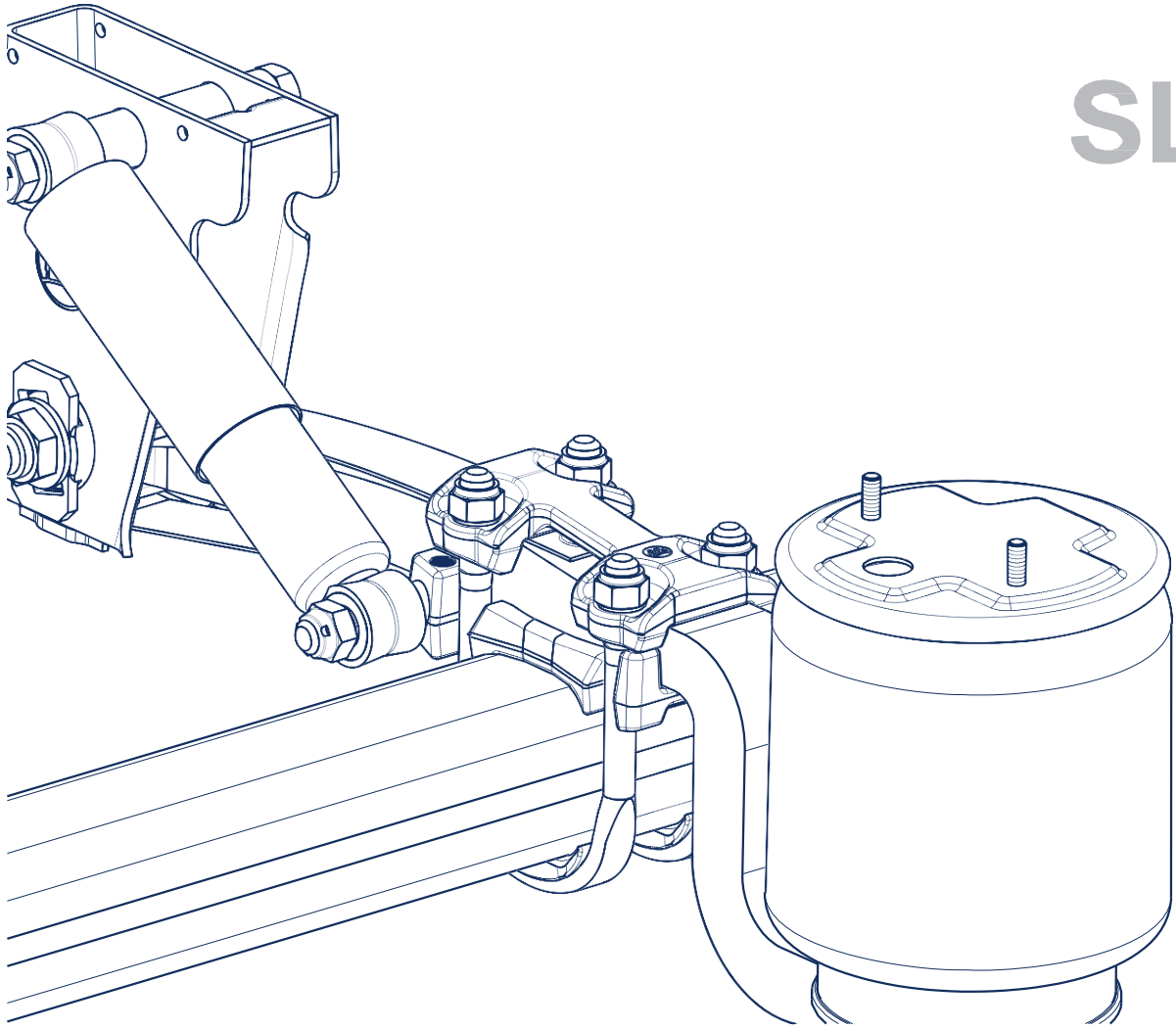


SL



Installation Guidelines

BPW air suspension



we think transport
हमारी सोच परिवहन

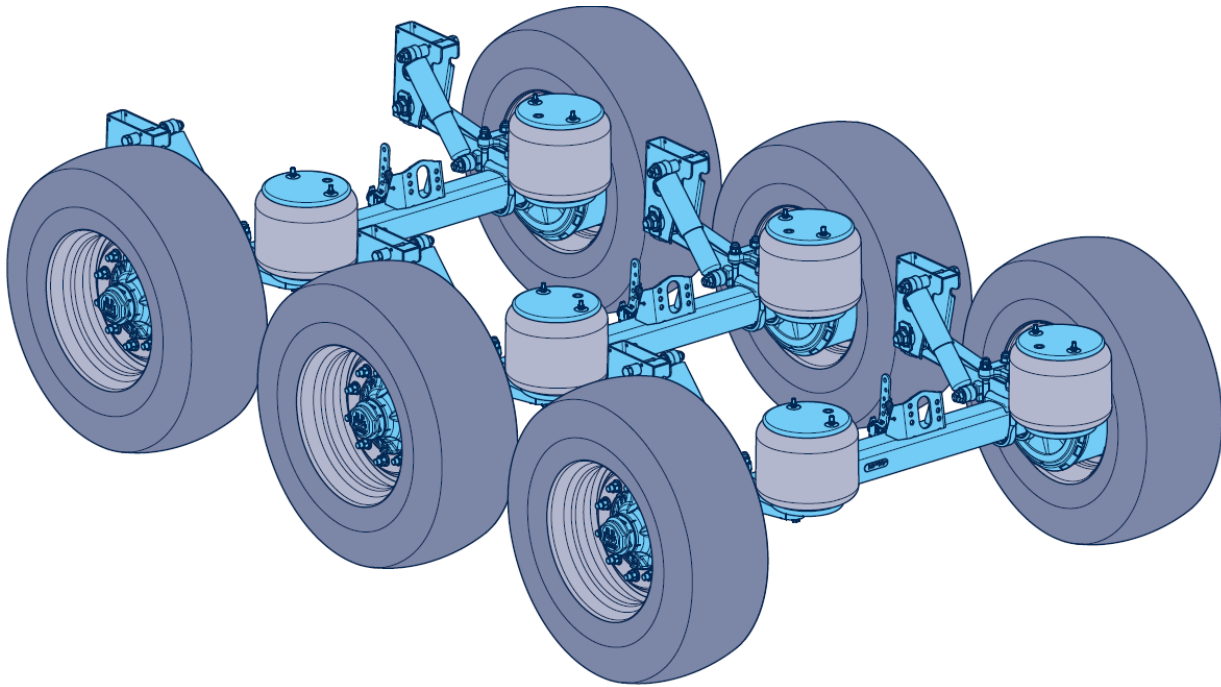




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1. Introduction



In these installation instructions for BPW SL running gear systems, we would like to outline the technical design guidelines and provide suggestions for installation.

Please note that the drawings in the guidelines are examples only and dimensions depend exclusively on the vehicle type and its operating conditions. This data is only known to the vehicle manufacturer who must incorporate it in their design.

The warranty shall lapse if installation of the BPW running gear system does not correspond to technical guidelines as per current BPW installation instructions.

Characteristics of the BPW air suspension: SL variants

- Axle load area 12 t
- 100 mm wide trailing arm
- Trailing arms made of spring steel
- Welded axle clamping
- Air suspension hanger brackets, rigid
- Spring bolt M 30



2. Design description

General

The combination of axle and air suspension (running gear system) can be used as single and multiple axle and suspension unit in the vehicle. The modular BPW concept of the multi-component assembly axle - trailing arm provides a maximum of adaptation options. The integrated vertical stop (bump stop in the air bag) ensures that the connection of the running gear to the vehicle frame only must be created through the air suspension hanger brackets and air bags.

Hydraulic suspensions with special BPW components should be used for suspensions with more than 6 axles.

Trailing arm and stabilizer function

The trailing arms (between axle and air suspension hanger bracket) transfer the wheel forces to the air suspension hanger bracket and are positioned in it through a steel / rubber / steel bush. Whilst air suspension is always used for the pure vertical movement, the body rolling of the vehicle and one-sided driving through dips or obstacles are compensated by the trailing arms (body rolling suspension). The U-shape configuration of axle beam and two trailing arms acts as a stabilizer to counteract the side tilt of the vehicle during lateral acceleration. The body roll stability can be supported with an additional stabilizer in special conditions.

