7 Load handling

General

The load handling consists of the lifting device and spreader.

7.2 Lifting/lowering

Safety

DANGER

Danger! High voltage!

The electric systems must be serviced and repaired by trained personnel.

For safety instructions, see Section B, *Safety*, section *Electric systems*.

Description

The spreader is lifted and lowered by an electric winch with hoist ropes.

Electric motors rotate the hoist drums via the hoisting gear, and the ropes are reeled onto the drums. The dead ends of the ropes are attached to the upper frame with fastening devices. The PLC uses the sensors in the fastening devices to monitor the slackening of the ropes when the spreader is lowered onto a container.

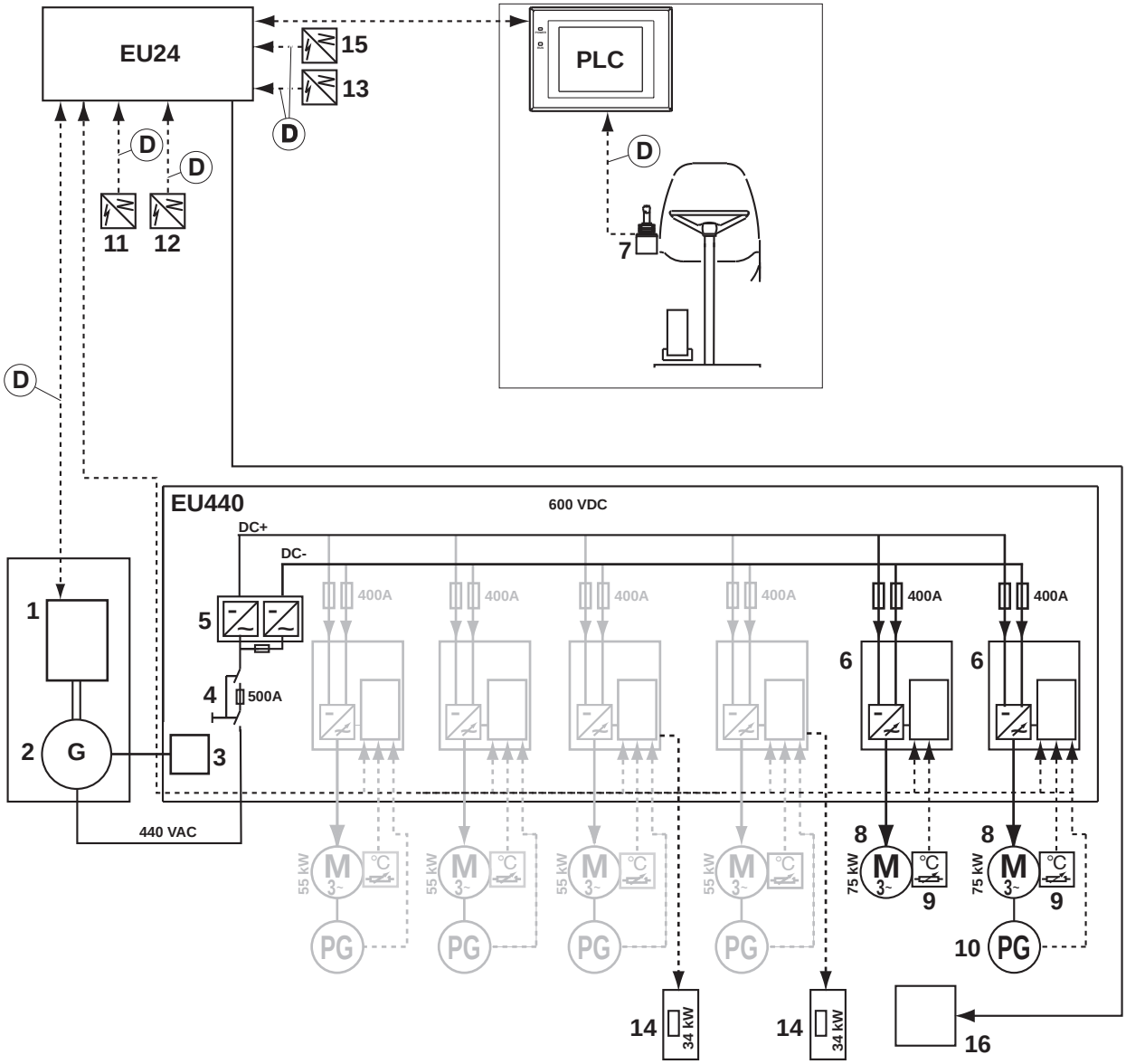
The electric hoist transmission system consists of the generator, rectifier, inverters and hoist motors. The system is powered by the generator, which is run by a diesel engine. The inverters control the hoist motors according to the position of the control lever. When the load is lowered, the hoist motors act as electric brakes. The electric power generated during braking is fed via the direct-current intermediate circuit to the brake resistors (R8-R9), which turn it into heat.

The winch is equipped with hoist brakes that prevent the spreader from being lowered when the engine is not running or when the spreader is not being lifted or lowered. The brakes are spring-loaded, fail-safe disc brakes. The brakes are released by hydraulic pressure. The PLC monitors brake pad wear with wear sensors located in the brakes.

The hoist system is equipped with an emergency lowering unit with which the load can be lowered safely in a situation where normal lowering is not possible.

The PLC receives information about the height position of the spreader from sensors on the column and a pulse encoder on one of the hoist motors. The PLC uses the height information for several different functions.

Function description



Item numbers in parentheses refer to the circuit diagram, Section *E*, Chapter *11 Common electrics*.

Pos	Function	Signal description	Reference
1	The diesel engine generates the power required by the generator.		
2	The generator (G1) supplies electric power to the system.	300–440 VAC	
3	The generator voltage regulator (A342) regulates the voltage of the generator appropriate for working speed range of 1300–1800 rpm.		

Pos	Function	Signal description	Reference
4	The main fuses (F1) protect the rectifier (U7) from overload.	300–440 VAC	
5	The rectifier (U7) converts variable alternating current voltage into steady direct-current voltage for the direct-current intermediate circuit.	300–440 VAC / 600 VDC	
6	The inverters (U5-U6) receive the electric power from the direct-current intermediate circuit and convert direct current into frequency-change alternating current.	600 VDC / 440 VAC	
7	The position signal of the control lever (R91) is sent to the inverters via the bus.	Control lever - PLC: 1-5 VDC PLC - inverter: Ethernet/IP	Section *8,* Chapter *8.4 Diagnostics*
8	The inverters control the direction of rotation and speed of the hoist motors (M5-M6).	440 VAC	
9	Temperature information from the hoist motors is sent to the inverters and from the inverters to the PLC via the bus.	Ethernet/IP	Section *8,* Chapter *8.4 Diagnostics*
10	The PLC monitors the height position and speed of the spreader with a pulse encoder (B6) on one of the hoist motors. Pulse encoder information is sent to the inverter and from the inverter to the PLC via the bus.	Ethernet/IP	Section *8,* Chapter *8.4 Diagnostics*
11	The PLC calibrates the height counter when the spreader passes the height counter reset switch (S77) during hoisting/lowering. The counter is set when the spreader is at reset height (5 m).		Section *8,* Chapter *8.4 Diagnostics* Chapter *7.2.4 Checking the height limits*
12	Machine equipped with a front cabin. The area switch (S75) centers the spreader during hoisting if the spreader has been shifted sideways towards the cab. This prevents the spreader from hitting the cabin.		Section *8,* Chapter *8.4 Diagnostics* Chapter *7.2.4 Checking the height limits*

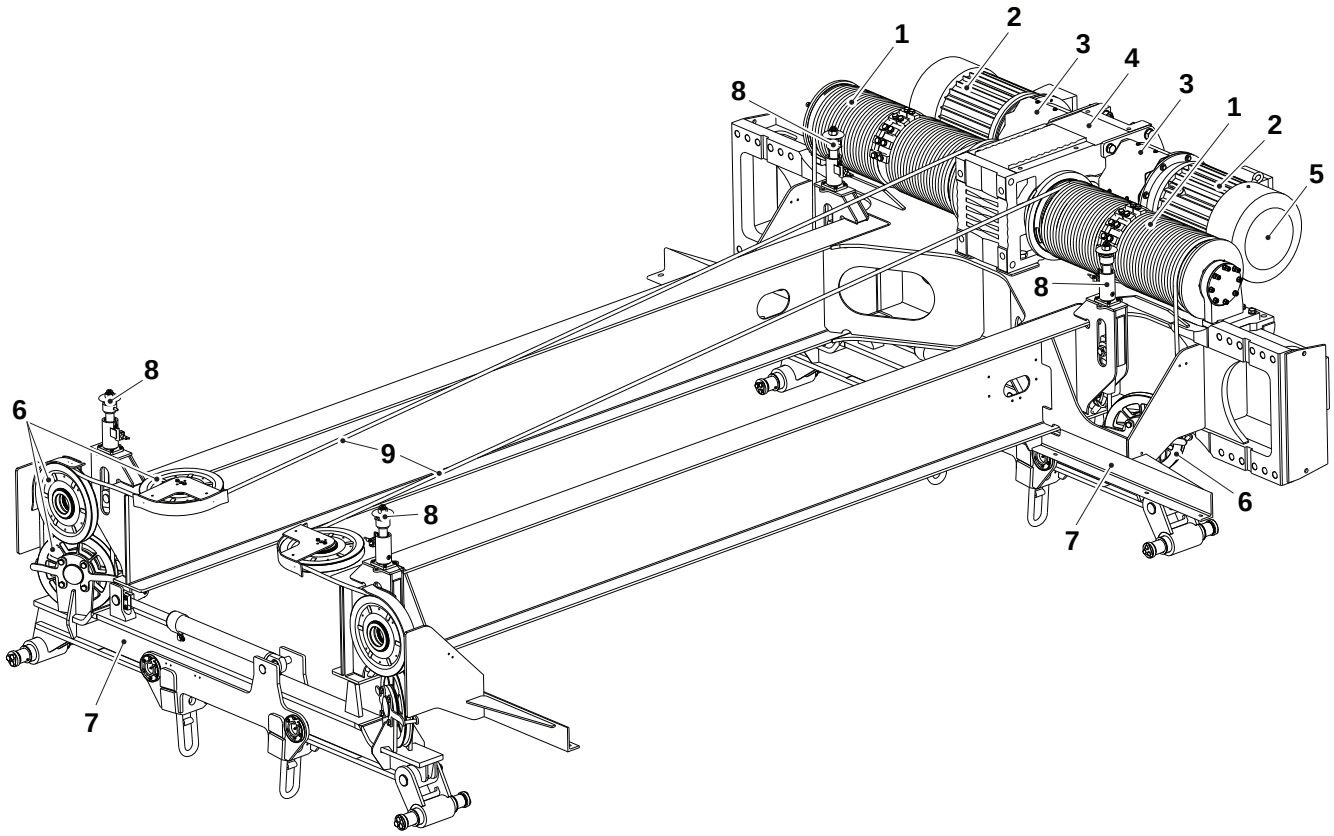
Pos	Function	Signal description	Reference
13	The PLC monitors the spreader's maximum hoisting height with the limit switch (S76).		Section *8,* Chapter *8.4 Diagnostics* Chapter *7.2.4 Checking the height limits*
14	When the spreader is lowered, the hoist motors act as electric brakes. The electric power generated during braking is fed via the direct-current intermediate circuit to the brake resistors (R8-R9), which turn it into heat.	~780 VDC	
15	The PLC monitors the slackening of the ropes when the spreader is lowered onto a container. The sensors (S101-S104) in the fastening devices at the dead ends of the ropes send a signal when the ropes slacken, and lowering is stopped automatically.		Section *8,* Chapter *8.4 Diagnostics* Chapter *7.2.3 Hoist ropes*
16	The hoist brake is a safety device that prevents the spreader from being lowered when the engine is not running or when the lifting or lowering movement of the spreader has not been activated.		Chapter *7.2.2 Hoist brake*

Component position

Electric centre EU440

See Section *3*, Chapter *3.6 Electrical drive*.

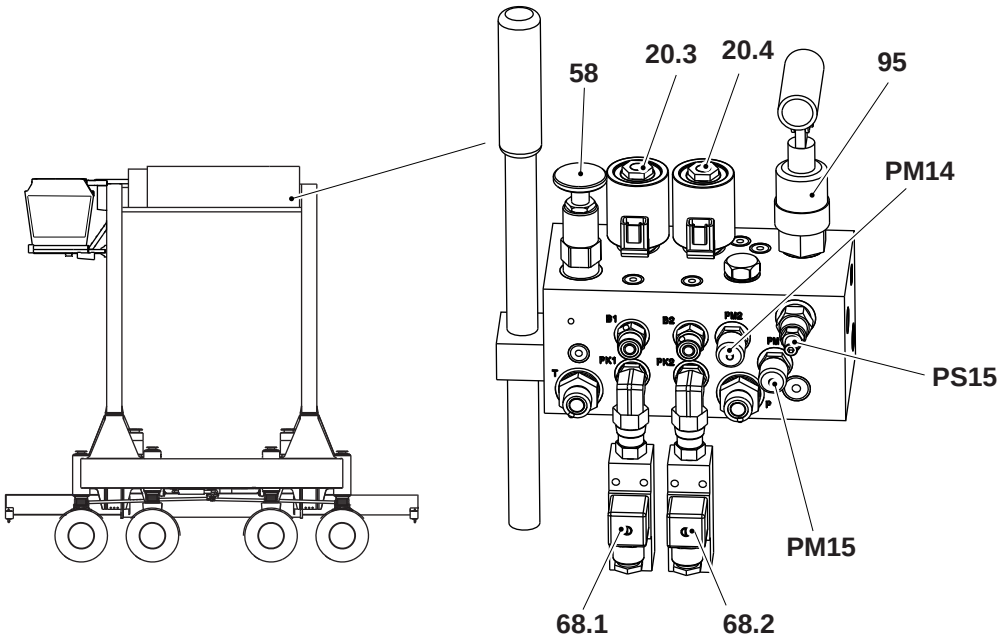
Hoisting device



Item numbers in parentheses refer to the circuit diagram, Section *E*, Chapter *11 Common electrics*.

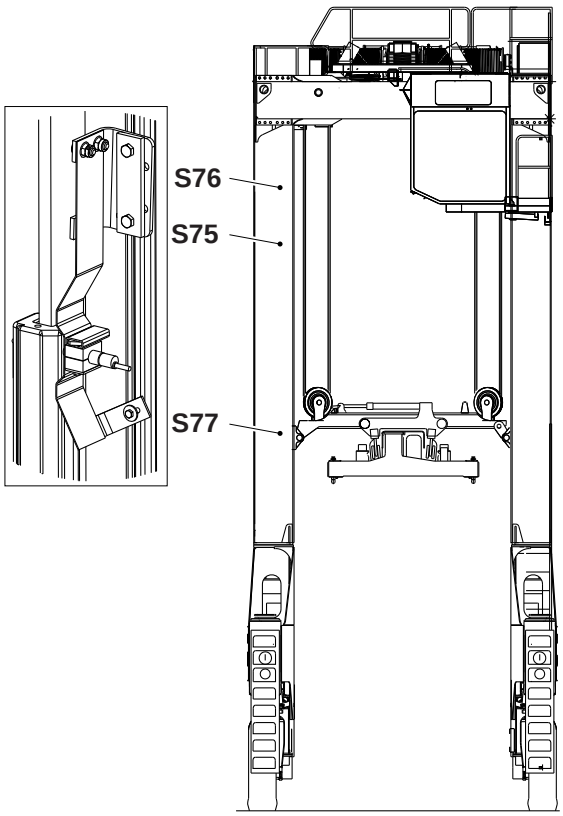
1. Rope drum
2. Hoist motor (M5-M6)
3. Hoist brake
4. Hoisting gear
5. Pulse encoder (B6)
6. Pulley
7. Lifting beam
8. Rope fastening device, sensors (S101-S104)
9. Hoist rope

Hoist brake valve, safety valve and pressure switch for brake pressure



Item numbers refer to the hydraulic diagram, Section *E*, Chapter *10 Common hydraulics*.

20	Hoist brake valve
58	Safety valve
68	Pressure switch for brake pressure
95	Hand pump
PS	Pressure adjustment screw
PM	Pressure measurement point



Height limit switches

Item numbers refer to the circuit diagram, Section *E*, Chapter *11 Common electrics*.

S75 Cabin area switch (machine equipped with a front cabin)

S76 Limit switch for maximum hoisting height

S77 Height counter reset switch

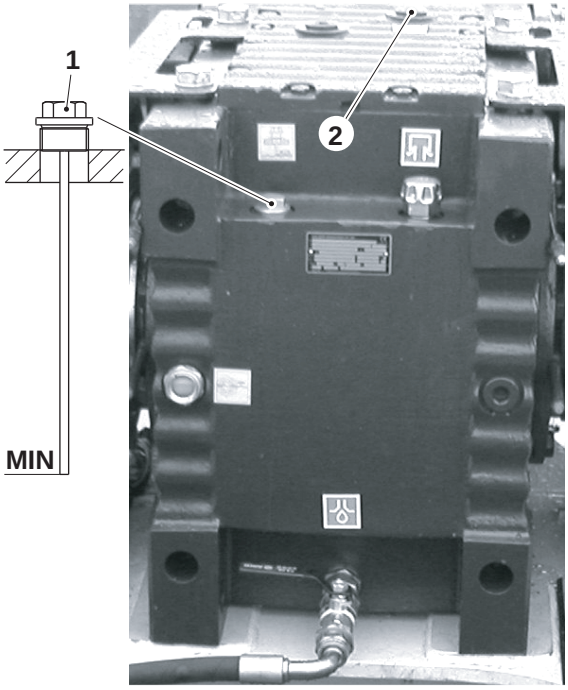
7.2.1 Hoisting device

7.2.1.1 Checking the hoisting gear oil level

Instructions

IMPORTANT

Take care to ensure absolute cleanliness. Impurities in oil cause damage to the system.



1 Clean the dipstick (1) and check the oil level as indicated in the figure.

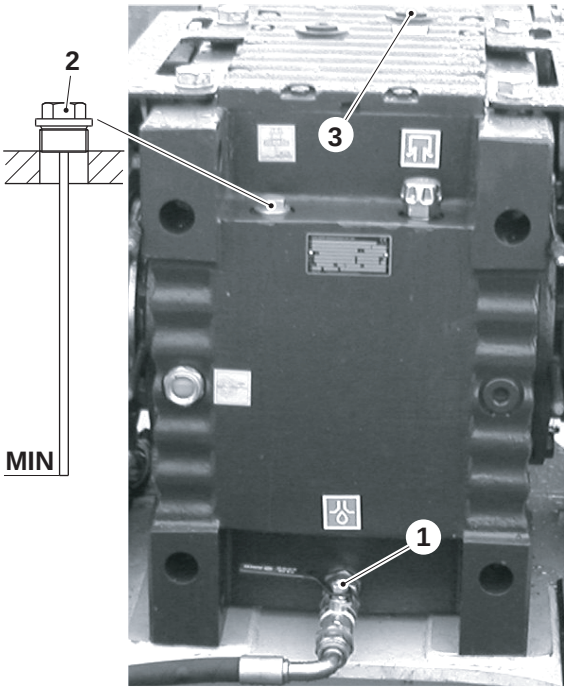
2 The oil level must be above the MIN mark on the dipstick. If necessary, add oil through the refilling point (2). For the oil type, see Section *F Specifications*.

7.2.1.2 Changing the hoisting gear oil

Instructions

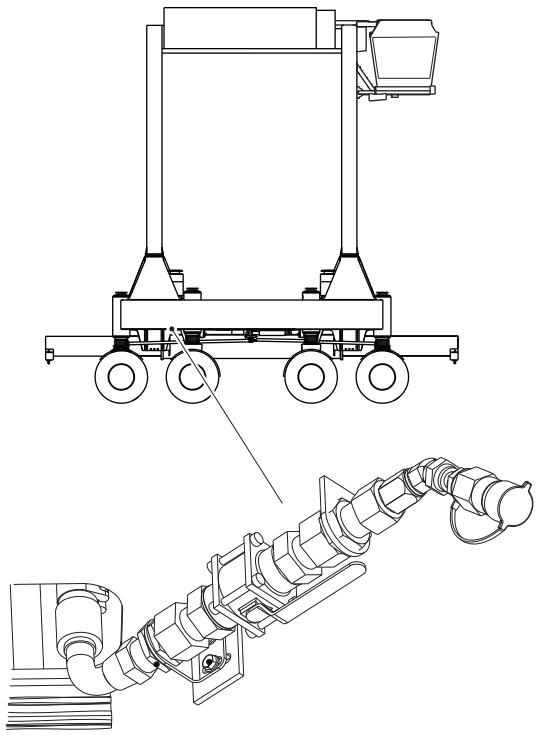
> **CAUTION**
>
> **Avoid skin contact with oil. Use protective gloves.**

> **IMPORTANT**
>
> **Be careful not to discharge oil into the environment. Use an appropriate container, and deliver the oil and the used filter to a hazardous waste collection point.**
>
> **Take care to ensure absolute cleanliness. Impurities in oil cause damage to the system.**



1 Operate the hoist system until the hoisting gear is warm.

2 Open the drain valve (1).



3 Drain the oil into a container through the drain line on the side frame.

4 Close the valve.

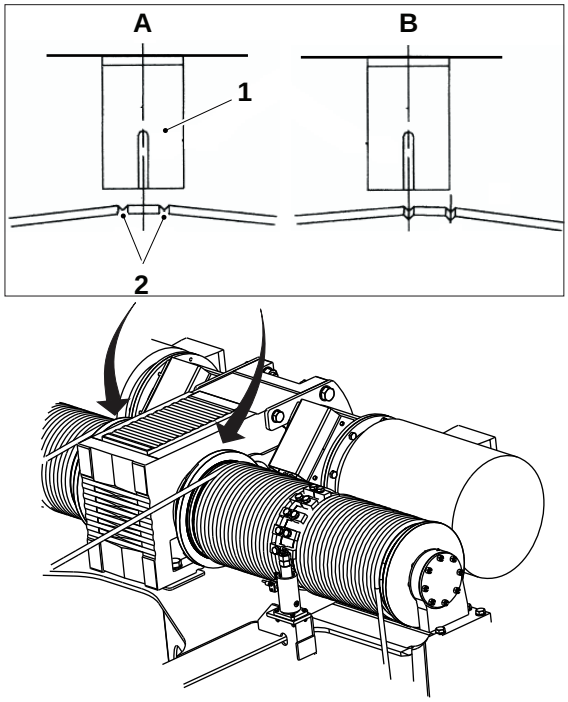
5 Fill the hoisting gear with oil through the filler opening (3). The oil level must be above the MIN mark on the dipstick (2). For the oil volume and type, see Section *F Specifications*.

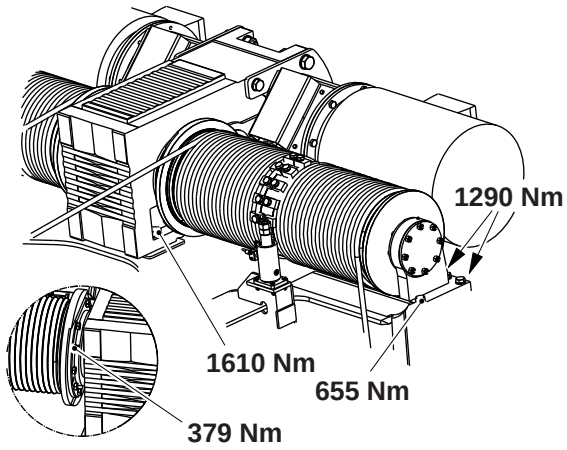
7.2.1.3 Checking the secondary coupling of the hoisting gear

Instructions

Check the wear of the coupling teeth on the basis of the indicator (1) on the coupling flange and the marks (2) on the hub.

