



Workshop literature

Electric forklift truck

RX60-60
RX60-70
RX60-80



6341 6342 6343 6344
56358012001 EN - 02/2017

first in intralogistics



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⚠ CAUTION

Releasing the tension from a flat spiral spring suddenly can damage the spring.

Only release the tension of the flat spiral spring using tensioning device 0009419010.

**ENVIRONMENT NOTE**

Oil must not be allowed to penetrate the sewage system or the ground.

Spring breakage and disposing of the spring assembly**⚠ DANGER**

A broken flat spiral spring can cause serious injury as a result of the sharp edge of the rotating steel strip.

If a spring breaks, do not open the spring assembly.

- Position the spring cover sheet on the spring cassette. Weld together using permanent welded seams all the way round.
- Dispose of the spring assembly.

Maintenance

Maintenance instructions

Maintenance work must be carried out in accordance with the following maintenance intervals. The intervals are designed for standard use. Depending on the application conditions of the truck, shorter maintenance intervals can be set, on agreement with the operating company.

These factors may call for shorter maintenance intervals:

- Contaminated, poor quality roads
- Dusty or salty air
- High air humidity
- Extremely high or low ambient temperatures, or extreme changes in temperature
- Multi-shift operation with a high duty cycle
- Specific national regulations for the truck or individual components

For maintenance tasks, only use original spare parts, and only use consumables that have been prescribed in the overview of consumables.

Slotted nut spanner

Use	Planetary transmission
Part number	399 900 7079

Other special tools:

- Claw extractor
- 2 washers 12.4 x 24 x 2
- 2 washers 8.4 x 24 x 2
- 2 M8 hexagon nuts
- Torque wrench up to 400 Nm
- Locking ring pliers
- Press-in device
- Torque multiplier
- Hotplate

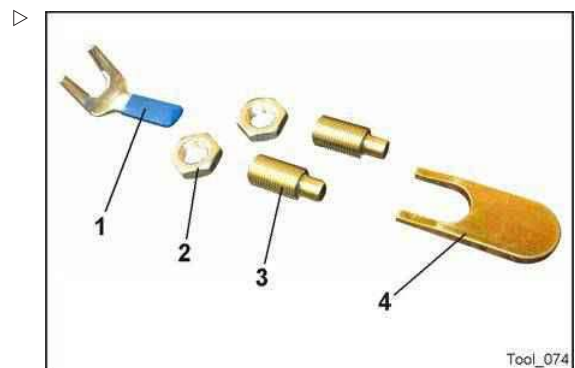
**Hose pulley special tools**

Tension belt; width 80 mm, length at least 2 m



Tool kit - 0009418102

- (1 Release tool
-)
- (2 Hexagon nut
-)
- (3 Locking pin
-)
- (4 Test gauge
-)



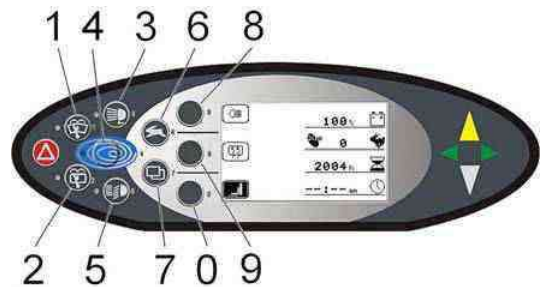
Tensioning device, 1 set - 0009419010



Working using the ABE

Read error list

- Switch on the truck and wait until the standard screen appears in the display. ▷
- Press buttons [6] and [7] simultaneously.



- The display will change to the password screen. Enter the password for the service level and confirm by pressing button [9]. Determine the unique password; see the chapter entitled "Reading out access codes". ▷



- Once the password has been successfully entered, the display will switch to the CONFIGURATION menu. ▷



- Press button [6] or [7] until ERROR LIST is displayed in a framed field. Confirm the entry by pressing button [9].

- The display changes to the ERROR LIST MODE menu. ▷



- Press button [6] or [7] until SERVICE is displayed in a framed field. Confirm the entry by pressing button [9].

- The display changes to the ERROR LIST menu.

Device	
A Z, a ... z	Selection of the relevant controller. For device IDs, see the chapter entitled "Overview of controllers"
*	Recommendation: Errors for all controllers are displayed.
Type	
1	The active errors are displayed
2	All errors that have occurred since the last error reset are displayed
3	All stored errors are displayed

- The framed field DEVICE is activated. Use button [6] or [7] to make the selection and confirm by pressing button [9]. ▷



- The framed field TYPE is activated. Make a selection and confirm in this field too.

- The START display is activated. Press button [9] to start generating the error list.

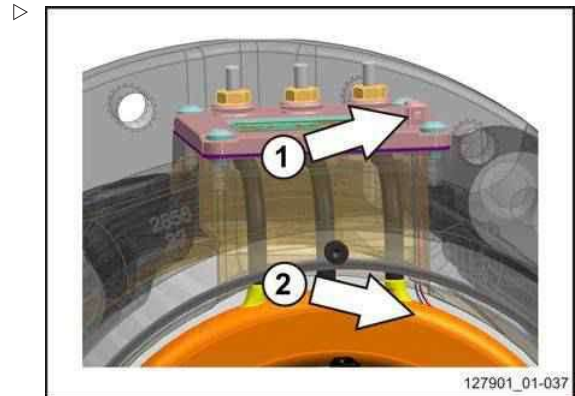
Temperature sensor KTY84

Function

Each traction motor is monitored by a temperature sensor.

The temperature sensors (2) are embedded in the motor stator windings. The connection lines of the temperature sensors are connected to the terminal board of the motor via the connector plug (1).

The signals are evaluated in the respective converter.



Technical data

Type	KTY 84-130
Power supply	Approx. 1.7 mA



NOTE

Observe the polarity of the temperature sensors when installing and testing them. Reverse polarity causes erroneous measured values at higher temperatures.

