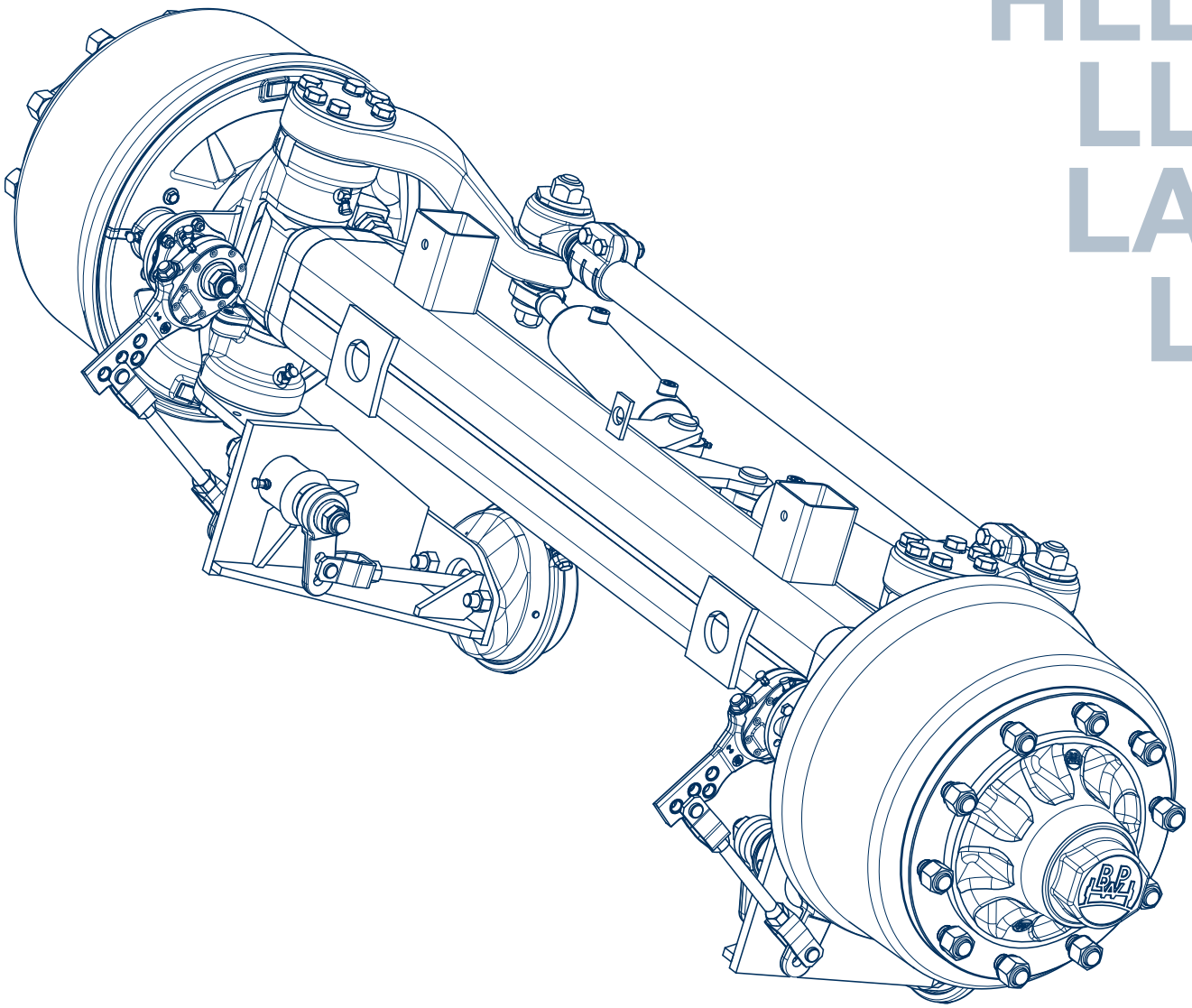
HLL
LL
LA
L



Workshop Manual

Agricultural Steering Axles

BPW-WH-Agrar 55021601e

we think transport

BPW agrarian steering axles with drum brake
Steering axle series L, LA, LL, HLL

Valid: 25.03.2021

Table of Contents

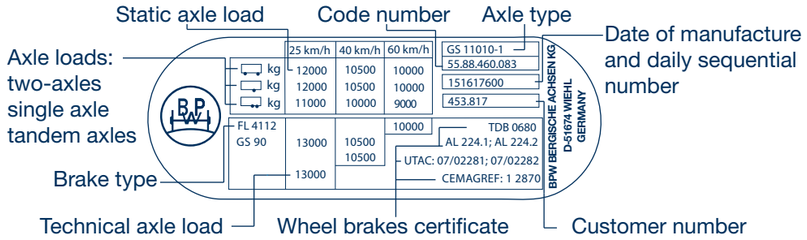
1 Product identification

1.1 BPW Type plate for agricultural axles

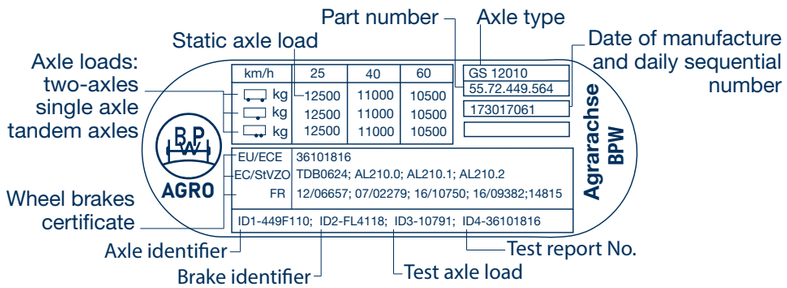
Every BPW axle has a type plate. It is affixed to the centre of the axle beam - opposite to the travel direction.

Data on the type plate can be used to define the required spare parts or - after an accident, for instance - the complete axle.

Type plate braked axle old version



Type plate braked axle new version from May 2018



Type designation and number key 1.2

Type designation axles: Example

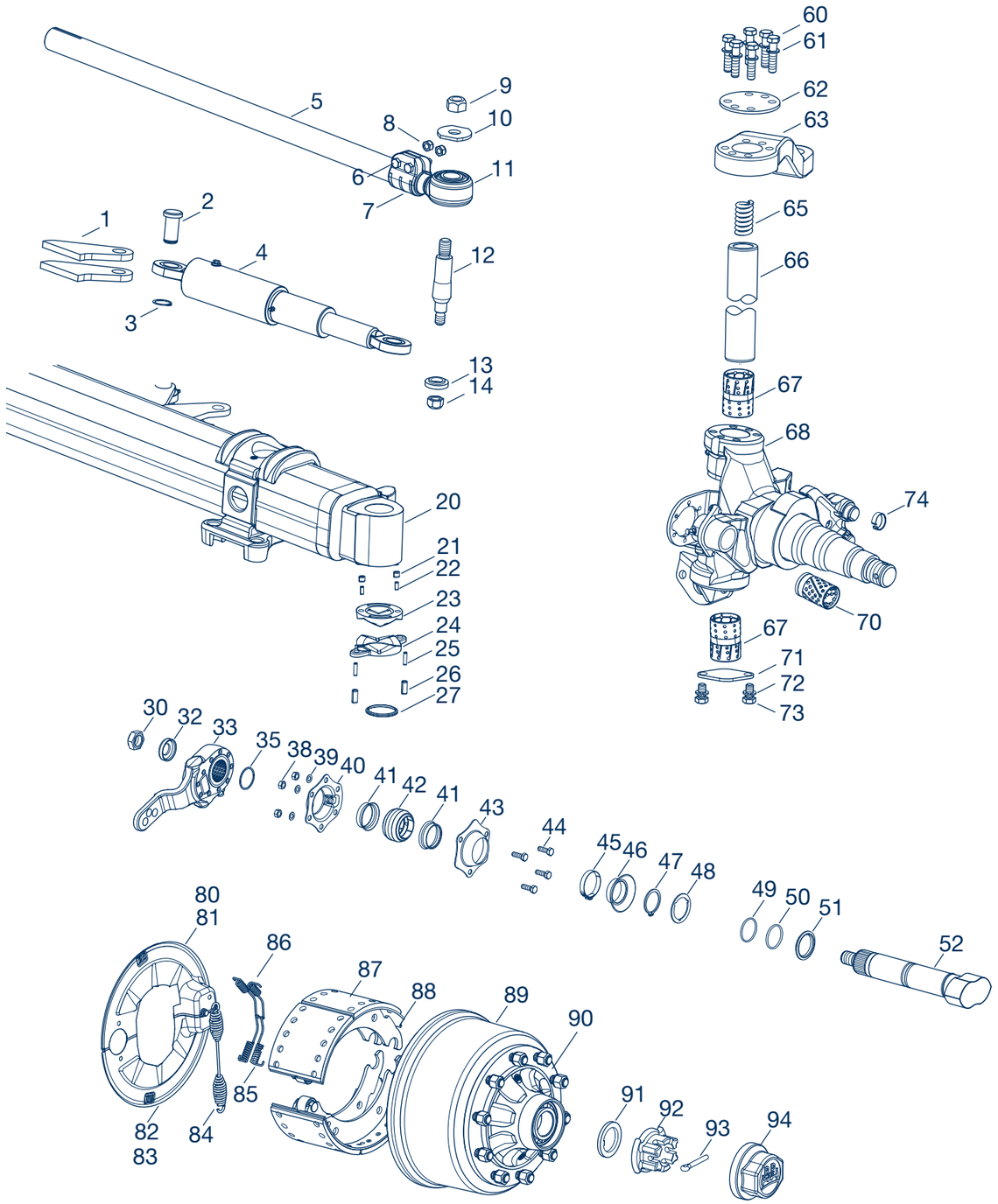
G	S		LA	11010	-1	
G						BPW trailer axle for agricultural vehicles
	S					Single wheels, wheels without offset
		N				Braked axle (max. speed: 80 km/h)
		ST				Axle stub
			LA			Unit steering axle, type LA
			LL			Unit steering axle type LL
			HLL			Unit steering axle type LL for underneath brake cylinders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

Code number key, axles: Example

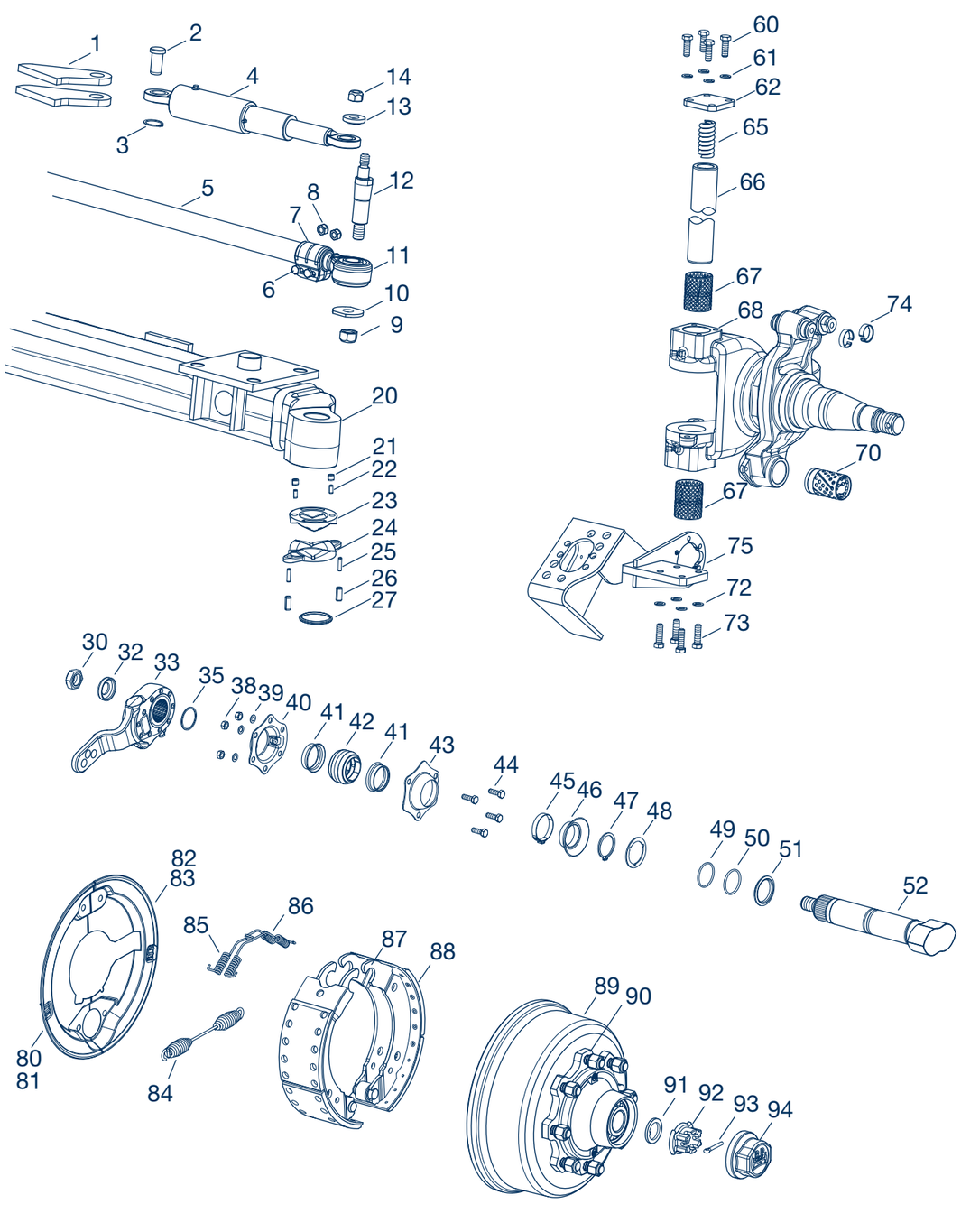
36.	74.	449.	081	
26. or **36.**				Agricultural trailer axle, steered
55**.**				Agricultural trailer axle, braked and unbraked
58.				Agricultural axle stub, braked and unbraked
	53.			GS 3606; Bearings: 30206-30209
	56.			GS 4006; Bearings: 32207-30210
	62.			GS 5006; Bearings: 32207-32211
	63.			GS 5506; Bearings: 32207-32013x
	66.			GS 8010-2; Bearings: 32310A-32215
	67.			GS 7006; GS 7008; Bearings: 30210-32014x
	70.			GS 8008-3; GS 8010-3; Bearings: 32213-32215
	72/77.			GS 12010; GSN 12010; Bearings: 33213-33118
	76.			GS 9010; Bearings: 32213-32215
	74.			GS 14010; Bearings: 33215-32219
	88/82**.**			GS 11008-1; GS 11010-1; Bearings: 32310A-33116
		001.		Without brake
		356.		Wedge - type brake S 3008 RA (3081)
		375.		Wedge - type brake S 3006-7 RASK
		376.		Wedge - type brake S 3006-7 SK
		381.		Wedge - type brake S 3006-7 RAZG
		384.		Wedge - type brake S 3006-7 ZG
		443.		Cam brake N 3006-3
		447.		Cam brake N 4408-3
		448.		Cam brake N 4012-3
		454.		Cam brake N 3108-3
		449.		Wing cam brake FL 4118
		460**.**		Wing cam brake FL 4112
		461.		Cam brake N 4008-4
		462.		Cam brake N 4012-4
		463.		Cam brake N 3411-1
		464.		Wing cam brake FL 4118 in case of hydraulic drive
		744.		S-Cam brake SN 4220
			001 999	Serial number

2 Exploded view

2.1 Steering axle series L

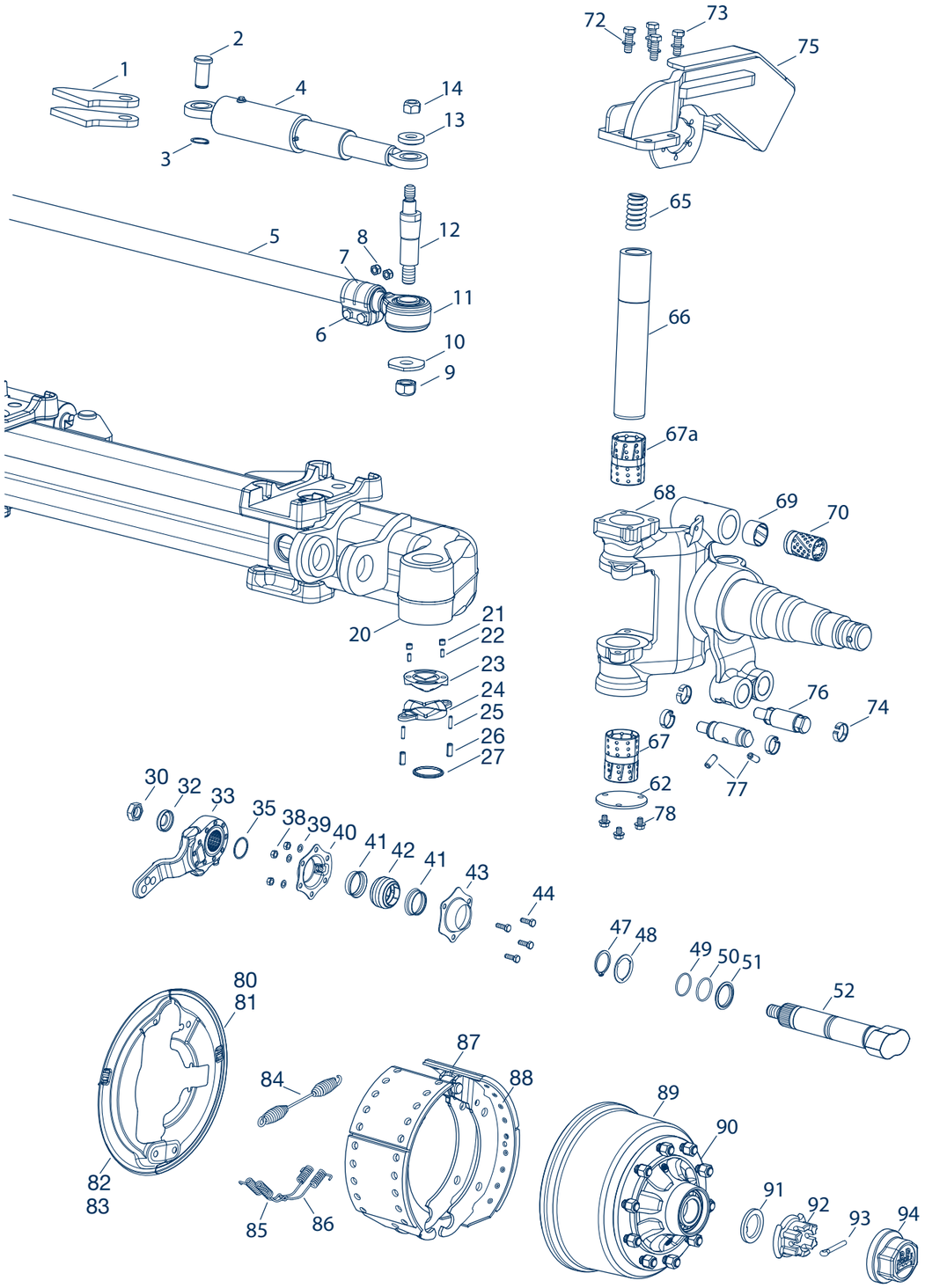


Steering axle series LA 2.2

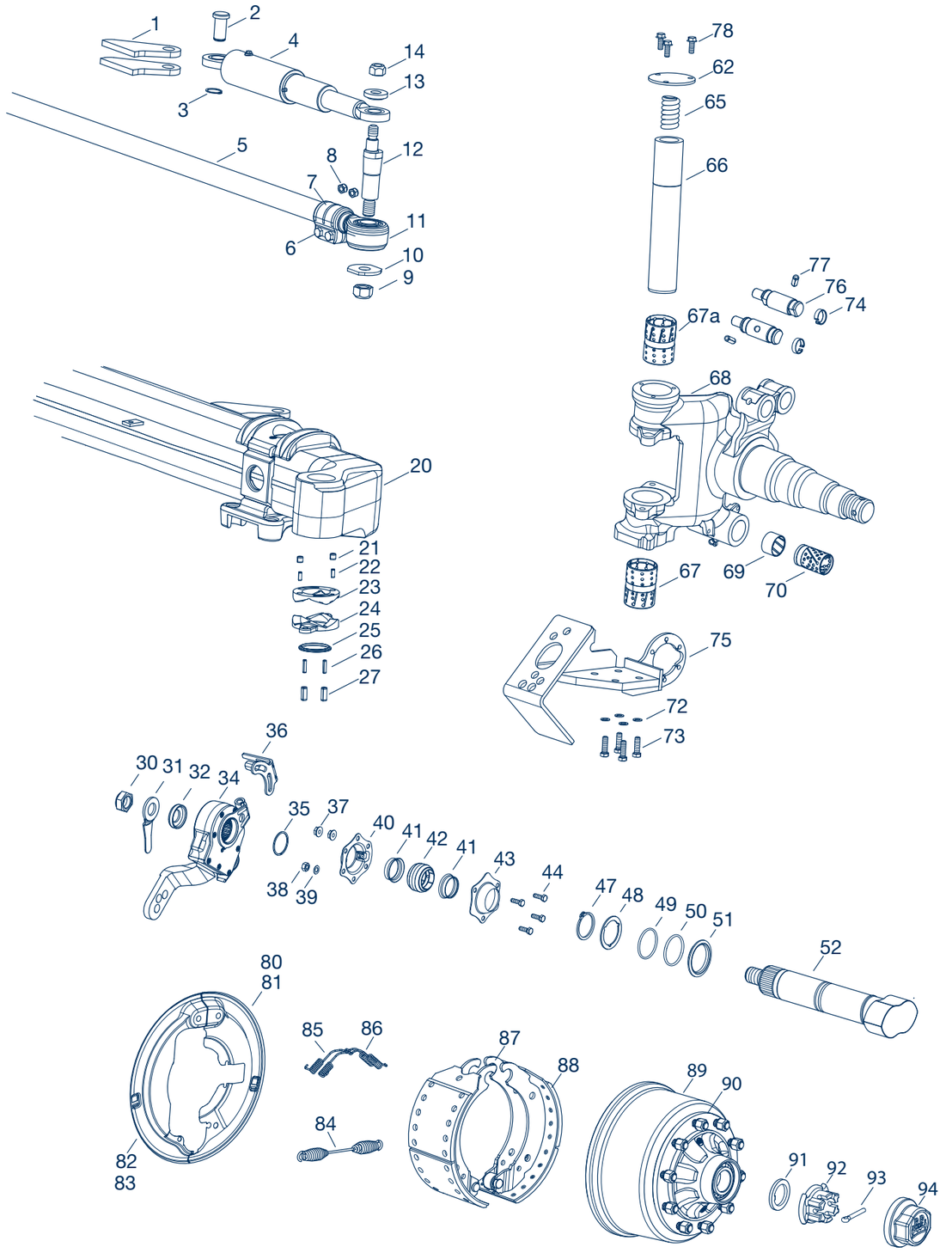


2 Exploded view

2.3 Steering axle series LL



Steering axle series HLL 2.4



2 Exploded view

2.5 Designation and specification of the components

Pos.	Name	Pos.	Name
1	Hydraulic cylinder bracket	48	Sealing ring
2	Pivot	49	O-Ring
3	Circlip	50	O-Ring
4	Hydraulic cylinder	51	Ring
5	Cross tube	52	Brake camshaft
6	Bolt		
7	Clamp	60	Fastening bolt
8	Locknut / Clamp	61	Spring washer
9	Locknut / Threaded bolt	62	Closing plate
10	Flat washer	63	Tie rod arm fixation by screw
11	Tie rod end / Eye ball joint	64	Spacer
12	Threaded bolt	65	Pressure spring
13	Ring	66	King pin
14	Locknut / Threaded bolt	67a	Bushing
		67	Bushing
20	Axle beam end	68	Steering knuckle
21	Roll pin	69	Bushing
22	Roll pin	70	Bushing
23	Thrust washer claw shaped (upper)	71	Closing plate
24	Thrust washer claw shaped (lower)	72	Spring washer
25	Roll pin	73	Fastening bolt
26	Roll pin	74	Hooked spring ring
27	Gasket	75	Welded brake booster bracket
		76	Brake anchor pin
30	Lock nut	77	Roll pin
31	Indicator lever	78	Fastening bolt
32	Disc		
33	Manual Slack Adjuster	80	Dust cover
34	Automatic Slack Adjuster	81	Dust cover
35	Retaining ring	82	Dust cover
36	Shaped plate	83	Dust cover
37	Flange nut	84	Brake return spring
38	Hexagon nut	85	Tension spring (Hook)
39	Spring washer	86	Tension spring (Eye)
40	Bearing box for grease nipple	87	Brake lining
41	Sealing ring	88	Brake shoe
42	Spherical bearing	89	Brake drum
43	Bearing box	90	Hub
44	Hexagon bolt	91	Tongued washer
45	Locking ring	92	Axle nut
46	Rubber sealing cap	93	Split pin
47	Circlip	94	Hub cap

Fasteners torque values 3

Description	Thread / Wrench size	Torque values
Fixing screw of the brake cylinder or base plate for king pin bearing	M 10 - 8.8 / WS 13	M = 38 Nm
	M 10 - 10.9 / WS 13	M = 53 Nm
	M 12 - 8.8 / WS 19	M = 66 Nm
	M 14 - 8.8 / WS 21	M = 105 Nm
	M 14 - 10.9 / WS 21	M = 148 Nm
	M 16 - 8.8 / WS 24	M = 163 Nm
	M 16 - 10.9 / WS 24	M = 230 Nm
Steering angle stop screw	M 20 - 8.8 / WS 30	M = 185 Nm
	M 24 - 8.8 / WS 36	M = 200 Nm
Locking and forced steering cylinder for steering axle unit		
Locking nut for locking and forced steering cylinder	M 20 / WS 27	M = 320 Nm
Tie rod for steering axle unit		
Locking nut of the tie rod	M 24 / WS 36	M = 550 Nm
Hexagon bolts of the clamps	M 12 x 1,5 - 8.8 / WS 19	M = 86 Nm
Steering axle with combined cylinder		
Fixing screws of the combined cylinder	M 16 / WS 24	M = 230 Nm
Ventilating valve	M 8 x 1 / WS 12	M = 20 Nm
Axial ball joint	M 30 x 1,5 / WS 55	M = 500 Nm
Tie rod versions for single-cylinder steering axle **Tie rod with mounted axial joint /A/**		
Axial ball joint	M 30 x 2 / WS 36	M = 755 Nm
Locking nut of the tie rod	M 28 x 1,5 / WS 41	M = 410 Nm
Tie rod with integrated axial joint /B/		
Locking nut of the tie rod	M 28 x 1,5 / WS 41	M = 410 Nm
Axial joint with locknut /C/		
Locking nut of the axial joint	M 30 x 2 / WS 46	M = 300 Nm
Locking nut of the clamp	M 12 x 1,5 - 8.8 / WS 19	M = 86 Nm
Ball joint with locking nut /D/		
Locking nut of the ball joint	M 30 x 1,5 / WS 46	M = 630 Nm
Castle nut of the ball joint	M 30 x 1,5 / WS 46	M = 500 Nm
Locking nut of the clamp	M 12 x 1,5 - 8.8 /WS 19	M = 86 Nm
Tie rod with integrated ball joint /E/		
Castle nut of the ball joint	M 30 x 1,5 / WS 46	M = 500 Nm
Locking nut of the tie rod	M 28 x 1,5 / WS 41	M = 410 Nm
Steering axle with forced steering cylinder		
Fixing screws of the forced cylinder	M 14 - 10.9 / WS 21	M = 100 Nm
	M 12 - 8.8 / WS 19	M = 66 Nm
	M 10 - 8.8 / WS 13	M = 38 Nm
Axial ball joint	M 30 x 1,5 / WS 55	M = 500 Nm
Shock absorber		
Locking nut of the clamp	M 12 x 1,5 - 8.8 / WS 19	M = 86 Nm
Fixing screws of the shock absorber	M 12 / WS 19	M = 66 Nm
Steering axle with locking cylinder		
Fixing screws of the tab washer	M 8 - 8.8 / WS 13	M = 19 Nm
Tie rod for locking cylinder at GSLA - axle	M 16 - 8.8 / WS 24	M = 163 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 googles, 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 vice.
- 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 information 4.2

- 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).

