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Hooklift WLS

Maintenance & Repair

(March. 2011)

1 GENERAL INTRODUCTION

1.1 Safety information

The hooklift can be hazardous when used incorrectly or without due care.
Ensure that you read and understand the general safety information in this chapter.
Take normal precautions for safety in the workplace.
The installation must be repaired according to the instructions in this manual.
Other repairs and modifications to the installation are prohibited.

1.1.1 Personnel / training

The hook arm may be operated, maintained and repaired solely by trained specialist personnel who must ensure that warnings, precautionary measures and instructions in this maintenance and repair manual are heeded.

1.1.2 Warnings

The hooklift is a powerful piece of equipment. Failure to give due care and attention when operating or repairing the equipment can lead to death or serious injury to the operator and bystanders. Always heed the instructions given in this workshop service manual.
The safety of this equipment depends on more than just heeding these instructions; it also depends on proper, safe driving.
If the lifting mechanism is left in the extended position, then it must be safely supported.
When operating the equipment with a fully operational hooklift, ensure that the lifting mechanism is returned to the fully loaded position (idle state). Avoid moving or driving the vehicle when the lifting mechanism is not in its home position. Do not use the lifting mechanism to lift or tow another vehicle.

1.1.3 Use of switches

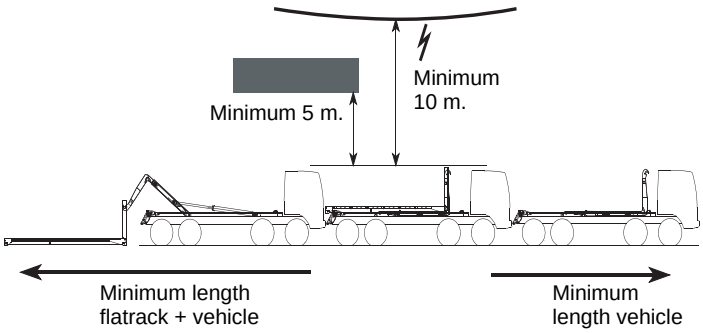
Except when necessary for tracing errors, always set the MODE switch on the cab control unit to the OFF (0) state whenever the lifting mechanism is in the fully loaded position (idle state). Under no other conditions whatsoever should you set the switch to the OFF state. Ensure that the MODE switch is always in the OFF (0) state, unless otherwise instructed. Failure to heed this instruction can lead to unexpected activation. Ensure that the switches in the cab are unobstructed by objects and rubbish, which can interfere with proper and safe operation of the installation, or cause unexpected activation.

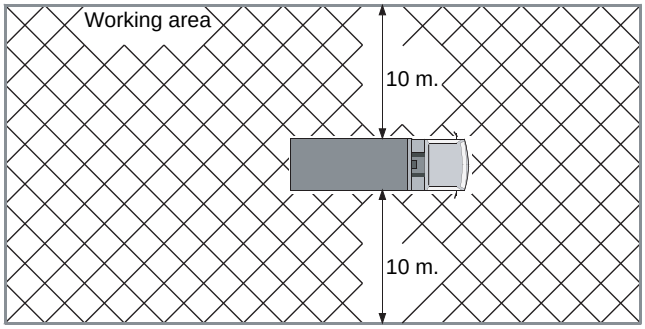
1.1.4 Personal safety

Never climb on the hooklift, and always prevent others from climbing on it, unless this is necessary for repair work. If you must climb on the vehicle, first ensure that all necessary safety precautions are taken.
To avoid any risk of injury to the face and head, always close the door of the cab after stepping in or out.
Always wear appropriate personal protection measures, such as safety shoes, gloves, hearing protection, facial protection, etc.

1.1.5 Required working clearances

Whenever it is necessary to operate the hooklift during or following repair or inspection, take account of the following working clearances around the vehicle:
- In front: 10 metres
- At rear: 10 metres
- Overhead: 5 metres from a fixed object, 10 metres from overhead power cables
- Sides:10 metres





1.1.6 Precautionary measures

Follow the instructions in the order they are given. Failure to do may endanger the installation.

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The vehicle engine should only be idling.
If the oil light of the cab control unit should illuminate during loading or unloading, continue with the procedure you have started. Do not start to use the hooklift if the oil light is already illuminated.
Do not change the settings of the system.

1.2 Consumables

It is important to use the correct type of hydraulic oil for the prevailing air temperature. Different environments may call for the use of a different hydraulic oil.

Purpose	Civil code / type	Military code / type	Remark
Lubricating grease	General purpose grease	G-403 / XG279	Lubrication and assembly of shafts, etc.
Lubricating oil	10W40 or 15W40 general purpose engine oil	O-236	When fitting moving parts with no automatic lubrication
Hydraulic oil	Class 46 hydraulic oil Class 32 hydraulic oil	H-540 ** C-635 **	For “normal” temperatures. For temp. continuously below -20 °C

** may be blended

1.3 Torques

The most common screw thread sizes and appropriate tightening torques are specified below. The quality of a fastening is (usually) stated on the head.

	Torque (Nm)		
Size	Quality		
	8.8	10.9	12.9
M6	9.5	13	16
M8	23	32	39
M10	46	64	77
M12	80	110	140
M14	120	180	220
M16	200	280	330
M20	380	540	650
M24	660	930	1100
M27	980	1400	1600
M30	1400	1800	2200

1.4 Preventive maintenance

1.4.1 Maintenance frequency

The hooklift installation requires preventive maintenance on an annual basis.
Whenever a hooklift installation is subjected to heavy usage, maintenance will be needed more frequently.
Usage is indicated by the running hours display in the cab (see 1TH).

1.5 Inspection items, overview

During each inspection, the following items must be checked off:

- Control of load/unload movement (See point 1.5.2).
- Thorough check of system control
- Inspection of joystick functioning
- Inspection of NATO locks and proximity switch (See point 2.2.25).
- Condition and functioning of twistlocks and proximity switches (See point 1.5.1).

- Condition and presence of locking pins and other locking features

- Leakages of hydraulic oil, from hydraulic hoses, lines and fittings
- Condition of hydraulic hoses, lines and couplings
- Condition of cable harnesses

- Valve and reservoir securely fastened
- Inspection of main valve
- Inspection of pump and valve
- Condition of hydraulic unit cover
- Condition of main valve
- Condition of hydraulic unit and frame; inspection and main valve

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- Condition and attachment of hydraulic oil reservoir
- Condition of filler cap, filter body, valve and sight glass
- Check for replacement of oil return filter
- Hydraulic oil level (See point 1.5.3).

- Condition of CHU
- Condition and functioning of upper grips
- Condition and functioning of locking levers
- Condition of feet
- Condition of locking pins/plates below and above
- Inspection of CHU stowage functioning

- Condition of hook arm
- Condition of hook arm buffers
- Condition of middle frame and main cylinders
- Condition of main shaft
- Main shaft locking screws are tight
- Condition of main cylinder pivots
- Condition of hook arm cylinder pivots
- Condition of hook (See point 2.2.11).
- Hook pivot securely fastened
- Condition of hook pivot and locking pin
- Condition of hook return spring

- Condition of subframe
- Subframe securely fastened
- Functioning of French lock
- Condition of hook support roller
- Condition of surfaces and bearings of flatrack rollers (See point 2.2.17).
- Condition of surfaces, pivots, shafts, and bearings of roller beds (See point 2.2.21).

- Check functioning of central lubrication system
- Lubrication of points not connected to the automatic lubrication system (See point 1.6.1).

1.5.1 Check twistlocks and proximity switches

Proceed as follows for all twistlocks:

a. Switch on the main switch of the installation.
b. Check that the twistlock can easily move up and down
c. Check that the proximity switch LED illminates when the twistlock is locked in the high position.

1.5.2 Unloading and loading movement

a. Start the vehicle engine.

At the next step you will load and unload the lifting mechanism. Ensure that you can do this safely. Avoid getting injured by the hook.

b. During loading and unloading with the hooklift, (see the User Manual) check that the loading movement takes place as described in the manual.
c. Switch off the installation and then the vehicle.

1.5.3 Level of the hydraulic oil

a. Set the installation in the home position.
b. Check the level of hydraulic oil in the level gauge at the side of the oil reservoir.
   The level should be visible at approximately the centre of the upper level gauge. If not, proceed as follows.

CAUTION
In the following step you must pour hydraulic oil into the oil reservoir.
Ensure that no dirt, water or other contamination can enter the oil reservoir. Failure to do so can cause serious damage to the lifting mechanism, and lead to a defective installation.

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c. Thoroughly clean the filler/breather cap, then unscrew the cap and remove it from the reservoir. Use the hydraulic oil specified under point 1.2 and top up the oil until the oil level is visible at approximately the centre of the upper level gauge. Fit the cap back on the reservoir.

1.6 Maintenance procedures

During the annual service, in addition to the inspections described above, the following procedures must be carried out.
Because these items are carried out in a similar manner to repairs, they are described in the relevant sections:

- Replacement of oil return filter (See point 3.8.1).
- Changing hydraulic oil (See point 3.8.4).
- Checking slide pads; replacement if necessary (See point 2.2.6).
- Checking slide pads at front end, replacement if necessary (See point 2.2.6).
- Lubrication of various lubrication points (See point 1.6.1).

1.6.1 Lubrication

a. Lubricate the following points with the grease specified under point 1.2. These lubrication points are not connected to the central lubrication system.
   - pivot pins of the hook
   - NATO (Din) locks
   - French lock

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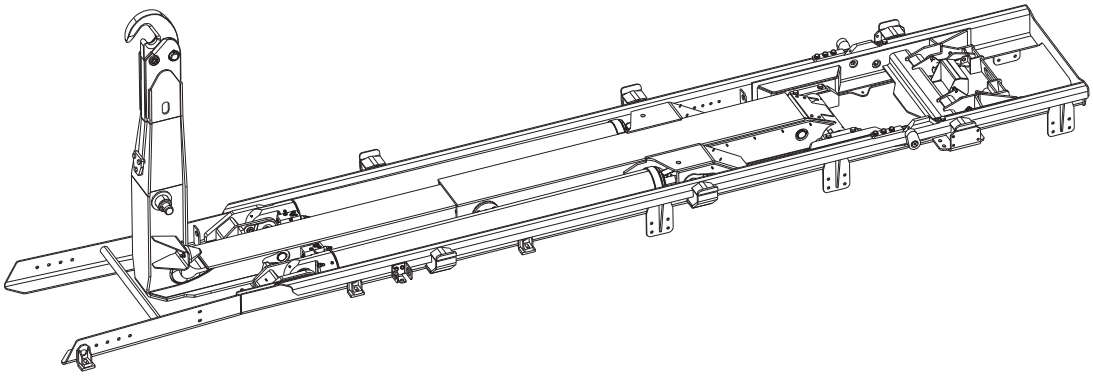
2 MECHANICAL SYSTEM

2.1 Description

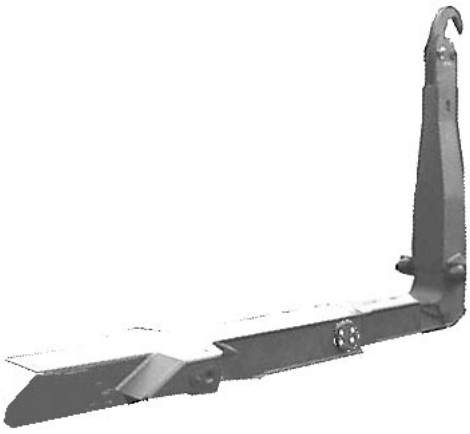
2.1.1 Subframe

The lifting mechanism, locking clamps, auxiliary cylinder and CHU stowage are mounted on a subframe that is fixed to the vehicle chassis.



2.1.2 Lifting mechanism

The lifting mechanism consists of two moving parts: the middle frame and the hook arm. The hook arm telescopes on slide pads in the central tube of the middle frame.
The middle frame is actuated by two hydraulic cylinders (main cylinders).
The hook arm is extended and retracted by a cylinder (hook arm cylinder) in the tube of the hook arm.
The hook of the lifting mechanism is attached to the free end of the hook arm.
When the lifting mechanism is not in use and a load is being transported, then the middle frame will be in its home position, retracted into the vehicle chassis.



The hook arm stops as follows:

- With a container or without load
  When the hook arm cylinder is extended 1400 mm.
  The hook is then at its front position
- With a flatrack or body
  The position is determined by the type of flatrack/body, and is as follows:
  - NATO flatrack/body: when the hook arm cylinder is extended 850 mm (the electrical/electronic subsystem stops the loading process).
  - Other flatracks/bodies: the forward movement is stopped by the locking clamps. The position of the hook is determined by the length of the flatrack/body (this is one way loading of a NATO flatrack/body can be completed)

2.1.3 Main cylinders and pivots

The two double-acting main cylinders are mounted between the subframe and the middle frame.
The cylinders move the middle frame and the hook arm.

2.1.4 Hook arm and hook

The hook arm can slide in and out on the slide pads in the middle frame.
The hook arm is tapered toward the end to create the mounting for the hook of the lifting mechanism.
The hookarm is delivered with two hooks:

- the normal hook (green) that is mounted with two shafts.
- the special hook (with yellow point) that can be mounted on one shaft, to be able to work with “French” flatracks/bodies, with a lower pickup handle. A contact flat on the hook presses on a leaf spring attached to the hook arm, to return the pivoting hook to the straight position.

Two rubber buffers on the hook arm prevent damage to the hook arm from loads.

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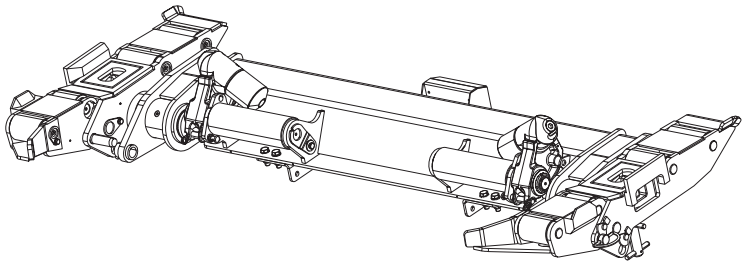
2.1.5 Hook arm cylinder

The hook arm cylinder slides the hook arm in and out of the middle frame, and is located within the hollow hook arm.

2.1.6 Hook arm support roller

The hook arm support roller is attached to a cross-member of the chassis, at a point where the roller can support the hook arm whenever the middle frame is in the home position.

2.1.7 Flatrack rollers and (container) roller beds



The rearmost rollers are mounted on a cross-member on the subframe. These are four rollers that provide support for a flatrack/body and two tilting roller beds to support a container.
(The situation shown here will not be seen in practice.)

Flatrack rollers

When loading a flatrack/body, the runners beneath the load make contact with the horizontal rollers, which support the load. The diagonal rollers guide the load to the centre of the vehicle.
When the vehicle is loading a container, the diagonal rollers are swivelled down, to prevent avoid with the container.
The container is then supported by the roller beds.

Roller beds

Each roller bed comprises two sections. Both sections can tilt on their mountings. When the roller beds are not being used for loading or unloading a container, the sections are locked together and to the cross-member, in their home position, with a locking pin.

When a container is to be loaded, the rear section on each side is first raised manually and locked to the front section. Once locked together, the combined roller bed can freely tilt forwards and backwards on the cross-member.
As the container is drawn up onto the vehicle, the sides of the container are supported and guided by the roller beds. Once the container is completely loaded, the roller beds are lowered to their home position.
A twistlock is integrated into the centre of the roller beds, with which the rear corners of the container can be secured during transportation.

2.1.8 Locks and load locking features

Flatracks/bodies are automatically latched at the rear of the vehicle. The way this happens depends on the type of load:
- NATO locks
- “French” lock

NATO locks

A NATO (DIN) flatrack/body is gripped at the rear end by two pivoting transit locks that protrude through the top of the corresponding side rail of the subframe. The chassis rails of flatracks/bodies (of every type) press down on a lever that raises the locks. The locks only engages in a corresponding feature that is present on the underside of NATO flatracks/bodies. Although the NATO locks are also raised when other types of flatracks/bodies are loaded, the locks do not grip the load in these cases.
When no flatrack/body is loaded on the vehicle (or when a container is loaded), the locks are kept retracted by a retaining spring.

