

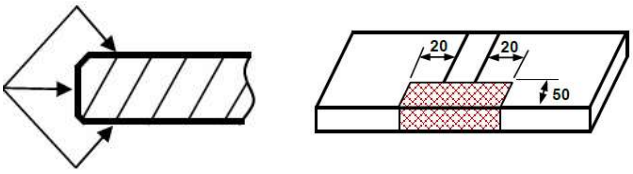
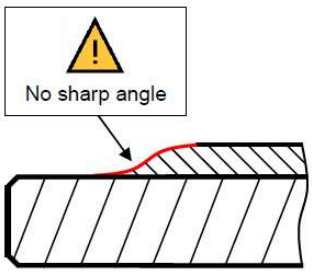
The different types of finishing are the following:

AC, GL, KG grinding

The "**KG**" finishing consists of all 4 steps defined below.

The "**GL**" finishing corresponds to step 3 & 4.

The "**AC**" finishing corresponds to step 3 only.

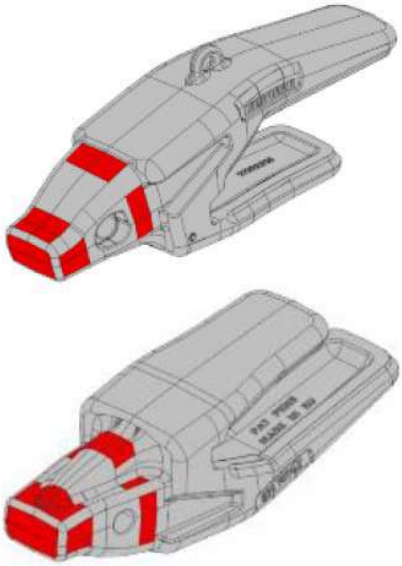
Step	Description	Sketches / Pictures
1 **KG**	Grinding shall be performed on the 3 faces (top, side, bottom) after removal of the run-off tabs.	
2 **KG**	A smooth transition is required between the weld cap reinforcement and the flattened ground area.	 

4.3.4 Rebuild of GET adapter

Caution!

This section is applicable to Liebherr GET adapters only. For GET adapters from other suppliers, refer to the supplier instructions.

Rebuild sequence

Step	Description	Sketches / Pictures
1	The welding area shall be thoroughly cleaned before welding.	
2	Identify the areas to be repaired with the GET adapter gauge. Weld build-up shall be deposited only at the contact areas defined in red. Stringer beads shall be used, with inter-pass cleaning to remove any slag or sili-cates. A minimum of 3mm shall be deposited.	
3	After completion of welding, use the GET gauge and grinding to adjust the weld build-up. Proceed in successive steps until a good fit-up is obtained between the GET gauge and the GET adapter. The final gap should not exceed 1mm.	

3.40: Adjustment procedure

1 General information

1.1 Structure of the procedure

This section is divided into two parts:

– The first part is the adjustment sheet which summarizes the machine data and all adjustment values. Each value is linked to an adjustment procedure given in the second part.
– The second part gives the adjustment procedures which show you how you must adjust the different functions or components.

▶ Fill in the adjustment sheet each time you do an adjustment on the machine.

▶ The adjustment sheet should be printed or saved after each adjustment. This is in order to have a record of the adjustments made and to be able to give correct feedback to the Customer Service. This record must be forwarded to the Customer Service if necessary.

1.2 Tools

Special tools can be specified in the adjustment procedures but a standard tool set is always necessary.

The pressure gauges which are usually used are 0-600 bar, class 1, with 10 to 10 graduations.

To reduce the uncertainty of measurement, Liebherr recommends to use the "Multi Handy" tool ID. 10288229 or similar.

Use the same pressure measurement device to measure equivalent pressures, for example:

– power regulator or pressure regulator on the different working pumps
– left and right working pressures on the different swing pumps

This to make sure that all these pressures are adjusted equally, with the same uncertainty of measurement.

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3.3.2 Adjust the replenishing pressure

- Install 100 bar gauge on **M3**.
- Start the electric motor.
- If necessary, adjust the replenishing pressure with the adjustment screw **SDV** until you get the correct pressure on **M3**.

3.3.3 Adjust the pressure cut-off - acceleration

- Install 600 bar gauge on **M1** and **M2**.
- Start the electric motor.
- Disconnect the solenoid valve **Y7**.
- Lift the access ladder (if installed).
- Fully actuate the joystick for the swing gear.

For each swing direction, the working pressure on **M1** and **M2** must be equal to the adjustment value.

If you do not find this value:

- Turn the adjustment screw **Da1** until you get correct pressure on **M1** and **M2**.
- Connect back the solenoid valve **Y7**.

3.3.4 Adjust the pressure cut-off - swing deceleration

- Stop the motor.
- Release hydraulic pressure. Refer to the Operating Manual.
- Install 600 bar gauge on **M1** and **M2**.
- Disconnect the hose which is connected to pressure cut-off screw (**Da1** and **Da2**).
- Put a cap on this hose.
- Start the electric motor.
- Lift up the access ladder (if installed).
- Disconnect the solenoid valve **Y7**.
- Fully actuate the joystick for the swing gear.

For each swing direction, the working pressure on **M1** and **M2** must be equal to the adjustment value.

If you do not find this value:

- Turn the adjustment screw **Da2** until you get correct pressure on **M1** and **M2**.
- Stop the motor.
- Connect the hose on pressure cut-off screw again.
- Connect back the solenoid valve **Y7**.

3.3.5 High pressure relief valves (secondary valves)

The high-pressure relief screws **HDV1** and **HDV2** are factory adjusted and sealed.

- Do not adjust these valves on a new machine.
- Do not adjust these valves on a new pump.

If you are in doubt that it does not work correctly, it must be replaced by a new one and its adjustment must be checked only by approved people (a test bench can be used). The secondary valve is not resistant to the maximum flow of the pump.

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4.10: General information

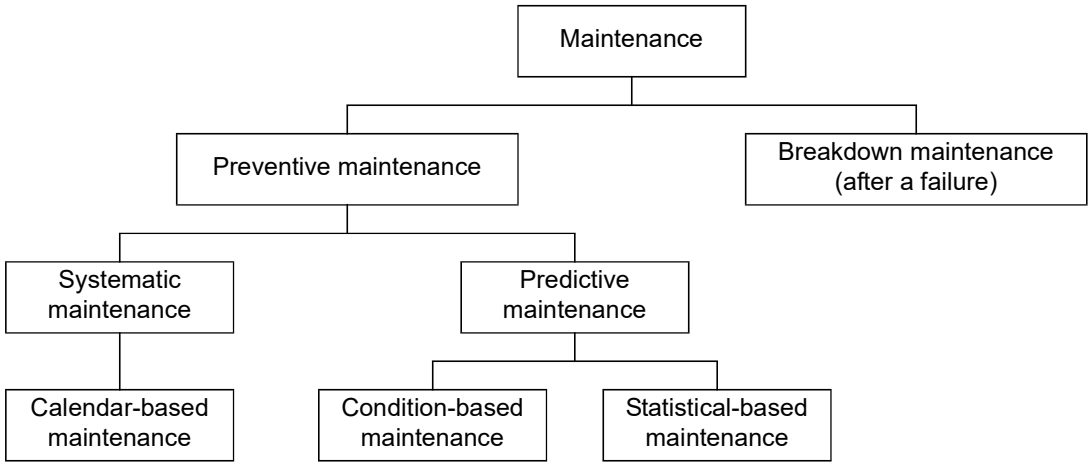
1 Function of preventive maintenance

1.1 General information about maintenance

Maintenance is necessary to maintain the machine in good working condition. There are two types: breakdown maintenance and preventive maintenance.

Breakdown maintenance consists of repairing machine when a failure occurs.

Preventive maintenance consists of scheduled maintenance tasks completed during planned machine downtime. These tasks reduce the risk of future failures and unscheduled (breakdown) maintenance on the machine. There are three types of preventive maintenance: calendar-based, condition-based and statistical-based maintenance.



Calendar-based maintenance

Maintenance tasks scheduled at regular intervals during the life of the machine (for example: every 1000 working hours), such as:

- check
- component cleaning
- fluid changes
- component replacement

Condition-based maintenance

Maintenance tasks on components or fluids which have reached their defined critical condition:

- ▶ The manufacturer defines the «critical» condition of deterioration for some components/ fluids and recommends checks intervals.
- ▶ The user checks the components/fluids at the recommended intervals or more frequently, dependant on the specific working conditions.
- ▶ The user immediately replaces/changes the components/ fluids which have reached their critical condition.

Statistical-based maintenance

Maintenance tasks on components/fluids completed at recommended intervals, before the components or fluids have reached their defined critical condition:

- ▶ The manufacturer calculates the checks and/or tasks intervals for some components/fluids, based on statistical data.
- ▶ The user completes the tasks at the recommended intervals, or more frequently, dependant on the specific working conditions.

This type of maintenance is even more important when the critical condition of a component can cause damage to other components of the machine.

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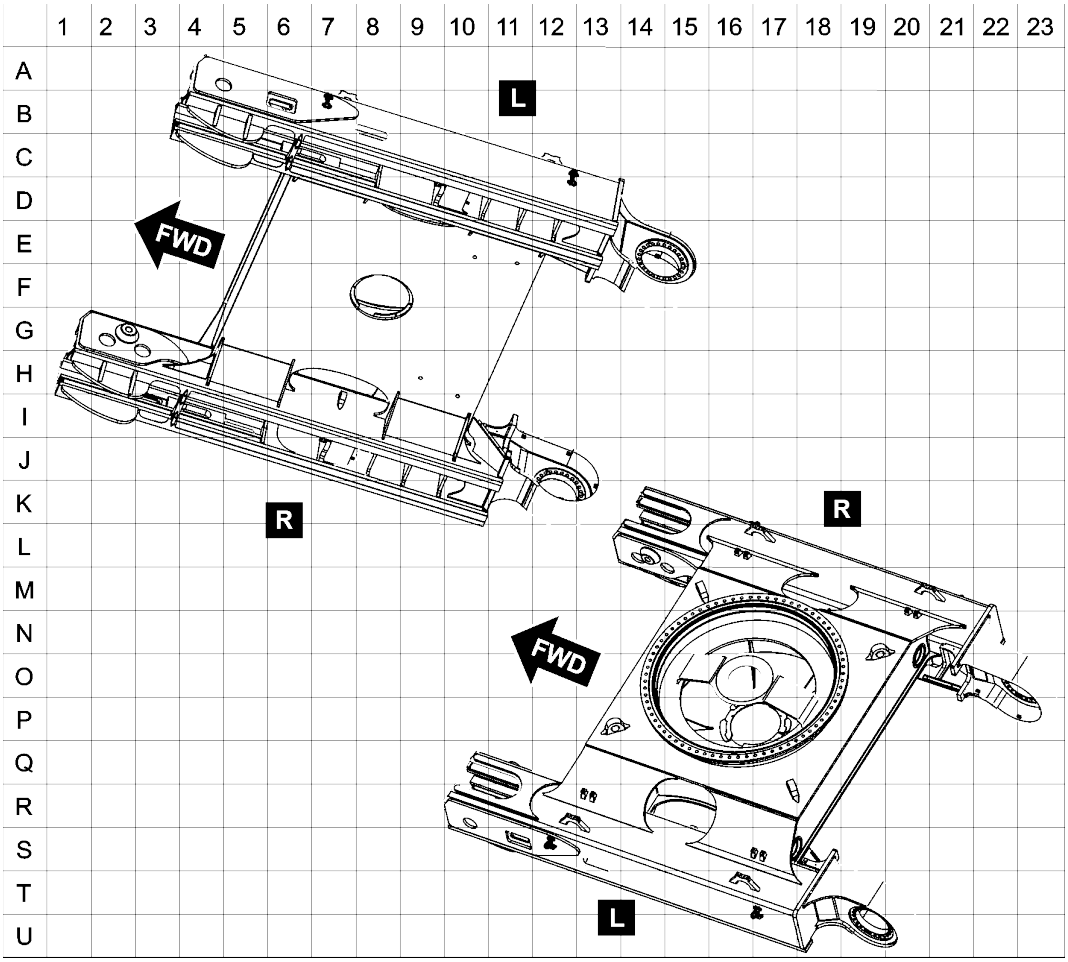
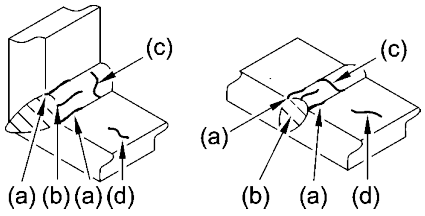
Machine serial N°:	Machine hours:	Travel hours:	Completed by:	Date:
Undercarriage with non removable side frames	Article N°:		Index N°:	
	Serial N°:		Component hours:	

▶ Find the defect coordinates on the grid and report them in the following table.



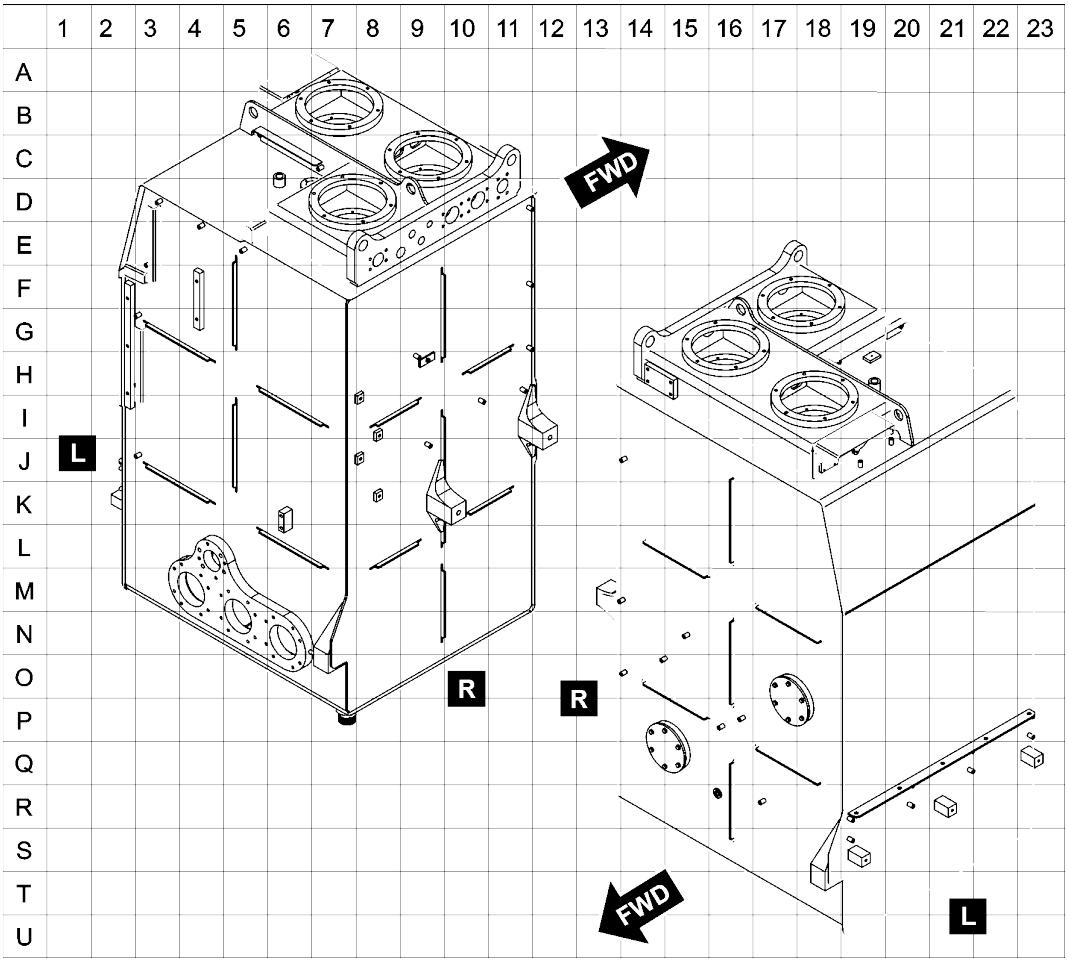
(Mark the following options: location a, b, c or d; defect longitudinal, perpendicular to the seam direction and/or on the plate or in another position.

Defect coordinates	Side of the defect(s) R or L		Details of the defect(s): (a),(b),(c),(d) or other	Picture N°

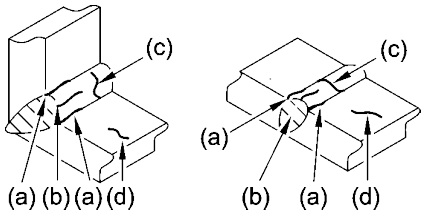
Do a description of the defect(s):

Machine serial N°:	Machine hours:	Travel hours:	Completed by:	Date:
Hydraulic tank	Article N°:		Index N°:	
	Serial N°:		Component hours:	

▶ Find the defect coordinates on the grid and report them in the following table.



(Mark the following options: location a, b, c or d; defect longitudinal, perpendicular to the seam direction and/or on the plate or in another position.

Defect coordinates	Side of the defect(s) R or L		Details of the defect(s): (a),(b),(c),(d) or other	Picture N°

Do a description of the defect(s):

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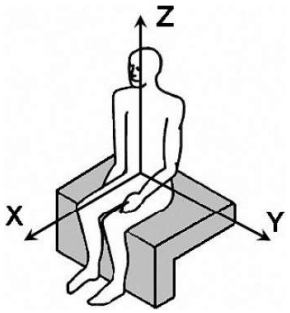
Hand-arm vibrations

– If the machine is operated as intended, the weighted (frequency-weighted) effective value of the hand-arm vibrations in accordance with ISO 5349-1:2001 is less than 2.5 m/s².

Whole-body vibrations



– The value conforms to the specifications of the technical report ISO/TR 25398:2006.
– As the specified values are individual effective values for specific typical application areas, only a limited assessment of the load imposed on the operator by whole-body vibrations is possible.
– In order to accurately assess the daily exposure of an operator over an 8-hour shift, use the Liebherr brochure concerning whole-body vibrations as well as the software developed especially for this purpose.
– Both these resources are available from the Liebherr dealers and are included on the documentation CD (Liebherr-Parts) delivered with every new machine.

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Minimized Impact on Life

Optimized Energy Consumption, Fewer Emissions
Constant power regulation of the hydraulic system and engine output optimize equipment fuel efficiency, depending on the application. In “Eco-Mode” setting, the machine is set up to reduce engine load, significantly improve fuel consumption and reduce emissions.

Controlled Emission Rejection
The R 9150 B is powered by a high horsepower diesel engine which complies with the US EPA Tier 2 or US EPA Tier 4f / EU Stage V compliant emission limits. This power drive makes the R 9150 B cost effective without compromising productivity and reduces the machines impact on the environment.

Sustainable Design and Manufacturing Process

Certified Environment Management Systems
Subject to the stringent European program for the regulation of the use of chemical substances in the manufacturing process REACH*, Liebherr undertakes a global evaluation to minimize the impacts of hazardous material, pollution control, water conservation, energy and environmental campaigns.

Extended Components and Fluids Lifetime
Liebherr is constantly working on ways to extend component life. Through the Exchange Components program, superior lubrication systems and the reinforcement of parts under stress, Liebherr can reduce frequency of part replacement. The result minimizes environmental impact and lowers the overall total cost of ownership.

*REACH is the European Community Regulation on chemicals and their safe use (EC 1907/2006)
It deals with the Registration, Evaluation, Authorization and Restriction of Chemical Substances.

The Liebherr-Mining Remanufacturing Program
- Reduced environmental impact
- Second life for your components
- Reduced costs and investment
- Liebherr certified workshops
- Alternative to purchase brand-new replacement components

Eco-Mode
The Eco-Mode can be manually selected by the operator when maximal power is not required according to job need for:
- An improved fuel efficiency
- Less load on the engine
- Less noise pollution
- Less dioxide carbon emissions

Automatic Idle Control
Electronic idle control of the engine results in:
- Less fuel consumption
- Less load on the engine
- Reduced emissions
- More comfort to the operator (reduced noise pollution)

- Authorize only experienced people to attach load and to give indications to the machine operator. This people must be in the operator's sight or in radio contact with him.
- Depending on the attachment combination, there is a risk of collision between the work tool and the machine (uppercarriage and undercarriage). The greatest degree of care must be taken to avoid damage.
- Depending on the attachment combination, there is a risk of collision between the work tool and the cab, the cab protection or the boom cylinders. The greatest degree of care must be taken to avoid damage when the hoe teeth come within this area.
- Depending on the attachment combination, there is a risk of collision between the work tool and the attachment parts. The greatest degree of care must be taken to avoid damage.
- Depending on the attachment combination, there is a risk of collision between the lift ring of the attachment and the cab or the cab protection. Before operating, ensure that there is no risk of collision, especially on excavator with cab elevation. If necessary remove the lift ring.
- In case of a thunderstorm:
  - lower the attachment to the ground and if possible anchor the digging tool into the soil.
  - leave the cab and move away from the machine before the storm breaks out. Otherwise, you must stop the excavator, turn off the radio and keep inside the closed cab until the end of the storm.
- Auxiliary control units can have various functions. Always check their functions when starting up the machine.
- Stop the swinging motion of the uppercarriage when lowering the attachment into a ditch without striking the attachment on the ditch walls.
- Inspect the machine for damage if the attachment has been swung into a wall or any other obstacles.
- Applications in which the attachment is to be used to strike the material being extracted are not permitted, even when working in a longitudinal direction.
- Repeated strikes against an object leads to damage to the steel structures and machine components.
- Please refer to your Liebherr dealer if special teeth for heavy-duty or special applications are required.
- Do not attach too large bucket or bucket with side cutters or that are during operations with rocky material. This would prolong the work cycles and may lead to damage to the bucket as well as further machine components.
- With the 2x45° offset articulation, the offset position may only be employed if the working tool or the attachment does not touch the material.
- Operation of the offset articulation to drill into the material is not permitted.
- Do not lift the machine during operation. Should this happen, lower the machine slowly back to the ground.
- Do not let the machine fall heavily on the ground and do not hold it back with the hydraulics. This would damage the machine.
- During operation with the attachment it is forbidden to raise the machine with the dozing blade (e.g. carving at the ceiling when tunnelling).
- Do not dig under the undercarriage. Take all necessary measures to prevent ground collapse under the machine.
- The operation of Liebherr Mining machines in the following Mining applications is not approved or condoned by Liebherr:
  - Batter pulling (also known as Scaling), without exception.
  - Double benching (also known as Split benching or Double flitching) when the

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2.7.2 Arrangement and explanations of signs

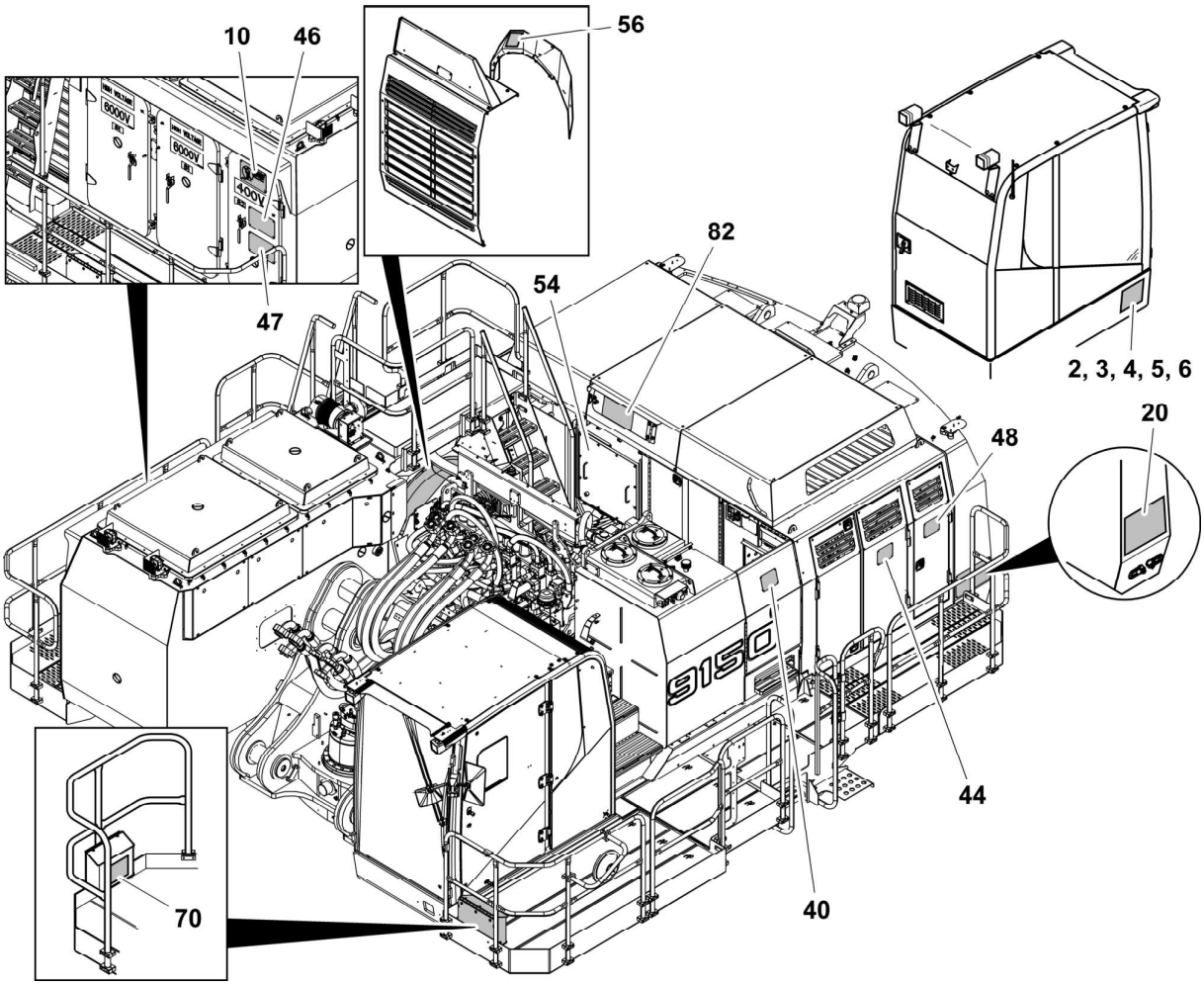
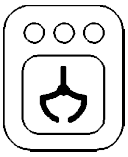


Fig. 2-2 *Arrangement of signs on the machine*

2	Typeplate LEC "CE" / "EAC"	**44**	Warning label
3	Typeplate LEC	**46**	Warning label
4	Typeplate LAM	**47**	Warning label
5	Typeplate LBR "CE" / "EAC"	**48**	Warning label
6	Typeplate LBR	**54**	Door-closing label
10	Warning label	**56**	Warning label
20	Danger signal	**70**	Emergency ladder label
40	Warning label	**82**	Security kit for high voltage label



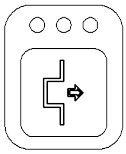
Turn of the grapple / shear (optional)

- ▶ Push the button.
  - ↳ The LED in the button comes on.
  - ↳ You can turn the grapple / shear with the related operating and control elements.
- ▶ Push the button again.
  - ↳ The LED in the button goes off.
  - ↳ The turn function of the grapple / shear is off.

High speed gear

- ▶ Push the button.
  - ↳ Transfer from normal drive to fast drive is activated.
  - ↳ First LED in the button comes on.
- ▶ Push the button again.
  - ↳ Transfer from normal drive to fast drive is deactivated.
  - ↳ First LED in the button goes off.

No function



Quick coupler (optional)

- ▶ Refer to the Operator's Manual of the quick coupler manufacturer.

– the remaining time before the next scheduled maintenance interval

Hours related to the electric motor

Hours related to the hydraulic system

When the necessary maintenance task is done:

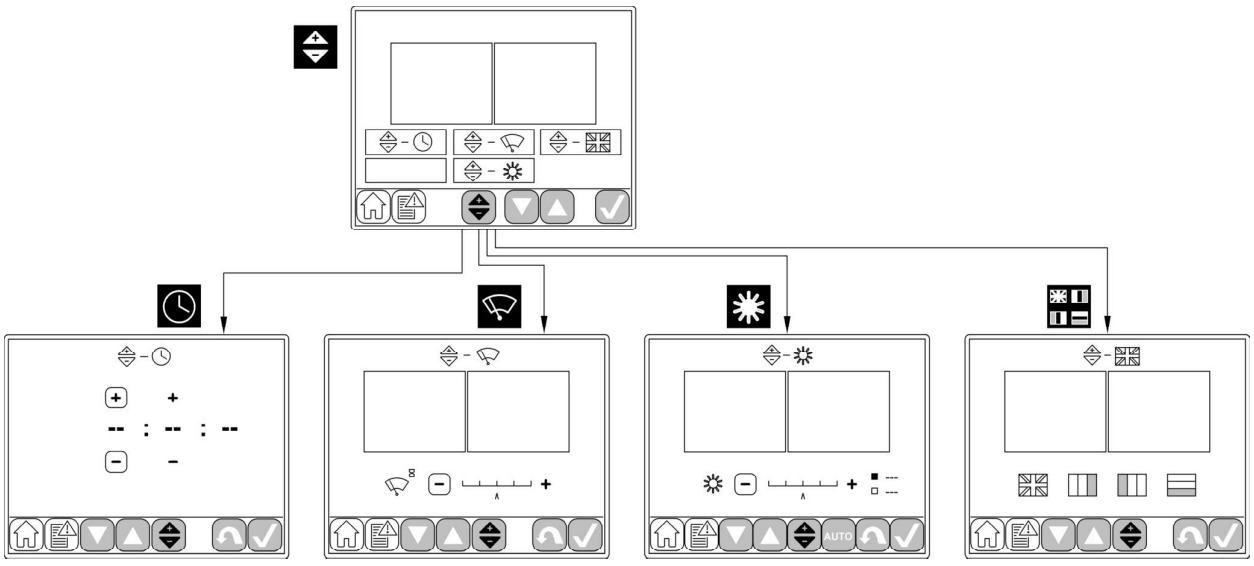
▶ Push the "**Up**" and "**Down**" buttons to select the applicable symbol.

