en

Service Manual

Hydraulic excavator
R 9100 - R 9100B

from 26573

Document identification

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Author: LEC - Technical documentation department

Product identification

Manufacturer: Liebherr-Mining Equipment Colmar SAS

Type: R 9100 - R 9100B

Type no.: 1132 / 1652

Conformity: CE

Address

Liebherr-Mining Equipment Colmar SAS
49 rue Frédéric Hartmann
CS 50038, F-68025 Colmar Cedex

LEC / en / version: 06 / 2020

LIEBHERR

Beginning with a material thickness of ¼'' (8mm), butt welds must be made in several layers. The weld is applied in several beads. Wide butt welds are filled with several side beads, with the last layer covering the center. The electrode should melt evenly without creating burrs and peaks. The valley or crater, which is created when changing electrodes must be filled in and overlapped with the next electrode. To prevent cracks in those craters, care must be taken that they are properly filled.

If the crack extends towards the outer edge of the material (pos. C), slag may be trapped or burn holes may be created. To prevent this, the following aid may be used : tack a piece of sheet of metal to the outer edge of material.

The welding seam begins now at the sheet metal in the direction of the arrow (pos. C). After the welding is completed, the sheet metal is removed and the edge of the material is ground smooth. The weld must cool off slowly and should therefore be protected from rain and wind.

4.3.3 Reinforcement of the welding seam

If the crack of the material is due to an oveload or abuse, a reinforcement plate should be welded over the crack. The selection of the correct reinforcement plate is based on the construction and load factors of the component to repair.

For this reason, only general recommendations can be made as to the size and shape of the reinforcement plates.

4.3.4 General application of reinforcement plates

Shape of reinforcement plates

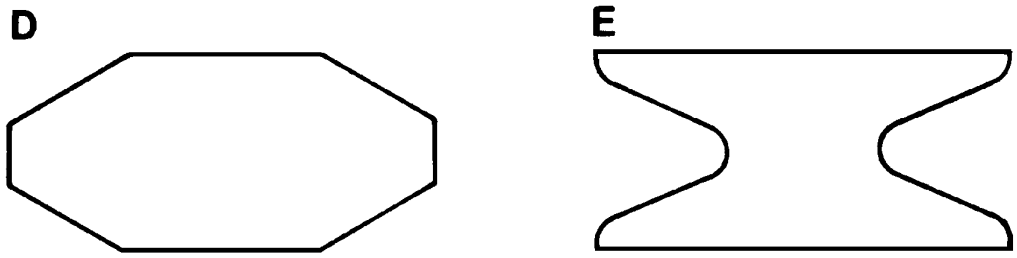

Fig. 5 *shape of reinforcement plates*

The crossover or connection between the reinforced and not reinforced part should be as gradual as possible. This means that the size of the plate should be selected in such a way that new or unacceptable high stress in the repaired parts are avoided. Plates with sharp corners (such as a rectangular plate) should not be used.

Suitable reinforcement plate with high tensile strenght (pos. D).

Suitable reinforcement plate against bending and alternating loads (pos. E).

Plate thickness

The thickness of the reinforcement plate should be up to 2/3 (66%) of the thickness of the material to be reinforced.

Plate quality

The yield and tensile strenght of the reinforcement plate should be equal to the material to be reinforced.

Plate installation

The welded area of the crack should be ground so it is a smooth and level.

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SWP 0.05.001 -R9100- Isolate machine for welding repairs

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
1	Isolate machine Follow SWP 0.02: Basic machine isolation				PPE	☐
2	Ensure that: machine is parked on flat surface	Mobile lifting devices may have trouble with uneven ground	Ensure that work area is flat, free of holes & rocks		Grader	☐

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Note!
The LIEBHERR equipment is large and heavy. It is mandatory that all work be done in a safe manner.
If you are in doubt about a procedure, always check with your supervisor before proceeding.

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
3	Unbolt hose fitting Plug the hose	High pressure Oil projections Oil leak	Ensure that hydraulic pressure is exhausted Unbolt on the far side first Use oil spill kit Wear safety glasses and gloves Wear oil protecting clothings If the hose may be under pressure again (not disconnected at both end), plug with steel cap and seals bolted to the right torque. Else a plastic cap is sufficient to avoid oil leaking and dirt contaminating the inside of the hose.			☐
4	Remove the hose Store in a safe place, out of the way	Weight Slipping Crushing fingers Tripping	Require help as needed. Lift the hose if needed Clean as you work Wear safety gloves, keep fingers clear Avoid letting the hose slide on the ground when moving it.		PPE	☐

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Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
22	Remove crane, manlift	Personnel injury when equipment is moving 	Keep visual contact with operator			☐
23	Restart Machine Test Operation	Personnel still working on machine Leaks Heavy equipment in movement	Ensure that ALL personnel clear Keep clear			☐
24	Clean Area Notify supervisor					☐

LEC / en / Edition: 11 / 2018

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Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
14	Remove both cylinder to deck pins using pin-puller and lift out.	Cylinder slipping Improper tool Pin slipping 	Ensure the cylinder is properly secured and the securing chain is taut. See tool listing in service manual for LEC tool ident Ensure tool is in good condition Use correct lifting procedures and equipment			☐
15	Remove both boom to deck pins using pin-puller and lift out	Boom moving Improper tool Pin slipping 	Do not stand under the boom Keep away from the area possibly affected by the boom. See tool listing in service manual for LEC tool ident Ensure tool is in good condition Use correct lifting procedures and equipment			☐

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Note!
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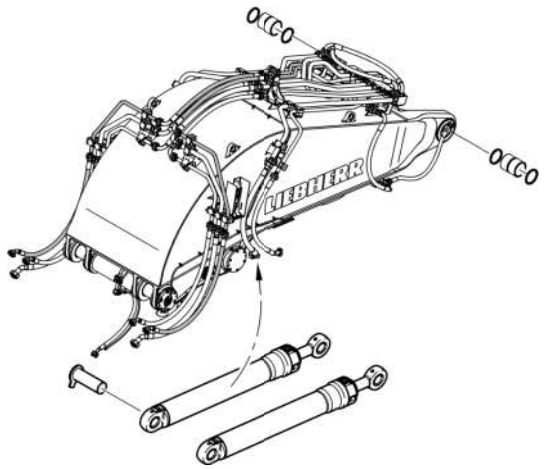
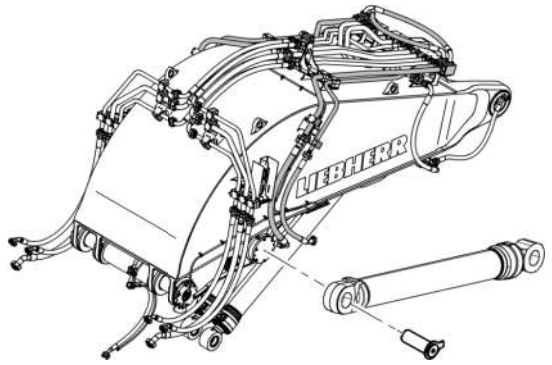
If you are in doubt about a procedure, always check with your supervisor before proceeding.

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
5	Align in stick cylinder, rod secured. Fit pin using pin-puller Secure stick cylinder to boom.	Heavy equipment in movement Crushing Cylinder falling Improper tool 	Use cylinder stands. Keep clear of the load. Rest rod head on wedges See tool listing in service manual for LEC tool ident Ensure tool is in good condition		Pin-puller Cylinder stand Wedges	☐
6	Align in boom cylinders, rod secured. Fit pins using pin-puller Secure boom cylinder to boom.	Heavy equipment in movement Crushing Cylinder falling Improper tool 	Use cylinder stands. Keep clear of the load. Rest rod head on wedges See tool listing in service manual for LEC tool ident Ensure tool is in good condition		Pin-puller Cylinder stand Wedges	☐

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If you are in doubt about a procedure, always check with your supervisor before proceeding.

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
32	Re-fit electrical wiring, counter-weight, inlet and exhaust sys-tems, engine covers	Weight Falling Tripping Slippery Restricted area 	Use correct lifting tech-niqes and equipments Be aware of the missing panels and holes when fit-ting covers Keep worlk area clean			☐
33	Fill all fluid levels and bleed as necessary Charge air conditionning system	Slippery Spills	Clean as you work Wear PPE See Operating and main-tenance manual See Service manual		Spill kit	☐
34	Start the engine Test the machine	Personnel still working Noise Dust Moving objects	Ensure ALL personnel clear Wear PPE Start and Test according to maintenance instruc-tions			☐
35	Clean Area Notify supervisor					☐

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Note!
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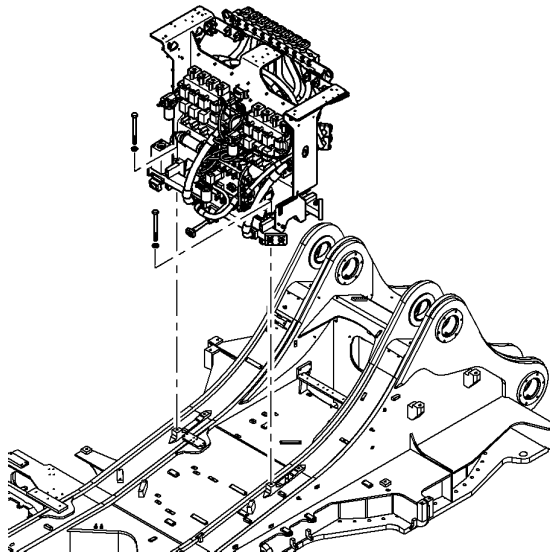
If you are in doubt about a procedure, always check with your supervisor before proceeding.

LIEBHERR

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
5	Unbolt valve bank & lift out Lower the valve-bank on the stand	Crushed fingers Heavy component in movement Crushing Valve bank swinging Valve bank toppling over	Keep in contact with crane operator Keep clear Use ropes to prevent swinging Be carefull when lowering the valve-bank Ensure the valve bank is properly seated/secured on the stand		Ropes Stands	☐
6	Hook new valve-bank Lift new valve bank in place and bolt	Crushed fingers Heavy component in movement Crushing Valve bank swinging	Use correct lifting procedures and equipment Keep in contact with crane operator Keep clear use ropes to prevent swinging		Ropes	☐

Note!
The LIEBHERR equipment is large and heavy. It is mandatory that all work be done in a safe manner.
If you are in doubt about a procedure, always check with your supervisor before proceeding.

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
15	Move the forklift from under the track and lower on ground	Heavy equipment in movement 	Keep clear			☐
16	Unstrap the track-roller Remove the track-roller from the forklift with crane	Heavy equipment in movement 	Keep clear			☐
17	Position and strap new track-roller on the forklift. Slide all the bolts in the roller bores.	Heavy equipment in movement Track-roller moving Crushing Bolt missing when mounting 	Keep clear Wear gloves The bolts cannot be positionned once the roller is on the forklift. Make sure to slide it in position before mounting on the forklift.			☐
18	Move the forklift under the track and lift the roller in position against the sideframe	Heavy equipment in movement Pinched fingers 	Keep clear Keep fingers clear			☐

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If you are in doubt about a procedure, always check with your supervisor before proceeding.

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SWP 3.06.001 -R9100- Undercarriage exchange

Step	Work procedure	Hazards identified	Precautions to be taken	Illustrations	Tools	Check Off
1	Prepare for intervention Follow SWP 0.01: Safety check-list				PPE	☐
2	Remove Bucket Follow SWP 1.06: Face-shovel bucket exchange or SWP 1.07: Backhoe bucket exchange	Forget a step	Follow appropriate SWP carefully			☐
3	Remove Stick Follow SWP 1.08: Remove face-shovel stick or SWP 1.09: Remove backhoe stick	Forget a step	Follow appropriate SWP carefully			☐
4	Remove Boom Follow SWP 1.10: Remove face-shovel boom or SWP 1.11: Remove backhoe boom	Forget a step	Follow appropriate SWP carefully			☐
5	Remove counterweight Follow SWP 2.04: Remove counterweight	Forget a step	Follow SWP 2.04 carefully			☐

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If you are in doubt about a procedure, always check with your supervisor before proceeding.

2.4 Engine and oil cooler boxes / radiators

2.4.1 Engine cooler box (without engine radiator)

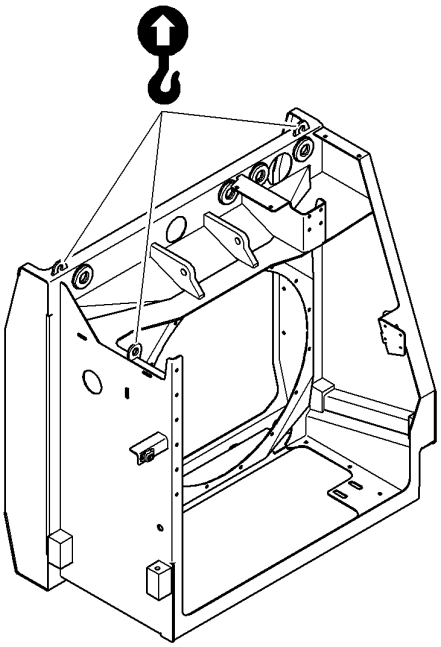

Fig. 2 *Lifting points of engine cooler box*

Weight: 418 kg

2.4.2 Engine radiator

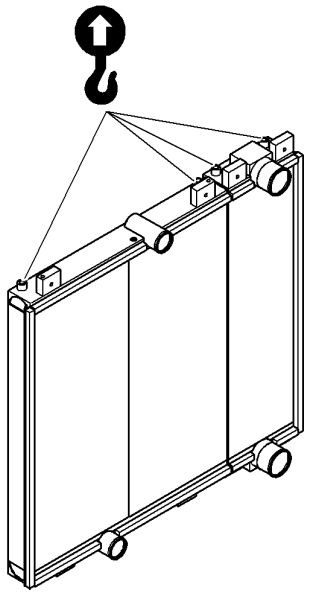

Fig. 3 *Lifting points of engine radiator*

Weight (empty): 186 + 85 = 271 kg

Thread of the lifting nut: M16 x 20

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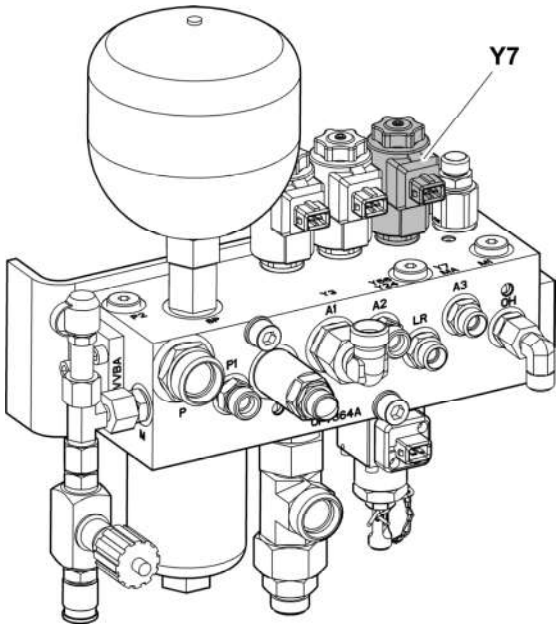


Fig. 9 *Solenoid valve Y7 on servo unit*

Y7 Solenoid valve swing brake

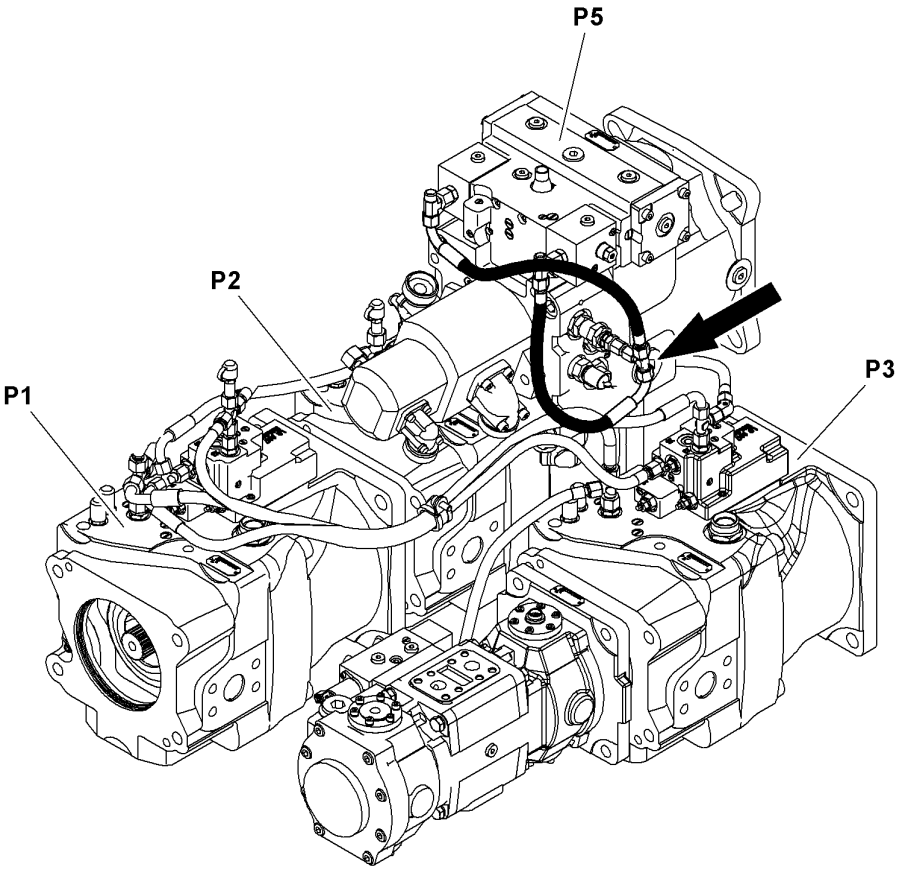
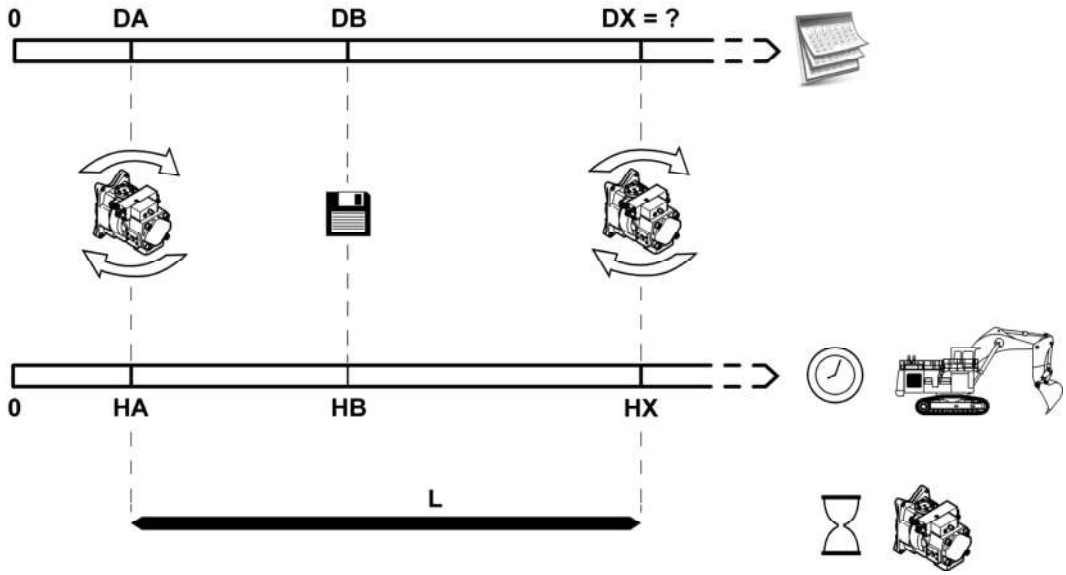


Fig. 10 *Hose of pressure cut-off valve on swing pump P5*

2 Calculate the next date you will replace a major component

In the section «Recommended intervals to replace the major components», the table gives an estimate of the life of major components. If you use the recommended intervals of the components and monitor the machine hours, you can calculate the date when you will need to replace the components.



Dates	**DA**	The last date when the component was replaced
	DB	The last date when the working hours of the machine were recorded
	DX	The next date when you will need to replace the component
Times	**L**	Lifetime of the component (hours)
Working hours of the machine	**HA**	Working hours when the component was replaced
	HB	Last recorded working hours
	HX	Working hours when you will need to replace the component
Other data	**AW**	Average working hours per day for the machine

The formula is:

$$\mathbf{DX} = \mathbf{DB} + \frac{\mathbf{L} - \mathbf{HB} + \mathbf{HA}}{\mathbf{AW}}$$

Example:

Component = rotary connection

Dates are written as «dd/mm/yyyy».

DB = 18/04/2015
HA = 32500 hours
HB = 33091 hours

L = 12000 hours
AW = 18 hours/day

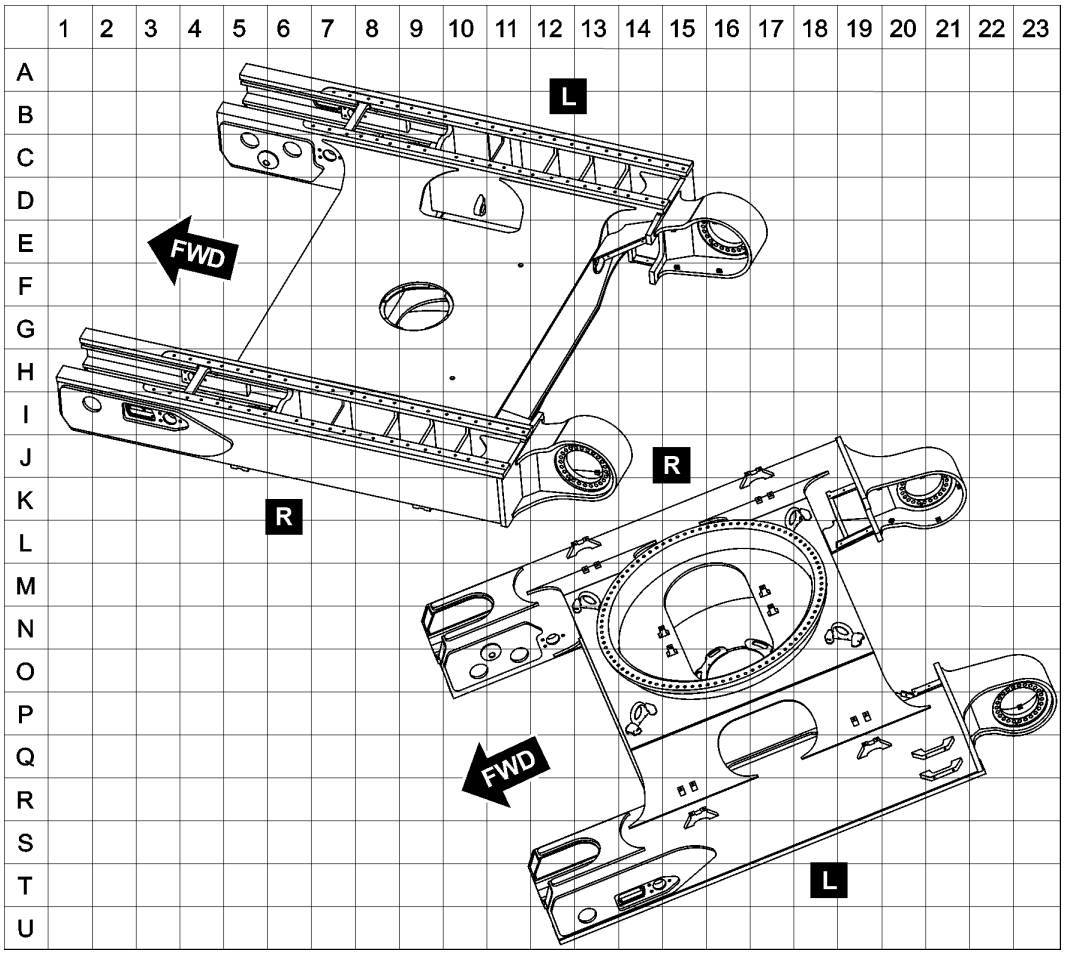
$$\mathbf{DX} = 18/04/2015 + \frac{12000 - 33091 + 32500}{18} = 18/04/2015 + 633{,}83 \text{ days} = 11/01/2017$$

The date when you will replace the rotary connection is the 11/01/2017.

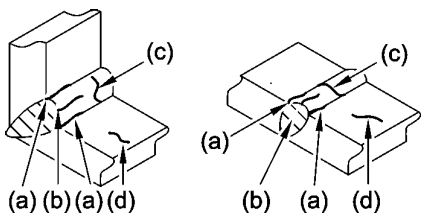
Machine serial N°:	Machine hours:	Travel hours:	Completed by:	Date:

Undercarriage	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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1.4 Technical data

1.4.1 Working technical data

	Backhoe	Shovel
Maximum working slope*	5,0° - 9,0% (7,5 m^3)	5,0° - 9,0% (7,0 m^3)
Maximum travelling angle	23° - 42%	22° - 40%
Maximum tilt angle of Diesel engine	35°	35°
Working ambient temperature range	-12°C to +55°C Arctic packages in option***	-12°C to +55°C Arctic packages in option***
Noise emission**: • L_{pA} (inside cab) • Measurement uncertainty	 76 dB(A) 1,13 dB(A)	 76 dB(A) 1,13 dB(A)

Tab. 1-2 *Working technical data*

Machine with Extra Wide (EW) undercarriage	Backhoe
Maximum working slope*	5,0° - 8,7% (7,0 m^3)
Maximum travelling angle	25,2° - 47,1%
Maximum tilt angle of Diesel engine	35°
Working ambient temperature range	-12°C to +55°C Arctic packages in option***
Noise emission**: • L_{pA} (inside cab) • Measurement uncertainty	 76 dB(A) 1,13 dB(A)

Tab. 1-3 *Working technical data for machine with Extra Wide (EW) undercarriage*

* The maximum working slope has been determined for a hydraulic excavator in standard configuration (with bucket volume as given in the table above) with a material density of 1,8 t/m^3.

Changing the excavator configuration or the material density has an impact on the maximum working slope. In this case, LEC recommends contacting Customer Service in order to determine specific working conditions and the maximum working slope in particular.

The machine stability has been defined relative to a horizontal surface and taking into account a safety factor. Operating the excavator with a different configuration will reduce this safety factor. When working on slopes, it is not permitted to overload the bucket and to work with a material density different from that intended for the bucket provided by LEC.

In order to use the excavator in material handling operations, LEC recommends also contacting the Customer Service.

** The sound pressure level (L_{pA}) is determined according to ISO 6396. The measurement uncertainty is determined according to ISO 4871.

*** If installed, the optional arctic packages change the working ambient temperature range of the machine. In this case, a special information label in the cab indicates the

LIEBHERR-MINING EQUIPMENT COLMAR SAS

Gemaess ISO 9248 kann die Ausmessung von allgemeinen Massen, Inhalten und Leistungen der Maschinen zwischen von dieser Norm gegebenen Toleranzen abweichen.

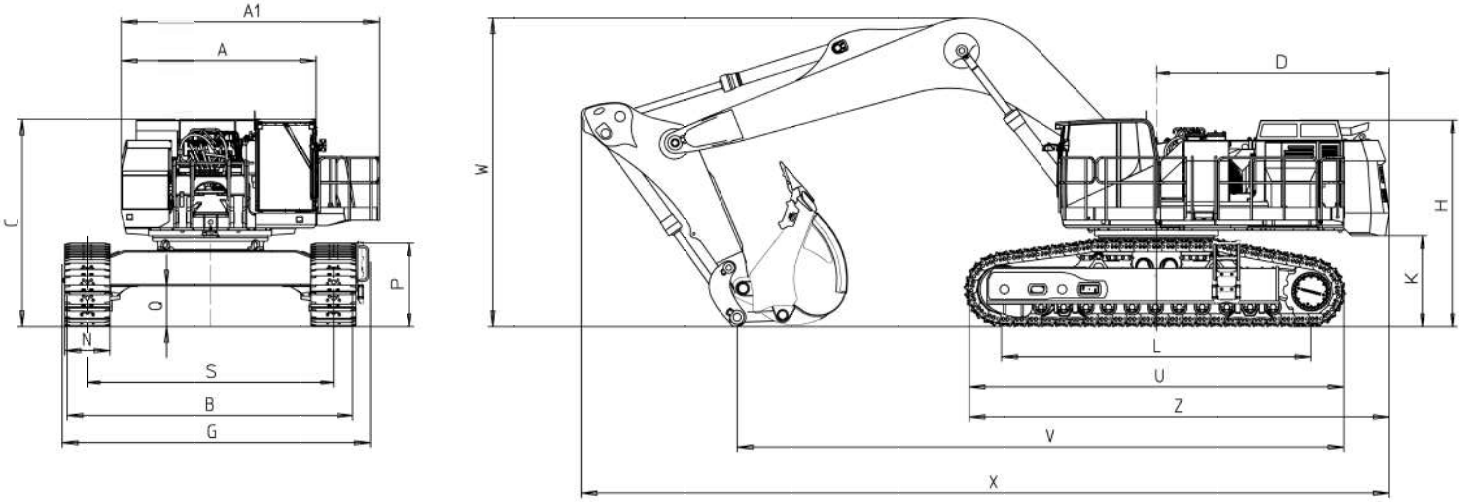
According to ISO 9248 , measurements of general machinery dimensions, performances and capacities may vary within tolerances given by this norm.