Electrical connections

3-pin mark II plug X13 (left)					
Red	X13/1	X152/12	Positive	Temp-MCT+	
Blue	X13/2	X152/14	Negative	Temp-MCT-	Black cathode ring

3-pin mark II plug X11 (right)					
Red	X11/1	X151/12	Positive	Temp-MCT+	
Blue	X11/2	X151/14	Negative	Temp-MCT-	Black cathode ring

Testing

⚠ CAUTION

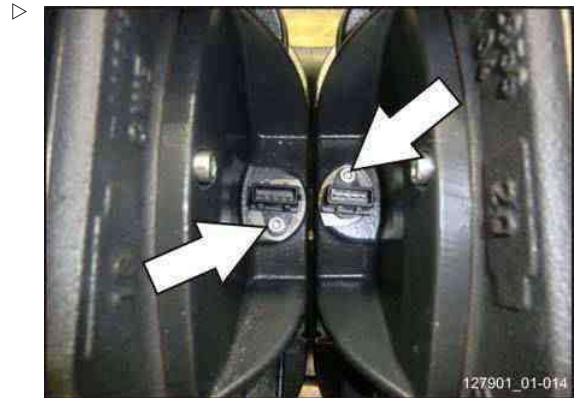
Improperly conducted insulation testing can destroy the temperature sensor.

Before insulation testing, the temperature sensor must be bridged at its connections.

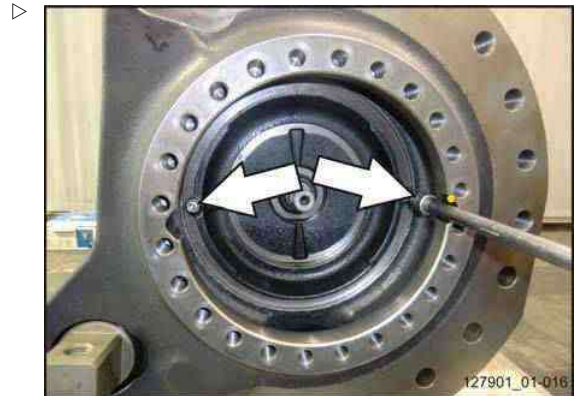
The resistance of the temperature sensor increases as the temperature of the stator winding increases. The resistance value can be checked at the two connections of the temperature sensor.

- Disconnect the connector plug at the terminal board.
- Connect a multimeter to the pins on the plug. The negative potential of the multimeter must

- Unscrew the M6 x 12 socket head screws from the speed sensor and pull out the speed sensor.



- Unscrew the two M8 x 20 socket head screws from the bearing shield.



- Place puller device **000 941 9424** on the bearing shield and secure the puller device to the motor housing using two M16 x 110 socket head screws.
- Screw tensioning screws **000 941 9107** with the nuts and the washers into the extraction bores on the bearing shield.
- Tighten the nuts on the tensioning screws.



- Release the bearing shield with the rotor and carefully pull out the bearing shield.
- Remove the puller device.

⚠ WARNING

The rotor is heavy.
During removal, put a support below the rotor or use a dismantling device.

⚠ WARNING

Do not damage the stator winding during removal.
Take the rotor straight out of the motor housing.

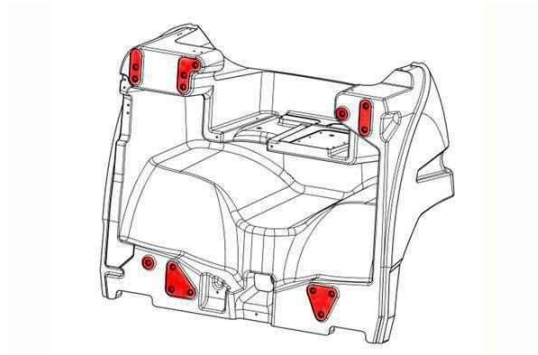


Counterweight

Counterweight

The counterweight is a solid cast component that differs in design according to the type carrier, depending on the load-bearing capacity, chassis and steering axle.

The counterweight is attached to the chassis using mounting screws. The number, arrangement and tightening torques of the mounting screws can vary; refer to the table below.



Type carrier	Mounting element	Number of units	Tightening torque
6341-6344	Hexagon head screw M24 x 90-10.9-ISO 4017	15	930 Nm
	Spring washer Ø24, DIN 6796		

Steering angle sensor 3B02

Function

Steering angle sensor 3B1 is fitted to the steering axle and records the current steering angle. This information controls the speed and the torque behaviour of both drive sides when cornering.

The number of revolutions of the traction motor on the inside of curve is reduced according to the steering lock.

Behaviour when a steering lock is greater than 70 degrees:

- The traction motor on the inside of the curve rotates in a forward direction; however it does so only very slowly.

For safety reasons, the steering angle sensor has two output signals (guide signal and reference signal). The steering angle sensor is connected to the truck control unit via a 4-pin plug.

The sensor disc is in an axial and twistproof position on the steering pivot pin. The steering angle sensor is screwed onto the steering axle by means of a cover.

Check

In the event of incorrect signals, the power supply, the connector plug and the line connection must be checked. It is possible to check the two output signal frequencies using an appropriate multimeter.

Electrical connections

3B02/1	5-V supply	X104/1	X44/14
3B02/2	Signal 2 (left-hand steering)	X104/2	X44/10
3B02/3	Signal 1 (right-hand steering)	X104/3	X44/27
3B02/4	GND analogue	X104/4	X44/42

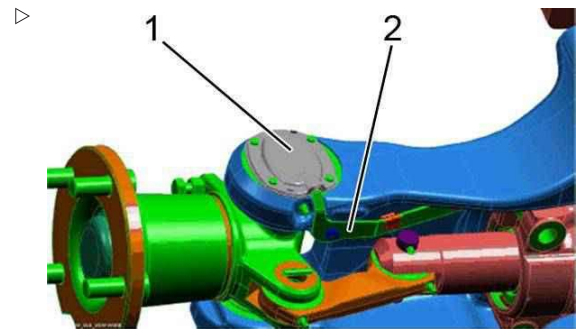
Output signals

The two output signals from the steering angle sensor operate in opposite directions. They have a constant frequency of:

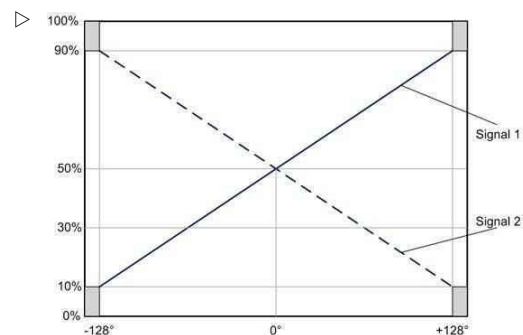
- Guide signal 280 Hz (signal A)
- Reference signal 200 Hz (signal B)

Depending on the position of the steering axle, the time for which the output signals are switched on varies from 10% to 90%.