↳ The applicable symbol is shown by a white frame.

▶ Push the "**Accept**" button to confirm that the related maintenance task is done.
↳ The system records the time of this task.
↳ It calculates the next scheduled maintenance interval.

Menu "Settings"

This menu gives access to the submenus that follow:



3.2.3 Operator’s seat

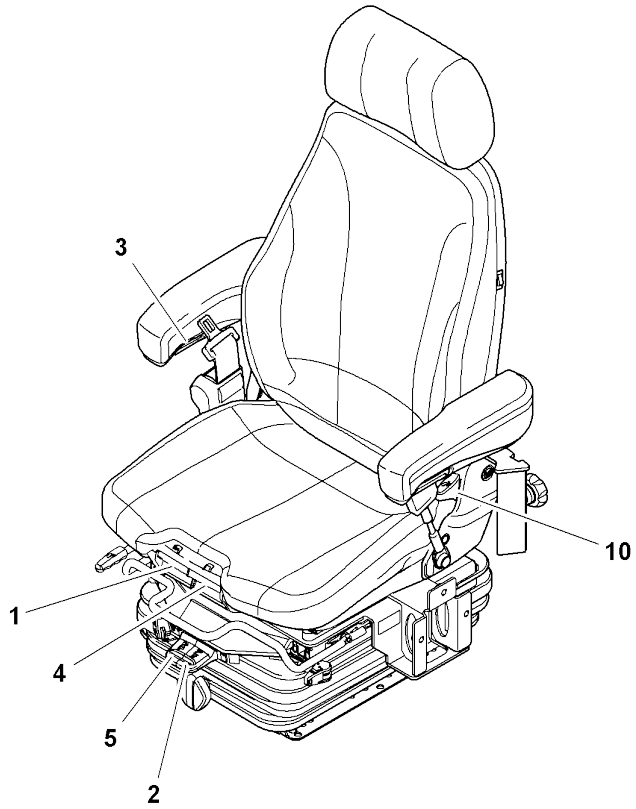


Fig. 3-27 *Standard operator’s seat*

1	Set horizontal, upper	**4**	Set seat inclination
2	Set weight	**5**	Set height
3	Adjust armrests	**10**	Set backrest

The operator’s seat must be set up before starting the machine.

- ❑ The electric motor is switched to off.
- ❑ The safety lever is pushed up.
  ↳ This will prevent unexpected movement of the machine.

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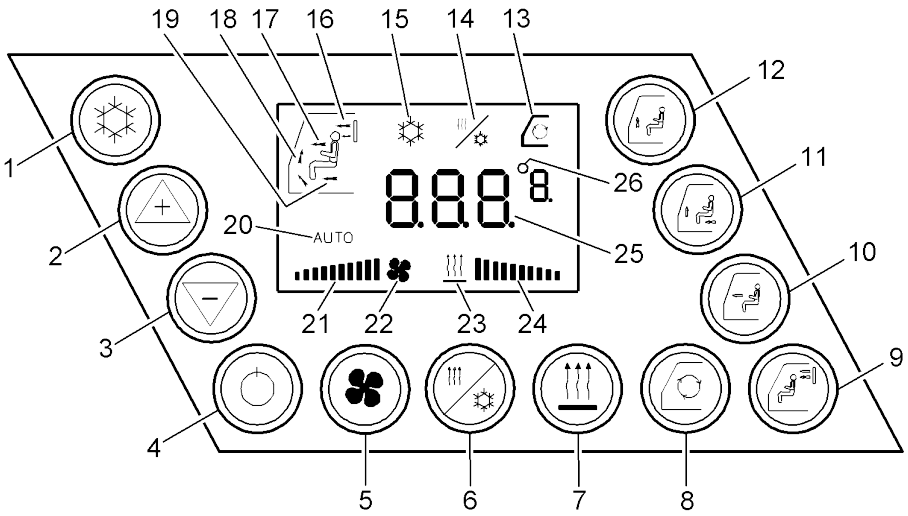


Fig. 3-46 *Air-conditioning system control device*

Control buttons

1 – Air conditioning (cooling)
2 - Increase cab temperature
3 – Reduce cab temperature
4 – Control ON / OFF
5 – Evaporator fan speed – manual / automatic
6 – REHEAT function
7 – Heating – manual / automatic
8 – Fresh air / recirculated air
9 – Rear wall ventilation flap OPEN / SHUT
10 – Right control panel ventilation flap (2 (17)) OPEN / SHUT
11 – Windscreen footwell ventilation flap CENTRE / SHUT
12 – Windscreen footwell ventilation flap CENTRE / OPEN

Main screen displays

13 – Recirculated air
14 – REHEAT function
15 – Air conditioning (cooling)
16 – Rear wall ventilation flap OPEN
17 – Right control panel ventilation flap (2 (17)) OPEN
18 – Windscreen footwell ventilation flap CENTRE
19 – Windscreen footwell ventilation flap OPEN
20 – Automatic function
21 – Fan speed in manual operation bar
22 – Fan speed in manual operation symbol
23 – Heating in manual operation symbol
24 – Heating in manual operation bar
25 – Nominal value / error code
26 – Temperature (°)

If the control unit identifies an error, a flashing error number **F1 – F5** will be displayed.

Note!

▶ In the event of an error occurring, please consult with the Liebherr customer service.

If installed, the actuator of the emergency stop **S100_4** is located under the counterweight.

Do an emergency shutdown

Caution!
Only use this method in case of emergency.

- ▶ Turn the ignition key **S1** to the "**off**" position or push one of the emergency stop buttons **S100_1** or **S100_2** and **S100_4** (if installed).
  - ↳ This action will stop the electric motor and disconnect the electrical system.
  - ↳ If an emergency stop is operated and the optional 45° access ladder is installed, it is automatically lowered.

After a shutdown with an emergency stop button, you must unlock the button before you try to start again.

Safety control for swing and travel brakes

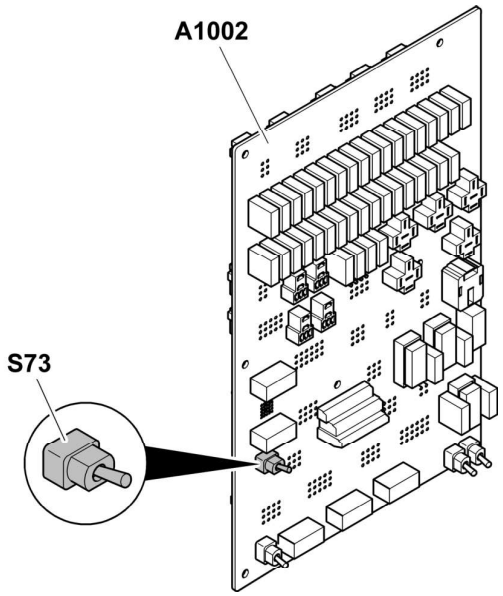


Fig. 3-64 *Safety control for swing and travel brakes*

A1002	Electrical plate in **E1005**
S73	Safety switch

The electrical plate **A1002** is located in the cab connection box **E1005**. You can also refer to chapter 4 of this manual.

If the swing and/or travel brake(s) does/do not operate correctly, because of the failure of the keypad **A168**:

- ▶ Push the switch **S73**.

In this mode, you can operate the brakes with the safety lever.

- ▶ Push the safety lever down.
  - ↳ The brakes are disengaged.

▶ Move the joystick forward **g**.
↳ The attachment will be lowered pressureless (see section above).

▶ Push the button **S6R** right on top of the right handle at the same time you actuate the joystick.
↳ The boom is lowered with pressure.

Float position of boom cylinder (with shovel attachment only)

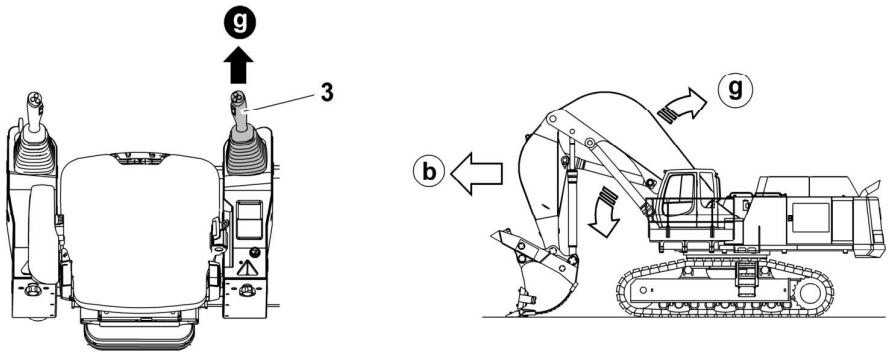


Fig. 3-76 *Float position*

▶ Move the right joystick **3** forward **g**.
↳ Now the bucket can be used for grabbing work while moving the joystick **4** forward to extend the crowd cylinders.
↳ The attachment can then move freely up or down depending on grade and the bucket will automatically follow the ground contour.

Operating the bucket

The bucket is operated using the right joystick **3**.

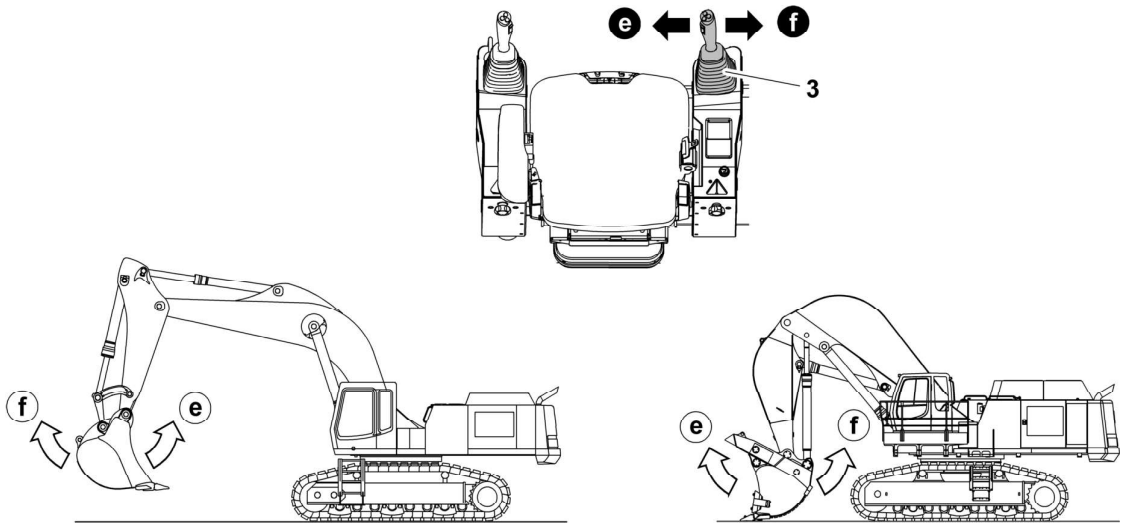


Fig. 3-77 *Operating the bucket cylinder*

▶ Move the joystick to the left **e**.
↳ Bucket will be tilted inwards.

▶ Move the joystick to the right **f**.
↳ Bucket will be tilted outwards.

3.5.4 Attach a non-rotary tool on and remove it from a quick coupler (optional equipments)

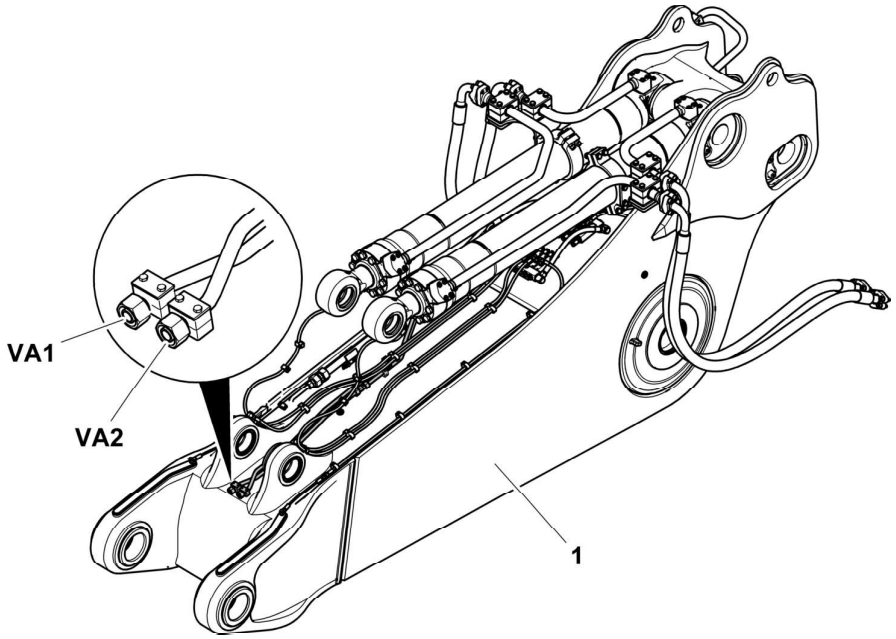


Fig. 3-95 *Pressure ports for the quick coupler*

1 Stick

VA1/2 Pressure ports for the quick coupler

▶ Make sure that:

– Pressure port **VA1** is connected to the locking port of the quick coupler.

– Pressure port **VA2** is connected to the unlocking port of the quick coupler.

▶ Obey the dedicated section of this manual for the control of the quick coupler.

▶ Also refer to the following installation and removal procedures for hydraulic connections of the special tools and how to set them.

3.5.5 Attach a rotary tool on and remove it from a quick coupler (optional equipments)

Danger!
The hydraulic lines of the quick coupler and of the rotary actuator of a special tool (for example: grapple, shear) are the same and operate at the same time!
Risk of death or serious injury and risk of damage.

▶ Before you attach a rotary tool on and you remove it from a quick coupler, always disconnect the hydraulic power supply of the rotary actuator.

3.6.9 Working with the grapple (industrial equipment)

❑ The machine must be in the working position.

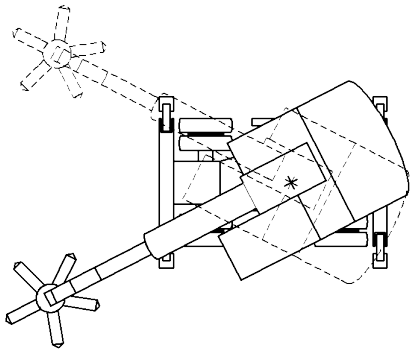


Fig. 3-117 *Taking up the load*

▶ Take the load up above the supported corners of the machine to attain maximum stability.

▶ The maximum lifting capacity is attained when the load is taken up as close to the chassis as possible.

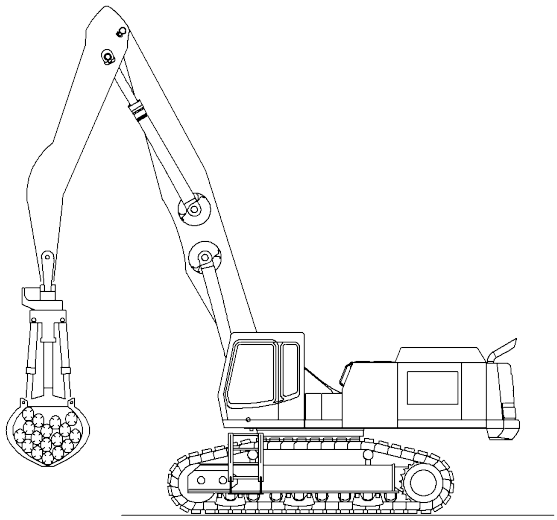


Fig. 3-118 *Transporting a load*

▶ Transport the load close to the chassis, but with sufficient safety distance to the cab (swinging grab!) and as close to the ground as possible.

Caution!
Particularly when loading wood, it can be necessary when working with a grab to move with the working equipment raised and the load taken up. This will shift the centre of gravity of the machine upwards. The way the machine drives will be negatively affected because of this.

▶ Please note the safety information “Use for loading work” at the beginning of these operating instructions.

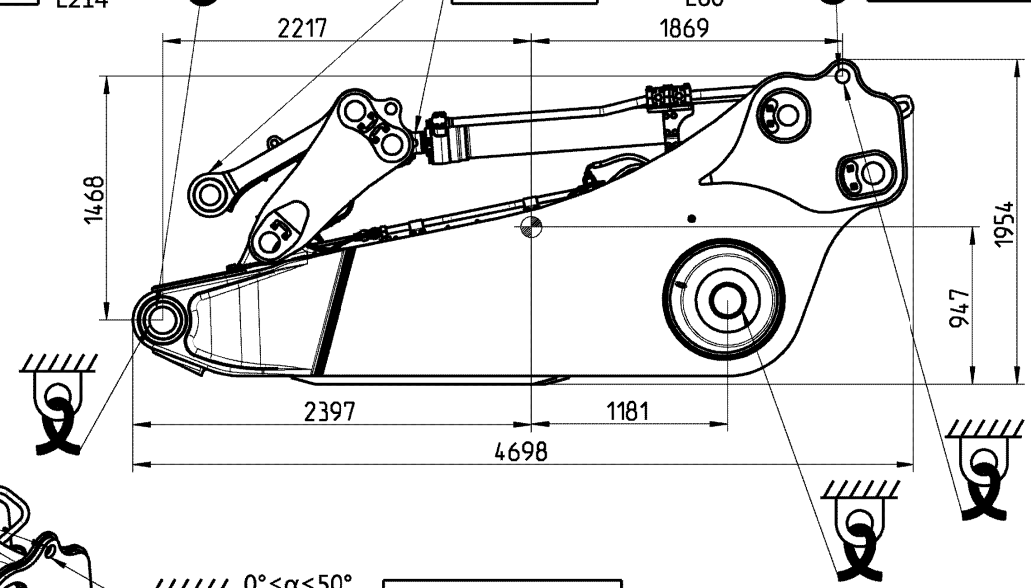
AUF BEIDEN SEITEN
ON BOTH SIDE
DES DEUX COTES

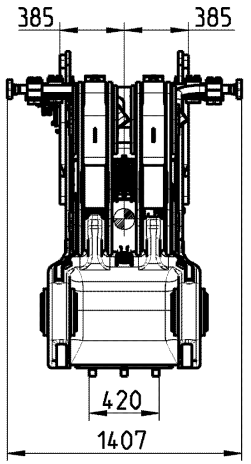
β≤30°
SWL=5t
D360/d160
E214

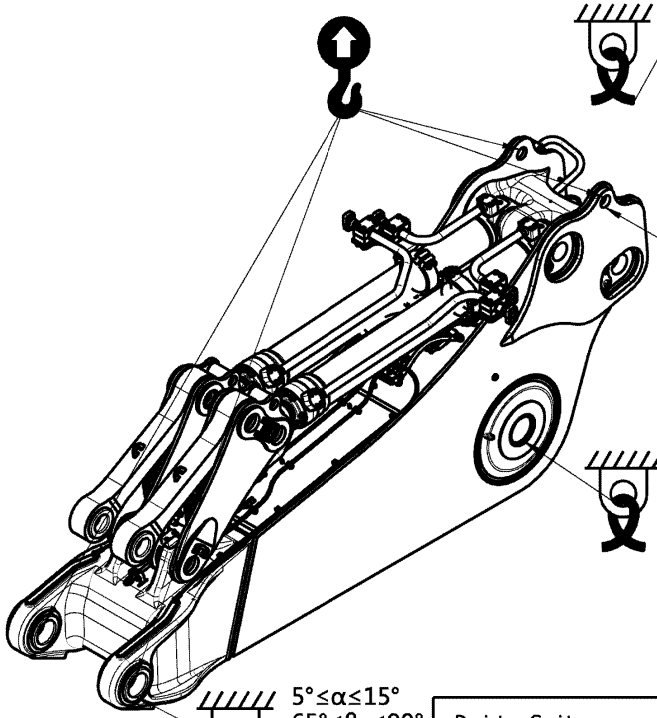
Blockieren
Immobilize
Immobiliser

β≤30°
SWL=6.2t
D200/d80
E60

AUF BEIDEN SEITEN
ON BOTH SIDE
DES DEUX COTES







2X
0°≤α≤50°
25°≤βx≤50°
LC= 6t
D200/d80
E60

Beide Seiten
Both sides
Des deux cotés

5°≤α≤15°
65°≤βx≤90°
LC= 3t
D180/d-
E734

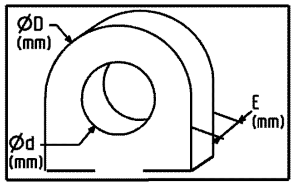
Beide Seiten
Both sides
Des deux cotés

Die Flächen schützen
Protect the surfaces
Protéger les surfaces

5°≤α≤15°
65°≤βx≤90°
LC= 3t
D360/d160
E214

Beide Seiten
Both sides
Des deux cotés

Die Flächen schützen
Protect the surfaces
Protéger les surfaces



SCHWERPUNKT
CENTER OF GRAVITY
CENTRE DE GRAVITE

	Gerechnet Calculated Calculé	Gewogen Weighed Pesé
Gewicht ohne Werkzeug und Verpackung Weight without tooling and packaging Poids sans outillage et emballage	7841 kg	
Gewicht mit Werkzeug und Verpackung Weight with tooling and packaging Poids avec outillage et emballage	7841 kg	

LIEBHERR

Bezeichnung / Description / Dénomination	Ident-Nr. / Ident No. N° d'ident	Index / Index Index	Blatt / Page Feuille
TRANSPORTPLAN LOEFFELSTIEL TRANSP.DRW.STICK R9150 PLAN DE TRANSP.BALAN.RETRO	11073414	001	1/1

F57 Fuse 5 A / **H92** fire alarm
F58 Fuse 15 A
F59 Fuse 15 A
F60 Fuse 15 A
F61 Fuse 15 A
F62 Fuse 15 A
F63 Fuse 15 A
F64 Fuse 15 A
F65 Fuse 15 A
F66 Fuse 15 A
F67 Fuse 15 A
F68 Fuse 15 A

K22 Relay
K24 Relay
K25 Relay
K26 Relay / **Y10.1** and **Y10.2**
K32 Relay 15 A / **P5**
K34 Relay timer
K35_1 Relay / Safety start
K35_2 Relay / Start CAN
K36 Relay / Buzzer
K37 Relay
S73 Switch safety brake
X072 Connector 36 poles

Electrical plate A1004

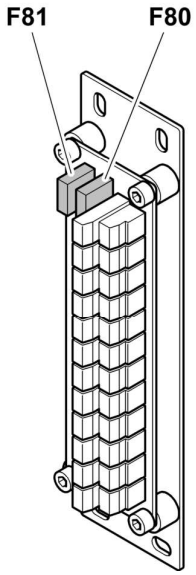


Fig. 4-8 *Fuses of electrical plate A1004*

F80 Fuse 10 A / Supply greasing
F81 Fuse 10 A / Supply centralized hydraulic lubrication (optional)

5.4.2 Lubrication chart

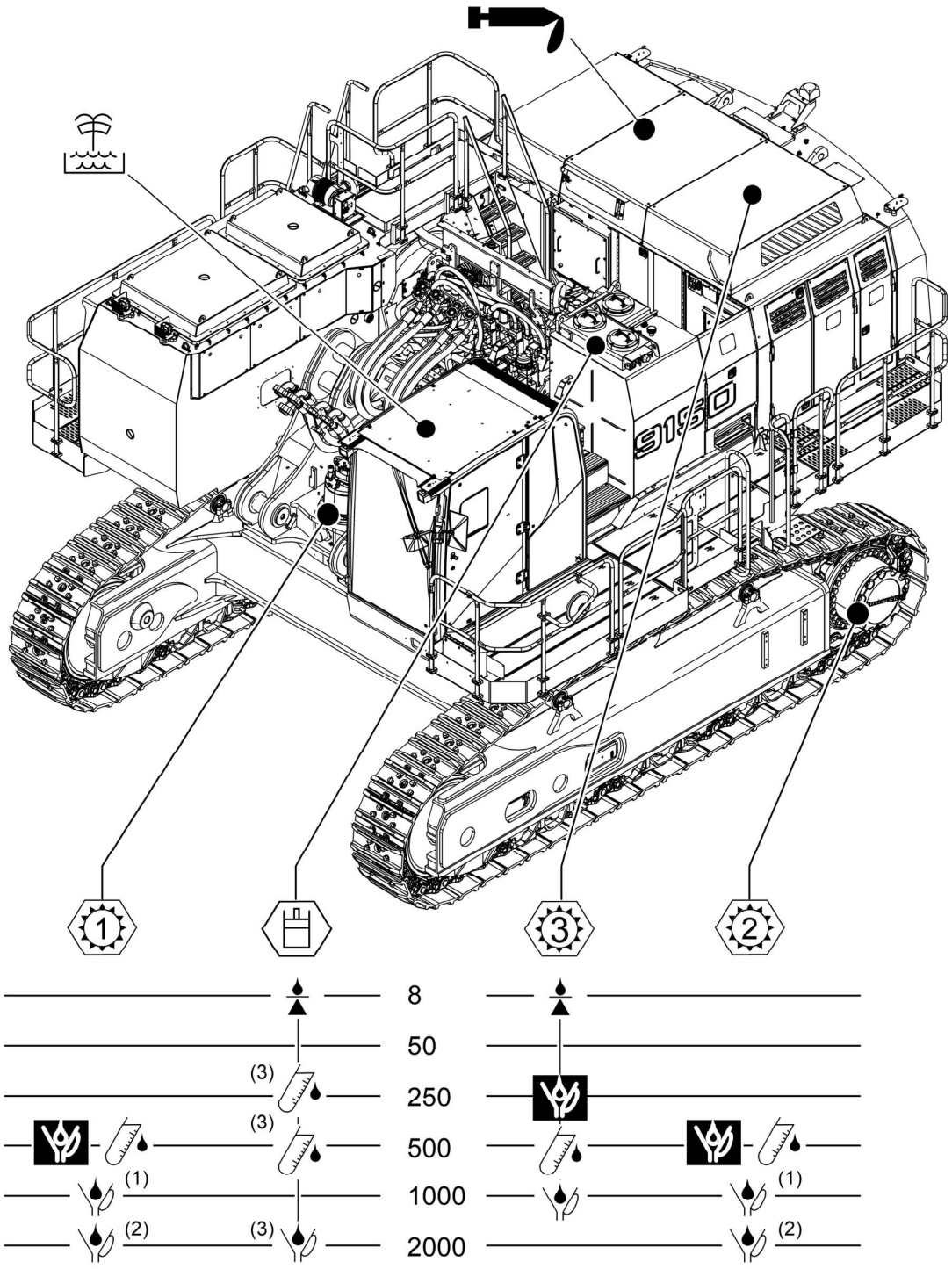


Fig. 5-8 *Lubrication chart - R 9150 E*

Symbol	Display
	Hydraulic system

– viscosity change
– additives change (e.g. Ca, Mg, B, Zn, P, Ba or S)

5.6.2 Oil sampling

Sampling intervals

– For each component, get an oil sample according to the Control and maintenance chart.
– When changing oil, get an oil sample of the used oil immediately before draining it.
– For new oil, get an oil sample twice a year and when changing to another oil supplier.

Sampling instructions

General sampling instructions:

▶ Wear personal protective equipment.

▶ Get the sample:
– during operation or immediately after stop
– at normal operating temperature
– not just after an oil change
– not just after a top-up

▶ Clean the area around the sampling point before you get the sample.

▶ Use an appropriate sampling kit.

▶ Keep the sampling material away from humidity and dust. Take these precautions to choose a storage area.

▶ Make sure the sampling material is perfectly clean (without dust, water, fuel...).

▶ If different sampling procedures are applicable for a component, always use the same sampling point and the same sampling procedure for this component to make sure that the analysis records stay relevant.

▶ Fill the sampling bottle with oil to 80% level. Do not fill the sampling bottle to the top.

▶ Close the sampling bottle tightly to ensure the integrity of the sample.

▶ Identify the sample with a label.

▶ Carefully fill in a sample information sheet. In any case, it is mandatory to give this information with the sample:
– machine type and serial number
– machine hours
– sampled component name:
  • splitterbox (front/rear)
  • swing gear (front/rear and left/right)
  • travel gear (left/right)
  • hydraulic oil
  • Diesel engine (front/rear)
– sampled components hours
– sampled oil hours

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Release the hydraulic pressure

- ▶ Set the machine in the check position given before in this section.
- ▶ Stop the electric motor.
- ▶ Make sure that the ignition key is on contact position.
- ▶ Move the operating and control elements (joystick and pedals) in all directions.

Danger!
The hydraulic oil is hot when at operating temperature.

- ▶ Do not allow the hot oil or oil-bearing parts to touch the skin.

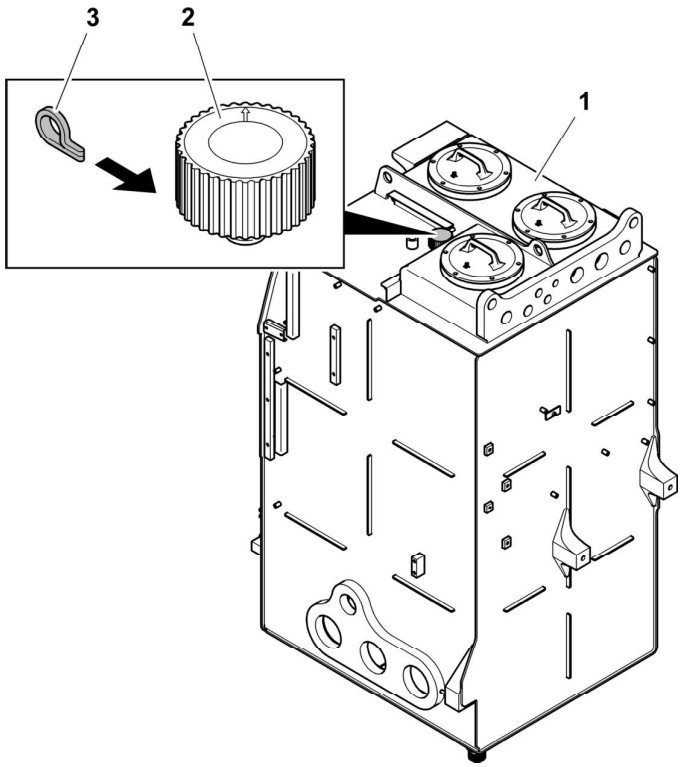

Fig. 5-32 *Release the hydraulic pressure*

1 Hydraulic tank
2 Breather filter
3 Locking pin

- ▶ Put the locking pin **3** into the breather filter **2**.
- ▶ Loosen the breather filter **2** only one turn.