“French” lock

When a “French” flatrack/body is to be loaded, the “French” lock feature must be manually raised. This lock engages in corresponding features on the underside of the flatrack/body to arrest forward motion during loading, and secure the load to the vehicle.

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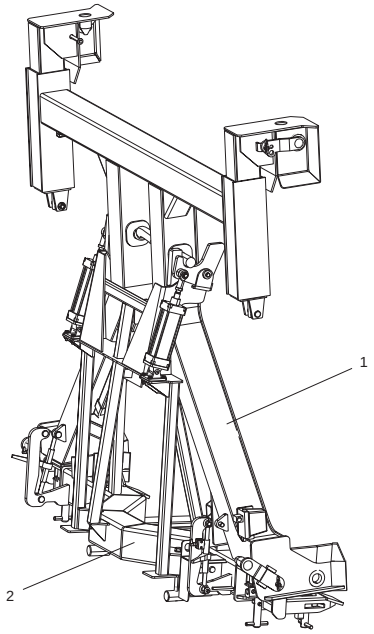
The French lock is used in conjunction with the lowered hook position (See point 2.1.4).

2.1.9 Container Handling Unit (CHU)



The CHU can be attached to the front or rear end of a container. The CHU is attached to the four corners of the container.
Two separate supports enable the CHU to be placed on the ground.
The CHU carries a manual pump to jack the corners up or down (see the 1TH for how to operate). The hydraulic system can be shut off to hold the corners in position.

2.1.10 Transit stowage for CHU

When the CHU is not in use, it should be placed on the CHU stowage.
The CHU stowage can “LOAD” the CHU (place it on the hook arm) and “STOW” it (place it back on the transit stowage). This movement is carried out by two pneumatic cylinders.
The controls for this are located on the CHU stowage.

A mobile loading crane can also be mounted at the location of the CHU stowage.
However, in that case, it is no longer possible to load containers.

2.2 Maintenance

2.2.1 Subframe inspection

a. Inspect the subframe for the following items. Report any problems encountered to the next highest maintenance level.
   - Damage
   - Deformation
   - Defective alignment with chassis
b. Check that the mounting bolts are tight.
c. Replace any damaged or weak fixing screws, washers and nuts.

2.2.2 Middle frame / lifting mechanism

We recommend combining the procedures described here.
If the lifting frame is removed, the slide pads and shafts can also be checked and replaced if necessary.

In these procedures, the term lifting mechanism does not include the subframe.
CAUTION
Read all the following instructions before starting.
Determine the setup for placement, lifting and support, for the relevant instructions.
Note the positions of all shafts and pivot pins in the installation before removing them.

2.2.3 Removal of lifting mechanism

Place in workshop position

a. Place the vehicle such that the lifting mechanism can be lifted and removed from the vehicle.
b. Retract the middle frame, and raise the lifting mechanism far enough to expose the pivot points of the main cylinder on the middle frame.
c. Place a suitable support under the front end of the middle frame, and ensure that the gap between the support and the middle frame does not exceed 5 mm.
   Note the exact position of the support; you will need to know this later.

CAUTION
In the following instruction, the front end of the middle frame will fall onto the support. Ensure this can be done safely before you carry out this instruction.
Do not use any other control to lower the middle frame.

d. Set the MODE switch to position M3.
   The middle frame will lower onto the support.
e. Switch off the vehicle engine.

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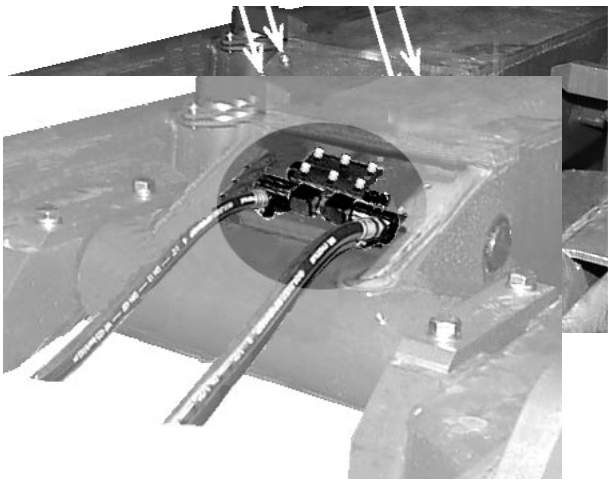
Detaching hook cylinder couplings

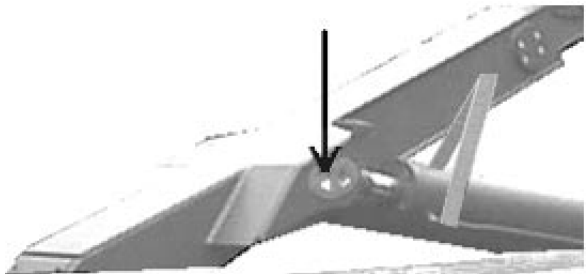


f. Remove the four screws and lift the cover from the rear end of the middle frame

CAUTION
In the next step, hydraulic oil under pressure can escape from the control valve when the attachment screws are loosened.

g. Remove the six screws that attach the hook arm control valve to the hook arm cylinder, and withdraw the valve together with the two attached hoses.
h. Fasten the control valve temporarily to the subframe.
i. Open the MUX (2) box (see point 5.4) beside the French lock.
j. Note the colours of the leads and detach connections P4 through P8.
k. Also disconnect the appropriate brown (power supply) lead from the printed circuit board.
l. Remove the detached leads from the box and ensure that they completely clear.
m. Return to the opening in the middle frame. The electrical connection of the cylinder is visible on the underside of the hook arm cylinder.
n. Disconnect the ribbed hose from its connection to the cylinder and withdraw it a short distance clear of the cylinder.
o. Carefully attempt to withdraw the individual leads from the ribbed hose. If possible, attach a cord to the leads before pulling them from the hose, so you can later pull the leads back into the hose.
p. Remove the entire set of leads. Roll them up and take care not to damage them any further.

Removal of main cylinder/middle frame shaft

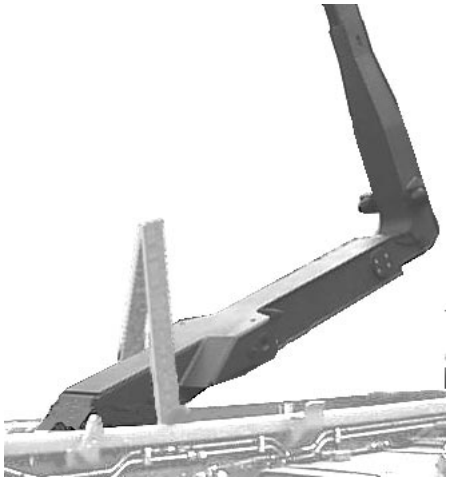


q. Disconnect the connection from the central lubrication.
r. Support the rear end of one of the main cylinders with a sling and a suitable hoist.

s. Remove the set screw fixing the rear pivot of the main cylinder to the middle frame, and withdraw the pivot-pin.
t. Lower the main cylinder until it comes to rest on the inner horizontal surface of the side rail of the subframe. Securely fasten the cylinder to the side rail to prevent it from slipping off the surface. Remove the sling.
u. Repeat the last 3 steps for the other main cylinder.

Main shaft removal

v. Disconnect the lubrication system at the connection between the middle frame and the subframe.
w. Check that all hoses, cables etc. have been detached.
x. Ensure that the locking pin of the hook is correctly fitted. Support the hook with a hoist and chains.
y. Hoist the hook up far enough, and remove the supports that were placed earlier below the middle frame.

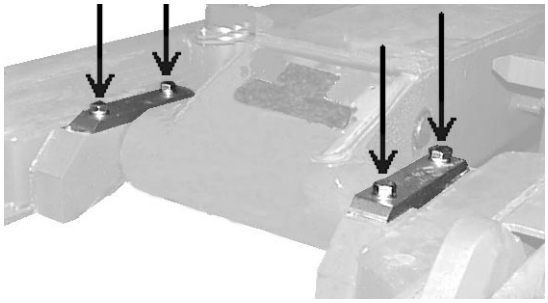


CAUTION
Make certain the hoisting direction is completely vertical (i.e. the hook of the hoist is directly above the hook of the hook arm). Failure to do so might cause the lifting installation to move unexpectedly when it comes free of the subframe.

z. Attach a sling around the rear end of the middle frame, just before the main shaft. Raise the sling until it just begins to tighten.

CAUTION
The main shaft will come free with the next instruction. Before proceeding further, ensure that the middle frame is not transferring any lifting force to the shaft (i.e. be sure you have properly carried out the preceding four steps).

aa. On each side, remove the two bolts that secure the retaining plate of the main shaft to the subframe.
ab. Remove both retaining plates.



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Middle frame removal

ac. Raise the rear end of the middle frame about 1 foot (300 mm) and withdraw the main shaft.
ad. Using the hoisting chain and sling, hoist the lifting mechanism from the vehicle and lower it onto supports of about 20 mm thick on the floor, with at least 3 m clear space in front of the hook. Ensure that the hoist continues to support the weight of the hook, to prevent the hook from dropping.

2.2.4 Lifting mechanism inspection

Check the hook arm and middle frame for damage or deformation; replace them, if necessary.
Refer also to the following paragraphs:
Point 3.4: Inspection, repair and replacement of main cylinder
Point 3.3: Inspection, repair and replacement of hook arm cylinder
Point 3.3.2: Inspection, repair and replacement of hook arm cylinder control valve

2.2.5 Installation of lifting mechanism

a. Fasten the sling to the rear end of the middle frame. With the sling and with the chain attached to the hook, hoist the lifting mechanism onto the vehicle, such that the main shaft bushes in the middle frame are about 1 foot (300 mm) above the subframe.
b. Apply grease to the main shaft and the Glycodur bushes (See point 1.2).
c. Insert the main shaft in the middle frame and ensure that it protrudes an equal amount on each side.
d. Lower the rear end of the middle frame until the main shaft settles into the casings in the side rails of the subframe. Align the flat surfaces of the shaft.
e. Fit the retaining plates of the main shaft, using the retaining bolts and spring and flat washers. Tighten them (to 200 Nm).
f. Remove the sling from the middle frame.

g. Put the support, used when removing the lifting mechanism, back in the exact same position.
h. Lower the hook until the middle frame settles on the support.
i. Attach a sling to one of the main cylinders and take up its weight, unfasten it from the side rail, and raise the cylinder far enough to align the eye of the cylinder with the corresponding bushes in the middle frame. Insert a pivot pin and fasten it with a set screw and spring/flat washers. Tighten them to 134 Nm.
j. Reconnect the central lubrication to the pivot.
k. Repeat the preceding instructions for the other main cylinder.
l. Raise the hook, remove the support, then slowly lower the hook until the lifting mechanism is hanging horizontally.
m. Pull the leads for the electrical connections back into the ribbed hose using a cable puller (or the cord suggested in point 2.1.2, o).
n. Reattach the ribbed hose to the cylinder.
o. Connect the leads in the MUX (2) box (see point 5.4) beside the French lock.
p. Take care that the leads do not get pulled from the box. Fit the pull relief.
q. Close the MUX box. Ensure that the sealing lip on the underside fits correctly.
r. Unfasten the hook arm control valve from the subframe, ensure that the O-rings are fitted correctly in the ports, and fit the valve onto the end of the hook arm cylinder. Fit the six fastening screws and spring washers of the control valve. Tighten them to 38 Nm.
s. Reconnect the central lubrication of the main shaft.
t. Fit the cover and the four fixing screws to the rear end of the middle frame.
u. Start the vehicle engine, load and unload the lifting mechanism several times to bleed off air, and return it completely to the home position. Switch off the engine.
v. Check the oil level in the level gauge and top up if necessary.

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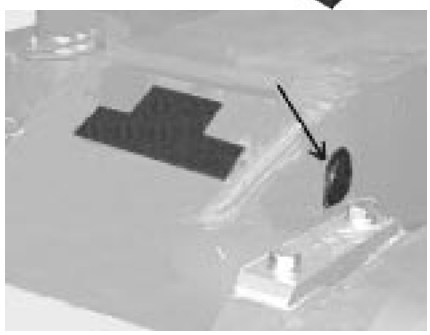
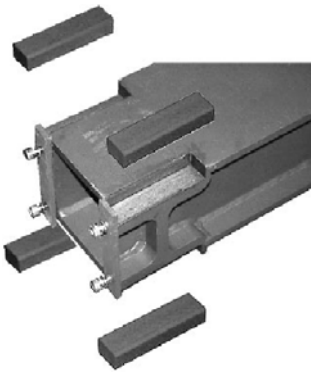
2.2.6 Slide pad replacement

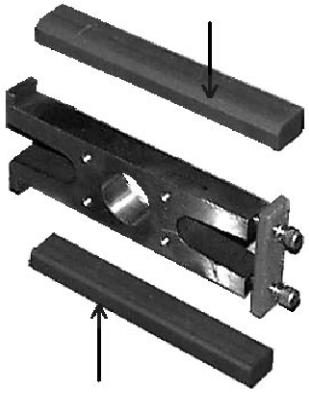
Slide pad removal





a. Remove the entire middle frame from the vehicle (See point 2.2.3).
b. Remove the four screws attaching each of the slide pad flanges to the front end, and withdraw the flanges.
c. Remove one of the circlips that secure the rear pivot of the hook arm cylinder.
d. Working through the opening at the rear of the middle frame, insert a crowbar under the end of the hook arm cylinder. Hold the crowbar firmly to support the cylinder, and withdraw the rear pivot pin.
e. Lower the cylinder onto the surface of the hook arm and remove the crowbar.
f. Withdraw the hook arm from the middle frame, using the hoist to pull it forward. If the hoisting rig tilts when you start pulling, lower the rig to prevent the hook arm from being hoisted, and reposition the rig.
g. Stop pulling when the front slide pad mounting blocks become accessible. Make sure that the hoist is carrying the weight of the hook arm, and continue pulling until the blocks fall out.
h. Continue pulling while supporting the hook arm, until about 1 m of the horizontal section of the hook arm has become exposed.
i. Support the hook arm immediately adjacent to the middle frame using e.g. a sling (see figure), or place a suitably-sized steel rod beneath the hook arm to serve as a roller.
j. Withdraw the hook arm completely free of the middle frame.
k. Loosen the two screws that fasten each of the rear slide pad retaining plates to the hook arm, and remove the slide pads.
l. Loosen the two screws that fasten each of the front slide pad retaining plates to the mounting blocks. Remove all slide pads.

Fitting slide pads



a. Fit new slide pads in the recesses in the front slide pad mounting blocks, ensuring that the bevelled edge of each pad is on the same side, and facing outwards when mounted. Tighten the retaining plate fixing screws to 134 Nm, ensuring at the same time that the slide pads are fully seated in the recesses.
b. Working on one side of the hook arm at a time, fit two new slide pads fully into the recesses at the rear of the hook arm, ensuring that the bevelled edge of each pad (indicated by arrow) is on the same side and facing outwards when mounted. Tighten the retaining plate fixing screws to 134 Nm, ensuring at the same time that the slide pads are fully seated in the recesses.
c. Insert the hook arm into the middle frame leaving approximately 600 mm of the horizontal section of the hook arm exposed.
d. Ensure that the bevelled edges (indicated by arrow) are facing outwards. Slide each front slide pad mounting block assembly into position between the hook arm and inner wall of the middle frame.
e. Align the large bush in each mounting block with the corresponding hole in the side of the middle frame.
f. Fit each slide pad flange to the front end of the middle frame, ensuring that the shaft on the flange is inserted in the bush of the mounting block. Fasten each flange using the four screws.
g. Remove the temporary support from the rear of the hook arm.
h. Support the front end of the hook arm with a sling or a roller, and push the hook arm further into the middle frame.
i. Unfasten the cable harness and attach it temporarily to the middle frame.
j. Working through the opening at the rear of the middle frame, insert a crowbar under the end of the hook arm cylinder and lever it up sufficiently to allow the rear pivot bushes to be vertically aligned. Then make final horizontal adjustments using the hoist.
k. Inset the rear pivot pin through the aligned bushes and cylinder eye, and fit a new circlip.

