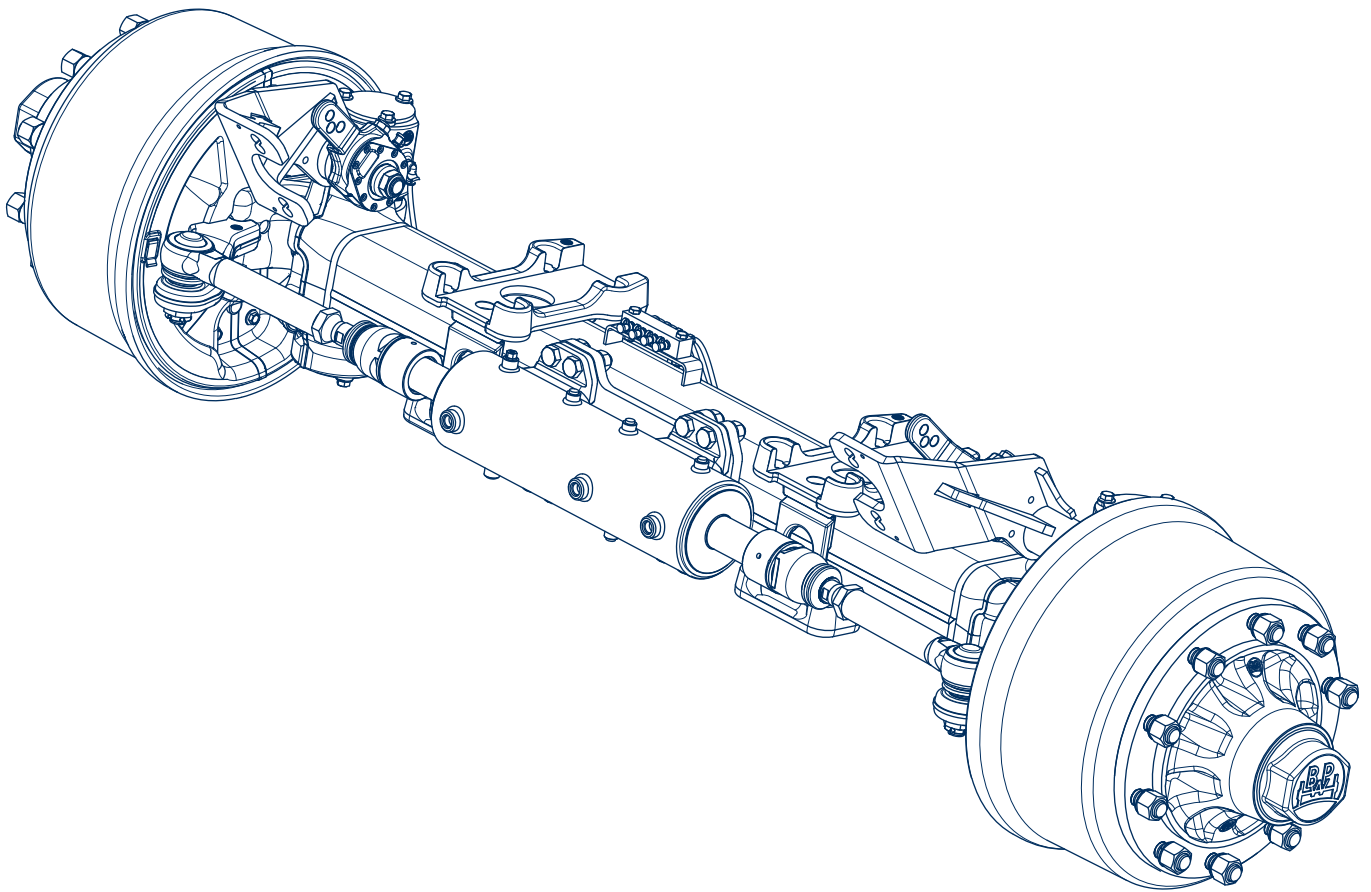




Workshop Manual

for AGRO Turn Steering Axles



AGRO Turn agricultural steering axles with drum brake

Steering axle series LL and HLL

Valid: 10 November 2016

Subject to change without notice.
Current versions and additional information can be found online at www.bpwagrar.com

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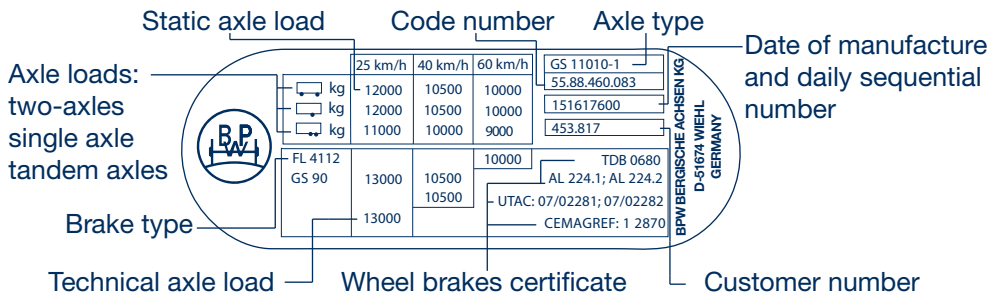
1 Product Identification

1.1 BPW Identification plate for agricultural axles

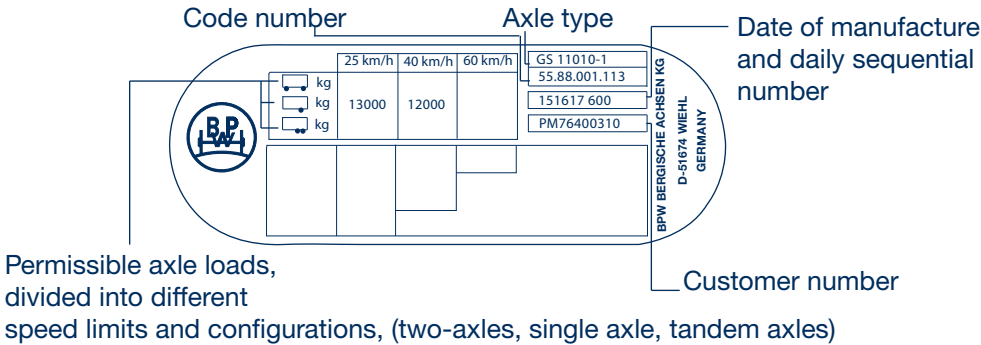
Every BPW axle has an identification tag. It is affixed to the centre of the axle beam - opposite to the travel direction.

The data on the identification tag can be used to define the required spare parts or - after an accident, for instance - the complete axle.

Type plate Braked axle



Type plate Unbraked axle



Type plate Suspension unit



Type designation and model number explanation 1.2

Type designation of the axles:

G	S		LL	11010	-1	
G						BPW trailer axle for agricultural vehicles
	S					Single wheels, wheels without offset
		N				Braked axles (Max. Speed: 80 km/h)
		ST				Axle stub
			LL			Unit steering axle type LL
			HLL			Unit steering axle type LL for underneath brake cylinders
				11010		Axle load number of wheel studs per wheel (last two digits)
					-1	Bearing type number

Explanation of the model number:

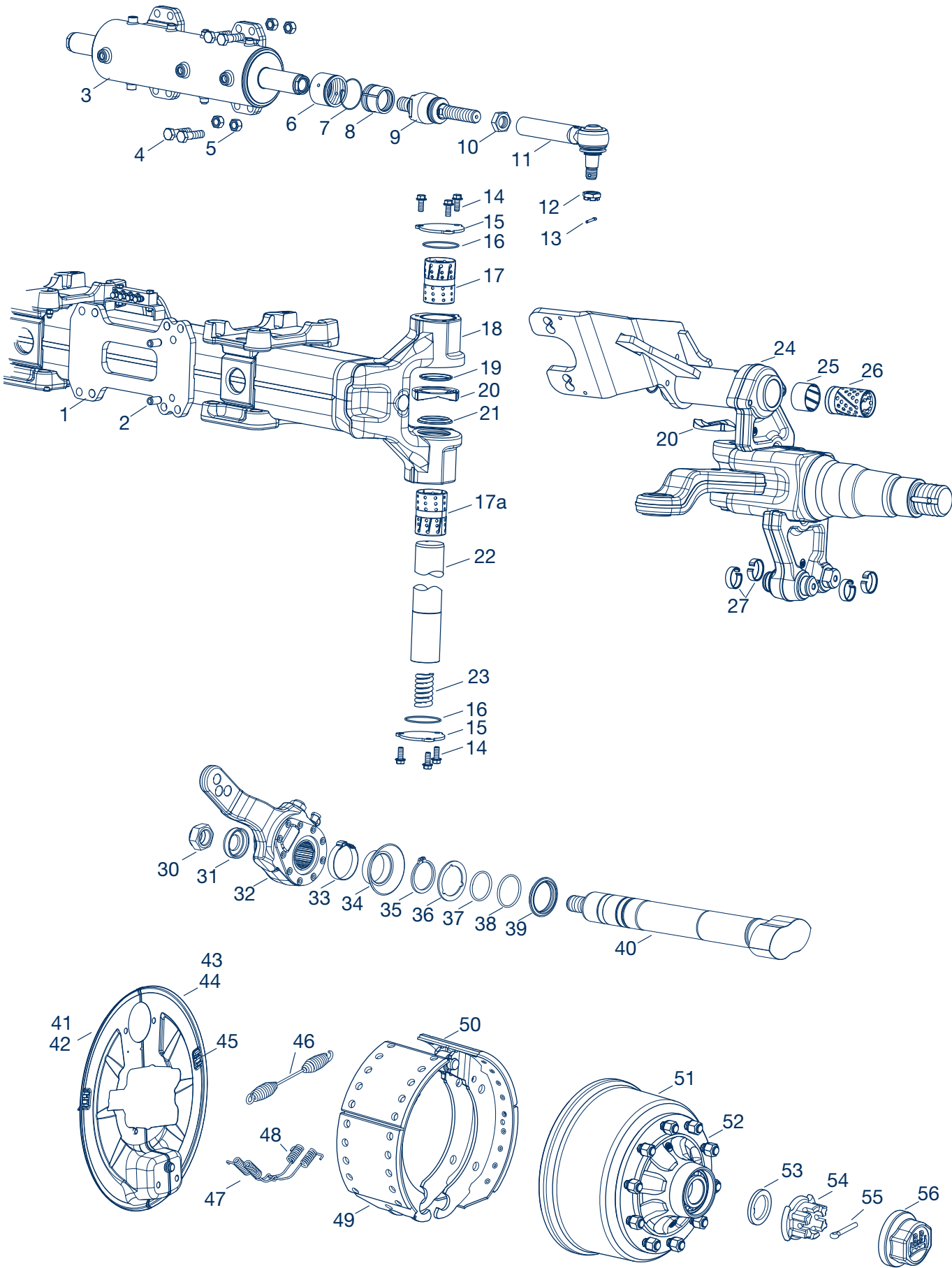
36.	77.	449.	000	
36.				Agricultural trailer axle, steered
	77.			GS 12010; GSN 12010; Bearings: 33213-33118
		449.		Wing cam brake FL 4118
			001 999	Serial number

2

2.1

Exploded View

Steering axle series LL

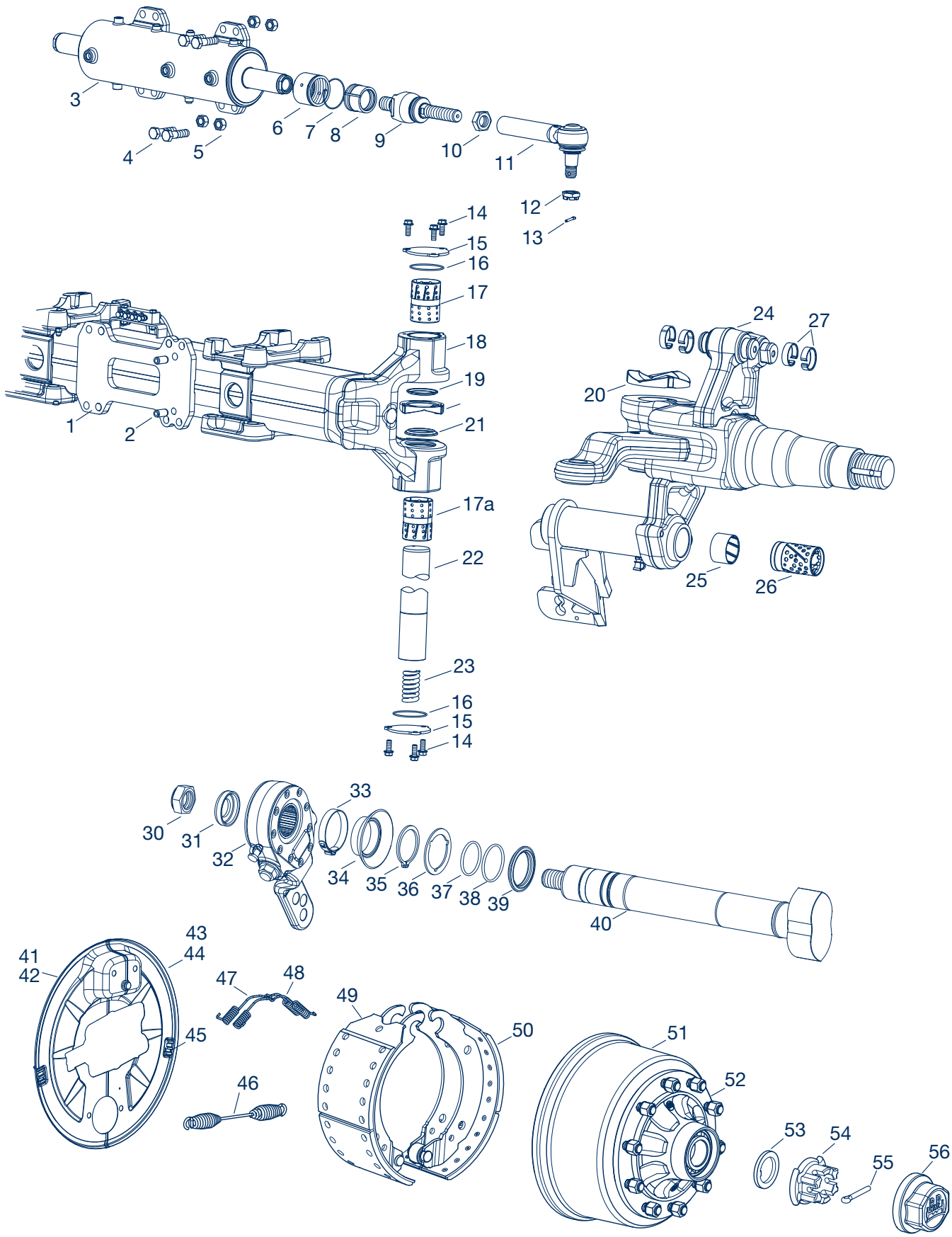


Exploded View

2

Steering axle series (H)LL

2.2



2

Exploded View

2.5

Designation and specification of the components

Pos.	Name	Pos.	Name
1	Hydraulic cylinder bracket	30	Lock nut
2	Pivot	31	Disc
3	Hydraulic cylinder	32	Manual Slack Adjuster
4	Locking screw	33	Securing clip
5	Safety nut	34	Rubber seal
6	Threaded stop sleeve	35	Circlip
7	Retaining ring	36	Plastic ring
8	Inner stop sleeve	37	O-ring (black)
9	Axial ball joint	38	O-ring (green)
10	Safety nut	39	Ring
11	Tie rod end / Eye ball joint	40	Brake camshaft
12	Castellated nut		
13	Split pin	41	Dust cover plate (front-left)
14	Locking screw	42	Dust cover plate (rear-left)
15	Closing plate	43	Dust cover plate (front-right)
16	O-ring	44	Dust cover plate (rear-right)
17	Bronze bushing	45	Rubber plug
17/a	Bronze bushing	46	Return spring
18	Axle beam end	47	Positioning spring (hook)
19	Sealing ring (blue)	48	Positioning spring (eye)
20	Thrust washer undulating shaped	49	Brake lining
21	Sealing ring (green)	50	Brake shoe
22	King pin	51	Brake drum
23	Pressure spring	52	Wheel hub
24	Steering knuckle	53	Shim
25	Bushing	54	Axle nut
26	Bushing	55	Split pin
27	C-clips	56	Hub cap

Fasteners Torque Values

3

Description	Thread / Wrench size	Tightening torques
Hub cap	M 125 x 2 / WAF 110	M = 500 Nm
Lug nut	M 22 x 1,5 / WAF 32	M = 510 Nm
Axle nut / KM axle nut	M 52 x 2 / M 55 x 2	M = 150 Nm
Locking nut of brake chambers	M 16 x 1,5 / WAF 24	M = 180 Nm
Locknuts of clevis	M 16 x 1,5 / WAF 24	M = 80 Nm
Locknut for release device	WAF 24	M = 20 Nm
Compressed air socket of brake chambers	WAF 27	M = 45 Nm
Locknut for slack adjuster	M 22 x 1,5 / WAF 32	M = 90 Nm
Locking screws of the cover plates	M 10 / WAF 13	M = 43 Nm
Locking screws for sensor plate	M 10 x 75 / WAF 13	M = 50 Nm
Locking screws of the sealing plates	M 10 x 25 / WAF 13	M = 53 Nm
Castle nut of the ball joint	M 24 x 1,5 / WAF 46	M = 260 Nm
Locknut of the tie rod	M 28 x 1,5 / WAF 41	M = 410 Nm
Axial joint	M 30 x 1,5 / WAF 55	M = 500 Nm
Steering stop nut	M 48 x 1 / D 60	M = 220 Nm
Locking screws for steering cylinder	M 16 / WAF 24	M = 230 Nm

4 Safety Regulations, Safety Information

4.1 Safety regulations

- ⦿ All work must be performed by trained mechanics at competent repair facilities or authorised specialised workshops who have access to all relevant tools and have acquired the know-how required for this work. Anyone who performs maintenance and repair work must have been trained as an automotive mechanic and already have experience in repairing trailers. Anyone who performs brake work must be trained in brake systems.
- ⦿ Comply with local safety regulations.
- ⦿ The relevant operations and service regulations as well as safety regulations of the vehicle manufacturer and of the manufacturers of the vehicle parts must be adhered to.
- ⦿ The dust created from grinding brake linings comprises particles that can cause lung damage. A safety mask must therefore be worn to prevent brake dust from being inhaled.
- ⦿ Use prescribed dust washing devices or vacuum cleaners for cleaning, never use compressed air or other high-pressure devices.
- ⦿ Ensure adequate ventilation at the workplace.
- ⦿ The vehicle must be prevented from moving during repair work. Please observe the relevant safety regulations for repair work on commercial vehicles, in particular the safety regulations for jacking up and securing the vehicle.
- ⦿ During repair work, make sure that the brake is not operated inadvertently.
- ⦿ Do not perform repair work unless wearing protective clothing (gloves, safety boots, safety goggles, etc.) and using the recommended tools.
- ⦿ Work on brake components removed from the vehicle must be carried out with the components fixed in place such as in a vise.
- ⦿ Only use recommended tools.
- ⦿ A second mechanic must provide assistance when working with heavy components (brake drums or brake removal/installation).
- ⦿ All air lines and components must be depressurised before being removed.
- ⦿ Following each repair, perform a function check or a test drive in order to make sure that the brakes are functioning correctly. New drums and linings only have maximum effect after a few braking actions. Avoid hard braking.
- ⦿ All exchanged components must be reused or disposed of in accordance with the applicable environmental regulations, laws and directives.
- ⦿ Tighten bolts and nuts with the prescribed tightening torque.

Safety information4.2

- ⦿ This workshop manual contains different types of safety instructions, each of which is designated an icon and a signal word. The signal word describes the severity of the potential danger.



- Danger !

Immediate potential danger of serious or fatal injury (severe injury or death).
- Warning !

Possible potential danger of serious or fatal injury (severe injury or death).
- Caution !

Possible dangerous situation (slight injury or damage to property).



- Repair Guide:

Risk of damage to property or consequential damage if this information is not observed.



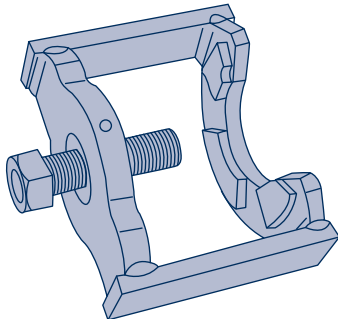
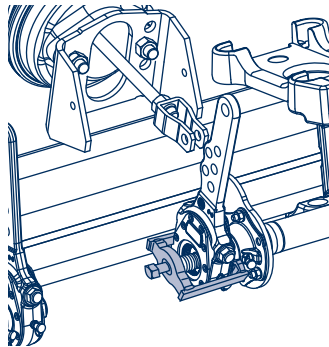
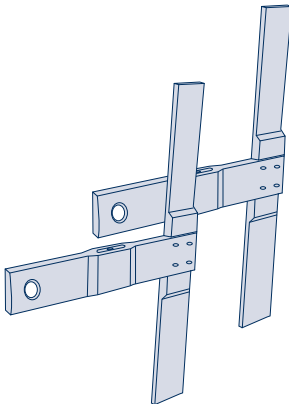
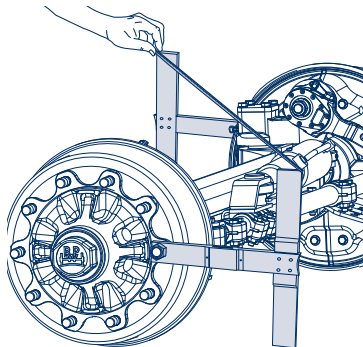
- Note:

Application hints and especially useful information.

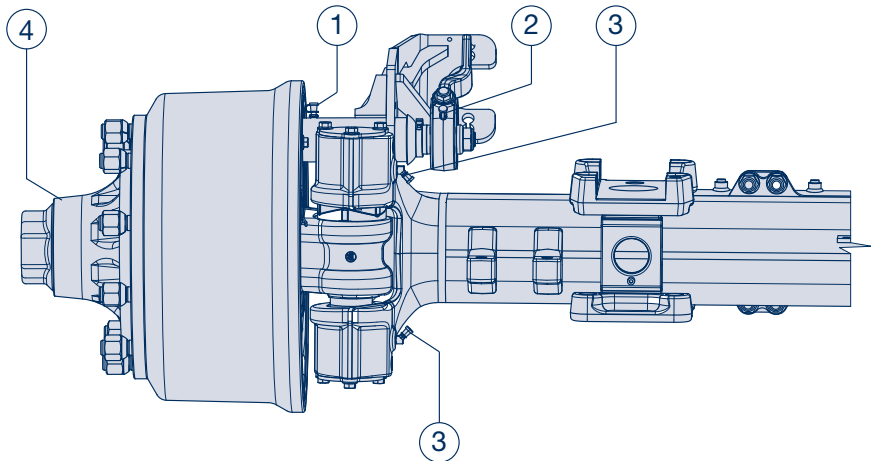
5 Special Tools

No.	Description	Illustration of tool	Tool in operation
1	Sockets for hub caps (BPW shape) BPW item number: 03.364.29.02.0 WAF 95 03.364.29.03.0 WAF 110		
2	Ring spanner for hub caps (flat shape / BPW shape) BPW item number: 03.339.04.03.0 WAF 95 03.339.05.04.0 WAF 110 03.339.05.02.0 WAF 120		
3	Sockets for axle nuts (BPW shape) BPW item number: 03.364.20.03.0 WAF 65 03.364.24.03.0 WAF 80		
4	Box spanner for axle nuts BPW item number: 03.364.20.02.0 WAF 65 03.364.24.02.0 WAF 80 03.364.26.03.0 WAF 85		

No.	Description	Illustration of tool	Tool in operation																					
5	Hub puller BPW item number: <table><tr><td>05.012.26.03.0</td><td>WAF 95</td><td>M 115 x 2</td></tr><tr><td>05.012.27.05.0</td><td>WAF 110</td><td>M 125 x 2</td></tr><tr><td>05.012.28.03.0</td><td>WAF 120</td><td>M 150 x 2</td></tr></table> Order bolt separately BPW item number: <table><tr><td>02.5026.70.80</td><td>M 22 x 100</td></tr></table>	05.012.26.03.0	WAF 95	M 115 x 2	05.012.27.05.0	WAF 110	M 125 x 2	05.012.28.03.0	WAF 120	M 150 x 2	02.5026.70.80	M 22 x 100												
05.012.26.03.0	WAF 95	M 115 x 2																						
05.012.27.05.0	WAF 110	M 125 x 2																						
05.012.28.03.0	WAF 120	M 150 x 2																						
02.5026.70.80	M 22 x 100																							
6	Puller for taper roller bearings for axles 6,5 -14 t BPW item number: 02.0125.10.00																							
7	Press tools for inserting the outer rings of roller bearings <table><thead><tr><th>Roller bearing</th><th>Ø</th><th>BPW item number</th></tr></thead><tbody><tr><td>32310</td><td>100</td><td>15.005.20052</td></tr><tr><td>32219</td><td>160</td><td>15.008.20052</td></tr><tr><td>33118</td><td>142</td><td>15.011.20052</td></tr><tr><td>33116</td><td>123</td><td>15.012.20052</td></tr><tr><td>33213</td><td>113</td><td>15.013.20052</td></tr><tr><td>33215</td><td>123</td><td>15.014.20052</td></tr></tbody></table>	Roller bearing	Ø	BPW item number	32310	100	15.005.20052	32219	160	15.008.20052	33118	142	15.011.20052	33116	123	15.012.20052	33213	113	15.013.20052	33215	123	15.014.20052		
Roller bearing	Ø	BPW item number																						
32310	100	15.005.20052																						
32219	160	15.008.20052																						
33118	142	15.011.20052																						
33116	123	15.012.20052																						
33213	113	15.013.20052																						
33215	123	15.014.20052																						

No.	Description	Illustration of tool	Tool in operation
10	Puller device for slack adjusters for GSK / AGS BPW item number: 02.4306.15.00		
11	Measuring Set (2 pieces) for hub BPW item number: 99.00.000.7.75		

6 Lubrication and Maintenance Work



Lubrication

Overview

Detailed description on pages 18 - 22.

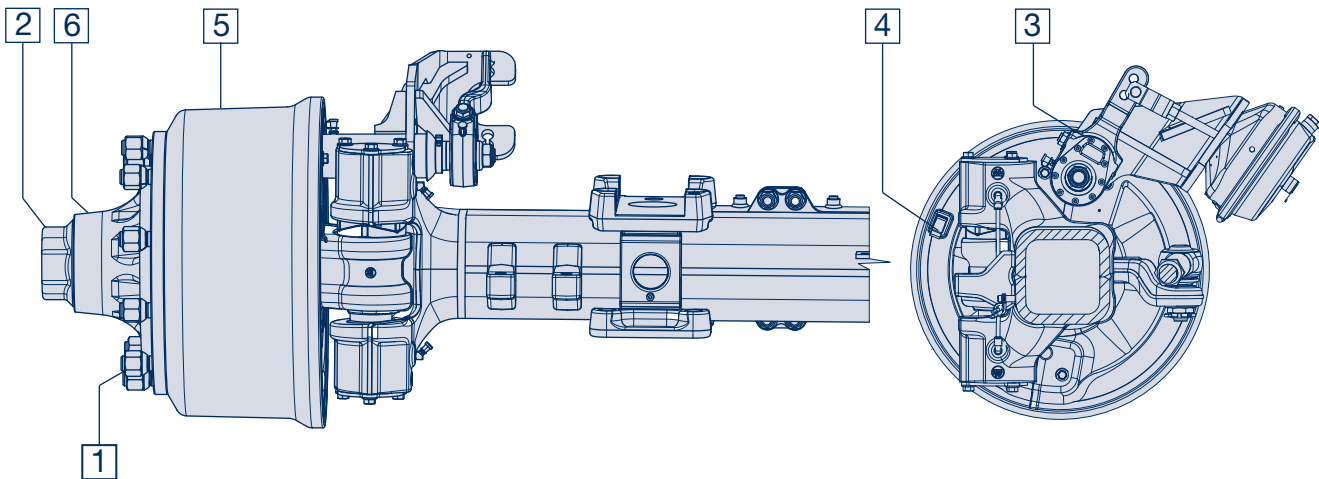
- Lubrication with BPW special longlife grease (ECO-Li 91).

	after the first run under load	every 200 operating hours, at every brake lining replacement, at the latest every half year ^{1), 2)}	every 500 operating hours, every brake lining replacement, latest annually ²⁾	every 1000 operating hours, every brake lining replacement, latest annually
① Brake shaft bearing		①		
② Manual slack adjuster		②		
Automatic slack adjuster			②	
③ Steering knuckle bushing top and bottom		③		
④ Change wheel hub bearing grease, check taper roller bearings and rotary shaft seal for wear.				④
With CTIS (Central Tyre Inflation System)			④	

¹⁾ After a long idle period, prior to use, actuate the brake lever and lubricate the brake camshaft bearing.

²⁾ During heavy use (e.g. Wagework Company) the given lubrication and maintenance intervals must be abridged.

For the position ① ② ③ use a high-pressure central lubrication system which is capable of feeding special longlife grease of consistency class 2-3 which is permissible. The use of liquid lubricants is not permitted!



Maintenance

Overview

Detailed description on pages 24 - 32.

- ☐ Maintenance work

	after the first run under load ¹⁾	every 200 operating hours, at every brake lining replacement, at the latest every half year ^{1) 2)}	every 500 operating hours, every brake lining replacement, latest annually ²⁾	every 1000 operating hours, every brake lining replacement, latest annually
① Check lug nuts for tightness, or re-tighten.	①			
② Check hub cap tightness.			②	
○ Check the tyres for uneven wear, adjust the inflation pressure if necessary according to the manufacturer's specification.		○		
③ Check the brake play in manual slack adjuster, adjust to 10-12% of the connected brake lever length whilst actuating manually or with 0.5-0.8 bar pressure air.		③		
Check the brake function, brake adjustment on the automatic slack adjuster, adjust if necessary.			③	
④ Check brake lining thickness. Residual thickness min. 5 mm.		④		
⑤ Check brake drum, cracking and inside diameter.		⑤		
- Inspect all parts and welds for damage and wear.		-		
⑥ Check wheel hub bearing play, adjust if necessary.	⑥		⑥	

¹⁾ After the first run under load conditions, as well as after each wheel change.

²⁾ During heavy use (e.g. Wagework Company) the given lubrication and maintenance intervals must be abridged.

Note: Components that have damages due to improper mounting are to be changed after a review by a BPW Service Centre.

6 Lubrication and Maintenance Work

Lubrication

Note:
After cleaning the vehicle with high-pressure cleaners, lubricate all lubrication points.

1 Brake camshaft bushing

- every 200 operating hours, at every brake lining replacement, at the latest every half year

Warning!
Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

Lubricate all parts through grease fittings with BPW special longlife grease (ECO-LI 91) until the fresh grease emerges.

2 Slack adjuster (manual)

- every 200 operating hours, at every brake lining replacement, at the latest every half year

Automatic slack adjuster

- every 500 operating hours, every brake lining replacement, latest annually

- [1] Remove the rubber seal cap.
- [2] Use BPW special longlife grease (80 gr) (ECO-LI 91) through the lubrication fitting, until the fresh grease emerges.
- [3] Turn back adjustment screw (keep clutch sleeve pressed down) by approx. one turn using a ring spanner. Actuate the brake lever several times by hand. The adjustment must be carried out smoothly. If necessary, repeat several times.
- [4] Once again only use BPW special longlife grease (ECO Li 91).
- [5] Adjust the brake.
See Page 27.
- [6] Fit the rubber seal cap.

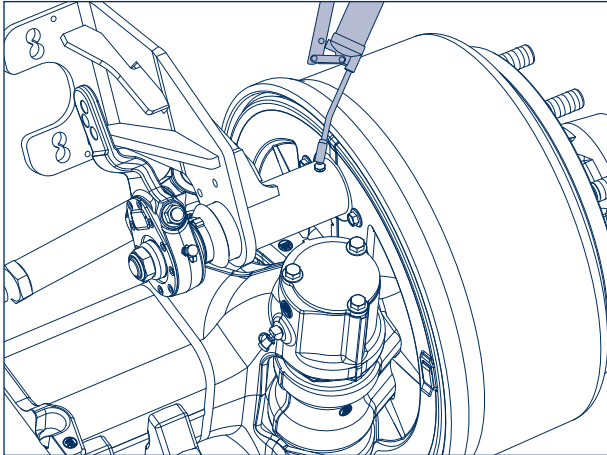


Figure 1

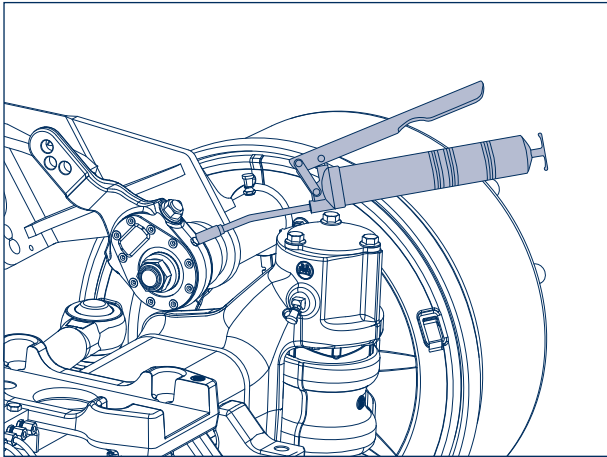


Figure 2

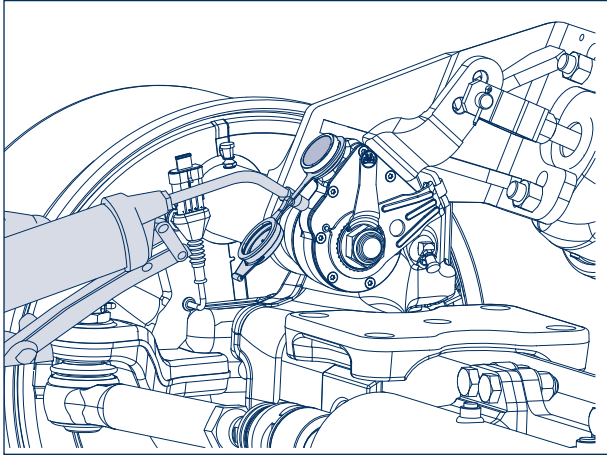


Figure 3

3 Steering knuckle bushing top and bottom

- every 200 operating hours, no later than half year

- [1] Raise the axle until the steering knuckle bearings are relieved. Use BPW special longlife grease (80 gr) (ECO-LI 91) through the lubrication fitting until fresh grease emerges at the undulating thrust washers or thrust washers.

4 Change wheel hub bearing grease (conventional)

- every 1000 operating hours, every brake lining replacement, latest annually
- [1] Lift up the axle and remove the wheels.

Warning!
Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

- [2] Remove and disassemble wheel hubs.
See Chapter 7 / 7.1

Repair Guide:
Mark wheel hubs and bearings together so that they are not interchanged during assembly. It is imperative that the bearing cups are used with bearing cone back into the same wheel hub.

