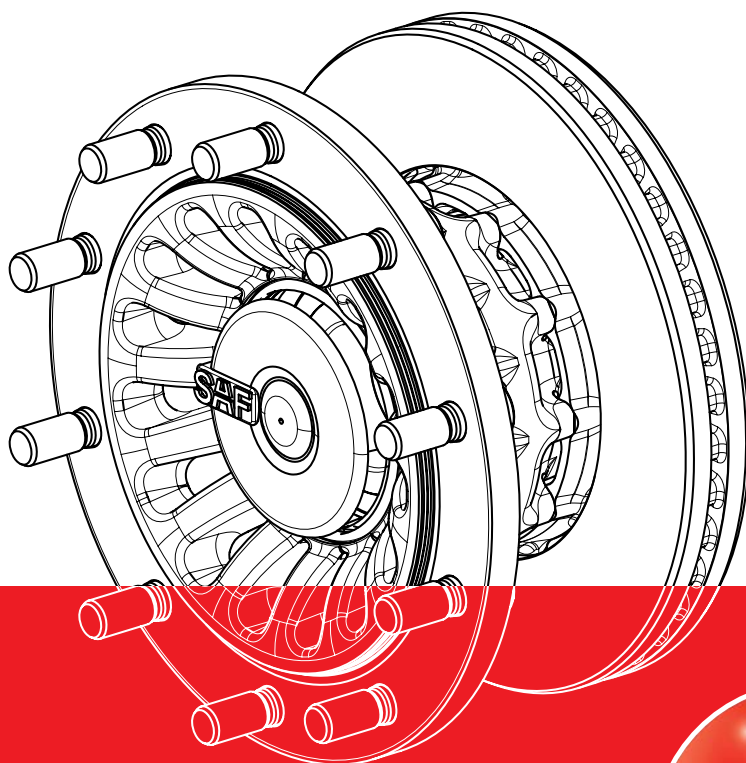


General Operating and Service Manual

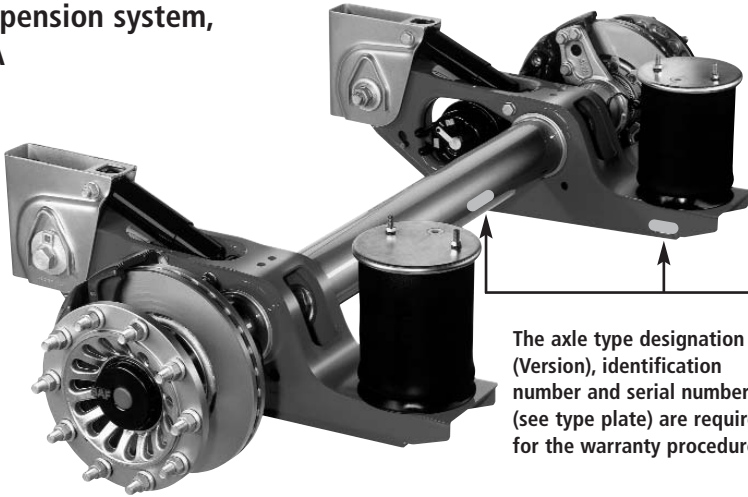
SAF Air suspension systems and axles with disc brakes



Edition 12/2006

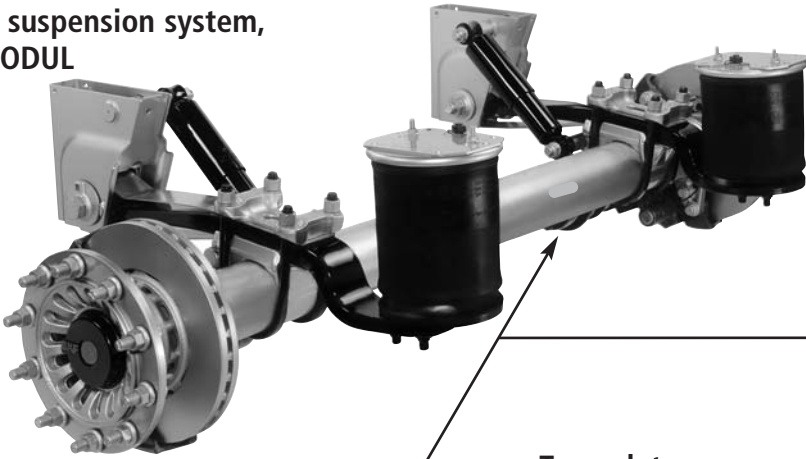


SAF air suspension system, Type INTRA



The axle type designation (Version), identification number and serial number (see type plate) are required for the warranty procedure.

SAF air suspension system, Type MODUL



Type plate

OTTO SAUER ACHENFABRIK GMBH D-63856 BESENBAACH · GERMANY		
Version B19-22K01	Serial No. 261 06 3 097	
Type SBK2243-115	Ident No. 247 91 34 7 49 20	
Test Report 36110303	Perm axle cap. stat. 9000 kg	
	V max. 105 km/h	
AN 1280397		SN 261063097



Identification if the type plate is missing:
 The Serial No. of the axle is embossed in the axle end on the right-hand side (as seen in the direction of travel).

Trailer manufacturer.....

Body type.....

Chassis No.

Date of delivery/date of registration

Spare parts service for SAF axles and suspension systems

Exact type designations are required for spare parts orders.

Please enter the identification data of the suspension system in the type plate illustrated below so that the correct information is available when necessary.