En accord avec la norme ISO 9248 , la mesure des dimensions, des volumes et des performances généraux des machines peut varier dans un intervalle de tolérance donné par cette norme.

INFORMATION :
unterliegt nicht dem Änderungsdienst,
Änderungen vorbehalten.

INFORMATION :
Right of modification reserved
Not sujected to be updated

INFORMATION :
n'est pas soumis à mise à jour,
modifications possibles sans préavis.



A = 3880 mm	N = 900 mm
A1 = 5150 mm	P = 1670 mm
B = 5685 mm	O = 810 mm
C = 4130 mm	S = 4900 mm
D = 4630 mm	U = 7460 mm
G = 6140 mm	V = 12090 mm
H = 4110 mm	W = 6145 mm
K = 1810 mm	X = 16085 mm
L = 6166 mm	Z = 8360 mm

900 mm BODENPLATTE
900 mm FLOOR PLATE
PATINS DE 900 mm

MONOBLOCKAUSLEGER
GOOSENECK BOOM 9200 mm
FLECHE MONOBLOC

LÖFFELSTIEL
STICK 3200 mm
BALANCIER

TIEFLOEFFEL
BACKHOE BUCKET R=2530 mm
GODET RETRO

R 9100 EW

Freimaßtoleranz / Tolerances not specified ISO 2768 T1-T2 / Tolérance générale - mK
Fertiggewicht / Weight / Poids: 0.0 kg
Modell od. Gesenk Nr. / Pattern or die No. / Modèle ou matrice N°: .
Bearbeitung/Finish/Usinage

Projektion E
Datum Date/Date | Name Name/Nom
Gezeichnet/Drawn/Dessiné 15-Mar-2018 KNUDSEN C.
Geprüft/Inspected/Vérifié BARUTHIO R.
Normgepr./Inspected standards/Vérifié normes

LIEBHERR
WERK FACTORY USINE LEC
A1
Maßstab / Scale / Echelle 1:50
Werkstoff/Material/Matière: .

Bezeichnung/Description/Dénomination
KINEMATIK
KINEMATICS
CINEMATIQUE

Zeichnungs Nr/Drawing No./N° de dessin
. 33 1652 1000 01 000
Ident Nr./Ident No./N° d'ident.
12198162
Blatt / Page / Feuille
2 / 2

Ersatz für/Replacement for/Remplace
Ersetzt durch/Replaced by/Remplacé par

Plate 3: Typeplate LEC (Liebherr-Mining Equipment Colmar SAS)

This typeplate gives the following information:

- Product identification number.
- Type.
- Construction year.
- Nominal engine power.
- Max. speed.
- Operating mass*.

Plate 4: Typeplate LAM (Liebherr America)

This typeplate gives the following information:

- Type.
- Product identification number.

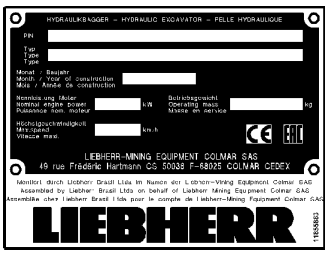


Plate 5: Typeplate LBR (Liebherr Brazil) "CE" / "EAC"

This typeplate gives the following information:

- Product identification number.
- Type.
- Construction month and year.
- Nominal engine power.
- Max. speed.
- Operating mass*.

Plate 6: Typeplate LBR (Liebherr Brazil)

This typeplate gives the following information:

- Product identification number.
- Type.
- Construction year.
- Nominal engine power.
- Max. speed.
- Operating mass*.

* Estimated mass of the machine in its standard version (without optional equipment) according to its configuration: Diesel, electric, backhoe, shovel or pontoon.

Plate 20: Danger signal label

Indicates to stay out of the surrounding operating area in order to avoid severe injury.

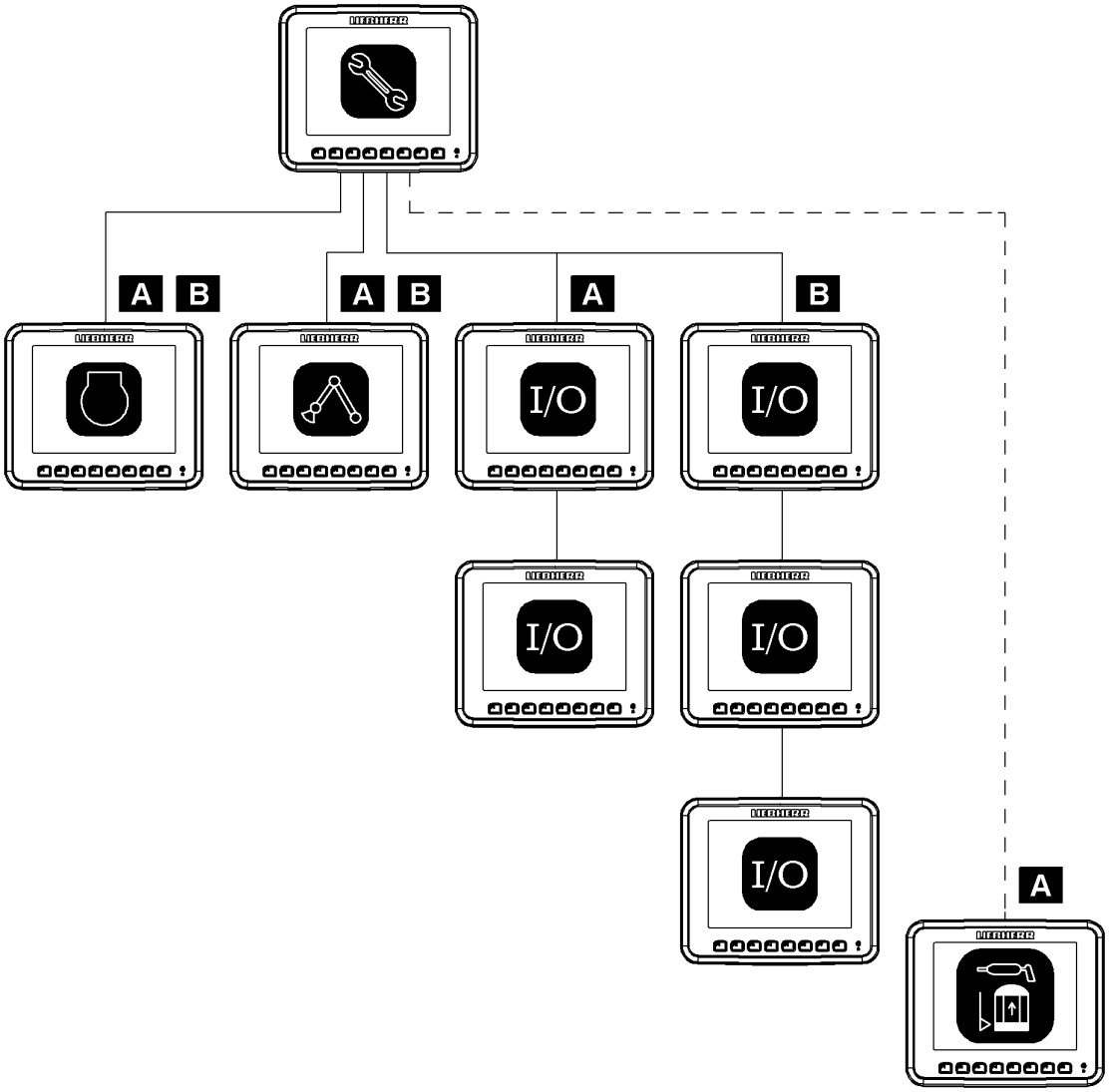


Fig. 3-15 *Submenus of the menu "Check"*

A Symbol mode
B Label mode

Submenus:

Engine

This submenu shows in real time different parameters values of the engine.

Inputs Attachment

This submenu shows the status of digital and analogical inputs of the machine attachment.

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Caution!
For safety reason, the excavator can only be operated if the ladder is locked in its top position. This means that the swing and travel movements remain locked.

This safety measure can be momentarily by-passed by pushing and holding the button **S122** on the control board.

Depending on the machines, the cab control board can be different.

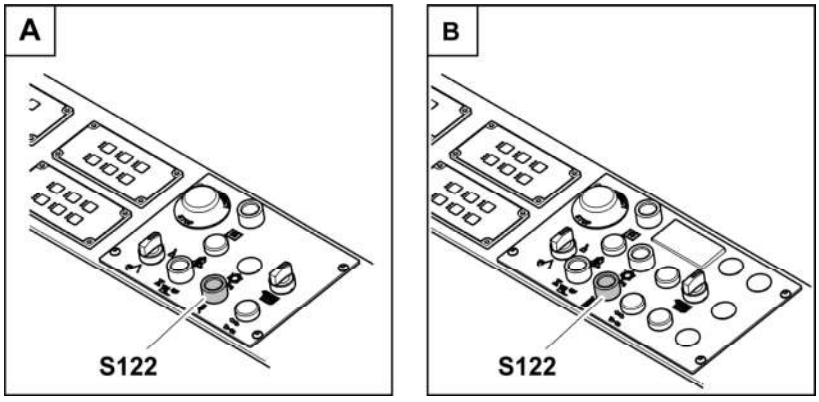

Fig. 3-24 *Button S122: Disable of ladder control position*

Move the 45° access ladder into lower position in case of emergency

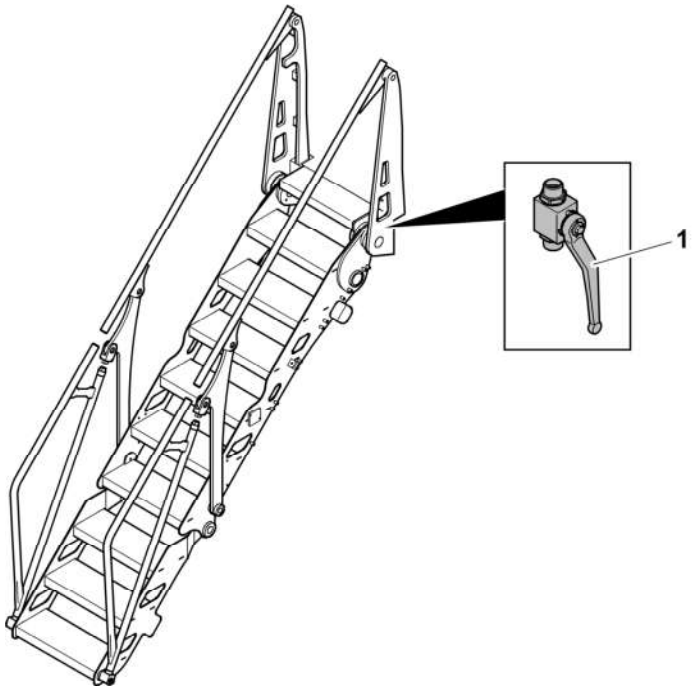

Fig. 3-25 *Emergency valve of access ladder*

1 Manual valve

In case of failure (service batteries out of order, defective solenoid valve or wiring, ...) of the access ladder moving procedure, an emergency valve is installed near the ac-

Note!
To prevent the starter motor and the battery from overloading, only switch on the air-conditioning after starting the diesel engine.

▶ If the machine is used for a longer period of time without using the air-conditioning unit, operate the compressor every 2 weeks by pressing the REHEAT button **6** (see Fig. 3-49).

Additional cab heater (optional)

An additional cab heater can be installed above the operator seat. Thus, in case of cold weather, it can improve the cab comfort during the machine operation.

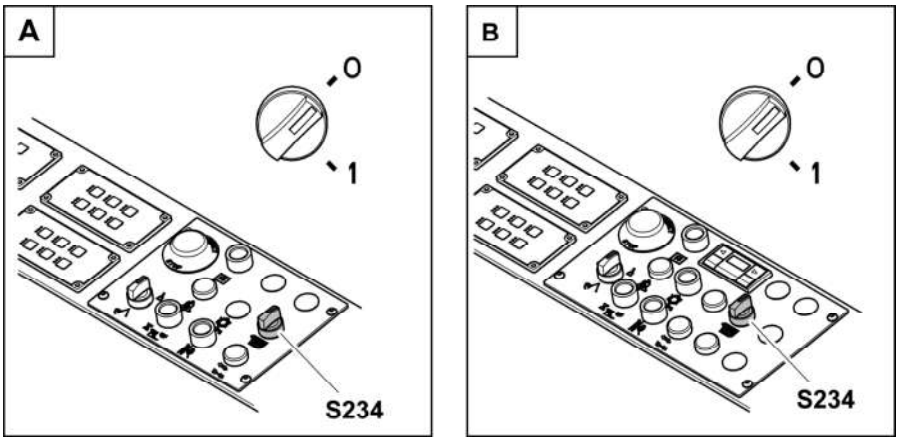

Fig. 3-52 *Rotary switch for additional cab heater*

S234 Rotary switch for the additional cab heater

Depending on the machines, the cab control board can be different.

▶ Start the Diesel engine.

▶ Use the rotary switch **S234** to start the additional cab heater.
↳ The temperature adjustment of this device is the same as the standard heating system.

▶ Use the rotary switch **S234** again to stop the additional cab heater.

Cab preheating system (optional)

The optional cab preheating system can start automatically, even if the machine is stopped. Thus, in case of cold weather, you can get a correct temperature in the cab before the start of the first shift.

The system has:
– a coolant heater
– an additional cab heater installed above the operator seat

Notes

To keep a safety level of the special batteries power (and of the principal batteries if applicable), the cab preheating procedure must take maximum 90 minutes.

▶ Take the maximum time above into account to set the cab preheating.

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▶ Set the necessary operating time with the "**Previous**" or "**Next**" button.

▶ Push the "**Filled**" button to confirm the setting.

The coolant heater will automatically stop.

Start and stop the coolant heater automatically

▶ Go to the menu "**Program**".

▶ Select a program number.

▶ Push the "**Previous**" or "**Next**" button to select "**ON**".

▶ Push the "**Filled**" button.
↳ The automatic start and stop of the coolant heater is activated, with the parameters set in the sections above.

▶ Push the "**Previous**" or "**Next**" button to select "**OFF**".

▶ Push the "**Filled**" button.
↳ The automatic start and stop of the coolant heater is deactivated.

Caution!
The coolant heater current time and the recorded data will be erased if the preheating electrical system is opened.

▶ Let the circuit breakers of the preheating electrical system in position "**CLOSE**" to keep the data.

Thus, while the coolant heater is on or on standby, the special preheating batteries continue to supply the resistors for the heating of the electrical boxes.

▶ Monitor the state of charge of the special preheating batteries.

Warning lights

After the coolant heater start, Diesel engine coolant and block warm up. Thus, different warning lights are located on the cab control board to control this preheating. Depending on the machines, the cab control board can be different.

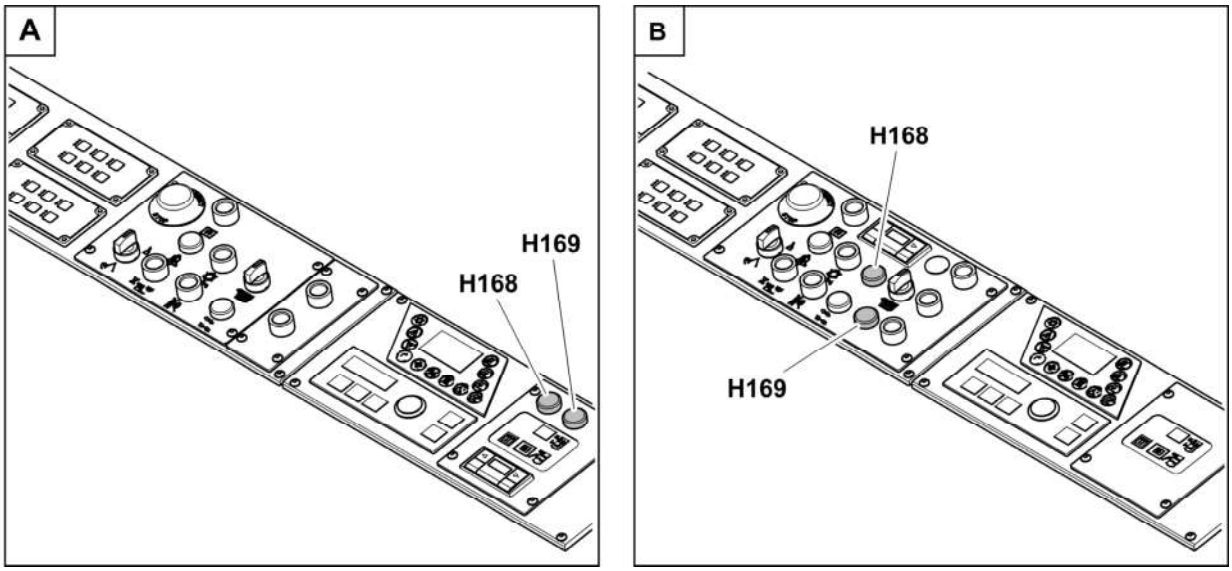
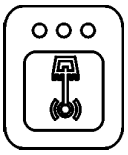


Fig. 3-71 *Warning lights of coolant preheating*



▶ Press "Swing brake" button on the keyboard.
  ↳ Swing brake is engaged.
  ↳ Uppercarriage is locked.
  ↳ First LED in the button comes on.

▶ Press button again.
  ↳ Swing brake is released.
  ↳ Uppercarriage is unlocked.
  ↳ First LED in the button goes out.

The swing brake is engaged if the safety lever is up or the access ladder is down (if installed) or the service trap is down (if installed).

In option, a buzzer can be activated in the cab if you operate the joystick to turn the uppercarriage while the swing brake is engaged.

Caution!
The brake only applies when the uppercarriage is near standstill and if no swing motion is actuated with the joystick.

To stop the uppercarriage when working on a slope:

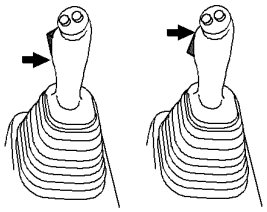
▶ Use the joystick to reduce the uppercarriage speed.

▶ Press "Swing brake" button to operate the swing brake.

▶ Move the joystick back to "0" position only after the brake operates.

Semi-automatic swing brake control (optional)

❑ Make sure that the swing brake does not operate.



▶ Tilt down the rocker switch **S57** on the right joystick handle.
  ↳ The semi-automatic control of the swing brake is on.

When the semi-automatic control of the swing brake is on:

– When the uppercarriage speed is less than a limit value:
  • The swing brake is applied.
  • The first and the second LEDs in the "Swing brake" button come on.
  • The swing brake symbol shows on the monitoring display.
– When the uppercarriage speed is more than the limit value:
  • The swing brake is released.
  • The first and the second LED in the "Swing brake" button go off.
  • The swing brake symbol disappears from the monitoring display.

▶ Tilt up the rocker switch **S57.**
  ↳ The semi-automatic control of the swing brake is off.
  ↳ The swing brake is released.

Caution!
The brake only applies when the uppercarriage is near standstill and if no swing motion is actuated with the joystick.

To stop the uppercarriage when working on a slope:

▶ Tilt down the rocker switch **S57**.

▶ Use the joystick to reduce the uppercarriage speed.

▶ Move the joystick back to "0" position only after the brake operates.

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3.7.4 Excavator lifting and lashing operations

Danger!
For safety reasons, always consider the precautions given in this section.

Lifting precautions

Lift element:

- always checking and respecting the lifting configuration indicated on the corresponding transport drawing,
- only with the provided lifting appliances,
- with adequate and approved lifting devices of other kind (cables, chains, slings) if necessary,
- only after mounting the lifting appliances in accordance with the regulations,
- only at the declared threads or lugs shown on the assembly drawing,
- with the best possible equal load distribution,
- only being sure that the lifted element has been already dismounted,
- only after having drained tanks (hydraulic, fuel…),
- if no specific value is indicated on the corresponding transport drawing, always respecting the angles given on the sticker for lifting and lashing operations (refer to the description below).

Additional lifting precautions for backhoe buckets

When you lift the backhoe bucket, also obey the precautions that follow:

- Only use the lifting points shown in the stickers placed on the bucket.
- You can use the bucket teeth as lifting points.
- Be careful about the position of the center of gravity of the bucket.
- The bucket has two possible transport positions. The height B1 gives the correct transport position as shown in the transport drawing.
- If the height B1 is more than 3,6 m, turn over the bucket safely.

Additional lifting precautions for shovel buckets

When you lift the shovel bucket, also obey the precautions that follow:

- Only use the lifting points shown in the stickers placed on the bucket.
- Do not use the bucket teeth as lifting points.
- Do not use the welded beam to lift the bucket.
- Be careful about the position of the center of gravity of the bucket.

Lashing precautions

Lash element:

- always using necessary and appropriate devices or tools (e.g. elevating platform) in order to ensure safe lashing,
- always checking and respecting the lashing configuration indicated on the corresponding transport drawing,
- if no specific value is indicated on the corresponding transport drawing, always respecting the angles given on the sticker for lifting and lashing operations (refer to the description below),
- always ensuring a sufficient coefficient of friction (0,6 or higher) between load and

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Fault / error	Cause	Solution
Fuel in the oil	Injection nozzle defective	Remove the injection nozzles. Replace defective injection nozzle and O-ring. Replace engine oil with engine oil filter. Store the dismantled injection nozzles in a clean receptacle containing clean diesel fuel. O-ring and seal of the injection nozzle must be replaced. Always replace the dismantled pressure pipe tube. The pressure pipe tube has a centring point and will fit in the cylinder head in one position only. Note: cleanliness: State-of-the-art components for the diesel injection nowadays are made of high-precision parts which are subjected to extreme stresses. Due to this high-precision technology, very high cleanliness must be observed when working on the fuel system, as even dirt particles measuring only 0.02 mm can cause components to malfunction and thus lead to engine damage.
	Fuel high-pressure pump defective	Replace fuel high-pressure pump
Cooling water in the fuel	Fuel tank contaminated	Clean the fuel system completely. Replace the fuel filter and bleed the fuel system
	Cylinder head defective	Replace cylinder head
Lube oil pressure insufficient	Lube oil pump defective	Replace the lube oil pump.
	Bearing clearance too great due to excessive wear or bearing damaged	Replace or reposition engine.
Lube oil in the cooling system	Oil cooler, oil cooler grill or seal leaking	Press out oil cooler, replace if leaking, replace seal
	Water pump for engine side leaking	Replace water pump
Cooling water in the lube oil	Oil cooler, oil cooler grate or seal leaking	Press out oil cooler, replace if leaking, replace seal.
	Water pump for engine side leaking	Replace water pump
	O-rings of the cylinder liners leaking	Remove cylinder liners and reseal
Oil in the fuel	Incorrect fuel in tank	Clean fuel system completely and replace fuel filter.
	Fuel low-pressure pump on the engine side leaking	Replace fuel low-pressure pump
	Fuel high-pressure pump defective	Replace fuel high-pressure pump
The Diesel engine oil consumption is too high	Engine leaking	Tighten screws, replace seals if necessary. The max. oil consumption is 0,5% from the fuel consumption.

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Drilled anchor points

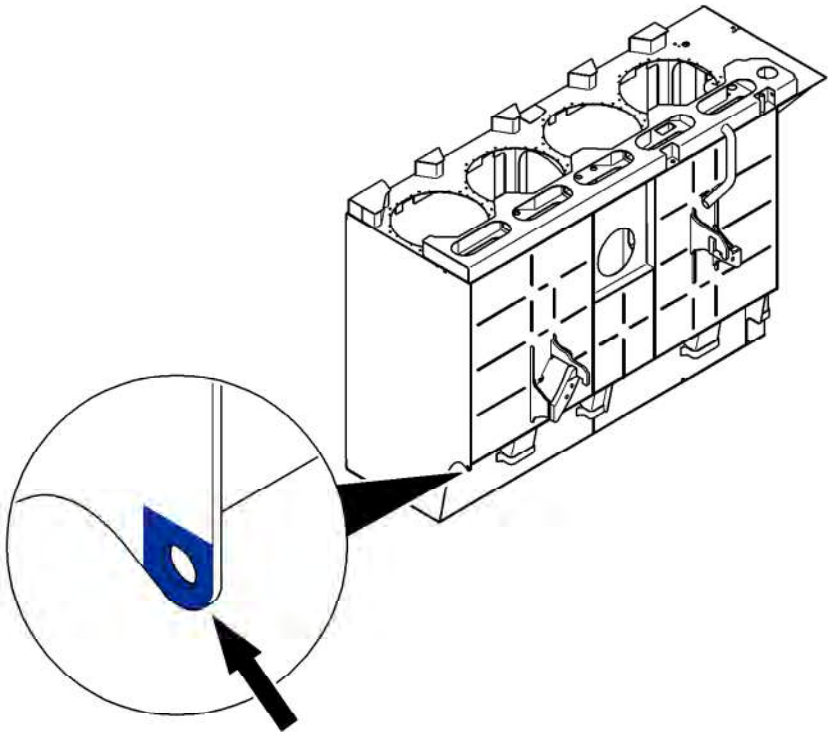

Fig. 5-5 *Drilled anchor point (example)*

5.3.2 Use the anchor points

- Before you use an anchor point, always do a check of its condition.
- If an anchor point has been used to arrest a fall, or if you are not sure about its safe condition, do not use this anchor point until it has been inspected and, if necessary, tested by a competent person.
- Always use the anchor points with applicable fall-arrest equipment.
- Use a harness with a maximum arrest force of 6 kN.
- Only attach to approved anchor points.
- Never attach more than three persons to a lifeline.
- Never attach more than one person to another type of approved anchor point. If several persons must attach themselves to the machine, they must use different anchor points.
- Never use an anchor point to attach parts or material.
- Persons who must work with fall-arrest equipment must be specially trained.
- All the anchor points and the tightening of the handrails mounting screws must be examined by authorized specialist personnel. For maintenance intervals, refer to the control and maintenance chart.

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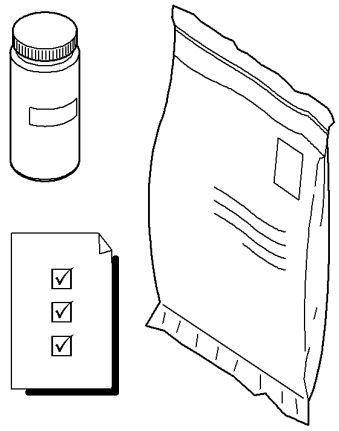
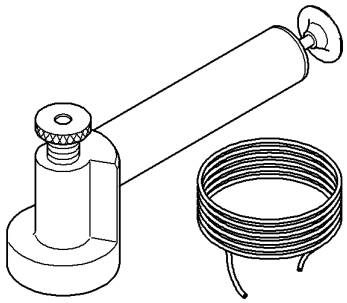
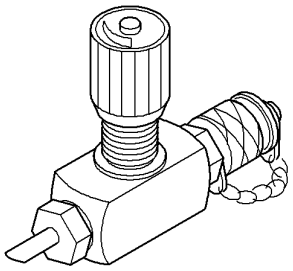
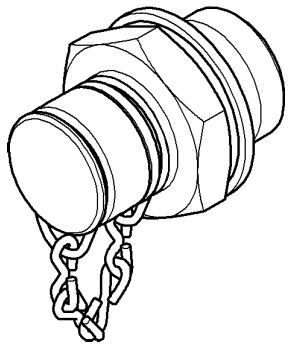
Ident Nr.	Description	Quantity	Illustration
8145660	Sampling kit for mineral and synthetic oils: – sample bottle – envelope addressed to OELCHECK GmbH – sample information sheet	1	
10029626		4	
7018368		6	
7018369		12	
7026817	Sampling kit for biodegradable oils: – sample bottle – envelope addressed to OELCHECK GmbH – sample information sheet	1	
7026088		6	
8145666	Sampling hand pump: – hand pump – sampling hose	1	
5613844	Sampling valve	1	
7019068		1	
	Compact sampling valve:		
12203274	– for hydraulic oil	1	
12203276	– for engine oil	1	
12203277	– for swing gear oil	1	
12203278	– for engine coolant	1	
12203279	– for splitterbox oil	1	

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Fill the fuel tank

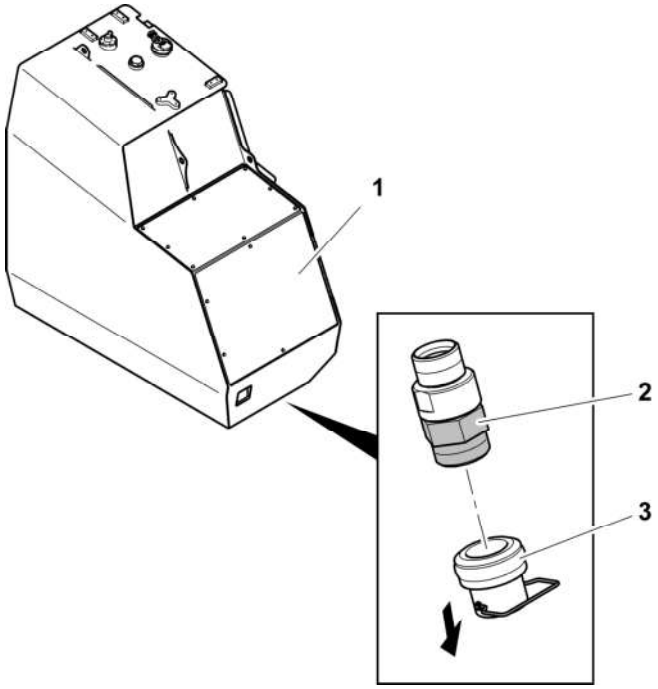

Fig. 5-41 *Fuel connection under the fuel tank*

1 Fuel tank
2 Fast fuel receiver
3 Receiver cover

- ▶ Remove the cover **3** from the fast fuel receiver **2**, which is installed below the fuel tank **1**.
- ▶ Plug the nozzle (fuel gun) to the receiver **2.**
- ▶ Add fuel until the system stops automatically.
- ▶ Install back the cover **3**.