- [3] Clean wheel hub inside and outside thoroughly. Remove old grease completely, clean tapered roller bearing (diesel oil), dry and check them for re-usability. Replace seals.
- [4] Force the BPW special longlife grease (ECO-Li 91) from the larger diameter end of the bearing cones into the cavities between the rollers and cage. Observe the final grease quantity (table A) see page 20.
- [5] Smear the remaining quantity of grease into the bearing outer ring of the hub.

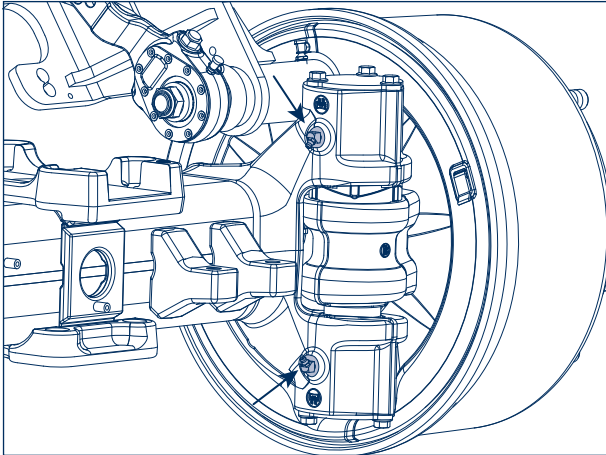


Figure 4

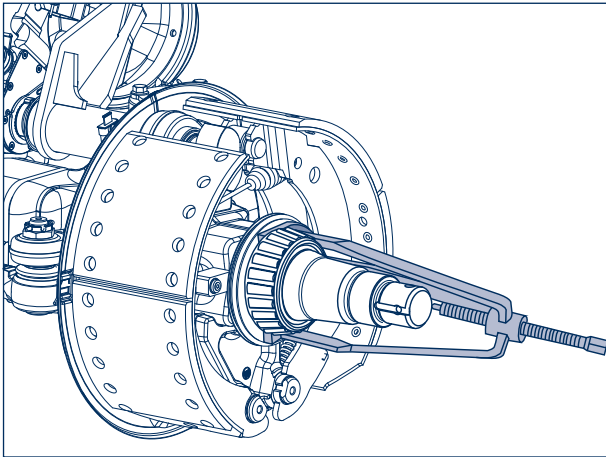


Figure 5

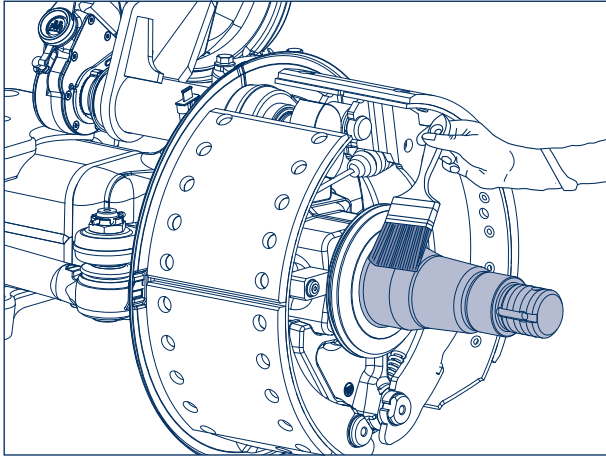


Figure 6

6 Lubrication and Maintenance Work

- [6] Install wheel hub and adjust bearing play.
🔧 See Pages 30 - 32.
- [7] Refill the hub cap with BPW special longlife grease (ECO-Li 91) the grease quantity (column B), see page 20.
🔧 Tightening torque see Page 25.

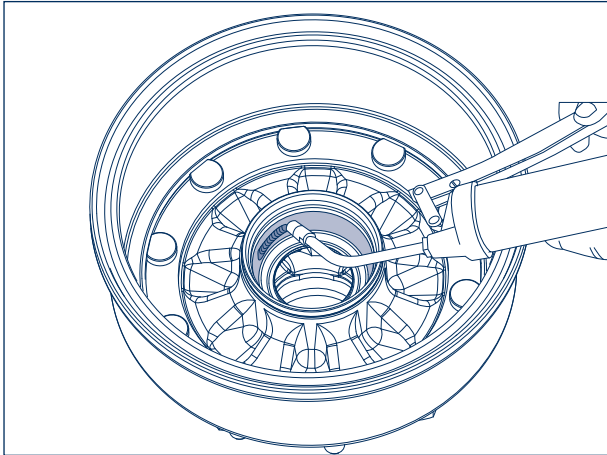
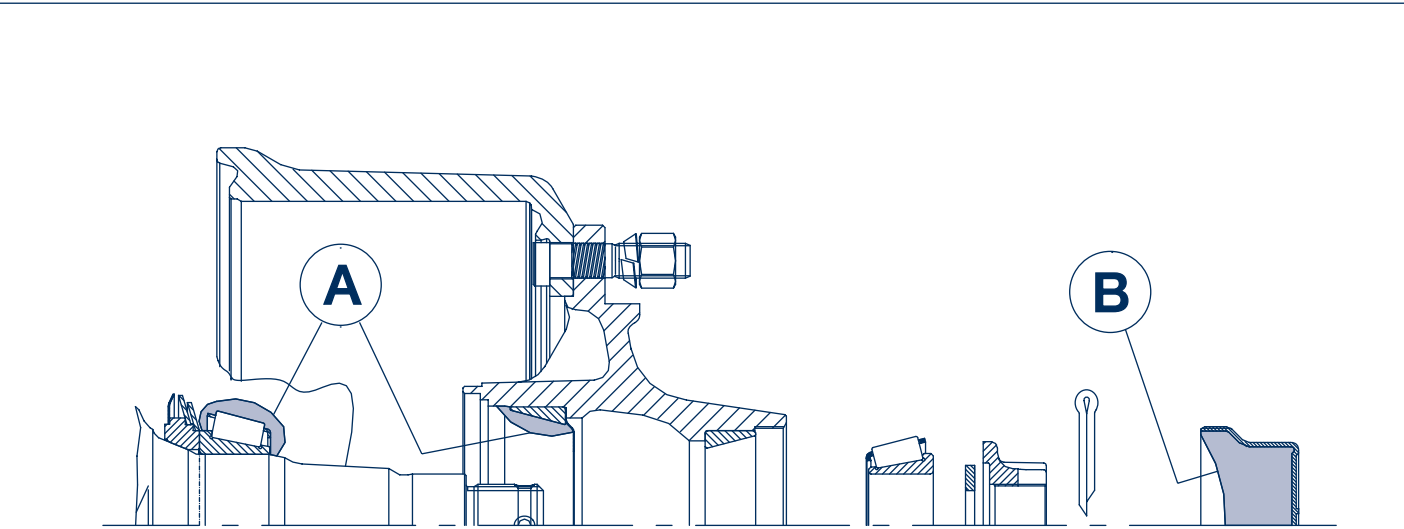


Figure 7



Type of bearing	Wheel hub	BPW Special-Longlife (ECO-LI 91) Grease quantity per tapered roller bearing	
		Inner A	Outer B
33213-33118	GS 12008	130 g	320 g
	GS 12010		
33213-33118	GS 12008	130 g	370 g
with KM axle nut	GS 12010		
		Smear any residual grease into the bearing outer ring of the hub. Fill up the free spaces between tapered rollers with grease and work them together.	The grease for the outside tapered roller bearing is injected when the hub cap filled with grease is screwed into the bearing.

- Change wheel hub bearing grease**
(at Central Tire Inflation System with KM axle nut)
- every 500 operating hours, every brake lining replacement, latest annually

- [1] Lift up the axle and remove the wheels.

Warning!
Prevent the vehicle from rolling away!
Release the park and service brake only after lifting!

- [2] Screw the air pressure connection out of the wheel hub cap or the axle stub.

Note:
Refer to the operating instructions of the control system manufacturer.

- [3] Unscrew the hub cap.

- [4] Screw down the outer KM axle nut and remove the retaining plate.

Repair Guide:
Reuse of the disassembled locking plate is prohibited!
It must be replaced!

- [5] Unscrew the inner KM axle nut and take out the washer.

- [6] Pull off the wheel hub with brake drum, tapered roller bearing and sealing elements using a suitable puller from the axle stub.

Note:
The wheel hub unit must be secured against falling down.

Repair Guide:
Mark hubs and bearings together so that, they are not interchanged during assembly.
It is imperative that the bearing inner rings with rollers be reused on the same hubs.

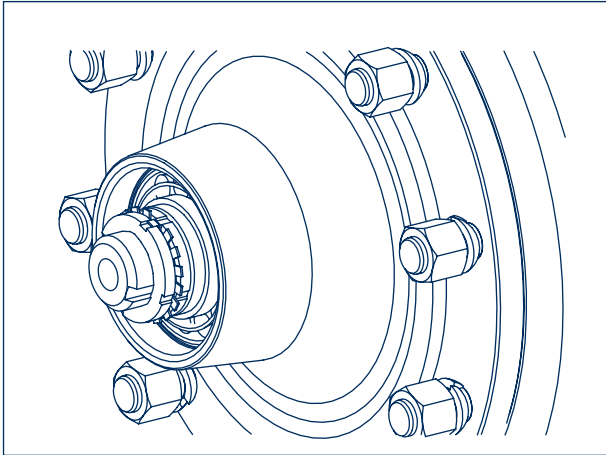


Figure 8

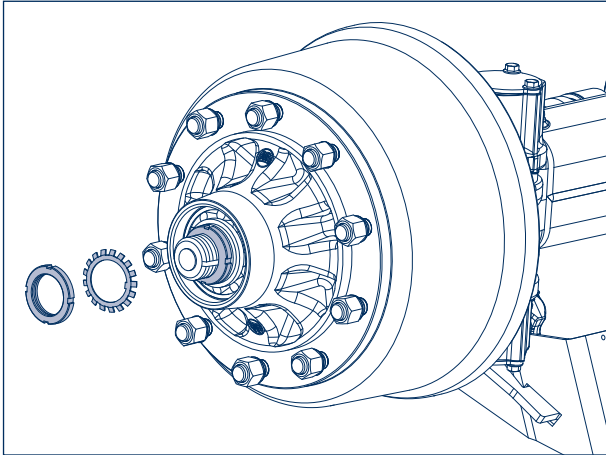


Figure 9

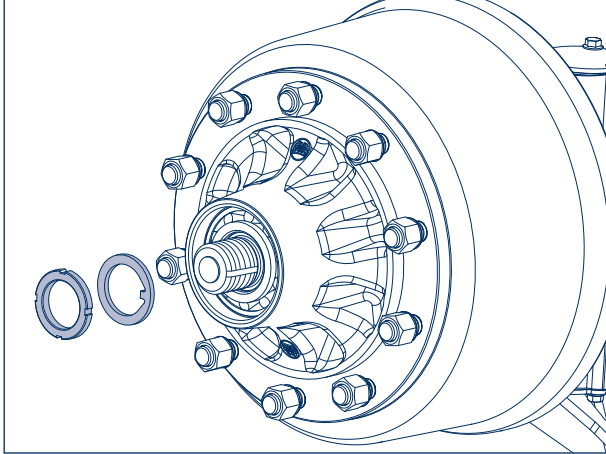


Figure 10

6 Lubrication and Maintenance Work

- [7] Clean wheel hub inside and outside thoroughly. Remove old grease completely, clean tapered roller bearing (diesel oil), dry and check them for re-usability. Replace seals.
- [8] Install the sealing elements.
 See Page 45.
- [9] Smear the BPW Special long-life grease (ECO-Li 91) into the free spaces between tapered rollers and cage.

For total grease quantity, see page 20, (table A, with KM axle nut).

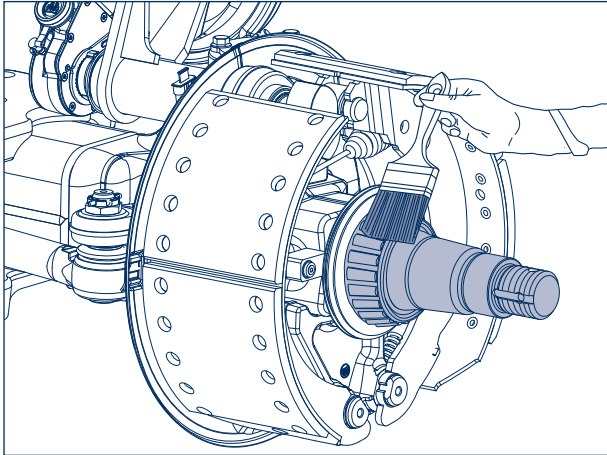


Figure 11

- [10] Smear the remaining quantity of grease into the bearing outer ring of the hub.
- [11] Install wheel hubs and adjust bearing play.
 See Page 30 - 46.

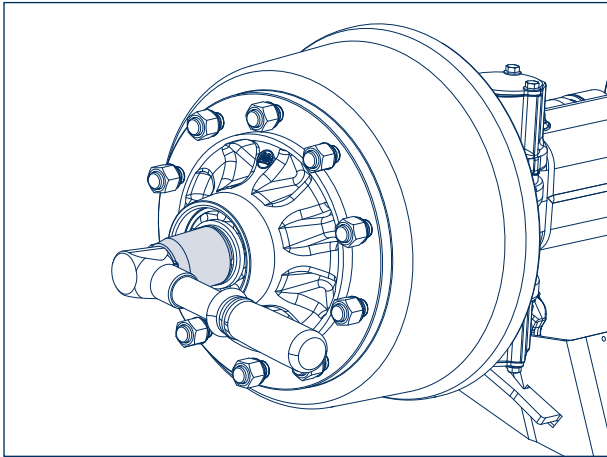


Figure 12



Note:
The air connection should be free from grease.

- [12] Refill the hub cap with BPW special longlife grease (ECO-Li 91) the grease quantity (table B), and tighten it to the prescribed 500 Nm tightening torque.
- [13] Install the Central Tyre Inflation System.

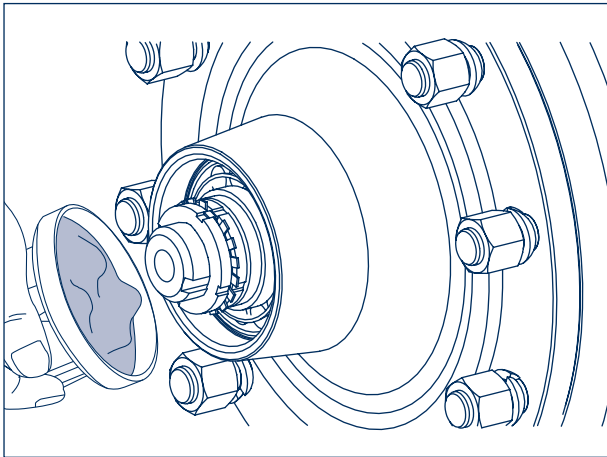


Figure 13



6 Lubrication and Maintenance Work

☐ Maintenance work

1 Check lug nuts for tightness

- After the first under load, after each wheel change, every 500 operating hours, latest annually.

Tighten lug nuts crosswise to the specified torque value in the table, using a torque wrench.

Wheel rim contact surfaces should not have additional coats of paint (risk of became loosening wheel rim!).

Tightening torques for lug nuts:

M 22 x 1,5 (WAF 32) M = 510 Nm



Warning!

It is imperative that the prescribed tightening torques are adhered to, in order to ensure that the wheels are securely fastened!

The values indicated by a torque wrench can be reached almost exactly by using an ordinary lug nut spanner (vehicle tool kit).



Repair Guide:

However always check the torque values with a torque wrench as soon as possible!

Reaching the tightening torque with hand tools

Tightening torque	Pipe length „A“	Body weight „B“
480 - 540 Nm	600 mm	80 - 90 kg
	700 mm	67 - 77 kg
	800 mm	60 - 67 kg

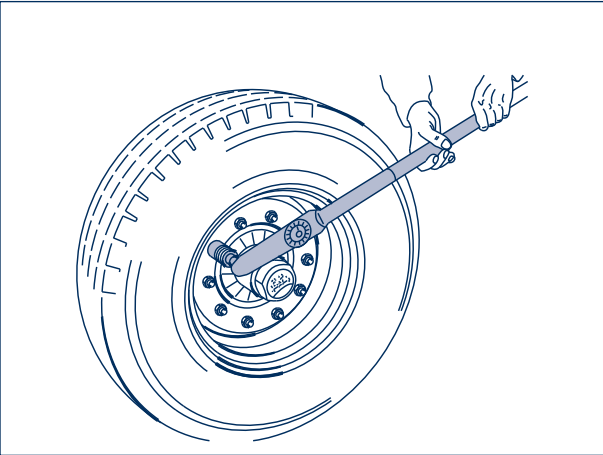


Figure 14

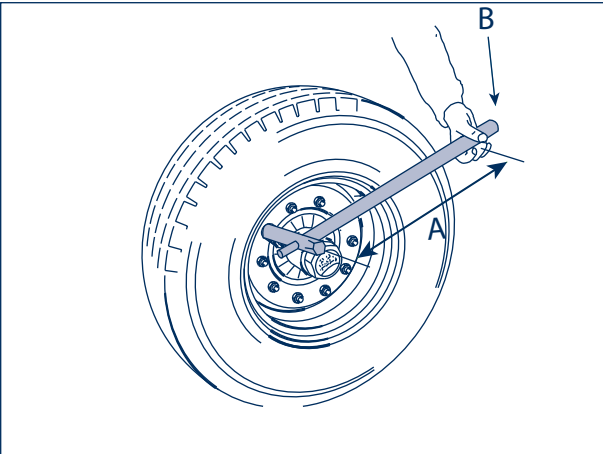


Figure 15

2 Check hub cap tightness

- every 500 operating hours, every brake lining replacement, latest annually

Check the hub cap with the torque wrench or the spanner.

Tightening torque:

Steel hub cap 10 - 12 t M = 500 Nm

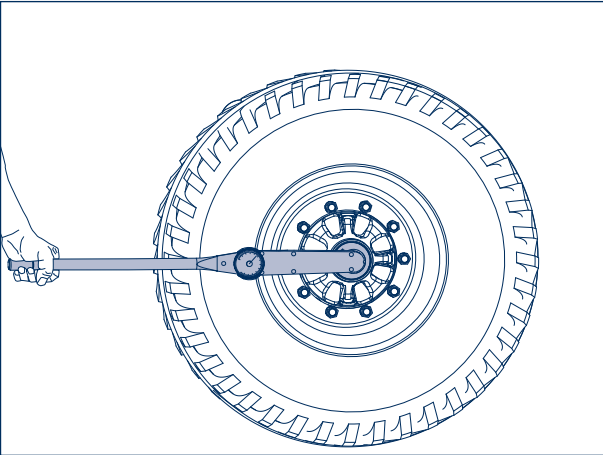


Figure 16

☐ Tyres

- quarterly

Check the tyre for uneven wear, adjust the air pressure according to the manufacturer's instructions.

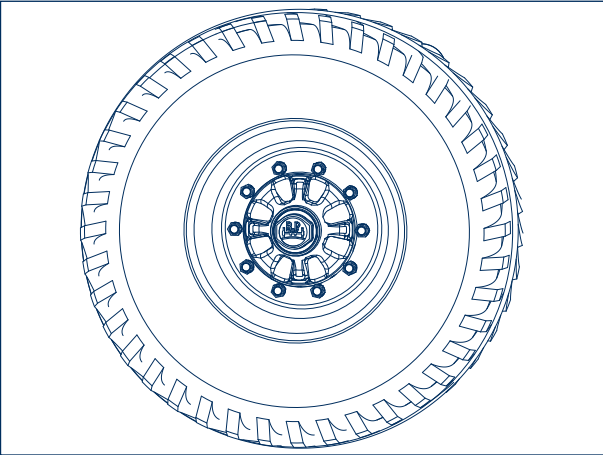


Figure 17

6 Lubrication and Maintenance Work

3 Checking and adjusting the brake in case of the manual slack adjuster

- every 200 operating hours, at every brake lining replacement, latest annually



Warning!

Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

Functional check:

Actuate the slack adjuster by hand in the direction of operation. Make sure that the free stroke of the push rod (a) is within max. 35 mm, if not it must be aligned.



Warning!

Re-adjustment is required when, in the total braking condition the 2/3 part of the maximum stroke of the brake cylinder has been used!

Adjustment:

- Turn the slack adjuster via the adjusting hexagon screw (WAF 19) with the ring spanner (clockwise) to the brake cylinder clevis head.
- Turn back the adjustment bolt while set play “a” to 10 - 12% of connected brake lever length “B”. E.g. if brake lever length = 150 mm, play = 15 - 18 mm.
- The angle between the slack adjuster and push rod is 90° or as close as practical. If not, then a brake adjustment is required.



Repair Guide:

After the brake adjustment a test drive must be carried out with the vehicle.

The function of the test-drive is necessary to confirm the correct operation of the brake.

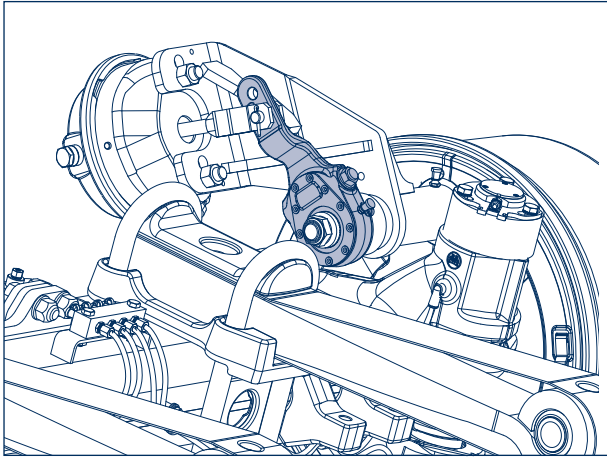


Figure 18

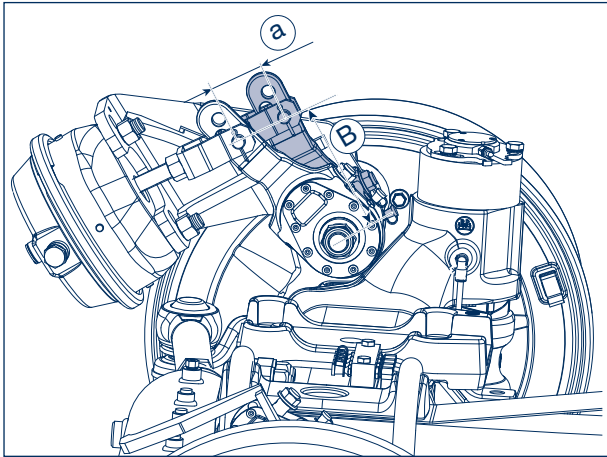


Figure 19

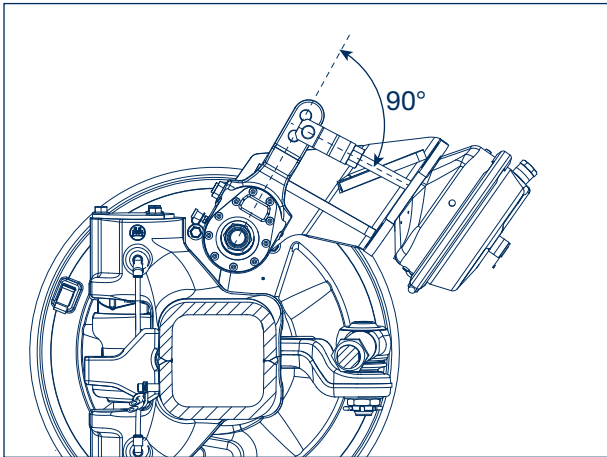


Figure 20

Automatic slack adjuster

- every 500 operating hours, every brake lining replacement, latest annually

Functional check:

- Operate the slack adjuster by hand or with air pressure 0.8 bar. In case, the idle stroke „a“ corresponds to 10 - 15 % of the connected brake lever length “B”, e.g. brake lever length 150 mm = idle stroke 15 - 22 mm.
- Check the adjustment if the idle stroke is not within tolerance.
- Remove rubber seal cap. Turn back adjustment screw by approximately 3/4 of a turn in a counter-clockwise direction using a ring spanner. Free play of at least 50 mm with a lever length of 150 mm must be available.
- Actuate the brake lever several times by hand. When this is done automatic adjustment must take place smoothly. Engagement of the clutch coupling is audible and on the return stroke the adjustment screw turns slightly in a clockwise direction.

- Fit the rubber seal cap.

Adjustment:

- Remove the rubber seal cap.
- Set play “a” to 10 - 15 % of the connected brake lever length “B” by turning the adjustment bolt (keep clutch sleeve pressed down). For example if brake lever length 150 mm = play 15 - 22 mm.
- When the brake is applied, the angle between the slack adjuster and cylinder push rod is 90° or as close as practical.
- Fit the rubber seal cap.



Repair Guide:

Brake lining wear indicators must be set vertically upwards.

Locknut of the brake camshaft must be tightened with a 90 Nm torque.

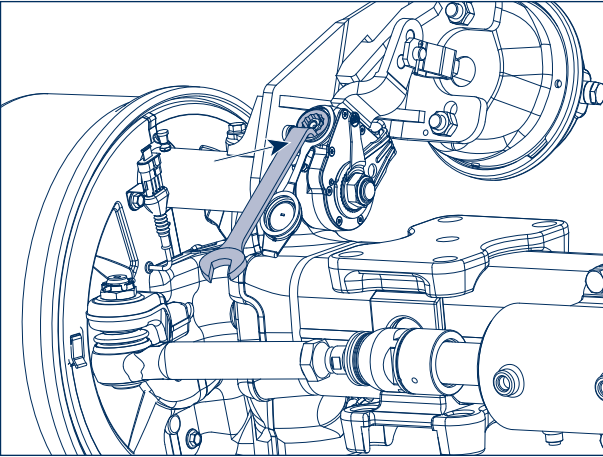


Figure 21

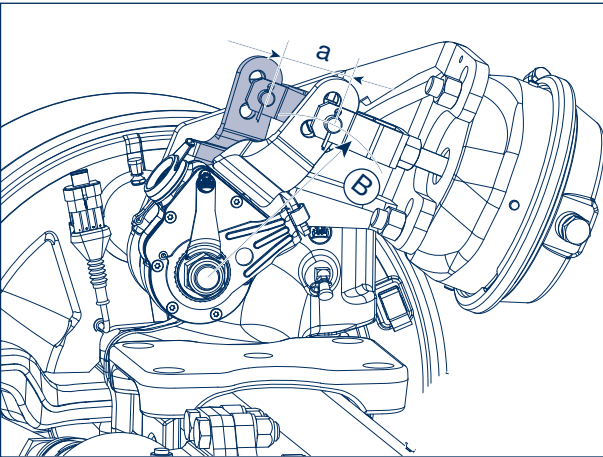


Figure 22

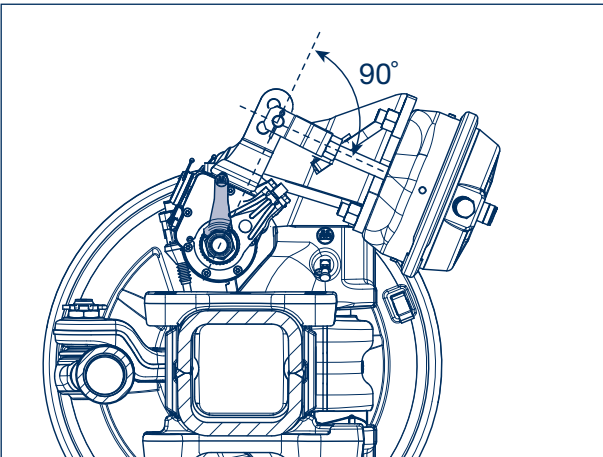


Figure 23

6 Lubrication and Maintenance Work

4 Check brake lining thickness

- every 200 operating hours, at every brake lining replacement, latest annually
- [1] In order to check the brake lining thickness, open the spy hole by pulling the rubber flap.

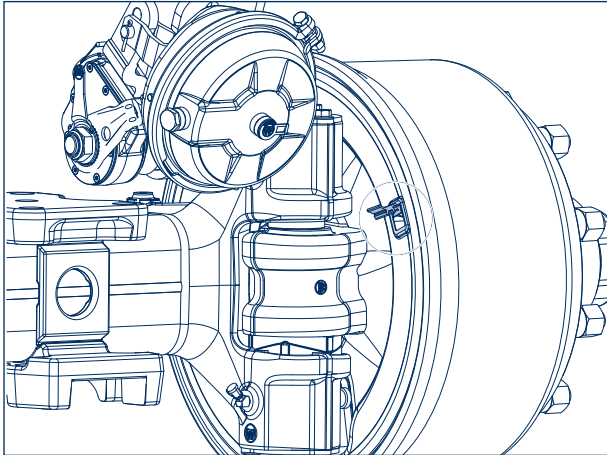


Figure 24

- [2] If the residual thickness of the lining is 5 mm or less (or when the bottom edge of the wear pocket on the brake lining is reached), the brake lining must be replaced.

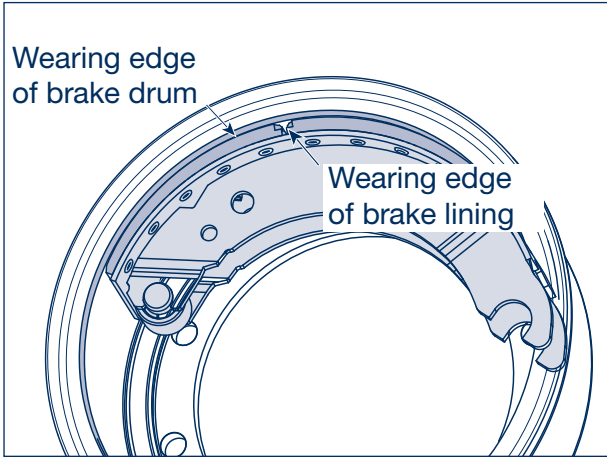


Figure 25

- [3] If brake lining wear indicators are fitted to the automatic slack adjusters, the minimum thickness of the brake linings is indicated by the horizontal position of the lever (when brake is released).

Note:

In certain cases the slack adjusters may not be fitted in the normal (i.e. vertical) position. In such instances, the position of the wear indicator will also be different.

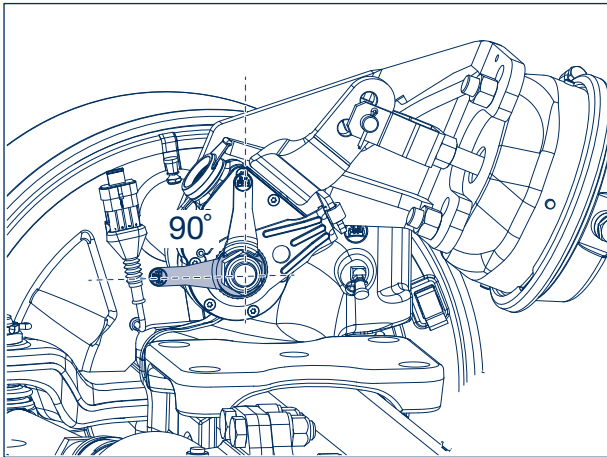


Figure 26

5 Check brake drum, cracking and inside diameter

- every 200 operating hours, at every brake lining replacement, latest annually
- [1] Check brake drum for condition and sufficient residual strength.
- [2] Check the condition of the brake drum and make sure there is adequate remaining thickness. If the wear is approaching the wear edge, measure the brake drum and replace it, if the maximum permitted amount of wear has been reached.

Max. values of wear, measured at the position with the greatest wear:

Brake type	FL 4118
Nominal diameter (Ø)	410 mm
Brake shoe width	180 mm
Max. values of wear	413,5 mm
Max. skimmed drum measure (Ø)	413 mm

Note:

Drum is equipped with the wear edge. Wear edge is visible after disassembling the cover plate or the drum.

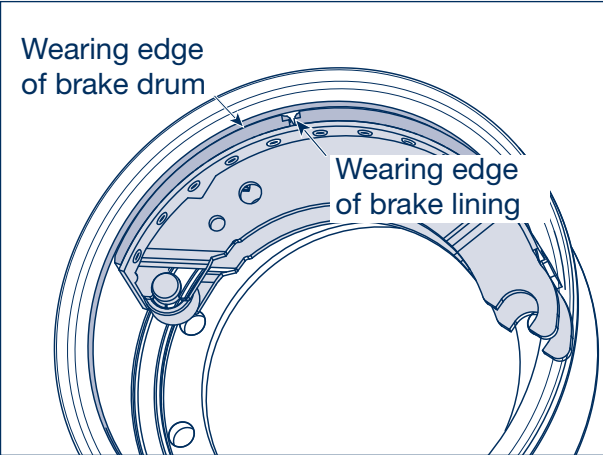


Figure 27

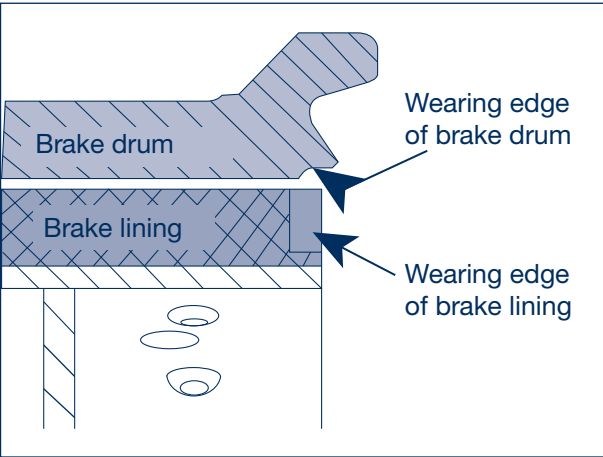


Figure 28

Visual inspection

- every half year
- Inspect all parts and welds for damage and wear.

6 Lubrication and Maintenance Work

- 6

Check wheel hub bearing end play, adjust if necessary
(Conventional)

every 500 operating hours, every brake lining replacement, latest annually

Check wheel hub bearing end play by lifting axle until the tyres are free. Release brake. Apply a lever between the tyre and the ground and check the play.

Warning!

Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

If there is a significant bearing play:

- [1] Remove wheels and hub caps.
- [2] Remove splint pin and axle nut.
- [3] Tighten the axle nut with a torque wrench whilst simultaneously turning the wheel hub to the torque shown in the table:

Type of external tapered roller bearings	Tightening torques (Nm)
33213	150 Nm
Tolerance: +5% -15%	

Tighten castellated nut with a normal axle nuts key (hand tools) until the running of the wheel bearing drags slightly.

- [4] If the cotter pin holes do not coincide after tightening turn back the axle nut until next hole. Hole deviation should be max. 30°.
- [5] Insert the split pin and bend it slightly.
- [6] Refill hub cap with special BPW Longlife grease (ECO-Li 91). Observe the grease quantity (Table B), page 20.
- [7] Grease the threads of the hub cap all around with special BPW longlife grease (ECO-Li 91) and tighten to the specified torque 500 Nm.