Axle and brake load equalization

All air bags are connected with one another through air pipes. Uneven driving surfaces or vehicle tilts therefore do not create different axle loads within the multiple axle and suspension unit. The brake forces are also evenly distributed across all axles. BPW air suspension running gear systems therefore provide maximum driving safety and minimal tire wear.

Suspension and shock absorbers

To achieve the optimal combination of safe and comfortable driving and minimal wear, the air bags and shock absorbers are perfectly matched up with their characteristic curves and installation diagrams. The oscillating movement (vertically and body roll) is absorbed effectively, and the wheels retain optimal road contact.

Vertical, longitudinal, and lateral forces

The vertical forces are distributed across air suspension hanger brackets and air bags. Longitudinal forces (from uneven road surfaces and due to braking) as well as lateral forces, on the other hand, are exclusively applied to the vehicle frame through the air suspension hanger bracket. Without an adjusted brace, which must be professionally made by the vehicle manufacturer, the lateral forces cannot be transferred from the hanger bracket to the frame.

Raising and lowering; axle lift device

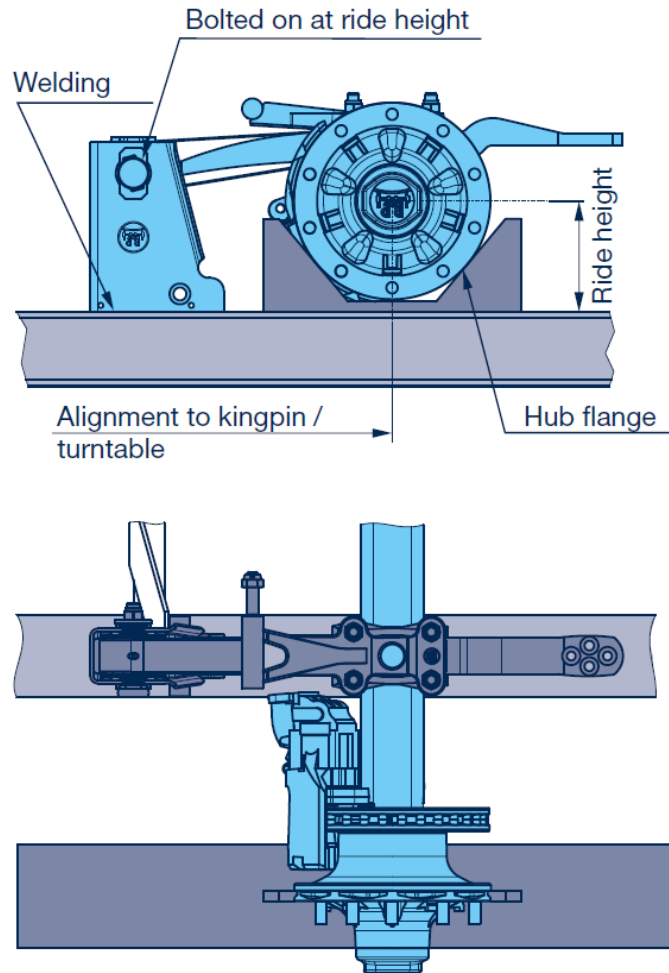
The air suspension facilitates the quick adjustment of the ride height through a switch or rotary disc valve for various loading and unloading processes. This typically involves adjustment to loading ramps or lowering for safe tipping. The also optional axle lift device (axle lift) for one or several axles makes it possible to influence the axle load distribution in an articulated truck and also the turning circle required. Tire wear and fuel consumption are also reduced on trips with partial loads and maneuverability is improved.