5.10.2 Drain the fuel tank

A drain valve is located at the bottom of the fuel tank.

- ▶ Attach a drain hose on the bleeding valve **3**. Drain the water until water free oil flows out.
- ▶ Close the breather filter.

5.12.5 Hydraulic oil coolers

Cleaning hydraulic oil coolers is necessary to get optimum hydraulic oil cooling.

- ▶ Clean hydraulic oil coolers with compressed air or a steam cleaner at the intervals given in the control and maintenance chart, and more often if working conditions make it necessary.

5.12.6 Leak oil filter and return filter

The leak oil filter and the return filters are located on the top of the hydraulic tank.

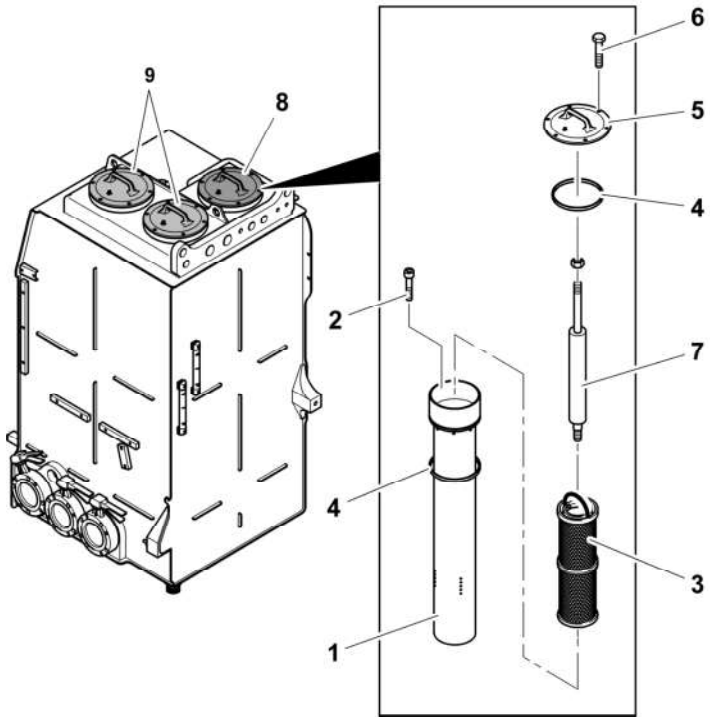

Fig. 5-66 *Oil filter parts*

1 Return pipe
2 Screw
3 Filter element
4 Seal kit
5 Cover
6 Hexagonal screw
7 Magnetic rod
8 Leak oil filter
9 Return filter

- ▶ Clean the magnetic rods **7** of the two types of filters at fixed intervals.
- ▶ Replace the filter element **3** at fixed intervals.

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Change the oil of the Lifetime interspace (optional)

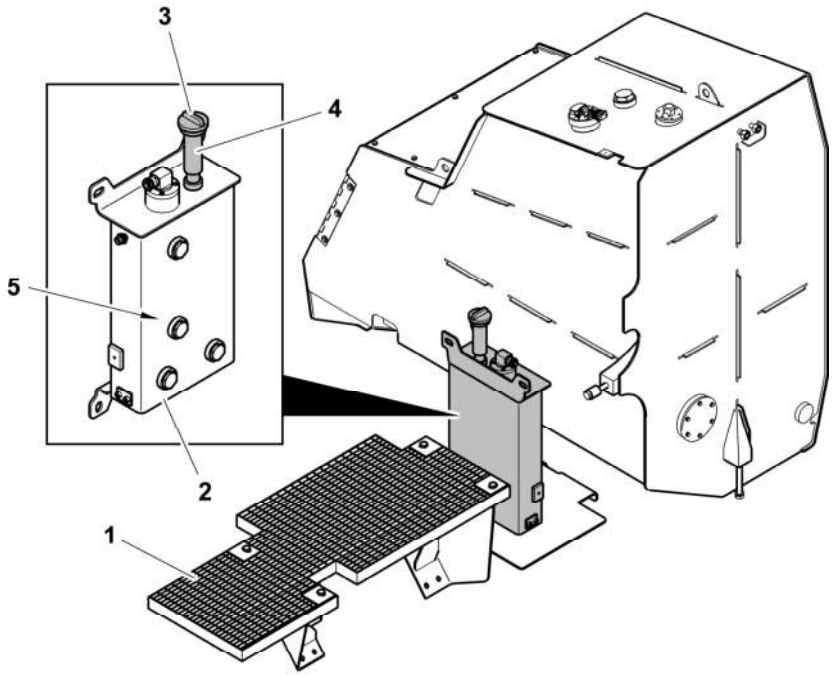

Fig. 5-89 *Special expansion tank of Lifetime interspace*

1 Rear cab grating
2 Expansion tank
3 Sealing cap
4 Oil filler neck
5 Sight gauges

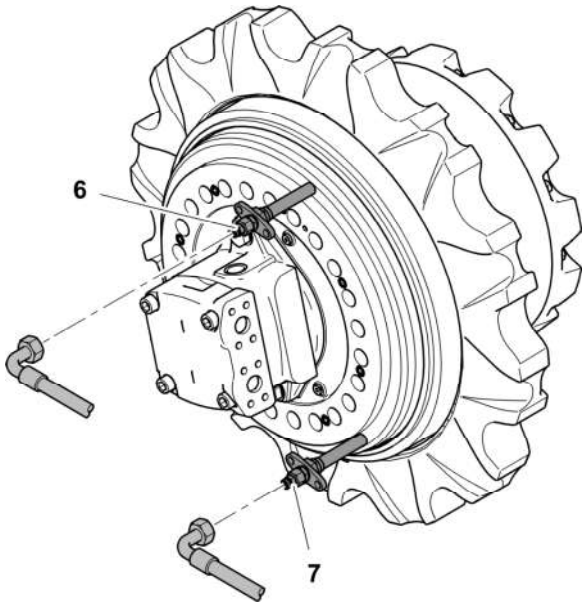

Fig. 5-90 *Oil change on the Lifetime interspace*

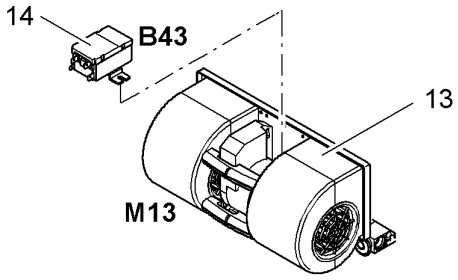

Fig. 5-116 *Fan motor in the heater*

13 Fan motor
14 Defrost thermostat

- ▶ Do a check of the function of the fan motor **13** (M13).
- ▶ Do a check of the function of the ventilation flaps on the heating / air-conditioning system.
- ▶ Do a check of the electric installation.
- ▶ Do a check of all hose fittings and couplings for leakage.
- ▶ Do a check of the defrost thermostat **14** (B43) in the evaporator (function, correct positioning and for damage).
- ▶ Do a check of the pressure switch on the dryer/receiver unit.

5.16.4 Additional cab heater (optional)

- ▶ If the additional cab heater is installed, refer to section "Starting aids" in chapter 5 for the maintenance to do.

5.16.5 Cab preheating system (optional)

- ▶ If the optional cab preheating system is installed, refer to section "Starting aids" in chapter 5 for the maintenance to do on:
- – the coolant heater
- – the additional cab heater installed above the operator seat

5.17 Cab pressurization (optional)

5.17.1 Aeration device (optional)

This optional aeration device is located on the rear top of the cab.

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WORK TO BE PERFORMED DAILY Check ❑ for first and only interval *or* Check ❍ for repeat interval	Check	Initials	Comments
Diesel engine: Check running noises	❍		
Diesel engine: Check exhaust gas colour	❍		
Diesel engine: Check oil pressure and coolant temperature during operation	❍		
Electrical system: Clean and check LCD screen of the display for proper function when starting	❍		
Electrical system: Check indicator lights and gauges on the control panel when starting	❍		
Electrical system: Check for warning and fault messages on display (monitoring, grease, air conditioning, ...). If necessary refer to chapter 4 in the Operating Manual to identify and rectify faults and errors.	❍		
Cabin: Check if the safety lever is working properly	❍		
Cabin: Check the horn	❍		
Cabin: Check for green flash light on control module if fire fighting system is installed	❍		

WEEKLY CHECK THESE STEPS IN ADDITION TO THE DAILY REQUIREMENTS			
UPPERCARRIAGE			
Check level in reservoir for windshield washer, refill if necessary	❍		
CENTRALIZED LUBRICATION SYSTEM			
Perform the complete weekly maintenance given in the SKF / Lincoln Operating Instructions Manual	❍		
DIESEL ENGINE AND SPLITTERBOX			
Do a visual check of the precleaner	❍		
Do a visual check of the air intake hose for condition and leaks	❍		
Do a visual check and clean the radiator core and fan	❍		
Do a visual check of the radiator cap for leaks, replace if necessary	❍		
Drain off water and sediment at fuel tank	❍		
HYDRAULIC SYSTEM			
Clean magnetic rods of all return filters (weekly during the first 250 hours)	❑		
Do a visual check of the hydraulic tank breather filter, clean if necessary	❍		
ELECTRICAL SYSTEM			
Do a visual check of the head and floodlights, clean and adjust if necessary	❍		

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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
Sample and analyse hydraulic oil and change oil if necessary	❍		
Change hydraulic oil	❍		
Clean magnetic rods of all return filters	❍		
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 the hydraulic tank breather filter	❍		
Replace the hydraulic tank breather filter (if hydraulic hammer is used)	❍		
Replace control oil filter element	❍		
Replace swing pumps replenishing oil filter elements	❍		
Replace the control valves high pressure filters, replace filter elements after each replacement or repair of a working pump and check the internal surface of the filter housing	❍		
Do a visual check of the oil cooler protection filters, clean or replace if necessary (optional equipment)	❍		
Replace filter elements of bypass filter (optional equipment)	❍		
Do a detailed check of the oil coolers, clean if necessary	❍		
Do a visual check of the cooling fan blades, replace if necessary	❍		
Check and adjust primary and secondary pressure relief valves	❍		
Do a detailed check of mounting of components (pumps, motors, ...)	❍		
Every 4000 hours (or at least once a year), all hydraulic pumps must be checked and adjusted by trained and qualified Liebherr personnel	❍		
Every 10000 hours, replace following high pressure (HP) hoses: – all HP hoses between work pumps and valve banks, – all HP hoses of the swing circuit: • all HP hoses between swing pumps and swing motors, • all pressure equalizing hoses between swing pump / swing motors circuits, • all HP pilot hoses of the swing pumps regulation, – all HP hoses of the oil cooler fan drive circuit, including HP pilot hoses, – all HP hoses of the water cooler fan drive circuit, including HP pilot hoses.	❍		
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)	❍		
Replace main element on aeration devices for cabin and electrical boxes (at least once a year) (optional equipment)	❍		

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Oil intake and oil replenishing circuit

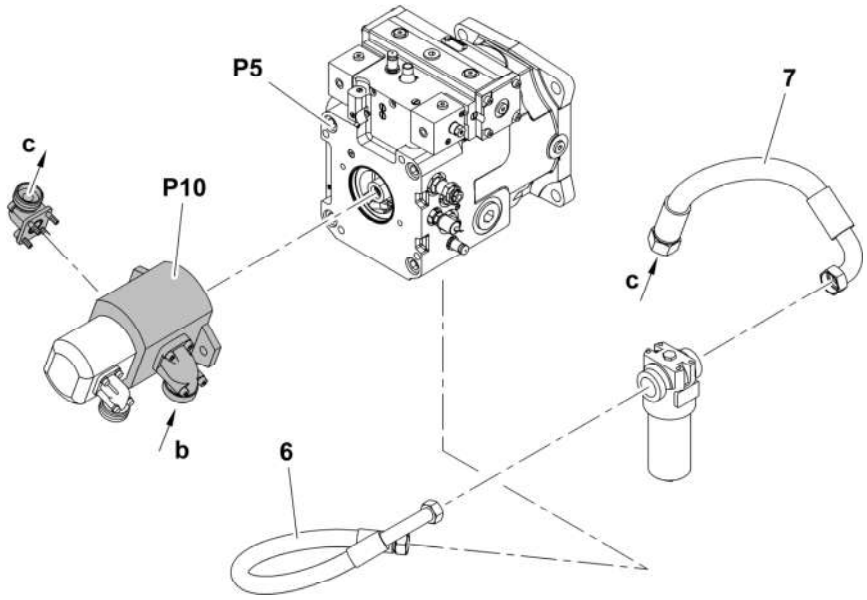

Fig. 6-16 *Intake and replenishing hoses*

6	Hydraulic hose	**P5**	Swing pump
7	Hydraulic hose	**P10**	Replenishing oil pump
b	Refer to section "Oil intake circuit" of the working pumps		

- ▶ Disconnect, drain and clean all the hydraulic hoses.
- ▶ Clean the hydraulic tank (refer to the related section).
- ▶ Do the restart procedure before you put the machine in operation (refer to the related section).

6.2.7 Cooling pumps circuit

Return oil circuit

- ▶ Refer to sections "Return oil circuit" and "Return lines on VB2" of the working pumps.
- ▶ Move to next section about the leak oil circuit.

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1 Guidelines

As you read these instructions, you will notice a number of depictions and symbols which are to facilitate the navigation and understanding of these instructions.

For reasons of better legibility, in these instructions we mainly use the male form for general references. Of course, the female form is also always intended.

Please read these instructions thoroughly and heed the warning and safety notes. Please observe the warning and safety notes and exercise particular caution in these cases.

Inform also other users accordingly.

Text representations	Meaning
Bold print	Highlighting of particularly important words or passages
• List 1	Marks lists
○ List 2	Marks lists
(parenthesis)	Item numbers
➢ Instructions	Instructions to personnel. These always appear in chronological order.

1.1 Explanation of symbols and signs

Activities which generate actual hazards (to life and limb or possible damage to the material) are marked by warnings. Definitely observe the instructions given in the warnings.

You will find these symbols, which warn of specific dangers to persons, material assets, or the environment, next to all safety instructions in these operating instructions.

Please read these instructions thoroughly and heed the warning and safety notes. Please observe the warning and safety notes and exercise particular caution in these cases.

Inform also other users accordingly.

The following warnings are possible.

Warning level		Consequence	Probability
	**DANGER**	Death/ serious injury	imminent
	**WARNING**	Serious injury	possible
	**CAUTION**	Minor injury	possible
	**ATTENTION**	Property damage	possible

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8 Technical data and operating instructions

8.1 Operating pressure / operating temperature

All system components must be designed for the maximum operating pressure and must be secured by an adequate pressure relief valve against too high system pressures. For details see operating or installation instructions and data sheets of the respective product.

8.2 Installation position, sound pressure level, weight, dimensions

For details see operating or installation instructions and data sheets of the respective product.

8.3 Tightening torques

For details see operating or installation instructions and data sheets of the respective product.

8.4 Output / connections

For details see operating or installation instructions and data sheets of the respective product. Deviating conditions such as NLGI class, temperature and counter pressure may lead to a deviation in the flow rate. This should be taken into account when designing the lubrication points.

8.5 Filling possibilities

For details see operating or installation instructions and data sheets of the respective product.

8.6 Electrical connection (electrically driven products)

Following the respective applicable installation prescriptions for electrical systems. For details see operating or installation instructions and data sheets of the respective product.

IP type of protection

Motor and system:
For IP or NEMA protective class see type identification plate of motor or system respectively the Technical Data chapter of the individual components. For details see operating or installation instructions and data sheets of the respective product.

8.7 Air pressure and air quality (air-operated products)

Filtered and oiled air according to DIN ISO 8573-1 not higher than class 5

Inlet air pressure	5.5 – 7 bar
Maximum particle density	10 mg / m^3
Water content (pressure dew point)	+ 7 °C
Oil content (maximum oil concentration)	25 mg / m^3

Please follow the instructions of the respective product.

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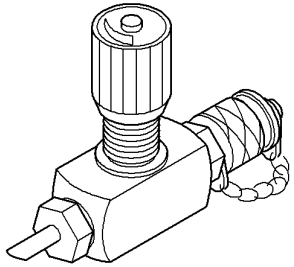
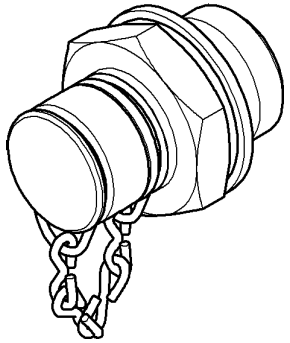
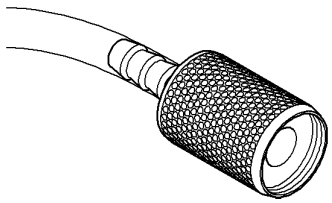
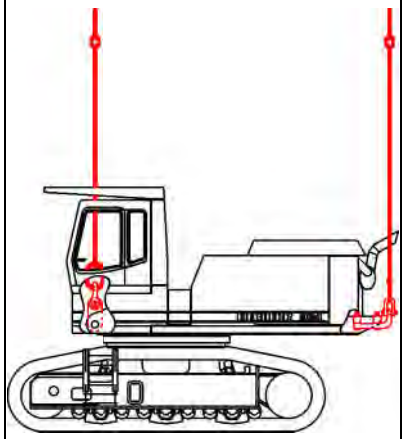
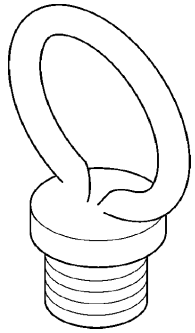
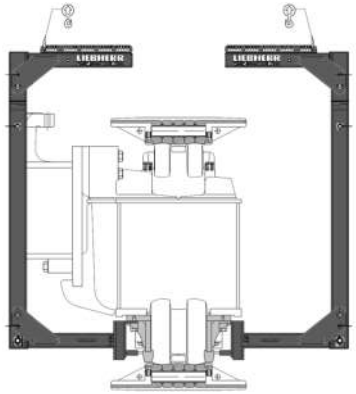
Representation	No.	Description	Size	Order No.	Model										Application
					R9100	R984C	R9150	R994	R9200	R9250	R994B R9350 R9400	R995	R996 R996B	R9800	
	81 82	Sampling valve Sampling valve Compact sampling valves		5613844 7019068	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	Used to take samples for oil analysis.
	83 84 85 86 87	Sampling valve Sampling valve Sampling valve Sampling valve Sampling valve		12203274 12203276 12203277 12203278 12203279	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	For hydraulic oil. For engine oil. For swing gear oil. For engine coolant. For splitterbox oil.
	88	Fitting for sampling hose		12203794	X	X	X	X	X	X	X	X	X	X	For compact sampling valves.

LEC / en / version: 04 / 2018

Representation	No.	Description	Size	Order No.	Model										Application
					R9100	R984C	R9150	R994	R9200	R9250	R9350 R994B R9400	R995	R996B R996	R9800	
	555	Basic machine lifting tool without lifting ropes		9756615		X									For the lifting of the complete uppercarriage and undercarriage without the counterweight and the attachment.
	560 562 564 565 566 567 568 569	Lifting eye Impact screw Impact screw Impact screw	M20x2.5 M24 M36x4 M48x5 M68x6 M36 M48 M68	4900313 8566100 4900491 4900835 4902077 9103255 95689958 9568957	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	For the lifting of different components of the excavator.

LEC / en / version: 04 / 2018

Representation	No.	Description	Size	Order No.	Model										Application
					R9100	R984C	R9150	R994	R9200	R9250	R994B R9350 R9400	R995	R996 R996B	R9800	
	950	Chain guide mounting tool (pump lifting tool not included)		11477039									X	X	
	960	Swing bearing lifting tool		11474186						X	X	X	X	X	

LEC / en / version: 04 / 2018

2 Cooling system

The cooling liquid is thermostatically controlled and its circulation is operated by a related water pump.

Each cylinder unit is cooled individually through the distribution channels cast in the crankcase.

The pistons are cooled through the cooling duct from the lubricating oil circuit of the Diesel engine.

2.1 Cooling schematic

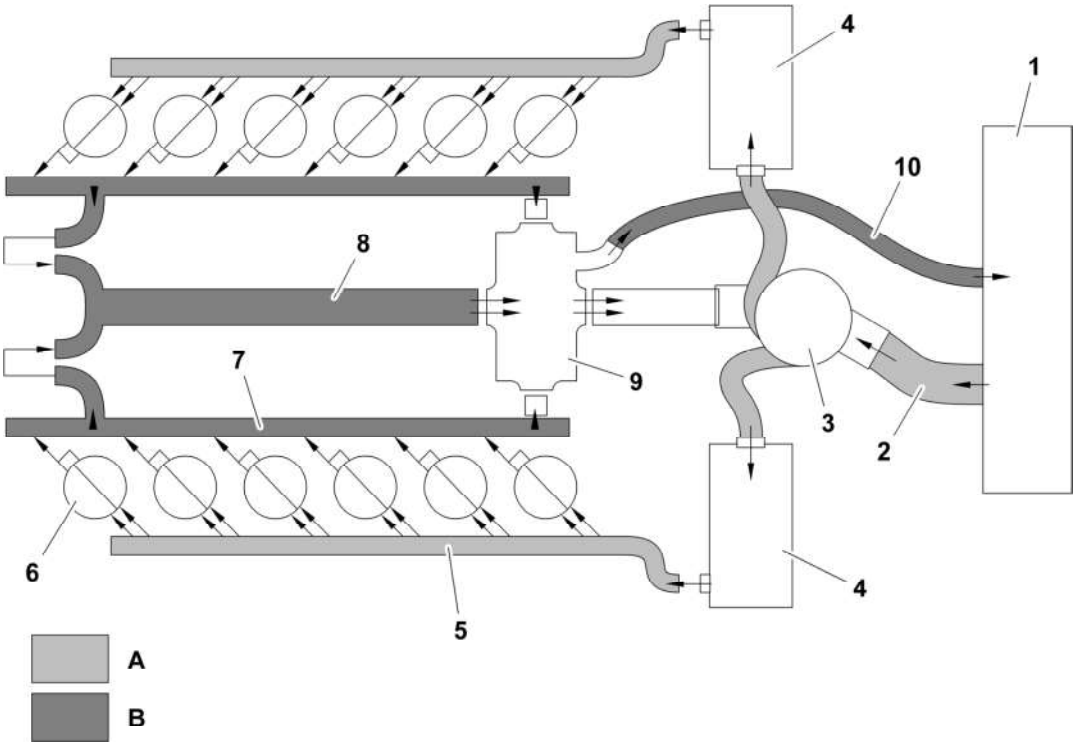


Fig. 2 *Cooling system diagram*

1 Coolant cooler / radiator
2 Coolant inlet to the engine
3 Engine water pump
4 Oil cooler
5 Coolant distributor rail
6 Cylinder head / line
7 Coolant collector rail
8 Coolant return to the thermostat
9 Thermostat
10 Coolant outlet to the radiator
A Supply from radiator
B Return from engine

LEC / en / version: 05 / 2019

3.4.5 Start the engine after the fuel system bleeding

With fuel prefilter with remote pump

- ▶ Start the engine.
- ▶ Operate it at low idle for approximately 10 minutes.

With fuel prefilter with integrated pump

- ▶ Start the engine.
- ▶ Operate it 1800 RPM idle for approximately 10 minutes.
- ▶ Stop the engine. Wait 2 minutes.
- ▶ Start the engine again.

If the engine does not start in less than 5 seconds:

- ▶ Do the bleeding procedure of the fuel system again.

LEC / en / version: 05 / 2019

Solenoid valves function

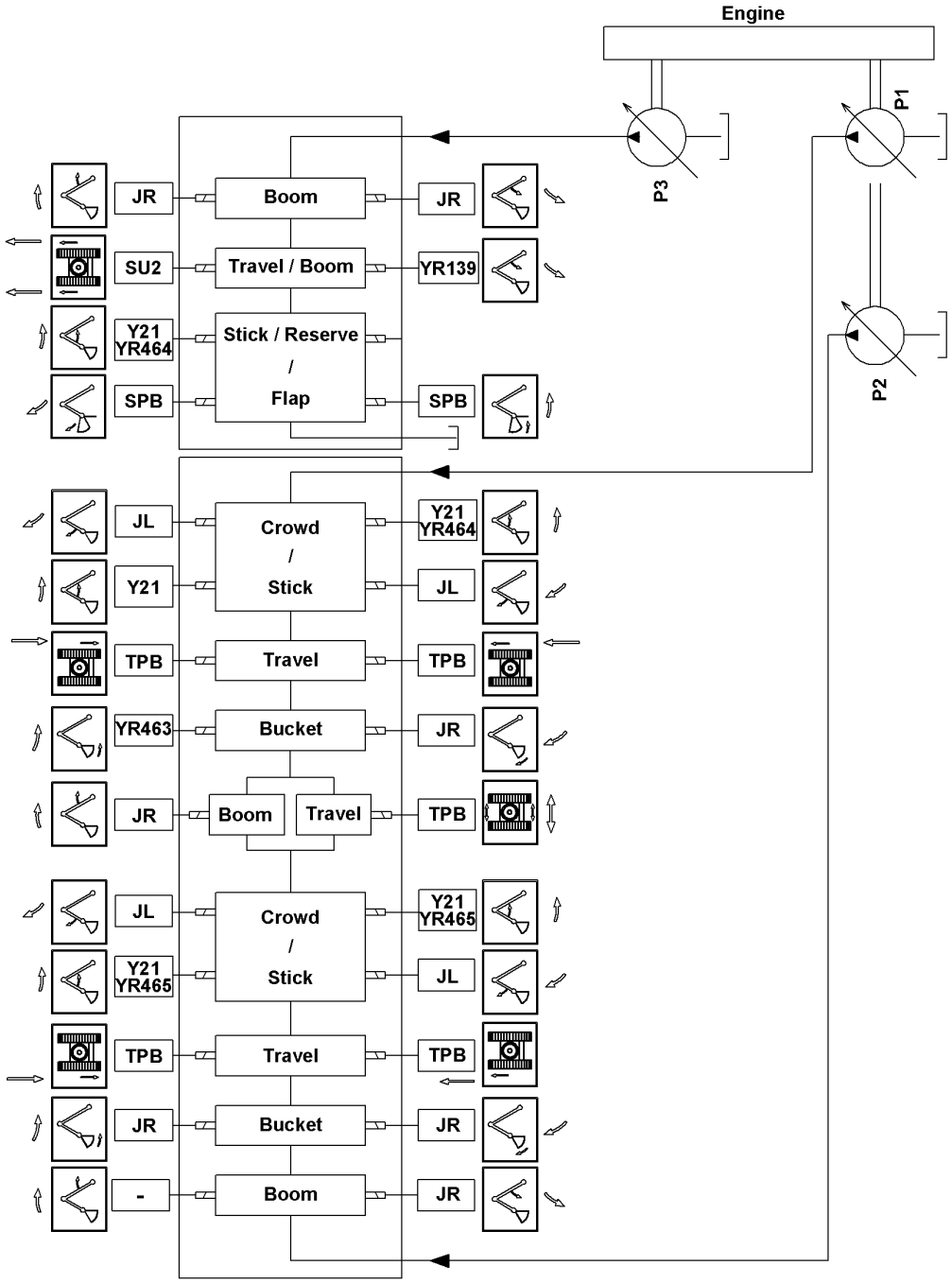


Fig. 16 *Solenoid valves*

3.2.4 Damping system for backhoe attachment

The machine has special damping systems to stop the movement of the attachment before the cylinders get suddenly the end position of the piston rods. Depending on the cylinders, this end stroke management can be done with:

- special devices integrated into the cylinders
- a movement cut-off

P1	Working pump 1	**VB1**	Control valve block 1
P2	Working pump 2	**VB2**	Control valve block 2
P3	Working pump 3	**YR463**	Reg. solenoid valve bucket tilted in

5.5 Shovel tilt cylinders for shovel attachment

One extremity of the two shovel tilt cylinders **CBT1** and **CBT2** is attached on the boom, the other extremity is attached on the shovel. Thus, the shovel bucket stays in a constant position to the ground when you extend or retract the crowd cylinders (parallelogram function).

A pressure sensor **B211** is installed on the bottom side of the shovel tilt cylinder, on **VB1**. In order to control the lowering speed, the spool valves are moved proportionally to the pressure read by the sensor **B211**. The out movements of the shovel tilt cylinders are also managed by a related system (refer to the section "Damping system" in this chapter).

The shovel tilt cylinder in and out movements are supplied by the working pumps **P1** and **P2** through the control valve block **VB1**.

Because of a primary pressure relief valve installed on each control valve block, the pressure coming from the working pumps cannot be more than 350 bar.

If the shovel movement is done simultaneously with others movements, the movement may not be supplied by these pumps.

The control valve block supply the oil flow equally between the shovel tilt cylinders **CBT1** and **CBT2**.