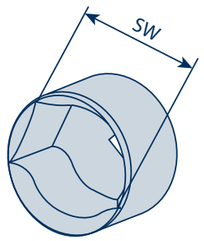
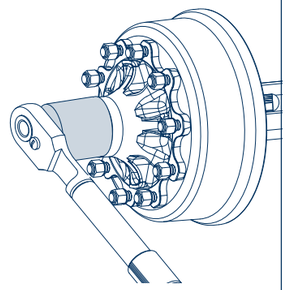
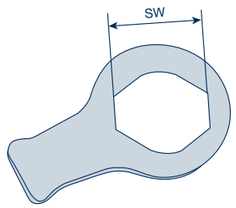
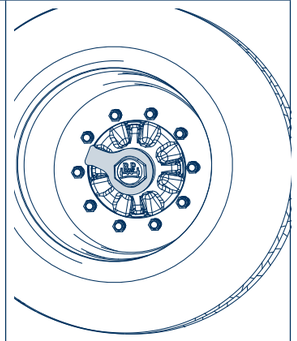
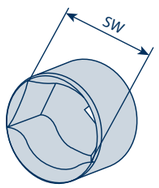
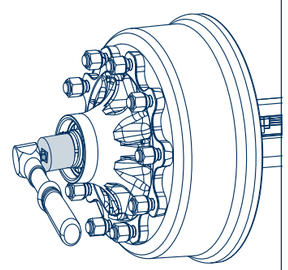
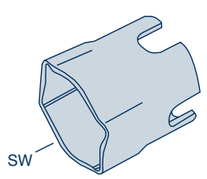
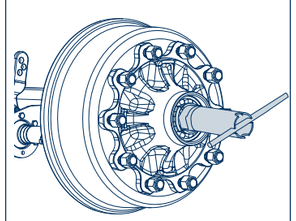
Warning ! **Possible** potential danger of serious or fatal injury (severe injury or death).

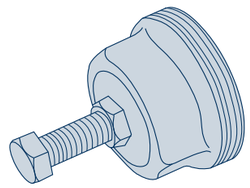
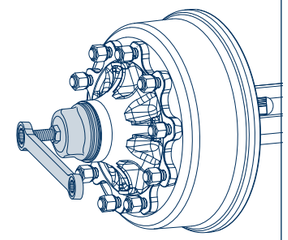
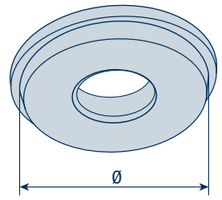
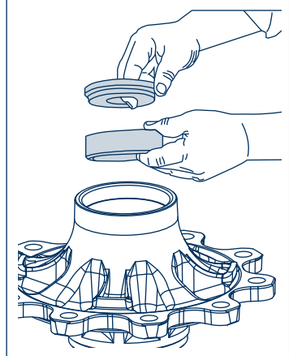
Caution ! **Possible** dangerous situation (slight injury or damage to property).

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

Note ! Application hints and especially useful information.

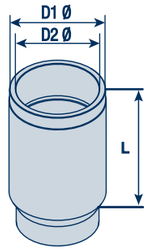
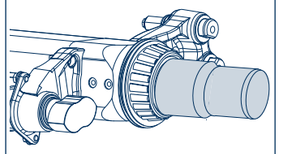
5 Special tools

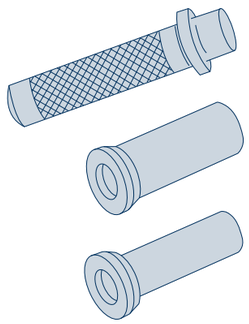
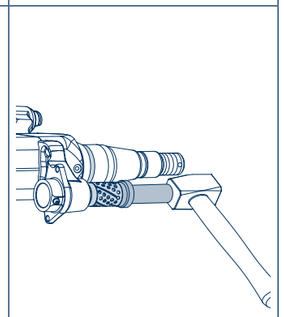
No.	Description	Illustration of tool	Tool in operation
1	Sockets for hub caps (BPW shape) BPW code number: **03.364.29.02.0** WS 95 **03.364.29.03.0** WS 110		
2	Ring spanner for hub caps (flat shape / BPW shape) BPW code number: **03.339.04.03.0** WS 95 **03.339.05.04.0** WS 110 **03.339.05.02.0** WS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

No.	Description	Illustration of tool	Tool in operation
5	Hub puller BPW code number: **05.012.26.03.0** WS 95 M 115 x 2 **05.012.27.05.0** WS 110 M 125 x 2 **05.012.28.03.0** WS 120 M 150 x 2 Order bolt separately BPW code number: **02.5026.70.80** M 22 x 100		
6	Press tools for inserting the outer rings of roller bearings **Roller bearing** / **Ø** / **BPW code 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		

5 Special tools

<table>
<tr><th>No.</th><th>Description</th><th>Illustration of tool</th><th>Tool in operation</th></tr>
<tr><td>7</td><td>Impact tool for bearing

<table><tr><th rowspan="2">Type of bearing</th><th colspan="3">Tool</th></tr><tr><th>D1Ø (mm)</th><th>D2Ø (mm)</th><th>L (mm)</th></tr><tr><td>33213</td><td>76</td><td>66</td><td>130</td></tr><tr><td>33118</td><td>97</td><td>91</td><td>190</td></tr><tr><td>33215</td><td>86</td><td>76</td><td>130</td></tr><tr><td>32219</td><td>102</td><td>96</td><td>200</td></tr><tr><td>32310</td><td>61</td><td>51</td><td>130</td></tr><tr><td>33116</td><td>87</td><td>81</td><td>180</td></tr></table></td><td> 
</td><td>  </td></tr>
<tr><td>8</td><td>Driving mandrel complete

BPW code number: 05.001.04.04.0</td><td>  </td><td>  </td></tr>
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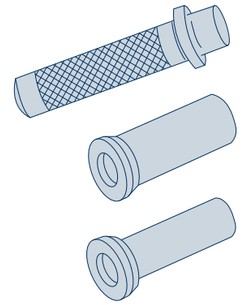
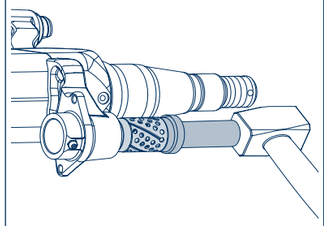
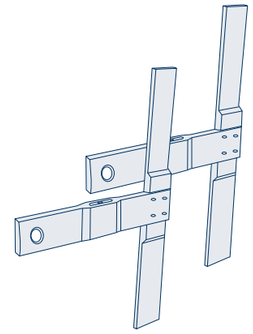
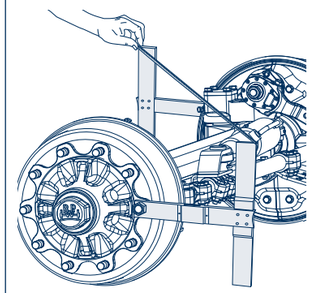
<table>
<tr><th>No.</th><th>Description</th><th>Illustration of tool</th><th>Tool in operation</th></tr>
<tr><td>9</td><td>Pulling device for slack adjusters for GSK / AGS

BPW code number:
02.4306.15.00</td><td>  </td><td>  </td></tr>
<tr><td>10</td><td>Measuring Set (2 pieces) for hub

BPW code number: 99.00.000.7.75</td><td>  </td><td>  </td></tr>
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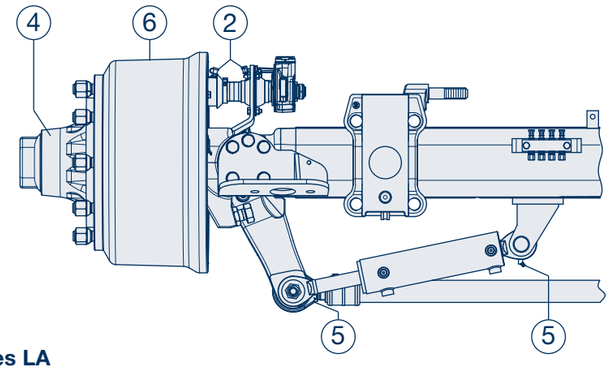
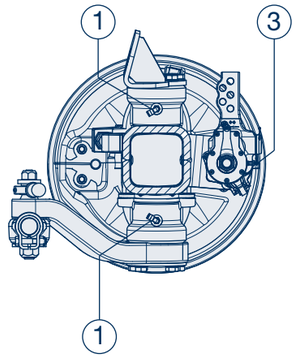
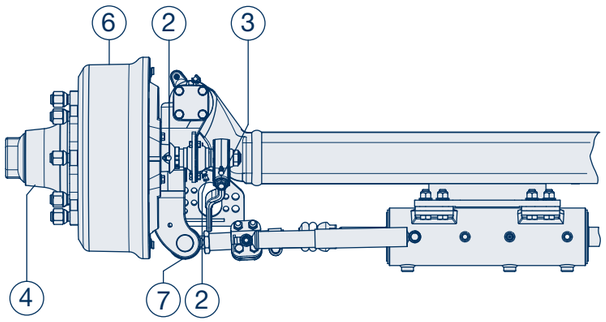
6 Lubrication

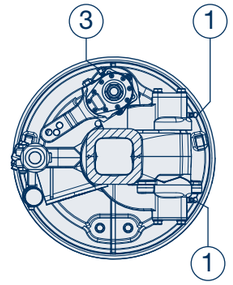
Series L



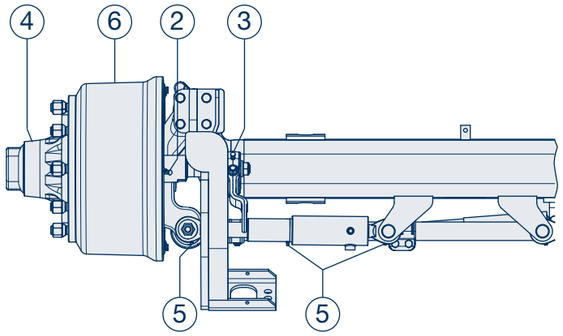


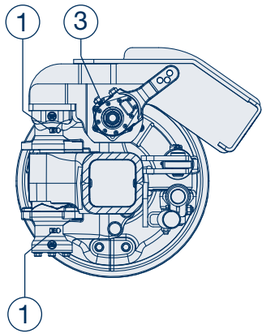
Series LA





Series LL





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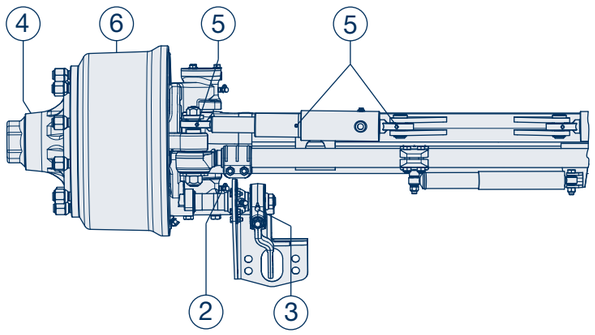
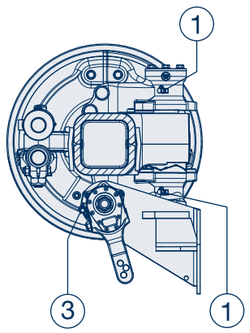




Lubrication

Overview

The detailed description for the listed positions ② ③ ④ ⑥ can be find in the next workshop manuals:

BPW-WH-Agrar 55081702e and
BPW-WH-Agrar 55021702e

○ Lubrication with BPW Special longlife grease ECO-Li-91.

	after the first run under load	after 40 operating hours [1), 2)]	every 200 operating hours, at every brake lining replacement, latest annually [1), 2)]	every 500 operating hours, at every brake lining replacement, latest half-yearly [2)]	every 1000 operating hours, at least annually, at each brake lining change
① Steering knuckle bushing top and bottom		①			
② Brake camshaft bearing outer and inner			②		
③ Manual slack adjuster			③		
Automatic slack adjuster				③	
④ Change wheel hub bearing grease, check taper roller bearings and rotary shaft seal for wear.					④
with CTIS (Central Tire Inflation System)				④	
⑤ Steering cylinder			⑤		
⑥ Brake shoe bearing					⑥
⑦ Tie rod ends at single cylinder steering axle				⑦	

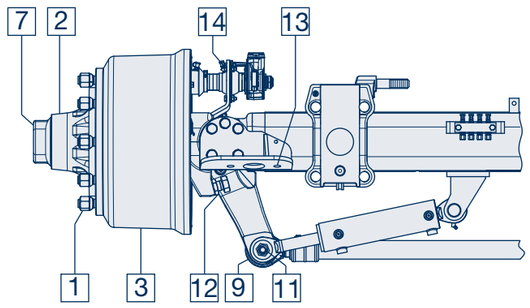
[1)] After a long idle period, prior to initial operation actuate the brake lever and lubricate the brake camshaft bearing.

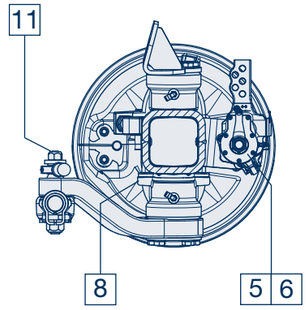
[2)] During heavy use (e.g. Farm Contracting Services) the given lubrication- and maintenance intervals must be abridged.

For the position ① ② ③ ⑤ ⑦ 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!

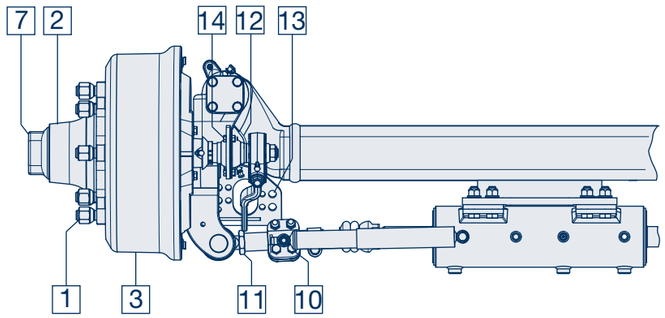
7 Maintenance work

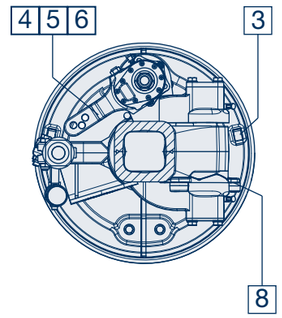
Series L





Series LA





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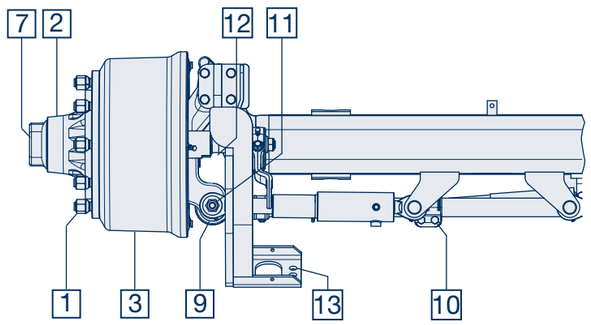
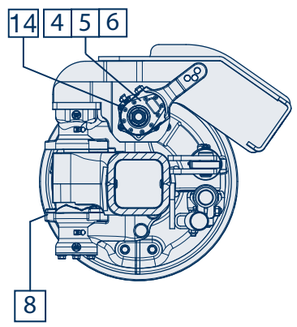
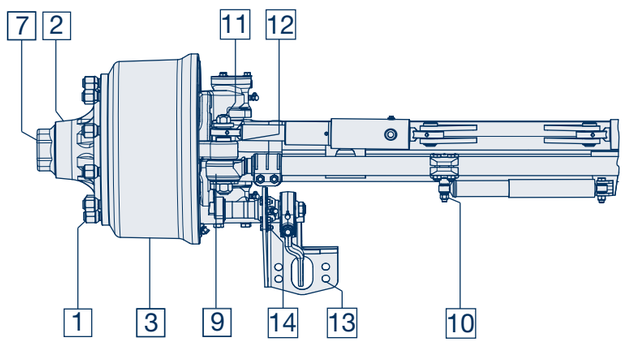
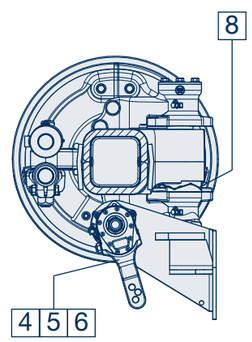




Series HLL





Maintenance

Overview

The detailed description for the listed positions 1 2 3 4 5 6 7 can be find in the next workshop manuals:

BPW-WH-Agrar 55081702e and
BPW-WH-Agrar 55021702e

☐ Maintenance	after the first run under load [1]	after 40 operating hours	every 200 operating hours, at every brake lining replacement, latest annually [1], [2]	every 500 operating hours, at every rake lining replacement, latest half-yearly [2]	every 1000 operating hours, at least annually, at each brake lining change
1 Check wheel nuts for tightness, or re-tighten	1			1	
2 Check wheel hub bearing play, adjust if necessary	2			2	
3 Check brake lining thickness			3		
4 Check brake adjustment on the slack adjuster			4		
5 Check brake adjustment on the automatic slack adjuster				5	
6 Check operation of automatic slack adjuster				6	
7 Check hub cap tightness			7		
8 Check undulating thrust washer and thrust washer					8
9 Check the steel-rubber-steel bushes on the tie rod ends for wear				9	
10 Check shock absorber fixation				10	
11 Check tightening torque of steering elements				11	
12 Check steering angle, adjust if necessary				12	
13 Check tightening torque of brake elements				13	
14 Check the bolts of spherical bearing support plates for tightness, and re-tighten if necessary			14		
- Visual inspection of all component parts and welding seams for damage and wear				-	
○ Check the tyres for uneven wear, adjust the inflation pressure if necessary according to the manufacturer's specification			○		

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

[2] **During heavy use (e.g. Farm Contracting Services) the given lubrication- and maintenance intervals must be abridged.**

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

8 Brake camshaft bearing

Warning!

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

Disassembly:

[1] Remove wheel, hub unit and brake shoes.

[2] Remove the securing nut of the brake camshaft then pull down the slack adjuster.

[3] Take out the circlip (1) from the groove of the brake camshaft and remove it with the sealing ring (2).

[4] Take the brake camshaft out from its bearing.

Note:

Check sealing rings for wear and damage, replace if necessary.

[5] Check bushes in brake anchor plate (bearing clearance max 0.8 mm) and change it if necessary.

Assembly:

GS(H)LL

[1] Drive in new outer bush (1) with a mandrel (BPW No. 05.001.04.04.0) with the ring groove (arrow) pointing towards the grease nipple.

[2] On the outside, the bush must stand back $7.2^{+0,5}$ mm. Apply only mild beats, when driving in and out, apply counter pressure to brake anchor plate if necessary.

[3] Firmly drive the new inner short bush (2) into the brake camshaft house. Work only with mild beats, apply counter pressure to brake anchor plate if necessary.

[4] Keep a check on the brake camshaft for its easy movement in the bushes and re-work the bushes if necessary.

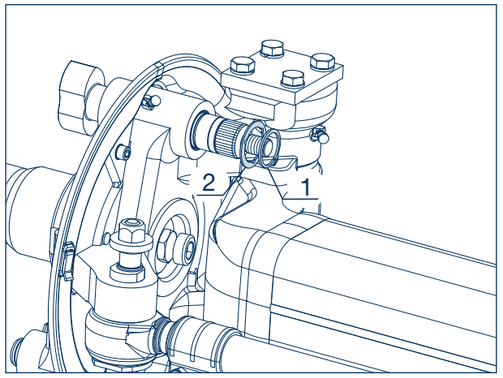


Figure 1

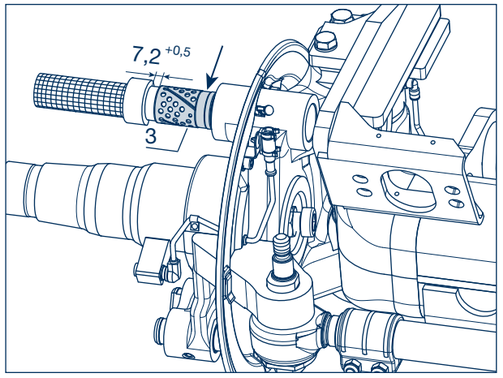


Figure 2

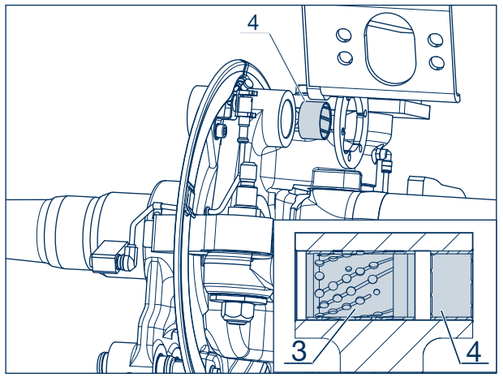


Figure 3

GSL-GSLA

[5] Drive in new outer bush with a mandrel (BPW no. 05.001.04.04.0) with the ring groove (arrow) pointing towards the grease nipple.

[6] On the outside, the bush must stand back $7.2^{+0,5}$ mm. Apply only mild beats, when driving in and out, apply counter pressure to brake anchor plate if necessary.

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

[8] Grease the lubrication point (arrow) with BPW Special long-life grease.

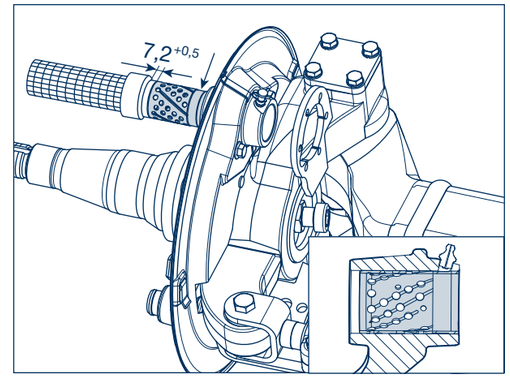


Figure 4

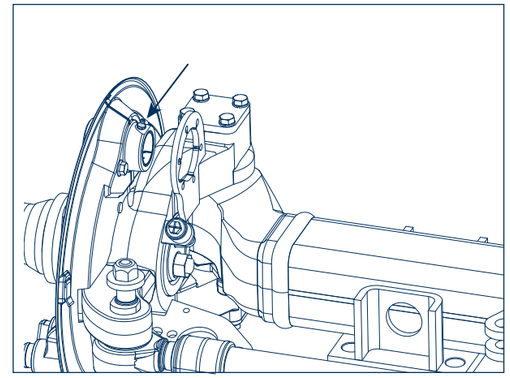


Figure 5

9 Brake bolt for brake shoes

Warning!