Installation and tracking

BPW vehicle components are designed for the simplest possible installation and maintenance. A tracking device integrated in the air suspension hanger bracket and spring seat arrangement make it possible to adjust the tire tracking more quickly when required. BPW provides a clamping device for initial installation, see Chapter 11.5, for optimally positioning air suspension hanger brackets and air bag brackets.

Your BPW contact will be happy to answer any further questions you may have.

3. Installation guidelines



Installation of pre-assembled air spring modules

BPW SL air suspensions with assembled trailing arms and air suspension hanger brackets are generally mounted at the hub flange, arranged according to the vehicle design and aligned precisely to the longitudinal center line of the vehicle using the center of kingpin or turntable.

The air suspension hanger brackets are welded on to the bottom flange of the vehicle frame.

Welding guidelines:

For all welding operations, the trailing arms, spring U-bolts, air bags, plastic pipes and shock absorbers must be protected against flying sparks and weld spatter.

The earth terminal should under no circumstances be attached to the trailing arm, spring U-bolt or hub.

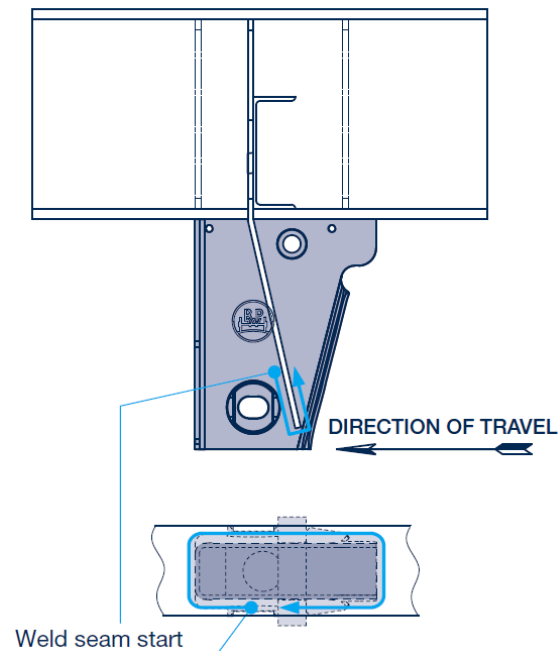
It is not permitted to weld the trailing arms!

It is not permitted for the air suspension hanger brackets to be heated for straightening work!

4. Air suspension hanger brackets

SL steel hanger brackets

- Gas shielded arc welding
Weld wire quality G 4 Si 1 – EN ISO 14341-A
- Manual arc welding
Stick electrodes E 46 5 B 32 H 5 – EN ISO 2560-A
- Mechanical quality values must correspond to the basic material S 420 or S 355 J 2
- Seam thickness acc. to DIN EN ISO 5817
 - Hanger bracket sheet thickness 8 mm -> a6



The general state-of-the-art regulations must be complied with when welding.

Avoid end craters and undercuts.

Functional surfaces must be free from weld spatter.

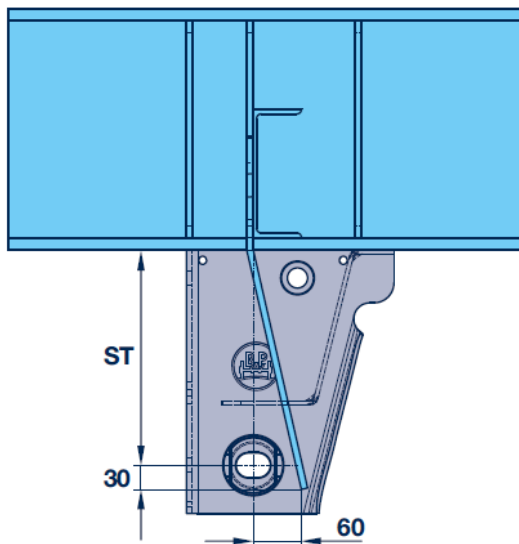
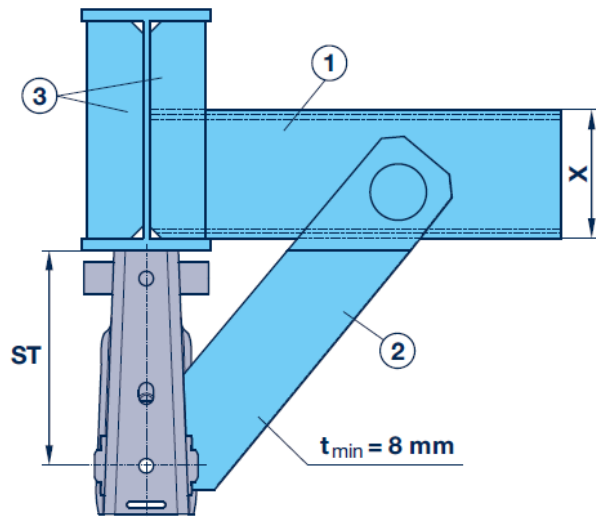
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It is not permitted to weld the trailing arms!