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This control valve block contains, in a compact housing, the directional spool valves which are necessary for the travel and attachments movements of the machine. It also contains pressure relief valves for the different circuits:

- Height hydraulically operated spool valves which supply hydraulic flow from the main hydraulic pumps to the different cylinders or motors.
- Two primary pressure relief valves **PRV** (pilot operated) that control the pressure between the main pumps and the control valve block. These valves are installed on the upper housing, directly above the high pressure connection.
- Ten secondary pressure relief valves **SRV** which are located on the control valve block. These valves limit the secondary pressure to the adjusted maximum pressure.

9.1.4 Function

Spool valves in neutral position

In neutral position, the connections between user and pumps and user and tank are closed.

The hydraulic oil from pumps comes to the pressure port of the control valve block. Nearly without pressure, it flows threw the spools to connection **T**. Then the oil returns to the tank.

Working position of spool valves

If a spool valve is moved from its neutral position, the connection from pump to user is opened and restricts at the same time the flow to the tank.

The pump pressure rises until it reaches the pressure on the user connection. Oil starts to flow to the user. When the spool valve moves further, the connection from pump to tank closes off and opens the connection for the returning oil from the user to the tank.

The total oil flow from the pump is now available for the user.

The movement of the spool valve depends only on the available control pressure. This control pressure can be changed continuously depending on the movement of the appropriate joystick (see description and function in § "Electro-hydraulic pilot control system").

Due to a negative spool overlap, together with the metering notches, the oil flows to the users and thus all working and travel movements can be controlled by pistons in the control blocks.

Springs, which are installed on the upper end of the spool, return the spools to neutral position if control pressure is not available.

Internal leakage on a user connection under pressure are influenced by the overlap and the play between housing and piston.

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9.4 Primary valve: pilot operated pressure limiting valve

9.4.1 Use

If the resistance, which acts against the load in a hydraulic system, were to rise to an undesirable and unacceptable level, the weakest point in the hydraulic system would be destroyed. To prevent this, an artificial weak point, a kind of circuit breaker (relief) is added. The object is locate this hydraulic component, which is initially held in a closed position by adjustable spring pressure, so the fluctuating system of the whole hydraulic pressure circuit can act on it. An increase in system pressure above the pressure setting of the relief valve lifts off the poppet, ball or piston and directs the excess pressurized fluid, supplied by the pump but not accepted by the end user, back to the tank. The hydraulic energy produced in this process is converted into heat.

This hydraulic component a pilot operated pressure-limiting valve (primary valve).

These cartridge types primary pressure relief valves in the control valve are located in front of the first piston. A direct acting relief valve is installed as a control part in the pilot operated pressure relief valve, which triggers an impulse to the second, larger valve. Both valves are normally open.

A characteristic of this valve is that once the valve has started to relieve and is contaminated; no further increase in pressure is possible. This protects the system and damage to the components is avoided.

9.4.2 Function

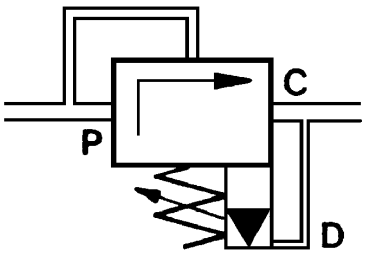
During operation, the system pressure pushes against the front side of piston **31**. The same pressure is simultaneously applied via orifice **A** on the backside of piston **31**, and via orifice **B** to poppet **33**. Springs **32** and **14** move piston **31** and poppet **33** into closed position.

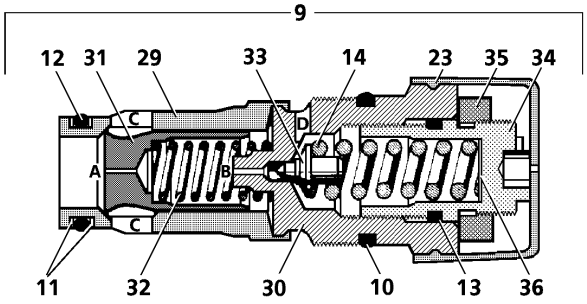
As soon as the system pressure exceeds the pressure setting of spring **14**, the poppet **33** is lifted off its seat, and some fluid escapes into the return line via orifice **D**. The previous static condition is now dynamic as fluid is trying to flow via orifice **A** in order to compensate for the loss of volume and pressure. The size of the orifice prevents immediate compensation, and a temporary difference in pressure between the top and bottom of the main piston **31** exists.

The difference in pressure causes the system pressure, which is still pushing against the front of piston **31**, to lift the piston from its seat and large amounts of fluid can return to the tank via connection **C**.

9.4.3 Pressure adjustment

To adjust pressure, remove cap **23**, loosen lock nut **35** and turn the adjustment screw **34** clock- or counterclockwise to lower or raise the pressure. After the adjustment has been made, secure screw with lock nut (torque to 10 Nm) and install a lead seal.





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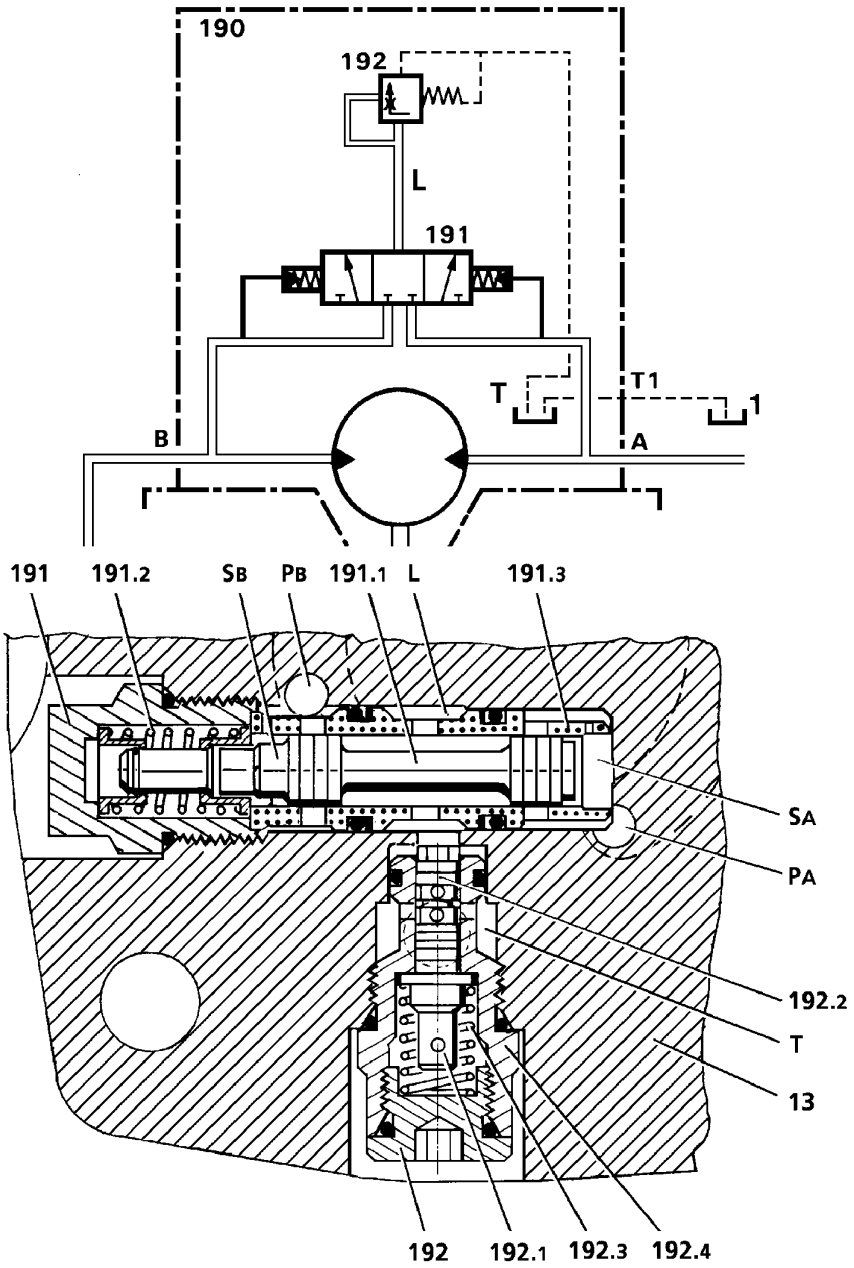

Fig. 8 *Section of discharge two ways check valve*

13	Connector plate - discharge two way check valve	**192**	Discharge pressure - flow regulator
191.1	Piston	**192.1**	Piston
191.2	Spring	**192.2**	Flow regulator
191.3	Bushing	**192.3**	Spring
		192.4	Bushing

6.2.4 Function of discharge valves in connector plate

The discharge valves **191** and **192** allows a small amount of oil from the low-pressure connection on the motor to escape into the motor housing.

6 Adjustment

▶ For adjustment instructions, refer to the section "Adjustment procedure R9100" in chapter 3 "Technical Data" of this manual.

LEC / en / version: 11 / 2018

2.13 Energies

	• Electricity
	• Temperature (hot or cold surfaces)
	• Position energy (raised components)
	• Parts subject to pressure (operating pressure, oil pressure, grease pressure, air pressure, etc.) • Bursting reservoir if filled by a high-performance pump
	• Parts subject to spring tension

2.14 Lubricants

- Greases
- Oils

Transport lifecycle	
Residual risks	**Remedy**
Tilting or falling of parts during transport, e.g. over inclines.	Secure parts against tilting or falling during transport (e.g. using tapes, belts, ropes, etc.).
Dropping of lifted parts or tools.	No people may remain under suspended loads. Keep unauthorized persons away. Secure suspended loads using suitable hoisting equipment (e.g. tapes, belts, ropes, etc.).

2.15 Existing residual risks

Installation life cycle	
Residual risks	**Remedy**
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. Follow the operational instructions for handling lubricants and contaminated parts.

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9.2.3 Single-line system

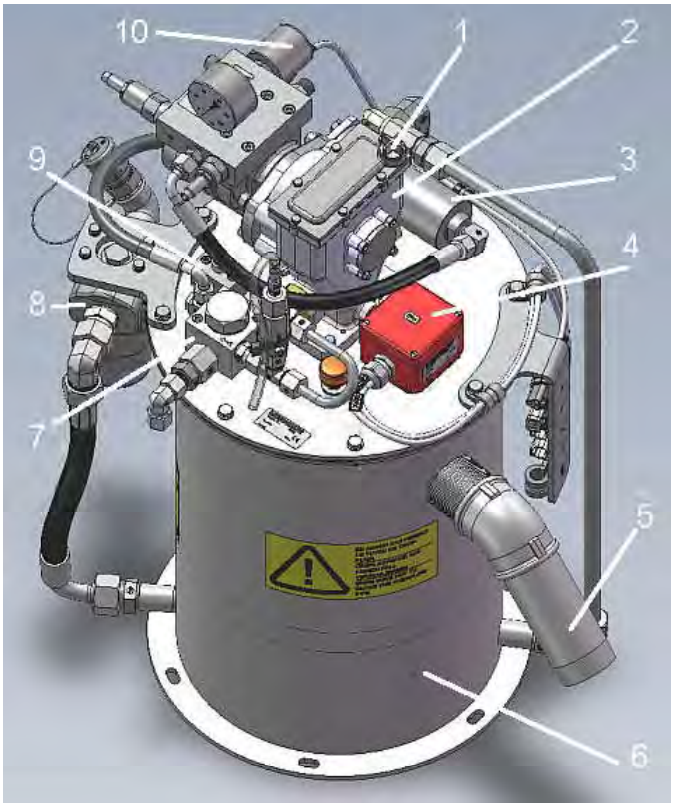
The single-line system consists of a pump to supply lubricant under pressure to the injector metering devices via the supply line. The injector metering devices deliver lubricant to a secondary (progressive) metering device or to the bearing through feed lines.

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.

9.2.4 Pump station 27L



1 Dip stick

2 Pump P1 – Model FlowMaster II

3 Hydaulic relief (vent) valve

4 Contact rod – B96 (low level control) + B185_1 (high-level control)

5 Overflow pipe

6 Grease reservoir 27L for FlowMaster II-pump

7 Strainer assembly, pressure line

8 Lubricant filter, refilling

9 Optical high-level control

10 Solenoid Y34_1 (pump control)

Fig. 10-6 Central lubrication pump 27L

For information and descriptions of the components, refer to chapter 13.

Introduction

Explanation of Symbols Used

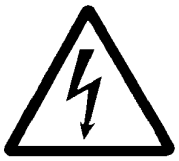
The following description standards are used in this manual:

Safety Instructions

Structure of safety instructions:

- Pictogram
- Signal word
- Danger text
  - Danger note
  - How to avoid danger

The following pictograms are used in this manual and are combined with the corresponding signal words:

 1013A94	 4273a00	 6001a02
- ATTENTION **- CAUTION** **- WARNING**	**- ATTENTION** **- CAUTION** **- WARNING**	**- NOTE** **- IMPORTANT**

The signal words give the seriousness of danger if the following text is not observed:

ATTENTION	refers to faults or damages on machines.
CAUTION	refers to bad damages and possible injuries.
WARNING	refers to possible dangerous injuries.
NOTE	indicates improved operation of the device.
IMPORTANT	indicates special operating features of the device.

Example:


1013A94

ATTENTION!

When making use of other than the tested spare parts, serious damage may affect your device.

Furthermore, you will find the following text symbols in this manual:

- Listing of applicable statements
  - Subpoint of applicable statements

1. Determination of the number or sequence of contents

➲ Procedural instruction

User's Responsibility

To ensure the safe operation of the unit, the user is responsible for the following:

1. The pump / system shall be operated only for the intended use (see next chapter "Safety Instructions") and its design shall neither be modified nor transformed.
2. The pump / system shall be operated only if it is in a proper functioning condition and if it is operated in accordance with the maintenance requirements.
3. The operating personnel must be familiar with this User Manual and the safety instructions mentioned within and observe these carefully.

The correct installation and connection of tubes and hoses, if not specified by SKF, is the user's responsibility.

Lincoln GmbH will gladly assist you with any questions pertaining to the installation.

Environmental Protection

Waste (e.g. used oil, detergents, lubricants) must be disposed of in accordance with relevant environmental regulations.

Service

The personnel responsible for the handling of the pump / system must be suitably qualified. If required, SKF offers you full service in the form of advice, on-site installation assistance, training, etc. We will be pleased to inform you about our possibilities to support you purposefully.

In the event of inquiries pertaining to maintenance, repairs and spare parts, we require model specific data to enable us to clearly identify the components of your pump / system. Therefore, always indicate the part, model and series number of your pump / system.

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Safety Instructions

Appropriate Use

Use SSVD and SSVD-E lubricant metering devices only for dispensing lubricants in centralized lubrication systems.

Suitable Lubricants

- The progressive metering devices can be used for dispensing
  - mineral oils of at least 40 mm²/s (cST) or
  - greases up to the penetration class NLGI 2


6001a02

IMPORTANT

It must nevertheless be ensured that the oils or greases used do not alter their consistency significantly in the course of time or under the influence of temperature or pressure.

General Safety Instructions

- The progressive centralized lubrication system connected to a pump must always be secured with a pressure relief valve.
- Lincoln SSVD and SSVD-E lubricant metering devices are state of the art.
- Incorrect use may result in bearing damage caused by poor or excessive lubrication.
- Each outlet needed must be provided with a check valve in order to be able to feed the lube points with the precise amount of lubricant and avoid poor lubrication.
- In the case of the metering devices model SSVD6 to 22 and SSVD6-E to 22-E outlets 1 and 2 must never be closed.
- Outlets 1 and 2 of the special metering devices model SSVD6/5 to 22/21 and SSVD6/5-E to 22/21-E are connected via a channel (marked by a double arrow). One of the two outlets must be closed. This means, the lubricant quantity of the closed outlet is lead to the opposite outlet (see Fig. 19).


1013A94

CAUTION

Damage due to poor lubrication!

If, however, both outlets are connected to a lube point the bypass metering device SSVD6/5 to 22/21 and SSVD6/5-E to 22/21-E cannot work to 100 %. The lubricant follows the way of the lowest resistance. It reaches the lube points of outlets 1 and 2 only insufficiently or not at all.

- Unauthorized modifications or changes to an installed system are not admissible. Any modification must be subject to prior consultation with the manufacturer of the lubrication system.
- Use only original spare parts (see Parts Catalog) or the parts approved by SKF.

Installation

- Install the metering devices at a suitable location in accordance with the lubrication diagram.
- It is recommended that the metering devices be installed in such a way that the outlets are not close to the chassis or the attaching plate. This will facilitate troubleshooting in the case the system is blocked.
- The main metering devices with indicator pin must be installed in such a way that the indicator pin is easily visible.

When the push-in type fittings are used, note the following:

- For the metering **device inlet** use only **push-in type fittings** (R 1/8) with **reinforced collar** and sealing ring.
- For the **outlet tube fittings** of the **SSV divider valve** (M 10x1) depending on the design of the lubricant line, for example
  - high-pressure plastic hose (Ø 4.1 x 2.3) use valve bodies with reinforced collar only, or,
  - pressure plastic tube (Ø 6 x 1.5) use valve bodies with knurled collar only
- For the **outlet fittings** of the **SSV M divider** divider valve (M 8x1) pressure plastic tube (Ø 4 x 1) use valve bodies with knurled collar only.


6001a02

NOTE

In the case of construction machines or agricultural machines use high pressure plastic hoses for the lubricant feet lines. In such cases the outlet fittings of the secondary metering devices and the connection fittings to the lubricant points must have a reinforced collet.

- Use only the main and feed lines specified by SKF and adhere to the specified system pressures.

Regulations for Prevention of Accidents

- To prevent accidents, observe all city, state and federal safety regulations of the country in which the product will be used.
- Avoid the operation with
  - unapproved parts.
  - insufficient or contaminated lubricants.


1013A94

CAUTION

Danger of injury in the case of serious corrosion of metering device surfaces: An increasing corrosion of the surfaces will cause the balls pressed in to lose their hold. Under pressure, they may suddenly burst out and cause injuries.
For applications in corrosive environments, use metering devices in stainless steel version only.

Operation, Repair and Maintenance

Authorized and instructed personnel who are familiar with the centralized lubrication systems should only perform repair.

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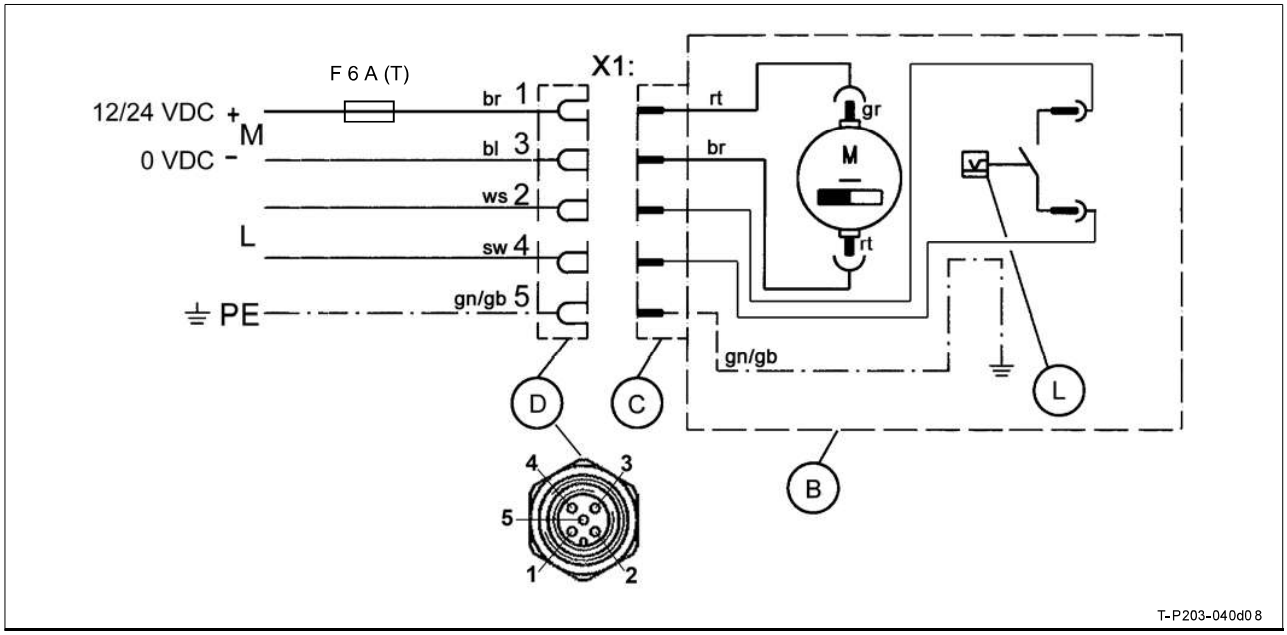
E-Mail: Lubrication-germany@skf.com

Technical Data, continuation

VDC connection diagram only for industrial application

- without integrated control unit
- with low-level control
- Supply voltage 12/24 VDC
- Type of connection **1A2** M12 plug, 5/5-pole (X1)



Connection diagram Quicklub P 203 VDC without integrated control unit

Connection X1: M12 plug, left 1A2
Socket, 5/5-pole for power supply 12/24 VDC and low-level control

B - Pump housing
C - Connection plug
D - Line socket 1 with connecting cable, 5 pole (1-5)
- alternatively: connecting cable from the user

M - Electric motor
L - Low-level control
Switching capacity max. 60 W/VA
Switching voltage max. 230 VAC
Switched current max. 1 A

rt - red
bl - blue
gr - grey
ws - white
br - brown
sw - black
gn/gb - green/yellow

Subject to modifications

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Technical Data

Rated voltage ..... 12/24V DC
Operating voltage 12V/ 24V ..... 9V to 30V

Residual rippple in relation
with the operating voltage ..... ± 5% acc. to DIN 41755

Motor output ..... transistor 7A/short-circuit proof
Reverse voltage protection:
The operating voltage inputs are protected against polarity reversal

Temperature range ..... -25°C to 70°C
Output fault / readiness for service:
..... transistor 3A/short-circuit proof

Class of protection:
Printed circuit board installed in housing..... IP 6K 9K

In order to protect the printed circuit board against condensation, it has been covered with a protective varnish.

All the printed circuit boards comply with the EMC (Electromagnetic compatibility) guidelines for road vehicles acc. to DIN 40839 T1, 3 and 4.

The printed circuit boards model **M** additionally comply with the EMC guideline 89 / 336 / EWG
Emitted interference acc. to.....EN 55011 / 03.91 and
.....EN 50081-1 / 01.92
Noise immunity acc. to ..... prEN 50082-2 / 1993

Time setting:
Pause time, acc.to jumper position:
..... 4, 8, 12,...to 60 minutes
.....1, 2, 3...to 15 hours
The operating time is switched off via the piston detector.

Factory setting
Pause time.....6 hours
or .....24 minutes
Monitoring time..... 5 minutes
or .....30 minutes

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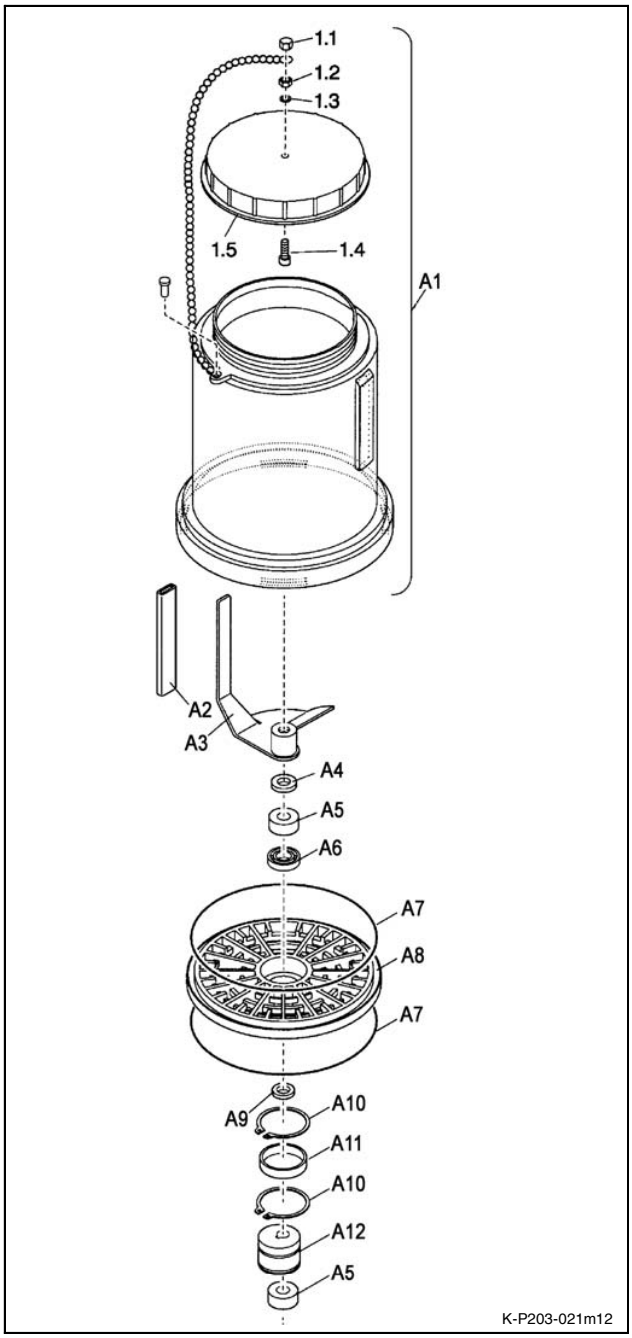
A … with 2 l reservoir for grease or oil A

P203-2XYNBO & P223/233-2XNBO-… without low-level control

- 2 l reservoir with lid
- with stirring paddle
- Control: V10-13 [1], V20-23 [1], MF/MDF01 [2], MF/MDF02 [3]
- Type of connection: 1A1.01/10 [1], 2A1.01/10 [1], 1A5.14 [1], 1A7.16 [1], 2A5.14 [2], 2A6.15 [3]



Pos.	Designation	Qty.	Part no.
A	**Reservoir assembly**		
A1	2-Liter-Behälter [4]	1	544-31940-1
1.1	Acorn nut M4 C	1	207-12247-5
1.2	Nut M4 C	1	207-12135-2
1.3	Washer A 4.3 C	1	209-12146-2
1.4	Hexagonal head screw M4 x 16	1	201-12015-4
1.5	Lid	1	221-12488-5
A2	Hose 12.5 cm	1	111-35089-2
A3	Stirring paddle incl. Pos. A2	1	544-33569-1
A4	Washer 8.4	1	209-13072-6
A5	Inner ring	2	444-24168-1
A6	Grooved ball bearing D 10/26 x 8	1	250-14009-7
A7	O-ring Ø 142 x 4	2	219-13730-7
A8	Intermediate bottom	1	444-24167-1
A9	Shim 10 x 16 x 0.5	1	209-13047-5
A10	Snap ring SW 32	2	211-14100-1
A11	Pressure ring Ø 33 x 37 x 13	1	444-24439-1
A12	Eccentric	1	444-24170-2

[1] for P203
[2] for P223/233, PCB terminals 15 + 30 bridged
[3] for P223/233, PCB terminals 15 + 30 not bridged
[1] or 2 l reservoir out of P203-2XLBO part no. 544-32027-1

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The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

Important information on product usage

All products from SKF may be used only for their intended purpose as described in this brochure and in any instructions. If operating instructions are supplied with the products, they must be read and followed.

Not all lubricants are suitable for use in centralized lubrication systems. SKF does offer an inspection service to test customer supplied lubricant to determine if it can be used in a centralized system. SKF lubrication systems or their components are not approved for use with gases, liquefied gases, pressurized gases in solution and fluids with a vapor pressure exceeding normal atmospheric pressure (1 013 mbar) by more than 0,5 bar at their maximum permissible temperature.

Hazardous materials of any kind, especially the materials classified as hazardous by European Community Directive EC 67/548/EEC, Article 2, Par. 2, may only be used to fill SKF centralized lubrication systems and components and delivered and/or distributed with the same after consulting with and receiving written approval from SKF.

Status of information:
07/2014

Manufacturer:
SKF Lubrication Systems Germany GmbH
Werk Walldorf
Heinrich Hertz-Str. 2-8
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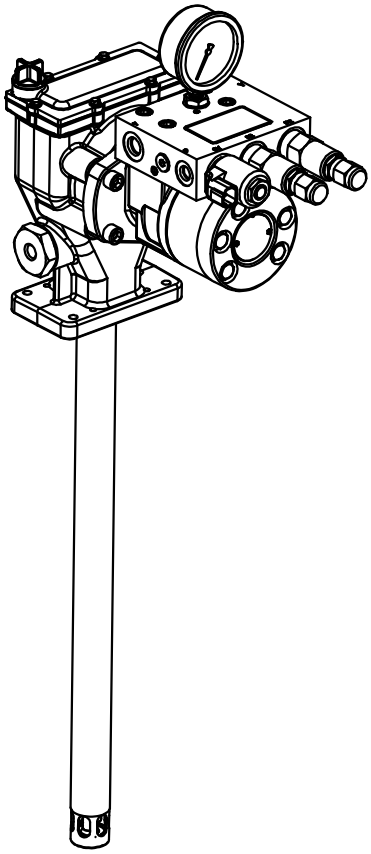
Fax: +49 (0) 6227 33-259
E-Mail: Lubrication-germany@skf.com

LINCOLN

Operation, assembly, disassembly and troubleshooting guide

FlowMaster II rotary driven hydraulic pump series “A”

85731, 5 U.S. gallon
85732, 60 lbs.
85733, 120 lbs.
85734, 400 lbs.