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

Disassembling

[1] Remove wheel / hub unit and brake shoes.

[2] Disassemble both cover plates.

[3] Check C-clips (1) on the brake bolt (2) for wear and their correct position. Replace if necessary.

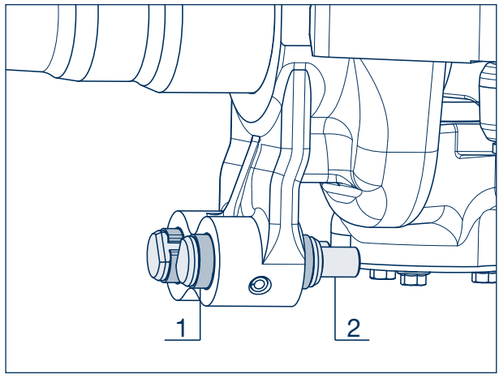


Figure 6

Repair Guide:

Hooked spring rings must be changed at the latest when the brake linings are changed, or earlier.

GS(H)LL

[4] Use a mallet to drive the brake bolt out of the brake anchor plate. The cotter pin in the brake anchor plate / brake bolt hole must shear off when doing this. Keep against the brake anchor plate if necessary.

[5] Clean the seat of the cotter pin in the brake anchor plate / brake bolt.

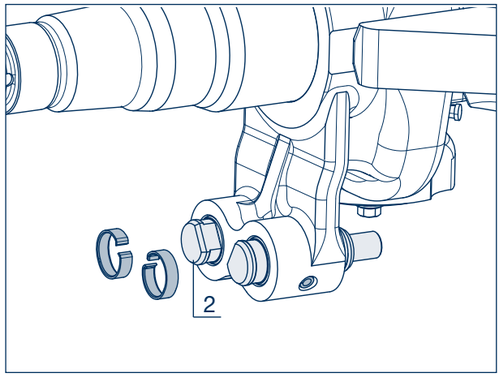


Figure 7

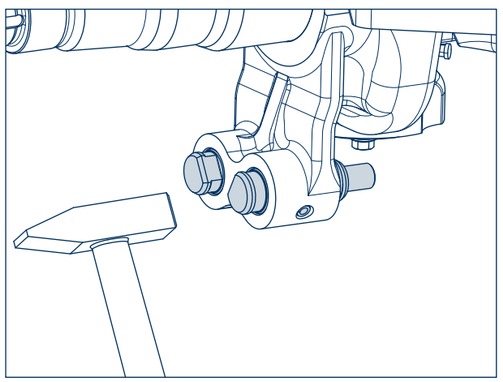


Figure 8

Mounting

[1] Insert a new brake bolt into the brake anchor plate with the threaded hole pointing towards the axle beam. Lubricate the surface of the brake bolt with BPW special longlife grease ECO-Li 91 before assembly.

Repair Guide:

Make sure the holes are lined.

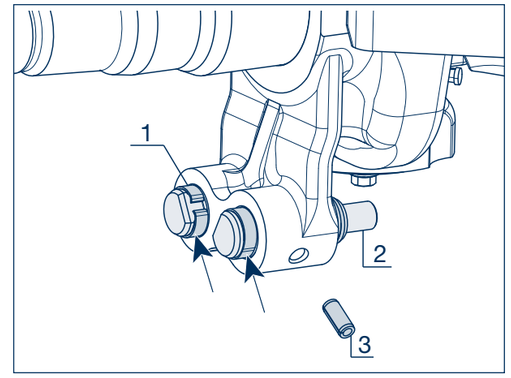


Figure 9

[2] Drive the new cotter pin into the brake anchor plate / brake bolt hole until it stops.

[3] Mount new C-clips and grease the bearings points for the brake shoes (arrows) using BPW special longlife grease ECO-Li 91.

Note:

In types (GSL and GSLA) no replaceable brake bolt is included!

10 Undulating thrust washer disassembly

Warning!

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

Repair Guide:

Check the vertical play of the king pin bearing. If the vertical play is x > 13 mm the clawed thrust washers are worn beyond the wear marking (arrow) or the wear limit H = 20 mm is below, the clawed thrust washers must be replaced.

Disassembly

[1] Remove the axle.

[2] Take off the hubs and brake units.

[3] Remove cross tube unit. Dismount shock absorber (steering damper) if present.

[4] Take off the steering cylinder.

[5] Remove the base plates or the upper closing plates and take out the compression spring.

Warning!

On the steering axles, a strong compression spring is fitted above the king pin!

[6] Turn the axle upside down so that the undulating thrust washers are on top.

[7] Unscrew the securing bolts of the lower locking plates or air cylinder brackets and take them off.

Note:

Inspect the king pins and bushes for wear. The wear limit of the bushes is reached at a wall thickness of 1.8 mm. If necessary exchange components.

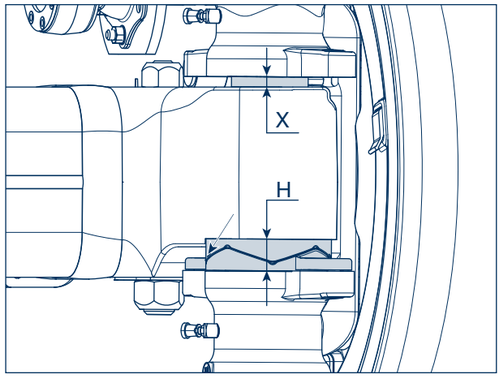


Figure 10

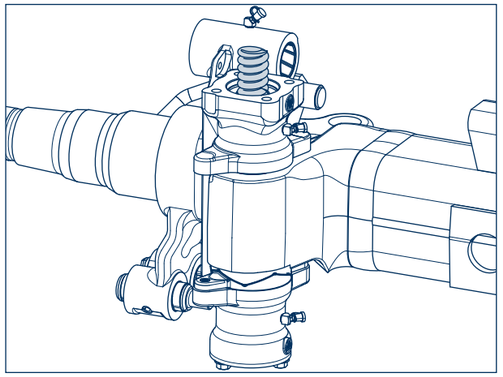


Figure 11

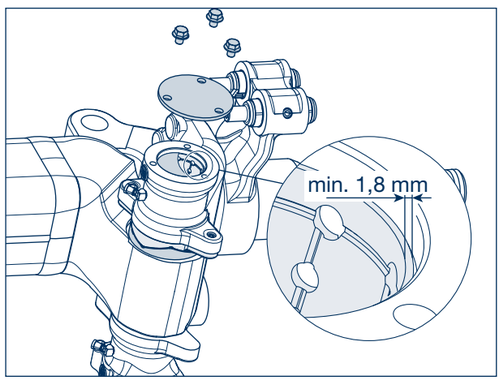


Figure 12

[8] Drive the two front spring dowel pins (1,2) out of the mountings in the steering knuckle.

[9] Drive the two rear spring dowel pins (3,4) as far as possible out of the axle beam.

[10] Place the steering knuckle under pressure so that the clawed thrust washers are above and the steering knuckle is upright (the undulating thrust washers are in total physical contact).

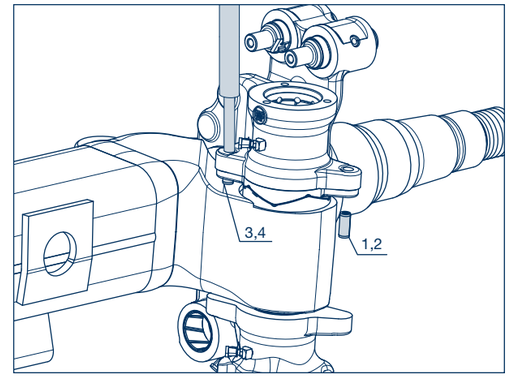


Figure 13

[11] Exert slight pressure on the king pin with a suitable mandrel.

[12] 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:

It is important that the king pin is dismantled from above to below.

[13] Remove the steering knuckle (5) and undulating thrust washers (6).

Repair Guide:

Cut off the welding from the undulating thrust washers and steering knuckle and take it down.

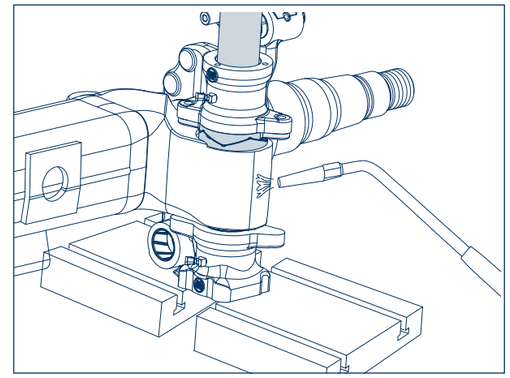


Figure 14

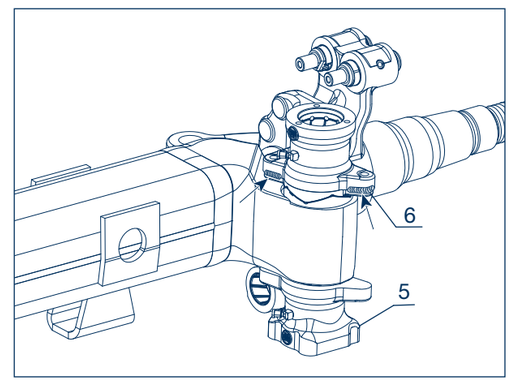


Figure 15

10 Undulating thrust washer disassembly

Note:

Inspect the king pins and bushes for wear. Make a visual inspection by opening up the upper and lower bearings. The wear limit of the bushes is reached at a wall thickness of 1.8 mm. If necessary replace components.

☞ See Chapter 10

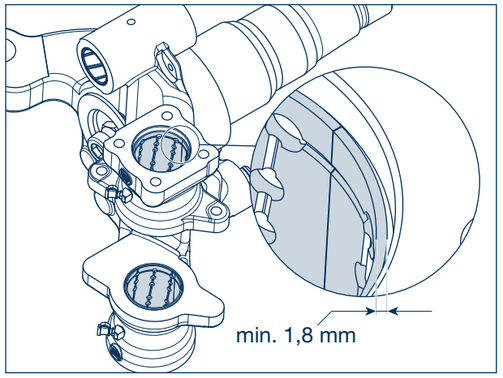


Figure 16

[14] Inspect the undulating thrust washers for wear and if necessary replace them.

Note:

New undulating thrust washers together have a total height (H) of 25 mm. Admissible wear limit: H = 20 mm.

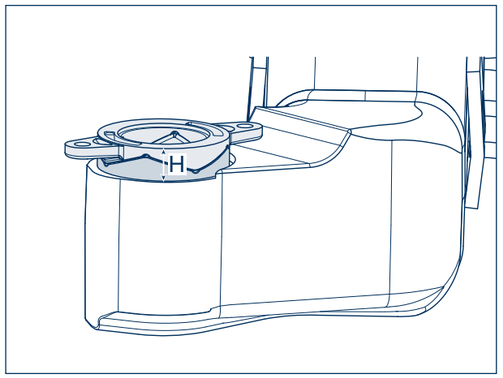


Figure 17

Note:

On the undulating thrust washer (on both sides) there may be a ribbing on the outside as a wear marker (arrow). If this marker is no longer visible, the clawed thrust washers must be replaced.

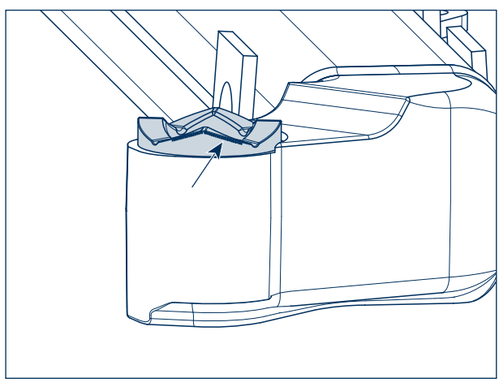


Figure 18

[15] To exchange the undulating thrust washers, grind down the weld seams (depending on the version different lengths) on the stub axle. Using a chisel, lift the pinned thrust washer off the axle beam. Do not damage the machining surface on the axle beam.

Repair Guide:

Undulating thrust washers must always be exchanged in pairs at the top and bottom and on both sides.

Note:

Depending on the version, the length of welds of the undulating thrust washers can be different.

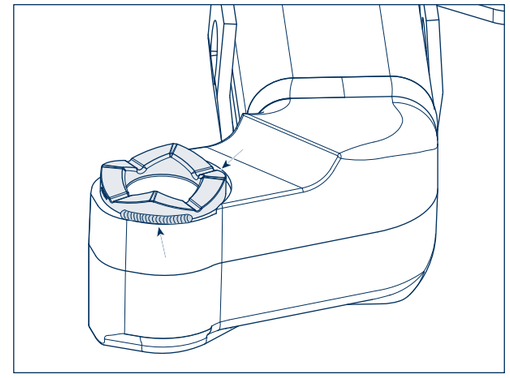


Figure 19

Installation

4-shoulder undulating thrust washer

[16] Drive two new, thick cotter pins (1) (Ø 12 x 12) into the thrust washer in such a way, that the slot points are towards the rotating direction as shown in the illustration (arrows). Then drive two new thin cotter pins (2) (7 x 18) into the thick cotter pins in such a fashion that the slots face each other.

[17] Place the undulating thrust washer onto the axle stub in such a way that the welding chamfer is faces out.

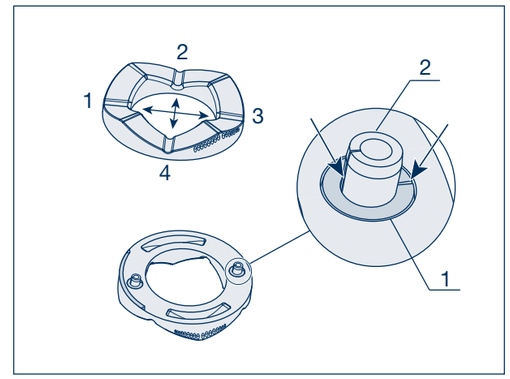


Figure 20

Repair Guide:

The installation surfaces must be clean, free of grease and horizontal.

[18] Insert the cotter pins (2) into the bores.

[19] Drive the undulating thrust washer onto its seat with a plastic hammer.

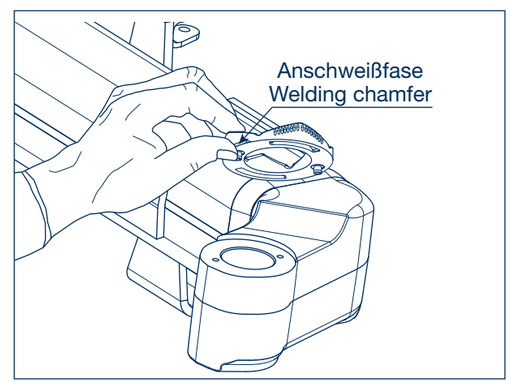


Figure 21

10 Undulating thrust washer disassembly

[20] Squeeze the undulating thrust washers onto the stub axle with an F-clamp in the correct position and weld them in the position with a single pass as shown in the drawing.

Rod electrode DIN EN 1600: E 18 8 Mn B 22
or alternatively
cored-wire electrode ISO 17633-A T 18 8 Mn M M 2
solid-wire electrode ISO 14343-A G 18 8 Mn

[21] Remove the weld spatter.

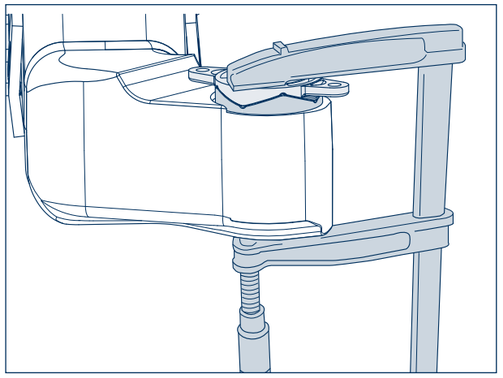
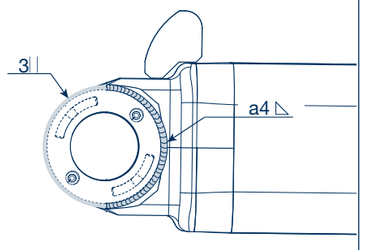
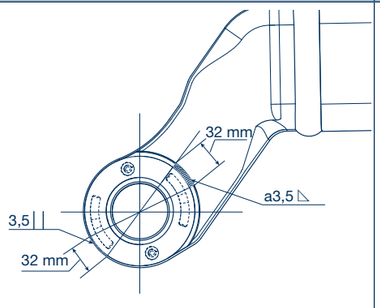
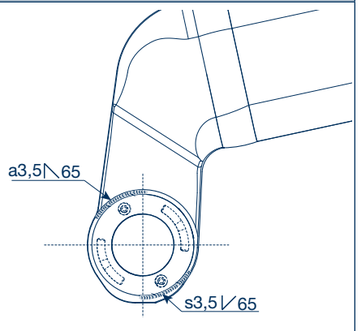
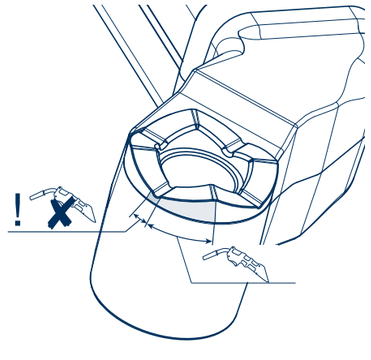
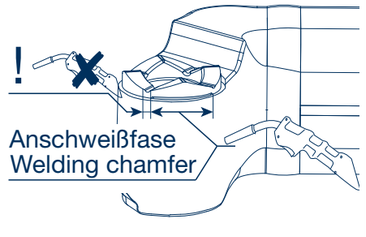


Figure 22

Repair Guide (GSLA, GS(H)LL)

The welding chamfers have to be placed at the specified positions.

Welding standards:

GSL	GSLA	GS(H)LL
		
		

King Pin Bushing 10.1

Note:

Inspect the king pins and bushes for wear. The wear limit of the bushes is reached at a wall thickness of 1.8 mm. If necessary replace components.

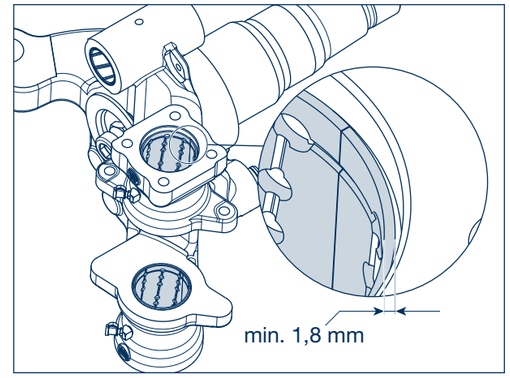


Figure 23

[22] Carefully press in the new bushings for the king pin in with a suitable mandrel and without tilting them until they are flush with the inner contact surfaces (arrow) of the steering knuckle.

Repair Guide:

For types (GS(H)LL and GSL 12010) the inner open lubrication channels (arrow) must face the center of the axle.

Repair Guide:

For types (GSL-GS(H)LL) installation takes place in such a way the thicker bush (inner Ø 60,5 mm) is above.

[23] Check whether the king pin slides with ease into the bushes. If necessary re-work the bushes.

Repair Guide:

For types (GSL GS(H)LL) pay attention to the mounting position of the king pin. The thicker dimension of the king pin must be fitted in the correct bush.

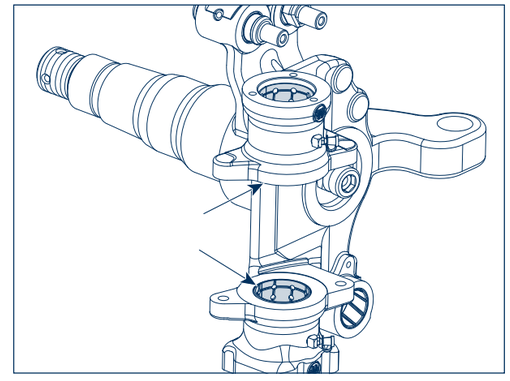


Figure 24

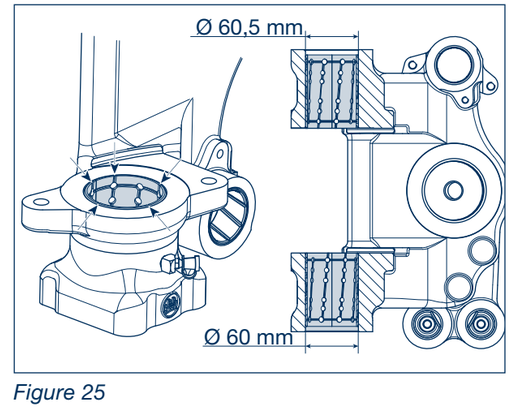


Figure 25

10 Undulating thrust washer assembly

[24] Set up the axle beam in such a way that the undulating thrust washers are on top.

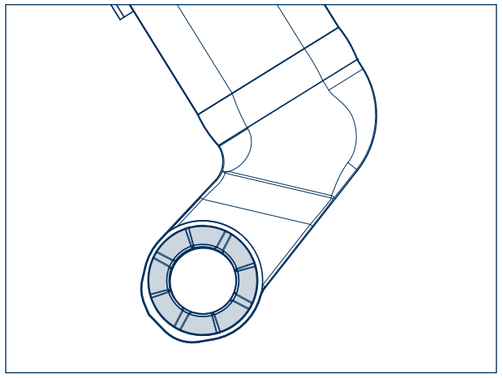


Figure 26

[25] Insert the seal (3) into the undulating thrust washer (4) in the correct position.

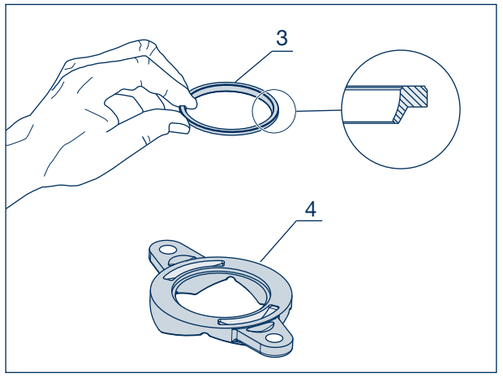


Figure 27

[26] Place the undulating thrust washer as shown in the picture.

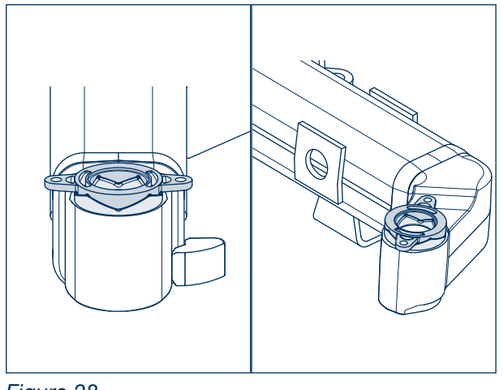


Figure 28

[27] Place the steering knuckle (5) on the undulating thrust washer (6).

[28] Use a guide mandrel (approx. 0.1 mm thinner than the king pin) to align all bores for the king pin.

Repair Guide:

After withdrawing the guide mandrel, do not move the steering knuckle any more.

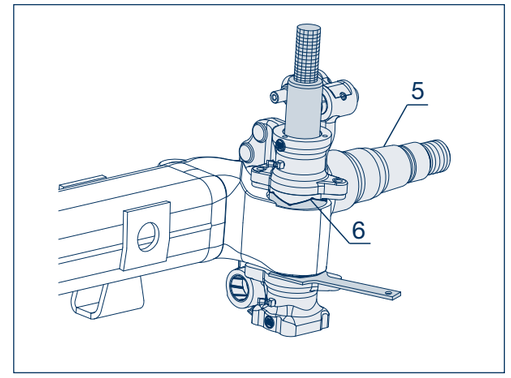


Figure 29

[29] The axle beam with the steering knuckle is pressed together, so that the clawed thrust washers (7) lie together with each other. For assembly a spacer fork (8) provides aid, which must be inserted between axle beam and steering knuckle.

Note:

During the mounting of the king pin the zero position at the undulating thrust washers are required.

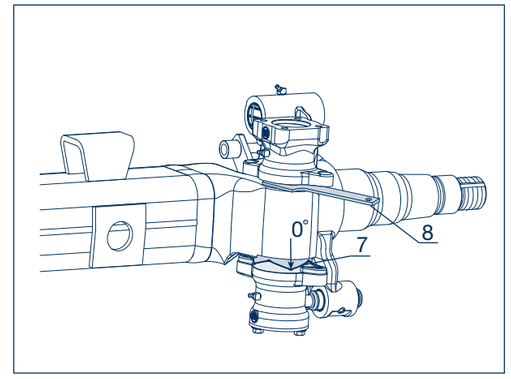


Figure 30

[30] Insert a spacer form into the lower bushing of king pin, its height is 6 mm for an assembly aid, then fasten the bottom closing plate or base plate with screws.

