PANTERA 4502 MY 2018 Section 09

Steering System

Stefan Kärcher, After Sales, 2017

AMAZONE

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1. Front-wheel steering

1.1 General layout

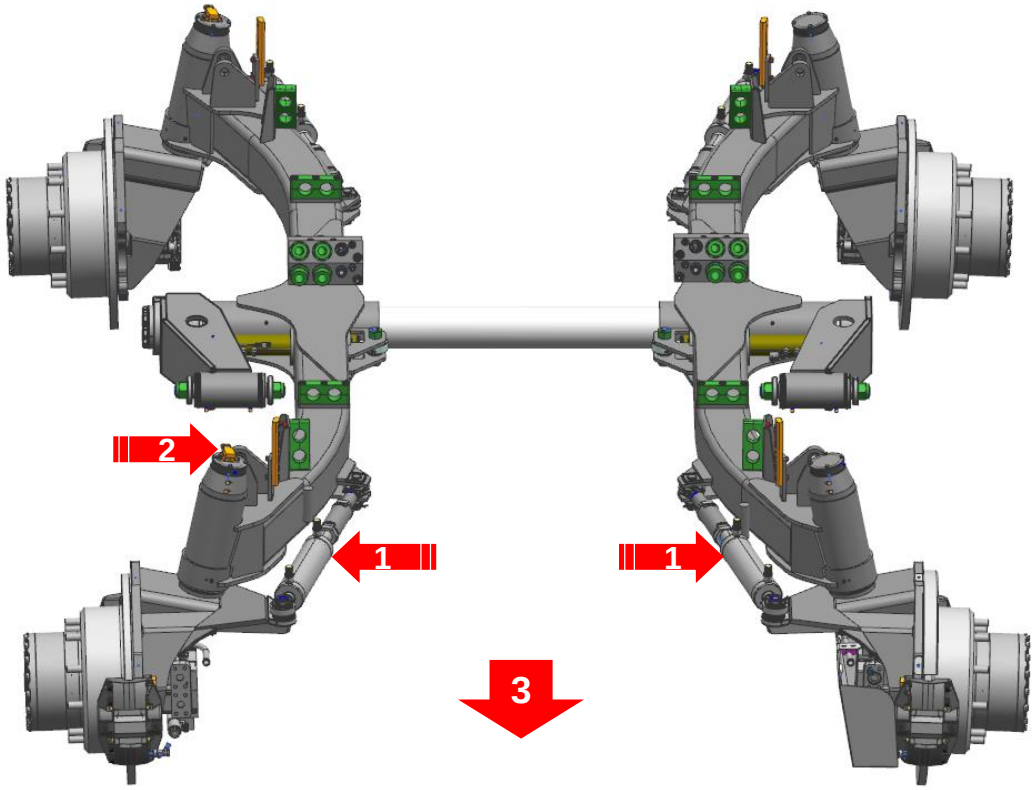
1.2 Hydraulics

1.3 Electrical system

1.1 General layout

The front-wheel steering system consists of the following components

- Constant pressure pump.
- Priority valve.
- Steering orbitrol.
- Track correction valve.
- Steering cylinder (1x per wheel).
- Steering wheel angle sensor (1x, right).



1- Steering cylinder

2 - Steering angle sensor

3 - Direction of travel

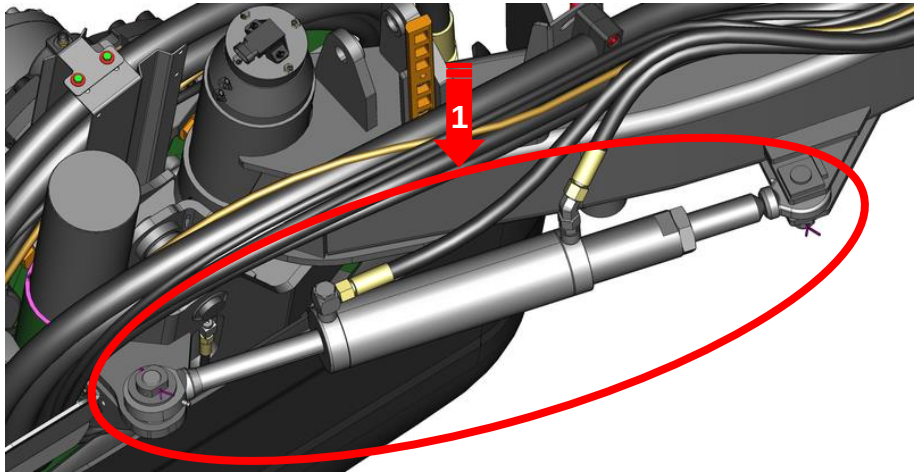
1.1 General layout

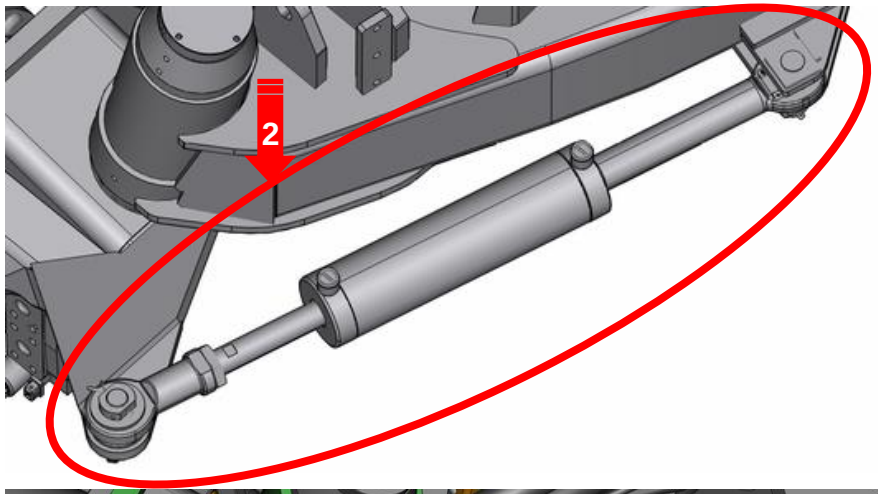
Steering cylinder

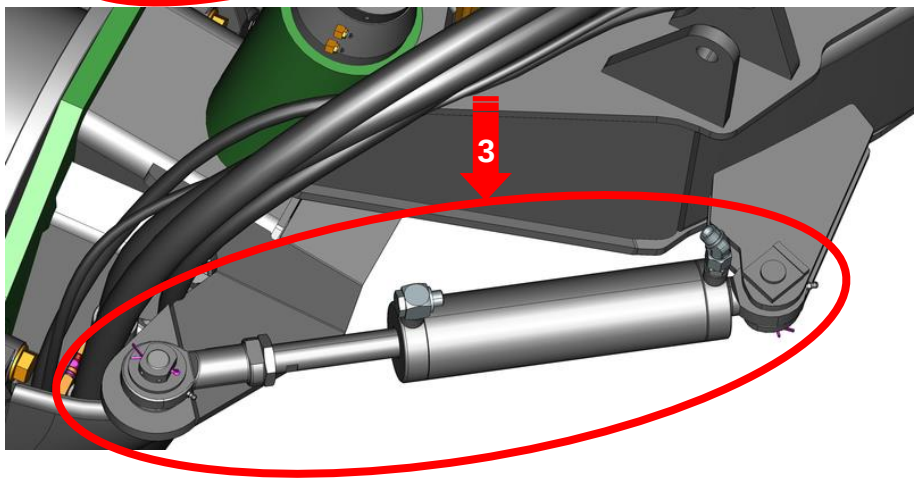
- The standard and H running gears have the same steering cylinder:
  944864 (1).

- During the course of model year 2018, this cylinder will be converted to cylinder **GA430** (2), which has a fine thread on the piston rod side. This make the adjustment easier.

- The W running gear has a different steering cylinder:
  GA307 (3).



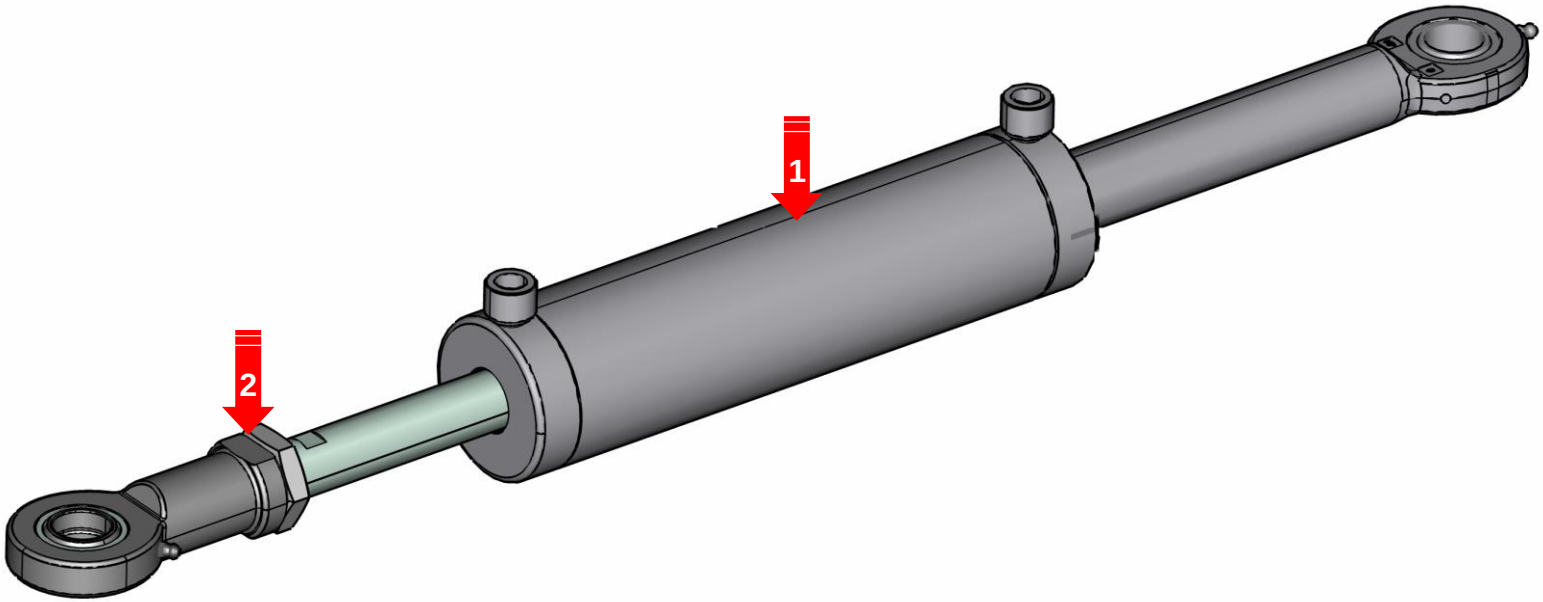




1.1 General layout

New steering cylinder GA430 for PANTERA and PANTERA-H

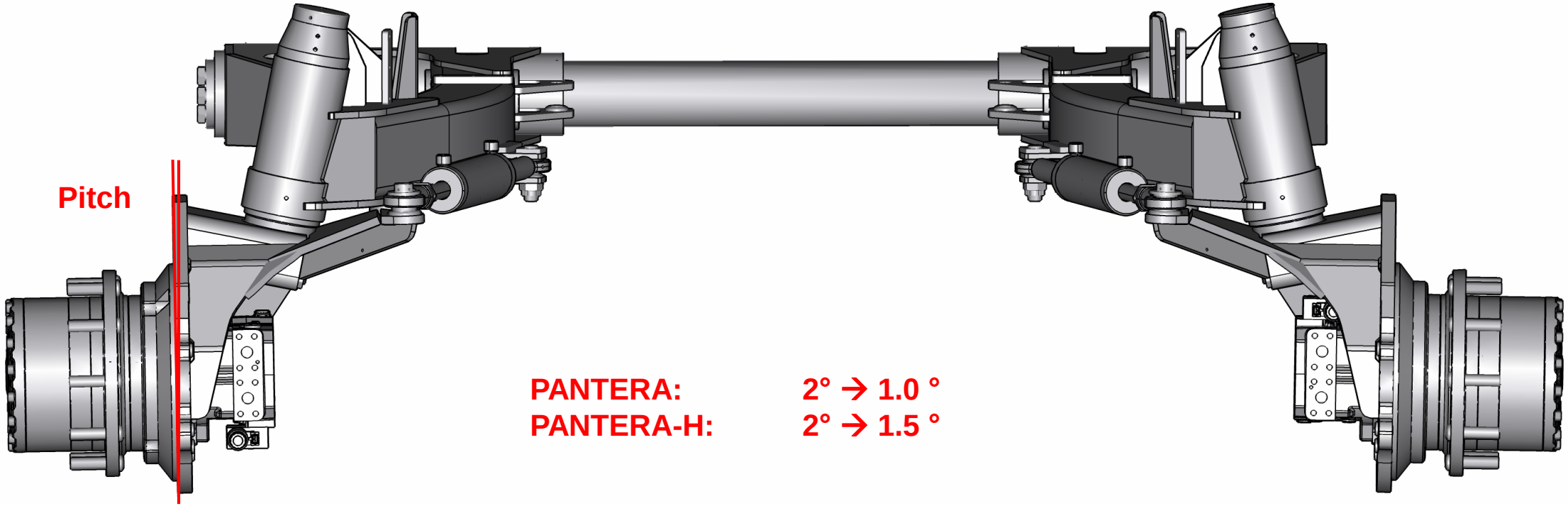
- During the course of model year 2018, the steering cylinder for PANTERA and PANTERA-H will be replaced by **GA430** (1).
- The cylinder has a fine thread (M30x2) on the piston rod side (2), which enables easier and more precise adjustment of the track.
- The new cylinder can be installed in both existing and in new running gears (regardless of the pitch).
- The old steering cylinder 944864 had a setting sleeve with a coarse thread (M36x3.5) and can only be installed in the old running gears with the large pitch.



1.1 General layout

Changing the pitch

- The reduce tyre wear, the pitch of the wheels on the standard and the H running gears will be reduced during the course of model year 2018.
- The W running gears remain unchanged.
- The running gears and components are given new part numbers.



1. Front-wheel steering

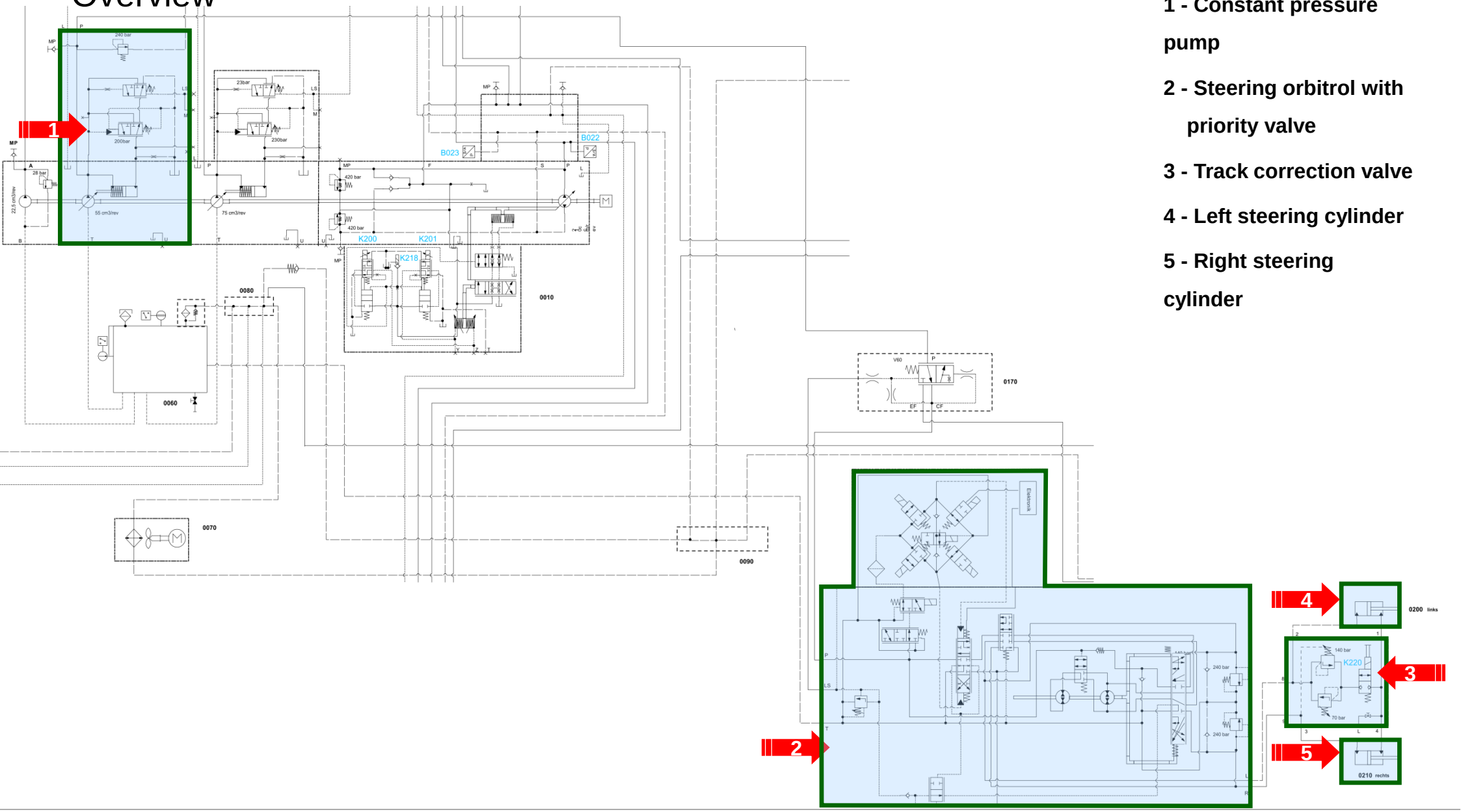
1.1 General layout

1.2 Hydraulics

1.3 Electrical system

1.2 Hydraulics

Overview



1 - Constant pressure pump

2 - Steering orbitrol with priority valve

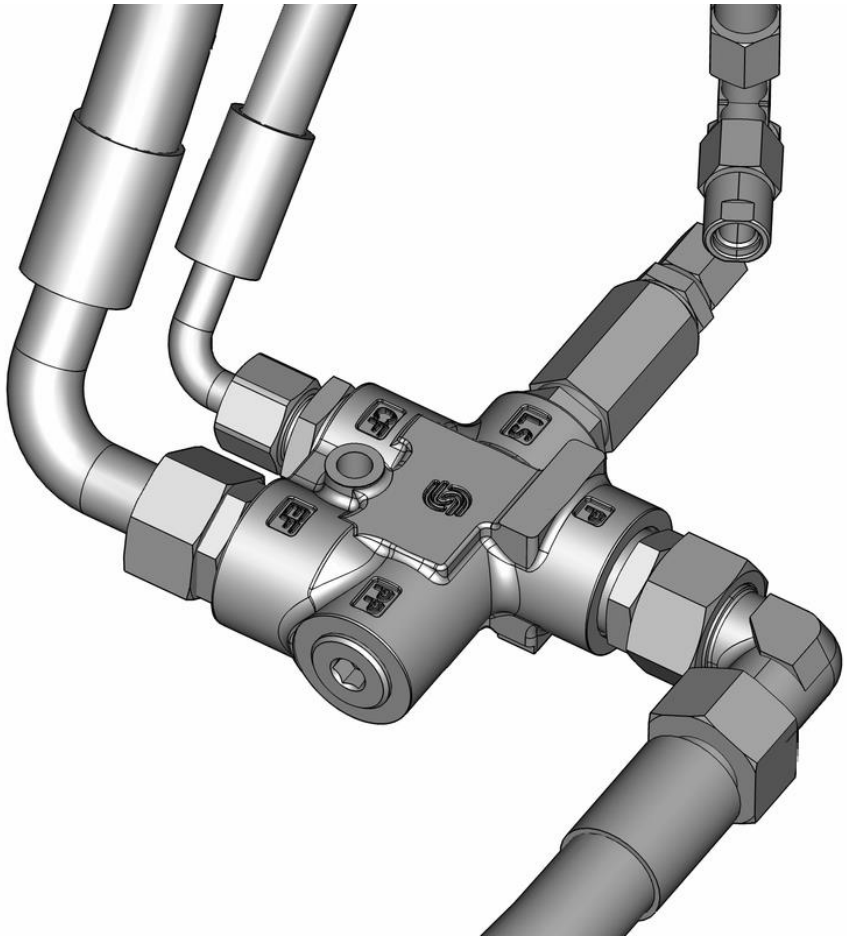
3 - Track correction valve

4 - Left steering cylinder

5 - Right steering cylinder

1.2 Hydraulics

Priority valve



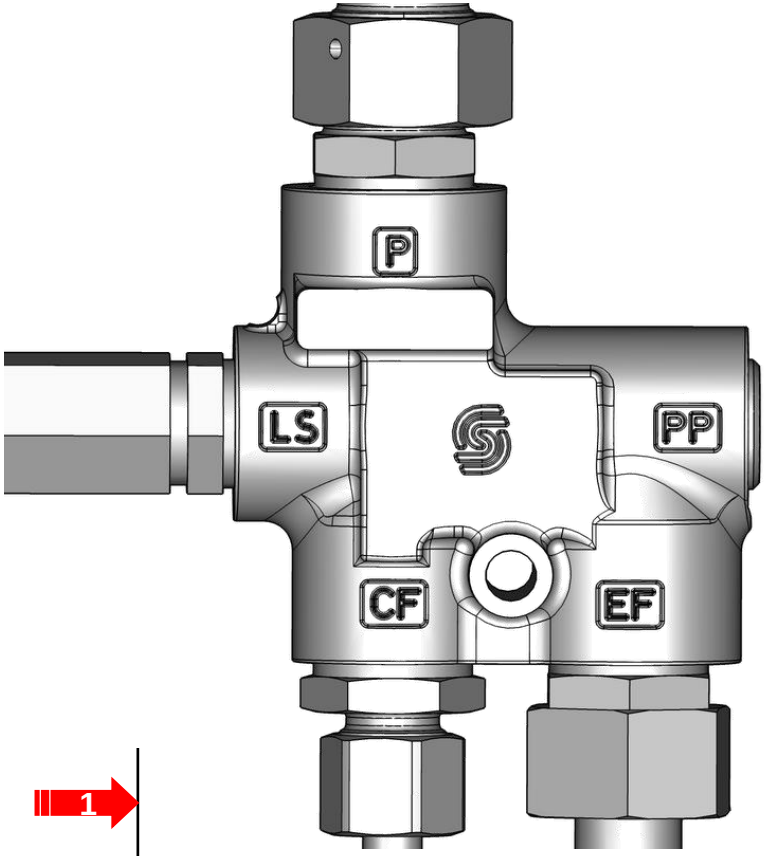
As of PAP0000370, **ALL** machines have a priority valve, regardless of whether they have an automatic steering system or not:

- Easy retrofitting of the Steer-Ready kit (947992):
- → no changing of the hydraulic hoses is necessary.
- → only the orbitrol must be changed (+ install foot pedal + software).
- Quieter in the cab, less humming noise.
- Standardised parts.