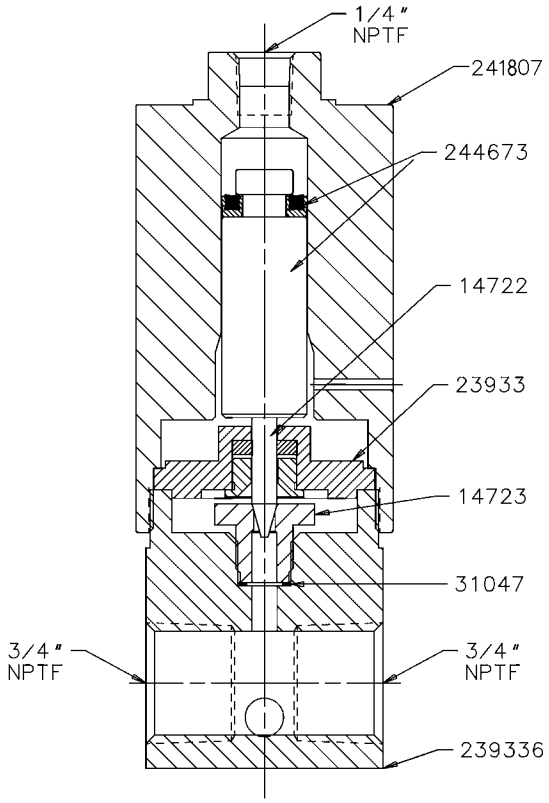
Date of issue	**October 2012**
Form number	**404432**
Section	**C8**
Page	**352A**

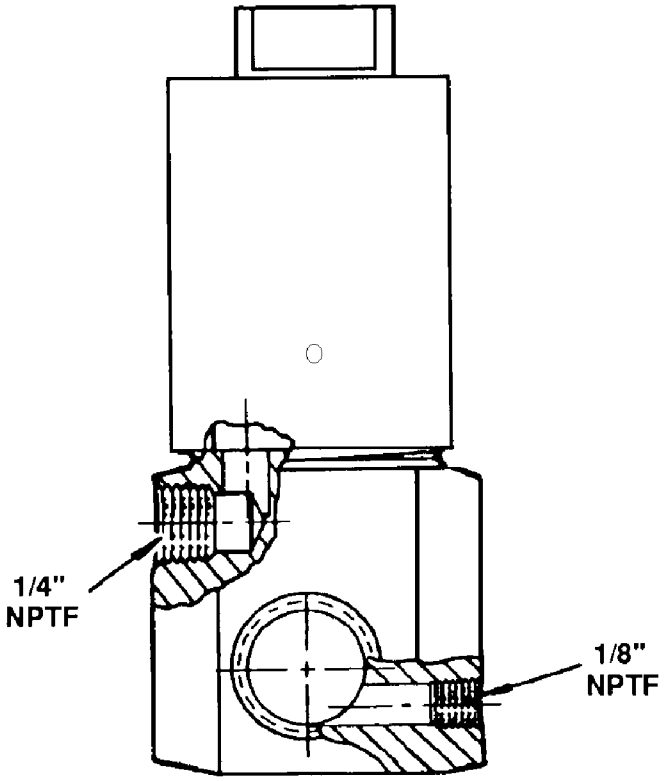
⚠ DANGER

Read manual prior to installation or use of this product. Keep manual nearby for future reference. Failure to follow instructions and safety precautions may result in death or serious injury.

SKF

MODEL 84980
HYDRAULIC VENT VALVE





SERVICE PARTS

Part	Qty.	Description	Part	Qty.	Description
14722	1	Needle	239330	1	Packing assembly
14723	1	Valve seat	239336	1	Valve body
31047	1	Check seat gasket	241807	1	Cylinder
			244673*	1	Piston & U-Cup Assy.

*Sold only as an assembly. Individual parts not available.

RETAIN THIS INFORMATION FOR FUTURE REFERENCE

When ordering replacement parts, list: Part Number, Description, Model Number, and Series Letter.
LINCOLN provides a Distributor Network that stocks equipment and replacement parts.

8 Utilisation

4 Seules les personnes autorisées sont habilitées à mettre en service et à utiliser l'interrupteur. Ne pas utiliser d'objets durs pour la saisie de données. Un autotest est exécuté lors de la première mise en service. La conduite est guidée par menus à l'aide de trois touches à membrane qui **ne doivent pas** être mises au contact d'objets durs ! Si une erreur est détectée au cours de l'autotest et du fonctionnement, elle est signalée par le clignotement d'une LED (jaune) ALARME (AL).
Cette erreur peut être appelée dans le menu Err. Les LEDs vertes S1 et S2 signalent l'activité des deux points de commutation.

9 Programmation

1		Après la mise sous tension M, passer au premier point de dialogue.
2	Passer à autre point de dialogue	A l'aide de ▼ ou ▲, sélectionner le point de dialogue souhaité (cf. chap. 10).
3	Activer le point de dialogue Entrée valeur/Sélect. fonction	A l'aide de M, sélectionner le point de dialogue souhaité, pour ensuite modifier la valeur correspondante ou la fonction souhaitée.
4	Modifier la valeur	A l'aide de M sélectionner les différents chiffres. A l'aide ▼ modifier la ▲ valeur numérique et confirmer à l'aide de M. Si la valeur entrée se situe á l'intérieur de la plage admissible, on passe au point de dialogue après saisie du dernier chiffre, sinon le premier chiffre clignote á nouveau.
5	Modifier la fonction	A l 'aide ▼ modifier la fonction ▲ et confirmer á l'aide de M.
	Activer le verrouillage du clavier	▲ + ▼ appuyer simultanément pendant au moins 5 s. L'affichage ne doit pas passer alors à un autre état. Si activé, apparaissent successivement Lu0 et par ex. u3.1*.
	Verrouillage du clavier activé	Les valeurs ou fonctions sont certes affichées, mais ne peuvent être modifiées. LOK apparaît à tout essai de modification.
	Désactiver le verrouillage du clavier	▲ + ▼ appuyer simultanément pendant au moins 5 s. L'affichage ne doit pas passer alors à un autre état. Si désactivé, apparaissent successivement Lu2 et par ex. u3.1*.
	Retour à la fonction de mesure	En l'absence de saisie pendant 2 min, l'interrupteur revient automatiquement en mode de mesure **sans** prise en compte des valeurs saisies.
	Terminer la programmation	M appuyer pendant au moins 5 s pour passer en mode de mesure.

* Version logiciel n°

10 Dialogue niveau utilisateur UDS8

Pt. de dialogue	Valeur	Fonction/Description			
ACt	0...4000	Affichage de la valeur de mesure actuelle			
S1		Sélection de l'unité d'affichage nbr = mbar PSH = psi x 10 hPo = hPa bar = bar PSI = psi nPa = mPa			
Und		Activation de l'affichage des unités on = Affichage des unités (toutes les 30 s) sur l'afficheur mis en service oFF = pas d'affichage sur l'afficheur			
SP1		u In = Technique de fenêtres Err = sortie d'erreurs Std = Evaluation standard			
on1*	0 ... xxxx	Point de mise en service pour SP1; si le réglage de la valeur ON est inférieur à celui de la valeur OFF, on obtient une évaluation des points de contact descendante.			
OF1*	0 ... xxxx	Point de mise hors service pour SP1			
dS1	0,0 s ... 9,9 s	Temporisation de mise en service pour SP1 en secondes			
dr1	0,0 s ... 9,9 s	Temporisation de mise hors service pour SP1 en secondes			
Iu1		Inversion de la sortie de commutation SP1 HFS = High-level-fail-save (fonction fermeture) LFS = Low-level-fail-save (fonction ouverture)			
SP2		u In	= Technique de fenêtres	Err	= Sortie d'erreurs
		Std	= évaluation standard		
on2*	0 ... xxxx	Point de mise en service pour SP2; si le réglage de la valeur ON est inférieur à celui de la valeur OFF, on obtient une évaluation des points de contact descendante.			
OF2*	0 ... xxxx	Point de mise hors service pour SP2			
dS2	0,0 s ... 9,9 s	Temporisation de mise en service pour SP2 en secondes			
dr2	0,0 s ... 9,9 s	Temporisation de mise hors service pour SP2 en secondes			
Iu2		Inversion de la sortie de commutation SP2			
		HFS	= High-level-fail-save (fonction fermeture)		
		LFS	= Low-level-fail-save (fonction ouverture)		

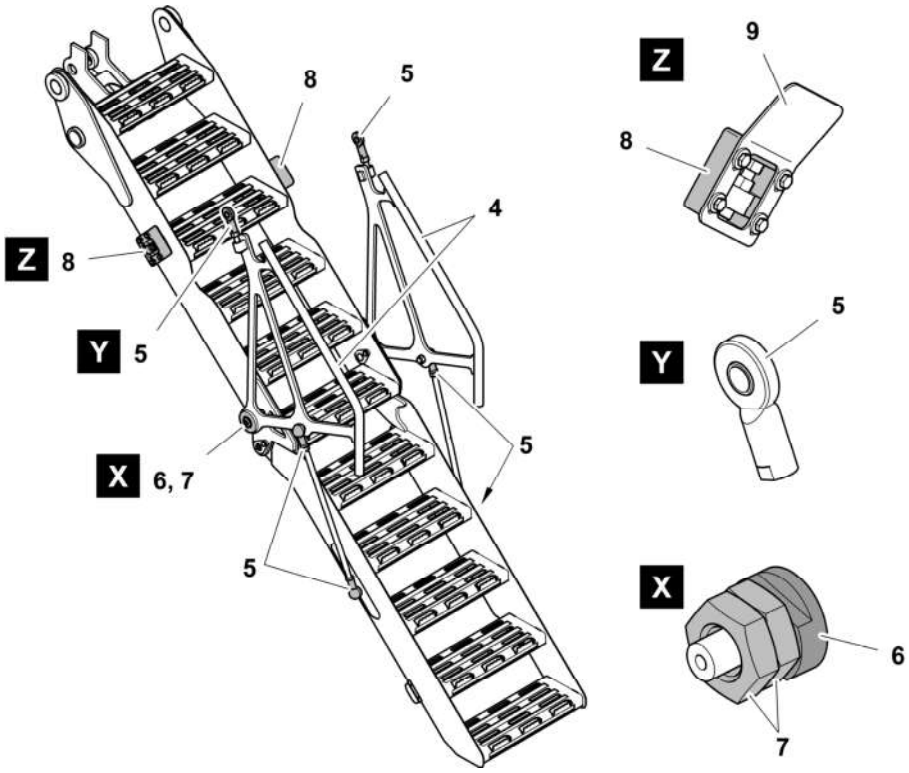


Fig. 15 *Installation of the access ladder components*

4 Handrail (2x)
5 Pivot (6x)
6 Handrail nut (2x)
7 Handrail locknut (4x)
8 Upper ladder stop (2x)
9 Upper guide plate (2x)

▶ Make sure that all the components **4** to **9** are installed on the access ladder.

LEC / en / version: 02 / 2020

F236	Fuse 15 A / Supply greasing	**X815**	Connector 2 poles / **R42**
F237	Fuse 7,5 A	**X828**	Connector 2 poles / **S100_2**
F238	Fuse 7,5 A / Supply KT56		

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4.2.3 Valve bank

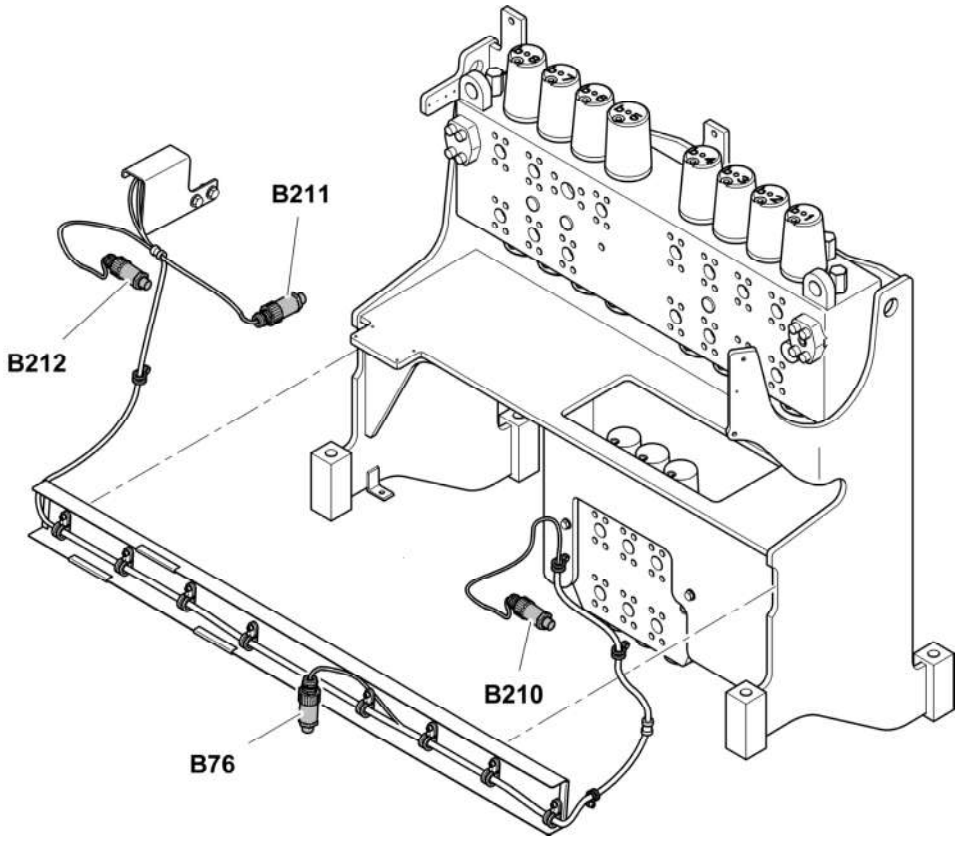


Fig. 30 *Configuration of valve bank sensors*

B76	Pressure sensor / Boom down with pressure	**B211**	Pressure sensor / Bucket/Shovel tilt cylinder
B210	Pressure sensor / Pressure boom up	**B212**	Pressure sensor / Stick/Crowd tilt cylinder

LEC / en / version: 08 / 2019

15.00: Uppercarriage - Mechanical

1 Coupling

1.1 Function and operation

1.1.1 Components location

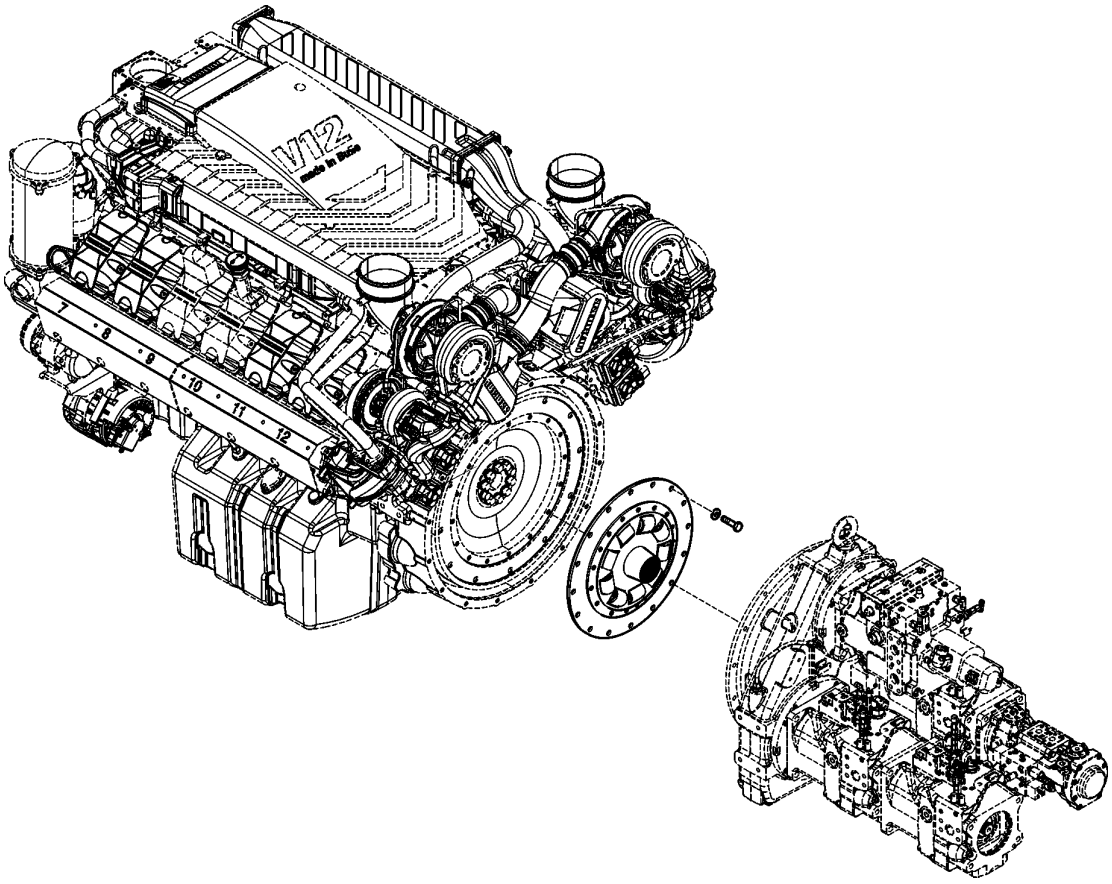


Fig. 1 *Location of the coupling*

1.1.2 Use

The elastic coupling (torsional vibration damper), which is installed between the Diesel engine and the splitterbox, compensates for shaft (crankshaft - pump input shaft) misalignments, which could be caused by manufacturing and dimensional variations. The elastic coupling also absorbs the residual torsional vibration of the Diesel engine as well as the torque jolts caused by load fluctuations.

It transfers engine torque to the splitterbox directly and constantly, which means that it cannot be disengaged.

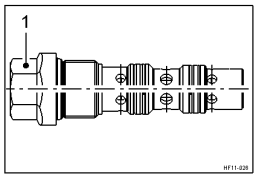
1.2 Install and remove the coupling

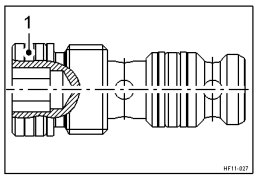
Caution!
Diesel engine and splitterbox must not be separated during installation or removal.

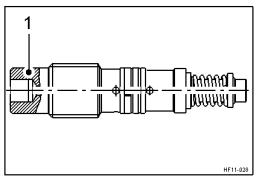
5.3.7 Expansion and conversion with other pieces of equipment

- Pieces of equipment and attachment parts of other manufacturers, or parts that have not been generally approved by LMB for installation or attachment, may not be attached or installed on the hydraulic product without prior written consent from LMB.
- The necessary technical documents are to be made available to LMB for this.
- Before each important repair or installation of other pieces of equipment, place the hydraulic product on a level and stable surface, or set it up on the respective assembly stand. See repair manual
- Do not work underneath the hydraulic product while it is not securely standing on the workbench / ground or is set up on the assembly stand.
- Before unscrewing a line or screw fitting, the pressure in the hydraulic system must be relieved.
- Do not attempt to lift heavy parts. Use suitable aids with sufficient load capacity for this.
- Do not use damaged ropes or ropes that do not have a sufficient load capacity. Wear work gloves when handling wire ropes.
- Never straighten the holes with your fingers, but use a suitable mandrel for this.
- During the repair work: Make sure that the hydraulic lines are properly attached and that all screw fittings and connections are correctly tightened.
- As soon as a piece of equipment is dismantled and wedged, close the open points of the hydraulic circuit in order to prevent the infiltration of dirt.
- Allow only authorised persons in the proximity of the hydraulic product or the lifting device used.

8.5.3 Shuttle valve torque

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

Item	Type	Torque Nm	
1 (complete valve)	**WV 5**	15	
1 (complete valve)	**WV 7**	35	
1 (complete valve)	**WV 10**	40	
1 (complete valve)	**Stop plug**	15	

Item	Type	Torque Nm	
1 (complete valve)	**WV 5**	15	
-	**-**	-	
-	**-**	-	

4 Swing bearing

4.1 Component location

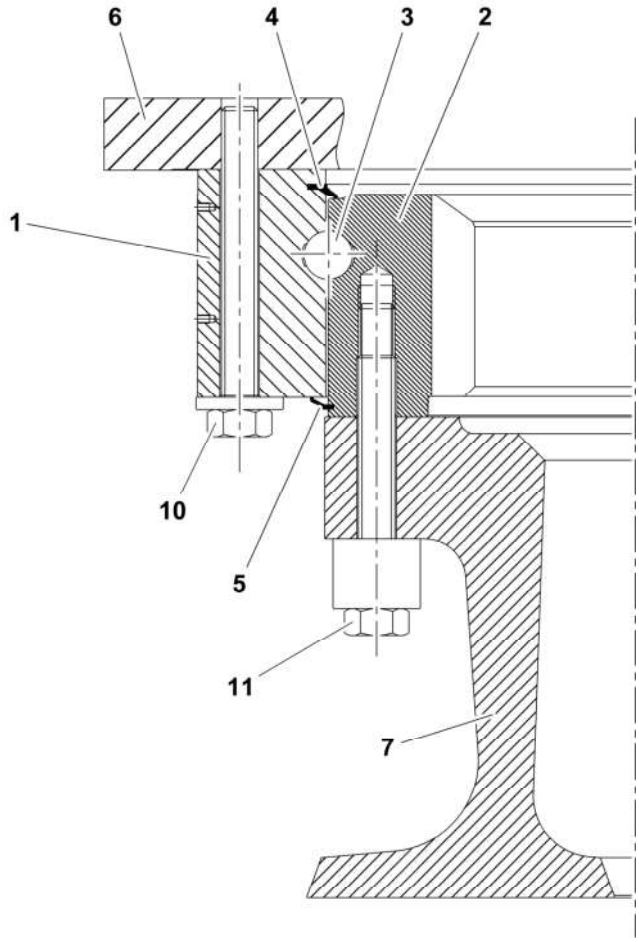


Fig. 9 *Swing ring installation*

1	Outer ring	**6**	Uppercarriage
2	Inner ring	**7**	Undercarriage
3	Roller	**10**	Hexagonal head screw M24x160 to uppercarriage x quantity 76
4	Upper seal	**11**	Hexagonal head screw M24x160 to undercarriage x quantity 90
5	Lower seal		

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

4.2 Technical data

	Units	Value
Type		KUD 464 VJ
Number of teeth		149

The bearing ring **5** bolted with the output housing **10** by the mounting bolts **11** drives the sprocket wheel and the chain. The RPM of the sprocket is the RPM of the hydraulic motor reduced by the complete ratio of transmission of the travel gear.
In contrast to that, the torque is raised. The torque generated at the bearing ring **5** is many times as high as the input torque existing at the hydraulic motor. The ratio of transmission is the complete transmission of the travel gear.

The rotating bearing ring **5** is seated on the stationary connection housing **1** by means of two rows of bearing rollers **3**, which are installed diagonally.

The axial face seal **58** is fixed between the connection housing **1** and the bearing ring **5**. Thanks to this seal the travel gear is sealed up from the exterior.

When there is no pressure in the hydraulic port for brake control pressure **89** the brake discs **86** are pressed together in the multi disc brake **70**.
The braking torque between the connection housing **1** and the plate carrier **65**, resulting from this pressure, is at least as high as the driving torque of the hydraulic motor and it is sufficient to ensure the blocking of the travel gear, even when the excavator is situated at a slope.

1.3 Installation / removal

1.3.1 Installation and removal of the inner travelling mechanism

For first installation or reparation, which necessitates the opening of travel gear, see the manufacturer documentation.

1.3.2 Installation and removal of the travel gear on the excavator

Component location

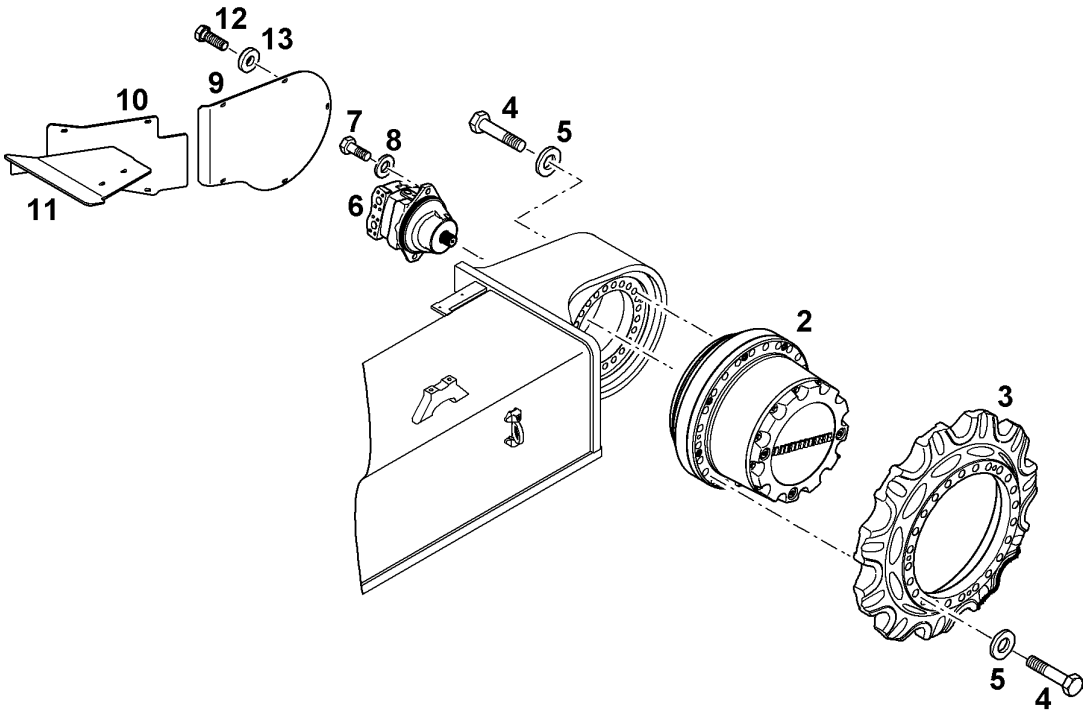


Fig. 6 *Travel gear components*

LEC / en / version: 11 / 2019

2.9 Install / remove the track components

Danger!
Falling parts!
Risk of death or serious injury.

- ▶ Only use applicable lifting devices, which are sufficiently dimensioned or which have been specially designed by Liebherr for this function. Only use an applicable crane.
- ▶ Before removal, make sure that the parts to remove are correctly attached with applicable devices.
- ▶ Make sure that no not approved persons are in the danger zone.

- ▶ To increase and decrease the track tension, refer to the Operating Manual.

2.9.1 Install / remove track pads and track chains

To prevent damages, you must examine the track pads at regular intervals.

- ▶ Do a check of the track pads conditions.
- ▶ Make sure that the pads wear does not get the maximal limit.
- ▶ Replace the damaged pads or the pads which have get the maximal wear limit.
- ▶ Refer to the Safe Work Procedures n° 0.04 and 3.02 in the chapter 2 of this Service Manual.

Replace damaged track pads

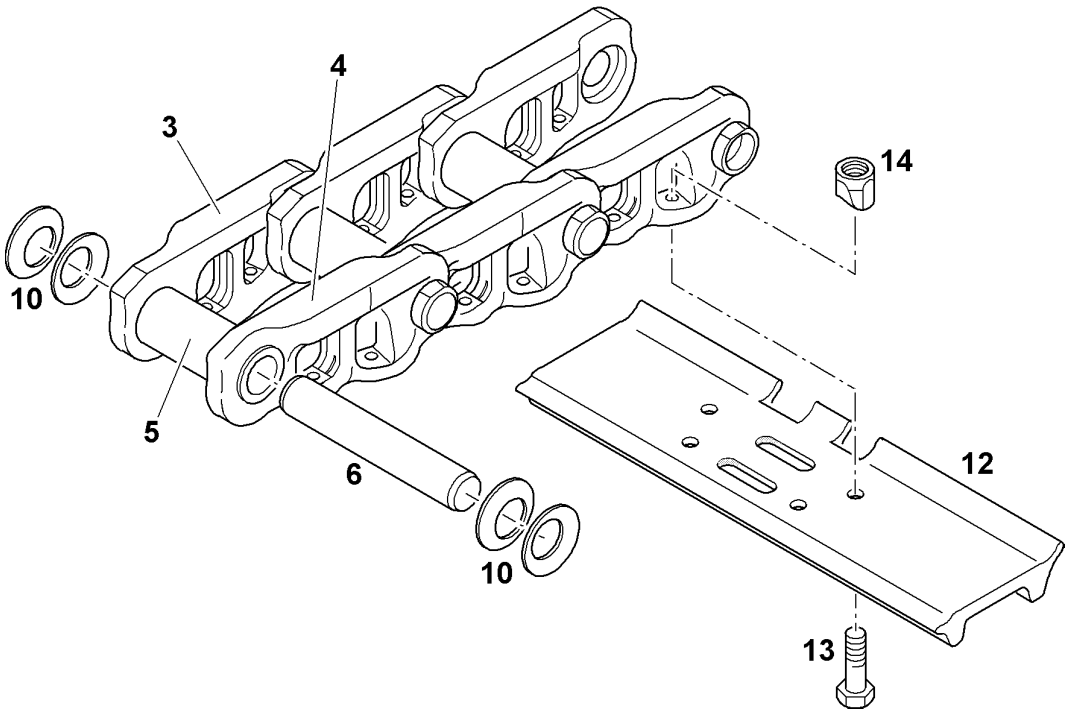


Fig. 27 *Track pad*

3	Left track link	**10**	Elastic washer
4	Right track link	**12**	Track pad
5	Track bushing	**13**	Locking screw
6	Track pin	**14**	Nut

- ▶ Make sure that bushes **7** are installed on the stick (crowd) **1** bushings.
- ▶ Lift the stick (crowd) **1** with a crane.
- ▶ Align the stick (crowd) **1** bushings with the boom **4** bushings (axis **a**).
- ▶ Install the pins **5** with related covers and screws.
- ▶ Extend the rod of the stick (crowd) cylinder **2** until the rod bushing is aligned with the related bushing of the stick (crowd) **1** (axis **b**).
- ▶ Install the pins **6** with related covers and screws.
- ▶ Make sure that all the pin covers are filled with grease: fill with grease through the grease supply inlet until grease goes out and make sure that the filling pressure is not more than 19 bar.
- ▶ Stop the engine.
- ▶ Turn the ignition key to contact position.
- ▶ Push the safety lever down.
- ▶ Move the joysticks in all directions to remove the stored energy from the hydraulic cylinders and from the servo accumulator.
- ▶ Depressurize the hydraulic tank. Refer to the Operating Manual.
- ▶ Isolate the machine by disconnecting the principal batteries switches **S9_1** and **S9_2**. Refer to the related Safe Work Procedure.
- ▶ Make sure that all grease lines between boom **4** and stick (crowd) **1** are filled with grease. Install and plug it.
- ▶ Install all electrical wiring.
- ▶ Install and plug hydraulic lines between boom **4** and stick (crowd) **1**.
- ▶ Connect the electrical system of the machine back.