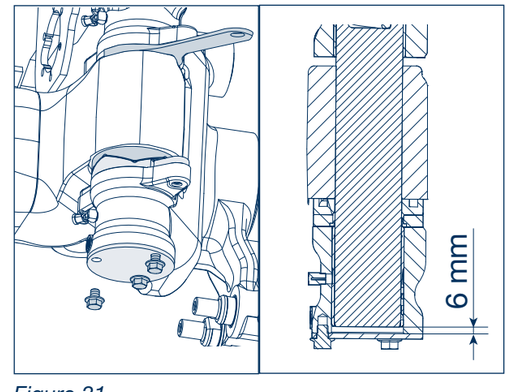


Figure 31

10 Undulating thrust washer assembly

[31] Heat axle beam end in the lower to medium area on both sides until a circular dark red coloration is visible. Do not overheat the undulating thrust washer in order not to damage the interior seal.

Note:

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

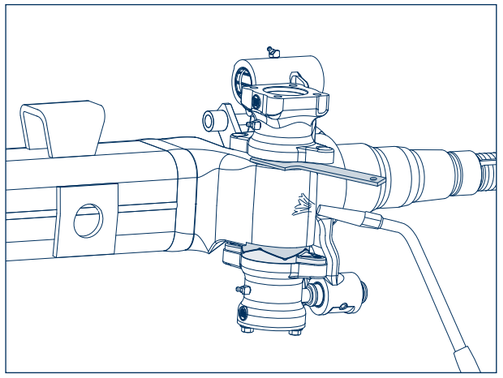


Figure 32

[32] Slide king pin (9) with the bore for the compression spring (from above), quickly to its place and if necessary set the position with slight hammer blows.

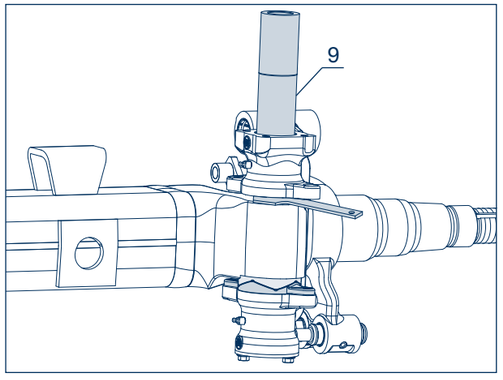


Figure 33

GSL-GS(H)LL

Repair Guide:

In these types (GSL-GSHLL) shouldered king pins are installed by the factory.

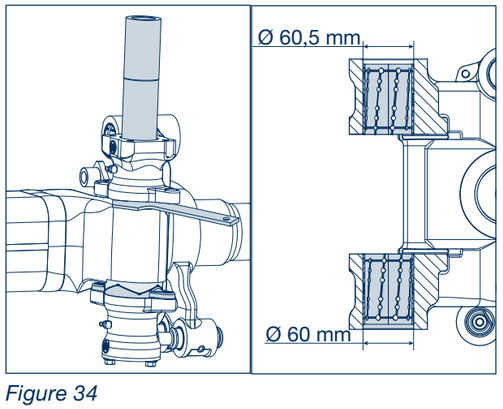


Figure 34

[33] Screw down the cover plate or base plate and extract the spacing piece (10) .

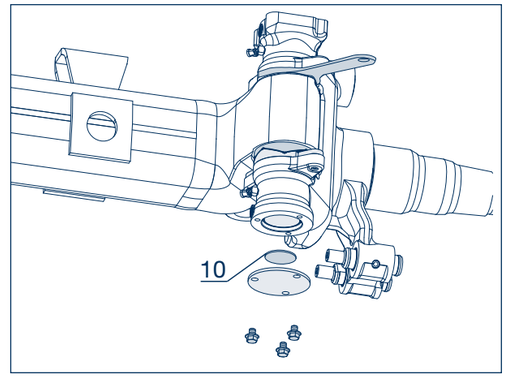


Figure 35

[34] Turn the axle so that the undulating thrust washer is on top, then remove the distance fork (11).

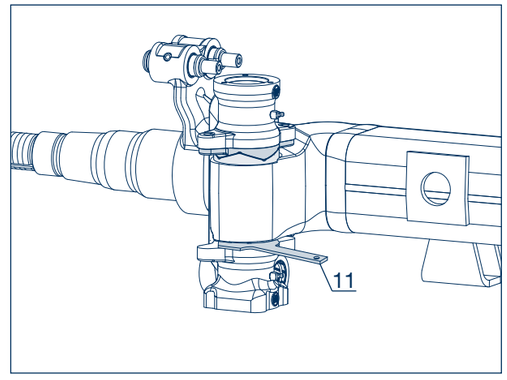


Figure 36

[35] Drive thick cotter pins (12) into the mountings in the steering knuckle (13) and the undulating thrust washer (14) in such a way that the slots (arrow) are always in the direction of rotation of the steering knuckle.

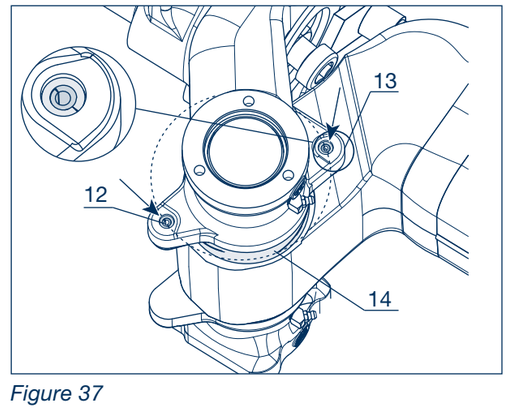


Figure 37

10 Undulating thrust washer assembly

[36] Then drive the thin cotter pins (15) into the thick cotter pins (16) in such a way that the slots are opposite each other.

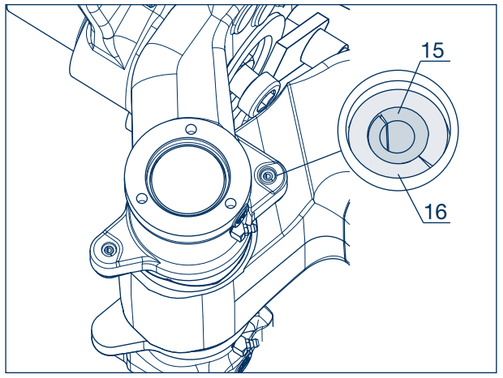


Figure 38

[37] Continue to drive both cotter pins until they overhang a little at the bottom of the undulating thrust washer.

[38] Then drive them back until the undulating thrust washer rests against the steering knuckle and the cotter pins still overhang approx. 1 mm. Position the cotter pins in the bores of the steering knuckle with two blows of a centre punch.

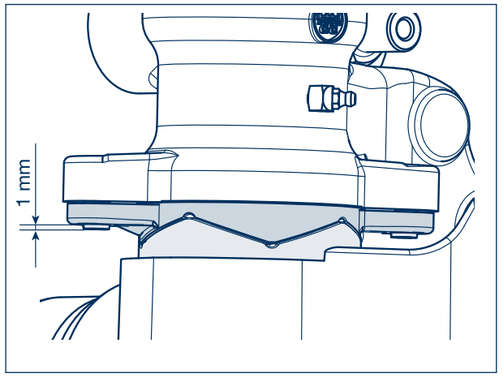


Figure 39

[39] Close the lower king pin assembly. Depending on design, install the bottom locking plates (17) or air cylinder brackets with safety screws or hexagonal bolts with spring washers then tighten them with the specified tightening torque.

Tightening torque:

M 10 - 8.8	M = 38 Nm
M 10 - 10.9	M = 53 Nm
M 12 - 8.8	M = 66 Nm
M 14 - 8.8	M = 105 Nm
M 14 - 10.9	M = 148 Nm
M 16 - 8.8	M = 163 Nm
M 16 - 10.9	M = 230 Nm

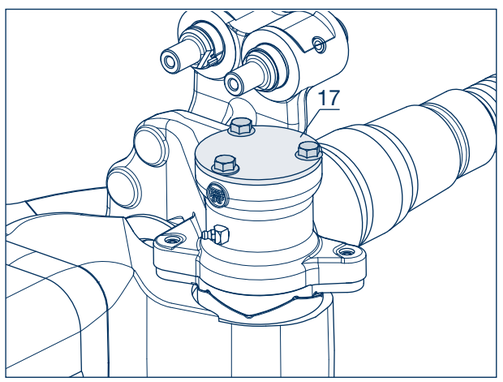


Figure 40

[40] Weld the clawed thrust washer to the steering knuckle assembly in one layer according to the drawing.

Rod electrode DIN EN 1600: E 18 8 Mn B 22
or alternatively
cored-wire electrode ISO 17633-A T 18 8 Mn M M 2
solid-wire electrode ISO 14343-A G 18 8 Mn

[41] Remove the weld spatter.

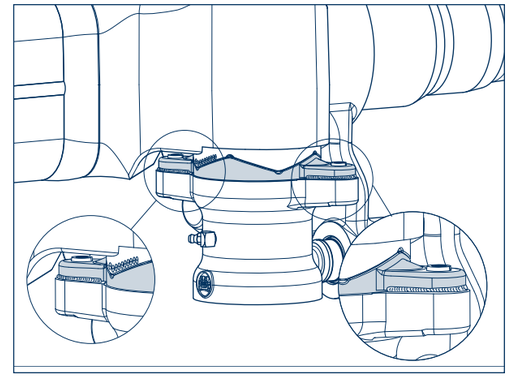


Figure 41

[42] Affix the axle in driving position. Place the compression spring into the bore of king pin. Fit the base plate or upper closing plate with locking screws or hexagonal bolts with spring washers. If needed, use longer screws for pre-loading.

[43] Tighten the screws crosswise until the compression spring is tensioned.

Tightening torque:

M 10 - 8.8	M = 38 Nm
M 10 - 10.9	M = 53 Nm
M 12 - 8.8	M = 66 Nm
M 14 - 8.8	M = 105 Nm
M 14 - 10.9	M = 148 Nm
M 16 - 8.8	M = 163 Nm
M 16 - 10.9	M = 230 Nm

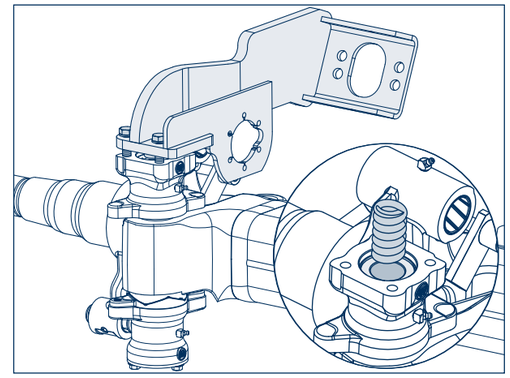


Figure 42

[44] Insert the tie rod and steering cylinder.

[45] Fit the brakes and hub units.

[46] Lubricate the king pin bushes and brake camshaft bearings with BPW special longlife grease ECO-Li 91 (arrows).

[47] Install the axle.

[48] Check the tracking.

☞ See Chapter 24.

[49] Make a functional inspection.

☞ See Chapter 14.

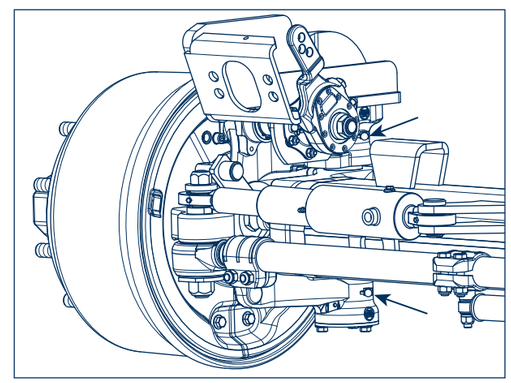


Figure 43

11 Thrust washers

Warning!

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

Repair Guide:

Check the vertical play of the king pin bearing. If the vertical play is X > 6,2 mm the thrust washer must be replaced.

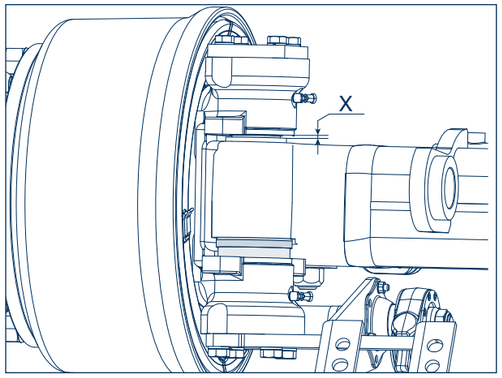


Figure 44

Disassembly

[1] Remove the axle.

[2] Take off the hubs and brake units.

[3] Remove cross tube unit. Dismount shock absorber (steering damper) if present.

[4] Take off the steering cylinder.

[5] Remove the upper and lower base plates (1) or the closing plates (2).

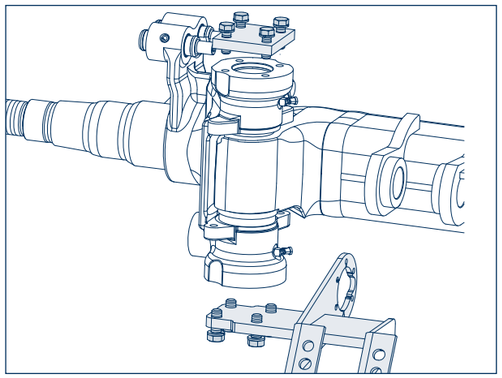


Figure 45

Warning!

These steering axles are mounted with a compression spring (3) on top of the king pin.

[6] Fasten the axle upside down, so that the thrust washer (4) be on top.

[7] Place the steering axle beam and steering knuckle (5) under pressure.

[8] Exert slight pressure on the king pin with a suitable mandrel.

[9] Heat the axle beam end (6), on the end face with a large torch flame, until the king pin is loosened, then force it right out in one go with the press.

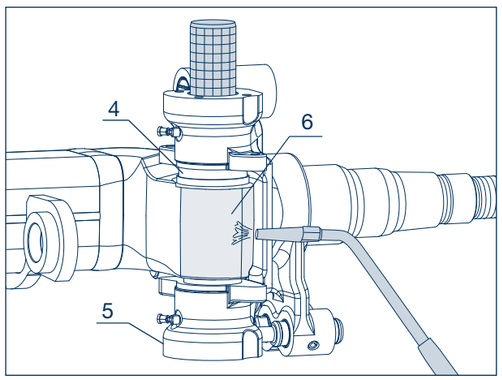


Figure 46

Repair Guide:

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

Repair Guide:

It is important to disassemble the king pin from above to down.

[10] Remove the steering knuckle with the thrust bearing (7) and the ring (8).

Repair Guide:

Steering axles GSLA and GSL 11010 are mounted with a special distance ring (9).

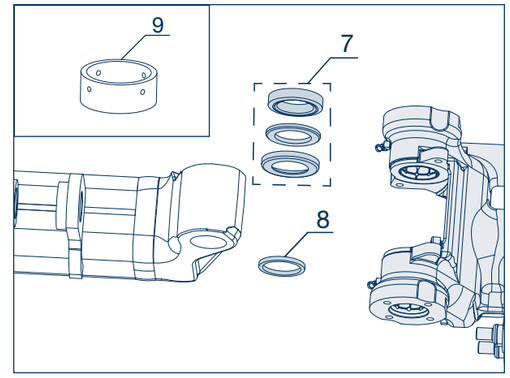


Figure 47

[11] Inspect the king pins and bushes (10) for wear. Make a visual inspection by opening up the upper and lower bearings. The wear limit of the bushes is reached at a wall thickness of 1.8 mm. If necessary replace components.

☞ See Chapter 10.

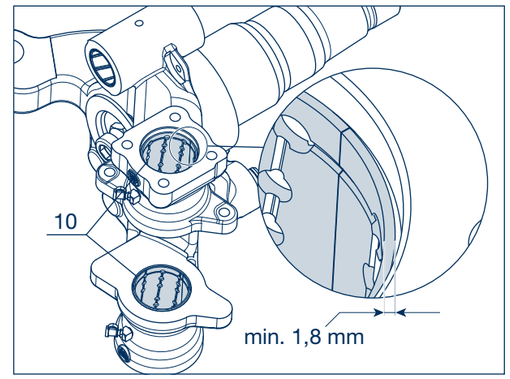


Figure 48

11 Thrust washers

Installation

[12] Grease the upper and lower (1,2) thrust washers and place them together.

[13] Place the upper thrust ring (1) (without lubrication groove) with the exterior chamfer facing upwards, on the lubrication groove side of the lower thrust ring (2).

[14] Place the cap (3) on both thrust rings.

Repair Guide:

Steering axles GSLA and GSL 11010 are mounted with a special distance ring (4).
It is important that the lubrication holes of distance ring go together with the adjustment of thrust washers.

[15] Turn the axle in such a way that the axle beam stands in installation position.

[16] Place the distance ring (5) on the axle beam end in such a way that the bores are aligned with each other.

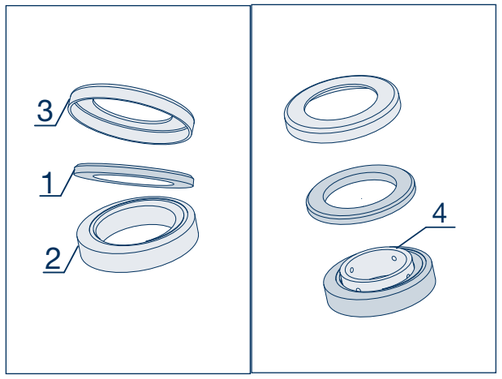


Figure 49

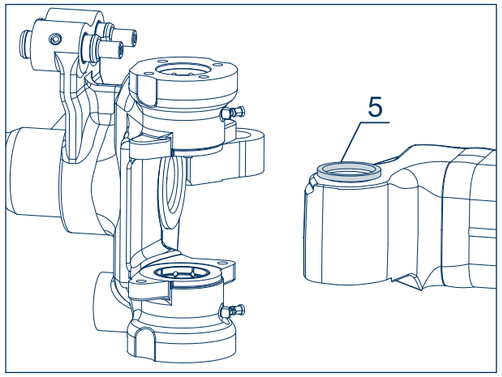


Figure 50

[17] Place the complete thrust bearings with cap (6) on the axle beam end, so that the bores align.

Repair Guide:

In the mounting position the thrust bearing must be below the steering axle beam with the cap facing the axle beam.

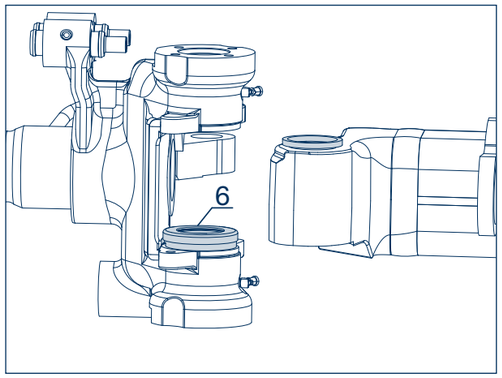


Figure 51

[18] Put a distance washer of 6 mm thickness in the bottom king pin bearings as an assembly aid. Attach the lower closing plate with two screws.

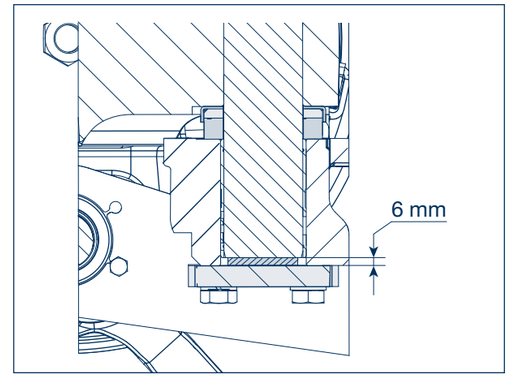


Figure 52

[19] Align the steering knuckle with the axle beam end using a guide mandrel approx. 0,1 mm thinner than the king pin.

Repair Guide:

After withdrawing the guide mandrel, do not move the steering knuckle any more.

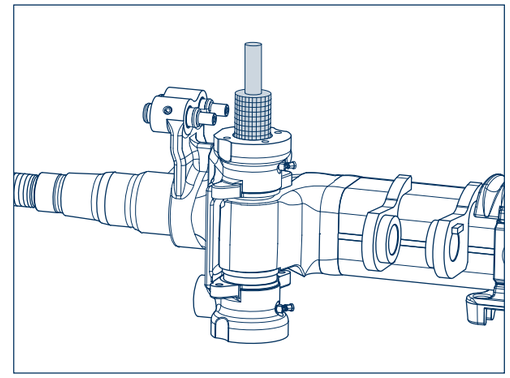


Figure 53

[20] Heat the rear part of the axle beam end on both sides in circles until it is dark red.

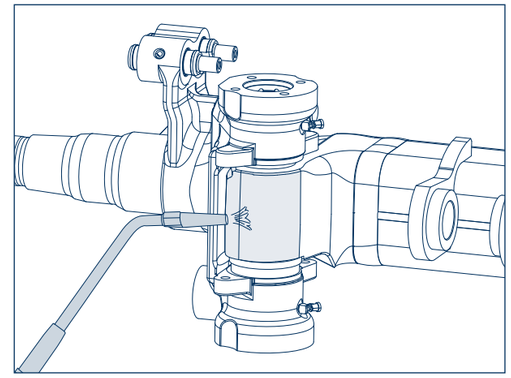


Figure 54

11 Thrust washers

[21] Drive the king pin (7) until it stops, using light hammer blows if necessary.

Note:

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

Repair Guide:

Note the correct installation direction (GSL-GSHLL). Larger diameter above.

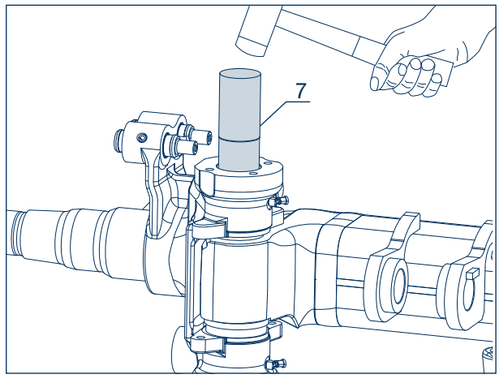


Figure 55

[22] Disassemble the lower closing plate and remove the assembly aid (8).

[23] Mount lower and upper locking plates or air cylinder brackets with safety screws or hexagon bolts with spring washers.

Tightening torque:

M 10 - 8.8	M = 38 Nm
M 10 - 10.9	M = 53 Nm
M 12 - 8.8	M = 66 Nm
M 14 - 8.8	M = 105 Nm
M 14 - 10.9	M = 148 Nm
M 16 - 8.8	M = 163 Nm
M 16 - 10.9	M = 230 Nm

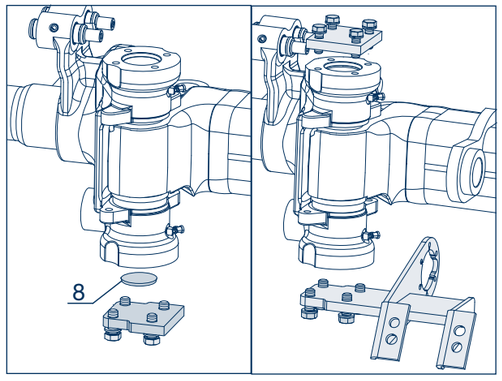


Figure 56

[24] Fit tie rod and steering cylinder.

[25] Insert hub and brake units.

[26] Lubricate the king pin bushes and brake camshaft bearings with BPW special longlife grease ECO-Li 91 (arrows).

[27] Install axle.

[28] Check the wheel alignment.

☞ See Chapter 24.

[29] Make a functional inspection.

☞ See Chapter 14.

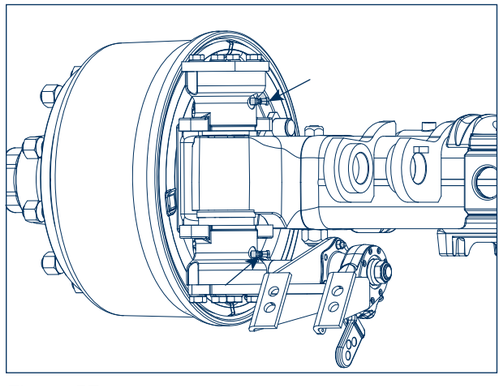


Figure 57

Function control and steering angle setting 12

[1] Turn the knuckle in the full turn position on the left and right direction. Meanwhile check for free movement and gap of all moving parts.

Note:

Take the action of the vehicle springs into account.

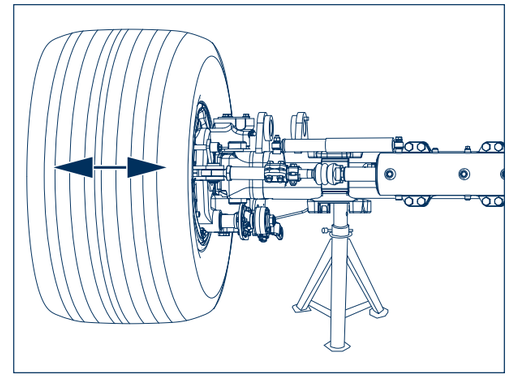


Figure 58

[2] If adjustment is required, loosen jam nut (1) (WS 30 or 36) of the stop screw (2).

[3] During adjustment turn the stop screw as necessary then re-tighten the jam nut with the specified torque.

Tightening torque:

M 20 - 8.8	M = 185 Nm
M 24 - 8.8	M = 200 Nm

Repair Guide:

When tightening the jam nut hold the stop screw with an Allen key (WS 17 or 19).