The truck control unit constantly monitors all signals and generates error messages in the event of incorrect or implausible values.



1 Curve sensor
2 Cable guide



tappet via a brake cable pull and a deflection lever. The brake valve can be operated manually by actuating the hand pump (7).

The valve block (3) contains an accumulator charging section that provides the pressure for the brake section and for the internal pilot control of the valve. The diaphragm accumulator (5) acts as an energy storage system that supplies the required volume flow rate for releasing the brake.

Two pressure sensors (4) continuously monitor the pressure values.

The left-hand pump motor with its flange-mounted hydraulic pump (2) supplies the brake section with the required hydraulic oil.

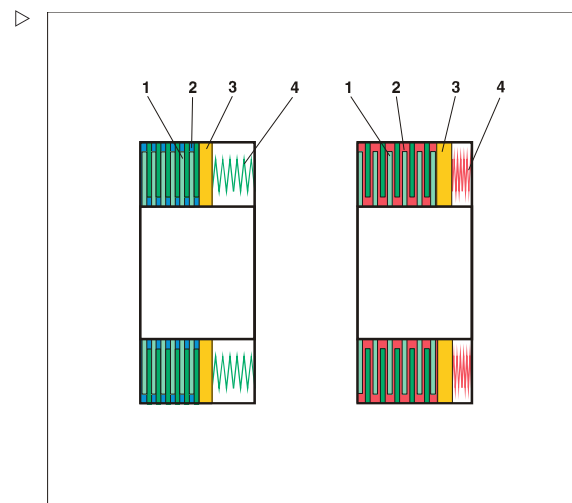
Function

The spring-operated brakes are fitted with compression springs (4) that apply force to the pistons (3) when depressurised. The brake discs (1) are actuated as a result. The brake is applied.

When the truck is switched on and the parking brake is not actuated, the available system pressure acts on the pistons. As a result, the compression springs are compressed sufficiently to free up the brake discs. The brake is released.

The latches of the parking brake in the end positions define the two statuses "brake released" (0% braking torque) and "brake applied" (100% braking torque).

Actuating the service brake activates the brake valve. Depending on the travel of the tappet rod, the pressure in the braking system either increases or decreases. The system pressure decreases in line with the actuation distance and the force exerted by the compression springs increases as the pressure falls. It is therefore possible for the braking characteristics of the truck to be regulated in a controlled manner using the brake pedal.



- 1 Brake discs
- 2 Cylinder chamber
- 3 Piston
- 4 Compression springs

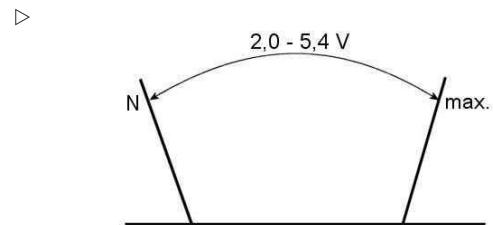
Check

Check	Measuring points	Measured values [Volt]	Correction
Supply voltage	X16/4 - X16/8	11.05 - 12.05	The sensor is adjusted for the accelerator pedal by the manufacturer. It is not possible to perform a subsequent adjustment. In the event of a fault, the entire accelerator pedal must be replaced.
C1 accelerator not actuated	X16/4 - X16/3	5.5 - 6.5	
C2 accelerator not actuated	X16/4 - X16/2	5.5 - 6.5	
C1 accelerator fully actuated	X16/4 - X16/3	8.2 - 11.0	
C2 accelerator fully actuated	X16/4 - X16/2	1.0 - 3.8	
GND breakdown detection		11.5	
VCC breakdown detection		0.5	

Voltage increase

The difference in voltage between the transmitter's inactive position (N) and maximum actuation (max) is referred to as the potentiometer voltage increase.

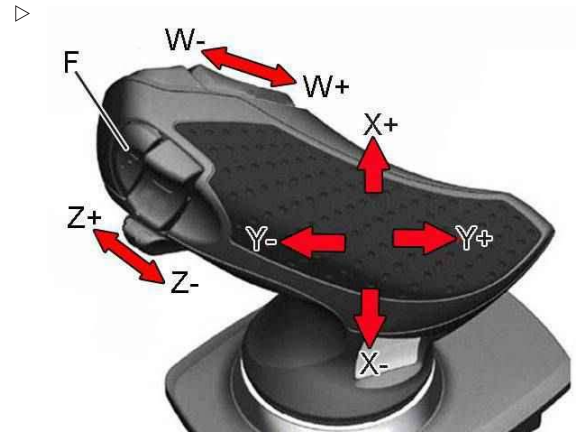
At maximum actuation, the voltage must be at least **2.0 V** and up to a maximum of **5.4 V** higher than in the neutral position (N).



Errors	
Voltage increase too small	The maximum speed is not reached
Voltage increase too large	No problem for the evaluation ▶ The maximum speed is reached but not exceeded. ▶ The end range of the voltage increase is ignored by the controller (dead travel)
Voltage increase significantly too large	Detection of breakdown with corresponding error message

Joystick 4Plus

Axle	Standard
X +	Lower
X -	Lift
Y +	Auxiliary hydraulics 1
Y -	Auxiliary hydraulics 1
Z +	Auxiliary hydraulics 2
Z -	Auxiliary hydraulics 2
W +	Tilt backward
W -	Tilt forward
Axle	Variant
X +	Tilt forward
X -	Tilt backward
Y +	Lift
Y -	Lower
Z +	Auxiliary hydraulics 1
Z -	Auxiliary hydraulics 1
W +	Auxiliary hydraulics 2
W -	Auxiliary hydraulics 2



Retrofitting

For retrofitting, it may be necessary to change the truck central control MCU/TCU; see Electrical Connections

Undo the electrical

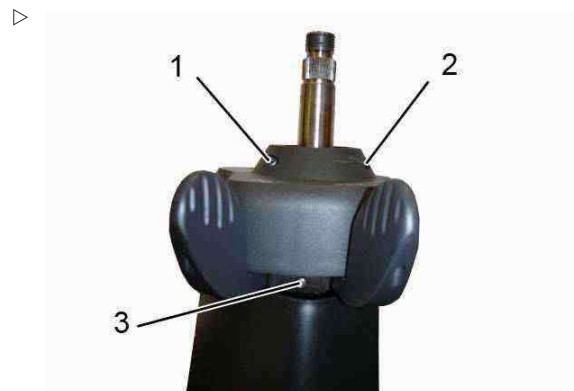
The direction of travel flasher module is connected to the truck central control MCU/TCU via the 4-pin CAN bus plug X45.