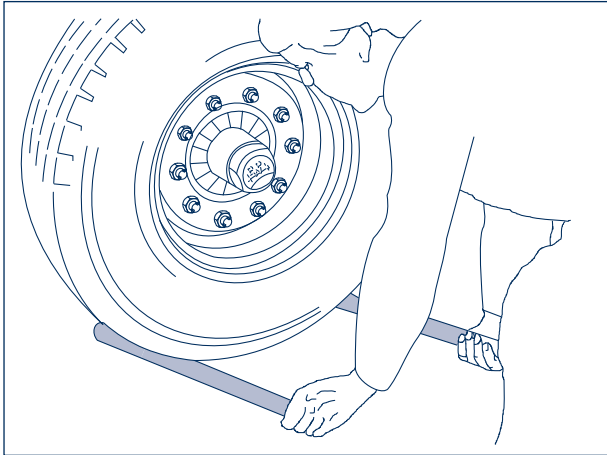


Figure 29

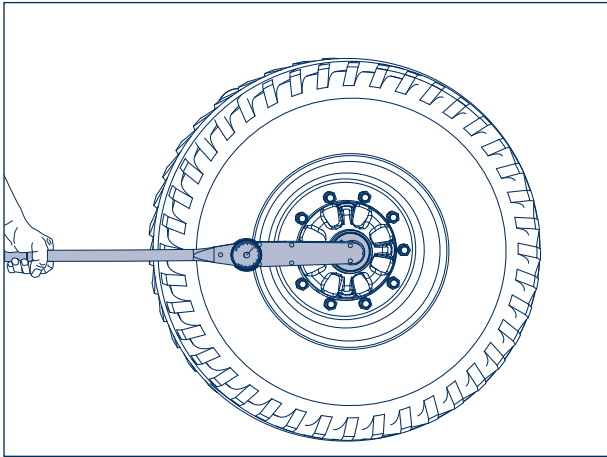


Figure 30

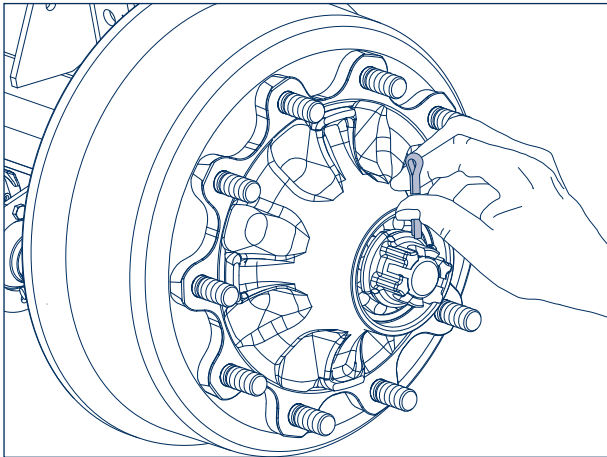


Figure 31

- Check wheel hub bearing play, adjust if necessary**
(for Central Tire Inflation System with KM axle nut)

[1] Remove the wheels. Screw the air pressure connection out of the wheel hub cap or the axle stub.

Note:

Refer to the operating instructions of the control system manufacturer.

- [2] Unscrew the hub cap.

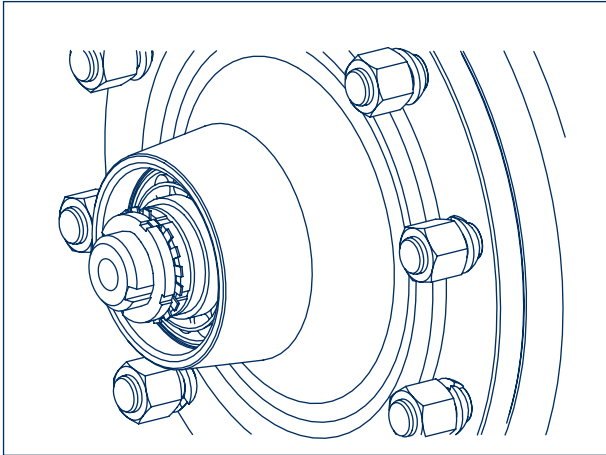


Figure 32

- [3] Screw down the outer KM axle nut and remove the retaining plate.

Repair Guide:

Reuse of the disassembled locking plate is prohibited! It must be replaced!

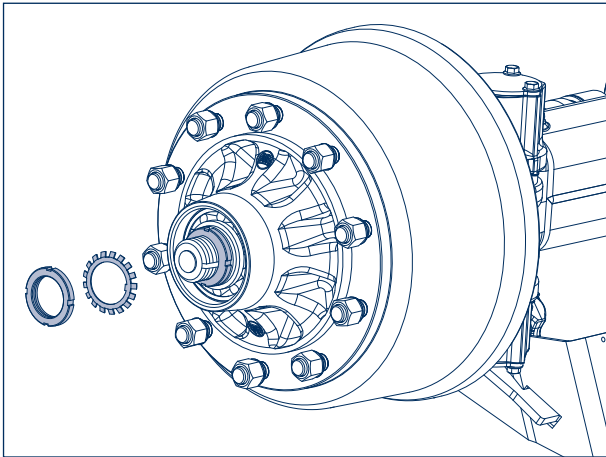


Figure 33

- [4] Tighten the inner KM axle nut using a torque wrench to tighten it, with the prescribed tightening torque according to the table, while simultaneously rotating the wheel hub. (Several turns must be carried out until the tightening torque is reached).

Type of external tapered roller bearings	Tightening torques (Nm)
33213	150 Nm
Tolerance: +5% -15%	

- When using a normal hook wrench 80-90 (DIN 1810 on board tool), tighten the KM axle nut until the running of the wheel bearing drags slightly.

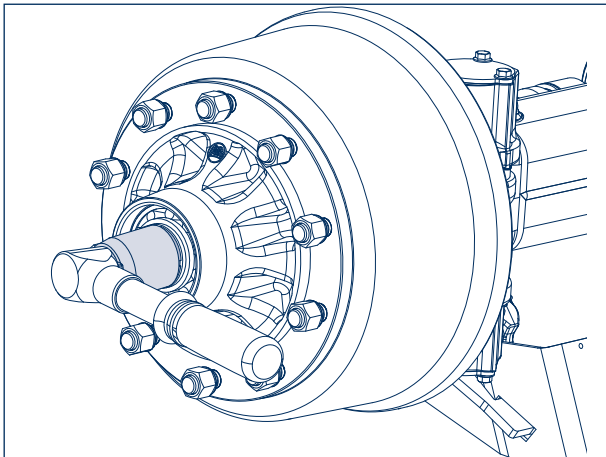


Figure 34

6 Lubrication and Maintenance Work

[5] Put the new retaining plate in place. Screw up the outer KM axle nut by hand until it tightens slightly.

i

Note:

Install the retaining plate with the convex side facing the axle centre. Pay attention to the correct installation of the axle nut.

- [6] Turn the inner KM axle nut back to the next possible groove for the locking collar and bend the nose into the groove of the axle nut, when the locking collar is opposite the next groove (max. 30°).
- [7] Tighten outer KM axle nut with 150 Nm tightening torque. Bend the locking collar into the groove of the KM axle nut.
- [8] Refill the hub cap with BPW special longlife grease (ECO-Li 91) the grease quantity (table B), see page 20.

i

Note:

The air connection should be free from grease.

- [9] Grease the thread of the hub cap all round with the BPW special longlife grease (ECO-Li 91) and tighten it to the prescribed 500 Nm tightening torque.
- [10] Install the Central Tire Inflation System.

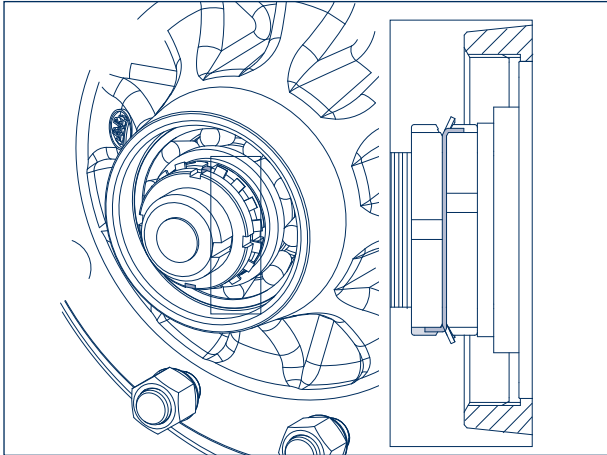


Figure 35

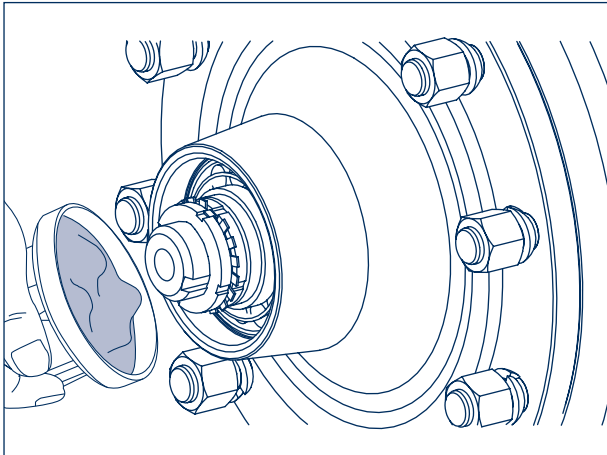


Figure 36



7 Brake lining replace

7.1 Dismantling the wheel hubs and brake drum unit



Warning!

Prevent the vehicle from rolling away!
Release the park and service brake only after lifting!

- [1] Raise axle until tyres are free rotating and remove wheels.
- [2] Unscrew hub cap from wheel hub with wrench .
(Before the wheel hub cap is released, the axle must be braked.)

👉 See Page 12.
- [3] Remove the splint pin from the axle nut and unscrew the nut.
Sockets for axle nuts see page 12.
- [4] Using a suitable puller to remove the wheel hub with brake drum, taper roller bearing as well as remove the sealing elements from the axle stub.



Note:

The wheel hub unit must be secured to prevent falling down.



Repair Guide:

Mark hubs and bearings together so that they are not interchanged during assembly.
It is imperative that the bearing inner rings with rollers be reused on the same hubs.

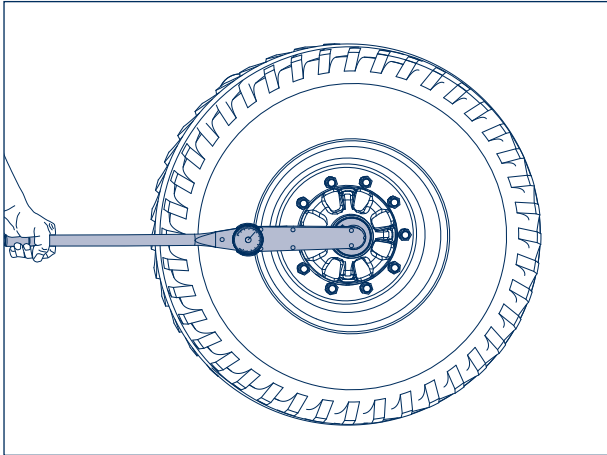


Figure 37

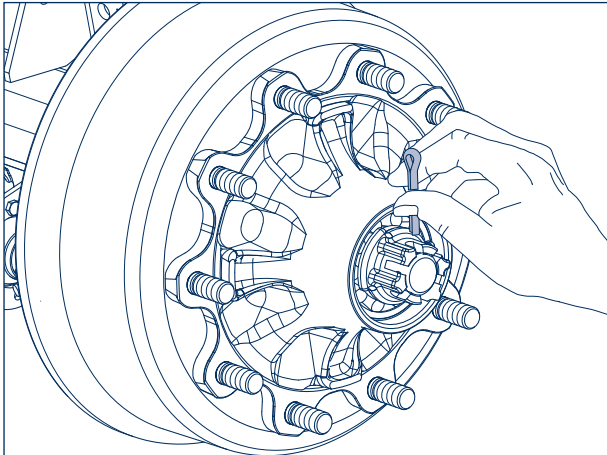


Figure 38

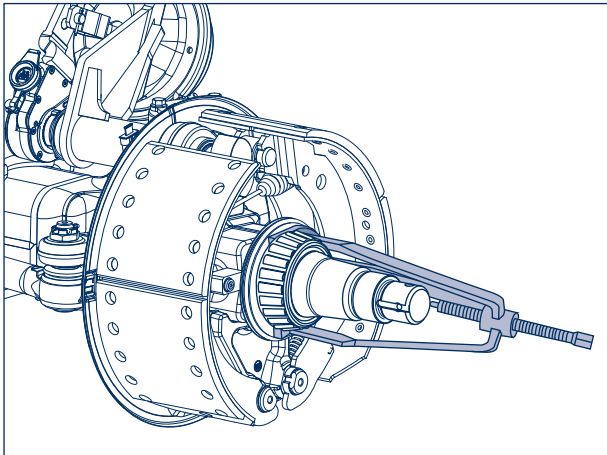


Figure 39

Replace of brake linings 7.2

- [5] Turn back the slack adjusters through the adjusting screw with wrench counter-clockwise until they reach the zero position of the brake camshaft.

Automatic Slack Adjuster:
Remove the rubber cap. Press down the clutch sleeve. Turn the adjustment screw back in the counter-clockwise direction with a ring spanner.

- [6] Hook out the positioning springs with a screw-driver.
- [7] Place the crowbar on the axle beam and with its help tip out the brake shoe from the mounting position.



Repair Guide:

Protect the sensor and the sensor cable from damage, if available.

- [8] Remove the brake shoes.

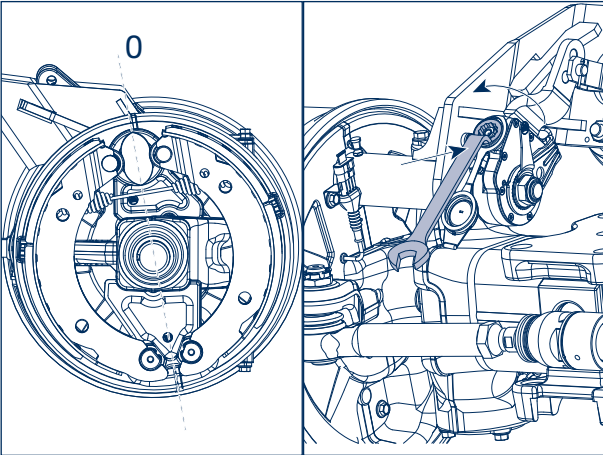


Figure 40

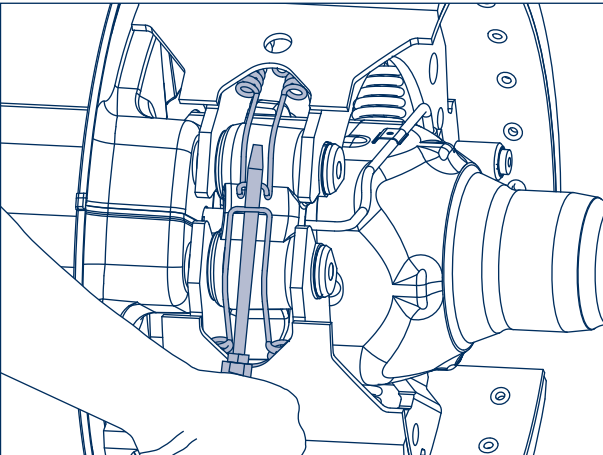


Figure 41

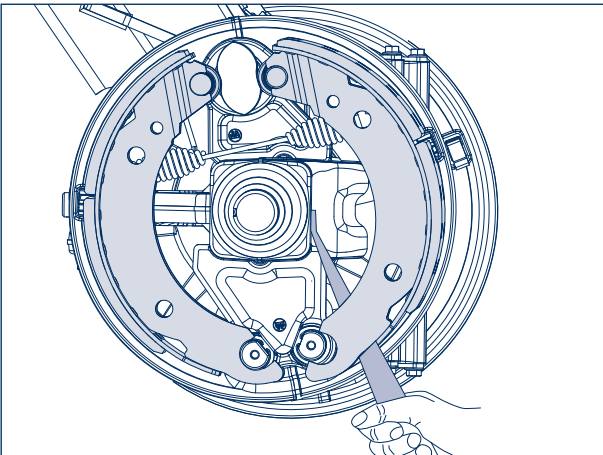


Figure 42

7.2 Change of brake linings

[9] Remove tension spring (1) from the tab of the brake shoes.

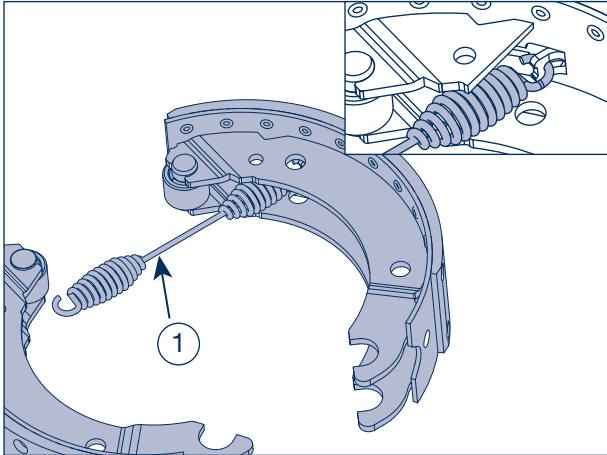


Figure 43

[10] Remove the positioning spring (2) from the brake shoes.

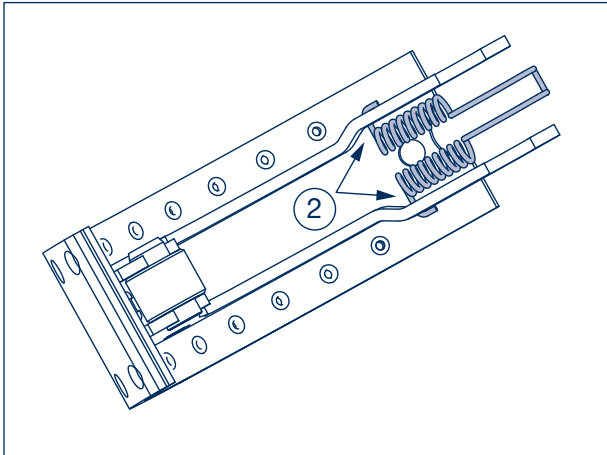


Figure 44

[11] Clean the contact surface of the brake shoes. It must be free of rust and contaminations.

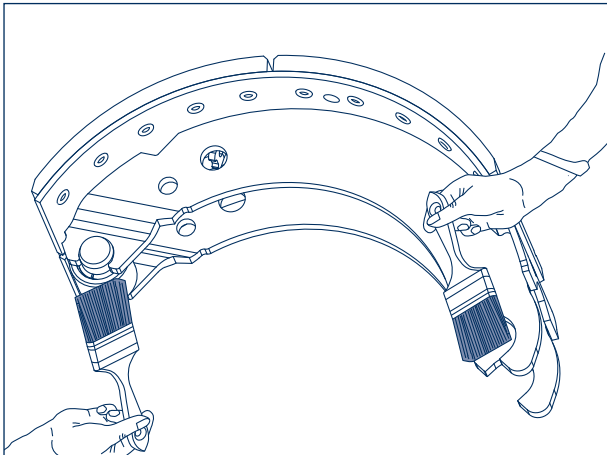


Figure 45

[12] Remove old brake linings and clean the brake shoes. The mounting face must be smooth and free of rust.

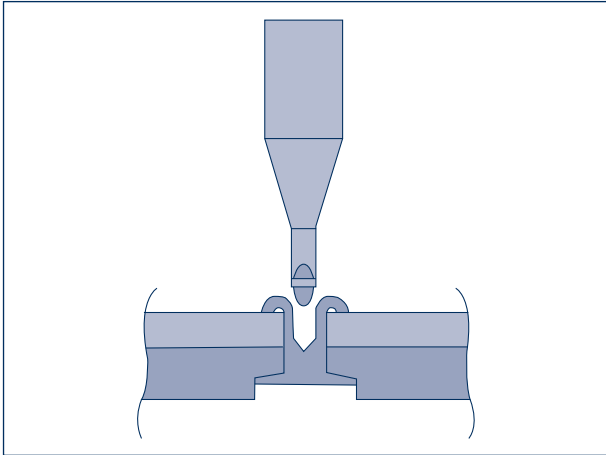


Figure 46

Repair Guide:

The rivets should always be pressed out using a riveting machine, preferably with hydraulic actuation. The equipment used must be suitable for the rivet diameter. Modern rivet punches can universally accept hollow and semi hollow rivets. The use of unsuitable rivet punches may damage the brake shoe.

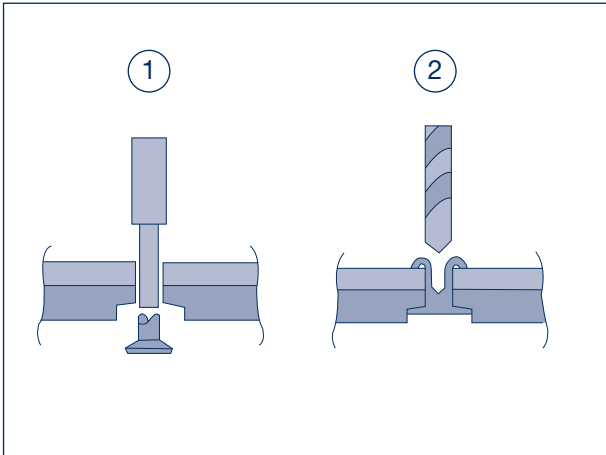


Figure 47

If there is no riveting machine available:

Remove the closed head using a 8,6 mm diameter drill bit (No.2) or drive out the rivet with a punch (No.1)

[13] Check the diameter of the rivet hole using a rivet hole gauge. The hole diameter must not be more than 0.6 mm larger than the rivet diameter. (DIN 7513)

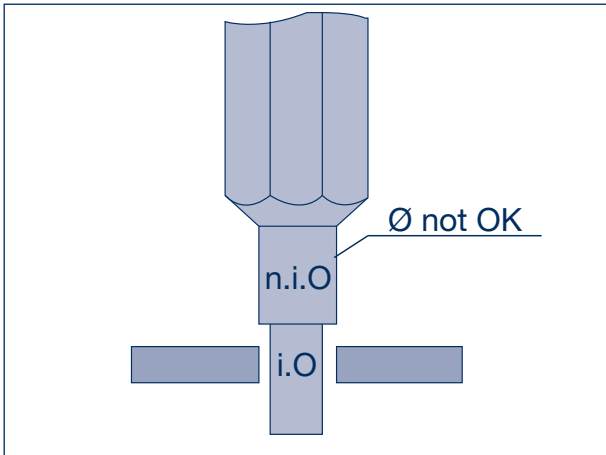


Figure 48

7.2 Change of brake linings

Frequently occurring errors:

- 1 Loose rivets indicate enlarged rivet holes
 - 2 Rivet hole damaged during boring
 - 3 Damaged platform edge
 - 4 Worn shoe support
 - 5 Deformed shoe web
 - 6 Rivet hole deformed during boring
 - 7 Rivet hole damaged by riveting machine
 - 8 Corroded platform area
 - 9 Damaged shoe web end
 - 10 Worn shoe roller bearings
 - 11 Cracked welding seam
 - 12 Damaged platform surface
 - 13 Corroded welding seam
 - 14 Deformed platform surface
- [14] Insert all rivets and hold in position by crimping edges. Rivet brake lining into place taking care to follow the correct riveting order.

Repair Guide:

The rivets should always be pressed out using a riveting machine, preferably with hydraulic actuation. The equipment used must be suitable for the rivet diameter. Modern rivet punches can universally accept hollow and semi hollow rivets. The use of unsuitable rivet punches may damage the brake shoe.

Mounting position: Observe the position of the brake linings. Apply the wear edge of the linings to the centre of the brake shoe.

See Figure 50.

Riveting force: 21000 N (20000 – 22000 N)

Rivets: Semi-tubular rivets, made of galvanised steel 8 x 15 mm (correspond to DIN 7338 B standards).

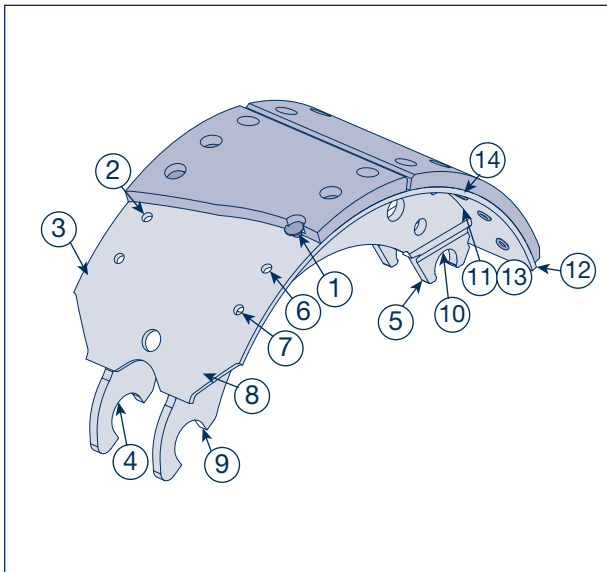


Figure 49

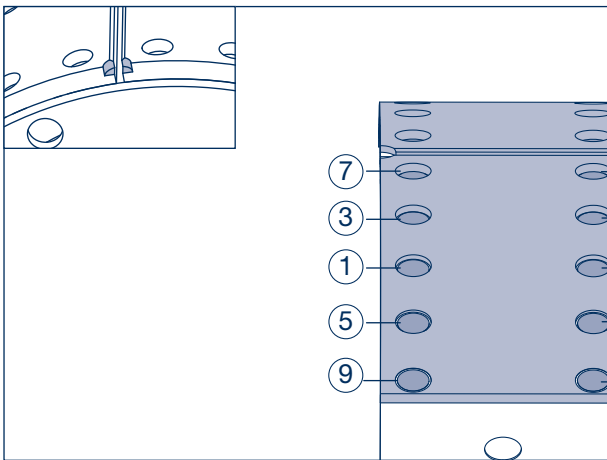


Figure 50

Control of riveting 7.3

Repair Guide:

Observe the correct position of the rivet!

Fig. 51., No.1: Rivet length correct, the hole inner wall and strength are correct.

Fig. 51., No. 2: Rivet too short, no inner hole recess and poor closing head formation.

Fig. 51., No. 3: Rivet too long, inadequate closing head, crack formation.

Further examination of the brake linings:

- A feeler gauge can be used to check for gaps under the lining. The gaps of more than 0,1 mm beyond the first row of rivet holes can lead to noise problems.
- Finally, the linings should be checked for cracks in the area of the rivets which would indicate incorrect riveting.

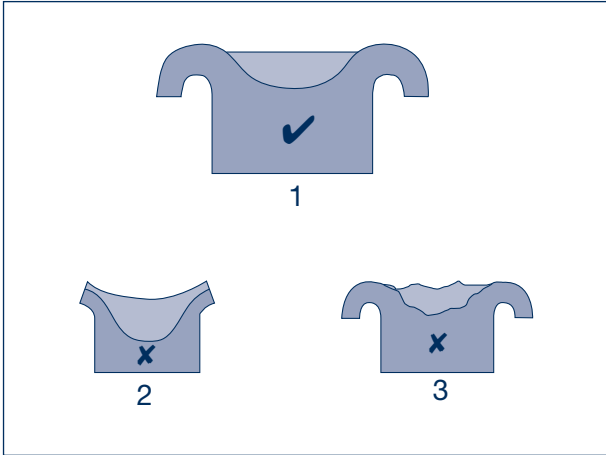


Figure 51

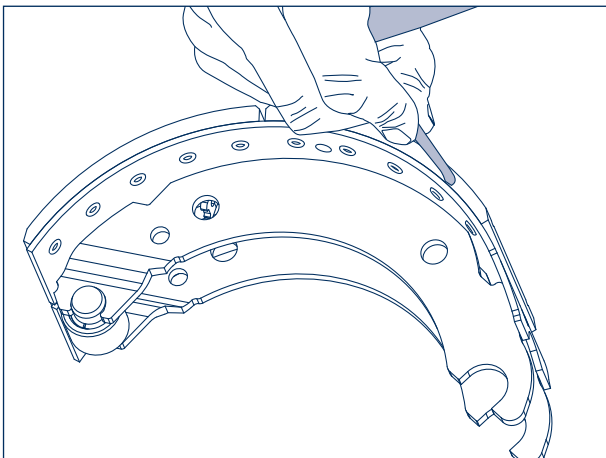


Figure 52

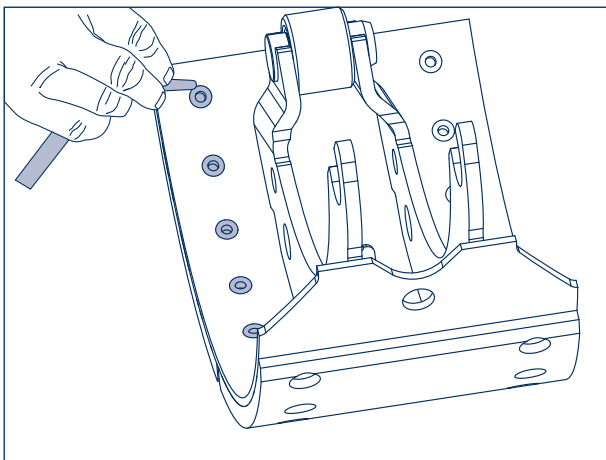


Figure 53

7.4 Brake shoes assembly

Health and safety measures!

Brake dust contains large volumes of breathable fine dust and is hazardous to your health, even in case of non-asbestos material. Safety regulations prescribe extraction systems with a suction power between 40 and 50 m³/h.

[15] Check roller (1) for wear, replace as appropriate. Remove bearing bolts (2).

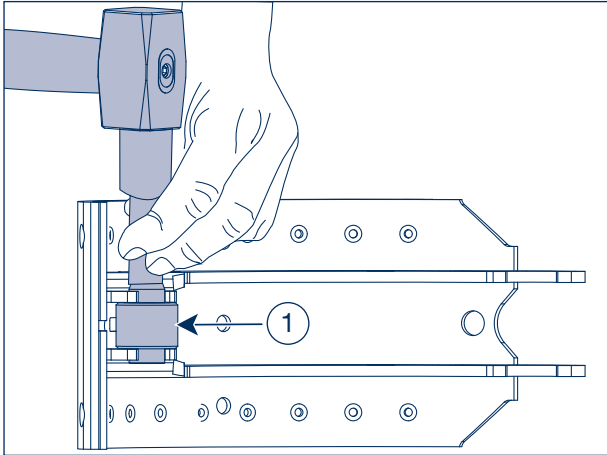


Figure 54

Repair Guide:

In the event of wear, exchange roller bearing bolts and rings.

[16] Clean bearing bush and apply BPW special longlife grease ECO-Li 91.

[17] Insert the new roller (1) with two rings (3) into the brake shoe webs.

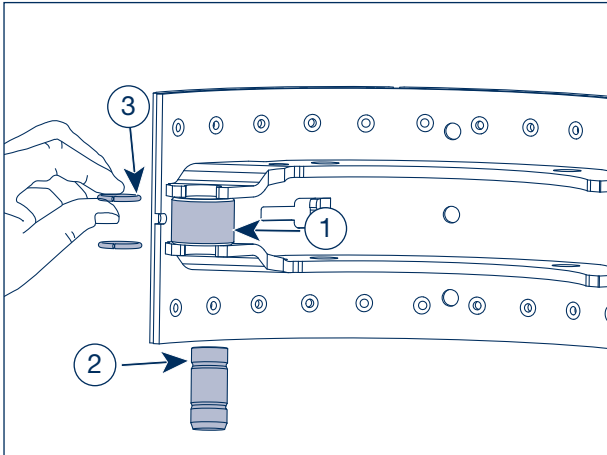


Figure 55

See fig. 55.

[18] Drive in bearing bolt with the tapered end facing down, until both rings sit into the grooves of the bearing bolt.

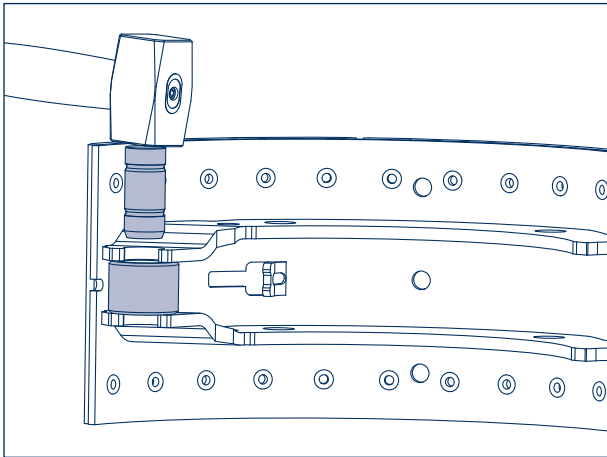


Figure 56

Repair Guide:

For every brake lining replacement, use new tension spring and position spring.

[19] Hook the tension spring (1) into the eyelets of the brake shoe.

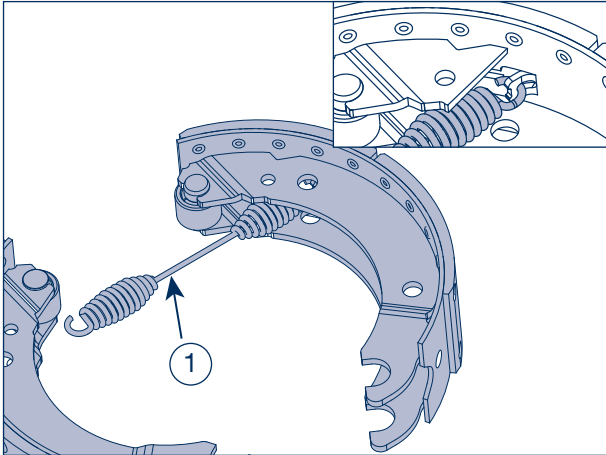


Figure 57

[20] Insert the position springs (2) in the brake shoes.

Note:

Observe the correct position.

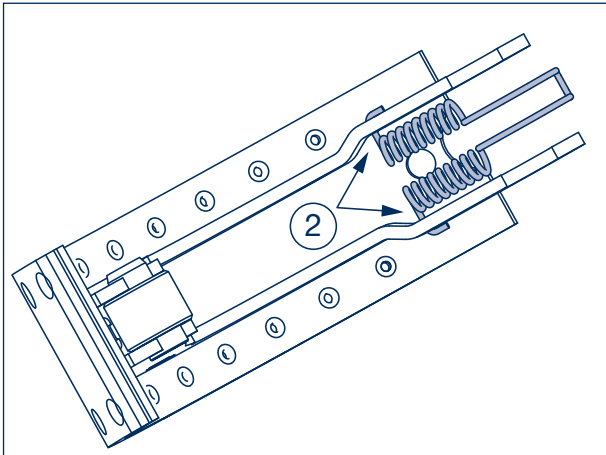


Figure 58

Only for ABS / SDS:

- Check sensor (3) for damage and displacement (displacement force 100 - 200 N).
- If necessary, smear clamping bush (4) and sensor with special silicon grease (replace clamping bush)
- Before fitting hubs, always press clamping bush and sensor up to endstop.
- When fitting the hub, the sensor will be pushed back into the appropriate position by the exciter ring.

