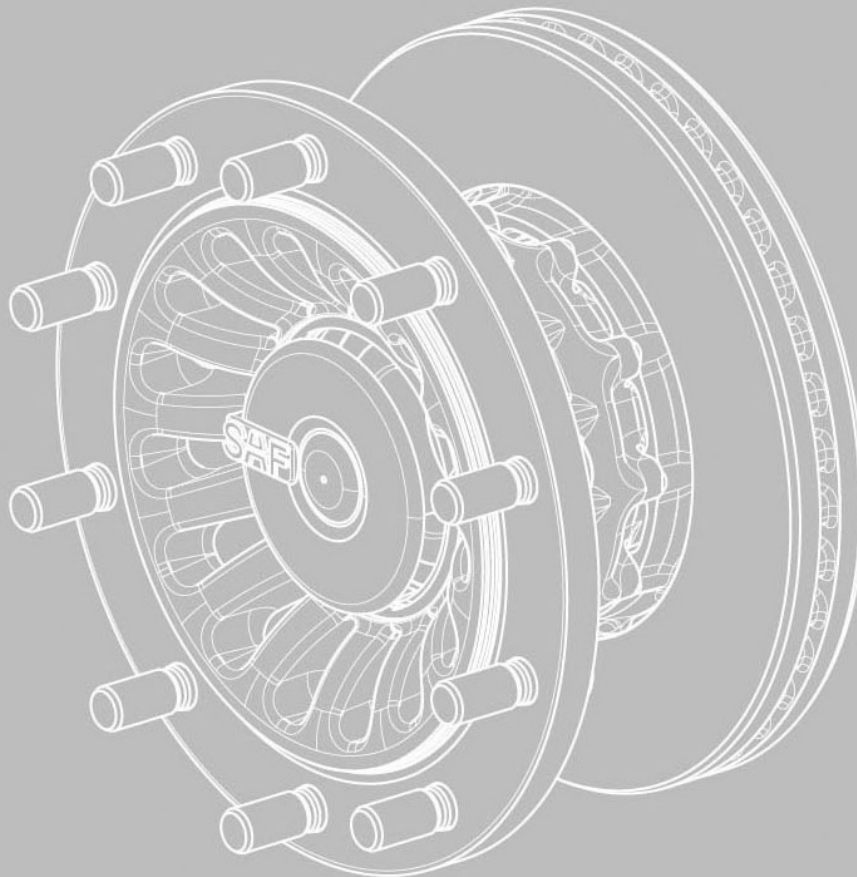


General operating and maintenance instructions

Air suspension systems and axles with disc brakes



Please note

These operating and maintenance instructions are intended for the exclusive use of trained personnel within the commercial vehicle industry and related workshops.

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No liability is assumed as a result of incorrect or inappropriate components being fitted to the product or the omission of appropriate tests after the servicing of the product. Use appropriate spare parts documentation when obtaining spare parts. Use only genuine SAF-HOLLAND GmbH spare parts in repairs.

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63856 Bessenbach, Germany

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Safety guidelines

1. No additional paint may be applied to the wheel contact surfaces on the wheel wrench and wheel hub as well as the wheel nut supporting surface on the wheel wrench. The contact surfaces must be clean, smooth and free of grease. Failure to observe this requirement poses a risk of the wheel mounting coming loose. Observe any instructions from the wheel manufacturer.
2. Only the rims and tyre sizes approved by the vehicle manufacturer may be used. The tyres must always have the prescribed air pressure.
3. In order to ensure reliable and even braking behaviour and even brake pad wear, the brake systems on the tractor and trailer/semi-trailer must be synchronised a maximum of 5,000 km after commissioning of the trailer/semi-trailer by means of a tractor/trailer brake synchronisation. Tractor/trailer brake synchronisation must be performed by appropriately qualified and equipped brake workshops. Use of an additional brake system other than the trailer anti-jack-knifing brake is prohibited by law on vehicles approved since January 1999.
4. Before commencing a journey, it must be ensured that the maximum permissible axle load has not been exceeded and that the load is well-balanced and evenly positioned.
5. On vehicles with air suspension, it must be ensured before commencing a journey that the air suspension bellows have been fully inflated. Inadequate ventilation can give rise to damage on axles, the chassis, frame and body and impair traffic safety.
6. It must be ensured that the brakes cannot overheat, e.g. through continuous use. On drum brakes, overheating can give rise to a considerable reduction in braking efficiency. On disc brakes, overheating can damage adjacent components, in particular the wheel bearings. This can seriously impact safety, e.g. may cause the failure of the wheel bearings.
7. If the brakes have become hot, the parking brake must not be engaged before the brakes have cooled down as brake discs and brake drums can become damaged due to the occurrence of tension during cooling.
8. When loading and unloading, the designated supports must be used in order to prevent damage to the axle.
9. Observe the usage recommendations from the vehicle manufacturer for off-road use of the installed axles and units. The definition of off-road used by SAF-HOLLAND means driving on untarmacked/unconcreted roads such as dirt/gravel roads, agricultural and forest tracks and in construction site/quarry applications. The use of SAF-HOLLAND axles and units that have not been designed for this purpose in off-road use can give rise to damage and impair traffic safety.
10. In order to maintain the operational reliability and roadworthiness of SAF-HOLLAND axles and units, continuous servicing, inspection and maintenance is required in order to identify natural wear and faults in a timely manner. It is the duty of the driver to perform a daily inspection of the vehicle for traffic safety before starting the journey. SAF-HOLLAND recommends performing all described inspections and maintenance work. When performing repairs, observe the SAF-HOLLAND repair instructions and notes. We recommend use of genuine spare parts from SAF-HOLLAND. A comprehensive service network of SAF-HOLLAND partner companies is available for technical support for SAF-HOLLAND axles and units and the provision of spare parts (see back page or visit www.safholland.com).




Where appropriate, updates will be announced at www.safholland.com.

Attention: Following a wheel change, tighten all wheel nuts to the prescribed tightening torque after 50 km and after 150 km.

- Check the thickness of the disc brake pad at regular intervals, e.g. when checking the tyre pressure. Minimum wear limits*.
 - Perform general visual inspections of the brakes, tyres and all chassis parts and check for fastening, wear, leak tightness, corrosion and damage.
 - On each disc brake pad change, perform a visual inspection of the wheel bearing unit to check for escaping grease.
 - Check the movement of the brake calliper guide system on each disc brake pad change.
 - Check the condition of the outer and inner bellows on the brake calliper for cracks and damage and check the correct seating of the adjuster cover cap on each disc brake pad change.
 - Check the brake disc for wear* and crack formation on each disc brake pad change.
 - Inspect and, if necessary, adjust the air suspension ride height at regular intervals in accordance with the information from the vehicle manufacturer.
 - On aluminium/stainless steel hanger brackets, check that the screwed connections of the spring bearings and shock absorbers are tightened to the prescribed tightening torque.
 - On MODUL units, check that the screwed connections of U-brackets are tightened to the tightening torques prescribed by the vehicle manufacturer.
 - General safety inspection in accordance with the legal regulations.
 - We recommend use of genuine spare parts from SAF-HOLLAND.
 - With steered axles, also observe the corresponding setting instructions.
- * If the minimum wear limits are reached, we recommend performing a safety inspection.

1. SAF-HOLLAND type plate

The SAF type plate with Quick Response (QR) code. Since end of 2012.

SAF-HOLLAND GMBH D-63856 BESENBACH · GERMANY			
Version	BI9-22K01	ID1 – SBK2243 – 11S	
Serial No.	11 12 117 0009	ID2 – SBK2243 – 11S 01	
Ident No.	147 96 62 7 48 20	ID3 – 10791	
Stat. 9000 kg Vmax. 105 km/h		ID4 – 36110303	
Made in Germany	E	 SN 11121170009	

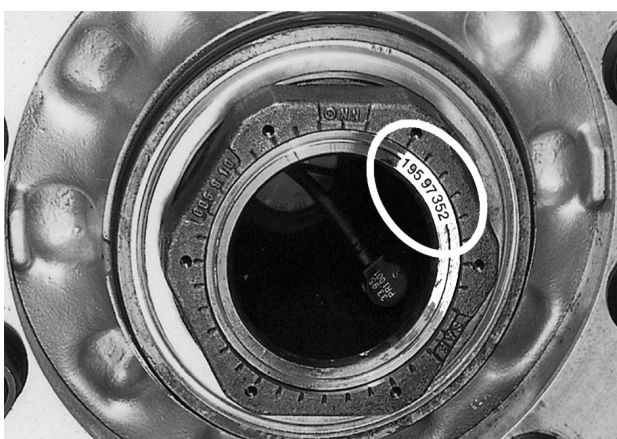


On INTRA:

On the suspension arm under the air suspension bellows, in the left direction of travel.