Since June 2007, the plug X45 has no longer formed part of standard equipment for the truck central control MCU/TCU.

- X45/1 – CAN r H
- X45/2 – CAN r L
- X45/3 - CAN supply
- X45/4 – GND F

Removal

- Park the vehicle safely.
- Disconnect the battery plug with electric forklift trucks
- Remove the steering wheel
- Remove the console from the housing
- Unscrew the size 8 TORQUE screw (3)
- Unscrew the two cross-recessed screws (1) and (2)



- Disconnect plug X45
- Remove the console from the steering column



Installation

- Connect plug X45
- Connect the console to the housing
- Tightly screw in the two cross-recessed screws (1) and (2)
- Tightly screw in the size 8 TORQUE screw (3)
- Attach the steering wheel
- Connect the battery plug in electric fork lift trucks.
- Perform an operational test.

For hand lever only

2.-5. Hydraulic sensor

Variant

6. Mast vertical

PAN process

Function

⚠ CAUTION

A deactivated PAN process can lead to undefined faults in the truck.

The PAN process must always be activated.

In the truck, the PAN process ensures that the truck control unit (MCU / TCU) always operates all available controllers in the truck according to the current parameters.

Each time the truck is started, the PAN process ensures that the checksums of the individual controllers are compared with the checksums saved in the truck control unit (MCU / TCU).

In the event of parameter changes, software changes or changes of individual controllers, the PAN process ensures that the relevant controllers and the truck control unit (MCU / TCU) process the changes correctly.

It is essential that the PAN process always remains activated, otherwise the necessary checksum comparisons and adjustments cannot be carried out.

Error profile generated when a PAN process is not being performed correctly:

- After switching on, the display of the display operating unit remains frozen on the welcome screen.
- Please wait appears in the display during operation

The current status of the PAN process can be checked via the truck diagnostics.

F4: Monitoring



Status



Status PAN

Starting current boost

Boosting the starting current increases the starting torque from stationary.

The starting current boost is activated by means of parameterisation. The driving behaviour always applies for all drive programs and cannot be changed by the driver.

The current boost is active at every start-up for a maximum of 3 seconds, as long as the truck does not move.

Stopping on a slope

The "Stopping on a slope" driving behaviour is switched on as standard. The driving behaviour is set once and applies to all drive programs.

Effects that occur only when the driver is sitting and the seat contact switch is actuated:

- Function switched on

The driver is sitting on the seat, the truck is positioned on the slope and does not roll downhill.

- Function switched off

The driver is sitting on the seat, the truck is positioned on the slope and rolls slowly downhill at a regulated speed of 1 cm/sec.

The truck remains in position on the slope if the drive direction is neutral and the driver gently actuates the accelerator.

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Wiring

CAN bus system

General

A CAN bus (Controller Area Network) is a "linear network" that comprises multiple participants based on microcontrollers. Due to the signal level technology used and the special structure of the data telegram, the CAN bus system is extremely resistant to interference at high transfer speeds.

Depending on the truck, there are several disconnected CAN bus systems that are used to transfer data between the controllers.

Resistors

In CAN bus systems, reflections at the ends of the wires can cause errors in the signal transmission. Resistors are placed in the wires to dampen these reflections. This is called "termination".

Depending on the truck and the installed CAN bus participants, these resistors are used in different ways.

- Terminating resistors of approx. $120\ \Omega$ define the start point and end point of the CAN bus. In between the start and end points are additional, high-ohmic CAN bus participants, usually decoupled with a resistor of approx. $40\ \text{k}\Omega$.

Terminating resistors can be tested when the truck is switched off.

- In newer truck generations, resistors of varying size are placed in one of the CAN bus participants (such as the truck control unit) via software. These resistors terminate the CAN bus as required.

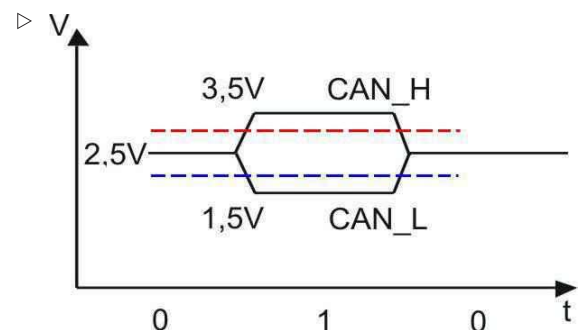
It is not possible to test these resistors, as they are deactivated via the software when the truck is switched off.

Difference signal

The signals used are "difference signals". The difference is measured between the "CAN_L" and "CAN_H" signals.

If both signals are at an idle level of 2.5 V, there is no "difference signal". A "0 information" is transmitted.

If the "CAN_H" signal is increased to 3.5 V and the "CAN_L" signal is simultaneously dropped to 1.5 V, a "difference signal" of 2 V is produced. A "1 information" is transmitted.

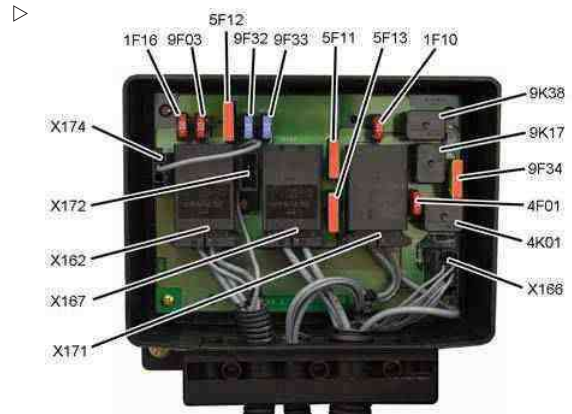


Rear fuse box A22

Fuse box A22 is a modular unit and includes the following components:

- Plug for the 12-volt supply for the additional electrical installations
- Fuses
- Relay

The relay cannot be replaced separately



Plug		Assignment
X166	6-pin	Control cables MCU
X162	A1	+12 V to CPP 1
	A2	+12 V to CPP 3
	B1	+12 V to option board A22
	B2	+12 V to CPP 2
X167	A1	+12 V to U2-OUT (voltage transformer)
	A2	+12 V to U4-OUT (voltage transformer)
	B1	+12 V to U3-OUT (voltage transformer)
	B2	+12 V to U5-OUT (voltage transformer)
X171	A1	+12 V to U1-OUT (voltage transformer)
	A2	GND
	B1	Fan 9M6/1
	B2	Cooling water pump 9M17/2
X172	1	+12 V socket
	2	Unassigned
X174	1	+12 V to servo hydraulics to MCU-X48/14
	2	Unassigned