The pressure in the hydraulic system will decrease.

- ▶ At the end of the work, tighten the breather filter **2**.
- ▶ Remove the locking pin **3**.

It is no longer possible to loosen the breather filter.

The breather filter **2** must be replaced at regular intervals.

2 Return port of the external hydraulic device **4** Access panel

The auxiliary hydraulic outlet is installed in a central location with easy access under the uppercarriage structure.
During the machine operation, the manual valve **1** is in the position **A**.

First, you must get access to the necessary submenu.

- ▶ Go to the monitoring menu "**Check**".
- ▶ Go to the submenu "**Auxiliary hydraulic outlet**".

- ▶ Push the "**Accept**" button on the first page of the submenu.
  - ↳ The display shows the complete procedure that you must validate step by step.
  - ↳ While a step is in progress, a green frame highlights the related symbol.

- ▶ Push the "**Next**" button to validate and go to the next step.

Then, you must obey the procedure and validate the steps that follow to connect the external hydraulic device to the machine.

- ▶ Lay down the attachment on the ground.

- ▶ Push the safety lever up.

- ▶ Open the access panel **4**.
- ▶ Turn the manual valve **1** from position **A** to position **B**.
  - ↳ The hydraulic pressure in the port **3** is released.
- ▶ Remove the protective caps.
- ▶ Connect the coupling **2** to the return port of the external hydraulic device.
  The coupling **2** is a Faster FFH06-7/2215F female.
- ▶ Connect the coupling **3** to the pressure port of the external hydraulic device.
  The coupling **3** is a Faster FFH06-7/1815M male.
- ▶ Turn the manual valve **1** from position **B** to position **A**.
  - ↳ The port **3** is pressurized again.

Thus, the power supply of the external hydraulic device is in progress.

- ▶ Push the "**Next**" button to stop the power supply.

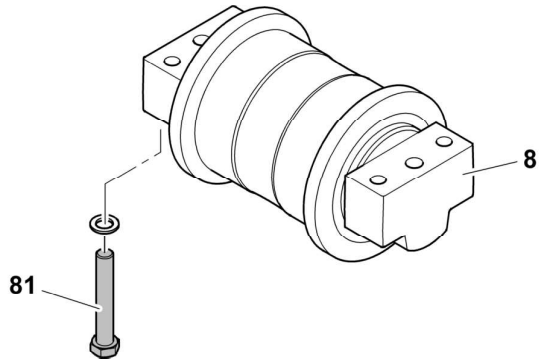

Fig. 5-66 *Track roller*

		Torque
8	Track roller	-
81	Screw M24x150 x quantity 4 for each track roller	965 Nm

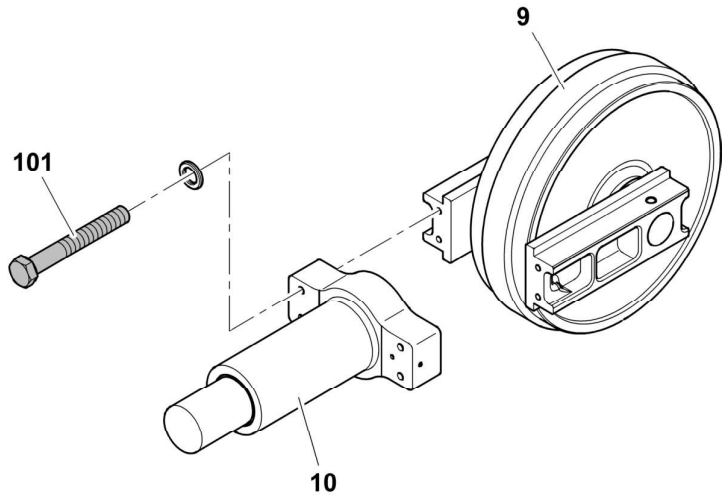

Fig. 5-67 *Idler and tension unit*

		Torque
9	Idler	-
10	Grease tensioner	-
101	Screw M24x180 x quantity 4 for each idler	965 Nm

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5.19.2 Lubrication of special tools (optional)

▶ Refer to the Operator's Manual of the special tool manufacturer for:
– detailed description of maintenance work to be performed on this device
– maintenance intervals
– grease specifications

5.20 Check mounting bolts for tightness

The mounting bolts listed below must be regularly checked and retightened if necessary. Refer to the control and maintenance chart for checks intervals.

Note!
When installing bolts of size bigger than M40 the thread of the screw must be slightly coated with a MoS2 based grease. Also grease the bolt head supporting surface, unless hereafter otherwise specified.

Danger!
Due to their size, most of the below listed mounting bolts require, to be tensioned to the prescribed torque, the use of a special, hydraulic or electric actuated tensioning device.
These high torque tensioning devices are power tools, which must be operated by trained mechanics, knowing the safety precautions edicted by the tool manufacturer and that must be observed to avoid accidents or personal injury.
In particular, pay attention to chose a solid and secure reaction point for the tool and position the reaction arm during operation. Keep clear of the reaction arm during operation; if it must be held or steaded during operation, use alternative means of securing the tool during operation.

Caution!
The mounting bolts of the main components (especially the bolts listed below), of the hydraulic hoses and of the counterweight must be replaced after every removal.

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5.25.4 250 Hours Maintenance Schedule - R 9150 E

Serial Number: Fleet Number: SMU HOURS: Travel Hours:	Completed by : Date and Signature :

WORK TO BE PERFORMED AT 250, 750, 1250 HOURS, ... Check ❑ for first and only interval *or* Check ❍ for repeat interval	Check	Initials	Comments
UPPERCARRIAGE			
Do a visual check of mirrors and cameras, clean and adjust if necessary	❍		
Do a visual check of the non-slip surfaces for wear and damage	❍		
ELECTRIC MOTOR AND SPLITTERBOX			
Check voltage / load gauges and lights into the cabin	❍		
Check oil level in the splitterbox	❍		
Change oil in splitterbox	❑		
HYDRAULIC SYSTEM			
Clean magnetic rods of return-line filter for the hydraulic hammer (optional equipment)	❍		
Sample and analyse hydraulic oil and change oil if necessary (if filled with HEES biodegradable oil)	❍		
ELECTRICAL SYSTEM			
Do a visual check of the head and floodlights, clean and adjust if necessary	❍		
Press to open dust discharge valve on aeration devices for cabin and electrical boxes (optional equipment)	❍		

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WORK TO BE PERFORMED AT 2000, 4000, 6000 HOURS, ... Check ❑ for first and only interval *or* Check ❍ for repeat interval	Check	Initials	Comments
Every 2000 hours, perform a complete 2000 hours Maintenance Echelon given in the SKF / Lincoln Operating Instructions	❍		
Do a check of the grease tank level	❍		
ELECTRIC MOTOR AND SPLITTERBOX			
Check voltage / load gauges and lights into the cabin	❍		
Check oil level in the splitterbox	❍		
Sample and analyse splitterbox oil	❍		
Change oil in splitterbox	❍		
Do a visual check of the splitterbox breather for clogging, replace if necessary	❍		
Replace filter in splitterbox breather	❍		
Grease the motor bearing. Refer to the Manual of safety, installation and maintenance of the electric motor manufacturer.	❍		
Clean the cooling tubes	❍		
Every 4000 hours (or at least twice a year), perform a general inspection of the electric motor given in the Manual of safety, installation and maintenance of the electric motor manufacturer	❍		
Every 8000 hours, perform a detailed inspection of the electric motor given in the Manual of safety, installation and maintenance of the electric motor manufacturer	❍		
Every 40000 hours (or at least every 5 years), perform a complete inspection of the electric motor given in the Manual of safety, installation and maintenance of the electric motor manufacturer	❍		
HYDRAULIC SYSTEM			
Drain water sediment from hydraulic tank	❍		
Check oil level in hydraulic tank	❍		
Sample and analyse hydraulic oil and change oil if necessary	❍		
Change hydraulic oil	❍		
Clean magnetic rods of all return filters	❍		
Clean magnetic rods of return-line filter for the hydraulic hammer (optional equipment)	❍		
Clean magnetic rods of the leak oil filter	❍		
Replace filter element of the return filters	❍		
Replace filter element of the return filters (if hydraulic hammer is used)	❍		
Replace filter element of the leak oil filter	❍		
Replace filter element of return-line filter for the hydraulic hammer (optional equipment)	❍		

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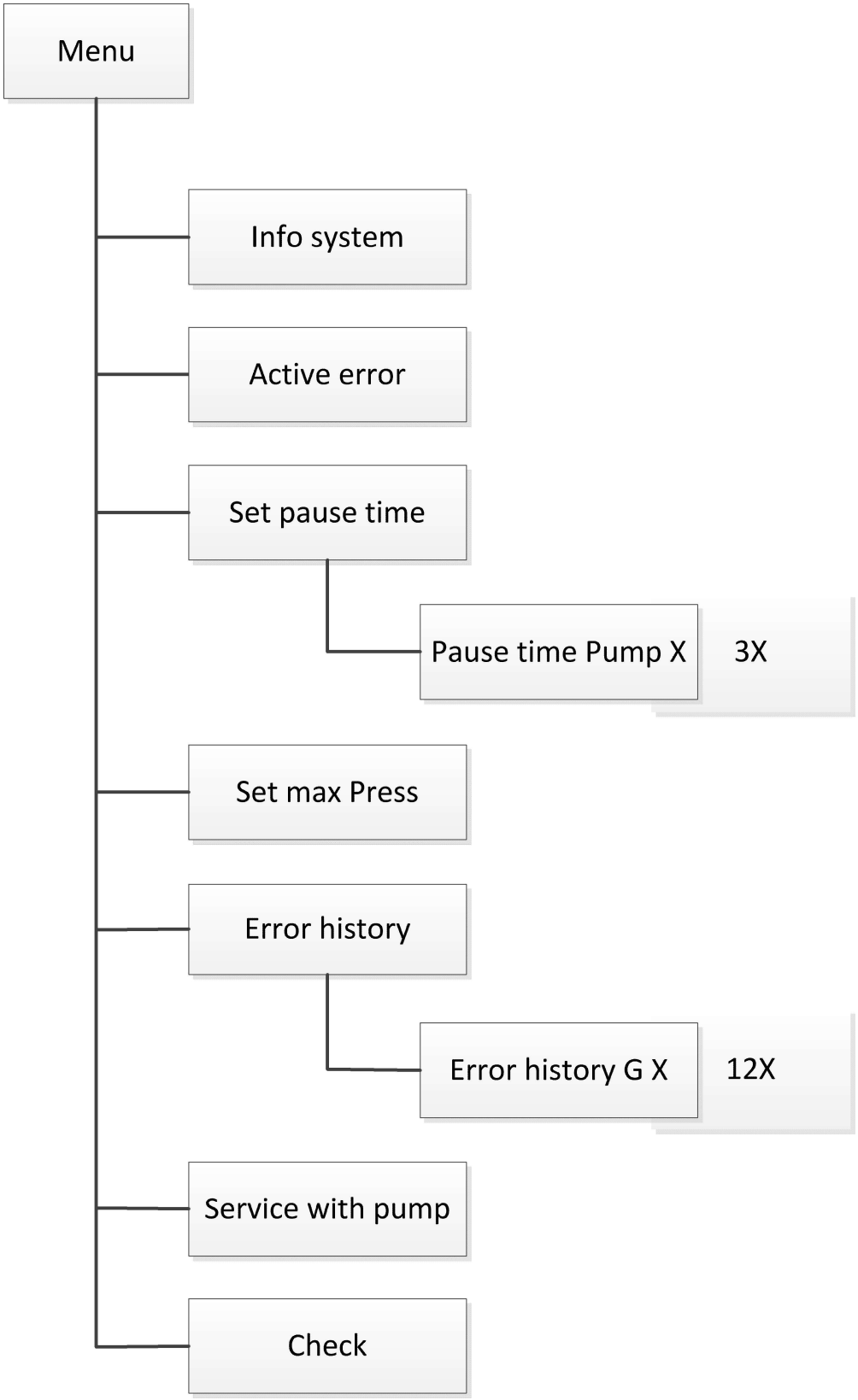
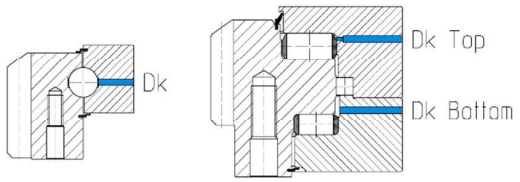
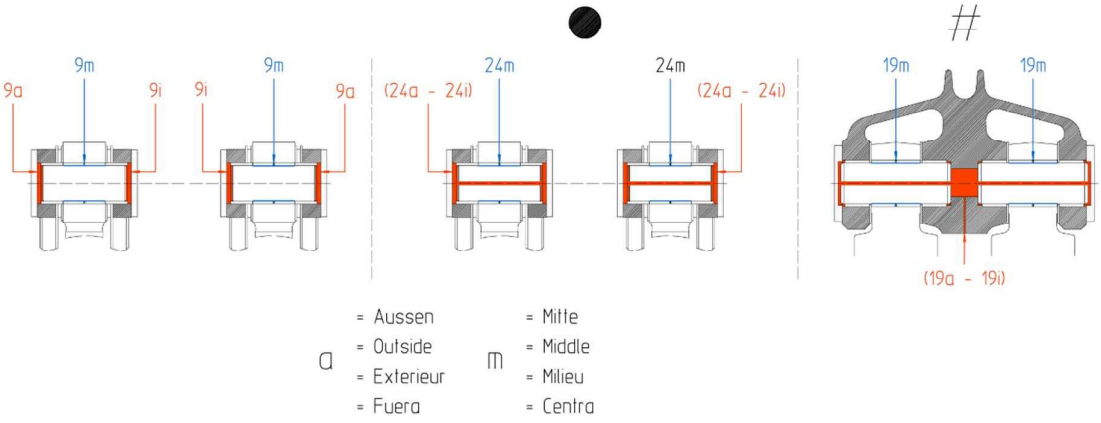
4. Architecture of Menus



Life cycle – commissioning	
Residual risks	**Remedy**
Lubricant spraying out due to incorrect screw connection of components or lines.	Tighten all parts with appropriate tightening torques. Use suitable hydraulic screw connections and lines for the stated pressures. Check these prior to commissioning for correct connection and damage.
Contact with corrosive or toxic substances that may be set free by a defective battery.	Wear protective clothes. Ensure sufficient ventilation. Storage and disposal of defective batteries in accordance with the corresponding safety data sheets for lithium.
People slipping due to floor contamination with spilled or leaked lubricant.	Take care when filling. Bind and remove leaked or spilled lubricant immediately with a suitable agent. Observe the legal or company regulations on dealing with oils and greases and contaminated parts.
Falling of parts due to insufficient fixing to the machine.	Fix parts only to machine parts with sufficient load capacity. Observe the weight and the stated tightening torques. If no tightening torques are stated, the tightening torques are to be applied to the screw size for 8.8 screws. ➔ Literature, see screw manufacturer.
Bursting reservoir if filled by a high-performance pump	Monitor the filling procedure and stop it when reaching the max marking of the reservoir
Contact with stirring paddle or shovel foot during "test operation" without lubricant reservoir or barrel	Always operate pump with lubricant reservoir or barrel. Do not reach into the stirring paddle, the drive or the supply piston.
Tearing or damaging of lines when installed on moving machine parts (e.g. pivot arm).	If possible, do not mount on moveable parts. Should this not be possible, use flexible hose lines of sufficient lengths.

Characteristics of lubrication points on the excavator





All the necessary information regarding the greasing points and quantities are available in chapter 21 of the Liebherr Service Manual.

Defective pressure relief valve or fault at the lubrication point	Lubricant leaking from the pressure relief valve	Determine cause. Replace pressure relief valve
Blockade in the downstream lubrication system	Grease leaking from the pressure relief valve	Determine cause and eliminate it.
If the fault cannot be determined and remedied, contact our Customer Service.		
Please follow the instructions of the respective product.		

For more details:

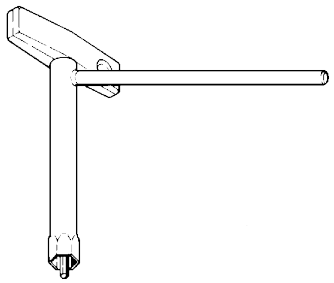
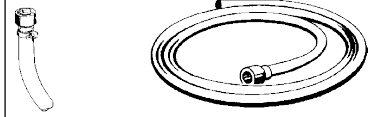
- Regarding error codes (fault indications)

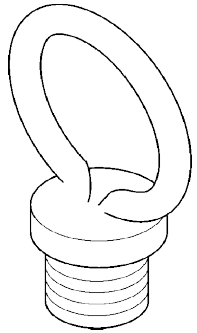
Refer to 4.4DE_EN-68610-xxx

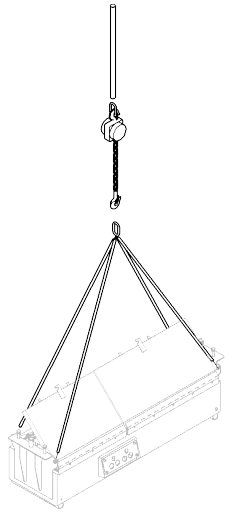
or

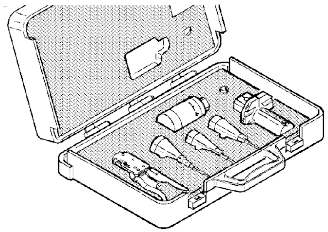
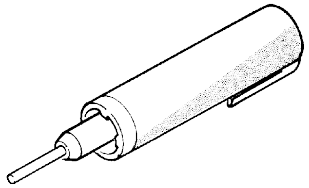
Refer to 93EN-98002-xxx

Fault indications (error codes)

Representation	No.	Description	Size	Order No.	T236	R9100	R984C	R9150	R994	R9200	R9250	R994B R9400- R9350	R995	R996B - R996	R9600	R9800	Application
	150 155	Special wrench	SW 17 SW 19	9359414 9210371		X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	To adjust primary and secondary relief valves on control valves.
	160 165 166	Drain hose	M26x1.5 M22x1.5 M52	9331004 9396155 10088112		X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X X	Use for the draining of the oil.
	200 201 202 203 204 205	Flushing lifetime interface pump Oil filter Empty oil filter Hoses set Hoses set	230V AC 24V DC 15 l/min 10µm 4bar	12197719 12197720 12235544 12235545 12235547 12235546		X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X			X X X X X X	

Representation	No.	Description	Size	Order No.	T236	R9100	R984C	R9150	R994	R9200	R9250	R994B R9400 - R9350	R995	R996B - R996	R9600	R9800	Application
	560	Lifting eye	M12	10651990	X												For the lifting of different components of the machine.
	561		M20x2.5	4900313		X	X	X	X	X	X	X	X				
	562		M24	8566100		X	X	X	X	X	X	X	X	X	X	X	
	564		M36x4	4900491						X	X	X	X	X	X	X	
	565		M48x5	4900835						X	X	X					
	566		M68x6	4902077						X	X	X	X	X	X	X	
	567	Impact screw	M36	9103255							X	X	X	X		X	
	568	Impact screw	M48	95689958						X	X	X					
	569	Impact screw	M68	9568957						X	X	X	X	X	X	X	

Representation	No.	Description	Size	Order No.	T236	R9100	R984C	R9150	R994	R9200	R9250	R994B R9400 - R9350	R995	R996B - R996	R9600	R9800	Application
	890	Lifting device for battery box		10393016												X	

Representation	No.	Description	Size	Order No.	T236	R9100	R984C	R9150	R994	R9200	R9250	R994B R9400 - R9350	R995	R996B - R996	R9600	R9800	Application
	1140	Kit for field repair contents special tools 306, 321, 322A and B, 324, operating instruction and lubricating fluid		7015073		X	X	X									
	1150	Extraction tool to push a crimped contact of the MATE-N-LOK connectors		7366655		X	X	X									
		Extraction tool to remove contacts of connectors DEUTSCH Size Wire range															
	1160	20		8503630		X	X	X	X	X	X	X	X	X		X	
	1161	16 (thin wall wire seal)		8145673		X	X	X	X	X	X	X	X	X		X	
	1162	16		8503631		X	X	X	X	X	X	X	X	X		X	
	1163	12		8145674		X	X	X	X	X	X	X	X	X		X	
	1164	8		8503632		X	X	X	X	X	X	X	X	X		X	
	1165	4		8503633		X	X	X	X	X	X	X	X	X		X	

4 Power supply

For information about the power supply, see section «Power supply», in chapter 13 «Electrical system».

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N4 series

The N4 series comprises a range of motors for all types of drives in most areas of application with voltages of up to 20 000V. Shaft heights are from 630 mm or greater and pole structure is 6-pole and higher.

These motors are highly modular and offer a wide variety of construction combinations.

The construction is based on a stator assembly mounted in a fabricated one-piece frame. High quality windings are ensured through a definition for each customer order and a vacuum-impregnated insulation system.

The rotor assembly is formed by bars and rings embedded together and brazed by an induction heating method to form a squirrel cage.

N37 series

9

N37 series comprises a range of motors for industrial applications with voltages up to 13800V. Shafts heights are offered in 630, 710, 800 and 900 mm at 50 Hz and 630, 710 and 800 mm at 60 Hz.
Pole structure is 4-Pole.

The construction is based on a stator assembly mounted in a fabricated frame. High quality windings are ensured through a definition for each customer order and a vacuum-impregnated insulation system.

The rotor assembly is formed by bars and rings embedded together and brazed by an induction heating method to form a squirrel cage.

2.2 MACHINE IDENTIFICATION

The Power Conversion motors are identified by the motor designation and production number.

2.2.1 Motor designation

The FL-F3-N3-N4-N37 series motors are designated by their type, followed by various characters to indicate the following:

Designation model - Flowpack series:

Example:

FL	X	C	N	355	Y	08	G

Series name

Voltage

T : low voltage U < 1000 V
X : medium voltage 1 000 V < U < 10 000 V
Y : high voltage 10 000 V < U < 11 000 V

Rotor type

C : copper cage

Protection (only if applicable)

N : anti-spark machine

Sizes (height of shaft in mm for horizontal machines)

280, 315, **355**, 400

Magnetic circuit length code

E, G, J, M, P, R, T, V, **Y**, Z

Number of Poles

02, 04, 06, **08**, 10, 12

Type of bearings

7

C : bushed bearings in oil
G : rolling element bearings lubricated by grease
H : rolling element bearings in oil

3.3.1.3 Protection concerning electrical equipment

Periodically check the insulation resistance of the stator winding, which must never be below 3000 Ohms per Volt of the operating voltage, increased by 1000 V.

Example:
- for a 5 kV motor = Insulation resistance 18 Megohms.
- for a 20 kV motor = Insulation resistance 63 Megohms.

These minimum values are valid for measurements taken at ambient temperature, between winding and ground, and between phases if the motor design so allows.

For wound rotor motors, retract the brushes or place a sheet of insulating material (mica or other) between the brushes and the rings; the insulating material must neither be porous or hygroscopic. The minimum insulation value at the wound rotor will depend on the rotor voltage, but must always be checked on the basis of 3000 Ohms per volt of the rotor voltage, increased by 1 000V.

Should the insulation resistances drop below the minimum values indicated, start by checking if the drop-in insulation is located at the insulators in the terminal boxes.

If an abnormal drop in insulation resistance is observed, the storage conditions must be modified to prevent the humidity from impacting the motor windings any further. This measure will reduce motor drying complications before commissioning. We recommend that you immediately proceed to fully dry the motor windings. This procedure is mandatory prior to commissioning. The recommended drying method is detailed in **paragraph *"4.5.1 Insulation resistance measurement and drying method"*.**

3.3.2 Storage instructions between 6 and 12 months (according IP806)

3.3.2.1 Storage condition

The following conditions concerning the storage area (only without taking into account the motor is packed or not) must be respected. The storage must be carry-out:

- in a ventilated and covered premises, in dry surrounding air, protected from dust, and from corrosive, explosive or gaseous atmosphere,

- not exposed to liquids (water, acid, oil, fuel and other),

- not exposed to major vibrations (floor of storeroom, frame or other), if the concrete base or the skid are not installed on vibration absorbers the motor itself has to be placed on such absorbers (ex: stringers made of restricted hygrometry wood -class C22 plate with class 3 pressure-sealed treatment- or buffers pads Grypsol type),

- within the temperatures range:
  minimum from -20°C without any tolerance,
  maximum to +40°C with tolerance (+10°C / -0°C),

- with a controlled rate of humidity < 70%. If this rate is increasing, a heating of the premises has to be ensured.

- the motor covered by a tarpaulin.

3.3.2.2 Conditioning and protection of the equipment

The motor space heater has to be switched on during storage.
The rotor has to be uncoupled from the driven machine.

The tool delivered with the motor for protection of the rotor during transport should be installed so far possible.

In case of failure of the pressurization unit of the machine, to avoid excessive pressure inside the machine, the air flow at the inlet of the pressurization unit must be limited to 125% of the purging flow or the air inlet pressure must be limited to 6 barg.

8

Concerning machine operating in dust atmosphere group III, the pressurized enclosure shall be cleaned as necessary to ensure there is no hazardous accumulation of combustible dust within the enclosure. After cleaning, the pressurized enclosure shall be filled with inert gas using the procedure specified. This step should be completed, in an area known to be non-hazardous.

4.4.2 "Enhanced safety" anti-spark motors

Check that the power supply cable ends are properly tightened on the connection strips provided for this purpose in the motor terminal boxes. If purging before start-up is required by the manufacturer, the purging flanges must be connected to the customer circuit provided for this purpose. The air used must be clean, dry and free of any oil, or flammable or explosive gas. The pressure, flow rate and purging time must be compliant with the data supplied by the manufacturer.

If a rotation sensor is to be used on the motor, it must be included in the motor start-up and protection chain with the timing corresponding to the contractual values.

4.5 ELECTRICAL RECOMMENDATIONS: ELECTRICAL CONNECTIONS

4.5.1 Insulation resistance measurement and drying method

Humidity is particularly harmful to correct operation of electrical motors.
Before powering up:

- check the insulation resistances of the stator windings with respect to ground.
- perform a bias index procedure.
- check the tightening torque (**paragraph "*7.2.3.1 Check of fastenings*"**) of all the power cable electrical connections on the HV and neutral terminals.

The insulation and bias index values of the machines must be entered in the insulation report.
When performing the insulation measurement, the auxiliaries must be connected to ground.
The measurement instrument must supply a measurement voltage consistent with the conditions indicated in the table below:

Motor voltage	Un< 1 000 V	1 000 V< Un <3 000 V	3 000 V < Un < 6 000 V	6 000 V< Un < 13 800 V	Un> 13 800 V
Applicable insulation measurement voltage	500 V	1 000 V	2 500 V	5 000 V	10 000 V

- Stator voltage > 2500 Volts

For these measurements, use a 2500 V megohmmeter (minimum).
To authorise start-up, the insulation resistance measured must be at least:

R=3 (1+U)

- R= insulation resistance in megohms
- U= nominal voltage in kV

- Stator voltage < 2500 Volts

Use a 500 V megohmmeter.
The insulation resistance must be at least 10 megohms.

7. MAINTENANCE

7.1 GENERAL RECOMMENDATIONS

The maintenance concept is aimed at reducing the probability of failure or damage to the motor under intensive use and under the environmental operating conditions at the site.

The various preventive maintenance actions must therefore be programmed to ensure:

- the operational availability of the motor in accordance with the functional requirements, at optimum cost efficiency,
- the operational safety of the motor, personnel and environment in observance of the applicable regulations,
- the forecast service life of the asynchronous machines.

Failure prevention must therefore be covered by a preventive maintenance task schedule defined in accordance with the various functionalities of the motor components and predefined criteria relative to their state of deterioration.

This section gives general recommendations aimed at maintaining the functional reliability of the motors. The maintenance actions recommended are not all-inclusive as each site will have its own special operating features. By intensifying and continuously developing maintenance and monitoring, enhanced motor reliability will be ensured.

We strongly recommend that you call on Power Conversion's expert services for assistance in isolating the causes of a malfunction and the procedures to be applied when a malfunction is observed. All work performed must be logged in a maintenance record; this work record will be useful to both the customer and the manufacturer.

WARNING

PROPER LOCKOUT/TAGOUT OF ENERGY SOURCES PRIOR TO MAINTENANCE PER SAFE SITE WORK PRACTICES IS THE END USERS RESPONSIBILITY.

9

CAUTION

- Ensuring the equipment is returned to proper condition after maintenance work is the end users responsibility.
- Allowing adequate cool-down time prior to performing maintenance is the end user's responsibility.

7.2 STRUCTURE OF RECOMMENDED MAINTENANCE ACTIONS

Unless otherwise specified by contract, a general inspection should be carried out at least two times per year (or after 4000 hours of operation).

7.2.1 Maintenance levels

As a general rule, we recommend that you set up, at the least, a maintenance program based on the following recommendations defined in accordance with the complexity of use of the operating unit in which the motor is integrated.

For induction motors, a maintenance concept with 3 levels is generally implemented.