OTTO SAUER ACHSENFABRIK GMBH D-63856 BESSENBACH · GERMANY		
Version B19-22K01	Serial No. 261 06 3 097	
Type SBK2243-11S	Ident No. 247 91 34 7 49 20	
Test Report 36110303	Perm axle cap. stat. 9000 kg	
	V max 105 km/h	
 AN 1280397		 SN 261063097

	Ident. No.	Prod. No. (Serial No.)
Example	247 91 34 7 49 20	261 06 3 097
1st axle		
2nd axle		
3rd axle		
4th axle		
5th axle		

Enter the axle data from the SAF type plate



Identification of SAF axles	2-3
SAF general safety instructions	6
SAF general service instructions	7
Tightening torques.....	8
Fuels, oils and tools	9

Service schedule

SK RB / RLB / SKNLB / SKVLB 9019 / 9022 B19-19 / B19-22 / BIL9-19 / BIL9-22 / BINL9-19 / BINL9-22 / BIVL9-19 / BIVL9-22 S19-19 / S19-22 / Z19-19 / Z19-22 / SI11-22 / ZI11-19 / ZI11-22	10
SK RS / RZ 9019 / 9022 / 11019 / 11222	11

Adjustment instructions

SKNLB / SKVLB 9019 / 9022 BINL9-19 / BINL 9-22 / BIVL9-19 / BIVL9-22	12-13
SKRLB 9019 / 9022 BIL9-19 / BIL9-22	14-15

Maintenance (visual inspection of brake pad wear)

Knorr disc brake Type SN7	SK RB / RLB 9022 K / KI SK RS / RZ 9022 / 11222 K	
Knorr disc brake Type SN6	SK RB / RLB 9019 K / KI SK RS / RZ 9019 / 11019 K B19-19K / BIL9-19K / BINL9-19K / BIVL9-19K S19-19K / Z19-19K / ZI11-19K	16
Knorr disc brake Type SK7	SK RB / RLB 9022 KI01 B19-22K01 / BIL9-22K01 / BINL9-22K01 / BIVL9-22K01 S19-22K01 / Z19-22K01 / SI11-22K01 / ZI11-22K01	17
Wabco disc brake Type PAN 22-1	SK RB / RLB 9022 W / WI SK RS / RZ 9022 / 11222 W	
Wabco disc brake Type PAN 19-1	SK RB / RLB 9019 W / WI SK RS / RZ 9019 / 11019 W	
Wabco disc brake Type PAN 22-1	B19-22W / BIL9-22W / BINL9-22W / BIVL9-22W S19-22W / Z19-22W / SI11-22W / ZI11-22W	18



General information

Brake disc safety check	19
Tightening instructions for adjustable pivot bolt	20
Semi-trailer tilt angle	21
Tyre changing on fully loaded trailer with INTRA axle	22
Adjustment of the air suspension system ride height	23
Axle alignment	24

Please observe the following safety instructions in order to maintain the operational and road safety of your SAF axles and suspension systems:

1. The wheel contact surfaces between the wheel disc and wheel hub and the wheel nut contact surface at the wheel disc must not be additionally painted. The contact surfaces must be clean, smooth and free from grease. Failure to observe this may result in the wheel coming loose. Any additional instructions of the wheel manufacturer must also be observed.
2. Only the wheel and tyre sizes approved by the trailer builder may be used. The tyres must always have the specified inflation pressure.
3. The brake systems of the tractor and the trailer/semi-trailer must be synchronised by means of a tractor/trailer brake synchronisation not later than 5,000 km after the initial start of operation of the trailer/semi-trailer in order to ensure a safe and uniform braking behaviour and uniform brake pad wear. Tractor/trailer brake synchronisations should be carried out by appropriately qualified and equipped brake workshops.
The use of an additional braking system, such as a trailer anti-jackknife brake is forbidden by law on vehicles with type approval after January 1999.
4. Before starting a journey, ensure that the maximum permissible axle load is not exceeded and that the load is distributed equally and uniformly.
5. On trailers with air suspension, ensure that the air bags are completely filled with air before starting the journey. Incompletely filled air bags may result in damage to axles, suspension, frame and superstructure and impair road safety.
6. Ensure that the brakes are not overheated by continuous operation.
With drum brakes, overheating can result in a hazardous deterioration in the braking efficiency.
With disc brakes, overheating can result in damage to surrounding components – in particular the wheel bearings. This can result in a significant deterioration in road safety, e.g. failure of wheel bearings.
7. The parking brake must not be immediately applied when the brakes are hot, as the brake discs and brake drums may be damaged by different stress fields during cooling.
8. Use the supports provided when loading and unloading in order to avoid damage to the axle.
9. Observe the operating recommendation of the trailer builder for off-road operation of the installed axles and suspension systems.
The SAF definition of OFF-ROAD means driving on non-asphalted / non-concreted routes, such as e.g. gravel roads, agricultural and forestry tracks, on construction sites and in gravel pits.
Off-road operation of SAF axles and suspension systems not designed for the purpose may result in damage and hence to an impairment of road safety.
10. SAF axles and suspension systems require continuous care, service and maintenance in order to maintain operational and road safety and to be able to recognise natural wear and defects in good time.
The daily inspection of the trailer for road safety before starting the journey is one of the driver's obligations. SAF recommends that the tests and maintenance operations described on page 7 are carried out.
The SAF repair manuals and instructions must always be observed during all repairs.

We recommend the use of original SAF spare parts.

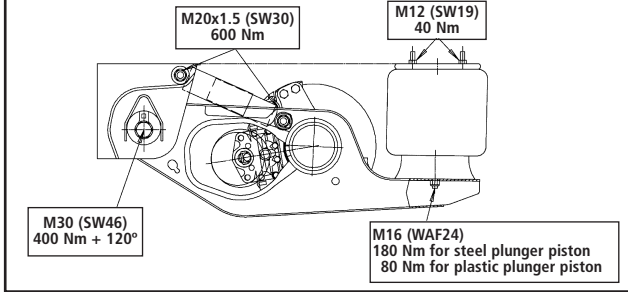
A close-knit service network of SAF partner companies is available for the technical support of the SAF axles and suspension systems and for the supply of original SAF spare parts (see rear cover or on the Internet under www.saf-axles.com).

Updates will be published as necessary on the Internet under www.saf-axles.com.