Fuse		Connection
1F16	10 A	Servo hydraulics (joystick)
1F10	10 A	Cooling water pump 9M17
4F01	10 A	Signal horn 4H1
9F03	10 A	Option board
9F32	15 A	+12 V socket
9F33	15 A	Unassigned
9F34	20 A	Fan 9M6
5F12	20 A	CPP 2 (front)
5F11	30 A	CPP 1 (roof)
5F13	30 A	CPP 3 (seat)

Relay		Connection
4K01	Must not be replaced individually	Signal horn 4H1
9K17		Fan 9M6
9K38		Cooling water pump 9M17

- All silicate-free coolant additives can be mixed together without a problem.
- Qualities G 30, G 30 +, G 33 and G 34 are all silicate-free

Note that the different colours of the coolant additives can create an undefined mixed colour. This makes it difficult to identify the coolant additive easily. This can cause problems with the manufacturer in the event of a warranty claim.

It is recommended that you always use the same coolant quality as found in the cooling system. It is also recommended that you continue to use the same quality that has been used in the cooling system for a long time, even after a complete refill.

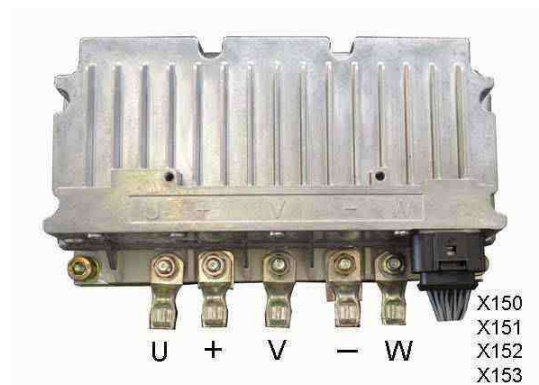
Instructions for the correct use of coolant additive:

- Coolant additives prevent freezing, corrosion-related damage and limescale deposits. They also increase the boiling temperature. The cooling system must therefore always be kept topped up with coolant additives throughout the year.
- Particularly in tropical countries, the coolant increases operational safety by increasing the boiling point in heavily loaded engines.
- Frost protection must be ensured down to around -25 °C (in countries with an Arctic climate, down to around -35 °C).
- In hot countries or even during warm seasons, the coolant concentration must not be reduced by adding water. The percentage of coolant additive must always be at least 40%.
- If greater frost protection is required for climatic reasons, the percentage of coolant additive can be increased to up to 60% (frost protection down to around -40°C). At a higher concentration, the frost protection and cooling effect are reduced.
- Dispose of the used coolant in an environmentally friendly manner. It must not be re-used.

SAC converter - 80 volt

Technical data

1U06, 1U07, 2U03, 2U04	
Manufacturer	STILL
Voltage	80 V
Rated current	400 A
Code letter	
Cooling	Water-cooled



Electrical connections

Power connections	
-	Batt- (GND-L)
+	U-Batt after main contactor
U	Field connection to motor
V	Field connection to motor
W	Field connection to motor

Control wiring harness	
X150	2U04 to 2M02, left-hand pump motor
X151	1U06 to 1M01, right-hand traction motor
X152	1U07 to 1M02, left-hand traction motor
X153	2U03 to 2M01, right-hand pump motor

Plugs X150, X151, X152, X153	
Pin 1	Speed sensor, GND-L
Pin 2	GND-F from SU
Pin 3	Speed sensor signal, phase 1
Pin 4	CAN H connected to SU
Pin 5	Speed sensor signal, phase 2
Pin 6	CAN L connected to SU
Pin 7	Speed sensor, 10 V
Pin 8	24 V from SU
Pin 9	Monitoring U
Pin 10	Enable signal from SU
Pin 11	Monitoring V
Pin 12	+ temperature sensor for motor
Pin 13	Monitoring W
Pin 14	- temperature sensor for motor

Item	Name	Number
1	640-A truck harness	1
2	640-A battery harness	1
3	Bracket for latching the battery door when open	1
4	Support for securing the cable to the chassis	1
5	Support for routing the cable around the corner of the chassis	1
6	Cable guide on the housing for the contactor stand (PDU)	1
7	Support for stop with rubber buffer	1
8	Charger adapter for the battery harness	1
1, 3	Socket head screw, M8x45-912-8.8	4
1, 3	Washer, M8-9021-A2S	4
1, 3	Polystop nut, M8	4
7	Hexagon head screw, M6x20-933-8.8	2
7	Washer, M6-6796-A2S	2
	Cable tie	10

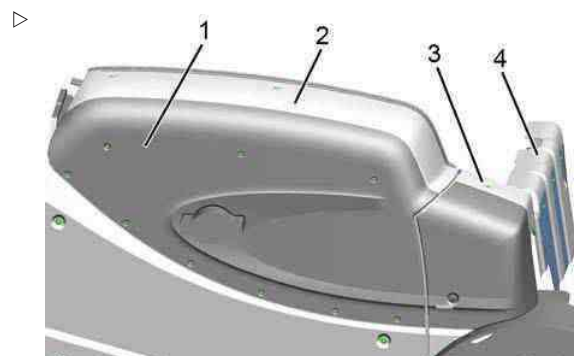
Preparation

To perform the conversion, the battery must be removed from the truck. A second truck with a sufficient load capacity is necessary for this purpose.

Assistance from a second person is helpful when installing the truck harness because the 120-mm² cables are very heavy and awkward.

Removing the truck harness from the truck

- Park the truck securely.
- Lower the lift mast. Tilt the lift mast forwards.
- Disconnect the battery male connector.
- Remove the battery using a second truck.
- Remove the upper panelling on the battery door (1).
- Remove the panelling above the battery (2).
- Disassemble the front right-hand panelling (3).
- Remove the panelling from the front structure (4).
- Remove the bottom plate.