8

Oil quality: ISO VG 100

	Kinematic viscosity in centiStokes at:			Dynamic viscosity in centiPoises at:	
	40°C	50°C	60°C	50°C	60°C
AGIP Ote 100	100		40		35.4
ARAL Degol CL 100	100	61		54	
B.P. Energol CS 100	96	67.6	38.55	59	33
CASTROL Perfecto T 100	96		38.3		32.3
CHEVRON Mechanism LPS 100	100		41		36
DEA Astron HL 100	100	59		51.4	
ELF Elfolna 100*	105		40.5		35.8
ESSO Teresso 100 Nuray 100	154 100	59	56	53	50
FUCHS Renolin 208 Renolin 104	105	63		54.7	
KLUBER LUBRICATION Crucolan 100	100	59		52	
MOBIL DTE 27 DTE Oil Heavy	100 94	48	53	50	47.2
SHELL Turbo T 100 Tellus oil C 100	100 100	62	40	53.3	35
TEXACO Regal R et O 100	99.5		39.39		33.6
TOTAL Azolla ZS 100	100		39		33.5

* This oil can be suitable for the bearings but it is not recommended by the bearing manufacturer.

9.3 SORTING AND RECLAMATION OF MATERIALS

Except for copper and aluminium, the various components used in the motor can be easily dismantled owing to the modular design of the motor construction by sub-assemblies.

9.3.1 Reclamation of cast iron and steel

The materials forming the frame, fans, covers and bearings can be dismantled and reclaimed by melting in a blast furnace in accordance with the approved recycling practices used in the metal production industry.

The steel in the magnetic circuits (stator and rotor) and shaft can only be recycled following complete extraction of the copper rotor bars and windings.

9.3.2 Reclamation of copper

Reclamation of the copper used in the electrical conductors of the stator and rotor in induction motors calls for extraction by skilled personnel qualified for cutting of metals.

The copper in the windings can only be extracted and separated from the electrical insulation components by a heat process at 380-420°C in a combustion oven lasting 5 minutes.

The combustion gases must be processed by a gas purification system with a residence time of at least 3 seconds at 850-920°C to reduce the toxic nature of the gas emissions.

This separation method must be stringently monitored in accordance with the regulations applicable to the incineration system.

9.3.3 Reclamation of aluminium

The aluminium tubes used in the motor heat exchangers must, in principle, be cut out or extracted for recycling through appropriate channels.

9.3.4 Reclamation of electronic components

The components forming part of the electrical and electronic instrumentation of the motors are compliant with the requirements of the European Directive covering electrical and electronic equipment waste DEEE 2002/96/CE. These components do not contain any dangerous substances as defined by the terms of directive RoHS 2002/95/CE. Sorting, selective processing, management and destruction of this waste must be carried out through the appropriate approved channels.

9.3.5 Reclamation of plastic

Certain plastic components used, in particular in the N3 motor (air guide, terminal box mounting plate), are made of polyester. This material can be reclaimed by grinding and integration in cement industry products.

9.3.6 Elimination of oils

Lubrication oils represent a hazardous waste for the environment; used lubrication oils must be stored and processed in compliance with all applicable regulations covering the elimination of this category of waste.

3. PRESCRIPTIONS OF EQUIPMENT CONDITIONING/PROTECTION

3.1 SPACE HEATER

The motor space heater has to be switched on during storage.

3.2 MOTOR ROTOR

- The rotor has to be uncoupled from the driven machine
- The tool delivered with the motor for protection of the rotor during transport should be installed so far possible.

3.3 ANTI-OXIDIZING PROTECTION

3.3.1 Shaft

Protect the shaft end using a chemical and mechanical encapsulation. To do that:
(so far the coupling hub is installed, it has to be included on the protection)

- **Dry clean** using a rag, the whole unpainted machining surfaces including cavities.
- **Apply**, under ambient temperature, using a brush a product **TECTYL 506 VALVOLINE type** (temperature resistance from -20°C to +200°C), on the whole unpainted machining surfaces including cavities.
- **Protect** the face of the shaft end with **a layer of 60 to 100 microns of intermediate or final paint**, after having properly removed any grease marks out from all surfaces to paint.
- **Protect** the cylinder of the shaft end with a plastic wrap.
- **Protect** the whole of the shaft sections with a product **Tectyl 506 Valvoline type**, including under instrumentation
  Ex.: **Earthing brushes**: Remove the earthing brush(es) from the shafting and temporarily protect the surface. Store the earthing brush(es) in the main terminals box.

NOTE The surface under shaft displacement instrumentation (ex.: Bently Nevada sensor) does not require additional protection.

- **Protect** keys with a product **TECTYL 506 VALVOLINE type**. **Pack** each key in oiled paper. **Put** the keys in a plastic bag and store it in the packing case provided with the motor.

7.00: Attachment / Travel systems

1 Schematic

Hydraulic valves

DBF	Distribution block for shovel flap cylinders
RC	Rotary connection
SBF	Summation block travel
SU1	Servo oil unit
SU2.x	Servo oil unit
VB1	Control valve block 1
VB2	Control valve block 2

Gears

GSF	Front swing gear
GSB	Rear swing gear
GTR	Right travel gear
GTL	Links travel gear

Hydraulic cylinders

CB1	Right boom cylinder
CB2	Left boom cylinder
CBT1	Bucket tilt cylinder
CBT2	Bucket tilt cylinder
CC1	Right crowd cylinder
CC2	Left crowd cylinder
CF1	Right shovel flap cylinder
CF2	Left shovel flap cylinder
CS1	Stick cylinder
CS2	Stick cylinder

Hydraulic pumps

P1	Working pump
P2	Working pump

Hydraulic motors

MF2	Oil fan motor
MSF	Front right swing motor
MSB	Rear right swing motor
MTR	Right travel motor
MTL	Left travel motor

Tanks

HT	Hydraulic tank
CP1L	Leak oil collecting pipe hydraulic tank
CP1R	Collecting pipe hydraulic tank
CP3	Collecting pipe
ETF	Front oil expansion tank
ETB	Back oil expansion tank

Filters

HF	Return hydraulic oil filter
LF	Leak oil filter
ROF	Replenishing oil filter
POF	Piloting oil filter
HPF	High pressure filter

Oil sample points

OSP1	Hydraulic oil sample point

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Y6	Solenoid valve travel brake	**YR110**	Reg. solenoid valve stick extended Reg. solenoid valve crowd drawn in
Y7	Solenoid valve swing brake	**YR111**	Reg. solenoid valve stick extended Reg. solenoid valve crowd drawn in
Y467	Solenoid valve travel left	**YR115**	Reg. solenoid valve stick drawn in Reg. solenoid valve crowd extended
Y468	Solenoid valve shovel tilted in	**YR116**	Reg. solenoid valve stick drawn in Reg. solenoid valve crowd extended
Y469	Solenoid valve shovel tilted out	**YR117**	Reg. solenoid valve stick drawn in Reg. solenoid valve crowd extended
Y470	Solenoid valve stick drawn in Solenoid valve crowd extended	**YR120**	Reg. solenoid valve shovel tilted out
Y471	Solenoid valve travel right	**YR121**	Reg. solenoid valve shovel tilted out
Y472	Solenoid valve stick extended Solenoid valve crowd drawn in	**YR125**	Reg. solenoid valve shovel tilted in
Y473	Solenoid valve boom extended	**YR126**	Reg. solenoid valve shovel tilted in
Y474	Solenoid valve boom drawn in	**YR127**	Reg. solenoid valve shovel tilted in
Y475	Solenoid valve shovel flap	**YR130**	Reg. solenoid valve shovel flap closed
YR4	Solenoid valve LR	**YR132**	Reg. solenoid valve shovel flap opened
YR100	Reg. solenoid valve boom extended	**YR139**	Reg. solenoid valve boom drawn in

4.3 Functions of regulator

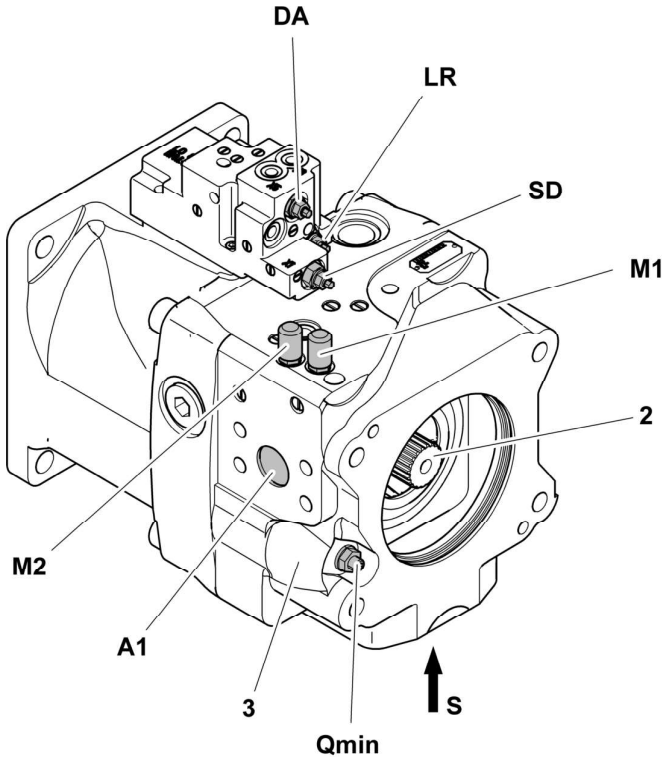

Fig. 30 *Test and adjustment points of working pumps*

2	Pump gear	**M1**	High pressure measurement
3	Positioning piston	**M2**	Working pressure measurement
A1	Working pressure	**Qmin**	Mechanical stop - flow min
DA	Pressure cut-off regulator	**S**	Suction port
LR	Power regulator	**SD**	Flow control valve

4.3.1 Pressure cut-off (DA)

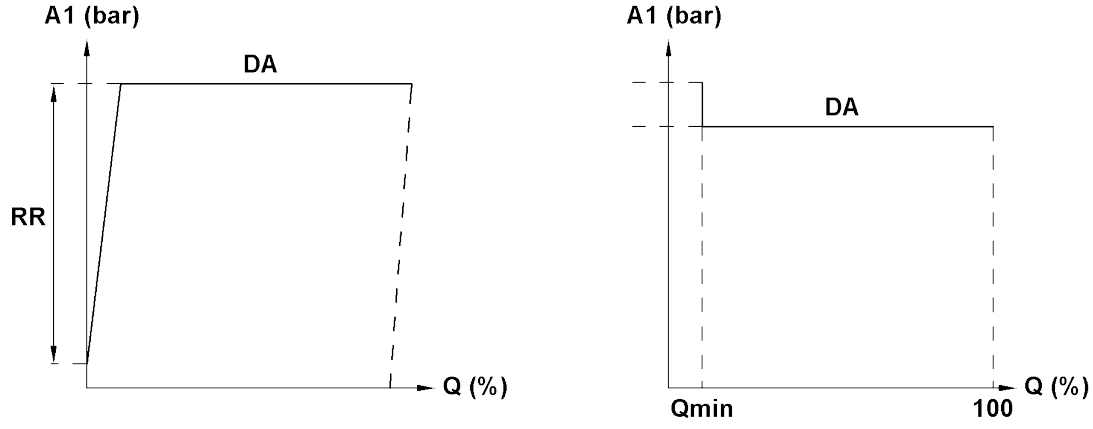

Fig. 31 *DA characteristic curve*

A1	Working pressure	**Q**	Displacement volume

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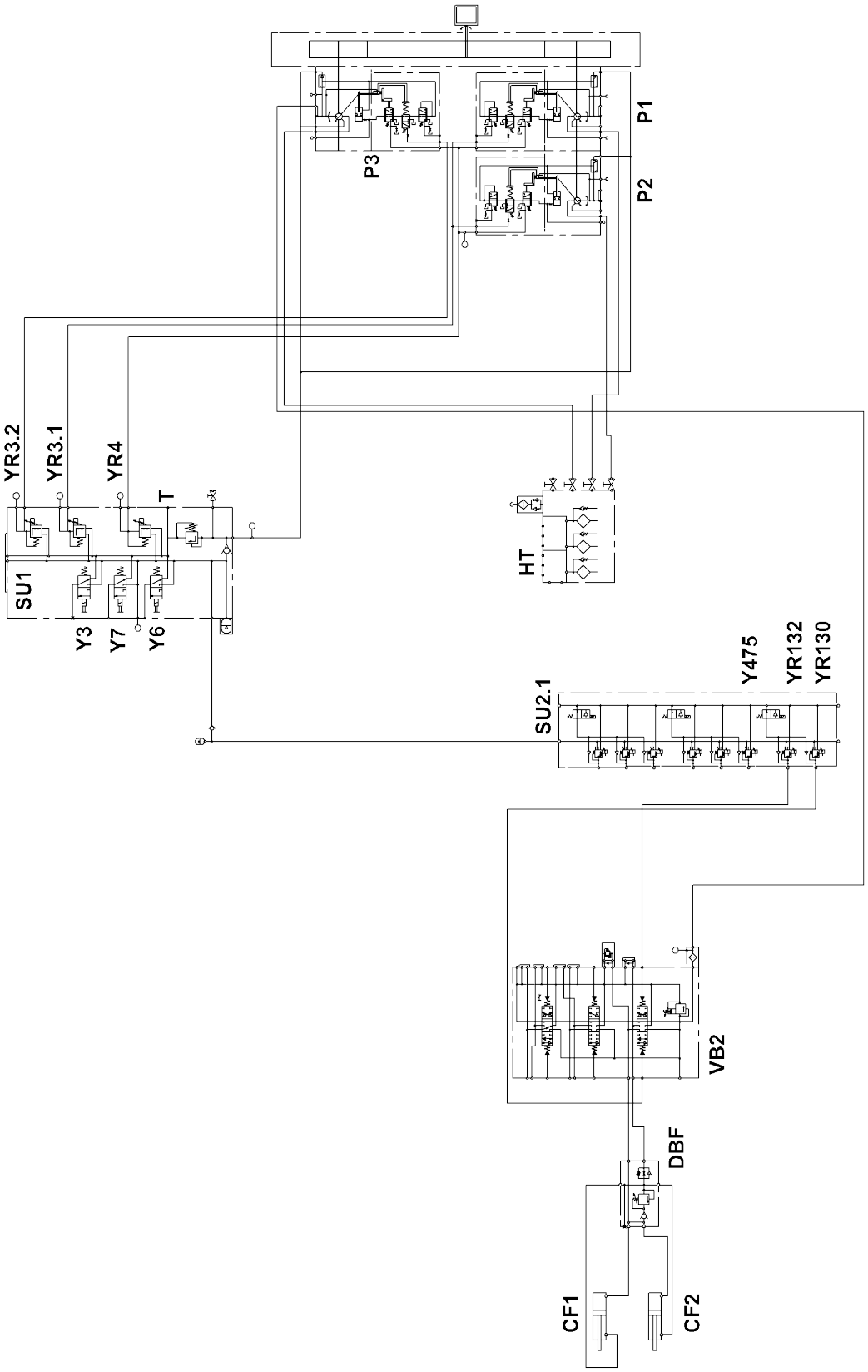

Fig. 43 *Hydraulic scheme of shovel flap cylinders*

8 Adjustment

▶ For adjustment instructions, refer to the section "Adjustment procedure R 9150 E" in chapter 3 "Technical Data" of this manual.

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When a storing period longer than one year is requested, cylinders will be delivered with an oil filling of above mentioned quality.

However, the storing instructions as under paragraph 3 are prerequisites for any period.

In case the cylinders are meant to be stored for more than 2 years it is highly recommended to consult the manufacturer.

Sealing:

The anti-corrosion-protection is only effective when airtight closing of all ports is ensured: Four-bolt flanges are sealed with a synthetic plug retained by a metal plate; pipe- and thread connections are plugged with synthetic couplings or plug caps.

Cylinders, which cannot be, emptied completely (e.g. cylinders with hollow rods) and oil-filled cylinders (such as tele rams) will be plugged-off oiltight using plug screws with integrated seal rings for female threads and plug caps with spigot nuts for threaded pipe ends.

Surface protection:

External surfaces such as flange surfaces, bearings, untreated cylinder barrels and also the exposed rod end section, in case the rod has no other corrosion protection, are all treated with ARAL Resilan WA or ESSO Rustban 397.

In addition, when plunger cylinders are concerned, the plunger rod, its guiding parts and cylinder bore interior surface are treated with an anti-corrosion-protective. All hydraulic cylinders will be dispatched coated with a proven versatile primer, if not otherwise specified by the client.

Transportation

- In preparation for transportation the hydraulic cylinders must be handled and packaged carefully. Any kind of impact, including bumping against each other must be avoided by using adequate handling auxiliaries and methods and also suitable packaging materials.
- Rods are to be secured adequately against self-extending.
- All ports are to be plugged (acc. to 1.2).
- Whenever rods project out of the cylinder like on twin-rod-cylinders, the projecting rod end must be protected against any damage by using appropriate packaging materials. Any contact with acids, which may ham the chromium plating, must be strictly avoided.

Storage

- Upon delivery the customer should check for any damage resulting from transportation. Damaged plugs are to be renewed and damaged coating is to be touched-up, immediately.
- Hydraulic cylinders should only be stored in a dry, dust- and steam-free room at a constant temperature ranging between 10 and 20°C.
- After the first year of storage the cylinders should be rotated (about 90°) in order to shift possible air bubbles and simultaneously re-oil these dried zones.

Installation

- In case hydraulic cylinders have been stored for longer than 2 years, the manufacturer should be contacted, because for some types it may be necessary to replace the seal kit prior to installation.
- In general, hydraulic cylinders may be installed in any desired position.
- In order to prevent premature wear or operational disturbances the hydraulic cylinders are to be installed tension-free and without lateral forces acting.
- Before connecting the hydraulic cylinders to the system all lines should be thoroughly flushed using suitable cleansing agents in order to remove any possible deposits.
- External preservatives are to be removed using benzine or petroleum ether.

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9.10 Joystick and pedal transmitters

9.10.1 Left joystick U21

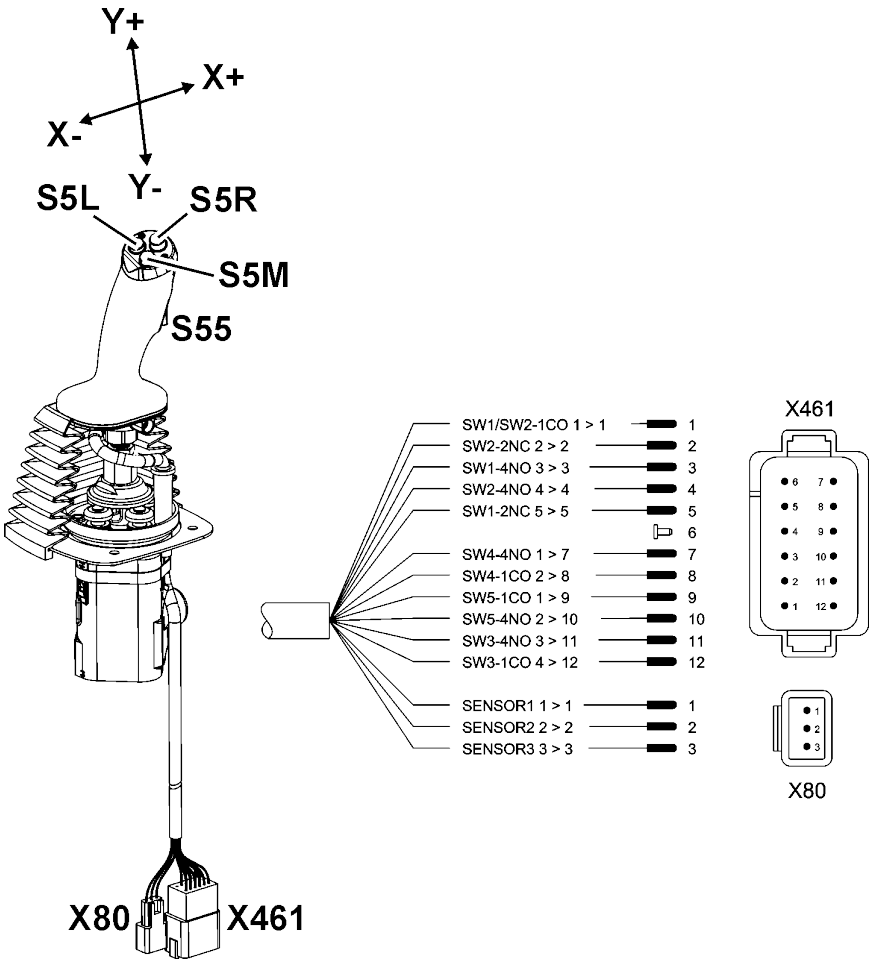

Fig. 62 *Left joystick*

	Type	Ident.
Joystick	ST-WE-XY-CAN / TA / 85 / FL100L	10061516

Pin on control unit	Signal	Element / connector-pin
1	+24V F74	KL15 - A1002 / X054
2	0V	A1002 / X054
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-

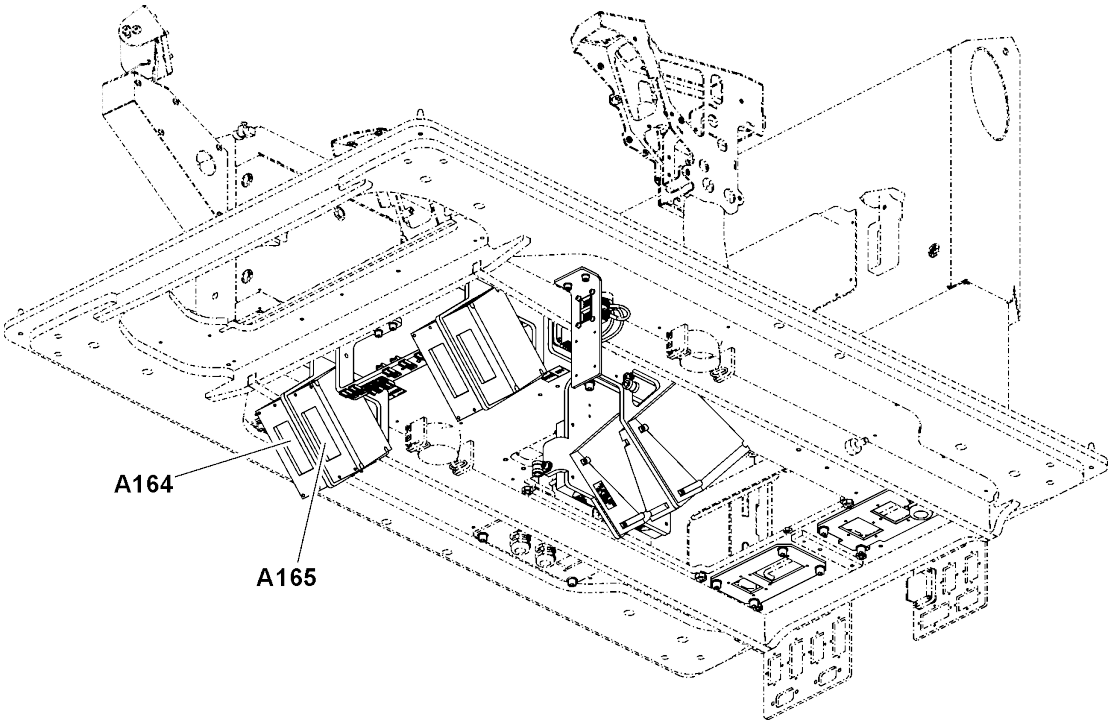

Fig. 3 *Input modules **A164** and **A165***

Chapter 9 - Cooling system

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Situation for intermediate temperature

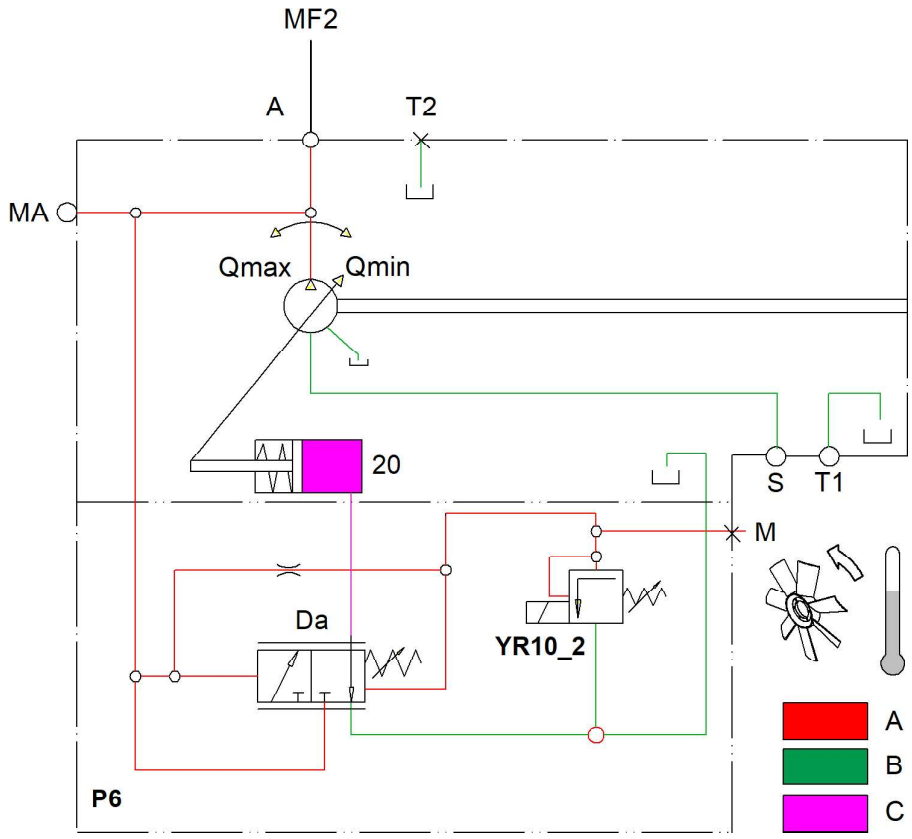

Fig. 10 *Pump regulation in intermediate situation*

20	Control piston	**A**	High pressure (**Hd**)
P6	Pump	**B**	Tank pressure (**T**)
Y10_2	Pump regulator	**C**	Regulation pressure (**Preg**)

- When the temperature of the machine increases, the current on **YR10_2** increases and **YR10_2** opens partially.
- **YR10_2** acts as a throttle on the pilot pressure. The positioning pressure applied on regulator **Da** side increases.
- The spring partially pushes the regulator **Da** to the left. The pressure applied on the bottom side of the control piston **20** decreases. So the piston moves to the right.
- The pump swivels out to a greater angle. The fans speed increases until a new balance with the temperature is got.
- The fan speed is intermediate.

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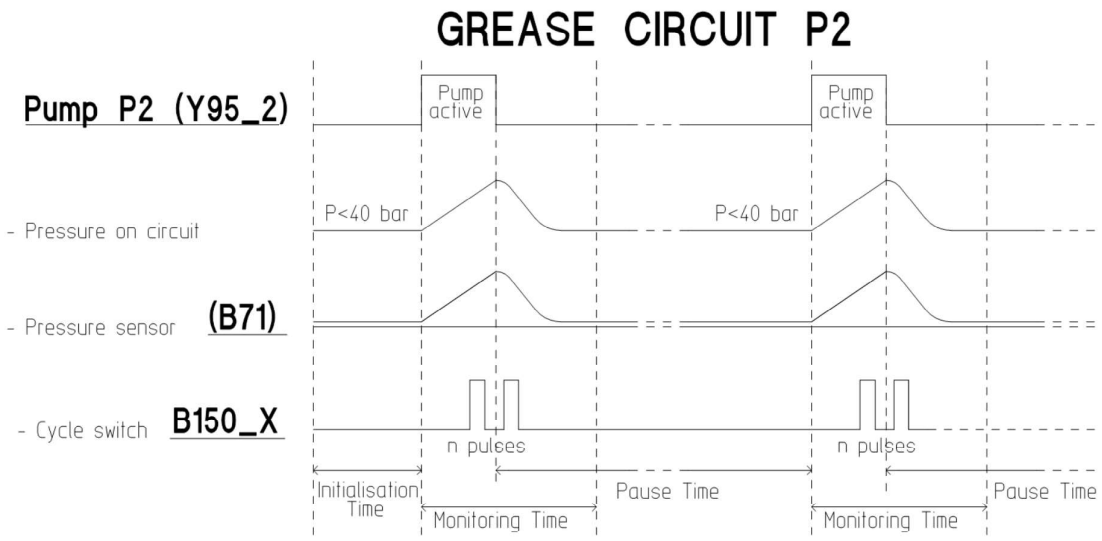
Nr.	Function	Components	Input	Output	Description	Note
2	Display Err_3	Error code		Type 3	CPU monitoring - no signal corresp-sonds to an error	Current 1A
3	Display Err_2	Error code		Type 3	Barrel 1 or 2 low level - signal corre-sponds to an error	Current 1A
4	Display Err_1	Error code		Type 3	Malfunction - signal corresponds to an error	Current 1A
5	Winter operation	S177	Type 2		Input 24V electric	Current 1A
6	Alarm 2	H38		Type 1	Control lamp	Current 2A
7	Alarm 1	H109		Type 2	Blinking lamp	Current 5A
8	Ground	KI31			Supply ground electronic	
9	Ground	KI31			Supply ground electronic	
10	Enable		Type 2		Input 24V electronic	
11	24 volt	KI15			Supply 24V electronic	
12	24 volt	KI15			Supply 24V electronic	

Connector X113 assignment

Nr.	Function	Components	Input	Output	Description	Note
1	Display Err_1	Error code		Type 1	Malfunction - signal corresponds to an error	Current 2A
2	Motor P3	M21		Type 1	Motor	Current 5A
3	Winter operation P3	Y97		Type 1	Servo valve	Current 2A
4	Pump P3	Y93		Type 1	Servo valve	Current 2A
5	Switching P2	Y82		Type 1	Servo valve	Current 2A
6	Switching P1/ P2	Y83		Type 1	Servo valve	Current 2A
7	Switching P1	Y80		Type 1	Servo valve	Current 2A
8	Pressure dump P2	Y81		Type 1	Servo valve	Current 2A
9	Pump P2	Y95_2		Type 1	Servo valve	Current 2A
10	Winter operation	Y114		Type 1	Servo valve	Current 2A
11	Pressure dump P1	Y79		Type 1	Servo valve	Current 2A

LEC / en / Edition: 06 / 2017



At the end of the initialization time or after pause time, the system begins a new lubrication cycle. The solenoid valve Y95_1 [Y95_2] starts the pump P1 [P2]. The dump valve causes a blockage of the coming back of the barrel. Thus the pressure increases in the circuit.