On MODUL:

At the centre of the axle tube.



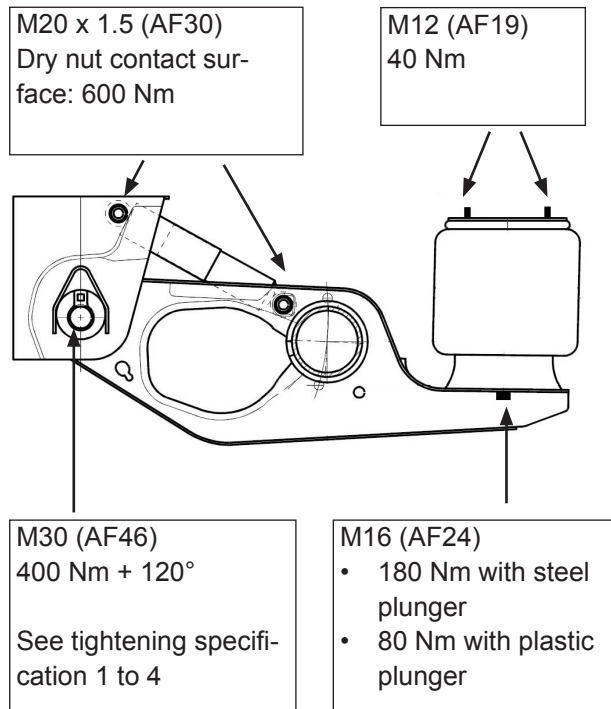
Identification in case of missing type plate:

The serial number of the axle is imprinted on the axle stub in the right direction of travel.

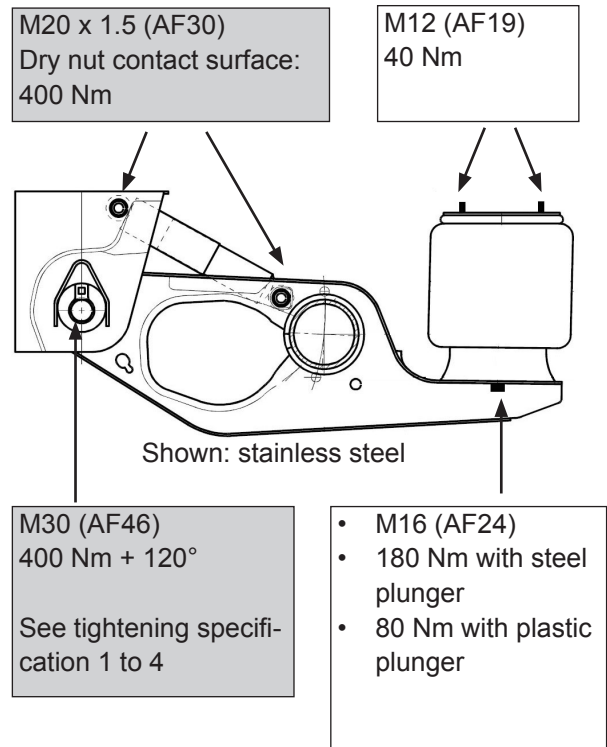
2. Torque tightening specification

INTRADISC / INTRADRUM

2.1 Steel hanger bracket torque settings



2.3 Stainless steel/aluminium hanger bracket torque settings



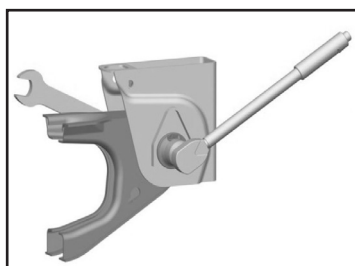
Caution!

The setting must always be marked if the shock absorber screwed connection is tightened to the intended torque.

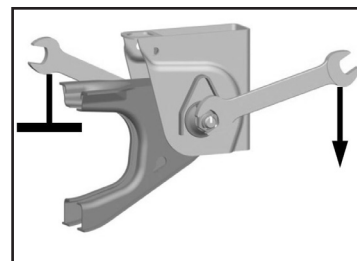
Caution!

Maintenance intervals for stainless steel/aluminium hanger brackets:
First inspection after 500 km.
Further inspections every 10,000 km or 6 months.

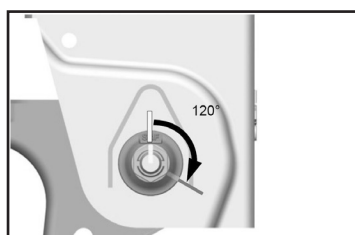
2.2 Spring bearing torque specification 1 to 4



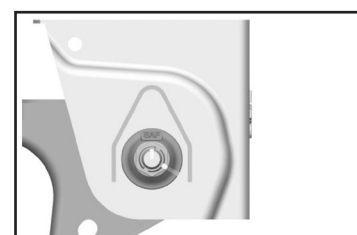
1. Pre-tightening
400 Nm



3. Angle tightening 120°
(two sides)



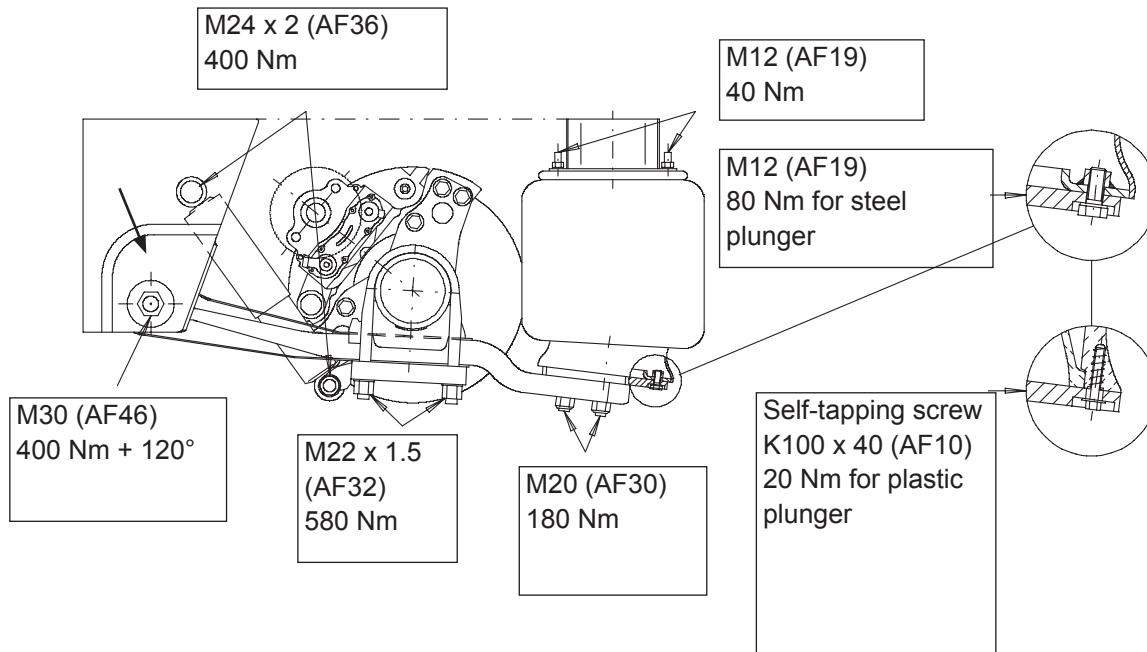
2. Marking for angle tightening
120° (two sides)



4. Marking for later visual inspection

3. Torque tightening specification

MODUL with disc brake or drum brake



Tightening specification:

1. The bearings for the trailing arm must be assembled in accordance with the maintenance and repair instructions.
2. Move the vehicle to the correct ride height.
3. Pre-tighten the nuts M30/AF46 to 400 Nm.
4. Position the eccentric under the screw head.
5. Tighten the nut a further 120° (2 corners) whilst countering the screw head.
6. Perform a visual inspection. Correct the tightening angle if necessary.
7. Once tightening is complete, mark the position of the washer, nut and screw on the hanger bracket.