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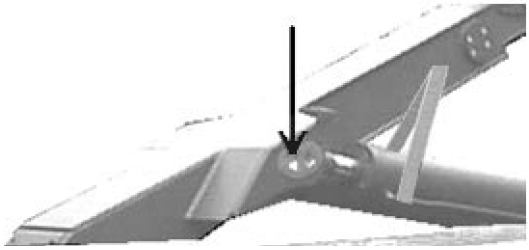
l. Place the middle frame back onto the vehicle (See point 2.2.3).

2.2.7 Main cylinder pivot replacement

Rear pivot replacement:

a. Place the middle frame in workshop position and remove the pivot pin (See point 2.2.3).
b. Apply grease to the pivot pin and pin bearing surfaces each main cylinder (See point 1.2).
c. Lift the end of the cylinder, fit the pivot pin and fasten it using the set screw plus spring and flat washers. Tighten to 134 Nm.

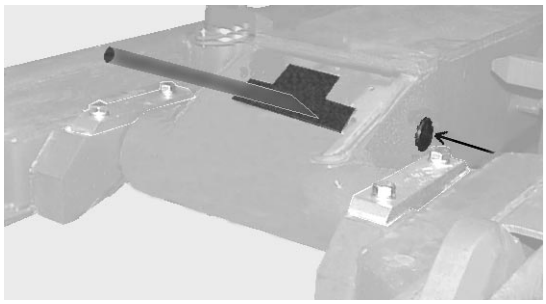


Front pivot replacement

a. Support the front end of the main cylinder using a sling.
b. Remove the fixing screws and the pivot pin.
c. Lower the end of the cylinder until it settles onto the inner horizontal surface of the side rail of the subframe. Securely fasten the front end of the cylinder to the side rail to prevent it from slipping off the surface. Remove the sling.
d. Repeat these steps, if necessary, for the other main cylinder.
e. Apply grease to the pivot pin and pin bearing surfaces of the cylinder (See point 1.2).
f. Lift the front end of the cylinder, fit the pivot pin, and fasten it using the set screw plus spring and flat washers. Tighten to 134 Nm. Repeat these steps, if necessary, for the other main cylinder.

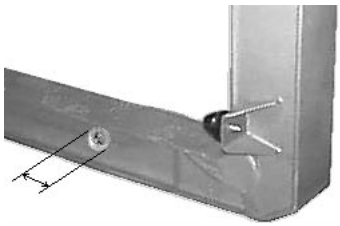
2.2.8 Hook arm cylinder pivot replacement

Rear pivot replacement



a. Remove one of the circlips that secure the rear pivot of the hook arm cylinder.
b. Working through the opening at the rear of the middle frame, insert a crowbar under the end of the hook arm cylinder. Hold the crowbar firmly to support the cylinder, and withdraw the rear pivot pin.
c. Lower the cylinder onto the surface of the hook arm and remove the crowbar.
d. Apply grease to the pivot pin and pin bearing surfaces of the cylinder (See point 1.2).
e. Working through the opening at the rear of the middle frame, insert a crowbar under the end of the hook arm cylinder and lever it up sufficiently to allow the rear pivot bushes to be vertically aligned. Then make final horizontal adjustments using the hoist.
f. Insert the new pivot pin through the aligned bushes and fit a new circlip.
g. Fit the pivot pin of the main cylinder (see point 2.2.7) and return the installation to the transit state.

Front pivot replacement



a. Remove one of the circlips that retain the front hook arm cylinder pivot pin, and withdraw the cylinder.
b. Inspect the pivot pin (See point 2.2.9).
c. Apply grease to the new pivot pin and pin bearing surfaces of the hook arm cylinder (See point 1.2).
d. Insert the hook arm cylinder far enough into the hook arm that the front eye of the cylinder is visible through the corresponding bush.
e. Insert a crowbar or something similar through the holes.
f. Lever the cylinder upwards until the holes align.
g. Insert the pivot pin from the other side, and fit a new circlip.

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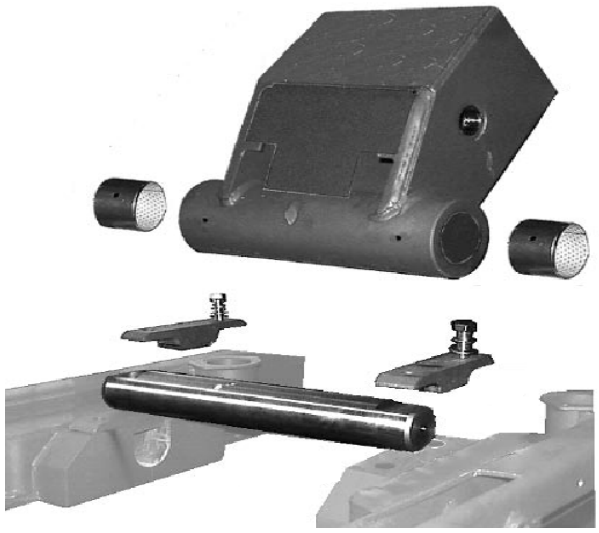
2.2.9 Inspecting shafts and pivots

a. Inspect the following shafts and pivots for wear. If there is visible wear, measure the diameters as follows (they may never be allow to fall below the stated limits):
   - Main shaft, minimum diameter 80.00 mm
   - Main cylinder pivots, minimum diameter 69.50 mm
   - Hook arm cylinder pivots, minimum diameter 49.00 mm
b. Replace the excessively worn components.

2.2.10 Inspection/replacement of middle frame, main shaft and bushes

Main shaft removal



a. Wrap a sling around the middle frame, as close as possible to the main shaft. Apply no tension to the sling.

CAUTION
When performing the next step, hydraulic oil may escape under pressure.

b. Slowly detach the two hydraulic hoses from the elbow connectors on the supply lines.
c. Remove the two bolts from both main shaft retaining plates on the middle frame, and remove the retaining plates.
d. Raise the middle frame sufficiently to lift the shaft free of the side rails of the subframe. Securely block the middle frame against dropping.
e. Slide the shaft out of the bearings in the middle frame.
f. Inspect the shaft(See point 2.2.9).

Bush replacement

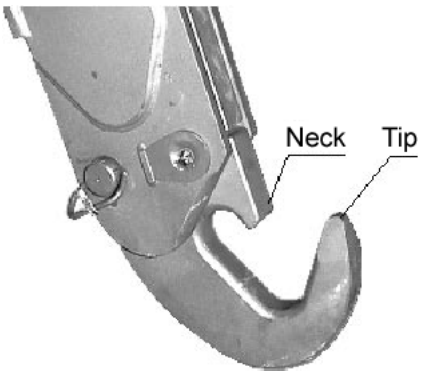
g. Remove the two grease nipples from the bearing housing on the middle frame.
h. Remove each bush by tapping a drift inserted through the other side of the middle frame.

i. Ensure that a hole in the side of the bush is aligned with the hole from the grease nipple on the middle frame. Fit a new bush on both sides of the middle frame.
j. Mount the grease nipples.

Fitting main shaft

k. Apply grease to the bushes (See point 1.2).
l. Apply grease to the shaft.
m. Insert the shaft through the bushes so that it protrudes equally on both sides of the middle frame, and on each side a flat section is uppermost.
n. Unblock the middle frame, and lower it until the main shaft settles onto the bottom of the shaft carriers on the subframe.
o. If necessary, realign the flats of the shaft.
p. Fit the retaining plates of the main shaft, using the retaining bolts and spring and flat washers. Tighten them to 332 Nm.
q. Remove the sling.
r. Connect the two hydraulic hoses to the elbows of the supply lines.
s. Check the level of the hydraulic oil in the level gauge at the side of the reservoir. If necessary, top up the oil (see points3.8.4 and 1.2).

2.2.11 Hook inspection



a. Inspect the neck and tip of the hook for wear and damage.
b. Try to move the tip sideways relative to the hook arm, and check that the play of the tip does not exceed 5 mm.
c. If excessive play is observed in the previous step, check the hook locking pin for wear and damage.
d. Remove the locking pin from the hook. (for the special hook with yellow point this should already have been done).
e. Check that the attachment bolt of the hook pivot is tightened to 400 Nm.
f. If the locking pin appears worn or damaged, check that the diameter is no less than 42 mm over its entire length.

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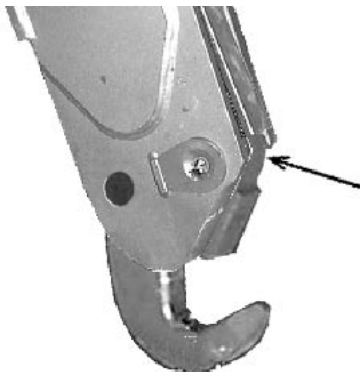
g. If the pin is within tolerance, then the hook pivot and/or the holes in the hook are excessively worn.
h. Inspect the contact flat of the leaf spring on the heel of the hook for wear and damage.



2.2.12 Removal and further inspection of hook

a. Remove the hook locking pin, if it is still in place.
b. Remove the M16 hexagon bolt that attaches the hook pivot to the hook arm.

CAUTION
In the next step, the hook will be removed from the hook arm. The hook weighs 26 kg. Support the hook so that it will not fall or swing about.

c. Withdraw the hook pivot pin, and remove the hook from the hook arm.
d. Inspect the pivot pin holes in the hook arm for wear and damage.
e. Inspect the hook pivot pin for wear and damage.
f. If the hook pivot pin appears worn or damaged, check that the diameter is no less than 48 mm over its entire length.
g. Remove the grease nipple and inspect it for damage and/or corrosion.

2.2.13 Fitting the hook

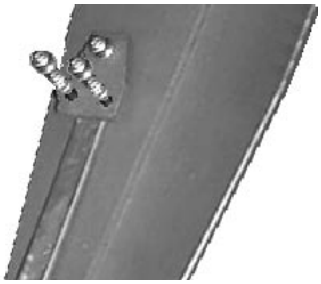
a. Fit the grease nipple into the threaded hole in the hook pivot pin, and tighten it.
b. Fit the hook into the hook arm such that the pivot pin holes in the hook and the hook arm are aligned.
c. Press the hook pivot pin fully in, and align the retaining plate with the hook arm.
d. Fit the M16 bolt with the spring washer in the retaining bolt hole, and tighten it firmly (400 Nm).
e. Check that the hook can pivot freely.

Carry out following steps only for the normal (green) hook:

f. Align the holes for the locking pin in both the hook and the hook arm, and fit the locking pin.

g. Insert the linchpin through the hole in the locking pin.

2.2.14 Inspection of hook spring



a. Check the torque of the three screws that fasten the spring and the spring retaining plate. These must be tightened to 332 Nm.
b. Check the spring for damage.
c. Check that the spring is correctly fitted: the spring must rest in the recess, and make contact with the heel of the hook.

2.2.15 Hook spring replacement

Removal

a. Remove the two lower screws from the retaining plate of the spring.
b. Support the spring and remove the upper screw from the retaining plate.
c. Remove the retaining plate and spring.
d. Inspect the spring for wear and damage, in particular the part that makes contact with the hook.
e. Check that the spring is not distorted when slack.

Fitting

a. Apply grease to the side of the spring that makes contact with the hook arm and the heel of the hook (See point 1.2).
b. Fit the leaf spring vertically as follows.
   - The attachment hole is at the top end of the spring (with the lifting mechanism unloaded) and is aligned with the central hole in the hook arm.
   - The greased side of the spring makes contact with the hook arm.
   - The lower end of the spring is recessed into the side plates of the hook arm, and makes contact with the heel of the hook.
c. Fit the retaining plate, with the middle screw finger tight.
d. Fasten the two lower screws of the retaining plate.

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e. Ensure that the spring can move freely between the two side plates, and tighten all three screws to 332 Nm.

2.2.16 Hook arm buffer inspection / replacement

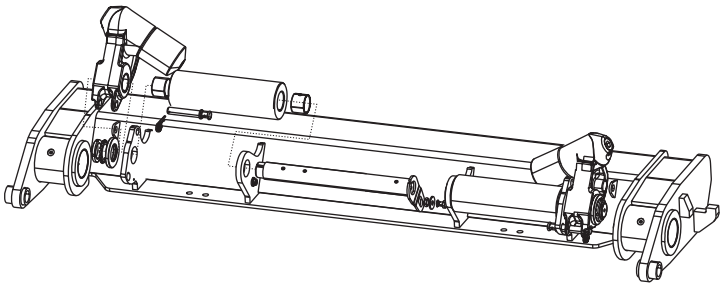
a. Inspect the buffers for the following points.
   - Distortion
   - Damage
   - Rubber detaching from mounting plate
   - Attachment bolts tightened to 160 Nm
b. To remove a buffer, undo the attachment bolt and spring washer.
c. To fit a buffer, insert the bolt through the hole in the support bracket on the hook arm, and tighten the bolt to 160 Nm.

2.2.17 Inspection of flatrack rollers

a. Check that both horizontal rollers can turn freely.
b. Check that both diagonal rollers can turn freely.
   These rollers will be heavier to turn, due to the way they are constructed.
c. Check that the central lubrication is working properly: is grease visible between the rollers and their supports?
d. Inspect the surfaces of the rollers for visible wear and damage. If wear and/or damage is visible, replace the rollers.
e. Check the (vertical) free play at both ends of each horizontal roller, which may not exceed 5 mm.
f. Check the axial free play (along the shaft) of the horizontal rollers, which may not exceed 10 mm.
g. Check that the axial free play of the bearings of the diagonal rollers does not exceed 10 mm.
h. Check that the axial free play of the diagonal rollers themselves does not exceed 5 mm.

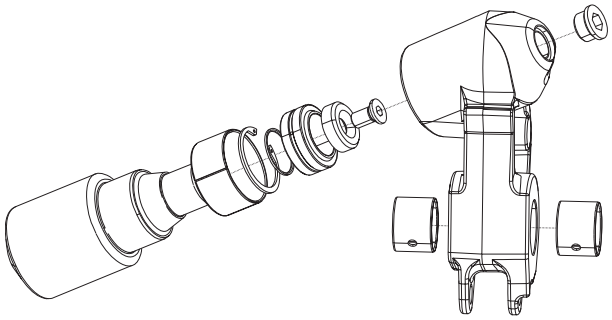
2.2.18 Removal of flatrack rollers

REMARK
The horizontal and diagonal rollers are mounted on the same shaft.



a. Remove the 4 connections of the central lubrication. (2x on horizontal shaft, 2x on support bracket of diagonal roller)
b. Remove the ring nut from the shaft. Remove any loose washers that may be present.
c. Remove the bolt at the other end of the shaft that prevents the shaft from turning.
d. Support the diagonal roller and withdraw the shaft towards the centre of the vehicle.
e. Remove the diagonal roller (and support bracket).
f. Support the horizontal roller and withdraw the shaft.
g. Inspect the shaft for wear and deformation. Replace the shaft if the wear is greater than 2.5 mm and/or the shaft is deformed.
h. Inspect the inside surface of each bush mounted in the roller for visible wear. Replace the bush if there is visible wear.
i. If necessary, remove each bush using a drift inserted from the other end of the roller.

2.2.19 Dismantling a diagonal flatrack roller (guide roller)



The description of this point assumes that the steps of point 2.2.18 have been performed.
The dismantling is more or less the same when the roller is still attached to the vehicle.

a. Unscrew the large Allen bolt. A smaller Allen bolt is visible beneath this
b. Grip the roller to prevent it turning, and unscrew this smaller bolt. Support the roller from falling, and withdraw the bolt.
c. Withdraw the roller from the support bracket.
d. Remove the circlip from the inside of the roller.
e. Remove the bearing and other loose parts.
f. Check the bearing bush for wear, and replace it if necessary.
g. Reassemble in reverse sequence.

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h. Fit a new seal.