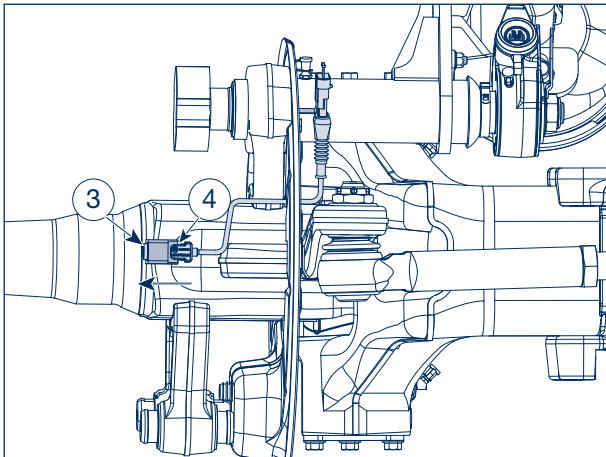


Figure 59

7.5 Mounting the brake shoes

- [21] Check C-clips (1) on the brake anchor plate for wear and seating, replace if necessary.



Repair Guide:

The hooked spring rings must be exchanged at the latest when changing the brake linings.

Disassembly:

- [22] Dismount the both dust covers.
-  See Page 52.

- [23] Remove the C-clips (1) by means of a screwdriver off brake anchor pin.
- [24] Clean the contact surface of the C-clips thoroughly.

Assembling:

- [25] Drive up the new C-clips (1) by means of a metal pipe and a bronze hammer on the brake anchor pin, then smear the surfaces with BPW special longlife grease ECO-Li 91.

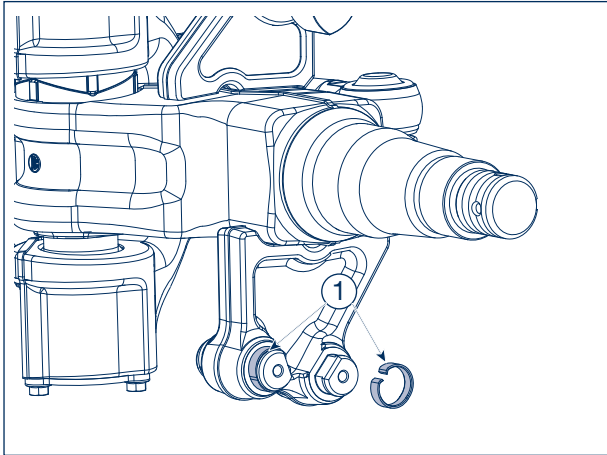


Figure 60

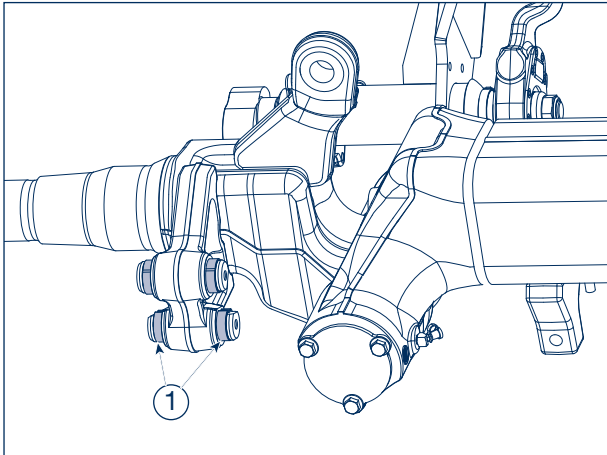


Figure 61

- [26] Place the brake shoe with the roller onto the wing-cam.
(The wing-cam be in the null (basis) position.)

- [27] Place the brake shoe on the C-clips and fix it by hitting lightly with a soft hammer.



Repair Guide:

The brake linings are not damaged by hammer blow.

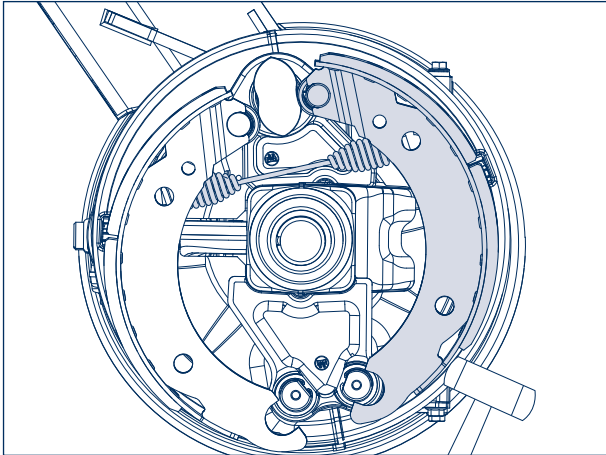


Figure 62

- [28] Mount the other brake shoe and fix it on the C-clips with slight hammer punches.

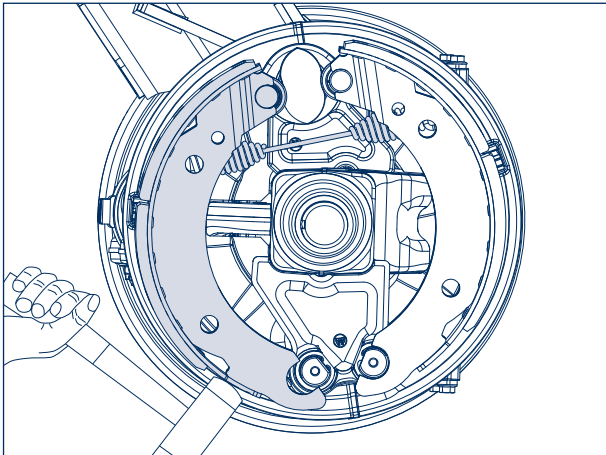


Figure 63

- [29] Engage the positioning springs with each other.
(Check the correct seating of the brake shoes on the C-clips with the help of a few slight hammer blows.)

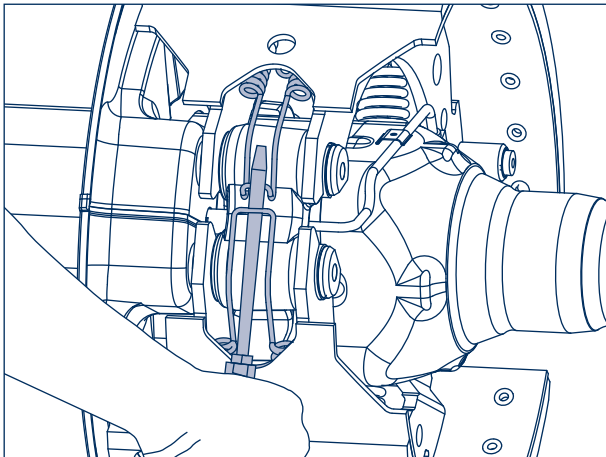


Figure 64

7.5 Mounting the brake shoes

- [30] Lathe the brake lining up to the brake drum inner diameter, in order to achieve the uniform contact pattern or surface.
- [31] Open the brake shoes on the prescribed value (b = 64 mm) with the help of the adjusting screw of the slack adjuster using a ring spanner (WAF 19).

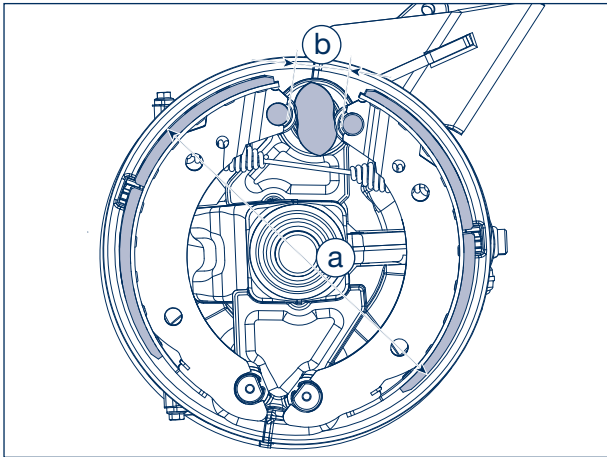


Figure 65

- [32] Lathe the brake lining up to the brake drum inner diameter, using a brake lining lathe machine in order to achieve the uniform contact pattern or surface.

Repair Guide:

In the case of using new BPW original brake shoes, the brake linings cannot be overturned.

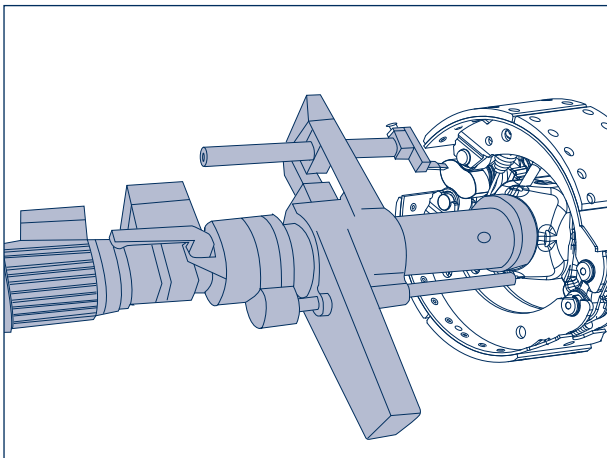


Figure 66

- [33] Check the condition of the brake drum and ensure there is adequate thickness remaining. If the wear is approaching the wear edge, measure the brake drum and replace it if the maximum permitted amount of wear has been reached. Max. amounts of wear, see page 29.

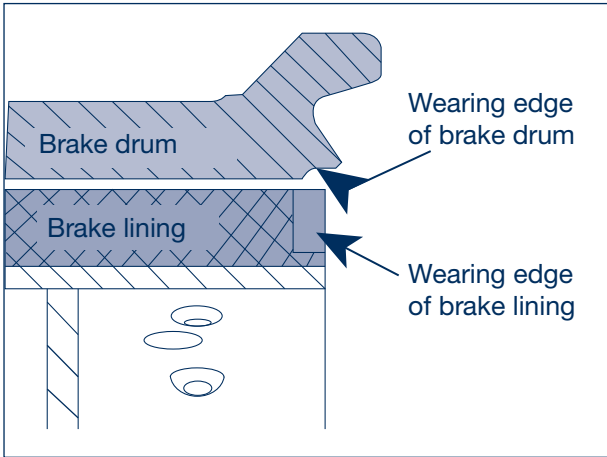


Figure 67

Mounting the wheel hub brake unit 7.6

- [34] Clean the bearing seats of the axle stub (it must be metallic bright, dry and free from grease) and grease all over with BPW special longlife grease (ECO-Li 91).

Note:

Do not over-grease!
Make sure that the sealing elements can be pushed up easily on the axle stub.

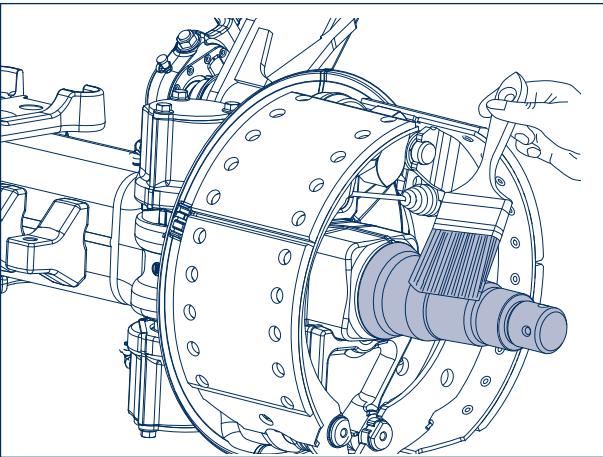


Figure 68

- [35] Push thrust ring and new sealing rings onto the stub axle.

Note:

Check the seals and bearings for wear and damage. Contact surfaces of the bearings must be free of damage. Replace if necessary

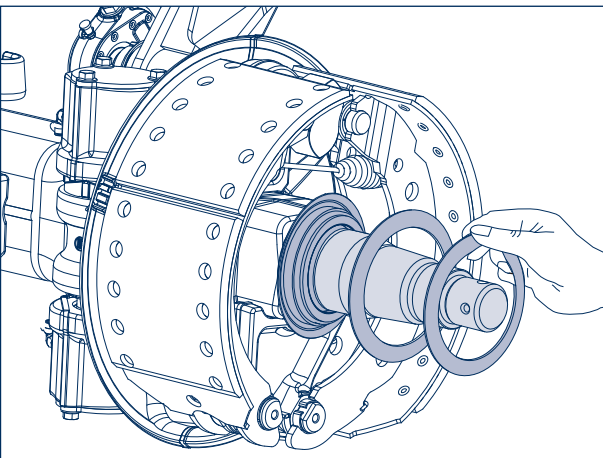


Figure 69

7.6 Mounting the wheel hub brake unit

[36] Clean and check the tapered roller bearing. Push bearing until the contact ring is pressed against the thrust ring. Smear BPW Special longlife grease (ECO-Li 91) into the free spaces between tapered rollers and cup - until the grease completely covers the rollers. For the total quantity of grease, see page 20.



Repair Guide:

Do not mix bearing cages and outer bearing cups.

[37] Smear the remaining quantity of grease into the bearing outer ring of the hub

[38] Push up the pre-assembled wheel hub and brake drum unit centrally on the axle stub. If the ABS or Speed sensor are available, push back into the correct position by the wheel hub and brake drum unit carefully. Therefore the wheel hub unit is not misaligned.



Note:

Before installing the wheel hub, check the sensors, for damage and displacement, see page 50.

[39] Insert outer taper roller bearing.

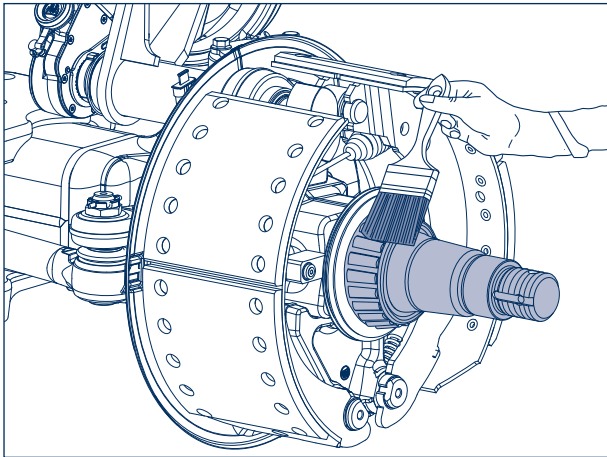


Figure 70

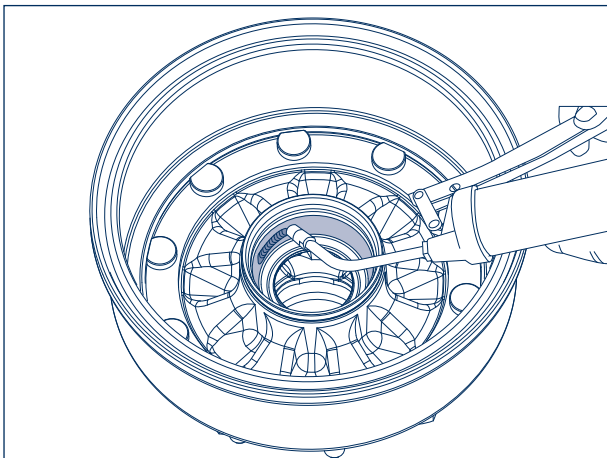


Figure 71

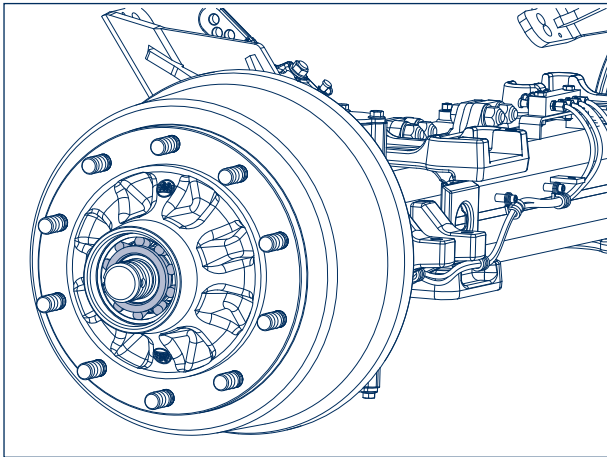


Figure 72

[40] Insert the washer and screw on the axle nut using a torque wrench to tighten the wheel hub the prescribed tightening torque according to the table (several turns until the tightening torque is reached).



Note:

When using a normal wrench (on board tool), tighten the axle nut until the running of the wheel bearing drags slightly.

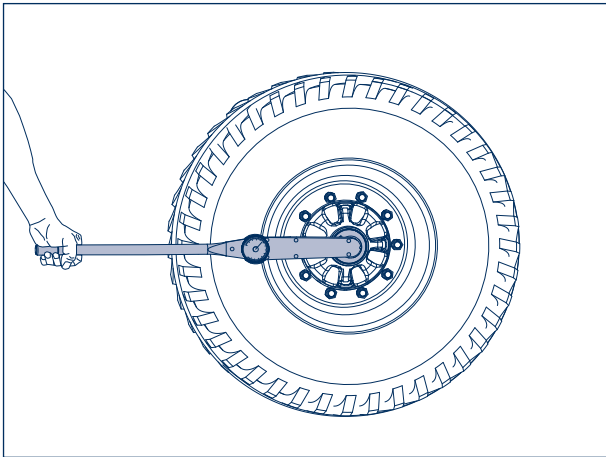


Figure 73

[41] Turn the axle nut back to the next possible hole. If the cover is the same, screw the axle nut back to the next hole. The max. deviation (max. 30°).

[42] Insert the split pin and bend it slightly.

[43] Refill the hub cap with BPW special longlife grease (ECO-Li 91) the grease quantity (table B), see page 20.

[44] Grease the threads of the hub cap all around with special BPW longlife grease (ECO-Li 91) and tighten to the specified torque 500 Nm. Thread protrusion 2 mm.

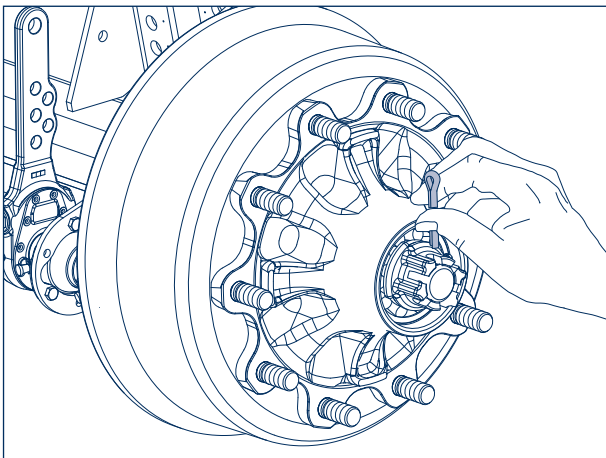


Figure 74

[45] Adjust the brake.

 See Page 26 - 27.



Note:

Braking effect on the new brake pads are optimal after some braking only.

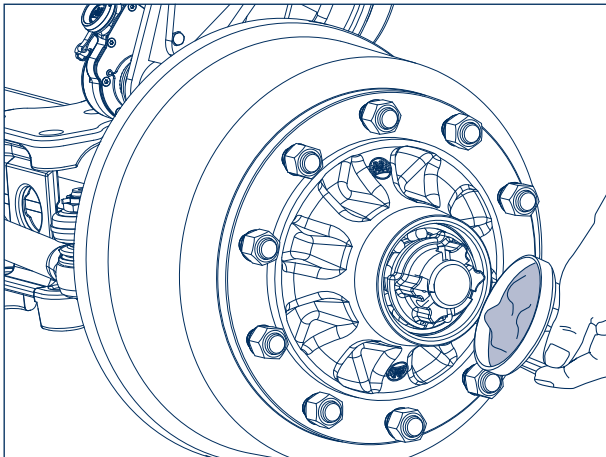


Figure 75

8 Disassembly and assembly of hub unit

[1] Dismantling and assembly of the complete wheel hub.

See Chapter 7.

Note:
To replace the outer bearing race it is recommended that the brake drum is disassembled from the hub.

[2] Drive out the wheel studs using a brass hammer. Caution: do not damage the stud threads.

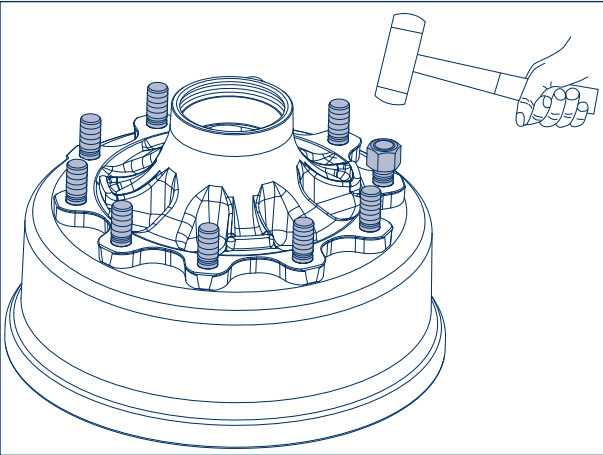


Figure 76

Dismantling of the bearing outer rings

[3] Remove the bearing cups together with the cover plate (grease plate) from the wheel hub.

Note:
Protect the bearing seat from damage.

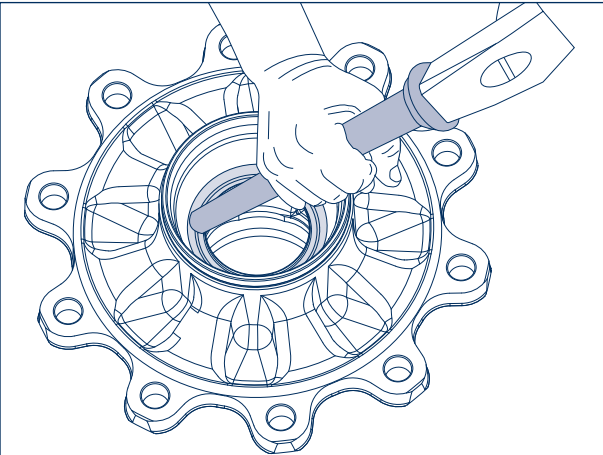


Figure 77

[4] Insert the new cover plate (grease pot) with the convex side facing down.

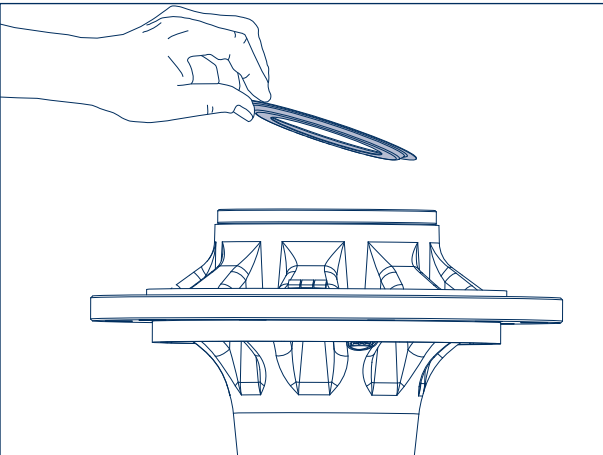


Figure 78

Mounting the bearing outer rings

[5] Insert new bearing cups centered in the wheel hub and mount with a press (at least 6 t) the BPW press tools.

See Page 13.

Note:
Observe the correct position of the bearing cups in the wheel hub.

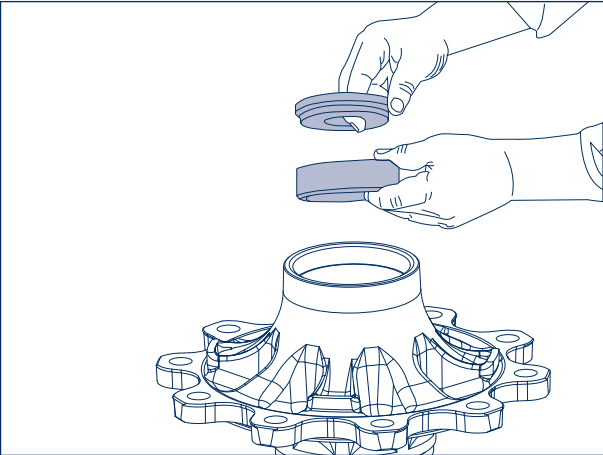


Figure 79

[6] Insert the wheel bolts as far as possible into the wheel hub by hand.

Note:
Ensure that the wheel bolt head is correctly seated on the brake drum. Before installing the brake drum remove the corrosion thoroughly.

[7] The flattened side of the head of the wheel bolt must rest on the brake drum collar (anti-rotation solution).

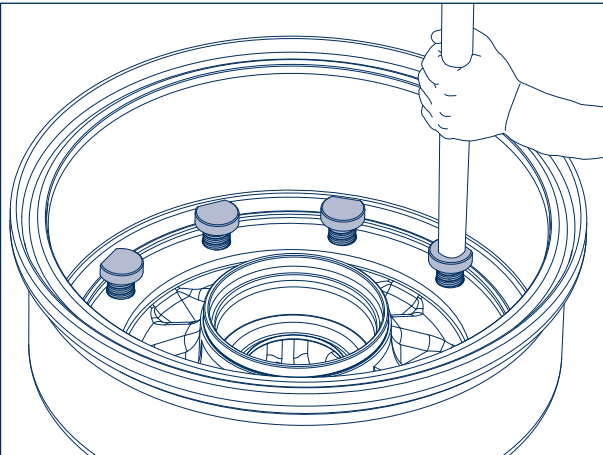


Figure 80

[8] Pull up the wheel bolts to the correct seating, with the help of a sleeve and a nut

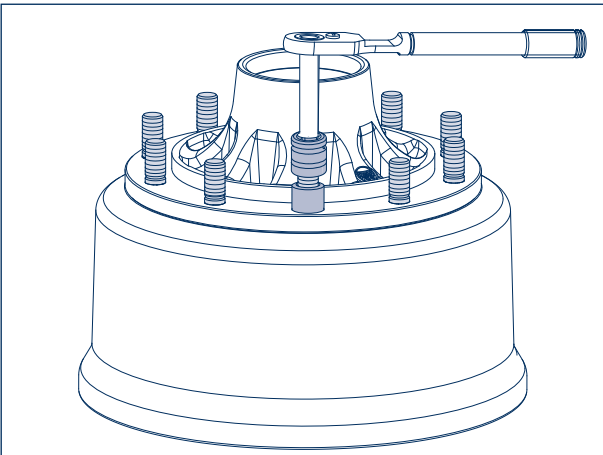


Figure 81

9 ABS / SDS

9.1 Anti-lock Braking System / Speed and Direction of rotation Sensor

- [1] Check the sensor for damage and displaceability (displacement force 100 - 200 Nm).
- [2] Apply the clamping bush and the sensor with a special silicone grease (replace the clamping sleeve). Before hub mounting, push back the clamping bush and the sensor as far as possible. The sensor is pushed back into the correct position by brake drum hub unit, during hub mounting.

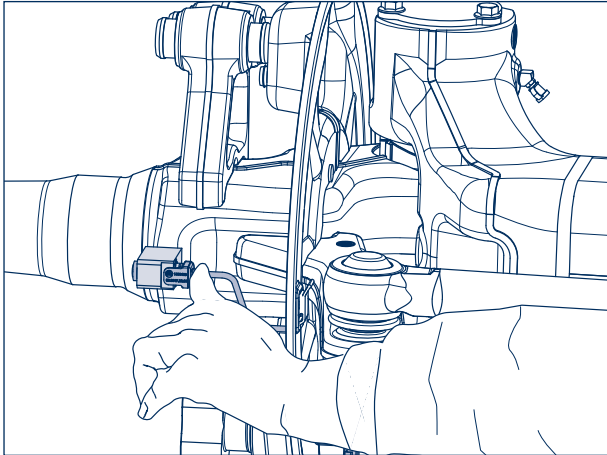


Figure 82

Note:
Check clamp and sensor for wear and damage, replace if necessary.

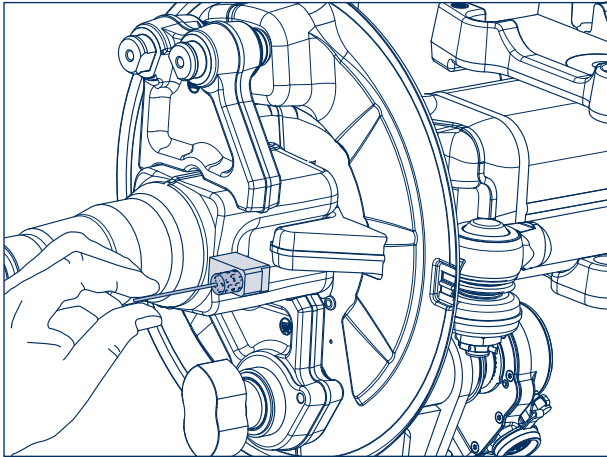


Figure 83

- [3] Place the sensor cable into the dust cover plate via rubber protective ring (arrow).

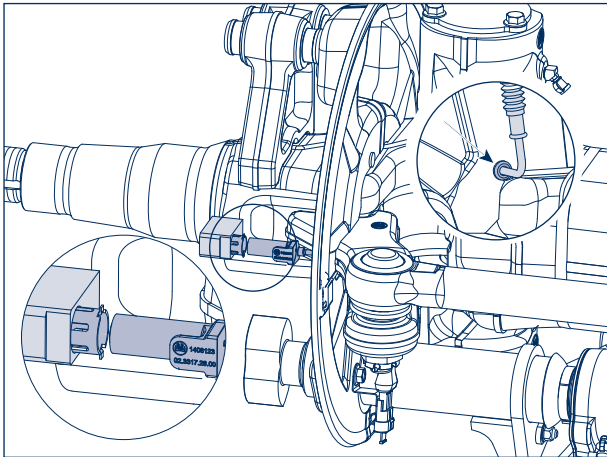


Figure 84

Exciter ring replacement:

- [1] To replace a damaged exciter ring, heat up the exciter ring with burner flame and pull it down.

Note:
Clean the groove and contact surfaces for the rotor. (Free of contamination, paint, etc.)

- [2] Heat the new exciter ring to a temperature of between 120 and 160°C and push the exciter ring onto the undamaged hub surface.

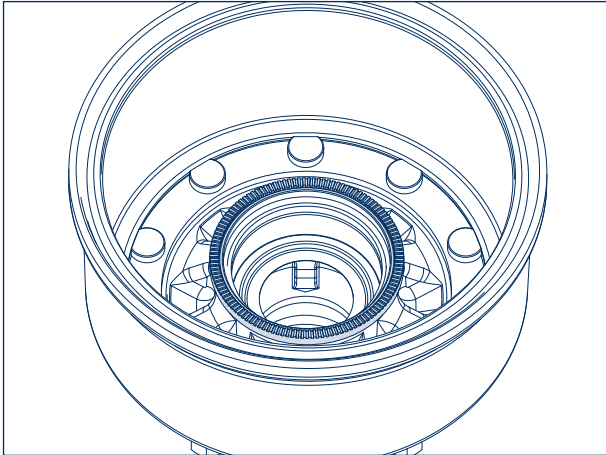


Figure 85

Note:
The tight fit of the exciter ring is very important for proper operation. Maximum tolerance is 0.2 mm!
Do not apply impact tools onto the gear teeth! The gear teeth must not show any signs of damage.

Repair Guide:
If replacement is required, a solid metal exciter ring must be installed instead of the press-fitted sheet metal exciter ring.

Sheet metal exciter ring (default exciter ring)	Solid exciter ring (replacement exciter ring)
03.310.09.35.0 / Ø 176	03.310.08.14.0

Note:
After the replacement of the sensor or the exciter ring the operation must be tested! During the testing of the ABS unit, it must be ensured that the installed parts provide appropriate information during the operation of the vehicle!

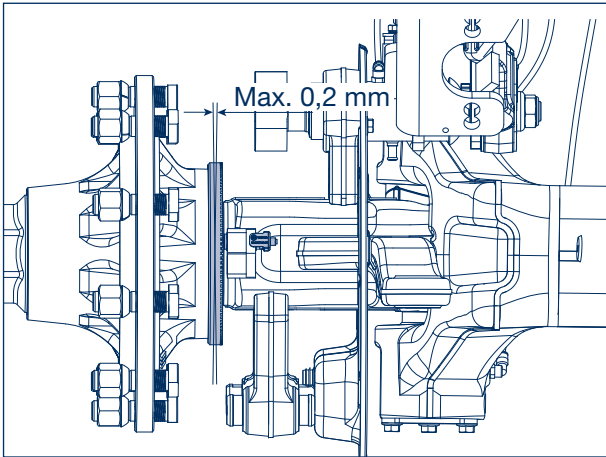


Figure 86

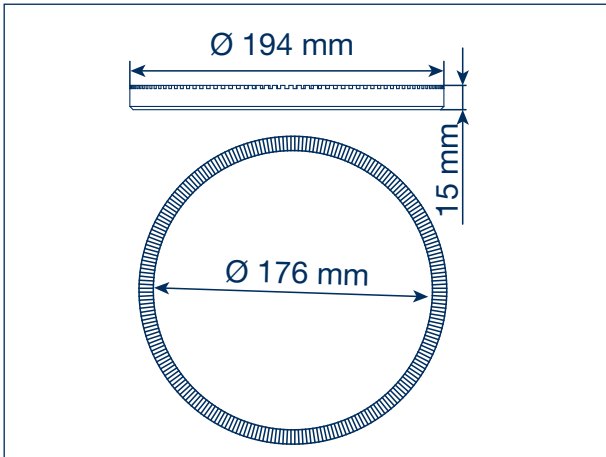


Figure 87

10 Dust Cover Plate

Disassembly:

- [1] Unscrew the securing screws (WAF 13) and the Allen screws (WAF 8) out of the brake support.
- [2] Remove cover plates.

Assembly:

- [1] Fix the cover plate to the brake support using the securing screw and /or Allen screws.

Tightening torque:

- ⦿ Securing screw: 38 Nm
- ⦿ Self-tapping screw: 43 Nm

- [2] Install the opposite cover plate in the same way.

Repair Guide:



Check the cover plates for properly positioning in the brake drum groove, if necessary re-adjust them.
Observe the sensor cable integrity and place it in the correct position.