Caution!

- Do not oil or grease the thread.
- The steel hanger bracket screwed connections do not require maintenance.
- The paint thickness on the screw contact surfaces between the shock absorber and hanger bracket and between the trailing arm and hanger bracket must not exceed 45 µm.

On galvanised axles:

- The paint thickness on the screw contact surfaces between the shock absorber and hanger bracket and between the trailing arm and hanger bracket must not exceed 120 µm.
- In the event of larger coating thicknesses, the screwed connections are no longer maintenance-free.

4. Operating materials and tools

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 / SI11-22K01 / ZI11-19 /
 ZI11-22K01 / SI11-22K11 / ZI11-22K11

Operating materials specifications:	Assembly tools:	P/N:
Greases for repair work are supplied with all repair kits. For axle stub: Assembly paste (1 kg) P/N 5 387 0042 01	Axle nut wrench AF85	4 434 3828 00
	Puller for hub unit	4 434 3822 00
	Socket 3/4" for Torx E24	4 434 3824 00
	Universal disc brake tool box	3 434 3328 02
	Socket for DSK screws 1/2", AF13	4 434 3831 00
	Socket for DSK screws 1/2", AF15	
	DSK nut AF24 with 3/4" connection	4 434 3862 00
	Socket AF17	4 434 3859 00
		Standard

SK RS / RZ 9019 / 9022 / 11019 / 11222

Operating materials specifications:	Assembly tools:	P/N:
For wheel bearing (400 g): P/N 5 387 0030 04	Axle nut wrench, AF140	1 012 0024 00
For bellows and brash bushings (1 kg): P/N 5 387 0030 01	Puller for wheel hub	4 434 3822 00
	Lever for wheel cap	1 434 1041 00
For rubber guide sleeve (1 kg): P/N 5 387 0030 01	Universal disc brake tool box	3 434 3328 02
	Socket AF17	
For axle stub (1 kg): P/N 5 387 0042 01 Assembly paste		Standard

5. Maintenance schedule

5.1 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 / ZI11-2

Maintenance-free hub unit.

Check for wear (e.g. escape of grease) on each brake disc change.

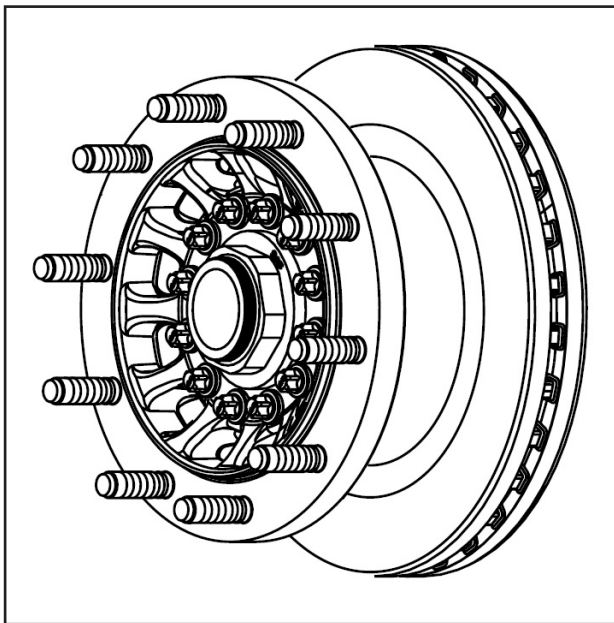
When repairing the brakes, note the following:

Visual inspection of the brake calliper seals.

High-pressure cleaners and liquid cleansers are not permitted on the brake disc and hub unit.

Remove grease residues from the axle stub and re-grease.

5.1.1 Tightening the axle nuts



Tightening the axle nuts

In the left direction of travel - left-hand thread
 In the right direction of travel - right-hand thread
 Pre-tightening: 150 Nm, turn the wheel head
 5 turns evenly
 Final tightening: tighten 1 mark (30°) or 900 Nm
 Identification of axle nut with left-hand thread:
 groove on outer edge
 Hub unit: permitted axial clearance 0 - 0.20 mm



Danger!

There is a risk of accident if this regulation is not observed!
 Worn brake pads and/or over-worn brake discs will reduce or stop braking efficiency.



Danger!

- Do not use an impact wrench.
- Do not oil the thread.

5.1.2 Tightening torques of screwed connections



Danger!

- The screws specified below must be replaced when performing maintenance and repair work.
- The screws must not be oiled or greased on assembly.
- Tighten the screwed connections with a torque wrench.



Danger!

- Do not use an impact wrench.
- Do not oil the thread.

Tightening torques (Nm) Screwed connections	Knorr	Wabco	SAF SBS H0
Wheel flange Torx screw E24 M18 x 1.5	1. Tighten to pre-tightening of 50 Nm crosswise 2. and tighten with rotation angle 90° crosswise (control tightening 450 Nm)		-
Integral brake disc DSK screw AF13 M12 x 1.5	1. Pre-tightening 40 Nm 2. Final tightening: 2. Tighten with rotation angle 90° crosswise (control tightening 130 Nm)		-
Brake calliper on axle body (6 screws) Hex screw M16 x 1.5	290 Nm		-
Brake calliper on axle body (4 screws) Multi-tooth screw M18 x 1.5	1. Pre-tightening (from inside to outside) 120 Nm 2. Check of pre-tightening of all screws, re-tighten to 120 Nm if necessary 3. Final tightening 450 Nm or 120 Nm + 60° (4 corners of multi-tooth screw)		
Brake chamber hex nut M16 x 1.5	Tighten in 2 stages evenly and alternately 1. Pre-tightening 120 Nm 2. Final tightening 210 Nm (control tightening 210 Nm)		210 Nm
guide pin on brake calliper	290 Nm	340 ± 20 Nm	180 Nm + 70°
Pad retainer	Split pin	30 ± 15 Nm	Spring lock
Brake disc B9, DSK 15	1. Pre-tightening 50 Nm 2. Final tightening 90° crosswise		

5.2 SK RS / RZ 9019 / 9022 / 11019 / 11222

Wheel bearing clearance, wheel bearing grease

Wheel bearing clearance setting not required.

Change of wheel bearing grease after 500,000 km or 50 months, check tapered roller bearings for reusability on grease change. Replace the O-ring and assemble the wheel cap.

When repairing the brakes, note the following:

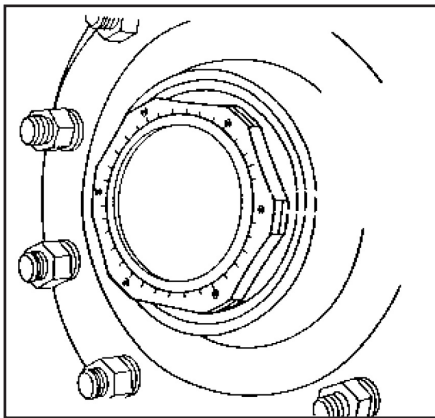
Visual inspection of the brake calliper seals.

Do not disassemble the wheel bearing unit.

High-pressure cleaners and liquid cleansers are not permitted on the brake disc and wheel hub.

Remove grease residues from the axle stub and re-grease.

5.2.1 Tightening the axle nuts



Tightening the axle nuts

In the left direction of travel - left-hand thread

In the right direction of travel - right-hand thread

Tightening torque 900 Nm, each wheel head must be rotated evenly at least two turns during screw tightening.

Identification of axle nut with left-hand thread: outside on hex with milled groove.

Hub unit: permitted axial clearance 0 - 0.20 mm



Danger!

- Do not use an impact wrench.
- Do not oil the thread.



Danger!

There is a risk of accident if this regulation is not observed!

Worn brake pads and/or over-worn brake discs will reduce or stop braking efficiency.