When you get the cut-off pressure (maximum value), the working phase stops. At this time, the pump is off and the pause time starts. If the working phase is unsatisfactory, the control unit stays in normal mode but operates the error case marking. If this occurs 3 times one after the other, then the module switches in the safety mode.

If you don't get the cut-off pressure at the end of monitoring time, an error code shows.

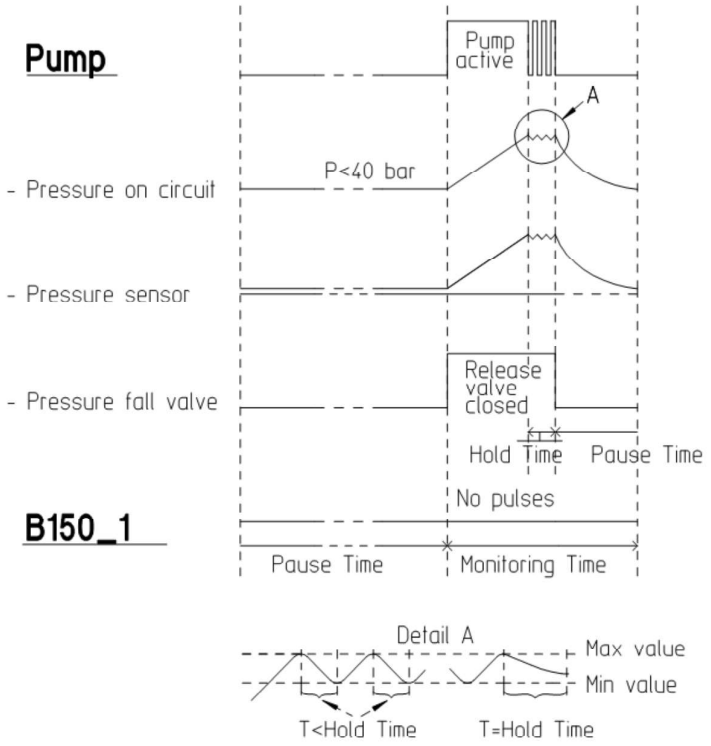
If the B150 X pulses back are not sufficient at the end of monitoring time, an error code shows.

If the pressure is more than 40 bar until the end of the pause time, an error code shows.

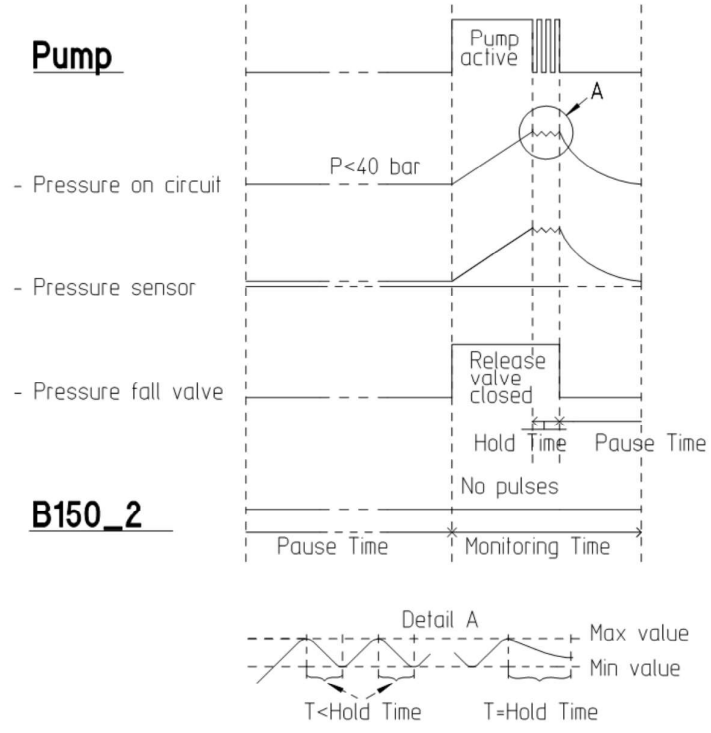
Pump P1 - 1P/execution ≥ 2 hold Time

This process is related to the configuration 1 pump in execution ≥ 2 with function winter operation off.

Grease circuit P1/P2 - error G37



Grease circuit P1/P2 - error G38



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Service Manual

Centralized Lubrication Systems

R9150

Product identification

Manufacturer: SKF Lubrication Systems Germany GmbH

Type: R9150

Type no.: 1133

Address

Heinrich-Hertz-Str. 2-8

69190 Walldorf - Germany

LEC / en / Edition: 09/2018

If the work is not carried out by the manufacturer, the repairs must be approved by a named expert and confirmed in writing. The repairs are to be marked by a repair sign on the machine, stating the following:

- Date
- Executing company
- Type of repair
- If applicable, expert's code

- Transport damages can result in the loss of the explosion protection. If transport damages can be seen, do not assemble the machine or put it into operation
- All parts of the earthing concept must be correctly available and connected with the superordinate machine.
- If transport lugs are dismantled after set-up, the threaded bores must be permanently sealed in accordance with the protection class.
- Handle the materials so that no sparks are generated by tilting, falling, sliding, rubbing, impacting, etc. If needed, cover materials with suitable means.
- Never disconnect plug-in connections when energized. Secure plug-in connections against inadvertent manual disconnection with the safety clips included in the delivery.
- The operator must check critically whether operation without a low-level signal might lead to a new risk potential (e.g. through heat-up of bearing points on the machine in the area of ignition temperature, poor lubrication or bearing damage). If this cannot be ascertained, provide a low-level signal or suitable organisational measures for monitoring of the bearing point temperature.
- Avoid dust accumulation and remove dust immediately. Dust accumulations have a thermally insulating effect and, if whirled up, generate the formation of a potentially explosive atmosphere.
- The pump should be integrated into the operator's lightning protection concept.
- All parts are to be checked regularly for corrosion. Replace the affected parts.
- Terminal boxes must be firmly closed and the cable breakthroughs correctly sealed.
- Additional electrical monitoring devices must be firmly connected and correctly adjusted.
- Protect the motor with a motor circuit breaker against inadmissible heating up. When reaching their nominal life, the motor bearings have to be replaced or inspected to ensure their suitability for further utilisation.

3.3 Transport / installation / maintenance / repairs / servicing

- All relevant persons (e.g., operating personnel, supervisors) must be informed of the respective activity prior to starting any work. Observe the precautionary operational measures and work instructions.
- If protective and safety equipment has to be dismantled, it must be reassembled immediately after finishing the work, and then checked for correct function.
- Ensure through suitable measures that movable or detached parts are immobilized during the work and that no limbs can be caught in between by inadvertent movements.
- Carry out transport using only suitable hoisting equipment.
- If transported separately (e. g. repair) lift the motor by means of the transport lugs or eye bolts. Ensure that transport lugs or eye bolts are firmly seated. Do not carry any further load on the transport lugs or eye bolts. Do not transport motors on the fan cover.

Single-line system

The single-line system consists of a pump to supply lubricant under pressure to the injector metering devices via the supply line. The injector metering devices deliver lubricant to a secondary (progressive) metering device or to the bearing through feed lines.

The lubrication cycle is initiated by an automated pump. The injectors have indicator stems, which move in and out to indicate that they have been cycled.

A controller will control the automated system.

The time between on cycles and the length of off cycles is adjustable. The controller includes the timer function above with a monitor function and alarm capability. A pressure switch is used to indicate when system pressure has been reached to turn off the pump and verify that a lube cycle has been completed. If the pressure switch does not detect full pressure within a preset period of time, the controller goes into alarm state.

If level II (for cold weather) is applied: the solenoid valve (Y79) allows to hold the pressure in the grease system, even if the pump has already stopped.

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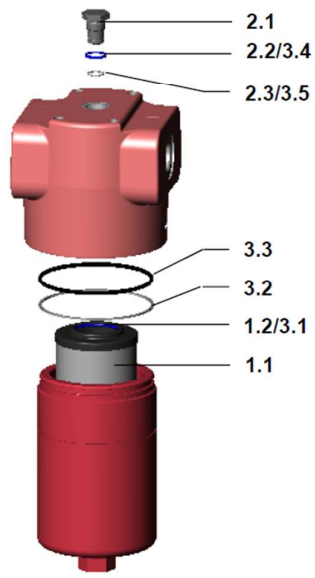
13.5 Lubricant filter (refilling)



DF-Filter for low temperature application
Operating temperature: -40°C up to +100°C
Storage temperature: -50°C

Changing the element

Removing
1. Switch off hydraulic system and release filter pressure.
2. Remove oil drain plug (if present). Drain lubricant into a suitable container.
3. Unscrew bowl (collect fluid in a suitable container and clean or dispose of it in accordance with environmental regulations).
4. Remove filter element from element location spigot (examine surface of element for dirt residue and larger particles; these can indicate damage to the components).
5. Replace or clean filter element.
6. Clean filter bowl and head, paying particular attention to the screw threads.
7. Examine filter, especially sealing surfaces and thread, for damage.
8. Check O-rings and replace parts if necessary.

Fitting
1. Moisten sealing surfaces and thread, and the O-rings with clean operating fluid.
2. When fitting a new element, check that the designation corresponds to that of the old element.
3. Place filter element carefully onto the element location spigot in the filter head. Screw in filter bowl fully.
4. Screw in oil drain plug (if present).
5. Unscrew filter bowl or end-cap by one quarter-turn.
6. Switch on hydraulic system and vent filter at an appropriate point in the system.
7. Check filter for leakage.

Fig. 18 Lubricant filter (refilling)

Group	Item	Consist of	Designation	Characteristics
Filter element 10002507	1.		Filter element 0240 D 200 T	
		1.1	Filter element	200µ
Repair Kit 10443790		1.2	O-ring	34 x 3
	2.		Air vent screw PLF / PFM / EDF 1.4571	
		2.1	Screw	
		2.2	O-ring VD	18 x 2
		2.3	O-ring VD	15 x 1,5
	3.		Repair kit-E DF …. 160 G 1.0	
		3.1	O-ring element	34 x 3
		3.2	Back-up ring DF … 160	DF … 16
		3.3	O-ring bowl	78,75 x 5,33
		3.4	O-ring VD-indicator	18 x 2
		3.5	O-ring VD-indicator	15 1,5

Note!

Contamination or incomplete pressure release on disassembly can lead to seizing of the bowl thread. Filter elements which cannot be cleaned must be disposed of in accordance with environmental regulations.

For more details refer to SP-List Filter 528-32616-1 and User Info 528-32616-1 (-40°).pdf.

Description

Progressive Metering Devices Model SSV, SSV-E and SSV M

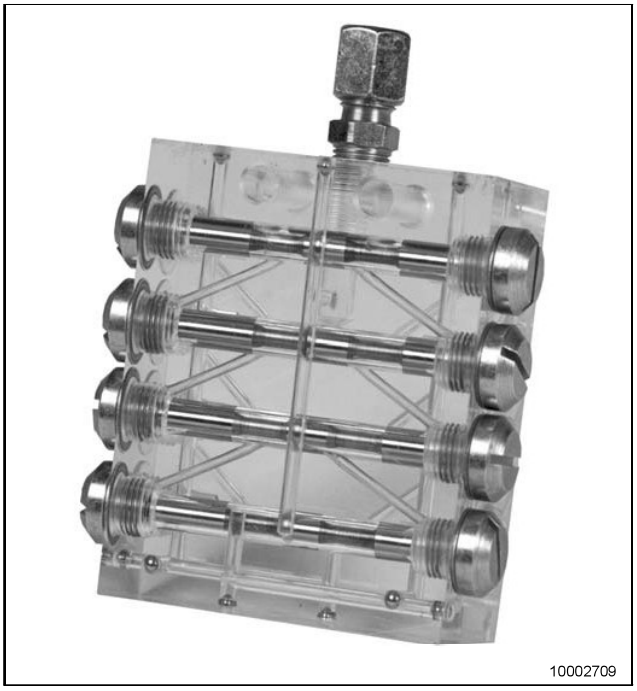


Fig. 9 Metering device type SSV 8

Progressive plunger metering devices - general

- The progressive metering devices
  - are piston-operated metering devices;
  - automatically (progressively) dispense the lubricant fed by the pump to the connected lubrication points;
  - **model SSV or SSV-E** have a **lubricant output of 0.2 ccm** per outlet and piston stroke;
  - **model SSV M** have a **lubricant output of 0.07 ccm** per outlet and piston stroke;
  - when one or more outlets are closed (see "Combining outlets") they can dispense a double or multiple lubricant quantity**;**
  - are available with 6 to 12 outlets or up to 22 outlets;
  - offer the option of combining several lubrication points into one centralized lubrication point.
  - meter the supplied lubricant into predetermined single quantities.
  - can be monitored visually (SSV, SSV-E and SSV M) or electronically (SSV and SSV-E).
  - in the SSV-E version include an emergency lubrication fitting.
- Any blockage in a lubrication circuit is indicated by grease leaking from the respective pressure relief valve.

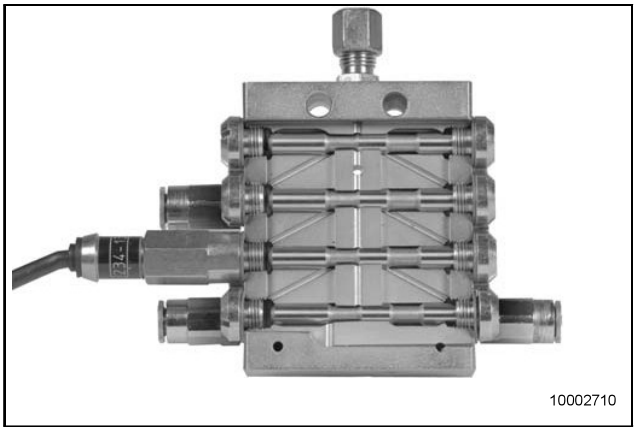


Fig. 10 SSV 8 with piston detector

Features of a Progressive Metering Device

- The term "progressive**" refers to the special features of the lubricant distribution within the metering devices, e.g.**
  - the successive movements of the individual pistons within the metering device due to the supplied lubricant being under pressure;
  - the pistons move in a predetermined order and the cycles are repeated constantly;
  - each piston must have completed its movement fully before the next piston can be moved, no matter whether the lubricant is dispensed continuously or intermittently;
  - the pistons operate interdependently of one another;
  - no lubrication point, which is connected to the system, is omitted.

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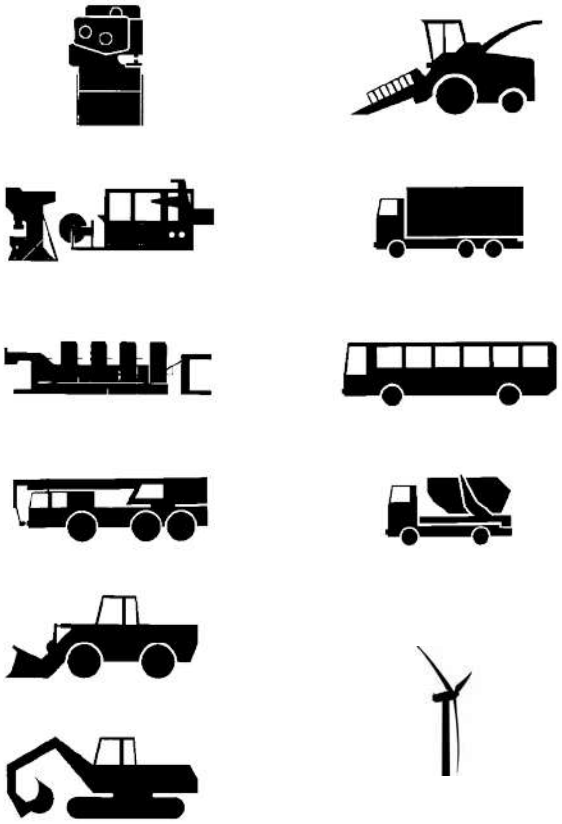
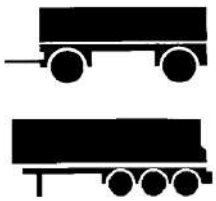
Fields of Applications of the Quicklub Progressive Central Lubrication Pumps

Industry - Machines - Commercial Vehicles - Building Machinery - Agricultural Machines - Wind Energy Plants	Pump Types
	**Pump** Quicklub 203 **Reservoir** 2 l -2XN[2],2XNFL[2], 2YN[3], 2XNBO[1], 2YNBO[3] 4 l -4XNBO[1], 4YNBO[3], 4XN[2], 4XL[2] 8 l - 8XNBO[1], 8YNBO[3], 8XN[2], 8XL[2] 15 l- 15XN[1], 15XL[1], 15XBF[2] [1] Filling from the top or bottom [2] Filling only from the bottom [3] Filling only from the top 4l, 8l with lockable reservoir lid (option) **Low-level control (option) possible with all reservoir sizes** **Control** Without control unit for 12/24 VDC or 230 VAC Integrated control units (V10-V13)[4] for 12/24 VDC Integrated control units (V10-V13)[4] for 230 VAC Integrated control units with metering device monitoring (M 08 - M 23)[4] External control units PSG 01 (Commercial vehicles) PSG 02 (Industry) PSG E2 (Industry & Commercial vehicles)
	**Control** H[4]
	**Control** V10 - ADR[4]
	**Control** H - ADR[4]

[4] See the respective model designation on the pump nameplate e.g. P203-2XN-1K6-24-1A1.10-**V10**

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Maintenance, Repair and Tests, continuation

Repair

Pump

- Use only original spare parts for repair on the pumps.
- The pump should be returned to the factory for warranty work or major repairs.

Replace pump element

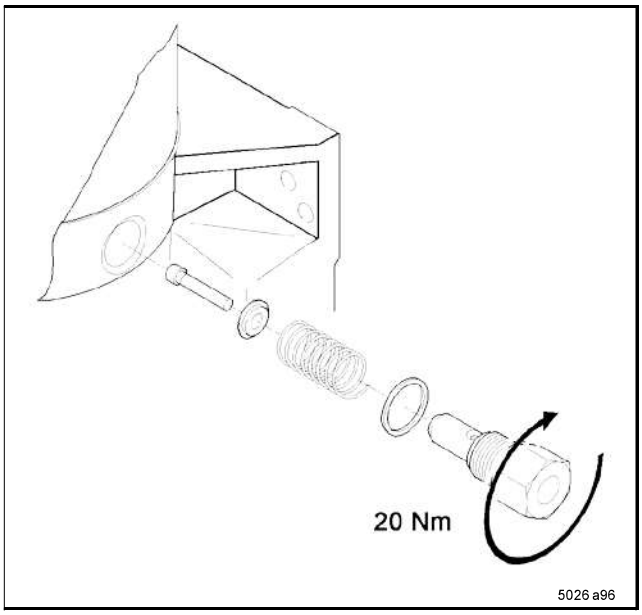

Fig. 9-3 Replace pump element

➲ Remove the the connection parts from the pump element.

➲ Unscrew the pump element.

600 1a02

IMPORTANT

Take care that the piston, the pull-back spring and the washer are not left lying in the grease. If these parts remain in the lubricant, the motor may seize. In the case of a later removal of the parts, the reservoir will have to be disassembled.

NOTE

Pump elements with adjustable lubricant output are to be set to the required output before installation.

➲ Install a new pump element with a new sealing ring.

Tests

Operational Test /
Triggering an Additional Lubrication

- To check the pump operation it is possible to perform an additional test (see User Manual of the external or internal control unit).

Check the Pressure Relief Valve

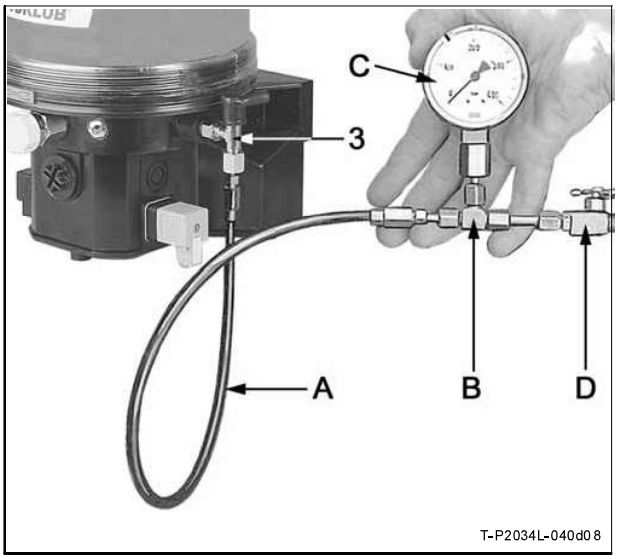

Fig. 9-4 Check the pressure relief valve

3 - Pressure relief valve
A - Hose line, min. length 1m
B - T-piece
C - Pressure gauge (0-600 bar / 0-8708 psi)
D Relief cock

1st option

➲ Connect the pressure gauge C (0-600 bar; 0-8708 psi) to the pressure relief valve 3 (see Fig. 9-4).

6001 a02

IMPORTANT

Do not connect the pressure gauge directly to the pump element 3. Use a hose line A of min. 1 m length. High pressure may exceed the above-mentioned range, causing the motor to stall The motor is designed in such a way that it can stall for about 30 minutes without being damaged.

➲ Trigger an additional lubrication.

2nd option

➲ Connect the manual pump of the pressure and checking set 604-36879-1 to the pressure relief valve and check the opening pressure by means of the manual pump.

➲ The pressure relief valve should open at a pressure of 200, 270 or 350 bar depending on its design.

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Table of Contents

Further information can be found in the following manuals:

Technical Description Pump Model 203
Technical Description Progressive Metering Devices for Grease and Oil, model SSV
Technical Description for “Electronic Control Units” of the 203 pump
Printed Circuit Board 236-13891-1 – Model V10-V13
Printed Circuit Board 236-13857-1 – Model H
Printed Circuit Board 236-13870-2 – Model M16-M23
Timer 236-13860-2 – Model PSG02
Installation Instructions
Parts Catalog

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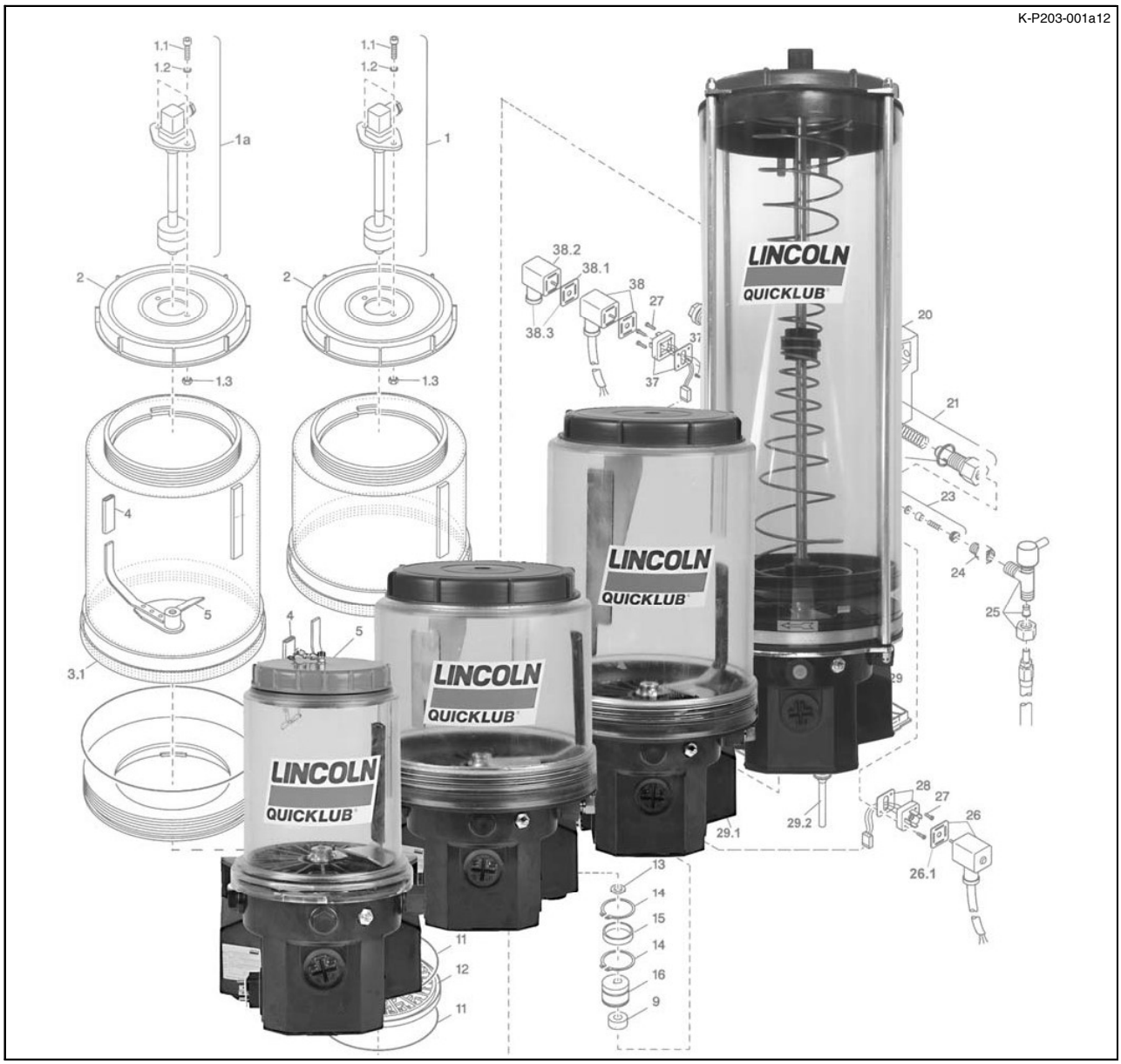
2.0EN-20003-I13

Components of the Quicklub Centralized Lubrication Pumps 203

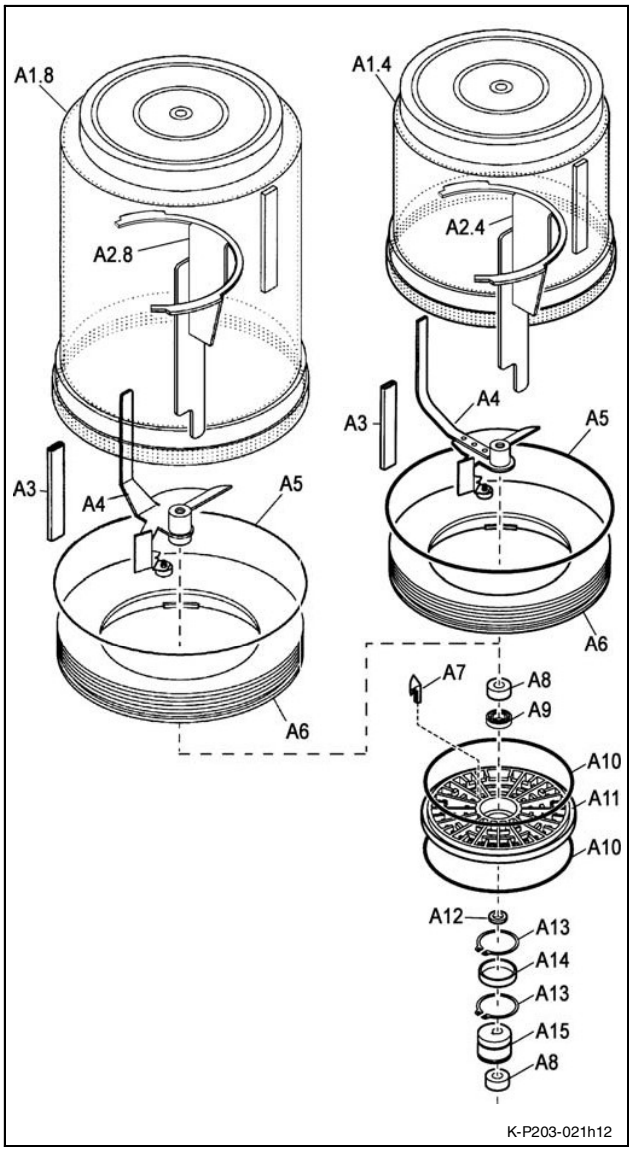


Subject to modifications

A … with 4 l or 8 l reservoir for grease A

P203- & P223/233- & P243-4XL or -8XL … with low-level control [1]

- 4 l or 8 l reservoir, closed
- with stirring paddle
- Control: without [2], V10-13 [2], V20-23 [2], MF/MDF01 [3], MF/MDF02 [4], MD20/21 [5] [6]
- Type of connection: 2A1.01/10 [2], 1A7.16 [2], 2A5.14 [3], 2A6.15 [4], 2A2.01 [5], 2A7.16 [6]



Pos.	Designation	Qty.	Part no.
A	**Reservoir assembly**		
A1	Reservoir	1	
A1.4	- 4 litres		544-32695-1
A1.8	- 8 litres		544-32696-1
A2	Fixed paddle	1	
A2.4	- for 4 l reservoir		444-70490-1
A2.8	- for 8 l reservoir		444-70491-1
A3	Hose 10 cm	1	111-35089-2
A4	Stirring paddle incl. pos. A3	1	544-33314-1
A5	O-ring Ø 210 x 5	1	219-13730-9
A6	Adapter ring	1	444-24235-1
A7	Control cam	1	444-24212-1
A8	Inner ring	2	444-24168-1
A9	Grooved ball bearing D 10 / 26 x 8	1	250-14009-7
A10	O-ring Ø 142 x 4	2	219-13730-7
A11	Intermediate bottom	1	444-24167-1
A12	Shim 10 x 16 x 0.5	1	209-13047-5
A13	Snap ring SW 32	2	211-14100-1
A14	Pressure ring Ø 33 x 37 x 13	1	444-24439-1
A15	Eccentric	1	444-24170-2

1) Low-level control only with magentic switch (pos. B)
2) for P203
3) for P223/233, PCB terminals 15 + 30 bridged
4) for P223/233, PCB terminals15 + 30 not bridged
5) for P243 wiht M12 plug
6) for P243 with bayonet plug

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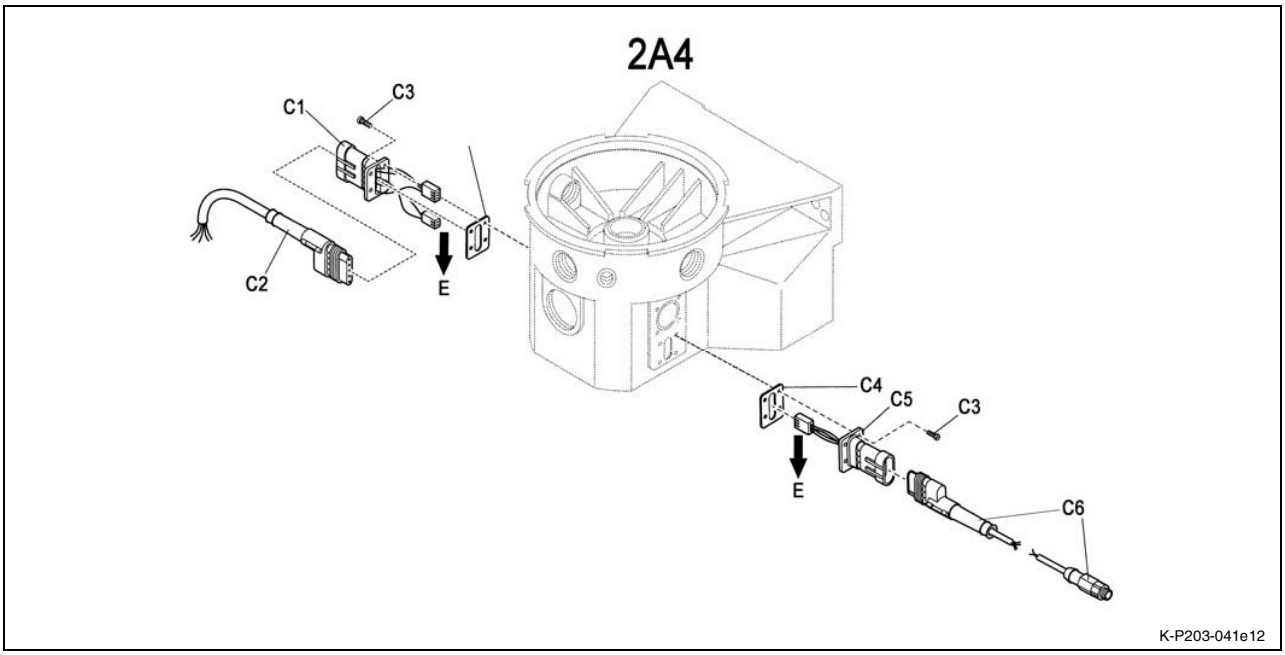
C … with AMP plug DC C

Type of connection …-2A4.12/13 with control p.c.b. M00-23 (only available as spare part)



Pos.	Designation	Qty.	Part no.
C	**Type of connection 2A4.12[1)]/13[2)]**		
C1	AMP flanged plug, 5-pole [3)]	1	664-36884-2
C2	AMP connection cable	1	
[1)]	- 4-core		664-36844-8
[2)]	- 5-core		664-36884-8
C3	Screw BZ 3 x 10 C	8	206-13796-6
C4	Flat packing 35 x 27 x 1	2	306-19562-1

Pos.	Designation	Qty.	Part no.
C5	AMP flanged plug, 4-pole [3)]	1	664-36884-1
C6	AMP connection cable	1	
	- incl. piston detector		234-13178-2

[1)] for control p.c.b. M00-07
[2)] for control p.c.b. M08-23

2A4	left for power supply DC **E** and for external signal exchange **E**
	right for signal exchange between piston detector C6 and **E**
E	- see chapter **… with control unit** (M00-23)

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Setting pump manifold pressure and flow controls

Notice
Pressure must be adjusted to make sure the desired flow setting is achieved. Refer to **fig. 6** that depicts the location of the valves.