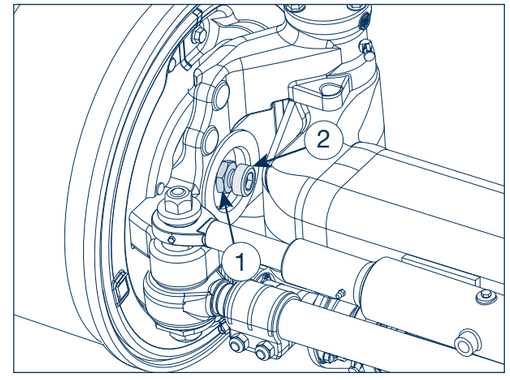


Figure 59

Repair Guide:

When adjusting the steering stop screw, the welds of the metal blocks must be checked.

Note:

After the stop screw adjustment, the freedom of movement and clearance of all moving parts needs to be tested, in order to avoid a collision.

Note:

Steering angle can be different on the axles, please call your BPW-partner for further information.

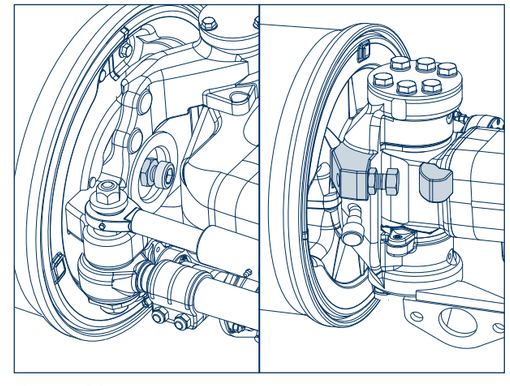


Figure 60

13 Locking- and forced steering cylinder

13.1 for unit steering axle

- **BPW-Nr.: 05.444.50.23 - 24.0** - locking cylinder (left and right version) Figure A
- **BPW-Nr.: 05.444.50.25 - 26.0** - forced steering cylinder (left and right version) Figure B

Note:

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

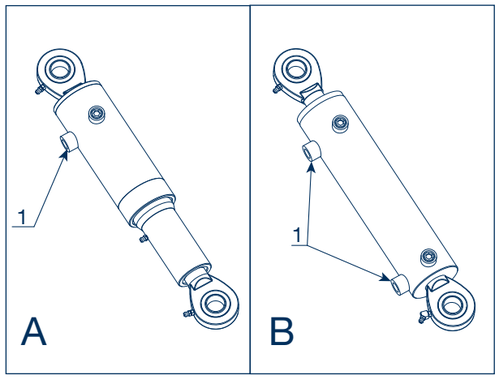


Figure 61

Repair Guide:

When mounting, the cylinder must not be under pressure!

Dismantling

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

Note:

Please note, the cylinders are filled with hydraulic oil.

[2] Unscrew the self-locking nut (2) (WS 27) and remove clamping shim (3).

[3] Remove snap ring (4) and take the pin (5) out of bore.

[4] Remove the cylinder (6).

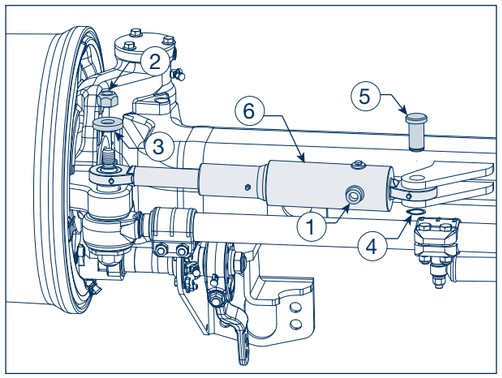


Figure 62

Installation:

Repair Guide:

Depending on version, the cylinder can be installed with eccentric pin. When installing the cylinder the eccentric pin must be set in a way that the position of the float rod of the locking cylinder should be seamless and without backlash.

Locking cylinder installed with eccentric pin

[1] Loosen the self-locking nut (1) (WS 36) of the tie rod (2).

[2] Loosen the eccentric pin (3) until it turns easily in the conical bore.

[3] Install the tension washer (5) of the cylinder (4) and screw the new self-lock nut (6) up.
Note, left- and right construction.

[4] Put the pivot (7) in and insert the snap ring (8).

Repair Guide:

It is important to insert the bolt in the bore from above.

[5] Screw in the inlet coupler.

[6] Inspect axle geometry (toe-in) and adjust if necessary.

☞ See Chapter 24.

[7] Put the cylinder under pressure.

Note:

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

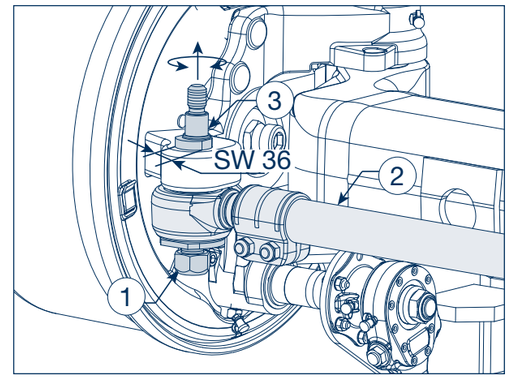


Figure 63

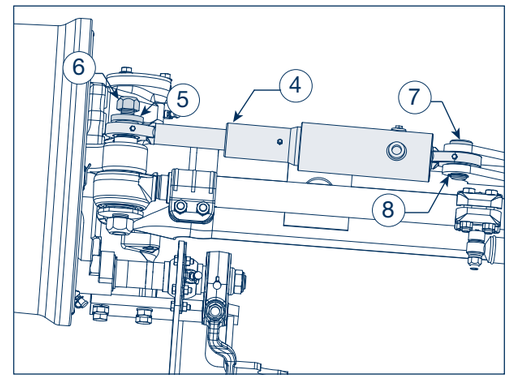


Figure 64

13 Locking- and forced steering cylinder

[7] Using an open wrench (WS 36) to the eccentric pin (both sides) turn it until the floating piston rod is pushed out to the maximum (without back-lash).

Repair Guide:

For the correct eccentric pin setting it is a requirement that the straight-line tracking should be fixed.
The straight position can be fixed by using a rod with two holes.
(L = 396 mm)

☞ See Chapter 21.

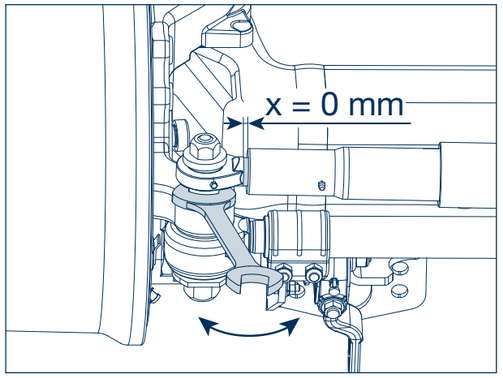


Figure 65

[8] Tighten the lock nuts of the tie rod (8) to the specified torque.

Tightening torque

M 24 M = 550 Nm

Repair Guide:

While tightening the lock nut (WS 36) of the eccentric pin secure it with the help of fork wrench (WS 36) against rotation.

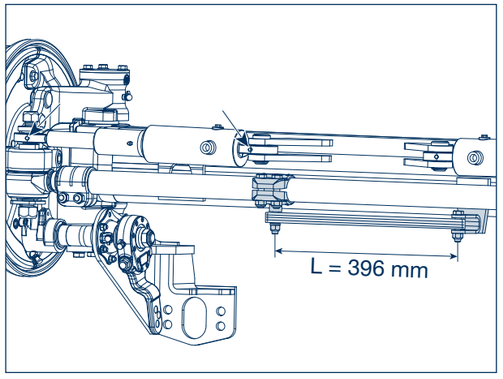


Figure 66

[9] Fasten the eccentric pin with the help of fork wrench (WS 36) and tighten the self-locking nut (9) to the prescribed torque.

Tightening torque

M 20 M = 320 Nm

[10] Install shock absorber if it was mounted.

☞ See Chapter 21.

[11] Lubricate the lubrication points of the cylinder with BPW special long-life grease (ECO-Li 91).

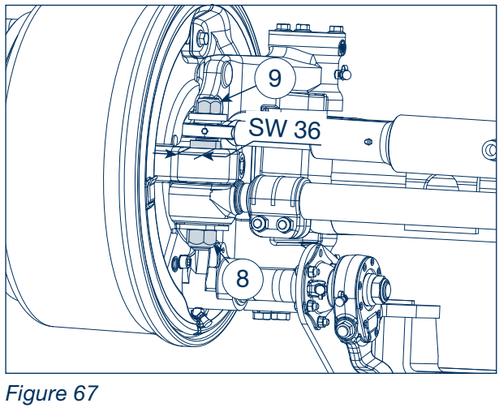


Figure 67

Forced steering cylinder without eccentric pin

Tie rod and cylinder built separately

[1] Install the tension washer (1) of the cylinder and screw the new self-lock nut (2) up.

[2] Put the pivot (3) in and insert the snap ring (4).

Repair Guide:

It is important to insert the threaded pin into the bore from above.

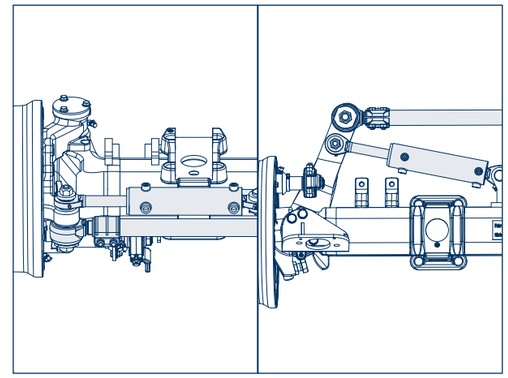


Figure 68

[3] Tighten the lock nuts of the threaded pin (2) to the specified torque.

Tightening torque

M 20 M = 320 Nm

[4] Screw in the inlet coupler (5) and put the cylinder under pressure.

Note:

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

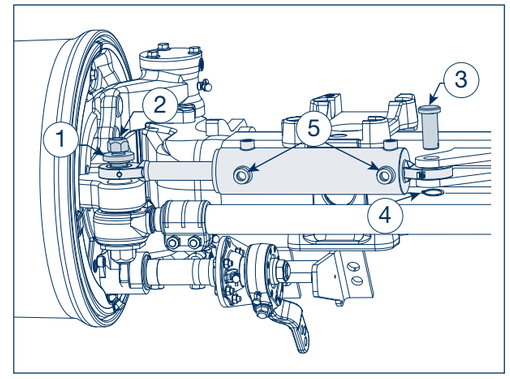


Figure 69

[5] Lubricate the lubrication points of the cylinder with BPW special long-life grease (ECO-Li 91).

[6] Inspect axle geometry (toe-in) and adjust if necessary.

☞ See Chapter 24.

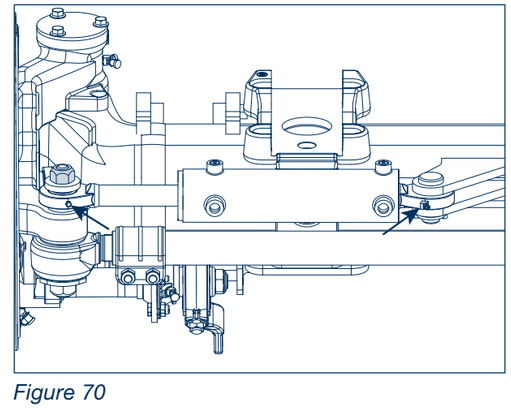


Figure 70

13 Locking- and forced steering cylinder

Forced steering cylinder with the eccentric pin

[1] Loosen the self-locking nut (1) of the tie rod (2).

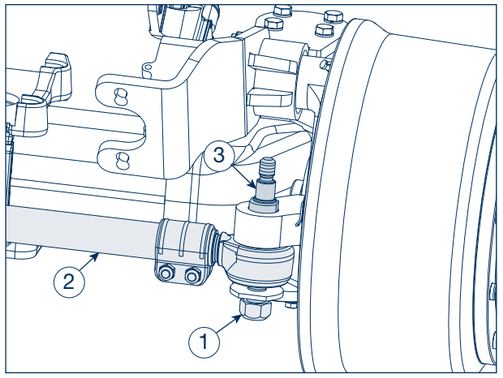


Figure 71

[2] Loosen the eccentric pin (3) until it turns easily in the conical bore.

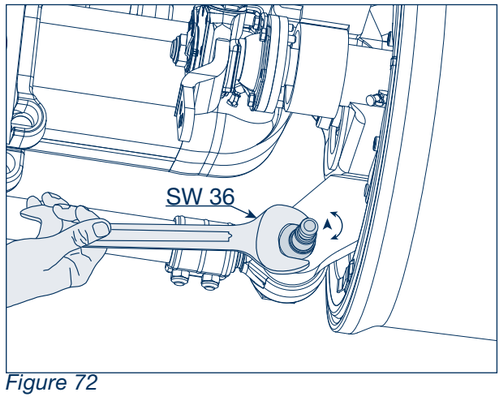


Figure 72

[3] Install the tension washer (5) of the cylinder (4) and screw the new self-lock nut (6) up.
Note, left- and right construction.

[4] Put the pivot (7) in and insert the snap ring (8).

Repair Guide:

It is important to insert the bolt in the bore from above.

[5] Adjust the eccentric pin.

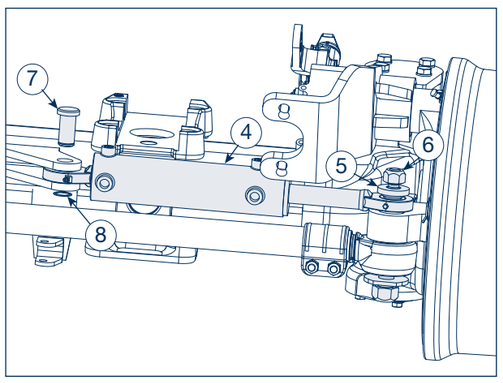


Figure 73

[6] Turn the eccentric pin (both sides) with the help of open wrench (WS 36) to the end-position, in order to set maximum distance.

[7] Tighten the lock nuts of the tie rod (9) to the specified torque.

Tightening torque

M 24 M = 550 Nm

Repair Guide:

While tightening lock nut (WS 36) of the eccentric pin secure it with the help of fork wrench (WS 36) against rotation.

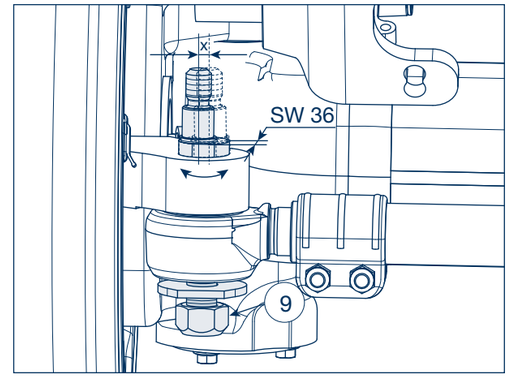


Figure 74

[8] Fasten the eccentric pin with the help of fork wrench (WS 36) and tighten the self-locking nut (10) to the prescribed torque.

Tightening torque

M 20 M = 320 Nm

[9] Install the inlet coupler.

[10] Inspect axle geometry (toe-in) and adjust if necessary.

☞ See Chapter 24.

[11] Put the cylinder under pressure.

Note:

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

[12] Lubricate the lubrication points of the cylinder (arrow) with BPW special long-life grease (ECO-Li 91).

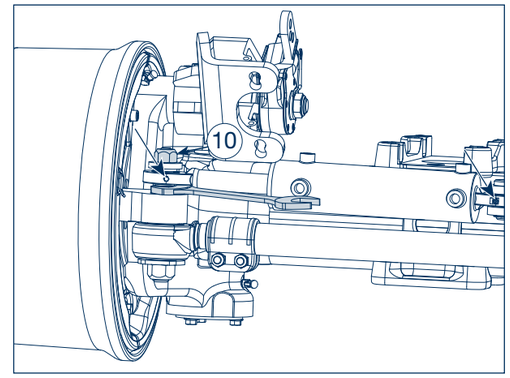


Figure 75

14 Tie rod for unit steering axle

14.1 Tie rod with rubber bushings

Warning!

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

Disassembly

Repair Guide:

Before the dismantling of the tie rod, remove the shock absorber if available.

☞ See chapter 21.

[1] Unscrew the lock nut (1), take off the washer (2).

Repair Guide:

Pay attention to tie rod position in relation to the tie rod head, and mark it before removing the tie rod.

[2] Pull or press off the tie rod (3).

Warning!

Check the steel-rubber-steel bushes (4) in the tie rod ends (5) and the threaded pins (6) in the knuckle (7) for wear and replace them, if necessary.

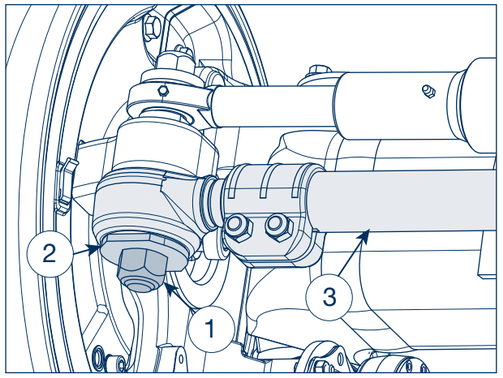


Figure 76

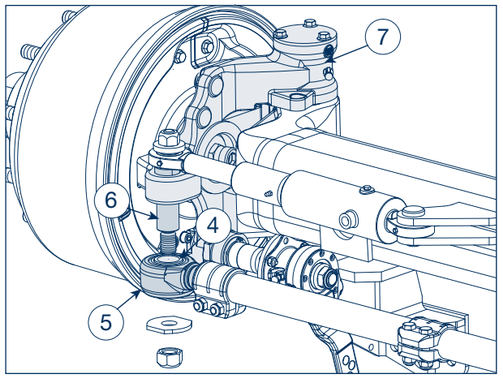


Figure 77

Installation

[1] Loosen the clamp nut (1) and unscrew the tie rod end (2). Notice that cross tube has right-hand and left-hand threads.

[2] Screw the new tie rod ends in equally. Note the right-hand and left-hand threads.

Repair Guide:

Screw the tie-rod end at least to such length that the cross tube slot is totally covered.

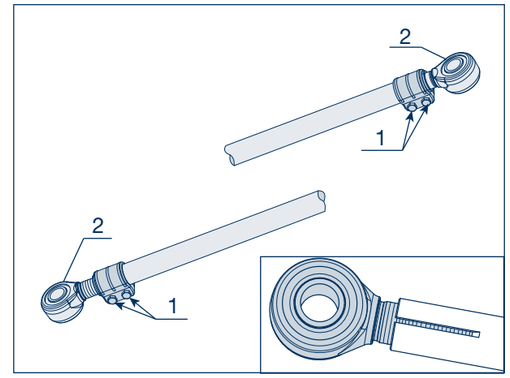


Figure 78

[3] First roughly adjust the tie rod length to the threaded pins distance.

Repair Guide:

When adjusting the tie rod length, it is absolutely essential that the thrust washers are in zero position.

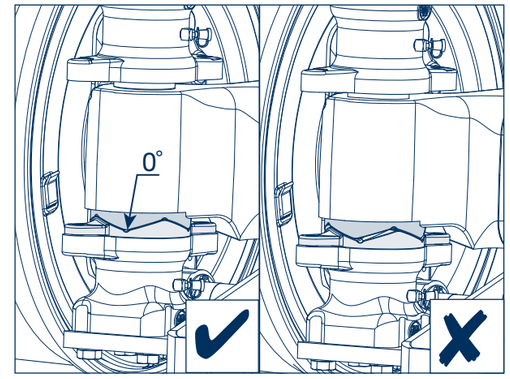


Figure 79

[4] Slide the tie rod in the correct position on one side onto the threaded pin (3). Align the other side exactly to the bore or the threaded pin in the tie rod arm by turning the cross tube.

Repair Guide:

After replacing or alteration of the tie rod, toe-in and tracking checks must be done.

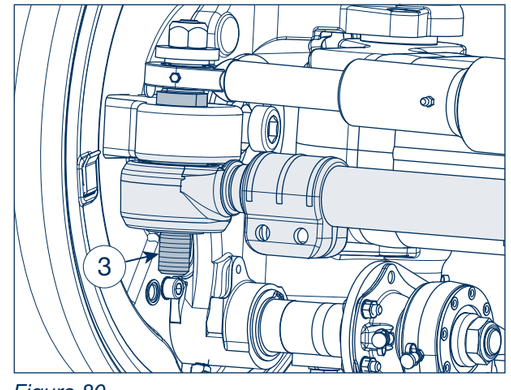


Figure 80

14 Tie rod for unit steering axle

[5] Insert the washer (4), screw the new lock nut up (5) and tighten it to the specified torque.

Tightening torque

M 24 M = 550 Nm

Repair Guide:

When fitting the lock nut (5) hold the washer (4) with a claw spanner (WS 65) to stop it turning.

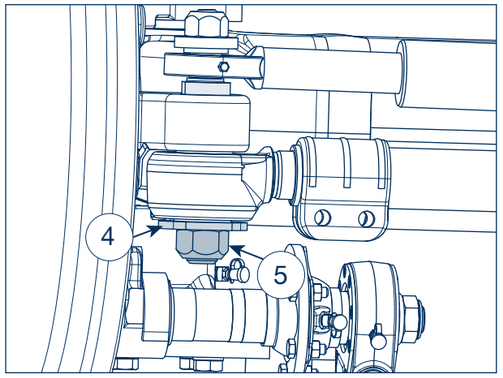


Figure 81

[6] Check the clamp (6) for smooth movement and tighten the lock nuts (7) to the specified torque.

Tightening torque

M 12 x 1,5 - 8.8 M = 86 Nm

Warning!

It is important that a toe-in and axle geometry setting must be performed after the dismantling of the tie rod unit.

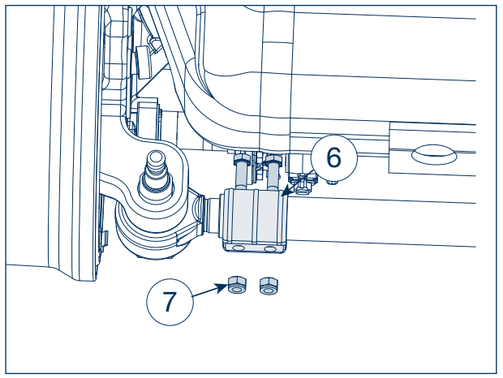


Figure 82

☞ See Chapter 24.

15 Steering axle with combined cylinder

BPW-Nr.: 05.444.50.73.0

Note:

The work is done with the axle removed from the 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!

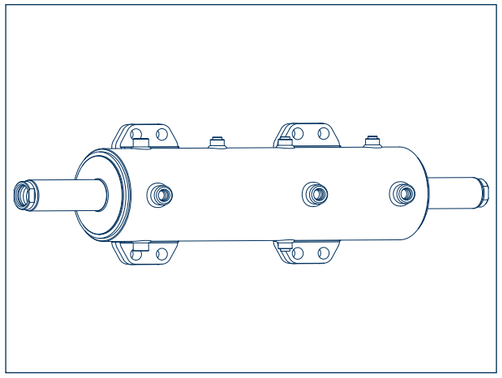


Figure 83

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 shock absorber (2) if available.

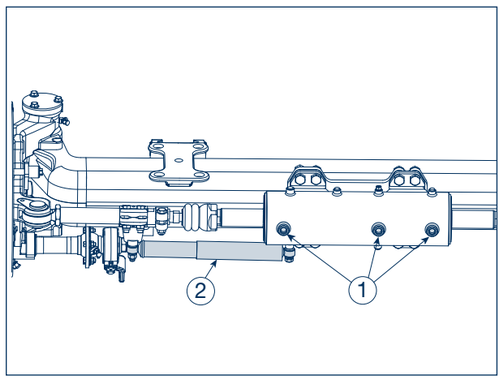


Figure 84

Repair Guide:

The self-steering system includes a shock-absorber, depending on the construction; it can be fitted above or below.

☞ See Chapter 21.

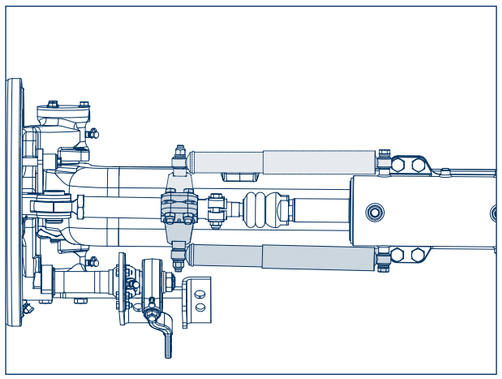


Figure 85

[3] Remove snap ring (3) and take the pin (4) out of bore.

[4] Remove the tie-rod assembly (5) depending on the version.

☞ See Chapter 18.

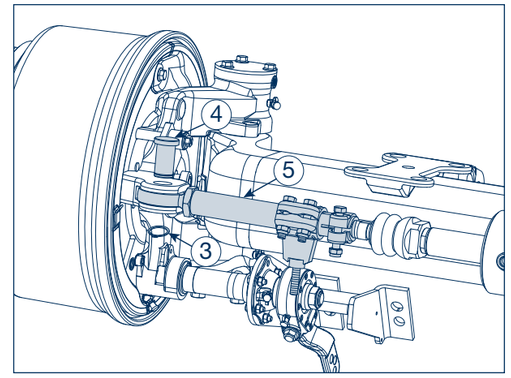


Figure 86

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

Repair Guide:

Axial ball joint must be secured with Loctite 243.
When loosening the axial ball joint (WS 55) from the piston rod hold the piston rod with a wrench (WS 36).