1.2 Hydraulics

Priority valve

- The priority valve splits the flow of oil arriving at P into a primary (CF) and a secondary circuit (EF).
- This is a proportional valve.
- It is controlled by the steering orbitrol through the LS cable.

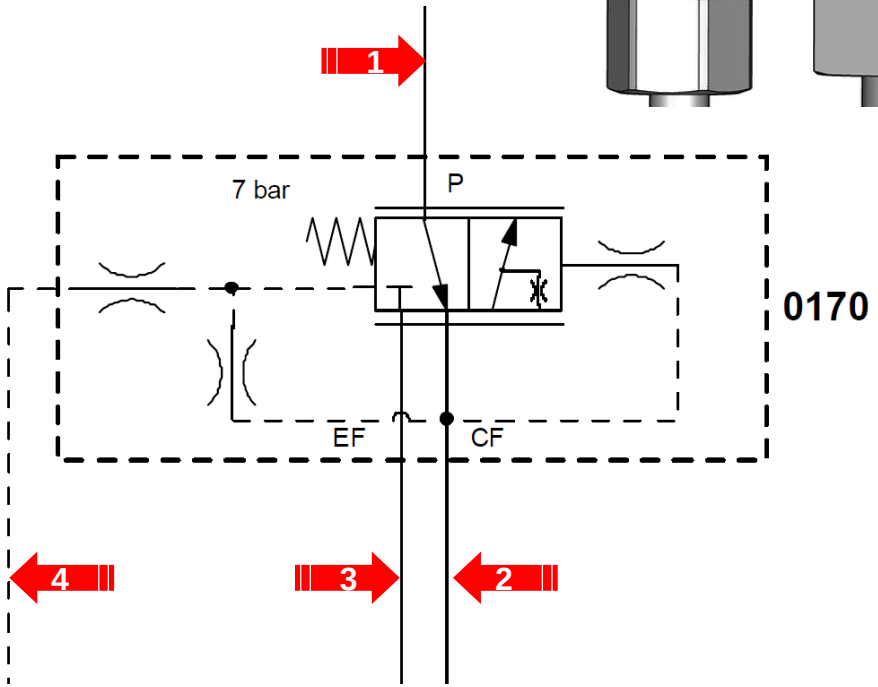


1 - P: from the constant pressure pump

2 - CF: to the steering orbitrol = primary circuit

3 - EF: to hydraulic block 1 = secondary circuit

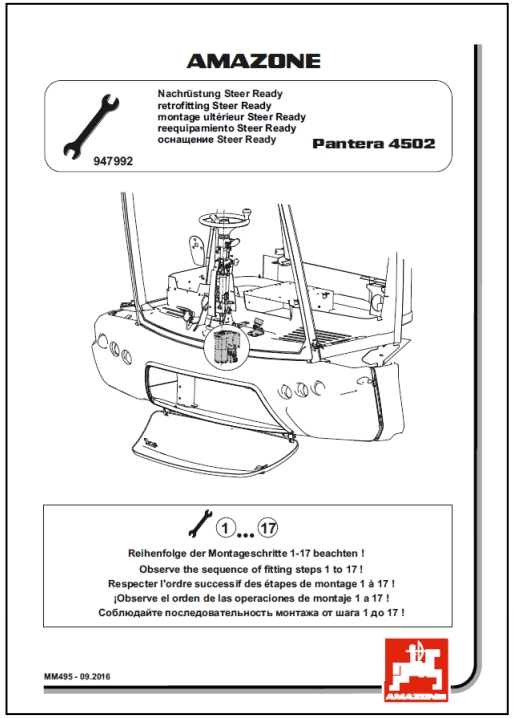
4 - LS cable to orbitrol

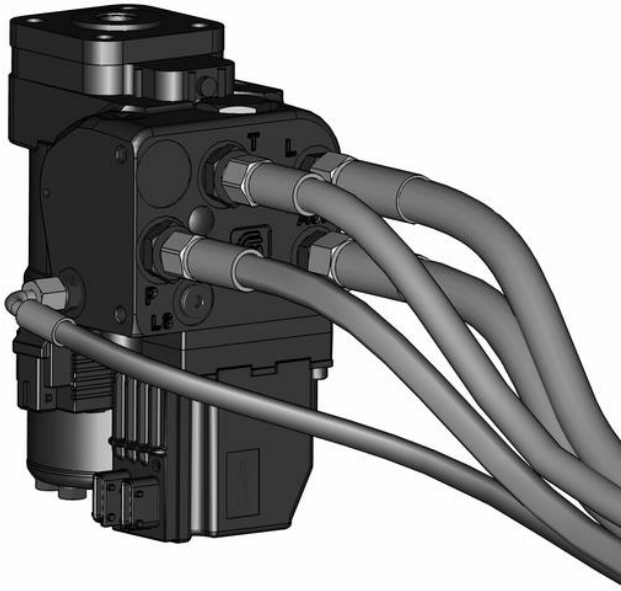


1.2 Hydraulics

Steer-Ready retrofitting kit 947992:

- Kit with steering orbitrol GD841, foot pedal, accessories and assembly instructions MM495.
- For PANTERA 4001 (as of PAN0000120) and all PANTERA 4502.
- No changing of the hydraulic hoses is necessary.
- A small modification on the pump is required.
- Setup with AGENT and PVEDoctor is required.
- Price: 5,500 € gross (parts only, plus installation).
- MM495.





1.2 Hydraulics

Steering orbitrol GD677 – without automatic steering system

The steering orbitrol is fed by the priority valve and has a tank and LS connection, plus connections for the steering cylinders.

1 - P: from the constant pressure pump (priority valve)

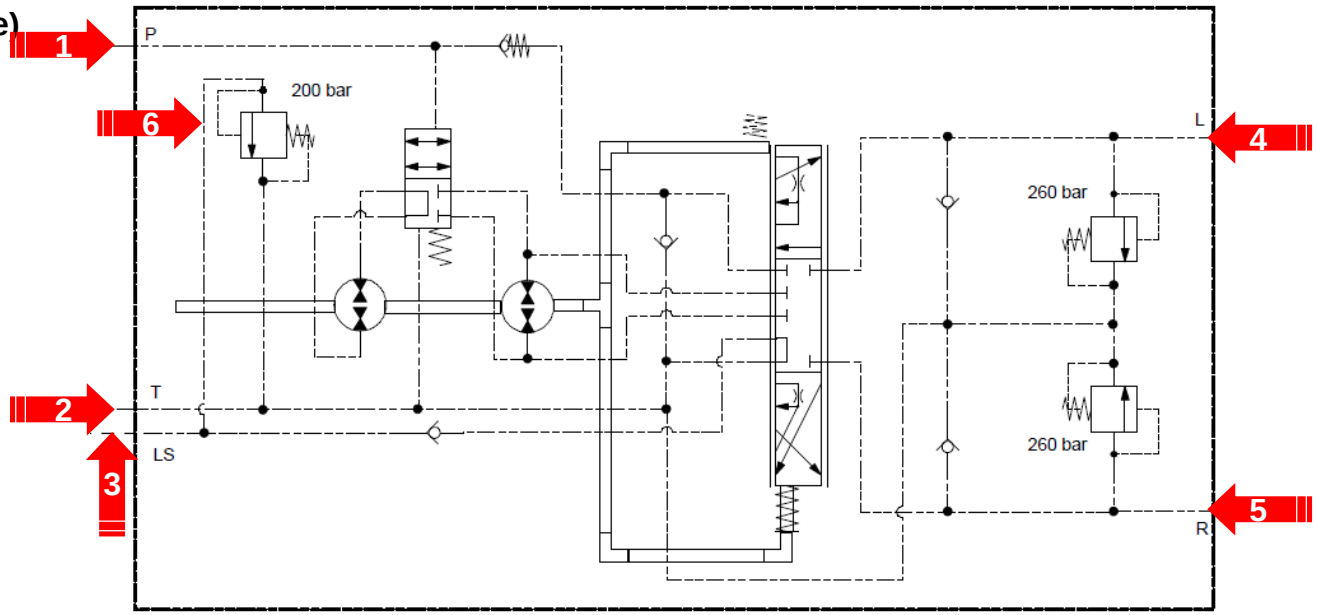
2 - T: to the tank

3 - LS: LS cable to the priority valve

4 - L: Left steering

5 - R: Right steering

6 - Pressure balance (adjustment screw)



1.2 Hydraulics

Steering orbitrol GD841 – with automatic steering system

1 - P: from the constant pressure pump (priority valve)

2 - T: to the tank

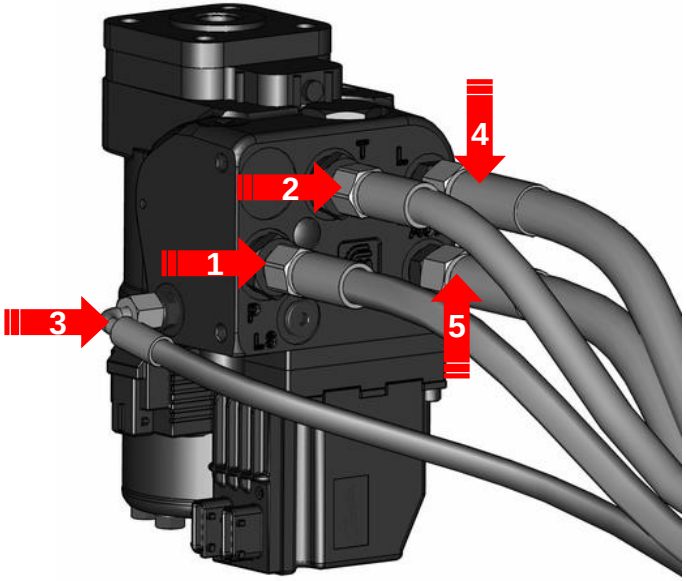
3 - LS: LS cable to the priority valve

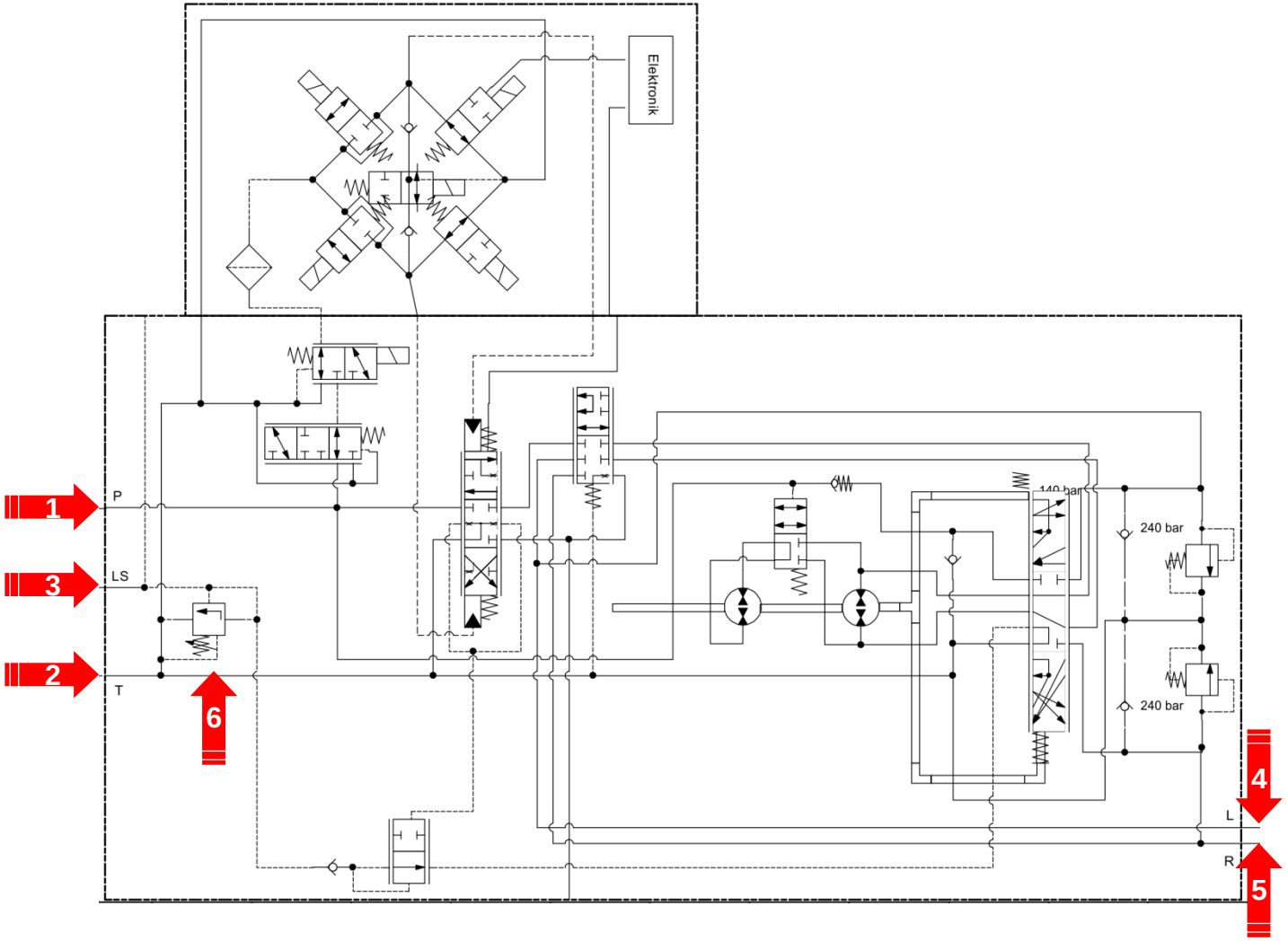
4 - L: Left steering

5 - R: Right steering

6 - Pressure balance

(adjustment screw under the plastic cap)

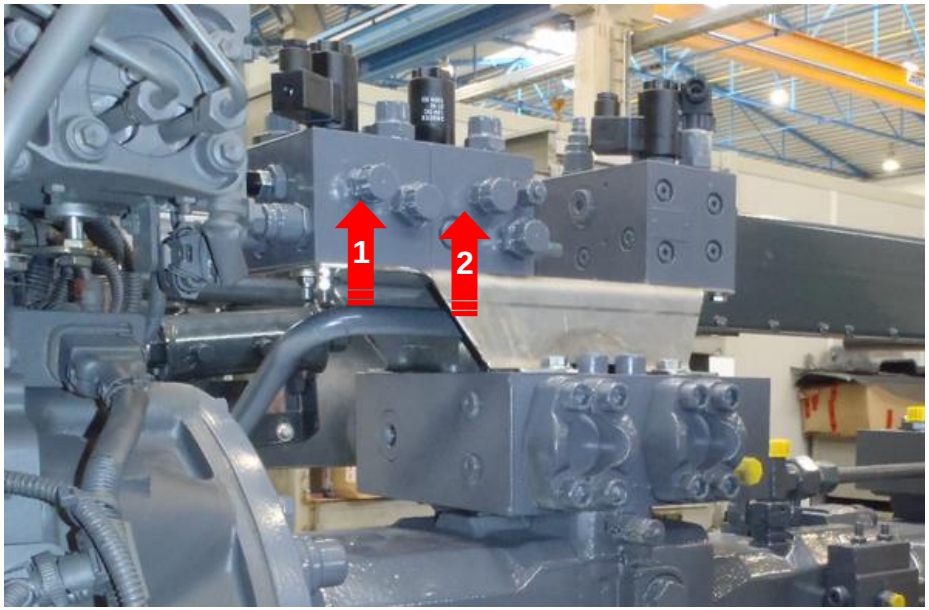


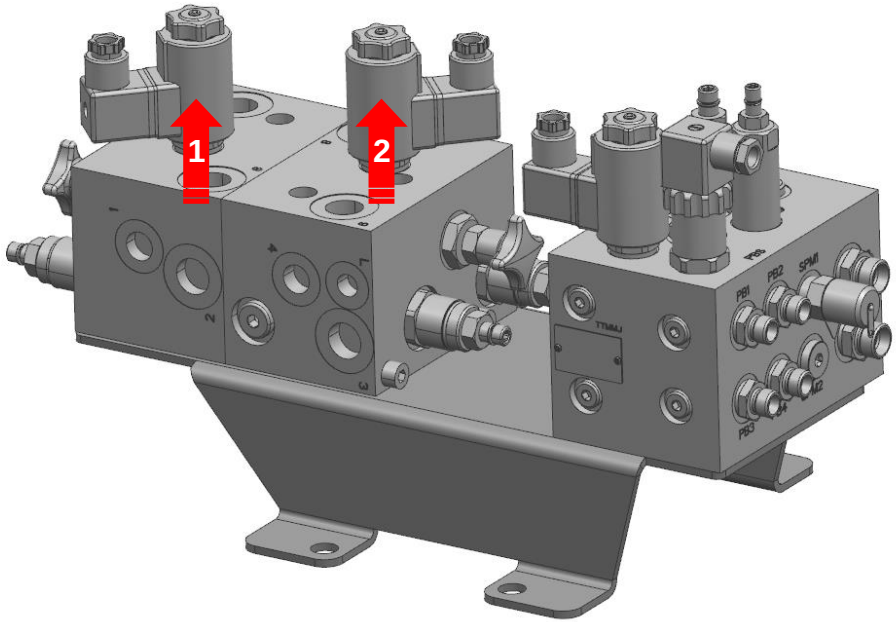


1.2 Hydraulics

Track correction valve and steering cylinder

- Hydraulic steering without a steering rod:
  - Wheels are no longer parallel over time (technically-related leakage oil in the cylinders)
  - → Perform daily track correction
- The track correction valves are behind the engine, above the drive pump
- The blocks for front / rear have the same design and are screwed back-to-back onto the carrier → mirror-image arrangement





1 - Solenoid valve front track correction K220

2 - Solenoid valve rear track correction K219

1.2 Hydraulics

Track correction valve GD937 - Structure and parts

1 - Steering cylinder front left piston rod side

2 - Steering cylinder front left piston crown

3 - Steering cylinder front right piston crown

4 - Steering cylinder front right piston rod side

5 - L: Measuring connection with mini-measuring connection / venting

6 - 70 bar pressure relief valve

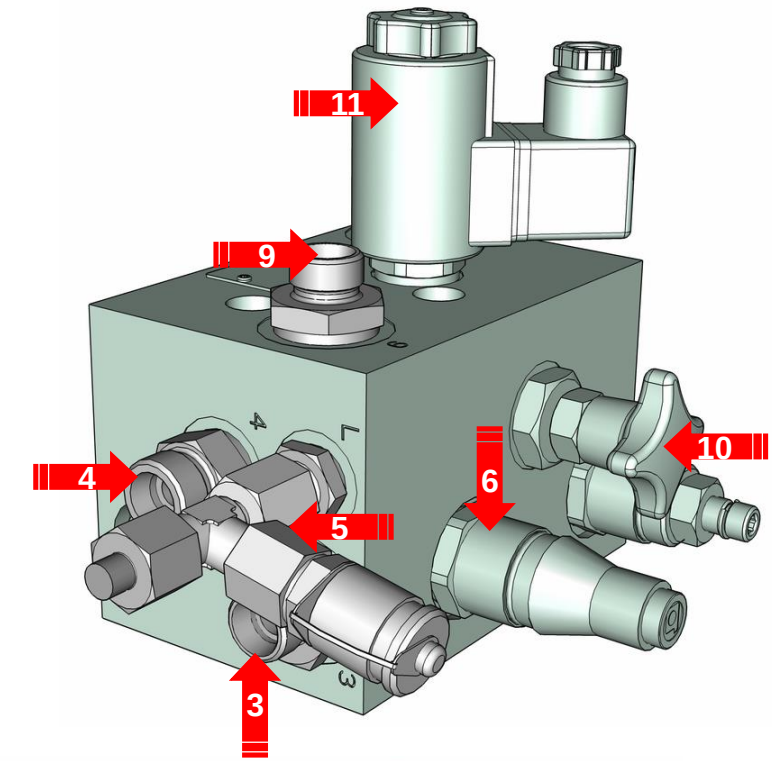
7 - 140 bar pressure relief valve

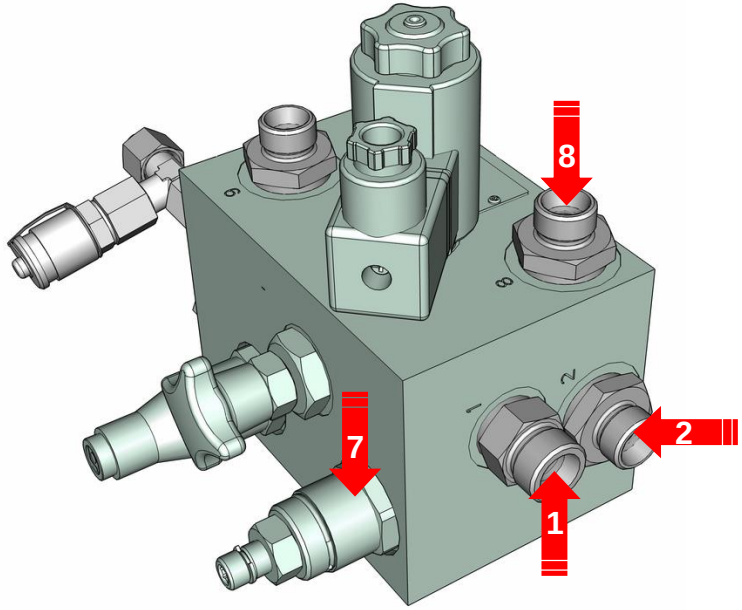
8 - From orbitrol connection L, steer left

9 - From orbitrol connection R, steer right

10 - Bleed screw

11 - Solenoid valve front track correction K220





Front track correction valve block:

Port 1 + 2 in direction of travel left!