2.2.20 Refitting flatrack rollers

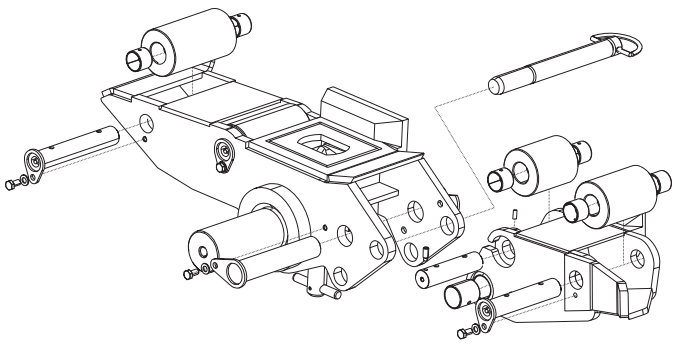
a. Insert new bearing bushes.
b. Apply grease to the inside surface of the bushes (See point 1.2).
c. Apply grease to the shaft.
d. Support the horizontal roller and align it with the holes the flanges.
e. Insert the shaft through the aligned holes.
f. When the shaft emerges through the second flange, stop pushing.
g. Align the diagonal roller support bracket with the shaft, then press the shaft in all the way.
h. Fit the fixing bolt that prevents the shaft from turning.
i. Fit the washers, toothed lock washer and ring nut.
j. Reconnect the 4 central lubrication connections.
k. Check that both rollers can turn freely.

2.2.21 Roller bed inspection

a. Check that each roller can turn freely.
b. Check that each roller is properly lubricated.
c. Check the surface of each roller for visible wear and damage. If wear and/or damage is visible on any roller, replace the roller.
d. Check the (vertical) free play at both ends of each roller, which may not exceed 5 mm.
e. Check the axial (horizontal) at the ends of each roller, which may not exceed 10 mm.
f. Check that the complete roller beds can pivot freely about their main pivot point.
g. Check that the twistlocks work smoothly.

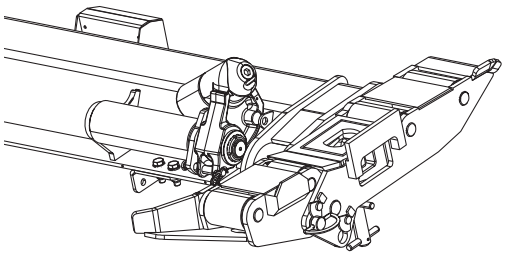
2.2.22 Inspection / replacement of rollers

a. Disconnect the central lubrication connection.
b. Remove the attachment bolt that holds the shaft to the roller bed.
c. Support the roller and withdraw the shaft.
d. Inspect the shaft for wear.
e. Check the wear on the running surface of the roller.



f. If the roller is in a good condition, check the two bushes inside the roller for wear. If there is visible wear, replace both bushes at the same time.
g. Apply grease to the shaft and bushes (See point 1.2).
h. Reassemble in reverse sequence.

2.2.23 Removal, inspection and reinstallation of roller bed



a. Remove the lock pin.
b. Disconnect the connections from the central lubrication.
c. Mark and remove the cabling of the proximity switches.
d. Remove the centre bolt and cover plate of the shaft locking.

CAUTION
In the following instruction, the entire roller bed will be removed from the vehicle. Make certain that the roller beds are properly supported to prevent unexpected sudden movement.

e. Remove the entire rollerbed. Take care not to lose any adjustment shims.
f. Place the roller beds on a suitable surface for dismantling.

Inspection

g. Check the main pivot pins for wear.
h. Inspect the pivot holes in the roller beds for wear.
i. Inspection all parts of the twistlocks for wear and damage.

Installation

j. Support the roller bed to allow alignment of the pivot pin and pivot holes.
k. Put back any shims that were previously fitted.
l. Insert the roller bed pivot pin into the hole in the cross-member.
m. Fit the cover plate and centre bolt.
n. Mount the cabling of hte porximity switches

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o. Reconnect the central lubrication.
p. Fit the lock pin to hold the roller bed in the transit position.
q. Check the functioning of the roller beds and porximity switches.

2.2.24 Removal and fitting of cross-member with roller beds

a. Detach the connections box of the safety system from the cross-member.
b. Ensure that both rear roller beds are in the correct position for flatrack/body loading.
c. Attach a sling (or hoisting chain) to both ends of the cross-member.

CAUTION
Ensure that the rear rollers are safely supported during the next two steps.

d. Ensure that the cross-member is fully supported while you remove the following nuts and bolts:
   - The bolts attaching the rear roller cross-member to the rear end of the subframe;
   - The bolts attaching the mounting plates to the chassis.
e. Detach the connection to the central lubrication at the distribution point on the cross-member.
   Cleanly seal the open ends (temporarily) from dust and dirt.
f. Lift the unit off the subframe.
g. Fit the cross-member in reverse sequence.

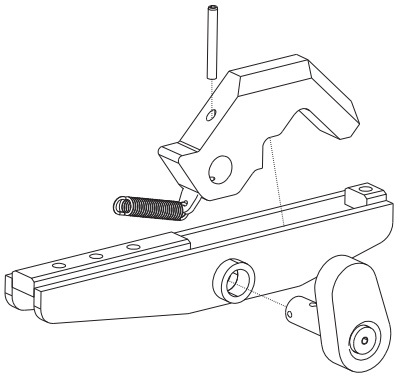
2.2.25 NATO lock inspection

Perform the following steps for both NATO locks.

a. Check that the NATO lock can pivot freely (under spring tension).
b. Inspect the actuating lever for visible wear and damage.
c. Turn the actuating lever to raise the lock. Inspect the lock for visible wear and damage.
d. Ensure that no dirt or debris is present on the tip of the proximity switch (in the right side rail of the subframe) and the surrounding area.

e. Switch on the vehicle ignition, but do not start the engine.
   Check that the indicator is illuminated: the indicator is on the side of the proximity switch, below the NATO lock on the right side.
f. Check that the LED indicator is extinguished when the NATO lock is raised.
g. Switch off the vehicle ignition.

2.2.26 Removal of NATO lock



a. Detach the return spring.
b. If necessary, remove the bolt, washer and nuts that anchor the spring.
c. Unhook the return spring from the lug on the lock.
d. Drive the retaining pin from the lock, and discard the pin.
e. Support the lock manually, and withdraw the pivot pin and lever outwards.
f. Lift the lock from the subframe.

2.2.27 Fitting NATO lock

a. Apply grease to the pivot pin of the actuating lever (See point 1.2).
b. Hold the lock firmly in the indicated direction while aligning the hole with the corresponding hole in the side rails of the subframe. Insert the pivot pin of the actuating lever through the aligned holes.
c. Turn the actuating lever such that the retaining pin holes in the pivot pin and lock are aligned. Fit a new retaining pin.
d. Hook the return spring onto the lug on the lock.
e. Fit the spring anchoring bolt, washer and nuts, if these were removed.
f. Fit the spring over the bolt end before tightening the last nut.
g. Check regularly that the NATO lock is working properly.

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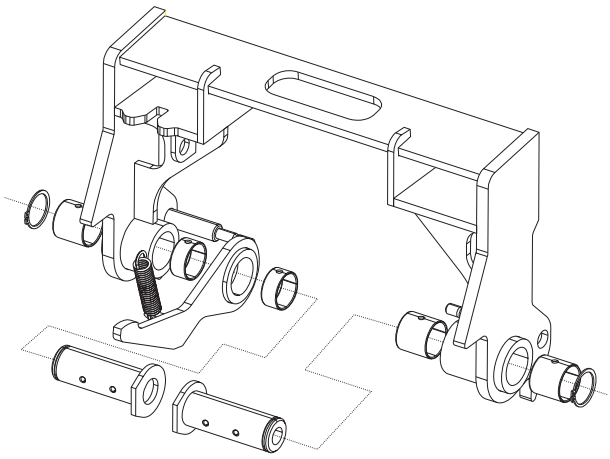
2.2.28 French lock inspection

a. Check that the lock can turn freely, and that both sides are under spring tension. Inspect all parts of the lock for wear and damage.
b. Check that both springs are in place, and that neither is damaged or deformed.

2.2.29 French lock removal and dismantling

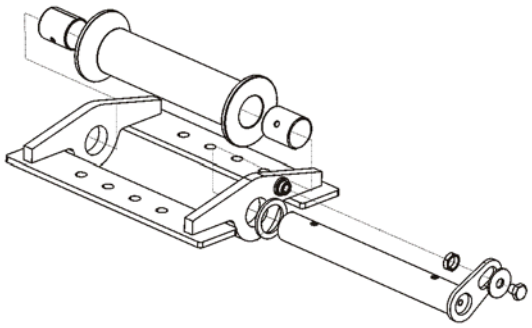


a. Ensure that the lock is horizontal.
b. Remove the locknut from the stud at each end of the spring.
c. Remove both springs.
d. Remove the circlip from each pivot.
e. Support the lock manually and withdraw the two pivot pins.
f. Lift the lock out of the subframe.
g. Using a drift inserted from the outer side of each bearing, remove each of the inner bushes.
h. Using a drift inserted from the inner side of each bearing, remove each of the outer bushes.
i. Check that the length of each fully relaxed spring does not exceed 120 mm. If either spring is too long, discard both springs.

2.2.30 Fitting French lock

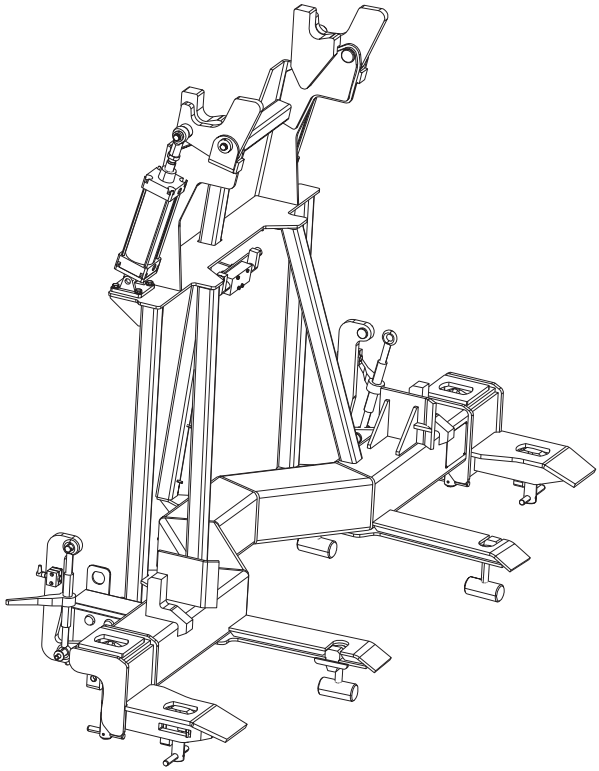
a. Insert new bearing bushes in both sides of the bearing housing. Ensure that the visible end of each bush is flush with the appropriate side plate.
b. Apply grease to the inside surface of each bush as well as the pivot pins (See point 1.2).
c. Place the lock in the vertical position with the triangular points facing forward and the bushes aligned with the holes in the support brackets on the subframe. Insert the two pivot pins from the outside of the lock.
d. Secure each pivot pin using a new circlip.
e. Lower the lock into the horizontal position.
f. Apply grease to the four stud bolts. Fit a spring between each pair of stud bolts, and fit the four lock nuts to secure the springs to the stud bolts.

2.2.31 Inspection / replacement of hook arm support roller



a. Check that the roller can turn freely.
b. Check that the vertical free play at both ends of the roller does not exceed 5 mm.
c. Detach the central lubrication connections.
d. To replace the roller, remove the two fastening bolts, nuts and washers. Tighten them again to 332 Nm.
e. Connect the central lubrication.

2.2.32 Replacement of CHU stowage



a. Detach the quick-release coupling of the air line.
b. Disconnect both electrical connections between CHU and hookarm.
c. Remove any tie-wraps that fasten the cable harness of the CHU stowage to the subframe.
d. Wrap a hoisting belt around the column of the CHU stowage, and ensure that the hoisting belt is tight.
e. Remove the four nuts and bolts attaching the CHU stowage to the subframe.
f. Lift the CHU stowage from the vehicle.
g. Install in reverse sequence.
h. Check that it works properly.

2.2.33 CHU stowage inspection

Preparation

REMARK
To inspect the CHU stowage and check that it works properly, you will need to climb on the vehicle. Ensure you are wearing suitable footwear, and take appropriate safety precautions.

a. Ensure that there is no CHU on the vehicle.
b. Ensure that the lifting mechanism is in the operating position.
c. Check that the MODE switch is in position 0.
d. Check that the vehicle engine is switched off.

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Inspection

a. Inspect the frame of the CHU stowage for damage and deformation.
b. Check the surfaces of the locking hooks for visible wear and damage.
c. Once you are sure it is safe to do so, start the vehicle engine and set the MODE switch in the cab control unit to position A3.
d. Alternately press the buttons LOAD and STOW, and check that the locks are able to move freely over their full travel.
e. Set the MODE switch of the cab control unit to position 0.
f. Switch off the vehicle engine.
g. Check the condition of the air lines and couplings.
h. Load a CHU and check again for proper functioning.

2.2.34 Inspection / replacement of CHU

Preparation

a. Unload the CHU, but ensure that it remains supported by the hook.
b. Set the MODE switch to position 0, and switch the vehicle engine off.

Inspection

a. Inspect the frame for damage and distortion. If damage is evident, prohibit any use of the frame.
b. Check the pickup handle for wear and damage.
   If damage is evident, prohibit any use of the frame.
c. For both upper grips, inspect the locating pin and guide plate for wear and damage. If damage is evident, fit new upper grips.
d. Raise, then lower the upper grips to check that they can move freely.

e. Inspect the four retaining pins and locking plates for wear, damage and deformation. If damage is evident, remove the grip so that the locking plate can be removed.
   Fit a new grip plate.
f. Check that each locking plate can move freely and fits properly in its guide.
g. Check the feet for damage and deformation, and for wear in the attachment holes. If damage is evident, replace the foot.
h. Inspect the crowbar for damage. If damage is evident, replace the crowbar.

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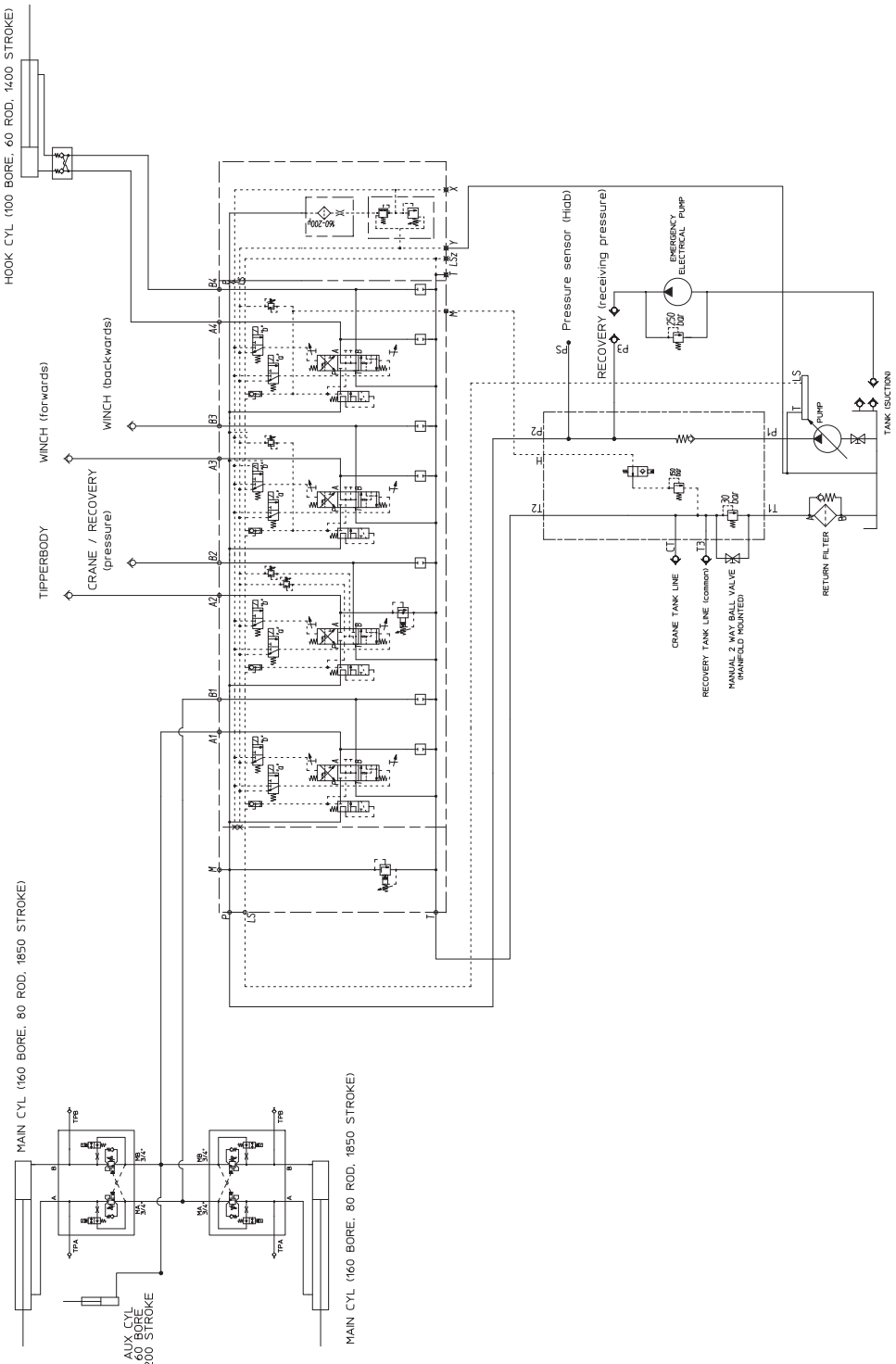
3 HYDRAULIC INSTALLATION

3.1 Description

3.1.1 Hydraulic installation



3.1.2 Main valve

The main valve (hydraulic unit) is located on the right-hand side of the vehicle on the chassis, immediately behind the cab. The valve is protected by a detachable cover panel.
The hydraulic unit has the following tasks:
- Feed oil from the pump to the main, hook arm and auxiliary cylinders.
- Feed oil from the pump to external systems (crane, tipper body, etc.)
- Feed oil from the cylinders back to the oil reservoir.
- Enable the auxiliary pressure line to be connected to a different hydraulic system.