Pressure control valve adjustment

1 With hydraulic pressure applied, stop the pump by turning the flow regulator (**69**) clockwise until completely closed.
2 Remove the hex head cap from the pressure reducing valve (**70**).

Notice
The adjustment screw will unscrew until it reaches the stop. It will not come off. This is the minimum pressure setting, which is about 100 psi *(6 bar)*.

3 Turn the hex head adjustment screw counterclockwise until it no longer turns.

Notice
A pressure of 320 psi *(22 bar)* is recommended. Do not exceed 400 psi *(27 bar)*. Damage to equipment may occur.

4 With the pump (**37**) stalled against pressure, turn the pressure reducing valve (**70**) hex head clockwise until the desired pressure is reached on the manifold pressure gauge (**64**).
5 Install and tighten the pressure reducing valve (**70**) hex head by turning the lock nut clockwise.

Flow control valve adjustment

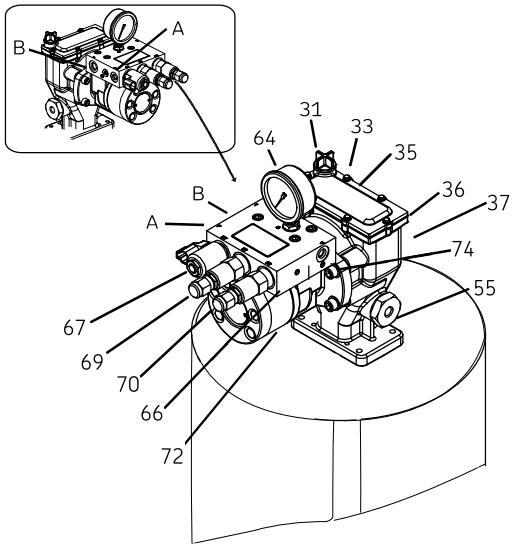
1 Loosen the hex head cap and remove from the flow regulator (**69**).
2 Using a hex head wrench, adjust the flow by turning the hex head screw clockwise to reduce the flow and counterclockwise to increase it.
3 Once flow rate is at the desired level, install and tighten the hex head cap on the flow regulator (**69**). See **fig. 6**.

Notice
Flow control valve can be turned in until valve is completely closed and out to adjust pump speed.Recommended flow control valve setting is four to five turns counter clockwise.

Crankcase oil service interval

- Check the oil level after every 750 hours of machine operation, or monthly.
- Change the oil after every 2,000 hours of machine operation or every year.
- Use SAE 10W30 motor oil in all units used in an ambient temperature between –40 to 150 °F *(–40 to 65 °C)*. For ambient temperatures between 50 to 70 °F *(10 to 21 °C)* , use Mobil Aero HFA low temperature oil.
- Oil level should be at indicating dot on dipstick (middle of crankshaft).
- Use 10W30 motor oil 15 oz. *(0,44 l)*.

Fig. 6



Call out	Nomenclature
A	Hydraulic fluid inlet port SAE 4 ORB
B	Hydraulic fluid return to tank
55	Lube outlet 1/4 NPTF
64	Pressure gauge
69	Flow regulator
67	Solenoid valve
70	Pressure reducing valve
72	Hydraulic motor

Model 84980 Hydraulic Vent Valve Assembly

This procedure should be performed if any of the following conditions are occuring:

1) The pump is running excessively.
2) The pump is not developing the proper pressure.
3) The system pressure is not venting or relieving.
4) Hydraulic fluid is leaking from the weep hole of the 241807 vent valve cylinder.
5) The lubricant being pumped is leaking from the weep hole in the 241807 vent valve cylinder.

Cleaning and/or Repairing Instructions

1) Turn off and disconnect the hydraulic supply to the pump assembly.
2) Standard tools required are a set of open end wrenches ranging from 7/16" to 1 1/2", a large open 24" adjustable wrench, a smaller 10" adjustable wrench and a bench mounted vice.
3) Remove the delivery hose, vent hose, hydraulic supply hose and all mounting hardware and remove the vent valve assembly from the pump.
4) Hold the 239336 Valve body in a bench vice by the flats that are machined on the base of the valve body.
5) Remove the 241807 Cylinder. Remove the 244673 Piston & U-Cup Assembly from the 241807 Cylinder. If hydraulic fluid is leaking from the weep hole in the 241807 Cylinder (see condition 4 above), replace the 244673 Piston & U-Cup, reassemble the Vent Valve and reconnect to the pump assembly, or continue as follows:
6) Remove 239330 Packing Assembly. If the lubricant being dispensed is leaking from the weep hole in the 241807 Cylinder (see condition 5 above), replace this packing assembly, reassemble the Vent Valve and reconnect to the pump assembly, or continue as follows:
7) Inspect 14722 Needle and 14723 Valve seat. If foreign matter is lodged in the area and is keeping the needle from sealing in the valve seat, clean thoroughly using mineral spirits or oleum and inspect for damage. If seat appears damaged by nicks, grooves or scoring it should be replaced. Remove the valve seat from the body using a 3/4" open end wrench.
8) Replace the valve seat if damaged. Be certain to remove and replace the 31047 Check seat gasket below the seat.
9) Reassemble the Vent Valve Assembly by reversing the above procedure. The 14722 Needle and the inside diameter of the 241807 Cylinder should be coated with grease to assist in assembling.
10) During reassembly, tighten the 14723 Valve seat into the 239336 Valve body using 25 ft-lb and tighten the 241807 Cylinder onto the 239336 Valve body using 100 ft-lbs.

Safety Instructions

Appropriate Use

- Use the "LFR" controller exclusively for controlling and monitoring of Lincoln single-line centralized lubrication systems in LIEBHERR mining excavators.

Misuse

Any use of the LFR that is not expressly mentioned as appropriate in this User Manual will be regarded as misuse.
If the LFR is used or operated in a different manner other than specified, any claim for warranty or liability will be null and void.

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NOTE

If personal injury or material damage occurs as a result of inappropriate operation, e.g. if the safety instructions are ignored or resulting from incorrect installation of the LFR, no claims or legal actions may be taken against Lincoln GmbH.

Exclusion of Liability

- The manufacturer of the LFR does not accept any liability for damages caused by:
  - inappropriate disposal of the LFR
  - arbitrary modification of system parts
  - use of spare parts not authorized by Lincoln
  - commissioning in defective condition
  - wrong programme selection by the user

General Safety Instructions

- The LFR controller
  - is designed with state-of-the-art technology.
  - can be assembled for safe operation.
- Incorrect use may result in bearing damage caused by under- or over-lubrication if bearings or bearing points.
- Modifications or alterations to an installed system by the customer are subject to prior consultation with the manufacturer of the lubrication system or with its appointed dealers.

Accident Prevention Regulations

- Observe all city, state or provincial and federal safety regulations of the country in which the LFR will be used.
- Never operate the LFR
  - with unauthorized spare parts.
  - with any power supply (VDC) other than the one stated in the technical data of the LFR.

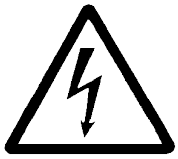
Operation, Maintenance and Repair

- Protective devices of the LFR
  - must not be modified or manipulated
  - may be removed temporarily only during the installation of the lubrication system
  - must be properly put back in place before commissioning.
- Install the LFR in a suitable opening in the driver's cab of the excavator.
- Keep the LFR controller away from sources of heat. Observe the operating temperature.
- Fully replace a defective LFR (see chapter "Spare parts").

1013A94

ATTENTION!

A use of the LFR in explosive areas is not admissible.



4273a00

WARNING!

Dangerous residual voltage!

Even in the case of the drive being stopped, there may still remain voltage on the motor or on the valve.

Disposal

- Dispose of the LFR following the legal regulations and in accordance with the relevant environmental regulations of the country where it is used.

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References, continuation

Displays, functions of the user interface, continued

7-segment displays for time/pressure

The 7-segment display shows the pressure respectively the remaining pause time. To identify the pause time the LED point in the first 7-segment display is lit. In the set-up mode the display flashes every second and shows the adjusted pause time. While the display is flashing, pressing a pushbutton for a longer period of time will increment the pause time, even though the display may be off.

7-segment display for errors

The 7-segment display shows the error/failure which occurred. If there occur different errors at a time, these will be switched through one after the other every 2 seconds. If the same error arises consecutively several times, it will be displayed once only.

Pushbutton Time-Px

Pressing this pushbutton is detected when releasing the pushbutton.
Pressing the pushbutton < 5 seconds will change from the remaining pause time display to the pressure display.
Pressing the pushbutton > 5 seconds will result in a change into the set-up mode. The adjusted pause time will be displayed in a flashing mode.
Pressing the pushbutton in the set-up mode < 5 seconds will increase the pause time in increments of 1 second.
Pressing the pushbutton in the set-up mode > 5 seconds will increase the pause time by 5 seconds in increments of 300 milli-seconds.
If there is no pushbutton pressed in the set-up mode during 20 seconds, the old pause time will be reassumed and the set-up mode will be quit.
By pressing the ENTER key the newly adjusted pause time will be confirmed and the set-up mode will be quit.
When pressing Time P1 and Time P3 at the same time, the P1 display will show the software version.

Pushbutton CYCLE-Start Px

Pressing this pushbutton is detected when releasing the pushbutton.
Pressing this pushbutton will trigger a lubrication cycle in the standard mode of the respective lubrication circuit. However, this will happen only, if pressure in the respective lubrication circuit has fallen below 40 bar (parameter: lubrication circuit pressure Px lower limit) and the circuit is in the pause time. As soon as pressure in the lubrication circuit P1/P2 during a lubrication cycle triggered such way rises to 220 bar (parameter: lubrication circuit pressure Px upper limit), the respective lubrication circuit operates in the standard mode, even though before it was in the emergency operation mode. If a lubrication pulse is detected by the B51 sensor in the P3 lubrication circuit during a lubrication cycle triggered via CYCLE start, this lubrication circuit will be shifted to standard operating mode, although the circuit was in the emergency operation mode before.
This means, the CYCLE start is seen as a confirmation in the case of an emergency operation.

Pushbutton Safety Pump

Pressing this pushbutton is detected when releasing the pushbutton.
This pushbutton is activated only, if the type of excavator contains a 2-pump system (P1 and P2) and if there is at least one sensor or actuator defective.
When the pushbutton is pressed for the first time, lubrication will be carried out via P1. Thereby the solenoid valves Y83 and Y82 are actuated and the P2 pump is switched off. The digital display for P2 is switched off, too.
When the pushbutton is pressed for the second time, lubrication will be carried out via P2. Thereby the solenoid valves Y80 and Y83 are actuated and the P1 pump is switched off. The digital display for P1 is switched off, too.
Pressing the pushbutton for the third time will result in the standard operation of the P1 and P2 pumps.

Pushbutton ENTER

Pressing ENTER will confirm inferior faults and switch off the buzzer. When pressing ENTER in the set-up mode (pause time setting), the adjusted pause time will be confirmed and memorized and the set-up mode will be quit.
If the buzzer is active during the set-up mode, pressing ENTER will first switch off the buzzer, and pressing ENTER again will then confirm the settings of the pause time.

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8 Bedienung

Der Schalter darf nur von autorisierten Personen in Betrieb genommen und bedient werden. Benutzen Sie keine harten Gegenstände bei der Eingabe. Bei Erst-Inbetriebnahme erfolgt ein Selbsttest. Die Bedienung erfolgt menügeführt über drei Folientasten. Diese dürfen **nicht** mit harten Gegenständen berührt werden! Wird während des Selbsttestes oder im laufenden Betrieb ein Fehler erkannt, wird dies durch die (gelbe) blinkende Alarm-LED (AL) signalisiert.
Der Fehler kann im Menü Err ausgelesen werden. Die grünen LEDs S1 und S2 signalisieren die Aktivität der beiden Schaltpunkte.

9 Programmierung

1		Nach dem Einschalten mit M in den ersten Dialogpunkt wechseln.
2	Dialogpunkt wechseln	Mit ▼ bzw. ▲ den gewünschten Dialogpunkt wählen (siehe Kap. 10).
3	Dialogpunkt aktivieren Werteingabe/ Funktionswahl	Mit M den gewünschten Dialogpunkt aktivieren, um anschließend den zugehörigen Wert bzw. die gewünschte Funktion zu ändern.
4	Wert ändern	Mit M die einzelnen Ziffern auswählen. Mit ▼ bzw. ▲ den Zahlenwert ändern und mit M bestätigen. Liegt der eingegebene Wert innerhalb des zulässigen Bereiches wird nach Eingabe der letzten Ziffer zum Dialogpunkt gewechselt, ansonsten blinkt die 1. Ziffer wieder.
5	Funktion ändern	Mit ▼ bzw. ▲ die Funktion ändern und mit M bestätigen.
	Tastatursperre aktivieren	▲ + ▼ für mindestens 5 s gleichzeitig drücken. Die Anzeige darf dabei nicht umspringen. Bei Aktivierung erscheint nacheinander LuO und z. B. u3.1*.
	Tastatursperre aktiv	Werte bzw. Funktionen werden zwar angezeigt, können aber nicht verändert werden. Es erscheint LOH bei dem Versuch der Änderung.
	Tastatursperre deaktivieren	▲ + ▼ für mindestens 5 s gleichzeitig drücken. Die Anzeige darf dabei nicht umspringen. Bei Deaktivierung erscheint nacheinander Lu2 und z. B. u3.1*.
	In den Messbetrieb rückkehren	Erfolgt 2 min lang keine Eingabe, kehrt der Schalter **ohne** Übernahme der Eingaben automatisch wieder in den Messbetrieb zurück.
	Programmierung beenden	M für mindestens 5 s drücken, um in den Messbetrieb zu wechseln.

* Software-Versions-Nr.

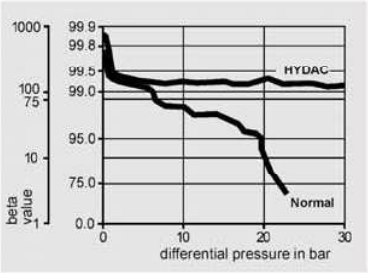
10 Dialog Benutzerebene UDS8

Dialog-punkt	Wert	Funktion/Beschreibung
ACt	0 ... 4000	Anzeige des aktuellen Messwertes
S1		Auswahl der Anzeigeeinheit nbr = mbar PSH = psi x 10 hPo = hPa bar = bar PSI = psi nPo = mPa
Und		Aktivierung der Einheitenanzeige on = Einheitenanzeige (alle 30 s) im Display eingeschaltet oFF = keine Anzeige im Display
SP1		u in = Fenstertechnik Err = Fehlerausgang Std = Standardauswertung
on1*	0 ... xxxx	Einschaltpunkt für SP1; wird der ON-Wert kleiner als der OFF-Wert eingestellt, erhält man fallende Schaltpunktauswertung
OF1*	0 ... xxxx	Ausschaltpunkt für SP1
dS1	0,0 s ... 9,9 s	Einschaltverzögerung für SP1 in Sekunden
dr1	0,0 s ... 9,9 s	Ausschaltverzögerung für SP1 in Sekunden
iu1		Invertierung des Schaltausgangs SP1 HFS = High-level-fail-save (Schließerfunktion) LFS = Low-level-fail-save (Öffnerfunktion)
SP2		u in = Fenstertechnik Err = Fehlerausgang Std = Standardauswertung
on2*	0 ... xxxx	Einschaltpunkt für SP2; wird der ON-Wert kleiner als der OFF-Wert eingestellt, erhält man fallende Schaltpunktauswertung
OF2*	0 ... xxxx	Ausschaltpunkt für SP2
dS2	0,0 s ... 9,9 s	Einschaltverzögerung für SP2 in Sekunden
dr2	0,0 s ... 9,9 s	Ausschaltverzögerung für SP2 in Sekunden
iu2		Invertierung des Schaltausgangs SP2 HFS = High-level-fail-save (Schließerfunktion) LFS = Low-level-fail-save (Öffnerfunktion)

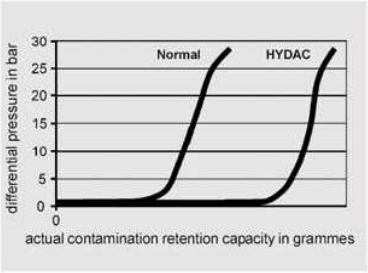
B. Filter Element (Model 0240 D 200 T /-03088803)

Technical details:

- Absolute filtration $\beta_x \geq 200$ from 3-20 micron
- Stable β_x-values across a wide range of differential pressures



- High differential pressure stability up to 210 bar



- High contamination retention capacity
- Disposable elements and cleanable elements
- Filtration of mineral oils, non-flam fluids and rapidly biodegradable fluids

1. …D… ../.. elements - suitable for use with the following filter types: DF, LF, MDF, DFDK, DFF, DFG, DF…P, DF…Z, DF…MA, DF...QE, filter module

Examples of Application

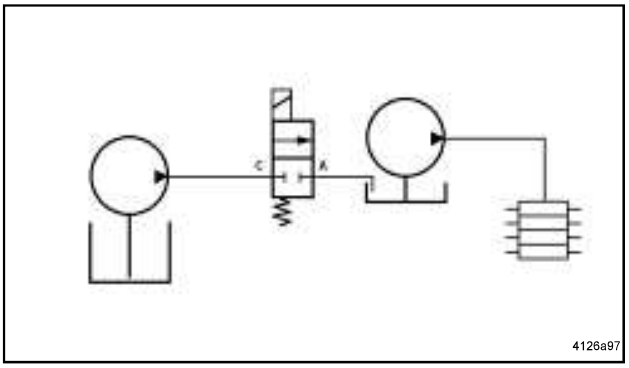


Fig. 1 - 2/2 - way - valve used as a shut-off valve in a filling line

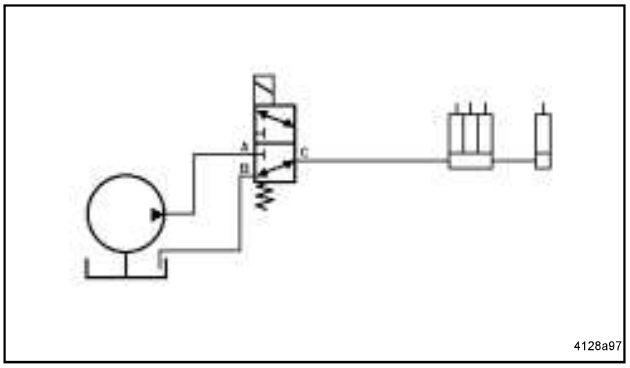


Fig. 3 - 3/2-way valve used as a relief valve in a single-line system

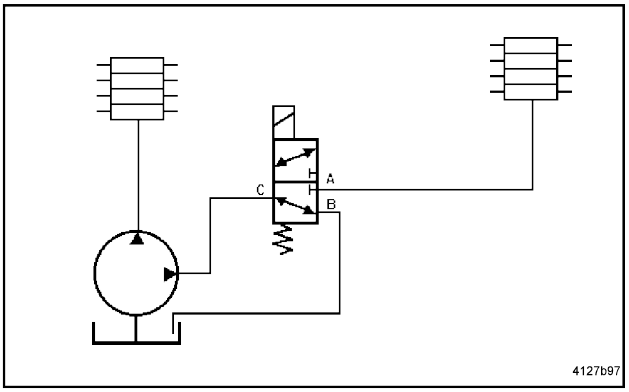


Fig. 2 - 3/2 - way valve for the connection or disconnection of a progressive metering device

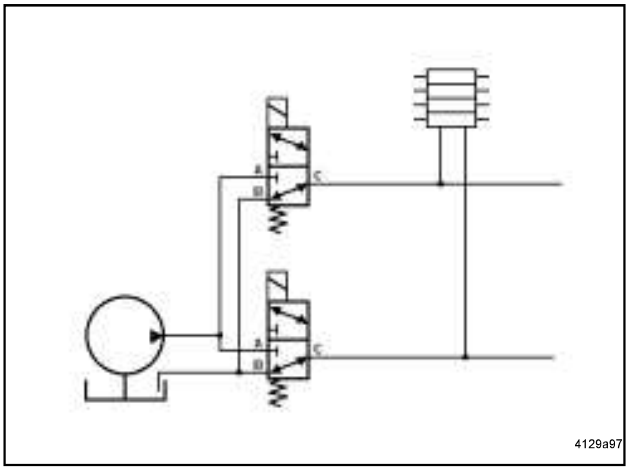


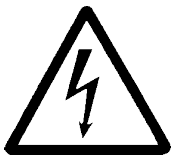
Fig. 4 - 3/2-way valve used as a 2-pole shut-off valve in a two-line system

Erection and Installation

Requirements on the installation site:

- even, stable and vibration-free installation site
- protected from dust and dirt
- safe from atmospheric influences
- Installation position : any

Electrical Connection



- Before the device is connected, disconnect the system.
- The installation of electrical devices should be carried out only by an electrician!
- The relevant rules of technology and the respective industrial safety laws (instructions, standards) must be observed.
- Electrical connection of the solenoid valve in accordance with the wiring diagram

CAUTION **The supply voltage and solenoid voltage must be identical.**

Operating Instructions

Starting up

- After the connection of the tube lines and electrical system, the solenoid valve is ready for operation.

Maintenance and Repair

- Any repair will be limited to a replacement of the complete solenoid valve, since special knowledge is required for the repair of the inner workings.

Before any replacement of parts of the solenoid valve observe the following:

* Disconnect the system and secure it against inadvertent restarting.
* Reduce the system pressure down to zero.
* Danger due to splashing lubricant

Access ladder components, first configuration

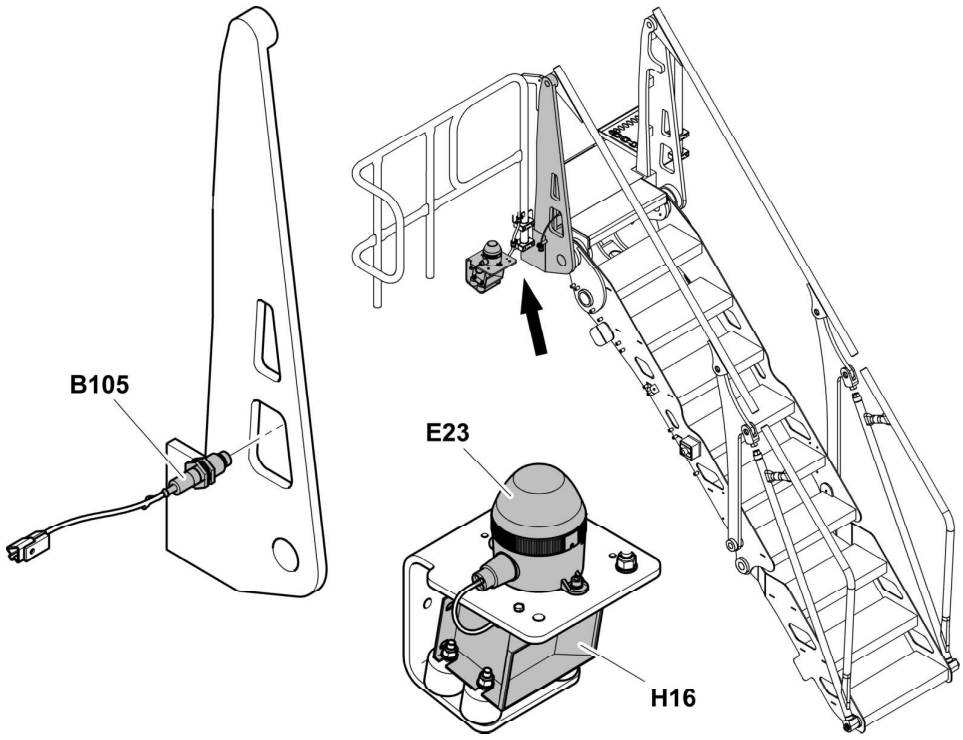


Fig. 9 *Access ladder components, first configuration*

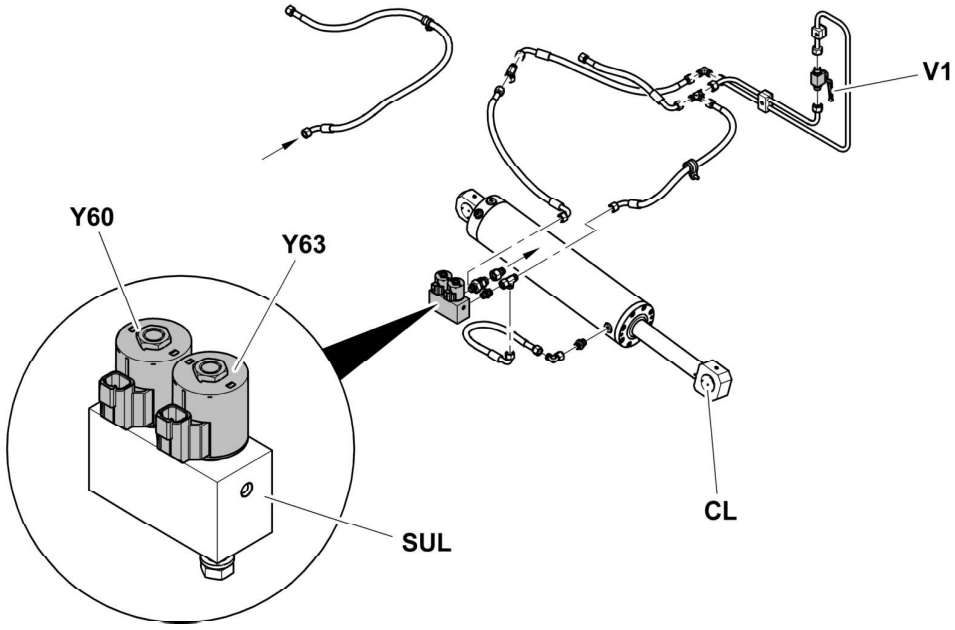


Fig. 10 *Access ladder components, first configuration*

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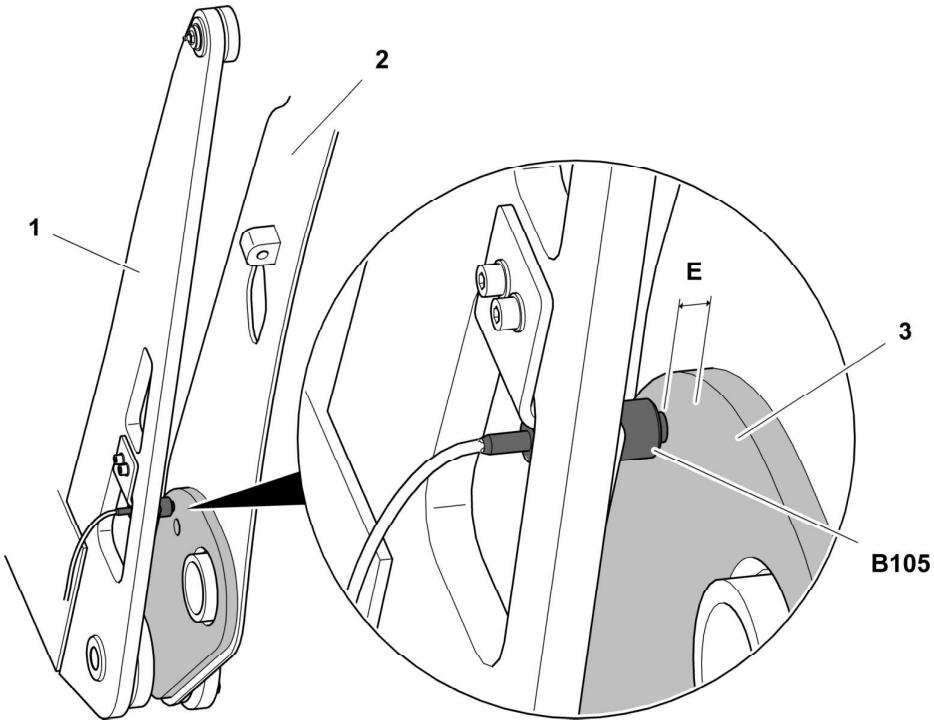

Fig. 27 *Set B105 position*

1 Machine catwalk
2 Access ladder
3 Plate
B105 Proximity sensor
E Distance between **B105** and the plate **3** = 6 mm

▶ Move the access ladder into upper position.