It is not permitted for the air suspension hanger brackets to be heated for straightening work!

5. Braces / Reinforcements



1. Cross-members

The forces created when travelling around bends are transmitted via the air suspension hanger brackets and gusset plates into the cross-member. This must be dimensioned accordingly. It must be ensured that the correct connection to the longitudinal beam is used. The connection of rigid-torsional, closed cross-member profiles to the soft-torsional dual-T longitudinal beam must be designed with extra care as there is a risk of cracking at stiff ness discontinuity.

2. Gusset plates

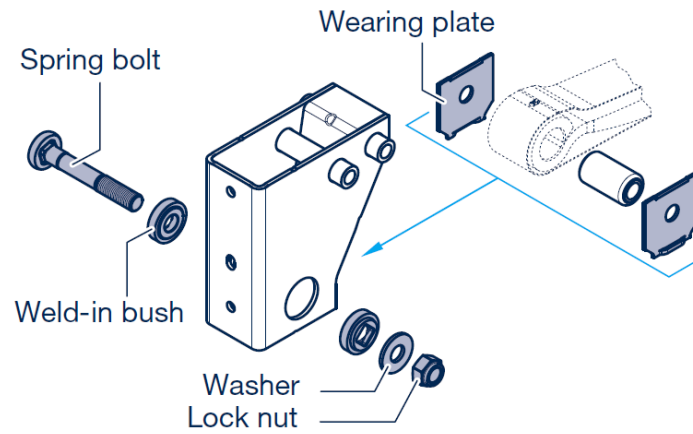
The lateral forces are transmitted via the gusset plates as tensile / compressive loads to the cross-member. The gusset plate must be connected at the inner side of the hanger bracket, behind the spring bolt to optimally stiffen the hanger bracket which is open at the rear. The gusset plate should reach 30 mm lower than the center of the spring bolt. It is recommended to attach the gusset plate to the frame in the center to the spring bolt.

*If BPW air suspension is equipped with two side axle lift, mounting of the axle lift must be taken into consideration. The depth of gusset plates will be less in that case

3. Vertical profiles

Suitable vertical profiles and ribs must be planned to stiffen the vehicle frame.

6. Spring bolt bearing



With BPW air suspension hanger brackets, the head of the spring bolt is secured from rotating by means of a profiled slot.

The spring bolts should be mounted from the outside (wheel side) towards the inside (from the inside to the outside for bolted-on gusset plates).

7. Airbags

Air bag with bolt-on bag plate or washer

(BPW 36) in the air spring piston

The bag is connected with the trailing arm with two fixing screws.

The following offsets are achieved with the bag plate:

- 45 / 80 mm with bag diameter 360 (32 / 90 mm with for steel piston airbag)

BPW 36 for 220 mm spring deflection at axle center

(spring deflection based on trailing arm

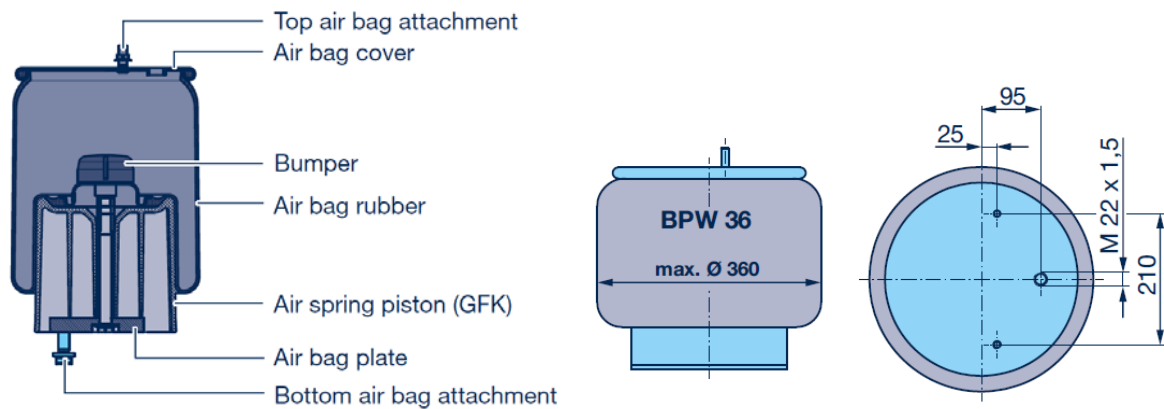
L1 = 500 mm, L2 = 380 mm)