The flow of oil to and from the cylinders is controlled by electrically actuated hydraulic valves.
These valves are opened in response to electrical signals (from the control system). The valves can be manual actuated in the event of an electrical fault.

3.1.3 Pressure-reducing valve

The pressure-reducing valve is a component of the emergency connection valve.
This valve restricts the pressure in the hook arm cylinder whenever a French flatrack is to be picked up.
It has the function of protecting the French lock at the rear of the frame.

3.1.4 Emergency connection valve

The emergency connection valve is located at the front of the frame, below the spare wheel holder.
This valve regulates the hydraulic flows when the installation is being fed from an external vehicle (via “recovery” or “slave” connections).
This function can be used whenever the hydraulic installation of a vehicle is no longer capable of supplying the hydraulic energy necessary to move the load. (empty fuel reservoir, defective hydraulic pump, etc.)
In this case, the hydraulic energy of another vehicle can be used. Refer further to the 1TH.

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The valve further ensures that the hydraulic systems remain separated, i.e. that oil cannot flow from the defective vehicle to the healthy vehicle.

3.1.5 Loadholding valves of main cylinders

The loadholding valves of the main cylinders perform the following tasks for the main cylinders:

- Load control: they prevent a flatrack/body or container making the piston move faster than desired when the weight is acting in the same direction as the movement of the load.
- They allow the cylinder to float freely when the vehicle is in motion (transit function).
  The cylinder can float freely through the presence of two ‘transit valves’. These are opened whenever their solenoid valves are energised, so that oil can flow from one side of the piston to the other (MODE switch in position 0 or M3), and whenever the hook arm is placed in the transit position).

3.1.6 Main cylinders

The main cylinders are double-acting and equipped with hoses leading from the main valve. These cylinders actually provide the force to raise and lower the load.

3.1.7 Auxiliary cylinder

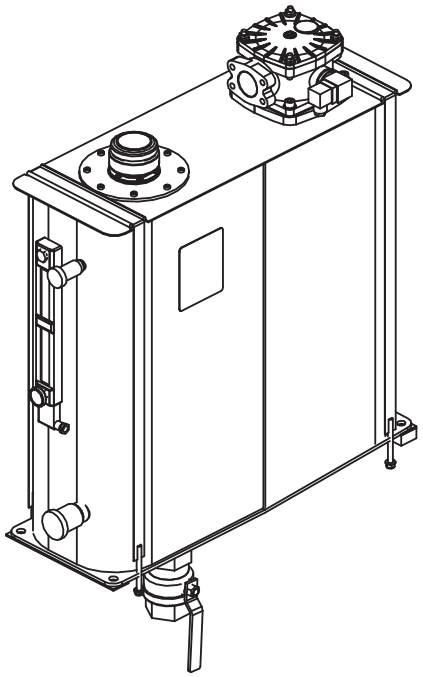
The auxiliary cylinder is single-acting.
This cylinder enables the initial lifting movement to take place within the low construction height of the installation.
When the middle frame is being loaded, the cylinder acts as a buffer, absorbing some of the speed of descent and ensuring that the load settles onto the vehicle in a controlled way.

3.1.8 Hook arm cylinder and valve

The hook arm cylinder is double-acting and is equipped with a bolted on loadholding valve.

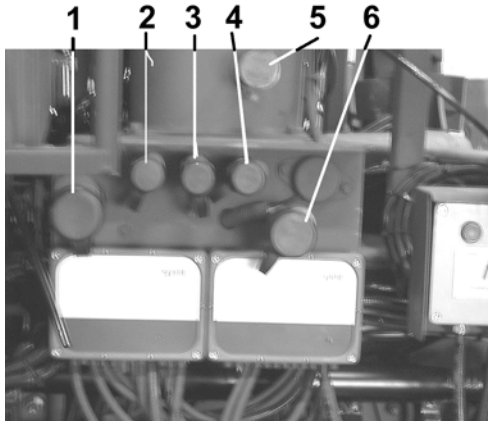
The cylinder has the function of extending and retracting the hook, and is mounted within the tubes of the hook arm and middle frame.

3.1.9 Oil reservoir



The oil reservoir is located on the left hand side, behind the cab. The reservoir is seated on the subframe, and fastened in place by two straps. The reservoir contains the oil used to operate van the main and auxiliary cylinders, and the hook arm cylinder. This oil is also used to feed additional installations that are mounted (such as a mobile loading crane, a tipper body, etc.)
The following components are also mounted in the reservoir: return filter, level gauge, connections for a filter truck, and sensors for monitoring the oil level and filter blockages.

3.1.10 Quick-release couplings for connecting external systems



The vehicle is prepared for the connection and use of a number of external systems, such as mobile loading crane, tipper body or BAP. There are also a number of couplings present for connecting the hydraulic installation of another vehicle or filter truck.

1. Tipper body connection
2. Pressure in
3. Recovery in / out
4. Pressure out (to e.g. crane)
5. Suction connection
6. Recovery in (from crane)

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3.2 Maintenance tasks

3.2.1 Replacement of main cylinder connections

Removal

In the next step, hydraulic oil under pressure can escape when detaching connections.

a. Disconnect both hoses from the T connectors in the centre of the cross-member of the subframe.
b. Withdraw the hoses through the hole in the side rail of the subframe.
c. Uncouple the two lines from the main valve.
d. Remove the bolt from each of the two pipe clamps on the outside of the right-hand side rail of the subframe. Remove the cover and the upper section of the pipe clamp from each unit.
e. Lift out the two lines, and store them temporarily.
f. Secure the lower section of each pipe clamp.

Fitting

a. Place the two supply lines from the main cylinder along the right side rail of the subframe and feed the two hoses through the hole in the side rail of the subframe.
b. Connect both hoses to the T-connectors in the middle of the front cross-member of the subframe. Turn the couplings tight.
c. Connect the two lines to the main valve. Turn the couplings tight.
d. Attach the two dual 25 mm pipe clamps to the supports on the outside of the right-hand side rail of the subframe.
e. Check the level of the hydraulic oil in the level gauge at the side of the reservoir. If necessary, remove the filler cap, top up the oil and put back the filler cap.

3.2.2 Replacement of hook arm cylinder hydraulic connections

Removal

a. Disconnect both hook arm cylinder hoses from the two lines.
b. Uncouple the two lines from the main valve.
c. Remove the bolt from each of the four pipe clamps on the outside of the right-hand side rail of the subframe. Also remove the bolt from the clamp on the front edge of the rear cross-member. Remove the cover and the upper section of the pipe clamp from each unit.
d. Lift out the two lines, and store them temporarily.
e. Secure the lower section of each pipe clamp.

Fitting

a. Place the two supply lines from the hook arm cylinder along the right side rail of the subframe.
b. Connect both hook arm cylinder hoses to the two lines. Turn the couplings tight.
c. Connect the two lines to the main valve. Turn the couplings tight.
d. Attach the four pipe clamps on the outside of the right-hand side rail of the subframe. Fasten them also to the front edge of the rear cross-member.

3.3 Hook arm cylinder

3.3.1 Hook arm cylinder replacement

a. Remove the middle frame from the vehicle (See point 2.2.2).
b. Remove both pivot pins from the cylinder (See point 2.2.8).
c. Remove all hydraulic and electrical couplings from the cylinder (See point 2.2.3).
d. Remove the cylinder from the hook arm.

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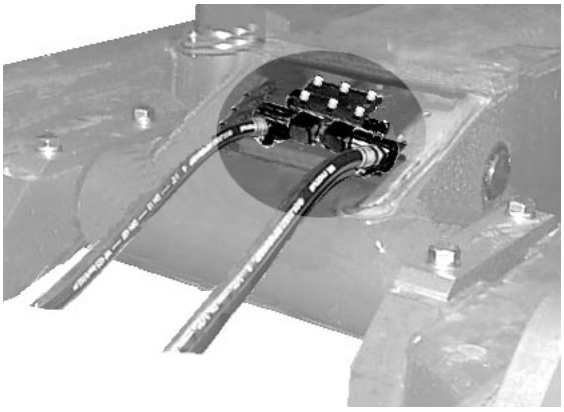
e. Ensure that the front end of the angled valve is pointing forward, insert the piston end into the hook arm and support it so that the pivot eye of the cylinder is aligned with the corresponding opening in the sides of the hook arm.
f. Fit both pivot pins to the cylinder.

3.3.2 Hook arm valve inspection

a. Remove the four screws and lift off the cover at the rear of the middle frame.
b. Replace the valve or the appropriate parts if you observe any of the following:
   - Damage to, or deformation of the valve.
   - Leakage from: Banjo couplings and fibre washers, Rotary unions, Hoses

3.3.3 Hook arm valve replacement

a. Remove both hoses from the rotary unions on the valve.
b. Remove the six screws that attach the hook arm control valve to the hook arm cylinder, and withdraw the valve.
c. When fitting a replacement part, tighten the six lock-screws firmly.
d. Reconnect the couplings and hoses.
e. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the home position. Switch off the engine.
f. Check the oil level and top up if necessary.



3.4 Main cylinder

3.4.1 Main cylinder removal

a. Remove the rear pivot pin of the cylinder (See point 2.2.7).

CAUTION:
Perform steps b. through i. only when replacing the left cylinder. The right cylinder has no electrical connections.

b. Open the MUX (2) box (see point 5.4) beside the French lock.
c. Note the colours of the leads and detach connection P3.3.
d. Also disconnect the appropriate brown (power supply) lead from the printed circuit board.
e. Take the loose leads from the box and make sure they are completely free.
f. Return to the connections on the cylinder. The electrical connection to the cylinder is visible on the hook arm cylinder.
g. Disconnect the ribbed hose from its connection to the cylinder and withdraw it a short distance clear of the cylinder.
h. Carefully attempt to withdraw the individual leads from the ribbed hose. If possible, attach a cord to the leads before pulling them from the hose, so you can later pull the leads back into the hose.
i. Remove the entire set of leads. Roll them up and take care not to damage them any further.

CAUTION:
During the next step, hydraulic oil can escape from the couplings when they are loosened.

j. Detach the two hoses at the couplings on the valve of the main cylinder.
k. Remove the front pivot pin of the cylinder.
l. Remove the main cylinder from the lifting mechanism and place the entire unit on a suitable work surface.

3.4.2 Fitting main cylinder

a. Place the main cylinder on the lifting mechanism. Align the front and rear cylinder eyes with the corresponding bushes in the subframe and middle frame.
b. Apply grease to the front pivot pin (See point 1.2).
c. Insert the pivot pin, and attach the retaining bolt and washers.
d. Apply grease to the rear pivot pin (See point 1.2).
e. Insert the pivot pin, and attach the retaining bolt and washers.

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f. Connect the hoses, ensuring that the hoses are not crossed.
g. Pull the electrical leads back through the ribbed hose using a cable puller or the cord (see point 3.4.1).
h. Reattach the ribbed hose to the cylinder.
i. Connect the leads in the MUX box (see point 5.4) beside the French lock.
j. Close the MUX box. Ensure that the sealing lip on the underside is properly fitted.
k. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
l. Check the hydraulic oil level and top up if necessary.

3.5 Auxiliary cylinder

3.5.1 Auxiliary cylinder removal

When performing the next step, hydraulic oil can escape from the coupling when this is loosened.

a. Thoroughly clean the couplings at foot of the cylinder.
b. Detach the hydraulic line at the coupling.
c. Remove the two screws attaching the flange plate.
d. Remove the flange plate.
e. Remove the cylinder from the cross-member.

3.5.2 Fitting auxiliary cylinder

f. Proceed as for removal, in reverse sequence.
g. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
h. Check the oil level in the level gauge and top up if necessary.

3.6 Main valve

3.6.1 Main valve inspection

a. Remove the safety seal, then remove the valve cover.
b. Check the valve for:
   - leakage
   - damage and deformation
   - correct attachment of all bolts

3.6.2 Main valve replacement

Hydraulic oil under pressure may escape when the couplings are loosened.

a. Place the installation in transit state.
b. Disconnect the lines connected to the couplings on the valve.
c. Note how the connections are made, and move all connectors out of the way.
d. Undo the attachment bolts and remove the valve.
e. To put the main valve back in the vehicle, proceed as for removal, in reverse sequence.
f. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
g. Check the oil level and top up if necessary.

3.7 Hydraulic Pump

3.7.1 Pump replacement

Hydraulic oil under pressure may escape when the components and couplings of the pump are loosened.

a. Close the valve below the oil reservoir.
b. Disconnect the hoses at the couplings on the pump.
c. Remove the pump fastening bolts and remove the pump.
d. Reconnect all couplings and adaptors to the new pump.

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e. Prime the pump with as much hydraulic oil as possible (See point 1.2).
f. To fit the pump, proceed through the above steps in reverse sequence.
g. Open the valve of the oil reservoir.
h. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
i. Check the oil level in the level gauge and top up if necessary.

3.8 Hydraulic oil reservoir

3.8.1 Oil filter replacement

REMARK
Ensure that no dirt, water or other debris particles enter the oil reservoir.
If this should happen, serious damage could be done to the lifting mechanism, leading to malfunctions.

a. Place the installation in transit state, switch the installation off and the turn off the vehicle engine.
b. Loosen the cap on the oil filter.
c. Remove the O-ring from the top side of the filter housing.
d. Take precautions to collect spilt oil. Lift the filter cassette out of the reservoir by gripping the spring which is visible inside the housing.
e. Loosen the wingnut below the cassette, and remove the cassette.
f. Remove the two O-rings.
g. Fit a new O-ring to the filter support.
h. Fit a new filter cassette in the filter support.
i. Fit the second new O-ring.
j. Refit the wingnut.
k. Put the filter cassette back in the filter housing.
l. Re-fit the filter cap, using a new O-ring.
m. Check the oil level (see point 1.5.3) and top up if necessary as per point 3.8.4.

3.8.2 Level Gauge replacement

Ensure that no dirt, water or other contamination can enter the oil reservoir. If this should happen, serious damage could be done to the lifting mechanism, leading to malfunctions.

a. Drain the hydraulic oil reservoir until the level falls to below the level gauge.
   Do this using a pump connected to the lowest quick-release coupling at the side of the reservoir, or drain off the oil via the plug in the bottom.
   The capacity of the reservoir is approximately 100 litres.
b. Remove the level gauge attachment screws.
c. Remove the level gauge from the side of the reservoir.
d. Fit a new level gauge.
e. If applicable, re-fit the drain plug, using a new sealing ring.
f. Fill the reservoir with the correct grade of oil (See point 1.2).
g. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
h. Check the oil level in the level gauge and top up if necessary (See point 1.5.3).