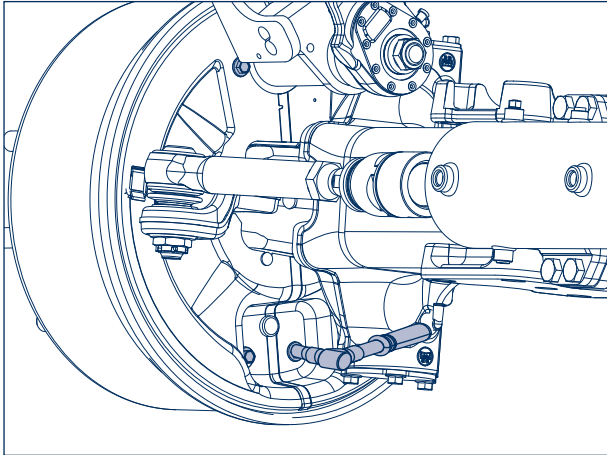


Figure 88

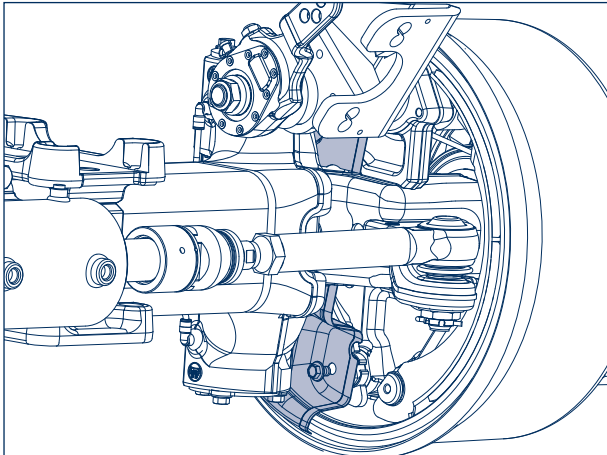


Figure 89

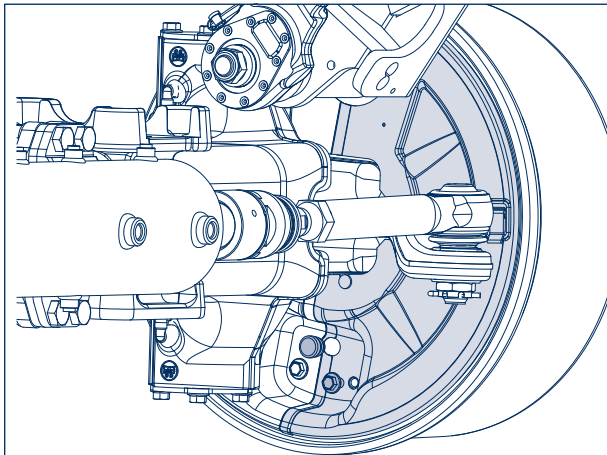


Figure 90



11 Brake Camshaft

Disassembly:

- [1] Remove the retaining ring (260) from the groove.

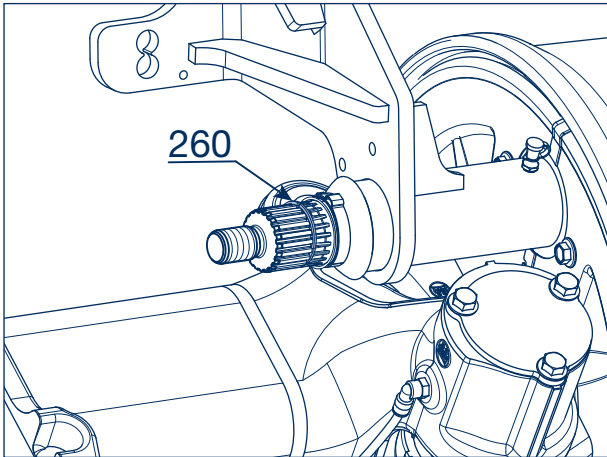


Figure 91

- [2] Open the safety clamp (239A) of the rubber sealing ring (239) and pull them off the camshaft.



Note:
After opening, the safety clamp has to be replaced.

- [3] Remove the retaining ring (221) from the groove and pull the plastic ring (222) from the brake camshaft.

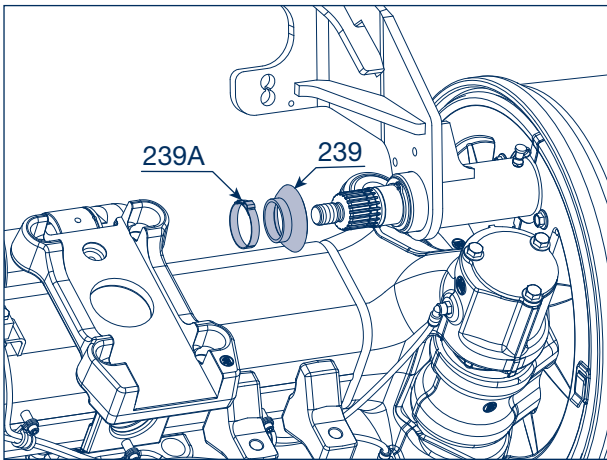


Figure 92



Note:
Check sealing ring for wear and damage, replace if necessary.

- [4] Take the brake camshaft out of the bushing.

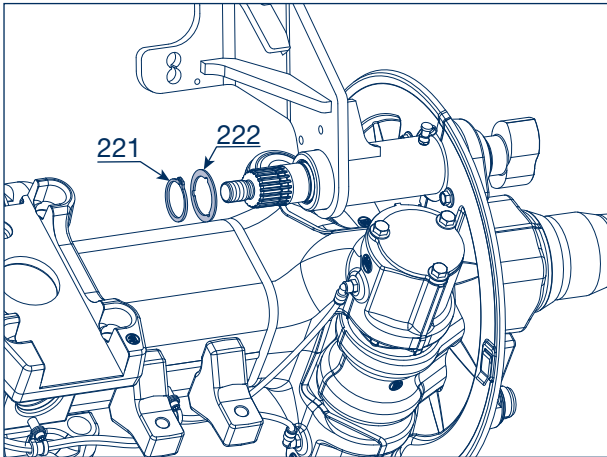


Figure 93

Assembly:

- [1] Brake camshaft accessories: Ring (226) and O-Rings (223, green) and (227, black). Place them on the brake camshaft in the correct position.



Note:
Grease bearing place with BPW special long-life grease (ECO-Li 91).

- [2] Insert the brake camshaft into the brake holder

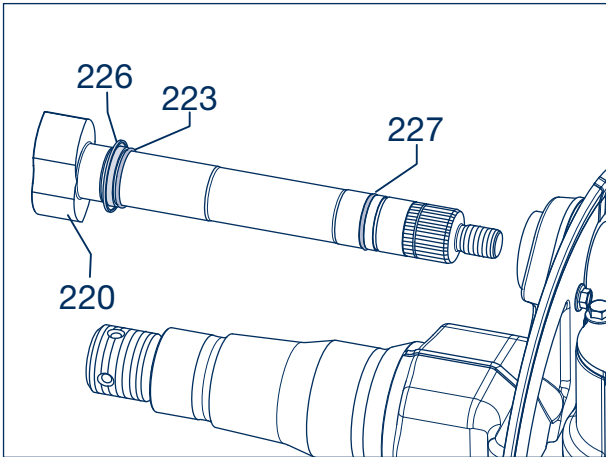


Figure 94

- [3] Install the plastic ring (222) with the convex side facing the axle centre.
- [4] Insert the retaining ring (221) into the groove.
- [5] Check brake camshaft for smooth operation.

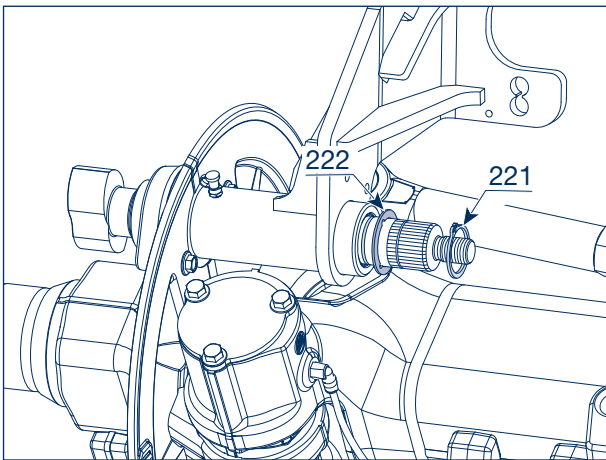


Figure 95

- [6] Push up the rubber sealing ring (239) with the new safety clamp (239A) and tighten.
- [7] Insert new retaining ring (260) into the groove of the brake camshaft.



Note:
Pay attention to the correct seat of the retaining ring!

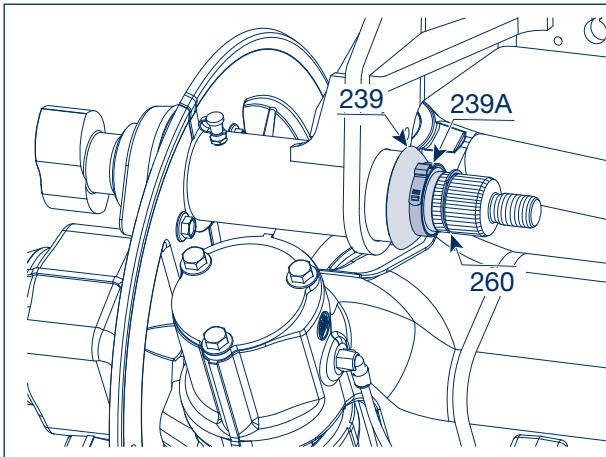


Figure 96

12 Brake Camshaft Bearing

Warning!



Prevent the vehicle from rolling away!
Release the park and service brake
only after lifting!

Removal:

[1] Remove wheel hub unit and brake shoes.

👉 See Chapter 7.

Repair Guide:



Before dismantling the wheel hub unit,
loosen the locking nut of the slack ad-
juster.

[2] Dismount the slack adjuster.

👉 See Chapters 14 - 15.

[3] Check the bushes in the brake holder (Max. bear-
ing play 0.8 mm) and replace if necessary.

[4] Drive in the new outer bushing with ring grooves
(arrow) pointing to grease nipple with driving
mandrel (BPW No.: 05.001.04.04.0)

👉 See Page 14.

[5] On the outside, the bushing must stand back
 $7,2^{+0,5}$ mm. Only apply light strokes when driv-
ing in and out, apply counter-pressure to brake
anchor plate if necessary.

[6] Firmly drive the new inner short bushing into the
brake camshaft house. Work only with mild beats,
apply counter pressure to brake anchor plate if
necessary.

[7] Keep a check on the brake camshaft for its easy
movement in the bushing and re-work the bush-
ing if necessary.

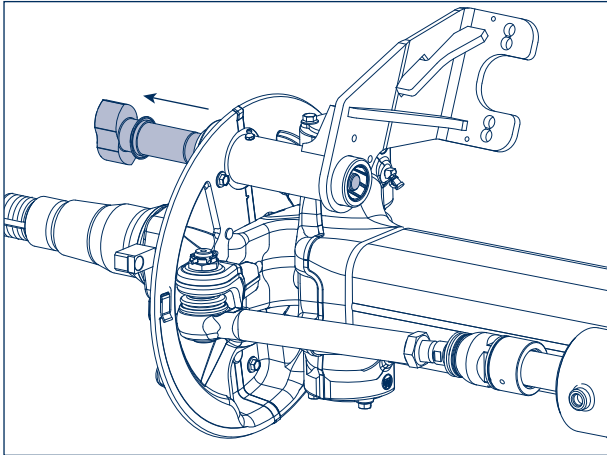


Figure 97

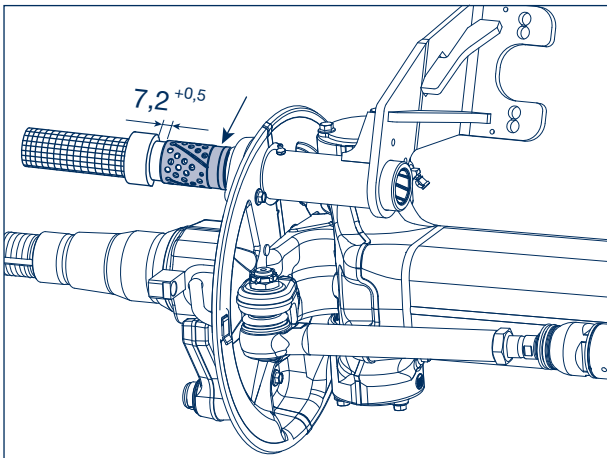


Figure 98

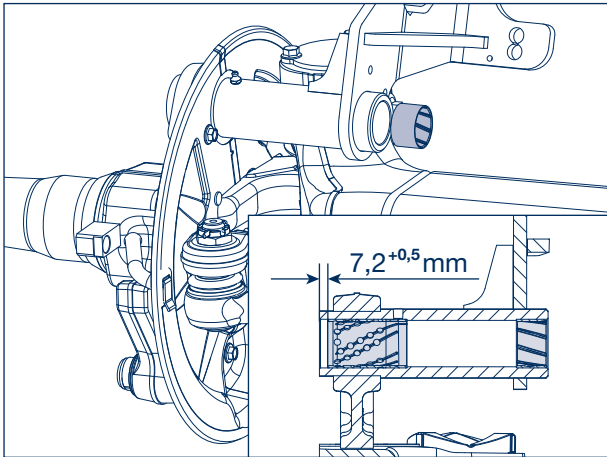


Figure 99



13 King Pin Bushing



Warning!
Prevent the vehicle from rolling away!
Release the park and service brake
only after lifting!



Note:
Inspect the king pins and bushings for wear. The wear limit of the bushing is reached at a wall thickness of 1.8 mm, if necessary replace components.
For testing the closure plate or steering angle sensor must be dismantled.

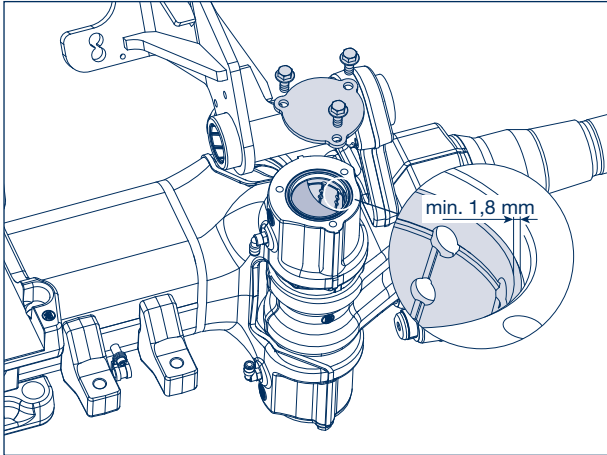


Figure 100

Disassembly:

- [1] Remove the axle.
- [2] Take off the hubs and brake units.
➡ See Chapter 7.
- [3] Remove tie rod unit.
Pull out the split pin (1) and screw down the castel-lated nut (2) then squeeze out the ball joint (3) from the conical bore.
- [4] Remove the closing plate (4) and take out the compression spring (6), then remove the O-ring from the groove (5).

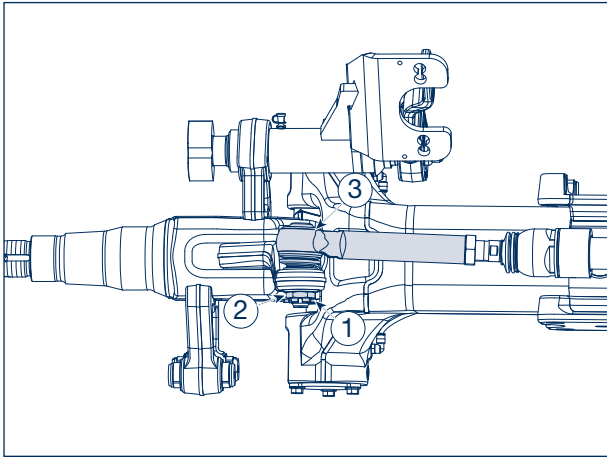


Figure 101



Warning!
At the steering axles a compression
spring (6) is mounted under the king pin.



Note:
Check O-rings for wear and damage and
replace them, if necessary.



Repair Guide:
Remove the steering angle sensor, if
fitted see Chapter 20.

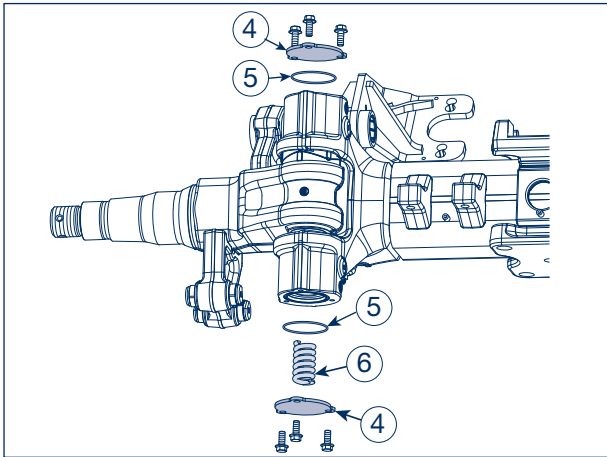


Figure 102

- [5] Place the steering knuckle under pressure so that the undulating thrust washers are above and the steering knuckle is upright.
- [6] Exert slight pressure on the king pin with a suitable mandrel.

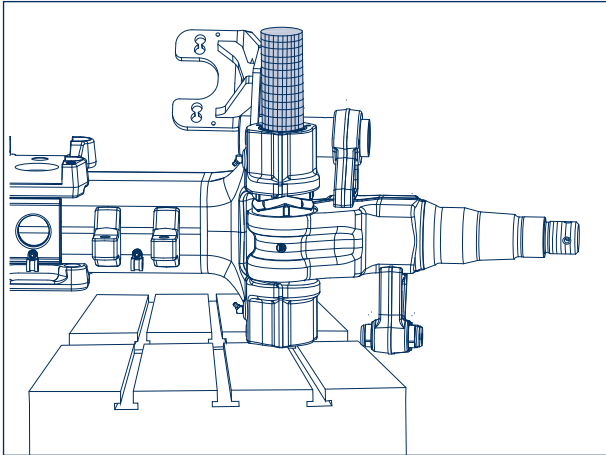


Figure 103

- [7] Heat the stub axle on the end face with a large weld torch flame until the king pin becomes loose, then force it right out in one go by pressing.



Repair Guide:
If the king pin is pressed out without
being heated, the steering knuckle
bore will be destroyed.



Repair Guide:
The steering axles are mounted with
the stepped king pins, for this reason
the removal of the king pin has to be
done from top to bottom.

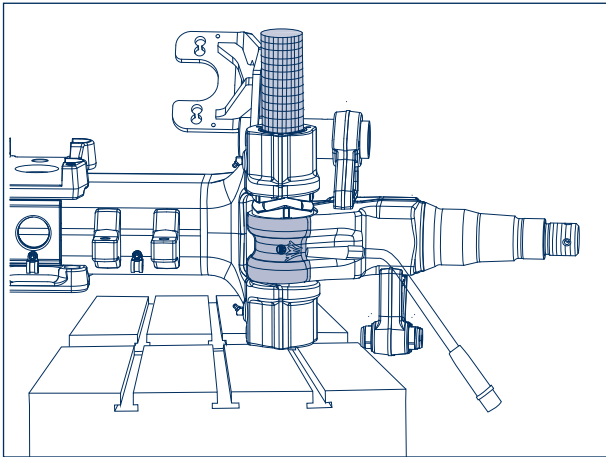


Figure 104

- [8] Remove the stub axle with the undulating thrust washer.



Note:
Please note.
The steering knuckle is hot.

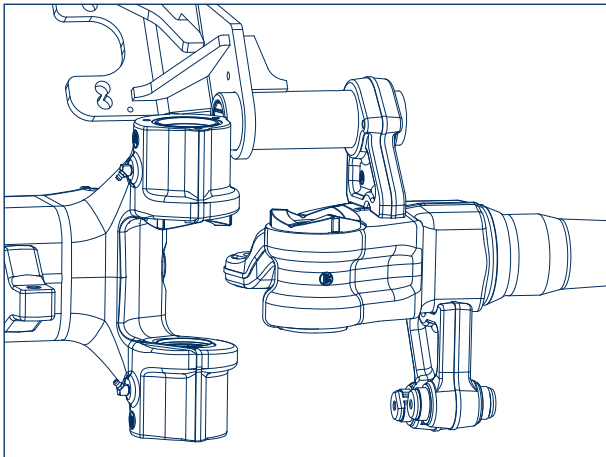


Figure 105

13 King Pin Bushing

Note:



Inspect the king pins and bushings for wear. The wear limit of the bushing is reached at a wall thickness of 1,8 mm, if necessary replace components.

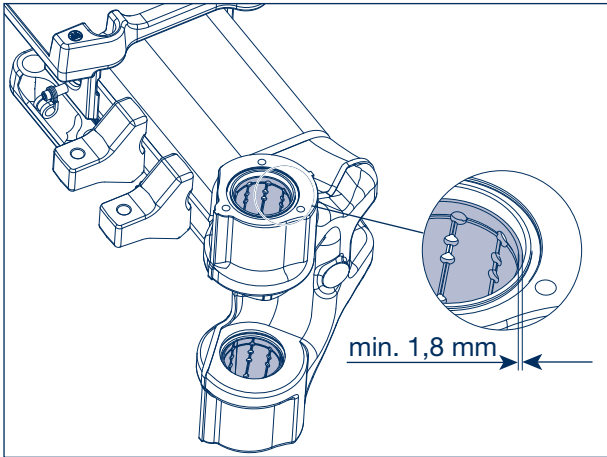


Figure 106

[9] Press new bushes for the king pin in with a suitable mandrel carefully and without tilting them until they are flush with the inner mating surfaces of the bottom of sealing rings.

Repair Guide:



The steering knuckle is mounted with a thicker bush (inner Ø 60,5 mm) from below.
The inner open lubrication drains must face the centre of the axle.

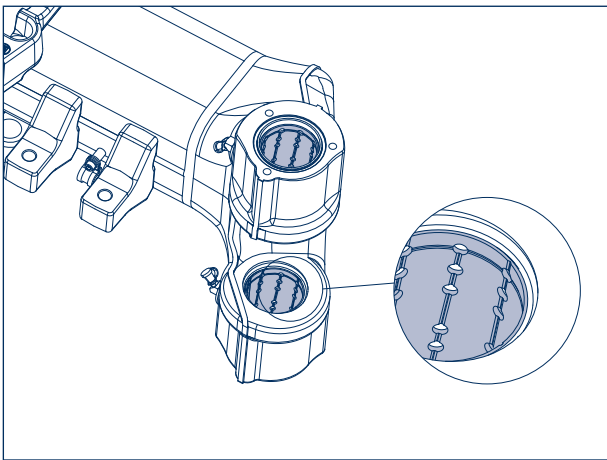


Figure 107

[10] Check whether the king pin slides with ease into the bushes; if necessary re-work the bushes.

Repair Guide:



Please note the installation direction of the king pin. The larger inner diameter bushing is below.

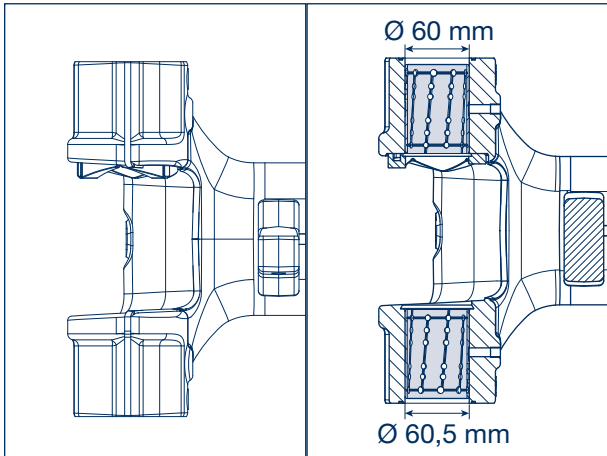


Figure 108

[11] Insert new seals in correct position into the groove of the axle stub as seen in the drawing.

Repair Guide:



Before placing the sealing elements wait a few minutes so that the welded components can cool.

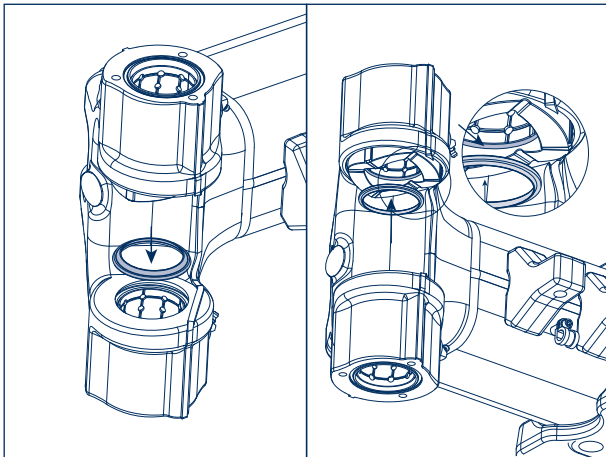


Figure 109

[12] The axle is mounted in a supine position, then insert a spacing ring Ø 55 x 5 mm into the upper king pin bushing for ease of installation. Fasten upper closure plate with two bolts.

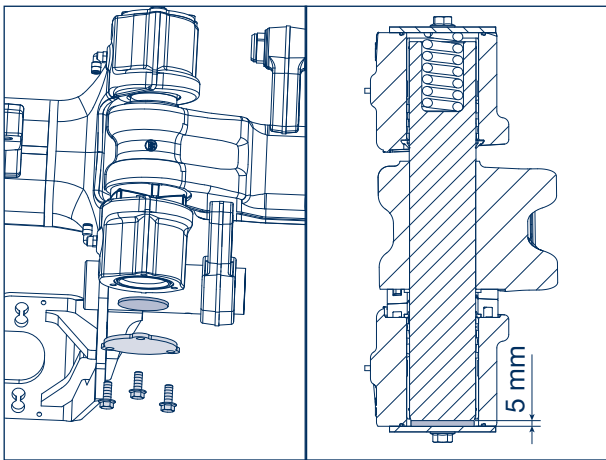


Figure 110

[13] Insert steering knuckle in the axle stub (undulating thrust washers lie below each other) and align all holes for the king pins with a guide-pin (about 0.1 mm thinner than the king pins).

Repair Guide:



Do not move the steering knuckle after pulling out the guide-pin.

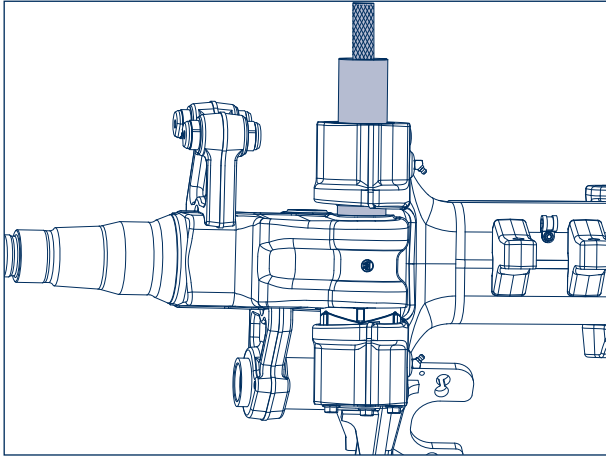


Figure 111

13 King Pin Bushing

[14] Heat the steering knuckle from the lower to middle part on both sides with circular movements while it becomes somewhat dark red. Do not overheat the undulating washers because too much heat can damage internal seals.



Note:

For the easy assembly of the king pin in addition it should be cooled to approximately -30°C.

[15] Push quickly the king pin with the hole of compression spring upwards until it stops, using light hammer blows if necessary.



Repair Guide:

Align the bore (Ø5) for steering angle sensor to correct position $60^\circ \pm 15^\circ$.

[16] Remove the locking plate and pick out the spacer.

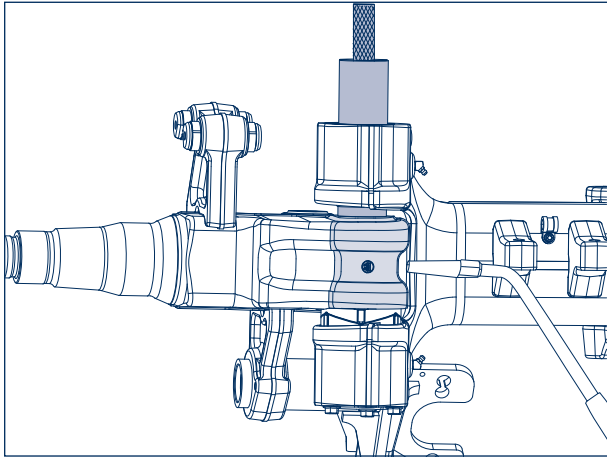


Figure 112

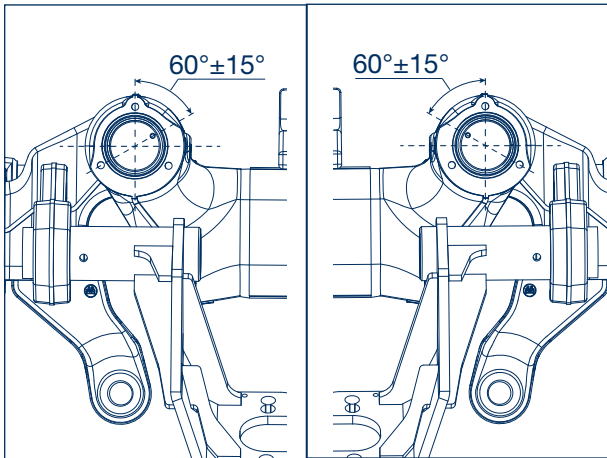


Figure 113

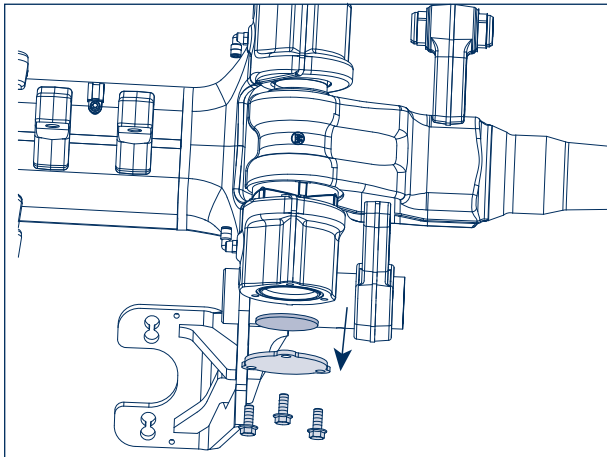


Figure 114

[17] Insert the new O-ring into the slot of the steering knuckle. Insert the compression spring into the bore of the king pin. Mount the lower locking plate with locking screws or hexagon bolts, if necessary, use longer bolts in the interest of easy installation.

[18] Tighten alternately the screws, until the compression spring is tightened, and tighten with the specified tightening torque.

Tightening torque:

M 10 x 25 M = 53 Nm

[19] Fasten the axle in the travel position. Insert the new O-ring into the slot of the steering knuckle. Depending on the version, install the upper locking plate or the steering angle sensor with locking screws.

[20] Tighten the bolts to the specified tightening torque.

Tightening torque:

M 10 x 25 M = 53 Nm



Note:

Pay attention to the steering angle sensor mounting, see chapter 20.

[21] Install the tie rod.

 See Chapter 17.

[22] Install brakes and hubs.

 See Chapter 7.

[23] Lubricate the king pin bearing and the brake shaft bearing with the BPW special long-life grease (ECO-Li 91)

[24] Install the axle.

[25] Perform tracking control.

 See Chapter 23.

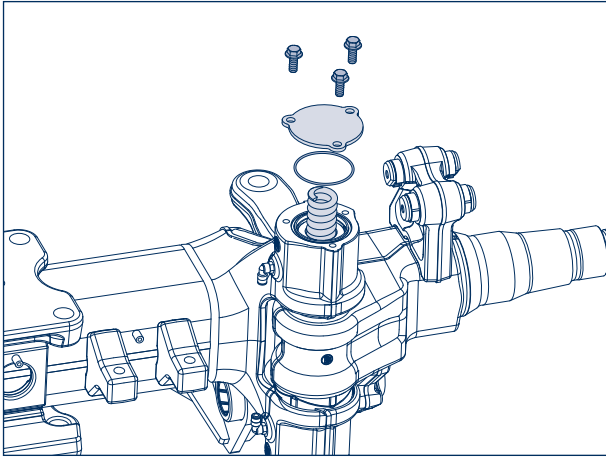


Figure 115

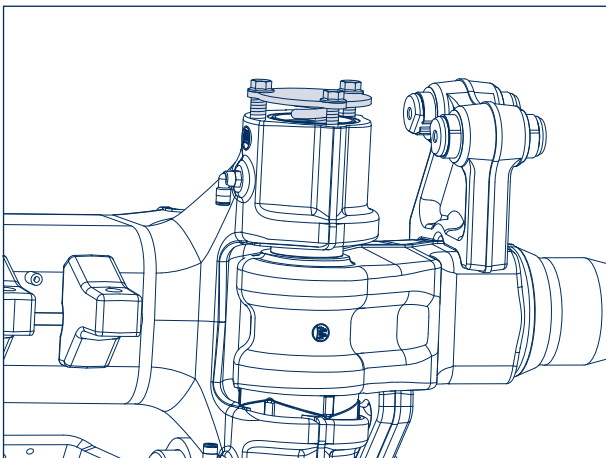


Figure 116

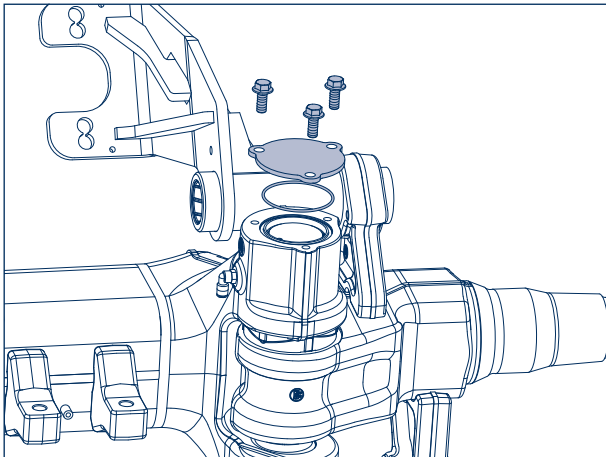


Figure 117

14 Manual Slack Adjuster (GSK)



Warning!
Prevent the vehicle from rolling away!
Release the park and service brake
only after lifting!

Disassembly:

- [1] Unhook the tension spring from the slack adjuster, if available.
- [2] Unscrew the securing nut (1) (WAF 32) and remove the disc (2).

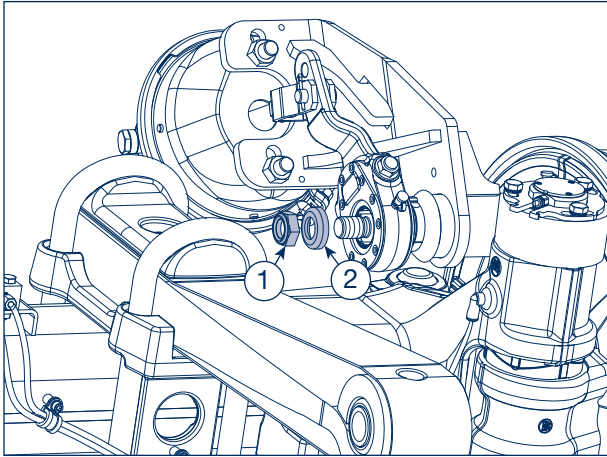


Figure 118

- [3] Remove the pin (3) and the split pin (4) from the clevis of the brake cylinder.



Repair Guide:
Before disassembly, the length of the brake lever has to be measured in order to restore the important factory settings.