In a new coupling, the indicator is at the middle of the marks (Figure A). As the teeth are worn, the indicator moves in relation to the marks. When the indicator has moved to the mark (Figure B), the coupling must be replaced.





7.2.1.4 Checking the fastening of the hoisting system

Instructions

Check the fastening of the hoisting system.

7.2.2 Hoist brake

Safety

DANGER

The spreader must always be fully lowered before servicing the hoist brakes.

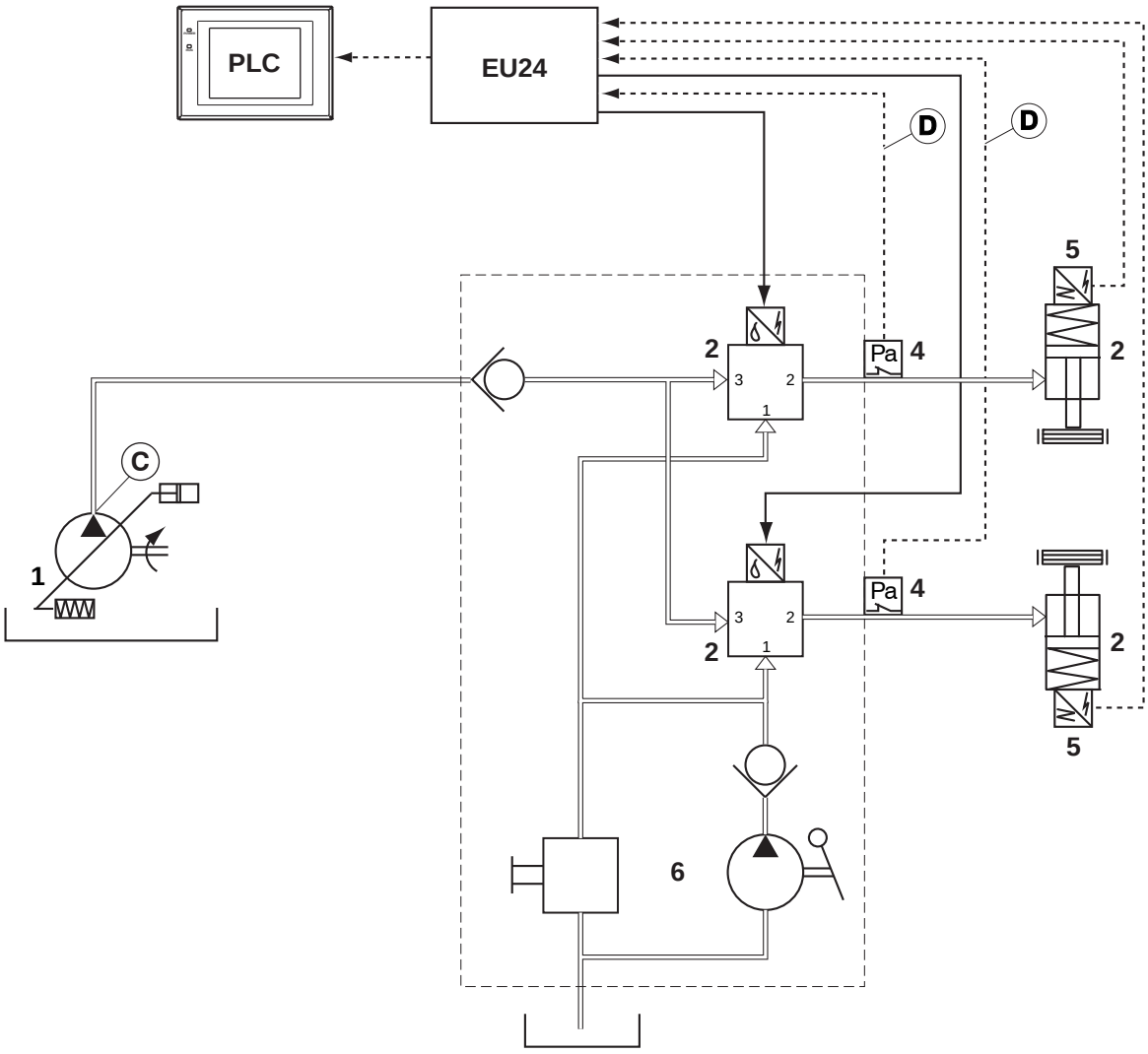
The hoist brake is a safety device. The brakes must be installed, serviced, and repaired by trained service personnel.

Description

The brakes are spring-loaded, fail-safe disc brakes. The brakes are released by hydraulic pressure. The hoisting system is equipped with an emergency lowering unit with which the spreader can be lowered safely in a situation where normal lowering is not possible.

The PLC monitors brake pad wear with a wear sensor, and indicates the need for brake adjustment.

Function description



Item numbers in parentheses refer to the hydraulic diagram, Section *E*, Chapter *4 Brakes* and Chapter *10 common hydraulics*

Pos	Function	Signal description	Reference
1	The variable displacement axial piston pump (12) produces the hydraulic power.		Section *10*, Chapter *10.4 Pumps*

Pos	Function	Signal description	Reference
2	When the hoisting or lowering is activated with the control lever, the solenoid valves (20.4, 20.5) are energised and the pressure is delivered to the hoist brakes. Brake is released. When the spreader movement stops, the solenoid valves are de-energised and the pressure is released from the brakes. Brake is applied.	Pressure value (PM14). See Section *E*, Chapter *10 Common hydraulics*.	Chapter *7.2.2.2 Checking and adjusting the brake pressure*
3	The hoist brakes (7.1, 7.2) are released by a piston that moves the brake pads away from the brake disc. The spring-loaded piston keeps the hoist brake on while the spreader is stationary.		
4	The PLC monitors the operation of the brake with the pressure switches (68.1, 68.2).		Section *8*, Chapter *8.4 Diagnostics*
5	The PLC monitors brake pad wear with wear sensors (S105, S106), and indicates the need for adjustment.		Chapter *7.2.2.3 Replacing and adjusting the brake pad wear sensor*
6	The lifting system is equipped with an emergency lowering unit, with which the spreader can be lowered manually.		Chapter *7.2.5 Emergency lowering of the spreader*

7.2.2.1 Checking and adjusting the hoist brake

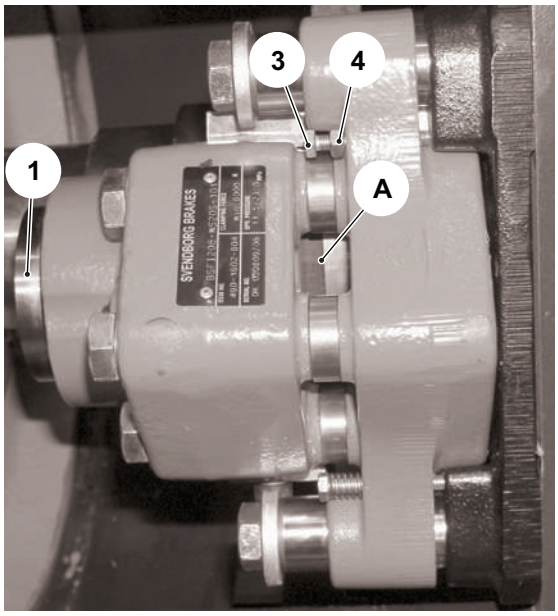
General

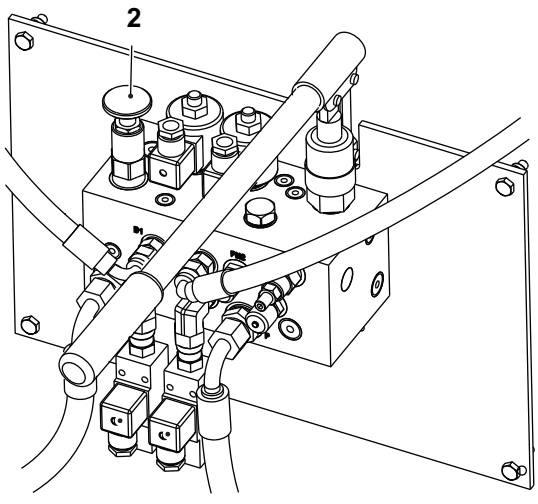
When the hoist brake is released, there is a gap between the brake disc and brake pad. When the gap increases excessively due to brake pad wear, the brake must be adjusted. The PLC indicates the need for adjustment.

Instructions

DANGER

When the hoist brake is released, the spreader falls freely. Before releasing the hoist brake, ensure that the spreader is fully lowered.





1 Lower the spreader fully.

2 Tighten the adjustment screw (1) with a spanner wrench until the resistance increases and the brake pads are pressed against the brake disc.

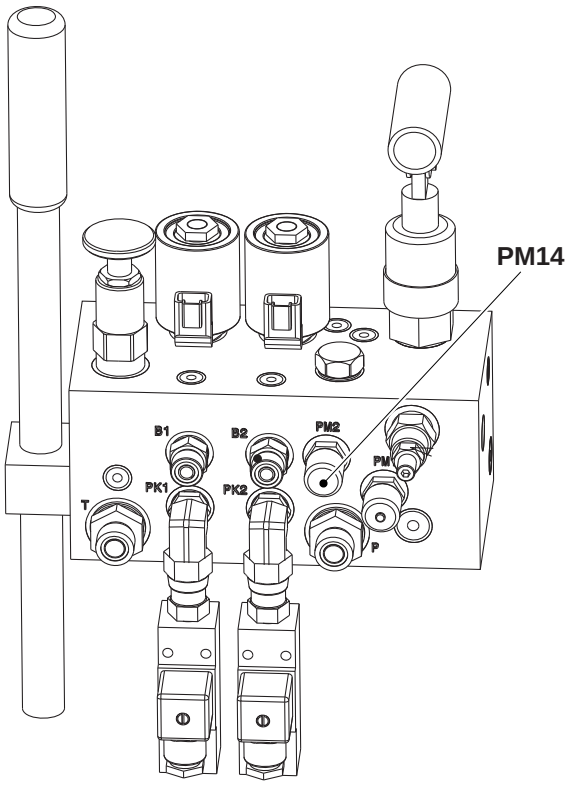
3 Turn the adjustment screw back a half-turn.

4 Release the brake with the emergency lowering unit:

Close the safety valve (2) by pressing the button down. Keep the button pressed, and pump with the hand pump until the brake is fully released.

5 Check the air gap (A) between the brake disc and brake pad. The air gap must be 0,5 mm on both sides of the disc. If necessary, adjust with the adjusting screw (3). Secure with the locking nut (4).

6 If the gap cannot be adjusted to 0,5 mm, the brake pads must be replaced. See *Instructions on page 20*.



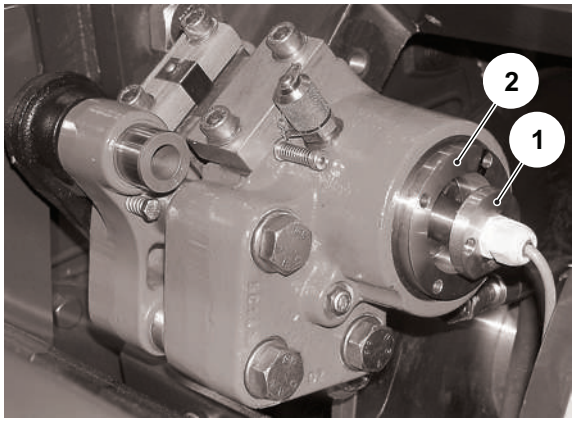
7.2.2.2 Checking the brake pressure

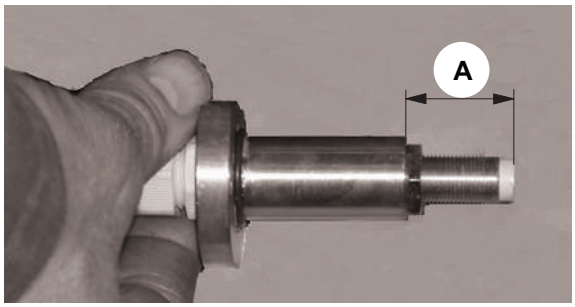
Instructions

1 Connect a pressure gauge to the measuring point (PM14).

2 Start the engine and switch to working speed.

3 Check the pressure on the gauge; for the correct pressure value, see the hydraulic diagram in Section *E*, Chapter *10 Common hydraulics.*





7.2.2.3 Replacing and adjusting the brake pad wear sensor

Instructions

1 Remove the sensor bracket (1).

2 Replace the sensor.

3 Adjust the distance between the sensor and the bracket to 26.6 mm (A), and lock with a nut.

4 Reinstall the sensor bracket.

Check operation

The PLC must signal the hoist brake wear alarm when the brake pads have worn 2 mm (the gap between the brake pad and brake disc is 3 (+/- 0.25) mm when the brake is released). Check the sensor operation as follows:

1 Tighten the adjustment screw (2) fully with a spanner wrench.

2 Open the adjustment screw 1 1/2 turns. This corresponds to the situation where the brake pads are worn to the alarm limit.

3 Check that the PLC signals the brake wear alarm.

4 Adjust the brake; see *Instructions on page 17*.

7.2.2.4 Replacing the brake pads

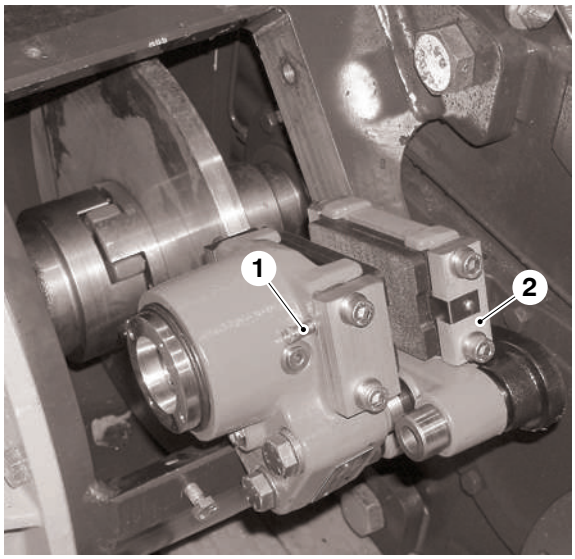
General

The brake pads must be replaced when they have worn by 5 mm.

Instructions

DANGER

When the hoist brake is released, the spreader falls freely. Before releasing the hoist brake, ensure that the spreader is fully lowered.



1 Lower the spreader fully.

2 Release the brake with the emergency lowering unit; see *Instructions on page 37*.

3 Remove the upper fastening screw of the brake and loosen the lower fastening screw. Turn the brake in position shown in the figure.

4 Remove fastening screws (1) of the brake pad and the brake pad holder (2).

5 Replace the brake pads.

NOTE

Keep oil and grease out of the brake pads. If the brake pads touch oil or grease, they must be discarded immediately.

6 Fasten the brake pads with the holder and the fastening screws.

7 Fasten the brake back in its place.

8 Adjust the brake; see *Instructions on page 17*.

7.2.2.5 Bleeding the brake system

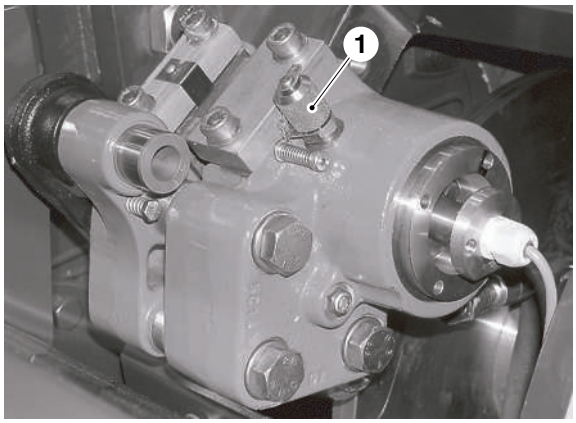
General

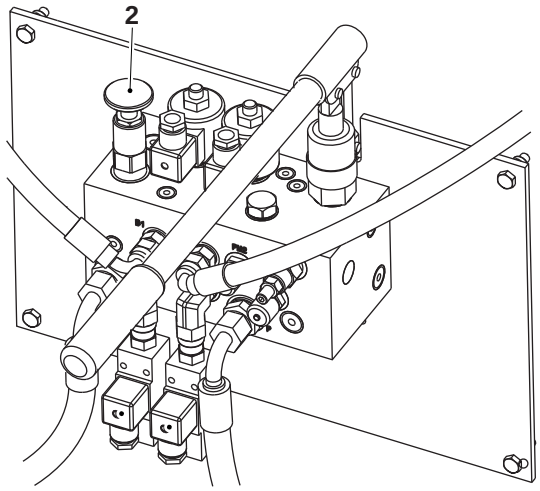
The brake system must always be bled when repairing or making changes to it. If air has entered the brake system, braking power decreases, as the air yields in the oil. Bleeding is recommended several times a year.

Instructions

IMPORTANT

Be careful not to discharge oil into the environment. Use an appropriate container, and deliver the oil to a hazardous waste collection point.





1 Lower the spreader fully before you start bleeding the brakes.

2 Connect a hose equipped with a pressure gauge fitting to the brake bleed nipple (1), and place the other end of the hose in a container.

3 Bleed the brake with the emergency lowering unit:

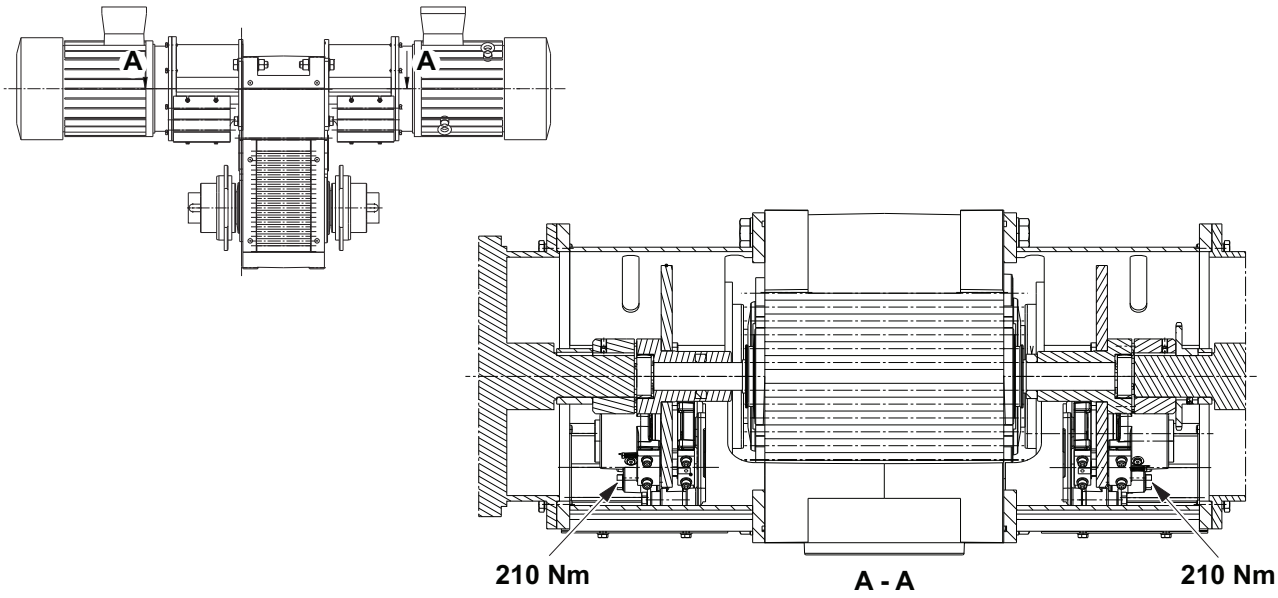
Close the safety valve (2) by pressing the button down. Keep the button pressed, and pump with the hand pump until the oil flowing out of the hose is completely free of air.

NOTE

Keep oil and grease out of the brake pads. If the brake pads touch oil or grease, they must be discarded immediately.

4 Both brakes must be bled at the same time.

7.2.2.6 Tightening torques

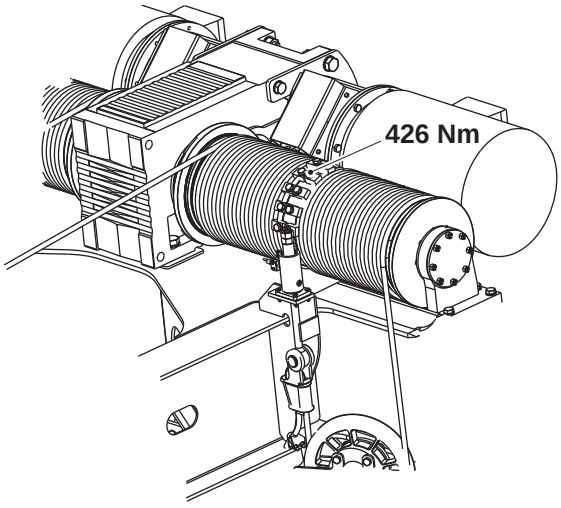


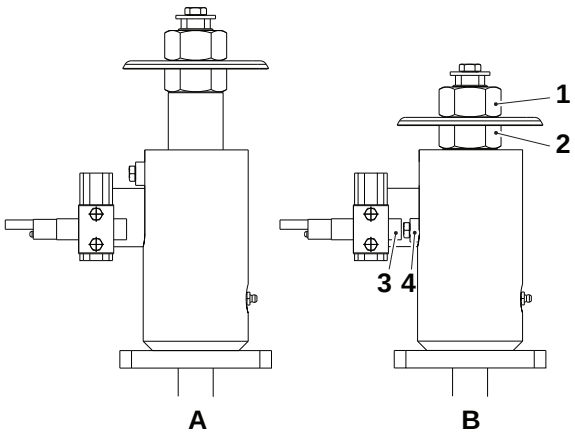
7.2.3 Hoist ropes

7.2.3.1 Checking the fastening of the hoist ropes

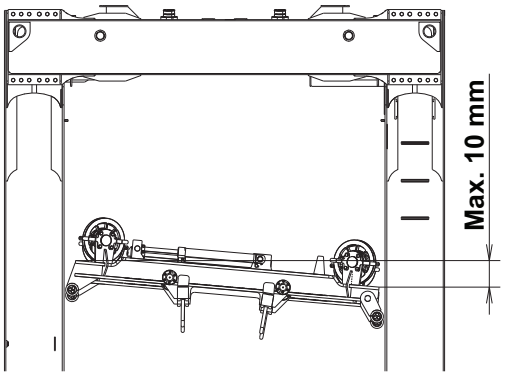
Instructions

Check the fastening of the hoist ropes.

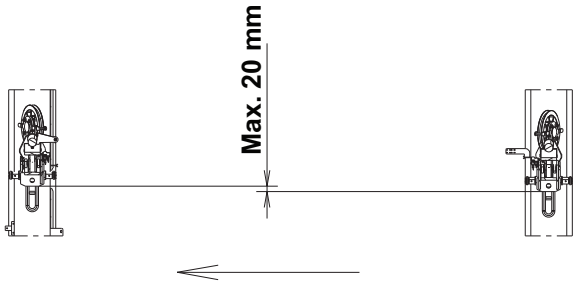




Rope fastening device
A. Ropes slackened (no spreader load)
B. Ropes suspended (with spreader load)



Machine front view.



Machine side view. Arrow indicates forward driving direction.

7.2.3.2 Checking the adjustment of the hoist ropes

Instructions

1 The machine must be parked on a level surface.

2 Hoist the spreader so that it is suspended from the ropes.

3 Check that the sensor (3) and its counterpart (4) are aligned in all fastening devices as shown in the figure (B). Adjust the sensors if necessary.

NOTE

The lifting beam has to be as straight as possible after the rope adjustment. Maximum allowed difference between lifting beam ends is 10 mm and maximum allowed difference between spreader ends is 20 mm.

If necessary, adjust as follows:

4 Slowly lower the spreader until the lowering movement is stopped automatically as the ropes slacken.

5 Loosen the lock nut (1), and adjust the rope with the adjustment nut (2). Tighten the lock nut.

7.2.3.3 Checking the condition of the hoist ropes

General

IMPORTANT

Any changes noticed in the condition of the hoist ropes must be reported to a supervisor or service personnel responsible for servicing the machine.