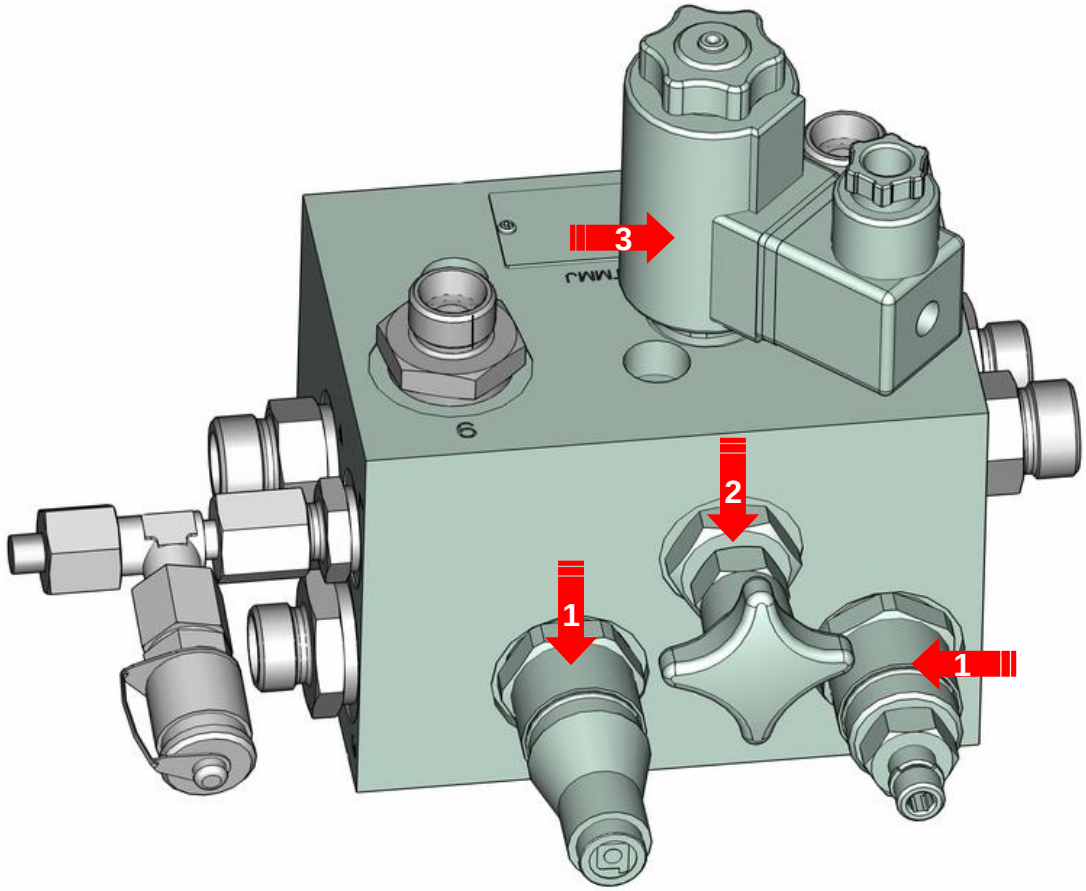
The 140 bar / 70 bar pressure relief valves ensure that oil can only flow while the valve is opened when the steering is at the stop on one side (pressure increase).

1.2 Hydraulics

Track correction valve GD937 - Tightening torques

The tightening torques refer to the components that are directly bolted onto the block, NOT the lock nuts or anything similar!

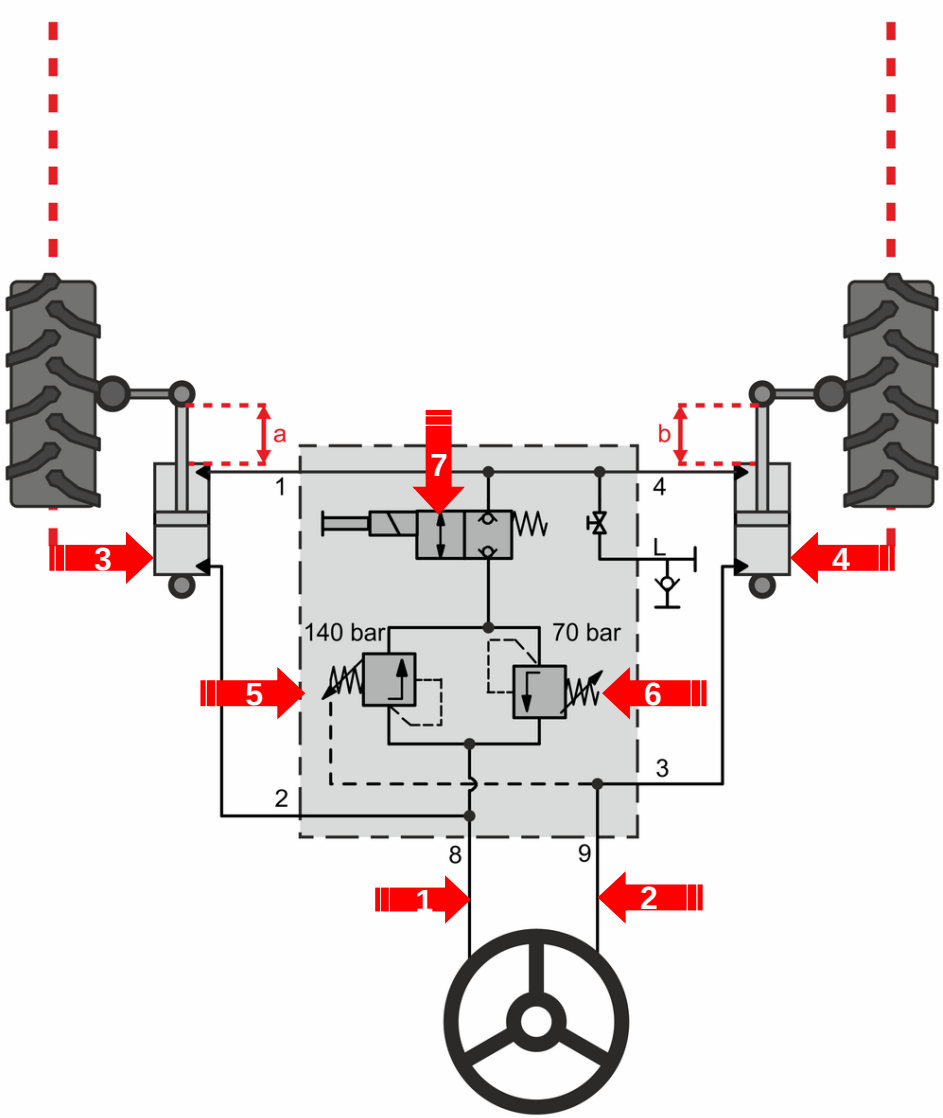
No.	[Nm]	Spanner
1	65	27
2	70	24
3	50	24



1.2 Hydraulics

Track correction valve and steering cylinder

- The track correction valve is connected downstream of the steering orbitrol.
- Pressure is applied on the piston crown sides when steering.
- The piston rod sides are connected with each other through the track correction block.



1 - L: Left steering

2 - R: Right steering

3 - Left steering cylinder

4 - Right steering cylinder

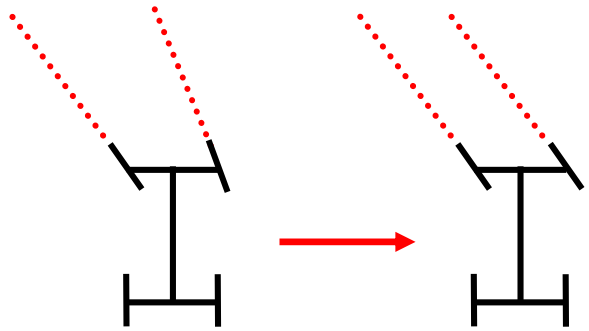
5 - 140 bar pressure relief valve

6 - 70 bar pressure relief valve

7 - Track correction control valve K220

1.2 Hydraulics

Performing the track correction

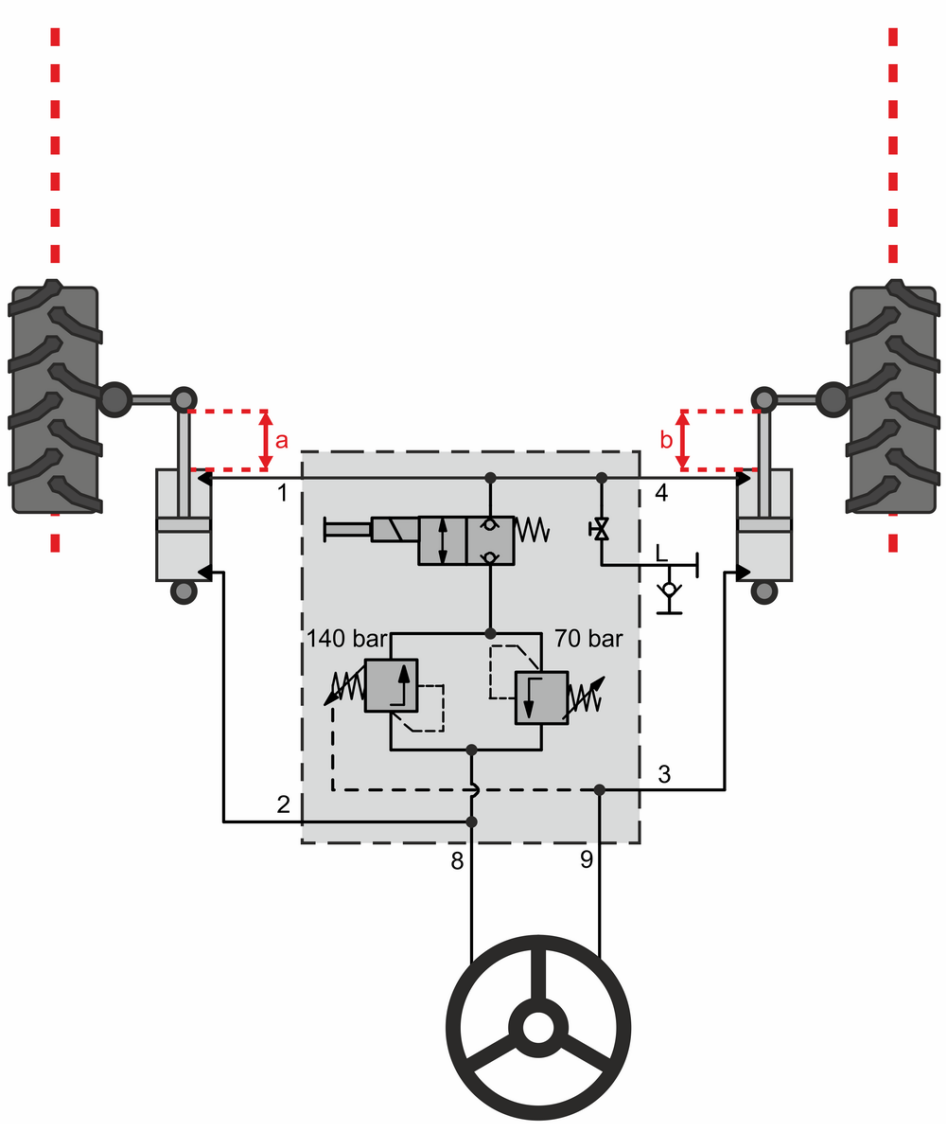


1. While driving forwards slowly (approx. 2 km/h), turn with the steering wheel all the way to the left. Hold the steering wheel, steer against the stop.
2. Press the switch (1) in the armrest to the front (2) and hold for 4 seconds.
3. Let go of the switch.
4. Let go of the steering wheel.
5. Steer all the way to the right with the steering wheel. Hold the steering wheel, steer against the stop.
6. Press the switch (1) in the armrest to the front again (2) and hold for 4 seconds.
7. Let go of the switch.
8. Let go of the steering wheel.
9. Stop.

1.2 Hydraulics

Wheels parallel - Driving straight ahead

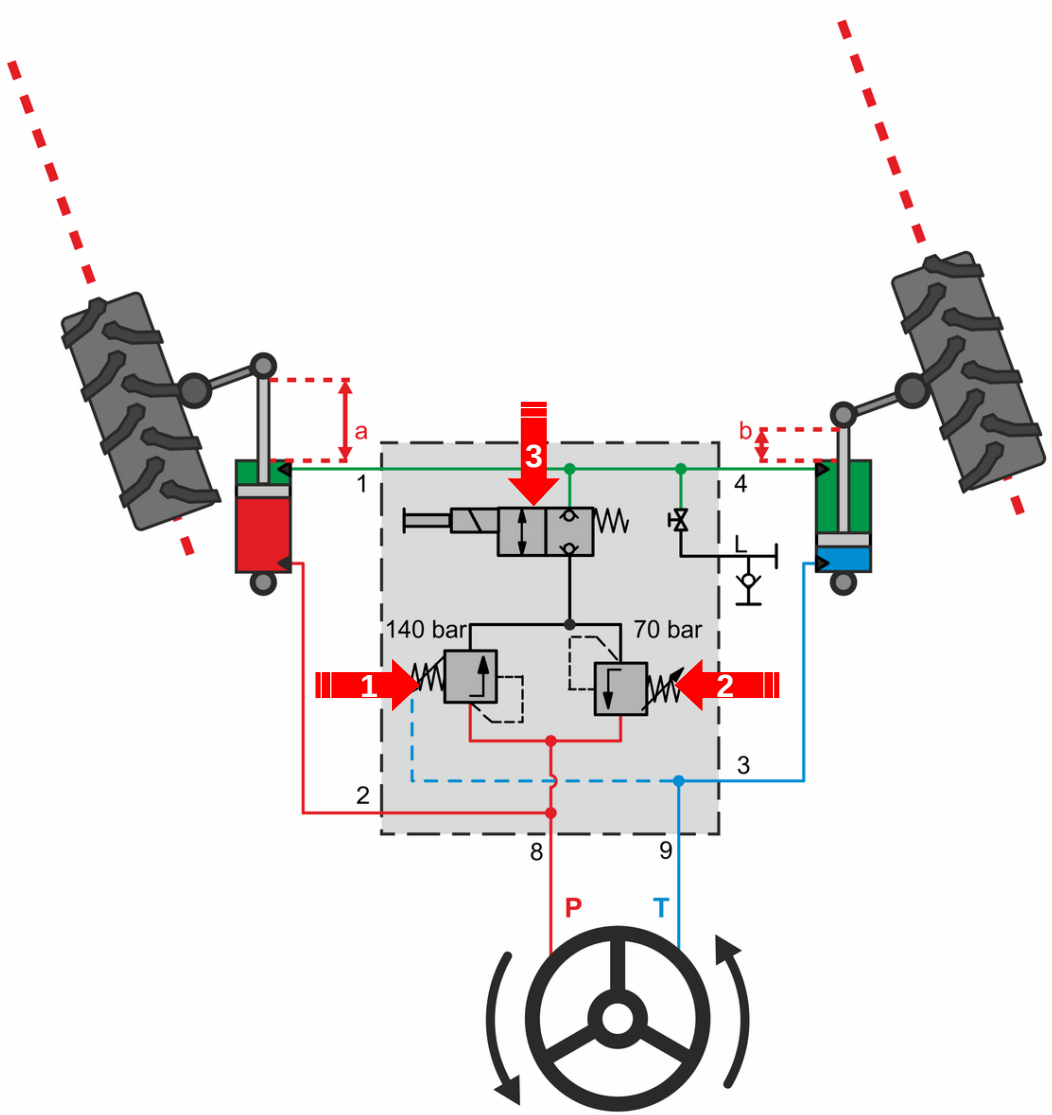
- The steering wheel is not moved, the steering system is in straight ahead position.
- The measurements (a) and (b) are identical:
- approx. 97.5 mm. The chromium-plated part of the piston rod is measured.
- Each steering cylinder has a maximum stroke of 200 mm. In straight ahead position, the cylinder is extended by slightly less than half the stroke.



1.2 Hydraulics

Wheels parallel - steering to the left

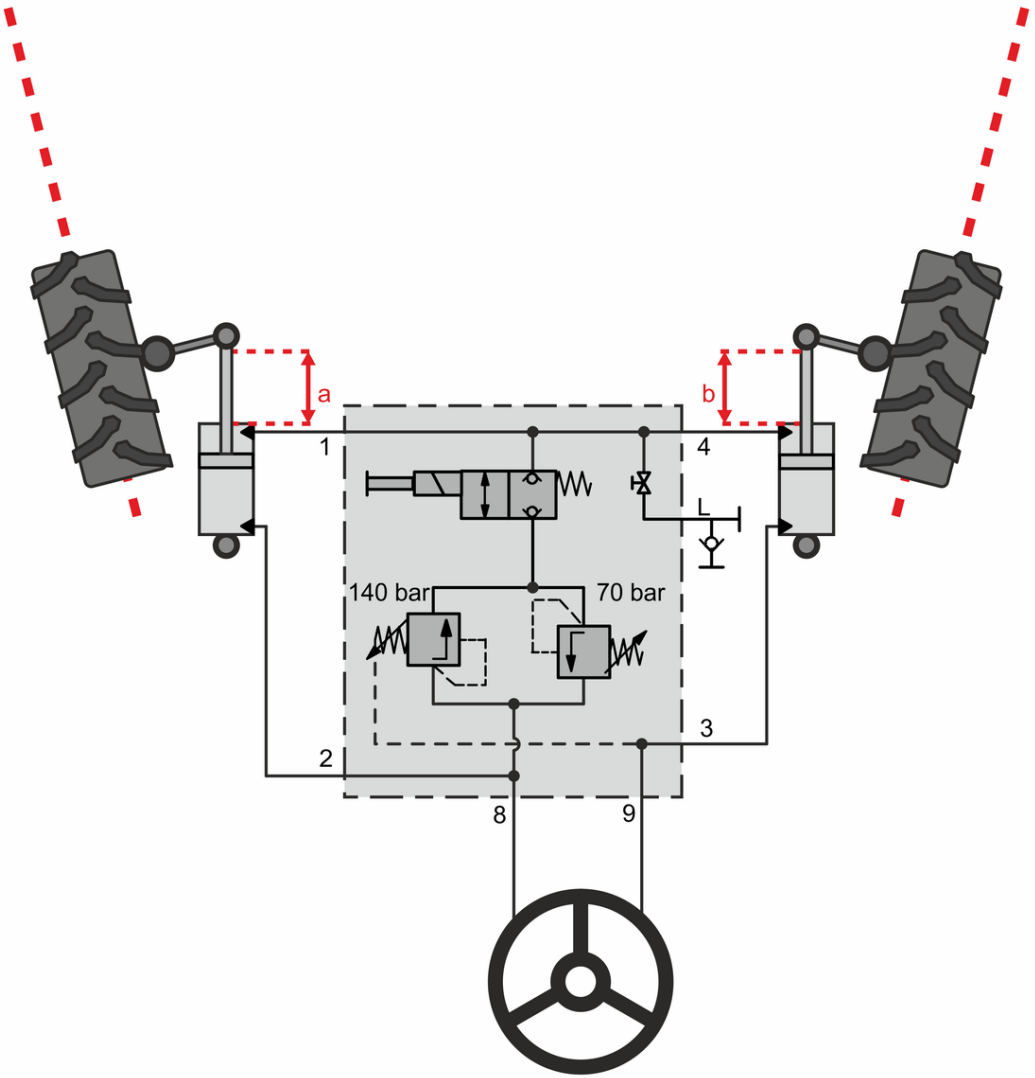
- The machine steers to the left.
- The piston crown side of the left cylinder is supplied with pressure.
- The oil of the piston rod side of the left steering cylinder is driven into the piston rod side of the right steering cylinder.
- Both wheels steer evenly.
- (a) increases by the same amount as (b) decreases.
- The pressure relief valves (1) and (2) as well as the control valve (3) are closed.
- Depending on the ground, the pressure on the "P" side is max. 80 bar, sometimes much less.