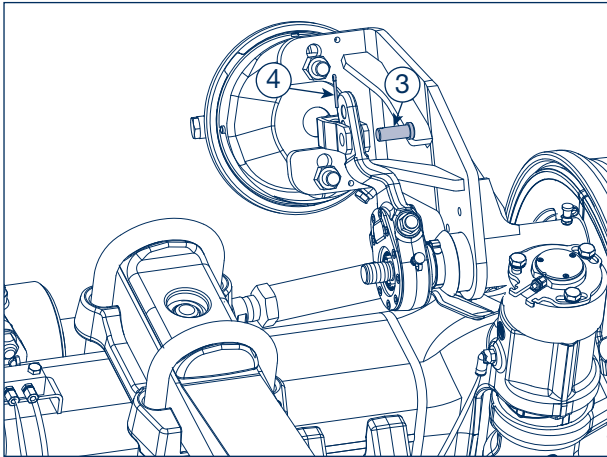


Figure 119

- [4] Turn back adjustment screw by approx. ¾ of a turn in the counter-clockwise direction using a ring spanner (WAF 19) until the slack adjuster became unencumbered appreciably.
- [5] Use a suitable puller for the slack adjuster removal.

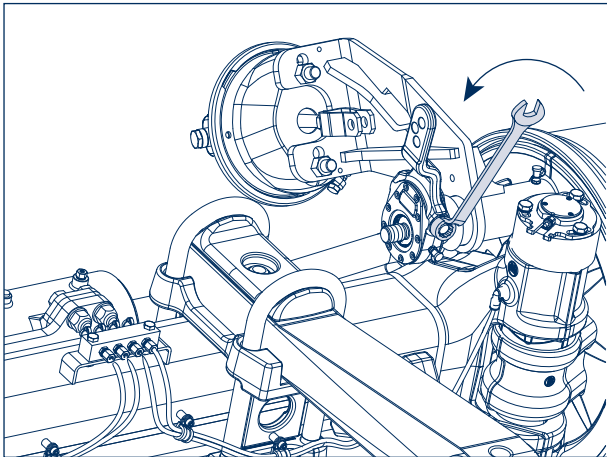


Figure 120

Assembly:

- [1] Grease the grooved part of camshaft with BPW special longlife grease ECO-Li 91.
- [2] Slide the slack adjuster onto the brake camshaft.
- [3] Place the washer with the countersink pointing towards the slack adjuster and screw on new locknut (WAF 32) and tighten to a torque of 90 Nm.

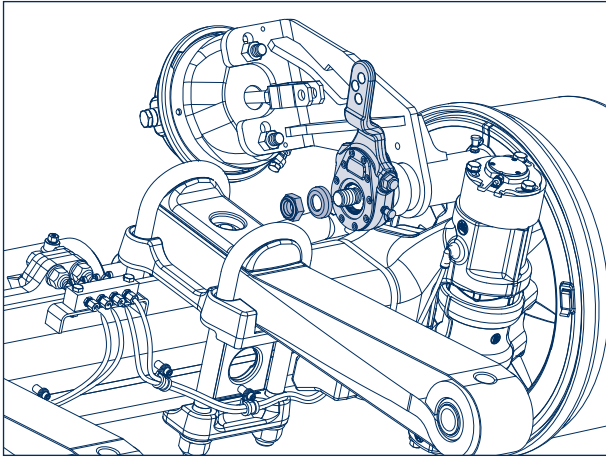


Figure 121

- [4] Align the slack adjuster by the adjusting screw to the brake cylinder clevis.

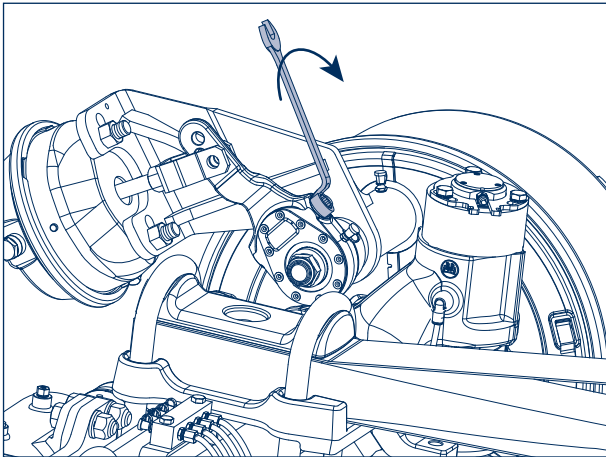


Figure 122

- [5] Insert and secure the bolts. If available remount the return spring.
- [6] Grease all lubrication points with BPW special long-life grease (ECO-Li 91).
- [7] Adjust the brake.
👉 See Page 26.

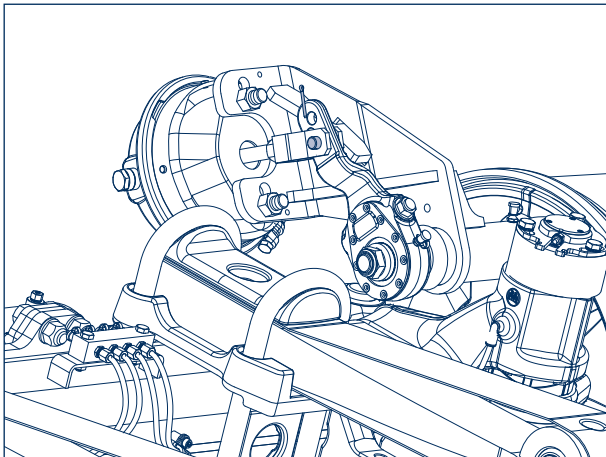


Figure 123

15 Automatic Slack Adjuster (AGS)

Assembly:

- [1] Grease the grooved part of camshaft with BPW special long-life grease ECO-Li 91.
- [2] Loosen lightly the securing screws of the anchor bracket, or if it is dismantled condition, lightly screw on again.
- [3] Push the automatic slack adjuster onto the brake camshaft.

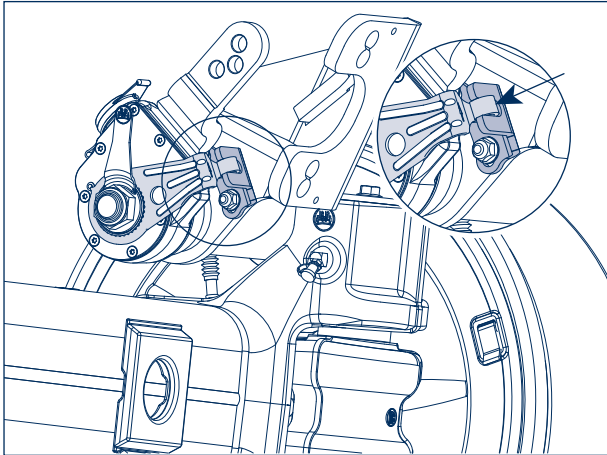


Figure 124

Note:



Insert the fork of the anchor bracket onto the control lever (arrow) (observe the left and right version).

- [4] Insert the shaped washer with the brake lining wear indicator vertically upwards and tighten the new securing nut with the specified tightening torque of 90 Nm.

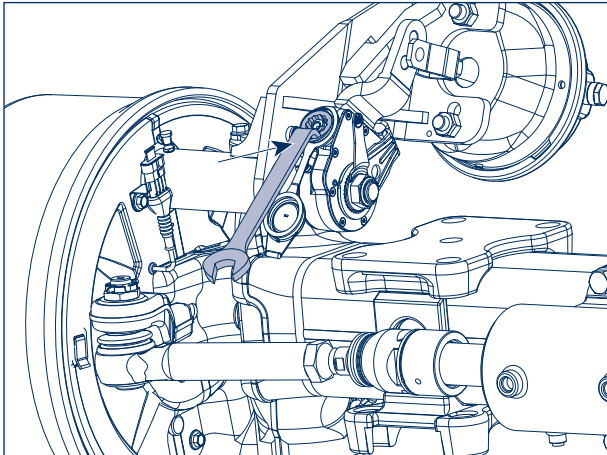


Figure 125

- [5] Pull down the rubber cover cap. Press the clutch sleeve with a ring spanner (WAF 19) (arrow) and turn the bolt hole in the brake lever while matching exactly to the bore on the clevis by turning clockwise or counter-clockwise.
- [6] Insert and secure the bolts. If available remount the return spring.

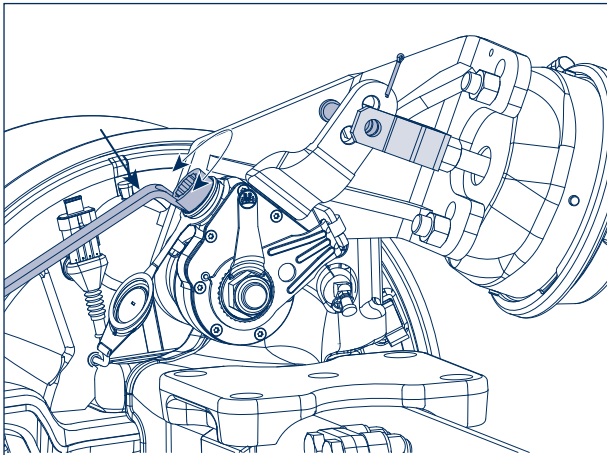


Figure 126

- [7] Press the anchor bracket and control arm in the direction of the arrow until it stop by the help of coupling sleeve depressed.
- [8] The lug on the control lever must be opposite to the control point.
- [9] Affix the anchor bracket to the base plate with two retaining nuts and tighten to the prescribed tightening torque of 19 Nm.

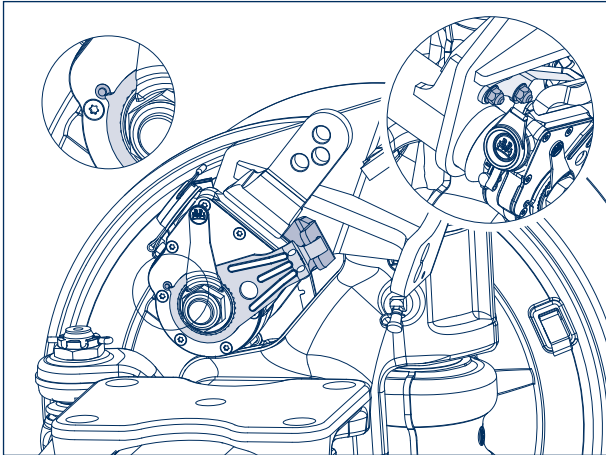


Figure 127

Repair Guide:



After fastening the control lever lug must point to the control point . (Basic setting).

- [10] Grease all lubrication points with BPW special long-life grease (ECO-Li 91).
- [11] Adjust the brake..

➡ See Page 27.

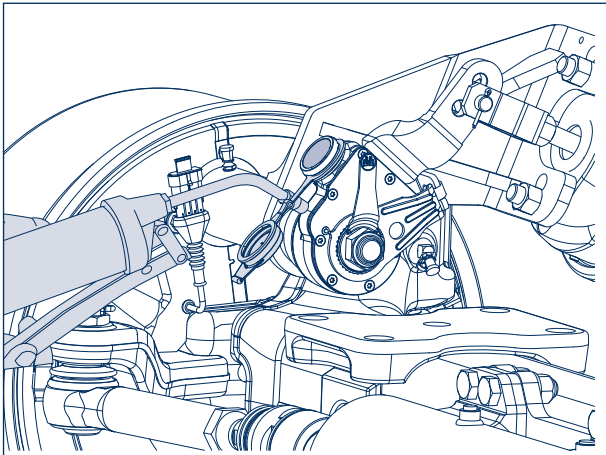


Figure 128

16 Brake Chambers

Maintenance:

The statutory examinations are to be observed. No special maintenance work is required.

The diaphragm cylinder should be removed and cleaned at least every 2 years. Only new wearing parts are to be fitted when installing brake cylinders.



Danger!
DANGER OR FATAL INJURY!
Dismantling the spring storage part is not possible!
Violent opening is absolutely avoided.

Installation preparations:

- Essential for the proper functioning of the brake chamber, that the rate of deviation of the straightness of the contact surface on the mounting bracket is not more at 0.4 mm.
- Before mounting the brake chamber the mounting brackets surface with only primed coated (max. painting thickness 100 µm). Other mounting parts such as washers, plates, securing rings, etc. must not be used.

Mounting diaphragm cylinder:

- [1] Screw the locknut (WAF 24) and clevis onto the cylinder push-rod.
- [2] Adjust the required push-rod length to the bottom of the cylinder (observe free space of at least 40 mm, see Fig. 130). Fasten the clevis with the lock nut by hand.
- [3] Put the slack adjuster back.
- [4] Place the brake chamber on the mounting bracket. Please ensure that the clevis pin is located in the correct position on the slack adjuster.

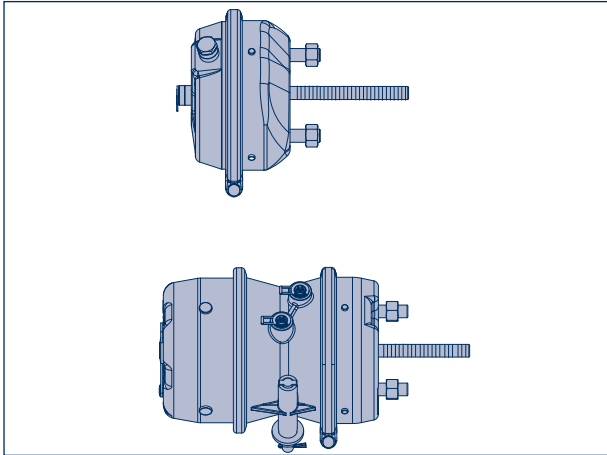


Figure 129

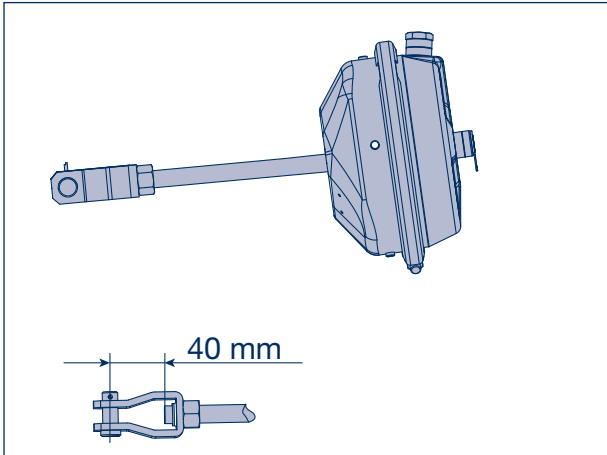


Figure 130

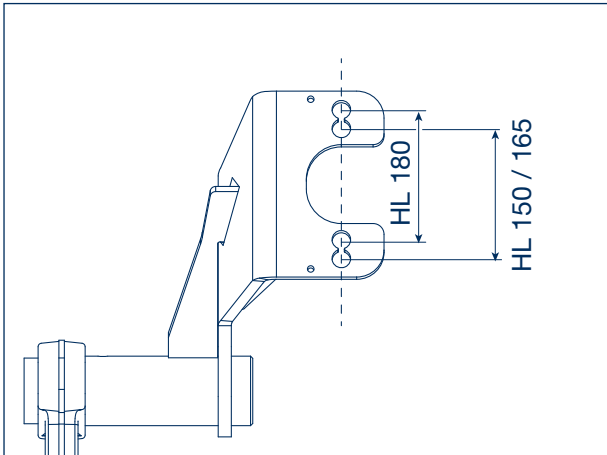


Figure 131

- [5] Fit on the fastening nuts (1) (WAF 24) until tight.
- [6] Tighten alternative sides to 180 Nm using a torque wrench.
- [7] Tighten the lock nut (2) (WAF 24) on the push rod to 80 Nm.

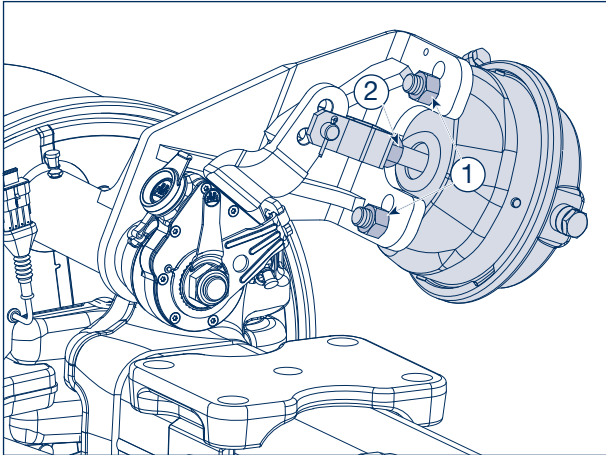


Figure 132



Note:
At those BPW brake chambers which mounted with round hole clevis, the external return spring is omitted.

- [8] An outer return spring is required if slot-type clevis is used. This must be taken into account in the EC Brake Calculation.
- [9] Remove the plug from the drain hole at the lowest point at the brake booster.

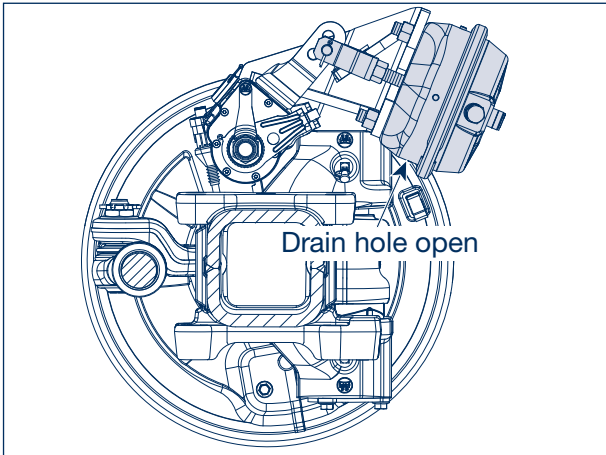


Figure 133



Repair Guide:
Comply with the installation instructions for the slack adjuster or Chapter 14 - 15 when connecting the push rod or clevis to the slack adjuster.
Do not pull the push rod out of the brake cylinder during installation or adjustment work.

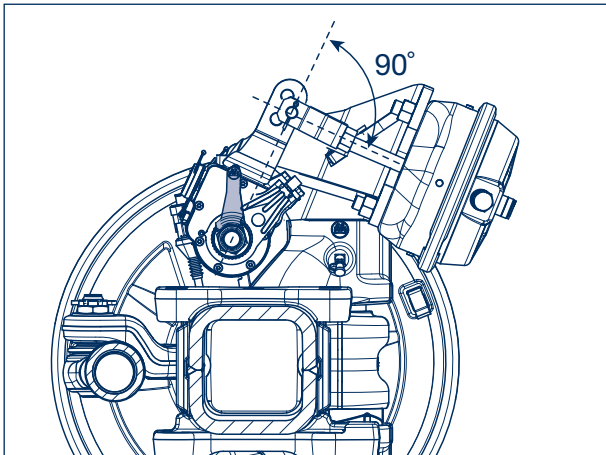


Figure 134

16 Brake Chambers

16.1 Spring Brake Chamber

- [1] Remove the release stud assembly from the side pocket. The release stud assembly consists of the release stud (1), washer (2), nut (3) and split pin (4).
- For new versions, a protection cap with thread replaces the split pin.

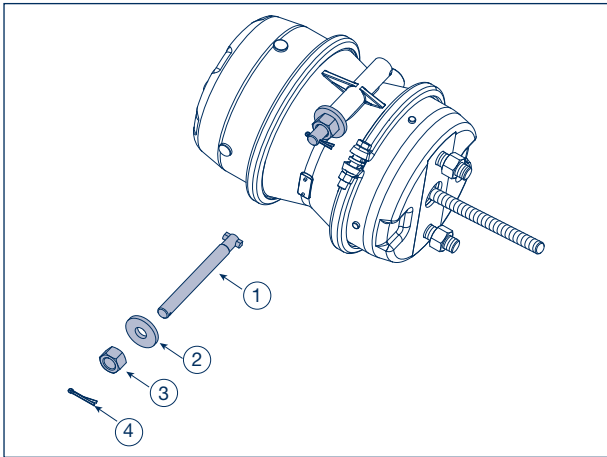


Figure 135

- [2] Fold open the plug (5) on top of the spring brake cylinder.
- [3] Apply min. 6 bar to compressed air connection.
- [4] Insert the release stud (1) into the cylinder and clip it into place.
- [5] Fit the washer (2) and hexagon nut (3) onto the release stud and use a ring spanner (WAF 24) to fully compress the spring. (Brake off position.)
See steps [1] - [9] for further assembly steps for spring brake chamber.
- [6] Remove the release stud to release the spring after installing the cylinder and insert it into the side pocket.
- [7] Tighten the nut to 20 Nm.
- [8] Insert the plug (5) back into the brake cylinder.
- [9] Secure and adjust the slack adjuster according to Chapter 14 - 15.
- [10] Tighten the compressed air connections (WAF 24) and the plug to 45 Nm.

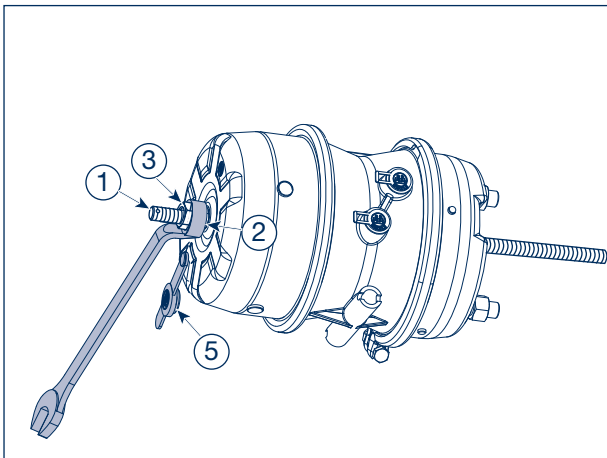


Figure 136

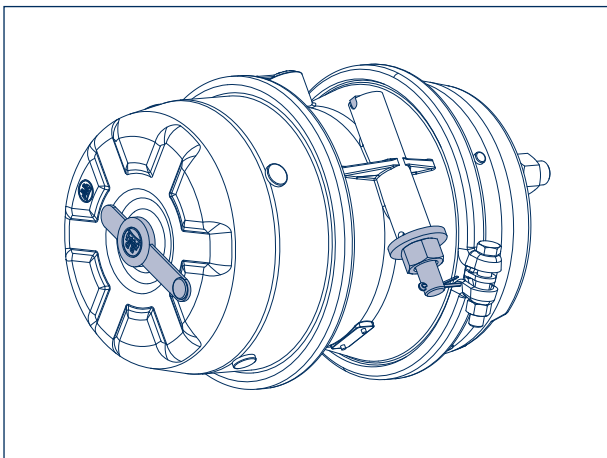


Figure 137

Note:

BPW recommend only installing one brand of brake cylinders on any particular vehicle!

Tie Rod 17

- Installation:**
- [1] Screw the locking nut (1) and tie rod (2) up to the axial ball joint (3).
 - [2] Screw the castellated nut (4) (WAF 46) of the ball joint and fasten it to the specified torque.
- Tightening torque:**
- M 24 x 1,5 M = 260 Nm
- [3] Install the split pin (5) and bend it slightly.

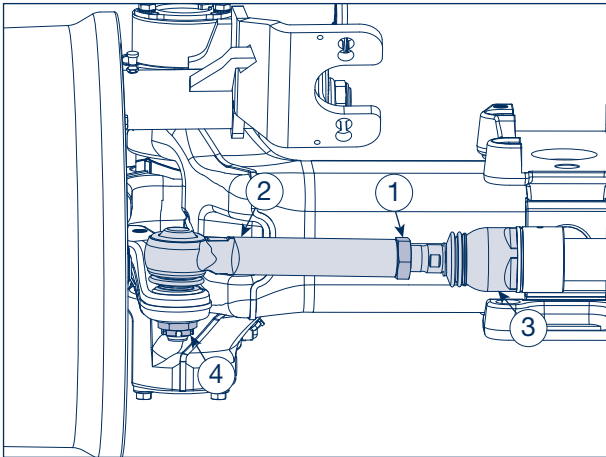


Figure 138

Repair Guide:

Turn onward the castellated nut to the closest possible pin hole in congruence with the next hole.

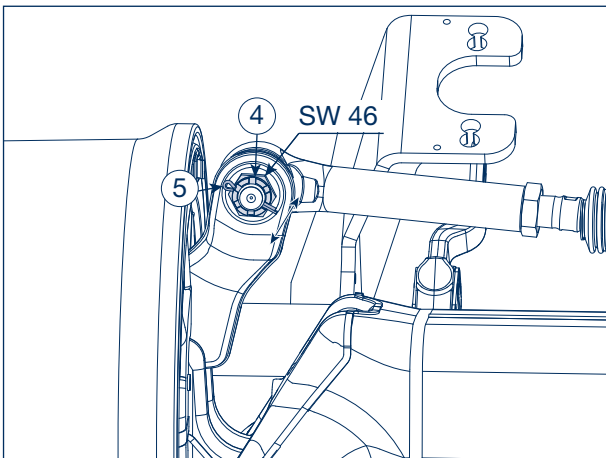


Figure 139

- [4] Align the tracking values. At the individual toe setting turn the threaded bolt (6) (WAF 27) with the open-end spanner of the axial ball joint.
- Repair Guide:**
- When setting the track values, set the lengths of the piston rod from the steering cylinder equally on both sides and secure it.
- See Chapter 23.
- [5] After the adjustment tighten the locking nuts (1) (WAF 41) to the specified torque.

- Tightening torque:**
- M 28 x 1,5 M = 410 Nm

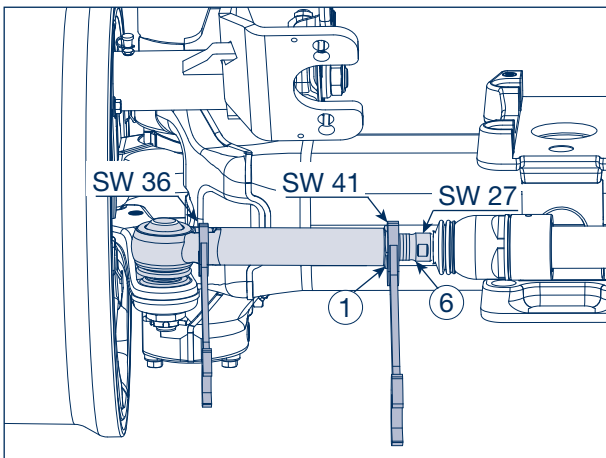


Figure 140

18 Threaded Stop Sleeve



Warning!

Prevent the vehicle from rolling away!
Release the park and service brake!

Disassembly:

- [1] Remove the tie rod.
 See Chapter 17.
- [2] Unhook the retaining ring out of the hole.
Unscrew the threaded stop sleeve (1).

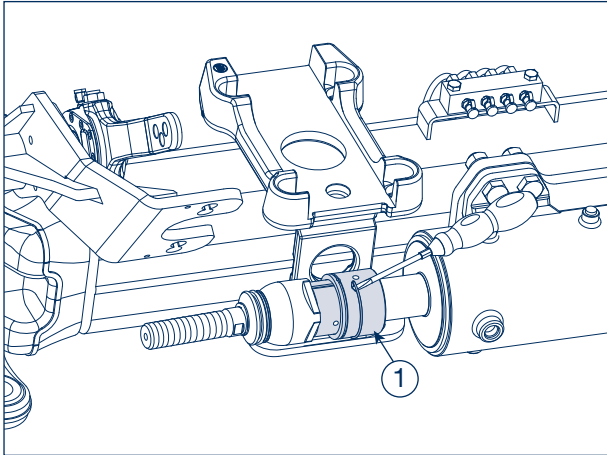


Figure 141

- [3] Loosen stop inner sleeve (2) using a hook wrench and unscrew.



Repair Guide:

When loosening the stop inner sleeve (D 60) hold the axial ball joint with a wrench (WAF 55).

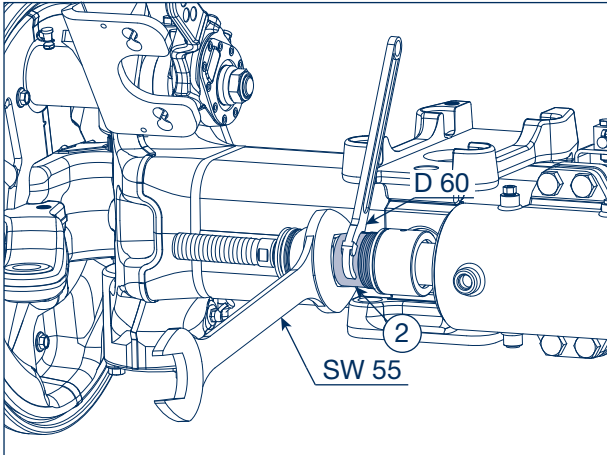


Figure 142

- [4] Loosen and unscrew the axial joint



Repair Guide:

When loosening the axial joint (WAF 55) hold the piston rod with an open-ended spanner (WAF 36).

- [5] Remove the threaded sleeves from the piston rod.

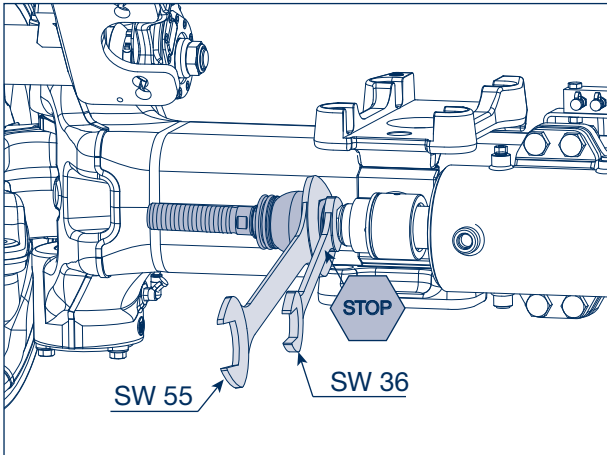


Figure 143

Assembly:

- [1] Slide the threaded stop sleeve up on the piston rod.



Note:

Pay attention to the correct position of the threaded stop sleeve.

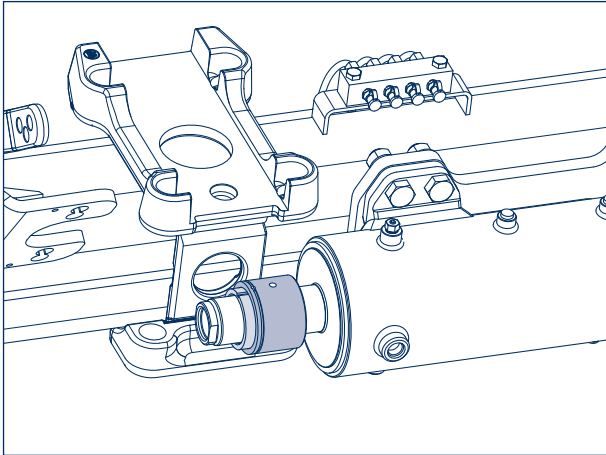


Figure 144

- [2] Screw on the axial joint and tighten with the prescribed tightening torque of 500 Nm.



Repair Guide:

When tightening the axial joint (WAF 55) hold the piston rod with an open-ended spanner (WAF 36).

- [3] Screw up the stop inner sleeve onto the piston rod and tighten with the prescribed tightening torque of 220 Nm.

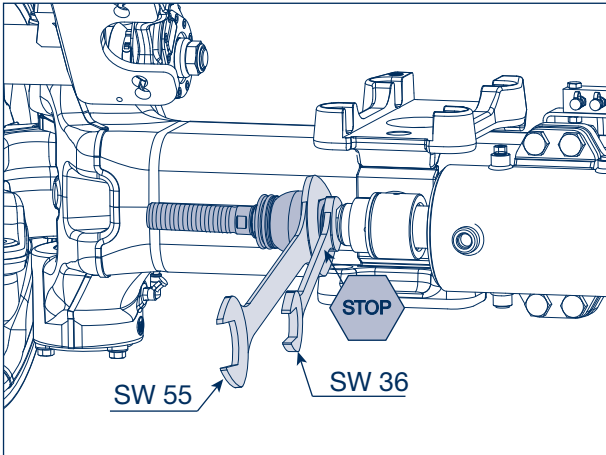


Figure 145



Repair Guide:

When tightening the stop inner sleeve (D 60) hold the axial ball joint with an open-ended spanner (WAF 55).

- [4] Screw on the outer sleeve onto the fastened inner sleeve.
- [5] Install the tie rod.
 See Chapter 17.
- [6] Adjust the steering angle
 See Chapter 19.

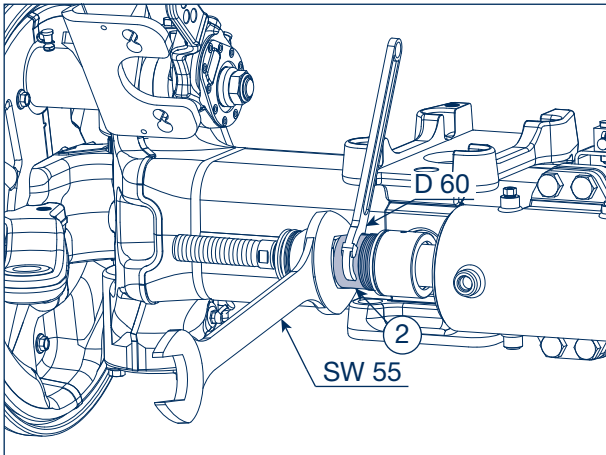


Figure 146

19 Steering Angle Adjustment

Note:
The work can only be performed on the raised axle.

[1] Unhook the retaining ring out of the hole.

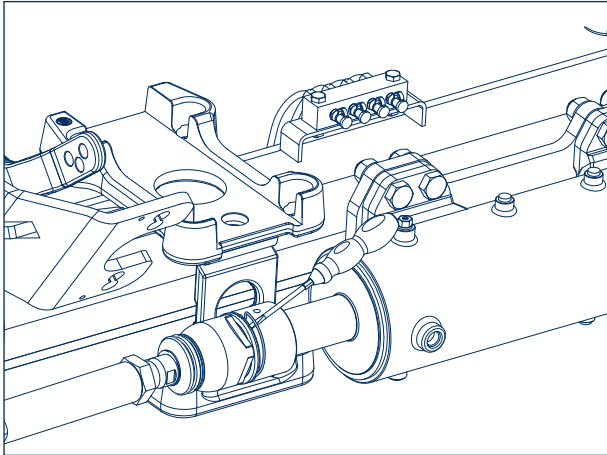


Figure 147

[2] Turn the threaded stop sleeve in the correct direction to reach the prescribed setting angle. (1 degree corresponds to about 5 turns)

Note:
Maximum setting value can be reached at the end of the thread.

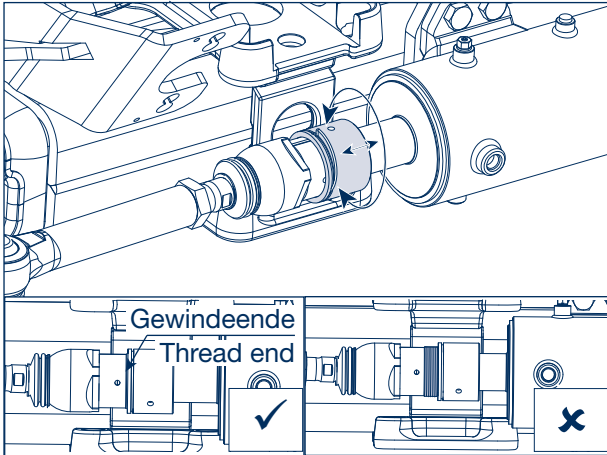


Figure 148

Repair Guide:
The condition of the stop inner sleeve on the axial joint must be verified, if necessary fasten it with the help of a hook wrench (D 60) and with the prescribed tightening torque 220 Nm.

