

## **Workshop manual** Mechanical suspension (VB)







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## **Product identification**



#### Explanation of BPW suspension type codes

## Special tools 2

Number	Description	Illustration of tool	Tool in operation
1	Installation and removal tool for steel-rubber bushes Ø 50 - 60 mm 14.825.11744	AA DA	
2	Assembly tool - for steel rubber bush in connecting rod <b>15.009.19433</b> Ø 60 - for steel rubber bush in equalising beam <b>15.006.19433</b> Ø 100		
3	Adapter for wheel alignment of axles ECO and 400k Unit 15.021.01609 M 135 x 2 12 t	D	
4	Extension tubes for wheel alignment of axles 15.001.01609 A 15.005.01609 B	A B B	AB

## 3 Exploded view







Leaf Spring

## Exploded view 3

### Equalising beam assembly

1200





## **Spare Parts List**

#### Pos. Part name

1100Support Front LH1105Support Front

- 1110 Wear Pad
- 1115 Bolt M12x120
- 1120 Tube
- 1125 Washer M12
- 1130 Locking Nut M12

#### 1200 Equalizing Beam Assembly

- 1205 Support Centre
- 1210 Wear Plate
- 1215 Disc
- 1220 Block
- 1225 Steel Rubber Bush M42
- 1230 Equalizing Beam
- 1110 Wear Pad
- 1235 Bolt M42x3
- 1240 Washer M42
- 1245 Locking Nut M42x3
- 1115 Bolt M12x120
- 1120 Tube
- 1125 Washer M12
- 1130 Locking Nut M12

1300 Support Rear LH

- 1305 Support Rear
- 1110 Wear Pad
- 1115 Bolt M12x120
- 1120 Tube
- 1125 Washer M12
- 1130 Locking Nut M12

- Pos. Part name 1400 Connecting Rod Adjustable L = 355 1900 Connecting Rod Adjustable L = 520 1405 Clamping Head LH Clamping Head RH 1410 1415 Steel Rubber Bush M24 1420 Bolt M36 1425 Bolt M12x65 1125 Washer M12 1130 Locking Nut M12 1430 Bolt M24x2 1435 Washer M24 Locking Nut M24x2 1440 1445 Bolt M36 1500 Connecting Rod Rigid L = 355 1800 Connecting Rod Rigid L = 520 1505 Connecting Rod L=355 Steel Rubber Bush M24 1415 1430 Bolt M24x2 1435 Washer M24 1440 Locking Nut M24x2 1510 Connecting Rod L=520 1600 Leaf Spring 10X76x13 1605 First Leaf 1610 Third Leaf 1615 Center Bolt 1620 Hexagon Nut
- 1625 Hexagon Bolt
- 1630 Spacer
- 1635 Roundhead Rivet
- 1640 Clip

#### **Other Parts**

- 1705 Spring Plate
- 1710 VB-Bracket
- 1715 Spring Pad
- 1720 U-Bolt
- 1435 Washer M24
- 1725 Locking Nut M24x3

## **Tightening torques**

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Area	Item.	Description	Thread	SW	Tightening torque (thread lightly greased)	
1	U-bolts					
	1.1	U-bolts <sup>1)</sup>	M 24-10.9	36	600 - 650 Nm	
2	Leaf spri	ings				
	2.1	Centre bolt of leaf spring	M 12-10.9	19	123 Nm	
	2.2	Nuts of the leaf spring clamps	M 12-8.8	19	85 Nm	
3	Connecting rods					
	3.1	Locking nut of the connecting rod	M 24 x 2-10.9	36	650 Nm	
	3.2	Locking nut of the clamping head	M 12-8.8	19	85 Nm	
4	Wear pad					
	4.1	Wear pad	M 12-8.8	19	85 Nm	
5	Equalizir	ng beam				
	5.1	Locking nuts	M 42 x 3	65	1300 Nm	

<sup>1)</sup> Apply grease to the threads of the U-bolts and nut contact surfaces.