1.2 Hydraulics

Toe-out - Driving straight ahead

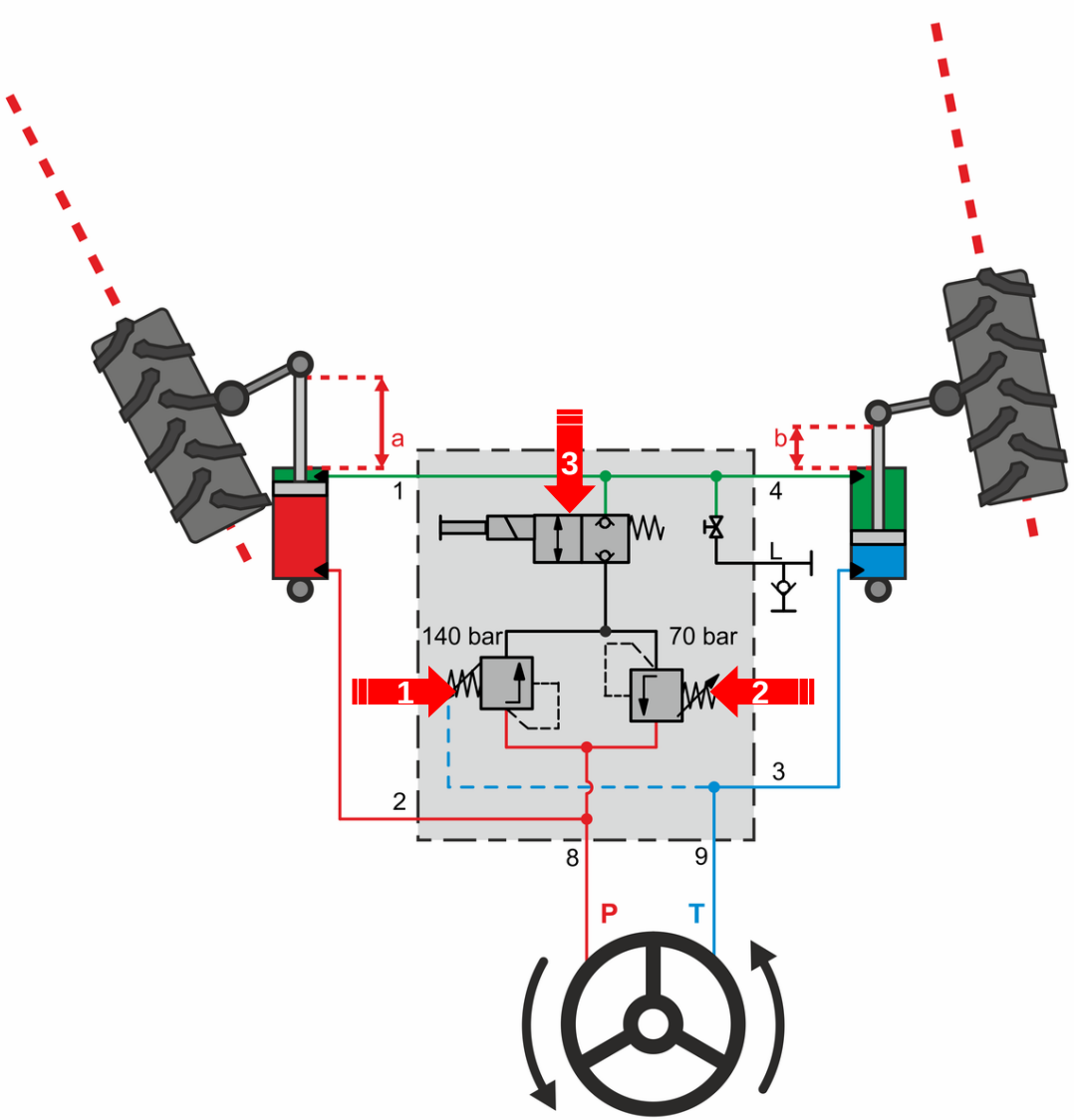
- There is too **little** oil on the piston crown side, which causes a **toe-out**.
- The tyres run more strongly on the inside than on the outside.
- The measurements (a) and (b) are identical, and the sum is > 200 mm.



1.2 Hydraulics

Toe-out - Track correction (1)

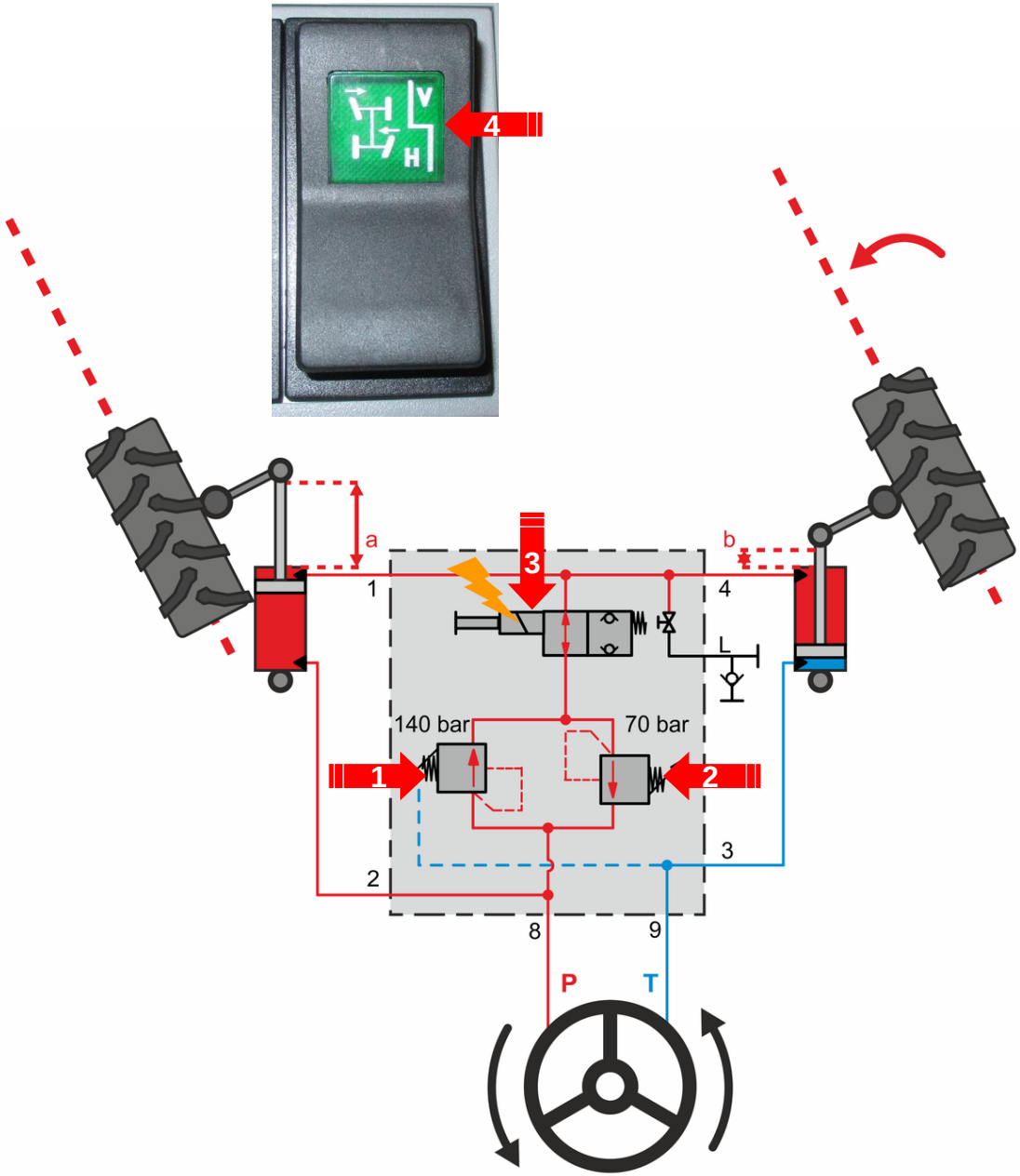
- The machine steers all the way to the left.
- The left steering cylinder is completely extended.
- The right steering cylinder cannot retract completely due to the lack of oil.
- The valves (1), (2) and (3) are still closed.
- The full constant pressure is now applied to "P" according to the priority valve = 180-185 bar. This pressure is only achieved when the steering wheel is held all the way at the stop.



1.2 Hydraulics

Toe-out - Track correction (2)

- The steering wheel is held at the stop, causing valve (1) to open. Approx. 180-185 bar of pressure are applied, and valve (1) opens at 140 bar.
- As a result, (2) is also opened, which has no effect here.
- The control valve (3) is opened by pressing and holding the button (4) towards the front.
- The oil pressure now flows on the piston rod side and replenishes the lack of oil.
- This causes the right steering cylinder to retract completely, the wheels are parallel again.
- (a) = 0 mm, (b) = 200 mm.

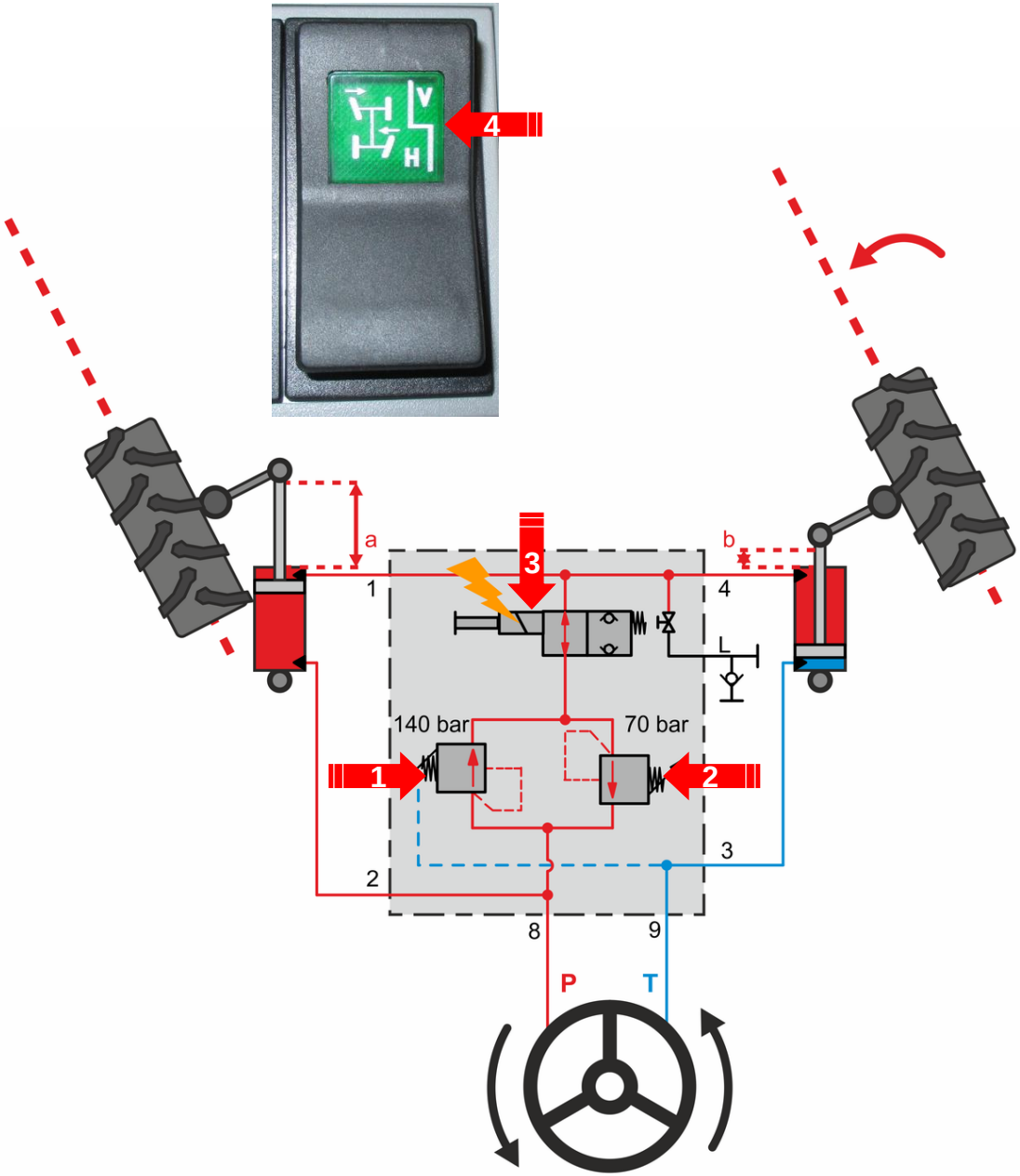


1.2 Hydraulics

Toe-out - Track correction (3)

Important:

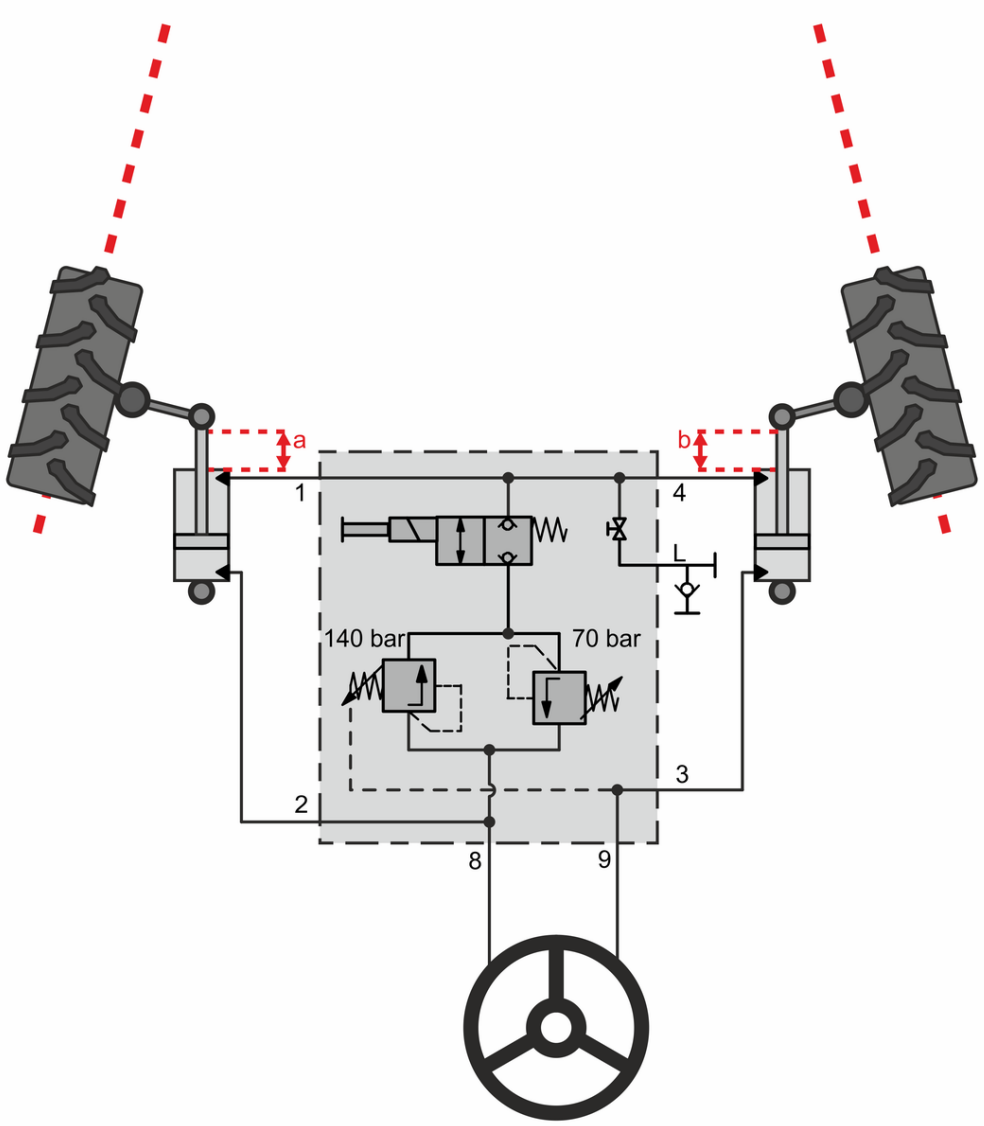
- the same pressure is now applied on the piston crown and piston rod side of the left steering cylinder. If a track correction is performed by mistake when at a standstill with the parking brake applied, it is possible that the wheel moves back due to the tension and a toe-in is accidentally generated. For this reason, the track correction must always be performed when driving slowly!



1.2 Hydraulics

Toe-in - Driving straight ahead

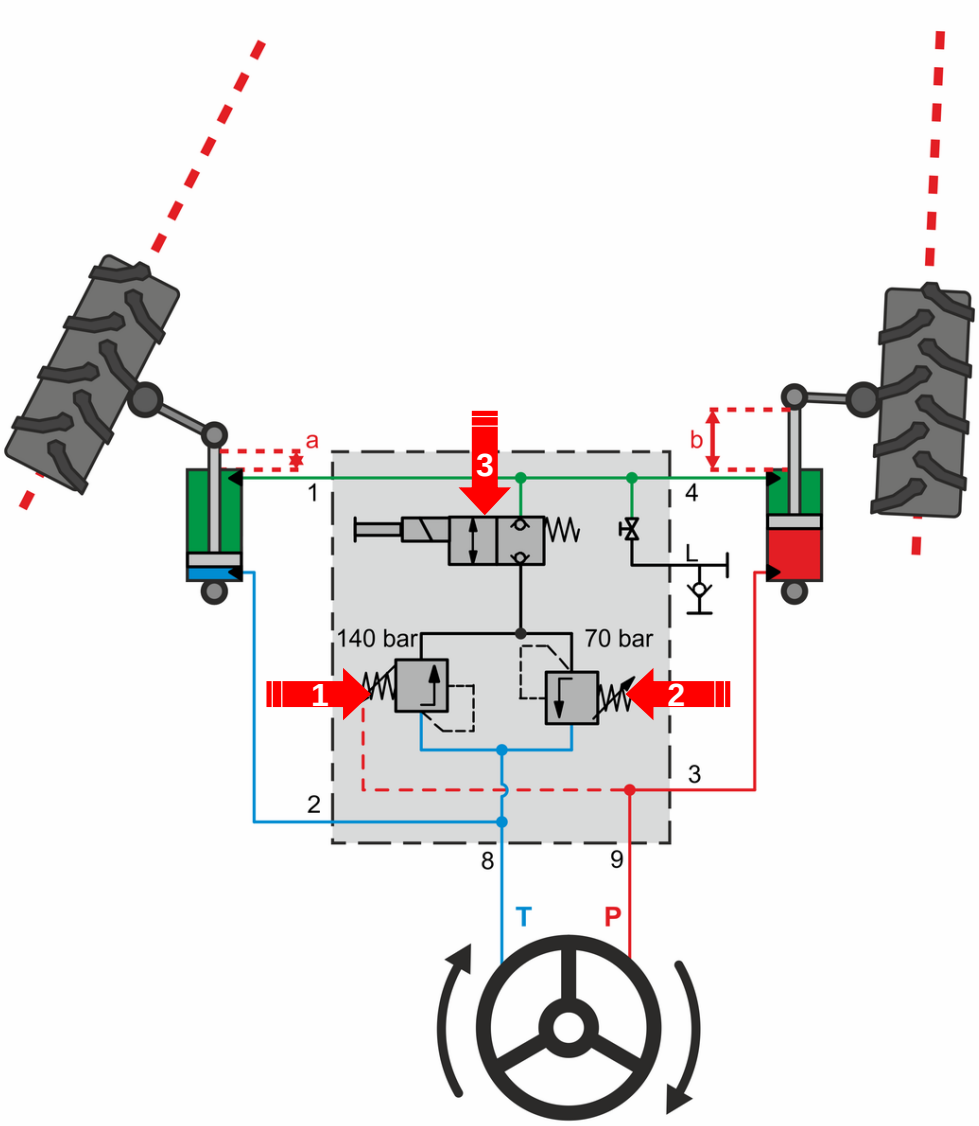
- There is too **much** oil on the piston crown side, which causes a **toe-in**.
- The tyres run more strongly on the outside than on the inside.
- The measurements (a) and (b) are identical, and the sum is < 200 mm.