Repair Guide:
When tightening the stop inner sleeve (D 60) hold the axial ball joint with a wrench (WAF 55).

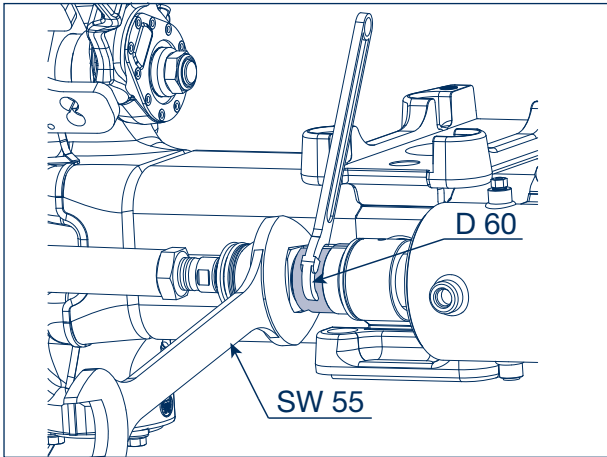


Figure 149

[3] Insert the retaining ring into the hole.

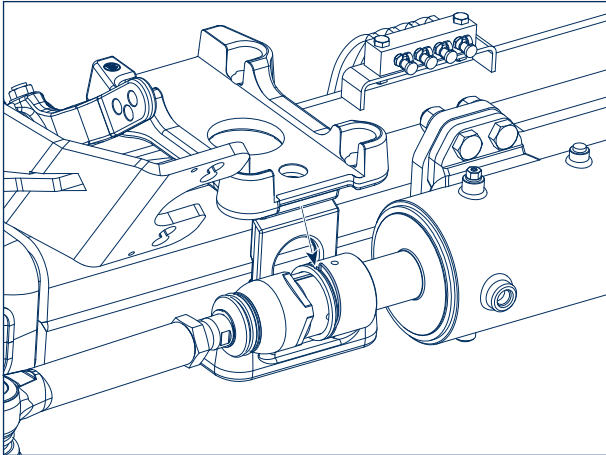


Figure 150

[4] Hook the retaining ring through hole of the stop sleeve into the groove of the inner sleeve, in order to fasten the adjusted steering angle.

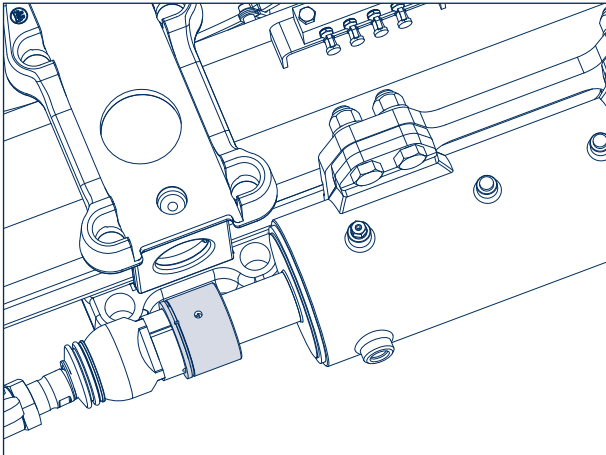


Figure 151

[5] Actuate the steering cylinder in full left and right direction and check for free movement and free space among all steering parts.

Note:
Steer the axle in to the left and to the right direction and check the freedom of movement and clearances of all moving parts to avoid collisions, adjust if necessary.

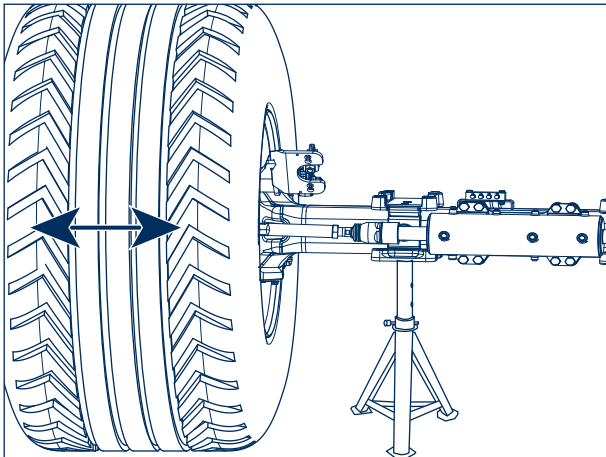


Figure 152

20 Steering Angle Sensor

20.1 Assembly of Component Parts

Note:
It is possible to carry out a subsequent installation of the steering angle sensor.

Axle preparation:

Warning!
Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

- [1] Raise the vehicle and remove the wheels.

Note:
Steering angle sensor is fitted by default on the left side of the steering axle.

- [2] Loosen and pull out the locking screws (WAF 17) then remove the closing plate.

- [3] Drive the dowel pin (Ø5 x 32) into the bore of the king pin in the correct depth 13,5 mm (tolerance: +1 mm).

Note:
When measuring, the zero position at the undulating thrust washers is required.

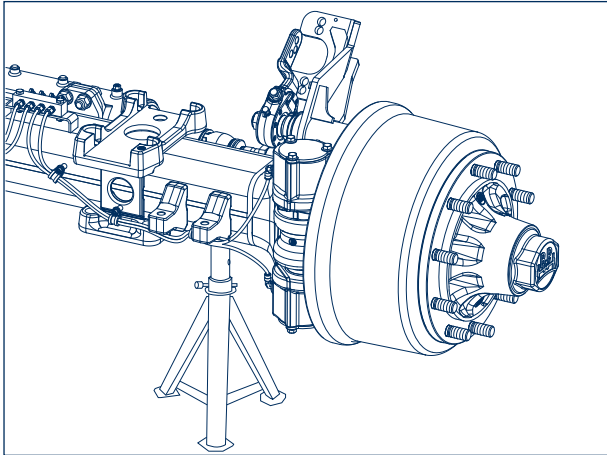


Figure 153

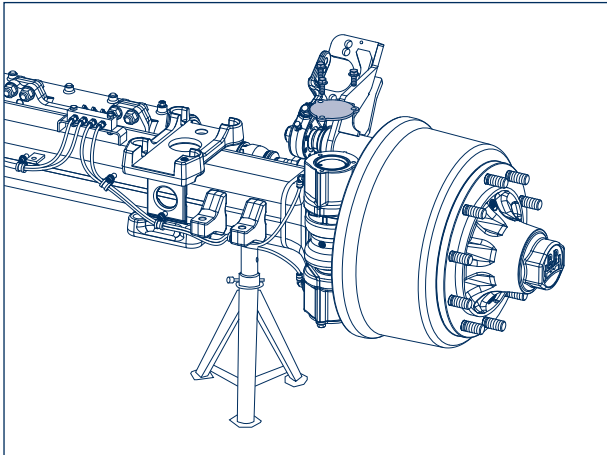


Figure 154

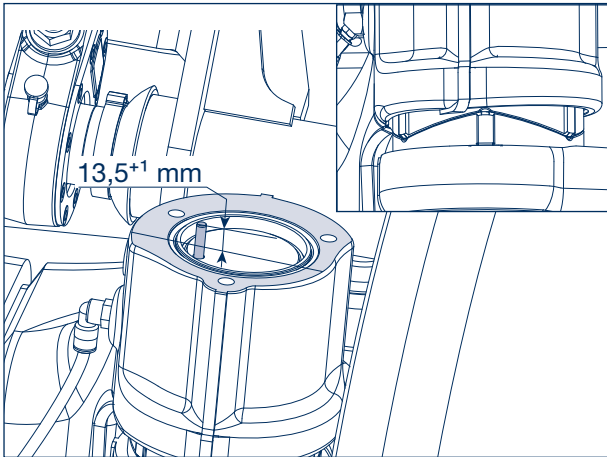


Figure 155

Adaptor:

Note:
Component parts of the adaptor are factory assembled and lubricated with BPW special longlife grease.

- [1] Lubricate lower disc is with BPW special longlife grease (ECO-Li 91) and insert the O-ring into the groove of the disc.

Repair Guide:
Put the O-ring on with your fingers and lubricate it with the (ECO-Li 91) grease.

- [2] Push disc into the bore of the adaptor from below.

Repair Guide:
Please protect the O-ring from damage.

- [3] Pre-assemble upper disc. Press or drive the dowel pins (Ø3 x 8) into the blind holes of the lower disc until they stop.

Note:
The sensor mounting includes two different upper discs depending on the sensor type.

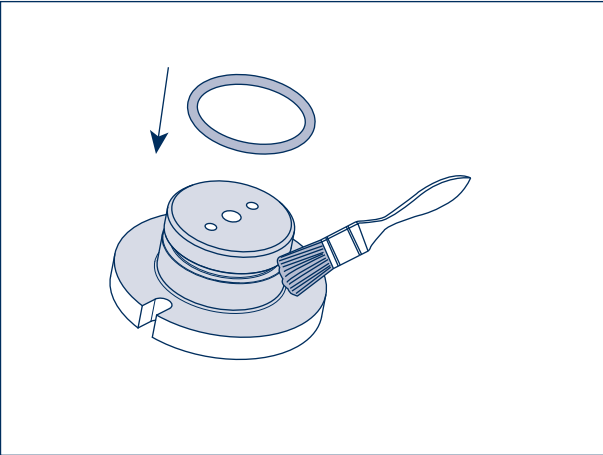


Figure 156

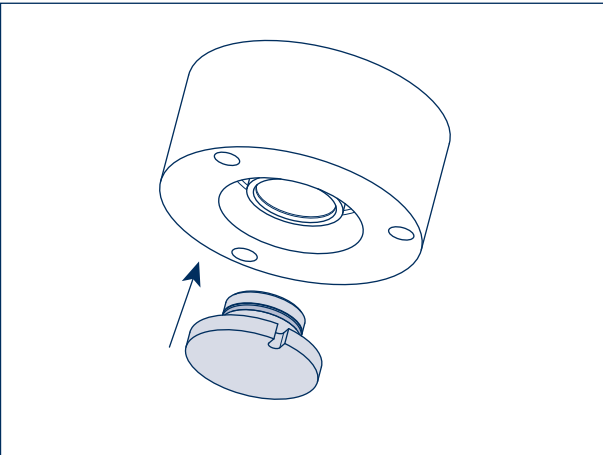


Figure 157

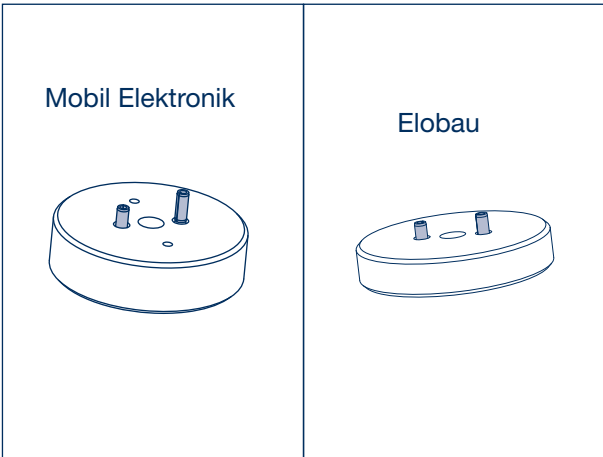


Figure 158

20.1 Assembly of Component Parts

- [4] Install the upper disc in correct position via dowel pins onto the mounted lower disc.



Repair Guide:

The blind hole on the upper disc must be opposite to the groove of the lower disc.

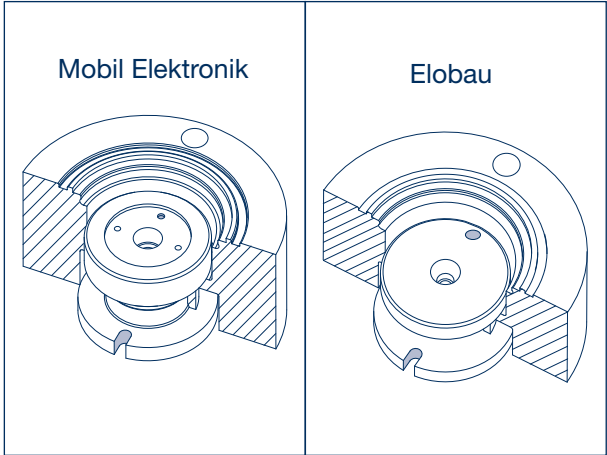


Figure 159

- [5] Install locking screw of the upper disc (Allen screw WAF 5) and tighten it to prescribed tightening torque.

Tightening torque

M 6 x 12 M = 5 Nm

- [6] Press the dowel pin (Ø5 x 20) into the blind hole until it stops.



Repair Guide:

Press or drive a dowel pin into the disc of Elobau-sensor for the actuator lever.

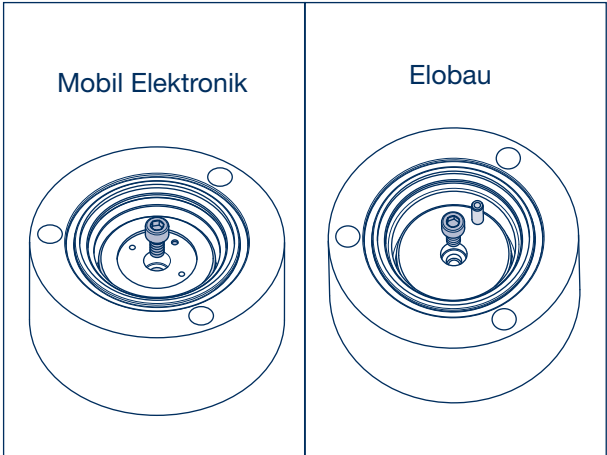


Figure 160

- [7] Place the adaptor onto the top of the steering knuckle.



Repair Guide:

Place the adaptor with the pre-assembled component parts in such a way that the dowel pin on the top of the king pin fit exactly into the groove of the lower disc.

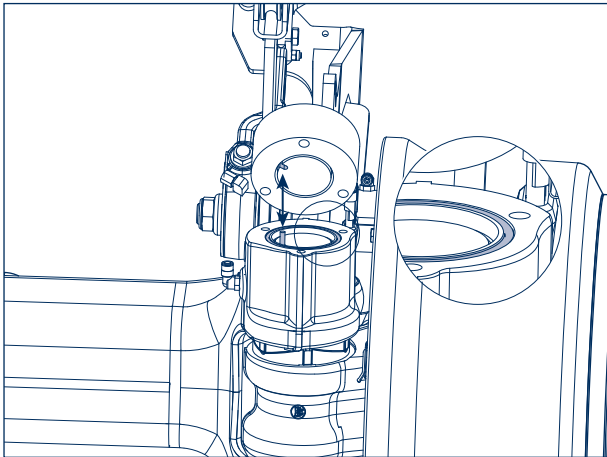


Figure 161



Repair Guide:

Check the correct position of the O-ring, check for wear and replace if necessary.

- [8] Install the sensor.

 See Pages 79 - 86.

Mobil Elektronik Sensor 20.2

Pre-assembly:



Warning!

Prevent the vehicle from rolling away! Release the park and service brake only after lifting!

- [1] Raise the vehicle and remove the wheels.



Note:

Steering angle sensor is fitted by default on the left side of the steering axle.

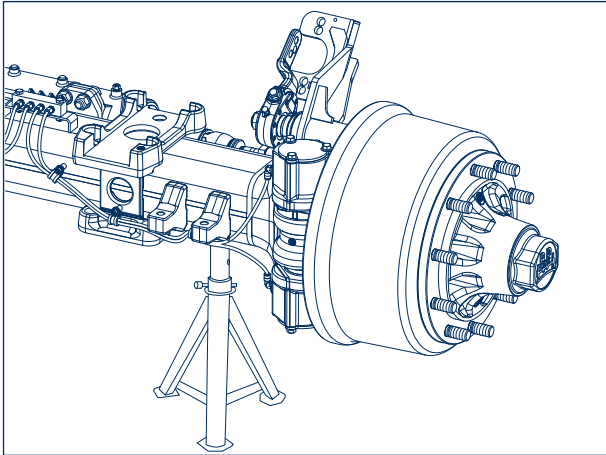


Figure 162

- [2] Loosen and pull out the locking screws (WAF 17).

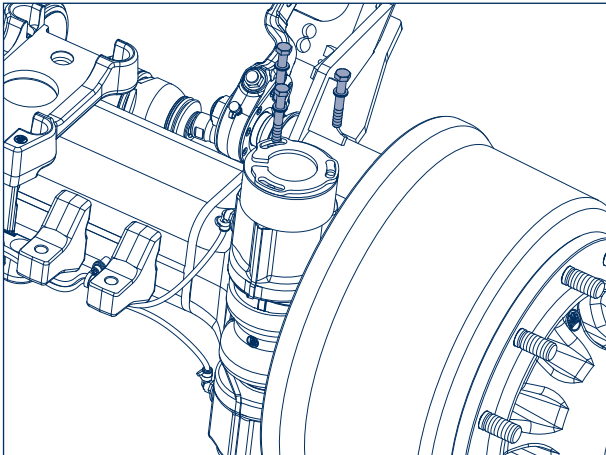


Figure 163

- [3] Dismantle the closing plate.



Note:

The upper closing plate has to be removed when mounting the steering angle sensor.

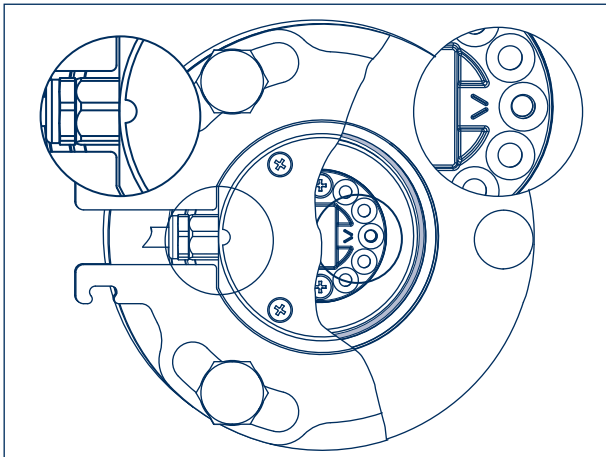


Figure 164

20.2 Mobil Elektronik Sensor

Assembly:

- [1] Place the magnet carrier unit in correct position on the pre-assembled disc and tighten the bolts.



Repair Guide:

The arrow on the magnet carrier must be exactly above the blind hole on the disc after installation.

- [2] Tighten the securing bolts with the prescribed tightening torque.

Tightening torque

M 3 x 12 M = 0,6 Nm



Repair Guide:

Secure the locking screw with Loctite 243.

- [3] Place the angle sensor in the correct position on the adaptor and insert the clamping plate.



Repair Guide:

When placing the sensor on the adaptor pay attention to the position of the groove of the sensor, it should stand on the opposite side to the arrow on the magnet carrier unit.



Repair Guide:

Check the correct position of the O-ring, if necessary correct it.



Repair Guide:

During assembly of the items pay attention to ensure that the cable of the sensor is not damaged.

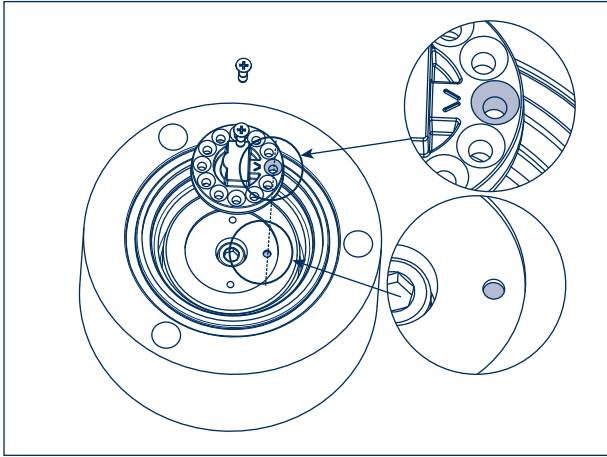


Figure 165

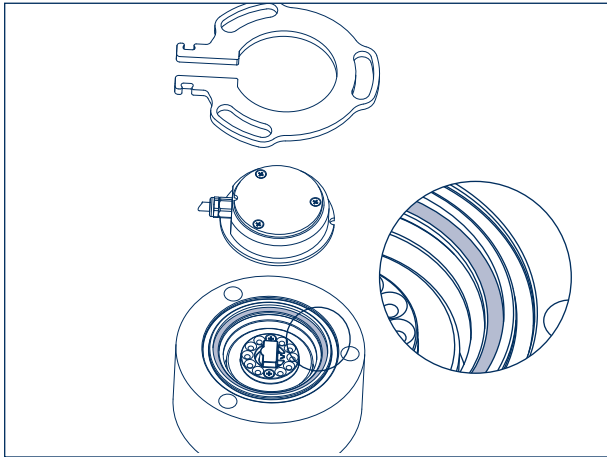


Figure 166

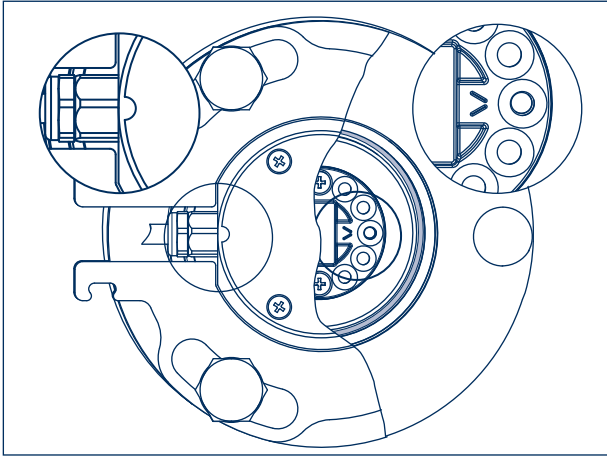


Figure 167

- [4] Insert hexagonal bolts with spring washers and tighten them to the specified tightening torque.

Tightening torque

M 10 M = 50 Nm



Repair Guide:

Before tightening the bolts the base position (0°) of the angle sensor has to be adjusted, see page 87 - 88.

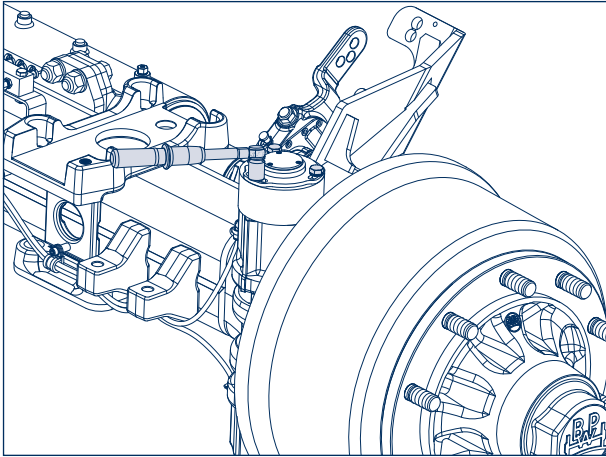


Figure 168

20.3 Elobau Sensor

Pre-assembly:



Warning!

Prevent the vehicle from rolling away!
Release the park and service brake
only after lifting!

[1] Raise the vehicle and remove the wheels.



Note:

Steering angle sensor is fitted by default
on the left side of the steering axle.

[2] Loosen and pull out the locking screws (WAF 17).

[3] Dismantle the closing plate.



Note:

Use the correct components which
are found under the closure plates to
assemble the Elobau sensors (normal or
redundant).

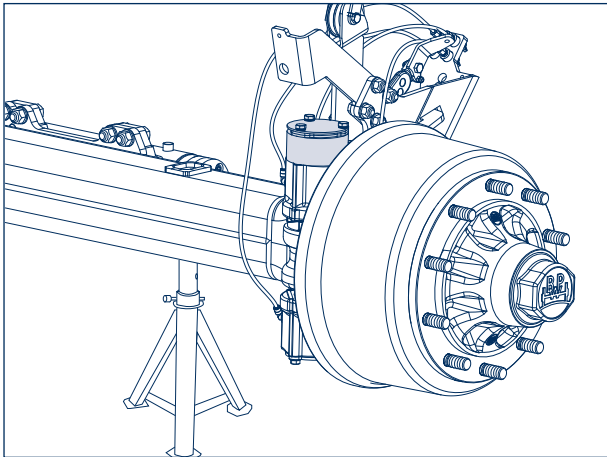


Figure 169

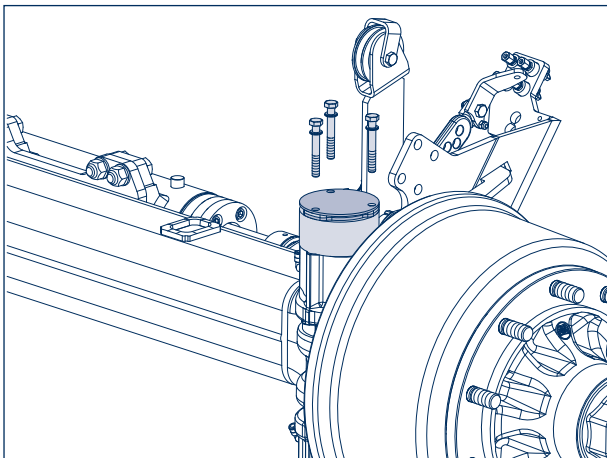


Figure 170

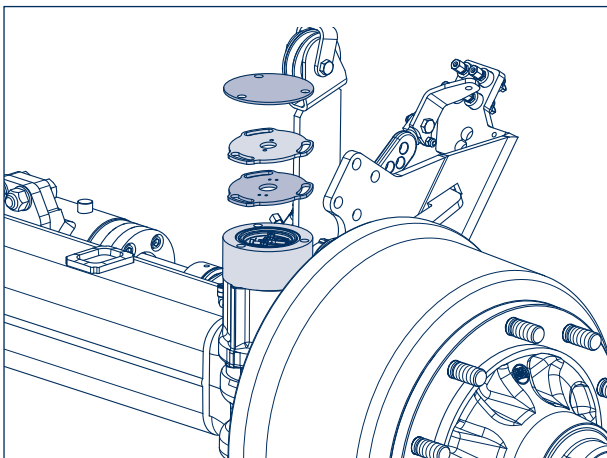


Figure 171



Note:

After dismantling the closure plate the
components for the sensor installation
can be found.

Component parts for sensor assembly (redundant):

Pos.	Designation	Quantity (piece)
1.	Closing plate	1
2.	Bolt (M4x45)	2
3.	Washer (A 4,3)	2
4.	Locking nut (M4)	2
5.	Actuator lever	1
6.	Dowel pin	1

Assembly:

[1] Push the sensor in the correct position on the
closing plate. Insert bolts with spring washers
and tighten them to the specified tightening
torque.

Tightening torque

M 4 M = 2,5 Nm



Repair Guide:

Pay attention to the correct position of
the sensor. The connector must stand
between two holes of the closing
plate.

[2] Push the actuator lever onto the shaft of the sensor.

[3] Drive the dowel pin (Ø5 x 20) into the hole of the
upper disc until it stops.



Repair Guide:

Pay attention to the correct seating of
the bolt.

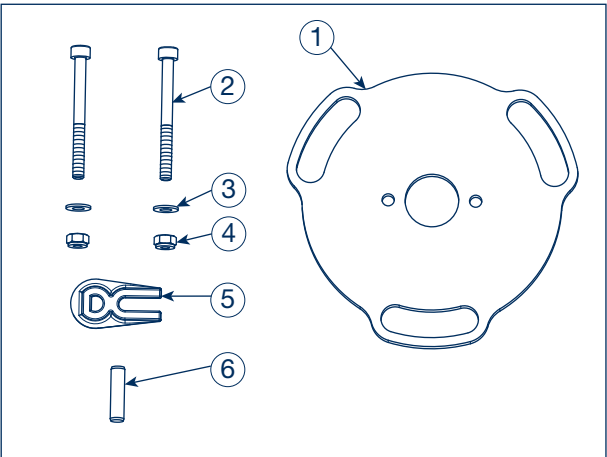


Figure 172

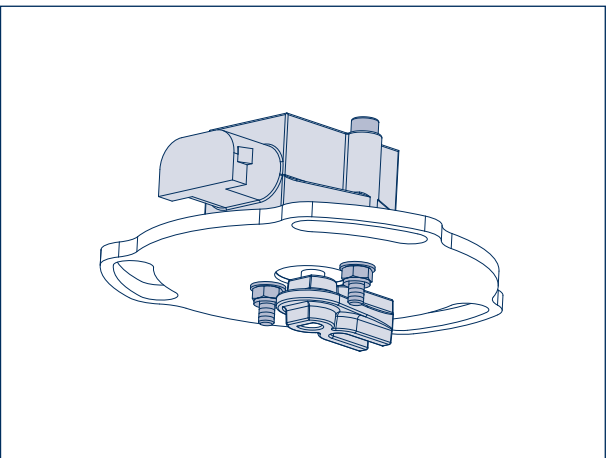


Figure 173

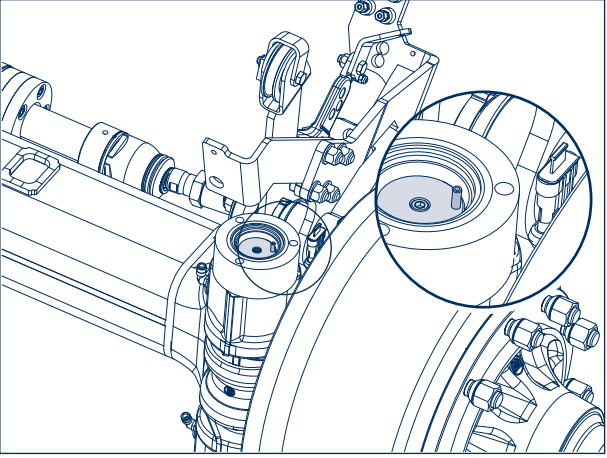


Figure 174

20.3 Elobau Sensor

[4] Place the sensor with the closing plate onto the adaptor in such a way that the dowel pin is inside the fork of the actuator lever.

Repair Guide:

Pay attention to the correct position of the actuator lever. Actuator lever adjusted in such a way that the sensor cable coupling stands opposite (180°) to the blind hole.

Note:

When mounting, the zero position at the undulating thrust washers is required.

Repair Guide:

Check the correct position of the O-ring, if necessary correct it.

[5] Insert hexagonal bolts with spring washers and tighten them to the specified tightening torque.

Tightening torque

M 10 M = 50 Nm

Repair Guide:

Before tightening the bolts the base position (0°) of the angle sensor has to be adjusted, see page 87.

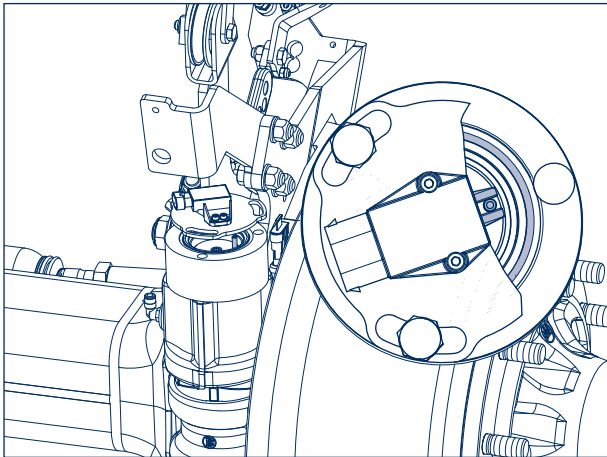


Figure 175

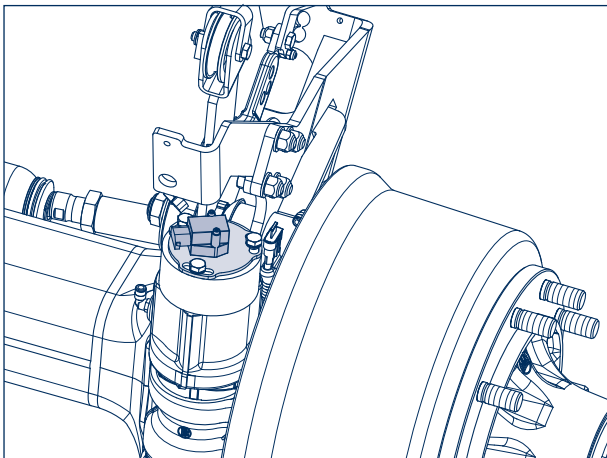


Figure 176

Note:

After dismantling the closure plate the components for the sensor installation can be found.

Component parts for sensor assembly (normal):

Pos.	Designation	Quantity (piece)
1.	Closing plate	1
2.	Bolt (M4x12)	4
3.	Washer (A4)	4
4.	Actuator lever	1
5.	Dowel pin	1

Assembly:

[1] Push the sensor in the correct position on the closing plate. Insert bolts with spring washers and tighten them to the specified tightening torque.

Tightening torque

M 4 M = 2,5 Nm

Repair Guide:

Pay attention to the correct position of the sensor. The connector must be between two holes of the closing plate.

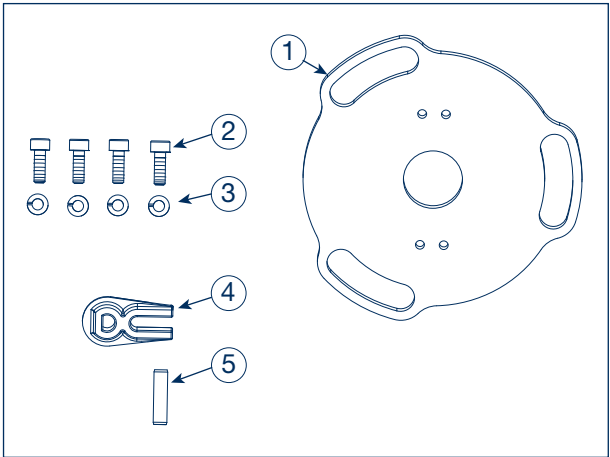


Figure 177

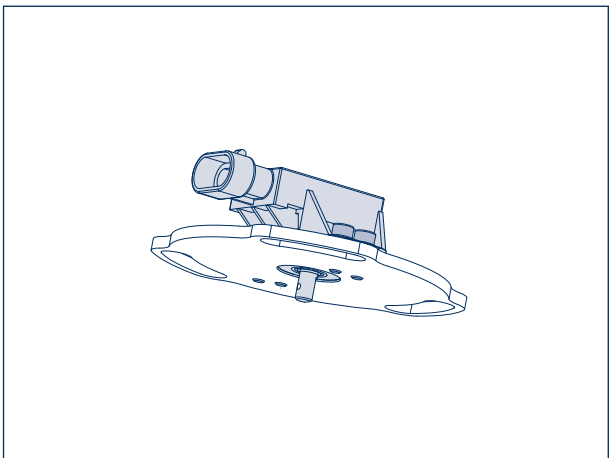


Figure 178

[2] Push up the actuator lever onto the shaft of the sensor in the correct position.