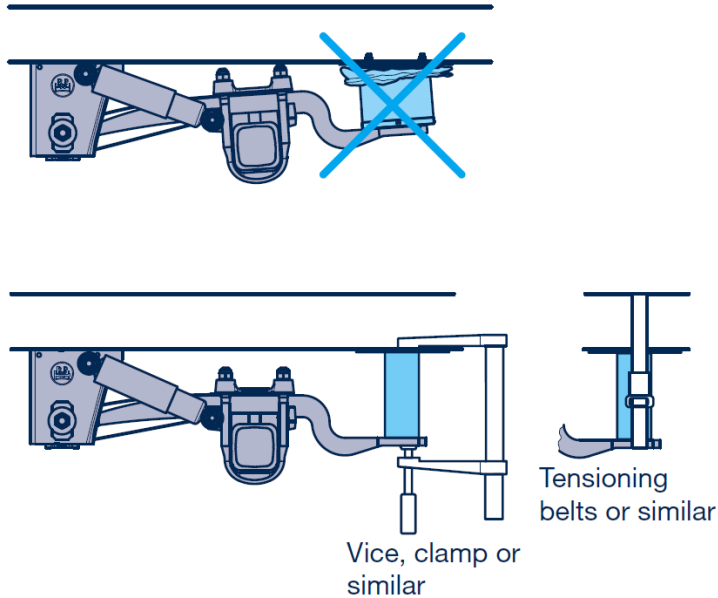
Diameter max. 360 mm

specific air bag pressure 0.000156 bar/N (at ride height)

Air bag off set V = 80, bottom air bag plate with t = 14 mm

Air bag off set V = 45 / 80 (0, 32, 55, 90), reinforced bottom air bag plate with t = 20 mm



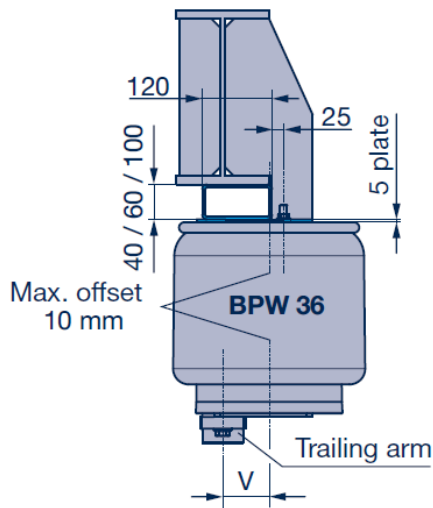


The rubber roll-up bag is a delicate component and must be protected against damage during the vehicle production process, just like the tires.

The air bag should always be installed with the rubber rolled up. The rubber must not crease as the folds leave a permanent mark and will influence the unrolling behavior and life expectancy at a later date.

If the semi-finished vehicle or chassis is moved on its own axis for purposes such as paint application, for instance, it is recommended to install a strut as an air bag replacement. By doing so, the air bag also does not have to be covered to protect it against the paint and is only installed during the final assembly stage.

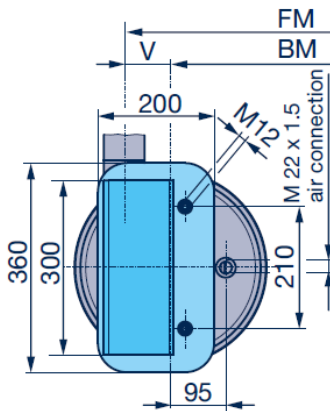
Air bag with offset



The transmission of force between the air bag and vehicle frame must be ensured with a suitable design. Particularly when installing components with an off set to the side, the bending moment which occurs must be absorbed with ribs and gusset plates or even crossmembers.

The “loaded without air” load case must also be taken into consideration, if necessary. In special situations (e. g. loading a semi-trailer onto a ferry or unloading a rear dump truck), the axle load portion which then must be supported through the air bag bumper can significantly exceed the static value.

During installation, the air bag center at the top (on the vehicle frame) must not deviate by more than 10 mm from the air bag center at the bottom (on the axle side). The air bag must not be installed with a twist between the top and bottom air bag attachment.



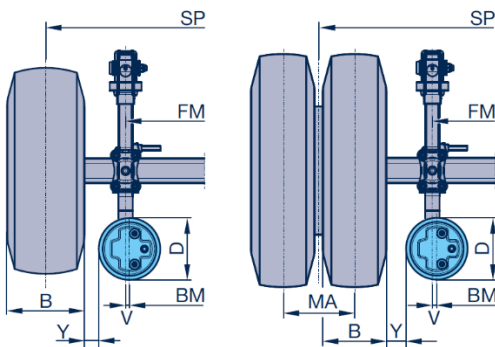
Example of installation and reinforcement with packer

In this case, an air bag plate with the following minimum dimensions must be planned in addition to the packer and respective reinforcements

360 mm x 200 mm

*Separate drawing will be provided.

For the calibration of EBS, pressure diagram and characteristics curves are provided upon request.



Clearance between air bag and tire

The min. clearance between the air bag and tire should be 30 mm and can be calculated as follows:

$$Y = 0.5 \times (SP - FM - B - D - MA) + V$$

SP = Track

FM = Spring center

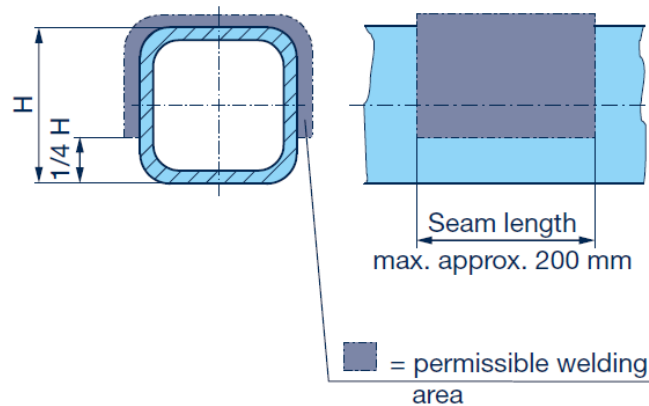
D = Air bag diameter

V = Air bag off set

B = Tire width

MA = Tire center distance (for single wheels = 0)

8. Axle beam



General

When installing trailer axles, it may be necessary to subsequently weld components on to the axle beam (e. g. support for central axle lift).