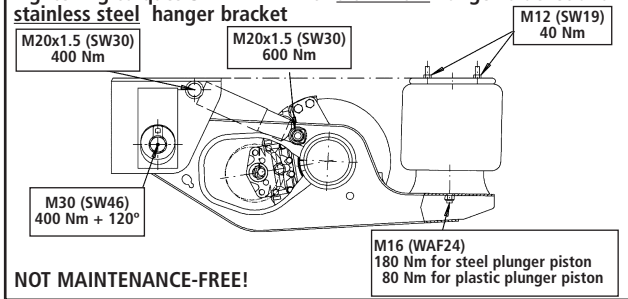
- **Caution:** After every wheel change, be sure to retighten the wheel nuts to the prescribed torque after 50 km and after 150 km.
- Check the brake pad thickness at regular intervals, e.g. when checking the tyre inflation pressure. Minimum wear limits*, see page 19.
- Carry out regular visual checks of the brakes, tyres and all chassis components and inspect for secure mounting, wear, leaks, corrosion and damage.
- At each brake pad change, inspect the wheel bearing unit for grease leaks.
- At each brake pad change, inspect the brake calliper guide system for free movement.
- Inspect the outer and inner bellows on the brake calliper for splits and damage and for the correct seating of the brake calliper adjuster cap at each brake pad change.
- Inspect the brake disc for wear* and cracking at each brake pad change.
- Check the air suspension system ride height according to the trailer builder's instructions at regular intervals and adjust, if necessary, as instructed on page 23.
- With aluminium and stainless steel hanger brackets, check that the bolts of suspension arm bearings and shock absorbers are tightened to the prescribed torque as described on page 8.
- With MODUL suspension systems, check that the U-bolts is tightened to the torque specified on page 8 according to the trailer builders instructions.
- Carry out a general safety check according to the statutory requirements.
- We recommend the use of only original SAF spare parts.
- In the case of steering axles, additionally observe the instructions on pages 12 to 15.

* We recommend that a safety check is performed when the minimum wear limit is reached.

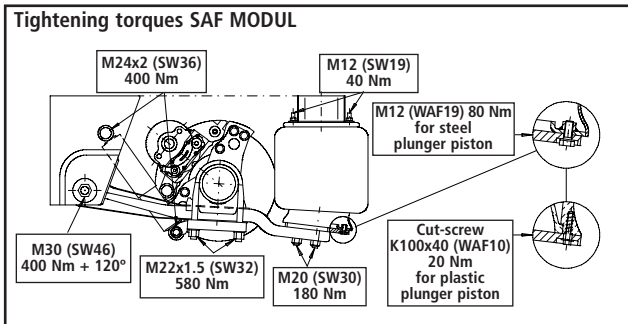
Tightening torques SAF INTRA with steel hanger bracket



Tightening torques SAF INTRA with aluminium hanger bracket and stainless steel hanger bracket



Tightening torques SAF MODUL



Attention!

- Threads not to be oiled or greased!
- Pivot bolt on steel hanger brackets maintenance-free.
- Service intervals for aluminium hanger brackets and stainless steel hanger brackets: first check after 500 km, further check after every 6 months
 Spring eye bolt: Inspection torque 1,200 Nm
 Shock absorber bolt: Inspection torque 400 Nm

**SK RB / RLB / SKNLB / SKVLB 9019 / 9022
 BI9-19 / BI9-22 / BIL9-19 / BIL9-22 / BINL9-19 / BINL9-22 / BIVL9-19 /
 BIVL9-22 / SI9-19 / SI9-22 / ZI9-19 / ZI9-22 / SI11-22 / ZI11-19 / ZI11-22**

Operating media specifications	Assembly tools	SAF Part No
Greases for repairs and maintenance are included in all repair kits.	Axle nut wrench	4 434 3828 00
	Puller for hub unit	4 434 3822 00
For axle stub end: SAF mounting paste SAF Part No 5 387 0021 01	3/4" socket for Torx E24	4 434 3824 00
	Universal disc brake tool case	3 434 3328 00
	Wrench for DSK bolts	4 434 3831 00
	12 point socket WAF 24 in 3/4" drive	4 434 3859 00
	17 mm socket	Commercially available

SK RS / RZ 9019 / 9022 / 11019 / 11222

Operating media specifications	Assembly tools	SAF Part No
For wheel bearings SAF Part No 5 387 0011 05	Axle nut wrench	1 012 0024 00
	Puller for wheel hub	4 434 3822 00
For rubber boots and brass bushes: SAF Part No 5 387 0016 00	Lever for wheel cap	1 434 1041 00
	Universal disc brake tool case	3 434 3328 00
	17 mm socket	Commercially available
For rubber guide sleeve: SAF Part No 5 387 0017 01		
For axle stub end: SAF Part No 5 387 0021 01 SAF mounting paste		

SK RB / RLB / SKNLB / SKVLB 9019 / 9022 BI9-19 / BI9-22 / BIL9-19 / BIL9-22 / BINL9-19 / BINL9-22 / BIVL9-19 / BIVL9-22 / SI9-19 / SI9-22 / ZI9-19 / ZI9-22 / SI11-22 / ZI11-19 / ZI11-22

Hub Unit maintenance-free.

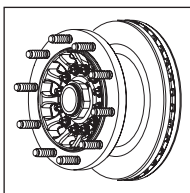
At each brake disc change, inspect for signs of wear (e.g. escaping grease).

Note during brake repairs: Carry out a visual inspection of the seals on the brake calliper.

Do not use high-pressure cleaners or liquid cleaners on the brake disc and hub unit.

Clean any residues of grease from the axle stub end and repack with grease.

Tighten axle nuts



On left-hand side in direction of travel: Left-hand thread
On right-hand side in direction of travel: Right-hand thread

Pretightening: 150 Nm, then turn the hub unit slowly by 5 revolutions.

Final tightening: Retighten by 1 increment (30°).

Marking of the nuts with left-hand thread: Groove on outer edge

Max. permissible axial backlash of hub unit: 0 - 0.20 mm

Caution! Failure to observe these instructions may result in an accident hazard! Brake pads and/or brake discs that are worn beyond their wear limit result in a deterioration or even complete failure of the braking effect.

Caution: The bolts listed below must be replaced during service and repair work.