## 5 Safety regulations, safety information

#### 5.1 Safety regulations

- All work must be performed by trained mechanics at competent repair facilities or authorized specialist companies who have access to all relevant tools and have acquired the knowledge required for this work. Anyone who performs maintenance and repair work must be trained in automotive mechanics 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 operation and service regulations as well as safety regulations of the vehicle manufacturer and of the manufacturers of other vehicle parts must be adhered to.
- 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. The brake must not be applied.
- Do not perform repair work unless wearing protective clothing (gloves, safety boots, safety goggles, etc.).
- Only use recommended tools.
- A second mechanic must provide assistance when working with heavy components (steering pivots, brake discs, 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 and suspensions are functioning correctly. New brake linings, drums and pads 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.
- The remaining thickness of the brake lining and the condition of the brake disc or brake drum must be visually
  inspected at regular intervals depending on the way in which the vehicle is used (see BPW maintenance
  instructions).
- Tighten all fixings to the recommended tightening torque.

#### 5.2 Safety information

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



It is essential that all maintenance work is carried out in accordance with the prescribed intervals in order to maintain the safe operation and roadworthiness of the trailer. The relevant operation and service regulations of the vehicle manufacturer and of the manufacturers of other vehicle parts must also be adhered to. Rectification of any defects which are discovered or replacement of worn parts should be carried out by a BPW Service Centre or BPW Direct Service Partner unless the vehicle owner has the facilities, equipment and workshop manuals and possesses an official certificate to perform interim inspections or special brake inspections.

When installing spare parts, it is strongly recommended that only original BPW components are used. Parts approved by BPW for trailer axles and suspensions regularly undergo special test procedures. BPW accepts product responsibility for them.

However, BPW cannot assess every single third-party product as to whether it can be used for BPW trailer axles and suspensions without any risk to safety. This applies even if such products have already been tested by an accredited test authority.

The warranty becomes null and void if spare parts other than original BPW parts are used.

## 6 Lubrication and Maintenance



	Lubrication Maintenance		3 weeks	eeks of y under after	eeks <sup>1)</sup>	eeks <sup>1)</sup> ıally)
	<ul> <li><sup>1)</sup> Under extreme conditions, increase frequency</li> </ul>	ially	ery 1 to :	t journey d, latest 00 km	ery 12 w arterly)	ery 26 w ice ann
	(e.g. construction sites and poor roads)	Init	Ъ	Wit firs loa 200	Dan (dn	Ev€ (tw
1	Grease the wear pads / ends of leaf springs.	1	1			
1	Check M42 bolts on Equalizing beam assembly for tightness.					1
-	Check centre support wear plate for wear.					-
2	Check axle connecting rod bolts for tightness.			2		2
3	Check connecting rod clamping screws for tightness.					3
-	Check axle alignment.					-
4	Check spring U-bolts for tightness using a torque wrench.			4		4
5	Check wear pad bolts for tightness.					5
-	Check wearing of wear pads.				-	
6	Check leaf spring fasteners.					6

#### Lubrication

Maintenance work

1) Clean and grease the wear pads / ends of leaf springs.

- initially after 2 weeks, then every 6 weeks.

- under extreme conditions, lubricate with more frequency.

Note: When exposed to highly abrasive particles (e.g. coal dust), we recommend not applying grease to avoid dust from sticking to components.

#### 1 Equaliser beam bearings

- twice anually.

Check nuts on the equaliser beam bearings for firm seating. The service life of the rubber-steel bush bearings is dependent on the firm seating of the inner steel bush.

Tightening torques: M 42 x 3 (SW 65) M = 1300 Nm







#### 2 Axle connecting rods

- twice anually, initially after 2 weeks.

Check lock nuts of the axle guide linkages / connecting rods for firm seating using a torque wrench.

Tightening torques: M 24 x 2 (SW 36)

M = 650 Nm

## 6 Lubrication and Maintenance

#### 3 Connecting rods

- twice annually.