	Tightening torque (Nm)	Width across flats (AF)	Hex external/internal	
Guide bearing on brake calliper 2 socket cap screws M16 x 1.5 - 10.9	290	14	-	x
Diaphragm chamber, combined chamber 2 hex nuts M16 x 1.5	210	24	x	-
Brake calliper attachment on axle body M16 x 1.5 x 55	290	24	x	-

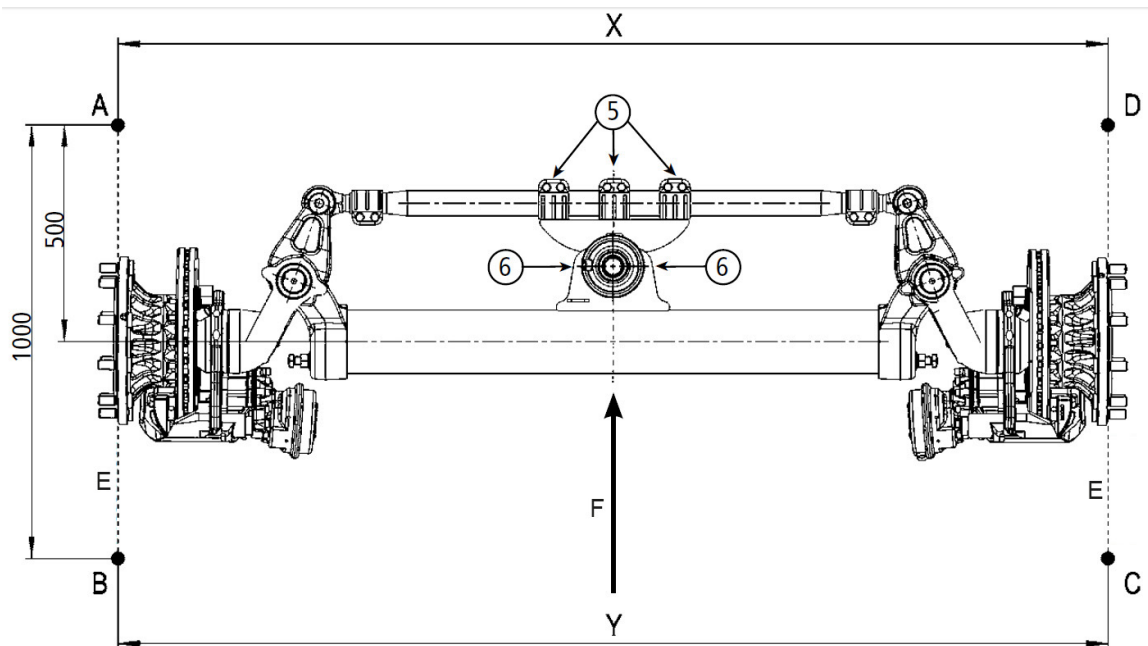
6. Setting instructions

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

Requirements:

- Axle alignment must take place unladen.
- With air suspension, the vehicle must be set to ride height.

6.1.1 Alignment



Steered axle permissible values		
Toe-in	min. +4 mm/m	max. +7 mm/m
Camber	±12'	
Example: Toe-in Y-X = 4 to 7 mm/m		



Caution!

SAF-HOLLAND steered axles must not exhibit any negative toe/toe-out.

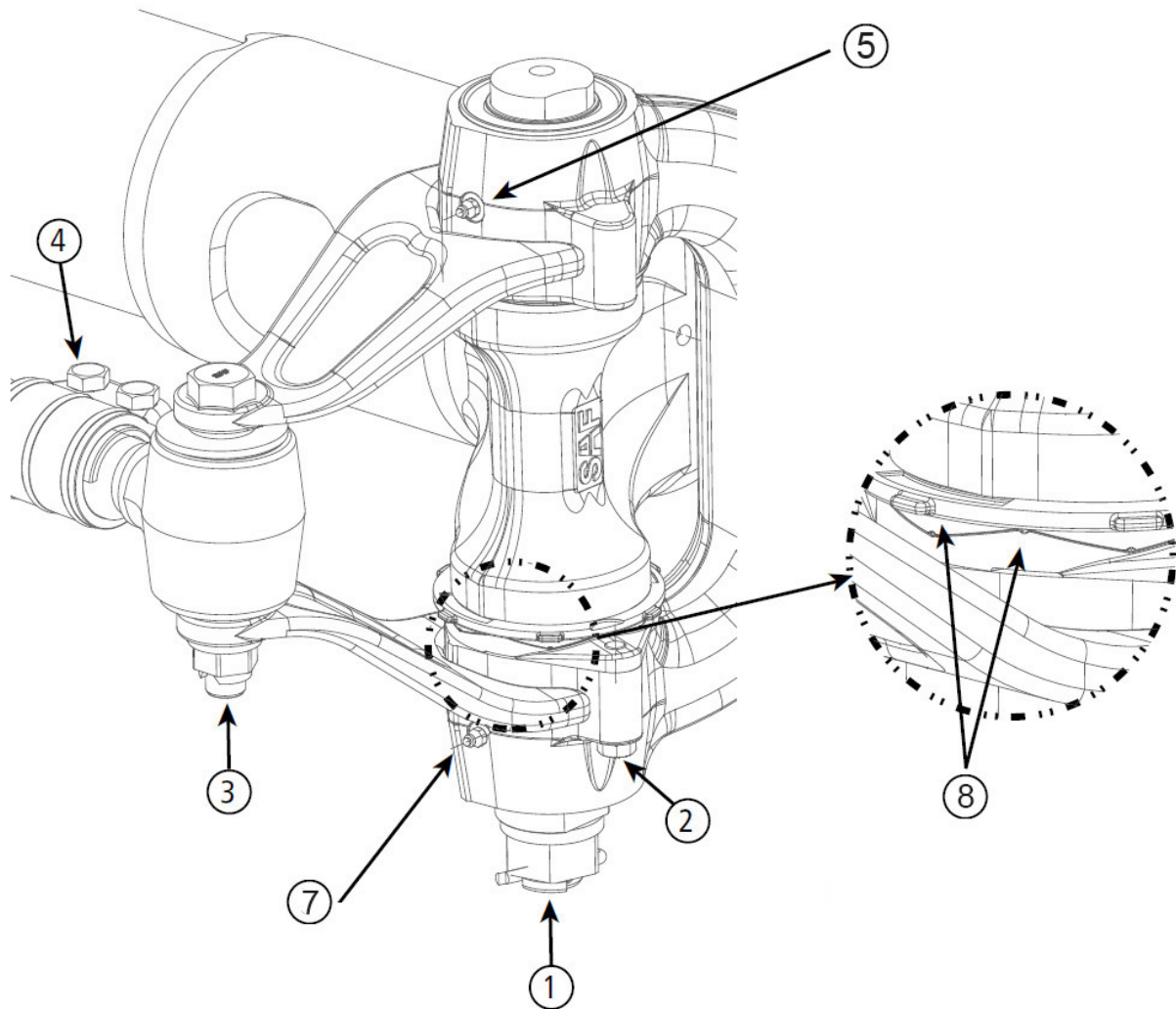


Danger!

- Lubricate the steering-knuckle pin support after assembly initially after 1 month and then every 6 months.
- Check the function of the components every 6 months.

6.1.2 Measuring the axle geometry

Difference between distances AC-BD = <3 mm



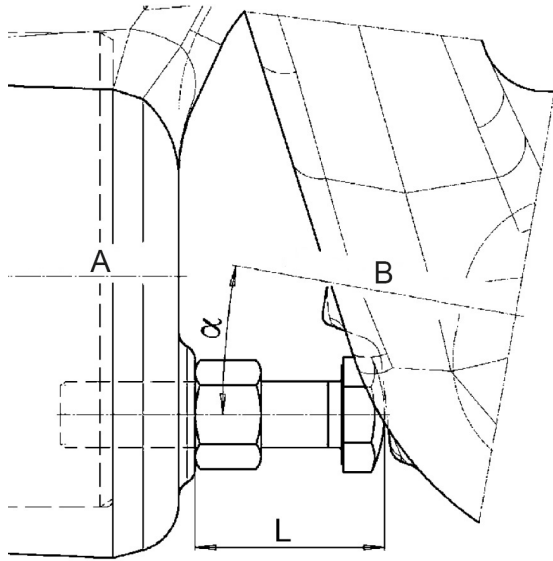
6.1.3 Tightening torques

No.	Description	Quantity/axle	Tightening torque
1	Steering knuckle bearing	2	450 Nm + 360°
2	Pressure disc attachment	4	120 Nm
3	Track rod end	2	600 Nm
4	Track rod compression fitting	4	120 Nm
5	Locking plate compression fitting	6	120 Nm
6	Locking cylinder	2	120 Nm

6.1.4 Other

No.	Description	Quantity/axle	Remark
7	Lubrication point	2	-
8	Zero position: both pressure discs are in place free of gaps!	2	-
E	Ruler	2	Figure p. 13
F	Direction of travel	-	Figure p. 13

6.1.5 Steering angle



Steering angle	
Screw protrusion "L"	Steering angle "α"
38 mm	16°
44.5 mm	14°
51 mm	12°
57.5 mm	10°



Caution!