1.2 Hydraulics

Toe-in - Track correction (1)

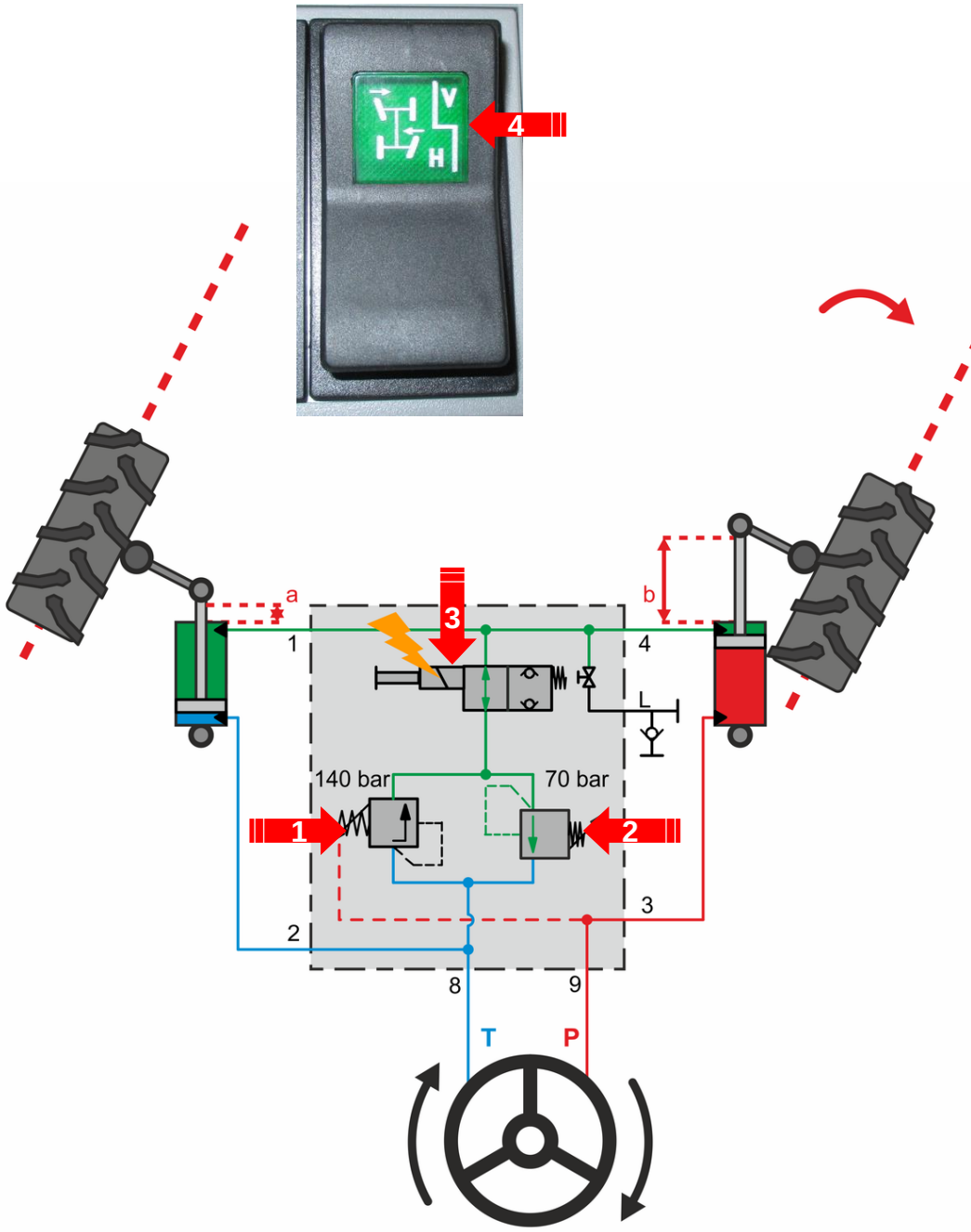
- The machine steers all the way to the right.
- The right steering cylinder extends a little bit. Due to the excess oil on the piston rod side, however, it cannot extend all the way.
- The left steering cylinder is completely retracted.
- The valves (1), (2) and (3) are still closed.



1.2 Hydraulics

Toe-in - Track correction (2)

- The steering wheel is held at the stop, approx. 180-185 bar of pressure are being applied.
- The valves (1) and (2) are still closed.
- The control valve (3) is opened by pressing and holding the button (4) towards the front.
- The oil pressure now flows out of the piston rod side through the valve (3) and opens the 70 bar pressure relief valve.
- The excess oil flows back to the tank, the valve (2) is closed as soon as the pressure drops below 70 bar on the piston rod side.
- This causes the right steering cylinder to extend completely, the wheels are parallel again.
- (a) = 0 mm, (b) = 200 mm.



1. Front-wheel steering

1.1 General layout

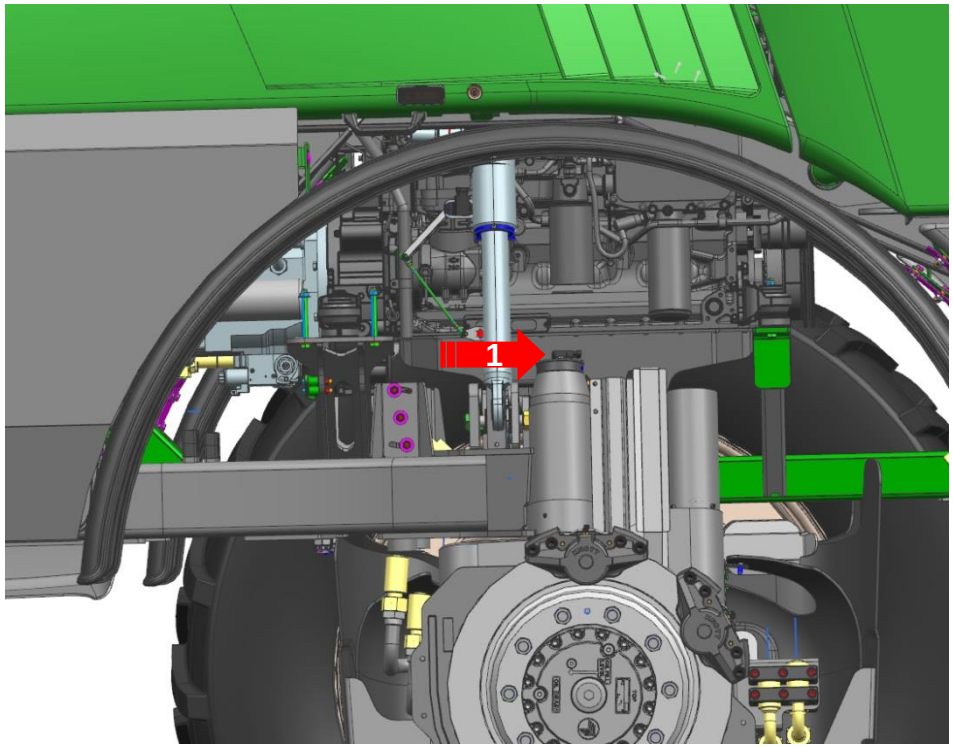
1.2 Hydraulics

1.3 Electrical system

1.3 Electrical system

General

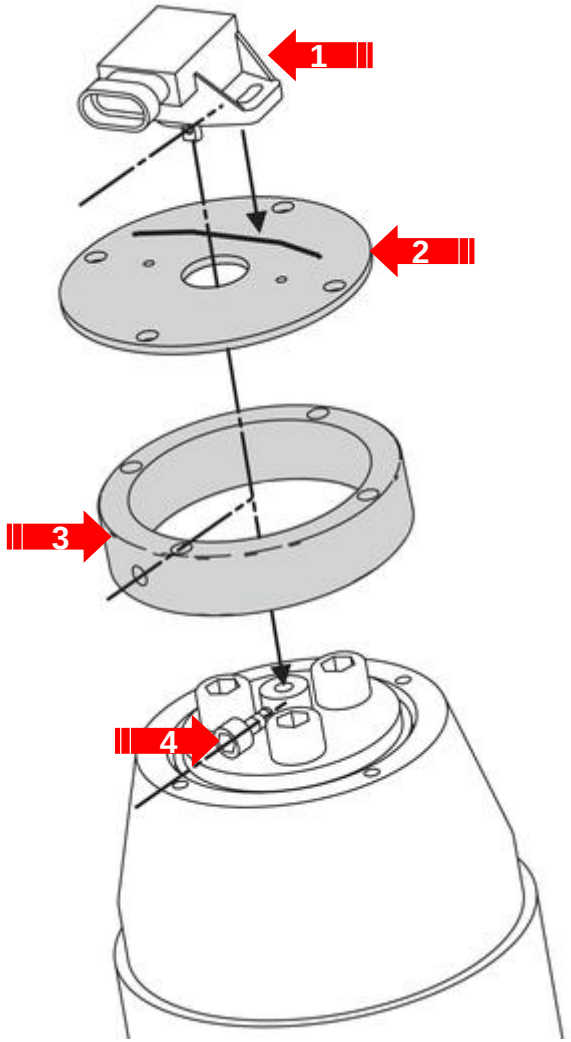
- Front-wheel steering is independent of the electrical system.
- Exception: when the steering system is activated.
- The required emergency steering properties are always present.
- The steering angle sensor R107 (1), NH022, on the right-hand stub axle serves as transmitter for the rear-wheel steering and must be properly calibrated (see "Software" section).
- The sensor is connected to wiring harness NL349, which leads to Patch_R2.
- The valve for the track correction K220 is connected to the button S024 via NL809 / NL810 and Patch_9 and Patch_12 and is fused via F085 (5A).



1.3 Electrical system

Steering angle sensor

- If a sensor R102 / R107 (NH022) is replaced, the flat side of the shaft must face the connector.
- The shaft is secured with the grub screw on the flat side before the spacer ring is screwed on tightly.

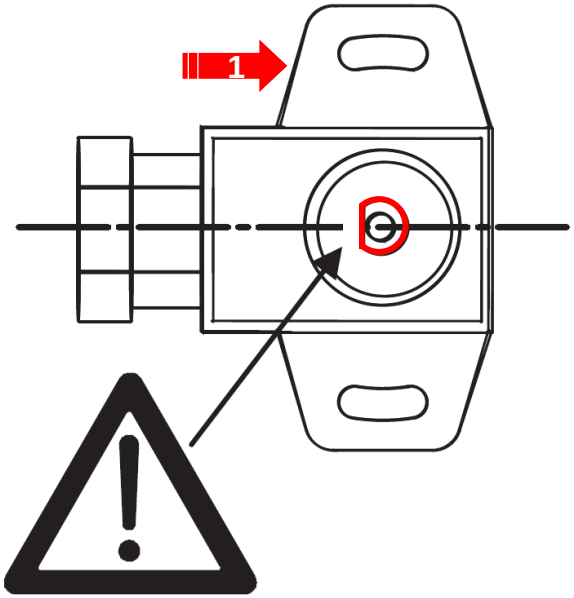


1 - Sensor NH022

2 - Retaining plate

3 - Spacer ring

4 - Grub screw



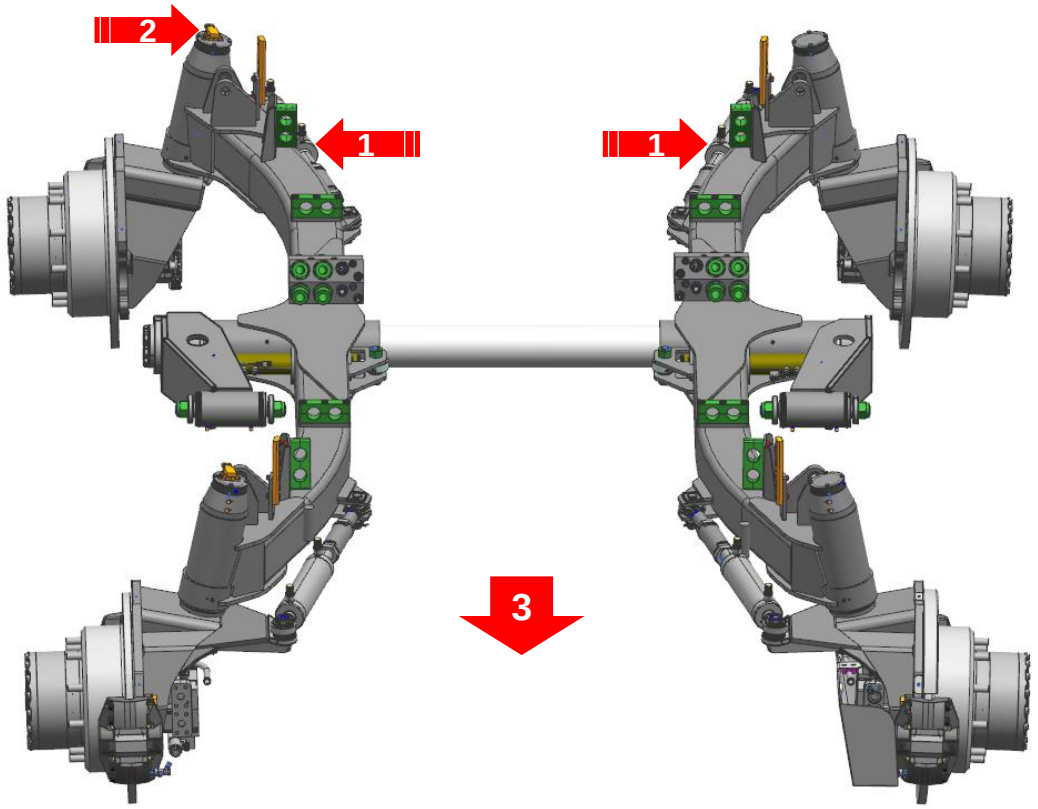
2. Rear-wheel steering

- 2.1 General layout
- 2.2 Hydraulics
- 2.3 Electrical system
- 2.4 Operation

2.1 General layout

The rear-wheel steering system comprises the following components

- Constant pressure pump.
- Priority valve.
- Hydraulic block 1 with proportional valve.
- Track correction valve.
- Steering cylinder (1x per wheel).
- Steering wheel angle sensor (1x, right).



1 - Steering cylinder

2 - Steering angle sensor

3 - Direction of travel

2. Rear-wheel steering

- 2.1 General layout
- 2.2 Hydraulics
- 2.3 Electrical system
- 2.4 Operation

2.2 Hydraulics

Overview

1 - Constant pressure pump

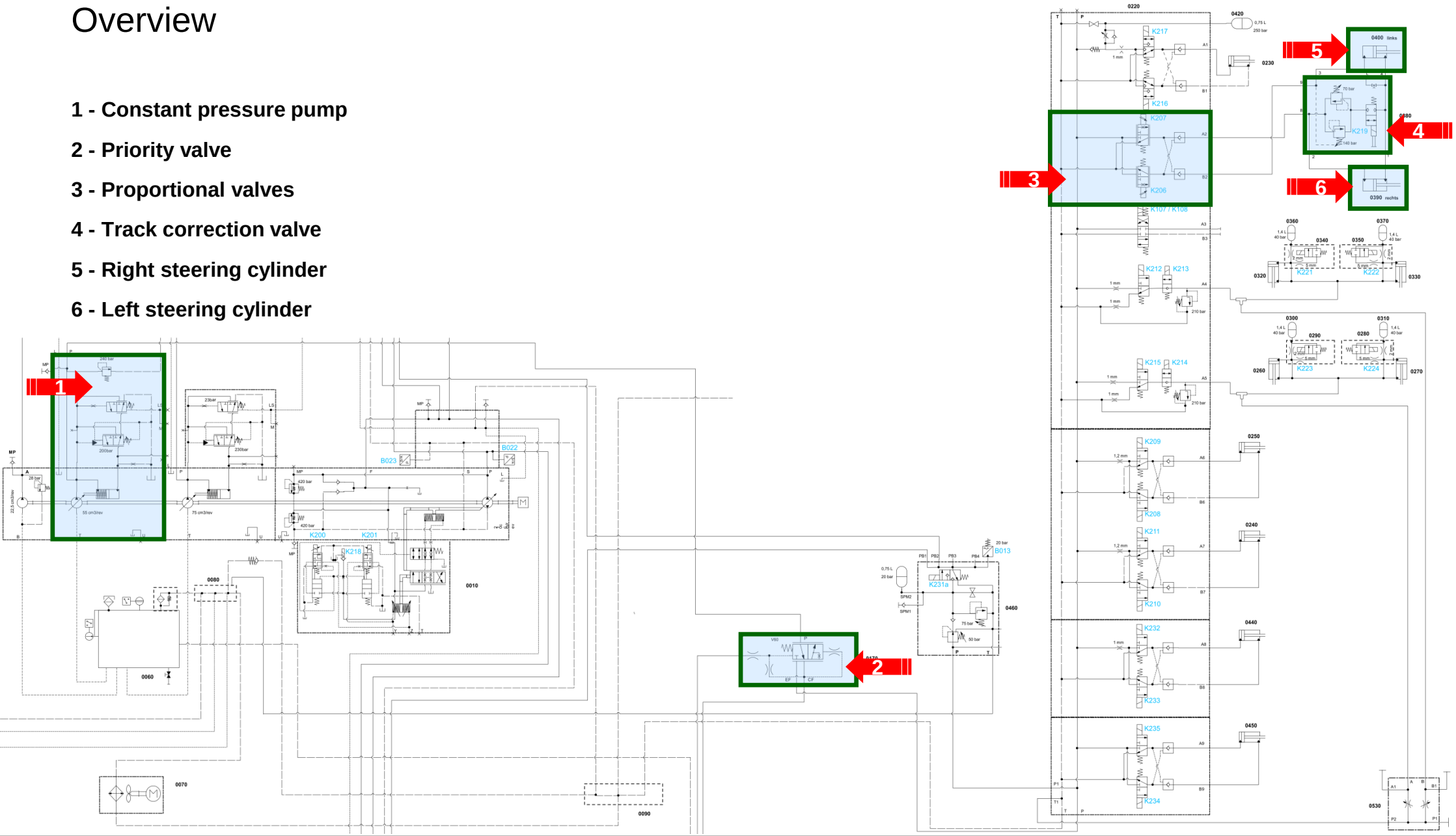
2 - Priority valve

3 - Proportional valves

4 - Track correction valve

5 - Right steering cylinder

6 - Left steering cylinder



2.2 Hydraulics

Track correction valve GD937 - Structure and parts

1 - Steering cylinder rear right piston rod side

2 - Steering cylinder rear right piston base side

3 - Steering cylinder rear left piston base side

4 - Steering cylinder rear left piston rod side

5 - L: measuring connection with mini-measuring connection / venting

6 - 70 bar pressure relief valve

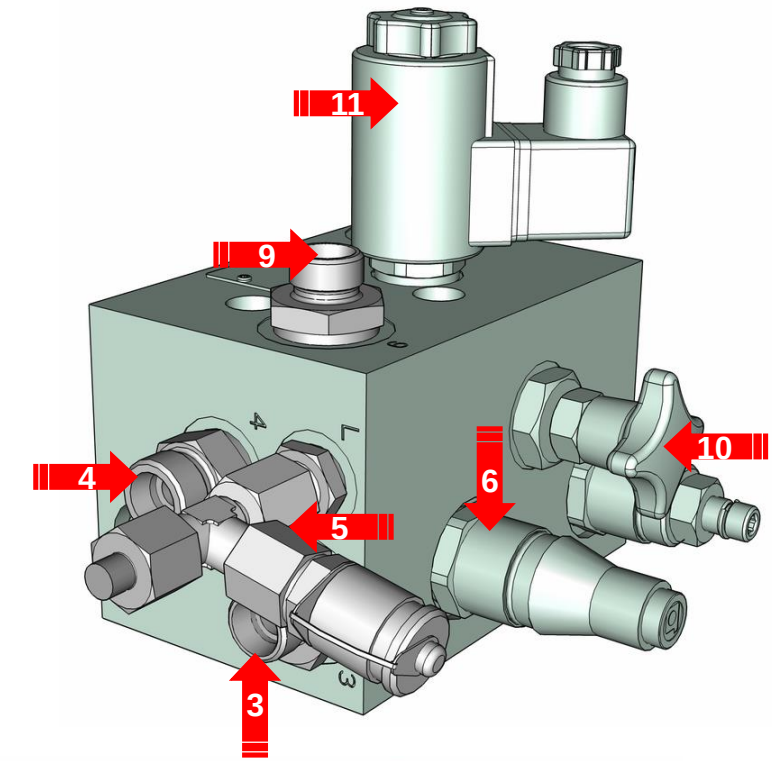
7 - 140 bar pressure relief valve

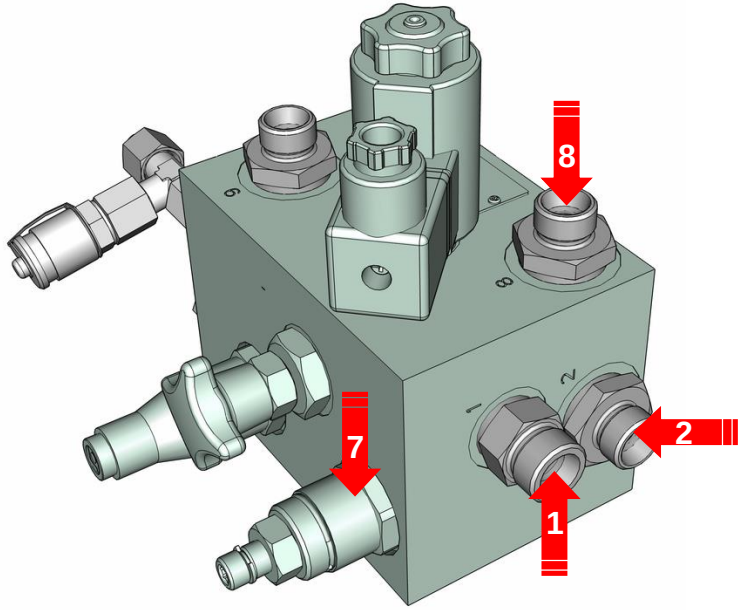
8 - From hydraulic block 1, steer right

9 - From hydraulic block 1, steer left

10 - Bleed screw

11 - Solenoid valve rear track correction K219





Rear track correction valve block:

Port 1 + 2 in direction of travel right!