Check connecting rod clamping screws for tightness.

Tightening torques: M 12 (SW 19)

M = 85 Nm







#### 4 Spring U-bolts

- twice annually, initially after 2 weeks.

Check spring U-bolts for tightness. If necessary loosen lock nuts, tighten nuts alternately to the prescribed torque, and a bit at a time, if necessary then re-lock.

Tightening torques: M 24 (SW 36)

M = 650 Nm

#### 5 Wear pads - twice anually.

Check wear pads and lateral wear plates in the shackle and equaliser beam for wear and the fastening screws for firm seating.

Tightening torques: M 12 (SW 19)

M = 85 Nm

#### **Visual inspection**

- twice anually.

Check all component parts and welding seams for wear and damage.

In order to check the bearing on the equaliser and axle guide linkage, move the vehicle back and forth slightly with the brake applied; or move the bearing points with the aid of a lever. No play should be present in the bearing when doing so.

## Removing and installing axle with leaf springs

#### 7.1 Removing

- [1] Safely support the vehicle frame.
- [2] Slightly raise axle with vehicle lift and support in secure position. Dismantle wheels.
- [3] Deactivate brakes. Dismantle air brake pipes for brake cylinder or air brake chamber (steering axle) and tension cable for parking brake.
- [4] Unscrew locking nuts (1440, SW 36) from the securing bolt (1430) of the left and right connecting rod (1505, 1420).



7

Picture 1

- [5] Remove the washers (1435) from the bolts (1430).
- [6] Remove the bolts (1430), from the Support and Connecting rods (1505, 1420).



Picture 2



Picture 3

- [7] Unscrew lock nuts (1130, SW 19) on the equalising beam (1230) or the support.
  - [8] Take out the securing bolts (1115).
  - [9] Take the tube (1120) out of both sides of the equaliser or support.

[10] Lower the axle and pull out.



Caution! RISK OF INJURY Protect the axle from falling off the jack. When lowering, leave sufficient space under the vehicle.

- [11] Check steel rubber bushes (1415) in the connecting rods (1505, 1420) for wear, if necessary remove connecting rod and change bushes.
- See Chapter 7.3 on page 18 for installation.



Picture 4

## 7.2 Replacing the bushes in the connecting rods



- [12] Align connecting rod (1505, 1420) under a press.
- [13] Press bush (1415) with a stepped bolt, Ø approx. 22/45 mm, from the connecting rod.
- [14] Align eye of the connecting rod (1505, 1420) in the centre on a backing with a hole diameter of approximately 66 mm.
- [15] Insert push-in tool with the phase (arrow) in the connecting rod eye.



Picture 5



Picture 6

## Removing and installing axle with leaf springs

- [16] Coat steel-rubber bush (1415) with soapy water or tyre fitting paste and insert it into the tool.
- [17] Push the bush in with the stepped bolt until the pushin tool releases.





[18] Remove push-in tool and stepped bolt. Rotate connecting rod and, if necessary, push the bush (1415) in a little In the opposite direction.



Picture 8





Picture 7

- [19] Loosen bolts (1425, SW 19) of the connecting rod ends (1410, 1405) and check the bolt (1420, 1445) of the connecting rod for smooth action. If necessary, remove the bolt, clean it thoroughly, and apply BPW special longlife grease ECO-LiPLUS to the thread.
- [20] Assemble the connecting rod (1400, 1900), paying attention to the right and left thread. Screw in connecting rod ends equally (minimum thread engagement 70 mm).

Repair guide! The securing bolts (1123) are secured after the axle alignment check (see chapter 10 / 11).

## 7 Removing and installing axle with leaf springs

#### 7.3 Installing

- [21] Check the wear pads (1110) in the equalising beams and supports for wear, see chapter 10.
- [22] Place axle securely on vehicle lift, push under vehicle and raise. Align axle with leaf springs and insert into the equalising beam or support.
- [23] Check tube (1120) for wear, use new one as appropriate and insert into the equalising beam or support. Insert securing bolt (1115).
- [24] Fit new washer (1125), locking nuts (1130) and tighten to the specified torque.