The bolts must not be oiled or greased for installation.

Tighten the bolts with a torque wrench.

Tightening torques (Nm) Bolts	Knorr	Wabco
Wheel flange Torx bolt E24 M18x1.5	1. Pretighten to 50 Nm diagonally. 2. Tighten by a further 90° diagonally (check torque 450 Nm)	
INTEGRAL brake disc DSK bolt SW 13 M12x1.5	1. Pretighten to 30 Nm diagonally. 2. Tighten by a further 90° diagonally (check torque 130 Nm)	
Brake calliper to axle beam (6 bolts) Hex. head bolt M16x1.5	290 Nm	
Brake calliper to axle beam (4 bolts) Multispline head screw M18x1.5	1. Pretighten (from inside to outside) 120 Nm 2. Check the pretightening of all the bolts. Retighten, if necessary to 120 Nm 3. Final tightening to 450 ± 30 Nm or 120 Nm + 60° (4 corners of the multispline head screw)	
Brake chamber hex. nut M16x1.5	Tighten alternately and uniformly in two steps 1. Pretighten 120 Nm 2. Final torque 210 Nm (check torque 210 Nm)	
Guide pins on brake calliper	290 Nm	340±20 Nm
Pad retainer clamp	cotter pin	30±15 Nm

SK RS / RZ 9019 / 9022 / 11019 / 11222

Wheel bearing backlash, wheel bearing grease

Adjustment of the wheel bearing backlash is not necessary.

Change the wheel bearing grease after 500,000 km or 50 months. When changing the grease, inspect the taper roller bearings for serviceability. Install a new O-ring and fit the wheel cap.

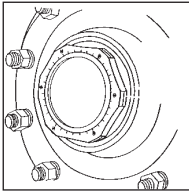
Note during brake repairs:

Carry out a visual inspection of the seals on the brake calliper. Do not dismantle the wheel bearing unit.

Do not use high-pressure cleaners or liquid cleaners on the brake disc and hub unit.

Clean any residues of grease from the axle stub end and repack with grease.

Tighten axle nuts



On left-hand side in direction of travel: Left-hand thread
On right-hand side in direction of travel: Right-hand thread

Tightening torque 900 Nm. Each hub unit must be rotated smoothly at least twice while tightening the bolts.

Marking of the nuts with left-hand thread:
Milled groove on outside of hexagon.

Max. permissible axial backlash of hub unit: 0 - 0.20 mm

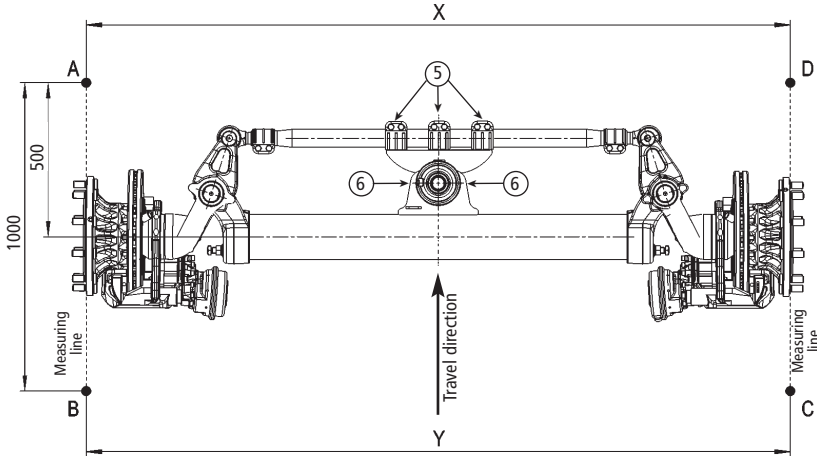
Caution! Failure to observe these instructions may result in an accident hazard! Brake pads and/or brake discs that are worn beyond their wear limit result in a deterioration or even complete failure of the braking effect.

	Tightening torque (Nm)	Wrench size (WAF)	Hexagon	
			Outer	Inner
Guide bearings on brake calliper 2 carriage bolts M16 x 1.5 - 10,9	290	14	–	X
Diaphragm / combination cylinder 2 hex. nuts M16 x 1.5	210	24	X	–
Brake calliper attachment to axle beam M16 x 1.5 x 55	290	24	X	–

SKNLB / SKVLB 9019 / 9022 BINL9-19 / BINL9-22 / BIVL9-19 / BIVL9-22

Preconditions:

- The track measurement must be carried out with the trailer in unloaded state.
- On trailers with air suspension, the trailer must be adjusted to ride height.



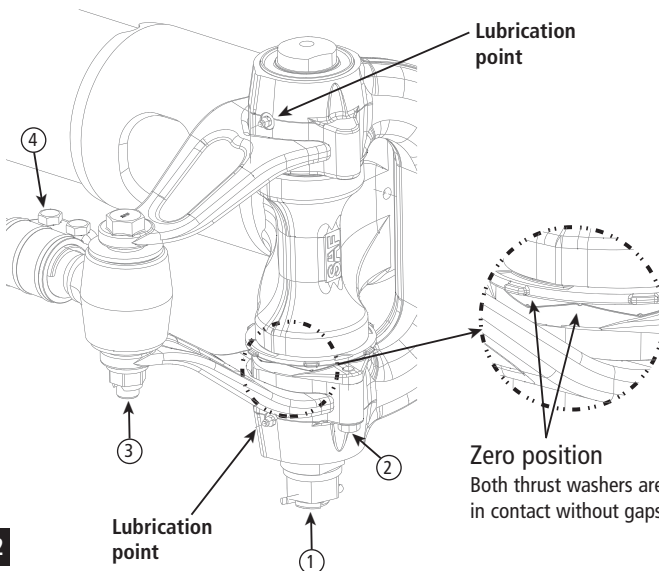
Permissible values for self-steering axle		
Toe-in	min +4 mm/m	max +7 mm/m
Camber angle	± 12'	

Example of toe-in: $Y - X = 4 \text{ mm/m}$ to 7 mm/m

SAF self-steering axles must not have a negative track / toe-out.