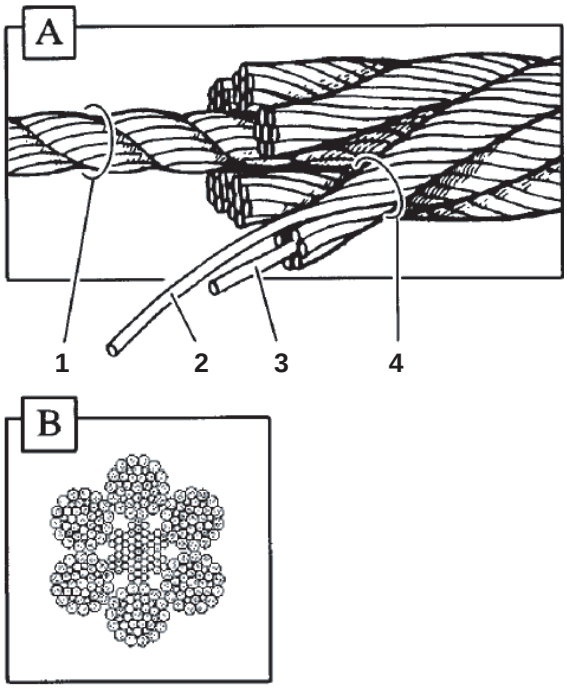
The condition of the hoist ropes is one of the key factors affecting the reliability and safety of lifting devices.

The hoist ropes must be visually checked daily for any damage and deformations. Pay special attention to the point at which the rope meets the pulley when the spreader is at the container transportation height.

Pay particular attention to the condition and operation of the ropes during the first 50 hours of operation after replacing the cable. Practically all acceptable deformations occur during this time.

Rope structure

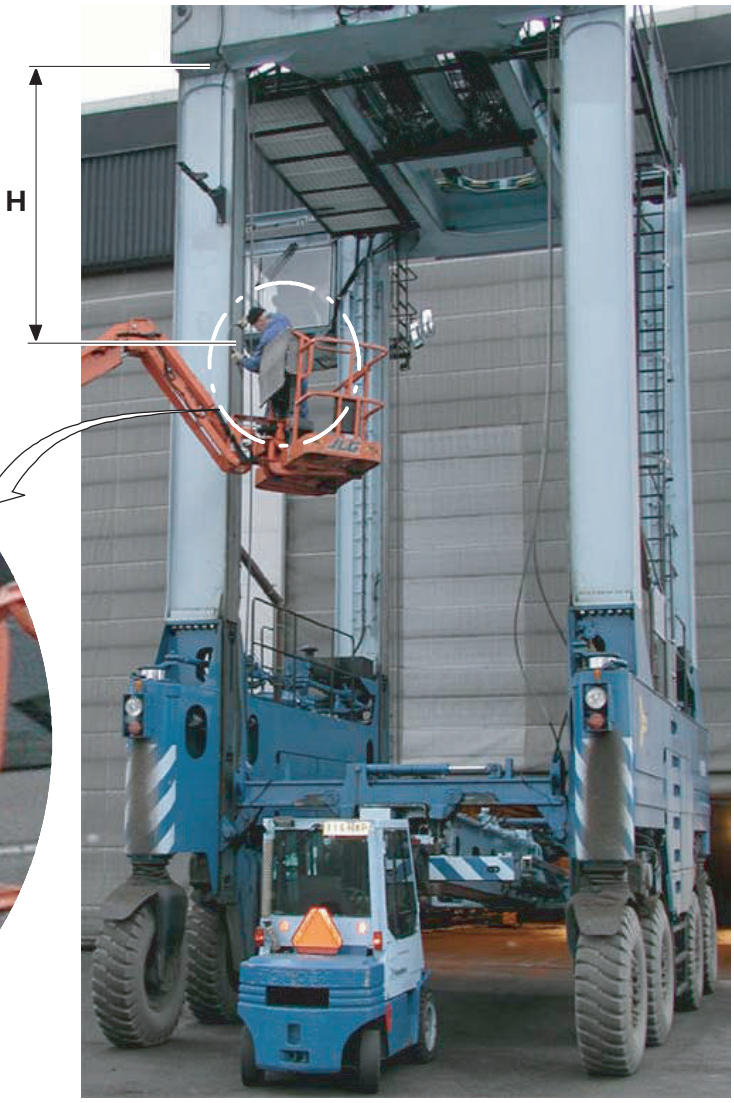
The hoist rope is a steel wire with a diameter of 22 mm.



A. General structure
   1. Rope core
   2. Cord
   3. Strand core
   4. Rope strand

B. Cross-section

Instructions



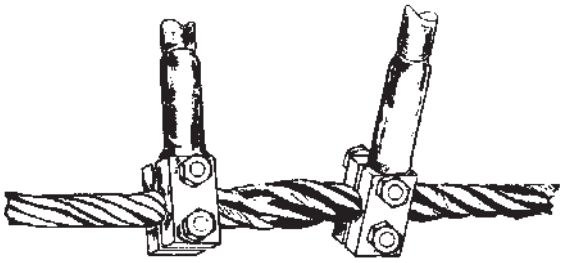
1 Lower the spreader fully.

2 Lift one end of the spreader about 1 metre to slacken the ropes.

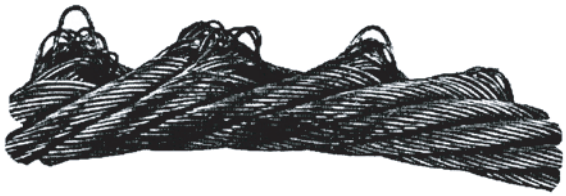
3 Check the ropes along their entire length. Damage is most likely at the points of the rope that are on the pulley when the spreader is at the container transport height. Pay special attention to these points, which are 1 metre up and down from distance H (2.5 m); see picture.

4 Bend the rope in several directions to find any broken cords that are hidden.

5 The inspection must be done for all of the ropes.



Alternatively, the check can be performed as shown in the adjacent figure.



Examples of wires that must be discarded immediately.

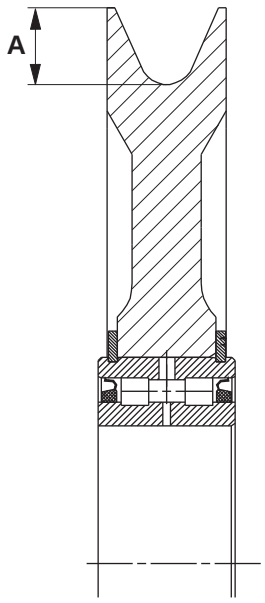
When to discard

The operational safety of a hoist rope is determined by the following:

- Number and type of wire fractures
- Wire fractures near terminals
- Many wire fractures within a short section
- Accumulation of wire fractures
- Broken strands
- Reduced diameter caused by a damaged core
- Reduced elasticity
- Internal and external wear
- Corrosion
- Deformations
- Damage caused by heat or electricity

If the rope damage was caused by a malfunction of the lifting device, the device must be repaired before replacing the rope.

The rope must be discarded if the number of broken cords is more than 14 on a section of 132 mm or 29 on a section of 660 mm. These limits are based on the ISO 4309 and DIN 15020 standards. If broken cords are found but there are fewer of them than this, the ropes must be checked every 500 hours of operation.



7.2.3.4 Checking the pulleys

Instructions

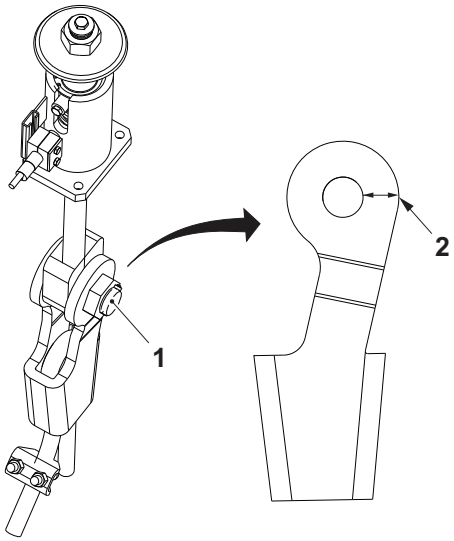
Check the rope groove depth (A). If the depth is more than 40 mm, the pulley must be replaced.

7.2.3.5 Checking the rope fastening wedge clamps

Instructions

The rope fastener wedge clamp mounting bolt and the bolt hole must be checked for amount of wear. Also check visually for signs of wear.

Checking

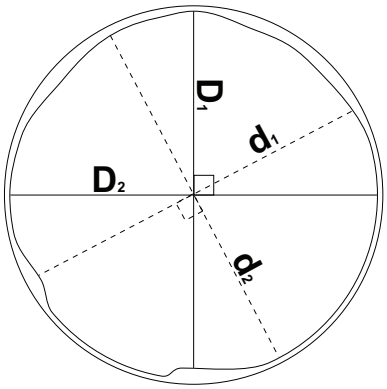


1 The machine must be parked on a level surface.

2 Lift the spreader (using a forklift or similar) and place supports under the lift beams in order to support the spreader.

3 Loosen and remove the wedge clamp mounting bolt (1) for measuring.

The mounting bolt hole wear is checked by measuring the distance from the edge of the hole to the outer edge of the wedge clamp (2) from several different spots. The measurement must be at least 23 mm. If the measurement is less than 23 mm, the wedge clamp must be replaced.



$$D = \frac{D_1 + D_2}{2} \qquad d = \frac{d_1 + d_2}{2}$$

Measuring and calculating the mounting bolt diameter averages.

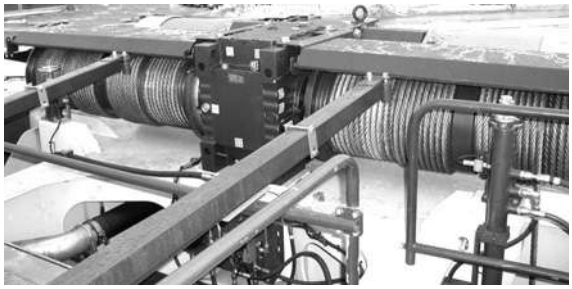
4 Measure the mounting bolt diameter from two places (D_1 , D_2) that are perpendicular to each other. Repeat the measurement from another spot (d_1 , d_2). Calculate the averages for these diameter measurements as shown in the figure.

The smallest calculated value must be at least 36 mm. If the lowest value is lower than 36 mm, the bolt must be replaced.

7.2.3.6 Checking the rope guards

Instructions

Check the condition and fastening of the rope guards.



7.2.3.7 Replacing the hoist ropes

General

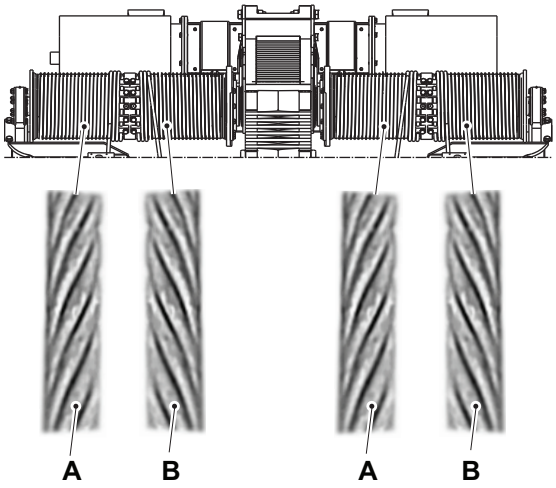
CAUTION

Weight of the rope: 2.2 kg/m.

Use appropriate lifting equipment for handling components.

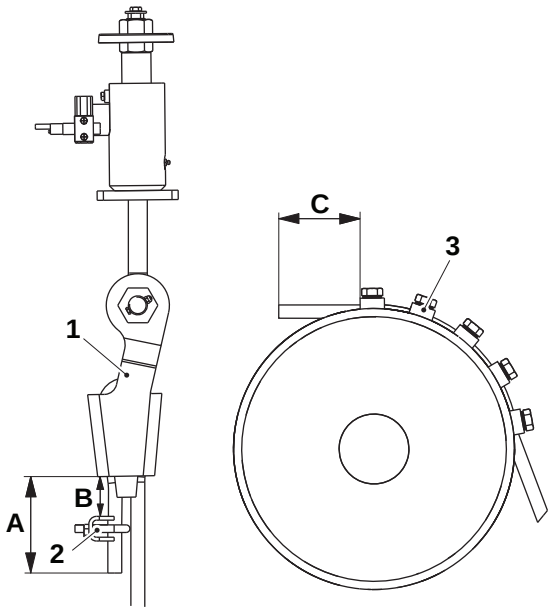
Instructions

Pay attention to the stranding direction when replacing the hoist ropes; see figure.



A. Right handed stranding

B. Left handed stranding



1 Lower the spreader fully.

2 Remove the rope to be replaced.

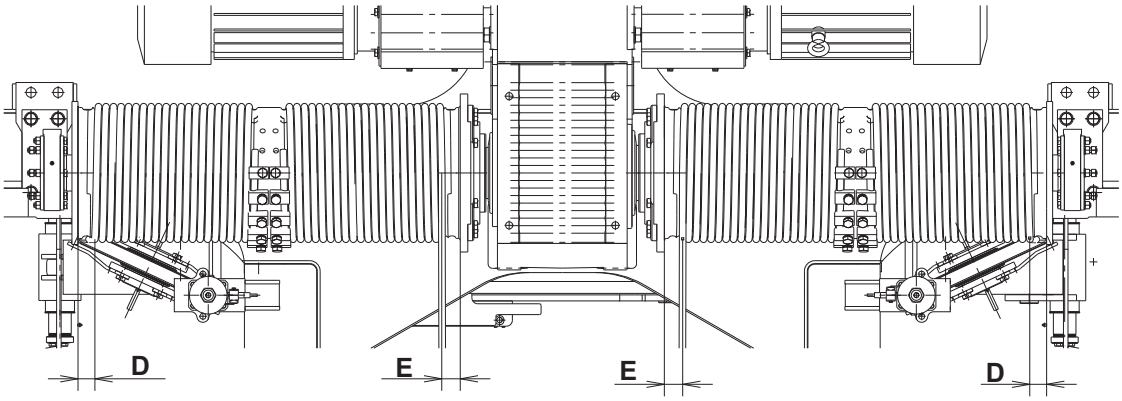
3 Before installing new ropes, lift the front lifting beam approximately 20 mm higher than the rear end lifting beam to compensate rope stretching.

4 Install the new rope in the wedge clamp pocket (1). Length of the rope's free end A = 200 mm. Tighten the rope lock (2) into place. The maximum distance (B) between the wedge clamp and the rope lock is 140 mm. Remaining rope ends are bent towards the load space.

5 Slide the rope through the pulleys and rope guards to the rope drum. Before fastening the rope with the mounting pieces, ensure that at least 3 revolutions of each rope is on the drums.

6 Fasten the rope to the drum with the mounting pieces (3). Length of the rope's free end C = 50 mm.

Tightening torque for the mounting pieces (3): 426 Nm. When tightening the mounting pieces, ensure that the mounting pieces do not turn.



7 Check the measurements from rope separation point from the hoist reel flange (D, E) with lifting beam in contact with the upper frame.

D= 56 mm

E= 61 mm

NOTE

If ropes are too long, ropes can be shortened from the hoist drum end. When hoist ropes are shortened, a rope clamp must be assembled to prevent the rope structure from breaking.

8 Adjust the hoist ropes; see Chapter *7.2.3.2 Checking the adjustment of the hoist ropes*.

Running in the hoist ropes

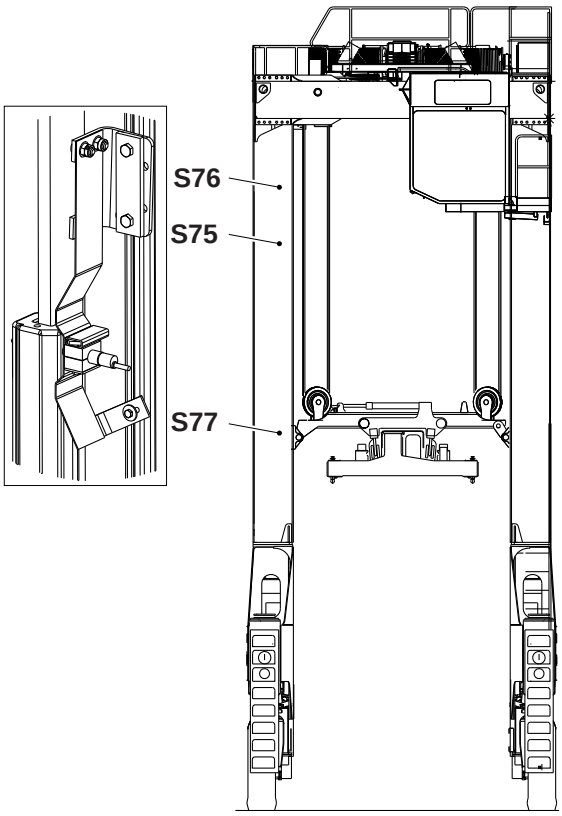
The hoist ropes should be run in before using them for work, so that the ropes are set in the correct positions.

1 Before lifting, check that the ropes are installed correctly and that they are not touching the structures.

2 Lift a container of 40 tons from the ground to the uppermost position 20 times. Use only half the speed for the two first lifts. Perform the whole running in by accelerating and decelerating carefully.

3 If there is no container of 40 tons available, a container of 25 tons can also be used for running in the ropes. In that case, 30 lifts are required.

4 Check the rope adjustments after the running in.



7.2.4 Checking the height limits

General

The operation of the spreader height counter and limit switches can be monitored from the PLC maintenance pages; see Section *8*, Chapter *8.4 Diagnostics*.

S75 Cabin area switch (machine equipped with a front cabin)

S76 Limit switch for maximum hoisting height

S77 Height counter reset switch

For correct heights, see table in *7.2.4.4 Adjusting the height limit sensors*.

7.2.4.1 Cabin area switch (S75) (machine equipped with a front cabin)

General

The cabin area switch (S75) sends a signal to the PLC when the spreader approaches the cabin. The purpose of the area switch is to prevent the spreader from hitting the cabin.

Instructions

Side shift the spreader fully towards the cabin. Hoist the spreader slowly until the area switch is activated. The side shift must be centred automatically, thus preventing the spreader from hitting the cab.

Stop hoisting immediately if the spreader hits the cabin. Check the limit switch.

7.2.4.2 Height counter reset switch (S77)

General

The PLC calibrates the height counter when the spreader passes the reset switch during hoisting/lowering.

Instructions

Check that the maintenance page reading corresponds to the distance of the spreader from the ground when the spreader is fully down, at reset height, and fully up. Measure the distance to the lower surface of the T-beam. Check the reset switch.

7.2.4.3 Limit switch for maximum hoisting height (S76)

General

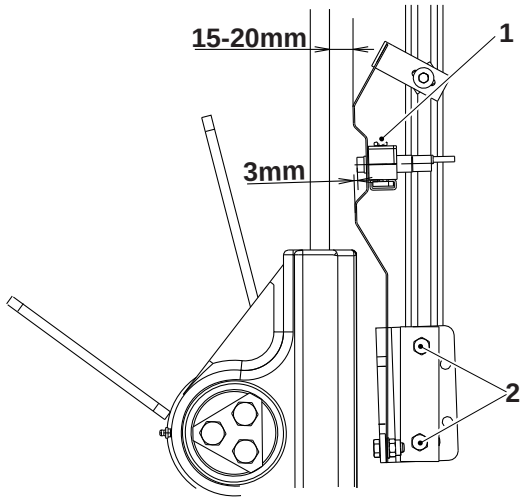
The limit switch for maximum hoisting height sends a signal to the PLC when the spreader reaches the maximum height. The PLC stops the hoisting and prevents the spreader from hitting the machine frame.

Instructions

Hoist the spreader slowly until the limit switch is activated and the spreader stops. If the spreader stops before the limit switch is activated, use the “hoist prevention bypass” key switch.

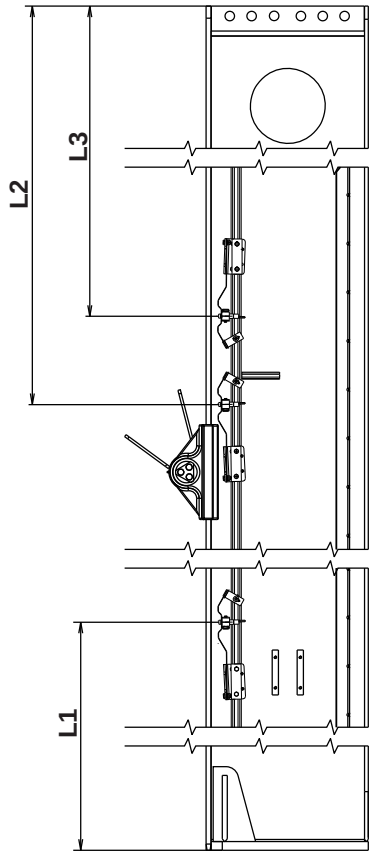
Stop hoisting immediately if the spreader hits the frame or pipes. Check the limit switch.

7.2.4.4 Adjusting the height limit sensors



Instructions

1. Check the sensor’s distance from the bracket. The optimal distance is 3mm. Adjust if necessary.
   - Loosen the nut (1) and adjust the distance.
   - Tighten the nut.
2. Check the angle of mounting bracket by measuring the distance between the rail and the bracket. The optimal distance is 15-20 mm. Adjust if necessary.
   - Loosen the screws (2) and adjust angle.
   - Tighten the screws.
3. If the mounting bracket structure has become loose and the adjustment cannot be performed, replace the mounting bracket.



Rear view of column 2.

Position of sensors

L1, L2, L3 Position of sensors on column.

Version	**L1** [mm]	**L2** [mm]	**L3** [mm]	**Reset** [mm]	**Upper limit** [mm]	**Cabin area switch** [mm]
N5942811	1541	-	1033	5000	9200	-
N5942812	1541	-	1407	5000	9200	-
N5942813	1541	2183	1833	5000	9200	8850
N5942814	1391	1459	1109	5000	9100	8750
N5942815	3541	2023	1673	7000	9510	9160
N5942816	1541	2318	1968	5000	12000	11650
N5942817	1541	1583	1233	5000	12000	-
N5942818	1541	-	1233	5000	12000	-
N5942819	1541	-	1233	5000	9600	-
N5954541	1546	2448	2048	5000	9510	9110
N5954542	1546	2558	2158	5000	9750	9350
N5954543	1546	2808	2458	5000	9150	8800
N5954544	1546	2893	2543	5000	12000	11650
N5954545	1546	-	1508	5000	9100	-
N5954546	1546	2558	2208	5000	9100	8750
N5954547	1546	2558	2208	5000	9500	9150
N5954548	1546	2778	2378	5000	9400	-
N5954691	1546	-	1526	5000	9100	-
N5954692	1728	2594	2244	5000	9200	8850
N5954693	1546	2576	2226	5000	9200	8850
N5954694	1046	3838	1676	4500	9550	7000
N5954695	3546	2416	2066	7000	9510	9160
N5954696	1546	2711	2361	5000	12000	11650
N5954697	1546	-	1626	5000	12000	-
N5954698	1546	2591	2141	5000	12100	11650
N5954811	1546	-	1526	5000	9100	-
N5954812	1546	3426	3076	5000	11950	11600
N5954813	1546	-	1626	5000	9100	-
N5954814	1546	1876	1526	5000	9100	8750
N5954815	1546	2081	1731	5000	12000	11650

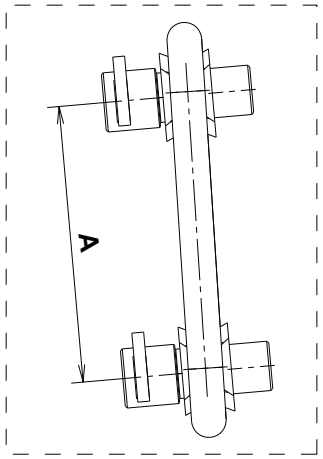
Version numbers refer to the Spare part catalogue, Section *7*, Chapter *7.2 Lifting/lowering*, *FASTENING, HEIGHT SENSOR*.