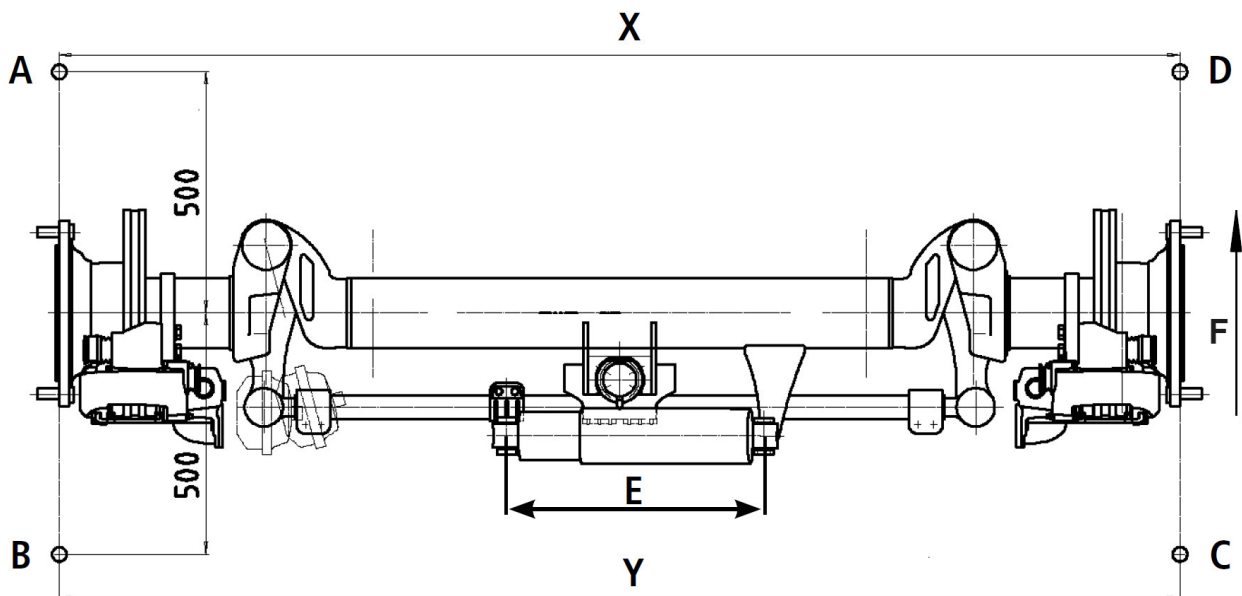
SAF-HOLLAND steered axles must not exhibit any negative toe/toe-out.

6.2 SKRLB 9019 / 9022, BIL9-19 / BIL9-22

Requirements:

- Axle alignment must take place unladen.
- With air suspension, the vehicle must be set to ride height.

6.2.1 Alignment



Steered axle permissible values		
Toe-in	min. +4 mm/m	max. +7 mm/m
Camber	±12'	
Example: Toe-in Y-X = 4 to 7 mm/m		



Caution!

SAF-HOLLAND steered axles must not exhibit any negative toe/toe-out.

6.2.2 Measuring the axle geometry

Difference between distances AC-BD = <3 mm

Dimension "E" = 537 mm. The reversing lock must be engaged when performing the measurement.

6.3 SKRLB 9019 / 9022, BIL9-19 / BIL9-22

6.3.1 Tightening torques

No.	Description	Quantity/axle	Tightening torque
1	Ball joint screwed connection	2	M30, 340 Nm
2	Clamp screwed connection	10	M12, 80 - 90 Nm
3	Steering damper screwed connection	2	M24, 600 - 660 Nm
4	Locking cylinder screwed connection	4	M6, 8 - 10 Nm
5	Top panel screwed connection	6	M8, 25 - 30 Nm



Danger!

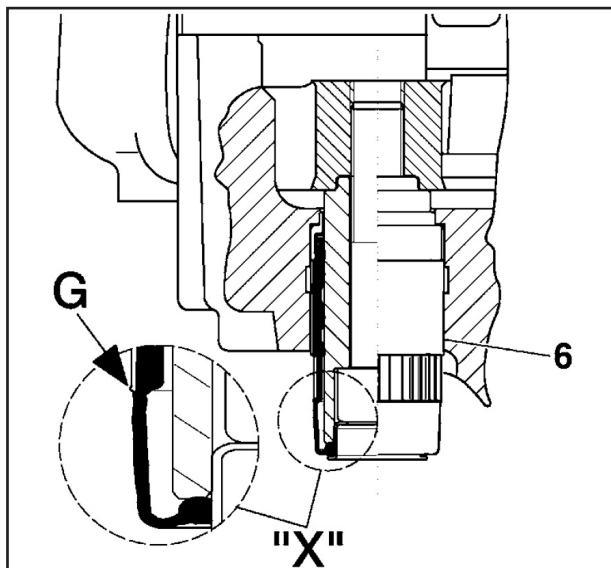
- Lubricate the steering-knuckle pin support after assembly initially after 1 month and then every 6 months.
- Check the function of the components every 6 months.

7. Visual inspection of brake pad wear

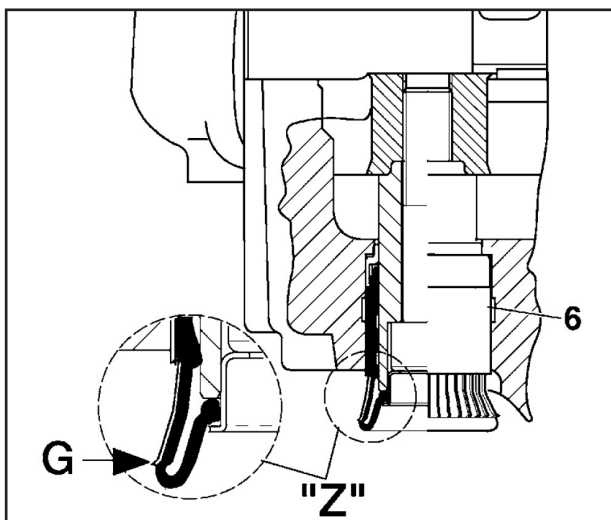
7.1 Knorr disc brake type SN7 – SK RB / RLB 9022 K / KI, SK RS / RZ 9022 / 11222 K

7.2 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



As-new state



Worn state



Danger!