BPW axles are made of materials that can be welded. The axle beams do not have to be pre-heated before welding.

The carrying capacity and faultless operation of BPW axles are not impaired by welding, if the following points are complied with.

Welding process

- Gas shielded arc welding
Weld wire quality G 4 Si 1 – EN ISO 14341-A
- Manual arc welding
Stick electrodes E 46 5 B 32 H 5 – EN ISO 2560-A
- Mechanical quality values must correspond to the basic material S 420 or S 355 J 2
- Weld thickness a 5 (DIN EN ISO 5817)
- Avoid end craters and undercuts!
- Functional areas free from weld spatter

Please note:

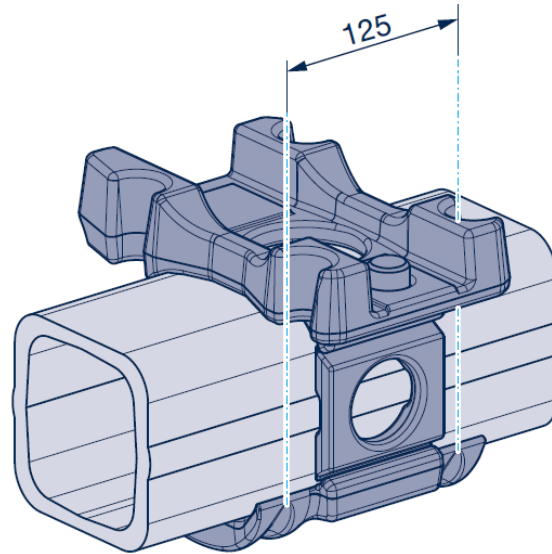
Weld seams must not create impermissible changes in the camber and side directions of the axle. The welding areas and seam lengths must always therefore be complied with.

Do not weld in the tensile stress area of the axle beam (bottom)!

For all welding operations, the trailing arms, spring U-bolts, air bags, plastic pipes and shock absorbers must be protected against flying sparks and weld spatter.

The earth terminal should under no circumstances be attached to the trailing arm, spring U-bolt or hub. It is not permitted to weld the trailing arms!

Axle connection



The welded SL axle connection contain the spring U-bolt M 24 (SW 36).

In case of welded axle connection, the screwed joints must be regularly checked and tightened, if necessary.

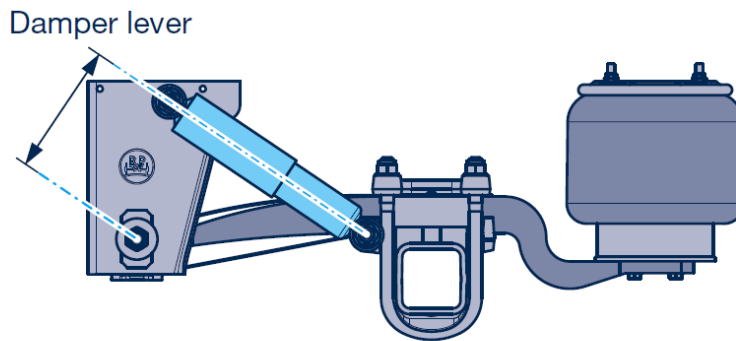
Please note:

The tight seat of the spring U-bolt screw joints for the clamped and welded axle connection must be checked at the specified intervals.

For more information about the maintenance intervals, please refer to the applicable maintenance regulations or workshop manuals.

The specified tightening torques must be complied with at all times to prevent damage to the components.

9. Shock absorber

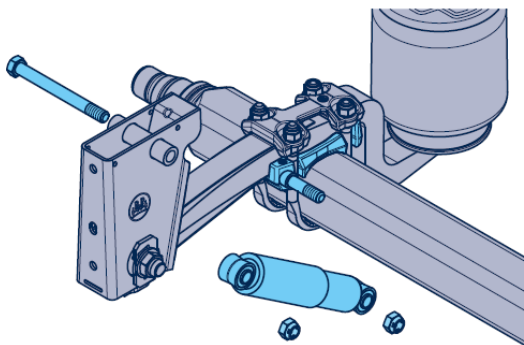


The purpose of shock absorbers is to rapidly reduce the vibrations occurring between the axle and body during driving.

This prevents any further yawing of the body and running gear components, and ensures that the tires maintain optimum roadholding. The purpose of this roadholding is to ensure that the vehicle tracking remains accurate and that the vehicle brakes correctly.

BPW shock absorbers operate according to the twin tube principle. In the compression stage (corresponding to upward travel), the oil is pressed into the working space at the top, which then flows back into the working space at the bottom during the rebound travel (corresponding to downwards travel). The built-in valves produce the required damping characteristics (characteristics curve).

The effect depends on this characteristics curve as well as the lever around the spring bolt. The damping moment crucial for the dampening process results from the damping force and this lever.