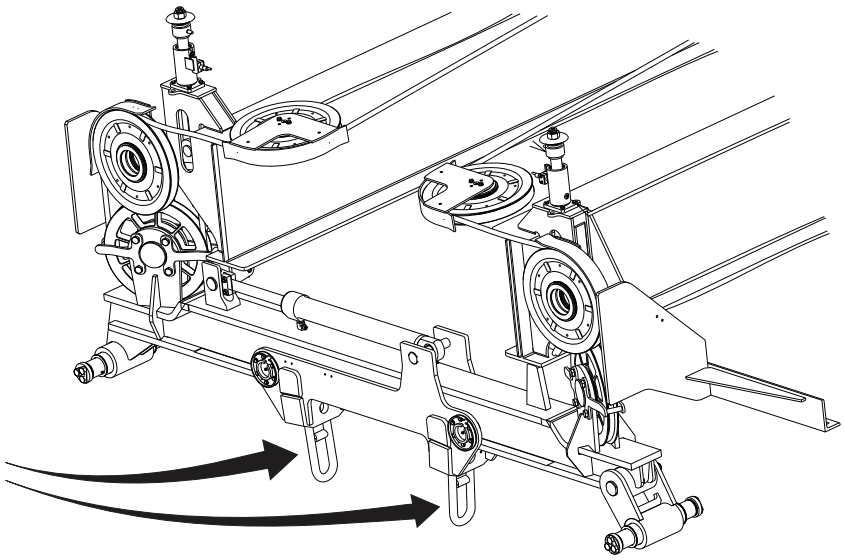
7.2.5 Checking the spreader links

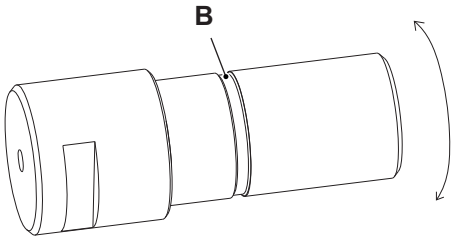
Instructions

Check the spreader link length by measuring the distance A.

After the length A has reached 285 mm (initial length 280mm), other spreader link check points (shaft, link diameter and sleeve) must be inspected once a year.

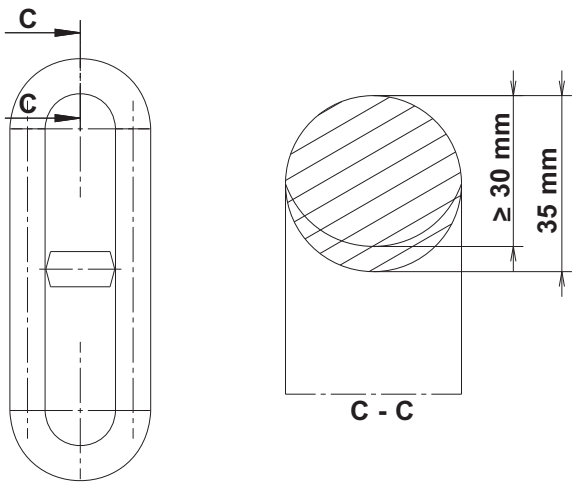






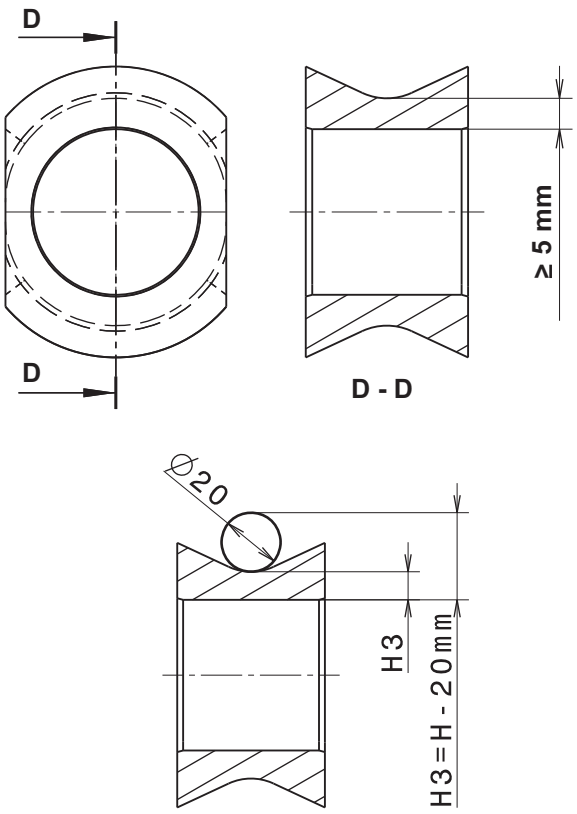
1. Shaft, 8 pcs.

   Check that the grease groove (B) is visible (depth at least 1 mm) and shaft can be rotated once around 180°.



2. Link diameter, 4 pcs.

   Minimum diameter (C) of the link is 30 mm. Check diameter for both ends, top and bottom. Diameter of a new link is 35 mm.



3. Sleeve, 4 pcs.

   Sleeve edge must have a minimum thickness of 5 mm.

   Measurement can be taken with a 20 mm diameter rod as a measuring aid.

7.2.6 Emergency lowering of the spreader

General

The hoisting system is equipped with an emergency lowering unit, with which the load can be lowered safely in case of an emergency.

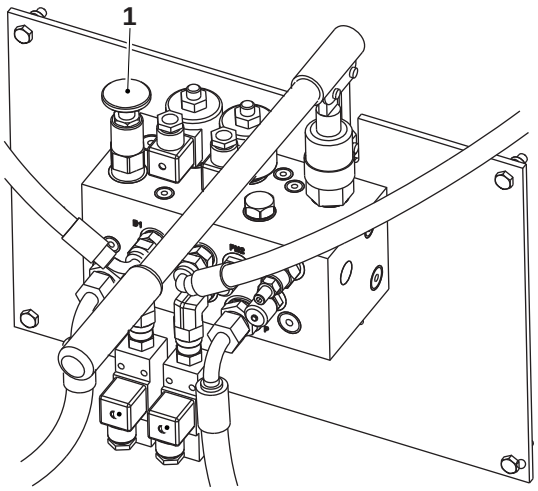
When the machine functions normally, the hoist brake is released by hydraulic pressure received from the machine's hydraulic system. In an emergency, the spreader is lowered by using the emergency lowering unit to generate the hydraulic pressure needed for releasing the hoist brake.

Instructions

⚠ DANGER

Ensure that there are no persons below the spreader when using the emergency lowering unit.

Lower the spreader slowly.



1 Close the safety valve (1) by pressing the button down. The button must be pressed in order for the brake to be released. When the button is released, the pressure is discharged through the safety valve and the brake is engaged.

2 Pump with the hand pump to start lowering the spreader. In case of an emergency, release the safety valve button.

7.2.7 Emergency hoisting of the spreader

General

In an emergency, the spreader can be lifted by using a separate emergency hoisting unit.

The unit's hydraulic motor drives the hoisting system by a chain gear. The hydraulic power needed is received from the machine's hydraulic system. If necessary, the hydraulic power is generated in the machine's hydraulic circuit by a separate emergency unit.

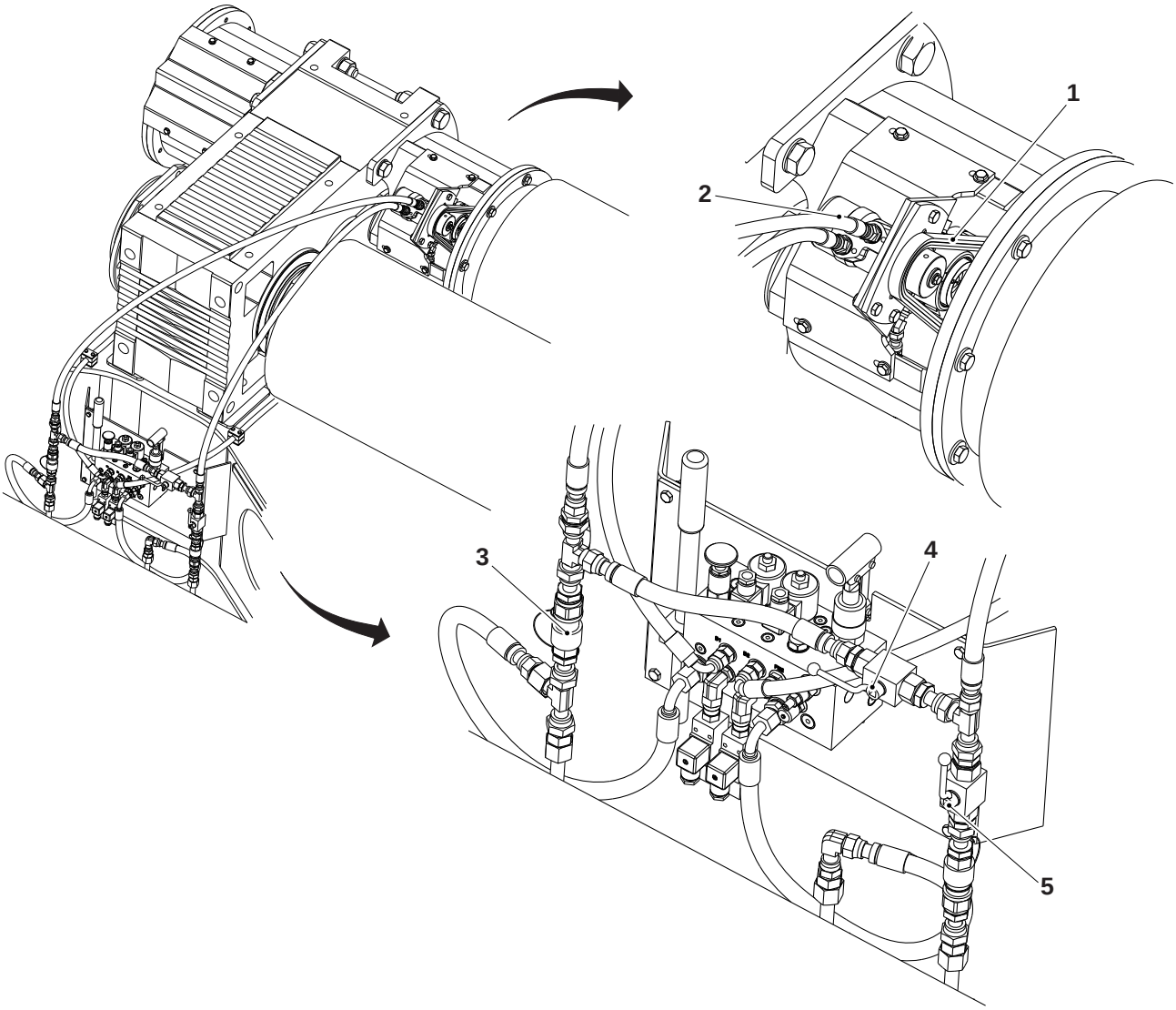
The hoisting is controlled with the hoist brake using the emergency lowering unit.

Instructions

DANGER

Ensure that there are no persons below the spreader when using the emergency lifting unit.

Lower/lift the spreader slowly.



1 Install the chain (1) on the chain wheel of the hoist motor shaft. Mount the emergency hoisting unit (2) on the hoisting system, and connect the hoses (3) to the machine's hydraulic system.

2 Close the hydraulic motor unloading circuit valve (4). Open the pressure line shut-off valve (5). The valves are shown in the open position in the figure.

3 Start the engine and switch to working speed.

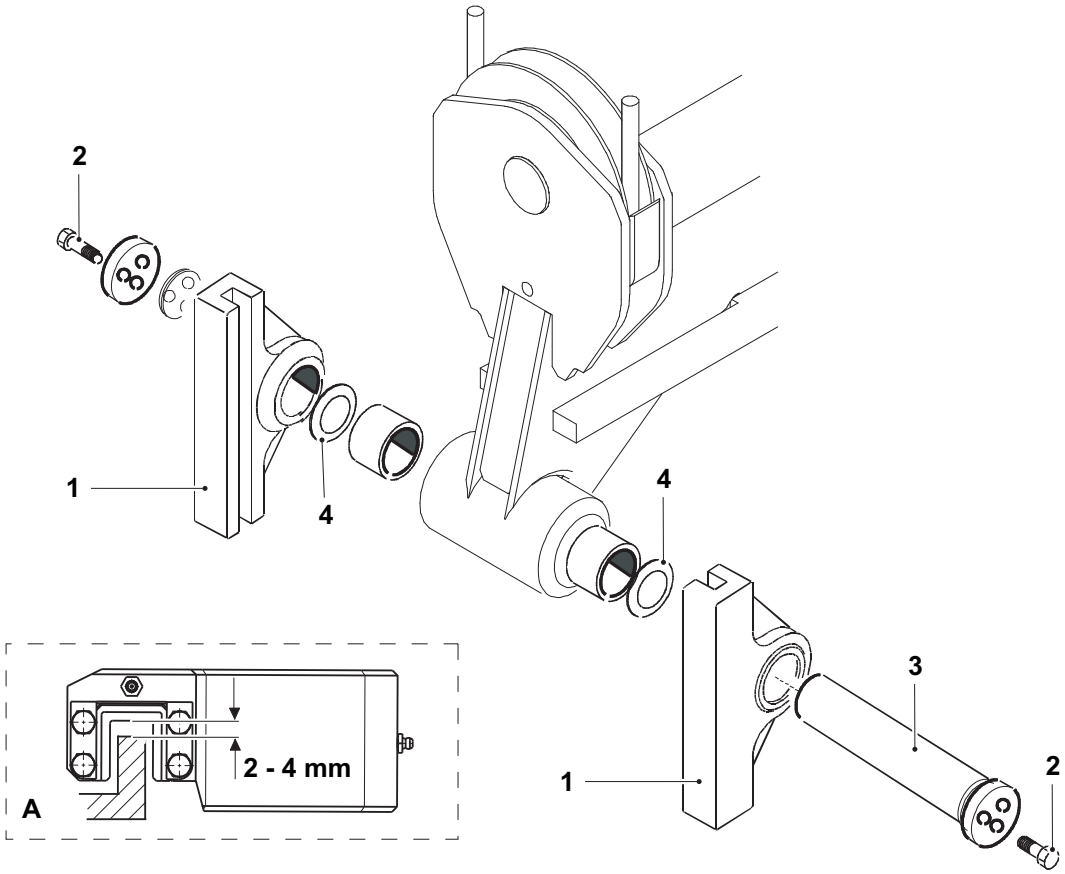
If hydraulic power cannot be received from the machine's own system, it is generated by the emergency unit; see Section *10*, Chapter *10.7 Hydraulic auxiliaries*.

4 The lifting/lowering is controlled with the hoist brake using the emergency lowering unit; see Chapter *7.2.7 Emergency lowering of the spreader*.

5 When lowering the spreader, open the unloading circuit valve (4) and close the pressure line shut-off valve (5).

7.2.8 Adjusting the lift beam play

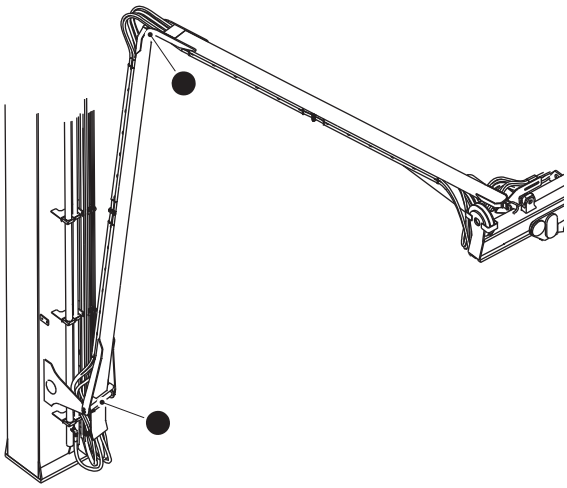
To adjust the play between the gliding plate and the slide piece (1), measure the top, middle, and bottom widths, for each respective gliding plate,. and then proceed to adjust where the gap is the widest. A suitable play between the plate and slide piece is 2-4 mm (A).



Adjusting

1 Unscrew the three bolts (2) at each end of the slide piece shaft (3).

2 Pull out the shaft (3).



3 There are a number of 2mm washers (4) that you move from inside the slide piece to the outside of the slide piece as required to adjust the play between the gliding plate and slide piece.

4 Replace the shaft.

7.2.9 Lubrication points

Hose bridge

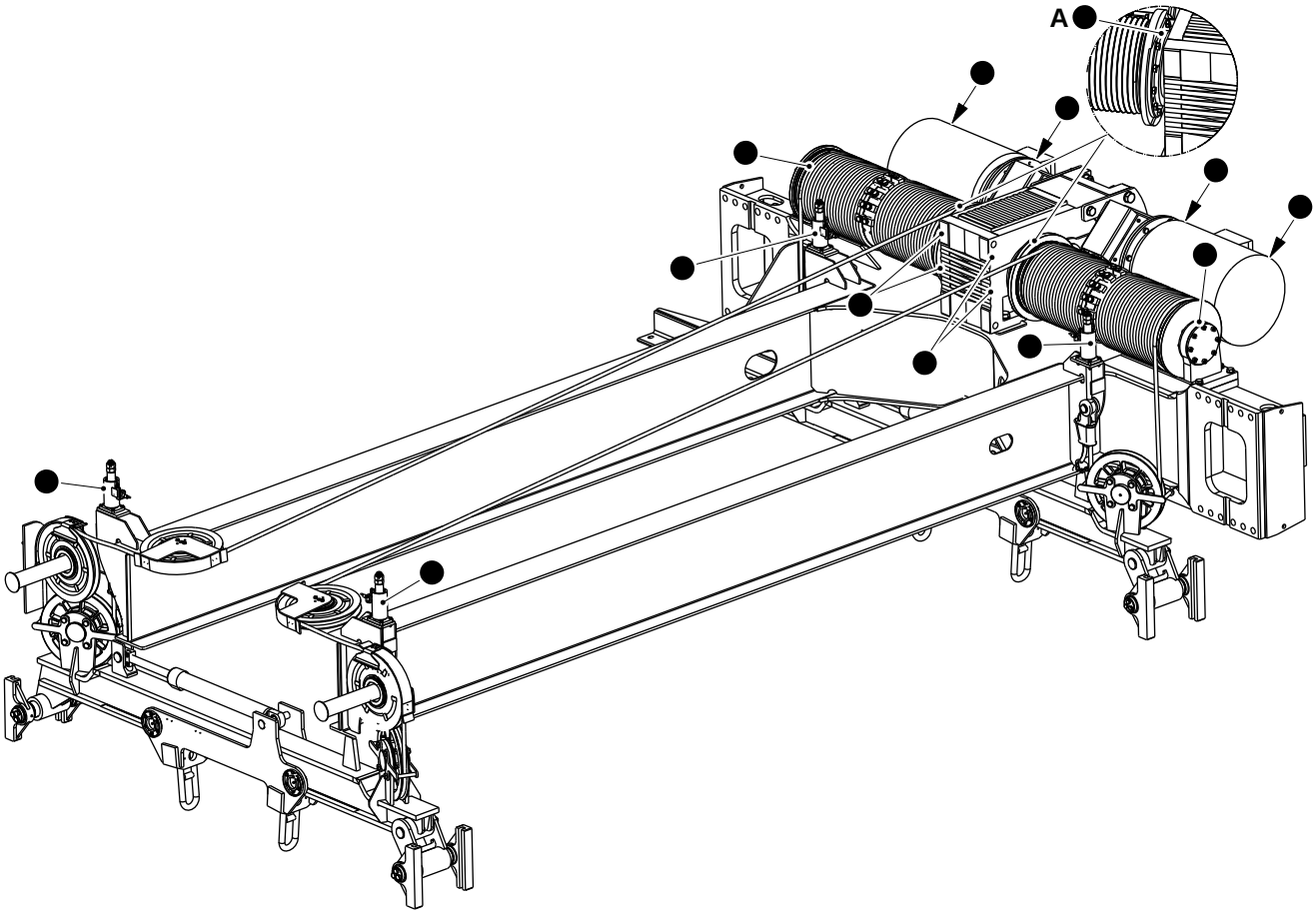
● Manual lubrication

■ Central lubrication

If the machine is not equipped with a central lubrication system

■ = ●

Lifting device



● Manual lubrication

■ Central lubrication

If the machine is not equipped with a central lubrication system

■ = ●

Changing the secondary coupling lubrication grease

IMPORTANT

Be careful not to discharge grease into the environment. Use an appropriate container, and deliver the used grease to a hazardous waste collection point.

Feed grease through the refilling point (A). Collect the grease coming out of the opposite side of the drum into the container.

Hoisting gear bearing axial seal lubrication

IMPORTANT

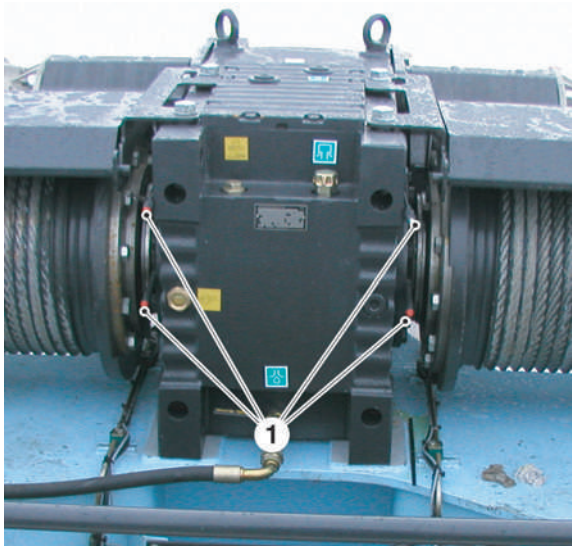
Fill in the grease WHILE THE GEAR UNIT IS ROTATING SLOWLY.

Do not fill in the grease with high pressure!

High pressure causes the grease to come out between shaft seal lip and shaft. As a result, the lip-seal might be damaged or move out of place, grease might enter other components and the bearing housing might become corroded inside.

DANGER

Be particularly careful when working near a rotating rope drum.



Fill in the grease while the gear unit is running by gently pressing the required amount of grease in (1). Do not overfill.

See *F Technical data* for the amount of lubrication grease required and type of lubricant.

7.4 Sideshift

Safety

DANGER

The spreader stop switch must always be depressed when repairing or servicing the spreader.