The 140 bar / 70 bar pressure relief valves ensure that oil can only flow while the valve is opened when the steering is at the stop on one side (pressure increase).

2.2 Hydraulics

Steering and track correction valve

1 - Proportional 3/2-directional valve (controlled via control unit 2): steer to the right (K207)

2 - Proportional 3/2-directional valve (controlled via control unit 2): steer to the left (K206)

3 - Unlockable check valve (poppet valve): maintain the position of the rear wheels

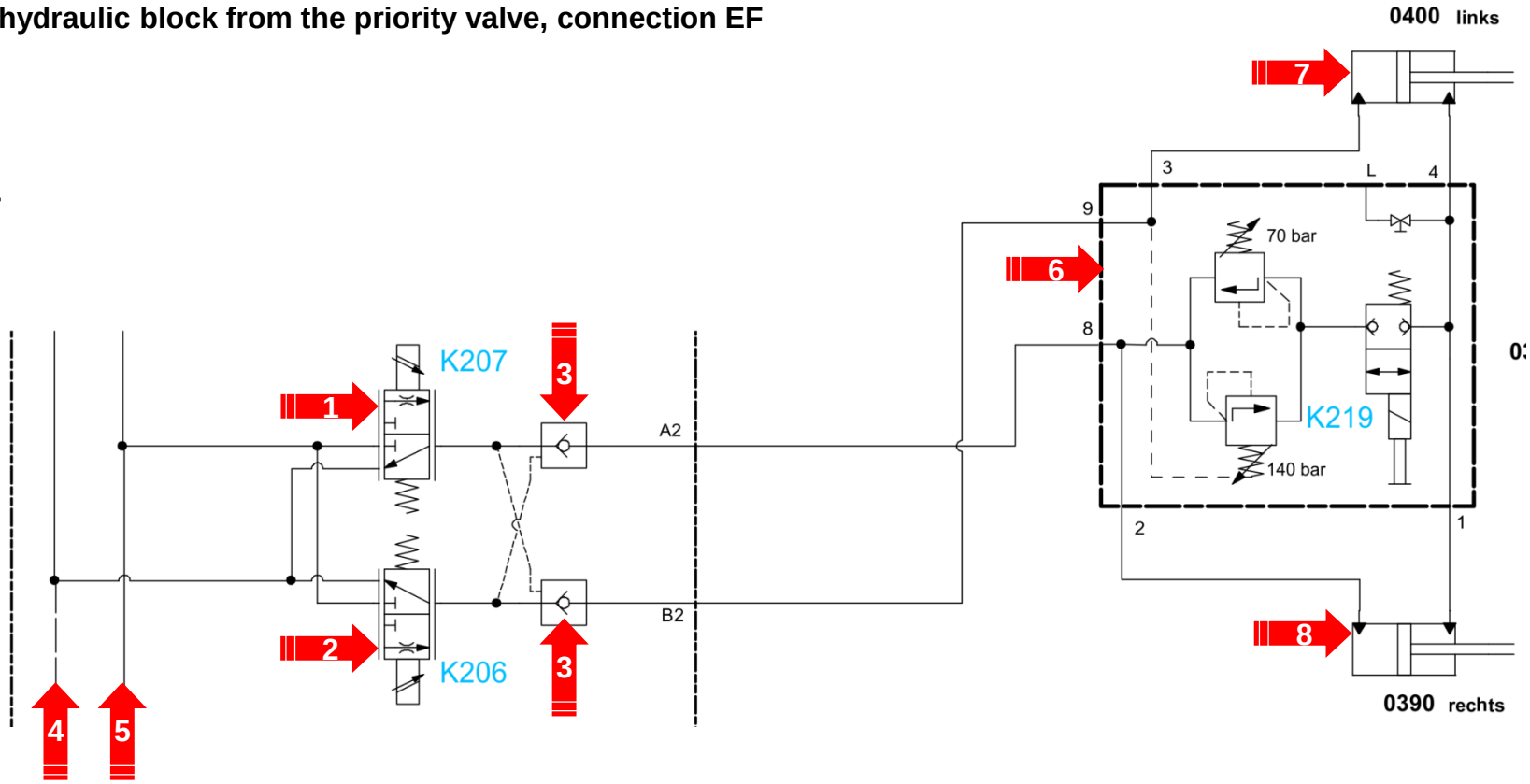
4 - T: to the manifold

5 - P: pressure line in the hydraulic block from the priority valve, connection EF

6 - Track correction valve

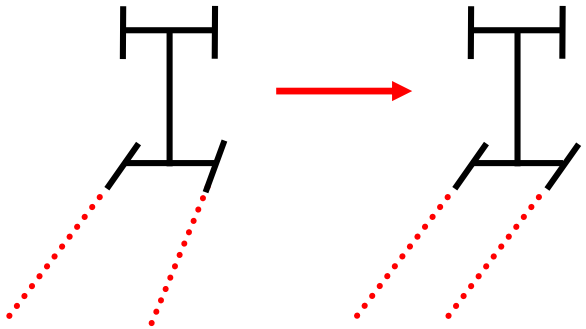
7 - Left steering cylinder

8 - Right steering cylinder



2.2 Hydraulics

Performing the track correction



1. While driving forwards slowly (approx. 2 km/h), steer all the way to the left with the switch on the AmaPilot and keep the switch pressed.
2. Press the switch (1) in the armrest to the rear (2) and hold for 4 seconds.
3. Let go of the switch.
4. Let go of the switch on the AmaPilot.
5. Steer all the way to the right with the button on the AmaPilot, and keep the switch pressed.
6. Press the switch (1) in the armrest to the rear (2) and hold for 4 seconds.
7. Let go of the switch.
8. Let go of the switch on the AmaPilot.
9. Stop.

The hydraulic details and animations correspond to those of the front-wheel steering, with the difference that the track correction block is supplied by the proportional valve for hydraulic block 1, and not via the steering orbitrol.

2. Rear-wheel steering

- 2.1 General layout
- 2.2 Hydraulics
- 2.3 Electrical system
- 2.4 Operation

2.2 Electrical system

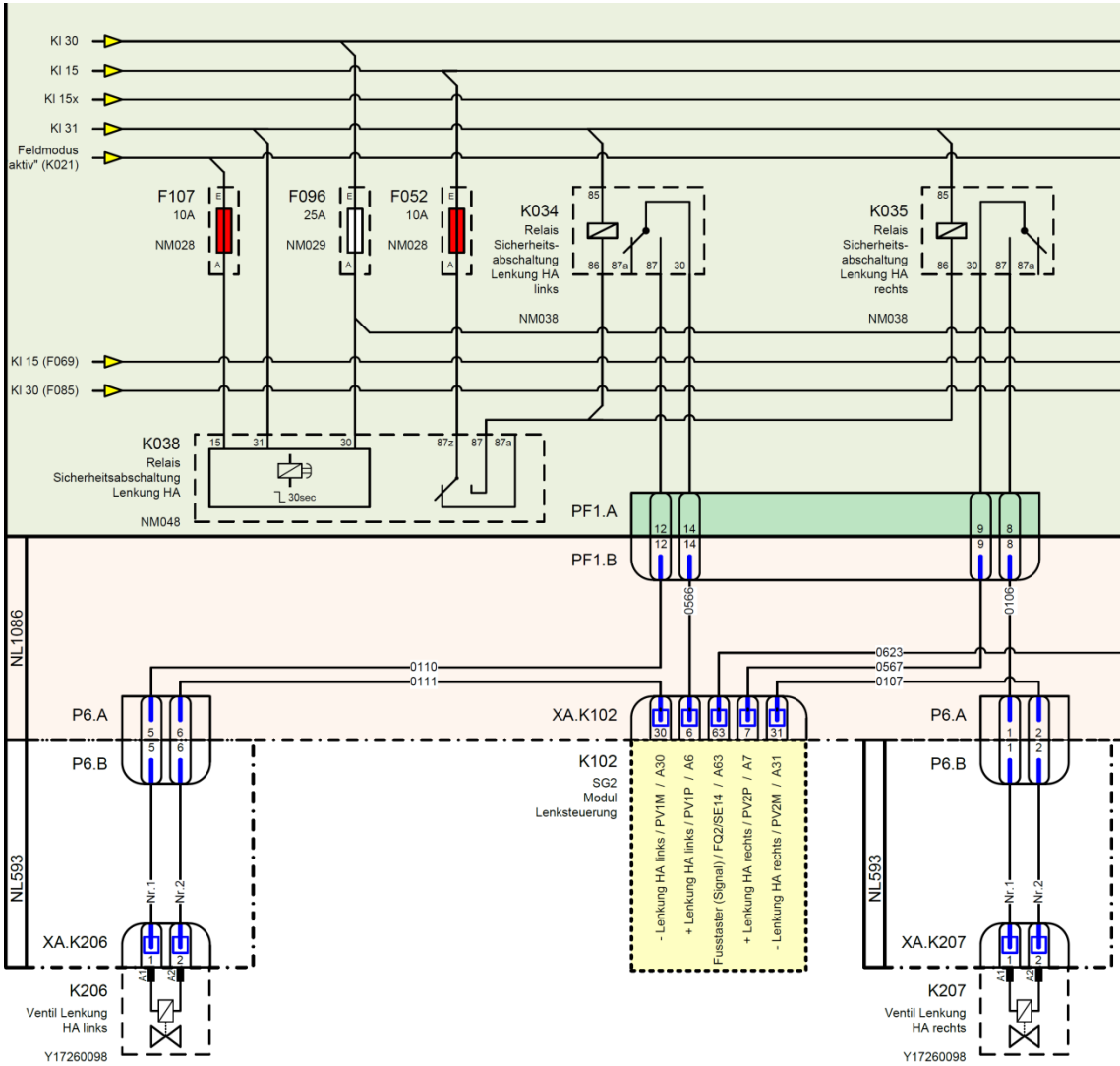
General

- The rear wheel steering is controlled purely electronically:
  - Via AMADRIVE (automatic 4-wheel steering).
  - Via the AmaPilot (automatic / manual 4-wheel steering).
- The electrical signals are always sent from the steering control unit (CU2) through
- the wiring harness NL593 to the proportional valves on hydraulic block 1.
- Rear-wheel steering is deactivated in road mode.
- The function requires 3 relays (K034, K035, K038), 3 fuses (F052 (10 A), F096 (25 A) and F107 (10 A), in the roof central unit)) as well as switch S052 and relay K021 (field / road).
- The steering angle sensor R102 is connected to wiring harness NL809 / NL810, which leads to Patch_3.
- The steering angle sensor on the right-hand stub axle serves as receiver for the rear axle steering and must be properly calibrated (see "Software" section) For general information about the steering angle sensor, see 1.3
- The rear wheel steering has a steering angle limiter:
  - 0-6 km/h: four-wheel steering with maximum angle.
  - 6-12 km/h: Four-wheel steering limited.
  - > 12 km/h: two-wheel steering only.
- Crab steering can be used to its full extent up to 20 km/h.

2.2 Electrical system

Function (see circuit diagram on page 31)

- The road drive switch S052 actuates K021 and K038.
- K038 switches K034 rear axle steering left and K035 rear axle steering right.
- The signals of the control unit can now be passed to the valve.
- When switching to road travel, K038 is without current. Since this is a timer relay, it will still remain active for 30 s. CU2 then straightens the steering automatically.
- After these 30 s, K034 and K035 are without current and no more electrical signals can go to the valve.
- Switching the steering type on the AmaPilot / AMADRIVE only has an effect on CU2 and changes the steering angle appropriately.
- As long as the button on the AmaPilot for steering left / right remains pressed, the respective valve K206 / K207 is fully energised (important for track correction).



2.2 Electrical system

Details on the controls

- Valves K206 / K207 are the only proportional valves on hydraulic block 1.
- In the calibration menu of the AMADRIVE, the increment for the control is only 1/10 of the automatic control → very precise control possible for the calibration.
- With activated headland management, the speed of the steering is limited to 65 % of the maximum possible speed as soon as all of the part-width sections are closed and the system automatically switches from 2 W to 4 W. The full speed is only available again when the wheels have reached their target position → Protects the boom.
- With activated headland management, switching from 4W to 2W takes place with a time delay of 5 seconds.

	Current K206 / K207 [mA]
Standby current	20
Initial current	700
Maximum current	1,650

2. Rear-wheel steering

- 2.1 General layout
- 2.2 Hydraulics
- 2.3 Electrical system
- 2.4 Operation

2.4 Operation

Rear wheel steering

In crab steering mode, rear-wheel steering

is controlled using the multi-function stick.

The front wheels are steered conventionally with the steering wheel.

Control in the multi-function stick

- Switchover from two-wheel to four-wheel steering
- Off-set track steering
- Can be accessed from all AmaPilot operating levels

10: Left

11: Right

12: 2W / 4W

3. Settings

- 3.1 General
- 3.2 Setting the steering pressure
- 3.3 Adjustment of the track
  - 3.3.1. General information
  - 3.3.2. Track correction
  - 3.3.3. Adjusting the track

3.1 General

Settings to be made as required

- Check and set the hydraulic pressure (constant pressure and LS pressure for the steering).
- Fixed attachment of steering angle sensors.
- Calibration of the steering angle sensors.

3. Settings

3.1 General

3.2 Setting the steering pressure

3.3 Adjustment of the track

3.3.1. General information

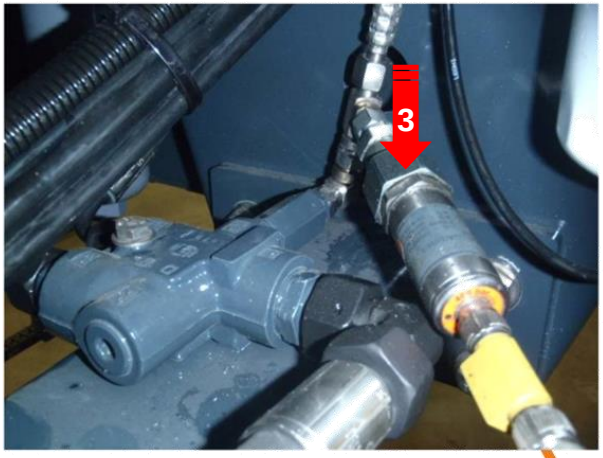
3.3.2. Track correction

3.3.3. Adjusting the track

3.2 Setting the steering pressure

Measurement of the steering pressure

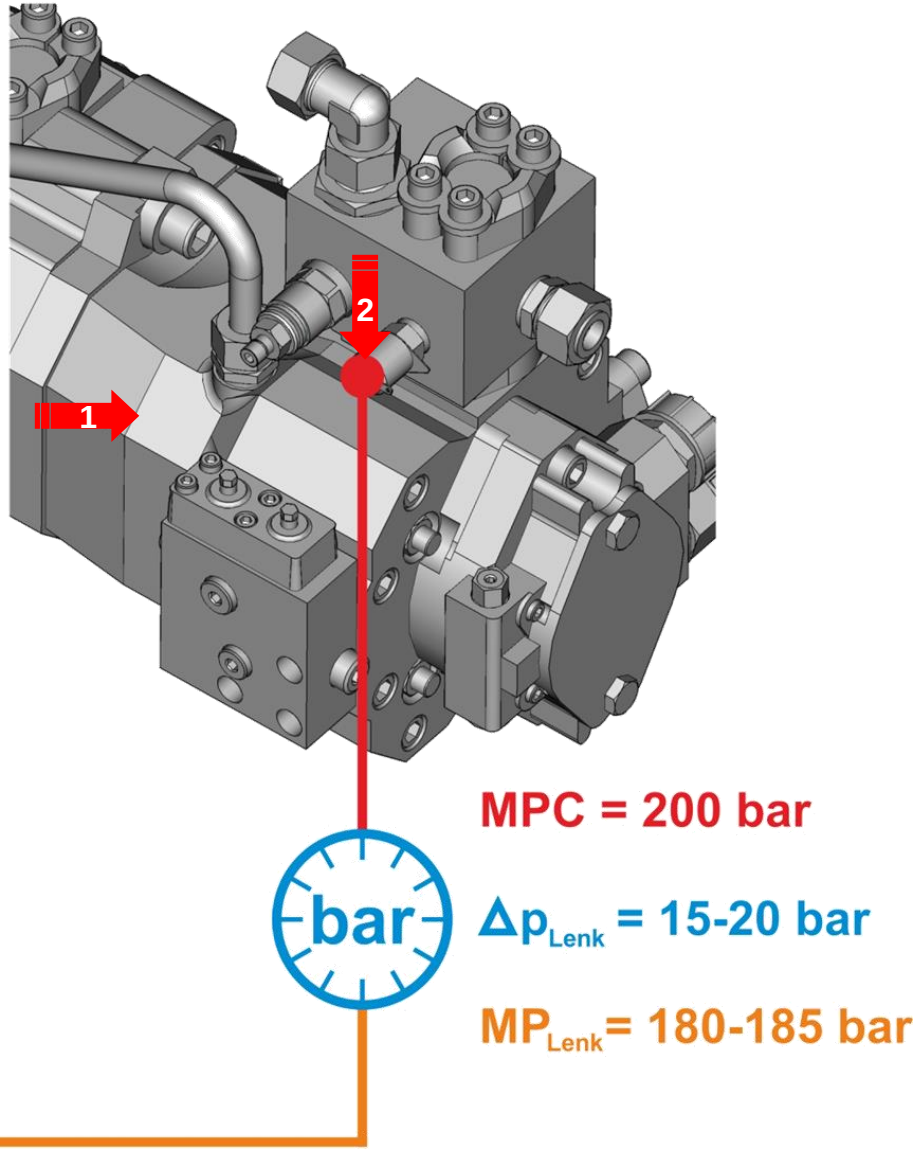
1. Connect pressure sensors to MP-C and MP_{steer}.
2. Bring the machine to operating temperature (approx. 80°C coolant temperature), allow the engine to idle.
3. If MPC is not 200 bar ± 3 bar, this must be set. See "Section07_Constant_pressure_hydraulics_PANTERA_4502_2017_xxx".
4. Δp_{steer} Determine LS steering (control pressure) of the steering by calculating the measured value "MPC – MP_{steer}".
5. Δp_{Steer} should be approx. 15 - 20 bar (15 bar = quick reaction of rear axle, > 20 bar = rear axle and all consumers attached to the constant pressure hydraulics are very slow).