1.2.5 Remove the stick (crowd)

- ▶ Make sure that the bucket is removed.
- ▶ Make sure that the machine is on level and hard ground.
- ▶ Make sure that the excavator is not in a blast area.
- ▶ Use the applicable tools (refer to chapter 5 of this Service Manual) and jacking equipment. Also refer to the related tool instruction manuals.
- ▶ Make sure that the attachment is in a rested position.
- ▶ Lay down the boom **4** on the ground with the stick (crowd) **1** extended.
- ▶ Stop the engine.
- ▶ Turn the ignition key to contact position.
- ▶ Push the safety lever down.
- ▶ Move the joysticks in all directions to remove the stored energy from the hydraulic cylinders and from the servo accumulator.
- ▶ Depressurize the hydraulic tank. Refer to the Operating Manual.
- ▶ Isolate the machine by disconnecting the principal batteries switches **S9_1** and **S9_2**. Refer to the related Safe Work Procedure.
- ▶ Unplug and remove all grease lines between boom **4** and stick (crowd) **1**.
- ▶ Remove all electrical wiring.
- ▶ Unplug and remove hydraulic lines between boom **4** and stick (crowd) **1**.

LEC / en / version: 06 / 2020

3.2 Montage

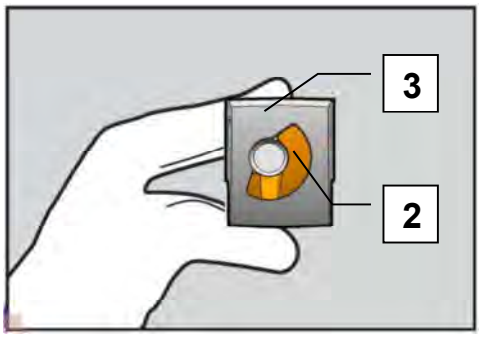
Das Sicherungselement (2) wie unten gezeigt in den Block (3) einführen.

3.2 Assembly

Place the retainer (2) into the block (3) as shown.

3.2 Montage

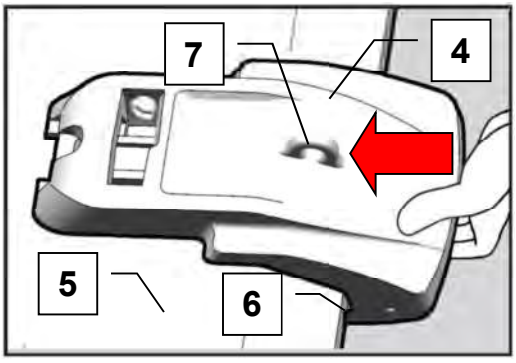
Insérer l'élément de retenue (2) dans le bloc (3) comme indiqué ci-dessous.



Den Schild (4) auf die Lippe (5) aufsetzen, bis er Kontakt mit der Vorderseite der Lippe (6) hat.

Place the shroud (4) on the blade (5), contacting the front of blade (6).

Mettre en place le bouclier de lame (4) sur la lame (5) jusqu'à ce qu'il soit en contact avec l'avant de la lame (6).



Bei Bedarf ein Hubgerät verwenden, hierfür ist ein Haken (7) vorgesehen /
Use a crane to lift the lip shroud if it is necessary. A lifting eye (7) is available /
Utiliser un moyen de levage si prévu à cet effet (7)

LEC / en / version: 12 / 2016

21. Charging and Evacuating Cooling Machines

The charging of refrigerant into the dried, evacuated and oil-filled machines is done under various conditions.

For units in operation, refrigerant can only be charged as vapor into the suction side.

It has to be observed that the volume of intake into the unit is not increasing, because an overcharging might happen.

It is necessary to control the weight of the refrigerant during charging.

During proper operation of the unit the receiver should be 1/3 filled with liquid refrigerant. The evaporator however, has to be filled to the maximum (based on the pre-calculated evaporation temperature), this means that the suction line should only be a few degrees warmer than the evaporation temperature indicated at the manometer.

The frosting of the suction line is no sign for judgement on the charging state, especially for deep-freezing units.

Evacuating during repair:
During repair works cooling machines have to be discharged of refrigerant in most cases.

In case of expensive refrigerants and bigger oil quantities it is mostly advisable to save the refrigerant for re-use.

For re-use the refrigerant needs to be discharged by a recycling unit.

Soldering and welding jobs should be executed under blowing with a small quantity of nitrogen.

In case of simple mechanical procedures for example replacing of a part with fittings, it is possible, after recycling of refrigerant, to give nitrogen to the circuit (approx. 0,5 bar).

During repairs nitrogen streams out of the open points which prevents air and humidity from infiltrating in, and this will shorten the vacuum time.

Ardent Vehicle Installation Manual

Manual Completion Date: 02/01/2013

Manual Revision Date: 22/04/2013

Equipment: Liebherr

Model: R9100

Type: Mining Excavator

System Type: A-3-50-16-1-LVS15-10-3M

Engine Type: Liebherr D9512

Specification:	**Powder Tank:**	Foray Dry Chemical Tank 50lb x **3**
	Nozzles:	Brass V 1/2 with blow-off cap x **15** Brass C 1/2 with blow-off cap x **1**
	LVS Tank:	LVS Wet Chemical Tank 15gal x **1**
	Nozzles:	Brass, non-aspirating with blow-off cap x **10**
	Manual Actuator:	Standard type x **3**
	Control Panel:	Ansul Checkfire SCN x **1**
	Shutdown:	Wired into main machine electrical cabinet

Nozzles N6 - covering the area below the manifold

The bracket is bolted to the nozzle bracket weld block.

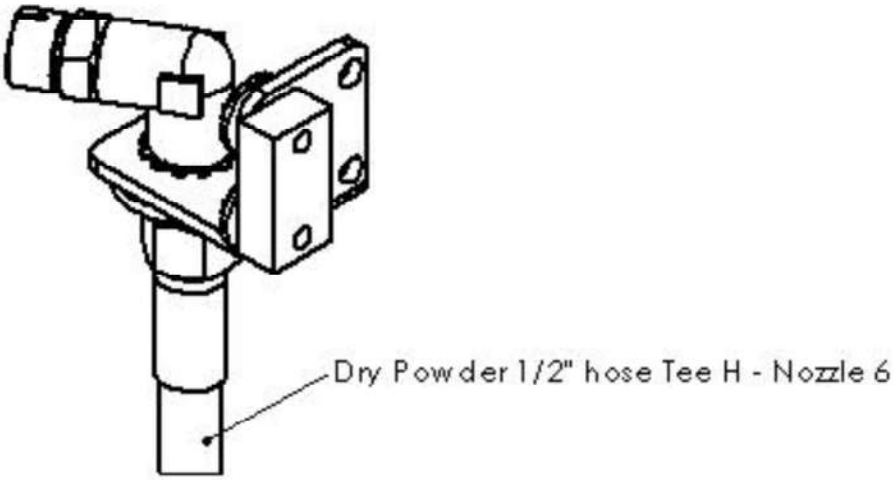


Table of Contents

This manual is intended for use with the CHECKFIRE® SC-N Electric Detection and Actuation System.

Those who install, operate, inspect, or maintain this system should read this entire manual. Specific sections will be of particular interest depending upon one's responsibilities.

As with all electro-mechanical equipment, the electric detection and actuation system needs periodic care to provide maximum assurance that it will operate effectively and safely. Inspection frequency shall be performed monthly, or sooner, depending on operating and/or environmental conditions. Maintenance shall be performed semi-annually, or sooner, depending on operating and/or environmental conditions.

The application and use of the CHECKFIRE SC-N system is limited to the application and uses described in this manual. For other applications, contact your local ANSUL distributor or the ANSUL technical representative in your area.

FUNCTION TEST (Continued)

Detection Circuit Functional Test (Continued)

The following will take place while the jumper wire is being held on the terminals:

- The RED Alarm LED and sounder will pulse at a rate of two times per second
- The first time delay cycle will start
- The alarm relay will transfer (non-latching)

After verifying the above, remove the jumper wire. The control module will reset to normal (as long as the cycle for Time Delay No. 1 has not been exceeded). Normal is when only the GREEN Power LED is pulsing and no other LEDs or the Audio Alarm are operating. Also, the alarm relay will return to normal.

2. This next test will verify the settings of the time delays. Again, hold the jumper wire on Terminals 3 and 4. Continue to hold the jumper wire on these terminals until the second time delay has started. Once the second time delay has started, the jumper wire can be removed.

   The following will take place while the jumper wire is being held on the terminals:

   - The RED Alarm LED and sounder will pulse at a rate of two times per second
   - The first time delay cycle will start and time through its cycle
   - The alarm relay will transfer (non-latching)

   After the first time delay has completed its cycle, the following will take place:

   - The RED Alarm LED and sounder will pulse at a rate of four times per second
   - The second time delay cycle will start and time through its cycle
   - The alarm relay will transfer
   - The shut-down relay will transfer, causing vehicle shutdown
   - At the end of the second time delay cycle, the release circuit will activate, causing the GREEN LED on the test module to illuminate.

3. After the jumper wire has been removed, reset test module by pressing the reset button on the tester.
4. Disconnect the actuation cable from the test module and verify that the module is indicating both a RED alarm LED and a YELLOW release fault LED.
5. Reconnect the actuation cable to the test module and push the “RESET” button on the CHECKFIRE SC-N control module. The module will return to the normal condition.
6. If required, make certain to reset any auxiliary shutdown devices.

Pressure Switch/Manual Pull Initiating Circuit

During the programming requirements of the pressure switch/manual pull circuit, two options are available. The first option allows the circuit to be programmed for immediate release and the second option allows for shutdown/time delay/release. If choosing the shutdown/time delay/release option, the programming will also require a length of time delay to be chosen.

When performing this functional test, it is necessary to know whether the first or second option was programmed into the module.

Immediate Release Option

1. Using the jumper wire, hold the wire on Terminals 5 and 6. This is the pull station circuit. If the circuit was programmed for immediate release, the following will take place:
   - The RED Alarm LED and the sounder will pulse at a rate of four times per second
   - The alarm relay will transfer
   - The shutdown relay will transfer
   - The release circuit will activate, causing the GREEN LED on the test module to illuminate
2. Reset test module by pressing the reset button on the tester. **Do not disconnect the test module at this time.**
3. Push the “RESET” button on the CHECKFIRE SC-N Control Module and the module will return to the normal condition.
4. If required, make certain to reset any auxiliary shutdown devices.

Shutdown/Time Delay/Release Option

1. Using the jumper wire, hold the wire on Terminals 5 and 6. This is the pull station circuit. If the circuit was programmed for shutdown/time delay/release, the following will take place:
   - The RED Alarm LED and sounder will pulse at a rate of four times per second
   - The alarm relay will operate immediately (transfer)
   - The shutdown relay will operate immediately (transfer)
   - A single time delay cycle will start (during test, verify length of delay)

   After the single time delay cycle is completed, the release circuit will actuate, causing the GREEN LED on the test module to illuminate.
2. Reset squib test module by pressing the reset button on the tester. **Do not disconnect the test module at this time.**
3. Push the “RESET” button on the CHECKFIRE SC-N Control Module and the module will return to the normal condition.
4. If required, make certain to reset any auxiliary shutdown devices.

Pressure Switch Option

1. Using the jumper wire, hold the wire on Terminals 5 and 6. This is the pressure switch circuit. The following will take place:
   - The alarm relay will transfer
   - The shutdown relay will transfer
   - The RED alarm LED and the sounder will pulse at a rate of four times per second.
2. Push the “RESET” button on the CHECKFIRE SC-N Control Module and the module will return to the normal condition.
3. If required, make certain to reset any auxiliary shutdown devices.

USER INTERFACE

This section provides the user with overall information on features and operation of the CHECKFIRE 210 Display Module and Interface Control Module (ICM).

FIELD CONNECTIVITY – Cables and Devices

The CHECKFIRE 210 ICM communicates with the Display Module and other devices through cable assemblies incorporating IP67 circular threaded connectors with color-coded overmolding.

IP67 is an environmental ingress protection rating. The first number indicates protection from solid objects (0 is no special protection, 6 is protection from dust). The second number is protection against liquids (0 is no protection, 7 is protection against the effect of immersion in water).

Display Cable (See Figure 3-2)

- 24 in. (610 mm) Cable
- Black color-coded IP67 anti-vibration connector (Female)

FIGURE 3-1
DISPLAY CABLE
009272

DISPLAY MODULE FRONT PANEL BUTTONS

"DELAY/Reset/Silence" Button

Manage fault and/or alarm conditions by pressing the "DELAY/Reset/Silence" button (see Figure 3-2) for the following results:

- **Audible Fault Silence**
  - o Silence an audible notification during a fault condition for two hours. Fault LED indicator(s) continue pulsing until the fault condition has been cleared.
  - o During a post-release condition the button will silence the sounder.
  - o Any new alarm or fault conditions will reactivate the audible notification.
  - o The audible notification for either a post-release or fault condition will resume after being silenced for two hours.
- **Restart Time Delay Sequence**

  Restart the time delay cycle during an alarm condition; must be initiated before Time Delay #1 (TD1) period expires.
- **System Reset**

  Press and hold (3 seconds) to reset the system.

FIGURE 3-2
DISPLAY MODULE FRONT PANEL BUTTONS
009290

General Instructions for Cable Installation (Continued)

Confirm cables are not subject to damage and will not interfere with vehicle/equipment service and maintenance procedures.

1. Follow planned route in the layout drawing and install each circuit starting at the ICM receptacle and work outward. Completely install one circuit at a time, finishing with the power circuit. Use correct size P-Clamps to avoid problems, see Figure 5-12. **Note:** Changes to the planned route will likely alter cable lengths needed for installation.

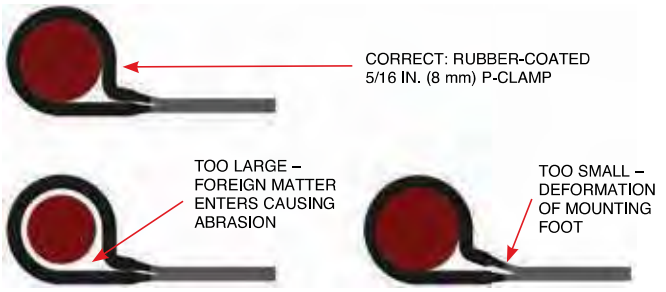


FIGURE 5-12
USE CORRECT SIZE P-CLAMPS
009210

2. If attachment points are not available for P-Clamps, a double-loop cable tie (Part No. 440737) is acceptable for support and separation between cables and the securing point. **Note: Cables should not be supported by hydraulic hoses.** See Figure 5-13.

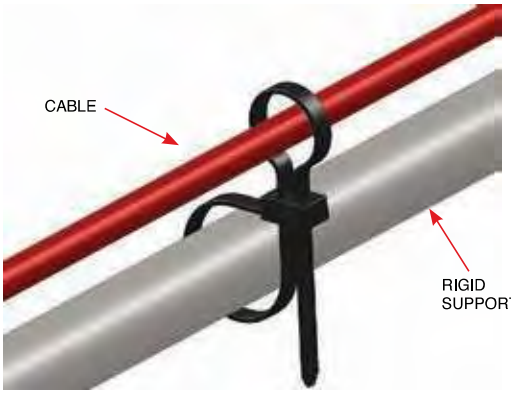


FIGURE 5-13
DOUBLE-LOOP CABLE TIE
009211

3. Secure cables at least every 3 ft (0.9 m) and within 1 ft (0.3 m) on both sides of connectors or connection to a device. See Figure 5-14.

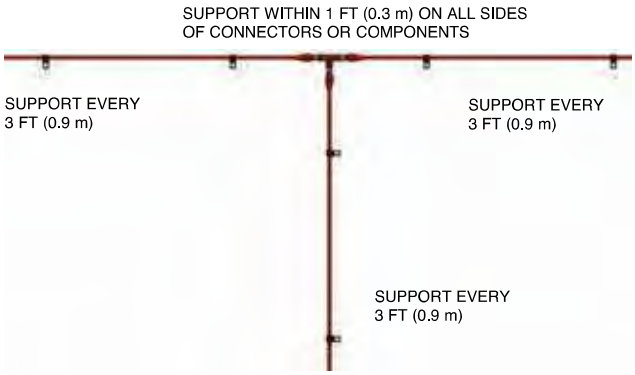


FIGURE 5-14
CABLE SUPPORT REQUIREMENTS
009212

4. Adjust slack to avoid droops in cable. Allow appropriate slack through areas that are intended to move under normal vehicle/equipment operation.
5. When cables pass through a partition, it is recommended to use a bulkhead connector designed for the appropriate cables. **Note: Cables must never be routed through a hole or near sharp edges without being properly protected.** See Figure 5-15.

Bulkhead Connectors

Part No.	Maximum Pass-through Thickness	Cable Type
439404	3/8 in. (9.5 mm)	Detection Circuit
439405	1 in. (25 mm)	Release Circuit Power Circuit Aux. Output Circuit
439449	3/8 in. (9.5 mm)	Display Circuit


DETECTION CIRCUIT


RELEASE CIRCUIT, POWER CIRCUIT, AND AUX. OUTPUT CIRCUIT


DISPLAY CIRCUIT

FIGURE 5-15
BULKHEAD CONNECTORS
009159/009166

TABLE 5-4: DOWNLOAD EVENT HISTORY LOG (Continued)

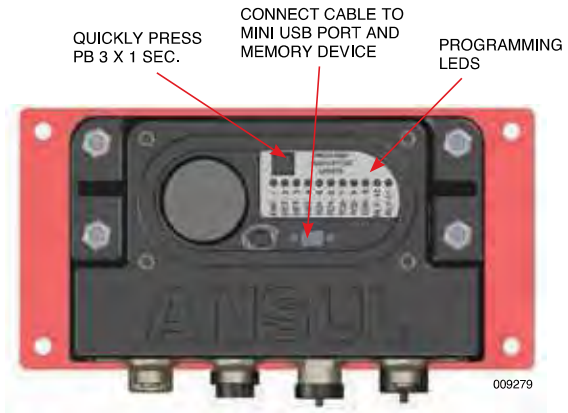
Accessing and Downloading the Event History Log

The Programming Button (PB) and programming LEDs are located under the ICM battery compartment cover. The programming button controls the download process and the programming LEDs indicate the start and end of the download.

Note: The Event History Log download should be performed at or near normal temperature conditions. Corrupted or incomplete history file data can occur if downloads are attempted at extreme high or low temperatures.

1. Loosen the (4) captive screws and remove cover to gain access to programming button and view LEDs.
2. Connect the USB communication cable and memory device to the mini USB port near the programming LEDs.
3. Push programming button 3 x 1 second to begin the file download. (ICM senses connection with a USB memory device and starts the download.)
4. Programming LEDs pulse briefly to indicate system has initiated the download. Then all LEDs pulse in marquee fashion to indicate the ICM is writing the contents of the Event History Log to the USB memory device.
5. When complete, all LEDs illuminate steady-on for 5 seconds. A text file is saved on the USB memory device with the current date. The text file name will be LOGxxxx where the x place holders will be a number (e.g. 0001, 0002) determined by the last number of any previously saved text files on the USB memory device.

   Note: The writing of the Event History Log can take several seconds to complete and **should not be interrupted.** If the writing is not successful after 30 seconds, the ICM will quickly pulse all LEDs together multiple times indicating an unsuccessful file download.
6. Disconnect cable and USB memory device. Re-install battery cover.



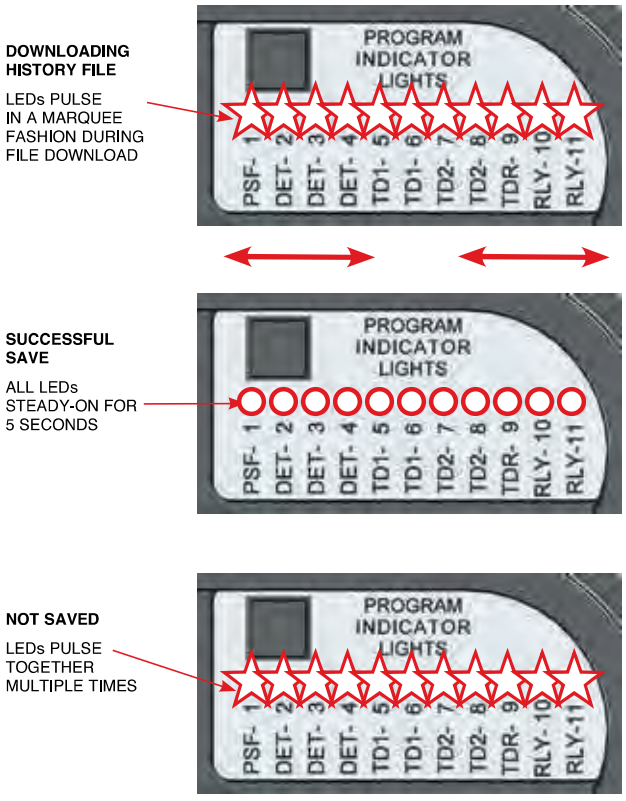


TABLE 6-5: ALARM CONDITION LED INDICATORS

			DETECTION CIRCUIT #1 and/or #2 LED(s)					"PUSH To Activate / Alarm When Lit" LED					DISCHARGE LED		SHUTDOWN LED			
Manual Action (Immediate Release Circuit Activation)			1 x 1 sec.	2 x 1 sec.	4 x 1 sec.	Steady-on for 10 sec.	1 x 10 sec. until cleared & reset**	1 x 1 sec.	2 x 1 sec.	4 x 1 sec.	Steady-on for 10 sec.	1 x 10 sec. until cleared & reset**	Steady-on for 10 sec.	1 x 10 sec. until cleared & reset**	4 x 1 sec.	Steady-on for 1 sec.	Steady-on for 10 sec.	1 x 10 sec. until cleared & reset**
Push the "PUSH To Activate/Alarm When Lit" button, Release Activated											■						■	
Post Release Activated																		■
Pull ring pin and strike button on EMA*** Release Activated						■					■						■	
Post Release Activated							■											■
Automatic Action (Detector Activation) (Detection Circuit #1 and/or #2 Input - Alarm Condition)																		
Alarm Only Programming or Isolate Mode			■					■										
Time Delay #1 (TD1) Programmed for:	0 seconds		**Immediately Enters Time Delay 2**															
	10 or 15 seconds			■					■									
	5, 10 or 15 seconds **(Starting the last five seconds of TD1)**				■					■					■			
	5, 10 or 15 seconds **(Last second of TD1)**															■		
Time Delay #2 (TD2) Programmed for:	0 seconds		**Immediately Activates Release Circuit When TD1 expires**															
	5, 10 or 15 seconds				■					■					■			
	Release Activated (TD2 Expired - Release Circuit Activation)					■					■						■	
Post Release Activated							■											■
Cross-Zone Programming	One Detection Circuit in Alarm (Pre-Alarm Condition)		■					■										
	Both Detection Circuits in Alarm – Time Delay #1 (TD1) Programmed for:	0 seconds	**Immediately Enters Time Delay 2**															
		10 or 15 seconds		■					■									
		5, 10 or 15 seconds **(Starting the last five seconds of TD1)**			■					■					■			
		5, 10 or 15 seconds **(Last second of TD1)**														■		
	Both Detection Circuits in Alarm – Time Delay #2 (TD2) Programmed for:	0 seconds	**Immediately Activates Release Circuit When TD1 Expires**															
		5, 10 or 15 seconds			■					■					■			
		Release Activated (TD2 Expired - Release Circuit Activation)				■					■						■	
	Post Release Activated						■											■
Detection Circuit #2 Only	Pressure Switch Feedback Programming****					■					■		■				■	
	Post Release Activated						■							■				■

* Sounder pulses at same rate as LED.
** Release LED also pulses Amber at this rate.
*** Detection Circuit 1 or 2 LED indicates; matching the circuit where EMA is installed.
**** Release Circuit activates, if programmed.

TABLE 9-7: SPECIFIC CIRCUIT TESTING PROCEDURES (Continued)

Release Circuit (Continued)

11. After drop line is clear, return to the last connection that was good and continue testing the main trunk and any drop lines in the same manner until release circuit fault is clear.

    When all faults are clear, verify proper operation of the CHECKFIRE 210 System by completing Section 6 – Operational Test and Place in Service.

Note: Specific jurisdictions or customer procedures may require documentation of all components replaced. Keep a record of all changes to the system as required.

11. AFTER DROP IS CLEAR, CONTINUE TESTING IN SAME MANNER UNTIL ENTIRE CIRCUIT IS CLEAR

Detection Circuit #1 and/or #2

If Detection Circuit #1 LED is pulsing AMBER and cannot be cleared check detection circuit #1 cable. Detection Circuit #2 is checked in a similar manner as the one described below, but should be investigated separately to avoid confusion.

Required Test Equipment (Confirm test equipment is new and functioning properly)

- Detection Circuit EOL Device (Part No. 439396)
- Detection Circuit Tester (DCT) (Part No. 440097) - set to "Normal" position
- Detection Circuit Branch Terminator (Part No. 439398)

1. Prior to testing the circuit, put system in Isolate Mode using the Isolate switch on the side of the ICM.
2. Disconnect Detection Circuit #1 Cable (and #2 if part of system) at the ICM receptacle. Install EOL Device or DCT on the ICM receptacle. If Detection Circuit #1 LED continues pulsing AMBER, there is an internal problem and the CHECKFIRE 210 ICM must be replaced.

3. If Detection Circuit #1 fault clears, the ICM is functioning properly. Re-install complete detection circuit to the ICM detection circuit receptacle.

   Reset to Normal: Press and hold "DELAY/Reset/ Silence" button for 3 seconds; Green and Red LEDs are steady-on for 1 second; then Amber LEDs are steady-on for 1 second; at end sounder quickly pulses 3 times.

3. IF FAULT CLEARS, RECONNECT AND RESET TO NORMAL

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

JIC Hose Fittings and 150 lb. Fittings

JIC hose fittings meeting Hydraulic Hose Fitting Standard J516 can be used in most applications. When using JIC hose fittings as elbows, use only elbows that have a long radiused bend. 150 lb NPT elbows and tees can also be used to assemble hose or pipe and attach hose or pipe to the discharge nozzles. Make certain that all elbows used in the agent distribution line, are of the same type (i.e., either all JIC or all 150 lb NPT elbows). Refer to the Installation Section for maximum and minimum elbow requirements.

Note: When figuring the maximum and minimum amount of elbows in the A-101/LT-A-101 system, two (2) 45 ° fittings can be counted as one 90° fitting.

Heat Resistant Fire Jacket for Hydraulic Hose

All hose assemblies, including actuation lines, expellant gas lines, and agent distribution hose that will be normally exposed to or located in areas with temperatures exceeding 200 °F (93 °C), should be sleeved with an extreme temperature heat-resistant fire jacket. (Do not route actuation or expellant gas hose through fire hazard areas. If this cannot be avoided, the hose must be fire jacketed.) Information concerning fire jacketing should be available through your local hose supplier. If not, Bentley Harris manufacturers a fire jacket that will withstand continuous operating temperatures from –65 °F to 500 °F (–54 °C to 260 °C) and short term exposures up to 2000 °F (1093 °C). For a listing of distributors in your area, call Bentley Harris at either 610-363-2600 or, 800-321-2295.

Dry Chemical Flow Characteristics

The assembly of piping (hose) for a dry chemical system probably lends itself to the greatest chance for error when installing the system. Dry chemical-gas mixtures do not flow like liquids, and, as a result, certain basic rules must be followed to assure correct dry chemical distribution to the nozzles.