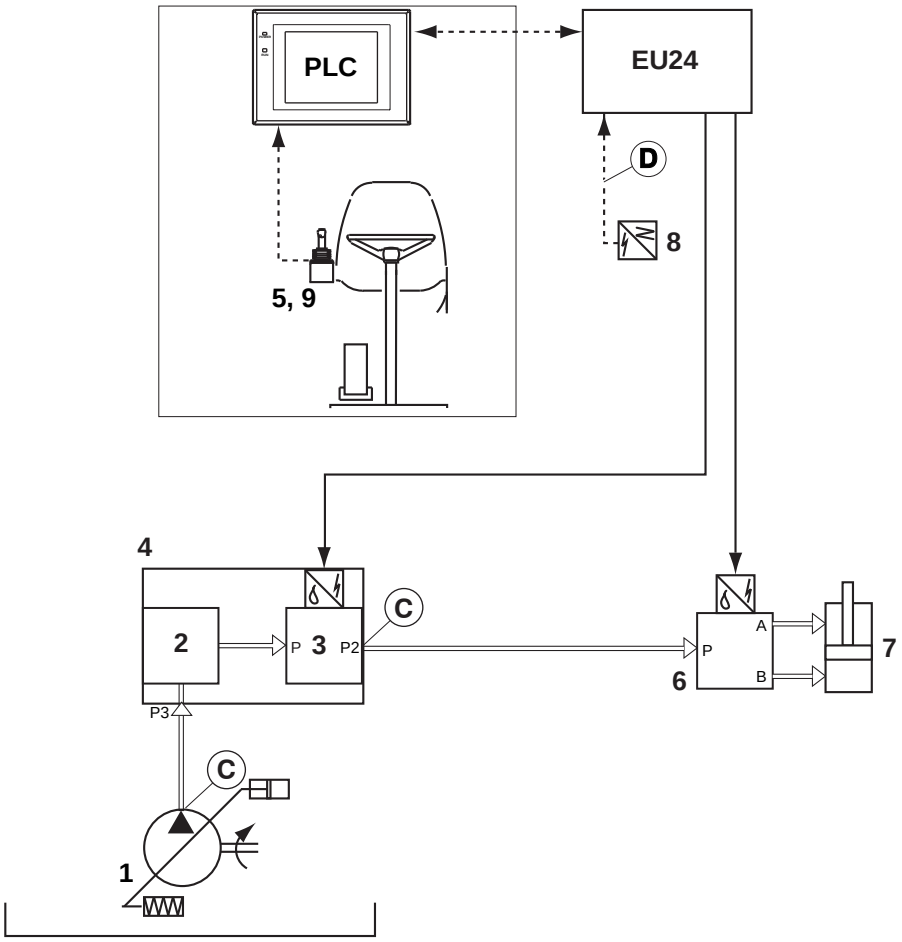
If the stop switch is not depressed, the spreader may move unintentionally, causing a risk of injury.

Description

Each end of the spreader can be moved sideways separately. The spreader is attached to the sideshift carriage, which is moved sideways from the lifting beam by a cylinder. The sideshift is controlled from the cabin with switches.

Centering is a function that returns the spreader to the centre position by the press of a switch.

Function description



Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter *10 Common hydraulics*, and Chapter *11 Common electrics*.

Pos	Function	Signal description	Reference
1	The variable displacement axial piston pump (12) produces the hydraulic power.		Section *10*, Chapter *10.4 Pumps*
2	The priority valve (33) distributes the volume flow between the steering system and spreader hydraulic circuit. The steering system always receives the necessary volume flow before the spreader.		
3	The hydraulic power is delivered to the spreader through the selection valve (20.2/Y65).	Pressure value (PM7). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
4	The spreader- and the priority block (52).		

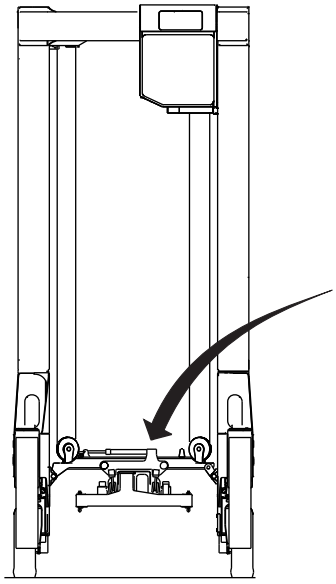
Pos	Function	Signal description	Reference
5	The spreader sideshift is controlled by switches (S25, S27).		
6	The sideshift valve (24.1, 24.3) delivers the hydraulic power to the side shift cylinder.		
7	The cylinder (5.1, 5.2) moves the spreader.		
8	The PLC monitors the position of the spreader with the centering device limit switches (S55-S58).		Section *8*, Chapter *8.4 Diagnostics*
9	The spreader is returned to the centre position with the centering switch (S18). The PLC controls the side shift cylinders on the basis of the signals received from the centering device limit switches. When all limit switches become inactive, the spreader has been centred.		Chapter *7.4.1 Checking the centering device*

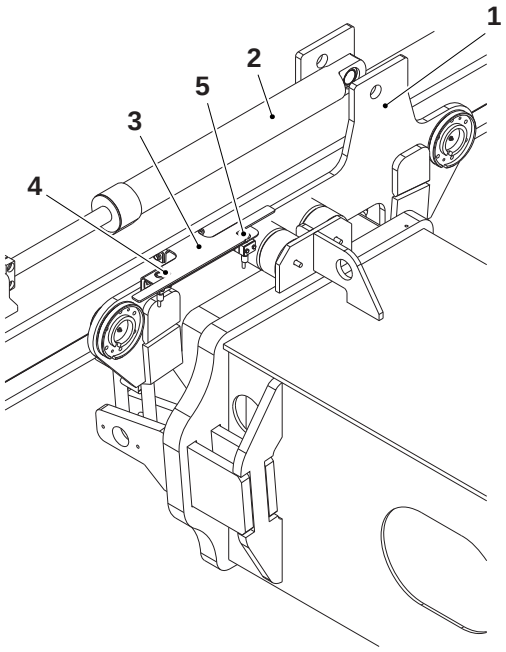
Component position

Hydraulic pump and oil tank

See Section *10,* Chapter *10.3 Tanks and accumulators* and Chapter *10.4 Pumps*

Sideshift carriage





Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter *10 Common hydraulics* and Chapter *11 Common electrics*.

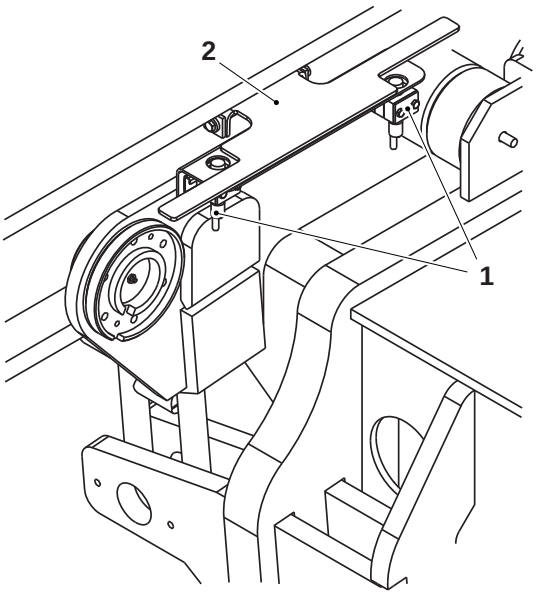
1. Sideshift carriage
2. Sideshift cylinder (5.1, 5.2)
3. Centering device
4. Limit switch (S56, S58)
5. Limit switch (S55, S57)

Valves

See Chapter *7.9 Load carrying*.

7.4.1 Checking the centering device

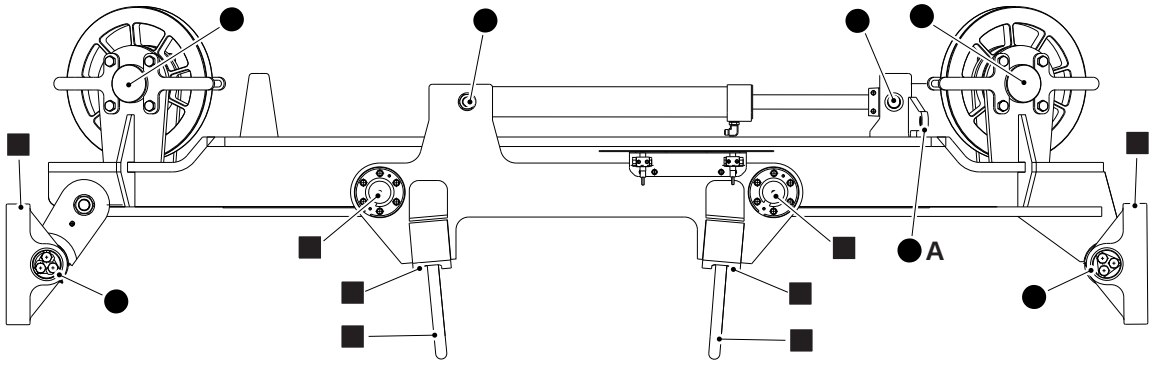
Instructions



The PLC detects the position of the spreader on the basis of the information received from the centering device limit switches (1). When sideshift is used, the limiter (2) activates one of the limit switches, depending on the sideshift direction. When the spreader is centred, both limit switches are inactive; see figure. Ensure that both limit switches cannot be activated at the same time when the spreader has been centered.

7.4.2 Lubrication points

Lift beam



● Manual lubrication

■ Central lubrication

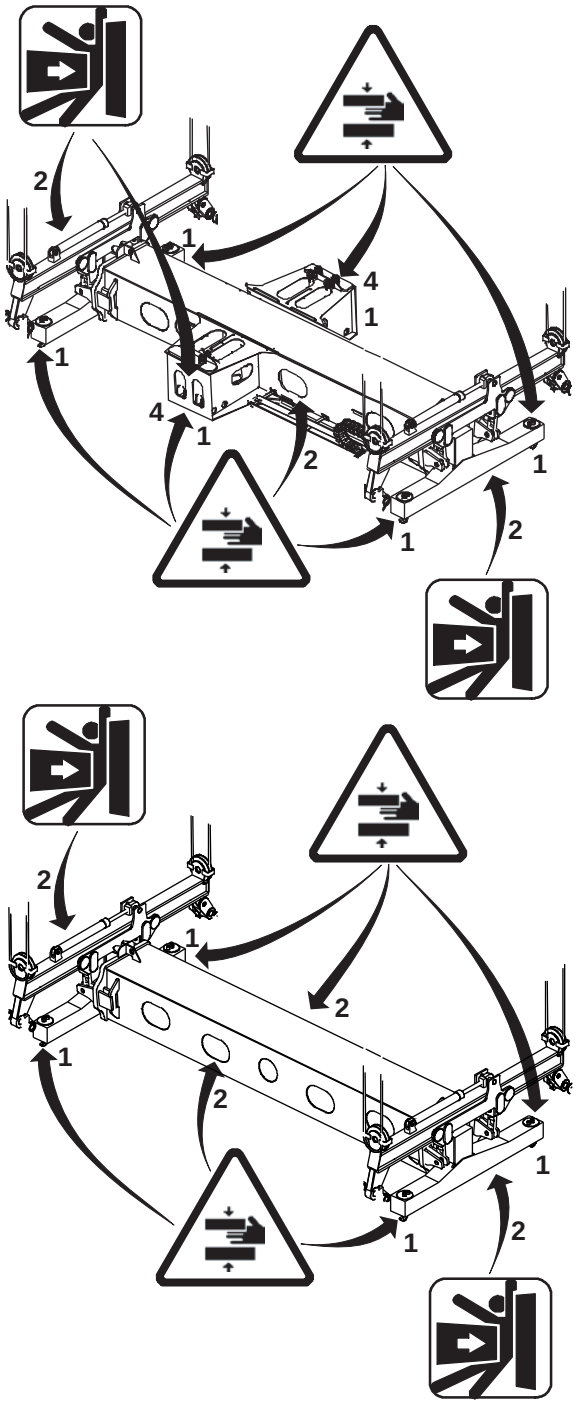
If the machine is not equipped with a central lubrication system

■ = ●

A = front-end lifting beam only

7.9 Load carrying

Safety



DANGER

The spreader is equipped with automatic functions which may cause a risk of injury. Observe the following functions when servicing or repairing the spreader:

1. **The twistlocks turn automatically to the closed position when all the feelers are in the upper position.**
2. **The spreader extends and retracts automatically when the length selection button is pressed in the cab. Do not put your hands in the maintenance holes during the startup or when the machine is running.**
3. **The hoist ropes move during the automatic functions. No personnel are allowed in the operating range of the rope system and the hoist ropes during the operation of the machine.**
4. **Twinlift spreader:**

   Twinlift boxes are lifted automatically when the machine is started. Do not put your hands in the maintenance holes on the twinlift boxes during the startup or when the machine is running.

DANGER

The spreader stop switch must always be depressed when repairing or servicing the spreader.

If the stop switch is not depressed, the spreader may move unintentionally, causing a risk of injury.

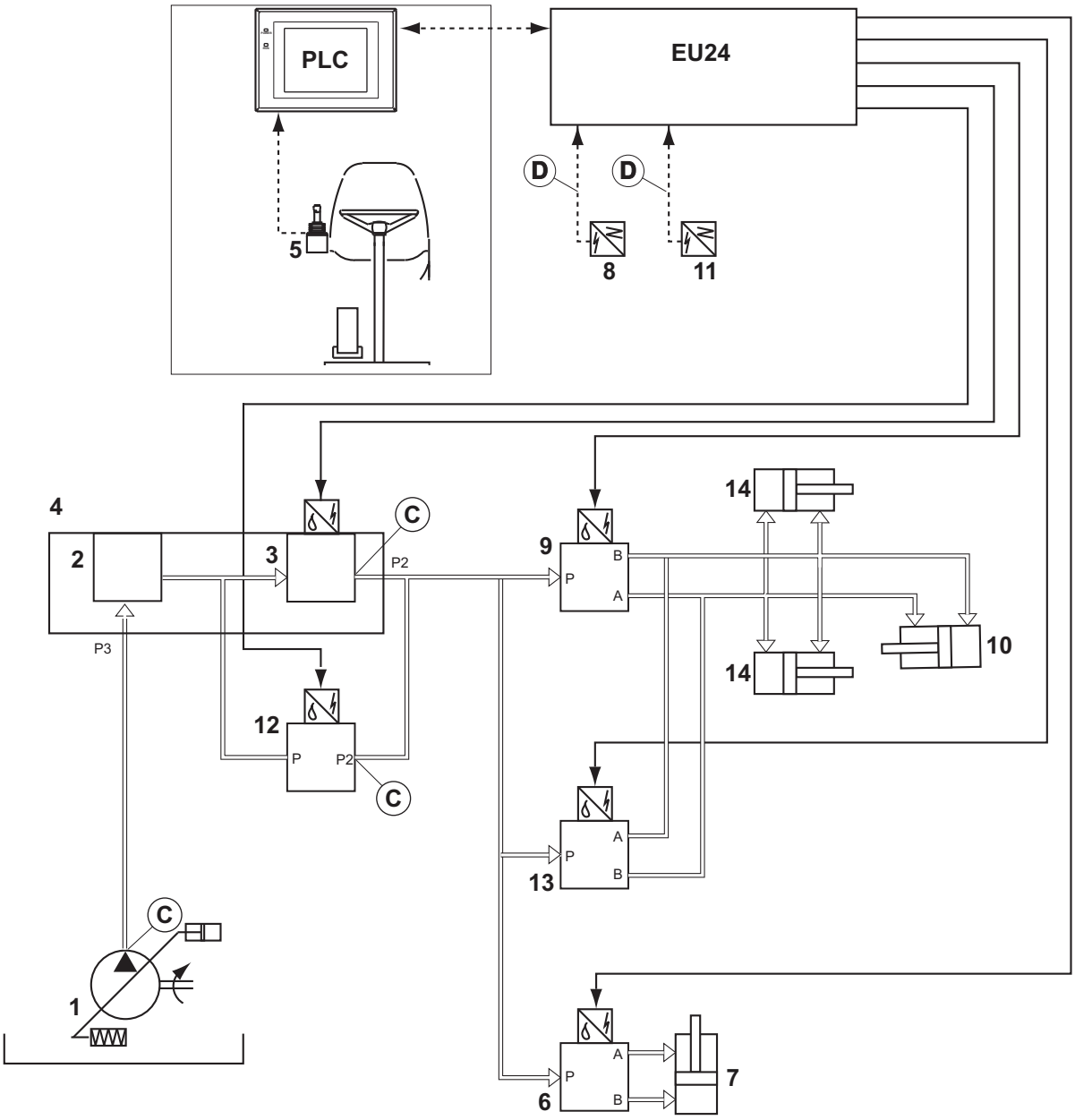
Description, length adjustment of the spreader

Spreader length adjustment is semiautomatic, i.e., the length is selected with a button in the cabin and set by the PLC.

Length adjustment is possible only with the twistlocks open, except for the 45’ extended twin extension/retraction. This is to prevent unintentional use with the spreader attached to a container.

The length is adjusted by two cylinders, one for the front and one for the rear end.

Function description, length adjustment of the spreader



Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter 7 *Load handling,* Chapter *10 Common hydraulics* and Chapter *11 Common electrics*.

Pos	Function	Signal description	Reference
1	The variable displacement axial piston pump (12) produces the hydraulic power.		Section *10*, Chapter *10.4 Pumps*.
2	The priority valve (33) distributes the volume flow between the steering system and spreader hydraulic circuit. The steering system always receives the necessary volume flow before the spreader.		
3	The hydraulic power is delivered to the spreader through the spreader selection valve (20.2).		
4	The spreader- and priority block (52).	Pressure value (PM7). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
5	The spreader length is selected with a switch (S12.1-S12.4).		
6	The slide beam locking device valves (24.1, 24.8) deliver the hydraulic power to the locking device cylinders.		Chapter *7.9.2 Length adjustment locking device*
7	The cylinders (6.1, 6.2) lift the lock pins up.		Chapter *7.9.2 Length adjustment locking device*
8	The locking device limit switches (S67, S68) are activated when the lock pins are in the upper position. Length adjustment is started after the limit switches are activated.		Chapter *7.9.2 Length adjustment locking device* Section *8*, Chapter *8.4 Diagnostics*
9	The length adjustment valves (23.1, 23.2) deliver the hydraulic power to the cylinders.		
10	The cylinders (4.1, 4.2) start the length adjustment.		

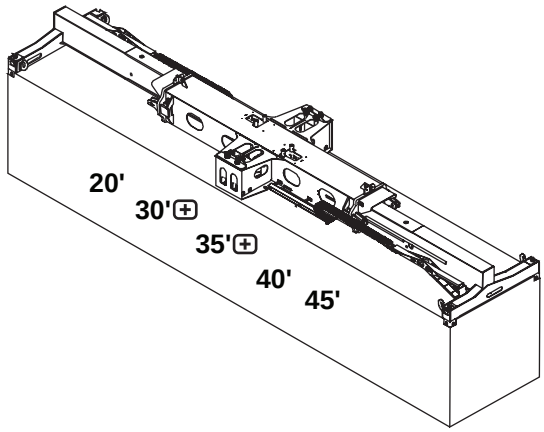
Pos	Function	Signal description	Reference
11	The length adjustment limit switches (S71-S74) are activated when the slide beam position approaches the selected length. When the next slide beam hole meets the lock pin, the lock pin is pushed into the hole. The lower limit switch becomes inactive. When both slide beams have been locked, the length adjustment is stopped by the lower limit switches. At the same time, the indicator light of the selected length is lit on the cabin button to indicate that length adjustment is finished.		Chapter *7.9.1 Length adjustment limit switches* Chapter *7.9.2 Length adjustment locking device* Section *8*, Chapter *8.4 Diagnostics*
12	The spreader extension/retraction is controlled with a display touch buttons. During extension/retraction the spreader requires an extra volume flow. Additional volume flow is delivered through the auxiliary spreader valve (51).	Pressure value (PM8). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
13	The twin frame valves (23.3, 23.4) deliver the hydraulic power to the cylinders.		
14	The cylinders (4.1 - 4.6) extend/retract the spreader.		

Description, gripping a container

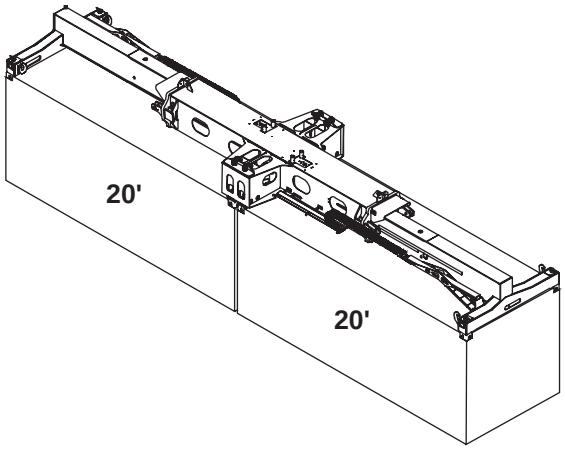
Containers are gripped by hydraulic twistlocks. The PLC monitors and controls the operation of the twistlocks with limit switches.

Gripping a container is an automatic function. Releasing a container is always done manually.

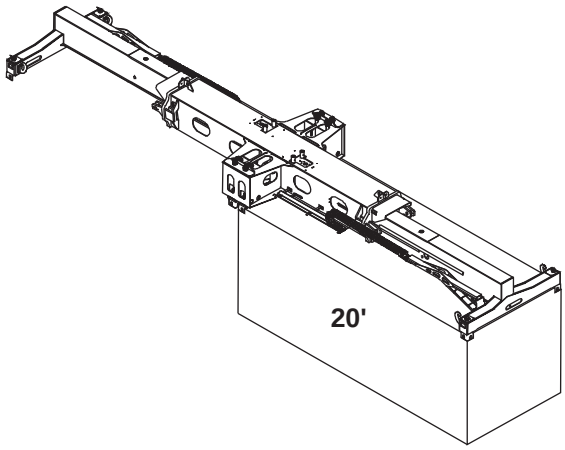
Containers to be handled with the spreader



- One container 20’ - 45’.

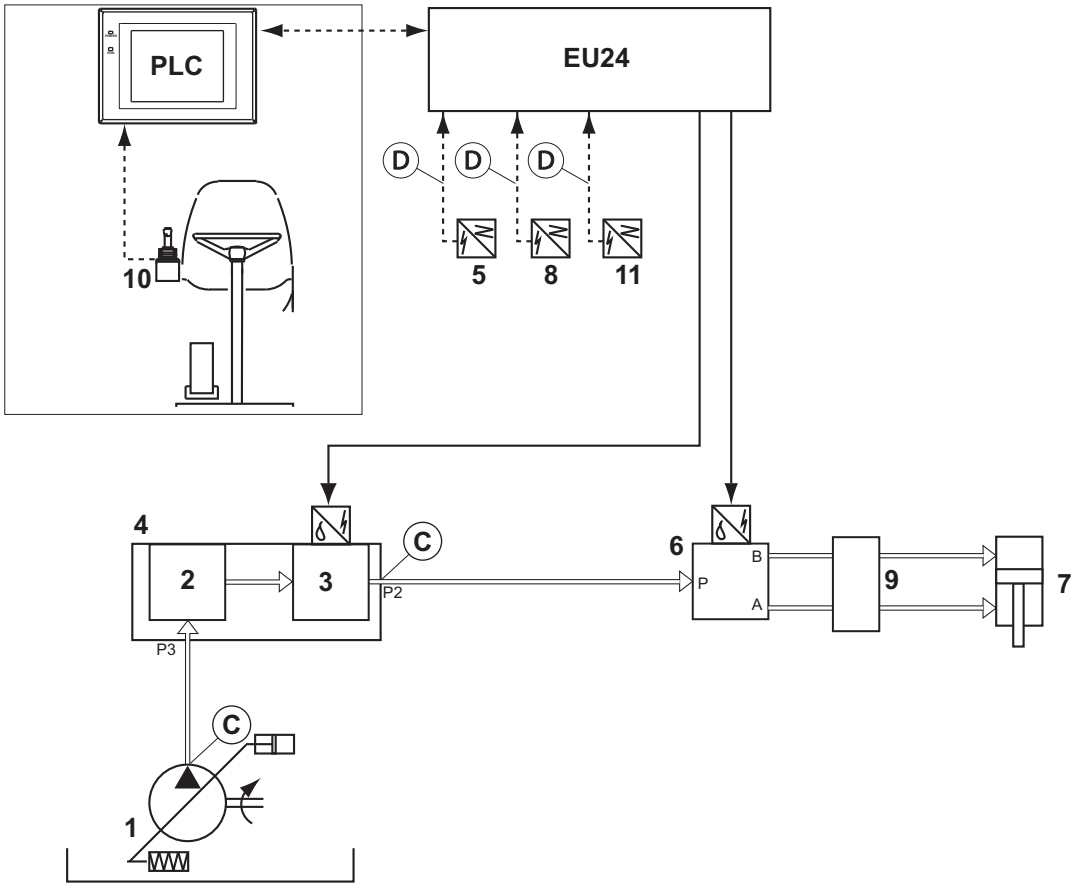


- Twinlift 2 x 20’.