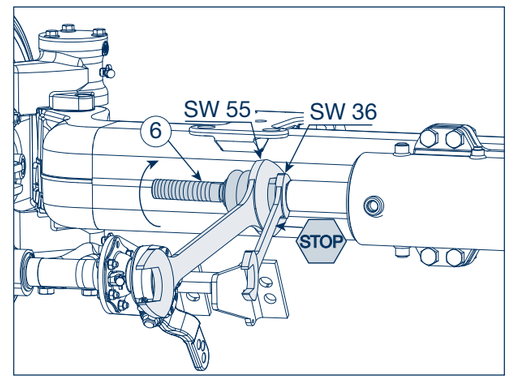


Figure 87

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

Repair Guide:

The steering cylinder is fitted by pins (9) on the holder.

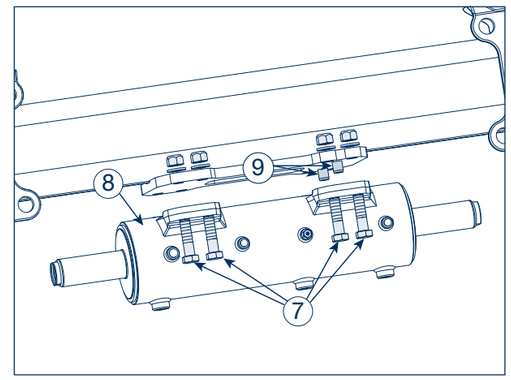


Figure 88

15 Steering axle with combined 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.

Note:

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

☞ Operating notes see Chapter 19.

[4] Screw the axial ball joint (4) into the piston rod.

Repair Guide:

Axial ball joint must be secured with Loctite 243.

[5] Fasten axial ball joint to the specified torque.

Tightening torque

M = 500 Nm

Repair Guide:

Tighten the axial ball joint (WS 55) into the piston rod while holding the piston rod with a wrench (WS 36).

[6] Install tie rod depending on the version.

☞ See Chapter 18.

[7] Install the shock absorber.

☞ See Chapter 21.

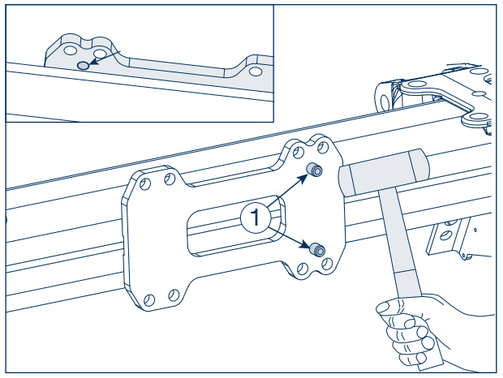


Figure 89

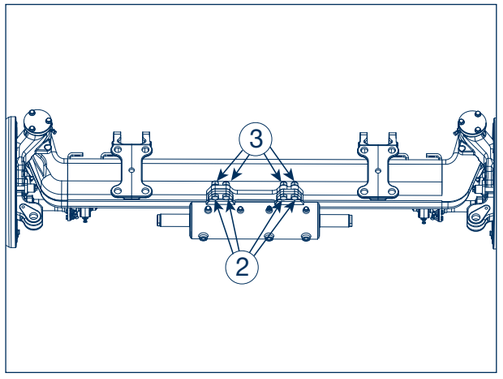


Figure 90

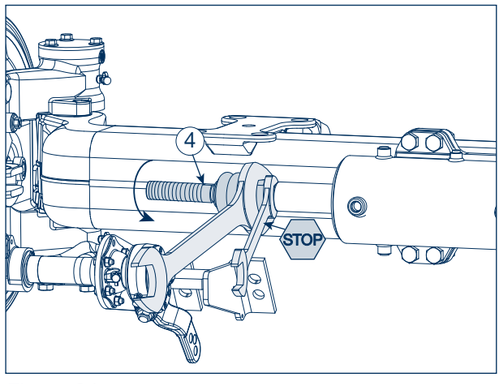


Figure 91

Tie rods versions for single-cylinder steering axle 16

„ A “ Tie rod with mounted axial joint

Installation:

[1] Screw the joint head (1) into the cross tube (2) to end point.

Repair Guide:

Secure the joint head in the cross tube with Loctite 243.

[2] Tighten the joint head to the specified torque.

Tightening torque:

M = 755 Nm

Repair Guide:

When tightening the axial ball joint (WS 36) into the cross tube hold the cross tube with a wrench (WS 36).

[3] Screw the locknut (3) and tie rod unit on the axial ball joint (4).

Repair Guide:

Slide the holder to the left side of the shock absorbers if available on the cross tube in the correct position. Install the holder with the screws and the nuts facing downwards. See Chapter 21.

[4] Put the pivot (5) in and insert the snap ring (6).

Repair Guide:

It is important to insert the pivot in the bore from above. Grease nipple should be mounted facing outward.

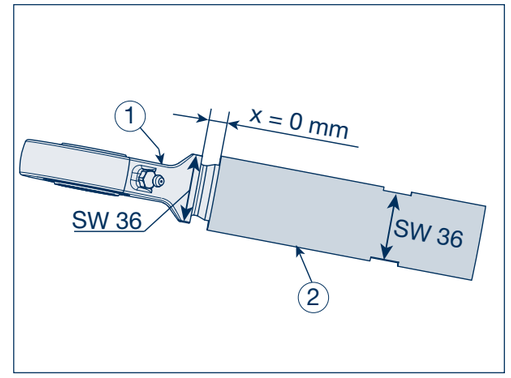


Figure 92

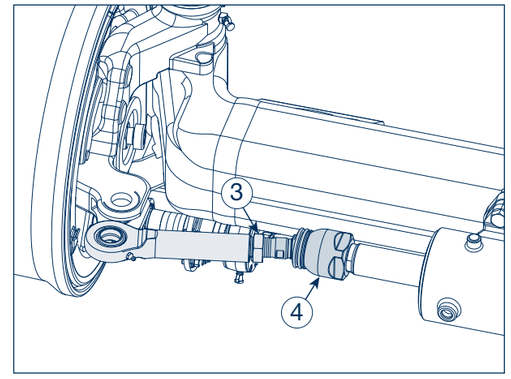


Figure 93

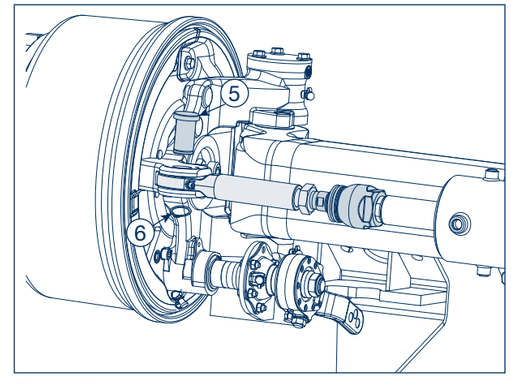


Figure 94

16 Tie rods versions for single-cylinder steering axle

[5] Align the tracking values.
At the individual toe setting turn the threaded bolt (7) with an open-end spanner (WS 27) 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 fasten it.

☞ See Chapter 24.

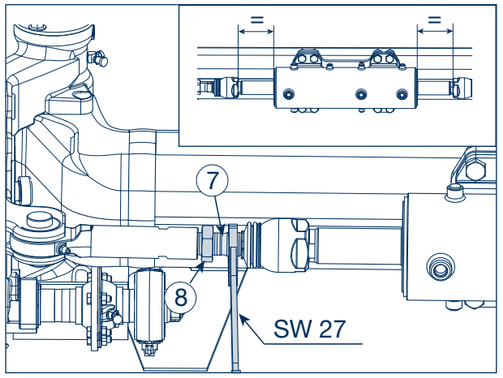


Figure 95

[6] After the adjustment tighten the locking nuts (8) (WS 41) to the specified torque.

Tightening torque:

M 28 x 1,5 M = 410 Nm

Repair Guide:

When tightening the locking nut (WS 41) onto the cross tube hold the cross tube with a wrench (WS 36).

[7] Install the shock absorber, if available.

☞ See Chapter 21.

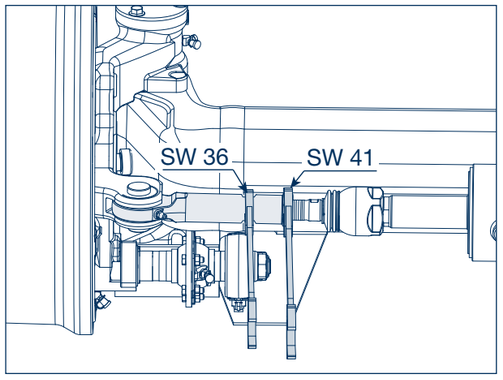


Figure 96

[8] Lubricate the tie rod ends with BPW special long-life grease ECO-Li 91.

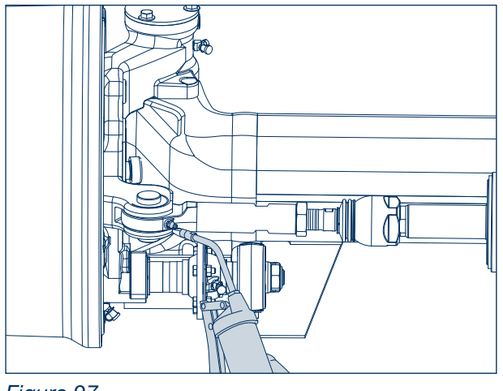


Figure 97

„ B “ Tie rod with integrated axial joint

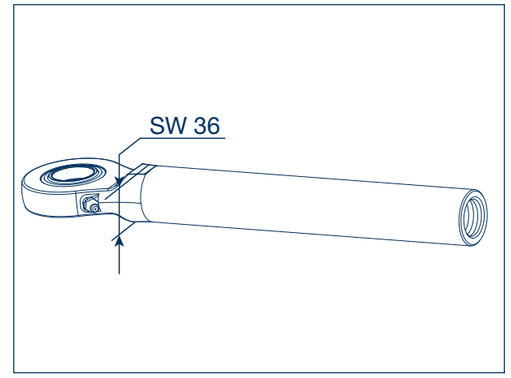


Figure 98

Installation:

[1] Screw the locking nut (1) and tie rod (2) up to the axial ball joint (3).

Repair Guide:

Slide the holder to the left side of the shock absorbers if available on the cross tube in the correct position. Install the holder with the screws and the nuts facing downwards.
See Chapter 21.

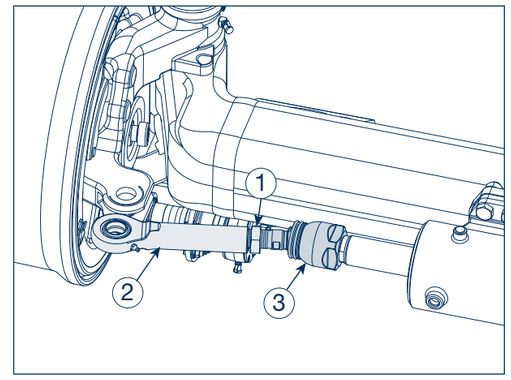


Figure 99

[2] Put the pivot (4) in and insert the snap ring (5).

Repair Guide:

It is important to insert the pivot in the bore from above. Grease nipple should be mounted facing out.

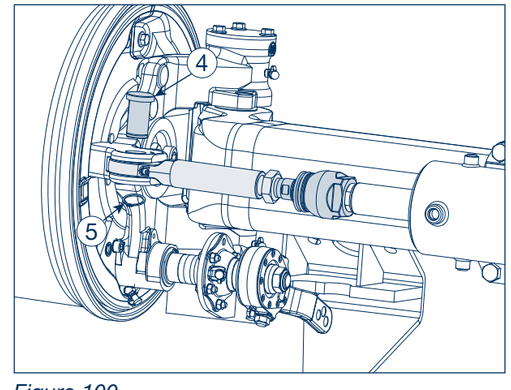


Figure 100

16 Tie rods versions for single-cylinder steering axle

[3] Align the tracking values.
At the individual toe setting turn the threaded bolt (6) with an open-end spanner (WS 27) 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 24.

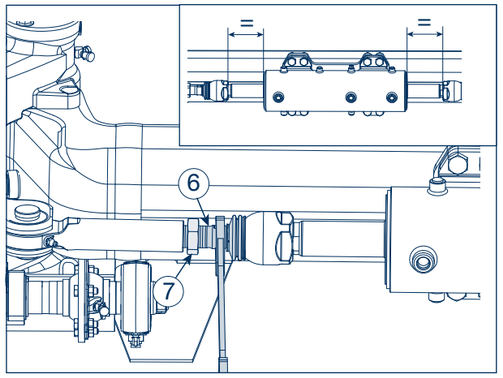


Figure 101

[4] After the adjustment tighten the locking nuts (7) (WS 41) to the specified torque.

Tightening torque:

M 28 x 1,5 M = 410 Nm

Repair Guide:

When tightening the locking nut (WS 41) onto the cross tube hold the cross tube with a wrench (WS 36).

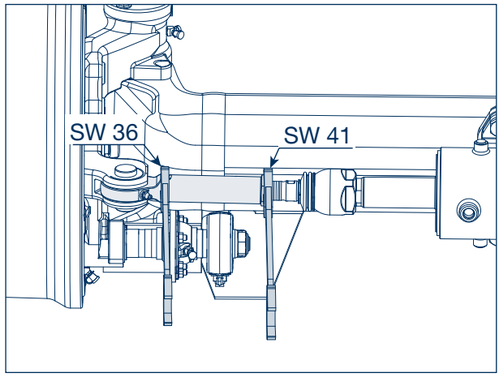


Figure 102

[5] Install the shock absorber, if available.

☞ See Chapter 21.

[6] Lubricate the tie rod ends with BPW special long-life grease ECO-Li 91.

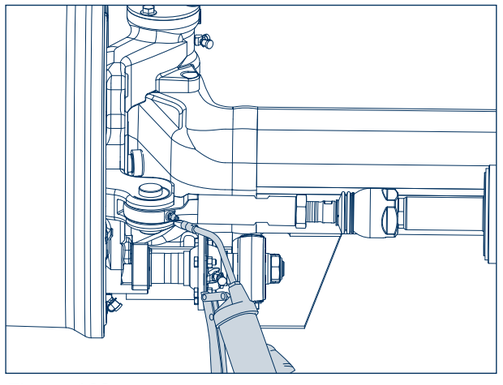


Figure 103

„ C “ Axial joint with locknut

Installation:

[1] Screw the joint head (1) with the locking nut (2) into the tie-rod (3) to end point.

[2] Tighten the locking nut to the specified torque.

Tightening torque:

M 28 x 2 M = 300 Nm

Repair Guide:

When tightening the locking nut (WS 41) onto the cross tube hold the cross tube with a wrench (WS 36).

[3] Screw the pre-assembled tie-rod with the clamp (4) onto the axial ball joint.

Repair Guide:

Slide the holder to the left side of the shock absorbers if available on the cross tube in the correct position. Install the holder with the screws and the nuts facing downwards.
See Chapter 21.

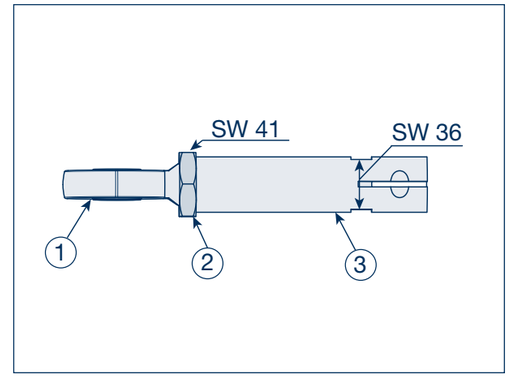


Figure 104

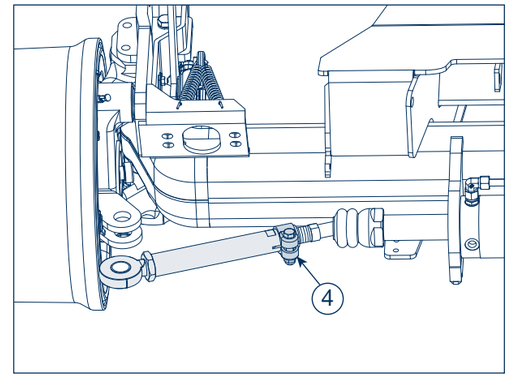


Figure 105

[4] Put the pivot (5) in and insert the snap ring (6).

Repair Guide:

It is important to insert the pivot in the bore from above.

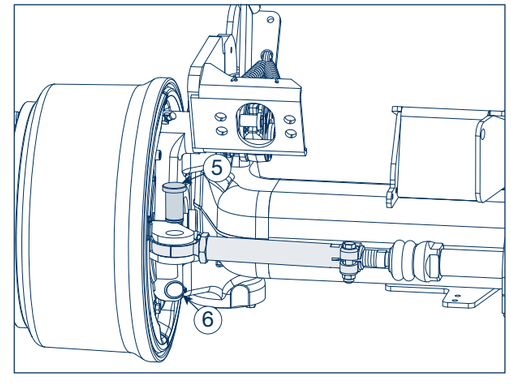


Figure 106

16 Tie rods versions for single-cylinder steering axle

[5] Align the tracking values.
At the individual toe setting turn the threaded bolt (7) with an open-end spanner (WS 27) 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 24.

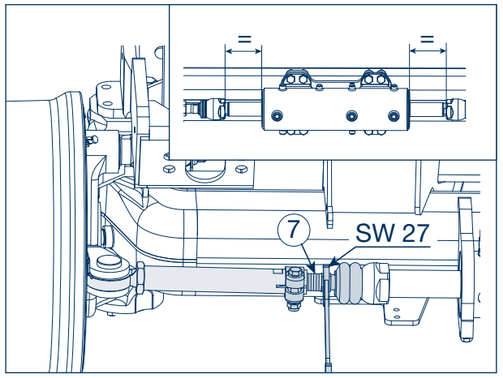


Figure 107

[6] After the adjustment tighten the locking nut (8) of the clamp with the prescribed tightening torque.

Tightening torque:

M 12 x 1,5 M = 86 Nm

[7] Install the shock absorber, if available.

☞ See Chapter 21.

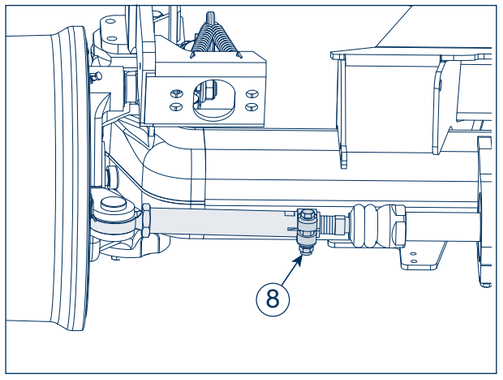


Figure 108

“ D “ Ball joint with locknut

Installation:

[1] Screw tie rod end (1) with the locking nut (2) into the cross tube (3) to end point.

[2] Tighten the locking nut to the specified torque.

Tightening torque:

M 30 x 1,5 M = 480 Nm

Repair Guide:

When tightening the locking nut (WS 41) onto the cross tube hold the cross tube with a wrench (WS 36).

[3] Screw the pre-assembled tie-rod with the clamp (4) onto the axial ball joint.

Repair Guide:

Slide the holder (on left side) of shock absorbers on the cross tube in the correct position. Install the holder with the screws and the nuts facing downwards.
See Chapter 21.

[4] Screw the castellated nut (5) (WS 46) of the ball joint and fasten it to the specified torque.

Tightening torque:

M 30 x 1,5 M = 500 Nm

[5] Refit the split pin (6) and bend it slightly.

Repair Guide:

Turn back the castellated nut to the closest possible pin hole in congruence with the next hole (Max. 30°).

[6] Align the tracking values.
At the individual toe setting turn the threaded bolt of the axial ball joint (7) (WS 27).

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 24.

[7] After the adjustment tighten the locking nut (8) (WS 19) of the clamp with the prescribed tightening torque.

Tightening torque:

M 12 x 1,5 M = 86 Nm

[8] Install shock absorber if available.

☞ See Chapter 21.

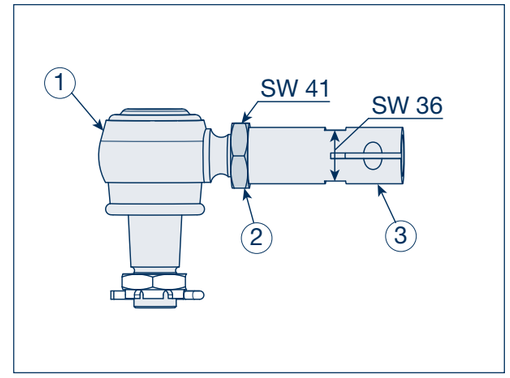


Figure 109

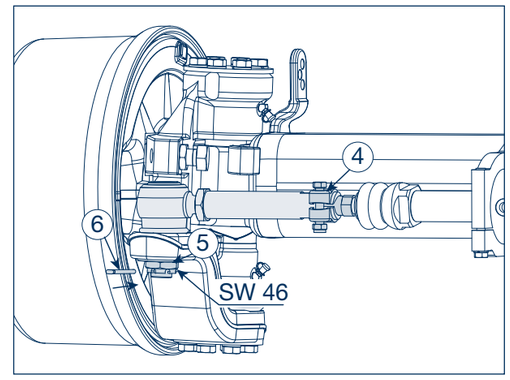


Figure 110

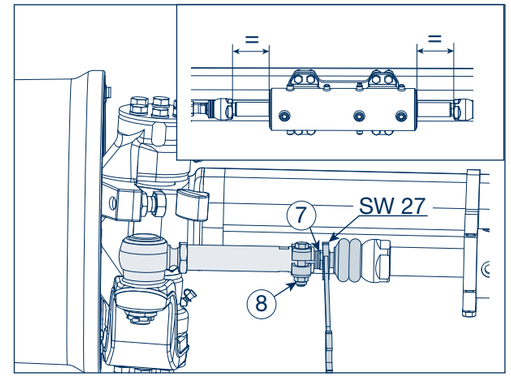


Figure 111

16 Tie rods versions for single-cylinder steering axle

“ E ” Tie rod with integrated ball joint

Installation:

[1] Screw the locking nut (1) and tie rod (2) up to the axial ball joint (3).

Repair Guide:

Slide the holder on left side of shock absorbers if available on the cross tube in the correct position. Install the holder with the screws and the nuts facing downwards.
See Chapter 21.

[2] Screw the castellated nut (4) (WS 46) of the ball joint and fasten it to the specified torque.

Tightening torque:

M 30 x 1,5 M = 500 Nm

[3] Install the split pin (5) and bend it slightly.

Repair Guide:

Turn onward the castellated nut to the closest possible pin hole in congruence with the next hole (max. 30°).

[4] Align the tracking values.
At the individual toe setting turn the threaded bolt (6) with the open-end spanner (WS 27) 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 24.

[5] After the adjustment tighten the locking nuts (7) (WS 41) to the specified torque.

Tightening torque:

M 28 x 1,5 M = 410 Nm

Repair Guide:

When tightening the locking nut (WS 41) onto the cross tube hold the cross tube with a wrench (WS 36).

[6] Install shock absorber if available.
See Chapter 21.

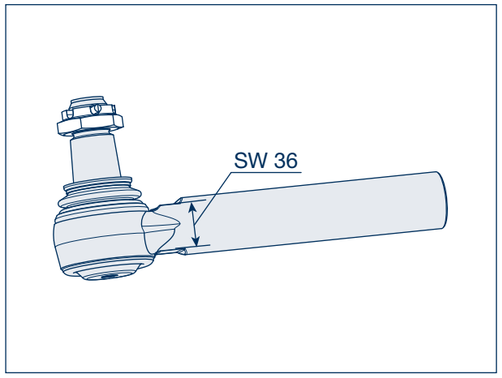


Figure 112

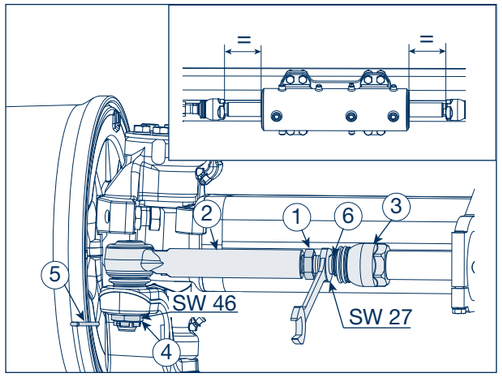


Figure 113

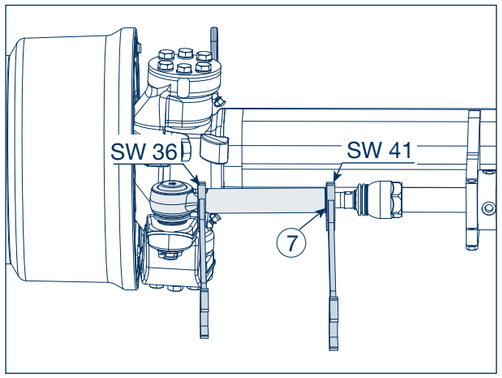


Figure 114

Operating instructions for Combined cylinder 17

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 bleed screws.