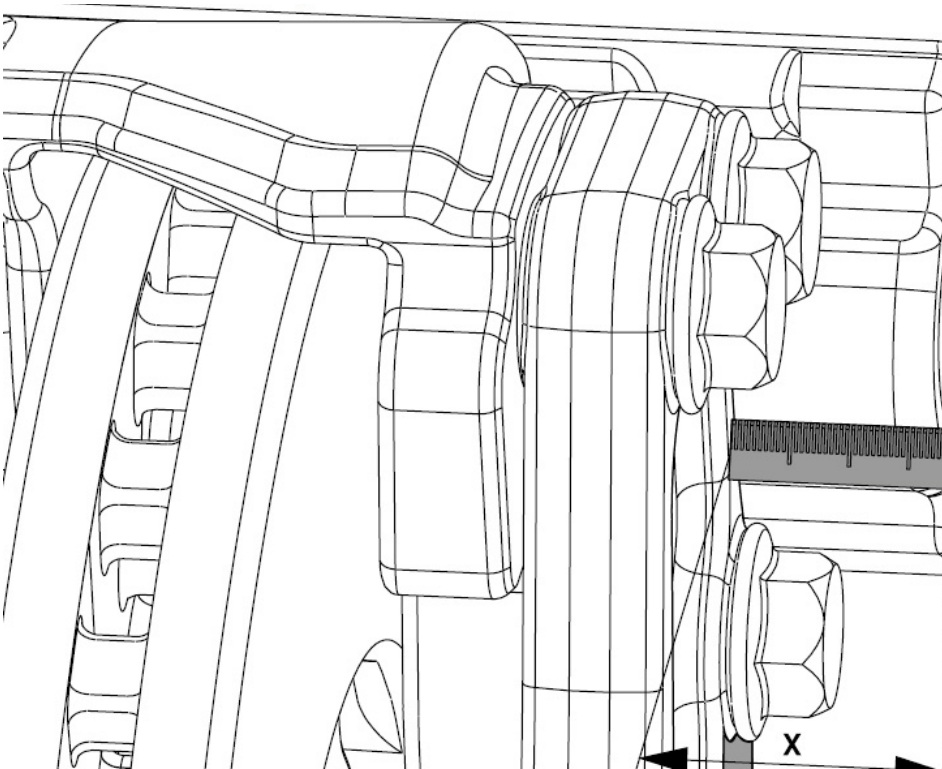
- Check the brake pads and brake discs, replace if necessary.
- The total wear is shown: both brake pads plus brake disc.

8. Visual inspection of brake pad wear

8.1 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, SI11-22K11 / ZI11-22K11, checking the pad wear

Checking the pad wear

Wear inspection SB7 ... SK7
On the long guide pin >115 mm
On the short guide pin >63 mm



Danger!

- Check the brake pads and brake discs, replace if necessary.
- The total wear is shown: both brake pads plus brake disc.

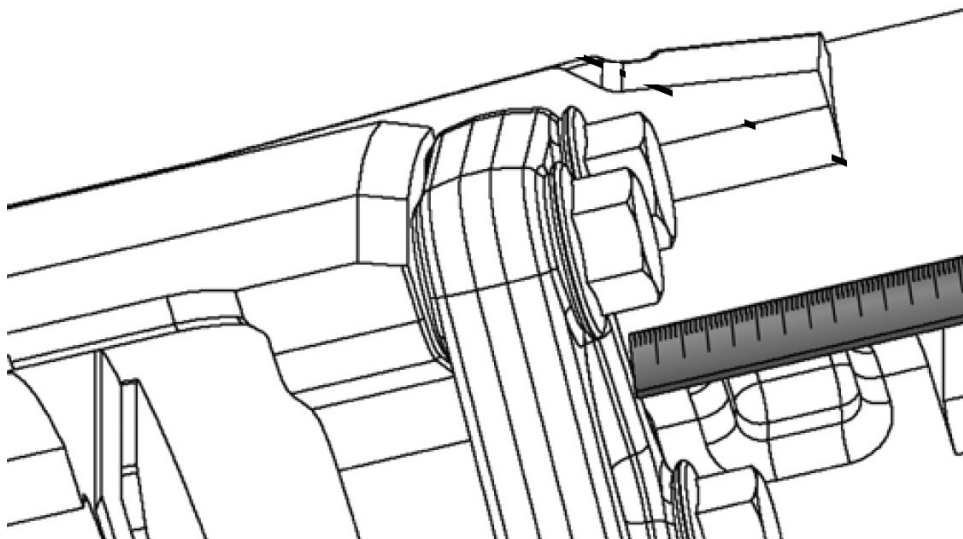
8.2 Wabco disc brake type PAN 22-1 – SK RB / RLB 9022 W / WI SK RS / RZ 9022 / 11222 W

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

8.4 Wabco disc brake version 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
On the long guide pin	>94 mm	>98 mm
On the short guide pin	>67 mm	>73 mm

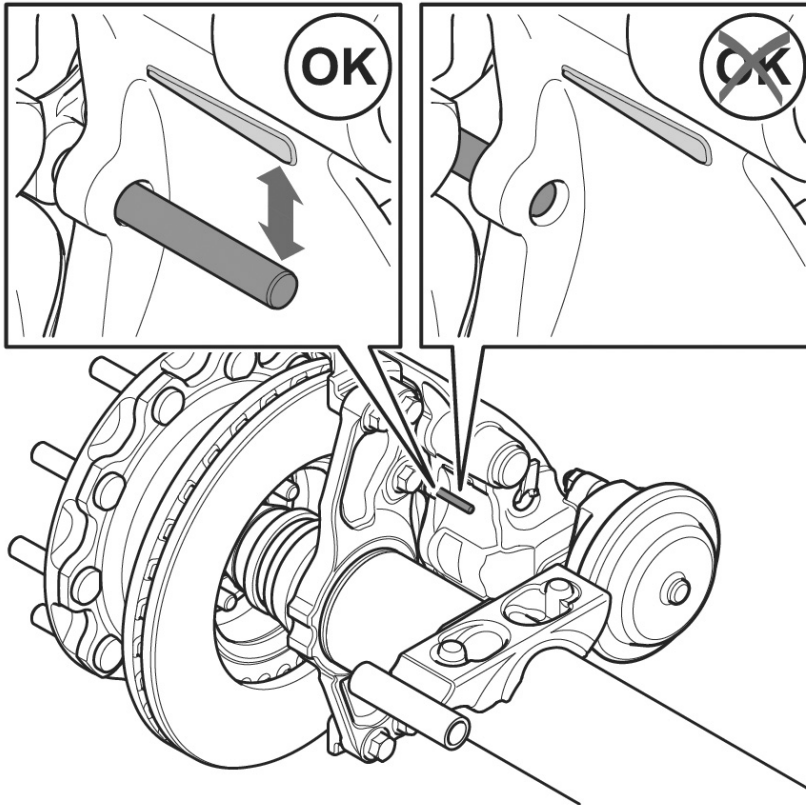


Danger!

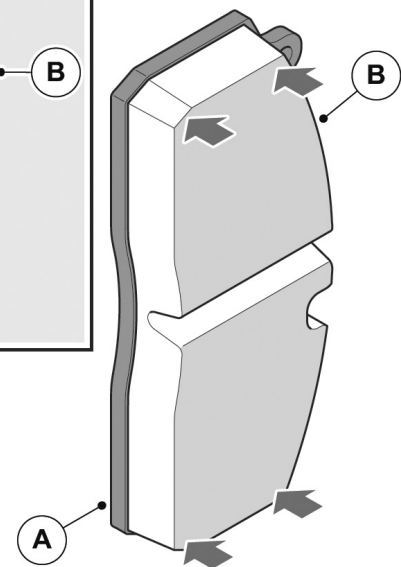
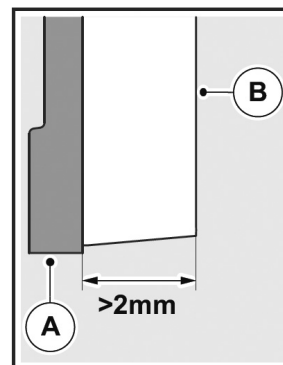
- Check the brake pads and brake discs, replace if necessary.
- The total wear is shown: both brake pads plus brake disc.

8.5 SBS 2220 H0 / SBS 1918 H0

Checking the pad wear

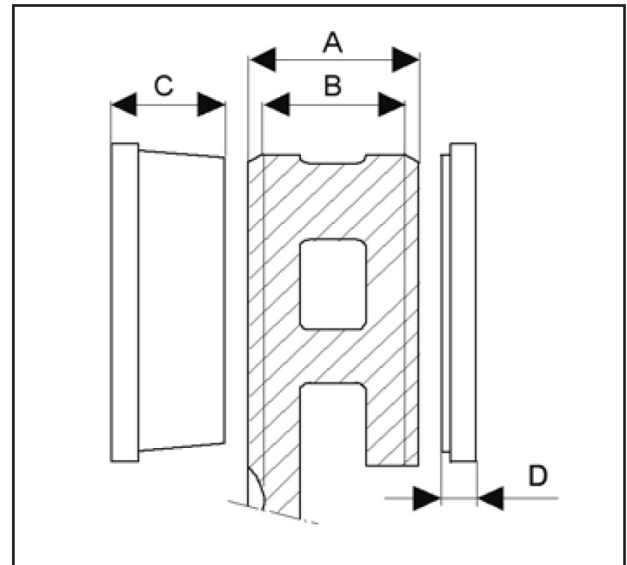
**Danger!**

- Check the brake pads and brake discs, replace if necessary.
- The total wear is shown: both brake pads plus brake disc.