1 - Constant pressure pump

2 - MP-C constant pressure 200 bar

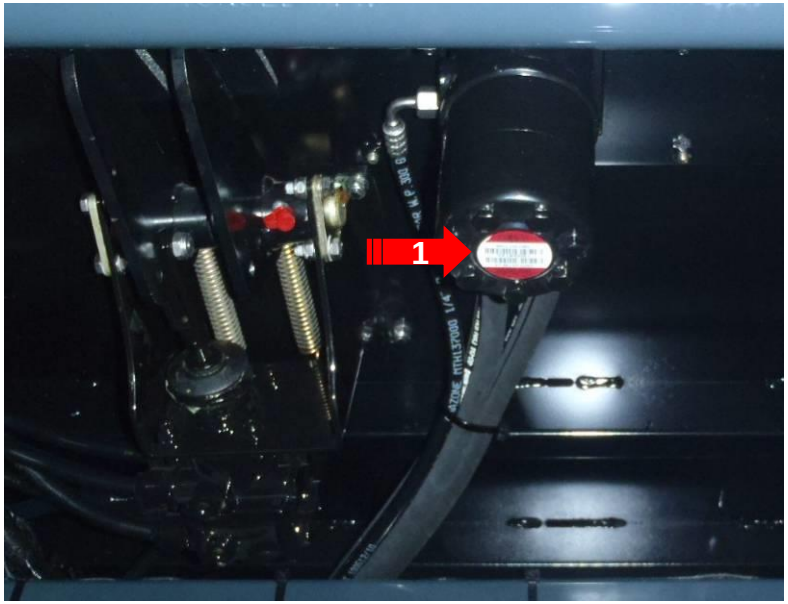
3 - Mounted measurement connection on the LS line of the steering

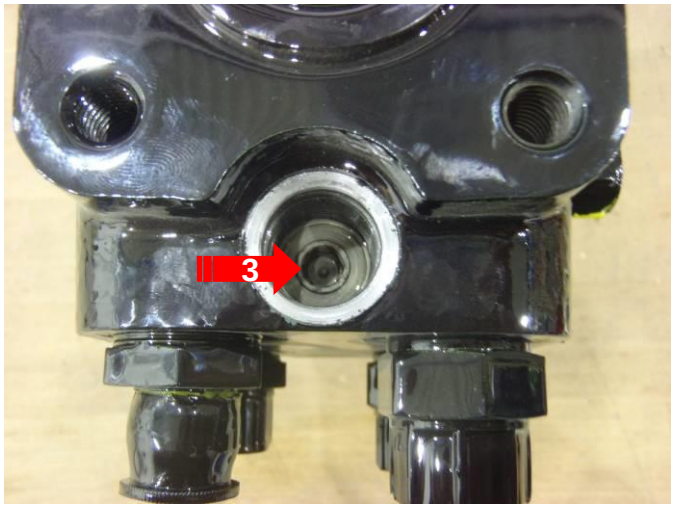


3.2 Setting the steering pressure

Machines with standard steering

6. If this Δp_{steer} is not reached, the pressure balance in the steering orbitrol (1) must be set.
7. Turn steering to one side to end stop. Dismantle the steering column trim in the cab and loosen the bolts of the steering orbitrol.
8. Pull the steering orbitrol away downwards, the hydraulic hoses do not need to be removed.
9. Unscrew the cover bolt (2) on the steering orbitrol and using an Allen key, turn the adjusting screw (3) until the desired value is reached. To apply pressure, the orbitrol needs to be turned with pliers or similar!
   Caution! The adjustment screw is very sensitive!
10. Screw the hexagon socket bolt back into the steering orbitrol and reassemble everything in the reverse order.

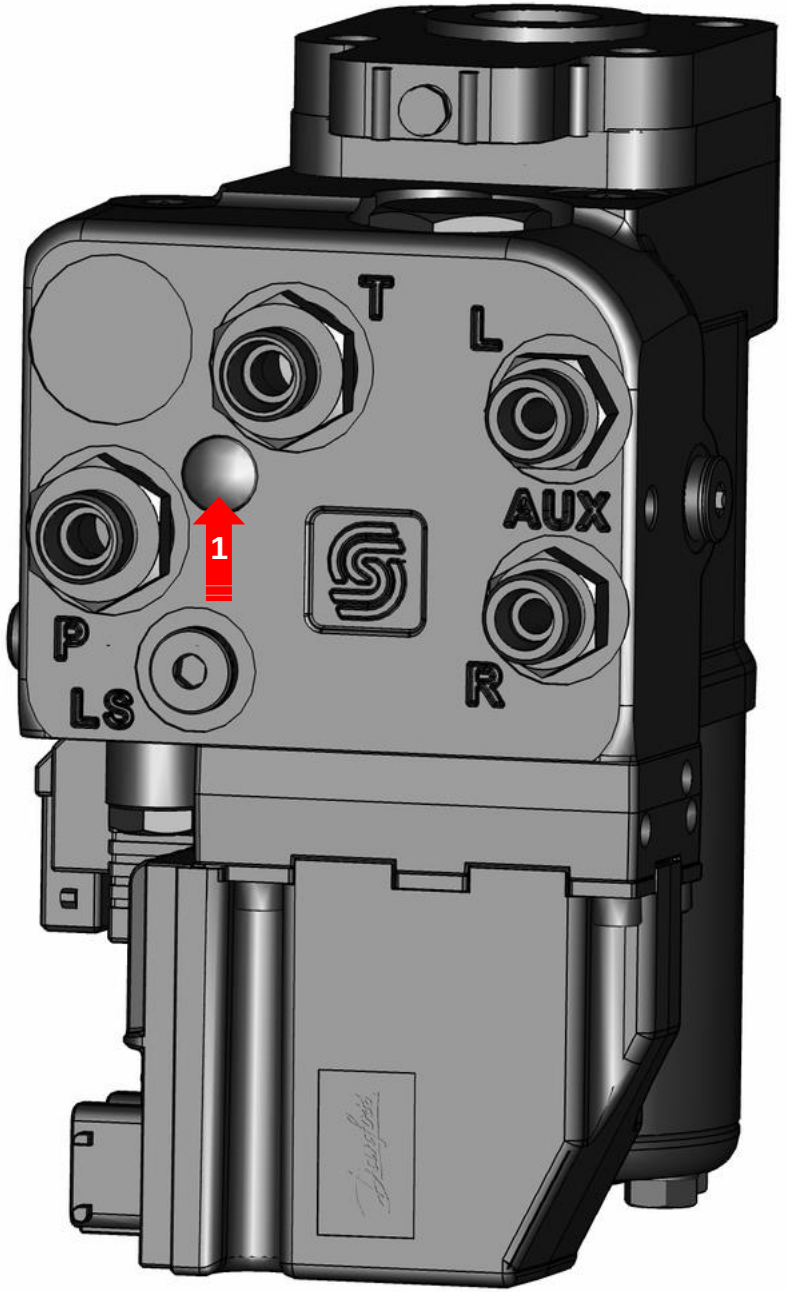




3.2 Setting the steering pressure

Machines with automatic steering system

6. The adjustment screw for the pressure balance is found on the rear of the orbitrol under a plastic cap (1).
7. The orbitrol for the automatic steering must not be disassembled!
8. Steer to the stop → measure → adjust.



1 - Cap over adjusting screw for Δp_{steer}

3. Settings

3.1 General

3.2 Setting the steering pressure

3.3 Adjustment of the track

3.3.1. General information

3.3.2. Track correction

3.3.3. Adjusting the track

3.3.1.1 Required tools

To adjust the track, the following tools is required:

- For all machines:
  - Laser measuring device / long aluminium bar.
  - Measuring tape / measuring stick.
  - Electrical tape / adhesive tape.
  - AMAZONE GREY 105842 top coat repair kit.
  - Level surface, ideally a smooth concrete floor in a hall.

- Additionally for PANTERA and PANTERA-H (old cylinder 944864):
  - Open-ended spanner size 55.
  - Open-ended spanner size 50.

- Additionally for PANTERA-W (cylinder GA307) and PANTERA / PANTERA-H with the new cylinder GA430:
  - Open-ended spanner size 28.
  - Open-ended spanner size 46.

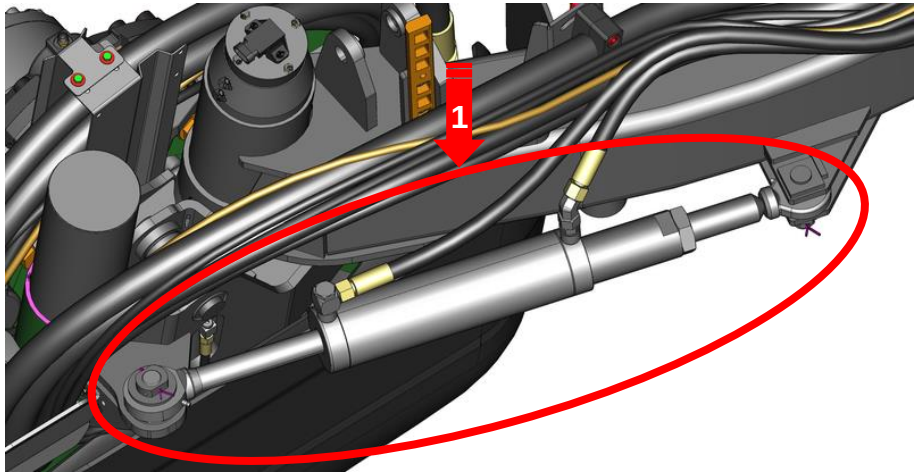
3.3.1.2 General layout

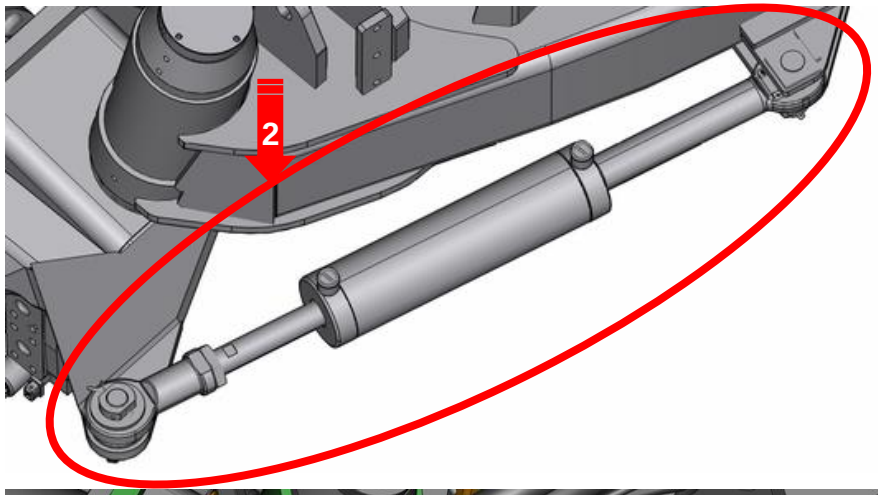
Steering cylinder

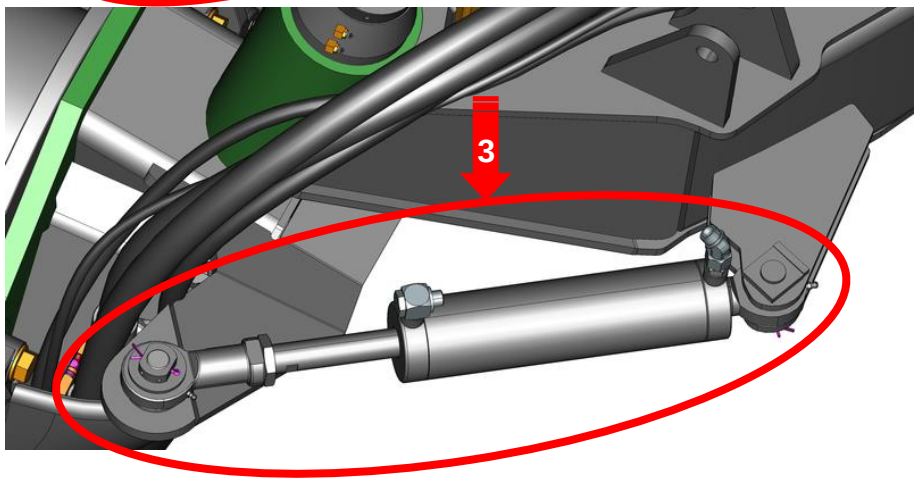
- The standard and H running gears have the same steering cylinder:
  944864 (1).
- During the course of model year 2018, this cylinder will be converted to cylinder **GA430** (2), which has a fine thread on the piston rod side. This make the adjustment easier.
- The W running gear has a different steering cylinder:
  GA307 (3).

All cylinder types each have a stroke of 200 mm.

- The track is adjusted mechanically on each wheel using the spindles on the piston crown side (PANTERA und PANTERA-H) or on the piston rod side (PANTERA-W and all PANTERAs in the future).



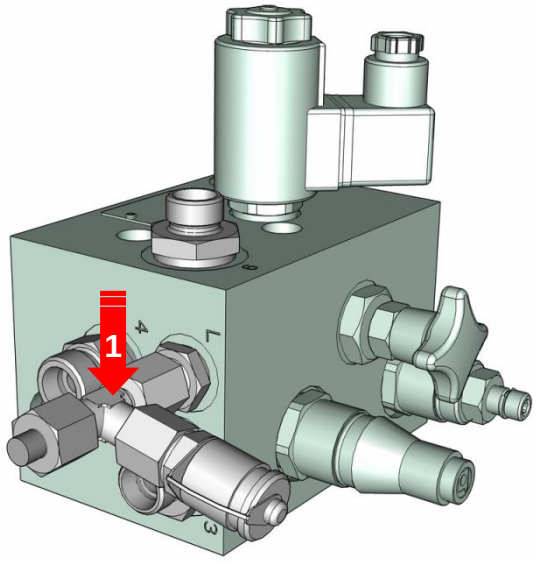




3.3.1.3 Preparations and procedure

Before you can start with the measuring and adjustment work, certain preparations are required, then the work can be performed:

- Check whether retrofit 104008 was performed on the track correction block (see MM627) on this machine. Retrofitted machines (up to PAP0000360) and all machines starting from PAP0000361 (ex factory) have a T-piece with a mini-measuring connection (1) as an indentifier on each track correction block. If the retrofit was not performed yet, it has to be performed urgently!
- Run the machine up to operating temperature, it is best to drive a few kilometres so that the steering oil also warms up.
- Perform the track correction for both axles SEVERAL TIMES while slowly driving forward (min. 3 times), see page 53.
- Check the track correction for proper function (see following pages).
- Measuring and determining the individual target piston rod lengths for each axle.
- Hydraulic adjustment of the determined target piston rod lengths for each axle.
- Measurement of the wheel position.
- Mechanical adjustment of each individual wheel.
- Checking of the adjustment work.



3.3.2. Track correction

3.1 General

3.2 Setting the steering pressure

3.3 Adjustment of the track

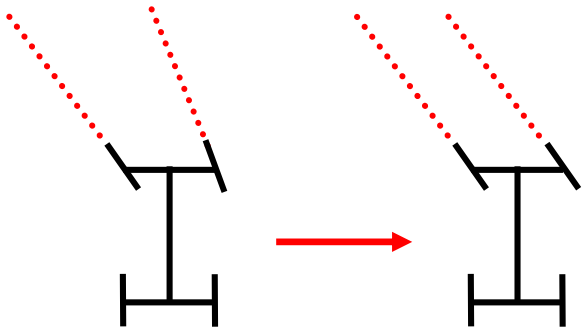
3.3.1. General information

3.3.2. Track correction

3.3.3. Adjusting the track

3.3.2.1 Performing the track correction

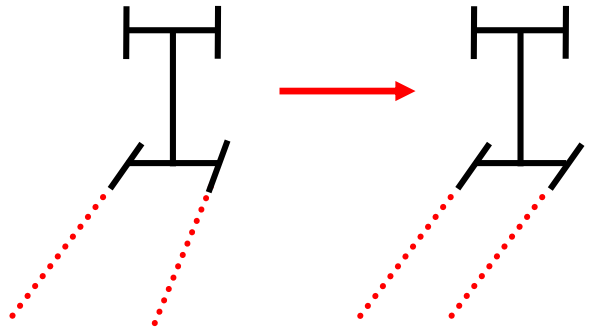
Front axle



1. While driving forwards slowly (approx. 2 km/h), turn with the steering wheel all the way to the left. Hold the steering wheel, steer against the stop.
2. Press the switch S024 (1) in the armrest to the front (2) and hold for 4 seconds.
3. Let go of the switch.
4. Let go of the steering wheel.
5. Steer all the way to the right with the steering wheel. Hold the steering wheel, steer against the stop.
6. Press the switch S024 (1) in the armrest to the front again (2) and hold for 4 seconds.
7. Let go of the switch S024.
8. Let go of the steering wheel.
9. Repeat steps 1-8 at least another two times.
10. Stop.

3.3.2.1 Performing the track correction

Rear axle



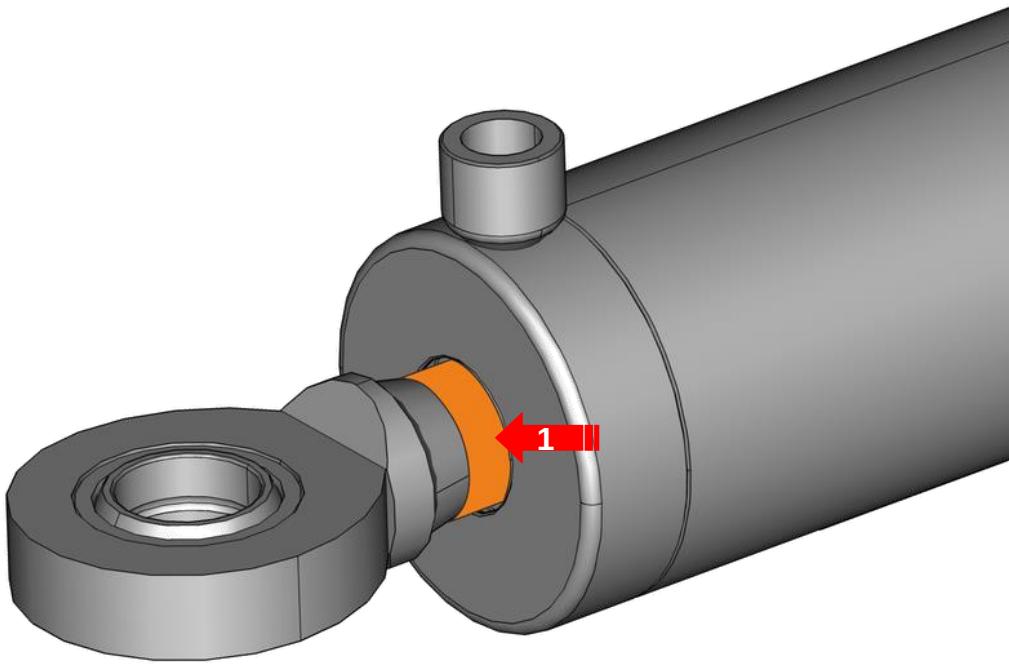
1. While driving forwards slowly (approx. 2 km/h), steer all the way to the left with the switch on the AmaPilot and keep the switch pressed.
2. Press the switch S024 (1) in the armrest to the rear (2) and hold for 4 seconds.
3. Let go of the switch.
4. Let go of the switch on the AmaPilot.
5. Steer all the way to the right with the button on the AmaPilot, and keep the switch pressed.
6. Press the switch S024 (1) in the armrest to the rear (2) and hold for 4 seconds.
7. Let go of the switch S024.
8. Let go of the switch on the AmaPilot.
9. Repeat steps 1-8 at least another two times.
10. Stop.

3.3.2.2 Checking the track correction for proper function

Measure the piston rod length (2 persons required, pay attention to the PARKING BRAKE!)

1. Person 1, in the cab:
   While slowly driving forwards, steer to the left up to the stop, stop, actuate the track correction and leave actuated. Then stop and apply the parking brake.
2. Person 2: at the steering cylinders:
   Apply the electrical tape to the retracted steering cylinder on the right (1), this serves as a stop for measuring. Then exit the danger zone.
3. Person 1: Like no.1, only steer to the other stop.
4. Person 2: Like no. 2, at the other cylinder.

Note: The electrical tape serves as a stop when measuring. If there is enough paint in this area, the stroke up to the paint can also be measured without the tape.



3.3.2.2 Checking the track correction for proper function

Measure the piston rod length (2 persons required, pay attention to the PARKING BRAKE!)

5. Measure the piston rod on the steering cylinders at the front:
   Drive again, steer to the left up to the stop, hold the steering wheel, actuate the track correction, stop, and leave the track correction actuated. The left cylinder must be completely extended (200 mm of chromium-plated piston rod must be visible), and the right cylinder must be completely retracted. See the next page.
6. Drive again, steer to the right up to the stop, hold the steering wheel, actuate the track correction, stop, and leave the track correction actuated, then measure the piston rod on the steering cylinders at the front: the left cylinder must be completely retracted and the right cylinder must be completely extended (200 mm of chromium-plated piston rod must be visible). See the page after next.
7. This step must be performed for both axles.