3.8.3 Reservoir replacement

a. Remove the oil from the hydraulic oil reservoir (See point 3.8.4).
b. Detach all couplings on the reservoir.
c. Remove the fixing straps.
d. Remove the complete reservoir.
e. Fit the filter, filler cap and other parts to the new reservoir. Use new seals.
f. Fill the reservoir with the correct oil (See point 3.8.4).
g. Check that the valve below the reservoir is open.
h. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
i. Check the oil level and top up if necessary. (See point 1.5.3).

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3.8.4 Changing the hydraulic oil

a. Place the installation in the transit state.
b. Drain the oil reservoir as completely as possible. Use one of the following alternatives to achieve this:
   - Using a pump connected to the lowest quick-release coupling at the side of the reservoir
   - Draining via the plug in the bottom.
   - Extraction through the opening of the return filter (remove first).

The capacity of the reservoir is approximately 100 litres.

c. To drain the last of the oil from the reservoir, carefully unscrew the drain plug in the bottom of the reservoir, at the same time taking care to protect yourself from a sudden flow of oil.
d. Re-fit the drain plug using a new sealing ring.
e. Fill the reservoir with hydraulic oil (See point 1.2).
f. The level must be visible in the centre of the upper level gauge.
g. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
h. Check the oil level in the level gauge and top up if necessary (See point 1.5.3).

3.9 Hoses and lines

3.9.1 Replacement of hoses and lines

Hydraulic oil under pressure may escape when the couplings are loosened.

a. Place the installation in the transit state.
b. Take suitable precautions for escaping oil under pressure, slowly and carefully loosen the hose or line couplings, and disconnect the couplings.
c. Remove the hose or line.
d. Fit the replacement part.

e. Start the vehicle engine, raise and lower the lifting mechanism several times to bleed off air, then allow the mechanism to return to the initial position. Switch off the engine.
f. Check the oil level in the level gauge and top up if necessary (See point 1.5.3).

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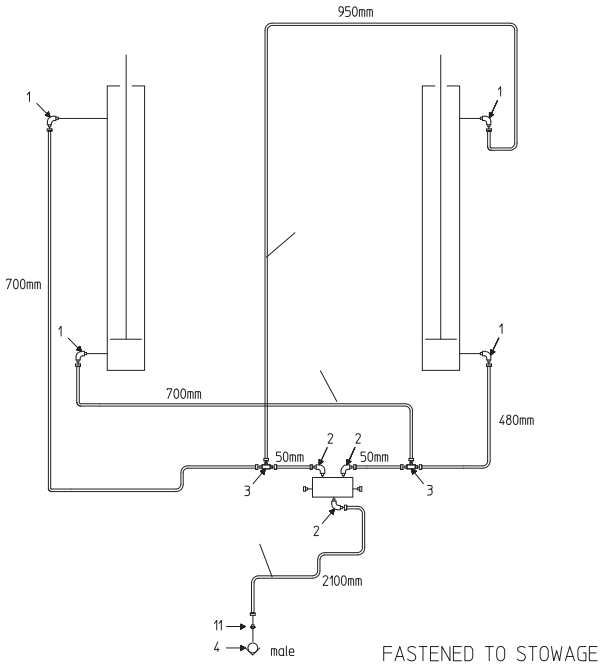
4 MAINTENANCE OF PNEUMATIC INSTALLATION



4.1 Pneumatic installation

The pneumatic system is connected to the vehicle system and is used to power the CHU stowage. Air pressure is obtained from the vehicle's compressor.

4.1.1 CHU stowage control circuit

Cylinders

The control circuit of the CHU stowage controls two pneumatic cylinders. These cylinders shift the CHU between the transit position and operating position.

CHU stowage controller

The CHU stowage controller is located to the left on the stowage, and consists of two push buttons that control the solenoid valve of the stowage. This solenoid valve feeds air pressure to the cylinders.

4.2 Removal, repair and replacement of CHU stowage control box

4.2.1 Removal and replacement of control box

a. Disconnect the electrical connectors.
b. Disconnect the pneumatic connections
c. Loosen the four screws and remove the cover from the valve box.
d. Open the connections and disconnect the wiring.

e. Remove any tie-wraps used to fasten cables to the rest of the construction.
f. Remove the screws attaching the control box to the CHU stowage and remove the unit.
g. To assemble the components, perform the same steps backwards.

4.2.2 Replacing the solenoid valve

a. Inspect the connections between the pneumatic hoses and the solenoid valve to see whether they need replacement.
b. Note the connections and remove the pneumatic hoses: Press the collar on each pneumatic hose in, withdraw the hose, then release the collar.
c. Unscrew the lock screw of the connector and remove the electrical connectors from the solenoid valve that is to be replaced.
d. Remove the screws that fasten the solenoid valve.
e. To fit the replacement part, perform the same steps backwards.
   To connect a pneumatic hose to a coupling, press and hold the collar, insert the hose, then release the collar.

4.3 Replacing the pneumatic cylinder

4.3.1 Cylinder removal and replacement

a. Switch off the installation.
b. Remove the hose van the cylinder: Press the collar on the hose in, withdraw the hose, then release the collar.
c. Remove the pivot pin that fixes the cylinder rod to the curved plate at the top.
d. Unscrew the four attachment bolts in the base of the cylinder.
e. Perform this procedure in reverse sequence to install the replacement cylinder.

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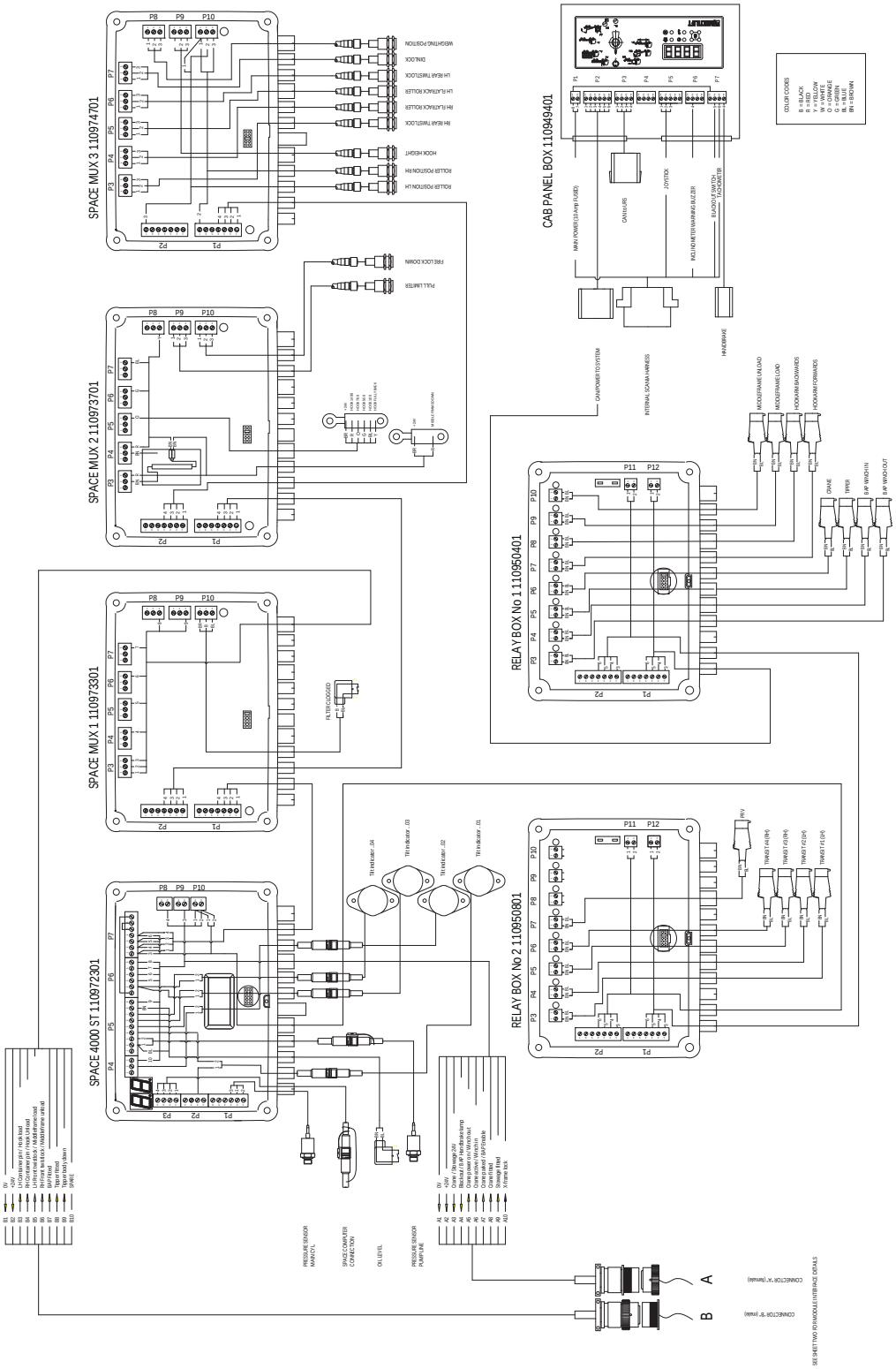
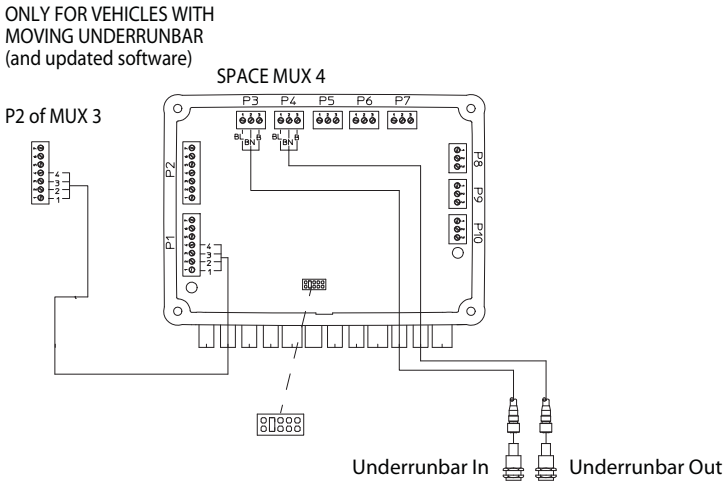
5 ELECTRICAL INSTALLATION

5.1 Electrical installation



5.1.1 Version with extendable underrun protection



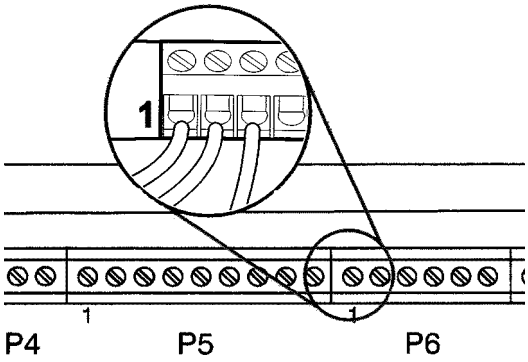
This is the extension of the electrical diagram in case of mounting of the extendable underrun protection. (on all Navy plus approx 20 “normal” WLS vehicles (as per 2010)).

The vehicles with extendable underrun protection also have a special version of the Space software. This software update can be used on all other vehicles, as it has a parameter to indicate whether an extendable underrun protection is mounted or not.

5.2 Components of control system

Connections, general description

The boxes of the control system are equipped with various connections.installation
In this manual, connections are indicated in figures and wiring diagrams by codes such as P2.1, P2.2, P2.3.
P2 for example is the number of the terminal block.
.1 is terminal number 1 of the terminal block, normally the leftmost terminal as viewed from the inbound lead.
Example: P6.1 is the 1st contact of the 6th terminal block in a box.



Lead colours and numbers

Within the control system, maximum use is made of a consistent system of colours for electrical connections.
The colours of the leads in the cable are as follows:

1. Brown, earth
2. Red, power supply
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple

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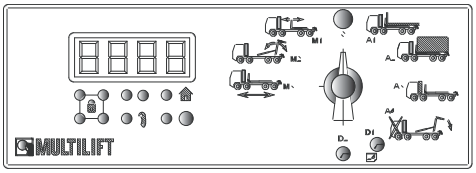
8. Grey
9. White

5.2.1 Cab Control Unit (CCU)



Together with the joystick, the CCU (Cab Control Unit) is the control centre of the hooklift.
The operating state is set on the CCU, and the joystick controls the system's movement.
The main control box of the control system (see point 5.3) validates all commands and controls the power sources.

Operating states

The operating states of the hooklift are selected using the MODE switch. The MODE switch positions are reviewed below:

0
In this position, the power supply is cut off to electrical components inside and outside the CCU, with the exception of the transit valves, which are energised to enable the main cylinders to float freely. Nor are any signals sent to these components.

A1
Position A1 is intended for loading and unloading a flatrack/body in the usual way.

A2
Position A2 is intended for loading and unloading a container in the usual way.

A3
In position A3, power is supplied to the connector at the main control box of the hooklift. This connector is used for:
connecting a CHU stowage, for stowage or loading of the CHU;
connecting a Mobile loading crane;
connecting other equipment, such as a tipper body or BAP.

A4
Position A4 is used when necessary to supply power to a defective hooklift on another vehicle.

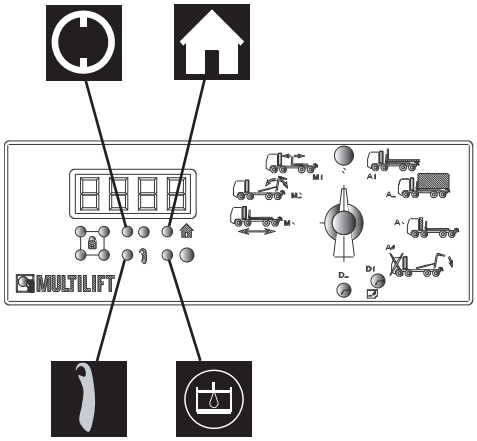
The MODE switch may not be left in position A3 or A4 once the task has been completed.

M1
M1 is used in special loading and unloading situations, or when there are errors in the electrical/ electronic subsystem. The joystick only controls the movements of the hook arm.

M2
M2 is used in special loading and unloading situations, or when there are errors in the electrical/ electronic subsystem. The joystick only controls the movements of the hook arm.

M3
M3 is used when the vehicle is being driven, and the lifting mechanism is in the home position after positions M1 and M2 have been used in the event of an error in the electrical/electronic subsystem.

Warning lamps



There are several warning lamps located on the CCU:
- ON indication (system switched on)
- HOME indication (hooklift is in transit position)
- HOOK indication (installation working with low hook, for French flatracks)
- OIL indication (level too low or clogged filter)

For further information, refer to 1TH.

5.3 Main control box

The central control unit supplies the power requirements of all other components of the system. The nominal supply voltage is 24 V DC, but the system can work with voltages from 16 up to approximately 32 Volts.
The central control unit is constructed with a number of automatic circuit breaker and one standard 7.5 A (automatic) circuit breaker.
The main control box is the leftmost of the two boxes located below the oil reservoir on the left-hand side.