- Single twinlift 20’.

Function description, gripping a container

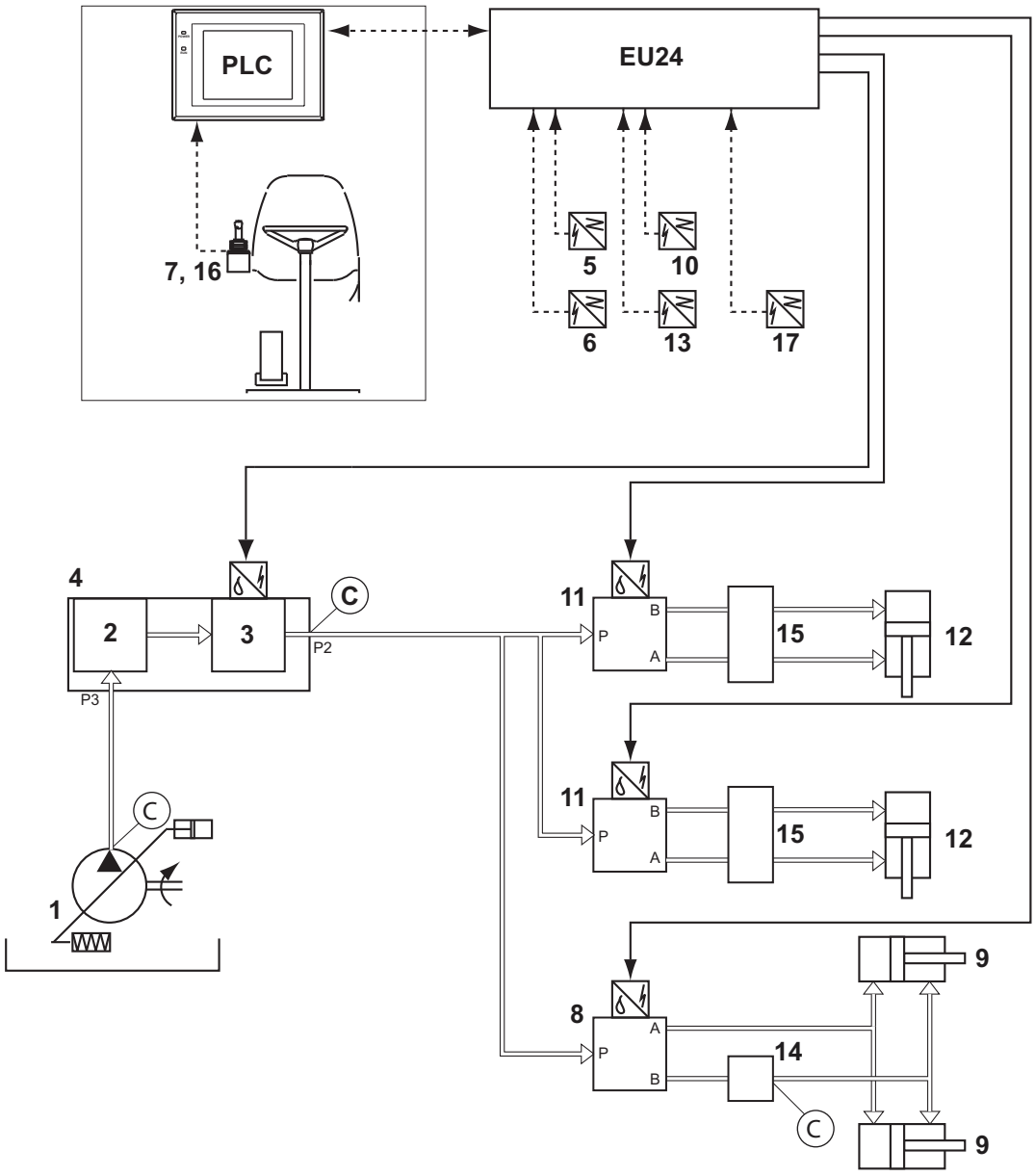


Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter 7 *Load handling,* Chapter *10 Common hydraulics* and Chapter *11 Common electrics*.

Pos	Function	Signal description	Reference
1	The variable displacement axial piston pump (12) produces the hydraulic power.		Section *10*, Chapter *10.4 Pumps*
2	The priority valve (33) distributes the volume flow between the steering system and spreader hydraulic circuit. The steering system always receives the necessary volume flow before the spreader.		
3	The hydraulic power is delivered to the spreader through the spreader selection valve (20.2).	Pressure value (PM7). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
4	The spreader- and priority block (52).		

Pos	Function	Signal description	Reference
5	When the spreader is lowered onto a container, the container contact feelers are lifted up. The limit switches (S63-S66) are activated by the feelers. When all limit switches have been activated, the PLC automatically turns the twistlocks to the closed position.		Chapter *7.9.3 Twistlocks* Section *8*, Chapter *8.4 Diagnostics*
6	The twistlock valves (24.2, 24.9) deliver the hydraulic power to the cylinders.		
7	The cylinders (6.3, 6.4) turn the twistlocks to the closed position through the linkage.		
8	The limit switches (S60, S62) are activated when the twistlocks have turned to the closed position. The PLC stops the close command on the basis of this information. The indicator light (H11) is lit. All twistlocks must be in the closed position in order for lifting to be performed.		Section *8*, Chapter *8.4 Diagnostics*
9	The lock valves (35.1, 35.2) lock the twistlocks hydraulically in the closed position. When the container is lifted, the container contact limit switches become inactive and the PLC prevents the twistlocks from being opened.		
10	The twistlocks are always turned to the open position manually with the switch (S10). The container contact limit switches must then be activated.		
11	The limit switches (S59, S61) are activated when the twistlocks have turned to the open position. The indicator light (H10) is lit.		Chapter *7.9.3 Twistlocks* Section *8*, Chapter *8.4 Diagnostics*

Function description, gripping a container (twinlift 2 x 20')



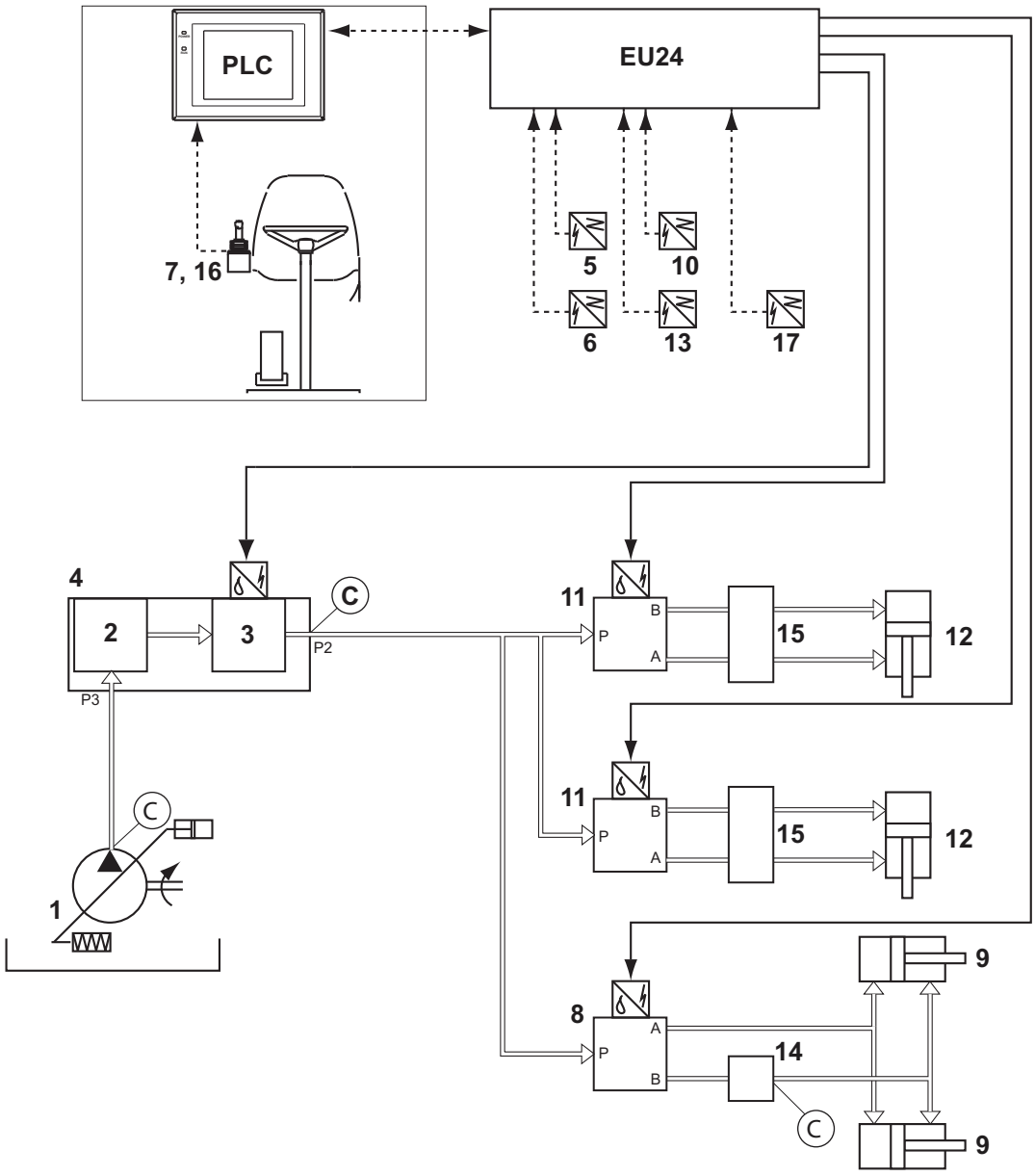
Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter 7, *Load handling,* Chapter *10, Common hydraulics* and Chapter *11, Common electrics*.

Pos	Function	Signal description	Reference
1	The variable displacement axial piston pump (12) produces the hydraulic power.		Section *10*, Chapter 10.4, *Pumps*.

Pos	Function	Signal description	Reference
2	The priority valve (33) distributes the volume flow between the steering system and spreader hydraulic circuit. The steering system always receives the necessary volume flow before the spreader.		
3	The hydraulic power is delivered to the spreader through the spreader selection valve (20.2).	Pressure value (PM7). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
4	The spreader- and priority block (52).		
5	When the spreader is lowered onto a container, the feelers of the T-beam container contact rise up. The feelers activate the container contact limit switches (S63-S66).		Chapter 7.9.3, *Twistlocks*. Section *8*, Chapter 8.4, *Diagnostics*
6	Infrared sensors (S700.1, S700.2) detect that there is a container below. On the basis of the information coming from the infrared sensors, the PLC detects that there are two containers below the spreader. The display shows a message about the twinlift function.		Section *8*, Chapter 8.4, *Diagnostics*
7	The twinlift boxes are lowered with the switch (S222).		
8	The twinlift box valves (24.4, 24.6) guide the hydraulic power to the cylinders.		
9	The cylinders (6.5.1, 6.6.1, 6.7.1, 6.8.1) lower the twinlift boxes.		
10	The feelers in the twinlift boxes activate the container contact limit switches (S603, S607, S611, S615). When all the container contact limit switches have been activated, the PLC automatically turns the twistlocks to the closed position.		Section *8*, Chapter 8.4, *Diagnostics*
11	Solenoid valves (24.2, 24.5, 24.7, 24.9) guide the hydraulic power to the cylinders.		
12	The cylinders (6.3 - 6.8) turn the twistlocks to the closed position through the linkage.		

Pos	Function	Signal description	Reference
13	The limit switches (S60, S62, S601, S605, S609, S613) are activated when the twistlocks have turned to the closed position. The PLC stops the close command on the basis of this information. The indicator light (H11) is lit. All twistlocks must be in the closed position in order for lifting to be performed.		Section *8*, Chapter 8.4, *Diagnostics*
14	Float valves (24.4.2, 24.6.2) are switched on when the twinlift boxes are in the floating status.		
15	The lock valves (35.1-35.4) lock the twistlocks hydraulically in the closed position. When the container is lifted, the container contact limit switches become inactive and the PLC prevents the twistlocks from being opened.		
16	The twistlocks are always turned to the open position manually with the switch (S10). The container contact limit switches must then be activated.		
17	The limit switches (S59, S61, S602, S606, S610, S614) are activated when the twistlocks have been turned to the open position. The indicator light (H10) is lit.		Section *8*, Chapter 8.4, *Diagnostics*
18	The twinlift boxes are lifted up automatically.		

Function description, gripping a container (single twinlift 20')

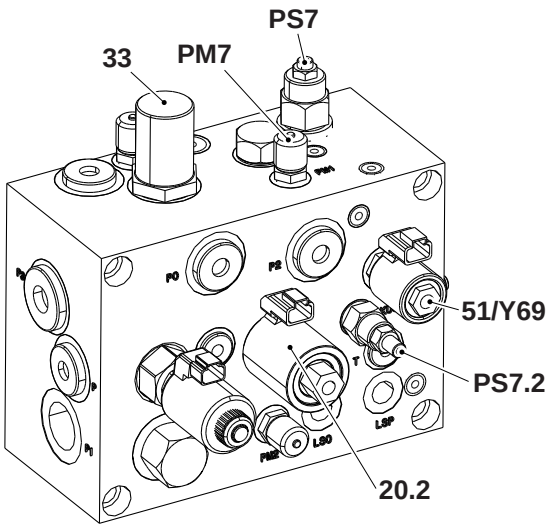


Item numbers in parentheses refer to the hydraulic and circuit diagrams, Section *E*, Chapter 7, *Load handling,* Chapter *10, Common hydraulics* and Chapter *11, Common electrics*.

Pos	Function	Signal description	Reference
1	The variable displacement pump (12) produces the hydraulic power.		Section *10*, Chapter 10.4, *Pumps*.

Pos	Function	Signal description	Reference
2	The priority valve (33) distributes the volume flow between the steering system and spreader hydraulic circuit. The steering system always receives the necessary volume flow before the spreader.		
3	The hydraulic power is delivered to the spreader through the spreader selection valve (20.2).	Pressure value (PM7). See Section *E,* Chapter *10 Common hydraulics.*	Chapter *7.9.4 Checking and adjusting the spreader hydraulic circuit pressure*
4	The spreader- and priority block (52).	Pressure value (PM7). See Section *E, Chapter 10, Common hydraulics.*	Chapter 7.9.4, *Checking and adjusting the spreader hydraulic circuit pressure*.
5	When the spreader is lowered onto a container, the feelers of the T-beam container contact rise up. The feelers activate the container contact limit switches (S65 - S66, front), (S63 - S64, rear).		Chapter 7.9.3, *Twistlocks*. Section *8*, Chapter 8.4, *Diagnostics*
6	The infrared sensor (S702.1 or S702.2) detects that there is a container below. On the basis of the information coming from the infrared sensors, the PLC detects that there is only one container below the spreader. The display shows a message about the single twinlift function.		Section *8*, Chapter 8.4, *Diagnostics*
7	The twinlift boxes are lowered with the switch (S222).		
8	The twinlift box valves (24.4, 24.6) guide the hydraulic power to the cylinders.		
9	The cylinders (6.5.1 and 6.6.1 rear, 6.7.1 and 6.8.1 front) lower the twinlift boxes.		
10	The feelers in the twinlift boxes activate the container contact limit switches (S603, S607, rear) (S611, S615, front). When all the container contact limit switches have been activated, the PLC automatically turns the twistlocks to the closed position.		Section *8*, Chapter 8.4, *Diagnostics*
11	The twistlock valves (24.2, 24.5, 24.7, 24.9) guide the hydraulic power to the cylinders.		

Pos	Function	Signal description	Reference
12	The cylinders (6.3 - 6.8) turn the twistlocks to the closed position through the linkage.		
13	The limit switches (S60, S62, S601, S605, S609, S613) are activated when the twistlocks have turned to the closed position. The PLC stops the close command on the basis of this information. The indicator light (H11) is lit. All twistlocks must be in the closed position in order for lifting to be performed.		Section *8*, Chapter 8.4, *Diagnostics*
14	Float valves (24.4.2, 24.6.2) are switched on when the twinlift box cylinders are in floating status.		
15	The lock valves (35.1-35.4) lock the twistlocks hydraulically in the closed position. When the container is lifted, the container contact limit switches become inactive and the PLC prevents the twistlocks from being opened.		
16	The twistlocks are always turned to the open position manually with the switch (S10). The container contact limit switches must then be activated.		
17	The limit switches (S59, S61, S602, S606, S610, S614) are activated when the twistlocks have been turned to the open position. The indicator light (H10) is lit.		Section *8*, Chapter 8.4, *Diagnostics*
18	The twinlift boxes are lifted up automatically.		



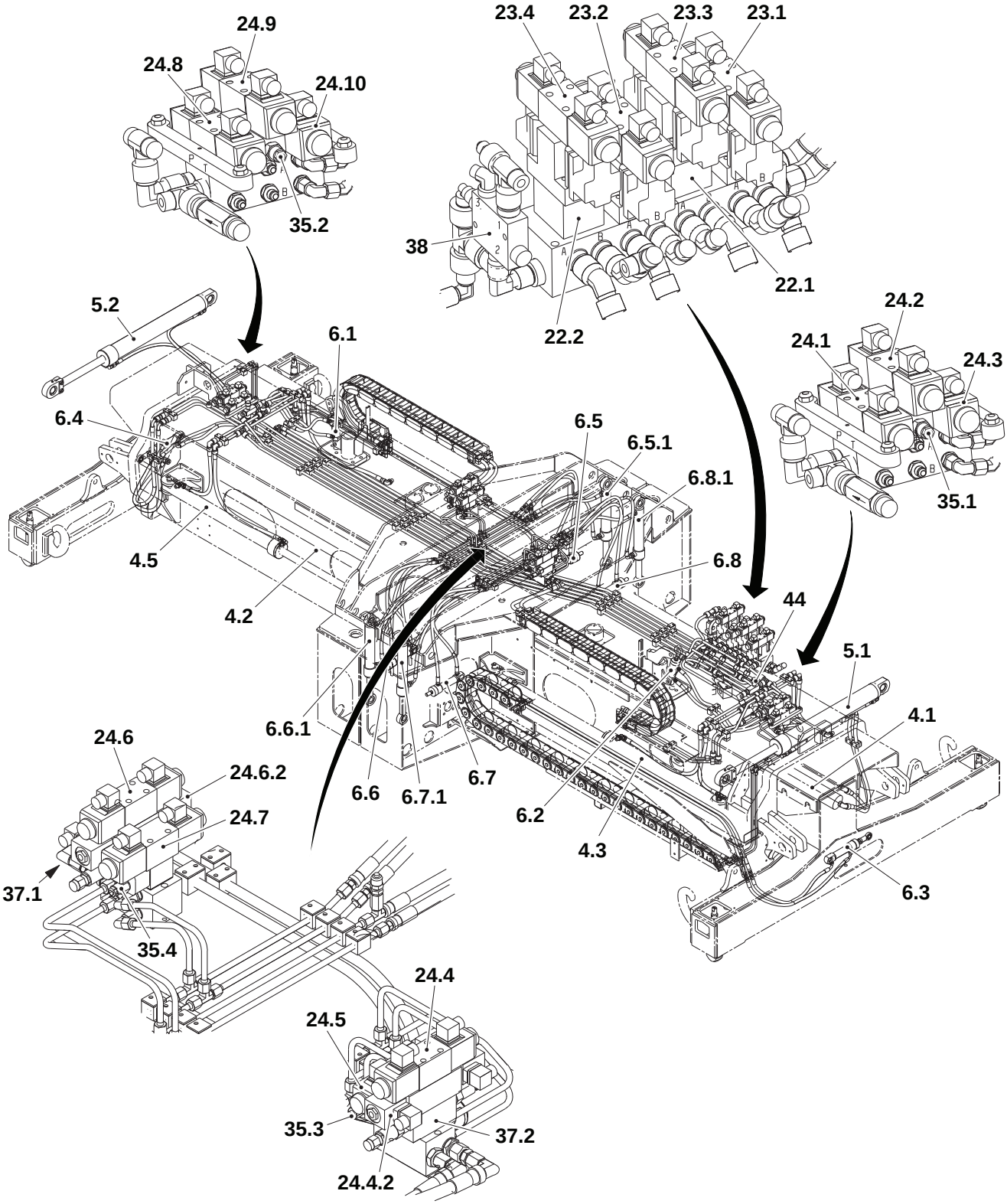
Component position

Priority valve and spreader valve

Item numbers refer to the hydraulic diagram, Section *E*, Chapter *10 Common hydraulics*.

20.2	Spreader valve
33	Priority valve
51/ Y69	Auxiliary valve for spreader
PS	Pressure adjustment screw
PM	Pressure measurement point

Hydraulic equipment of the spreader



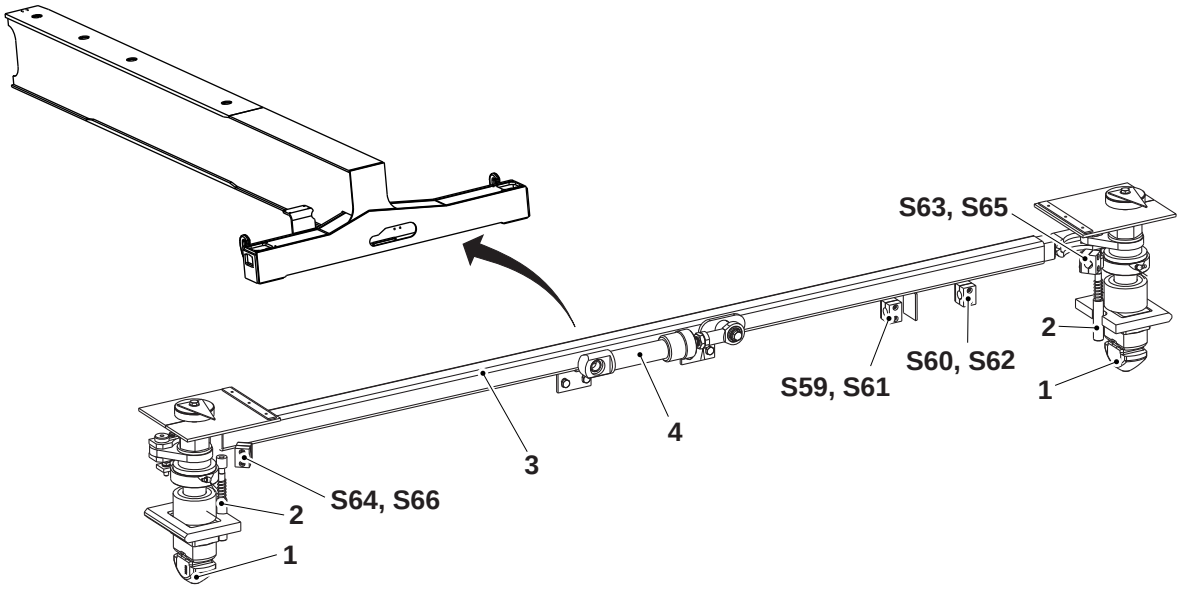
Item numbers refer to the hydraulic diagram, Section *E*, Chapter *7 Load handling*.