[4] Steer the steering knuckle out to the left or right end position, remove the bleed screw (5) and screw into the ventilating valve instead. Tighten the ventilating valve with 20 Nm tightening torque.

Repair Guide:

Before screwing the ventilating valve the cylinder should be filled with 50 ml of hydraulic oil.

[5] Install the shock absorber.

Repair Guide:

When installing the shock absorber the steering cylinder must be set so that the piston rod length is equal on both sides (depending on the construction, it can be fitted above or below).

[6] Adjust the dimension of bracket for shock absorber (Basic setting L = 396 mm), and tighten its bolt to the prescribed tightening torque.

Tightening torque:

M 12 M = 86 Nm

[7] Put shock absorber (7) onto the holder,insert spring washer and locking screws and tighten them to the specified torque.

Tightening torque:

M 12 M = 66 Nm

Repair Guide:

The thicker side of the steering damper has to be mounted onto the cylinder.

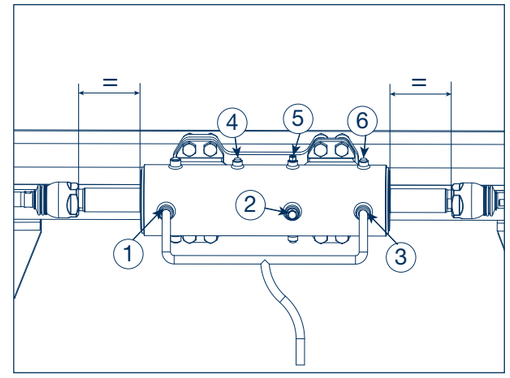


Figure 115

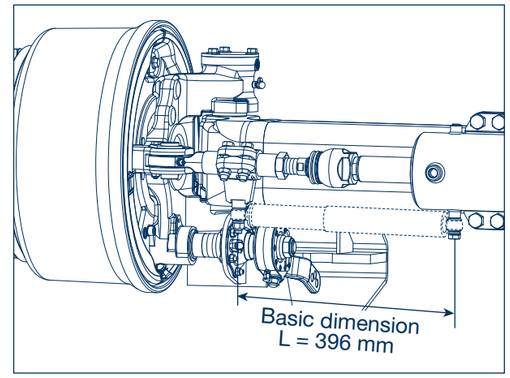


Figure 116

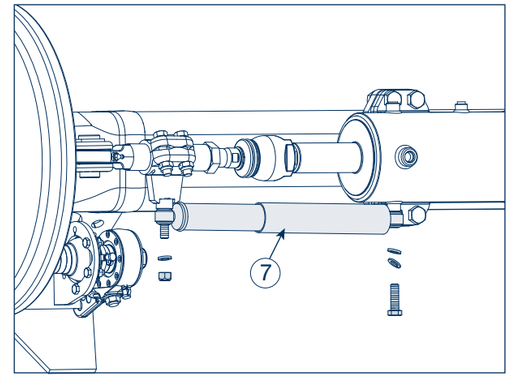


Figure 117

17 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.

Note:

The cylinder ports are combined as shown in the picture.

Note:

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

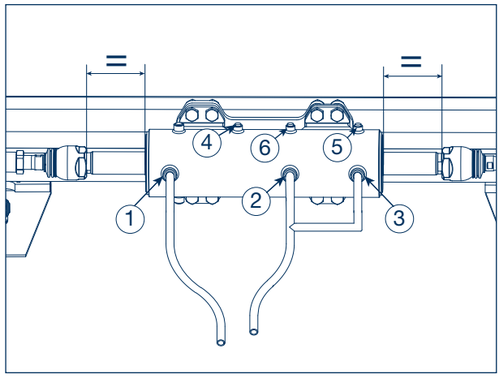


Figure 118

Steering axle with forced steering cylinder 18

BPW No.: 05.444.50.64.0

Note:

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

Repair Guide:

When mounting, the steering cylinder must not be under pressure!

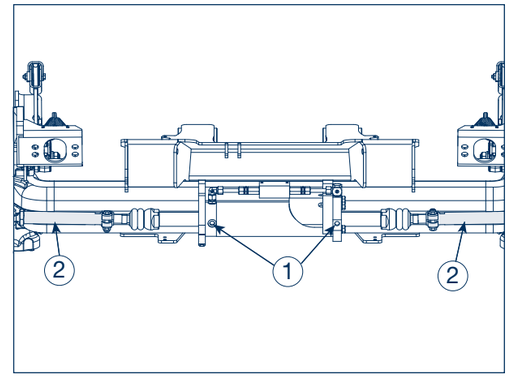


Figure 119

Dismantling

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

Note:

Please note, the cylinders are filled with hydraulic oil.

[2] Remove the tie rods (2), which may be different depending on the version.

☞ See Chapter 18.

[3] Dismantle the axial ball joint (3) from the piston rod.

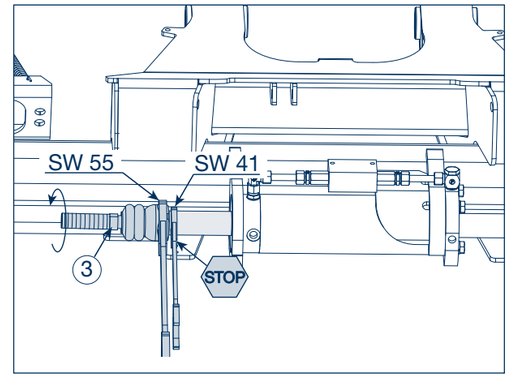


Figure 120

Repair Guide:

Axial ball joint must be secured with Loctite 243.
Loosen the axial ball joint (WS 55) from the piston rod while holding the piston rod with a wrench (WS 41).

[4] Dismantle the locking screws (4) from the steering cylinder.

Repair Guide:

Before loosening the screws of the cylinder protect it from falling down.

[5] Lift off the steering cylinder.

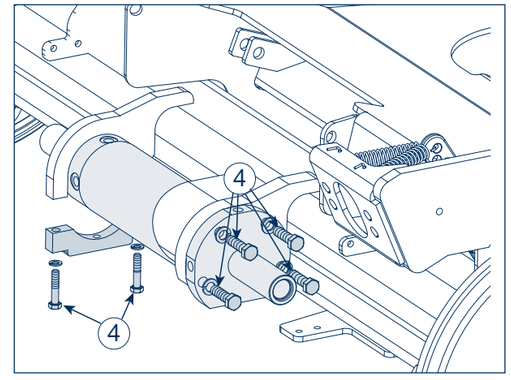


Figure 121

18 Steering axle with forced steering cylinder

Installation:

[1] Insert the cylinder on the holder.

[2] Insert locking screws (1) with spring washers and tighten them to the specified torque.

Tightening torque:

M 14 x 50	M = 100 Nm
M 12 x 80	M = 66 Nm
M 12 x 50	M = 38 Nm

Repair Guide:

Reinstall the clack valve (2) onto the new steering cylinder.

[3] Screw the axial ball joint (3) into the piston rod.

Repair Guide:

Axial ball joint must be secured with Loctite 243.

[4] Tighten the axial ball joint to the prescribed tightening torque.

Tightening torque:

M = 500 Nm

Repair Guide:

Tighten the axial ball joint (WS 55) into the piston rod while holding the piston rod with a wrench (WS 41).

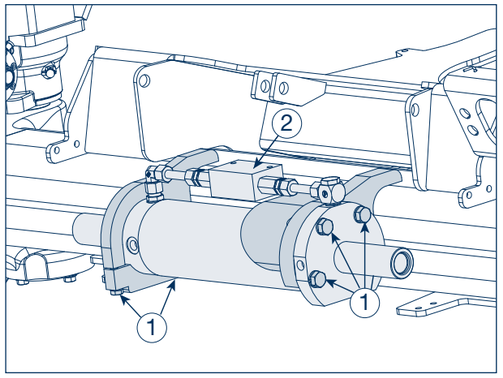


Figure 122

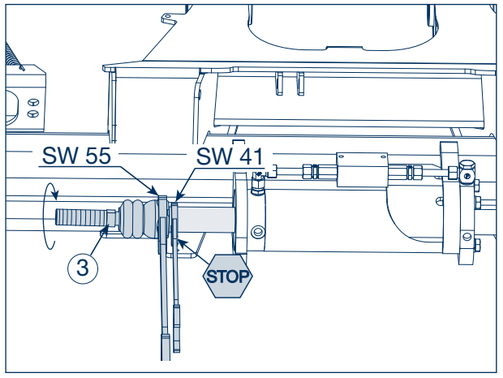


Figure 123

[5] Install the tie rod (4), which may be depending on the version.

☞ See Chapter 18.

[6] Align the tracking values.
At the individual toe setting turn the threaded bolt (5) with the open-end spanner (WS 27) of the axial ball joint.

☞ See Chapter 24.

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.

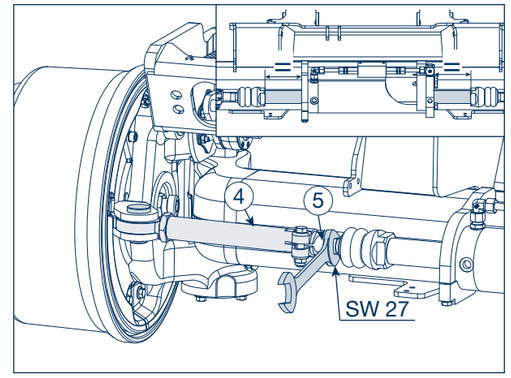


Figure 124

19 Shock absorber

Repair Guide:

Depending on the version of the shock absorbers they are mounted in upper or lower construction.

Dismantling

[1] Remove lock nuts (1), (2) and pull out the through-bolt (3).

[2] Remove shock absorber (4).

Note:

Please note that the shock absorber is in tensioned condition.

Note:

Before dismantling, the holder clamp (5) should be measured and to note the value of distance of fixing bolts. It is absolutely essential that the undulating thrust washers are in zero position.

Repair Guide:

Check steel-rubber-steel bushes (6) in the shock absorber heads for wear and replace them if necessary.

[3] Before dismantling the holder clamp (5) the tie rod should be removed.

☞ See Chapter 16 or 18. (depending on the version)

[4] Dismantle the tie rod end (7) and the clamp (8) on the relevant side. Loosen the holder clamp fixing screw (9) and pull down the support from tie rod.

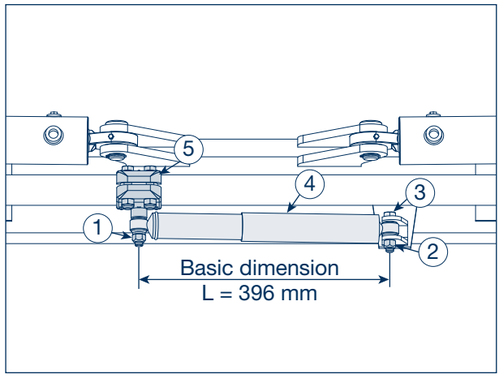


Figure 125

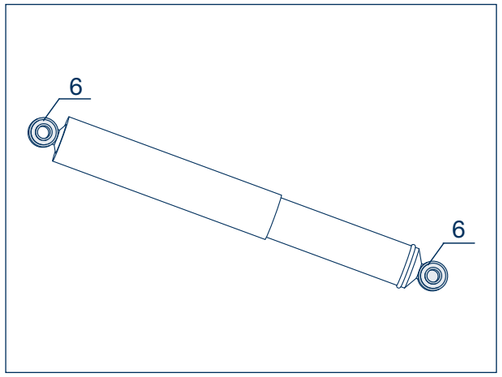


Figure 126

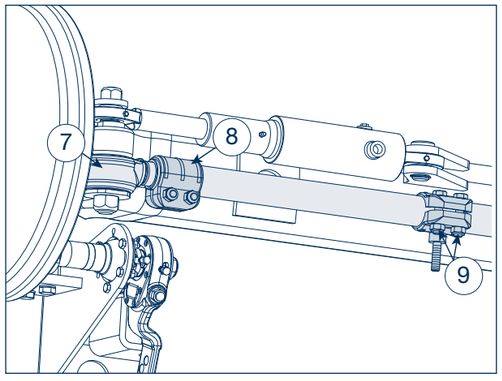


Figure 127

Installation

[1] Slide the holder clamp (1) in the correct position on the tie rod (2).

Repair Guide:

Place the holder clamp with bolt on tie rod, and the nut facing downward.

[2] Assemble the tie rod.

☞ See Chapter 16 or 18.

[3] Set up the distance of support back to the value measured while dismantling. (Basic dimension L = 396 mm)

Repair Guide:

During alignment of the distance value it is absolutely essential that the clawed thrust washers are in zero position.

[4] Assemble the fixing screws (3) with the lock nuts (4) an tighten them to the prescribed torque.

Tightening torque:

M 12 M = 86 Nm

[5] Slide the thinner part of the shock absorber on the threaded bolt of the holder clamp and fasten it with a self-locking nut (5).

Tightening torque:

M 12 M = 66 Nm

[6] Place the other side of the shock absorber on the welded bracket of the axle and thereafter tighten the locking screw (6) with the lock nut (7) to the prescribed torque.

Tightening torque:

M 12 M = 66 Nm

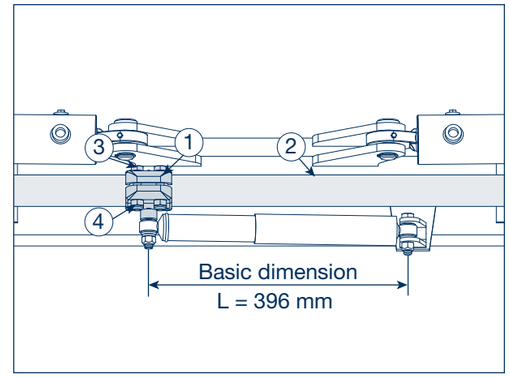


Figure 128

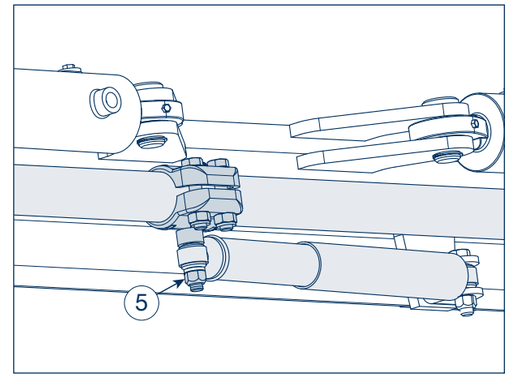


Figure 129

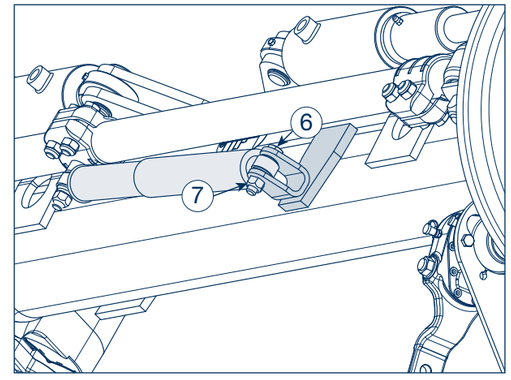


Figure 130

20 Steering axle with locking cylinder

BPW No.: 02.4905.37.00

Note:

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

Repair Guide:

When measuring, the steering cylinder must not be under pressure!

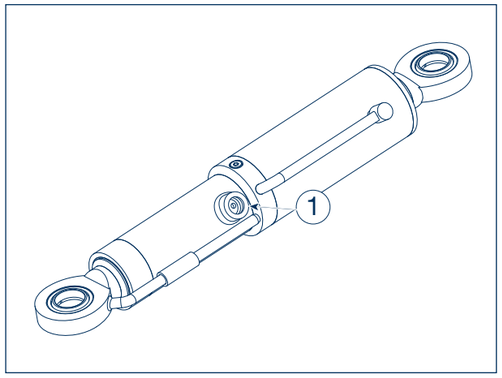


Figure 131

Dismantling

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

Note:

Please note, the cylinders are filled with hydraulic oil.

Locking cylinder above the tie rod:

[2] Remove both cotter pins (2) and pull out the bolts (3).

[3] Take off the cylinder (4).

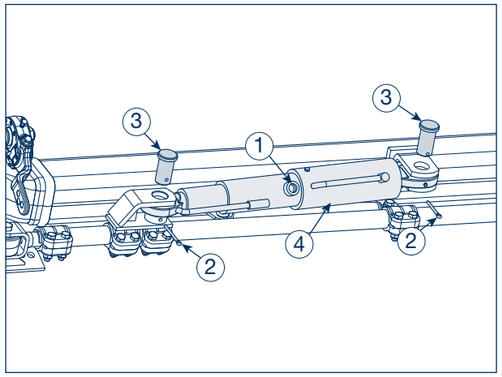


Figure 132

Locking cylinder under the tie rod:

[4] Loosen locking screws (5) from cylinder bracket and remove the locking plate (6).

[5] Remove cotter pin (7) and pull out the bolt (8).

Repair Guide:

To aid disassembly, a threaded hole has been prepared in a bolt (M12).

[6] Remove the cotter pin (9) on the other side and pull out the bolt (10).

[7] Take off the cylinder (11).

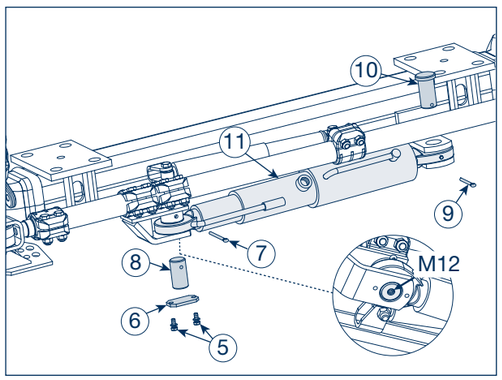


Figure 133

Locking cylinder above the tie rod:

Installation:

[1] Loosen the clamping screws (1) on welded clamp (2) as long as the welded clamp can be moved easily on the tie rod.

[2] Set the distance of clamp in advance similarly to the length of the cylinder.

Repair Guide:

Place the holder with bolt on tie rod, and the nut facing downward.

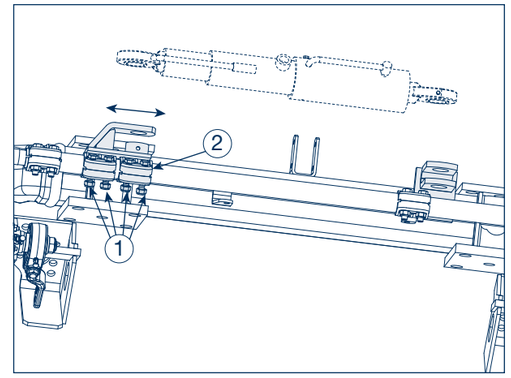


Figure 134

[3] Install the cylinder (3).

[4] Insert the bolt (4) on the right side.

[5] Insert the split pin (5) and bend it slightly.

[6] Put in the bolt (6) on the left side into the welded clamp in such a way that the holes are aligned.

Repair Guide:

Note for mounting direction. Insert the bolt into the bore from above.

[7] Insert the split pin (7) and bend it slightly.

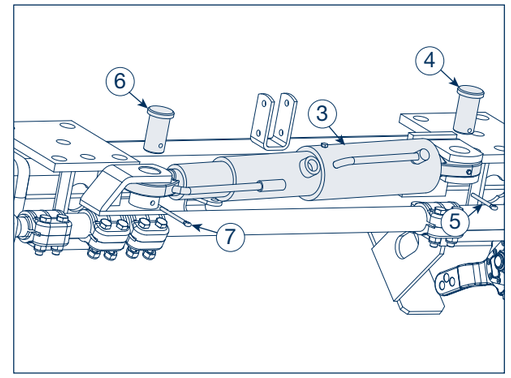


Figure 135

[8] Screw in the inlet coupler (8).

[9] Inspect axle geometry (toe-in) and adjust if necessary.

☞ See Chapter 24.

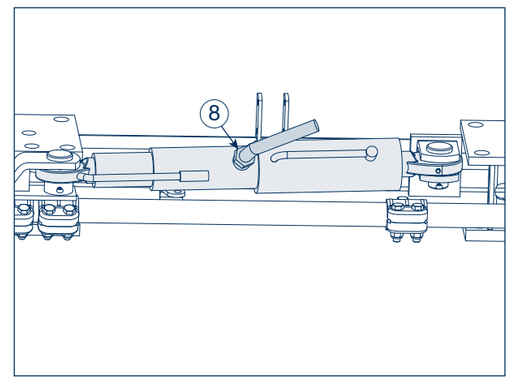


Figure 136

20 Steering axle with locking cylinder

[10] Put the cylinder under pressure and adjust floating piston rod.

Note:

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

Repair Guide:

For the correct setting it is a requirement that the straight-ahead travel should be fixed.
The straight position can be fixed by using an assembly aid device (2) with two holes (L = 396 mm), while the shock absorber must be in a dismantled condition.

[11] Move the holder of the cylinder on the tie-rod until the floating rod is tight.

[12] Tighten the clamping screws (1) in the welded clamp of the cylinder to the prescribed tightening torque.

Tightening torque

M 12 x 1,5 - 8.8 M = 86 Nm

[13] Remove assembly aid device (2) and insert the shock absorber (3).

☞ See Chapter 21.

[14] Grease the lubrication points on the cylinder with BPW special longlife grease ECO-Li 91.

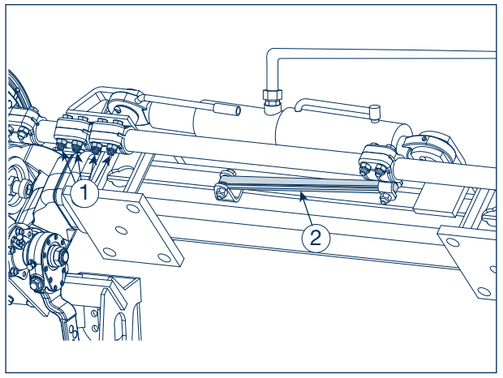


Figure 137

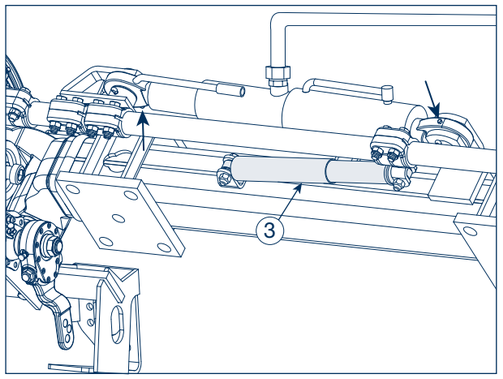


Figure 138

Locking cylinder under the tie rod:

[1] Loosen the clamping screws (1) on welded clamp (2), until the welded clamp can be moved easily on the tie rod.

[2] Set the distance of clamp in advance similarly to the length of the cylinder.

Repair Guide:

Place the holder with bolt on tie rod, and the nut facing downward.

[3] Install the cylinder (3).

[4] Insert the bolt (4) on the right side.

Repair Guide:

It is important to insert the bolt into the bore from above.

[5] Insert the split pin (5) and bend it slightly.

[6] Put in the bolt (6) on the left side into the welded clamp in such a way that the holes are aligned.

Repair Guide:

It is important to insert the bolt into the bore from below.

[7] Insert the split pin (7) and bend it slightly.

[8] Fasten the securing plate (8) with the spring washers (9) and screws (10) and tighten them with the prescribed tightening torque.

Tightening torque

M 8 x 20 - 8.8 M = 19 Nm

[9] Screw in the inlet coupler (11) and put the cylinder under pressure.

Note:

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

[10] Inspect axle geometry (toe-in) and adjust if necessary.

☞ See Chapter 24.

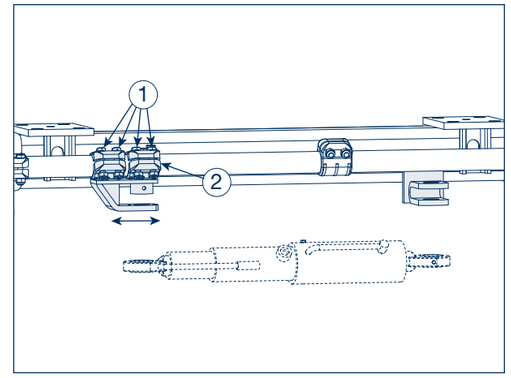


Figure 139

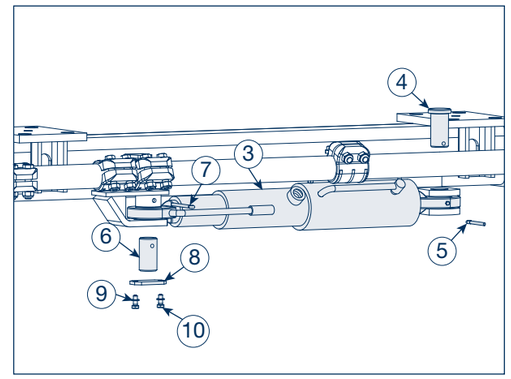


Figure 140

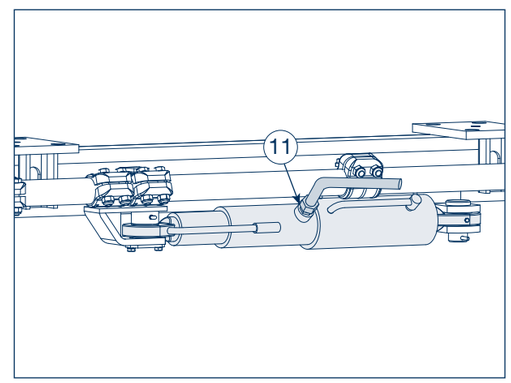


Figure 141

20 Steering axle with locking cylinder

[11] Put the cylinder under pressure and adjust floating piston rod.