Measurement of the axle geometry

Difference in the distances AC and BD = <3 mm



Service instructions:

Lubricate the king pin bearing after assembly

For the first time after 1 month, then every 6 months

Visual inspection:

Inspect the components for proper function every 6 months.

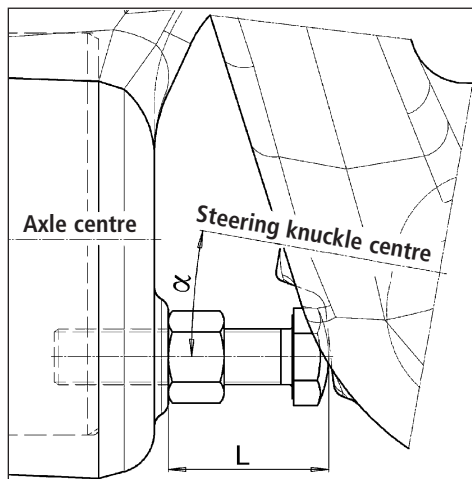
SKNLB / SKVLB 9019 / 9022 BINL9-19 / BINL9-22 / BIVL9-19 / BIVL9-22

Tightening torques

No.	Designation	Number per axle	Tightening torque
1	Stub axle bearing	2	450 Nm + 360°
2	Thrust washer retainer	4	120 Nm
3	Tie rod end	2	600 Nm
4	Clamp bolt Tie rod	4	120 Nm
5	Clamp bolt Locking plate	6	120 Nm
6	Locking cylinder	2	120 Nm

Steering angle table

Bolt overhang "L"	Steering angle "α"
38 mm	16°
44.5 mm	14°
51 mm	12°
57.5 mm	10°



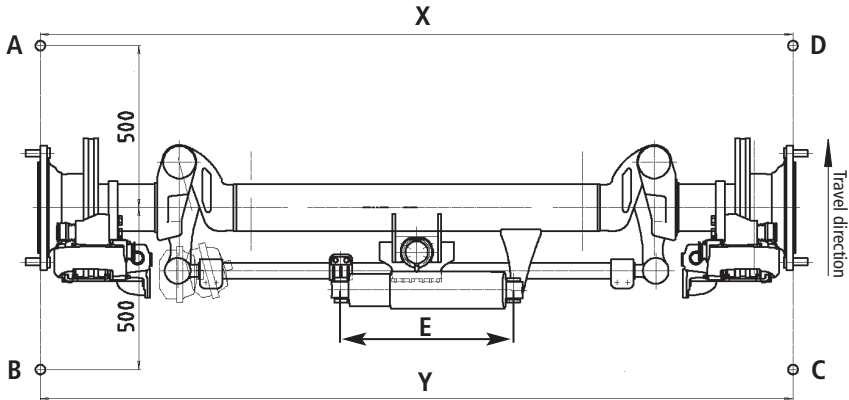
Note:

In order to avoid incorrect measurement, the steering axle must be relieved.

SKRLB 9019 / 9022 BIL9-19 / BIL9-22

Preconditions:

- The track measurement must be carried out with the trailer in unloaded state.
- On trailers with air suspension, the trailer must be adjusted to ride height.



Permissible values for self-steering axle		
Toe-in	min +4 mm/m	max +7 mm/m
Camber angle	± 12'	

Example of toe-in: $Y - X = 4 \text{ mm/m to } 7 \text{ mm/m}$

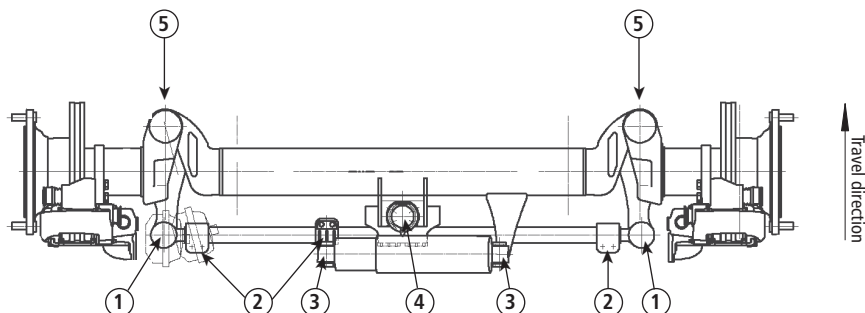
SAF self-steering axles must not have a negative track / toe-out.

Measurement of the axle geometry

Difference in the distances AC and BD = <3 mm

Dimension "B" is 537 mm; engage the reversing lock

SKRLB 9019 / 9022 BIL9-19 / BIL9-22



Tighten all bolts to the prescribed torque and lock the nuts or insert the cotter pin.

Tightening torques

No.	Designation	Number per axle	Tightening torque
1	Ball joint screw	2	M30 (340 Nm)
2	Reating clamp screw	10	M12 (80 - 90 Nm)
3	Steering damper screw	2	M24 (600 - 660 Nm)
4	Lock cylinder screw	4	M6 (8 - 10 Nm)
5	Cover plate screw	6	M8 (25 - 30 Nm)

Note:

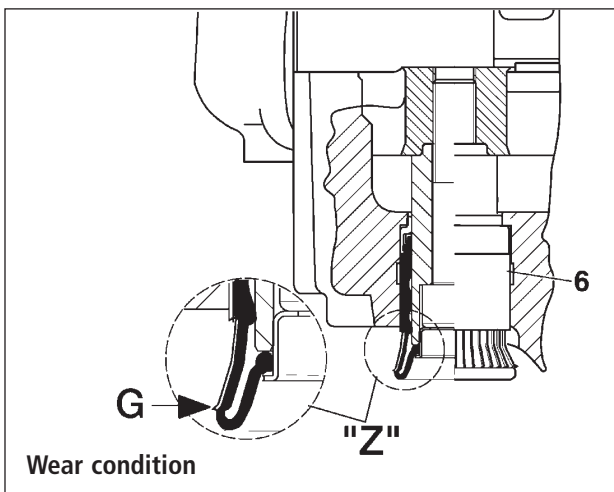
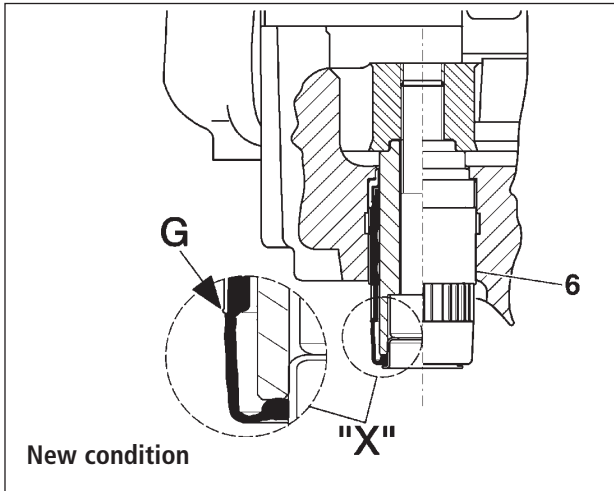
During lubrication work on the steering pin bearing, the axle must be relieved (raised).

Lubrication at the bearing points of the king pin bolt for the first time after 1 month, then every 6 months

**Knorr disc brake Type SN7 – SK RB / RLB 9022 K / KI
SK RS / RZ 9022 / 11222 K**

**Knorr disc brake Type SN6 – SK RB / RLB 9019 K / KI
SK RS / RZ 9019 / 11019 K
BI9-19K / BIL9-19K / BINL9-19K / BIVL9-19K
SI9-19K / ZI9-19K / ZI11-19K**

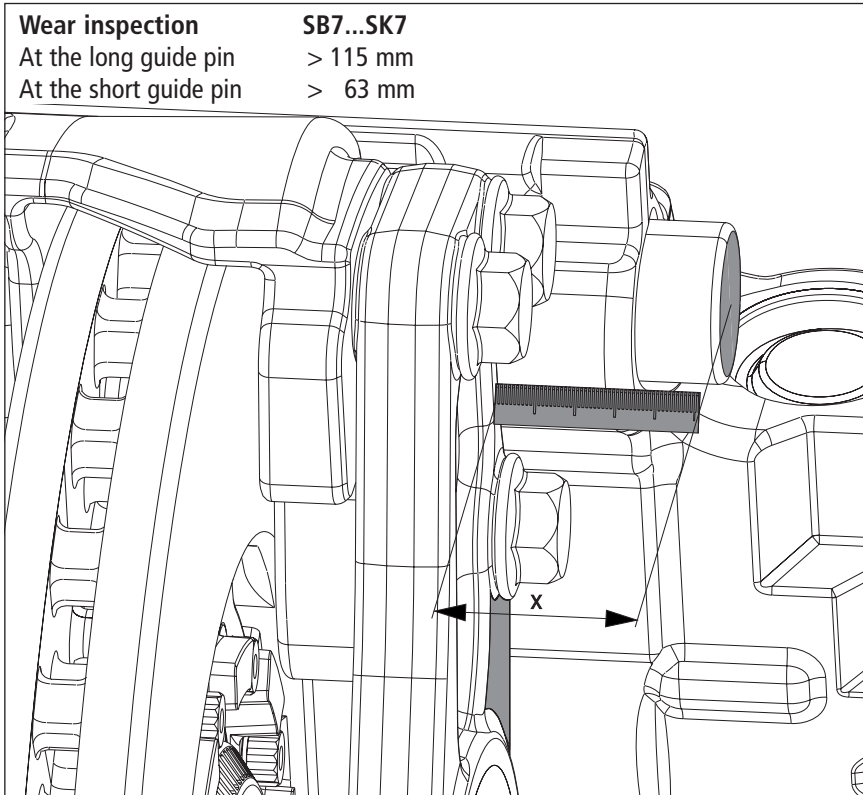
Checking the pad wear



Inspect the brake pads and brake discs and replace, if necessary.

Knorr disc brake Type SK7 – SK RB / RLB 9022 KI01 BI9-22K01 / BIL9-22K01 / BINL9-22K01 / BIVL9-22K01 SI9-22K01 / ZI9-22K01 SI11-22K01 / ZI11-22K01

Checking the pad wear



Inspect the brake pads and brake discs and replace, if necessary, if the dimensions are larger than shown in the table above.

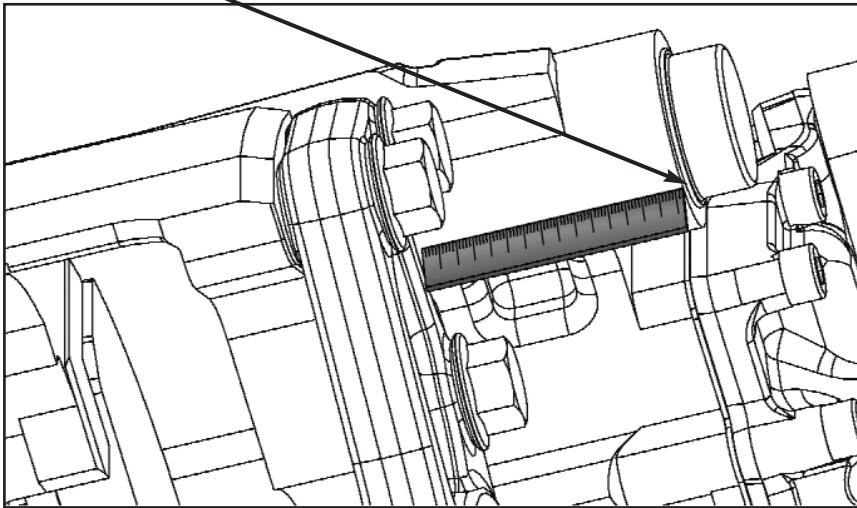
**Wabco disc brake Type PAN 22-1 – SK RB / RLB 9022 W / WI
SK RS / RZ 9022 / 11222 W**