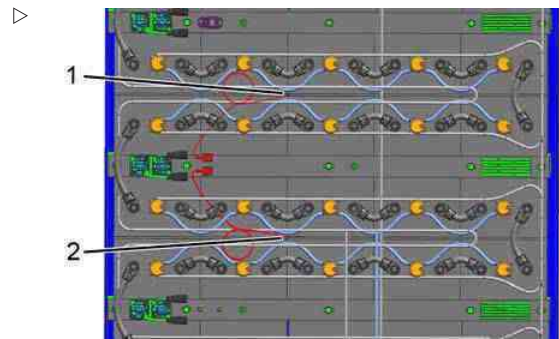


Temperature sensors

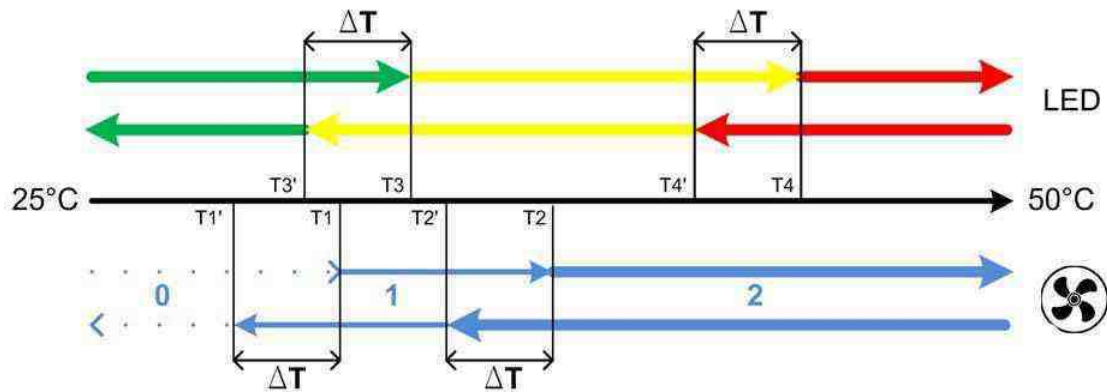
Function

Two temperature sensors are installed in the centre of the battery, as this is where the highest temperatures are to be expected. The sensors are designated as measurement 1 and measurement 2.

The higher temperature value of the two measurements controls the fan and the LED display.



Temperature management

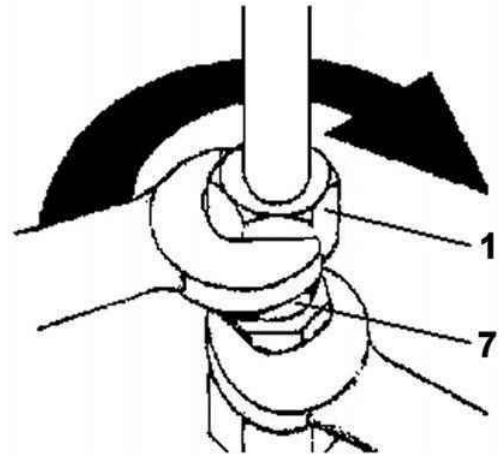


The limits and the hystereses can be parameterised separately for the temperature and fan stages.

The right-hand pump motor is only switched on once the working hydraulics (lifting, tilting, auxiliary hydraulics, oil cooling) are actuated. In this mode, the speeds of the two pump motors are precisely synchronised. Synchronising the speed reduces noise.

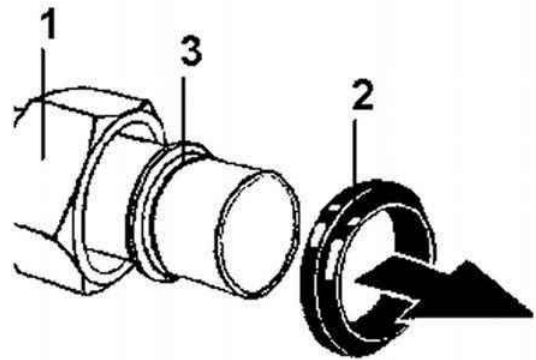
The temperature sensors of the pump motors provide the signal for opening the bypass valve to the oil cooler. In the truck control unit (MCU), a theoretically increased oil temperature is calculated using the temperature signals from the pump motors. It is only at this point that the bypass valve opens and the oil is conveyed to the oil cooler.

- Tighten the functional nut (1) until you clearly feel an increase in connection strength, **approx. 1 to 1 ½ turns** ▷
- Hold the socket (7) together when doing so

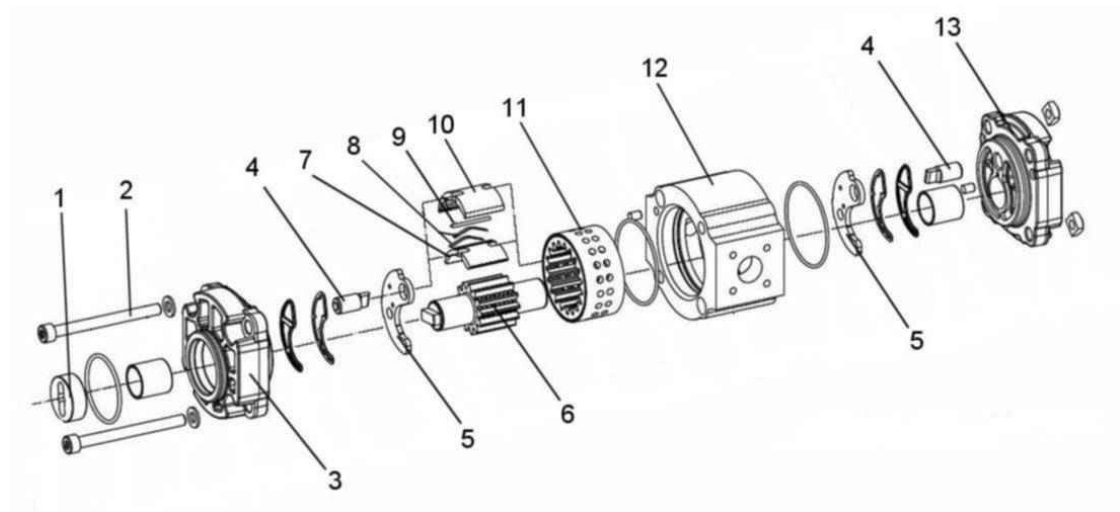


Sealing ring replacement

- In the event of leaks at the screw joint, the sealing ring (2) can be removed from the free pipe end and replaced ▷