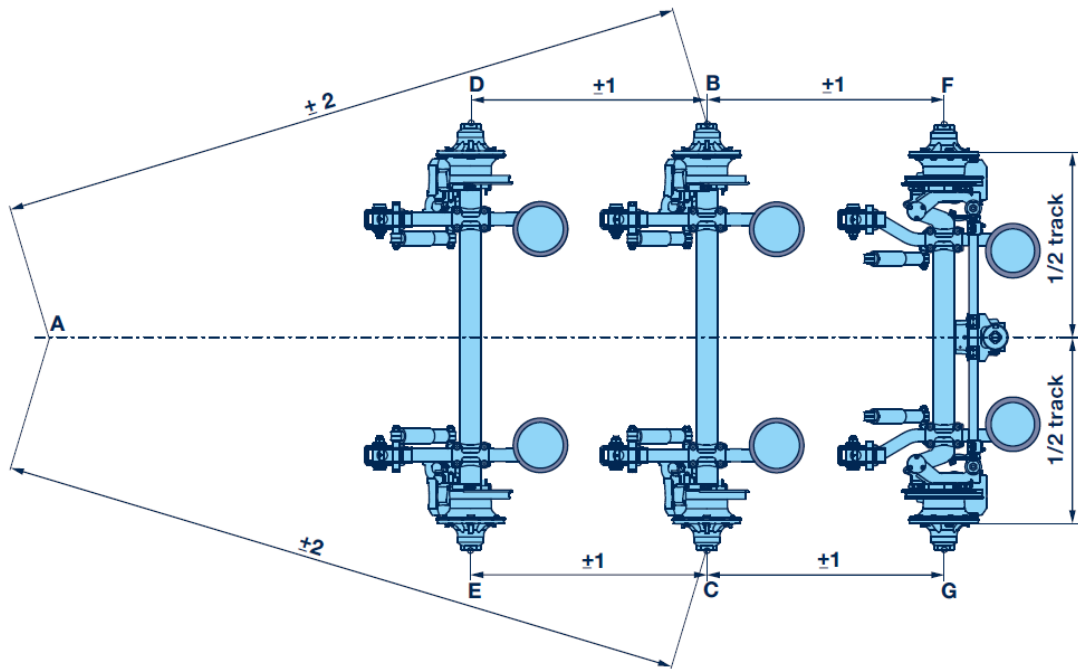


Shock absorbers are arranged in following way:

On the side next to the air suspension hanger bracket (towards the center of the axle next to the trailing arms)

The shock absorbers are attached using M 24 screws
or welded on threaded bolts with lock nuts.

10. Axle alignment



To compensate for manufacturing tolerances, an axle alignment check must be conducted, and any corrections made as necessary.

Determine the diagonal dimensions A - B and A - C for the mid-axle (reference axle) by means of comparative measurements (± 2 mm tolerance). Check and if necessary, correct the wheelbase dimensions B - D and C - E for the front axle, and B - F and C - G for the rear axle (max. tolerance 1 mm). Measurement is generally carried out above the hub cap center point (illustration on the right). It can also be carried out using suitable distancing devices or screwed-on calibration tubes.

Care must be taken to ensure that the axle is aligned horizontally (at ride height) with the base in order to obtain a correct measurement.

The triangle in the BPW logo is in the center and can be used for holding a measuring tool:



The maximum possible wheelbase correction per axle is ± 10 mm for tracking plates. This method only takes into consideration the distances of the axles, but not the individual tracking values on the axle sides. This is sufficient for axles with optimal tracking values. The measurement of smaller differences across greater lengths can be impacted by factors such as the elasticity in the measuring tool (manual force).

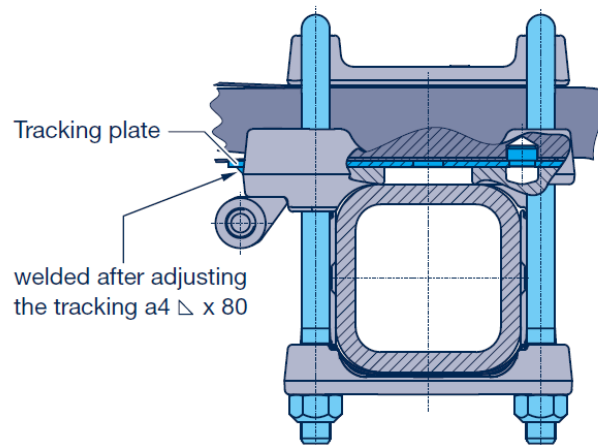
Axle alignment

It is necessary to check the tracking accuracy during installation as well as after repairs on axles, hanger brackets or guide links. The diagonal measurements and the wheelbases must be checked as described before.

If a track correction is necessary, it can be carried out as follows:

Axle alignment correction:

1. Raise and support the vehicle frame at ride height
2. Deflate air bags
3. Loosen the spring U-bolts
4. If necessary, grind off the welding seam on the tracking plate and axle plate / spring plate.
5. Align the center axle (reference axle)
6. Tighten the spring U-bolts evenly
7. Check the correct track settings of the front and rear axles and re-align if necessary
8. Tighten the spring U-bolts evenly and weld all tracking plates to the front of the axle plates / spring plates
9. Inflate the air bags and remove supports from underneath the vehicle



Please note:

For all welding operations, the trailing arms, spring U-bolts, air bags, plastic pipes and shock absorbers must be protected against flying sparks and weld spatter.

The earth terminal should under no circumstances be attached to the trailing arm, spring U-bolt or hub.

It is not permitted to weld the trailing arms!

11. Air installation

General

BPW air suspension axles are prepared for use with a support and air suspension valve as standard.