Note:

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

Repair Guide:

For the correct setting it is a requirement that the straight-ahead travel should be fixed.
The straight position can be fixed by using an assembly aid device (2) with two holes (L = 396 mm), while the shock absorber must be in a dismantled condition.

[12] Move the holder of the cylinder on the tie-rod until the floating rod is tight.

[13] Tighten the clamping screws (1) in the welded clamp of the cylinder to the prescribed tightening torque.

Tightening torque

M 12 x 1,5 - 8.8 M = 86 Nm

[14] Remove assembly aid device (2) and insert the shock absorber (3).

☞ See Chapter 21.

[15] Grease the lubrication points on the cylinder with BPW special longlife grease ECO-Li 91.

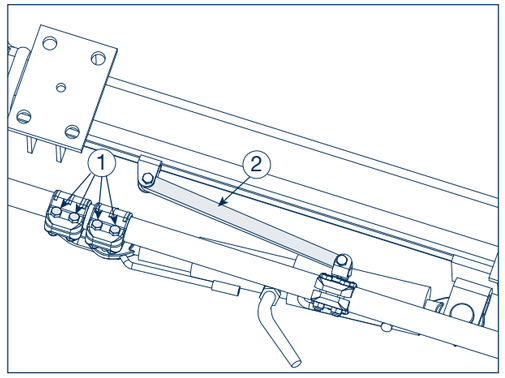


Figure 142

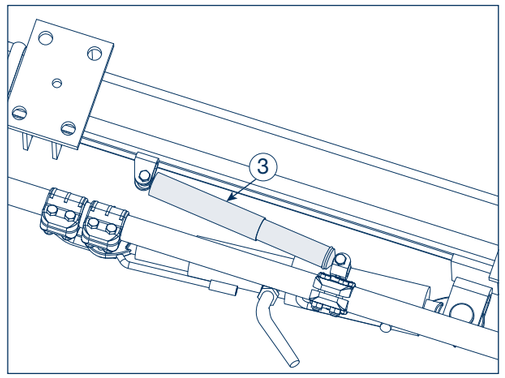


Figure 143

Tie rod for locking cylinder at GSLA 21

Note:

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

Dismantling

Repair Guide:

Before dismantling the tie rod, the shock absorber and the steering cylinder have to be dismantled.

☞ See Chapter 21 - 22.

[1] Remove the fixing nut (1) and pull out the bolt (2).

[2] Take off the tie rod (3).

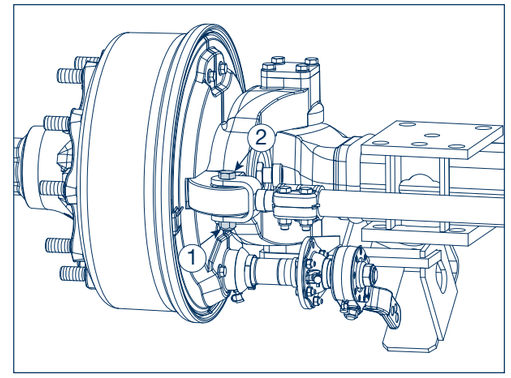


Figure 144

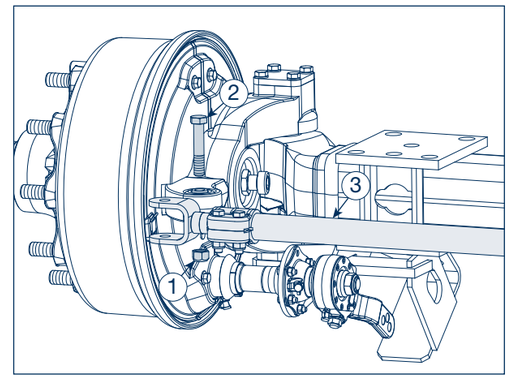


Figure 145

Warning!

Check the steel-rubber-steel bushes (4) in the steering arm and the holes (5) in the forked tie rod ends for wear and replace if necessary.

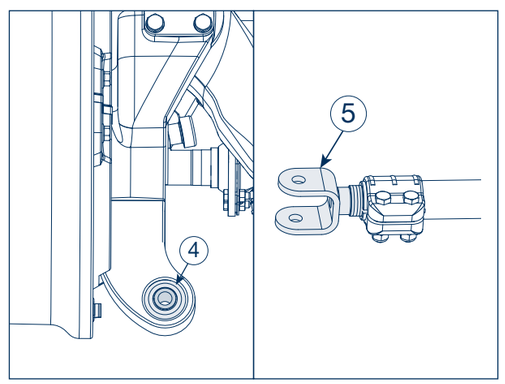


Figure 146

21 Tie rod for locking cylinder at GSLA

Installation:

[1] Loosen the fixing nuts (1) of the clamps and screw out the forked tie rod end (2). Note left- and right-hand thread.

[2] Screw in the new forked tie rod end (2) to the same length. Note left- and right-hand thread.

Repair Guide:

Screw the forked tie-rod end at least to such length that the cross tube slot is totally covered.

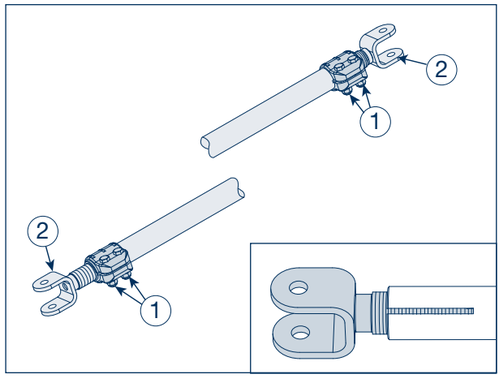


Figure 147

[3] The tie rod length with the thread of the forked tie rod ends must be set in advance.

Repair Guide:

When adjusting the track rod length the zero position of the thrust washers is required.

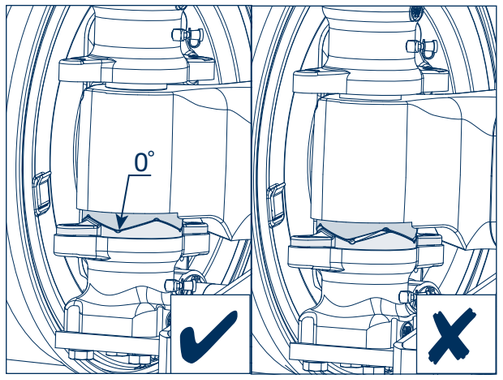


Figure 148

[4] Insert the tie rod on one side in the correct position and insert the screw (1). On the other side align the hole in the steering arm precisely by turning the tie rod tube.

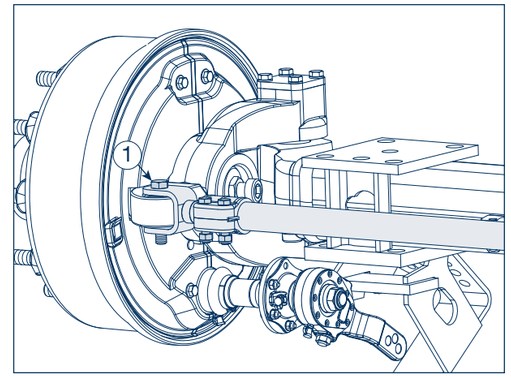


Figure 149

[5] Insert the screw (2) and new fixing nut (3) then tighten them to the specified torque.

Tightening torque:

M 16 - 8.8 M = 163 Nm

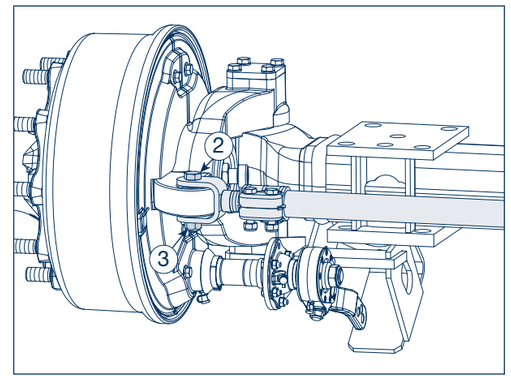


Figure 150

[6] Ensure the free movement of clamp (4). Tighten the fixing nuts (5) to the prescribed tightening torque.

Tightening torque:

M 12 x 1,5 - 8.8 M = 86 Nm

Repair Guide:

After replacing or changing of the tie rod check the axle geometry.

☞ See Chapter 24.

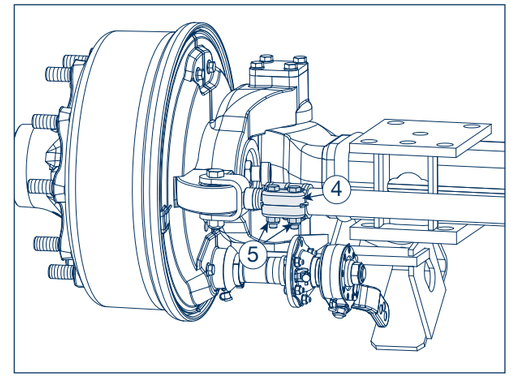


Figure 151

22 Toe-in setting

Note:

The process is done with the axle removed from under the vehicle. The procedure can be performed under the vehicle too 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 for Double cylinder steering axle and Single cylinder steering axle equipped with locking cylinder.

When measuring or adjusting, the steering cylinder must not be under pressure!

Note for Single cylinder steering axle equipped with Combined cylinder or Forced steering cylinder.

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

Measurement

[1] Screw the measuring tools onto a wheel bolt on both sides of the axle.

☞ See Chapter 5.

[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 ≤ (H - V) ≤ 6
GSL	4 ≤ (H - V) ≤ 5
GSLA	3 ≤ (H - V) ≤ 6

[5] Check whether the determined toe-in and toe-out values are within the specified tolerance values.

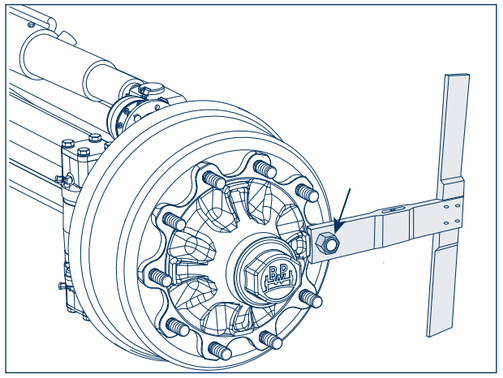


Figure 152

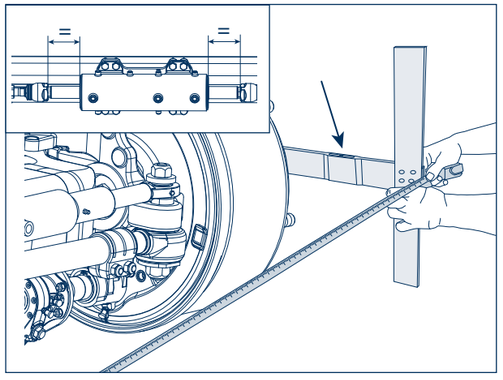


Figure 153

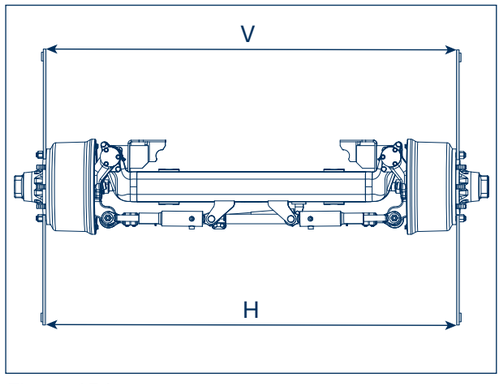


Figure 154

Adjustment:

Note:

The toe-in and toe-out values must be adjusted slightly.

Assemble double- and single cylinder-steering axle with tie rods (silent bushings):

Note:

When measuring or adjusting, the steering cylinder must not be under pressure!

[1] Loosen the clamping bolts (1) on the tie rod ends and at the holder of shock absorbers, if available.

Repair Guide:

When the axle is fitted with locking cylinder (single-cylinder steering axle) loosen the clamping bolts (2) at the holding clamp, this way the tie-rod can be rotated.

Note:

When loosening the fixing screws of the shock absorber the length (L) of the distance between the shock absorber fixing screws must be measured and noted.
It is absolutely essential that the clawed thrust washers are in zero position.

[2] If necessary, turn the cross tube as required with a pipe wrench.

[3] Check the distance in front of and behind the axle and if necessary, adjust again.

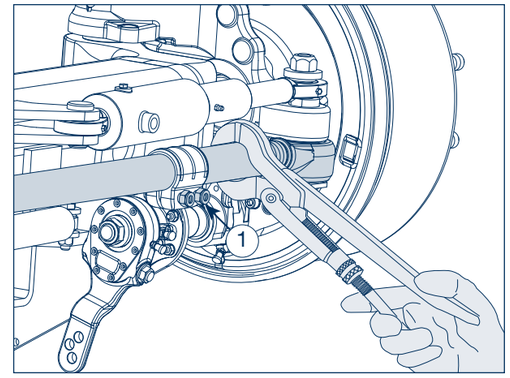


Figure 155

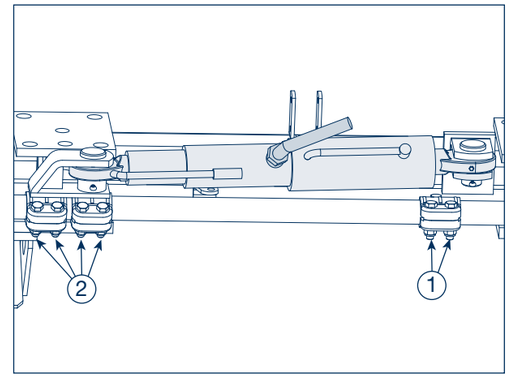


Figure 156

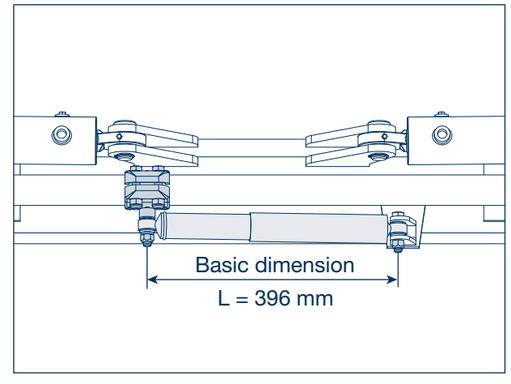


Figure 157

22 Toe-in setting

Assemble single cylinder steering axle with tie rods (ball joint or axial joint):

> **Repair Guide:**
>
> **When setting or measuring the single-cylinder steering axle, the same length of the piston rod on both sides must be adjusted and fastened.**

[1] Loosen the locking nut or self-locking nut (3) of the tie-rod.

[2] At the lateral toe-in setting, turn the threaded bolt (2) with the open-end wrench (WS 27) of the axial ball joint on both sides of the axle.

[3] Check the distance in front of and behind the axle and if necessary, adjust again.

Straight-ahead position:

[1] To achieve the corresponding straight-ahead (travel) position place the measuring tools again and carry out the measurement horizontally and diagonally on both sides.

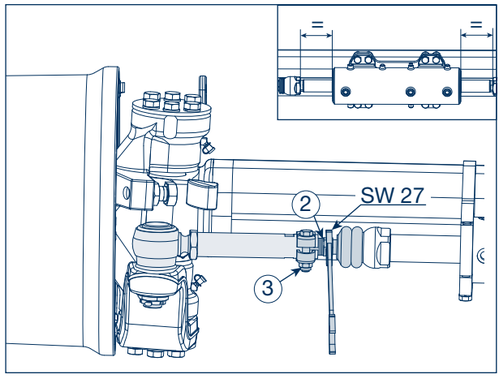


Figure 158

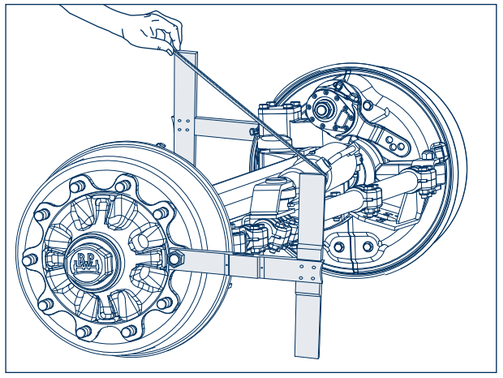


Figure 159

[2] 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.

[3] Check whether the determined values are within the specified tolerance values.

$0 \leq (D1-D2) \leq 2$

> **Repair Guide:**
>
> **If the differences are greater, check the zero position of the thrust washers.**

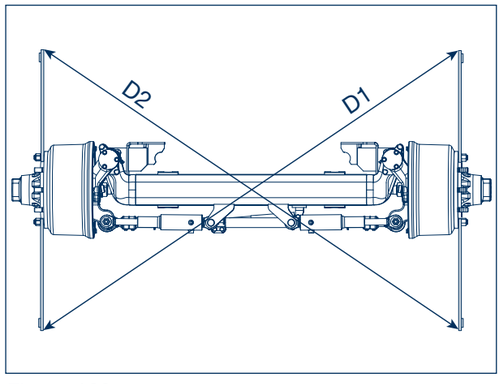


Figure 160

Fixing tracking values:

[1] After setting the track values check the tie rod clamps for free movement. Tighten the locking nuts of the clamps with the prescribed tightening torque.

Tightening torque:

M 12 x 1,5 - 8.8 M = 86 Nm

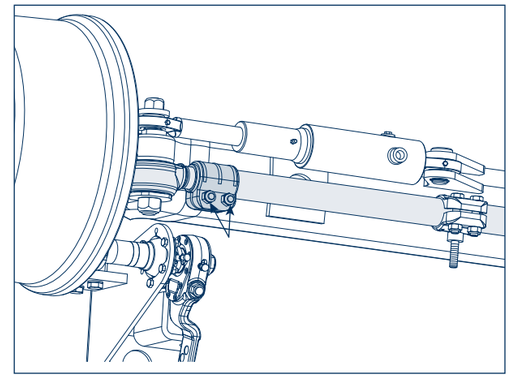


Figure 161

[2] Adjust the distance of shock absorber to the value measured (Basic setting L = 396 mm) while dismantling and tighten the self-locking nuts to the prescribed tightening torque.
In this case it is absolutely essential that the clawed thrust washers are in zero position.

Tightening torque:

M 12 x 1,5 - 8.8 M = 86 Nm

☞ See Chapter 21.

> **Repair Guide:**
>
> **In case of single-cylinder steering axle the tie rod clamp screws or fixing nut must be tightened to the prescribed tightening torque.**
> **See Chapter 17.**

> **Repair Guide:**
>
> **When steering axle fitted with locking cylinder (single cylinder steering axle) the clamping screws on the cylinder holder must be tightened. Please refer to the Chapter 21 starting from working step 10.**

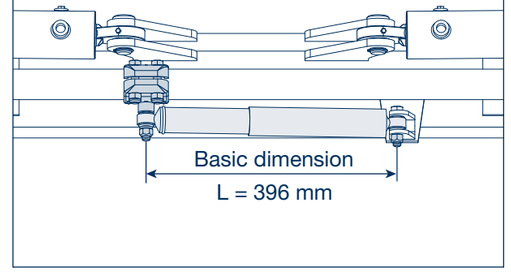
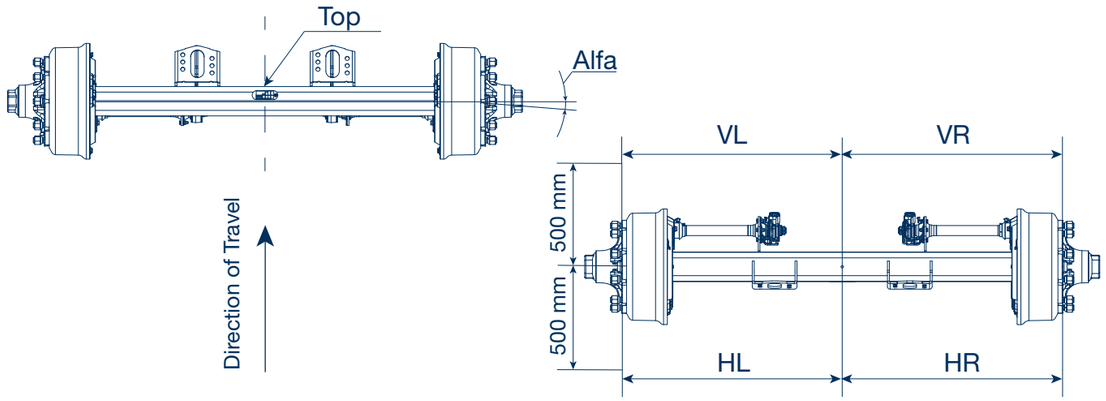


Figure 162

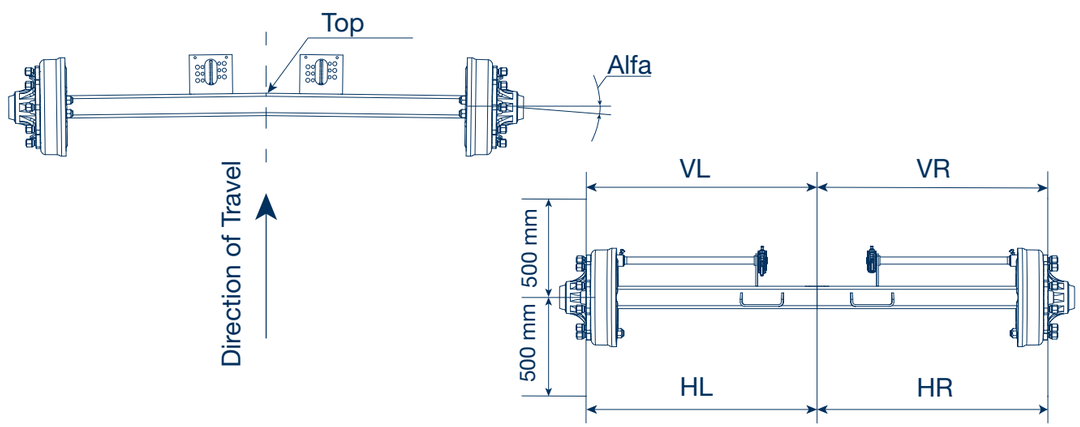
23 Limit values for axles geometry

Check the track and wheel caster values according to the table:

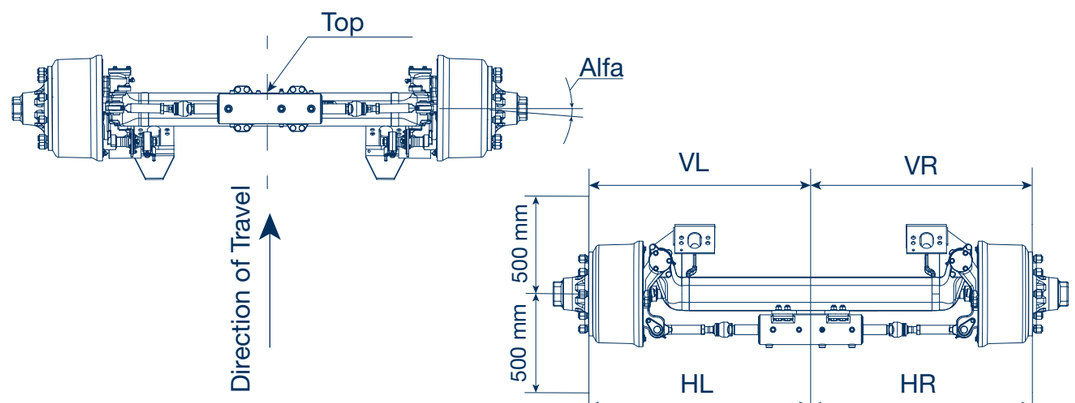
Rigid axle with hollow axle beam		
Toe-in	Straight-ahead position	Camber
(HL+HR)-(VL+VR)	HR-VR und HL-VL	Alfa
+1,5 / -1 mm	+ / - 1 mm	0 - 1,5°



Rigid axle with solid axle beam		
Toe-in	Straight-ahead position	Camber
(HL+HR)-(VL+VR)	HR-VR und HL-VL	Alfa
+ / -2 mm	+ / - 2 mm	0,5 - 1°



Steering axle		
Toe-in	Straight-ahead position	Camber
(HL+HR)-(VL+VR)	HR-VR und HL-VL	Alfa
0 - 6 mm	+ / - 2 mm	0 - 1°



Note:

When exceeding the prescribed limit values, please contact your BPW partner. Values for the special vehicles as specified by the vehicle manufacturer.

Notes

Notes

BPW-WH-Agrar 550216 01e

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.

BPW, the owner-operated company, consistently pursues one target: To always give you exactly the solution which will pay off. To this end, we focus our attention on uncompromising quality for high reliability and service life, weight and time-saving concepts for low operating and maintenance costs as well as personal customer service and a close-knit service network for quick and direct support. You can be sure that with your international mobility partner BPW, you always use the most efficient method.

Your partner on the path to economic viability

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