Structure



- | | | | |
|---|---------------------|----|----------------------|
| 1 | Tappet | 8 | Segment springs |
| 2 | Clamping screw | 9 | Sealing roller |
| 3 | Flange cover | 10 | Annular gear segment |
| 4 | Retaining pin | 11 | Annular gear |
| 5 | Thrust washer I | 12 | Housing ring |
| 6 | Pinion shaft | 13 | End cover |
| 7 | Pinion gear segment | | |

Hydraulic pump — error detection

Error	Cause	Remedy
Noise in the hydraulic pump	The hydraulic system has leaks and is sucking in air	- Check the radial seal ring in the pump motor
Hydraulic oil is frothy		- Check the O-ring between the intake hose and the hydraulic pump
Hydraulic functions are slow to respond		- Mechanical damage in the hydraulic pump

Enable via 1/3 actuation of the operating lever, three-way valve block			
Address	Value	Description	
A 10 042	00	Crossbar switch index for setpoint value limiter, analogue input	
	2B	In RX60-25-50 (6321-6330)	Four-way mini-lever
	3A		Duplicate mini-lever
	3A		Fingertip
A 10 043	00	Crossbar switch index for setpoint value limiter, digital input	
	31	In RX60-25-50 (6321-6330)	
A 10 044	2B	Crossbar switch index for setpoint value limiter, analogue input	Four-way mini-lever
	3A		Duplicate mini-lever
	3A		Fingertip
	00	In RX60-25-50 (6321-6330)	
A 10 045	31	Crossbar switch index for setpoint value limiter, digital input	
	00	In RX60-25-50 (6321-6330)	
A 10 04D	2B	Crossbar switch index for universal output 1	Four-way mini-lever
	3A		Duplicate mini-lever
	2B		Fingertip

- Seal off the connections on the distributor of the hose pulley using union nut 0009510108 and stopper 0009527004.
- Cover the fork arms and the hose pulley with plastic.

**NOTE**

The plastic protects the hose pulley against damage.

- Position the fork arms under the hose pulley.
- Secure the hose pulley to the fork arms using a tensioning belt.

⚠ CAUTION

Stud bolts can be damaged.

During removal, ensure that the stud bolts are aligned with the mounting bores. Do not tilt the lift mast.

- Take out and remove the hose pulley.

**Installing the hose pulley****⚠ DANGER**

The new hose pulley is delivered in a tensioned and secured state.

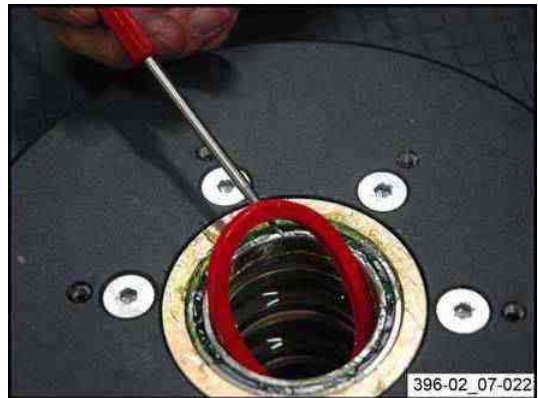
Do not loosen the locking pins.

- Cover the fork arms with plastic.
- Secure the hose pulley to the fork arms using a tensioning belt.

- Remove the wiper from hose guide 1 and 2. ▷



- Remove the rotation seals. Do not damage the groove base or the edges of the groove. To remove, carefully insert a scriber in the seal. ▷



Installing seals

i NOTE

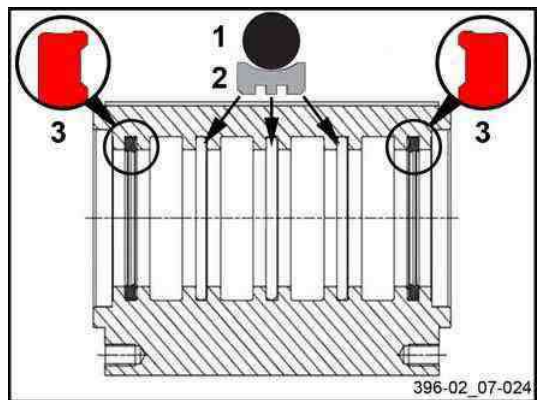
- *Incorrectly fitted seals are often the reason for hose pulleys leaking; fit the sealing rings with the specified pliers; press down using your fingers*
- *Kinked seals no longer seal reliably, therefore avoid kinks*
- *Use your finger or carefully insert the stator to check the seal is seated correctly in the rotor*

Assembly sequence:

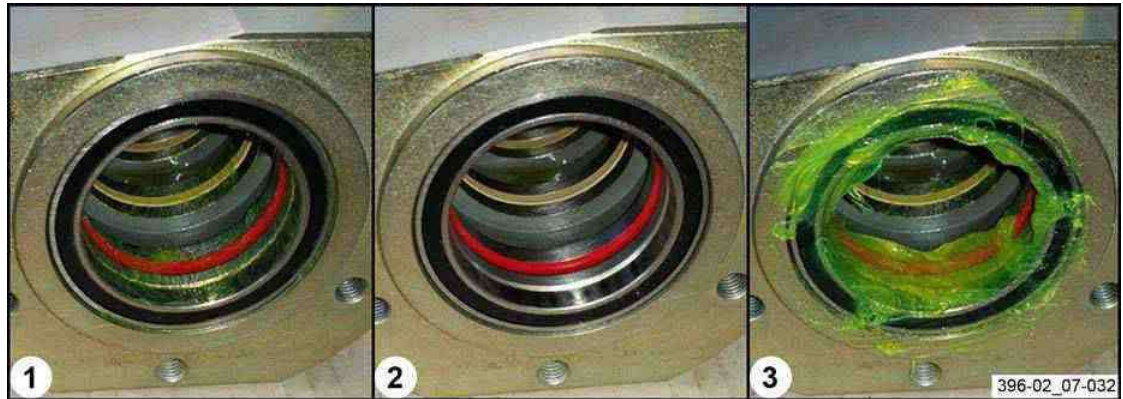
	Single auxiliary hydraulics	Double auxiliary hydraulics
1 O-ring	1 x	3 x
2 Profile sealing ring	1 x	3 x
3 Grooved ring	2 x	2 x

i NOTE

Install grooved rings with the groove facing inwards.



Lubricating the swivel joint



1 Optimally greased

2 Insufficiently greased

3 Excessively greased

Lubricate the swivel joint as shown in the picture (sample illustration), as incorrect lubrication may result in apparent leakage.