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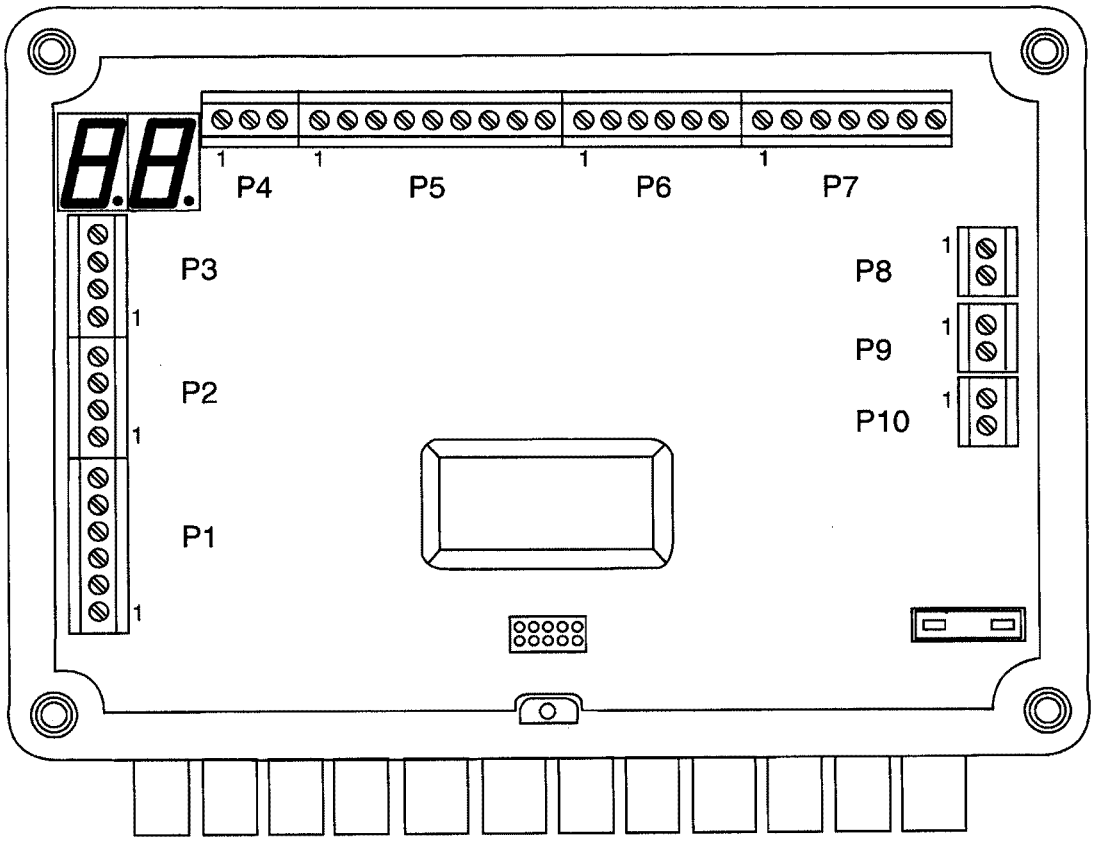

Terminal	Description of connection
P1	Sensor input from pressuresensor main cilinder
P1.1 P1.2 P1.3	Earth 24 V Signal from pressure sensor
P2	Sensor inputs
P2.2	Power supply to tilt indicator 01
P3	Computer connection
P3.1 P3.2 P3.3 P3.4	Earth 24 V Data out Data in
P4	Sensor (signal not used)
P4.2 P4.3	Power supply to tilt indicator 02 Signal from CHU tighteners
P5	Sensors / inputs

Terminal	Description of connection
P5.1 P5.2 P5.3 P5.4 P5.5 P5.6 P5.7 P5.8 P5.9	- 24 V Signal from pressure sensor Signal from tilt indicator 01 (10 or 19 mA) Signal from tilt indicator 02 (10 or 19 mA) Signal from tilt indicator 03 (10 or 19 mA) Signal from tilt indicator 04 (10 or 19 mA) Signal from oil level switch Signal from CHU stowage (if installed)
P6	Sensors / inputs
P6.1 P6.2 P6.3 P6.4 P6.5 P6.6	Earth 24V Crane power on / BAP Winch out Crane active / BAP Winch in Crane parked / Spare BAP input Crane installed
P7	Can Bus
P7.1 P7.2 P7.3 P7.4 P7.5 P7.6 P7.7	Earth 24 V CAN + CAN - Emergency stop output Emergency stop input On/off (external)
P8	Output signal
P8.2	Black-out
P9	Output
P9.2	24 V crane power supply / CHU stowage
P10	Power in
P10.1 P10.2	Earth 24 V in

REMARK:
The 24 V power supply from the vehicle can only be measured on P10. All other terminal blocks have a lower voltage due to built-in filters.

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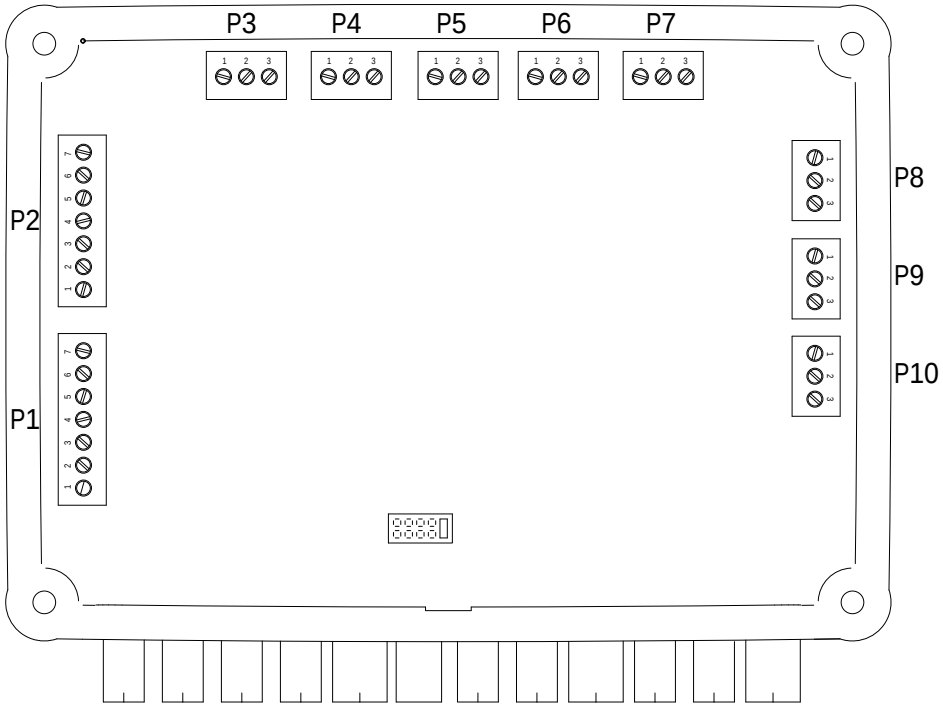
5.4 MUX box

In total, there are threeMultiplexer (MUX) boxes built into the system. These function as a “collection point” for information from sensors, coding and combining the information before sending it on to the main control box via the Can Bus system.

- MUX 1 is the rightmost of the two boxes below the oil reservoir, on the right-hand side.
- MUX 2 is located beside the “French” lock, in the middle of the subframe.
- MUX 3 is located at the front of the cross-member that carries the roller beds.
- MUX 4 is only mounted on vehicles with retractable underrun protection, and is in that case located adjacent to MUX 3.

Jumpers:

The address of the MUX box is set with a jumper. The rightmost position is 1, the 2nd from the right is 2, etc.
No two boxes in a single system may have the same address.



	Description			
Terminal	MUX 1	MUX 2	MUX 3	MUX 4 (retractable underrun protection
P1	CAN BUS	CAN BUS	CAN BUS	CAN BUS
P1.1 P1.2 P1.3 P1.4	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -
P2	CAN BUS	CAN BUS	CAN BUS	CAN BUS
P2.1 P2.2 P2.3 P2.4	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -
P3	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P3.1 P3.2 P3.3	Earth 24 V Left container pin / Hook arm cylinder load	- 24 V sensor main cylinder 0 position main cylinder	Earth 24 V Twistlock right rear	Earth 24 V Underrun protection in
P4	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P4.1 P4.2 P4.3	- - Right container pin / Hook arm cylinder unload	- 24 V sensors hook arm cylinder Hook 1400	Earth 24 V Flatrack roller right	Earth 24 V Underrun protection out

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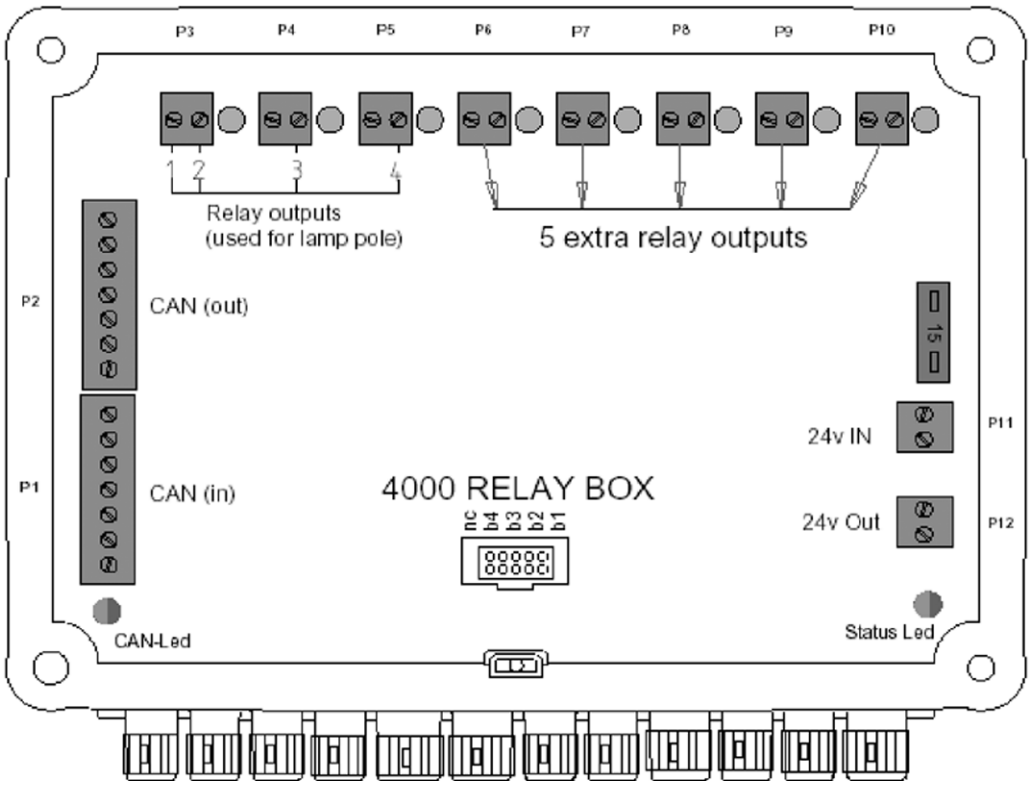
	Description			
P5	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P5.1 P5.2 P5.3	- - Left front twistlock / Middle frame load	- - Hook 700	Earth 24 V Flatrack roller left	
P6	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P6.1 P6.2 P6.3	- - Right front twistlock / Middle frame unload	- - Hook 550	Earth 24 V Twistlock left rear	
P7	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P7.1 P7.2 P7.3	- - BAP installed	- - Hook 100	Earth 24 V NATO (Din) lock	
P8	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P8.1 P8.2 P8.3	- - Tipper body installed	- - Hook arm fully retracted	Earth 24 V Weighing position	
P9	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P9.1 P9.2 P9.3	- - Tipper body down	Earth 24 V Pull limiter	Earth 24 V Low hook	
P10	Sensor / input	Sensor / input	Sensor / input	Sensor / input
P10.1 P10.2 P10.3	Clogged filter indicator earth Clogged filter indicator earth 24 V power Clogged filter indicator signal	Earth 24 V French lock down	Earth 24 V Roller beds extended	

5.5 Relay box

Two relay boxes are installed. These boxes are controlled by the control system using the Can Bus signal. They energise various system functions, and indirectly initiate movements. The relay boxes are protected by 15 A fuses.



Connections:

	Description	
Terminal	Relay box 1	Relay box 2
P1	CAN BUS	CAN BUS
P1.1 P1.2 P1.3 P1.4	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -
P2	CAN BUS	CAN BUS
P2.1 P2.2 P2.3 P2.4	Earth 24 V CAN + CAN -	Earth 24 V CAN + CAN -
P3	Relay / output	Relay / output
P3.1 P3.2	Earth BAP winch out	Earth Transit valve 1 left
P4	Relay / output	Relay / output
P4.1 P4.2	Earth BAP winch in	Earth Transit valve 2 left
P5	Relay / output	Relay / output

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	Description	
Terminal	Relay box 1	Relay box 2
P5.1 P5.2	Earth Tipper body	Earth Transit valve 1 right
P6	Relay / output	Relay / output
P6.1 P6.2	Earth Crane	Earth Transit valve 2 right
P7	Relay / output	Relay / output
P7.1 P7.2	Earth Hook arm forwards	Earth Pressure reducing valve
P8	Relay / output	Relay / output
P8.1 P8.2	Earth Hook arm backwards	-
P9	Relay / output	Relay / output
P9.1 P9.2	Earth Middle frame load	-
P10	Relay / output	Relay / output
P10.1 P10.2	Earth Middle frame unload	-
P11	Relay / output	Relay / output
P11.1 P11.2	Earth 24 V in	Earth 24 V in
P12	Relay / output	Relay / output
P12.1 P12.2	Earth 24 V out	Earth 24 V out

Explanation of the LEDs:

- LED beside each output:
  - illuminated green when the output is in use
- CAN LED (below left in box):
  - blinks red: CAN protocol missing or jumper incorrectly set
  - blinks green: Space system running
- Status LED (below right in box):
  - illuminated green: CAN, relay and power supply OK
  - blinks red: defective relay. All relays blocked

Jumpers:

The address of the relay box is set with a jumper. The rightmost position is 1, the 2nd from the right is 2, etc.
No two boxes in a single system may have the same address.

5.6 Cab Control Unit (CCU) replacement

5.6.1 Removal and replacement

a. Switch off the installation and turn off the main switch.
b. Pull the control unit forward via the opening. Hold the unit at a right angle to the front of the panel. Do not use excessive force.
c. Carefully withdraw the unit further, and ensure that the cable harnesses connected at the rear also come out with the unit, without catching on anything.
d. Loosen the terminals and withdraw the leads.
e. Perform this procedure in reverse sequence when replacing the control unit.

5.7 Joystick replacement

5.7.1 Removal and replacement

a. Switch off the installation and turn off the main switch.
b. Remove the support panel for the joystick in order to access the back of the joystick.
c. Loosen the nut that attaches the joystick and the label to the panel, and remove the joystick.
d. Disconnect the white nylon connector block between the cable harness and the joystick.
e. Assemble following the same steps in reverse sequence.

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5.8 Proximity switch replacement

5.8.1 Removal and replacement

The procedure described here can be applied to the majority of the proximity switches on the hooklift installation.
Proximity switches are installed for e.g.:
- NATO lock
- Pivot pin bush in “low hook” position
- “French” lock
- Twistlocks
- Flatrack rollers
- etc.

a. Switch off the installation and turn off the main switch.
b. Loosen the nut attaching the connector to the proximity switch, and unplug the connector.
c. Loosen the nut and unscrew the proximity switch.
d. Proceed through the same steps in reverse to fit a new switch.
e. Adjust the proximity switch and tighten the lock nut such that the tip will maintain a 3 to 10 mm clearance from the object to be signaled.
f. Also ensure that the LED remains easily visible.
g. Switch on the installation.
h. Set the MODE switch to the desired position and check the correct functioning of the proximity switch.
   Check that the functioning is correct even when the object moves within its free play.

5.9 Replacing wiring

a. Switch off the installation using the main switch in the cab.
b. If necessary, open the box(es) where the cable terminates.
c. Remove any clips that fasten the cable to the outside of the box(es). This only requires pressing a small screwdriver into the closure of the clip.

d. Note the lead connections, and loosen all terminals.
e. Remove the tie-wraps holding the cable.
f. Reassemble in reverse sequence. The clips can be re-closed using small needlenose pliers.

REMARK:
Ensure that the cable is not stretched tightly, especially when attached to moving parts of the installation.
Also check that the cable cannot become jammed due to movements of the installation.

5.10 Tilt indicator replacement

a. Switch off the installation.
b. Note how the tilt indicator is currently mounted (cable exits to upper or lower side).
c. Unscrew the two screws and remove the tilt indicator.
d. Loosen the terminal and remove any tie-wraps.
e. Fit the new tilt indicator in the same way. Make sure that the cable is not stretched too tightly.