▶ Adjust the sensor **B105** which is installed on the machine catwalk **1** to get the distance **E** between the sensor **B105** and the plate **3**.

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2.3 Cab connection box E1005

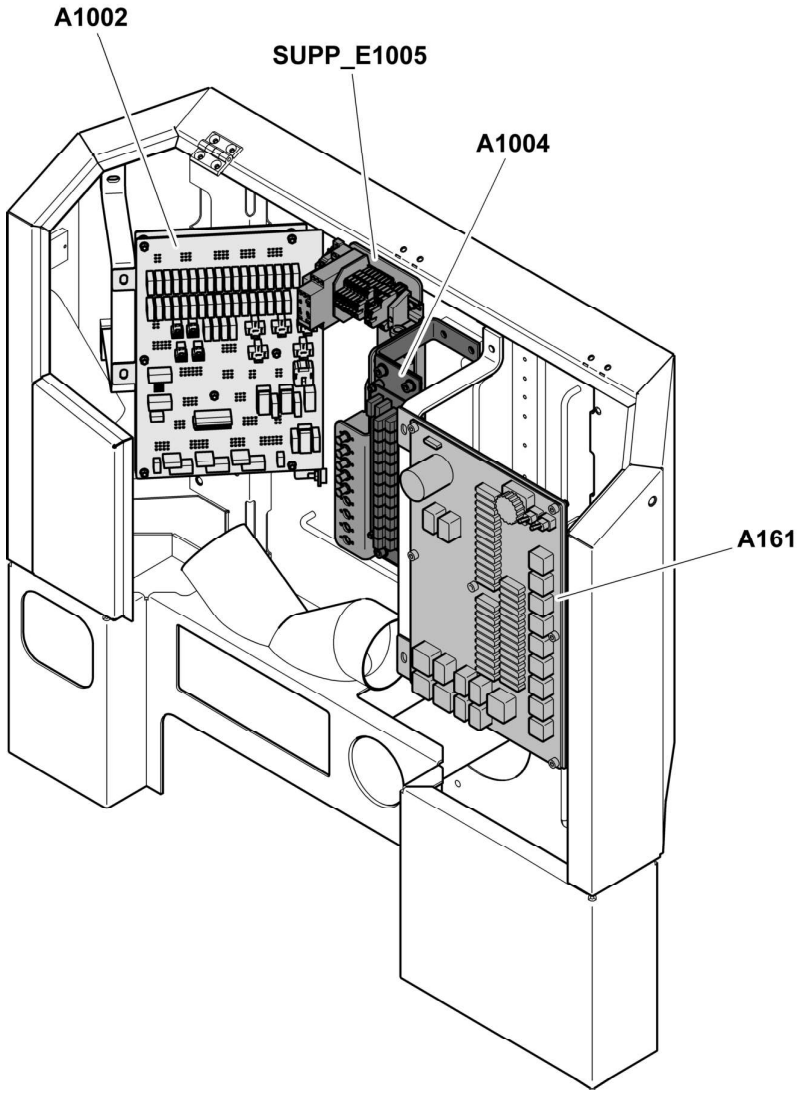

Fig. 7 *Locations of the electrical plates in E1005*

A161	Electrical plate
A1002	Electrical plate
A1004	Electrical plate
SUPP_E1005	Electrical plate

The cab connection box **E1005** is located in the cab, behind the operator seat. This box has different electrical plates with fuses, relays and connectors.

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4.1.2 Valve bank

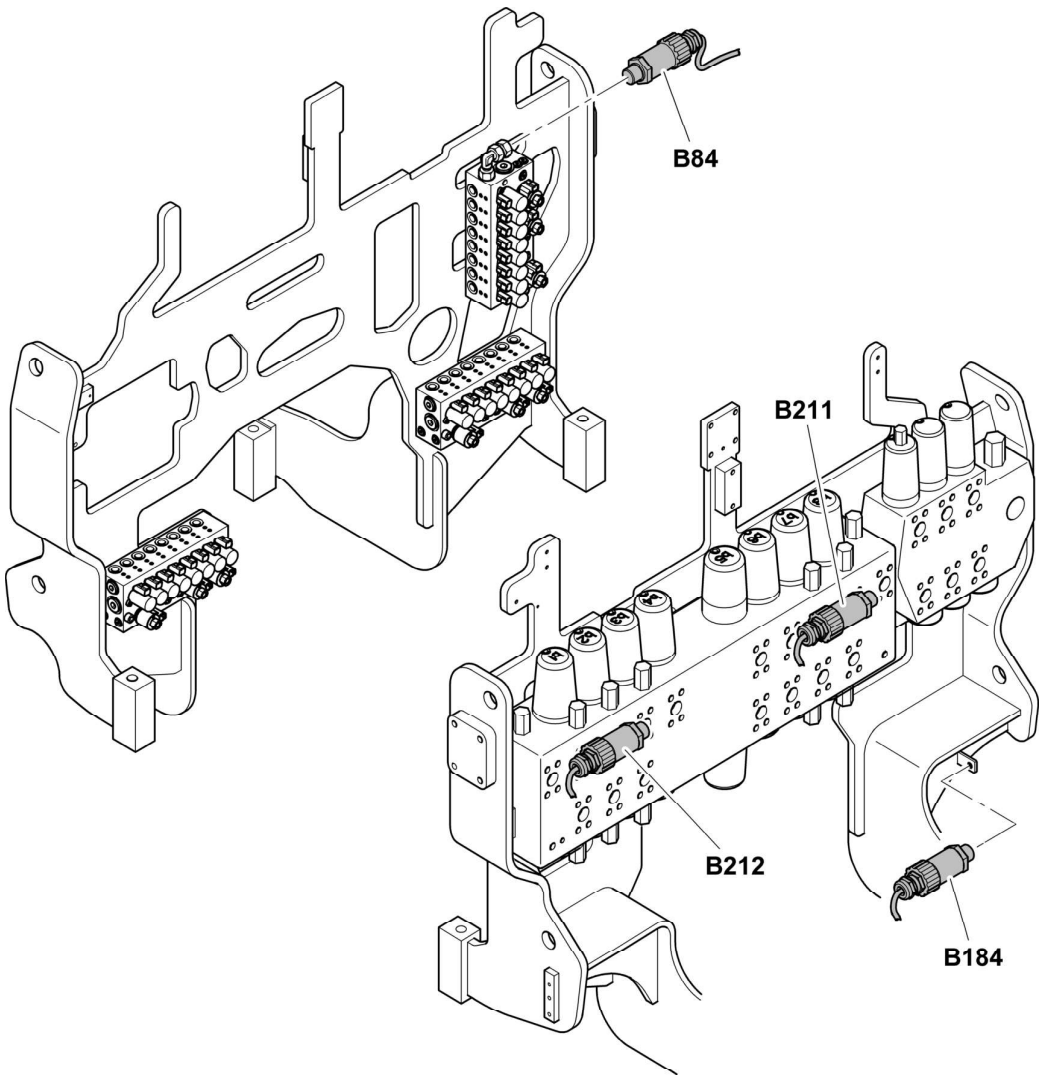

Fig. 19 *Configuration of valve bank sensors*

B84	Control pressure / Pumps	**B211**	Pressure sensor / Bucket/Shovel tilt cylinder
B184	Pressure control	**B212**	Pressure sensor / Stick/Crowd tilt cylinder

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7 Power supply

This section aims at describing the power supply of electric driven excavators.

The current is supplied by the mine's power supply and goes through the cable and the electric rotary connection via the connecting box. It then supplies the high and the low voltage electrical boxes and the motors.

The electrical schematic that follows is a rough power supply electrical schematic. For complete schematics, refer to section 4 previously in this chapter.

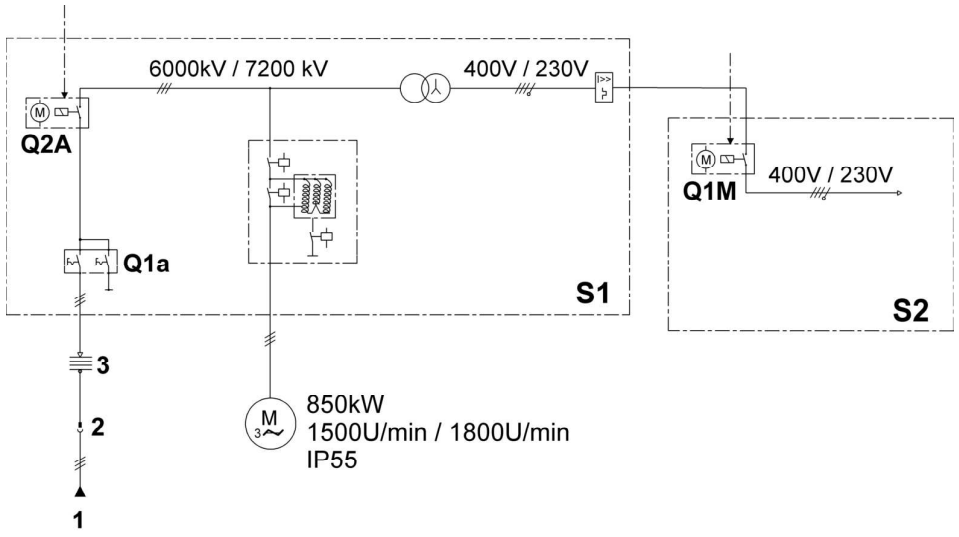


Fig. 32 *Rough power supply electrical schematic*

1 Power supply 6kV; 50Hz (or 7,2kV;60Hz)
2 Connecting box
3 Electric rotary connection
M Electric motor
Q1a Mechanical isolator switch
Q1M 400V breaker
Q2A Main circuit breaker
S1 High voltage electrical box
S2 Low voltage electrical box

7.1 Power supply

The power supply must follow the requirements below.

Data	Unit	Values
Network power supply		3-phase AC
Voltage tolerance	V	Un ± 10%
Frequency tolerance	Hz	± 5%
Excavator's energy consumption at 80% load factor	kWh	850 + 34 for auxiliaries

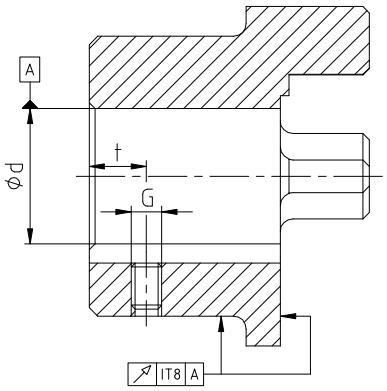
Un: nominal voltage

4 Assembly

4.2 Hint Regarding the Finish Bore

D A N G E R !
The maximum permissible bore diameters d (see table 1 to 3 in chapter 1 - Technical Data) must not be exceeded. If these figures are disregarded, the coupling may tear. Rotating particles may cause serious danger.

- Hub bores machined by the customer have to observe concentric running or axial running, respectively (see picture 13).
- Please make absolutely sure to observe the figures for d_{max}.
- Carefully align the hubs when the finish bores are brought in.
- Please use a setscrew according to DIN EN ISO 4029 with a cup point or an end plate to fasten the hubs axially.



picture 13: concentric running and axial running

C A U T I O N !
The orderer is responsible for all subsequently made machinings to unbored or pilot bored and to finish machined coupling parts and spare parts. KTR does not assume any warranty claims resulting from insufficient refinish.

P R E C A U T I O N !
Any mechanical rework to couplings that are used in hazardous areas require an explicit release by KTR.
The orderer must send a drawing to KTR acc. to which the manufacture must be made. KTR checks this drawing and returns it to the orderer with approval.
KTR supplies unbored or pilot bored coupling parts and spare parts on explicit customer´s request. These parts are additionally labelled with the symbol Ⓤ.

Table 4: setscrews DIN EN ISO 4029

size	24	28	38	42	48	55	65	75	90	100	110	125	140	160	180
dimension G	M5	M8	M8	M8	M8	M10	M10	M10	M12	M12	M16	M16	M20	M20	M20
dimension t	10	15	15	20	20	20	20	25	30	30	35	40	45	50	50
tightening torque T_A [Nm]	2	10	10	10	10	17	17	17	40	40	80	80	140	140	140

4.3 Assembly of the Coupling (General)

A T T E N T I O N !
We recommend to check bores, shaft, keyway and feather key for dimensional accuracy before assembly.

Heating the hubs or coupling flanges slightly (approx. 80 °C) allows for an easier installation onto the shaft.

P R E C A U T I O N !
Please pay attention to the danger of ignition in hazardous areas.

D A N G E R !
Touching the heated hubs or coupling flanges causes burns.
We would recommend to wear safety gloves.

en

Repair manual

Pump distribution gear

PVG 450 C 470

Document identification

Order number:	10145472
Edition:	02/2013
Valid for:	PVG 450 C 470
Author:	LMB department BE-MD3
Version:	1.0

Product identification

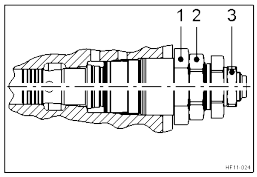
Manufacturer:	Liebherr Machines Bulle SA
Type:	PVG 450 C 470

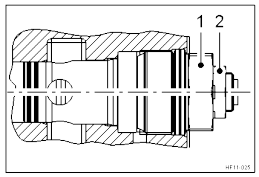
Mailing address

Address:	Liebherr Machines Bulle SA 45, rue de l'Industrie CH - 1630 Bulle

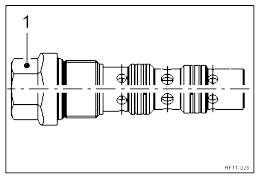
Cover page.fm

LMB/1.0/Edition: 02/2013/en

Item	Type	Torque Nm	
1 (complete valve)	**DBVZ 22 Px internal**	75	
2	**DBVZ 22 Px internal**	45	
3	**DBVZ 22 Px internal**	28	

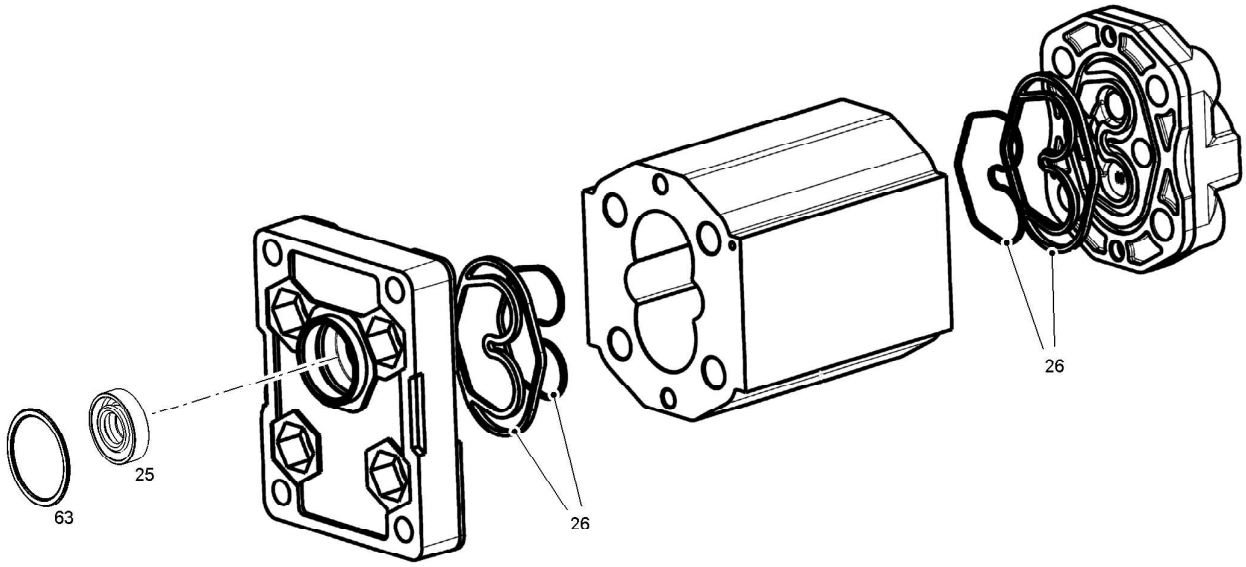
Item	Type	Torque Nm	
1 (complete valve)	**MHDBV 40**	300	
2	**MHDBV 40**	28	
-	**-**	-	

3.5.3 Shuttle valve torque

Item	Type	Torque Nm	
1 (complete valve)	**WV 10**	100	
-	**-**	-	
-	**-**	-	

5.2 Cooling circuit pump seal kit

5.2.1 Overview

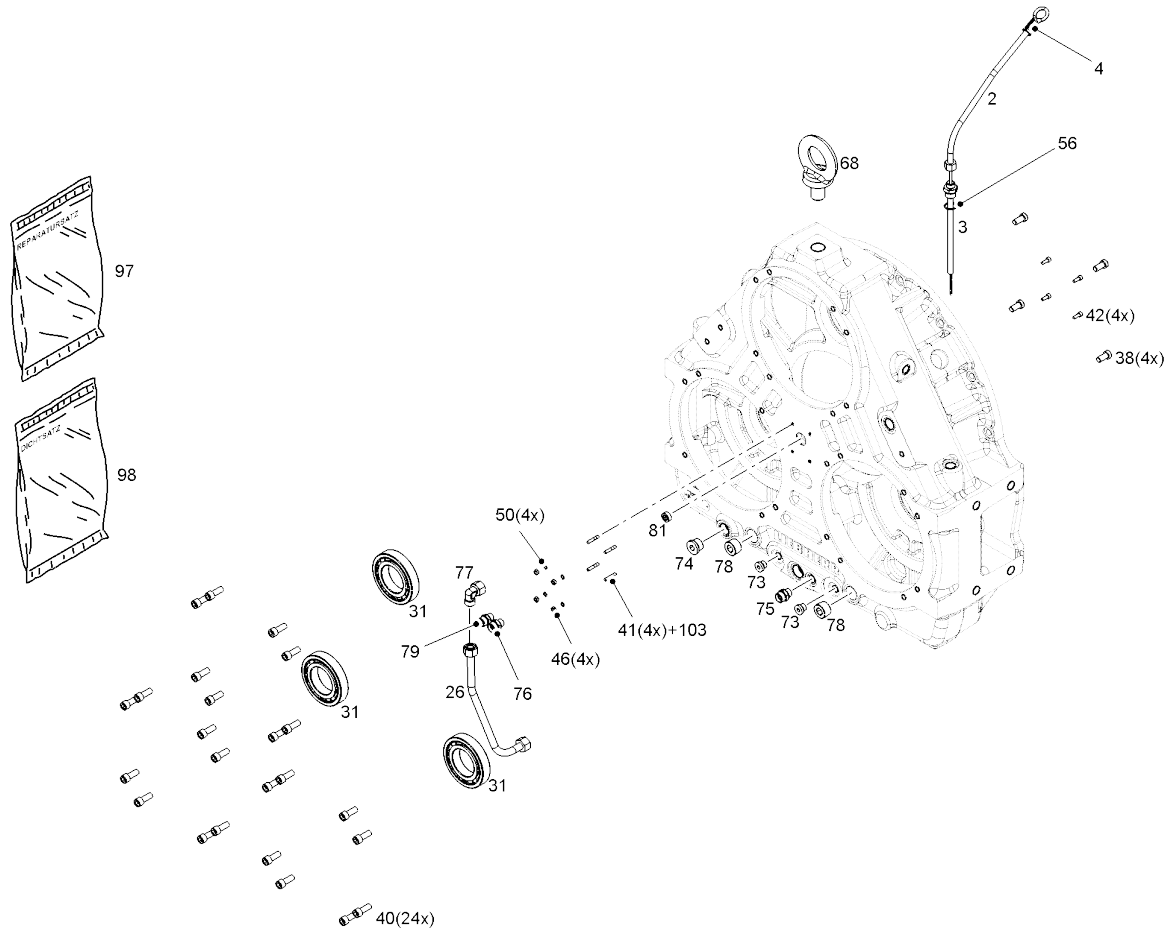


HF16-060

Item	Name	Note
25	Rotary shaft lip seal	see chapter 5.2.3
26	Sealing element	see chapter 5.2.3
63	O-ring	see chapter 5.2.2

7 RK pump distribution gear

7.1 Overview



Item	Name	Note	Item	Name	Note
2	Oil dipstick guide	see chapter 5.5	68	Ring bolt	Tightening torque: 115 Nm
3	Complete guiding pipe	see chapter 5.5	73	Screw plug	see chapter 3
4	Oil dipstick	see chapter 5.5	74	Screw plug	see chapter 3
26	Suction pipe	see chapter 5.2.2	75	Screw fitting	Tightening torque: 70 Nm
31	Cylindrical roller bearing	see chapter 5.4	76	Screw fitting	Tightening torque: 70 Nm
38	Cylinder screw	see chapter 5.3.1	77	Screw fitting	Tightening torque: 105 Nm
40	Cylinder screw	see chapter 5.4.1	78	Screw plug	see chapter 3
41	Double-ended stud	see chapter 3	79	Screw fitting	Tightening torque: 70 Nm
42	Cylinder screw	see chapter 5.3.1	97	RK drive shaft	see chapter 6
46	Hex nut	see chapter 5.2.2	98	Seal kit	see chapter 5
50	Lock washer	see chapter 5.2.2	103	Screw locking	in item 41
56	Sealing ring	see chapter 5.5			

4 Swing bearing

4.1 Component location

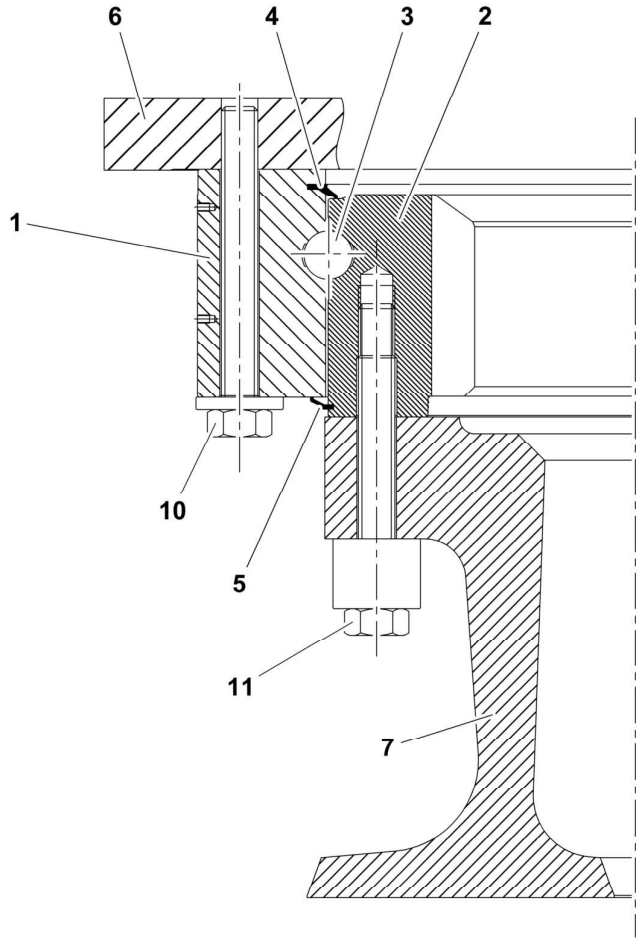


Fig. 9 *Swing ring installation*

1	Outer ring	**6**	Uppercarriage
2	Inner ring	**7**	Undercarriage
3	Roller	**10**	Hexagonal head screw M30x180 to uppercarriage x quantity 60
4	Upper seal	**11**	Hexagonal head screw M30x180 to undercarriage x quantity 72
5	Lower seal		

▶ For the tightening torques and control intervals, refer to the Operating Manual.

4.2 Technical data

	Units	Value
Type		KUD 594 VJ
Number of teeth		138

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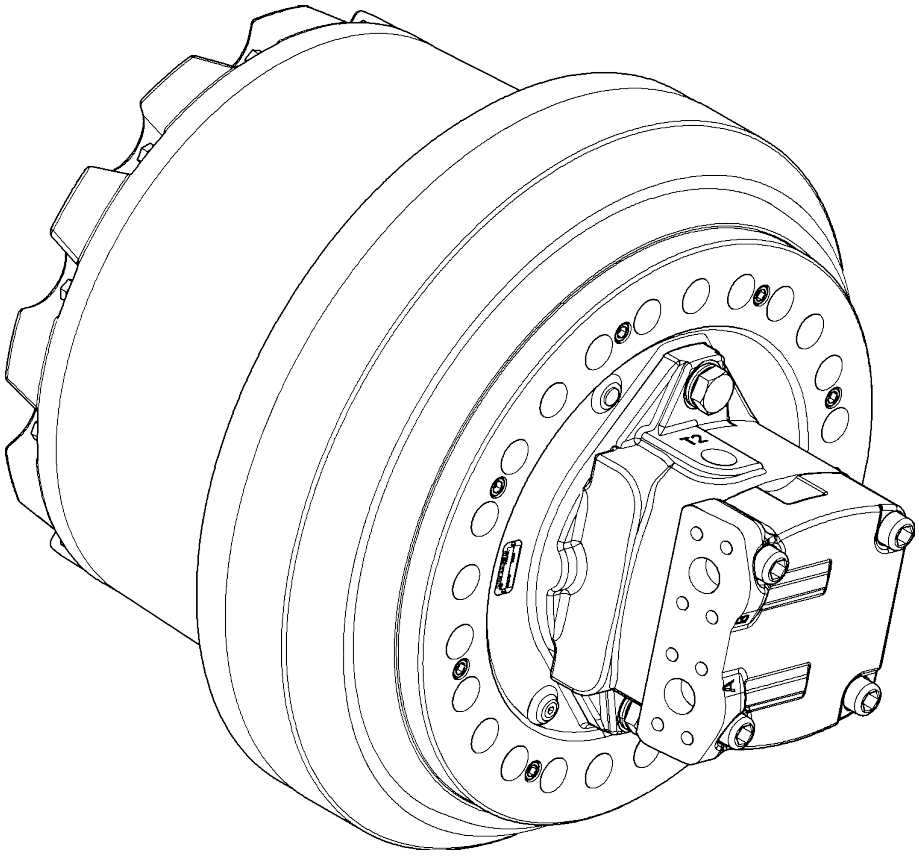


Fig. 3 *Travel gear with motor*

LEC / en / Edition: 11 / 2019

2.8 Monitoring

Make sure at regular intervals that the wear of the track components does not get the maximal limit. If the wear gets the maximal limit, you must replace the defective components.