9. Safety inspection of the brake disc

To assess the friction surface of the brake pads, the pad retainer must be removed and the adjustment of the brake calliper de-adjusted. Remove and inspect the pads.



9.5.1 Brake disc wear dimensions

Diameter (mm)	"A" new (mm)	"B" wear limit (mm)
430	45	37
377	45	37

9.5.2 Brake pad wear dimensions

"C" new (mm)			"D" wear limit (mm)		
SAF SBS H0	Knorr	Wabco	SAF SBS H0	Knorr	Wabco
30	30	32	10	11	11
30	30	32	10	11	11



Danger!

Only brake pads approved by SAF-HOLLAND may be installed.
In the event of wear repair, the brake pads on the axle must be replaced on both sides.
Brake pad wear difference max. 5.0 mm (inner/outer pad).



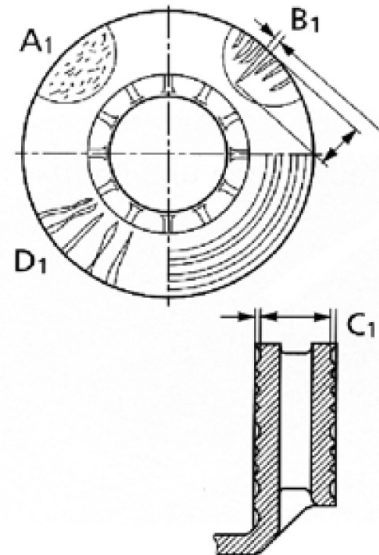
Danger!

- The clearance must be set (0.7 - 1.1 mm) after the pad change.
- When the adjustment unit is fully opened, the adjustment function is blocked.

9.5.3 Brake disc crack formation

The brake surface of the brake disc must be inspected carefully for reusability.

- A1 Network-like formation of cracks is permissible.
- B1 Cracks running towards the centre of the hub to max. 1.5 mm (width and depth) are permissible.
- C1 Unevenness of the disc surface is permissible.
- D1 Continuous cracks are impermissible. Check the brake disc thickness and planish if necessary.



For safety reasons, the minimum dimensions for polishing the brake discs is 39 - 40 mm.

10. Semi-trailer inclination

Ride heights

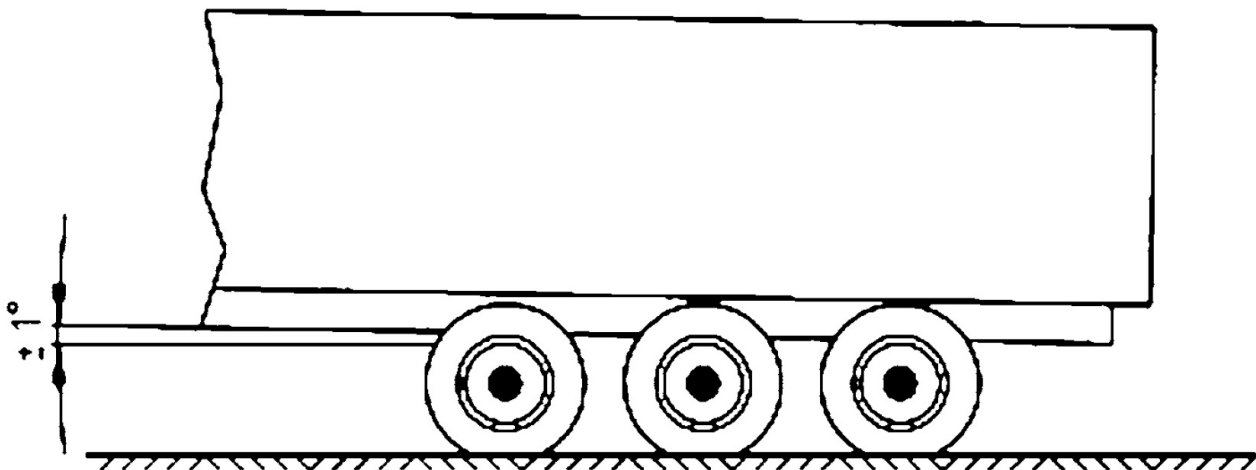
The ride height of the air suspension axles must be set to the permissible range specified in the corresponding documentation from SAF-HOLLAND.

On single axles, a minimum spring compression of 60 mm must be observed.

On multi-axle units, a minimum spring compression of 70 mm must be observed.

Exception:

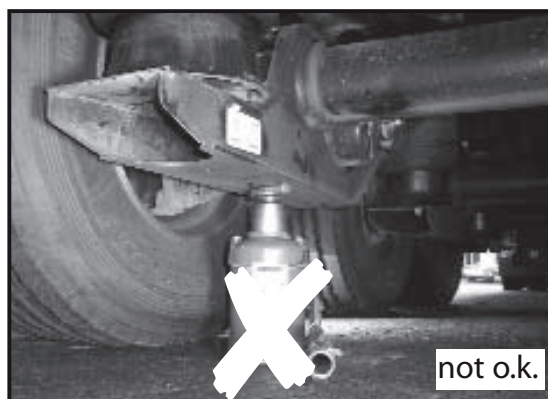
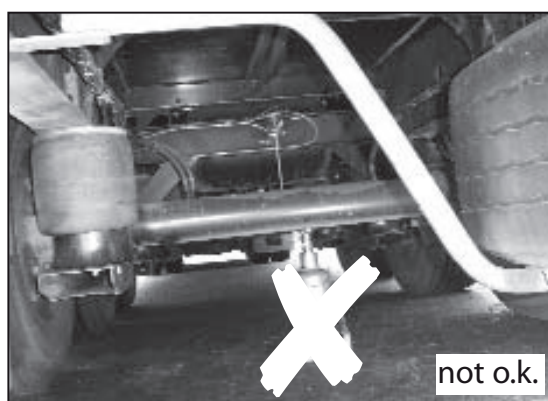
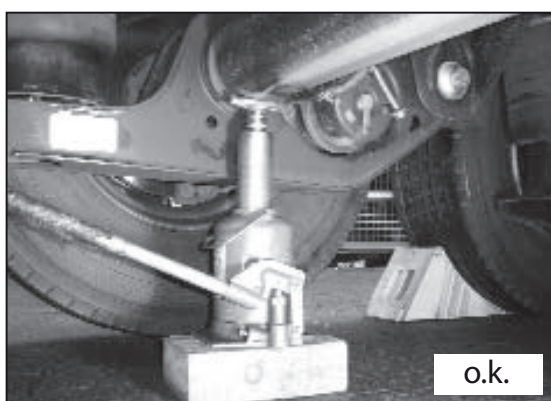
On multi-axle units with lift axles, a minimum spring compression of 100 mm must be met on the lift axle in order to ensure sufficient ground clearance.



11. Tyre change

With a fully laden vehicle with INTRA units.

Jack positioning points:



12. Setting the air suspension ride height

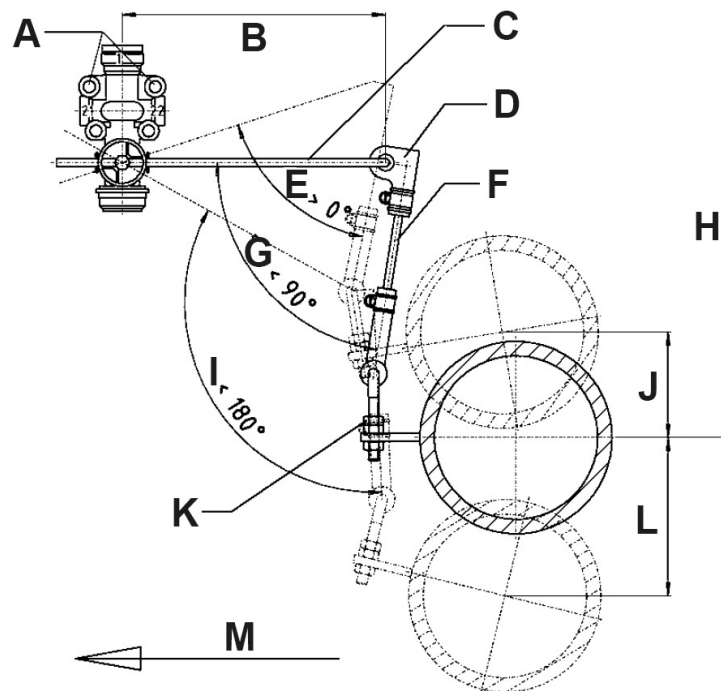
12.1 Levelling valve

SAF-HOLLAND air suspension axles and units require only one levelling valve as standard.