5.11 Errors

5.11.1 Errors displayed on main control box

Space, the control system, will indicate the presence of errors on its display.
The error LED will glow or blink red, to indicate that an error has been detected.
The system also gives additional information about the error. Section 5.11.2 describes how to interpret this information.

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REMARK:
When multiple errors occur simultaneously, the display will show the error with the lowest number. Once the cause of the error has been removed, the next error code will be displayed.

a. Unscrew the cover of the main control box (on the left-hand side) and remove the cover. The error indicator alternately displays the number of errors and the error code. Example: A 4 with a dot, followed by 03 with no dot indicates that 4 errors have been detected, of which the lowest is code 03.
b. Look up the displayed error in the list.
c. Follow the directions to rectify the error
d. Repeat these steps until all messages disappear, and the display shows 0.

REMARK:
Errors are divided into 3 main groups: Faults, Conflicts and Diagnostics.
These are indicated in the display by F, C or D.

5.11.2 Errors in the control system

Most error messages disappear automatically once the error has been rectified. A number of errors/ malfunctions must be "reset" by switching the system off, then back on.

5.11.3 F0: Supply voltage to main control box too low

Vehicle battery voltage too low, or circuit breaker contacts oxidised.

a. Check the voltage between P10.1 and P10.2 in the main control box. Is this at least 16 volts?
   Yes: go to b.
   No: search for the cause of the problem in the vehicle electrical circuit.
b. Remove the fuse in the main control box and check the voltage across the circuit breaker contacts (measure between P10.1 and the circuit breaker contacts).
c. Check the circuit breaker contacts for oxidation if this voltage is less than 16 volts.

5.11.4 F1: Automatic I/O circuit breaker tripped

The automatic circuit breaker for the 24 V supply to the sensors and indicators has tripped.

a. Switch the entire installation off and on again (using the main switch of the vehicle).

5.11.5 F2: Automatic circuit breaker has tripped

Automatic circuit breaker for P9.2, power supply to crane / CHU stowage has tripped.
Lead to P9 short-circuited to earth, or contact resistance in connections.

a. Disconnect the power supply connector for the crane or CHU stowage.
b. Set the entire system off and back on (main switch
c. Check whether F2 is still active:
   Yes: go to d.
   No: Error in crane or CHU stowage.
d. Check whether terminal P9.2 in the main control box is short-circuited to earth.
   Yes: replace the cable to the power supply connector of the crane or CHU stowage, and reconnect everything again.

5.11.6 F3: Emergency stop circuit interrupted

Connection between P7.5 and P7.6 is dead or not properly connected.

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5.11.7 F5: Automatic circuit breaker for P5.2 has tripped

The automatic circuit breaker for the 24 V supply to the pressure sensor and oil level switch has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).

5.11.8 F6: Automatic circuit breaker for P3.2 has tripped

The automatic circuit breaker for the 24 V supply to the data connection has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).

5.11.9 F7: Voltage on Can Bus signal is too low

The (+5 V) supply for the Can Bus system is low.
Possible short circuit in Can Bus line.
Contact resistance in connections, defective cable, main control box, relay box or MUX box defective.

a. Disconnect the leads from P7.3 and P7.4 in the main control box.
b. Turn the system off then on again.
c. Check whether F7 is still active.
   Yes: replace the main control box (4th maintenance level).
   No: reconnect the leads of one of the cables, and go to d. Leave the other cable disconnected.
d. Turn the system off then on again. Check whether F7 is still active.
   Yes: Go to g.
   No: Disconnect this cable again, and connect the other cable. Go to e.
e. Turn the system off then on again. Check whether F7 has become active again.
   Yes: Go to g.
   No: Reconnect all cables as they were at the start of this procedure.

f. Turn the system off then on again. Check whether F7 has become active again.
Yes: report this error to the next highest maintenance level.
No: Error was caused by bad contact resistance. Stop tracing the error.

g. Follow the connected cable to its end. Check whether this cable to runs to MUX1 (on the right beside the main control box).
Yes: Go to h.
No: Go to m.

h. The error originates in the MUX section of the Can Bus. Open MUX1 and detach the leads from P1.3 and P1.4.

i. Turn the system off then on again, and check whether F7 is still active.
Yes: reconnect the leads and go to j.
No: replace the cable connected to P1 of MUX1.

j. Detach the leads from P2.3 and P2.4 of MUX1.

k. Turn the system off then on again, and check whether F7 is still active.
Yes: reconnect the leads and go to l.
No: replace the MUX box.

l. Repeat steps h. through k. for MUX2 next, then MUX3. Then stop troubleshooting.

m. The error originates in the relay box section of the Can Bus. Open relay box 1 and detach the leads from P1.3 and P1.4.

n. Turn the system off then on again, and check whether F7 is still active.
Yes: reconnect the leads and go to o.
No: replace the cable connected to P1 of relay box 1.

o. Detach the leads from P2.3 and P2.4 of relay box 1.

p. Turn the system off then on again, and check whether F7 is still active.
Yes: reconnect the leads and go to q.
No: replace the relay box.

q. Repeat steps m. through p. for the other relay box.

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5.11.10 F8 Internal error

Error in processor or program.

a. Turn the system off then on again.
b. Replace the main control box if the error persists.

5.11.11 F9: Pressure sensor, signal outside range

The signal received by the pressure sensor is out of range.

a. Replace the pressure sensor.

5.11.12 F10: Main control box, parameter fault

Invalid settings, error during programming, box not initialised, main control box defective.

a. Turn the system off then on again.
b. Check whether the error is still active.
   Yes: go to c. (4th maintenance level)
   No: stop.
c. Read the error message with the aid of the terminal. Follow the directions on the screen.
   Incorrect parameter setting: go to d.
   "Checksum": go to e.
d. Set the named parameter to a value within the stated limits. Go to f.
e. Set the parameter(s) to the same value(s) as before the error.
f. Close the connection, and check the functioning of the installation.

5.11.13 F11: MUX1 fault

The main control box is receiving no signals from MUX1. This is where the NATO (Din) locks and cylinder sensors are connected.

a. Check the placement of the address jumper in the MUX box.
b. Check for correct connection of the cable between P7 of the main control box and P1 of MUX1.
c. Turn the system off then on again.
d. Replace the MUX box if the error persists.

5.11.14 F12: MUX2 fault

The main control box is receiving no signals from MUX2. This is where the rear twistlocks and rollers are connected.

a. Check the placement of the address jumper in the MUX box.
b. Check for correct connection of the cable between P2 of MUX1 and P1 of MUX2.
c. Turn the system off then on again.
d. Replace the MUX box if the error persists.

5.11.15 F13: MUX3 fault

The main control box is receiving no signals from MUX3. This is where the sensors of the hydraulic system and the crane/CHU are connected.

a. Check the placement of the address jumper in the MUX box.
b. Check for correct connection of the cable between P2 of MUX2 and P1 of MUX3.
c. Turn the system off then on again.
d. Replace the MUX box if the error persists.

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5.11.16 F14: Relay box 1 fault

The main control box is receiving no signals from relay box 1.

a. Check the placement of the address jumper in the relay box.
b. Check the connection of the cable between P2 of relay box 1 and P1 of the relay box 2.
c. Turn the system off then on again.
d. Replace the relay box if the error persists.

5.11.17 F15: Relay box 2 fault

The main control box is receiving no signals from relay box 2.

a. Check the placement of the address jumper in the relay box.
b. Check the connection of the cable between P7 of the central box and P1 of relay box 2.
c. Turn the system off then on again.
d. Replace the relay box if the error persists.

5.11.18 F16: Cab control box missing.

The main control box is receiving no signals from the cab control panel.

a. Check the cable connections.

5.11.19 F17: MUX1 circuit breaker tripped

The automatic circuit breaker in MUX1 for power supply to sensors has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).
b. Disconnect one of the cables and restart the system.
c. Repeat this procedure until the error is rectified.
d. Check the relevant sensor and replace if necessary.

5.11.20 F18: MUX2 circuit breaker tripped

The automatic circuit breaker in MUX2 for power supply to sensors has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).
b. Disconnect one of the cables and restart the system.
c. Repeat this procedure until the error is rectified.
d. Check the relevant sensor and replace if necessary.

5.11.21 F19: MUX3 circuit breaker tripped

The automatic circuit breaker in MUX3 for power supply to sensors has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).
b. Disconnect one of the cables and restart the system.
c. Repeat this procedure until the error is rectified.
d. Check the relevant sensor and replace if necessary.

5.11.22 F20: Relay box 1, output fault

Relay box 1 indicates an error on one of the outputs (short circuit or defective relay).

a. Open the relay box and check its functioning (observing the LEDs) while operating the installation.
b. Check that the cables are properly connected.
c. Test the cables for possible short circuiting.

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5.11.23 F21: Relay box 2, output fault

Relay box 2 indicates an error on one of the outputs (short circuit or defective relay).

a. Open the relay box and check its functioning (observing the LEDs) while operating the installation.
b. Check that the cables are properly connected.
c. Test the cables for possible short circuiting.

5.11.24 F22: Program halted

The entire control system has halted due to one of the following reasons:
- Supply voltage too low (see also F0)
- Incorrect parameter setting (see also F10)
- Halted during programming work (higher maintenance level)

5.11.25 F23: Can buffers full

The internal Can buffers are full.

a. Switch the installation off, then on again.
b. Check for other faults (on the display)

5.11.26 F24: Real time lost

The internal clock of the control system has halted or lost the correct time.
This error is not noticeable further during operation.

a. Report this error to the next highest maintenance level.

5.11.27 F25: Pressure sensor of main cylinder defective

The signal received from the pressure sensor is out of reach.

a. Replace the pressure sensor.

5.11.28 F26: Oil filter clogged

The main control box receives a signal from the sensor in the oil filter.

a. Replace the oil filter.
b. Check when the oil was last changed. Change the oil if this last took place more than a year previously.
c. Check that fault F26 has now disappeared.

5.11.29 F27: Oil level too low.

When the cylinders of the hook arm are fully extended, or when the crane is in full use, the oil level will be at its lowest level.

a. Check that in the transit position (hook arm “home” and crane folded away) the oil level is visible in the centre of the upper level gauge.
b. Top up the oil if necessary.
c. Check that fault code F27 does not appear now when the hooklift is positioned completely “over the back”.

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5.11.30 F28: Defective circuit breaker in CCU (Cab Control Unit).

Report this error to the next highest maintenance level.

5.11.31 F29: Signal from tilt indicator out of range.

The signal received from (one of) the tilt indicators is out of range. Signal or power supply lead interrupted or short circuited, defective sensor, contact resistance in connections.

Because no indication is given which sensor is sending an out of range signal, the following procedure must be carried out for all 4 sensors.

a. Unplug the connector from the tilt indicator.
b. Check the voltage in the cable connector. Is this at least 14.5 volts?
c. Detach the cables from P5.4, 5.5, 5.6 and 5.7 in the main control box.
d. Check the voltage across P5.2 and each of connections. is the voltage still at least 14.5 volts?
e. If all voltages seem good: Measure the current between the connection leads and terminals P5.4, 5.5, 5.6 and 5.7.
   This current must be 10 or 19 mA. If not, replace the tilt indicator in question.

5.11.32 F30 through 42: Automatic circuit breaker tripped in relay box

Fault code	Circuit breaker of output: (Relay box / terminal block, function)
F30	1 / 3, BAP winch out
F31	1 / 4, BAP winch in
F32	1 / 5, tipper body
F33	1 / 6, crane
F34	1 / 7, hook arm forwards
F35	1 / 8, hook arm backwards
F36	1 / 9, middle frame load
F37	1 / 10, middle frame unload
F38	2 / 3, transit valve 1
F39	2 / 4, transit valve 2
F40	2 / 5, transit valve 3
F41	2 / 6, transit valve 4
F42	2 / 7, pressure reducing valve

a. Release the joystick and try again.
   The circuit breaker will be automatically reset.

5.11.33 F43: MUX4 fault

The main control box is receiving no signals from MUX4. This is where the sensors of the retractable underrun protection are connected.

a. Check the placement of the address jumper in the MUX box.
b. Check for correct connection of the cable between P2 of MUX3 and P1 of MUX4.
c. Turn the system off then on again.
d. Replace the MUX box if the error persists.

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5.11.34 F44: MUX4 circuit breaker tripped

The automatic circuit breaker in MUX4 for power supply to sensors has tripped.

a. Switch the entire installation off then on again (using the main switch of the vehicle).
b. Disconnect one of the cables and restart the system.
c. Repeat this procedure until the error is rectified.
d. Check the relevant sensor and replace if necessary.

5.11.35 C0: MODE switch conflict

The MODE switch (in the Cab Control Unit) is sending multiple values simultaneously.

a. Replace the CCU.

5.11.36 C1: Joystick conflict

The joystick is sending multiple values simultaneously.

a. Replace the joystick.

5.11.37 C2: Installation conflict

An invalid combination of signals has been received from crane, CHU stowage, BAP or tipper body.

a. Check that the power supply connectors of the installed components have been connected.

5.11.38 C3: Rear roller conflict

Both rollers must be in the same state.

5.11.39 C4: Rear twistlock conflict

The two rear twistlocks are not in the same state.

5.11.40 C5: Front twistlock, CHU, conflict

The two twistlocks of the CHU stowage are not in the same state.

5.11.41 C6: Container twistlock conflict

The two twistlocks of the front container grips are not in the same state.

5.11.42 C7: Hook position conflict

The hook arm cylinder can only be in one position at any time.

a. Report this error to the next highest maintenance level.

5.11.43 C8: Low hook conflict

The “low hook / French flatrack” function can only work when the hook pivot pin in inserted in the special bush in the hook arm, and the French lock is raised.

5.11.44 C9: Hookarm in safety mode

De safety mode is active. Move the joystick forward briefly.

5.11.45 D0: Not in “HOME” position

This message is displayed when the hooklift is not in the “HOME” position while the MODE switch is set to A3.

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5.11.46 D1: Crane not in transit state

This message is displayed when the crane is not fully in the transit state when the MODE switch is set to A1.

a. Check the transit state of the crane.
b. Check the attachment of the crane connector.

5.11.47 D2: Rollers in wrong position

The state of the rollers does not correspond to the operational state chosen.

5.11.48 D3: NATO lock

The NATO lock is in a position that does not “fit” the current operations.

a. Check the position of the lock.
b. Check that the proximity switch is working properly.
c. Check the condition of the cable and connector on the switch.

5.11.49 D4: Wrong unit installed

This message is displayed when there is a conflict between the installed unit (crane, BAP, tipper body, CHU stowage) and the selected operational state.
(In mode A1 when a BAP or tipper body is installed;
in mode A2 when no CHU stowage is installed)

5.11.50 D5: Low hook not permitted

This message is displayed when the hook is in the low position (special yellow hook placed and shaft in holder) and mode A2 or A3 is selected.

5.11.51 D6: Twistlocks not open

This message is displayed when there are still twistlocks closed while operating in mode A2.

5.11.52 D7: Front container twistlocks locked

The front container twistlocks are locked.

5.11.53 D8: Vehicle speed too high

This message is displayed when attempting to operate the hook lift at an excessive vehicle speed (faster than approx. 7 km/h).

5.11.54 D9: Tipper body not down

This message is displayed when attempting to tip the tipper body while the crane is not in the transit state, or when the hooklift is operated while the tipper body is not down.

5.11.55 dA: Low hook required

This message is displayed when the French locking is raised, but the hook has not been rebuild for the low position (special yellow hook mounted and shaft in holder).

5.11.56 db: Roller bed in wrong position

This message is displayed when one of the rollerbeds is not in the correct position for the current modus.

5.11.57 dC: CHU not unlocked

This message is displayed when CHU is still locked while operation is attempted.

5.11.58 dd: BAP operation is disabled

This message is displayed in situations when operation of BAP could lead to damage or dangerous situation. The operation is disabled.

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5.11.59 dE: CHU is not locked

This message is displayed when CHU is not locked in tranportposition.

5.11.60 dF: Software seal not open

The safety system for engaging the M-modes is active. Follow the description from operator manual.

5.11.61 bu: Underrun protection not in transport position

The underrun protection is not completely in transportposition.

a. Check sensor adjustment.
b. Check cabling.

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