**Wabco disc brake Type PAN 19-1 – SK RB / RLB 9019 W / WI
SK RS / RZ 9019 / 11019 W**

**Wabco disc brake Type
Type PAN 22-1 – BI9-22W / BIL9-22W /
BINL9-22W / BIVL9-22W /
SI9-22W / ZI9-22W /
SI11-22W /
ZI11-22W**

Checking the pad wear

Wear inspection	PAN 19-1	PAN 22-1
At the long guide pin	> 94 mm	> 98 mm
At the short guide pin	> 67 mm	> 73 mm

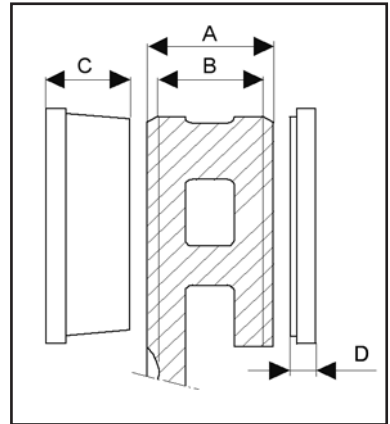


Inspect the brake pads and brake discs and replace, if necessary, if the dimensions are larger than shown in the table above.

Brake disc safety check

In order to be able to inspect the friction surface of the brake pads, the pad retaining bracket has to be removed and the brake calliper adjuster backed off.

Remove and inspect the pads.



Wear limits: Brake disc, brake pad

Diameter (mm)	Brake disc		Brake pad			
	„A“ new (mm)	„B“ Wear limit reached (mm)	„C“ new (mm)		„D“ Wear limit reached (mm)	
			Wabco	Knorr	Wabco	Knorr
430	45	37	32	30	11	11 (SK7 - 9)
377	45	37	32	30	11	11

Brake pads: Install only brake pads approved by SAF.

When replacing brake pads due to wear, the pads on both sides of the axle must be replaced.

Brake pad wear difference: max. 5.0 mm (inner/outer pad)

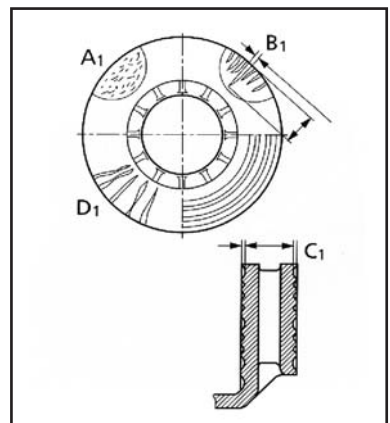
Brake disc

Carefully inspect the braking surface of the brake disc for further serviceability.

- A₁ - Mesh-like cracking is permissible.
- B₁ - Cracks running to the hub centre up to max. 1.5 mm (width and depth) are permissible.
- C₁ - Unevenness of the disc surface is permissible.
- D₁ - Through cracks are not permissible.

Measure the brake disc thickness and polish, if necessary.

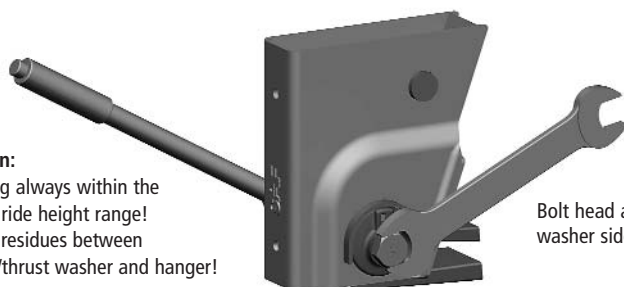
For safety reason, the minimum thickness for polishing the brake discs is defined as 39 - 40 mm.



Tightening instructions for adjustable pivot bolt

Attention:

Tightening always within the specified ride height range!
No paint residues between eccentric/thrust washer and hanger!



Bolt head always on the eccentric washer side.

Pretightening 400 Nm
Use Torque wrench



Marking for angle tightening



Angle tightening 120°
Use impact wrench or extend lever to 2.5 m



Visual inspection



Semi-trailer tilt angle

Ride heights

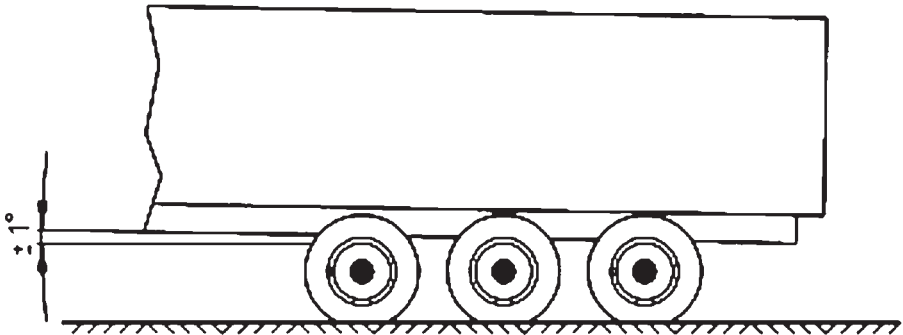
Adjust the ride height of the air suspension axles to the permissible range indicated in the corresponding SAF documents.

With single axles, allow for a minimum suspension travel of 60 mm.

For trailers with multiple axles, allow for a minimum suspension travel of 70 mm.

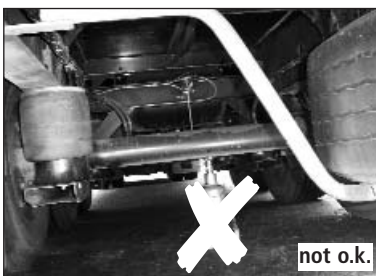
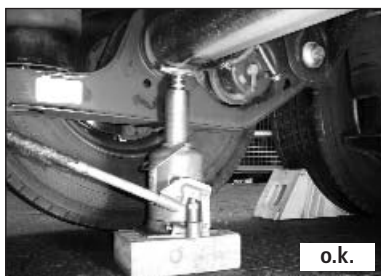
Exception:

For multi-axle trailers with lift axles, the minimum suspension travel at the lift axle should not be less than 100 mm in order to ensure an adequate ground clearance.