Tightening torques: M 12 (SW 19)

M = 85 Nm

[25] Assemble connecting rods with bolts (1430) to the equalising beam or support and to the axle.

Fit new washers (1435), locking nuts (1440) and tighten to the specified torque.

[26] Tightening torques: M 24 (SW 36) M = 650 Nm



Picture 10



Picture 11

## **Removing and installing leaf springs**

#### 8.1 Removing

- [1] Remove axle with leaf spring, see chapter 7 work procedures 1-11.
- [2] Unscrew the double nuts or the self-locking nuts (1725, SW 36) from the U-bolts. Remove the washers (1435). Remove spring plates (1715) and remove the spring U-bolt (1720).
- [3] Remove leaf spring (1600) from the axle.



#### Caution! RISK OF INJURY

Be careful while disassembling the leaf spring. Leaf springs are under tension and might release suddenly.

- [4] Take apart corroded leaf springs (1600). Unscrew hexagon nut (1620, SW 19) and remove spring screw (1615).
- [5] Unscrew nuts (1620, SW 19) from hexagon bolts (1625) and remove spring clamps (1640).
- [6] Thoroughly clean each leaf with a wire bush and inspect it for cracks.
   Replace heavily corroded spring leaves and those having cracks. Change the top spring leaf when the wear is more than 20% of the leaf thickness.
- [7] Apply graphite grease to the cleaned spring leaves.
- [8] Insert centre bolt and tighten nut with the prescribed torque.

Tightening torques: M 12 - 10.9 (SW 19) M = 123 Nm

- [9] Place spring clamps (1640) over the spring leaves and insert distance sleeve (1630).
- [10] Insert hexagonal screws (1625). Fit nuts (1620), tighten with the prescribed torque of 85 Nm and secure with a counter-nuts.



Picture 1



Picture 2



Picture 3

## 8 Removing and installing leaf springs

#### 8.2 Installing



Note: Spring leaves (multi-spring leaves) with only one hook end must be assembled with the hook to the rear.

- [11] Place the spring (1600) with the spring centre bolt head into the bore of the spring seat.
- [12] Insert U-bolt (1720) with Spring Plate (1705) into the spring pad.



Picture 4

- [13] Fit spring pads (1715).
- [14] Lightly grease the M24 threads of the U-bolts (1720).
- [15] Attach the washers (1435) and fit the lock nuts M24 (1725, SW 36).
- [16] Tighten the lock nuts with the prescribed torque in even stages to 650 Nm.



Picture 5

## Removing and installing equalising beams

#### 9.1 Removing equalising beam

#### Note:

To remove the equalising beam, remove the centre axle, or tile rear axle in case of a tandem axle suspension, and loosen the connecting rods of the second axle.

[1] Unscrew the lock nut (1130, SW 19) and washer (1125) from the fixing bolt (1115). Pull fixing bolt from the wear pad (1110) on the arm.





[2] Check wear pads (111) (sliders with wear covers) for wear.
 Upon reduction of the thickness of the guide rod by 25% of the total thickness, the supports must be exchanged.



Picture 2

[3] Use chisel or grind off the upper weld seams of the wear pads.





## 9 Removing and installing equalising beams

- [4] Remove locking nut (1245, SW 65) and washer (1240).
- [5] Remove disc (1215) and threaded bolt (1235).



Picture 4

1235 1235

Picture 5



Picture 6

- [6] If the threaded bolt (1235) is stuck, weld a hexagonal nut (arrow) on to the middle of the bolt head. Remove threaded bolt with a drawing tool.
- [7] Remove equalising beam from the support.

**Replacing rubber-steel bushes** 

under a press. and replace it if required.