Support roller play (195)

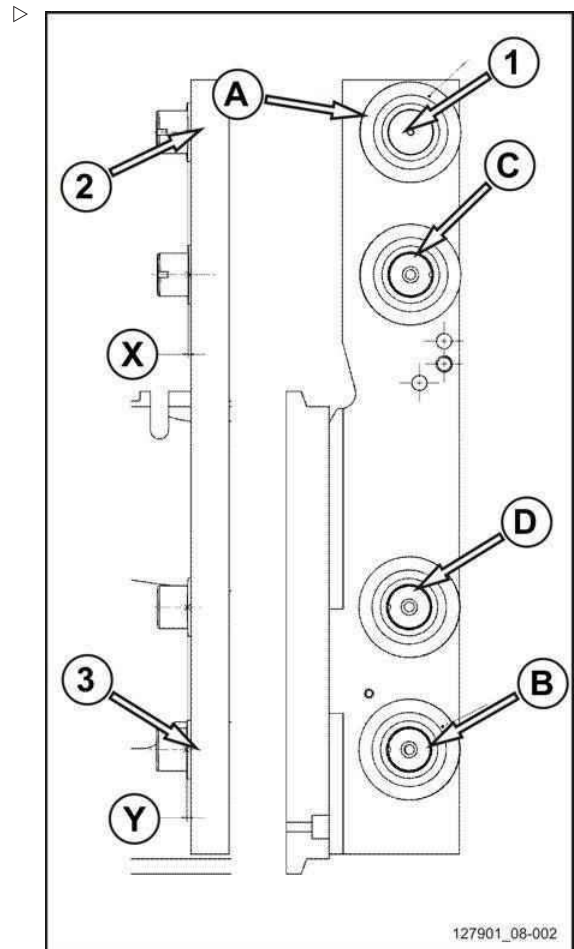
General

The settings described here refer to a new assembly of support rollers. They are not maximum permissible wear values or play for lift masts in service.

Wear in mast profiles does not occur uniformly along the entire length: it mainly occurs in the working area. This is usually where the support rollers are positioned during transportation. Often, the mast rails at the top are used so infrequently that they are like new. As a result, larger support rollers or additional shim rings cannot be fitted to compensate for play without having the effect of jamming the support rollers.

It is impossible to determine general limits for localised wear of this kind. Many factors affect whether the existing play is disruptive or hardly noticeable. The operational safety of the lift mast is not impaired by this. It is only necessary to critically inspect whether a lift mast continues to function correctly once wear of approx. 3% of the diameter is detected. It may be necessary to inspect tall triplex lift masts earlier, and short telescopic lift masts only at 4% wear.

The operational safety of the lift mast is maintained for a significantly longer period of time as the individual mast components remain securely locked into each other even in the case of extreme wear. If a support roller fails or breaks, the lift mast must be taken out of operation immediately.

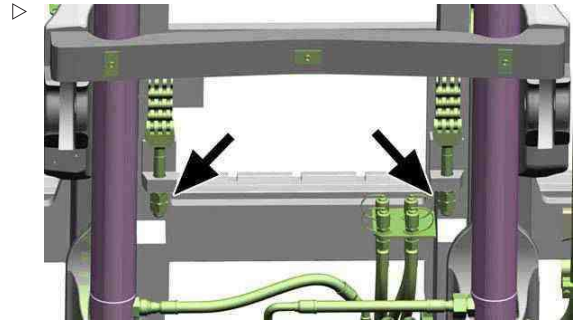


Axial clearance

Axial clearance is compensated for using shim rings. The shim rings are available in thicknesses of 0.5 mm and 1.5 mm.

- Axial clearance AS on support roller A and B (for a four-roller fork carriage):
Min. 0 mm, max. 0.5 -1.5 mm
- Axial clearance AS on support roller A (for six-roller and eight-roller fork carriages):
Min. 0 mm, max. 0.5 -1.5 mm
Support roller A is secured using a screw plug (1)

- Adjust the load chains on the chain anchors evenly on both sides.
- Secure the tensioning nuts using lock nuts.
- Extend the lift mast up to the stop and check its clearance to the run-out barrier.



End position damping, type B (bottom)

General

While lowering during lift 2, the end position damping hydraulically brakes the piston rod of the right-hand outer cylinder just before it reaches its end position.

This prevents metal striking on metal.

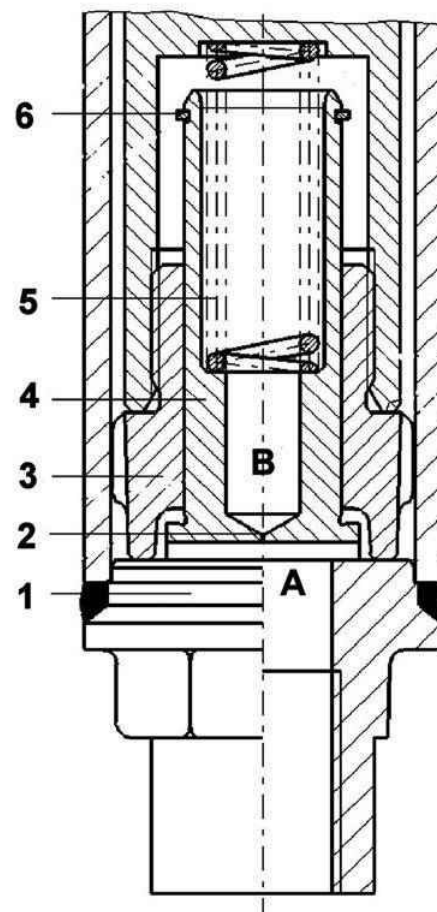
The right-hand outer cylinder is equipped with end position damping. In telescopic lift masts, end position damping is not installed.

Function

During lifting, the piston (4) is moved towards the cylinder bottom (1) by the spring force of the compression spring (5) until the snap ring (6) lies against the piston cover (3). The hydraulic oil is unrestricted as it flows out of the cylinder.

During lowering, the oil flows out of the cylinder unrestricted until the piston (4) reaches the cylinder bottom (1). The piston (4) is moved into the piston cover (3). As a result, the hydraulic oil flows from area (B) into area (A) via the orifice bore (2).

This pressure balancing brakes the lift mast hydraulically.



- 1 Reducer bore
- 2 Piston cover
- 3 Piston
- 4 Compression spring
- 5 Snap ring

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