Tyre changing on fully loaded trailer with INTRA axle

Jack positioning points:



Adjustment of the air suspension system ride height

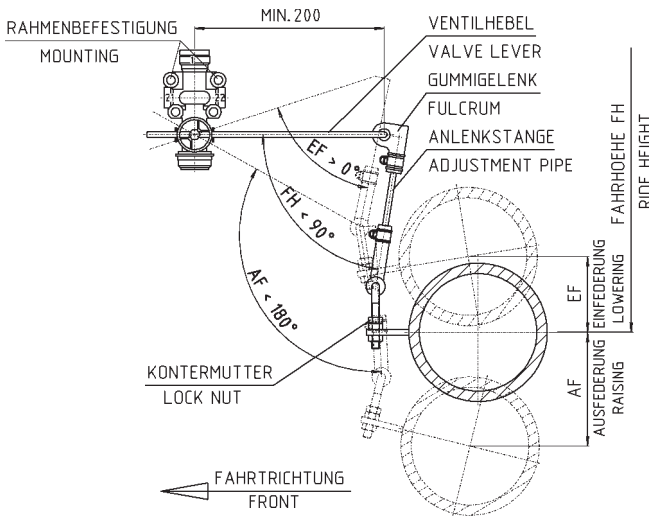
Air suspension valve

As standard, SAF air suspension axles and system require only one air suspension valve.

The air suspension valve controls the air bag pressure in relation to the trailer load in order to maintain a constant ride height in every load condition.

The air suspension valve is fastened to the trailer frame with screws and connected to the axle via the pivot joint (valve lever and adjustment pipe). On triple-axle trailers, the system is generally connected to the middle axle (normally in the middle of the axle), and on twin-axle trailers to the rear axle. In special cases (e.g. large trailer tilt angle), the air suspension valve can be installed in the rear axle.

For trailers with axle lifting system, the axle to which the system is connected depends on the axle to be lifted.



Installation

The valve lever should be at least 200 mm long and is horizontal when the trailer is in the driving position.

As a function check, move the lever down slightly. Air must now escape via the venting cap into the atmosphere. If air flows into the air bags when the lever is pushed down, the valve lever has to be turned through 180°. For this the valve lever has to be disconnected. The ride height is set by adjusting the adjustment pipe in the fulcrums and by turning the lock nuts.

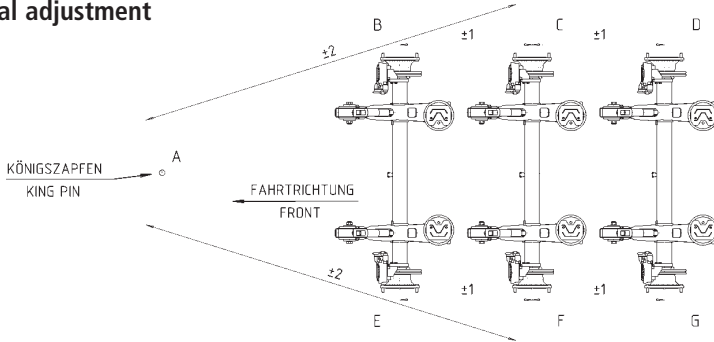
The adjustment must be carried out with the trailer standing on level ground. It can be carried out with the trailer either empty or loaded.

Note

For a final check, the air suspension system should be lowered to the suspension stop or raised to the limit (shock absorbers, stop ropes, air bag length). During this process, the specified angle between valve lever and adjustment pipe must not be exceeded in order that the valve lever does not move in the wrong direction.

In order to compensate for production tolerances, an axle alignment and, if necessary, a correction should be carried out. The maximum permissible deviations (tolerances) of the alignment values are specified by the tyre manufacturer. The maximum possible wheelbase correction per axle is ± 6 mm.

Conventional adjustment



Determine the lengths of the diagonals A - C and A - F for the middle axle (reference axle) by comparison measurements, observing the tolerances.

Check the wheelbases B - C and E - F for the front axle and C - D and F - G for the rear axle and correct, if necessary, observing the tolerances.

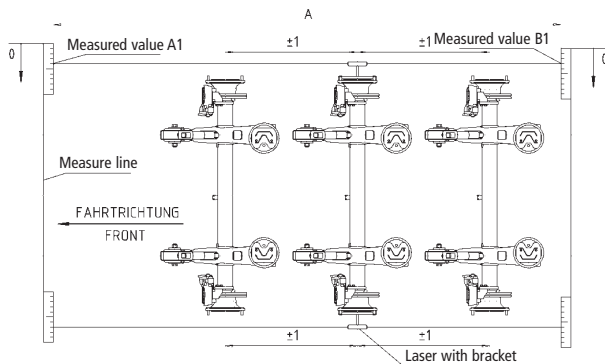
Optical adjustment

Observe the operating and setting instructions of the measuring system manufacturer.

Calculation of the toe-in and toe-out values:

$$\frac{A1 - B1 \text{ (mm)}}{A \text{ (m)}} = S$$

S = positive value = Toe-in
S = negative value = Toe-out



Notes


1. In order to avoid tyre wear, we recommend that an axle alignment is performed at regular intervals.
2. We recommend the use of an optical measuring system for carrying out the axle alignment.
3. For alignment, only the centres of the middle of the wheel cap or the middle of the axle stub end are of interest as reference points.
4. Possible causes of deviations in the axle alignment are:
 - Loose U-bolts
 - Wear of the spring guide bearing
 - Deformation of the axle assembly components due to improper use

Soforthilfe im Pannenfall

NonStopService 24

Support in the case of service

- Im Servicefall wählen Sie bitte **immer** die Rufnummer Ihres **Heimatlandes**.
- In the case of service please **always** dial the number of your **own country**.

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