22.1	Flow control, front-end
22.2	Flow control, rear-end
23.1	Solenoid valve, front-end length adjustment
23.2	Solenoid valve, rear-end length adjustment
23.3	Solenoid valve, front twin frame shift
23.4	Solenoid valve, rear twin frame shift
24.1	Solenoid valve, locking of the front-end length adjustment
24.2	Solenoid valve, turning the front-end T-beam twistlocks
24.3	Solenoid valve, front-end side shift
24.4	Solenoid valve, lifting/lowering the front twinlift boxes
24.5	Solenoid valve, turning the front-end Twinlift twistlocks
24.6	Solenoid valve, lifting/lowering the rear twinlift boxes
24.7	Solenoid valve, turning the rear-end Twinlift twistlocks
24.8	Solenoid valve, locking of the rear-end length adjustment
24.9	Solenoid valve, turning the rear-end T-beam twistlocks
24.10	Solenoid valve, rear-end side shift
24.4.2	Solenoid valve, floating the front twinlift boxes
24.6.2	Solenoid valve, floating the rear twinlift boxes
35.1	Valve, locking the front T-beam twistlocks
35.2	Valve, locking the rear T-beam twistlocks
35.3	Valve, locking the front Twinlift twistlocks
35.4	Valve, locking the rear Twinlift twistlocks
37.1 - 37.4	Pressure relief valve
38	Pressure reducing valve
44	Non-return valve with restriction
4.1, 4.2	Cylinder, length adjustment
4.3, 4.6	Cylinder, twin frame shift
5.1, 5.2	Cylinder, side shift
6.1, 6.2	Cylinder, locking the length adjustment
6.3, 6.4	Cylinder, turning the T-beam twistlocks
6.5, 6.8	Cylinder, turning the Twinlift twistlocks
6.5.1, 6.6.1	Cylinder, lifting/lowering the rear twinlift boxes
6.7.1, 6.8.1	Cylinder, lifting/lowering the front twinlift boxes

Electrical equipment of the spreader

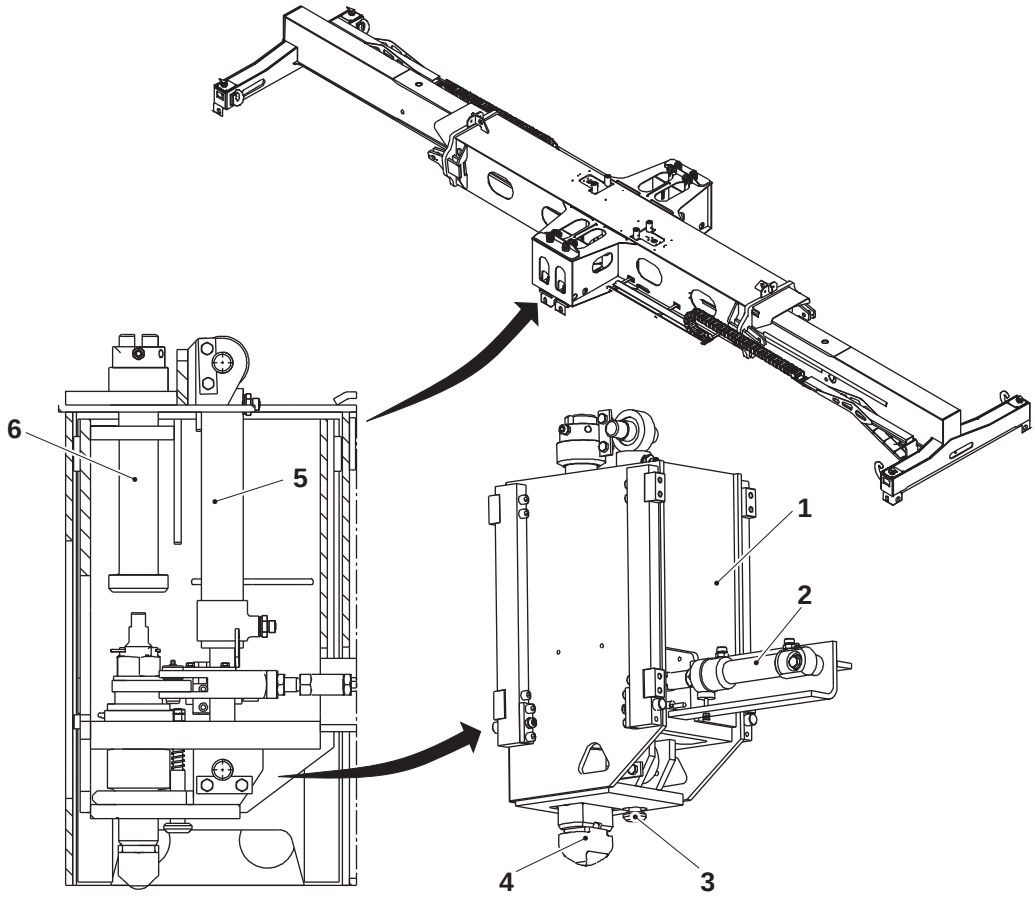
See the circuit diagram, Section *E*, Chapter *11 Common electrics*.

T-beam



1	Twistlock
2	Feeler
3	Turning rod
4	Cylinder, turning the twistlocks
S63 - S66	Limit switch, container contact
S59, S61	Limit switch, twistlocks open
S60, S62	Limit switch, twistlocks closed

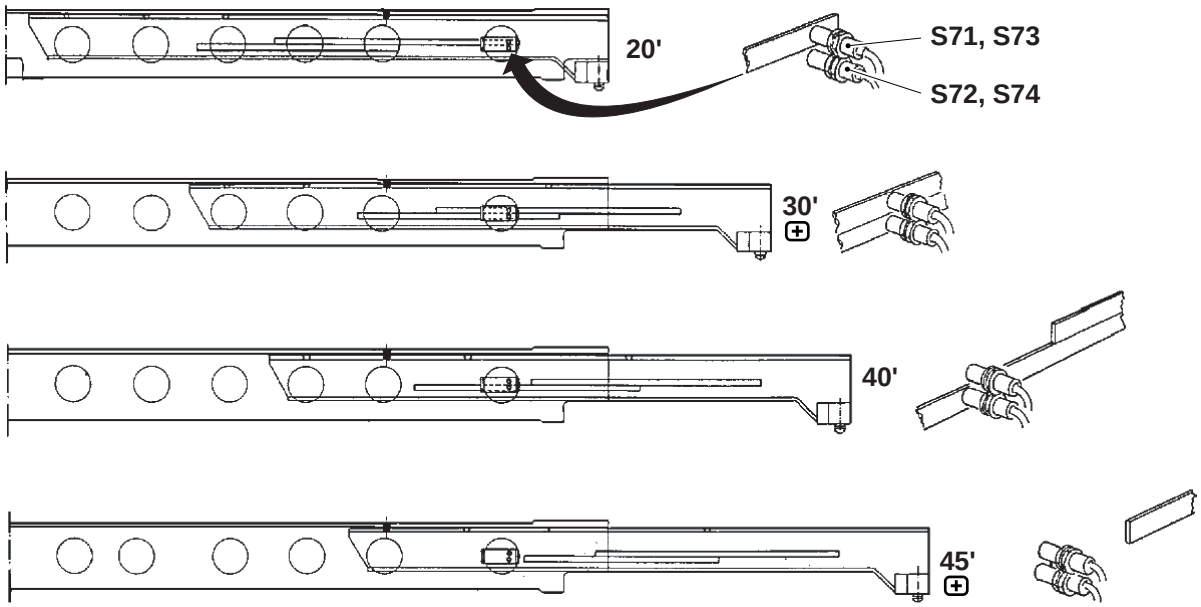
Twinlift boxes



1. Twinlift box
2. Cylinder, turning the twistlock
3. Feeler
4. Twistlock
5. Cylinder, lifting/lowering the twinlift box
6. Adjustment screw of the twinlift box

7.9.1 Length adjustment limit switches

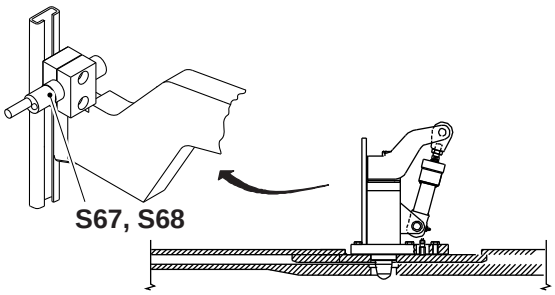
Description



Spreader length	Active limit switch
20’	S71, S73
30’ ⊞	S71 - S74
40’	S72, S74
45’ ⊞	-

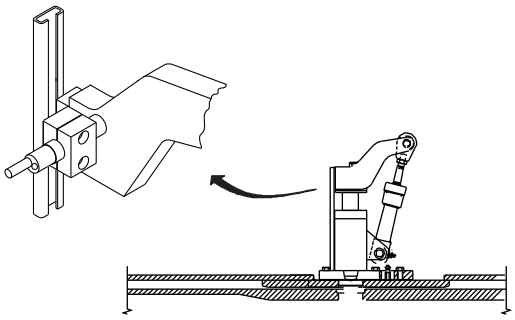
7.9.2 Length adjustment locking device

Function description

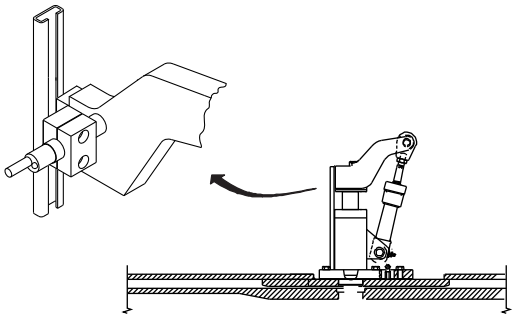


S67, S68 Limit switch, locking device

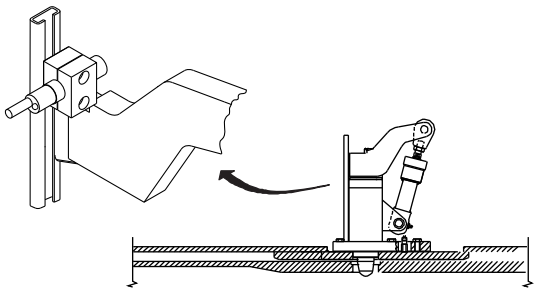
1 Length adjustment locked. Limit switch is inactive.



2 The spreader length has been selected, and the lock pin is lifted up by the cylinder. Limit switch is activated, and length adjustment begins.



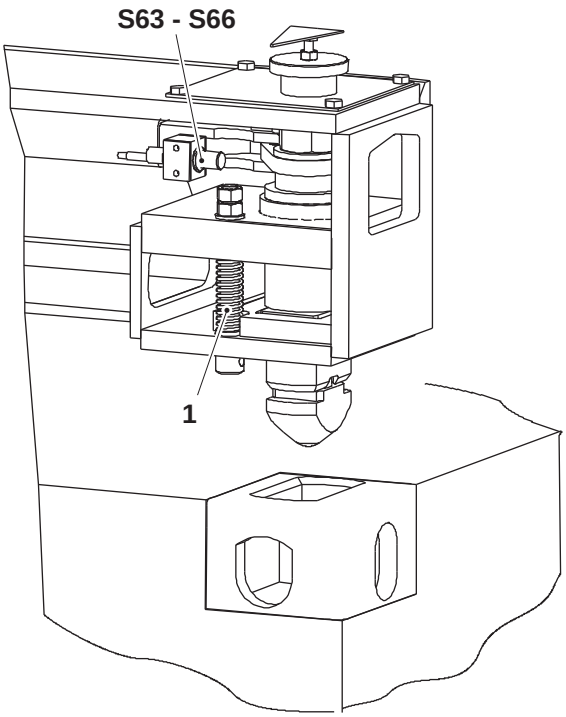
3 When the selected length is approached, the cylinder is depressurised on the basis of the signal received from the length adjustment limit switches. The lock pin is lowered down to the slide beam by spring force. Limit switch is still activated.



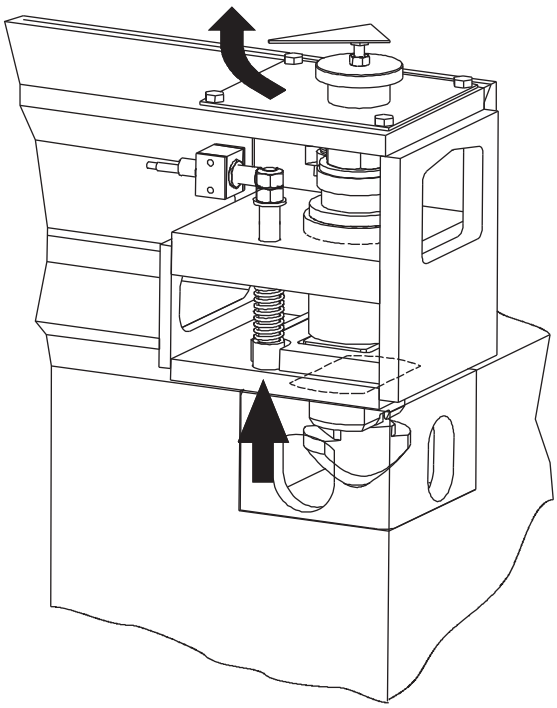
4 When the next slide beam hole meets the lock pin, the lock pin is pushed into the hole by a spring. Limit switch goes inactive. When both slide beams have been locked, the length adjustment is stopped. At the same time, the indicator light of the selected length is lit on the cab button to indicate that length adjustment is finished.

7.9.3 Twistlocks

Function description



1 The spreader is not touching the container. The feeler (1) is in the lower position, and the container contact limit switch (S63 - S66) is inactive.



2 The spreader has been lowered onto the container. The feeler activates the container contact limit switch. When all container contact limit switches have been activated, the twistlocks automatically turn to the closed position.

When the twistlocks have turned to the closed position, they are locked hydraulically. The twistlocks can be turned manually.

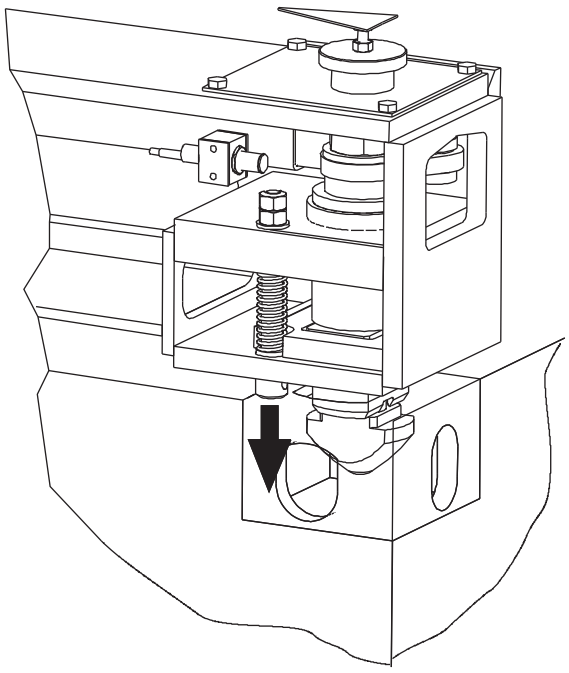
The PLC receives the information about the position of the twistlocks from the “twistlocks closed” and “twistlocks open” limit switches. Lifting is always prevented if the twistlocks are in some other position than open or closed at both ends of the spreader. This can be bypassed with the “hoist prevention bypass” switch in the cabin.

NOTE

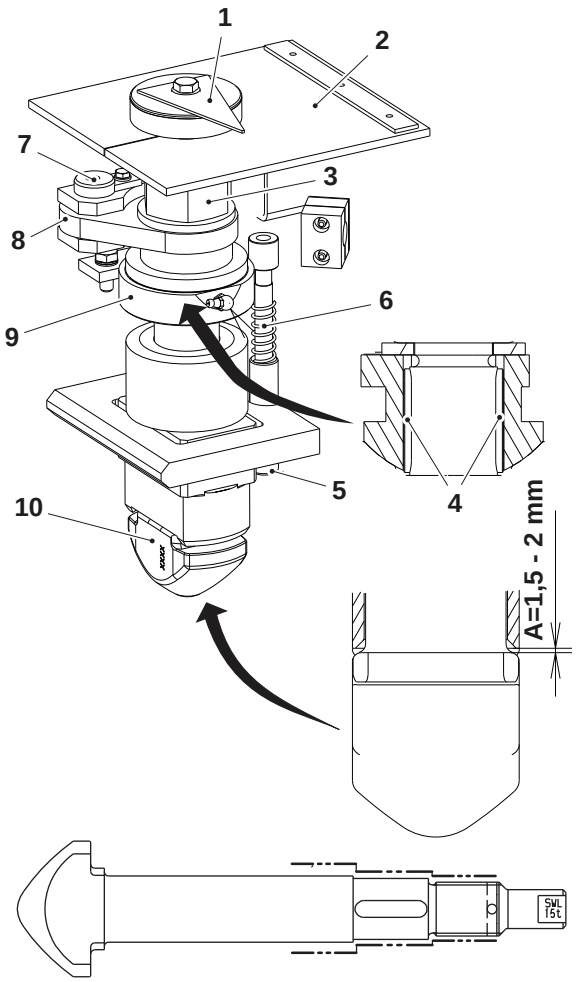
Hoist prevention bypass switch (S1) must only be used by authorized service personnel. The key must never be left to the switch key slot in between maintenances.

⚠ WARNING

Use of bypass key switch (S1) will override safety functions and enable inappropriate use of the machine functions causing substantial damage to the machine or surrounding operations, for example spreader-cabin collision.



3 The container has been lifted so that it is suspended from the twistlocks. The container contact limit switch is inactive, so turning the twistlocks has been prevented electronically.



7.9.3.1 Checking the twistlocks

Instructions

Removal

1 Remove the indicator (1) and cover (2). Note the position of the indicator for reinstallation.

2 Remove the feeler (5) and its spring (6).

3 Remove the cotter pin, castle nut (3), and washer.

4 Release the pivoted level (8) by removing the mounting pin (7).

5 Remove the pivoted level and keys (4).

6 Pull the twistlock (10) out from below.

Checking

1 Check the condition of the pivoted level (8) and bearing housing (9).

2 Check the condition of the feeler (5) and spring. If the end of the feeler has expanded, grind or lathe it back to the correct size. Length of a new spring is 45mm+-1. Maximum allowed wear is +-1mm. If the spring is out of dimensions or visually damaged, it must be replaced.

3 Visually check the condition of the twistlock. If the twistlock is deformed, discard it immediately.

4 Check the twistlock with penetrant liquid or magnetic particles on the area indicated in the figure.

If there are any cracks, discard the twistlock immediately.

Assembly

1 Reinstall the feeler.

2 Reinstall the twistlock, keys (4), and pivoted level (8). Fasten the pivoted level to the turning bar with the mounting pin (7).

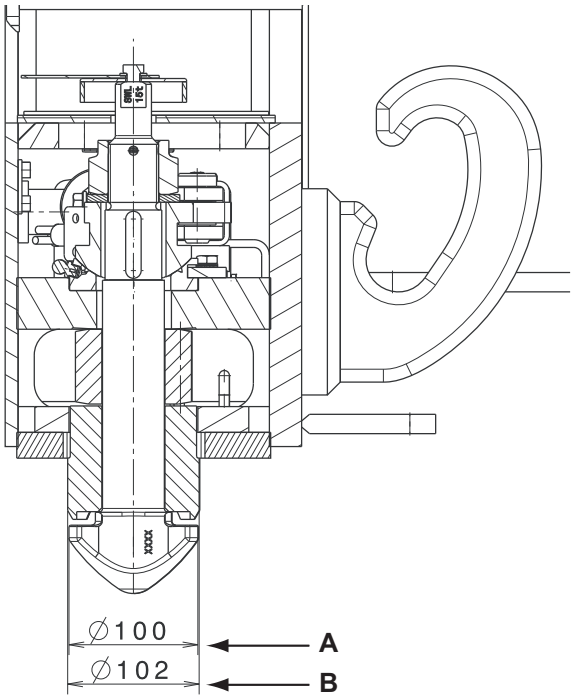
3 Fasten the twistlock with the lock nut, and secure it with the cotter pin. Ensure the proper clearance between the twistlock and its housing (A = 1,5 - 2 mm).

4 Reinstall the cover (2) and indicator (1).

NOTE

Twistlocks must be replaced latest at 20 000 operating hours.

7.9.3.2 Checking the twistlock housing wear



Instructions

Measure the twistlock housing (B). If the measured wear is more than 1,5mm from the original measurement of 102mm, twistlock housing must be replaced.

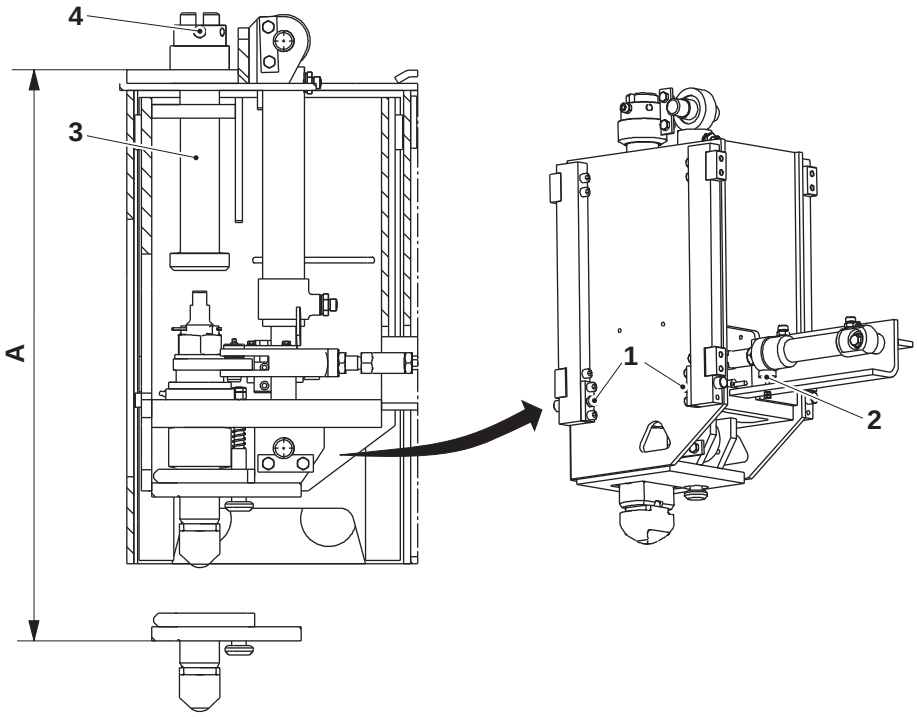
A. Twistlock measurement

B. Twistlock housing measurement

7.9.3.3 Adjusting the twinlift boxes and twistlocks

Instructions

1 Check that the T-beam twistlocks are straight in relation to the T-beam. Adjust the bracket of the turning cylinder if necessary.



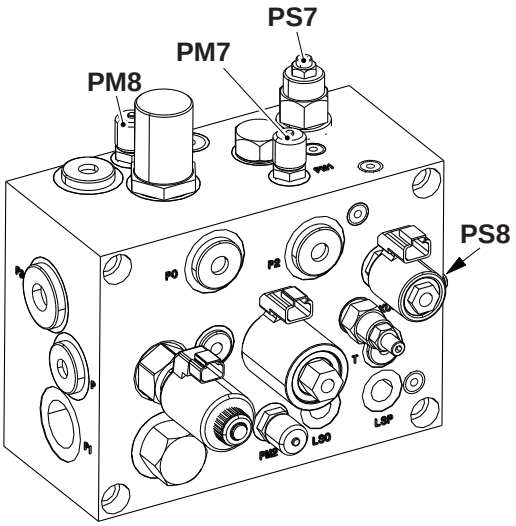
2 Check that the twinlift boxes are straight in relation to the spreader frame. Use the adjustment screws of the slide pieces (1) to adjust if necessary.

3 Check that the twinlift twistlocks are straight in relation to the spreader frame. Use the cylinder support (2) to adjust if necessary.

4 Use the spreader to grip two 20' containers of the same weight (twinlift) and lift the containers.

5 Adjust the twinlift box height (A) with the adjustment screws (3) so that the containers are aligned. Distance A = 961...986 mm. Adjust all the twinlift boxes to the same level.

6 Lock the adjustment screws with clamping screws (4).



7.9.4 Checking and adjusting the spreader hydraulic circuit pressure

Instructions

The adjustment must be performed with the hydraulic oil at the normal operating temperature.