In order to obtain equal distribution at a tee, the dry chemical must enter the center opening (bull) of the tee and exist the two side opening which are 180° apart. See Figure 2.

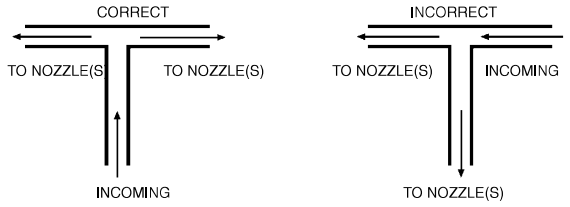


FIGURE 2
003477

When dry chemical makes a change of direction through an elbow, a tee, or a hose bend, a separation of the dry chemical and gas mixture occurs. If a tee follows this change of direction where separation can occur, and if this tee lies in the same plane as the change in direction through an elbow, tee, or hose bend, more dry chemical will discharge through one of the tee outlets and more gas will discharge out the other tee outlet. A certain minimum length of hose must be allowed from the bend (elbow) to the tee or from the first tee to the second tee in order to permit the dry chemical and gas to intermix before striking the tee. The minimum length required is equal to 20 hose diameters. 30 in. (762 mm) is required for 1 1/2 in. hose, 20 in. (508 mm) is required for 1 in. hose,18 in. (457 mm) is required for 7/8 in. hose, 15 in. (381 mm) is required for 3/4 in. hose, and 10 in. (254 mm) is required for 1/2 in. hose. See Figure 3. **Note:** When using the distribution tee, Part No. 25031, a minimum length of 30 in. (762 mm) of 1/12 in., 20 in. (508 mm) of 1 in., 15 in. (381 mm) of 3/4 in., or 18 in. (457 mm) of 7/8 in. hose will always be required between any bend or elbow and the distribution tee.

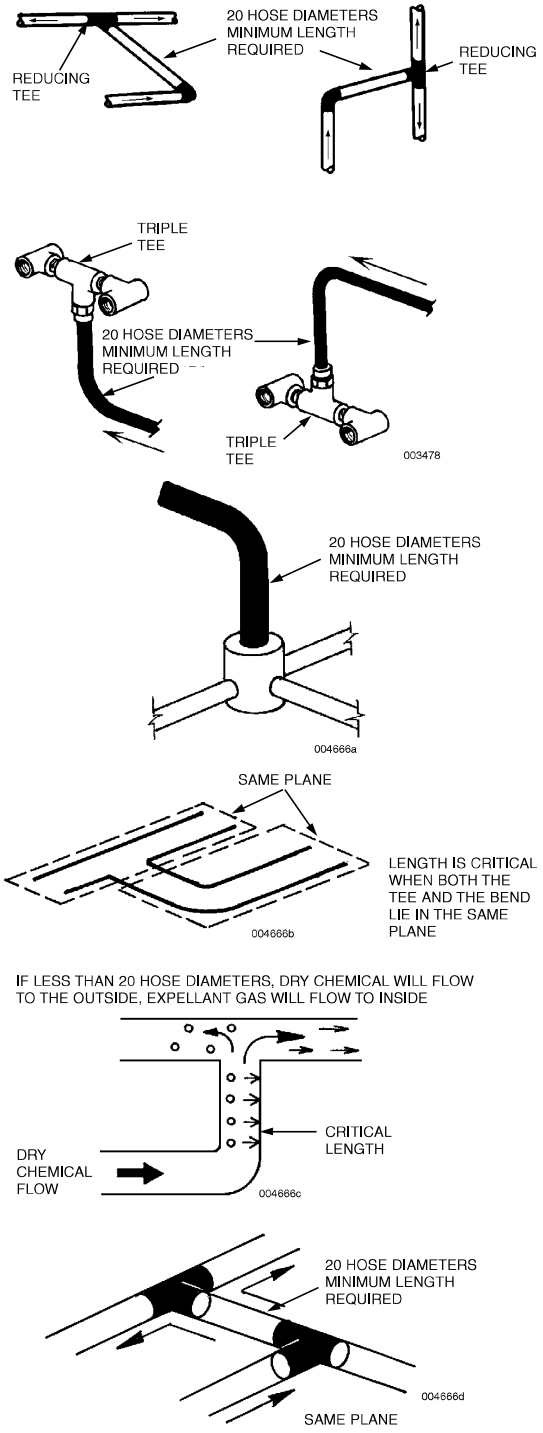


FIGURE 3

MAINTENANCE

Maintenance is a "thorough check" of the system. It is intended to give maximum assurance that the system will operate effectively and safely. It includes a thorough examination and any necessary repair or replacement. It will normally reveal if there is a need for hydrostatic testing of the tank.

Maintenance shall be performed semi-annually or sooner, depending on operating and/or environmental conditions. The fire suppression system including alarms, shutdown and associated equipment shall be thoroughly examined and checked for proper operation by the fire protection manufacturer, authorized distributor or their designee in accordance with this manual.

SEMI-ANNUAL MAINTENANCE

To provide maximum assurance that your ANSUL A-101 system will operate effectively and safely:

1. Check to see that the hazard has not changed.
2. Remove all cartridges, install safety shipping caps, and put in a safe place for future reinstalling.
3. Note the general appearance of the system components checking for mechanical damage or corrosion, and check that the components are securely fastened and all hose fittings are tight.
4. Check nameplates and additional labels to make certain they are clean, readable, and properly attached.
5. Remove tank fill cap(s) and check that the agent tank is filled to the proper level with ANSUL FORAY dry chemical. The following table indicates the proper level for each size tank.

   Note: All measurements should be taken from the TOP of the fill opening (top of threaded fill collar).

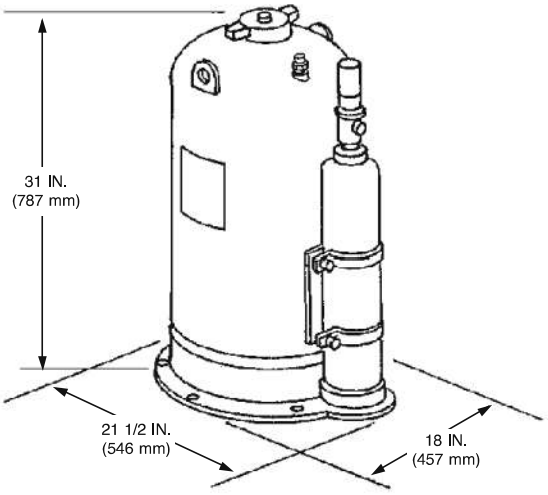
Tank Size	Maximum Depth of Dry Chemical in.	(mm)
LT-A-101-50	8 1/2	(216)
LT-A-101-125	9 1/2	(241)
LT-A-101-250	19	(483)

   Important: If the depth of dry chemical exceeds the maximum, **do not add additional dry chemical.** Tank(s) must be emptied and refilled with the correct amount of dry chemical as specified in Section IX, RECHARGE.

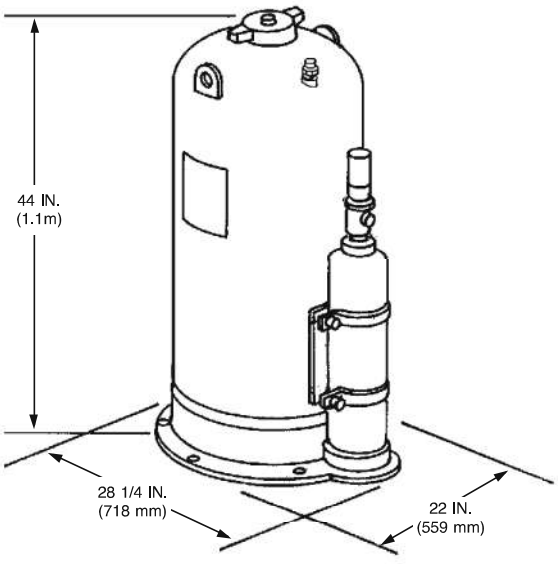
   Check the dry chemical for lumps. If lumps are present, drop one from a height of 4 in. (102 mm) onto a hard surface. If the lump does not break up completely, the dry chemical must be replaced.
6. Inspect threads on fill cap and on tank fill opening for nicks, burrs, or cross-threading.
7. Check fill cap gasket and quad ring for elasticity, cuts, or checking, and lightly coat them with an extreme temperature silicone grease, such as Dow Corning No. 4 or equal, if equipped. Make certain indicator stem is in the "down" position. Reinstall fill cap and hand tighten.
8. Disconnect the union and examine the disc in the seal burst disc assembly or burst disc nipple to ensure that it is not damaged in any way and then reconnect the union. **Note:** Before reconnecting, blow all lines clear with dry air or nitrogen.
9. Check that the nozzle openings are not obstructed and that the nozzles are properly aimed and have not rotated out of position.
10. **Make certain each nozzle has a blow-off cap properly installed** (the opening of an F-1/2 nozzle can be packed with an extreme temperature silicone grease, such as Dow Corning No. 4 or equal, to avoid build-up of foreign material) and check that the caps are pliable and free of cuts and checks. **Note: Blow-off caps must be replaced annually.**
11. Remove the pneumatic actuator(s) from the nitrogen cartridge on the LT-A-101 tank(s) and inspect all threaded areas for nicks, burrs, and cross threads.
12. Clean actuator(s) as follows: (see Figure 1):
    - Using two wrenches, one positioned on the swivel nut, and one positioned on the bottom portion of the actuator, loosen the swivel nut and remove the top portion of the actuator.
    - Using a wooden dowel, push pin assembly and spring out of the actuator body.
    - Remove the gasket from inside the cartridge thread port. Inspect, clean, apply a good grade of low temperature grease, such as Dow Corning No. 4, or equal, and reinstall the gasket. Replace if necessary.
    - Remove the O-Rings from the pin assembly and swivel adaptor. Inspect, clean, apply a good grade of low temperature grease, such as Dow Corning No. 4, or equal, and reinstall the O-Rings. Replace if necessary.
    - Apply a small amount of grease to the puncture pin shaft. There is a U-Cup guide inside the actuator body and when the pin is reinstalled into the body, the grease on the shaft will lubricate the U-Cup.
    - Clean the inner surface of the actuator body and, using a small diameter wire, clean the vent hole. **Make certain not to scratch the inner surface.**
    - Reinstall spring onto puncture pin shaft and insert into actuator body. Push pin down several times to allow grease to coat U-Cup. When positioned back in body, make certain the tip of the pin is above the gasket in the bottom of the actuator.
    - Reinstall the actuator unto the cartridge. Hand tighten.
    - Reinstall swivel adaptor in the correct position for the actuation lines and wrench tighten the swivel nut. Make certain all actuation and expellant lines are properly tightened into the actuator.

LVS-15, 30 TANK ASSEMBLY

The LVS-15 (Part No. 438775) (CE version 438838), or LVS-30 (Part No. 438821) (CE version 438839) Tank Shipping Assembly consists of a carbon steel tank capable of holding 15 gallons (LVS-15) or 30 gallons (LVS-30) of LVS Wet Chemical Solution. Included with the tank assembly is an integral nitrogen cartridge used to pressurize the tank and expel the agent out of the tank. The tank and all tank components are painted with a red, corrosion-resistant paint. See Figure 3-2a.



LVS-15

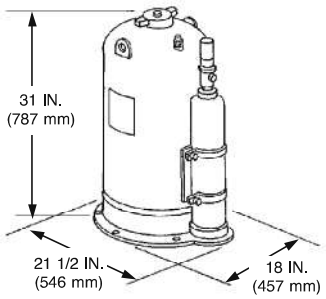


LVS-30

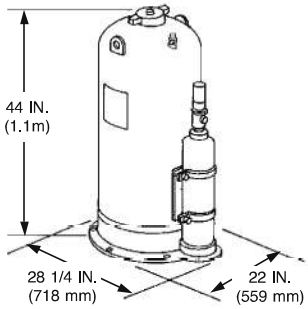
FIGURE 3-2a
004328

LT-A-101-125/250 TANK ASSEMBLY

The tank assemblies, LT-A-101-125 (Part No. 427745) (CE Version 434378) and LT-A-101-250 (Part No. 427746) (CE Version 434379) are factory filled with 112 lb (50.8 kg) and 225 lb (102.1 kg) respectively with FORAY dry chemical. Each tank is finished with a red, corrosion resistant paint. A nameplate is affixed to the exterior and contains information on recharge and maintenance. Each tank assembly contains the proper size nitrogen cartridge for expelling the dry chemical. Each tank is manufactured with a seismic mounting ring on the bottom, which can be bolted to the mounting surface or to the optional mounting ring. See Figure 3-2b.



LT-A-101-125
Shipping Wt. 297 lb (135 kg)



LT-A-101-250
Shipping Wt. 515 lb (233 kg)

FIGURE 3-2b
004477

LT-A-101-50/LVS-5 TANK BRACKET

The LT-A-101-50/LVS-5 Tank Bracket (Part No. 433685) consists of heavy gauge steel back/bottom plate, and clamp arms. The bracket is constructed to properly retain the agent tank from movement or damage in the rugged environment in which these systems are normally used. The bracket contains rubber pads to minimize the shock and vibration effect on the tank. The bracket is finished in red, corrosion-resistant paint. See Figure 3-3a.

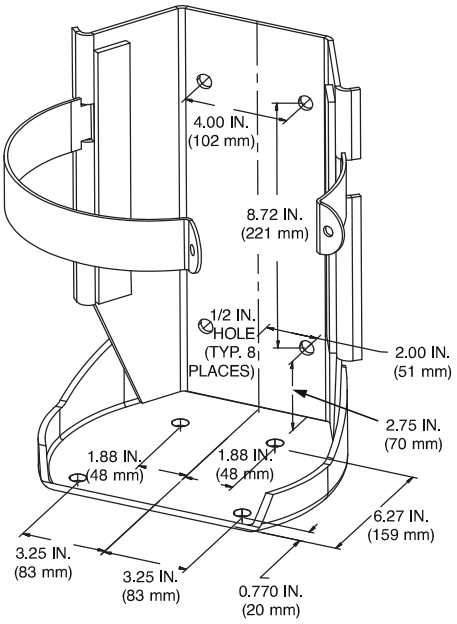


FIGURE 3-3a
007278

MOUNTING COMPONENT BRACKETS

When considering locations for mounting the agent tanks, expellant gas cartridges, and manual and automatic actuators, choose areas where the components are easily accessible for operation and service, and where components will not be abused or will not interfere with vehicle operation or maintenance procedures, or obstruct operator vision or vehicle egress. Keep in mind not only the requirements for each individual component, but also how the components are connected, and the maximum hose lengths required between each component. Discuss potential mounting locations with the vehicle owner, and/or vehicle maintenance personnel before installing components.

NOTICE

When mounting brackets for fire suppression and detection system components, make certain the mounting surface is a rigid surface capable of supporting the total weight of the equipment (e.g. a 100 lb (45.4 kg) LVS-5 tank assembly, a 195 lb (88.5 kg) LVS-10 assembly, a 400 lb (181.4 kg) LVS-15 tank assembly, and a 600 lb (272.2 kg) LVS-30 tank assembly). Before securing brackets, verify acceptance by the vehicle manufacturer to weld or bolt onto that surface.

Nozzle Bracket

Based on the layout sketch, locate a secure mounting location for each nozzle bracket that will allow the nozzle to be positioned within its effective discharge range. The nozzle is to be properly aimed at the furthest portion of the area to be protected, without obstruction to the agent discharge.

1. Weld or bolt the bracket to the mounting surface. When welding the bracket, make certain there is enough weld to keep the bracket properly in place.
2. If welding is not possible, the bracket can be drilled and bolted to the mounting surface with appropriate fasteners. Make certain the bolting method does not allow the mounting bracket to rotate out of position or interfere with the nozzle discharge.

   Note: When welding is not used, a minimum of two bolts is required for proper mounting.

Distribution Fittings or Manifold Blocks

Based on the sketch done in the Design Section, choose locations for the supply line tee and secondary supply line tees (if applicable), or the Distribution Manifold Blocks that will not result in hose lines exceeding corresponding tank size maximums, cause interference for vehicle maintenance access, or hinder service.

1. When locating the agent distribution tees or manifold blocks, make certain the locations do not cause the hose to be exposed to extreme heat or physical abuse.

   Note: If areas with normally high operating temperatures are unavoidable, make certain the hoses routed in those areas are protected with extreme temperature fire jacketing.
2. All distribution fittings must be secured to the mounting surface with suitable clamping devices or to a mounting bracket that can be welded to the mounting surface. See Figure 5-1. If the Distribution Manifold Block is to be used, they can be installed either by welding or bolting. When bolting the blocks, use two 5/16 in. bolts with a flat washer and a lock washer on each. Bolts and washers are supplied by others. Make certain the mounting location allows for easy hose installation and a 3/4 in. NPT pipe plug to be installed at the end of the block.
3. All welds must be made before any hose has been installed to avoid damage to the hose due to high welding temperatures.

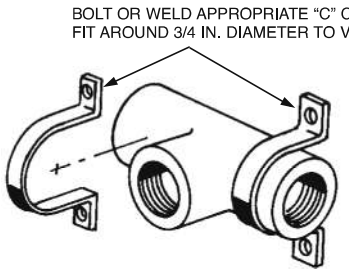


FIGURE 5-1
003513

Agent Storage Tanks and Brackets

NOTICE

The location of the LVS tank must not cause the hose length limitations to be exceeded.

Because the weight of a fully charged LVS-5 tank is in excess of 100 lb (45.4 kg), the weight of a fully charged LVS-10 tank is in excess of 195 lb (88.5 kg), the weight of a fully charged LVS-15 tank is in excess of 400 lb (181.4 kg), and the weight of a fully charged LVS-30 tank is in excess of 600 lb (272.2 kg), proper mounting is very important. The tank should be bolted or welded in place.

TOTAL SYSTEM

The fire detection/suppression package is designed and approved for mining vehicle applications which are required to be permissible in an explosive methane/air atmosphere.

The complete CHECKFIRE MP system is composed of components which are combined to provide automatic fire detection and actuation. The electric detection and actuation system is designed for use only with Ansul fire suppression systems requiring pneumatic input as a means of actuation.

Some of its features include linear and/or spot (thermal) detection, supervised circuitry, internally powered, adjustable pre-alarm and alarm time delays, and one-button operation.

CHECKFIRE MP Electric Detection and Actuation System consists of the following components (Figure 1):

1. Control Module
2. Manual Actuator
3. Automatic Actuator
4. Mounting Brackets
5. Linear Detection Wire
6. Thermal Spot Detectors
7. Pneumatic/Linear Detection
8. Gas Motor
9. LT-5-R Cartridges
10. Check Valves
11. Explosion-Proof Pressure Switch
12. Gas Motor Test Module (not shown)

See Appendix for Component Index which includes shipping assembly part numbers for main components, accessories, and recharge materials.

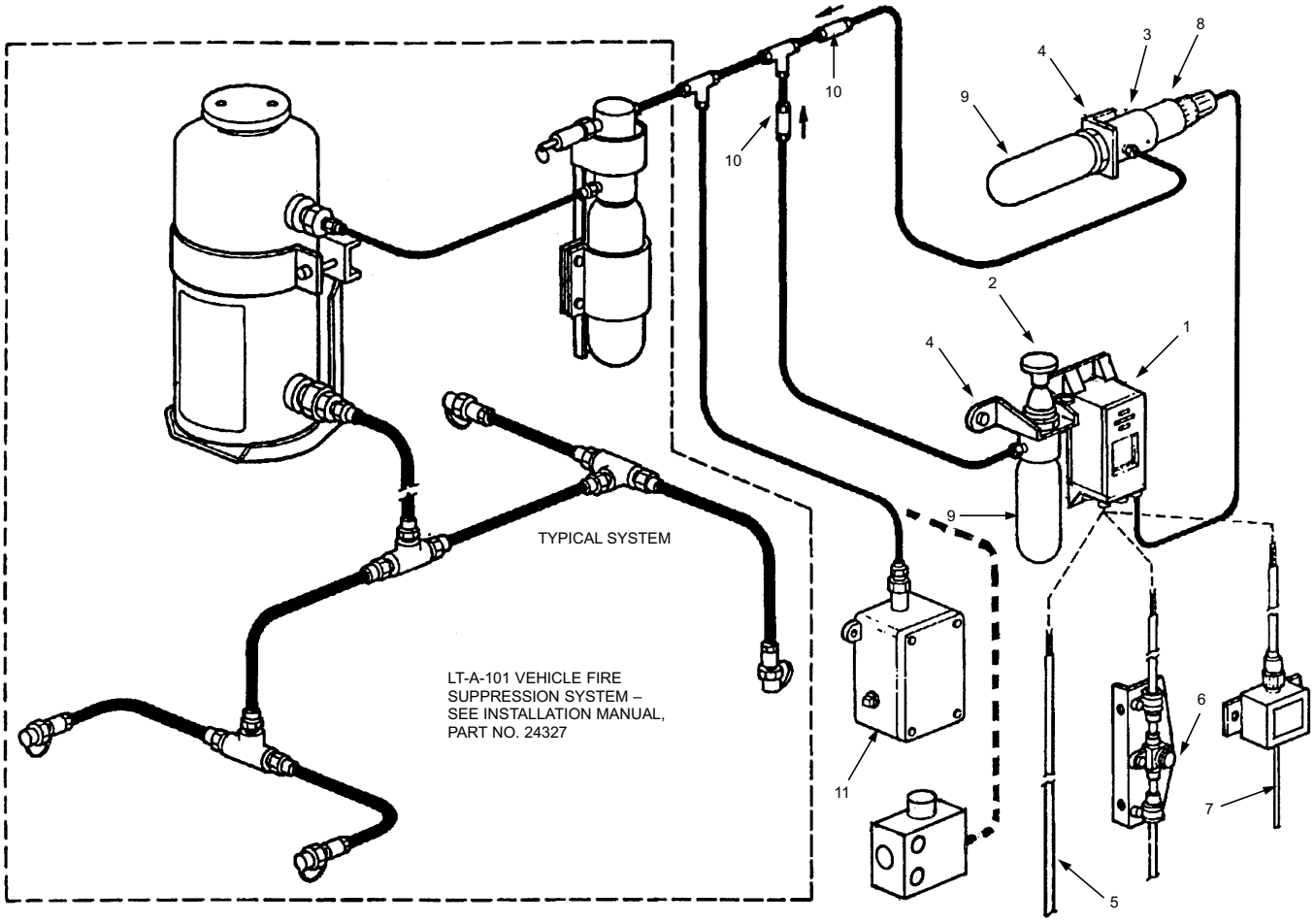
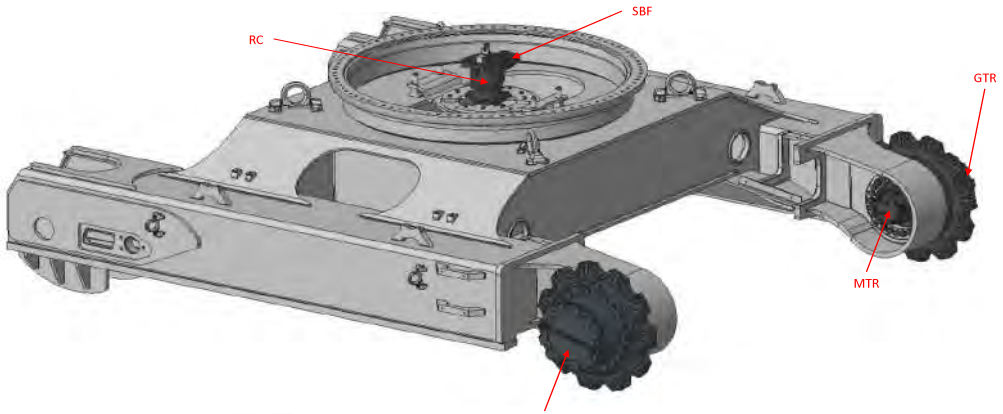
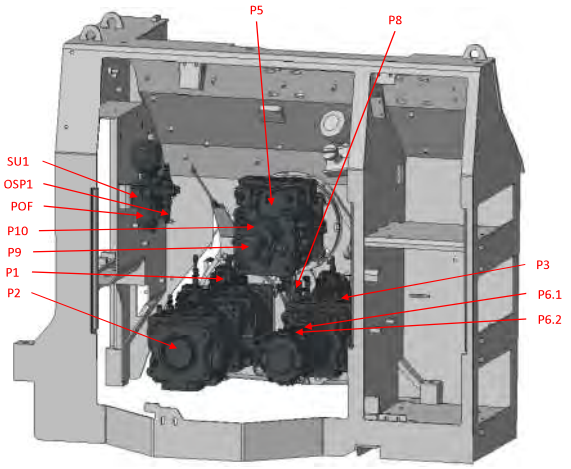
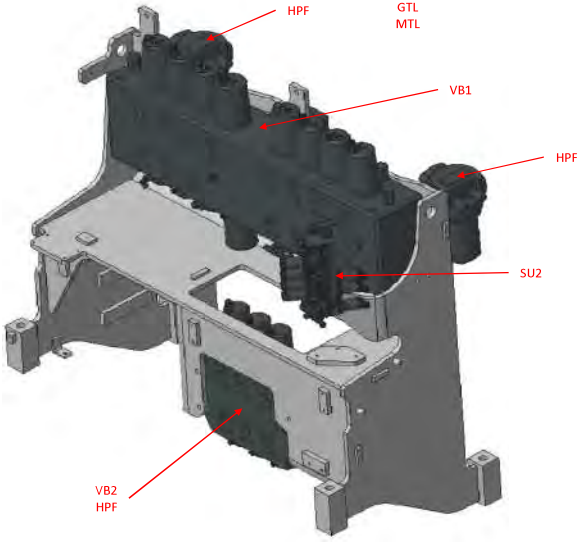
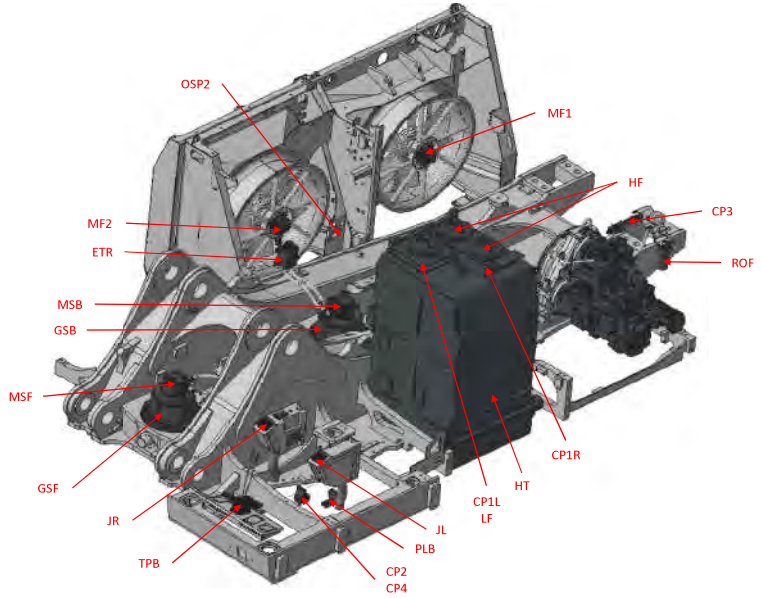