2.8.1 Track pad

Classic measurement

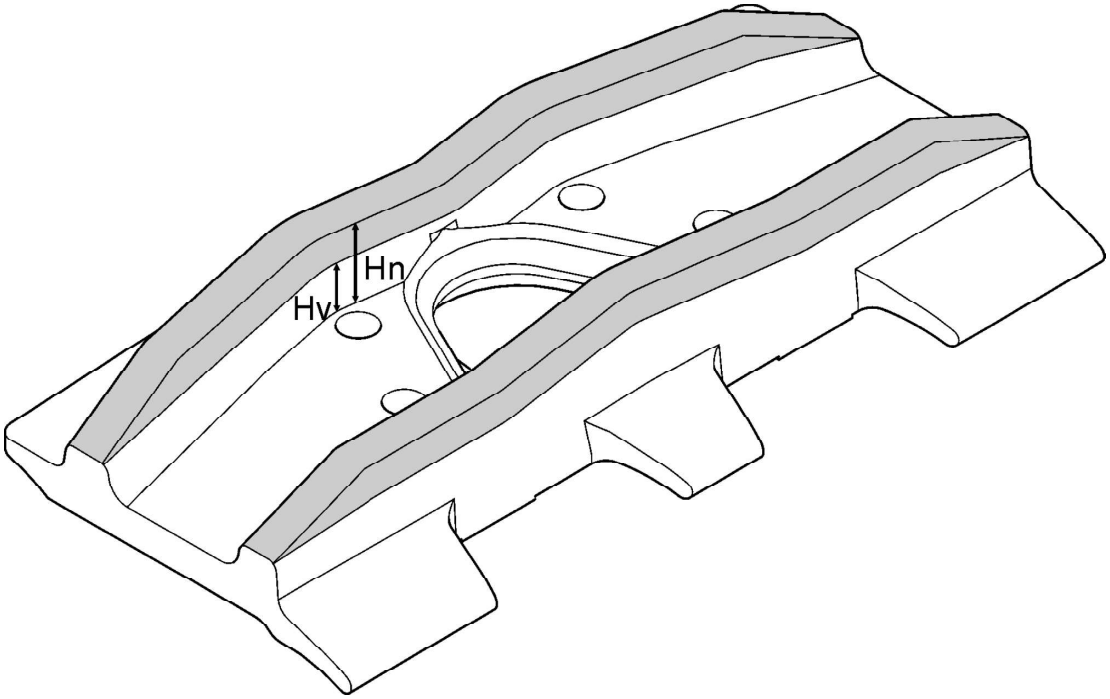


Fig. 15 *Track pads for classic measurement*

New: **Hn** mm	50
Max. wear limit: **Hv** mm	25

LEC / en / Edition: 11 / 2019

2.9.4 Install / remove the sprocket

▶ Refer to the section "Install / remove the travel gear" above.

2.9.5 Install / remove the tensioning unit

▶ Refer to the Safe Work Procedure n° 3.04 in the chapter 2 of this Service Manual.

Remove and install the idler assembly

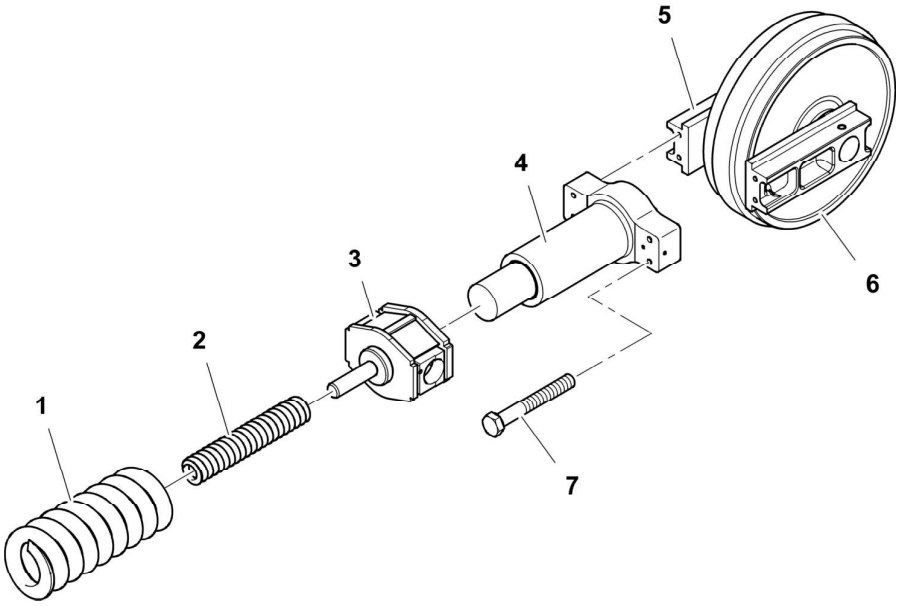


Fig. 31 *Tensioning unit installation*

1 Outer tension spring
2 Inner tension spring
3 Limit stop
4 Grease tensioner
5 Slider
6 Idler wheel
7 Screw

The idler assembly has two parts:
– the grease tensioner **4**
– the idler wheel **6** with sliders **5**

Note!
This section does not give the installation and the removal of the tension springs **1** and **2**.
If it is necessary to remove them, you must release their pre-tension before you remove the track chain.
During the installation of the track chain, you must compress the springs **1** and **2** and lock them into the side frame.

▶ Refer to section "Install and remove the complete tensioning unit" below.

▶ Make sure that the machine is on level and hard ground.

▶ Make sure that the limit stop **3** is attached correctly and in good conditions.

▶ Remove the track chain. Refer to section "Remove the complete track chain" above.
– Unwind the track chain.
– Do not remove the track chain from under the track rollers.

6	Stick	**b**	Connection between shift lever and bucket
7	Pin	**c**	Connection between bucket cylinder and shift lever
8	Pin		

1.3.3 Shovel bucket assembly

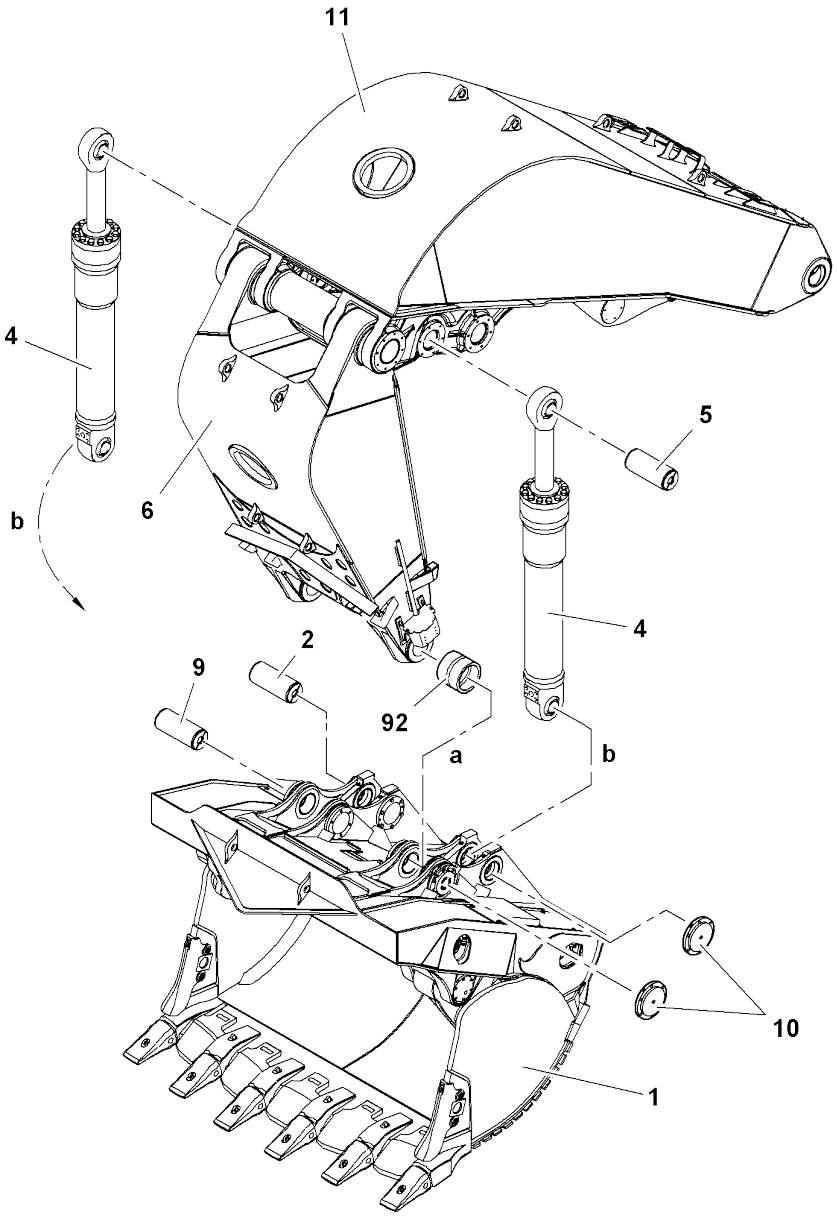


Fig. 9 *Shovel bucket assembly*

1	Shovel bucket	**10**	Cover
2	Pin	**11**	Shovel boom
4	Bucket cylinder	**92**	Bush
5	Pin	**a**	Connection between crowd bushing and bucket bushing

4. Safety

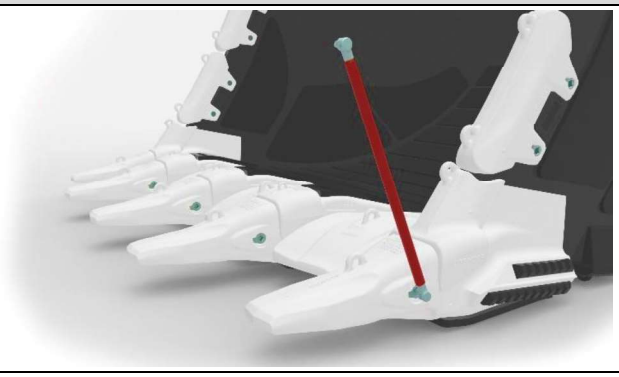
During the installation and removal of GETs, the use of protective clothing is recommended:
- Safety shoes,
- Gloves,
- Safety glasses
- Hard hat,
- Specific welding protection equipment, for the welding of lifting rings on used GET.

PINCH POINTS	
	**CAUTION** Take care of your fingers when assembling or removing GET parts. Specific gloves for the handling of heavy parts should be worn.

HEAVY PARTS	
	**CAUTION** Big GET parts should not be handled by hand. Use suitable lifting devices when assembling or removing GET. When removing used GETs, a lifting ring may be welded to perform a safe lifting operation.

5. Extraction tool

The extraction tool defined in this document for the installation and removal of LIEBHERR GETs may be ordered at LIEBHERR:

Extraction tool	
Article code 11110099	

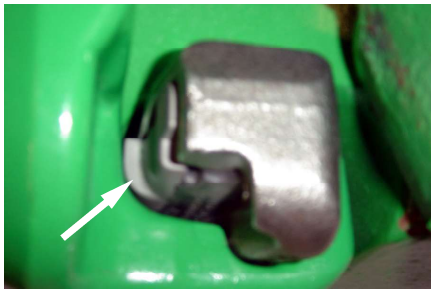
To reduce tooling to one unique extraction tool, the teeth, shrouds and wing shrouds are equipped with one single locking system.

ESCO® SV2™ Tooth System Installation, Removal, and Pin Inspection

Tooth Removal continued

For 70SV2, 75SV2, and 85SV2 Teeth

4. Rotate tool handle toward the tip of the tooth. As tool is rotated, latch will release and pin will lift up and out of the ear. Pumping tooling as it is rotated helps loosen packed fines.



5. Latch disengagement

6. Visually inspect pin prior to reuse. Clean and inspect for wear, and replace if worn or damaged.

Inspecting and Rebuilding the SV2™ Pin

For 70SV2, 75SV2, and 85SV2 Teeth

The SV2 pin can be reused unless on the unacceptable conditions exist.

1. Inspect for top wear.

2. Inspect for missing or damaged latch or rubber.

3. Check for bending by comparing with a new pin.

⚠ ***WARNING:*** *ESCO's warranty is void when points and adapters are repaired or hardfaced.*

All persons performing maintenance work should wear OSHA-approved hard hat, safety glasses, steel-toed shoes, and gloves. To avoid injury to others, keep people not directly involved well out of the way.

6.2. Drier/collector sight-glass unit completely mounted on the machine

6.3. Excess-pressure valve

An excess-pressure valve (minimum pressure of response: 32±4 bar) is build on the drier/collector sight-glass unit.
When exceeding the system pressure (over 32 bar), refrigerant (possibly due to defective over-pressure switch) will be discharged to the atmosphere for reasons of safety, until the system pressure is under 32 bar. The valve then closes in self-consistent function.

6.4. Pressure switch combination B11-AC1-351 (10292659)

A pressure switch combination is mounted on the drier/collector sight-glass unit

Overpressure:
- 26±2bar switched off
- 20±3 bar switched on

System protection against overpressure

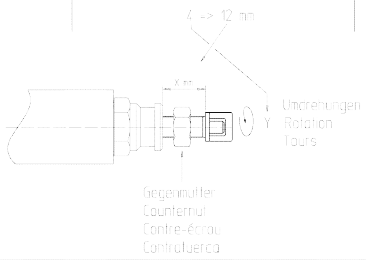
Low pressure
- 2,0±0,3 bar switched off
- 2,1±0,3 bar switched on

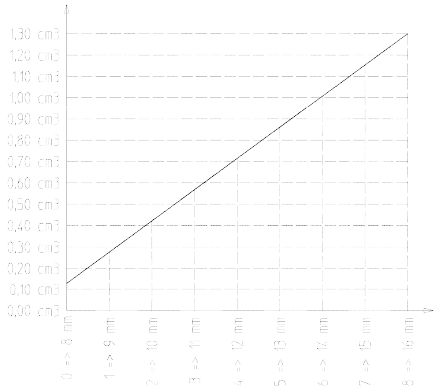
System protection against loss of refrigerant protects the compressor from defect.

Both pressure switch-combinations are interchangeable!

Dosiereinstellung des Injector SL1
SL1 injector adjustement
Reglage de l'injecteur SL1
Reglaje inyector SL1

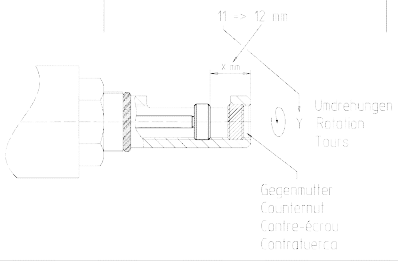
Umdrehungen fuer den Fett Injektor
Rotation number for the grease injector
Nbre de tours pour l'injecteur de graisse
Vueltas de la grasa inyector

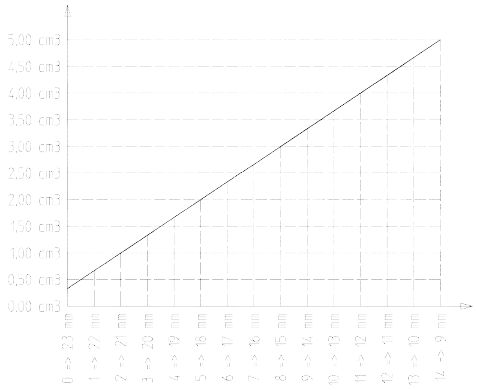




Dosiereinstellung des Injector LM5
LM5 injector adjustement
Reglage de l'injecteur LM5
Reglaje inyector LM5

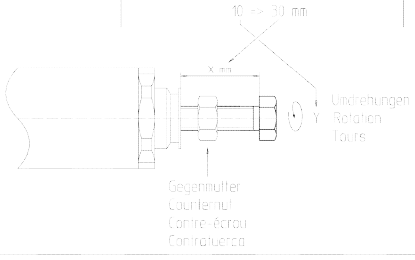
Umdrehungen fuer den Fett Injektor
Rotation number for the grease injector
Nbre de tours pour l'injecteur de graisse
Vueltas de la grasa inyector

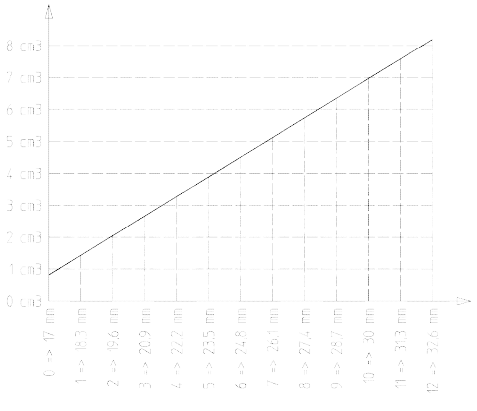


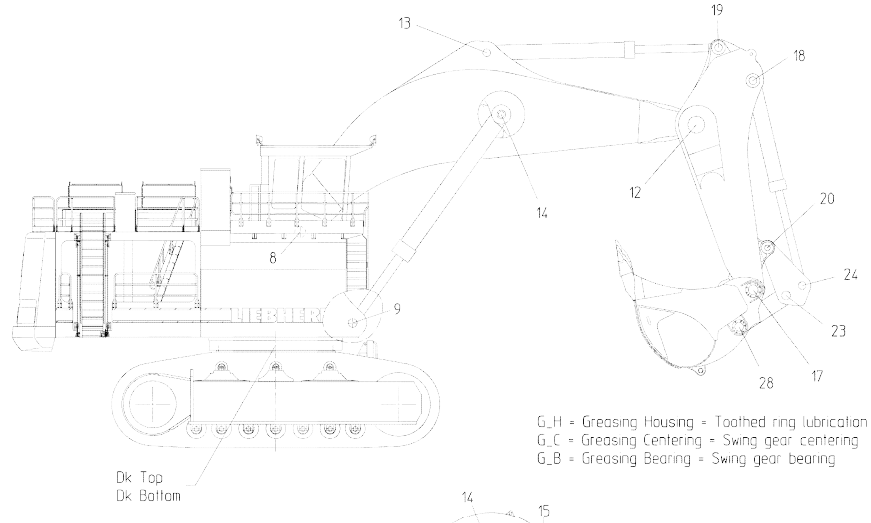


Dosiereinstellung des Injector SL11
SL11 injector adjustement
Reglage de l'injecteur SL11
Reglaje inyector SL11

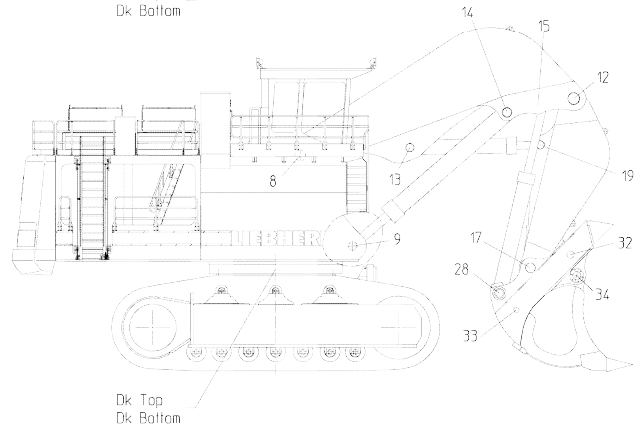
Umdrehungen fuer den Fett Injektor
Rotation number for the grease injector
Nbre de tours pour l'injecteur de graisse
Vueltas de la grasa inyector

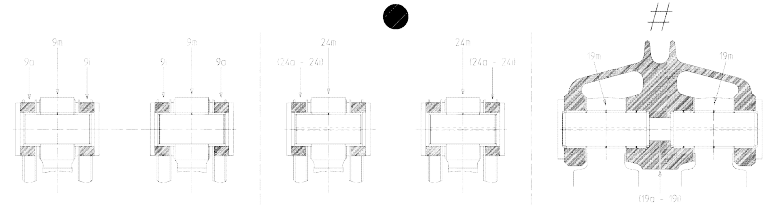






G_H = Greasing Housing = Toothed ring lubrication
G_C = Greasing Centering = Swing gear centering
G_B = Greasing Bearing = Swing gear bearing





a - Aussen - Outside - Exterieur - Fuera
m - Mitte - Middle - Milieu - Centra
i - Innen - Inside - Interieur - Dentro

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GREASING QUANTITIES
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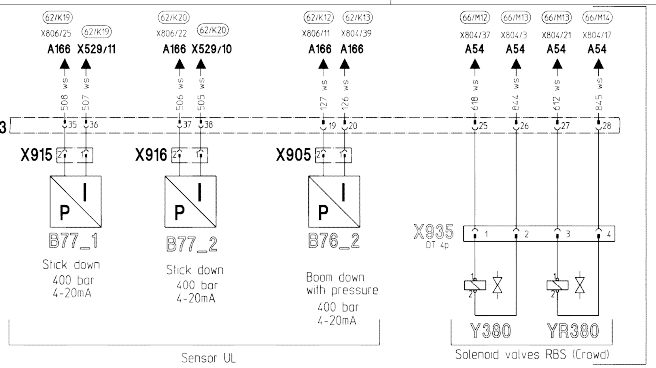
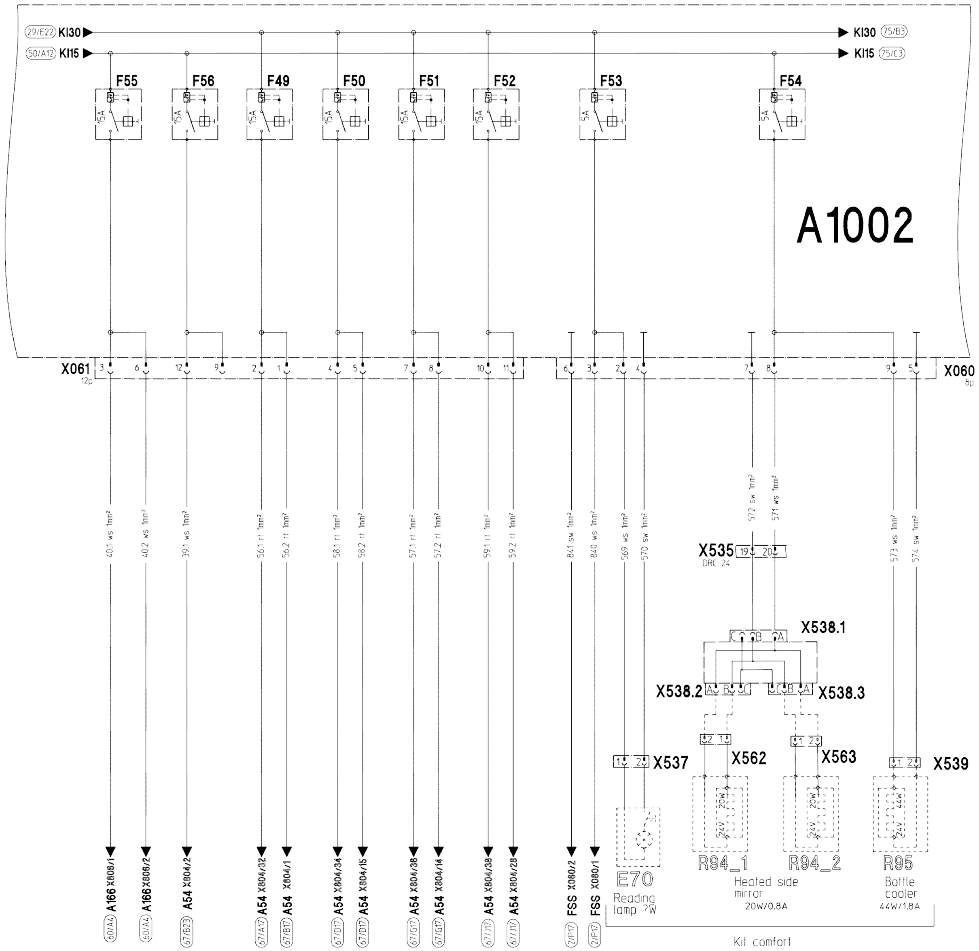
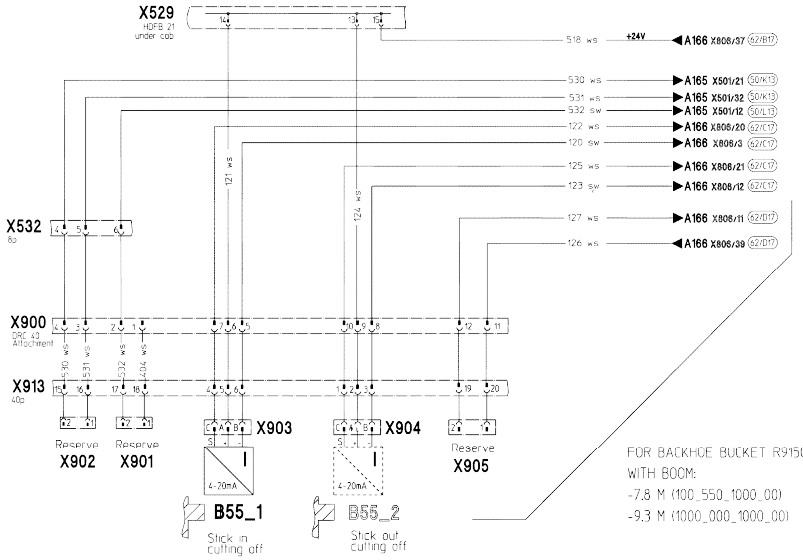
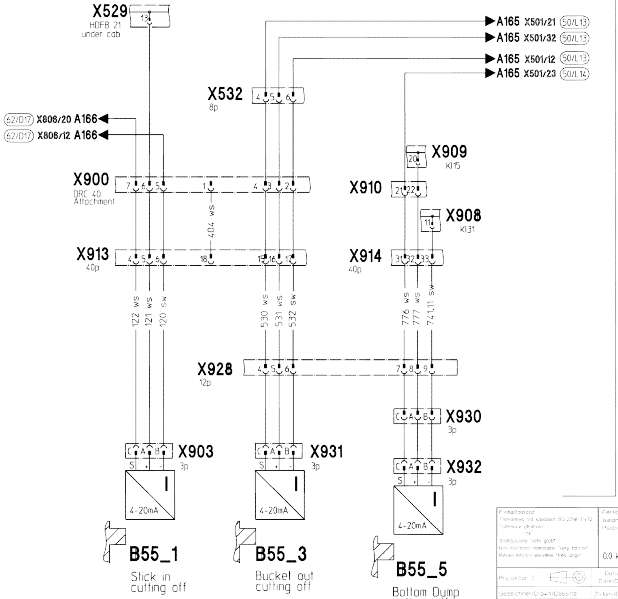


ONLY FOR BOOM
9.3 M (1000_000_1000_00)





FOR BACKHOE BUCKET R9150
WITH BOOM:
-7.8 M (100_550_1000_00)
-9.3 M (1000_000_1000_00)



BOTTOM DUMP BUCKET R9150
KLAPPSCHAUFEL R9150
CHOULEUR R9150

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SCHEMA ELECTRIQUE
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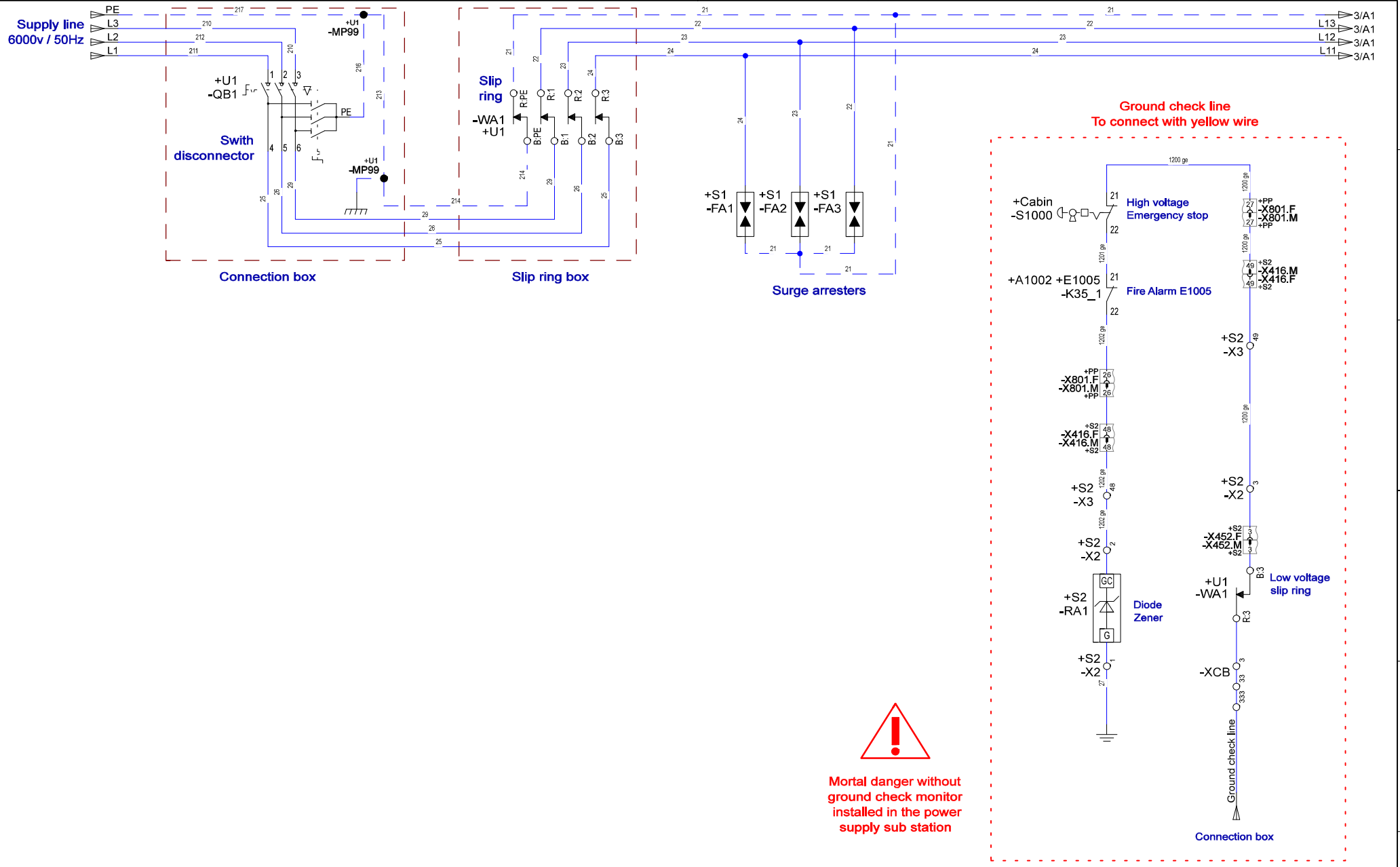

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CONFIDENTIAL		INSPECTED	MULLER F.					DRAWING NUMBER	INDEX	SHEET 2 FROM 21
		TECHNICAL REFEREE						1134 9010 10	000	