1 Connect a pressure gauge to the measuring point (PM7).

2 Start the engine and switch to working speed.

Spreader valve

3 Drive the sideshift cylinder towards the end position to increase the working pressure in the spreader circuit.

4 Check the pressure on the gauge (PM7); for the correct pressure value, see the hydraulic diagram in Section *E,* Chapter *10 Common hydraulics.* Use the adjustment screw (PS7) to adjust if necessary.

Auxiliary spreader valve

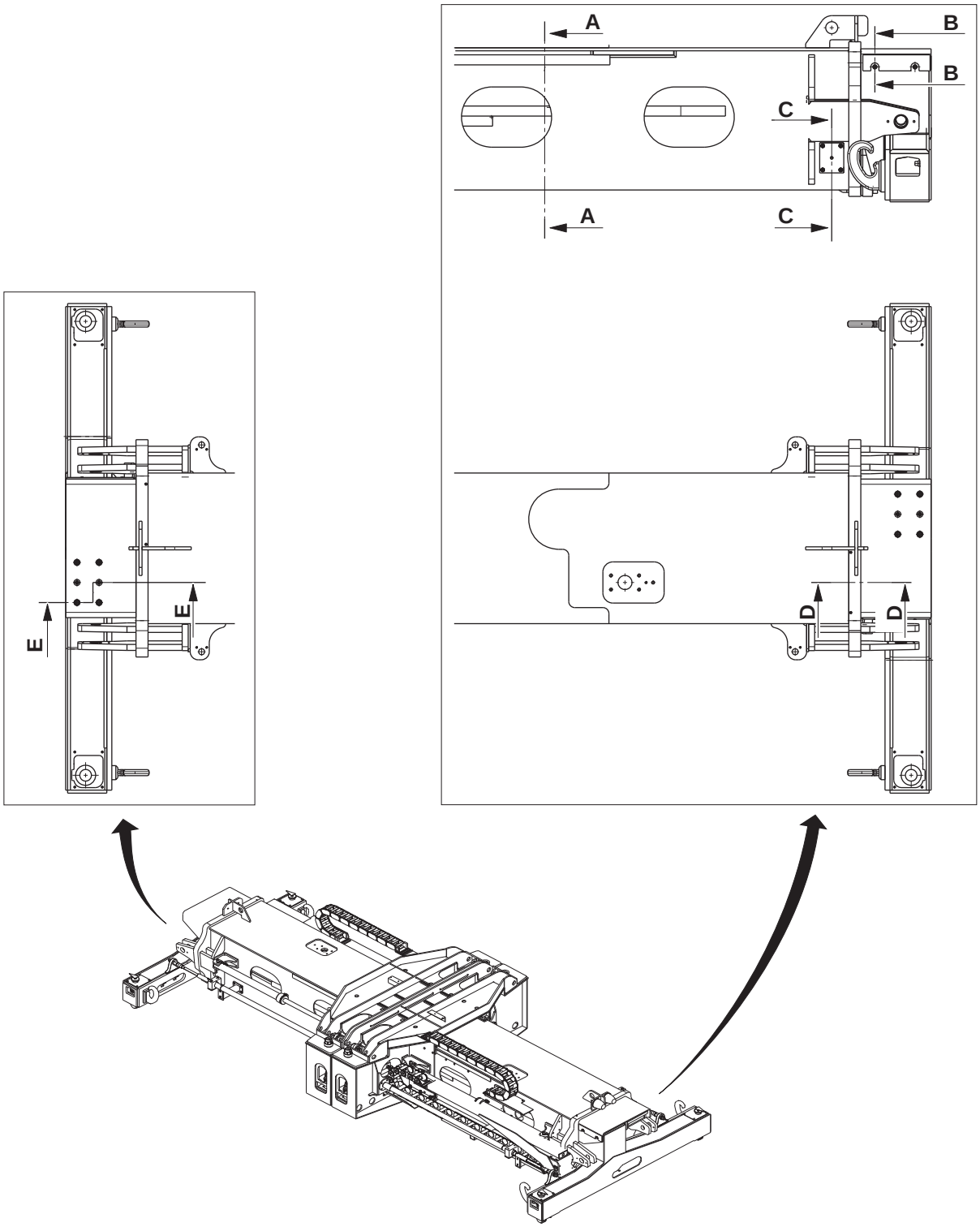
5 Extend the spreader towards the end position to increase the working pressure in the spreader circuit.

6 Check the pressure on the gauge (PM8); for the correct pressure value, see the hydraulic diagram in Section *E,* Chapter *10 Common hydraulics.* Use the adjustment screw (PS8) to adjust if necessary.

7.9.5 Checking and adjusting the spreader slide pieces

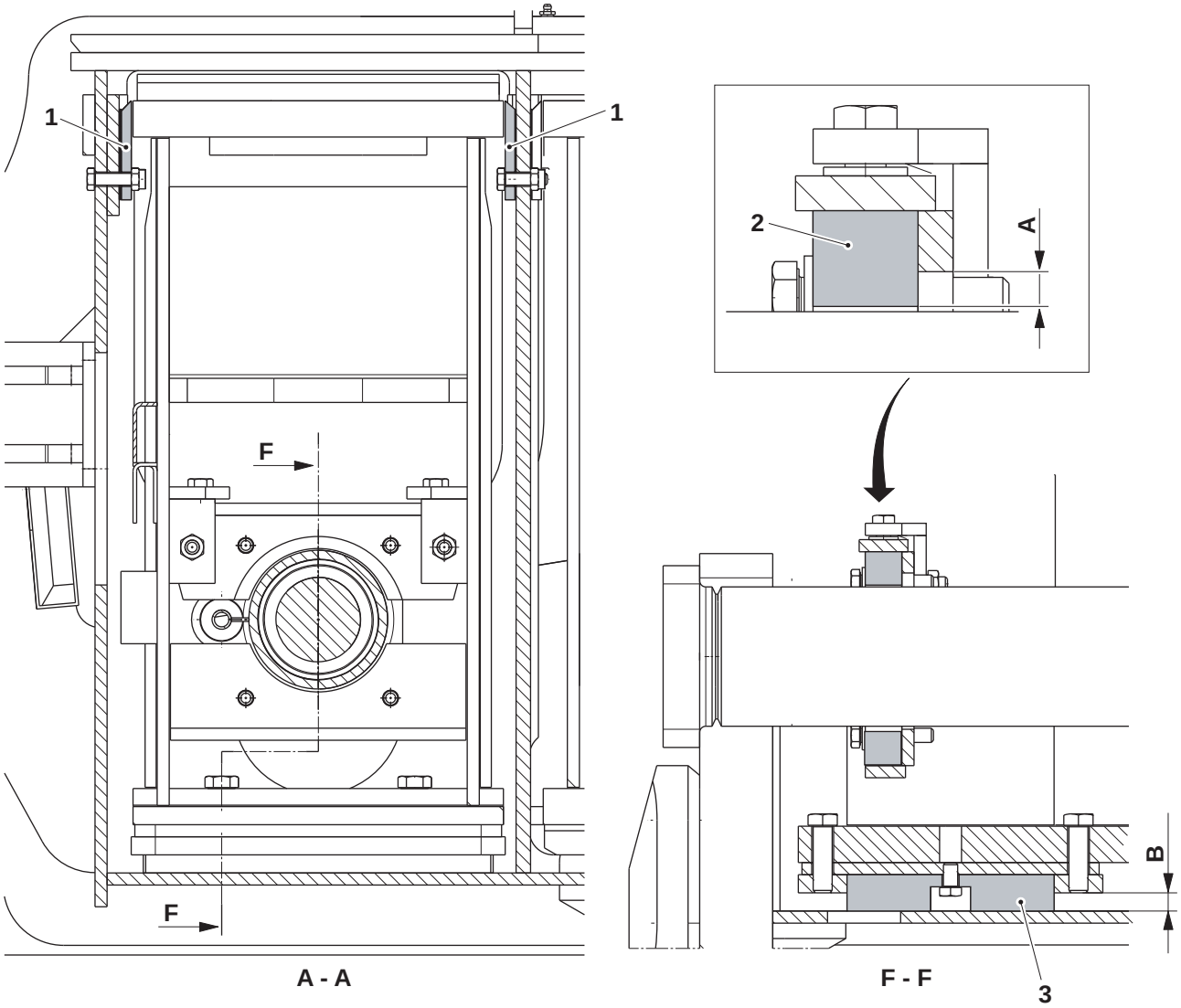
7.9.5.1 T-beams

Component position



Instructions

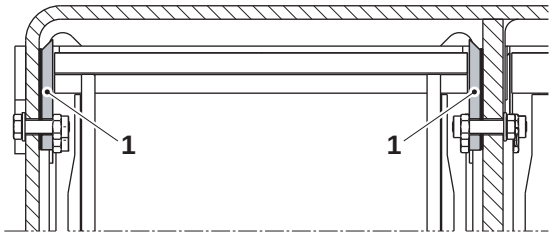
Slide pieces A



Check the thickness of the slide piece (1). If the slide pieces are thinner than 5 mm, replace them.

Check the clearance (A) between the slide piece bracket and the slide piece (2). If the clearance is less than 2 mm, replace the slide piece.

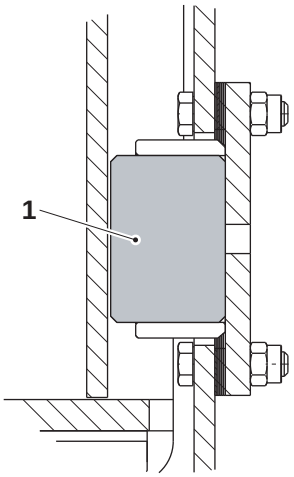
Check the clearance (B) between the slide piece bracket and the frame of the spreader. If the clearance is less than 8 mm, replace the slide piece (3).



B - B

Slide pieces B

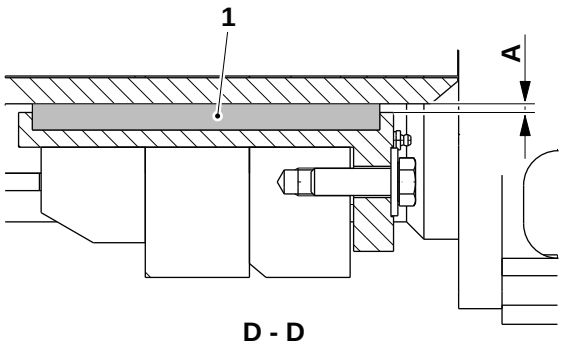
Check the thickness of the slide piece (1). If the slide pieces are thinner than 5 mm, replace them.



C - C

Slide pieces C

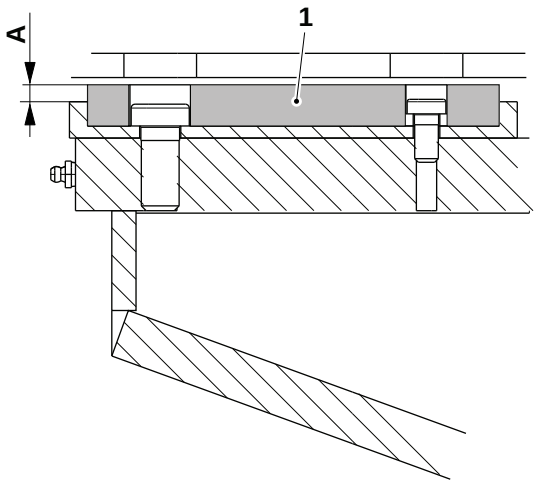
Check the thickness of the slide piece (1). If the slide pieces are thinner than 50 mm, replace them.



D - D

Slide pieces D

Check the clearance (A) between the slide piece bracket and the T-beam. If the clearance is less than 1 mm, replace the slide piece (1).



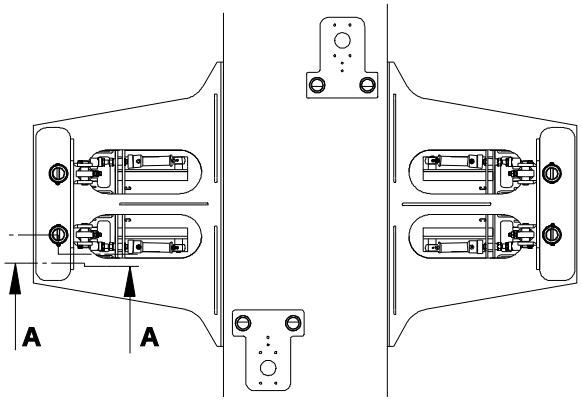
E - E

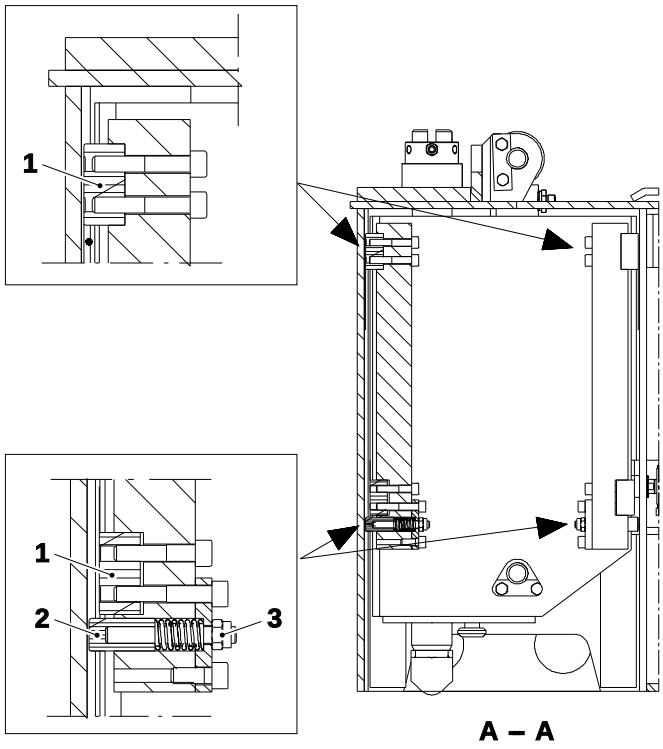
Slide pieces E

Check the clearance (A) between the slide piece bracket and the slide piece (1). If the clearance is less than 2 mm, replace the slide piece.

7.9.5.2 Twinlift boxes

Instructions



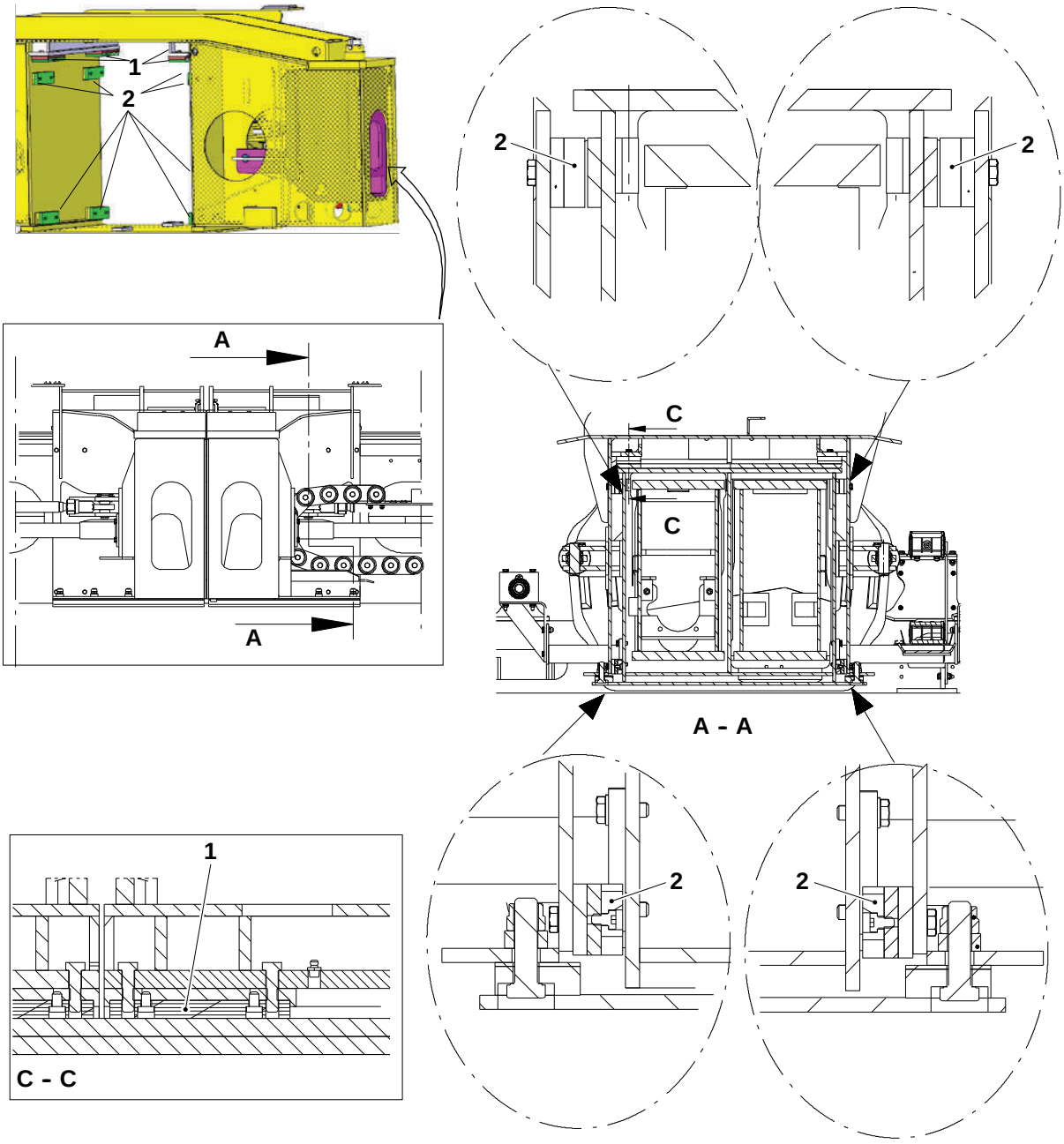


Check the thickness of the slide piece (1). If the slide pieces are thinner than 20 mm, replace them.

Adjust the slide piece (2) with the adjusting screw (3). The adjustment can be done as long as the head of the screw reaches the level of the locking nut. After that the slide piece must be replaced.

7.9.5.2 Twinlift frames

Instructions

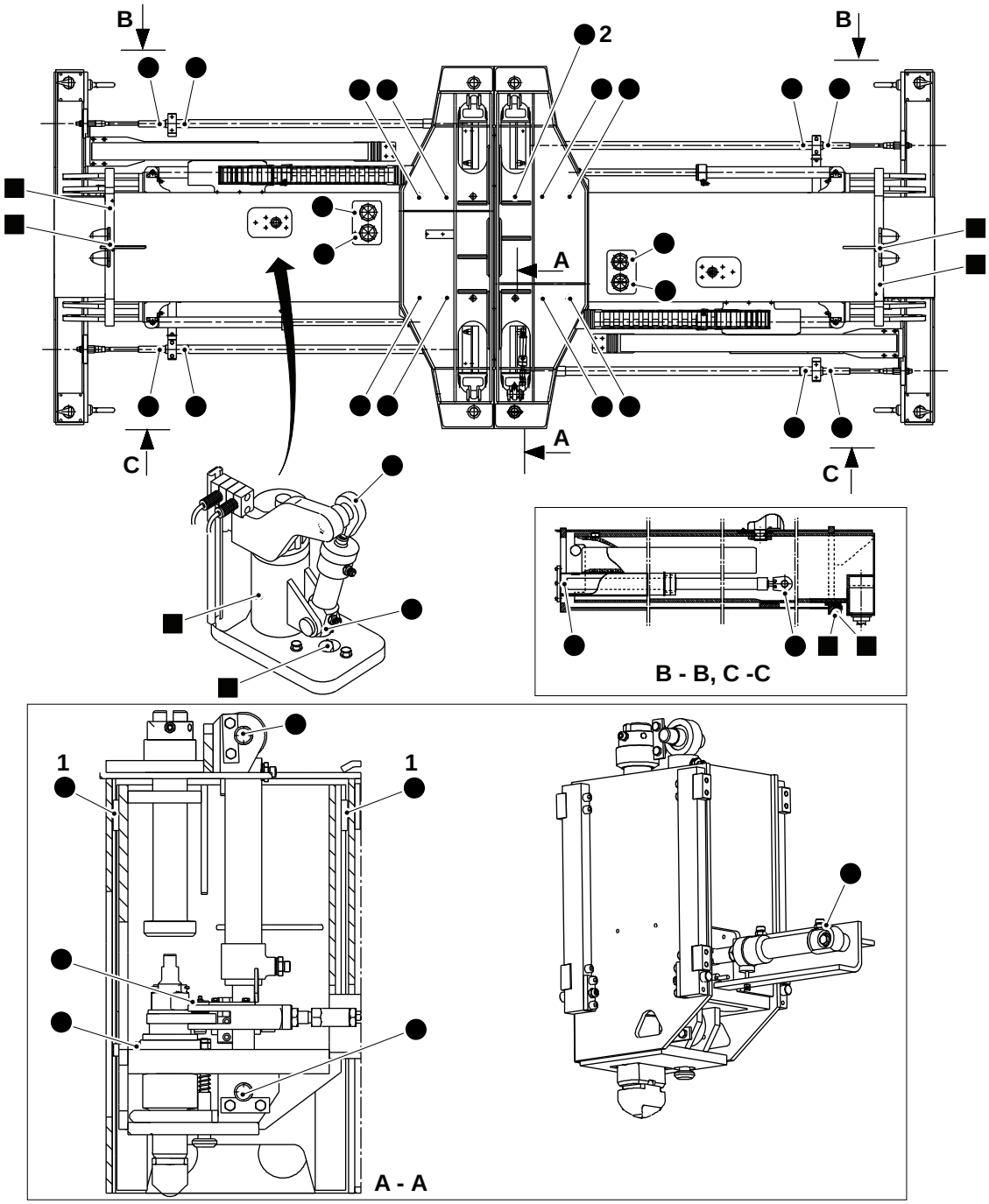


Check the thickness of the slide piece (1). If the slide pieces are thinner than 6 mm, replace them.

Check the thickness of the slide piece (2). If the slide pieces are thinner than 11 mm, replace them.

7.9.6 Lubrication points

Spreader



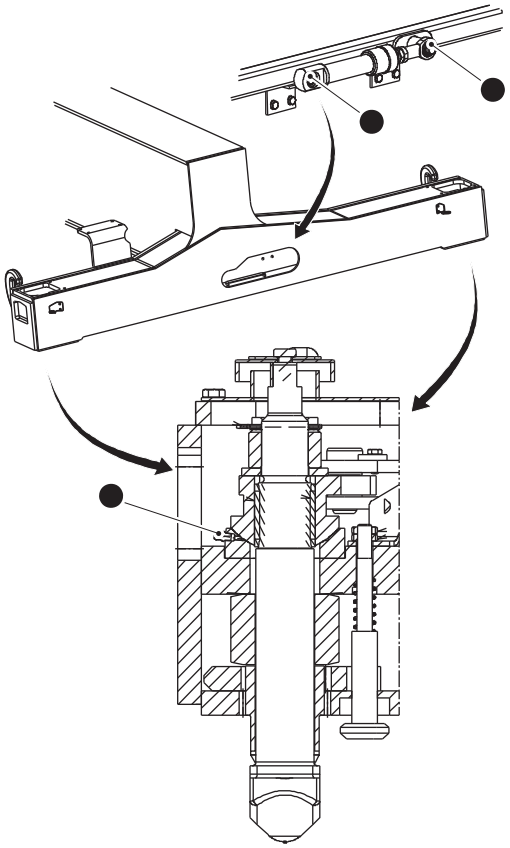
1 Slide surfaces

● Manual lubrication

■ Central lubrication

If the machine is not equipped with a central lubrication system

■ = ●



T-beam

● Manual lubrication

■ Central lubrication

If the machine is not equipped with a central lubrication system

■ = ●