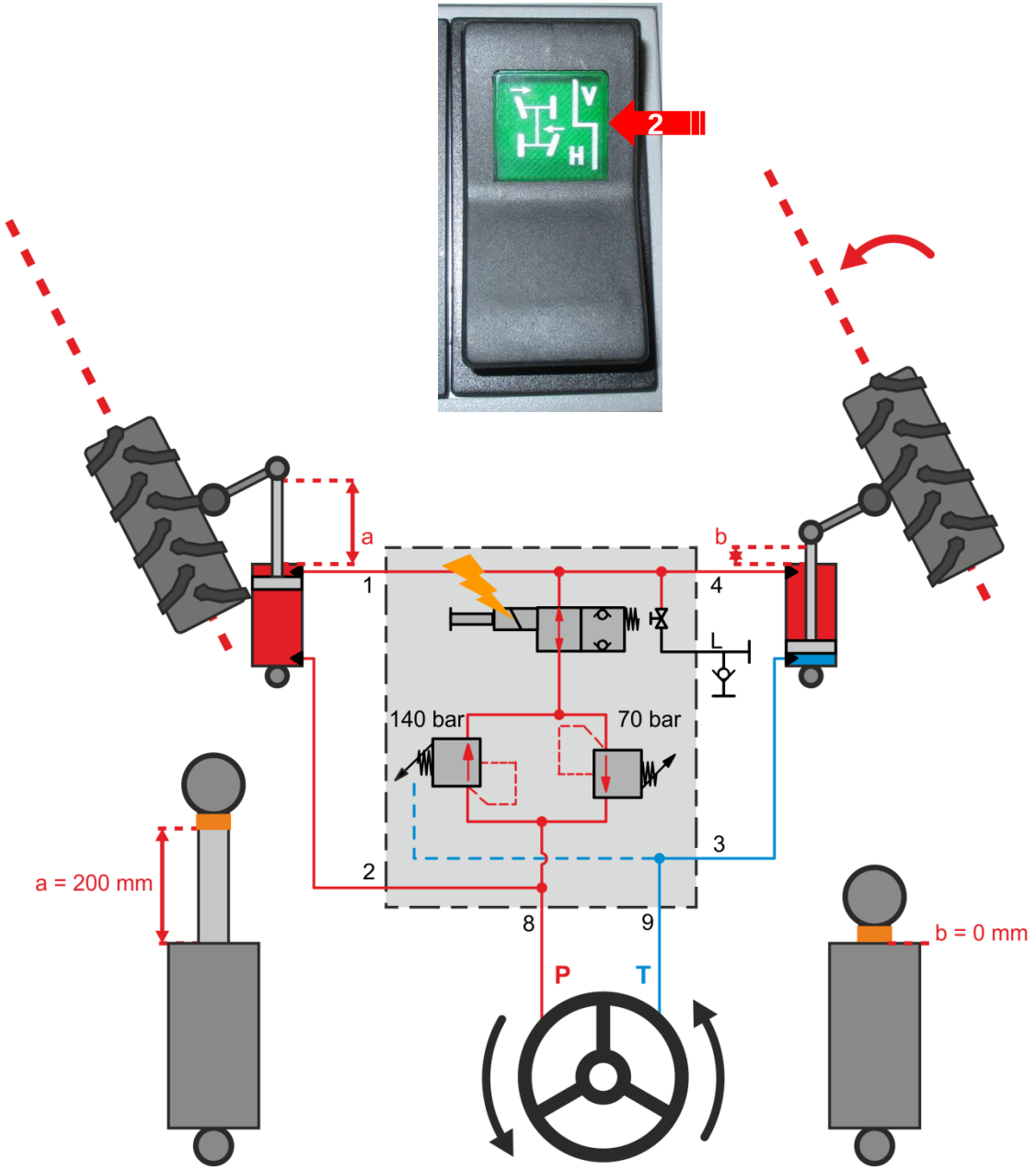
3.3.2.2 Checking the track correction for proper function

Left stop during the track correction

8. The left cylinder must be completely extended and have a piston length of a = 200 mm.
9. The right cylinder must be completely retracted and have a piston length of b = 0 mm.

Note:

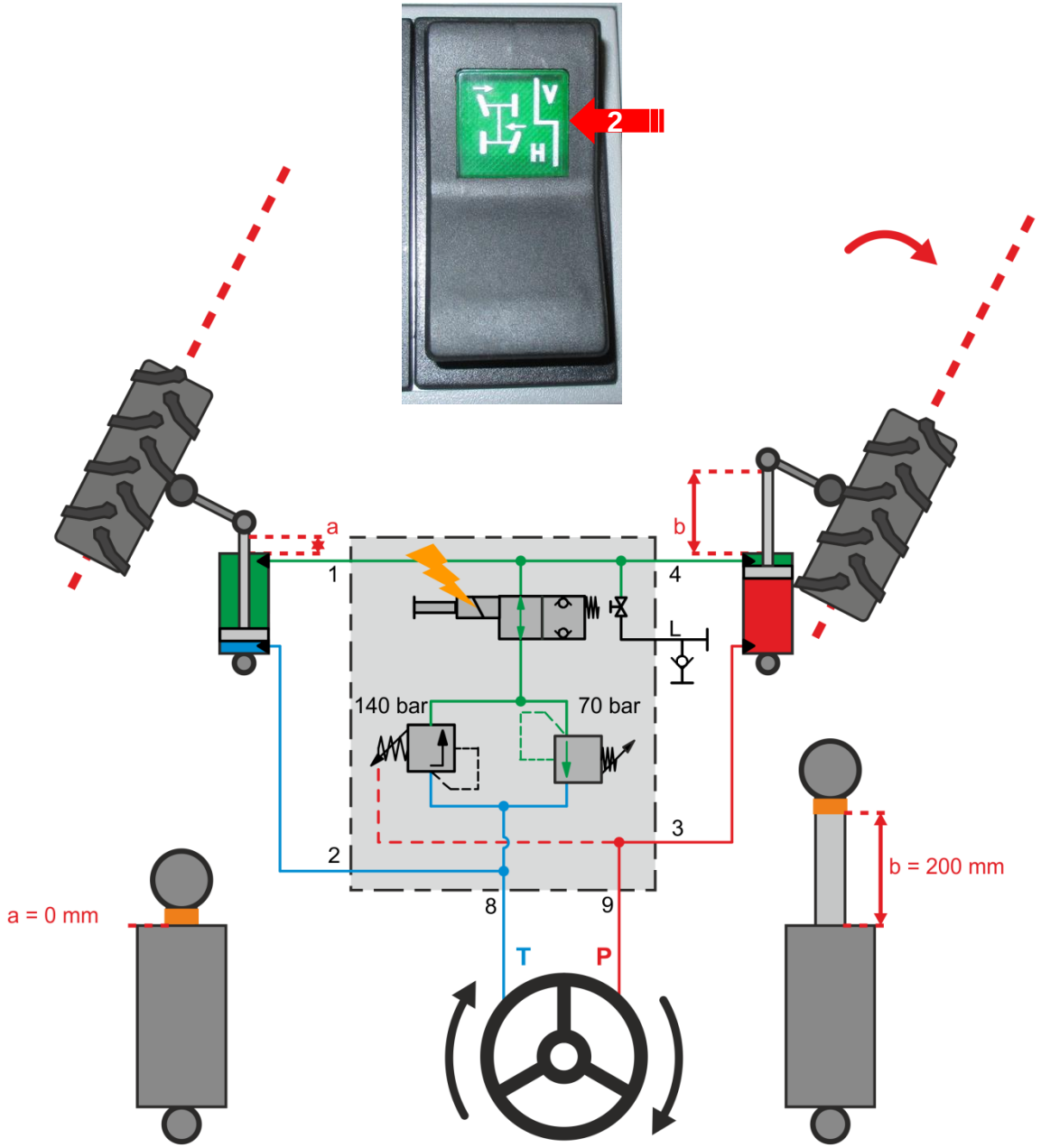
It is only DURING the track correction that one cylinder is completely retracted and the other completely extended!



3.3.2.2 Checking the track correction for proper function

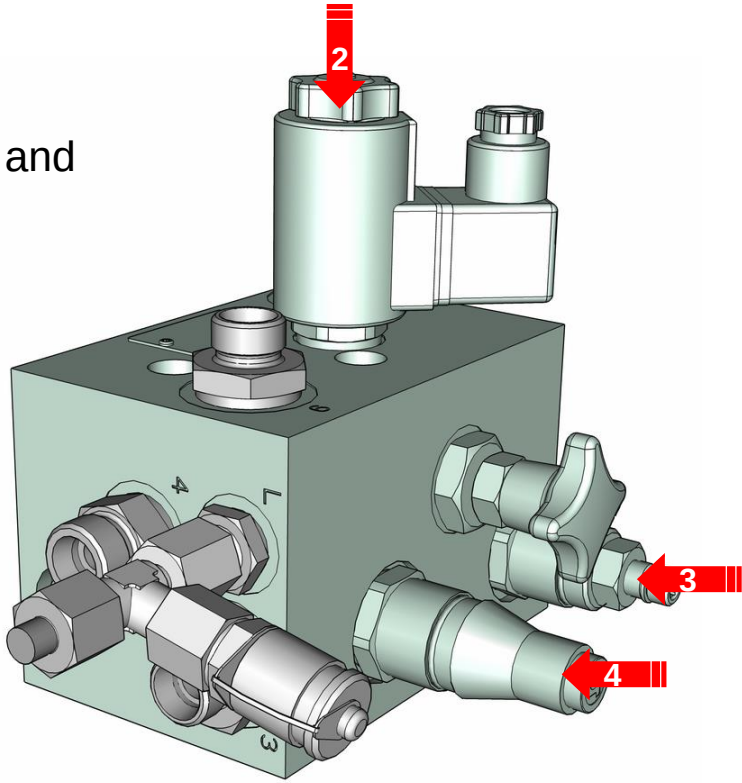
Right stop during the track correction

10. The left cylinder must be completely retracted and have a piston length of a = 0 mm.
11. The right cylinder must be completely extended and have a piston length of b = 200 mm.



3.3.2.2 Checking the track correction for proper function

12. If the cylinders are not retracted or extended as described in the sub-steps "8" to "11", i.e., the end stops cannot be reached, the electrical and hydraulic function of the track correction block must be checked:
    - Are the valves properly connected?
    - Are valves K219 and K220 (2) energised when pressing button S024? (Pay attention to the assignment of the front / rear axle).
    - If not:
        - Remove the valve, apply current from an external source and check the switching behaviour.
        - Check the valve for contamination / splinters / jamming.
        - Check the wiring if necessary.
    - If necessary, remove the valves (3, 140 bar opening pressure) and (4, 70 bar opening pressure) and clean them.
      CAUTION: observe the correct installation position, it must not be confused!
13. If the track correction is fully functional and the end stops of the steering cylinders are reached (0 / 200 mm), but the wheels are still not standing parallel to each other, the track must be readjusted mechanically. The steps to do this are listed in section 3.



3.3.3. Adjusting the track

3.1 General

3.2 Setting the steering pressure

3.3 Adjustment of the track

3.3.1. General information

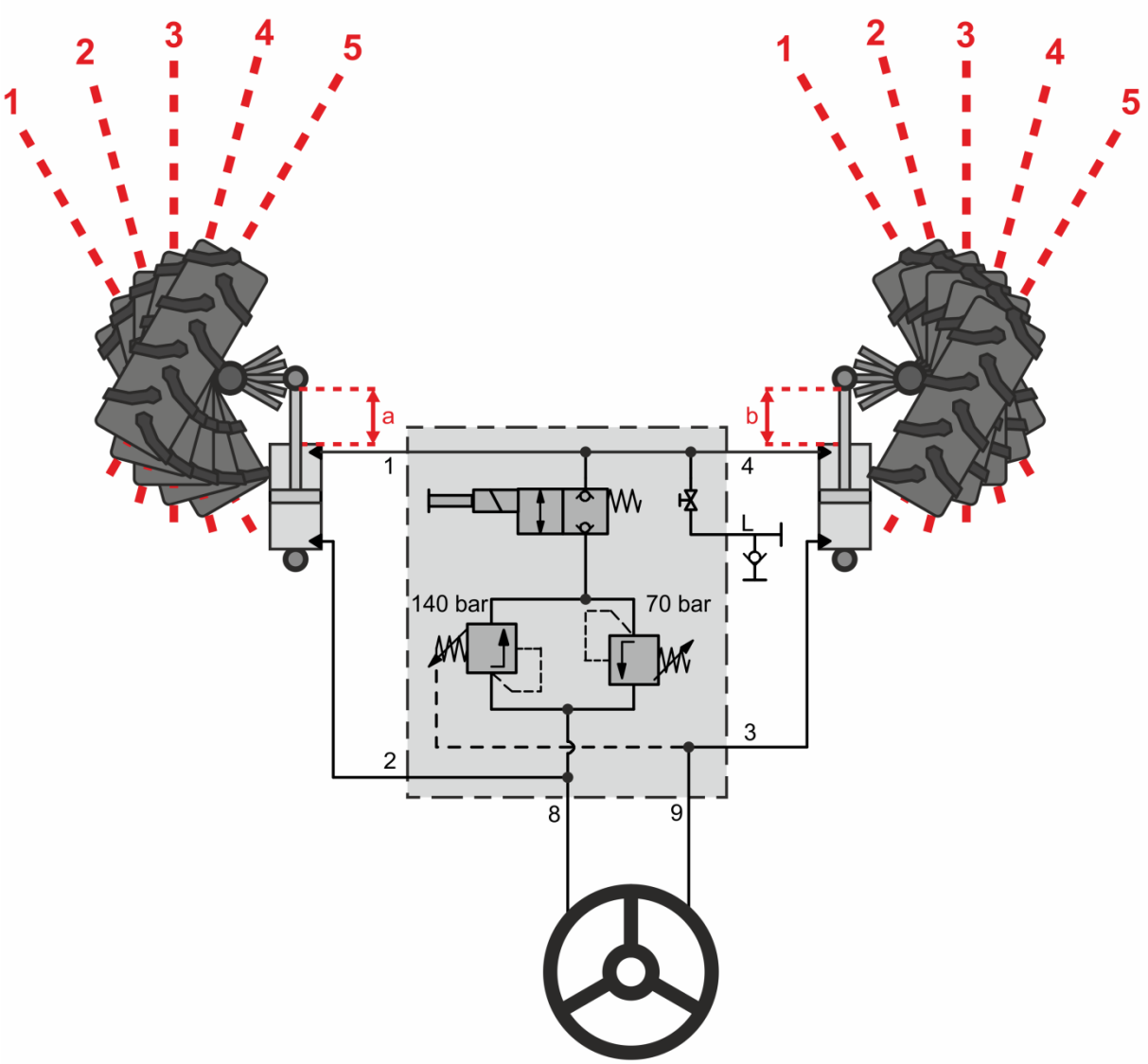
3.3.2. Track correction

3.3.3. Adjusting the track

3.3.3.1 Measuring the cylinders

Procedure

- Now 5 different steering positions should be consecutively set, and the piston rod lengths between the gasket and the electrical / adhesive tape is measured for each cylinder in each position.
- Enter the values in a table. Refer to the sample calculation on the next page.
- This must be performed both for the front and the rear axle.
- An average is then calculated from the values.
- **IMPORTANT: while performing these measurements, you must not steer all the way to the end stop, i.e. positions 1 and 5 each must be at least 1 cm away from the end stop.**



3.3.3.1 Measuring the cylinders

Sample calculation

Front axle			
Position	**a [mm]**	**b [mm]**	**a + b [mm]**
1	25	170	195
2	78	116	194
3	105	90	195
4	142	54	196
5	165	33	198
Sum of all (a + b)			978
Half of the average			**97.8**

Rear axle			
Position	**a [mm]**	**b [mm]**	**a + b [mm]**
1	28	167	195
2	75	124	199
3	110	87	197
4	138	58	196
5	160	38	198
Sum (a + b)			985
Half of the average			**98.5**

- The average is calculated from the total, and then halved.
- For 5 measurements, half of the average corresponds to one tenth of the sum of all (a+b).

3.3.3.1 Measuring the cylinders

Template to be filled in

Front axle			
Position	**a [mm]**	**b [mm]**	**a + b [mm]**
1			
2			
3			
4			
5			
Sum of all (a + b)			
Half of the average			

Rear axle			
Position	**a [mm]**	**b [mm]**	**a + b [mm]**
1			
2			
3			
4			
5			
Sum of all (a + b)			
Half of the average			

- The average is calculated from the total, and then halved.
- For 5 measurements, half of the average corresponds to one tenth of the sum of all (a+b).

3.3.3.1 Measuring the cylinders

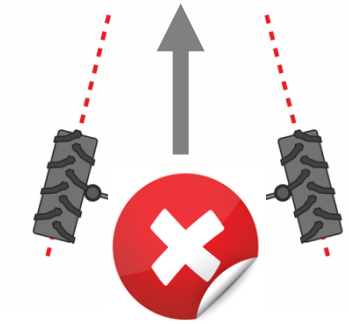
Information

- To properly adjust the track for each machine, the behaviour of the steering cylinders relative to each other while steering must be measured for each axle.
- This measurement is specific for each machine and depends on various parameters.
- Theoretically, for a stroke of 200 mm on each cylinder, the straight position should be adjusted at 100 mm. The practical values differ because of slight compression of the hydraulic fluid together with slight stretching of the hydraulic hoses.
- The track can be adjusted using the values determined with the previous example.

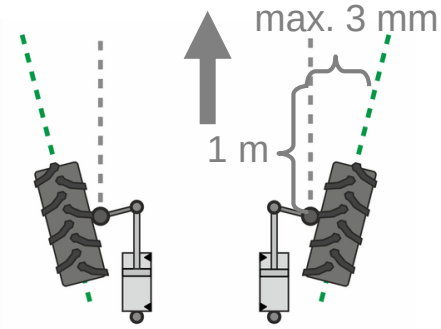
3.3.3.2 Setting specifications

For proper track adjustment, the following specifications apply:

1. A toe-in may not be set!



2. The wheels should be parallel or have a slight toe-out.



(Drawing not true to scale for representation reasons!)

3. The maximum permissible toe-out is of 3 mm/m per wheel, measured relative to the straight position or 6 mm/m, measured from wheel to wheel (= total toe-out). The minimum total toe-out should be 3.8 mm/m = 1.9 mm/m per wheel. The toe-out compensates for tyre wear caused by the pitch. A toe-in would increase tyre wear.

3.3.3.2 Setting specifications

More information:

1. Per 1 mm of steering cylinder stroke, the angle of the wheel changes as follows:
   - 0.2 degrees.
   - 3.49 mm/m.
2. This means:
   - You must work very carefully and precisely when making adjustments, since already a small change in the piston rod length has a large influence on the position of the wheels!

3.3.3.3 Adjustment of the track

General procedure:

1. Set up the measuring equipment and put into operation.
2. Set the front left wheel hydraulically at the calculated value. Here in the example: 97.8 mm (see P. 63).
3. Loosen the lock nuts on the spindles and align the wheel:
   a. Practice-oriented: straight ahead (can be achieved with any measuring equipment).
   b. Optimised: setting a slight toe-out:
      - Method 1 (practical method): turn the spindle so that the spindle stroke (CAUTION: not the piston rid stroke) is 0.5 – 1 mm longer than the straight position.
      - Method 2 (requires an precise laser measuring device): measure directly and set.
4. Tighten the lock nut. CAUTION: in no case should the spindle be adjusted again!
5. All other wheels are then adjusted using the same method (observe the values for the rear axle!). For fine hydraulic adjustment of the rear axle, it is recommended to move it using the calibration menu.
6. During operation, the correct piston rod stroke of the respective steering cylinder must be checked and adjusted time and again.
7. Recalibrating the centre position for the front and rear axle steering potentiometer:
   - With method 3a: calibrate the straight position.
   - With method 3b: in the centre position of the wheels, the toe-out must be the same on the left and right.
8. On machines with automatic steering systems, it must be reactivated with AGENT after the calibration.

4. Error patterns and diagnosis

4. Error patterns and diagnosis

Problem	Solution / parts for inspection
Wheels on an axle are not parallel	- Perform / check the track correction - Leak in a cylinder - Spindles on the cylinder are set incorrectly → contact AMAZONE service department
Rear wheels do not correctly follow the front wheels in the 4-wheel steering mode	- Check the steering wheel angle sensors (damage, cables, power supply, installation position) - Calibrate the steering wheel angle sensors - Check the hydraulic pressure
Rear wheels are not straight in the 2-wheel steering mode	- Check the steering wheel angle sensors (damage, cables, power supply, installation position) - Calibrate the steering wheel angle sensors
Rear wheel steering is not working	- Check the steering wheel angle sensors, relays, fuses, cables, connectors - Check valves (dirt, shavings)
Rear wheels steer very slow	- Check the LS pressure of the steering, reduce where necessary (→ more oil to hydraulic block 1 and a faster response). ΔpSteer should be 15 - 20 bar; it must not fall below 15 bar - Check valves (dirt, shavings)

Basic rule:
the first thing you should always check is whether the problem is mechanical, electrical, or hydraulic in nature!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