The levelling valve regulates the air suspension bellows pressure according to the load of the vehicle and maintains the set ride height (RH) in all load states.

The levelling valve is attached to the vehicle frame with screws and joined to the axles via the linkage (valve lever and adjustment pipe). The link to the axle (usually in the centre of the axle) is typically on the centre axle on three-axle units and on the rear axle on dual-axle units. In certain cases (e.g. large vehicle inclination), the levelling valve may be attached to the rear axle.

For units with axle lifting device, the link is selected according to the axle to be lifted.



Key:

Letter	Meaning
A	Frame attachment
B	Min. 200 mm
C	Valve lever
D	Rubber joint
E	Compression $>0^\circ$
F	Adjustment pipe
G	Ride height $<90^\circ$
H	Ride height
I	De-compression $<180^\circ$
J	Compression
K	Control nut
L	De-compression
M	Direction of travel

12.2 Installation

The valve lever must be a minimum of 200 mm long and be level in the drive position.

For the functional inspection, the lever is moved slightly downwards. In this case, air must be released through the ventilation cap. In the event that air flows into the bellows, the valve shaft must be rotated 180°. For this, the valve lever must be repositioned. The ride height is set by adjusting the adjustment pipe in the rubber joints and by adjusting the lock nuts.

Setting must be performed on level ground. It may be performed with the vehicle unladen or laden.

12.3 Final inspection

For the final inspection, the air suspension must be compressed as far as the air suspension bellows will go or until a limit is reached (shock absorber, arrestor cable, length of the air suspension bellows). The specified angles between the valve lever and adjustment pipe must be maintained to prevent the valve rod from turning over.

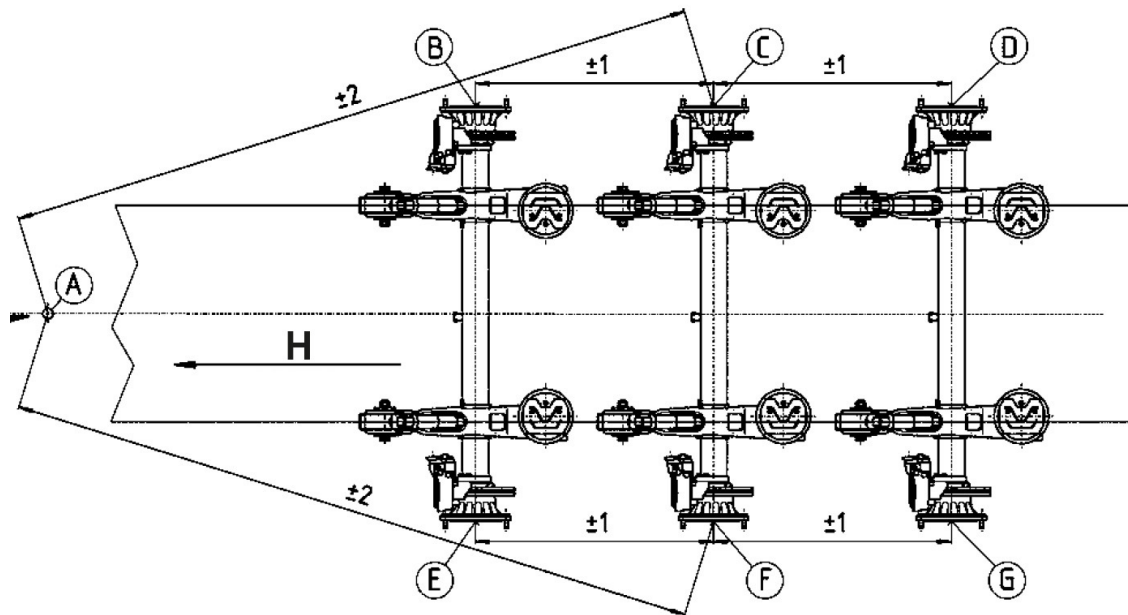
13. Axle alignment

To compensate manufacturing tolerances, axle alignment and, if necessary, correction is required.

The maximum permissible alignment deviations (tolerances) are in accordance with the information from the tyre manufacturer.

The maximum possible wheelbase correction per axle is ± 6 mm.

13.1 Conventional setting



Determine the diagonal dimensions A - C and A - F for the centre axle (reference axle) by performing comparative measurements, note the tolerances.

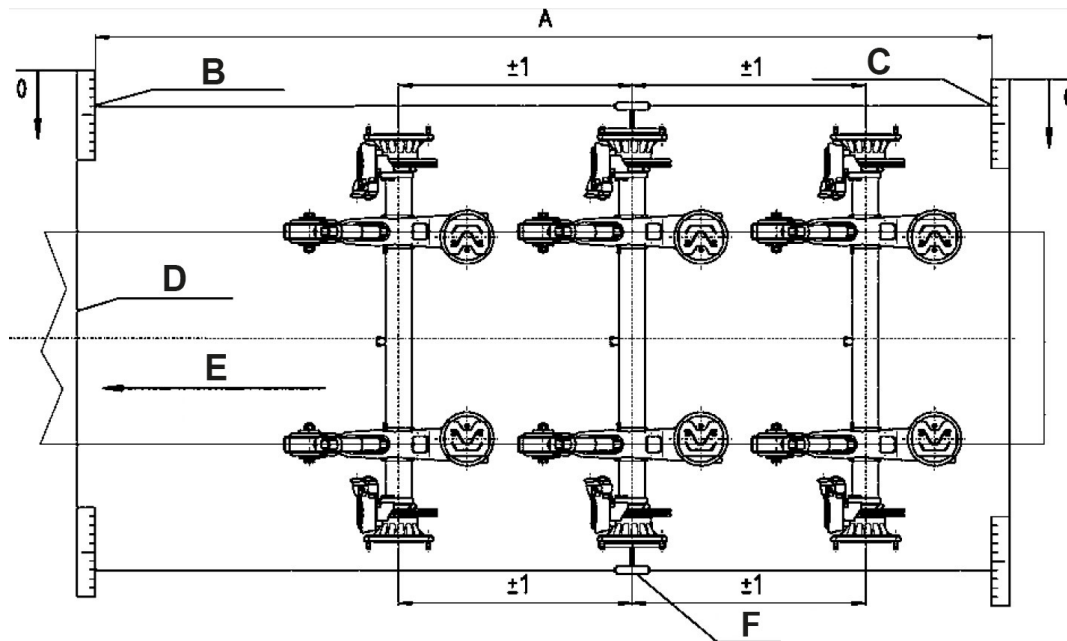
Check the wheelbase dimensions B - C and E - F for the front axle and C - D and F - G for the rear axle and correct if required, note the tolerances.

A: Kingpin

H: Direction of travel

13.2 Visual setting

The operating and setting instructions from the measurement system manufacturer must be observed!



Calculating the toe-in and toe-out values:

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

"/" means divided by

S = positive value = toe-in

S = negative value = toe-out

Key:

Letter	Meaning
A	Measurement distance
B	Measured value A1
C	Measured value B1
D	Ruler
E	Direction of travel
F	Laser with holder

Note!

- To prevent tyre wear, we recommend regular axle alignment.
- We recommend use of a visual measuring device when performing axle alignment.
- When aligning, only the centre wheel cap and/or centre axle stub centrings are decisive.

Note!

Possible causes of alignment deviation are:

- Loose U-bracket attachment
- Spring bearing wear
- Deformation on the axle unit due to improper use



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