FIGURE 1
003901



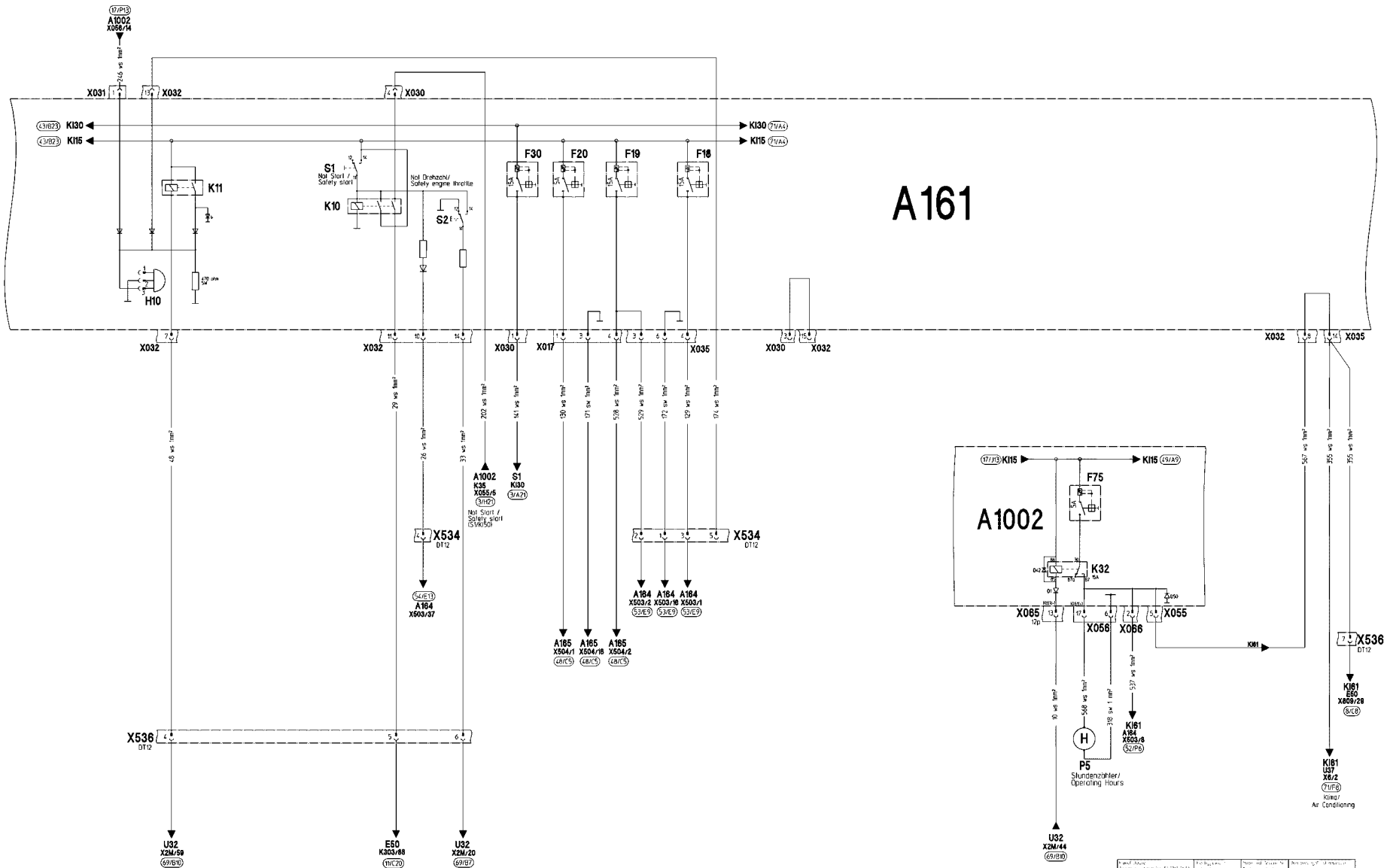






Gezeichnet mit / Drawn with / Dessiné avec: EXCEL	LIEBHERR; WERK FACTORY USINE: LEC	A3	Gezeichnet / Drawn / Dessiné: INTI-NAEGELIN M.	Datum / Date / Date: 31-Oct-2018	Blatt / Page / Feuille: 2/2	Bezeichnung / Description / Dénomination: BEZEICHNUNG HYDRAULIKKOMPONENT DESCRIPTION HYDR.COMPONENTS DENOMINATION COMPOSANTS HYDR.	Ident-Nr. / Ident No. / N° d'ident.: 10824259
			Geprüft / Inspected / Vérifié: SIMON J.	Ersatz für / Replacement for / Remplace: .			Zeichnungs-Nr. / Drawing No. / N° de dessin: 1132 7010 50 002

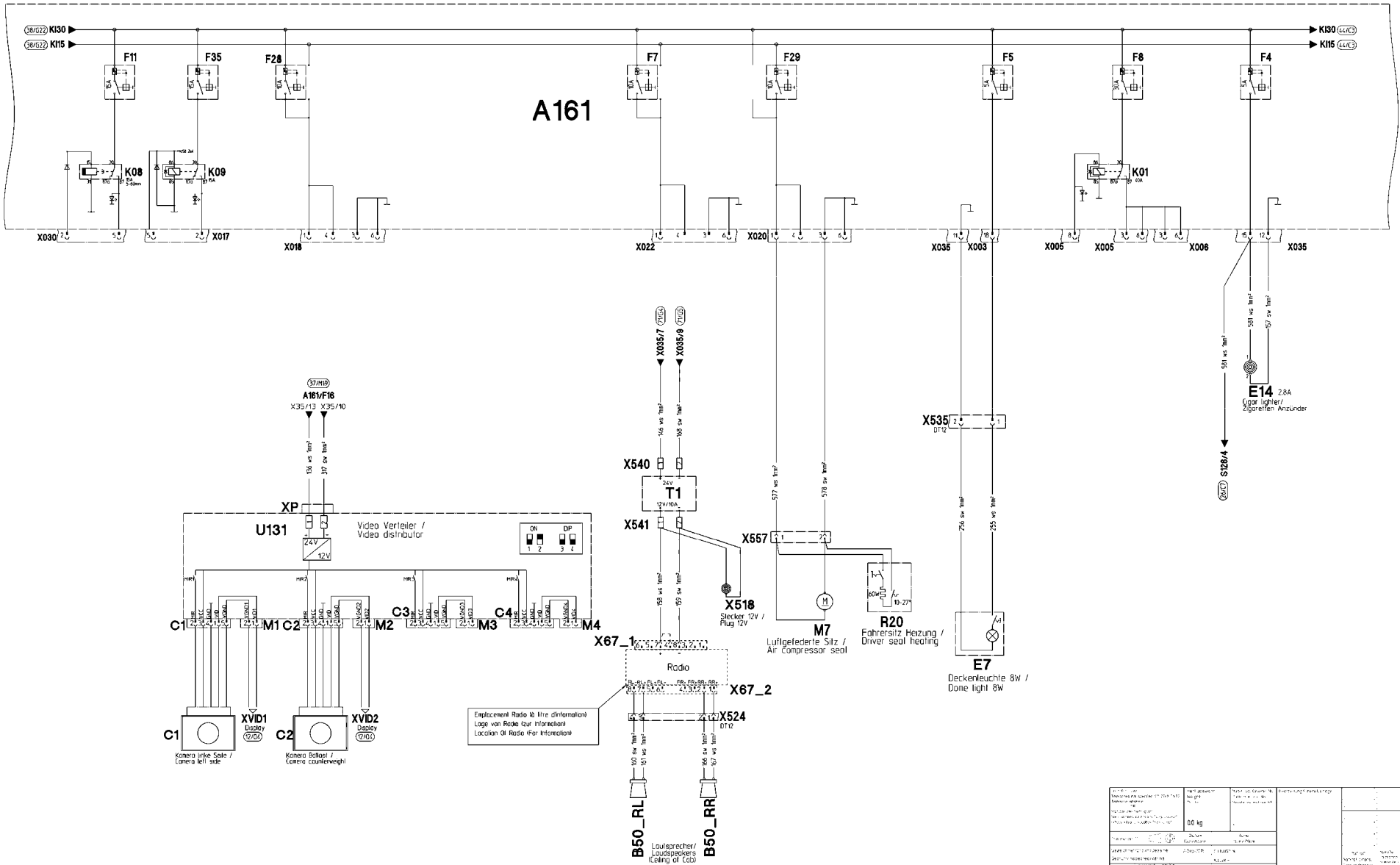
44	45	46	47
Notsteuerung Motor / Safety control engine	Versorgung A164/A165 / Supply A164/A165	Reserve A161 / Reserve A161	Kl61 Verteilung / Kl61 distribution



LIEBHERR LEC	A0	
ELEKTROSCHEMA	9100	1132 9010 00 602
ELECTRIC SCHEME	9100	
SCHEMA ELECTRIQUE	9100	12189590

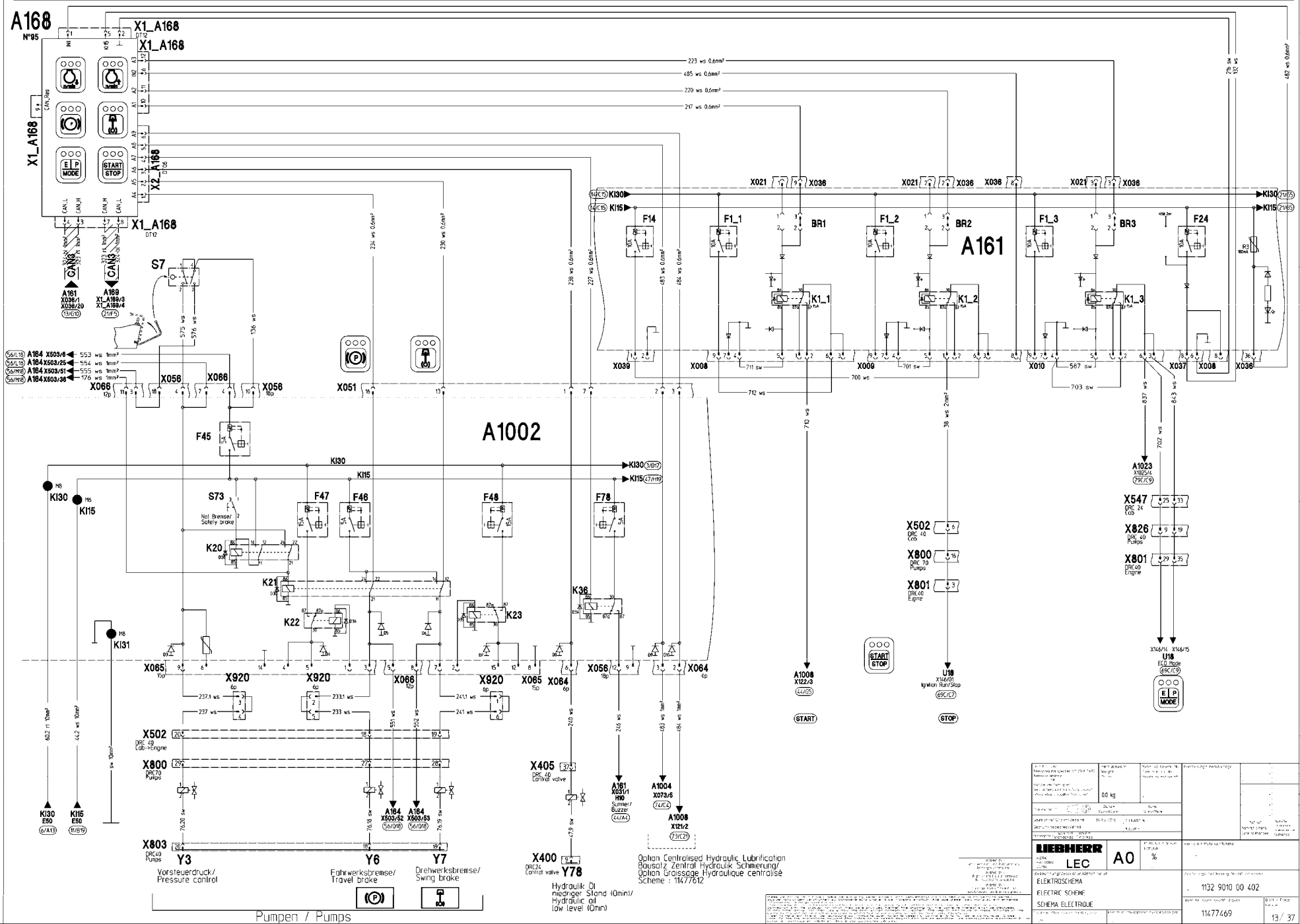
16 / 27

39	40	41	42	43
Video Verteiler / Video distributor	Radio / Radio	Fahrersitz / Driver seat	Deckenleuchte/ Dome light	Zigarettenanzünder / Cigar lighter

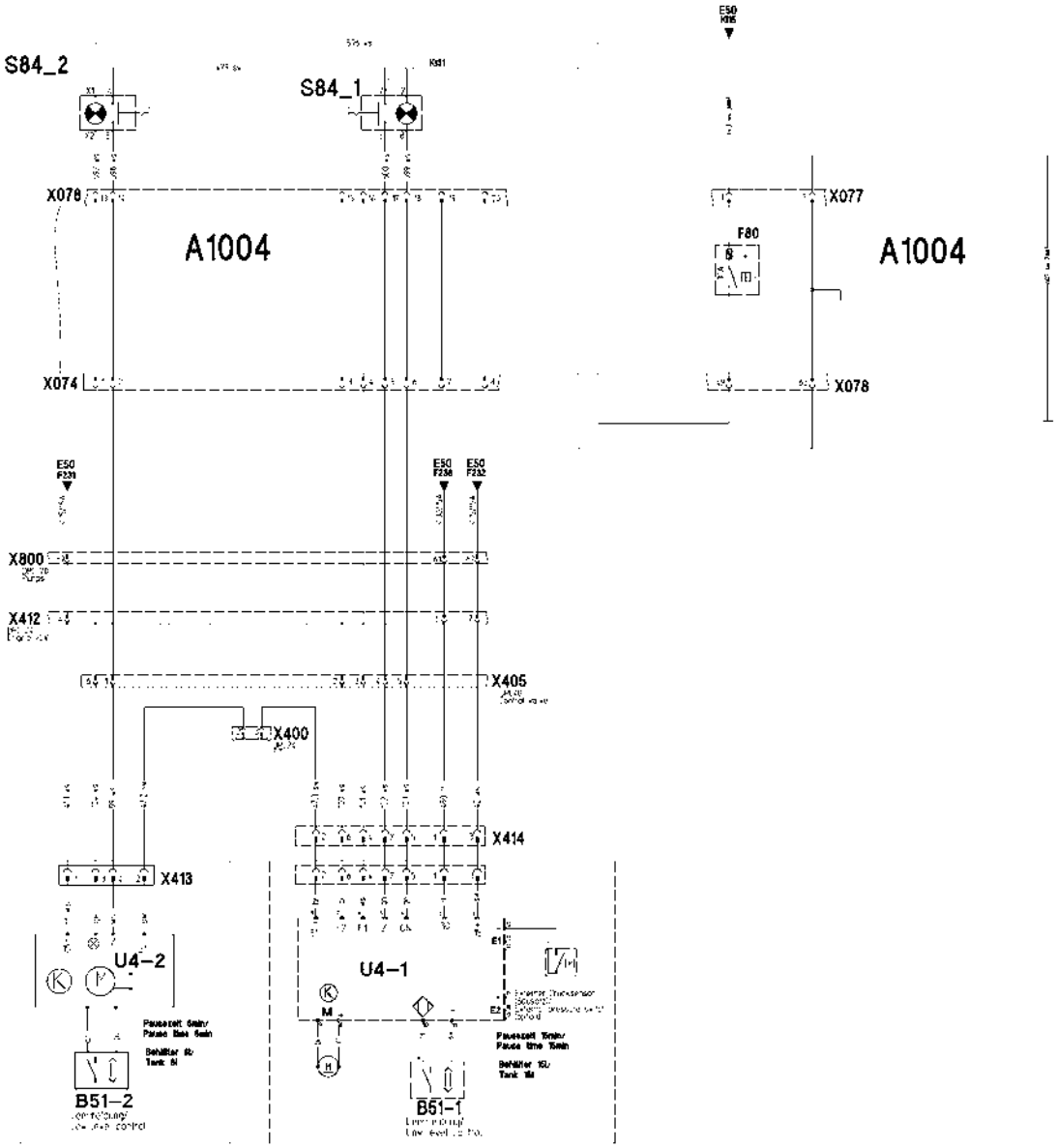


LIEBHERR
LEC
A0
ELEKTROSCHEMA
ELECTRIC SCHEME
SCHEMA ELECTRIQUE
0.0 kg
1132 9010 00 500
11859337
14 / 26

15 C	16 C	17 C	18 C	19 C	20 C
Tastatur A168 / Keyboard A168	Sicherheitshebel, Bremse, Steuerdruck / SAfety switch, breaks, pressure control	Qmin, Summer / Qmin, Buzzer	Motorstop / Engine Stop	Reserve A161 / Reserve A161	Versorgung A168 / Supply A168



Automatische Schmierung/ Greasing automatic



- A1004 Electronic plate

B51_1 Sensor/Level comm.
B51_2 Sensor/Level control

S84_1 Switch greasing
S84_2 Switch greasing

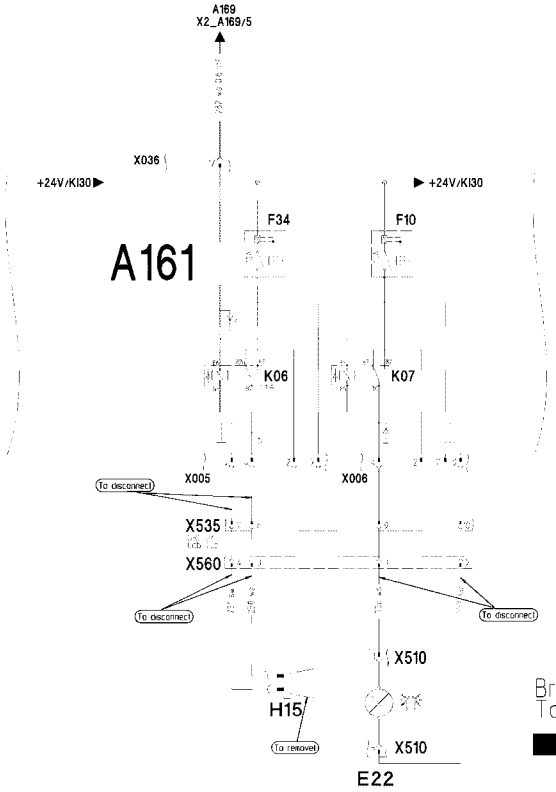
U4_1 Greasing module
U4_2 Greasing module

- X074 Connector/Plate A1004
- X077 Connector/Plate A1004
- X078 Connector/Plate A1004
- X405 Connector/Ground fuel tank
- X412 Connector/Fuel tank
- X413 Connector/Control valve tank
- X414 Connector/Control valve tank
- X415 Connector/Greasing tank
- X800 Connector/Pumps

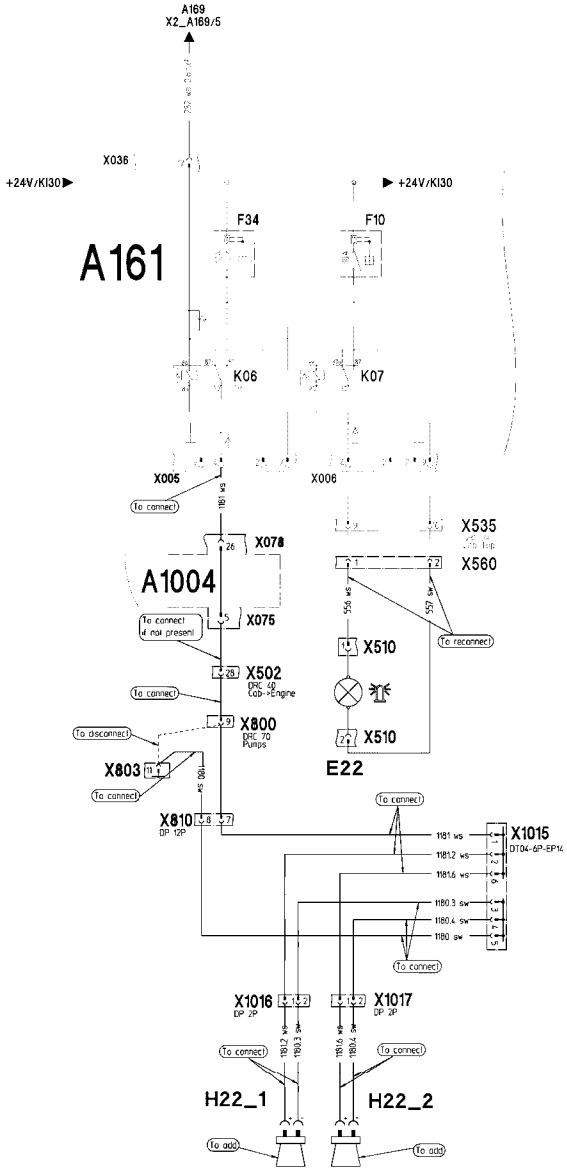
Principle scheme

LIEBHERR LEC A0

Bausatz Fahrwarneinrichtung Lynx – R9100/R9150
Lynx Travel alarm kit – R9100/R9150
Option alarme de recul cri du Lynx – R9100/R9150



Brancher comme ci après
To connect as follows



Fahralarm Kabinen Dach /
Travel alarm top of cab

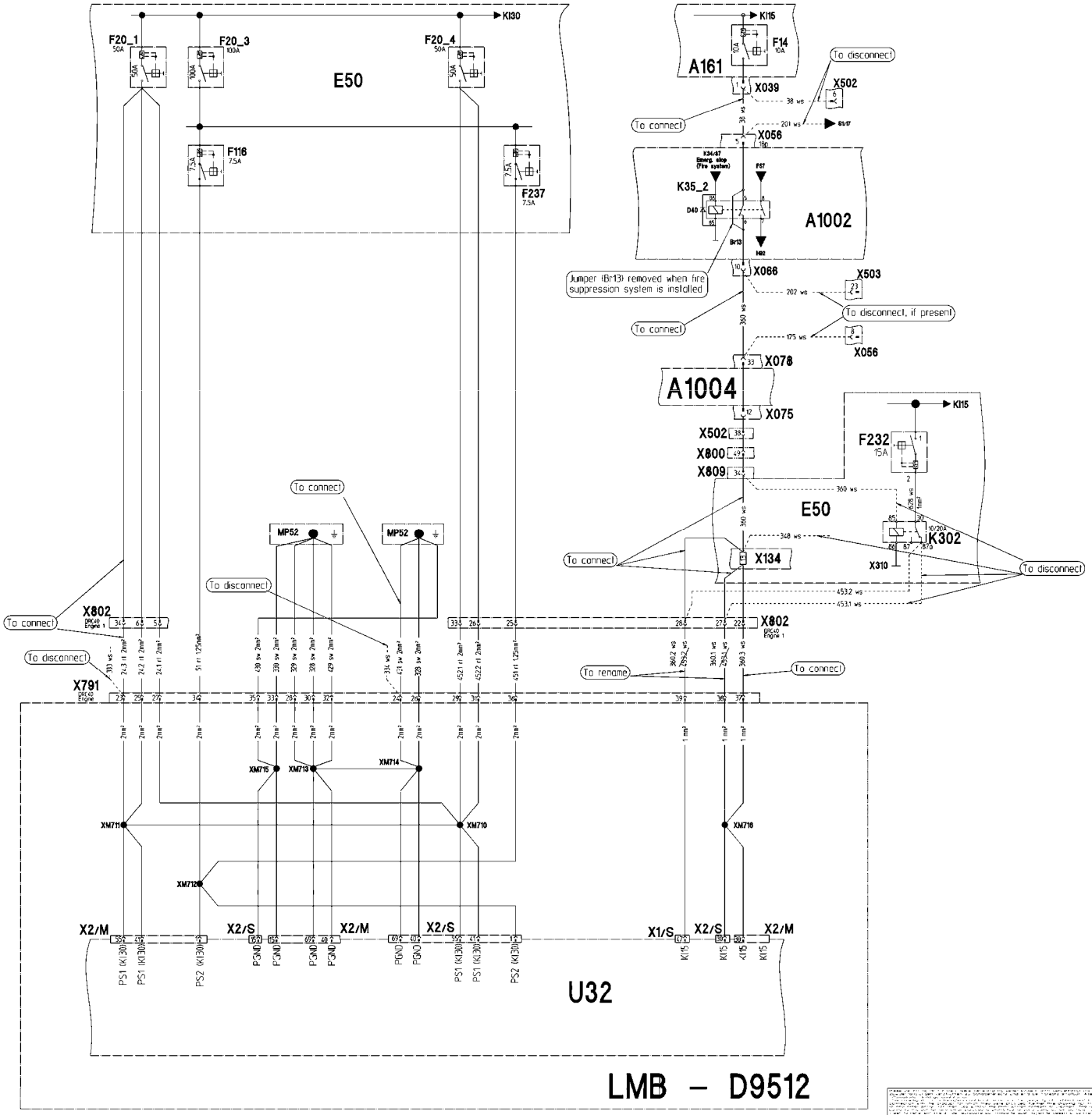
LEGENDE

LABEL	DESCRIPTION
*A167	Input module
*A169	Keyboard
*A1004	Electronic base
*E22	Warning travel alarm
*H22	Travel alarm
H22_1	Travel alarm Lynx
H22_2	Travel alarm Lynx
*K06	Relay 12A
*K07	Relay
*X005	Connector 10 poles / A161
*X007	Connector 10 poles / A161
*X006	Connector 10 poles / A161
*X535	Connector 24 poles / A161
*X078	Connector 26 poles / A1004
*X075	Connector 12 poles / A1004
*X502	Connector 40 poles / Cabin
*X560	Connector 2 poles / E22
*X535	Connector 24 poles / Cabin
*X560	Connector 4 poles / Cabin top
*X800	Connector 70 poles / Pumps
*X801	Connector 40 poles / Engine
*X803	Connector 12 poles / Pumps control
*X810	Connector 12 poles / Counterweight
X1015	Connector 6 poles / Counterweight
X1016	Connector 2 poles / Travel Alarm
X1017	Connector 2 poles / Travel Alarm

* Principal electrical diagram

LIEBHERR LEC	A0		KEIN-NONE-SANS
ELEKTROSCHEMA	CRLYNX		1132 9010 50 000
ELECTRIC SCHEME	CRLYNX		
SCHEMA ELECTRIQUE	CRLYNX		12716187

1 / 1


Kit de rattrapage R9100/R9150
Bausatz Nachrüstung R9100/R9150
Retrofitting kit R9100/R9150
E50
A161
A1002
A1004
U32
LMB – D9512
To connect
To disconnect
To disconnect, if present
To rename
Jumper (Br13) removed when fire suppression system is installed
LEGENDE
LABEL DESCRIPTION
*A161 Electric Plate
*A1002 Electric Plate
*A1004 Electric plate
*E50 Connection box
*F14 Fuse 10A
*F20_1 Fuse 50A / Supply KL30
*F20_3 Fuse 100A / Supply KL30
*F20_4 Fuse 50A / Supply KL30
*F116 Fuse 7.5A
*F232 Fuse 15A
*F237 Fuse 7.5A
*K35_2 Relay / Start CAN
*K302 Relay 10/20A
*U32 Motor plug
*X039 Connector 4 poles / A161
*X056 Connector/A1002
*X066 Connector 12 poles / A1002
*X075 Connector 15 poles / A1004
*X078 Connector 72 poles / A1004
*X134 Terminal bloc E50
*X502 Connector 40 poles / Cabine
*X791 Connector 31 poles / Motor
*X800 Connector 70 poles / Pumps
*X802 Connector 40 poles / Engine
*X809 Connector 40 poles / E50
* Principal electrical diagram
LIEBHERR
LEC
A0
KEIN-NONE-SANS
ELEKTROSCHEMA BAUSATZ
ELECTRIC SCHEME ACCESSORIES
SCHEMA ELECTRIQUE OPTION
1133 9010 74 000
12191573
1 / 1

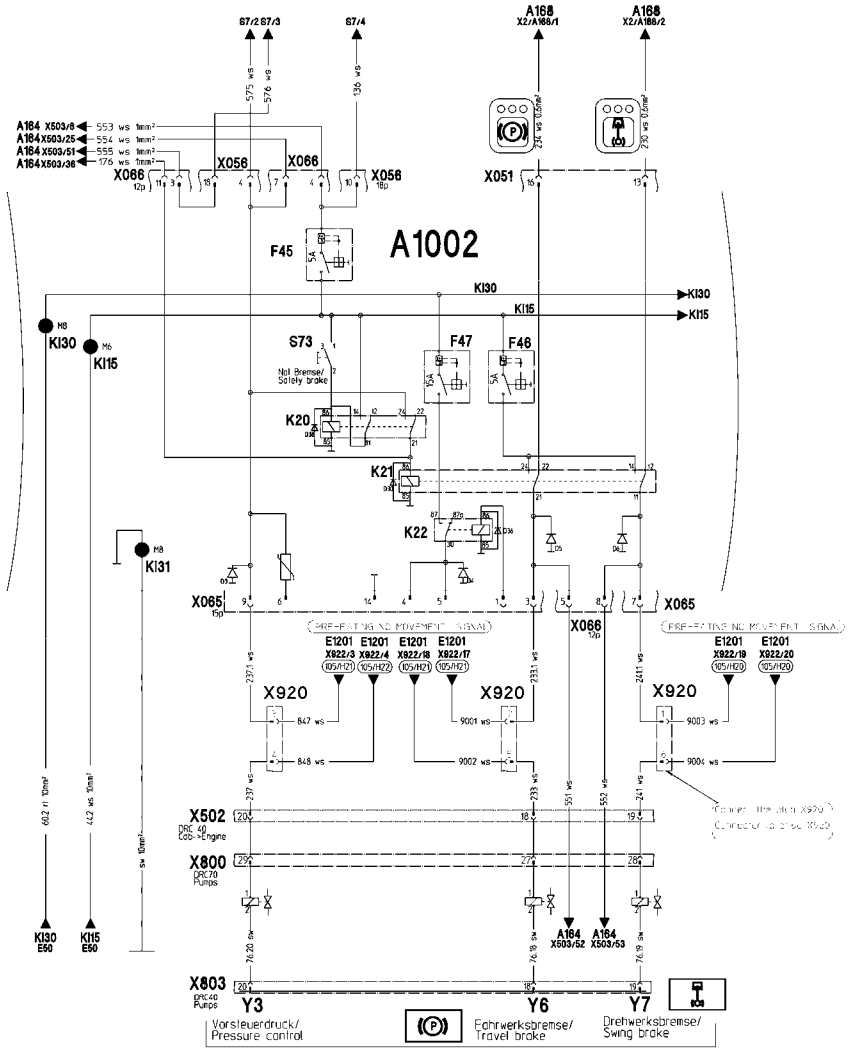
E1201

111

"KEIN BEWEGUNG" function /
Preheating "NO MOVEMENT" function

WARNING

[illegible]



LIEBHERR	A0	KEIN-NONE-SANS
LEC		1132 9010 13 300
ELEKTROSCHEMA VORWAERMUNG ELECTRIC SCHEME VORWAERMUNG SCHEMA ELECTRIQUE VORWAERMUNG		12187233