Check rubber-steel bush (1225) in the equalising beam for wear. Upon detection of wear, push out

Coat the outside of the new bushes (1225) with

soapy water and press into position using the extraction tool and suitable mandrel. After installation there must be an equal excess of the bush on both

9.2

[8]

[9]

sides.

#### 9.3 Install equaliser beam

- [10] Check wear plates (1210) and wear discs (1215) for wear, replace if necessary and weld-tack.
- [11] Apply grease on the square wear plates (1210) and insert equalizing beam (1230) into the support.



Picture 7

- [12] Grease threaded bolt (1235) and insert from outside into the bore hole support/equalising beam.
- [13] Apply grease on the washer (1240) and push on to the bolt (1235).
- [14] Screw on new lock nut (1245, SW 65) and tighten to the specified torque.

Tightening torques: M 42 x 3 M = 1300 Nm

- Insert new wear pad (1110) into the equalizing beam, insert bolt (1115) with tube (1120) through the wearpad and equalizing beam.
- Push washer (1125) and fasten the locking nut (1130, SW 19) on to the bolt (1115).

Place weight on the leaf springs by lowering the vehicle.

Repair guide! During welding work, protect the leaf springs, plastics and other sensitive components from weld spatter and heat. Under no circumstances should the earth terminal be attached to the leaf spring or the hub.



Picture 8



Picture 9

## 9 Removing and installing equalising beams

[15] Fasten wear pad above with two short weld seams (1110/arrows), observing the correct position of the support.





Picture 10

[16] Tighten locking nuts (1115) to the specified torque. Tightening torques:

M 12 (SW 19)

M = 85 Nm



Picture 11



Picture 12

- [15] Insert connecting rod (1800, 1900) into the support.
- See page 18, from work step [25] for screw connection of the connecting rod.

## 10 Axle Alignment

#### 10.1 Conventional system



To compensate manufacturing tolerances, an axle alignment check must be done before the vehicle starts to operate.

#### Semi-trailer:

Determine diagonal dimensions **A** - **B** and **A** - **C** for the centre axle (reference axle) using comparative measurements and correct if necessary.

Check wheel base measurements **B** - **D** and **C** - **E** for the front axle and **B** - **F** and **C** - **G** for the rear axle and correct if necessary.

Measurements are generally taken from the centre of the hub cap (Fig.).

The triangle in the BPW logo is in the centre of the axle.



#### **IMPORTANT:**

The tracking tolerances defined by BPW must be maintained. Only by maintaining these tolerances, low-wear operation of the vehicle can be assured.

## Axle Alignment 10

#### Laser measuring system 10.2



Make sure that the axle is aligned horizontally to the base, if a laser measuring system is used. Otherwise the camber values will affect the result.

The operating and setting instructions of the system manufacturer must be considered.

## Calculation of the toe-in and toe-out settings:

 $\frac{A1 - B1 (mm)}{A (m)} = track width$ 

Positive value = toe-in Negative value = toe-out

The measurement must be performed on both sides of the axle. The measurement values are then added together.

The Sum of values is the toe-in/toe-out value of the axle and must be within the permitted tolerance range (-1 to +5 mm/m).

#### **IMPORTANT:**

The tracking tolerances defined by BPW must be maintained. Only by maintaining these tolerances, low-wear operation of the vehicle can be assured.

## **10 Axle Alignment**

The maximum possible wheel base correction per axle is +/-25 mm.



(2)

#### Axle alignment procedure:

- 1. Lift and support the vehicle frame.
- 2. Loosen the M12 locking nuts from the clamping heads (Fig. (2)).
- 3. Align the axles (centre axle first, then the remaining axles).
- Align the axles by turning the connecting rod bolt M36 with left-right threads (Fig. ③).
- Tighten M12 locking nuts with below mentioned tightening torque. M12 M=85 Nm
- 6. Lower the vehicle and remove the chassis jacks.

#### **IMPORTANT:**

Make sure that the thread engagement (M 36) is at least 70 mm.



## Notes :

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 wellestablished 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 the 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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