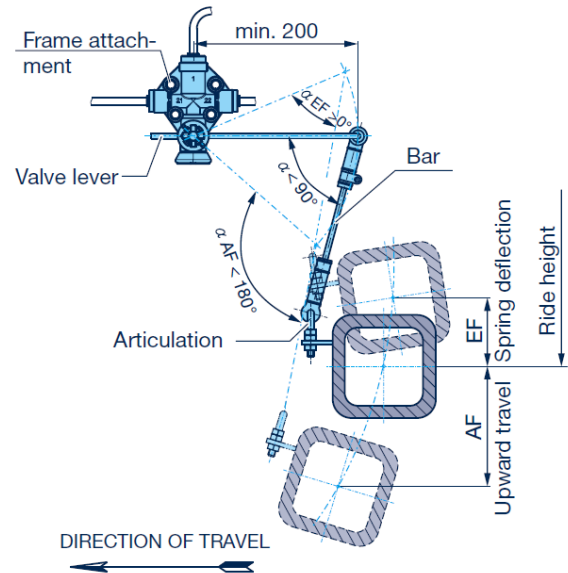
This regulates the air bag pressure according to the respective vehicle load, thereby holding the vehicle at a constant ride height. The air suspension valve is screwed to the vehicle frame and connected to the axle via the lever and bar. The pivot link is located in the middle of the axle, on three-axle units at the center axle, on two axle units on the rear axle. In special cases (e. g. axle lift device, large vehicle slope) the air suspension valve may also be connected to the front or rear axle.

The valve lever, which is at least 200 mm long, is positioned horizontally in the direction of travel. For testing purposes, the lever is pressed slightly downwards. The air must be released into the atmosphere via the pressure relieve valve.

If the air is directed into the air bag, the valve shaft must be rotated by 180°.

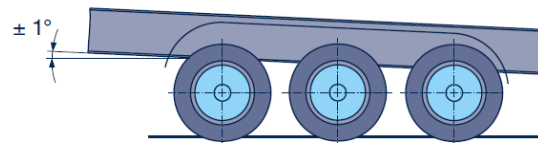
The valve lever must be switched over for this purpose. The ride height is set by adjusting the link rod in the rubber joints and then fixing this position with the lock nuts.

The vehicle must be standing on a level ground when this setting is made. The setting can be performed when the vehicle is laden or unladen. Electronic ride height measuring devices can also be installed.



Ride height

The ride height of the air suspension axles should be set to the permitted range indicated according to the corresponding documents (data sheets). With single axles a minimum upward travel of 60 mm is necessary. With multi-axle bogies a minimum upward travel of 70 mm is necessary.



The max. superstructure inclination of the semi-trailer must not exceed ± 1 .

Please note:

The air suspension can be checked by activating the compression stroke to the air bag bump stop, and then the extension stroke to its limits (shock absorber, air bag length).

The angles stated must be maintained to avoid the valve linkage going over center.

Due to the strong stabilizing effect, the use of two air suspension valves for regulating the sides is not recommended.

Stroke limitation of the suspension:

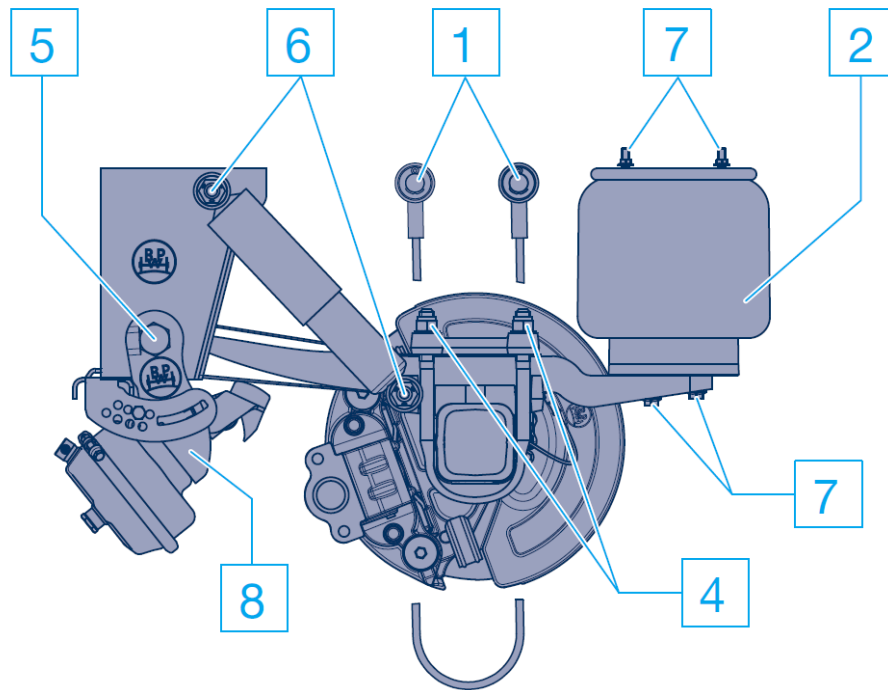
The stroke limitation may be in the form of a catch-strap. When assembling the catch straps, their exact length must be ensured as well as that they rub as little as possible on the axle beam, do not collide with other components

(e.g. cylinders, brake camshaft or pipes) and have sufficient ground clearance.

*Separate drawing is provided.

12. Tightening Torques

Position No.	Description	Thread Size	Spanner Width	Tightening Torque
4	U-bolts	M 24	SW 36	M = 650 Nm
5	Spring pivot bolts	M 30	SW 46	M = 900 Nm
6	Shock absorber fastening	M 24	SW 36	M = 420 Nm
7	Airbag fastening			
	Top attachment	M 12	SW 17	M = 66 Nm
	Bottom attachment	M 16	SW 22	M = 260 Nm
	Central screw	M 16	SW 22	M = 300 Nm





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 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.

BPW-II-SL IN

Your partner on the path to economic viability



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