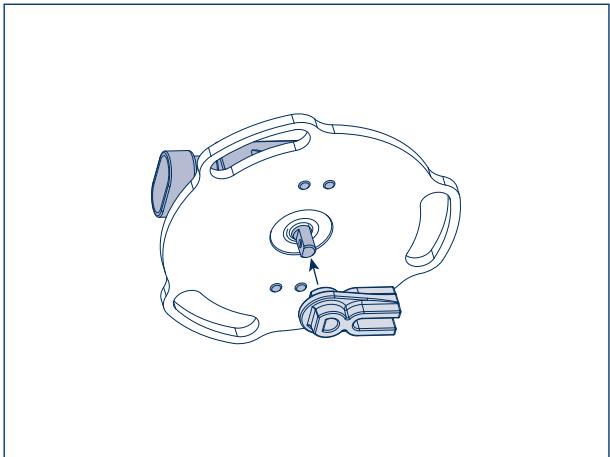


Figure 179

20.3 Elobau Sensor

- [3] Drive the dowel pin (Ø5 x 20) into the hole of the upper disc until it stops.

Repair Guide:

Pay attention to the correct seating of the dowel pin.

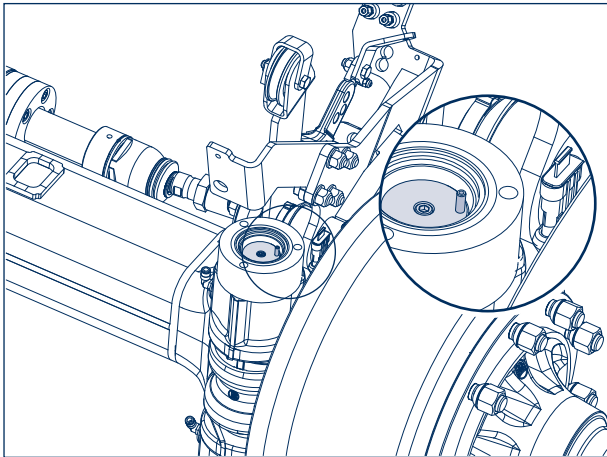


Figure 180

- [4] Place the sensor with the closing plate onto the adaptor in such a way that the dowel pin is inside the fork of the actuator lever.

Repair Guide:

Pay attention to the correct position of the actuator lever. Actuator lever adjusted in such a way that the sensor cable coupling stands opposite (180°) to the blind hole.

Note:

When mounting, the zero position at the undulating thrust washers is required.

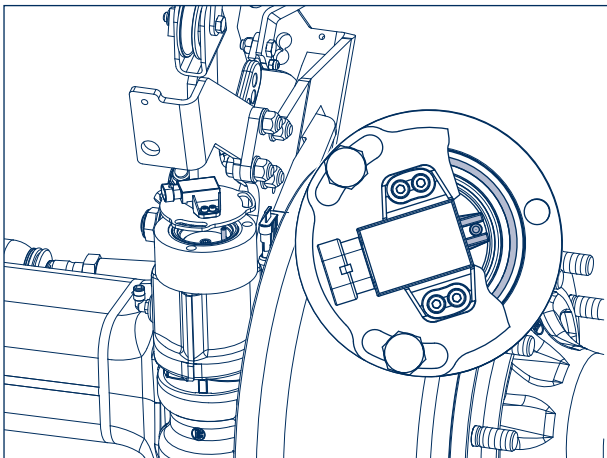


Figure 181

Repair Guide:

Check the correct position of the O-ring, if necessary correct it.

- [5] Insert hexagonal bolts with spring washers and tighten them to the specified tightening torque.

Tightening torque

M 10 M = 50 Nm

Repair Guide:

Before tightening the bolts the base position (0°) of the angle sensor has to be adjusted, see page 87.

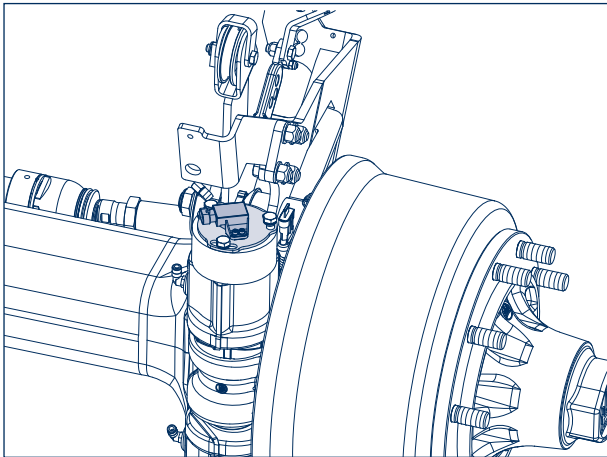


Figure 182

Setting or Readjustment 20.4

Note:

Steering angle sensor is set at the factory. After the first installation of the steering axle the sensor must be checked, if necessary readjust.

- [1] Raise the vehicle and remove the wheels.

Note:

Steering angle sensor is installed as standard on the left side of the steering axle.

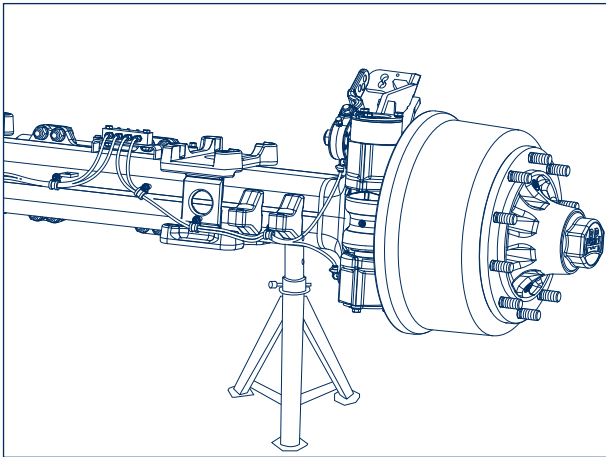


Figure 183

- [2] Loosen the locking screws (WAF 17) of the locking plate until the plate can be rotated with the sensor.

Note:

Before adjusting the steering angle sensor, the steering axle should be straight ahead position, then must be adjusted and fixed the steering angle sensor.

See Chapter 23.

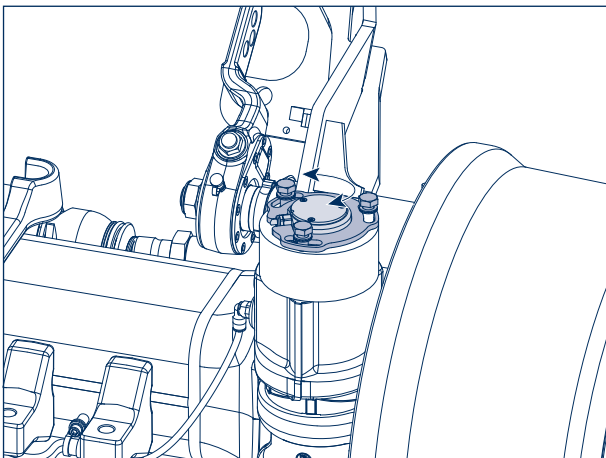


Figure 184

- [3] Connect the measuring instrument (voltmeter) to the sensor.

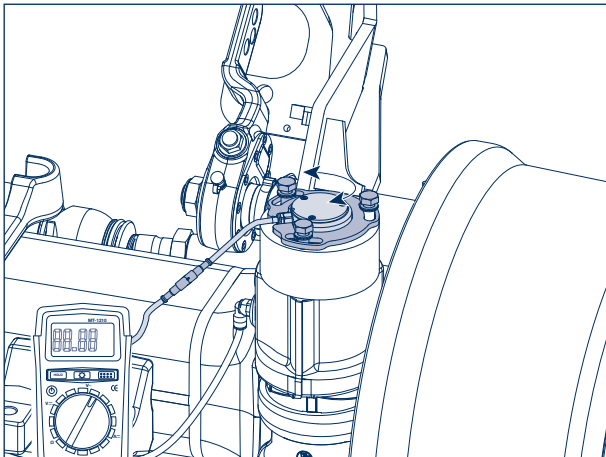


Figure 185

20.4 Setting or Readjustment

[4] Setting or readjust the sensor. Set the sensor with the locking plate by turning clockwise or counter-clockwise.

i

Note for Mobil Elektronik Sensor:

At 0° position of the sensor, should be measured 2,5 V value.
Tolerance: +/- 0,1 V.

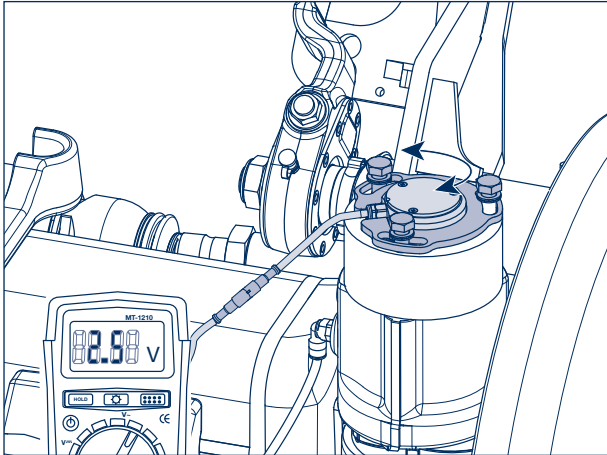


Figure 186

i

Note for Elobau Sensor:

To set the sensor correctly, the voltage value must be measured.
For example: when $R = 220\text{ Ohm}$
($U = 12\text{ mA (0,012 A)} \times 220\text{ Ohm} = 2,64\text{ V}$).
At 0° position of the sensor, should be measured 2,64 V value.
Tolerance: +/- 0,1 V.

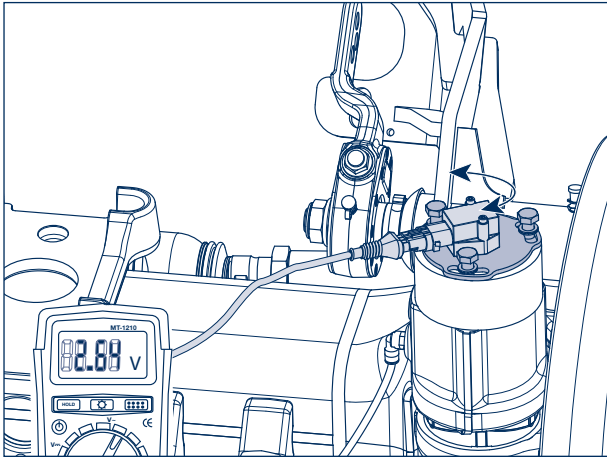
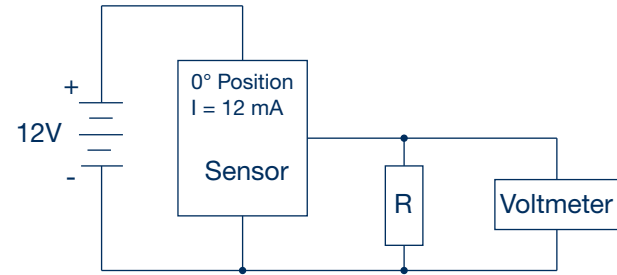


Figure 187



[5] Tighten the locking screws with the prescribed tightening torque.

Tightening torque

M 10 M = 50 Nm

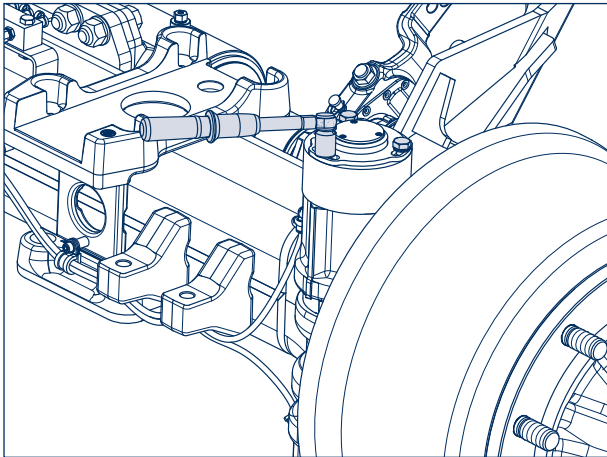


Figure 188



21 Combined Steering Cylinder

⦿ BPW-Nr.: 05.444.50.73.0



Note:

The work is done with the axle removed from vehicle. The work can be performed under the vehicle after the wheels are removed.



Repair Guide:

When mounting, the cylinder must not be under pressure!

Dismantling:

[1] Loosen the inlet coupler (1) of the cylinder.



Repair Guide:

Depending on the version, the cylinder can be assembled as self- or forced steering system.

[2] Disassemble the tie rod.

👉 See Chapter 17.

[3] Loosen the threaded stop sleeves.

👉 See Chapter 18.

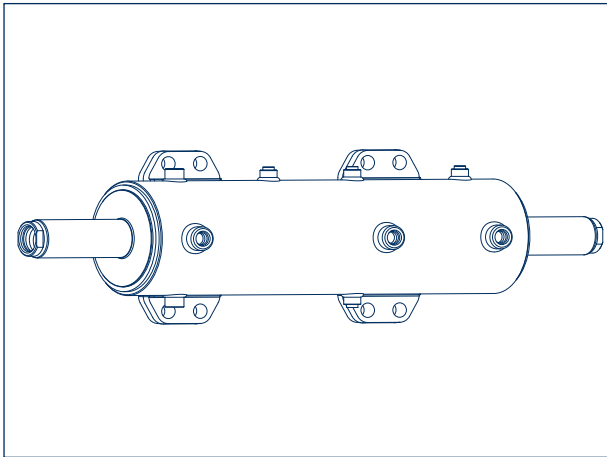


Figure 189

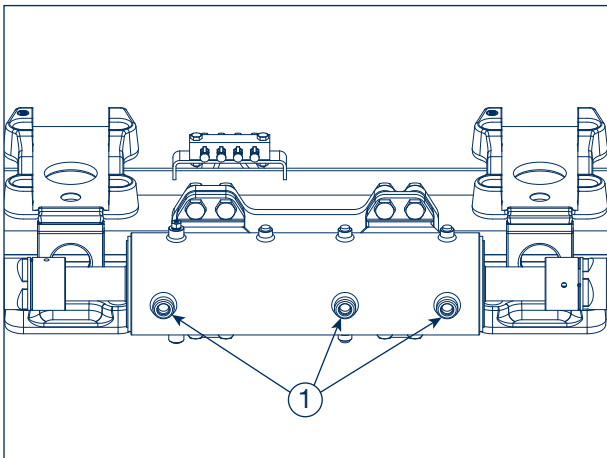


Figure 190

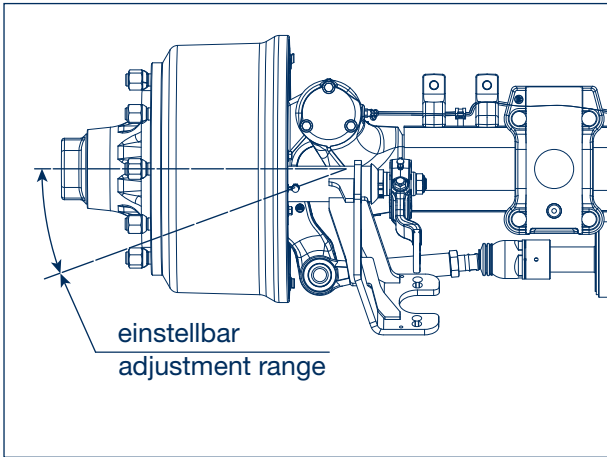


Figure 191

[4] Remove the axial ball joint (6) from the piston rod.



Repair Guide:

When loosening the axial ball joint (WAF 55) from the piston rod, hold the piston rod with a wrench (WAF 36).

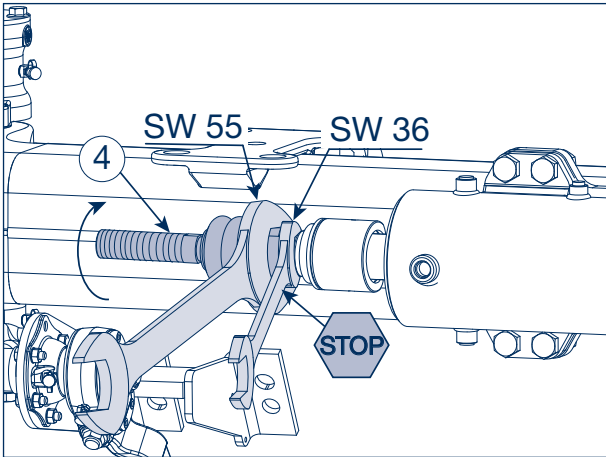


Figure 192

[5] Dismantle the locking screws (7) from the steering cylinder (8).



Repair Guide:

The steering cylinder is fitted by pins on the holder. Cylinder must be secured against falling down.

[6] Remove the cylinder.

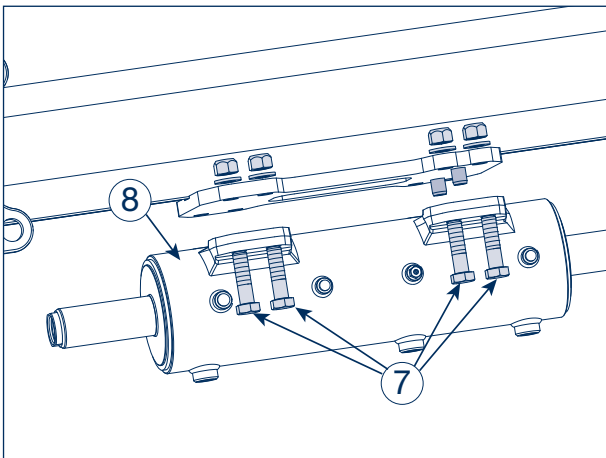


Figure 193

21 Combined Steering Cylinder

Installation:

- [1] For cylinder assembly both pins (1) are driven into the holder in flush-mounted position.
- [2] Install the cylinder in the correct position via locating pin; insert the screws (2) and lock nuts (3) and tighten them to the specified torque.

Tightening torque

M 16 M = 230 Nm

- [3] Install the inlet couplers according to the self- or forced steering system.

👉 See Chapter 22.

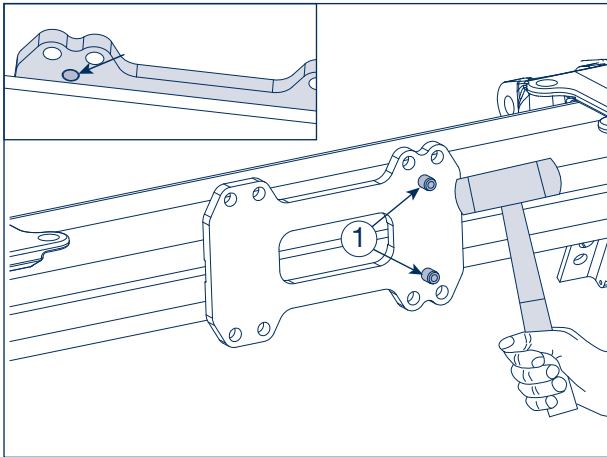


Figure 194



Note:
After replacement of the steering cylinder or disassembly of the hydraulic connecting fittings the steering system has to be bled.

- [4] Push up the threaded stop sleeve onto the piston rod.
- [5] Screw up the axial joint (4) in the piston rod and tighten with the specified tightening torque.

Tightening torque

M = 500 Nm

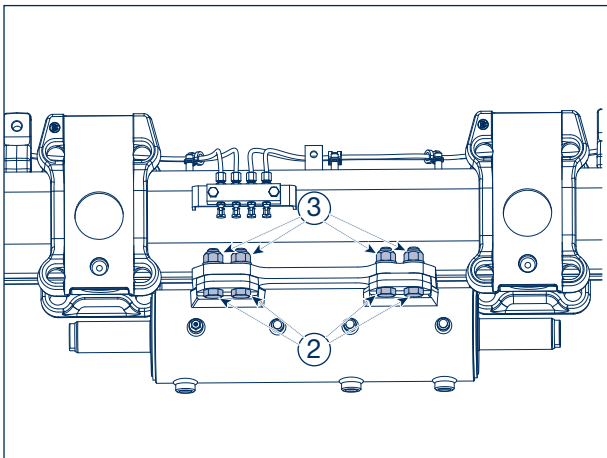


Figure 195



Repair Guide:
Tighten the axial ball joint (WAF 55) into the piston rod while holding the piston rod with a wrench (WAF 36).

- [6] Install the threaded stop sleeve.
👉 See Chapter 18.
- [7] Install the tie rod.
👉 See Chapter 17.

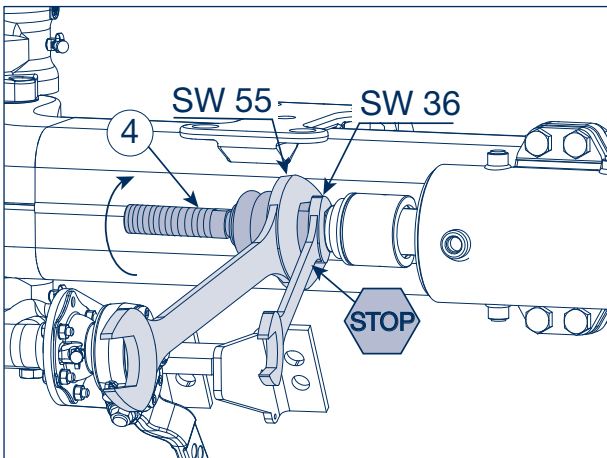


Figure 196

Operating Instructions for Combined Cylinder 22

⦿ BPW No.: 05.444.50.73.0



Note:
After replacement of the steering cylinder or disassembly of the hydraulic connecting fittings the steering system has to be bled.

In case of self-steering:

- [1] Cylinder ports (1) and (3) are connected.
- [2] Cylinder port (2) is fitted with a screw plug.
- [3] After filling with oil the system needs to be vented with (4) and (6) bleed screws.
- [4] Move the steering axle to left or right deflected end position, while removing the bleed screw (5) and screw in the ventilating valve (7).
- [5] Tighten the ventilating valve with 20 Nm tightening torque.



Repair Guide:
Before screwing the ventilating valve the cylinder should be filled with 50 ml hydraulic oil.

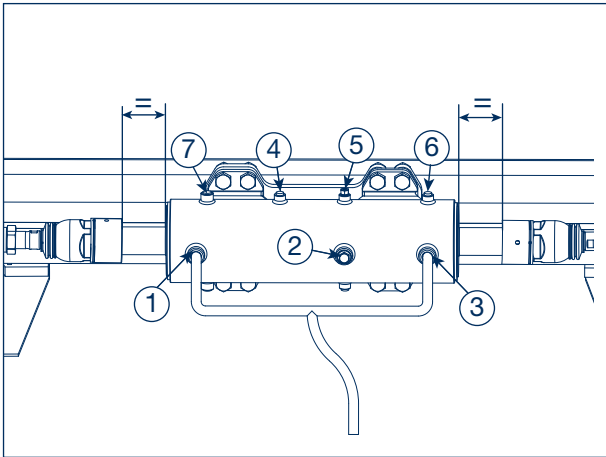


Figure 197

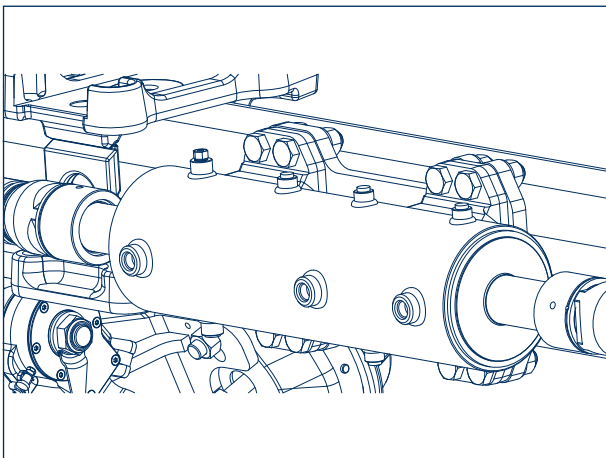


Figure 198



Repair Guide:
Before relocating the ventilating valve have to be removed the pre-assembled O-rings (two pieces). The ventilation valve must be screwed in altogether with the sealing ring.

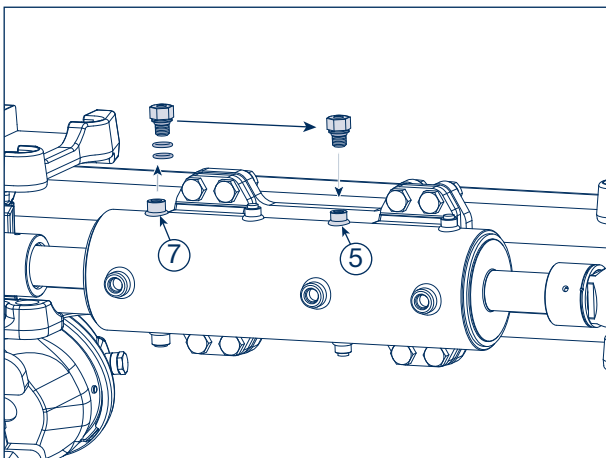


Figure 199

22 Operating Instructions for Combined Cylinder

In case of forced steering:

- [1] At the left side cylinder port (1) is the oil supply.
- [2] Cylinder ports (2) and (3) are connected with each other.



Note:

The cylinder ports (2) and (3) have to be joined with each other as shown in the picture.



Note:

After filling with oil the system needs to be vented with bleed screws (4,5,6).

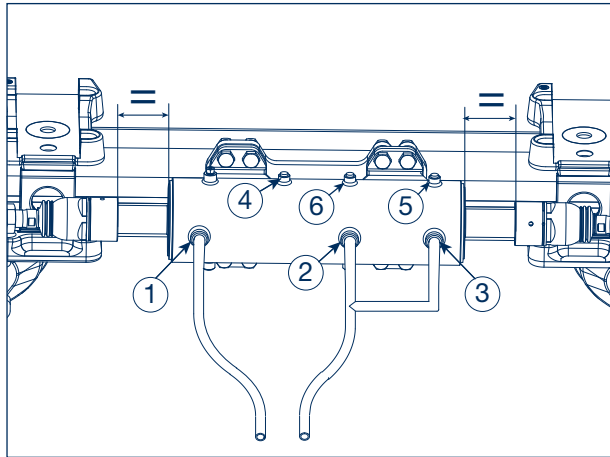


Figure 200



23 Toe-in setting

Note:



The work is done with the axle removed from vehicle. The work can be performed under the vehicle after the wheels are removed. For measurement of track values it is absolutely essential for the thrust washers to be in their zero position.

Note:



When setting or measuring the steering axle, the same length must be adjusted and fastened of the piston rod on both sides.

Measurement:

- [1] Screw the measuring tools onto a wheel bolt on both sides of the axle.
- See Page 15.
- [2] Move both measuring tools horizontally forwards (arrow). Measure and note the distance (**V**) from measuring tool to measuring tool.
- [3] Make a similar measurement behind the axle. Note linear dimension (**H**).
- [4] Insert both measured distance values (**V**) and (**H**) into the following formula
(Axle is in the direction of travel).
 $GS(H)LL: 3 \leq (H - V) \leq 6$
- [5] Check whether the determined toe-in and toe-out values are within the specified tolerance values.

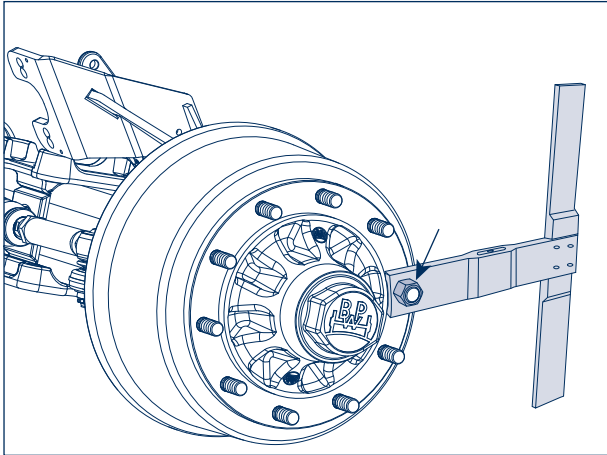


Figure 201

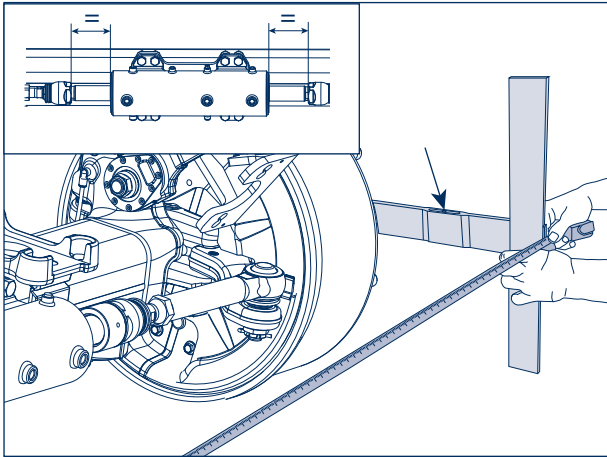


Figure 202

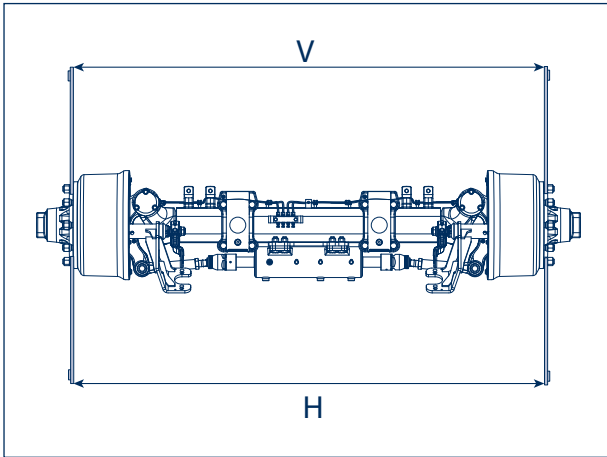


Figure 203

Note:



The toe-in and toe-out values must be adjusted slightly. When setting the steering axle, the same length must be adjusted and fastened of the piston rod on both sides.

- [1] Loosen the locknut (WAF 41) of the tie rod
- [2] At the lateral toe-in setting turn the threaded bolt with the open-end wrench (WAF 27) of the axial ball joint on both sides of the axle.
- [3] Check the distances in front and behind the axle again if necessary.

Straight-ahead position:

- [4] To achieve the corresponding straight-ahead (travel) position place the measuring tools again and carry out the measurement horizontally and diagonally on both sides.
- [5] Measure and note the distances **D1** and **D2** from measuring tool to measuring tool. Insert both measured distance values D1 and D2 into the following formula.
- [6] Check whether the determined values are within the specified tolerance values.
 $GS(H)LL: 0 \leq (D1-D2) \leq 2$

Repair Guide:



If the differences are greater, check the zero position of the thrust washers.

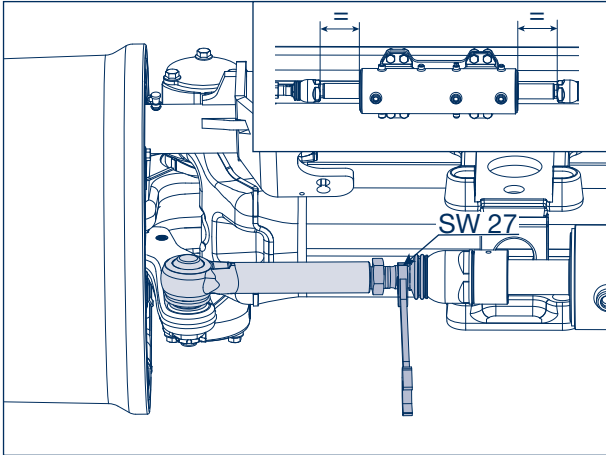


Figure 204

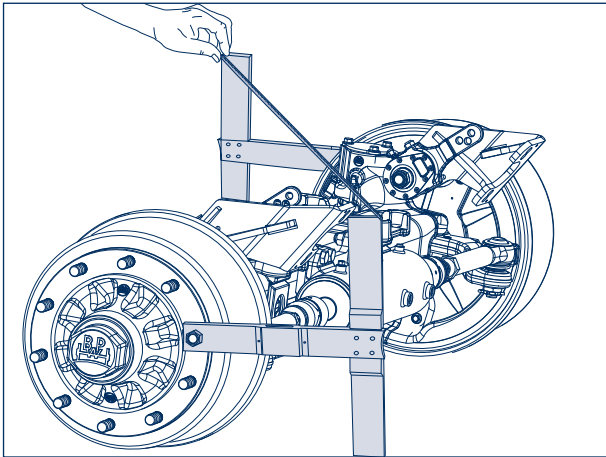


Figure 205

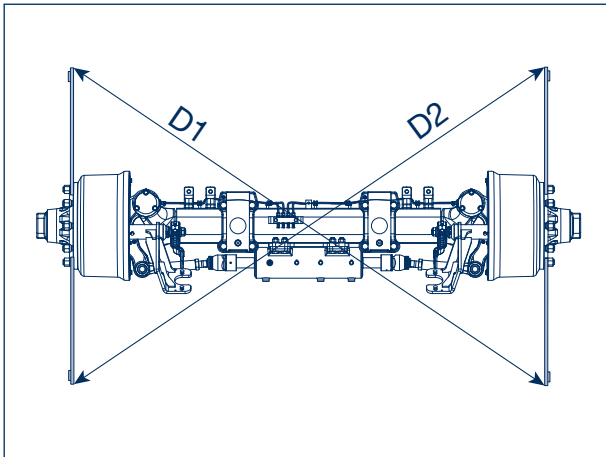


Figure 206

23 Toe-in setting

Fixing tracking values:

- [1] After setting the track values tighten the locknut to the specified tightening torque of 410 Nm.



Repair Guide:

When tightening the lock nut (WAF 41), hold in the tie rod with an open-ended spanner (WAF 36).

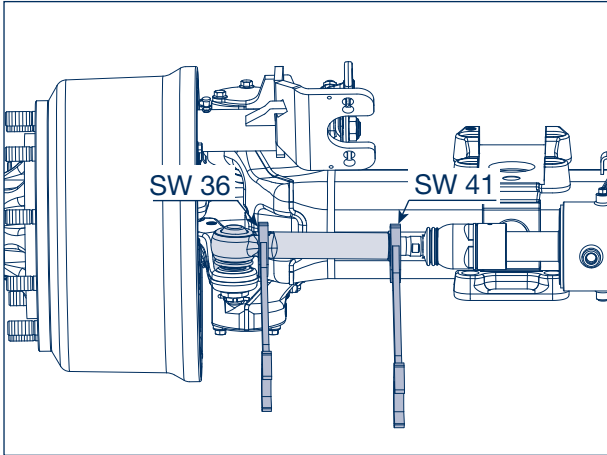


Figure 207

Notes



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BPW is a globally leading manufacturer of intelligent running gear systems for trailers and semi-trailers. As an international mobility and system partner, we offer a wide range of solutions for the transport industry from a single source, from axle to suspension and brake to user-friendly telematics applications. We thereby ensure outstanding transparency in loading and transport processes and facilitate efficient fleet management. Today, the well-established brand represents an international corporation with a wide product and service portfolio for the commercial vehicle industry. Offering running gear systems, telematics, lighting systems, composite solutions and trailer superstructures, BPW is the right system partner for automotive manufacturers.

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Your partner on the path to economic viability



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